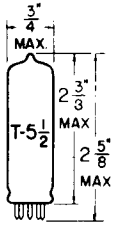
TUNG-SOL

VOLTAGE REGULATOR

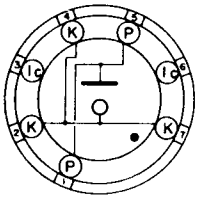
MINIATURE TYPE

COLD-CATHODE GLOW DISCHARGE

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE OA2 IS A COLD CATHODE GLOW-DISCHARGE TUBE USING THE MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A VOLTAGE REGULATOR TO MAINTAIN CONSTANT VOLTAGE ACROSS A LOAD WITH MODERATE CHANGES IN LOAD CURRENT AND SUPPLY VOLTAGE.

RATINGS

MAXIMUM AND MINIMUM RATINGS ARE ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	75	MA.
MAXIMUM DC OPERATING CURRENT (CONTINUOUS)	30	MA.
MINIMUM DC OPERATING CURRENT (CONTINUOUS)	5	MA.
MAXIMUM AMBIENT TEMPERATURE	+90	°C
MINIMUM AMBIENT TEMPERATURE	-55	°C

[A] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

MINIMUM DC ANODE SUPPLY VOLTAGE[B]	185	VOLTS
DC STARTING VOLTAGE (APPROX.)	155	VOLTS
DC OPERATING VOLTAGE (APPROX.)	150	VOLTS
SERIES RESISTOR	C	
MAXIMUM SHUNT CAPACITOR	0.1	µf
REGULATION (5 TO 30 MA.)	2	VOLTS

[B] NOT LESS THAN INDICATED SUPPLY VOLTAGE SHOULD BE PROVIDED TO INSURE "STARTING" THROUGHOUT TUBE LIFE.

[C] SHOULD BE SUFFICIENT TO LIMIT OPERATING CURRENT THROUGH TUBE TO 30 MA. AT ALL TIMES AFTER THE STARTING PERIOD.

SIMILIAR TYPE REFERENCE: Ratings and characteristics somewhat similiar to type OD3/VR150.

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PLATE 2018
JUNE 1, 1948

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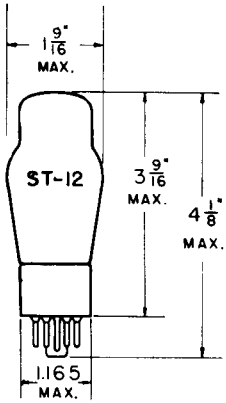
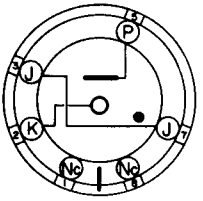


VOLTAGE REGULATOR

COLD CATHODE - GLOW DISCHARGE

GLASS BULB

SMALL SHELL OCTAL 6-PIN BASE



BOTTOM VIEW

THE 0A3/VR75, 0B3/VR90, 0C3/VR105, AND 0D3/VR150 ARE COLD-CATHODE, GLOW-DISCHARGE TUBES. THEY ARE INTENDED FOR USE AS VOLTAGE REGULATORS IN APPLICATIONS WHERE IT IS NECESSARY TO MAINTAIN A CONSTANT DC OUTPUT VOLTAGE ACROSS A LOAD, INDEPENDENT OF LOAD CURRENT AND MODERATE LINE-VOLTAGE VARIATIONS. LIKE OTHER GLOW-DISCHARGE TUBES, THEY MAY ALSO BE USED AS RELAXATION OSCILLATORS, AND FOR SPARK-OVER PROTECTION.

RATINGS AND TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

MAXIMUM AND MINIMUM RATINGS ARE ABSOLUTE VALUES

	0A3/VR75	0B3/VR90	
DC ANODE SUPPLY VOLTAGE [A]	105 MIN.	125 MIN.	VOLTS
DC OPERATING CURRENT (CONTINUOUS)	40 MAX.	30 MAX.	MA.
DC OPERATING CURRENT (CONTINUOUS)	5.0 MIN.	10 MIN.	MA.
AMBIENT TEMPERATURE RANGE	-55 TO + 90		°C
DC STARTING VOLTAGE (APPROX.)	100		VOLTS
DC OPERATING VOLTAGE (APPROX.)	75	90	VOLTS
REGULATION (5 TO 30 MA.)	3.0		VOLTS
REGULATION (5 TO 40 MA.)	5.0		VOLTS
REGULATION (10 TO 30 MA.)		8.0	VOLTS

	0C3/VR105	0D3/VR150	
DC ANODE SUPPLY VOLTAGE [A]	133 MIN.	185 MIN.	VOLTS
DC OPERATING CURRENT (CONTINUOUS)	40 MAX.	40 MAX.	MA.
DC OPERATING CURRENT (CONTINUOUS)	5.0 MIN.	5.0 MIN.	MA.
AMBIENT TEMPERATURE RANGE	-55 TO + 90	-55 TO + 90	°C
DC STARTING VOLTAGE (APPROX.)	115	160	VOLTS
DC OPERATING VOLTAGE (APPROX.)	105	150	VOLTS
REGULATION (5 TO 30 MA.)	1.0	2.0	VOLTS
REGULATION (5 TO 40 MA.)	2.0	4.0	VOLTS

[A] NOT LESS THAN INDICATED SUPPLY VOLTAGES SHOULD BE PROVIDED TO INSURE "STARTING" THROUGHOUT TUBE LIFE.

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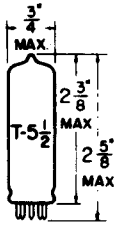
VOLTAGE REGULATOR

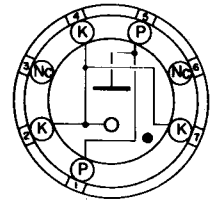
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

THE OB2 IS A TWO ELECTRODE, INERT-GAS-FILLED COLD CATHODE MINIATURE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 108 VOLTS OVER A CURRENT RANGE OF 5 TO 30 MA. THE OB2 IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 5/8	INCHES
MAXIMUM SEATED LENGTH	2 3/8	INCHES
MAXIMUM DIAMETER	3/4	INCH
WEIGHT (APPROX.)	0.3	OUNCES
BULB	T-5 1/2	
BASE	SMALL-BUTTON MINIATURE 7-PIN	

RATINGS

ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	75	MA.
MAXIMUM DC CATHODE CURRENT	30	MA.
MINIMUM DC CATHODE CURRENT	5	MA.
MAXIMUM INVERSE VOLTAGE	50	VOLTS
AMBIENT TEMPERATURE	-55 TO +90	°C

[A] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

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TUNG-SOL

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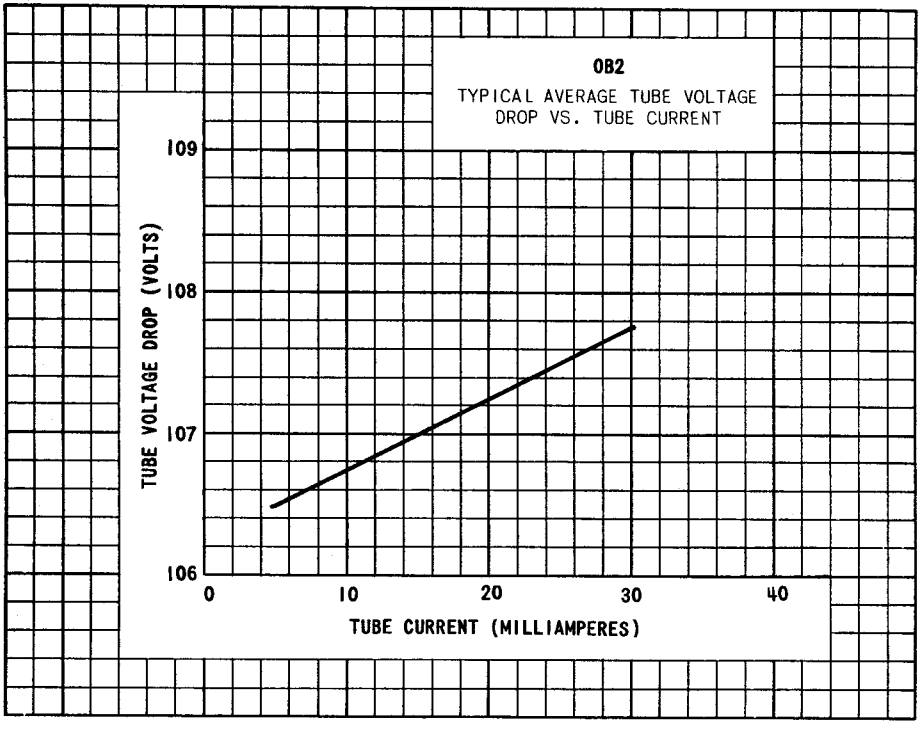
CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR	0.1	μf
SERIES RESISTOR	SEE OPERATION NOTES	

EQUIPMENT DESIGN AND RANGE VALUES

	MINIMUM VOLTS	AVERAGE VOLTS	MAXIMUM VOLTS
DC ANODE SUPPLY VOLTAGE	133[B]	---	---
ANODE BREAKDOWN VOLTAGE	---	114	133
TUBE VOLTAGE DROP	101	108	114
REGULATION (5 TO 30 MA.)	---	1.1	4

[B] IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.



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OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP ON THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_L IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_L}{R_1 + R_L} < V \text{ STARTING}$$

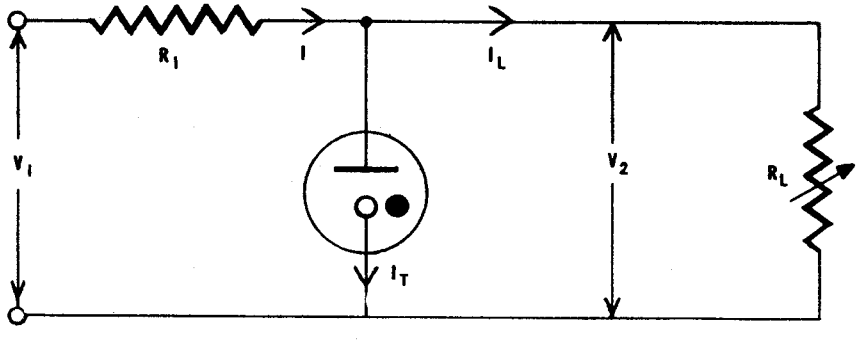

FIGURE 1

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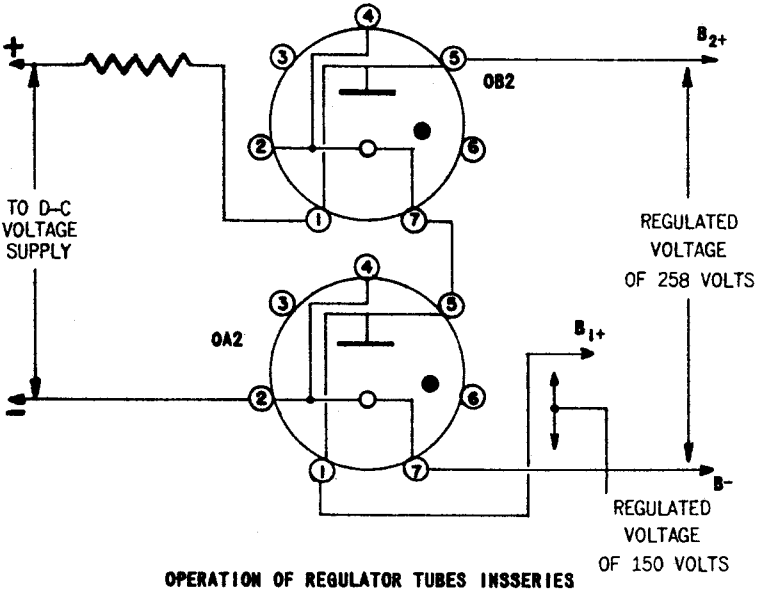
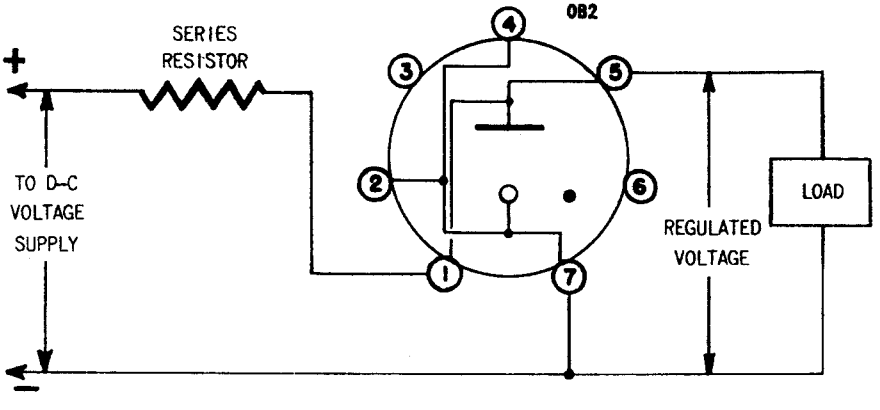


OPERATION OF REGULATOR TUBES INSSERIES
FIGURE 2



TYPICAL CIRCUIT FOR VOLTAGE REGULATOR
FIGURE 3

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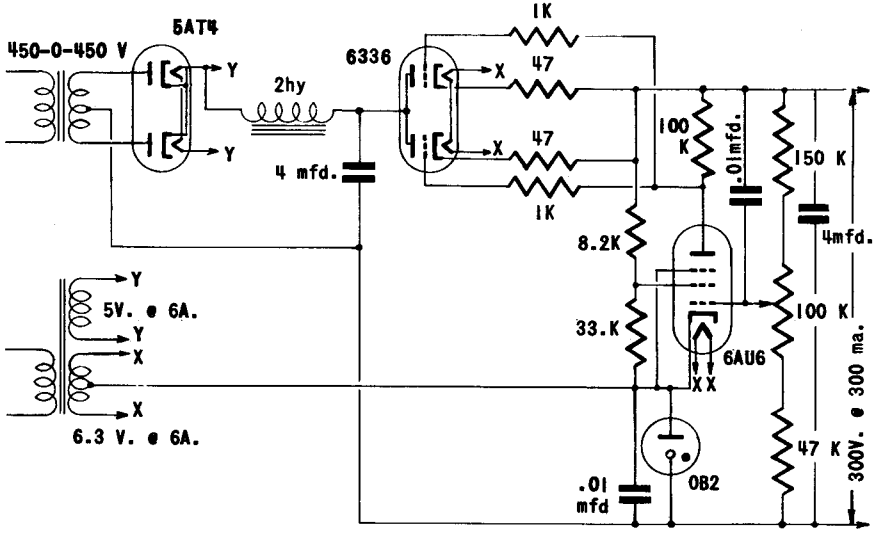
WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OB2 SHOULD BE LIMITED IN VALUE TO TO 0.1 μf, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OB2 IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OB2 TO EQUILIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.



TYPICAL APPLICATION OF OB2
USED IN VOLTAGE REGULATED POWER SUPPLY
FIGURE 4

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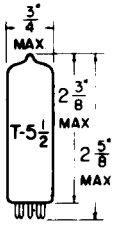
VOLTAGE-REGULATOR

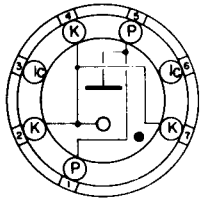
MINIATURE TYPE

COLD CATHODE

ANY OPERATING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

5B0

THE OC2 IS A COLD-CATHODE, GLOW-DISCHARGE VOLTAGE REGULATOR IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN VOLTAGE REGULATOR APPLICATIONS IN WHICH A RELATIVELY CONSTANT DC OUTPUT VOLTAGE IS REQUIRED ACROSS A LOAD, INDEPENDENT OF MODERATE LINE-VOLTAGE VARIATIONS.

RATINGS
MAXIMUM AND MINIMUM [A]

VOLTAGE-REGULATOR SERVICE

MAXIMUM AVERAGE STARTING CURRENT[B]	75	MA.
MAXIMUM DC CATHODE CURRENT	30	MA.
MINIMUM DC CATHODE CURRENT	5	MA.
MAXIMUM FREQUENCY	0	CPS.
AMBIENT TEMPERATURE RANGE	-55 TO + 90	°C
MAXIMUM CIRCUIT VALUES:		
SHUNT CAPACITANCE	0.1	μf

[A] ABSOLUTE VALUES.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.	AVG.	MAX.	
DC ANODE-SUPPLY VOLTAGE	C	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE:				
UNDER TOTAL DARKNESS	---	---	145[D]	VOLTS
UNDER NORMAL AMBIENT LIGHT CONDITIONS	---	105	115[D]	VOLTS
ANODE VOLTAGE DROP	68[E]	75	83	VOLTS
REGULATION (5 TO 30 MA.)	---	3	4.5	VOLTS

[B] AVERAGED OVER STARTING PERIOD NOT EXCEEDING 10 SECONDS. THIS STARTING PERIOD MUST BE FOLLOWED BY A STEADY-STATE OPERATING CONDITION OF AT LEAST 20 MINUTES, OR TUBE PERFORMANCE WILL BE IMPAIRED.

[C] THE MINIMUM VALUE TO INSURE "STARTING" THROUGHOUT TUBE LIFE MUST BE EQUAL TO THE ANODE BREAKDOWN VOLTAGE PLUS THE VOLTAGE DROP ACROSS THE SERIES RESISTOR AT THE MAXIMUM VALUE OF THE LOAD CURRENT.

[D] MAXIMUM INDIVIDUAL TUBE VALUE DURING USEFUL LIFE. [E] MIN. INDIVIDUAL TUBE VALUE DURING USEFUL LIFE.

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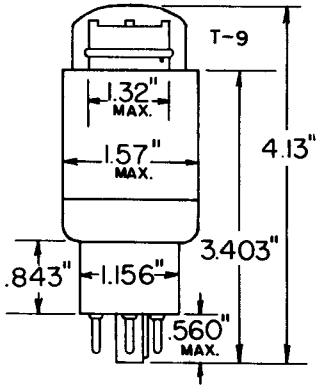
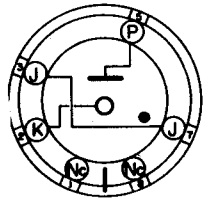
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL OCTAL
6 PIN

LOW LOSS
PHENOLIC MATERIAL

THE OC3W IS A TWO ELECTRODE, INERT GAS FILLED COLD CATHODE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 108 VOLTS OVER A CURRENT RANGE OF 5 TO 40 MILLIAMPERES.

THE OC3W IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE. TUBE ENVELOPE IS FLOATED WITHIN THE BASE SHELL BY A SPONGE RUBBER FILLER. THIS CUSHION DAMPENS VIBRATION AND DECREASES THE TRANSMISSION OF SHOCK TO THE ACTIVE TUBE ELEMENTS. BOTH THE BASING ARRANGEMENT AND HEAVY DUTY PARTS CONSTRUCTION MAKE THE OC3W ESPECIALLY SUITED FOR USE IN APPLICATIONS WHERE SEVERE MECHANICAL PUNISHMENT WILL BE ENCOUNTERED.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED HEIGHT	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
WEIGHT (APPROX.)	2	OUNCES
BULB (SEE OUTLINE)	T-9	
BASE	SPECIAL SKIRTED, SMALL SHELL OCTAL 6-PIN, LOW LOSS PHENOLIC MATERIAL	

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TUNG-SOL

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RATINGS
ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	100	MA.DC
MAXIMUM D.C. CATHODE CURRENT	40	MA.DC
MINIMUM D.C. CATHODE CURRENT	5	MA.DC
AMBIENT TEMPERATURE	-55 TO 70	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM INVERSE VOLTAGE	-50	VDC
SHOCK IMPACT	900	G/M SEC.
MAXIMUM VIBRATION RATING (D=0.08" @ 50 CPS)	10	G

[A] AVERAGE OVER A STARTING PERIOD NOT EXCEEDING 10 SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

ADDITIONAL TESTS TO INSURE RELIABILITY
RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 60° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (900 G/MSEC.)

VIBRATION: 10-50-10 CPS, 0.08" TOTAL DISPLACEMENT, IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES. (10 G)

FATIGUE VIBRATION: 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES (2.5 G).

LIFE TEST 500 HOURS: $R_{p/1_b}$= 30 MA. DC

POST SHOCK AND FATIGUE, AND LIFE TEST LIMITS:

IONIZATION VOLTAGE (MAX.)	133	VDC
TUBE VOLTAGE DROP	103 TO 113	VDC
REGULATION (5 TO 40 MA)	4.0	VDC
REGULATION (5 TO 30 MA)	2.5	VDC

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TUNG-SOL

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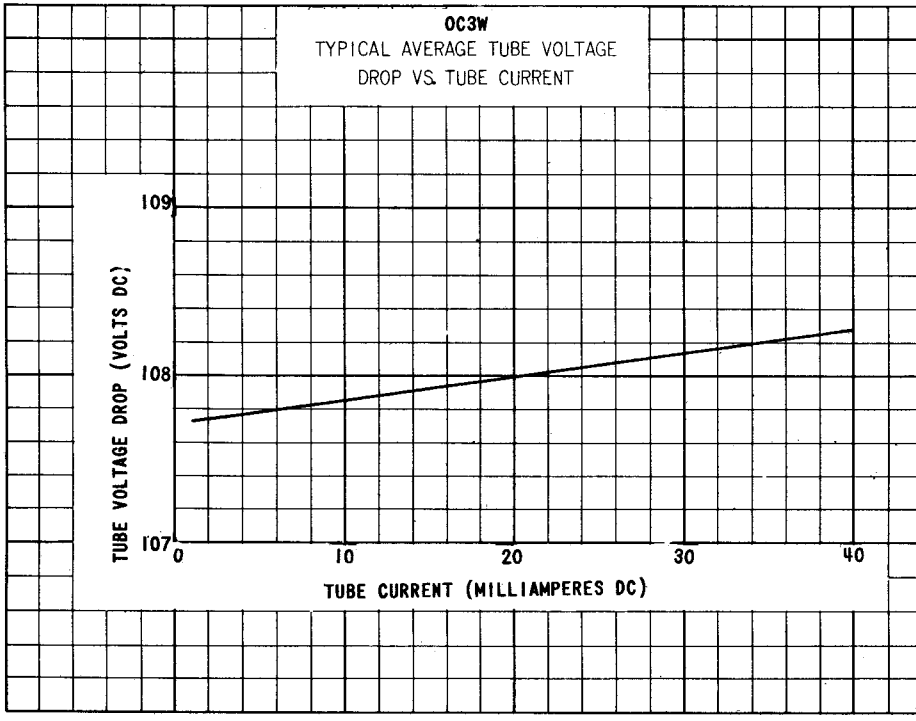
EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
D.C. ANODE SUPPLY VOLTAGE IN DARKNESS	210[B]	---	---	VOLTS
D.C. ANODE SUPPLY VOLTAGE IN LIGHT	133[B]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	123	133	VOLTS
TUBE VOLTAGE DROP (1) AT 40 MA.	---	108.5	114	VOLTS
TUBE VOLTAGE DROP (2) AT 30 MA.	---	---	113	VOLTS
TUBE VOLTAGE DROP (3) AT 5 MA.	103	107.8	---	VOLTS
REGULATION	---	0.7	4.0	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	---	15	MVAC
LEAKAGE CURRENT (E_b=50V.DC; R_p= 100 KΩ)	---	---	10	μA
SERIES RESISTOR	C	---	---	
SHUNT CAPACITOR	---	---	0.1	μfd
CURRENT THROUGH INTERCONNECTED LEADS	---	---	2.0	AMP.

[B] IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

[C] SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 40 MA.DC AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 5 MA.D.C. AT THE LOWEST ANODE SUPPLY VOLTAGE.



TUNG-SOL

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OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_2 IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_2}{R_1 + R_2} > V \text{ STARTING}$$

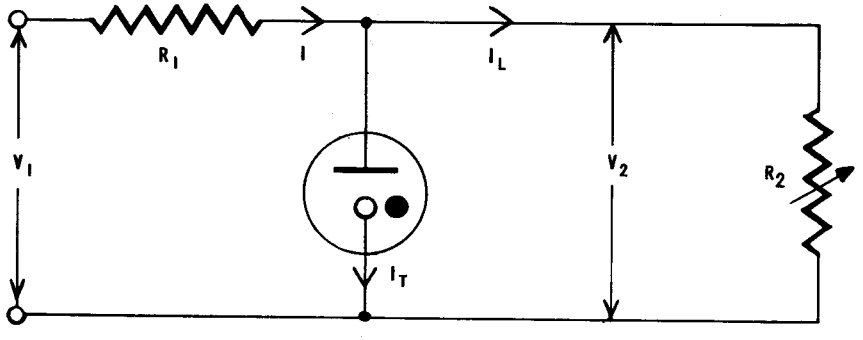

FIGURE 1

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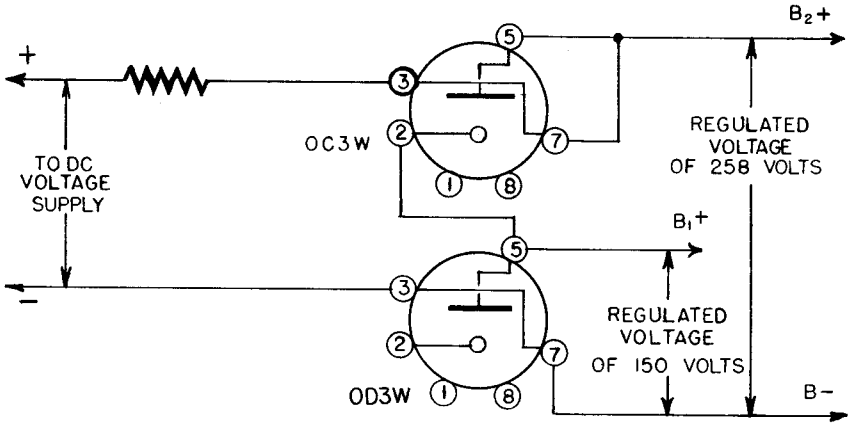

FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

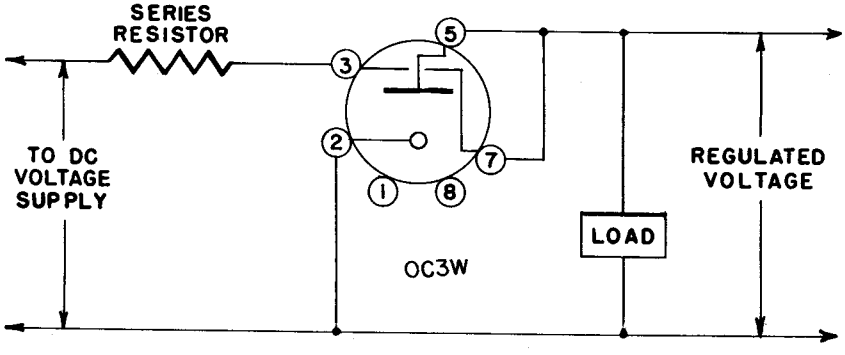

FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

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WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE OC3W SHOULD BE LIMITED IN VALUE TO 0.1 μf, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

OPERATION OF THE OC3W IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH OC3W TO EQUALIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.

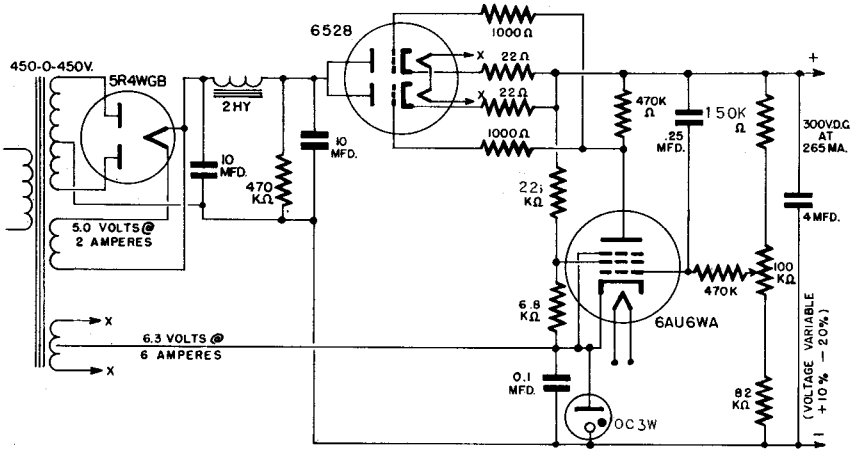
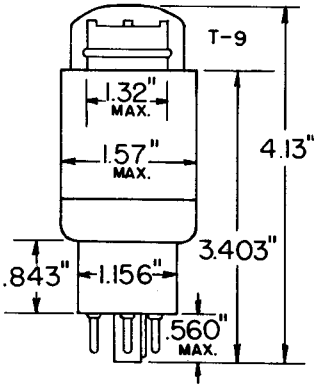


FIGURE 4

TYPICAL APPLICATION OF OC3W USED IN VOLTAGE REGULATED POWER SUPPLY

TUNG-SOL

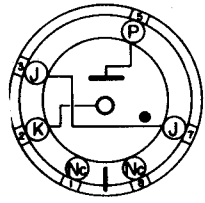
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL OCTAL
6 PIN

LOW LOSS
PHENOLIC MATERIAL

THE OD3W IS A TWO ELECTRODE, INERT GAS FILLED COLD CATHODE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 150 VOLTS OVER A CURRENT RANGE OF 5 TO 40 MILLIAMPERES.

THE OD3W IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE. TUBE ENVELOPE IS FLOATED WITHIN THE BASE SHELL BY A SPONGE RUBBER FILLER. THIS CUSHION DAMPENS VIBRATION AND DECREASES THE TRANSMISSION OF SHOCK TO THE ACTIVE TUBE ELEMENTS. BOTH THE BASING ARRANGEMENT AND HEAVY DUTY PARTS CONSTRUCTION MAKE THE OD3W ESPECIALLY SUITED FOR USE IN APPLICATIONS WHERE SEVERE MECHANICAL PUNISHMENT WILL BE ENCOUNTERED.

ELECTRICAL DATA

CATHODE	COLD	

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED HEIGHT	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
WEIGHT (APPROX.)	2	OUNCES
BULB (SEE OUTLINE)	T-9	
BASE	SPECIAL SKIRTED, SMALL SHELL OCTAL 6-PIN, LOW LOSS PHENOLIC MATERIAL	

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TUNG-SOL

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RATINGS
ABSOLUTE VALUES

MAXIMUM AVERAGE STARTING CURRENT[A]	100	MA.DC
MAXIMUM D.C. CATHODE CURRENT	40	MA.DC
MINIMUM D.C. CATHODE CURRENT	5	MA.DC
AMBIENT TEMPERATURE	−55 TO 70	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM INVERSE VOLTAGE	−50	VDC
SHOCK IMPACT	900	G/M SEC.
MAXIMUM VIBRATION RATING (D=0.08" @ 50 CPS)	10	G

[A] AVERAGE OVER A STARTING PERIOD NOT EXCEEDING 10 SECONDS. NORMAL OPERATION SHOULD BE CONTINUED FOR AT LEAST TWENTY MINUTES AFTER PASSING THIS CURRENT TO STABILIZE THE TUBE.

ADDITIONAL TESTS TO INSURE RELIABILITY
RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 60° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (900 G/MSEC.)

VIBRATION: 10–50–10 CPS, 0.08" TOTAL DISPLACEMENT, IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES. (10 G)

FATIGUE VIBRATION: 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES (2.5 G).

LIFE TEST 500 HOURS: $R_{p/}{}_{b}$= 30 MA. DC

POST SHOCK AND FATIGUE, AND LIFE TEST LIMITS:

IONIZATION VOLTAGE (MAX.)	185	VDC
TUBE VOLTAGE DROP (5 TO 30 MA.)	142 TO 163	VDC
REGULATION (5 TO 40 MA) (MAX.)	5.5	VDC
REGULATION (5 TO 30 MA) (MAX.)	4.5	VDC

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TUNG-SOL

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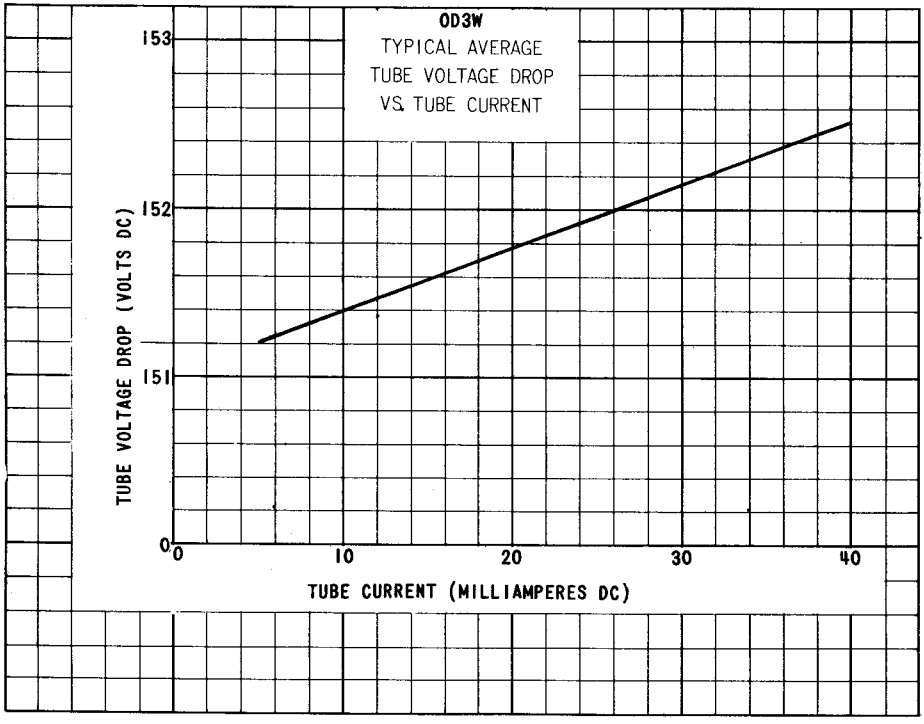
EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
D.C. ANODE SUPPLY VOLTAGE IN DARKNESS	225[B]	---	---	VOLTS
D.C. ANODE SUPPLY VOLTAGE IN LIGHT	185[B]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	158	185	VOLTS
TUBE VOLTAGE DROP (1) AT 40 MA.	---	153	165	VOLTS
TUBE VOLTAGE DROP (2) AT 30 MA.	---	---	163	VOLTS
TUBE VOLTAGE DROP (3) AT 5 MA.	142	151	---	VOLTS
REGULATION	---	2.0	5.5	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	15	MVAC
LEAKAGE CURRENT (E_b=50V.DC; R_p= 100 KΩ)	---	0	10	μA
SERIES RESISTOR	C	---	---	
SHUNT CAPACITOR	---	---	0.1	μfd
CURRENT THROUGH INTERCONNECTED LEADS	---	---	2.0	AMP.

[B] IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

[C] SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 40 MA.DC AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 5 MA.D.C. AT THE LOWEST ANODE SUPPLY VOLTAGE.



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OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_2 IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_2}{R_1 + R_2} > V \text{ STARTING}$$

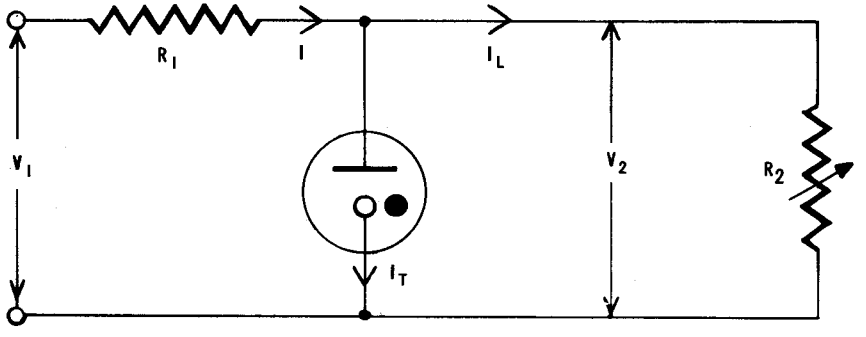

FIGURE 1

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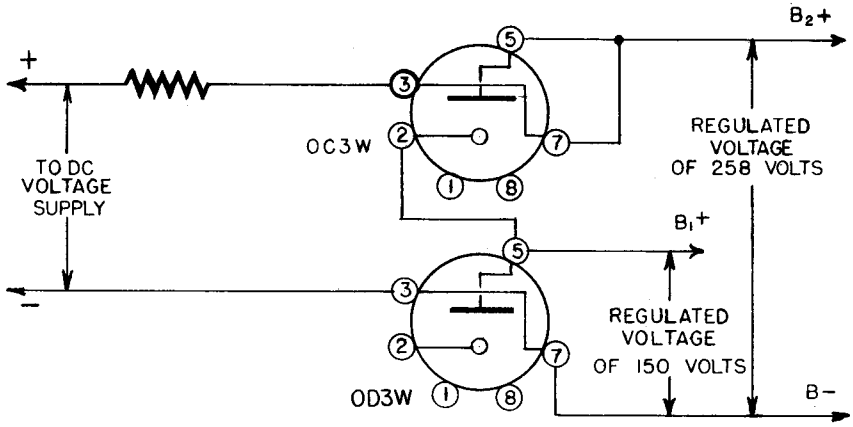

FIGURE 2 - OPERATION OF REGULATOR TUBES IN SERIES

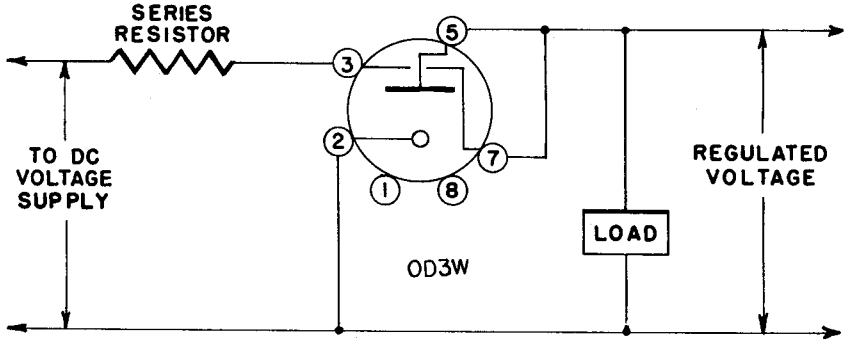

FIGURE 3 - TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

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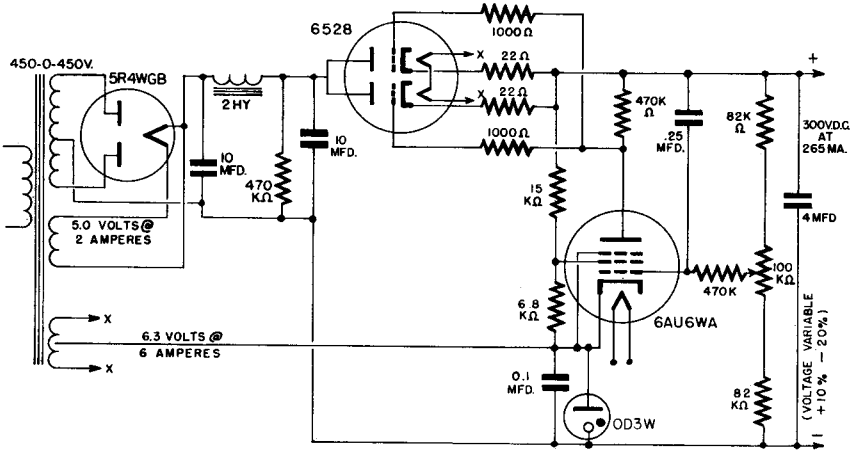

FIGURE 4

TYPICAL APPLICATION OF OD3W USED IN VOLTAGE REGULATED POWER SUPPLY

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GAS RECTIFIER

PHYSICAL SPECIFICATIONS

EMITTER IONICALLY HEATED	PIN CONNECTIONS	
BASE SMALL WAFER OCTAL 5-PIN	PIN 1 SHELL	PIN 7 FILAMENT
CAP ---	PIN 2 NONE	PIN 8 FILAMENT
BULB MT-8	PIN 3 STARTER ANODE	
MAX. DIAMETER 1 5/16"	PIN 4 NONE	MOUNTING POS. ANY
MAX. SEATED HEIGHT 2 1/16"	PIN 5 PLATE	
MAX. OVERALL LENGTH 2 5/8"	PIN 6 NONE	

THE OY4 IS A HALF-WAVE GAS RECTIFIER WITH A STARTER ANODE WHICH MAKES IT POSSIBLE TO OPERATE DIRECTLY FROM A 117-VOLT AC OR DC LINE.

RATINGS AND CHARACTERISTICS

HALF-WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

PINS 7 AND 8 MUST BE CONNECTED TOGETHER[A]

MAXIMUM INVERSE PEAK VOLTAGE	300	VOLTS
MAXIMUM PEAK CURRENT	500	MA.
MAXIMUM DC OUTPUT CURRENT	75	MA.
MINIMUM DC OUTPUT CURRENT	40	MA.
MINIMUM SERIES ANODE RESISTANCE (117-VOLT LINE OPERATION)	50	OHMS
APPROXIMATE TUBE DROP	12	VOLTS
MAXIMUM DC STARTING VOLTAGE[B]	95	VOLTS

[A] RAPID INTERMITTENT OPERATION IS UNDESIRABLE.

[B] WITH STARTER ANODE CONNECTED TO THE ANODE THROUGH A 10 MEGOHM RESISTOR BY-PASSED WITH A 0.002 μF CONDENSER.

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GAS RECTIFIER

PHYSICAL SPECIFICATIONS

EMITTER IONICALLY HEATED	PIN CONNECTIONS		
BASE OCTAL 5-PIN DWARF	PIN 1 NO CONNECTION	PIN 7 FILAMENT	
CAP ---	PIN 2 NONE	PIN 8 FILAMENT	
BULB T-7	PIN 3 STARTER ANODE		
MAX. DIAMETER 1 5/64"	PIN 4 NONE	MOUNTING POS. ANY	
MAX. SEATED HEIGHT 2 1/16"	PIN 5 PLATE		
MAX. OVERALL LENGTH 2 5/8"	PIN 6 NONE		

THE OY4G IS A HALF-WAVE GAS RECTIFIER WITH A STARTER ANODE WHICH MAKES IT POSSIBLE TO OPERATE DIRECTLY FROM A 117-VOLT AC OR DC LINE.

RATINGS AND CHARACTERISTICS

HALF-WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

PINS 7 AND 8 MUST BE CONNECTED TOGETHER[A]

MAXIMUM INVERSE PEAK VOLTAGE	300	VOLTS
MAXIMUM PEAK CURRENT	500	MA.
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APPROXIMATE TUBE DROP	12	VOLTS
MAXIMUM DC STARTING VOLTAGE[B]	95	VOLTS

[A] RAPID INTERMITTENT OPERATION IS UNDESIRABLE.

[B] WITH STARTER ANODE CONNECTED TO THE ANODE THROUGH A 10 MEGOHM RESISTOR BY-PASSED WITH A 0.002 MF CONDENSER.

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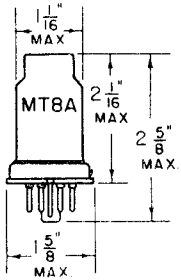
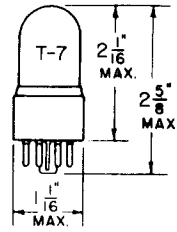
FULL WAVE GAS FILLED RECTIFIER

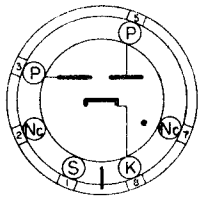


0Z4

COLD CATHODE TYPE

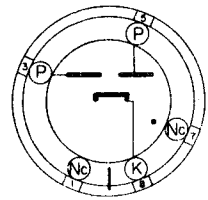


0Z4G



BOTTOM VIEW

SMALL WAFER
6 PIN OCTAL BASE



BOTTOM VIEW

DWARF SHELL
5 PIN OCTAL BASE

THE 0Z4 AND 0Z4G ARE FULL WAVE GAS FILLED RECTIFIER TUBES WITH COLD CATHODES REQUIRING NO HEATER SUPPLY VOLTAGE. THEY ARE USED WHERE HIGH OVERALL EFFICIENCY IS DESIRED.

MAXIMUM RATINGS

MINIMUM PEAK STARTING SUPPLY VOLTAGE PER PLATE	300	VOLTS
MAXIMUM PEAK PLATE TO PLATE VOLTAGE	1000	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	200	MA.
MAXIMUM DC OUTPUT CURRENT	75	MA.
MINIMUM DC OUTPUT CURRENT	30	MA.
MAXIMUM DC OUTPUT VOLTAGE	300	VOLTS
TUBE VOLTAGE DROP	24	VOLTS

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1944

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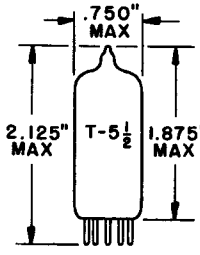
DIODE

MINIATURE TYPE



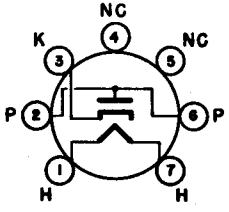
GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

FOR
USE IN PORTABLE FM RECEIVERS
AND PORTABLE HF MEASURING
EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5AP

THE 1A3 IS AN INDIRECTLY HEATED DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS PARTICULARLY USEFUL AS A DISCRIMINATOR TUBE IN PORTABLE FM RECEIVERS, AND IN PORTABLE HF MEASURING EQUIPMENT. THE RESONANT FREQUENCY OF THE 1A3 IS APPROXIMATELY 1000 MC/S.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE TO CATHODE (P TO K)	0.4	pf
PLATE TO HEATER (P TO H)	0.8	pf
HEATER TO CATHODE (H TO K)	0.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.4	VOLTS	150	MA.
LIMITS OF APPLIED VOLTAGE			1.4±0.2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE, DC:			140	VOLTS

RATINGS - RECTIFIER SERVICE

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

MAXIMUM PEAK INVERSE PLATE VOLTAGE,	330	VOLTS
MAXIMUM PEAK PLATE CURRENT	5	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

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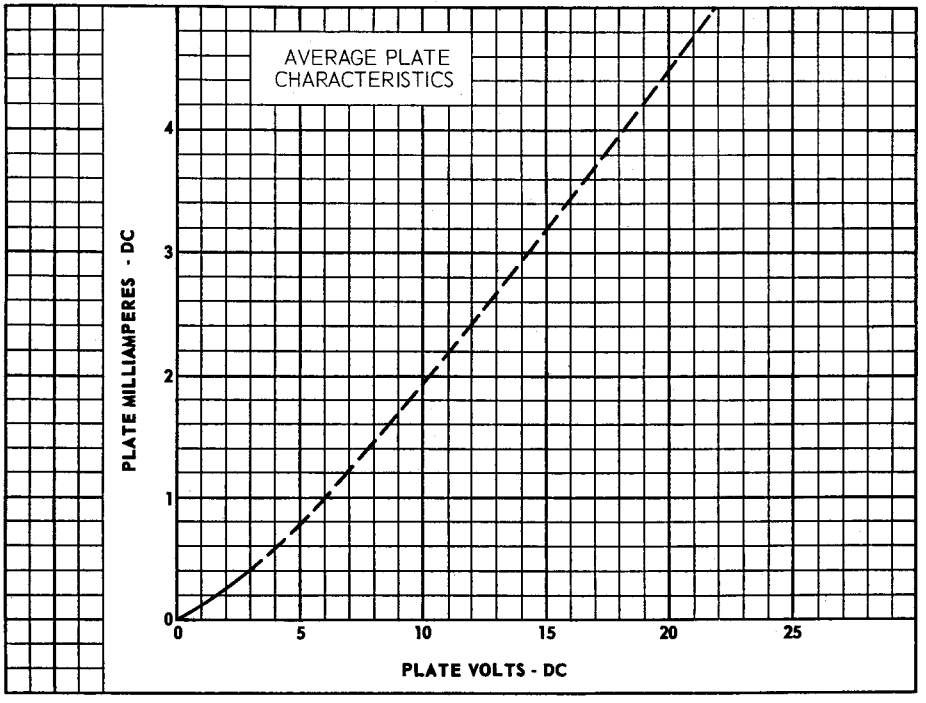
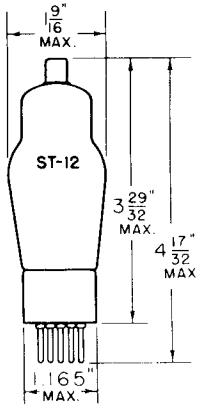
TYPICAL OPERATION WITH CONDENSER-INPUT FILTER

AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
FILTER INPUT CONDENSER	2	μf
MIN. TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	0	OHMS



TUNG-SOL



1A4P
SMALL METAL CAP
SMALL 4 PIN BASE

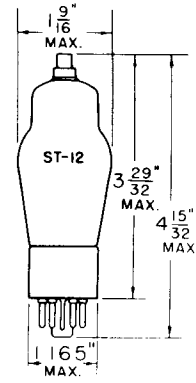
REMOTE CUT-OFF
PENTODE AMPLIFIER

COATED FILAMENT

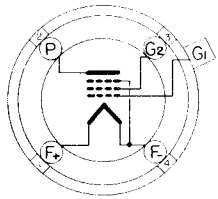
2.0 VOLTS 0.060 AMPERE

AC OR DC

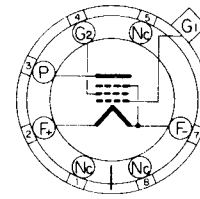
GLASS BULB



1D5GP
MINIATURE METAL CAP
SMALL 7 PIN OCTAL BASE



BOTTOM VIEW



BOTTOM VIEW

THESE TUBES ARE REMOTE CUT-OFF PENTODE AMPLIFIERS DESIGNED FOR USE IN BATTERY OPERATED RECEIVERS. EITHER TUBE IS SUITABLE FOR USE WITH AUTOMATIC VOLUME CONTROL IN RF AND IF AMPLIFIERS WITH A MINIMUM OF CROSS MODULATION.

MOUNTING POSITION

THESE TUBES SHOULD BE OPERATED VERTICALLY WITH THE BASE DOWN. HOWEVER, HORIZONTAL OPERATIONS MAY BE PERMITTED IN THE 1D5GP TUBE TYPE IF PINS 2 AND 7 ARE ON A VERTICAL PLANE. THE SAME WILL BE TRUE FOR THE 1A4P TUBE TYPE IF PINS 1 AND 4 ARE ON A VERTICAL PLANE.

DIRECT INTERELECTRODE CAPACITANCES

MAXIMUM CONTROL GRID TO PLATE (WITH EXTERNAL SHIELD)	0.007	μμf
INPUT (G_1 TO G_2, G_3, F)	5.0	μμf
OUTPUT (P TO G_2, G_3, F)	11	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	90	180 MAX.	VOLTS
SCREEN VOLTAGE	67.5	67.5 MAX.	VOLTS
MINIMUM CONTROL GRID VOLTAGE	−3	−3	VOLTS
PLATE CURRENT	2.2	2.3	MA.
SCREEN CURRENT	0.9	0.8	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
TRANSCONDUCTANCE	720	750	μMHOS
AMPLIFICATION FACTOR (APPROX.)	425	750	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE OF 15 μMHOS	−15	−15	VOLTS

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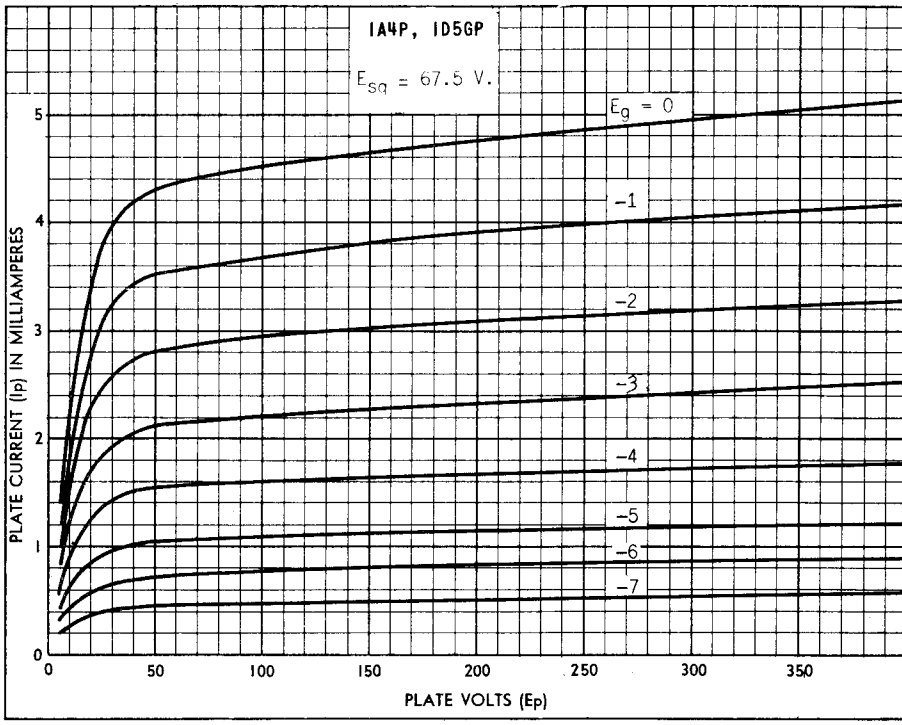

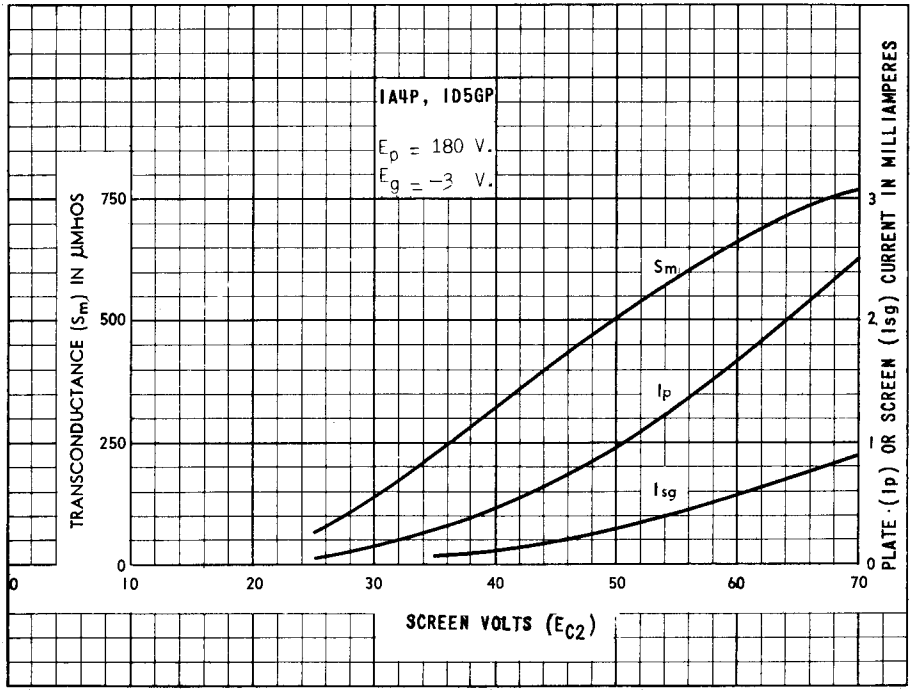

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1A4P (1D5GP)

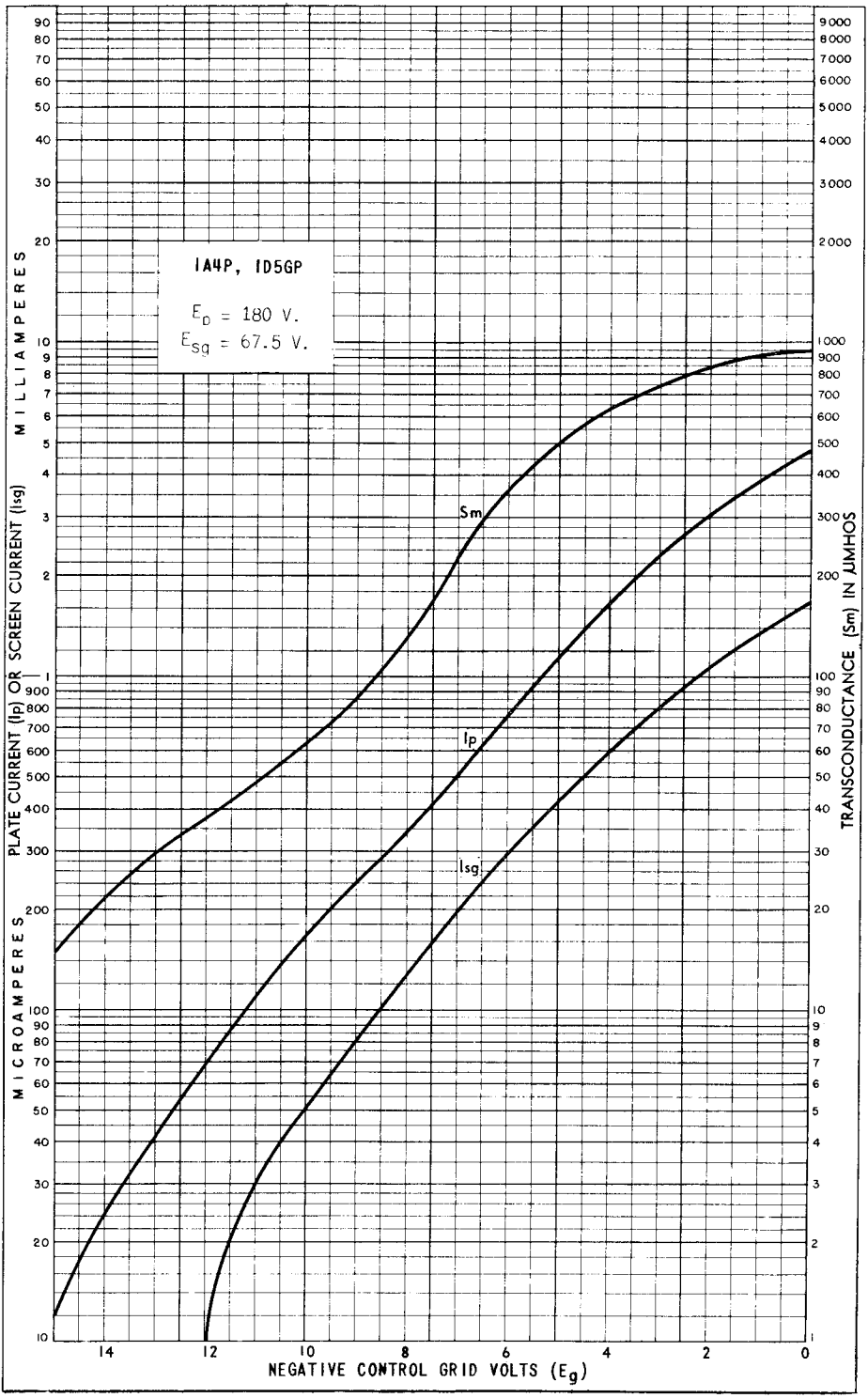

PLATE
1457
AUG. 31
1944

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TUNG-SOL

PENTODE POWER AMPLIFIER

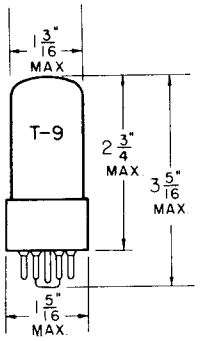
COATED FILAMENT

1.4 VOLTS 0.05 AMPERE

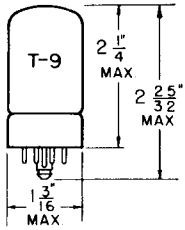
DC

GLASS BULB

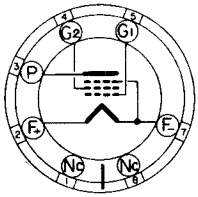
ANY MOUNTING POSITION



1A5GT/G



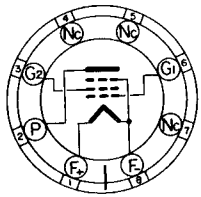
1LA4



BOTTOM VIEW

INTERMEDIATE SHELL

7-PIN OCTAL BASE



BOTTOM VIEW

LOCKING-IN

8-PIN

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	6.0	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	85	90	VOLTS
SCREEN VOLTAGE	85	90	VOLTS
GRID VOLTAGE [A]	-4.5	-4.5	VOLTS
PEAK A-F GRID VOLTAGE	4.5	4.5	VOLTS
ZERO-SIG. PLATE CURRENT	3.5	4.0	MA.
MAXIMUM SIG. PLATE CURRENT	3.5	4.0	MA.
ZERO-SIG. SCREEN CURRENT	0.7	0.8	MA.
MAXIMUM SIG. SCREEN CURRENT	1.0	1.1	MA.
PLATE RESISTANCE	0.3	0.3	MEGOHM
TRANSCONDUCTANCE	800	850	µMHOS
LOAD RESISTANCE	25 000	25 000	OHMS
TOTAL HARMONIC DISTORTION	10	7.0	PER CENT
MAXIMUM SIG. POWER OUTPUT	100	115	MW.

[A] RETURN TO NEGATIVE FILAMENT

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PLATE 1523

JAN. 15 1945

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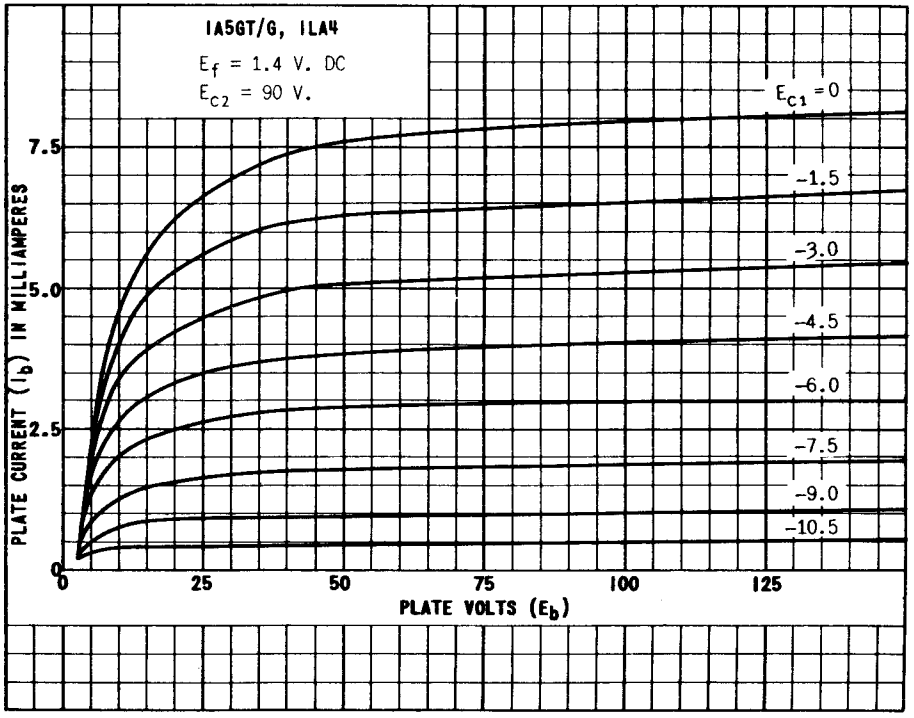
1A5GT/G (1LA4)



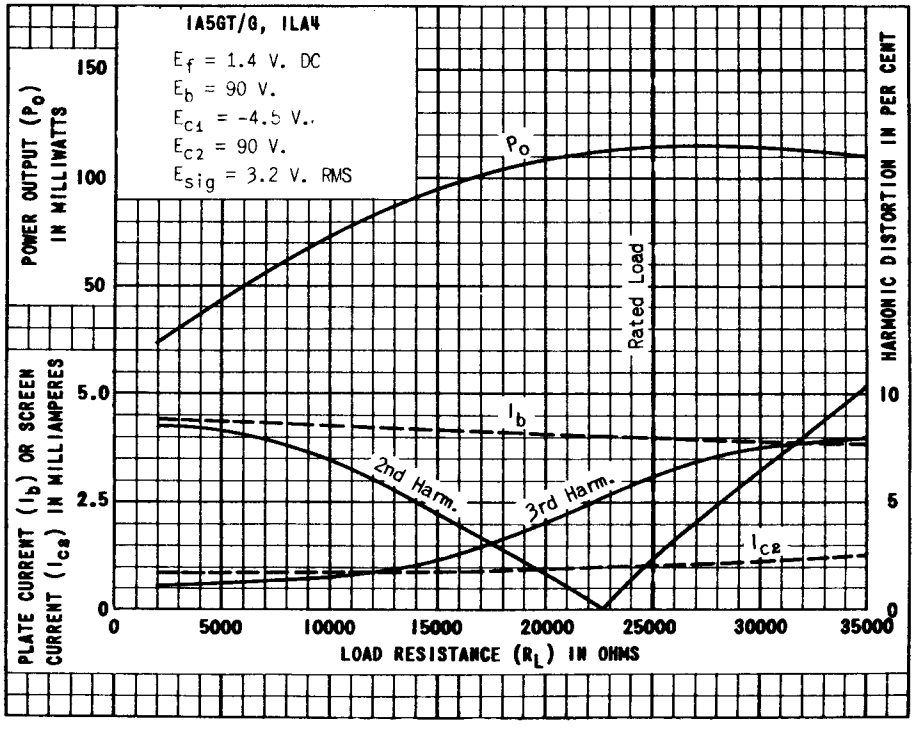


PLATE 1524
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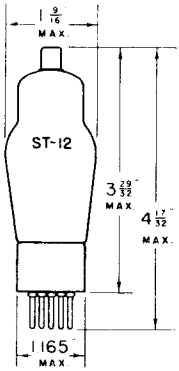
TUNG-SOL



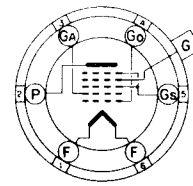
PENTAGRID CONVERTER

COATED FILAMENT

2.0 VOLTS 0.06 AMPERE
DC

GLASS BULB

SMALL 6 PIN BASE



6L

BOTTOM VIEW

THE TUNG-SOL 1A6 IS A COMBINED OSCILLATOR AND MIXER DESIGNED FOR SERVICE AS THE FIRST DETECTOR IN BATTERY OPERATED SUPERHETERODYNE RECEIVERS WHERE ECONOMY IN FILAMENT CURRENT CONSUMPTION IS DESIRED. WITH THE EXCEPTION OF CAPACITANCES ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 107G.

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE (P) VOLTAGE MAX.	180	VOLTS
SCREEN (G_S) VOLTAGE MAX.	67.5	VOLTS
ANODE GRID (G_A) VOLTAGE MAX.	135	VOLTS
ANODE GRID (G_A) VOLTAGE SUPPLY MAX.	180 [A]	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	−3	VOLTS
TOTAL CATHODE CURRENT MAX.	9	MA.

CONVERTER SERVICE

PLATE (P) VOLTAGE	135	180	VOLTS
SCREEN (G_S) VOLTAGE	67.5	67.5	VOLTS
ANODE GRID (G_A) VOLTAGE	135	135	VOLTS
ANODE GRID (G_A) SUPPLY VOLTAGE	135	180 [A]	VOLTS
CONTROL GRID (G) VOLTAGE	−3	−3	VOLTS
OSCILLATOR GRID RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.2	1.3	MA.
SCREEN CURRENT	2.5	2.4	MA.
ANODE GRID CURRENT	2.3	2.3	MA.
OSCILLATOR GRID CURRENT	0.2	0.2	MA.
TOTAL CATHODE CURRENT	6.2	6.2	MA.
PLATE RESISTANCE	0.4	0.5	MEGOHM
CONVERSION CONDUCTANCE	275	300	μMHOS
CONTROL GRID (G) VOLTAGE APPROX.	−22.5	−22.5	VOLTS

FOR CONVERSION CONDUCTANCE = 4 μMHOS

[A] APPLIED THROUGH 20 000 OHM DROPPING RESISTOR.

PLATE 378-1

APR. 14 1939

CONTINUED NEXT PAGE

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STATIC CHARACTERISTICS OF OSCILLATOR SECTION – NOT OSCILLATING

PLATE (P) VOLTAGE	135 TO 180	VOLTS
SCREEN (G_S) VOLTAGE	67.5	VOLTS
ANODE GRID (G_A) VOLTAGE	135	VOLTS
CONTROL GRID (G) VOLTAGE	-3	VOLTS
OSCILLATOR GRID (G_O) VOLTAGE	0	VOLTS
TRANSCONDUCTANCE – OSCILLATOR GRID (G_O) TO ANODE GRID (G_A)	425	μMHOS
ANODE GRID CURRENT	2.3	MA.

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID (G) TO PLATE (P)[S]	0.26	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)[S]	0.1	μμf
CONTROL GRID (G) TO ANODE GRID (G_A)[S]	0.2	μμf
OSCILLATOR GRID (G_O) TO ANODE GRID (G_A)	0.8	μμf
RF INPUT ELECTRODE, GRID (G) TO ALL OTHER ELECTRODES	10.5	μμf
OSC. INPUT ELECTRODE, GRID (G_O) TO ALL OTHER ELECTRODES	5.0	μμf
OSC. OUTPUT ELECTRODE, GRID (G_A) TO ALL OTHER ELECTRODES	6.0	μμf
MIXER OUTPUT ELECTRODE, PLATE (P) TO ALL OTHER ELECTRODES	9.0	μμf

[S] WITH SHIELD

PLATE
379-1

TUNG-SOL

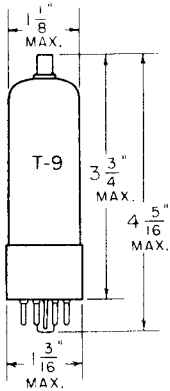
PENTAGRID CONVERTER

COATED FILAMENT

1.4 VOLTS 0.05 AMPERE DC

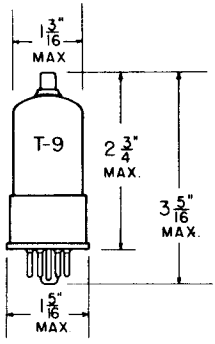
GLASS BULB

ANY MOUNTING POSITION



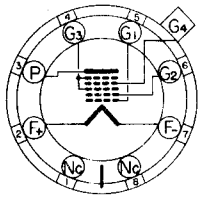
1A7G

SKIRTED MINIATURE CAP



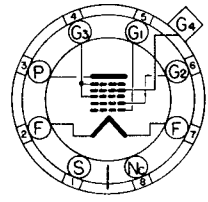
1A7GT

SKIRTED MINIATURE CAP



BOTTOM VIEW

SMALL 8 PIN OCTAL BASE



BOTTOM VIEW

SMALL WAFER 8 PIN OCTAL BASE WITH METAL SHELL

THE 1A7G AND 1A7GT ARE FILAMENT TYPE PENTAGRID CONVERTERS DESIGNED FOR SERVICE AS COMBINED OSCILLATORS AND MIXERS IN PORTABLE BATTERY OPERATED EQUIPMENT. THEY FEATURE HIGH EFFICIENCY FILAMENTS AND PROVIDE REASONABLE CONVERSION GAINS WITH LOW BATTERY VOLTAGES AND LOW ELECTRON CURRENTS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN (G3 AND G5) VOLTAGE	60	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	110	VOLTS
MAXIMUM ANODE-GRID (G2) VOLTAGE	110	VOLTS
MAXIMUM TOTAL ZERO-SIGNAL CATHODE CURRENT	4.0	MA.

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PLATE 1491
OCT. 31 1944

CONTINUED ON NEXT PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO NEGATIVE FILAMENT TERMINAL

GRID #4 TO PLATE	0.5 MAX.	μμf
GRID #4 TO GRID #2	0.4 MAX.	μμf
GRID #4 TO GRID #1	0.2 MAX.	μμf
GRID #1 TO GRID #2	0.9	μμf
GRID #4 TO ALL OTHER ELECTRODES (R-F INPUT)	7.0	μμf
GRID #2 TO ALL OTHER ELECTRODES EXCEPT GRID #1 (OSCILLATOR OUTPUT)	4.4	μμf
GRID #1 TO ALL OTHER ELECTRODES EXCEPT GRID #2 (OSCILLATOR INPUT)	3.4	μμf
PLATE TO ALL OTHER ELECTRODES (MIXER OUTPUT)	10	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE VOLTAGE	90	VOLTS
SCREEN (G2 AND G5) VOLTAGE[A]	45	VOLTS
ANODE-GRID (G2) VOLTAGE	90	VOLTS
CONTROL-GRID (G4) VOLTAGE[B]	0	VOLTS
OSCILLATOR-GRID (G1) RESISTOR	200 000	OHMS
PLATE RESISTANCE	0.6	MEGOHM
CONVERSION TRANSCONDUCTANCE	250	μMHOS
CONVERSION TRANSCONDUCTANCE WITH GRID #4 BIAS OF -3 VOLTS	5.0 APPROX.	μMHOS
PLATE CURRENT	0.6	MA.
SCREEN (G3 AND G5) CURRENT	0.7	MA.
ANODE-GRID (G2) CURRENT	1.2	MA.
OSCILLATOR-GRID (G1) CURRENT	0.035	MA.
TOTAL CATHODE CURRENT	2.5	MA.

THE TRANSCONDUCTANCE OF THE OSCILLATOR PORTION (NOT OSCILLATING) IS 550 MICROMHOS UNDER THE FOLLOWING CONDITIONS: PLATE VOLTS, 90; SCREEN VOLTS, 45; CONTROL-GRID VOLTS, 0; ANODE-GRID VOLTS, 90; AND OSCILLATOR-GRID VOLTS, 0.

[A] OBTAINED PREFERABLY BY USING A PROPERLY BY-PASSED 45 000 TO 75 000 OHM VOLTAGE-DROPPING RESISTOR IN SERIES WITH THE 90 VOLT SUPPLY.

[B] A RESISTANCE OF AT LEAST 1.0 MEGOHM SHOULD BE USED IN THE GRID RETURN TO NEGATIVE FILAMENT PIN.

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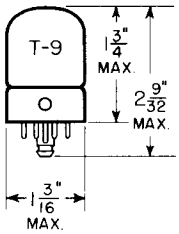
TUNG-SOL

PENTODE

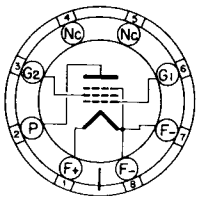


GLASS BULB

COATED FILAMENT

FILAMENT
1.2 VOLTS 130 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
5BF

THE 1AB5 IS A FILAMENTARY TYPE PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE AS A MIXER OR RF AMPLIFIER IN CIRCUITS REQUIRING A TUBE WITH HIGHER TRANSCONDUCTANCE THAN THE 1LN5.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED TO NEGATIVE FILAMENT

GRID TO PLATE: (G_1 TO P) MAX.	0.25	μμf
INPUT: G_1 TO ($F+G_2+G_3$)	2.8	μμf
OUTPUT: P TO ($F+G_2+G_3$)	4.2	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.2	VOLTS
FILAMENT CURRENT	130	MA.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM GRID #2 DISSIPATION	0.3	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.2	1.2	VOLTS
FILAMENT CURRENT	130	130	MA.
PLATE VOLTAGE	90	150	VOLTS
GRID #2 VOLTAGE	90	150	VOLTS
GRID #1 VOLTAGE	0[A]	-1.5	VOLTS
GRID #1 RESISTOR (SELF BIAS)	---	170	OHMS
PLATE RESISTANCE (APPROX.)	0.275	0.125	MEGOHM
TRANSCONDUCTANCE	1 100	1 350	μMHOS
PLATE CURRENT	3.5	6.8	MA.
GRID #2 CURRENT	0.8	2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	-14	-23	VOLTS
GRID #1 VOLTAGE (APPROX.) FOR G_m = 725 μMHOS	-3	-6	VOLTS

[A] GRID #1 RESISTOR SHOULD BE 1 MEGOHM UNDER CONDITIONS OF ZERO-BIAS.

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NOV. 1, 1949

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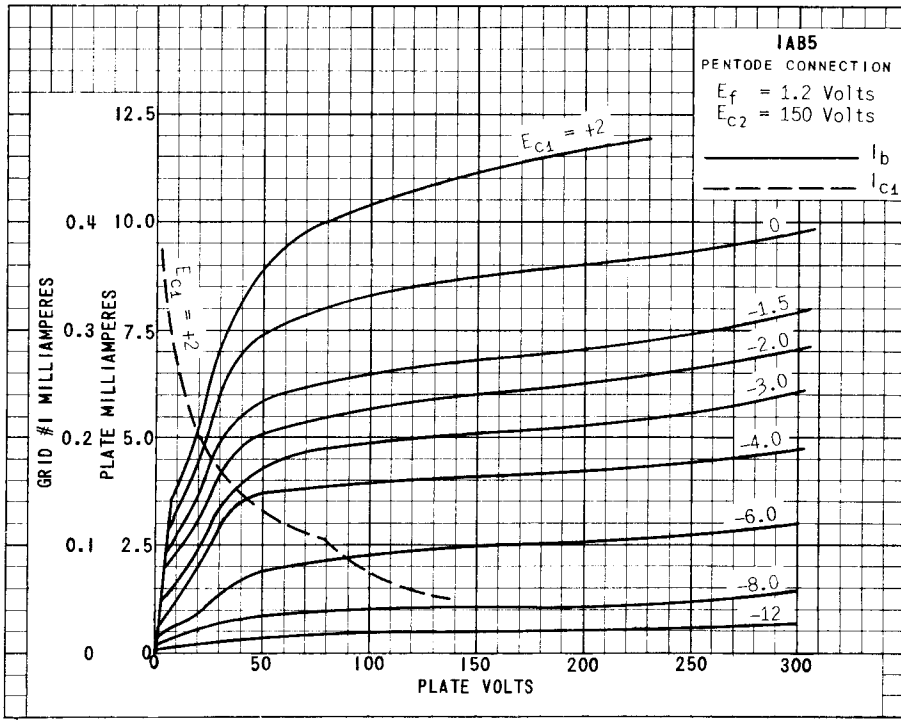
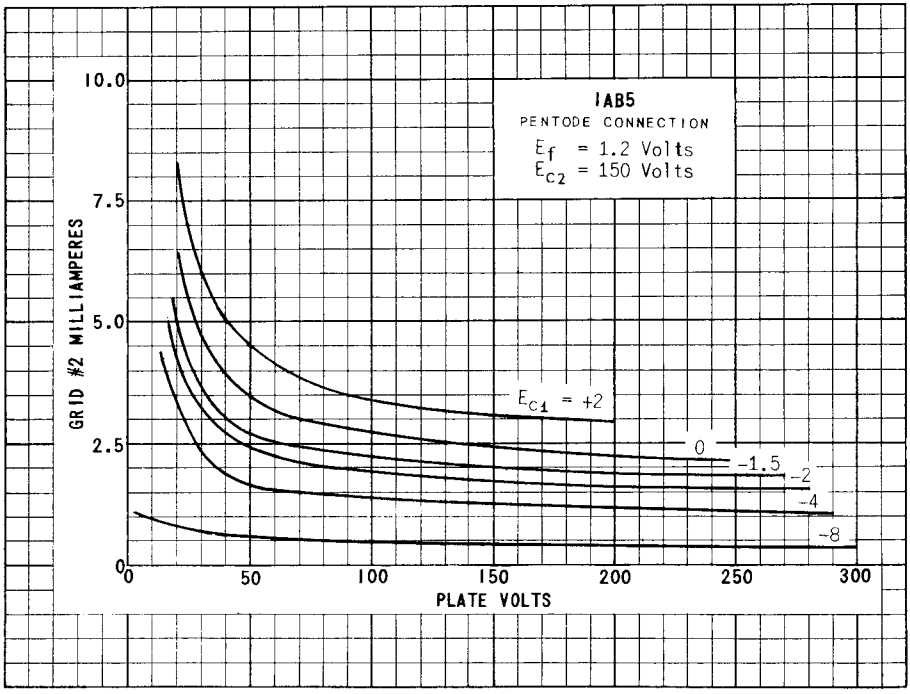
1AB5





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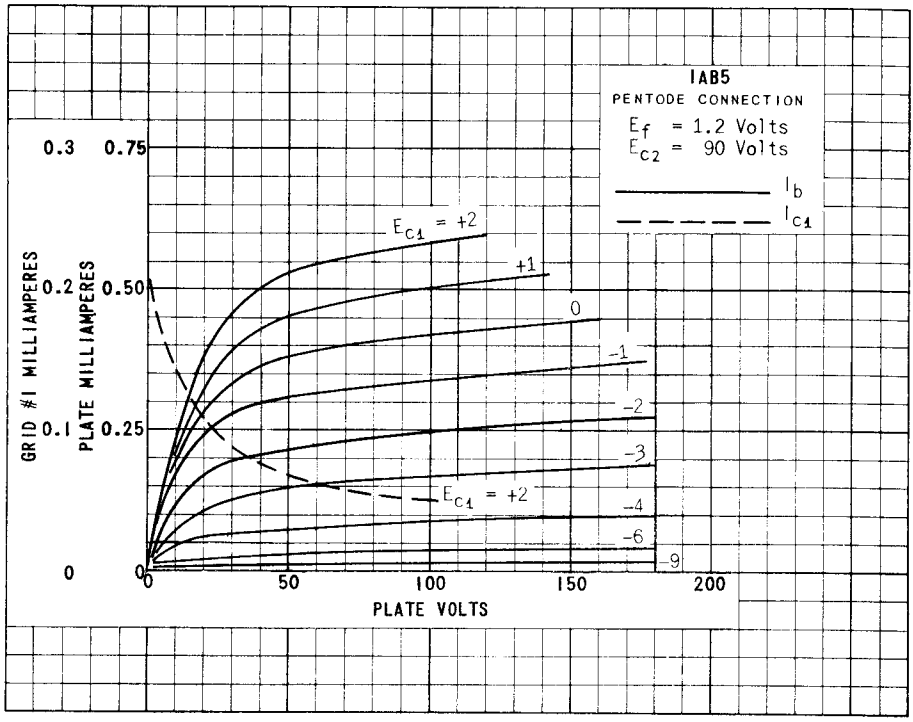

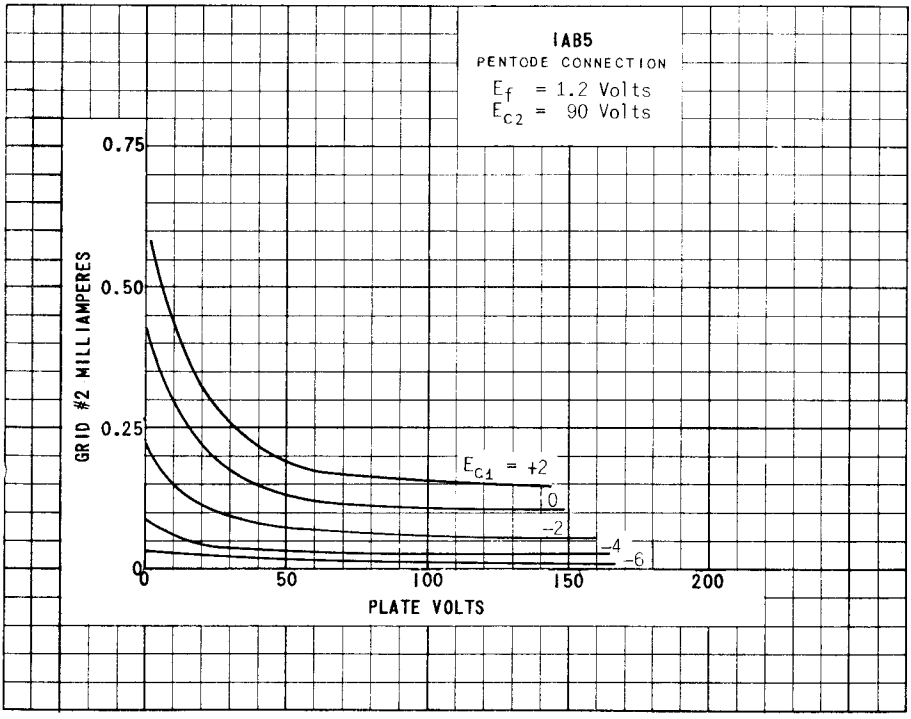

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PLATE
2265
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1949

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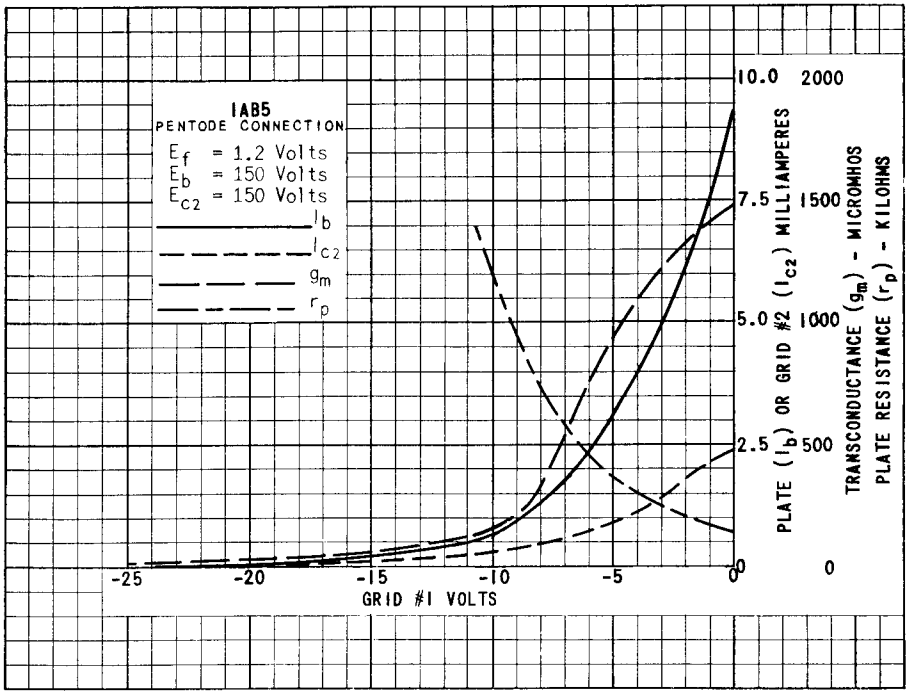
1AB5



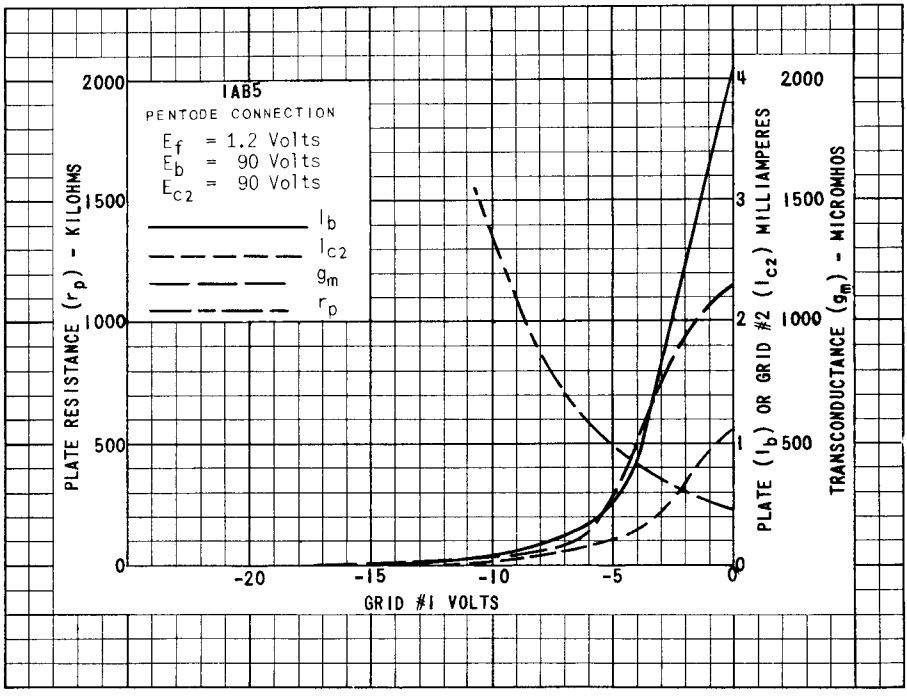


PLATE 2266
NOV. 1, 1949

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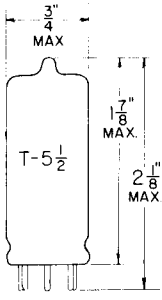
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

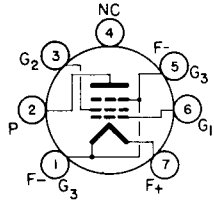
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

FILAMENT

1.25±0.19 VOLTS 0.1 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6AR

THE 1AE4 IS A FILAMENT TYPE SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR RF APPLICATIONS IN PORTABLE EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #313

GRID #1 TO PLATE (MAX.)	0.008	pf
INPUT	3.6	pf
OUTPUT	4.4	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE (DC)	1.25±0.19	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM GRID #1 VOLTAGE		
NEGATIVE-BIAS VALUE	50	VOLTS
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	11	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE	0.5	MEGOHM
TRANSCONDUCTANCE	1550	μMHOS
PLATE CURRENT	3.5	MA.
GRID #2 CURRENT	1.2	MA.
GRID #1 VOLTAGE (APPROX. FOR Ib = 50 μA)	-5	VOLTS

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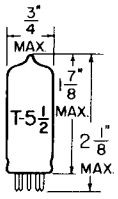
TUNG-SOL

PENTODE

MINIATURE TYPE

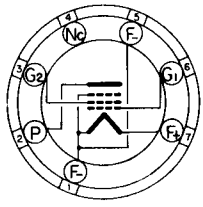


GLASS BULB

COATED FILAMENT

1.4 VOLTS 25 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6AR

THE 1AF4 IS A FILAMENTARY TYPE VOLTAGE AMPLIFIER PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE IN PORTABLE RECEIVERS AS AN AF OR RF AMPLIFIER. THE FILAMENT POWER CONSUMPTION HAS BEEN CUT IN HALF WITH RESPECT TO TUBES PREVIOUSLY USED IN THIS SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE: (G_1 TO P) MAX.	0.008	0.008	μμf
INPUT: G_1 TO (F&G_3&IS+G_2)	3.8	3.8	μμf
OUTPUT: P TO (F&G_3&IS+G_2)	7.5	7.6	μμf

[A] SHIELD #316 CONNECTED TO PINS 1 AND 5.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	110	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	2.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	25	25	MA.
PLATE VOLTAGE	67.5	90	VOLTS
GRID #2 VOLTAGE	67.5	90	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
PLATE RESISTANCE	2	1.8	MEGOHMS
TRANSCONDUCTANCE	825	950	μMHOS
PLATE CURRENT	1	1.65	MA.
GRID #2 CURRENT	0.3	0.5	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS	-2.5	-3.5	VOLTS

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PLATE 2429
JULY 1 1950

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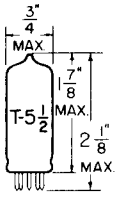
TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

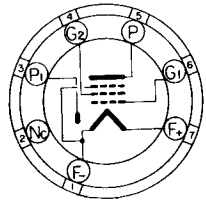


GLASS BULB

COATED FILAMENT

1.4 VOLTS 25 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6AU

THE 1AF5 IS A FILAMENTARY TYPE DIODE PENTODE VOLTAGE AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE IN PORTABLE RECEIVERS AS A DETECTOR AND AF AMPLIFIER. THE FILAMENT POWER CONSUMPTION HAS BEEN CUT IN HALF WITH RESPECT TO TUBES PREVIOUSLY USED IN THIS SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE: (G_1 TO P)	0.2	0.2	μμf
INPUT: G_1 TO ($F\&G_3+G_2$)	2.3	2.5	μμf
OUTPUT: P TO ($F\&G_3+G_2$)	2.4	4.3	μμf
DIODE TO GRID #1: (P_1 TO G_1) MAX.	0.03	0.03	μμf

[A] SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	2.5	MA.
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	0.25	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	25	25	MA.
PLATE VOLTAGE	67.5	90	VOLTS
GRID #2 VOLTAGE	67.5	90	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
PLATE RESISTANCE	2.3	2	MEGOHMS
TRANSCONDUCTANCE	500	600	μMHOS
PLATE CURRENT	0.7	1.1	MA.
GRID #2 CURRENT	0.25	0.4	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS	-2.5	-3.5	VOLTS
AVERAGE DIODE CURRENT WITH 10 VOLTS DC APPLIED	0.7	0.7	MA.

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PLATE 2430
JULY 1 1950

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TUNG-SOL

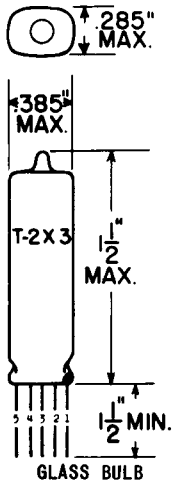
PENTODE

SUBMINIATURE TYPE

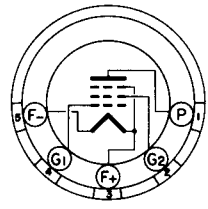
COATED FILAMENT

1.25 VOLTS 0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB
COLORED DOT IS ADJACENT TO LEAD 1



BOTTOM VIEW
0.016" TINNED FLEXIBLE LEADS
LENGTH: 1.5" MIN.
SPACING: 0.048" CENTER-TO-CENTER

GRID #3 IS COMPOSED OF TWO SEPARATE DEFLECTOR PLATES, ONE OF WHICH IS CONNECTED TO LEAD 3 & THE OTHER TO LEAD 5.

THE 1AG4 IS A FILAMENT TYPE POWER PENTODE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR USE IN THE OUTPUT STAGE IN BATTERY OPERATED RECEIVERS. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE (DC)	1.25	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT (ZERO SIGNAL)	4	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE (DC)	1.25	VOLTS
FILAMENT CURRENT	0.04	AMP.
PLATE VOLTAGE	41.4	VOLTS
GRID #2 VOLTAGE	41.4	VOLTS
GRID #1 VOLTAGE	-3.6	VOLTS
PEAK AF GRID #1 VOLTAGE	3.6	VOLTS
PLATE RESISTANCE	.18	MEGOHM
TRANSCONDUCTANCE	1 000	μMHOS
ZERO-SIGNAL PLATE CURRENT	2.4	MA.
ZERO-SIGNAL GRID #2 CURRENT	0.6	MA.
LOAD RESISTANCE	12 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	12	PERCENT
POWER OUTPUT	35	MW.

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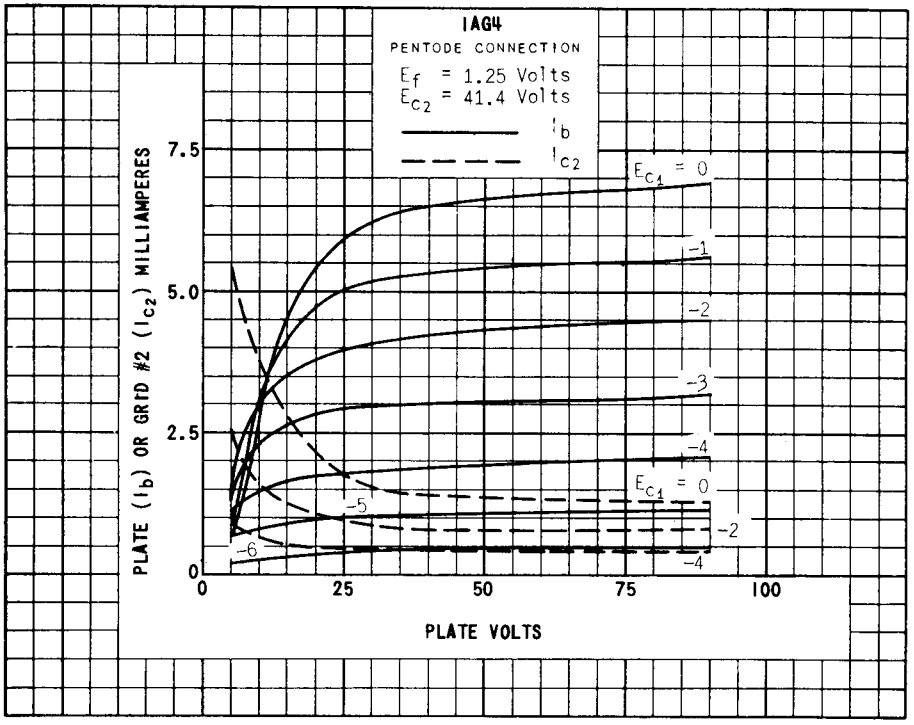
1AG4



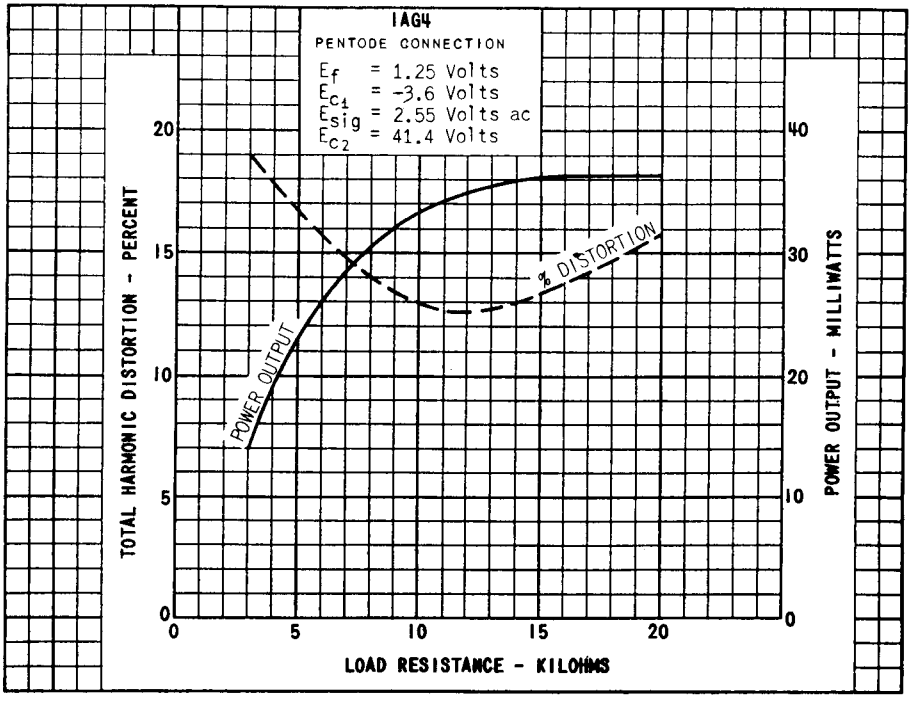
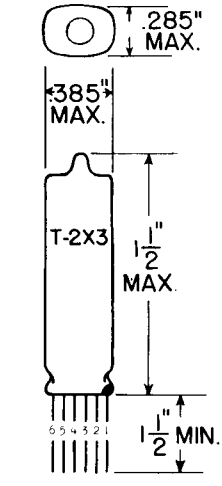


PLATE #4263 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

DIODE PENTODE

SUBMINIATURE TYPE

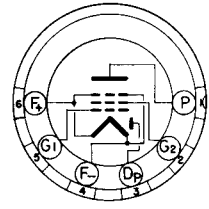


GLASS BULB

COLORED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT
1.25 VOLTS .03 AMP.
DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS
LENGTH: 1.5" MIN.
SPACING: 0.048" CENTER-TO-CENTER

GRID #3 IS COMPRISED OF TWO SEPARATE DEFLECTOR PLATES, ONE OF WHICH IS CONNECTED TO LEAD 4 AND THE OTHER TO LEAD 6.

THE 1AG5 IS A FILAMENT TYPE DIODE-PENTODE DESIGNED FOR USE IN APPLICATIONS REQUIRING EXTREME ECONOMY OF SPACE, WEIGHT, AND BATTERY DRAIN. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.020" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH CLOSE FITTING SHIELD CONNECTED TO LEAD 4

GRID TO PLATE: (G1 TO P)	0.10	μμf
INPUT: G1 TO (F+G2+G3)	1.7	μμf
OUTPUT: P TO (F+G2+G3)	2.4	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

MAXIMUM FILAMENT VOLTAGE (DC)	1.25±20%	VOLTS
MAXIMUM PLATE VOLTAGE	50	VOLTS
MAXIMUM GRID #2 VOLTAGE	50	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	0.5	MA.
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION[A]	0.25	MA.

[A] THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

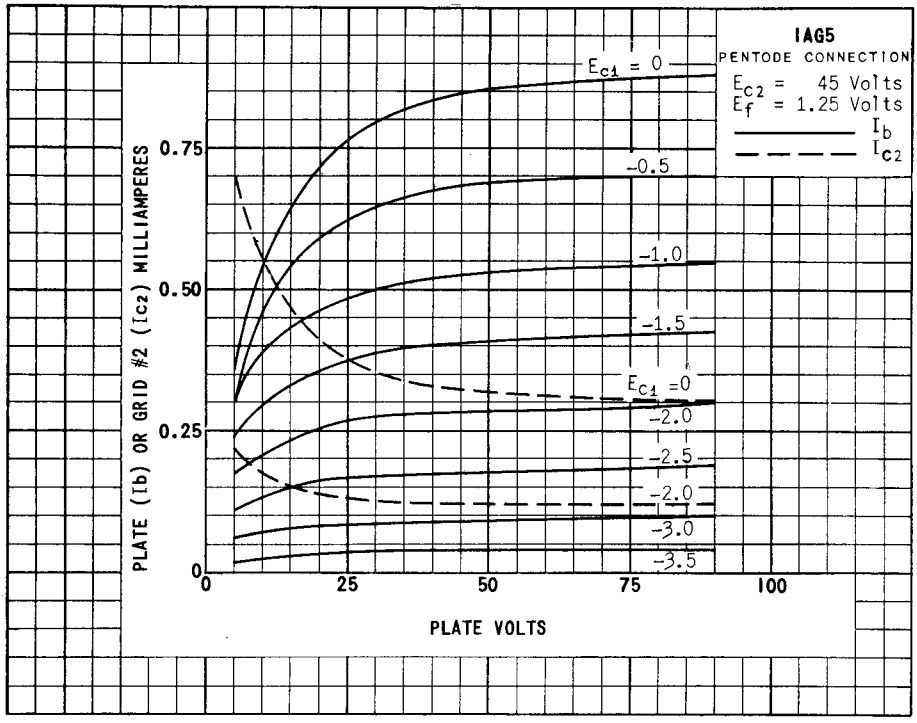
FILAMENT VOLTAGE (DC)	1.25	1.25	VOLTS
FILAMENT CURRENT	.03	.03	AMP.
PLATE VOLTAGE	22.5	45	VOLTS
GRID #2 VOLTAGE	22.5	45	VOLTS
GRID #1 VOLTAGE	0	-2.0	VOLTS
PLATE RESISTANCE	0.7	2.5	MEGOHM
TRANSCONDUCTANCE	235	250	μMHOS
PLATE CURRENT	0.17	0.28	MA.
GRID #2 CURRENT	0.043	0.12	MA.
GRID #1 RESISTOR	5	0	MEGOHM
MINIMUM DIODE CURRENT AT 10 VOLTS DC[A]	0.5		MA.

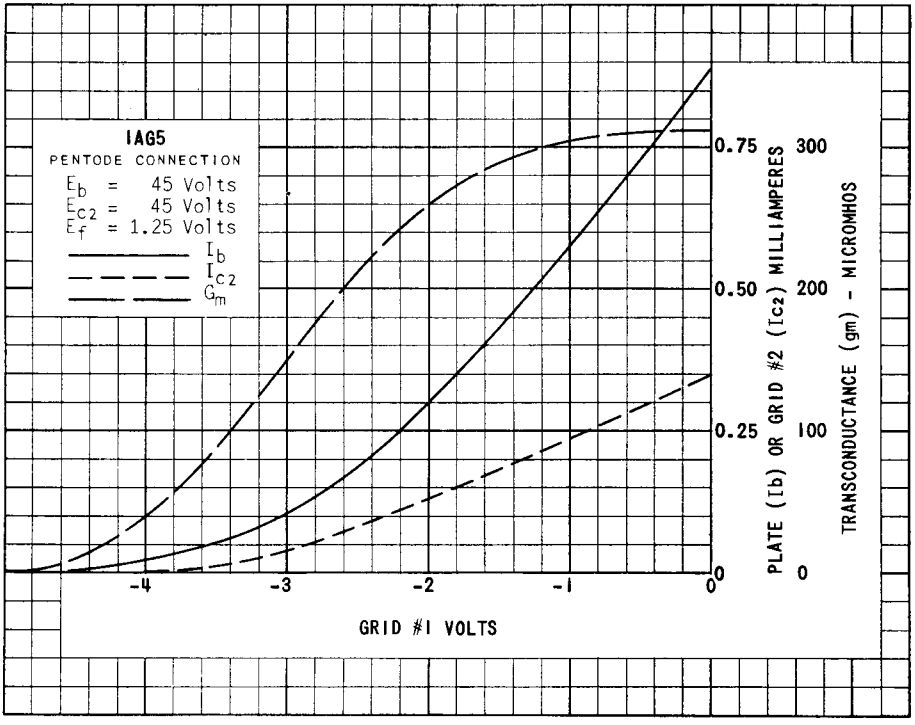
RESISTANCE – COUPLED AMPLIFIER

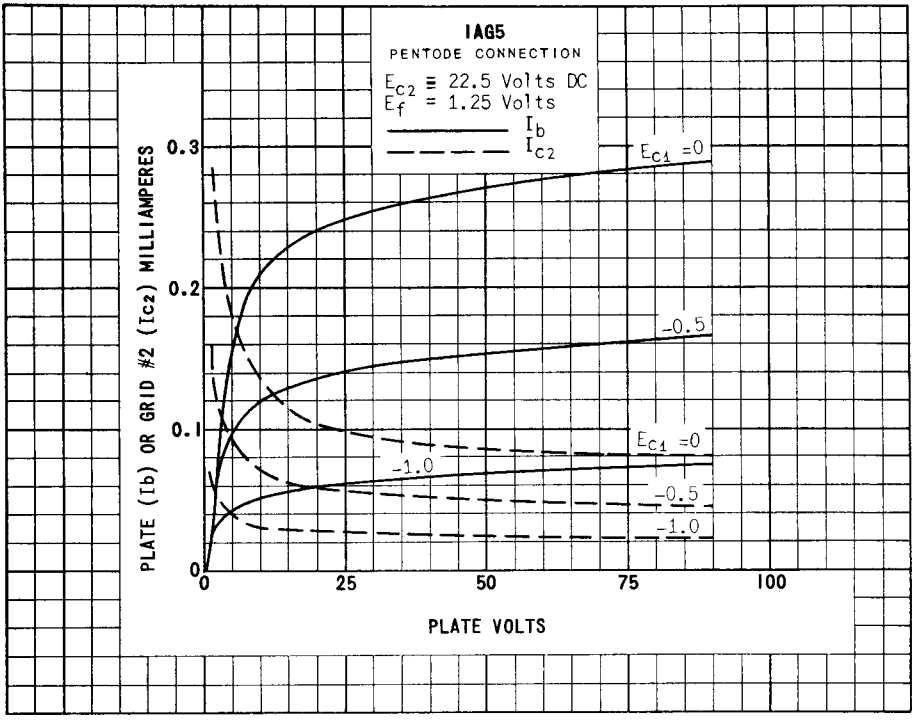
FILAMENT VOLTAGE (DC)	1.25	1.25	VOLTS
FILAMENT CURRENT	.03	.03	AMP.
PLATE SUPPLY VOLTAGE	45	67.5	VOLTS
GRID #2 SUPPLY VOLTAGE	45	67.5	VOLTS
GRID #1 VOLTAGE[B]	0	0	VOLTS
LOAD RESISTANCE	1	1	MEGOHM
SERIES GRID #2 RESISTOR	5	5	MEGOHMS
GRID #2 BY-PASS CONDENSER	0.1	0.1	μf
GRID #1 RESISTOR (FOLLOWING TUBE)	10	10	MEGOHMS
VOLTAGE GAIN (APPROX.)	50	70	

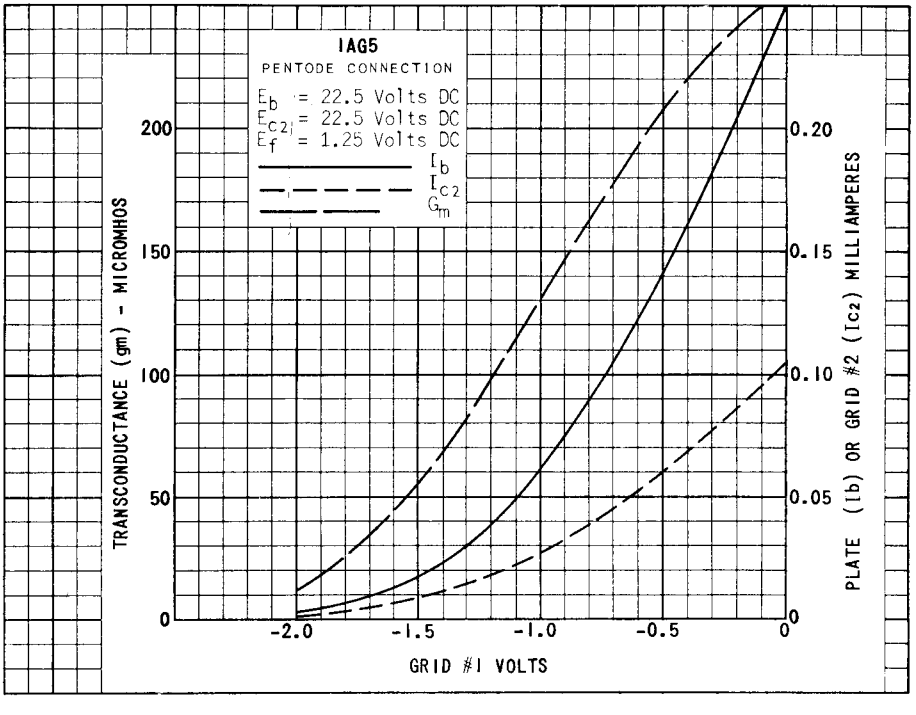
[A] THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT.

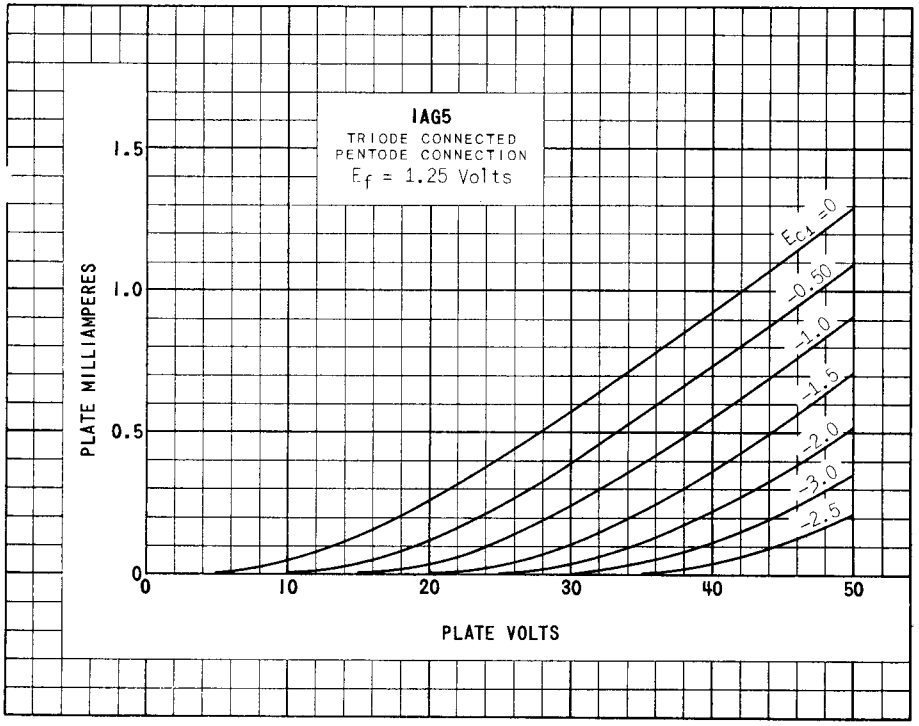
[B] GRID #1 RESISTOR = 5 MEGOHMS.


1AG5
PENTODE CONNECTION
Ec2 = 45 Volts
Ef = 1.25 Volts
Ib
Ic2
Ec1 = 0
-0.5
-1.0
-1.5
Ec1 =0
-2.0
-2.5
-2.0
-3.0
-3.5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0.75
0.50
0.25
0
0
25
50
75
100
PLATE VOLTS


1AG5
PENTODE CONNECTION
Eb = 45 Volts
Ec2 = 45 Volts
Ef = 1.25 Volts
Ib
Ic2
Gm
0.75
0.50
0.25
0
300
200
100
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


1AG5
PENTODE CONNECTION
Ec2 = 22.5 Volts DC
Ef = 1.25 Volts
Ib
Ic2
Ec1 =0
-0.5
-1.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0.3
0.2
0.1
0
0
25
50
75
100
PLATE VOLTS

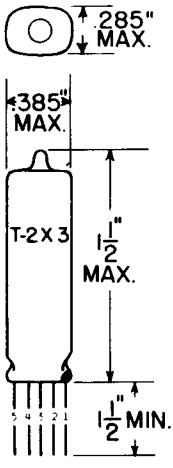

1AG5
PENTODE CONNECTION
Eb = 22.5 Volts DC
Ec2 = 22.5 Volts DC
Ef = 1.25 Volts DC
Ib
Ic2
Gm
TRANSCONDUCTANCE (gm) - MICROMHOS
200
150
100
50
0
0.20
0.15
0.10
0.05
0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
-2.0
-1.5
-1.0
-0.5
0
GRID #1 VOLTS


1AG5
TRIODE CONNECTED
PENTODE CONNECTION
E_f = 1.25 Volts
PLATE MILLIAMPERES
1.5
1.0
0.5
0
0
10
20
30
40
50
PLATE VOLTS
E_{c1} =0
-0.50
-1.0
-1.5
-2.0
-3.0
-2.5

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



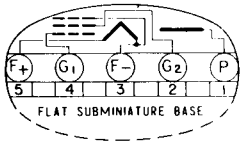
GLASS BULB
RED DOT IS ADJACENT TO LEAD 1

BULB IS ENTIRELY COATED WITH A METALLIC SHIELD CONNECTED TO LEAD 3.

COATED FILAMENT

1.25 VOLTS 0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED FLEXIBLE LEADS
0.05" SPACING CENTER-TO-CENTER

GRID #3 IS COMPRISED OF TWO SEPARATE DEFLECTOR PLATES, ONE OF WHICH IS CONNECTED TO LEAD 3 AND THE OTHER TO LEAD 5.

THE 1AH4 IS A FILAMENT TYPE, FULLY SHIELDED, SUBMINIATURE PENTODE DESIGNED FOR SERVICE IN RF APPLICATIONS REQUIRING ECONOMY OF SPACE, WEIGHT, AND BATTERY DRAIN. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (MAX.)	0.01	μμf
INPUT	3.5	μμf
OUTPUT	4.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

FILAMENT VOLTAGE	1.25	VOLTS
PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
TOTAL CATHODE CURRENT	2.0	MA.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

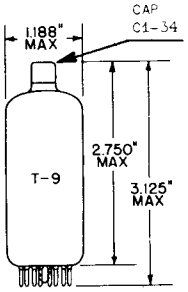
CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.25	1.25	VOLTS
FILAMENT CURRENT	0.04	0.04	AMP.
PLATE VOLTAGE	45	67.5	VOLTS
GRID #2 VOLTAGE	45	---	VOLTS
GRID #2 SUPPLY VOLTAGE	---	67.5	VOLTS
GRID #2 RESISTOR	---	0.1	MEGOHM
GRID #1 RESISTOR[A]	0	0	VOLTS
PLATE RESISTANCE	1.5	2.0	MEGOHMS
TRANSCONDUCTANCE	750	750	µMHOS
PLATE CURRENT	0.75	0.75	MA.
GRID #2 CURRENT	0.2	0.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 µMHOS	-3	-3.5	VOLTS

[A] GRID RESISTOR = 5 MEGOHMS.

TUNG-SOL

DIODE



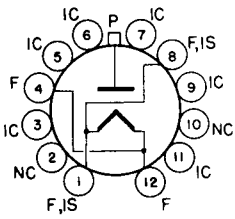
GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-98

COATED FILAMENTARY CATHODE

FOR TV HIGH VOLTAGE
RECTIFIER

ANY MOUNTING POSITION

SOCKET CLIPS 2 & 10 MAY BE USED AS
TIE POSTS AT A POTENTIAL NEAR
THAT OF THE FILAMENT



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12EL

THE 1AJ2 IS A FILAMENTARY HIGH-VOLTAGE DIODE IN A DOUBLE-ENDED T-9 COMPACTRON CONSTRUCTION. IT IS DESIGNED FOR USE AS THE RECTIFIER IN THE FLY-BACK CIRCUIT TO SUPPLY THE ANODE OF THE TELEVISION PICTURE TUBE.

DIRECT INTERELECTRODE CAPACITANCE

WITHOUT EXTERNAL SHIELD

PLATE TO ALL: P TO (P + I.S.) - APPROX.	1.8	pf

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25 VOLTS	200	MA.
LIMITS OF APPLIED FILAMENT VOLTAGE			
AC OR DC		1.25±0.20	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER SERVICE

INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK	26	KV.
DC	22	KV.
PEAK PLATE CURRENT	50	MA.
DC OUTPUT CURRENT	0.5	MA.

AVERAGE CHARACTERISTICS

TUBE DROP WITH 7 MA PLATE CURRENT - APPROX.	140	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

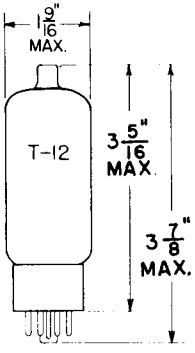
THE FLYBACK PULSE SHOULD BE TAKEN FROM THE HORIZONTAL DEFLECTION CIRCUIT OF A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS" FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

PRECAUTIONARY NOTE:

THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED.

TUNG-SOL

DIODE



GLASS BULB

COATED FILAMENT CATHODE

FILAMENT

1.25±0.2 VOLTS 0.20 AMP.

ANY MOUNTING POSITION

BOTTOM VIEW

SHORT MEDIUM SHELL
OCTAL
7 PIN BASE[A]
3C

THE 1AU3 IS A FILAMENTARY HALF-WAVE DIODE INCORPORATING AN ELECTROSTATIC SHIELD, WHICH IS LOCATED ADJACENT TO THE FILAMENT. IT IS INTENDED FOR SERVICE AS THE HIGH VOLTAGE RECTIFIER IN TELEVISION RECEIVERS AND OTHER HIGH VOLTAGE RECTIFIER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

PLATE TO FILAMENT AND INTERNAL SHIELD	2.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[D]

FLYBACK VOLTAGE RECTIFIER[E]

FILAMENT VOLTAGE[B]	1.25±0.2	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK	30 000	VOLTS
DC	26 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	50	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.5	MA.

CHARACTERISTICS

FILAMENT VOLTAGE[B]	1.25±0.2	VOLTS
FILAMENT CURRENT[C]	0.20	AMP.
TUBE DROP FOR Ib = 7 MA. (APPROX.)	225	VOLTS

[A] SOCKET TERMINALS 1, 3, 4, 5, 6 AND 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTES TO TERMINAL 7. TERMINALS 4 AND 6 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.

CONTINUED ON FOLLOWING PAGE

B THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE. FILAMENT SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN FILAMENT VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

C THE BOGEY VALUE OF CURRENT IS OBTAINED WHEN OPERATING THE FILAMENT AT THE SPECIFIED 1.25 VOLTS.

D DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

E FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

WARNING:

X-RAY RADIATION SHIELD MAY BE NECESSARY TO PROTECT AGAINST POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE IF THIS TUBE IS OPERATED AT HIGHER THAN THE MANUFACTURER'S MAXIMUM RATED PLATE VOLTAGE OF 16,000 VOLTS, WHICHEVER IS LESS.

TUNG-SOL

DIODE

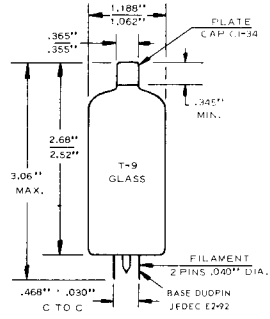
FOR HIGH VOLTAGE SUPPLY

IN TV SERVICE

COATED FILAMENT

ANY MOUNTING POSITION

OUTLINE DRAWING



OUTLINE NOTES

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.

MAXIMUM ECCENTRICITY OF PIN CENTER LINE AND BULB CENTER LINE .040".

EITHER FILAMENT PIN MAY BE USED FOR THE OUTPUT CONNECTION.

THE 1AY2 IS A FILAMENTARY HIGH-VOLTAGE DIODE IN DOUBLE-ENDED CONSTRUCTION WITH A NEW TWO-PIN "DUOPIN" BASE. IT IS DESIGNED FOR USE AS THE HIGH-VOLTAGE RECTIFIER IN THE FLY-BACK CIRCUIT TO SUPPLY THE ANODE OF THE TELEVISION PICTURE TUBE. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THE 1B3GT.

DIRECT INTERELECTRODE CAPACITANCE

PLATE TO FILAMENT	1.4	pf

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER ▲

INVERSE PLATE VOLTAGE: TOTAL DC AND PEAK	26	KV
DC	22	KV
PEAK PLATE CURRENT	50	mA
AVERAGE PLATE CURRENT	0.5	mA

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25 VOLTS	200	mA
LIMITS OF APPLIED VOLTAGE - AC OR DC		1.25 ± 0.20	VOLTS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP FOR I_b = 7 mA	75	VOLTS

▲ FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

WARNING

This tube may produce soft X-rays which can constitute a health hazard unless adequately shielded.

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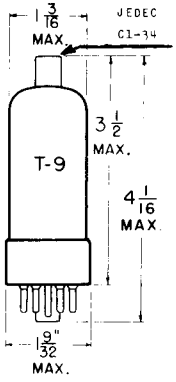
TUNG-SOL

DIODE



GLASS BULB

SEE NOTE "A"

OUTLINE DRAWING
JEDEC 9-51 OR 9-52

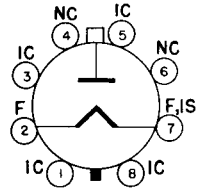
COATED FILAMENT

FOR HIGH VOLTAGE SUPPLY

IN T.V. SERVICE

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

SOCKET TERMINALS 1, 3, 4, 5, 6 & 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTS TO TERMINAL 7. TERMINALS 4&6 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.

THE 1B3GT IS A FILAMENTARY DIODE DESIGNED TO OPERATE AT RELATIVELY HIGH INVERSE PEAK VOLTAGES OVER A CONSIDERABLE RANGE OF SUPPLY VOLTAGE FREQUENCIES. IT IS INTENDED TO SUPPLY THE REQUIRED HIGH VOLTAGES FOR THE CATHODE RAY PICTURE TUBE IN TELEVISION SERVICE.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

PLATE TO FILAMENT: (P TO F+I.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES -SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	125 VOLTS	200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION[B]		1.25±0.2	VOLTS
CURRENT OPERATION (AT Ef =1.25 V.)		200	MA.
TUBE DROP (APPROX) WITH 7 MA. PLATE CURRENT		100	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD, RS-239

FLYBACK VOLTAGE RECTIFIER[C]

INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK	26	KV
DC	22	KV
PEAK PLATE CURRENT	50	MA.
AVERAGE PLATE CURRENT	0.5	MA.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

RF VOLTAGE RECTIFIER

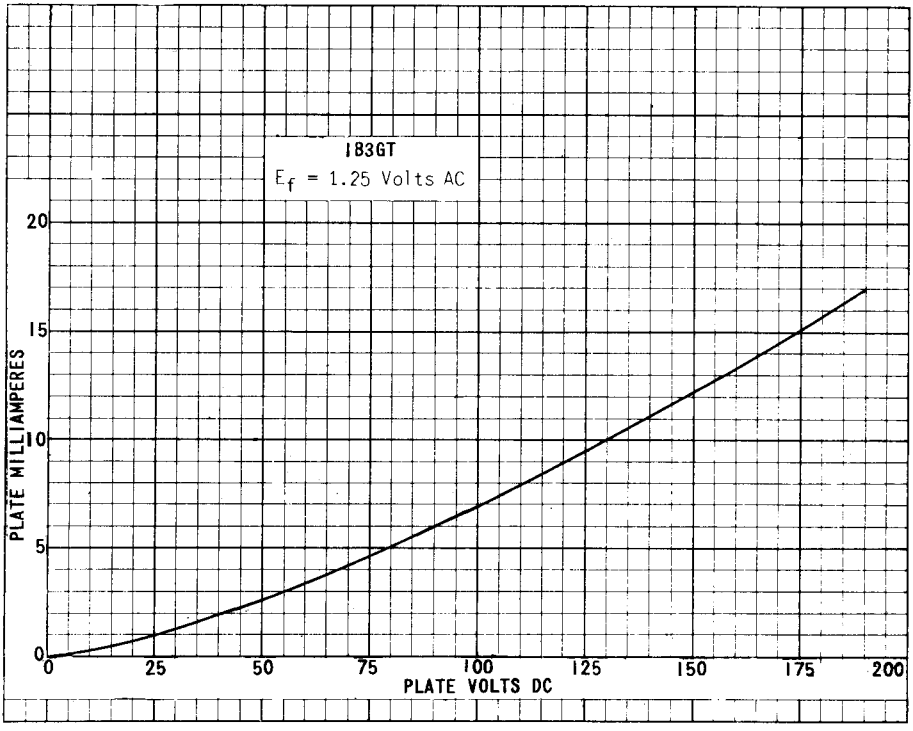
PEAK INVERSE PLATE VOLTAGE	33	KV
PEAK PLATE CURRENT	.35	MA.
AVERAGE PLATE CURRENT	1.1	MA.
FREQUENCY OF SUPPLY VOLTAGE (MAX.)	100	KCS
FREQUENCY OF SUPPLY VOLTAGE (MIN.)	1.5	KCS

[A] B5-82,B6-8, B6-60, B6-144, B7-166, B7-211, B8-6, B8-50, OCTAL 5, 6, 7, OR 8- PIN

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED



TUNG-SOL

R-F PENTODE AMPLIFIER

COATED FILAMENT

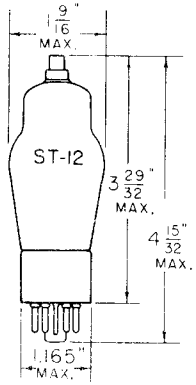
2.0 VOLTS 0.06 AMPERE

DC

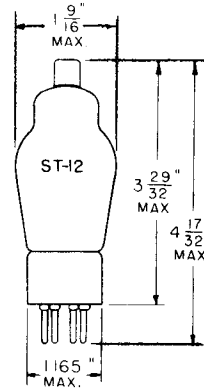
GLASS BULB

MOUNTING POSITION

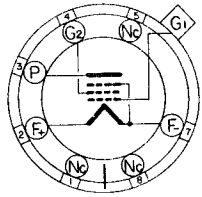
FOR TUBE TYPE 1B4P, HORIZONTAL OPERATION WILL BE PERMITTED IF PINS 1 AND 4 ARE IN A VERTICAL PLANE. THE SAME WILL HOLD TRUE FOR TYPE 1E5GP IF PINS 5 AND 7 ARE IN A VERTICAL PLANE.



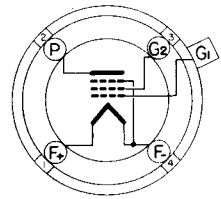
1E5GP
SKIRTED MINIATURE CAP



1B4P
SMALL METAL CAP



BOTTOM VIEW
SMALL SHELL OCTAL 7 PIN BASE



BOTTOM VIEW
SMALL 4 PIN BASE

THE 1E5GP AND 1B4P ARE DESIGNED FOR SERVICE AS GENERAL PURPOSE SHARP CUT-OFF PENTODE AMPLIFIERS IN BATTERY OPERATED EQUIPMENTS.

RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	67.5	VOLTS
MAXIMUM CATHODE CURRENT	6.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (WITH SHIELD)	0.007 MAX.	μμf
INPUT	5.0	μμf
OUTPUT	11	μμf

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PLATE 1493
OCT. 31 1944

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	180	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE[A]	-3.0	-3.0	VOLTS
PLATE CURRENT	1.6	1.7	MA.
SCREEN CURRENT	0.7	0.6	MA.
PLATE RESISTANCE (APPROX.)	1.0	1.5	MEGOHMS
TRANSCONDUCTANCE	600	650	μMHOS
AMPLIFICATION FACTOR (APPROX.)	550	1000	
CONTROL GRID VOLTAGE FOR PLATE CURRENT CUT-OFF[A]	-8.0	-8.0	VOLTS

[A] RETURN TO NEGATIVE FILAMENT (PIN #7)

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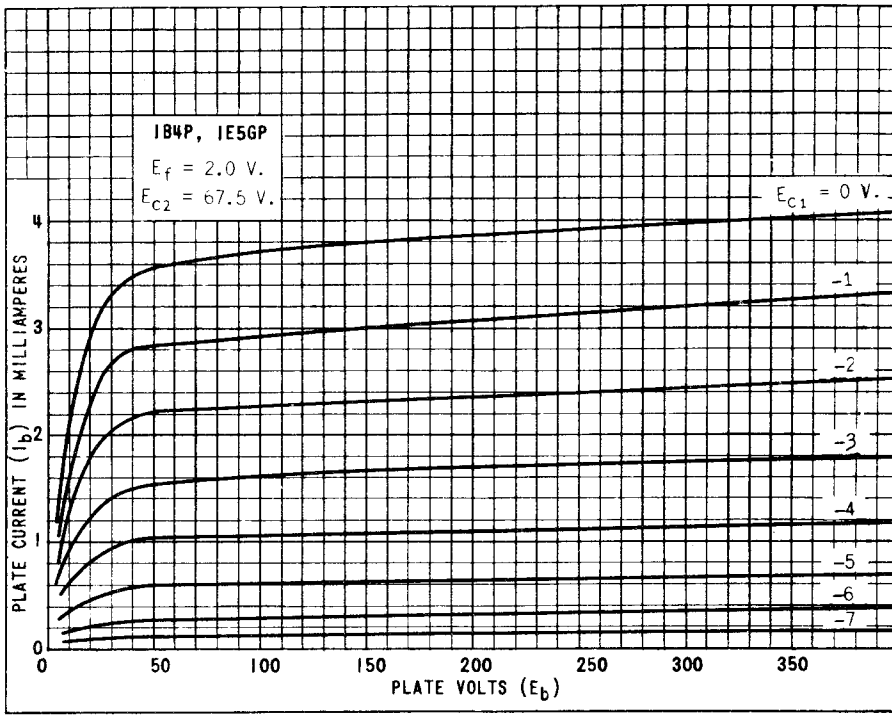

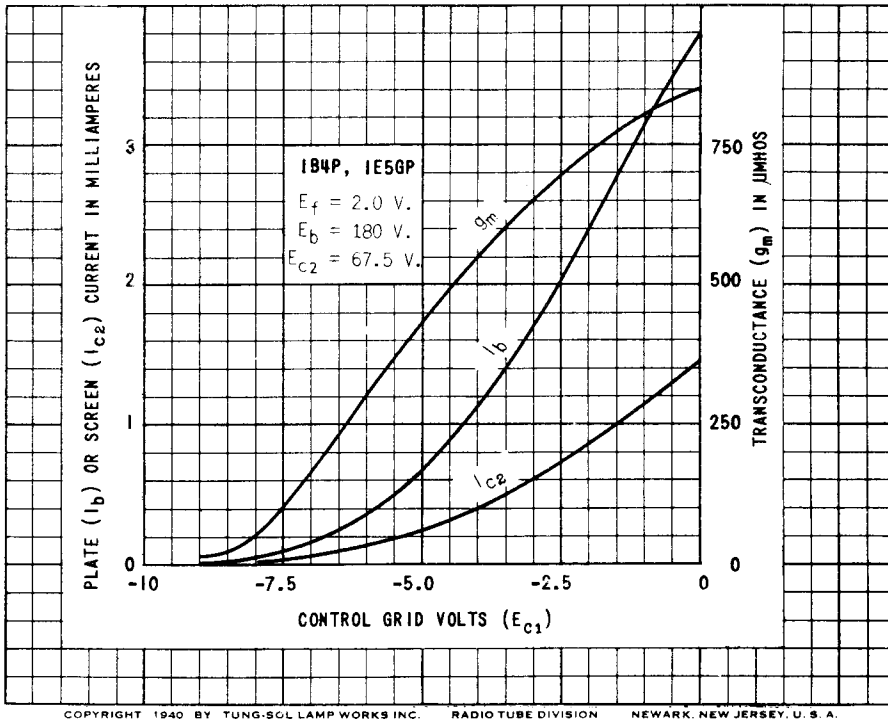

PLATE
1495
OCT. 31
1944

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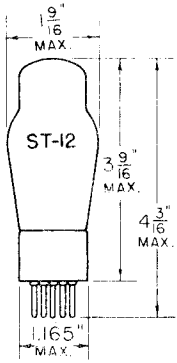
TUNG-SOL

DUO-DIODE TRIODE AMPLIFIER



1B5/25S

COATED FILAMENT

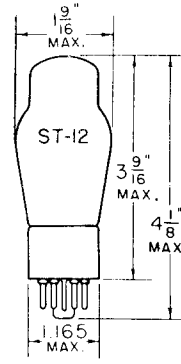
2.0 VOLTS 0.06 AMPERE

DC

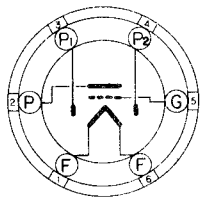
GLASS BULB

MOUNTING POSITION

THESE TUBES SHOULD BE OPERATED VERTICALLY WITH BASE DOWN. HOWEVER, HORIZONTAL OPERATION MAY BE PERMITTED FOR TUBE TYPE 1B5/25S WHEN PINS 2 AND 5 ARE HORIZONTAL. THE SAME WILL BE TRUE FOR THE 1H6G TUBE TYPE WHEN PINS 2 AND 7 ARE HORIZONTAL.

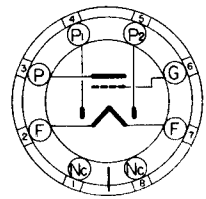


1H6G



BOTTOM VIEW

SMALL 6 PIN BASE



BOTTOM VIEW

SMALL 8 PIN OCTAL BASE

THE 1B5/25S AND 1H6G COMBINE TWO DIODES AND A TRIODE IN A SINGLE BULB. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS, AND IMPEDANCE OR RESISTANCE COUPLED AMPLIFIERS IN BATTERY OPERATED RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	1B5/25S	1H6G	
GRID TO PLATE	3.6	3.6	μμf
INPUT	1.6	1.6	μμf
OUTPUT	1.9	1.9	μμf

OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT – CLASS A_1 AMPLIFIER

MAXIMUM PLATE VOLTAGE	135	VOLTS
CONTROL GRID VOLTAGE	-3.0	VOLTS
PLATE CURRENT	0.8	MA.
PLATE RESISTANCE	35 000	OHMS
TRANSCONDUCTANCE	575	μMHOS
AMPLIFICATION FACTOR	20	

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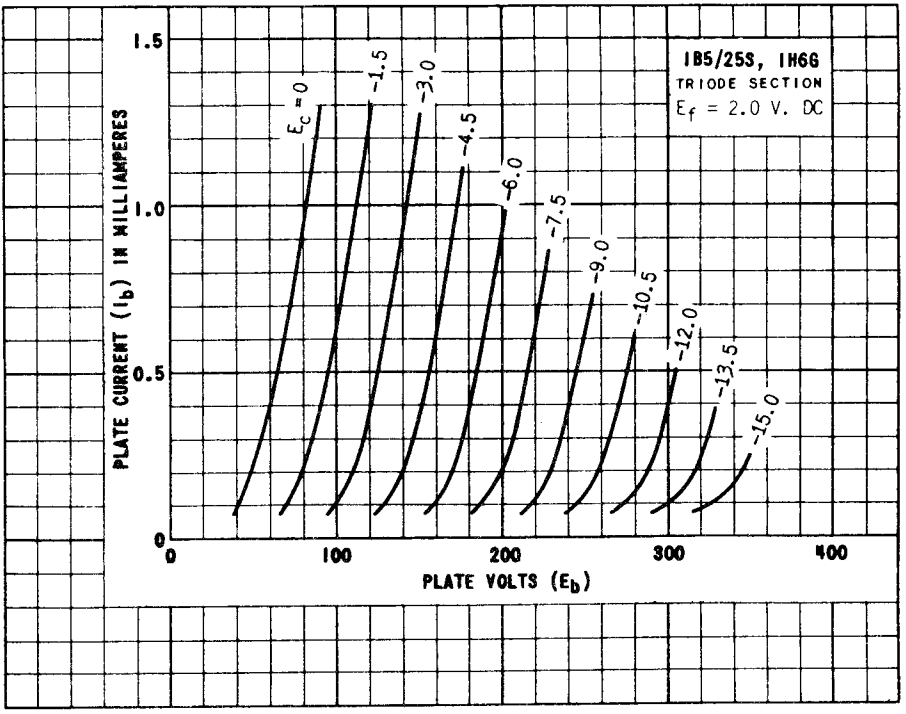
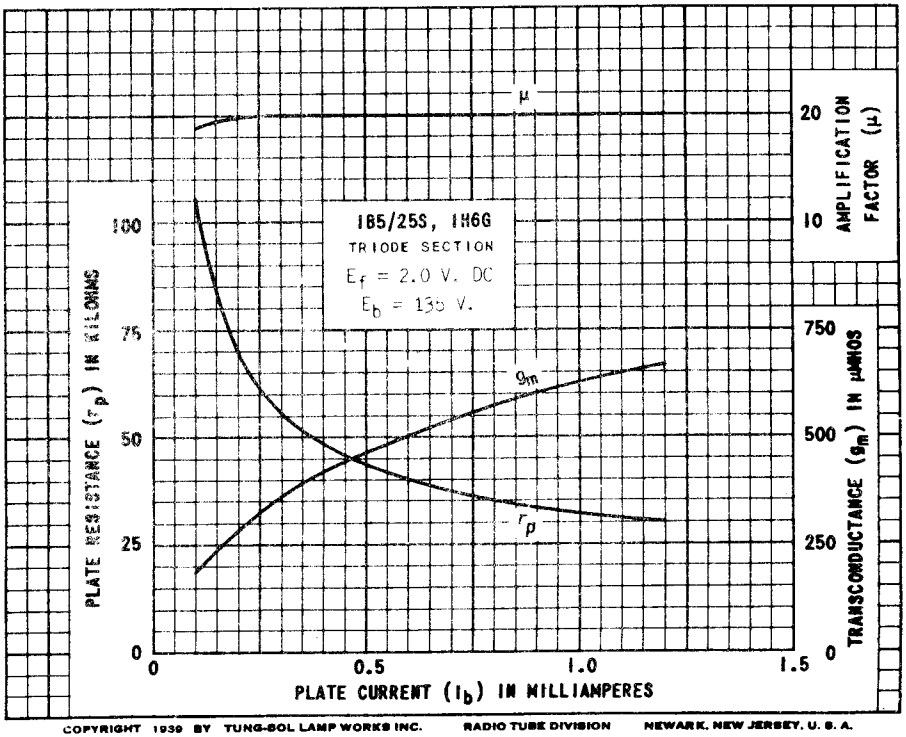
1B5/25S(1H6G)





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TUNG-SOL

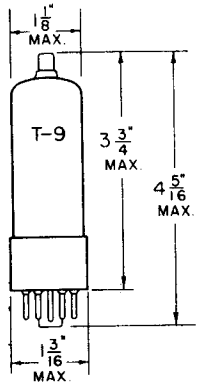
PENTAGRID CONVERTER

COATED FILAMENT

1.4 VOLTS 0.10 AMPERE

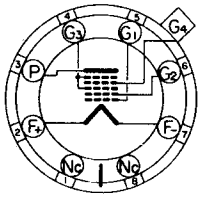
DC

GLASS BULB



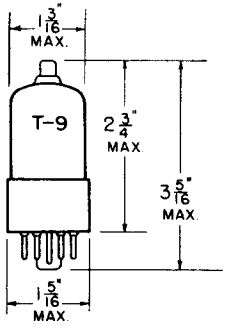
1B7G

SKIRTED MINIATURE
STYLE C CAP



BOTTOM VIEW

SMALL 8-PIN OCTAL



1B7GT

SKIRTED MINIATURE
STYLE C CAP

ANY MOUNTING POSITION

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	100	VOLTS
MAXIMUM SCREEN (G3 AND G5) VOLTAGE	55	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	90	VOLTS
MAXIMUM ANODE GRID (G2) VOLTAGE	90	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	6.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

TUBE SHIELD CONNECTED TO NEGATIVE FILAMENT

SIGNAL GRID (G4) TO MIXER PLATE (P)	0.34	μμf
SIGNAL GRID (G4) TO OSC. PLATE (G2)	0.26	μμf
SIGNAL GRID (G4) TO OSC. GRID (G1)	0.12	μμf
OSC. GRID (G1) TO OSC. PLATE (G2)	0.90	μμf
SIGNAL INPUT: G4 TO (F+G1+G2+G3+G5+P+SHIELD)	7.00	μμf
OSC. OUTPUT: G2 TO (F+G3+G4+G5+P+SHIELD)	4.20	μμf
OSC. INPUT: G1 TO (F+G3+G4+G5+P+SHIELD)	4.00	μμf
MIXER OUTPUT: P TO (F+G1+G2+G3+G4+G5+SHIELD)	7.50	μμf

CONTINUED ON NEXT PAGE

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PLATE
1525
JAN. 15
1945

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CONTINUED FROM PRECEDING PAGE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE VOLTAGE	90	VOLTS
SCREEN (G3 AND G5) VOLTAGE	45	VOLTS
ANODE GRID (G2) VOLTAGE	90	VOLTS
CONTROL GRID (G4) VOLTAGE[A]	0	VOLTS
OSC. GRID (G1) RESISTOR	200 000	OHMS
PLATE RESISTANCE	0.35	MEGOHM
CONVERSION TRANSCONDUCTANCE	350	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE=2 μMHOS (APPROX.)	-14.5	VOLTS
PLATE CURRENT	1.5	MA.
SCREEN CURRENT	1.3	MA.
ANODE GRID CURRENT	1.6	MA.
OSC. GRID (G1) CURRENT	0.035	MA.
TOTAL CATHODE CURRENT	4.4	MA.

[A] RETURN TO NEGATIVE FILAMENT PIN #7

PLATE 1526
JAN. 15 1945

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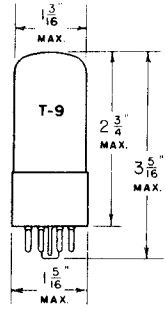
TUNG-SOL

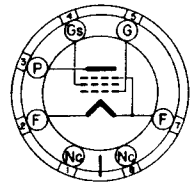


PENTODE POWER AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.10 AMPERE
DC

GLASS BULB



G-6X

BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 1C5GT/G IS A LOW VOLTAGE, LOW CURRENT DRAIN, BATTERY TYPE PENTODE POWER AMPLIFIER. IT IS DESIGNED FOR SERVICE WITH 90 VOLTS OF "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION – VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC – DC POWER LINE OPERATION – DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT (ZERO SIGNAL)	12	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

FILAMENT VOLTAGE	1.4 DC	1.4 DC	VOLTS
FILAMENT CURRENT	0.10	0.10	AMPERE
PLATE VOLTAGE	83	90	VOLTS
SCREEN VOLTAGE	83	90	VOLTS
CONTROL GRID VOLTAGE [A]	-7.0	-7.5	VOLTS
PEAK AF SIGNAL VOLTAGE	7.0	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	7.0	7.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	7.3	7.8	MA.
ZERO-SIGNAL SCREEN CURRENT	1.6	1.6	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	3.5	3.5	MA.
PLATE RESISTANCE APPROX.	110000	115000	OHMS
TRANSCONDUCTANCE	1500	1550	μMHOS
LOAD RESISTANCE	9000	8000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PER CENT
POWER OUTPUT	200	240	MILLIWATTS

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL

CONTINUED NEXT PAGE

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PLATE
1071-3

JULY 28
1941

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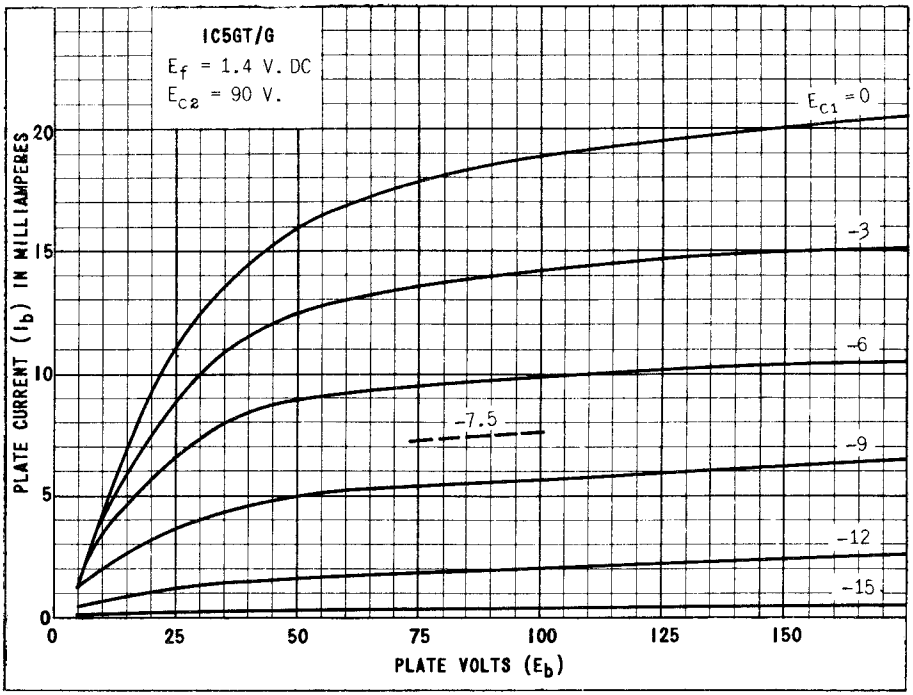
1C5GT/G



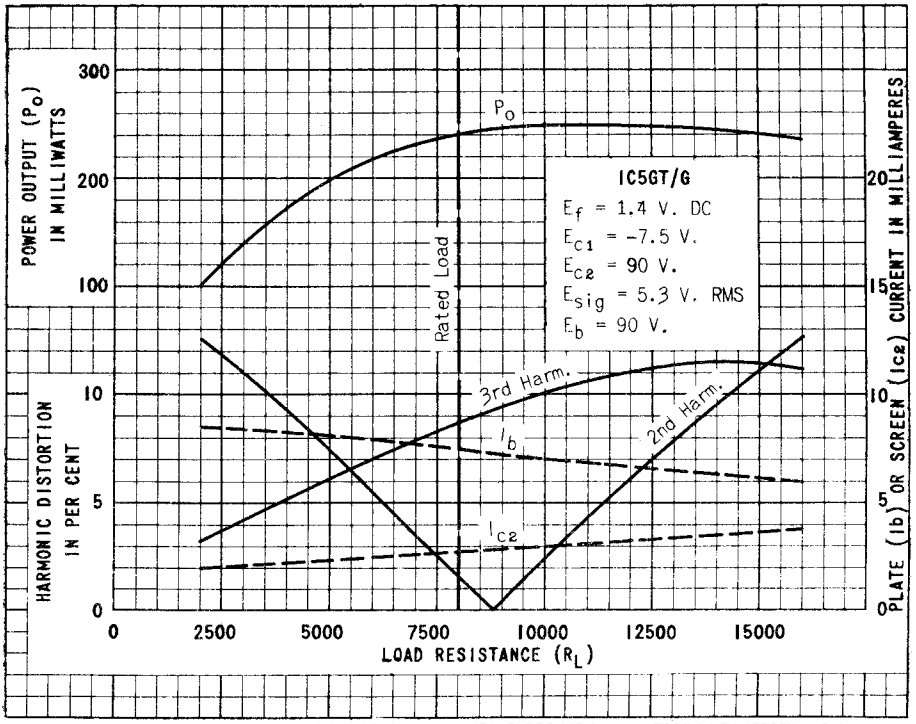


PLATE
1072-2

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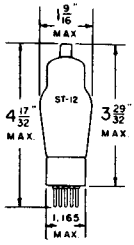
TUNG-SOL

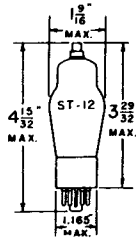


SMALL 6 PIN BASE
1C6

PENTAGRID CONVERTER

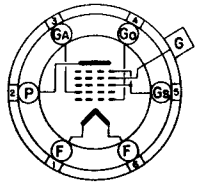
COATED FILAMENT

2.0 VOLTS 0.12 AMPERE
DC



SMALL 8 PIN OCTAL BASE
1C7G

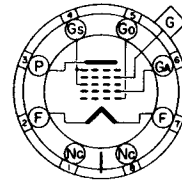
GLASS BULB



6L

BOTTOM VIEW

1C6



G-7Z

BOTTOM VIEW

1C7G

THE TUNG-SOL 1C6 AND 1C7G ARE FILAMENT TYPE PENTAGRID CONVERTERS DESIGNED FOR SERVICE AS OSCILLATORS AND MIXERS IN BATTERY OPERATED RECEIVERS.

RATINGS

MAXIMUM PLATE (P) VOLTAGE	180	VOLTS
MAXIMUM SCREEN (Gs) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	67.5	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (GA) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM OSCILLATOR ANODE VOLTAGE	135	VOLTS
MAXIMUM CATHODE CURRENT	9	MA.
MAXIMUM PLATE DISSIPATION	0.3	WATT
MAXIMUM SCREEN DISSIPATION	0.2	WATT
MAXIMUM OSCILLATOR ANODE DISSIPATION	0.4	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE
914-2

DEC. 30
1940

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

	1C6	1C7G[S]	
CONTROL GRID (G) TO MIXER PLATE (P)	0.3[S]	0.26	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)	0.3[S]	0.32	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)	0.15[S]	0.11	μμf
OSCILLATOR GRID (G_O) TO OSCILLATOR ANODE (G_A)	1.5	1.2	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	10	10	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_O) TO ALL OTHER ELECTRODES	6	4.8[A]	μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES	6	5.5[B]	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	10	14	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE (P) VOLTAGE	135	180	VOLTS
SCREEN (G_S) VOLTAGE	67.5	67.5	VOLTS
CONTROL GRID (G) VOLTAGE[C]	−3	−3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE[D]	135	180	VOLTS
OSCILLATOR GRID (G_O) RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.3	1.5	MA.
SCREEN CURRENT	2.5	2.0	MA.
OSCILLATOR ANODE CURRENT	3.1	4.0	MA.
OSCILLATOR GRID CURRENT	0.2	0.2	MA.
TOTAL CATHODE CURRENT	7.1	7.7	MA.
PLATE RESISTANCE APPROX.	0.6	0.7	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −1.5 V.	440	450	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −3.0 V.	300	325	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −6.0 V.	95	105	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = −14.0 V.	4	4	μMHOS

[A] EXCEPT OSCILLATOR ANODE (GA)

[B] EXCEPT OSCILLATOR GRID (GO)

[C] RETURN TO NEGATIVE FILAMENT (PIN #6 – 1C6 AND PIN #7 – 1C7G)

[D] APPLIED THROUGH 20 000 OHM DROPPING RESISTOR

[S] WITH EXTERNAL SHIELD CONNECTED TO NEGATIVE FILAMENT (PIN #6 – 1C6 AND PIN #7 – 1C7G)

PLATE 915-2

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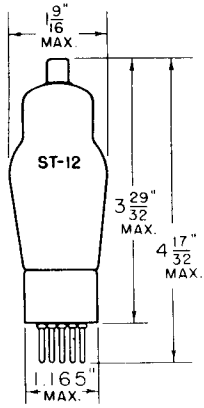
TUNG-SOL



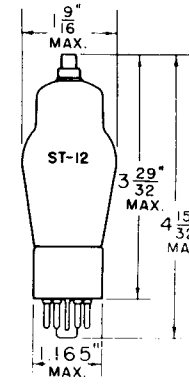
REMOTE CUT-OFF
PENTODE AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.060 AMPERE

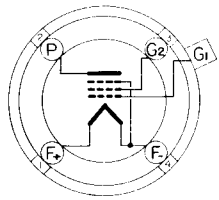
AC OR DC

GLASS BULB

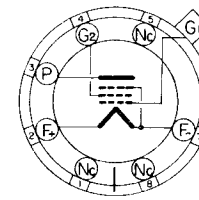


1A4P
SMALL METAL CAP
SMALL 4 PIN BASE

1D5GP
MINIATURE METAL CAP
SMALL 7 PIN OCTAL BASE



BOTTOM VIEW



BOTTOM VIEW

THESE TUBES ARE REMOTE CUT-OFF PENTODE AMPLIFIERS DESIGNED FOR USE IN BATTERY OPERATED RECEIVERS. EITHER TUBE IS SUITABLE FOR USE WITH AUTOMATIC VOLUME CONTROL IN RF AND IF AMPLIFIERS WITH A MINIMUM OF CROSS MODULATION.

MOUNTING POSITION

THESE TUBES SHOULD BE OPERATED VERTICALLY WITH THE BASE DOWN. HOWEVER, HORIZONTAL OPERATIONS MAY BE PERMITTED IN THE 1D5GP TUBE TYPE IF PINS 2 AND 7 ARE ON A VERTICAL PLANE. THE SAME WILL BE TRUE FOR THE 1A4P TUBE TYPE IF PINS 1 AND 4 ARE ON A VERTICAL PLANE.

DIRECT INTERELECTRODE CAPACITANCES

MAXIMUM CONTROL GRID TO PLATE (WITH EXTERNAL SHIELD)	0.007	μμf
INPUT (G_1 TO G_2, G_3, F)	5.0	μμf
OUTPUT (P TO G_2, G_3, F)	11	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	90	180 MAX.	VOLTS
SCREEN VOLTAGE	67.5	67.5 MAX.	VOLTS
MINIMUM CONTROL GRID VOLTAGE	−3	−3	VOLTS
PLATE CURRENT	2.2	2.3	MA.
SCREEN CURRENT	0.9	0.8	MA.
PLATE RESISTANCE (APPROX.)	0.6	1.0	MEGOHM
TRANSCONDUCTANCE	720	750	μMHOS
AMPLIFICATION FACTOR (APPROX.)	425	750	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE OF 15 μMHOS	−15	−15	VOLTS

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PLATE 1458
AUG. 31 1944

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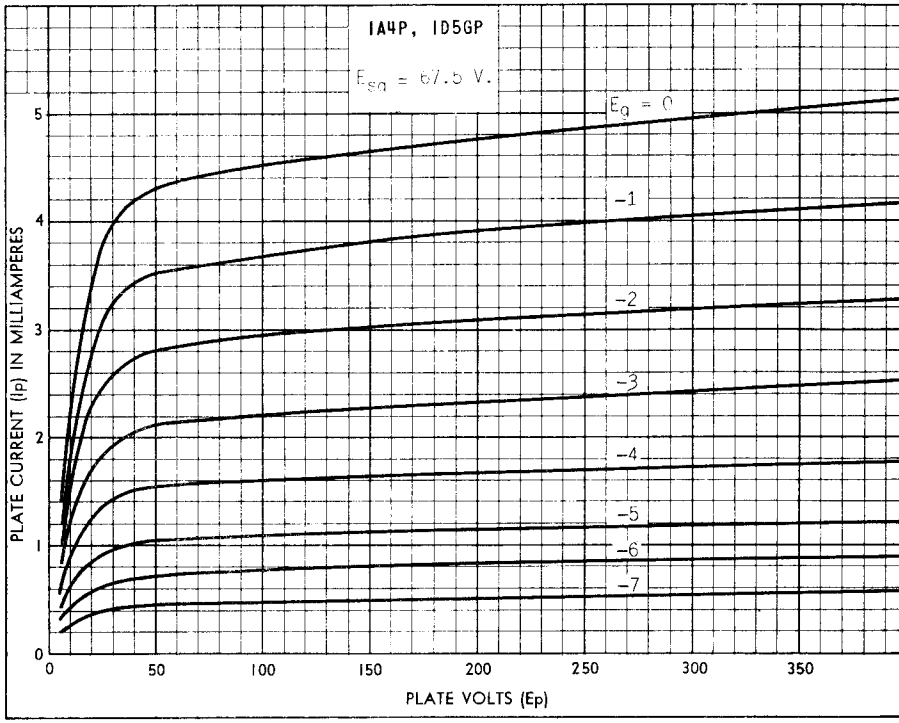

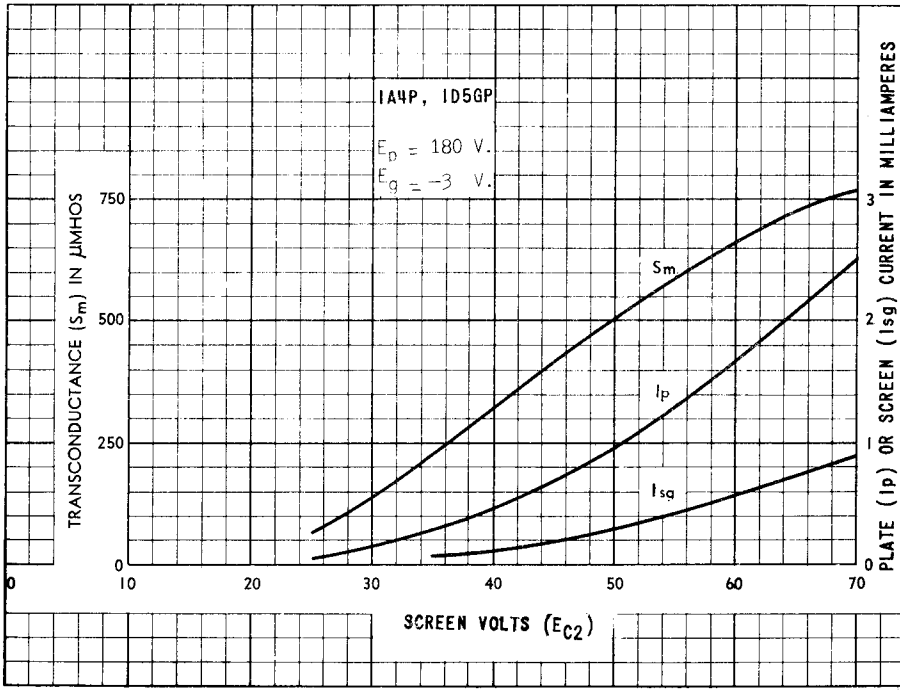

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PLATE
1459
AUG. 31
1944

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ID5GP(1A4P)

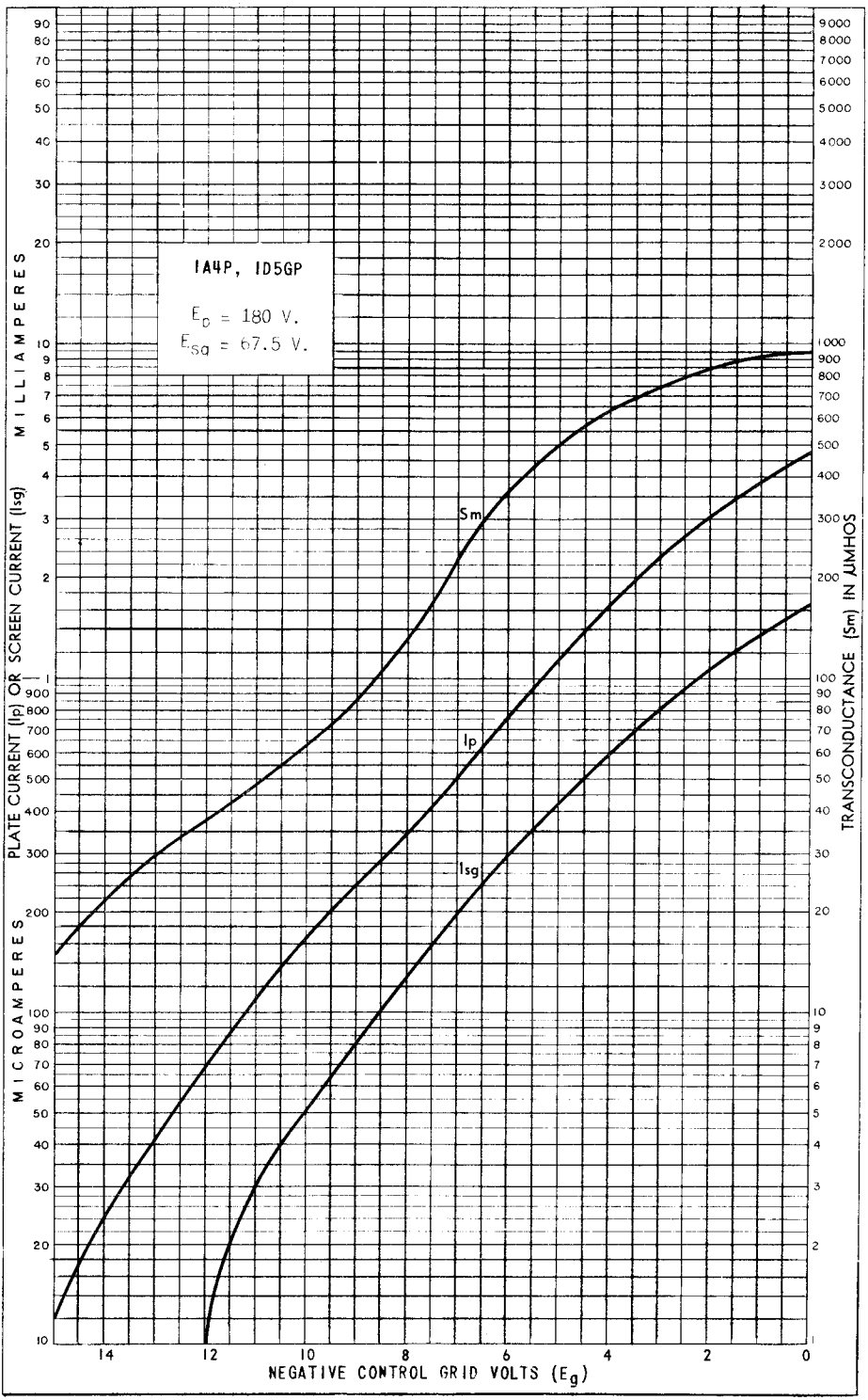

PLATE
1460
AUG. 31
1944

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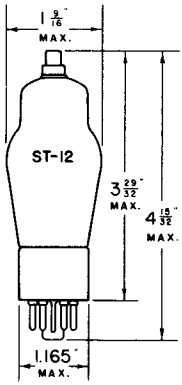
TUNG-SOL



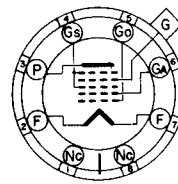
PENTAGRID CONVERTER

COATED FILAMENT

2.0 VOLTS 0.06 AMPERE
DC

GLASS BULB

SMALL 8 PIN OCTAL BASE



G-7Z

THE TUNG-SOL 1D7G IS A COMBINED OSCILLATOR AND MIXER DESIGNED FOR SERVICE AS THE FIRST DETECTOR IN BATTERY OPERATED SUPERHETERODYNE RECEIVERS WHERE ECONOMY IN FILAMENT CURRENT CONSUMPTION IS DESIRED. WITH THE EXCEPTION OF CAPACITANCES ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 1A6.

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE (P) VOLTAGE MAX.	180	VOLTS
SCREEN (Gs) VOLTAGE MAX.	67.5	VOLTS
ANODE GRID (GA) VOLTAGE MAX.	135	VOLTS
ANODE GRID (GA) VOLTAGE SUPPLY MAX.	180 [A]	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	-3	VOLTS
TOTAL CATHODE CURRENT MAX.	9	MA.

CONVERTER SERVICE

PLATE (P) VOLTAGE	135	180	VOLTS
SCREEN (Gs) VOLTAGE	67.5	67.5	VOLTS
ANODE GRID (GA) VOLTAGE	135	135	VOLTS
ANODE GRID (GA) SUPPLY VOLTAGE	135	180 [A]	VOLTS
CONTROL GRID (G) VOLTAGE	-3	-3	VOLTS
OSCILLATOR GRID RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.2	1.3	MA.
SCREEN CURRENT	2.5	2.4	MA.
ANODE GRID CURRENT	2.3	2.3	MA.
OSCILLATOR GRID CURRENT	0.2	0.2	MA.
TOTAL CATHODE CURRENT	6.2	6.2	MA.
PLATE RESISTANCE	0.4	0.5	MEGOHM
CONVERSION CONDUCTANCE	275	300	μMHOS
CONTROL GRID (G) VOLTAGE APPROX.	-22.5	-22.5	VOLTS

FOR CONVERSION CONDUCTANCE = 4 μMHOS

[A] APPLIED THROUGH 20 000 OHM DROPPING RESISTOR.

CONTINUED NEXT PAGE

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PLATE
217-1

TUNG-SOL

STATIC CHARACTERISTICS OF OSCILLATOR SECTION – NOT OSCILLATING

PLATE (P) VOLTAGE	135 TO 180	VOLTS
SCREEN (G_S) VOLTAGE	67.5	VOLTS
ANODE GRID (G_A) VOLTAGE	135	VOLTS
CONTROL GRID (G) VOLTAGE	−3	VOLTS
OSCILLATOR GRID (G_O) VOLTAGE	0	VOLTS
TRANSCONDUCTANCE – OSCILLATOR GRID (G_O) TO ANODE GRID (G_A)	425	μMHOS
ANODE GRID CURRENT	2.3	MA.

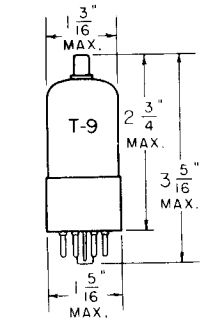
DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID (G) TO PLATE (P)	0.26	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)	0.11	μμf
CONTROL GRID (G) TO ANODE GRID (G_A)	0.32	μμf
OSCILLATOR GRID (G_O) TO ANODE GRID (G_A)	1.2	μμf
RF INPUT ELECTRODE, GRID (G) TO ALL OTHER ELECTRODES	10	μμf
OSC. INPUT ELECTRODE, GRID (G_O) TO ALL OTHER ELECTRODES	4.8	μμf
OSC. OUTPUT ELECTRODE, GRID (G_A) TO ALL OTHER ELECTRODES	5.5	μμf
MIXER OUTPUT ELECTRODE, PLATE (P) TO ALL OTHER ELECTRODES	14	μμf

[S] WITH SHIELD

PLATE
218-1

TUNG-SOL



SKIRTED MINIATURE CAP

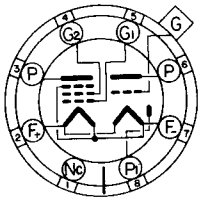
DIODE-TRIODE POWER PENTODE AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.10 AMPERE DC

GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE 8 PIN OCTAL BASE

THE 1D8GT IS A LOW VOLTAGE, LOW CURRENT BATTERY TYPE TUBE, WHICH COMBINES A SINGLE DIODE, TRIODE AND A POWER PENTODE IN ONE BULB.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE (TRIODE SECTION)	110	VOLTS
MAXIMUM PLATE VOLTAGE (PENTODE SECTION)	110	VOLTS
MAXIMUM SCREEN VOLTAGE (PENTODE SECTION)	110	VOLTS
MAXIMUM CATHODE CURRENT—ZERO SIGNAL (PENTODE SECTION)	6.0	MA.
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE UNIT

PLATE VOLTAGE	45	67.5	90	VOLTS
GRID VOLTAGE	0	0	0	VOLTS
PLATE CURRENT	0.3	0.6	1.1	MA.
PLATE RESISTANCE (APPROX.)	77 000	55 500	43 500	OHMS
TRANSCONDUCTANCE	325	450	575	UMHOS
AMPLIFICATION FACTOR	25	25	25	

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PLATE 1498
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CONTINUED ON NEXT PAGE

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CONTINUED FROM PRECEDING PAGE

PENTODE UNIT

PLATE VOLTAGE	45	62.5	67.5	90	VOLTS
SCREEN VOLTAGE	45	62.5	67.5	90	VOLTS
CONTROL GRID VOLTAGE	-4.5	-5.0	-6.0	-9.0	VOLTS
PEAK AF SIGNAL VOLTAGE	4.5	5.0	6.0	9.0	VOLTS
PLATE CURRENT	1.6	3.8	3.8	5.0	MA.
SCREEN CURRENT	0.3	0.8	0.8	1.0	MA.
PLATE RESISTANCE (APPROX.)	0.3	0.2	0.2	0.2	MEGOHM
TRANSCONDUCTANCE	650	875	875	925	UMHOS
LOAD RESISTANCE	20 000	16 000	16 000	12 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	10	10	PER CENT
POWER OUTPUT	35	90	100	200	MW.

DIODE UNIT

THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT, AND IS INDEPENDENT OF THE TRIODE UNIT AND OF THE PENTODE UNIT EXCEPT FOR THE COMMON FILAMENT.

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TUNG-SOL

DIODE PENTODE

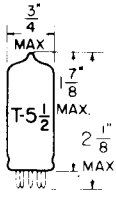
MINIATURE TYPE

COATED FILAMENT

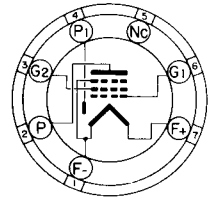
1.4 VOLTS 0.05 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

6BW

THE DIODE PLATE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT

THE 1DN5 IS A COMBINED SINGLE DETECTOR DIODE AND REMOTE CUT-OFF PENTODE WITH A COMMON FILAMENTARY CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN AUDIO AMPLIFIER IN LIGHT-WEIGHT, PORTABLE EQUIPMENT AT LOW PLATE SUPPLY VOLTAGE. THE DESIGN OF THIS TYPE PERMITS THE APPLICATION OF AVC VOLTAGE TO THE CONTROL GRID, THEREBY IMPROVING OVERALL RECEIVER AVC.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

DIODE PLATE TO GRID #1 (MAX.)	0.04	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM CATHODE CURRENT	3	MA.
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	0.25	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	0.05	AMP.
PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	2.1	MA.
GRID #2 CURRENT	0.55	MA.
TRANSCONDUCTANCE	630	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR Gm =10 μMHOS	-11.5	VOLTS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHMS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	1.0	MA.

TUNG-SOL

R-F PENTODE AMPLIFIER

COATED FILAMENT

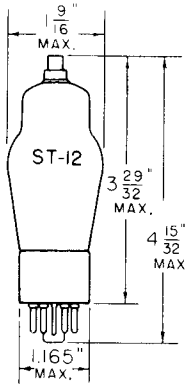
2.0 VOLTS 0.06 AMPERE

DC

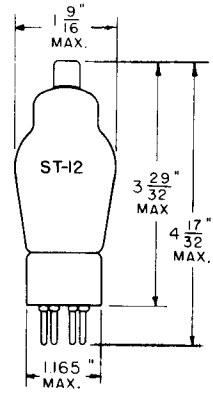
GLASS BULB

MOUNTING POSITION

FOR TUBE TYPE 1B4P, HORIZONTAL OPERATION WILL BE PERMITTED IF PINS 1 AND 4 ARE IN A VERTICAL PLANE. THE SAME WILL HOLD TRUE FOR TYPE 1E5GP IF PINS 5 AND 7 ARE IN A VERTICAL PLANE.

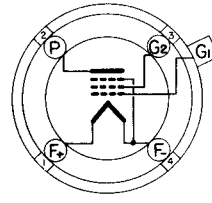


1E5GP
SKIRTED MINIATURE CAP



1B4P
SMALL METAL CAP

BOTTOM VIEW
SMALL SHELL OCTAL 7 PIN BASE



BOTTOM VIEW
SMALL 4 PIN BASE

THE 1E5GP AND 1B4P ARE DESIGNED FOR SERVICE AS GENERAL PURPOSE SHARP CUT-OFF PENTODE AMPLIFIERS IN BATTERY OPERATED EQUIPMENTS.

RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	67.5	VOLTS
MAXIMUM CATHODE CURRENT	6.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (WITH SHIELD)	0.007 MAX.	μμf
INPUT	5.0	μμf
OUTPUT	11	μμf

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OCT. 31 1944

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	180	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE[A]	-3.0	-3.0	VOLTS
PLATE CURRENT	1.6	1.7	MA.
SCREEN CURRENT	0.7	0.6	MA.
PLATE RESISTANCE (APPROX.)	1.0	1.5	MEGOHMS
TRANSCONDUCTANCE	600	650	μMHOS
AMPLIFICATION FACTOR (APPROX.)	550	1000	
CONTROL GRID VOLTAGE FOR PLATE CURRENT CUT-OFF[A]	-8.0	-8.0	VOLTS

[A] RETURN TO NEGATIVE FILAMENT (PIN #7)

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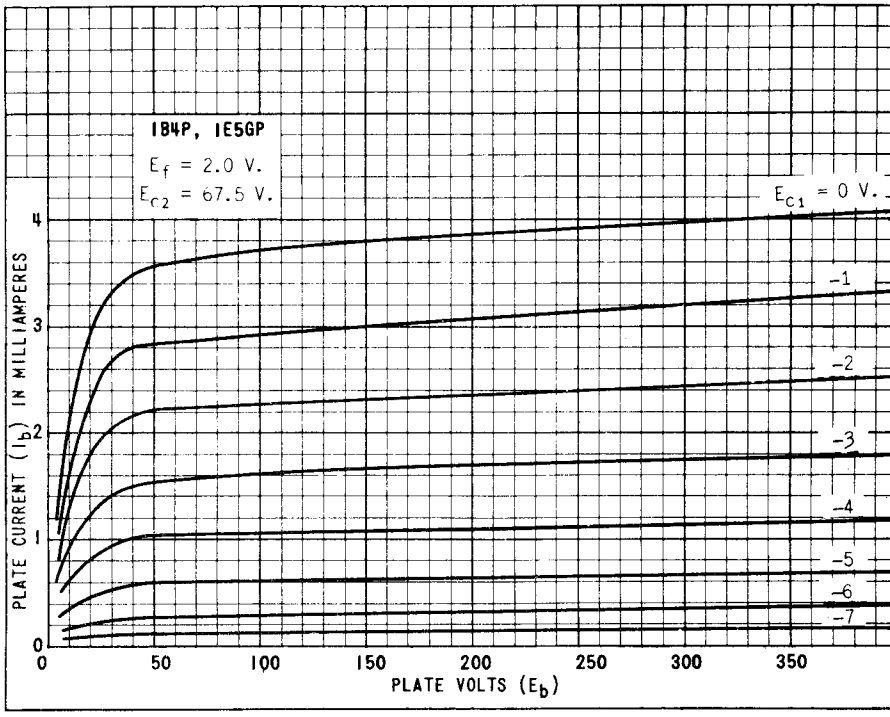

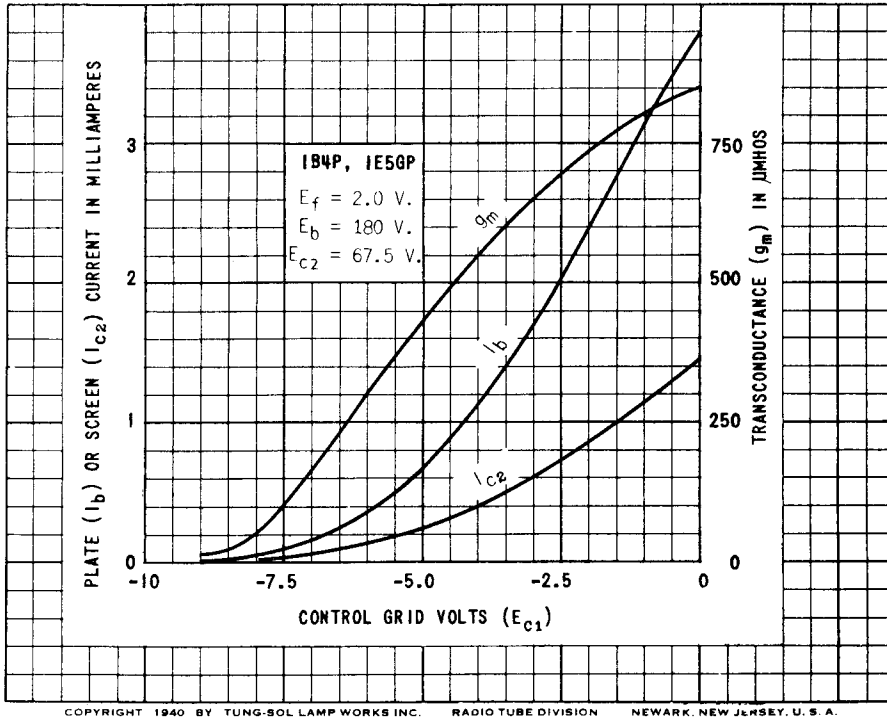

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OCT. 31
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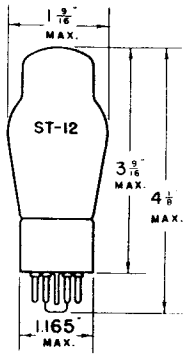


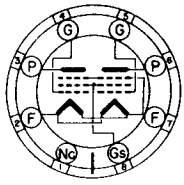
TWIN PENTODE

POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.24 AMPERE
DC

GLASS BULB



G-8C

BOTTOM VIEW

SMALL 8 PIN OCTAL BASE

THE TUNG-SOL 1E7G COMBINES TWO FILAMENT TYPE POWER PENTODES IN A SINGLE BULB. IT IS DESIGNED FOR SERVICE AS A PUSH-PULL POWER AMPLIFIER IN BATTERY OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

EACH PENTODE SECTION

PLATE VOLTAGE	90	135	VOLTS
SCREEN VOLTAGE	90	135	VOLTS
CONTROL GRID VOLTAGE[A]	-3	-4.5	VOLTS
GRID CIRCUIT RESISTANCE MAX.			
FIXED BIAS	0.5	0.5	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
ZERO-SIGNAL PLATE CURRENT	3.8	7.5	MA.
ZERO-SIGNAL SCREEN CURRENT	1.1	2.2	MA.
TRANSCONDUCTANCE	1150	1425	μMHOS
AMPLIFICATION FACTOR	390	370	
LOAD RESISTANCE	20 000	16 000	OHMS
PEAK SIGNAL VOLTAGE	3	4.5	VOLTS
TOTAL DISTORTION	5.5	4.5	PER CENT
POWER OUTPUT	.110	.290	WATT

[A] RETURN TO NEGATIVE FILAMENT (PIN #7)

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DEC. 5
1938

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TUNG-SOL

CLASS A1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	135	VOLTS
SCREEN VOLTAGE	135	VOLTS
CONTROL GRID VOLTAGE	-7.5	VOLTS
GRID CIRCUIT RESISTANCE		
FIXED BIAS	0.5	MEGOHM
SELF BIAS	1.0	MEGOHM
ZERO-SIGNAL PLATE CURRENT	14	MA.
MAX.-SIGNAL PLATE CURRENT	21	MA.
ZERO-SIGNAL SCREEN CURRENT	4	MA.
MAX.-SIGNAL SCREEN CURRENT	7	MA.
LOAD RESISTANCE PLATE TO PLATE	24 000	OHMS
PEAK SIGNAL VOLTAGE GRID TO GRID	15	VOLTS
TOTAL DISTORTION	5.5	PER CENT
THIRD HARMONIC	4.5	PER CENT
POWER OUTPUT[P]	.575	WATT

[P] WITH A PEAK SIGNAL VOLTAGE (GRID TO GRID) OF 21 VOLTS, A POWER OUTPUT OF ONE WATT CAN BE OBTAINED WITH 10% DISTORTION. (CLASS A2).

DIRECT INTERELECTRODE CAPACITANCES[S]

	PENTODE A	PENTODE B	
CONTROL GRID TO FILAMENT	7.5	7.5	μμf
PLATE TO FILAMENT	12	12	μμf
CONTROL GRID TO PLATE	0.9	0.9	μμf
CONTROL GRID A TO CONTROL GRID B	0.3		μμf
PLATE A TO PLATE B	2.0		μμf
CONTROL GRID B TO PLATE A	0.16		μμf
CONTROL GRID A TO PLATE B	0.16		μμf

PENTODE A - PENTODE WITH PLATE BROUGHT OUT TO PIN #6.
PENTODE B - PENTODE WITH PLATE BROUGHT OUT TO PIN #3.
[S] WITH SHIELD

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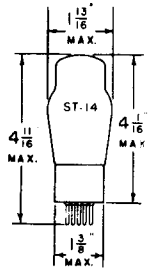
TUNG-SOL



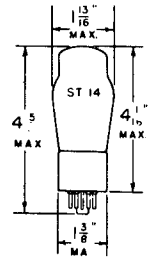
MEDIUM 5 PIN BASE
1F4

PENTODE POWER AMPLIFIER

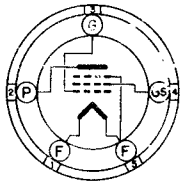
CCATED FILAMENT

2.0 VOLTS 0.12 AMPERE
DC

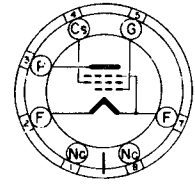
GLASS BULB



MEDIUM 7 PIN OCTAL BASE
1F5G



5K
BOTTOM VIEW
1F4



G 6X
BOTTOM VIEW
1F5G

THE TUNG-SOL 1F4 AND 1F5G ARE PENTODE POWER AMPLIFIERS OF THE FILAMENT TYPE. THEY ARE DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF BATTERY OPERATED RECEIVERS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	180	VOLTS
MAXIMUM PLATE DISSIPATION	1.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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P. N. DI. U.S.A.

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JAN.-31
1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	135	VOLTS
SCREEN VOLTAGE	90	135	VOLTS
CONTROL GRID VOLTAGE[A]	-3	-4.5	VOLTS
PEAK AF SIGNAL VOLTAGE	3	4.5	VOLTS
PLATE CURRENT	4.0	8.0	MA.
SCREEN CURRENT	1.1	2.4	MA.
PLATE RESISTANCE APPROX.	0.24	0.20	MEGOHM
TRANSCONDUCTANCE	1400	1700	μMHOS
LOAD RESISTANCE	20000	16000	OHMS
TOTAL HARMONIC DISTORTION	6	5	PER CENT
POWER OUTPUT	0.110	0.310	WATT

CLASS AB1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	180	VOLTS
SCREEN VOLTAGE	180	VOLTS
CONTROL GRID VOLTAGE[A]	-7.5	VOLTS
PEAK AF SIGNAL VOLTAGE GRID TO GRID	15	VOLTS
ZERO-SIGNAL PLATE CURRENT	19	MA.
ZERO-SIGNAL SCREEN CURRENT	5.5	MA.
MAXIMUM-SIGNAL PLATE CURRENT	21	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	7	MA.
LOAD RESISTANCE PLATE-TO-PLATE	20000	OHMS
TOTAL HARMONIC DISTORTION	4.5	PER CENT
POWER OUTPUT	1.25	WATTS

[A] RETURN TO NEGATIVE FILAMENT (1F4: PIN #5 - 1F5G: PIN #7)

PLATE
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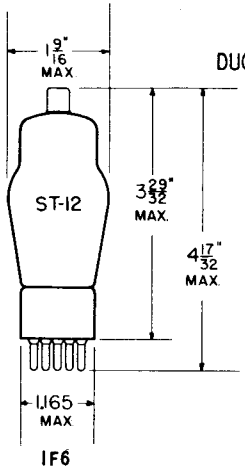
TUNG-SOL

DUO-DIODE PENTODE AMPLIFIER



1F6

SMALL METAL CAP

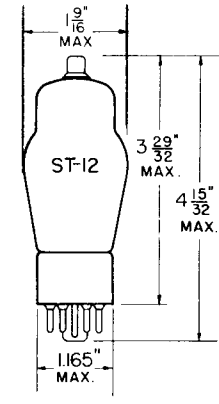
COATED FILAMENT

2.0 VOLTS 0.06 AMPERE DC

GLASS BULB

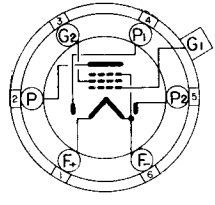
MOUNTING POSITION

HORIZONTAL OPERATION MAY BE PERMITTED IN THE 1F6 TUBE TYPE IF PINS 1 AND 6 ARE ON A VERTICAL PLANE. THE SAME WILL BE TRUE FOR THE 1F7GH TUBE TYPE IF PINS 2 AND 7 ARE ON A VERTICAL PLANE.



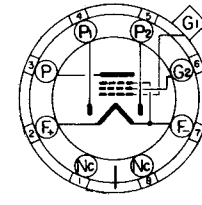
1F7GH

SKIRTED MINIATURE CAP



BOTTOM VIEW

SMALL 6-PIN



BOTTOM VIEW

SMALL SHELL 8-PIN OCTAL

THE 1F6 AND 1F7GH CONSIST OF TWO DIODES AND A PENTODE IN A SINGLE BULB. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS AND PENTODE AMPLIFIERS. WITH THE EXCEPTION OF CAPACITANCES, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	67.5	VOLTS
MAXIMUM PLATE DISSIPATION	0.4	WATT
MAXIMUM SCREEN DISSIPATION	0.05	WATT
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED.	0.5	MA.
MAXIMUM DIODE CURRENT PER PLATE FOR CONTINOUS OPERATION.	0.25	MA.

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TUNG-SOL

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DIRECT INTERELECTRODE CAPACITANCES

	IF6	IF7GH	
GRID TO PLATE [A]	0.007 MAX.	0.01 MAX.	μμf
INPUT: G1 TO (F+G2+G3)	4.0	3.8	μμf
OUTPUT: P TO (F+G2+G3)	9.0	9.5	μμf

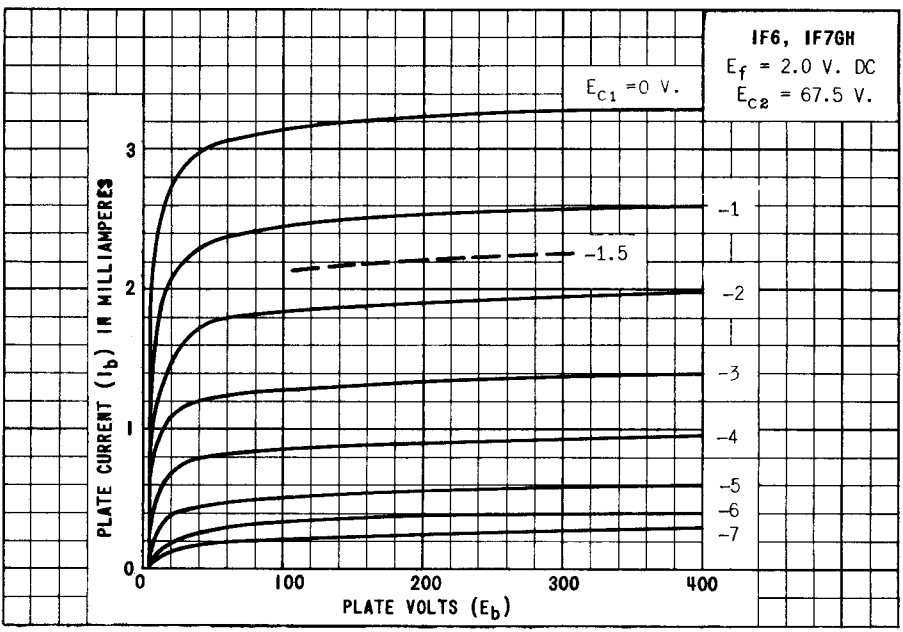
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

-RF OR IF AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	180	VOLTS
SCREEN VOLTAGE	67.5	VOLTS
CONTROL GRID VOLTAGE	-1.5	VOLTS
PLATE RESISTANCE (APPROX.)	1.0	MEGOHM
TRANSCONDUCTANCE	650	μMHOS
TRANSCONDUCTANCE FOR E_{c_1} = -12 VOLTS	20	μMHOS
PLATE CURRENT	2.2	MA.
SCREEN CURRENT	0.7	MA.

[A] WITH SHIELD CAN



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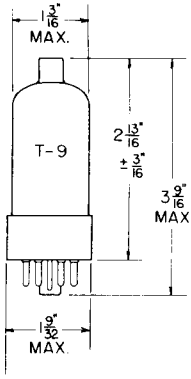
HALF-WAVE RECTIFIER



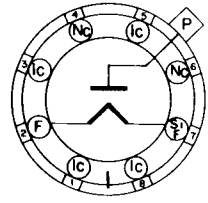
GLASS BULB

COATED FILAMENT

1.25 VOLTS 0.2 AMP.

AC
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
5 PIN OCTAL

OR

SHORT INTERMEDIATE SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS

OR

INTERMEDIATE SHELL
6 PIN OCTAL

OR

SHORT INTERMEDIATE SHELL
6 PIN OCTAL
WITH EXTERNAL BARRIERS

OR

SHORT INTERMEDIATE SHELL
7 PIN OCTAL

OR

INTERMEDIATE SHELL
7 PIN OCTAL

THE 1G3GT IS A HALF-WAVE RECTIFIER UTILIZING A COATED FILAMENT. IT IS INTENDED FOR USE AS A RECTIFIER OF HIGH-VOLTAGE PULSES PRODUCED IN THE SCANNING SYSTEMS OF MONOCHROME TELEVISION RECEIVERS AND AS A RECTIFIER IN HIGH VOLTAGE RF-OPERATED POWER SUPPLIES OF ELECTRONIC EQUIPMENT. IT IS SIMILAR TO THE 1B3GT, BUT IS CONSTRUCTED IN A SMALLER BULB FOR COMPACT EQUIPMENT DESIGN.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

PLATE TO FILAMENT AND INTERNAL SHIELD	1.3	μμf

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PULSE-RECTIFIER SERVICE[A]

FILAMENT VOLTAGE[B]	1.25	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK (ABS. MAX.)[C]	26 000[C]	VOLTS
DC	21 000	VOLTS
MAXIMUM PLATE CURRENT:		
PEAK	50	MA.
AVERAGE	0.5	MA.

RF RECTIFIER SERVICE

FILAMENT VOLTAGE[B]	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABS. MAX.)	33 000[C]	VOLTS
MAXIMUM PLATE CURRENT:		
PEAK	30	MA.
AVERAGE	1	MA.
FREQUENCY RANGE OF SUPPLY VOLTAGE	1.5 TO 100	KC.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] FILAMENT VOLTAGE: 1.05 MIN., 1.25 AVG., 1.45 MAX. VOLTS.

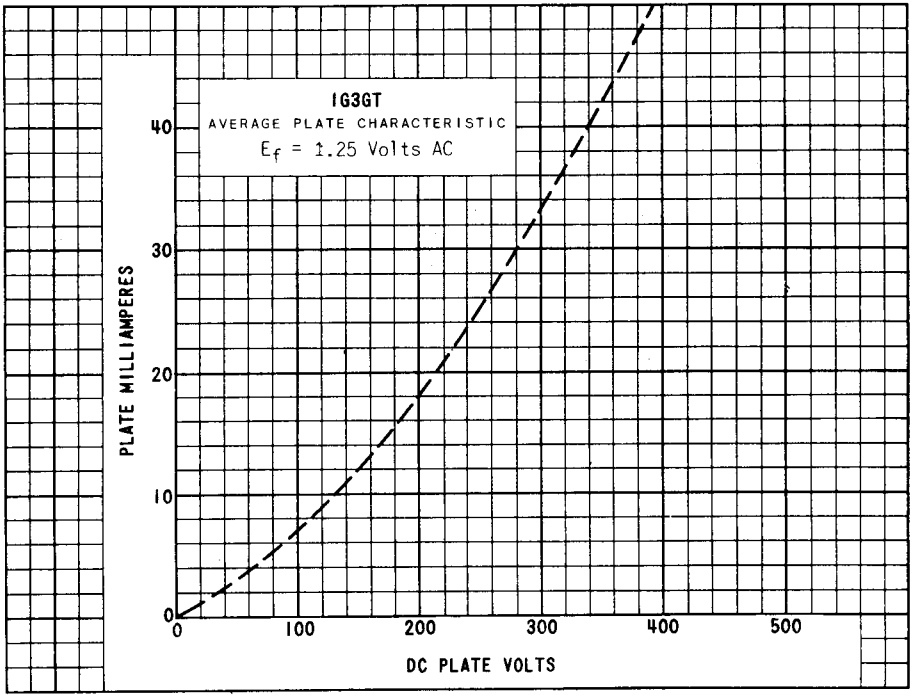
[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

NOTES:

ON THE 5-PIN BASES, PIN #1 IS OMITTED.

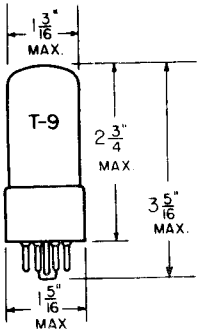
ON THE 5-PIN BASES, THE 6-PIN BASES, AND THE 7-PIN BASE JEDEC #B7-166, PIN 4 IS OMITTED.

ON THE 5-PIN BASES, THE 6-PIN BASES, AND THE 7-PIN BASE JEDEC #B7-47, PIN 6 IS OMITTED.


1G3GT
AVERAGE PLATE CHARACTERISTIC
E_f = 1.25 Volts AC
PLATE MILLIAMPERES
0
10
20
30
40
0
100
200
300
400
500
DC PLATE VOLTS

TUNG-SOL

TRIODE AMPLIFIER



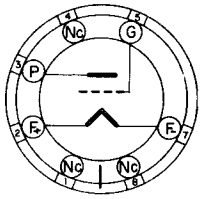
COATED FILAMENT

1.4 VOLTS 0.05 AMPERE

DC

GLASS BULB

ANY MOUNTING POSITION



INTERMEDIATE 7 PIN
OCTAL BASE

THE 1G4GT/G IS A FILAMENT TYPE GENERAL PURPOSE TRIODE ESPECIALLY DESIGNED FOR USE IN LOW DRAIN BATTERY OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	4.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	2.8	μμf
INPUT	2.2	μμf
OUTPUT	3.4	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
GRID VOLTAGE[A]	-6.0	VOLTS
PLATE CURRENT	2.3	MA.
PLATE RESISTANCE	10 700	OHMS
MUTUAL CONDUCTANCE	825	μMHOS
AMPLIFICATION FACTOR	8.8	

[A] NEGATIVE FILAMENT RETURN

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PLATE
1503
OCT. 31
1944

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1G4GT/G

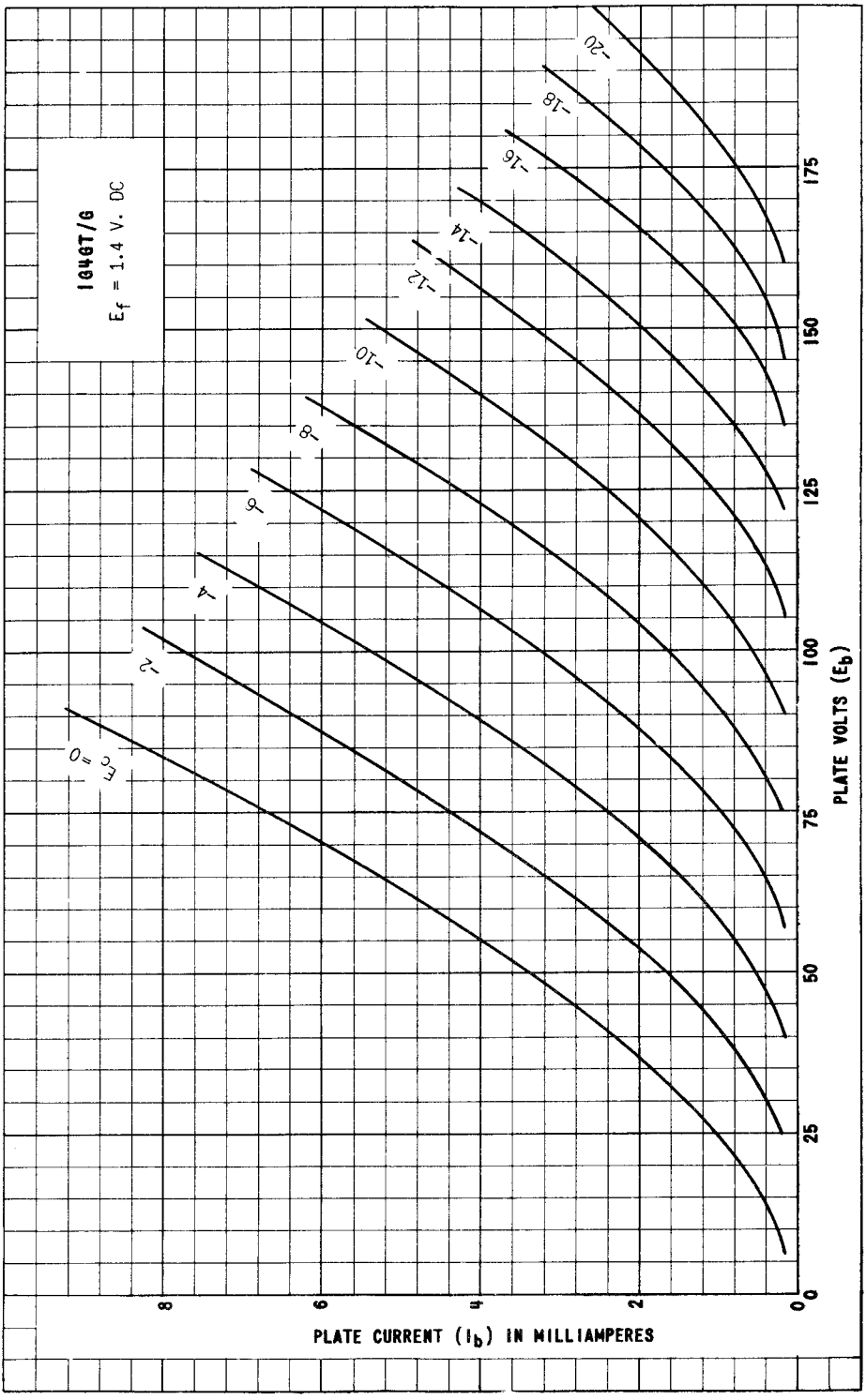

PLATE
1504
OCT. 31
1944

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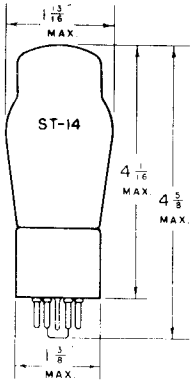
TUNG-SOL



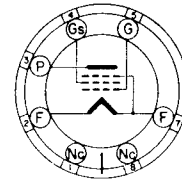
PENTODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.12 AMPERE
DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE



6X-0-0

THE TUNG-SOL 1G5G IS A FILAMENT TYPE PENTODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF BATTERY OPERATED RECEIVERS.

RATINGS

MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	1.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.6	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	124	135	VOLTS
SCREEN VOLTAGE	90	124	135	VOLTS
CONTROL GRID VOLTAGE[A]	-6	-11	-13.5	VOLTS
PEAK AF SIGNAL VOLTAGE	6	9.9	9.2	VOLTS
ZERO-SIGNAL PLATE CURRENT	8.5	10.0	8.7	MA.
ZERO-SIGNAL SCREEN CURRENT	2.5	3.0	2.5	MA.
MAXIMUM-SIGNAL PLATE CURRENT	8.7	10.7	9.7	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	3.0	4.3	3.6	MA.
PLATE RESISTANCE APPROX.	133 000	145 000	160 000	OHMS
TRANSCONDUCTANCE	1500	1500	1550	μMHOS
LOAD RESISTANCE	8500	8000	9000	OHMS
TOTAL HARMONIC DISTORTION	6	10.5	11	PER CENT
SECOND HARMONIC DISTORTION	3	7	*8	PER CENT
THIRD HARMONIC DISTORTION	5	7.5	7	PER CENT
POWER OUTPUT	.250	.600[B]	.550[C]	WATT

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL.

[B] WITH A PEAK AF GRID VOLTAGE OF 11 VOLTS, A POWER OUTPUT OF .650 WATT CAN BE OBTAINED WITH 13% TOTAL DISTORTION (6% SECOND, 11% THIRD).

[C] WITH A PEAK AF GRID VOLTAGE OF 13.5 VOLTS, A POWER OUTPUT OF .750 WATT CAN BE OBTAINED WITH 18% TOTAL DISTORTION (9 % SECOND, 15% THIRD).

CONTINUED NEXT PAGE

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PLATE 1170-3

FEB. 28 1942

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1G5G

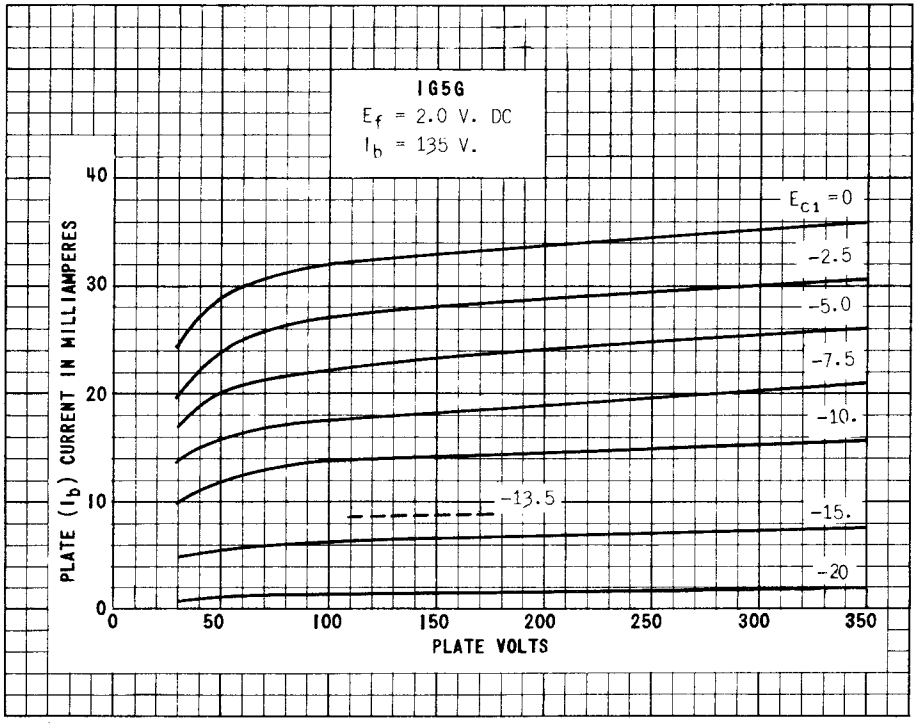

PLATE
1171-1

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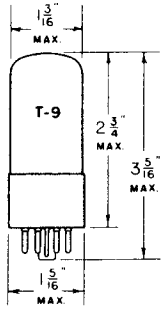
TUNG-SOL

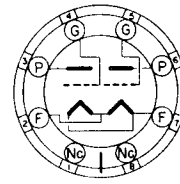


CLASS B TWIN TRIODE AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.10 AMPERE
DC

GLASS BULB



7AB-0-0

INTERMEDIATE 8 PIN OCTAL BASE

THE TUNG-SOL 1G6GT/G IS A LOW VOLTAGE, LOW CURRENT DRAIN, TWIN TRIODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS A ZERO BIAS CLASS "B" POWER AMPLIFIER.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION — VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC — DC POWER LINE OPERATION — DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE PER PLATE	110	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	20	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS B POWER AMPLIFIER

VALUES ARE FOR 2 UNITS UNLESS OTHERWISE SPECIFIED

PLATE VOLTAGE	90	90	VOLTS
DC GRID VOLTAGE [A]	0	0	VOLTS
PEAK AF SIGNAL VOLTAGE GRID TO GRID B	42	48	VOLTS
ZERO SIGNAL DC PLATE CURRENT	2	2	MA.
MAXIMUM SIGNAL DC PLATE CURRENT	14	11	MA.
PEAK GRID CURRENT PER UNIT	5	6	MA.
PLATE SUPPLY IMPEDANCE	0	0 [C]	OHMS
EFFECTIVE GRID CIRCUIT IMPEDANCE PER UNIT	0	2530 [D]	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	12000	12000	OHMS
TOTAL HARMONIC DISTORTION	3	4	PER CENT
POWER OUTPUT APPROX.	0.675	0.350	WATT

[A] RETURN TO NEGATIVE FILAMENT TERMINAL (PIN #7).

[B] INCLUDES PEAK GRID IMPEDANCE VOLTAGE DROP.

[C] BATTERY SUPPLY.

[D] AT 400 CYCLES THE EFFECTIVE RESISTANCE PER GRID CIRCUIT IS 2500 OHMS, AND THE LEAKAGE REACTANCE OF THE COUPLING TRANSFORMER IS 155 MILLIHENRYS.

CONTINUED NEXT PAGE

PLATE
1190-1

FEB. 28
1942

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1G6GT/G

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

EACH TRIODE UNIT

FILAMENT VOLTAGE	1.4 DC	VOLTS
FILAMENT CURRENT	0.1	AMPERE
PLATE VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE[A]	0	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE APPROX.	45 000	OHMS
TRANSCONDUCTANCE	675	µMHOS
AMPLIFICATION FACTOR	30	

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL.

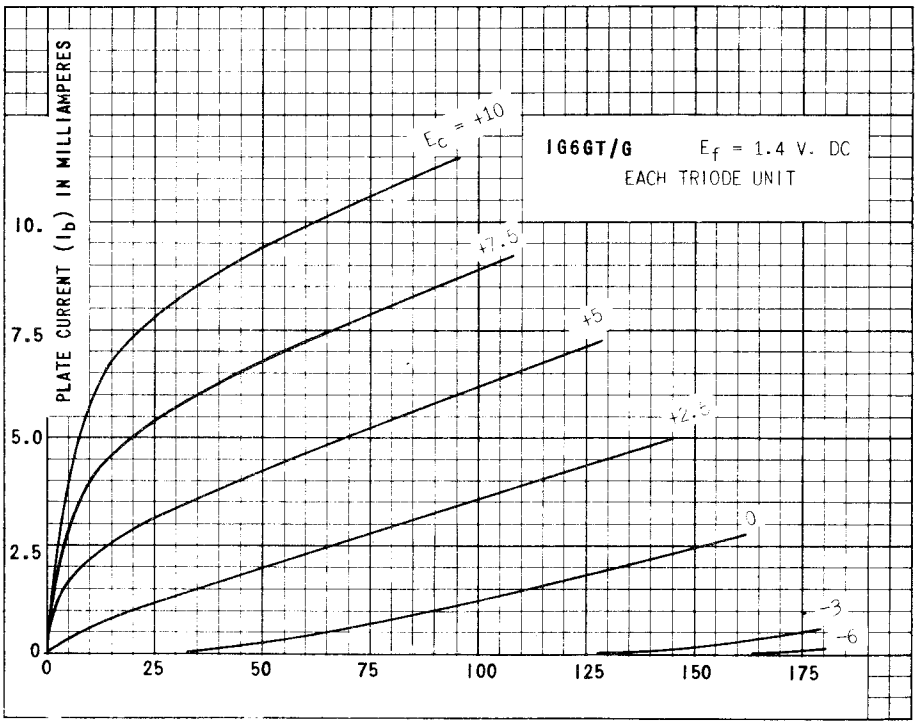

PLATE 1191-1

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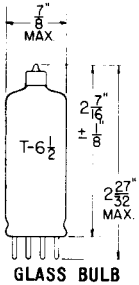
TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB
TOP CAP—MINIATURE

COATED UNIPOTENTIAL CATHODE

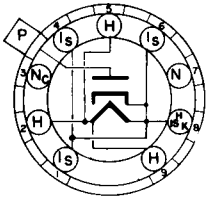
HEATER

1.4 VOLTS 0.55 AMP.

AC OR DC

ANY MOUNTING POSITION

*SOCKET TERMINALS 3 & 7 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9LX

THE 1H2 IS A MINIATURE HEATER—CATHODE TYPE DIODE DESIGNED FOR USE IN TELEVISION RECEIVERS AS THE HIGH-VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE TELEVISION PICTURE TUBE. THE 1H2 IS PRIMARILY INTENDED FOR USE IN FLY-BACK TYPES OF POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE & INTERNAL SHIELD	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK RECTIFIER SERVICE[A]

HEATER VOLTAGE	1.4	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	24 000	VOLTS
TOTAL DC AND PEAK	30 000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	50	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP (APPROX.)		
I_b = 7.0 MA.	100	VOLTS

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION.

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TUNG-SOL

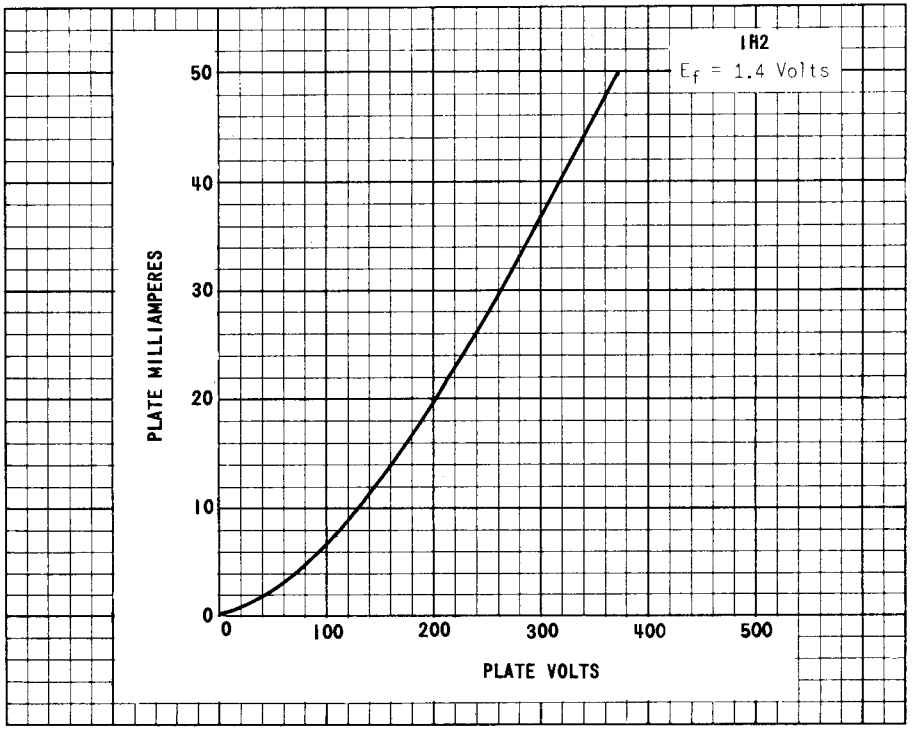
CONTINUED FROM PRECEDING PAGE

NOTES

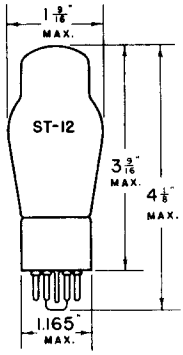
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

THE VOLTAGES EMPLOYED IN SOME TELEVISION RECEIVERS AND OTHER HIGH-VOLTAGE EQUIPMENT ARE SUFFICIENTLY HIGH THAT HIGH-VOLTAGE RECTIFIER TUBES MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS SUCH TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.



TUNG-SOL



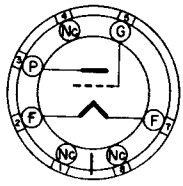
TRIODE AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.06 AMPERE
DC

GLASS BULB

SMALL 7 PIN OCTAL BASE



G-5Z

THE TUNG-SOL 1H4G IS A GENERAL PURPOSE FILAMENT TYPE TRIODE DESIGNED FOR SERVICE IN BATTERY OPERATED RECEIVERS. WITH THE EXCEPTION OF CAPACITANCES ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 30.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE		90	135	180 MAX.	VOLTS
GRID VOLTAGE		-4.5	-9	-13.5	VOLTS
GRID CIRCUIT RESISTANCE	MAX.	2	2	2	MEGOHMS
PLATE CURRENT		2.5	3.0	3.1	MA.
PLATE RESISTANCE		11 000	10 300	10 300	OHMS
TRANSCONDUCTANCE		850	900	900	μMHOS
AMPLIFICATION FACTOR		9.3	9.3	9.3	

DETECTOR

		BIASED		GRID LEAK	
PLATE VOLTAGE	90	135	180 MAX.	45 MAX.	VOLTS
GRID VOLTAGE	-9 A	-13.5 A	-18 A	RETURN TO (+) FILAMENT	VOLTS
PLATE CURRENT P	ADJUSTED TO 0.2 MA. WITH NO INPUT SIGNAL			—	
GRID LEAK	—	—	—	1 TO 5	MEGOHMS
GRID CONDENSER	—	—	—	250	μμf

A APPROXIMATE. GRID RETURN TO NEGATIVE END OF FILAMENT.

P WITH MAXIMUM SIGNAL THE AVERAGE DC PLATE CURRENT SHOULD NOT EXCEED 2.0 MA.

CONTINUED NEXT PAGE

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PLATE 206-1

TUNG-SOL

CLASS B_2 AMPLIFIER

PLATE VOLTAGE	180 MAX.	VOLTS
PEAK PLATE CURRENT PER TUBE	50 MAX.	MA.
ZERO-SIGNAL PLATE CURRENT PER TUBE	1.5 MAX.	MA.

TYPICAL OPERATING CONDITIONS

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	157.5	VOLTS
GRID VOLTAGE	-15	VOLTS
ZERO-SIGNAL PLATE CURRENT	1	MA.
LOAD RESISTANCE PER TUBE	2000	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	8000	OHMS
PEAK POWER INPUT GRID TO GRID	260 MAX.	MILLIWATTS
POWER OUTPUT[D] (6% TO 7% DISTORTION)	2.1	WATTS

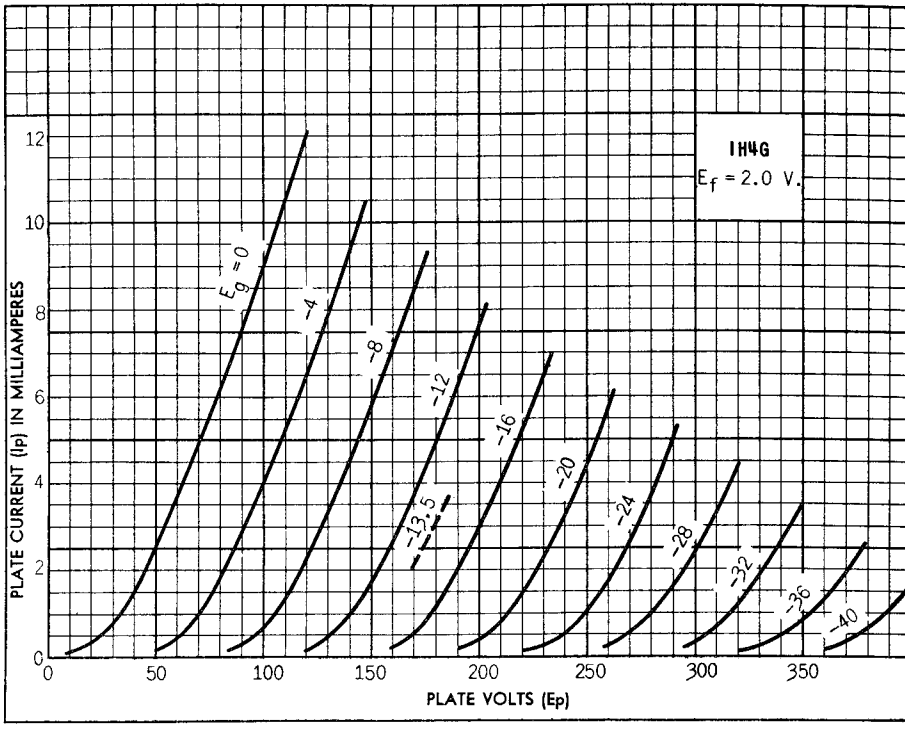
[D] WITH ONE TYPE 1H4G AS DRIVER, OPERATED WITH PLATE VOLTAGE = 157.5 VOLTS, GRID VOLTAGE = -11.3 VOLTS, PLATE LOAD OF APPROXIMATELY 18 000 OHMS, AND INPUT TRANSFORMER RATIO, PRIMARY TO ONE HALF SECONDARY = 1.165.

DIRECT INTERELECTRODE CAPACITANCES [S]

GRID TO FILAMENT	3.6	μμf
PLATE TO FILAMENT	5.0	μμf
GRID TO PLATE	5.0	μμf

[S] WITH SHIELD

PLATE 207-1



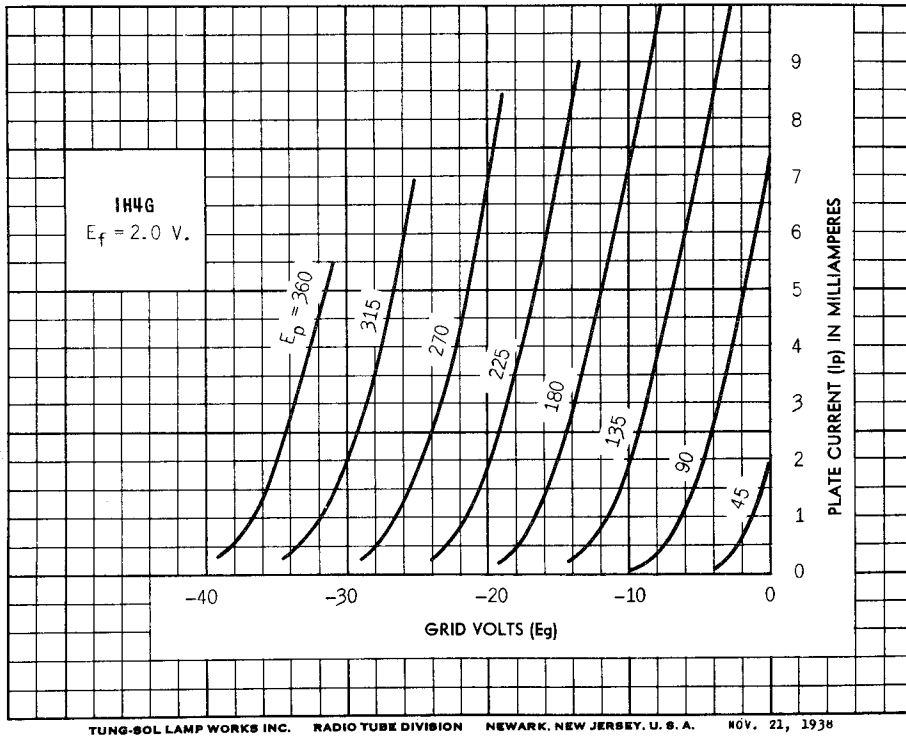


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PLATE
200-1

1H4 G

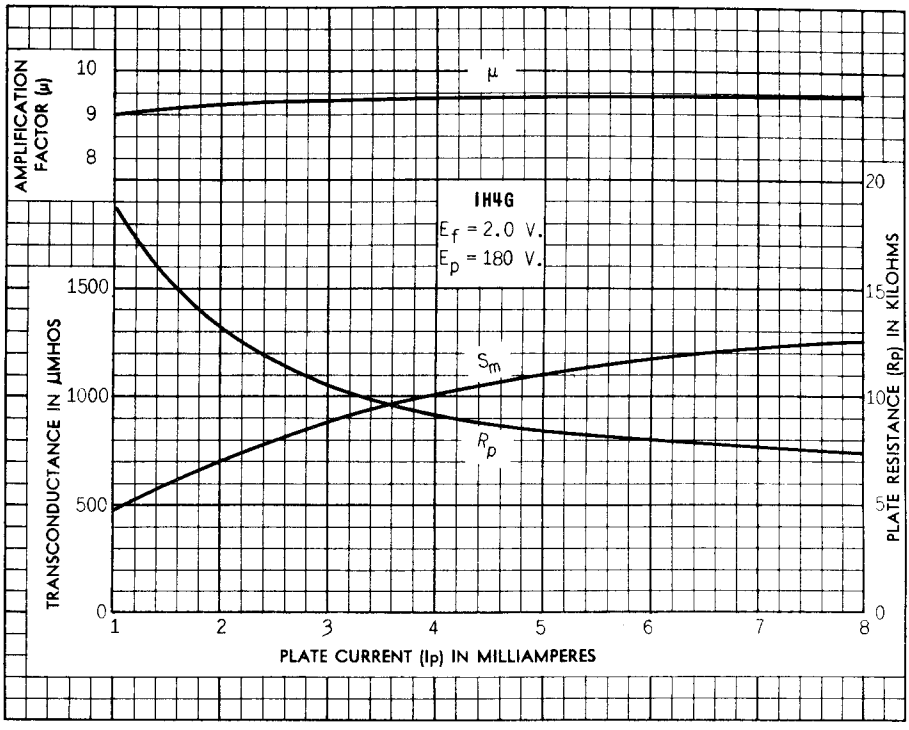


PLATE
201-1

TUNG-SOL

DIODE TRIODE AMPLIFIER

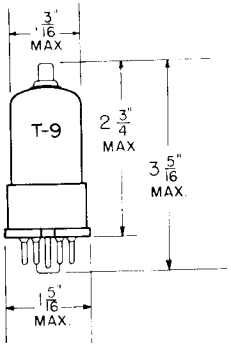
COATED FILAMENT

1.4 VOLTS 0.05 AMPERE

DC

GLASS BULB

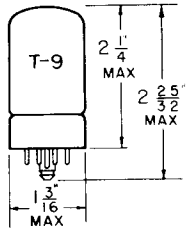
ANY MOUNTING POSITION



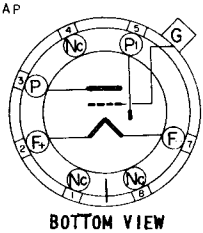
1H5GT/G

SKIRTED

MINIATURE CAP



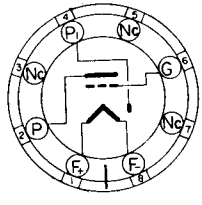
1LH4



BOTTOM VIEW

7-PIN OCTAL BASE

WITH METAL SHELL



BOTTOM VIEW

LOCKING-IN

8-PIN

THE 1H5GT/G AND 1LH4 ARE TUBES COMBINING A SINGLE DIODE AND A HIGH-MU TRIODE IN ONE BULB. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS, AND AS RESISTANCE COUPLED AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	110	VOLTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE UNIT

PLATE VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE [A]	0	VOLTS
PLATE CURRENT	0.15	MA.
PLATE RESISTANCE	0.24	MEGOHM
TRANSCONDUCTANCE	275	μMHOS
AMPLIFICATION FACTOR	65	

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL

DIODE UNIT

THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT AND IS INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON FILAMENT.

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PLATE 1529

JAN. 15 1945

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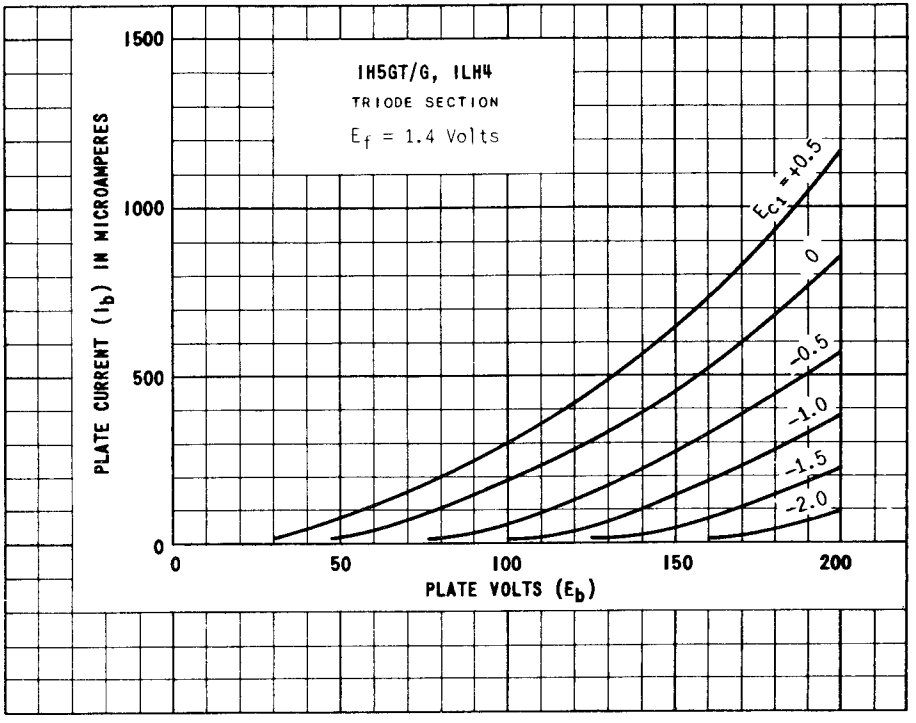
1H5GT/G (1LH4)



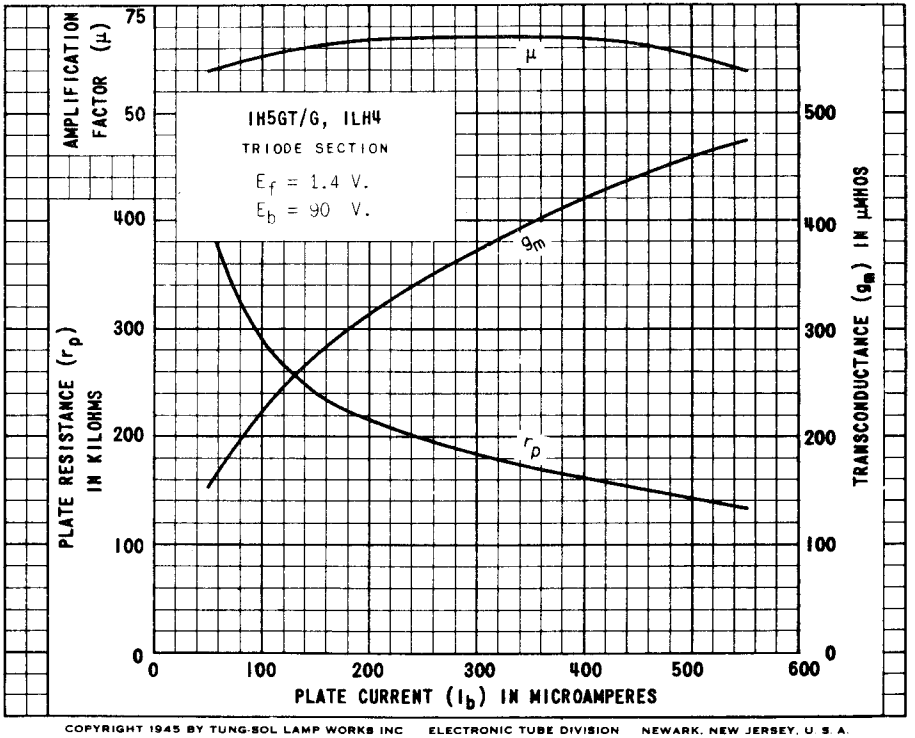


PLATE 1530
JAN. 15 1945

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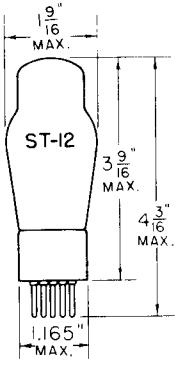
TUNG-SOL

DUO-DIODE TRIODE AMPLIFIER



1B5/25S

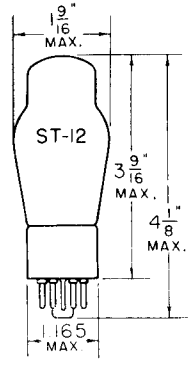
COATED FILAMENT

2.0 VOLTS 0.06 AMPERE
DC

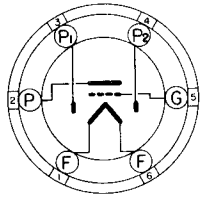
GLASS BULB

MOUNTING POSITION

THESE TUBES SHOULD BE OPERATED VERTICALLY WITH BASE DOWN. HOWEVER, HORIZONTAL OPERATION MAY BE PERMITTED FOR TUBE TYPE 1B5/25S WHEN PINS 2 AND 5 ARE HORIZONTAL. THE SAME WILL BE TRUE FOR THE 1H6G TUBE TYPE WHEN PINS 2 AND 7 ARE HORIZONTAL.



1H6G



BOTTOM VIEW

SMALL 6 PIN BASE

BOTTOM VIEW

SMALL 8 PIN OCTAL BASE

THE 1B5/25S AND 1H6G COMBINE TWO DIODES AND A TRIODE IN A SINGLE BULB. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS, AND IMPEDANCE OR RESISTANCE COUPLED AMPLIFIERS IN BATTERY OPERATED RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	1B5/25S	1H6G	
GRID TO PLATE	3.6	3.6	μμf
INPUT	1.6	1.6	μμf
OUTPUT	1.9	1.9	μμf

OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT - CLASS A_1 AMPLIFIER

MAXIMUM PLATE VOLTAGE	135	VOLTS
CONTROL GRID VOLTAGE	-3.0	VOLTS
PLATE CURRENT	0.8	MA.
PLATE RESISTANCE	35 000	OHMS
TRANSCONDUCTANCE	575	μMHOS
AMPLIFICATION FACTOR	20	

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PLATE 1505
OCT. 31 1944

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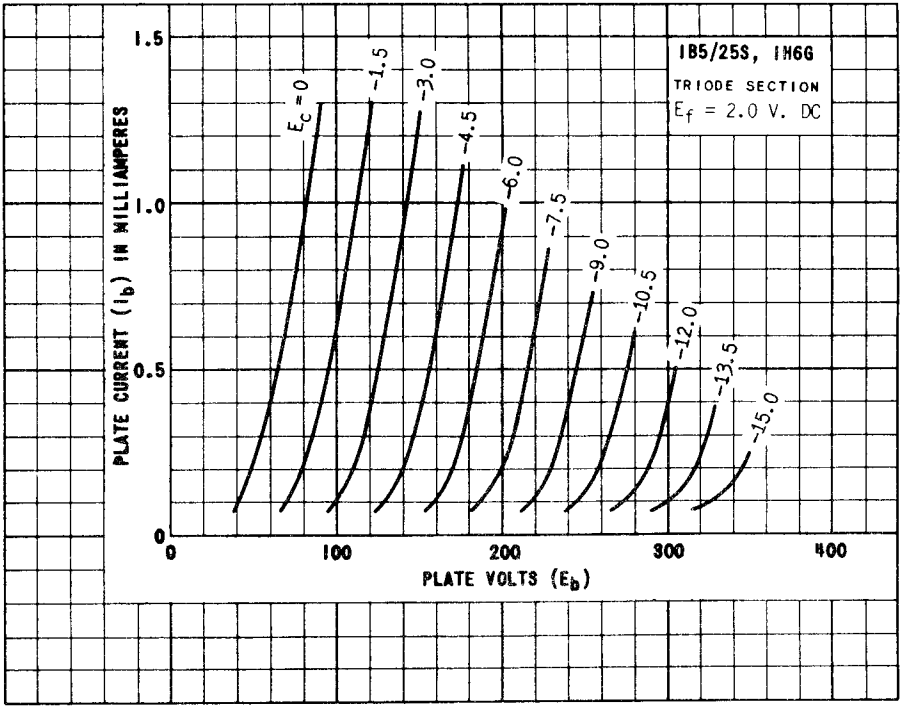
1H6G (1B5/25S)



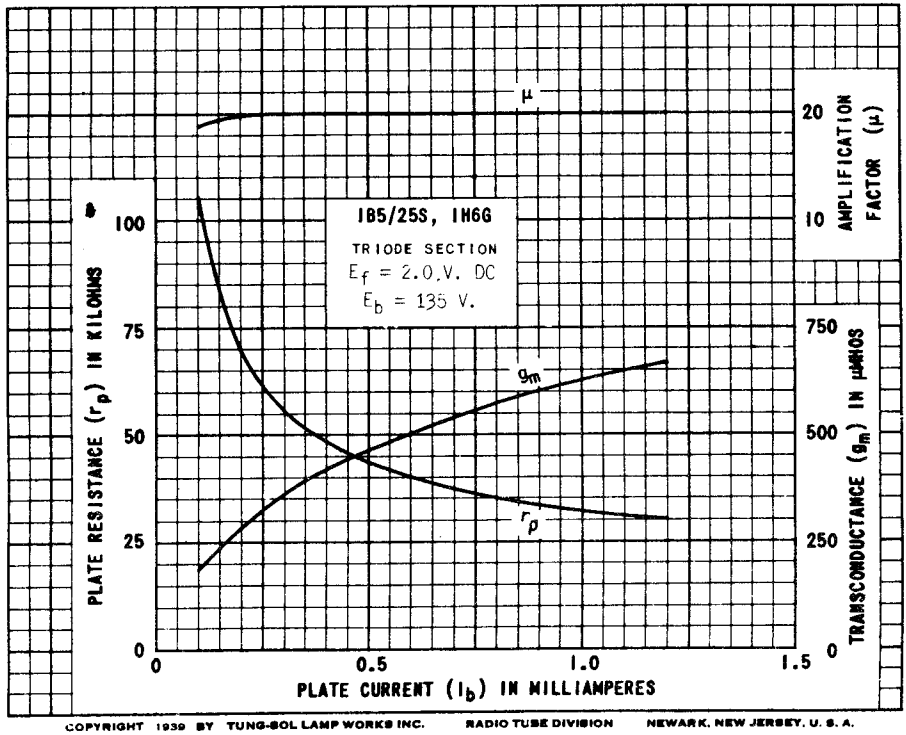


PLATE 1506
OCT. 31 1944

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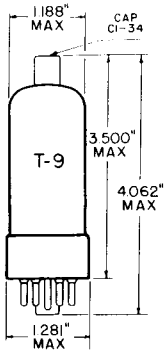
TUNG-SOL

DIODE



GLASS BULB

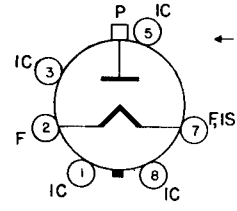
86-8 INTERMEDIATE SHELL
OR
86-60 SHORT
INTERMEDIATE SHELL
6 PIN OCTAL

COATED FILAMENT

1.25 VOLTS 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

SOCKET TERMINALS 1,3,4,5,6, AND 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTS TO TERMINAL 7. TERMINALS 4 AND 6 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.

THE 1J3 IS A FILAMENTARY DIODE DESIGNED FOR USE IN TELEVISION RECEIVERS AS THE HIGH-VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE TELEVISION PICTURE TUBE. IT IS INTENDED PRIMARILY FOR USE IN FLYBACK TYPES OF POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITHOUT EXTERNAL SHIELD

PLATE TO FILAMENT	1.6	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	1.25[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	22 000	VOLTS
TOTAL DC AND PEAK	26 000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	50	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
TUBE VOLTAGE DROP (APPROX.) I_b=7.0 MA. DC	225	VOLTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

NOTES

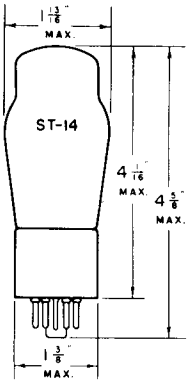
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

THE VOLTAGES EMPLOYED IN SOME TELEVISION RECEIVERS AND OTHER HIGH-VOLTAGE EQUIPMENT ARE SUFFICIENTLY HIGH THAT HIGH-VOLTAGE RECTIFIER TUBES MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS SUCH TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.

TUNG-SOL



PENTODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.12 AMPERE
DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE

THE TUNG-SOL 1J5G IS A FILAMENT TYPE PENTODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF BATTERY OPERATED RECEIVERS. ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 950.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	VOLTS
SCREEN VOLTAGE	135	VOLTS
CONTROL GRID VOLTAGE [A]	-16.5	VOLTS
GRID CIRCUIT RESISTANCE WITH FIXED BIAS MAX.	0.5	MEGOHM
PLATE CURRENT	7	MA.
SCREEN CURRENT	2	MA.
TRANSCONDUCTANCE	950	μMHOS
AMPLIFICATION FACTOR	100	
LOAD RESISTANCE	13 500	OHMS
POWER OUTPUT	0.45	WATT

[A] RETURN TO NEGATIVE FILAMENT (PIN #7)

DIRECT INTERELECTRODE CAPACITANCES [S]

CONTROL GRID TO FILAMENT	8	μμf
PLATE TO FILAMENT	14	μμf
CONTROL GRID TO PLATE	0.8	μμf

[S] WITH SHIELD

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PLATE 536-2

AUG. 14 1939

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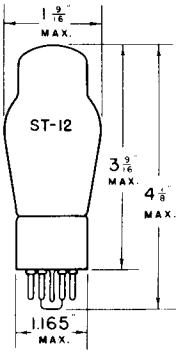
TUNG-SOL



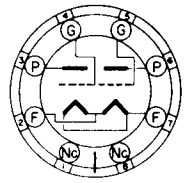
TWIN TRIODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.24 AMPERE
DC

GLASS BULB

SMALL 8 PIN OCTAL BASE



G-7AB

BOTTOM VIEW

THE TUNG-SOL 1J6G IS DESIGNED FOR SERVICE AS A CLASS B POWER OUTPUT AMPLIFIER IN BATTERY OPERATED RECEIVERS. WITH THE EXCEPTION OF FILAMENT CURRENT AND CAPACITANCES, ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 19.

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE MAX.	135	VOLTS
PEAK PLATE CURRENT PER PLATE MAX.	50	MA.

CLASS B_2 AMPLIFIER

PLATE VOLTAGE MAX.	135	135	135	VOLTS
GRID VOLTAGE [A]	-6	-3	0	VOLTS
ZERO-SIGNAL PLATE CURRENT PER PLATE	0.1	1.7	5	MA.
LOAD RESISTANCE PER PLATE	2500	2500	2500	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	10 000	10 000	10 000	OHMS
AVERAGE POWER INPUT APPROX. GRID TO GRID	0.095	0.130	0.170	WATT
POWER OUTPUT APPROX.	1.6	1.9	2.1	WATTS

[A] RETURN TO NEGATIVE FILAMENT (PIN #7)

DIRECT INTERELECTRODE CAPACITANCES [S]

	TRIODE 2		TRIODE 1	
GRID TO FILAMENT	3.2		3.2	μμf
PLATE TO FILAMENT	4.4		4.4	μμf
GRID TO PLATE	7.5		7.5	μμf
GRID 1 TO GRID 2		0.26		μμf
PLATE 1 TO PLATE 2		0.5		μμf
GRID 2 TO PLATE 1		0.05		μμf
GRID 1 TO PLATE 2		0.05		μμf

TRIODE 2 IS TRIODE HAVING GRID BROUGHT OUT TO PIN #4.
TRIODE 1 IS TRIODE HAVING GRID BROUGHT OUT TO PIN #5.
[S] WITH SHIELD

PLATE 537-2

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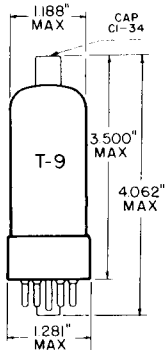
TUNG-SOL

DIODE



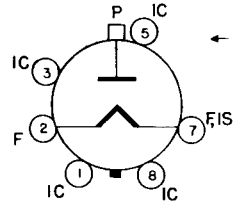
GLASS BULB
B6-8 INTERMEDIATE SHELL
OR
B6-6C SHORT
INTERMEDIATE SHELL
7 PIN OCTAL
OUTLINE DRAWING
6-83 WITH B6-8C OR
6-84 WITH B6-8

COATED FILAMENT

1.25 VOLTS 200 MA.
AC OR DC

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP. *



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

SOCKET TERMINALS 1, 3, 4, 5, 6, AND 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTS TO TERMINAL 7. TERMINALS 4 AND 6 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR FILAMENT POTENTIAL.

THE 1K3 IS A FILAMENTARY DIODE DESIGNED FOR USE IN TELEVISION RECEIVERS AS A HIGH-VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE TELEVISION PICTURE TUBE. IT IS INTENDED PRIMARILY FOR USE IN FLYBACK TYPES OF POWER SUPPLIES AND IS A DIRECT REPLACEMENT FOR THE 1J3.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO FILAMENT	1.6	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	1.25[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	22 000	VOLTS
TOTAL DC AND PEAK	26 000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	50	MA.
MAXIMUM DC OUTPUT CURRENT	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
TUBE VOLTAGE DROP (APPROX.) I_b =7.0 MA. DC	225	VOLTS

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION.

→INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

NOTES

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

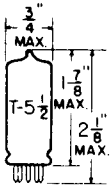
RF AMPLIFIER PENTODE

MINIATURE TYPE

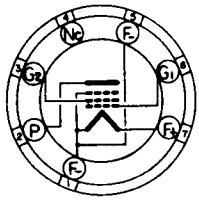
COATED FILAMENT

FILAMENT
1.4 VOLTS 0.05 AMPERE
DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 1L4 IS A RF PENTODE OF THE MINIATURE TYPE WITH A SHARP CUT-OFF CHARACTERISTIC. IT IS RECOMMENDED FOR USE WHEREVER A SHARP CUT-OFF PENTODE IS REQUIRED IN COMPACT, LIGHT-WEIGHT, PORTABLE RECEIVERS. THE TUBE IS, THEREFORE, OF INTEREST IN FM RECEIVERS AND IN OTHER CIRCUITS NOT REQUIRING AVC. THE 1L4 FEATURES INTERNAL SHIELDING WHICH ELIMINATES THE NEED FOR AN EXTERNAL BULB SHIELD, BUT A SOCKET WITH SHIELDING IS ESSENTIAL IF MINIMUM GRID-PLATE CAPACITANCE IS TO BE OBTAINED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P) MAX.	0.008	μμf
INPUT: G_1 TO (F + G_2 + G_3 + I.S.)	3.6	μμf
OUTPUT: P TO (F + G_2 + G_3 + I.S.)	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	110	VOLTS
MINIMUM GRID #1 VOLTAGE	0	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	6.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	0.05	0.05	AMP.
PLATE VOLTAGE	90	90	VOLTS
GRID #2 VOLTAGE	67.5	90	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
PLATE CURRENT	2.9	4.5	MA.
GRID #2 CURRENT	1.2	2.0	MA.
PLATE RESISTANCE (APPROX.)	0.6	0.35	MEGOHM
TRANSCONDUCTANCE	925	1 025	μMHOS
GRID #1 VOLTAGE FOR PLATE CURRENT = 10 μAMPS	-6	-8	VOLTS

SIMILIAR TYPE REFERENCE: Characteristics somewhat similiar to 1LE5 and 1N5GT.

→INDICATES A CHANGE OR ADDITION.

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PLATE 1829
JUNE 2, 1947

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1L4

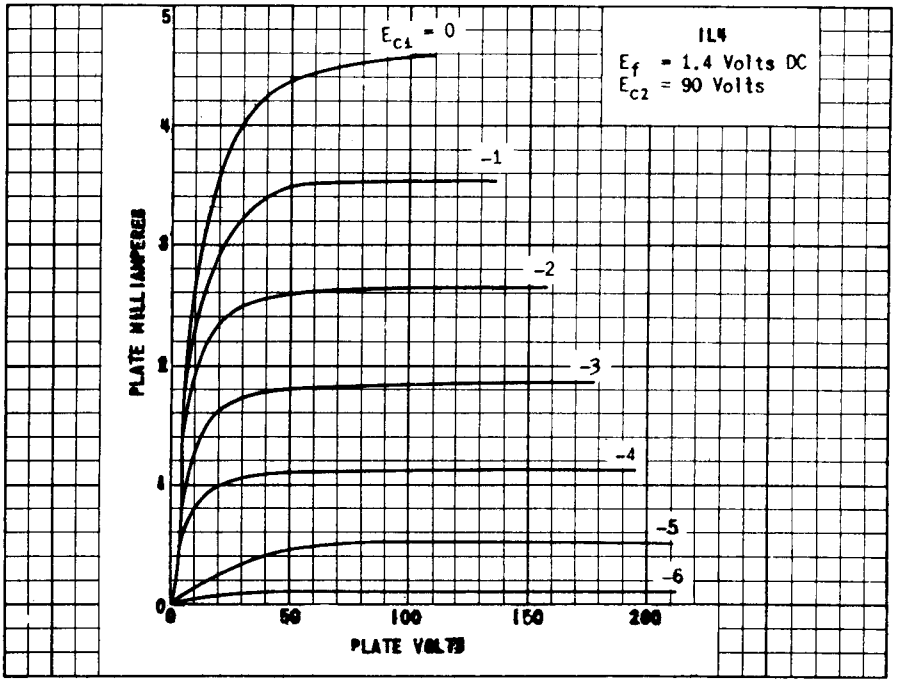

PLATE 1826
JUNE 2, 1947

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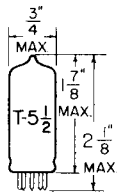
TUNG-SOL

HEPTODE

MINIATURE TYPE



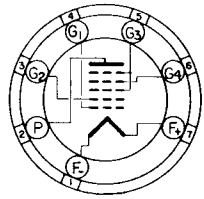
GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7DC

THE 1L6 IS A PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN LOW DRAIN BATTERY OPERATED RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #316 CONNECTED TO PIN 1

RF INPUT: G_4 TO $(F+G_1+G_2+G_{3\&5}+P)$	7.5	μμf
OSC. OUTPUT: G_2 TO $(F+G_{3\&5}+G_4+P)$	2.6	μμf
OSC. INPUT: G_1 TO $(F+G_{3\&5}+G_4+P)$	2.2	μμf
MIXER OUTPUT: P TO $(F+G_1+G_2+G_{3\&5}+G_4)$	12	μμf
GRID #4 TO PLATE: $(G_4$ TO P)	0.3	μμf
GRID #4 TO GRID #2: $(G_4$ TO $G_2)$	0.24	μμf
GRID #4 TO GRID #1: $(G_4$ TO $G_1)$	0.19	μμf
GRID #1 TO GRID #2: $(G_1$ TO $G_2)$	0.8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #3 AND #5 VOLTAGE	65	VOLTS
MAXIMUM GRID #3 AND #5 SUPPLY VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	4	MA.
MINIMUM GRID #4 CIRCUIT RESISTANCE	1	MEGOHM

CONTINUED ON FOLLOWING PAGE

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PLATE 2353
MAR. 1 1950

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	50	MA.
PLATE VOLTAGE	90	VOLTS
GRID #3 AND #5 VOLTAGE[A]	45	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #4 VOLTAGE	0	VOLTS
GRID #4 CIRCUIT RESISTANCE	1	MEGOHM
GRID #1 RESISTOR	0.2	MEGOHM
PLATE RESISTANCE (APPROX.)	0.65	MEGOHM
PLATE CURRENT	0.5	MA.
GRID #3 AND #5 CURRENT	0.6	MA.
GRID #2 CURRENT	1.2	MA.
GRID #1 CURRENT	0.035	MA.
TOTAL CATHODE CURRENT	2.35	MA.
CONVERSION TRANSCONDUCTANCE	300	µMHOS
CONVERSION TRANSCONDUCTANCE AT $E_{C4} = -3$ VOLTS (APPROX.)	10	µMHOS

[A] OBTAINED PREFERABLY BY USING A PROPERLY BY-PASSED DROPPING RESISTOR OF FROM 45000 OHMS TO 75000 OHMS IN SERIES WITH THE B SUPPLY.

OSCILLATOR TRANSCONDUCTANCE
NOT OSCILLATING

GRID #4 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE VOLTAGE	90	VOLTS
GRID #3 AND #5 VOLTAGE	45	VOLTS
GRID #2 VOLTAGE	90	VOLTS
OSCILLATOR TRANSCONDUCTANCE	650	µMHOS

PLATE 2354
MAR. 1 1950

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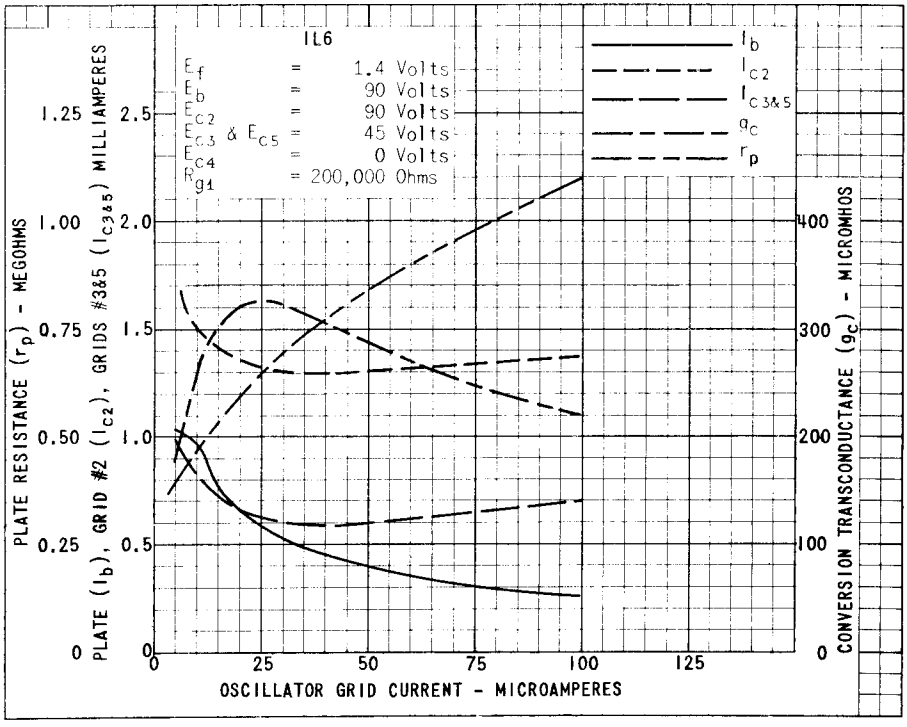

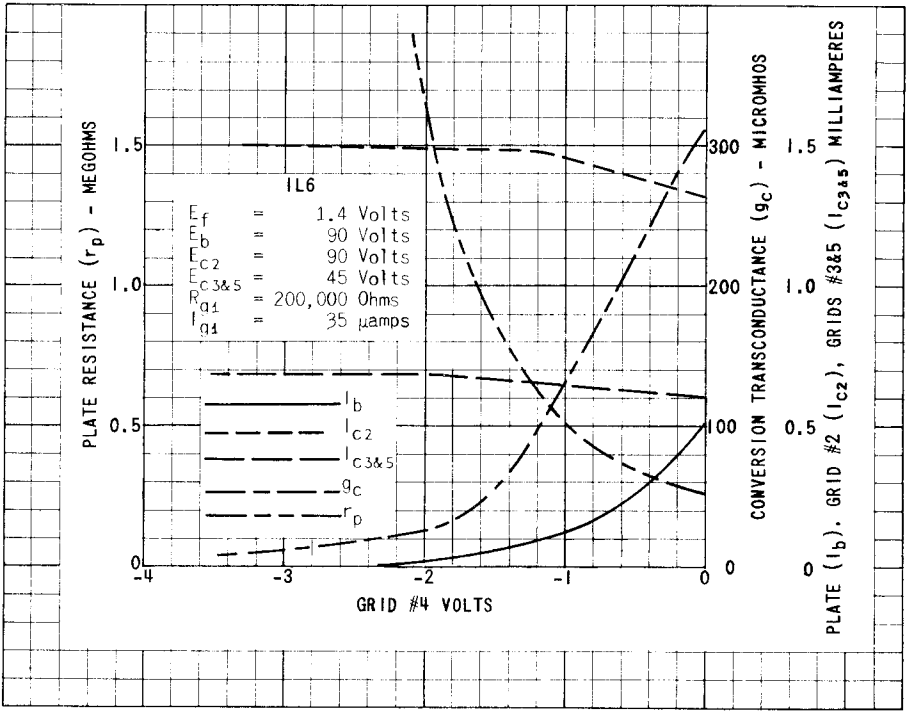

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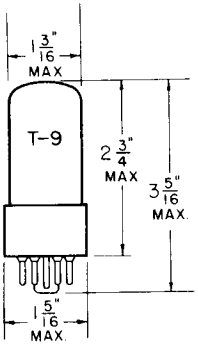


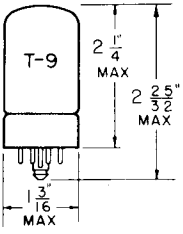
PENTODE POWER AMPLIFIER

COATED FILAMENT

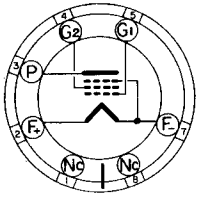
1.4 VOLTS 0.05 AMPERE

DC

GLASS BULB



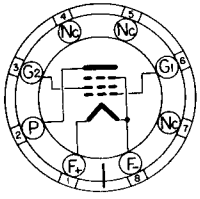
1A5GT/G ANY MOUNTING POSITION **1LA4**



BOTTOM VIEW

INTERMEDIATE SHELL

7-PIN OCTAL BASE



BOTTOM VIEW

LOCKING-IN

8-PIN

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	6.0	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	85	90	VOLTS
SCREEN VOLTAGE	85	90	VOLTS
GRID VOLTAGE[A]	-4.5	-4.5	VOLTS
PEAK A-F GRID VOLTAGE	4.5	4.5	VOLTS
ZERO-SIG. PLATE CURRENT	3.5	4.0	MA.
MAXIMUM SIG. PLATE CURRENT	3.5	4.0	MA.
ZERO-SIG. SCREEN CURRENT	0.7	0.8	MA.
MAXIMUM SIG. SCREEN CURRENT	1.0	1.1	MA.
PLATE RESISTANCE	0.3	0.3	MEGOHM
TRANSCONDUCTANCE	800	850	µMHOS
LOAD RESISTANCE	25 000	25 000	OHMS
TOTAL HARMONIC DISTORTION	10	7.0	PER CENT
MAXIMUM SIG. POWER OUTPUT	100	115	MW.

[A] RETURN TO NEGATIVE FILAMENT

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PLATE 1531

JAN. 15 1945

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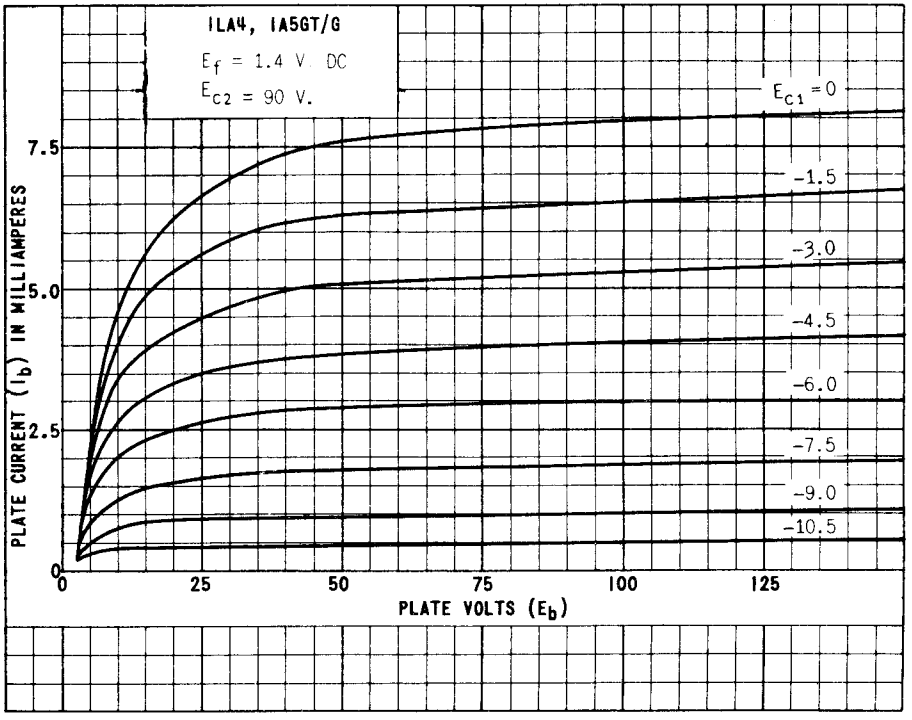
1LA4 (1A5GT/G)



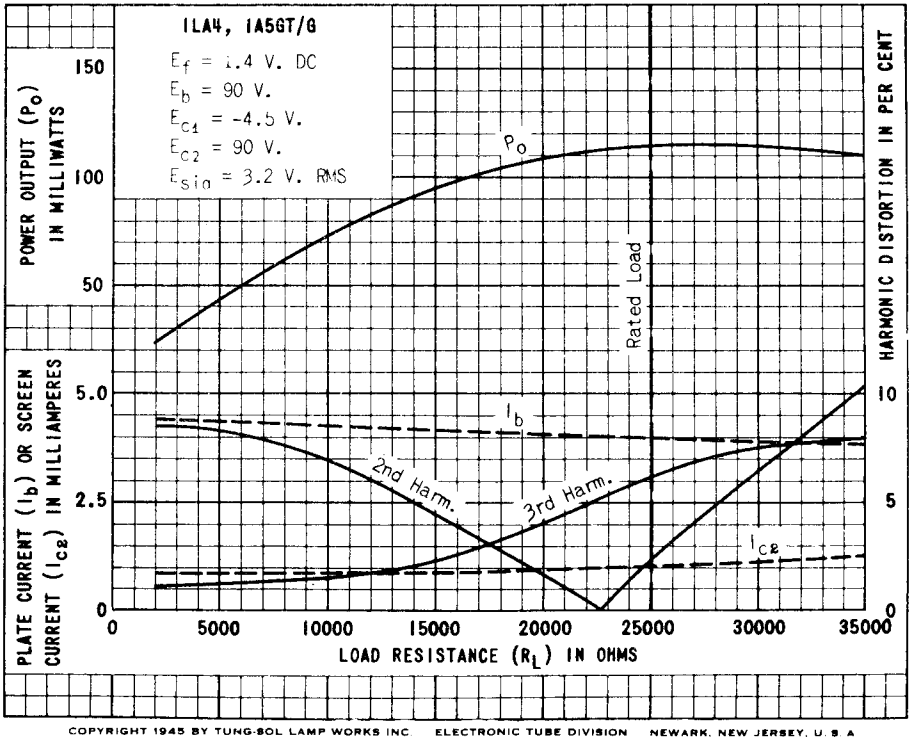


PLATE 1532
JAN. 15 1945

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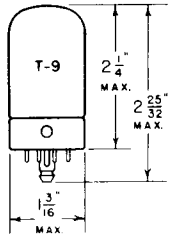
TUNG-SOL



PENTAGRID CONVERTER

COATED FILAMENT

1.4 VOLTS 0.05 AMPERE
DC

GLASS BULB

7AK

BOTTOM VIEW

LOCKING-IN 8 PIN BASE

THE TUNG-SOL 1LA6 IS A LOW VOLTAGE, LOW CURRENT DRAIN, BATTERY TYPE PENTAGRID CONVERTER. IT IS DESIGNED FOR SERVICE AS AN OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS WHICH REQUIRE ONLY 90 VOLTS OF "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 1A7G.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION — VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC — DC POWER LINE OPERATION — DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE (P) VOLTAGE	90	VOLTS
MAXIMUM SCREEN (Gs) SUPPLY VOLTAGE	90	VOLTS
MAXIMUM SCREEN VOLTAGE[A]	55	VOLTS
MAXIMUM OSCILLATOR ANODE (Ga) VOLTAGE	90	VOLTS
MAXIMUM TOTAL CATHODE CURRENT-ZERO SIGNAL	3	MA.

[A] OBTAINED BY USING A PROPERLY BY-PASSED VOLTAGE DROPPING RESISTOR OF 45000 TO 75000 OHMS IN SERIES WITH A "B" SUPPLY VOLTAGE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1102-2
SEPT. 17
1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE (P) VOLTAGE	90	VOLTS
SCREEN (G_S) VOLTAGE[A]	45	VOLTS
CONTROL GRID (G) VOLTAGE[B]	0	VOLTS
OSCILLATOR ANODE (G_A) VOLTAGE	90	VOLTS
OSCILLATOR GRID (G_O) RESISTOR	200 000	OHMS
PLATE CURRENT	0.55	MA.
SCREEN CURRENT	0.6	MA.
OSCILLATOR ANODE CURRENT	1.2	MA.
OSCILLATOR GRID CURRENT	0.035	MA.
TOTAL CATHODE CURRENT	2.4	MA.
PLATE RESISTANCE	0.75	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = 0 V.	250	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID VOLTAGE = −3 V.	10	μMHOS

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID (G) TO MIXER PLATE (P)	0.4	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)	0.3	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)	0.15	μμf
OSCILLATOR GRID (G_O) TO OSCILLATOR ANODE (G_A)	0.6	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	7.7	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_O) TO ALL OTHER ELECTRODES EXCEPT OSCILLATOR ANODE (G_A)	2.9	μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES EXCEPT OSCILLATOR GRID (G_O)	3.3	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	8.0	μμf

[A] OBTAINED PREFERABLY BY USING A PROPERLY BY-PASSED VOLTAGE DROPPING RESISTOR OF 45000 TO 75000 OHMS IN SERIES WITH A "B" SUPPLY VOLTAGE.

[B] A RESISTANCE OF AT LEAST 1 MEGOHM SHOULD BE IN GRID RETURN TO NEGATIVE FILAMENT TERMINAL (PIN #8).

[S] WITH EXTERNAL SHIELD CONNECTED TO NEGATIVE FILAMENT TERMINAL.

NOTE: THE TRANSCONDUCTANCE OF THE OSCILLATOR SECTION (NOT OSCILLATING) IS APPROXIMATELY 550 μMHOS, THE AMPLIFICATION FACTOR IS 40, AND THE OSCILLATOR ANODE CURRENT IS 2.2 MA. CONDITIONS: PLATE VOLTAGE = 90 VOLTS, OSCILLATOR ANODE VOLTAGE = 90 VOLTS, SCREEN VOLTAGE = 45 VOLTS, AND THE GRID VOLTAGE = 0 VOLTS.

PLATE 1103-1

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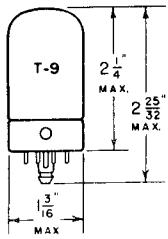
TUNG-SOL



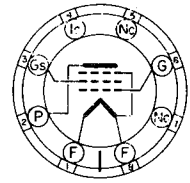
PENTODE POWER AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.05 AMPERE
DC

GLASS BULB

LOCKING-IN 8 PIN BASE



5AD

BOTTOM VIEW

NOTE. Nc DENOTES NO INTERNAL CONNECTION.

THE TUNG-SOL 1LB4 IS A LOW VOLTAGE, LOW CURRENT DRAIN, BATTERY TYPE POWER PENTODE. IT IS DESIGNED FOR SERVICE WITH 90 VOLTS OF "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE PENTODE SECTION OF THE 1D8GT.

RATINGS

MAXIMUM FILAMENT VOLTAGE:		
DRY BATTERY OPERATION — VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC-DC POWER LINE OPERATION — DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT — ZERO SIGNAL	6	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	45	62.5	67.5	90	VOLTS
SCREEN VOLTAGE	45	62.5	67.5	90	VOLTS
CONTROL GRID VOLTAGE [A]	-4.5	-5.0	-6.0	-9.0	VOLTS
PEAK AF SIGNAL VOLTAGE	4.5	5.0	6.0	9.0	VOLTS
PLATE CURRENT	1.6	3.8	3.8	5.0	MA.
SCREEN CURRENT	0.3	0.8	0.8	1.0	MA.
PLATE RESISTANCE APPROX.	0.3	0.2	0.2	0.2	MEGOHM
TRANSCONDUCTANCE	650	875	875	925	μMHOS
LOAD RESISTANCE	20000	16000	16000	12000	OHMS
TOTAL HARMONIC DISTORTION	10	10	10	10	PER CENT
POWER OUTPUT	35	90	100	200	MILLIWATTS

[A] RETURN TO NEGATIVE FILAMENT (PIN #8)

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 989-1

JAN. 31 1941

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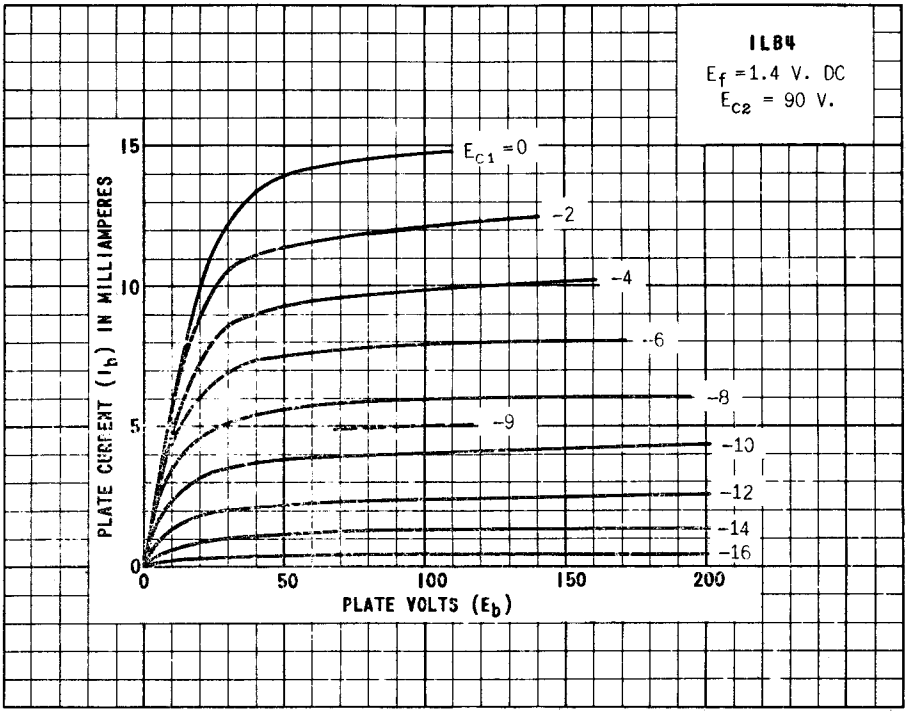
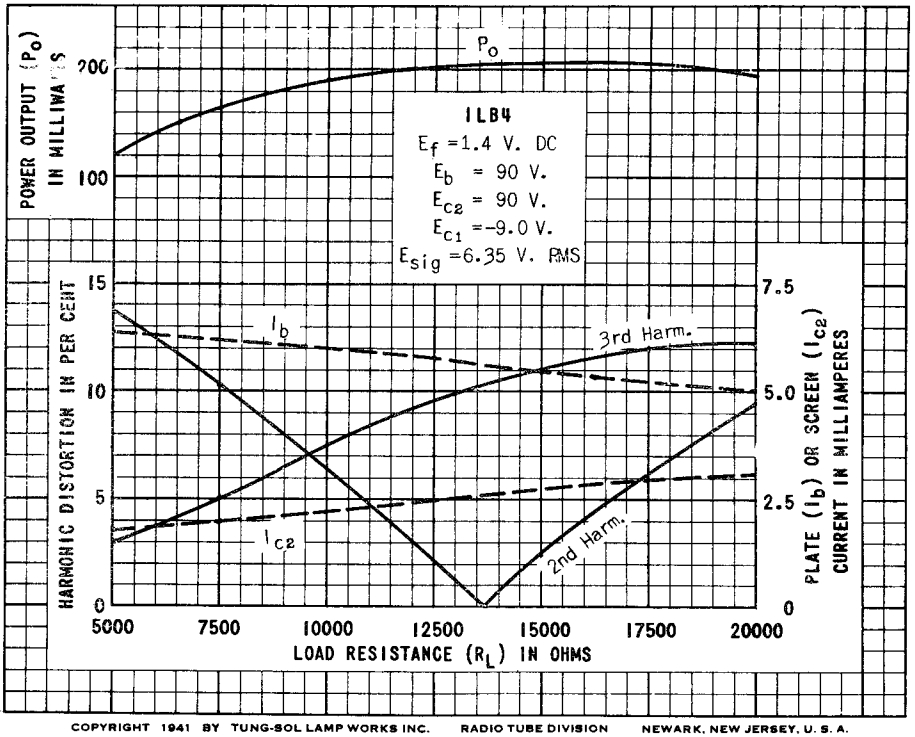
1LB4





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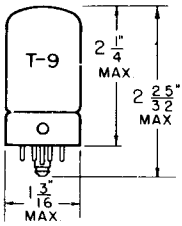
TUNG-SOL

PENTODE



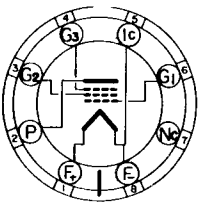
GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

LOCK-IN 8 PIN BASE

7A0

THE 1LC5 IS A SHARP CUT-OFF BATTERY TYPE PENTODE AMPLIFIER. IT IS INTENDED FOR SERVICE AS AN RF OR AF AMPLIFIER WHERE ECONOMY OF BATTERY POWER IS IMPORTANT.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD NO. 308 CONNECTED TO NEGATIVE FILAMENT

GRID TO PLATE: (G_1 TO P) MAX.	0.007	μμf
INPUT: G_1 TO ($F+G_2+G_3$)	3.2	μμf
OUTPUT: P TO ($F+G_2+G_3$)	7	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	45	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	MA.
PLATE VOLTAGE	45	90	VOLTS
GRID #3 VOLTAGE	PIN #4 CONNECTED TO PIN #8 AT SOCKET		
GRID #2 VOLTAGE	45	45	VOLTS
GRID #1 VOLTAGE[A]	0	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.7	1.5	MEG.
TRANSCONDUCTANCE	750	775	μMHOS
PLATE CURRENT	1.1	1.15	MA.
GRID #2 CURRENT	0.35	0.30	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA	-3.4	-3.4	VOLTS

[A] A RESISTANCE OF AT LEAST 1 MEGOHM SHOULD BE IN THE GRID RETURN TO THE NEGATIVE FILAMENT, PIN #8, UNDER MAXIMUM RATED CONDITIONS.

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PLATE 2137
FEB. 1, 1949

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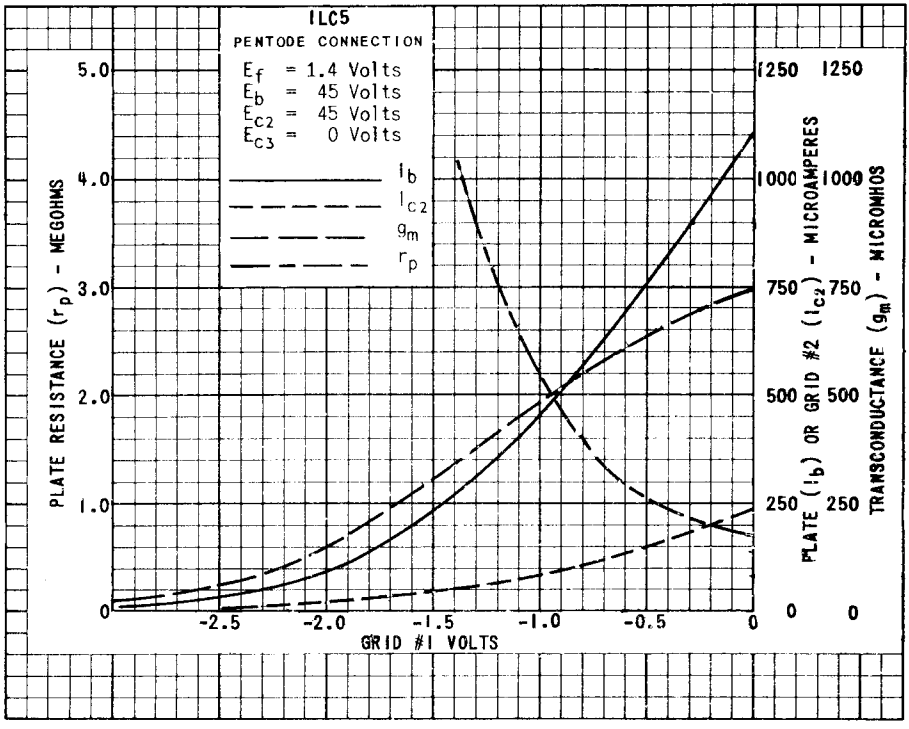
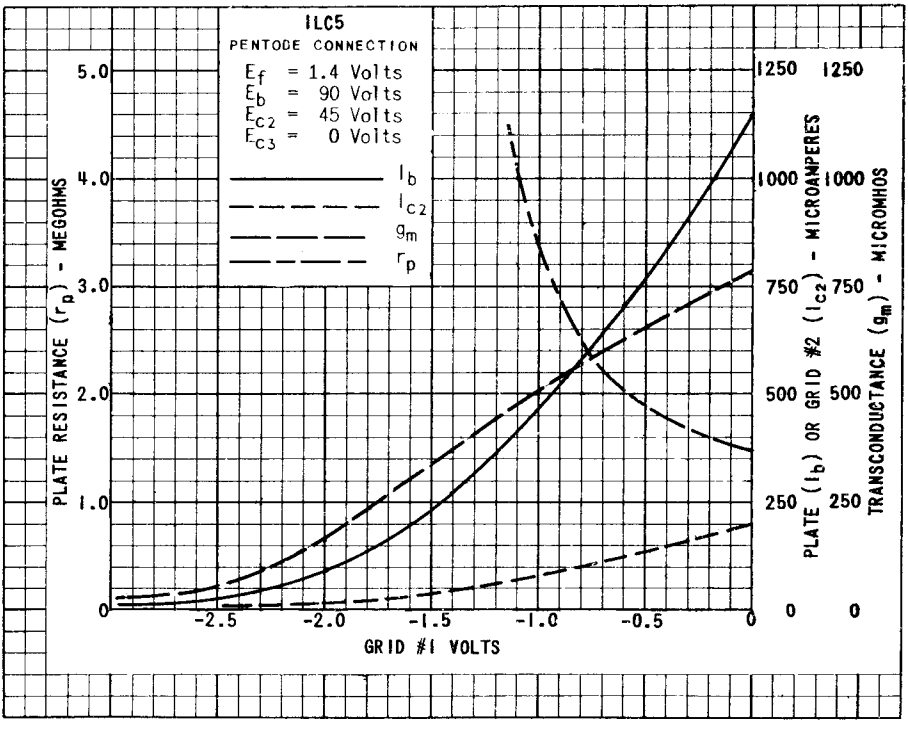
ILC5





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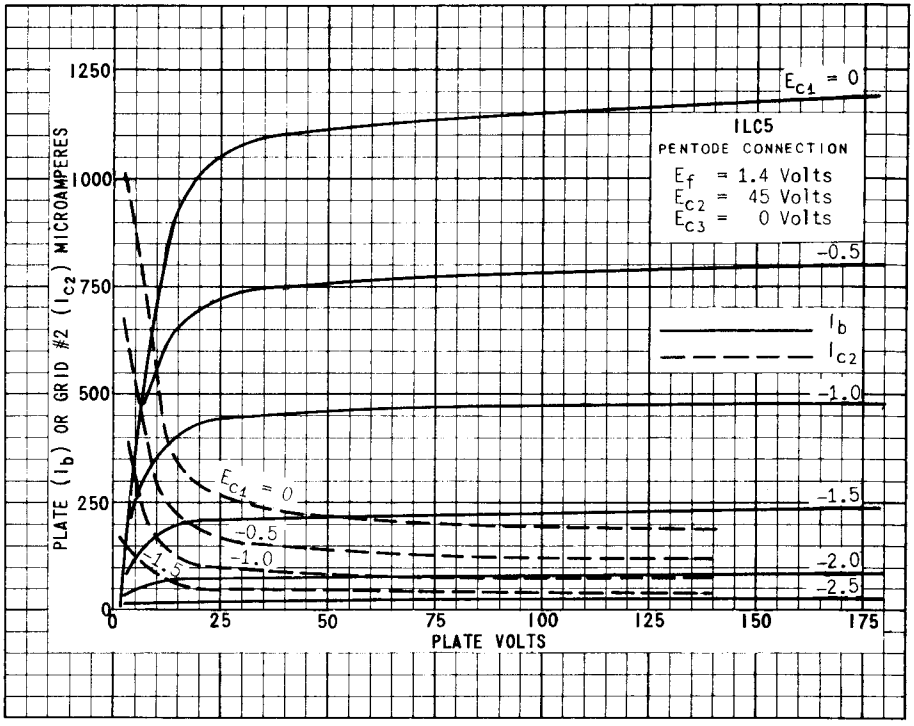

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PLATE
2139
FEB. 1,
1949

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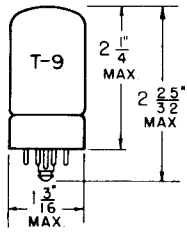


PENTAGRID CONVERTER

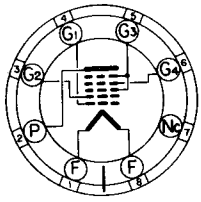
COATED FILAMENT

1.4 VOLTS 0.050 AMPERE

DC

GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

LOCKING-IN
8-PIN BASE

THE 1LC6 IS A PENTAGRID CONVERTER, DESIGNED FOR SERVICE AS AN OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM SCREEN (G3 AND G5) VOLTAGE	35	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	90	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	3.0	MA.
MAXIMUM ANODE GRID (G2) VOLTAGE	45	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO NEGATIVE FILAMENT (PIN 8)

SIGNAL GRID (G4) TO MIXER PLATE (P)	0.28	μμf
SIGNAL GRID (G4) TO OSC. PLATE (G2)	0.38	μμf
SIGNAL GRID (G4) TO OSC. GRID (G1)	0.11	μμf
OSC. GRID (G1) TO OSC. PLATE (G2)	0.6	μμf
SIGNAL INPUT: G4 TO ALL OTHER ELECTRODES	9.0	μμf
OSC. INPUT: G1 TO ALL OTHER ELECTRODES EXCEPT G2	2.4	μμf
OSC. OUTPUT: G2 TO ALL OTHER ELECTRODES EXCEPT G1	4.8	μμf
MIXER OUTPUT: P TO ALL OTHER ELECTRODES	5.5	μμf

CONTINUED ON NEXT PAGE

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PLATE 1533

JAN. 15 1945

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE VOLTAGE	45	90	VOLTS
SCREEN (G3 AND G5) VOLTAGE	35	35	VOLTS
CONTROL GRID (G4) VOLTAGE [A]	0	0	VOLTS
ANODE GRID (G2) VOLTAGE	45	45	VOLTS
PLATE CURRENT	0.7	0.75	MA.
SCREEN CURRENT	0.75	0.7	MA.
ANODE GRID CURRENT	1.4	1.4	MA.
OSC. GRID CURRENT	0.035	0.035	MA.
TOTAL CATHODE CURRENT	2.9	2.9	MA.
OSC. GRID (G1) RESISTOR	0.2	0.2	MEGOHM
CONVERSION TRANSCONDUCTANCE AT EC4 = 0	250	275	μMHOS
CONVERSION TRANSCONDUCTANCE AT EC4 = -2	50	50	μMHOS
CONVERSION TRANSCONDUCTANCE AT EC4 = -3	5.0	5.0	μMHOS
PLATE RESISTANCE	0.3	0.65	MEGOHM

[A] UNDER MAXIMUM RATED CONDITIONS THERE SHOULD BE A RESISTANCE OF AT LEAST 1.0 MEGOHM IN THE RETURN TO THE NEGATIVE FILAMENT PIN.

PLATE 1534
JAN. 15 1945

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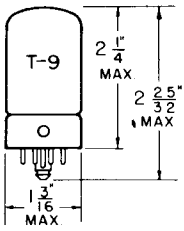
TUNG-SOL

DIODE PENTODE



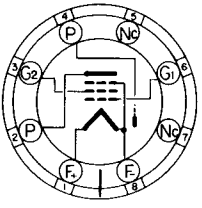
GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

LOCK-IN
8 PIN BASE
6AX

THE 1LD5 IS A DIODE-AUDIO PENTODE DESIGNED ESPECIALLY FOR SERVICE AS A COMBINED DIODE DETECTOR AND PENTODE AUDIO AMPLIFIER. THE DIODE PLATE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD CONNECTED TO NEGATIVE FILAMENT

GRID TO PLATE: (G_1 TO P) MAX.	0.18	μμf
INPUT: G_1 TO ($F+G_2+G_3$)	3.2	μμf
OUTPUT: P TO ($F+G_2+G_3$)	6.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	50	VOLTS
MAXIMUM DIODE DROP FOR 0.5 MA.	10	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	MA.
PLATE VOLTAGE	45	90	VOLTS
GRID #2 VOLTAGE	45	45	VOLTS
GRID #1 VOLTAGE	0	0	VOLTS
PLATE CURRENT	0.55	0.6	MA.
GRID #2 CURRENT	0.12	0.1	MA.
PLATE RESISTANCE (APPROX.)	0.75	0.9	MEGOHM
TRANSCONDUCTANCE	550	575	μMHOS

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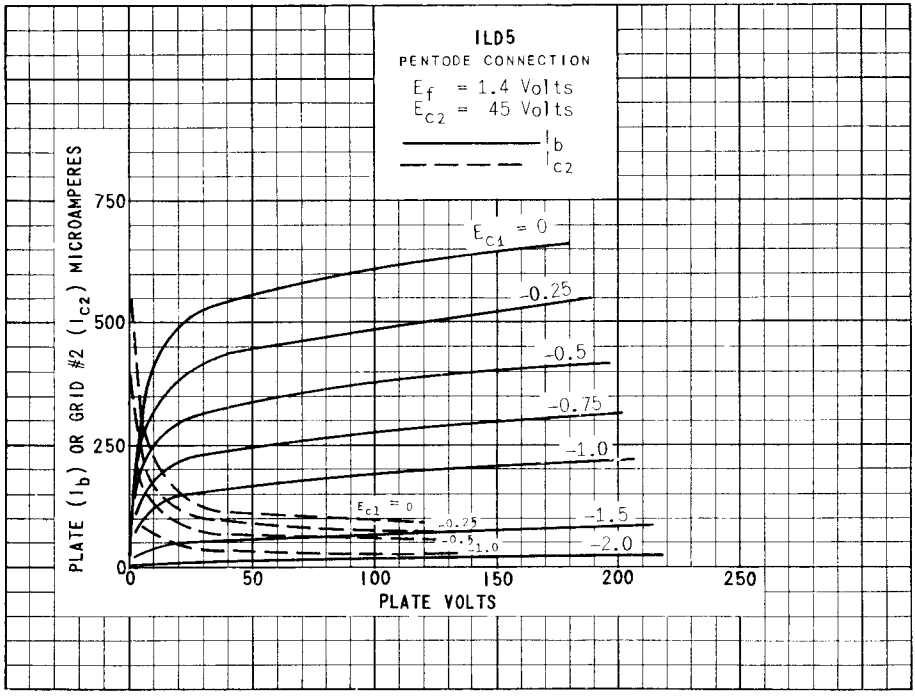

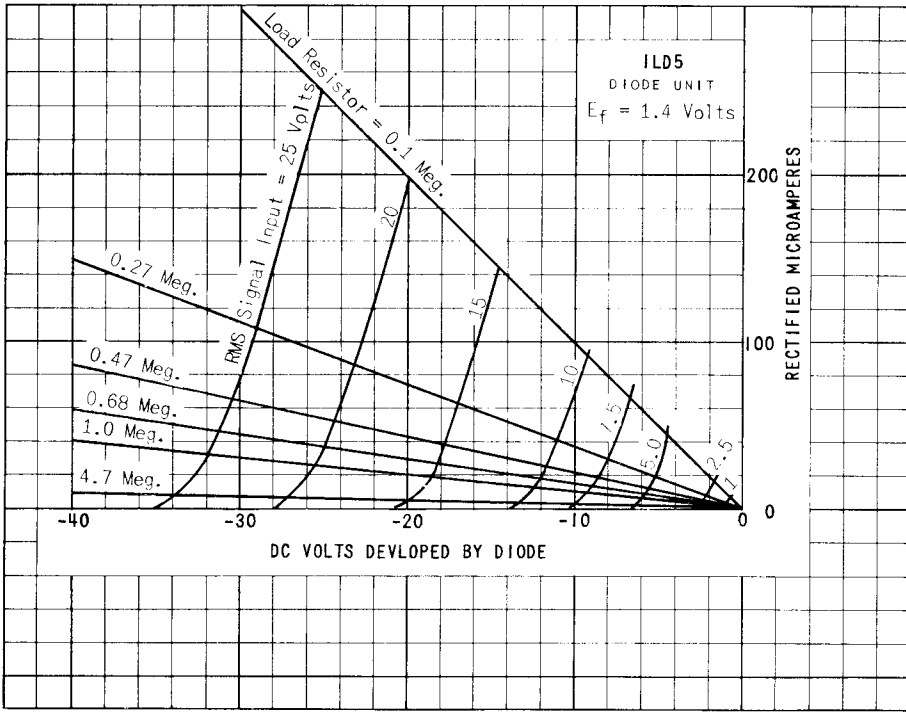

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PLATE
2185
MAY 2
1949

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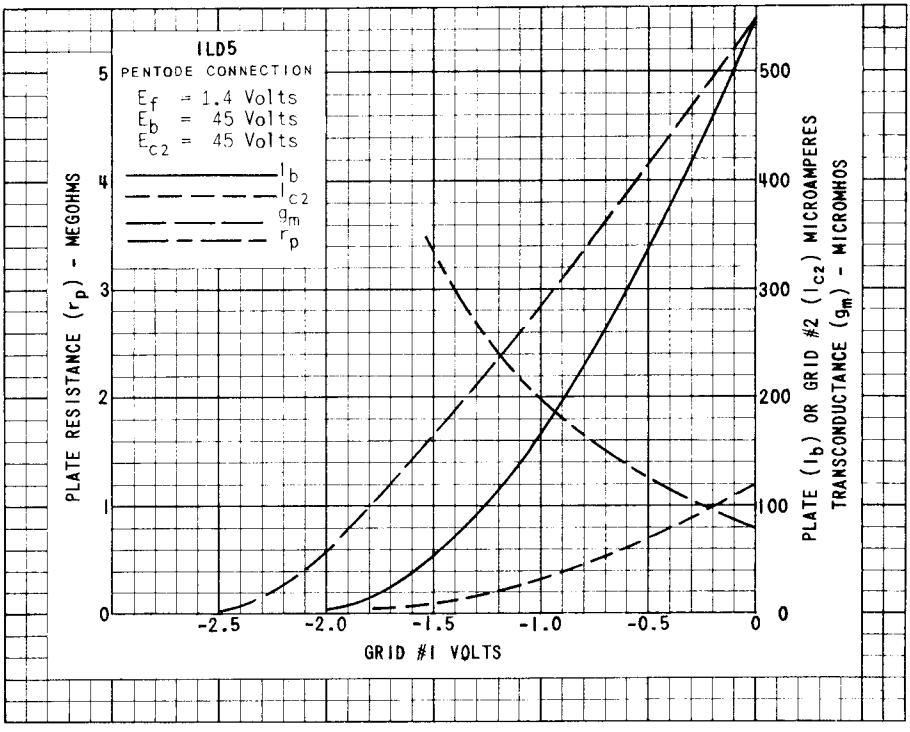
ILD5



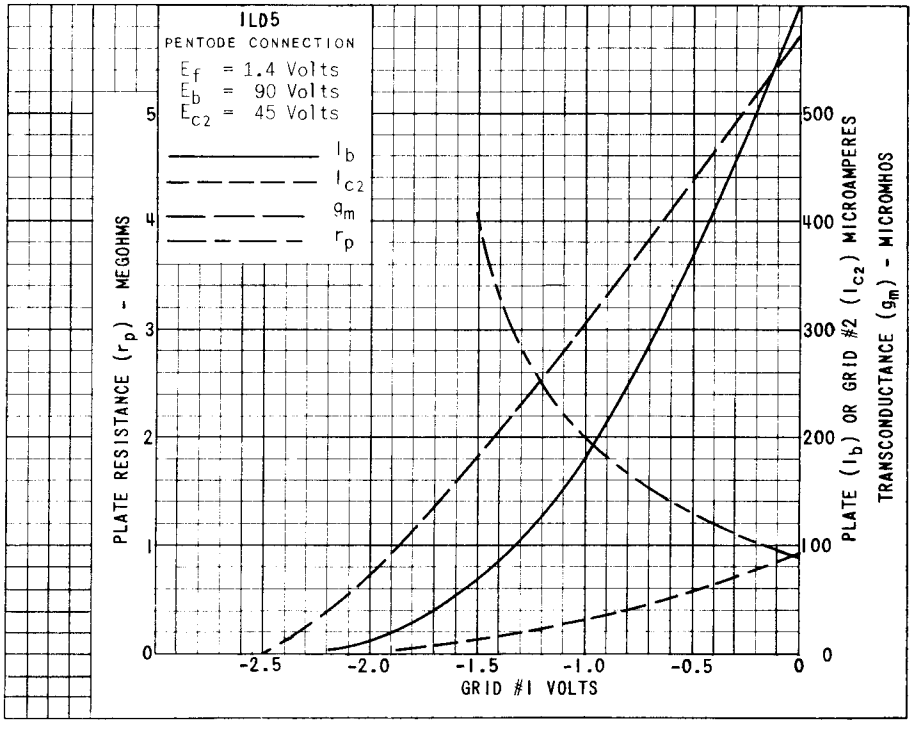


PLATE
2186
MAY 2
1949

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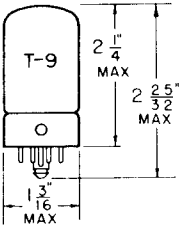
TUNG-SOL

TRIODE

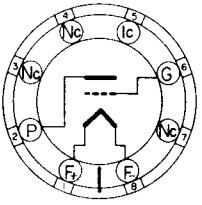


GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN 8 PIN BASE
4AA

THE 1LE3 IS A LOW VOLTAGE, LOW CURRENT DRAIN, BATTERY TYPE TRIODE. IT IS DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER IN RECEIVERS USING 90 VOLTS "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #308 CONNECTED TO PIN #8

GRID TO PLATE: (G TO P)	1.7	μμf
INPUT: (G TO F)	1.7	μμf
OUTPUT: (P TO F)	3	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	MA.
PLATE VOLTAGE	90	90	VOLTS
GRID VOLTAGE[A]	0	-3	VOLTS
PLATE CURRENT	4.5	1.7	MA.
PLATE RESISTANCE	11 200	16 500	OHMS
TRANSCONDUCTANCE	1 300	850	μMHOS
AMPLIFICATION FACTOR	14.5	14	

[A] NEGATIVE FILAMENT RETURN TO PIN #8

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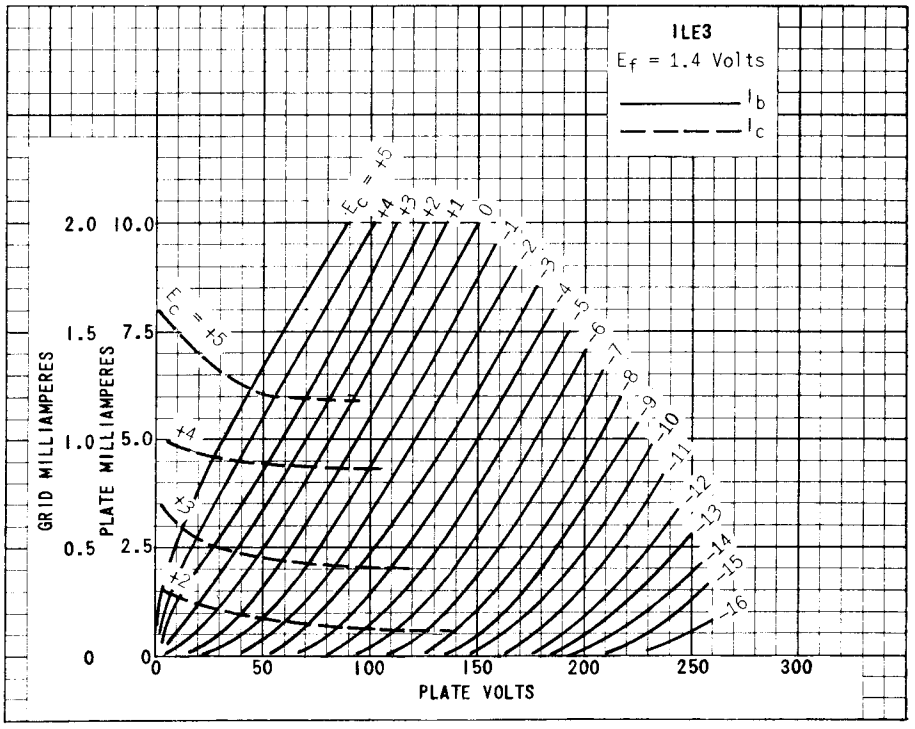
1LE3



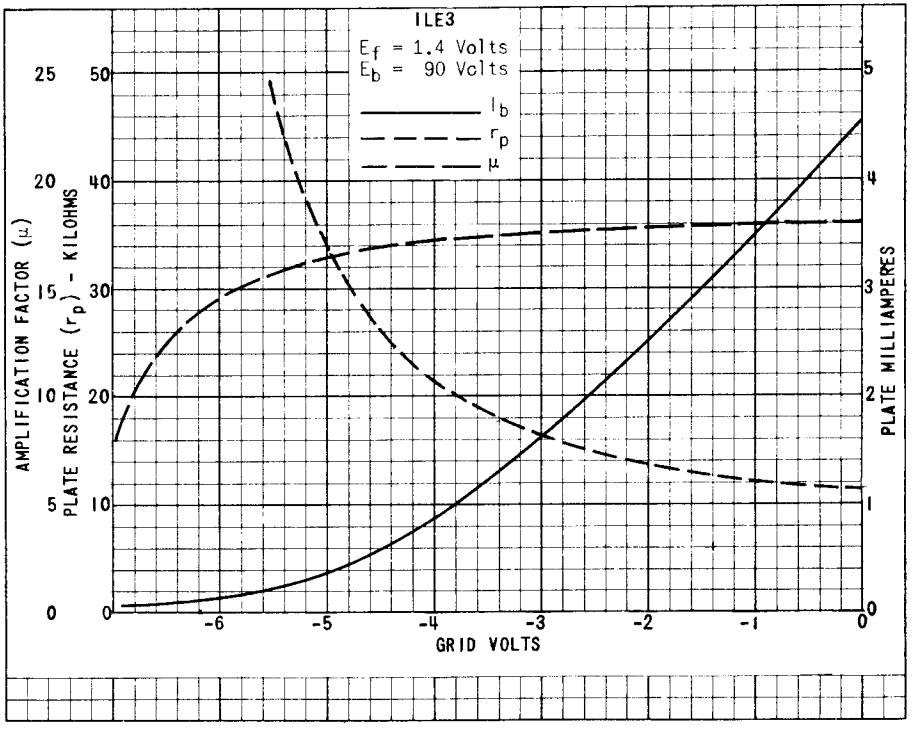


PLATE 2148
MAR. 1, 1949

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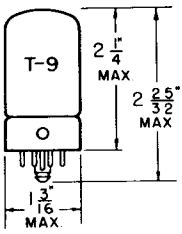
TUNG-SOL

PENTODE

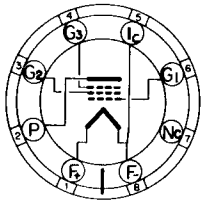


GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN 8 PIN BASE
7A0

THE 1LG5 IS A FILAMENTARY TYPE SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS PARTICULARLY ADAPTABLE TO PORTABLE RECEIVERS AS AN RF OR IF AMPLIFIER WHERE AUTOMATIC VOLUME CONTROL IS NOT REQUIRED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #308 CONNECTED TO PIN #8

GRID TO PLATE: (G_1 TO P) MAX.	0.007	μμf
INPUT: G_1 TO (F&IS+G_2+G_3)	3.2	μμf
OUTPUT: P TO (F&IS+G_2+G_3)	7	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	MA.
PLATE VOLTAGE	90	90	VOLTS
GRID #3 VOLTAGE	PIN #4 CONNECTED TO PIN #8 AT SOCKET		
GRID #2 VOLTAGE	90	45	VOLTS
GRID #1 VOLTAGE	-1.5	0	VOLTS
GRID #1 RESISTOR	2	2	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.5	>1	MEGOHM
TRANSCONDUCTANCE	1 150	800	μMHOS
PLATE CURRENT	3.7	1.7	MA.
GRID #2 CURRENT	0.9	0.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 10 μMHOS	-19	-10	VOLTS

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PLATE 2149
MAR. 1, 1949

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1LG5

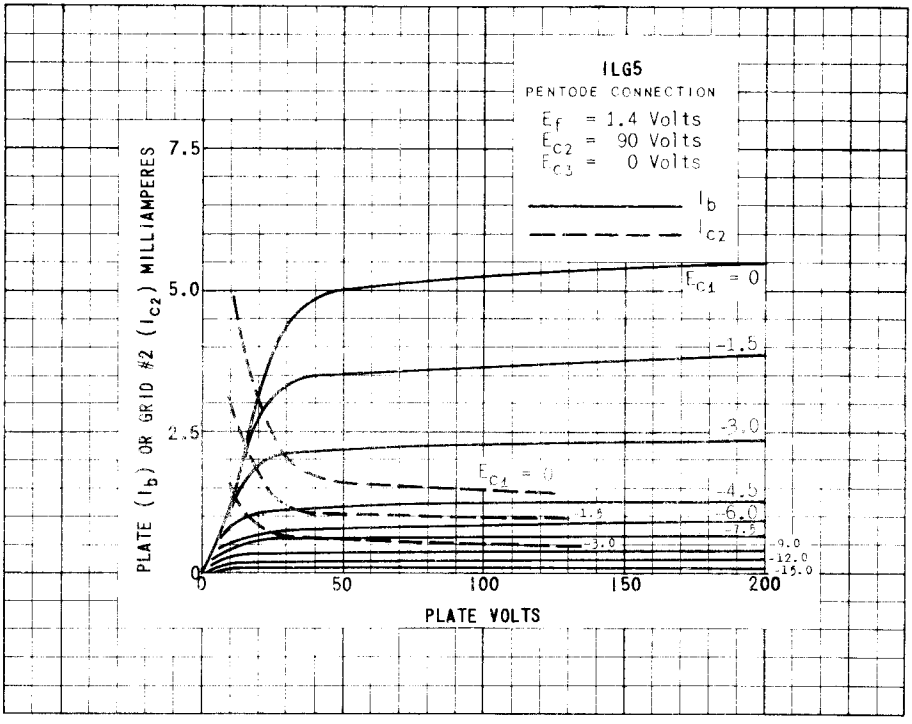

PLATE 2150
MAR. 1 1949

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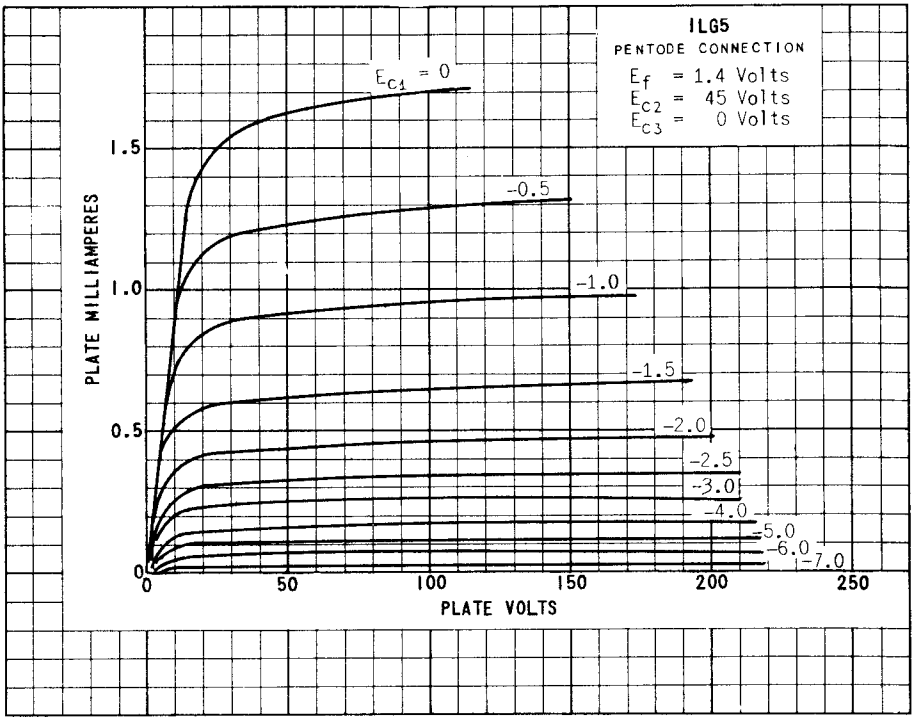

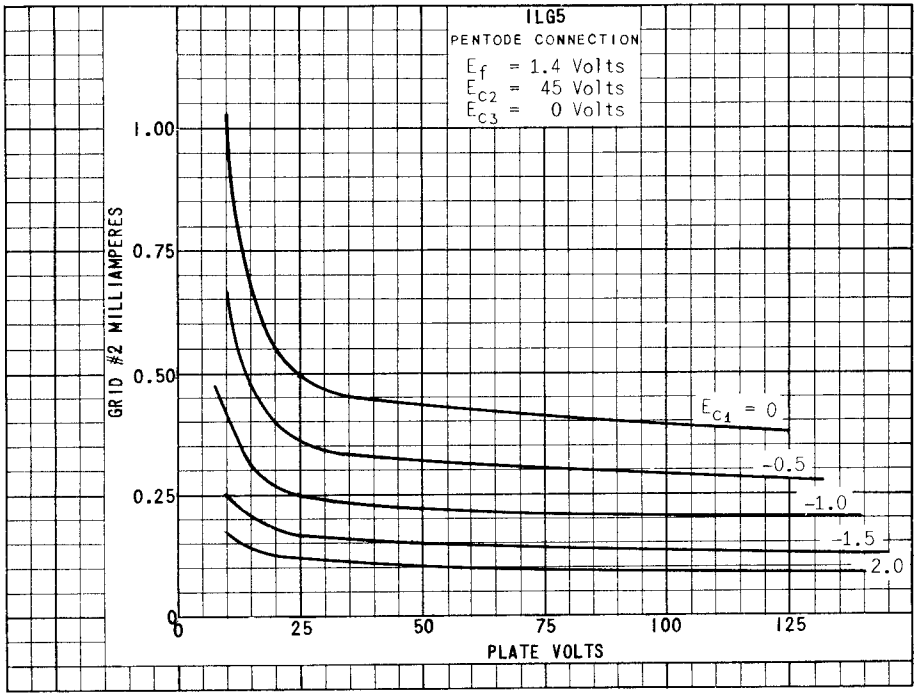

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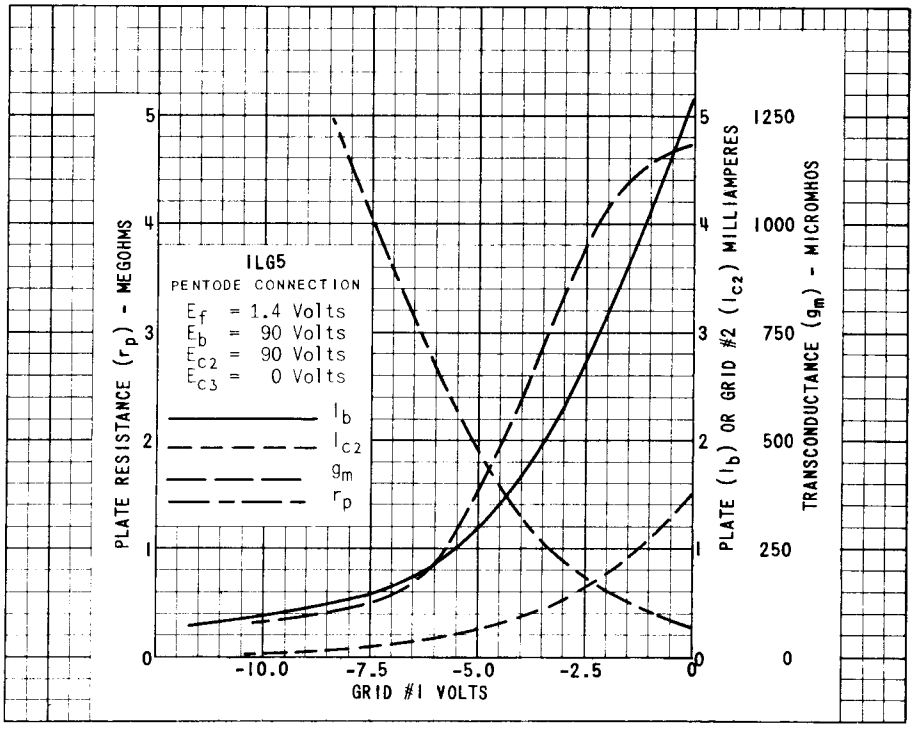
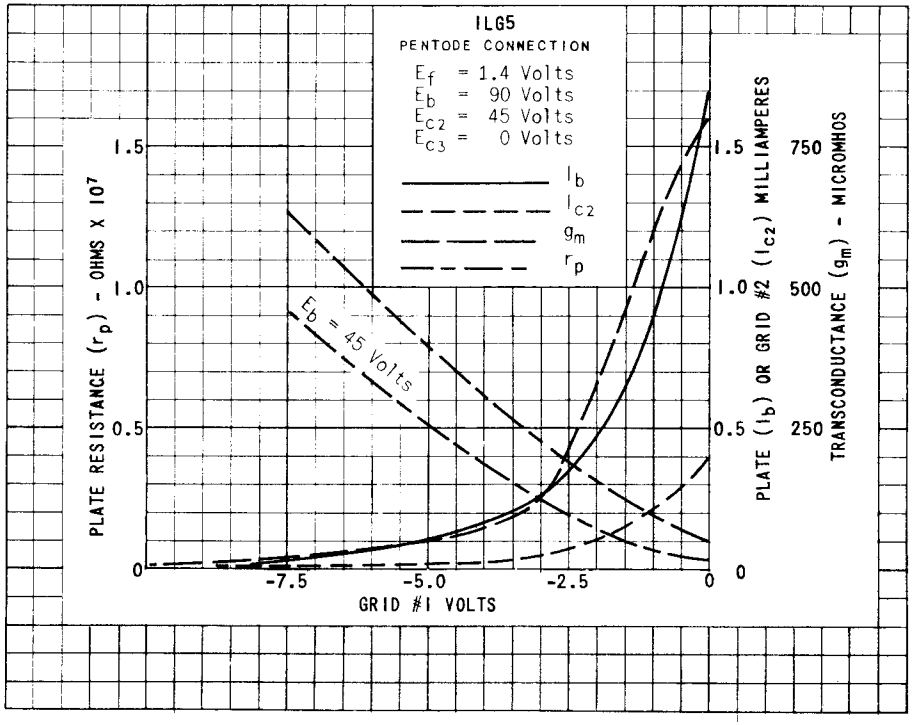
1LG5





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MAR. 1, 1949

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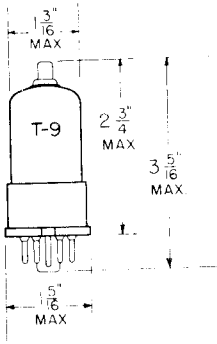


1H5GT/G

SKIRTED
MINIATURE CAP

DIODE TRIODE AMPLIFIER

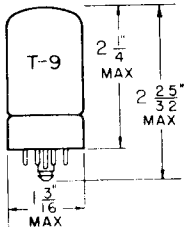
COATED FILAMENT

1.4 VOLTS 0.05 AMPERE

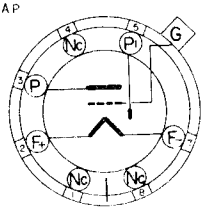
DC

GLASS BULB

ANY MOUNTING POSITION

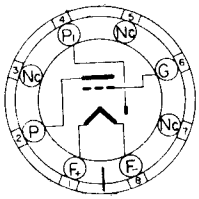


1LH4



BOTTOM VIEW

7-PIN OCTAL BASE
WITH METAL SHELL



BOTTOM VIEW

LOCKING-IN
8-PIN

THE 1H5GT/G AND 1LH4 ARE TUBES COMBINING A SINGLE DIODE AND A HIGH-MU TRIODE IN ONE BULB. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS, AND AS RESISTANCE COUPLED AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	110	VOLTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED	0.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE UNIT

PLATE VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE [A]	0	VOLTS
PLATE CURRENT	0.15	MA.
PLATE RESISTANCE	0.24	MEGOHM
TRANSCONDUCTANCE	275	µMHOS
AMPLIFICATION FACTOR	65	

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL

DIODE UNIT

THE DIODE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT AND IS INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON FILAMENT.

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PLATE
1537
JAN. 15
1945

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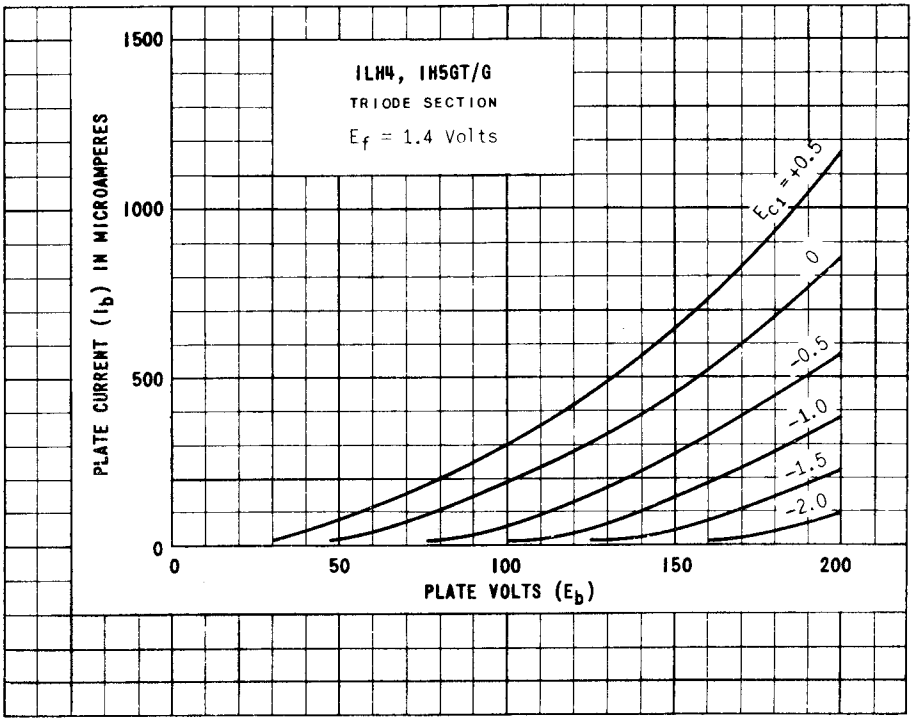
1LH4 (1H5GT/G)



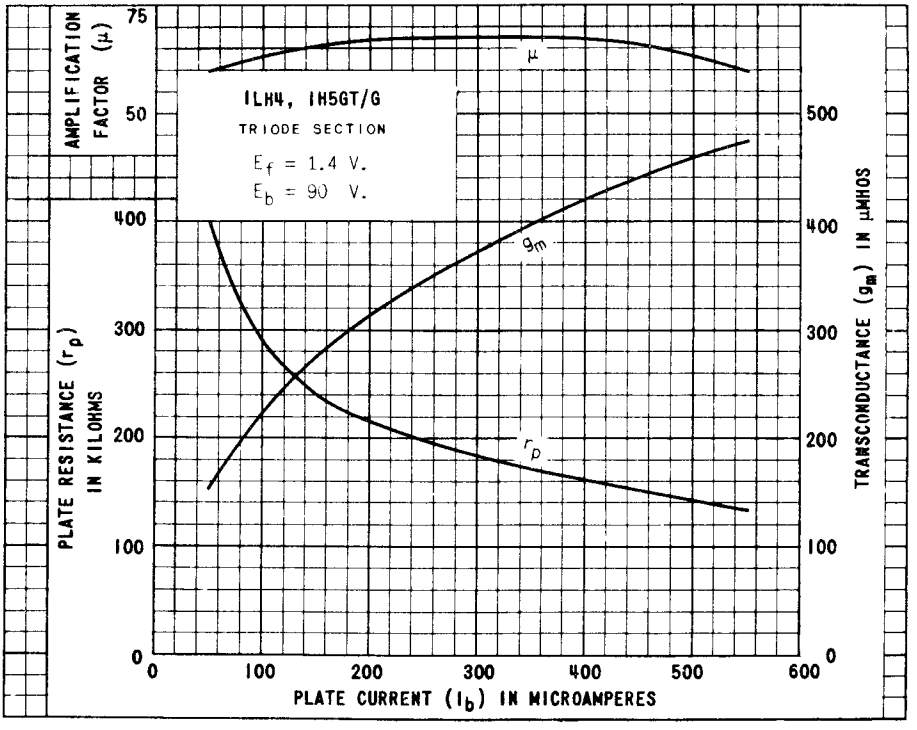


PLATE 1538
JAN. 15 1945

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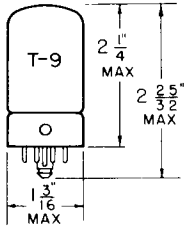
TUNG-SOL

PENTODE



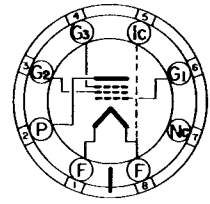
GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

LOCK-IN
8 PIN BASE

7A0

THE 1LN5 IS AN RF PENTODE USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN LOW DRAIN BATTERY OPERATED RECEIVERS AS AN RF, IF, OR AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #316 CONNECTED TO NEGATIVE FILAMENT

GRID TO PLATE: (G_1 TO P) MAX.	0.007	μμf
INPUT: G_1 TO (F&IS+G_2+G_3)	3	μμf
OUTPUT: P TO (F&IS+G_2+G_3)	8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE		1.4	VOLTS
HEATER CURRENT		50	MA.
PLATE VOLTAGE		90	VOLTS
GRID #3 VOLTAGE	PIN #4 CONNECTED TO PIN #8 AT SOCKET		
GRID #2 VOLTAGE		90	VOLTS
GRID #1 VOLTAGE[A]		0	VOLTS
PLATE RESISTANCE (APPROX.)		1.1	MEGOHMS
TRANSCONDUCTANCE		800	μMHOS
PLATE CURRENT		1.6	MA.
GRID #2 CURRENT		0.35	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS		-4.5	VOLTS

[A] GRID RETURN TO NEGATIVE END OF FILAMENT.

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PLATE 2330
FEB. 1 1950

→ INDICATES A CHANGE OR ADDITION

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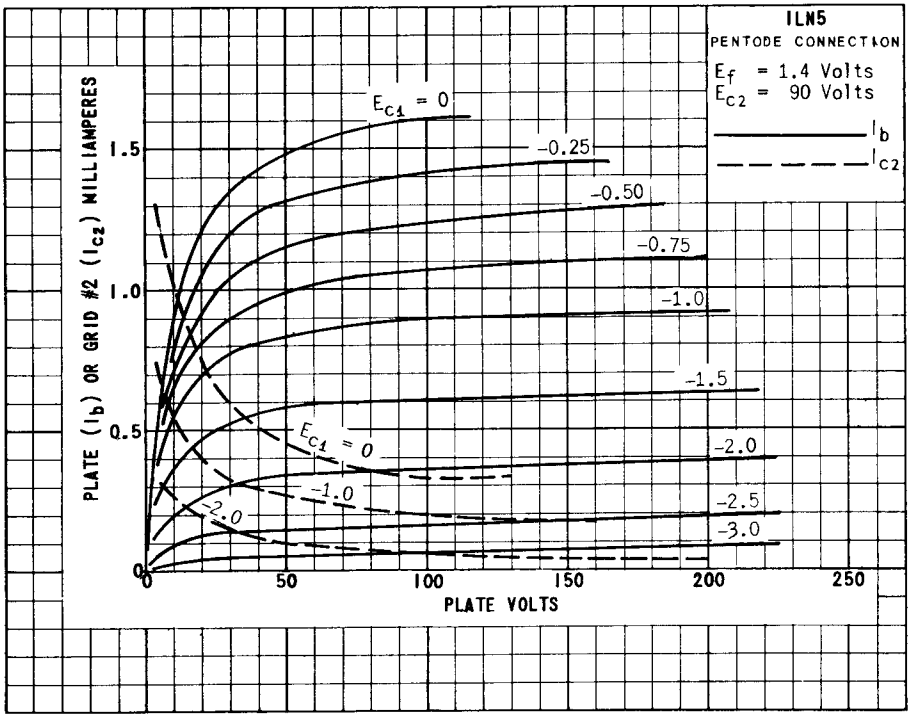
1LN5



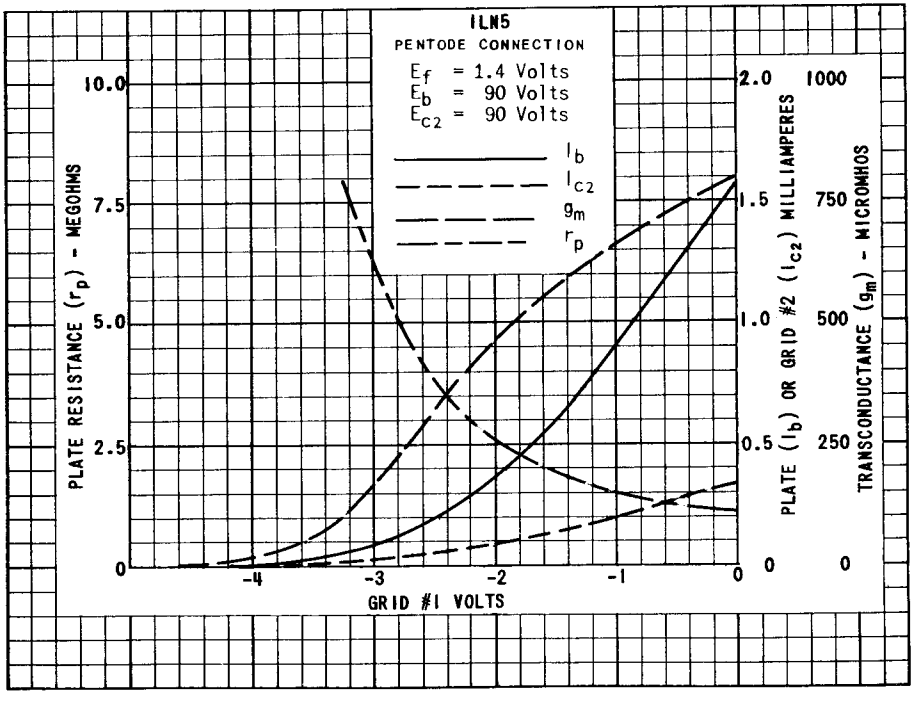


PLATE 2331
FEB. 1 1950

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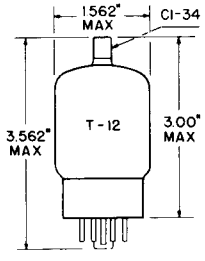
TUNG-SOL

DIODE

COATED FILAMENT

FOR HIGH VOLTAGE
RECTIFIER APPLICATIONS

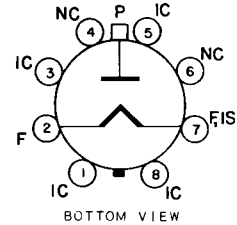
ANY MOUNTING POSITION



GLASS BULB

SHORT MEDIUM SHELL
7 PIN OCTAL B7-227

SOCKET TERMINALS 1,3,4,5,6 AND 8 MAY BE CONNECTED TO TERMINAL 7 OR TO A CORONA SHIELD WHICH CONNECTS TO TERMINAL 7. TERMINALS 4 & 6 MAY BE USED AS TIE POINTS AT OR NEAR FILAMENT POTENTIAL.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 3C

THE 1N2A IS A FILAMENTARY HALF-WAVE DIODE INTENDED FOR SERVICE AS THE HIGH VOLTAGE RECTIFIER IN TELEVISION RECEIVERS AND OTHER HIGH VOLTAGE RECTIFIER APPLICATIONS.

IT IS IDENTICAL TO TYPE 1N2 EXCEPT TYPE 1N2A IS CONTAINED IN A SHORTER BULB THAN TYPE 1N2.

DIRECT INTERELECTRODE CAPACITANCES

PLATE TO FILAMENT AND INTERNAL SHIELD	1.4	pf

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25 VOLTS	200	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION [C]		1.25±0.20	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK VOLTAGE RECTIFIER[D]

INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK	28,000	VOLTS
DC	24,000	MA.
PEAK PLATE CURRENT	50	MA.
AVERAGE PLATE CURRENT	0.5	MA.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS

TUBE DROP FOR Ib = 7 MA. (APPROX.)	100	VOLTS

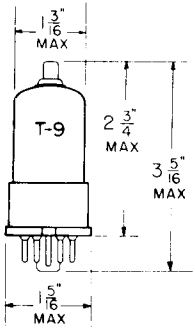
[C] FILAMENT SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN FILAMENT VOLTAGE WITHIN THE SPECIFIED VALUES.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

X-RAY RADIATION SHIELDING MAY BE NECESSARY TO PROTECT AGAINST POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE IF THIS TUBE IS OPERATED AT HIGHER THAN THE MANUFACTURER'S MAXIMUM RATED PLATE VOLTAGE OR 16,000 VOLTS WHICHEVER IS LESS.

TUNG-SOL

PENTODE



GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION

BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
5Y

THE 1N5GT IS A FILAMENTARY TYPE SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER. IT IS DESIGNED FOR SERVICE IN LOW DRAIN BATTERY OPERATED RECEIVERS AS AN RF, IF OR AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #308 CONNECTED TO PIN 7

GRID TO PLATE: (G_1 TO P) MAX.	0.007	μμf
INPUT: G_1 TO (F&G_3&IS+G_2+BS)	2.8	μμf
OUTPUT: P TO (F&G_3&IS+G_2+BS)	9.0 ←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	5.0 ←	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	50	MA.
PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	1.5	MEGOHMS
TRANSCONDUCTANCE	750	μMHOS
PLATE CURRENT	1.2	MA.
GRID #2 CURRENT	0.3	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 50 μMHOS	-3.2	VOLTS
GRID #1 VOLTAGE (APPROX.) FOR g_m = 5 μMHOS	-4.0 ←	VOLTS

← INDICATES A CHANGE.

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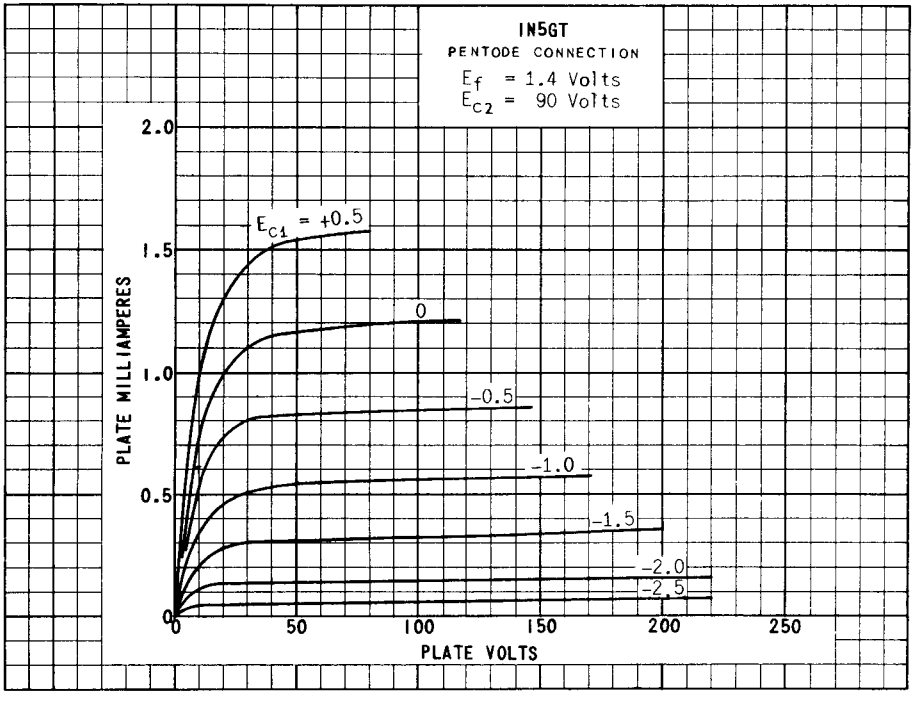
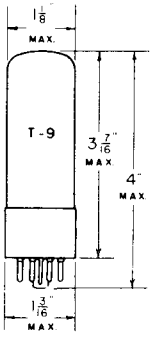
1N5GT


1N5GT
PENTODE CONNECTION
E_f = 1.4 Volts
E_{c2} = 90 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
0
0.5
1.0
1.5
2.0
0
50
100
150
200
250

TUNG-SOL



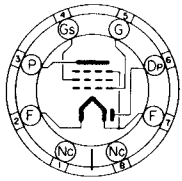
DIODE-POWER PENTODE AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.05 AMPERE
DC

GLASS BULB

SMALL 8 PIN OCTAL BASE



G-7AM

BOTTOM VIEW

THE TUNG-SOL 1N6G IS A LOW VOLTAGE, LOW CURRENT DRAIN BATTERY TYPE POWER PENTODE WITH A SINGLE DIODE SECTION. IT IS DESIGNED FOR SERVICE WITH 90 VOLTS OF "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION—VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC—DC POWER LINE OPERATION—DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM TOTAL CATHODE CURRENT OF THE PENTODE SECTION		
ZERO-SIGNAL	6	MA.
MINIMUM DIODE CURRENT[A]	0.5	MA.
WITH 10 VOLTS DC APPLIED		

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
SCREEN VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE[B]	−4.5	VOLTS
PEAK AF SIGNAL VOLTAGE	4.9	VOLTS
ZERO-SIGNAL PLATE CURRENT	3.4	MA.
ZERO-SIGNAL SCREEN CURRENT	0.7	MA.
MAXIMUM-SIGNAL PLATE CURRENT	3.4	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	1.2	MA.
PLATE RESISTANCE APPROX.	0.3	MEGOHM
TRANSCONDUCTANCE	800	μMHOS
LOAD RESISTANCE	25 000	OHMS
TOTAL HARMONIC DISTORTION	7	PER CENT
POWER OUTPUT — AT PEAK SIGNAL	100	MILLIWATTS

[A] DIODE PLATE LOCATED AT THE NEGATIVE END OF THE FILAMENT (PIN #7).

[B] RETURN TO NEGATIVE FILAMENT (PIN #7).

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 1012-2

APR. 21 1941

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1P5G 1P5GT

TUNG-SOL

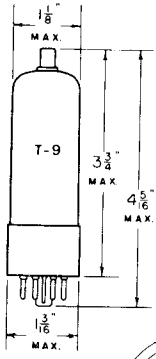
PENTODE AMPLIFIER

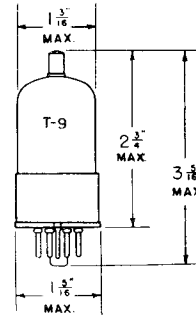
COATED FILAMENT

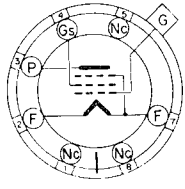
1.4 VOLTS 0.05 AMPERE

DC

CLASS BULB

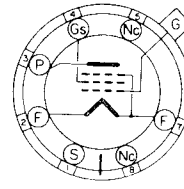






G-5Y

BOTTOM VIEWS



5Y

THE TUNG-SOL 1P5G AND 1P5GT ARE LOW VOLTAGE, LOW CURRENT DRAIN BATTERY TYPE RF PENTODES. WITH THE EXCEPTION OF CAPACITANCES, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION — VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC/DC POWER LINE OPERATION — DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS

DIRECT INTERELECTRODE CAPACITANCES[$]

CONTROL GRID TO FILAMENT	1P5G — 2.2 μμf	1P5GT — 3 μμf
PLATE TO FILAMENT	10	μμf
CONTROL GRID TO PLATE	.007	μμf

[$] WITH EXTERNAL SHIELD CONNECTED TO NEGATIVE FILAMENT (PIN #7).

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
SCREEN VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE	RETURN TO NEGATIVE FILAMENT	
PLATE CURRENT	2.3	MA.
SCREEN CURRENT	0.7	MA.
PLATE RESISTANCE APPROX.	0.8	MEGOHM
TRANSCONDUCTANCE	750	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE OF 10 μMHOS	— 12	VOLTS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

PLATE 1013-2

APR. 21 1941

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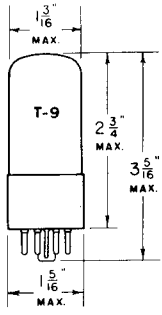
TUNG-SOL



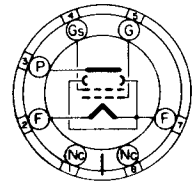
BEAM POWER AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.10 AMPERE
DC

GLASS BULB

INTERMEDIATE 7 PIN OCTAL BASE



6AF

BOTTOM VIEW

THE TUNG-SOL 1Q5GT/G IS A LOW VOLTAGE, LOW CURRENT DRAIN BATTERY TYPE BEAM POWER OUTPUT TUBE. IT IS DESIGNED FOR SERVICE WITH 90 VOLTS OF "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION—VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC —DC POWER LINE OPERATION—DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT (ZERO-SIGNAL)	12	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

FILAMENT VOLTAGE	1.4 DC	1.4 DC	VOLTS
FILAMENT CURRENT	0.10	0.10	AMPERE
PLATE VOLTAGE	85	90	VOLTS
SCREEN VOLTAGE	85	90	VOLTS
CONTROL GRID VOLTAGE[A]	-5	-4.5	VOLTS
PEAK AF SIGNAL VOLTAGE	5	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	7	9.5	MA.
ZERO-SIGNAL SCREEN CURRENT (NOMINAL)	0.8	1.3	MA.
TRANSCONDUCTANCE	1950	2200	μMHOS
LOAD RESISTANCE	9000	8000	OHMS
TOTAL HARMONIC DISTORTION	5.5	6.0	PER CENT
POWER OUTPUT	250	270	MILLIWATTS

[A] GRID RETURN SHOULD BE MADE TO NEGATIVE SIDE OF FILAMENT, PIN #7.

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PLATE
1075-3

JULY 28
1941

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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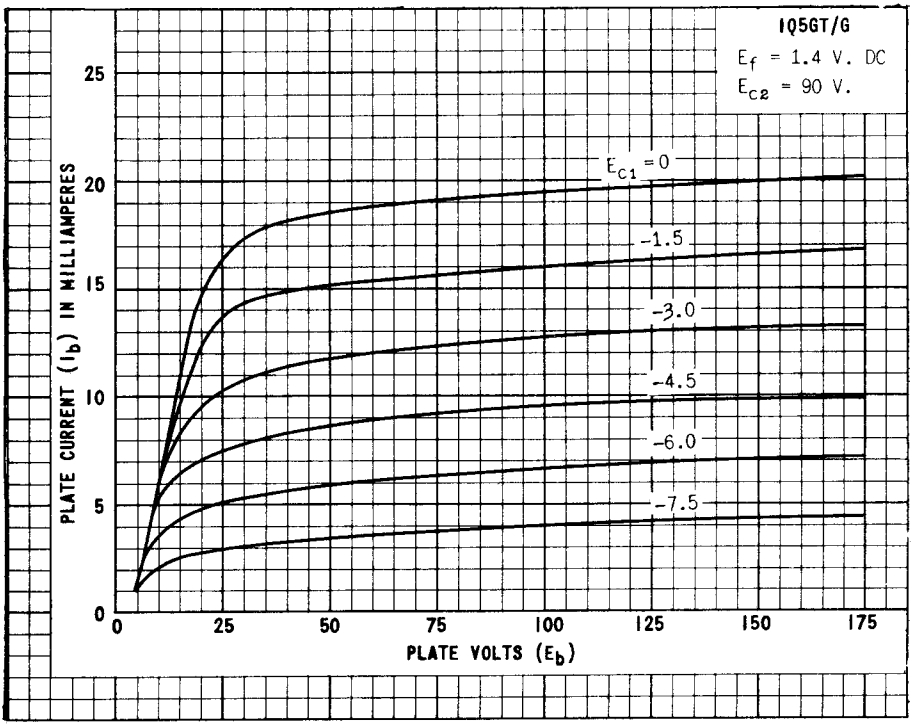
1Q5GT/G



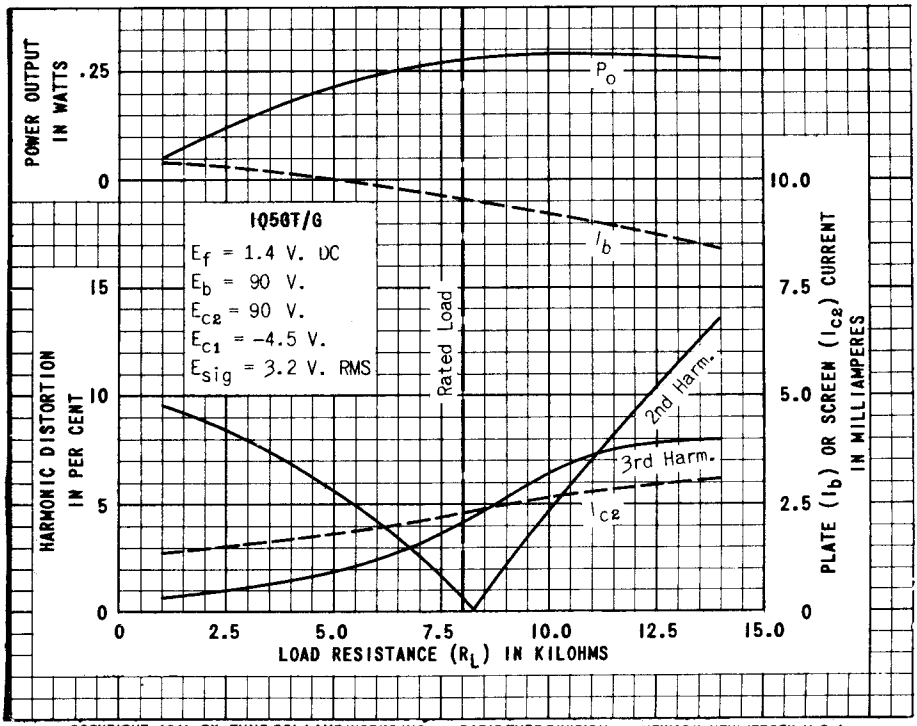


PLATE 1076-2

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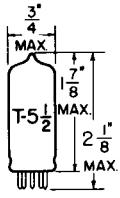
TUNG-SOL

HEPTODE

MINIATURE TYPE

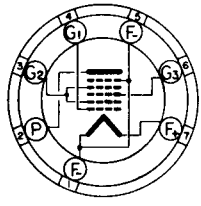


GLASS BULB

COATED FILAMENT

1.4 VOLTS 0.05 AMP.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7AT

THE 1R5 IS A HEPTODE CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER IN COMPACT, LIGHT-WEIGHT, PORTABLE BATTERY OPERATED EQUIPMENT. IT FEATURES A HIGH EFFICIENCY FILAMENT, ADAPTABILITY TO AVC AND PROVIDES REASONABLE CONVERSION GAIN WITH LOW BATTERY VOLTAGE AND LOW ELECTRODE CURRENTS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.3	0.4	μμf
RF INPUT: G_3 TO ($F+G_1+G_{2\&4}+G_5+P$)	7.0	7.0	μμf
MIXER OUTPUT: P TO ($F+G_1+G_{2\&4}+G_3+G_5$)	12.0	7.5	μμf
OSCILLATOR INPUT: G_1 TO ($F+G_{2\&4}+G_3+G_5+P$)	3.8	3.8	μμf
COUPLING: (G_1 TO G_3) MAX.	0.2	0.2	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.10	0.10	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	67.5	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT (ZERO-SIGNAL)	5.5	MA.
MINIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS

CONTINUED ON FOLLOWING PAGE

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PLATE 3015
1952

→ INDICATES A CHANGE OR ADDITION

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SEPARATE EXCITATION[B]

FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	0.05	0.05	0.05	AMP.
PLATE VOLTAGE	45	67.5	90	VOLTS
GRIDS #2 AND #4 VOLTAGE	45	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	15	25	25	VOLTS
GRID #1 CURRENT (OSCILLATOR GRID)	150	250	250	μA.
GRID #1 RESISTANCE (OSCILLATOR GRID)	0.1	0.1	0.1	MEGOHM
PLATE RESISTANCE (APPROX.)	0.5	0.4	0.4	MEGOHM
PLATE CURRENT	0.7	1.4	1.5	MA.
GRIDS #2 AND #4 CURRENT	2.1	3.5	3.5	MA.
CATHODE CURRENT	3.0	5.2	5.3	MA.
CONVERSION TRANSCONDUCTANCE	210	280	280	μMHOS
GRID #3 VOLTAGE FOR G_C = 10 μMHOS	−7.0	−13	−13	VOLTS
GRID #3 VOLTAGE FOR G_C = 100 μMHOS	−2.2	−4.9	−5.0	VOLTS

[B] CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

OSCILLATOR TRANSCONDUCTANCE
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	67.5	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	1400	μMHOS
CATHODE CURRENT	9.0	MA.
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	6.5	
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	17	VOLTS

PLATE 3016
SEPT. 1 1952

→ INDICATES A CHANGE OR ADDITION.

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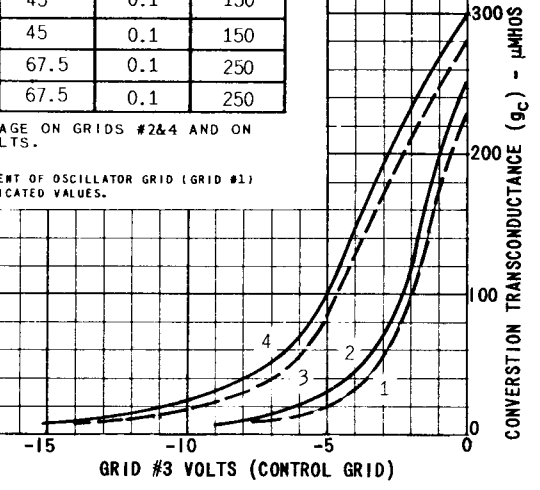
1R5
E_f = 1.4 Volts DC

CURVE	PLATE VOLTS	GRIDS 2 & 4 volts	GRID #1 RESISTOR MEGOHM	GRID #1 CURRENT[A] µAMP
1	45	45	0.1	150
2	90	45	0.1	150
3	67.5	67.5	0.1	250
4	90	67.5	0.1	250

OSCILLATOR VOLTAGE ON GRIDS #2&4 AND ON FILAMENT = 0 VOLTS.

[A] OBTAINED BY ADJUSTMENT OF OSCILLATOR GRID (GRID #1) VOLTAGE TO GIVE INDICATED VALUES.



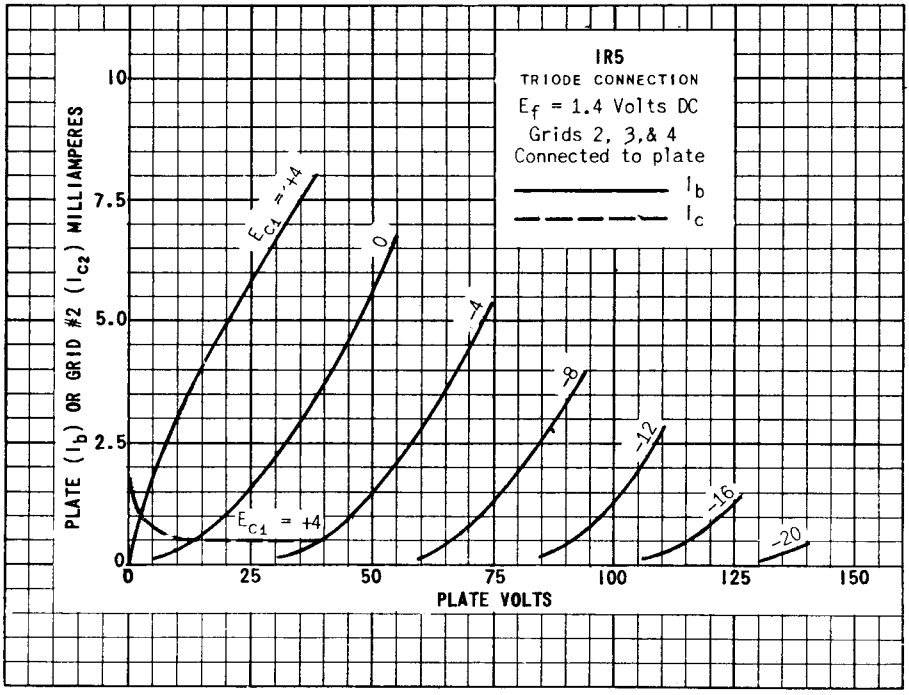


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PLATE
3017
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1952

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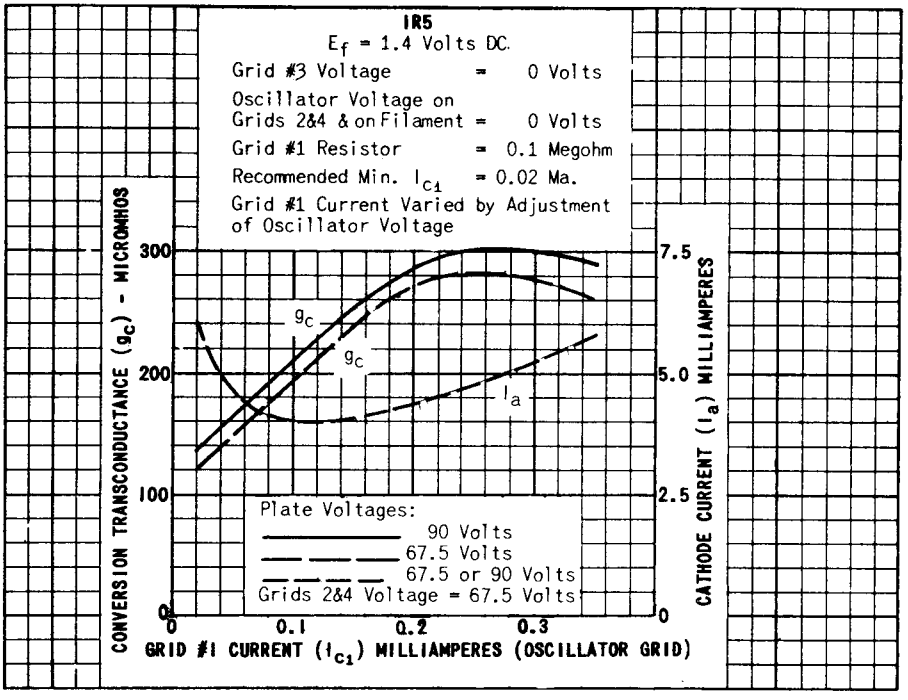
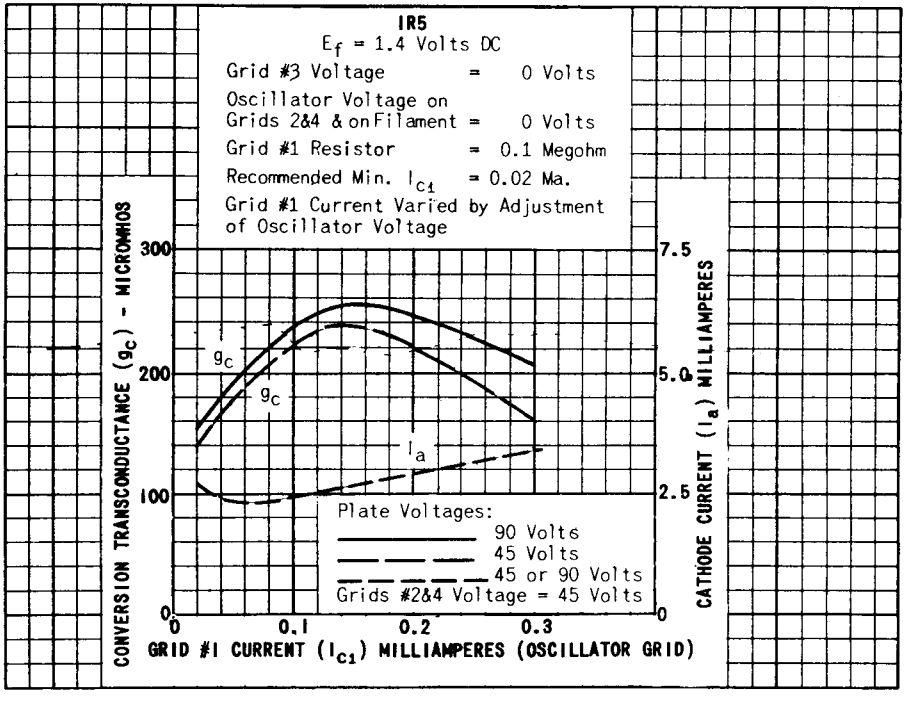
1R5





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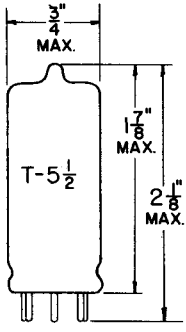
TUNG-SOL

HEPTODE CONVERTER

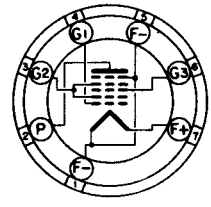
MINIATURE TYPE

HEATER

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7AT

THE 1R5WA IS A FILAMENT TYPE HEPTODE CONVERTER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED OSCILLATOR AND MIXER IN BATTERY OPERATED EQUIPMENT. ITS PRINCIPAL APPLICATION IS AS A MIXER IN OSCILLATOR SECTIONS OF PORTABLE RECEIVERS. THE 1R5WA IS PARTICULARLY USEFUL IN CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	90	90	100	Vdc
GRID VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2	---	45	45	75	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.1	WATTS
GRID #2 DISSIPATION	Pg(2&4):	---	---	---	0.19	WATTS
GRID RESISTANCE	Rg(1):	---	0.1	0.1	---	MEG.
CONVERSION TRANSCON.	Sc:	---	---	235	---	μMHOS
PLATE CURRENT	Ib1:	---	---	0.90	---	mAdc
GRID VOLTAGE #3	Ec3:	---	0	0	0	Vdc
CATHODE CURRENT	Ik:	---	---	---	6.5	mAdc

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CHARACTERISTICS AND QUALITY CONTROL[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1			COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES						
GRID CURRENT (1): Ec3=-1 Vdc Eg1=15 Vac (NOTE 9)	0.65	Ic3:	0	---	---	---	-0.6	---	μAdc
PLATE CURRENT (1): Eg1=15 Vac (NOTE 9)	0.65	Ib:	0.55	---	---	---	1.25	---	mAdc
CATHODE CURRENT: Eg1=15 Vac; (NOTE 9)	0.65	Ik:	2.25	---	---	---	4.75	---	mAdc
CONVERSION TRANS-CONDUCTANCE (1): Eg1=15Vac; Ef = 1.0 Vdc (NOTE 9)	0.65	Sc:	130	---	---	---	340	---	μMHOS
OSCILLATOR GRID CURRENT: Ef=1.0 Vdc; PLATE FLOATING (NOTE 10)	0.65	Ic1:	125	---	---	---	---	---	μAdc
NOISE AND MICROPHONICS: Ebb=Ecc2&4 =Ecc3=135 Vdc; Ecal=10.0 mVac Rp=2.2 MEG; Rg2&4 =4MEG; Cg2&4=0.01 μf TO F-; Rg3=8 MEG.	0.65	Eb:	---	---	---	---	17	---	VU
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE OUTLINE (6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: g1-all		Rg-all:	100	---	---	---	---	---	MEG.
p-all	4.0	Rp-all:	100	---	---	---	---	---	MEG.
g3-all		Rg3-all:	100	---	---	---	---	---	MEG.
CONVERSION TRANSCON DUCTANCE (2): Eg1=15 Vac (NOTE 9)	6.5	Sc:	160	---	---	---	340	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
CAPACITANCE: WITHOUT SHIELD		Cg3-all:	4.7	---	---	---	6.9	---	μμf
WITHOUT SHIELD	6.5	Cp-all:	5.0	---	---	---	7.5	---	μμf
WITHOUT SHIELD		Cg3-p:	---	---	---	---	0.45	---	μμf
VIBRATION (1): Rp=10,000 OHMS; Ec1=-5 Vdc; 40 cps; 15g; Rg1=0	6.5	Ep(1):	---	---	---	---	10	---	mVac
VIBRATION (2): F=50cps-3500 cps; Rp= 10,000 OHMS; Ec1=-5Vdc; Rg1=0; (NOTE 8)	6.5	Ep(1):	---	---	---	---	25	---	mVac

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CHARACTERISTICS AND QUALITY CONTROL[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
SHOCK: HAMMER ANGLE= 30°	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5; F=25 MIN; 60 MAX. FIXED FREQUENCY	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS: CONVERSION TRANS-CONDUCTANCE (2):	---	Sc:	125	---	---	---	---	---	μMHOS
VIBRATION (1):	---	Ep:	---	---	---	---	15	---	mVac
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN:	2.5	---	---	---	---	---	---	---	---

	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	LIMITS MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
INTERMITTENT LIFE TEST: Ef=1.25 Vdc; OR Vac WITH EQUIVALENT BIAS: GROUP A; Ecal=-16.0 Vdc; Esig=17.5 Vac; Ec 2&4=67.5 Vac; (NOTE 12)	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS: CONVERSION TRANS-CONDUCTANCE (2):	---	---	---	Sc:	125	---	μMHOS
OSCILLATOR GRID CURRENT	---	---	---	Ic1:	100	---	μAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1, AND MIL-STD-105A.
2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

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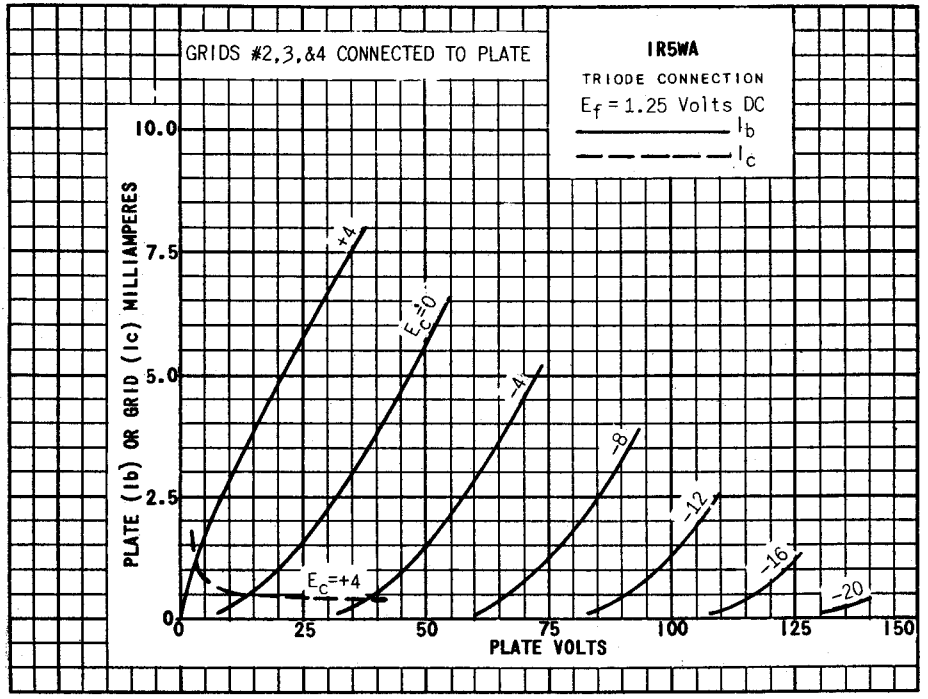
NOTES - CONT'D.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.
5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.
7. PLATE AND SCREEN VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.
8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.
9. FOR RAPID TESTING USE EQUIPMENT WHICH CORRELATES WITH MIL-E-1 PARAGRAPH 4.10.12.
10. WITH CONVERTER OSCILLATOR TEST SET (DRAWING 195-JAN) HAVING R_{gl}=50,000 OHMS AND WITH GRID TO FILAMENT RESONANT IMPEDANCE ADJUSTED TO 9500 OHMS.
11. TUBES SHALL BE SO SHIELDED THAT OPERATOR PROXIMITY OR MOVEMENT WILL NOT AFFECT OUTPUT READINGS.
12. BIAS OF GRID #1 MAY BE OBTAINED FROM A DC SOURCE OF SELF BIAS.



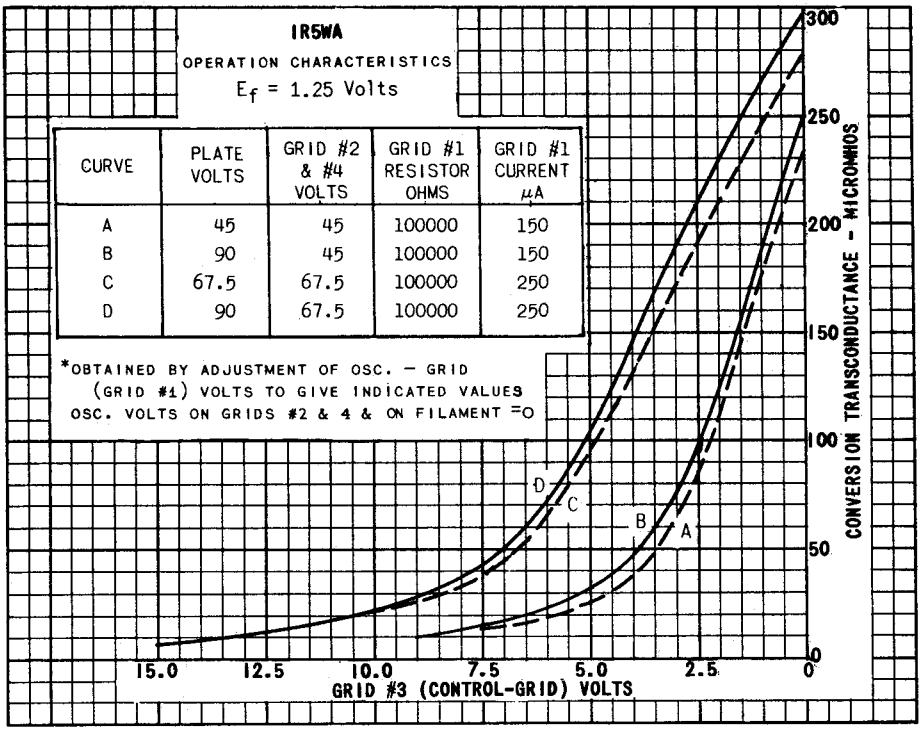
IR5WA

OPERATION CHARACTERISTICS

E_f = 1.25 Volts

CURVE	PLATE VOLTS	GRID #2 & #4 VOLTS	GRID #1 RESISTOR OHMS	GRID #1 CURRENT μA
A	45	45	100000	150
B	90	45	100000	150
C	67.5	67.5	100000	250
D	90	67.5	100000	250

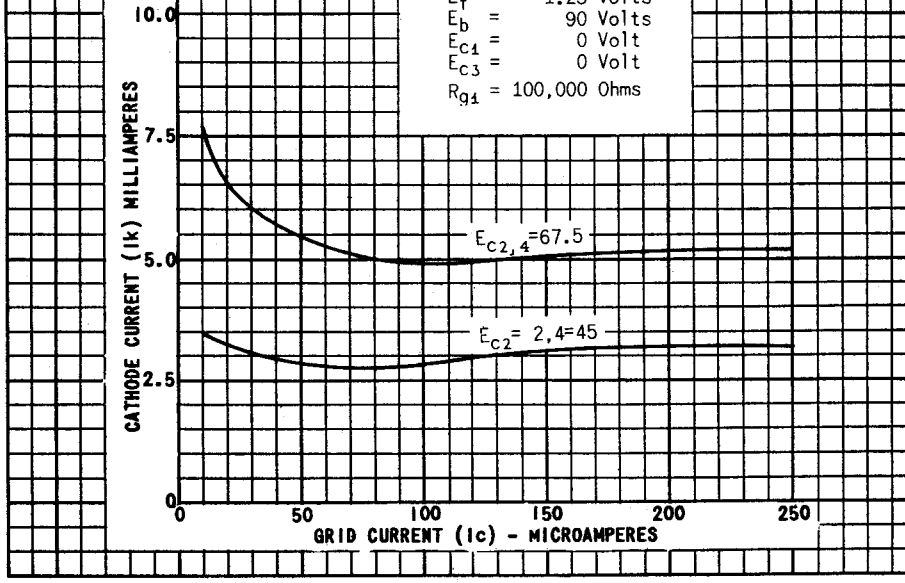
*OBTAINED BY ADJUSTMENT OF OSC. — GRID (GRID #1) VOLTS TO GIVE INDICATED VALUES OSC. VOLTS ON GRIDS #2 & 4 & ON FILAMENT =0



IR5WA

OPERATION CHARACTERISTICS

E_f = 1.25 Volts
E_b = 90 Volts
E_{c1} = 0 Volt
E_{c3} = 0 Volt
R_{g1} = 100,000 Ohms



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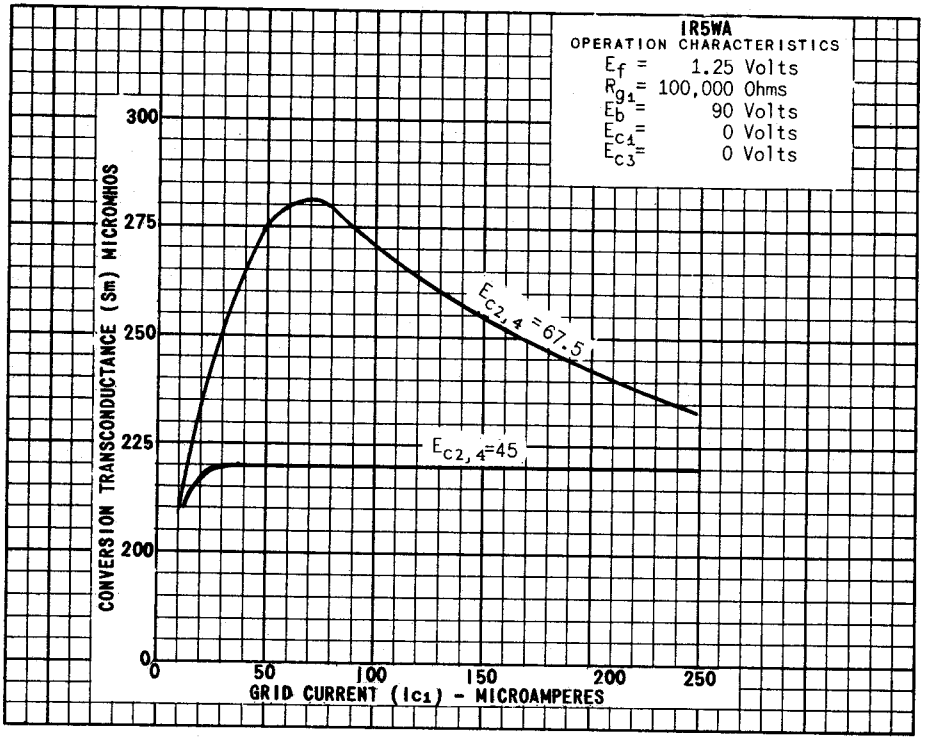
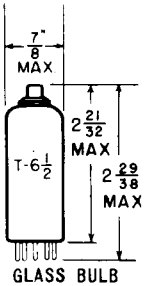


TUNG-SOL

RECTIFIER

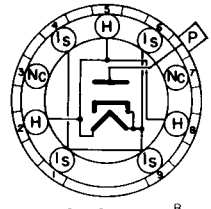


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
1.4 VOLTS[A] 0.55 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW[B]
SMALL BUTTON
9 PIN NOVAL
9DT

THE 1S2A IS A HIGH VACUUM-SINGLE ANODE RECTIFIER DESIGNED FOR E.H.T. SUPPLY FROM THE LINE TIME BASE IN TELEVISION RECEIVERS. EXCEPT FOR A CHEMICALLY TREATED ENVELOPE, WHICH AVOIDS FLASH-OVER UNDER CONDITIONS OF HIGH HUMIDITY AND LOW ATMOSPHERIC PRESSURE, IT IS IDENTICAL TO THE 1S2.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

PLATE TO CATHODE AND HEATER	1.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	1.4	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	22 000[CD]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE AT ZERO PLATE CURRENT	24 000[CD]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABS. LIMIT)	27 000[CD]	VOLTS
MAXIMUM DC OUTPUT CURRENT	0.8	MA.
MAXIMUM PEAK PLATE CURRENT	40[E]	MA.
MAXIMUM FILTER INPUT CAPACITOR	2 000	μμf
HEATER VOLTAGE AT A D.C. OUTPUT CURRENT LESS THAN 200 μAMPS (ABSOLUTE LIMITS)	1.4±15%	VOLTS
HEATER VOLTAGE AT D.C. OUTPUT CURRENT HIGHER THAN 200 μAMPS. (ABS. LIMITS)	1.4±7%	VOLTS

OPERATING CONDITIONS

HEATER VOLTAGE	1.4	VOLTS
HEATER CURRENT	0.55	AMP.
DC OUTPUT CURRENT	0.15	MA.
DC OUTPUT VOLTAGE	18 000	VOLTS

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NOTES

[A] WHEN THE HEATER IS TO BE OPERATED ON R.F. VOLTAGE OR FLY BACK PULSES, THE HEATER VOLTAGE CAN BE ADJUSTED TO 1.4 VOLTS BY COMPARISON OF THE COLOR OF THE CATHODE WITH THAT OF A CATHODE HEATED BY 1.4 VOLTS DC OR LOW-FREQUENCY AC.

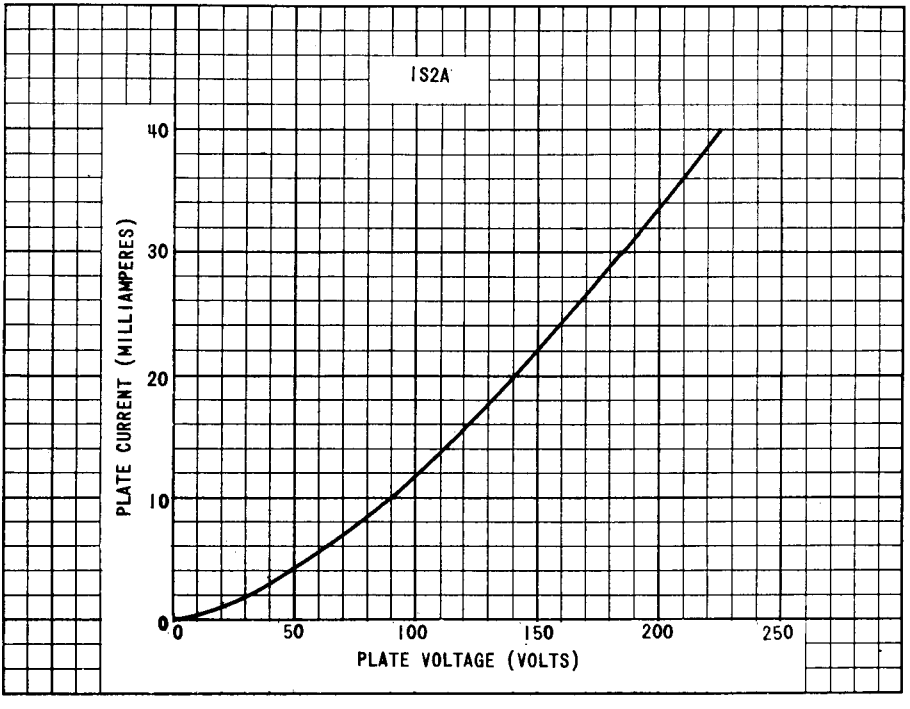
[B] TO PREVENT CORONA IT IS RECOMMENDED TO USE AN ANTI-CORONA RING AROUND THE TUBEHOLDER, WHICH SHOULD BE CONNECTED TO THE CATHODE (PINS 1,4,6 AND 9).

CIRCUIT ELEMENTS HAVING THE SAME POTENTIAL AS THE HEATER (E.G. A SERIES RESISTOR) MAY BE SUPPORTED BY THE TUBEHOLDER CONTACTS 3 OR 7. THESE CONTACTS SHOULD, HOWEVER, NEVER BE EARTHED.

[C] DUE TO RINGING CAUSED BY THE LINE OUTPUT TRANSFORMER, AN ADDITIONAL NEGATIVE PLATE VOLTAGE MAY OCCUR, THE PEAK VALUE OF WHICH MUST BE TAKEN INTO ACCOUNT. THE INCREASE OF THE PEAK INVERSE PLATE VOLTAGE DUE TO THIS EFFECT MAY AMOUNT UP TO 23% OF THE D.C. OUTPUT VOLTAGE OF THE TUBE.

[D] MAXIMUM PULSE DURATION 18% OF A CYCLE, WITH A MAXIMUM OF 18 μSEC.

[E] MAXIMUM PULSE DURATION 10% OF A CYCLE, WITH A MAXIMUM OF 10 μSEC.



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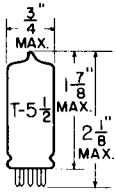
POWER AMPLIFIER PENTODE

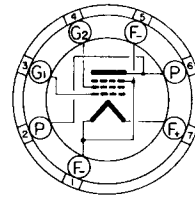


GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 0.1 AMPERE
DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 1S4 IS A POWER AMPLIFIER PENTODE OF THE MINIATURE CONSTRUCTION, ESPECIALLY DESIGNED FOR OUTPUT SERVICE IN COMPACT, LIGHT-WEIGHT PORTABLE EQUIPMENT. THE HIGH OPERATING EFFICIENCY ALLOWS THE TUBE TO BE USED EXTREMELY LOW B SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	67.5	VOLTS
MAXIMUM CATHODE CURRENT (MAX.-SIGNAL)	11	MA.
MAXIMUM CATHODE CURRENT (ZERO-SIGNAL)	9	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	0.10	0.10	0.10	AMP.
PLATE VOLTAGE	45	67.5	90	VOLTS
GRID #2 VOLTAGE	45	67.5	67.5	VOLTS
GRID #1 VOLTAGE (REFERRED TO NEG. FIL. TERMINAL)	-4.5	-7	-7	VOLTS
PEAK AF GRID VOLTAGE	4.5	7	7	VOLTS
ZERO-SIGNAL PLATE CURRENT	3.8	7.2	7.4	MA.
ZERO-SIGNAL GRID #2 CURRENT	0.8	1.5	1.4	MA.
PLATE RESISTANCE (APPROX.)	0.1	0.1	0.1	MEGOHM
TRANSCONDUCTANCE	1 250	1 550	1 575	µMHOS
LOAD RESISTANCE	8 000	5 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	12	10	12	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	0.065	0.18	0.27	WATTS

SIMILIAR TYPE REFERENCE: *Characteristics somewhat similiar to type 3S4.*

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PLATE 1827
JUNE 2, 1947

→ INDICATES A CHANGE OR ADDITION.

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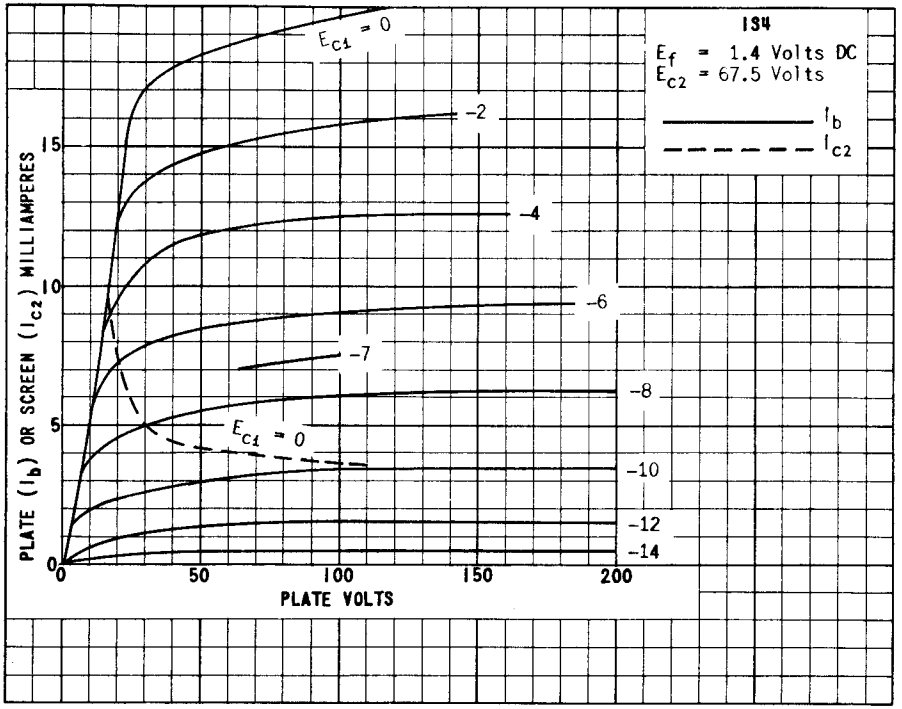
1S4



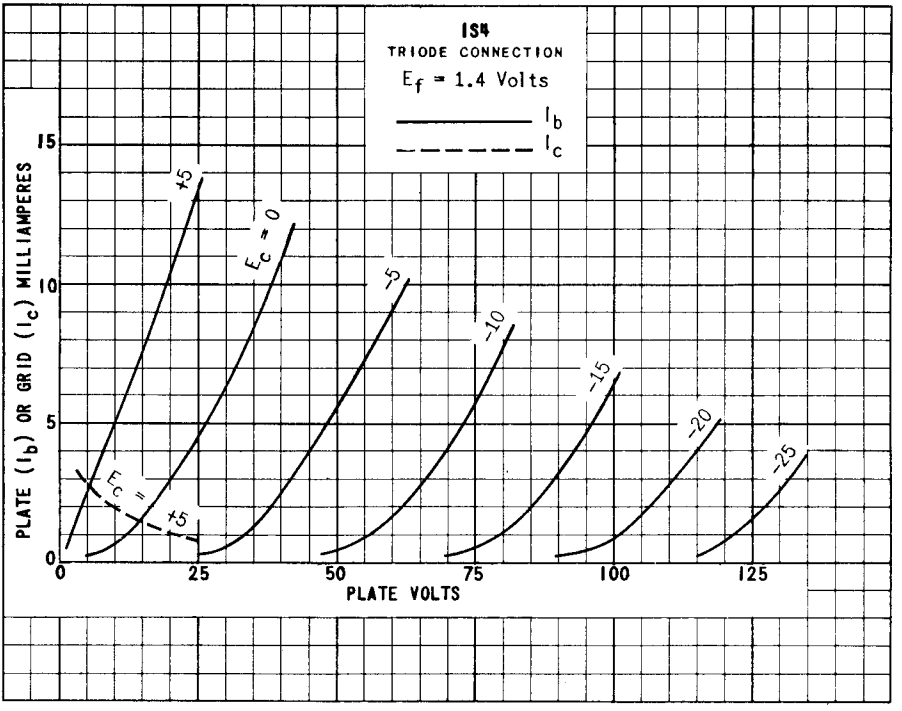


PLATE
1828
JUNE 2,
1947

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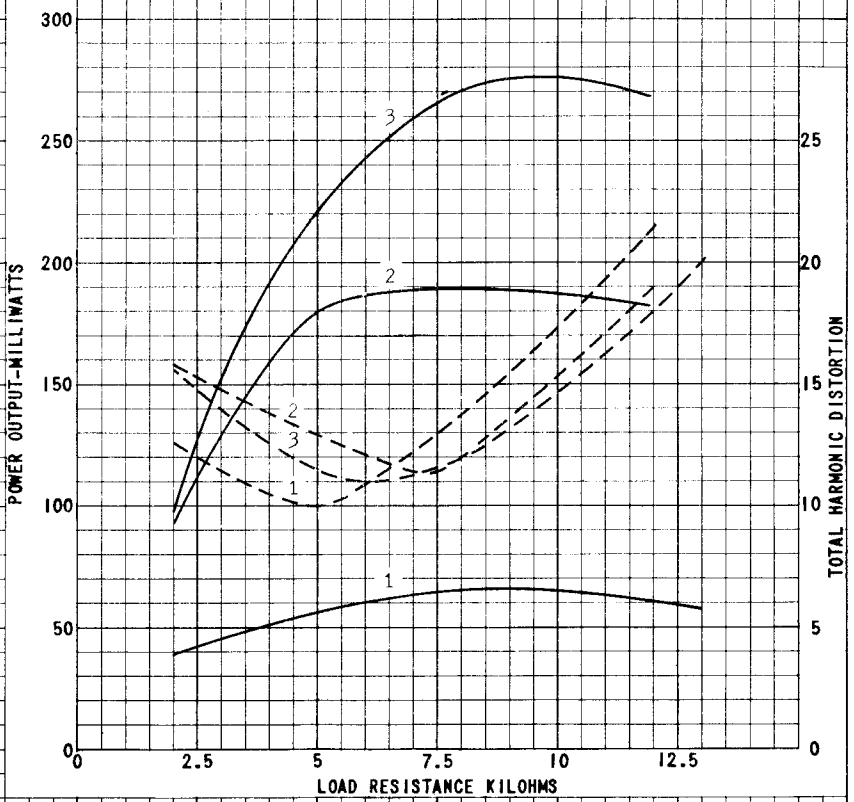
1S4

E_f = 1.4 Volts DC

CURVE	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	SIGNAL VOLTS
1	45	45	-4.5	3.2
2	67.5	67.5	-7	4.95
3	90	67.5	-7	4.95

——— P_o

– – – – – – – Dist.



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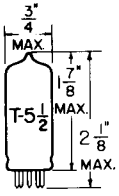
DIODE PENTODE

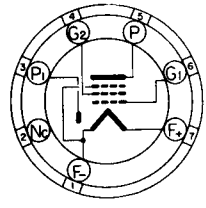


GLASS BULB

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6AU

THE 1S5 IS A DIODE PENTODE AMPLIFIER ESPECIALLY DESIGNED FOR DETECTOR-AUDIO SERVICE IN COMPACT, LIGHT-WEIGHT, PORTABLE EQUIPMENT. THE HIGH OPERATING EFFICIENCY ALLOWS IT TO BE USED WITH EXTREMELY LOW PLATE-SUPPLY VOLTAGE.

DIRECT INTERELECTRODE CAPACITANCES ←

DIODE PLATE TO GRID #1 [A]	0.1	μμf
DIODE PLATE TO FILAMENT & PIN #2 [B]	1.1	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM CATHODE CURRENT	3	MA.
MAXIMUM DIODE CURRENT FOR CONTINOUS OPERATION	0.25	MA.
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-50	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE UNIT

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	50	MA.
PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
TRANSCONDUCTANCE	625	μMHOS
PLATE CURRENT	1.6	MA.
GRID #2 CURRENT	0.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA DC	-5	VOLTS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	1.5	MA.

CONTINUED ON FOLLOWING PAGE

[A] WITHOUT EXTERNAL SHIELD OR WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

[B] WITHOUT EXTERNAL SHIELD.

→ INDICATES A CHANGE.

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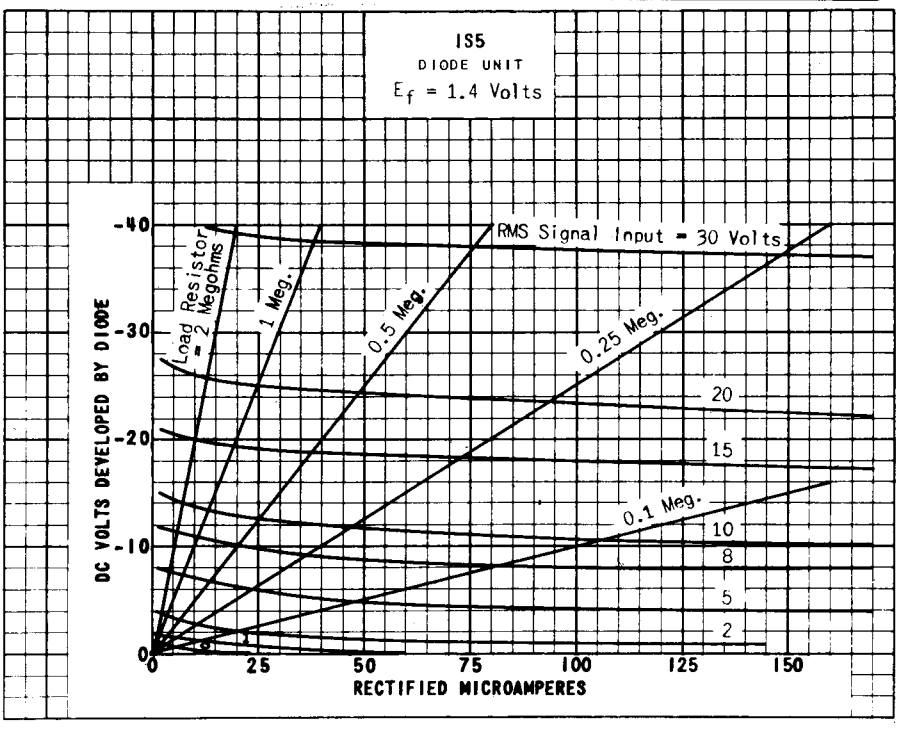
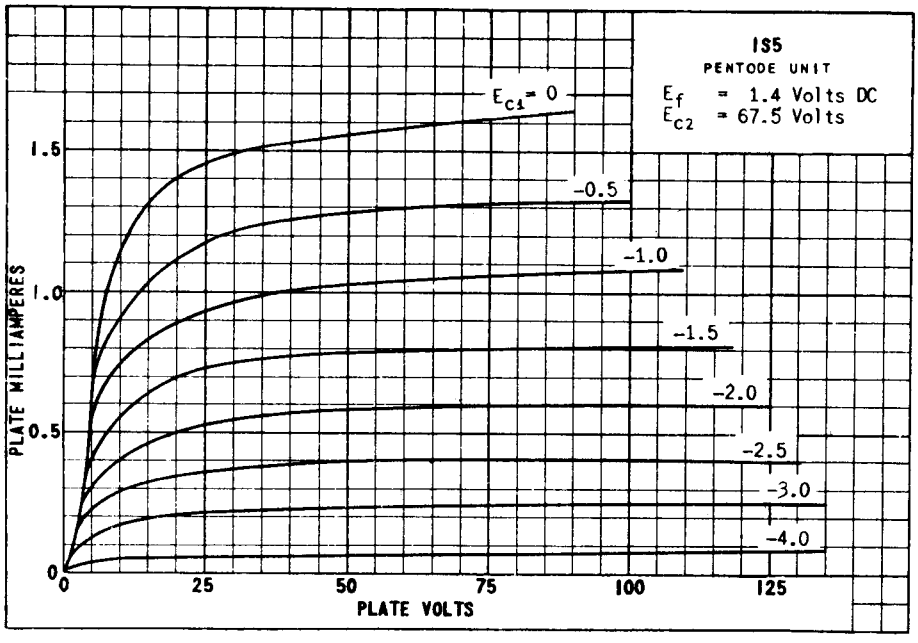
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

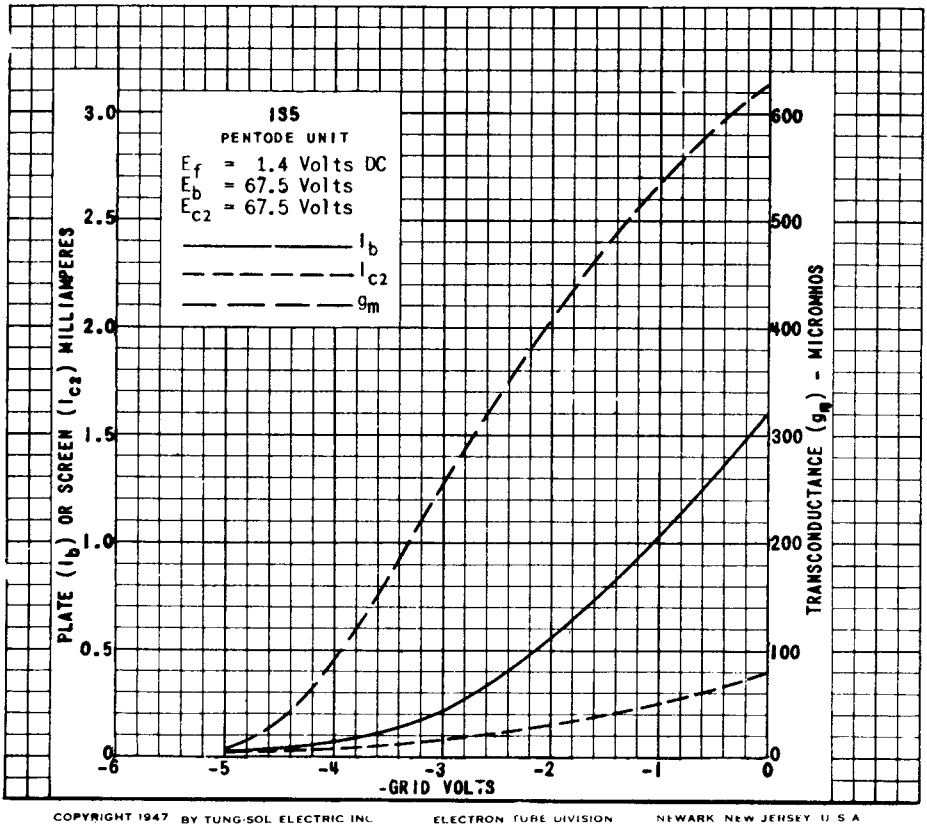
RESISTANCE COUPLED AMPLIFIER

PENTODE UNIT

FILAMENT VOLTAGE	1.4	1.4	VOLTS
PLATE SUPPLY VOLTAGE	45	90	VOLTS
SCREEN SUPPLY VOLTAGE	45	90	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	470 000	470 000	OHMS
CONTROL GRID RESISTOR	10	10	MEGOHMS
SERIES SCREEN RESISTOR	2.2	2.2	MEGOHMS
SCREEN BY-PASS CONDENSER	0.1	0.1	μf
INPUT CONDENSER	0.01	0.01	μf
OUTPUT CONDENSER	0.01	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	1.0	1.0	MEGOHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1000	1000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	17.0	VOLTS
VOLTAGE GAIN AT 400 CPS	33	50	







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1768
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1947

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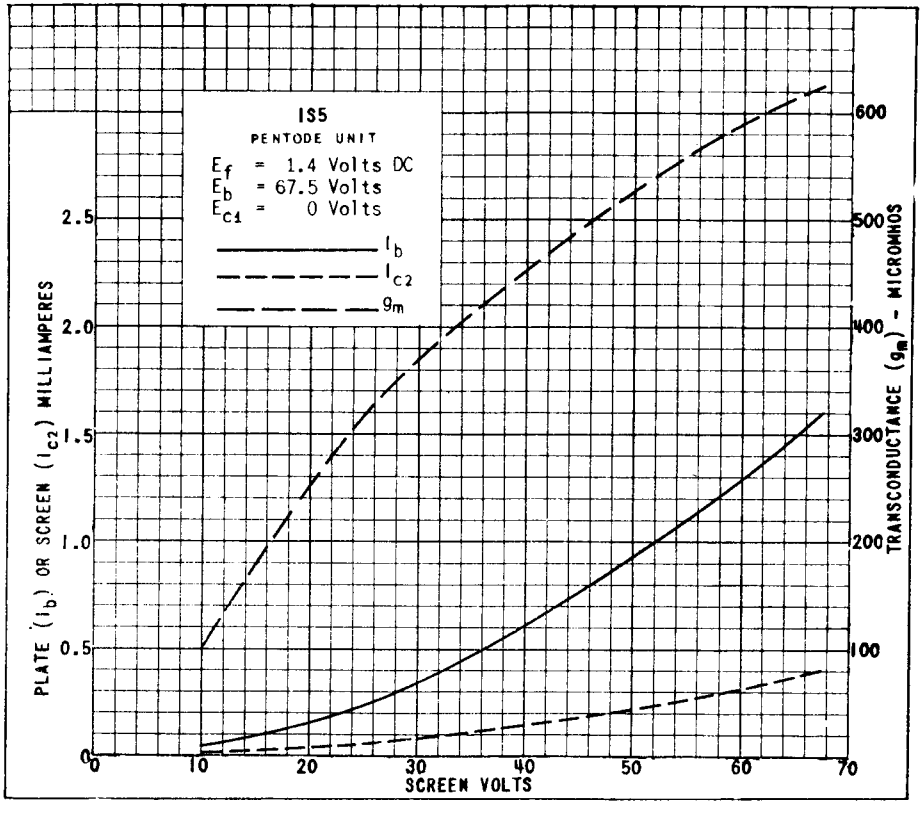
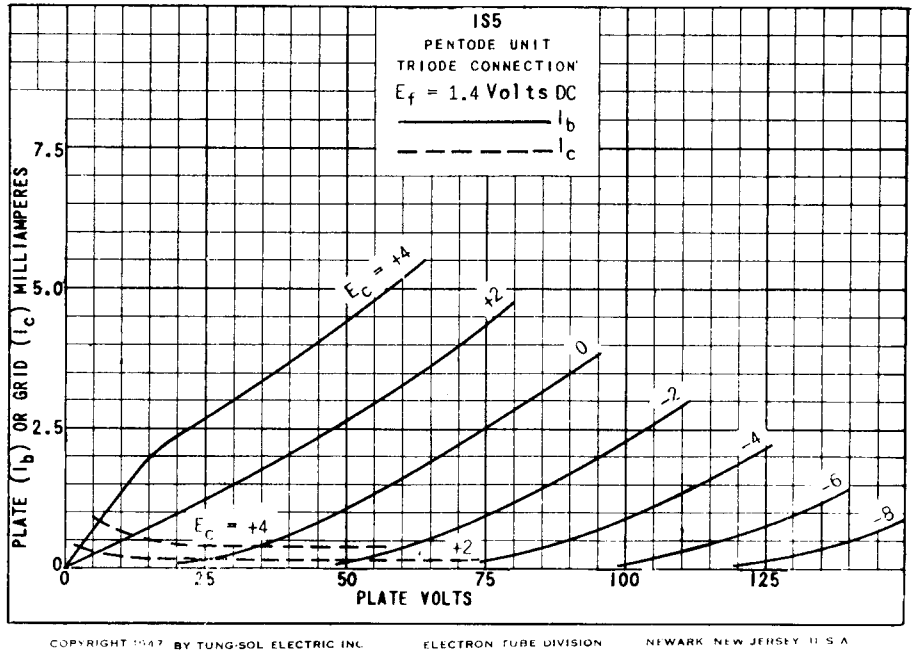
1S5





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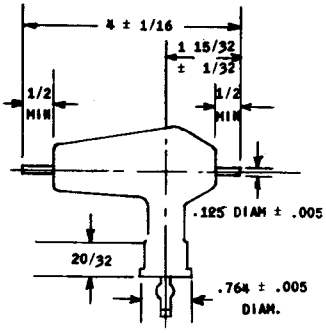
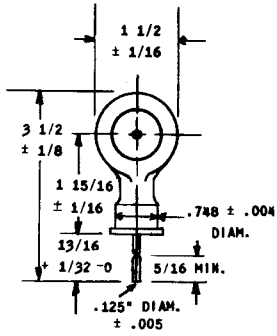
VACUUM SWITCH





THE 1S22 IS A SINGLE POLE, DOUBLE THROW, HIGH VACUUM SWITCH. THE SWITCH IS ACTUATED MECHANICALLY BY MEANS OF A LEVER ARM EXTENDING THROUGH A FLEXIBLE KOVAR DIAPHRAGM. HIGH CURRENTS AND HIGH VOLTAGES MAY BE SWITCHED WITH A MINIMUM AMOUNT OF SPARKING AND OXIDATION AT THE CONTACT POINTS BECAUSE OF THE "BREAK CLEAN" CHARACTERISTICS OF A VACUUM SWITCH.

THE 1S22 HAS HAD SUCCESSFULL APPLICATION IN AIRBORNE EQUIPMENT PARTICULARLY AS AN ANTENNA SWITCH. IT HAS ALSO FOUND APPLICATION IN EXPLOSIVE ATMOSPHERES, IN CORROSIVE ATMOSPHERES AND IN SAFETY LOAD DUMPING CIRCUITS.

ELECTRICAL DATA

MAXIMUM CONTINUOUS CURRENT, RMS	20	AMPS
MAXIMUM INITIAL CONTACT RESISTANCE	0.05	OHMS

MECHANICAL DATA

	MIN.	MAX.	
ARM TRAVEL (MEASURED 5/8" FROM DIAPHRAGM)	.009	.017	INCHES
ACTUATING FORCE (MEASURED 5/8" FROM DIAPHRAGM)	200	500	GRAMS
MAXIMUM ALLOWABLE ACTUATING FORCE	---	1000	GRAMS

ALTITUDE RATINGS

ALTITUDE	EXTERNAL HOLD-OFF VOLTAGE (RMS)	INTERNAL HOLD-OFF VOLTAGE (RMS) ←
27,000 FT	10,000 VOLTS	10,000 VOLTS
40,000	7,500	10,000
50,000	5,000	10,000

→ INDICATES A CHANGE.

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TUNG-SOL

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INTERRUPTING RATINGS
FOR INFORMATION ONLY

WITH RESISTIVE LOAD AT 10,000 V. RMS AT 60 CPS.

OPERATIONS	AMPERES
1000	10.0
1,000,000	3.0
500,000,000	0.1

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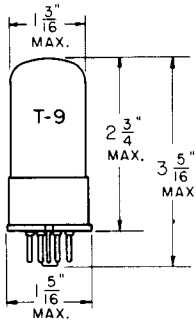
R. F. PENTODE



COATED FILAMENT

1.4 VOLTS .050 AMPERE

DC

GLASS BULB

ANY MOUNTING POSITION

BOTTOM VIEW

SMALL WAFER OCTAL
8 PIN BASE WITH
METAL SHELL

1SA6GT IS A FILAMENT TYPE MEDIUM CUT-OFF PENTODE AMPLIFIER DESIGNED FOR PORTABLE EQUIPMENT. IT PROVIDES HIGH GAIN THROUGH THE USE OF HIGH TRANSCONDUCTANCE AND ADEQUATE SHIELDING TO MAINTAIN LOW GRID-PLATE CAPACITANCE WITH SINGLE ENDED STRUCTURE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM SCREEN VOLTAGE	67.5	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	6.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO PLATE	0.01	MAX.	μμf
INPUT (CONTROL GRID - FIL, G2, G3)	5.2		μμf
OUTPUT (PENTODE PLATE - FIL, G2, G3)	8.6		μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	45	67.5	90	VOLTS
SCREEN GRID (G2) VOLTAGE	45	67.5	67.5	VOLTS
CONTROL GRID (G1) VOLTAGE	0	0	0	VOLTS
SUPPRESSOR GRID (G3) VOLTAGE	0	0	0	VOLTS
PLATE CURRENT	1.1	2.4	2.45	MA.
SCREEN GRID CURRENT	0.3	0.7	0.68	MA.
TRANSCONDUCTANCE	750	950	970	μMHOS
PLATE RESISTANCE	0.7	0.6	0.8	MEGOHM
APPROXIMATE CONTROL GRID VOLT FOR TRANSCONDUCTANCE = 5 μMHOS	-3.5	-5.5	-5.5	VOLTS

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1SB6GT

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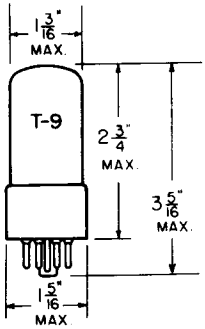
DIODE PENTODE AMPLIFIER



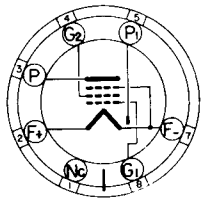
COATED FILAMENT

1.4 VOLTS 0.05 AMPERE

D C

GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL

OCTAL 7 PIN BASE

THE 1SB6GT IS A LOW DRAIN FILAMENT TYPE SINGLE DIODE-PENTODE TUBE DESIGNED FOR USE IN BATTERY OPERATED EQUIPMENT. IT FEATURES SINGLE ENDED CONSTRUCTION AND INCORPORATES A PENTODE CAPABLE OF RELATIVELY HIGH VOLTAGE GAIN.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

MAXIMUM PENTODE PLATE VOLTAGE	90	VOLTS
MAXIMUM SCREEN GRID VOLTAGE	67.5	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO PENTODE PLATE	0.25	μμf
INPUT (CONTROL GRID - FIL, G2, G3)	3.2	μμf
OUTPUT (PENTODE PLATE - FIL, G2, G3)	3.0	μμf
PENTODE PLATE TO DIODE PLATE	0.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE PLATE VOLTAGE	45	67.5	90	VOLTS
SCREEN GRID VOLTAGE	45	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE	0	0	0	VOLTS
PLATE CURRENT	0.6	1.4	1.45	MA.
SCREEN GRID CURRENT	0.16	0.4	0.38	MA.
TRANSCONDUCTANCE	500	650	665	μMHOS
PLATE RESISTANCE	0.9	0.6	0.7	MEGOHMS

AS VOLTAGE AMPLIFIER

PLATE SUPPLY VOLTAGE	45	67.5	90	VOLTS
SCREEN GRID SUPPLY VOLTAGE	45	67.5	90	VOLTS
CONTROL GRID VOLTAGE[A]	0	0	0	VOLTS
LOAD RESISTOR*	1.0	1.0	1.0	MEGOHMS
SERIES SCREEN GRID RESISTOR	5.0	5.0	5.0	MEGOHMS
SCREEN GRID BY-PASS CONDENSER	0.1	0.1	0.1	μf
CONTROL GRID RESISTOR	5.0	5.0	5.0	MEGOHMS
VOLTAGE GAIN	65	90	110	

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL

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OCT. 31 1944

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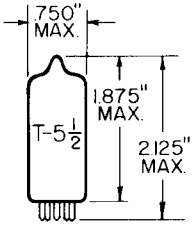
PENTODE

MINIATURE TYPE

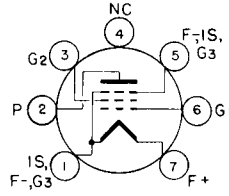


GLASS BULB
MINIATURE BUTTON 7 PIN BASE E7-1
OUTLINE DRAWING JEDEC 5-2

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AR

THE 1T4 IS A MINIATURE SUPER-CONTROL RF PENTODE. IT IS RECOMMENDED FOR USE IN COMPACT, LIGHT-WEIGHT, PORTABLE RECEIVERS WHERE AVC IS REQUIRED. THE 1T4 FEATURES ADEQUATE INTERNAL SHIELDING FOR MOST PURPOSES, BUT EXTERNAL SHIELDING IS RECOMMENDED WHERE MINIMUM GRID-PLATE CAPACITANCE IS TO BE OBTAINED.

DIRECT INTERELECTRODE CAPACITANCES

WITH OR WITHOUT EXTERNAL SHIELD #316 CONNECTED TO PIN #1

GRID TO PLATE: (G_1 TO P) MAX.	0.01	pf
INPUT: G_1 TO ($F\&G_3+G_2$)	3.6	pf
OUTPUT: P TO ($F\&G_3+G_2$)	7.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	→ 90	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	5.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	45	67.5	90	90	VOLTS
GRID #2 VOLTAGE	45	67.5	45	67.5	VOLTS
GRID #1 VOLTAGE	0	0	0	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.35	0.25	0.8	0.5	MEGOHM
TRANSCONDUCTANCE	700	875	750	900	µMHOS
PLATE CURRENT	1.7	3.4	1.8	3.5	MA.
GRID #2 CURRENT	0.7	1.5	0.65	1.4	MA.
GRID #1 VOLTAGE FOR g_m = 10 µMHOS	-10	-16	-10	-16	VOLTS

→ INDICATES A CHANGE.

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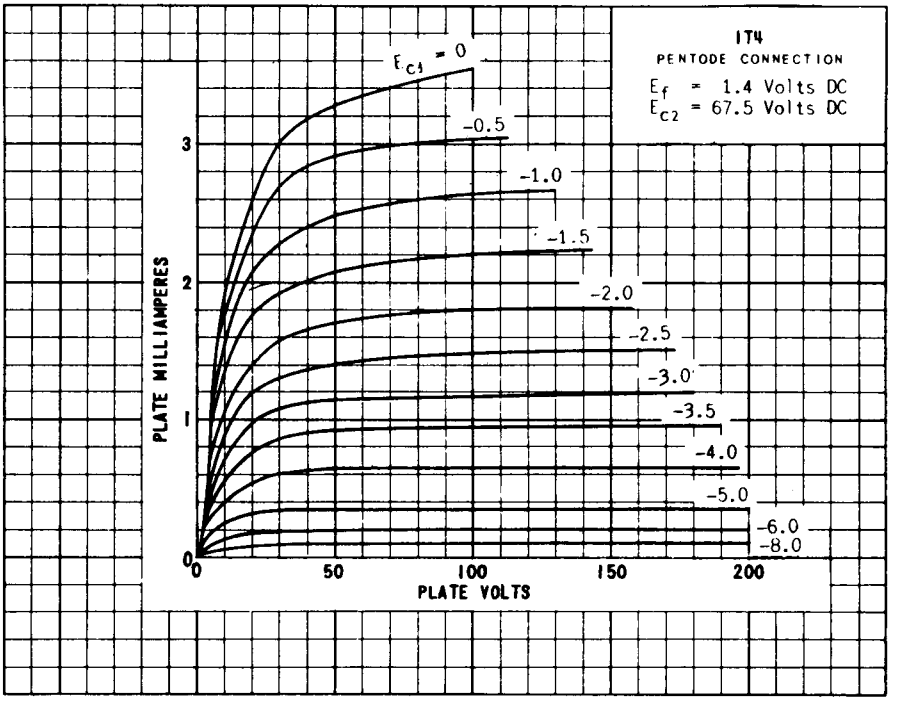
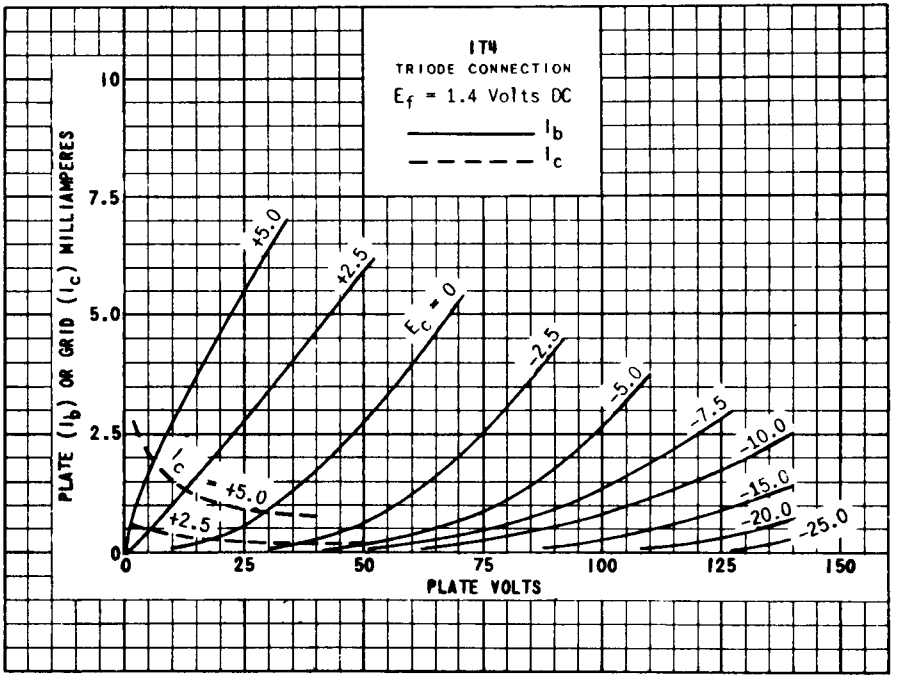
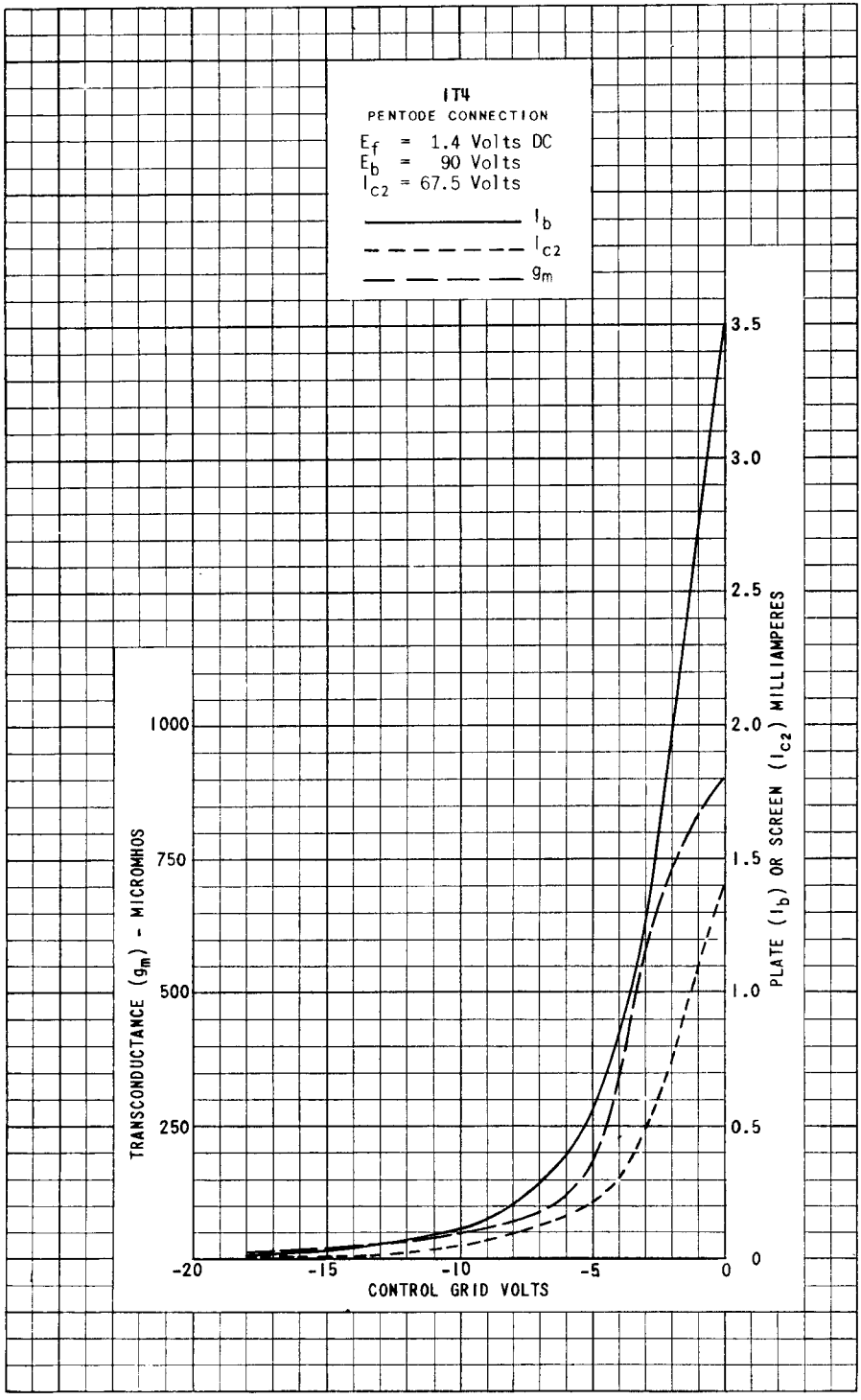
1T4


1T4
PENTODE CONNECTION
E_f = 1.4 Volts DC
E_{c2} = 67.5 Volts DC
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-5.0
-6.0
-8.0
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
0
50
100
150
200


1T4
TRIODE CONNECTION
E_f = 1.4 Volts DC
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
E_c = 0
+5.0
+2.5
-2.5
-5.0
-7.5
-10.0
-15.0
-20.0
-25.0
I_c
0
2.5
5.0
7.5
10
0
25
50
75
100
125
150



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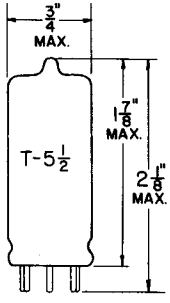
PENTODE

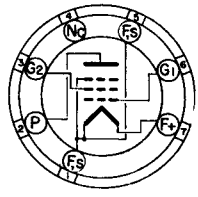
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

6AR

THE 1T4WA IS A FILAMENT TYPE SEMI-REMOTE CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A RADIO FREQUENCY OR INTERMEDIATE FREQUENCY AMPLIFIER IN BATTERY OPERATED EQUIPMENT WHERE EXTREME CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE TUBE IS PARTICULARLY USEFUL IN VOLTAGE AMPLIFIER CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY ELECTRONIC EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HOUR FATIGUE TEST – NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL E 1 SYMBOL	DES. MIN.	NORM. TEST COND. NOTE 5	NORM. OPER ATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	90	90	100	Vdc
GRID VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2:	---	67.5	67.5	75	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.4	WATTS
GRID #2 DISSIPATION	Pg2:	---	---	---	0.15	WATTS
GRID RESISTANCE	Rg(1):	---	---	---	2.0	MEG.
TRANSCONDUCTANCE	Sm:	---	---	900	---	μMHOS
PLATE CURRENT	Ib1:	--	---	3.5	---	mAdc
CATHODE CURRENT	Ik:	---	---	---	6.5	mAdc

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS, PART 1									
COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES									
GRID CURRENT (1): Eb=Ec2=90 Vdc; Ec1=-2.0 Vdc	0.65	Ic1:	0	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib1:	2.3	---	---	---	4.7	---	mAdc
SCREEN GRID CURRENT:	0.65	Ic2:	0.65	---	---	---	2.15	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	660	---	---	---	1125	---	μMHOS
NOISE AND MICROPHONICS: Ebb=90 Vdc; Ecc2=67.5 Vdc; Ecal=10.0 mVac; Rp=1.0 MEG; Rg2=4.7 MEG; Cg2=0.1 μf; Rg1=0	0.65	EB:	---	---	---	---	17	---	VU
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE OUTLINE (6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: g-all=-100 Vdc	4.0	Rg-all:	100	---	---	---	---	---	MEG.
p-all=-100 Vdc		Rp-all:	100	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2): Ef=1.0 Vdc; Eb=75 Vdc; Ec2=55 Vdc	6.5	Sm(2):	500	---	---	---	1125	---	μMHOS
TRANSCONDUCTANCE (3): Ec1=-16 Vdc	6.5	Sm(3):	1	---	---	---	50	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
GRID VOLTAGE: Ec1/Ic1=0.1 μAdc; Ec2=45 Vdc (NOTE 9)	6.5	Ec(1):	---	---	---	---	2.0	---	Vdc
PLATE CURRENT (2): Ef=1.25 Vdc; Rg=50,000 OHMS; Ec1=25 Vac (NOTE 10)	6.5	Ib:	2.0	---	---	---	---	---	mAdc
PLATE RESISTANCE: Eb=Ec2=45 Vdc	6.5	rp:	0.17	---	---	---	---	---	MEG.
CAPACITANCE: (SHIELD 316)		Cg1p:	---	---	---	---	0.02	---	μμf
CAPACITANCE: (WITHOUT SHIELD)	6.5	Cin:	3.0	---	---	---	4.7	---	μμf
CAPACITANCE: (WITHOUT SHIELD)		Cout:	4.5	---	---	---	8.5	---	μμf
VIBRATION (1): Rp=10,000 OHMS; 40 cps; 15g	6.5	Ep:	---	---	---	---	10	---	mVac
VIBRATION (2): F=40 cps-3500 cps; Rp=10,000 OHMS (NOTE 8)	6.5	Ep(2):	---	---	---	---	20	---	mVac

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS									
SHOCK: HAMMER ANGLE=30° (NOTE 2)	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5; F=25cps MIN; 60 cps MAX.; FIXED FREQUENCY (NOTE 3)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS: TRANSCONDUCTANCE (1):	---	Sm(1):	570	---	---	---	---	---	μMHOS
VIBRATION (1):	---	Ep:	---	---	---	---	15	---	mVac
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK:	2.5	---	---	---	---	---	---	---	---

TEST	ALLOW. DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TEST							
INTERMITTENT LIFE TEST: Ef=1.25 Vdc OR Vac WITH EQUIVALENT BIAS; GROUP A	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS: TRANSCONDUCTANCE (1):	---	---		Sm(1):	540	---	μMHOS
GRID CURRENT:	---	---		Ic(1):	---	-1.0	μAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1, AND MIL-STD-105A.
2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.
5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

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NOTES - cont'd.

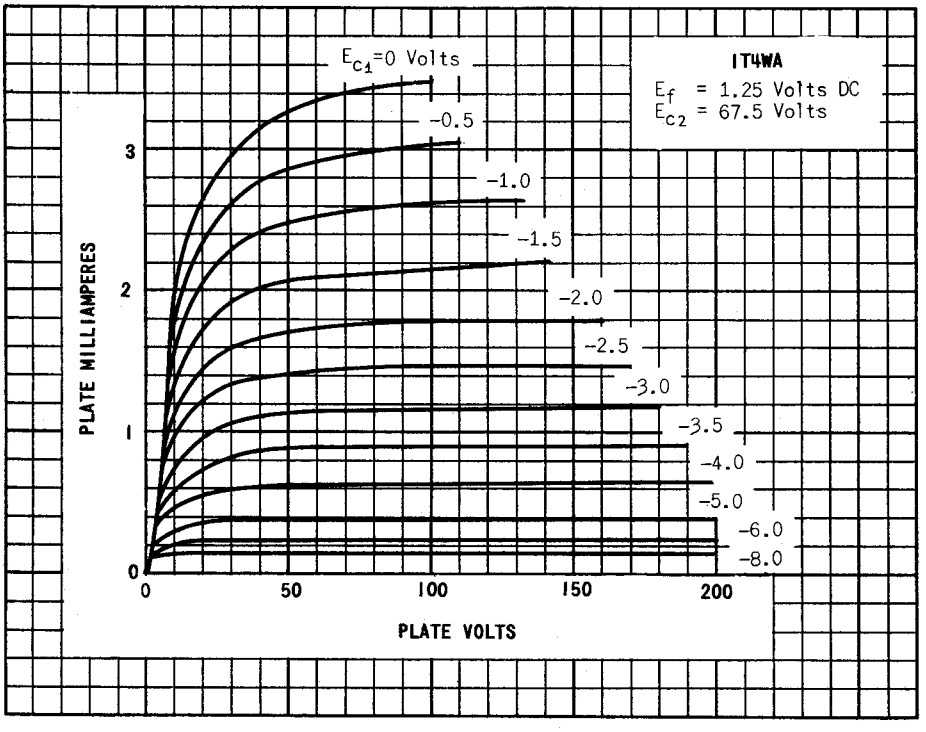
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

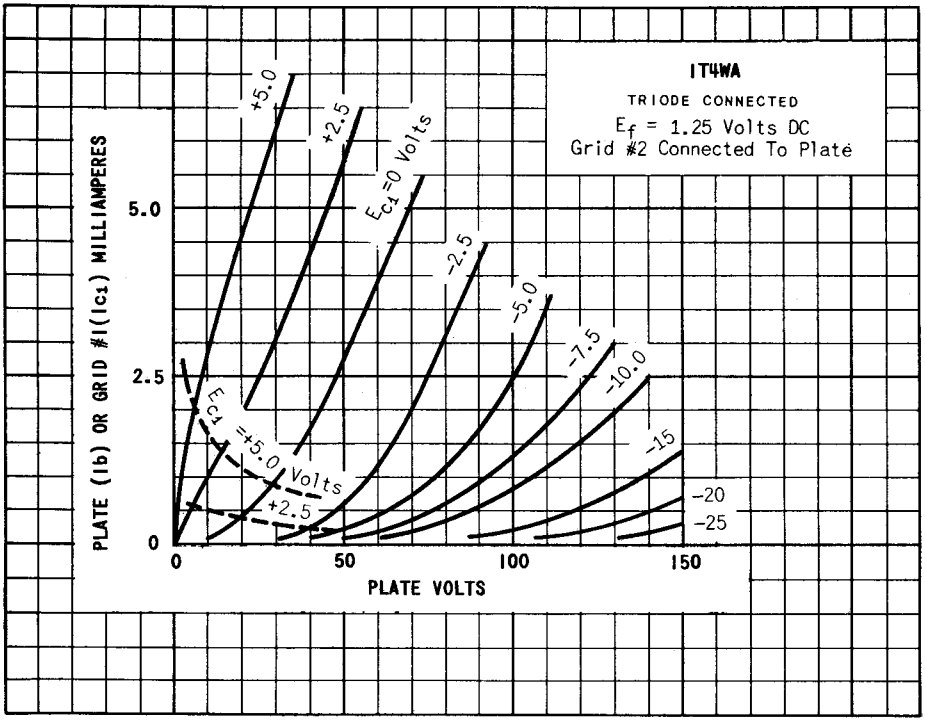
7. PLATE AND SCREEN SUPPLY VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

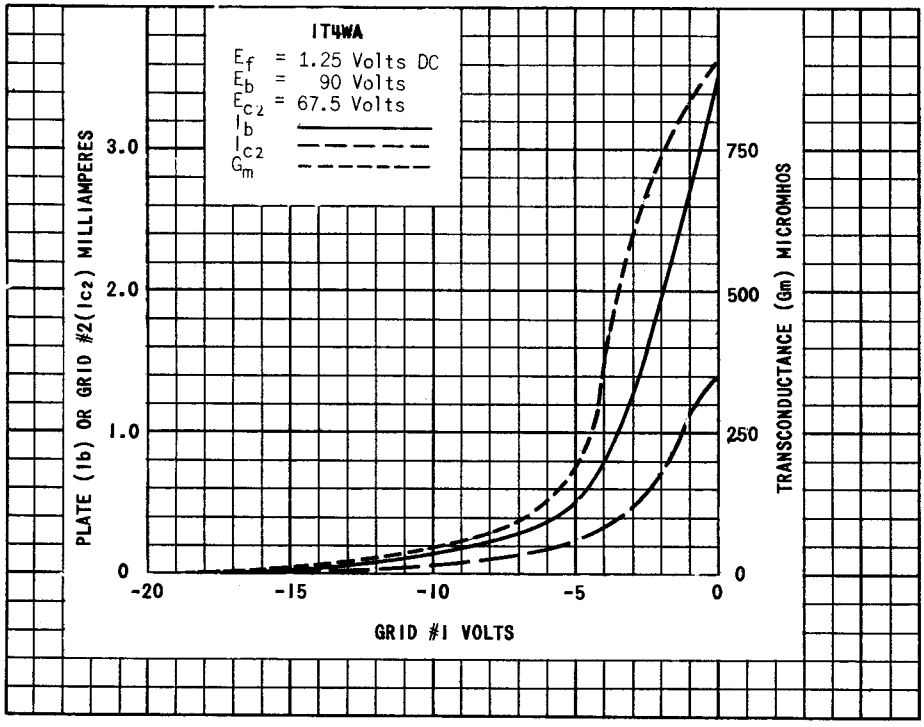
8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_p MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.

9. THE VOLTAGE DROP IN THE GRID CURRENT METER SHALL BE INCLUDED IN THE GRID VOLTAGE REQUIRED FOR THE 0.1μAdc GRID CURRENT.

10. THE SIGNAL SHALL BE COUPLED THROUGH A 1μf CONDENSER AND SHALL HAVE A SOURCE IMPEDENCE OF APPROXIMATELY 500 OHMS.







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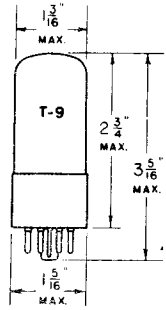


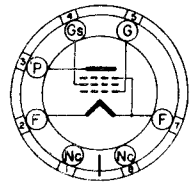
BEAM POWER AMPLIFIER

COATED FILAMENT

1.4 VOLTS 0.050 AMPERE

DC

GLASS BULB



G-6X

BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 1T5GT IS A LOW VOLTAGE, LOW CURRENT DRAIN BATTERY TYPE BEAM POWER OUTPUT TUBE. IT IS DESIGNED FOR SERVICE WITH 90 VOLTS OF "B" BATTERY AND A SINGLE DRY CELL "A" BATTERY.

RATINGS

MAXIMUM FILAMENT VOLTAGE		
DRY BATTERY OPERATION — VOLTAGE MUST NEVER EXCEED	1.6	VOLTS
AC — DC POWER LINE OPERATION — DESIGN CENTER	1.3	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM SCREEN VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT (ZERO SIGNAL)	7.3	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

	SELF-BIAS	FIXED-BIAS	
FILAMENT VOLTAGE	1.4 DC	1.4 DC	VOLTS
FILAMENT CURRENT	0.050	0.050	AMPERE
PLATE VOLTAGE	84	90	VOLTS
SCREEN VOLTAGE	84	90	VOLTS
CONTROL GRID VOLTAGE[A]	-6	-6	VOLTS
ZERO SIGNAL PLATE CURRENT	5.4	6.5	MA.
ZERO SIGNAL SCREEN CURRENT (NOMINAL)	0.6	0.8	MA.
MAXIMUM SIGNAL PLATE CURRENT	5.5	6.5	MA.
MAXIMUM SIGNAL SCREEN CURRENT (NOMINAL)	1.5	1.5	MA.
PLATE RESISTANCE APPROX.	.25	.25	MEGOHM
TRANSCONDUCTANCE	1050	1150	μMHOS
LOAD RESISTANCE	14000	14000	OHMS
TOTAL HARMONIC DISTORTION	7.5	7.5	PER CENT
POWER OUTPUT	145	170	MILLIWATTS

[A] REFERRED TO NEGATIVE FILAMENT TERMINAL.

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PLATE 1077-2

JULY 28 1941

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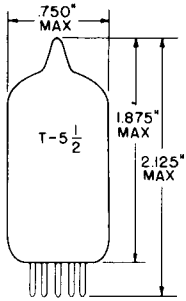
TUNG-SOL

PENTODE



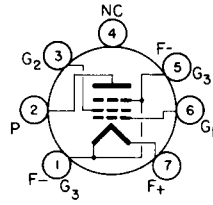
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FOR

AF AND RF APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AR

THE 1U4 IS A MINIATURE FILAMENTARY TYPE SHARP CUT-OFF PENTODE AMPLIFIER. IT IS INTENDED FOR RF OR AF APPLICATION WHERE CONSERVATION OF BATTERY POWER IS IMPORTANT.

DIRECT INTERELECTRODE CAPACITANCES

WITH OR WITHOUT SHIELD 316 CONNECTED TO PIN 1 OR 5

GRID TO PLATE: G1 TO P (MAX.)	0.01	pf
INPUT: G1 TO (F+G2+G3+I.S.)	3.6	pf
OUTPUT: P TO (F+G2+G3+I.S.)	7.5	pf

FILAMENT CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.4 VOLTS	50	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION: 1.5 VOLT DRY CELL SUPPLY	1.1 TO 1.6		VOLTS
OTHER BATTERY SUPPLIES OR POWER LINE	1.1 TO 1.5		VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	→ 120	VOLTS
GRID 2 VOLTAGE	→ 120	VOLTS
POSITIVE DC GRID 1 VOLTAGE	→ 0	VOLTS
CATHODE CURRENT	→ 6.6	MA.

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→ INDICATES A CHANGE.

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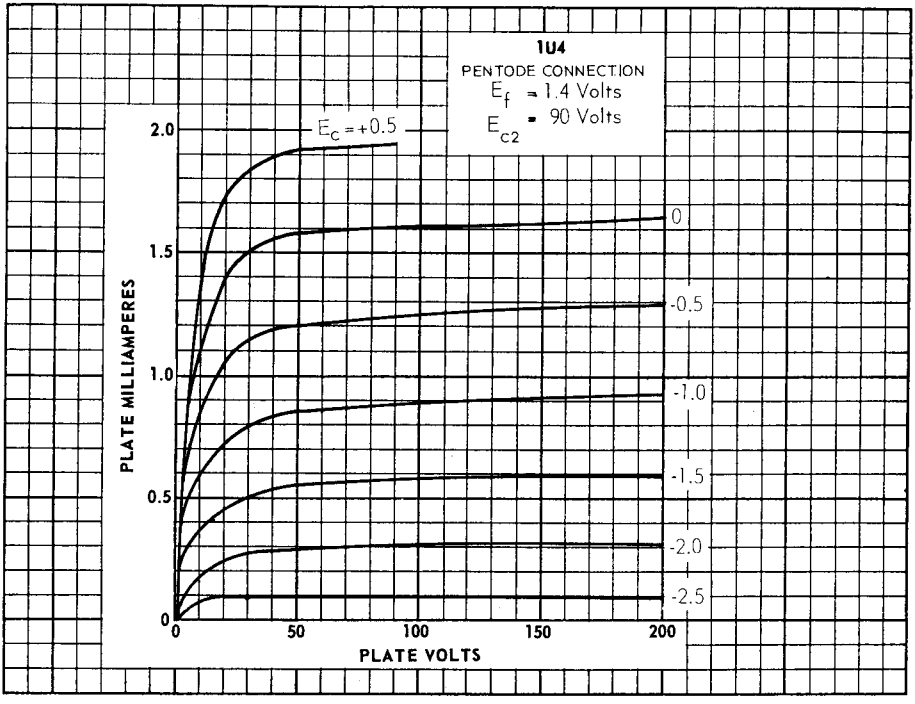
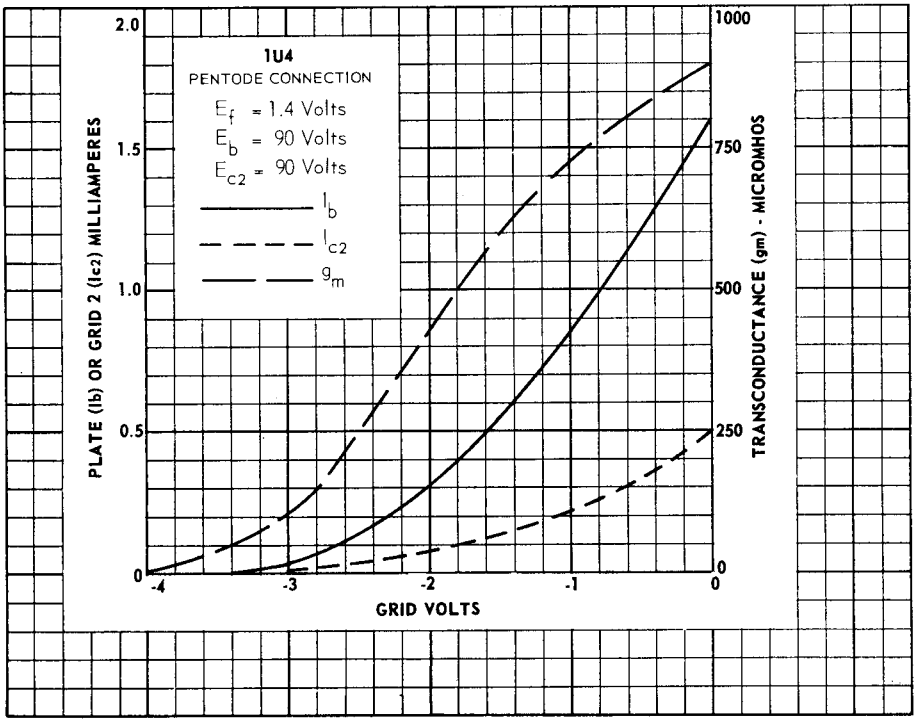
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	90	VOLTS
GRID 2 VOLTAGE	90	VOLTS
GRID 1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	1.0	MEGOHM
TRANSCONDUCTANCE	900	μMHOS
PLATE CURRENT	1.6	MA.
GRID 2 CURRENT	0.50	MA.
GRID 1 VOLTAGE FOR Ib= 10 μA. (APPROX)	-4	VOLTS





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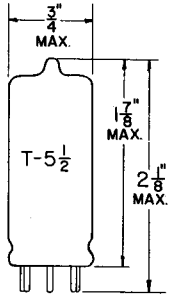
TUNG-SOL

PENTODE

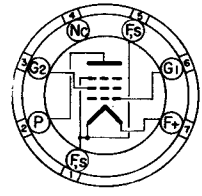
MINIATURE TYPE

HEATER

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

6AR

THE 1U4WA IS A FILAMENT TYPE SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR RF AND AF APPLICATIONS IN PORTABLE EQUIPMENT WHERE EXTREME CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE TUBE IS PARTICULARLY USEFUL IN VOLTAGE AMPLIFIER CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY ELECTRONIC EQUIPMENT.

RATINGS
MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST - NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST (NOTE 3)	2.5	G

RATINGS
AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	90	90	135	Vdc
GRID VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2:	---	90	90	135	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.17	WATTS
GRID #2 DISSIPATION	Pg2:	---	---	---	0.05	WATTS
GRID RESISTANCE	Rg(1):	---	---	---	2.0	MEG.
TRANSCONDUCTANCE	Sm:	---	---	900	---	μMHOS
PLATE CURRENT	Ib1:	---	---	1.6	---	mAdc
CATHODE CURRENT	Ik:	---	---	---	3.0	mAdc

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CHARACTERISTICS AND QUALITY CONTROL[1]

TEST	AQL %	MIL E-1 SYMBOL	MIN.	LAL	BOG.	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1		COMBINED AQL=1.0 % EXCLUDING MECH. AND INOPERATIVES							
GRID CURRENT (1): Eb=Ec2=135 Vdc; Ec1=-2.0 Vdc	0.65	Ic1:	0	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib1:	1.0	---	---	---	2.1	---	mAdc
SCREEN GRID CURRENT:	0.65	Ic2:	0.28	---	---	---	0.62	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	720	---	---	---	1080	---	μMHOS
NOISE AND MICROPHONICS: Ebb=Ecc2=90 Vdc: Ecal=10.0mVac;Rp= 1.0 MEG.; Rg2=4.7 MEG.; Cg2=0.1 μf	0.65	EB:	---	---	---	---	17	---	VU
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: (ENVELOPE OUTLINE 6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS- PART 2									
INSULATION OF ELECTRODES: g-all=-100 Vdc	4.0	Rg-all:	100	---	---	---	---	---	MEG.
p-all=-100Vdc		Rp-all:	100	---	---	---	---	---	MEG.
PLATE CURRENT(2): Ec1=-4.5 Vdc	6.5	Ib:	0	---	---	---	30	---	μAdc
TRANSCONDUCTANCE (2): Ef= 1.0 Vdc	6.5	Sm(2):	610	---	---	---	1080	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
CAPACITANCE: (SHIELD #316)	6.5	Cg1p:	---	---	---	---	0.02	---	μμf
CAPACITANCE (SHIELD #316)		Cin:	3.0	---	---	---	4.2	---	μμf
CAPACITANCE (SHIELD #316)		Cout:	5.6	---	---	---	7.6	---	μμf
VIBRATION (1): Rp=10,000 OHMS; 40 cps;15 g	6.5	Ep:	---	---	---	---	10	---	mVac
VIBRATION (2): f=50 cps-3500 cps; Rp=10,000 OHMS (NOTE 8)	6.5	Ep(2):	---	---	---	---	15	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SHOCK:: HAMMER ANGLE=30° (NOTE 2)	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5; F=25cps MIN; 60 cps MAX; FIXED FREQUENCY (NOTE 3)	6.5	---	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL[1]; cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG.	UAL	MAX.	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.)	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
POST SHOCK AND FATIGUE TEST END POINTS:									
TRANSCONDUCTANCE (1)	---	Sm:	540	---	---	---	---	---	μMHOS
VIBRATION	---	Ep:	---	---	---	---	15	---	mVac
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK):	2.5	---	---	---	---	---	---	---	---

ACCEPTANCE LIFE TESTS	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYM.	MIN.	MAX.	MIL-E-1 UNITS
INTERMITTENT LIFE TEST: Ef=1.25 Vdc; OR Vac WITH EQUIVALENT BIAS; GROUP A	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS:							
TRANSCONDUCTANCE (1)	---	---	---	Sm(1):	540	---	μMHOS
GRID CURRENT	---	---	---	Ic(1):	---	-1.0	μAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, AND MIL-STD-105A.

2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AND IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

7. PLATE AND SCREEN VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND Ep MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.

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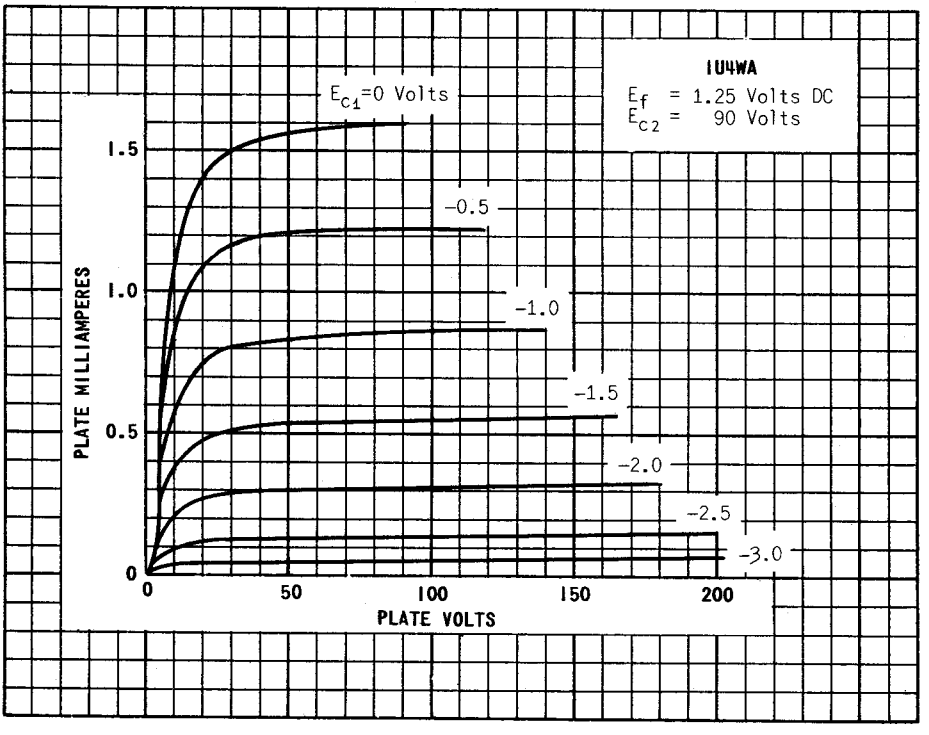
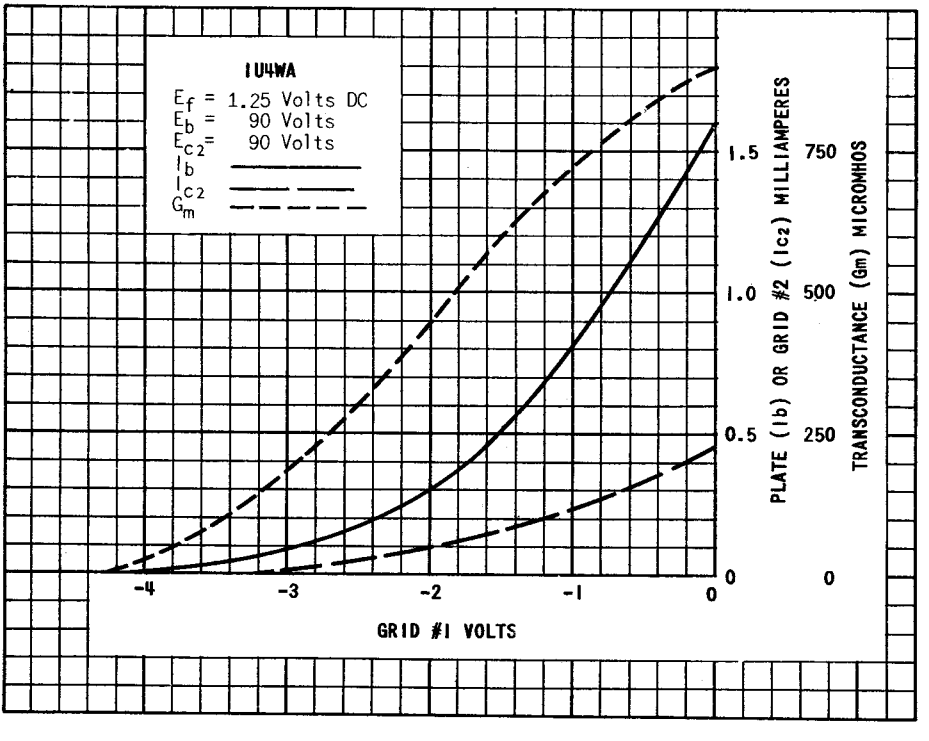
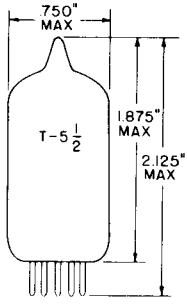

1U4WA
E_f = 1.25 Volts DC
E_{c2} = 90 Volts
E_{c1}=0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
1.5
1.0
0.5
0
0
50
100
150
200
PLATE VOLTS


1U4WA
E_f = 1.25 Volts DC
E_b = 90 Volts
E_{c2} = 90 Volts
I_b
I_{c2}
G_m
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
1.5
1.0
0.5
0
750
500
250
0
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

DIODE PENTODE

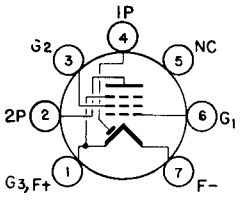


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FILAMENT
1.4 VOLTS 50 MA.
DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6BW

THE 1U5 IS A DIODE PENTODE AMPLIFIER ESPECIALLY DESIGNED FOR DETECTOR-AUDIO SERVICE IN COMPACT, LIGHT-WEIGHT, PORTABLE EQUIPMENT. THE HIGH OPERATING EFFICIENCY ALLOWS IT TO BE USED WITH EXTREMELY LOW PLATE-SUPPLY VOLTAGE.

DIRECT INTERELECTRODE CAPACITANCES ←

PENTODE GRID #1 TO DIODE PLATE (PG1 TO DP) MAX.	0.04	pf

FILAMENT CHARACTERISTICS AND RATINGS*

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.4 VOLTS	50	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION: 1.5 VOLT DRY CELL SUPPLY		1.1 TO 1.6	VOLTS
OTHER BATTERY SUPPLIES OR POWER LINE		1.1 TO 1.5	VOLTS

MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

		MA.
		MA.
PENTODE PLATE VOLTAGE	100	VOLTS
PENTODE GRID #2 VOLTAGE	100	VOLTS
CATHODE CURRENT	3.3	MA.
DIODE PLATE CURRENT	0.28	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE UNIT

PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
TRANSCONDUCTANCE	625	μMHOS
PLATE CURRENT	1.6	MA.
GRID #2 CURRENT	0.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA DC	-5	VOLTS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	1.5	MA.

CONTINUED ON FOLLOWING PAGE

*WITH SHIELD #316 CONNECTED TO PIN #1 OR WITHOUT EXTERNAL SHIELD.

← INDICATES A CHANGE. *INDICATES AN ADDITION.

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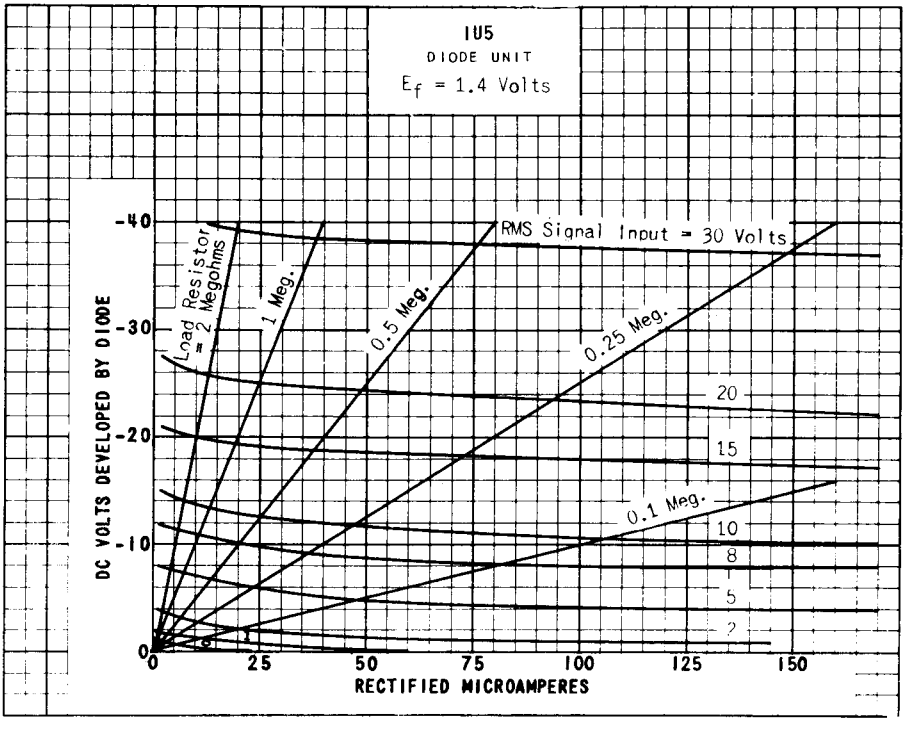
CONTINUED FROM PRECEDING PAGE

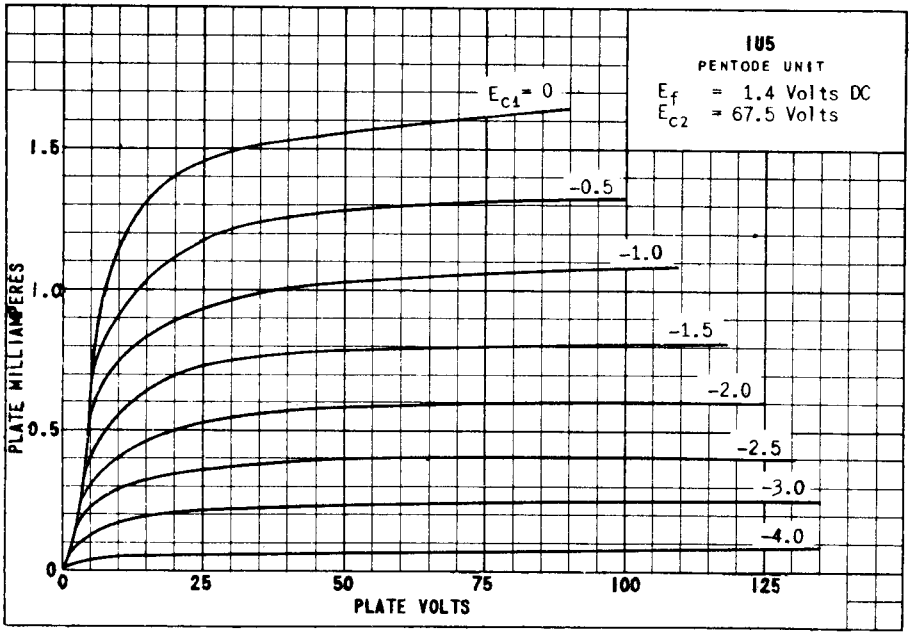
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

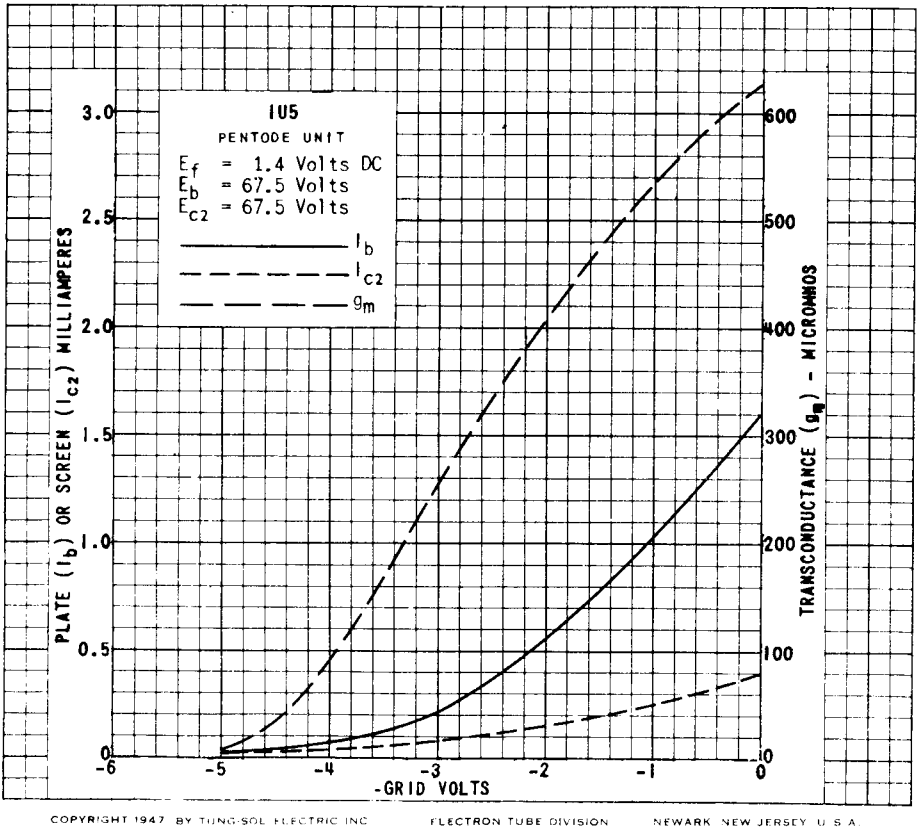
RESISTANCE COUPLED AMPLIFIER

PENTODE UNIT

PLATE SUPPLY VOLTAGE	45	90	VOLTS
SCREEN SUPPLY VOLTAGE	45	90	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	470 000	470 000	OHMS
CONTROL GRID RESISTOR	10	10	MEGOHMS
SERIES SCREEN RESISTOR	2.2	2.2	MEGOHMS
SCREEN BY-PASS CONDENSER	0.1	0.1	μf
INPUT CONDENSER	0.01	0.01	μf
OUTPUT CONDENSER	0.01	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	1.0	1.0	MEGOHM
SIGNAL SOURCE IMPEDANCE (MAX.)	1000	1000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	17.0	VOLTS
VOLTAGE GAIN AT 400 CPS	33	50	







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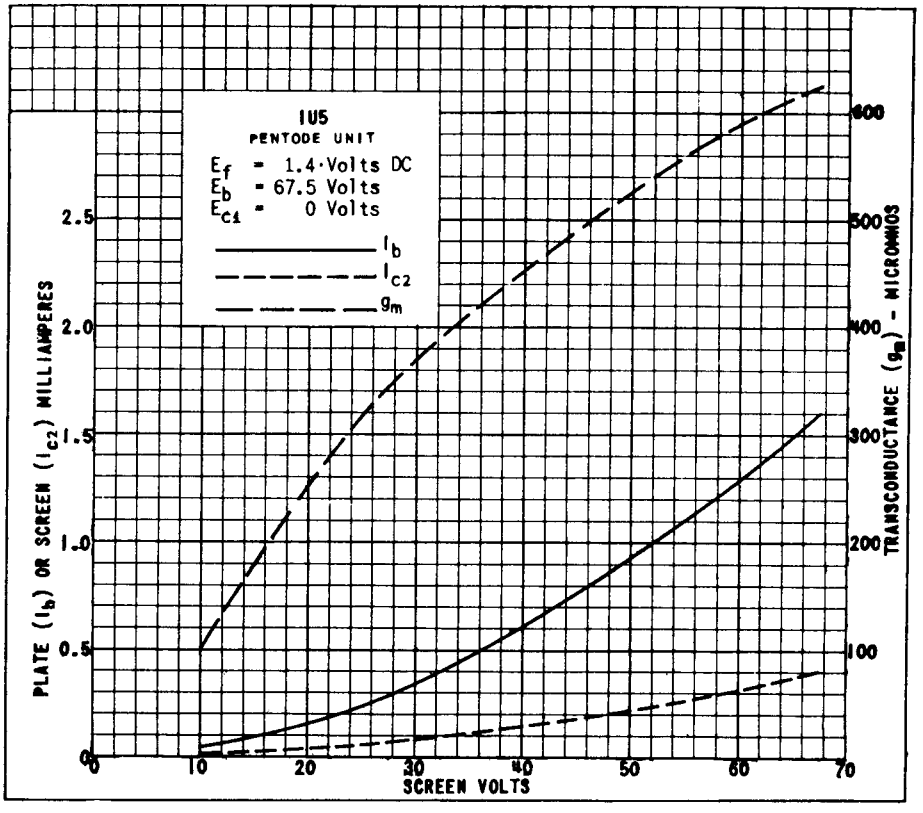
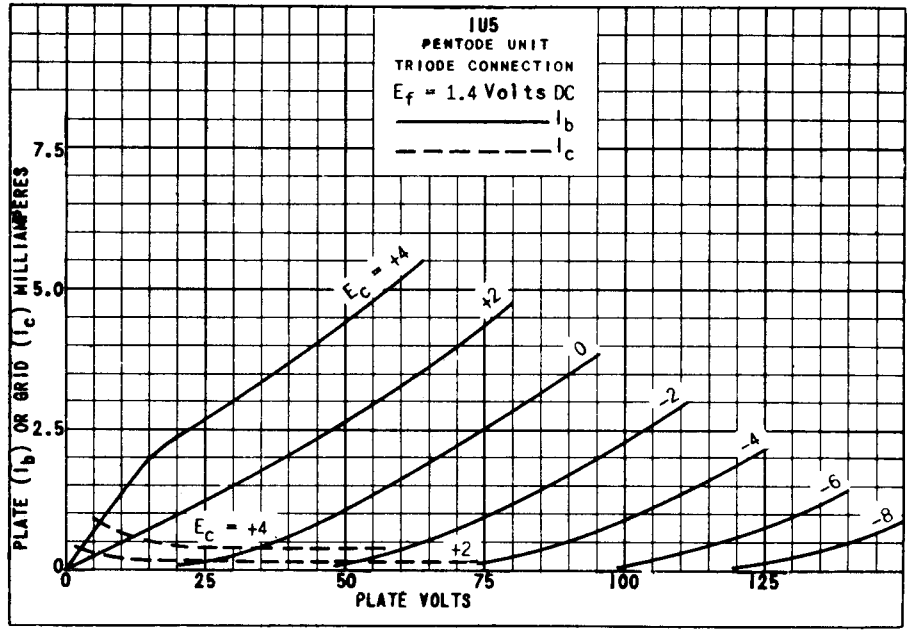
1U5





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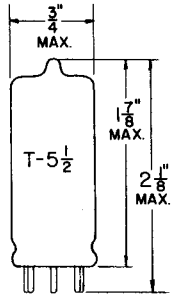
DIODE PENTODE

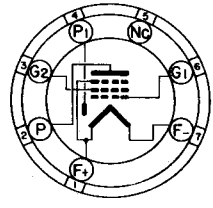
MINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BW

THE 1U5WA IS A FILAMENT TYPE, SHARP CUT-OFF, DIODE PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. ITS PRINCIPAL APPLICATION IS AS A DIODE DETECTOR, AVC RECTIFIER, AUDIO FREQUENCY AMPLIFIER IN PORTABLE RECEIVERS. THE 1U5WA IS PARTICULARLY USEFUL IN DETECTOR AMPLIFIER CIRCUITS WHERE ITS LOW MICROPHONIC NOISE AND VIBRATION OUTPUT ARE ESSENTIAL FOR SPECIALIZED MILITARY ELECTRONIC EQUIPMENT.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST – NOTE 2)	450	G
MAXIMUM VIBRATIONAL ACCELERATION(96 HR. FATIGUE TEST–NOTE 3)	2.5	G

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 5	NORM. OPERATION NOTE 4	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 6)	Ef:	1.00	1.25	1.25	1.50	Vdc
PLATE VOLTAGE (NOTE 7)	Eb:	---	67.5	67.5	100	Vdc
GRID VOLTAGE	Ec1:	---	0	0	0	Vdc
GRID VOLTAGE #2 (NOTE 7)	Ec2:	---	67.5	67.5	100	Vdc
PLATE DISSIPATION	Pp:	---	---	---	0.13	WATTS
GRID #2 DISSIPATION	Pg2:	---	---	---	0.035	WATTS
GRID RESISTANCE	Rg(1):	---	---	---	2.0	MEG.
TRANSCONDUCTANCE	Sm:	---	---	650	---	μMHOS
PLATE CURRENT	Ib1:	---	---	1.6	---	mAdc
CATHODE CURRENT	Ik:	---	---	---	5.0	mAdc
DIODE CURRENT	Iib:	---	---	---	250	μAdc

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CHARACTERISTICS AND QUALITY CONTROL[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1			COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES.						
GRID CURRENT (1): Eb=Ec2=90Vdc; Ec1=-2.5 Vdc	0.65	Ic1:	0	---	---	---	-0.5	---	μAdc
PLATE CURRENT (1):	0.65	Ib1:	1.05	---	---	---	2.15	---	mAdc
SCREEN GRID CURRENT:	0.65	Ic(2):	0.24	---	---	---	0.56	---	mAdc
TRANSCONDUCTANCE (1): Ef=1.0 Vdc	0.65	Sm(1):	380	---	---	---	775	---	μMHOS
AC AMPLIFICATION: Ebb=Ecc2=45 Vdc; Rg2=2.0 MEG; Rg1= 10 MEG.; Rp=0.5MEG.; Esig=0.2 Vac;0.1μf BETWEEN G2 &-F	0.65	Ep:	6.5	---	---	---	---	---	Vac
EMISSION (DIODE) Eib=10 Vdc	0.65	Lis:	0.5	---	---	---	---	---	mAdc
NOISE AND MICROPHONICS: Ebb=Ecc2=135 Vdc; Ecal=10.0 mVac; Rp= 1.0 MEG.; Cg2=0.1 μf; Ec1=0; Rp OF DIODE = 2 MEG. TO GROUND. COUPLE PLATE OF DIODE TO G1 THROUGH A 0.1μf CAPACITOR; Rg1=1.5 MEG.; R_{g2}=0.1μf (NOTE 9, 10)	0.65	---	---	---	---	---	---	---	---
CONTINUITY AND SHORTS: (INOPERATIVES)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE OUTLINE (6-2)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: g1-all=-100 Vdc	4.0	Rg-all:	100	---	---	---	---	---	MEG.
p-all=-100 Vdc		Rp-all:	100	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2):	6.5	Sm:	525	---	---	---	775	---	μMHOS
FILAMENT CURRENT:	6.5	If:	44	---	---	---	56	---	mA
VIBRATION (1): Rp=10,000 OHMS; F= 40 cps; G=15	6.5	Ep(1):	---	---	---	---	10	---	mVac
VIBRATION (2): F=50 cps-3500 cps; Rp=10,000 OHMS (NOTE 8)	6.5	Ep(2):	---	---	---	---	25	---	mVac

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS	COMBINED AQL =1.0% EXCLUDING MECH. AND INOPERATIVES								
SHOCK: HAMMER ANGLE=30° (NOTE 2)	---	---	---	---	---	---	---	---	---
FATIGUE: G=2.5; F=25cps MIN., 60 cps MAX., FIXED FREQUENCY (NOTE 3)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS:									
TRANSCONDUCTANCE (2):	---	Sm:	450	---	---	---	---	---	μMHOS
VIBRATION (1):	---	Ep:	---	---	---	---	15	---	mVac
DIODE EMISSION	---	Iis:	0.2	---	---	---	---	---	mAdc
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK):	2.5	---	---	---	---	---	---	---	---

TEST	ALLOW. DEF. PER CHARAC. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
INTERMITTENT LIFE TEST: Ef=1.25 Vdc OR Vac WITH EQUIVALENT BIAS, GROUP A	---	---	---	t:	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS:							
TRANSCONDUCTANCE (2)	---	---	---	Sm(2):	450	---	μMHOS
OR AC AMPLIFICATION	---	---	---	Ep:	5.0	---	Vac
EMISSION (DIODE)	---	---	---	Iis:	0.2	---	mAdc

NOTES

1. CHARACTERISTICS, QUALITY CONTROL PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1, AND MIL-STD-105A.
2. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
4. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

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NOTES

CONT'D.

5. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

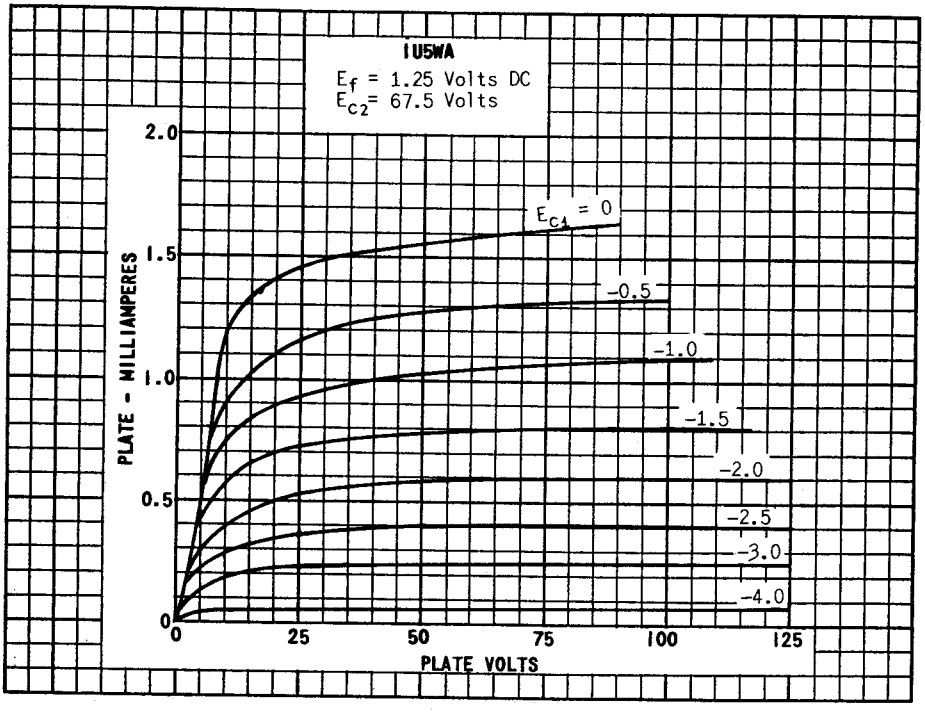
6. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

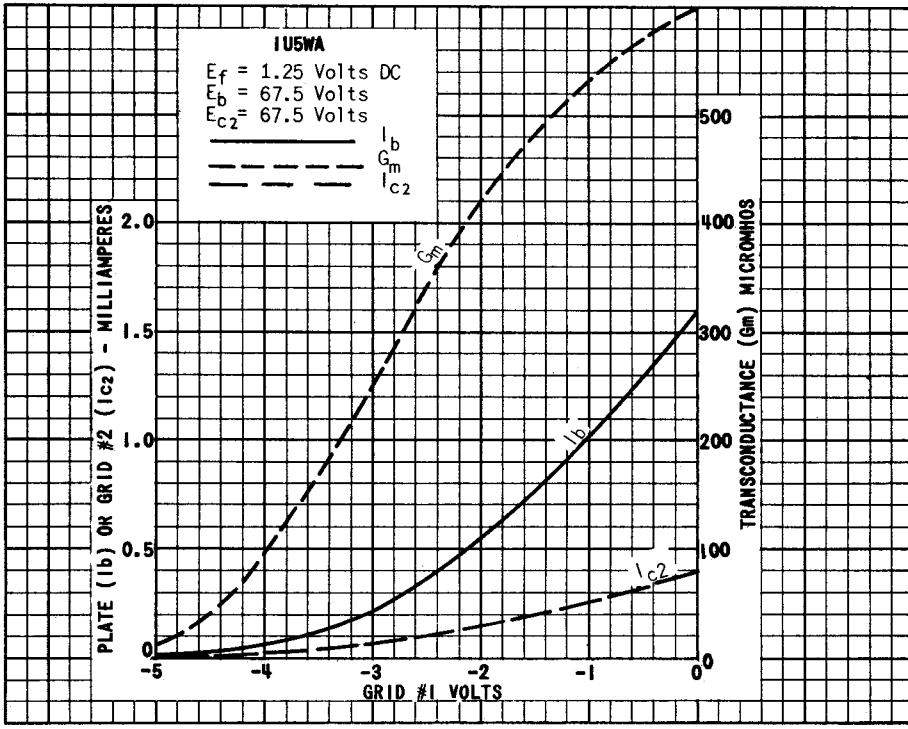
7. PLATE AND SCREEN VOLTAGES SHOULD NOT EXCEED THESE VALUES UNDER ANY CIRCUMSTANCES.

8. THE TUBE UNDER TEST SHALL BE RIGIDLY MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND E_P MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50-3500 CPS AND THE PEAK ACCELERATION CONTROLLED CONSTANT AT 2G. A LOW PASS FILTER WHICH FOLLOWS THE LOAD RESISTOR OF THE TUBE UNDER TEST SHALL HAVE A CUT-OFF FREQUENCY OF 3500 CPS. THE TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE.

9. TUBES SHALL BE SO SHIELDED THAT OPERATOR PROXIMITY OR MOVEMENT WILL NOT AFFECT OUTPUT READINGS.

10. THE REJECTION LEVEL SHALL BE SET AT THE VU METER READING OBTAINED DURING CALIBRATION.

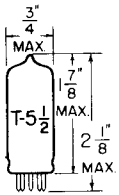



1U5WA
E_f = 1.25 Volts DC
E_b = 67.5 Volts
E_{c2} = 67.5 Volts
I_b
G_m
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
GRID #1 VOLTS
0
0.5
1.0
1.5
2.0
100
200
300
400
500
-5
-4
-3
-2
-1
0
Gm
Ib
Ic2

TUNG-SOL

HEPTODE

MINIATURE TYPE



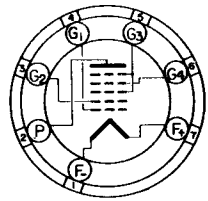
GLASS BULB

COATED FILAMENT

1.4 VOLTS 25 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CD

THE 1U6 IS A FILAMENTARY TYPE PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE IN PORTABLE RECEIVERS. THE FILAMENT POWER CONSUMPTION HAS BEEN CUT IN HALF WITH RESPECT TO TUBES PREVIOUSLY USED IN THIS SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID #4 TO PLATE: (G_4 TO P)	0.4	0.4	μμf
GRID #4 TO GRID #2: (G_4 TO G_2)	0.2	0.2	μμf
GRID #4 TO GRID #1: (G_4 TO G_1)	0.2	0.2	μμf
GRID #1 TO GRID #2: (G_1 TO G_2)	0.8	0.8	μμf
GRID #4 TO ALL: G_4 TO ($F+G_1+G_2+G_3\&G_5+P$)	8	8	μμf
GRID #2 TO ALL EXCEPT GRID #1: G_2 TO ($F+G_3\&G_5+G_4+P$)	2.2	2.4	μμf
GRID #1 TO ALL EXCEPT GRID #2: G_1 TO ($F+G_3\&G_5+G_4+P$)	2	2.2	μμf
PLATE TO ALL: P TO ($F+G_1+G_2+G_3\&G_5+G_4$)	7	12	μμf

[A] SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRIDS #3 & #5 VOLTAGE[B]	65	VOLTS
MAXIMUM GRIDS #3 & #5 SUPPLY VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	4	MA.
MINIMUM GRID #4 CIRCUIT RESISTANCE	1	MEGOHM

[B] OBTAINED BY USING A BY-PASSED VOLTAGE DROPPING RESISTOR IN SERIES WITH THE PLATE SUPPLY VOLTAGE, OR BY EQUIVALENT MEANS.

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PLATE 2431

JULY 1 1950

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	25	25	MA.
PLATE VOLTAGE	67.5	90	VOLTS
GRIDS #3 & #5 VOLTAGE	45	45	VOLTS
GRID #2 VOLTAGE	67.5	90	VOLTS
GRID #4 VOLTAGE	0	0	VOLTS
GRID #1 RESISTOR	0.2	0.2	MEGOHM
PLATE RESISTANCE	0.55	0.60	MEGOHM
PLATE CURRENT	0.5	0.55	MA.
GRIDS #3 & #5 CURRENT	0.6	0.55	MA.
GRID #2 CURRENT	0.95	1.1	MA.
GRID #1 CURRENT	0.028	0.035	MA.
TOTAL CATHODE CURRENT	2.1	2.2	MA.
CONVERSION TRANSCONDUCTANCE	260	275	μMHOS
GRID #4 VOLTAGE FOR G_c = 10 μMHOS APPROX.	-3	-3	VOLTS
OSCILLATOR TRANSCONDUCTANCE WITH 0 VOLTS ON GRIDS #1 & #4		475	μMHOS

PLATE 2432

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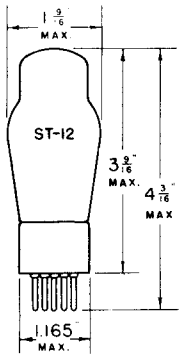


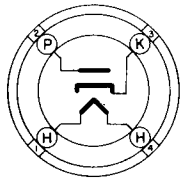
HALF WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



4G

BOTTOM VIEW

SMALL 4 PIN BASE

THE TUNG-SOL 1V IS DESIGNED FOR SERVICE IN EITHER STORAGE BATTERY, AC OR AC – DC OPERATED RECEIVERS.

RATINGS

MAXIMUM DC HEATER TO CATHODE POTENTIAL	500	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1000	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	270	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

HALF WAVE RECTIFIER

CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE (RMS)	117	150	325 MAX.	VOLTS
DC OUTPUT CURRENT MAX.	45	45	45	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE MIN. A	0	30	75	OHMS
TUBE VOLTAGE DROP AT 90 MA. PLATE CURRENT	20			VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

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PLATE 685-2

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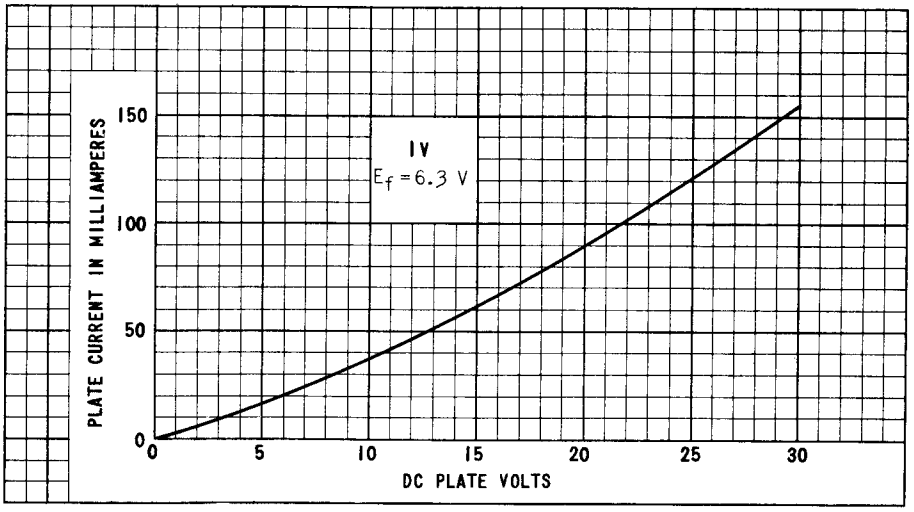

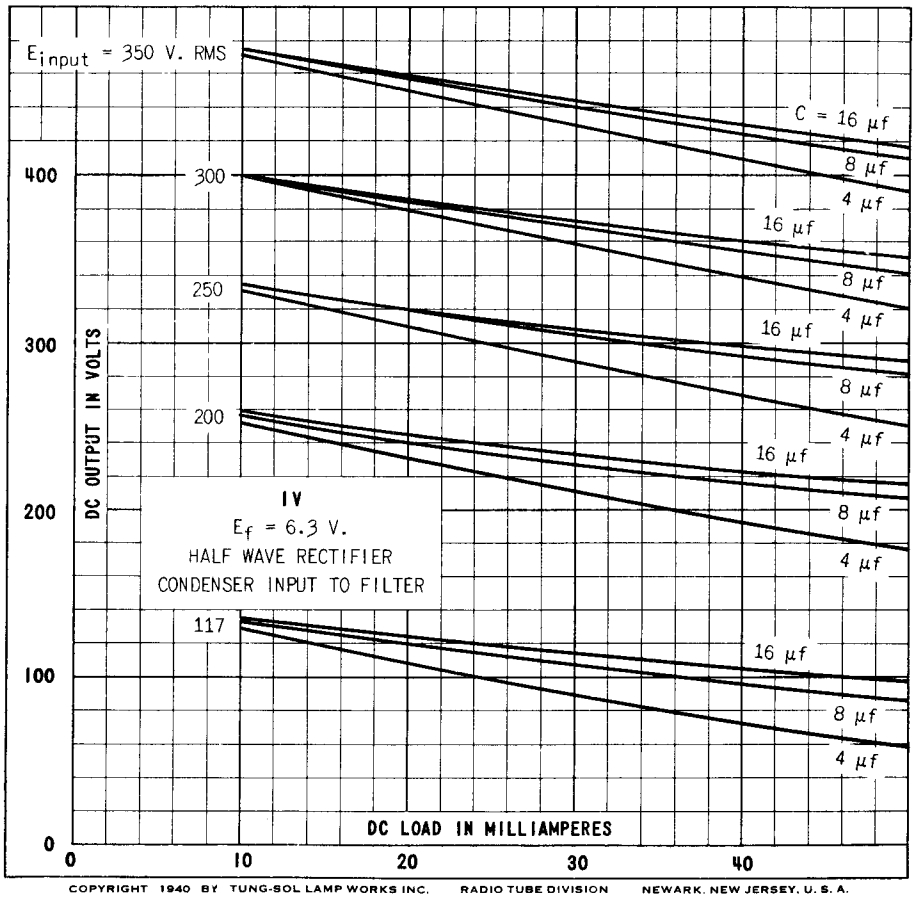

PLATE
686-1

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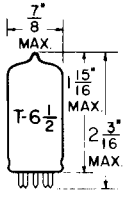
TUNG-SOL

DIODE

MINIATURE TYPE

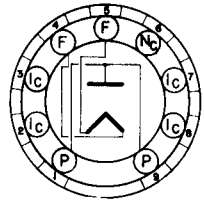


GLASS BULB

COATED FILAMENT
0.625 VOLTS 300 MA.
AC

ANY MOUNTING POSITION

SOCKET TERMINALS 2,3,7 AND 8 SHALL NOT BE USED. TERMINAL 6 MAY BE USED AS A TIE POINT FOR COMPONENTS AT NEAR FILAMENT POTENTIAL.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9U

THE 1V2 IS A FILAMENTARY DIODE USING THE SMALL BUTTON 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN HIGH-VOLTAGE, PULSE-OPERATED RECTIFYING SYSTEMS. IN VIEW OF ITS SINGLE-ENDED CONSTRUCTION AND RESULTANT LOWER VOLTAGE RATINGS, THIS TUBE IS INTENDED FOR USE IN VOLTAGE DOUBLER CIRCUITS TO PROVIDE ADEQUATE HIGH VOLTAGE IN TELEVISION RECEIVING SYSTEMS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

PLATE TO FILAMENT: (P TO F)	0.8	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLYBACK VOLTAGE RECTIFIER[B]

FILAMENT VOLTAGE[C]	0.625	VOLTS
FILAMENT CURRENT	300	MA.
MAXIMUM INVERSE PLATE VOLTAGE		
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	8250 ←	VOLTS
DC	7000 ←	VOLTS
MAXIMUM PEAK PLATE CURRENT	11 ←	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.6 ←	MA.
TUBE DROP (APPROX.) WITH 7 MA. PLATE CURRENT)	135	VOLTS

[A] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[C] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 0.525 VOLTS OR MORE THAN 0.725 VOLTS.

→ INDICATES A CHANGE

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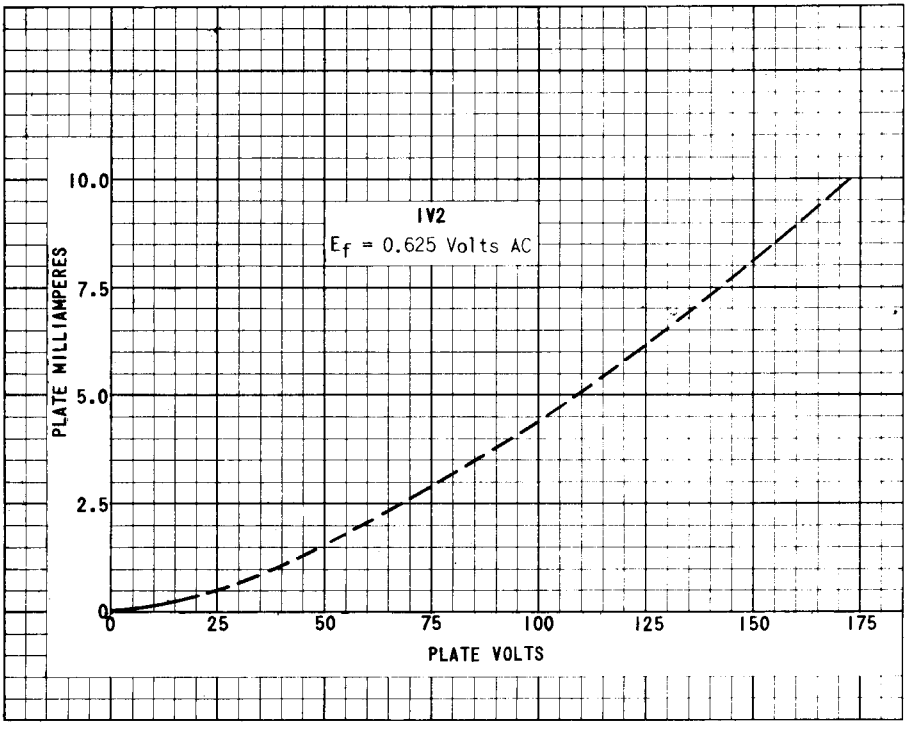
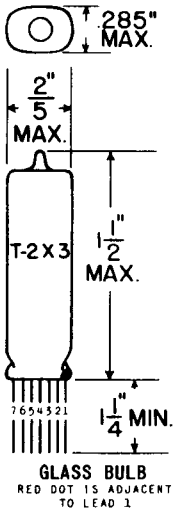

1V2
E_f = 0.625 Volts AC
PLATE MILLIAMPERES
10.0
7.5
5.0
2.5
0
0
25
50
75
100
125
150
175
PLATE VOLTS

TUNG-SOL

TRIODE PENTODE

SUBMINIATURE TYPE

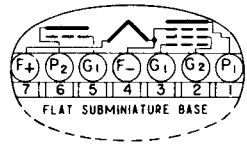


GLASS BULB
RED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED FLEXIBLE LEADS
0.05" SPACING CENTER-TO-CENTER

THE 1V6 IS A FILAMENT TYPE COMBINED TRIODE-PENTODE DESIGNED FOR SERVICE AS A CONVERTER IN RADIO RECEIVERS AND OTHER PORTABLE EQUIPMENT WHERE SMALL SIZE, LIGHT WEIGHT, AND LOW BATTERY DRAIN ARE IMPORTANT. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITH CLOSE FITTING SHIELD CONNECTED TO FILAMENT, NEGATIVE

TRIODE GRID #1 TO PENTODE GRID #1	0.75	μμf
PENTODE GRID #1 PENTODE PLATE	0.05	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.12	μμf
TRIODE GRID #1 TO TRIODE PLATE	1.2	μμf
PENTODE GRID #1 TO ALL	3.2	μμf
TRIODE GRID #1 TO ALL	4.0	μμf
TRIODE PLATE TO ALL	1.9	μμf
PENTODE PLATE TO ALL	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

FILAMENT VOLTAGE	1.25	VOLTS
PLATE VOLTAGE (PENTODE)	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
PLATE VOLTAGE (TRIODE)	90	VOLTS
GRID #1 VOLTAGE (PENTODE)	NEVER POSITIVE	
TOTAL CATHODE CURRENT	1.5	MA.

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FREQUENCY CONVERTER

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.04	AMP.
PLATE VOLTAGE (PENTODE)	45	VOLTS
GRID #2 VOLTAGE	45	VOLTS
PLATE VOLTAGE (TRIODE)	45	VOLTS
GRID #1 VOLTAGE (PENTODE)[B]	0	VOLTS
GRID #1 RESISTOR (OSCILLATOR)[C]	1	MEGOHM
PLATE CURRENT (PENTODE)	400	μAMP.
GRID #2 CURRENT (PENTODE)	150	μAMP.
CONVERSION PLATE RESISTANCE (APPROX.)	1.0	MEGOHM
PLATE CURRENT (TRIODE) APPROX.	400	μAMP.
GRID #1 CURRENT (OSCILLATOR)	12	μAMP.
CONVERSION TRANSCONDUCTANCE	200	μMHOS
GRID #1 VOLTAGE (PENTODE) (APPROX.) FOR CONVERSION TRANSCONDUCTANCE = 5 μMHOS.	3.5	VOLTS

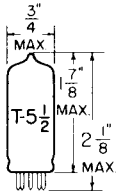
[B] GRID #1 RESISTOR = 5 MEGOHMS.

[C] GRID COUPLING CONDENSER = 10 μμFD.

TUNG-SOL

PENTODE

MINIATURE TYPE



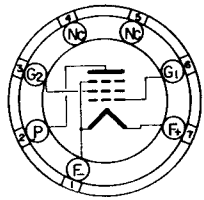
GLASS BULB

COATED FILAMENT

1.4 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

5BZ

THE 1W4 IS A POWER AMPLIFIER PENTODE USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN LOW DRAIN BATTERY OPERATED RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE: (G_1 TO P)	0.12	0.1	μμf
INPUT: G_1 TO (F&G_3+G_2)	3.4	3.6	μμf
OUTPUT: P TO (F&G_3+G_2)	3.6	7	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 1.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	VOLTS
MAXIMUM CATHODE CURRENT	6	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	1.4	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	50	50	MA.
PLATE VOLTAGE	45	62.5	67.5	90	VOLTS
GRID #2 VOLTAGE	45	62.5	67.5	90	VOLTS
GRID #1 VOLTAGE	-4.5	-5	-6	-9	VOLTS
PEAK AF GRID #1 SIGNAL VOLTAGE	4.5	5	6	9	VOLTS
PLATE RESISTANCE	0.4	0.3	0.3	0.25	MEGOHM
TRANSCONDUCTANCE	650	875	875	925	μMHOS
ZERO SIGNAL PLATE CURRENT	1.6	3.8	3.8	5	MA.
ZERO SIGNAL GRID #2 CURRENT	0.2	0.8	0.8	1	MA.
LOAD RESISTANCE	20 000	16 000	16 000	12 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	10	10	PERCENT
POWER OUTPUT	35	90	100	200	MW.

SIMILAR TYPE REFERENCE: Ratings and characteristics identical to type 1LB4 and to pentode section of 1D8GT.

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PLATE 2413

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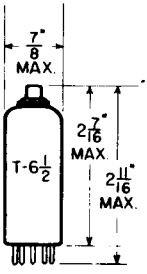


GLASS BULB

DIODE

MINIATURE TYPE

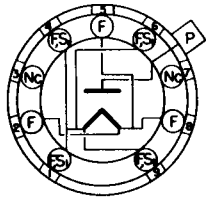
COATED FILAMENT

1.25 VOLTS 200 MA.

AC

ANY MOUNTING POSITION

PINS 3 AND 7 MAY BE USED AS TIE POINTS FOR FILAMENT DROPPING RESISTOR AND HIGH VOLTAGE FILTER RESISTOR OR CONNECTED TO FILAMENT. DO NOT CONNECT TO LOW POTENTIAL CIRCUITS.



BOTTOM VIEW

MINIATURE BUTTON 9 PIN BASE

THE 1X2 IS A FILAMENTARY DIODE USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN TELEVISION SET AS A HIGH VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE PICTURE TUBE. IT CAN BE USED IN BOTH RF AND FLYBACK TYPES OF POWER SUPPLIES AS WELL AS FOR USE AT POWER LINE FREQUENCY.

DIRECT INTERELECTRODE CAPACITANCES

PLATE TO FILAMENT: (P TO F)	1	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	200	MA.
MAXIMUM PEAK INVERSE PLATE POTENTIAL	15 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	10	MA.
MAXIMUM DC LOAD CURRENT	1	MA.
MAXIMUM FREQUENCY OF SUPPLY VOLTAGE	300	KC
TUBE VOLTAGE DROP WITH TUBE CONDUCTING 7 MA.	100	VOLTS

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SEPT. 1 1949

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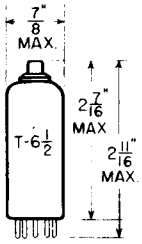
DIODE

MINIATURE TYPE



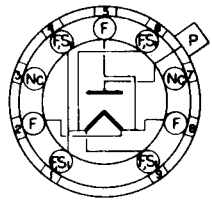
GLASS BULB

COATED FILAMENT

1.25 VOLTS 200 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9Y

THE 1X2A IS A FILAMENTARY DIODE USING THE MINIATURE CONSTRUCTION. IT IS ELECTRICALLY EQUIVALENT TO THE 1X2 BUT IT HAS HIGHER RATINGS THAN THE 1X2. IT IS DESIGNED FOR USE IN TELEVISION SETS AS A HIGH VOLTAGE RECTIFIER TO SUPPLY POWER TO THE ANODE OF THE PICTURE TUBE. IT CAN BE USED IN BOTH RF AND FLY-BACK TYPES OF POWER SUPPLIES AND AT POWER LINE FREQUENCY. IN NEW EQUIPMENT APPLICATIONS THE 1X2A, WHEN USED WITHIN ITS MAXIMUM RATINGS, IS A REPLACEMENT FOR TYPE 1B3GT AT DC OUTPUT POTENTIALS AS HIGH AS 14 TO 15 KILOVOLTS.

RATINGS

ABSOLUTE MAXIMUM VALUES[A]

FILAMENT VOLTAGE	1.25	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	20 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	11	MA.
MAXIMUM DC LOAD CURRENT	1.1	MA.

[A] ABSOLUTE MAXIMUM RATINGS ARE THE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED FROM THE VIEWPOINT OF LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS, THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED UNDER ANY USUAL CONDITION OF LINE VOLTAGE, VARIATION MANUFACTURING VARIATIONS (INCLUDING COMPONENTS) IN THE EQUIPMENT ITSELF, OR ADJUSTMENTS OF CONTROLS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FLY-BACK PULSE RECTIFIER[B]

FILAMENT VOLTAGE[C]	1.25	VOLTS
FILAMENT CURRENT	200	MA.
POSITIVE PULSE PLATE VOLTAGE	14	KV.
NEGATIVE PULSE PLATE VOLTAGE	3.5	KV.
PEAK INVERSE PLATE VOLTAGE	17.5	KV.
DC OUTPUT VOLTAGE (APPROX.)	14	KV.
DC OUTPUT CURRENT	175	μA.

[B] SEE FOLLOWING PAGE FOR TYPICAL CIRCUIT.

[C] AT 117 VOLT LINE AND NORMAL PICTURE-VIEWING CONDITIONS. IN LABORATORY SET-UP, THE VALUE MAY BE CHECKED USING THERMAL MILLIAM METER WITH THE CIRCUIT SO ADJUSTED TO GIVE THE SAME CURRENT AS WITH 1.25 VOLTS AC OR DC ON THE FILAMENT OF THE TUBE. SUITABLE ACCOUNT SHOULD BE TAKEN OF INTERNAL RESISTANCE OF THE THERMAL METER.

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JAN. 1 1951

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TYPICAL FLY-BACK POWER SUPPLY

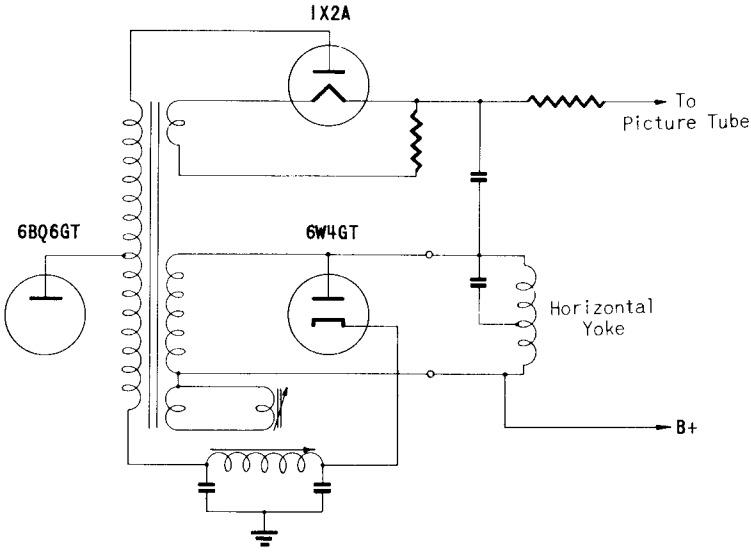

PLATE
2549
JAN. 1
1951

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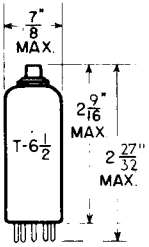
DIODE

MINIATURE TYPE



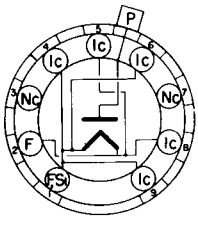
GLASS BULB
SKIRTED
MINIATURE CAP

COATED FILAMENT

1.25 VOLTS[A] 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION

THIS TUBE MAY PRODUCE SOFT X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS ADEQUATELY SHIELDED.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9Y

PINS #3&7 MAY BE CONNECTED TO FILAMENT; OTHERWISE DO NOT USE

THE 1X2B IS A MINIATURE FILAMENTARY TYPE DIODE PARTICULARLY SUITED FOR USE IN FLYBACK VOLTAGE TYPE POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

PLATE TO FILAMENT: P TO (F+IS)	1.0	μμf

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLY-BACK VOLTAGE RECTIFIER[C]

FILAMENT VOLTAGE[A]	1.25	VOLTS
FILAMENT CURRENT	0.2	AMP.
MAXIMUM INVERSE PLATE VOLTAGE:		
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	22 ←	KV.
DC	18 ←	KV.
MAXIMUM PEAK PLATE CURRENT	45 ←	MA.
MAXIMUM AVERAGE PLATE CURRENT	0.5 ←	MA.
TUBE VOLTAGE DROP (APPROX.) WITH 7 MA. PLATE CURRENT	100	VOLTS

[A] UNDER NO CIRCUMSTANCES SHOULD THE FILAMENT VOLTAGE BE LESS THAN 1.05 VOLTS OR MORE THAN 1.45 VOLTS.

[B] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE OF TELEVISION BROADCASTING STATIONS"; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

→ INDICATES A CHANGE.

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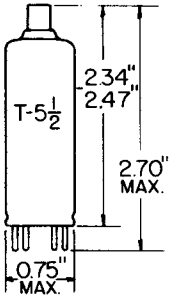
DIODE

MINIATURE TYPE



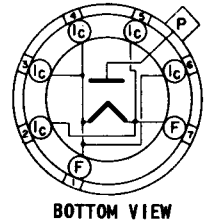
GLASS BULB

FILAMENT

1.25±5% VOLTS 0.265 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 1Z2 IS A HIGH VOLTAGE LOW CURRENT VACUUM RECTIFIER TUBE IN A MINIATURE BULB. THIS TUBE FEATURES A LOW DRAIN, THORIATED TUNGSTEN FILAMENT WHICH WILL WORK SATISFACTORILY IN FLYBACK AND RF POWER SUPPLY CIRCUITS AS WELL AS WITH CONVENTIONAL TRANSFORMER OR DRY BATTERY FILAMENT SUPPLY. FULL ANODE VOLTAGE MAY BE APPLIED TO A COLD TUBE SIMULTANEOUSLY WITH THE APPLICATION OF FILAMENT VOLTAGE. BECAUSE OF THE SMALL SPACE AND WEIGHT OF THE 1Z2, THIS TUBE IS EXPECIALLY ADAPTABLE TO COMPACT AND PORTABLE EQUIPMENT.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE PLATE VOLTAGE	15 000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	8.5	MA.
MAXIMUM DC OUTPUT CURRENT	1.5	MA.
MAXIMUM SUPPLY VOLTAGE FREQUENCY	200	KCYCLES
MAXIMUM ALTITUDE FOR FULL RATINGS	10 000	FEET
MINIMUM SUPPLY SOURCE IMPEDANCE (AT EPX =15 KV)	300 000	OHMS

ELECTRICAL DATA

FILAMENT VOLTAGE	1.25±5%	VOLTS
FILAMENT CURRENT	0.265	AMP.
TUBE VOLTAGE DROP AT 1.5 MA. (APPROX.)	18	VOLTS
TUBE VOLTAGE DROP AT 8.5 MA. (APPROX.)	125	VOLTS
MINIMUM FILAMENT HEATING TIME	0	SECONDS

CONTINUED ON FOLLOWING PAGE

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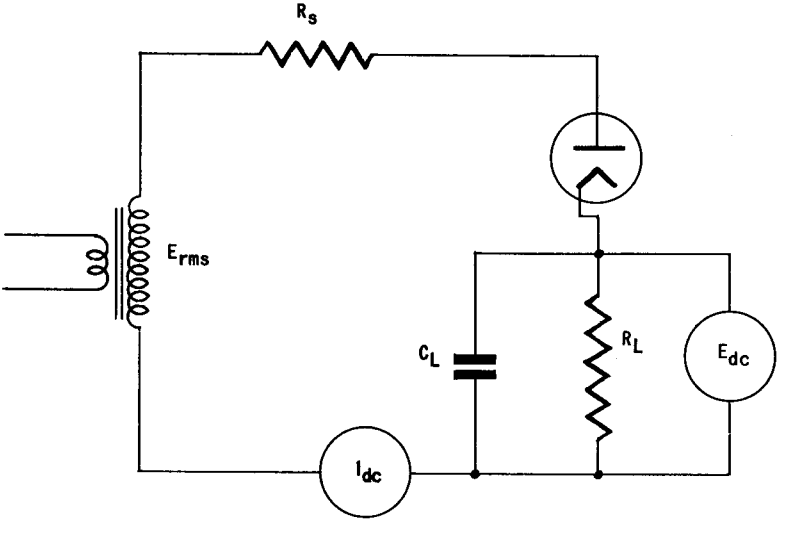
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

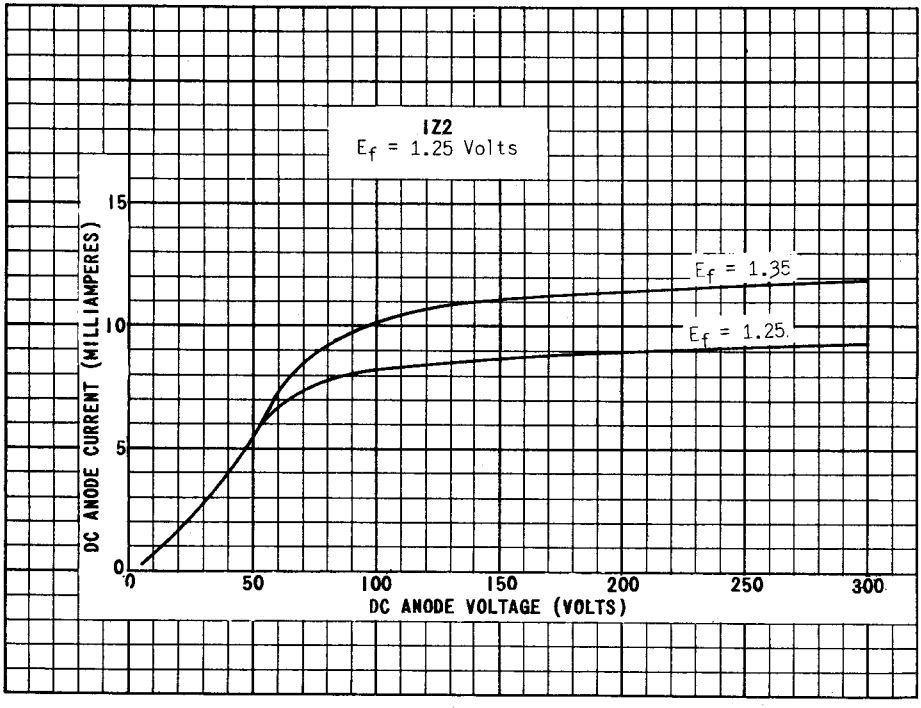
MECHANICAL DATA

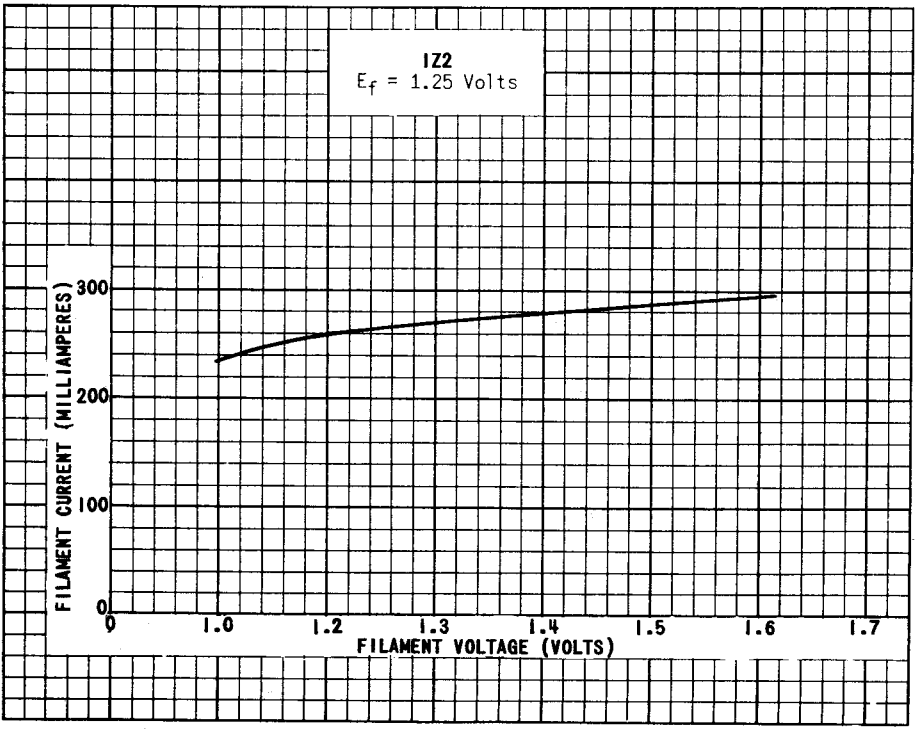
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2.70	INCHES
SEATED LENGTH	2.34 TO 2.47	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
CAP	SKIRTED MINIATURE	
BASE	MINIATURE BUTTON 7 PIN	
MAXIMUM WEIGHT (NET)	0.5	OUNCES

TYPICAL CIRCUIT VALUES



E_{rms}	R_s	R_L	C_L	E_{dc}	I_{dc}
KILOVOLTS	MEGOHMS	MEGOHMS	mfd	KILOVOLTS	MILLIAMPS
5.3	0.44	278.	.012	4.15	1.5
5.3	0.3	43.	.024	6.8	0.155





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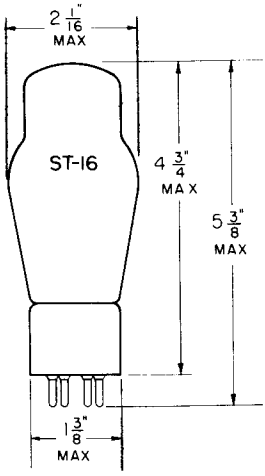


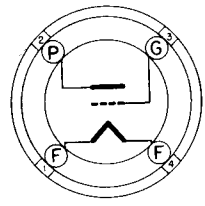
TRIODE POWER AMPLIFIER

COATED FILAMENT
2.5 VOLTS 2.5 AMPERE
AC OR DC

GLASS BULB

MOUNTING POSITION

THIS TUBE SHOULD BE MOUNTED VERTICALLY. HOWEVER HORIZONTAL OPERATION IS PERMISSIBLE IF PINS 1 AND 4 ARE IN A HORIZONTAL PLANE.



BOTTOM VIEW

MEDIUM
4-PIN BASE

THE 2A3 IS A FILAMENT TYPE TRIODE POWER AMPLIFIER. IT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AUDIO AMPLIFIERS WHERE HIGH OUTPUT AND LOW HARMONIC DISTORTION IS DESIRED.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	15	WATTS

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

GRID TO PLATE	16.5	μμf
INPUT	7.5	μμf
OUTPUT	5.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

SINGLE TUBE

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE, (MEASURED FROM MID-POINT OF AC OPERATED FILAMENT)	-45	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE		
FIXED BIAS	0.05	MEGOHM
SELF BIAS	0.5	MEGOHM
PLATE CURRENT	60	MA.
PLATE RESISTANCE	800	OHMS
TRANSCONDUCTANCE	5 250	μMHOS
AMPLIFICATION FACTOR	4.2	
LOAD RESISTANCE	2 500	OHMS
POWER OUTPUT	3.5	WATTS
SECOND HARMONIC DISTORTION	5.0	PER CENT

CONTINUED ON NEXT PAGE

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CONTINUED FROM PRECEDING PAGE

CLASS AB_1 AMPLIFIER — PUSH-PULL

VALUES ARE FOR TWO TUBES

	FIXED BIAS	SELF BIAS	
PLATE VOLTAGE	300	300	VOLTS
GRID VOLTAGE [A]	-62	-	VOLTS
CATHODE BIAS RESISTOR	-	780	OHMS
ZERO-SIGNAL PLATE CURRENT	80	80	MA.
LOAD RESISTANCE (PER TUBE)	750	1 250	OHMS
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	3 000	5 000	OHMS
TOTAL HARMONIC DISTORTION	2.5	5.0	PER CENT
POWER OUTPUT	15	10	WATTS

[A] GRID VOLTAGE MEASURED FROM MID-POINT OF AC OPERATED FILAMENT. THE TOTAL EFFECTIVE GRID CIRCUIT RESISTANCE SHOULD BE KEPT AT A MINIMUM. UNDER FIXED BIAS CONDITIONS IT SHOULD NEVER EXCEED 50,000 OHMS WHILE WITH SELF BIAS IT SHOULD NEVER EXCEED 0.5 MEGOHM.

PLATE 1540
JAN. 15 1945

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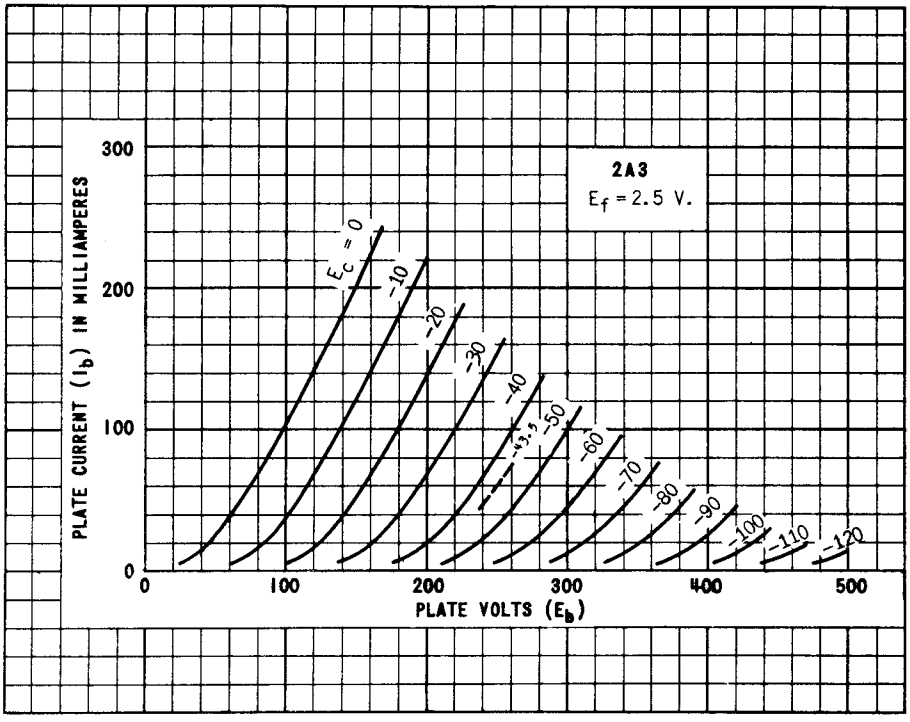

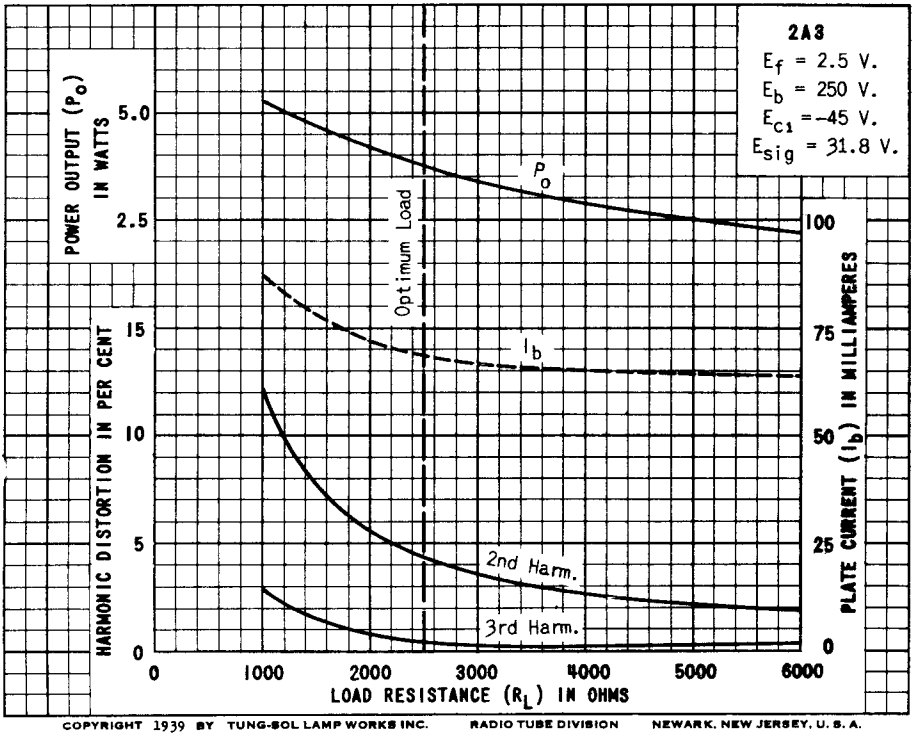

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PLATE
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2A3

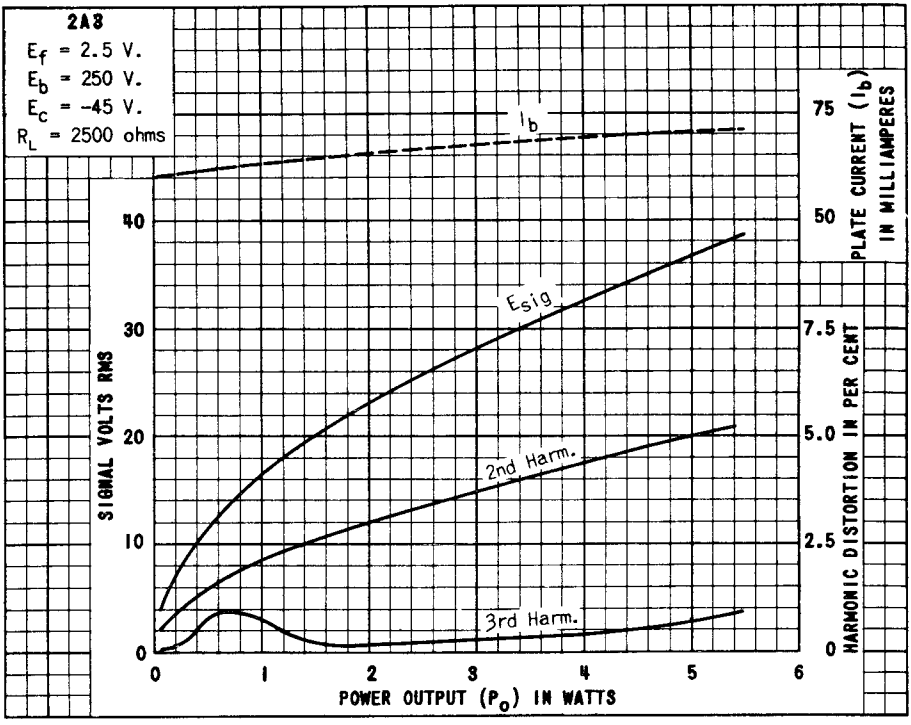

PLATE
296-1

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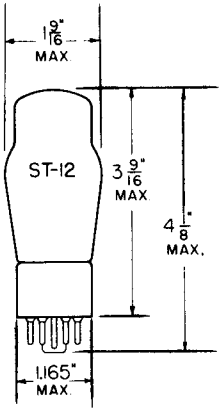


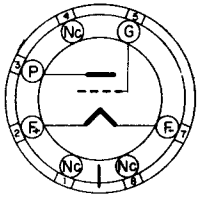
ARGON FILLED THYRATRON

COATED FILAMENT

2.5 VOLTS 2.5 AMPERE

DC

GLASS BULB



SMALL
7-PIN OCTAL BASE

THE 2A4G IS A HOT CATHODE, ARGON FILLED, SINGLE GRID, THYRATRON TUBE PARTICULARLY USEFUL IN APPLICATIONS WHERE CONSTANCY OF CHARACTERISTICS IS NECESSARY EVEN WITH LARGE VARIATIONS IN AMBIENT TEMPERATURE.

RATINGS

MAXIMUM ANODE VOLTAGE: (INSTANTANEOUS)		
FORWARD	200	VOLTS
INVERSE	200	VOLTS
MAXIMUM VOLTAGE BETWEEN ANY TWO ELECTRODES	250	VOLTS
MAXIMUM ANODE CURRENT:		
PEAK	1.25	AMPERES
AVERAGE	0.10	AMPERE
MAXIMUM AVERAGING TIME	45	SECONDS
TUBE VOLTAGE DROP	15	VOLTS
COLD STARTING TIME	2.0	SECONDS

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1945

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TUNG-SOL

PENTODE POWER AMPLIFIER

COATED UNIPOTENTIAL CATHODE

HEATERS

6F6, 6F6GT/G, 42 – 6.3 V., 0.7 AMPERE
2A5 – 2.5 V., 1.75 AMPERES

TYPES 6F6, 6F6GT/G, 2A5 AND 42 ARE PENTODE AMPLIFIERS DESIGNED FOR APPLICATION IN POWER OUTPUT STAGES OF RECEIVERS. WITH THE EXCEPTION OF HEATER RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

MAXIMUM RATINGS

	PENTODE CONNECTION	TRIODE CONNECTION	
MAXIMUM PLATE VOLTAGE	375	350	VOLTS
MAXIMUM SCREEN VOLTAGE	285	–	VOLTS
MAXIMUM PLATE DISSIPATION	11	–	WATTS
MAXIMUM SCREEN DISSIPATION	3.75	–	WATTS
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION	–	10	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE [C]

	PENTODE CONNECTION		TRIODE CONNECTION	
PLATE VOLTAGE	250	285	250	VOLTS
SCREEN VOLTAGE	250	285	–	VOLTS
CONTROL GRID VOLTAGE [A]	-16.5	-20	-20	VOLTS
PEAK AF SIGNAL VOLTAGE	16.5	20	20	VOLTS
ZERO-SIGNAL PLATE CURRENT	34	38	31	MA.
ZERO-SIGNAL SCREEN CURRENT	6.5	7	–	MA.
MAXIMUM-SIGNAL PLATE CURRENT	36	40	34	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	10.5	13	–	MA.
PLATE RESISTANCE (APPROX.)	80000	78000	2600	OHMS
TRANSCONDUCTANCE	2500	2550	2600	µMHOS
AMPLIFICATION FACTOR	–	–	6.8	
LOAD RESISTANCE	7000	7000	4000	OHMS
TOTAL HARMONIC DISTORTION	8	9	6.5	PER CENT
POWER OUTPUT	3.2	4.8	0.85	WATTS

PUSH-PULL AMPLIFIER – TWO TUBES [F]

	CLASS A_1 AMPLIFIER [C]	CLASS AB_2 AMPLIFIER [D]		
	PENTODE CONNECTION	PENTODE CONNECTION	TRIODE CONNECTION	
PLATE VOLTAGE	315	375	350	VOLTS
SCREEN VOLTAGE	285	250	–	VOLTS
CONTROL GRID VOLTAGE	-24 [A]	-26	-38	VOLTS
PEAK AF SIGNAL VOLTAGE (GRID TO GRID)	48	82	123	VOLTS
ZERO-SIGNAL PLATE CURRENT	62	34	48	MA.
ZERO-SIGNAL SCREEN CURRENT	12	5	–	MA.
MAXIMUM-SIGNAL PLATE CURRENT	80	82	92	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	19.5	19.5	–	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	10000	10000	6000	OHMS
TOTAL HARMONIC DISTORTION	4	3.5	2	PER CENT
POWER OUTPUT	11	18.5	13	WATTS

(CONTINUED NEXT PAGE)

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DEC. 15 1943

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TYPICAL OPERATING CONDITIONS FOR CATHODE BIAS

	CLASS A_1 AMPLIFIER [C]				CLASS AB_2 AMPLIFIER [D]		
	SINGLE TUBE AMPLIFIER		PUSH-PULL AMPLI.		PUSH-PULL AMPLI.		
	Pentode Conn.	Triode Conn.	Pentode Conn. [F]		Pentode Conn. [F]	Triode Conn. [F]	
Plate	250	285	250	315	375	350	Volts
Screen	250	285	-	285	250	-	Volts
Cathode Resistor	410	-	650	320	340 [B]	730 [E]	Ohms
Peak A-F Grid Voltage	16.5	20	20	-	-	-	Volts
Peak A-F Grid-to-Grid Voltage	-	-	-	56	94	132	Volts
Zero-Sig. Plate Cur.	34	38	31	62	54	50	Ma.
Max.-Sig. Plate Cur.	35	38	32	73	77	60	Ma.
Zero-Sig. Screen Cur.	6.5	7	-	12	8	-	Ma.
Max.-Sig. Screen Cur.	9.7	12	-	18	18	-	Ma.
Load Resistance	7000	7000	4000	-	-	-	Ohms
Effective Load Resis. (plate to plate)	-	-	-	10000	10000	10000	Ohms
Total Harmonic Dist.	8.5	9	6.5	3	5	3	%
Max.-Sig. Power Output	3.1	4.5	0.8	10.5	19	9	Watts

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER RATED MAXIMUM CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED-BIAS OPERATION.

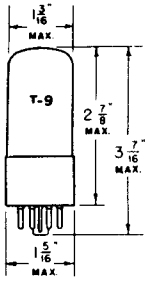
[B] THE VALUE GIVEN FOR THE CATHODE RESISTOR IS DETERMINED FOR A GRID BIAS OF -21 VOLTS.

[C] SUBSCRIPT 1 INDICATES THAT GRID CURRENT DOES NOT FLOW DURING ANY PART OF INPUT CYCLE.

[D] SUBSCRIPT 2 INDICATES THAT GRID CURRENT FLOWS DURING SOME PART OF INPUT CYCLE.

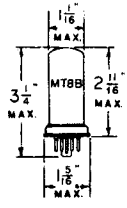
[E] THE VALUE GIVEN FOR THE CATHODE RESISTOR IS DETERMINED FOR A GRID BIAS OF -36.5 VOLTS.

[F] UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR 2 TUBES.



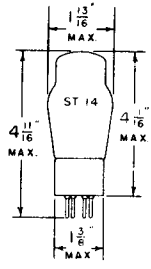
GLASS BULB

6F6GT/G



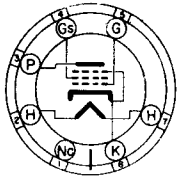
METAL SHELL

6F6

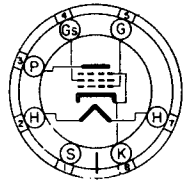


GLASS BULB

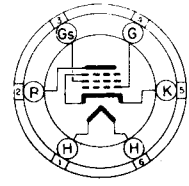
2A5 - 42



MEDIUM 7 PIN OCTAL BASE



7 PIN OCTAL BASE



MEDIUM 6 PIN BASE

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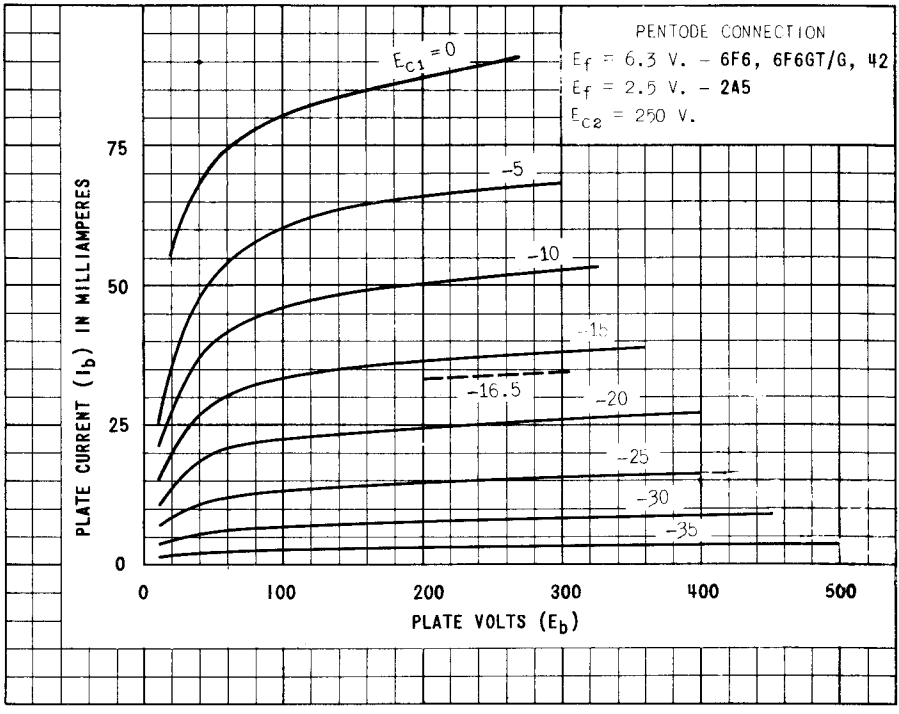

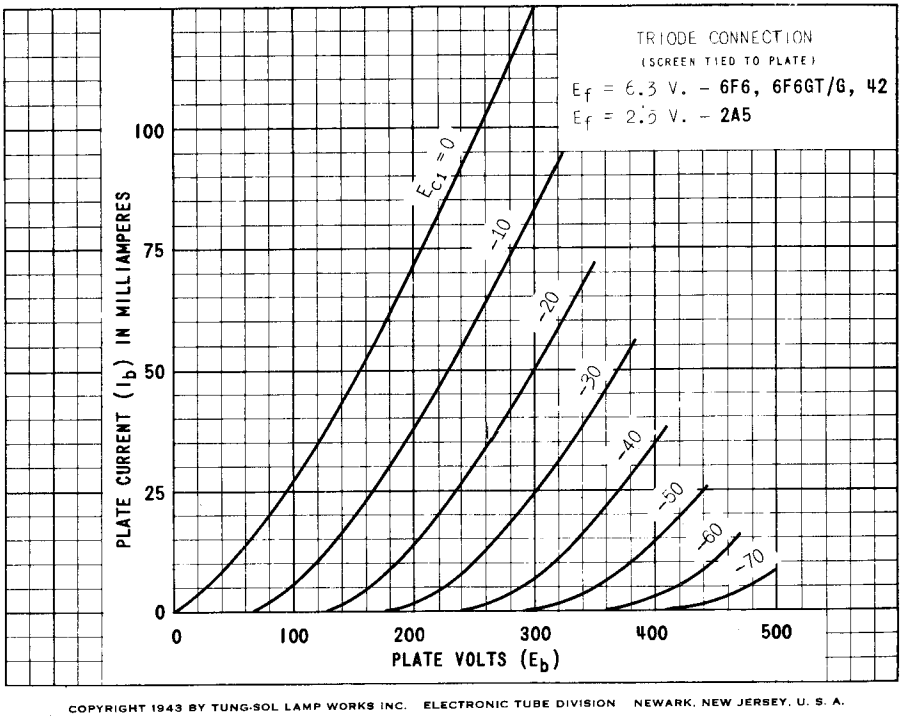

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1370-1
OCT. 25
1943

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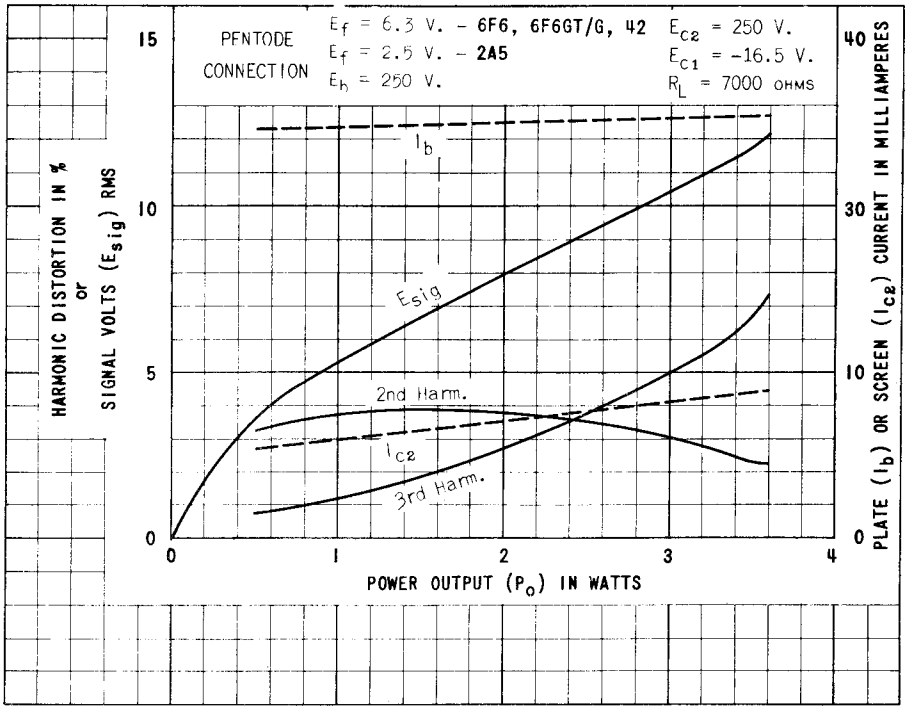
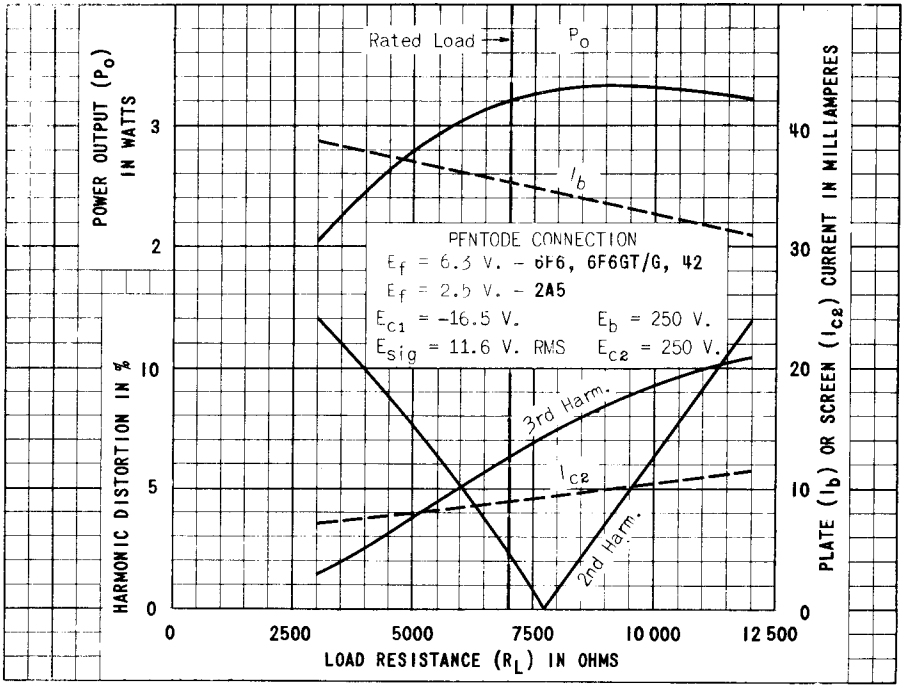
2A5 (42, 6F6, 6F6GT/G)





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OCT. 25 1943

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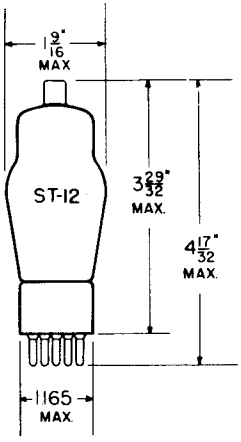


2A6, 75

SMALL METAL CAP

DUO-DIODE HIGH-MU TRIODE AMPLIFIER

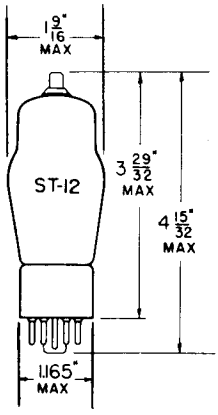
COATED UNIPOTENTIAL CATHODE

2A6	2.5 VOLTS	0.8 AMPERE
75	6.3 VOLTS	0.3 AMPERE
6B6G	6.3 VOLTS	0.3 AMPERE

AC OR DC

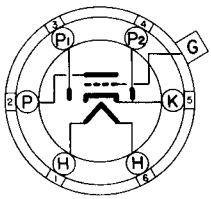
GLASS BULB

ANY MOUNTING POSITION



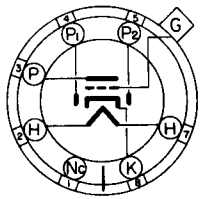
6B6G

SKIRTED MINIATURE CAP



BOTTOM VIEW

SMALL 6-PIN BASE



BOTTOM VIEW

SMALL 7-PIN OCTAL BASE

THE 2A6, 6B6G AND 75 COMBINE TWO DIODES AND A HIGH-MU TRIODE IN A SINGLE BULB, USING A COMMON CATHODE. THEY ARE DESIGNED FOR USE AS DIODE DETECTORS, AVC RECTIFIERS AND RESISTANCE COUPLED AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.
MAXIMUM CATHODE VOLTAGE	100	VOLTS

CONTINUED ON NEXT PAGE

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CONTINUED FROM PRECEDING PAGE.

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

TRIODE UNIT

GRID TO PLATE	1.7	μμf
INPUT	1.7	μμf
OUTPUT	3.8	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE UNIT

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2.0	VOLTS
PLATE CURRENT	0.9	MA.
PLATE RESISTANCE	91 000	OHMS
TRANSCONDUCTANCE	1 100	μMHOS
AMPLIFICATION FACTOR	100	

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	100	100	250	VOLTS
PLATE LOAD RESISTOR	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	0.0	10 000	4 000	OHMS
GRID CIRCUIT RESISTOR	6.0	1.0	1.0	MEGOHMS
GRID COUPLING CONDENSER	0.01	0.05	0.05	μf
VOLTAGE GAIN	35	35	52	

PLATE
1543
JAN. 15
1945

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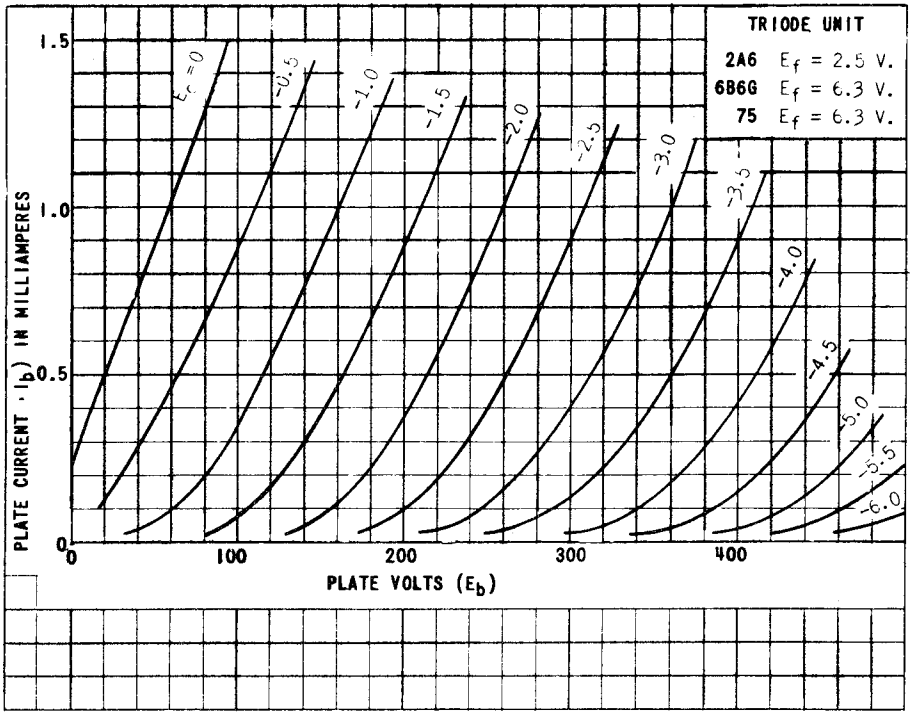

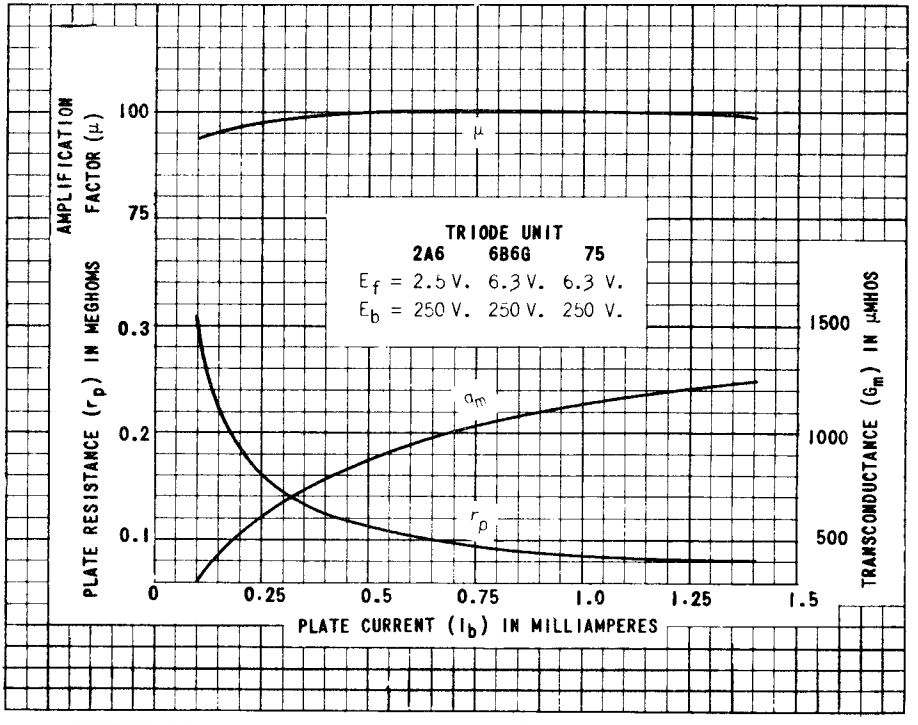

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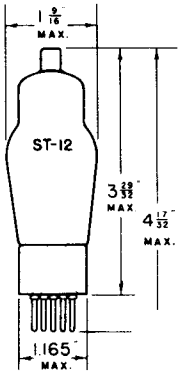


PENTAGRID CONVERTER

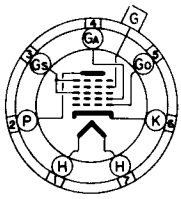
UNIPOTENTIAL CATHODE

HEATER

2A7 – 2.5 VOLTS 0.8 AMPERE
6A7 – 6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 7 PIN BASE



7C
BOTTOM VIEW

THE TUNG-SOL 2A7 AND 6A7 ARE PENTAGRID CONVERTERS DESIGNED FOR SERVICE AS OSCILLATORS AND MIXERS IN AC OPERATED AND AC–DC OPERATED RECEIVERS. WITH THE EXCEPTION OF HEATER RATINGS, THEY HAVE IDENTICAL RATINGS AND ELECTRICAL CHARACTERISTICS.

RATINGS

MAXIMUM PLATE (P) VOLTAGE	300	VOLTS
MAXIMUM SCREEN (G_S) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM OSCILLATOR ANODE VOLTAGE	200	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM OSCILLATOR ANODE DISSIPATION	0.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
916-2

DEC. 30
1940

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID (G) TO MIXER PLATE (P)[S]	0.3	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)[S]	0.15	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)[S]	0.15	μμf
OSCILLATOR GRID (G_O) TO OSCILLATOR ANODE (G_A)	1.0	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	8.5	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_O) TO ALL OTHER ELECTRODES	7.0	μμf μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES	5.5	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	9.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE (P) VOLTAGE	100	250	VOLTS
SCREEN (G_S) VOLTAGE	50	100	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	−1.5	−3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE[A]	–	250	VOLTS
OSCILLATOR ANODE VOLTAGE	100	–	VOLTS
OSCILLATOR GRID (G_O) RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.1	3.5	MA.
SCREEN CURRENT	1.3	2.7	MA.
OSCILLATOR ANODE CURRENT	2.0	4.0	MA.
OSCILLATOR GRID CURRENT	0.25	0.4	MA.
TOTAL CATHODE CURRENT	4.6	10.6	MA.
PLATE RESISTANCE APPROX.	0.6	0.36	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −1.5 V.	360	–	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −3 V.	180	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −6 V.	50	325	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −10 V.	–	100	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = −20 V.	3	–	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = −35 V.	–	6	μMHOS

[A] APPLIED THROUGH A 20 000 OHM DROPPING RESISTOR

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PLATE 917-2

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TUNG-SOL

TRIODE

MINIATURE TYPES

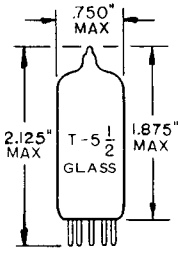
FOR

UHF TELEVISION SERVICE

COATED UNIPOTENTIAL CATHODE

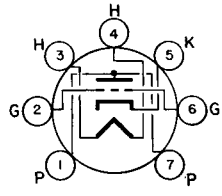
ANY MOUNTING POSITION

2AF4
OUTLINE
JEDEC 5-2



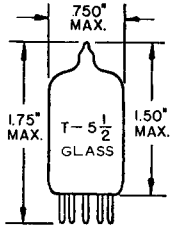
BASE 7 PIN BUTTON
JEDEC E7-1

BASING DIAGRAM
JEDEC 7DK



BOTTOM VIEW

2AF4A
OUTLINE
JEDEC 5-1



BASE 7 PIN BUTTON
JEDEC E7-1

THE 2AF4 AND 2AF4A ARE MEDIUM MU TRIODES IN THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE UHF REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. ELECTRICALLY, THE 2AF4 IS IDENTICAL TO THE 2AF4A AND DIFFERS IN ENVELOPE SIZE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE EXCEPT AS NOTED

GRID TO PLATE	1.9	pf
GRID TO CATHODE AND HEATER	2.2	pf
PLATE TO CATHODE AND HEATER	1.4	pf
HEATER TO CATHODE - SEE NOTE BELOW	2.2	pf

NOTE: WITH EXTERNAL SHIELD #316 CONNECTED TO PLATE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.35 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		50	VOLTS
DC COMPONENT		25	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID CURRENT	2	mA
CATHODE CURRENT	24	mA

CHARACTERISTICS

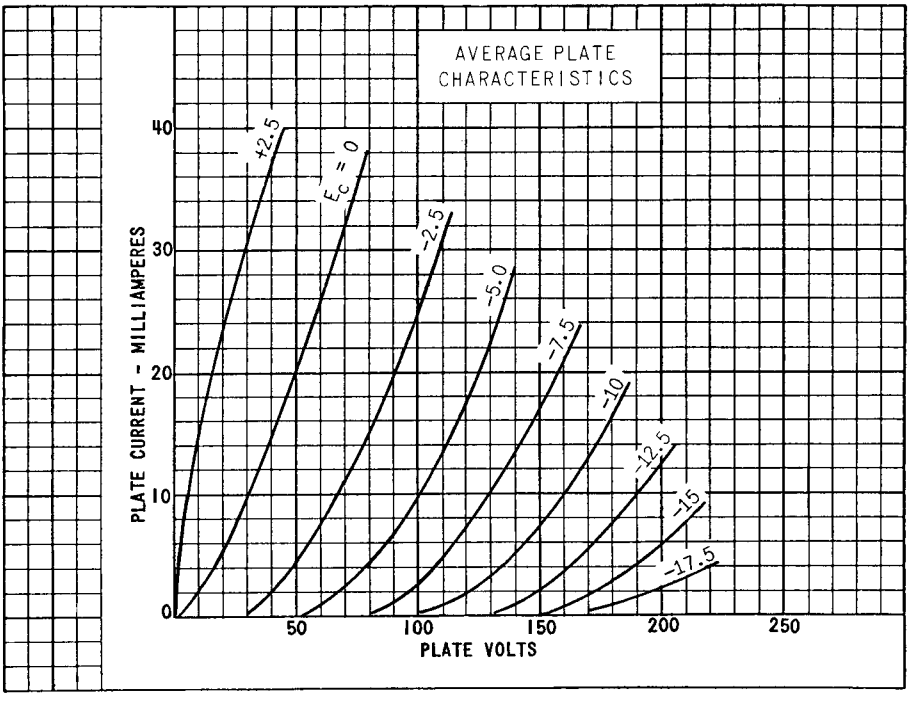
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	80	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	17.5	mA
TRANSCONDUCTANCE	6,500	μMHOS
AMPLIFICATION FACTOR	13.5	
PLATE RESISTANCE	APPROX. 2,100	OHMS

TYPICAL OPERATION

AT FREQUENCY OF 1.000 MC/S

PLATE VOLTAGE	100	VOLTS
PLATE RESISTOR	220	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	17	mA
GRID CURRENT	APPROX. 750	μA



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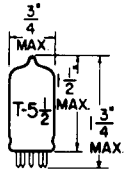
TUNG-SOL

TRIODE

MINIATURE TYPE

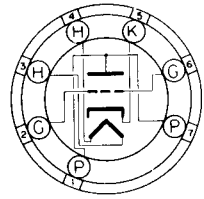


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER.
2.35 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 2AF4B IS A MEDIUM MU TRIODE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE ULTRA-HIGH-FREQUENCY REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE	1.9	μμf
GRID TO CATHODE AND HEATER	2.2	μμf
PLATE TO CATHODE AND HEATER	0.45	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

OSCILLATOR SERVICE

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	180	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC GRID VOLTAGE	-50	VOLTS
MAXIMUM DC GRID CURRENT	8	MA.
MAXIMUM PLATE INPUT	2.5	WATTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM DC CATHODE CURRENT	28	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS	NOT RECOMMENDED	
CATHODE BIAS	0.5	MEGOHM
HEATER WARM-UP TIME*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

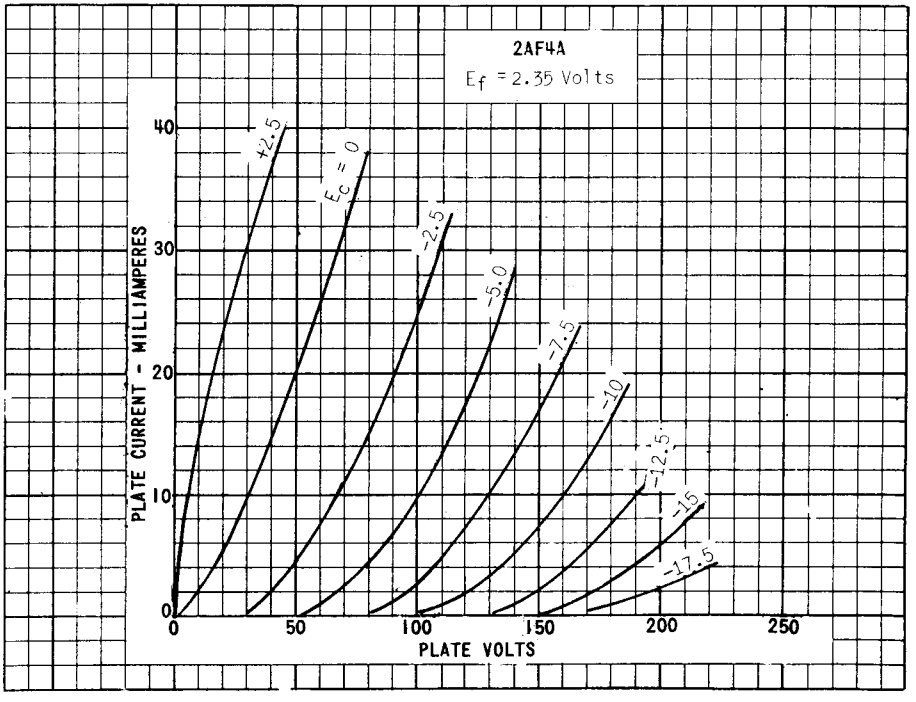
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	15	
PLATE RESISTANCE	2 270	OHMS
TRANSCONDUCTANCE	6 600	μMHOS
PLATE CURRENT	16	MA.

OPERATION AT 950 MC.

DC PLATE VOLTAGE	100	VOLTS
DC GRID VOLTAGE	−4	VOLTS
FROM A GRID RESISTOR OF	10 000	OHMS
DC PLATE CURRENT	22	MA.
DC GRID CURRENT (APPROX.)	400	μAMP.

SIMILAR TYPE REFERENCE: Except for the higher heater-cathode voltage rating, the 2AF4B is identical to the 2AF4A.

The 2AF4 curves also apply to 2AF4B.



TUNG-SOL

HIGH VACUUM CATHODE-RAY TUBE

ELECTROSTATIC DEFLECTION AND FOCUSING

NO. 1 PHOSPHOR
GREEN FLUORESCENT SCREEN
MEDIUM PERSISTENCE

HEATER
6.3 VOLTS (± 10%) 0.6 AMPERE
AC OR DC

COATED UNIPOTENTIAL CATHODE

GLASS BULB

SMALL SHELL MAGNAL 11 PIN BASE

RATINGS*

MAXIMUM ANODE NO. 2 VOLTAGE (HIGH VOLTAGE ELECTRODE)	1100	VOLTS
MAXIMUM ANODE NO. 1 VOLTAGE (FOCUSING ELECTRODE)	550	VOLTS
GRID VOLTAGE (CONTROL ELECTRODE)	NEVER POSITIVE	
MAXIMUM PEAK VOLTAGE BETWEEN ANODE NO. 2 AND ANY DEFLECTOR	660	VOLTS
MAXIMUM DC HEATER CATHODE POTENTIAL[A]	125	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM IMPEDANCE OF ANY DEFLECTOR CIRCUIT AT HEATER SUPPLY FREQUENCY	1.0	MEGOHM

*MAXIMUM RATINGS ARE ABSOLUTE VALUES

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

CONTROL ELECTRODE TO ALL OTHER ELECTRODES	8.0	μμf
CATHODE TO ALL OTHER ELECTRODES	5.5	μμf
D1 TO D2	0.6	μμf
D3 TO D4	1.1	μμf
D1 TO ALL OTHER ELECTRODES	8.5	μμf
D3 TO ALL OTHER ELECTRODES	9.0	μμf
D1 TO ALL OTHER ELECTRODES EXCEPT D2	8.0	μμf
D2 TO ALL OTHER ELECTRODES EXCEPT D1	4.6	μμf
D3 TO ALL OTHER ELECTRODES EXCEPT D4	7.5	μμf
D4 TO ALL OTHER ELECTRODES EXCEPT D3	3.6	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE NO. 2 VOLTAGE[B]	500	1000	VOLTS
ANODE NO. 1 VOLTAGE FOR FOCUS AT 75% OF GRID VOLTAGE CUT-OFF (APPROX.)[C]	125	250	VOLTS
GRID VOLTAGE FOR CUT-OFF[D]	-30[E]	-60[E]	VOLTS
DEFLECTION SENSITIVITY:[F]			
D1 AND D2	0.220	0.110	MM/VOLT DC
D3 AND D4	0.260	0.130	MM/VOLT DC
DEFLECTION FACTOR:[F]			
D1 AND D2	115	230	VOLTS DC/IN
D3 AND D4	98	196	VOLTS DC/IN

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PLATE 1395
MARCH 15 1944

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SPOT POSITION AND TEST CONDITIONS

THE UNDEFLECTED FOCUSED SPOT FALLS WITHIN A 10 MM. SQUARE CENTERED ON THE TUBE FACE.

TEST CONDITIONS ARE:

ANODE NO. 2 VOLTAGE	1000 VOLTS
ANODE NO. 1 VOLTAGE	ADJUSTED FOR FOCUS
GRID VOLTAGE	NEAR CUT-OFF
DEFLECTOR RESISTORS (CONNECTED TO ANODE NO. 2)	1 MEGOHM EACH

NOTE: SHIELD TUBE FROM ALL STRAY FIELDS.

[A] WHEN THE HEATER IS OPERATED AT A NEGATIVE POTENTIAL WITH RESPECT TO THE CATHODE THEN THE CATHODE RETURN SHOULD BE MADE AT THE CENTER TAP OF THE FILAMENT TRANSFORMER.

[B] USE OF LESS THAN 500 VOLTS RESULTS IN DECREASED BRILLIANCE.

[C] CERTAIN TUBES MAY REQUIRE ADJUSTMENT OF +20% TO -45% WITH GRID VOLTAGE BETWEEN ZERO AND CUT-OFF.

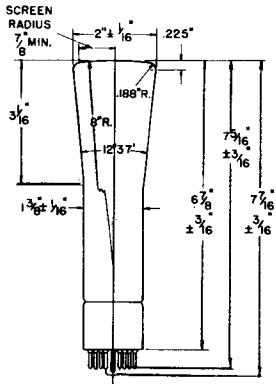
[D] THE VISUAL EXTINCTION OF A FOCUSED SPOT.

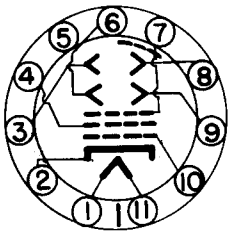
[E] THE GRID SUPPLY SHOULD BE VARIABLE TO ± 50%.

[F] VALUES SUBJECT TO VARIATION OF ± 20%.

DEFLECTOR LOCATIONS:

D1 AND D2	NEAREST TO SCREEN
D3 AND D4	NEAREST TO BASE
D1	SAME SIDE OF TUBE AS PIN NO. 4
D3	SAME SIDE AS PIN NO. 1





BOTTOM VIEW

1. HEATER
2. CATHODE
3. DEFLECTOR NO. 1 (D1)
4. ANODE NO. 1
5. NO CONNECTION
6. DEFLECTOR NO. 4 (D4)
7. ANODE NO. 2
8. DEFLECTOR NO. 2 (D2)
9. DEFLECTOR NO. 3 (D3)
10. GRID
11. HEATER

PLATE 1396
MARCH 15 1944

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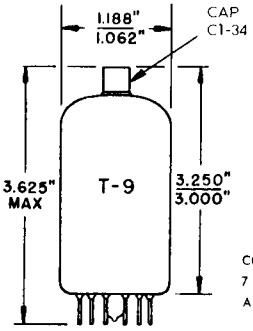
TUNG-SOL

DIODE

COMPACTRON TYPE



GLASS BULB

BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-100

FOR

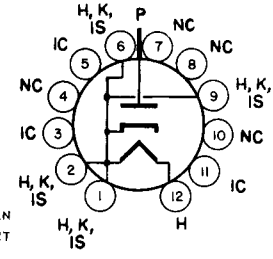
TV HIGH VOLTAGE

RECTIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM

JEDEC 12EW

TERMINALS 4, 7 & 10 MAY BE USED AS TIE POINTS FOR COMPONENTS AT OR NEAR HEATER POTENTIAL

THE 2AS2 IS A HEATER-CATHODE TYPE DIODE IN A T-9 COMPACTRON ENVELOPE. IT IS DESIGNED FOR USE AS A HIGH-VOLTAGE RECTIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE AND INTERNAL SHIELD	(APPROX.) 1.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.5	VOLTS	330	MA.
LIMITS OF APPLIED VOLTAGE			2.5±0.4	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLYBACK RECTIFIER SERVICE[A]

PEAK INVERSE PLATE VOLTAGE		
DC COMPONENT	24	KVOLTS
TOTAL DC AND PEAK	30	KVOLTS
STEADY-STATE PEAK CURRENT	80	MA.
DC OUTPUT CURRENT	1.5	MA.

A
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

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TUNG-SOL

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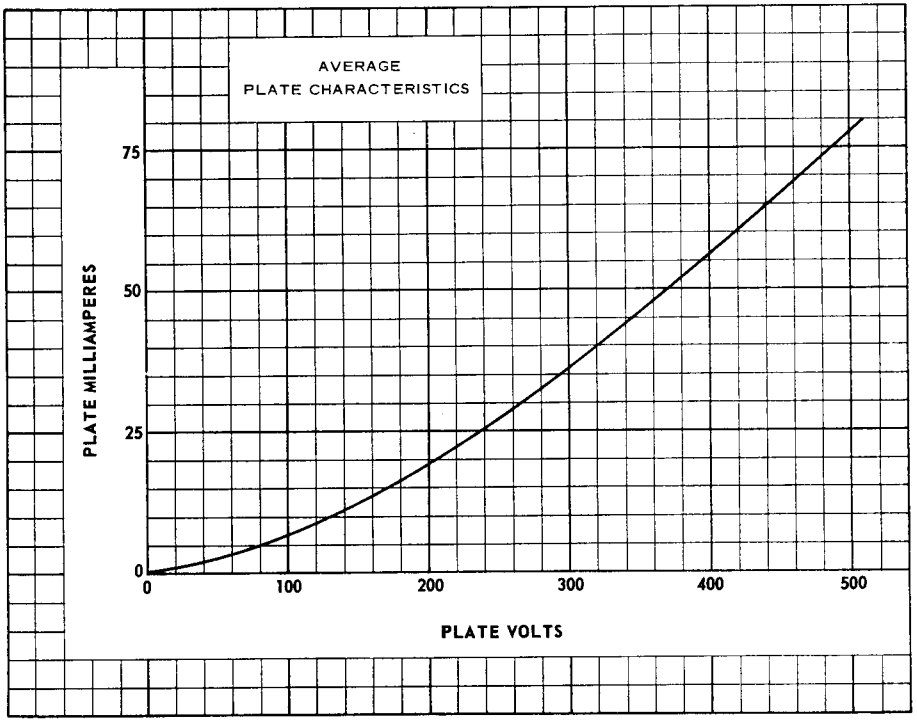
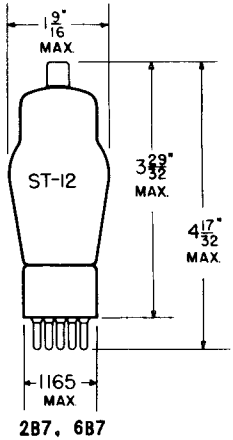
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, APPROX. Ib = 7.0 MA.	100	VOLTS



TUNG-SOL



2B7, 6B7

SMALL METAL CAP

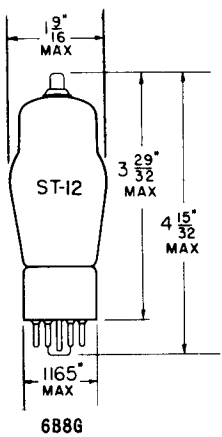
DUO-DIODE PENTODE AMPLIFIER

COATED UNIPOTENTIAL CATHODE

2B7	2.5 VOLTS	0.8 AMPERE
6B7	6.3 VOLTS	0.3 AMPERE
6B8G	6.3 VOLTS	0.3 AMPERE

AC OR DC

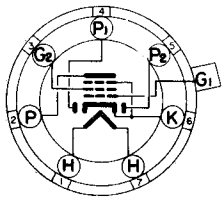
GLASS BULB



6B8G

SKIRTED MINIATURE CAP

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL 7-PIN BASE

BOTTOM VIEW

SMALL SHELL 8-PIN OCTAL BASE

THE 2B7, 6B7, AND 6B8G CONSIST OF TWO DIODES AND A PENTODE UTILIZING A COMMON CATHODE. THEY ARE DESIGNED FOR SERVICE AS COMBINED DETECTORS, AVC RECTIFIERS AND PENTODE AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC	0.8	MA.
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATTS

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PLATE 1545
JAN. 15 1945

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PENTODE UNIT

	2B7, 6B7	6B8G	
INPUT: G1 TO (F+K+G2+G3)	3.5	3.6	μμf
OUTPUT: P TO (F+K+G2+G3)	9.5	9.5	μμf
CONTROL GRID TO PLATE	0.007 (MAX.)	0.01 (MAX.)	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	100	180	250	250	VOLTS
SCREEN VOLTAGE	100	75	100	125	VOLTS
CONTROL GRID VOLTAGE	-3.0	-3.0	-3.0	3.0	VOLTS
PLATE CURRENT	5.8	3.4	6.0	9.0	MA
SCREEN CURRENT	1.7	0.9	1.5	2.3	MA.
PLATE RESISTANCE (APPROX.)	0.3	1.0	0.8	0.6	MEGOHM
TRANSCONDUCTANCE	950	840	1 000	1 125	μMHOS
GRID BIAS (FOR CATHODE CURRENT CUT-OFF, APPROX.)	-17	-13	-17	-21	VOLTS

PLATE 1546
JAN. 15 1945

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TUNG-SOL

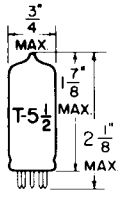
TRIODE

MINIATURE TYPE

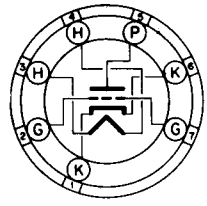
COATED UNIPOTENTIAL CATHODE

HEATER
2.35 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7EG

THE 2BN4 AND 2BN4A ARE MINIATURE MEDIUM-MU TRIODES DESIGNED FOR USE AS RADIO-FREQUENCY AMPLIFIERS IN VHF TELEVISION TUNERS. THERMAL CHARACTERISTICS OF THE HEATERS ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED THEY ARE USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE HIGHER TRANSCONDUCTANCE AND LOWER PLATE RESISTANCE OF THE 2BN4A, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316

GRID TO PLATE	1.2	μμf
INPUT	3.2	μμf
OUTPUT	1.4	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS
HEATER WARM-UP TIME*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

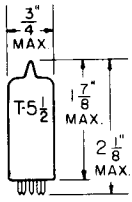
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.) FOR 2BN4	6 300	OHMS
PLATE RESISTANCE (APPROX.) FOR 2BN4A	5 400	OHMS
TRANSCONDUCTANCE (FOR 2BN4)	6 800	μMHOS
TRANSCONDUCTANCE (FOR 2BN4A)	8 000	μMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.)		
I_b = 100 μAMPS.	-6	VOLTS

TUNG-SOL

THYRATRON

MINIATURE TYPE

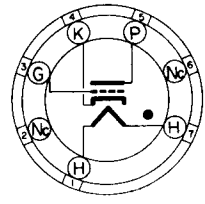


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 0.650 AMPERE
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 2C4 IS A THYRATRON DESIGNED FOR USE IN COMPACT, LIGHT-WEIGHT, PORTABLE EQUIPMENT. IT IS RECOMMENDED THAT NO MATERIAL BE PERMITTED TO OBSTRUCT THE HOLE IN THE BASE SOCKET AS THIS TYPE MAY BE MANUFACTURED WITH THE EXHAUST-TUBE TIP AT THE BASE END.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	2.5	VOLTS
HEATER CURRENT	0.650	AMP.
HEATING TIME (MINIMUM)	30	SECONDS
MAXIMUM VOLTAGE BETWEEN ELEMENTS	450	VOLTS
AVERAGE ANODE CURRENT[A]	5.0	MA.
PEAK ANODE CURRENT	20	MA.
TUBE VOLTAGE DROP AT 5.0 MA. (APPROX.)	16	VOLTS

[A] AVERAGED OVER PERIOD OF NOT MORE THAN 30 SECONDS.

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PLATE 1742
NOV. 1, 1946

→ INDICATES A CHANGE OR ADDITION.

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2C4

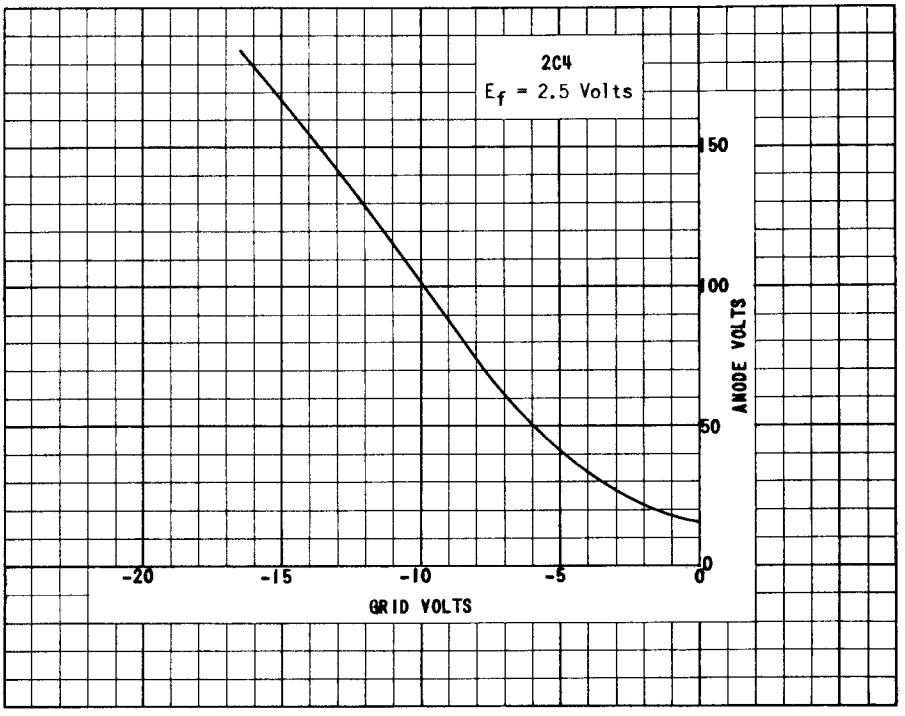

PLATE 1743
NOV. 1, 1946

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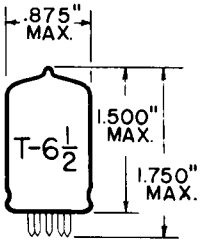
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

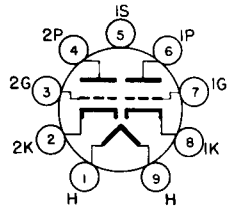
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-1

COATED UNIPOTENTIAL CATHODE

FOR

APPLICATIONS IN THE LOW
TO VHF FREQUENCY RANGE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8CJ

THE 2C51 COMBINES TWO INDEPENDENT AND SHIELDED, MEDIUM-MU, INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN AMPLIFIER, MIXER, OSCILLATOR, MULTIVIBRATOR AND CLAMP CIRCUITS. THE USEFUL RANGE EXTENDS FROM LOW FREQUENCIES THROUGH THE VHF RANGE.

→ DIRECT INTERELECTRODE CAPACITANCES

EACH SECTION

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	1.3[A]	1.3	pf
INPUT: G TO (H+K+I.S.)	2.3[A]	2.2	pf
OUTPUT: P TO (H+K+I.S.)	1.3[A]	1.0	pf
PLATE TO PLATE	0.03[B]	0.04	pf

A
PIN #5 & EXTERNAL SHIELD #315 CONNECTED TO CATHODE PIN OF SECTION UNDER TEST. ELEMENTS OF OTHER SECTION GROUNDED.

B
PIN #5 & EXTERNAL SHIELD #315 CONNECTED TO GROUND WITH OTHER ELEMENTS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		90	VOLTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	300	VOLTS
PLATE POSITIVE DC GRID VOLTAGE*	0	VOLTS
PLATE DISSIPATION	1.5	WATTS
CATHODE CURRENT	18	MA.
GRID CIRCUIT RESISTANCE*	1	MEGOHM

→ TYPICAL OPERATING CHARACTERISTICS

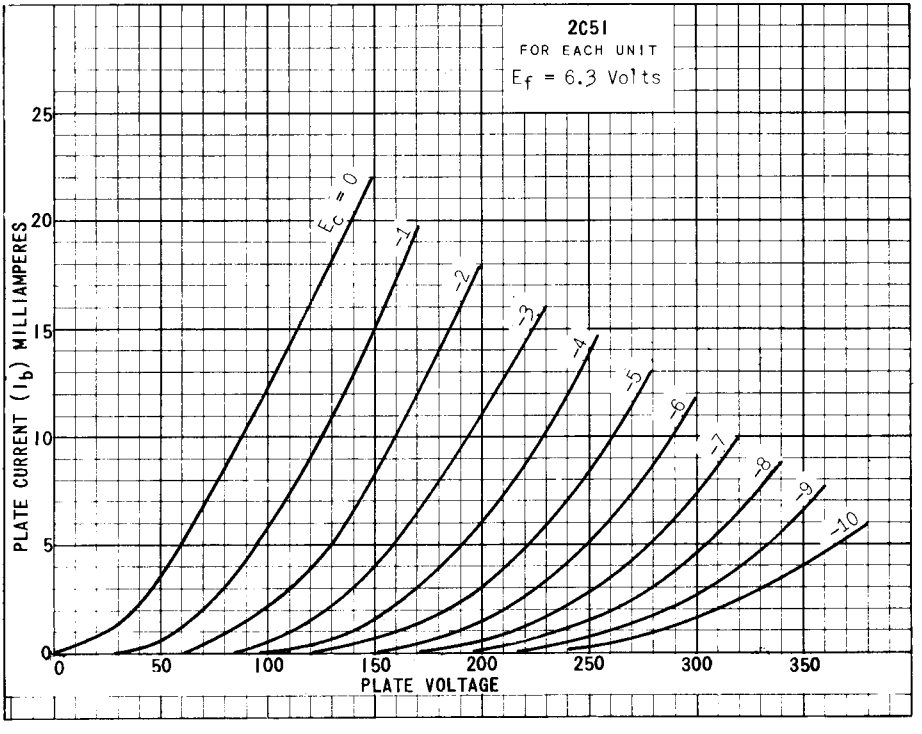
CLASS A_1 AMPLIFIER

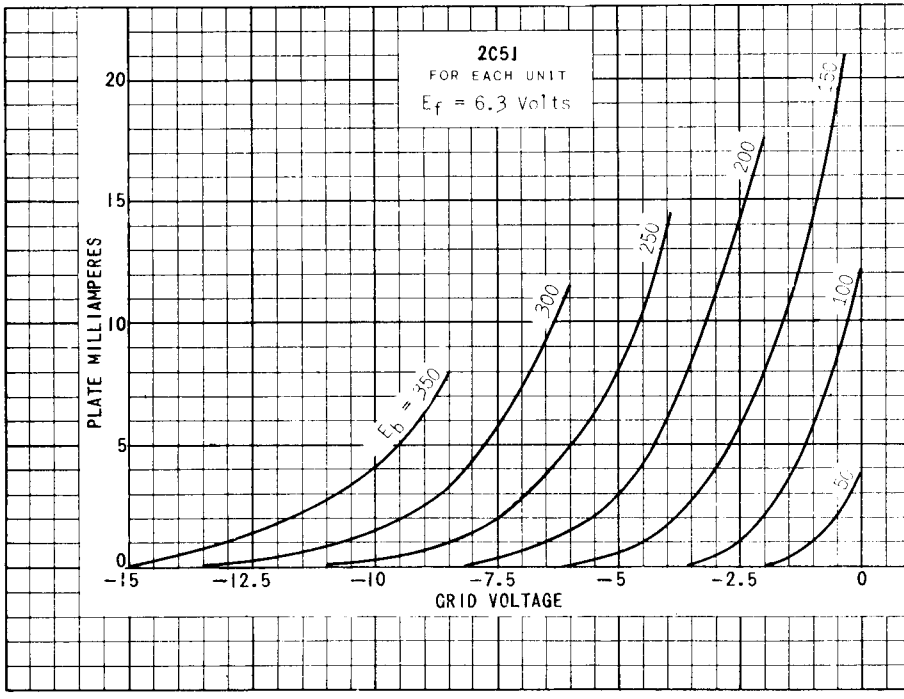
EACH SECTION

PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	240	OHMS
PLATE CURRENT	8.2	MA.
PLATE RESISTANCE (APPROX.)	6500	OHMS
TRANSCONDUCTANCE	5500	μMHOS
AMPLIFICATION FACTOR	35	
GRID #1 VOLTAGE FOR Ib = 10 μA	-8	VOLTS

*INDICATES AN ADDITION.

→ INDICATES A CHANGE.





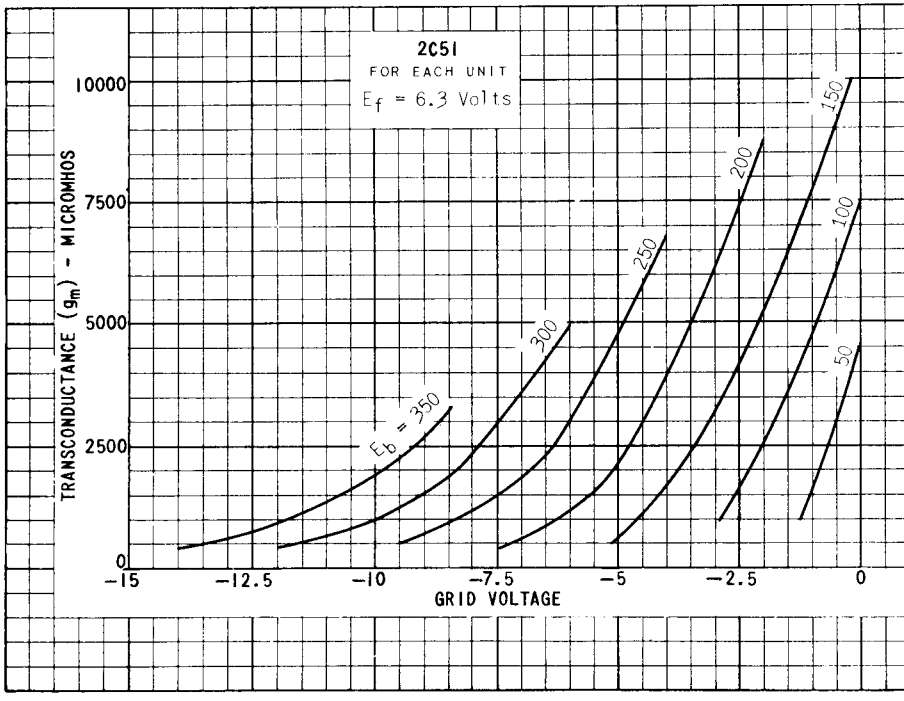


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PLATE
2645
MAY 1
1951

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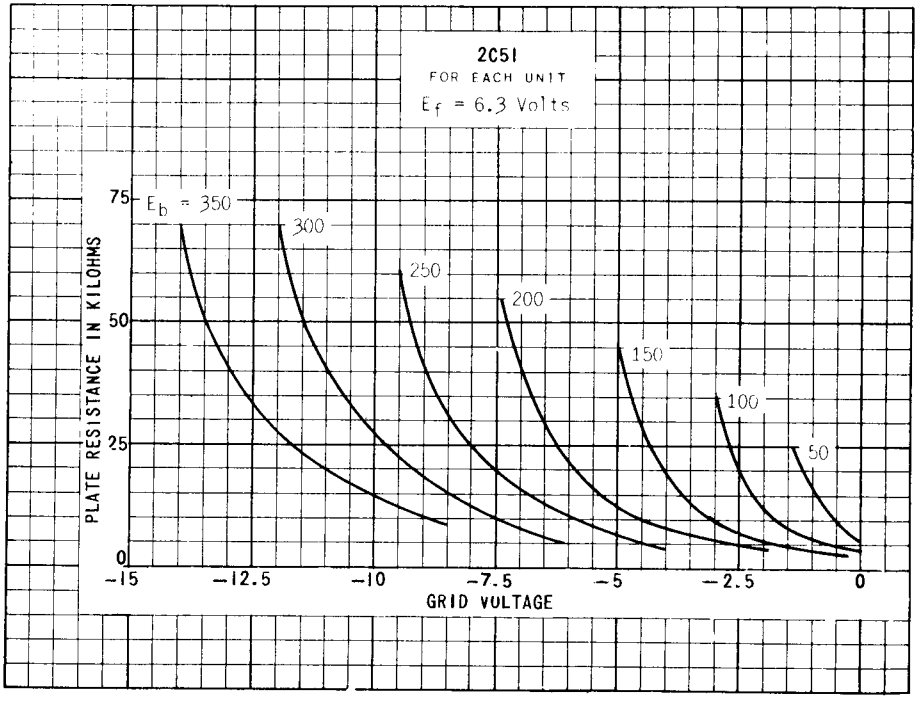
2C51



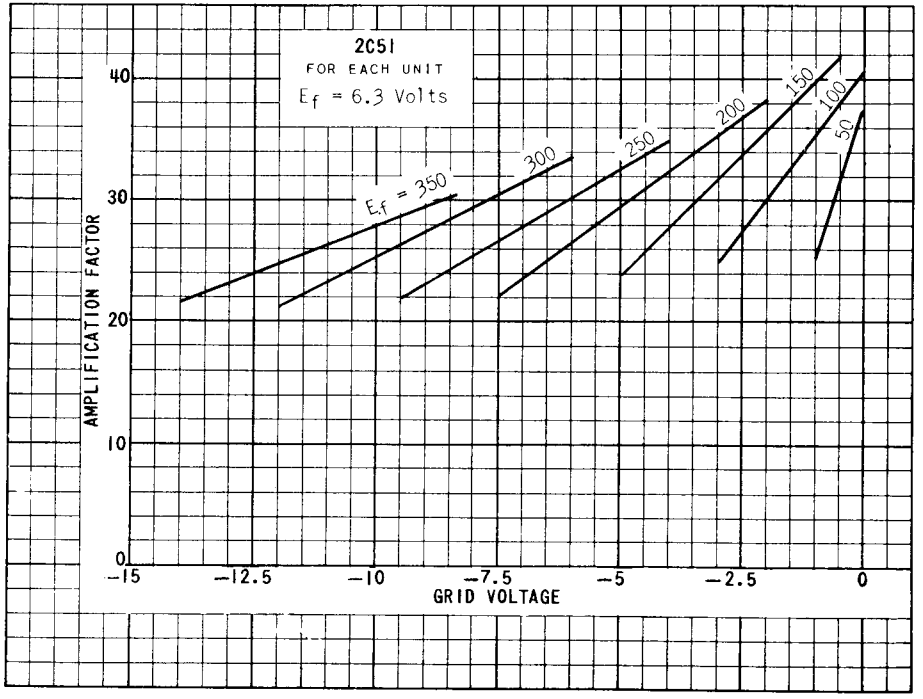


PLATE
2646
MAY 1
1951

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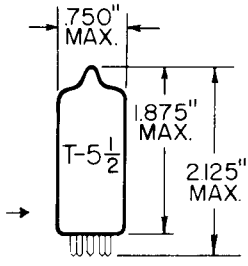


GLASS BULB
MINIATURE BUTTON
7 PIN BASE ET-1
OUTLINE DRAWING
JEDEC 5-2

TETRODE

MINIATURE TYPE

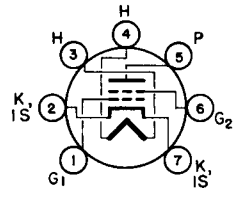
COATED UNIPOTENTICAL CATHODE

HEATER

2.4 VOLTS 600±36 MAMPS. ←

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 2CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 2CY5 IS IDENTICAL TO THE 3CY5, 4CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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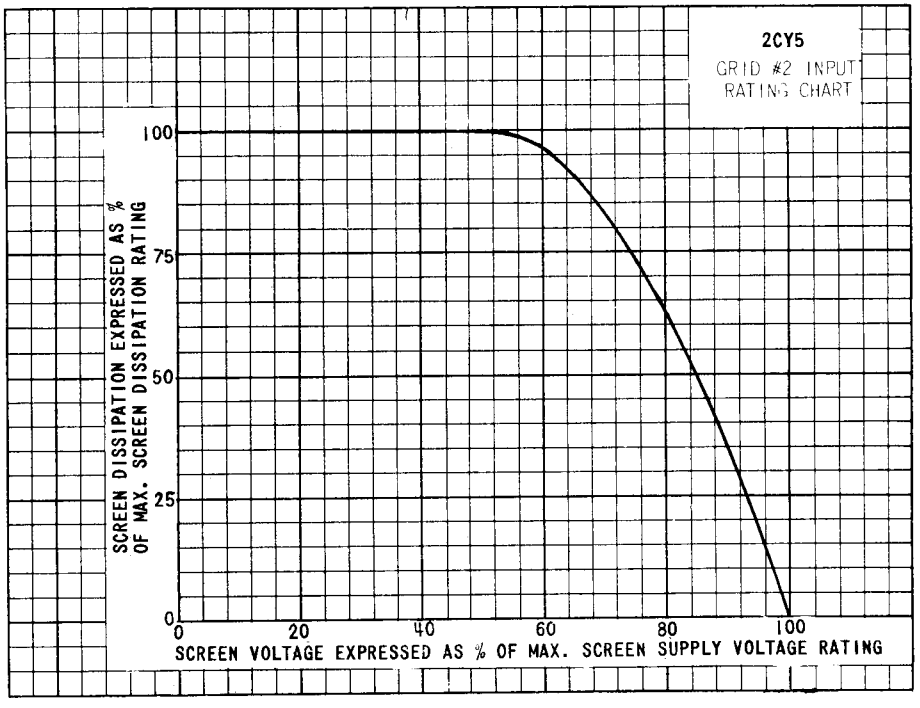
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

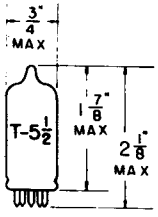
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	-6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

[C] PLATE CURRENT 20 μA.



TUNG-SOL

THYRATRON



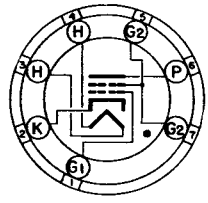
GLASS BULB

HEATER

6.3±10% VOLTS 0.600 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7-BN

THE 2D21W IS A RUGGEDIZED, XENON FILLED, FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTICS. THIS TUBE IS ELECTRICALLY EQUIVALENT TO THE POPULAR TYPE 2D21, BUT HAS BEEN RUGGEDIZED THROUGH THE USE OF CERAMIC INSULATORS AND STRONGER ELEMENTS TO PERMIT THE TUBE TO STAND HIGH IMPACT SHOCKS AND VIBRATION. IT HAS FOUND WIDE USAGE AS A SWITCHING TUBE, AS A PULSE MODULATOR, AND IN GRID CONTROLLED RECTIFIER SERVICE. BECAUSE OF ITS SHIELD GRID CONSTRUCTION, THE INPUT OF THE 2D21W WILL WORK DIRECTLY FROM A HIGH IMPEDANCE SOURCE SUCH AS A PHOTOTUBE. THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PINS #5 & #7 TO #2 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL. THE SMALL SIZE AND LIGHT WEIGHT OF THE 2D21W AND ITS RELATIVE FREEDOM FROM TEMPERATURE RESTRICTIONS MAKE THIS TUBE PARTICULARLY SUITED FOR USE IN COMPACT EQUIPMENT.

ELECTRICAL DATA

HEATER VOLTAGE[A]	6.3±10%	VOLTS
HEATER CURRENT (Ef =6.3 VOLTS)	0.600	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.026	μμFARADS
CONTROL GRID TO CATHODE (&SHIELD GRID) CAPACITANCE	2.4	μμFARADS
ANODE TO CATHODE (&SHIELD GRID) CAPACITANCE	1.6	μμFARADS
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE)		
WITH GRID VOLTS =-100, GRID RES.=10000Ω		
ANODE VOLTS =125, ANODE CUR. =0.1AMPS.	35	μSECONDS
WITH GRID VOLTS=-10, GRID RES.=1000Ω		
ANODE VOLTS =125, ANODE CUR.= 0.1 AMPS.	75	μSECONDS
IONIZATION TIME, APPROX.	0.5	μSECONDS
ANODE VOLTAGE DROP, APPROX.	8	VOLTS
MAXIMUM CRITICAL GRID CURRENT (AT E_{bb}=460V, RMS)	0.5	μAMPS.

[A] +10%, -5% IN PULSE MODULATOR SERVICE.

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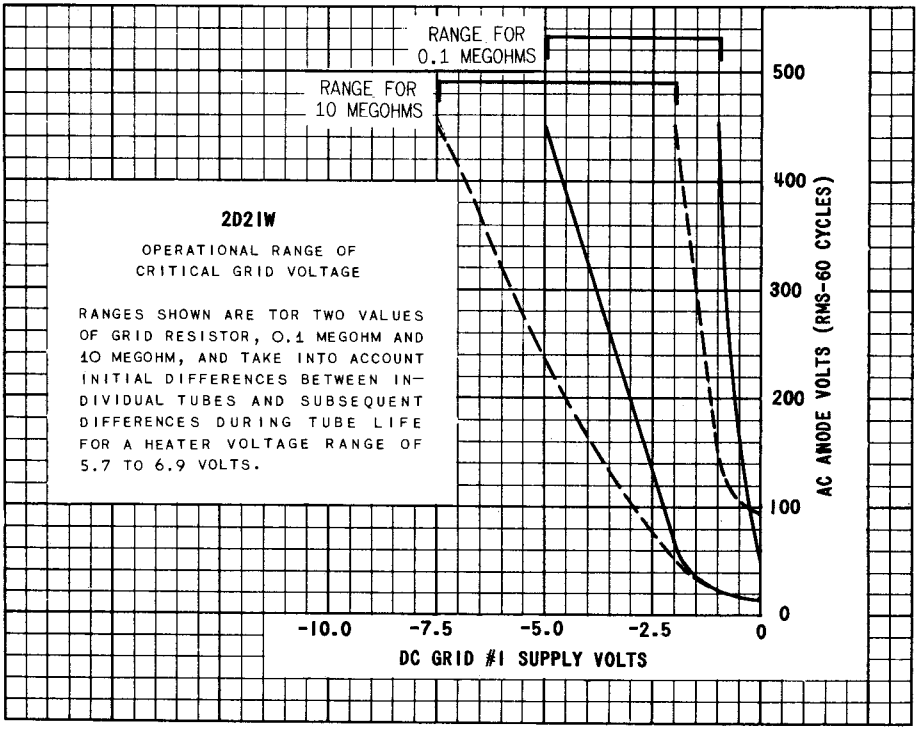
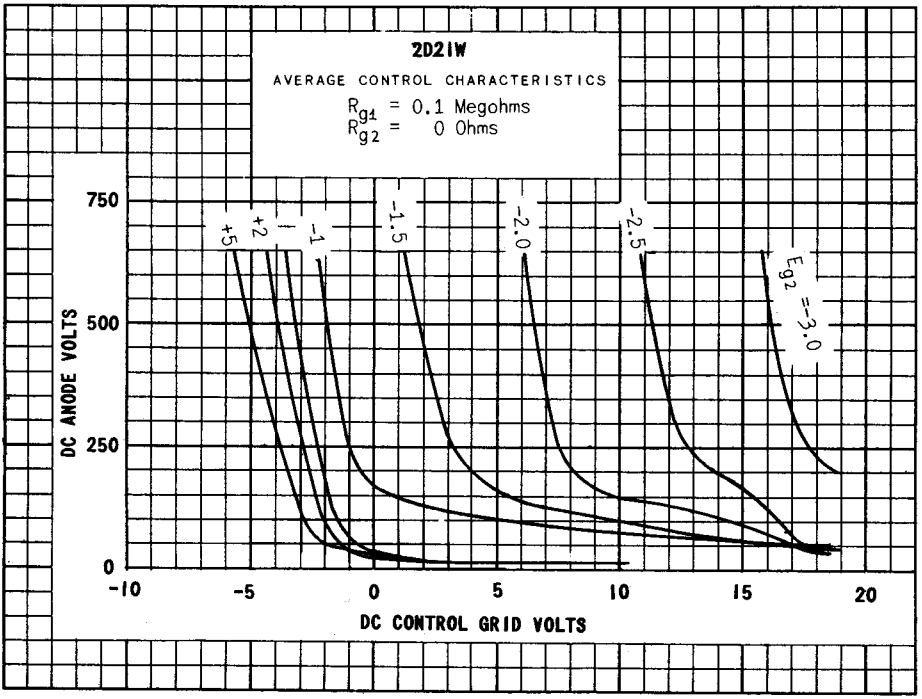
MECHANICAL DATA

MAXIMUM SHOCK RATING	720	G
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2.13	INCHES
MAXIMUM SEATED LENGTH	1.88	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
BASE	MINIATURE BUTTON 7 PIN	
WEIGHT (NET)	0.5	OUNCES

RATINGS
ABSOLUTE VALUES

	RELAY & GRID CONTROLLED RECTIFIER SERVICE	PULSE MODULATOR SERVICE	
MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	1300	100	VOLTS
FORWARD	650	500	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	0.5	10.	AMPS.
AVERAGE	100.	10.	MA.
SURGE (MAX. DURATION 0.1 SECONDS)	10.	---	AMPS.
MAXIMUM AVERAGE TIME	30.	---	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE			
BEFORE CONDUCTION	-100	-100	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	-10	-10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT			
AVERAGE	10	---	MA.
PEAK	---	20	MA.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE			
BEFORE CONDUCTION	-100	-50	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	-10	-10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT			
AVERAGE	10	---	MA.
PEAK	---	20	MA.
MAXIMUM FREQUENCY	---	500	PPS.
MAXIMUM PULSE TIME	---	5	μSECONDS
MAXIMUM RATE OF RISE (AMPS. PER μSECOND)	---	100	
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER NEGATIVE	-100	0	VOLTS
HEATER POSITIVE	25	0	VOLTS
AMBIENT TEMPERATURE LIMITS	-75 TO +90	-75 TO+90	°C
MAXIMUM CONTROL GRID (G1) CIR. RESISTANCE	10	0.5	MEGOHMS
MAXIMUM SHIELD GRID (G2) CIRCUIT RESISTANCE	---	25 000	OHMS
MINIMUM SHIELD GRID (G2) CIRCUIT RESISTANCE	---	2 000	OHMS





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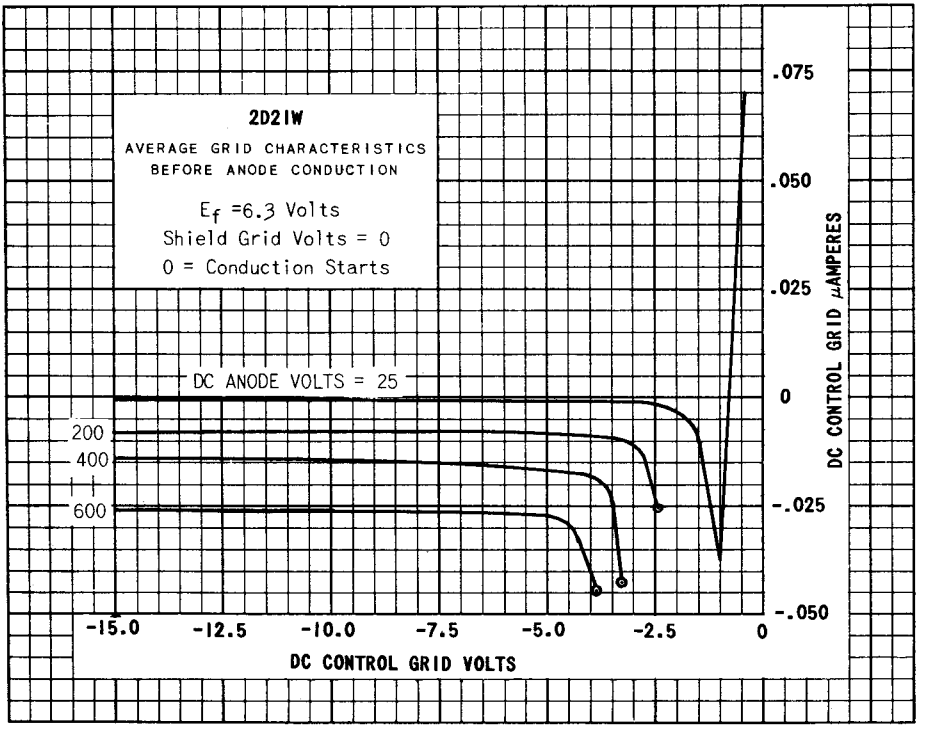
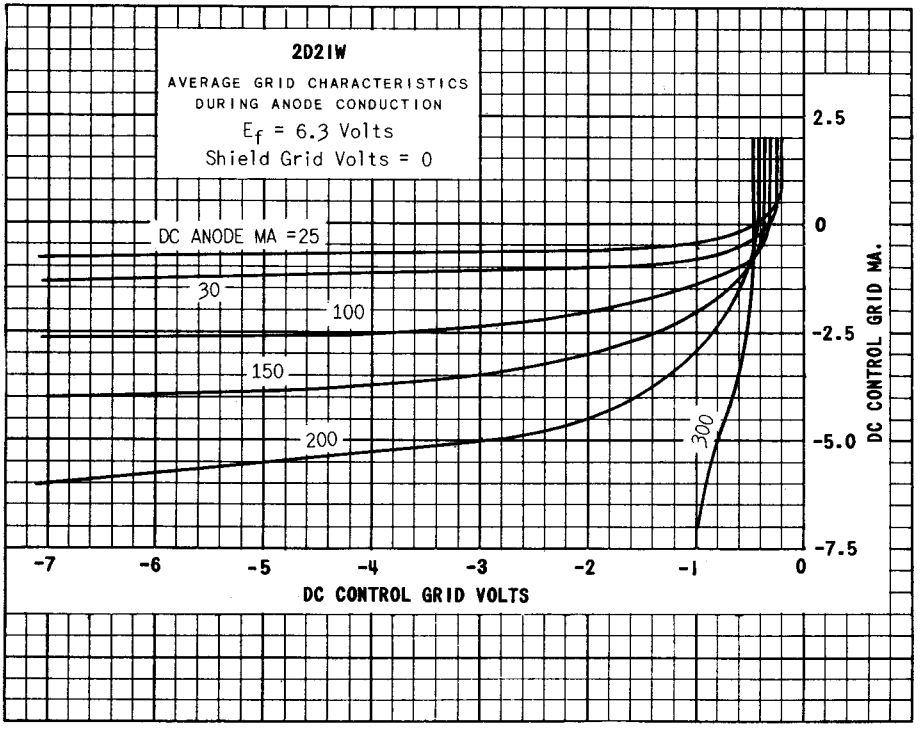

2D21W
AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION
E_f =6.3 Volts
Shield Grid Volts = 0
0 = Conduction Starts
DC ANODE VOLTS = 25
200
400
600
.075
.050
.025
0
-.025
-.050
DC CONTROL GRID μAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
DC CONTROL GRID VOLTS

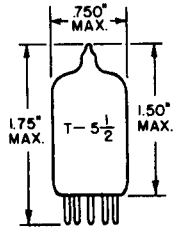

2D21W
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts = 0
DC ANODE MA =25
30
100
150
200
300
2.5
0
-2.5
-5.0
-7.5
DC CONTROL GRID MA.
-7
-6
-5
-4
-3
-2
-1
0
DC CONTROL GRID VOLTS

TUNG-SOL

TRIODE

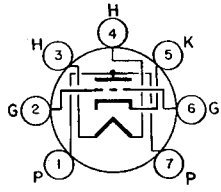
MINIATURE TYPE

MEDIUM MU TRIODE
FOR
UHF OSCILLATOR SERVICE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
7 DK

THE 2DZ4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR UHF OSCILLATOR SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 2DZ4 IS IDENTICAL TO THE 3DZ4 AND THE 6DZ4.

DIRECT INTERELECTRODE CAPACITANCES
WITH SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K + E.S.)	2.2	pf
OUTPUT: P TO (H + K + E.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.35 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
HEATER - CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		180	VOLTS
HEATER POSITIVE WITH-RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		180	VOLTS

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MAXIMUM RATINGS
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

UHF OSCILLATOR SERVICE

PLATE VOLTAGE	135	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.3	WATTS
CATHODE CURRENT	20	MA.
GRID CURRENT	2	MA.

CHARACTERISTICS AND TYPICAL OPERATION
CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
PLATE CURRENT	15	MA.
TRANSCONDUCTANCE	6,700	μMHOS
AMPLIFICATION FACTOR	14	
PLATE RESISTANCE	APPROX. 2,000	OHMS
GRID VOLTAGE FOR $I_b = 20\ \mu A$	APPROX. -11	VOLTS

OSCILLATOR AT 1000 Mc/s
MEASURED IN JEDEC STANDARD OSCILLATOR NO. 400

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	15.5	MA.
GRID CURRENT	APPROX. 800	μA

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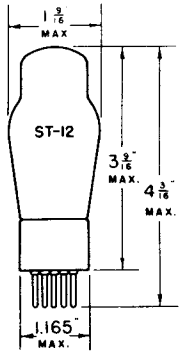
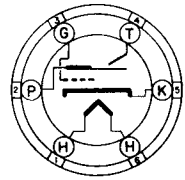


CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 0.8 AMPERE
AC OR DC

GLASS BULB



6R
BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 2E5 CONSISTS OF A CIRCULAR FLUORESCENT TARGET WITH AN INDICATING SHADOW ANGLE CONTROLLED BY AN INTERNALLY CONNECTED SHARP CUT-OFF AMPLIFIER. WHEN THE 2E5 IS USED AS A TUNING INDICATOR AVC VOLTAGE IS APPLIED TO THE TRIODE GRID. WITH THE EXCEPTION OF HEATER RATINGS, ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 6E5.

RATINGS

MAXIMUM PLATE SUPPLY VOLTAGE	250	VOLTS
MAXIMUM TARGET VOLTAGE	250	VOLTS
MINIMUM TARGET VOLTAGE	100	VOLTS

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE AND TARGET SUPPLY VOLTAGE	100	200	250	VOLTS
TRIODE GRID VOLTAGE (0^{o} SHADOW ANGLE) APPROX.	-3.3	-6.5	-8.0	VOLTS
TRIODE GRID VOLTAGE (90^{o} SHADOW ANGLE) APPROX.	0	0	0	VOLTS
SERIES TRIODE PLATE RESISTOR	0.5	1	1	MEGOHM
TRIODE PLATE CURRENT (TRIODE GRID V.=0)	0.19	0.19	0.24	MA.
TARGET CURRENT (TRIODE GRID V.=0)[B]	1	3	4	MA.

[B] SUBJECT TO WIDE VARIATIONS

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FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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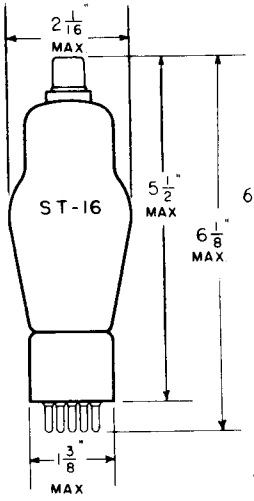
TUNG-SOL

PENTODE POWER AMPLIFIER OSCILLATOR



COATED FILAMENT

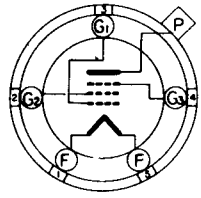
6.3 VOLTS[A] 1.5 AMPS.
AC OR DC

GLASS BULB

MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.

MEDIUM METAL CAP



BOTTOM VIEW

MEDIUM 5 PIN
MICANOL BASE

TYPE 2E22 IS DESIGNED PRIMARILY FOR CLASS C AMPLIFIER OR OSCILLATOR SERVICE IN PORTABLE EQUIPMENT.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	750	VOLTS
MAXIMUM SCREEN GRID VOLTAGE	250	VOLTS
MAXIMUM CONTROL GRID VOLTAGE	-200	VOLTS
MAXIMUM PLATE DISSIPATION	30	WATTS
MAXIMUM SCREEN DISSIPATION	10	WATTS
MAXIMUM PLATE CURRENT	110	MA.
MAXIMUM CONTROL GRID CURRENT	9.0	MA.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (WITH SHIELD)	0.20 MAX.	μμf
INPUT	13	μμf
OUTPUT	8.0	μμf

[A] THE FILAMENT VOLTAGE SHOULD BE HELD AS CLOSE TO 6.3 VOLTS AS POSSIBLE. INTERMITTENT OPERATION TO AS HIGH AS 7.0 OR AS LOW AS 5.5 VOLTS IS PERMISSIBLE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS C, R-F AMPLIFIER OR OSCILLATOR

PLATE VOLTAGE	500	500	750	750	VOLTS
SCREEN VOLTAGE	250	250	250	250	VOLTS
SCREEN RESISTOR[B]	15 000	15 000	30 000	30 000	OHMS
SUPPRESSOR VOLTAGE	0	22.5	0	22.5	VOLTS
PLATE CURRENT	100	100	100	100	MA.
SCREEN CURRENT	16	16	16	16	MA.
CONTROL GRID CURRENT (APPROX.)	6.0	6.0	6.0	6.0	MA.
CONTROL GRID RESISTOR[C]	10 000	10 000	10 000	10 000	OHMS
PEAK R-F GRID VOLTAGE (APPROX.)	100	100	100	100	VOLTS
GRID DRIVING POWER (APPROX.)	0.55	0.55	0.55	0.55	WATT
POWER OUTPUT (APPROX.)	30	34	48	53	WATTS

SUPPRESSOR MODULATED CLASS C AMPLIFIER

PLATE VOLTAGE	500	750	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
SCREEN RESISTOR	8 500	17 000	OHMS
SUPPRESSOR VOLTAGE	-65	-90	VOLTS
PEAK A-F INPUT	65	90	VOLTS
PEAK R-F GRID VOLTAGE	100	100	VOLTS
PLATE CURRENT	50	55	MA.
SCREEN CURRENT (APPROX.)	29	29	MA.
CONTROL GRID CURRENT (APPROX.)	6.5	6.5	MA.
CONTROL GRID RESISTOR[C]	10 000	10 000	OHMS
GRID DRIVING POWER (APPROX.)	0.6	0.6	WATT
POWER OUTPUT (APPROX.)	10.5	16.5	WATTS
MODULATION	95	95	PER CENT

[B] SERIES SCREEN DROPPING RESISTOR SHOULD NOT BE USED IF UNDER KEY-UP CONDITIONS THE SCREEN VOLTAGE EXCEEDS 500 VOLTS.

[C] THE TOTAL EFFECTIVE GRID CIRCUIT RESISTANCE SHALL NOT EXCEED 25,000 OHMS.

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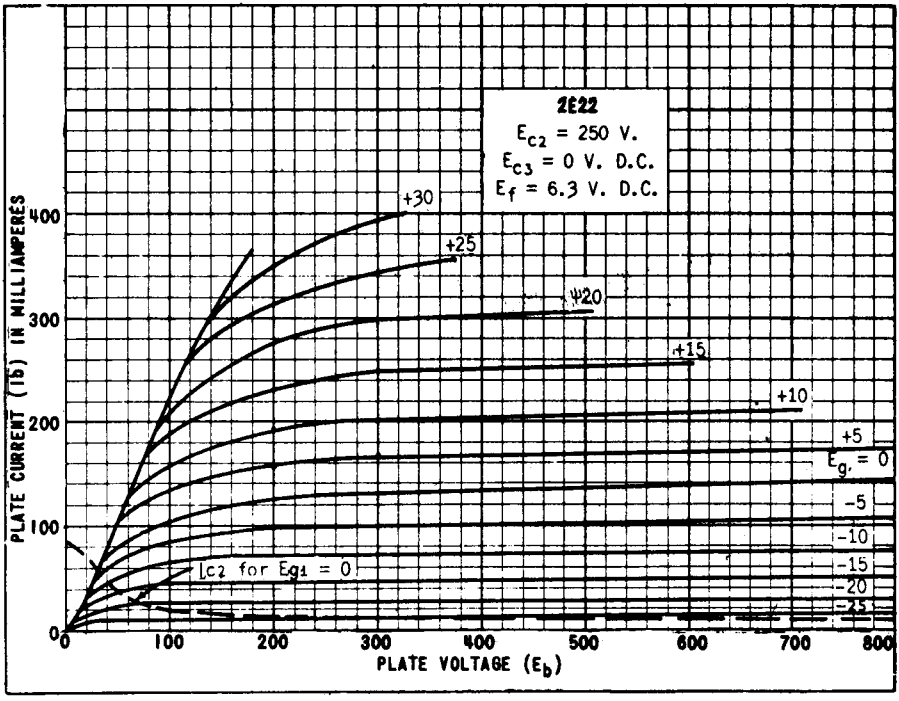

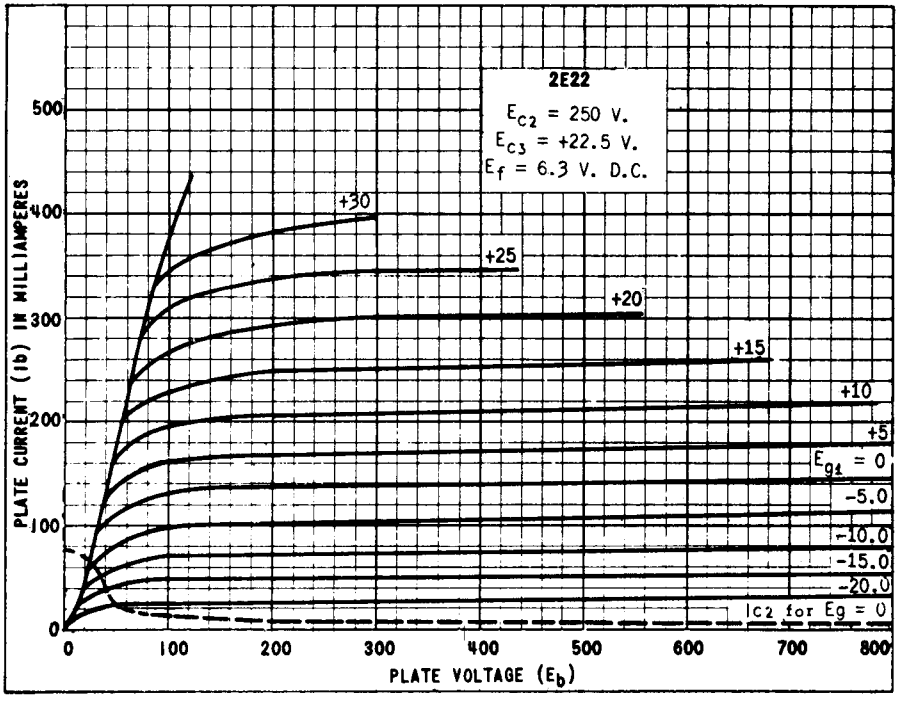

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1945

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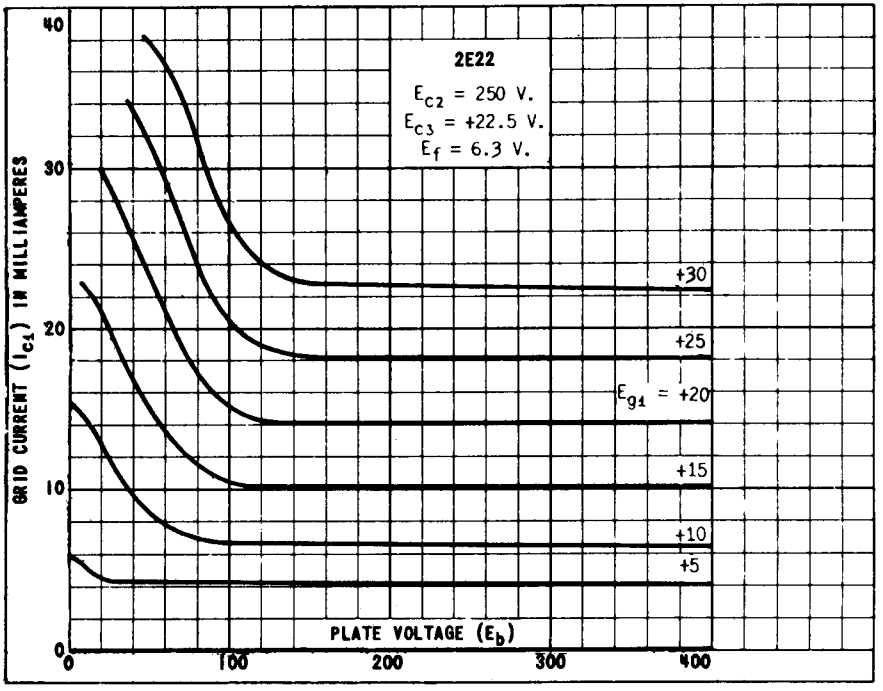
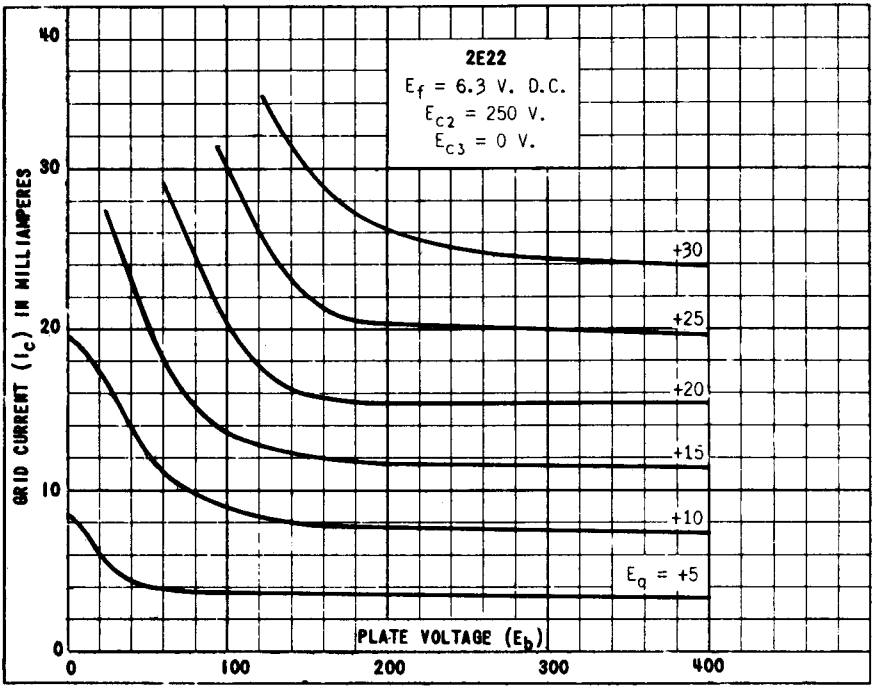
2E22





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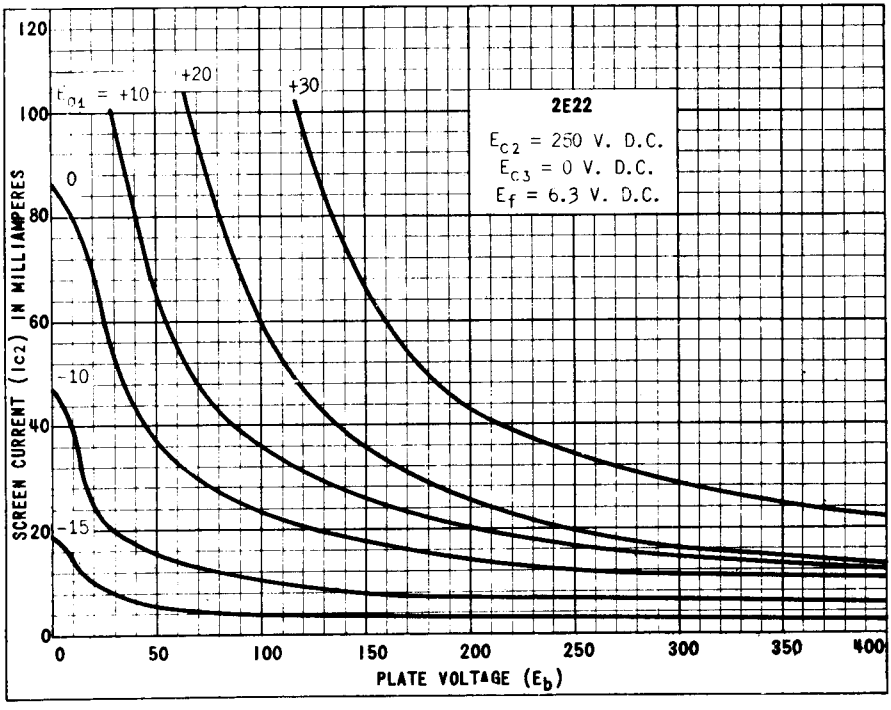

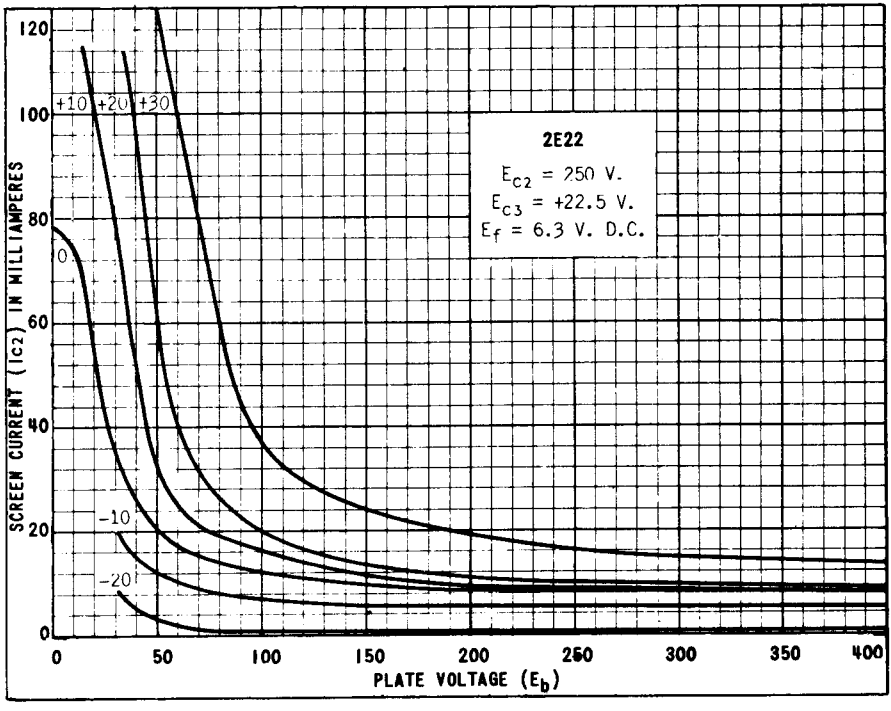

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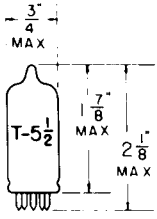
TETRODE

MINIATURE TYPE



GLASS BULB

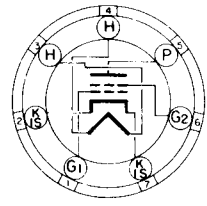
COATED UNIPOTENTIAL CATHODE

HEATER

2.4 VOLTS 0.60±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7EW

THE 2EA5 IS A SHARP CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR HIGH PLATE VOLTAGE OPERATION AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 2EA5 IS IDENTICAL TO THE 3EA5 AND 6EA5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (G1 TO P) (MAX.)	0.05	0.06	μμf
INPUT: G1 TO (H+K+G2+I.S.)	4.5	3.8	μμf
OUTPUT: P TO (H+K+G2+I.S.)	3.0	2.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.4	2.4	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.25	3.25	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	0.5	0.5	WATTS
MAXIMUM CATHODE CURRENT (DC)	20	20	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100	100	100	VOLTS
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	11.0	11.0	SECONDS

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.4	2.4	2.4	VOLTS
HEATER CURRENT	0.60±6%	0.60±6%	0.6 ±5%	AMPS.
PLATE VOLTAGE	250	250	250	VOLTS
GRID #2 VOLTAGE	140	140	140	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	-1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.15	0.15	MEGOHM
TRANSCONDUCTANCE	8000	8000	8000	μMHO
PLATE CURRENT	10	10	10	MA.
GRID #2 CURRENT	0.95	0.95	0.95	MA.
GRID #1 VOLTAGE FOR GM LESS THAN 100 μMHO	-6	-6	-6	VOLTS

B

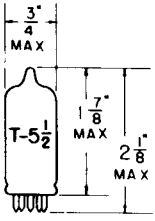
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

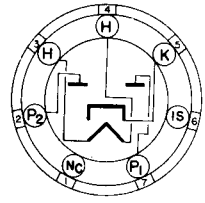


GLASS BULB

COATED UNIOPTENTIAL CATHODE

HEATER
2.1 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
7FL

THE 2EN5 IS A DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE AS A PHASE COMPARATOR IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
DIODE INPUT: P TO (H+K+I.S.) (EACH UNIT)	3.7	3.8	μμf
COUPLING: PLATE TO PLATE 1P TO 2P (MAX.)	1.3	3.8	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	2.1	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA.PLATE)	5.0	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.1	VOLTS
HEATER CURRENT	0.45±6%	AMP.
DIODE VOLTAGE DROP (APPROX.) FOR I_b=20 MA.(EA.PLATE)	5.0	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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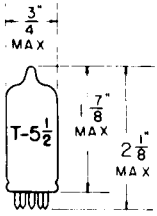
TUNG-SOL

HI-MU TRIODE ←

MINIATURE TYPE



GLASS BULB

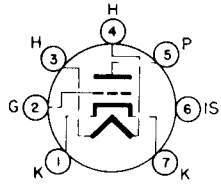
BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 2ER5 IS A HIGH TRANSCONDUCTANCE SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE IN V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE AND THE INTERNAL SHIELD REDUCES DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 2ER5 IS IDENTICAL TO THE 3ER5 AND THE 6ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
PLATE TO GRID	0.38	0.36	μμf
GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	4.4	4.4	μμf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
GRID TO CATHODE	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.3	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MAMPS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

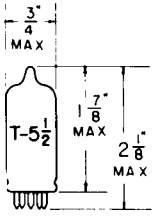
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.3	2.3		VOLTS
HEATER CURRENT	0.60	0.60		AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	−1.2	−3.8	−5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

TUNG-SOL

TRIODE

MINIATURE TYPE



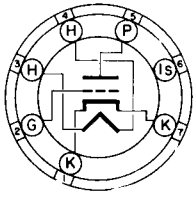
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

2.35 VOLTS 0.60±6% AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE

7 PIN BASE

7FP

THE 2ES5 IS A TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 2ES5 IS IDENTICAL TO THE 3ES5 AND THE 6ES5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.)	0.5	0.5	μμf
INPUT: G TO (H+K+I.S.)	3.2	3.2	μμf
OUTPUT: P TO(H+K+I.S.)	4.0	3.2	μμf

[A]WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.60±6%	AMP.
PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-1.0	VOLT
PLATE RESISTANCE (APPROX.)	8000	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	75	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	-6.0	VOLTS

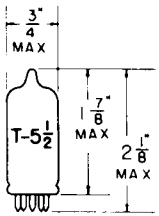
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

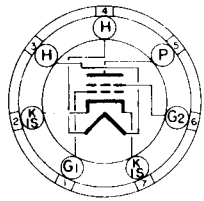
COATED UNIPOTENTIAL CATHODE

HEATER

2.4 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
7 PIN BASE
7EW

THE 2EV5 IS A HIGH GAIN, SHARP-CUTOFF SEVEN PIN TETRODE DESIGNED PARTICULARLY FOR SERVICE IN V.H.F. TELEVISION TUNERS. IT HAS HIGH TRANSCONDUCTANCE, EXTREMELY LOW SCREEN CURRENT AND HIGH INPUT IMPEDANCE AT 200 MC. RESULTING IN IMPROVED NOISE FIGURE. EXCEPT FOR HEATER RATINGS, THE 2EV5 IS IDENTICAL TO THE 3EV5 AND IS SIMILAR TO THE 6EV5.

DIRECT INTERELECTRODE CAPACITANCES[A]

WITH EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.035	μμf
INPUT	4.50	μμf
OUTPUT	2.90	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	1.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.2	WATTS
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME*	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO PIN #2.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT USEFUL LIFE NO DESIGN MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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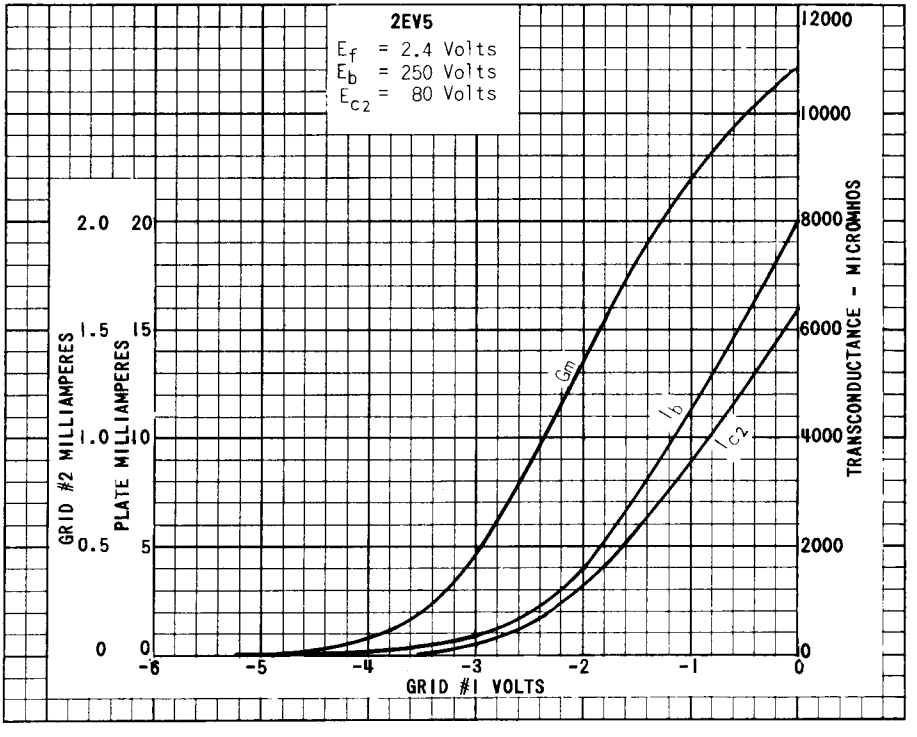
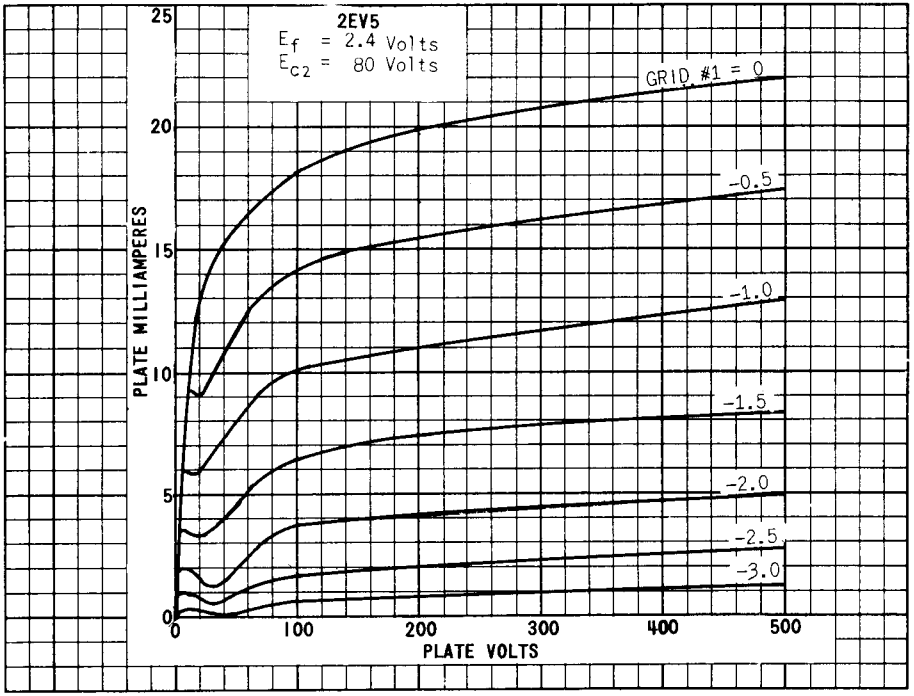
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

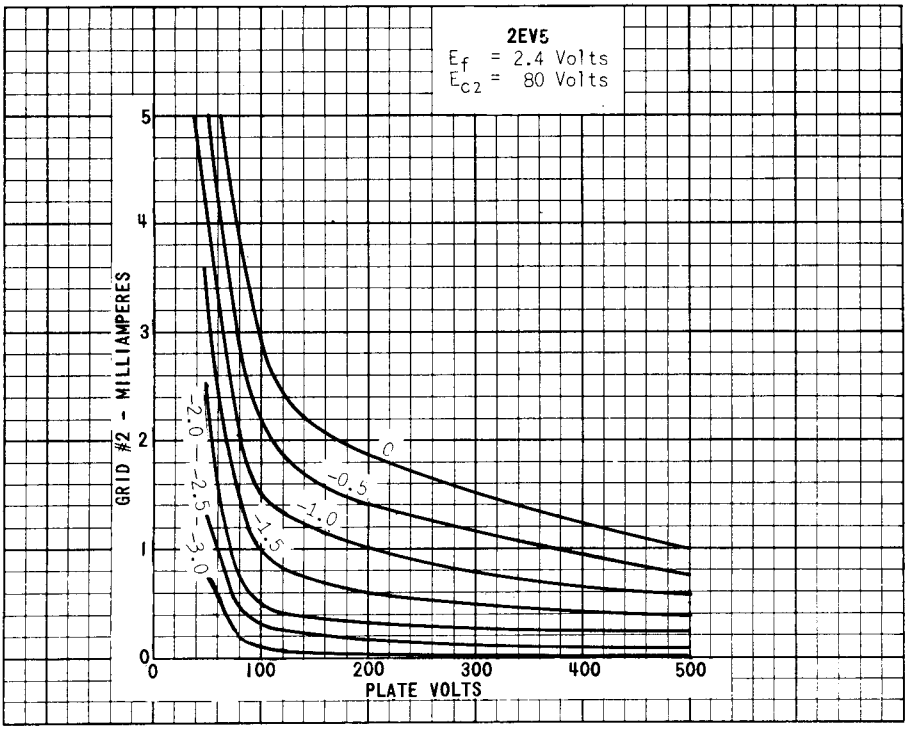
HEATER VOLTAGE	2.4	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

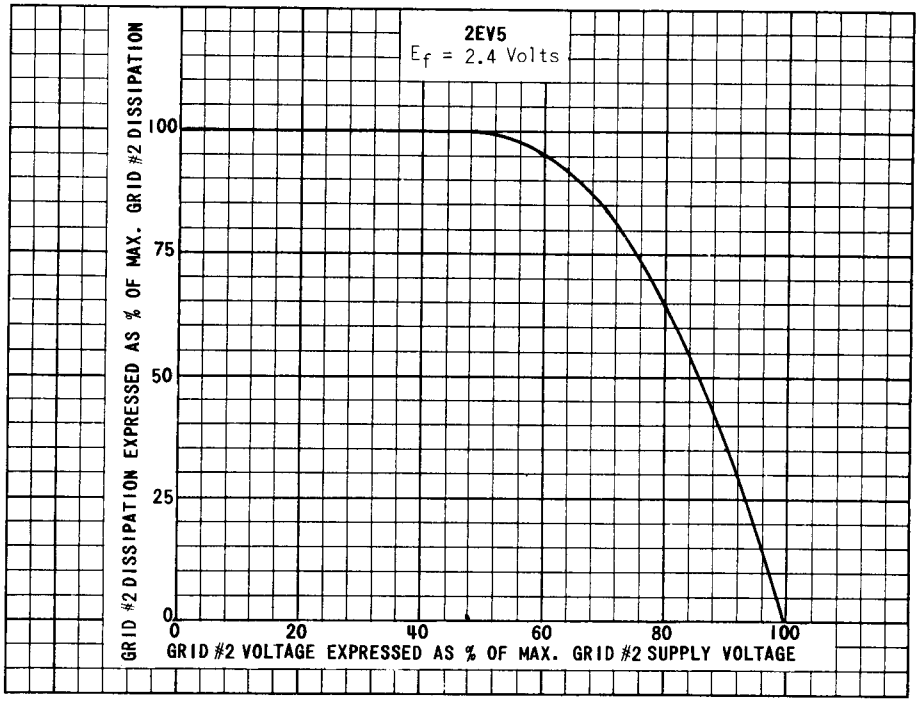
[C]FOR TRANSCONDUCTANCE OF 100 μMHOS.




2EV5
E_f = 2.4 Volts
E_{c2} = 80 Volts
GRID #1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
100
200
300
400
500


2EV5
E_f = 2.4 Volts
E_{c2} = 80 Volts
GRID #2 - MILLIAMPERES
PLATE VOLTS
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
0
1
2
3
4
5
100
200
300
400
500

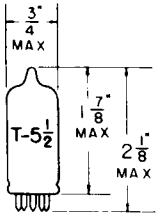
TENTATIVE DATA



TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

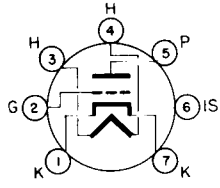
SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.35 VOLTS 0.6±6% AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 2FH5 IS A NEUTRODE TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS WITH THE NEUTRODE CONSTRUCTION PROVIDING A LOWER GRID TO PLATE CAPACITANCE WITH CONSEQUENT EASE OF NEUTRALIZATION. THE CONVENTIONAL GRID RESULTS IN LOW INPUT CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 2FH5 IS IDENTICAL TO THE 3FH5 AND 6FH5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.) (BOGEY)	→ 0.52	→ 0.52	pf
INPUT: G TO (H+K+I.S.)	3.2	3.2	pf
OUTPUT: P TO (H+K+I.S.)	4.0	3.2	pf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID VOLTAGE (POSITIVE)	0	VOLT
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
→ MAXIMUM DC HEATER-CATHODE VOLTAGE (TOTAL DC AND PEAK):		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	−1.0	VOLT
PLATE RESISTANCE (APPROX.)	5600	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	50	
PLATE CURRENT	11	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	−5.5	VOLTS

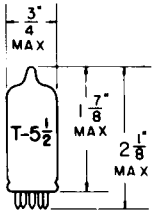
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE

MINIATURE TYPE



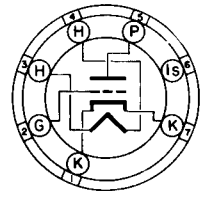
GLASS BULB
5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7FP

THE 2FQ5 IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS, AND HEATER WARM-UP TIME, THE 2FQ5 IS IDENTICAL TO THE 3FQ5 AND THE 6FQ5.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT: G TO (H+K+I.S.+E.S.)	4.8	μμf
OUTPUT: P TO (H+K+I.S.+E.S.)	4.0	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[D]	2.3[A]	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.3[A]	VOLTS
HEATER CURRENT[D]	0.60±.04	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	11.5	MA.
TRANSCONDUCTANCE	11 000	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	5 500	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-5	VOLTS

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TUNG-SOL

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NOTES

[A] THE BOGEY VALUE OF VOLTAGE/CURRENT PRECEDING THIS NOTE IS OBTAINED WHEN OPERATING THE HEATER WITH THE SPECIFIED VALUE OF CURRENT/VOLTAGE.

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT. LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

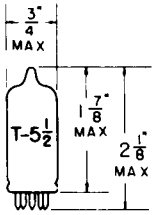
[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

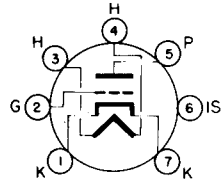
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.3 VOLTS 0.60[B] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 2FQ5A IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS, AND HEATER WARM-UP TIME, THE 2FQ5A IS IDENTICAL TO THE 3FQ5A AND THE 6FQ5A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H+K+I.S.+E.S.)	5.0	pf
OUTPUT: P TO (H+K+I.S.+E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[C]

HEATER VOLTAGE[D]	2.3	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.3	VOLTS
HEATER CURRENT[D]	0.60±.04	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	8.9	MA.
TRANSCONDUCTANCE	12000	μMHOS
AMPLIFICATION FACTOR	74	
PLATE RESISTANCE (APPROX.)	6300	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-4.3	VOLTS

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NOTES

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

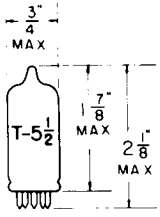
[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

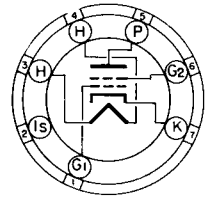
UNIPOTENTIAL CATHODE

HEATER

2.4 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE

7 PIN BASE

7FQ

THE 2FV6 IS A SHARP-CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THIS TUBE FEATURES HIGH TRANSCONDUCTANCE AND A HIGH RATIO OF PLATE CURRENT TO GRID #2 CURRENT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE

GRID #1 TO PLATE (MAX.)	0.03	μμf
GRID #1 TO CATHODE, I.S., G2, & H.	4.5	μμf
PLATE TO CATHODE, I.S., G2, & H.	3	μμf
CATHODE TO HEATER	2.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE FIG.#3	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 90 VOLTS	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 90 & 180 VOLTS	SEE FIG.#3	
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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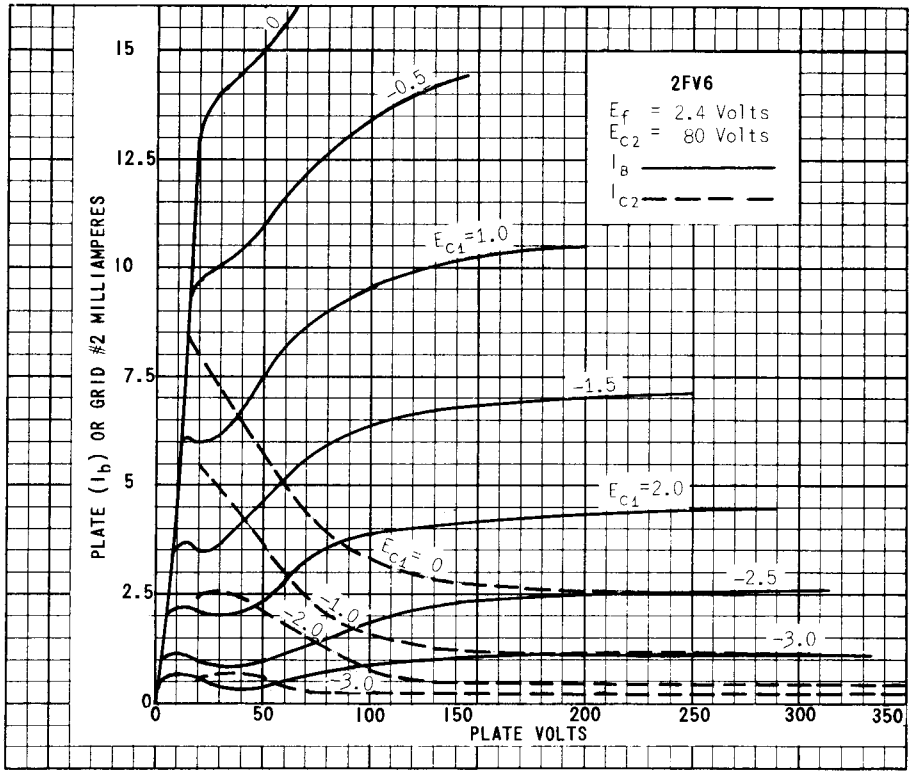
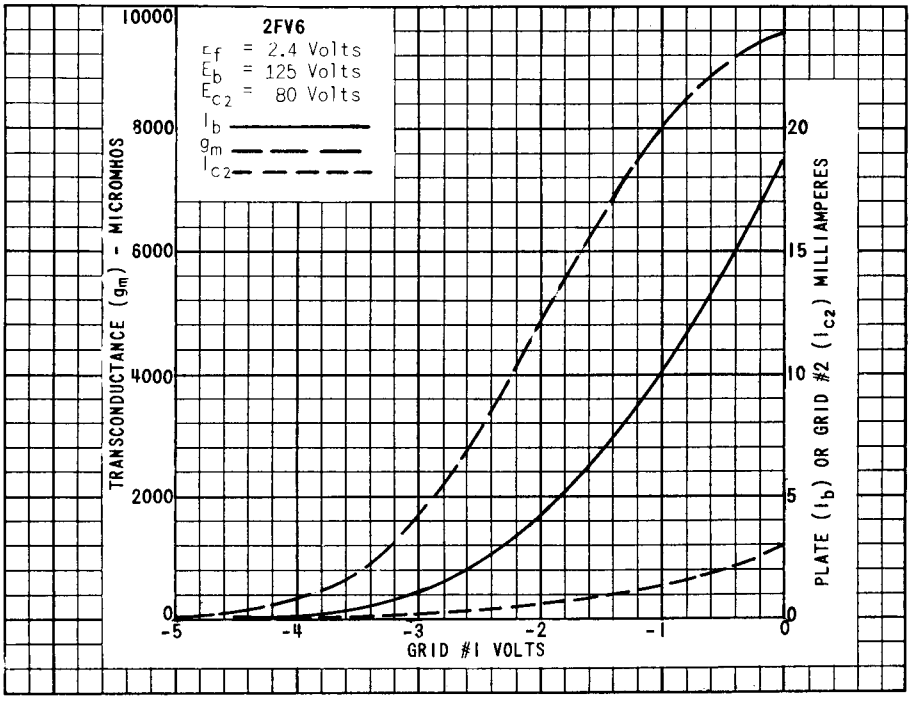
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

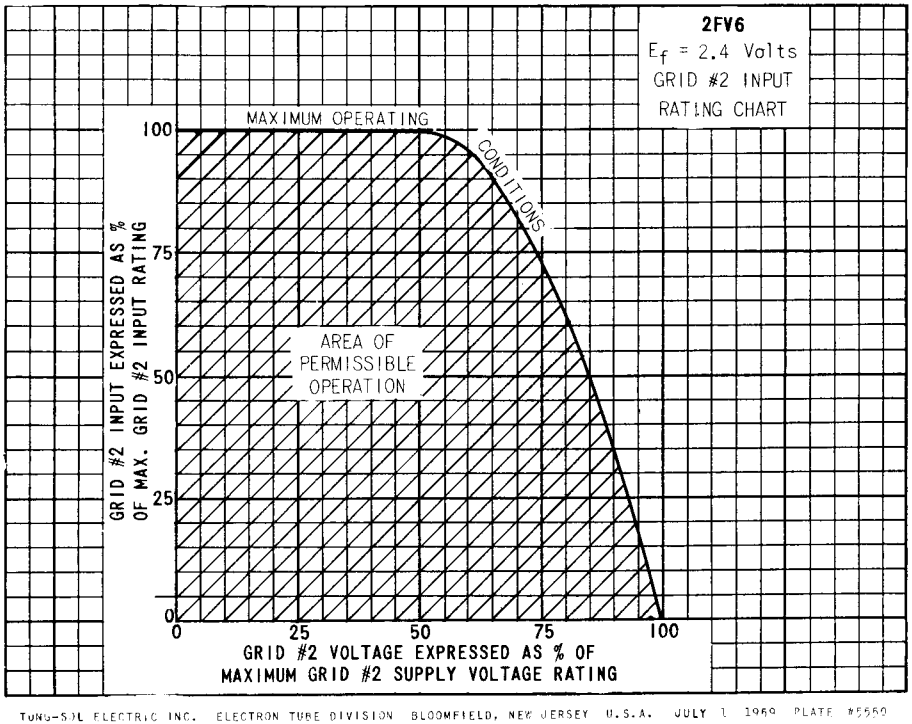
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	2.4	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	80	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-1	VOLTS
PLATE RESISTANCE (APPROX.)	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 20 μA.	-6	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.







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TUNG-SOL

TRIODE

MINIATURE TYPE

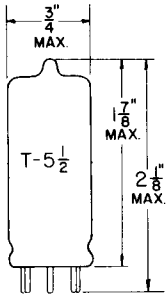
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES SUPPLY

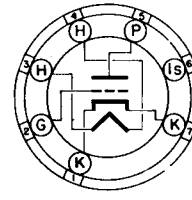
2.4 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



GLASS BULB

5-2



BOTTOM VIEW

7FP

THE 2FY5 IS A REMOTE CUT-OFF, FRAME GRID SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS, AND IS CONTROLLED FOR LOW NOISE FIGURE AT 220 MC/S AND OPERATION AT LOW SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 2FY5 IS IDENTICAL TO THE 3FY5 AND THE 6FY5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXT. SHIELD	WITH EXT. SHIELD	
INPUT	4.75	4.75	μμf
OUTPUT	3.3	4.3	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.25	0.21	μμf
GRID TO CATHODE	3.2	3.2	μμf
CATHODE TO HEATER	2.5	2.5	μμf
PLATE TO GRID	0.50	0.48	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	2.4	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE (ZERO PLATE CURRENT)	550	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CATHODE-HEATER VOLTAGE	100	VOLTS
MAXIMUM CATHODE-HEATER CIRCUIT RESISTANCE	20 000	OHMS

TYPICAL OPERATION

HEATER VOLTAGE		2.4			VOLTS
HEATER CURRENT		0.60			AMP.
PLATE VOLTAGE	135	135	135	135	VOLTS
NEGATIVE GRID BIAS	1	3.1	5	4.5	VOLTS
PLATE CURRENT	11			0.1	MA.
TRANSCONDUCTANCE	13 000	625	125	---	μMHOS
AMPLIFICATION FACTOR	70				

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2G5

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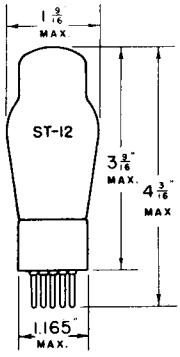
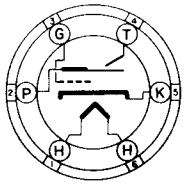


CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 0.8 AMPERE
AC OR DC

GLASS BULB



6R
BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 2G5 CONSISTS OF A CIRCULAR FLUORESCENT TARGET WITH AN INDICATING SHADOW ANGLE CONTROLLED BY AN INTERNALLY CONNECTED REMOTE CUT-OFF AMPLIFIER. WHEN THE 2G5 IS USED AS A TUNING INDICATOR, AVC VOLTAGE IS APPLIED TO THE TRIODE GRID. WITH THE EXCEPTION OF HEATER RATINGS, ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 6U5/6G5.

RATINGS

MAXIMUM PLATE SUPPLY VOLTAGE	250	VOLTS
MAXIMUM TARGET VOLTAGE	250	VOLTS
MINIMUM TARGET VOLTAGE	100	VOLTS

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE AND TARGET SUPPLY VOLTAGE	100	200	250	VOLTS
TRIODE GRID VOLTAGE (0^{o} SHADOW ANGLE)$^{APPROX.}$	-8	-18.5	-22	VOLTS
TRIODE GRID VOLTAGE (90^{o} SHADOW ANGLE)$^{APPROX.}$	0	0	0	VOLT
SERIES TRIODE PLATE RESISTOR	0.5	1	1	MEGOHM
TRIODE PLATE CURRENT (TRIODE GRID V.=0)	0.19	0.19	0.24	MA.
TARGET CURRENT (TRIODE GRID V.=0)[A]	1	3	4	MA.

[A] SUBJECT TO WIDE VARIATIONS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

PLATE 892-1

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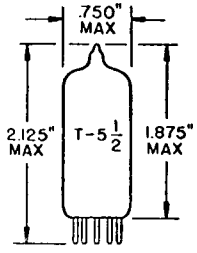
TUNG-SOL

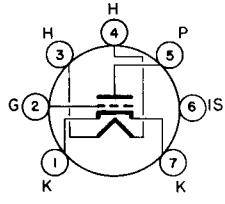
TRIODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

SHIELDED TRIODE
FOR
NEUTRODE CIRCUIT
APPLICATIONS



BOTTOM VIEW
JEDEC 7 FP

THE 2GK5 IS A FRAME GRID GAIN CONTROLLED SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF RF AMPLIFIER AT A B+ OF 135 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H + K + I.S. + E.S.)	5.0	pf
OUTPUT: P TO (H + K + I.S. + E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.3 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT	600 ± 40		MA.
HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
DC CATHODE CURRENT	22	MA.
GRID CIRCUIT RESISTANCE - SELF BIAS	1.0	MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A1 AMPLIFIER

PLATE VOLTAGE		135	VOLTS
GRID VOLTAGE		-1.0	VOLTS
PLATE CURRENT		11.5	MA.
TRANSCONDUCTANCE		15,000	μMHOS
AMPLIFICATION FACTOR		78	
PLATE RESISTANCE	Approx.	5,400	OHMS
E_c FOR G_m = 150 μMHOS	Approx.	-4.2	VOLTS
E_c FOR G_m = 1,500 μMHOS	Approx.	-2.5	VOLTS
HOT INPUT RESISTANCE - 200 Mc/s - GROUNDED PLATE		275	OHMS
HOT INPUT CAPACITANCE - 200 Mc/s - GROUNDED PLATE		11.2	pf
NOISE FIGURE - 200 Mc/s - OPTIMIZED NEUTRALIZED TRIODE RF AMPLIFIER STAGE, NOISE MATCHED		4.7	DB

TUNG-SOL

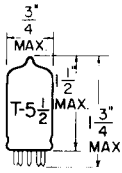
TRIODE

MINIATURE TYPE

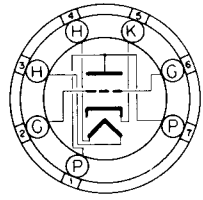
COATED UNIPOTENTIAL CATHODE

HEATER
2.35 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 2T4 IS A LOW-MU TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN OSCILLATOR IN UHF, 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6T4.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	1.7	1.7	μμf
INPUT	3.3	2.9	μμf
OUTPUT	1.8	0.25	μμf
HEATER TO CATHODE[B]	2.9	3.0	μμf
GRID TO CATHODE[B]	2.6	2.6	μμf
PLATE TO CATHODE[B]	0.18	0.20	μμf
GROUNDED GRID OPERATION			
INPUT	5.7	5.5	μμf
OUTPUT	3.4	1.8	μμf

[A] SHIELD #316.

[B] MEASURED BETWEEN SPECIFIED ELEMENTS ONLY. WHEN EXTERNAL SHIELD IS USED, IT SHALL BE GROUNDED.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.35	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	25	VOLTS
TOTAL DC AND PEAK	50	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	3.5	WATTS
MAXIMUM GRID CURRENT	8	MA.
MAXIMUM CATHODE CURRENT	30	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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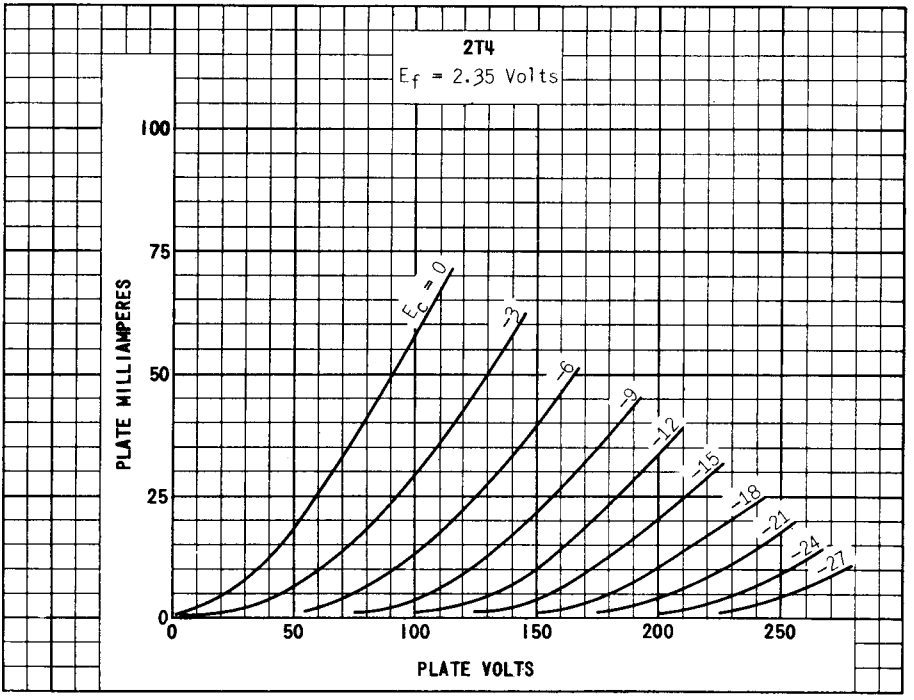
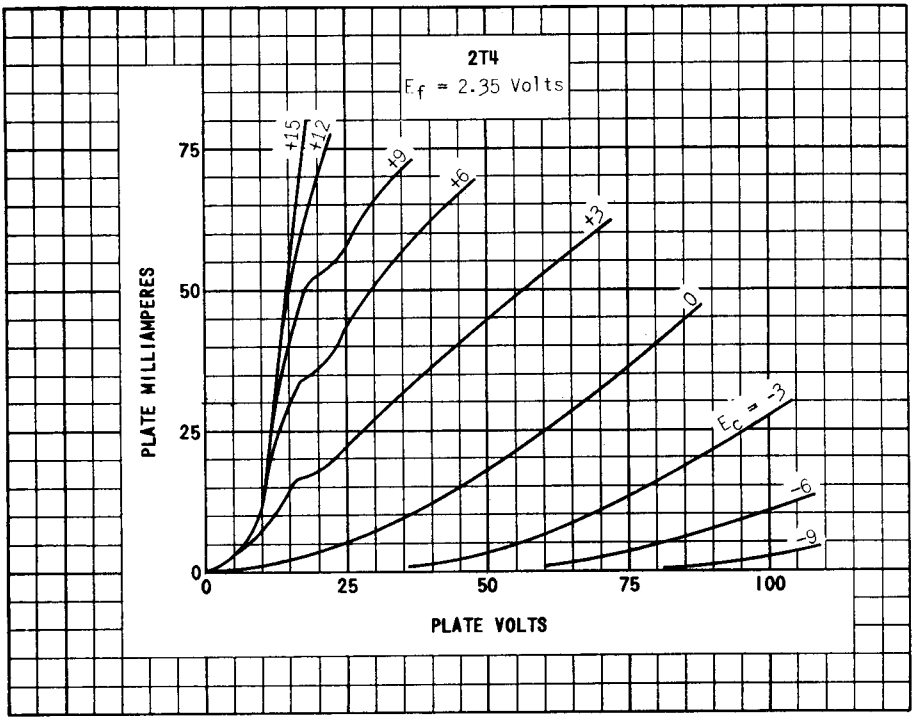
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

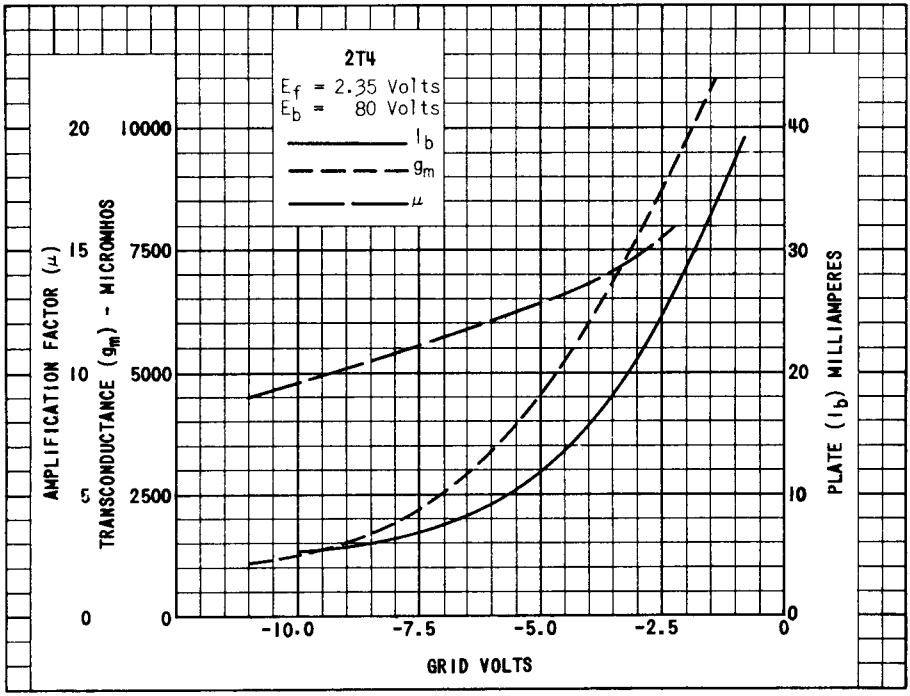
HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	18	MA.
TRANSCONDUCTANCE	7 000	μMHOS
AMPLIFICATION FACTOR	13	
PLATE RESISTANCE	1 860	OHMS
GRID VOLTAGE FOR 50 μA. PLATE CURRENT	−15	VOLTS

OSCILLATOR AT 950 MC.

HEATER VOLTAGE	2.35	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	80	VOLTS
GRID VOLTAGE (SELF BIAS)	−4	VOLTS
GRID RESISTOR	10 000	OHMS
PLATE CURRENT	18	MA.
GRID CURRENT (APPROX.)	400	μA.







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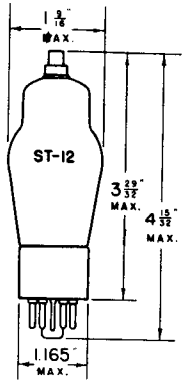
HALF WAVE, HIGH VACUUM RECTIFIER



TUNGSTEN FILAMENT

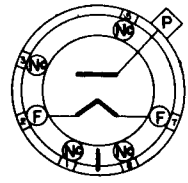
2.5 VOLTS 5 AMPERES

AC

GLASS BULB

SMALL SHELL OCTAL 6 PIN BASE

MOUNTING POSITION – VERTICAL ONLY



THE 2V3G IS INTENDED FOR USE AS THE RECTIFIER IN THE HIGH VOLTAGE SUPPLY FOR CATHODE-RAY TUBES.

RATINGS*

MAXIMUM PEAK INVERSE VOLTAGE	16500	VOLTS
MAXIMUM PEAK PLATE CURRENT	12	MA.
MAXIMUM AVERAGE PLATE CURRENT	2	MA.

*INTERPRETED ACCORDING TO RMA STANDARD M8-210

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PLATE 1410
MARCH 15 1944

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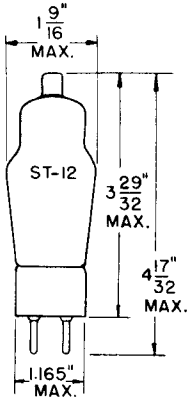
2X2 (879)

TUNG-SOL

HALF WAVE, HIGH VACUUM RECTIFIER



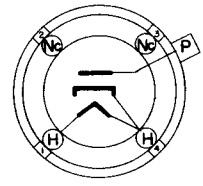
COATED UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS[A] 1.75 AMPERES
AC

GLASS BULB

SMALL 4 PIN BASE

MOUNTING POSITION – ANY



BOTTOM VIEW

THE 2X2 (879) IS INTENDED FOR USE AS THE RECTIFIER IN THE HIGH VOLTAGE SUPPLY FOR CATHODE-RAY TUBES.

RATINGS*

MAXIMUM AC PLATE VOLTAGE (RMS)[B]	4500	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	12500	VOLTS
MAXIMUM PEAK PLATE CURRENT	100	MA.
MAXIMUM DC OUTPUT CURRENT	7.5	MA.
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE (MIN.)		

*INTERPRETED ACCORDING TO RMA STANDARD M8-210

[A] IT IS IMPORTANT THAT THE HEATER TRANSFORMER SECONDARY BE INSULATED TO WITHSTAND THE MAXIMUM PEAK INVERSE VOLTAGE ENCOUNTERED IN THE INSTALLATION.

[B] IN A VOLTAGE DOUBLER CIRCUIT THE TWO 2X2 TUBES MAY BE OPERATED TO DELIVER APPROXIMATELY TWICE THE VOLTAGE OBTAINABLE FROM A HALF-WAVE RECTIFIER CIRCUIT FOR THE SAME AC INPUT VOLTAGE. IN THIS CASE A SEPARATE HEATER SUPPLY WINDING IS REQUIRED FOR EACH TUBE.

SMOOTHING FILTER REQUIREMENTS, DUE TO THE LOW CURRENT DEMAND OF CATHODE-RAY TUBES, MAY BE MET BY A SIMPLE RESISTIVE CAPACITIVE FILTER. WITH A BLEEDER LOAD CURRENT OF 1 MILLIAMPERE A CONDENSER OF 0.05 μf FOLLOWED BY A 0.5 MEGOHM RESISTOR AND A SECOND CONDENSER OF 0.15 μf IS ADEQUATE. WHEN THE VOLTAGE DROP MUST BE KEPT AT A MINIMUM, A CONDENSER OF 0.5 TO 2 μf MAY BE SHUNTED ACROSS THE BLEEDER. FILTER CONDENSERS MUST HAVE A RATING TO WITHSTAND THE INSTANTANEOUS PEAK AC INPUT VOLTAGE.

PLATE
1402
MARCH 15
1944

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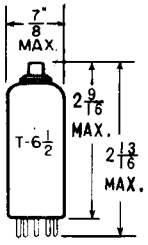
TUNG-SOL

DIODE

MINIATURE TYPE

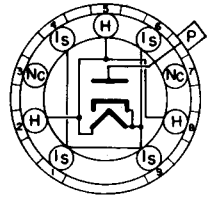


GLASS BULB
SKIRTED
MINIATURE CAP

UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.22 AMP.
AC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9DT

THE 3A2 IS A DOUBLE-ENDED, 9 PIN MINIATURE TYPE OF HALF-WAVE VACUUM RECTIFIER UTILIZING AN INDIRECTLY HEATED CATHODE. IT IS DESIGNED FOR USE AS A RECTIFIER OF HIGH VOLTAGE PULSES PRODUCED IN THE SCANNING SYSTEMS OF COLOR TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE, & INTERNAL SHIELD	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PULSED RECTIFIER SERVICE *

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	18 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	80	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.5	MA.

*FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

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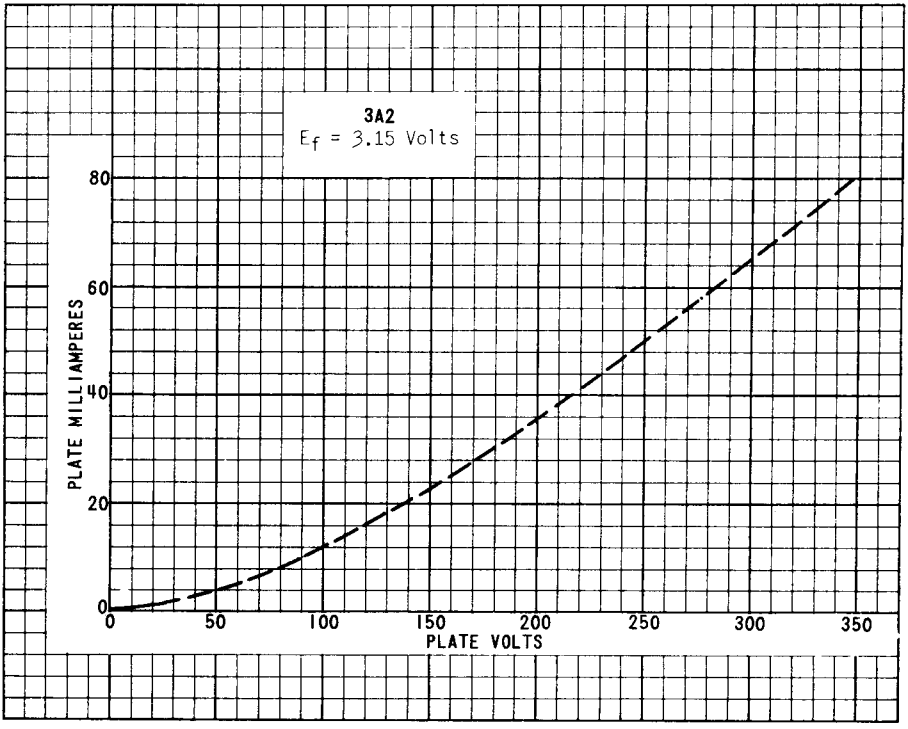
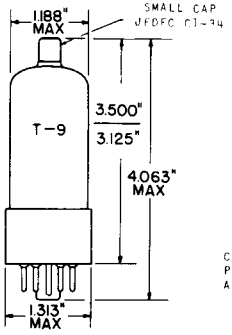

3A2
E_f = 3.15 Volts
PLATE MILLIAMPERES
0
20
40
60
80
0
50
100
150
200
250
300
350
PLATE VOLTS

TUNG-SOL

DIODE



GLASS BULB

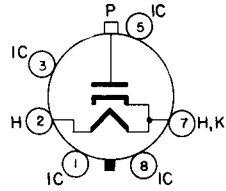
INTERMEDIATE SHELL
PIN OCTAL 86-8 x 86-60

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.22 AMP.
AC

ANY MOUNTING POSITION

CONNECTORS SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8E2

THE 3A3 IS A HALF-WAVE VACUUM RECTIFIER TUBE OF THE GLASS OCTAL TYPE UTILIZING AN INDIRECTLY HEATED CATHODE. IT IS DESIGNED FOR USE AS A RECTIFIER OF HIGH VOLTAGE PULSES PRODUCED IN THE SCANNING SYSTEMS OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

PLATE TO HEATER, CATHODE & INTERNAL SHIELD	1.5	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

PULSED RECTIFIER SERVICE

HEATER VOLTAGE	3.15[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[C]	30 000	VOLTS
MAXIMUM PEAK PLATE CURRENT	88	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.7	MA.

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS." FEDERAL COMMUNICATIONS COMMISSION.

[B] UNDER NO CIRCUMSTANCES SHOULD THIS VOLTAGE FALL BELOW 2.65 VOLTS, OR EXCEED 3.65 VOLTS.

[C] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN 525 LINE, 30 FRAME SYSTEM, 15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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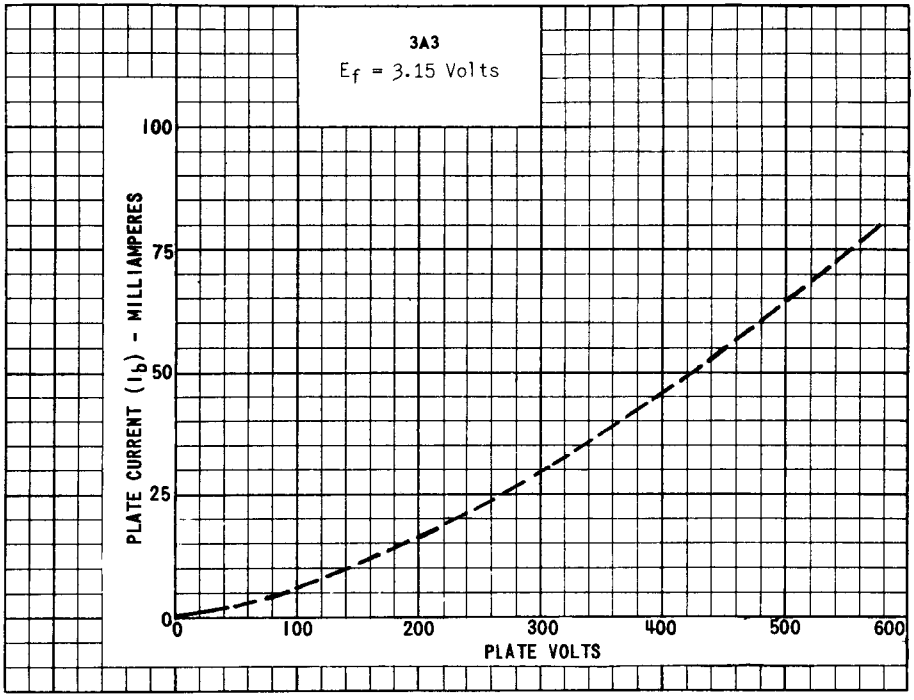
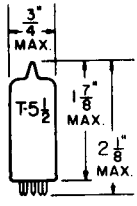

3A3
E_f = 3.15 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
100
75
50
25
0
0
100
200
300
400
500
600
PLATE VOLTS

TUNG-SOL

POWER AMPLIFIER PENTODE

MINIATURE TYPE

COATED FILAMENT



GLASS BULB

SERIES FILAMENT

E_f APPLIED BETWEEN PINS 1 & 7

E_{g1} REFERRED TO PIN 1

2.8 VOLTS
0.1 AMP.

PARALLEL FILAMENT

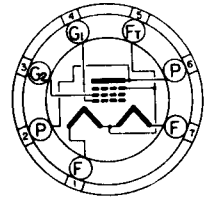
E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER.

E_{g1} REFERRED TO PIN 5

1.4 VOLTS
0.2 AMP.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 5 AND 7. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3A4.



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

ANY MOUNTING POSITION

THE 3A4 IS DESIGNED FOR USE IN COMPACT, LIGHTWEIGHT, PORTABLE EQUIPMENT. THE RELATIVELY LARGE FILAMENT EMPLOYED IN THE 3A4 ENABLES IT TO SUPPLY THE HIGH PEAK CURRENTS REQUIRED IN RF POWER APPLICATIONS. IN RF AMPLIFIER SERVICE THE 3A4 WILL DELIVER A POWER OUTPUT OF ABOUT 1.2 WATTS AT 10 MEGACYCLES. IT IS RECOMMENDED THAT NO MATERIAL BE PERMITTED TO OBSTRUCT THE HOLE IN THE BASE SOCKET AS THIS TYPE MAY BE MANUFACTURED WITH THE EXHAUST-TUBE TIP AT THE BASE END.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	AF POWER AMPLIFIER	RF POWER AMPLIFIER	
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM SCREEN VOLTAGE	90	135	VOLTS
MAXIMUM GRID VOLTAGE	---	-30	VOLTS
MAXIMUM PLATE CURRENT	---	20	MA.
MAXIMUM GRID CURRENT	---	0.25	MA.
MAXIMUM TOTAL CATHODE CURRENT	18	25	MA.
MAXIMUM PLATE INPUT	---	3.0	WATTS
MAXIMUM PLATE DISSIPATION	2.0	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.4	0.9	WATT

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE (MAX.)	0.34	μμf
INPUT	4.8	μμf
OUTPUT	4.2	μμf

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PLATE 1794
NOV. 1, 1946

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

VALUES FOR SERIES-FILAMENT OPERATION WILL BE APPROXIMATELY THE SAME AS FOR PARALLEL-FILAMENT OPERATION.

	PARALLEL FILAMENT ARRANGEMENT			
	AF POWER AMPLIFIER		RF POWER AMPLIFIER AT 10 MC.	
PLATE VOLTAGE	135	150	150	VOLTS
SCREEN VOLTAGE	90	90	135	VOLTS
GRID VOLTAGE	-7.5	-8.4	---	VOLTS
PEAK AF GRID VOLTAGE	7.5	8.4	---	VOLTS
ZERO-SIGNAL PLATE CURRENT	14.8	13.3	---	MA.
ZERO-SIGNAL SCREEN CURRENT	2.6	2.2	---	MA.
MAXIMUM-SIGNAL PLATE CURRENT	14.9	14.1	18.3	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	3.5	3.5	6.5	MA.
GRID CURRENT	---	---	0.13	MA.
GRID RESISTOR	---	---	0.2	MEGOHM
LOAD RESISTANCE	8 000	8 000	---	OHMS
PLATE RESISTANCE	90 000	100 000	---	OHMS
TRANSCONDUCTANCE	1 900	1 900	---	µMHOS
MAXIMUM-SIGNAL POWER OUTPUT	0.6	0.7	1.2 (APPROX.)	WATTS
TOTAL HARMONIC DISTORTION	5.0	6.0	---	PER CENT

PLATE 1765
NOV. 1, 1946

→ INDICATES A CHANGE OR ADDITION

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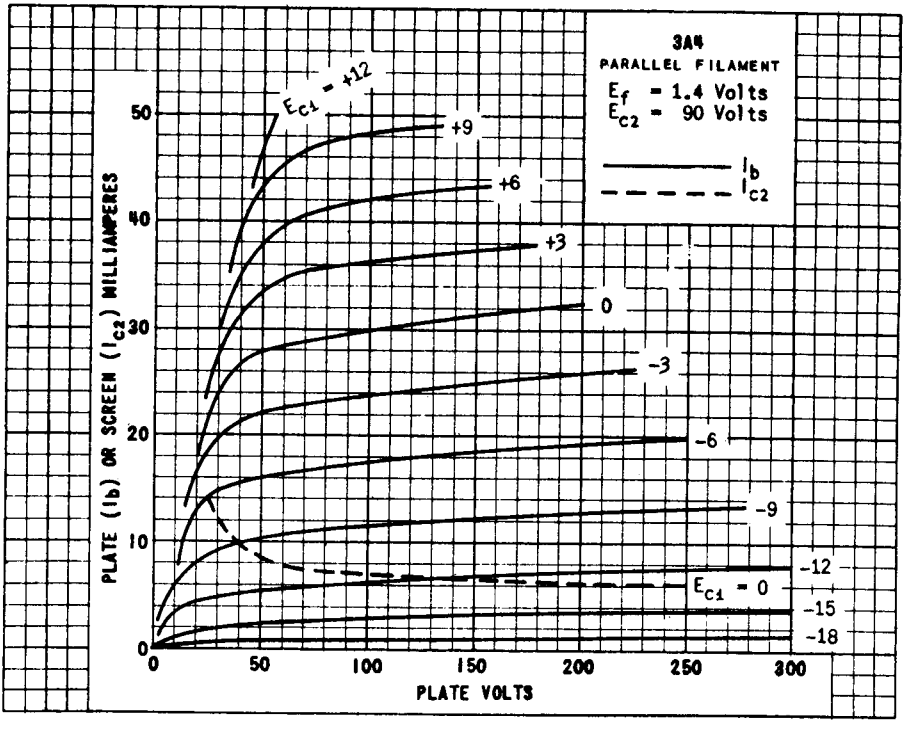

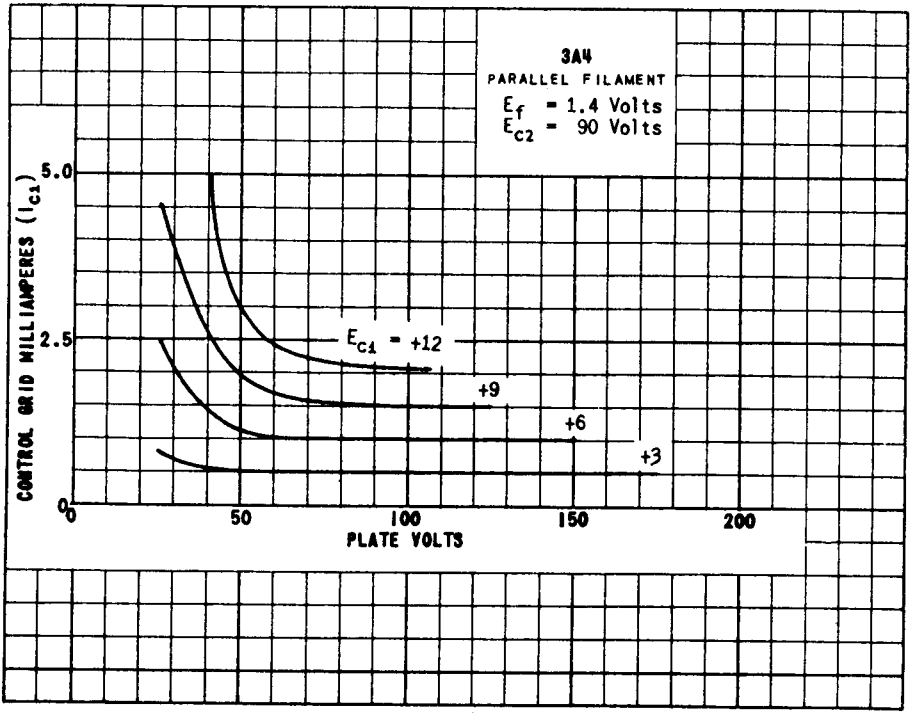

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1746
NOV. 1,
1946

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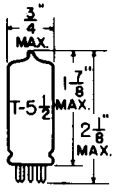
DOUBLE TRIODE

MINIATURE TYPE

COATED FILAMENT

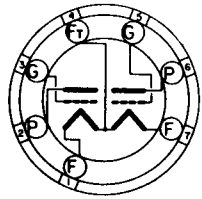


GLASS BULB

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7	E_f APPLIED BETWEEN PIN 4 AND PINS 1 & 7 TIED TOGETHER.
E_g REFERRED TO PIN 1	E_g REFERRED TO PIN 4
2.8 VOLTS 110 MA.	1.4 VOLTS 220 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 4 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 4 AND 7. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3A5.



BOTTOM VIEW
MINIATURE BUTTON 7 PIN BASE

ANY MOUNTING POSITION

THE 3A5 IS INTENDED FOR USE IN HIGH FREQUENCY APPLICATIONS. THE RELATIVELY LARGE FILAMENT EMPLOYED IN THE 3A5 ENABLES IT TO SUPPLY THE HIGH PEAK CURRENTS REQUIRED IN RF POWER APPLICATIONS. IN CLASS C SERVICE, A 3A5 WITH ITS UNITS IN PUSH-PULL WILL DELIVER A POWER OUTPUT OF APPROXIMATELY 2 WATTS AT 40 MEGACYCLES. IT MAY BE USED AT STILL HIGHER FREQUENCIES WITH REDUCED EFFICIENCY. EACH TRIODE MAY BE USED INDEPENDENTLY OF THE OTHER.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT 1	TRIODE UNIT 2	
GRID TO PLATE: (G TO P)	3.2	3.2	μμf
INPUT: (G TO H)	0.9	0.9	μμf
OUTPUT: (P TO H)	1.0	1.0	μμf
PLATE TO PLATE: (P TO P)	0.32		μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	AF AMPLIFIER	RF AMPLIFIER	
FILAMENT VOLTAGE	1.4 2.8	1.4 2.8	VOLTS
MAXIMUM PLATE VOLTAGE	135	135	VOLTS
MAXIMUM DC GRID VOLTAGE	---	-30	VOLTS
MAXIMUM PLATE CURRENT	5	---	MA.
MAXIMUM DC PLATE CURRENT (PER UNIT)	---	15	MA.
MAXIMUM DC GRID CURRENT (PER UNIT)	---	2.5	MA.
MAXIMUM PLATE DISSIPATION	0.5	---	WATT
MAXIMUM PLATE DISSIPATION (PER UNIT)	---	1.0	WATT
MAXIMUM PLATE INPUT (PER UNIT)	---	2.0	WATT

CONTINUED ON FOLLOWING PAGE

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PLATE 1909
NOV. 1, 1947

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF AMPLIFIER

HEATER VOLTAGE	1.4	2.8	VOLTS
HEATER CURRENT	220	110	MA.
PLATE VOLTAGE	90		VOLTS
GRID VOLTAGE	-2.5		VOLTS
PLATE CURRENT	3.7		MA.
PLATE RESISTANCE	8 300		OHMS
TRANSCONDUCTANCE	1 800		µMHOS
AMPLIFICATION FACTOR	15		

RF POWER AMPLIFIER AND OSCILLATOR-CLASS "C' TELEGRAPHY

AT 40 MC WITH BOTH UNITS IN PUSH-PULL
(KEY-DOWN CONDITIONS PER TUBE WITHOUT MODULATION)

FILAMENT VOLTAGE	1.4	2.8	VOLTS
FILAMENT CURRENT	220	110	MA.
DC PLATE VOLTAGE	135		VOLTS
DC GRID VOLTAGE:			
FROM A FIXED SUPPLY OF	-20		VOLTS
FROM A GRID RESISTOR OF	4 000		OHMS
FROM A CATHODE RESISTOR OF	570		OHMS
PEAK RF GRID-TO-GRID VOLTAGE	90		VOLTS
DC PLATE CURRENT	30		MA.
DC GRID CURRENT (APPROX.)	5		MA.
DRIVING POWER (APPROX.)	0.2		WATT
POWER OUTPUT (APPROX.)	2		WATTS

PLATE 1910
NOV. 1, 1947

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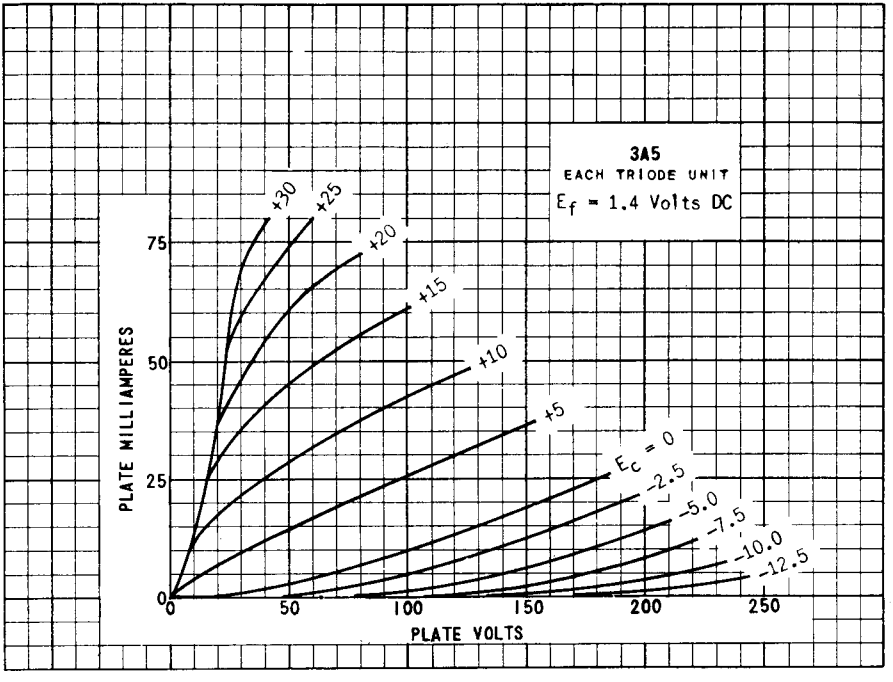

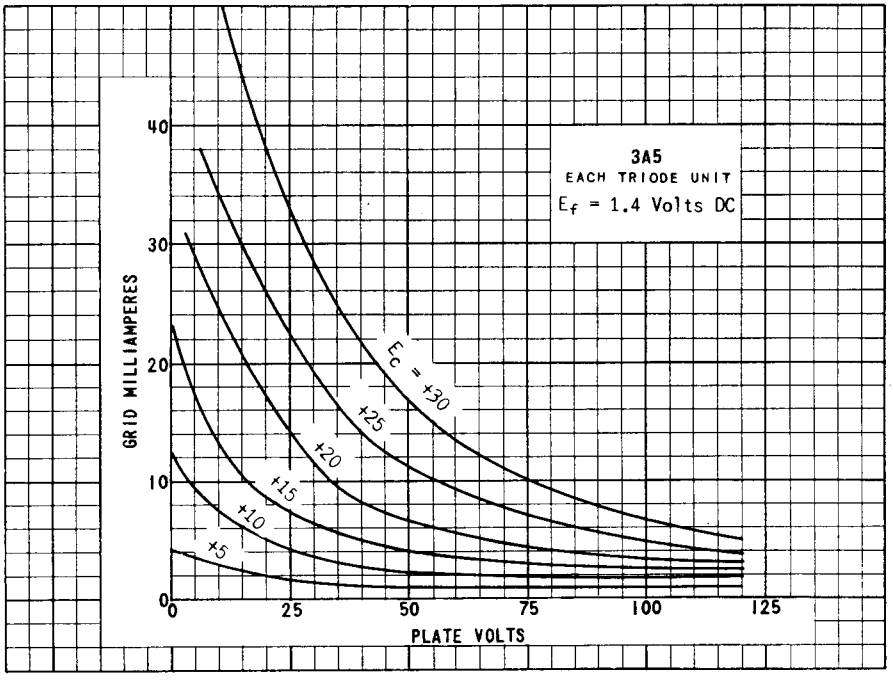

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1911
NOV. 1,
1947

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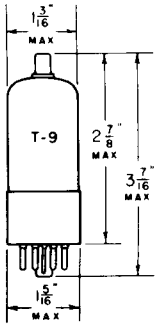
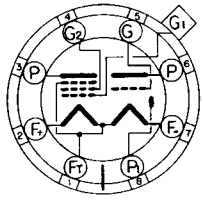


DIODE TRIODE PENTODE

DETECTOR AMPLIFIER

COATED FILAMENT

SERIES	PARALLEL
2.8 V.	1.4 V.
.05 A.	0.1 A.



BOTTOM VIEW

GLASS BULB

INTERMEDIATE 8 PIN OCTAL BASE

THE 3A8GT IS A LOW FILAMENT DRAIN TYPE INCORPORATING IN ONE ENVELOPE A SINGLE DIODE, A HIGH MU-TRIODE, AND A VOLTAGE AMPLIFIER PENTODE. THE THREE UNITS ARE INDEPENDENT WITH THE EXCEPTION OF THE COMMON TAPPED FILAMENT. THE TUBE IS ESSENTIALLY THE EQUIVALENT OF A 1H5GT AND A 1N5GT IN ONE ENVELOPE.

RATINGS

	TRIODE	PENTODE	
MAXIMUM PLATE VOLTAGE	110	110	VOLTS
MAXIMUM SCREEN VOLTAGE	–	110	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH CLOSE FITTING SHIELD CONNECTED TO FILAMENT

	TRIODE	PENTODE	
GRID TO PLATE	2.0	.012	μμf
INPUT	2.6	3.0	μμf
OUTPUT	4.2	10.0	μμf

CONTINUED NEXT PAGE

PLATE 1461
AUG. 31 1944

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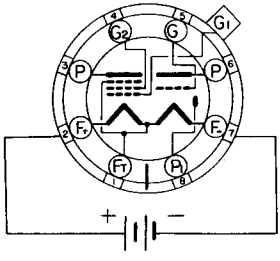
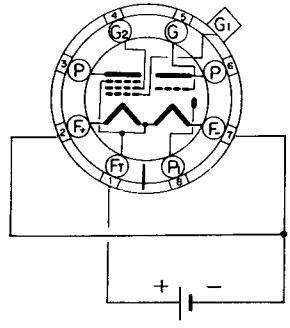
3A8GT

TUNG-SOL

FILAMENTS CONNECTED IN SERIES



FILAMENTS CONNECTED IN PARALLEL



TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	90	90	VOLTS
SCREEN VOLTAGE	–	90	VOLTS
GRID VOLTAGE [A]	0	0	VOLTS
PLATE CURRENT	0.2	1.5	MA.
SCREEN CURRENT	–	0.5	MA.
PLATE RESISTANCE (APPROX.)	0.2	0.8	MEGOHM
TRANSCONDUCTANCE	325	750	μMHOS
AMPLIFICATION FACTOR	65	–	

[A] GRID BIAS MEASURED FROM THE NEGATIVE FILAMENT OF EACH SECTION.

DIODE UNIT

THE DIODE PLATE IS LOCATED AT THE NEGATIVE END OF THE FILAMENT, AND IS INDEPENDENT OF THE TRIODE UNIT AND OF THE PENTODE UNIT EXCEPT FOR THE COMMON FILAMENT.

MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED IS 0.5 MA.

PLATE 1462
AUG. 31 1944

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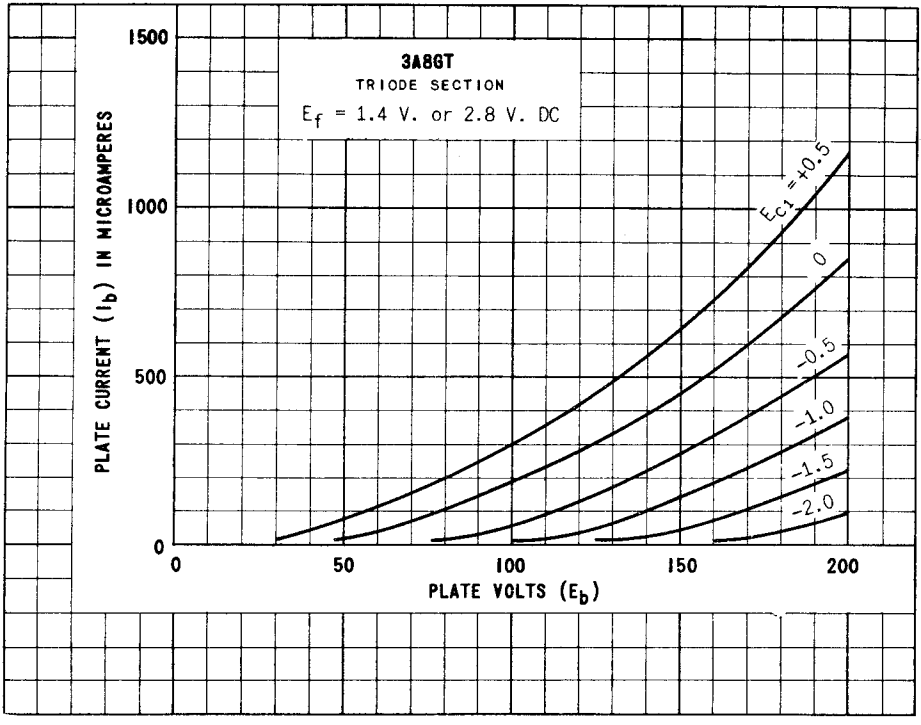

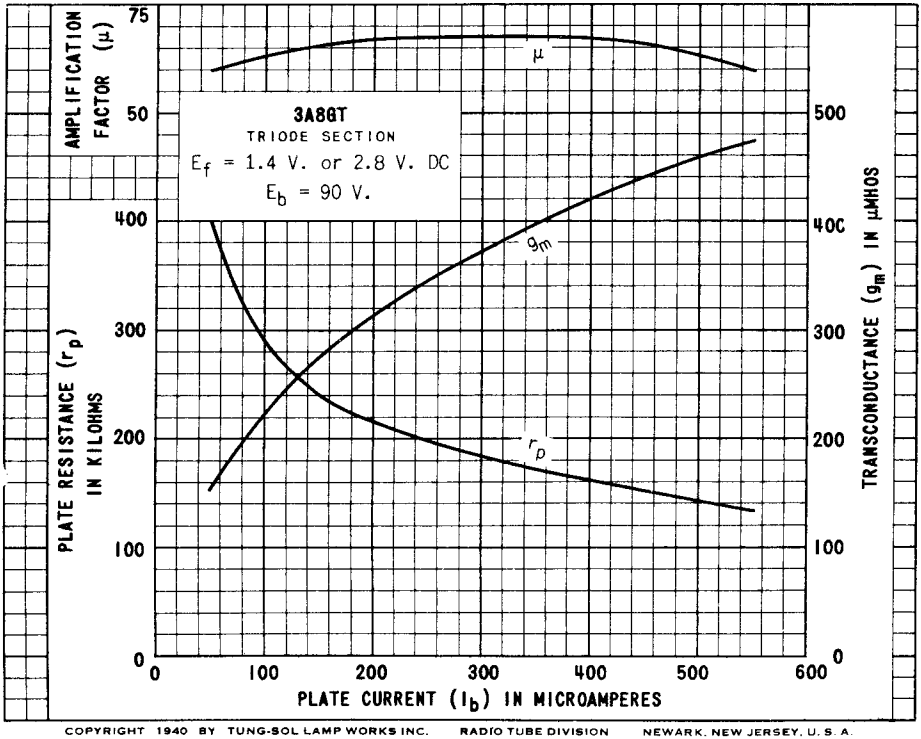

PLATE
724-1

MAY 20
1940

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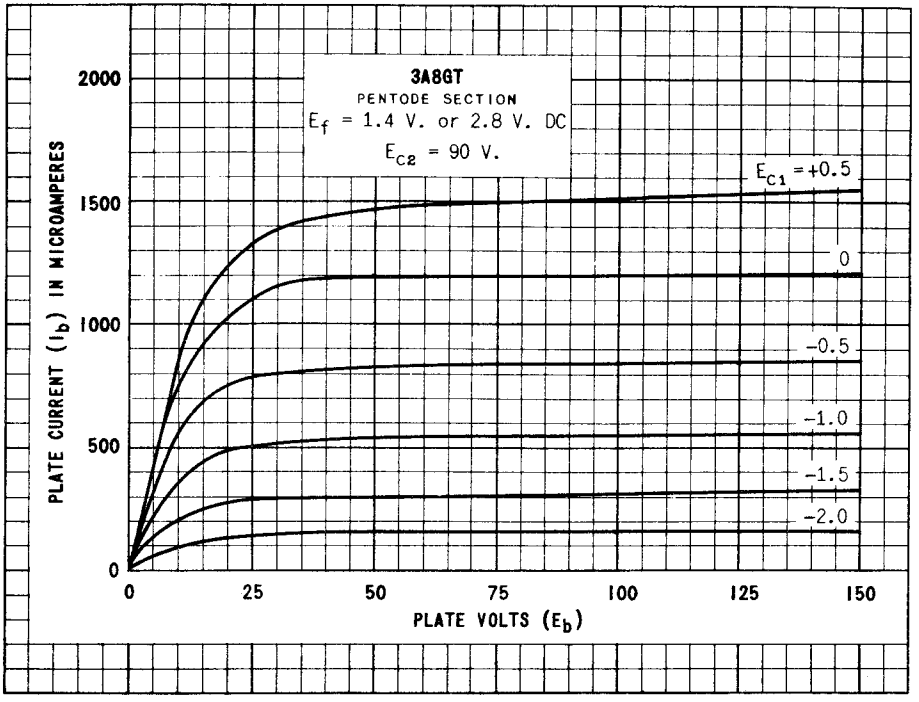
3A8 GT



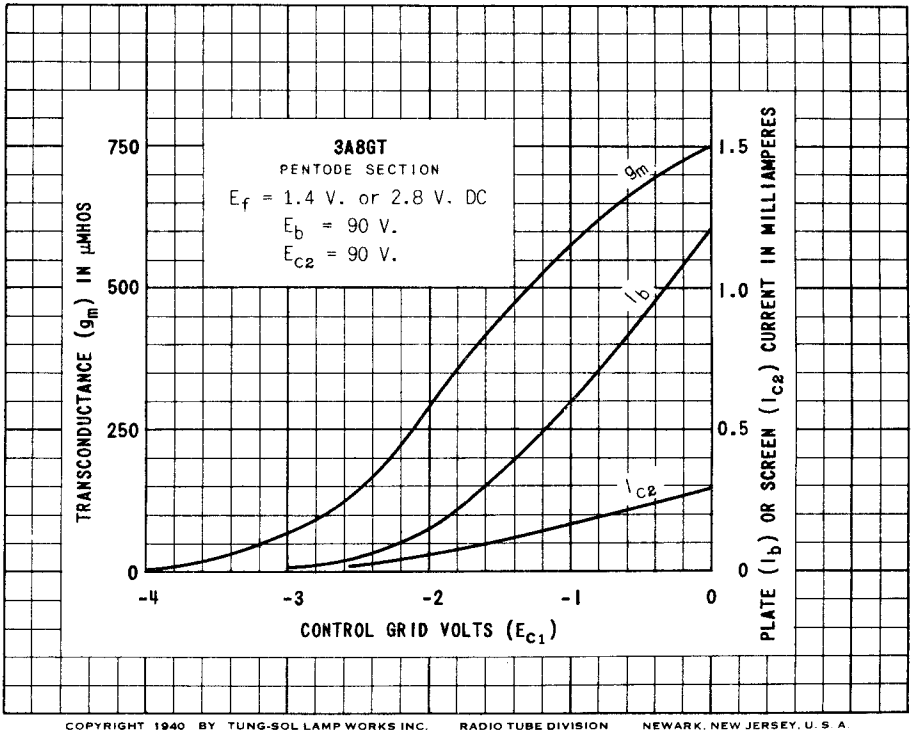


PLATE 725-1

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TUNG-SOL

TRIODE

MINIATURE TYPES

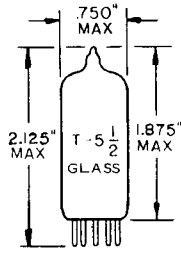
FOR

UHF TELEVISION SERVICE

COATED UNIPOTENTIAL CATHODE

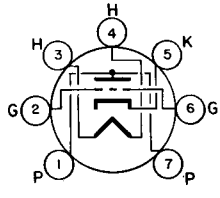
ANY MOUNTING POSITION

3AF4
OUTLINE
JEDEC 5-2



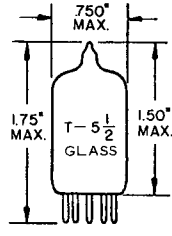
BASE 7 PIN BUTTON
JEDEC E7-1

BASING DIAGRAM
JEDEC 7DK



BOTTOM VIEW

3AF4A
OUTLINE
JEDEC 5-1



BASE 7 PIN BUTTON
JEDEC E7-1

THE 3AF4 AND 3AF4A ARE MEDIUM MU TRIODES IN THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE UHF REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. ELECTRICALLY THE 3AF4 IS IDENTICAL TO THE 3AF4A AND DIFFERS IN ENVELOPE SIZE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE EXCEPT AS NOTED

GRID TO PLATE	1.9	pf
GRID TO CATHODE AND HEATER	2.2	pf
PLATE TO CATHODE AND HEATER	1.4	pf
HEATER TO CATHODE - SEE NOTE BELOW	2.2	pf

NOTE: WITH EXTERNAL SHIELD #316 CONNECTED TO PLATE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		50	VOLTS
DC COMPONENT		25	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID CURRENT	2	mA
CATHODE CURRENT	24	mA

CHARACTERISTICS

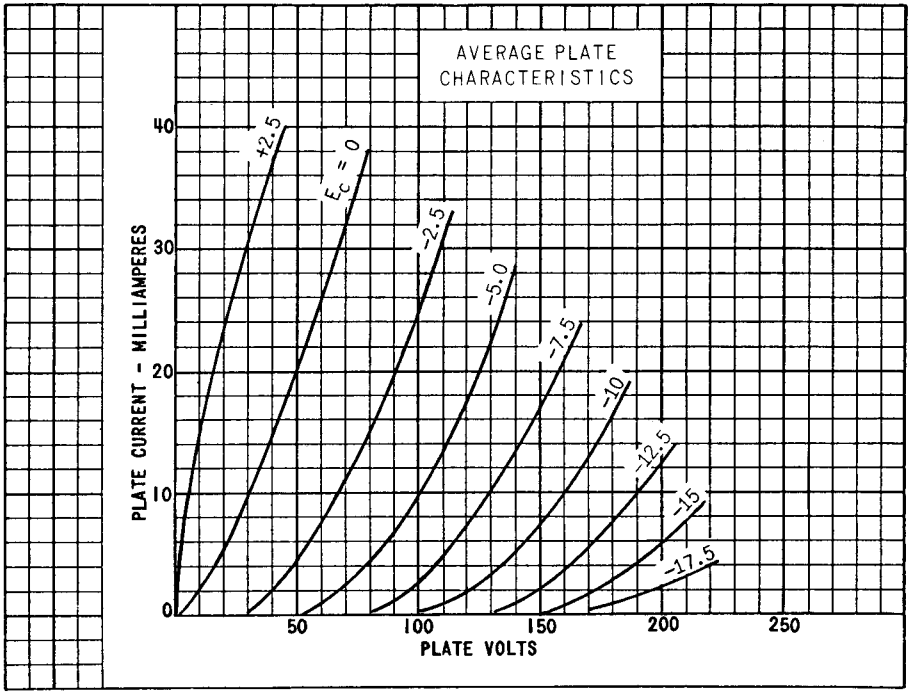
CLASS A_1 AMPLIFIER

PLATE VOLTAGE		80	VOLTS
CATHODE RESISTOR		150	OHMS
PLATE CURRENT		17.5	mA
TRANSCONDUCTANCE		6,500	μMHOS
AMPLIFICATION FACTOR		13.5	
PLATE RESISTANCE	APPROX.	2,100	OHMS

TYPICAL OPERATION

AT FREQUENCY OF 1.000 MC/S

PLATE VOLTAGE		100	VOLTS
PLATE RESISTOR		220	OHMS
GRID RESISTOR		10,000	OHMS
PLATE CURRENT		17	mA
GRID CURRENT	APPROX.	750	μA



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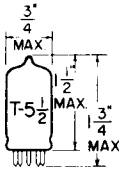
TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

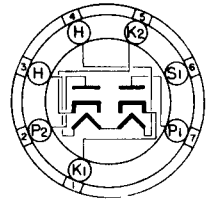


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 3AL5 COMBINES TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS, ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM DETECTOR SERVICE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6AL5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
PLATE INPUT: P TO (H+K+IS) EACH UNIT	2.5	3.2	μμf
COUPLING: 1P TO 2P (MAX.)	0.068	0.026	μμf
CATHODE INPUT: K TO (P+H+IS) EACH UNIT	3.4	3.6	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM HEATER-CATHOLDE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM AC PLATE VOLTAGE (EACH PLATE) RMS	117	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	54	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	9	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	OHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	60	MA.

THE RESONANT FREQUENCY OF EACH UNIT OF THE 3AL5 IS 700 MC. (APPROX.)

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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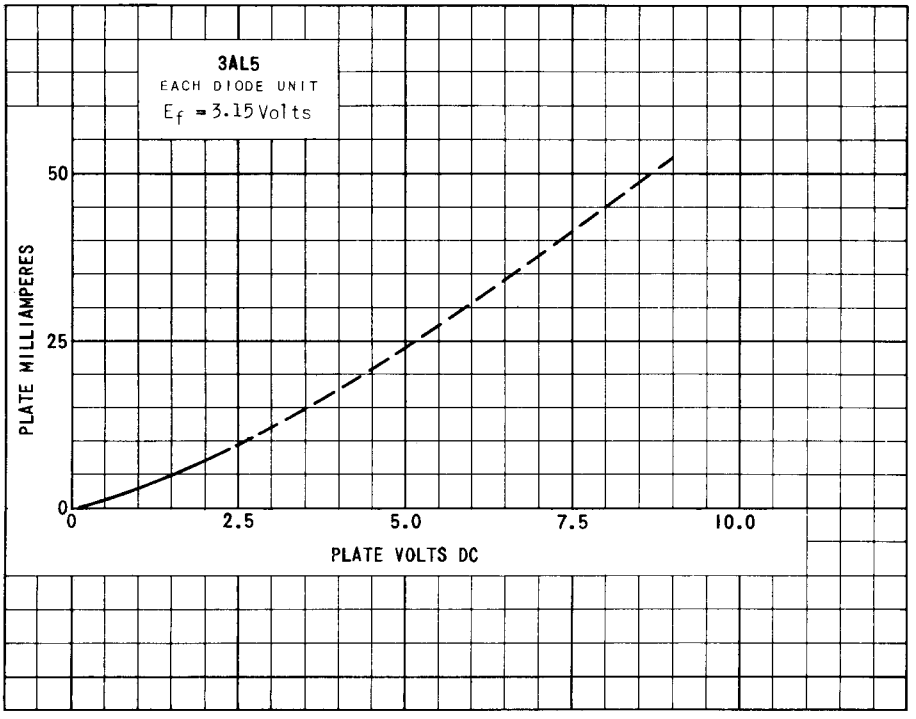
3AL5



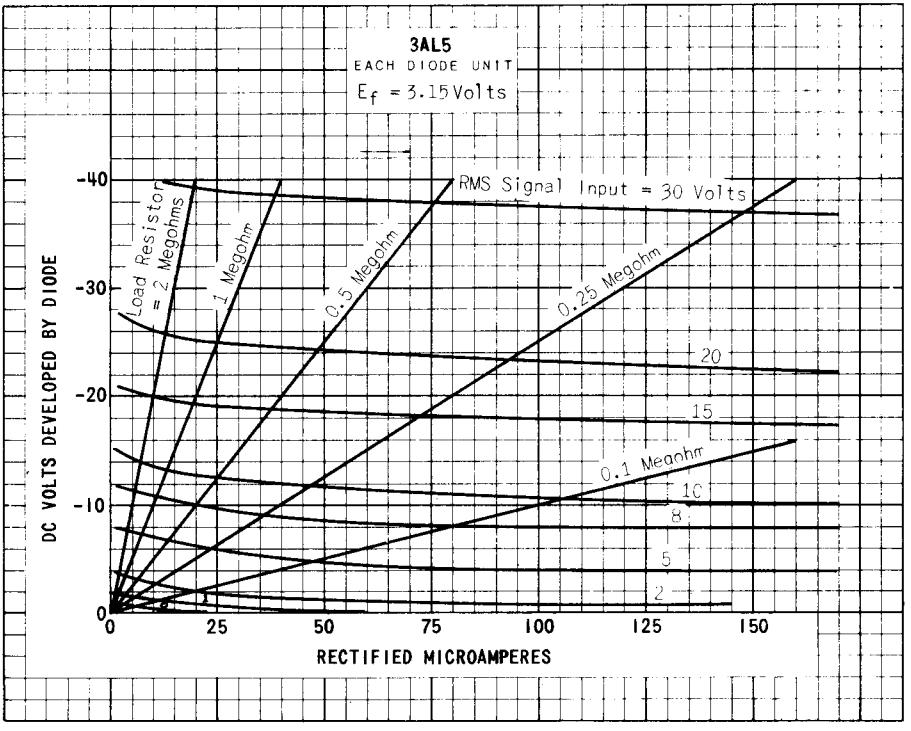


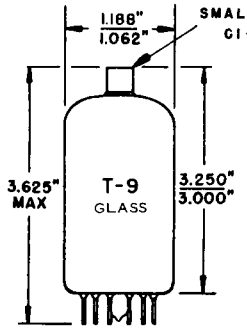
PLATE #3933 SEPTEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

OUTLINE DRAWING
JEDEC 9-100

DIODE

COMPACTRON

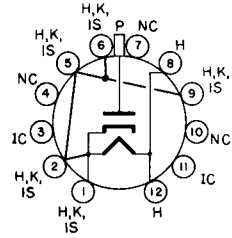


BASE 12 PIN BUTTON
JEDEC E12-70

CATHODE TYPE DIODE
FOR
USE AS A HIGH VOLTAGE
HALF-WAVE RECTIFIER
IN T.V. RECEIVERS

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12FV ←



BOTTOM VIEW

THE 3AT2 IS A CATHODE TYPE DIODE IN THE T-9, 12 PIN, DOUBLE ENDED COMPACTRON CONSTRUCTION. IT IS DESIGNED FOR USE AS A HIGH VOLTAGE RECTIFIER IN THE FLY-BACK CIRCUITS OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER, CATHODE AND INTERNAL SHIELD	Approx. 1.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	220	MA
LIMITS OF APPLIED VOLTAGE		3.15 ± 0.3	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FLY-BACK VOLTAGE RECTIFIER

PEAK INVERSE PLATE VOLTAGE	30,000	VOLTS
PEAK PLATE CURRENT	88	MA
DC PLATE CURRENT	1.7	MA

→ INDICATES A CHANGE

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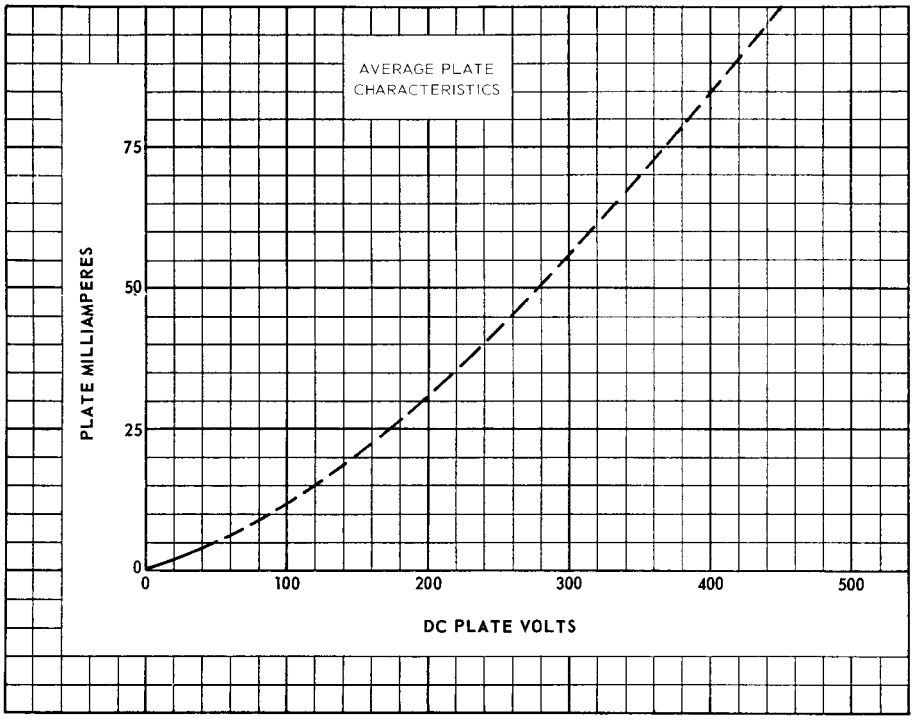
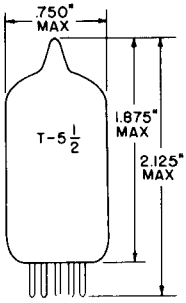
3AT2


AVERAGE PLATE
CHARACTERISTICS
PLATE MILLIAMPERES
75
50
25
0
0
100
200
300
400
500
DC PLATE VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

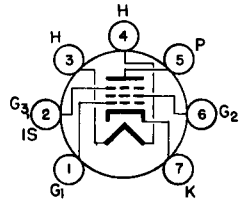
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 600±40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 3AU6 IS A PENTODE AMPLIFIER WITH SHARP CUT-OFF CONTROL CHARACTERISTICS. USING THE 7 PIN MINIATURE CONSTRUCTION, IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. WITH HIGH TRANSCONDUCTANCE AND LOW GRID PLATE CAPACITANCE, IT IS INTENDED FOR SERVICE AS EITHER AN RF OR AF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6AU6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	0.003	0.003	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	pf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	pf
INPUT: G_1 TO (H+K)	3.2	3.2	pf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	8.5	1.2	pf

[A] SHIELD #316 CONNECTED TO PIN #7.

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[C]	PENTODE CONNECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200●	200●	VOLTS
MAXIMUM PLATE VOLTAGE	275	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE J5-C4-2	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.5	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	---	WATTS
MAXIMUM GRID #2 INPUT: *			VOLTS
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.75	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS *	---	SEE J5-C4-2	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11.0		SECONDS

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	130	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	µMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA.	-4.2	-5.5	-6.5	VOLTS

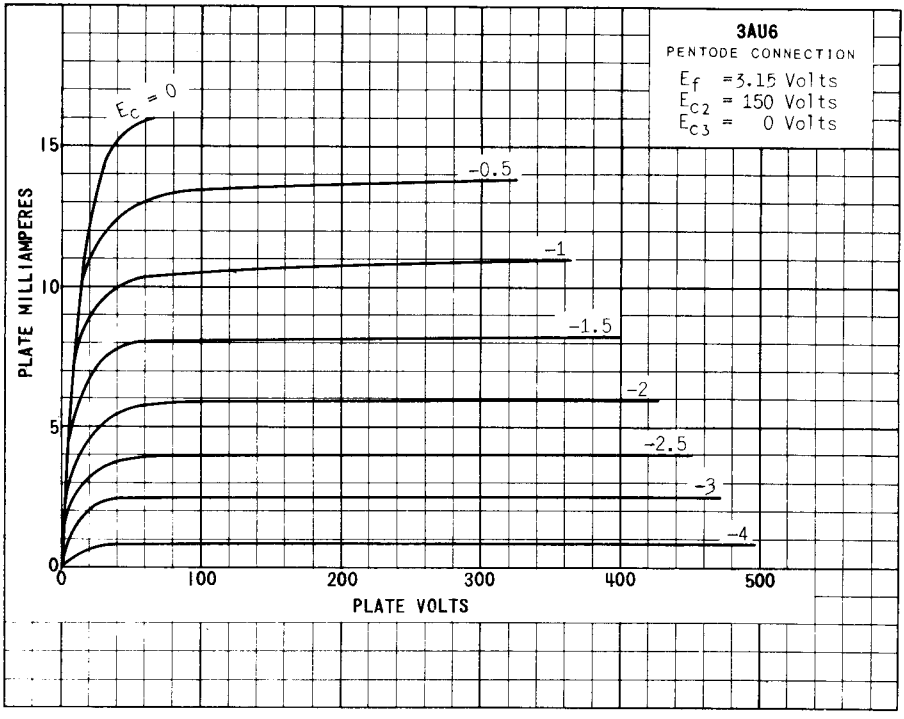
CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

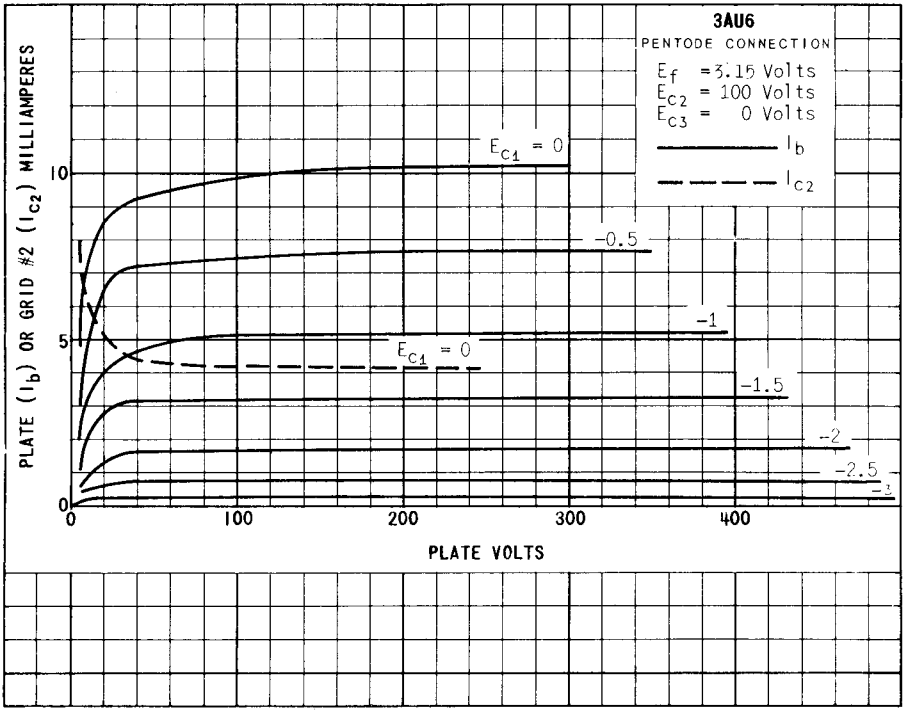
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	µMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

•THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.





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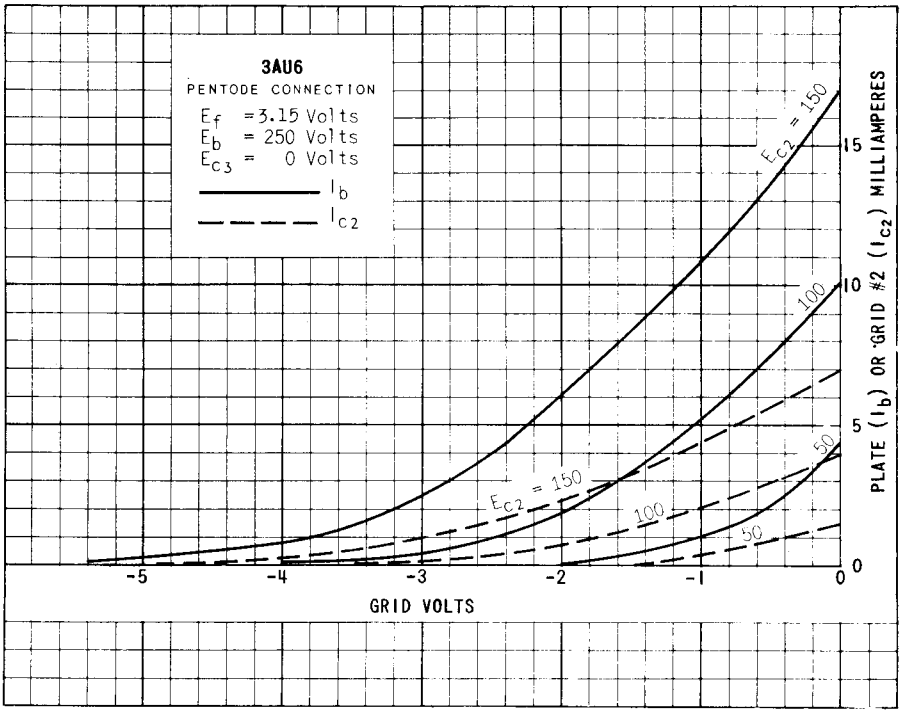
3AU6



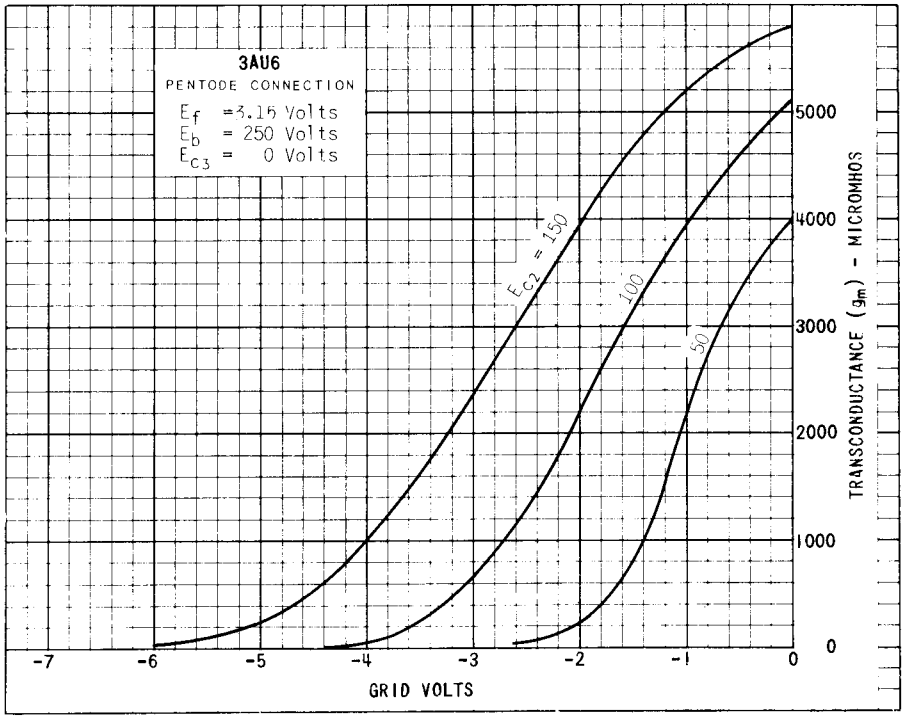
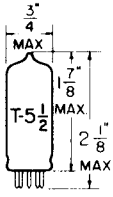


PLATE #3873 AUGUST 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

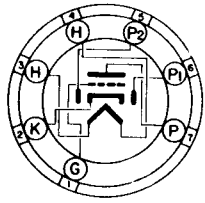


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
78T

THE 3AV6, WHICH COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT PERMITS A SINGLE TUBE TO FUNCTION AS A DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6AV6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
→ MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EACH UNIT)	1	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

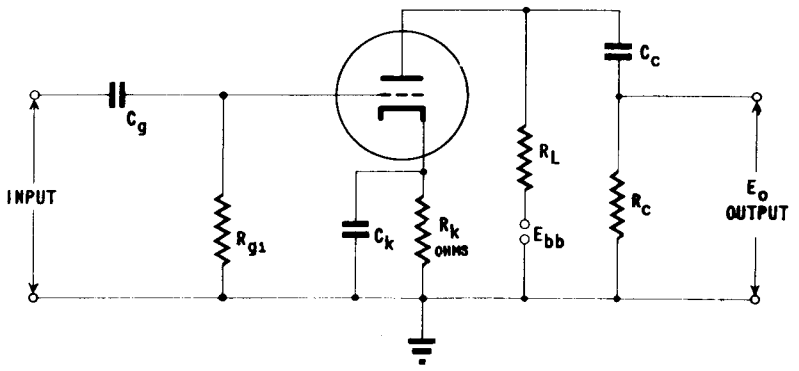
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	-1	-2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

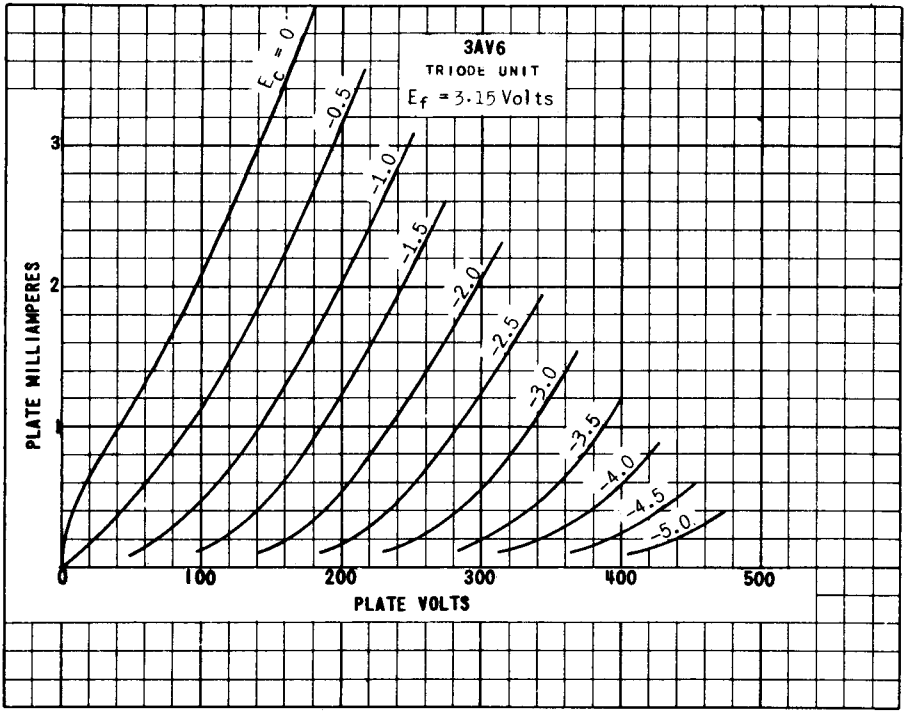
RESISTANCE COUPLED AMPLIFIER

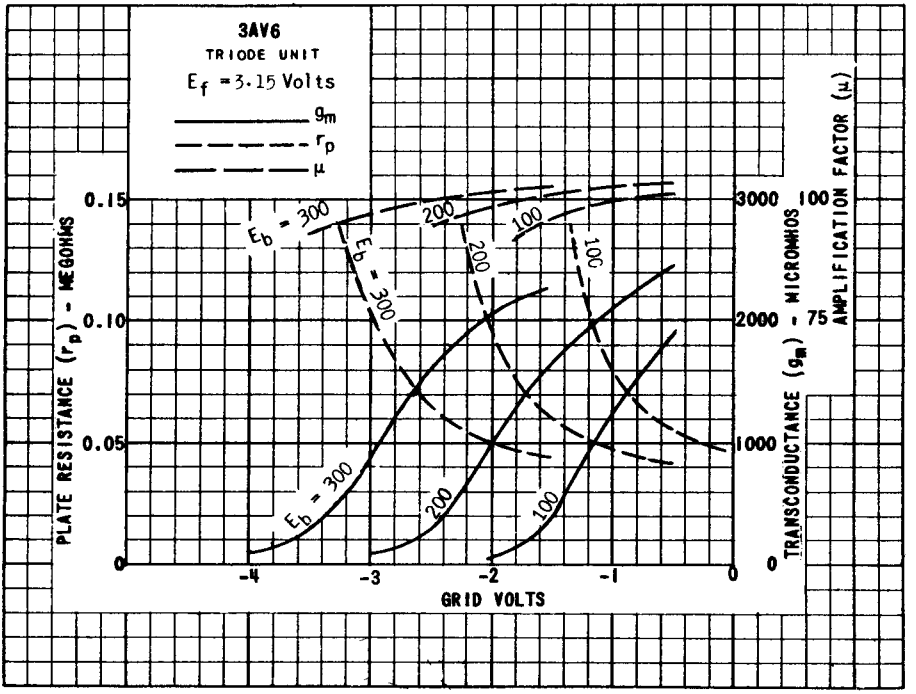
TRIODE UNIT

HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.





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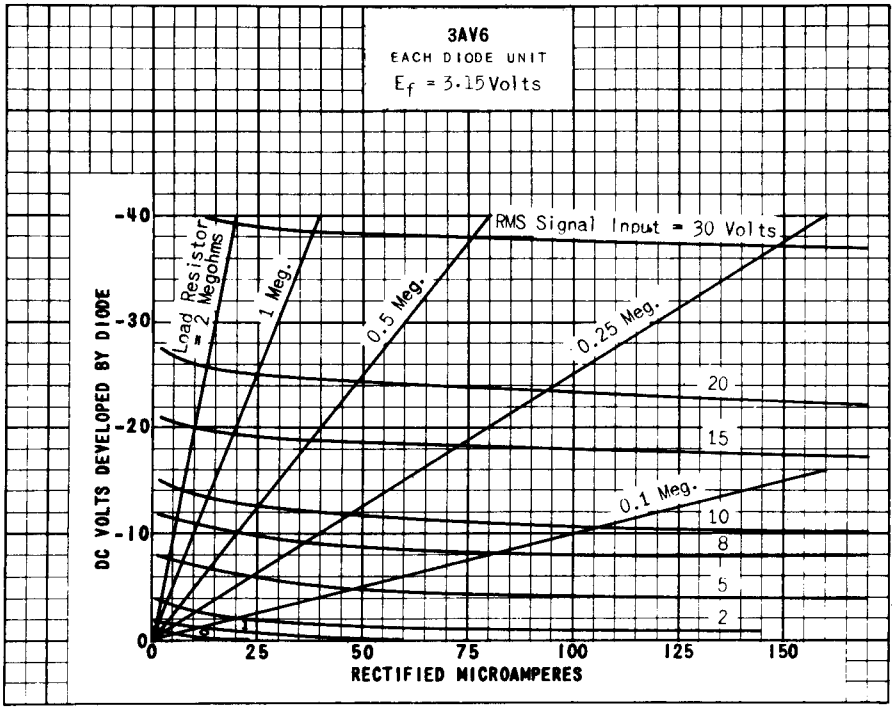
3AV6


3AV6
EACH DIODE UNIT
E_f = 3.15 Volts
RMS Signal Input = 30 Volts
Load Resistor = 2 Megohms
1 Meg.
0.5 Meg.
0.25 Meg.
0.1 Meg.
20
15
10
8
5
2
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

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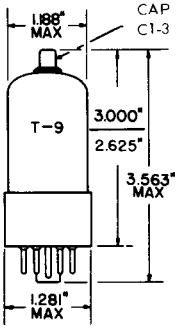
DIODE

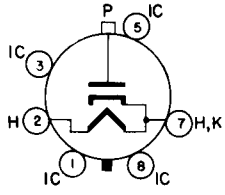


GLASS BULB
INTERMEDIATE SHELL
6 PIN OCTAL B6-8
OR
SHORT INTERMEDIATE SHELL
6 PIN OCTAL
WITH BARRIERS B6-62

HEATER

3.15 VOLTS 0.22 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8EZ

THE 3AW3 IS A CATHODE TYPE DIODE DESIGNED FOR USE AS A HIGH VOLTAGE, HALF-WAVE RECTIFIER OF THE HIGH-VOLTAGE PULSES PRODUCED IN THE SCANNING SECTIONS OF TELEVISION RECEIVERS. ELECTRICALLY IT IS SIMILAR TO THE 3A3, BUT IT IS SHORTER IN LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD.

PLATE TO HEATER CATHODE & INTERNAL SHIELD (APPROX.)	1.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FLY BACK VOLTAGE RECTIFIER[B]

HEATER VOLTAGE[A]	3.15	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE	30,000	VOLTS
MAXIMUM PEAK PLATE CURRENT	88	MA.
MAXIMUM AVERAGE PLATE CURRENT	1.7	MA.
MAXIMUM VOLTAGE PULSE DURATION	10	μSEC.

[A] THE HEATER VOLTAGE SHOULD NEVER FALL BELOW 2.65 VOLTS NOR RISE ABOVE 3.65 VOLTS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

→ INDICATES A CHANGE.

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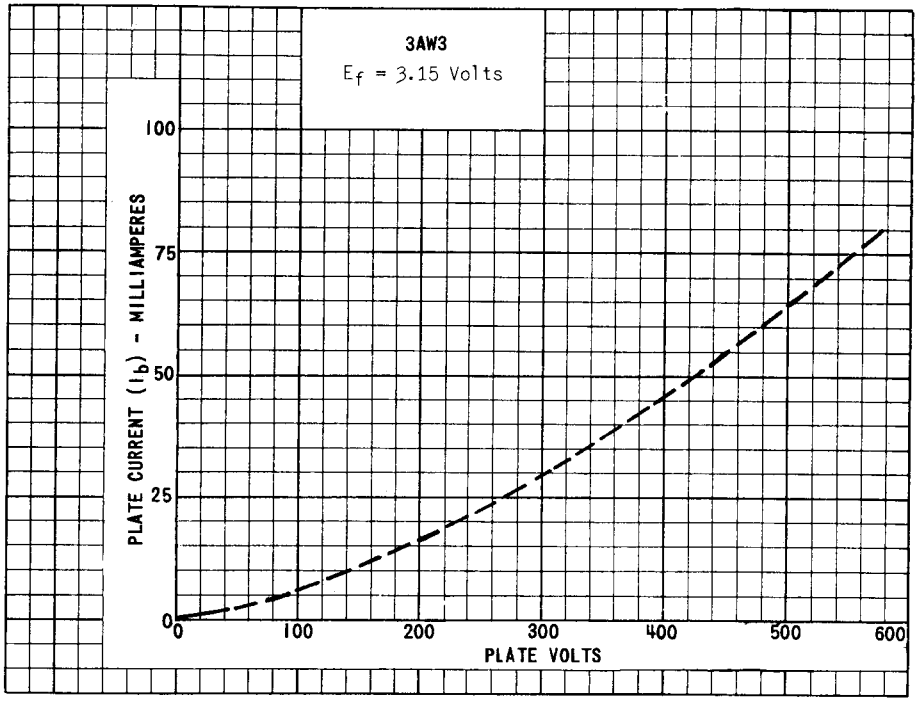
3AW3


3AW3
E_f = 3.15 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
0
25
50
75
100
0
100
200
300
400
500
600
PLATE VOLTS

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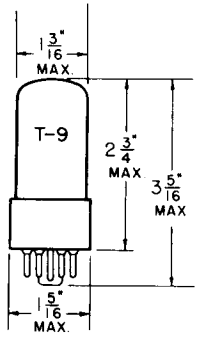
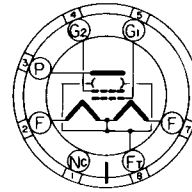


BEAM POWER AMPLIFIER

COATED FILAMENT

SERIES FILAMENTS	PARALLEL FILAMENTS
2.8 VOLTS	1.4 VOLTS
.05 AMP.	.10 AMP.

GLASS BULB



BOTTOM VIEW

†INTERMEDIATE SHELL
OCTAL 7 PIN BASE

ANY MOUNTING POSITION

TYPE 3B5GT IS DESIGNED FOR AUDIO SERVICE IN PORTABLE EQUIPMENT WHERE THE PLATE VOLTAGE SUPPLY IS LIMITED.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	SERIES FILAMENTS	PARALLEL FILAMENTS	
MAXIMUM PLATE VOLTAGE	67.5	67.5	VOLTS
MAXIMUM CATHODE CURRENT	6.0[A]	12	MA.
MAXIMUM SCREEN VOLTAGE	67.5	67.5	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	SERIES FILAMENTS	PARALLEL FILAMENTS		
PLATE VOLTAGE	67.5	45	67.5	VOLTS
SCREEN GRID VOLTAGE	67.5	45	67.5	VOLTS
CONTROL GRID VOLTAGE	-7.0	-4.5	-7.0	VOLTS
PLATE CURRENT	6.7	4.4	8.0	MA.
SCREEN CURRENT	0.5	0.3	0.6	MA.
TRANSCONDUCTANCE	1 500	1 400	1 650	µMHOS
PLATE RESISTANCE	0.1	0.1	0.1	MEGOHM
LOAD RESISTANCE	5 000	8 000	5 000	OHMS
POWER OUTPUT	180	70	200	MW.
TOTAL HARMONIC DISTORTION	10	12	10	PER CENT

[A] PER 1.4 VOLT FILAMENT SECTION (SHUNTING RESISTOR ACROSS NEGATIVE SECTION OF FILAMENT MAY BE NECESSARY TO LIMIT CURRENT TO VALUE SHOWN.)

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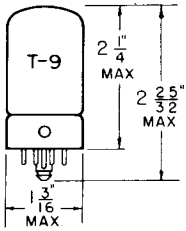
DOUBLE TRIODE



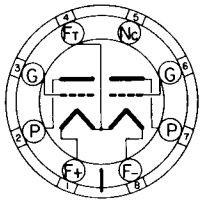
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 8	E_f APPLIED BETWEEN PIN 4 & PINS 1 & 8 TIED TOGETHER
E_{g1} REFERRED TO PIN 1	E_{g1} REFERRED TO PIN 4
2.8 VOLTS 110 MA.	1.4 VOLTS 220 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 4 AND 8 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 1 AND 8. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 8 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3B7/1291.



BOTTOM VIEW
LOCK-IN
8 PIN BASE
7BE

ANY MOUNTING POSITION

THE 3B7/1291 IS A FILAMENTARY TYPE TWIN TRIODE USING THE LOCK-IN CONSTRUCTION AND IS DESIGNED FOR ULTRA-HIGH FREQUENCY APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES - EACH UNIT

	WITHOUT[B] SHIELD	WITH[A] SHIELD	
GRID TO PLATE: (G TO P)	2.6	2.6	μμf
INPUT: G TO (F+BS)	1.4	1.4	μμf
OUTPUT: P TO (F+BS)	1.8	2.6	μμf
GRID TO GRID: (1G TO 2G) MAX.	0.004	0.004	μμf

[A] PIN #5 CONNECTED TO PIN #4.
[B] WITH RMA SHIELD #308 CONNECTED TO NEGATIVE FILAMENT. PIN #5 CONNECTED TO PIN #4.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	SERIES FILAMENT	PARALLEL FILAMENT	
FILAMENT VOLTAGE DC	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	180	180	VOLTS
MAXIMUM CATHODE CURRENT (EACH SECTION)	15	15	MA.
MAXIMUM GRID CURRENT (EACH SECTION)	4	3	MA.
MAXIMUM PLATE DISSIPATION (EACH SECTION)	2.7	2.7	WATTS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF POWER AMPLIFIER - CLASS AB_2
PUSH-PULL - BOTH UNITS

FILAMENT VOLTAGE	1.4	1.4	VOLTS
FILAMENT CURRENT	220	220	MA.
PLATE VOLTAGE	90	135	VOLTS
GRID VOLTAGE	0	0	VOLTS
GRID DRIVING VOLTAGE (RMS)	23	19	VOLTS
ZERO SIGNAL PLATE CURRENT	10.4	18.2	MA.
MAXIMUM SIGNAL PLATE CURRENT	21	22	MA.
GRID CURRENT	3.6	2.7	MA.
GRID DRIVING POWER	45	28	MW.
TRANSCONDUCTANCE (EACH SECTION)	1 850	1 900	µMHOS
AMPLIFICATION FACTOR (EACH SECTION)	20	20	
LOAD RESISTANCE	8 000	16 000	OHMS
TOTAL DISTORTION	8	8	PERCENT
POWER OUTPUT	1	1.5	WATTS

RF POWER AMPLIFIER - CLASS C
PUSH-PULL - BOTH UNITS

FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	220	220	220	MA.
PLATE VOLTAGE	90	135	180	VOLTS
GRID VOLTAGE[A]	-8	-18	-30	VOLTS
PEAK RF GRID TO GRID VOLTAGE	60	80	110	VOLTS
PLATE CURRENT	15	25	25	MA.
GRID CURRENT	2	4.5	4.5	MA.
CATHODE CURRENT (NOT TO EXCEED 30 MA.)	17	29.5	29.5	MA.
DRIVING POWER (APPROX.)	0.10	0.20	0.30	WATT
POWER OUTPUT:				
25 MEGACYCLES	0.85	2	2.8	WATTS
125 MEGACYCLES	0.32	1	1.4	WATTS

[A] MAY BE OBTAINED FROM A FIXED SOURCE OR A GRID RESISTOR.

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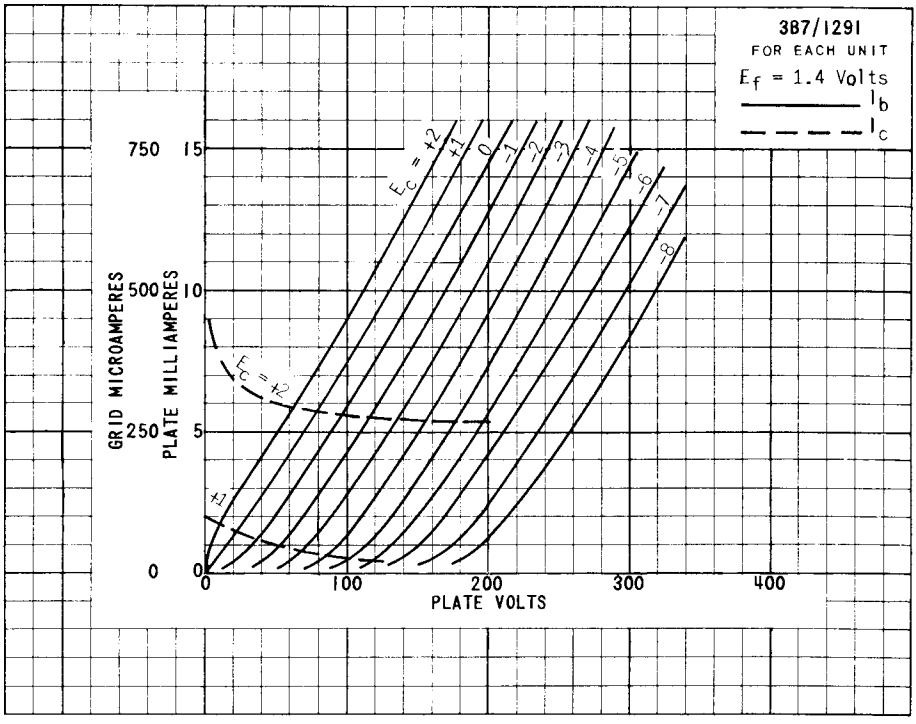

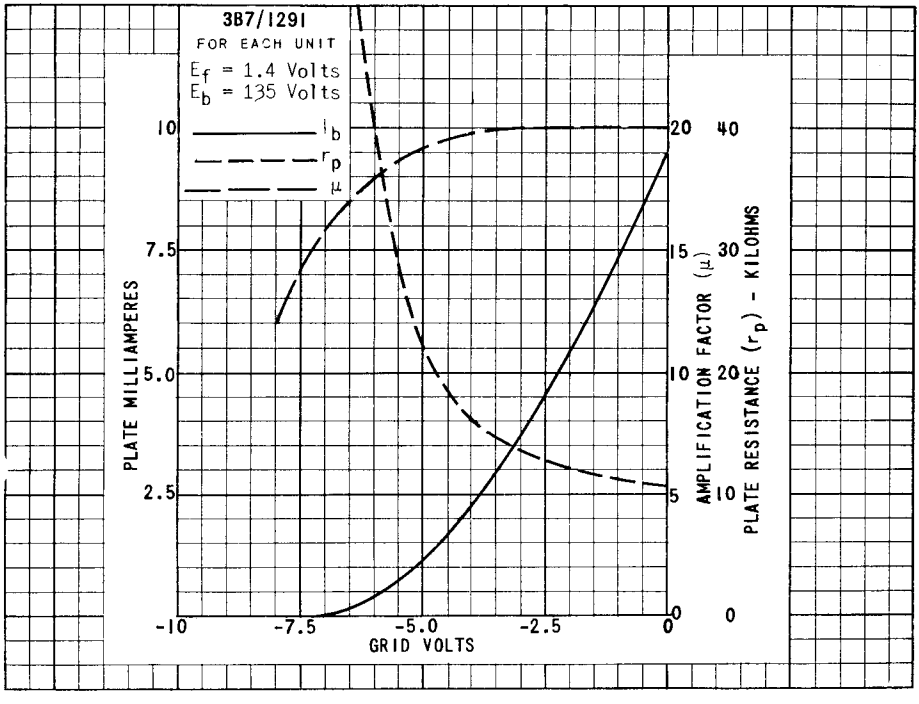

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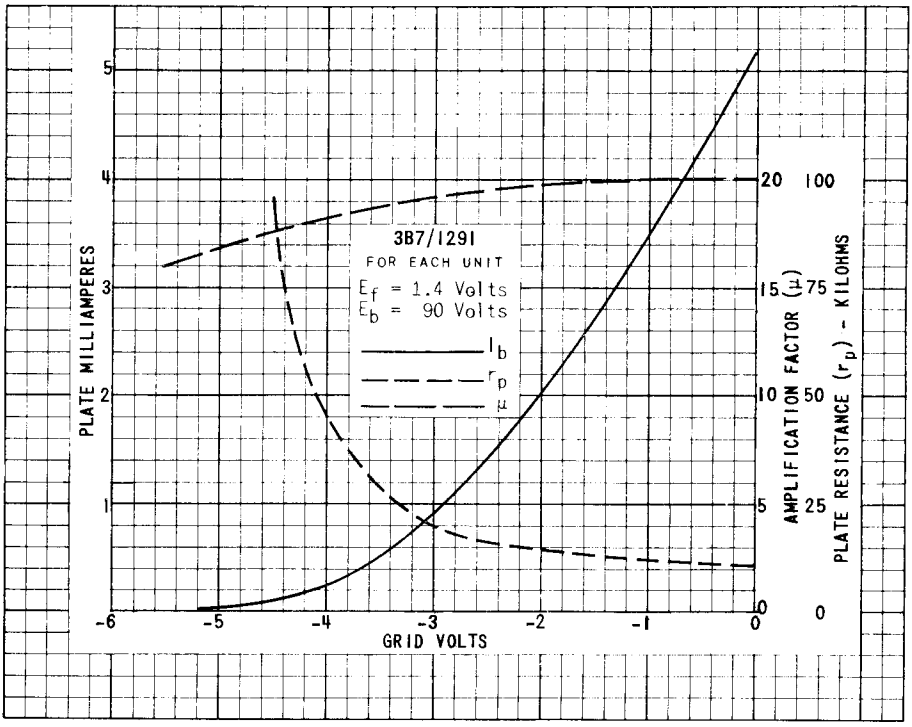
3B7/1291



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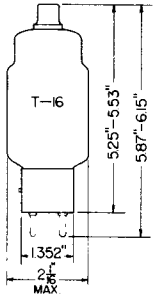
DIODE



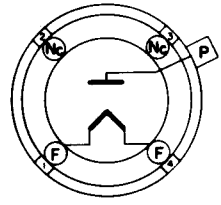
GLASS BULB

FILAMENT

2.5±5% VOLTS 5.0 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL MEDIUM SHELL
4 PIN BAYONET BASE

4P

THE 3B28 IS A XENON FILLED HALF WAVE RECTIFIER FOR USE IN HIGH VOLTAGE CIRCUITS. THE TUBE IS DESIGNED TO OPERATE OVER A WIDE TEMPERATURE RANGE WITHOUT THE NECESSITY OF HEATING OR COOLING DEVICES. ITS HARD GLASS ENVELOPE AND WELL SUPPORTED MOUNT MAKE IT PARTICULARLY SUITED FOR MILITARY AND INDUSTRIAL USE. AS CONTRASTED TO SIMILAR MERCURY-VAPOR TUBES, THE 3B28 MAY BE MOUNTED IN ANY POSITION AND IS NOT SUBJECT TO MERCURY-SPLASH PROBLEMS. ITS EFFICIENT OXIDE COATED FILAMENT IS FAST HEATING. AS CONSISTENT WITH FILAMENTARY GAS AND VAPOR RECTIFIER TUBE PRACTICE, QUADRATURE EXCITATION OF THE FILAMENT IS RECOMMENDED FOR OBTAINING THE LONGEST TUBE LIFE. IN QUADRATURE OPERATION, THE FILAMENT CURRENT IS PHASED TO BE AT A MINIMUM WHEN THE PEAK ANODE CURRENT FLOWS. HOWEVER THE TUBE CARRIES FULL RATINGS FOR IN PHASE OPERATION OF THE FILAMENT.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	5 000	10 000	VOLTS
MAXIMIM PEAK CATHODE CURRENT	2.	1.	AMP.
MAXIMUM AVERAGE CATHODE CURRENT	0.5	0.25	AMP.
MAXIMUM SURGE CATHODE CURRENT (MAXIMUM DURATION TIME 0.1 SECONDS)	20.	20.	AMP.
MAXIMUM AVERAGING TIME	30.	30.	SECONDS
MAXIMUM SUPPLY FREQUENCY	500	150	CPS
AMBIENT TEMPERATURE LIMITS	-55 TO +75	-55TO+75	°C

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±5%	VOLTS
FILAMENT CURRENT AT 2.5 VOLTS	5.0	AMP.
MINIMUM CATHODE HEATING TIME	5.	SECONDS
AVERAGE ANODE VOLTAGE DROP	10.	VOLTS
PEAK ANODE VOLTAGE DROP	14.	VOLTS
CRITICAL ANODE VOLTAGE	50.	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

MOUNTING POSITION	ANY	
OVERALL LENGTH	5.87 TO 6.15	INCHES
SEATED LENGTH	5.25 TO 5.53	INCHES
MAXIMUM DIAMETER	2.07	INCHES
BULB	T- 16	NONEX
CAP	MEDIUM METAL, C1-5	
BASE	MEDIUM 4 PIN BAYONET, A4-10	
WEIGHT (NET) MAX.	4	OUNCES

MAXIMUM CIRCUIT VALUES

FIG.	CIRCUIT	TRANSFORMER	FILAMENT OPERATION	NO. OF TUBES	A.C. SECONDARY VOLTS E_{RMS}	DC OUTPUT (APPROX.) E_{DC} IN VOLTS	DC OUTPUT (APPROX.) I_{DC} IN AMPERES	RIPPLE VOLTS RMS	RIPPLE FREQ.
1	HALF WAVE SINGLE PHASE	SINGLE PHASE	IN PHASE	1	7000[A] 3500[B]	3200 1600	0.25 0.50	3500 1750	f
2	FULL WAVE SINGLE PHASE	SINGLE PHASE CENTER TAP	IN PHASE	2	3500[A] 1750[B]	3200 1600	0.50 1.00	1500 750	2f
3	BRIDGE CIRCUIT SINGLE PHASE	SINGLE PHASE	IN PHASE	4	7000[A] 3500[B]	6400 3200	0.50 1.00	3000 1500	2f
4	HALF WAVE THREE PHASE	DELTA—WYE	———	3	4000[A] 2000[B]	4800 2400	0.75 1.50	860 430	3f
5	FULL WAVE THREE PHASE	DELTA—WYE	QUADRATURE	6	4000[A] 2000[B]	9500 4750	0.75 1.50	400 200	6f
6	FULL WAVE THREE PHASE	DELTA—DELTA	QUADRATURE	6	7000[A] 3500[B]	9500 4750	0.75 1.50	400 200	6f
7	HALF WAVE SIX PHASE (THREE PHASE SUPPLY)	DELTA—STAR	QUADRATURE	6	3500[A] 1750[B]	4800 2400	1.0 2.0	200 100	6f

DC OUTPUT VALUES ARE THOSE SUPPLIED TO A CHOKE INPUT FILTER WITH A PURE SINE WAVE SUPPLY.

[A] VALUES ARE FOR A MAXIMUM OF 10KV PEAK INVERSE VOLTAGE PER TUBE AND 150 CPS MAXIMUM SUPPLY FREQUENCY.

[B] VALUES FOR A MAXIMUM FO 5. KV PEAK INVERSE VOLTAGE PER TUBE AND 500 CPS MAXIMUM SUPPLY FREQUENCY.

TUNG-SOL

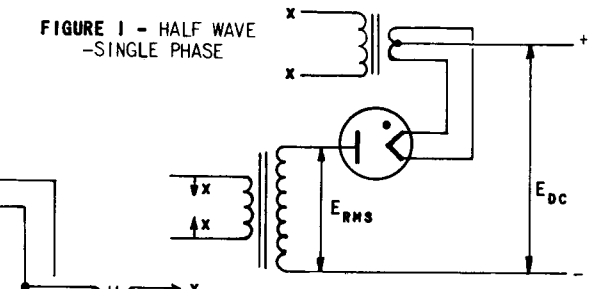


FIGURE 1 - HALF WAVE -SINGLE PHASE

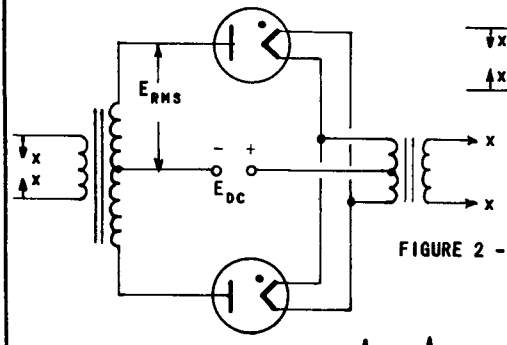


FIGURE 2 - FULL WAVE - SINGLE PHASE

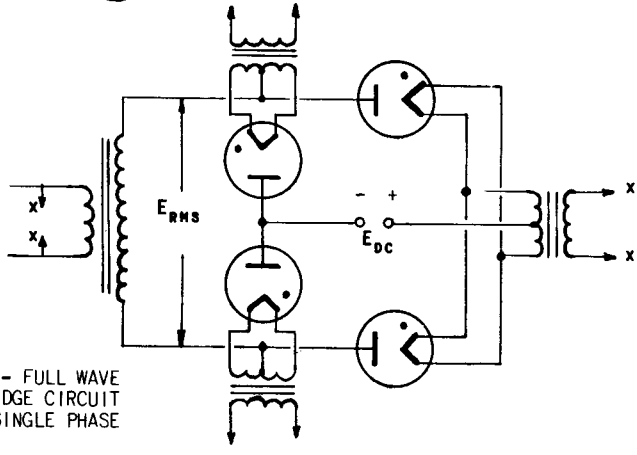


FIGURE 3 - FULL WAVE BRIDGE CIRCUIT -SINGLE PHASE

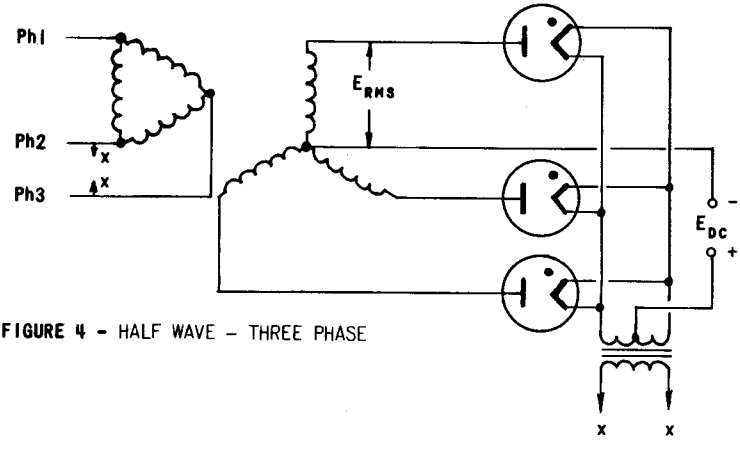


FIGURE 4 - HALF WAVE - THREE PHASE

FIGURE 5 - FULL WAVE–THREE PHASE

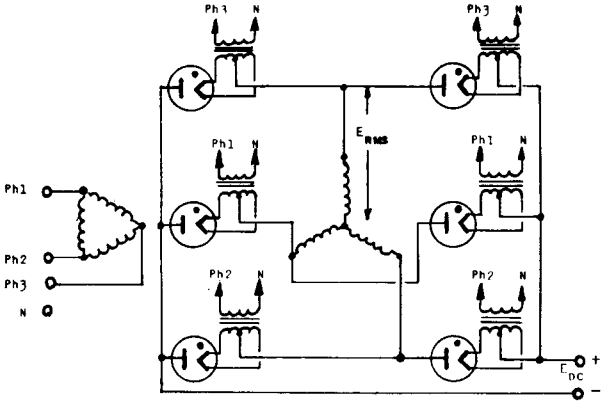


FIGURE 6 - FULL WAVE – THREE PHASE

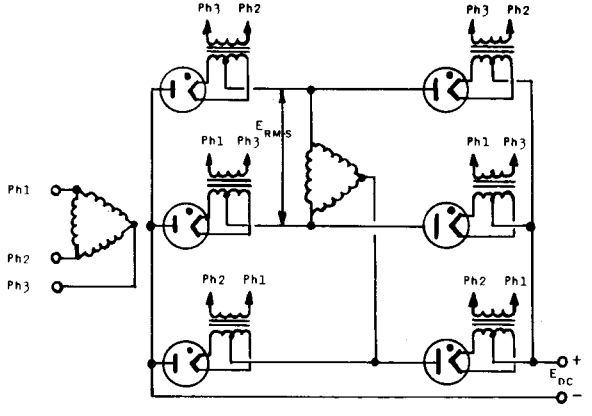
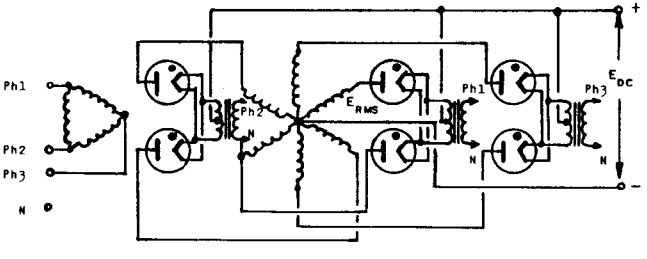


FIGURE 7 - HALF WAVE–SIX PHASE (3 PHASE SUPPLY)



TUNG-SOL

PENTODE

MINIATURE TYPE

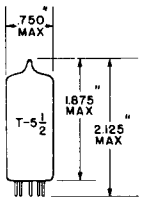
COATED UNIPOTENTIAL CATHODE

HEATER

3.15 VOLTS 600±40 MA.

AC OR DC

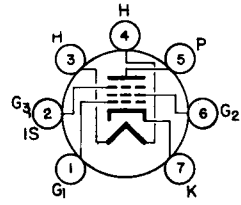
ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1

OUTLINE DRAWING JEDEC 5-?



BOTTOM VIEW

BASING DIAGRAM JEDEC 7BK ←

THE 3BA6 IS A REMOTE CUT-OFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A HIGH-GAIN FREQUENCY OR INTERMEDIATE-FREQUENCY AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BA6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.0035	0.0035	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

→RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE (PIN #2 CONNECTED TO PIN #7 AT SOCKET)		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.4	WATTS
MAXIMUM GRID #2 DISSIPATION:		
FOR VOLTAGES UP TO 165 VOLTS	0.7	WATT
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE J5-C4	

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	μMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 μMHOS	−20	−20	VOLTS

→INDICATES A CHANGE.

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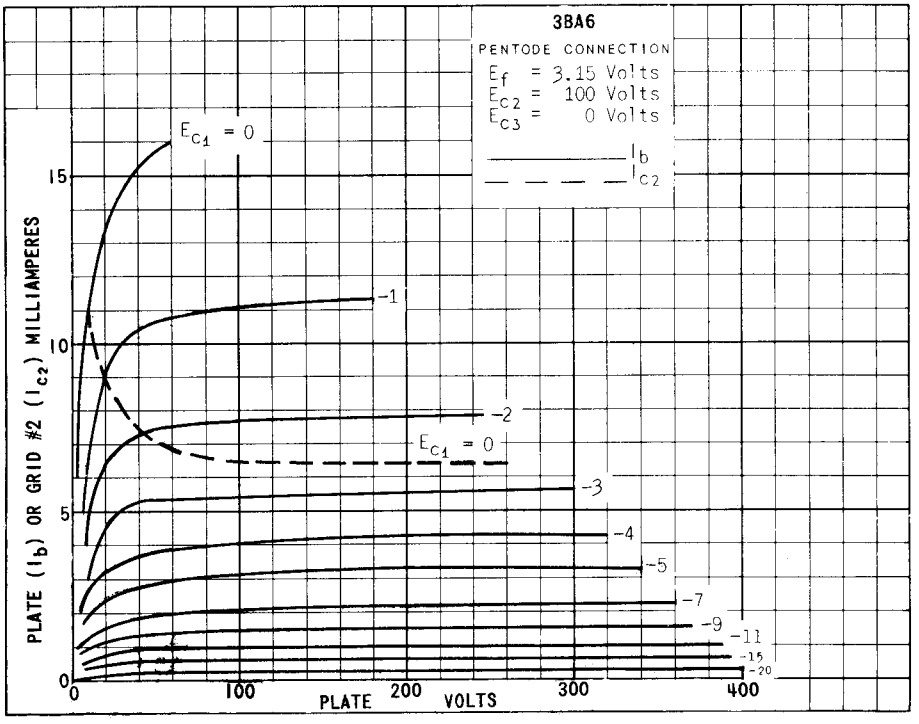
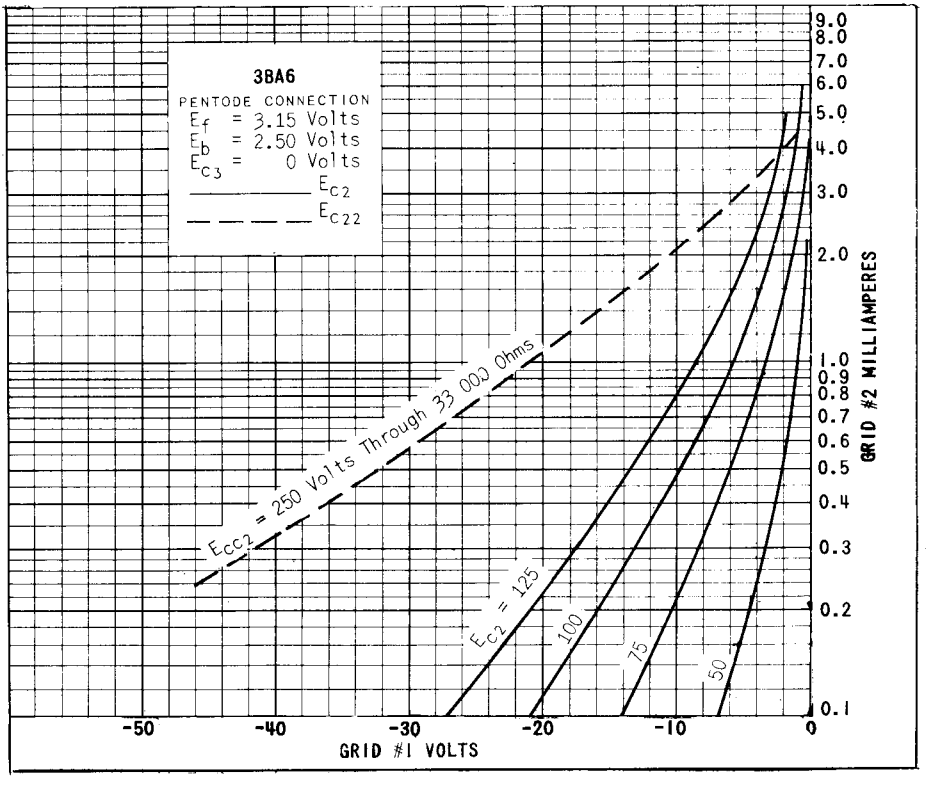
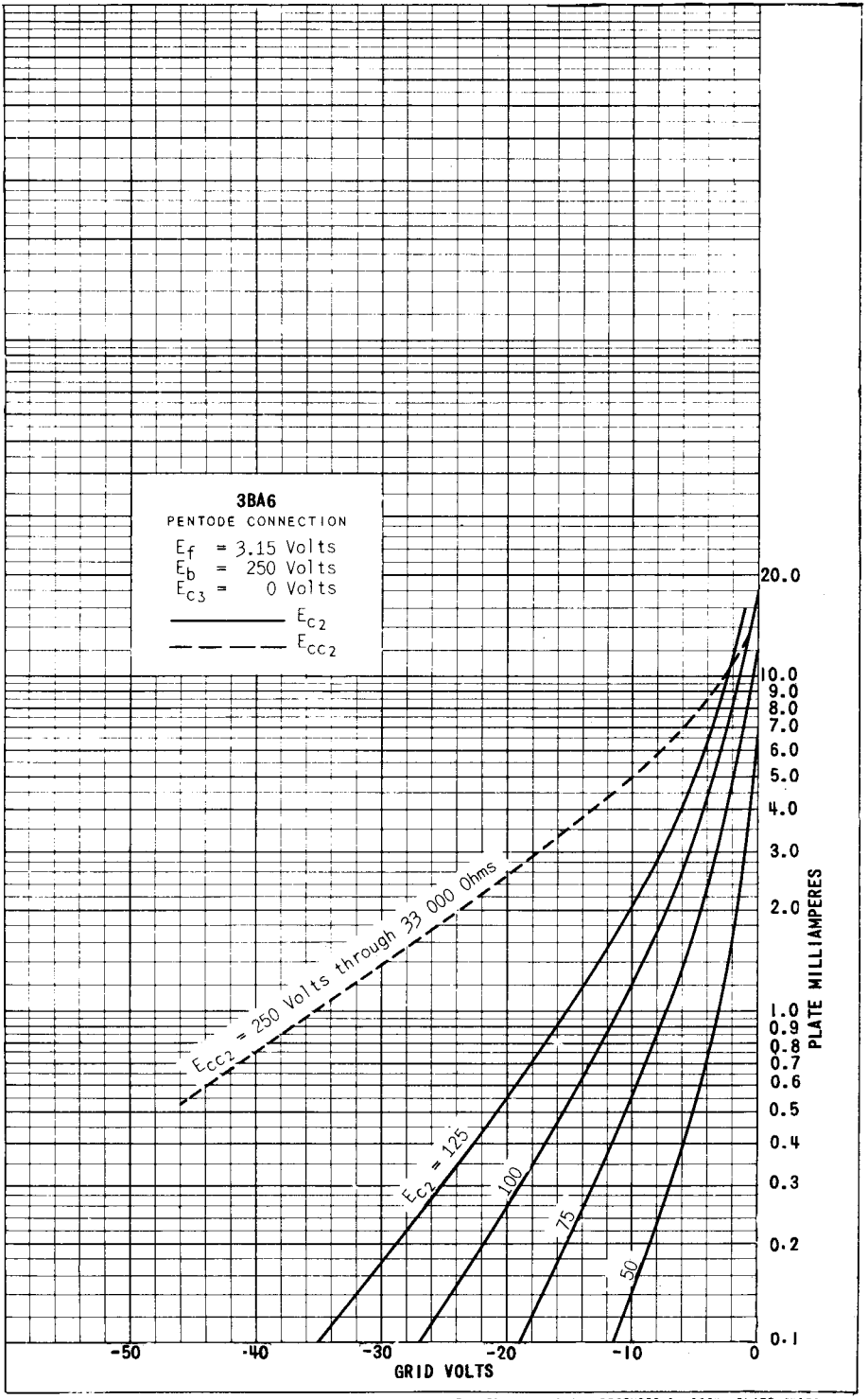
3BA6


3BA6
PENTODE CONNECTION
Ef = 3.15 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-1
-2
Ec1 = 0
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400


3BA6
PENTODE CONNECTION
Ef = 3.15 Volts
Eb = 2.50 Volts
Ec3 = 0 Volts
Ec2
Ec22
Ecc2 = 250 Volts Through 33 000 Ohms
Ec2 = 125
100
75
50
GRID #2 MILLIAMPERES
GRID #1 VOLTS
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-50
-40
-30
-20
-10
0



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3BA6

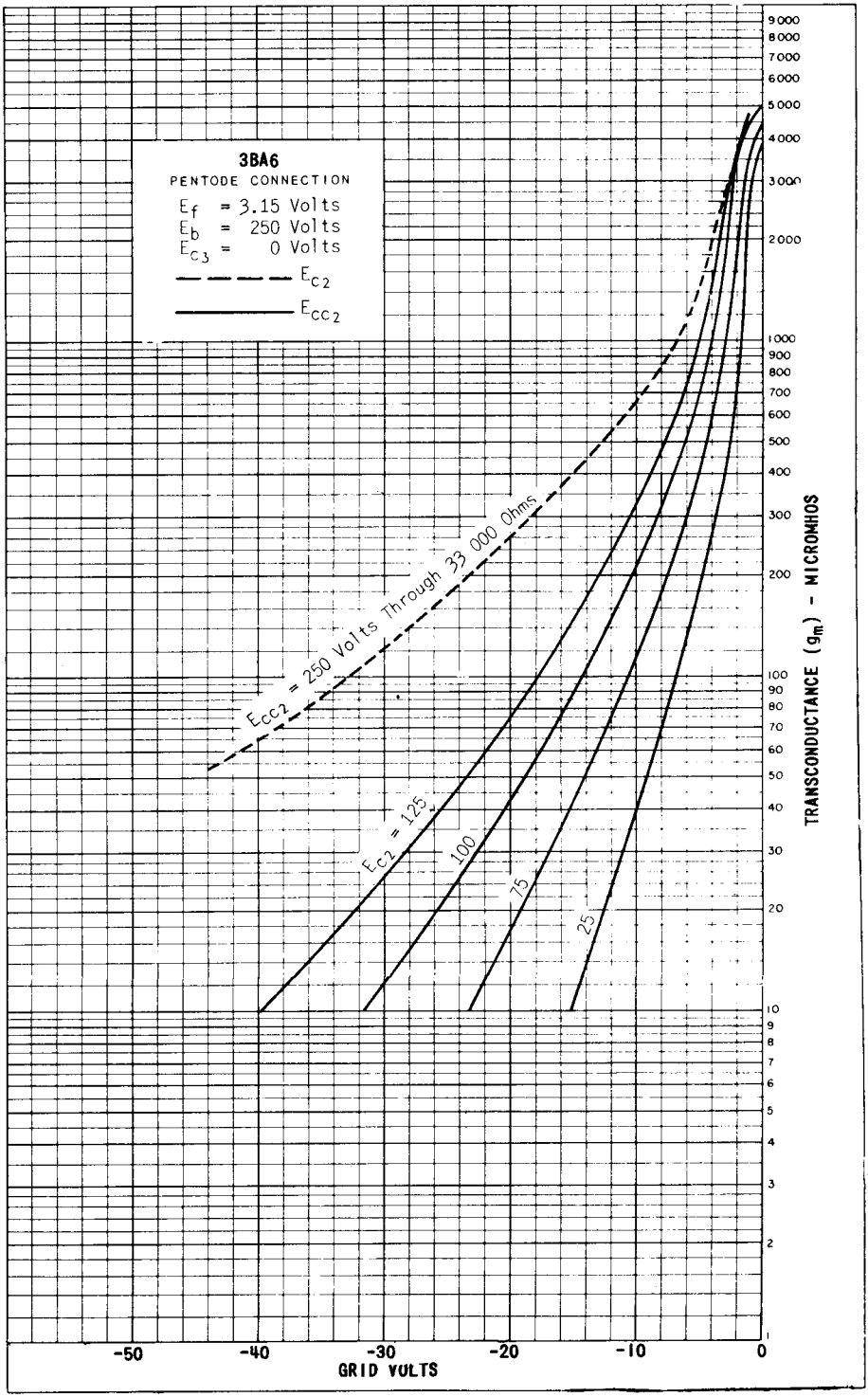


PLATE #4174 DECEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

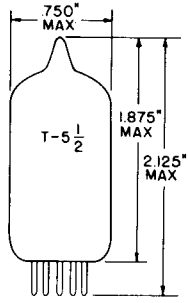
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HIGH FREQUENCY INTERMEDIATE AND RF AMPLIFIER

ANY MOUNTING POSITION

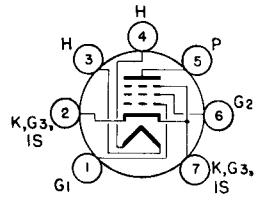


GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1

OUTLINE DRAWING

JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM

BASING DIAGRAM

JEDEC 7BD

THE 3BC5 IS A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MC. AND AS A HIGH-FREQUENCY INTERMEDIATE AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G1 TO P) MAX.	0.020	0.030	pf
INPUT: G1 TO (H+K+G2+G3 & I.S.)	6.6	6.5	pf
OUTPUT: P TO (H+K+G2+G3& I.S.)	3.1	1.8	pf
TRIODE CONNECTION: (G2 TIED TO PLATE)			
GRID TO PLATE: G1 TO (P+G2)	2.5	2.5	pf
INPUT: G1 TO (H+K+G3 & I.S.)	4.0	3.9	pf
OUTPUT: (P+G2) TO (H+K+G3 & I.S.)	4.3	3.0	pf

A
EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600 ± 40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE;			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200 [B]	VOLTS

B
DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE [C]	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID #2 VOLTAGE	PLATE	SEE RATING CHART	
GRID #2 SUPPLY VOLTAGE	PLATE [C]	330	VOLTS
PLATE DISSIPATION	2.9	2.3	WATTS
GRID #1 VOLTAGE (POSITIVE BIAS VALUE)	0	0	VOLT
GRID #2 DISSIPATION			
FOR VOLTAGES UP TO 165 V.	---	0.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 V.	---	SEE RATING CHART	

→ TYPICAL OPERATING CHARACTERISTICS

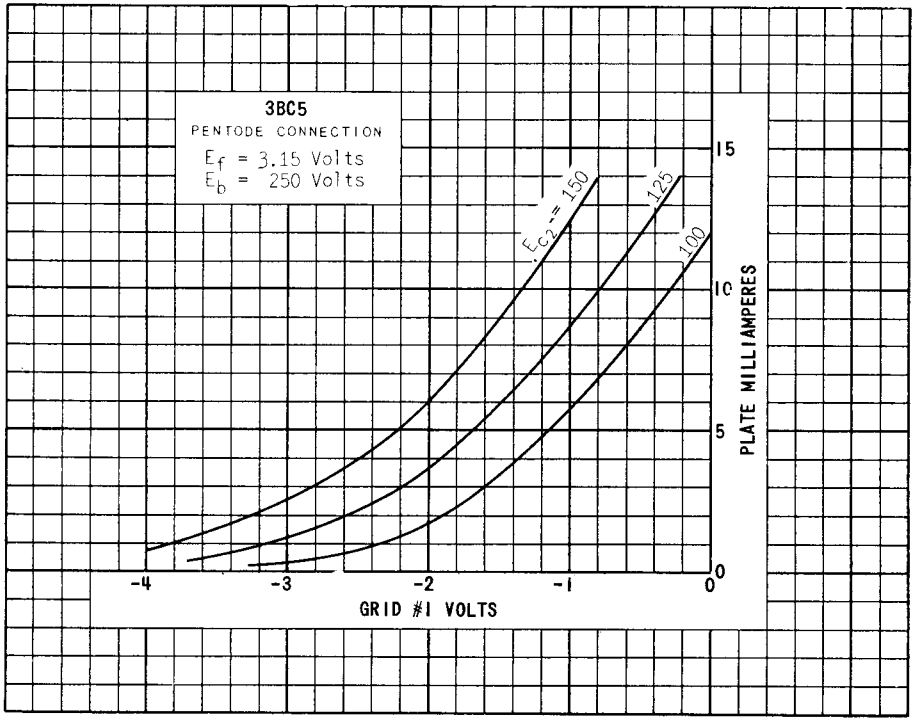
CLASS A_1 AMPLIFIER

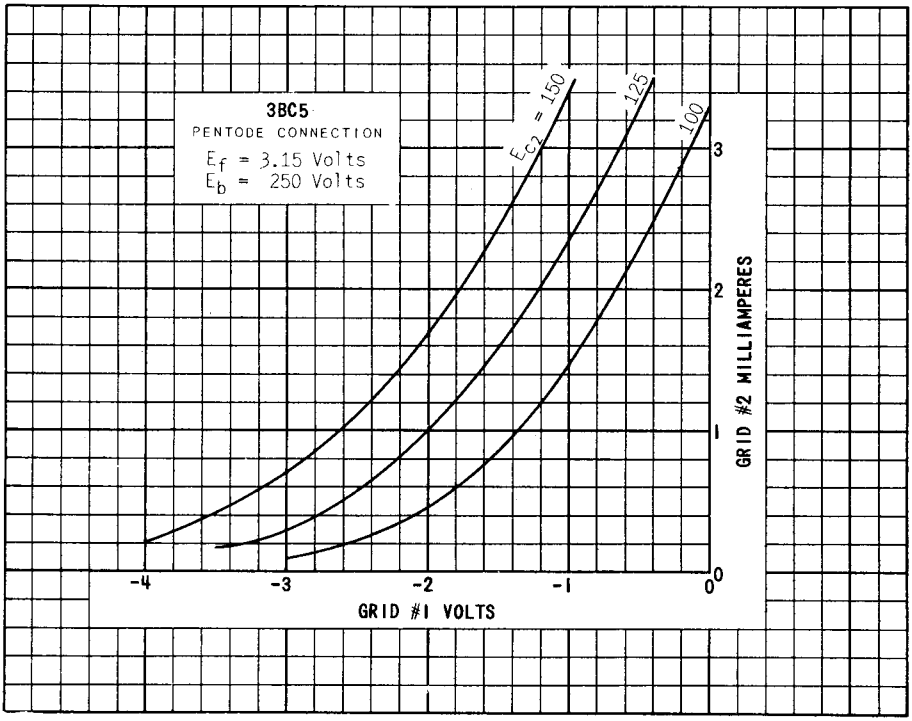
	TRIODE [C]		PENTODE			
PLATE VOLTAGE	250	180	100	125	250	VOLTS
GRID #2 VOLTAGE			100	125	150	VOLTS
CATHODE RESISTOR	820	330	180	100	180	OHMS
TRANSCONDUCTANCE	4400	6000	4900	6100	5700	μMHOS
PLATE RESISTANCE (APPROXIMATELY)	0.009	0.006	0.6	0.5	0.8	MEGOHM
AMPLIFICATION FACTOR	40	42	---	---	---	
PLATE CURRENT	6.0	8.0	4.7	8.0	7.5	MA.
GRID #2 CURRENT	---	---	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA.	---	---	-5	-6	-8	VOLTS

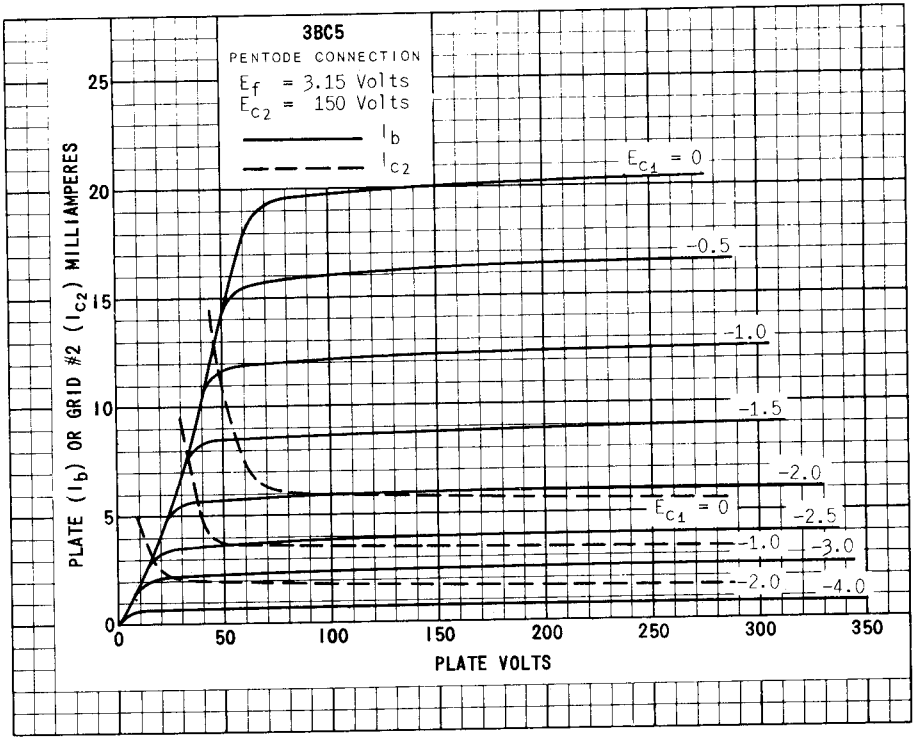
[C] G2 TIED TO PLATE.

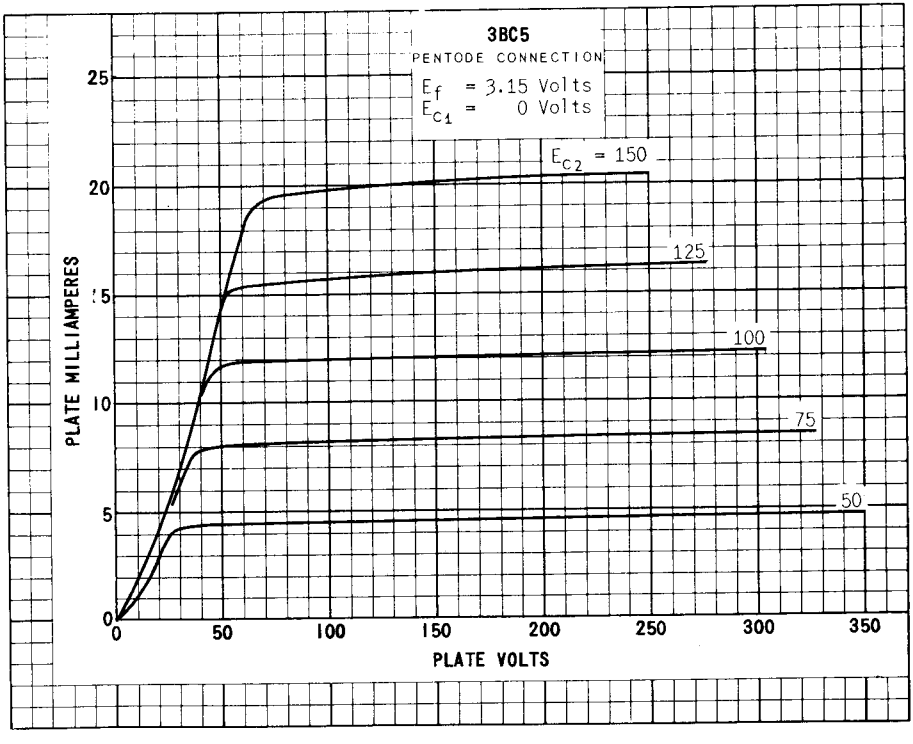
→ INDICATES A CHANGE.

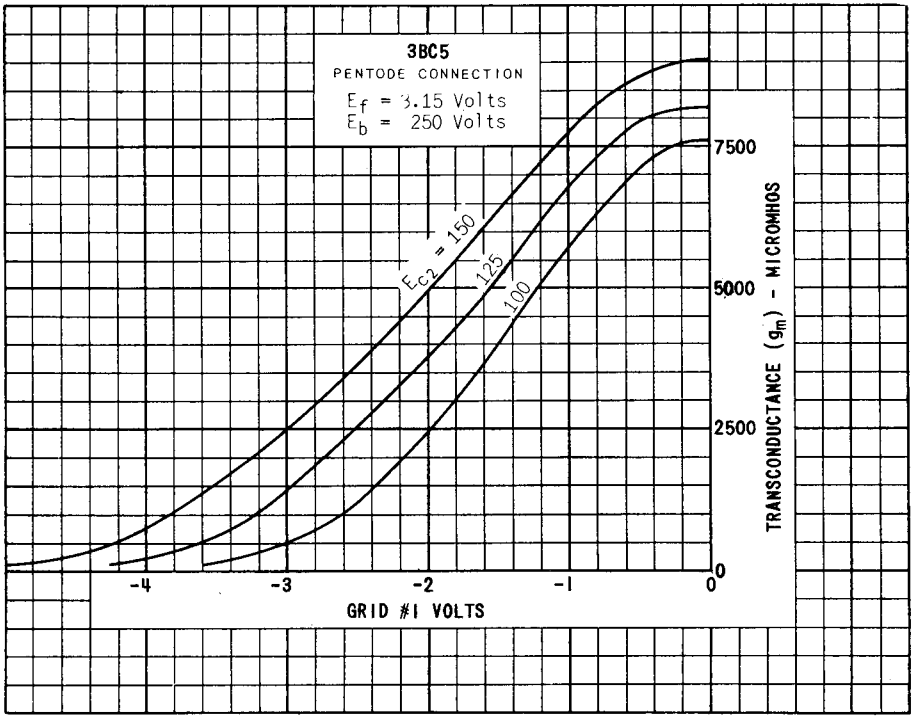
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

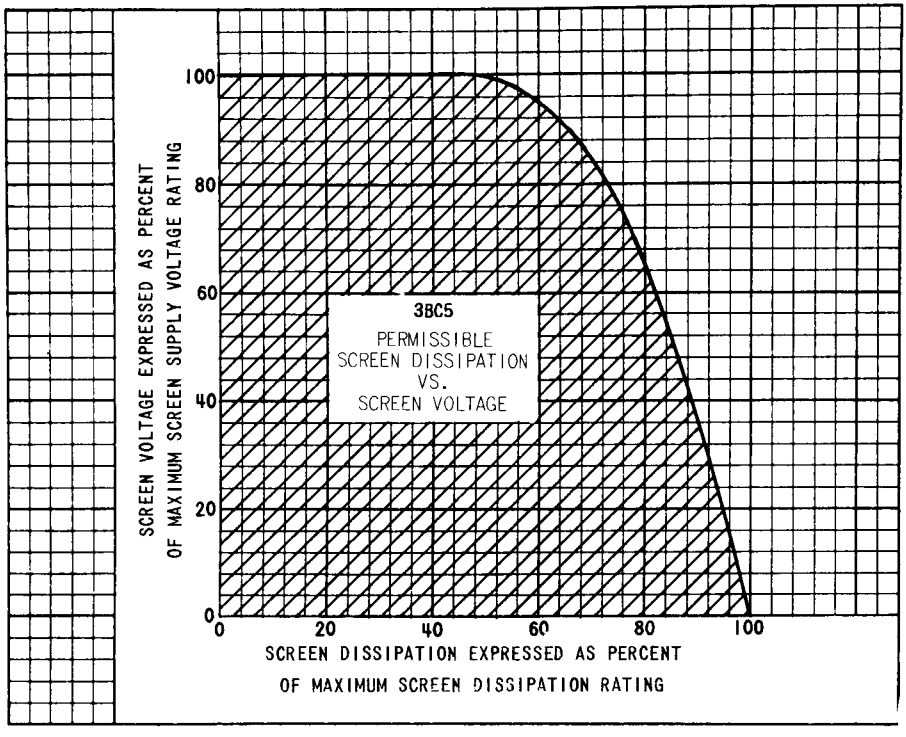

3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} = 150
125
100
15
10
5
0
PLATE MILLIAMPERES
-4
-3
-2
-1
0
GRID #1 VOLTS


3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} = 150
125
100
3
2
1
0
GRID #2 MILLIAMPERES
-4
-3
-2
-1
0
GRID #1 VOLTS


3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_{c_2} = 150 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
E_{c_1} = 0
-0.5
-1.0
-1.5
-2.0
E_{c_1} = 0
-2.5
-1.0
-3.0
-2.0
-4.0
0
5
10
15
20
25
0
50
100
150
200
250
300
350


3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_{c_1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c_2} = 150
125
100
75
50
0
5
10
15
20
25
0
50
100
150
200
250
300
350

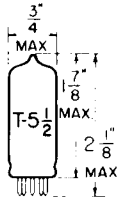

3BC5
PENTODE CONNECTION
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} = 150
125
100
7500
5000
2500
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


3BC5
PERMISSIBLE
SCREEN DISSIPATION
VS.
SCREEN VOLTAGE
SCREEN VOLTAGE EXPRESSED AS PERCENT
OF MAXIMUM SCREEN SUPPLY VOLTAGE RATING
100
80
60
40
20
0
0
20
40
60
80
100
SCREEN DISSIPATION EXPRESSED AS PERCENT
OF MAXIMUM SCREEN DISSIPATION RATING

TUNG-SOL

HEPTODE

MINIATURE TYPE

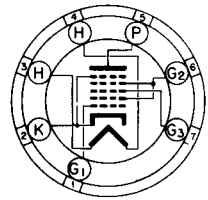


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 3BE6, A PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED SUPERHETERODYNE RECEIVERS. IT IS INTENDED FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6BE6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	0.30	μμf
MIXER GRID TO OSCILLATOR GRID: (G_3 TO G_1) MAX.	0.15	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	7.0	7.0	μμf
OSCILLATOR INPUT: G_1 TO (H+K+$G_{2\&4}$+G_3+G_5+P)	5.5	5.5	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	13	8.0	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G_5)	3.0	3.0	μμf
OSCILLATOR OUTPUT: K TO (H+$G_{2\&4}$+G_3+P)	20	15	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.05	0.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
→ MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	-50	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRIDS #2 AND #4 DISSIPATION	1.0	WATT
MAXIMUM CATHODE CURRENT	14	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SEPARATE EXCITATION[B]

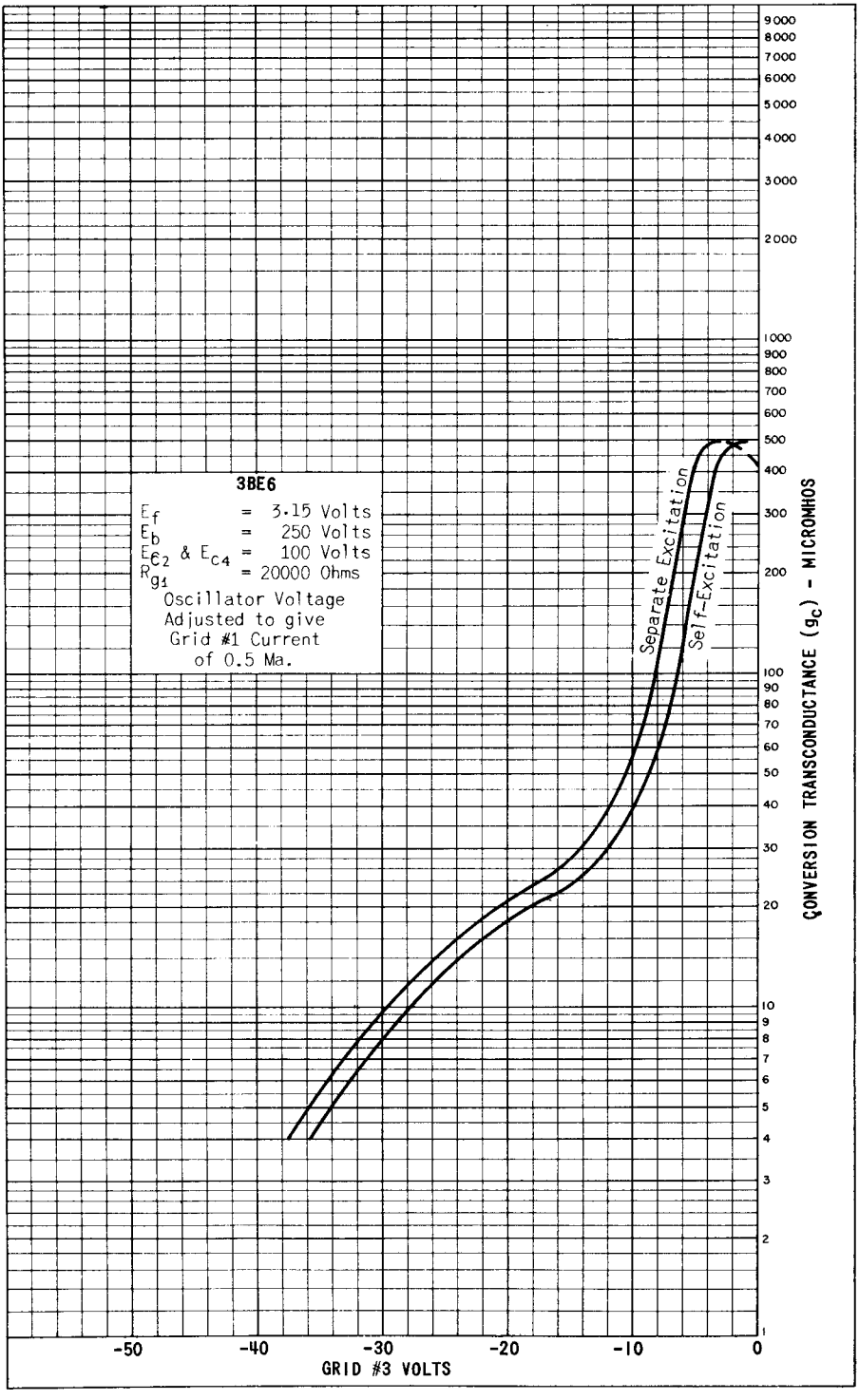
HEATER VOLTAGE	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	-1.5	-1.5	VOLTS
GRIDS #2 AND #4 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	10	10	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.4	1.0	MEGOHMS
GRID #1 CURRENT (OSCILLATOR GRID)	0.5	0.5	MA.
CONVERSION TRANSCONDUCTANCE	455	475	µMHOS
PLATE CURRENT	2.6	2.9	MA.
GRIDS #2 AND #4 CURRENT	7.0	6.8	MA.
CATHODE CURRENT	10.1	10.2	MA.
GRID #3 VOLTAGE FOR G_c = 10 µMHOS (APPROX.)	-30	-30	VOLTS
GRID #3 VOLTAGE FOR G_c = 100 µMHOS (APPROX.)	-6	-6	VOLTS

[B] CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

OSCILLATOR CHARACTERISTICS

NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	7 250	µMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	20	
CATHODE CURRENT	25	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA	-11	VOLTS


3BE6
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} & E_{c4} = 100 Volts
R_{g1} = 20000 Ohms
Oscillator Voltage Adjusted to give Grid #1 Current of 0.5 Ma.
Separate Excitation
Self-Excitation
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
9000
8000
7000
6000
5000
4000
3000
2000
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
-50
-40
-30
-20
-10
0
GRID #3 VOLTS

3BE6

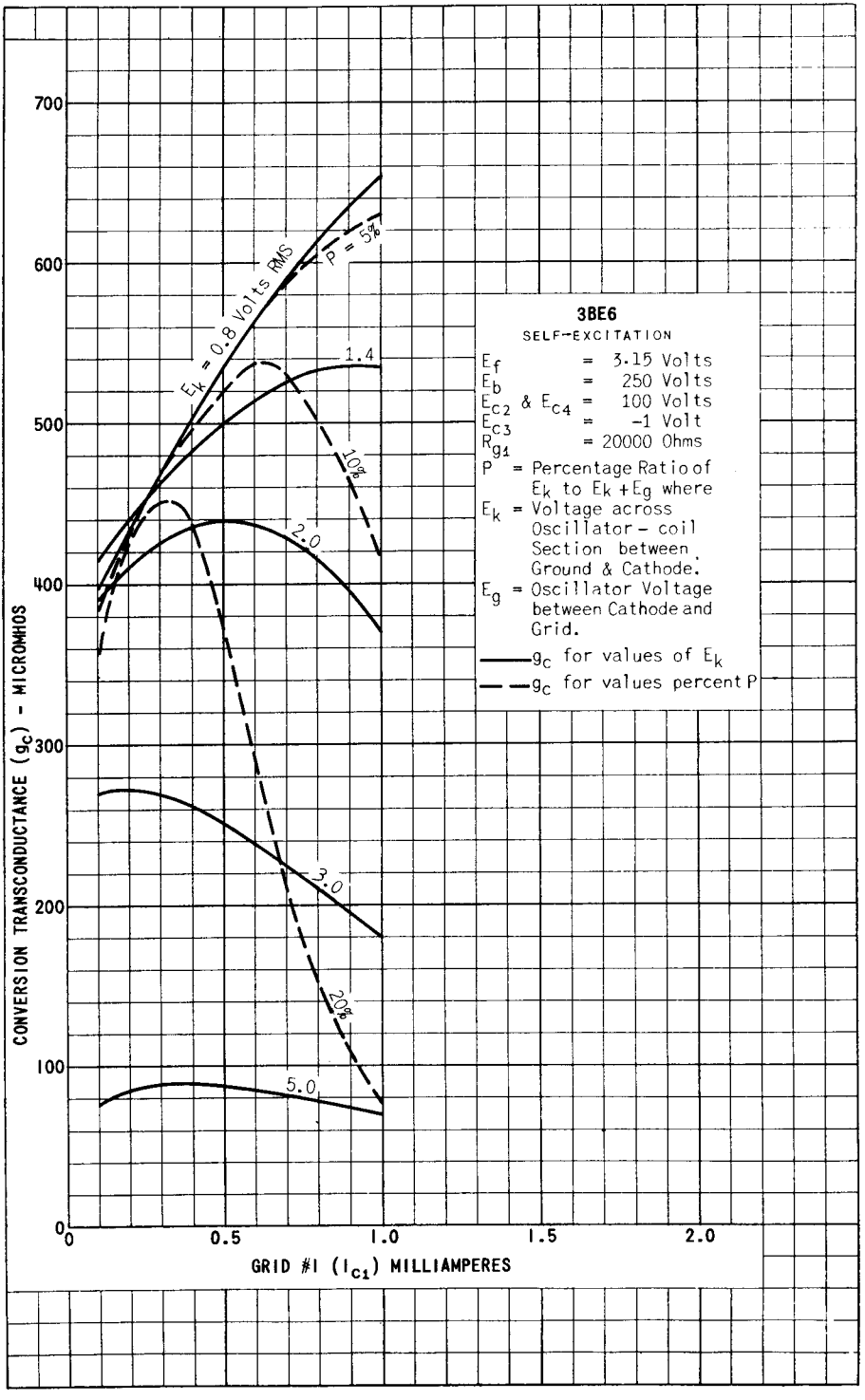
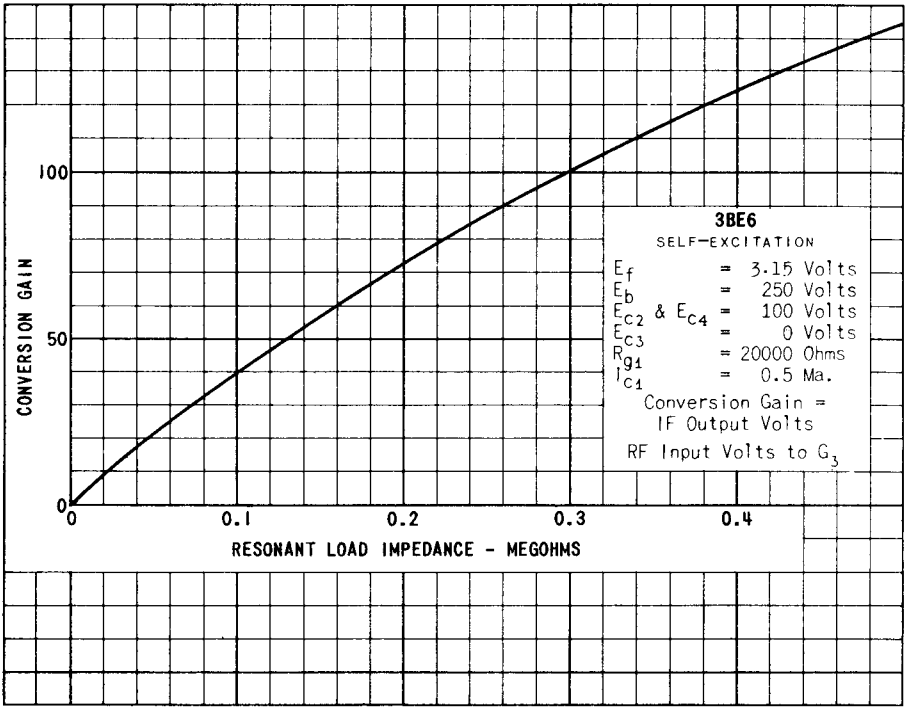
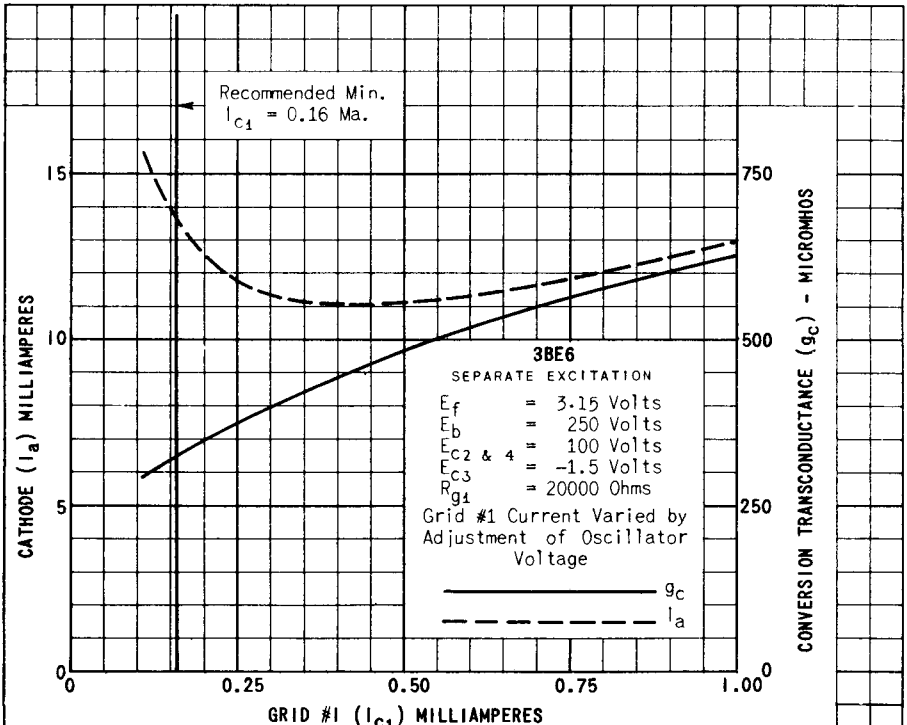


PLATE #3885 AUGUST 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.


CONVERSION GAIN
100
50
0
0
0.1
0.2
0.3
0.4
RESONANT LOAD IMPEDANCE - MEGOHMS
3BE6
SELF-EXCITATION
E_f = 3.15 Volts
E_b = 250 Volts
E_{c2} & E_{c4} = 100 Volts
E_{c3} = 0 Volts
R_{g1} = 20000 Ohms
I_{c1} = 0.5 Ma.
Conversion Gain = IF Output Volts / RF Input Volts to G_3


Recommended Min.
I_{c1} = 0.16 Ma.
CATHODE (I_a) MILLIAMPERES
15
10
5
0
0
0.25
0.50
0.75
1.00
GRID #1 (I_{c1}) MILLIAMPERES
750
500
250
0
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
3BE6
SEPARATE EXCITATION
E_f = 3.15 Volts
E_b = 250 Volts
$E_{c2\ \&\ 4}$ = 100 Volts
E_{c3} = -1.5 Volts
R_{g1} = 20000 Ohms
Grid #1 Current Varied by Adjustment of Oscillator Voltage
g_c
I_a

TUNG-SOL

TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

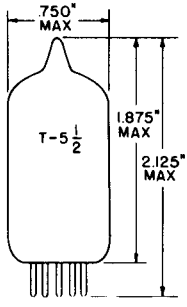
HEATER

3.0 VOLTS 450±30 MA.[A]

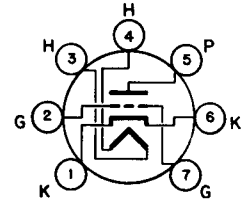
AC OR DC

ANY MOUNTING POSITION

[A] DESIGN MAXIMUM RATING SYSTEM.



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EG

THE 3BN4A IS A MINIATURE MEDIUM-MU TRIODE DESIGNED FOR USE AS A RADIO-FREQUENCY AMPLIFIER IN VHF TELEVISION TUNERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316

GRID TO PLATE	1.2	pf
INPUT	3.2	pf
OUTPUT	1.4	pf
HEATER TO CATHODE	2.8	pf

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS
HEATER WARM-UP TIME*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

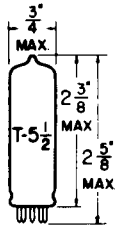
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	5 400	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.)		
I_b = 100 μAMPS.	-6	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

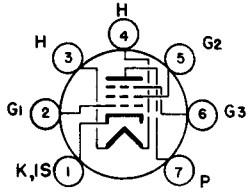


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 3BN6 IS A GATED-BEAM DISCRIMINATOR TUBE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. A UNIQUE DESIGN, MAKING USE OF THE ELECTROSTATIC BEAM DEFLECTION PRINCIPLE, RESULTS IN VERY EFFICIENT LIMITING AS WELL AS PROVIDING FOR FM DETECTION AND AMPLIFICATION. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BN6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±60	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	1.25	1.25	1.25	VOLTS
DC PLATE CURRENT	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

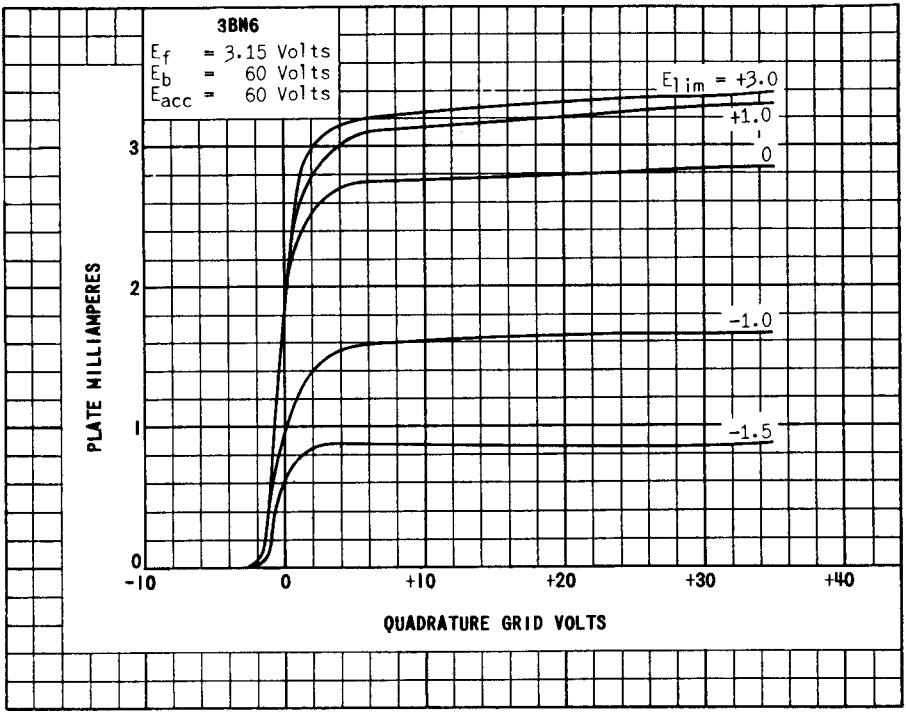
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

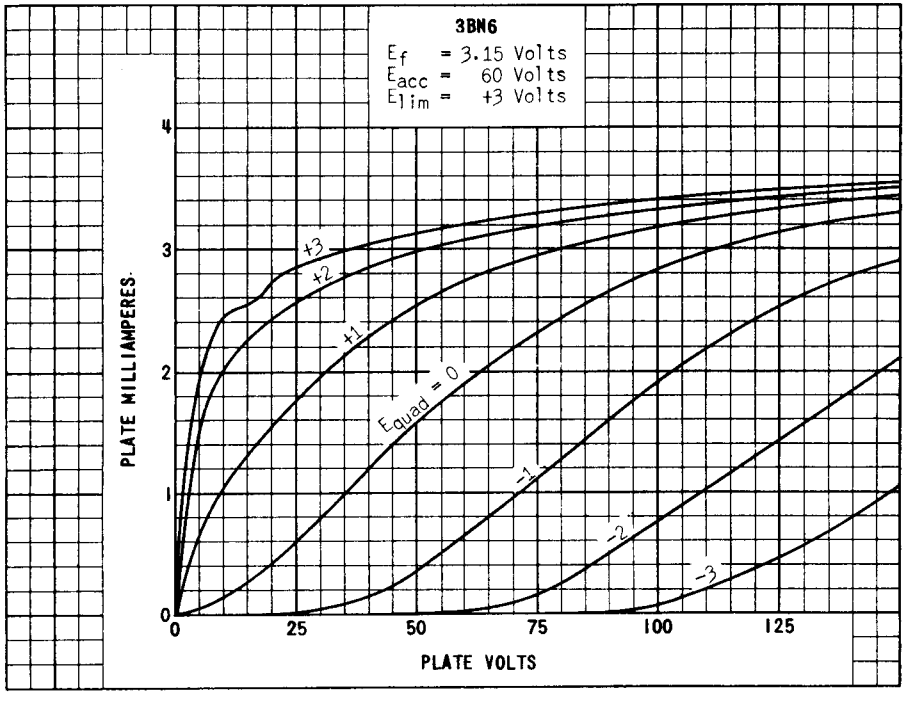
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

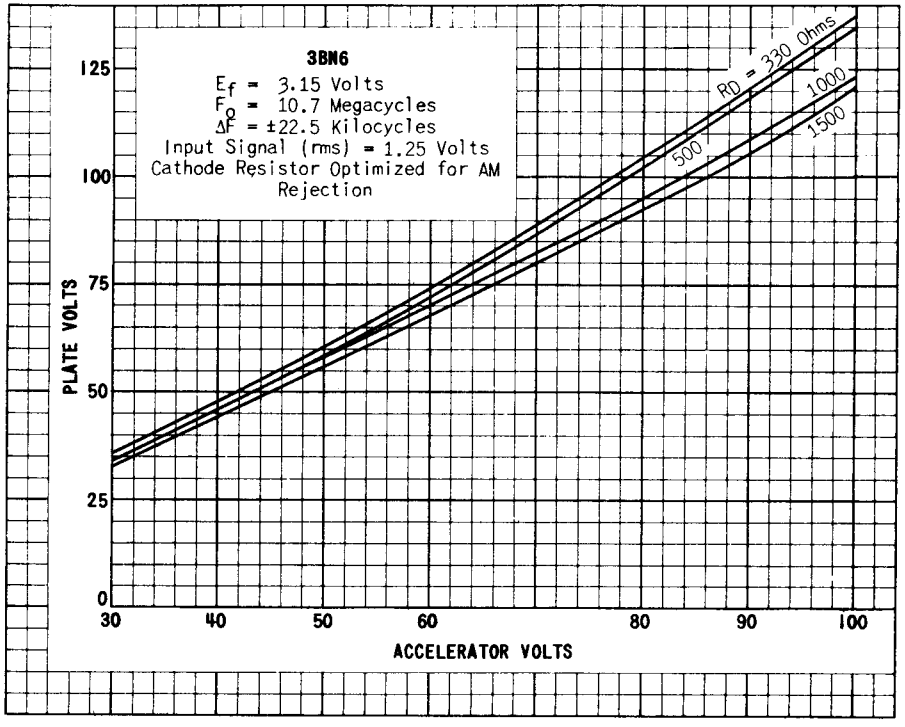
STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

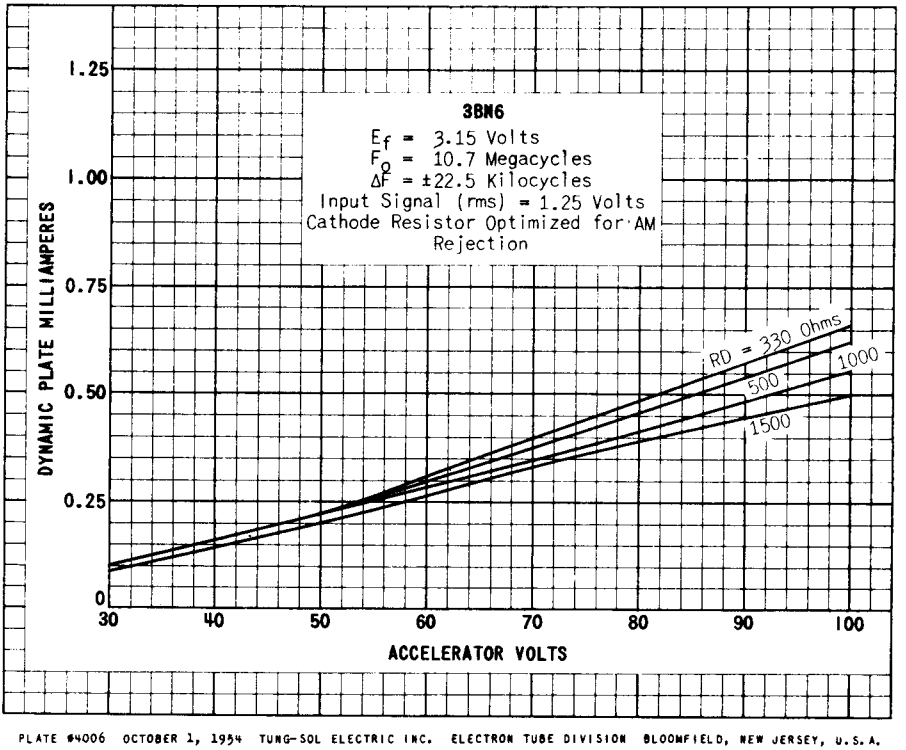
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

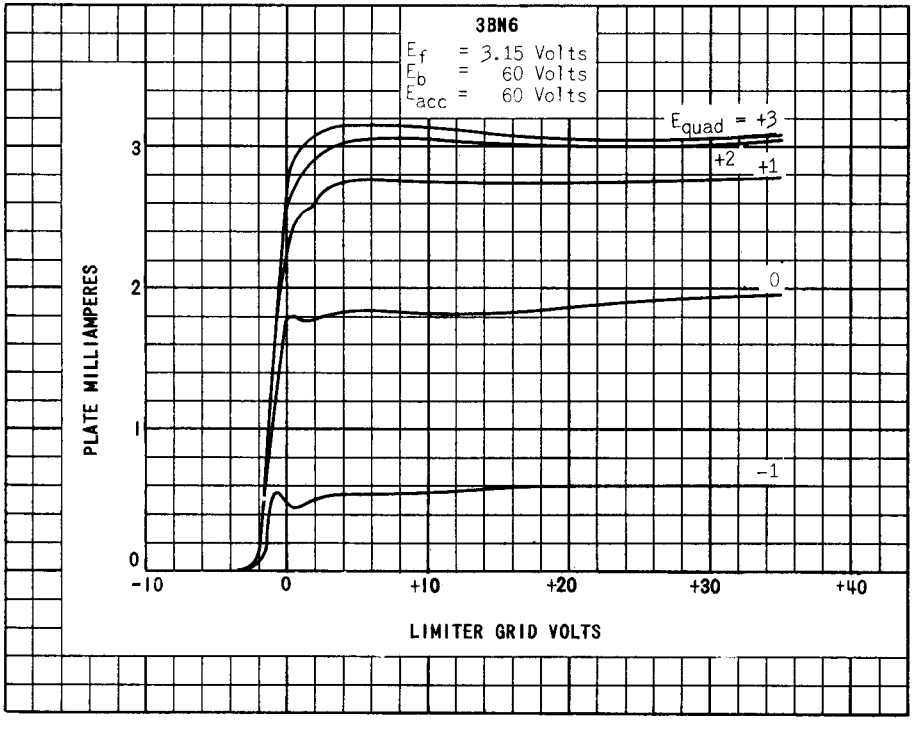
→ INDICATES A CHANGE.


3BN6
Ef = 3.15 Volts
Eb = 60 Volts
Eacc = 60 Volts
Elim = +3.0
+1.0
0
-1.0
-1.5
PLATE MILLIAMPERES
QUADRATURE GRID VOLTS
-10
0
+10
+20
+30
+40
1
2
3


3BN6
Ef = 3.15 Volts
Eacc = 60 Volts
Elim = +3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
+3
+2
+1
Equad = 0
-1
-2
-3
0
25
50
75
100
125
1
2
3
4


3BN6
E_f = 3.15 Volts
F_o = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
PLATE VOLTS
125
100
75
50
25
0
30
40
50
60
80
90
100
ACCELERATOR VOLTS


3BN6
E_f = 3.15 Volts
F_o = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
DYNAMIC PLATE MILLIAMPERES
1.25
1.00
0.75
0.50
0.25
0
30
40
50
60
70
80
90
100
ACCELERATOR VOLTS



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TUNG-SOL

HIGH VACUUM CATHODE-RAY TUBE

ELECTROSTATIC DEFLECTION AND FOCUSING

NO. 1 PHOSPHOR
GREEN FLUORESCENT SCREEN
MEDIUM PERSISTENCE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

COATED UNIPOTENTIAL CATHODE

GLASS BULB

MEDIUM SHELL DIHEPTAL 12 PIN BASE

RATINGS*

MAXIMUM ANODE NO. 2 VOLTAGE (HIGH-VOLTAGE ELECTRODE)	2200	VOLTS
MAXIMUM ANODE NO. 1 VOLTAGE (FOCUSING ELECTRODE)	1100	VOLTS
GRID VOLTAGE (CONTROL ELECTRODE)	NEVER POSITIVE	
MAXIMUM PEAK VOLTAGE BETWEEN ANODE NO. 2 AND ANY DEFLECTOR	550	VOLTS
MAXIMUM DC HEATER CATHODE POTENTIAL[A]	125	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM IMPEDANCE OF ANY DEFLECTOR CIRCUIT AT HEATER SUPPLY FREQUENCY	1.0	MEGOHM

*MAXIMUM RATINGS ARE ABSOLUTE VALUES

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

GRID TO ALL OTHER ELECTRODES	8.0	μμf
CATHODE TO ALL OTHER ELECTRODES	7.0	μμf
D1 TO D2	2.0	μμf
D3 TO D4	2.0	μμf
D1 TO ALL OTHER ELECTRODES	9.0	μμf
D3 TO ALL OTHER ELECTRODES	7.0	μμf
D1 TO ALL OTHER ELECTRODES EXCEPT D2	7.0	μμf
D2 TO ALL OTHER ELECTRODES EXCEPT D1	7.0	μμf
D3 TO ALL OTHER ELECTRODES EXCEPT D4	5.0	μμf
D4 TO ALL OTHER ELECTRODES EXCEPT D3	6.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE NO. 2 VOLTAGE[B]	1500	2000	VOLTS
ANODE NO. 1 VOLTAGE FOR FOCUS AT 75% OF GRID VOLTAGE CUT-OFF[C]	430	575	VOLTS
GRID VOLTAGE FOR CUT-OFF[D]	-45[E]	-60[E]	VOLTS
DEFLECTION SENSITIVITY:[F]			
D1 AND D2	0.153	0.115	MM/VOLT DC
D3 AND D4	0.207	0.155	MM/VOLT DC
DEFLECTION FACTOR:[F]			
D1 AND D2	166	221	VOLTS DC/IN
D3 AND D4	123	164	VOLTS DC/IN

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PLATE
1397
MARCH 15
1944

CONTINUED NEXT PAGE

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CONTINUED FROM PRECEDING PAGE

SPOT POSITION AND TEST CONDITIONS

THE UNDEFLECTED FOCUSED SPOT FALLS WITHIN A 15 MM. SQUARE CENTERED ON THE TUBE FACE.

TEST CONDITIONS ARE:

ANODE NO. 2 VOLTAGE	2000 VOLTS
ANODE NO. 1 VOLTAGE	ADJUSTED FOR FOCUS
GRID VOLTAGE	NEAR CUT-OFF
DEFLECTOR RESISTORS (CONNECTED TO ANODE NO. 2)	1 MEGOHM EACH

NOTE: SHIELD TUBE FROM ALL STRAY FIELDS.

[A] WHEN THE HEATER IS OPERATED AT A NEGATIVE POTENTIAL WITH RESPECT TO THE CATHODE THEN THE CATHODE RETURN SHOULD BE MADE AT THE CENTER TAP OF THE FILAMENT TRANSFORMER.

[B] USE OF LESS THAN 1500 VOLTS RESULTS IN DECREASED BRILLIANCE.

[C] CERTAIN TUBES MAY REQUIRE ADJUSTMENT OF +20% TO −35% WITH GRID VOLTAGE BETWEEN ZERO AND CUT-OFF.

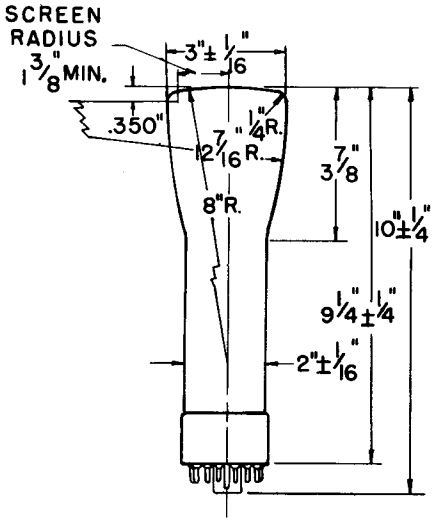
[D] THE VISUAL EXTINCTION OF A FOCUSED SPOT.

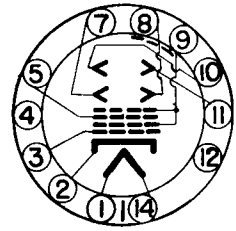
[E] THE GRID SUPPLY SHOULD BE VARIABLE TO ± 50%.

[F] VALUES SUBJECT TO VARIATION OF ± 20%.

DEFLECTOR LOCATIONS:

D1 AND D2	NEAREST TO SCREEN
D3 AND D4	NEAREST TO BASE
D1	SAME SIDE OF TUBE AS PIN NO. 5
D3	SAME SIDE AS PIN NO. 2





BOTTOM VIEW

1. HEATER
2. CATHODE
3. GRID NO. 1
4. INTERNAL CONNECTION (DO NOT USE)
5. ANODE NO. 1
7. DEFLECTOR NO. 3 (D3)
8. DEFLECTOR NO. 4 (D4)
9. GRID NO. 2
   ANODE NO. 2
10. DEFLECTOR NO. 2 (D2)
11. DEFLECTOR NO. 1 (D1)
12. NO CONNECTION
14. HEATER

PLATE 1398
MARCH 15 1944

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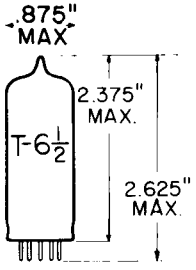
TUNG-SOL

TWIN PENTODE

MINIATURE TYPE

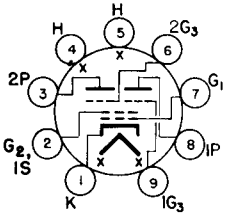


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 600 ± 40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 3BU8 IS A MINIATURE MULTISECTION TUBE WHICH INCORPORATES SEPARATE PLATES AND NUMBER 3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, NUMBER 1 GRID, AND CATHODE. THE TUBE IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. IN THIS SERVICE, WHEN USED IN CONJUNCTION WITH SUITABLE CIRCUITRY, ONE SECTION OF THE 3BU8 FUNCTIONS AS SYNC SEPARATOR AND SYNC CLIPPER, WHILE THE OTHER SECTION IS USED TO GENERATE THE AUTOMATIC-GAIN-CONTROL VOLTAGE. IN ADDITION, BY UTILIZING THE COMMON, #1 GRID, NOISE PULSES CAN BE SUPPRESSED FROM BOTH SYNCHRONIZING AND AUTOMATIC-GAIN-CONTROL CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS THE 3BU8 IS IDENTICAL TO THE 6BU8.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, (EACH SECTION)	1.9	pf
GRID #1 TO ALL	6.0	pf
GRID #3 TO ALL (EACH SECTION)	3.6	pf
PLATE TO ALL (EACH SECTION)	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2) MAX.	0.015	pf

RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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RATINGS – CONT'D

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHMS
HEATER WARM–UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	–10	0	VOLTS
GRID #1 VOLTAGE	**	**	
PLATE CURRENT (EACH SECTION)		2.2	MA.
SCREEN CURRENT	6.5	3.3	MA.
CATHODE CURRENT	6.6	7.8	MA.

EACH SECTION SEPARATELY [A]

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	**	VOLTS
GRID #3 TRANSCONDUCTANCE	---	180	μMHOS
GRID #1 TRANSCONDUCTANCE	1 500	---	μMHOS
PLATE CURRENT	---	2.2	MA.
GRID #3 VOLTAGE (APPROX.) I_b=100μAMPS	---	–4.5	VOLTS
GRID #1 VOLTAGE (APPROX.) I_b=100μAMPS	---	2.3	VOLTS

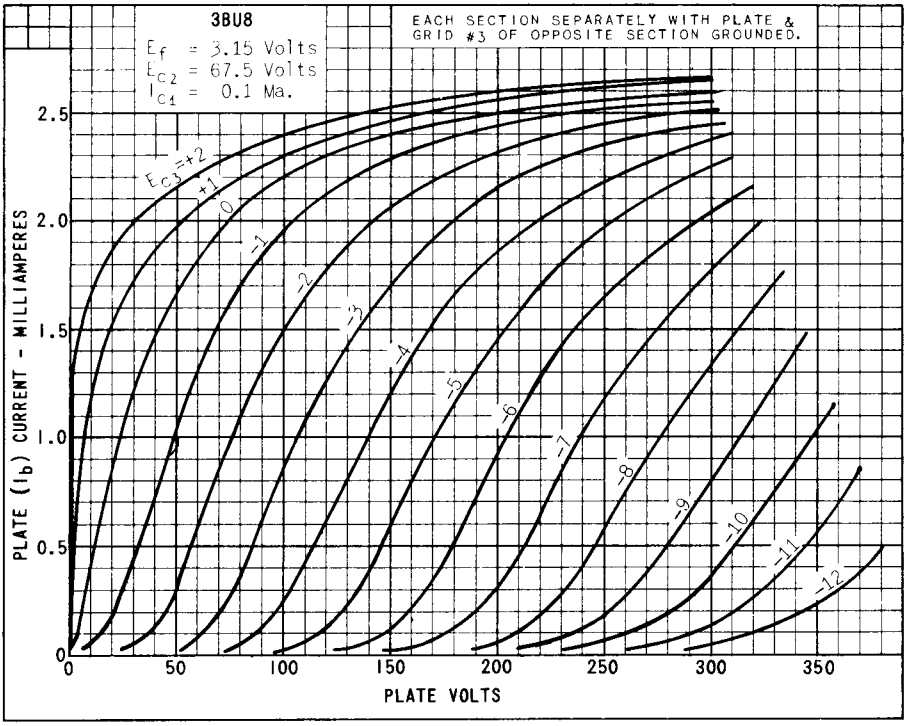
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

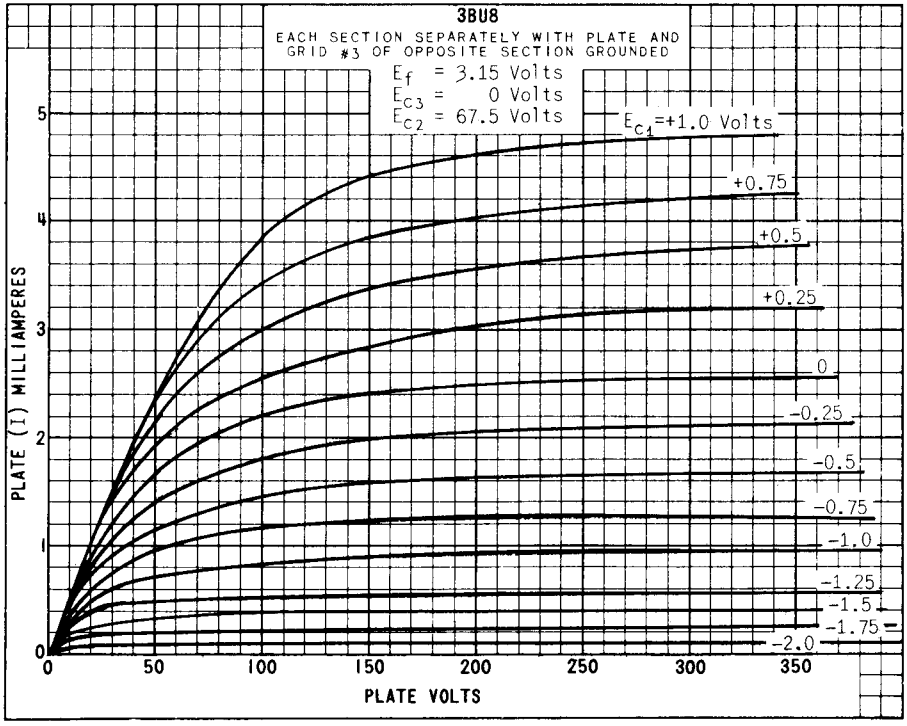
**WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

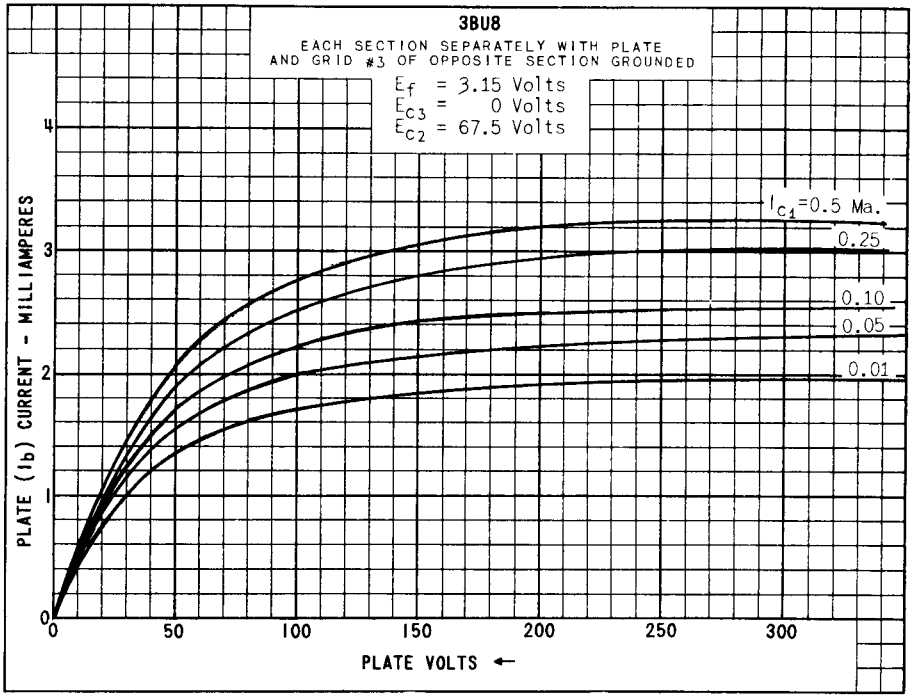
[A]WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

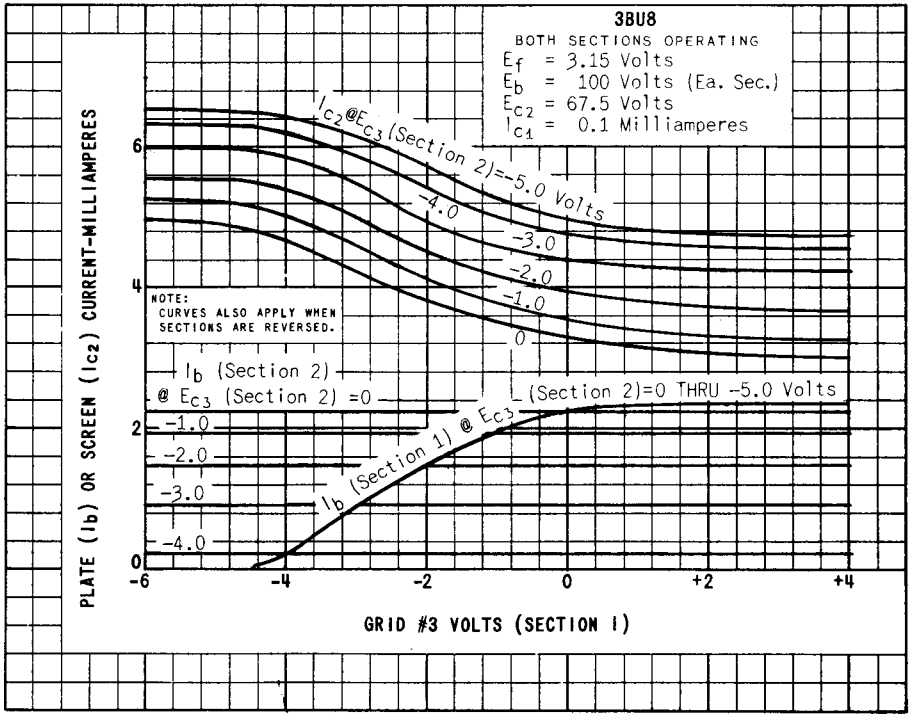
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

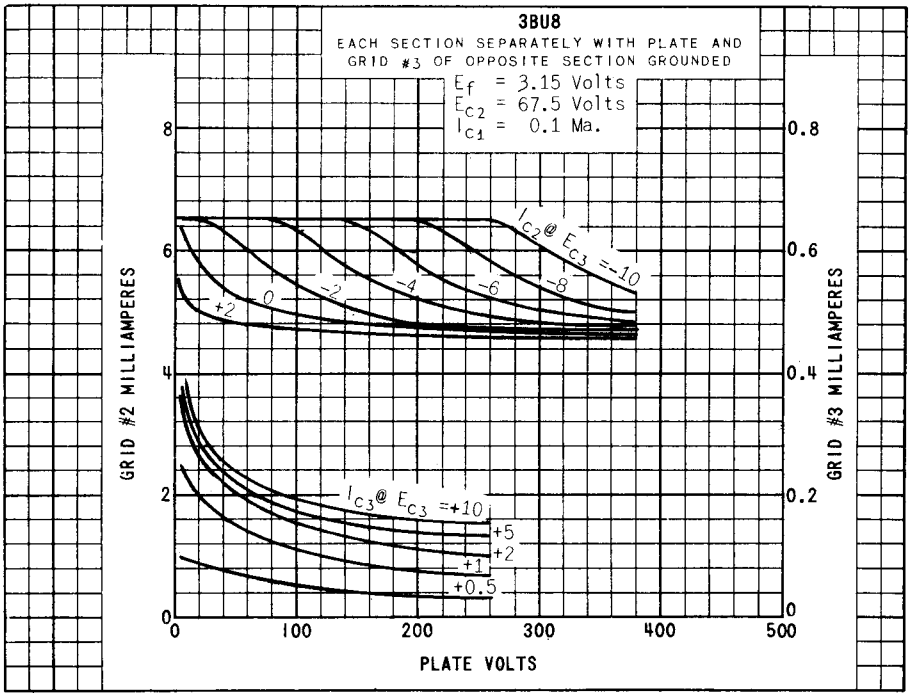
SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 3BU8 is identical to the 6BU8.*

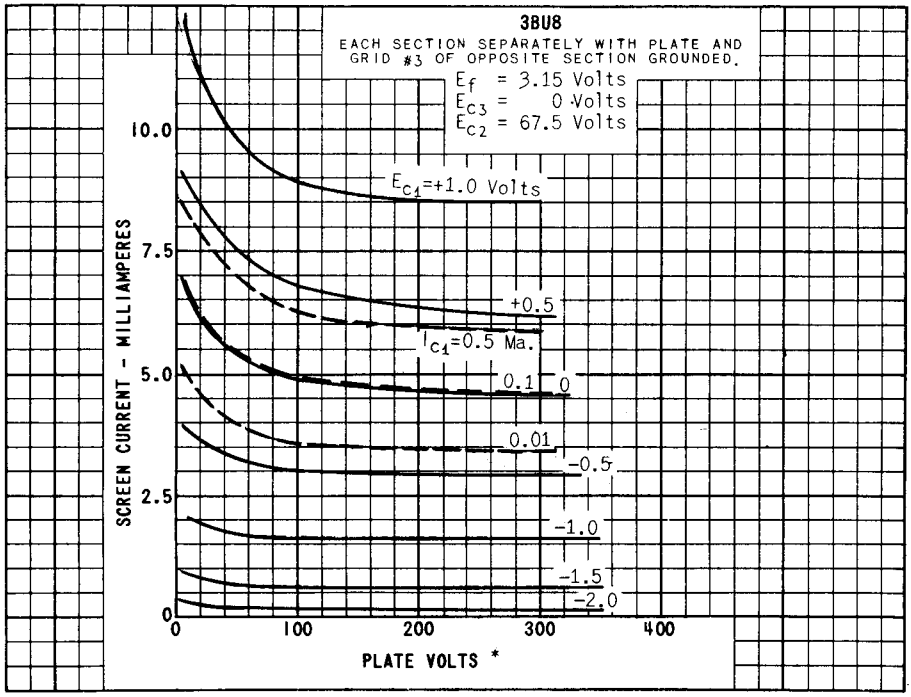

3BU8
E_f = 3.15 Volts
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Ma.
EACH SECTION SEPARATELY WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED.
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS
E_{c3}=+2
+1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12


3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 3.15 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
E_{c1}=+1.0 Volts
+0.75
+0.5
+0.25
0
-0.25
-0.5
-0.75
-1.0
-1.25
-1.5
-1.75
-2.0
PLATE (I) MILLIAMPERES
PLATE VOLTS


3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 3.15 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c_1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS ←
0
50
100
150
200
250
300
1
2
3
4


3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c_1} = 0.1 Milliamperes
I_{c_2}@E_{c_3} (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE:
CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
I_b (Section 2) @ E_{c_3} (Section 2) =0
-1.0
-2.0
-3.0
-4.0
I_b (Section 1) @ E_{c_3} (Section 2)=0 THRU -5.0 Volts
PLATE (I_b) OR SCREEN (I_{c_2}) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)
-6
-4
-2
0
+2
+4
2
4
6





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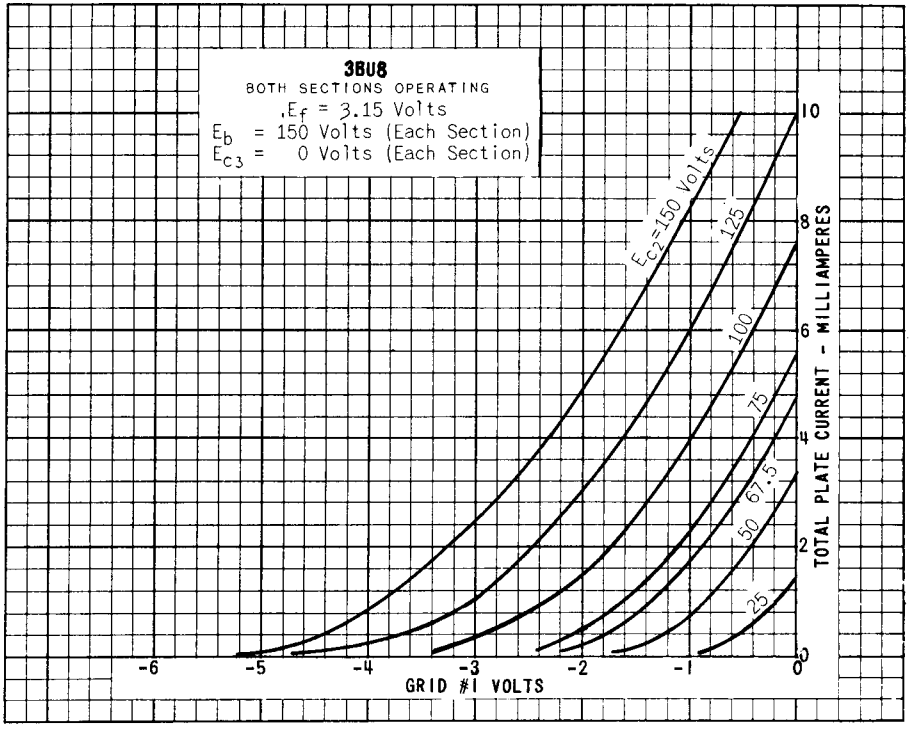
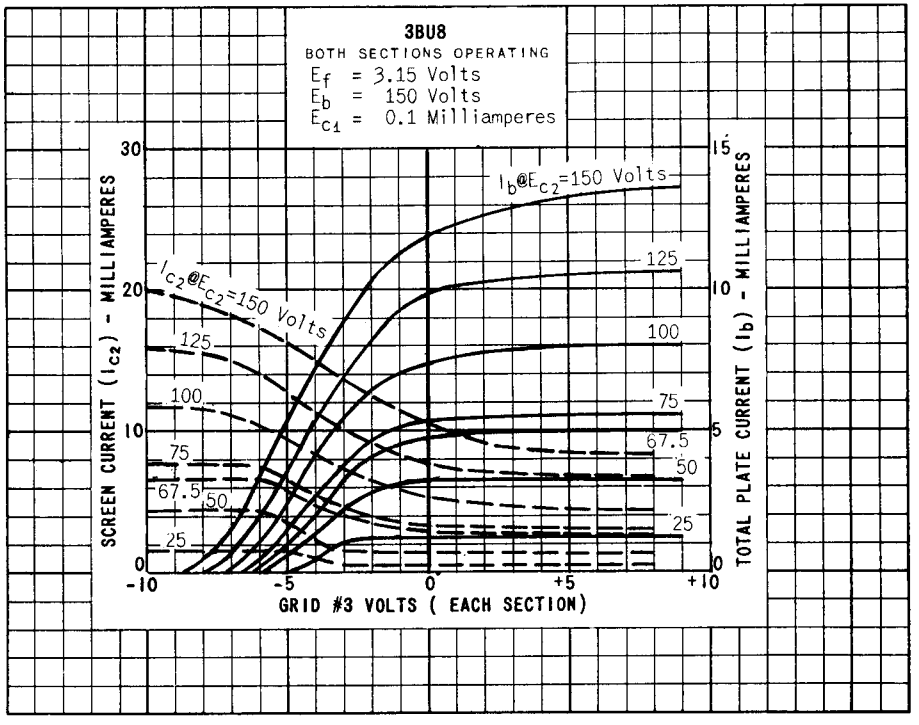
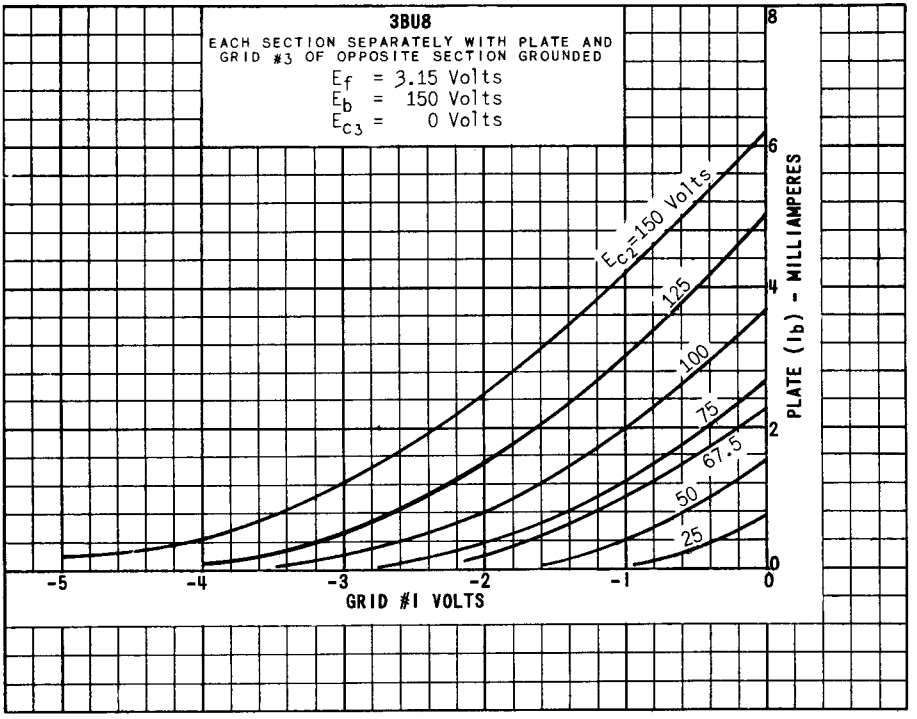
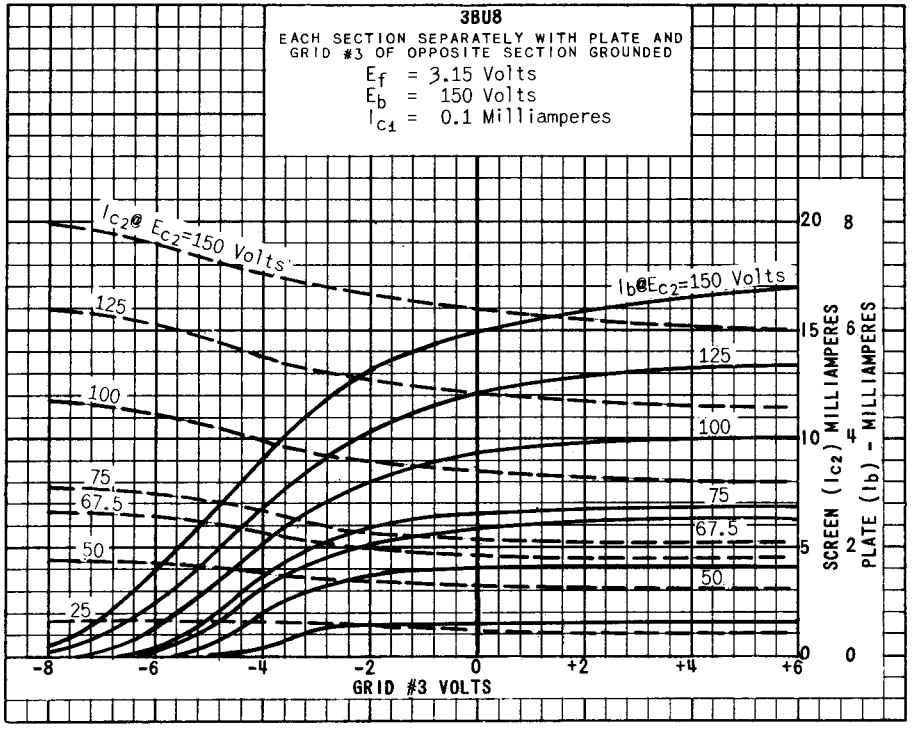

3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
10
8
6
4
2
0


3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
I_{c2}@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
GRID #3 VOLTS (EACH SECTION)
-10
-5
0
+5
+10
30
20
10
0
15
10
5
0





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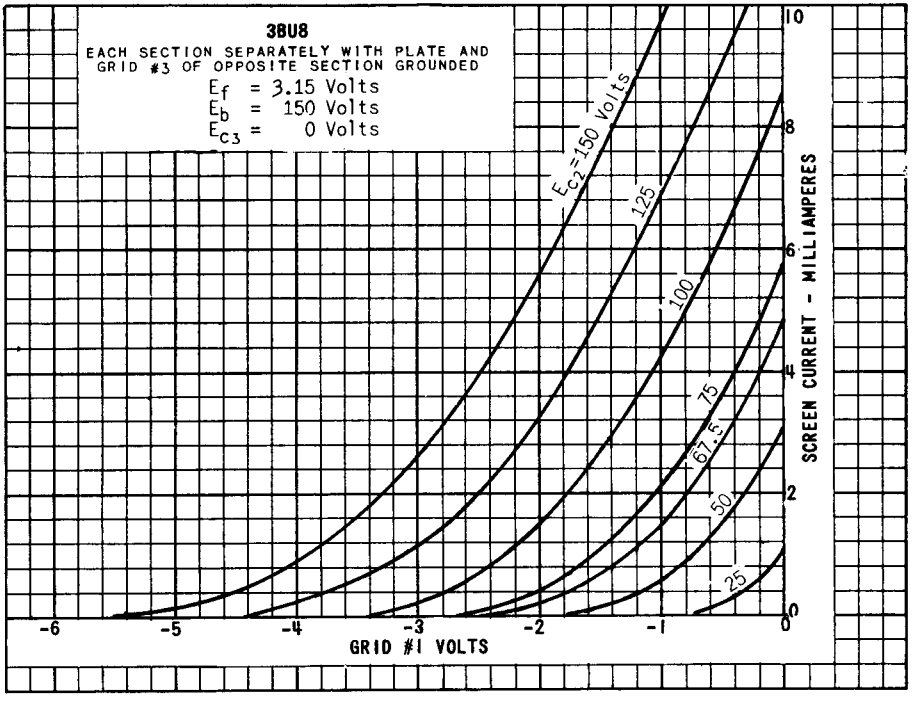
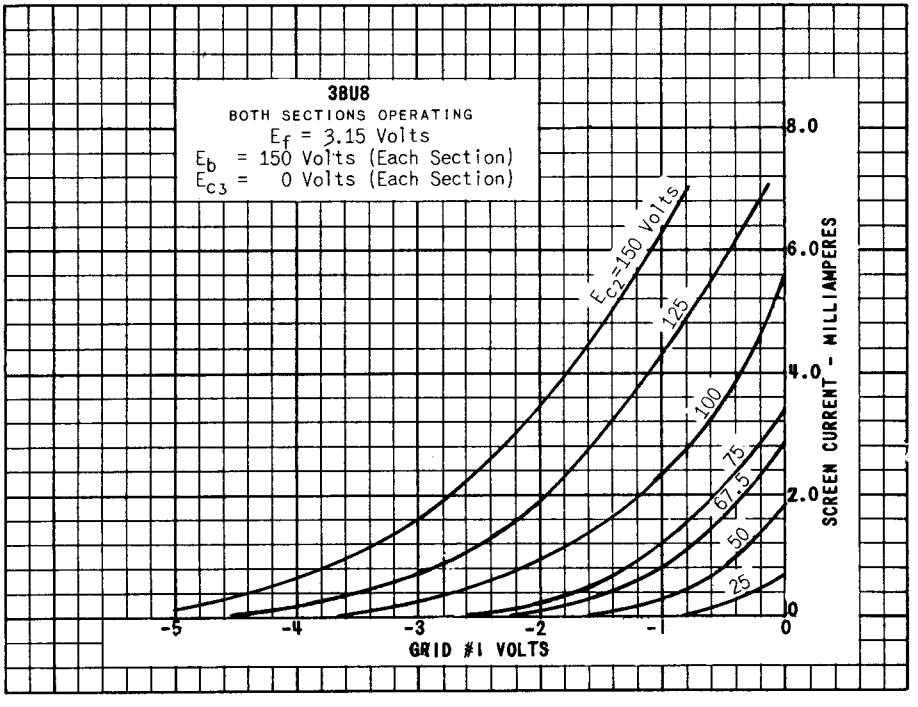
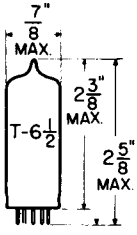

3BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 3.15 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10


3BU8
BOTH SECTIONS OPERATING
E_f = 3.15 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-5
-4
-3
-2
-1
0
2.0
4.0
6.0
8.0

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

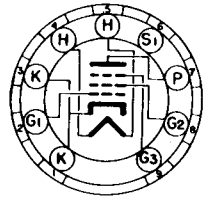
COATED UNIPOTENTIAL CATHODE

HEATER

3.4 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9AQ

THE 3BX6 IS A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN R.F., I.F. OR A VIDEO AMPLIFIER OR MIXER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS, THE 3BX6 IS IDENTICAL TO THE 12BX6.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT ANODE	7.5	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	3.3	μμf
PLATE TO GRID #1 (MAX.)	0.007	μμf
PLATE TO CATHODE (MAX.)	0.012	μμf
GRID #2 TO ALL OTHER ELEMENTS	5.4	μμf
GRID #2 TO GRID #1	2.6	μμf
GRID #1 TO HEATER (MAX.)	0.15	μμf
CATHODE TO HEATER	5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.4	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 VOLTAGE WITH COLD CATHODE	550	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATTS
MAXIMUM GRID #2 DISSIPATION AT PLATE DISSIPATION < 1.8 WATTS	0.9	WATTS
MAXIMUM CATHODE CURRENT	15	MAMPS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	150	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

R.F. AMPLIFIER

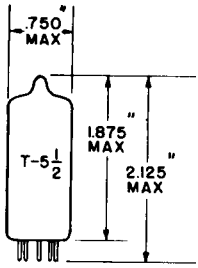
HEATER VOLTAGE	3.4	3.4	3.4	VOLTS
HEATER CURRENT	0.60	0.60	0.60	AMP.
PLATE VOLTAGE	170	200	250	VOLTS
GRID #3 VOLTAGE	0	0	0	VOLT
GRID #2 VOLTAGE	170	200	250	VOLTS
GRID #1 VOLTAGE	-2.0	-2.55	-3.5	VOLTS
PLATE CURRENT	10	10	10	MAMPS
GRID #2 CURRENT	2.5	2.6	2.8	MAMPS
TRANSCONDUCTANCE	7400	7100	6800	μMHOS
PLATE RESISTANCE	0.5	0.55	0.65	MEGOHM
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	50	50	50	
EQUIVALENT NOISE RESISTANCE	1000	1100	1200	OHMS
INPUT RESISTANCE AT FREQUENCY = 50 Mc (PIN 1 CONNECTED TO PIN 3)	10 000	12 000	15 000	OHMS

OBSERVATION

WHEN USING THE 3BX6 AS VIDEO AMPLIFIER THE AMPLIFICATION BETWEEN THE INPUT GRID OF THE 3BX6 AND THE INPUT OF THE CATHODE RAY TUBE SHOULD NOT EXCEED A VALUE OF 25, IN ORDER TO PREVENT MICROPHONIC EFFECT.

TUNG-SOL

HEPTODE
MINIATURE TYPE



GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

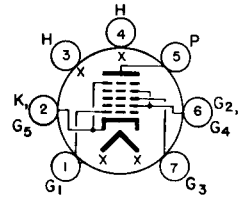
COATED UNIPOTENTIAL CATHODE

FOR USE

AS A GATED AMPLIFIER IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 3BY6 IS A PENTAGRID AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED EXPECIALLY FOR USE AS A GATED AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TV RECEIVERS. IN SUCH SERVICE, IT MAY BE USED AS A COMBINED SYNC SEPARATOR AND SYNC CLIPPER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BY6.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.08	pf
GRID #3 TO PLATE (MAX.)	0.35	pf
GRID #1 TO GRID #3 (MAX.)	0.22	pf
GRID #1 TO ALL OTHER ELECTRODES AND HEATER	5.4	pf
GRID #3 TO ALL OTHER ELECTRODES AND HEATER	6.9	pf
PLATE TO ALL OTHER ELECTRODES AND HEATER	7.6	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER SUPPLY LIMITS: CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS
HEATER WARM-UP TIME[A]		11	SECONDS

MAXIMUM RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

PLATE VOLTAGE	→ 330	VOLTS
GRID #2 & #4 VOLTAGE	SEE RATING CHART	
GRID #2 & #4 SUPPLY VOLTAGE	→ 330	VOLTS
GRID #3 VOLTAGE:		
NEGATIVE BIAS VALUE	→ 55	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
POSITIVE PEAK VALUE	→ 27	VOLTS

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MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

GRID #1 VOLTAGE:		
NEGATIVE BIAS VALUE	→ 110	VOLTS
PLATE DISSIPATION	→ 2.3	WATTS
GRID #3 INPUT	0.1	WATT
GRIDS #2 & #4 INPUT:*		
FOR GRIDS #2 & #4 VOLTAGES UP TO 165 VOLTS	1.1	WATTS
FOR GRIDS #2 & #4 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS	SEE RATING CHART	
GRID #1 INPUT	0.1	WATT
GRID #1 OR GRID #3 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.5	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-2.5	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
GRID #3 TO PLATE TRANSCONDUCTANCE	500	µMHOS
GRID #1 TO PLATE TRANSCONDUCTANCE	1 900	µMHOS
PLATE CURRENT	6.5	MA.
GRID #2 & #4 CURRENT	9	MA.
GRID #3 VOLTS (APPROX.) FOR I_b = 35 µAMP. AND GRID #1 VOLTS = -4	-15	VOLTS
GRID #1 VOLTS (APPROX.) FOR I_b = 35 µAMP. AND GRID #3 VOLTS = 0	-12	VOLTS

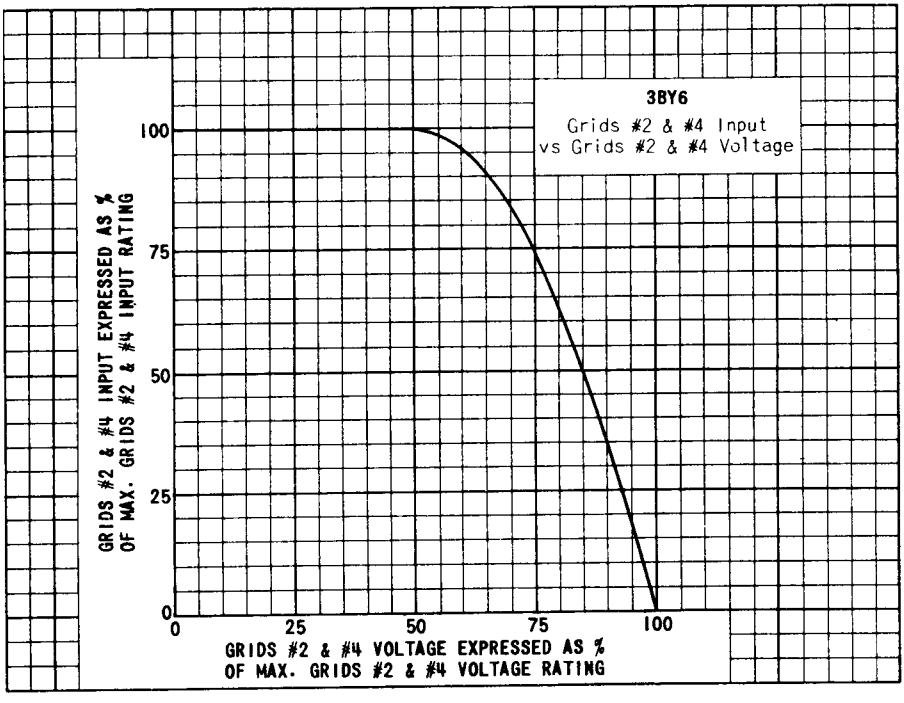
SYNC SEPARATOR AND SYNC CLIPPER

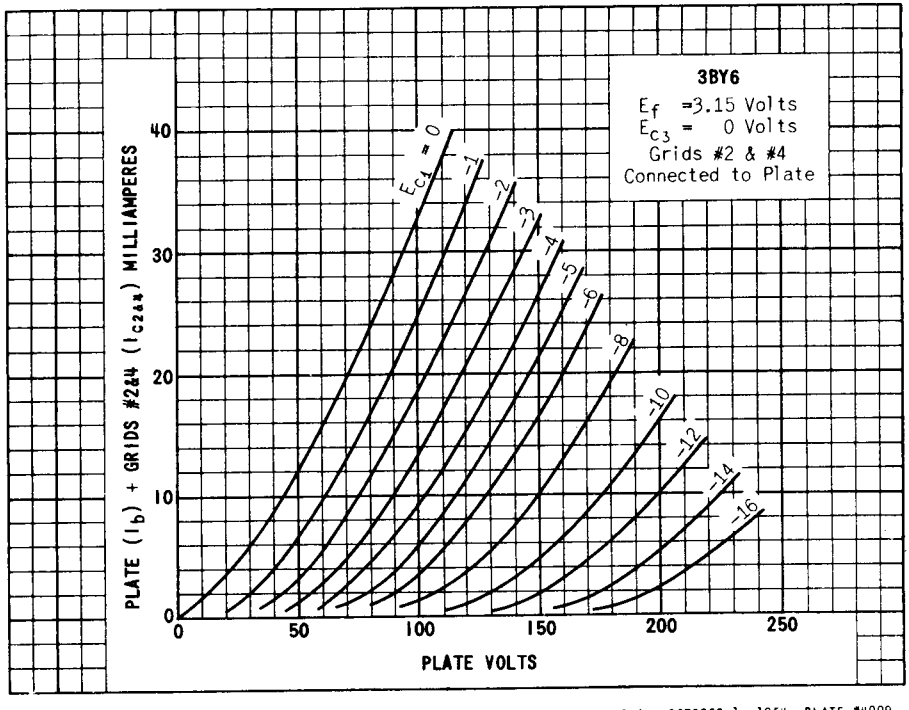
PLATE VOLTAGE	10	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 & #4 VOLTAGE	25	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.4	MA.
GRIDS #2 & #4 CURRENT	3.5	MA.
GRID #3 BIAS VOLTS (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #1 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 µAMP.	-2.5	VOLTS
GRID #1 BIAS VOLTAGE (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #3 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 µAMP.	-2.3	VOLTS

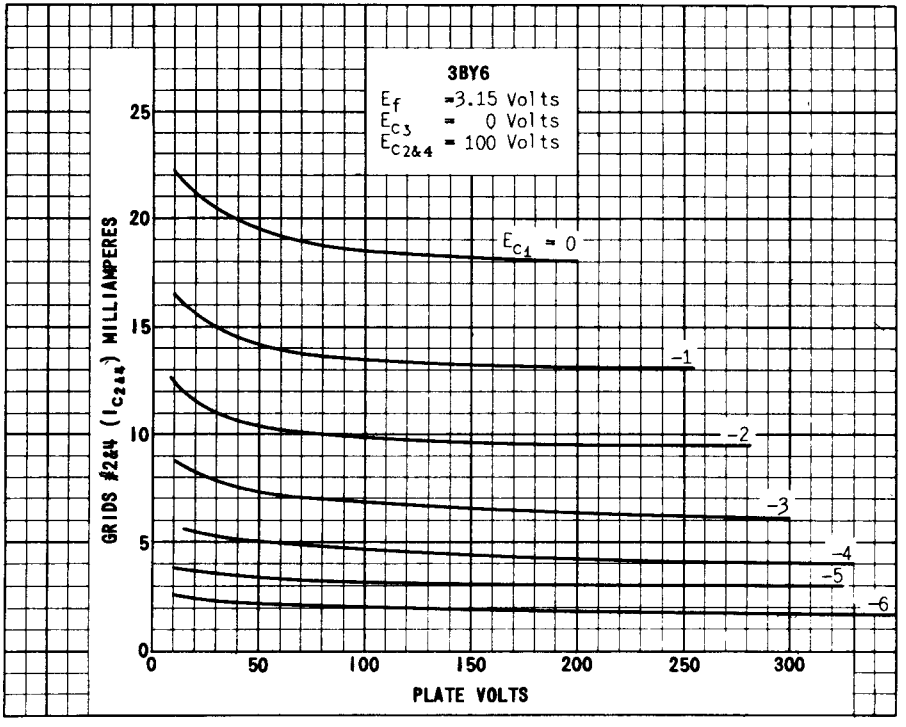
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

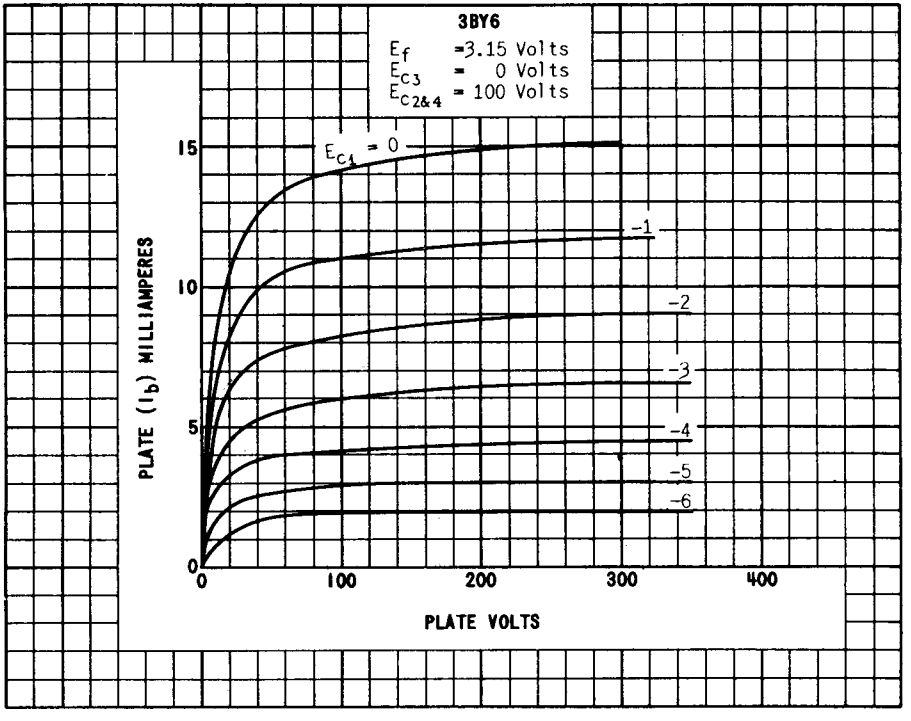
[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

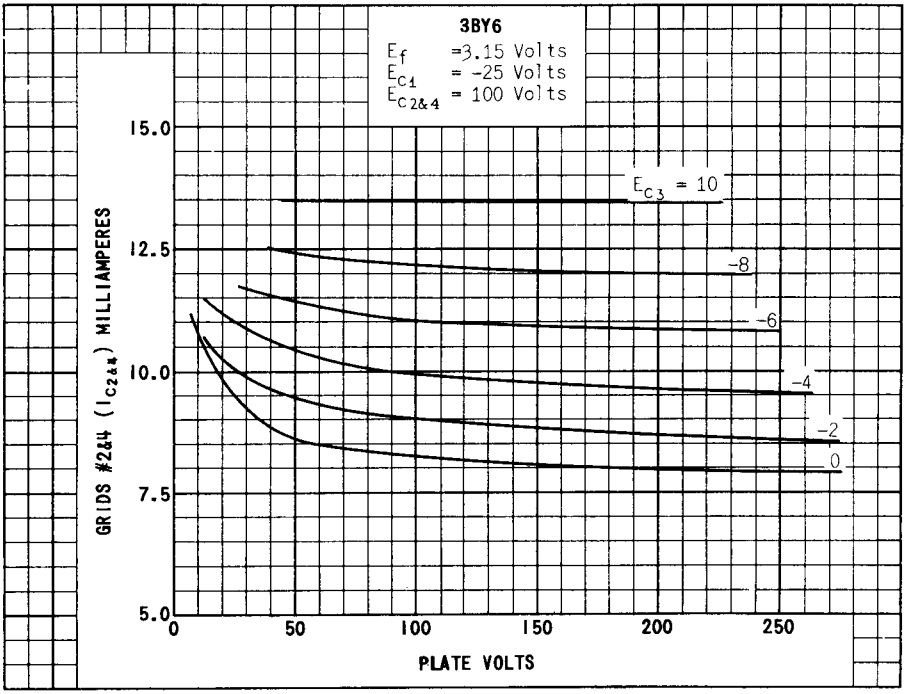
→ INDICATES A CHANGE. * INDICATES AN ADDITION.

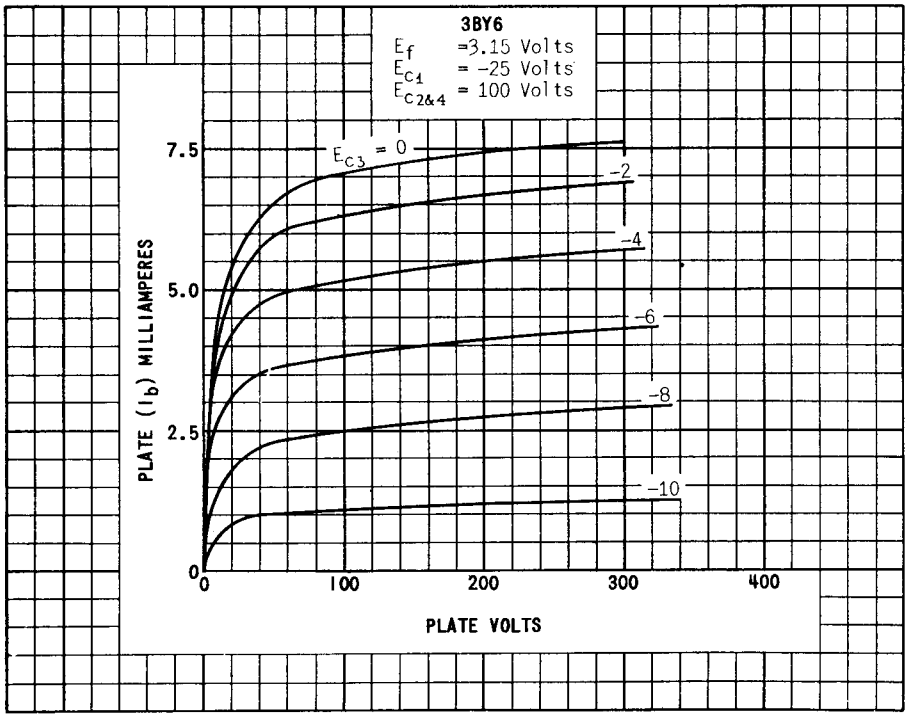

3BY6
Grids #2 & #4 Input
vs Grids #2 & #4 Voltage
GRIDS #2 & #4 INPUT EXPRESSED AS %
OF MAX. GRIDS #2 & #4 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRIDS #2 & #4 VOLTAGE EXPRESSED AS %
OF MAX. GRIDS #2 & #4 VOLTAGE RATING


3BY6
E_f =3.15 Volts
E_{c3} = 0 Volts
Grids #2 & #4
Connected to Plate
PLATE (I_b) + GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
40
30
20
10
0
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
-12
-14
-16
0
50
100
150
200
250
PLATE VOLTS


3BY6
E_f =3.15 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-1
-2
-3
-4
-5
-6
0
5
10
15
20
25
0
50
100
150
200
250
300


3BY6
E_f =3.15 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-1
-2
-3
-4
-5
-6
0
5
10
15
0
100
200
300
400

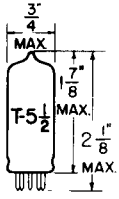

3BY6
E_f =3.15 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
15.0
12.5
10.0
7.5
5.0
0
50
100
150
200
250
PLATE VOLTS
E_{c3} = 10
-8
-6
-4
-2
0


3BY6
E_f =3.15 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
PLATE (I_b) MILLIAMPERES
7.5
5.0
2.5
0
100
200
300
400
PLATE VOLTS
E_{c3} = 0
-2
-4
-6
-8
-10

TUNG-SOL

PENTODE

MINIATURE TYPE

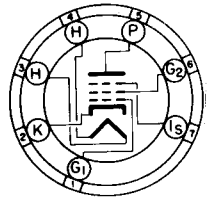


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 3BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.015	0.02	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.5	7.5	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	2.8	1.8	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE[C] ←		
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.25	MEGOHM
SELF BIAS OPERATION	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SECOND

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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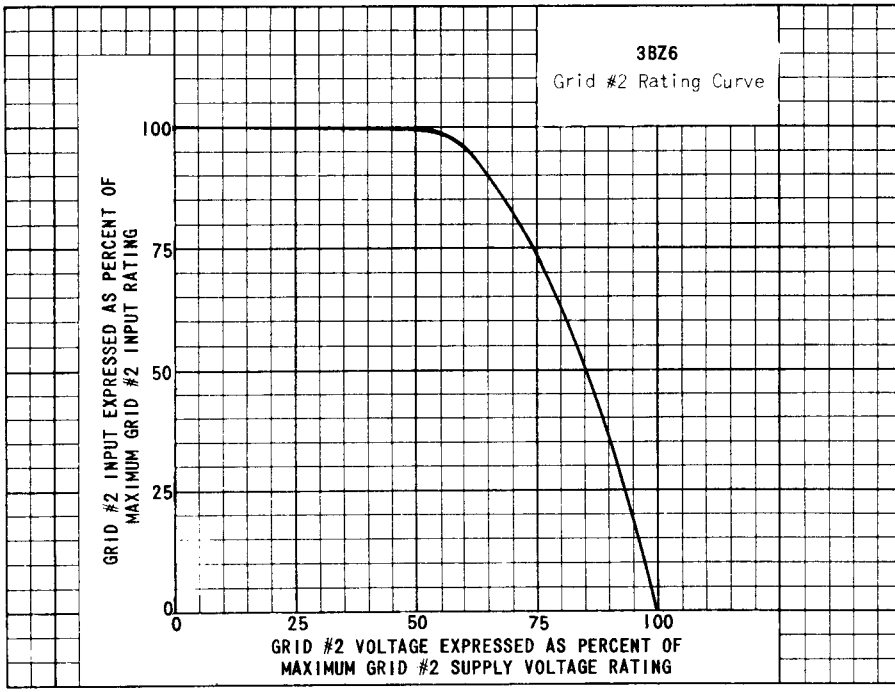
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

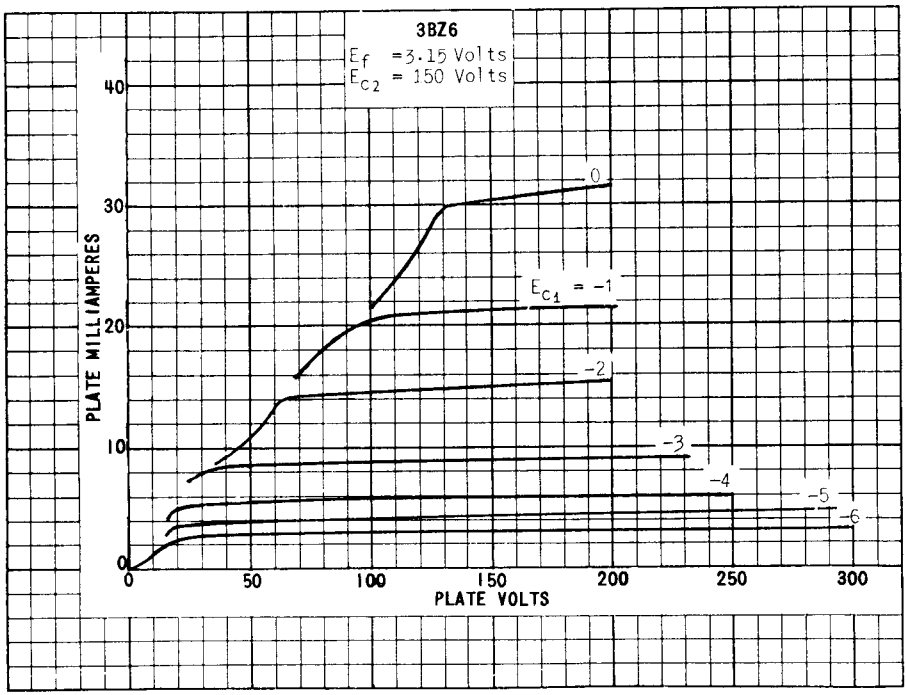
CLASS A_1 AMPLIFIER

HEATER VOLTAGE		3.15	VOLTS
HEATER CURRENT		0.6	AMP.
PLATE VOLTAGE		200	VOLTS
GRID #2 VOLTAGE		150	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
CATHODE BIAS RESISTOR		180	OHMS
PLATE RESISTANCE (APPROX.)		0.6	MEGOHM
TRANSCONDUCTANCE		6 100	μMHOS
PLATE CURRENT		11	MA.
GRID #2 CURRENT		2.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS		−23	VOLTS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] THE DC COMPONENT MUST NOT EXCEED 200 VOLTS.





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3BZ6

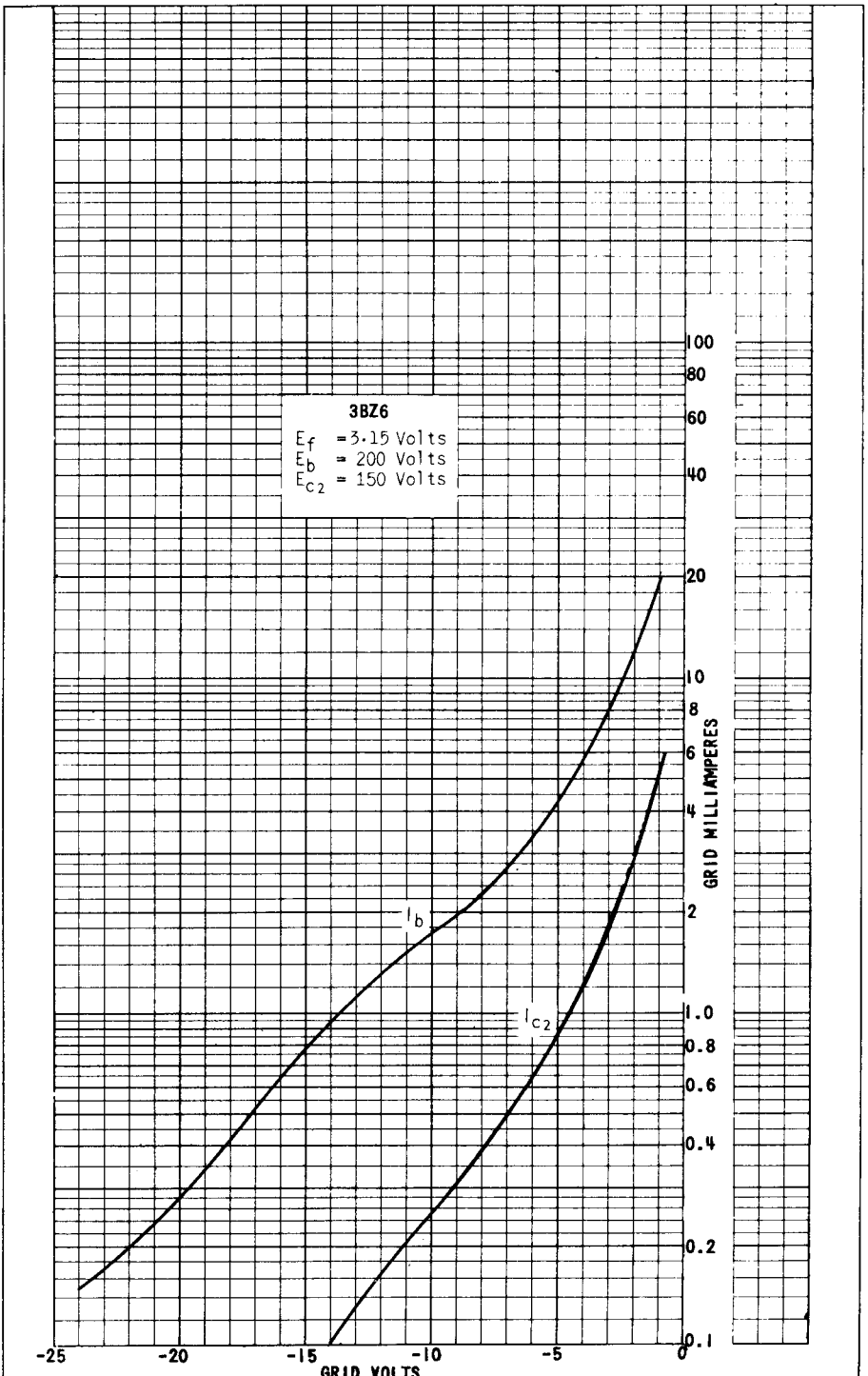
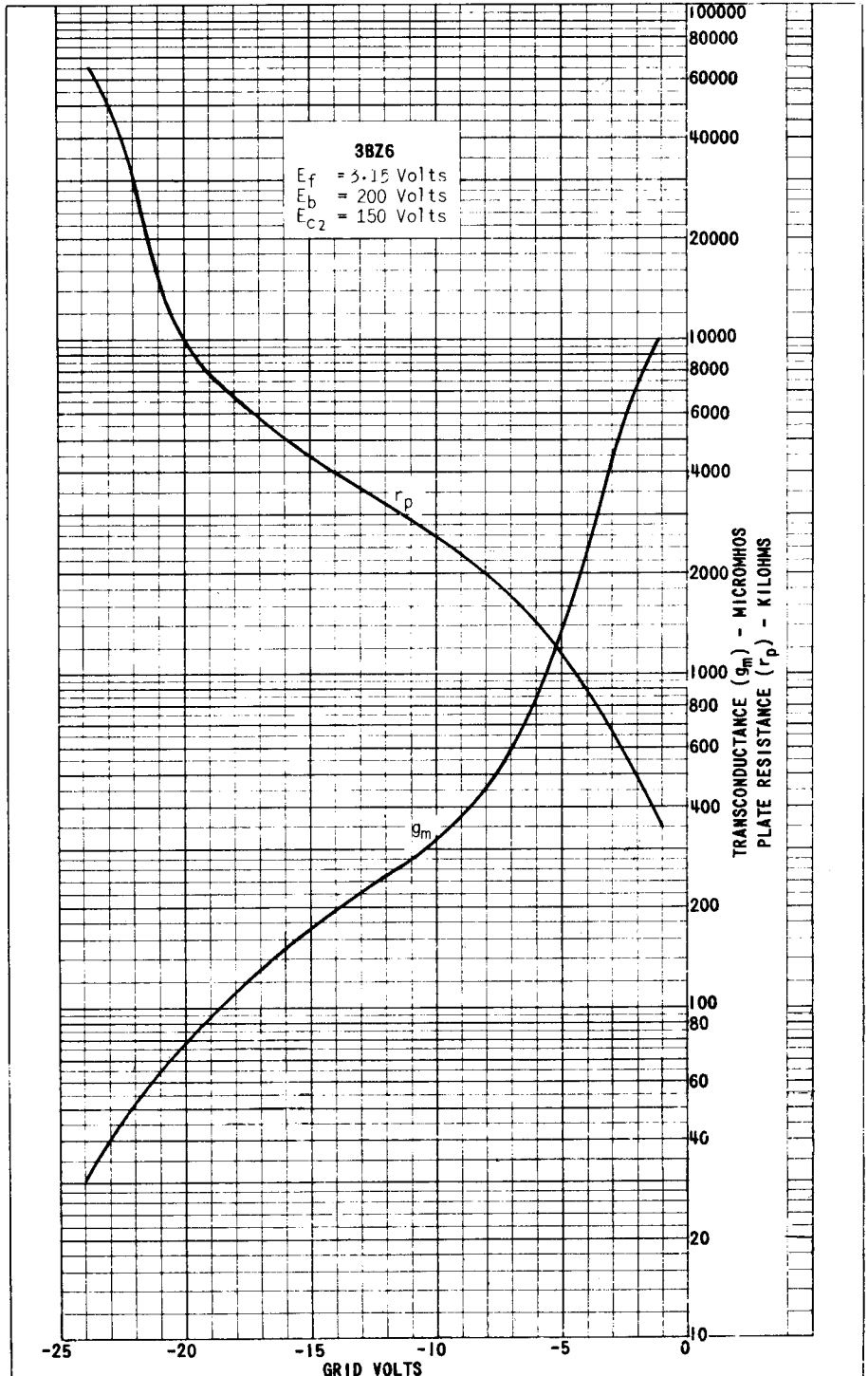


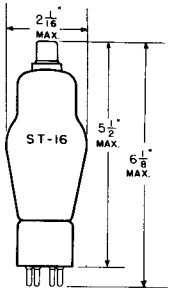
PLATE #4015 OCTOBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.


3BZ6
E_f = 3.15 Volts
E_b = 200 Volts
E_{c_2} = 150 Volts
r_p
g_m
100000
80000
60000
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
80
60
40
20
10
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

THYRATRON

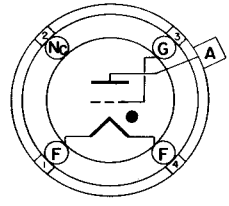
ARGON AND MERCURY - VAPOR



FILAMENT

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

GLASS BULB

THE 3C23 IS A THREE ELECTRODE, ARGON AND MERCURY-VAPOR FILLED THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC DESIGNED FOR GRID CONTROLLED RECTIFIER, MOTOR CONTROL, OR RELAY SERVICE. THE ADDITION OF ARGON GAS TO THE MERCURY-VAPOR ATMOSPHERE PERMITS THE TUBE TO START CONDUCTION AT LOW TEMPERATURES.

THE 3C23 EMPLOYS A MEDIUM, 4-PIN BAYONET BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±0.125	VOLTS
FILAMENT CURRENT @ Ef= 2.5 VOLTS	7	AMPS
CATHODE HEATING TIME——MINIMUM	15	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	1.8	μμf
DE-IONIZATION TIME — APPROXIMATE		
ANODE VOLTS = 120, ANODE CURRENT = 1.5 AMPS		
GRID VOLTS = - 20, GRID RESISTOR = 10,000 OHMS	360	μμf
ANODE VOLTS = 120 (ANODE CURRENT = 1.5 AMPS.		
GRID VOLTS = - 500 GRID RESISTOR = 100,000 OHMS	60	μμf
ANODE VOLTAGE DROP — APPROXIMATE		
INITIAL	10	VOLTS
END OF LIFE	20	VOLTS

MECHANICAL DATA

MOUNTING POSITION	VERTICAL BASE DOWN
TYPE OF COOLING	CONVECTION
BULB	ST16
BASE	A4-10 MEDIUM
CAP	C1-5 MEDIUM
NET WEIGHT	3 OUNCES MAXIMUM
SOCKET	MEDIUM 4 PIN BAYONET

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TUNG-SOL

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RATINGS

ABSOLUTE VALUES

	MIN.	MAX.	
PEAK ANODE VOLTAGE			
FORWARD	---	1250	VOLTS
REVERSE	---	1250	VOLTS
GRID VOLTAGE			
PEAK OR DC BEFORE TUBE CONDUCTION	---	-500	VOLTS
AVERAGE DURING TUBE CONDUCTION - NOTE 1	---	-10	VOLTS
ANODE CURRENT			
PEAK	---	6	AMPS.
AVERAGE - NOTE 2	---	1.5	AMPS.
FAULT - FOR DURATION OF 0.1 SEC. MAX. - NOTE 3	---	120	AMPS.
GRID CURRENT			
AVERAGE - NOTE 4	---	+0.01	AMP.
OPERATING FREQUENCY (PER SECOND)	---	420	CYCLES
ALTITUDE	---	10,000	FEET
TEMPERATURE RANGE - NOTE 5	40	80	°C
FILAMENT VOLTAGE	2.37	2.63	VOLTS

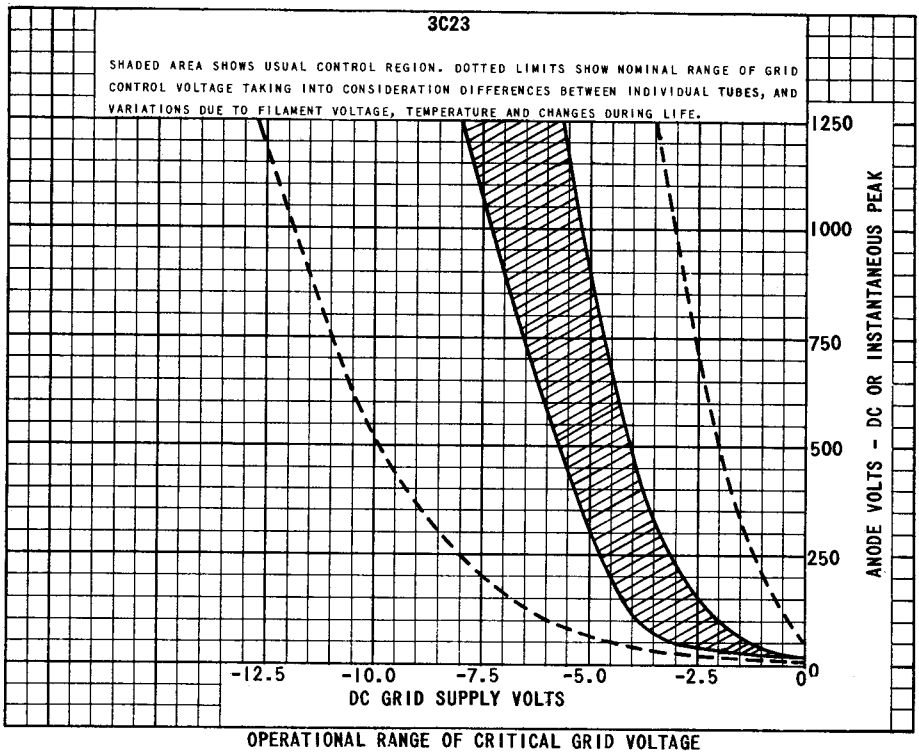
1. AVERAGED OVER ONE CONDUCTING PERIOD.

2. AVERAGED OVER ANY INTERVAL OF FIVE SECONDS MAXIMUM.

3. THE EQUIPMENT DESIGNER SHOULD LIMIT THE SHORT CIRCUIT CURRENT TO 120 AMPERES CIRCUITWISE. IT SHOULD BE UNDERSTOOD THAT WHILE THE TUBE MAY STAND SEVERAL FAULTS AT THIS MAGNITUDE OF CURRENT, EACH FAULT WILL ADVERSELY AFFECT TUBE LIFE.

4. AVERAGED OVER THE PERIOD OF GRID CONDUCTION.

5. THE RECOMMENDED OPERATING RANGE FOR THIS TUBE IS FROM 40° TO 80° CENTIGRADE. OPERATION BETWEEN -55° AND +40° CENTIGRADE AT REDUCED RATINGS, OR "STARTS" IN THIS TEMPERATURE RANGE ARE PERMISSIBLE, BUT WILL RESULT IN CONSIDERABLY SHORTENED LIFE.



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

APPLICATION NOTES

THYRATRON TUBES, IF CORRECTLY USED, WILL GIVE MANY THOUSANDS OF HOURS OF RELIABLE SERVICE. THE CORRECT USE OF A TUBE INVOLVES AMONG OTHER THINGS ADHERENCE TO THE FOLLOWING RULES:

1. AVOID COLD STARTS. THE HEAT SHIELDED, OXIDE COATED FILAMENT SHOULD BE ENERGIZED BEFORE THE ANODE VOLTAGE IS APPLIED IN ORDER TO OBTAIN MAXIMUM LIFE.

2. AVOID OPERATING THE TUBE OUTSIDE OF THE SPECIFIED FILAMENT VOLTAGE RANGE.

3. AVOID EXCEEDING THE RATED PEAK INVERSE VOLTAGE. EXCESS INVERSE VOLTAGE CAN CAUSE EITHER AN IMMEDIATE FAILURE OR A RAPID DECLINE IN USEFUL LIFE.

NO CLEAR CUT METHOD OF FORETELLING TUBE FAILURE HAS BEEN DEVISED. PERIODIC REPLACEMENT OF A TUBE AS A ROUTINE PREVENTIVE MAINTENANCE DEVICE IS NOT RECOMMENDED AS A TUBE THAT HAS OPERATED FOR SEVERAL THOUSAND HOURS MAY BE GOOD FOR SEVERAL MORE THOUSAND HOURS OF USEFUL OPERATION. QUITE OFTEN MAINTENANCE PERSONNEL CAN, AFTER SOME EXPERIENCE WITH A PIECE OF EQUIPMENT, ANTICIPATE TUBE FAILURE BY OBSERVATION. VISUAL CHECKS OF TUBE (ARC) DROP WILL INDICATE TUBES APPROACHING END OF LIFE. TUBE DROP VOLTAGES CONSIDERABLY HIGHER THAN THAT OF THE LAST READINGS, OR READINGS ABOVE 20 VOLTS INDICATE TUBES THAT MAY SOON FAIL. WHILE SUCH A READING CAN BE TAKEN DIRECTLY AT THE TUBE IN THE OPERATING EQUIPMENT, IT IS A DANGEROUS PRACTICE. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL.

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TUNG-SOL

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APPLICATION NOTES - CONT'D.

A MORE PRACTICAL AND EXACT MEASUREMENT IS OBSERVING THE TUBE VOLTAGE DROP IN A TEST JIG WHILE IT PASSES ONE OR TWO HIGH CURRENT PULSES. SUCH A JIG IS ILLUSTRATED IN FIGURE 1. THE OSCILLOSCOPE IS CALIBRATED BY FIRST SETTING SWITCH S2 TO CURRENT CHECK. MOMENTARY CONTACT SWITCH S1 IS THEN TAPPED WHILE CURRENT SET RESISTOR R2 IS ADJUSTED UNTIL A PATTERN 8 VOLTS HIGH APPEARS ON THE OSCILLOSCOPE SCREEN. THIS INDICATES THAT A PEAK CURRENT OF EIGHT AMPERES IS FLOWING THROUGH THE TUBE UNDER TEST AND THROUGH CALIBRATING RESISTOR R3. THE TUBE VOLTAGE DROP CAN THEN BE READ DIRECTLY IN VOLTS ON THE OSCILLOSCOPE SCALE BY SETTING SWITCH S2 TO THE TEST POSITION AND TAPPING SWITCH S1. A NEW TUBE WILL HAVE A VOLTAGE DROP OF APPROXIMATELY 10 VOLTS. A TUBE APPROACHING THE END OF LIFE MAY HAVE A VOLTAGE DROP OF 20 VOLTS.

GRID-CONTROLLED THYRATRONS CAN BE INCORPORATED INTO CIRCUITS TO PROVIDE NUMEROUS SERVICES INCLUDING THE SPEED CONTROL OF DC MOTORS, DC TO AC INVERSION, AC TO DC RECTIFICATION, AND SUPPLYING VARIABLE AC POWER FROM AN AC SOURCE.

FIGURE 2 ILLUSTRATES ONE METHOD OF CONVERTING AC TO DC. THE MAGNITUDE OF THE DC OUTPUT VOLTAGE IS CONTROLLED BY THE VARIABLE RESISTOR WHICH CONTROLS THE FIRING ANGLE, OR GRID VOLTAGE PHASE, OF THE THYRATRONS. THE USE OF THYRATRONS TO SUPPLY A VARIABLE AC OUTPUT FROM A FIXED AC SOURCE IS SHOWN IN FIGURE 3. AGAIN, THE VARIABLE RESISTOR SERVES TO CONTROL THE PHASE ANGLE OF THE APPLIED GRID VOLTAGE AND THUS THE OUTPUT VOLTAGE.

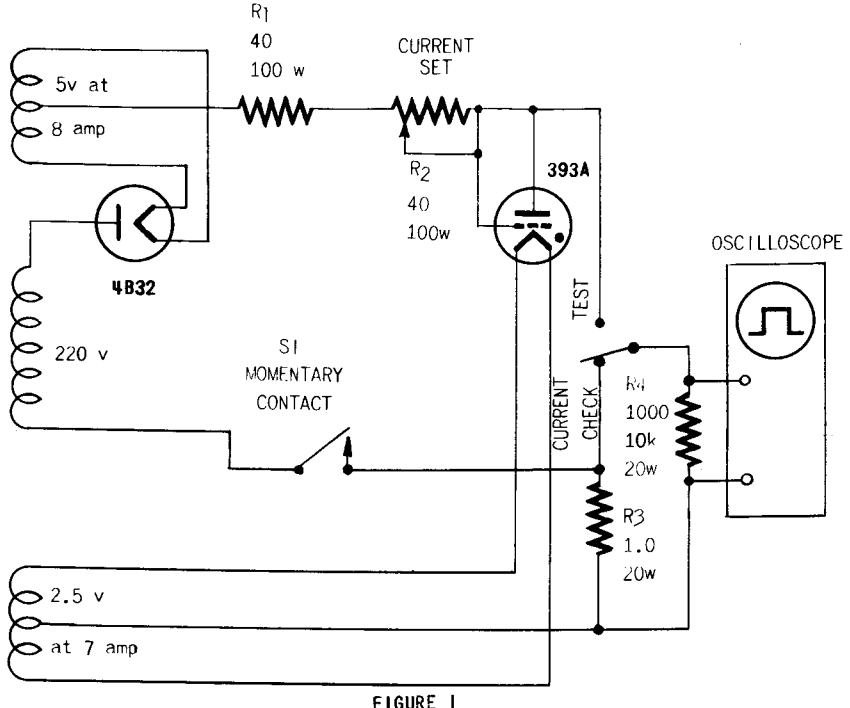

FIGURE 1

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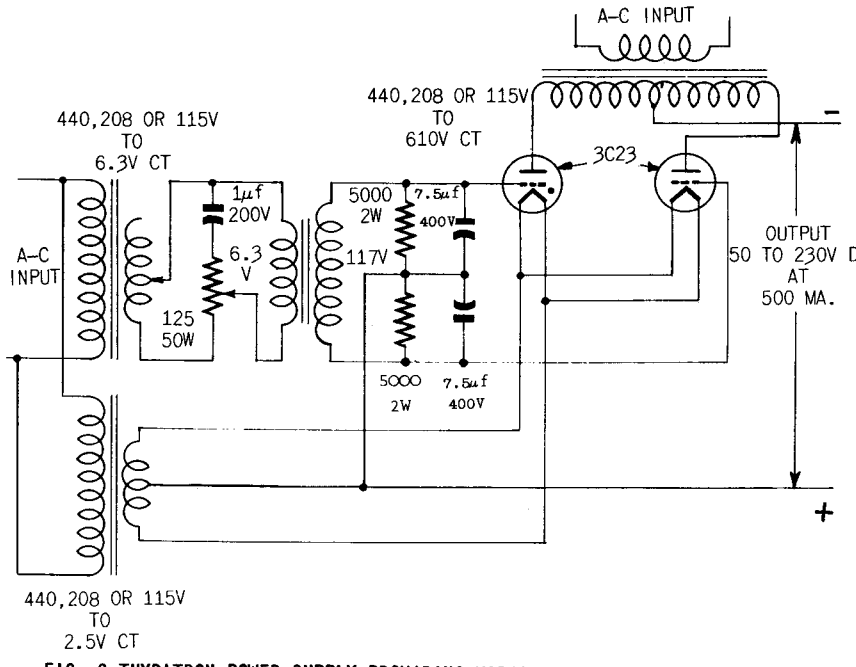

FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

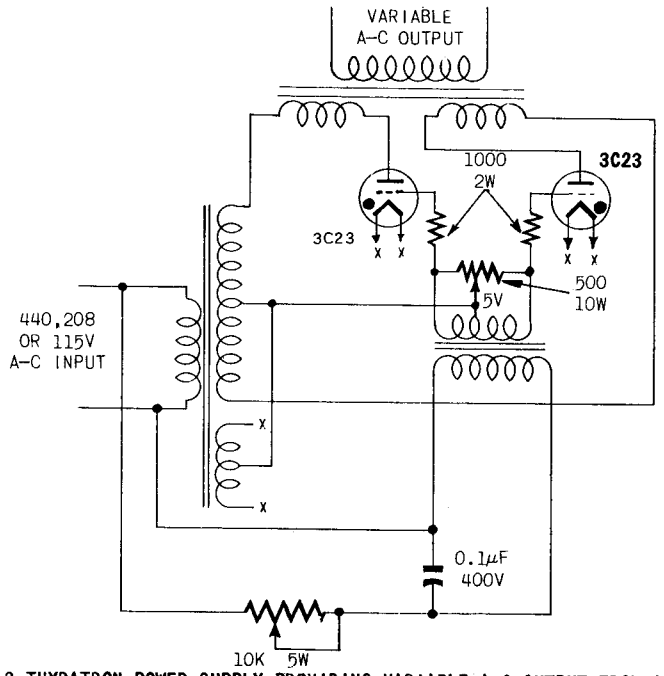

FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

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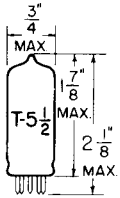
TUNG-SOL

PENTODE

MINIATURE TYPE

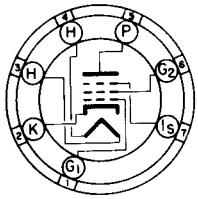


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 3CB6 IS A SHARP CUT-OFF PENTODE USING THE SMALL BUTTON SEVEN PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS AS AN IF AMPLIFIER OPERATING AT FREQUENCIES ABOVE 20 MC. IT IS ALSO WELL SUITED FOR USE AS AN RF AMPLIFIER IN VHF TELEVISION RECEIVERS. IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW CAPACITANCE VALUES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH EXCEPTION OF HEATER RATINGS ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CB6.

DIRECT INTERELECTRODE CAPACITANCES

		WITHOUT SHIELD	WITH[A] SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	→	0.025	→ .015	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)		6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	→	2.0	3.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

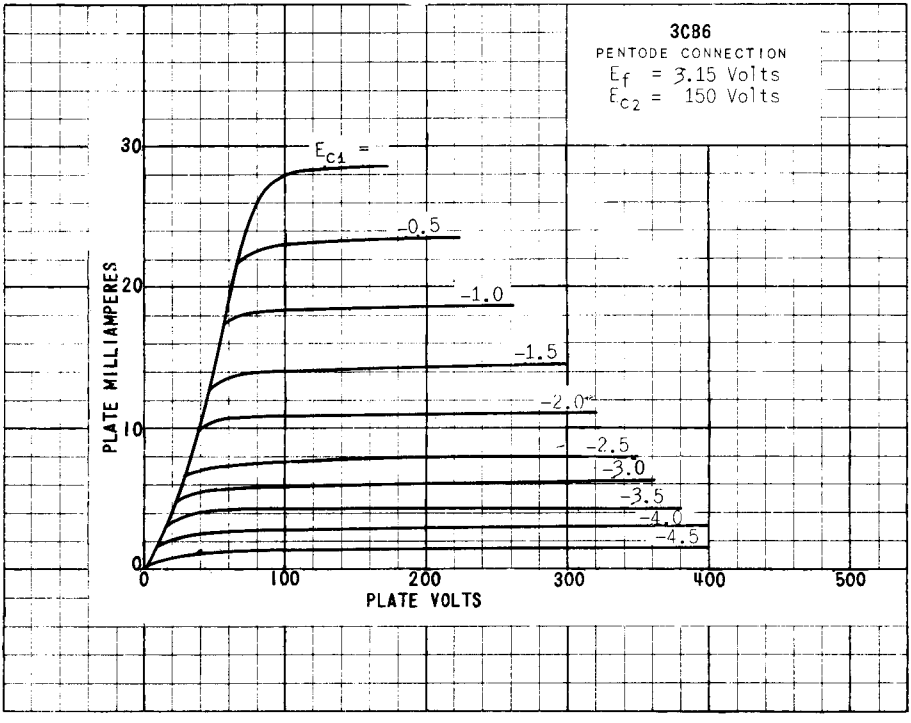
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE		
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.28	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	13.0	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b=20 μA.	-6.5	VOLTS
PLATE CURRENT AT E_{c1}=-3V., R_k=0	2.8	MA.

B DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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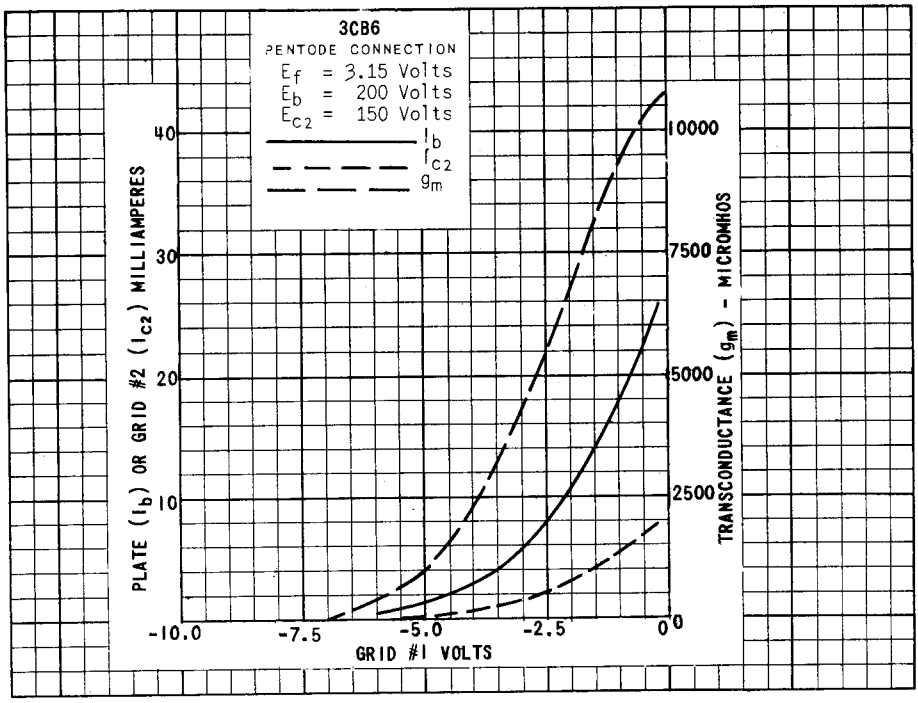

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TUNG-SOL

PENTODE

MINIATURE TYPE

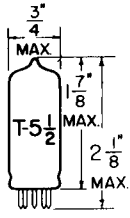
COATED UNIPOTENTIAL CATHODE

HEATER

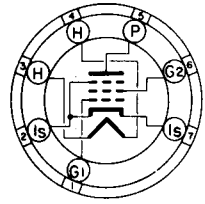
3.15 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7B0

THE 3CE5 IS AN RF PENTODE HAVING HIGH TRANSCONDUCTANCE COUPLED WITH CLOSELY CONTROLLED GRID CUTOFF CHARACTERISTICS IN THE MINIATURE SEVEN PIN CONSTRUCTION. DESIGNED TO OBTAIN BETTER PERFORMANCE OF LOW COST VHF TELEVISION TUNERS AND TELEVISION IF STAGES, THE 3CE5 IMPROVES AUTOMATIC GAIN CONTROL WITH RESULT THAT SIGNAL CAPACITY IS INCREASED. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (MAX.)	0.030	μμf
INPUT	6.5	μμf
OUTPUT	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
* MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
* MAXIMUM GRID #2 VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS
* MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)[A]	11.0	SECONDS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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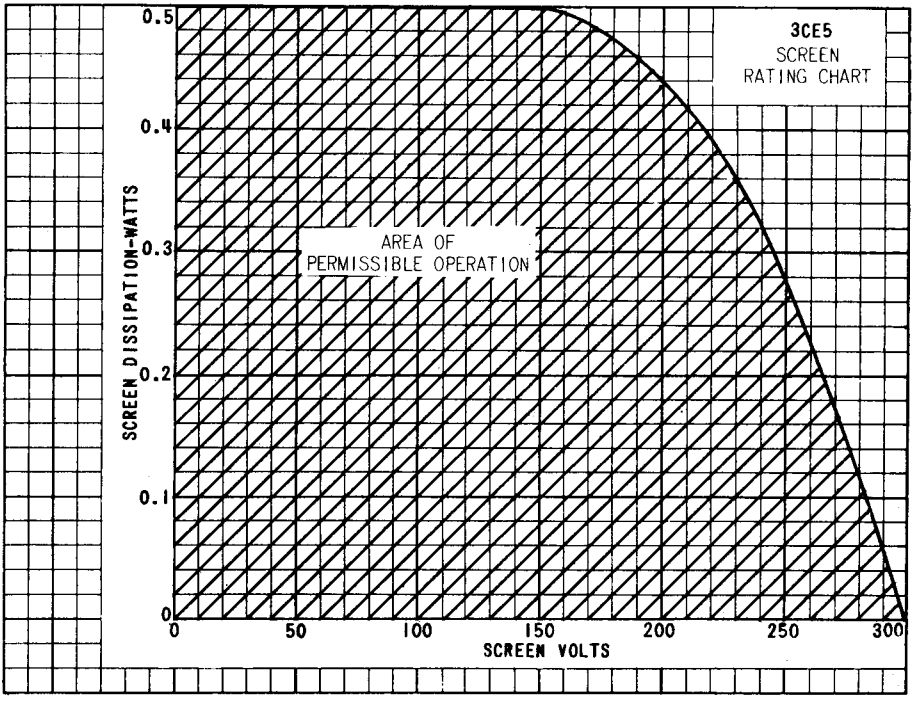
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

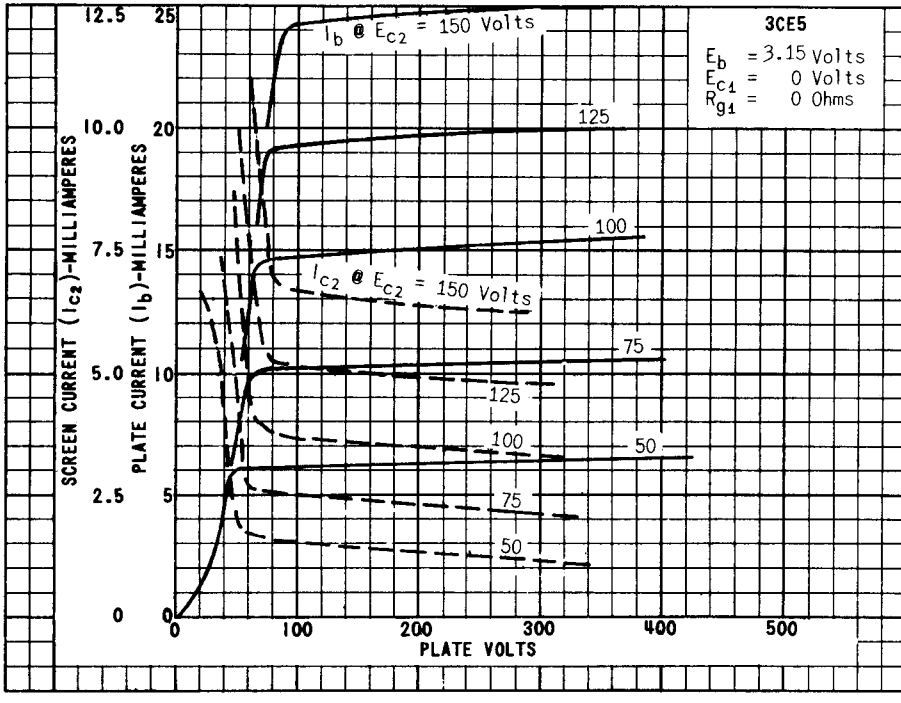
CLASS A_1 AMPLIFIER

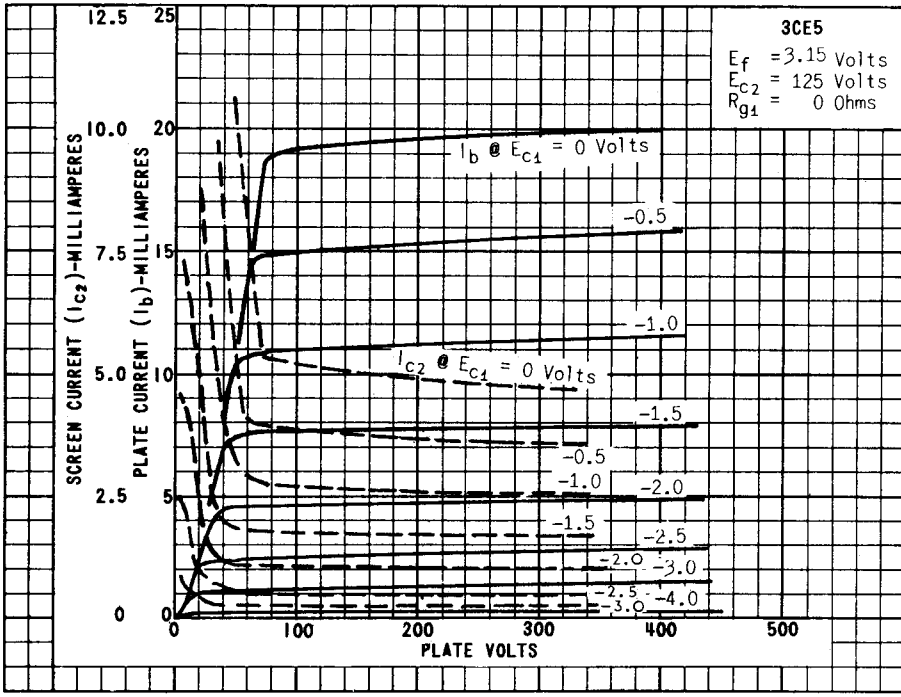
HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	125	VOLTS
SCREEN VOLTAGE	125	VOLTS
* GRID #1 SUPPLY VOLTAGE	-1.0	VOLTS
GRID #1 RESISTOR (BYPASSED)	1.0	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHMS
TRANSCONDUCTANCE	7 600	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	2.8 ←	MA.
GRID #1 VOLTAGE (APPROX.) Ib = 35 μAMPS.	-5.0	VOLTS

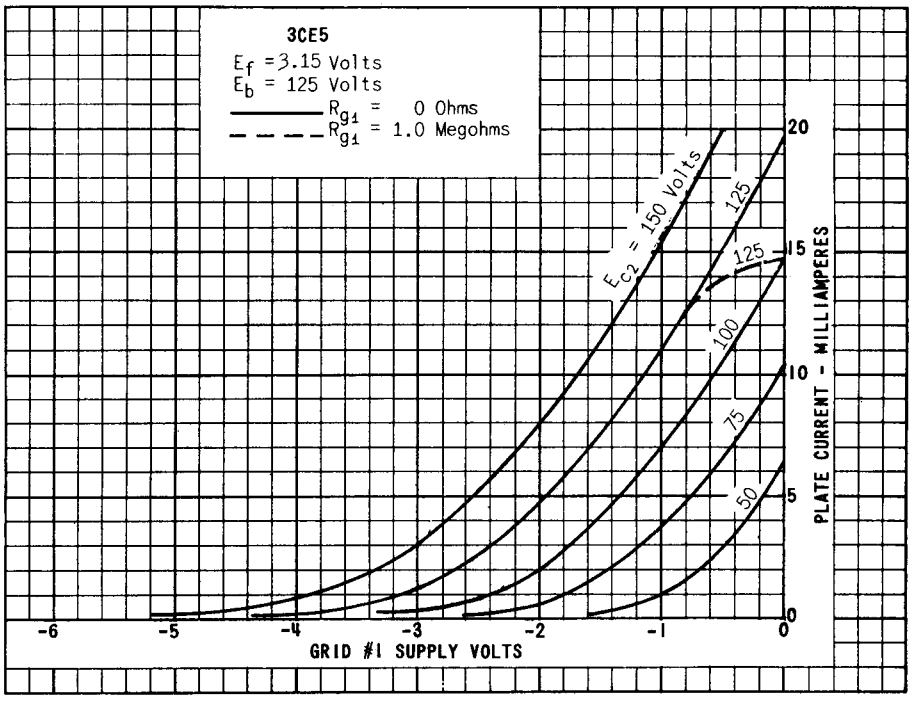
SIMILAR TYPE REFERENCE. Except for heater ratings, the 3CE5 is identical to the 4CE5 and the 6CE5.

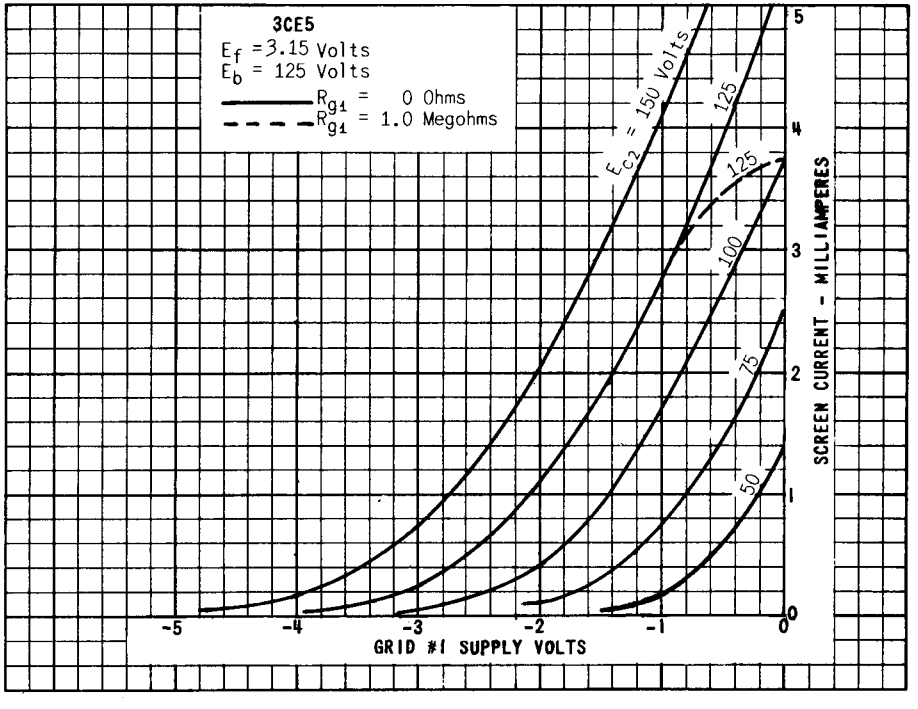
→ INDICATES A CHANGE.
* INDICATES AN ADDITION.

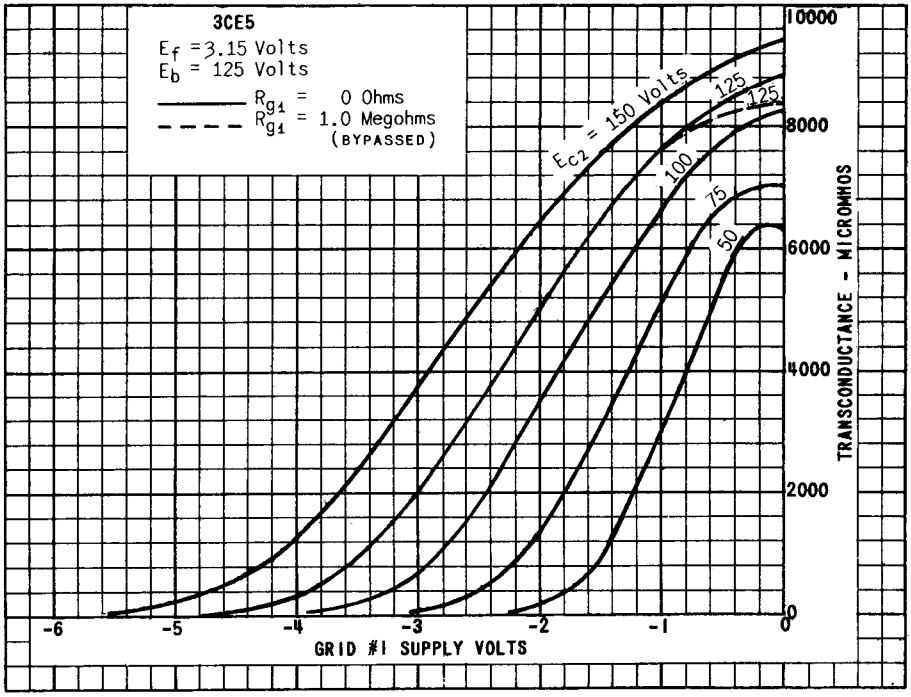



3CE5
E_b = 3.15 Volts
E_{c_1} = 0 Volts
R_{g_1} = 0 Ohms
I_b @ E_{c_2} = 150 Volts
I_{c_2} @ E_{c_2} = 150 Volts
125
100
75
50
SCREEN CURRENT (I_{c_2})-MILLIAMPERES
PLATE CURRENT (I_b)-MILLIAMPERES
PLATE VOLTS
12.5
10.0
7.5
5.0
2.5
0
25
20
15
10
5
0
100
200
300
400
500


3CE5
E_f = 3.15 Volts
E_{c_2} = 125 Volts
R_{g_1} = 0 Ohms
I_b @ E_{c_1} = 0 Volts
I_{c_2} @ E_{c_1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
SCREEN CURRENT (I_{c_2})-MILLIAMPERES
PLATE CURRENT (I_b)-MILLIAMPERES
PLATE VOLTS
12.5
10.0
7.5
5.0
2.5
0
25
20
15
10
5
0
100
200
300
400
500


3CE5
E_f = 3.15 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
PLATE CURRENT - MILLIAMPERES
GRID #1 SUPPLY VOLTS
-6
-5
-4
-3
-2
-1
0
20
15
10
5
0


3CE5
E_f = 3.15 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
SCREEN CURRENT - MILLIAMPERES
GRID #1 SUPPLY VOLTS
-5
-4
-3
-2
-1
0
5
4
3
2
1
0



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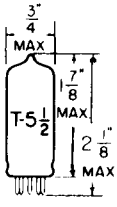
TUNG-SOL

HEPTODE

MINIATURE TYPE

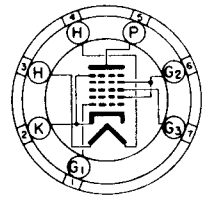


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6 AMP
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 3CS6 IS A MINIATURE DUAL CONTROL PENTAGRID DESIGNED FOR USE IN SYNC SEPARATOR CIRCUITS IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. EACH OF THE CONTROL GRIDS HAVE A SHARP CUT-OFF CHARACTERISTIC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CS6.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE: G_1 TO P (MAX.)	0.05	μμf
GRID #3 TO PLATE: G_3 TO P (MAX)	0.36	μμf
#1 INPUT: G_1 TO (H+K+G_2+$G_{3\&5}$)	5.5	μμf
#3 INPUT: G_3 TO (H+K+G_1+$G_{2\&5}$)	7.0	μμf
OUTPUT: P TO (H+K+G_1+G_2+$G_{3\&5}$)	7.5	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.22	μμf

RATINGS ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 & #4 VOLTAGE[A]		
MAXIMUM GRID #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION		
MAXIMUM SCREEN DISSIPATION:		
FOR GRIDS #2 & #4 VOLTAGE UP TO 150 VOLTS	1.0	VOLTS
FOR GRIDS #2 & #4 VOLTAGE BETWEEN 150 & 300 VOLTS [A]		
MAXIMUM CATHODE CURRENT	14	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] SEE SCREEN DISSIPATION RATING CHART JEDEC #J5-C4-2.

→ INDICATES A CHANGE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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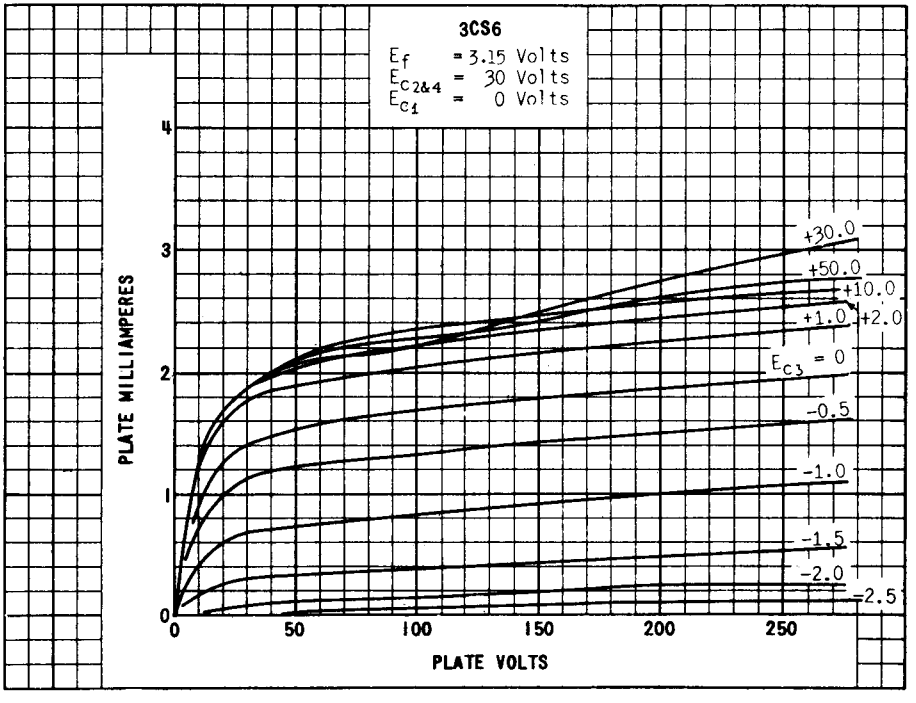
TUNG-SOL

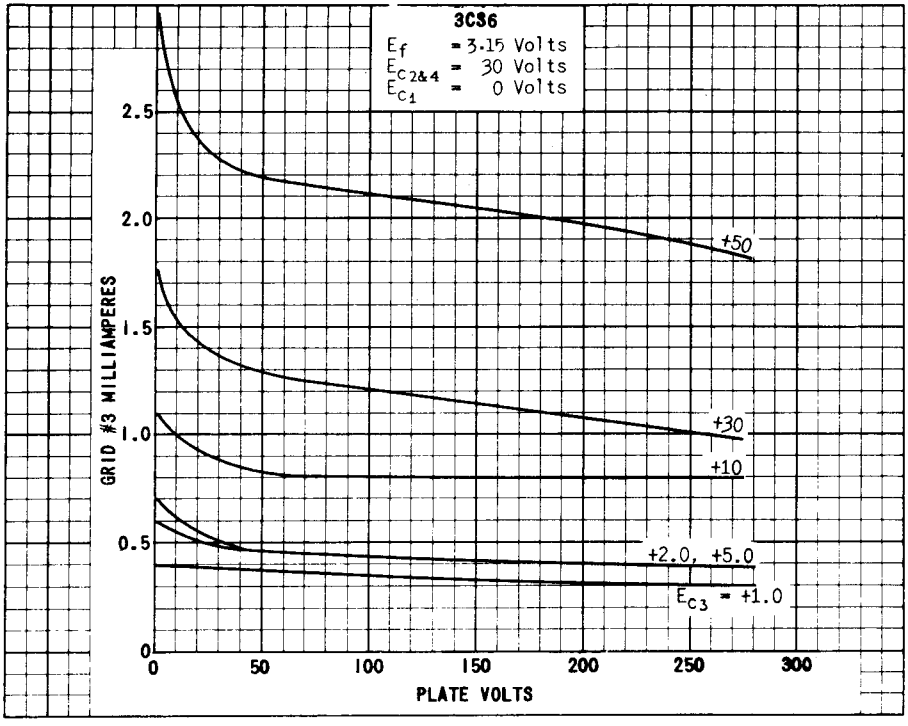
CONTINUED FROM PRECEDING PAGE

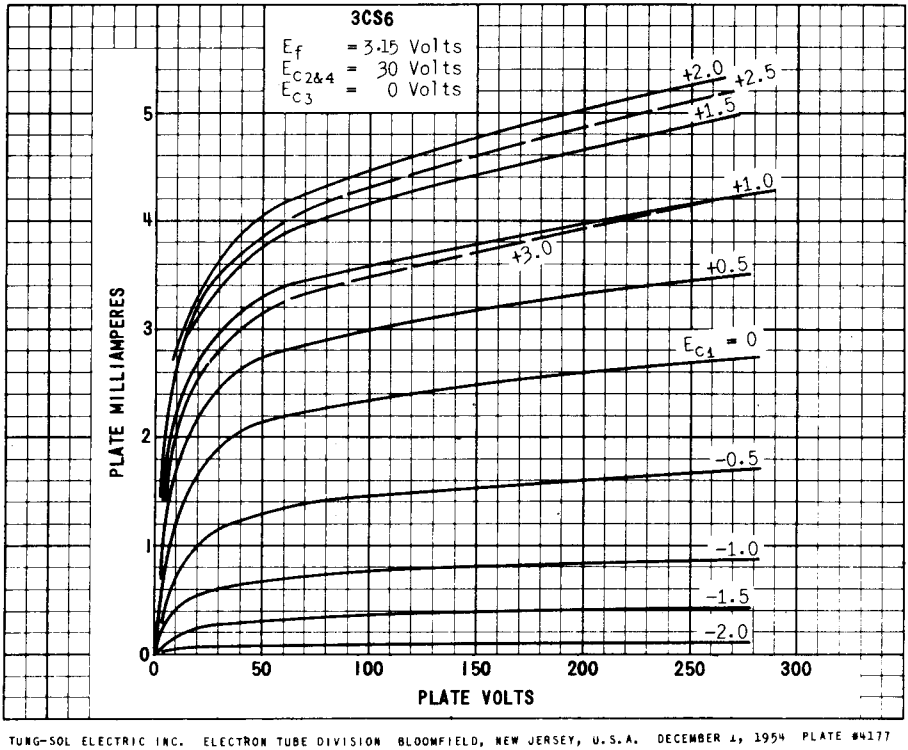
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

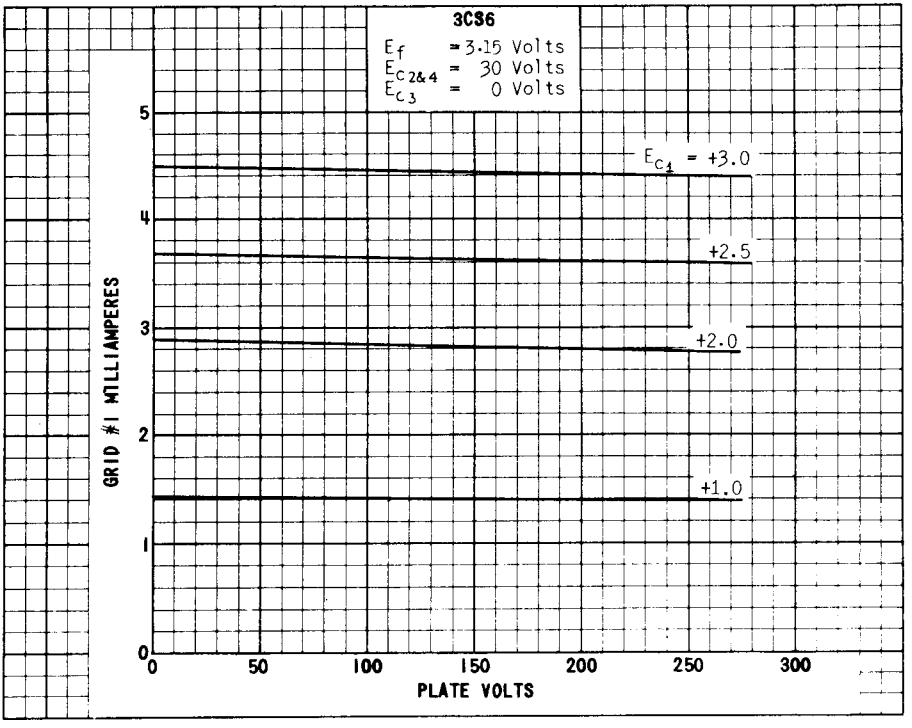
HEATER VOLTAGE	3.15	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-0	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 AND PLATE)	---	---	1 100	μMHOS
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #3 AND PLATE)	---	1 500	---	μMHOS
PLATE RESISTANCE (APPROX.)	---	0.7	1.0	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b=50 μA	---	---	-2.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR I_b=50 μA	---	-2.2	---	VOLTS




3CS6
E_f = 3.15 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRID #3 MILLIAMPERES
PLATE VOLTS
0
0.5
1.0
1.5
2.0
2.5
50
100
150
200
250
300
+50
+30
+10
+2.0, +5.0
E_{c3} = +1.0


3CS6
E_f = 3.15 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
50
100
150
200
250
300
+2.0
+2.5
+1.5
+1.0
+3.0
+0.5
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0

3CS6



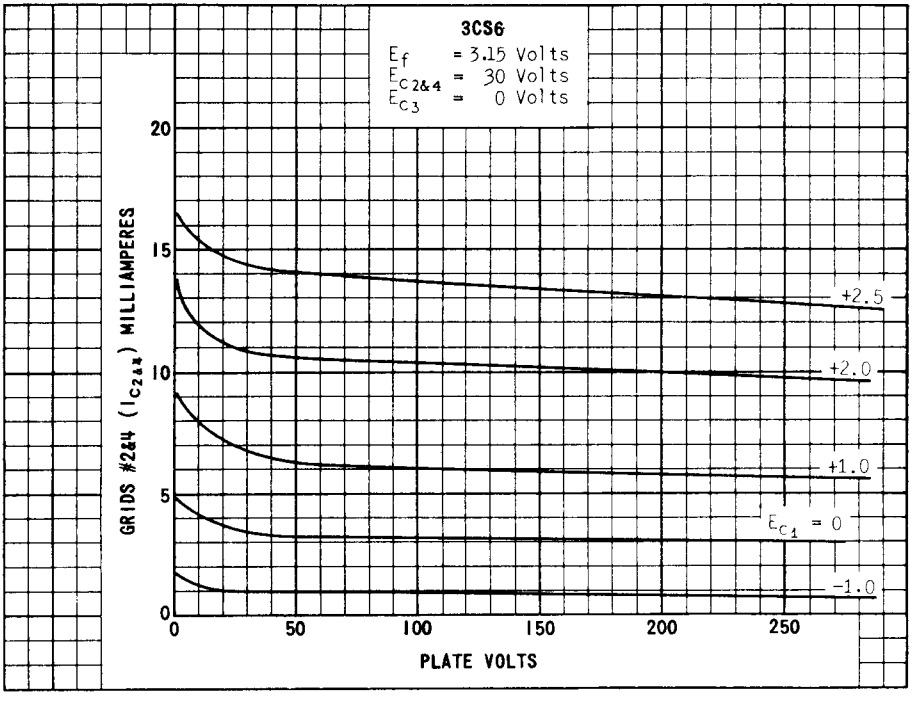
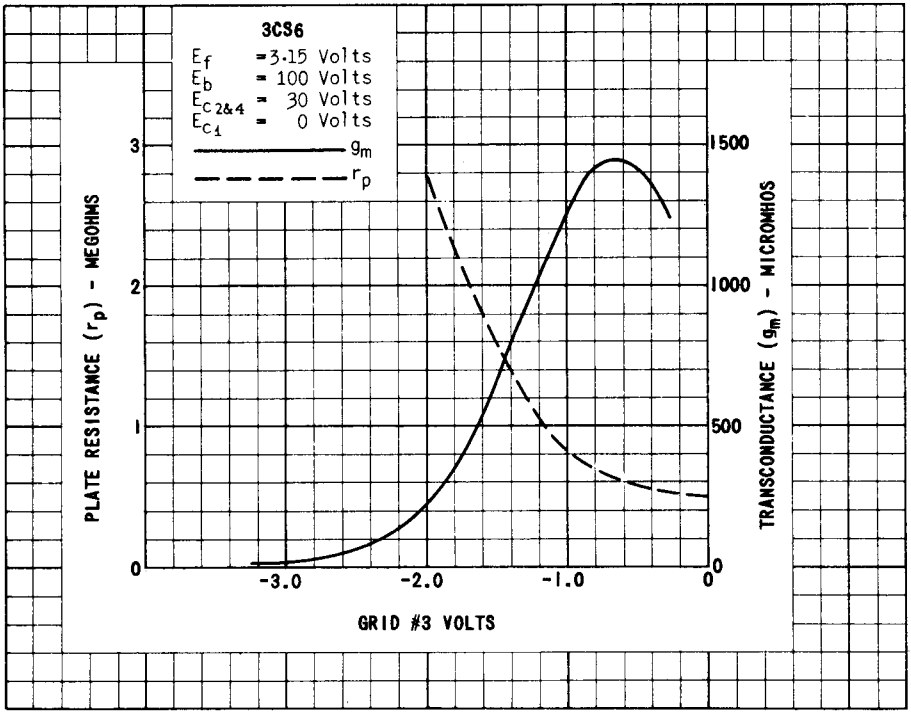
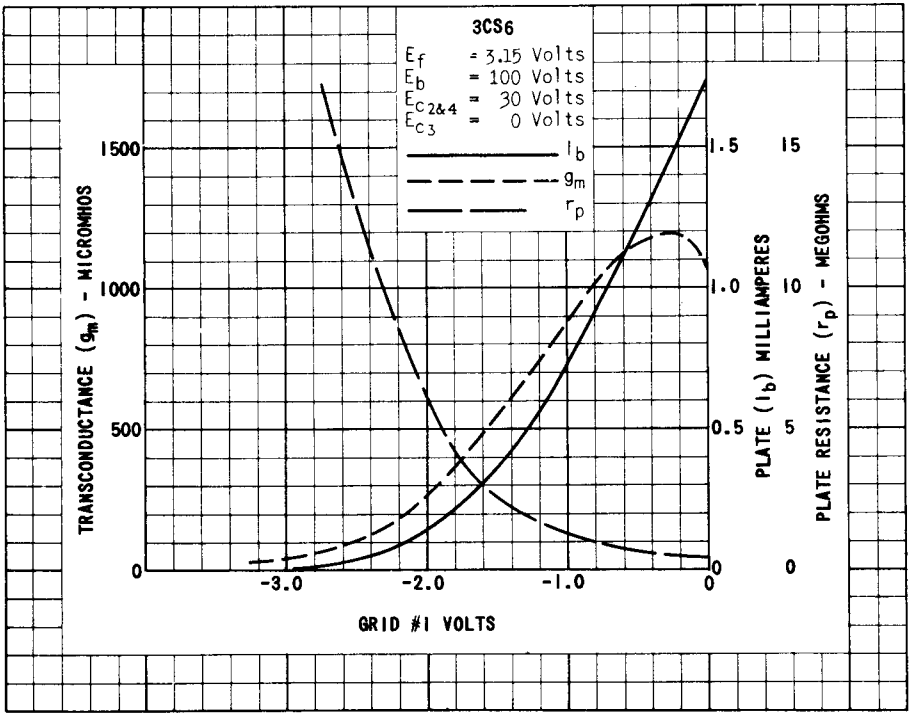


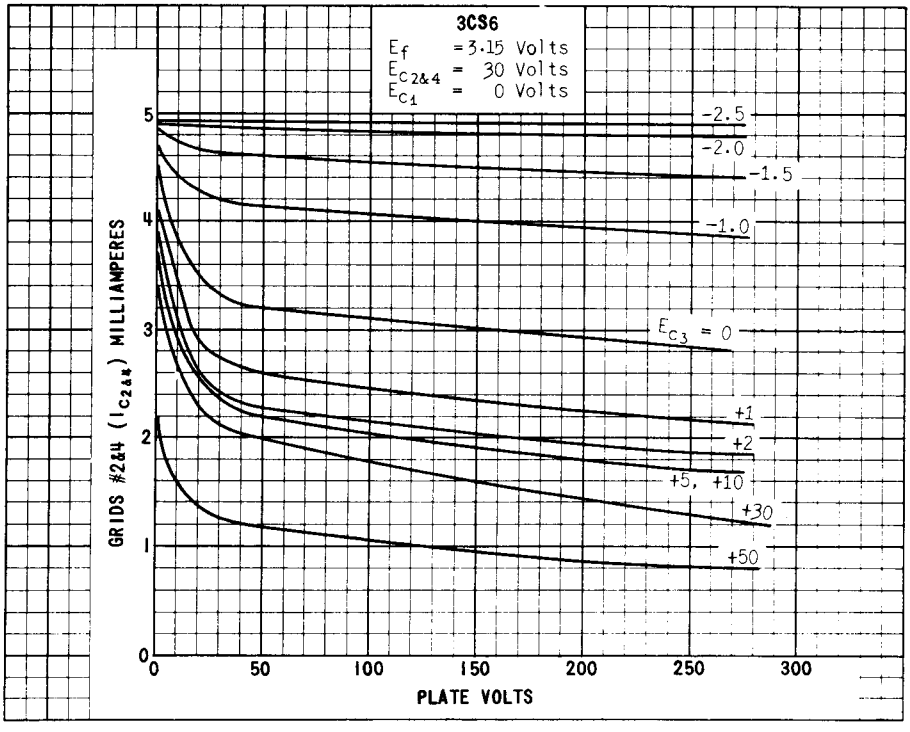
PLATE #4178 DECEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.



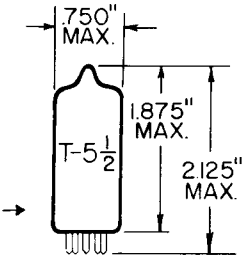


TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. DECEMBER 1, 1954 PLATE #4179

3CS6


3CS6
E_f = 3.15 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
-2.5
-2.0
-1.5
-1.0
E_{c3} = 0
+1
+2
+5, +10
+30
+50

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

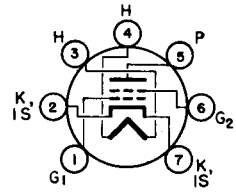
TETRODE

MINIATURE TYPE

COATED UNIPOTENTICAL CATHODE

HEATER
2.9 VOLTS 450±27 MAMPS. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 3CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 3CY5 IS IDENTICAL TO THE 2CY5, 4CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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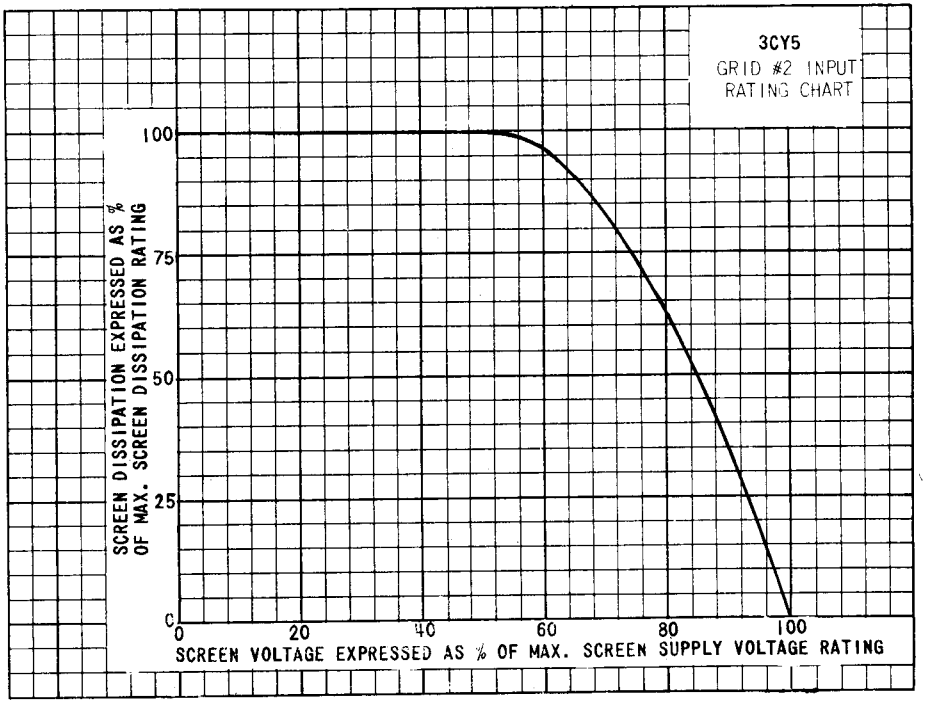
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

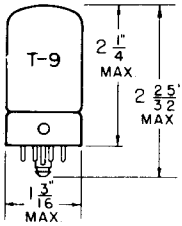
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	−6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

[C] PLATE CURRENT 20 μA.



TUNG-SOL

BEAM PENTODE



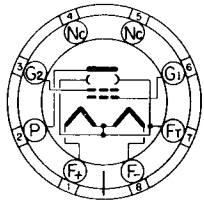
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 8	E_f APPLIED BETWEEN PIN 7 AND PINS 1 & 8 TIED TOGETHER
E_{g1} REFERRED TO PIN 8	E_{g1} REFERRED TO PIN 7
2.8 VOLTS 110 MA.	1.4 VOLTS 220 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 7 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 7 AND 8. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 8 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3D6/1299.



BOTTOM VIEW
LOCK-IN 8 PIN BASE
6B8

ANY MOUNTING POSITION

THE 3D6/1299 IS A FILAMENTARY TYPE BEAM POWER AMPLIFIER FOR USE IN LIGHT AND PORTABLE EQUIPMENT USING THE LOCK-IN CONSTRUCTION. IN AUDIO SERVICE, IT WILL DELIVER RELATIVELY LARGE AMOUNTS OF AUDIO POWER. IN RF AMPLIFIER SERVICE IT WILL DELIVER A POWER OUTPUT OF 1.4 WATTS AT 50 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD[B]	
GRID TO PLATE: (G_1 TO P)	0.3	0.3	μμf
INPUT: G_1 TO ($F+G_2+B_p+S$)	7.5	7.5	μμf
OUTPUT: P TO ($F+G_2+B_p+S$)	6.5	5.5	μμf

[A] WITH EXTERNAL SHIELD CONNECTED TO F-. PIN 5 CONNECTED TO FILAMENT CENTER TAP.

[B] PIN 5 CONNECTED TO FILAMENT CENTER TAP.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	SERIES FILAMENT	PARALLEL FILAMENT	
MAXIMUM FILAMENT VOLTAGE	3.5	1.75	VOLTS
MINIMUM FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	180	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	135	135	VOLTS
MAXIMUM PLATE DISSIPATION	4.5	4.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.9	0.9	WATT
MAXIMUM CATHODE CURRENT	30	30	MA.

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PLATE 2202
JUNE 1, 1949

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF POWER AMPLIFIER - CLASS A_1

VALUES FOR SERIES-FILAMENT OPERATION WILL BE APPROXIMATELY THE SAME AS FOR PARALLEL-FILAMENT OPERATION.

FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	220	220	220	MA.
PLATE VOLTAGE	90	135	150	VOLTS
GRID #2 VOLTAGE	90	90	90	VOLTS
GRID #1 VOLTAGE	-4.5	-4.5	-4.5	VOLTS
PEAK AF SIGNAL VOLTAGE	4.5	4.5	4.5	VOLTS
TRANSCONDUCTANCE	2 400	2 400	2 400	µMHOS
ZERO-SIGNAL PLATE CURRENT	9.5	9.8	9.9	MA.
ZERO-SIGNAL GRID #2 CURRENT	1.6	1.2	1.0	MA.
MAXIMUM SIGNAL PLATE CURRENT	8.5	9.8	10.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	3.2	2	1.8	MA.
LOAD RESISTANCE	8 000	12 000	14 000	OHMS
TOTAL HARMONIC DISTORTION	5	5	5	PERCENT
POWER OUTPUT	270	500	600	MW.

RF POWER AMPLIFIER AT 50 MC - CLASS C

FILAMENT VOLTAGE	1.4	VOLTS
FILAMENT CURRENT	220	MA.
PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	135	VOLTS
GRID #1 VOLTAGE (APPROX.)[C]	-20	VOLTS
PEAK RF GRID #1 VOLTAGE	55	VOLTS
PLATE CURRENT	23	MA.
GRID #2 CURRENT	6	MA.
GRID #1 CURRENT	1	MA.
TOTAL DC CATHODE CURRENT (NOT TO EXCEED 30 MA.)	30	MA.
RF POWER INPUT	0.25	WATT
RF POWER OUTPUT	1.4	WATTS

[C] OBTAINED FROM A FIXED SOURCE OR FROM THE DROP ACROSS A SUITABLE GRID RESISTOR.

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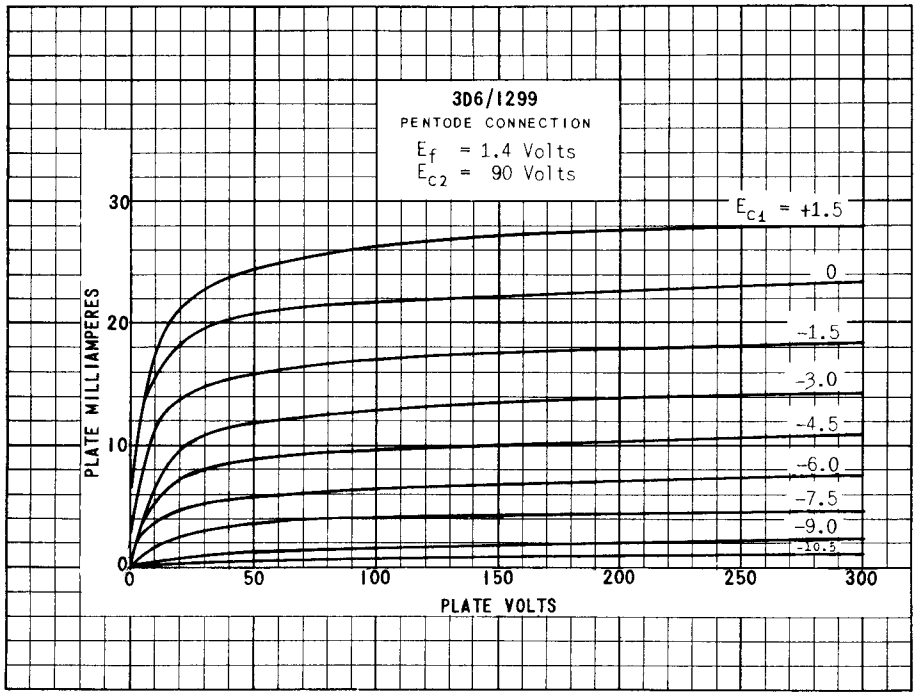

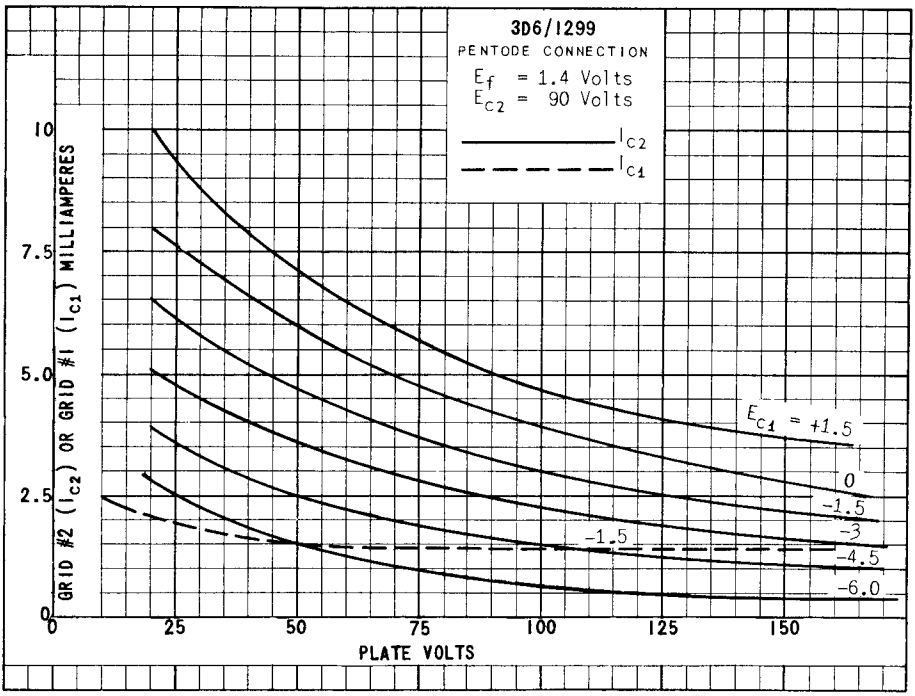

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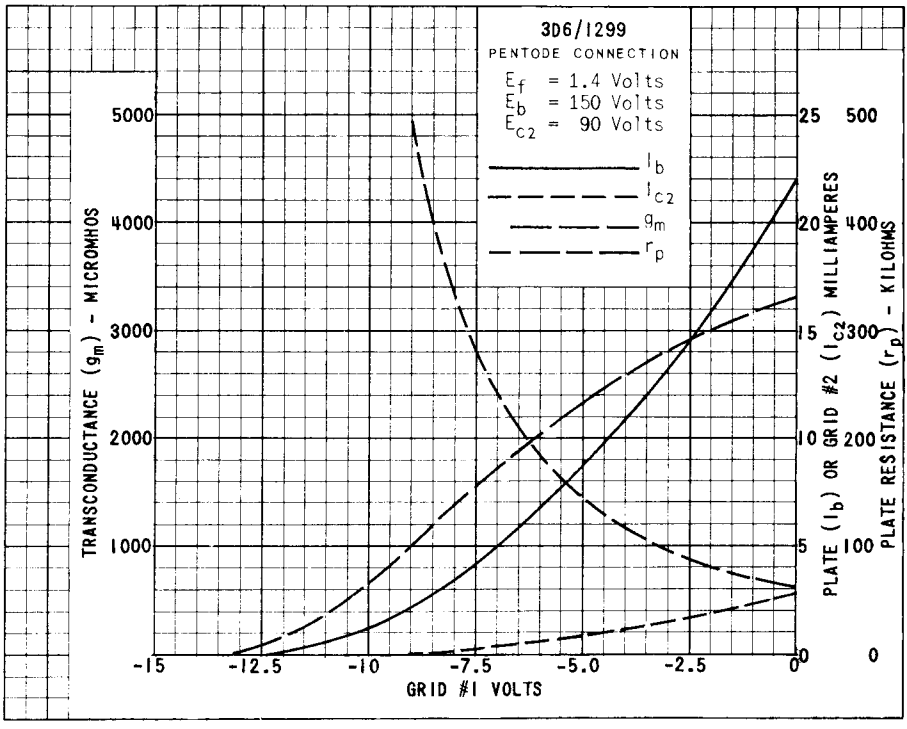
3D6/1299



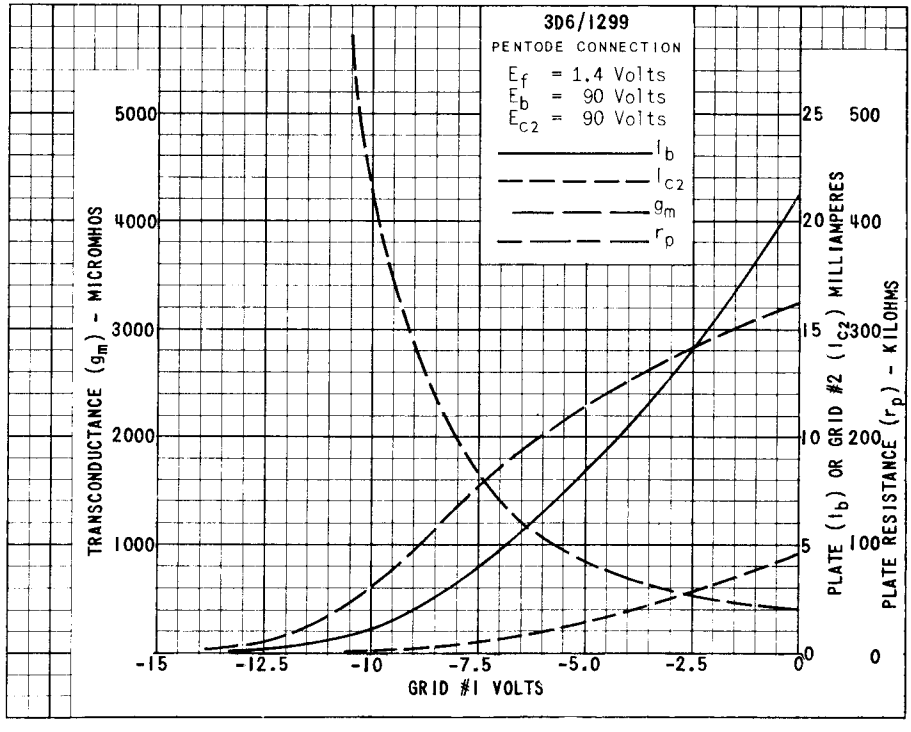


PLATE 2205
JUNE 1, 1949

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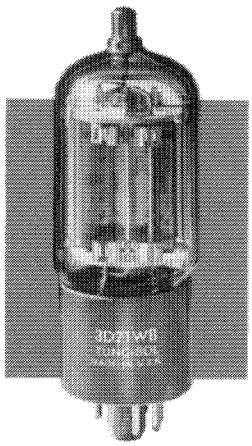
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBES TYPE 3D21WB

SEPTEMBER 1964

PULSE BEAM POWER TETRODE



DESCRIPTION — The 3D21WB is a rugged, reliable, beam power tetrode designed for pulse service. Featuring the ability to operate under high voltage and high pulse current conditions, the 3D21WB is electrically and mechanically interchangeable with its predecessor types. Rated for 6.3 or 12.6 volts, it can be used either in fixed or mobile equipment.

Good use can also be made of the low tube drop, high current handling capacity and high voltage characteristics in pulse modulators, deflection amplifiers, blocking oscillators, and shunt or series regulated power supplies.

This type replaces such earlier versions as 3D21, 3D21A, 3D21B & 3D21WA.

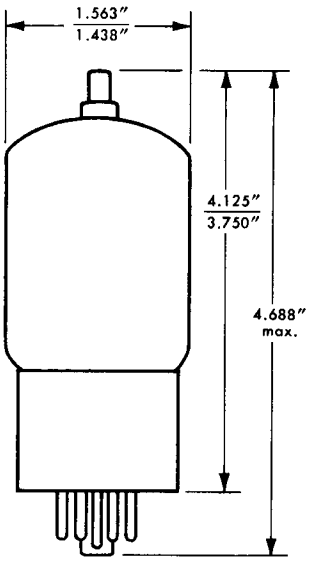
MAXIMUM RATINGS

ABSOLUTE MAX. SYSTEM — SEE EIA STANDARD RS-239

DC Plate Voltage — Note 1	4000 Volts
Peak Plate Voltage including Transient — Note 2	5000 Volts
Grid 2 Voltage — Note 1	850 Volts
Negative DC Grid 1 Voltage	200 Volts
Negative Peak Grid 1 Voltage — Note 1	500 Volts
Positive Peak Grid 1 Voltage — Note 1	220 Volts
Plate Dissipation	40 Watts
Grid 2 Dissipation	3.5 Watts
Grid 1 Dissipation	0.5 Watt
D-C Cathode Current	175 Milliamperes
Peak Cathode Current— See Rating Chart	10 Amperes

Notes: 1. Series resistance must be inserted in the power supply sufficient to limit the short circuit current to less than 0.5 ampere.

2. With a screen potential not exceeding 400Vdc and when no instantaneous voltage due to transient is present (essentially resistive plate load) a maximum plate potential of 4500Vdc may be used.

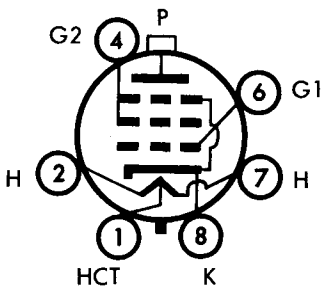


OUTLINE DRAWING

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAX. SYSTEM — SEE EIA STANDARD RS-239

Heater Sections Series Connected:		
Average Characteristics	12.6 Volts	0.85 Amp
Limits of Applied Voltage		11.4 to 13.9 Volts
Heater Sections Parallel Connected:		
Average Characteristics	6.3 Volts	1.70 Amp
Limits of Applied Voltage		5.7 to 6.9 Volts
Heater — Cathode Voltage — Either Polarity		Max. 500 Volts
Cathode Heating Time		Min. 30 Sec.



TERMINAL DIAGRAM
BOTTOM VIEW

INTERELECTRODE CAPACITANCES

	Min.	Max.
Grid to Plate	—	1.2 Picofarads
Input	13	21 Picofarads
Output	7.5	12.5 Picofarads

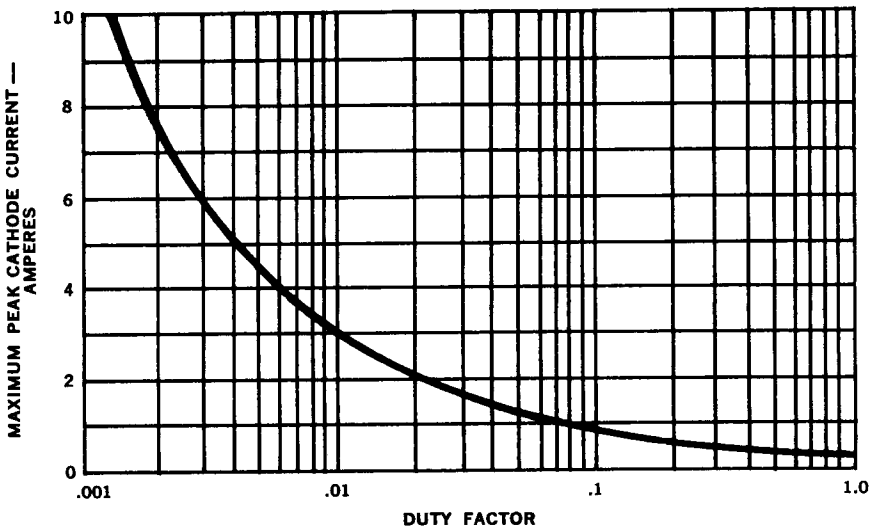
SPECIAL TESTS

Shock	450G for 1 millisecond
Vibration — D = 0.08 inch at 25 cps	2.5G
Fatigue Vibration — 96 hours	50 to 500 cps at 5G
Heater Cycling Test	

MECHANICAL DATA

Mounting Position	Any
Maximum Bulb Temperature	300 degree Centigrade
Maximum Altitude	80,000 feet
Bulb	T-12 hard glass
Base	Medium shell octal, 6 pin, JEDEC type B8-11 low loss phenolic
Cap	Skirted miniature, JEDEC type C1-2
Maximum Weight	4 ounces

PULSE RATING CHART



Definitions: Duty factor (10,000 microsecond averaging time) is the ratio of "on" time in microseconds to 10,000 microseconds.

"On" Time is defined as the sum of the duration of all individual pulses which occur during any 10,000 microsecond interval.

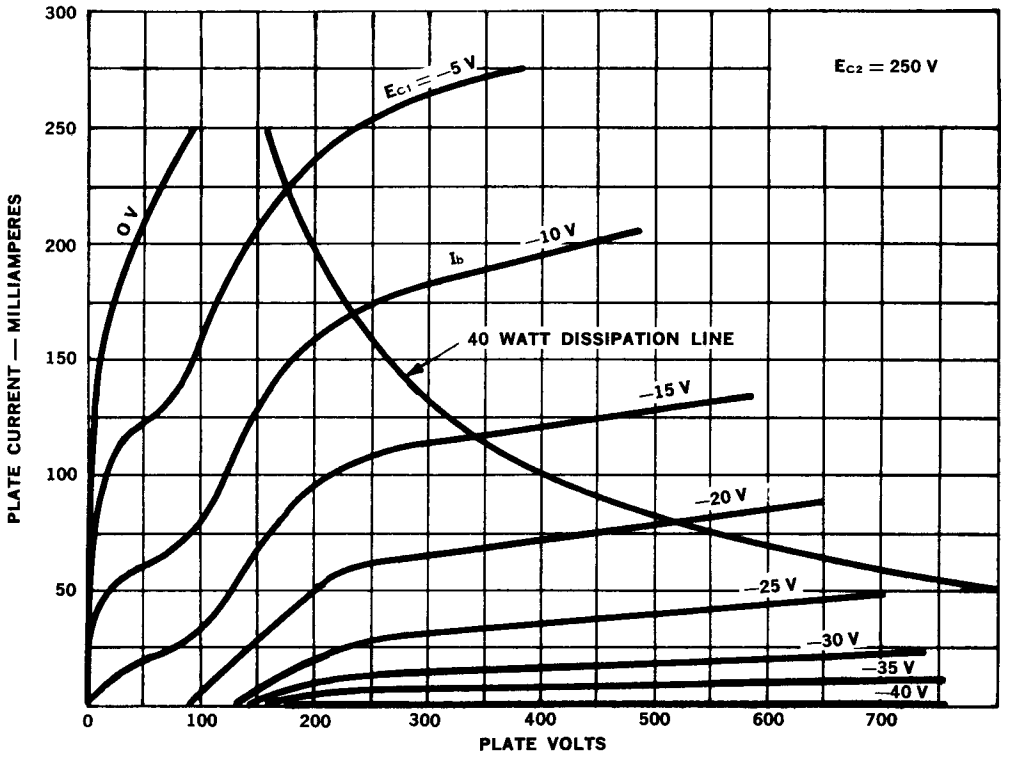


PLATE CURRENT — MILLIAMPERES
PLATE VOLTS
E_{c2} = 250 V
E_{c1} = −5 V
0 V
−10 V
I_b
40 WATT DISSIPATION LINE
−15 V
−20 V
−25 V
−30 V
−35 V
−40 V
300
250
200
150
100
50
0
100
200
300
400
500
600
700

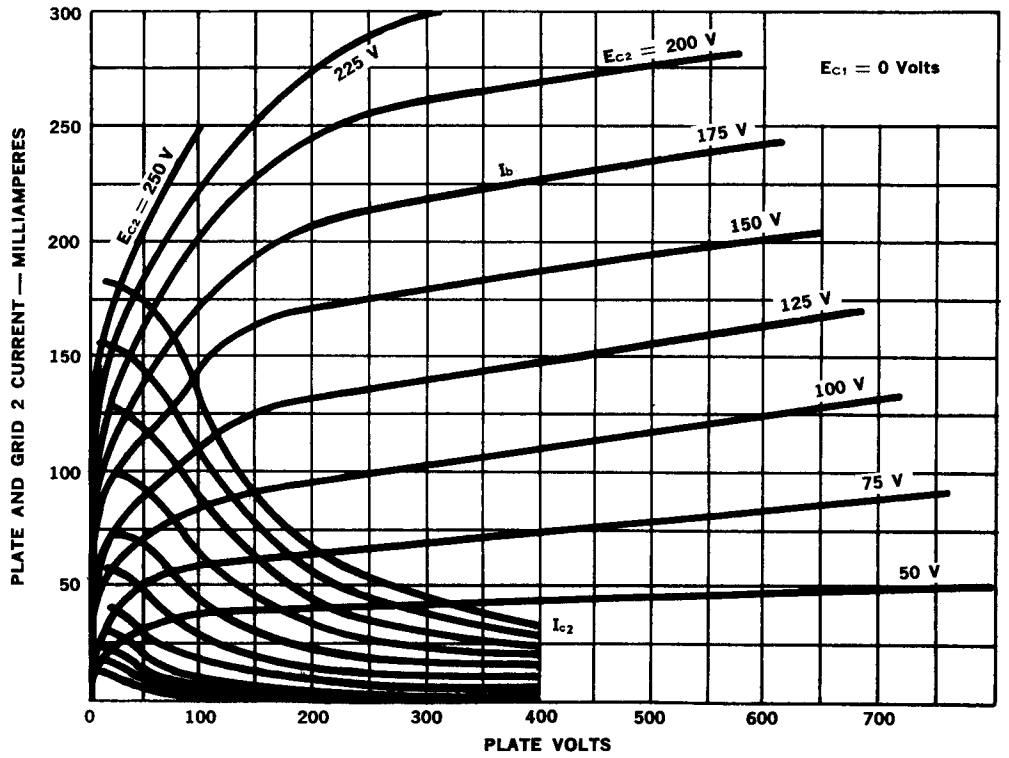
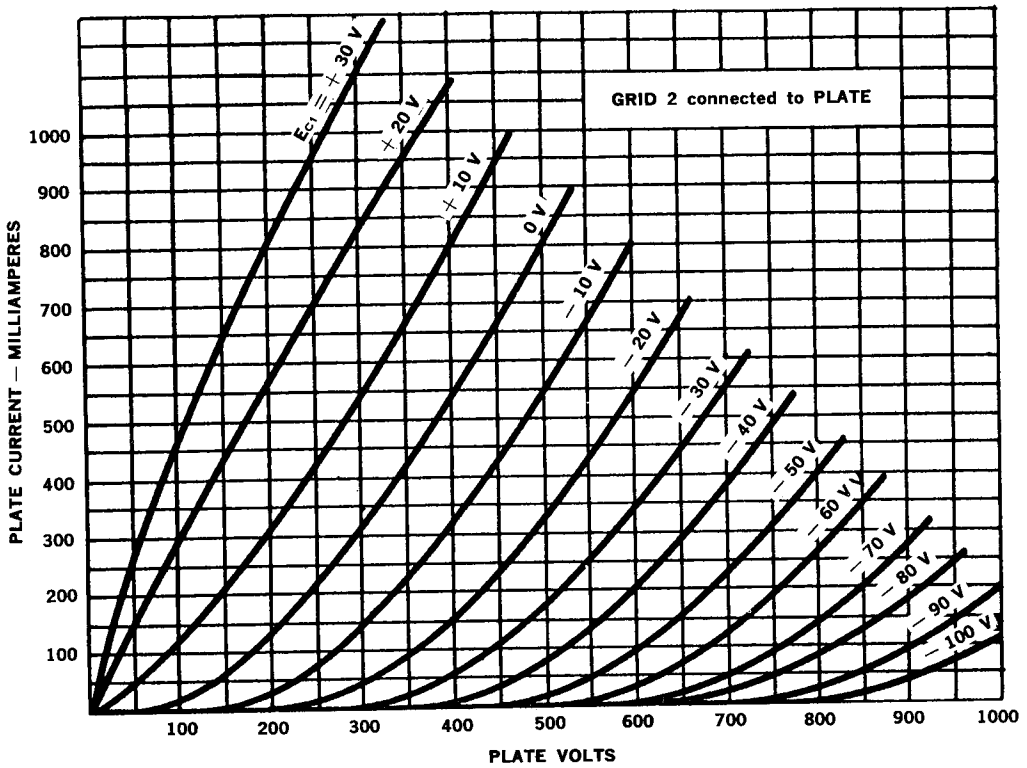
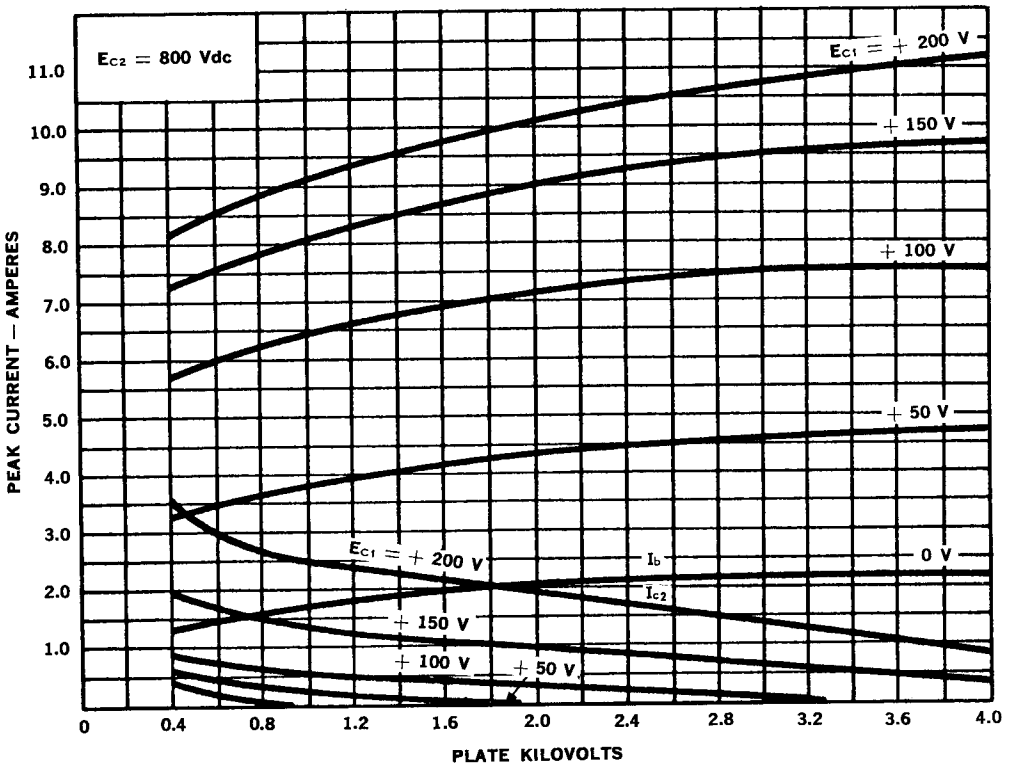
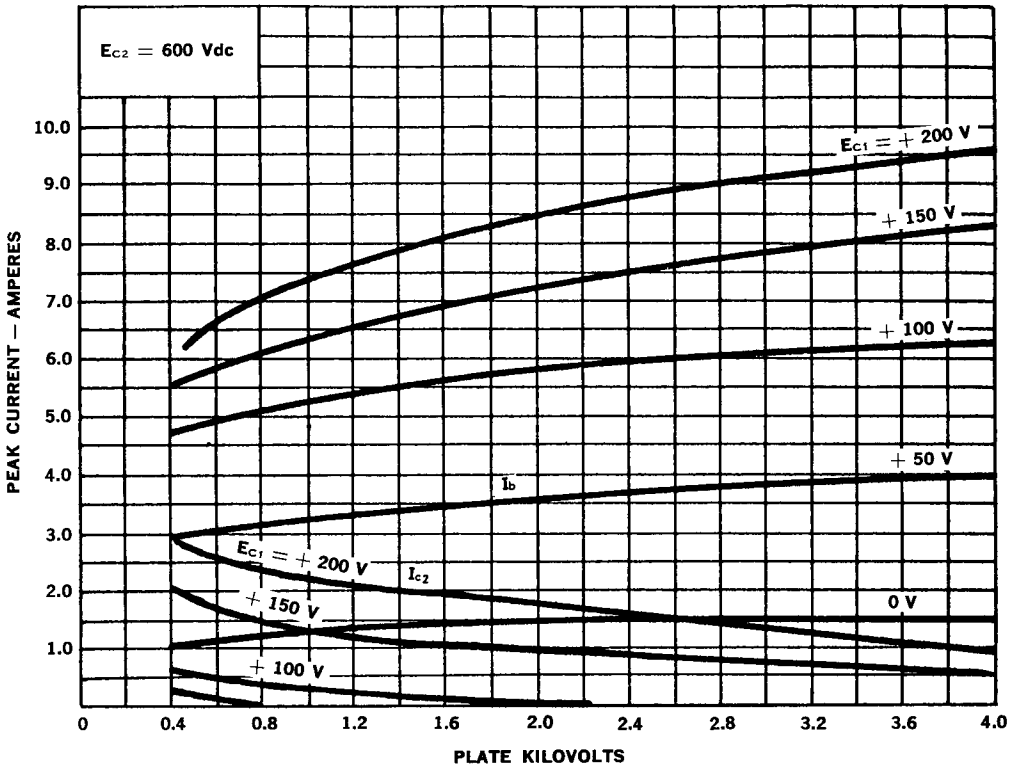
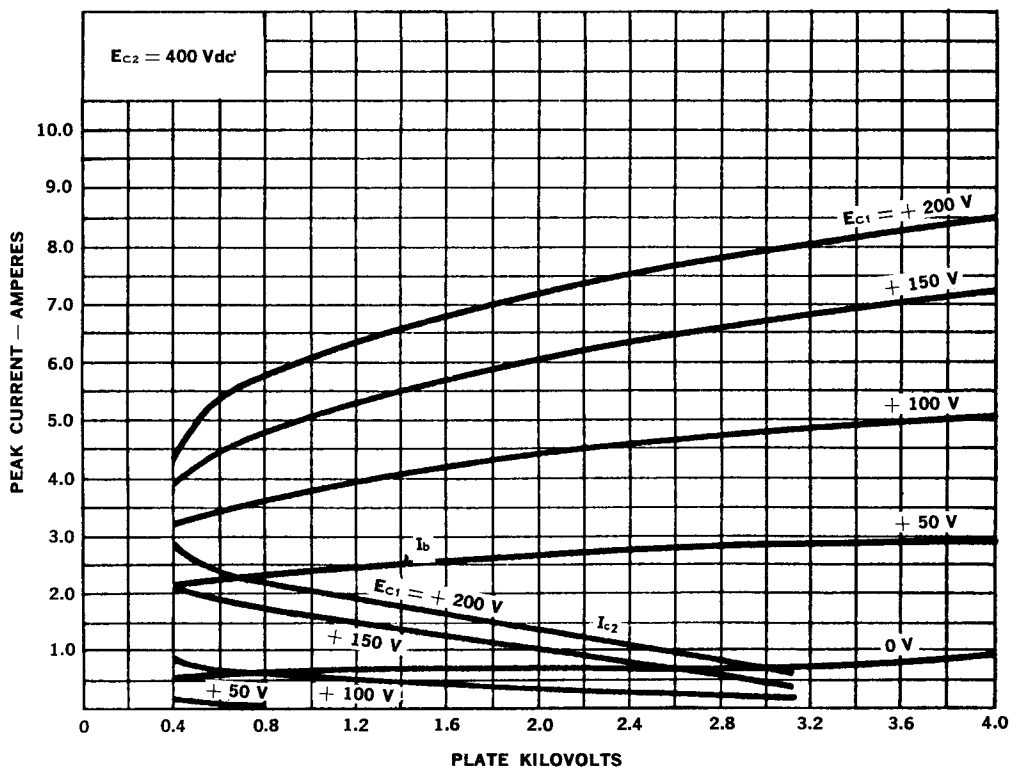


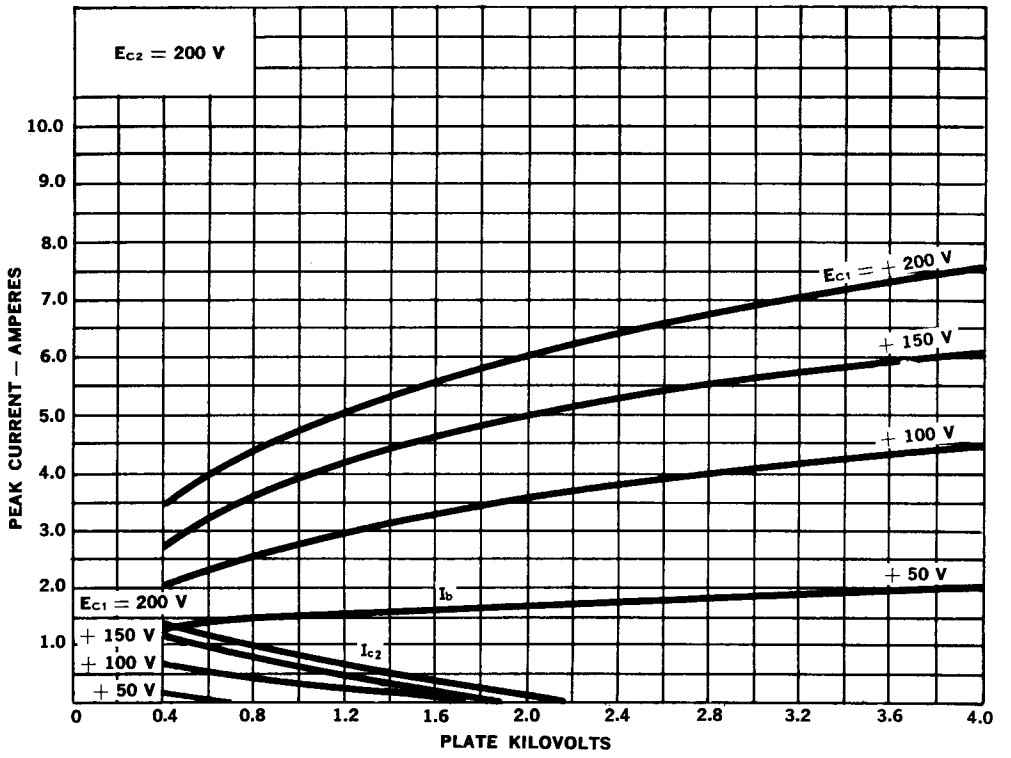
PLATE AND GRID 2 CURRENT — MILLIAMPERES
PLATE VOLTS
E_{c1} = 0 Volts
E_{c2} = 200 V
225 V
E_{c2} = 250 V
175 V
I_b
150 V
125 V
100 V
75 V
50 V
I_{c2}
300
250
200
150
100
50
0
100
200
300
400
500
600
700

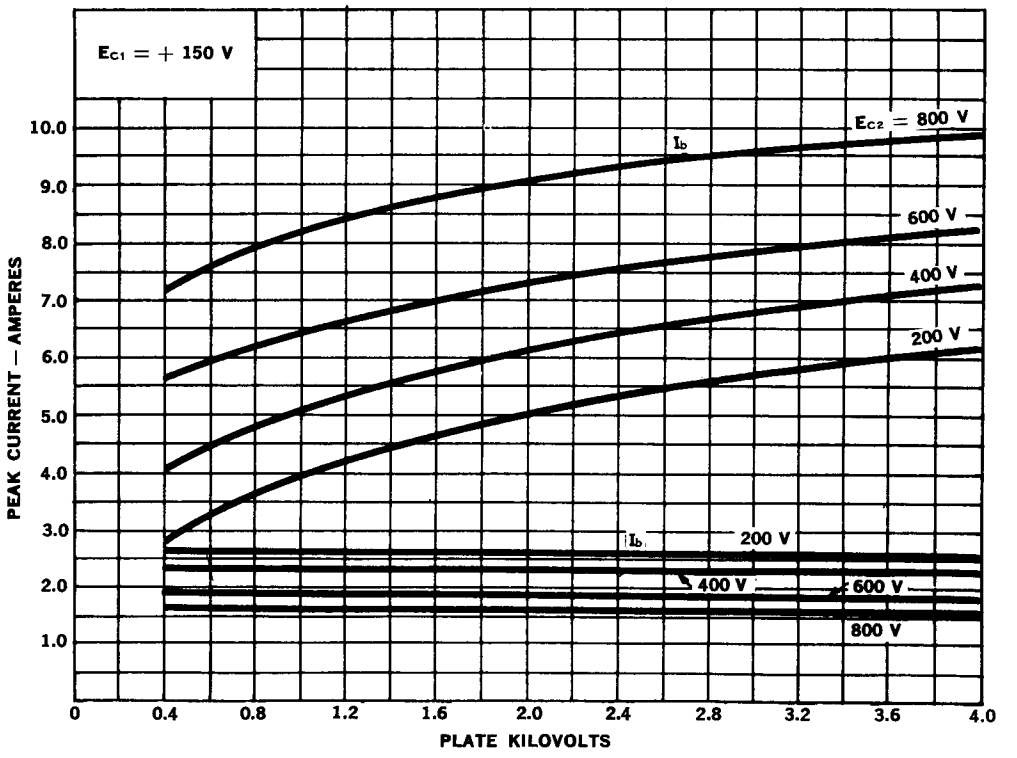

GRID 2 connected to PLATE
PLATE CURRENT — MILLIAMPERES
PLATE VOLTS
1000
900
800
700
600
500
400
300
200
100
100
200
300
400
500
600
700
800
900
1000
E_{C1} = + 30 V
+ 20 V
+ 10 V
0 V
− 10 V
− 20 V
− 30 V
− 40 V
− 50 V
− 60 V
− 70 V
− 80 V
− 90 V
− 100 V

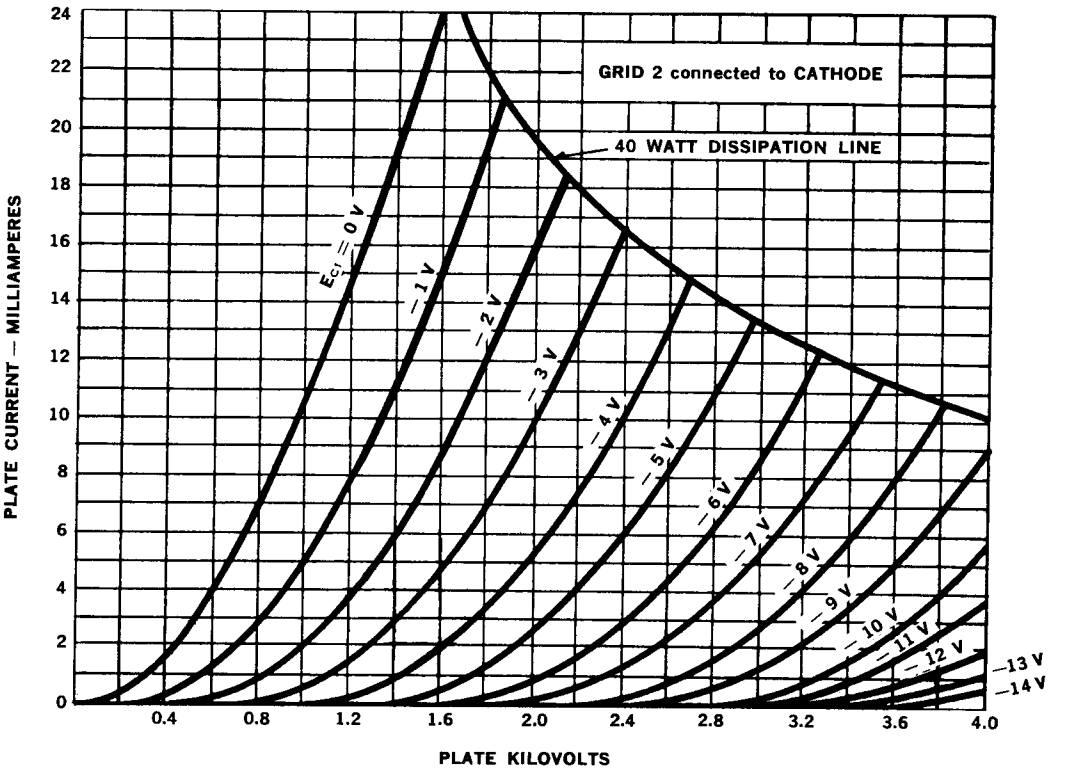

E_{c2} = 800 Vdc
PEAK CURRENT — AMPERES
PLATE KILOVOLTS
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
E_{C1} = + 200 V
+ 150 V
+ 100 V
+ 50 V
E_{C1} = + 200 V
I_b
0 V
I_{c2}
+ 150 V
+ 100 V
+ 50 V

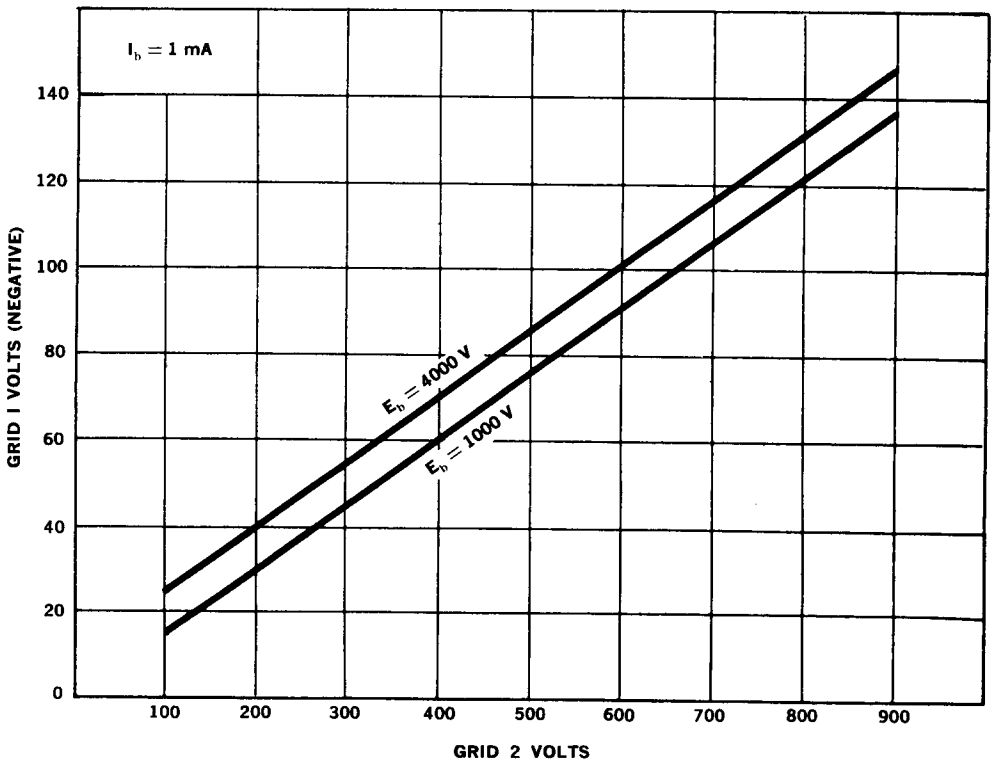

E_{c2} = 600 Vdc
PEAK CURRENT — AMPERES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
E_{c1} = + 200 V
+ 150 V
+ 100 V
+ 50 V
I_b
E_{c1} = + 200 V
I_{c2}
+ 150 V
0 V
+ 100 V
0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
PLATE KILOVOLTS


E_{c2} = 400 Vdc
PEAK CURRENT — AMPERES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
E_{c1} = + 200 V
+ 150 V
+ 100 V
+ 50 V
I_b
E_{c1} = + 200 V
I_{c2}
+ 150 V
0 V
+ 50 V
+ 100 V
0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
PLATE KILOVOLTS


Ec2 = 200 V
PEAK CURRENT — AMPERES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
Ec1 = + 200 V
+ 150 V
+ 100 V
+ 50 V
Ib
Ec1 = 200 V
+ 150 V
+ 100 V
+ 50 V
Ic2
0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
PLATE KILOVOLTS

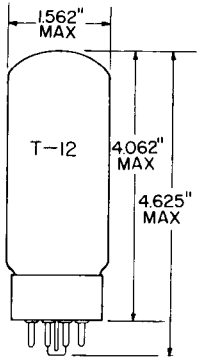

Ec1 = + 150 V
PEAK CURRENT — AMPERES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
Ec2 = 800 V
Ib
600 V
400 V
200 V
Ib
200 V
400 V
600 V
800 V
0
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0
PLATE KILOVOLTS


GRID 2 connected to CATHODE
40 WATT DISSIPATION LINE
E_{c_1} = 0 V
−1 V
−2 V
−3 V
−4 V
−5 V
−6 V
−7 V
−8 V
−9 V
−10 V
−11 V
−12 V
−13 V
−14 V
PLATE CURRENT — MILLIAMPERES
PLATE KILOVOLTS
0
2
4
6
8
10
12
14
16
18
20
22
24
0.4
0.8
1.2
1.6
2.0
2.4
2.8
3.2
3.6
4.0


I_b = 1 mA
E_b = 4000 V
E_b = 1000 V
GRID I VOLTS (NEGATIVE)
GRID 2 VOLTS
0
20
40
60
80
100
120
140
100
200
300
400
500
600
700
800
900

TUNG-SOL

TWIN DIODE



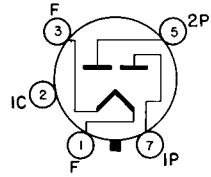
GLASS BULB
SHORT MEDIUM-SHELL
5 PIN OCTAL
B8-110 OR B8-118
OUTLINE DRAWING
JEDEC 12-16

COATED FILAMENT

3.3±0.3 VOLTS 3.8 AMP.
AC OR DC

ANY MOUNTING POSITION

*OPPOSITE ENDS OF THE DIRECTLY HEATED CATHODE ARE CONNECTED TO PINS 1 AND 3. CATHODE-HEATING VOLTAGE SHOULD BE CONNECTED BETWEEN THESE PINS. OUTPUT CURRENT MAY BE TAKEN FROM EITHER PIN 1 OR PIN 3.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5DE

THE 3DG4 IS A TWIN DIODE WITH A DIRECTLY HEATED FILAMENT DESIGNED FOR USE AS A FULL-WAVE RECTIFIER IN THE POWER SUPPLY OF TELEVISION RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RECTIFIER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	1050	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE	SEE RATING CHART	
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	1200	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE,	SEE RATING CHART	
MAXIMUM DURATION 0.2 SECOND	6.5	AMP.
MAXIMUM DC OUTPUT CURRENT		
BULB TEMPERATURE AT HOTTEST POINT	200	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	CAPACITOR-INPUT FILTER	
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	275	VOLTS
FILTER INPUT CAPACITOR	40	μF
TOTAL PLATE-SUPPLY RESISTANCE PER PLATE	32	OHMS
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	300	VOLTS
TUBE VOLTAGE DROP		
I_b = 350 MA. DC PER PLATE	25	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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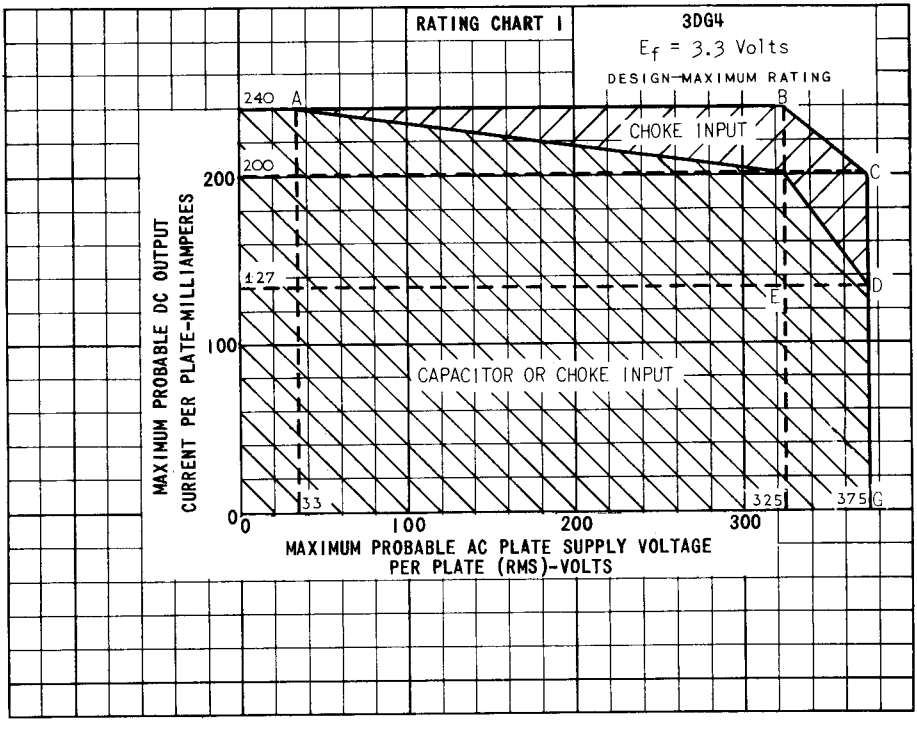
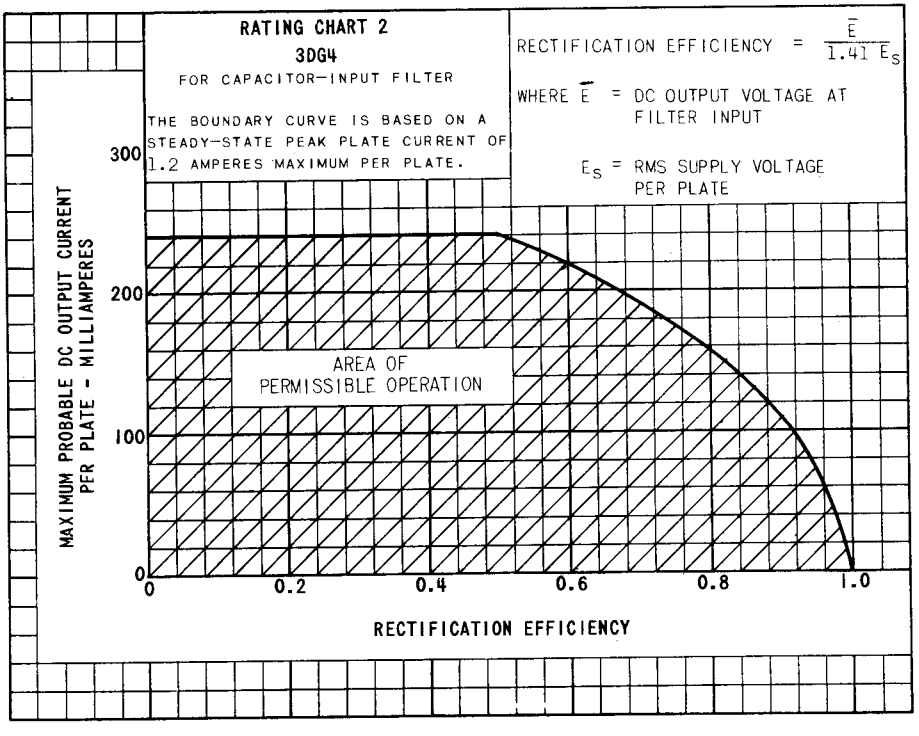

RATING CHART 1
3DG4
E_f = 3.3 Volts
DESIGN-MAXIMUM RATING
240
A
B
CHOKE INPUT
200
C
127
E
D
CAPACITOR OR CHOKE INPUT
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE-MILLIAMPERES
200
100
0
33
325
375
G
0
100
200
300
MAXIMUM PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS)-VOLTS


RATING CHART 2
3DG4
FOR CAPACITOR-INPUT FILTER
THE BOUNDARY CURVE IS BASED ON A STEADY-STATE PEAK PLATE CURRENT OF 1.2 AMPERES MAXIMUM PER PLATE.
RECTIFICATION EFFICIENCY = $\frac{\bar{E}}{1.41\ E_s}$
WHERE $\bar{E}$ = DC OUTPUT VOLTAGE AT FILTER INPUT
E_s = RMS SUPPLY VOLTAGE PER PLATE
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
300
200
100
0
AREA OF PERMISSIBLE OPERATION
0
0.2
0.4
0.6
0.8
1.0
RECTIFICATION EFFICIENCY

$R_s = R_{sec} + N^2R_{pri} + R_A$

WHERE

R_s = PLATE SUPPLY RESISTANCE PER PLATE

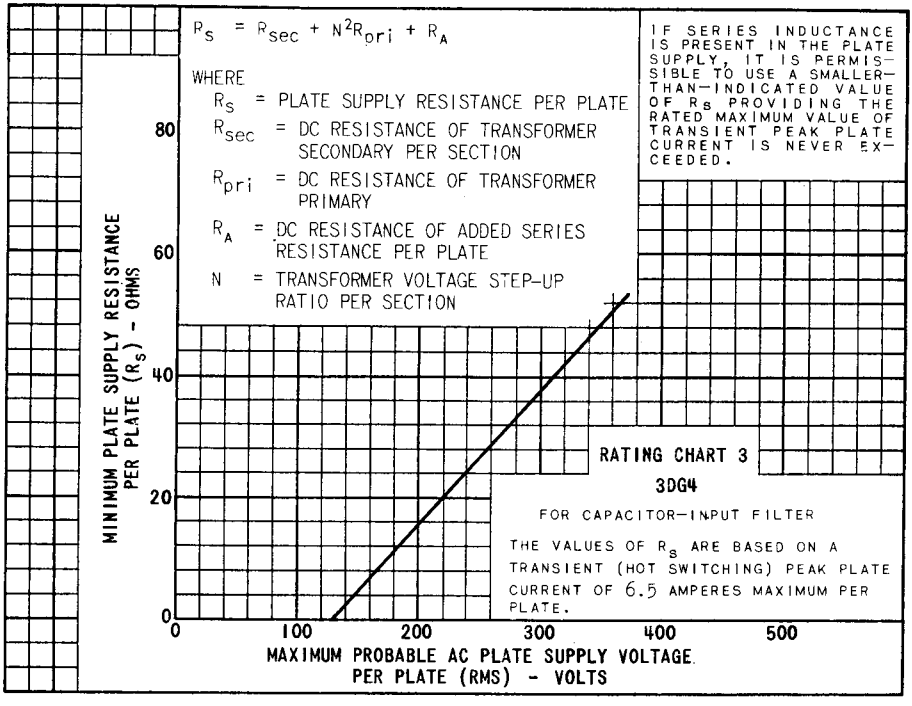
R_{sec} = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION

R_{pri} = DC RESISTANCE OF TRANSFORMER PRIMARY

R_A = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE

N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION

IF SERIES INDUCTANCE IS PRESENT IN THE PLATE SUPPLY, IT IS PERMISSIBLE TO USE A SMALLER-THAN-INDICATED VALUE OF R_s PROVIDING THE RATED MAXIMUM VALUE OF TRANSIENT PEAK PLATE CURRENT IS NEVER EXCEEDED.

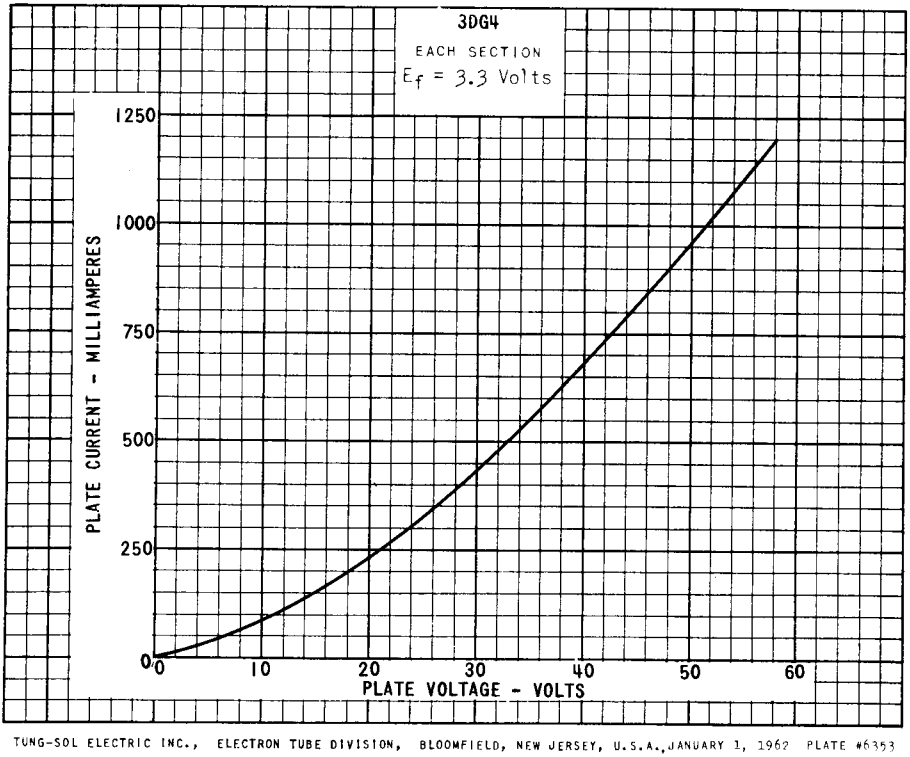


RATING CHART 3

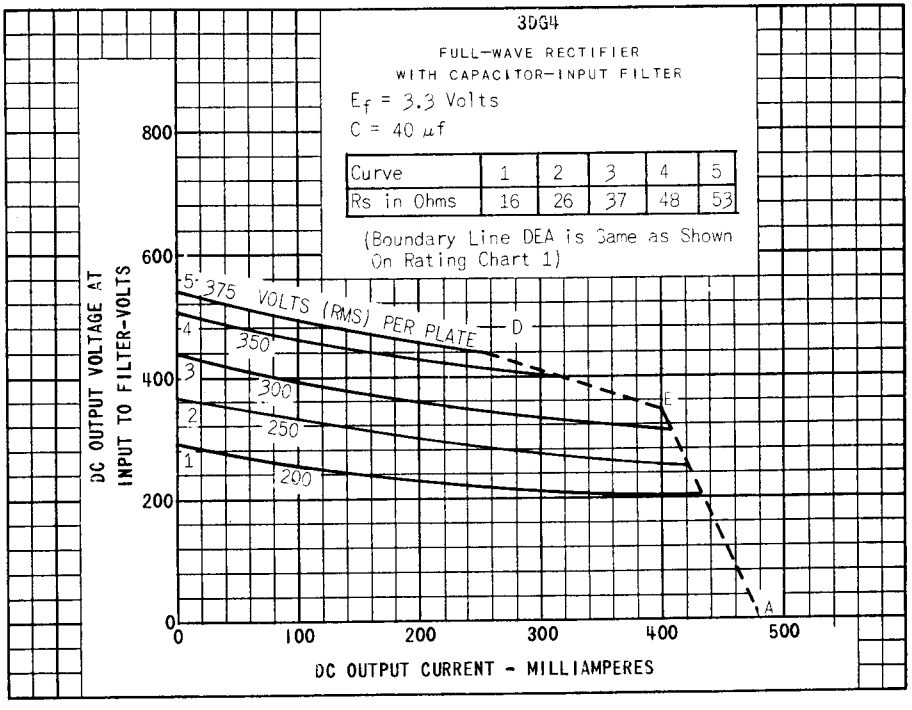
3DG4

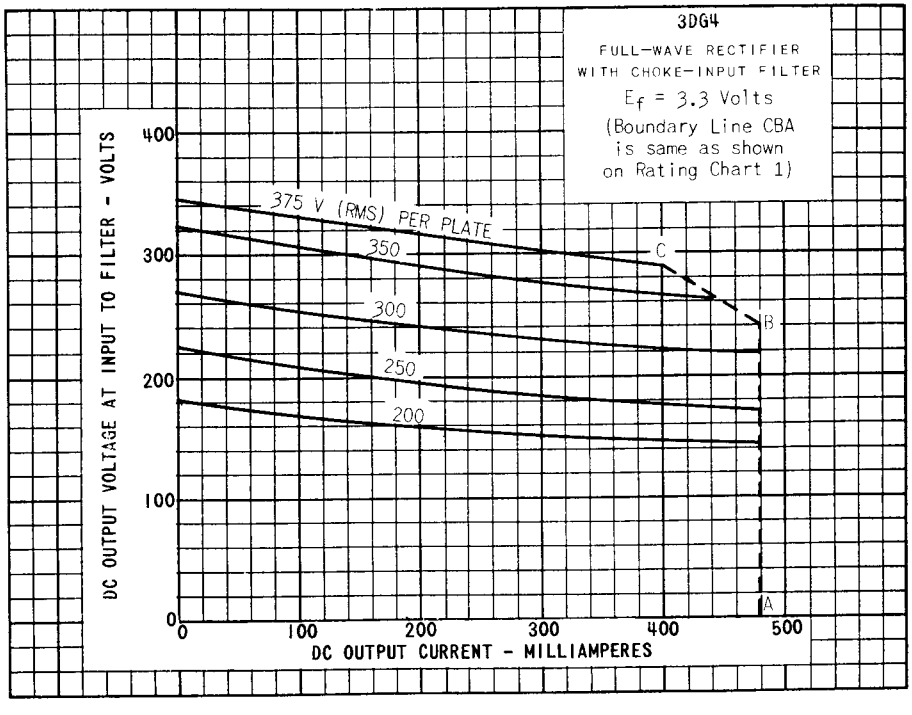
FOR CAPACITOR-INPUT FILTER

THE VALUES OF R_s ARE BASED ON A TRANSIENT (HOT SWITCHING) PEAK PLATE CURRENT OF 6.5 AMPERES MAXIMUM PER PLATE.



3DG4

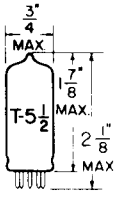

3DG4
FULL-WAVE RECTIFIER
WITH CAPACITOR-INPUT FILTER
E_f = 3.3 Volts
C = 40 μf
Curve 1 2 3 4 5
Rs in Ohms 16 26 37 48 53
(Boundary Line DEA is Same as Shown On Rating Chart 1)
375 VOLTS (RMS) PER PLATE
350
300
250
200
5
4
3
2
1
D
E
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER-VOLTS
800
600
400
200
0
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES


3DG4
FULL-WAVE RECTIFIER
WITH CHOKE-INPUT FILTER
E_f = 3.3 Volts
(Boundary Line CBA is same as shown on Rating Chart 1)
375 V (RMS) PER PLATE
350
300
250
200
C
B
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
400
300
200
100
0
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE

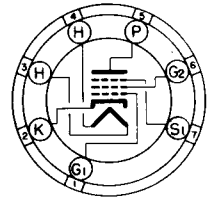


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6±10% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 3DK6 IS A SHARP CUTOFF PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION DESIGNED FOR SERVICE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER. THE VERY HIGH TRANSCONDUCTANCE AT LOW PLATE AND SCREEN POTENTIALS COMBINED WITH THE LOW INTERELECTRODE CAPACITANCES MAKES IT PARTICULARLY SUITABLE FOR USE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 3DK6 IS IDENTICAL TO THE 4DK6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)*	0.025	μμf
INPUT	6.3	μμf
OUTPUT	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE*	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATTS
MAXIMUM GRID #1 VOLTAGE:*		
POSITIVE VALUE	0	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)[A]		

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION

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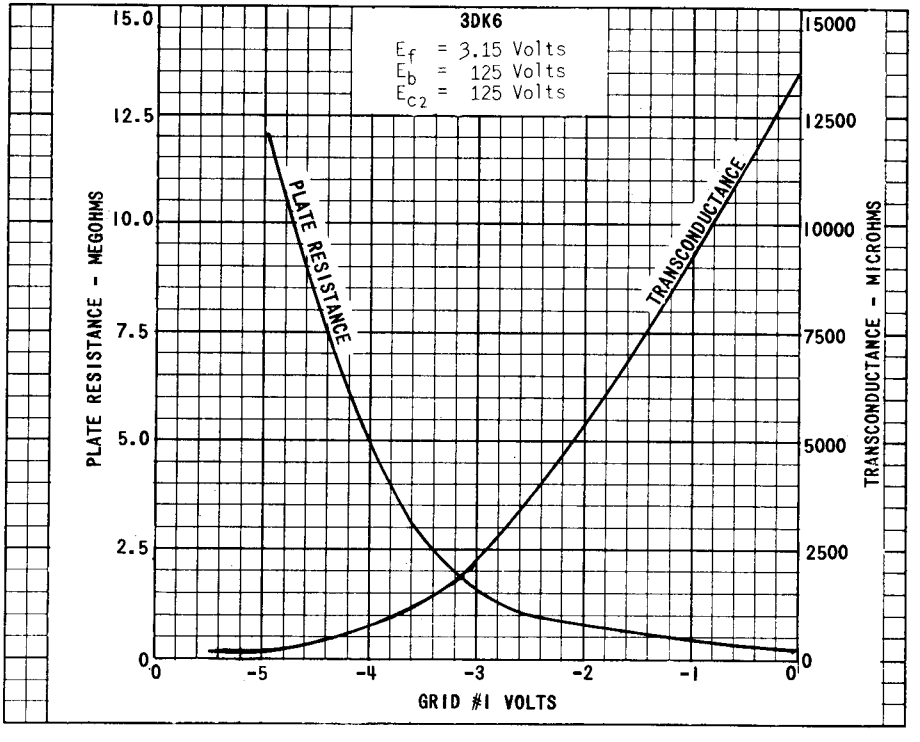
TUNG-SOL

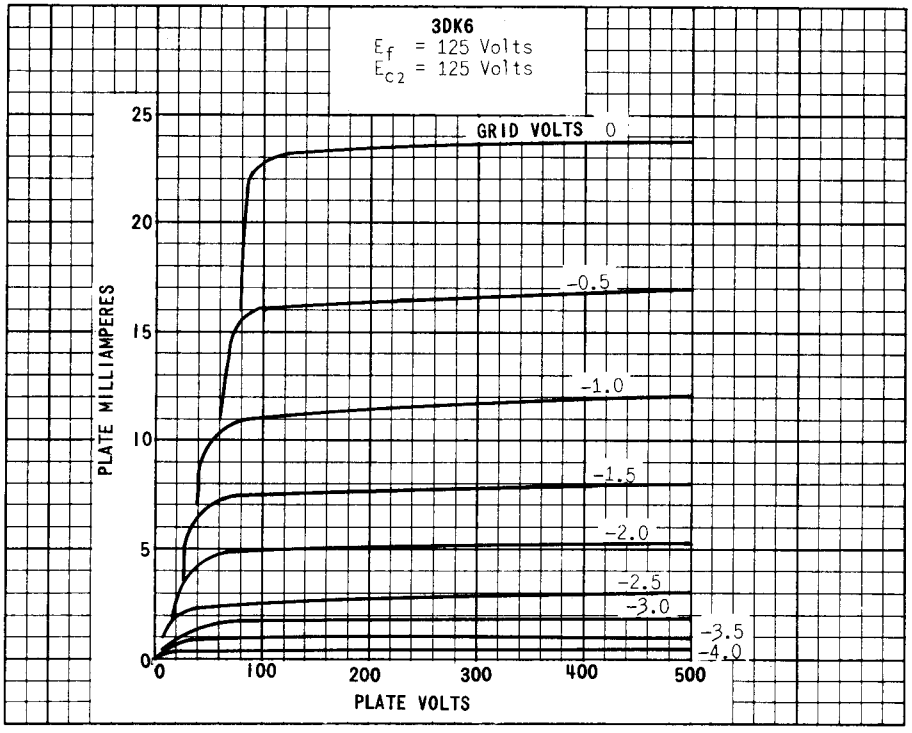
CONTINUED FROM PRECEDING PAGE

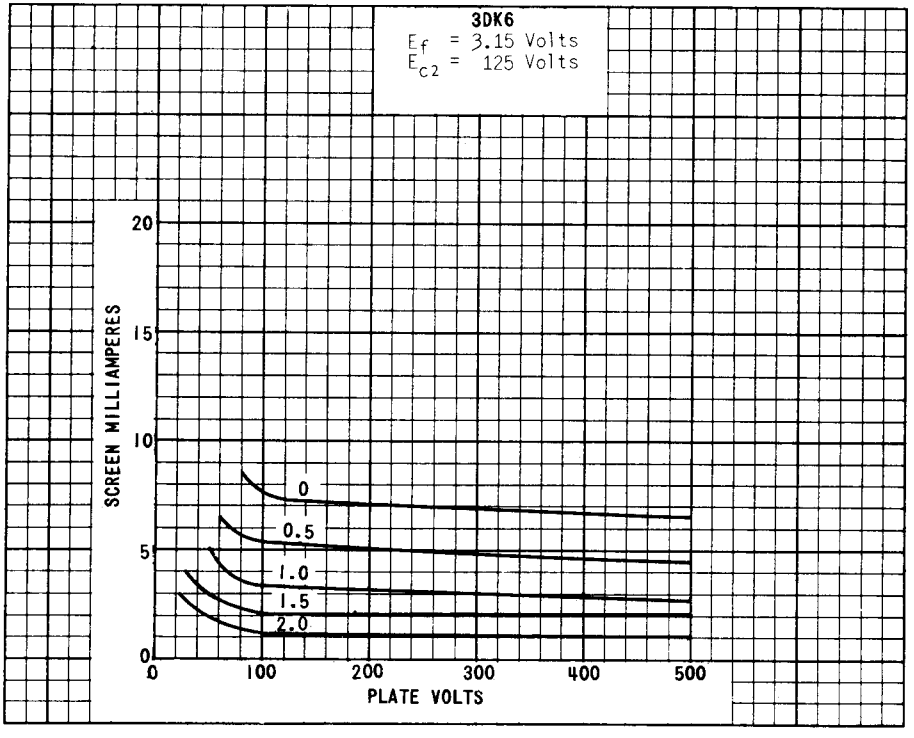
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6±10%	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #3 (SUPPRESSOR)	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)*	0.35	MEGOHM
TRANSCONDUCTANCE	9800	μMHOS
PLATE CURRENT	12.0	MA.
GRID #2 CURRENT	3.8	MA.
GRID #1 CUTOFF BIAS[B]	-6.5	VOLTS

[B] FOR PLATE CURRENT OF 20 μA.







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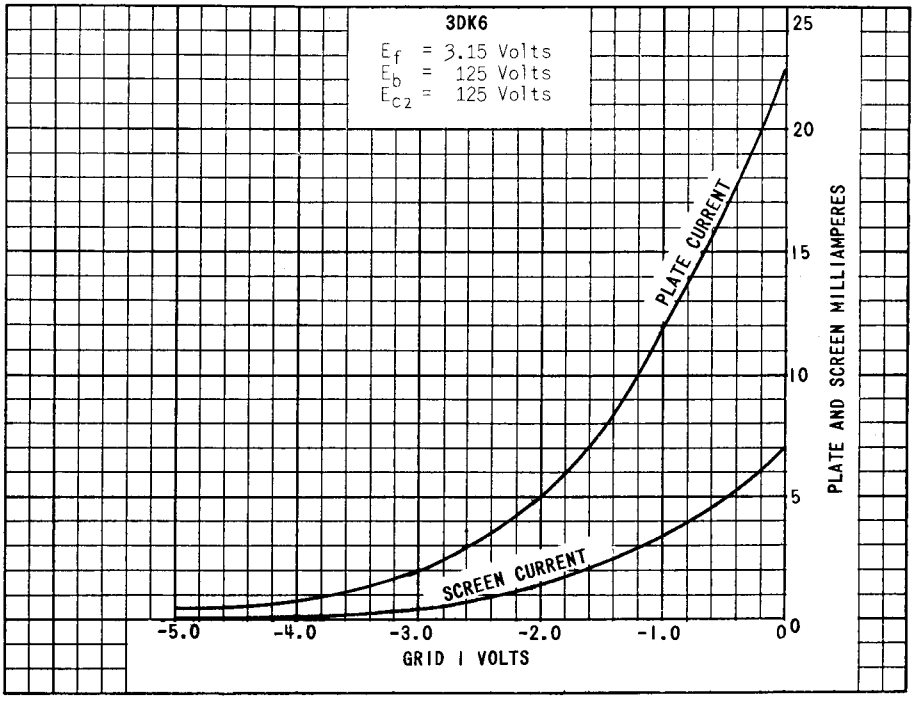
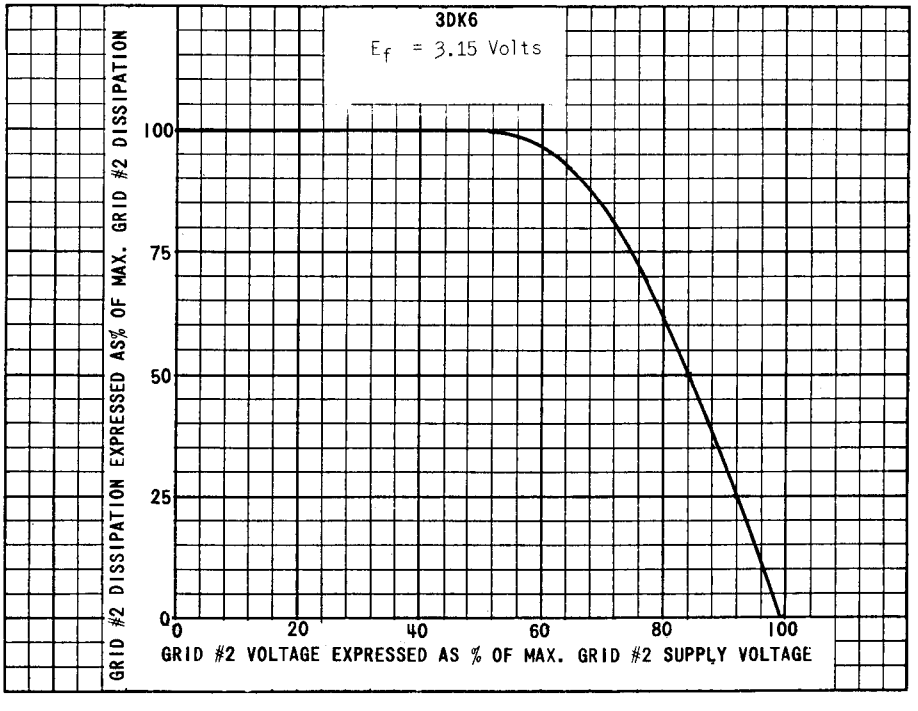

3DK6
E_f = 3.15 Volts
E_b = 125 Volts
E_{c2} = 125 Volts
PLATE CURRENT
SCREEN CURRENT
PLATE AND SCREEN MILLIAMPERES
25
20
15
10
5
0
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID 1 VOLTS


3DK6
E_f = 3.15 Volts
GRID #2 DISSIPATION EXPRESSED AS% OF MAX. GRID #2 DISSIPATION
100
75
50
25
0
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

TUNG-SOL

PENTODE

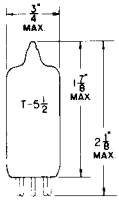
MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
3.15 VOLTS 0.6±10% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
7EM

THE 3DT6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN FM DETECTOR IN 600 MA SERIES HEATER OPERATED TELEVISION RECEIVERS. DESIGNED SO THAT GRID #1 AND GRID #3 CAN EACH BE USED AS INDEPENDENT SHARP CUTOFF CONTROL ELECTRODES, THE TUBE MAY ALSO BE USED IN DELAY CIRCUITS, GAIN-CONTROLLED AMPLIFIER CIRCUITS, AND MIXER CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, THE 3DT6 IS IDENTICAL TO THE 6DT6.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH EXTERNAL SHIELD, #316, CONNECTED TO CATHODE

GRID #1 TO PLATE	0.02	μμf
GRID #1 TO GRID #3	0.1	μμf
GRID #3 TO ALL OTHER ELECTRODES	6.1	μμf
GRID #1 TO GRID #2, GRID #3, HEATER, AND INTERNAL SHIELD AND CATHODE	5.8	μμf
GRID #3 TO PLATE	1.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FM DETECTOR SERVICE

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	28 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL--GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	1.1 ←	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART	
MAXIMUM HEATER--CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.15	VOLTS
HEATER CURRENT	0.6±10%	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	560	OHMS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHM
TRANSCONDUCTANCE:		
GRID #1 TO PLATE	800	μMHOS
GRID #3 TO PLATE	515	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-3.5	VOLTS
PLATE CURRENT	1.1	MA.
GRID #2 CURRENT	2.1	MA.

TYPICAL OPERATION IN THE ACCOMPANYING LOCKED-OSCILLATOR, QUADRATURE-GRID FM DETECTOR CIRCUIT AT A CARRIER FREQUENCY OF 4.5 MC:

INPUT SIGNAL TO GRID OF DRIVER TUBE	**15**	**200**	**500**	**MV RMS**
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	0.22	0.21	MA.
GRID #2 CURRENT	3.4	5.5	6	MA.
GRID #1 CURRENT	0.013	0.6	0.8	MA.
BANDWIDTH:				
FOR A TOTAL HARMONIC DISTORTION OF 10 PERCENT	65	120	118	KC
AM REJECTION (APPROX.)[B]	33	29	28	DB
AUDIO OUTPUT VOLTAGE (RMS, APPROX.):				
WITH ± 7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	5.5	6.5	7.5	VOLTS
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	17	21	23	VOLTS
TOTAL HARMONIC DISTORTION:				
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	2	3	4	PERCENT
SENSITIVITY:				
WITH ±7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			5[C]	MILLIVOLTS
WITH ±25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			15[C]	MILLIVOLTS
MAXIMUM CIRCUIT VALUES:				
GRID #1 CIRCUIT RESISTANCE:				
FOR FIXED-BIAS OPERATION			0.25	MEGOHM
FOR CATHODE-BIAS OPERATION			0.5	MEGOHM

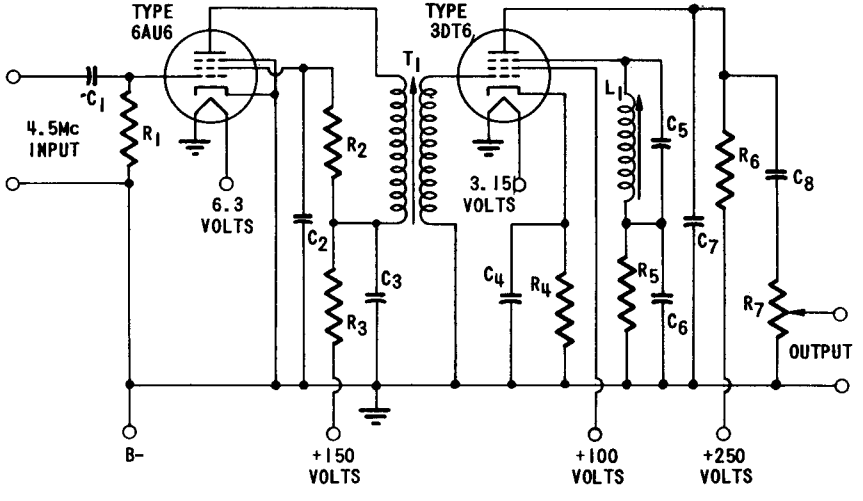
[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

→ INDICATES A CHANGE.

TUNG-SOL

LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT UTILIZING TYPE 3DT6

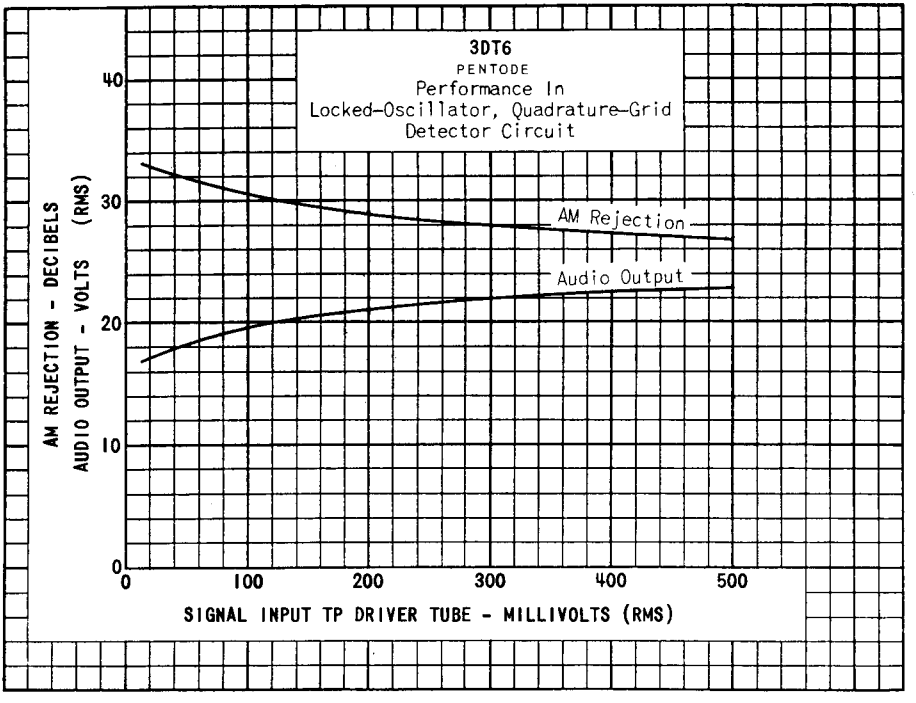


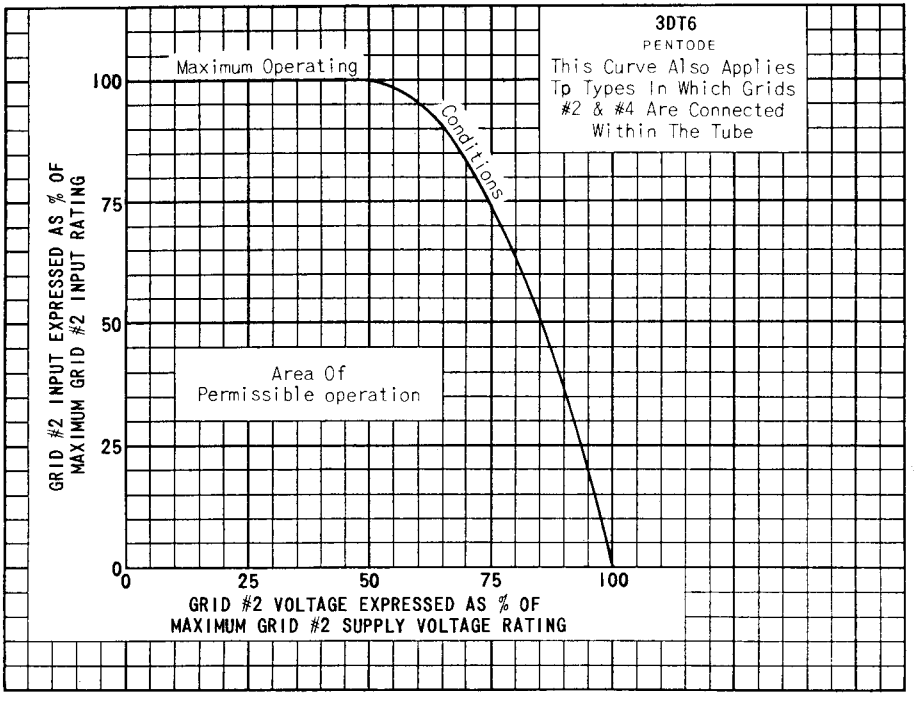
C_1: 47μμf, 400 VOLTS
C_2 C_3: 0.01μf, 400 VOLTS
C_4: 0.01μf, 200 VOLTS
C_5: 18μμf, 200 VOLTS
C_6: 0.05μf, 200 VOLTS
C_7: 100 TO 1000μμf, 400 VOLTS
C_8: 0.01μf, 400 VOLTS

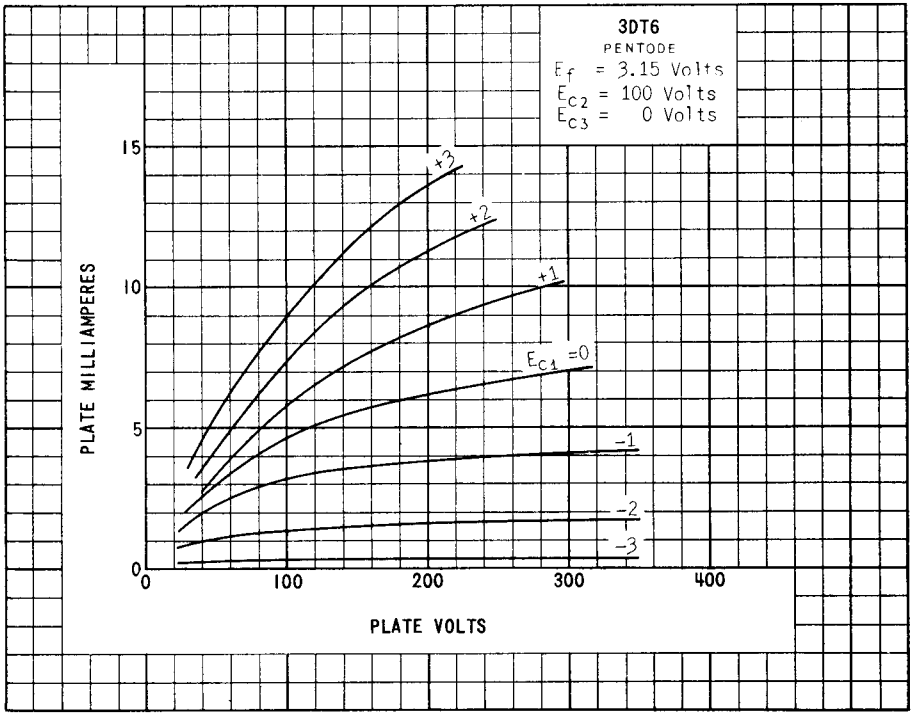
L_1: SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC.

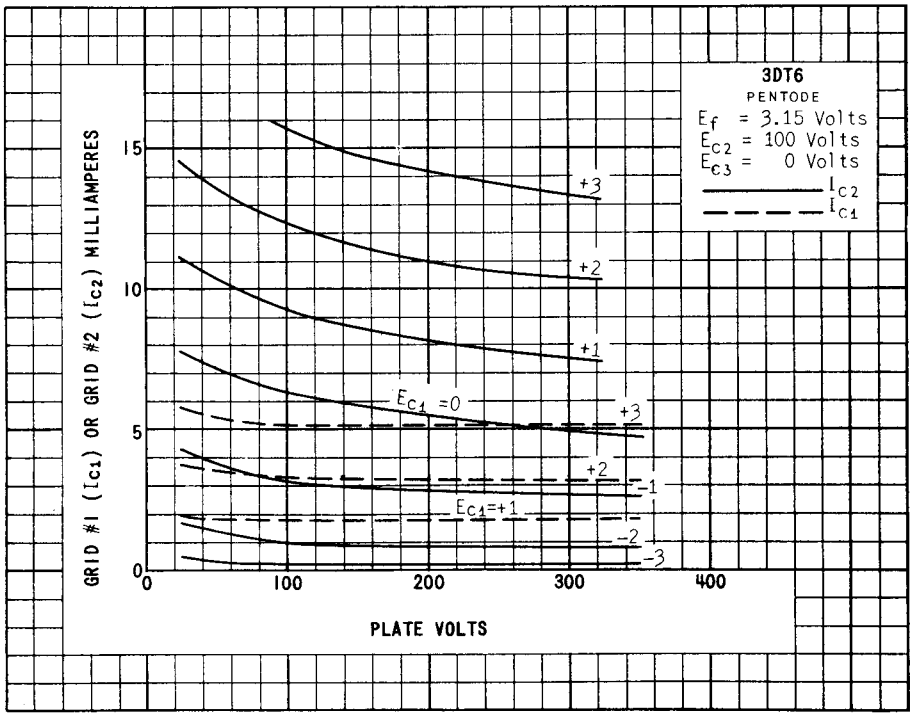
R_1: 100000 OHMS, 0.5 WATT
R_2: 12000 OHMS, 0.5 WATT
R_3: 1000 OHMS, 0.5 WATT
R_4: 560 OHMS, 0.5 WATT
R_5: 560000 OHMS, 0.5 WATT
R_6: 270000 OHMS, 0.5 WATT
R_7: 0.5 MEGOHM POTENTIOMETER

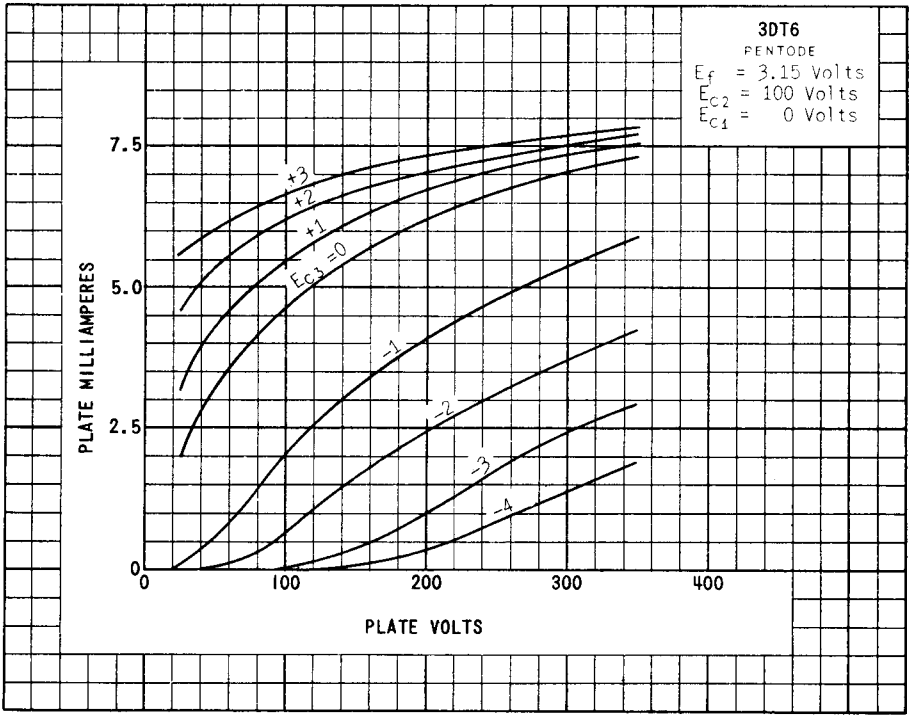
T_1: SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q > 60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE.

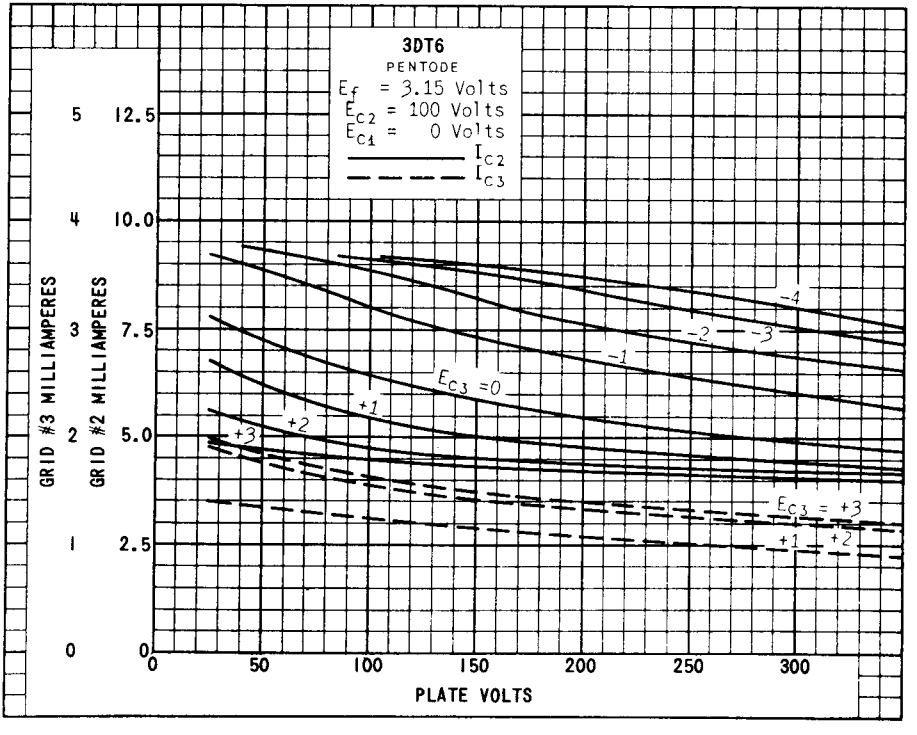

3DT6
PENTODE
Performance In
Locked-Oscillator, Quadrature-Grid
Detector Circuit
AM REJECTION - DECIBELS
AUDIO OUTPUT - VOLTS (RMS)
AM Rejection
Audio Output
0
10
20
30
40
0
100
200
300
400
500
SIGNAL INPUT TP DRIVER TUBE - MILLIVOLTS (RMS)

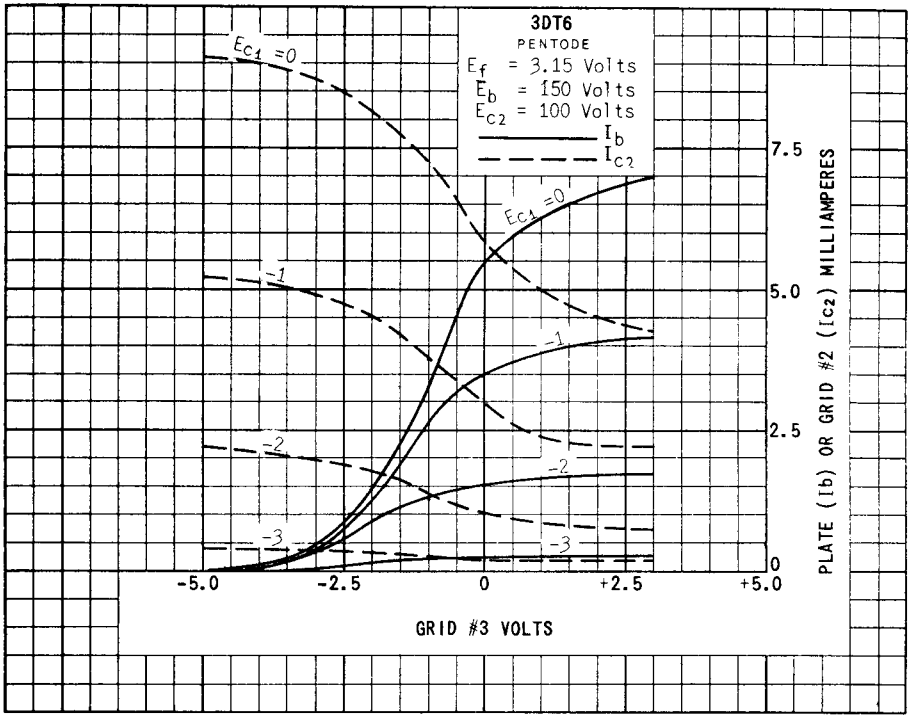

3DT6
PENTODE
This Curve Also Applies
Tp Types In Which Grids
#2 & #4 Are Connected
Within The Tube
Maximum Operating
Conditions
Area Of
Permissible operation
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 SUPPLY VOLTAGE RATING

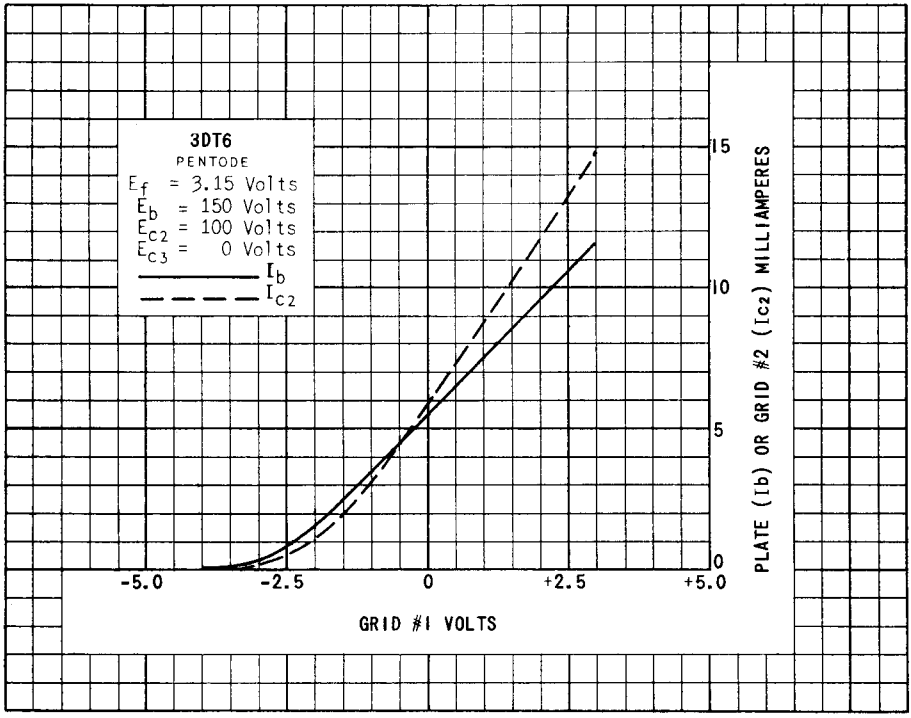

3DT6
PENTODE
E_f = 3.15 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
+3
+2
+1
E_{c1} =0
-1
-2
-3
0
5
10
15
0
100
200
300
400


3DT6
PENTODE
E_f = 3.15 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_{c2}
I_{c1}
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
+3
+2
+1
E_{c1} =0
+3
+2
-1
E_{c1}=+1
-2
-3
0
5
10
15
0
100
200
300
400


3DT6
PENTODE
E_f = 3.15 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
2.5
5.0
7.5
100
200
300
400
+3
+2
+1
E_{c3} =0
-1
-2
-3
-4


3DT6
PENTODE
E_f = 3.15 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
I_{c2}
I_{c3}
GRID #3 MILLIAMPERES
GRID #2 MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
2.5
5.0
7.5
10.0
12.5
50
100
150
200
250
300
-4
-2
-3
-1
E_{c3} =0
+1
+2
+3
E_{c3} = +3
+1
+2


3DT6
PENTODE
Ef = 3.15 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ib
Ic2
Ec1 =0
-1
-2
-3
7.5
5.0
2.5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #3 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

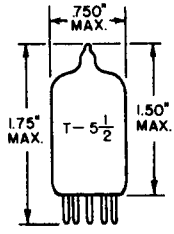

3DT6
PENTODE
Ef = 3.15 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
15
10
5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #1 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

TUNG-SOL

TRIODE

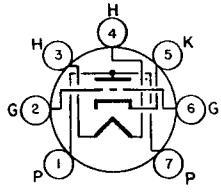
MINIATURE TYPE

MEDIUM MU TRIODE
FOR
UHF OSCILLATOR SERVICE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
7 DK

THE 3DZ4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR UHF OSCILLATOR SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3DZ4 IS IDENTICAL TO THE 2DZ4 AND THE 6DZ4.

DIRECT INTERELECTRODE CAPACITANCES
WITH SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K + E.S.)	2.2	pf
OUTPUT: P TO (H + K + E.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.2 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER - CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		180	VOLTS
HEATER POSITIVE WITH-RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		180	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS • SEE EIA STANDARD RS-239

UHF OSCILLATOR SERVICE

PLATE VOLTAGE	135	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.3	WATTS
CATHODE CURRENT	20	MA.
GRID CURRENT	2	MA.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
PLATE CURRENT	15	MA.
TRANSCONDUCTANCE	6,700	μMHOS
AMPLIFICATION FACTOR	14	
PLATE RESISTANCE	APPROX. 2,000	OHMS
GRID VOLTAGE FOR I_b = 20 μA	APPROX. -11	VOLTS

OSCILLATOR AT 1000 Mc/s

MEASURED IN JEDEC STANDARD OSCILLATOR NO. 400

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	15.5	MA.
GRID CURRENT	APPROX. 800	μA

TUNG-SOL

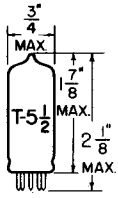
BEAM PENTODE

MINIATURE TYPE

COATED FILAMENT

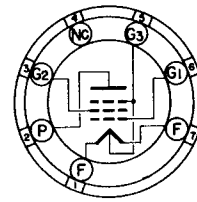
SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7	E_f APPLIED BETWEEN PIN 5 & PINS 1 & 7 TIED TOGETHER
E_{g1} REFERRED TO PIN 1	E_{g1} REFERRED TO PIN 1
2.8 VOLTS	1.4 VOLTS
25 MA.	50 MA.

DC



GLASS BULB

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 & 5 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 5 & 7. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3E5.



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

6BX

ANY MOUNTING POSITION

THE 3E5 IS A FILAMENTARY TYPE BEAM PENTODE POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE IN THE OUTPUT STAGE OF PORTABLE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	PARALLEL FILAMENT	SERIES FILAMENT	
FILAMENT VOLTAGE	1.4	2.8	VOLTS
MAXIMUM PLATE VOLTAGE	110	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	110	VOLTS
MAXIMUM CATHODE CURRENT	8	4[A]	MA.

[A] EACH 1.4 VOLTS FILAMENT SECTION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	PARALLEL FILAMENT		SERIES FILAMENT		
FILAMENT VOLTAGE	1.4	1.4	2.8	2.8	VOLTS
FILAMENT CURRENT	50	50	25	25	MA.
PLATE VOLTAGE	67.5	90	67.5	90	VOLTS
GRID #2 VOLTAGE	67.5	90	67.5	90	VOLTS
GRID #1 VOLTAGE	-5	-8	-5	-8	VOLTS
PEAK AF GRID #1 VOLTAGE	5	8	5	8	VOLTS
PLATE RESISTANCE	120 000	140 000	110 000	120 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	1 200	1 100	µMHOS
LOAD RESISTANCE	7 000	8 000	7 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	7.5	9.5	10.5	11	PERCENT
POWER OUTPUT	100	200	90	175	MW.

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PLATE 2449
AUG. 1 1950

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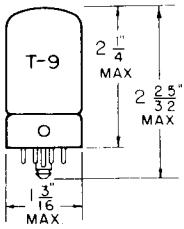
TUNG-SOL

PENTODE

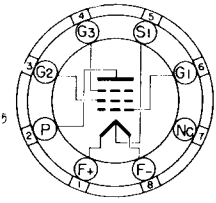
COATED FILAMENT



GLASS BULB

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 2 & 8	E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 8 TIED TOGETHER
E_{g1} REFERRED TO PIN 8	E_{g1} REFERRED TO PIN 5
2.8 VOLTS 50 MA.	1.4 VOLTS 100 MA.

AC OR DC



BOTTOM VIEW

LOCK-IN 8 PIN BASE
7CJ

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 5 AND 8 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 5 AND 8. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 8 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3E6.

ANY MOUNTING POSITION

THE 3E6 IS A HIGH TRANSCONDUCTANCE SHARP CUT-OFF FILAMENTARY TYPE RF PENTODE IN THE LOCK-IN CONSTRUCTION.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED PIN #8

GRID TO PLATE: (G_1 TO P)	0.007	μμf
INPUT: G_1 TO ($F+G_2+G_3+IS$)	5.5	μμf
OUTPUT: P TO ($F+G_2+G_3+IS$)	8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	PARALLEL FILAMENT	SERIES FILAMENT	
FILAMENT VOLTAGE	1.4	2.8	VOLTS
MAXIMUM PLATE VOLTAGE	110	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	110	VOLTS
MAXIMUM CATHODE CURRENT	6[A]	12	VOLTS

[A] FOR EACH 1.4 VOLT FILAMENT SECTION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	PARALLEL FILAMENT	SERIES FILAMENT	
FILAMENT VOLTAGE	1.4	2.8	VOLTS
FILAMENT CURRENT	100	50	MA.
PLATE VOLTAGE	90	90	VOLTS
GRID #3 VOLTAGE	PIN #4 CONNECTED TO PIN #8 AT SOCKET		
GRID #2 VOLTAGE	90	90	VOLTS
GRID #1 VOLTAGE[B]	0	0	VOLTS
GRID #1 RESISTOR	2	2	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.25	0.325	MEGOHM
TRANSCONDUCTANCE	2 000	1 700	μMHOS
PLATE CURRENT	4.2	2.9	MA.
GRID #2 CURRENT	1.7	1.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-5.5	-4	VOLTS

[B] GRID RETURN TO NEGATIVE END OF FILAMENT THROUGH A 2 MEGOHM RESISTOR

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JUNE 1, 1949

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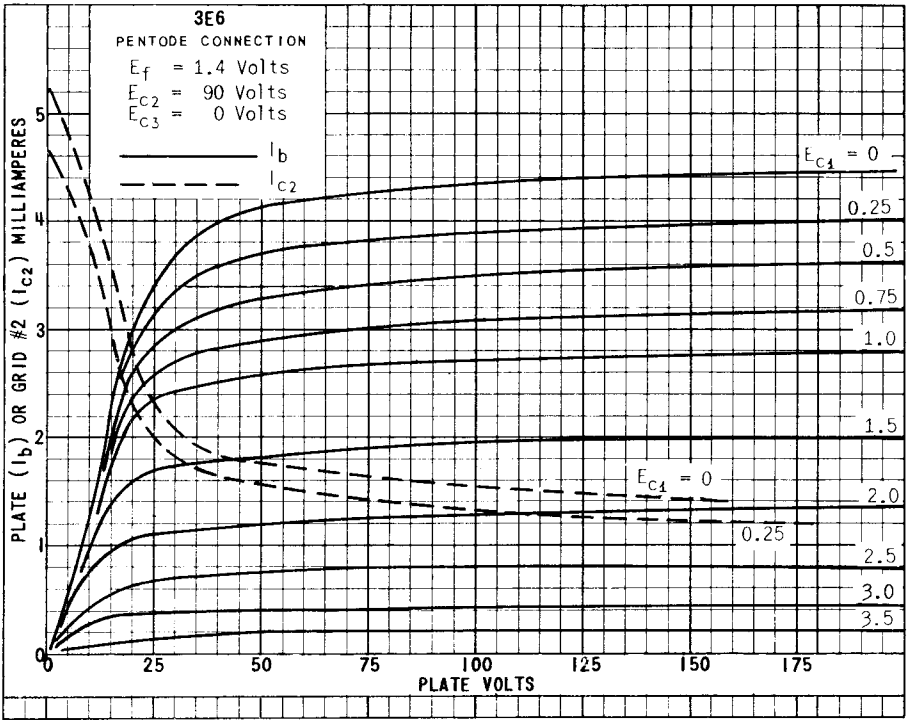
3E6



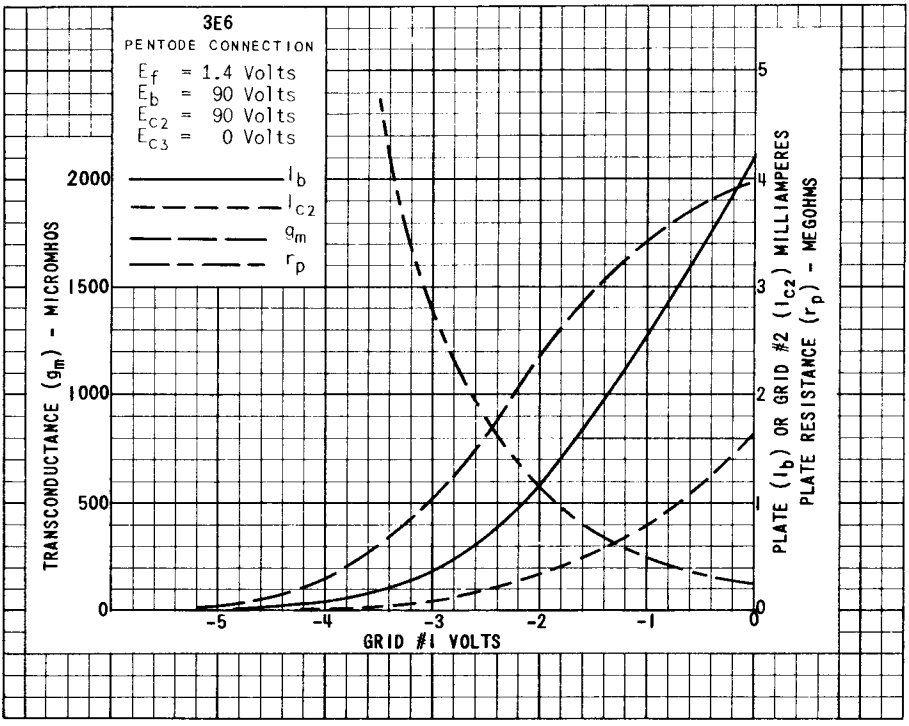


PLATE 2207

JUNE 1, 1949

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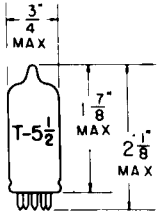
TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

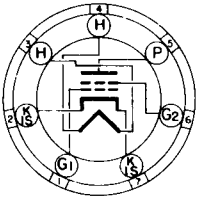
COATED UNIPOTENTIAL CATHODE

HEATER

2.9 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7EW

THE 3EA5 IS A SHARP CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR HIGH PLATE VOLTAGE OPERATION AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 2EA5 IS IDENTICAL TO THE 2EA5 AND 6EA5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (G1 TO P) (MAX.)	0.05	0.06	μμf
INPUT: G1 TO (H+K+G2+I.S.)	4.5	3.8	μμf
OUTPUT: P TO (H+K+G2+I.S.)	3.0	2.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.9	2.9	2.9	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.25	3.25	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	0.5	0.5	WATTS
MAXIMUM CATHODE CURRENT (DC)	20	20	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100	100	100	VOLTS
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	11.0	11.0	SECONDS

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.9	2.9	2.9	VOLTS
HEATER CURRENT	0.45±6%	0.45±6%	0.45±6%	AMPS.
PLATE VOLTAGE	250	250	250	VOLTS
GRID #2 VOLTAGE	140	140	140	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	-1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.15	0.15	MEGOHM
TRANSCONDUCTANCE	8000	8000	8000	μMHO
PLATE CURRENT	10	10	10	MA.
GRID #2 CURRENT	0.95	0.95	0.95	MA.
GRID #1 VOLTAGE FOR GM LESS THAN 100 μMHO	-6	-6	-6	VOLTS

B

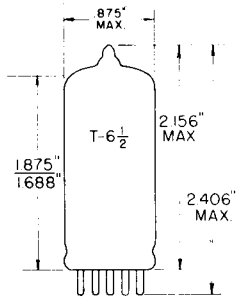
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

REMOTE-CUTOFF PENTODE

MINIATURE TYPE

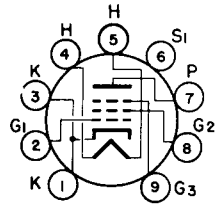


GLASS BULB
MINIATURE
9 PIN BASE E9-1

UNIPOTENTIAL CATHODE

HIGH Gm, SMALL SIGNAL
RF & IF AMPLIFIER
WITH GAIN CONTROL

SERIES STRING OPERATION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AQ

THE 3EH7 IS A REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT FEATURES VERY HIGH Gm WITH A REMOTE CUTOFF AND IS DESIGNED FOR FREQUENCIES INTO THE VHF RANGE. ITS CHIEF APPLICATION IS IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P) MAX.	0.0055	pf
INPUT: G1 TO (H+G2+G3+K+IS)	9.5	pf
OUTPUT: P TO (H+G2+G3+K+IS)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.4 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE		165	VOLTS
HEATER WARM-UP TIME*		11	SECONDS

MAXIMUM RATINGS

DESING CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 VOLTAGE	250	VOLTS
GRID #2 DISSIPATION	0.65	WATTS
CATHODE CURRENT	20	MA
GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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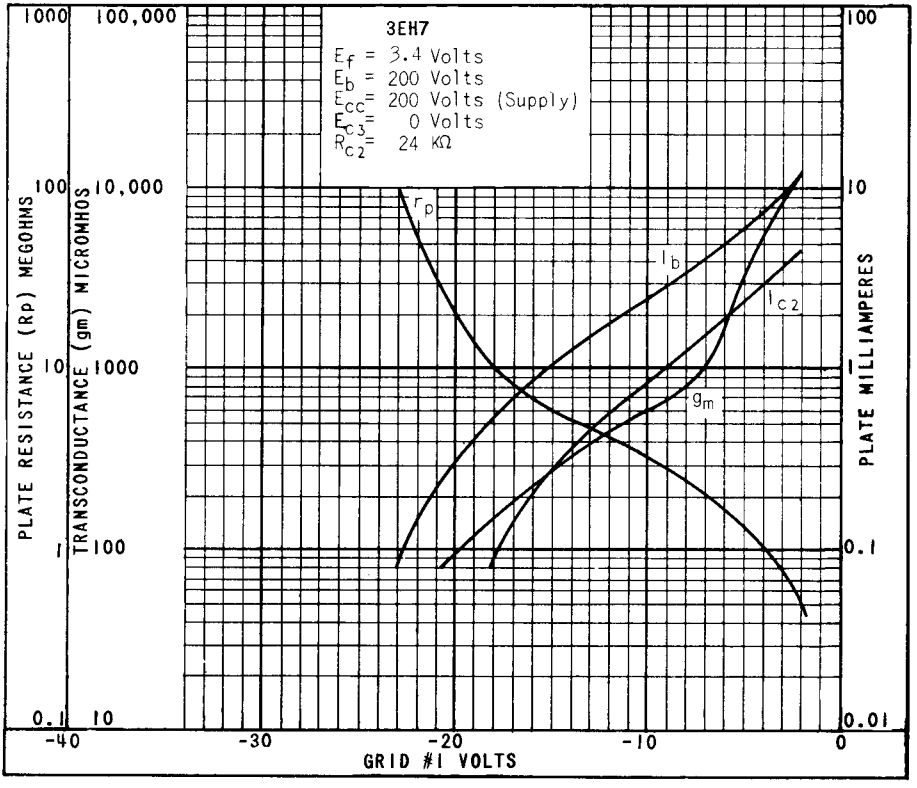
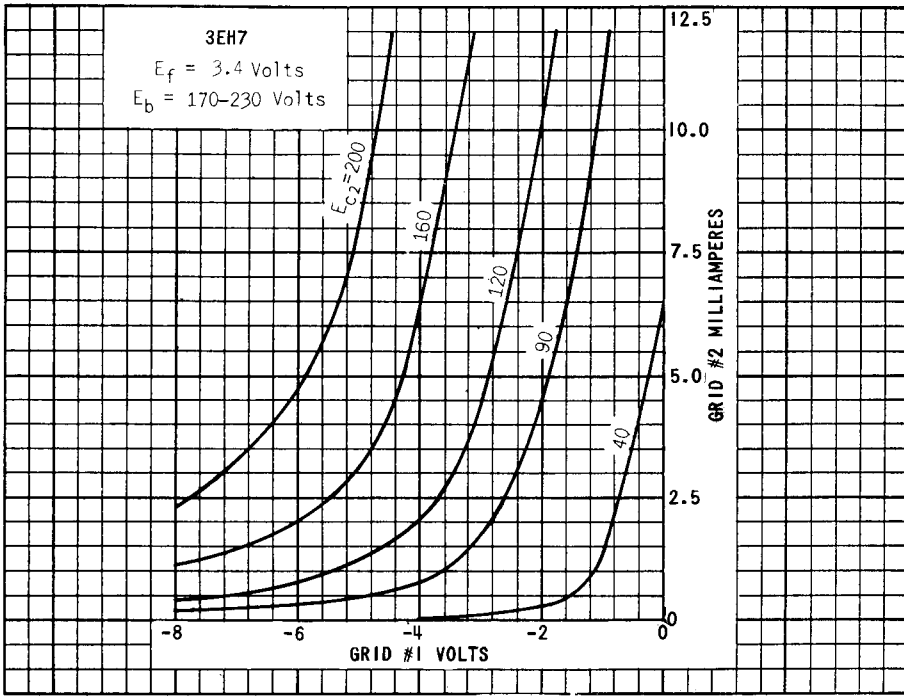
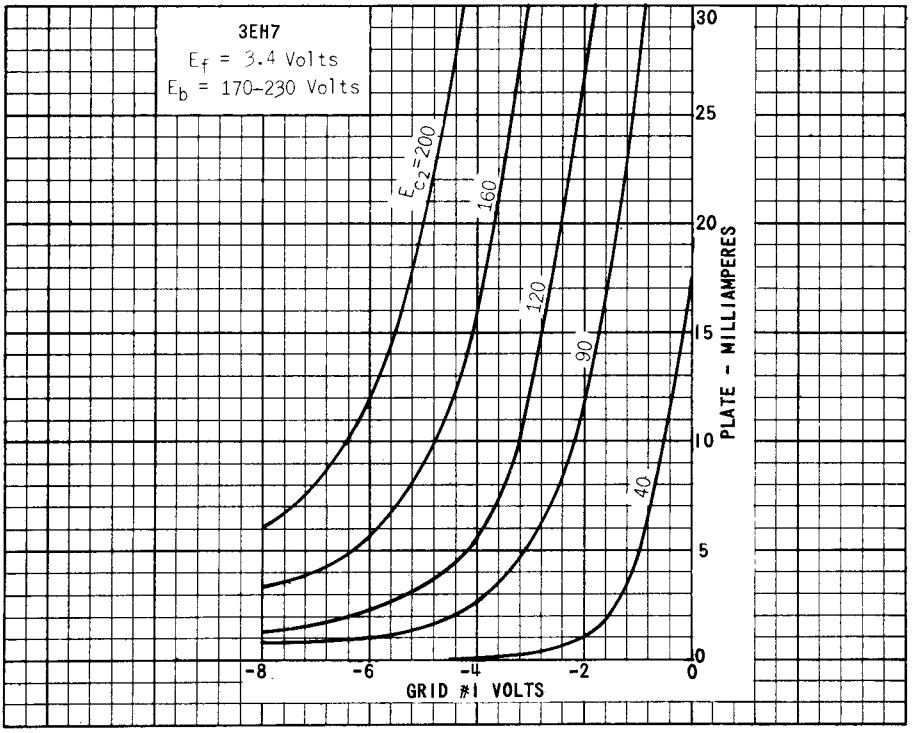
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	200	200	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE (SUPPLY)	90	200	VOLTS
GRID #2 SERIES RESISTOR	0	24	KILOHMS
GRID #1 VOLTAGE	-2	-2	VOLTS
PLATE CURRENT	12	---	MA.
GRID #2 CURRENT	4.5	---	MA.
TRANSCONDUCTANCE	12500	12500	μMHOS
PLATE RESISTANCE	0.5	---	MEGOHMS
GRID #1 IMPEDANCE AT 40 MC	13	---	KILOHMS
GRID #1 CUTOFF: E_{c1} =-6.5		1250	μMHOS
E_{c1} =-9.5		625	μMHOS
E_{c1}=-19.5		125	μMHOS
GRID #1 VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1%:			
E_{c1} =-6.5		100	MV.
E_{c1} =-9.5		160	MV.
E_{c1}=-19.5		450	MV.







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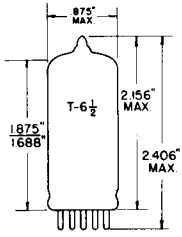
SHARP CUTOFF PENTODE

MINIATURE TYPE



MINIATURE BUTTON 9 PIN BASE E9-1

OUTLINE DRAWING SPECIAL

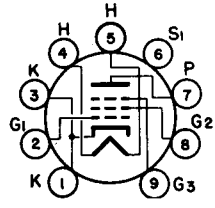
GLASS BULB

COATED UNIPOTENTIAL CATHODE

FOR IF CIRCUITS IN TV RECEIVERS

SERIES STRING OPERATION

ANY MOUNTING POSITION



BASING DIAGRAM

JEDEC 9AQ

BOTTOM VIEW

THE 3EJ7 IS A HIGH TRANSCONDUCTANCE SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. CONTROLLED HEATER WARM-UP TIME MAKES THE TUBE SUITABLE FOR SERIES STRING OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.005	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	10	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.4 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		150	VOLTS
HEATER WARM-UP TIME [A]		11	SECONDS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239 [B]

PLATE VOLTAGE WITH Ib = 0 MA.	550	VOLTS
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE WITH Ic2 = 0 MA	550	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 DISSIPATION	0.9	WATTS
CATHODE CURRENT	25	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM

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TUNG-SOL

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TYPICAL OPERATING CHARACTERISTICS

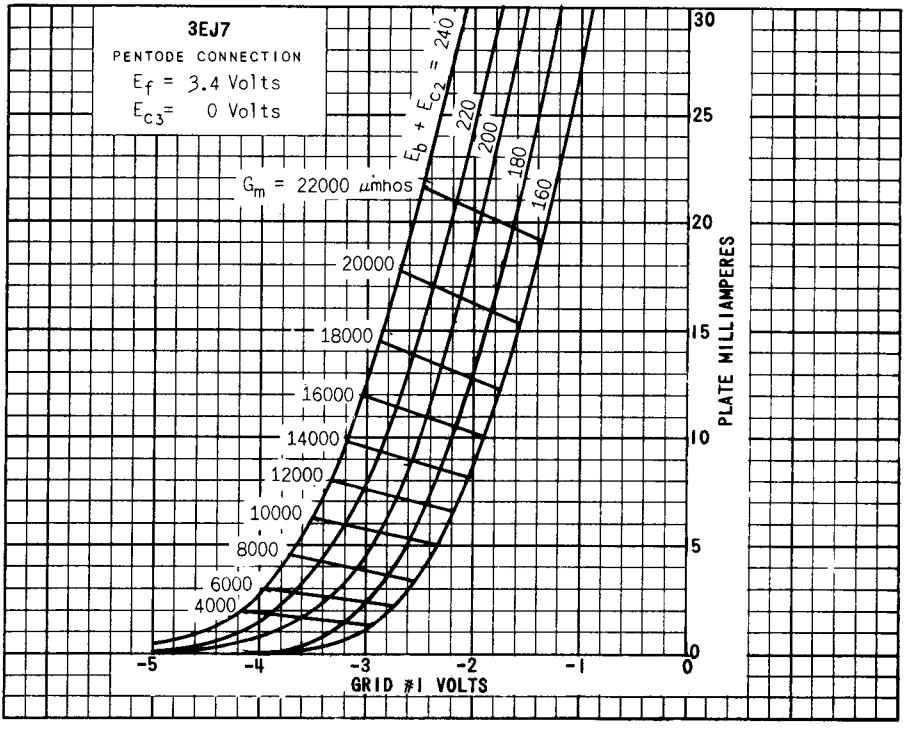
CLASS A_1 AMPLIFIER

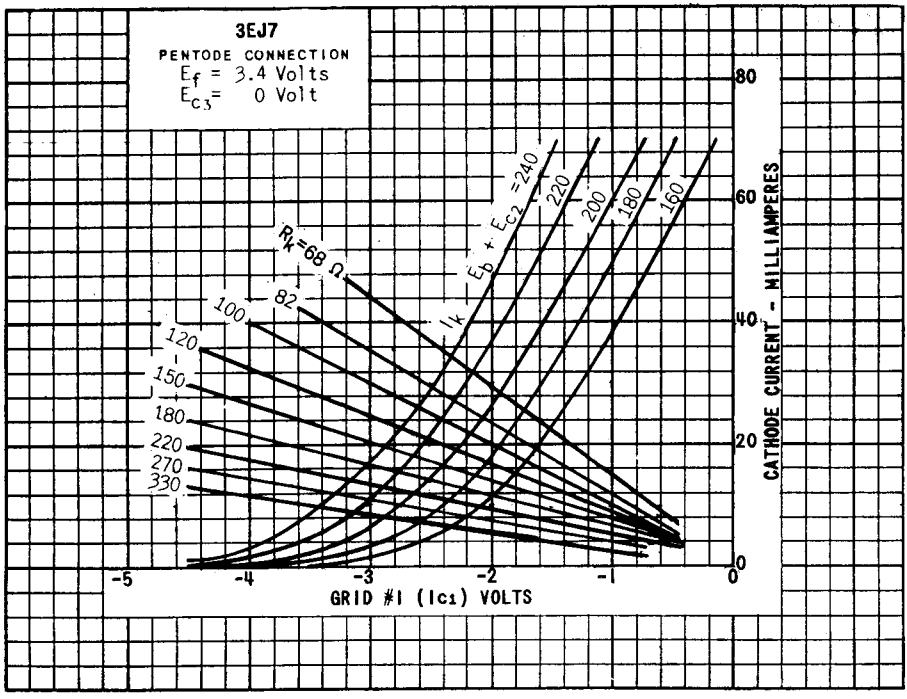
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	μMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40MC	30000	OHMS[C]

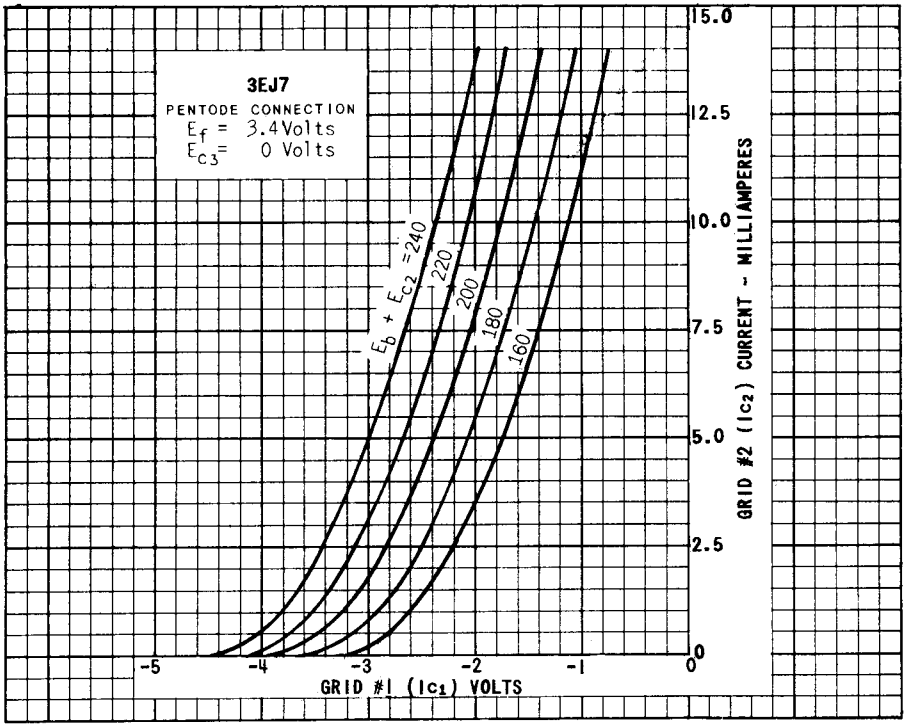
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.







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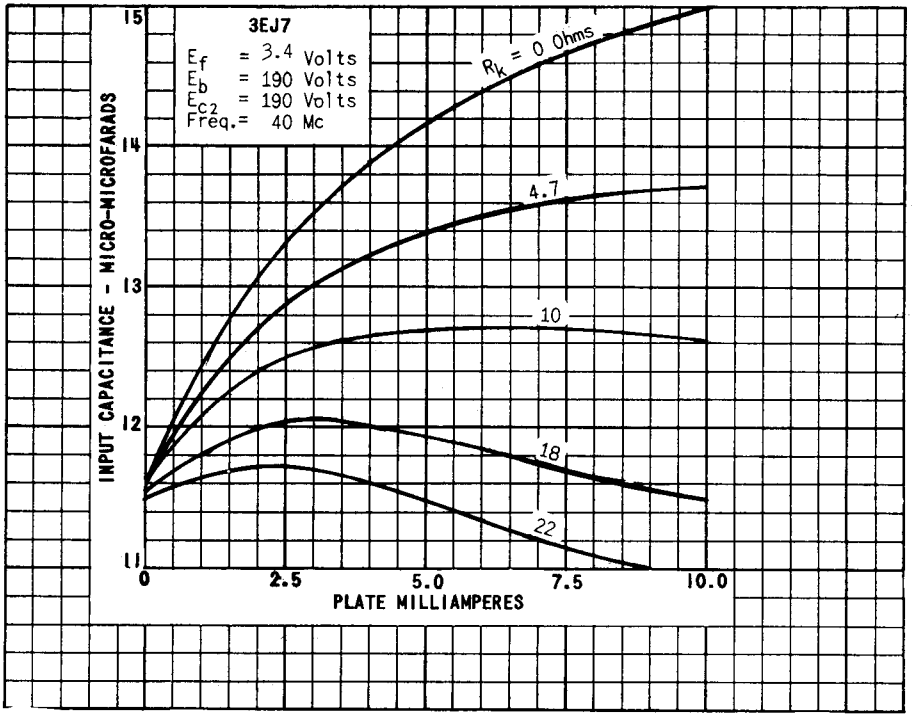
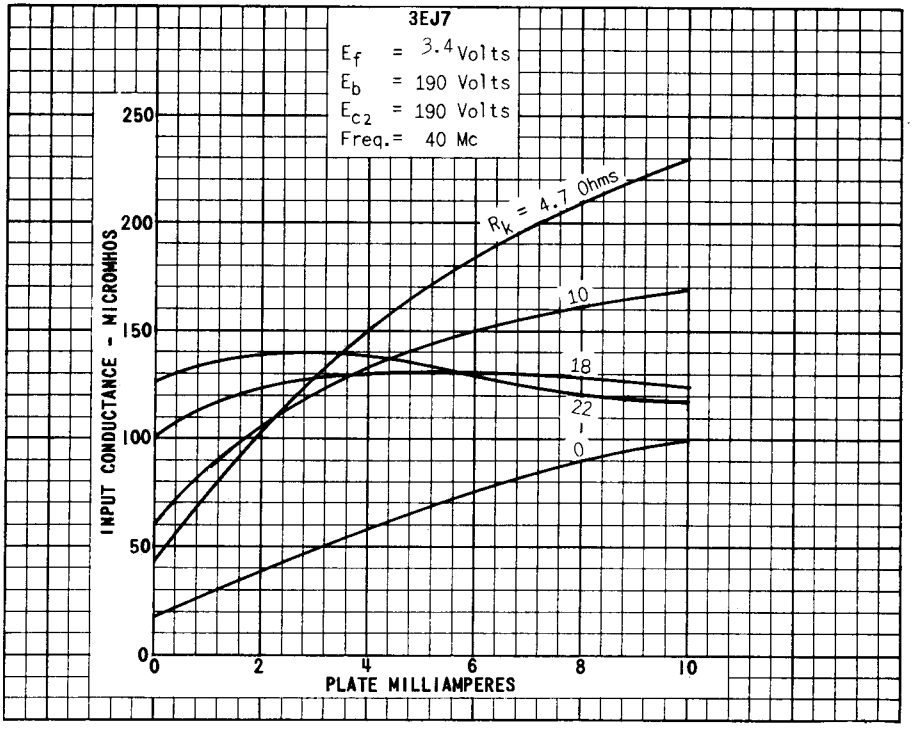
3EJ7

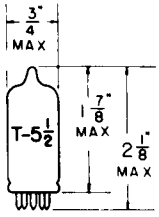

3EJ7
E_f = 3.4 Volts
E_b = 190 Volts
E_{c2} = 190 Volts
Freq.= 40 Mc
R_k = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
15
14
13
12
11
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES


3EJ7
E_f = 3.4 Volts
E_b = 190 Volts
E_{c2} = 190 Volts
Freq.= 40 Mc
R_k = 4.7 Ohms
10
18
22
0
INPUT CONDUCTANCE - MICROMHOS
250
200
150
100
50
0
0
2
4
6
8
10
PLATE MILLIAMPERES

TUNG-SOL

HI-MU TRIODE ←

MINIATURE TYPE



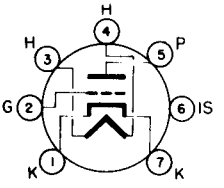
GLASS BULB
BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.8 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7FP

THE 3ER5 IS A HIGH TRANSCONDUCTANCE SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE IN V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE AND THE INTERNAL SHIELD REDUCES DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3ER5 IS IDENTICAL TO THE 2ER5 AND THE 6ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
PLATE TO GRID	0.38	0.36	μμf
GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	4.4	4.4	μμf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
GRID TO CATHODE	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	2.8	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MAMPS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.8		2.8	VOLTS
HEATER CURRENT	0.45		0.45	AMP.
PLATE VOLTAGE	200			VOLTS
GRID VOLTAGE	-1.2	-3.8	-5.6	VOLTS
PLATE CURRENT	10			MAMPS
TRANSCONDUCTANCE	10 500	500	100	μMHOS
AMPLIFICATION FACTOR	80			
GRID VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1% (RMS)	100	100	100	MV.

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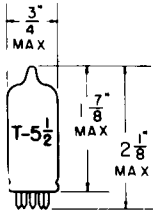
TRIODE

MINIATURE TYPE



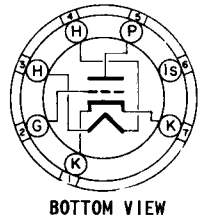
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

3.0 VOLTS 0.45±6% AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7FP

THE 3ES5 IS A TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3ES5 IS IDENTICAL TO THE 2ES5 AND THE 6ES5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.)	0.5	0.5	μμf
INPUT: G TO (H+K+I.S.)	3.2	3.2	μμf
OUTPUT: P TO(H+K+I.S.)	4.0	3.2	μμf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	3.0	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	3.0	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-1.0	VOLT
PLATE RESISTANCE (APPROX.)	8000	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	75	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	-6.0	VOLTS

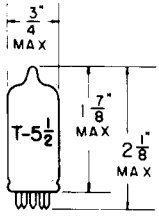
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

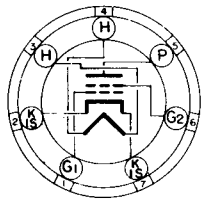
COATED UNIPOTENTIAL CATHODE

HEATER

2.9 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
7 PIN BASE
7EW

THE 3EV5 IS A HIGH GAIN, SHARP-CUTOFF SEVEN PIN TETRODE DESIGNED PARTICULARLY FOR SERVICE IN V.H.F. TELEVISION TUNERS. IT HAS HIGH TRANSCONDUCTANCE, EXTREMELY LOW SCREEN CURRENT AND HIGH INPUT IMPEDANCE AT 200 MC. RESULTING IN IMPROVED NOISE FIGURE. EXCEPT FOR HEATER RATINGS, THE 3EV5 IS IDENTICAL TO THE 2EV5 AND IS SIMILAR TO THE 6EV5.

DIRECT INTERELECTRODE CAPACITANCES[A]

WITH EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.035	μμf
INPUT	4.50	μμf
OUTPUT	2.90	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	2.9	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.2	WATTS
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	50	VOLTS
TOTAL DC AND PEAK	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

[A] WITH SHIELD #316 CONNECTED TO PIN #2.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABEE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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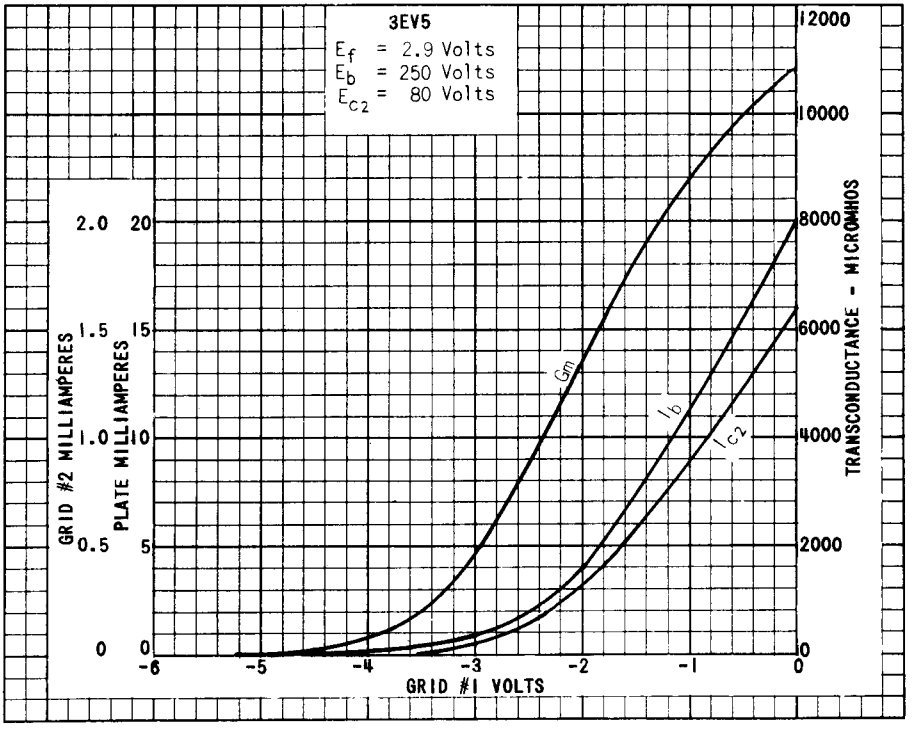
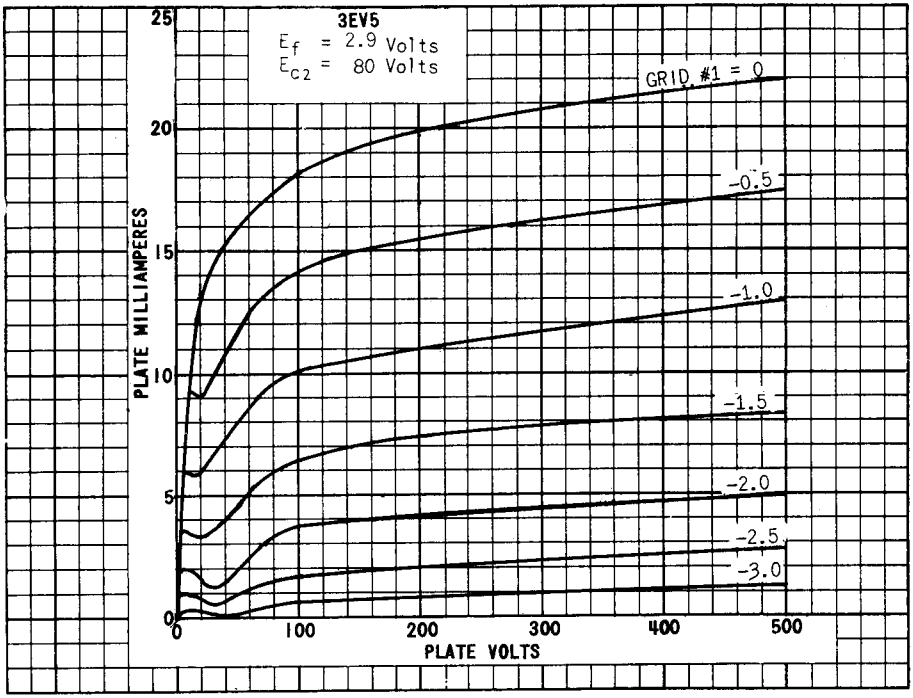
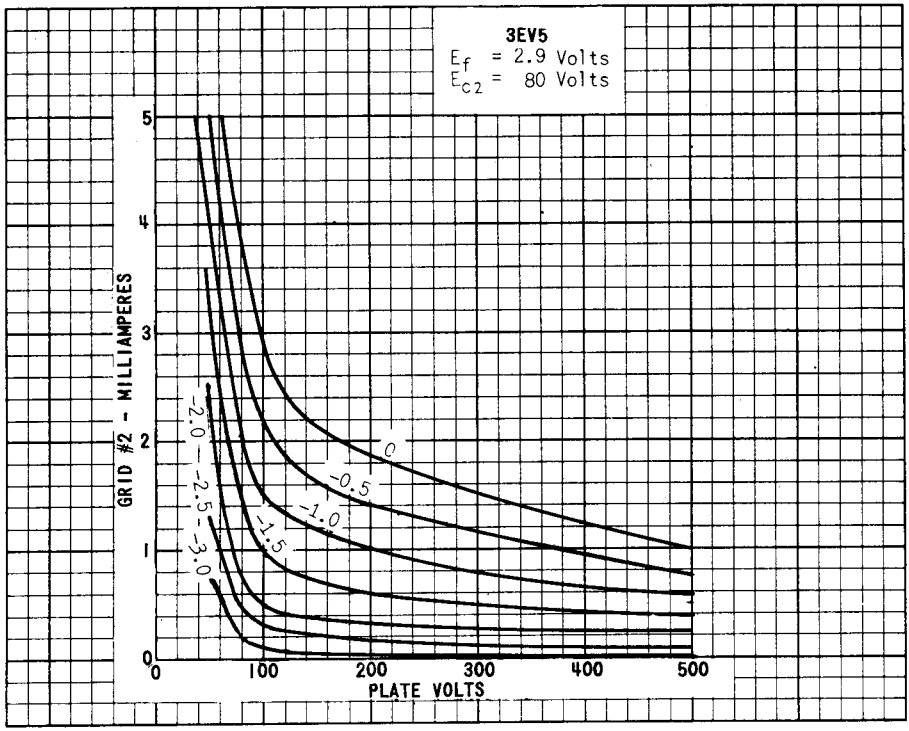
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	2.9	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

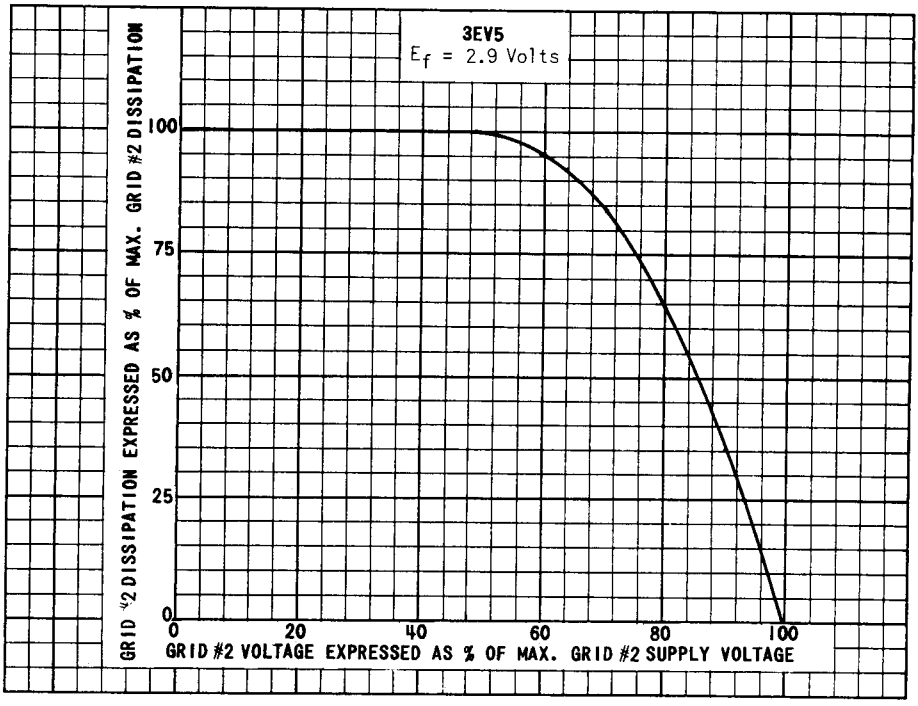
[C] FOR TRANSCONDUCTANCE OF 100 μMHOS.




3EV5
E_f = 2.9 Volts
E_{c2} = 80 Volts
GRID #1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
100
200
300
400
500


3EV5
E_f = 2.9 Volts
E_{c2} = 80 Volts
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
GRID #2 - MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
100
200
300
400
500

TENTATIVE DATA



TUNG-SOL

TRIODE

MINIATURE TYPE

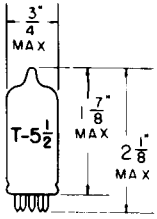
COATED UNIPOTENTIAL CATHODE

HEATER

3.0 VOLTS 0.45±6% AMP.

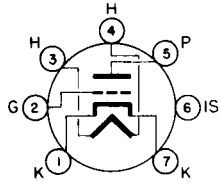
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 3FH5 IS A NEUTRODE TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS, WITH THE NEUTRODE CONSTRUCTION PROVIDING A LOWER GRID TO PLATE CAPACITANCE WITH CONSEQUENT EASE OF NEUTRALIZATION. THE CONVENTIONAL GRID RESULTS IN LOW INPUT CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3FH5 IS IDENTICAL TO THE 2FH5 AND 6FH5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.) (BOGEY)	→ 0.52	→ 0.52	pf
INPUT: G TO (H+K+I.S.)	3.2	3.2	pf
OUTPUT: P TO (H+K+I.S.)	4.0	3.2	pf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	3.0	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID VOLTAGE (POSITIVE)	0	VOLT
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
→ MAXIMUM DC HEATER-CATHODE VOLTAGE (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLI FIER

HEATER VOLTAGE	3.0	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.0	VOLT
PLATE RESISTANCE (APPROX.)	5600	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	50	
PLATE CURRENT	11	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	-5.5	VOLTS

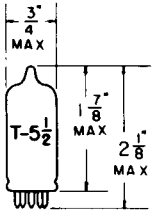
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE

MINIATURE TYPE



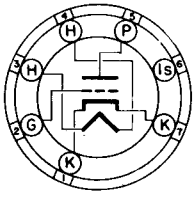
GLASS BULB
S-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.8[A] VOLTS 0.45[B] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7FP

THE 3FQ5 IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3FQ5 IS IDENTICAL TO THE 2FQ5 AND THE 6FQ5.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT: G TO (H+K+I.S.+E.S.)	4.8	μμf
OUTPUT: P TO (H+K+I.S.+E.S.)	4.0	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[D]	2.8[A]	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.8[A]	VOLTS
HEATER CURRENT[D]	0.45±.03	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	11.5	MA.
TRANSCONDUCTANCE	11 000	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	5 500	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-5	VOLTS

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TUNG-SOL

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NOTES

[A] THE BOGEY VALUE OF VOLTAGE/CURRENT PRECEDING THIS NOTE IS OBTAINED WHEN OPERATING THE HEATER WITH THE SPECIFIED VALUE OF CURRENT/VOLTAGE.

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

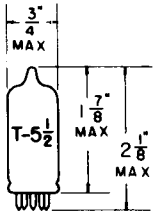
[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

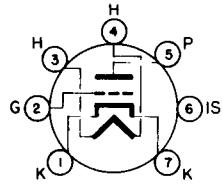
MINIATURE BUTTON 7 PIN BASE E7-1 OUTLINE DRAWING JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

2.8 VOLTS 0.45[B] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM JEDEC 7FP

THE 3FQ5A IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3FQ5A IS IDENTICAL TO THE 2FQ5A AND THE 6FQ5A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H+K+I.S.+E.S.)	5.0	pf
OUTPUT: P TO (H+K+I.S.+E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[C]

HEATER VOLTAGE[D]	2.8	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	2.8	VOLTS
HEATER CURRENT[D]	0.45±.03	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	8.9	MA.
TRANSCONDUCTANCE	12000	μMHOS
AMPLIFICATION FACTOR	74	
PLATE RESISTANCE (APPROX.)	6300	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-4.5	VOLTS

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NOTES

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE

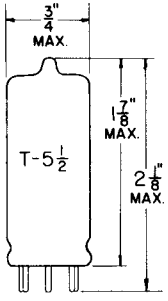
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES SUPPLY

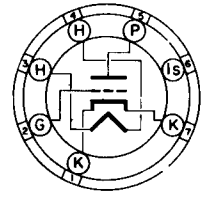
3.1 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



GLASS BULB

5-2



BOTTOM VIEW

7FP

THE 3FY5 IS A REMOTE CUT-OFF, FRAME GRID SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS, AND IS CONTROLLED FOR LOW NOISE FIGURE AT 220 MC/S AND OPERATION AT LOW SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 3FY5 IS IDENTICAL TO THE 2FY5 AND THE 6FY5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXT. SHIELD	WITH EXT. SHIELD	
INPUT	4.75	4.75	μμf
OUTPUT	3.3	4.3	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.25	0.21	μμf
GRID TO CATHODE	3.2	3.2	μμf
CATHODE TO HEATER	2.5	2.5	μμf
PLATE TO GRID	0.50	0.48	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	3.1	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE (ZERO PLATE CURRENT)	550	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CATHODE-HEATER VOLTAGE	100	VOLTS
MAXIMUM CATHODE-HEATER CIRCUIT RESISTANCE	20 000	OHMS

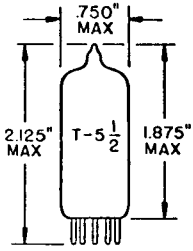
TYPICAL OPERATION

HEATER VOLTAGE		3.3			VOLTS
HEATER CURRENT		0.45			AMP.
PLATE VOLTAGE	135	135	135	135	VOLTS
NEGATIVE GRID BIAS	1	3.1	5	4.5	VOLTS
PLATE CURRENT	11			0.1	MA.
TRANSCONDUCTANCE	13 000	625	125	---	μMHOS
AMPLIFICATION FACTOR	70				

TUNG-SOL

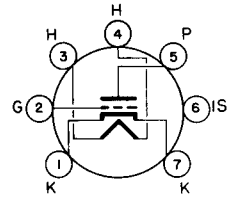
TRIODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

SHIELDED TRIODE
FOR
NEUTRODE CIRCUIT
APPLICATIONS



BOTTOM VIEW
JEDEC 7 FP

THE 3GK5 IS A FRAME GRID GAIN CONTROLLED SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF RF AMPLIFIER AT A B+ OF 135 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H + K + I.S. + E.S.)	5.0	pf
OUTPUT: P TO (H + K + I.S. + E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	2.8 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED	600 ± 40		MA.
HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
DC CATHODE CURRENT	22	MA.
GRID CIRCUIT RESISTANCE - SELF BIAS	1.0	MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

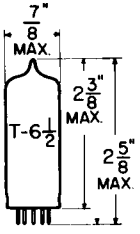
CLASS A1 AMPLIFIER

PLATE VOLTAGE		135	VOLTS
GRID VOLTAGE		-1.0	VOLTS
PLATE CURRENT		11.5	MA.
TRANSCONDUCTANCE		15,000	μMHOS
AMPLIFICATION FACTOR		78	
PLATE RESISTANCE	Approx.	5,400	OHMS
E_c FOR G_m = 150 μMHOS	Approx.	-4.2	VOLTS
E_c FOR G_m = 1,500 μMHOS	Approx.	-2.5	VOLTS
HOT INPUT RESISTANCE - 200 Mc/s - GROUNDED PLATE		275	OHMS
HOT INPUT CAPACITANCE - 200 Mc/s - GROUNDED PLATE		11.2	pf
NOISE FIGURE - 200 Mc/s - OPTIMIZED NEUTRALIZED TRIODE RF AMPLIFIER STAGE, NOISE MATCHED		4.7	DB

TUNG-SOL

DUAL PENTODE

MINIATURE TYPE



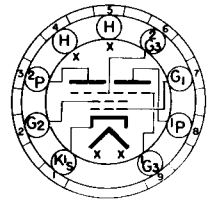
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

3.15 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON

9 PIN BASE

9LW

THE 3GS8 IS A DUAL PENTODE WITH A SEPARATE PLATE AND A SEPARATE #3 GRID IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR SERVICE AS A COMBINED SYNC SEPARATOR-CLIPPER AND AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 3GS8 IS IDENTICAL TO THE 4GS8 AND THE 6GS8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE (EACH SECTION)	2.0	μμf
GRID #1 TO ALL	6.0	μμf
GRID #3 (EACH SECTION) TO ALL	3.8	μμf
PLATE (EACH SECTION) TO ALL	3.2	μμf
GRID #3 (SECTION #1) TO GRID #3 (SECTION 2) (MAX.)	0.015	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM A

HEATER VOLTAGE	3.15	VOLTS
MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

HEATER VOLTAGE		3.15	VOLTS
HEATER CURRENT		0.60	AMP.
PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	NOTE B	NOTE B	
PLATE CURRENT (EACH SECTION)		2.0	MA.
GRID #2 CURRENT	6.0	3.6	MA.
CATHODE CURRENT	6.1	7.7	MA.

EACH SECTION OPERATING SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	NOTE B	
PLATE CURRENT		2.0	MA.
GRID #3 TRANSCONDUCTANCE		270	μMHOS
GRID #1 TRANSCONDUCTANCE	1200		μMHOS
E_{c3} FOR I_b = 100 μA (APPROX.)		-3.7	VOLTS
E_{c1} FOR I_b = 100 μA (APPROX.)		-2.0	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

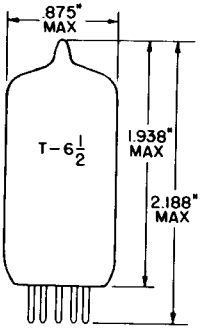
A DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

B GRID CURRENT ADJUSTED FOR 100 μA DC.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

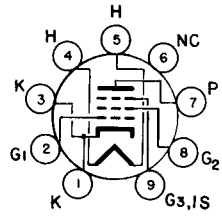
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SHARP-CUTOFF PENTODE

FOR

IF AMPLIFIER STAGES

IN TV RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9PM

THE 3HM6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3HM6 IS IDENTICAL TO THE 4HM6 AND THE 6HM6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315 CONNECTED TO CATHODE	WITHOUT SHIELD	
GRID TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15	VOLTS	600	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF SUPPLIED CURRENT			600 ± 40	MA.
HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

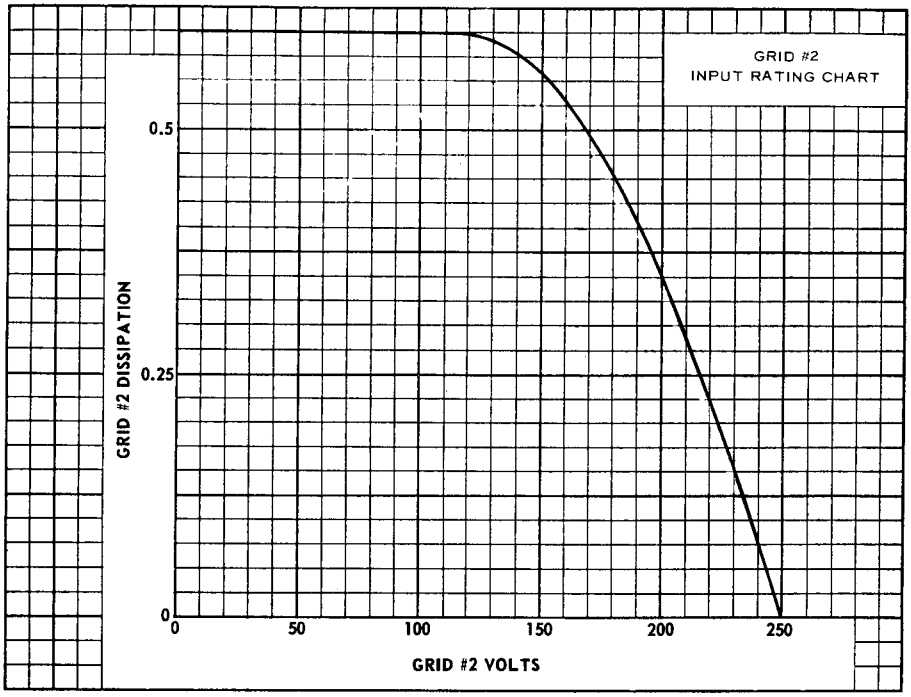
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

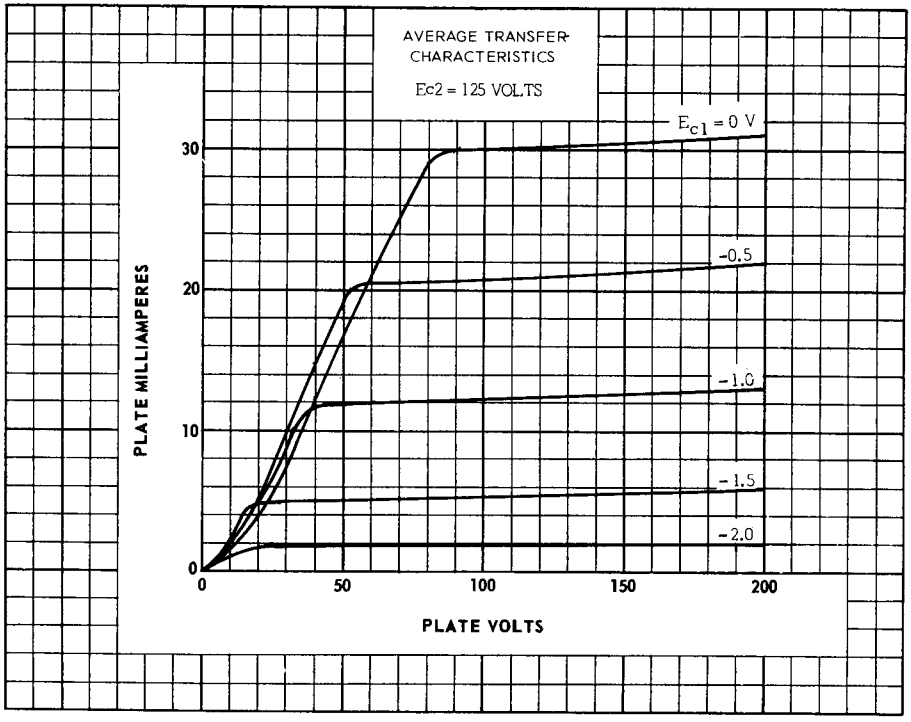
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
NEGATIVE GRID 1 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 125 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCE:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	MA.
GRID 2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.156	MEGOHM
HOT INPUT RESISTANCE [A]	13,000	OHMS
HOT INPUT CAPACITANCE [A]	7.4	pf
GRID 1 VOLTAGE AT Gm = 100 μMHOS	-3.0	VOLTS

[A] MEASURED AT 44 MC/S WITH UNBYPASSED 56 OHM CATHODE RESISTOR.





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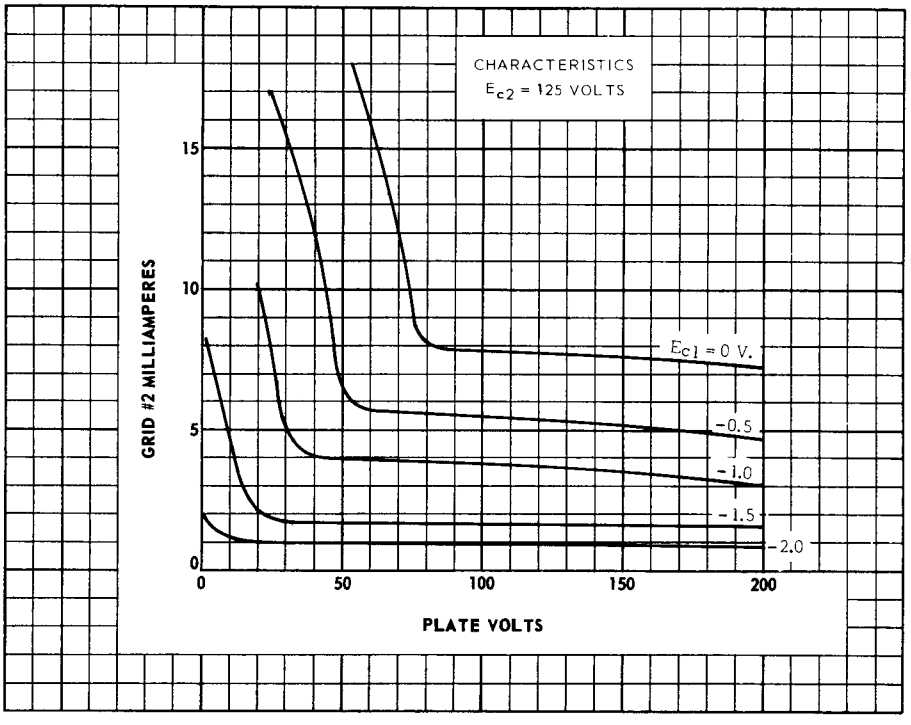
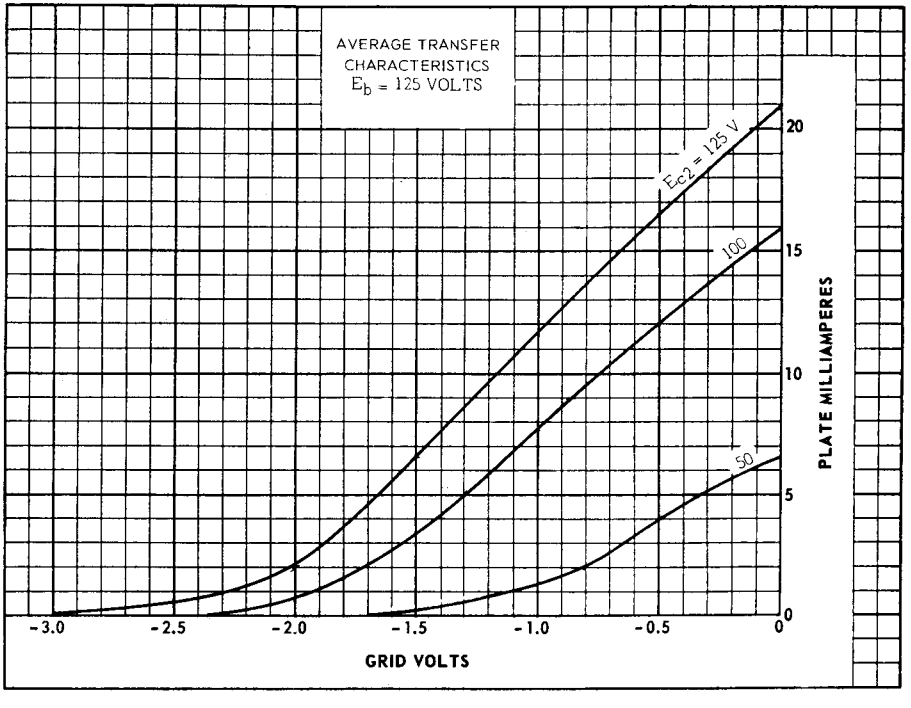
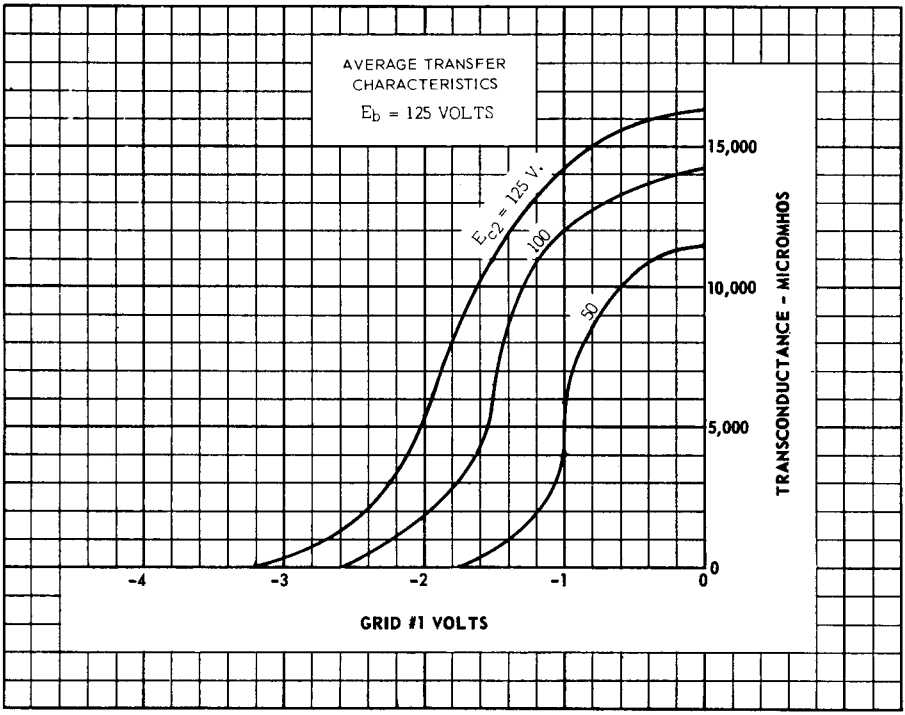
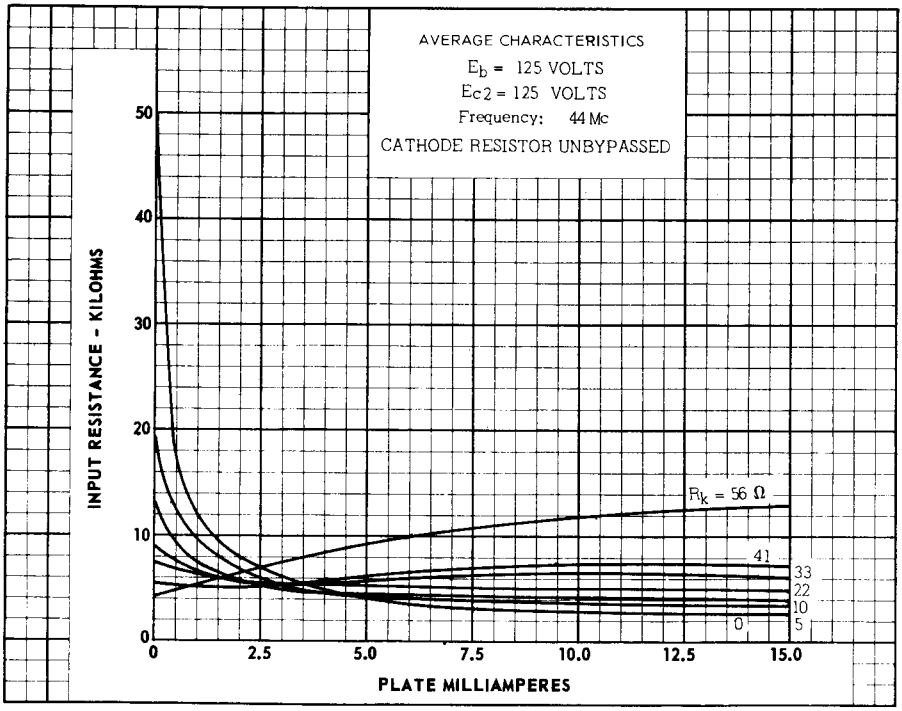
3HM6

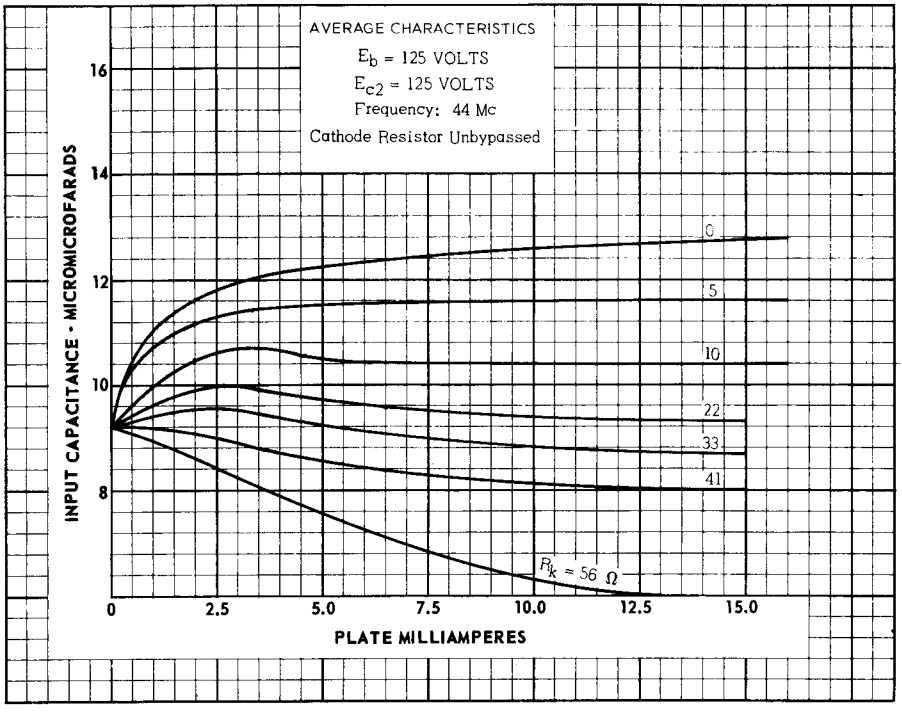

CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
15
10
5
0
0
50
100
150
200
PLATE VOLTS
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 V
100
50
PLATE MILLIAMPERES
20
15
10
5
0
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID VOLTS


AVERAGE TRANSFER CHARACTERISTICS
Eb = 125 VOLTS
Ec2 = 125 V.
100
50
15,000
10,000
5,000
0
TRANSCONDUCTANCE - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


AVERAGE CHARACTERISTICS
Eb = 125 VOLTS
Ec2 = 125 VOLTS
Frequency: 44 Mc
CATHODE RESISTOR UNBYPASSED
INPUT RESISTANCE - KILOHMS
50
40
30
20
10
0
Rk = 56 Ω
41
33
22
10
5
0
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES

3HM6


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
Cathode Resistor Unbypassed
INPUT CAPACITANCE - MICROMICROFARADS
16
14
12
10
8
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES
0
5
10
22
33
41
R_k = 56 Ω

TUNG-SOL

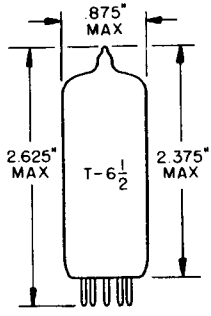
TWIN PENTODE

MINIATURE TYPE

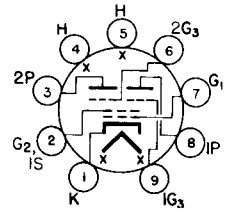
COATED UNIPOTENTIAL CATHODE

FOR T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 3HS8 IS A MINIATURE TWIN PENTODE THAT INCORPORATES SEPARATE PLATES AND #3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, #1 GRID, AND CATHODE. IT IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 3HS8 IS IDENTICAL TO THE 4HS8 AND THE 6HS8.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, EACH SECTION	2.0	pf
GRID #1 TO ALL	6.0	pf
GRID #3 (EACH SECTION) TO ALL	3.6	pf
PLATE (EACH SECTION) TO ALL	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2), MAX.	0.015	pf

HEATER RATINGS AND CHARACTERISTICS

DESIGN-MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15	VOLTS	600	MA.
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600 ± 40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER WARM-UP TIME[A]			11	SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, EACH SECTION	300	VOLTS
SCREEN VOLTAGE	150	VOLTS
POSITIVE DC GRID #3 VOLTAGE, EACH SECTION	3.0	VOLTS
NEGATIVE DC GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
PEAK POSITIVE GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS
SCREEN DISSIPATION	0.75	WATT
DC CATHODE CURRENT	12	MA.
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
GRID #3 CIRCUIT RESISTANCE, EACH SECTION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS - BOTH SECTIONS OPERATING

PLATE VOLTAGE, EACH SECTION	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE, EACH SECTION	-10	0	VOLTS
GRID #1 VOLTAGE [B]			
PLATE CURRENT, EACH SECTION	---	2.0	MA.
SCREEN CURRENT	7.0	4.4	MA.
CATHODE CURRENT	7.1	8.5	MA.

AVERAGE CHARACTERISTICS - EACH SECTION SEPARATELY

WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED

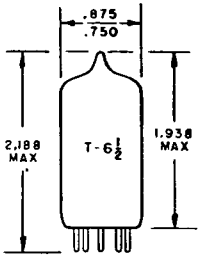
PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	B	VOLTS
GRID #3 TRANSCONDUCTANCE	---	450	μMHOS
GRID #1 TRANSCONDUCTANCE	1100	---	μMHOS
PLATE CURRENT	---	2.0	MA.
GRID #3 VOLTAGE, (APPROX.) AT Ib = 100 μA	---	-3.5	VOLTS
GRID #1 VOLTAGE, (APPROX.) Ib = 100 μAMPS.	---	-2.5	VOLTS

B WITH GRID CURRENT ADJUSTED FOR 100 MICROAMPERES DC.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SEMI-REMOTE-CUTOFF PENTODE

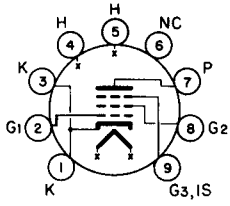
FOR

I.F. AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9 PM

THE 3HT6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3HT6 IS IDENTICAL TO THE 6HT6 AND THE 4HT6.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO GROUND	UNSHIELDED	
GRID 1 TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.15 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

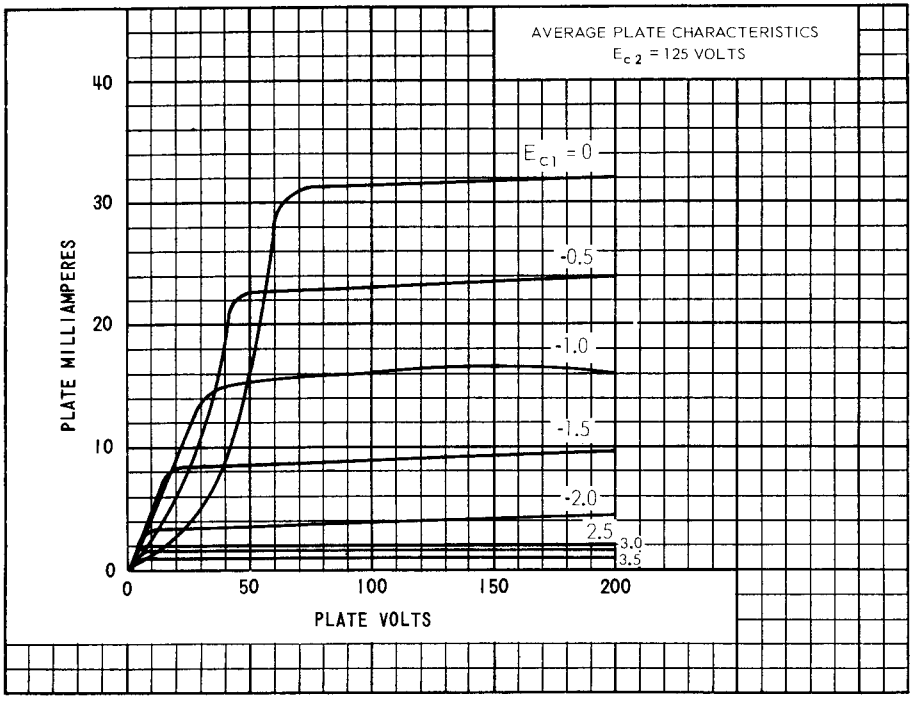
DESIGN MAXIMUM VALUES • SEE EIA STANDARD RS-239

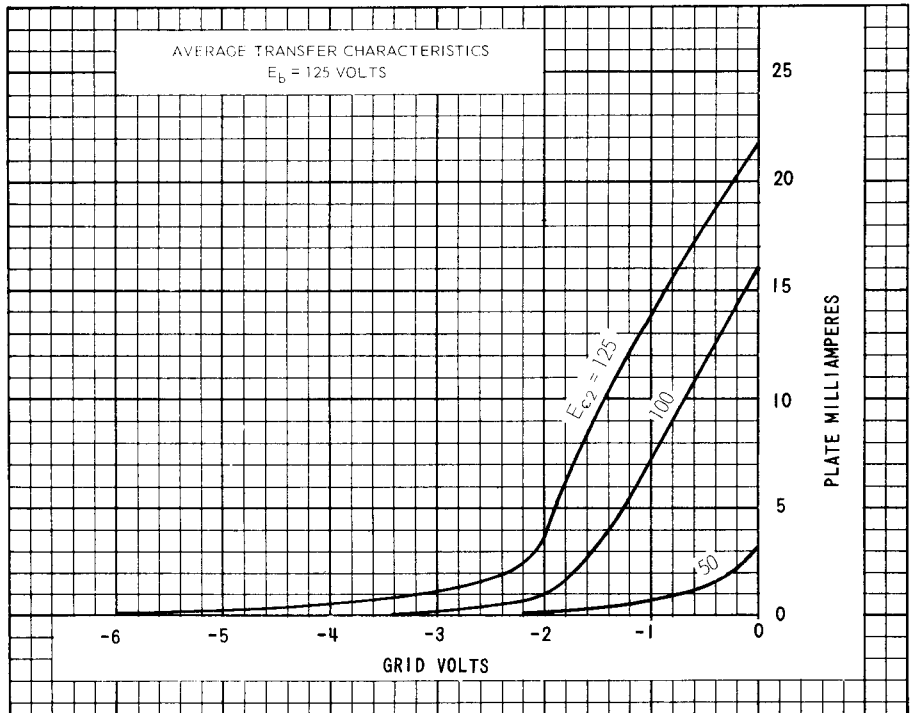
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
GRID 1 VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION	0.6	WATTS
CATHODE CURRENT	25	MA.
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	MA.
GRID 2 CURRENT	4.0	MA.
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.143	MEGOHM
GRID 1 CUTOFF BIAS FOR G_m = 50 μMHOS	-6.7	VOLTS
CUTOFF TRANSCONDUCTANCE:		
FOR E_{c1} = -1.5	12,000	μMHOS
FOR E = -3.5	300	μMHOS
HOT INPUT RESISTANCE [A]	12,700	OHMS
HOT INPUT CAPACITANCE [A]	7.45	pf

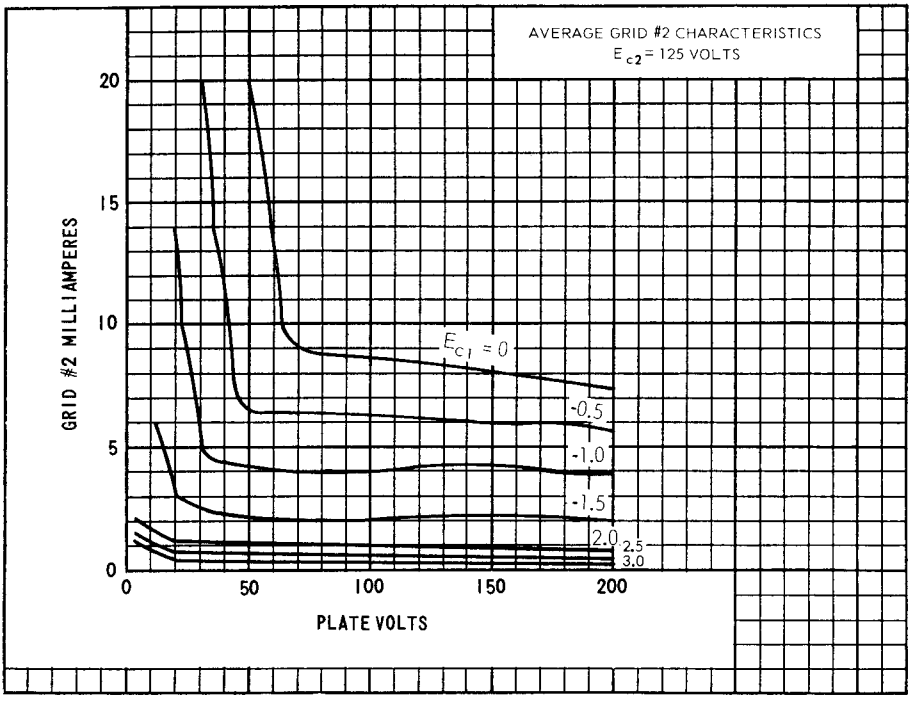
A - MEASURED 44 Mc/s WITH UNBYPASSED 56 OHM CATHODE RESISTANCE

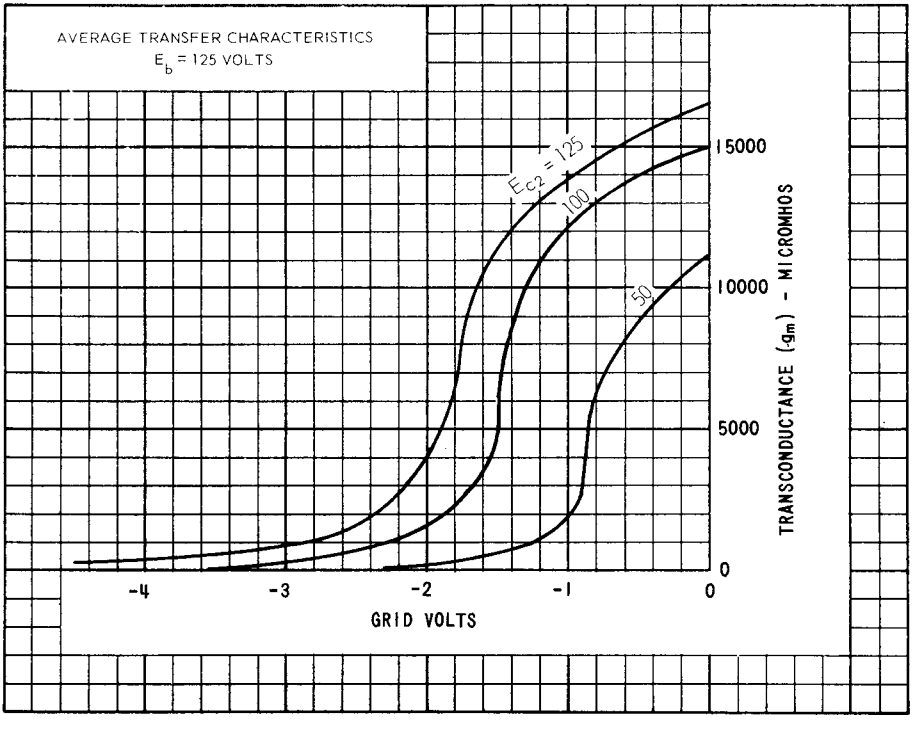


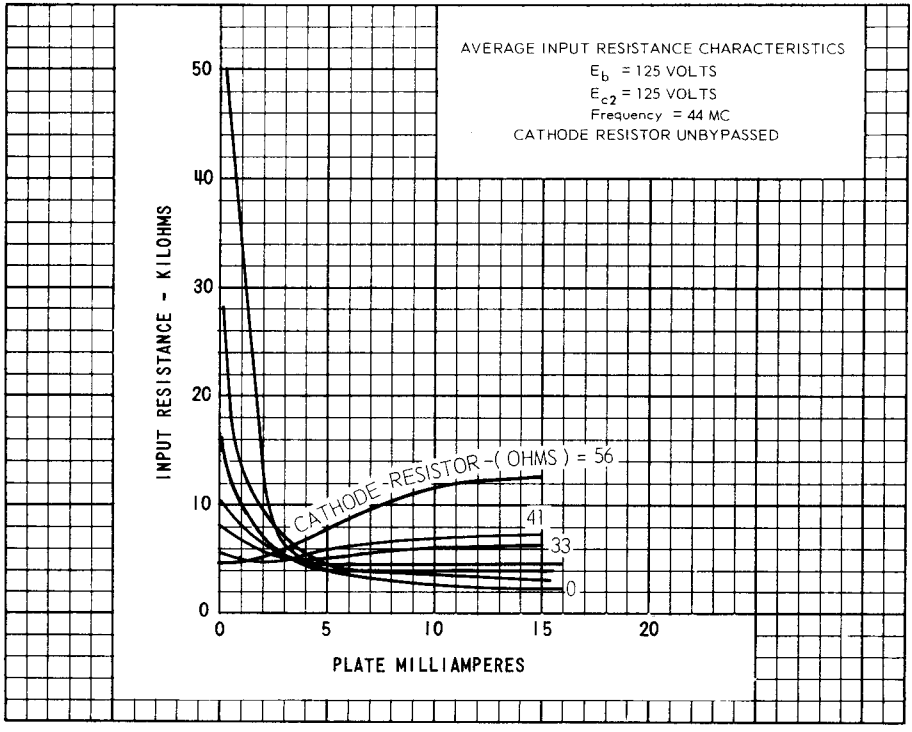


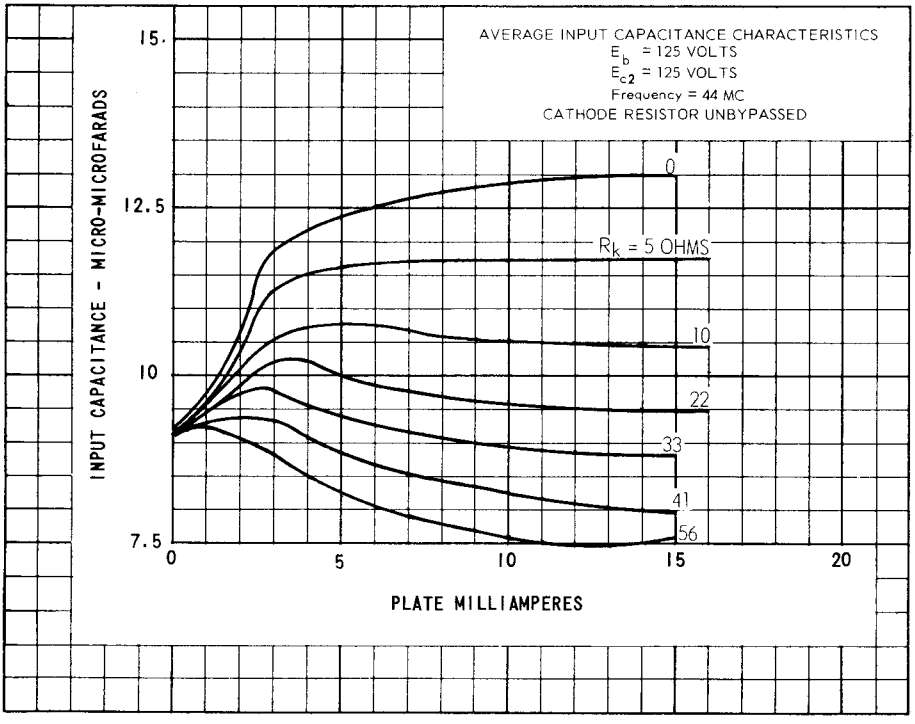
TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., JANUARY 1, 1964 PLATE #6646

3HT6


AVERAGE GRID #2 CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
20
15
10
5
0
E_{c1} = 0
-0.5
-1.0
-1.5
2.0
2.5
3.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125
100
50
15000
10000
5000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID VOLTS


AVERAGE INPUT RESISTANCE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency = 44 MC
CATHODE RESISTOR UNBYPASSED
INPUT RESISTANCE - KILOHMS
50
40
30
20
10
0
CATHODE-RESISTOR-(OHMS) = 56
41
33
0
0
5
10
15
20
PLATE MILLIAMPERES

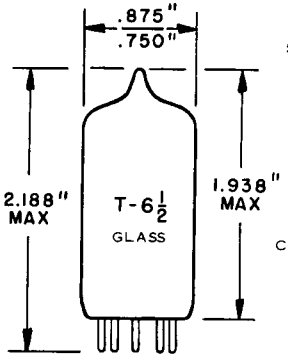

AVERAGE INPUT CAPACITANCE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency = 44 MC
CATHODE RESISTOR UNBYPASSED
INPUT CAPACITANCE - MICRO-MICROFARADS
15.
12.5
10
7.5
0
R_k = 5 OHMS
10
22
33
41
56
0
5
10
15
20
PLATE MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2



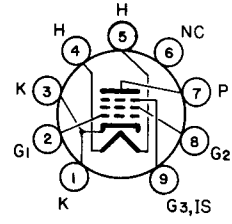
BASE 9 PIN BUTTON
JEDEC E9-1

SEMI-REMOTE-CUTOFF PENTODE
FOR
I.F. AMPLIFIER STAGES
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 3JC6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3JC6 IS IDENTICAL TO THE 4JC6 AND THE 6JC6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	.019	pf
INPUT (G1 TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.5 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

CONTINUED ON FOLLOWING PAGE

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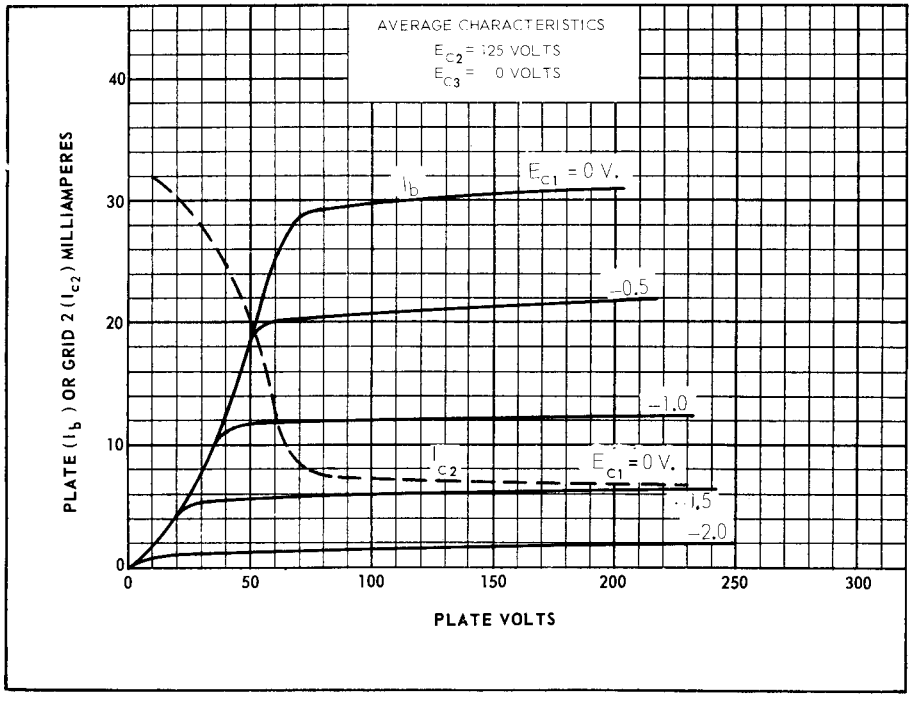
MAXIMUM RATINGS

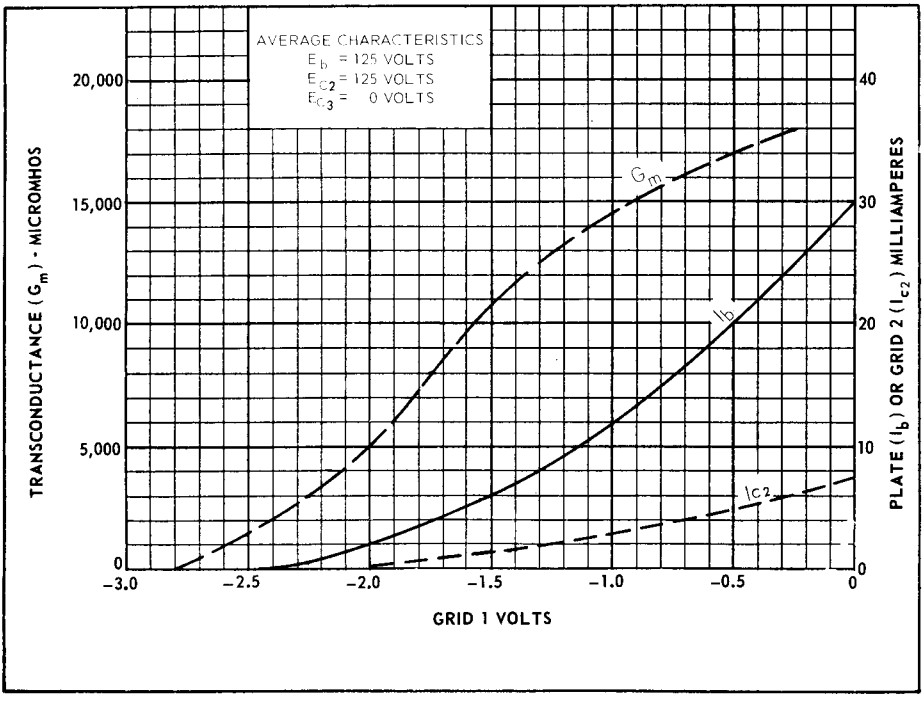
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCES:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

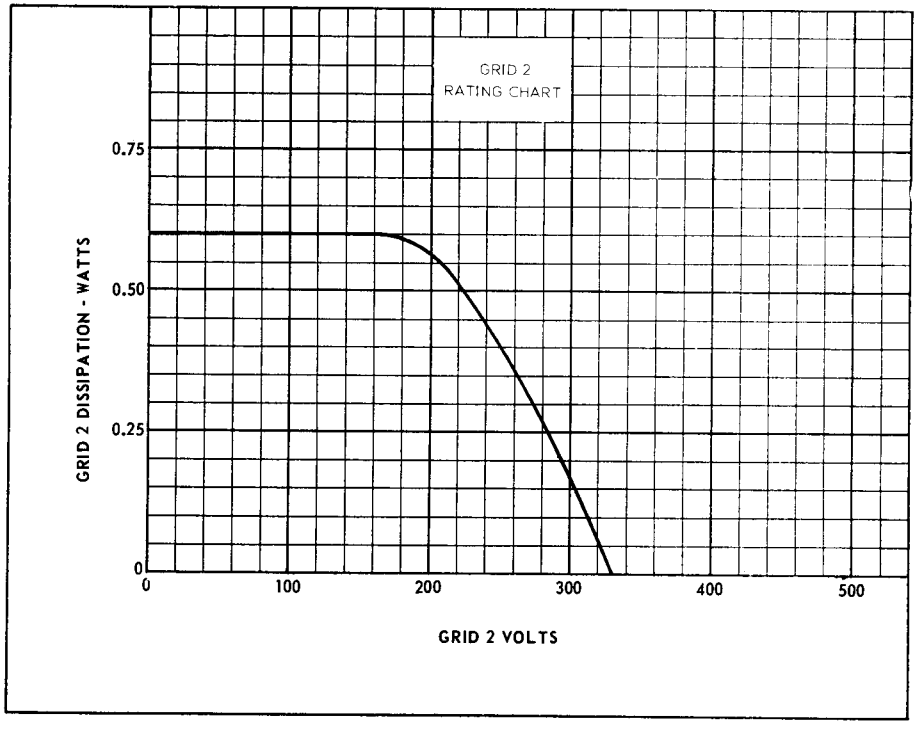
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	mA
GRID 2 CURRENT	3.2	mA
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.18	MEGOHM
GRID 1 VOLTAGE FOR I_b = 100 mA	-3.0	VOLTS


AVERAGE CHARACTERISTICS
E_{c2} = 125 VOLTS
E_{c3} = 0 VOLTS
I_b
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0
I_{c2}
E_{c1} = 0 V.
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
0
50
100
150
200
250
300


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
E_{c3} = 0 VOLTS
G_m
I_b
I_{c2}
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
GRID 1 VOLTS
0
5,000
10,000
15,000
20,000
0
10
20
30
40
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0

3JC6

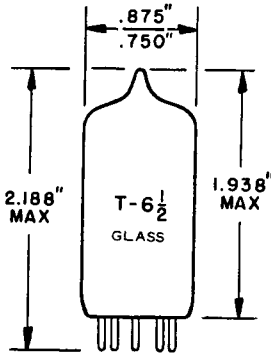

GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2



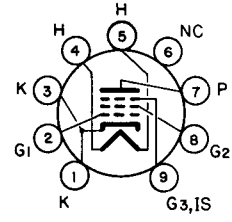
BASE 9 PIN BUTTON
JEDEC E9-1

SHARP-CUTOFF PENTODE
FOR
IF AMPLIFIER STAGES
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 3JD6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 3JD6 IS IDENTICAL TO THE 4JD6 AND THE 6JD6.

DIRECT INTERELECTROCE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	0.019	pf
INPUT (G TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	3.5 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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CONTINUED ON FOLLOWING PAGE

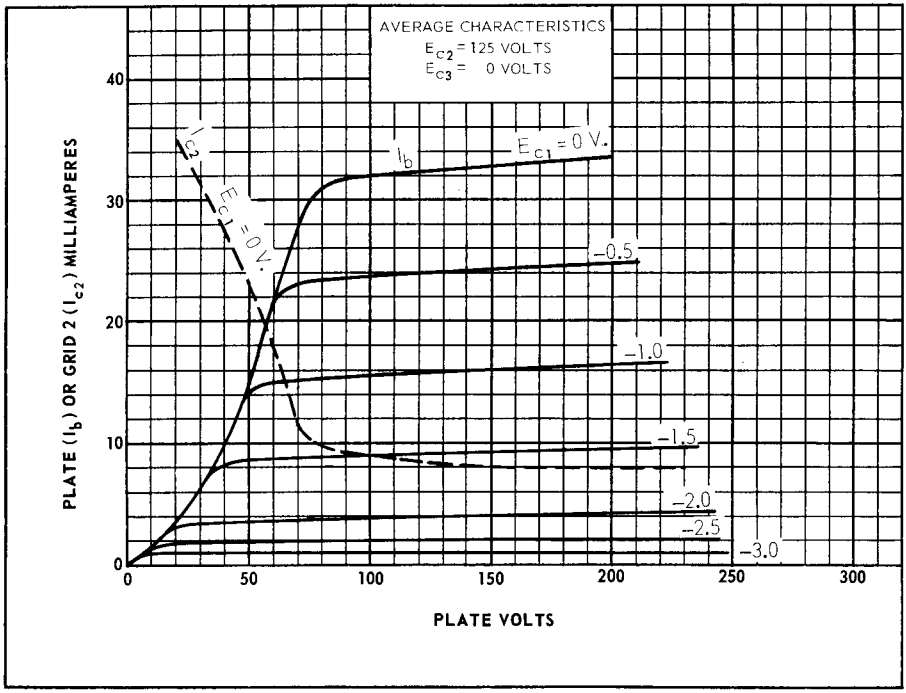
MAXIMUM RATINGS

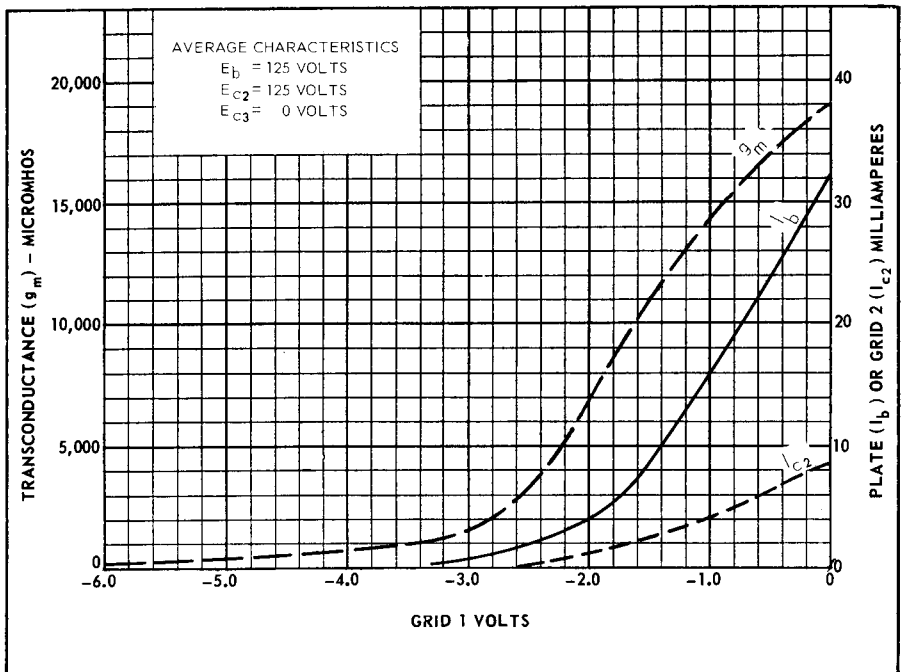
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

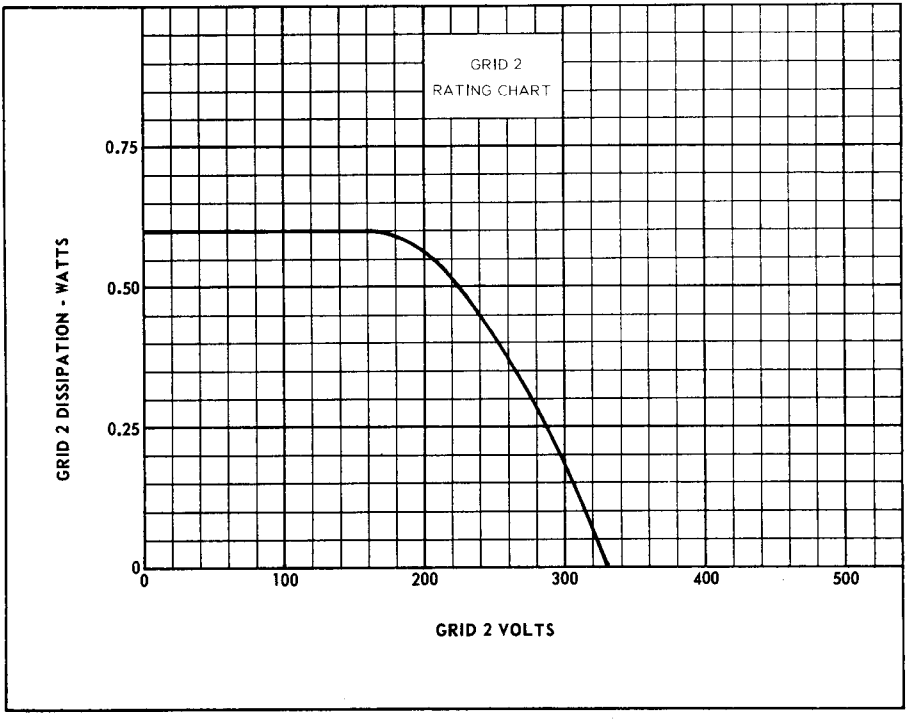
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	mA
GRID 2 CURRENT	4	mA
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.16	MEGOHM
GRID 1 VOLTAGE FOR G_m = 600 μMHOS	−4.5	VOLTS


AVERAGE CHARACTERISTICS
E_{c2} = 125 VOLTS
E_{c3} = 0 VOLTS
I_b
I_{c2}
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
150
200
250
300

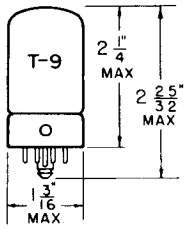

AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
E_{c3} = 0 VOLTS
g_m
I_b
I_{c2}
TRANSCONDUCTANCE (g_m) – MICROMHOS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
GRID 1 VOLTS
0
5,000
10,000
15,000
20,000
10
20
30
40
-6.0
-5.0
-4.0
-3.0
-2.0
-1.0
0

3JD6


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

BEAM PENTODE



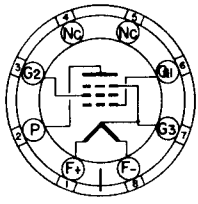
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 8	E_f APPLIED BETWEEN PIN 7 AND PINS 1 & 8 TIED TOGETHER.
E_{g1} REFERRED TO PIN 8	E_{g1} REFERRED TO PIN 7
2.8 VOLTS 50 MA.	1.4 VOLTS 100 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 7 AND 8 FOR SERIES-FILAMENT OPERATION. ITS VALUE SHOULD BE SUCH THAT THE VOLTAGE ACROSS THE SHUNTED SECTION IS EQUAL TO THE VOLTAGE BETWEEN PINS 1 AND 7. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 8 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3LF4.



BOTTOM VIEW
LOCK-IN
8 PIN BASE
6B8

ANY MOUNTING POSITION

THE 3LF4 IS A FILAMENTARY TYPE BEAM POWER AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS CHARACTERIZED BY A LOW CURRENT DRAIN FILAMENT AND IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF THREE-WAY PORTABLE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	SERIES FILAMENT	PARALLEL FILAMENT	
MAXIMUM FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	110	VOLTS
MAXIMUM CATHODE CURRENT (ZERO SIGNAL)	6[A]	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	1	MEGOHM

[A] EACH 1.4 VOLT FILAMENT SECTION

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	SERIES FILAMENT		
FILAMENT VOLTAGE	2.8	2.8	VOLTS
FILAMENT CURRENT	50	50	MA.
PLATE VOLTAGE	90	110	VOLTS
GRID #2 VOLTAGE	90	110	VOLTS
GRID #1 VOLTAGE	-4.5	-6.6	VOLTS
PEAK AF SIGNAL VOLTAGE	4.5	5.1	VOLTS
PLATE CURRENT	8	8.5	MA.
GRID #2 CURRENT	1	1.1	MA.
PLATE RESISTANCE (APPROX.)	0.08	0.11	MEGOHM
TRANSCONDUCTANCE	2 000	2 000	μMHOS
LOAD RESISTANCE	8 000	8 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	8.5	8.5	PERCENT
POWER OUTPUT	230	330	MW

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

		PARALLEL FILAMENT		
FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	100	100	100	MA.
PLATE VOLTAGE	85	90	110	VOLTS
GRID #2 VOLTAGE	85	90	110	VOLTS
GRID #1 VOLTAGE	-5	-4.5	-6.6	VOLTS
PEAK AF SIGNAL VOLTAGE	5	4.5	5.4	VOLTS
PLATE CURRENT	7	9.5	10	MA.
GRID #2 CURRENT	0.8	1.3	1.4	MA.
PLATE RESISTANCE (APPROX.)	0.07	0.09	0.1	MEGOHM
TRANSCONDUCTANCE	1 950	2 200	2 000	µMHOS
LOAD RESISTANCE	9 000	8 000	8 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	5.5	6	6	PERCENT
POWER OUTPUT	250	270	400	MW

SIMILAR TYPE REFERENCES: Ratings and characteristics are identical to type 3Q5GT.

PLATE 2253
OCT. 1, 1949

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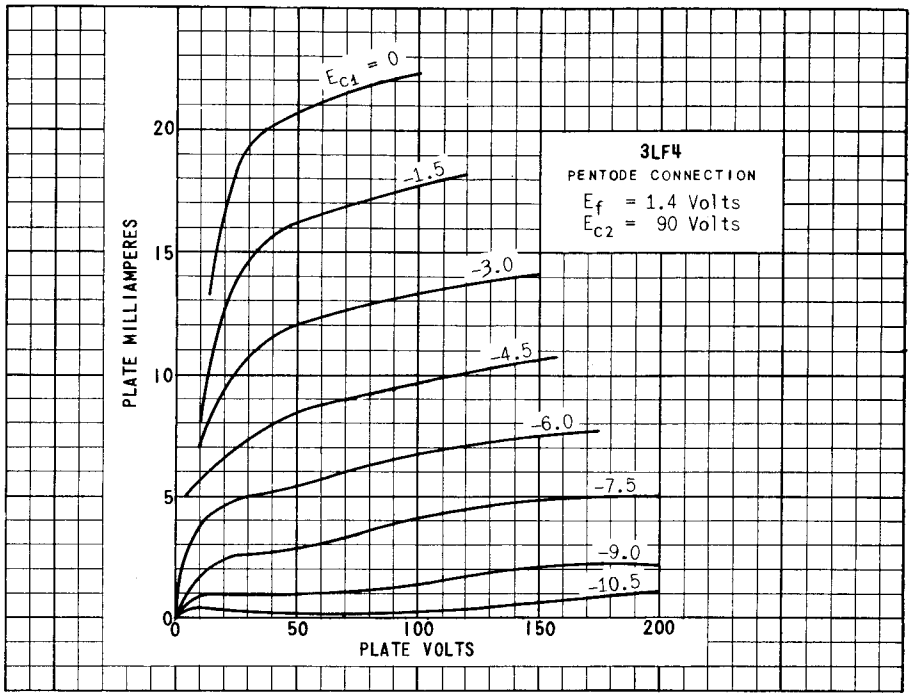

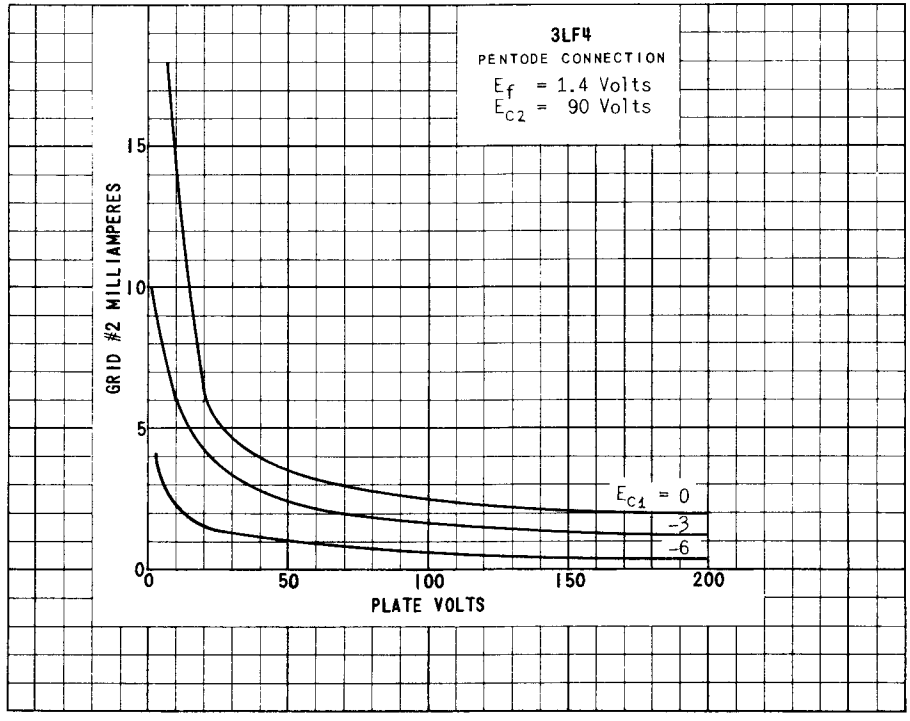

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PLATE
2254
OCT. 1,
1949

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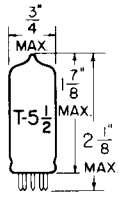
TUNG-SOL

PENTODE

MINIATURE TYPE



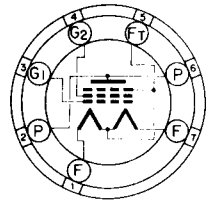
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7	E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER
E_{g1} REFERRED TO PIN 1	E_{g1} REFERRED TO -F
2.8 VOLTS 50 MA.	1.4 VOLTS 100 MA.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION TO BY-PASS ANY CATHODE CURRENT IN EXCESS OF THE 6 MA. RATED MAXIMUM PER SECTION. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3Q4.



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

ANY MOUNTING POSITION

THE 3Q4 IS A FILAMENTARY TYPE POWER OUTPUT PENTODE IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY ECONOMY OF FILAMENT POWER AND HIGH POWER SENSITIVITY ADAPTING IT TO USE IN THE "3-WAY" OPERATED PORTABLE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

	SERIES FILAMENT	PARALLEL FILAMENT	
FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	90	VOLTS
MAXIMUM CATHODE CURRENT	6[A]	6[A] ←	MA.

[A] FOR EACH 1.4 VOLT FILAMENT SECTION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	2.8	1.4	1.4	VOLTS
FILAMENT CURRENT	50	100	100	MA.
PLATE VOLTAGE	90	85	90	VOLTS
GRID #2 VOLTAGE	90	85	90	VOLTS
GRID #1 VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK AF SIGNAL VOLTAGE	4.5	5	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	7.7	6.9	9.5	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	1.7	1.5	2.1	MA.
PLATE RESISTANCE (APPROX.)	0.12	0.12	0.1	MEGOHM
TRANSCONDUCTANCE	2 000	1 975	2 150	μMHOS
LOAD RESISTANCE	10 000	10 000	10 000	OHMS
TOTAL HARMONIC DISTORTION	7	10	7	PERCENT
POWER OUTPUT	240	250	270	MW

→ INDICATES A CHANGE.

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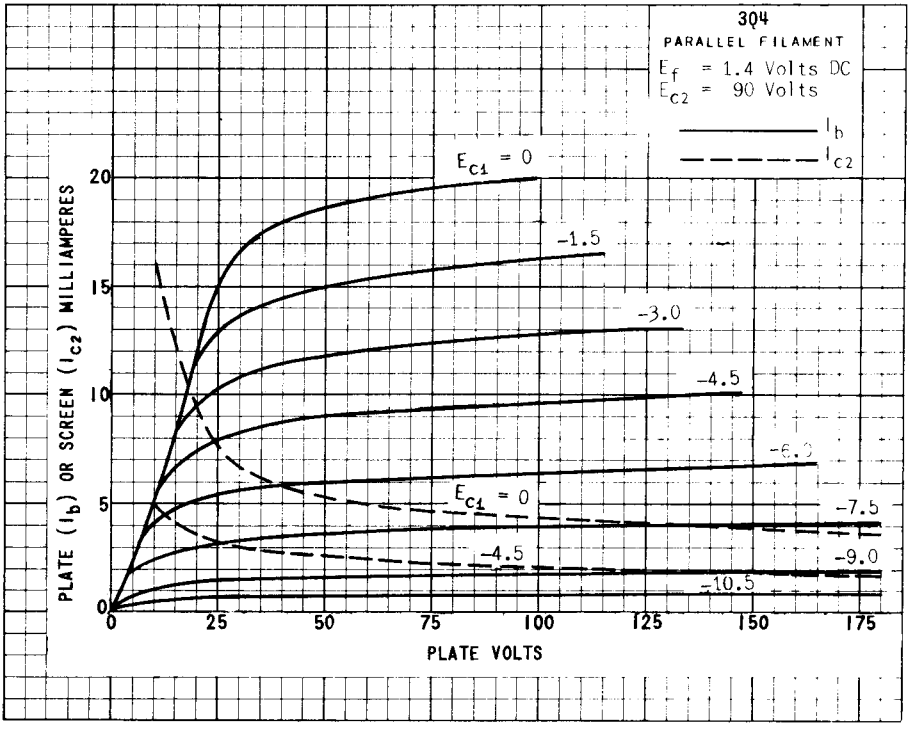
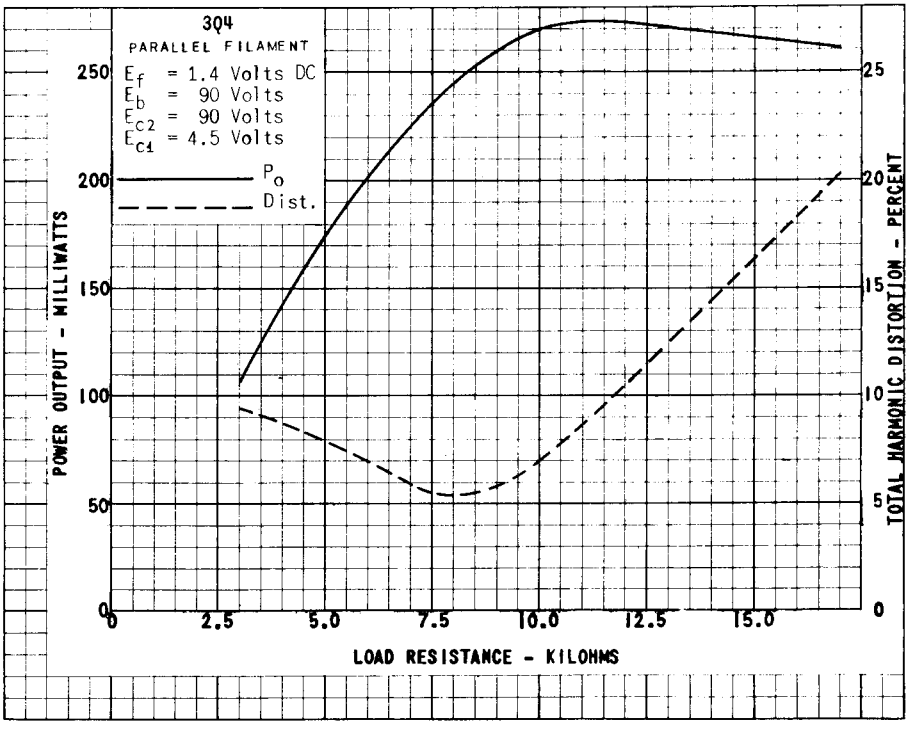
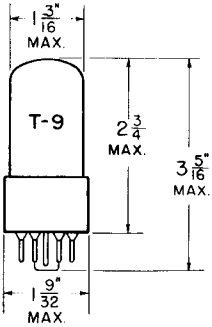
3Q4


3Q4
PARALLEL FILAMENT
E_f = 1.4 Volts DC
E_{c2} = 90 Volts
I_b
I_{c2}
E_{c1} = 0
-1.5
-3.0
-4.5
-6.0
E_{c1} = 0
-7.5
-4.5
-9.0
-10.5
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
0
25
50
75
100
125
150
175


3Q4
PARALLEL FILAMENT
E_f = 1.4 Volts DC
E_b = 90 Volts
E_{c2} = 90 Volts
E_{c1} = 4.5 Volts
P_o
Dist.
POWER OUTPUT - MILLIWATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE - KILOHMS
0
50
100
150
200
250
0
5
10
15
20
25
0
2.5
5.0
7.5
10.0
12.5
15.0

TUNG-SOL

PENTODE



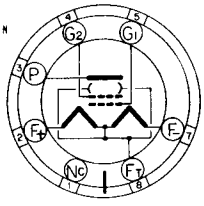
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS 2 AND 7	E_f APPLIED BETWEEN PIN 8 AND PINS 2 AND 7 TIED TOGETHER
E_{g1} REFERRED TO PIN 7	E_{g1} REFERRED TO PIN 8
2.8 VOLTS 50 MA.	1.4 VOLTS 100 MA.

AC OR DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 2 AND 8 FOR SERIES-FILAMENT OPERATION TO BY-PASS ANY CATHODE CURRENT IN EXCESS OF THE 6 MA. RATED MAXIMUM PER SECTION. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 2 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3Q5GT.



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AP

ANY MOUNTING POSITION

THE 3Q5GT IS A FILAMENTARY TYPE BEAM POWER AMPLIFIER, CHARACTERIZED BY A LOW CURRENT DRAIN FILAMENT. IT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF THREE-WAY PORTABLE RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P)	0.6	μμf
INPUT: G_1 TO (F+G_2+BP)	8	μμf
OUTPUT: P TO (F+G_1+BP)	6.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

	SERIES FILAMENT	PARALLEL FILAMENT	
FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	110	110	VOLTS
MAXIMUM GRID #2 VOLTAGE	110	110	VOLTS
MAXIMUM CATHODE CURRENT	6[A]	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF OR FIXED BIAS)	1	1	MEGOHM

[A] FOR EACH 1.4 VOLT FILAMENT SECTION.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SERIES FILAMENT

FILAMENT VOLTAGE	2.8	2.8	VOLTS
FILAMENT CURRENT	50	50	MA.
PLATE VOLTAGE	90	110	VOLTS
GRID #2 VOLTAGE	90	110	VOLTS
GRID #1 VOLTAGE	-4.5	-6.6	VOLTS
PEAK AF SIGNAL VOLTAGE[B]	4.5	5.1	VOLTS
PLATE RESISTANCE	0.08	0.11	MEGOHM
TRANSCONDUCTANCE	2 000	2 000	µMHOS
PLATE CURRENT	8	8.5	MA.
GRID #2 CURRENT	1	1.1	MA.
LOAD RESISTANCE	8 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	8.5	8.5	PERCENT
POWER OUTPUT	230	330	MW

CLASS A_1 AMPLIFIER – PARALLEL FILAMENT

FILAMENT VOLTAGE	1.4	1.4	1.4	VOLTS
FILAMENT CURRENT	100	100	100	MA.
PLATE VOLTAGE	85	90	110	VOLTS
GRID #2 VOLTAGE	85	90	110	VOLTS
GRID #1 VOLTAGE	-5	-4.5	-6.6	VOLTS
PEAK AF SIGNAL VOLTAGE[B]	5	4.5	5.4	VOLTS
PLATE RESISTANCE	0.07	0.09	0.1	MEGOHM
TRANSCONDUCTANCE	1 950	2 200	2 200	µMHOS
PLATE CURRENT	7	9.5	10	MA.
GRID #2 CURRENT	0.8	1.3	1.4	MA.
LOAD RESISTANCE	9 000	8 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	5.5	6	6	PERCENT
POWER OUTPUT	250	270	400	MW

[B] WITH PEAK AUDIO FREQUENCY SIGNAL EQUAL TO GRID BIAS VOLTAGE, THE POWER OUTPUT FOR THE 110 VOLT CONDITION IS 400 MW AT 10% DISTORTION FOR THE SERIES CONNECTION AND 500 MW AT 10% DISTORTION FOR THE PARALLEL CONNECTION.

SIMILAR TYPE REFERENCES: *Ratings and characteristics are identical to type 3LF4.*

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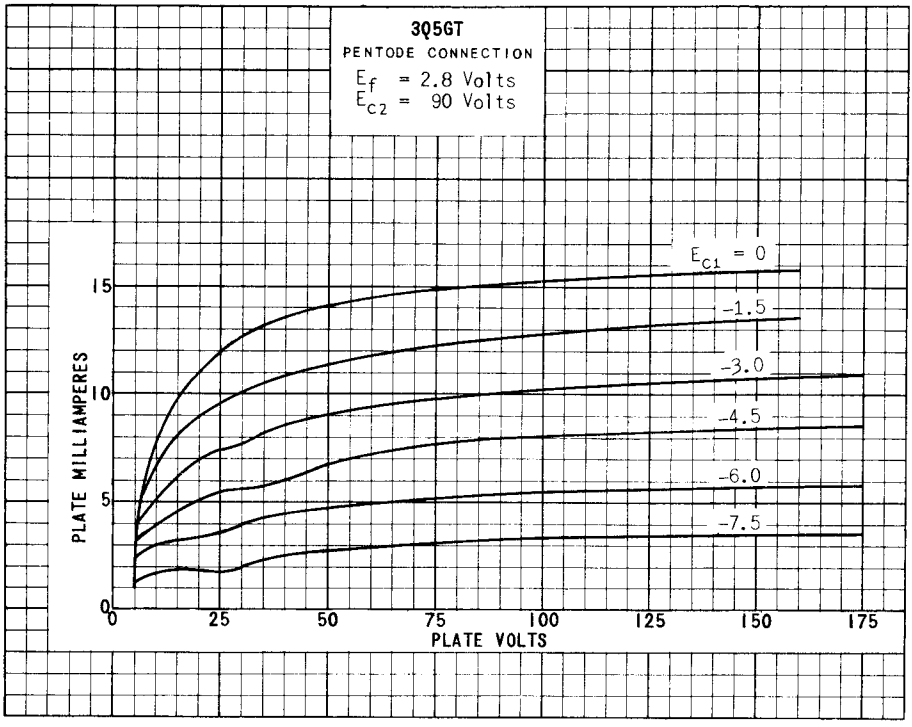

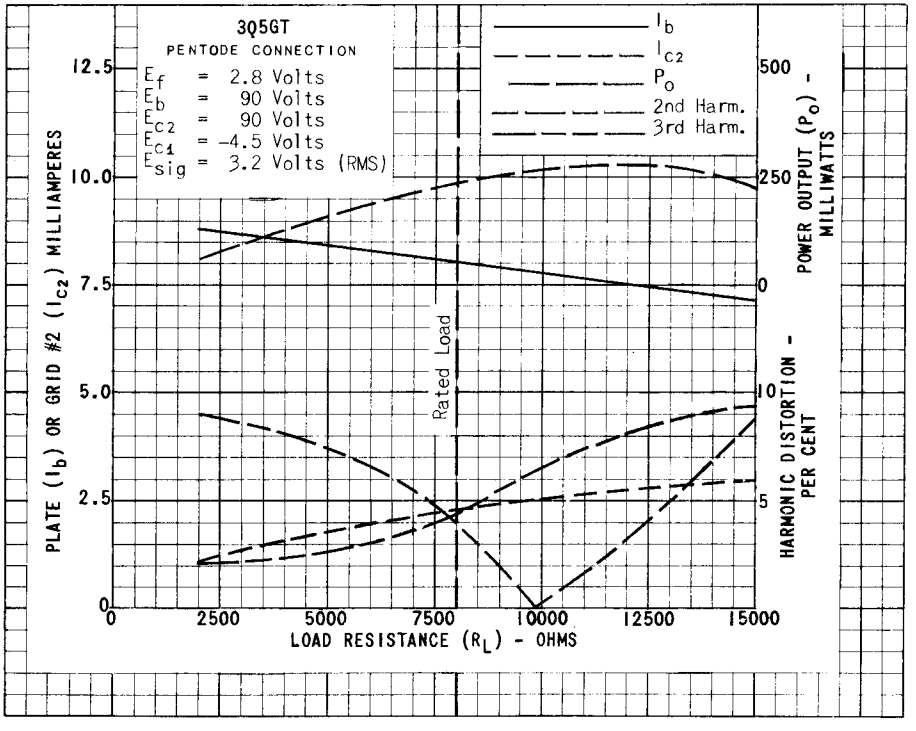

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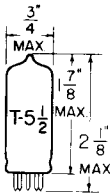
PENTODE

MINIATURE TYPE

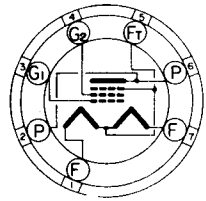


GLASS BULB

COATED FILAMENT

SERIES FILAMENT		PARALLEL FILAMENT	
E_f	APPLIED BETWEEN PINS 1 & 7	E_f	APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER
E_{g1}	REFERRED TO PIN 1	E_{g1}	REFERRED TO PIN -F
2.8 VOLTS 50 MA.		1.4 VOLTS 100 MA.	

DC



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION TO BY-PASS ANY CATHODE CURRENT IN EXCESS OF THE 5.5 MA. RATED MAXIMUM PER SECTION. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 & 7 IF OTHER TUBES USED IN SERIES FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3S4.

ANY MOUNTING POSITION

THE 3S4 IS A FILAMENTARY TYPE POWER OUTPUT PENTODE IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY ECONOMY OF FILAMENT POWER AND ABILITY TO PERFORM WELL AT LOW PLATE SUPPLY VOLTAGES SUCH AS ENCOUNTERED IN PORTABLE EQUIPMENT.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

	SERIES FILAMENT	PARALLEL FILAMENT	
FILAMENT VOLTAGE	2.8	1.4	VOLTS
MAXIMUM PLATE VOLTAGE	90	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	67.5	67.5	VOLTS
MAXIMUM CATHODE CURRENT	6[A] ←	6[A] ←	MA. MA.

[A] FOR EACH 1.4 FILAMENT SECTION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	SERIES FILAMENT		PARALLEL FILAMENT		
FILAMENT VOLTAGE	2.8	2.8	1.4	1.4	VOLTS
FILAMENT CURRENT	50	50	100	100	MA.
PLATE VOLTAGE	67.5	90	67.5	90	VOLTS
GRID #2 VOLTAGE	67.5	67.5	67.5	67.5	VOLTS
GRID #1 VOLTAGE	-7	-7	-7	-7	VOLTS
PEAK AF SIGNAL VOLTAGE	7	7	7	7	VOLTS
PLATE RESISTANCE (APPROX.)	0.1	0.1	0.1	0.1	MEGOHM
TRANSCONDUCTANCE	1 400	1 425	1 550	1 575	μMHOS
ZERO-SIGNAL PLATE CURRENT	6	6.1	7.2	7.4	MA.
ZERO-SIGNAL GRID #2 CURRENT	1.2	1.1	1.5	1.4	MA.
LOAD RESISTANCE	5 000	8 000	5 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	12	13	10	12	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	160	235	180	270	MW

→ INDICATES A CHANGE.

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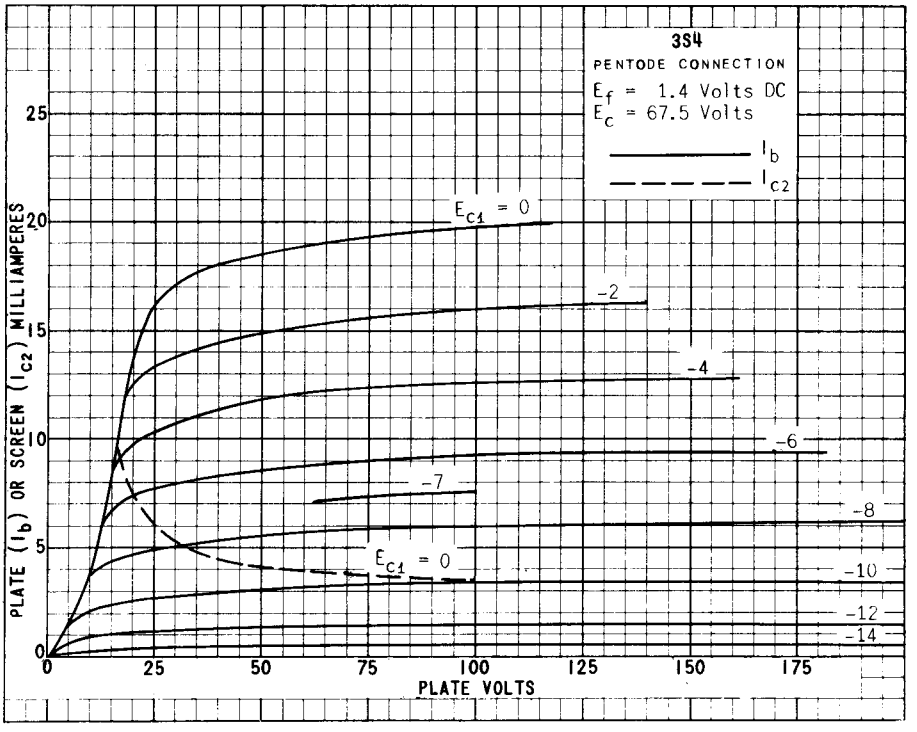
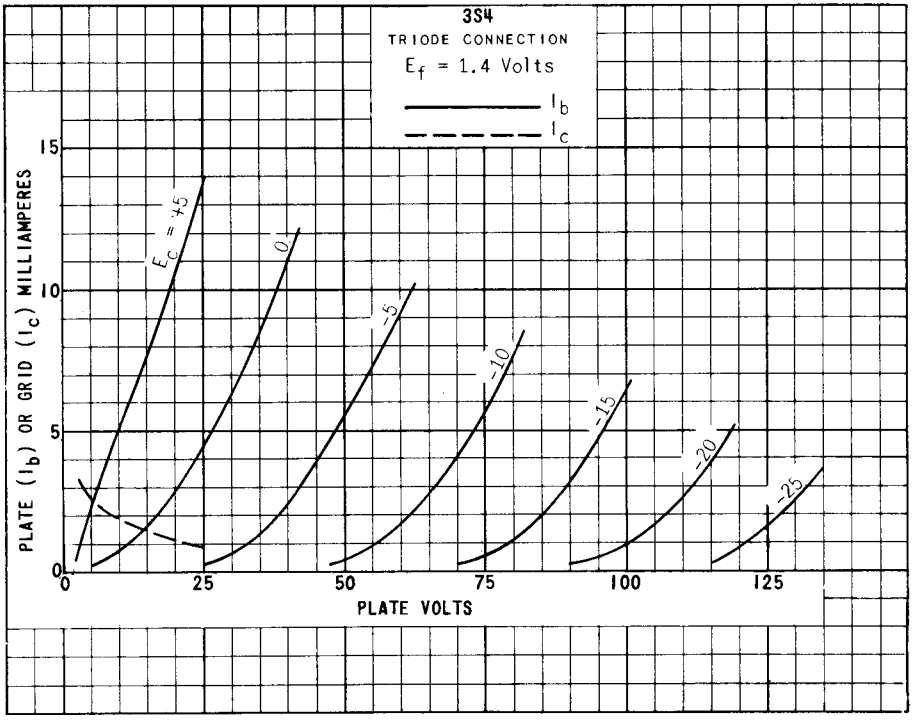
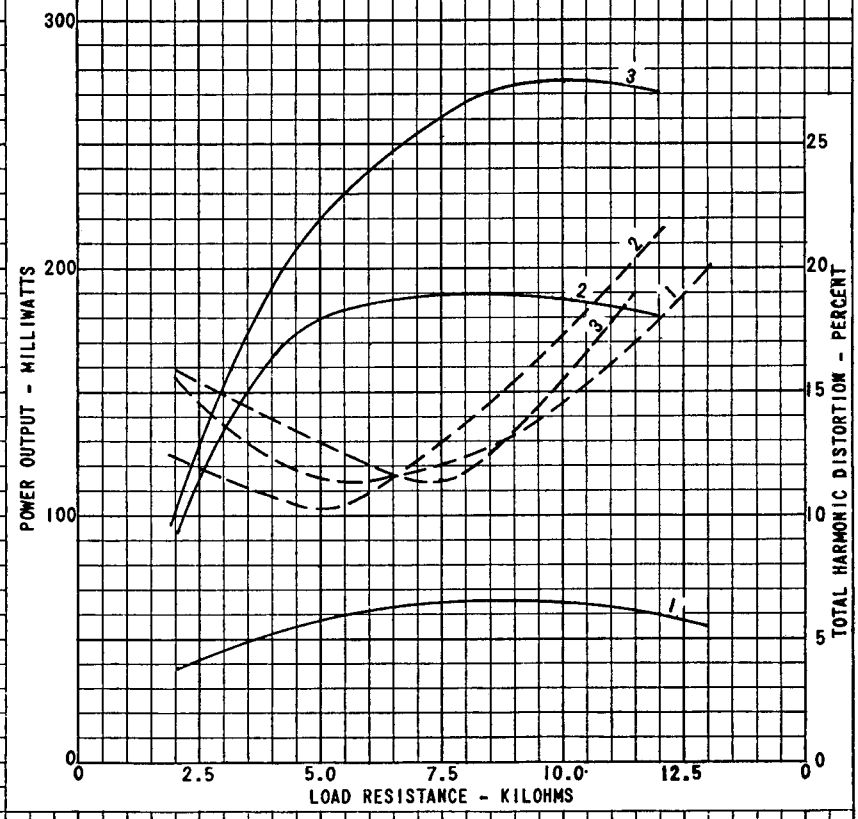
3S4


3S4
PENTODE CONNECTION
E_f = 1.4 Volts DC
E_c = 67.5 Volts
I_b
I_{c2}
E_{c1} = 0
-2
-4
-6
-7
-8
E_{c1} = 0
-10
-12
-14
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
125
150
175
5
10
15
20


3S4
TRIODE CONNECTION
E_f = 1.4 Volts
I_b
I_c
E_c = +5
0
-5
-10
-15
-20
-25
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
125
5
10
15

3S4
PENTODE CONNECTION
E_f = 1.4 Volts DC
——— P_o
– – – – – Dist.

CURVE	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	SIGNAL VOLTS
1	45	45	-4.5	3.2
2	67.5	67.5	-7	4.95
3	90	67.5	-7	4.95



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1948

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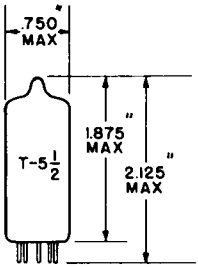
POWER AMPLIFIER PENTODE

MINIATURE TYPE

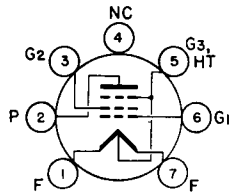


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED FILAMENT

FOR USE IN THE OUTPUT STAGE OF
AC/DC PORTABLE RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6BX

THE 3V4 IS A POWER AMPLIFIER PENTODE UTILIZING THE MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN THE OUTPUT STAGE OF AC/DC BATTERY PORTABLE RECEIVERS. IT IS IDENTICAL TO THE 3Q4 EXCEPT FOR THE DIFFERENT BASING ARRANGEMENT.

FILAMENT CHARACTERISTICS AND RATINGS *

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
SERIES [A]	2.8 VOLTS	50	MA.
PARALLEL [B]	1.4 VOLTS	100	MA.
FILAMENT SUPPLY LIMITS:			
VOLTAGE OPERATION:	SERIES [A]	PARALLEL [B]	
1.5 VOLT DRY CELL SUPPLY	2.2 TO 3.2	1.1 TO 1.6	VOLTS
OTHER BATTERY SUPPLIES OR POWER LINE	2.2 TO 3.0	1.1 TO 1.5	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	SERIES [A]	PARALLEL [B]	
PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE CURRENT	12.0 [C]	12.0	MA.

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TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

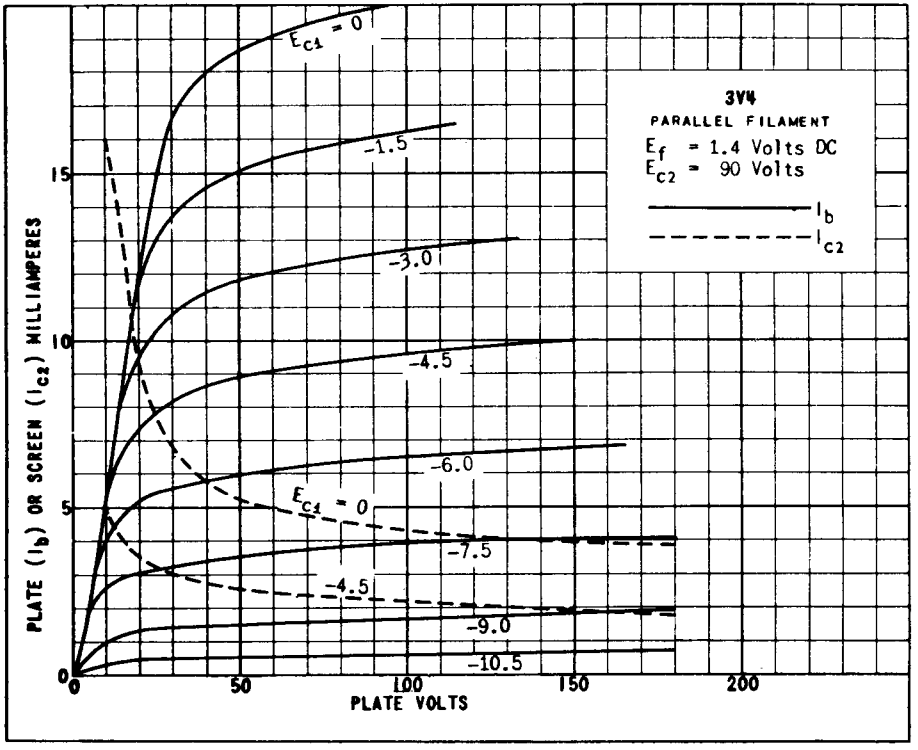
	SERIES	PARALLEL		
FILAMENT VOLTAGE	2.8	1.4	1.4	VOLTS
PLATE VOLTAGE	90	85	90	VOLTS
GRID #2 VOLTAGE	90	85	90	VOLTS
GRID #1 VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK GRID #1 SIGNAL VOLTAGE	4.5	5	4.5	VOLTS
PLATE CURRENT (AT ZERO SIGNAL)	7.7	6.9	9.5	MA.
GRID #2 CURRENT (AT ZERO SIGNAL)	1.7	1.5	2.1	MA.
PLATE RESISTANCE (APPROX.)	0.12	0.12	0.1	MEGOHMS
TRANSCONDUCTANCE	2,000	1,975	2,150	μMHOS
LOAD RESISTANCE	10,000	10,000	10,000	OHMS
TOTAL HARMONIC DISTORTION	7	10	7	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	240	250	270	MW

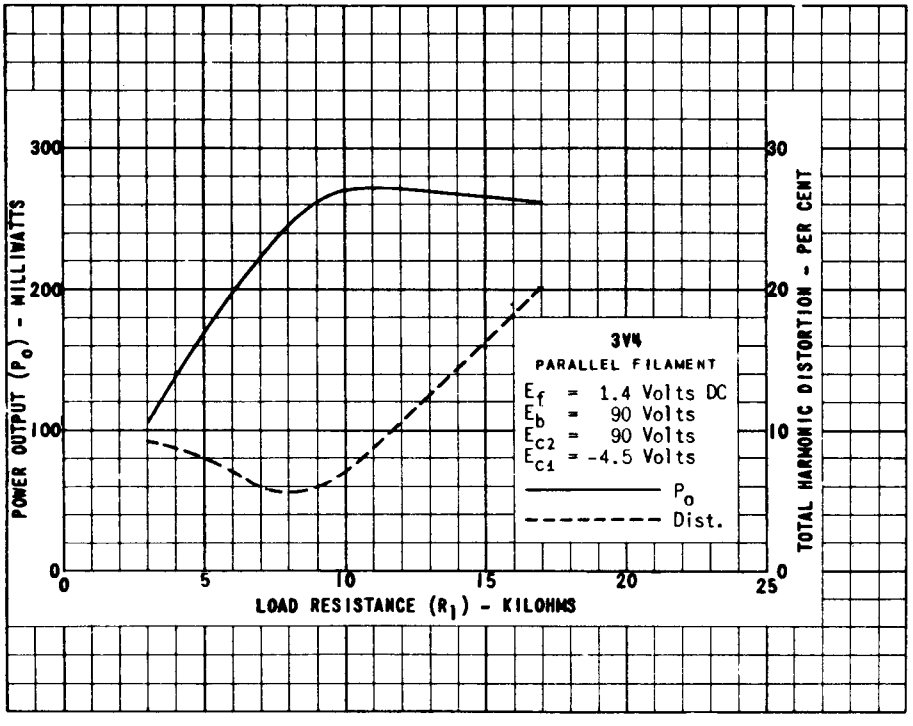
[A] FILAMENT VOLTAGE APPLIED ACROSS THE TWO SECTIONS IN SERIES BETWEEN PIN #1 & #7. GRID #1 VOLTAGE IS REFERRED TO PIN #1.

[B] FILAMENT VOLTAGE APPLIED ACROSS THE TWO SECTIONS IN PARALLEL, BETWEEN PIN #5 & PINS #1 & #7 TIED TOGETHER. GRID #1 VOLTAGE REFERRED TO PIN #5.

[C] THE MAXIMUM ALLOWABLE CATHODE CURRENT FOR EACH 1.4 VOLT FILAMENT SECTION IS 6 MA. FOR SERIES OPERATION OF THE SECTIONS, A SHUNTING RESISTOR MUST BE CONNECTED ACROSS THE SECTION BETWEEN PINS #1 & #5 TO BYPASS CATHODE CURRENT IN EXCESS OF 6 MA. WHEN OTHER TUBES IN A SERIES FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3V4, AN ADDITIONAL SHUNTING RESISTOR MAY BE REQUIRED BETWEEN PINS #1 & #7.

* INDICATES AN ADDITION.
→ INDICATES A CHANGE.





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FEB. 3, 1947

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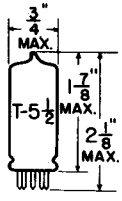
POWER AMPLIFIER PENTODE

MINIATURE TYPE

COATED FILAMENT CATHODE



GLASS BULB

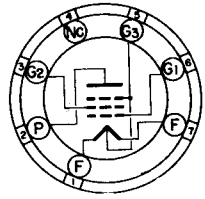
SERIES FILAMENT
E_f APPLIED BETWEEN PINS 1 & 7
E_{g1} REFERRED TO PIN 1

PARALLEL FILAMENT
E_f APPLIED BETWEEN PIN 5 AND PINS 1 & 7 TIED TOGETHER.
E_{g1} REFERRED TO PIN 5

1.25±20% VOLTS 0.1 AMP.

DC

A SHUNTING RESISTOR MUST BE CONNECTED BETWEEN PINS 1 AND 5 FOR SERIES-FILAMENT OPERATION TO BY-PASS ANY CATHODE CURRENT IN EXCESS OF THE 6 MA. RATED MAXIMUM PER SECTION. AN ADDITIONAL SHUNTING RESISTOR MAY BE NECESSARY BETWEEN PINS 1 AND 7 IF OTHER TUBES USED IN SERIES-FILAMENT ARRANGEMENT CONTRIBUTE TO THE FILAMENT CURRENT OF THE 3V4.



BOTTOM VIEW
MINIATURE BUTTON 7 PIN BASE

ANY MOUNTING POSITION

THE 3V4WA IS A POWER AMPLIFIER PENTODE UTILIZING THE 7PIN MINIATURE CONSTRUCTION. IT IS A RUGGEDIZED VERSION OF THE 3V4, MAKING IT SUITABLE FOR MILITARY EQUIPMENT APPLICATIONS.

RATINGS

POWER AMPLIFIER PENTODE

	TEST COND.	ABS. MAX.	
FILAMENT VOLTAGE	1.25	1.25±20%	VOLTS
MAXIMUM PLATE VOLTAGE	90	100	VOLTS
MAXIMUM GRID #1 VOLTAGE	-4.5	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	100	VOLTS
MAXIMUM CATHODE CURRENT	---	13	MA.
MAXIMUM ALTITUDE		10 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AF POWER AMPLIFIER - CLASS A_1

	SERIES FILAMENT	PARALLEL FILAMENT		
PLATE VOLTAGE	90	85	90	VOLTS
SCREEN VOLTAGE	90	85	90	VOLTS
GRID VOLTAGE	-4.5	-5	-4.5	VOLTS
PEAK AF GRID VOLTAGE	4.5	5	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	7.7	6.9	9.5	MA.
ZERO-SIGNAL SCREEN CURRENT	1.7	1.5	2.1	MA.
LOAD RESISTANCE	10 000	10 000	10 000	OHMS
PLATE RESISTANCE (APPROX.)	0.12	0.12	0.1	MEGOHM
TRANSCONDUCTANCE	2 000	1 975	2 150	µMHOS
MAXIMUM-SIGNAL POWER OUTPUT	0.24	0.25	0.27	WATT
TOTAL HARMONIC DISTORTION	7	10	7	PER CENT

→ INDICATES A CHANGE.

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PERFORMANCE TESTS
(MIL-E-1)

RESONANCE:

THE TUBE UNDER TEST SHALL BE MOUNTED ON A VIBRATION TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. TEST CONDITIONS OF PARAGRAPH 4.9.19.1 OF MIL-E-1 SHALL BE APPLIED AND Ep MONITORED WHILE THE FREQUENCY OF VIBRATION IS CONTINUOUSLY SWEPT FROM 50 TO 4500 cps AND THE PEAK ACCELERATION CONTROLLED CONSTANT @ 2G. TOTAL TIME OF SWEEP SHALL NOT BE LESS THAN ONE (1) MINUTE. THE MAX. VALUE OF Ep FOR THIS TEST SHALL NOT EXCEED 175 mVAC. THIS TEST SHALL BE CONSIDERED A "DESIGN TEST" AND SHALL BE CONDUCTED @ INSPECTION LEVEL 1A AND AN AQL OF 0.65%.

SHOCK:

TEST CONDITIONS OF PARAGRAPH 4.9.20.5 OF MIL-E-1 SHALL APPLY. HAMMER ANGLE SHALL BE 30°.

FATIGUE:

THE TEST CONDITIONS OF PARAGRAPH 4.9.20.6 OF MIL-E-1 SHALL APPLY.

PERFORMANCE TEST (MIL-E-1/343) DATED AUG. 14, 1953:

THE PERFORMANCE REQUIREMENTS AND APPLICABLE TESTS SHALL BE AS SPECIFIED ON SHEETS 1 & 2 OF MIL-E-1/343 EXCEPT AS FOLLOWS:

(A) ON SHEET 1, (1) THE MAXIMUM Ep FOR THE VIBRATION TEST SHALL READ "50 mVAC" AND (2) SYMBOL "Eb" AND THE MAX. VALUE "18 VU" FOR THE AF NOISE AND MICROPHONISM TEST SHALL BE DELETED.

(B) ON SHEET 2, (NOTE 1 SHALL BE CHANGED TO READ: "E_{bb}=E_{cc2}=135 VDC; E_{c1}= 0, R_{g1}= 3.3 MEG; R_p= 0.27 MEG; R_{g2}=2.0 MEG (BYPASSED WITH A 0.5 μf CAPACITOR TO −F). SET AMPLIFIER GAIN FOR 50MW OUTPUT WITH E_{sig}= 500 mVAC. THE REJECTION LEVEL SHALL BE SET AT THE VU METER READING OBTAINED DURING THE CALIBRATION.

GENERAL:

3V4WA SHALL MEET REQUIREMENTS OF MIL-E-1/343 DATED AUGUST 14, 1953 WITH FOLLOWING EXCEPTIONS.

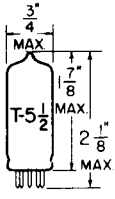
(A) THE FILAMENT SHALL BE MADE OF COATED TUNGSTEN AND NO DAMPER BARS SHALL BE USED.

(B) ABSOLUTE MAXIMUM RATING OF FILAMENT VOLTAGE (E_f) SHALL BE 1.25 ±20% VDC.

TUNG-SOL

PENTODE

MINIATURE TYPE



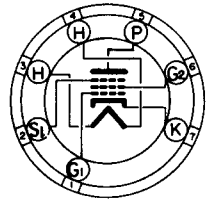
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
78K

THE 4AU6 IS A PENTODE AMPLIFIER HAVING A SHARP CUT-OFF CONTROL CHARACTERISTIC USING THE MINIATURE CONSTRUCTION. WITH HIGH TRANSCONDUCTANCE, LOW GRID-PLATE CAPACITANCE, IT IS INTENDED FOR SERVICE AS EITHER AN RF OR AF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 4AU6 IS IDENTICAL TO THE 6AU6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	0.003	0.003	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	μμf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	μμf
INPUT: G_1 TO (H+K)	3.2	3.2	μμf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	8.5	1.2	μμf

[A] SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE CONNECTION[B]	PENTODE CONNECTION	
HEATER VOLTAGE	4.2	4.2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS
MAXIMUM PLATE VOLTAGE	250	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	PLATE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	PLATE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.2	3	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.65	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[B] TRIODE CONNECTION: G_2 AND G_3 CONNECTED TO PLATE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

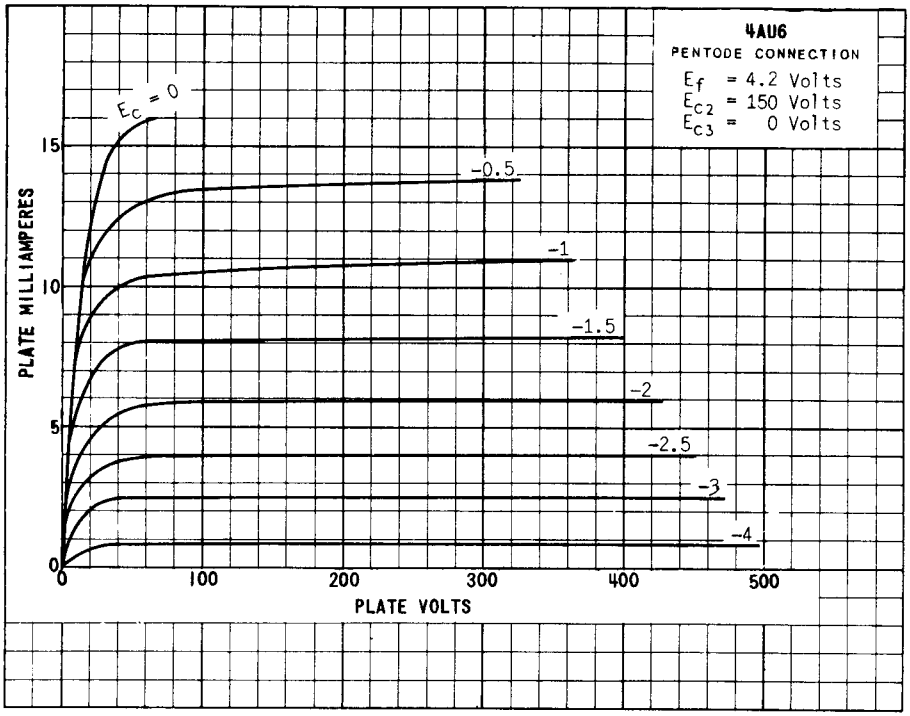
CLASS A_1 AMPLIFIER – PENTODE CONNECTION

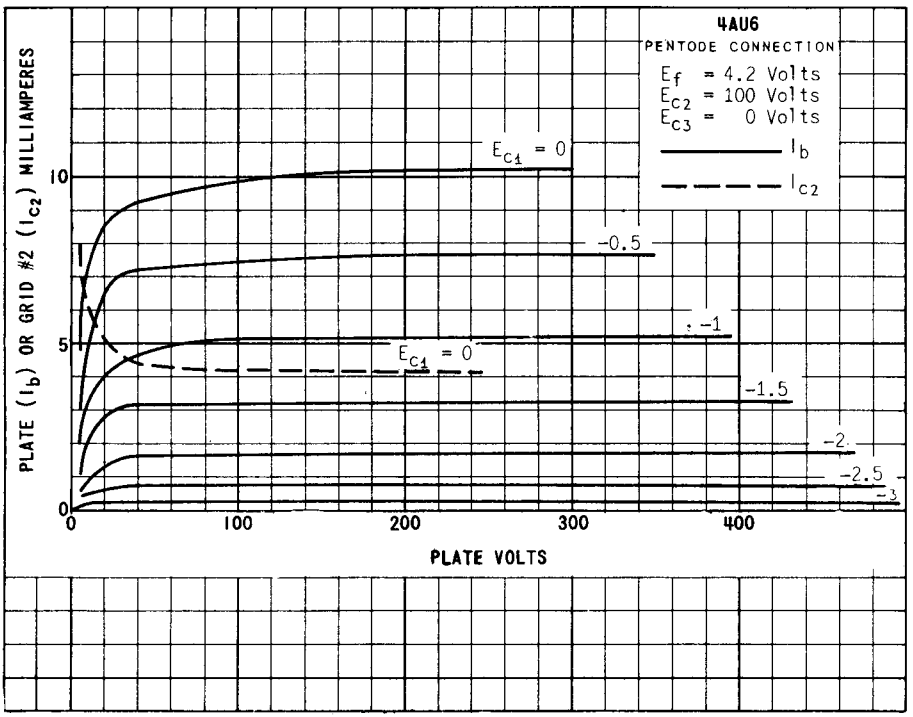
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	μMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-4.2	-5.5	-6.5	VOLTS

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.





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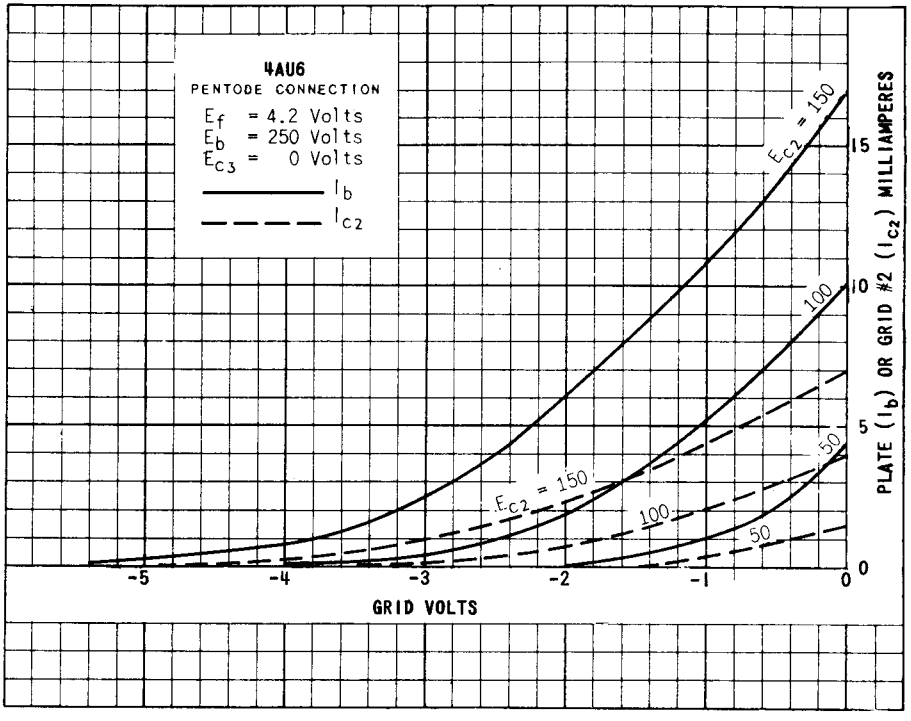
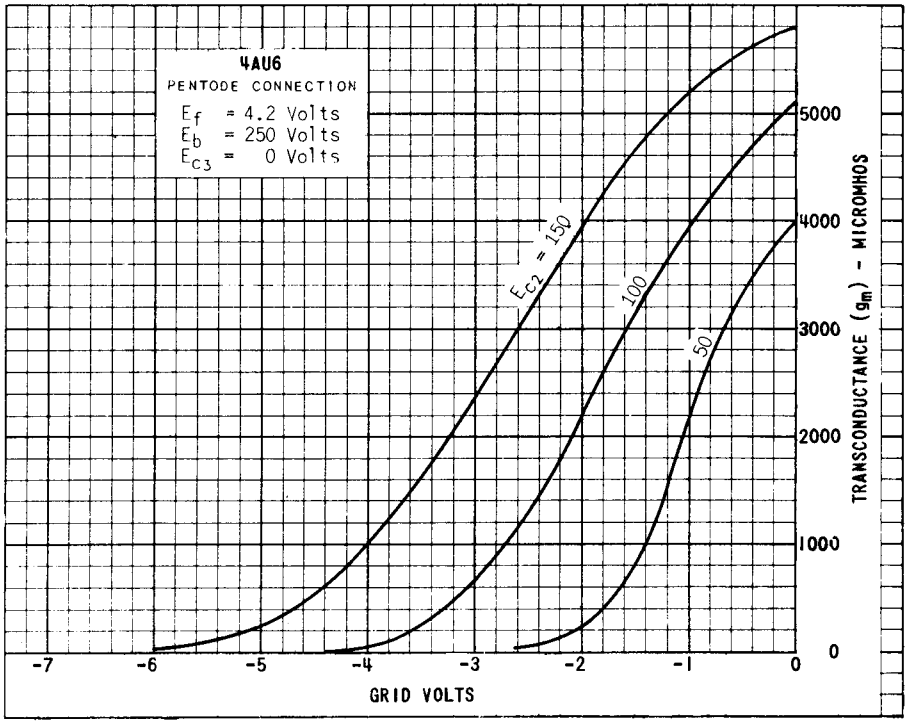

4AU6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c2} = 150
100
50
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID VOLTS
-5
-4
-3
-2
-1
0
15
10
5
0


4AU6
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 150
100
50
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID VOLTS
-7
-6
-5
-4
-3
-2
-1
0
5000
4000
3000
2000
1000
0

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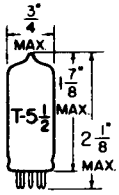
DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

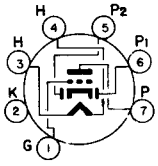
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45±.03 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BT

THE 4AV6 COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 4AV6 IS IDENTICAL TO THE 6AV6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1	MA.
HEATER WARM-UP TIME (AVG.)	11	SECONDS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

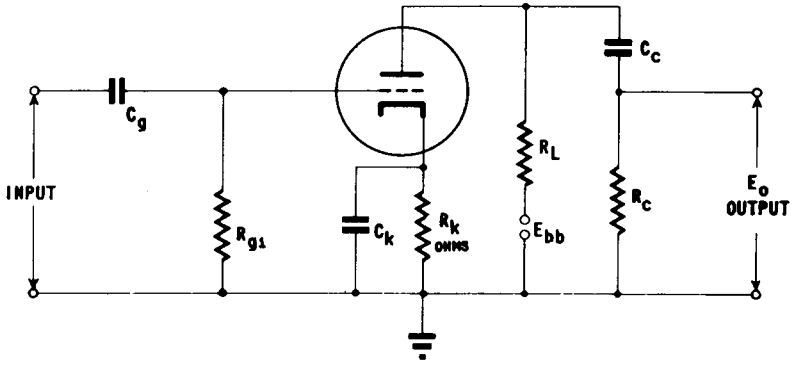
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	−1	−2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

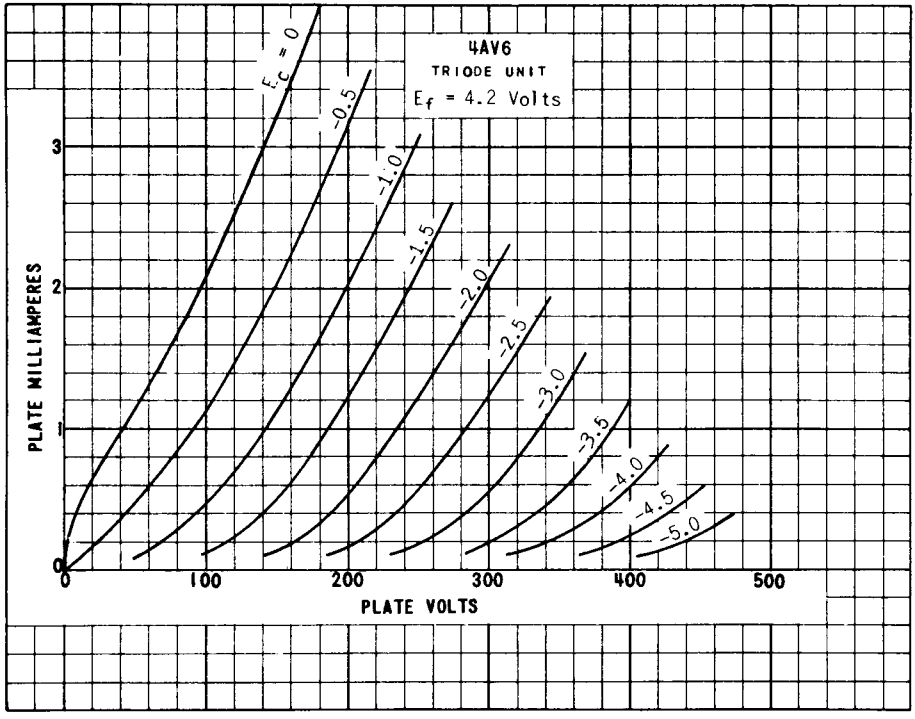
RESISTANCE COUPLED AMPLIFIER

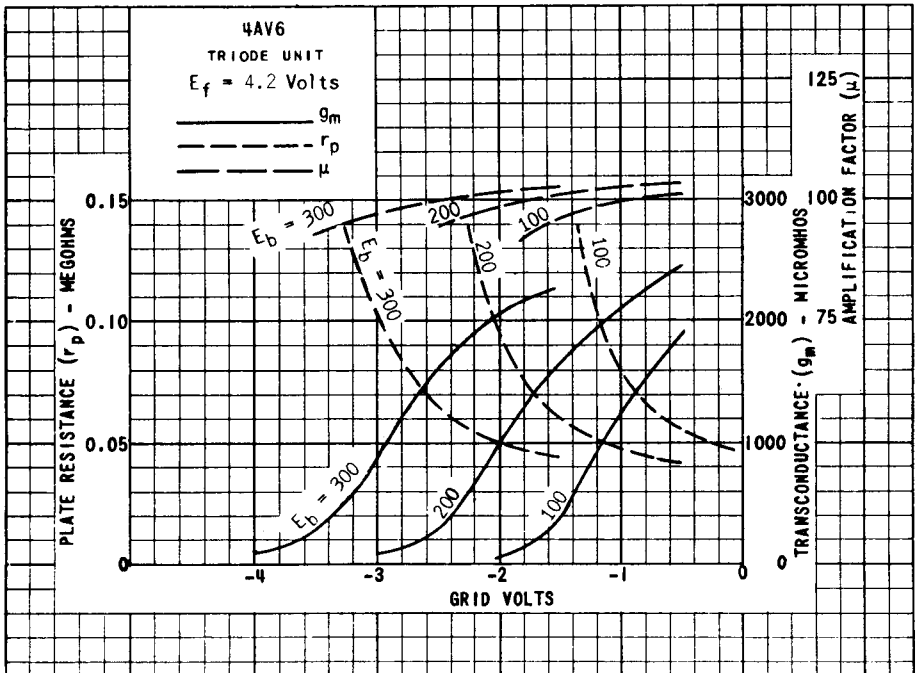
TRIODE UNIT

PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPALITOR C_k.





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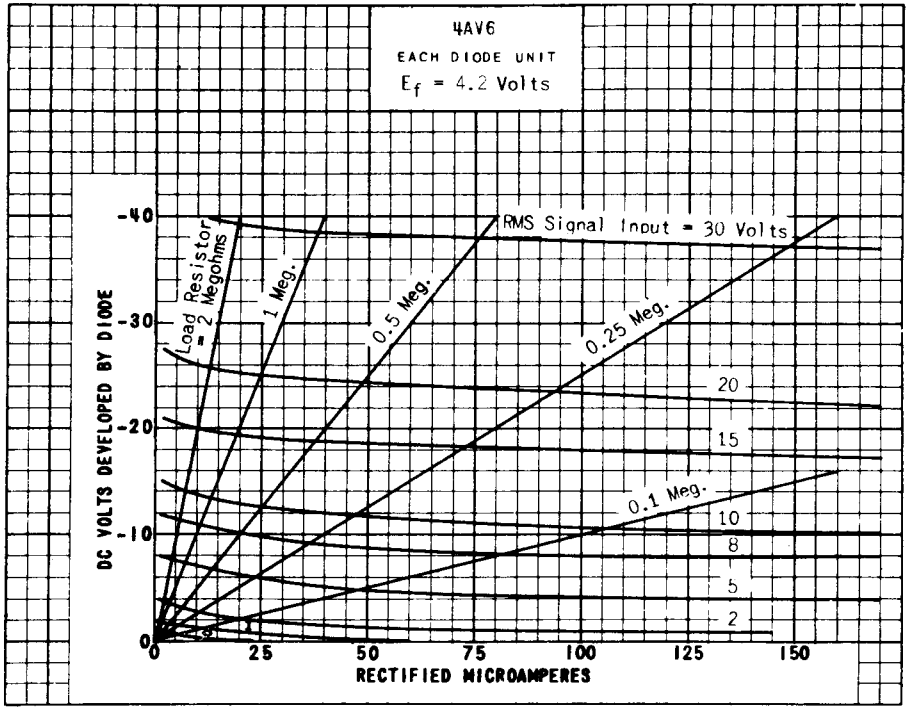
4AV6
EACH DIODE UNIT
E_f = 4.2 Volts
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
Load Resistor = 2 Megohms
1 Meg.
0.5 Meg.
0.25 Meg.
0.1 Meg.
RMS Signal Input = 30 Volts
20
15
10
8
5
2
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

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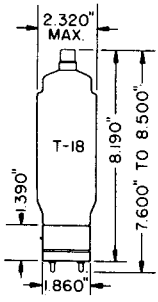
DIODE



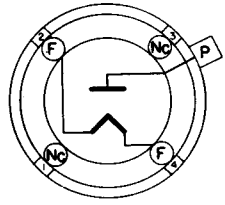
GLASS BULB

FILAMENT

5.0±5% VOLTS 7.25 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

JUMBO BAYONET
4 PIN BASE

4AT

THE 4B32 IS A XENON FILLED HALF WAVE RECTIFIER FOR USE IN HIGH VOLTAGE CIRCUITS. THE TUBE IS DESIGNED TO OPERATE OVER A WIDE TEMPERATURE RANGE WITHOUT THE NECESSITY OF HEATING OR COOLING DEVICES. ITS HARD GLASS ENVELOPE AND WELL SUPPORTED MOUNT MAKE IT PARTICULARLY SUITED FOR MILITARY AND INDUSTRIAL USE. AS CONTRASTED TO SIMILAR MERCURY-VAPOR TUBES, THE 4B32 MAY BE MOUNTED IN ANY POSITION AND IS NOT SUBJECT TO MERCURY-SPLASH PROBLEMS. ITS EFFICIENT OXIDE COATED FILAMENT IS FAST HEATING. AS CONSISTENT WITH FILAMENTARY GAS AND VAPOR RECTIFIER TUBE PRACTICE, QUADRATURE EXCITATION OF THE FILAMENT IS RECOMMENDED FOR OBTAINING THE LONGEST TUBE LIFE. IN QUADRATURE OPERATION, THE FILAMENT CURRENT IS PHASED TO BE AT A MINIMUM WHEN THE PEAK ANODE CURRENT FLOWS. HOWEVER THE TUBE CARRIES FULL RATINGS FOR IN PHASE OPERATION OF THE FILAMENT.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	10 000	VOLTS
MAXIMUM PEAK CATHODE CURRENT	5.0	AMP.
MAXIMUM AVERAGE CATHODE CURRENT	1.25	AMP.
MAXIMUM SURGE CATHODE CURRENT (MAXIMUM DURATION TIME 0.1 SECONDS)	50.	AMP.
MAXIMUM AVERAGING TIME	15.	SECONDS
MAXIMUM SUPPLY FREQUENCY	150.	CPS
AMBIENT TEMPERATURE LIMITS	−55 TO +70°	C

ELECTRICAL DATA

FILAMENT VOLTAGE	5.0±5%	VOLTS
FILAMENT CURRENT AT 5.0 VOLTS	7.25	AMP.
MINIMUM CATHODE HEATING TIME	30.	SECONDS
AVERAGE ANODE VOLTAGE DROP	12.	VOLTS
PEAK ANODE VOLTAGE DROP	16.	VOLTS
CRITICAL ANODE VOLTAGE	50.	VOLTS

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MECHANICAL DATA

MOUNTING POSITION	ANY	
OVERALL LENGTH	7.6 TO 8.5	INCHES
MAXIMUM DIAMETER	2.32	INCHES
BULB	T-18	NONEX
CAP	MEDIUM METAL C-1-5	
BASE	JUMBO 4 PIN, A4-29	
WEIGHT (NET) MAX.	7 1/2	OUNCES

MAXIMUM CIRCUIT VALUES

FIG.	CIRCUIT	TRANSFORMER	FILAMENT OPERATION	NO. OF TUBES	A.C. SECONDARY VOLTS E_{RMS}	DC OUTPUT (APPROX.) E_{DC} IN VOLTS	DC OUTPUT (APPROX.) I_{DC} IN AMPERES	RIPPLE VOLTS RMS	RIPPLE FREQ.
1	HALF WAVE SINGLE PHASE	SINGLE PHASE	IN PHASE	1	7000	3200	1.25	3500	f
2	FULL WAVE SINGLE PHASE	SINGLE PHASE CENTER TAP	IN PHASE	2	3500	3200	2.50	1500	2f
3	BRIDGE CIRCUIT SINGLE PHASE	SINGLE PHASE	IN PHASE	4	7000	6400	2.50	3000	2f
4	HALF WAVE THREE PHASE	DELTA-WYE	———	3	4000	4800	3.75	860	3f
5	FULL WAVE THREE PHASE	DELTA-WYE	QUADRATURE	6	4000	9500	3.75	400	6f
6	FULL WAVE THREE PHASE	DELTA-DELTA	QUADRATURE	6	7000	9500	3.75	400	6f
7	HALF WAVE SIX PHASE (THREE PHASE SUPPLY)	DELTA-STAR	QUADRATURE	6	3500	4800	5.0	200	6f

DC OUTPUT VALUES ARE THOSE SUPPLIED TO A CHOKE INPUT FILTER WITH A PURE SINE WAVE SUPPLY.

VALUES ARE FOR A MAXIMUM OF 10KV PEAK INVERSE VOLTAGE PER TUBE AND 150 CPS MAXIMUM SUPPLY FREQUENCY.

TUNG-SOL

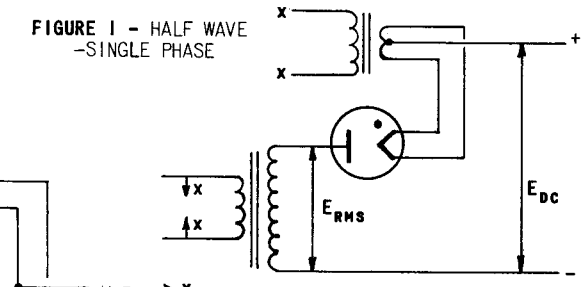


FIGURE 1 - HALF WAVE -SINGLE PHASE

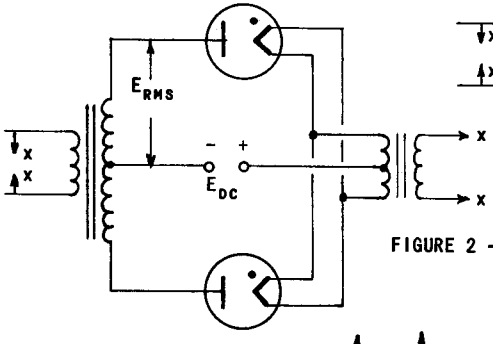


FIGURE 2 - FULL WAVE - SINGLE PHASE

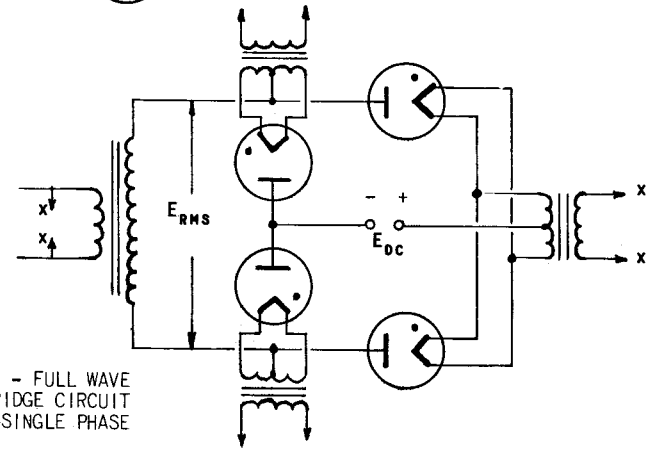


FIGURE 3 - FULL WAVE BRIDGE CIRCUIT -SINGLE PHASE

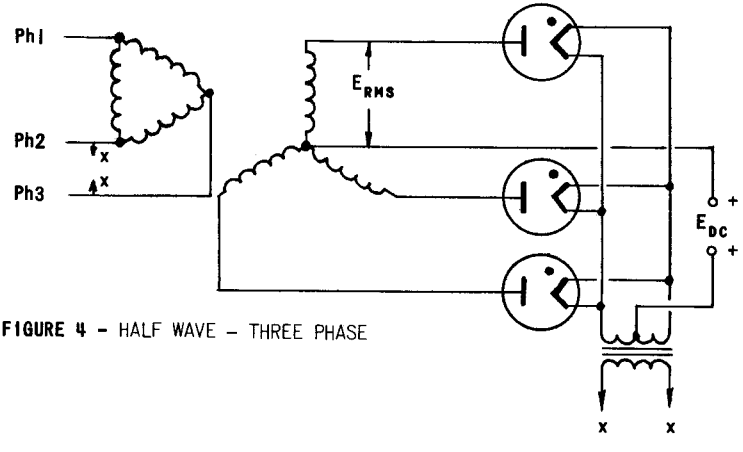


FIGURE 4 - HALF WAVE - THREE PHASE

FIGURE 5 - FULL WAVE–THREE PHASE

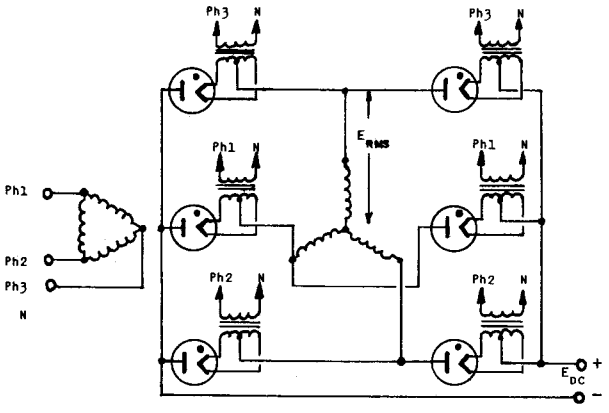


FIGURE 6 - FULL WAVE – THREE PHASE

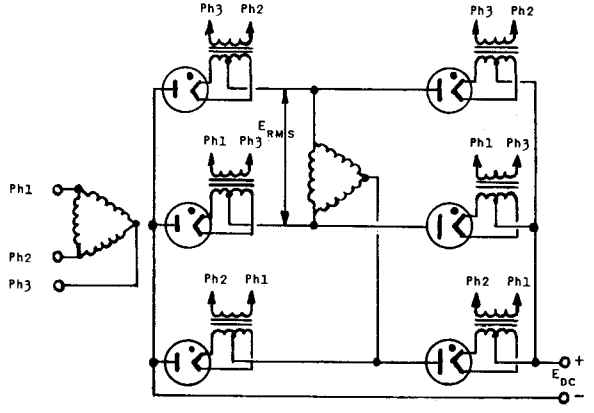
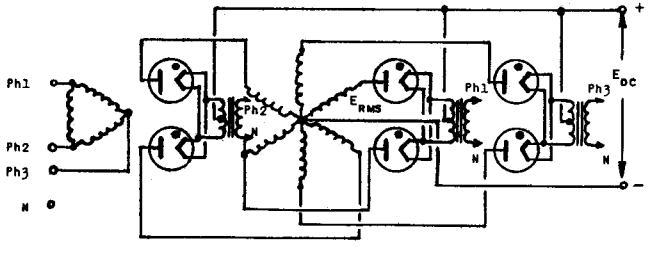


FIGURE 7 - HALF WAVE–SIX PHASE (3 PHASE SUPPLY)



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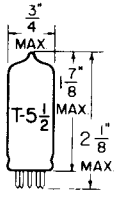
PENTODE

MINIATURE TYPE

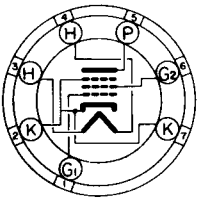


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7B0

THE 4BC5, A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 450 MA. SERIES HEATER OPERATED RECEIVERS. IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MC. AND AS A HIGH-FREQUENCY INTERMEDIATE AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6BC5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P)	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.6	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	3.1	1.8	μμf
TRIODE CONNECTION: (G_2 TIED TO PLATE)			
GRID TO PLATE: (G_1 TO P+G_2)	2.5	2.5	μμf
INPUT: G_1 TO (H+K+G_3&IS)	4	3.9	μμf
OUTPUT: P+G_2 TO (H+K+G_3&IS)	4.3	3	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE[B]	PENTODE	
HEATER VOLTAGE	4.2	4.2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5[C]	2	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[A] TRIODE CONNECTION: G_2 CONNECTED TO PLATE.

[B] TOTAL DISSIPATION FOR PLATE PLUS SCREEN.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

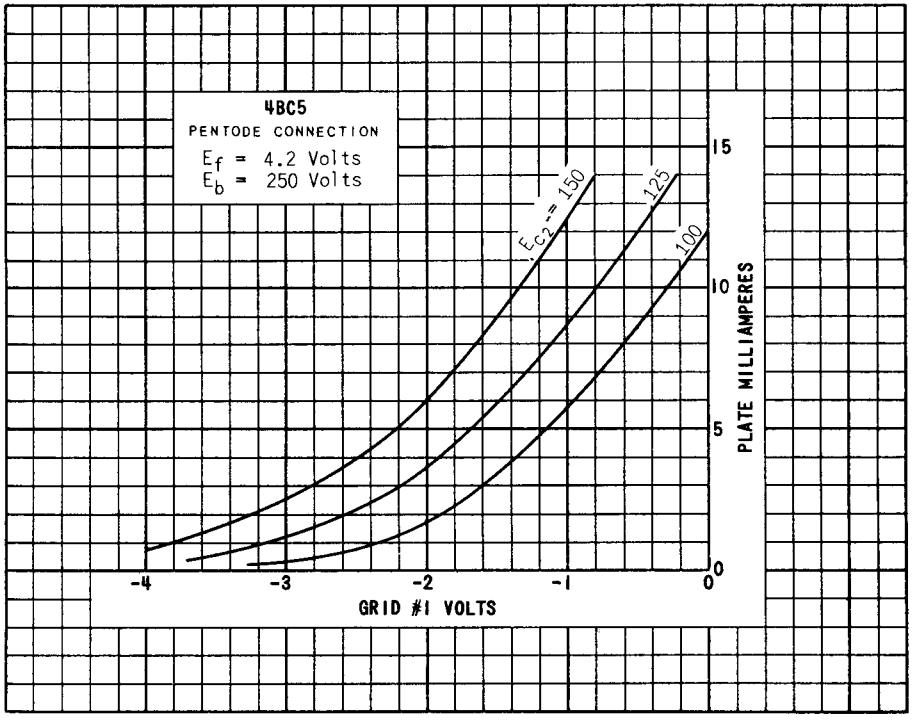
CLASS A_1 AMPLIFIER - PENTODE CONNECTION

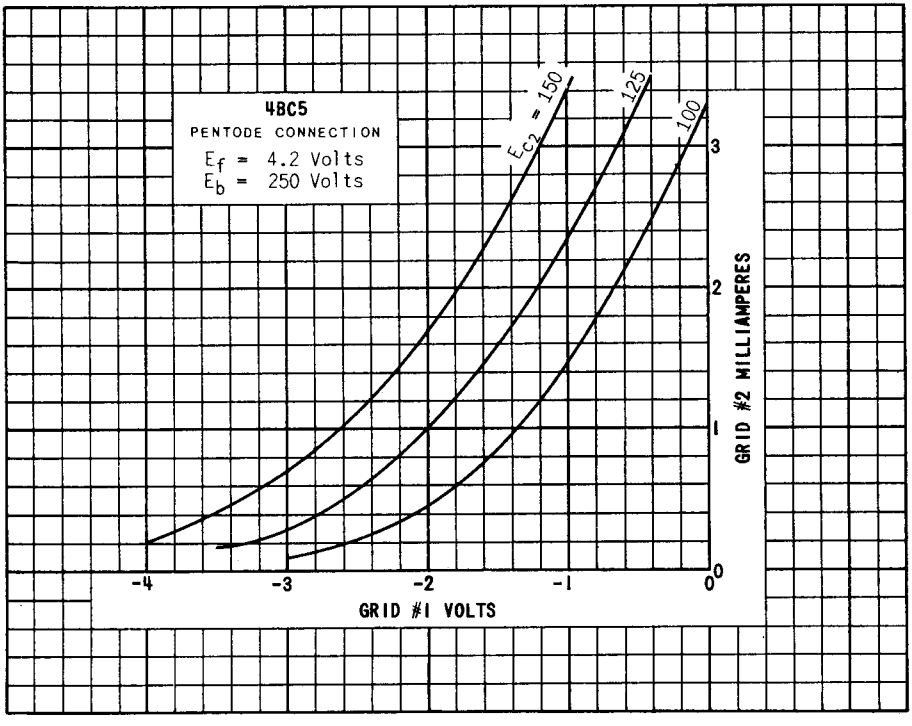
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE RESISTOR	180	100	180	OHMS
PLATE RESISTANCE (APPROX.)	0.6	0.5	0.8	MEGOHM
TRANSCONDUCTANCE	4900	6100	5700	µMHOS
PLATE CURRENT	4.7	8	7.5	MA.
GRID #2 CURRENT	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_{b2} = 10 µA.	-5	-6	-8	VOLTS

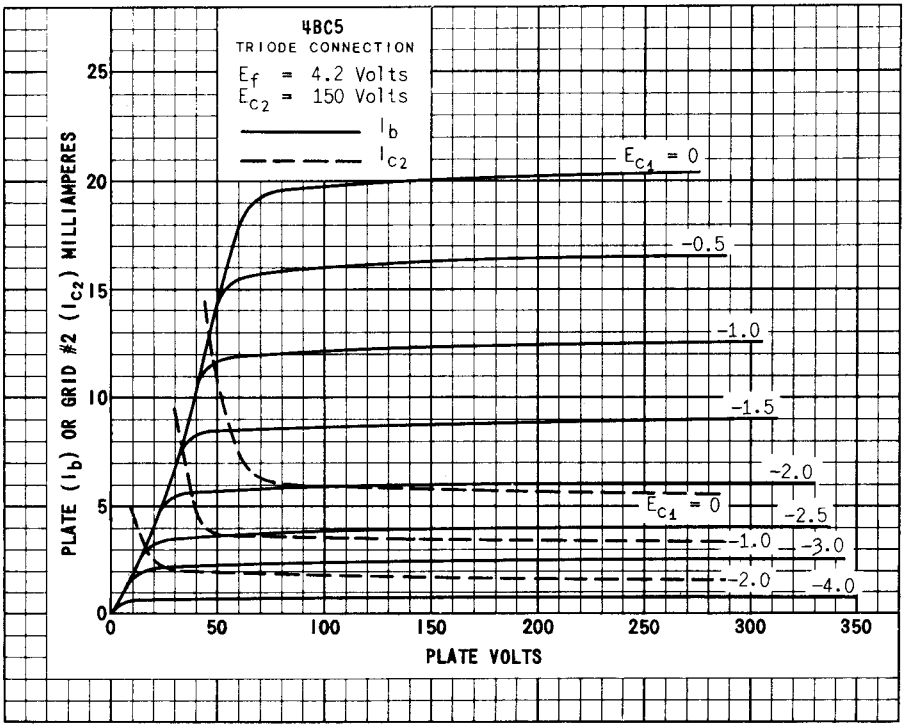
CLASS A_1 AMPLIFIER - TRIODE CONNECTION[B]

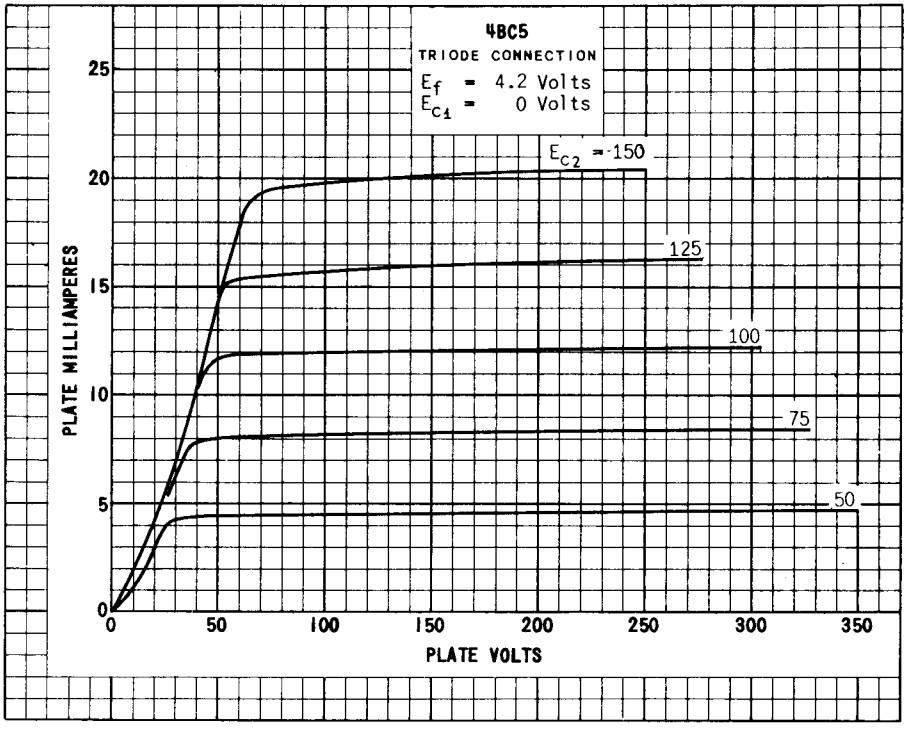
HEATER VOLTAGE	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	250	180	VOLTS
CATHODE RESISTOR	820	330	OHMS
PLATE RESISTANCE (APPROX.)	0.009	0.006	MEGOHM
TRANSCONDUCTANCE	4400	6000	µMHOS
PLATE CURRENT	6	8	MA.
AMPLIFICATION FACTOR	40	42	

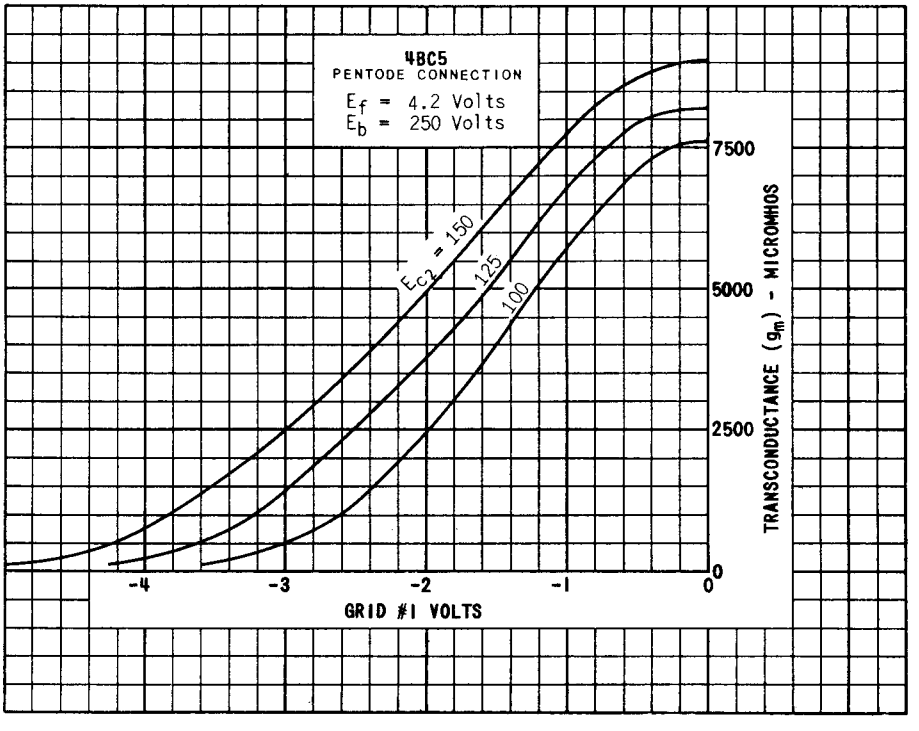
[B] TRIODE CONNECTION G_2 CONNECTED TO PLATE.




4BC5
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c2} = 150
125
100
GRID #2 MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
1
2
3


4BC5
TRIODE CONNECTION
E_f = 4.2 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
0
5
10
15
20
25
50
100
150
200
250
300
350

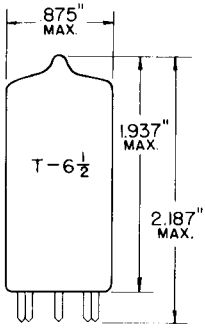

4BC5
TRIODE CONNECTION
E_f = 4.2 Volts
E_{c_1} = 0 Volts
E_{c_2} = 150
125
100
75
50
PLATE MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
350
PLATE VOLTS


4BC5
PENTODE CONNECTION
E_f = 4.2 Volts
E_b = 250 Volts
E_{c_2} = 150
125
100
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
2500
5000
7500
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

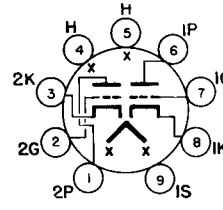


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

CASCODE AMPLIFIER
FOR SERIES STRING VHF
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 4BC8 IS A MEDIUM-MU, SEMI-REMOTE CUT-OFF TWIN TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A CASCODE AMPLIFIER IN 600 MA. SERIES HEATER OPERATED VHF TELEVISION RECEIVER TUNERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #315 CONNECTED TO PIN 9

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	→1.2	→ 1.2	pf
PLATE TO CATHODE (P TO K)		→0.12	pf
HEATER TO CATHODE (H TO K)	→2.8	→ 2.8	pf
#1 INPUT: G1 TO (H+K+I.S.)	→2.6		pf
#2 INPUT: K TO (H+G+I.S.)[A]		→ 5.5	pf
#1 OUTPUT: P TO (H+K+I.S.)	1.3		pf
#2 OUTPUT: P TO (H+G+I.S.)[A]		→ 2.4	pf
#1 PLATE TO #2 PLATE (1P TO 2P)(MAX.)	→.02		pf
#2 PLATE TO #1 PLATE AND GRID:(2P TO 1P+1G) MAXIMUM	→.04		pf

[A] READ AS GROUNDED GRID AMPLIFIER.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE[B]			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME (AVG.)[C]		11	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.2	WATTS
CATHODE CURRENT	→ 22	MA.
GRID CIRCUIT RESISTANCE	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

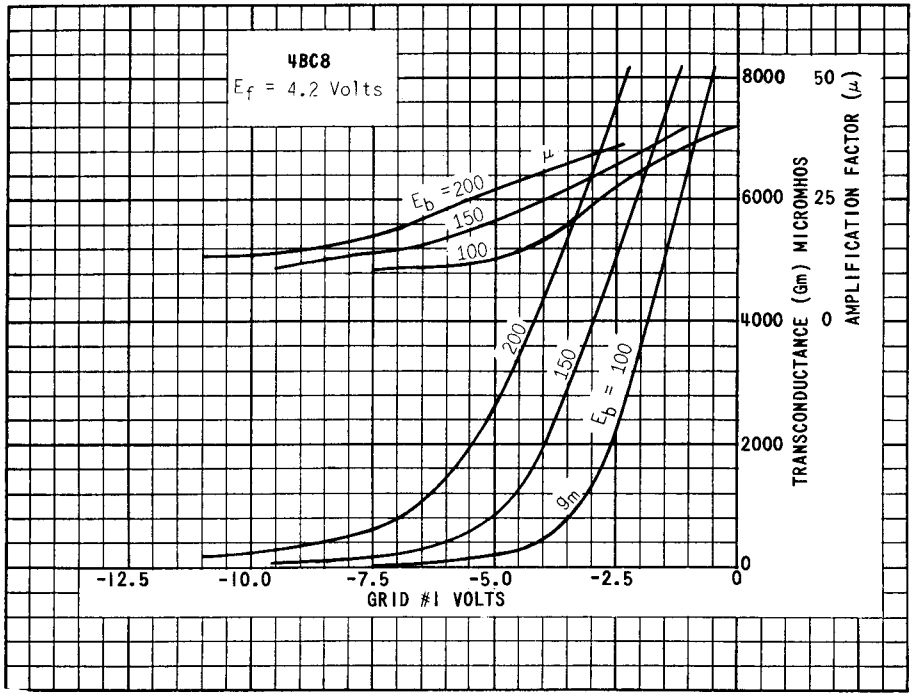
EACH UNIT

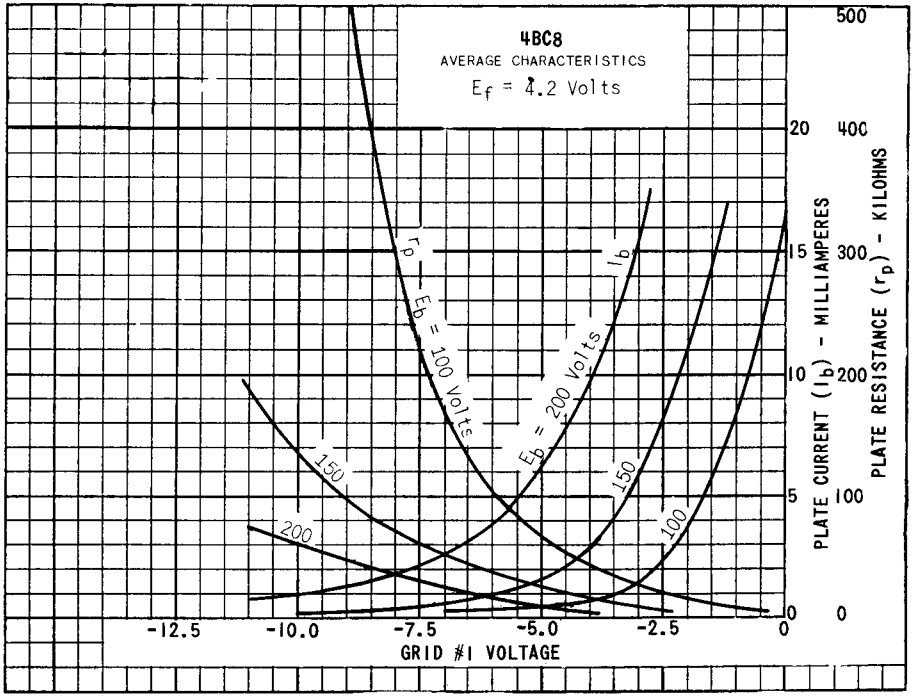
PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR	220	OHMS
PLATE RESISTANCE*	5300	OHMS
TRANSCONDUCTANCE	6200	μMHOS
AMPLIFICATION FACTOR	35	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR GM =50 μMHOS	-13	VOLTS

[B] THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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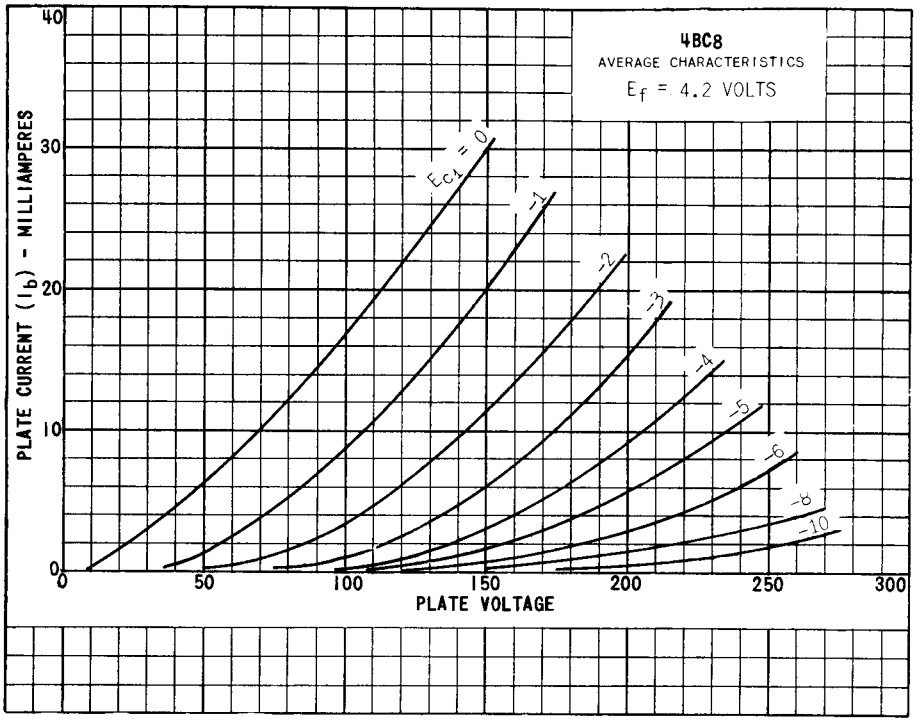
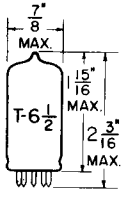

4BC8
AVERAGE CHARACTERISTICS
E_f = 4.2 VOLTS
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
0
10
20
30
40
0
50
100
150
200
250
300

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

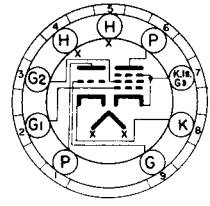
COATED UNIPOTENTIAL CATHODE

HEATER

4.6 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9DC

THE 4BL8 IS A TRIODE PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A FREQUENCY CHANGER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

PENTODE SECTION:		
INPUT CAPACITANCE	5.2	μμf
OUTPUT CAPACITANCE	3.4	μμf
PLATE TO GRID #1 (MAX.)	0.025	μμf
TRIODE SECTION		
INPUT CAPACITANCE	2.5	μμf
OUTPUT CAPACITANCE	1.8	μμf
PLATE TO GRID	1.5	μμf
BETWEEN PENTODE AND TRIODE SECTIONS		
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.07	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	0.02	μμf
PENTODE GRID TO TRIODE PLATE (MAX.)	0.16	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION		
HEATER VOLTAGE	4.6	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT OF 14 MAMPS	175	VOLTS
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT LESS THAN 10 MAMPS	200	VOLTS
MAXIMUM GRID #2 DISSIPATION AT A PLATE DISSIPATION MORE THAN 1.2 WATTS	0.75	WATT

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TUNG-SOL

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION (CONT'D.)

MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEG.
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	0.5	MEG.
MAXIMUM CATHODE CURRENT	14	MAMPS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE NEGATIVE WITH RESPECT TO HEATER)	100	VOLTS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE POSITIVE WITH RESPECT TO HEATER)	200[A]	VOLTS

TRIODE SECTION

HEATER VOLTAGE	4.6	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEG.
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE NEGATIVE WITH RESPECT TO HEATER)	100	VOLTS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE POSITIVE WITH RESPECT TO HEATER)	200[A]	VOLTS
MAXIMUM CATHODE CURRENT	14	MAMPS.

[A] DC COMPONENT 120 VOLTS MAX.

TYPICAL CHARACTERISTICS

PENTODE SECTION

HEATER VOLTAGE	4.6	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	170	VOLTS
GRID #2 VOLTAGE	170	VOLTS
GRID #1 BIAS	−2	VOLTS
PLATE CURRENT	10	MAMPS.
GRID #2 CURRENT	2.8	MAMPS.
TRANSCONDUCTANCE	6200	μMHOS
PLATE RESISTANCE	0.4	MEG.
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	47	
INPUT RESISTANCE AT 50MC	10 000	OHMS
EQUIVALENT NOISE RESISTANCE	1500	OHMS

TRIODE SECTION

HEATER VOLTAGE	4.6	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−2	VOLTS
PLATE CURRENT	14	MAMPS.
TRANSCONDUCTANCE	5000	μMHOS
AMPLIFICATION FACTOR	20	

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TUNG-SOL

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OPERATING CHARACTERISTICS

FOR USE AS MIXER

HEATER VOLTAGE	4.6		VOLTS
HEATER CURRENT	0.60		AMP.
PLATE VOLTAGE	170	170	VOLTS
GRID #2 VOLTAGE	170	170	VOLTS
GRID #1 CIRCUIT RESISTANCE	0.1	0.1	MEG.
CATHODE RESISTOR	330	820	OHMS
OSCILLATOR VOLTAGE (RMS)	3.5	3.5	VOLTS
PLATE CURRENT	6.5	5.2	MAMPS
GRID #2 CURRENT	2.0	1.5	MAMPS.
GRID #1 CURRENT	20	0	μAMPS
CONVERSION CONDUCTANCE	2200	2100	μMHOS
PLATE RESISTANCE	0.8	0.87	MEG.

OPTIMUM PEAK CATHODE CURRENT OF THE TRIODE SECTION IN FRAME OUTPUT APPLICATION. TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE CURRENT OF 100 MA (MAX. PULSE DURATION 4% OF A CYCLE, WITH A MAXIMUM OF 0.8 MSEC.) IT STILL OPERATES SATISFACTORILY. IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY TO THIS MAX. VALUE OF 100 MA. (e.g. BY NON-BYPASSED RESISTANCES IN THE GRID LEAD).

NOTE: IT IS RECOMMENDED TO EMPLOY THE TRIODE IN A COLPITTS TYPE OF CIRCUIT AND NOT IN A HARTLEY TYPE.

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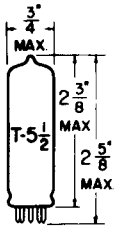
TUNG-SOL

PENTODE

MINIATURE TYPE

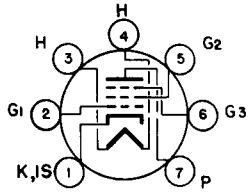


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 4BN6 IS A GATED-BEAM DISCRIMINATOR TUBE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. A UNIQUE DESIGN, MAKING USE OF THE ELECTROSTATIC BEAM DEFLECTION PRINCIPLE, RESULTS IN VERY EFFICIENT LIMITING AS WELL AS PROVIDING FOR FM DETECTION AND AMPLIFICATION. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BN6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±45	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	1.25	1.25	1.25	VOLTS
DC PLATE CURRENT	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

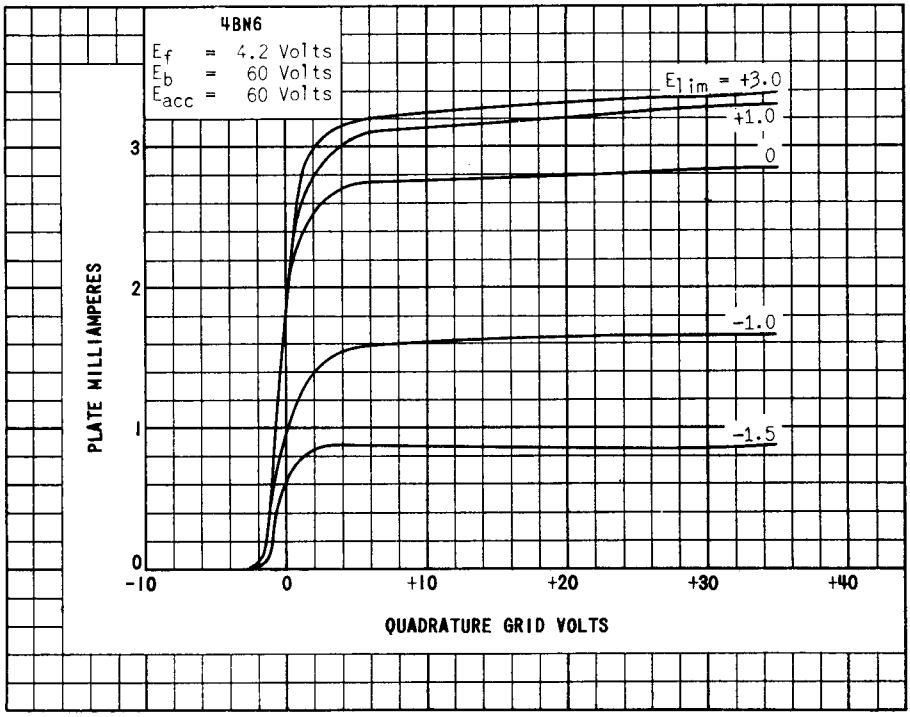
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

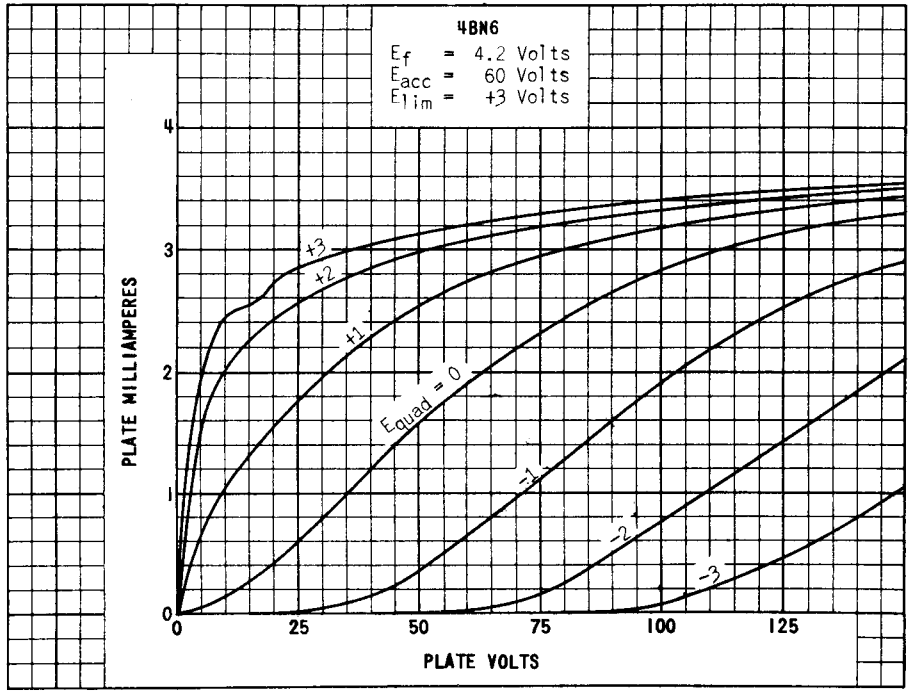
ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

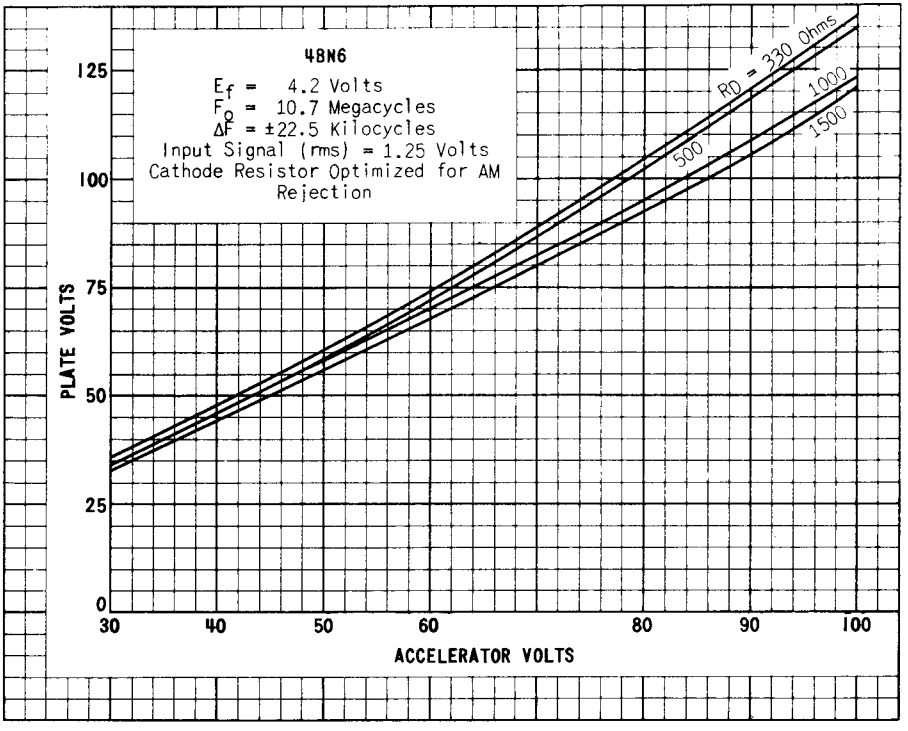
STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

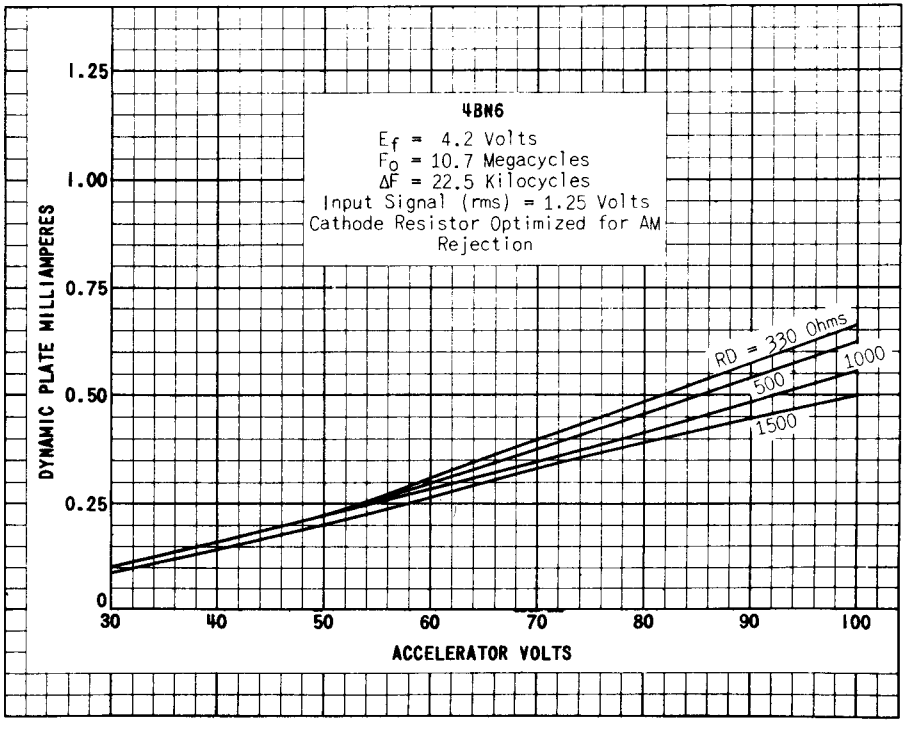
THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

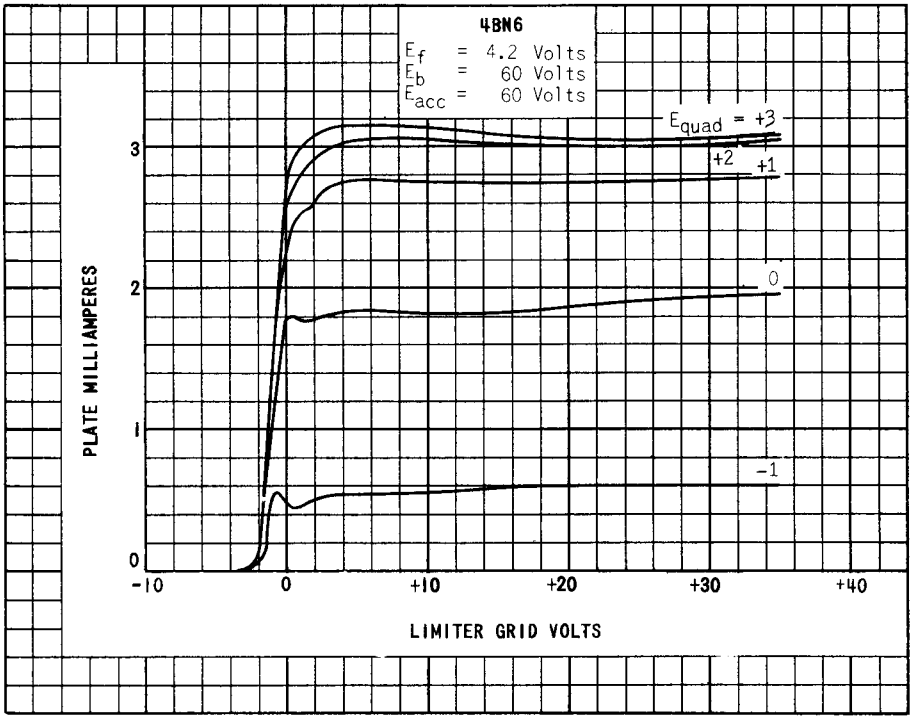
→ INDICATES A CHANGE.


4BN6
E_f = 4.2 Volts
E_b = 60 Volts
E_{acc} = 60 Volts
E_{1im} = +3.0
+1.0
0
-1.0
-1.5
PLATE MILLIAMPERES
0
1
2
3
-10
0
+10
+20
+30
+40
QUADRATURE GRID VOLTS


4BN6
E_f = 4.2 Volts
E_{acc} = 60 Volts
E_{1im} = +3 Volts
+3
+2
+1
E_{quad} = 0
-1
-2
-3
PLATE MILLIAMPERES
0
1
2
3
4
0
25
50
75
100
125
PLATE VOLTS


4BN6
E_f = 4.2 Volts
F_o = 10.7 Megacycles
ΔF = ±22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
PLATE VOLTS
0
25
50
75
100
125
30
40
50
60
80
90
100
ACCELERATOR VOLTS


4BN6
E_f = 4.2 Volts
F_o = 10.7 Megacycles
ΔF = 22.5 Kilocycles
Input Signal (rms) = 1.25 Volts
Cathode Resistor Optimized for AM Rejection
RD = 330 Ohms
500
1000
1500
DYNAMIC PLATE MILLIAMPERES
0
0.25
0.50
0.75
1.00
1.25
30
40
50
60
70
80
90
100
ACCELERATOR VOLTS



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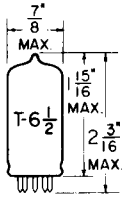
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

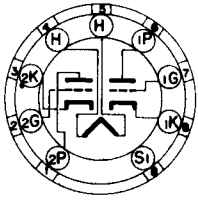


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN NOVAL
9AJ

THE 4BQ7A, A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION, IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS INTENDED FOR SERVICE AS THE FIRST RF AMPLIFIER TUBE IN TUNERS OF VHF TELEVISION RECEIVERS OR AS A LOW NOISE IF PRE-AMPLIFIER TUBE IN UHF TELEVISION RECEIVERS EMPLOYING A CRYSTAL MIXER. HIGH TRANSCONDUCTANCE, LOW INPUT CAPACITANCE, LOW INPUT LOADING, AND LOW PLATE TO CATHODE CAPACITANCE MAKE IT SPECIALLY USEFUL IN THE DIRECT-COUPLED RF STAGE OF TELEVISION RECEIVERS UTILIZING A DRIVEN RF-GROUNDED-GRID AMPLIFIER FOR THE CASCODE TYPE OF CIRCUIT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES THAT ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BQ7A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE	1.15	1.15	μμf
INPUT	2.85	----	μμf
INPUT (GROUNDED GRID)	----	4.95	μμf
OUTPUT	1.35	----	μμf
OUTPUT (GROUNDED GRID)	----	2.27	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.65	2.70	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)	0.010		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1 (MAX.)	0.024		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	4.2	VOLTS
→ MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	250[A]	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SEC.

[A] UNDER CUT-OFF CONDITIONS, IN RF-GROUNDED-GRID CIRCUITS WITH DIRECT-COUPLED DRIVE, IT IS PERMISSIBLE FOR THIS VOLTAGE TO BE AS HIGH AS 300 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6 100	OHMS
TRANSCONDUCTANCE	6 400	µMHOS
PLATE CURRENT	9	MA.
GRID VOLTS (APPROX.) FOR I_b = 10 µAMP.	−10	VOLTS

PUSH–PULL RF GROUNDED GRID CIRCUIT – EACH UNIT

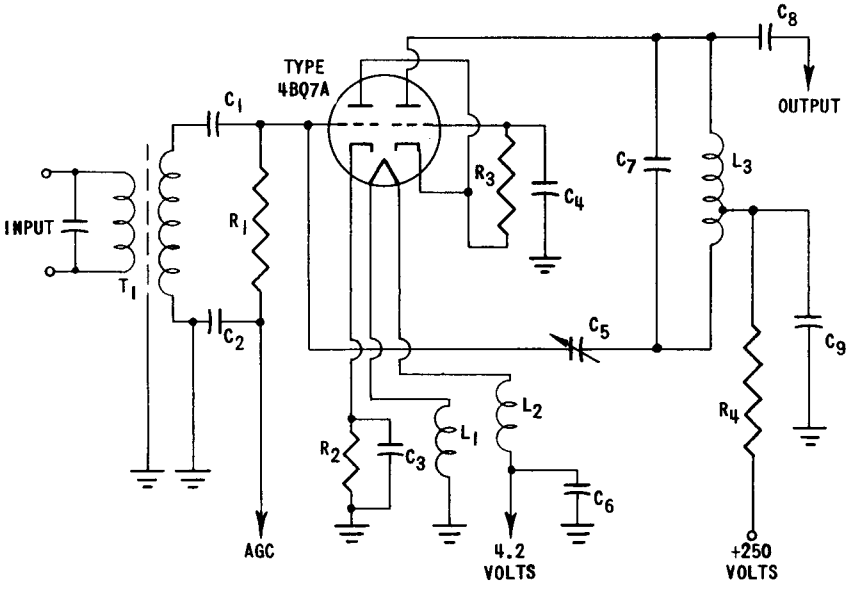
HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	−2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

RF GROUNDED GRID CIRCUIT WITH DIRECT–COUPLED DRIVE

UNIT #1 (DRIVER TUBE) IS DIRECTLY COUPLED TO UNIT #2 (DRIVEN RF-GROUNDED-GRID AMPLIFIER TUBE) AS SHOWN IN ACCOMPANYING CIRCUIT.

	UNIT #1	UNIT #2	
HEATER VOLTAGE	4.2	4.2	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PEAK HEATER CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	1	250	VOLTS
PLATE SUPPLY VOLTAGE	250	250	VOLTS
PLATE VOLTAGE	135	115	VOLTS
GRID VOLTAGE	−1	---	VOLTS
GRID RESISTOR	---	0.5	MEGOHM
PLATE CURRENT	10	10	MA.
GRID CURRENT	0	0	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−14	---	VOLTS

TUNG-SOL

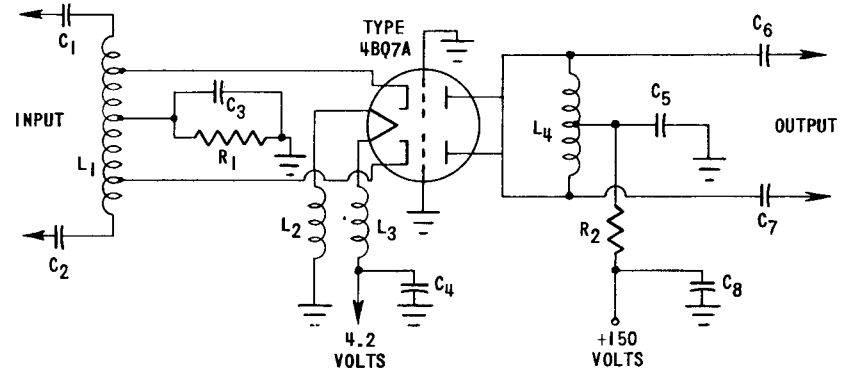


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

L1, L2: BIFILAR CHOKES, EACH 10 TURNS NO. 18 ENAMEL WIRE 1/4" COIL FORM
L3: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES. TO DETERMINE TAP POINT, TAP DOWN TO 80 TO 90% OF TOTAL NUMBER OF TURNS

R1: 10000 OHMS, 0.5 WATT
R2: 100 OHMS, 0.5 WATT
R3: 500000 OHMS, 0.5 WATT
R4: 100 OHMS, 0.5 WATT
T1: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES.

DRIVEN RF-GROUNDED GRID AMPLIFIER CIRCUIT WITH DIRECT COUPLED DRIVE



C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT

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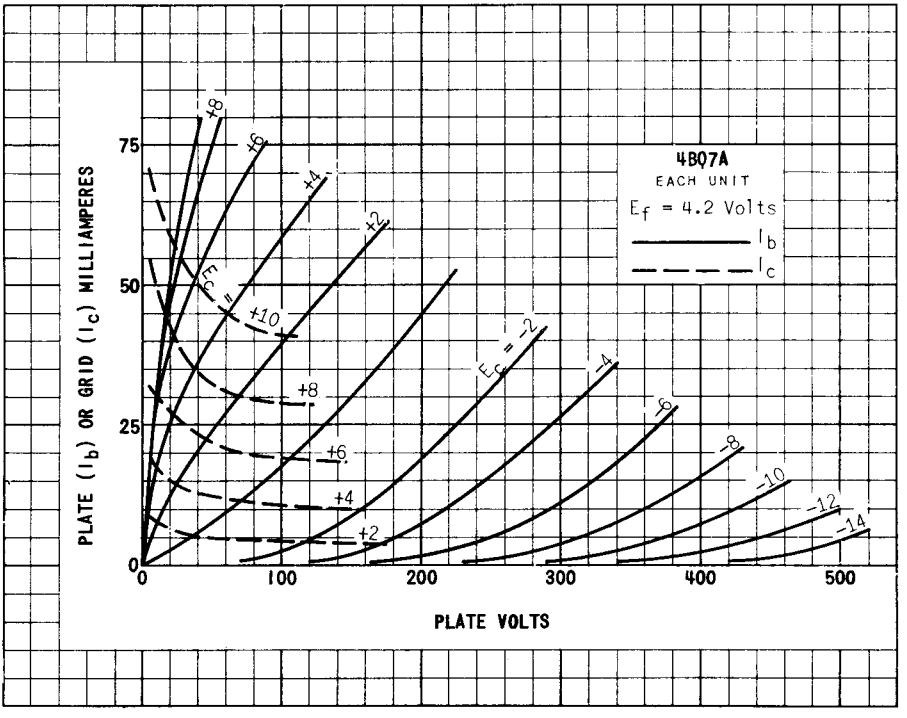
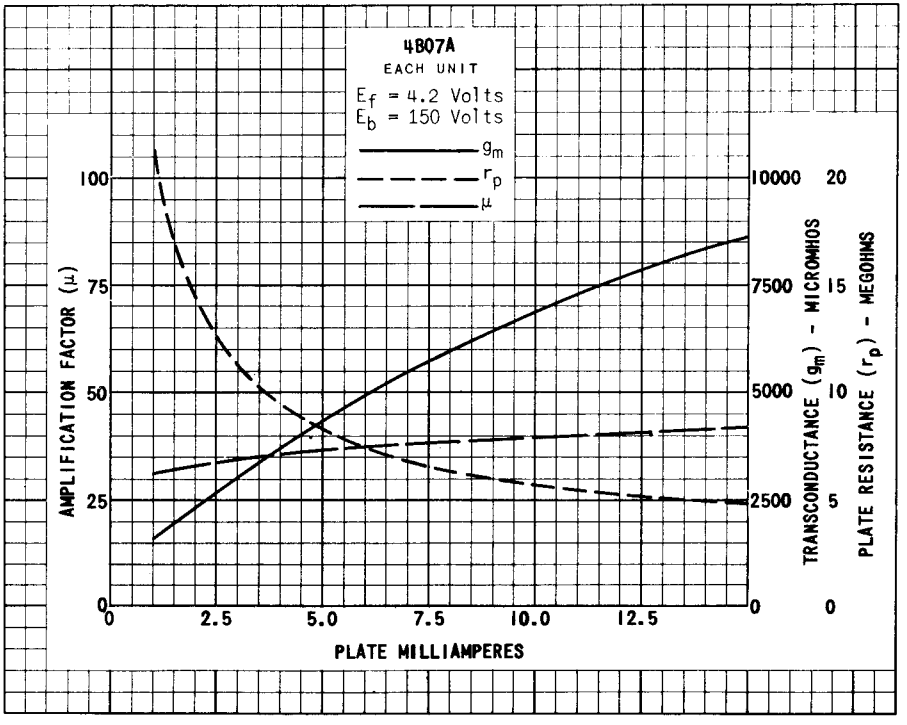
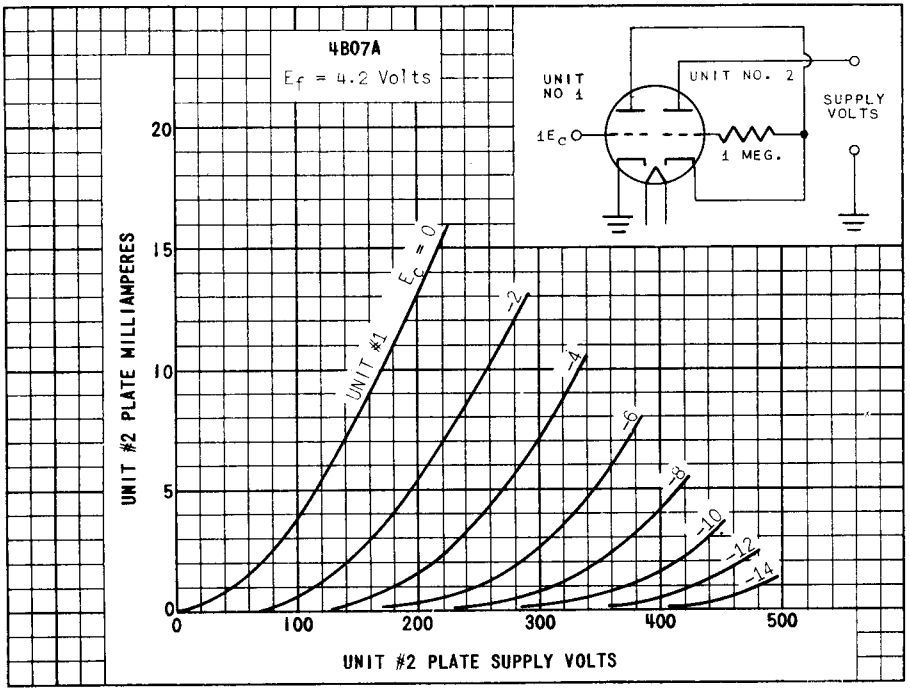
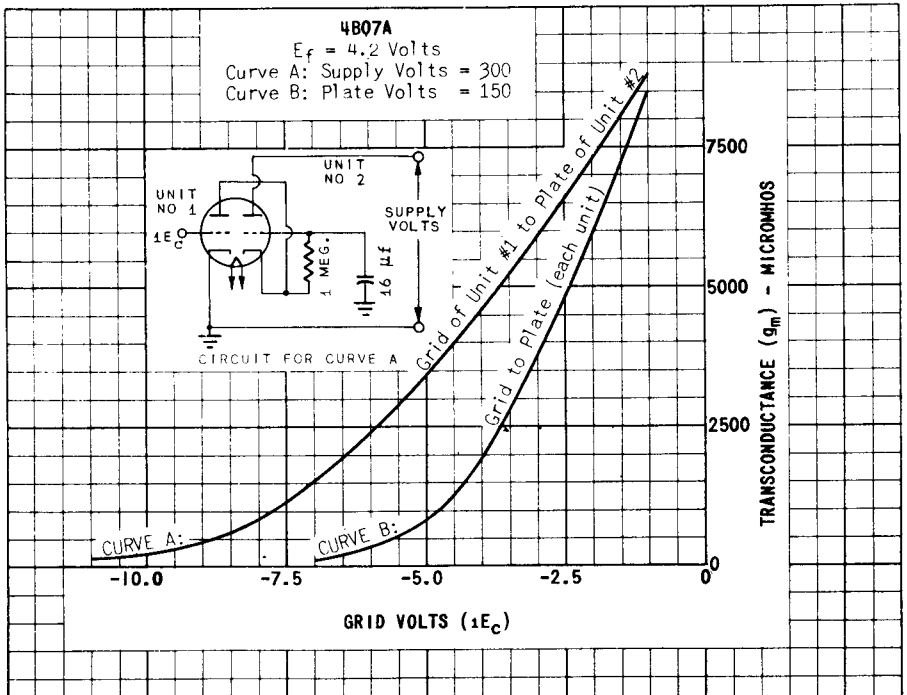
4BQ7A


4BQ7A
EACH UNIT
E_f = 4.2 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
E_c = +8
+6
+4
+2
0
+10
+8
+6
+4
+2
E_c = −2
−4
−6
−8
−10
−12
−14
0
25
50
75
0
100
200
300
400
500


4BQ7A
EACH UNIT
E_f = 4.2 Volts
E_b = 150 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - MEGOHMS
PLATE MILLIAMPERES
0
25
50
75
100
2500
5000
7500
10000
0
5
10
15
20
0
2.5
5.0
7.5
10.0
12.5





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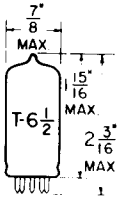
TUNG-SOL

TWIN TRIODE

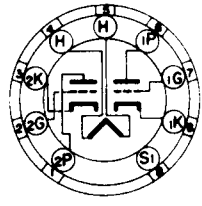
MINIATURE TYPE
COATED UNIPOTENTIAL CATHODE

HEATER
4.5 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON NOVAL
9 PIN BASE
9AU

THE 4BS8 IS A 9-PIN MINIATURE TWIN TRIODE DESIGNED FOR USE AS A LOW-NOISE VHF AMPLIFIER IN CASCODE OPERATION. THIS TYPE HAS HIGH GAIN AND HIGH CASCODE TRANSCONDUCTANCE. IT IS DESIGNED FOR OPERATION WITH SECTION 2 (PINS 1, 2, AND 3) AS INPUT SECTION OF THE CASCODE CIRCUIT. THERMAL CHAPACTERISTICS OF THE HEATER HAVE BEEN CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER WARM-UP TIME AND HEATER RATINGS, IT IS IDENTICAL TO THE 6BS8.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD #315

	UNIT 1	UNIT 2	
GRID TO PLATE	1.15	1.15	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.60	2.6	μμf
INPUT	2.60		μμf
OUTPUT	1.2		μμf
PLATE OF UNIT 1 TO PLATE OF UNIT 2 (MAX.)		0.010	μμf
PLATE OF UNIT 2 TO PLATE AND GRID OF UNIT 1 (MAX.)		0.024	μμf
GROUNDED GRID OPERATION:			
INPUT		5.0	μμf
OUTPUT		2.2	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER -EACH UNIT

HEATER VOLTAGE	4.5	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM CIRCUIT VALUE: (EACH UNIT)		
GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	4.5	VOLTS
HEATER CURRENT	0.6	AMPERE
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE	5000	OHMS
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	-7 (SEC. 2 ONLY)	VOLTS
TRANSCONDUCTANCE	7200	μMHOS

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TYPICAL CASCODE CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	4.5	VOLTS
HEATER CURRENT	0.6	AMPERE
PLATE SUPPLY VOLTAGE	250	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	16	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-6	VOLTS
TRANSCONDUCTANCE	10 000	μMHOS

→ INDICATES A CHANGE.

TUNG-SOL

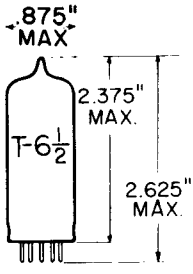
TWIN PENTODE

MINIATURE TYPE

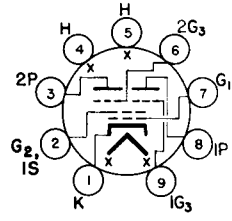
COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 4BU8 IS A MINIATURE MULTISECTION TUBE WHICH INCORPORATES SEPARATE PLATES AND NUMBER 3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, NUMBER 1 GRID, AND CATHODE. THE TUBE IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. IN THIS SERVICE, WHEN USED IN CONJUNCTION WITH SUITABLE CIRCUITRY, ONE SECTION OF THE 4BU8 FUNCTIONS AS SYNC SEPARATOR AND SYNC CLIPPER, WHILE THE OTHER SECTION IS USED TO GENERATE THE AUTOMATIC-GAIN-CONTROL VOLTAGE. IN ADDITION, BY UTILIZING THE COMMON, #1 GRID, NOISE PULSES CAN BE SUPPRESSED FROM BOTH SYNCHRONIZING AND AUTOMATIC-GAIN-CONTROL CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS THE 4BU8 IS IDENTICAL TO THE 6BU8.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, (EACH SECTION)	1.9	pf
GRID #1 TO ALL	6.0	pf
GRID #3 TO ALL (EACH SECTION)	3.6	pf
PLATE TO ALL (EACH SECTION)	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2) MAX.	0.015	pf

RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.

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→ INDICATES A CHANGE.

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RATINGS – CONT'D

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHMS
HEATER WARM–UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	**	**	
PLATE CURRENT (EACH SECTION)		2.2	MA.
SCREEN CURRENT	6.5	3.3	MA.
CATHODE CURRENT	6.6	7.8	MA.

EACH SECTION SEPARATELY [A]

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	**	VOLTS
GRID #3 TRANSCONDUCTANCE	---	180	μMHOS
GRID #1 TRANSCONDUCTANCE	1 500	---	μMHOS
PLATE CURRENT	---	2.2	MA.
GRID #3 VOLTAGE (APPROX.) I_b=100μAMPS	---	-4.5	VOLTS
GRID #1 VOLTAGE (APPROX.) I_b=100μAMPS	---	2.3	VOLTS

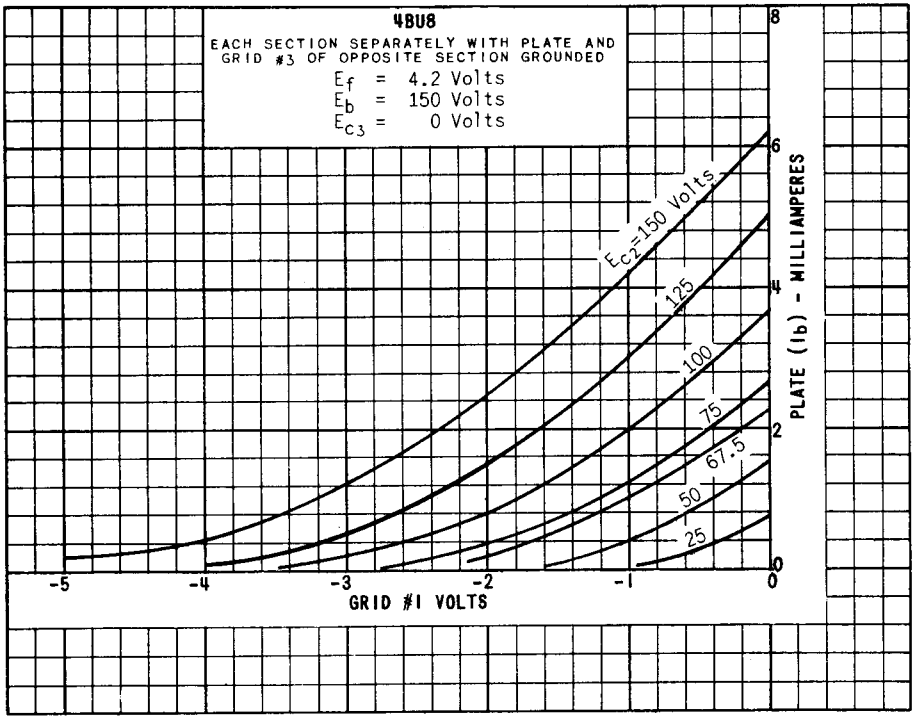
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

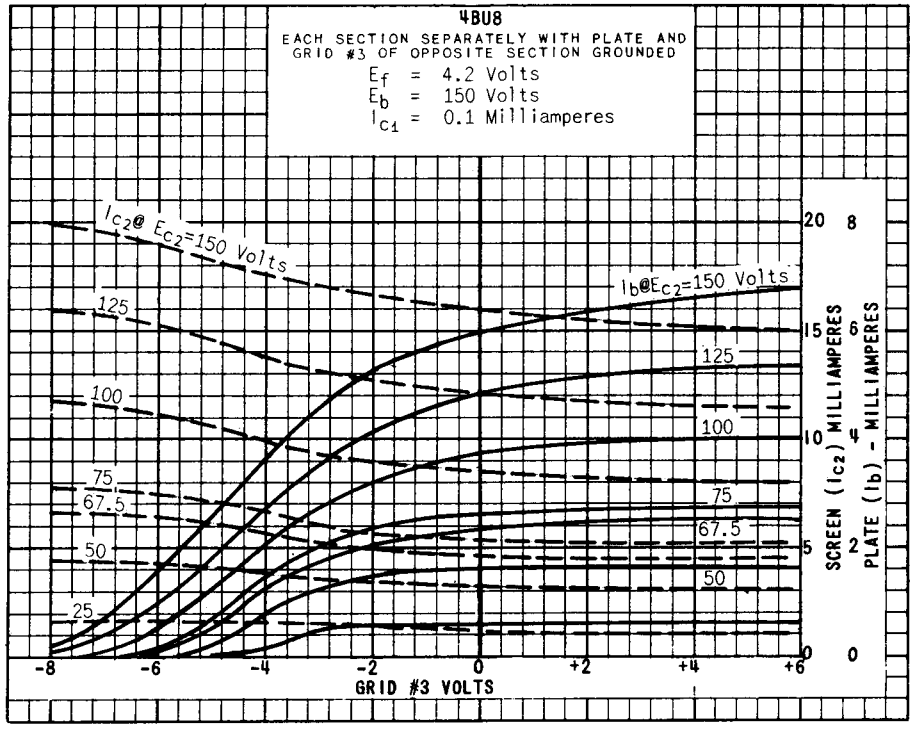
**WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

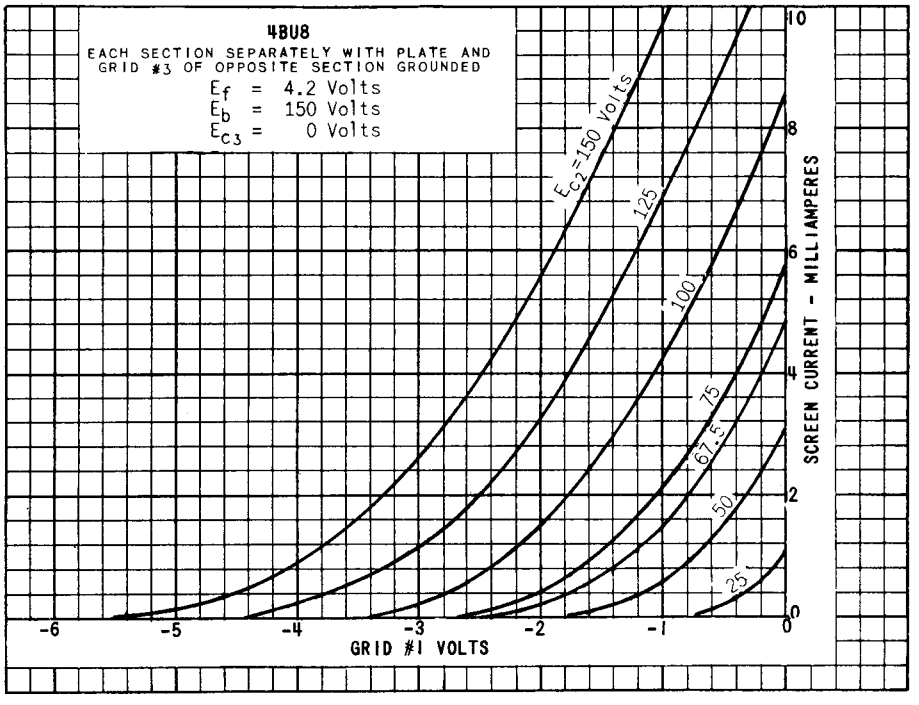
[A]WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

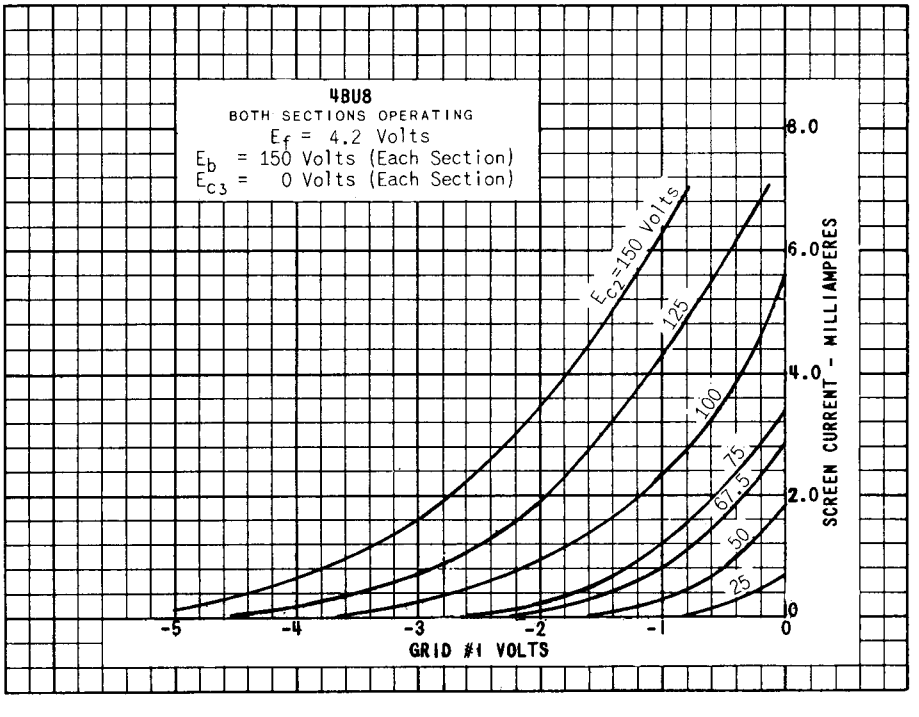
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

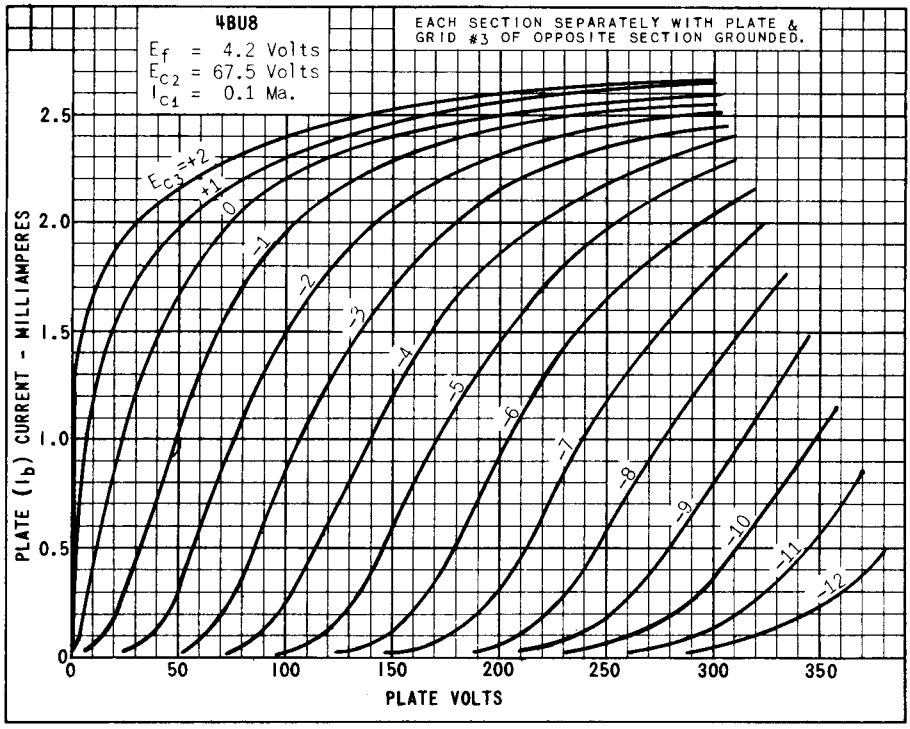
SIMILAR TYPE REFERENCE: Except for heater ratings the 4BU8 is identical to the 6BU8.

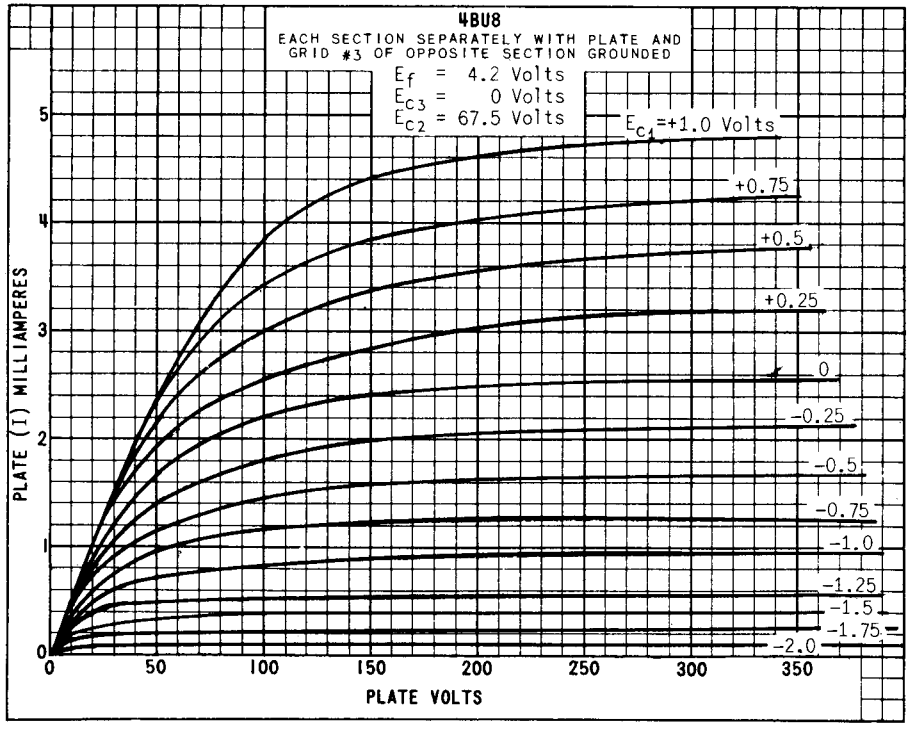

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
PLATE (Ib) - MILLIAMPERES
GRID #1 VOLTS
-5
-4
-3
-2
-1
0
2
4
6
8

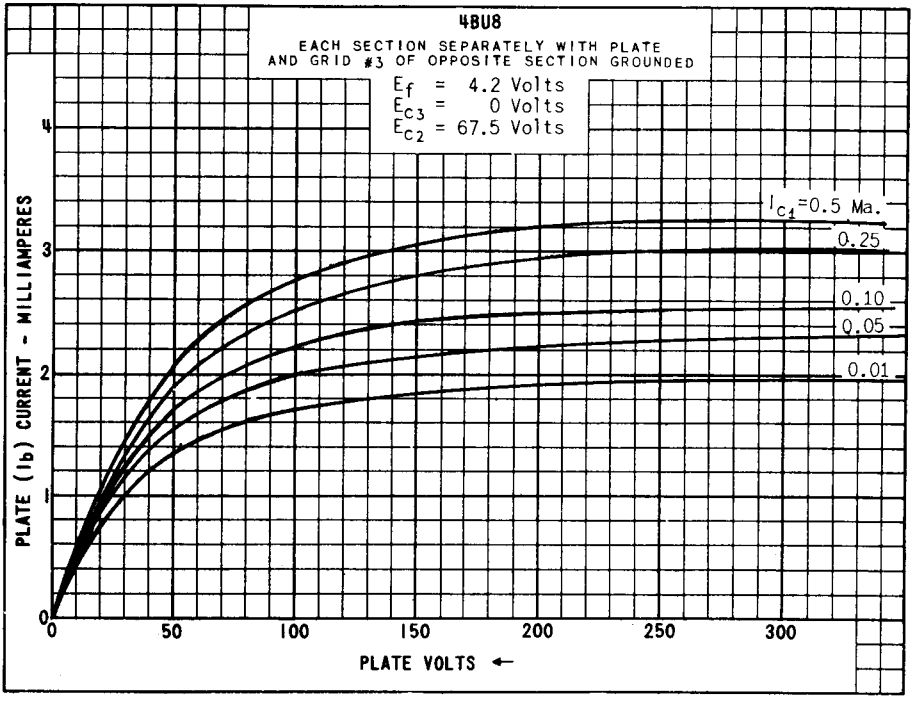

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_b = 150 Volts
I_{c1} = 0.1 Milliamperes
I_{c2}@ E_{c2}=150 Volts
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN (I_{c2}) MILLIAMPERES
PLATE (Ib) - MILLIAMPERES
GRID #3 VOLTS
-8
-6
-4
-2
0
+2
+4
+6
0
5
10
15
20
2
4
6
8

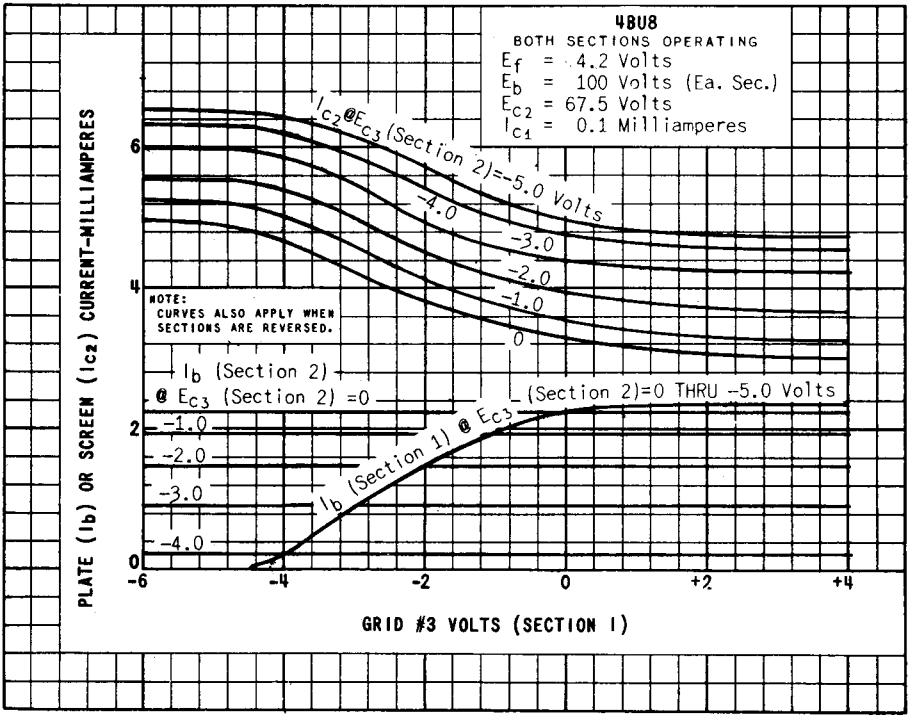

4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10

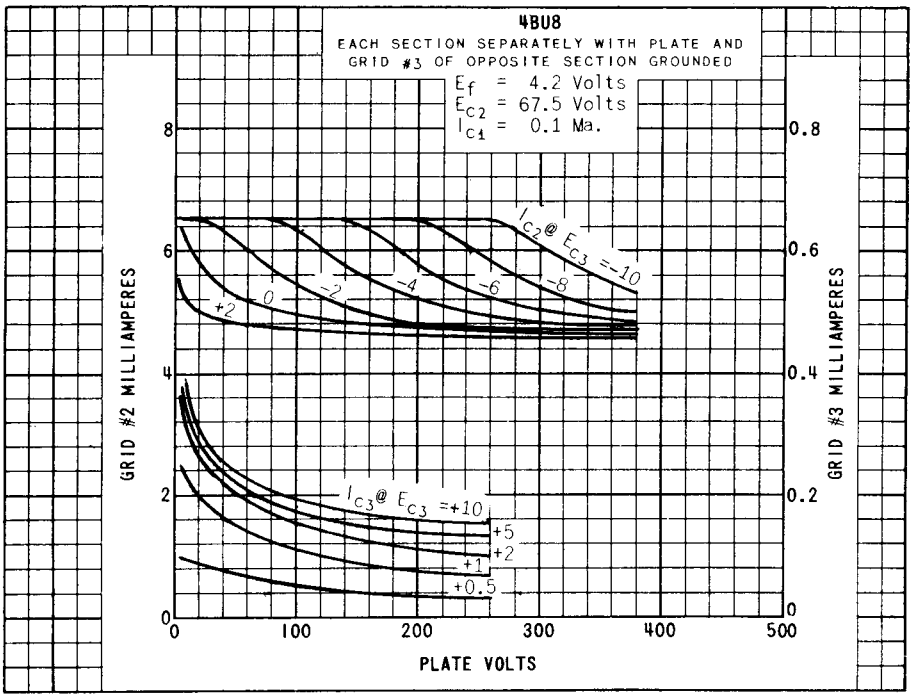

4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-5
-4
-3
-2
-1
0
2.0
4.0
6.0
8.0

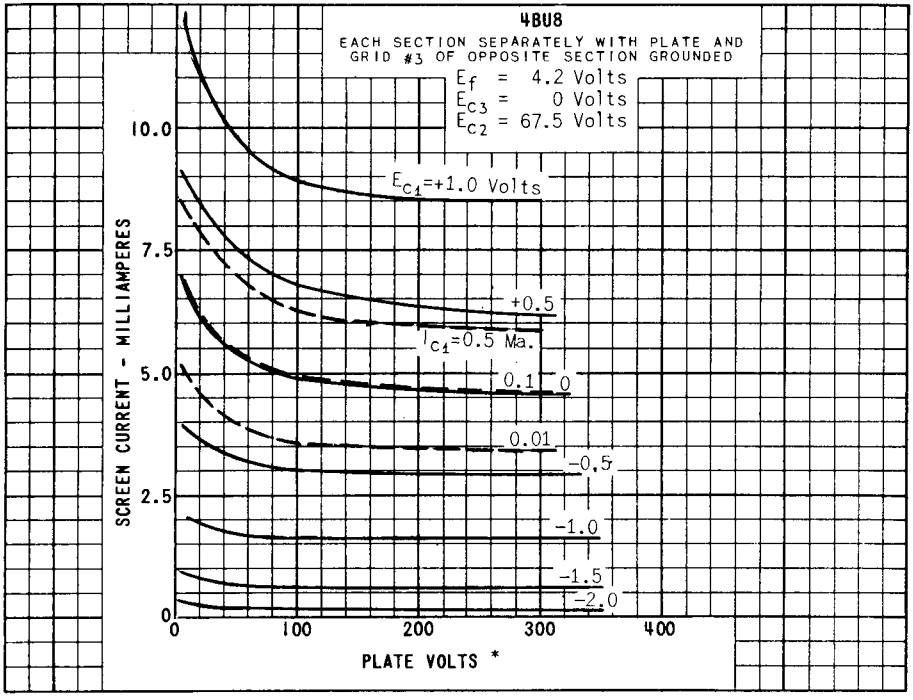

4BU8
E_f = 4.2 Volts
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Ma.
EACH SECTION SEPARATELY WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED.
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS
E_{c3}=+2
+1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12


4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
E_{c1}=+1.0 Volts
+0.75
+0.5
+0.25
0
-0.25
-0.5
-0.75
-1.0
-1.25
-1.5
-1.75
-2.0
PLATE (I) MILLIAMPERES
PLATE VOLTS


4BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 4.2 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (I_b) CURRENT - MILLIAMPERES
PLATE VOLTS


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Milliamperes
I_{c2}@E_{c3} (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE: CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
I_b (Section 2) @ E_{c3} (Section 2) =0
I_b (Section 1) @ E_{c3} (Section 2)=0 THRU -5.0 Volts
-1.0
-2.0
-3.0
-4.0
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)





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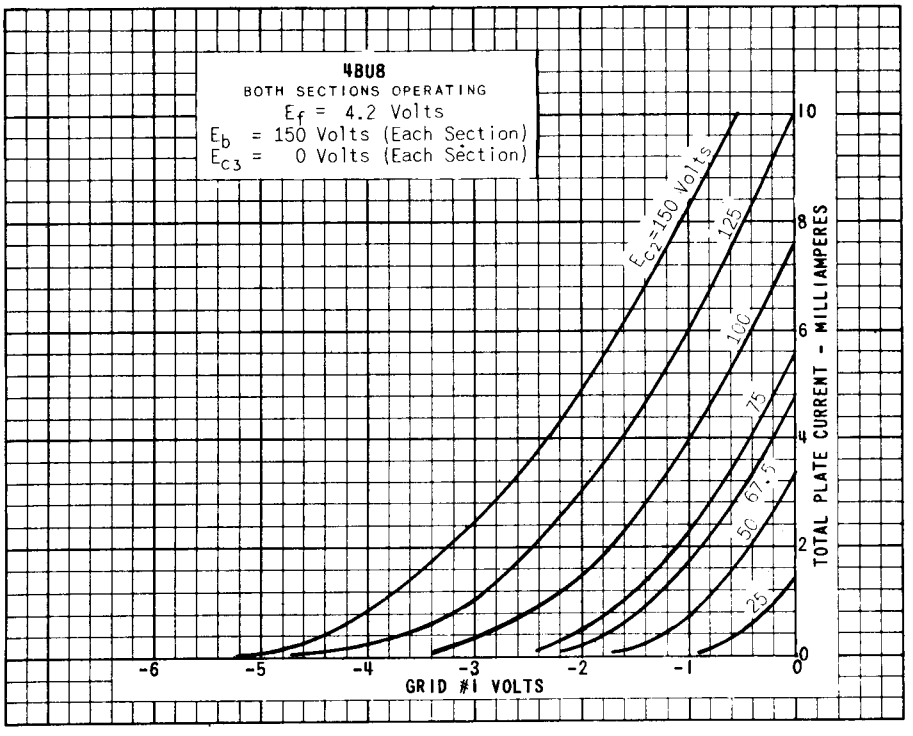
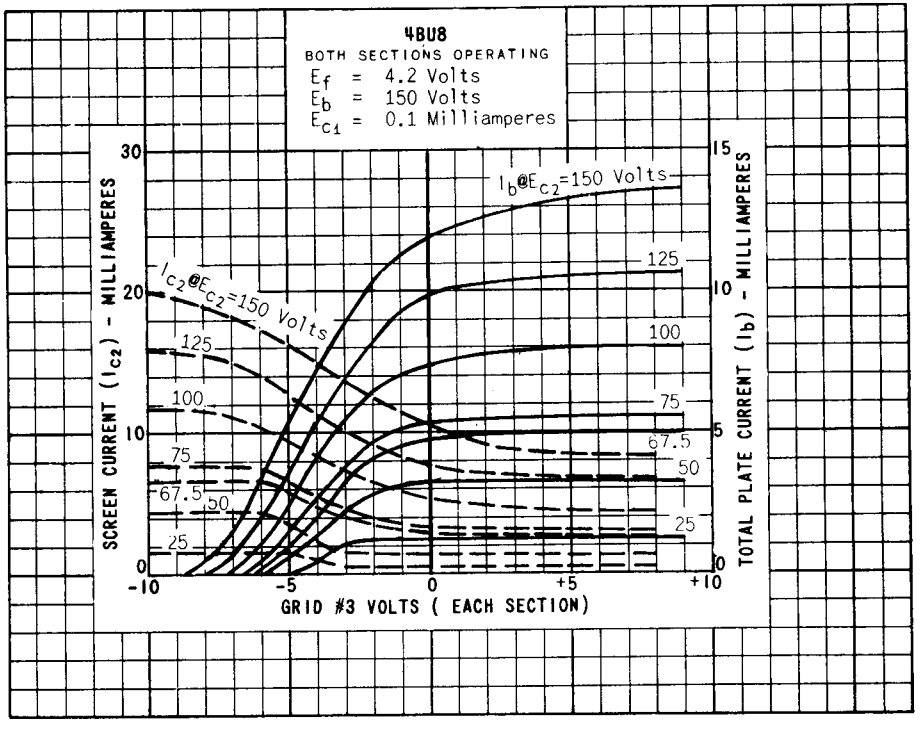
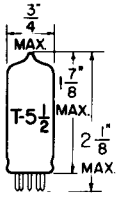

4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10


4BU8
BOTH SECTIONS OPERATING
E_f = 4.2 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
125
100
75
67.5
50
25
I_{c2}@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
GRID #3 VOLTS (EACH SECTION)
-10
-5
0
+5
+10
0
10
20
30
0
5
10
15

TUNG-SOL

PENTODE

MINIATURE TYPE

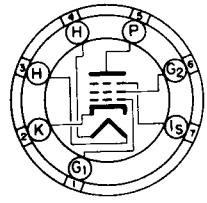


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 4BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.0	7.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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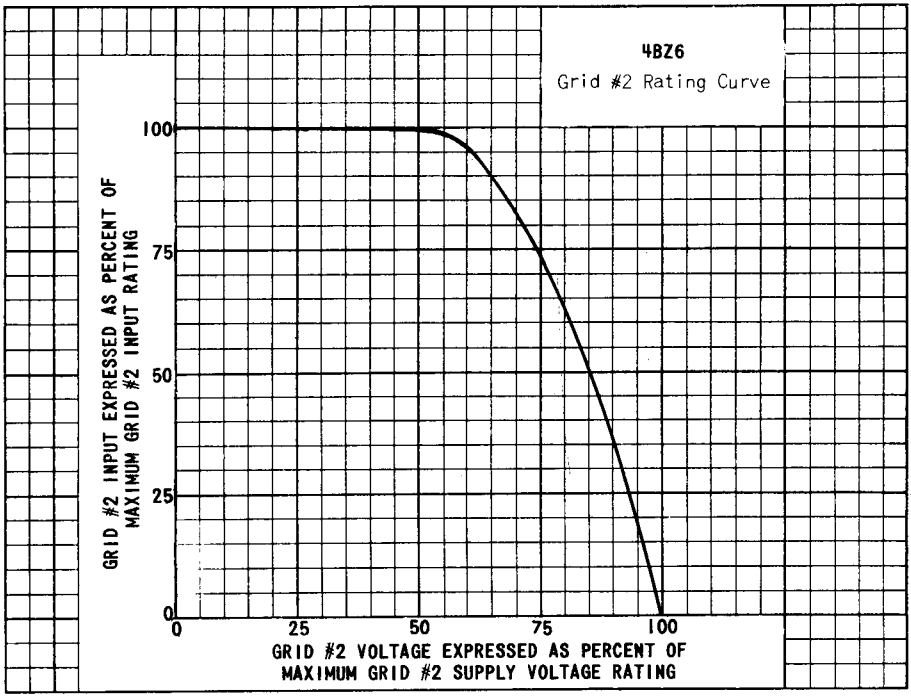
CONTINUED FROM PRECEDING PAGE

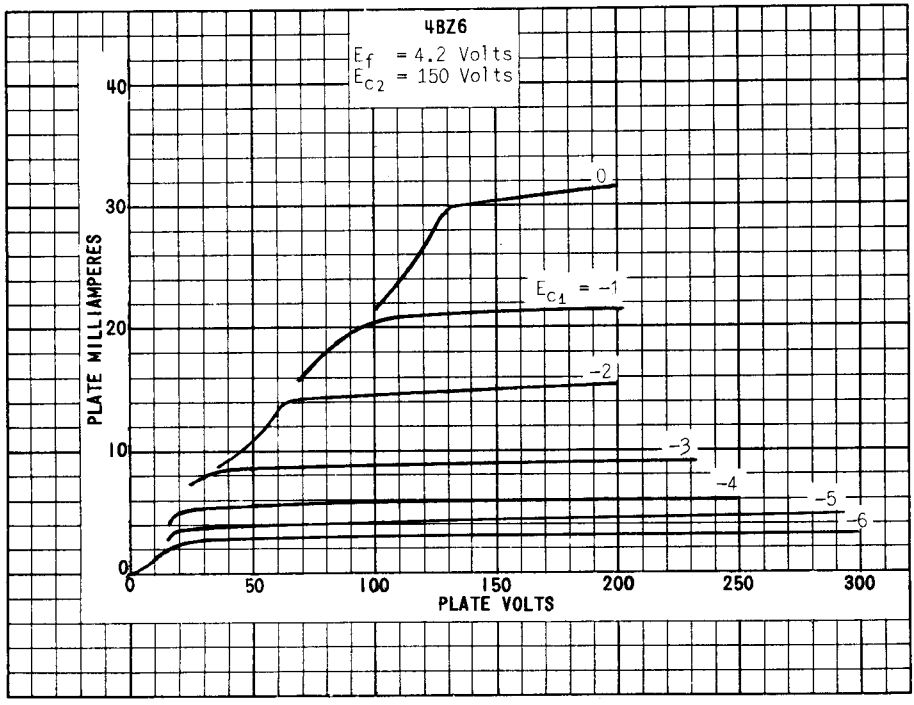
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE		4.2	VOLTS
HEATER CURRENT		0.45±6%	AMP.
PLATE VOLTAGE		125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
CATHODE BIAS RESISTOR		56	OHMS
PLATE RESISTANCE (APPROX.)		0.26	MEGOHM
TRANSCONDUCTANCE		8 000	μMHOS
PLATE CURRENT		14	MA.
GRID #2 CURRENT		3.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS		−19	VOLTS
TRANSCONDUCTANCE (E_{c1}=−4.5 V., R_k=0)		700	μMHOS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.





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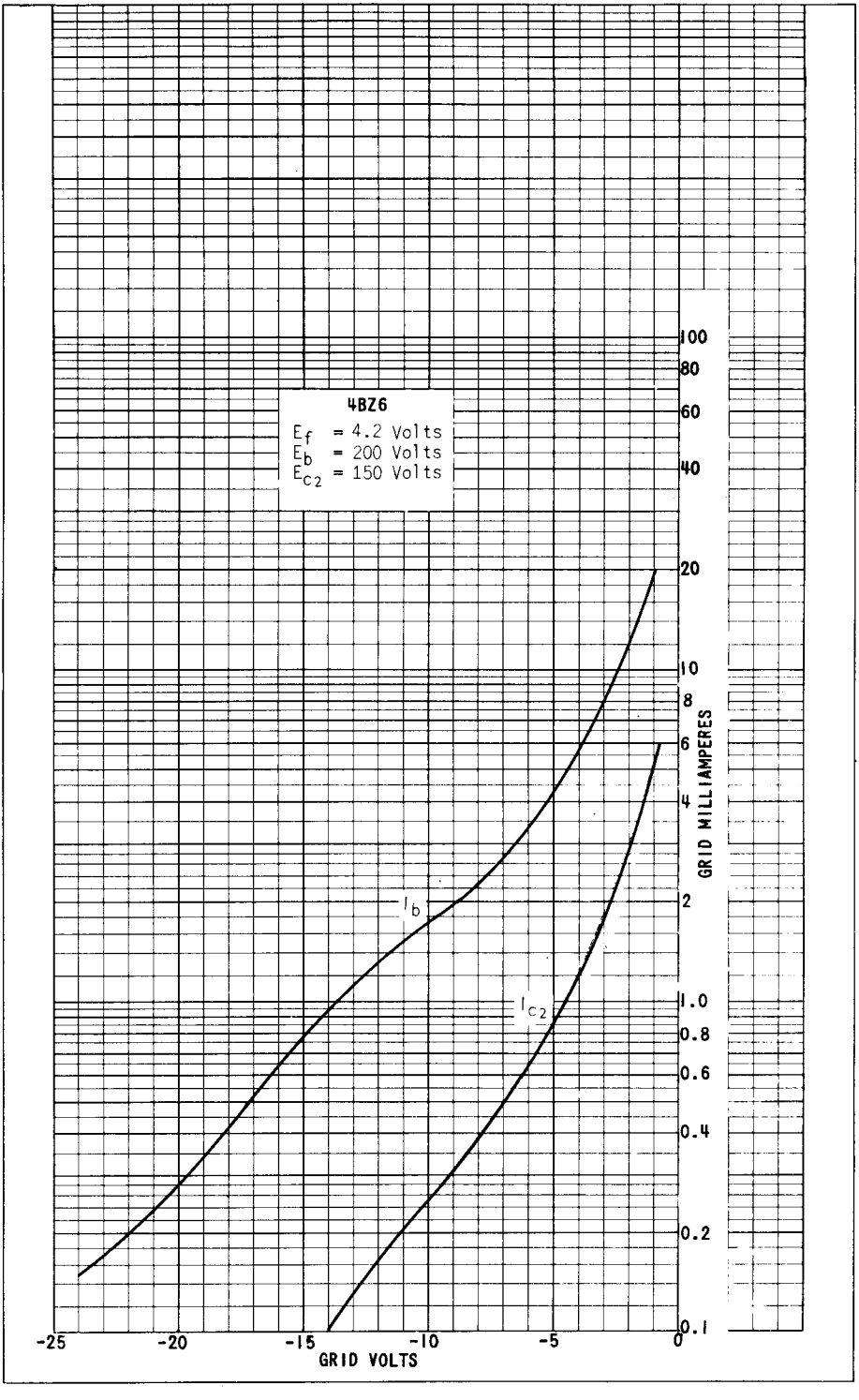
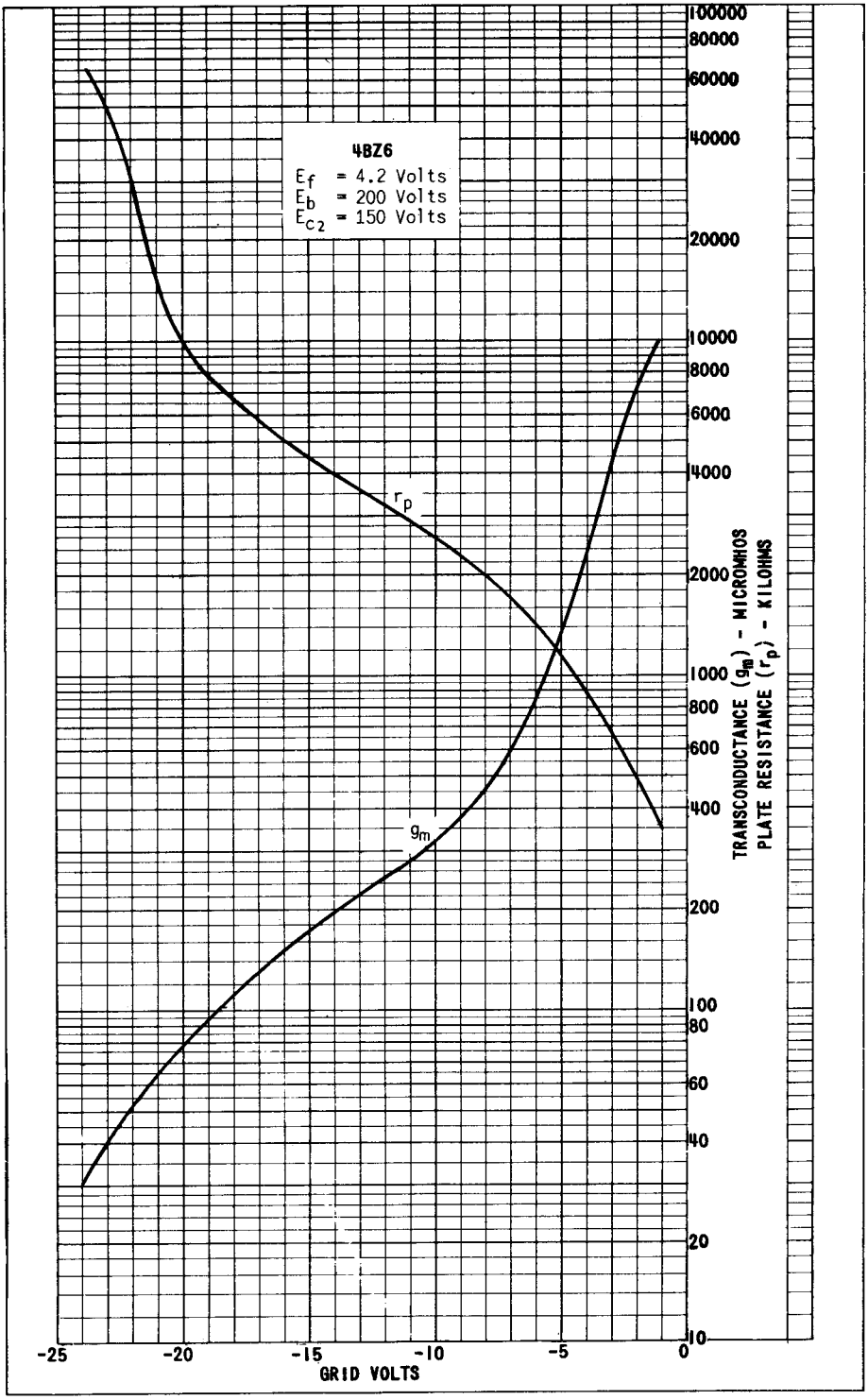
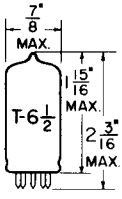

4BZ6
E_f = 4.2 Volts
E_b = 200 Volts
E_{c_2} = 150 Volts
I_b
I_{c_2}
100
80
60
40
20
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.1
GRID MILLIAMPERES
-25
-20
-15
-10
-5
0
GRID VOLTS


4BZ6
E_f = 4.2 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
r_p
g_m
100000
80000
60000
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
80
60
40
20
10
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

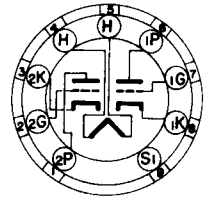


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

THE 4BZ7 IS A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS AND IS INTENDED FOR SERVICE IN LOW NOISE VHF CASCODE AMPLIFIER APPLICATIONS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ7.

DIRECT INTERELECTRODE CAPACITANCES

WITH RETMA SHIELD #315

	TRIODE UNIT #1		TRIODE UNIT #2	
GRID TO PLATE	1.15		1.15	μμf
INPUT	2.85		---	μμf
INPUT (GROUNDED GRID)	---		4.95	μμf
OUTPUT	1.35		---	μμf
OUTPUT (GROUNDED GRID)	---		2.27	μμf
PLATE TO CATHODE (MAX.)	0.15		0.15	μμf
HEATER TO CATHODE	2.20		2.30	μμf
PLATE UNIT #1 TO PLATE UNIT #2 (MAX.)		0.01		μμf
PLATE UNIT #2 TO PLATE & GRID UNIT #1 (MAX.)		0.024		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	5 600	OHMS
TRANSCONDUCTANCE	6 800	µMHOS
PLATE CURRENT	10	MA.
GRID VOLTAGE FOR PLATE CURRENT OF 10 MA. (APPROX.)	11	VOLTS

TUNG-SOL

PENTODE

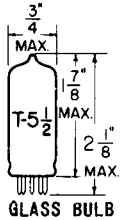
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

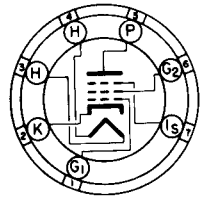
HEATER

4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BUB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

7CM

THE 4CB6 IS A SHARP CUT-OFF PENTODE USING THE SMALL BUTTON SEVEN PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 450 MA. SERIES HEATER OPERATED RECEIVERS AS AN IF AMPLIFIER OPERATING AT FREQUENCIES ABOVE 20 MC. IT IS ALSO WELL SUITED FOR USE AS AN RF AMPLIFIER IN VHF TELEVISION RECEIVERS. IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW CAPACITANCE VALUES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH EXCEPTION OF HEATER RATINGS ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CB6.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.025	.015	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	2.0	3.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE ●		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

● DC COMPONENT MUST NOT EXCEED 200 VOLTS.

→ INDICATES A CHANGE.

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TUNG-SOL

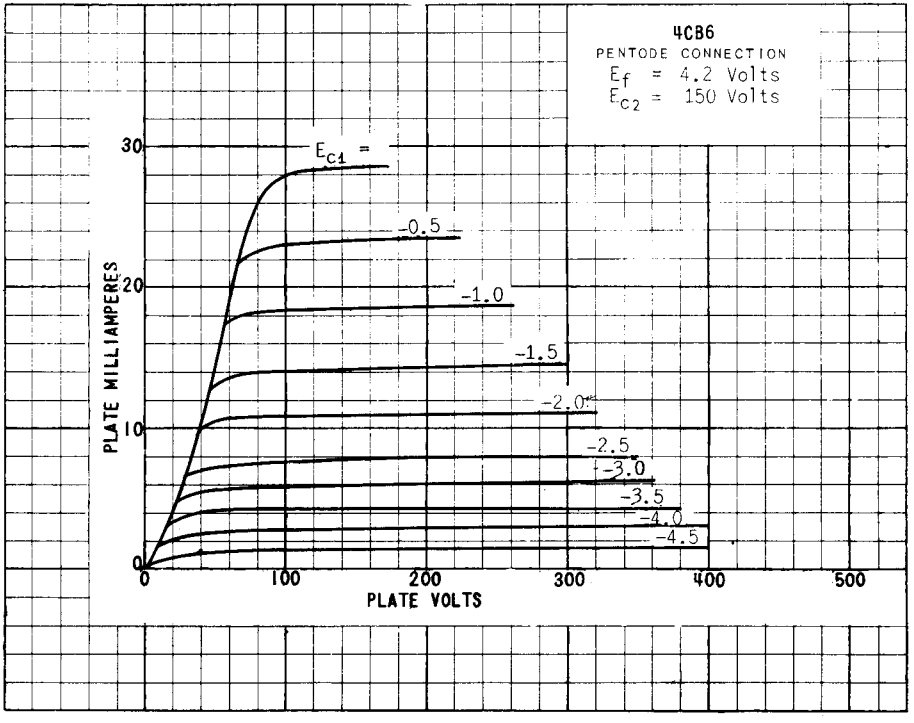
CONTINUED FROM PRECEDING PAGE

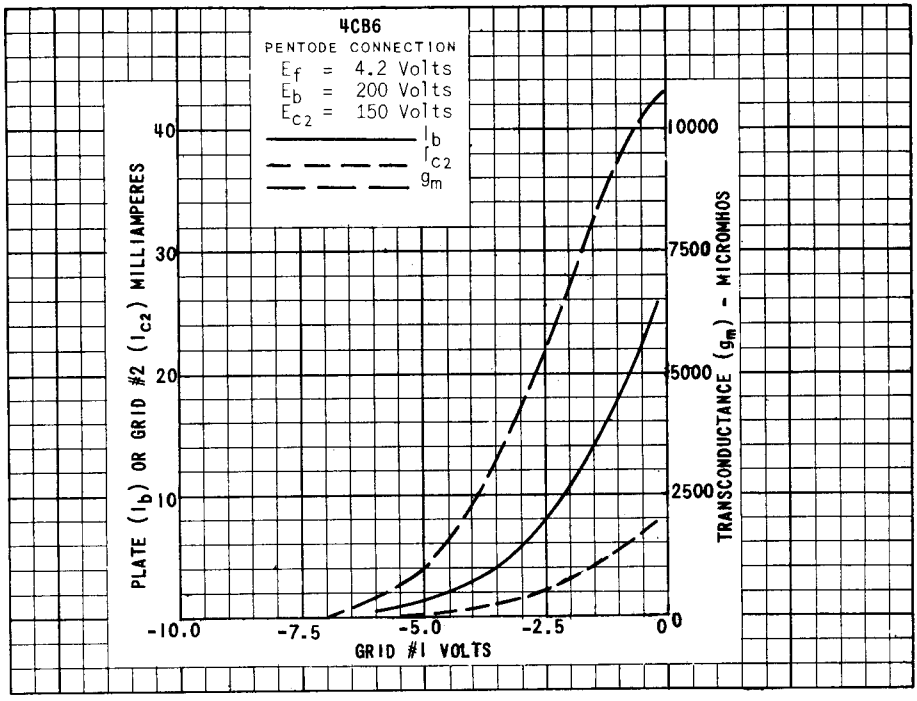
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE		
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.28	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	13.0	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b=20 μA.	−6.5	VOLTS
PLATE CURRENT AT E_{c1}=−3V., R_k=0	2.8	MA.

B DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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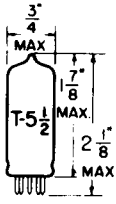
TUNG-SOL

HEPTODE

MINIATURE TYPE

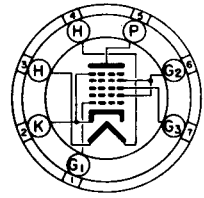


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.2 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 4CS6 IS A MINIATURE DUAL CONTROL PENTAGRID TUBE INTENDED FOR USE IN SYNC SEPARATOR CIRCUITS. IN THESE CIRCUITS IT PROVIDES IMPROVED NOISE IMMUNITY. BOTH CONTROL GRIDS HAVE SHARP CUT-OFF CHARACTERISTICS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE: G_1 TO P (MAX.)	0.05	μμf
GRID #3 TO PLATE: G_3 TO P (MAX)	0.36	μμf
#1 INPUT: G_1 TO (H+K+G_2+$G_{3\&5}$)	5.5	μμf
#3 INPUT: G_3 TO (H+K+G_1+$G_{2\&5}$)	7.0	μμf
OUTPUT: P TO (H+K+G_1+G_2+$G_{3\&5}$)	7.5	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.22	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & #4 DISSIPATION	1.0	WATT
MAXIMUM CATHODE CURRENT	14	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS
HEATER WARM-UP TIME*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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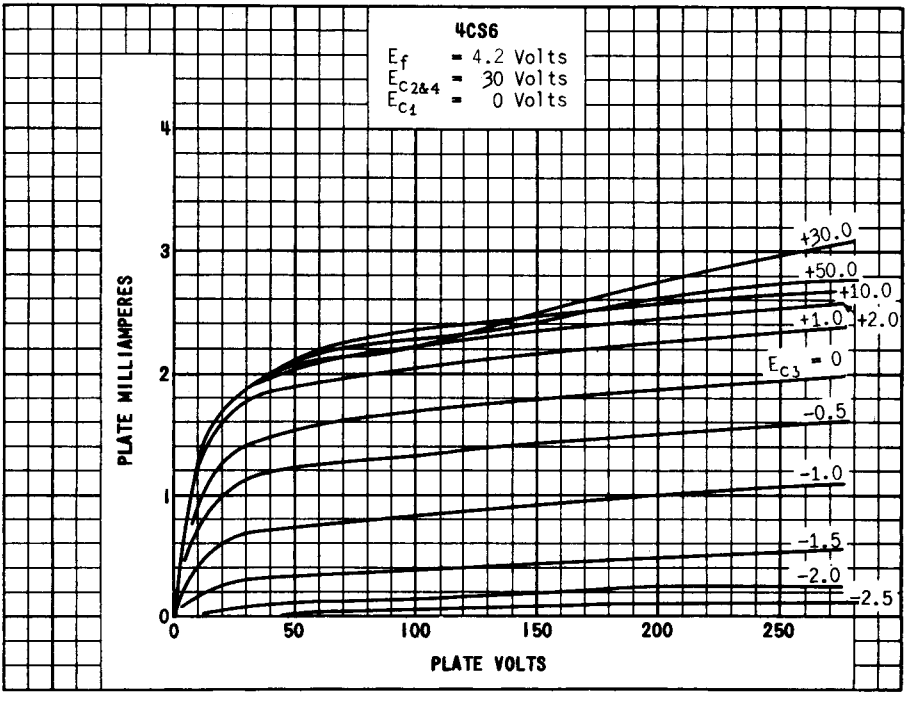
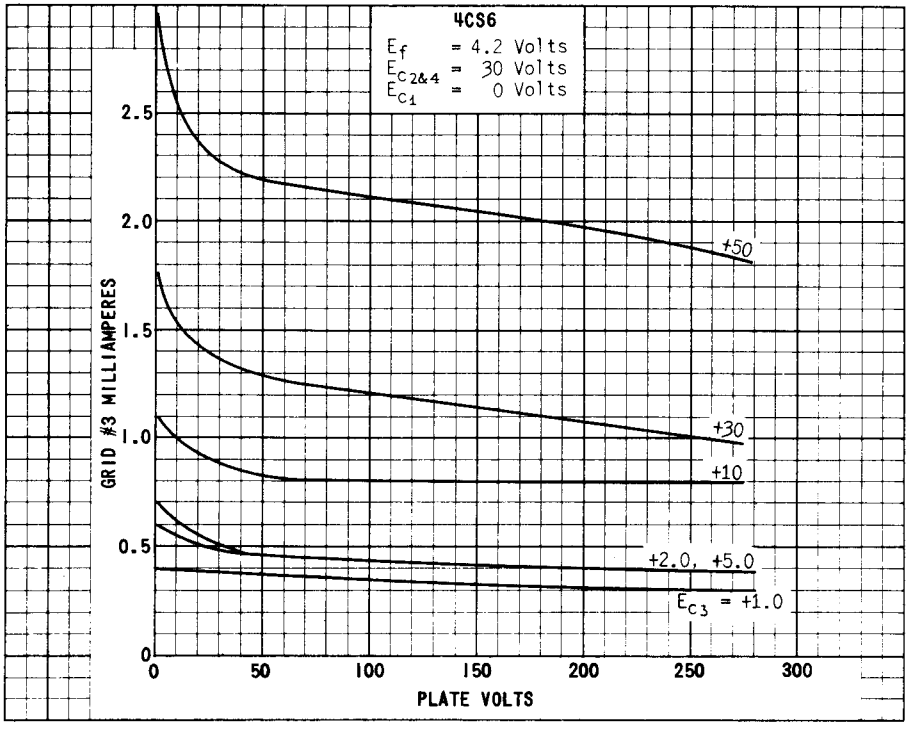
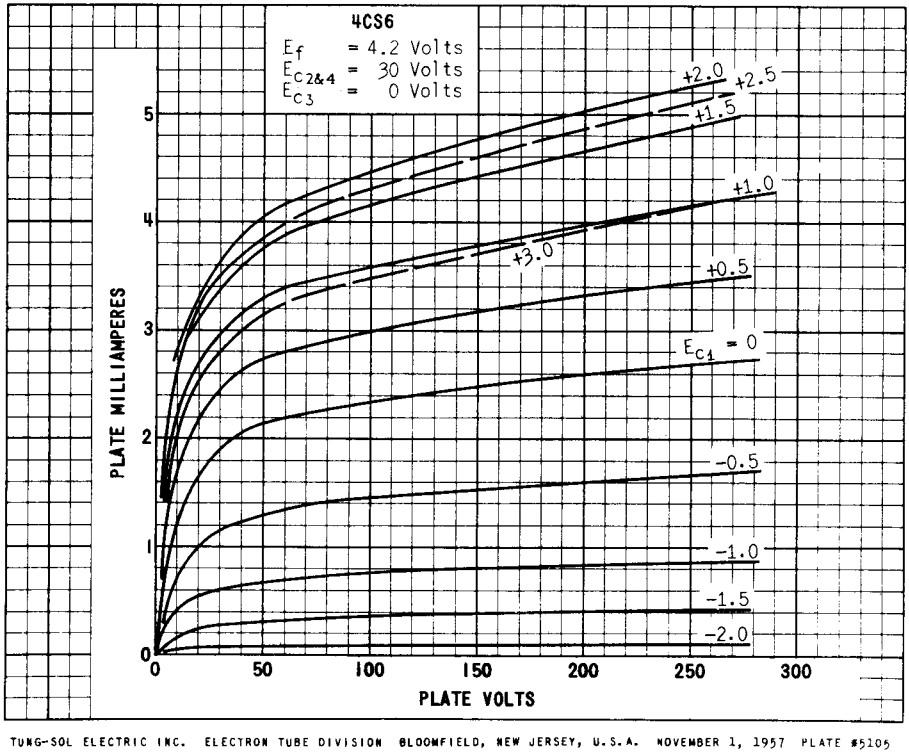
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

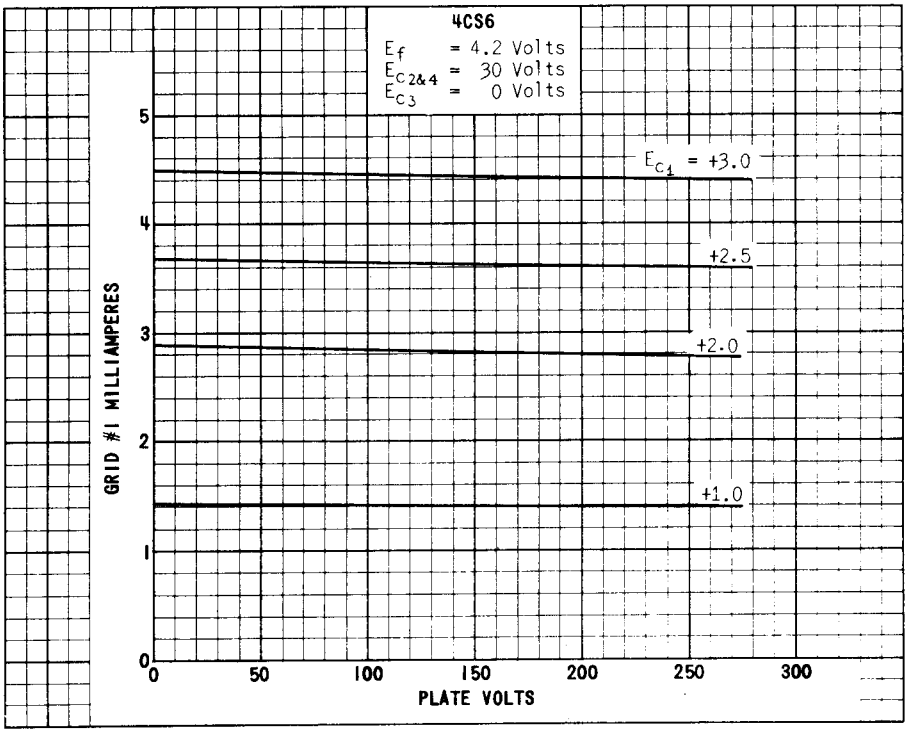
CLASS A_1 AMPLIFIER

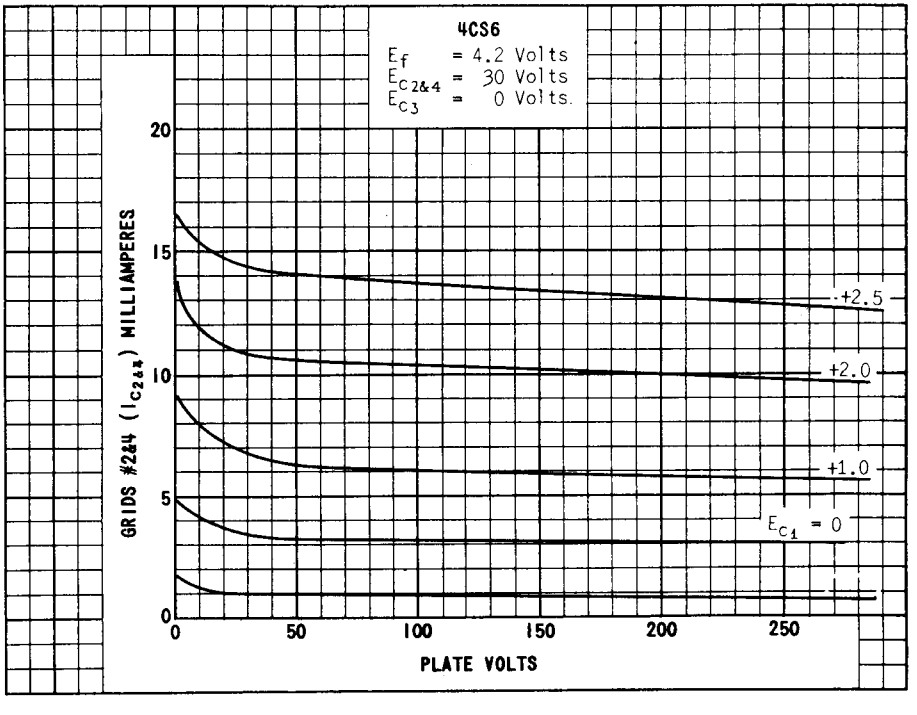
HEATER VOLTAGE	4.2	4.2	4.2	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-1	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 AND PLATE)	---	---	1 100	μMHOS
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #3 AND PLATE)	---	500	---	μMHOS
PLATE RESISTANCE (APPROX.)	---	0.7	1.0	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b=50 μA	---	---	-2.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR I_b=50 μA	---	-2.2	---	VOLTS

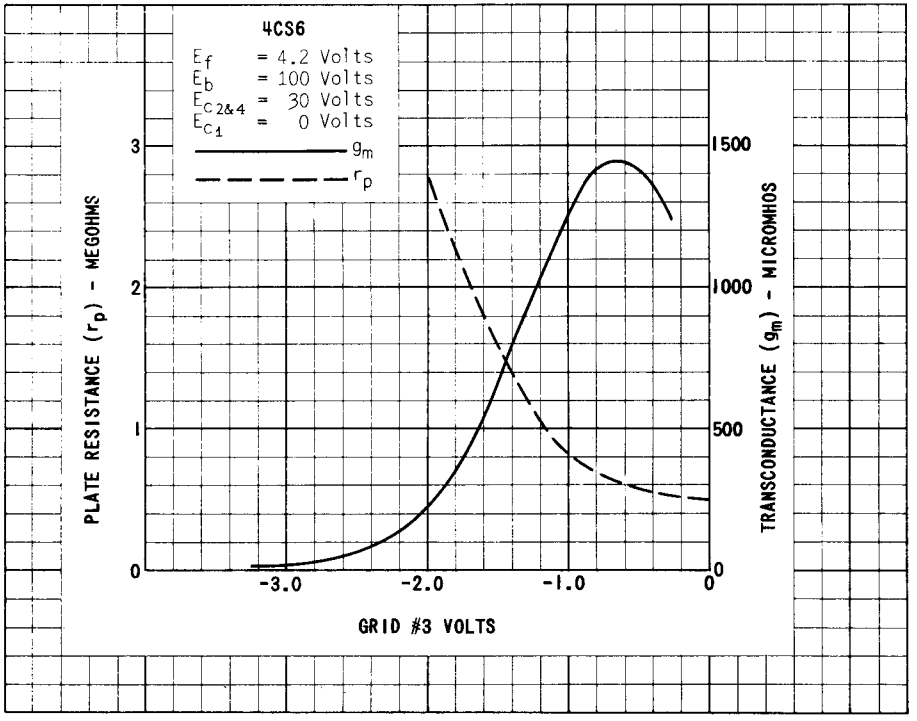


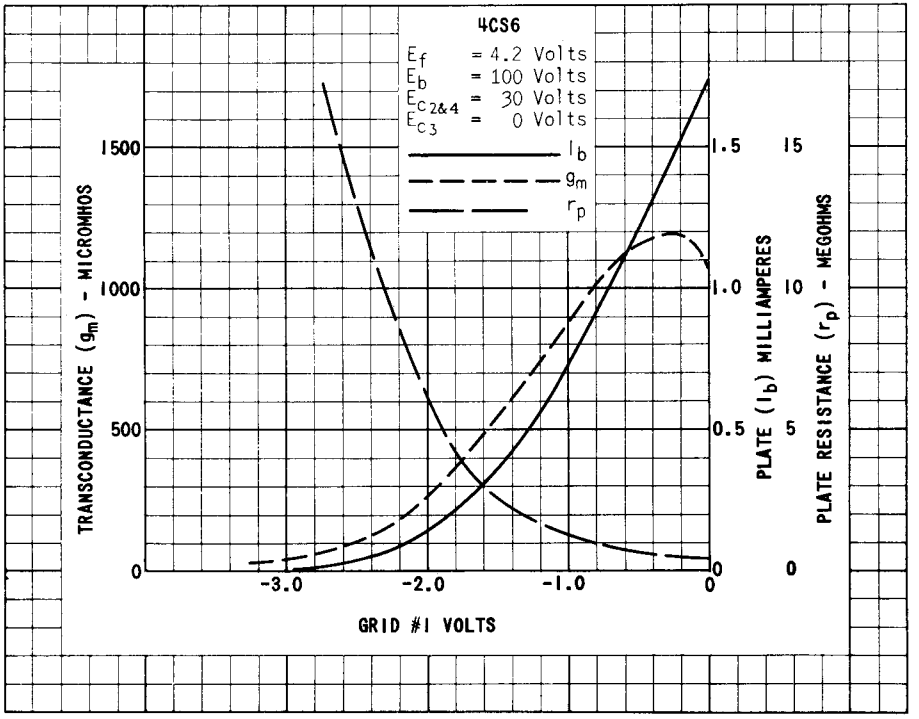

4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
GRID #3 MILLIAMPERES
2.5
2.0
1.5
1.0
0.5
0
+50
+30
+10
+2.0, +5.0
E_{c3} = +1.0
0
50
100
150
200
250
300
PLATE VOLTS


4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
5
4
3
2
1
0
+2.0
+2.5
+1.5
+1.0
+3.0
+0.5
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
0
50
100
150
200
250
300
PLATE VOLTS

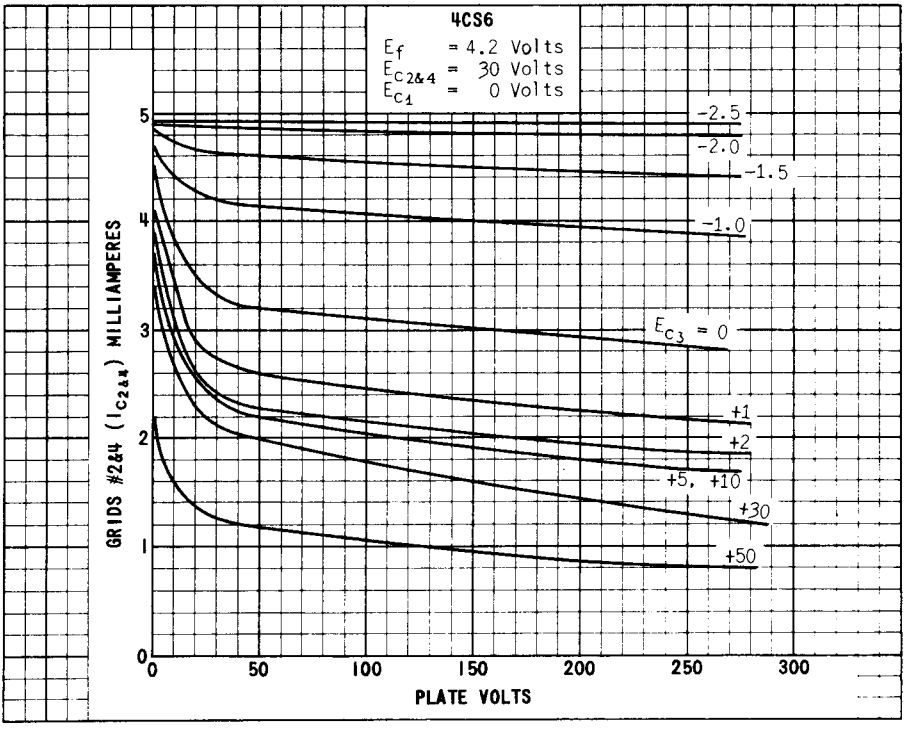

4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
E_{c1} = +3.0
+2.5
+2.0
+1.0
GRID #1 MILLIAMPERES
0
1
2
3
4
5
0
50
100
150
200
250
300
PLATE VOLTS


4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts.
+2.5
+2.0
+1.0
E_{c1} = 0
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
0
5
10
15
20
0
50
100
150
200
250
PLATE VOLTS


4CS6
E_f = 4.2 Volts
E_b = 100 Volts
$E_{c2\&4}$ = 30 Volts
E_{c_1} = 0 Volts
g_m
r_p
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID #3 VOLTS
0
1
2
3
500
1000
1500
-3.0
-2.0
-1.0
0


4CS6
E_f = 4.2 Volts
E_b = 100 Volts
$E_{c2\&4}$ = 30 Volts
E_{c_3} = 0 Volts
I_b
g_m
r_p
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
PLATE RESISTANCE (r_p) - MEGOHMS
GRID #1 VOLTS
0
500
1000
1500
0.5
1.0
1.5
5
10
15
-3.0
-2.0
-1.0
0

4CS6


4CS6
E_f = 4.2 Volts
$E_{c2\&4}$ = 30 Volts
E_{c_1} = 0 Volts
-2.5
-2.0
-1.5
-1.0
E_{c_3} = 0
+1
+2
+5, +10
+30
+50
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

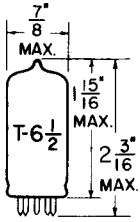
COATED UNIPOTENTIAL CATHODE

HEATER

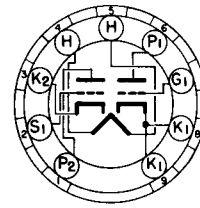
4.2 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9FC

THE 4CX7 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR OPERATION AS A CASCODE (VHF) AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, IT IS IDENTICAL TO THE 6CX7.

DIRECT INTERELECTRODE CAPACITANCES

SHIELD #315 CONNECTED TO HEATER UNLESS SPECIFIED DIFFERENTLY

	SECTION #1		SECTION #2	
GRID TO PLATE: (G TO P)	1.2		---	μμf
INPUT: G TO (H+K+E.S.)	2.4		---	μμf
OUTPUT: P TO (H+K+E.S.)	1.3		---	μμf
HEATER TO CATHODE: (H TO K) [A]	2.4		2.2	μμf
PLATE TO CATHODE: (P TO K) (MAX)	0.17		0.17	μμf
#2 PLATE TO #1 PLATE AND #1 GRID:				
#2 P TO (#1P+#1G) (MAX.)		.027		μμf
PLATE TO PLATE: (#1 P TO #2 P) (MAX.)		.017		μμf
GROUNDED GRID OPERATION:				
INPUT: K TO (G+I.S.+H+E.S.)	---		4.2	μμf
OUTPUT: P TO (G+I.S.+H+E.S.)	---		1.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK [C]	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE [C]	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
HEATER WARM-UP TIME [B]	11	SECONDS

[A] SHIELD #315 CONNECTED TO GROUND.

[B] HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER, THIS RATING MAY BE AS HIGH AS 300 VOLTS MAXIMUM.

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TUNG-SOL

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

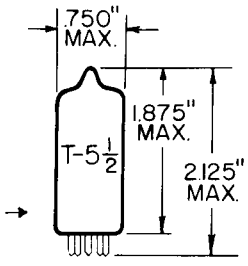
CATHODE CURRENT (MAX.)	20	MA.
GRID CIRCUIT RESISTANCE (MAX.)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE	0	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
PLATE CURRENT	9.0	MA.
TRANSCONDUCTANCE	6 400	μMHOS
AMPLIFICATION FACTOR	39	
GRID VOLTAGE FOR I_b =10 μA (APPROX.)	−10	VOLTS

TUNG-SOL



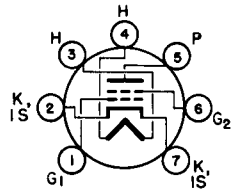
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

TETRODE
MINIATURE TYPE

COATED UNIPOTENTICAL CATHODE

HEATER
4.5 VOLTS 300±18 MAMPS. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 4CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 4CY5 IS IDENTICAL TO THE 2CY5, 3CY5, AND THE 6CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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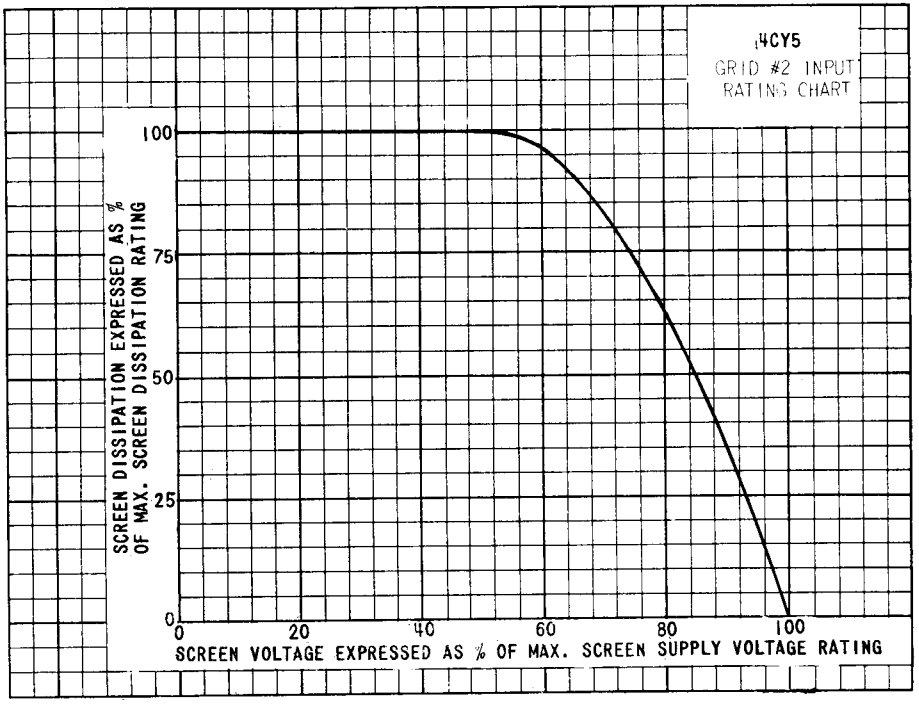
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	-6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

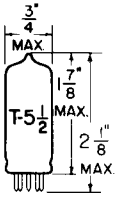
[C] PLATE CURRENT 20 μA.



TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

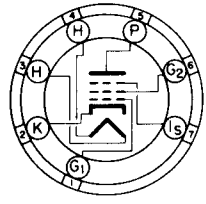
COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CM

THE 4DE6 IS A SHARP-CUTOFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 40 MEGACYCLE GAIN-CONTROLLED VIDEO IF STAGES. EXCEPT FOR HEATER CHARACTERISTICS, THE 4DE6 IS IDENTICAL TO THE 6DE6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+i.s.)	6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3+i.s.)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE CURVE
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

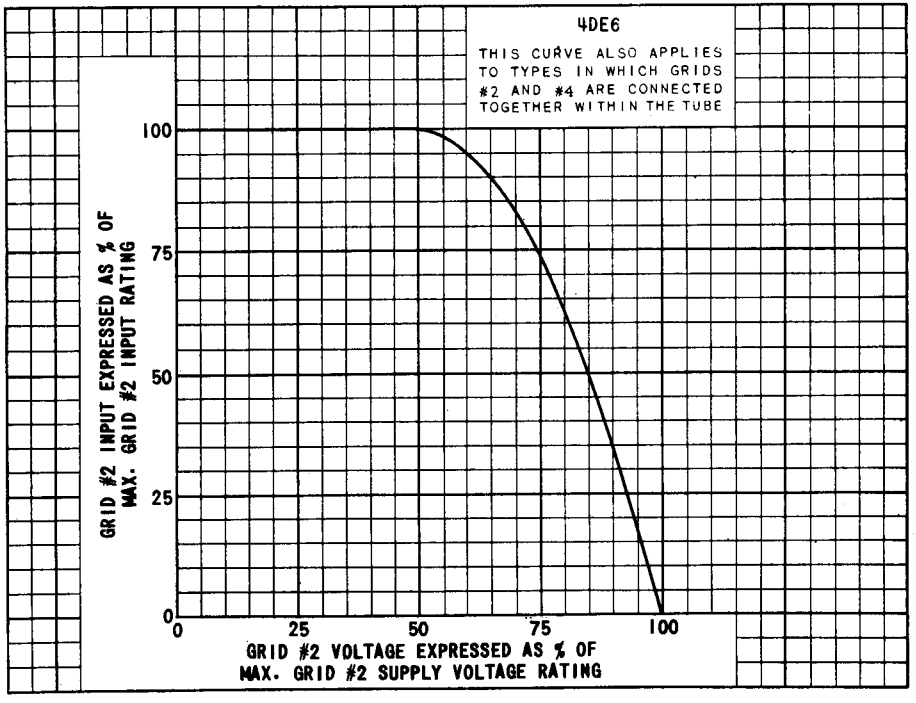
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN 7 CONNECTED TO PIN 2 AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
TRANSCONDUCTANCE	3 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 20 μA	-9	VOLTS
TRANSCONDUCTANCE (Ec1 = - 5.5V., Rk = 0)	700	μMHOS
PLATE CURRENT	15.5	MA.
GRID #2 CURRENT	4.2	MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



TUNG-SOL

PENTODE

MINIATURE TYPE

SHARP-CUTOFF PENTODE

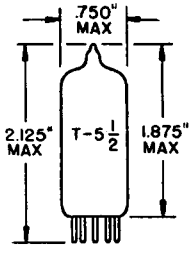
FOR

USE AS AN IF AMPLIFIER

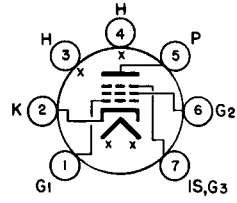
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 4DK6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER AND IS PARTICULARLY SUITABLE FOR USE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4DK6 IS IDENTICAL TO THE 3DK6 AND THE 6DK6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	MAX.	0.025	pf
INPUT		6.3	pf
OUTPUT		1.9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2	VOLTS	450	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.

MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

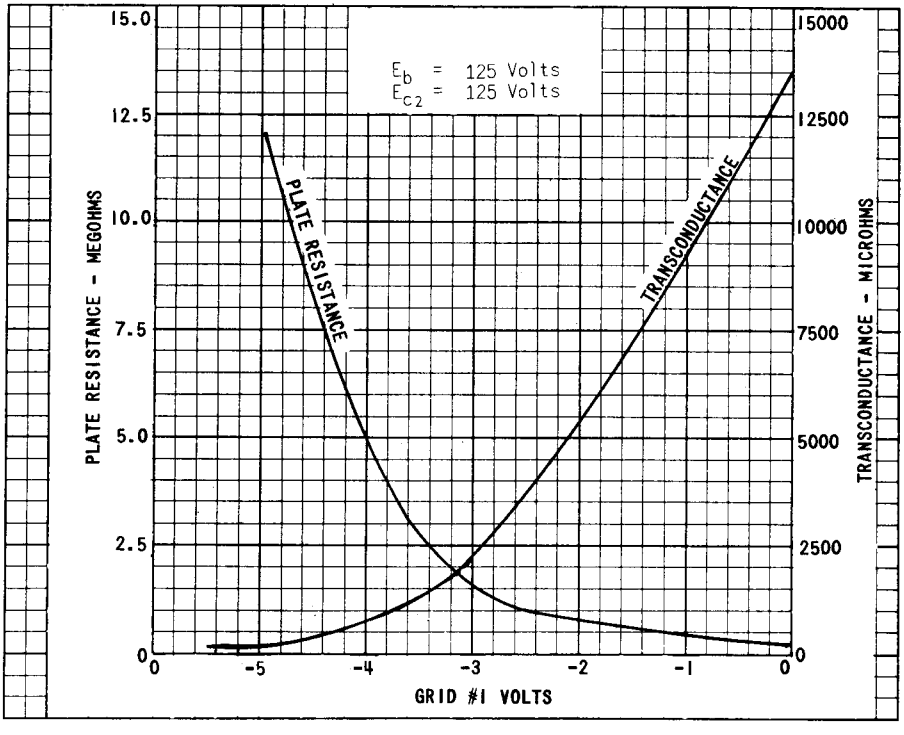
MAXIMUM RATINGS

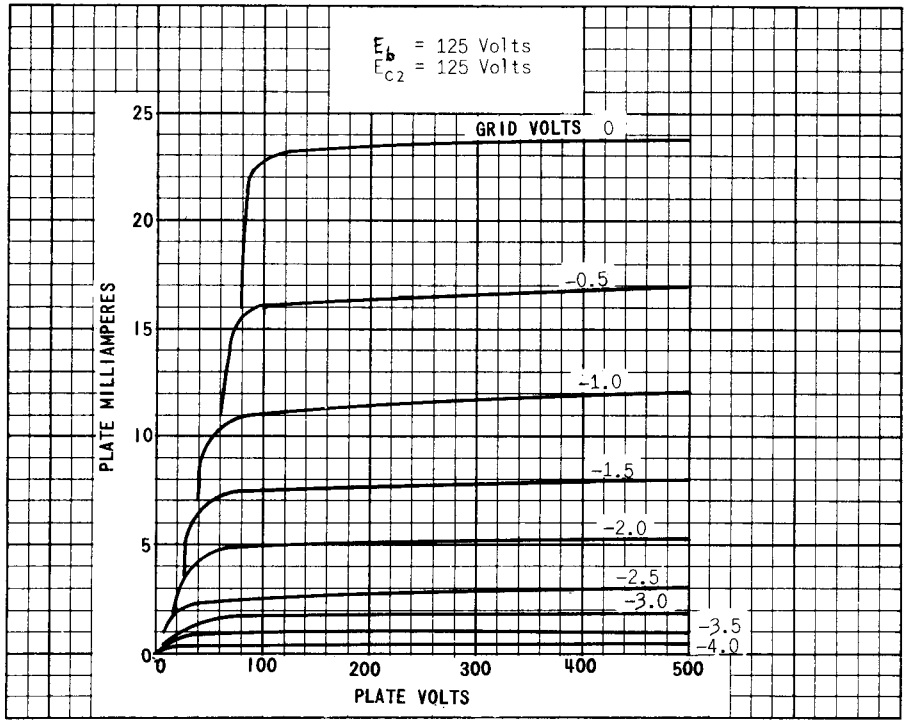
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

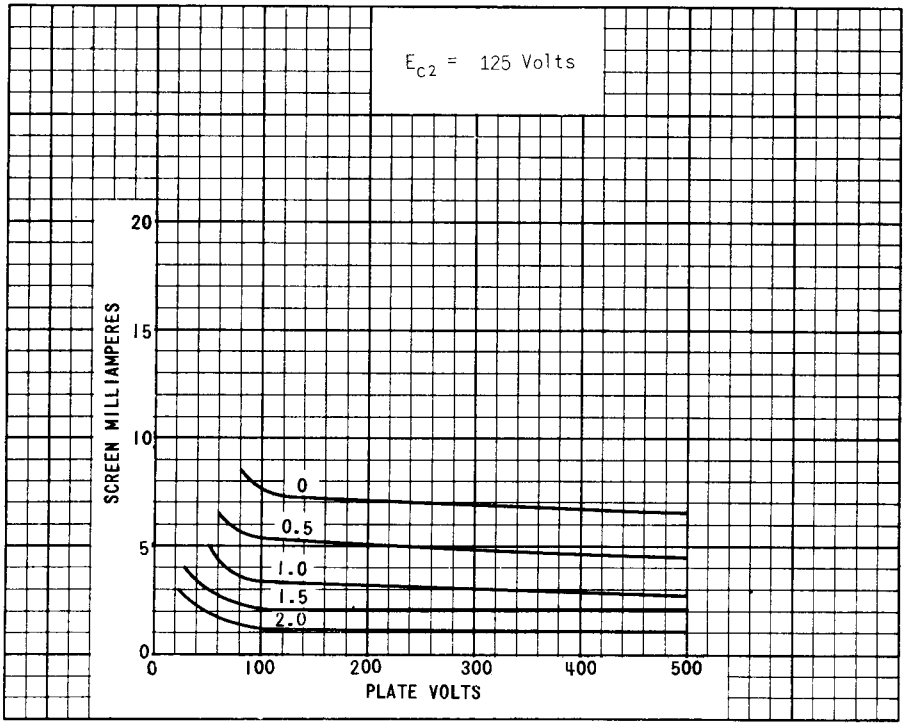
PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.55	WATTS
GRID 1 VOLTAGE - POSITIVE VALUE	0	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE		125	VOLTS
GRID 3 (SUPPRESSOR)	Connected To Cathode At Socket		
GRID 2 VOLTAGE		125	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT		12.0	MA.
GRID 2 CURRENT		3.8	MA.
TRANSCONDUCTANCE		9 800	μMHOS
PLATE RESISTANCE	APPROX.	0.35	MEGOHMS
GRID 1 VOLTAGE FOR Ib = 20 μA		-6.5	VOLTS







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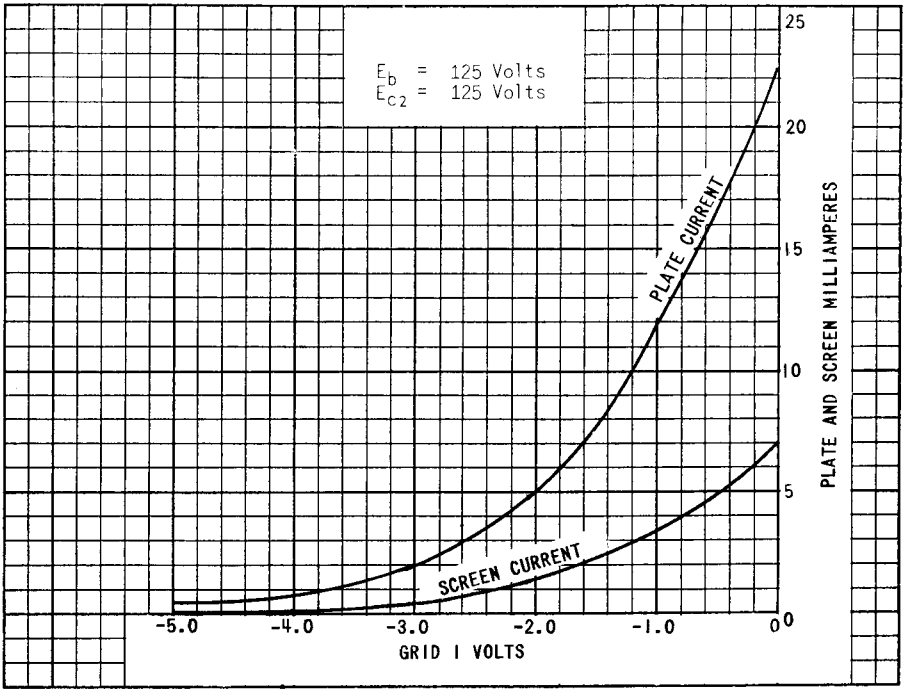
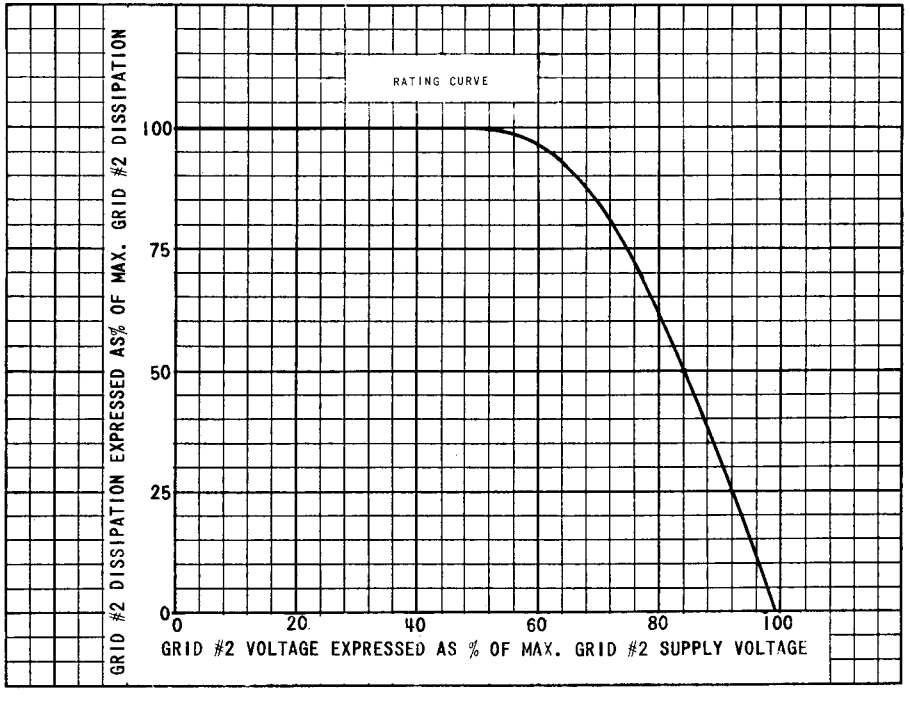
4DK6


E_b = 125 Volts
E_{c2} = 125 Volts
PLATE CURRENT
SCREEN CURRENT
25
20
15
10
5
0
PLATE AND SCREEN MILLIAMPERES
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID 1 VOLTS


RATING CURVE
100
75
50
25
0
GRID #2 DISSIPATION EXPRESSED AS% OF MAX. GRID #2 DISSIPATION
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

TUNG-SOL

PENTODE

MINIATURE TYPE

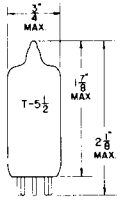
UNIPOTENTIAL CATHODE

HEATER

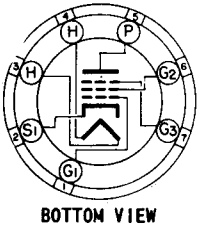
4.2 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

7EN

THE 4DT6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN FM DETECTOR IN TELEVISION RECEIVERS. DESIGNED SO THAT GRID #1 AND GRID #3 CAN EACH BE USED AS INDEPENDENT SHARP CUTOFF CONTROL ELECTRODES, THE TUBE MAY ALSO BE USED IN DELAY CIRCUITS, GAIN-CONTROLLED AMPLIFIER CIRCUITS, AND MIXER CIRCUITS. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, IT IS IDENTICAL TO THE 3DT6.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH EXTERNAL SHIELD, #316, CONNECTED TO CATHODE

GRID #1 TO PLATE	0.02	μμf
GRID #1 TO GRID #3	0.1	μμf
GRID #3 TO ALL OTHER ELECTRODES	6.1	μμf
GRID #1 TO GRID #2, GRID #3, HEATER, AND INTERNAL SHIELD AND CATHODE	5.8	μμf
GRID #3 TO PLATE	1.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FM DETECTOR SERVICE

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	28 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	SEE J5-C4-2 ←	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	1.1 ←	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE J5-C4-2 ←	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	560	OHMS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHM
TRANSCONDUCTANCE:		
GRID #1 TO PLATE	800	μMHOS
GRID #3 TO PLATE	515	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-3.5	VOLTS
PLATE CURRENT	1.1	MA.
GRID #2 CURRENT	2.1	MA.

TYPICAL OPERATION IN THE ACCOMPANYING LOCKED-OSCILLATOR, QUADRATURE-GRID FM DETECTOR CIRCUIT AT A CARRIER FREQUENCY OF 4.5 MC:

INPUT SIGNAL TO GRID OF DRIVER TUBE	**15**	**200**	**500**	**MV RMS**
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	0.22	0.21	MA.
GRID #2 CURRENT	3.4	5.5	6	MA.
GRID #1 CURRENT	0.013	0.6	0.8	MA.
BANDWIDTH: FOR A TOTAL HARMONIC DISTORTION OF 10 PERCENT	65	120	118	KC
AM REJECTION (APPROX.)[B]	33	29	28	DB
AUDIO OUTPUT VOLTAGE (RMS, APPROX.):				
WITH ± 7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	5.5	6.5	7.5	VOLTS
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	17	21	23	VOLTS
TOTAL HARMONIC DISTORTION:				
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	2	3	4	PERCENT
SENSITIVITY:				
WITH ±7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			59	MILLIVOLTS
WITH ±25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			15[C]	MILLIVOLTS
MAXIMUM CIRCUIT VALUES:				
GRID #1 CIRCUIT RESISTANCE:				
FOR FIXED-BIAS OPERATION			0.25	MEGOHM
FOR CATHODE-BIAS OPERATION			0.5	MEGOHM

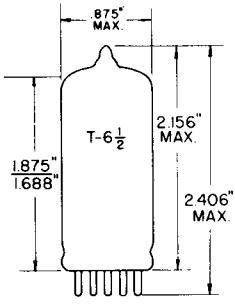
[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

TUNG-SOL

REMOTE-CUTOFF PENTODE

MINIATURE TYPE

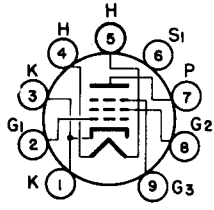


GLASS BULB
MINIATURE
9 PIN BASE E9-1

UNIPOTENTIAL CATHODE

HIGH Gm, SMALL SIGNAL
RF & IF AMPLIFIER
WITH GAIN CONTROL

SERIES STRING OPERATION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AQ

THE 4EH7 IS A REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT FEATURES VERY HIGH Gm WITH A REMOTE CUTOFF AND IS DESIGNED FOR FREQUENCIES INTO THE VHF RANGE. ITS CHIEF APPLICATION IS IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P) MAX.	0.0055	pf
INPUT: G1 TO (H+G2+G3+K+IS)	9.5	pf
OUTPUT: P TO (H+G2+G3+K+IS)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.4 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM HEATER CATHODE VOLTAGE		165	VOLTS
HEATER WARM-UP TIME *		11	SECONDS

MAXIMUM RATINGS

DESING CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 VOLTAGE	250	VOLTS
GRID #2 DISSIPATION	0.65	WATTS
CATHODE CURRENT	20	MA
GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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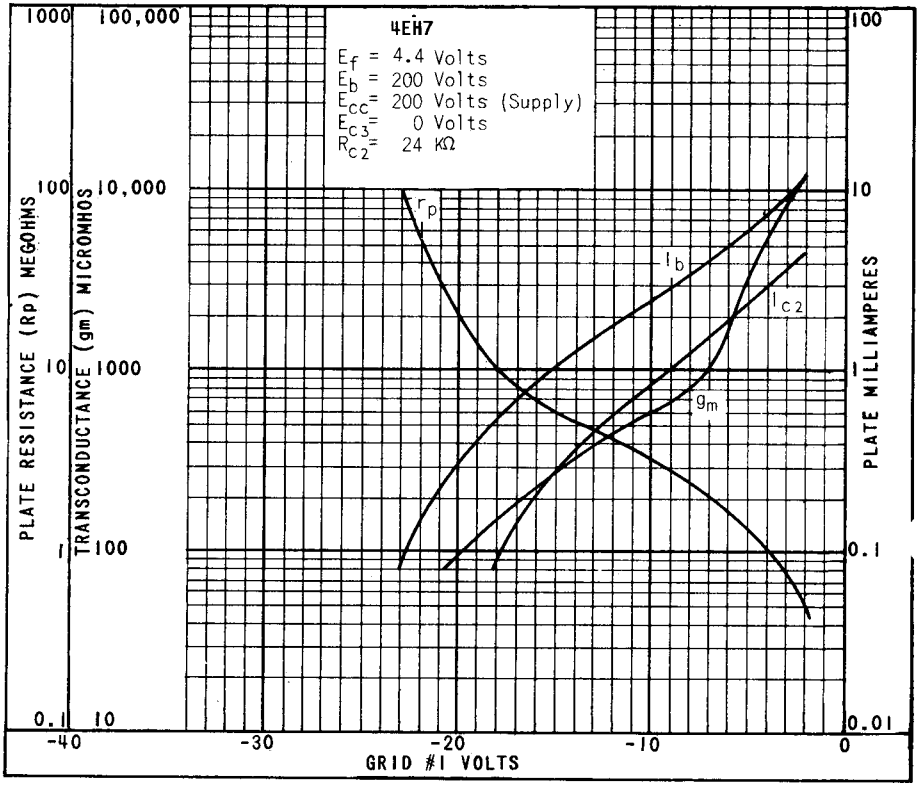
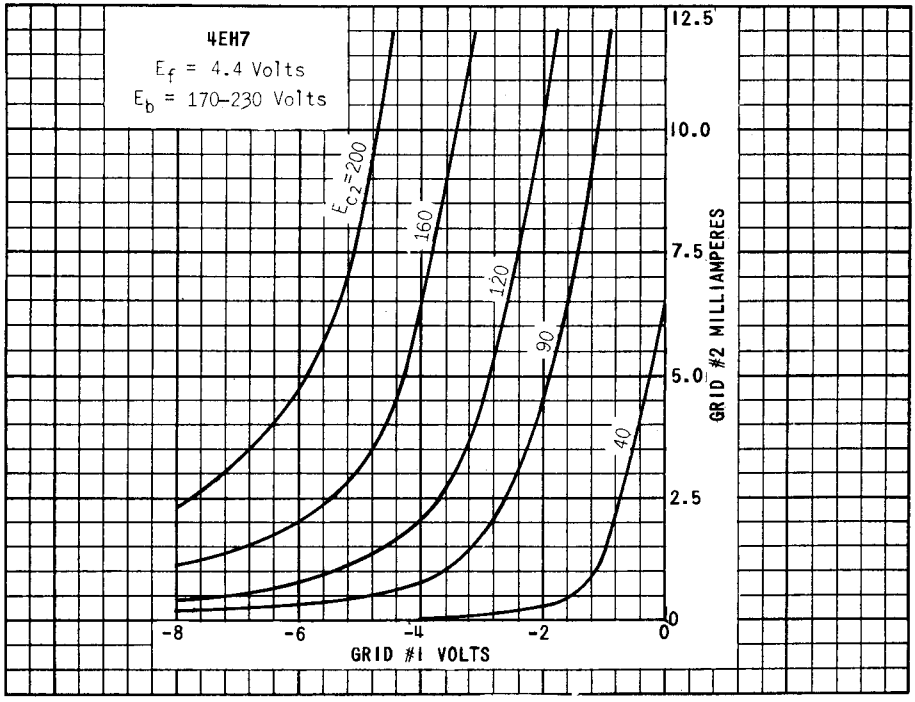
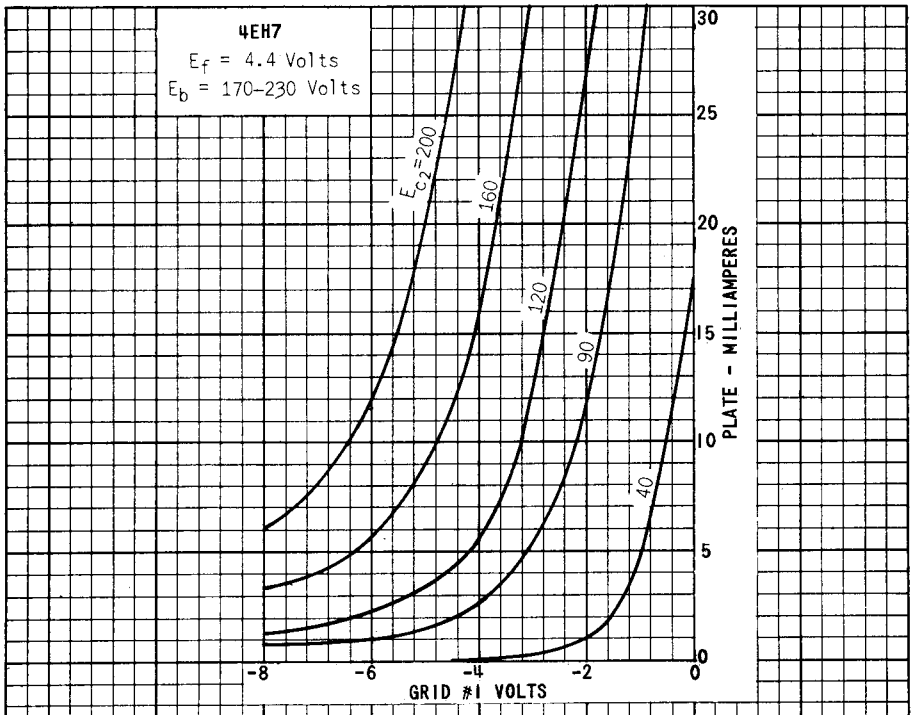
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	200	200	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE (SUPPLY)	90	200	VOLTS
GRID #2 SERIES RESISTOR	0	24	KILOHMS
GRID #1 VOLTAGE	-2	-2	VOLTS
PLATE CURRENT	12	---	MA.
GRID #2 CURRENT	4.5	---	MA.
TRANSCONDUCTANCE	12500	12500	μMHOS
PLATE RESISTANCE	0.5	---	MEGOHMS
GRID #1 IMPEDANCE AT 40 MC	13	---	KILOHMS
GRID #1 CUTOFF: E_{c1} =-6.5		1250	μMHOS
E_{c1} =-9.5		625	μMHOS
E_{c1}=-19.5		125	μMHOS
GRID #1 VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1%:			
E_{c1} =-6.5		100	MV.
E_{c1} =-9.5		160	MV.
E_{c1}=-19.5		450	MV.







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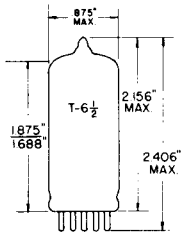
TUNG-SOL

SHARP CUTOFF PENTODE

MINIATURE TYPE



MINIATURE BUTTON
9 PIN BASE E9-1

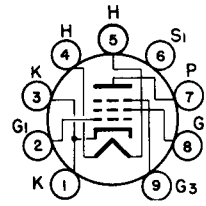
OUTLINE DRAWING
SPECIAL
GLASS BULB

COATED UNIPOTENTIAL CATHODE

FOR IF CIRCUITS IN TV RECEIVERS

SERIES STRING OPERATION

ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 9AQ

BOTTOM VIEW

THE 4EJ7 IS A HIGH TRANSCONDUCTANCE SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. CONTROLLED HEATER WARM-UP TIME MAKES THE TUBE SUITABLE FOR SERIES STRING OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.005	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	10	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.4 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		150	VOLTS
HEATER WARM-UP TIME [A]		11	SECONDS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239 [B]

PLATE VOLTAGE WITH Ib = 0 MA.	550	VOLTS
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE WITH Ic2 = 0 MA	550	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 DISSIPATION	0.9	WATTS
CATHODE CURRENT	25	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM

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TUNG-SOL

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TYPICAL OPERATING CHARACTERISTICS

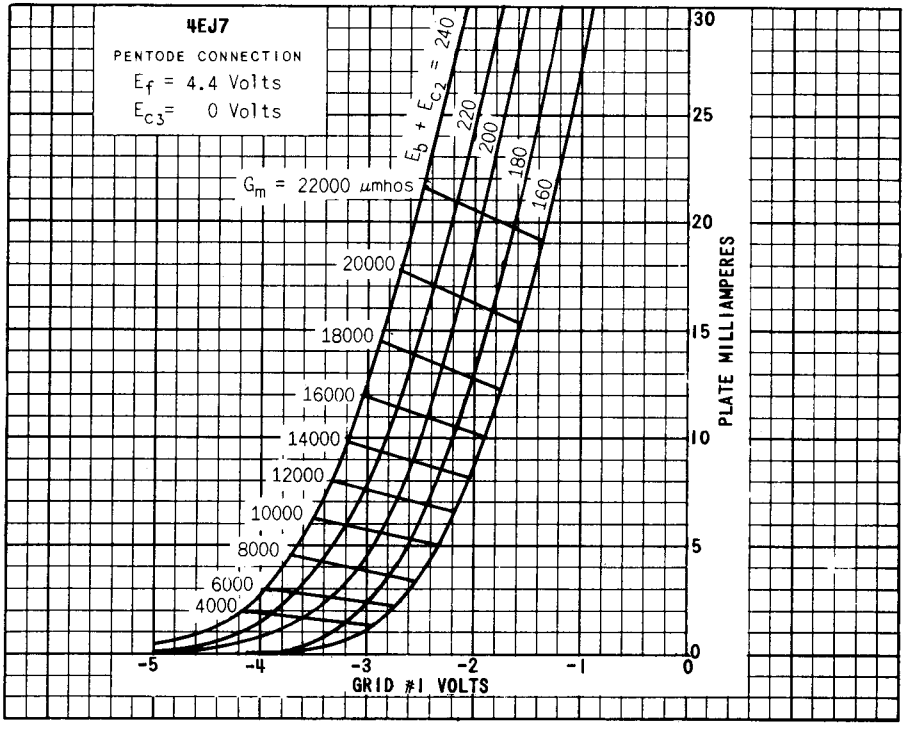
CLASS A_1 AMPLIFIER

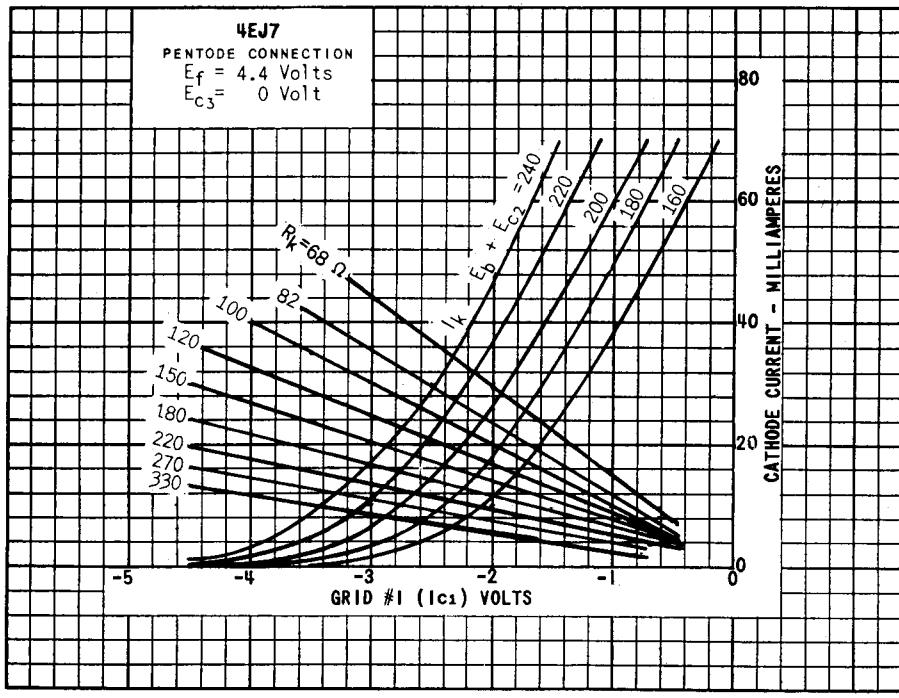
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	μMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40 MC	30000	OHMS[C]

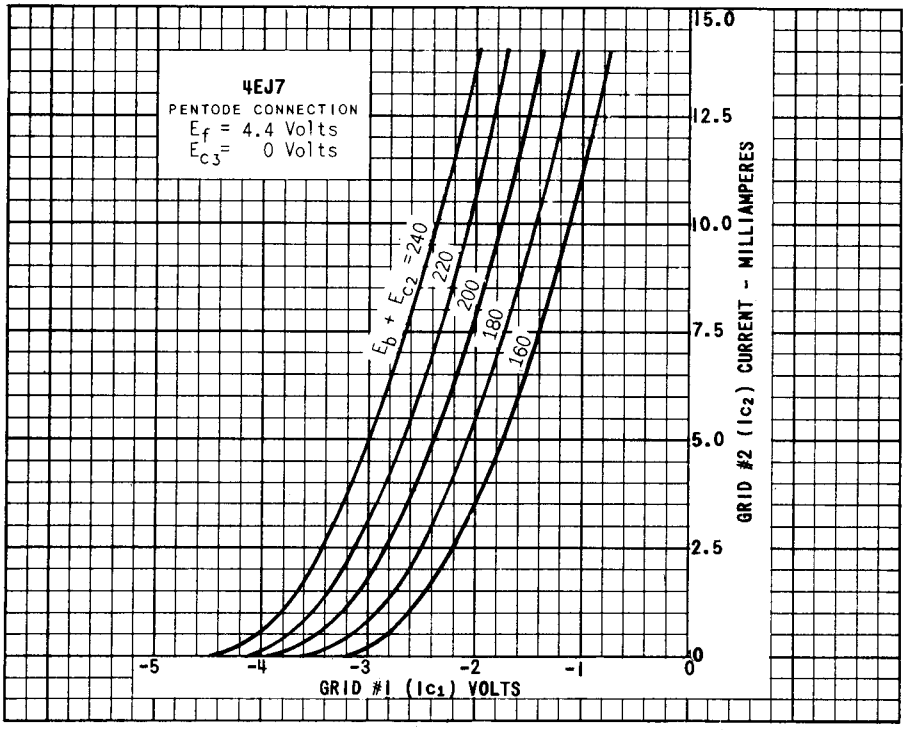
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.







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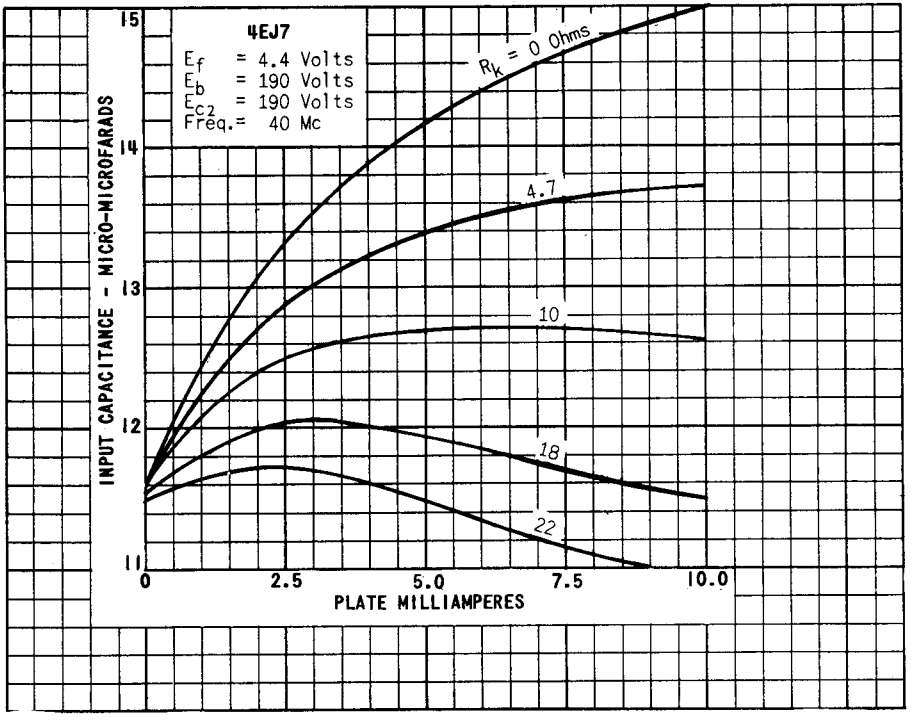
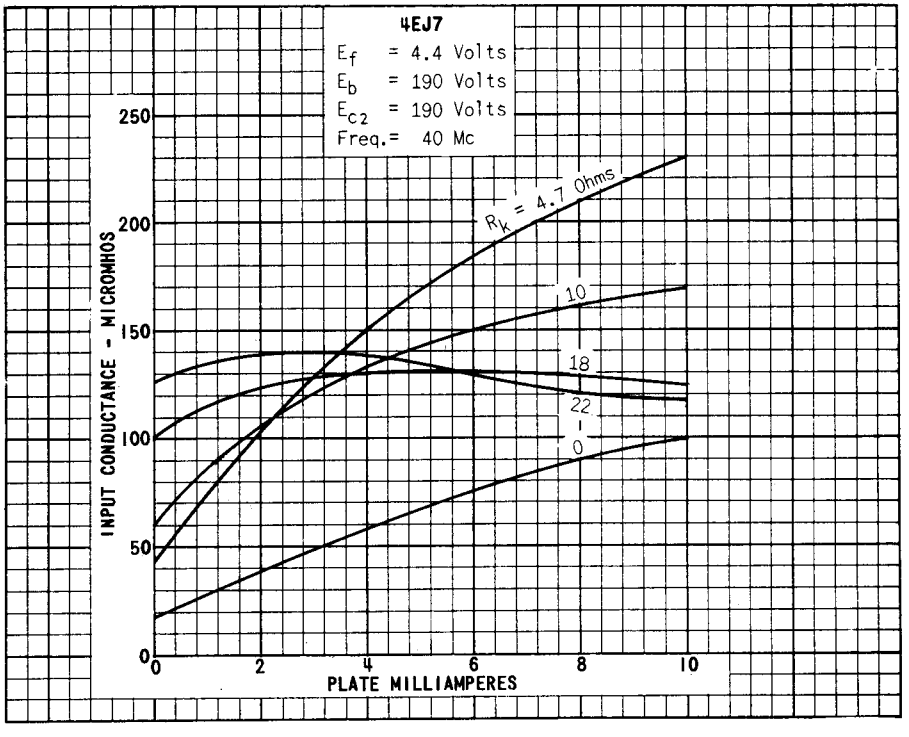
4EJ7

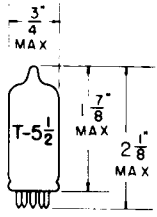

4EJ7
Ef = 4.4 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
PLATE MILLIAMPERES
15
14
13
12
11
0
2.5
5.0
7.5
10.0


4EJ7
Ef = 4.4 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 4.7 Ohms
10
18
22
0
INPUT CONDUCTANCE - MICROMHOS
PLATE MILLIAMPERES
250
200
150
100
50
0
2
4
6
8
10

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

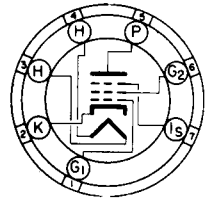
COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.6±6% AMPS.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CM

THE 4EW6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR INTERMEDIATE AMPLIFIER SERVICE IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 4EW6 IS IDENTICAL TO THE 6EW6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.03	0.04	μμf
INPUT	10.0	10.0	μμf
OUTPUT	3.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH EXTERNAL SHIELD (EIA 316) CONNECTED TO CATHODE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

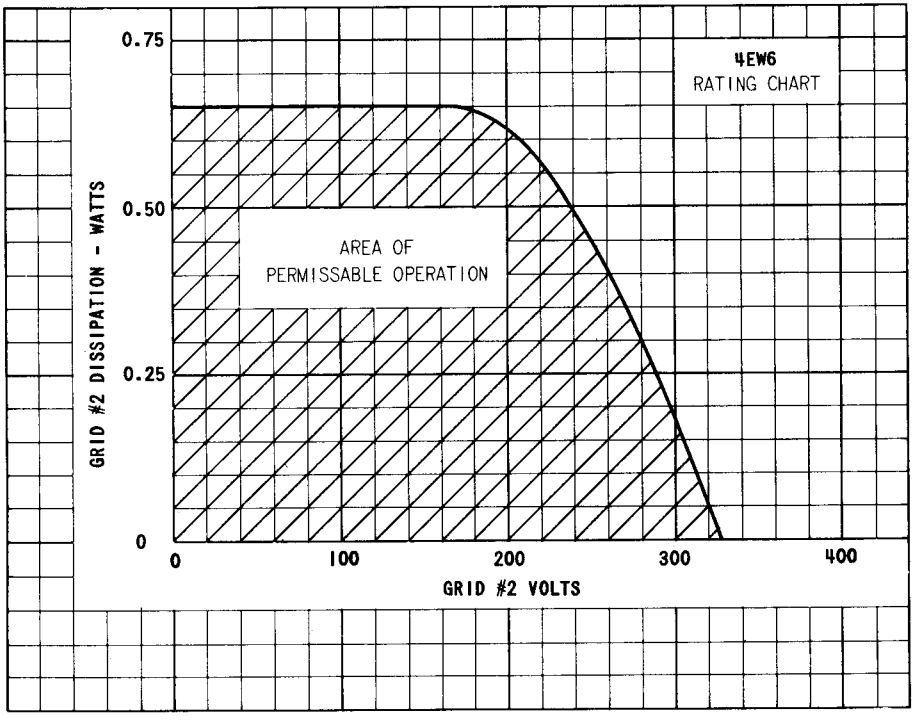
CONTINUED FROM PRECEDING PAGE

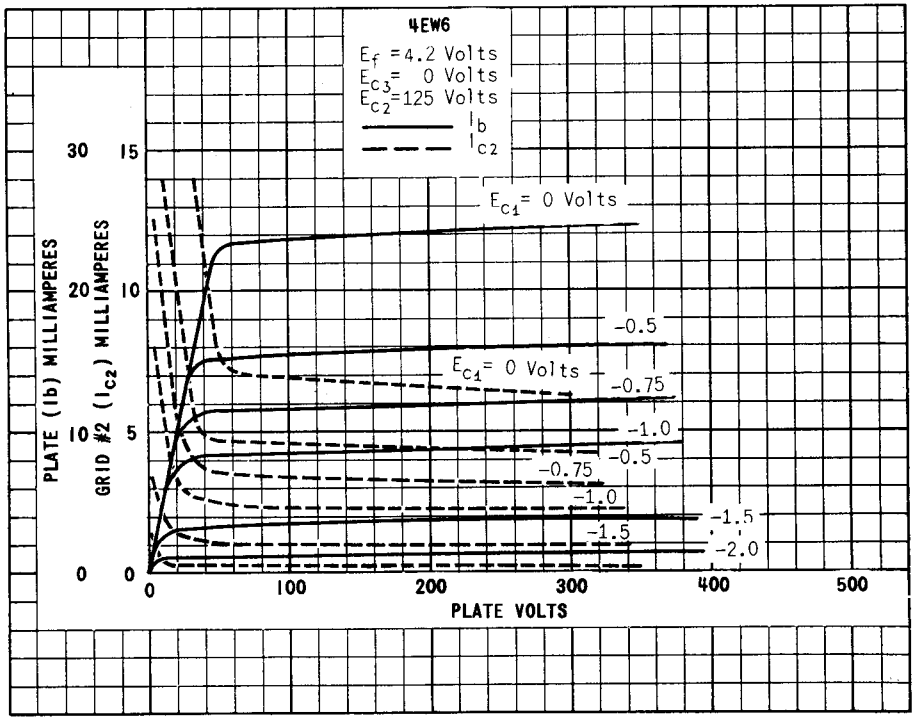
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	-3.5	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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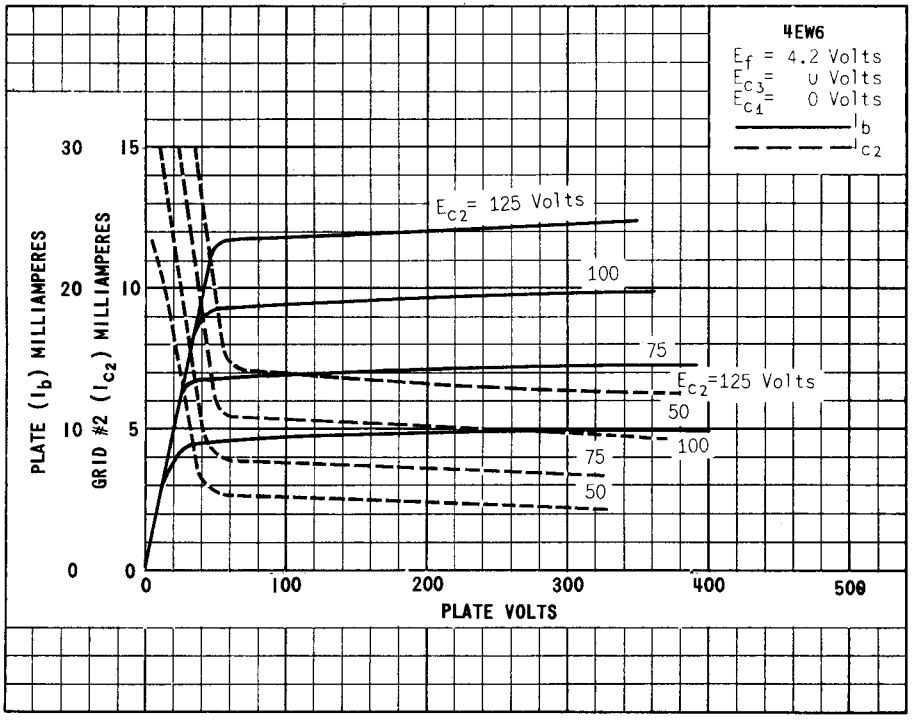
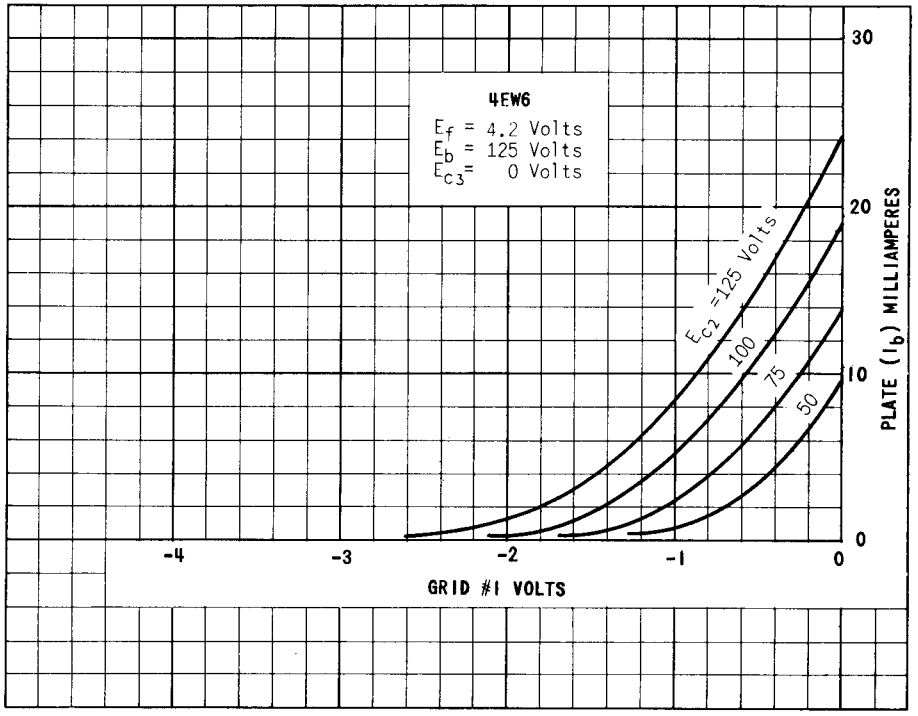
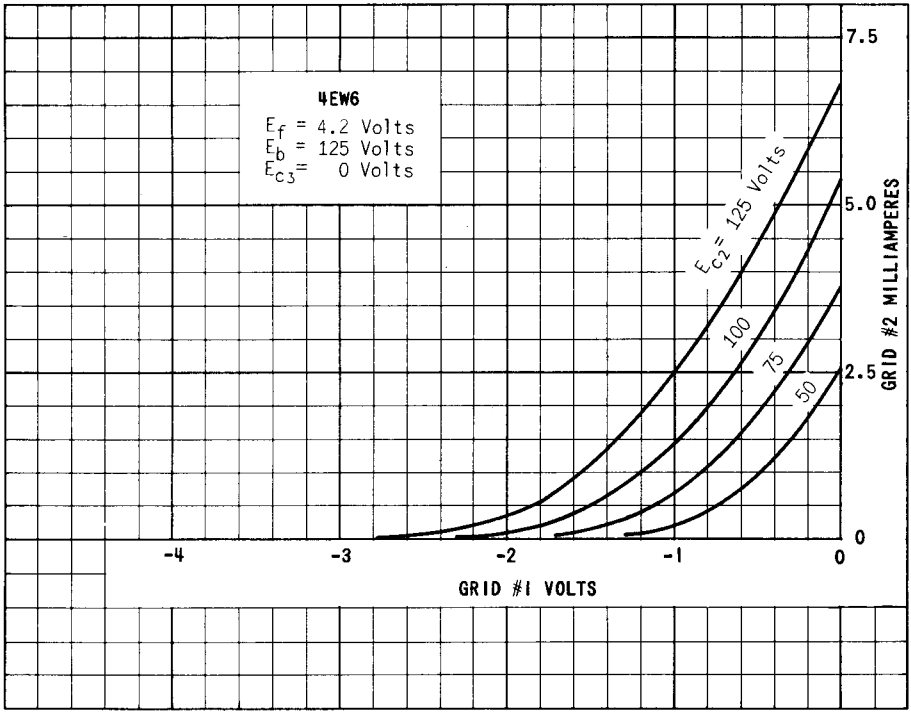
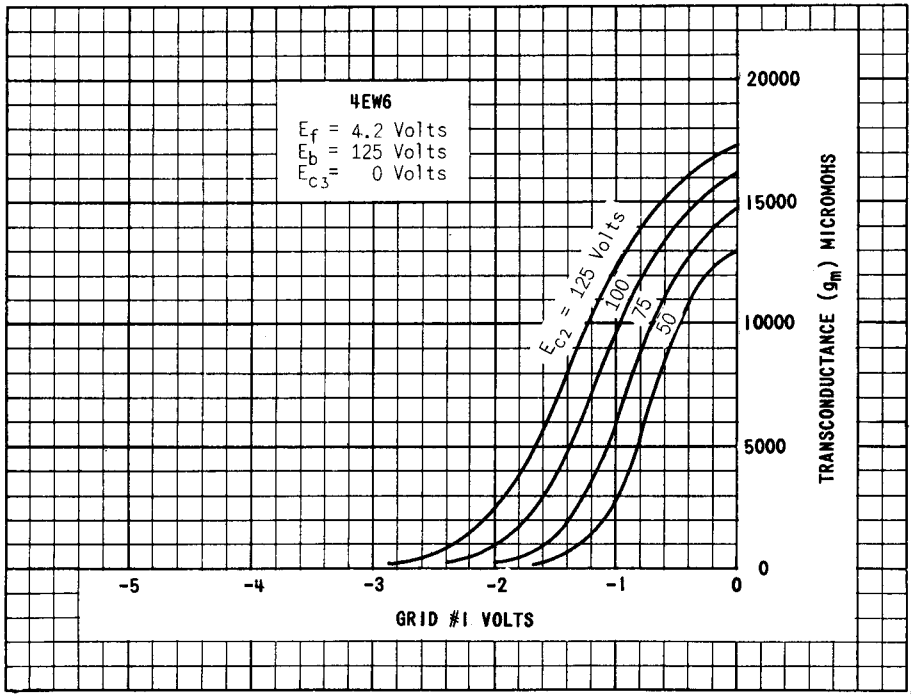

4EW6
E_f = 4.2 Volts
E_{c3}= 0 Volts
E_{c1}
I_b
I_{c2}
E_{c2}= 125 Volts
100
75
50
E_{c2}=125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
5
10
15
20
30


4EW6
E_f = 4.2 Volts
E_b = 125 Volts
E_{c3}= 0 Volts
E_{c2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
10
20
30





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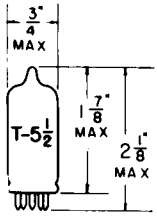
TUNG-SOL

PENTODE

MINIATURE TYPE



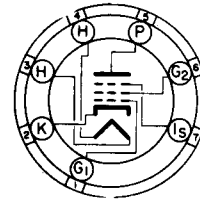
GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
7CM

THE 4GM6 IS A SEMIREMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR USE IN GAIN-CONTROLLED PICTURE-IF STAGES OF TELEVISION RECEIVERS OPERATING AT INTERMEDIATE FREQUENCIES OF THE ORDER OF MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.036	μμf
GRID #1 TO CATHODE, INTERNAL SHIELD & G3,G2 & H.	10	μμf
PLATE TO CATHODE, INTERNAL SHIELD & G3, G2 & H.	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	0.65	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.2	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE SUPPLY VOLTAGE	125	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	125	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	13 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANCONDUCTANCE = 60 μMHOS	-15	VOLTS

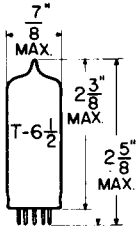
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SER ICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WROST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time, the 4GM6 is identical to the 5GM6 and the 6GM6.*

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DUAL PENTODE
MINIATURE TYPE



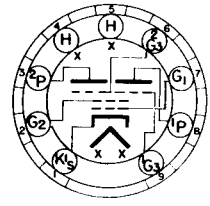
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

4.2 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9LW

THE 4GS8 IS A DUAL PENTODE WITH A SEPARATE PLATE AND A SEPARATE #3 GRID IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR SERVICE AS A COMBINED SYNC SEPARATOR-CLIPPER AND AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 4GS8 IS IDENTICAL TO THE 3GS8 AND THE 6GS8.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE (EACH SECTION)	2.0	μμf
GRID #1 TO ALL	6.0	μμf
GRID #3 (EACH SECTION) TO ALL	3.8	μμf
PLATE (EACH SECTION) TO ALL	3.2	μμf
GRID #3 (SECTION #1) TO GRID #3 (SECTION 2) (MAX.)	0.015	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM A

HEATER VOLTAGE	4.2	VOLTS
MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

HEATER VOLTAGE		4.2	VOLTS
HEATER CURRENT		0.45	AMP.
PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	NOTE B	NOTE B	
PLATE CURRENT (EACH SECTION)		2.0	MA.
GRID #2 CURRENT	6.0	3.6	MA.
CATHODE CURRENT	6.1	7.7	MA.

EACH SECTION OPERATING SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	NOTE B	
PLATE CURRENT		2.0	MA.
GRID #3 TRANSCONDUCTANCE		270	μMHOS
GRID #1 TRANSCONDUCTANCE	1200		μMHOS
E_{c3} FOR I_b = 100 μA (APPROX.)		-3.7	VOLTS
E_{c1} FOR I_b = 100 μA (APPROX.)		-2.0	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

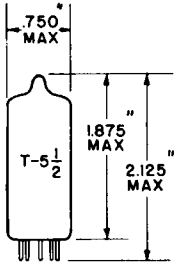
A DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST-PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

B GRID CURRENT ADJUSTED FOR 100 μA DC.

TUNG-SOL

PENTODE

MINIATURE TYPE

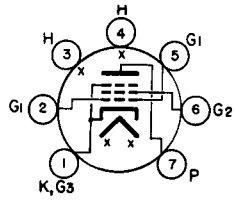


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

FOR AUDIO OUTPUT
APPLICATIONS
IN RADIO AND T.V.
RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 4GZ5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS. ITS HEATER IS DESIGNED FOR OPERATION IN A 600 MILLIAMPERE SERIES STRING CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: G1 TO P	0.24	pf
INPUT: G1 TO (H+K+G2)	8.5	pf
OUTPUT: P TO (H+K+G2)	3.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.0 VOLTS	600	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	300	VOLTS
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	4.8	WATTS
GRID #2 DISSIPATION — CONTINUOUS	1.1	WATTS
CATHODE CURRENT— AVERAGE	30	MA.
GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	.5	MEGOHM
SELF BIAS	1.0	MEGOHM
BULB TEMPERATURE	200	°C

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TUNG-SOL

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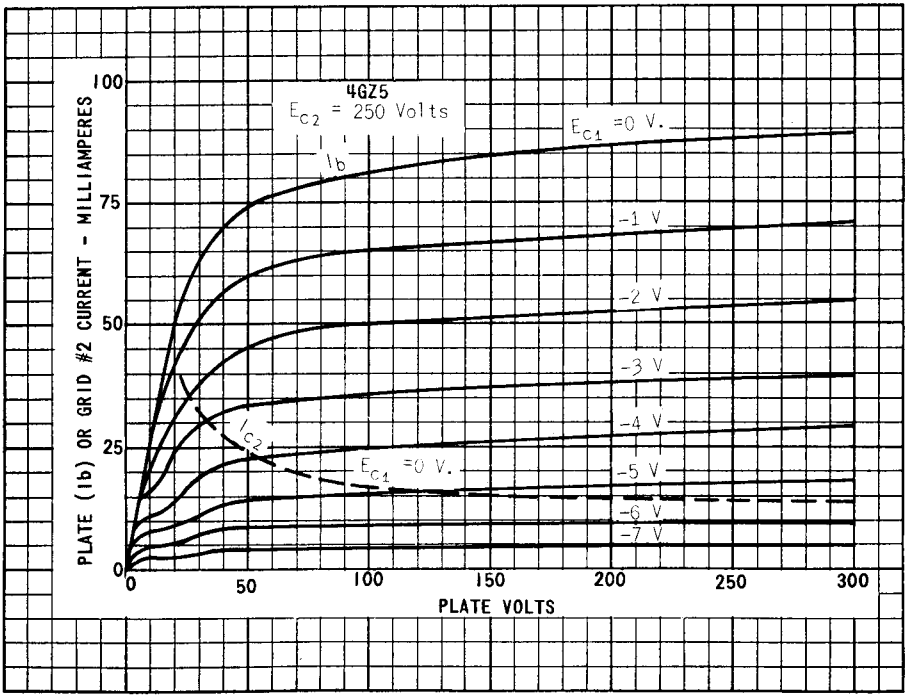
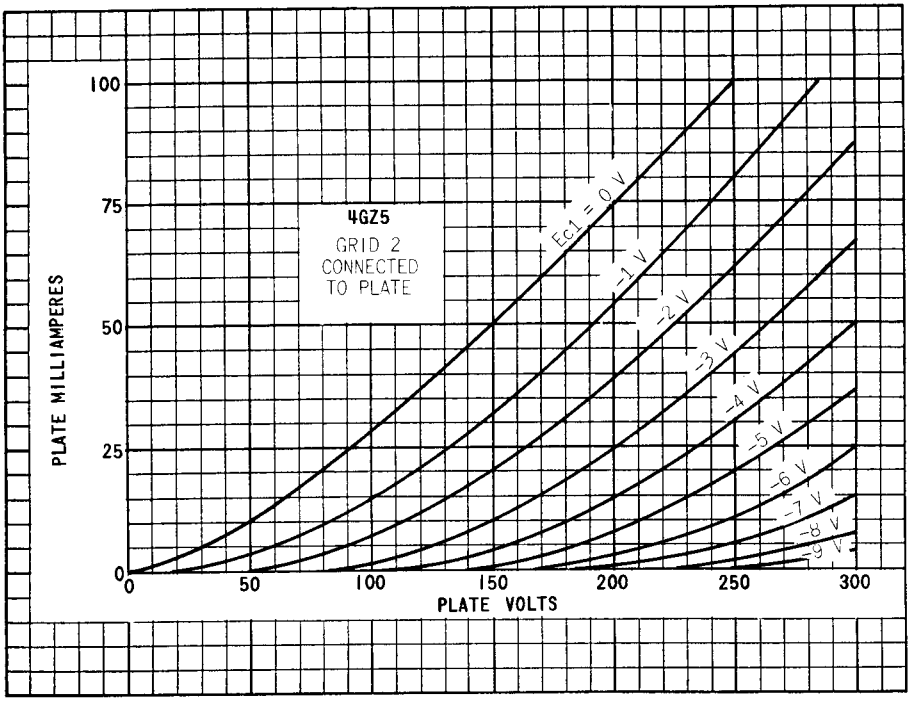
TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AUDIO AMPLIFIER

PLATE SUPPLY VOLTAGE	250	250	VOLTS
GRID #2 SUPPLY VOLTAGE	250	250	VOLTS
CATHODE RESISTOR	270	270	OHMS
BYPASSING	NONE	CONDENSER	
PEAK AUDIO GRID #1 VOLTAGE	9.8	2.0	VOLTS
ZERO SIGNAL PLATE CURRENT	16	16	MA.
MAXIMUM SIGNAL PLATE CURRENT	16	16	MA.
ZERO SIGNAL GRID #2 CURRENT	2.7	2.7	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	5.0	5.0	MA.
TRANSCONDUCTANCE	---	8400	μMHOS
PLATE RESISTANCE (APPROX.)	---	.15	MEGOHMS
LOAD RESISTANCE	15 000	15 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	1.8	1.1	WATTS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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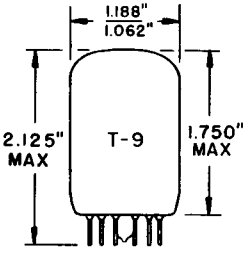
TUNG-SOL

DUAL TRIODE

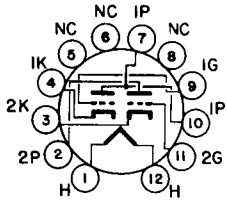
MINIATURE TYPE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING

TWO DISSIMILAR TRIODES
FOR
SYNC CLIPPER AND
AGC AMPLIFIER
SERVICE IN
TV RECEIVERS

COATED UNIPOTENTIAL CATHODES
ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 12 FR

THE 4HC7 CONTAINS TWO DISSIMILAR TRIODES IN A T-9 COMPACTRON CONSTRUCTION. EACH ELEMENT IS BROUGHT OUT TO A SEPARATE BASE PIN. TRIODE #1 HAS A LOW MU AND TRIODE #2 HAS A HIGH MU. THE 4HC7 IS DESIGNED FOR SYNC CLIPPER AND GATED AGC AMPLIFIER SERVICE IN TV RECEIVERS. THE HEATER IS INTENDED TO BE OPERATED IN A SERIES STRING. EXCEPT FOR HEATER RATINGS, THE 4HC7 IS IDENTICAL TO THE 5HC7

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	
GRID TO PLATE (g to p)	1.9	2.2	pf
INPUT: g to (h + k)	2.0	1.9	pf
OUTPUT: p to (h + k)	0.7	0.56	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECS.
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE 1	TRIODE 2	
PLATE VOLTAGE	330	330	VOLTS
NEGATIVE DC GRID VOLTAGE	100	100	VOLTS
POSITIVE DC GRID VOLTAGE	0	0	VOLTS
POSITIVE TRANSIENT GRID VOLTAGE	60	-	VOLTS
PLATE DISSIPATION	3	1.2	WATTS
GRID CIRCUIT RESISTANCE	5.0	5.0	MEGOHMS

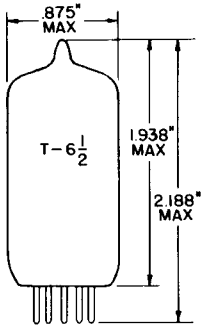
CHARACTERISTICS

PLATE VOLTAGE	150	150	VOLTS
GRID VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	18	1.0	MA
TRANSCONDUCTANCE	4400	1900	μMHOS
AMPLIFICATION FACTOR	23	100	
PLATE RESISTANCE (APPROX.)	5,200	53,000	OHMS
GRID VOLTAGE FOR I_b = 10 μA (APPROX.)	-13	-2.2	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

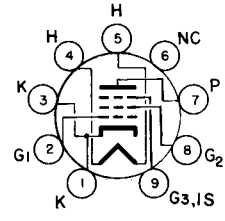
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SHARP-CUTOFF PENTODE

FOR

IF AMPLIFIER STAGES

IN TV RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9PM

THE 4HM6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4HM6 IS IDENTICAL TO THE 3HM6 AND THE 6HM6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315 CONNECTED TO CATHODE	WITHOUT SHIELD	
GRID TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2	VOLTS	450	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.
HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		MAX.	200	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

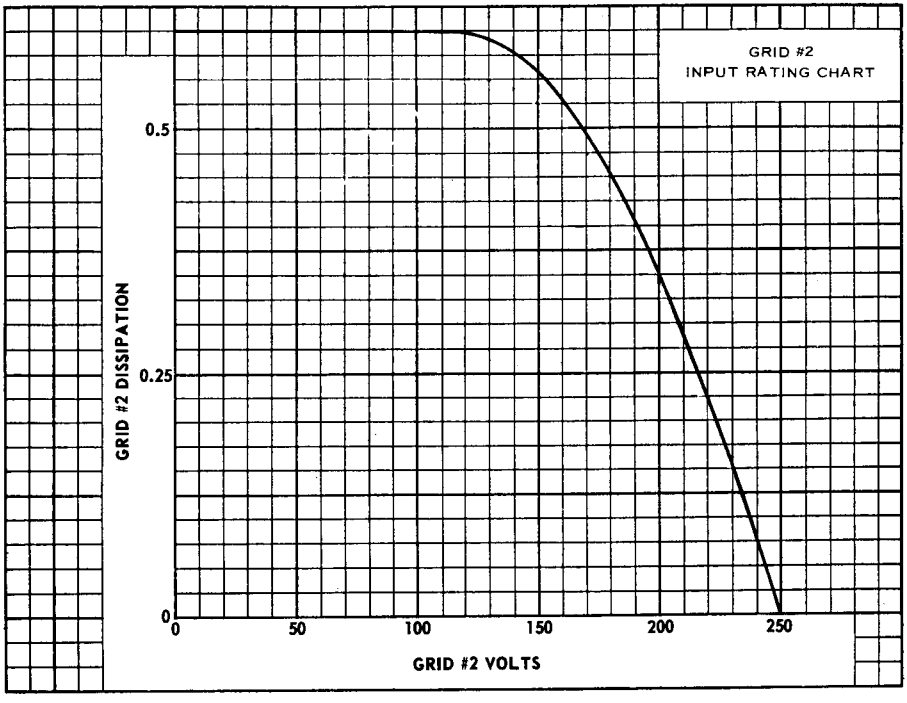
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

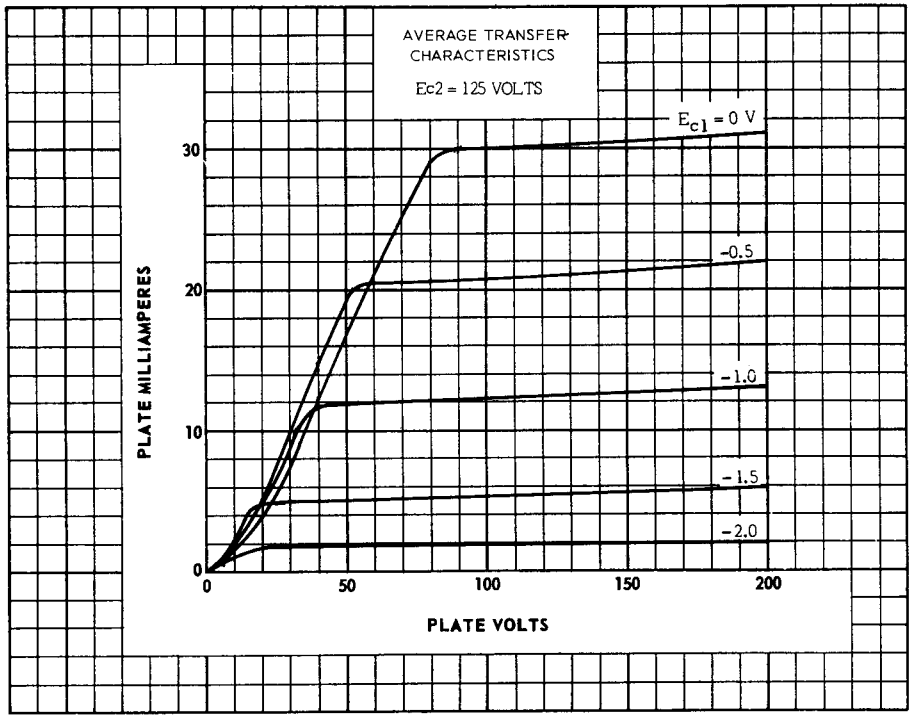
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
NEGATIVE GRID 1 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 125 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCE:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	MA.
GRID 2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.156	MEGOHM
HOT INPUT RESISTANCE [A]	13,000	OHMS
HOT INPUT CAPACITANCE [A]	7.4	pf
GRID 1 VOLTAGE AT Gm = 100 μMHOS	-3.0	VOLTS

[A] MEASURED AT 44 MC/S WITH UNBYPASSED 56 OHM CATHODE RESISTOR.





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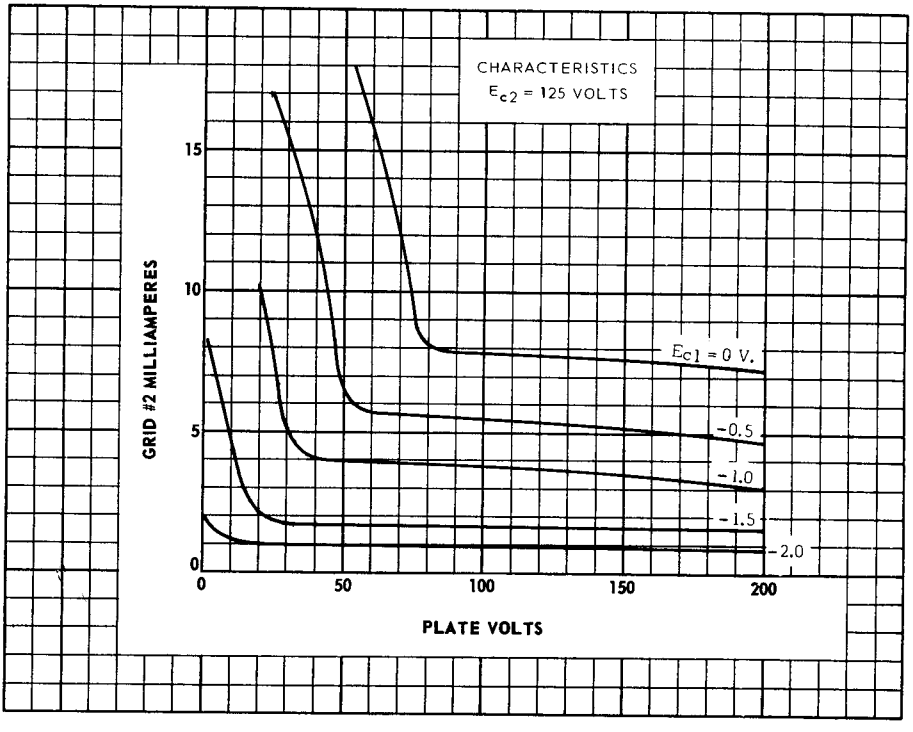
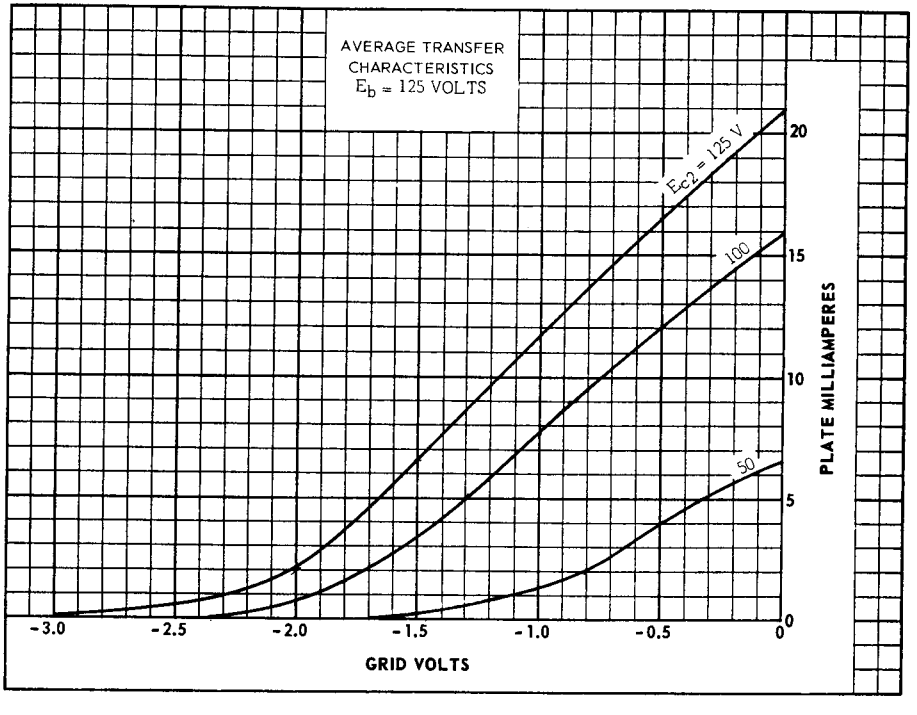
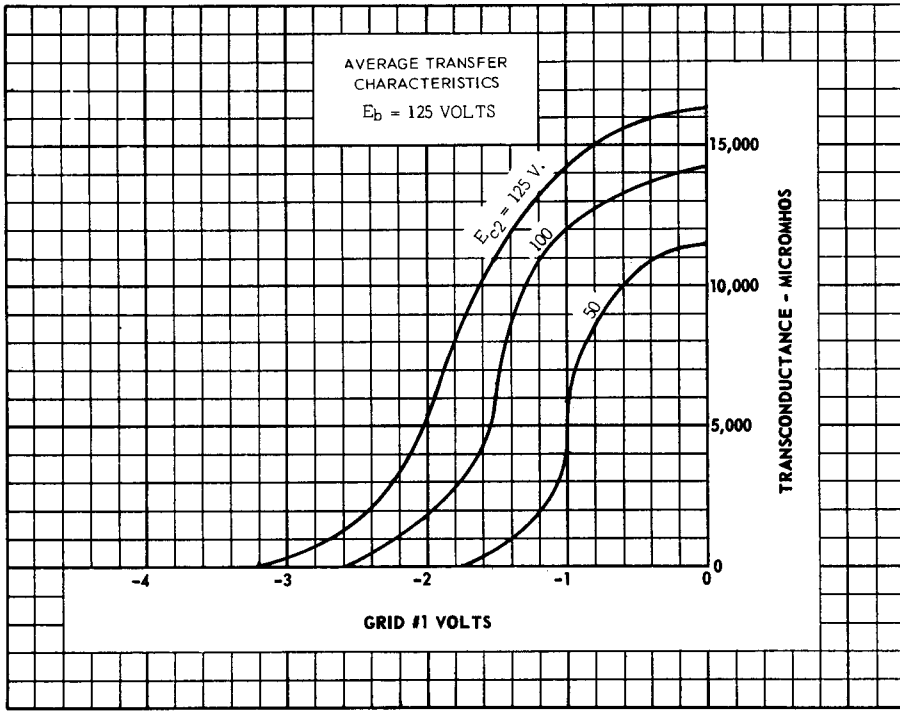
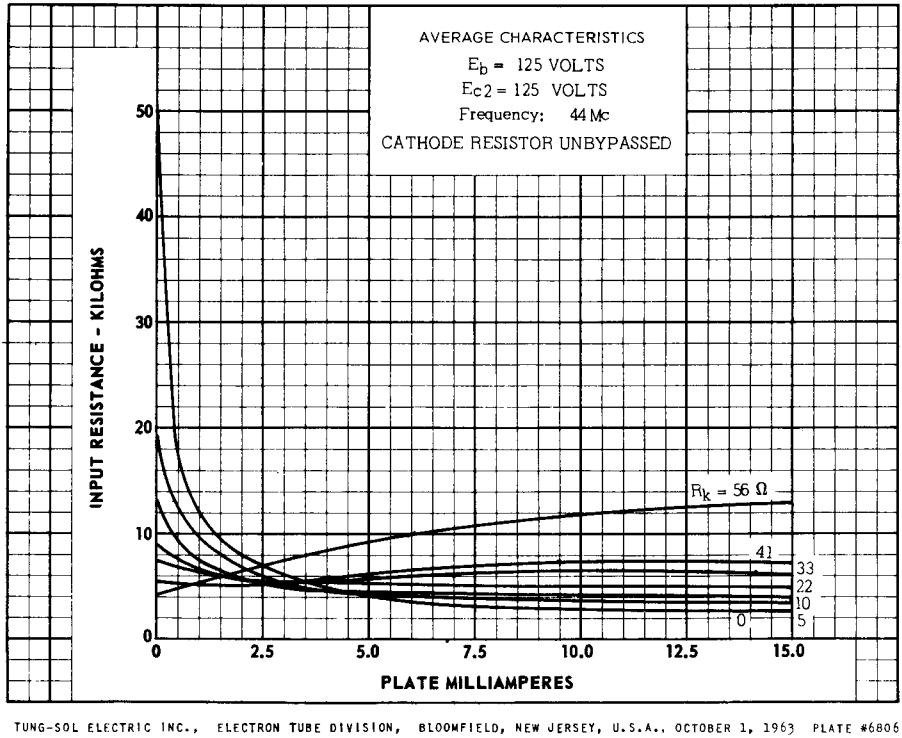
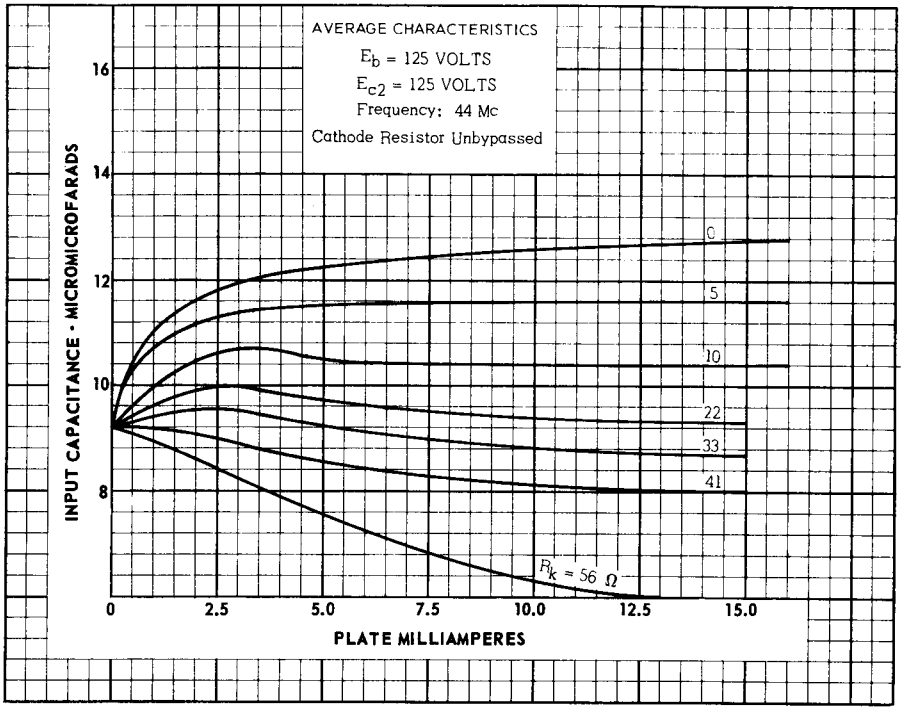

CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
50
100
150
200
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 125 VOLTS
PLATE MILLIAMPERES
GRID VOLTS
0
5
10
15
20
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
E_{c2} = 125 V
100
50


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 V.
100
50
15,000
10,000
5,000
0
TRANSCONDUCTANCE - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
CATHODE RESISTOR UNBYPASSED
INPUT RESISTANCE - KILOHMS
50
40
30
20
10
0
R_k = 56 Ω
41
33
22
10
5
0
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES

4HM6


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
Cathode Resistor Unbypassed
INPUT CAPACITANCE - MICROMICROFARADS
16
14
12
10
8
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES
0
5
10
22
33
41
R_k = 56 Ω

TUNG-SOL

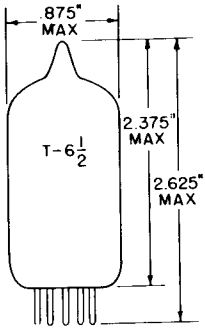
TWIN PENTODE

MINIATURE TYPE

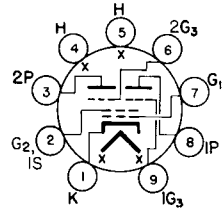
COATED UNIPOTENTIAL CATHODE

FOR T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 4HS8 IS A MINIATURE TWIN PENTODE THAT INCORPORATES SEPARATE PLATES AND #3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, #1 GRID, AND CATHODE. IT IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, EACH SECTION	2.0	pf
GRID #1 TO ALL	6.0	pf
GRID #3 (EACH SECTION) TO ALL	3.6	pf
PLATE (EACH SECTION) TO ALL	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2), MAX.	0.015	pf

HEATER RATINGS AND CHARACTERISTICS

DESIGN-MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±25	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME[A]		11	SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, EACH SECTION	300	VOLTS
SCREEN VOLTAGE	150	VOLTS
POSITIVE DC GRID #3 VOLTAGE, EACH SECTION	3.0	VOLTS
NEGATIVE DC GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
PEAK POSITIVE GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS
SCREEN DISSIPATION	0.75	WATT
DC CATHODE CURRENT	12	MA.
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
GRID #3 CIRCUIT RESISTANCE, EACH SECTION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS - BOTH SECTIONS OPERATING

PLATE VOLTAGE, EACH SECTION	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE, EACH SECTION	-10	0	VOLTS
GRID #1 VOLTAGE [B]			
PLATE CURRENT, EACH SECTION	---	2.0	MA.
SCREEN CURRENT	7.0	4.4	MA.
CATHODE CURRENT	7.1	8.5	MA.

AVERAGE CHARACTERISTICS - EACH SECTION SEPARATELY

WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	B	VOLTS
GRID #3 TRANSCONDUCTANCE	---	450	μMHOS
GRID #1 TRANSCONDUCTANCE	1100	---	μMHOS
PLATE CURRENT	---	2.0	MA.
GRID #3 VOLTAGE, (APPROX.) AT Ib = 100 μA	---	-3.5	VOLTS
GRID #1 VOLTAGE, (APPROX.) Ib = 100 μAMPS.	---	-2.3	VOLTS

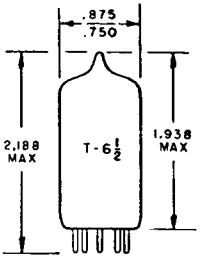
B
WITH GRID CURRENT ADJUSTED FOR 100 MICROAMPERES DC.

SIMILAR TYPE REFERENCE: *Except for heater ratings, and heater warm-up time, the 4HS8 is identical to the 6HS8.*

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SEMI-REMOTE-CUTOFF PENTODE

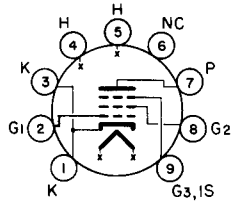
FOR

I.F. AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9 PM

THE 4HT6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4HT6 IS IDENTICAL TO THE 3HT6 AND THE 6HT6.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO GROUND	UNSHIELDED	
GRID 1 TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.2 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

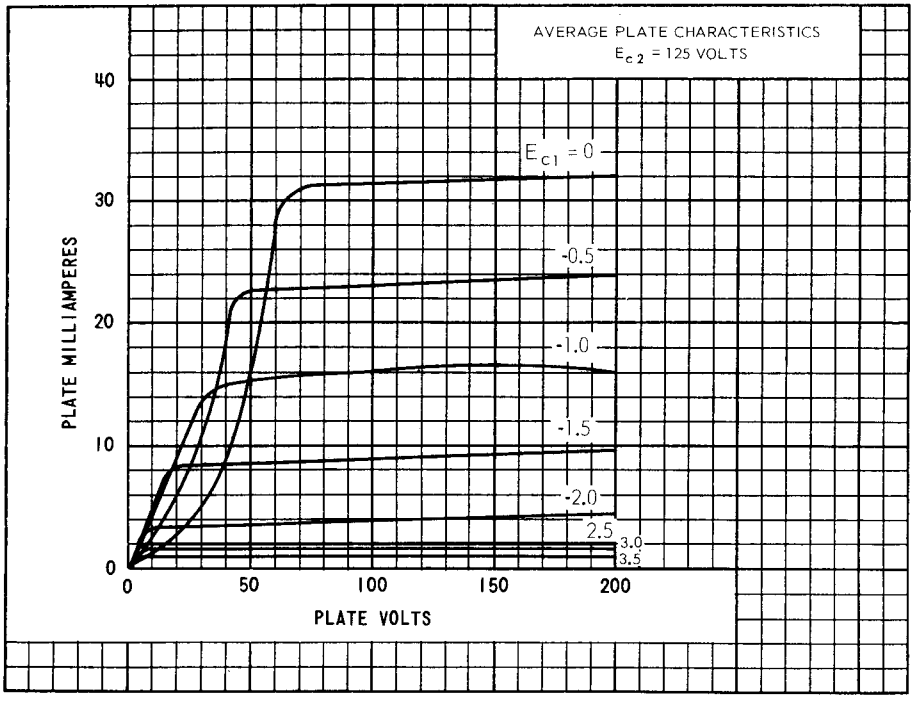
DESIGN MAXIMUM VALUES • SEE EIA STANDARD RS-239

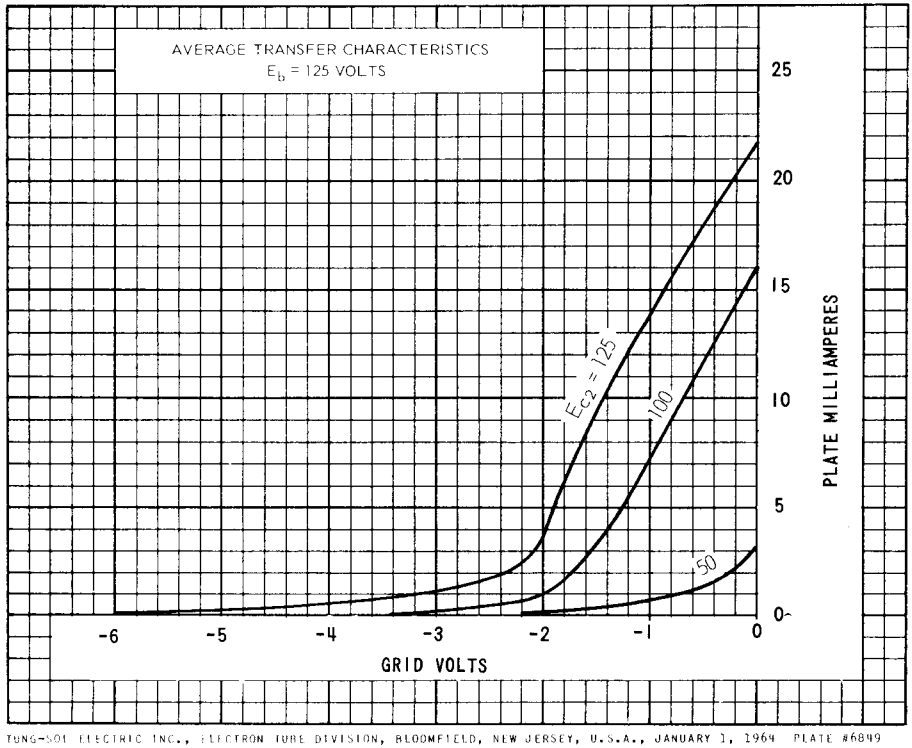
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
GRID 1 VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION	0.6	WATTS
CATHODE CURRENT	25	MA.
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

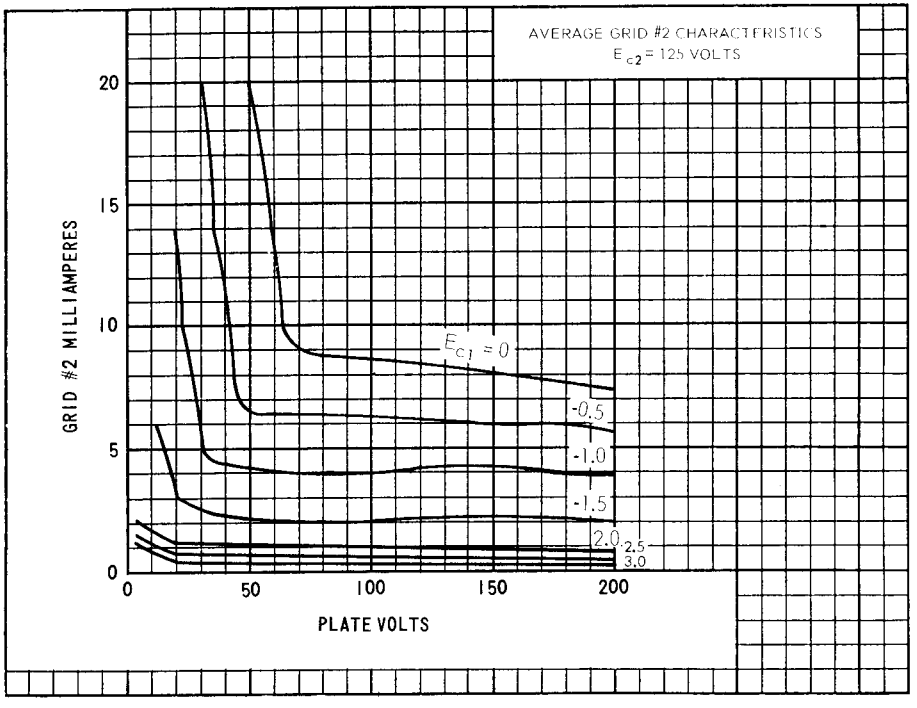
PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	MA.
GRID 2 CURRENT	4.0	MA.
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.143	MEGOHM
GRID 1 CUTOFF BIAS FOR G_m = 50 μMHOS	-6.7	VOLTS
CUTOFF TRANSCONDUCTANCE:		
FOR E_{c1} = -1.5	12,000	μMHOS
FOR E = -3.5	300	μMHOS
HOT INPUT RESISTANCE [A]	12,700	OHMS
HOT INPUT CAPACITANCE [A]	7.45	pf

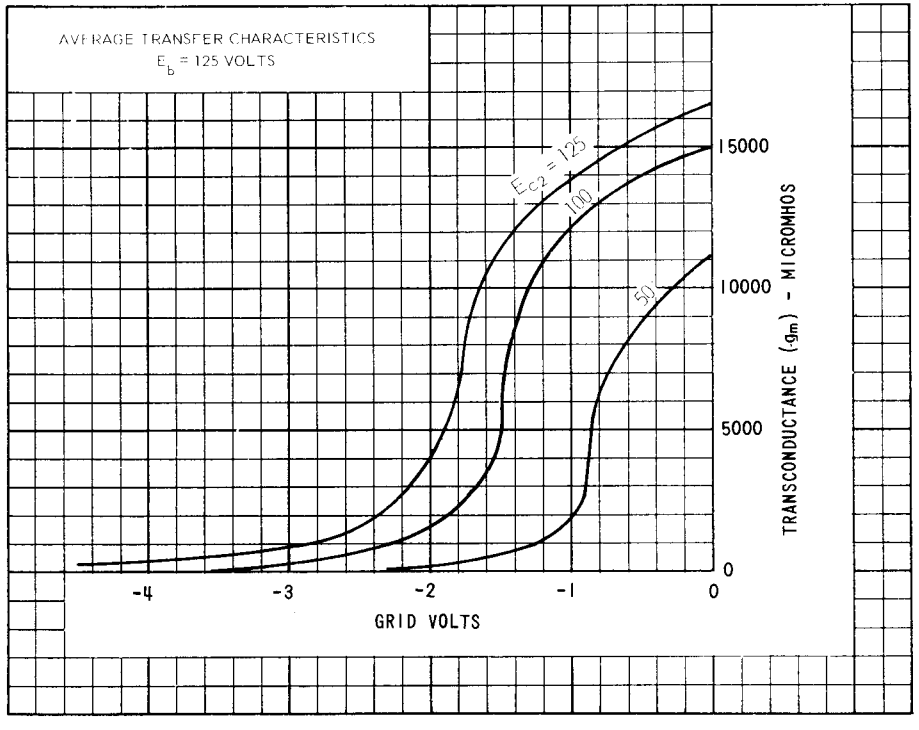
A - MEASURED 44 Mc/s WITH UNBYPASSED 56 OHM CATHODE RESISTANCE

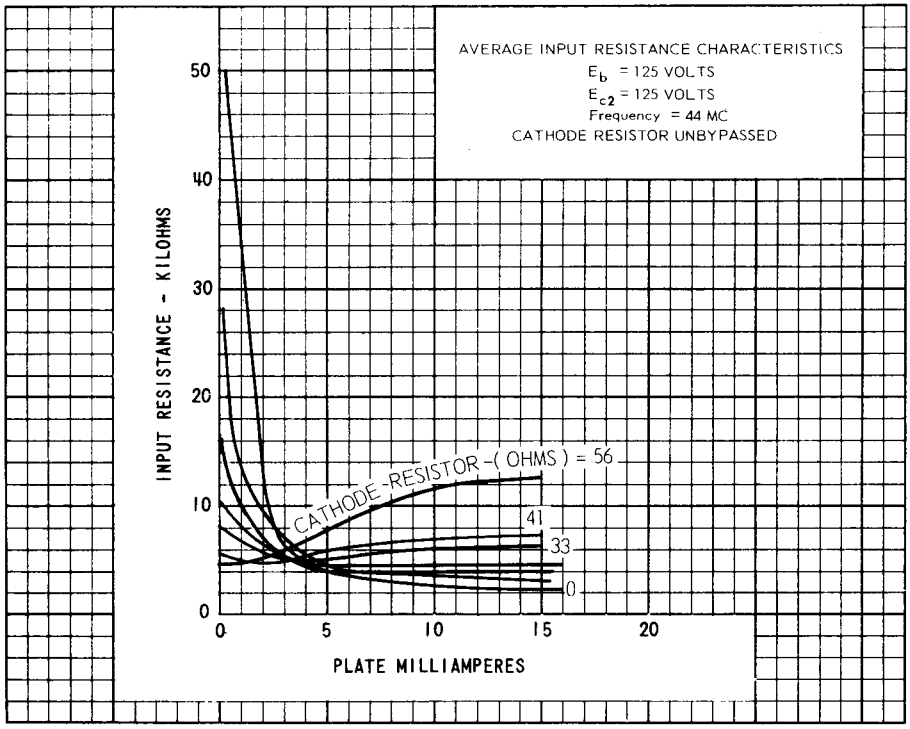


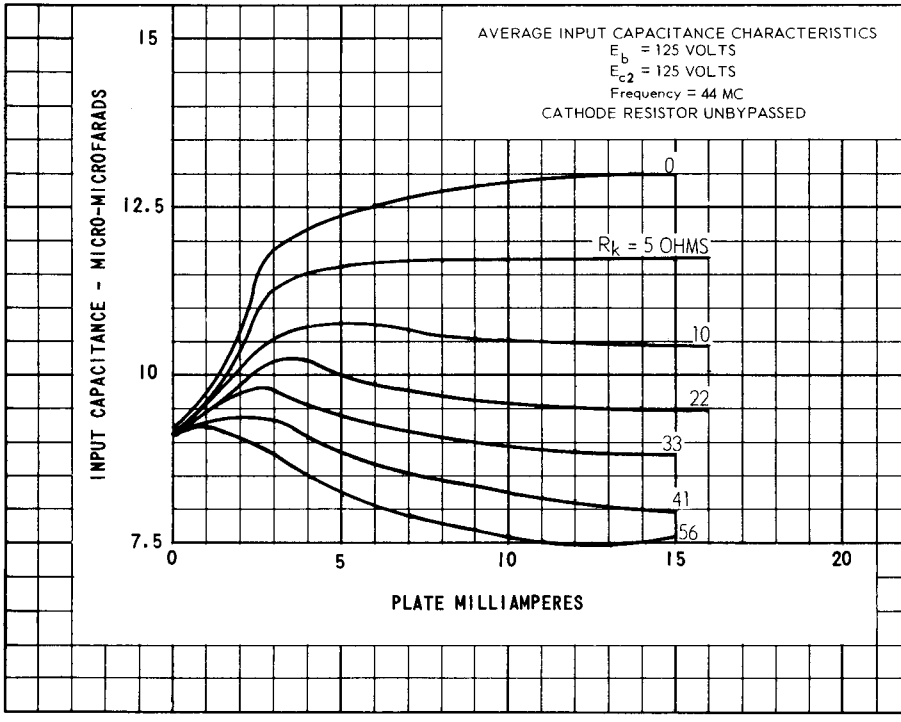


TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., JANUARY 1, 1964 PLATE #6849


AVERAGE GRID #2 CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
0
5
10
15
20
50
100
150
200


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID VOLTS
E_{c2} = 125
100
50
0
5000
10000
15000
-4
-3
-2
-1
0





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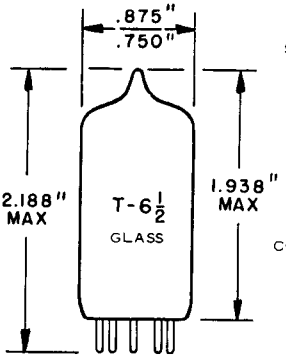
TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2

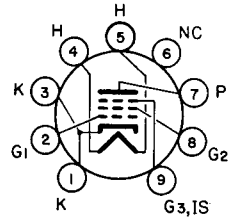


BASE 9 PIN BUTTON
JEDEC E9-1

SEMI-REMOTE-CUTOFF PENTODE
FOR
I.F. AMPLIFIER STAGES
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 4JC6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4JC6 IS IDENTICAL TO THE 3JC6 AND THE 4JC6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	.019	pf
INPUT (G1 TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS • SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.5 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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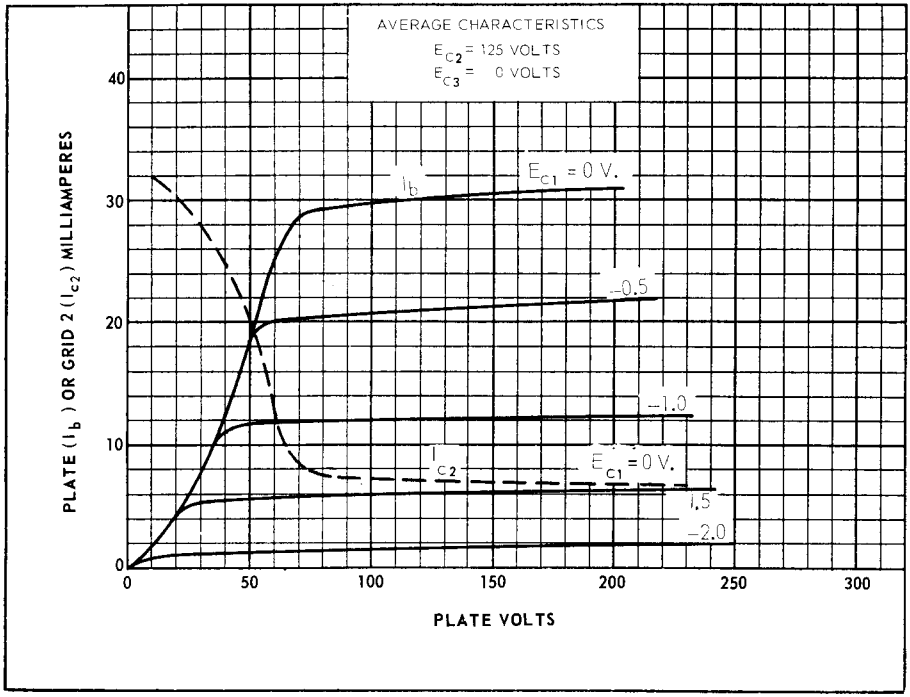
MAXIMUM RATINGS

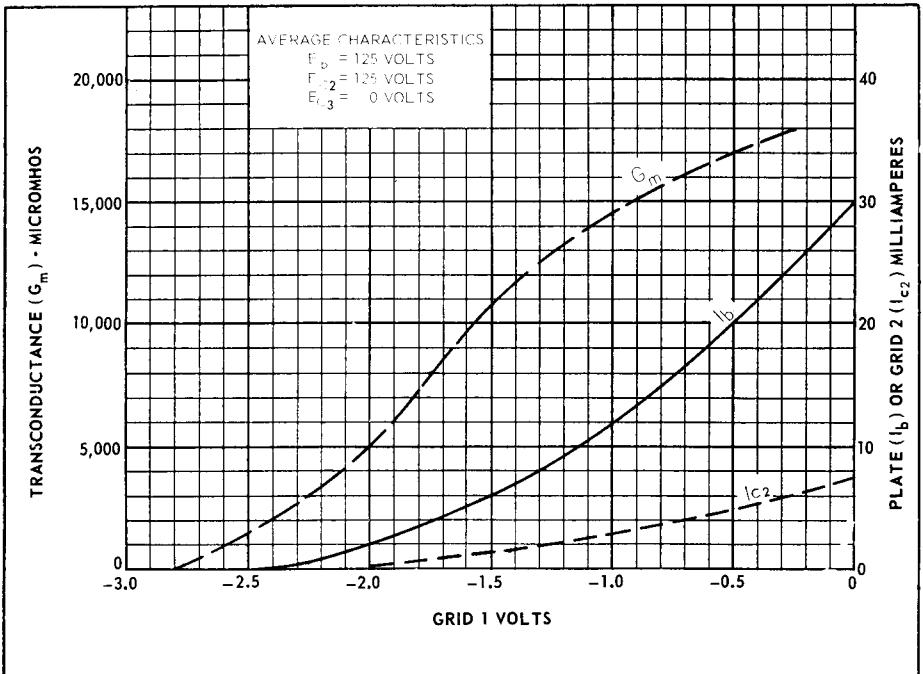
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

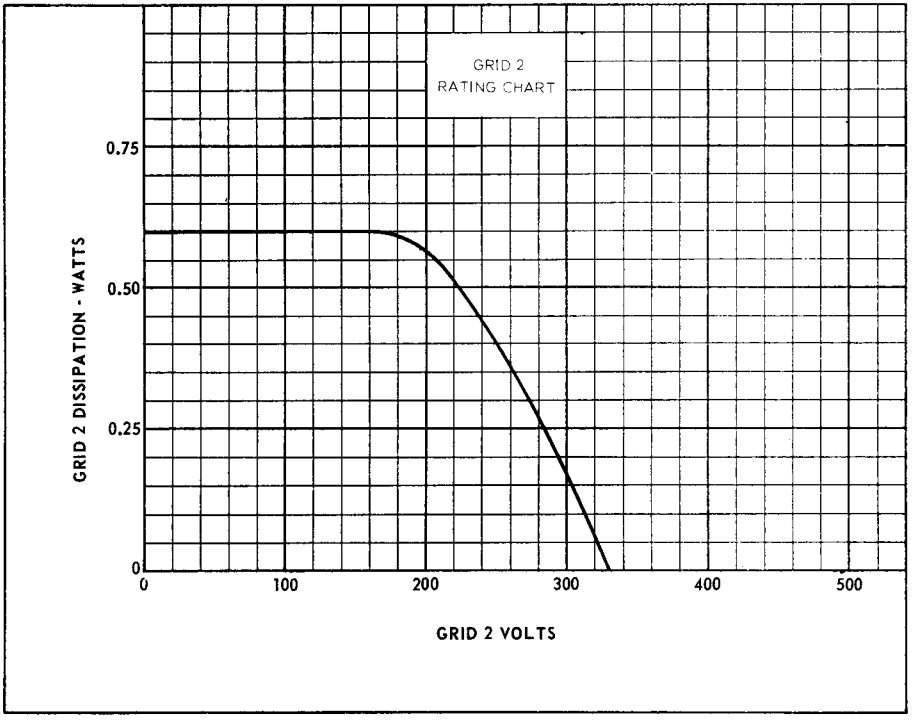
PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCES:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	mA
GRID 2 CURRENT	3.2	mA
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.18	MEGOHM
GRID 1 VOLTAGE FOR I_b = 100 mA	-3.0	VOLTS


AVERAGE CHARACTERISTICS
E_{c2} = 125 VOLTS
E_{c3} = 0 VOLTS
I_b
E_{c1} = 0 V.
-0.5
-1.0
I_{c2}
E_{c1} = 0 V.
-1.5
-2.0
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
0
50
100
150
200
250
300


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
E_{c3} = 0 VOLTS
G_m
I_b
I_{c2}
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
GRID 1 VOLTS
0
5,000
10,000
15,000
20,000
0
10
20
30
40
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0

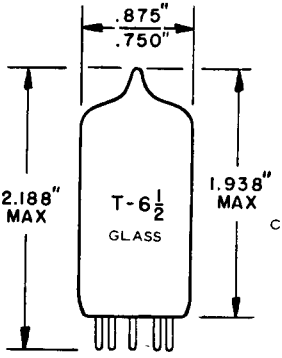

GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2



BASE 9 PIN BUTTON
JEDEC E9-1

SHARP-CUTOFF PENTODE

FOR

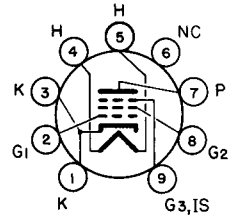
IF AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 4JD6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 4JD6 IS IDENTICAL TO THE 3JD6 AND THE 6JD6.

DIRECT INTERELECTROCE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	0.019	pf
INPUT (G TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.5 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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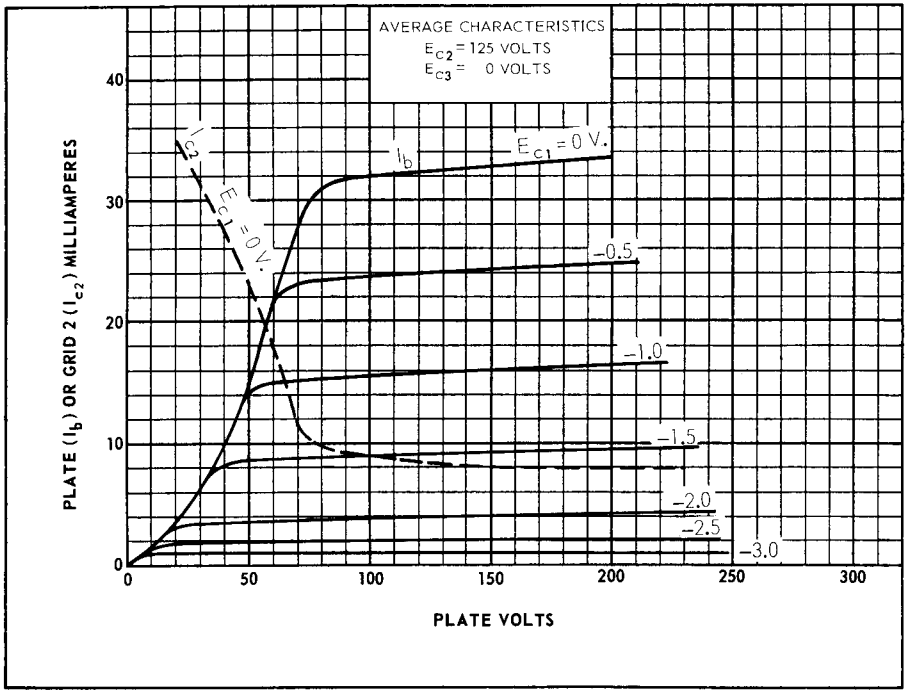
MAXIMUM RATINGS

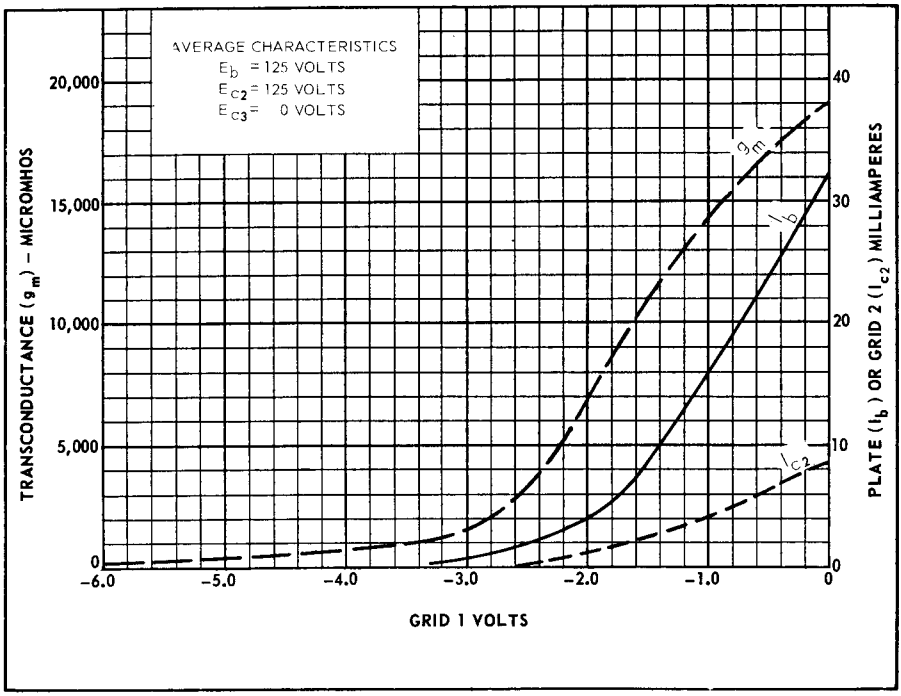
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	mA
GRID 2 CURRENT	4	mA
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.16	MEGOHM
GRID 1 VOLTAGE FOR G_m = 600 μMHOS	-4.5	VOLTS





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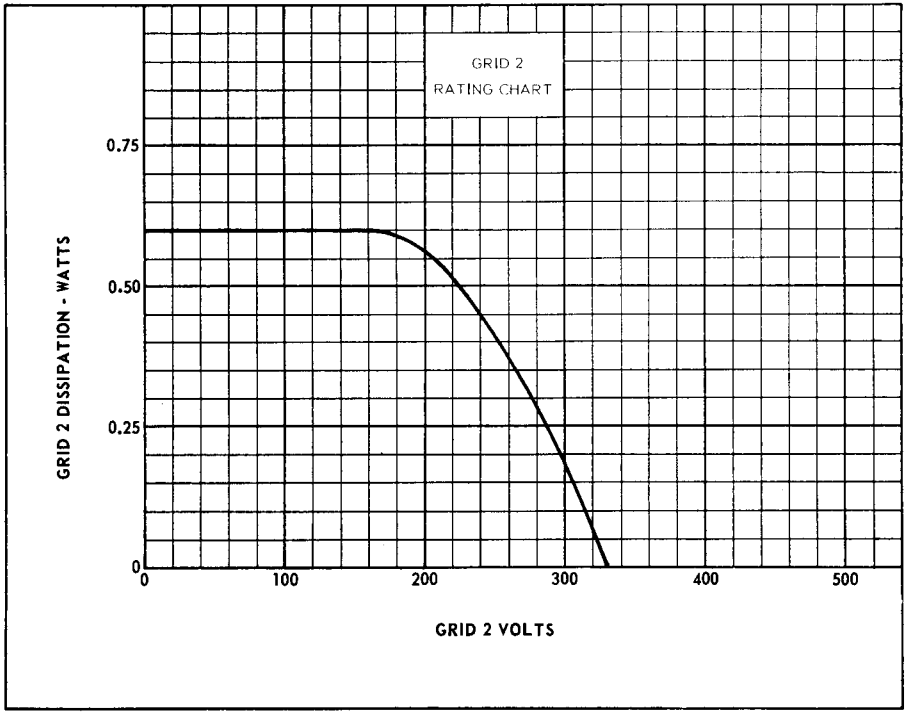
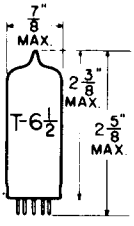
4JD6


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



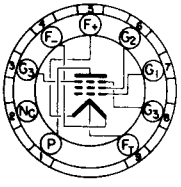
GLASS BULB

COATED FILAMENT

SERIES FILAMENT	PARALLEL FILAMENT
E_f APPLIED BETWEEN PINS #4 AND #5	E_f APPLIED BETWEEN PIN #9 AND PINS #4 & #5 TIED TOGETHER.
E_{g1} REFERRED TO PIN #4	E_{g1} REFERRED TO PIN #9
5.0 VOLTS 230 MA.	2.5 VOLTS 460 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 9 PIN BASE

9L

THE 5A6 IS A MINIATURE FILAMENTARY TYPE PENTODE RF POWER AMPLIFIER, INTENDED FOR SERVICE WHERE MODERATE AMOUNTS OF RF POWER ARE DESIRED IN PORTABLE EQUIPMENT. ITWILL DELIVER 3 WATTS OF RF POWER WITH LOW DRIVING POWER AT 70 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.10	0.15	μμf
INPUT: G_1 TO ($F+G_2+G_3$)	8.5	8.5	μμf
OUTPUT: P TO ($F+G_2+G_3$)	9.5	6	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CLASS B OR CLASS C AMPLIFIER

FILAMENT VOLTAGE (±15%)	2.5	5.0	VOLTS
MAXIMUM PLATE VOLTAGE	150		VOLTS
MAXIMUM GRID #3 VOLTAGE	0		VOLTS
MAXIMUM GRID #2 VOLTAGE	150		VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	−75		VOLTS
MAXIMUM PLATE DISSIPATION	5		WATTS
MAXIMUM GRID #2 POWER INPUT	2		WATTS
MAXIMUM PLATE CURRENT	40		MA.
MAXIMUM GRID #1 CURRENT	3		MA.
MAXIMUM FREQUENCY FOR MAXIMUM PLATE INPUT POWER	100		MC

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PLATE 2270
NOV. 1, 1949

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

RF AMPLIFIER AT 70 MC

	CLASS B		CLASS C		
FILAMENT VOLTAGE	2.5	5.0	2.5	5.0	VOLTS
FILAMENT CURRENT	460	230	460	230	MA.
DC PLATE VOLTAGE	150		150		VOLTS
GRID #3 VOLTAGE	0		0		VOLTS
DC GRID #2 VOLTAGE	150		150		VOLTS
DC GRID #1 VOLTAGE	-15		-24		VOLTS
PEAK RF GRID #1 VOLTAGE	23		35		VOLTS
GRID #2 RESISTOR	1 500		0		OHMS
GRID #1 RESISTOR	15 000		20 000		OHMS
DC PLATE CURRENT	40		40		MA.
DC GRID #2 CURRENT	7		11		MA.
DC GRID #1 CURRENT	1		1.2		MA.
GRID #1 DRIVING POWER (APPROX.)	60		100		MW.
USEFUL POWER OUTPUT	2.8		3.1		WATTS
TRIODE AMPLIFICATION FACTOR (APPROX. AT I_b = 30 MA.)		6.8			

PLATE 2271
NOV. 1, 1949

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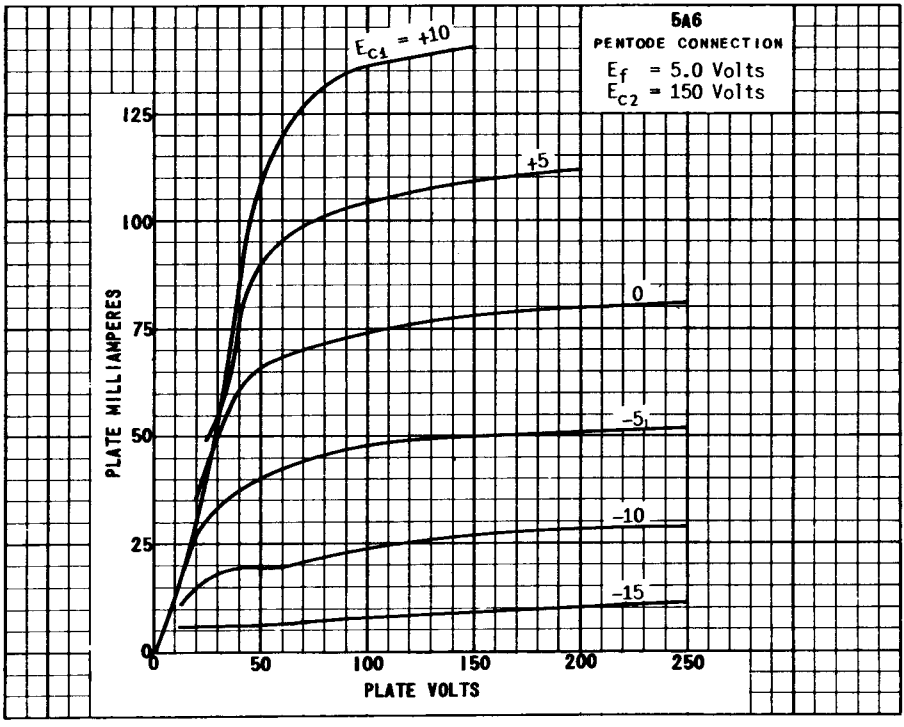

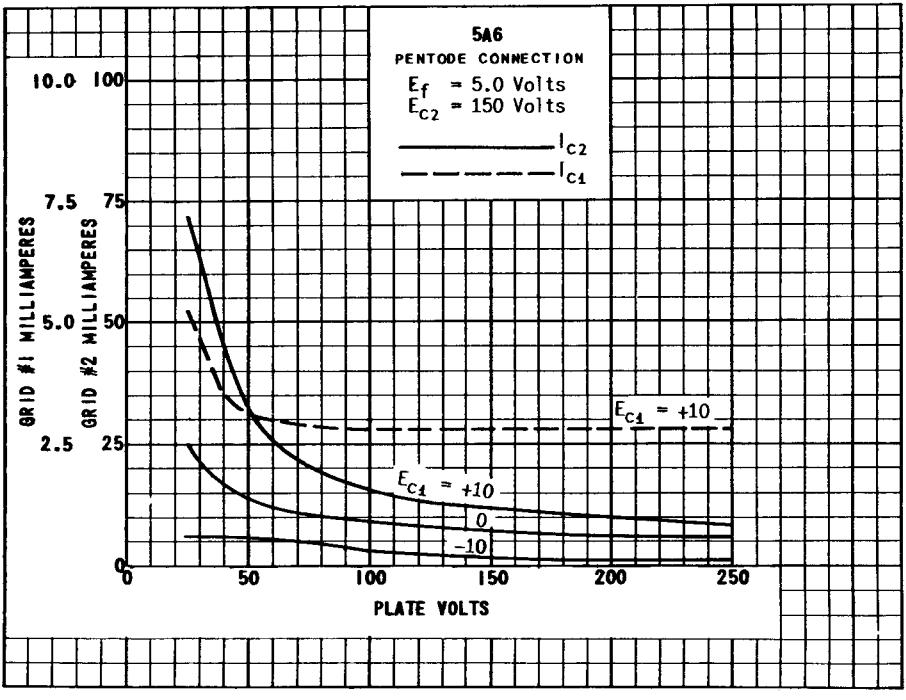

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PLATE
2210
JUNE 1,
1949

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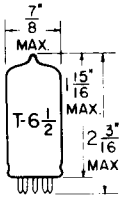
TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

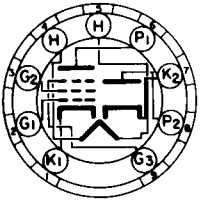


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9CY

THE 5AM8 IS A DIODE PENTODE ESPECIALLY DESIGNED FOR USE AS A VIDEO DETECTOR AND IF AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE			
GRID #1 TO PLATE (MAX.)	0.015	0.015	μμf
INPUT	6.0	6.0	μμf
OUTPUT	3.4	2.6	μμf
DIODE			
INPUT: P TO (H+K)	2.3	1.7	μμf
CATHODE TO (H+P)	3.0	3.0	μμf
COUPLING (DIODE PLATE TO PENTODE PLATE)	0.035	0.10	μμf
COUPLING (DIODE PLATE TO GRID #1)	0.005	0.006	μμf
COUPLING (DIODE CATHODE TO PENTODE PLATE)	0.15	0.15	μμf

[A] SHIELD #315.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC.	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.8	WATTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS	1.0	MEGOHM
FIXED BIAS	0.25	MEGOHM
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	5.0	MA.
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

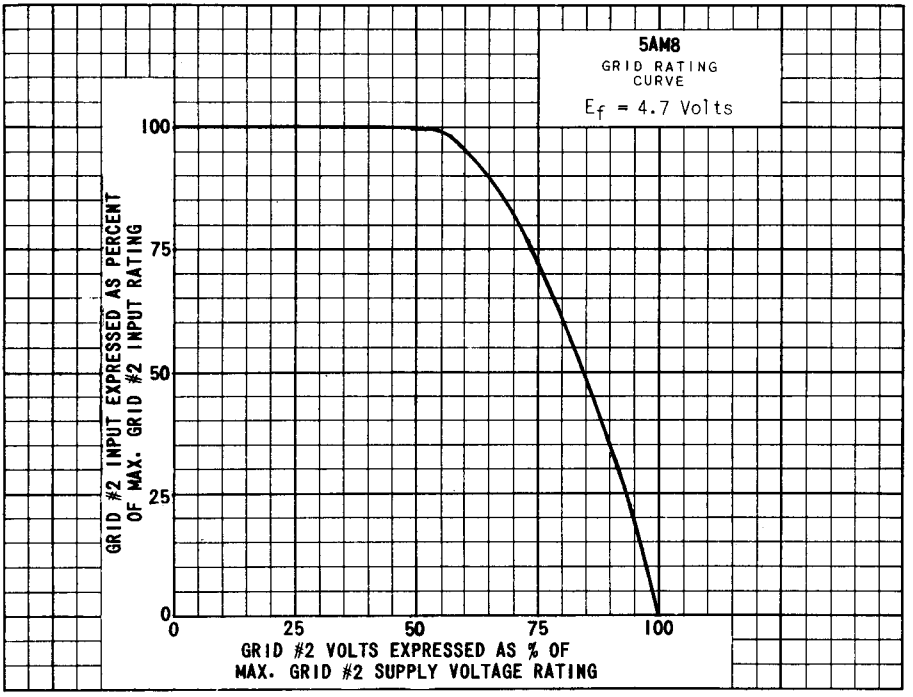
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

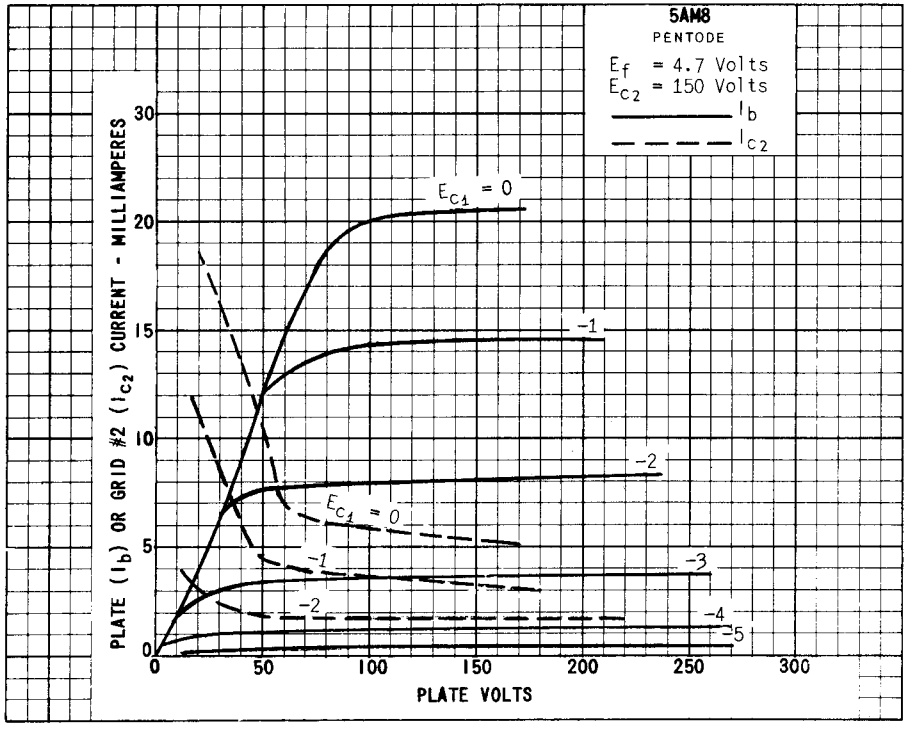
HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #3 VOLTAGE	0	VOLTS
CATHODE RESISTOR	120	OHMS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	2.7	MA.
TRANSCONDUCTANCE	7 000	μMHOS
PLATE RESISTANCE (APPROX.)	0.6	MEGOHM
GRID #1 VOLTAGE FOR I_b = 10 μAMP.	-8	VOLTS
DIODE PLATE VOLTAGE FOR DIODE CURRENT = 50 MA.[C]	10	VOLTS

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] TEST CONDITION ONLY. OPERATING CONDITIONS MUST NOT EXCEED THE DESIGN CENTER RATING.

SIMILAR TYPE REFERENCE: Its characteristics are identical to the 6AM8 except for heater ratings and heater warm-up time.

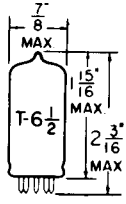

5AM8
GRID RATING
CURVE
E_f = 4.7 Volts
GRID #2 INPUT EXPRESSED AS PERCENT OF MAX. GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTS EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING


5AM8
PENTODE
E_f = 4.7 Volts
E_{c_2} = 150 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) CURRENT - MILLIAMPERES
30
20
15
10
5
0
E_{c_1} = 0
-1
-2
E_{c_1} = 0
-1
-2
-3
-4
-5
0
50
100
150
200
250
300
PLATE VOLTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

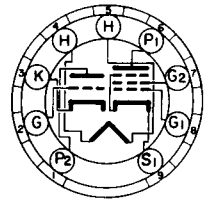


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 5AN8 IS A GENERAL PURPOSE, MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. CONTAINING A MEDIUM-MU TRIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE, IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS INTENDED FOR A WIDE VARIETY OF APPLICATIONS IN COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6AN8.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

TRIODE UNIT		
GRID TO PLATE	1.5	μμf
INPUT	2.0	μμf
OUTPUT	0.27	μμf
PENTODE UNIT		
GRID #1 TO PLATE (MAX.)	0.04	μμf
INPUT	7.0	μμf
OUTPUT	2.3	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.006	μμf
PENTODE PLATE TO TRIODE PLATE	0.045	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER -- DESIGN CENTER VALUES

	TRIODE UNIT		PENTODE UNIT	
HEATER VOLTAGE	4.7			VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100		100	VOLTS
TOTAL DC AND PEAK	200[A]		200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	300		300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	---		SEE CURVE #1	
MAXIMUM GRID #1 VOLTAGE				
POSITIVE BIAS VALUE	0		0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6	←	2.0	WATTS
MAXIMUM GRID #2 INPUT	---		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:[B]				
FOR CATHODE-BIAS OPERATION	1.0		1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5		0.25	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0			SEC.

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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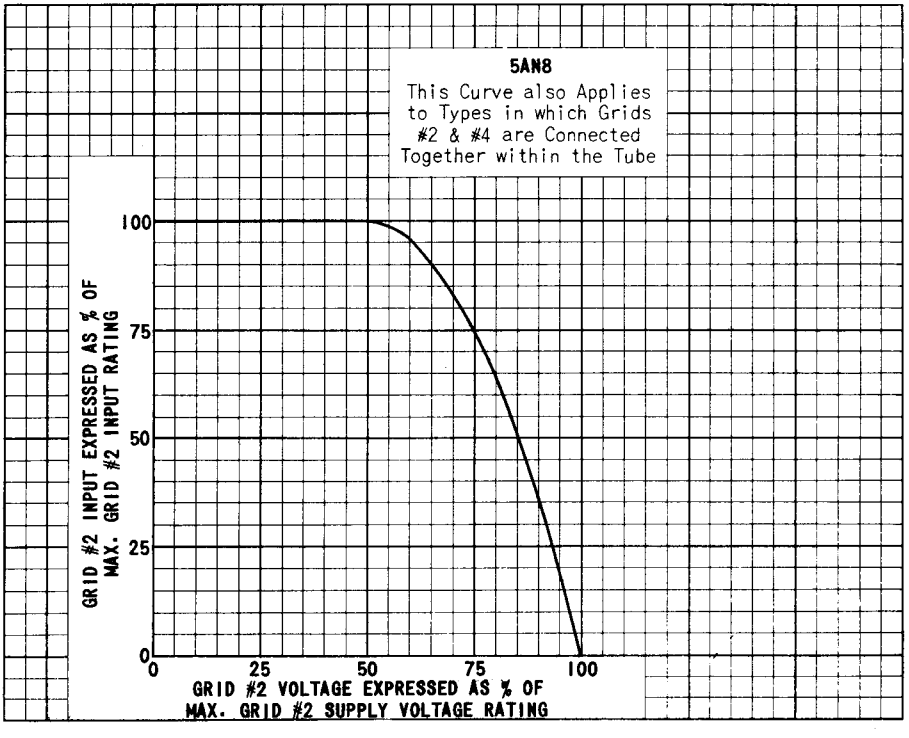
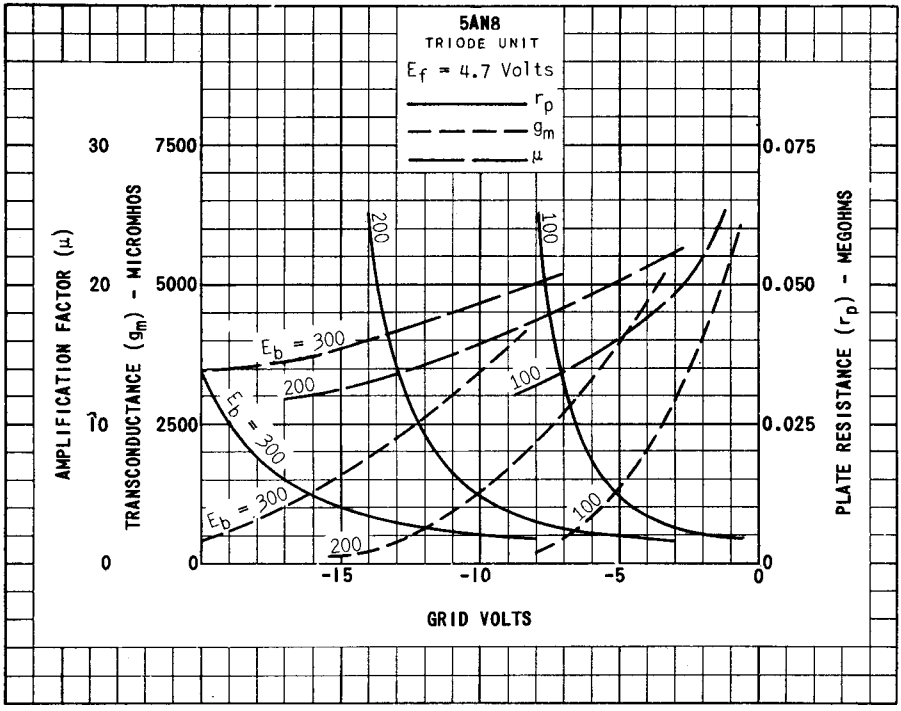
TUNG-SOL

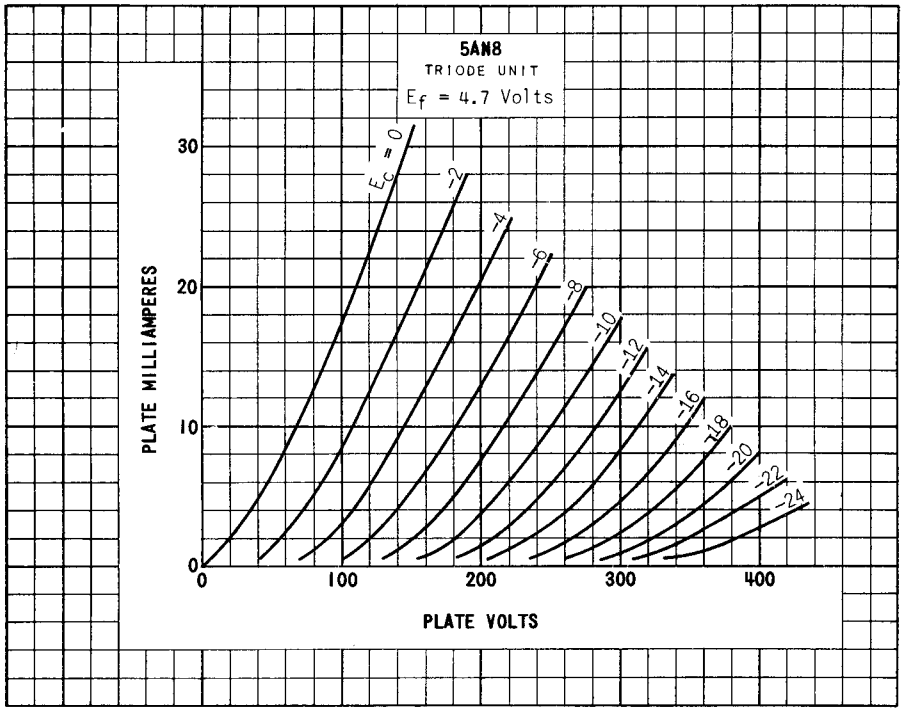
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	4.7		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	3 300	6 200	µMHOS
GRID #1 BIAS (APPROX.) FOR I_b = 10 µA.	-19	-8	VOLTS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	2.8	MA.







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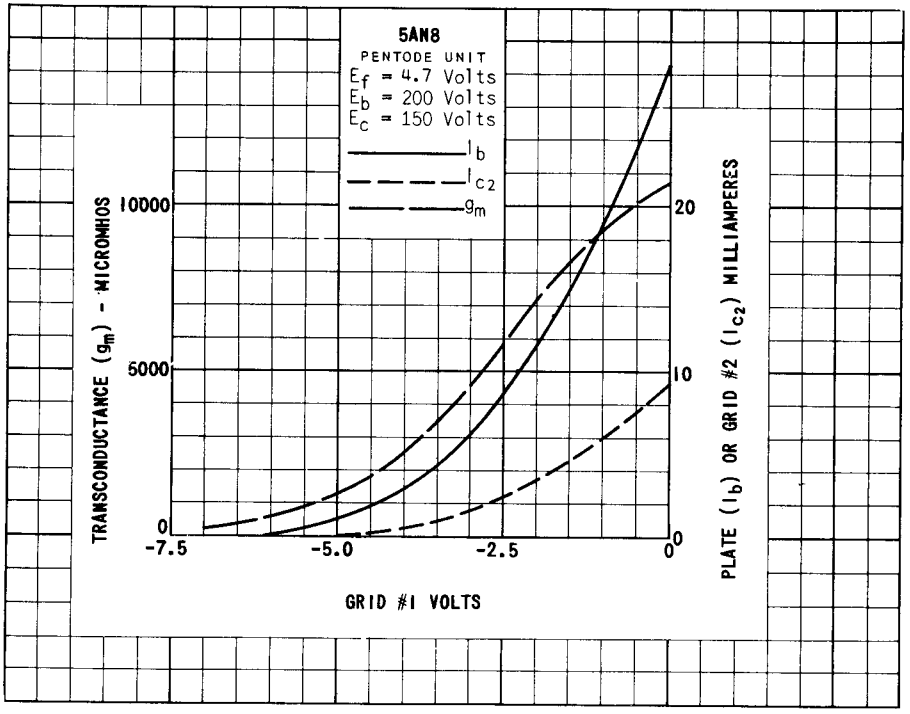
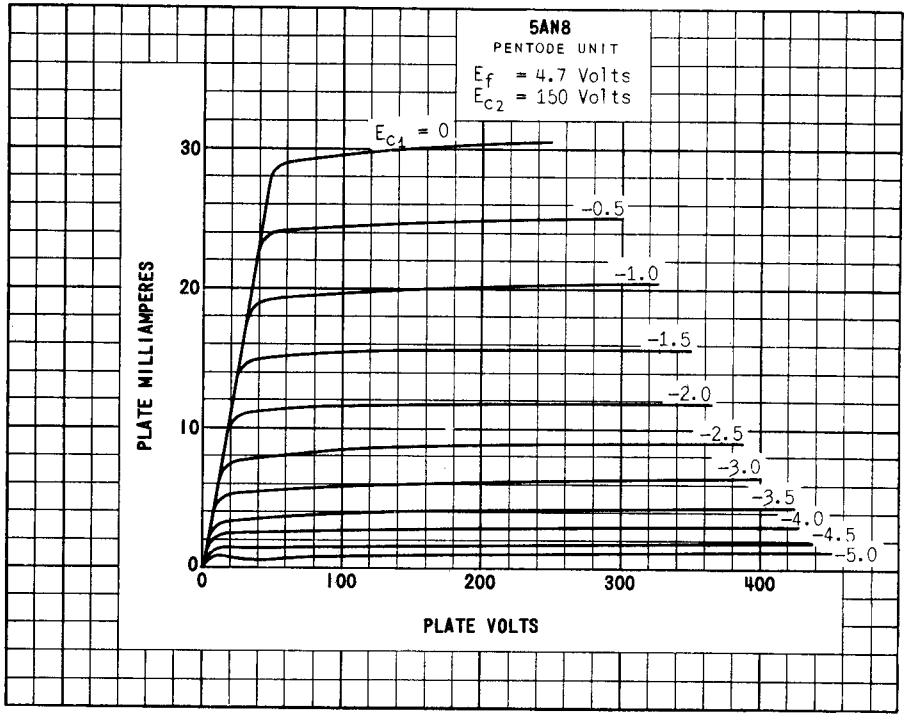

5AN8
PENTODE UNIT
E_f = 4.7 Volts
E_b = 200 Volts
E_c = 150 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
5000
0
-7.5
-5.0
-2.5
0
20
10
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 VOLTS


5AN8
PENTODE UNIT
E_f = 4.7 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

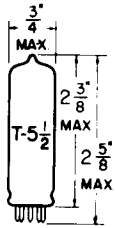
COATED UNIPOTENTIAL CATHODE

HEATER

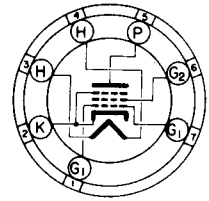
4.7 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BZ

THE 5AQ5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN 600MA. SERIES HEATER OPERATED TV RECEIVERS WHERE HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT IS DESIRED. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6AQ5.

DIRECT INTERELECTRODE CAPACITANCES — APPROX. ←

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.4	μμf
INPUT	8.0	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	0.6±6%	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	275 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	275 ←	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 INPUT	2	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)[A]	250	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHMS
CATHODE BIAS OPERATION	0.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] HIGH AMBIENT TEMPERATURE AND SHIELDING MAY NECESSITATE A REDUCTION IN OPERATING DISSIPATION. WHEN TUBE SHIELDS ARE USED, IT IS ADVISABLE TO PAINT THE INSIDE AND OUTSIDE SURFACES OF THE TUBE SHIELD A DULL BLACK AND TO PROVIDE VENTILATION SLOTS TO REDUCE OPERATING TEMPERATURE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B C] *

GRID #2 CONNECTED TO PLATE

HEATER VOLTAGE	0.6±6%	VOLTS
MAXIMUM DC PLATE VOLTAGE	275	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABS. MAX.)	1100	VOLTS
MAXIMUM PLATE DISSIPATION[D]	10	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	275	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	40	MA.
MAXIMUM PEAK CATHODE CURRENT	115	MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER[E]

HEATER VOLTAGE	0.6±6%	0.6±6%	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	3	4.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	4	7	MA.
PLATE RESISTANCE (APPROX.)	58 000	52 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	μMHOS
LOAD RESISTANCE	5 500	5 000	OHMS
TOTAL HARMONIC DISTORTION	8	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.0	4.5	WATTS

[E] SINGLE TUBE.

AVERAGE CHARACTERISTICS - TRIODE CONNECTED*

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	4800	μMHOS
AMPLIFICATION FACTOR	9.5	
PLATE RESISTANCE (APPROX.)	1970	OHMS
GRID VOLTAGE (APPROX.) FOR I_b=0.5 MA.	-37	VOLTS

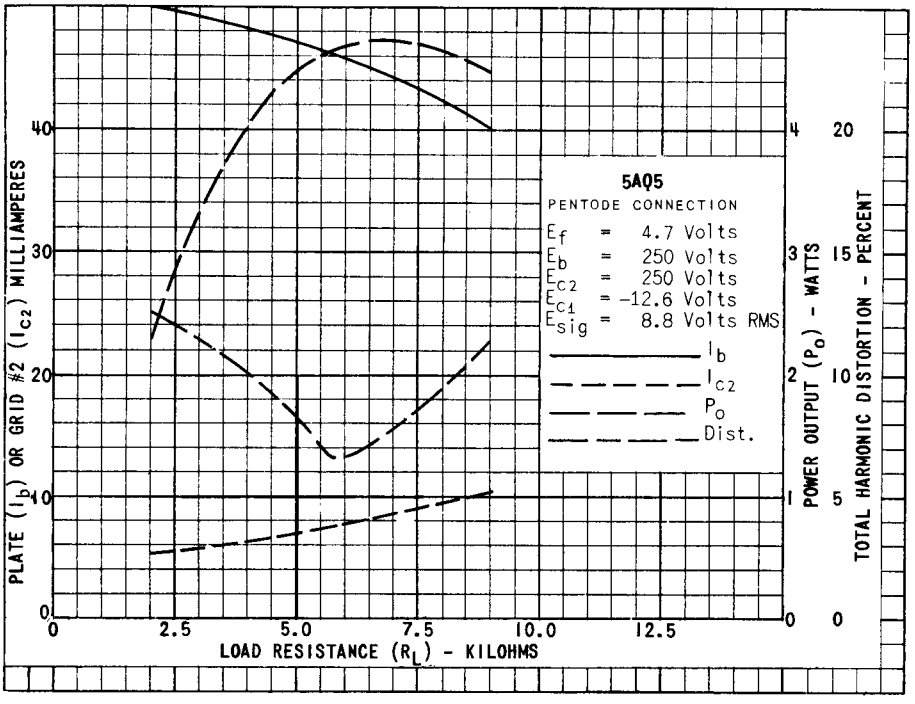
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

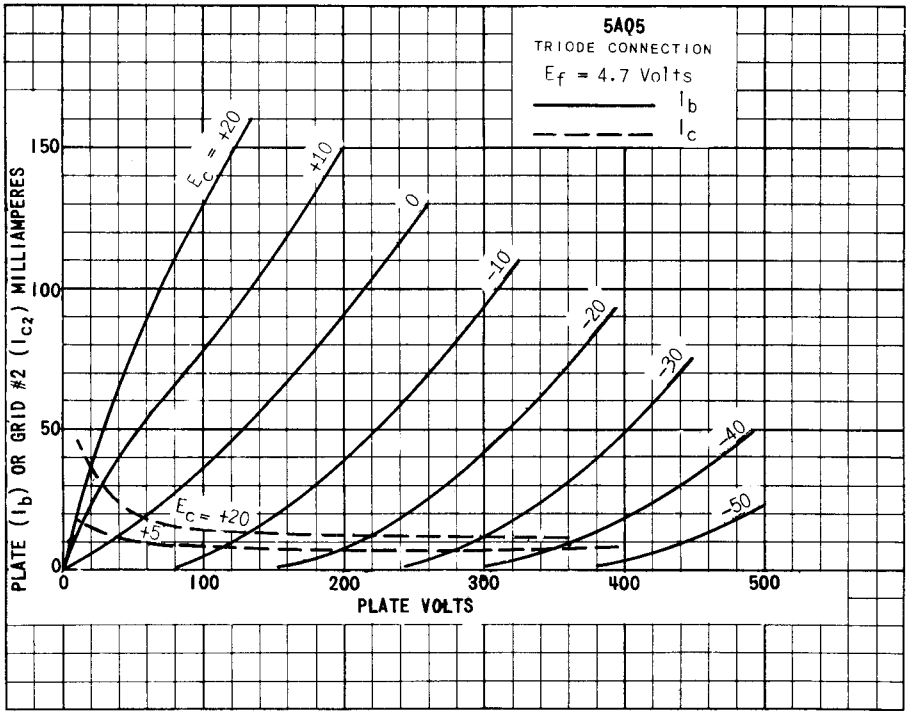
[C] TRIODE CONNECTED

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*INDICATES AN ADDITION.

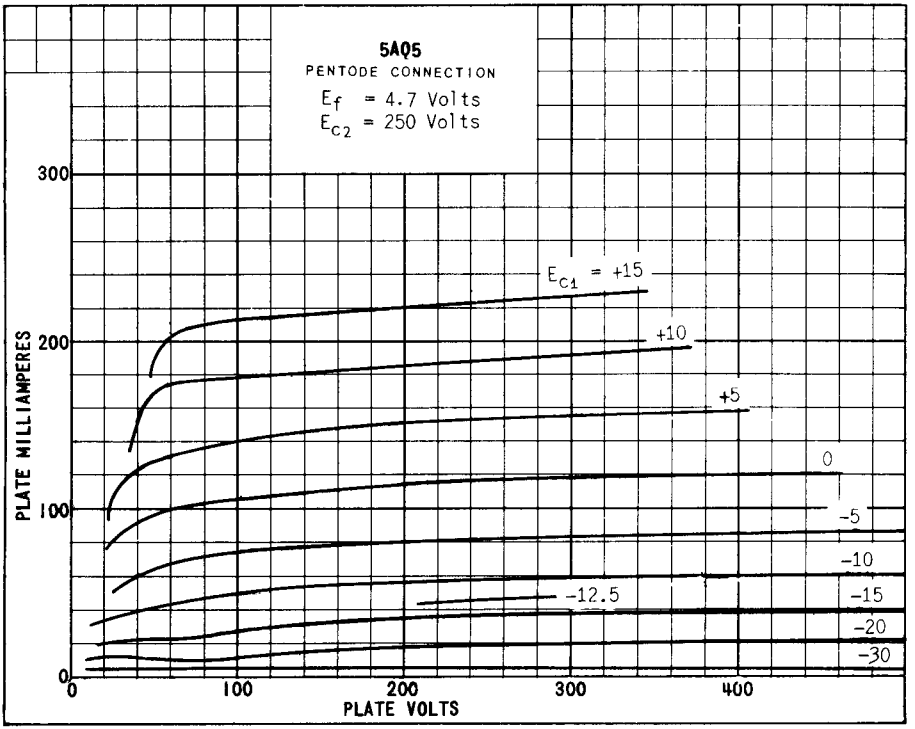
→ INDICATES A CHANGE.





TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1954 PLATE #4022

5AQ5



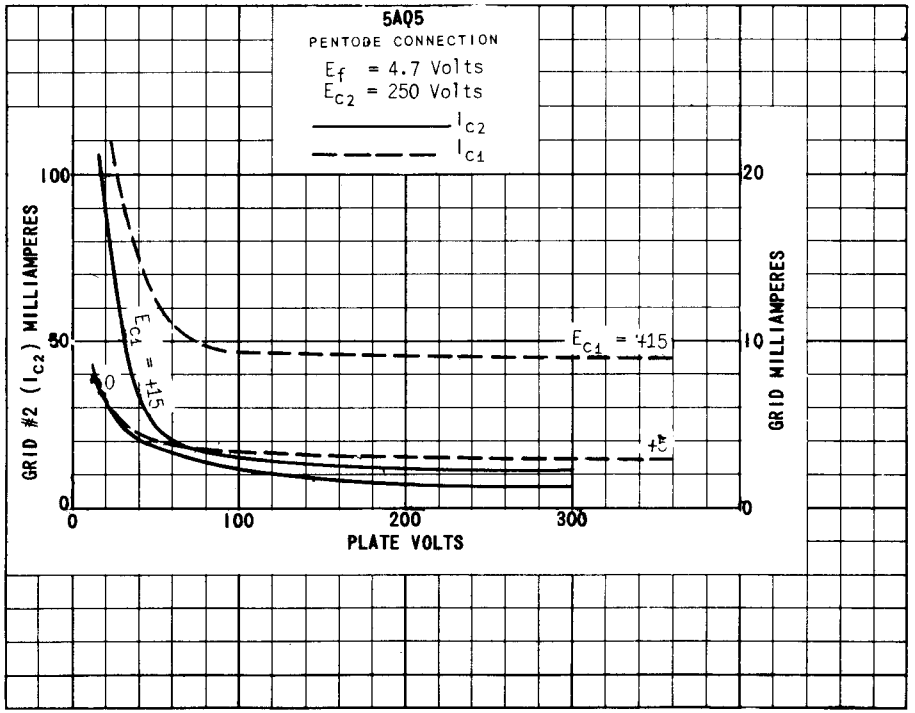
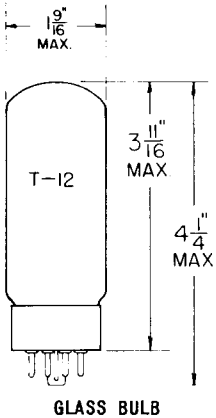


PLATE #4023 OCTOBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

TWIN-DIODE



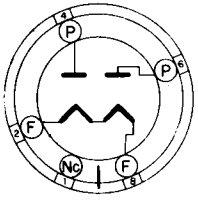
GLASS BULB

COATED FILAMENT

FILAMENT
5 VOLTS 3 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 & 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

SHORT MEDIUM SHELL
5 PIN OCTAL
OR
SHORT MEDIUM SHELL
8 PIN OCTAL
WITH
EXTERNAL BARRIERS
5T
PINS 3, 5, & 7
NO CONNECTION.

THE 5AS4A IS A FULL-WAVE VACUUM RECTIFIER INTENDED FOR USE IN POWER SUPPLIES OF TELEVISION RECEIVERS AND RADIO EQUIPMENT HAVING HIGH DC REQUIREMENTS. IT IS ESPECIALLY DESIGNED TO PERMIT OPERATION AT HIGHER PEAK AND AVERAGE CURRENT RATINGS. EXCEPT FOR THE USE OF A T-12 BULB, IT IS IDENTICAL TO THE 5AS4.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FULL-WAVE RECTIFIER

FILAMENT VOLTAGE	5	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 550	VOLTS
MAXIMUM STEADY STATE PEAK CURRENT PER PLATE	1.0	AMP.
MAXIMUM AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE	550	VOLTS
MAXIMUM DC OUTPUT CURRENT PER PLATE (SEE RATING CHART 1)		
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE	4.6	AMP.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER
CAPACITOR-INPUT FILTER

FILAMENT VOLTAGE	5	5	VOLTS
FILAMENT CURRENT	3	3	AMP.
AC PLATE TO PLATE SUPPLY VOLTAGE (RMS)[A]	600	900	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
TOTAL EFFECT. PLATE SUPPLY IMPEDANCE(PER PLATE)	21	67	OHMS
DC OUTPUT CURRENT	300	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	290	460	VOLTS
TUBE VOLTAGE DROP	54	50	VOLTS

[A] MEASURED WITHOUT LOAD.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

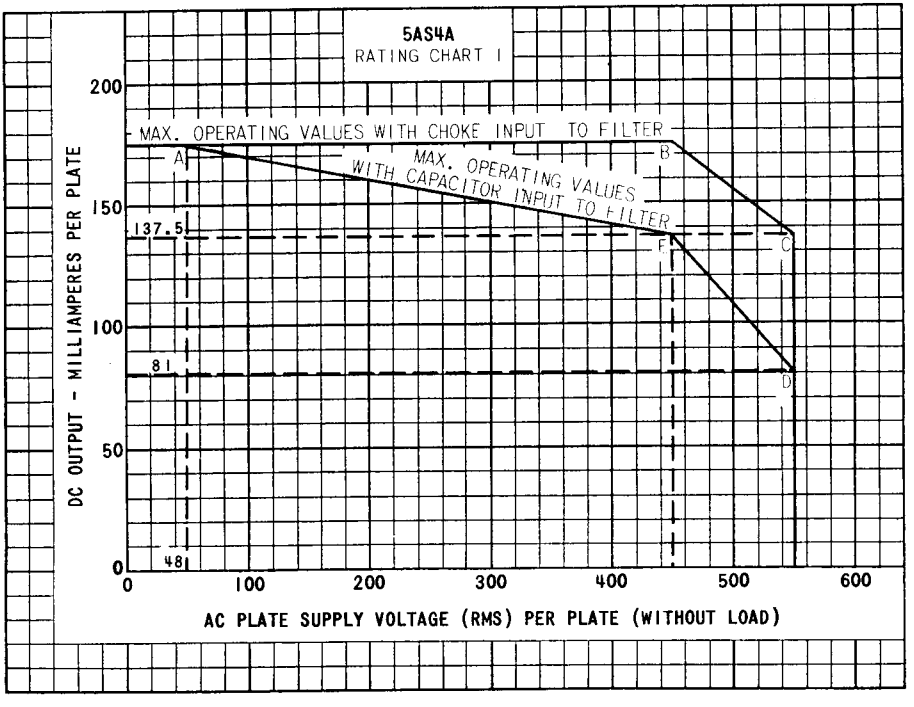
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

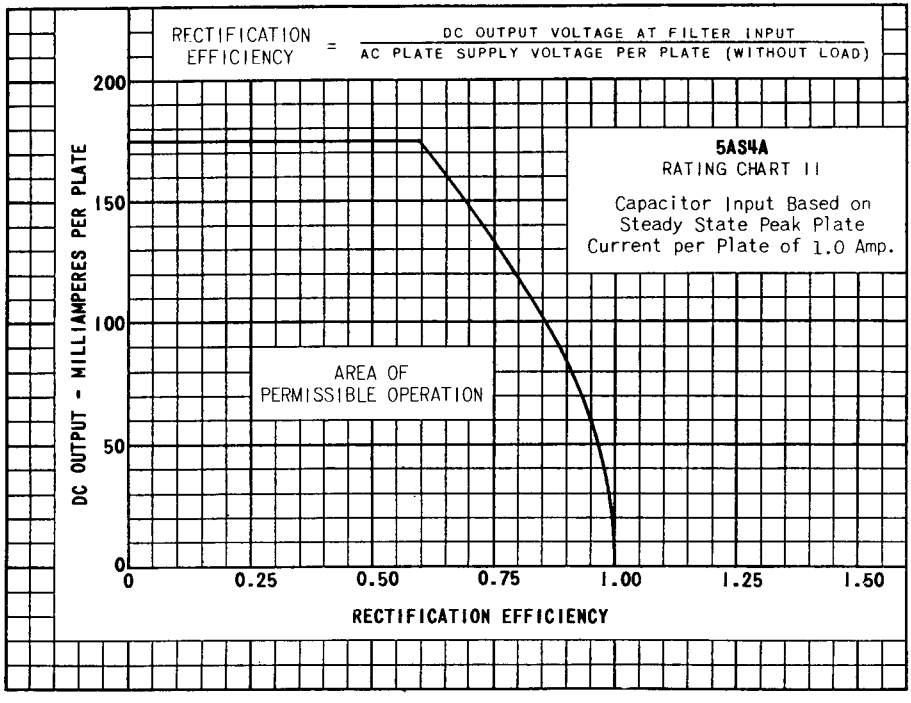
FULL-WAVE RECTIFIER

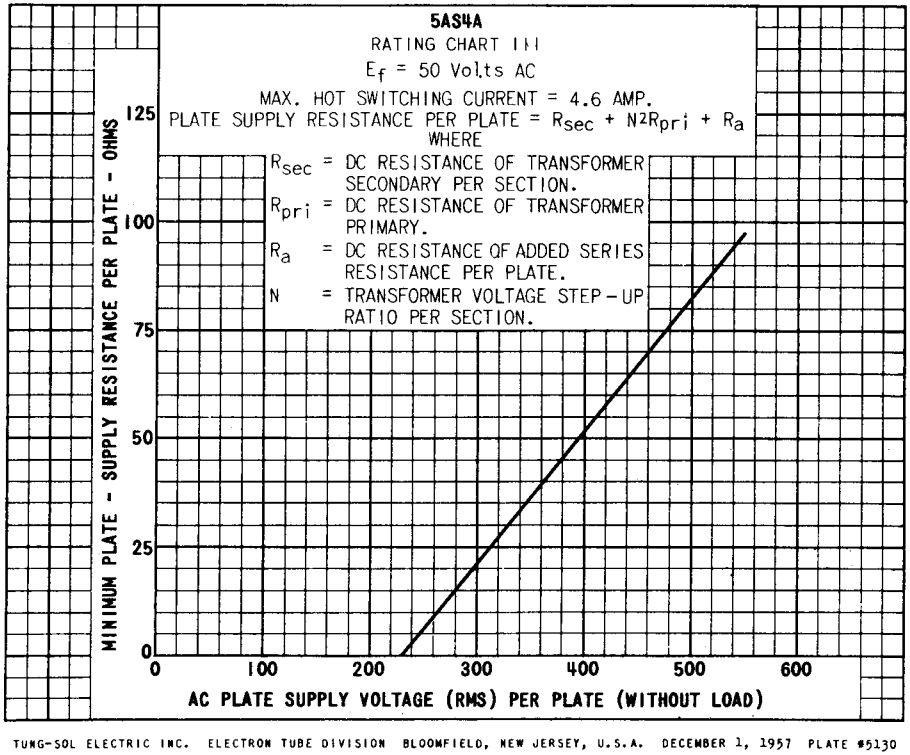
CHOKE-INPUT FILTER

FILAMENT VOLTAGE	5	VOLTS
FILAMENT CURRENT	3	AMP.
AC PLATE TO PLATE SUPPLY VOLTAGE (RMS)[A]	1,100	VOLTS
FILTER INPUT CHOKE	10	HENRIES
DC OUTPUT CURRENT	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	420	VOLTS

[A] MEASURED WITHOUT LOAD




RECTIFICATION EFFICIENCY = DC OUTPUT VOLTAGE AT FILTER INPUT / AC PLATE SUPPLY VOLTAGE PER PLATE (WITHOUT LOAD)
5AS4A
RATING CHART II
Capacitor Input Based on Steady State Peak Plate Current per Plate of 1.0 Amp.
AREA OF PERMISSIBLE OPERATION
DC OUTPUT - MILLIAMPERES PER PLATE
200
150
100
50
0
0
0.25
0.50
0.75
1.00
1.25
1.50
RECTIFICATION EFFICIENCY

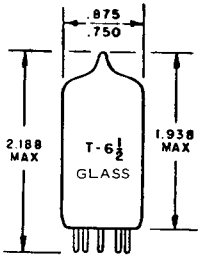

5AS4A
RATING CHART III
E_f = 50 Volts AC
MAX. HOT SWITCHING CURRENT = 4.6 AMP.
PLATE SUPPLY RESISTANCE PER PLATE = $R_{sec} + N^2R_{pri} + R_a$
WHERE
R_{sec} = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION.
R_{pri} = DC RESISTANCE OF TRANSFORMER PRIMARY.
R_a = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE.
N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION.
MINIMUM PLATE - SUPPLY RESISTANCE PER PLATE - OHMS
125
100
75
50
25
0
0
100
200
300
400
500
600
AC PLATE SUPPLY VOLTAGE (RMS) PER PLATE (WITHOUT LOAD)

TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



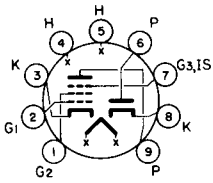
BASE 9 PIN BUTTON
JEDEC E9-1

FOR
GENERAL PURPOSE
APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9DS



BOTTOM VIEW

THE 5AS8 IS A GENERAL-PURPOSE, MULTIUNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A HIGH PERVEANCE DIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE. IT IS INTENDED FOR DIVERSIFIED APPLICATIONS IN TELEVISION AND RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHEILD

DIODE UNIT		
PLATE TO HEATER & CATHODE & INTERNAL SHIELD	3.0	pf
PENTODE UNIT		
GRID #1 TO PLATE (MAX.)	0.03	pf
INPUT	7.0	pf
OUTPUT	2.4	pf
PENTODE GRID TO DIODE PLATE (MAX.)	0.005	pf
PENTODE PLATE TO DIODE CATHODE (MAX.)	0.15	pf
PENTODE PLATE TO DIODE PLATE (MAX.)	0.10	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA
HEATER WARM-UP TIME		APPROX. 11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

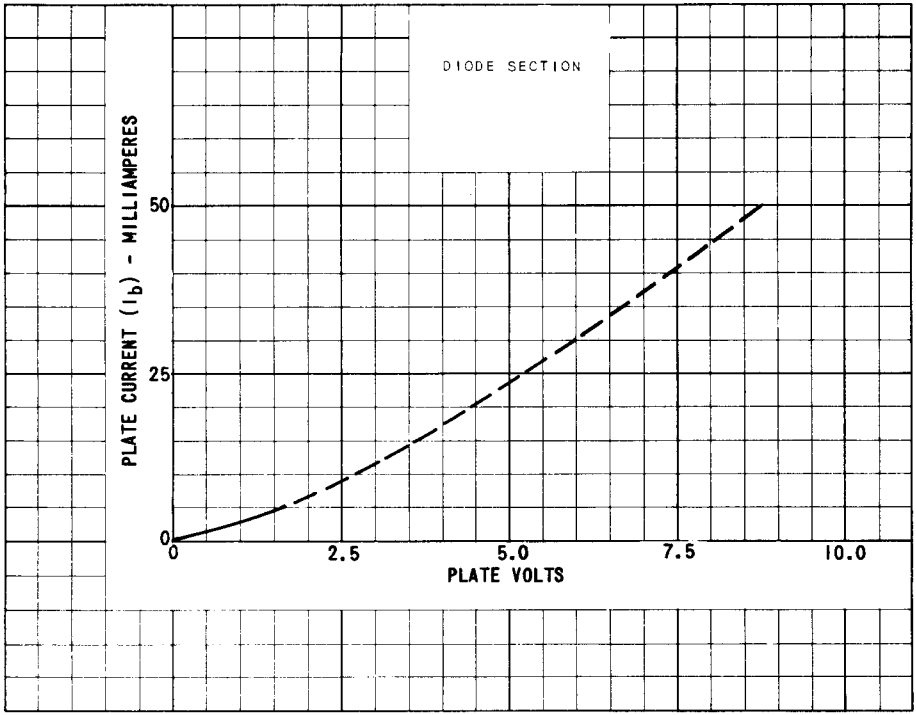
MAXIMUM RATINGS

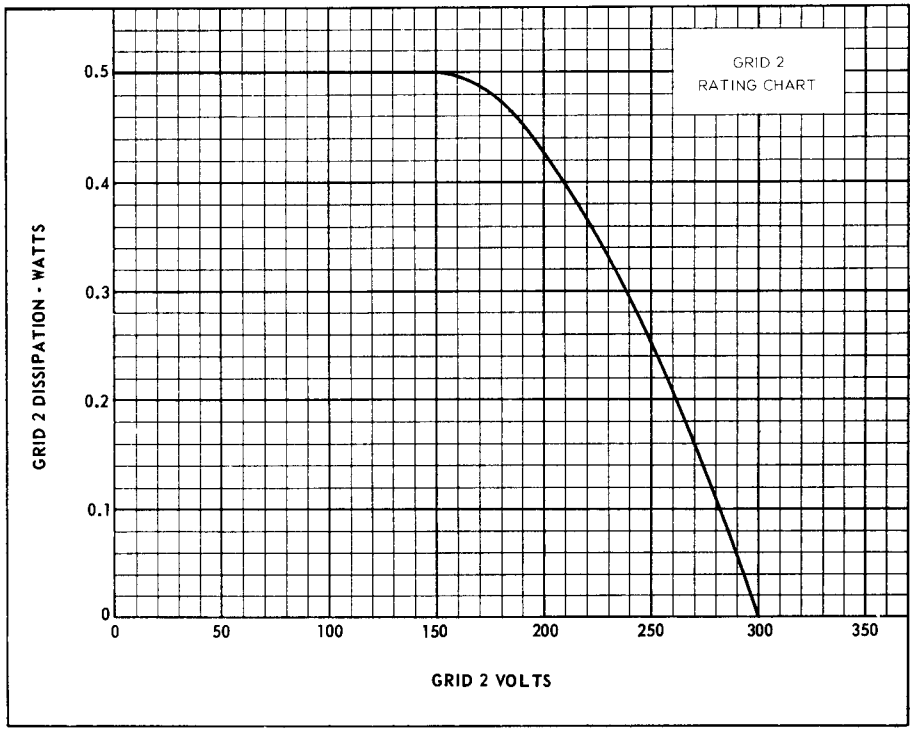
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

	DIODE UNIT	PENTODE UNIT	
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM GRID #3 VOLTAGE		0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE RATING CHART	
MAXIMUM GRID #1 VOLTAGE:			
POSITIVE BIAS VALUE		0	VOLTS
MAXIMUM PLATE DISSIPATION		2.5	WATTS
MAXIMUM GRID #2 INPUT		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
CATHODE BIAS OPERATION		1.0	MEGOHM
FIXED BIAS OPERATION		0.25	MEGOHM
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330		VOLTS
MAXIMUM PEAK PLATE CURRENT	50		MA
MAXIMUM DC PLATE CURRENT	5		MA

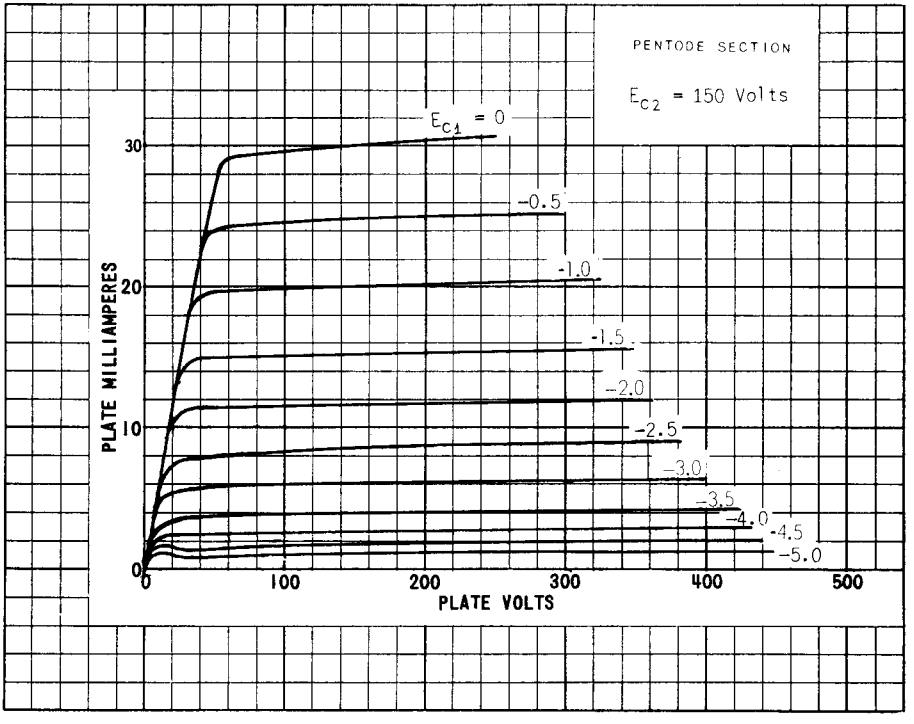
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

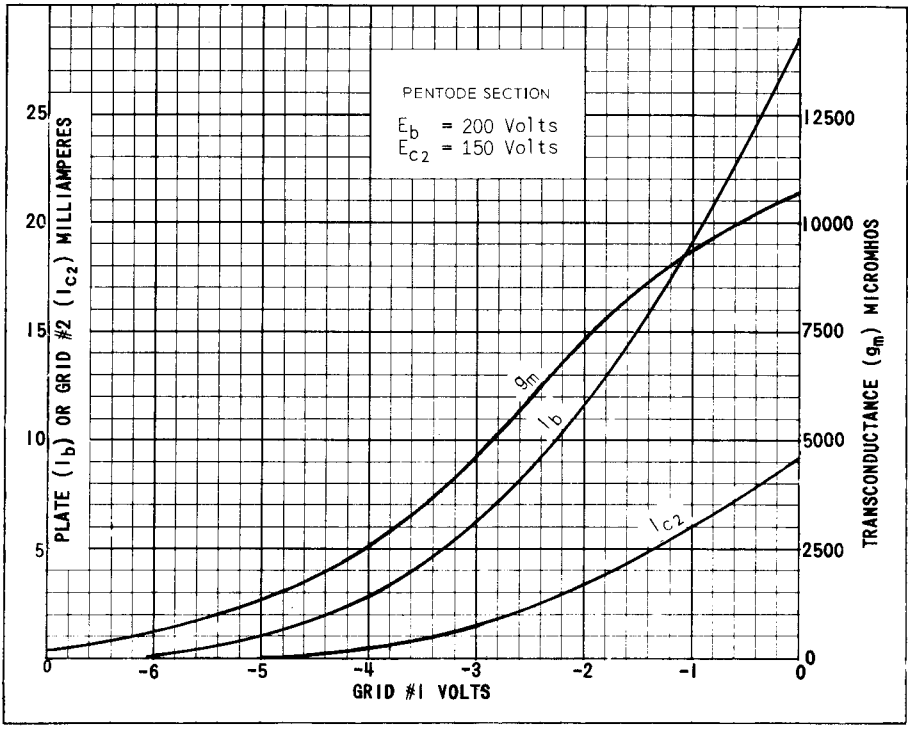
PLATE SUPPLY VOLTAGE	200	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	180	OHMS
PLATE CURRENT	9.5	MA
GRID #2 CURRENT	3	MA
TRANSCONDUCTANCE	6,200	μMHOS
PLATE RESISTANCE (APPROX.)	300,000	OHMS
GRID #1 BIAS (APPROX.) FOR I_b = 10 μA	−8	VOLTS


DIODE SECTION
PLATE CURRENT (I_b) - MILLIAMPERES
50
25
0
0
2.5
5.0
7.5
10.0
PLATE VOLTS


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.5
0.4
0.3
0.2
0.1
0
0
50
100
150
200
250
300
350
GRID 2 VOLTS

5AS8


PENTODE SECTION
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
0
100
200
300
400
500


PENTODE SECTION
E_b = 200 Volts
E_{c2} = 150 Volts
g_m
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) MICROMHOS
GRID #1 VOLTS
0
5
10
15
20
25
2500
5000
7500
10000
12500
-6
-5
-4
-3
-2
-1
0

Registration data being supplied to complete past records.

from JEDEC release #3129,
Feb. 6, 1961

TUNG-SOL ELECTRIC INC.

LIVINGSTON, NEW JERSEY

5 AT 4

High Vacuum Full-Wave Rectifier

Unipotential Cathode

Hard Glass Bulb

Volt Heater 5.0 Volts A.C. 5.5 Amperes

The Chatham 5AT4 is a power Rectifier with very low internal voltage drop. It is designed for D. C. Power supplies that require high currents.

Ratings

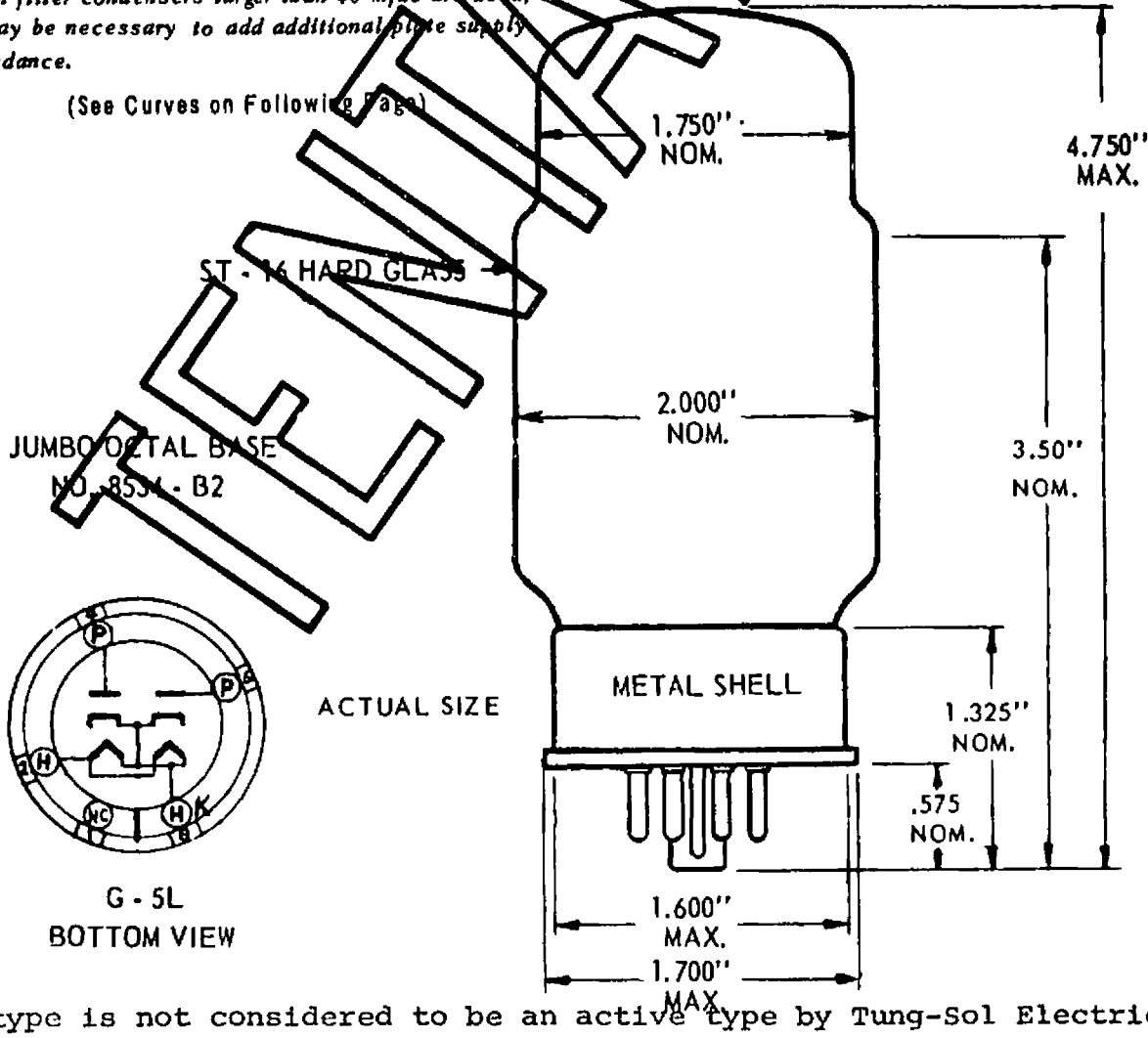
Maximum peak inverse voltage	1550 volts
Maximum steady-state peak plate current per plate	2.25 Amps

Operating Conditions and Characteristics

AC plate voltage per plate (RMS) max.	550 volts
DC output current max.	800 mA
Min. total effective plate supply impedance per plate max.*	75 ohms
Aver. tube voltage drop at 500 mA per plate	30 volts
Min heating time	30 secs

* *When filter condensers larger than 40 mfds are used, it may be necessary to add additional plate supply impedance.*

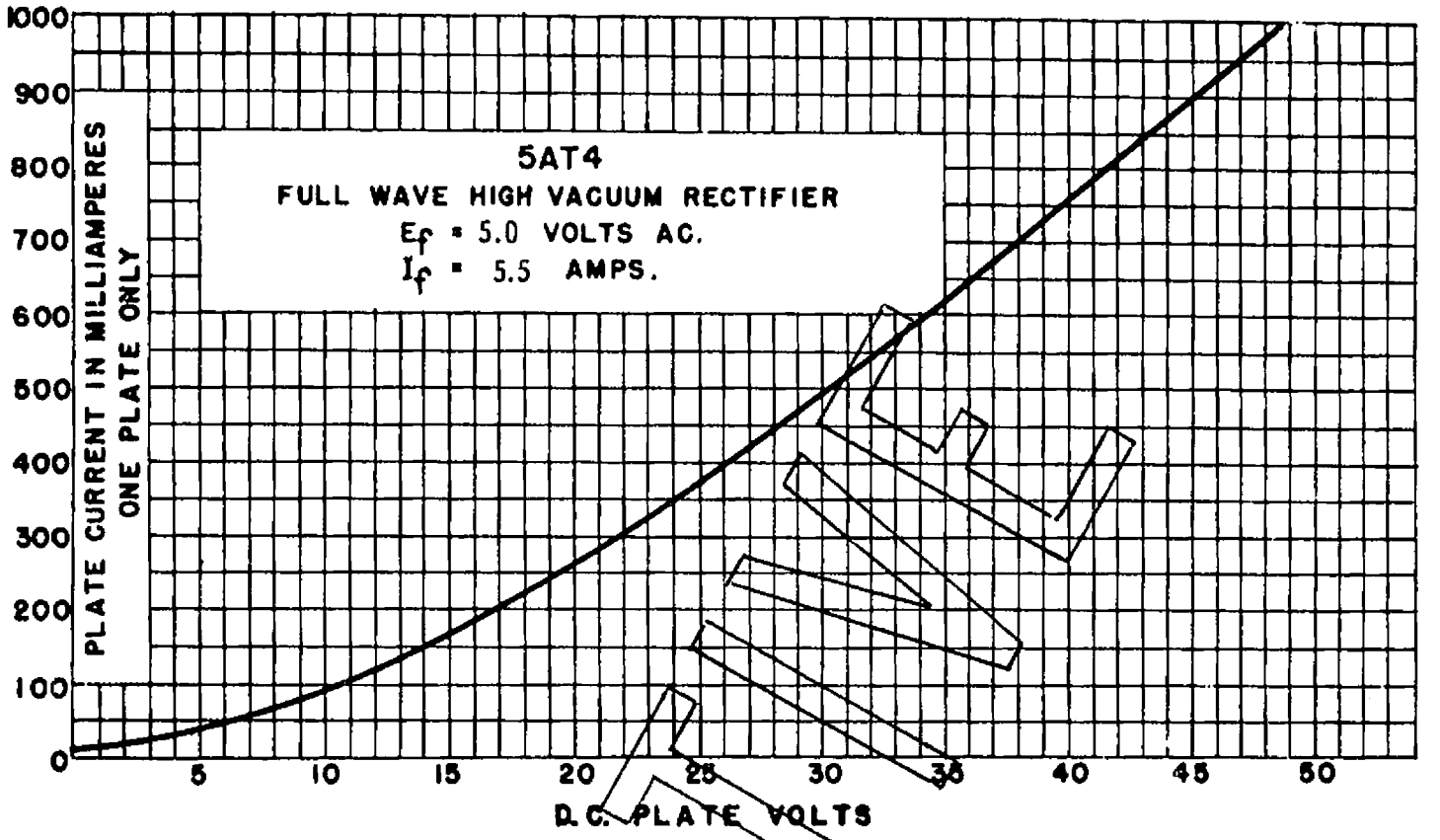
(See Curves on Following Page)

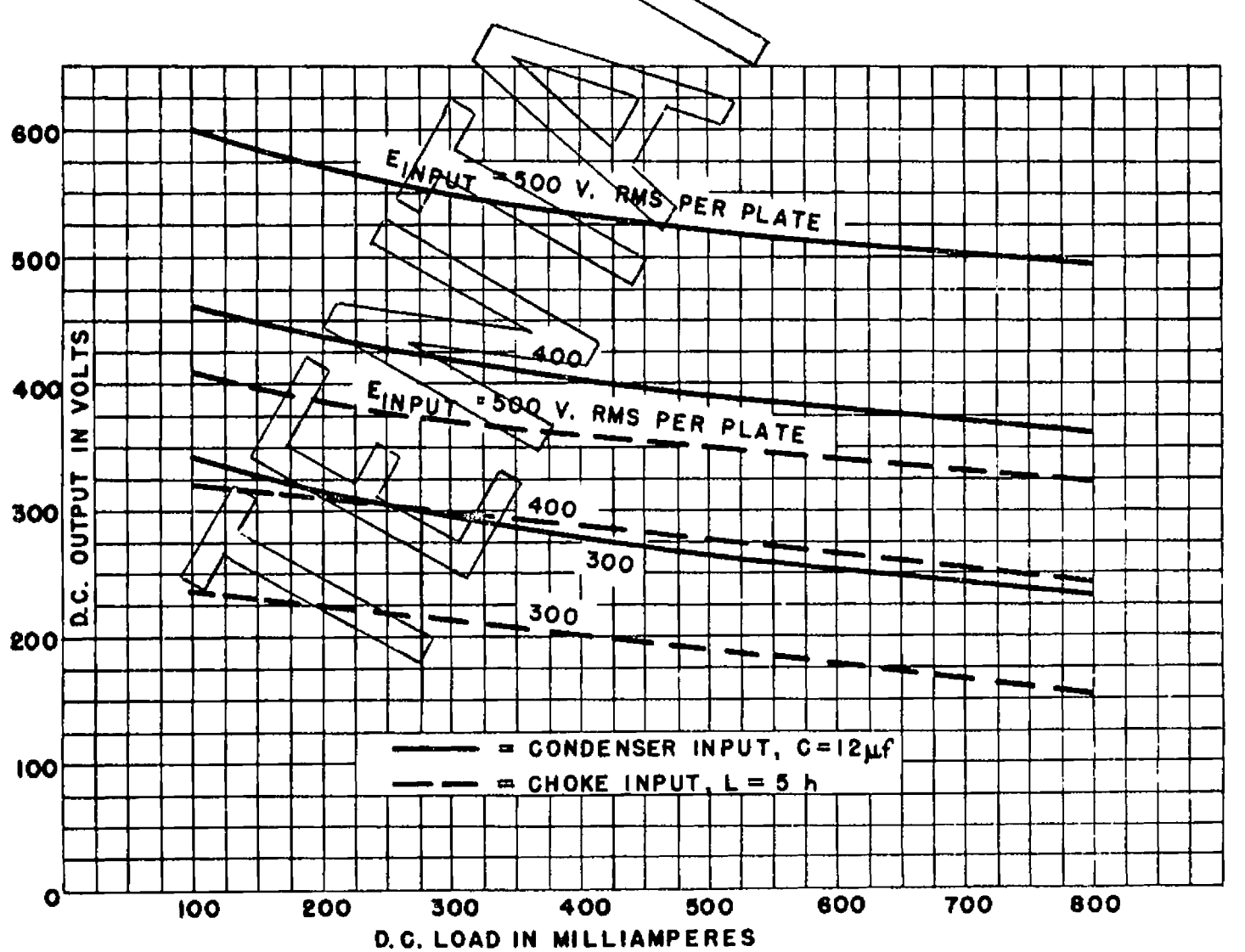


TENTATIVE

This type is not considered to be an active type by Tung-Sol Electric Inc.

TUNG-SOL ELECTRIC INC.
LIVINGSTON, NEW JERSEY

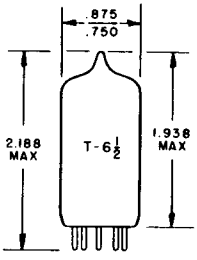




TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

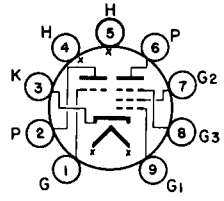
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR

CONVERTER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DW

THE 5AT8 IS A MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A MEDIUM-MU TRIODE AND A SHARP CUT-OFF PENTODE WITH A COMMON CATHODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

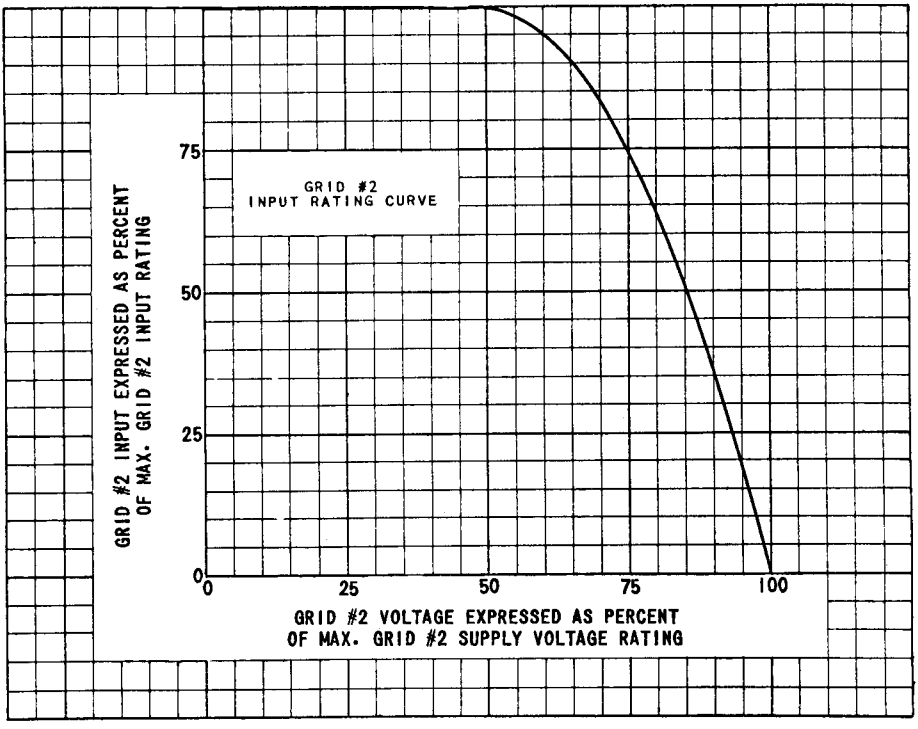
		WITH SHIELD #315	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE:(PG1 TO PP)	MAX.	→ 0.03	→ 0.06	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)		→ 4.8	→ 4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG3+PG2)		1.6	0.9	pf
CATHODE TO HEATER (K TO H)		→ 6.0	→ 6.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)		1.5	1.5	pf
TRIODE INPUT: TG TO (H + K)		2.4	2.0	pf
TRIODE OUTPUT: TP TO (H + K)		1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP)	MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP)	MAX.	0.008	0.05	pf

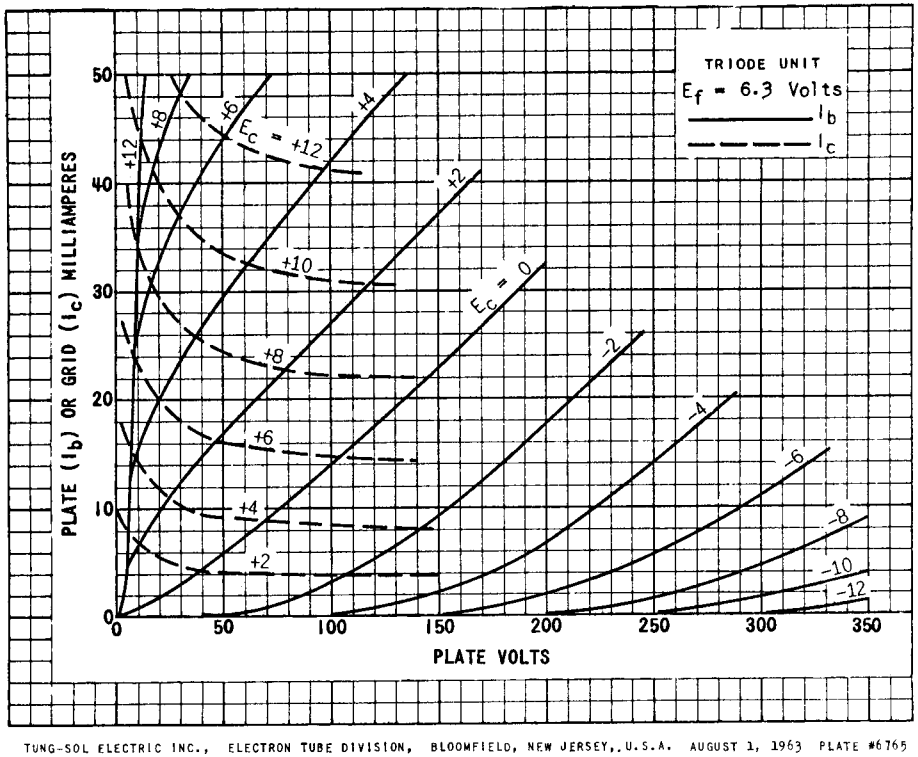
HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7	VOLTS	600	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
LIMITS OF SUPPLIED CURRENT			600 ± 40	MA.

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	→ 200	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	VOLTS

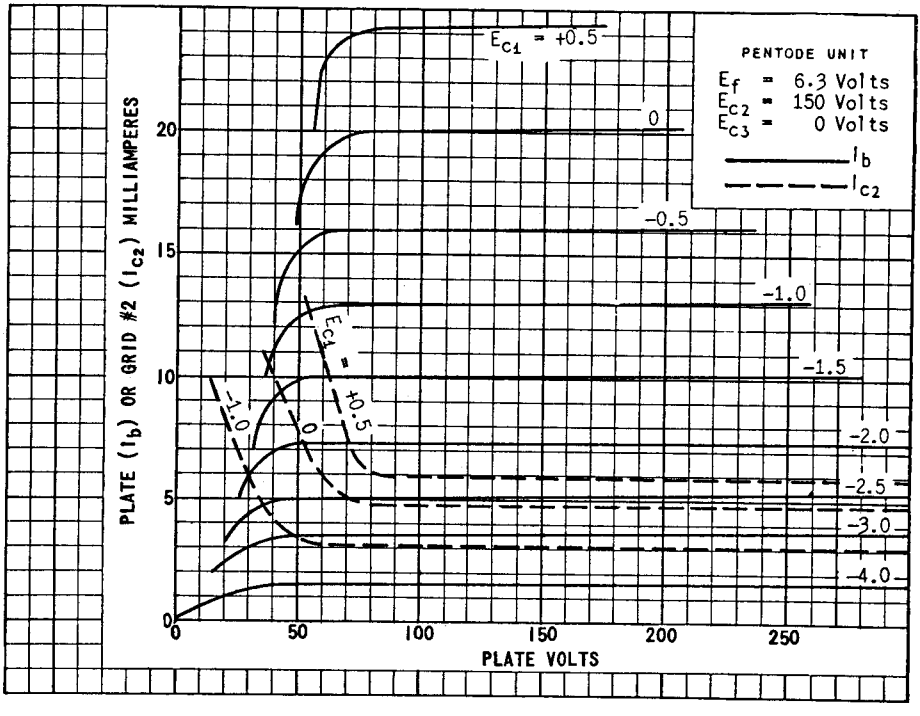
TYPICAL OPERATING CHARACTERISTICS

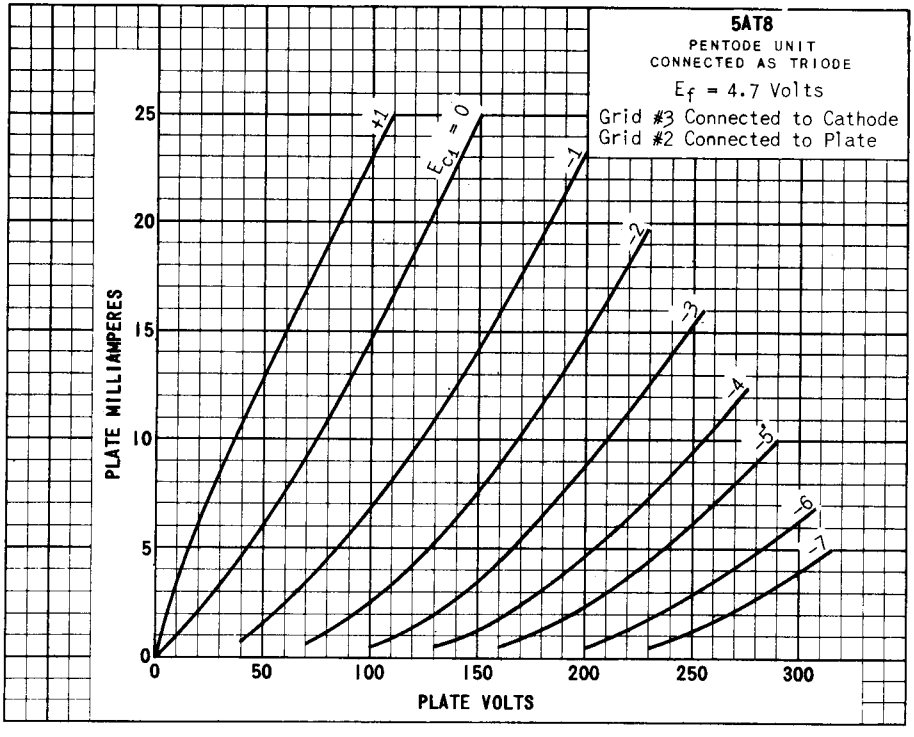
CLASS A1 AMPLIFIER

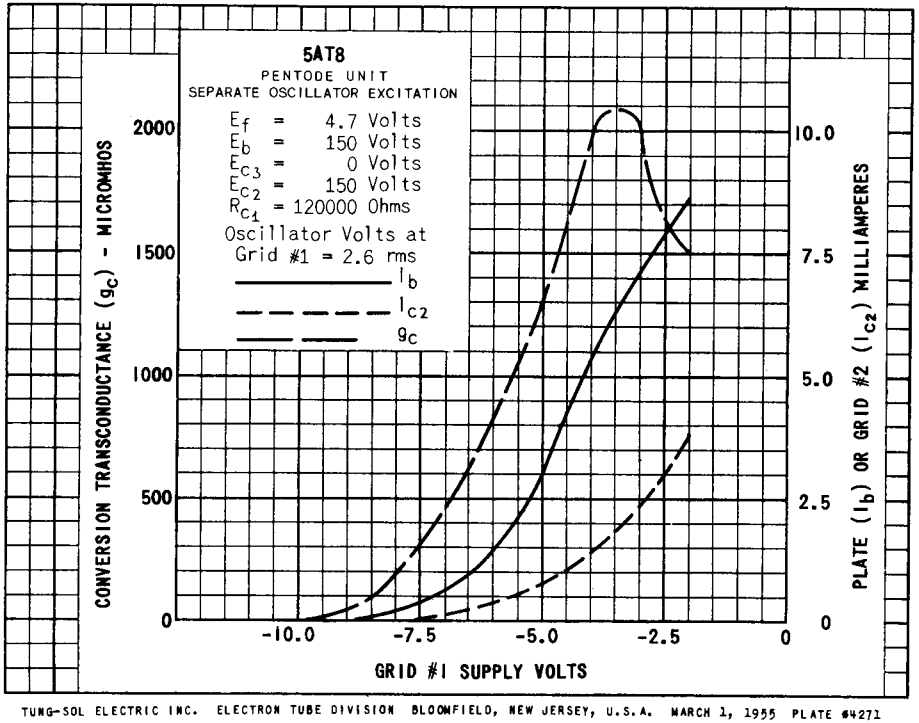
		PENTODE	TRIODE	
PLATE VOLTAGE		125	125	VOLTS
GRID 3 VOLTAGE		Connected to pin 3 at socket		
GRID 2 VOLTAGE		125	-----	
GRID 1 VOLTAGE		-1.0	-1.0	VOLTS
PLATE CURRENT		9.0	12.0	MA.
GRID 2 CURRENT		2.2	-----	MA.
TRANSCONDUCTANCE		5,500	6,500	μMHOS
PLATE RESISTANCE	(APPROX.)	300,000	6,000	OHMS
AMPLIFICATION FACTOR		-----	40	
GRID 1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	-7	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb = 100 V; Ec2 = 70 V)		5,700	-----	μMHOS

→ INDICATES A CHANGE.

5AT8

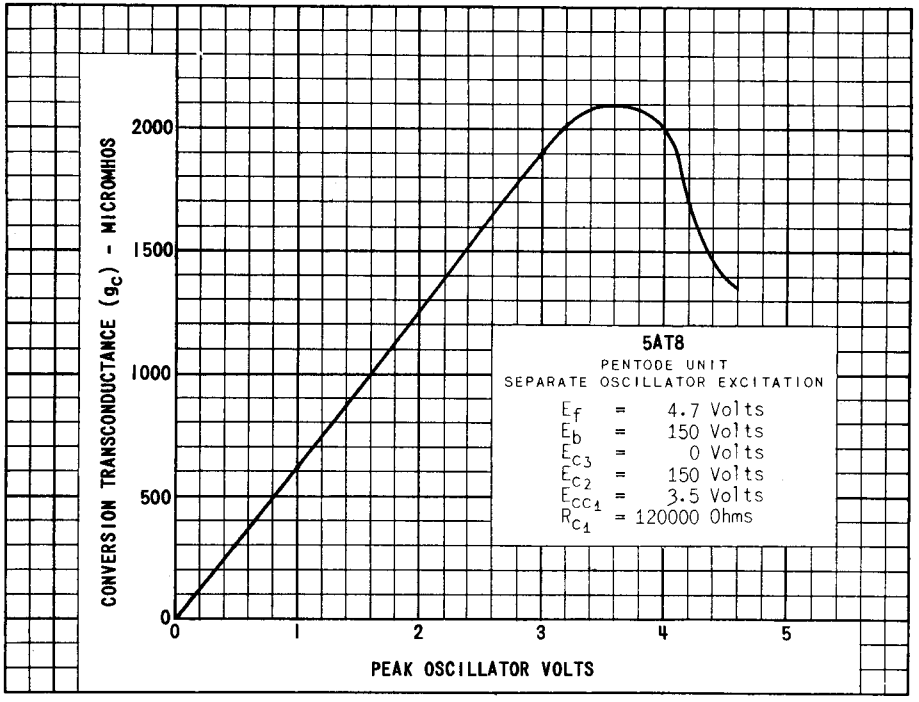

PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
E_{c1} =
+0.5
0
-1.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
15
20
0
50
100
150
200
250
PLATE VOLTS





TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. MARCH 1, 1955 PLATE #4271

5AT8



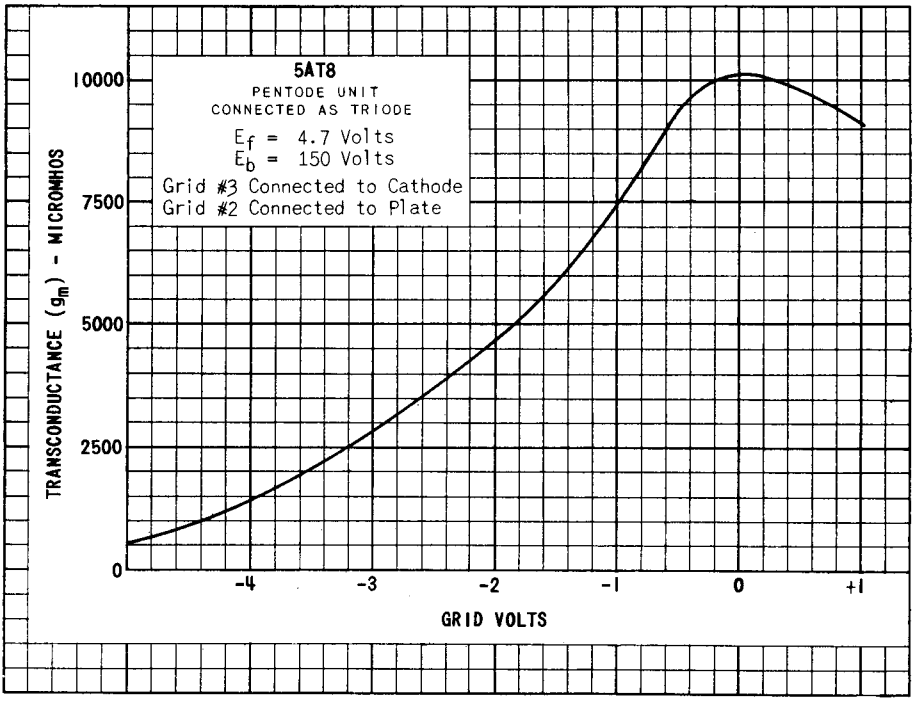
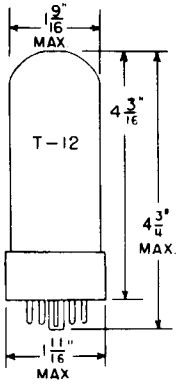


PLATE #4272 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

TWIN DIODE



GLASS BULB

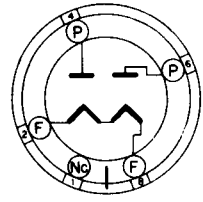
COATED FILAMENT

5.0 VOLTS 3.75 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

8 PIN OCTAL

5T

THE 5AU4 IS A FILAMENTARY FULL-WAVE HIGH-VACUUM RECTIFIER DESIGNED FOR USE IN THE POWER SUPPLY OF TELEVISION RECEIVERS AND OTHER EQUIPMENTS WHICH HAVE HIGH OUTPUT CURRENT REQUIREMENTS. IN FULL-WAVE OPERATION WITH A SUPPLY VOLTAGE OF 300 VOLTS RMS, THE 5AU4 IS CAPABLE OF DELIVERING A DC OUTPUT CURRENT OF 350 MILLIAMPERES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE[A]

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE (PER PLATE)	SEE RATING CHART #1	
MAXIMUM STEADY-STATE PEAK PLATE CURRENT (PER PLATE)	1 075	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (PER PLATE) MAXIMUM DURATION 0.2 SECOND	5.25	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	

[A] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CYCLES PER SECOND.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

FILAMENT VOLTAGE		5.0	VOLTS
FILAMENT CURRENT		3.75 ←	AMP.
AC PLATE-SUPPLY VOLTAGE (PER PLATE) RMS	300	400	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
TOTAL PLATE-SUPPLY RESISTANCE (PER PLATE)	30	50	OHMS
DC OUTPUT CURRENT	350	325	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	275	395	VOLTS

FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	4.5	AMP.
AC PLATE-SUPPLY VOLTAGE (PER PLATE) RMS	500	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	325	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	395	VOLTS
TUBE VOLTAGE DROP		
I_b = 350 MA. DC (PER PLATE)	50	VOLTS

→ INDICATES A CHANGE.

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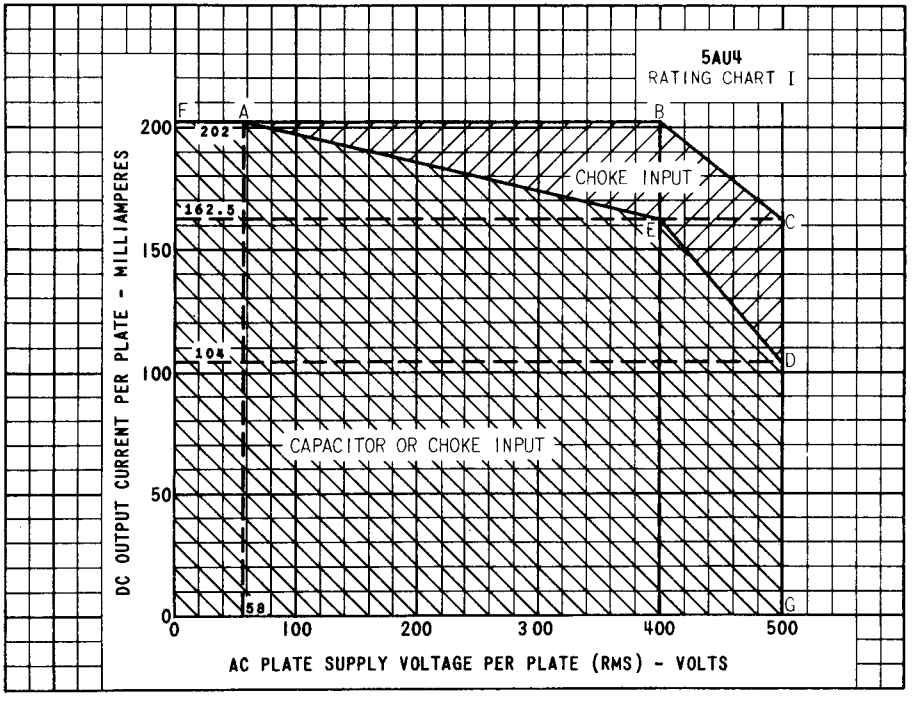
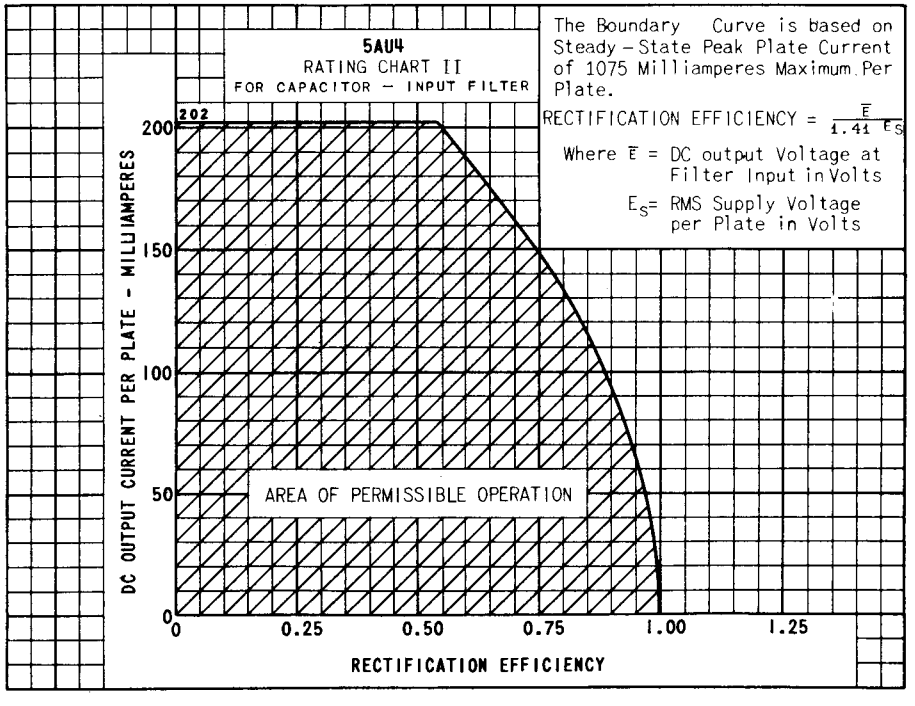
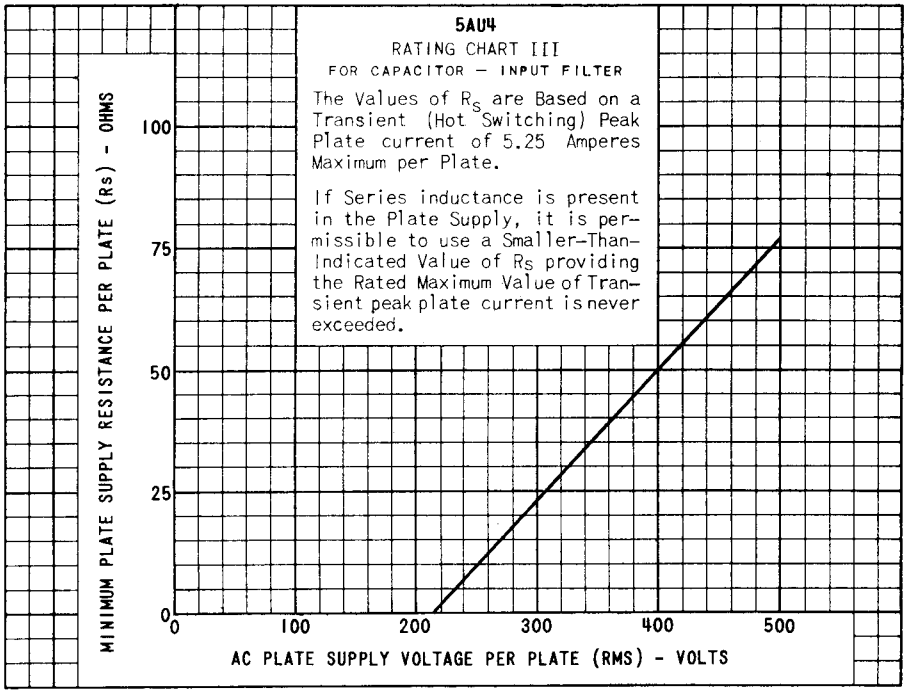
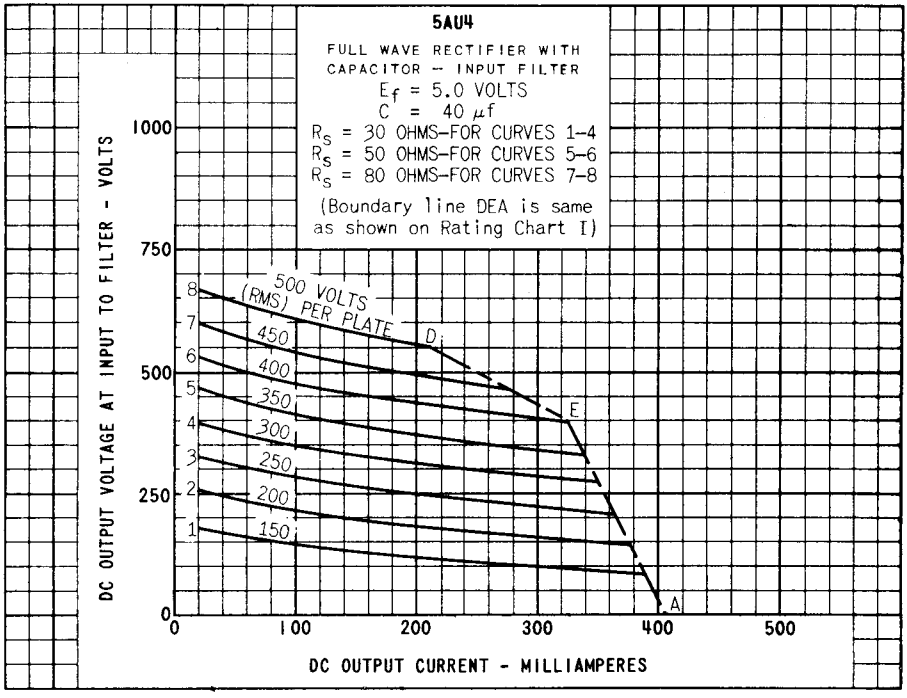
5AU4

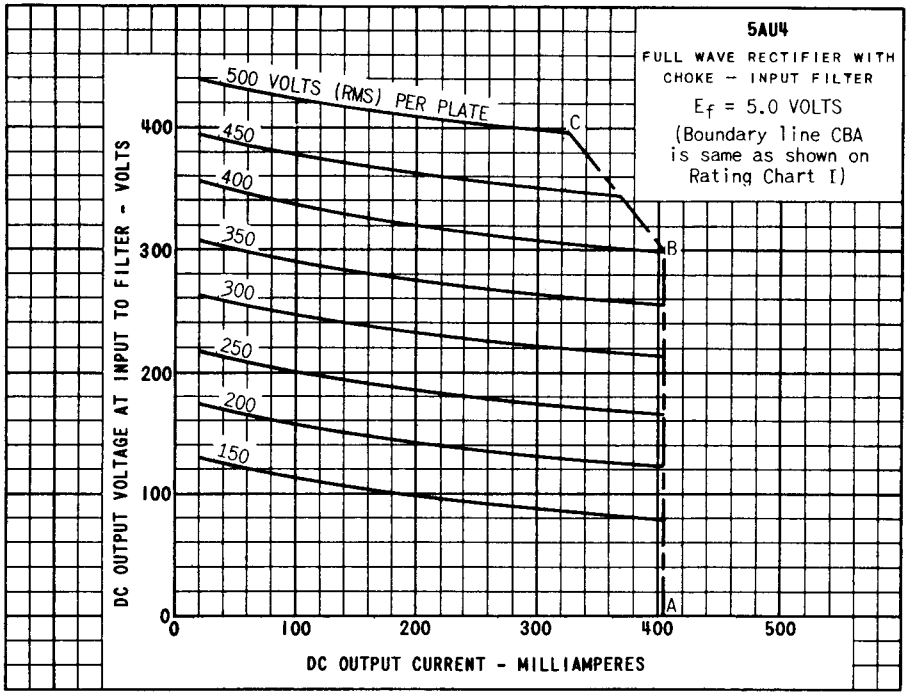

5AU4
RATING CHART I
F
A
B
C
D
E
G
202
162.5
105
58
CHOKE INPUT
CAPACITOR OR CHOKE INPUT
200
150
100
50
0
0
100
200
300
400
500
DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS

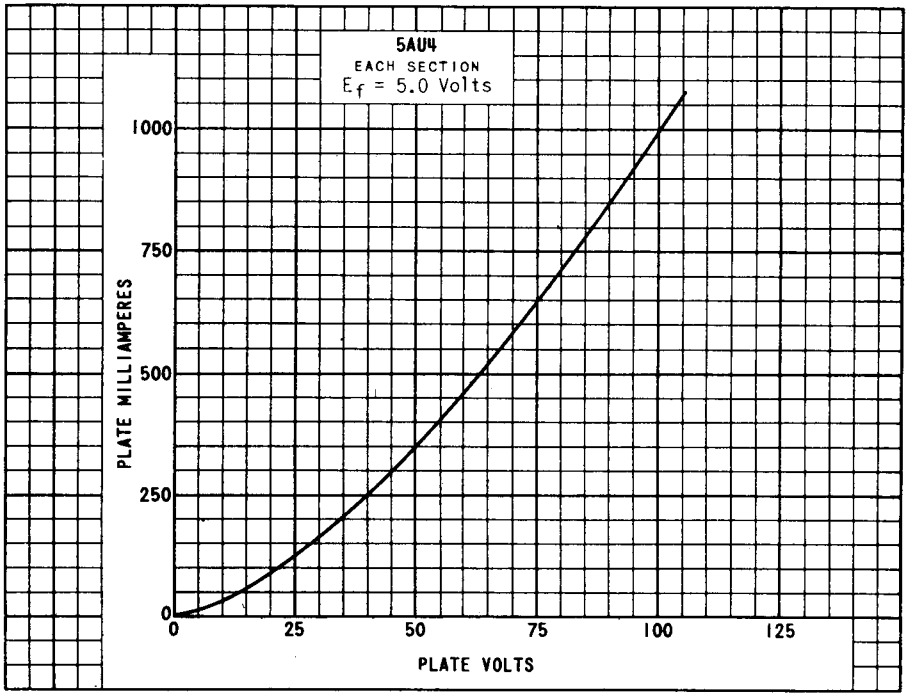

5AU4
RATING CHART II
FOR CAPACITOR - INPUT FILTER
The Boundary Curve is based on Steady-State Peak Plate Current of 1075 Milliamperes Maximum Per Plate.
RECTIFICATION EFFICIENCY = $\frac{\bar{E}}{1.41\ E_S}$
Where $\bar{E}$ = DC output Voltage at Filter Input in Volts
E_S = RMS Supply Voltage per Plate in Volts
202
AREA OF PERMISSIBLE OPERATION
200
150
100
50
0
0
0.25
0.50
0.75
1.00
1.25
DC OUTPUT CURRENT PER PLATE - MILLIAMPERES
RECTIFICATION EFFICIENCY


5AU4
RATING CHART III
FOR CAPACITOR – INPUT FILTER
The Values of R_s are Based on a Transient (Hot Switching) Peak Plate current of 5.25 Amperes Maximum per Plate.
If Series inductance is present in the Plate Supply, it is permissible to use a Smaller-Than-Indicated Value of R_s providing the Rated Maximum Value of Transient peak plate current is never exceeded.
MINIMUM PLATE SUPPLY RESISTANCE PER PLATE (Rs) - OHMS
100
75
50
25
0
0
100
200
300
400
500
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS


5AU4
FULL WAVE RECTIFIER WITH CAPACITOR – INPUT FILTER
E_f = 5.0 VOLTS
C = 40 μf
R_s = 30 OHMS–FOR CURVES 1–4
R_s = 50 OHMS–FOR CURVES 5–6
R_s = 80 OHMS–FOR CURVES 7–8
(Boundary line DEA is same as shown on Rating Chart I)
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
1000
750
500
250
0
500 VOLTS (RMS) PER PLATE
450
400
350
300
250
200
150
8
7
6
5
4
3
2
1
D
E
A
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES

5AU4


5AU4
FULL WAVE RECTIFIER WITH CHOKE – INPUT FILTER
E_f = 5.0 VOLTS
(Boundary line CBA is same as shown on Rating Chart I)
500 VOLTS (RMS) PER PLATE
450
400
350
300
250
200
150
C
B
A
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
0
100
200
300
400
0
100
200
300
400
500
DC OUTPUT CURRENT - MILLIAMPERES


5AU4
EACH SECTION
E_f = 5.0 Volts
PLATE MILLIAMPERES
0
250
500
750
1000
0
25
50
75
100
125
PLATE VOLTS

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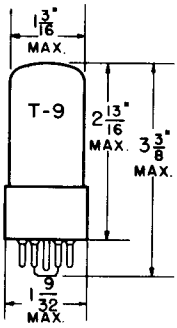
DOUBLE DIODE



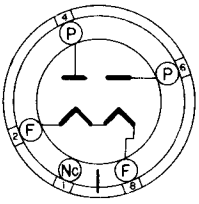
GLASS BULB

COATED FILAMENT

5 VOLTS 2.5 AMP.
AC OR DC

MOUNTING POSITION

VERTICAL - BASE UP OR DOWN.
HORIZONTAL - PLANE OF PINS 6 & 8 VERTICAL.



BOTTOM VIEW

INTERMEDIATE SHELL
5 PIN OCTAL

5T

THE 5AX4GT IS A FULL-WAVE HIGH-VACUUM RECTIFIER DESIGNED FOR USE AS A POWER RECTIFIER IN AC OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	5	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (EACH PLATE):		
CONDENSER INPUT	350	VOLTS
CHOKE INPUT	500	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 400	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	525	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE)	3.5	AMP.
MAXIMUM OUTPUT CURRENT	175	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	CONDENSER INPUT TO FILTER	CHOKE INPUT TO FILTER	
FILAMENT VOLTAGE	5	5	VOLTS
FILAMENT CURRENT	2.5	2.5	AMP.
PLATE SUPPLY VOLTAGE (EACH PLATE)	350	500	VOLTS
FILTER INPUT CAPACITANCE	10	---	µf
FILTER INPUT INDUCTANCE	---	10	HENRIES
EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	50	---	OHMS
OUTPUT CURRENT	175	175	MA.
OUTPUT VOLTAGE	330	375	VOLTS

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PLATE
2550
JAN. 1
1950

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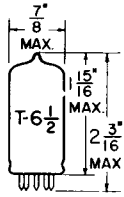
TRIODE PENTODE

MINIATURE TYPE

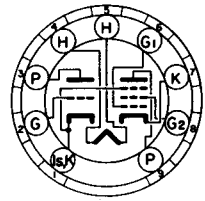


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9EC

THE 5B8 IS A MEDIUM-MU TRIODE AND A SHARP CUTOFF PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF OSCILLATOR AND MIXER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

TRIODE GRID TO TRIODE PLATE	1.7	μμf
PENTODE GRID #1 TO PENTODE PLATE (MAX.)	0.032 ←	μμf
TRIODE GRID TO (TRIODE CATHODE, PENTODE GRID #3, I.S., HEATER)	1.9	μμf
TRIODE PLATE TO (TRIODE CATHODE, PENTODE GRID #3, I.S., HEATER)	1.4	μμf
PENTODE GRID #1 TO (PENTODE CATHODE, GRID #2, HEATER)	6.0	μμf
PENTODE PLATE TO (PENTODE CATHODE, GRID #2, GRID #3, TRIODE CATHODE, I.S., HEATER)	2.6	μμf
PENTODE PLATE TO (PENTODE CATHODE, GRID #2, HEATER)	0.15	μμf
TRIODE GRID TO PENTODE PLATE	0.0078	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.0033	μμf
TRIODE PLATE TO PENTODE PLATE	0.060	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE RATING CHART	
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE[A]:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[A] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHALL NOT EXCEED THE STATED VALUES.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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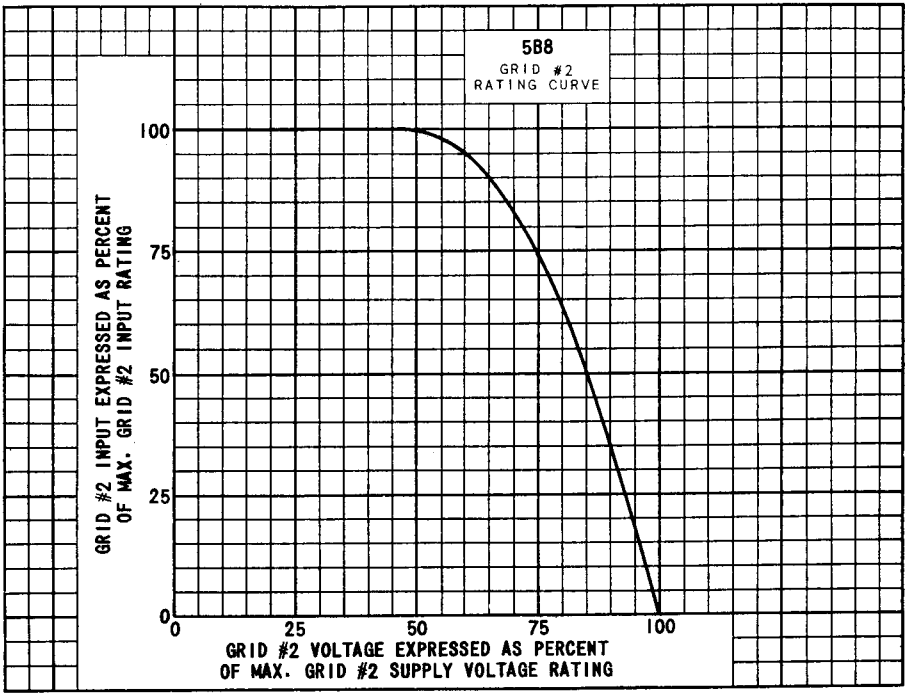
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE[B]	
HEATER VOLTAGE	4.7		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	2.8	MA.
AMPLIFICATION FACTOR	19	---	
TRANSCONDUCTANCE	3 300	6 200	μMHOS
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μAMP.	-19	-8	VOLTS

[B] WHEN READING CHARACTERISTICS OF THE PENTODE SECTION, ALL TRIODE ELEMENTS SHALL BE AT GROUND POTENTIAL. THUS, BECAUSE OF INTERNAL CONNECTIONS TO PIN #1, THE PENTODE SUPPRESSOR WILL ALSO BE AT GROUND.



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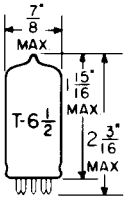
DOUBLE TRIODE

MINIATURE TYPE

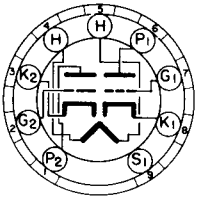


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

IT IS RECOMMENDED THAT PIN #9 BE GROUNDED

THE 5BK7A IS A MINIATURE DOUBLE TRIODE DESIGNED PRIMARILY FOR USE AS A CASCODE AMPLIFIER AT FREQUENCIES BELOW APPROXIMATELY 300 MEGACYCLES IN 600 MA. SERIES HEATER OPERATED RECEIVERS. THE PERFORMANCE OF THE TUBE AS A CASCODE AMPLIFIER IN CHARACTERIZED BY HIGH GAIN AND A LOW NOISE FIGURE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BK7A.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	1.8	1.8	μμf
INPUT	3.0	3.0	μμf
OUTPUT	1.0	0.9	μμf
HEATER TO CATHODE	2.8	3.0	μμf
GRID TO GRID (MAX.)	0.004		μμf
PLATE TO PLATE (MAX.)	0.075		μμf
GROUNDED GRID OPERATION			
PLATE TO CATHODE	0.22	0.22	μμf
INPUT	6.0	6.0	μμf
OUTPUT	2.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	WATTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] WHEN THE 5BK7A IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES, THE HEATER CATHODE VOLTAGE OF THE GROUNDED GRID STAGE MAY BE AS HIGH AS 250 VOLTS MAXIMUM WITH RESPECT TO THE CATHODE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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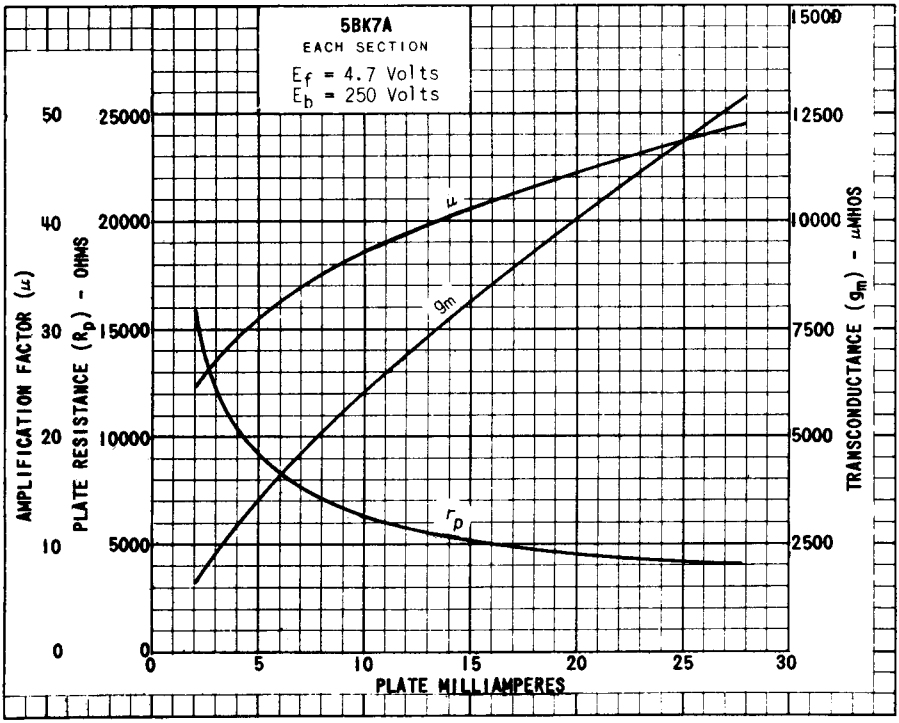
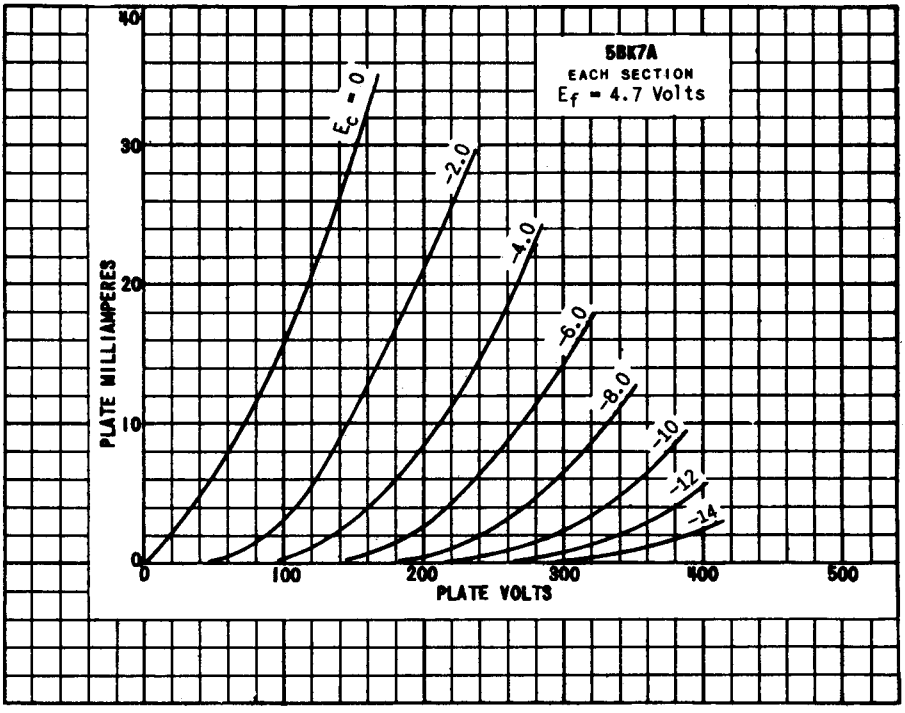
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

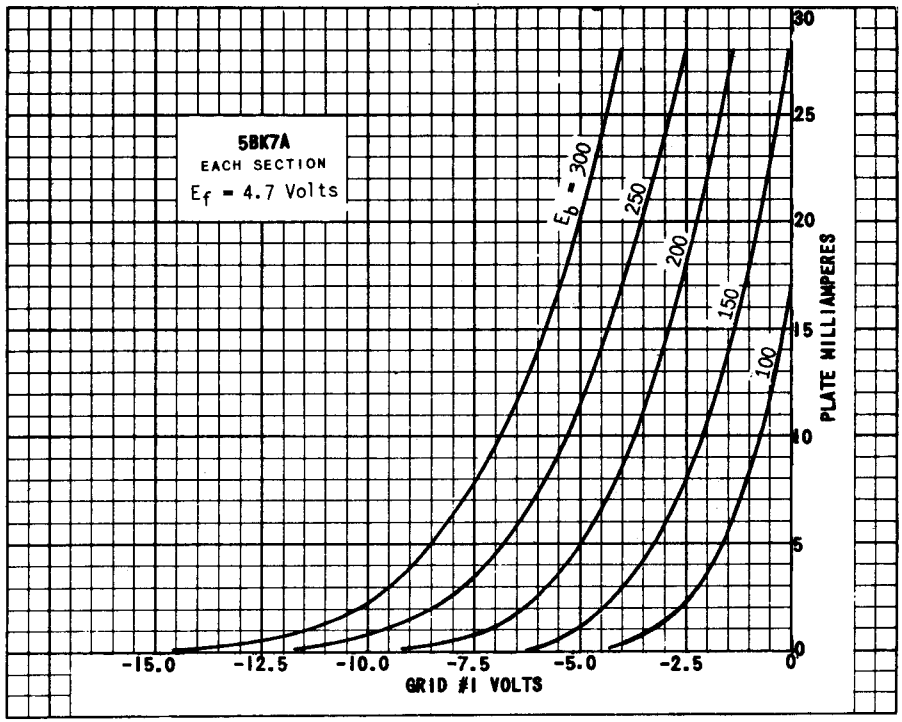
CLASS A_1 AMPLIFIER - EACH SECTION

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	4 600	OHMS
TRANSCONDUCTANCE	9 300	µMHOS
PLATE CURRENT	18	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	-11	VOLTS
NOISE FIGURE[B]	7	DECIBELS

[B] AS MEASURED IN A CASCODE AMPLIFIER WHICH OPERATES AT A PLATE SUPPLY VOLTAGE OF 250 VOLTS, A PLATE CURRENT OF 18 MA., A FREQUENCY OF 200 MEGACYCLES, A STAGE BANDWIDTH OF 7 MEGACYCLES, AND AN EFFECTIVE NOISE BANDWIDTH OF 3.5 MEGACYCLES.




5BK7A
EACH SECTION
E_f = 4.7 Volts
E_c = 0
-2.0
-4.0
-6.0
-8.0
-10
-12
-14
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
0
100
200
300
400
500


5BK7A
EACH SECTION
E_f = 4.7 Volts
E_b = 300
250
200
150
100
PLATE MILLIAMPERES
GRID #1 VOLTS
0
5
10
15
20
25
30
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0

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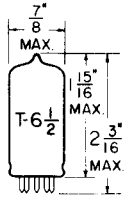
DOUBLE TRIODE

MINIATURE TYPE

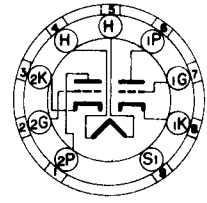


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
5.6 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN NOVAL
9AJ

THE 5BQ7A IS A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS THE FIRST RF AMPLIFIER TUBE IN TUNERS OF VHF TELEVISION RECEIVERS OR AS A LOW NOISE IF PRE-AMPLIFIER TUBE IN UHF TELEVISION RECEIVERS EMPLOYING A CRYSTAL MIXER. HIGH TRANSCONDUCTANCE, LOW INPUT CAPACITANCE, LOW INPUT LOADING AND LOW PLATE TO CATHODE CAPACITANCE MAKES IT ESPECIALLY USEFUL IN THE DIRECT-COUPLED RF STAGE OF TELEVISION RECEIVERS UTILIZING A DRIVEN RF-GROUNDED-GRID AMPLIFIER OR THE CASCODE TYPE OF CIRCUIT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE	1.15	1.15	μμf
INPUT	2.85	----	μμf
INPUT (GROUNDED GRID)	----	4.95	μμf
OUTPUT	1.35	----	μμf
OUTPUT (GROUNDED GRID)	----	2.27	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.65	2.70	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)	0.010		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1 (MAX.)	0.024		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	5.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	250[A]	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SEC.

[A] UNDER CUT-OFF CONDITIONS, IN RF-GROUNDED-GRID CIRCUITS WITH DIRECT-COUPLED DRIVE, IT IS PERMISSIBLE FOR THIS VOLTAGE TO BE AS HIGH AS 300 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	5.6	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6 100	OHMS
TRANSCONDUCTANCE	6 400	µMHOS
PLATE CURRENT	9	MA.
GRID VOLTS (APPROX.) FOR I_b = 10 µAMP.	−10	VOLTS

PUSH–PULL RF GROUNDED GRID CIRCUIT – EACH UNIT

HEATER VOLTAGE	5.6	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	−2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

RF GROUNDED GRID CIRCUIT WITH DIRECT–COUPLED DRIVE

UNIT #1 (DRIVER TUBE) IS DIRECTLY COUPLED TO UNIT #2 (DRIVEN RF-GROUNDED-GRID AMPLIFIER TUBE) AS SHOWN IN ACCOMPANYING CIRCUIT.

	UNIT #1	UNIT #2	
HEATER VOLTAGE	5.6	5.6	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PEAK HEATER CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	1	250	VOLTS
PLATE SUPPLY VOLTAGE	250	250	VOLTS
PLATE VOLTAGE	135	115	VOLTS
GRID VOLTAGE	−1	---	VOLTS
GRID RESISTOR	---	0.5	MEGOHM
PLATE CURRENT	10	10	MA.
GRID CURRENT	0	0	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−14	---	VOLTS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 5BQ7A is identical to the 6BQ7A.*

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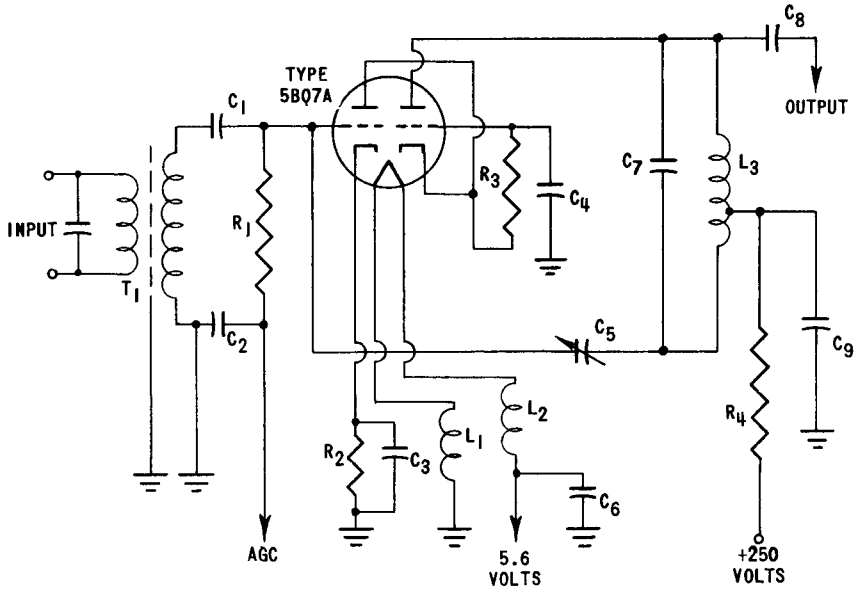
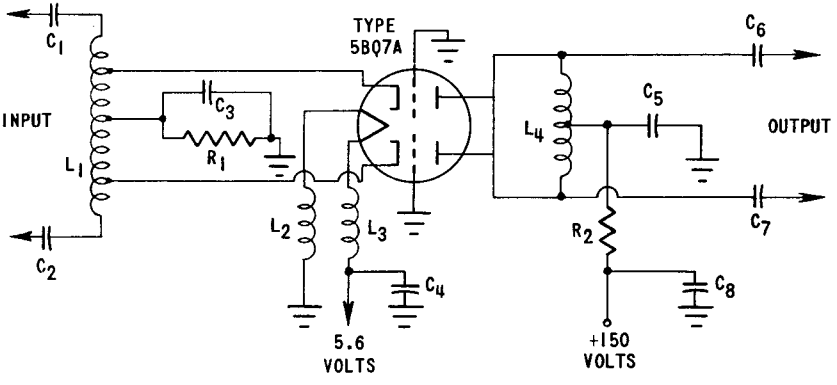


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

L1, L2: BIFILAR CHOKES, EACH 10 TURNS NO. 18 ENAMEL WIRE 1/4" COIL FORM
L3: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES. TO DETERMINE TAP POINT, TAP DOWN TO 80 TO 90% OF TOTAL NUMBER OF TURNS

R1: 10000 OHMS, 0.5 WATT
R2: 100 OHMS, 0.5 WATT
R3: 500000 OHMS, 0.5 WATT
R4: 100 OHMS, 0.5 WATT
T1: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES.

DRIVEN RF-GROUNDED GRID AMPLIFIER CIRCUIT WITH DIRECT COUPLED DRIVE



C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT

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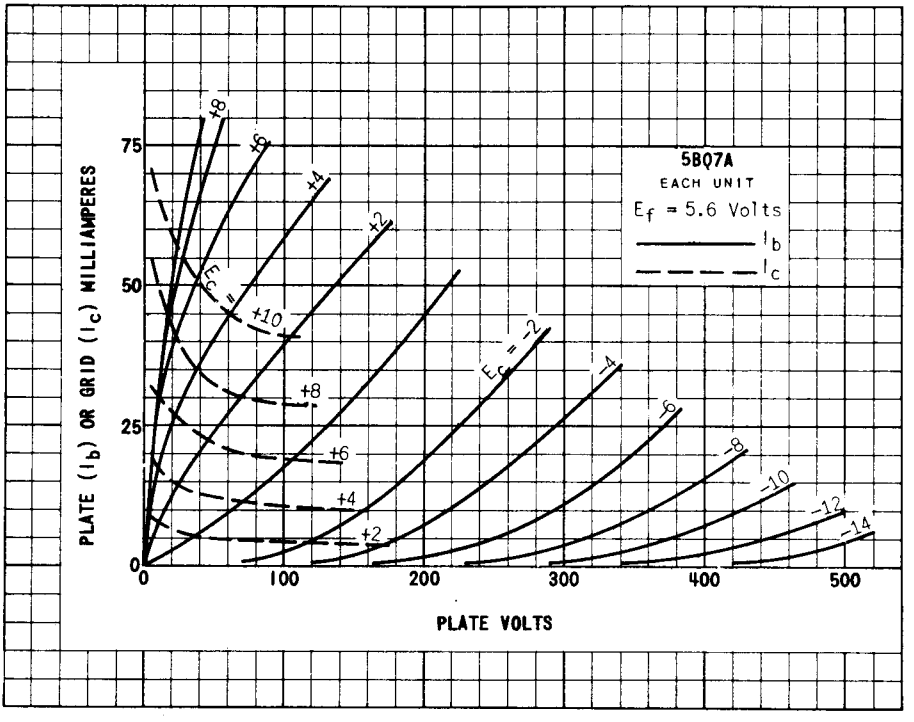
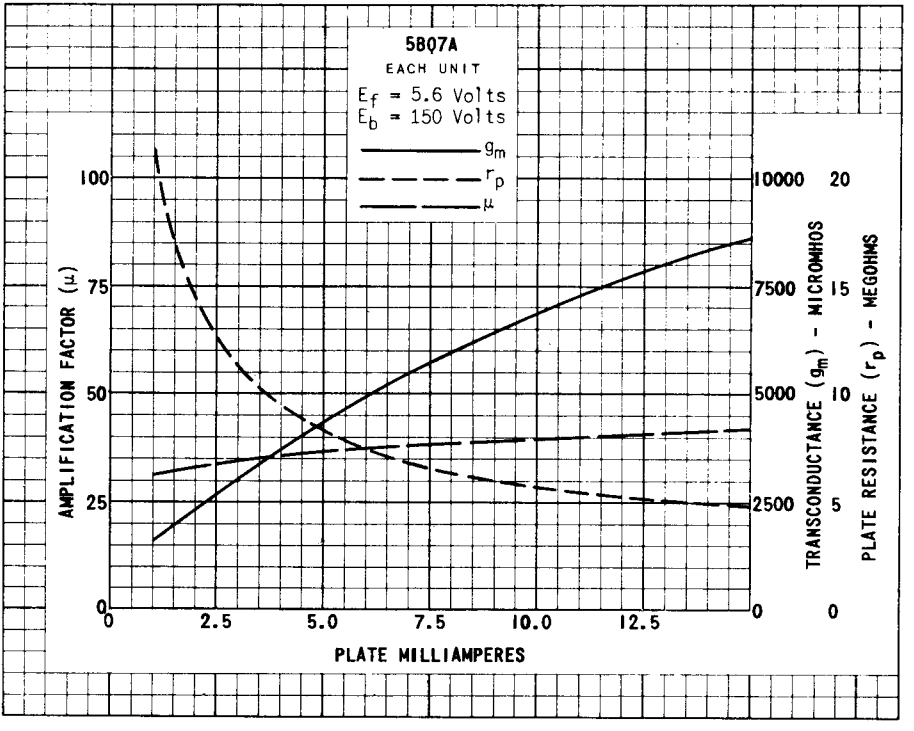
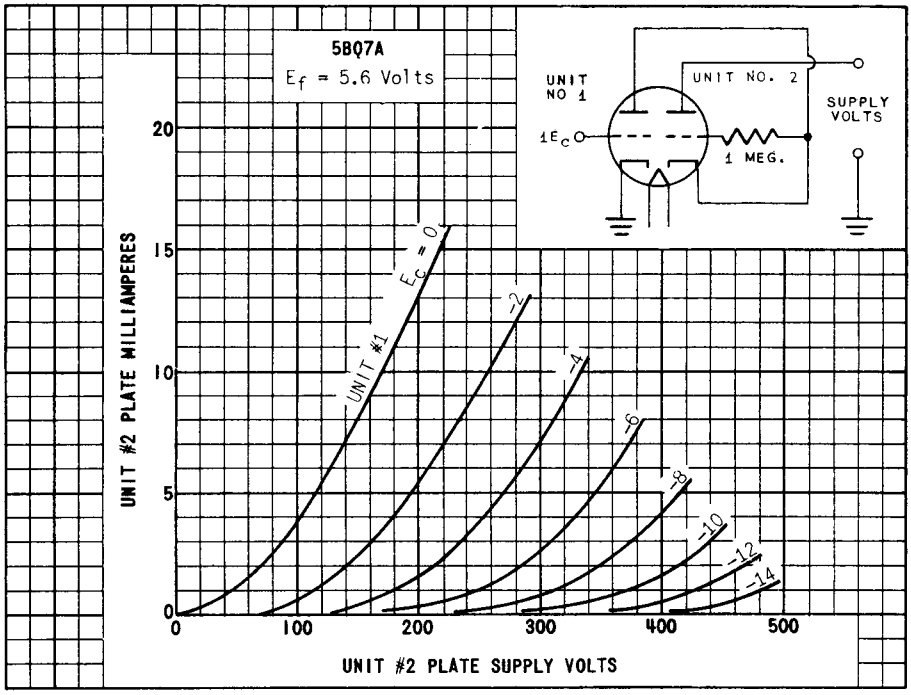
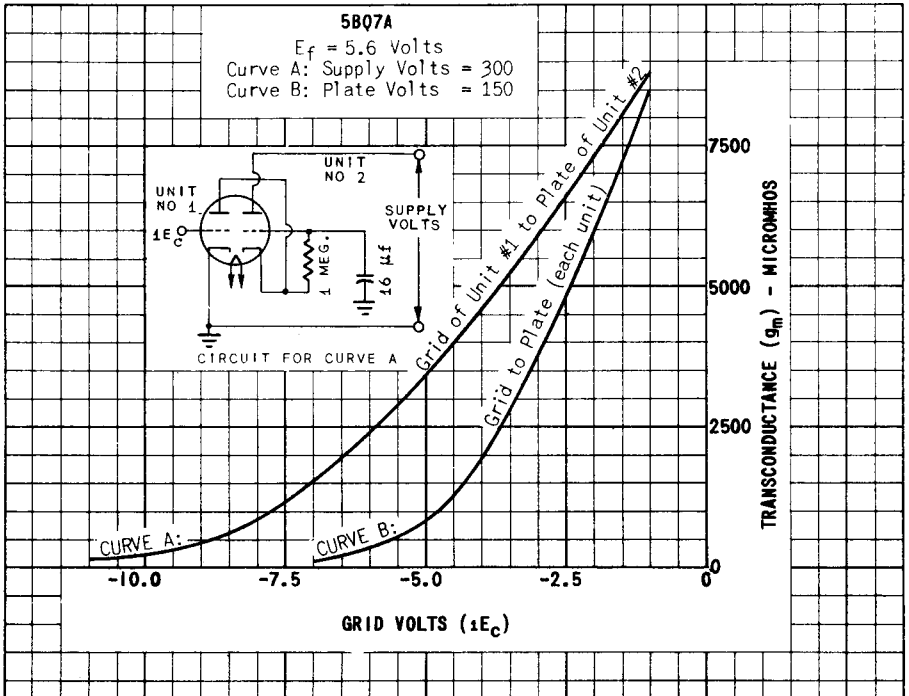

5BQ7A
EACH UNIT
E_f = 5.6 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500
+8
+6
+4
+2
+10
E_{cc} = 0
E_{cc} = -2
-4
-6
-8
-10
-12
-14


5BQ7A
EACH UNIT
E_f = 5.6 Volts
E_b = 150 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - MEGOHMS
PLATE MILLIAMPERES
0
25
50
75
100
2.5
5.0
7.5
10.0
12.5
2500
5000
7500
10000
5
10
15
20





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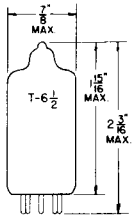
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

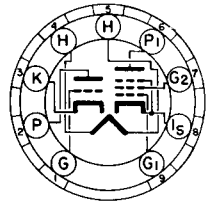


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FA

THE 5BR8 COMPRISES TWO ELECTRICALLY INDEPENDENT SECTIONS -- A TRIODE AND A PENTODE -- IN THE 9 PIN MINIATURE CONSTRUCTION. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGHER FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR PENTODE MIXER FOR FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS IN SUCH RECEIVERS. THE 5BR8 IS INTENDED FOR USE IN 600 MA. SERIES HEATER RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF THE HEATER VOLTAGE ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BR8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
PENTODE UNIT:			
GRID #1 TO PLATE	0.008	0.015MAX.	μμf
INPUT	5.0	5.0	μμf
OUTPUT	3.5	2.6	μμf
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	μμf
GRID TO CATHODE	2.5	2.5	μμf
PLATE TO CATHODE	1.0	0.4	μμf
CATHODE TO HEATER (EITHER SECTION) APPROX.	3.0	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	4.7		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE;			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	250	250	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		300	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	---	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE		4.7		VOLTS
HEATER CURRENT		0.6		AMP.
PLATE VOLTAGE	150		250	VOLTS
GRID #2 VOLTAGE	---		110	VOLTS
CATHODE RESISTOR	56		68	OHMS
TRANSCONDUCTANCE	8 500		5 200	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b=10 μA.	-12		-10	VOLTS
PLATE CURRENT	18		10	MA.
GRID #2 CURRENT	---		3.5	MA.
PLATE RESISTANCE (APPROX.)	.005		0.40	MEGOHM
AMPLIFICATION FACTOR	40		---	

TUNG-SOL

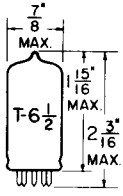
DOUBLE-DIODE PENTODE

MINIATURE TYPE

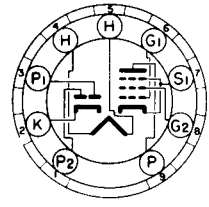
COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9HK

THE 5BW8 IS A DOUBLE-DIODE PENTODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE TWO SECTIONS. THE DIODE SECTIONS ARE INTENDED FOR USE PRIMARILY AS A HORIZONTAL PHASE DETECTOR IN TELEVISION RECEIVERS. THE PENTODE SECTION IS SUITABLE FOR USE AS A SOUND IF AMPLIFIER, SOUND LIMITER, AND AUTOMATIC-GAIN-CONTROL KEYER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE GRID #1 TO PLATE (MAX.)	0.020	μμf
PENTODE INPUT	4.8	μμf
PENTODE OUTPUT	2.6	μμf
GRID #1 TO EACH DIODE PLATE (MAX.)	0.006	μμf
DIODE #1 PLATE TO DIODE CATHODE & HEATER	1.3	μμf
DIODE #2 PLATE TO DIODE CATHODE & HEATER	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	0.6±6%	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. SEC.)	5.0	MA.
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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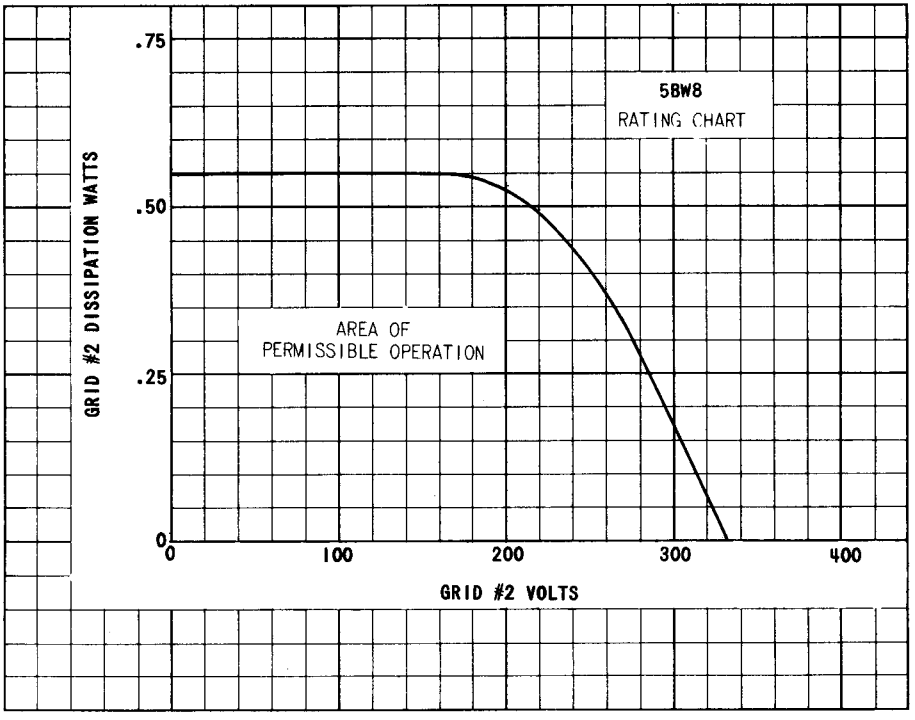
TUNG-SOL

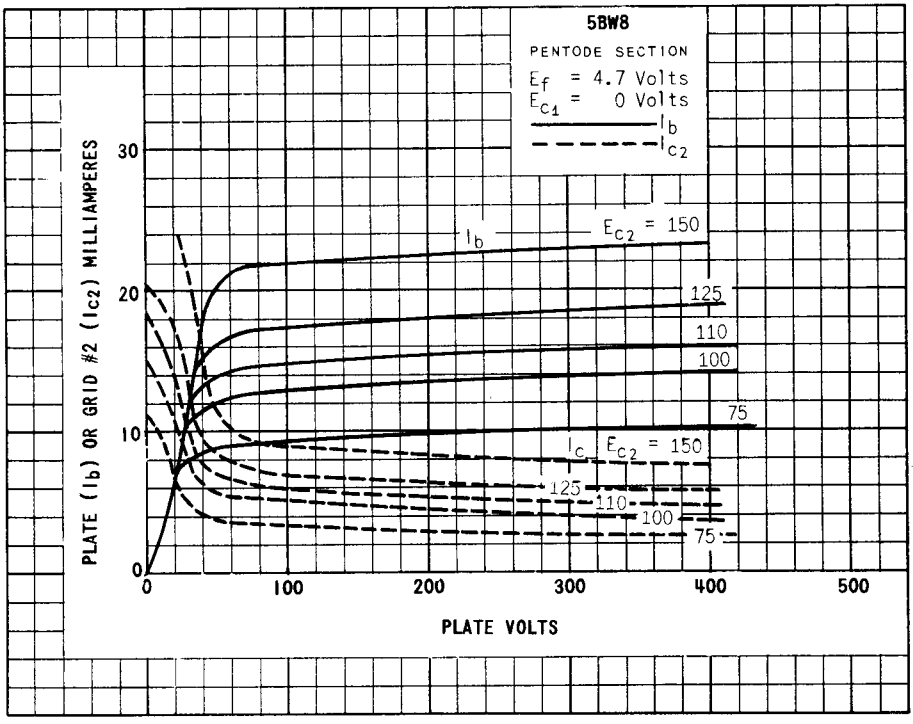
CONTINUED FROM PRECEDING PAGE

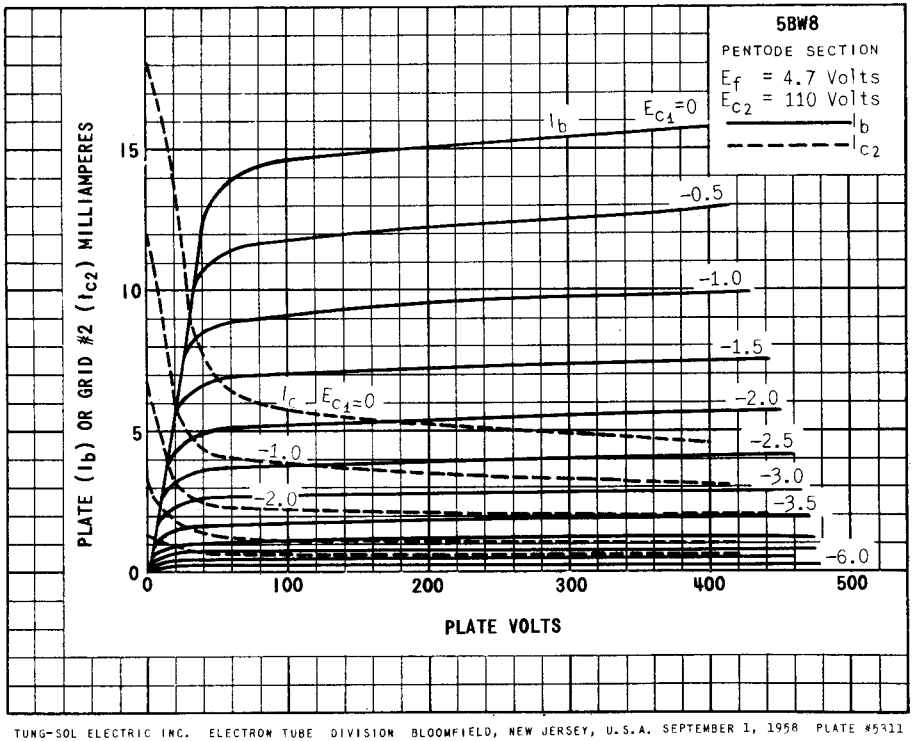
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

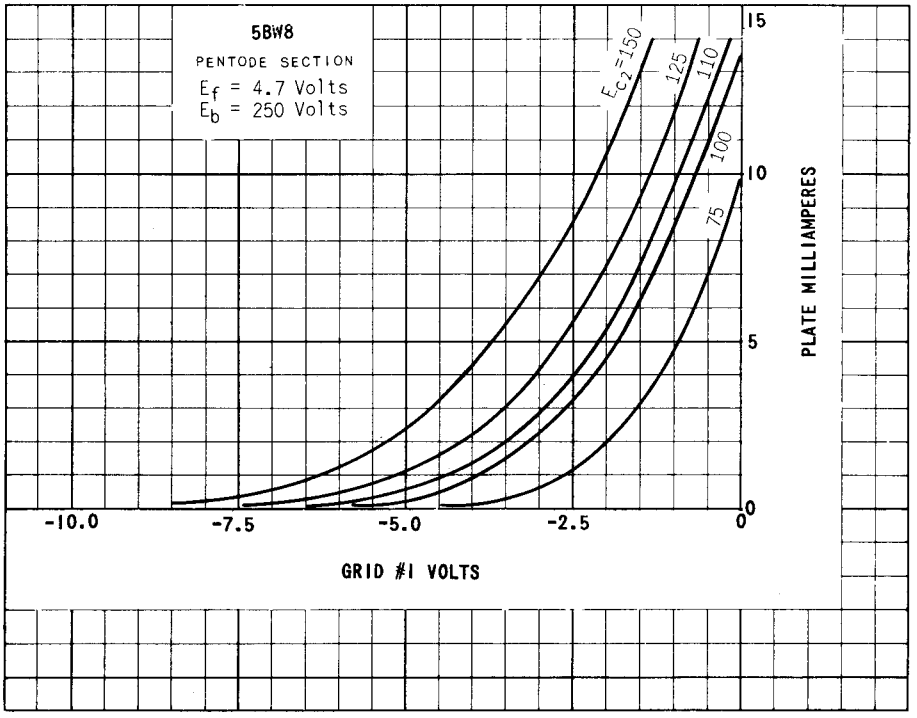
HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6±6%	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	5200	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) I_b=10 μAMPS	-10	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5 VOLTS DC APPLIED	20	MA.

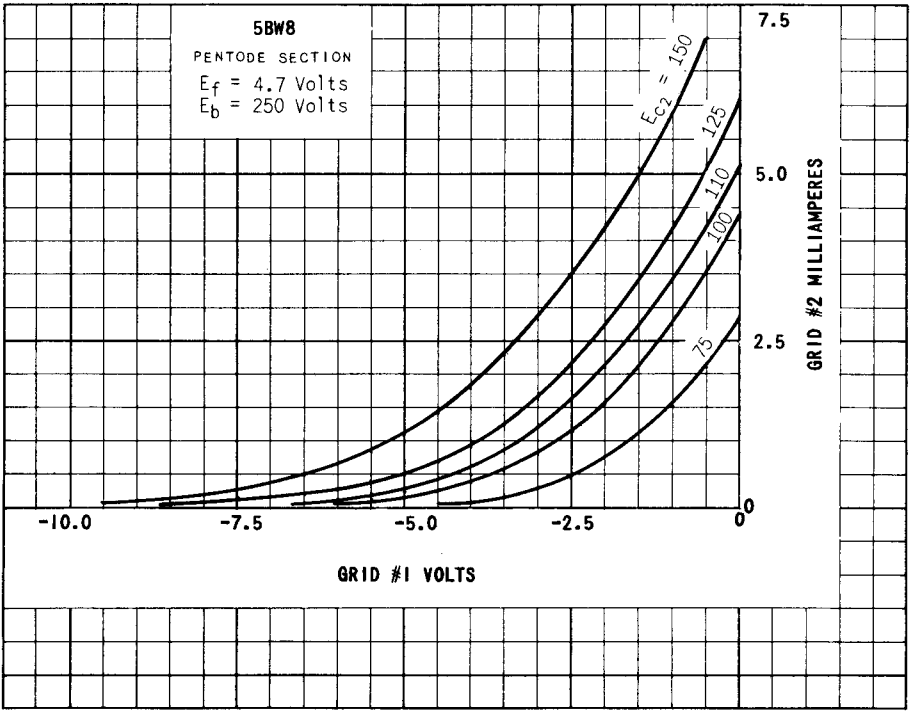
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

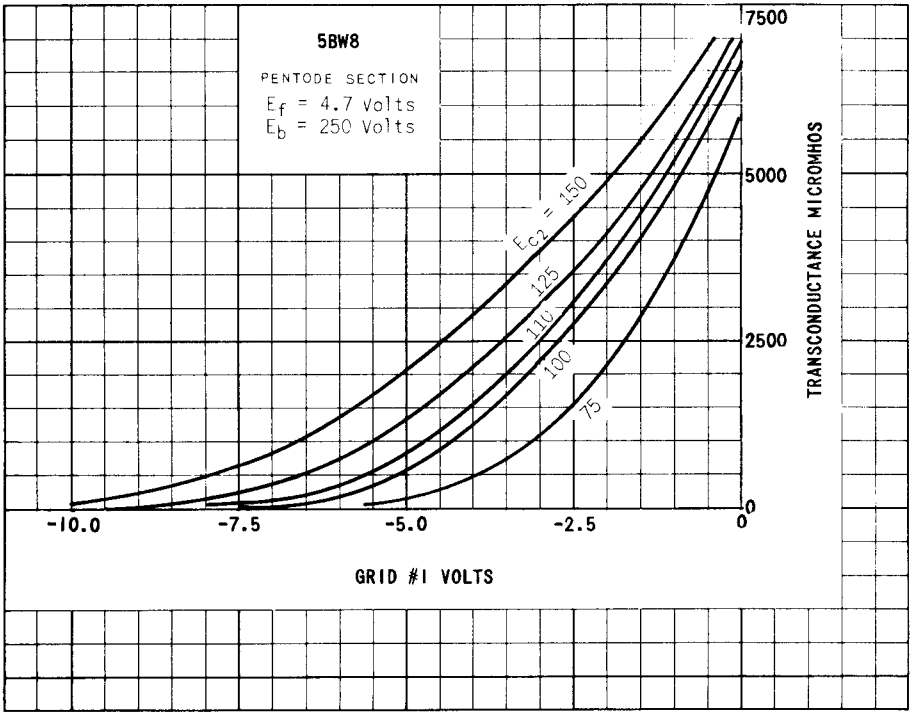


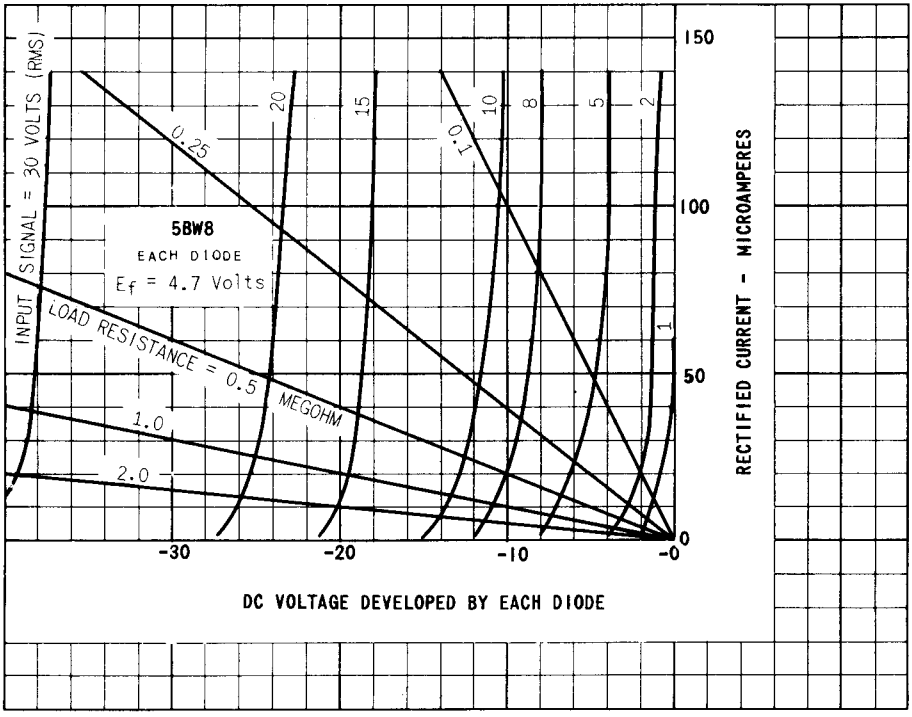

5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
I_b E_{c_2} = 150
125
110
100
75
I_c E_{c_2} = 150
125
110
100
75
0
10
20
30
0
100
200
300
400
500


5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_{c_2} = 110 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
I_b E_{c_1}=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-6.0
I_c E_{c_1}=0
-1.0
-2.0
0
5
10
15
0
100
200
300
400
500


5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_b = 250 Volts
E_{c_2}=150
125
110
100
75
15
10
5
0
PLATE MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_b = 250 Volts
E_{c_2} = 150
125
110
100
75
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

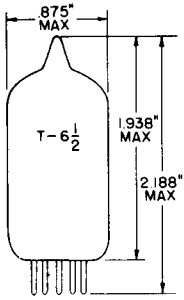

5BW8
PENTODE SECTION
E_f = 4.7 Volts
E_b = 250 Volts
E_{c2} = 150
125
110
100
75
7500
5000
2500
0
TRANSCONDUCTANCE MICROMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


INPUT SIGNAL = 30 VOLTS (RMS)
5BW8
EACH DIODE
E_f = 4.7 Volts
LOAD RESISTANCE = 0.5 MEGOHM
1.0
2.0
0.25
20
15
10
8
5
2
1
0.1
150
100
50
0
RECTIFIED CURRENT - MICROAMPERES
-30
-20
-10
-0
DC VOLTAGE DEVELOPED BY EACH DIODE

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

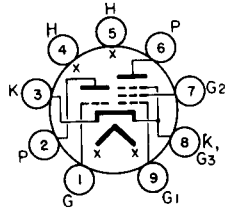


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR USE AS A COMBINED
OSCILLATOR AND MIXER
IN TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GF

THE 5CG8 IS A MULTIUNIT TUBE OF THE 9 PIN MINIATURE CONSTRUCTION CONTAINING A MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS A COMBINED OSCILLATOR AND MIXER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP) MAX.	0.02	0.04	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)	4.8	4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG2+PG3)	1.6	0.9	pf
CATHODE TO HEATER: (K TO H)	6.0[B]	6.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	1.5	1.5	pf
TRIODE INPUT: TG TO (H+K)	2.4	2.0	pf
TRIODE OUTPUT: TP TO (H+K)	1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX.	0.008	0.05	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 3.

[B] EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		4.7	VOLTS
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	SEE J5-C4-2	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS

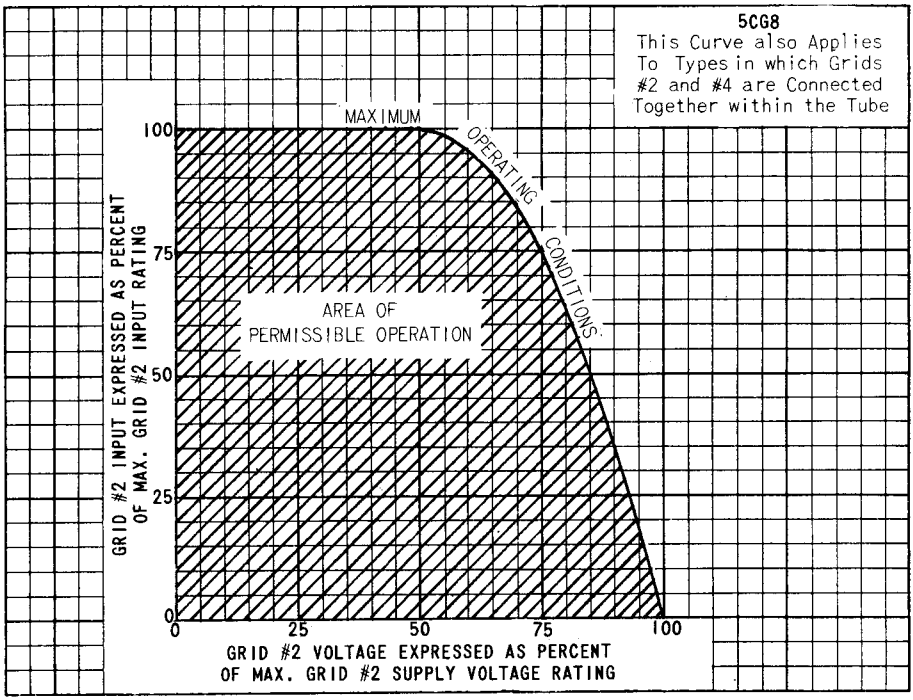
TYPICAL OPERATING CHARACTERISTICS

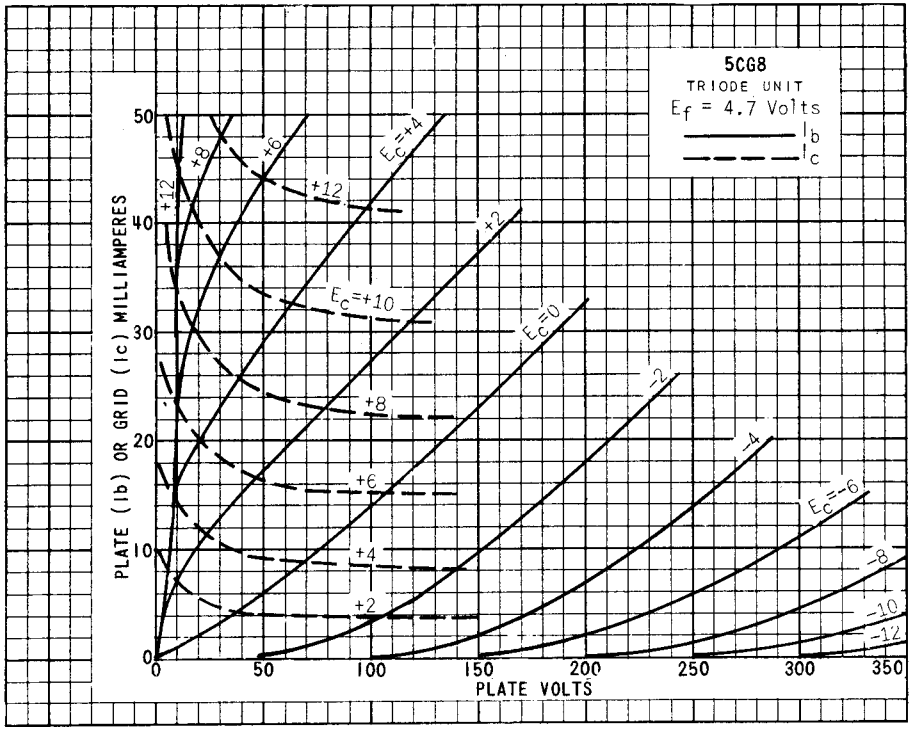
CLASS A1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO PIN 3 AT SOCKET		
GRID 2 VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	6,500	5,500	μMHOS
PLATE CURRENT	12.0	9.0	MA.
GRID 2 CURRENT	----	2.2	MA.
PLATE RESISTANCE (APPROX.)	6,000	300,000	OHMS
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20μA	-7	-6.5	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb = 100 V; Ec2 = 70 V)	----	5,700	μMHOS

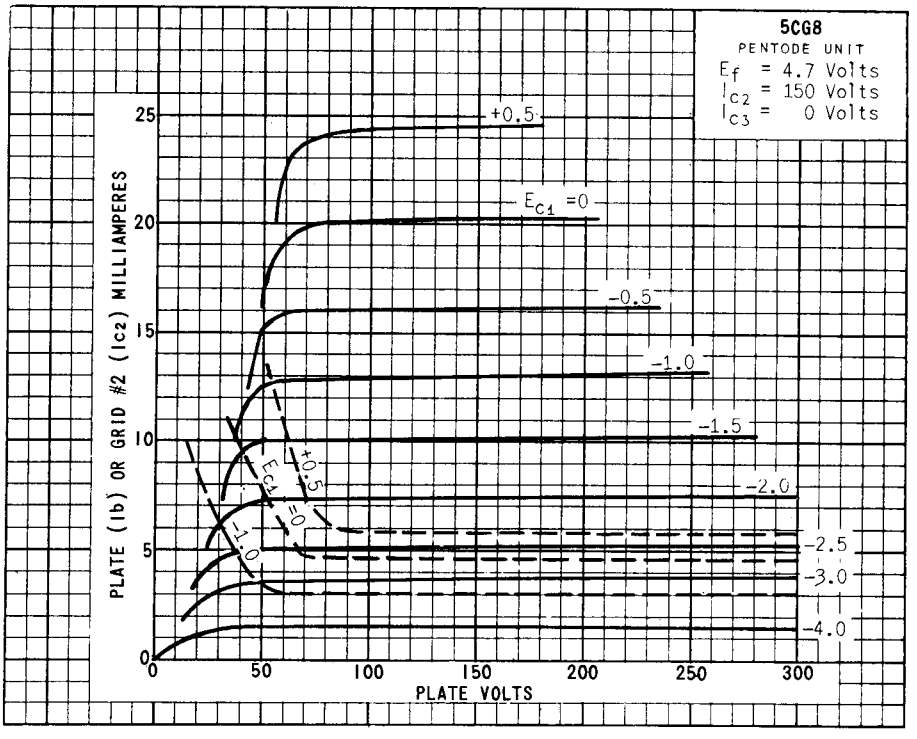
C

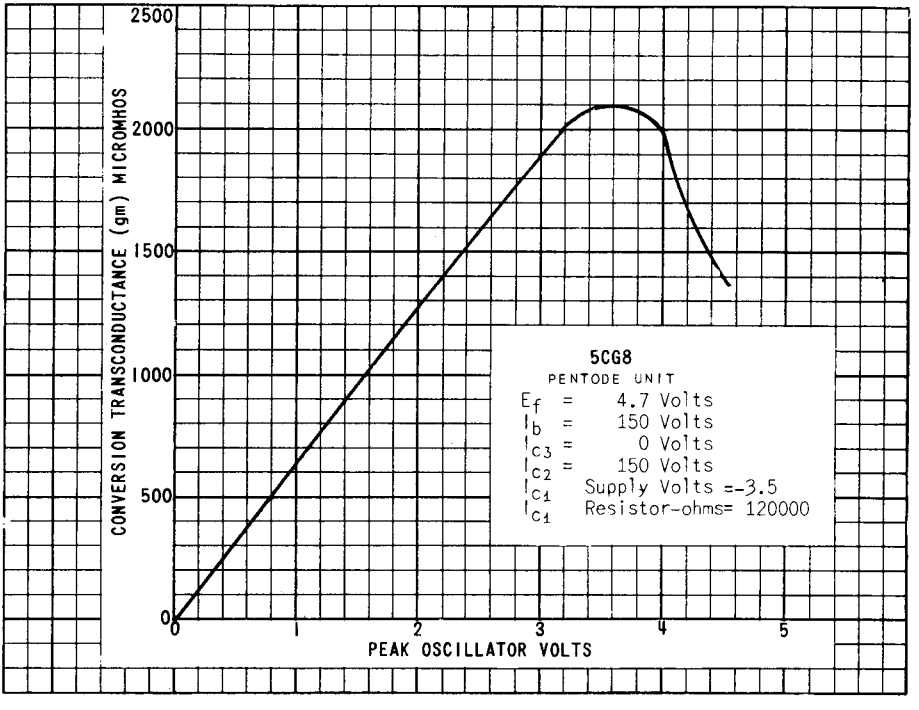
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

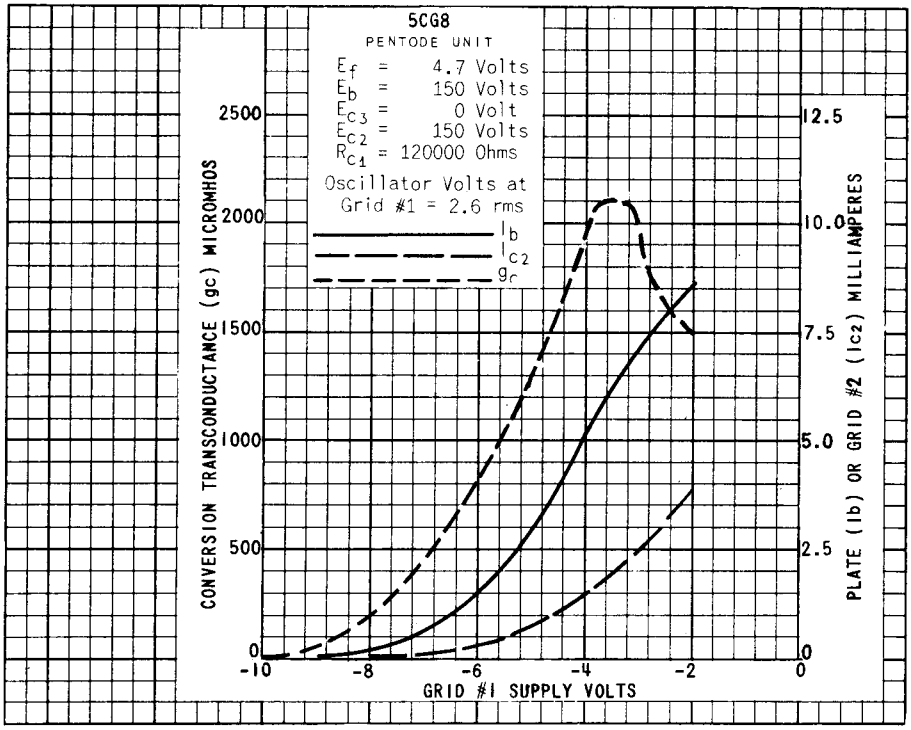

5CG8
This Curve also Applies To Types in which Grids #2 and #4 are Connected Together within the Tube
MAXIMUM OPERATING CONDITIONS
AREA OF PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS PERCENT OF MAX. GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAX. GRID #2 SUPPLY VOLTAGE RATING


5CG8
TRIODE UNIT
Ef = 4.7 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
50
40
30
20
10
0
0
50
100
150
200
250
300
350
PLATE VOLTS
Ec=+4
+12
+8
+6
+12
+2
Ec=+10
Ec=0
+8
+6
+4
+2
-2
-4
Ec=-6
-8
-10
-12

5CG8


5CG8
PENTODE UNIT
Ef = 4.7 Volts
Ic2 = 150 Volts
Ic3 = 0 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
+0.5
Ec1 =0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
0
5
10
15
20
25
50
100
150
200
250
300


CONVERSION TRANSCONDUCTANCE (gm) MICROMHOS
PEAK OSCILLATOR VOLTS
5CG8
PENTODE UNIT
Ef = 4.7 Volts
Ib = 150 Volts
Ic3 = 0 Volts
Ic2 = 150 Volts
Ic1 Supply Volts =-3.5
Ic1 Resistor-ohms= 120000
0
500
1000
1500
2000
2500
1
2
3
4
5



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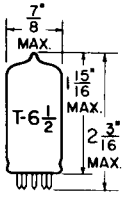
TRIODE TETRODE

MINIATURE TYPE

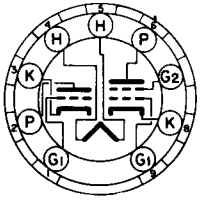


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FX

THE 5CL8 IS A MINIATURE TRIODE TETRODE DESIGNED FOR USE AS A VHF OSCILLATOR-MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 5CL8 IS IDENTICAL TO THE 6CL8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
TRIODE:			
GRID TO PLATE (G TO P)	1.8	1.8	μμf
INPUT: G TO (H + K)	2.7	2.7	μμf
OUTPUT: P TO (H + K)	1.2	0.4	μμf
TETRODE:			
GRID TO PLATE (G_1 TO P) (MAX.)	.016	.028	μμf
INPUT: G_1 TO (H+K+G_2)	5.0	5.0	μμf
OUTPUT: P TO (H+K+G_2)	3.0	2.0	μμf
CATHODE TO HEATER (EITHER SECTION APPROX.)	2.5	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	TETRODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS

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RATINGS—CONT'D.

	TRIODE	TETRODE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME*	11.0		SECONDS

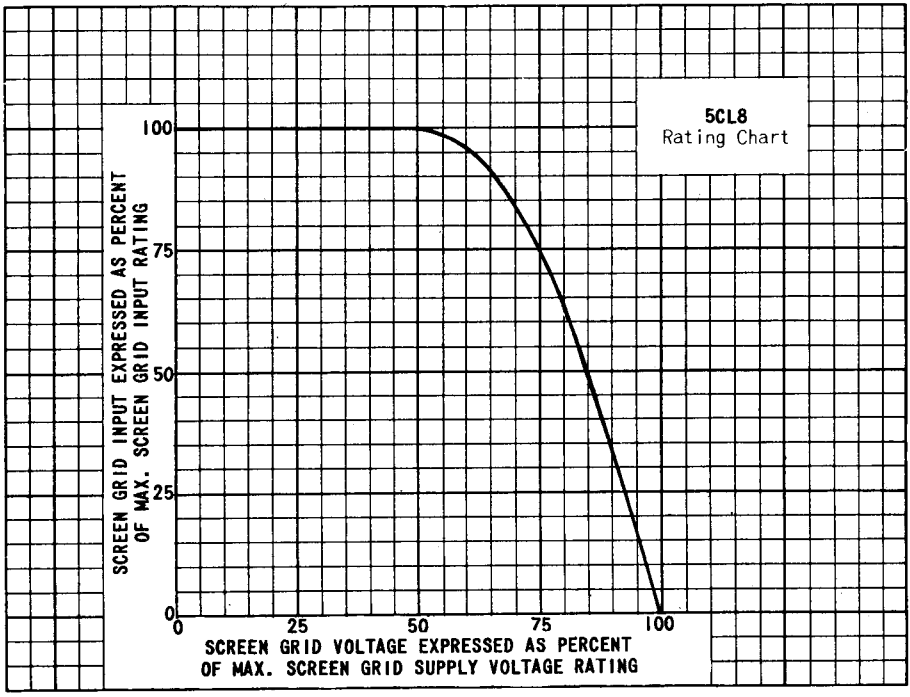
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	0	-1.0	VOLTS
CATHODE BIAS RESISTOR	56	---	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	.005	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	5 800	μMHOS
PLATE CURRENT	15	12	MA.
GRID #2 CURRENT	---	4.0	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b =10 μA. DC	-9	-10	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

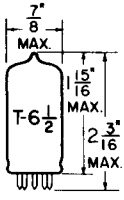
SIMILAR TYPE REFERENCE: Except for heater ratings and heater warm-up time the 5CL8 is identical to the 6CL8.


5CL8
Rating Chart
SCREEN GRID INPUT EXPRESSED AS PERCENT OF MAX. SCREEN GRID INPUT RATING
100
75
50
25
0
0
25
50
75
100
SCREEN GRID VOLTAGE EXPRESSED AS PERCENT OF MAX. SCREEN GRID SUPPLY VOLTAGE RATING

TUNG-SOL

TRIODE TETRODE

MINIATURE TYPE

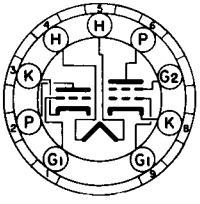


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FX

THE 5CL8A IS A MINIATURE TRIODE TETRODE DESIGNED FOR USE AS A VHF OSCILLATOR-MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS THE 5CL8A IS IDENTICAL TO THE 6CL8A.

DIRECT INTERELECTRODE CAPACITANCES

	WITH [B] SHIELD #315	WITHOUT SHIELD	
TRIODE:			
GRID TO PLATE (G TO P)	1.8	1.8	μμf
INPUT: G TO (H + K)	2.7	2.7	μμf
OUTPUT: P TO (H + K)	1.2	0.4	μμf
TETRODE:			
GRID TO PLATE (G_1 TO P) (MAX.)	0.010	0.028	μμf
INPUT: G_1 TO (H+K+G_2)	5.0	5.0	μμf
OUTPUT: P TO (H+K+G_2)	3.4	2.4	μμf
CATHODE TO HEATER (EITHER SECTION APPROX.)	2.5 [C]	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	TETRODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS

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RATINGS—CONT'D.

	TRIODE	TETRODE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME[A]	11.0		SECONDS

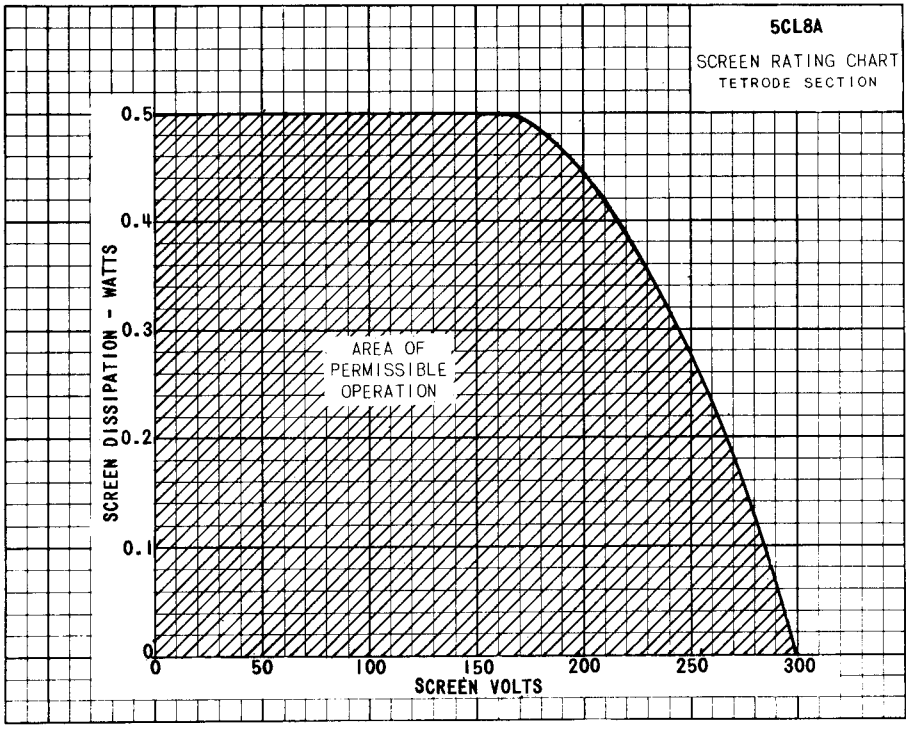
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TETRODE SECTION		TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	100	125	125	VOLTS
SCREEN VOLTAGE	100	125	---	VOLTS
GRID #1 VOLTAGE	0	-1.0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	56	OHMS
AMPLIFICATION FACTOR	---	---	40	
PLATE RESISTANCE (APPROX.)	---	100000	5000	OHMS
TRANSCONDUCTANCE	8200	6400	8000	μMHOS
PLATE CURRENT	---	12	15	MA.
SCREEN CURRENT	---	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)				
I_b = 10 μAMPERES	---	-10	-9	VOLTS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 5CL8A is identical to the 6CL8A.



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HIGH VACUUM CATHODE-RAY TUBE

ELECTROSTATIC DEFLECTION AND FOCUSING

5CP1	5CP4
NO. 1 PHOSPHOR GREEN FLUORESCENT SCREEN MEDIUM PERSISTENCE	NO. 4 PHOSPHOR WHITE FLUORESCENT SCREEN MEDIUM PERSISTENCE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

GLASS BULB

MEDIUM SHELL DIHEPTAL 12 PIN BASE

RATINGS*

MAXIMUM ANODE NO. 3 VOLTAGE (SUPPLEMENTARY HIGH VOLTAGE ELECTRODE)	4400	VOLTS
MAXIMUM ANODE NO. 2 VOLTAGE (HIGH VOLTAGE ELECTRODE)	2200	VOLTS
MAXIMUM ANODE NO. 1 VOLTAGE (FOCUSING ELECTRODE)	1100	VOLTS
GRID VOLTAGE (CONTROL ELECTRODE)	NEVER POSITIVE	
MAXIMUM PEAK VOLTAGE BETWEEN ANODE NO. 2 AND ANY DEFLECTOR	550	VOLTS
MAXIMUM DC HEATER CATHODE POTENTIAL[A]	125	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM IMPEDANCE OF ANY DEFLECTOR CIRCUIT AT HEATER SUPPLY FREQUENCY	1.0	MEGOHM

*MAXIMUM RATINGS ARE ABSOLUTE VALUES

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

GRID TO ALL OTHER ELECTRODES	8.0	μμf
CATHODE TO ALL OTHER ELECTRODES	8.0	μμf
D1 TO D2	2.0	μμf
D3 TO D4	2.0	μμf
D1 TO ALL OTHER ELECTRODES	9.0	μμf
D3 TO ALL OTHER ELECTRODES	7.0	μμf
D1 TO ALL OTHER ELECTRODES EXCEPT D2	7.0	μμf
D2 TO ALL OTHER ELECTRODES EXCEPT D1	7.0	μμf
D3 TO ALL OTHER ELECTRODES EXCEPT D4	5.0	μμf
D4 TO ALL OTHER ELECTRODES EXCEPT D3	6.0	μμf

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1399
MARCH 15
1944

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE NO. 3 VOLTAGE	2000	3000	4000	VOLTS
ANODE NO. 2 VOLTAGE[B]	2000	1500	2000	VOLTS
ANODE NO. 1 VOLTAGE FOR FOCUS AT 75% OF GRID VOLTAGE CUT-OFF[C]	575	430	575	VOLTS
GRID VOLTAGE FOR CUT-OFF[D]	-60[E]	-45[E]	-60[E]	VOLTS
DEFLECTION SENSITIVITY:[F]				
D1 AND D2	0.350	0.370	0.280	MM/VOLT DC
D3 AND D4	0.390	0.450	0.340	MM/VOLT DC
DEFLECTION FACTOR[F]				
D1 AND D2	73	69	92	VOLTS DC/IN
D3 AND D4	64	56	74	VOLTS DC/IN

SPOT POSITION AND TEST CONDITIONS

THE UNDEFLECTED FOCUSED SPOT FALLS WITHIN A 25 MM. SQUARE CENTERED ON THE TUBE FACE.

TEST CONDITIONS ARE:

ANODE NO. 3 VOLTAGE	4000	VOLTS
ANODE NO. 2 VOLTAGE	2000	VOLTS
ANODE NO. 1 VOLTAGE	ADJUSTED FOR FOCUS	
GRID VOLTAGE	NEAR CUT-OFF	
DEFLECTOR RESISTORS (CONNECTED TO ANODE NO. 2)	1 MEGOHM EACH	

NOTE: SHIELD TUBE FROM ALL STRAY FIELDS.

[A] WHEN THE HEATER IS OPERATED AT A NEGATIVE POTENTIAL WITH RESPECT TO THE CATHODE THEN THE CATHODE RETURN SHOULD BE MADE AT THE CENTER TAP OF THE FILAMENT TRANSFORMER.

[B] USE OF LESS THAN 1500 VOLTS RESULTS IN DECREASED BRILLIANCE.

[C] CERTAIN TUBES MAY REQUIRE ADJUSTMENT OF +25% TO -30% WITH GRID VOLTAGE BETWEEN ZERO AND CUT-OFF.

[D] THE VISUAL EXTINCTION OF A FOCUSED SPOT.

[E] THE GRID SUPPLY SHOULD BE VARIABLE TO ± 50%.

[F] VALUES SUBJECT TO VARIATION OF ± 20%.

DEFLECTOR LOCATIONS:

D1 AND D2	NEAREST TO SCREEN
D3 AND D4	NEAREST TO BASE
D1	SAME SIDE OF TUBE AS PIN NO. 6
D3	SAME SIDE AS PIN NO. 2

CONTINUED NEXT PAGE

PLATE 1400
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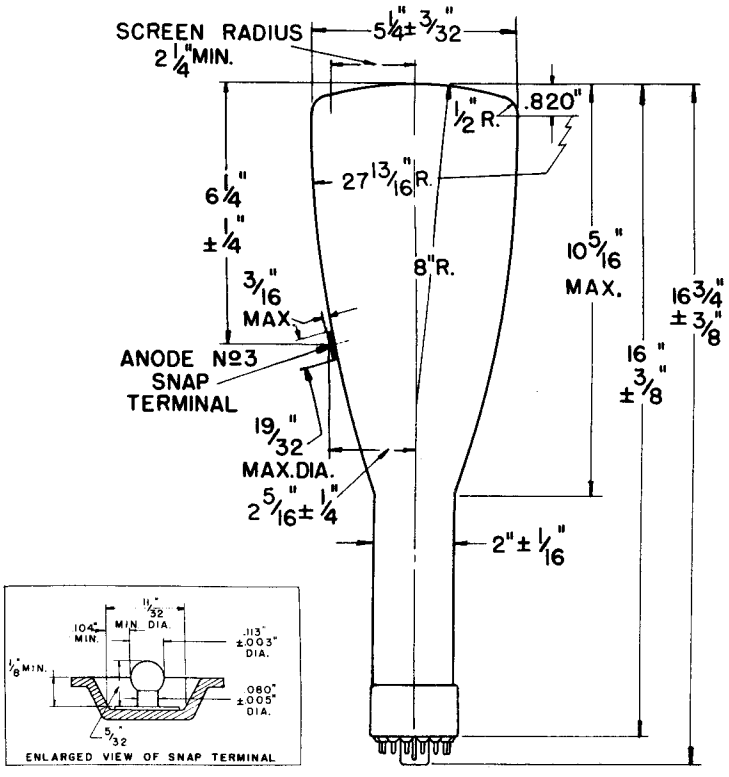

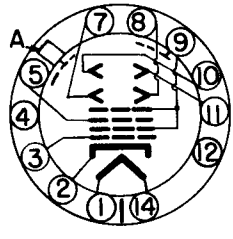

BOTTOM VIEW

1. HEATER
2. CATHODE
3. GRID NO. 1
4. INTERNAL CONNECTION (DO NOT USE)
5. ANODE NO. 1
7. DEFLECTOR NO. 3 (D3)
8. DEFLECTOR NO. 4 (D4)
9. GRID NO. 2 ANODE NO. 2
10. DEFLECTOR NO. 2 (D2)
11. DEFLECTOR NO. 1 (D1)
12. NO CONNECTION
14. HEATER

A. ANODE NO. 3 (SNAP TERMINAL)

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TUNG-SOL

HIGH VACUUM CATHODE-RAY TUBE

ELECTROSTATIC DEFLECTION AND FOCUSING

5CP1	5CP4
NO. 1 PHOSPHOR GREEN FLUORESCENT SCREEN MEDIUM PERSISTENCE	NO. 4 PHOSPHOR WHITE FLUORESCENT SCREEN MEDIUM PERSISTENCE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

GLASS BULB

MEDIUM SHELL DIHEPTAL 12 PIN BASE

RATINGS*

MAXIMUM ANODE NO. 3 VOLTAGE (SUPPLEMENTARY HIGH VOLTAGE ELECTRODE)	4400	VOLTS
MAXIMUM ANODE NO. 2 VOLTAGE (HIGH VOLTAGE ELECTRODE)	2200	VOLTS
MAXIMUM ANODE NO. 1 VOLTAGE (FOCUSING ELECTRODE)	1100	VOLTS
GRID VOLTAGE (CONTROL ELECTRODE)	NEVER POSITIVE	
MAXIMUM PEAK VOLTAGE BETWEEN ANODE NO. 2 AND ANY DEFLECTOR	550	VOLTS
MAXIMUM DC HEATER CATHODE POTENTIAL[A]	125	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM IMPEDANCE OF ANY DEFLECTOR CIRCUIT AT HEATER SUPPLY FREQUENCY	1.0	MEGOHM

*MAXIMUM RATINGS ARE ABSOLUTE VALUES

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

GRID TO ALL OTHER ELECTRODES	8.0	μμf
CATHODE TO ALL OTHER ELECTRODES	8.0	μμf
D1 TO D2	2.0	μμf
D3 TO D4	2.0	μμf
D1 TO ALL OTHER ELECTRODES	9.0	μμf
D3 TO ALL OTHER ELECTRODES	7.0	μμf
D1 TO ALL OTHER ELECTRODES EXCEPT D2	7.0	μμf
D2 TO ALL OTHER ELECTRODES EXCEPT D1	7.0	μμf
D3 TO ALL OTHER ELECTRODES EXCEPT D4	5.0	μμf
D4 TO ALL OTHER ELECTRODES EXCEPT D3	6.0	μμf

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE NO. 3 VOLTAGE	2000	3000	4000	VOLTS
ANODE NO. 2 VOLTAGE[B]	2000	1500	2000	VOLTS
ANODE NO. 1 VOLTAGE FOR FOCUS AT 75% OF GRID VOLTAGE CUT-OFF[C]	575	430	575	VOLTS
GRID VOLTAGE FOR CUT-OFF[D]	-60[E]	-45[E]	-60[E]	VOLTS
DEFLECTION SENSITIVITY:[F]				
D1 AND D2	0.350	0.370	0.280	MM/VOLT DC
D3 AND D4	0.390	0.450	0.340	MM/VOLT DC
DEFLECTION FACTOR[F]				
D1 AND D2	73	69	92	VOLTS DC/IN
D3 AND D4	64	56	74	VOLTS DC/IN

SPOT POSITION AND TEST CONDITIONS

THE UNDEFLECTED FOCUSED SPOT FALLS WITHIN A 25 MM. SQUARE CENTERED ON THE TUBE FACE.

TEST CONDITIONS ARE:

ANODE NO. 3 VOLTAGE	4000 VOLTS
ANODE NO. 2 VOLTAGE	2000 VOLTS
ANODE NO. 1 VOLTAGE	ADJUSTED FOR FOCUS
GRID VOLTAGE	NEAR CUT-OFF
DEFLECTOR RESISTORS (CONNECTED TO ANODE NO. 2)	1 MEGOHM EACH

NOTE: SHIELD TUBE FROM ALL STRAY FIELDS.

[A] WHEN THE HEATER IS OPERATED AT A NEGATIVE POTENTIAL WITH RESPECT TO THE CATHODE THEN THE CATHODE RETURN SHOULD BE MADE AT THE CENTER TAP OF THE FILAMENT TRANSFORMER.

[B] USE OF LESS THAN 1500 VOLTS RESULTS IN DECREASED BRILLIANCE.

[C] CERTAIN TUBES MAY REQUIRE ADJUSTMENT OF +25% TO -30% WITH GRID VOLTAGE BETWEEN ZERO AND CUT-OFF.

[D] THE VISUAL EXTINCTION OF A FOCUSED SPOT.

[E] THE GRID SUPPLY SHOULD BE VARIABLE TO ± 50%.

[F] VALUES SUBJECT TO VARIATION OF ± 20%.

DEFLECTOR LOCATIONS:

D1 AND D2	NEAREST TO SCREEN
D3 AND D4	NEAREST TO BASE
D1	SAME SIDE OF TUBE AS PIN NO. 5
D3	SAME SIDE AS PIN NO. 2

PLATE 1612
MARCH 15 1944

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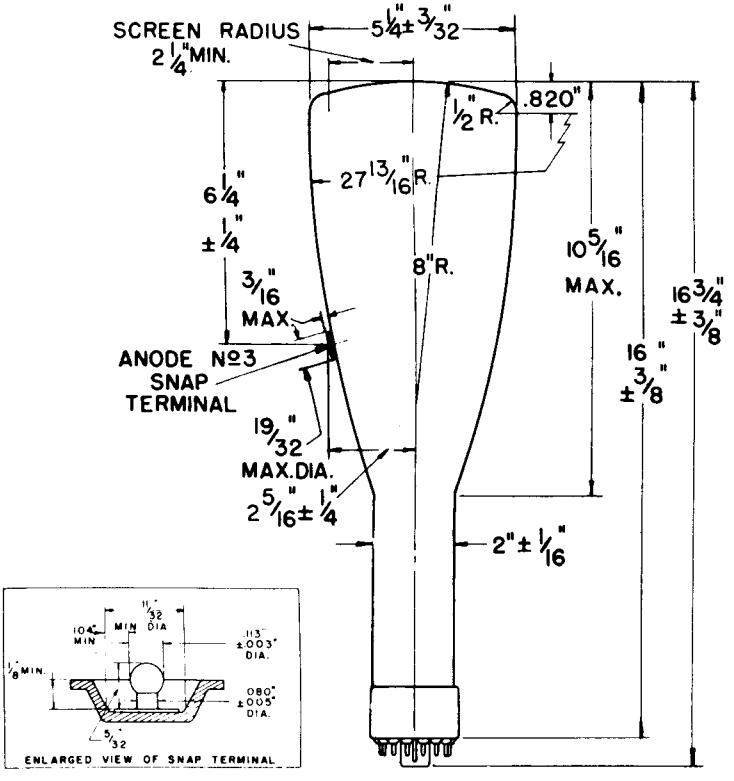

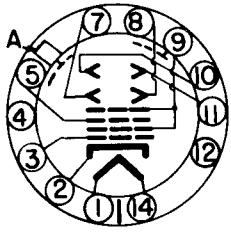

BOTTOM VIEW

1. HEATER
2. CATHODE
3. GRID NO. 1
4. INTERNAL CONNECTION (DO NOT USE)
5. ANODE NO. 1
7. DEFLECTOR NO. 3 (D3)
8. DEFLECTOR NO. 4 (D4)
9. GRID NO. 2 ANODE NO. 2
10. DEFLECTOR NO. 2 (D2)
11. DEFLECTOR NO. 1 (D1)
12. NO CONNECTION
14. HEATER

A. ANODE NO. 3 (SNAP TERMINAL)

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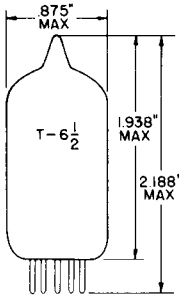
TUNG-SOL

TRIODE-TETRODE
MINIATURE TYPE

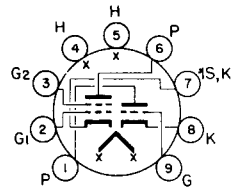


GLASS BULB
SMALL-BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

HEATER
6.7 VOLTS 600±40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GE

THE 5CQ8 IS A MEDIUM-MU TRIODE AND SHARP CUTOFF TETRODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT MAY BE USED IN A WIDE VARIETY OF APPLICATIONS IN BLACK AND WHITE AND COLOR TELEVISION RECEIVERS, PARTICULARLY AS A COMBINED VHF OSCILLATOR AND MIXER IN TUNERS OF SUCH RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THE TETRODE UNIT IS INTENDED FOR USE AS A MIXER TUBE, BUT IT IS ALSO USEFUL AS A VIDEO INTERMEDIATE-FREQUENCY AMPLIFIER TUBE AND AS A SOUND INTERMEDIATE FREQUENCY AMPLIFIER TUBE. THE TRIODE UNIT IS SUITABLE FOR USE NOT ONLY AS A VHF OSCILLATOR, BUT ALSO AS A PHASE SPLITTER, SYNC-CLIPPER, SYNC-SEPARATOR, AND RF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXTERNAL SHIELD	WITH[A] EXTERNAL SHIELD	
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	pf
GRID TO CATHODE & HEATER	2.7	2.7	pf
PLATE TO CATHODE AND HEATER	0.4	1.2	pf
TETRODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.019	0.015	pf
GRID #1 TO CATHODE & I.S., GRID #2 & HEATER	5.0	5.0	pf
PLATE TO CATHODE & I.S., GRID #2 & HEATER	2.5	3.3	pf
TETRODE PLATE TO TRIODE PLATE (MAX.)	0.07	0.01	pf
HEATER TO CATHODE	3.0	3.0[B]	pf

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM ←

CONVERTER SERVICE

	TRIODE UNIT AS OSC.	TETRODE UNIT AS MIXER	
MAXIMUM PLATE VOLTAGE	330 ←	330 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	---	SEE FIGURE #2	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1 ←	3.2 ←	WATTS
MAXIMUM GRID #2 INPUT:			
→ FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.7 ←	WATT
→ FOR GRID #2 VOLTAGES BETWEEN 165 & 300V.	---	SEE FIGURE #2	
MAXIMUM GRID #1 INPUT	0.55 ←	---	WATT
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[C]	200	200[C]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

MAXIMUM CIRCUIT VALUES

	TRIODE UNIT	TETRODE UNIT	
GRID #1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION (MAX.)	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION (MAX.)	0.5	0.25	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	TETRODE UNIT	
PLATE SUPPLY VOLTAGE	125	125	VOLTS
GRID #2 SUPPLY VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	---	-1	VOLT
CATHODE-BIAS RESISTOR	56	---	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	5 000	140 000	OHMS
TRANSCONDUCTANCE	8 000	5 800	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR PLATE CURRENT OF 100 μAMP	-7	-7	VOLTS
PLATE CURRENT	15	12	MA.
GRID #2 CURRENT	---	4.2	MA.

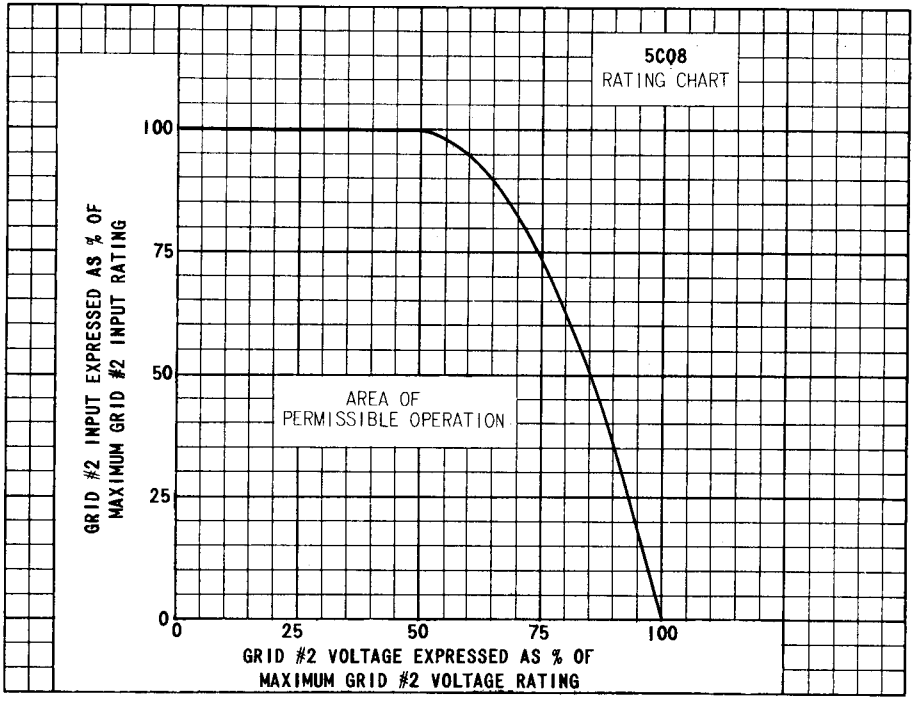
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

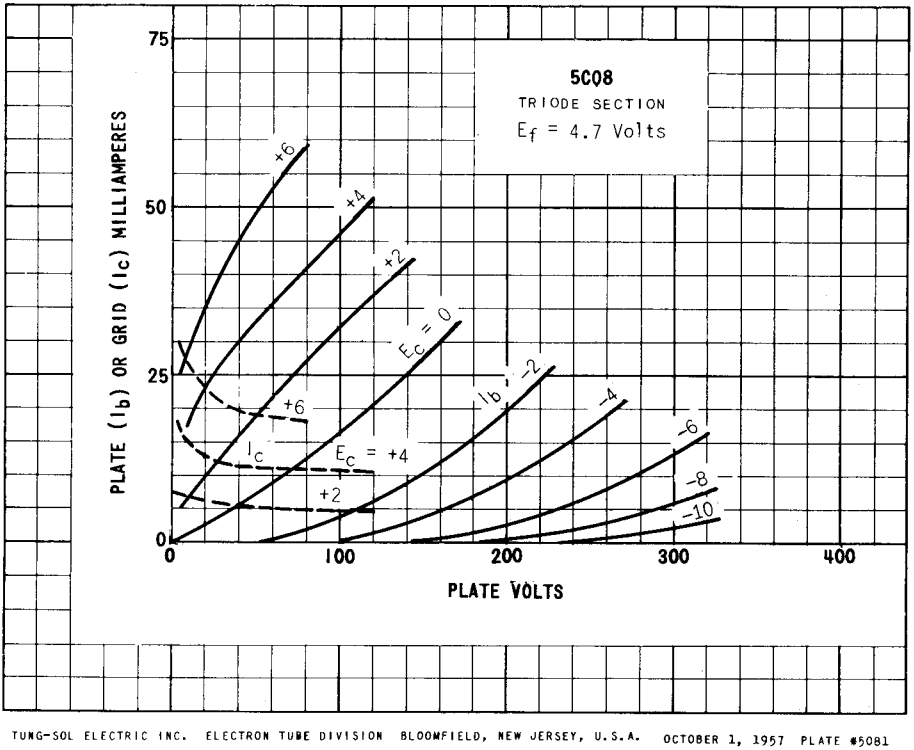
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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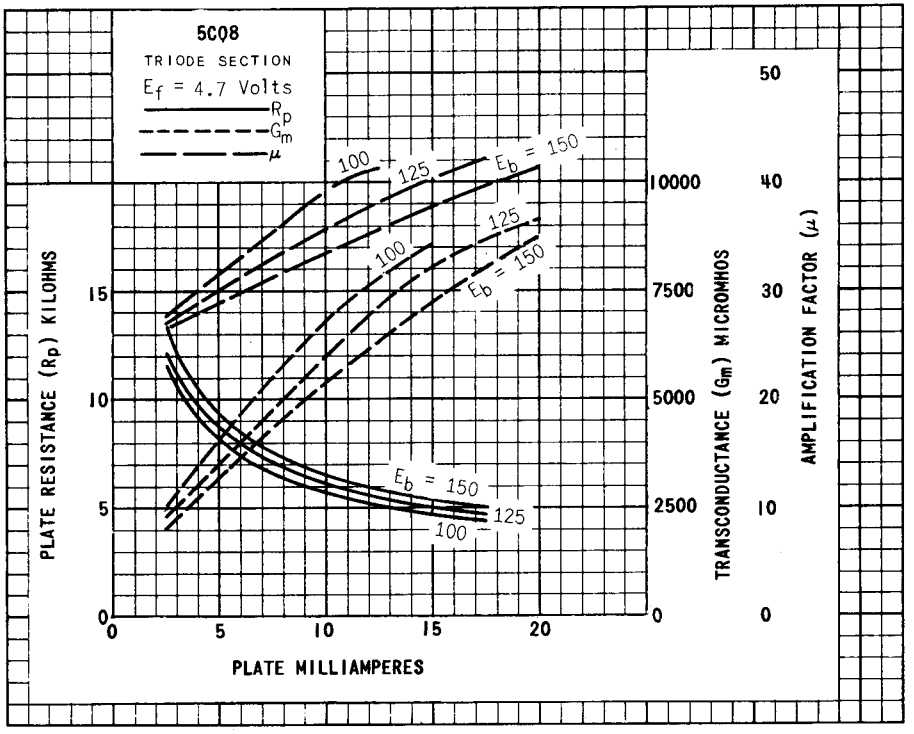
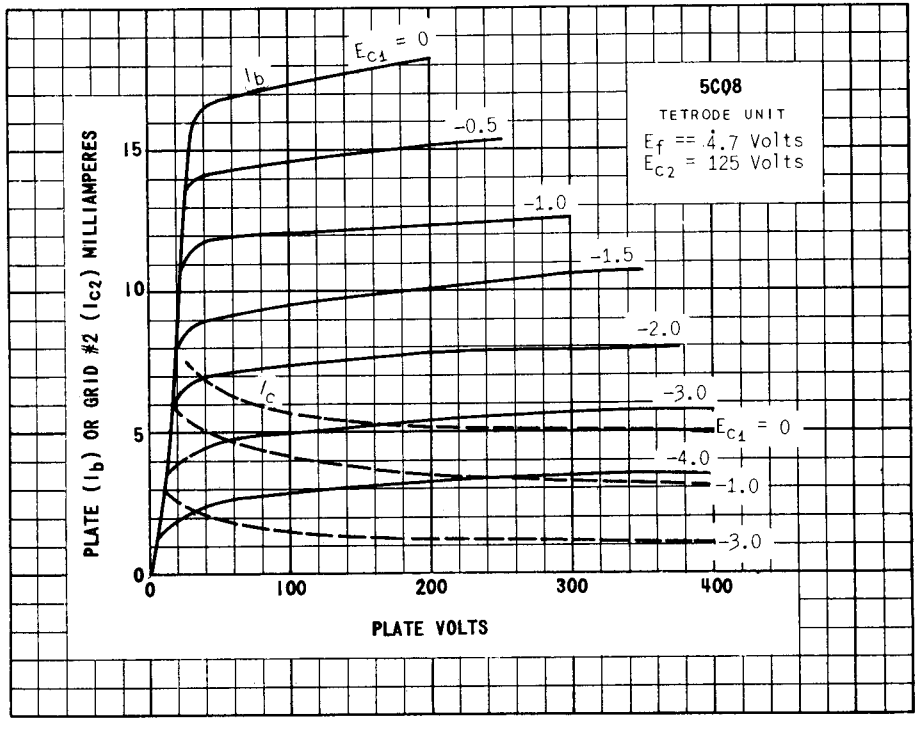
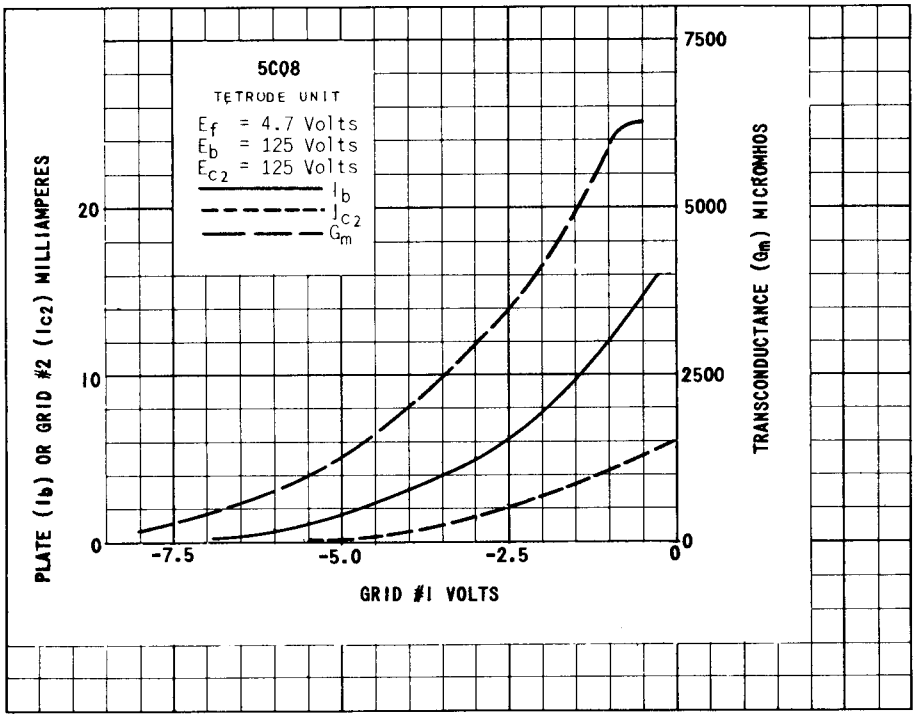

5CQ8
TRIODE SECTION
E_f = 4.7 Volts
R_p
G_m
μ
PLATE RESISTANCE (R_p) KILOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
E_b = 150
125
100
0
5
10
15
20
2500
5000
7500
10000
30
40
50


5CQ8
TETRODE UNIT
E_f = 4.7 Volts
E_{c2} = 125 Volts
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_b
I_c
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
0
100
200
300
400
5
10
15



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TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

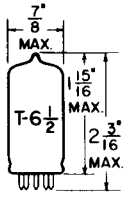
COATED UNIPOTENTIAL CATHODE

HEATER

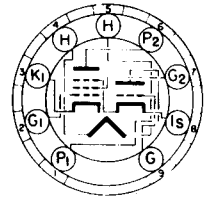
4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9GJ

THE 5CR8 IS A MINIATURE TRIODE PENTODE USING THE 9-PIN MINIATURE CONSTRUCTION. THE PENTODE IS DESIGNED FOR TELEVISION IF AND CONTAINS A SUPPRESSOR INTERNALLY CONNECTED TO THE TRIODE CATHODE PERMITTING DEGENERATION IN THE PENTODE CATHODE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER VOLTAGE AND CURRENT, THE 5CR8 IS IDENTICAL TO THE 6CR8.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

TRIODE:		
GRID TO PLATE: G TO P	1.6	μμf
INPUT: G TO (H + K)	2.6	μμf
OUTPUT: P TO (H + K)	1.4	μμf
PENTODE:		
GRID #1 TO PLATE: G_1 TO P (MAX.)	0.018	μμf
INPUT: G_1 TO (H+K+G_2+G_3+I.S.)	6.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	2.8	μμf
COUPLING:		
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.10	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.14	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	0.011	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5		MEGOHM
SELF BIAS	1.0		MEGOHM
HEATER WARM-UP TIME*	11.0		SECONDS

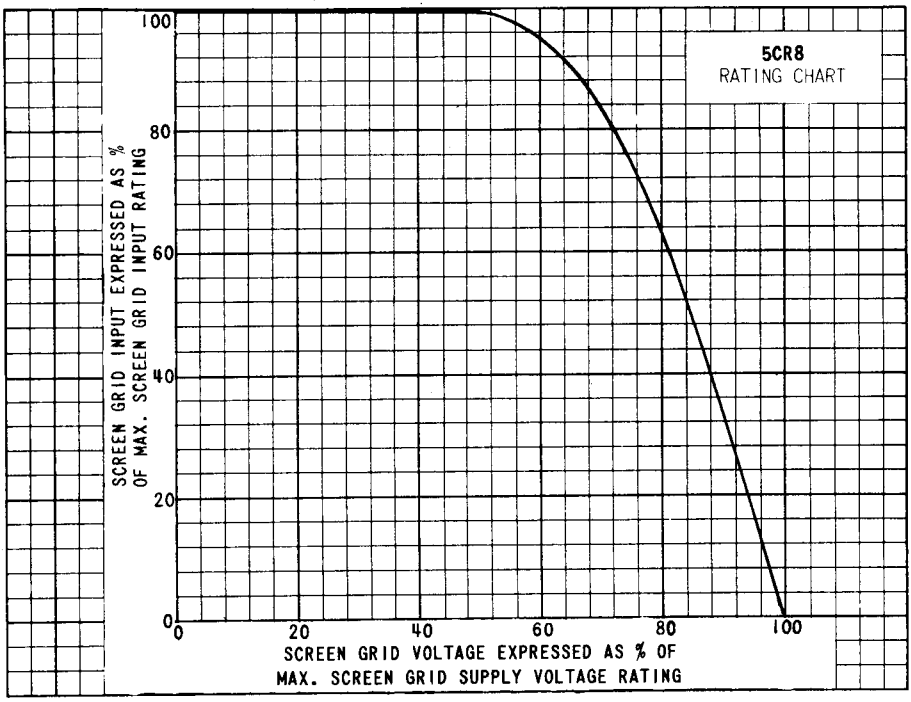
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2	0	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT	12	13	MA.
GRID #2 CURRENT		3	MA.
AMPLIFICATION FACTOR	22		
TRANSCONDUCTANCE	4 000	7 700	μMHOS
PLATE RESISTANCE (APPROX.)	5 500	300 000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA	-13		VOLTS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	VOLTS
PLATE CURRENT WITH E_{c1} =-3 Vdc, RK=0		2.8	MA.

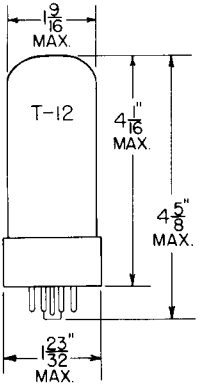
[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


5CR8
RATING CHART
SCREEN GRID INPUT EXPRESSED AS % OF MAX. SCREEN GRID INPUT RATING
100
80
60
40
20
0
0
20
40
60
80
100
SCREEN GRID VOLTAGE EXPRESSED AS % OF
MAX. SCREEN GRID SUPPLY VOLTAGE RATING

TUNG-SOL

RECTIFIER



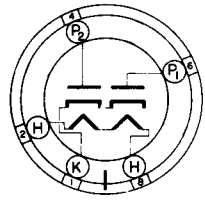
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

5.0 VOLTS 3.5 AMP.

ANY MOUNTING POSITION •



BOTTOM VIEW
SHORT MEDIUM SHELL
5 PIN OCTAL
8KD

THE 5CU4 IS AN INDIRECTLY-HEATED CATHODE TYPE RECTIFIER DESIGNED FOR USE IN TELEVISION RECIEVERS. THE HIGH PERVEANCE OF THE DESIGN PERMITS MAXIMUM DC VOLTAGE OUTPUT..

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	800	VOLTS
MAXIMUM AC PLATE VOLTAGE PER PLATE	285	VOLTS
MAXIMUM DC OUTPUT CURRENT	425	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	1.3	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	6.0	AMP.
TUBE VOLTAGE DROP	SEE CURVE	

TYPICAL OPERATION

FULL WAVE RECTIFIER WITH CAPACITANCE INPUT

HEATER VOLTAGE	5.0	VOLTS
HEATER CURRENT	3.5	AMP.
AC PLATE SUPPLY VOLTAGE EACH PLATE (R.M.S.)	260	VOLTS
INPUT CAPACITANCE	40	μfd
EFFECTIVE PLATE SUPPLY RESISTANCE (EACH PLATE)	30	OHMS
DC OUTPUT CURRENT	385	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	300	VOLTS

• IN SERVICE, CATHODE SHOULD BE CONNECTED TO HEATER.

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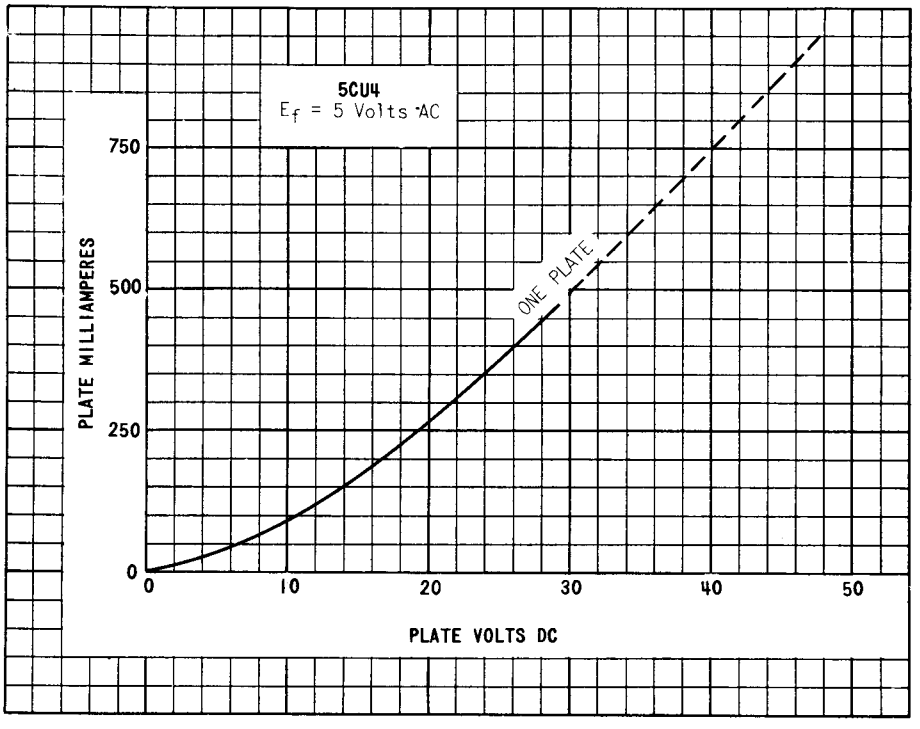
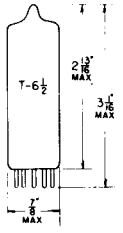
TENTATIVE DATA



TUNG-SOL

BEAM POWER PENTODE

MINIATURE TYPE

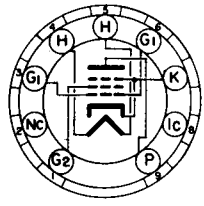


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±10% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN NOVAL

9HN

THE 5CZ5 IS A HIGH PERVEANCE BEAM POWER PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A VERTICAL-DEFLECTION AMPLIFIER TUBE IN HIGH-EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS UTILIZING PICTURE TUBES HAVING DIAGONAL DEFLECTION ANGLES OF 110 DEGREES AND OPERATING AT VOLTAGES UP TO 18,000 VOLTS. IT IS ALSO USEFUL IN THE AUDIO OUTPUT STAGES OF TELEVISION AND RADIO RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.4	μμf
GRID #1 TO: (K+G_3+G_2+H)	9.0 ←	μμf
PLATE TO: (K+G_3+G_2+H)	6.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	4.7	**VOLTS**
MAXIMUM PLATE VOLTAGE:		
DC	315	VOLTS
PEAK POSITIVE PULSE (ABS. MAX.)[B]	2 200[C]	VOLTS
MAXIMUM GRID #2 VOLTAGE	315 ←	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	-275 ←	VOLTS
MAXIMUM CATHODE CURRENT:		
PEAK	155 ←	MA.
AVERAGE	45 ←	MA.
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 INPUT	2.2 ←	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	75	250	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	0	-14	VOLTS
PLATE RESISTANCE (APPROX.)	---	73 000	OHMS
TRANSCONDUCTANCE	---	4 800	μMHOS
PLATE CURRENT	130[G]	46	MA.
GRID #2 CURRENT	16[G]	4.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 100 μAMP.	---	-40 ←	VOLTS

NOTES

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[B] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PER CENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE SCANNING CYCLE IS 2.5 MILLISECONDS.

[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[E] SUBSCRIPT 1 INDICATES THAT GRID #1 CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

[F] THE TYPE OF INPUT COUPLING NETWORK USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT. TRANSFORMER OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED

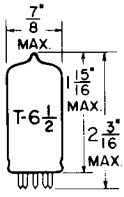
[G] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

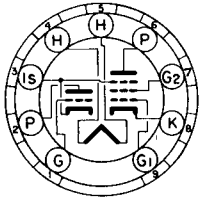


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
5.2 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9EG

THE 5DH8 IS A MINIATURE TUBE CONTAINING A SHARP-CUTOFF PENTODE AND A HIGH-MU TRIODE IN ONE ENVELOPE. THE PENTODE SECTION IS INTENDED FOR USE AS A VIDEO IF AMPLIFIER OR AS AN AUDIO IF AMPLIFIER. PROVIDED THE CATHODE IS GROUNDED, THE TRIODE SECTION MAY BE USED AS A VERTICAL OSCILLATOR, SYNC AMPLIFIER, SYNC SEPARATOR, OR SYNC CLIPPER. AN INTERNAL CONNECTION BETWEEN THE PENTODE SUPPRESSOR AND TRIODE CATHODE ALLOWS THE SUPPRESSOR TO BE GROUNDED WHEN A CATHODE BIAS RESISTOR IS EMPLOYED FOR THE PENTODE SECTION. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION:		
GRID #1 TO PLATE (MAX.)	0.03	μμf
INPUT: G_1 TO (K+H+S)	6.5	μμf
OUTPUT: PLATE TO (K+S+TK+I.S.+H&SUPPRESSOR)	2.2	μμf
PLATE TO (K+S & H)	4.2	μμf
TRIODE SECTION:		
GRID TO PLATE	1.6	μμf
INPUT: G TO (K+I.S.+H & P_S)	2.4	μμf
OUTPUT: P TO (K+I.S.+H & P_S)	1.4	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.008	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf
PENTODE PLATE TO TRIODE PLATE	0.04	μμf

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TUNG-SOL

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RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER SERVICE

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	5.2	5.2	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.25	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

VERTICAL OSCILLATOR SERVICE[A]

	TRIODE SECTION	
HEATER VOLTAGE	5.2	VOLTS
MAXIMUM DC PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM PEAK CATHODE CURRENT	35	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE:		
WITH FIXED BIAS	2.2	MEGOHMS
WITH CATHODE BIAS	2.2	MEGOHMS
WITH GRID-LEAK BIAS	2.2	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	5.2	5.2	VOLTS
HEATER CURRENT	0.6±6%	0.6±6%	AMP.
PLATE VOLTAGE	125	250	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	---	---	VOLTS
CATHODE-BIAS RESISTOR	56	390	OHMS
AMPLIFICATION FACTOR	---	53	

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TUNG-SOL

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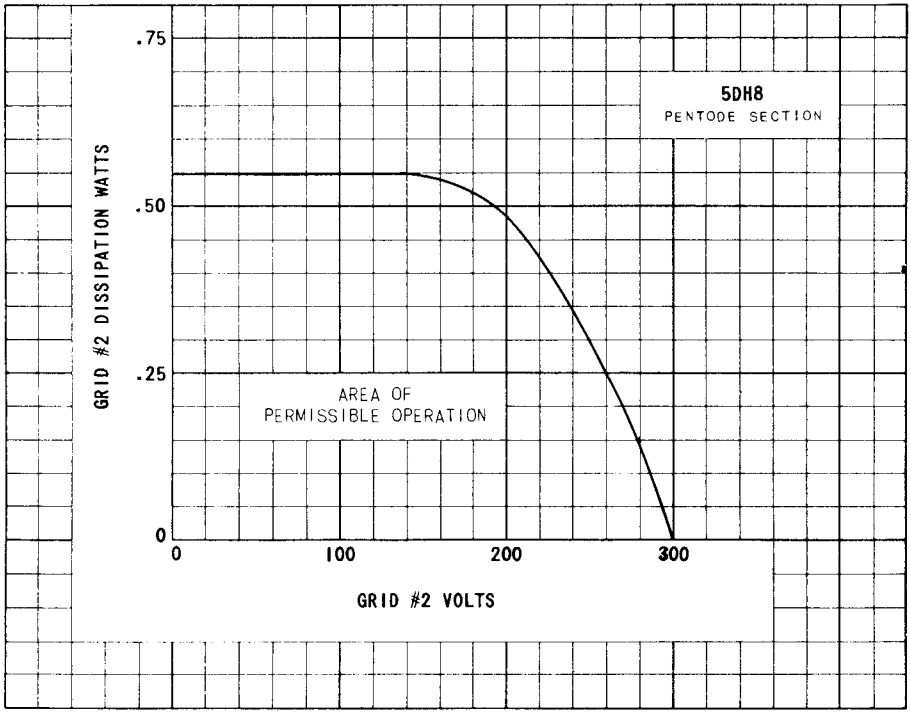
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

	PENTODE SECTION	TRIODE SECTION	
PLATE RESISTANCE (APPROX.)	150 000	12 000	VOLTS
TRANSCONDUCTANCE	8 600	4 400	μMHOS
PLATE CURRENT	13.5	7.3	MA.
SCREEN CURRENT	3.8	---	MA.
GRID #1 VOLTAGE (APPROX.)			
Ib = 10 μAMPS	---	-10	VOLTS
Ib = 20 μAMPS	-6	---	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

AFOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.



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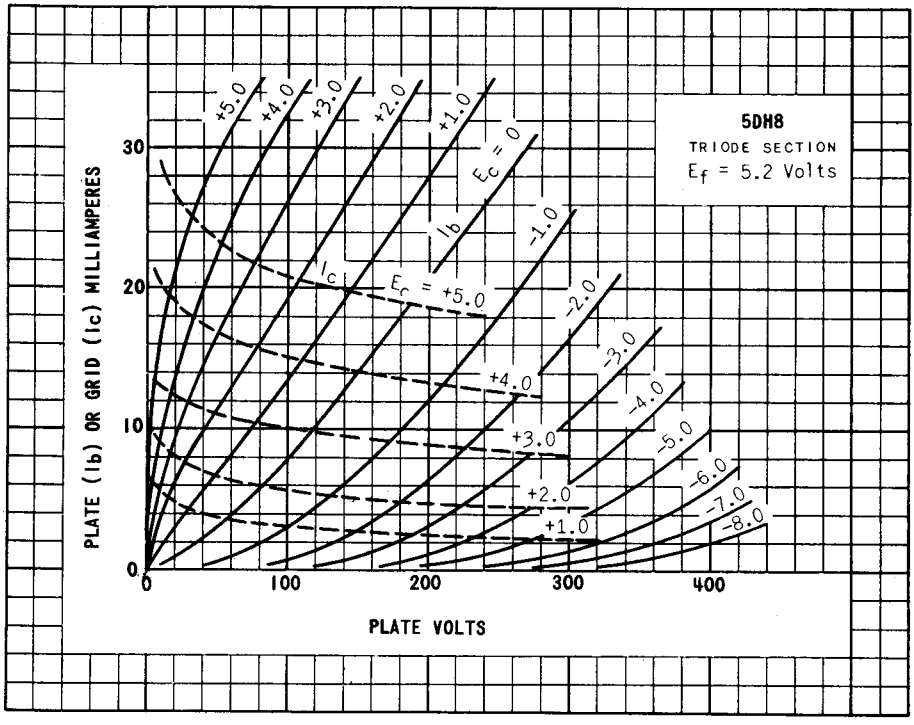
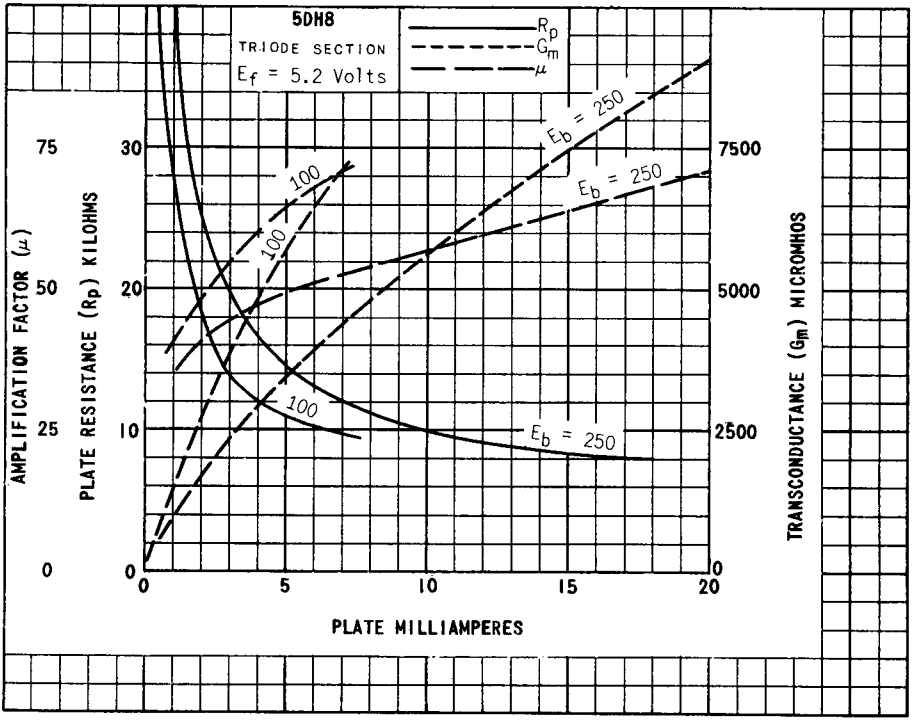
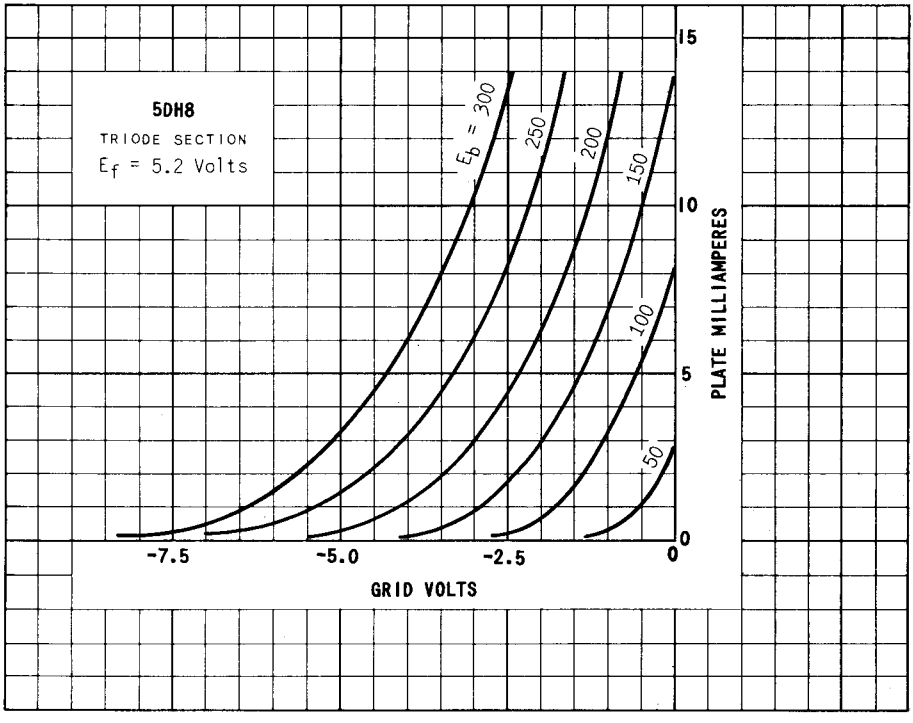
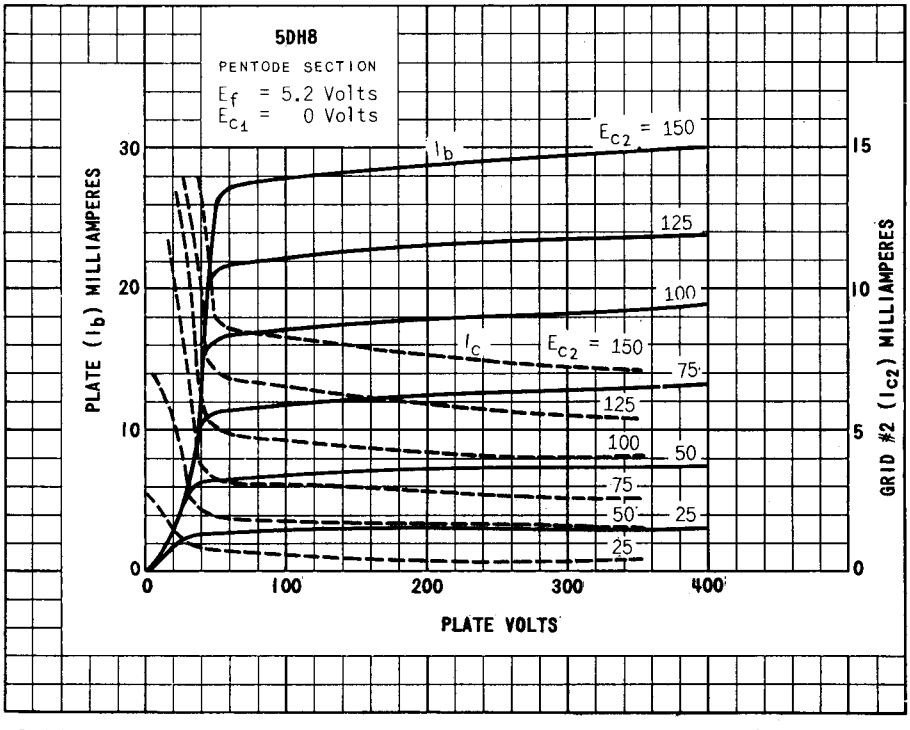
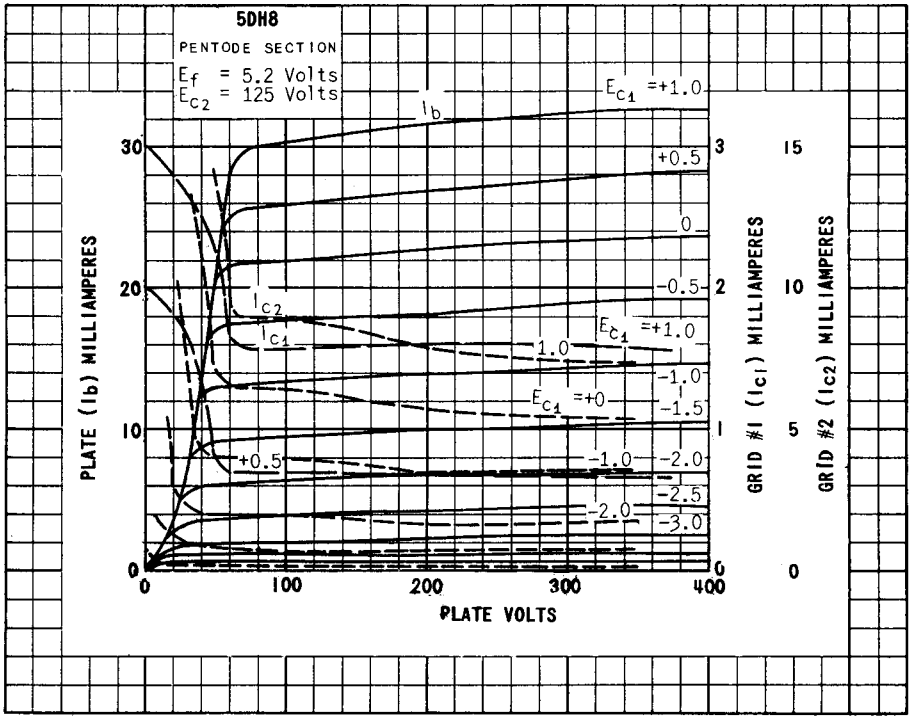
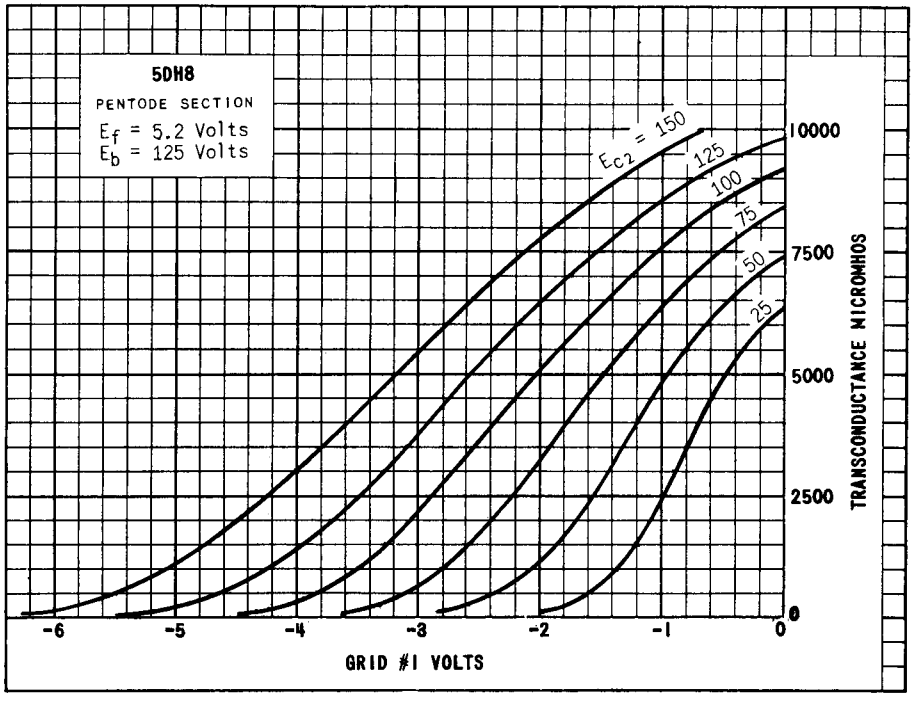

5DH8
TRIODE SECTION
E_f = 5.2 Volts
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ib
Ic
E_c = 0
E_c = +5.0
+5.0
+4.0
+3.0
+2.0
+1.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
0
10
20
30
100
200
300
400

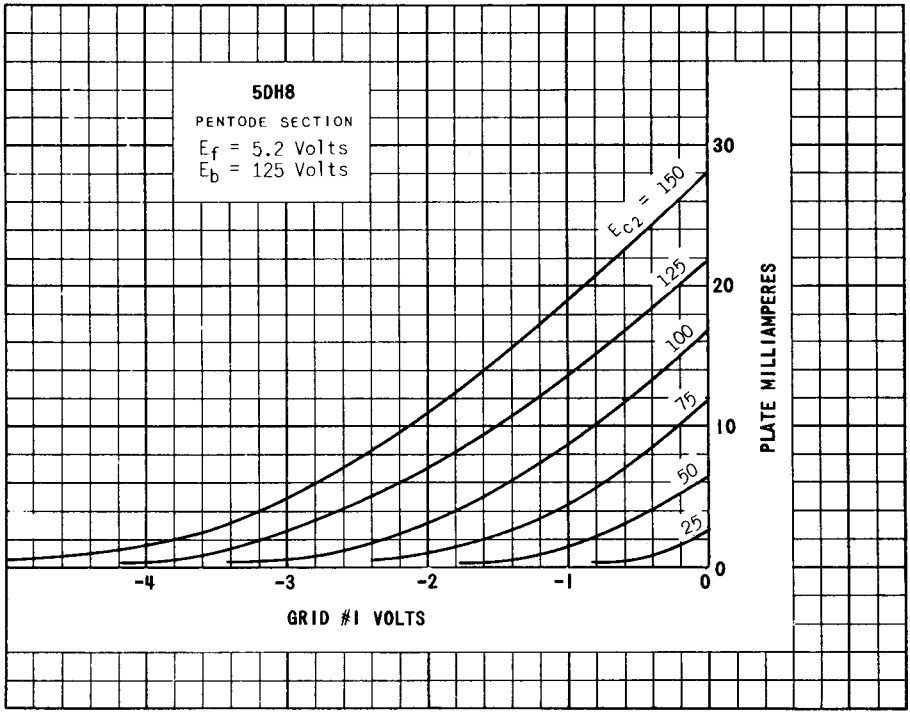

5DH8
TRIODE SECTION
E_f = 5.2 Volts
R_p
G_m
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) KILOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
PLATE MILLIAMPERES
E_b = 250
100
0
5
10
15
20
25
30
50
75
2500
5000
7500

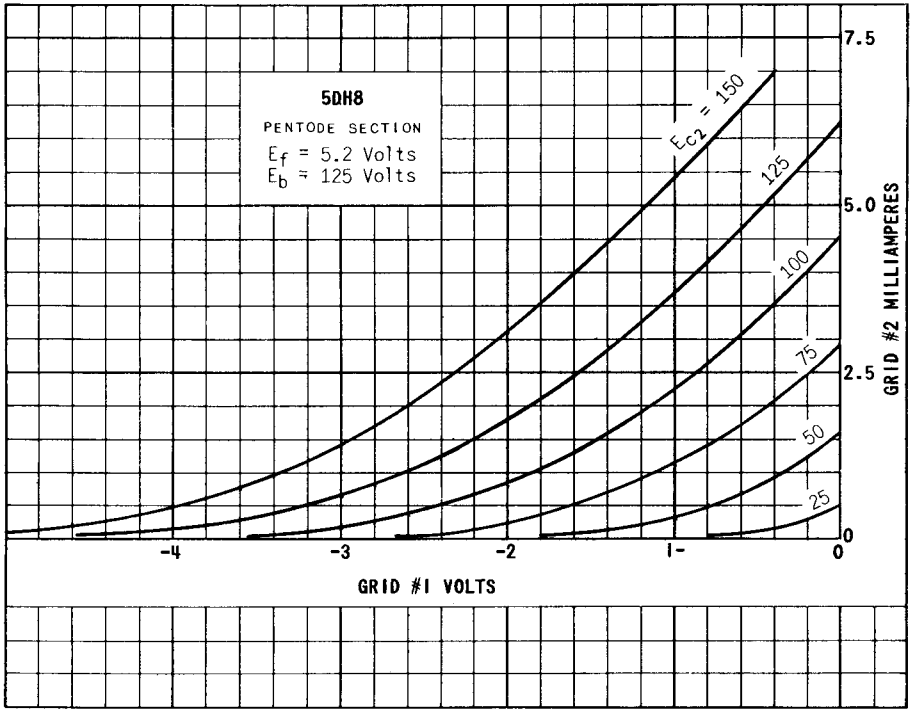

5DH8
TRIODE SECTION
E_f = 5.2 Volts
E_b = 300
250
200
150
100
50
15
10
5
0
PLATE MILLIAMPERES
-7.5
-5.0
-2.5
0
GRID VOLTS


5DH8
PENTODE SECTION
E_f = 5.2 Volts
E_{c_1} = 0 Volts
I_b
E_{c_2} = 150
125
100
75
50
25
I_c
E_{c_2} = 150
125
100
75
50
25
30
20
10
0
PLATE (I_b) MILLIAMPERES
15
10
5
0
GRID #2 (I_{c_2}) MILLIAMPERES
0
100
200
300
400
PLATE VOLTS


5DH8
PENTODE SECTION
E_f = 5.2 Volts
E_{c2} = 125 Volts
I_b
I_{c2}
I_{c1}
E_{c1} =+1.0
+0.5
0
-0.5
1.0
-1.0
E_{c1} =+0
-1.5
+0.5
-1.0
-2.0
-2.5
-2.0
-3.0
PLATE (Ib) MILLIAMPERES
GRID #1 (I_{c1}) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
10
20
30
1
2
3
5
10
15


5DH8
PENTODE SECTION
E_f = 5.2 Volts
E_b = 125 Volts
E_{c2} = 150
125
100
75
50
25
TRANSCONDUCTANCE MICROMHOS
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2500
5000
7500
10000





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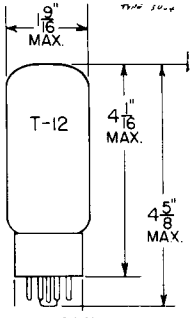
POWER RECTIFIER



GLASS BULB
12-16

COATED FILAMENT CATHODE

FILAMENT

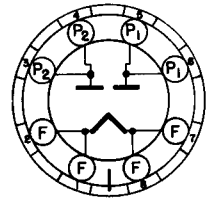
5.0 VOLTS 3.0 AMP.[A]

AC OR DC

[A] 1.5 AMP PER BASE LEAD

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PIN 2 & 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM SHELL
8 PIN OCTAL
8KS

THE 5DJ4 IS A HIGH-VACUUM POWER RECTIFIER WITH DOUBLE FILAMENT LEADS AND DOUBLE PLATE LEADS WHICH REDUCE THE CURRENT THROUGH EACH LEAD TO ONE-HALF THE CURRENT OF SINGLE LEAD TUBES.

ELECTRICALLY, THE 5DJ4 IS IDENTICAL TO THE 5U4GB AND MAY BE USED FOR THE SAME APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RECTIFIER SERVICE[B]

MAXIMUM VOLTAGE, PEAK INVERSE	1700	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE, RMS (RATING CHART 1)	600	VOLTS
MAXIMUM DC OUTPUT CURRENT (RATING CHART 1)		
MAXIMUM STEADY-STATE PEAK PLATE CURRENT, EACH PLATE (RATING CHART 2)	1.0	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT, EACH PLATE (RATING CHART 3)	5.0	AMP.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TUBE CONDUCTING:		
225 MA (EACH PLATE)	44	VOLTS
275 MA (EACH PLATE)	50	VOLTS
300 MA (EACH PLATE)	54	VOLTS

FULL-WAVE RECTIFIER - CAPACITOR INPUT FILTER

PLATE SUPPLY VOLTAGE, RMS (EACH PLATE)[C]	300	450	VOLTS
PLATE SUPPLY RESISTANCE (EACH PLATE)	21	67	OHMS
FILTER INPUT CAPACITOR	40	40	μf
OUTPUT CURRENT, DC	300	275	MA
OUTPUT VOLTAGE AT FILTER INPUT, DC	290	460	VOLTS

[B] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 C.P.S.

[C] THE INDICATED AC SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

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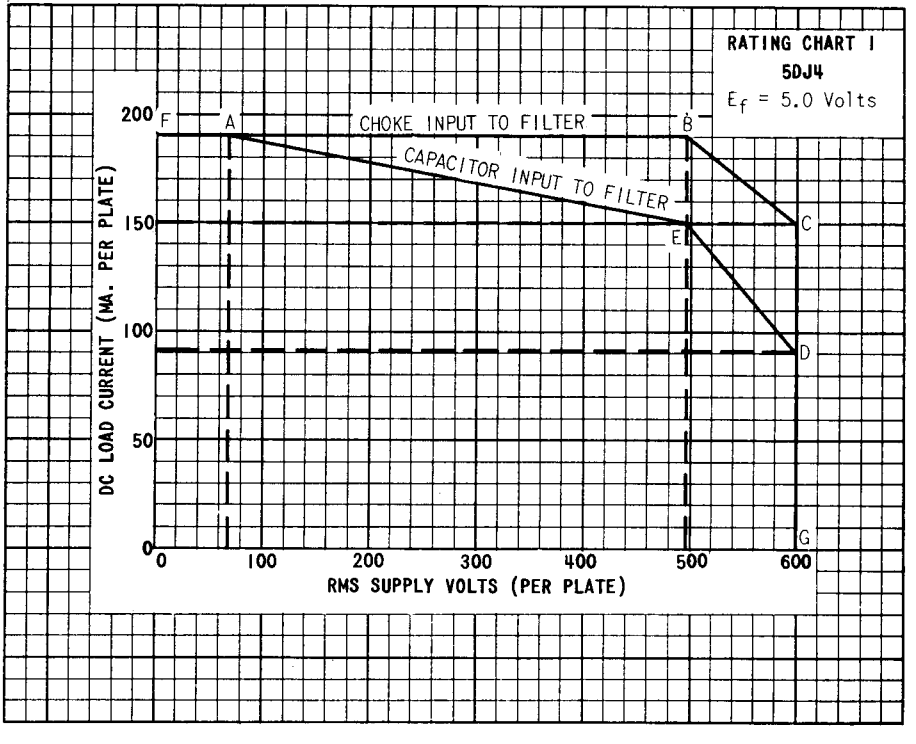
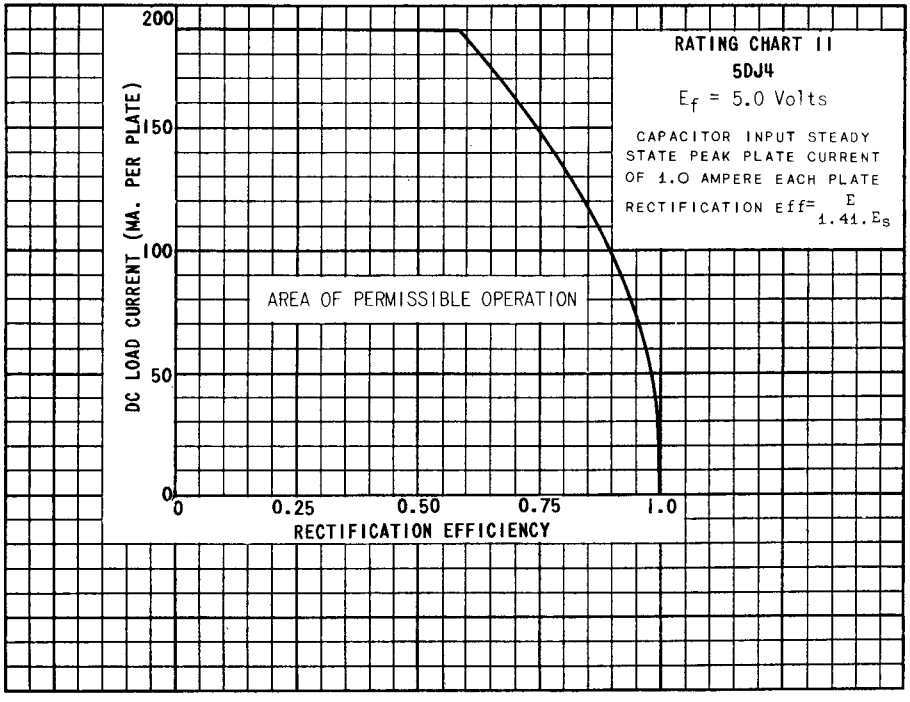
TYPICAL OPERATING CONDITIONS AND CHARAGTERISTICS - cont'd.

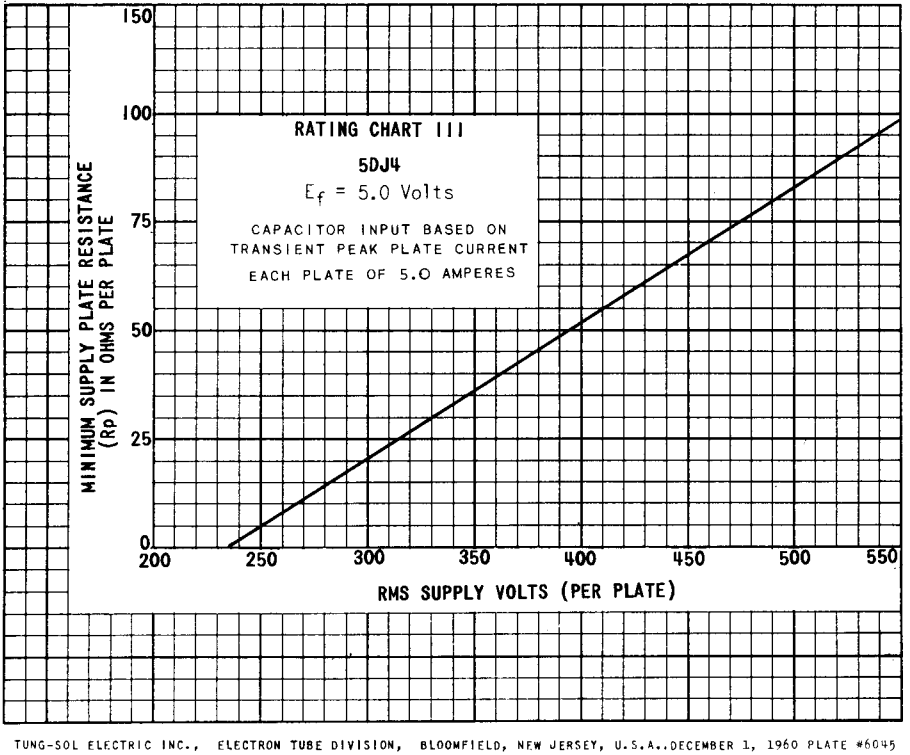
FULL-WAVE RECTIFIER – CHOKE INPUT FILTER

PLATE SUPPLY VOLTAGE, RMS (EACH PLATE)[C]	550	VOLTS
FILTER INPUT CHOKE	10	HENRYS
OUTPUT CURRENT, DC	275	MA
OUTPUT VOLTAGE AT FILTER INPUT, DC	420	VOLTS

[C] THE INDICATED AC SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.




RATING CHART II
5DJ4
E_f = 5.0 Volts
CAPACITOR INPUT STEADY STATE PEAK PLATE CURRENT OF 1.0 AMPERE EACH PLATE
RECTIFICATION eff= E / 1.41.Es
AREA OF PERMISSIBLE OPERATION
DC LOAD CURRENT (MA. PER PLATE)
200
150
100
50
0
0
0.25
0.50
0.75
1.0
RECTIFICATION EFFICIENCY


RATING CHART III
5DJ4
E_f = 5.0 Volts
CAPACITOR INPUT BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 5.0 AMPERES
MINIMUM SUPPLY PLATE RESISTANCE (Rp) IN OHMS PER PLATE
150
100
75
50
25
0
200
250
300
350
400
450
500
550
RMS SUPPLY VOLTS (PER PLATE)

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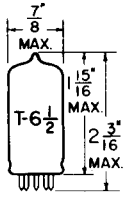
TRIODE PENTODE

MINIATURE TYPE

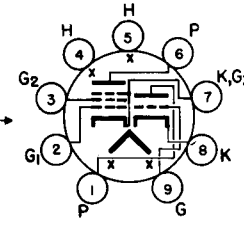


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AE

THE 5EA8 IS A SHARP CUTOFF PENTODE AND A TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE IS INTENDED PRIMARILY FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 5EA8 IS IDENTICAL TO THE 6EA8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.01	0.02	pf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.0	5.0	pf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	pf
HEATER TO CATHODE: (Pk TO h)	3.0[B]	3.0	pf
TRIODE SECTION:			
GRID TO PLATE: (Tg TO Tp)	1.7	1.7	pf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.2	3.0	pf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	1.1	0.3	pf
HEATER TO CATHODE: (Tk TO H)	3.0	3.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE			
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS

→ INDICATES A CHANGE.

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM-UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

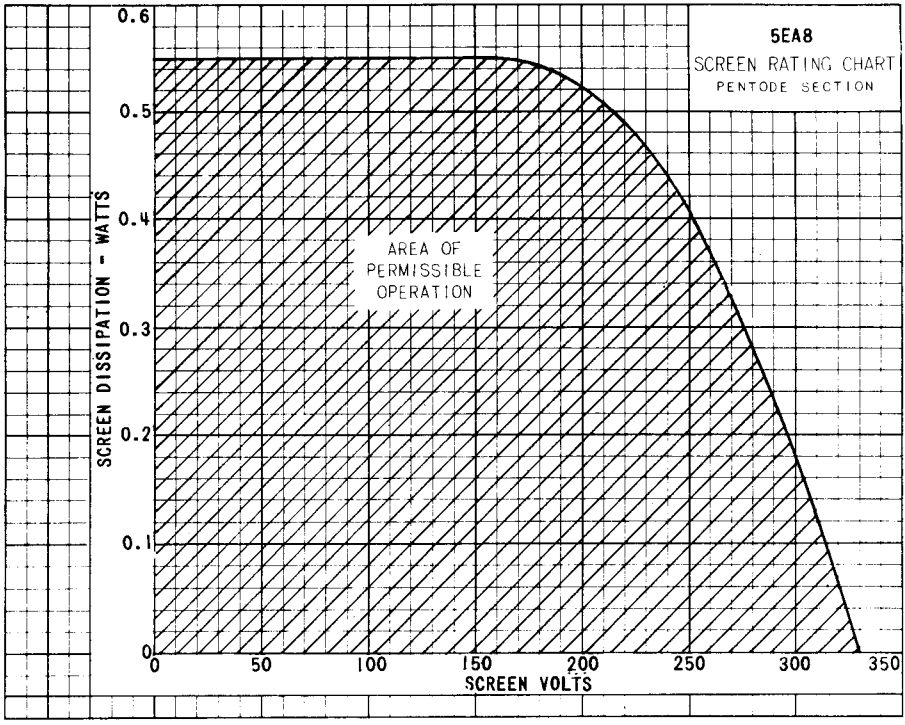
	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	125	150	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	---	
CATHODE–BIAS RESISTOR	---	56	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	200 000	5 000	OHMS
TRANSCONDUCTANCE	6 400	8 500	μAMPS
PLATE CURRENT	12	18	MA.
SCREEN CURRENT	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-9	-12	VOLTS

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.



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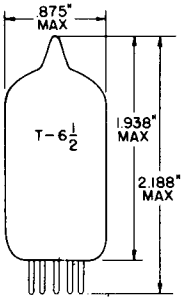


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TRIODE PENTODE

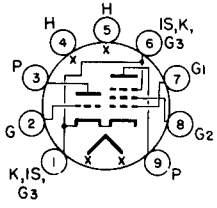
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9JG

THE 5EH8 IS A MEDIUM MU-TRIODE AND A SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT THE HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH CTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
TRIODE:*			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H+K+P_K+P_{G3}+I.S.)	2.8	2.8	pf
OUTPUT: P TO (H+K+P_K+P_{G3}+I.S.)	2.2	1.7	pf
PENTODE:*			
GRID #1 TO PLATE (MAX.)	.012	.020	pf
INPUT: G_1 TO (H+K+G_2+G_3+TK+I.S.)	4.8	4.8	pf
OUTPUT: P TO (H+K+G_2+G_3+TK+I.S.)	3.2	2.4	pf
CATHODE TO HEATER: H TO (TK+P_K+P_{G3}+I.S.)	7.5	7.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE			
MAXIMUM PLATE DISSIPATION	2.5	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATT

*INDICATES AN ADDITION.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [A]

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.5	0.25	MEGOHM
WITH SELF BIAS	1.0	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM-UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE SECTION	PENTODE SECTION		
PLATE VOLTAGE	125	100	125	VOLTS
GRID #2 VOLTAGE		70	125	VOLTS
GRID #1 VOLTAGE	-1.0	0	-1.0	VOLTS
PLATE CURRENT	13.5		12	MA.
GRID #2 CURRENT			4.0	MA.
TRANSCONDUCTANCE	7500	6500	6000	μMHOS
AMPLIFICATION FACTOR	40			
PLATE RESISTANCE (APPROX.)			0.17	MEGOHM
GRID #1 VOLTAGE FOR I_b=20 μA (APPROX.)	-9		-10	VOLTS

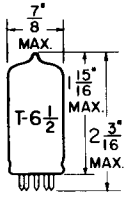
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



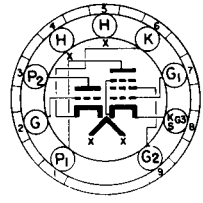
GLASS BULB

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON

9 PIN BASE

9JF

THE 5EU8 IS A HEATER-CATHODE TYPE TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR THE USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THE TRIODE HAS A CONTROLLED CATHODE WARM-UP CHARACTERISTIC. EXCEPT FOR HEATER CHARACTERISTICS, THE 5EU8 IS IDENTICAL TO THE 6EU8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (G1 TO P) (MAX.)	0.10	0.02	μμf
INPUT: G1 TO (H+K)	5.0	5.0	μμf
OUTPUT: P TO (H+K)	3.4	2.6	μμf
TRIODE SECTION:			
GRID TO PLATE: (G TO P)	1.7	1.7	μμf
INPUT: G TO (H+K)	3.2	3.0	μμf
OUTPUT: P TO (H+K+S)	1.1	1.6	μμf
CATHODE TO HEATER (EACH SECTION): (K TO H)	3.60	3.60	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	3.1	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.55	WATTS
MAXIMUM GRID #1 RESISTANCE	100	100	KILOHMS

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TUNG-SOL

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

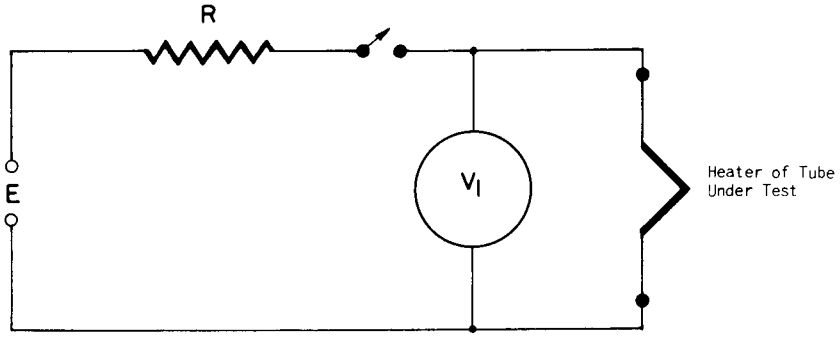
	TRIODE	PENTODE	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	150	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
CATHODE RESISTOR	56	---	OHMS
GRID #1 VOLTAGE	---	-1.0	VOLT
AMPLIFICATION FACTOR	40.0	---	
TRANSCONDUCTANCE	8500	6400	μMHOS
PLATE RESISTANCE (APPROX.)	5000	80000	OHMS
PLATE CURRENT	18.0	12.0	MA.
GRID #2 CURRENT	---	4.0	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10μA	-12.0	-9.0	VOLTS
CATHODE WARM-UP TIME[A]	35	---	SECONDS

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE FROM ZERO TO THE HEATER TEST VOLTAGE (V_1).

FOR TYPE	5EU8
E=	18.8
V_1=	3.76
R=	23.5

A. CATHODE WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR TRANSCONDUCTANCE TO REACH 6500 μMHOS WHEN A TUBE IS OPERATED FROM A COLD START AT A PLATE POTENTIAL OF 100 VOLTS DC, ZERO GRID BIAS, AND AT A CONSTANT HEATER CURRENT OF 560 MILLIAMPERES FOR 5EU8 OR A HEATER POTENTIAL OF 5.5 VOLTS FOR THE 6EU8.

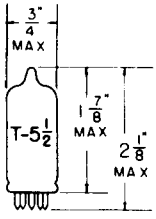
TUNG-SOL



TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

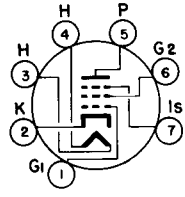
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

5.6 VOLTS 0.45±.03 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CM

THE 5EW6 IS A SHARP CUTOFF PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR INTERMEDIATE AMPLIFIER SERVICE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 5EW6 IS IDENTICAL TO THE 6EW6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.03	0.04	μμf
INPUT	10.0	10.0	μμf
OUTPUT	3.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES

HEATER VOLTAGE	5.6	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (AVG.) *	11	SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH EXTERNAL SHIELD (EIA 316) CONNECTED TO CATHODE.

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TUNG-SOL

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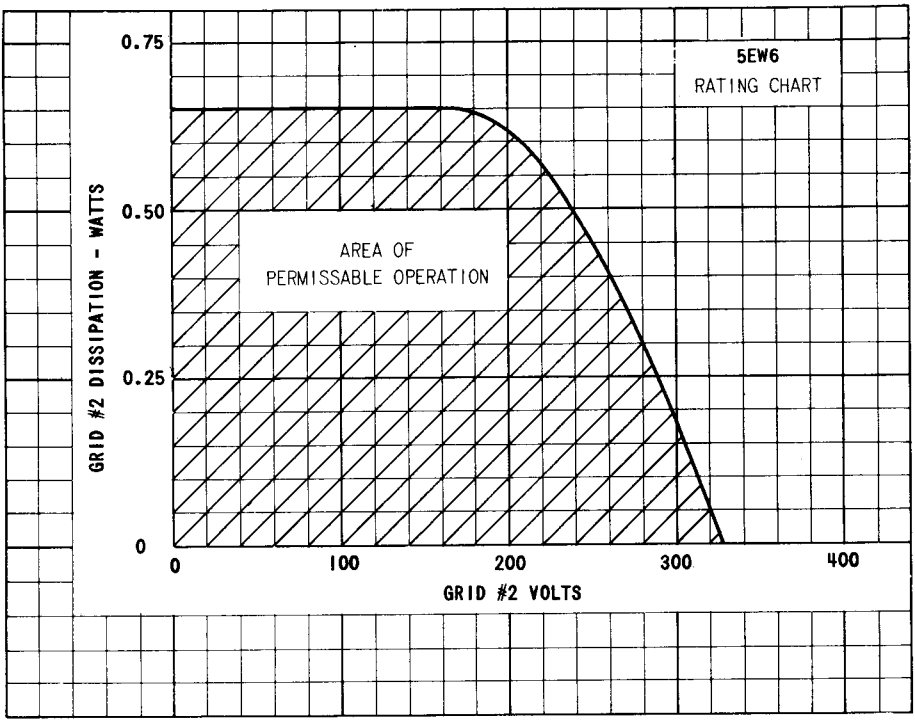
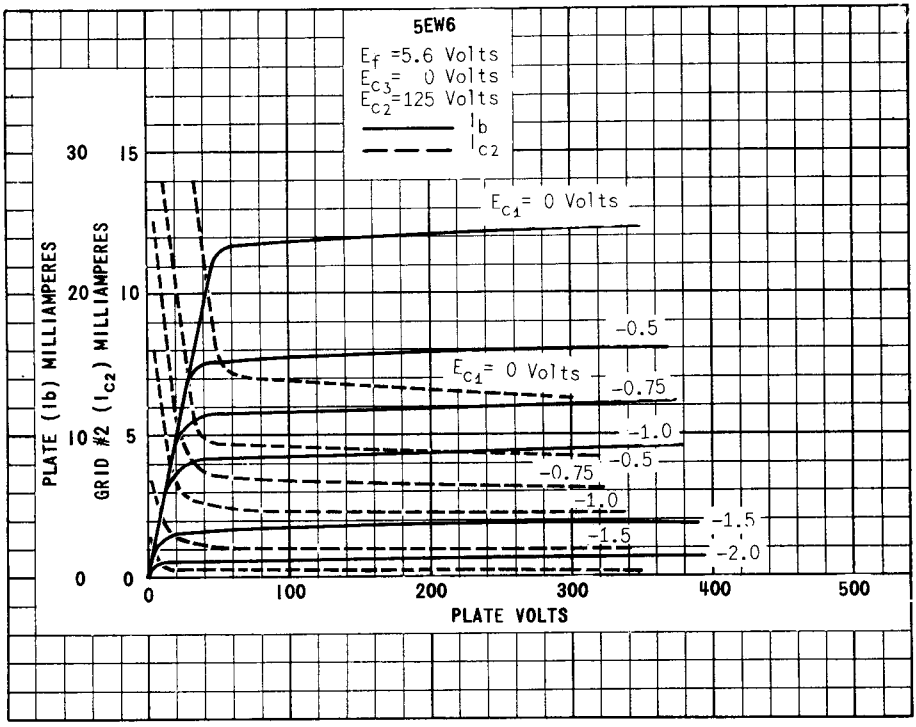
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

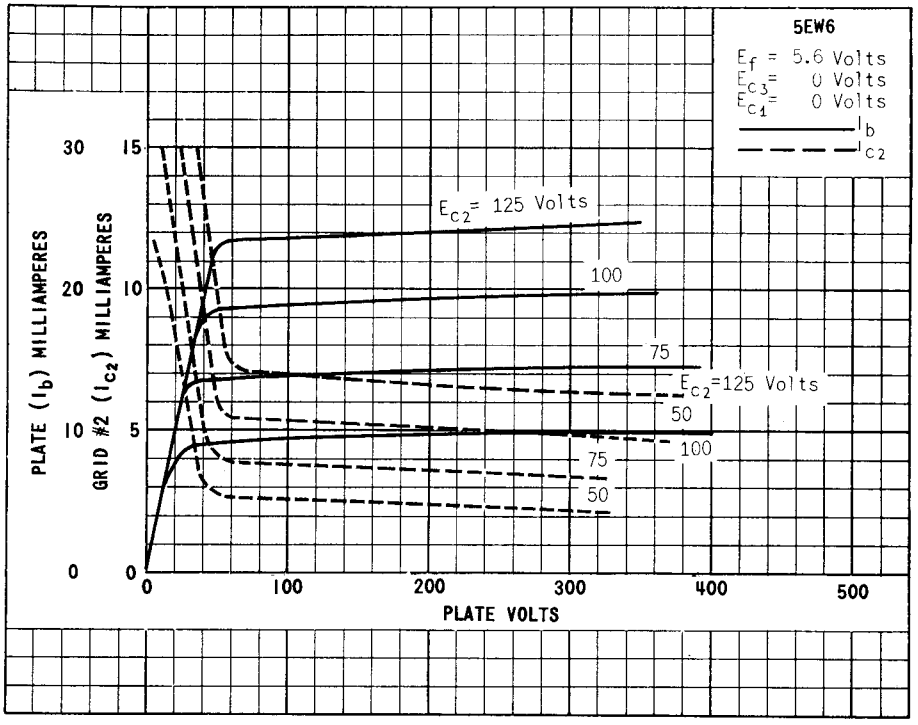
PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	−3.5	VOLTS

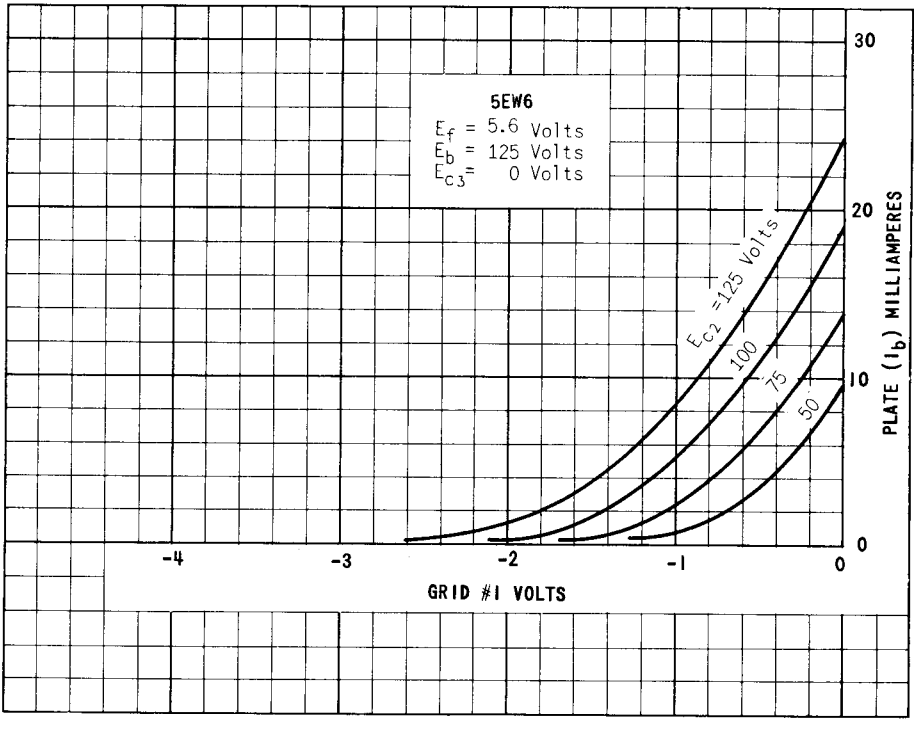
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

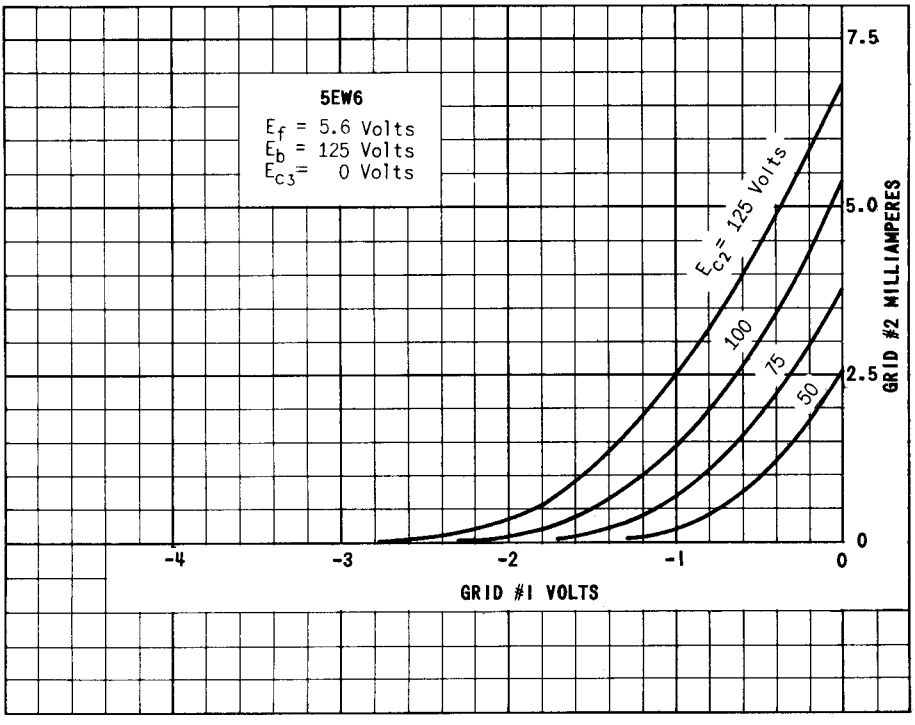

5EW6
RATING CHART
AREA OF
PERMISSABLE OPERATION
GRID #2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
GRID #2 VOLTS

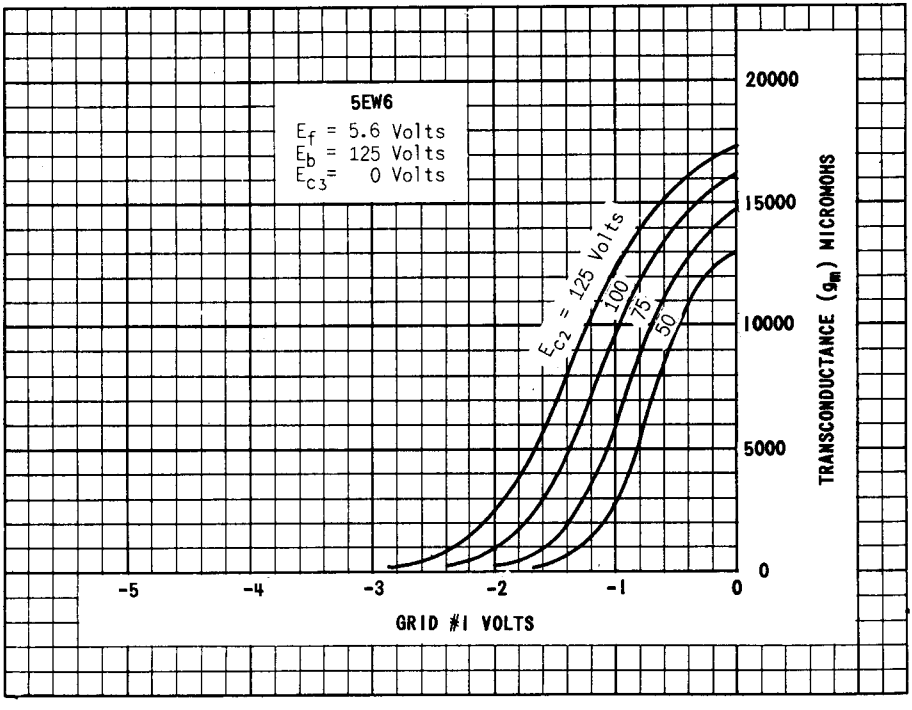

5EW6
Ef =5.6 Volts
Ec3= 0 Volts
Ec2=125 Volts
Ib
Ic2
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
30
20
10
0
15
10
5
0
Ec1= 0 Volts
-0.5
-0.75
-1.0
-1.5
-2.0
0
100
200
300
400
500
PLATE VOLTS

5EW6


5EW6
E_f = 5.6 Volts
E_{c3} = 0 Volts
E_{c1} = 0 Volts
I_b
I_{c2}
E_{c2}= 125 Volts
100
75
50
E_{c2}=125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
5
10
15
20
30


5EW6
E_f = 5.6 Volts
E_b = 125 Volts
E_{c3} = 0 Volts
E_{c2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
10
20
30





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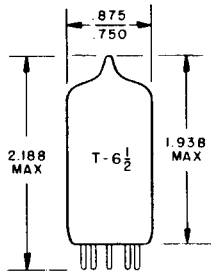
TRIODE - PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



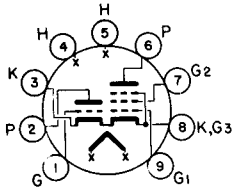
BASE 9 PIN BUTTON
JEDEC E9-1

FOR
USE IN VHF
TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9GF



BOTTOM VIEW

THE 5FG7 IS A VENTRIODE-TRIODE AND SHARP-CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN VHF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 5FG7 IS IDENTICAL TO THE 6FG7.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	SHIELD #315 CONNECTED TO CATHODE	
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	pf
GRID TO CATHODE AND PENTODE GRID 3 & HEATER 3	3	3	pf
PLATE TO CATHODE & PENTODE GRID 3 & HEATER	1.3	1.9	pf
PENTODE UNIT:			
GRID 1 TO PLATE - MAX.	0.02	0.01	pf
GRID 1 TO CATHODE & GRID 3, GRID 2, AND HEATER	5	5	pf
PLATE TO CATHODE & GRID, GRID 2, AND HEATER	2.4	3.4	pf
HEATER TO CATHODE & PENTODE GRID 3	6	6 [A]	pf

A - SHIELD #315 CONNECTED TO GROUND

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA
PEAK HEATER - CATHODE VOLTAGE - EACH UNIT:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

MAXIMUM RATINGS

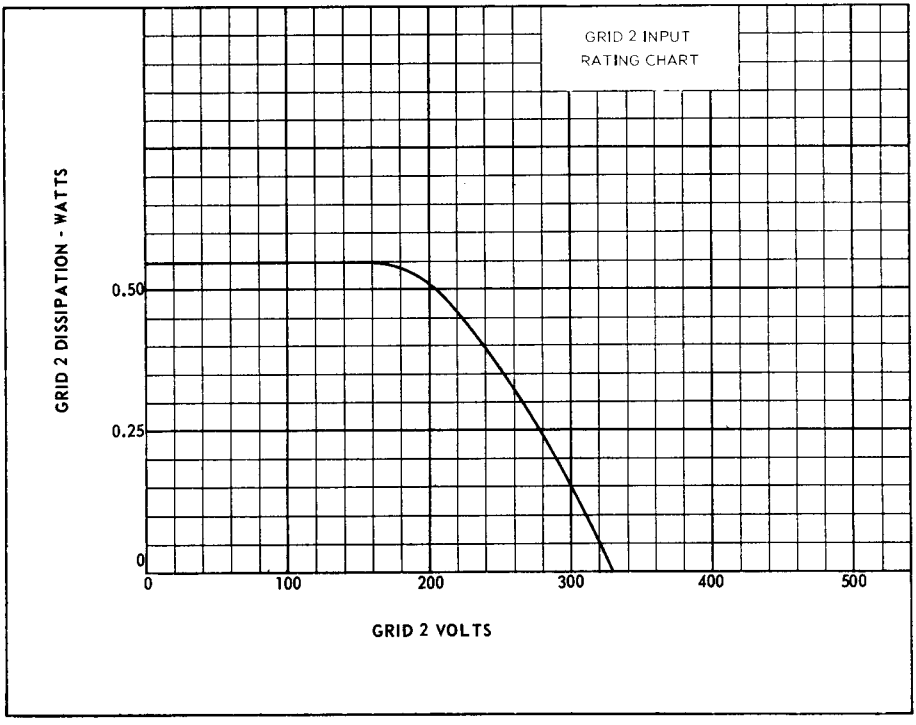
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART		
GRID 1 VOLTAGE:			
POSITIVE - BIAS VALUE	0	0	VOLTS
GRID 2 INPUT:			
FOR GRID 2 VOLTAGES UP TO 165 VOLTS		0.55	WATT
FOR GRID 2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART		
PLATE DISSIPATION	2.5	3	WATTS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT		
PLATE VOLTAGE	125	100	125	VOLTS
GRID 2 VOLTAGE	–	100	125	VOLTS
GRID 1 VOLTAGE	–1	0	–1	VOLTS
PLATE CURRENT	13		11	mA
GRID 2 CURRENT	–	–	4	mA
TRANSCONDUCTANCE	7,500	7,400	6,000	μMHOS
AMPLIFICATION FACTOR	43			
PLATE RESISTANCE - APPROX.	5.7	–	180	KOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA - APPROX.	–6.5	–	–7.5	VOLTS



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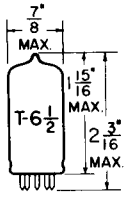
TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

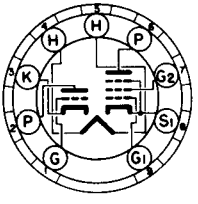
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9FA

THE 5FV8 IS A TRIODE-PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR SERVICE IN TELEVISION RECEIVERS WITH THE TRIODE SERVING AS A VERTICAL DEFLECTION OSCILLATOR, AND THE PENTODE SERVING AS A GENERAL PURPOSE OR *IF* AMPLIFIER. DESIGN OF THE TUBE IS SUCH THAT HIGH VALUES OF INTERELEMENT LEAKAGE RESISTANCE ARE MAINTAINED THROUGHOUT LIFE. EXCEPT FOR HEATER RATINGS, THE 5FV8 IS IDENTICAL TO THE 6FV8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
TRIODE SECTION:			
GRID TO PLATE	1.8	1.8	μμf
INPUT: G TO (H+TK+I.S.)	2.8	2.8	μμf
OUTPUT: P TO (H+TK+I.S.)	2.0	1.5	μμf
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	.010	.020	μμf
INPUT: G1 TO (H+PK+G2+G3+I.S.)	5.0	5.0	μμf
OUTPUT: P TO (H+PK+G2+G3+I.S.)	3.0	2.0	μμf
PENTODE PLATE TO TRIODE PLATE((MAX.)	0.03	0.15	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[B] SECTION VER-DEF OSC.	PENTODE SECTION CLASS A AMPLIFIER	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE		0	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250		VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20		MA.
MAXIMUM PEAK CATHODE CURRENT	70		MA.
MAXIMUM PLATE DISSIPATION	2.0	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS		0.25	MEGOHM
SELF BIAS	3.0[C]	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.60	0.60	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	8 000	6 500	μMHOS
PLATE CURRENT	14.0	12.0	MA.
GRID #2 CURRENT		4.0	MA.
PLATE RESISTANCE (APPROX.)	5 000	200,000	OHMS
AMPLIFICATION FACTOR	40		
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA.	-9	-9	VOLTS

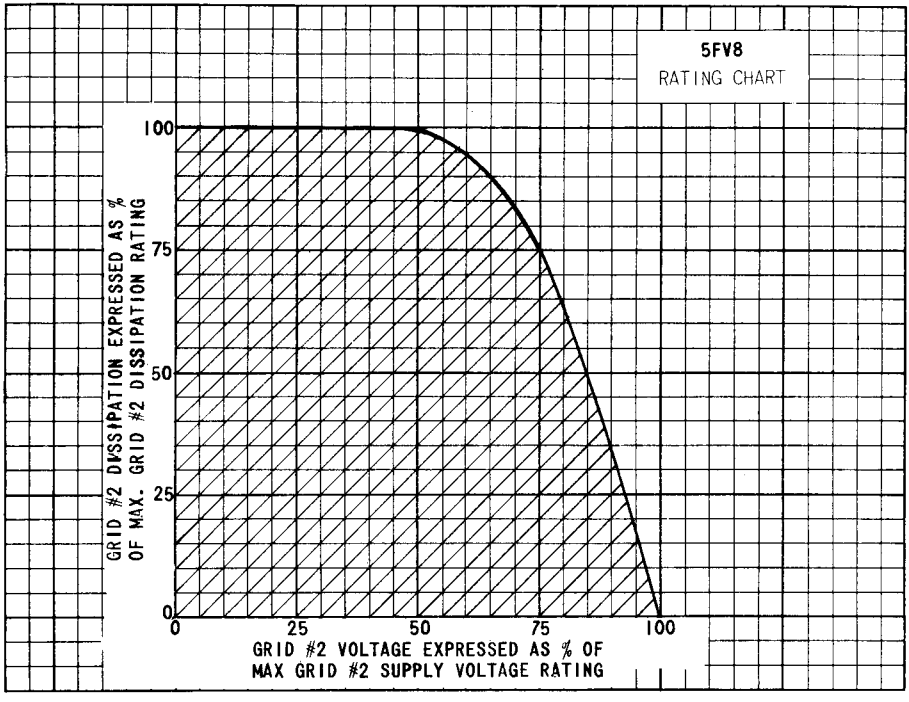
[A] SHIELD #315 TIED TO PIN #4.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[*] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THD DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



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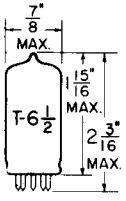
TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

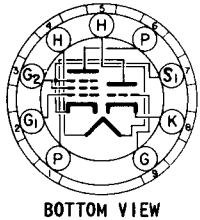
COATED UNIPOTENTIAL CATHODE

HEATER

4.7 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9AE

THE 5GH8 IS A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE CONTAINED IN A 9 PIN MINIATURE ENVELOPE. EACH SECTION HAS A SEPARATE CATHODE AND IS ELECTRICALLY INDEPENDENT. THE PENTODE SECTION IS INTENDED PRIMARILY FOR SERVICE AS AN OSCILLATOR IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS, THE 5GH8 IS IDENTICAL TO THE 6GH8.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.015	0.02	μμf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.5	5.5	μμf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	μμf
HEATER TO CATHODE (Pk TO H)	3.0[B]	3.0	μμf
TRIODE SECTION:			
GRID TO PLATE:(Tg TO Tp)	1.6	1.6	μμf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.6	3.4	μμf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	2.2	1.7	μμf
HEATER TO CATHODE: (Tk TO H)	3.0[B]	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE[C] SECTION (HORIZONTAL OSCILLATOR SERVICE)	TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
MAXIMUM ALLOWABLE HEATER CURRENT	0.56 to 0.64		AMP.
MAXIMUM DC PLATE VOLTAGE	350	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0.	VOLTS
MAXIMUM PEAK NEGATIVE DC GRID #1 VOLTAGE	175	---	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS
MAXIMUM DC CATHODE CURRENT	20	---	MA.
MAXIMUM PEAK CATHODE CURRENT	300	---	MA.

→ INDICATES A CHANGE.

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RATINGS — CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION (HORIZONTAL OSCILLATOR SERVICE)[C]		TRIODE SECTION	
HEATER VOLTAGE	4.7		4.7	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT	100		100	VOLTS
TOTAL DC AND PEAK	200		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200		200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE				
WITH FIXED BIAS	2.2		2.2	MEGOHMS
WITH CATHODE BIAS	2.2		2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*		11.0		SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	125	125	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
AMPLIFICATION FACTOR	---	46	
PLATE RESISTANCE (APPROX.)	200 000	5400	OHMS
TRANSCONDUCTANCE	7500	8500	μMHOS
PLATE CURRENT	12	13.5	MA.
SCREEN CURRENT	4.0	----	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-8	-8	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

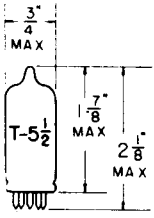
[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB.

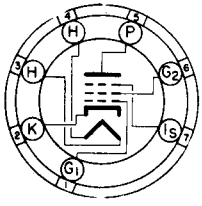
UNIPOTENTIAL CATHODE

HEATER

5.6 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE
7CM

THE 5GM6 IS A SEMIREMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR USE IN GAIN-CONTROLLED PICTURE-IF STAGES OF TELEVISION RECEIVERS OPERATING AT INTERMEDIATE FREQUENCIES OF THE ORDER OF 40 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.036	μμf
GRID #1 TO CATHODE, INTERNAL SHIELD & G3,G2 & H.	10	μμf
PLATE TO CATHODE, INTERNAL SHIELD & G3, G2 & H.	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	5.6	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	0.65	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	5.6	VOLTS
HEATER CURRENT	0.45±6%	AMP.
PLATE SUPPLY VOLTAGE	125	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	125	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	13 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANCONDUCTANCE = 60 μMHOS	-15	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SER ICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WROST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time, the 5GM6 is identical to the 4GM6 and the 6GM6.*

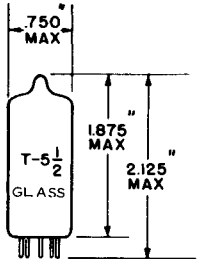
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-2



BASE 7 PIN BUTTON
JEDEC E7-1

FOR

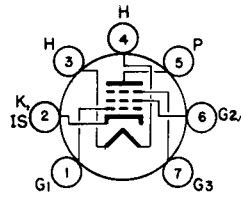
FM SOUND DETECTOR

SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7EN



BOTTOM VIEW

THE 5GX6 IS A SHARP-CUTOFF PENTODE WITH DUAL CONTROL GRIDS IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR FM SOUND DETECTOR - SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 5GX6 IS IDENTICAL TO THE 6GX6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.26	pf
GRID 1 TO (K & I.S., G3, G2, H)	8	pf
GRID 1 TO GRID 3	0.12	pf
GRID 3 TO PLATE	1.6	pf
GRID 3 TO (K & I.S., P, G2 G1, H)	6.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	mA
HEATER WARM UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ±40	mA
PEAK HEATER - CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

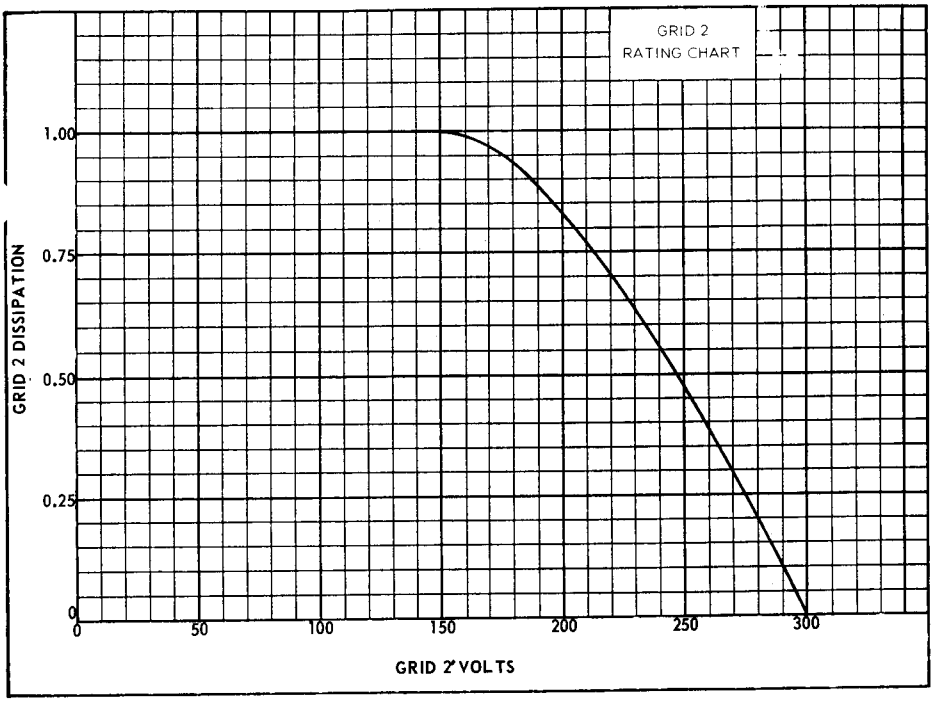
FM SOUND DETECTOR SERVICE

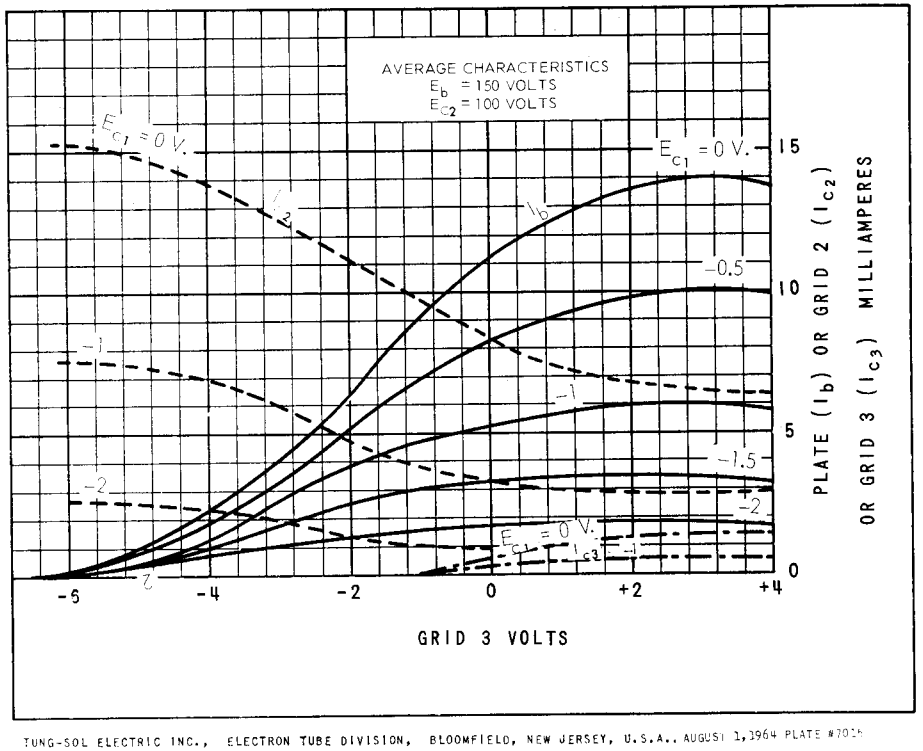
PLATE VOLTAGE		300	VOLTS
GRID 3 VOLTAGE:			
NEGATIVE VALUE - DC AND PEAK		100	VOLTS
POSITIVE VALUE - DC AND PEAK		25	VOLTS
GRID 2 SUPPLY VOLTAGE		300	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
GRID 1 VOLTAGE:			
NEGATIVE - BIAS VALUE		50	VOLTS
POSITIVE - BIAS VALUE		0	VOLTS
GRID 3 INPUT		0.1	WATT
GRID 2 INPUT - UP TO 150 VOLTS		1	WATT
- BETWEEN 150 VOLTS AND 300 VOLTS		SEE RATING CHART	
PLATE DISSIPATION		1.7	WATTS
GRID 3 CIRCUIT RESISTANCE		0.68	MEGOHM
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED - BIAS OPERATION		0.22	MEGOHM
FOR CATHODE - BIAS OPERATION		0.47	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE SUPPLY VOLTAGE		150	VOLTS
GRID 3 SUPPLY VOLTAGE		0	VOLTS
GRID 2 SUPPLY VOLTAGE		100	VOLTS
GRID 1 SUPPLY VOLTAGE		0	VOLTS
CATHODE RESISTOR		180	OHMS
PLATE CURRENT		3.7	mA
GRID 2 CURRENT		3.0	mA
TRANSCONDUCTANCE - GRID 1 TO PLATE		3,700	μMHOS
TRANSCONDUCTANCE - GRID 3 TO PLATE		750	μMHOS
PLATE RESISTANCE	APPROX.	0.14	MEGOHM
GRID 1 VOLTAGE FOR I_b = 20 μA	APPROX.	−4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 20 μA	APPROX.	−7	VOLTS





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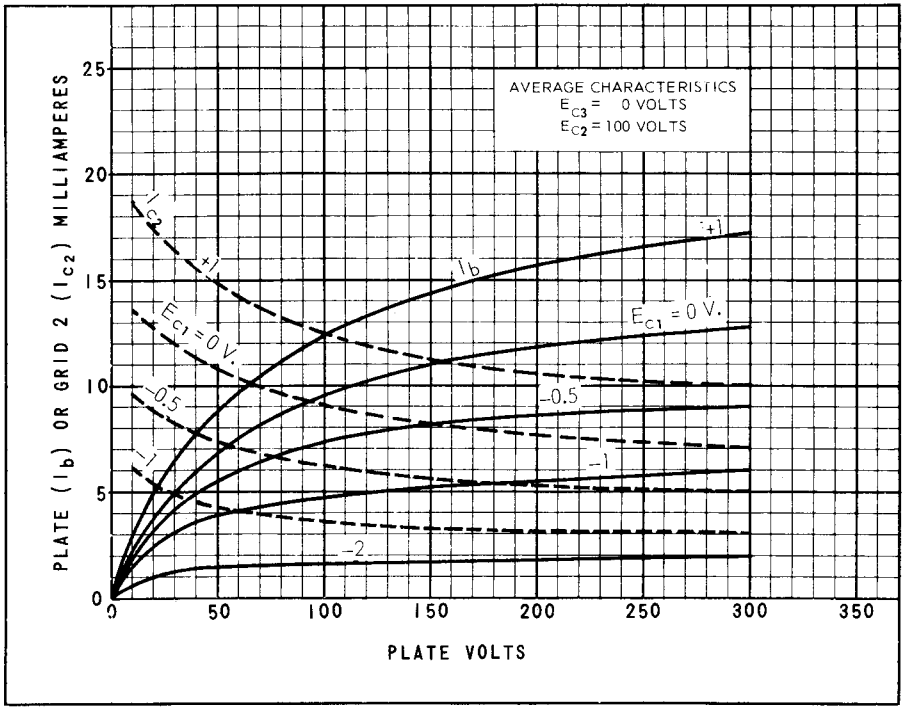
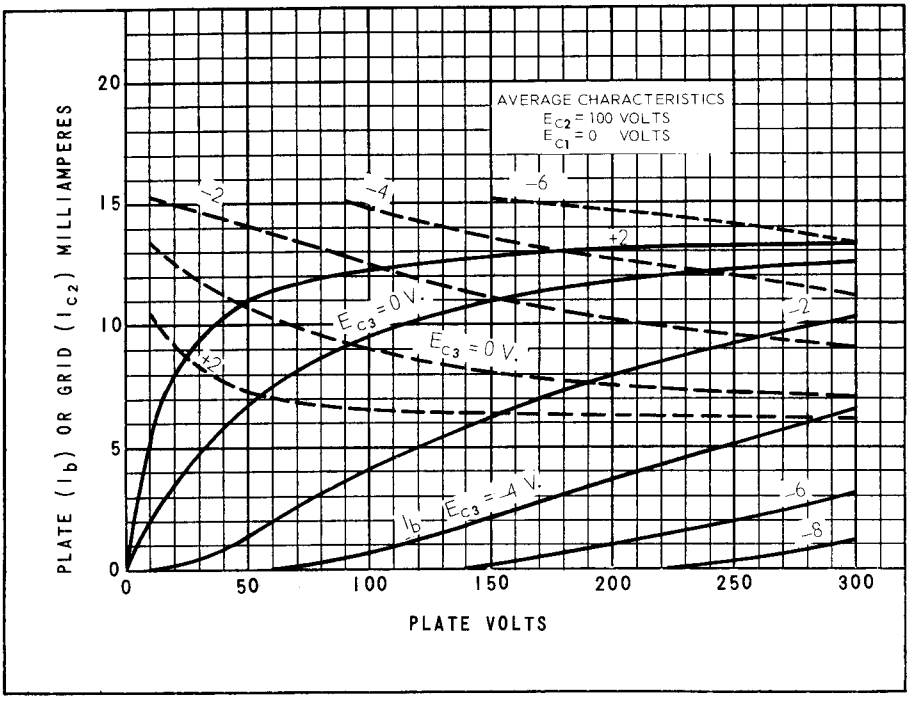
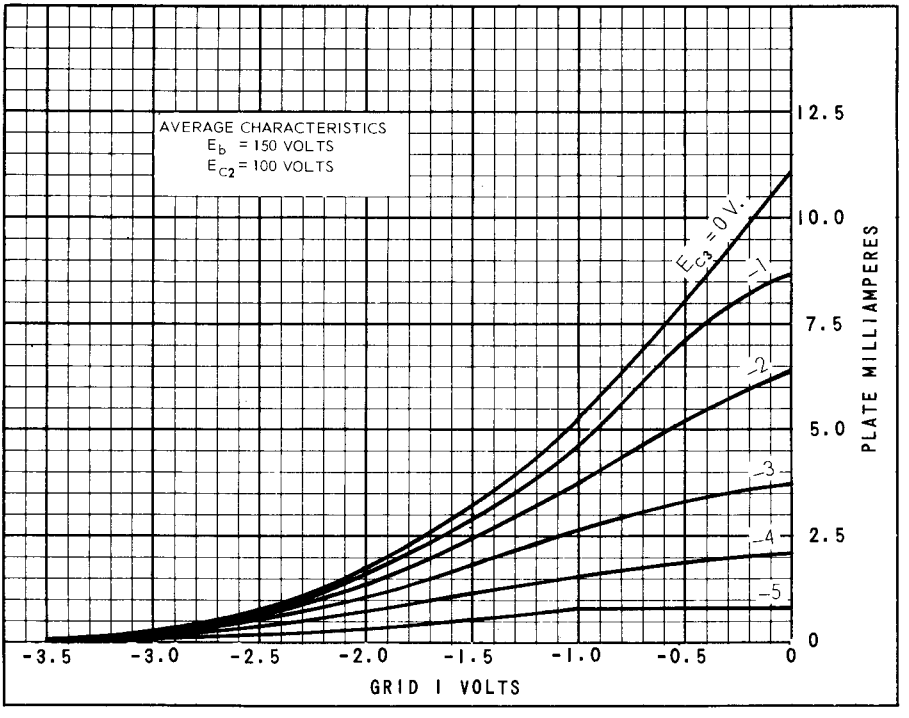
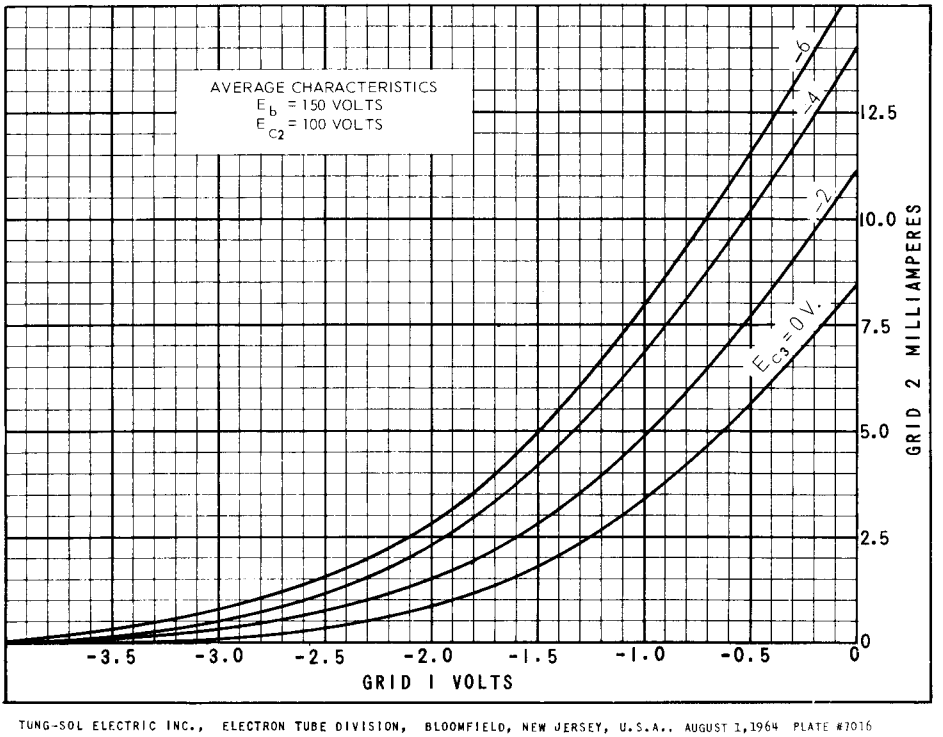
5GX6


AVERAGE CHARACTERISTICS
E_{C3} = 0 VOLTS
E_{C2} = 100 VOLTS
PLATE (I_b) OR GRID 2 (I_{C2}) MILLIAMPERES
PLATE VOLTS
I_{C2}
I_b
E_{C1} = 0 V.
+1
-0.5
-1
-2
0
5
10
15
20
25
50
100
150
200
250
300
350


AVERAGE CHARACTERISTICS
E_{C2} = 100 VOLTS
E_{C1} = 0 VOLTS
PLATE (I_b) OR GRID (I_{C2}) MILLIAMPERES
PLATE VOLTS
E_{C3} = 0 V.
E_{C3} = -4 V.
I_b
-2
-4
-6
+2
-8
0
5
10
15
20
50
100
150
200
250
300





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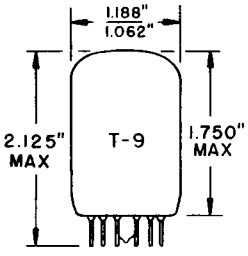
TUNG-SOL

DUAL TRIODE

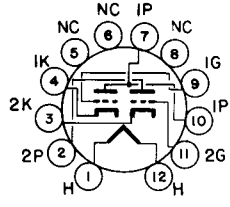
MINIATURE TYPE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING

TWO DISSIMILAR TRIODES
FOR
SYNC CLIPPER AND
AGC AMPLIFIER
SERVICE IN
TV RECEIVERS

COATED UNIPOTENTIAL CATHODES
ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 12 FR

THE 5HC7 CONTAINS TWO DISSIMILAR TRIODES IN A T-9 COMPACTRON CONSTRUCTION. EACH ELEMENT IS BROUGHT OUT TO A SEPARATE BASE PIN. TRIODE #1 HAS A LOW MU AND TRIODE #2 HAS A HIGH MU. THE 5HC7 IS DESIGNED FOR SYNC CLIPPERAND GATED AGC AMPLIFIER SERVICE IN TV RECEIVERS. THE HEATER IS INTENDED TO BE OPERATED IN A SERIES STRING. EXCEPT FOR HEATER RATINGS, THE 5HC7 IS IDENTICAL TO THE 4HC7

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	
GRID TO PLATE (g to p)	1.9	2.2	pf
INPUT: g to (h + k)	2.0	1.9	pf
OUTPUT: p to (h + k)	0.7	0.56	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	5.6 VOLTS	450	MA
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE 1	TRIODE 2	
PLATE VOLTAGE	330	330	VOLTS
NEGATIVE DC GRID VOLTAGE	100	100	VOLTS
POSITIVE DC GRID VOLTAGE	0	0	VOLTS
POSITIVE TRANSIENT GRID VOLTAGE	60	-	VOLTS
PLATE DISSIPATION	3	1.2	WATTS
GRID CIRCUIT RESISTANCE	5.0	5.0	MEGOHMS

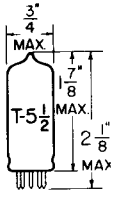
CHARACTERISTICS

PLATE VOLTAGE	150	150	VOLTS
GRID VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	18	1.0	MA
TRANSCONDUCTANCE	4400	1900	μMHOS
AMPLIFICATION FACTOR	23	100	
PLATE RESISTANCE (APPROX.)	5,200	53,000	OHMS
GRID VOLTAGE FOR I_b = 10 μA (APPROX.)	-13	-2.2	VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

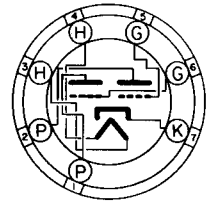


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BF

THE 5J6 IS A TWIN TRIODE HAVING TWO PLATES AND TWO GRIDS WITH A COMMON CATHODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE RF AMPLIFIER, OSCILLATOR AND MIXER STAGES OF 450 MA. SERIES HEATER OPERATED TV RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER HEATER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS ITS CHARACTERISTICS ARE IDENTICAL TO THE 6J6.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE (EACH SECTION)	1.6	1.5	μμf
INPUT (EACH SECTION)	2.2	2.6	μμf
OUTPUT (SECTION 1)	0.4	1.6	μμf
OUTPUT (SECTION 2)	0.4	1.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

	AF AMPLIFIER	RF AMPLIFIER	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE ←	±100	±100	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	---	-40	VOLTS
MAXIMUM PLATE INPUT	---	4.5	WATTS
MAXIMUM PLATE DISSIPATION	1.5	1.5	WATTS
MAXIMUM PLATE CURRENT	---	15	MA.
MAXIMUM GRID CURRENT	---	8	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	0.5	---	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

*HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR (BOTH SECTIONS)[B]	50	OHMS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	7 100	OHMS
TRANSCONDUCTANCE	5 300	μMHOS
PLATE CURRENT	8.5	MA.

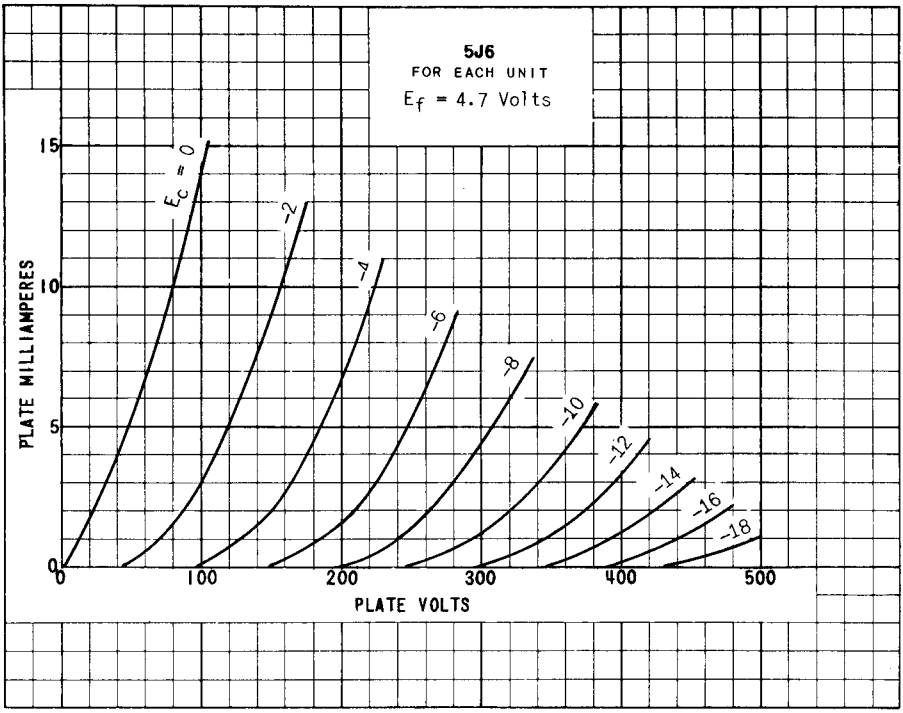
[B] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

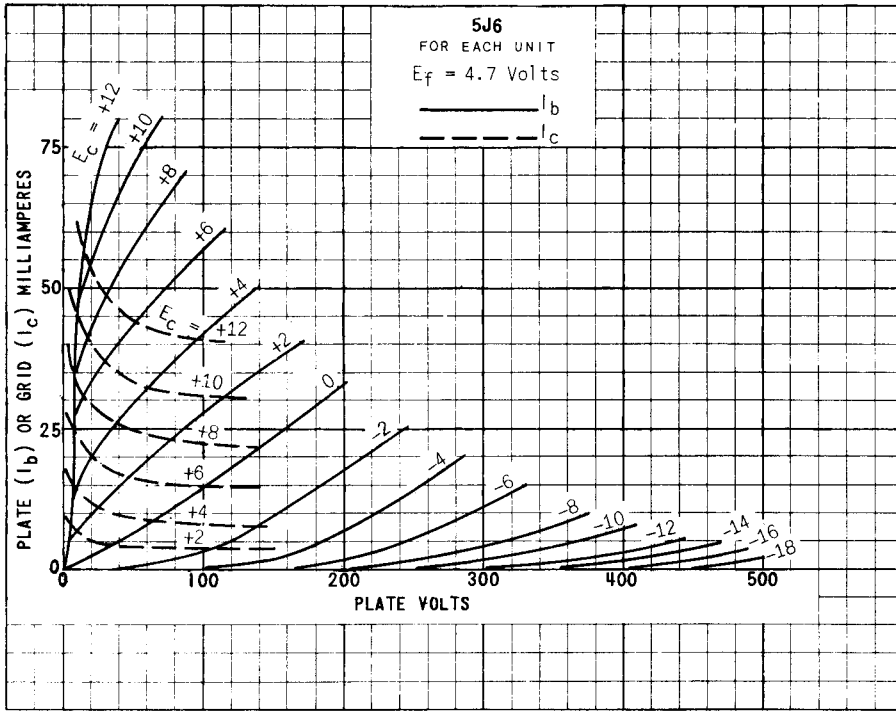
CLASS C TELEGRAPHY – RF POWER AMPLIFIER AND OSCILLATOR

BOTH SECTIONS IN PUSH PULL

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
DC PLATE VOLTAGE	150	VOLTS
DC GRID VOLTAGE[C]	−10	VOLTS
DC PLATE CURRENT	30	MA.
DC GRID CURRENT (APPROX.)	16	MA.
DRIVING POWER (APPROX.)	0.35	WATT
POWER OUTPUT (APPROX.)	3.5	WATTS

[C] OBTAINED BY A 525-OHMS GRID RESISTOR, A 220-OHMS CATHODE RESISTOR, OR A FIXED VOLTAGE SUPPLY.





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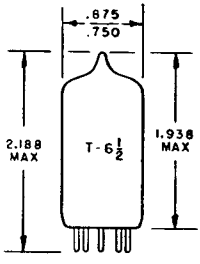
TRIODE-PENTODE

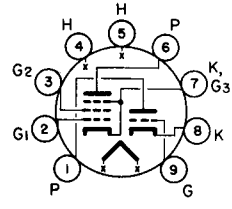
MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR
USE AS A COMBINED
VHF OSCILLATOR AND MIXER

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9 AE

THE 5KD8 IS A MEDIUM MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9 PIN MINATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER IN TELEVISION RECEIVERS.

GRID 1 (CONTROL GRID) TO CATHODE SPACING ON THE 6KD8 IS OF SUCH LOW ORDER OF MAGNITUDE AS TO PRECLUDE THE USE OF VOLTAGE BETWEEN THESE ELEMENTS OF MORE THAN 100 VOLTS DC OR PEAK AC IN COMMERCIAL TUBE CHECKERS AND SHORTS INDICATING DEVICES, PARTICULARY WHERE MECHANICAL EXCITATION OF THE TUBE IS EMPLOYED. THE 5KD8 IS SIMI- TO THE 6KD8.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO PIN 4	UNSHIELDED	
PENTODE SECTION			
GRID 1 TO PLATE	Max. .007	Max. .015	pf
INPUT: G1 TO (H + K + G2 + G3 + I.S.)	5.0	5.0	pf
OUTPUT: P TO (H + K + G2 + G3 + I.S.)	3.5	2.6	pf
CATHODE TO HEATER	3.0 [A]	3.0	pf
TRIODE SECTION			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H + PK + TK + G3 + I.S.)	2.8	2.8	pf
OUTPUT: P TO (H + PK + TK + G3 + I.S.)	2.0	1.5	pf
CATHODE TO HEATER	3.0 [A]	3.0	pf
COUPLING			
PENTODE GRID 1 TO TRIODE PLATE	Max. 0.2	Max. 0.2	pf
PENTODE PLATE TO TRIODE PLATE	Max. .02	Max. 0.1	pf

A- SHIELD 315 CONNECTED TO PIN 6.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	5.6 VOLTS	450	MA.
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER WARM - UP		11	SEC.
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.5	3.0	WATTS
GRID 2 DISSIPATION		0.55	WATTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS		0.5	MEGOHM
SELF BIAS		1.0	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE		110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT		3.5	MA.
TRANSCONDUCTANCE	7,500	5,000	μMHOS
AMPLIFICATION FACTOR	40		
PLATE RESISTANCE		Approx. 0.2	MEGOHM
E_{c1} FOR I_b = 20 μA	Approx. -9	Approx. -8	VOLTS
G_m AT E_{c1} = 0 V., E_b = 100 V., E_{c2} = 70 V.		5,500	μMHOS

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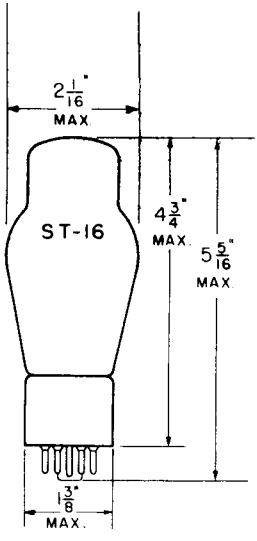
FULL-WAVE HIGH-VACUUM RECTIFIER



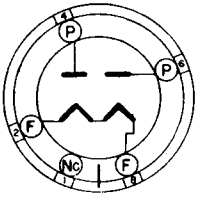
GLASS BULB

COATED FILAMENT

HEATER
5.0 VOLTS 2.0 AMPERES
AC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMISSIBLE IF PINS 1 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

MEDIUM SHELL 5-PIN
OCTAL MICANOL BASE

THE 5R4GY IS DESIGNED FOR RECTIFIER USE IN EQUIPMENT REQUIRING A HIGH PEAK INVERSE VOLTAGE RATING. SATISFACTORY OPERATION OF THIS TUBE TYPE UNDER CONDITIONS FALLING WITHIN AREA 1 ON CURVE NO. 1 MAY BE OBTAINED WITHOUT FILAMENT PREHEATING. FILAMENT PREHEATING FOR 10 SECONDS BEFORE PLATE VOLTAGE IS APPLIED IS RECOMMENDED FOR SATISFACTORY OPERATION UNDER CONDITIONS FALLING WITHIN AREA 2 ON THE SAME CURVE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FULL-WAVE RECTIFIER

FILAMENT VOLTAGE (AC)	5.0	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	2.0	AMPS.
MAX. PEAK INVERSE PLATE VOLTAGE (NO LOAD)	2100	2400	2800	VOLTS
MAX. PEAK PLATE CURRENT PER PLATE	650	650	650	MA.
DC OUTPUT CURRENT:				
WITH CONDENSER INPUT TO FILTER	250	175	150	MA.
WITH CHOKE INPUT TO FILTER	250	250[A]	175[B]	MA.

[A] FOR INPUT CHOKE FILTER=5 HENRIES MINIMUM.
[B] FOR INPUT CHOKE FILTER=10 HENRIES MINIMUM.

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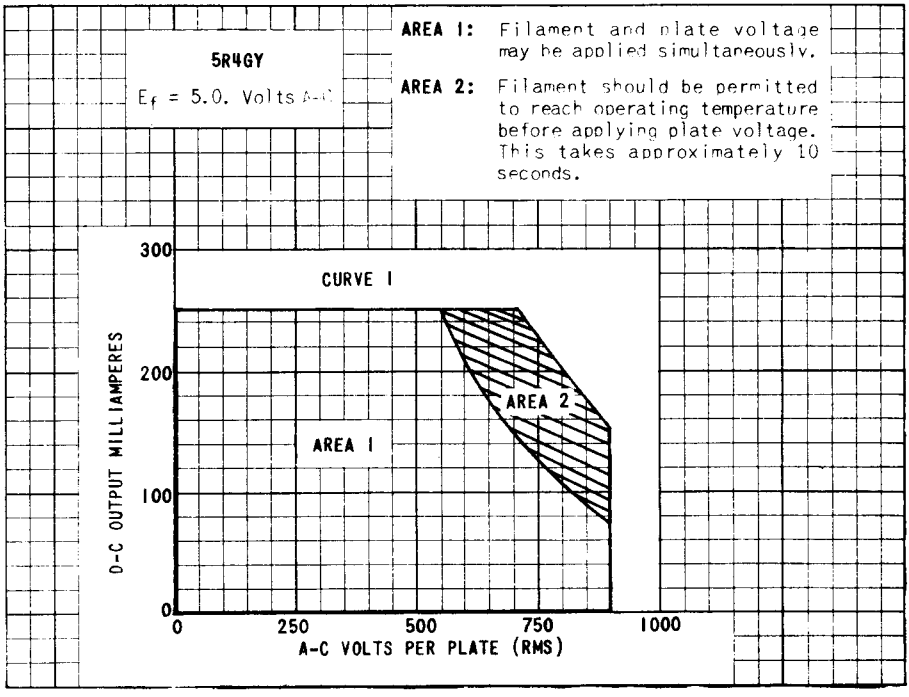
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	CONDENSER-INPUT FILTER		CHOKE-INPUT FILTER		
AC PLATE-TO-PLATE SUPPLY VOLTAGE (RMS)					
FULL LOAD	1400	1800	1500	1900	VOLTS
NO LOAD	1900	2000	1700	2000	VOLTS
FILTER INPUT CONDENSER	4	4	-	-	µf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE PER PLATE[C]	125	575	-	-	OHMS
FILTER INPUT CHOKE	-	-	5	10	H.
DC OUTPUT CURRENT	250	250	250	175	MA.
DC OUTPUT VOLTAGE (APPROX.) (AT INPUT TO FILTER)	700	700	550	750	VOLTS
VOLTAGE REGULATION (APPROX.) (HALF-LOAD TO FULL-LOAD CURRENT)	90	110	40	60	VOLTS

[C] PEAK PLATE CURRENT WILL BE LIMITED TO MAXIMUM RATED VALUE FOR THE GIVEN CONDITIONS AND VALUES. FOR A FILTER-INPUT CONDENSER GREATER THAN 4 µf, MORE PLATE-SUPPLY IMPEDANCE MAY BE REQUIRED TO LIMIT THE PEAK PLATE CURRENT TO THE RATED VALUE.



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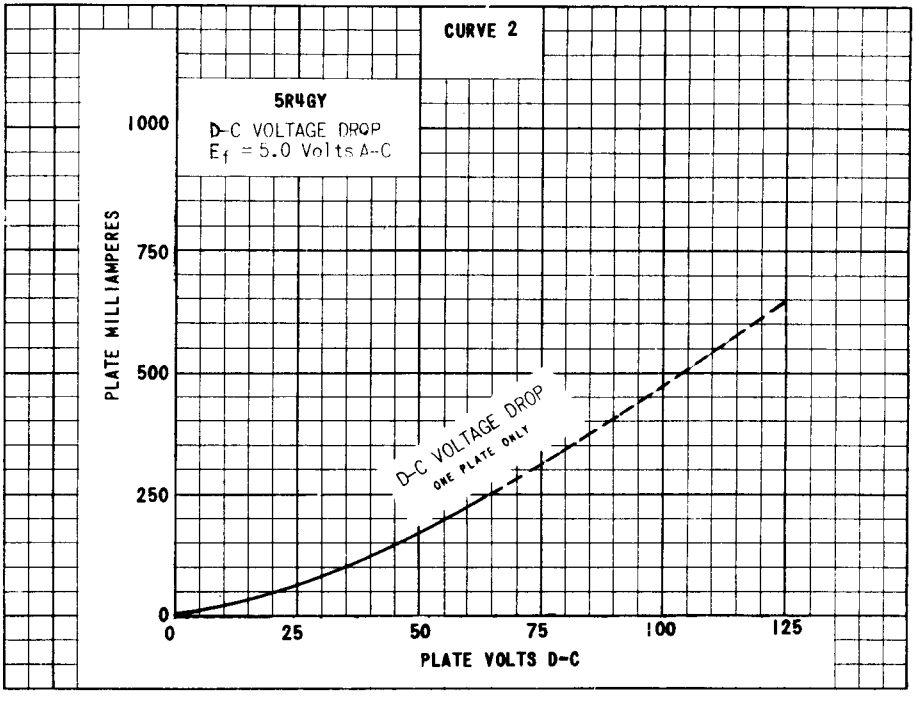

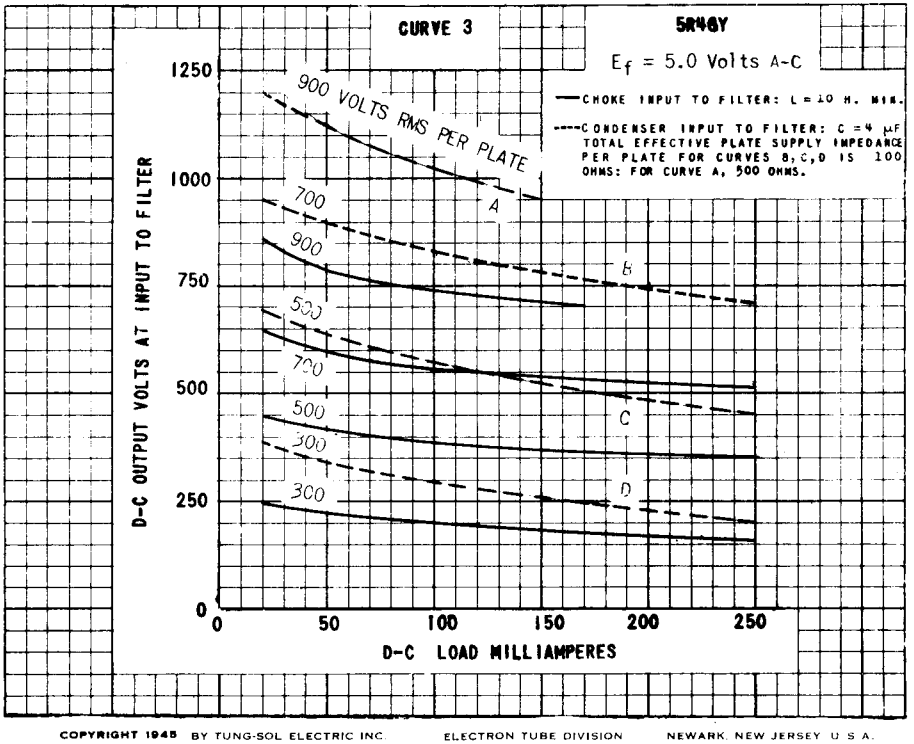

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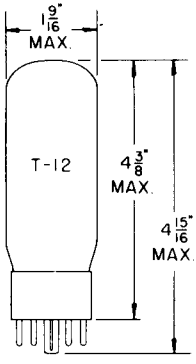
TWIN DIODE



GLASS BULB

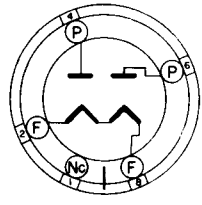
COATED FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 & 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

MEDIUM SHELL
5 PIN OCTAL
WITH
EXTERNAL BARRIERS

5T

THE 5R4GYA IS A FULL-WAVE HIGH-VACUUM RECTIFIER DESIGNED FOR USE IN POWER SUPPLIES OF HIGH CURRENT REQUIREMENTS. THE TUBE INCORPORATES A LOW-LOSS BASE AND IS CAPABLE OF WITHSTANDING HIGH PEAK INVERSE PLATE VOLTAGES. ELECTRICALLY, THE 5R4GYA IS A REPLACEMENT FOR THE 5R4GY; IT DIFFERS PRIMARILY FROM THE 5R4GYA BY EMPLOYING A STRAIGHT-SIDED T-12 CONSTRUCTION.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE

FILAMENT VOLTAGE*	5.0	5.0	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE				
NO-LOAD CONDITION[A]	2100	2400	2800	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE				
CURRENT PER PLATE	650	650	650	MA.
MAXIMUM DC OUTPUT CURRENT				
WITH CAPACITOR-INPUT FILTER	250	175	150	MA.
WITH CHOKE-INPUT FILTER	250	250[B]	175[C]	MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	210	210	°C

* SEE RATING CHART 1 FOR RESTRICTIONS ON APPLYING THE PLATE AND FILAMENT VOLTAGES SIMULTANEOUSLY.

[A] OPERATION WITH PEAK INVERSE PLATE VOLTAGES UP TO 2400 VOLTS MAXIMUM IS PERMITTED AT ALTITUDES UP TO 40000 FEET. OPERATION WITH PEAK INVERSE PLATE VOLTAGES GREATER THAN 2400 AND UP TO 2800 VOLTS IS PERMITTED ONLY WHEN THE ALTITUDE DOES NOT EXCEED 20000 FEET AND THE DC OUTPUT CURRENT IS REDUCED TO THE VALUE INDICATED IN THE MAXIMUM RATINGS.

[B] INPUT CHOKE OF 5 HENRYS MINIMUM REQUIRED FOR 60-CYCLE POWER SUPPLY.

[C] INPUT CHOKE OF 10 HENRYS MINIMUM REQUIRED FOR 60-CYCLE POWER SUPPLY.

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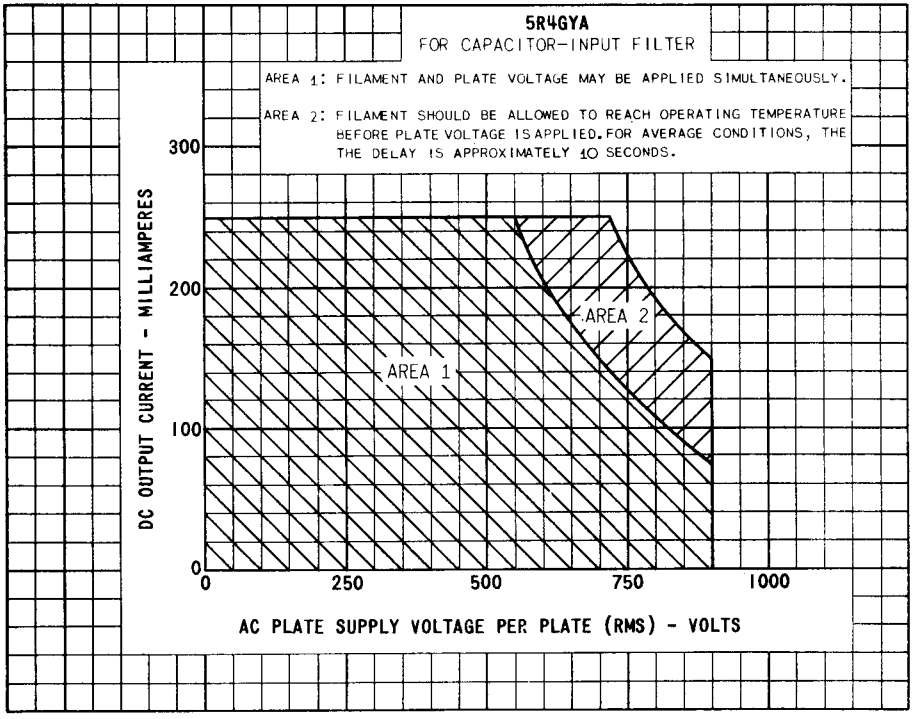
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

FILAMENT VOLTAGE	5.0	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	2.0	AMP.
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS				
FULL LOAD	700	750	900	VOLTS
NO LOAD	750	850	1000	VOLTS
FILTER INPUT CAPACITOR	4	4	4	μFD.
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE PER PLATE	125	500	575	OHMS
DC OUTPUT CURRENT	250	150	150	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT				
FOR DC OUTPUT CURRENT OF 75 MA.	---	900	1060	VOLTS
FOR DC OUTPUT CURRENT OF 125 MA.	790	---	---	VOLTS
FOR DC OUTPUT CURRENT OF 150 MA.	---	810	950	VOLTS
FOR DC OUTPUT CURRENT OF 250 MA.	700	---	---	VOLTS

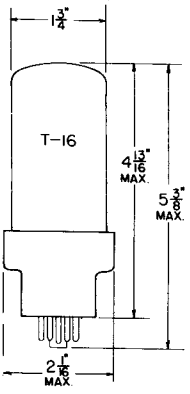
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER

FILMENT VOLTAGE	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	AMP.
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS			
FULL LOAD	750	950	VOLTS
NO LOAD	850	1000	VOLTS
FILTER INPUT CHOKE	5	10	HENRYS
DC OUTPUT CURRENT	250	175	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT			
FOR DC OUTPUT CURRENT OF 87.5 MA.	---	810	VOLTS
FOR DC OUTPUT CURRENT OF 125 MA.	590	---	VOLTS
FOR DC OUTPUT CURRENT OF 175 MA.	---	750	VOLTS
FOR DC OUTPUT CURRENT OF 250 MA.	550	---	VOLTS
TUBE VOLTAGE DROP			
Ib=250 MA. DC PER PLATE		67	VOLTS


5R4GYA
FOR CAPACITOR-INPUT FILTER
AREA 1: FILAMENT AND PLATE VOLTAGE MAY BE APPLIED SIMULTANEOUSLY.
AREA 2: FILAMENT SHOULD BE ALLOWED TO REACH OPERATING TEMPERATURE BEFORE PLATE VOLTAGE IS APPLIED. FOR AVERAGE CONDITIONS, THE THE DELAY IS APPROXIMATELY 10 SECONDS.
DC OUTPUT CURRENT - MILLIAMPERES
300
200
100
0
AREA 2
AREA 1
0
250
500
750
1000
AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) - VOLTS

TUNG-SOL

FULL WAVE RECTIFIER



GLASS BULB
HARD GLASS

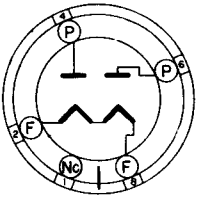
FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

TUBE MAY BE OPERATED IN HORIZONTAL POSITION IF PINS #1 AND #4 ARE IN VERTICAL PLANE.



BOTTOM VIEW
SPECIAL SKIRTED
5 PIN. OCTAL
5T

THE 5R4WGA IS A HIGH VUCUUM FULL WAVE RECTIFIER CAPABLE OF SUPPLYING 950 VDC AT 165MA OR 750 VDC AT 275 MA. THIS TUBE TYPE PROVEN BY MILLIONS NOW IN FIELD USE FEATURES A RUGGED CONSTRUCTION THAT WILL WITHSTAND A SHOCK IMPACT OF 900 G AND HIGH VIBRATIONAL STRESSES.

ONE OF THE DESIGN FEATURES IS THE SHOCK MOUNTING OF THE BULB IN A SKIRTED TYPE BASE BY A RESILIENT SILICONE RUBBER. THUS, ALTHOUGH THE BASE MAY BE SECURELY CLAMPED TO THE CHASSIS, THE TUBE PROPER IS INSULATED AGAINST SHOCKS. THIS TYPE OF BASING ALSO PERMITS OPERATION AT HIGH ALTITUDES WITHOUT FLASH OVER. ANOTHER DESIGN FEATURE IS THE "CROSS PRESS" STEM WHICH KEEPS ELECTROLYSIS TO A MINIMUM WHILE OFFERING A STABLE SUPPORT FOR THE MOUNT STRUCTURE. THE USE OF A HARD GLASS BULB PERMITS THE TUBE TO BE PROCESSED AT HIGH TEMPERATURES DURING MANUFACTURE SO THAT IT WILL REMAIN GAS FREE UNDER THE HIGH TEMPERATURES ENCOUNTERED IN OPERATION. THE LOW DRAIN, FAST HEATING, RUGGED FILAMENT PERMITS INSTANT APPLICATION OF PLATE VOLTAGE OVER A LARGE PORTION OF THE OPERATING CHARACTERISTICS. (SEE CURVES).

ELECTRICAL DATA

FILAMENT VOLTAGE (± 10%) A.C.	5.0	VOLTS
FILAMENT CURRENT A.C.	2.0	AMPS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

	INPUT TO FILTER		
	CHOKE	CAPACITOR	
AC PLATE VOLTAGE RMS PER PLATE	900	700	VAC
INPUT CONDENSER	---	4	Mfd
INPUT CHOKE	10	---	H
EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	---	100	OHMS
DC OUTPUT CURRENT	165	275	MA.
DC OUTPUT VOLTAGE AT FULL LOAD	840	730	VDC
DC OUTPUT VOLTAGE AT HALF LOAD	860	800	VDC
REGULATION, HALF LOAD TO FULL LOAD	20	70	VDC

MECHANICAL DATA

MOUNTING POSITION	VERTICAL	
MAXIMUM OVERALL HEIGHT	5.31	INCHES
MAXIMUM SEATED HEIGHT	4.75	INCHES
MAXIMUM DIAMETER	2.06	INCHES
BULB, HARD GLASS	T-16	
BASE: SPECIAL SKIRTED OCTAL 5 PIN, GLASS FILLED ALKYD, INSULATION ZONE 5 OR BETTER.	SEE OUTLINE	

MAXIMUM RATING CHART

ALTITUDE	FILTER INPUT	PEAK INV. VOLTAGE	VOLTS RMS PER PLATE	MIN. SUPPLY IMPEDANCE PER PLATE
UP TO 30,000 FT.	4 μf	3050v⊕	1070v	575Ω⊕
UP TO 40,000 FT.	4 μf	2150⊕	760	---
	5 HENRIES	2300⊕	815	---
	4 μf	2800⊕	990	575⊕
UP TO 60,000 FT.	4 μf	1850⊕	655	---

ALTITUDE	PEAK PLATE CURRENT	CURRENT	FULL LOAD VOLTAGE
UP TO 30,000 FT.	0 MA.⊕	0 MA.⊕	1525v
UP TO 40,000 FT.	700⊕	275⊕	770
	---	275⊕	650
	550	165⊕	1100
UP TO 60,000 FT.	700⊕	275⊕	620

⊕INDICATES MAXIMUM RATINGS; ALL OTHERS INDICATE APPROXIMATE VALUES.

ALL VALUES ARE FOR E_f = 5.0 V. AND 10 SECONDS PREHEATING (NO PREHEATING IS NECESSARY FOR NO LOAD CONDTIONS). HIGHER VALUES OF FILTER CONDENSER CAPACITY MAY BE USED IF PLATE SUPPLY IMPEDANCE IS INCREASED TO KEEP PEAK PLATE CURRENT WITHIN RATINGS. FILTER VALUES ARE FOR 60 CYCLE OPERATION.

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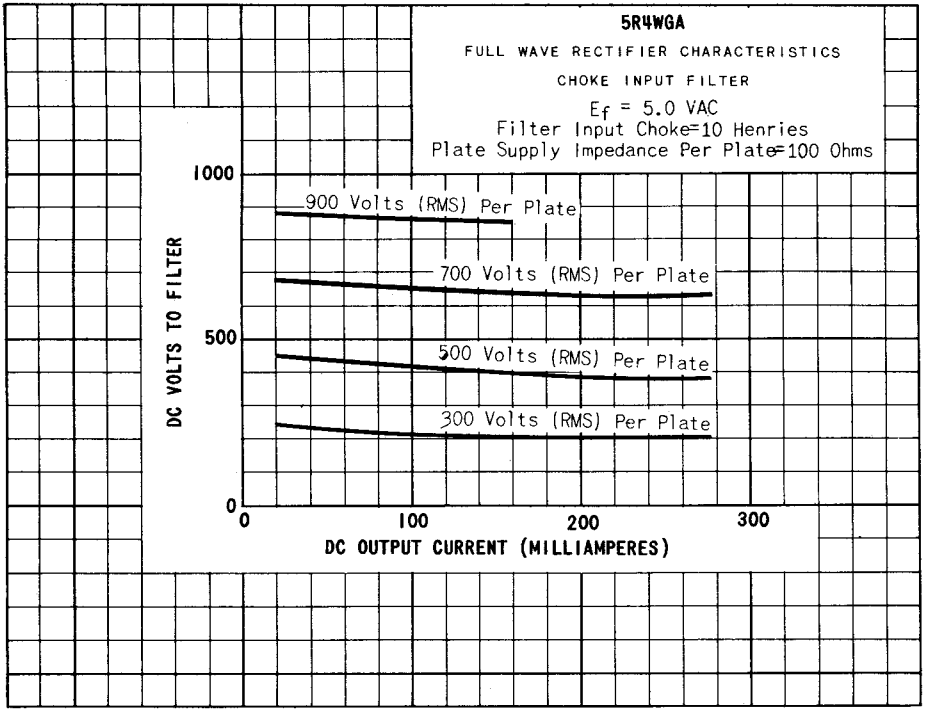

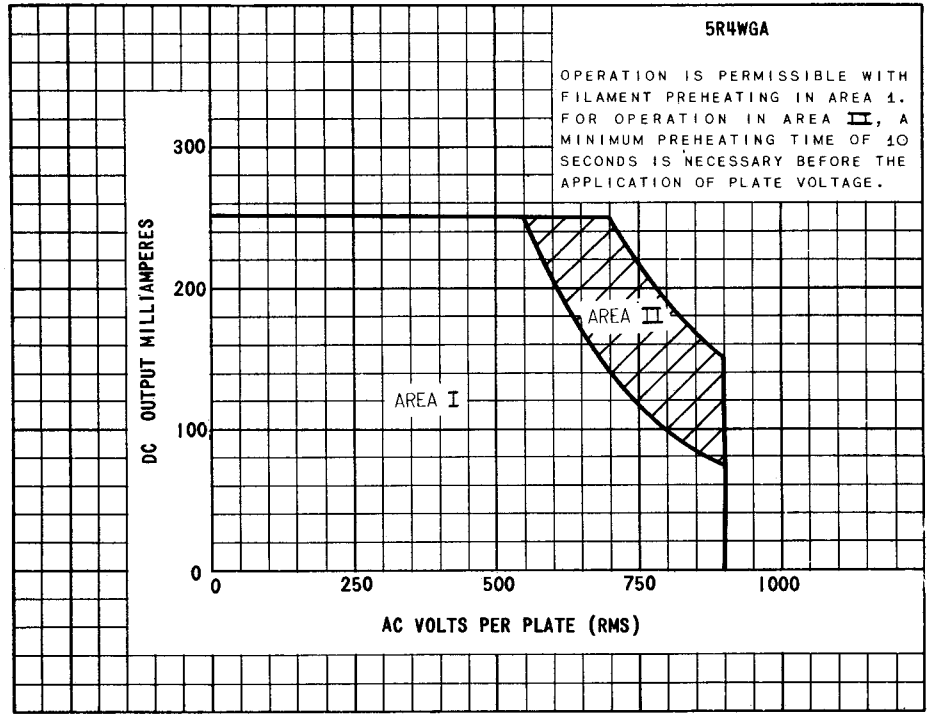

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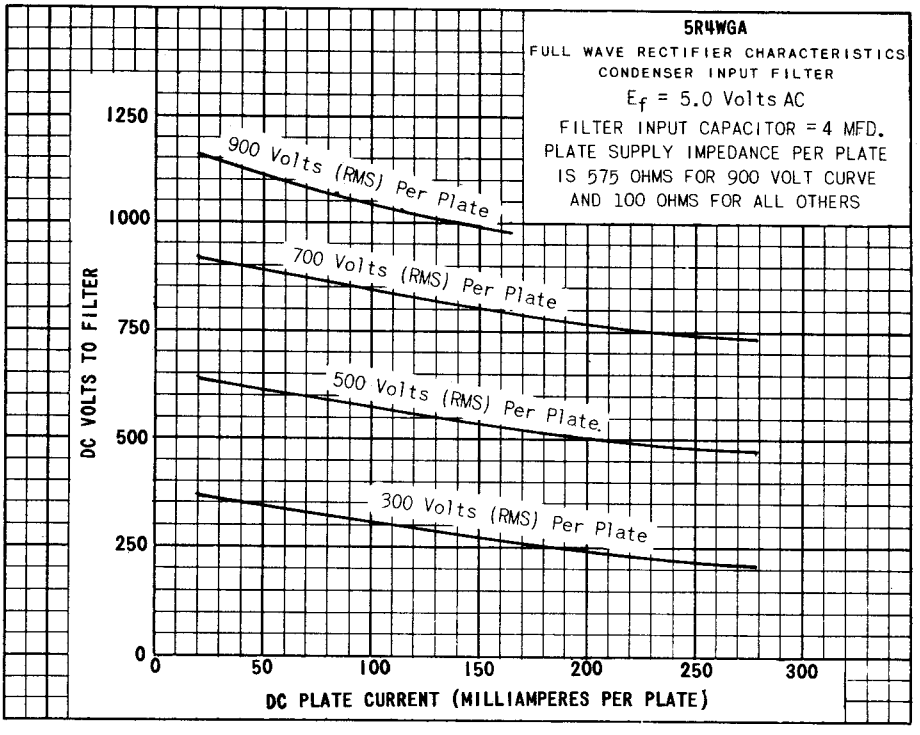
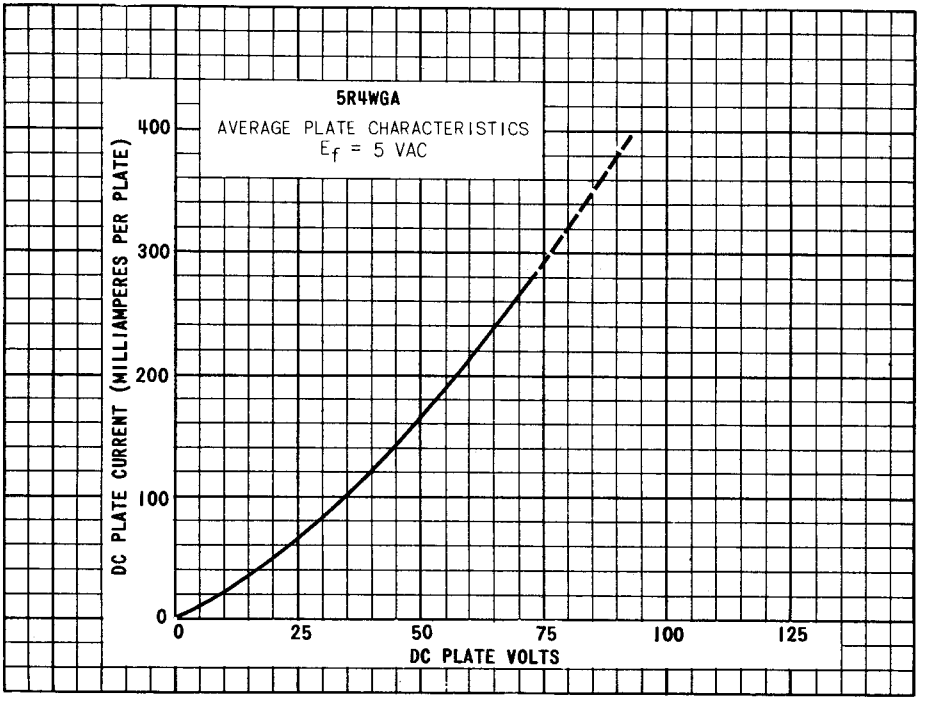
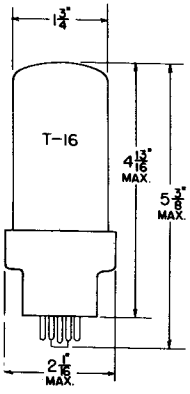

5R4WGA
FULL WAVE RECTIFIER CHARACTERISTICS
CONDENSER INPUT FILTER
E_f = 5.0 Volts AC
FILTER INPUT CAPACITOR = 4 MFD.
PLATE SUPPLY IMPEDANCE PER PLATE
IS 575 OHMS FOR 900 VOLT CURVE
AND 100 OHMS FOR ALL OTHERS
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
1250
1000
750
500
250
0
0
50
100
150
200
250
300
DC PLATE CURRENT (MILLIAMPERES PER PLATE)


5R4WGA
AVERAGE PLATE CHARACTERISTICS
E_f = 5 VAC
DC PLATE CURRENT (MILLIAMPERES PER PLATE)
400
300
200
100
0
0
25
50
75
100
125
DC PLATE VOLTS

TUNG-SOL

FULL WAVE RECTIFIER



GLASS BULB
HARD GLASS

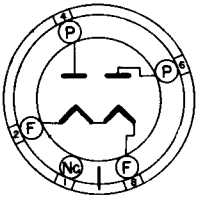
FILAMENT

5.0 VOLTS 2.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

TUBE MAY BE OPERATED IN HORIZONTAL POSITION IF PINS #1 AND #4 ARE IN VERTICAL PLANE.



BOTTOM VIEW
SPECIAL SKIRTED
5 PIN OCTAL
5T

THE 5R4WGB IS A LONG LIFE, RUGGEDIZED, RELIABLE FULL WAVE RECTIFIER TUBE. WHILE SIMILAR IN CONSTRUCTION TO THE POPULAR 5R4WGA, THIS TUBE IS SUBJECTED TO MORE EXACTING REQUIREMENTS IN MANUFACTURE. THIS INCLUDES A 100% CHECK OF WELDS UNDER MAGNIFICATION. EVERY TUBE IS ELECTRICALLY STABILIZED WITH REPEATED COLD STARTS TO WEED OUT TUBES THAT ARE PRONE TO ARCING. THE 5R4WGB IS MADE IN "LOTS" WITH AN ENTIRE LOT BEING REJECTED UPON THE REJECTION OF SAMPLE TUBES. THIS IS OF PARTICULAR IMPORTANCE ON DESTRUCTIVE TESTS.

ONE OF THE DESIGN FEATURES IS THE SHOCK MOUNTING OF THE BULB IN A SKIRTED TYPE BASE BY A RESILIENT SILICONE RUBBER. THUS, ALTHOUGH THE BASE MAY BE SECURELY CLAMPED TO THE CHASSIS, THE TUBE PROPER IS INSULATED AGAINST SHOCKS. THIS TYPE OF BASING ALSO PERMITS OPERATION AT HIGH ALTITUDES WITHOUT FLASH OVER. ANOTHER DESIGN FEATURE IS THE "CROSS PRESS" STEM WHICH KEEPS ELECTROLYSIS TO A MINIMUM WHILE OFFERING A STABLE SUPPORT FOR THE MOUNT STRUCTURE. THE USE OF A HARD GLASS BULB PERMITS THE TUBE TO BE PROCESSED AT HIGH TEMPERATURES DURING MANUFACTURE SO THAT IT WILL REMAIN GAS FREE UNDER THE HIGH TEMPERATURES ENCOUNTERED IN OPERATION. THE LOW DRAIN, FAST HEATING, RUGGED FILAMENT PERMITS INSTANT APPLICATION OF PLATE VOLTAGE OVER A LARGE PORTION OF THE OPERATING CHARACTERISTICS. (SEE CURVES).

ELECTRICAL DATA

FILAMENT VOLTAGE (± 10%) A.C.	5.0	VOLTS
FILAMENT CURRENT A.C.	2.0	AMPS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

	INPUT TO FILTER CHOKE	INPUT TO FILTER CAPACITOR	
AC PLATE VOLTAGE RMS PER PLATE	900	700	VAC
INPUT CONDENSER	---	4	Mfd
INPUT CHOKE	10	---	H
EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	---	100	OHMS
DC OUTPUT CURRENT	165	275	MA.
DC OUTPUT VOLTAGE AT FULL LOAD	840	730	VDC
DC OUTPUT VOLTAGE AT HALF LOAD	860	800	VDC
REGULATION, HALF LOAD TO FULL LOAD	20	70	VDC

MECHANICAL DATA

MOUNTING POSITION	VERTICAL	
MAXIMUM OVERALL HEIGHT	5.31	INCHES
MAXIMUM SEATED HEIGHT	4.75	INCHES
MAXIMUM DIAMETER	2.06	INCHES
BULB, HARD GLASS	T-16	
BASE: SPECIAL SKIRTED OCTAL 5 PIN, GLASS FILLED ALKYD, INSULATION ZONE 5 OR BETTER.	SEE OUTLINE	

MAXIMUM RATING CHART

ALTITUDE	FILTER INPUT	PEAK INV. VOLTAGE	VOLTS RMS PER PLATE	MIN. SUPPLY IMPEDANCE PER PLATE
UP TO 30,000 FT.	4 μf	3050v⊕	1070v	575Ω⊕
UP TO 40,000 FT.	4 μf	2150⊕	760	---
	5 HENRIES	2300⊕	815	---
	4 μf	2800⊕	990	575⊕
UP TO 60,000 FT.	4 μf	1850⊕	655	---

ALTITUDE	PEAK PLATE CURRENT	CURRENT	FULL LOAD VOLTAGE
UP TO 30,000 FT.	0 MA.⊕	0 MA⊕	1525v
UP TO 40,000 FT.	700⊕	275⊕	770
	---	275⊕	650
	550	165⊕	1100
UP TO 60,000 FT.	700⊕	275⊕	620

⊕INDICATES MAXIMUM RATINGS; ALL OTHERS INDICATE APPROXIMATE VALUES.

ALL VALUES ARE FOR E_f = 5.0 V. AND 10 SECONDS PREHEATING (NO PREHEATING IS NECESSARY FOR NO LOAD CONDTIONS). HIGHER VALUES OF FILTER CONDENSER CAPACITY MAY BE USED IF PLATE SUPPLY IMPEDANCE IS INCREASED TO KEEP PEAK PLATE CURRENT WITHIN RATINGS. FILTER VALUES ARE FOR 60 CYCLE OPERATION.

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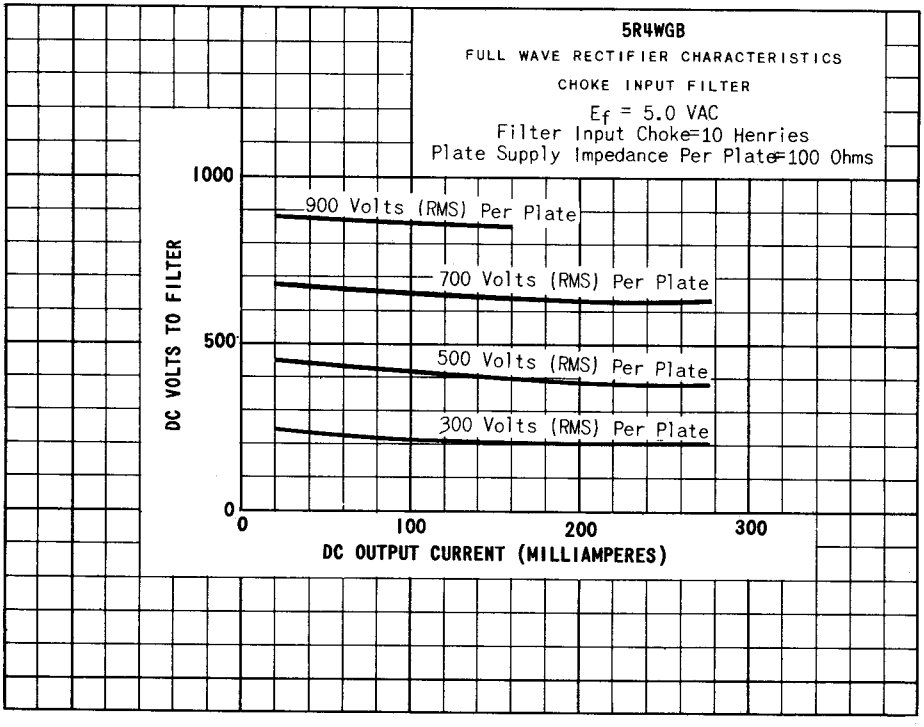
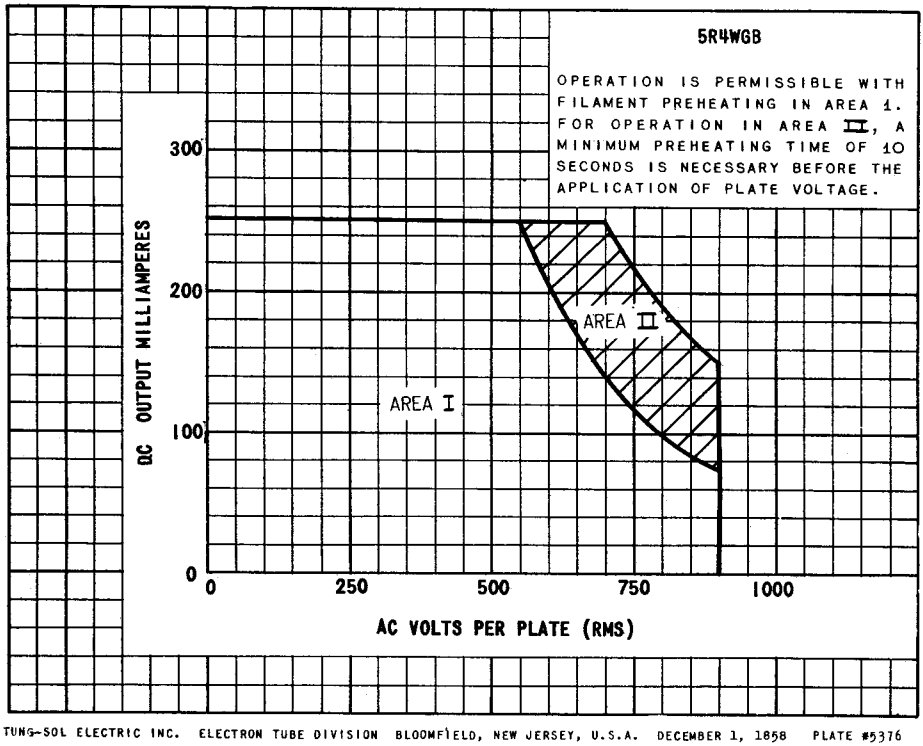
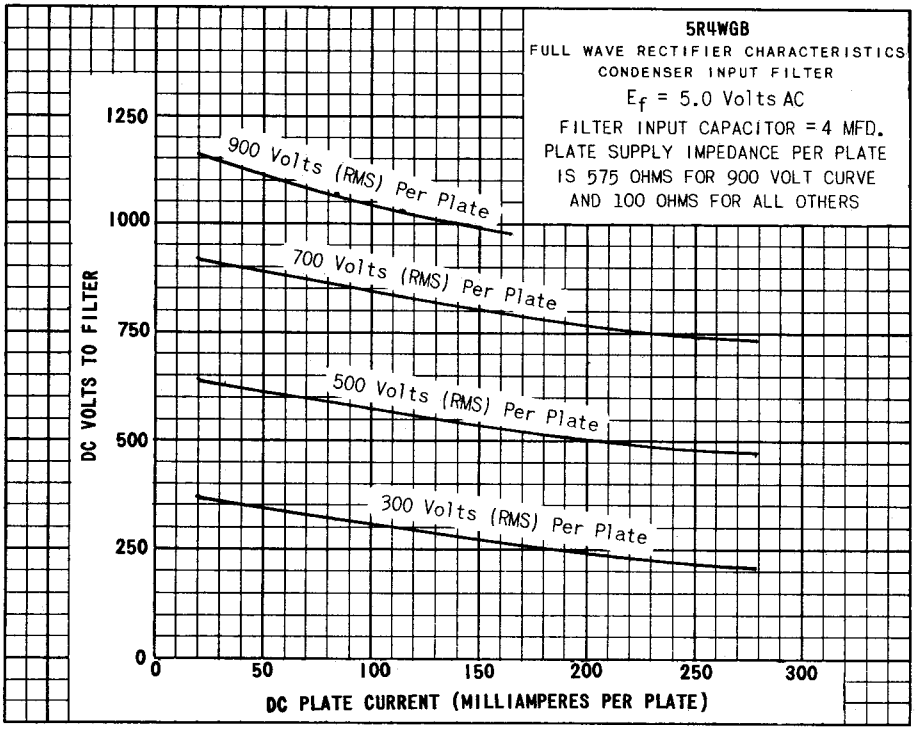
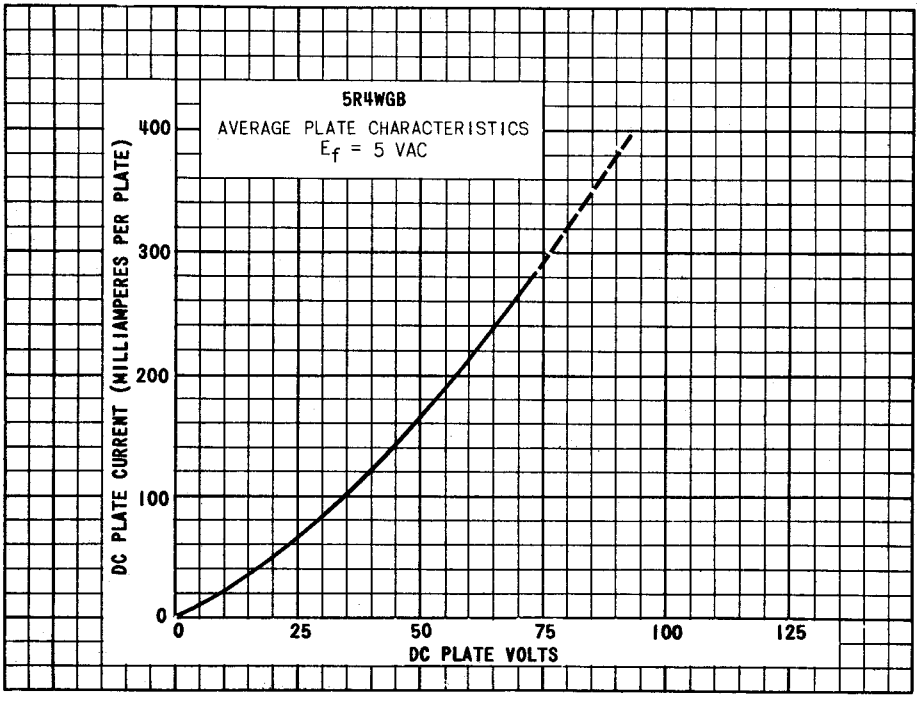

5R4WGB
FULL WAVE RECTIFIER CHARACTERISTICS
CHOKE INPUT FILTER
E_f = 5.0 VAC
Filter Input Choke=10 Henries
Plate Supply Impedance Per Plate=100 Ohms
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
1000
500
0
0
100
200
300
DC OUTPUT CURRENT (MILLIAMPERES)


5R4WGB
OPERATION IS PERMISSIBLE WITH FILAMENT PREHEATING IN AREA 1. FOR OPERATION IN AREA II, A MINIMUM PREHEATING TIME OF 10 SECONDS IS NECESSARY BEFORE THE APPLICATION OF PLATE VOLTAGE.
AREA I
AREA II
DC OUTPUT MILLIAMPERES
300
200
100
0
0
250
500
750
1000
AC VOLTS PER PLATE (RMS)


5R4WGB
FULL WAVE RECTIFIER CHARACTERISTICS
CONDENSER INPUT FILTER
E_f = 5.0 Volts AC
FILTER INPUT CAPACITOR = 4 MFD.
PLATE SUPPLY IMPEDANCE PER PLATE
IS 575 OHMS FOR 900 VOLT CURVE
AND 100 OHMS FOR ALL OTHERS
900 Volts (RMS) Per Plate
700 Volts (RMS) Per Plate
500 Volts (RMS) Per Plate
300 Volts (RMS) Per Plate
DC VOLTS TO FILTER
1250
1000
750
500
250
0
0
50
100
150
200
250
300
DC PLATE CURRENT (MILLIAMPERES PER PLATE)


5R4WGB
AVERAGE PLATE CHARACTERISTICS
E_f = 5 VAC
DC PLATE CURRENT (MILLIAMPERES PER PLATE)
400
300
200
100
0
0
25
50
75
100
125
DC PLATE VOLTS

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ADDITIONAL TESTS TO INSURE RELIABILITY

ALL TUBES: OPERATION (1): e_{px} = 2800 Vac; FULL WAVE; $Z_{p/p}$ = 500; C_L = 4 mfd; R_L = 7000 OHMS; t_k = 10 I_o > 140 mAdc

OPERATION (2): $E_{pp/p}$ = 850 Vac, FULL WAVE; C_L = 4mfd; R_L = 3500 OHMS, t_k = 10; $Z_{p/p}$ ADJUSTED FOR A BOGIE TUBE TO READ 260 mAdc, AND I_b NOT LESS THAN 630 mA PER PLATE. (A BOGIE TUBE IS A TUBE WITH A DROP OF 75Vdc AT 320 mAdc PER PLATE) I_o > 245 mA.

STABILIZATION: 6 HOURS AT E_F = 5.0Vac; $E_{pp/p}$ = 800 Vac; I_o = 300 mAdc; R_L = 3000; t_k = 0 (CYCLED 15 MINUTES ON 5 MINUTES OFF)

RANDOM SAMPLE TESTED FOR THE FOLLOWING:

LOW PRESSURE VOLTAGE BREAKDOWN:

1). $E_{pp/p}$ = 1050Vac; FULL WAVE; R_L/I_o = 165 mAdc; t_k = 10SEC; C_L = 4 mfd, $Z_{ptotal/p}$ = 500 Ω: PRESSURE 140 mm (40000ft.)

2). e_{px} = 1850 Vac; R_L/I_o = 275 mAdc; t_k = 10 SEC; C_L = 4 mfd; $Z_{ptotal/p}$ = 200Ω: FULL WAVE; PRESSURE = 55 mm (60000 ft.)

SHOCK: 60° HAMMER ANGLE IN NAVY FLYWEIGHT, HIGH IMPACT MACHINE (900G/mSEC).

FATIGUE: 25 CPS, 0.80" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THESE MUTUALLY PERPENDICULAR PLANES (2.5 G).

POST SHOCK AND FATIGUE TEST END POINT:
OPERATION (2) I_o > 240 mAdc.

LIFE TEST:

FILAMENT CYCLING: 2000 CYCLES; E_f = 5.5 Vac; 1 MINUTE ON, 1 MINUTE OFF PER CYCLE. (FILAMENT VOLTAGE REGULATION 3% NO LOAD TO FULL LOAD).

INTERMITTENT LIFE TEST

OPERATION (2) 100 HOURS	I_o > 245 mAdc.
OPERATION (2) 500 HOURS	I_o > 240 mAdc.
OPERATION (2) 1000 HOURS	I_o > 240 mAdc.

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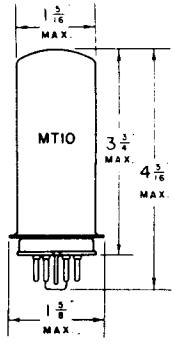
TUNG-SOL



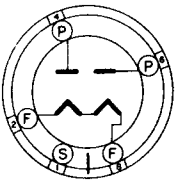
FULL WAVE

HIGH VACUUM RECTIFIER

COATED FILAMENT

5.0 VOLTS 2.0 AMPERES
AC

METAL SHELL



5T
BOTTOM VIEW

5 PIN OCTAL BASE

THE TUNG-SOL 5T4 IS DESIGNED FOR SERVICE AS A POWER RECTIFIER IN AC OPERATED RECEIVERS.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	675	MA.
TUBE VOLTAGE DROP AT 225 MA. DC PER PLATE	45	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[A]	150	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
VALUE OF INPUT CHOKE MIN.	3	HENRYS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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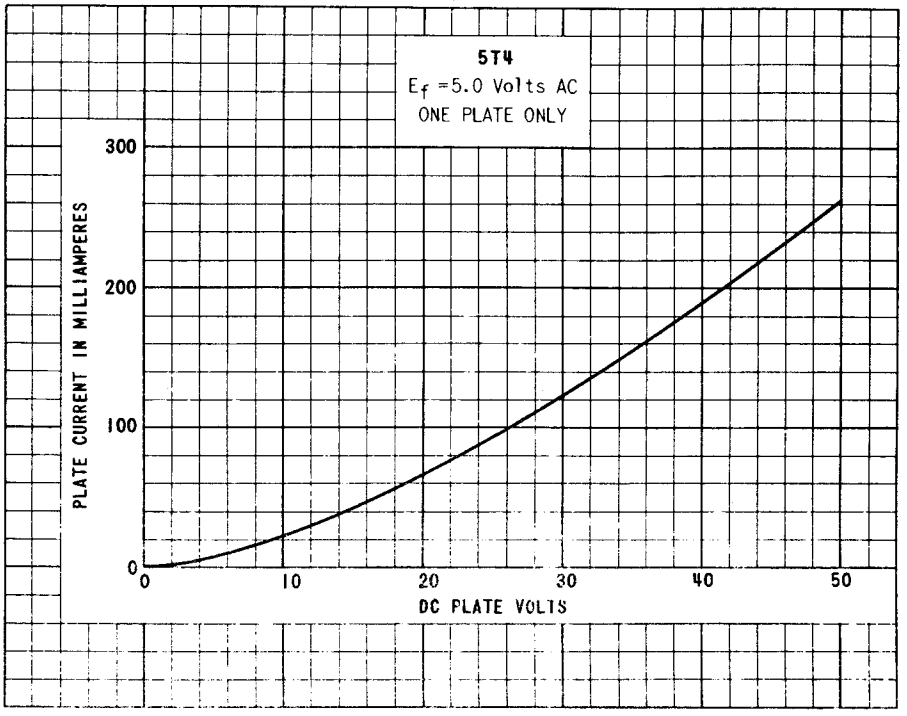
5T4



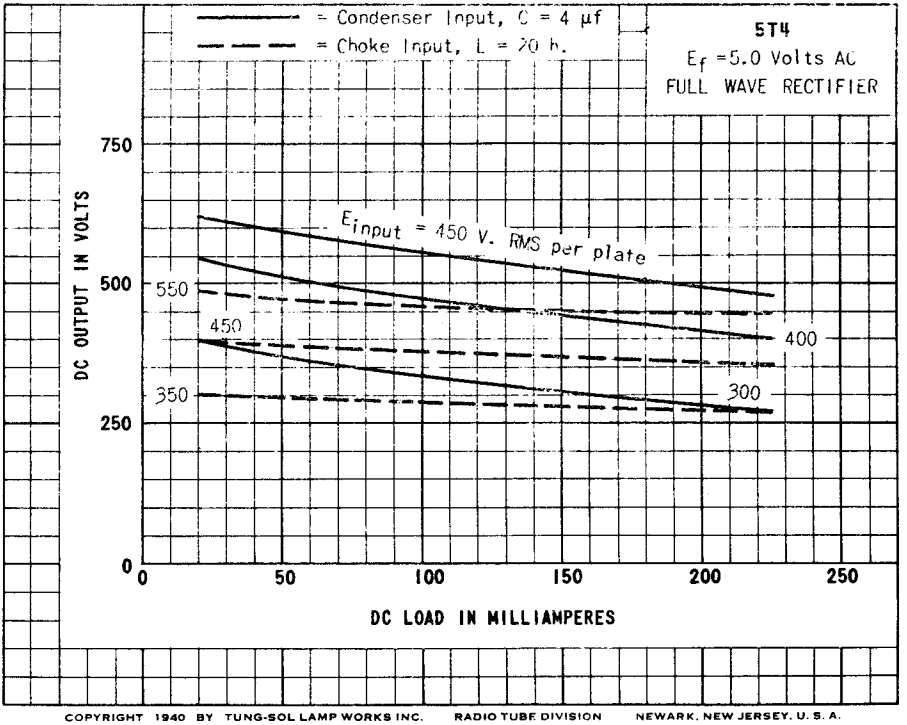


PLATE
871-1

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TUNG-SOL

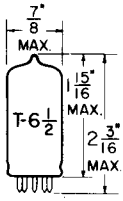
TRIPLE-DIODE TRIODE

MINIATURE TYPE

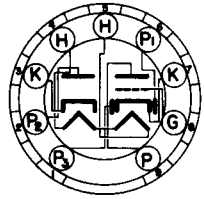
COATED UNIPOTENTIAL CATHODES

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE GLASS BUTTON
9 PIN BASE
9E

THE 5T8 COMBINES THREE HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. ONE OF THE THREE DIODE PLATES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6T8.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE GRID TO PLATE	1.7	1.7	μμf
TRIODE INPUT	1.6	1.7	μμf
TRIODE OUTPUT	1.2	2.4	μμf
GRID TO ANY DIODE PLATE (MAX.)	.034	.034	μμf
INPUT DIODE 1	3.8	3.8	μμf
INPUT DIODE 2	3.8	3.8[B]	μμf
INPUT DIODE 3	3.4	3.6	μμf
DIODE 2 CATHODE TO ALL	7.5	8.5[C]	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1 ←	WATTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. PLATE)	5.5 ←	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)**	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6±6%	0.6±6%	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−3	VOLTS
AMPLIFICATION FACTOR	70	70	
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT: (EACH SECTION) MEASURED WITH 5 VOLTS DC APPLIED		20	MA.

TRIODE UNIT AS RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PLATE LOAD RESISTOR	220 000	OHMS
CONTROL GRID RESISTOR	10.0	MEGOHMS
INPUT CONDENSER	0.01	μf
OUTPUT CONDENSER	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	OHMS
DISTORTION	5	PERCENT
OUTPUT VOLTAGE	8.5	VOLTS
VOLTAGE GAIN AT 400 CPS	35	

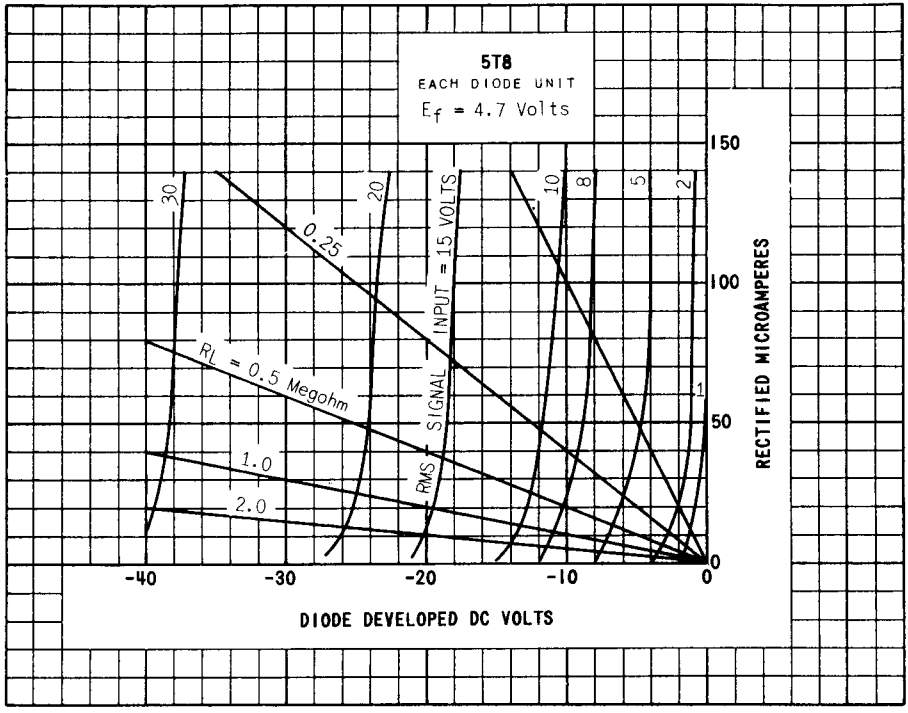
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #7.

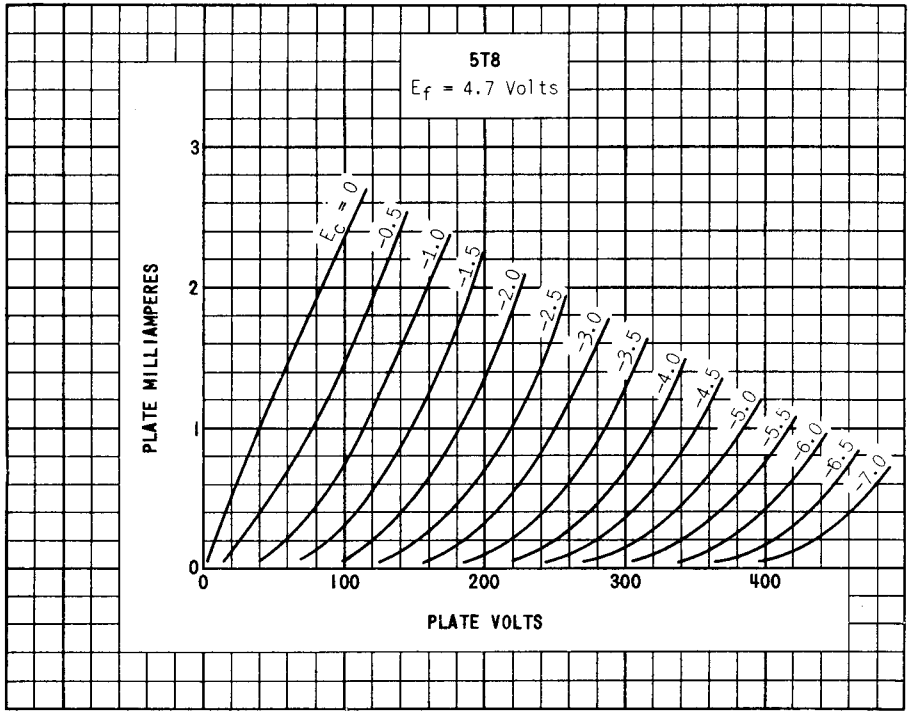
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #3.

[C] WITH EXTERNAL SHIELD #315 CONNECTED TO PINS #4 AND #5.

** HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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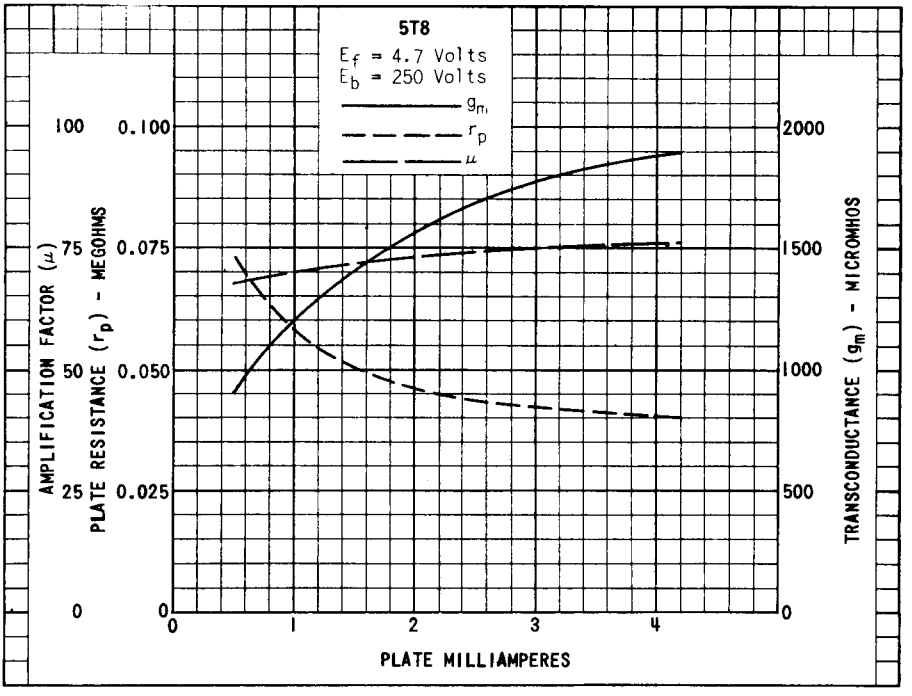
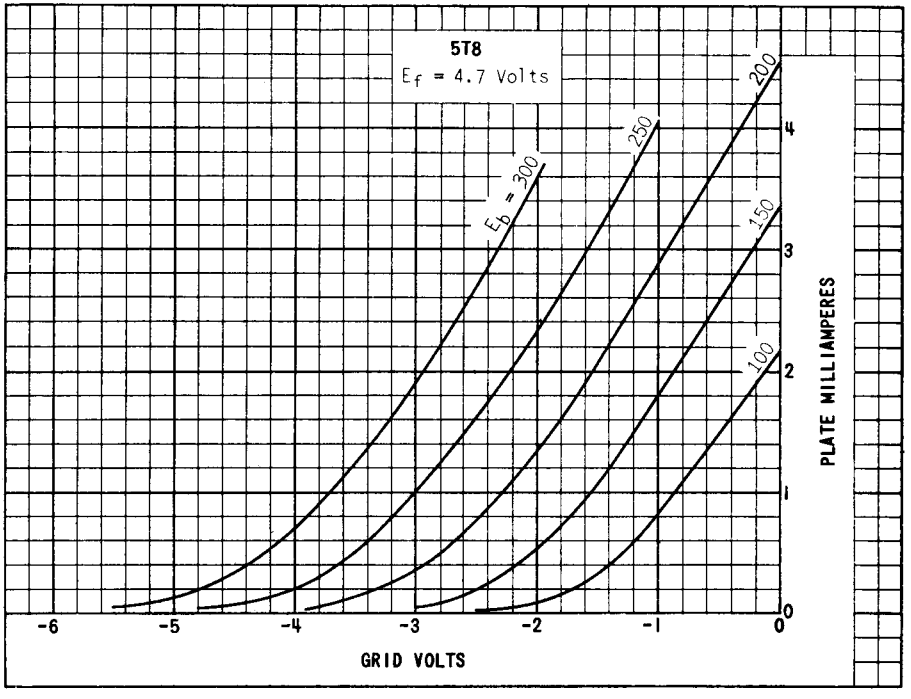

5T8
E_f = 4.7 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
100
75
50
25
0
0.100
0.075
0.050
0.025
0
2000
1500
1000
500
0
0
1
2
3
4


5T8
E_f = 4.7 Volts
E_b = 300
250
200
150
100
PLATE MILLIAMPERES
GRID VOLTS
-6
-5
-4
-3
-2
-1
0
0
1
2
3
4

RESISTANCE COUPLED AMPLIFIER

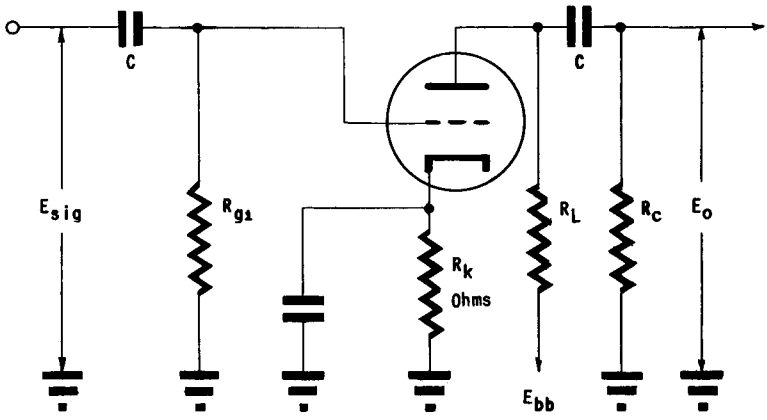
R1 MEG.	Rg1 MEG.	Rc MEG.	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
			Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	A	1	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	---	31	5.0	---	44	19	---	48	40
0.24	10	0.51	---	37	7.0	---	49	25	---	52	52
0.51	10	0.51	---	39	7.5	---	51	22	---	54	44
0.51	10	1	---	42	10	---	54	28	---	58	56

[A] VALUE OF Rg1 IS NOT CRITICAL.

Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.

Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

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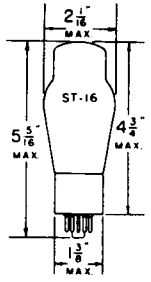
TUNG-SOL



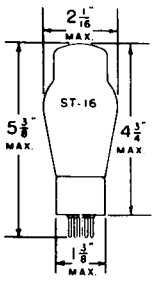
5U4G – MEDIUM 5 PIN OCTAL BASE
5X4G – MEDIUM 8 PIN OCTAL BASE

FULL WAVE
HIGH VACUUM RECTIFIER

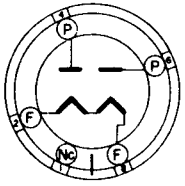
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

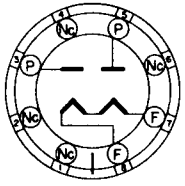
GLASS BULB



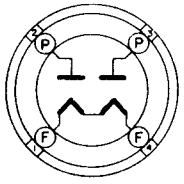
5Z3 – MEDIUM 4 PIN BASE



G-5Ta
BOTTOM VIEW
5U4G



G-5Q
BOTTOM VIEW
5X4G



4C
BOTTOM VIEW
5Z3

THE TUNG-SOL 5U4G, 5X4G AND 5Z3 ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS WHICH REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	675	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	75	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
VALUE OF INPUT CHOKE MIN.	3	HENRYS
TUBE VOLTAGE DROP AT 225 MA. PER PLATE	58	VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

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PLATE 687-2

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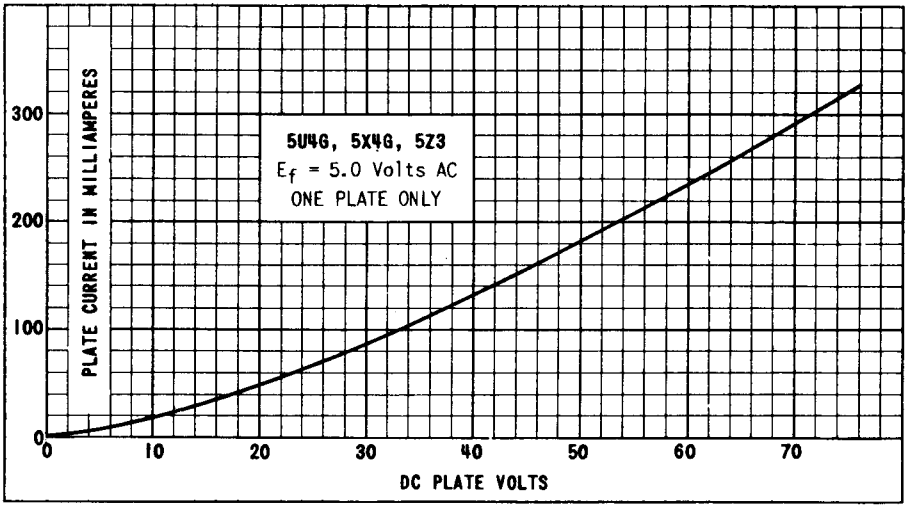
5U4G (5X4G, 5Z3)



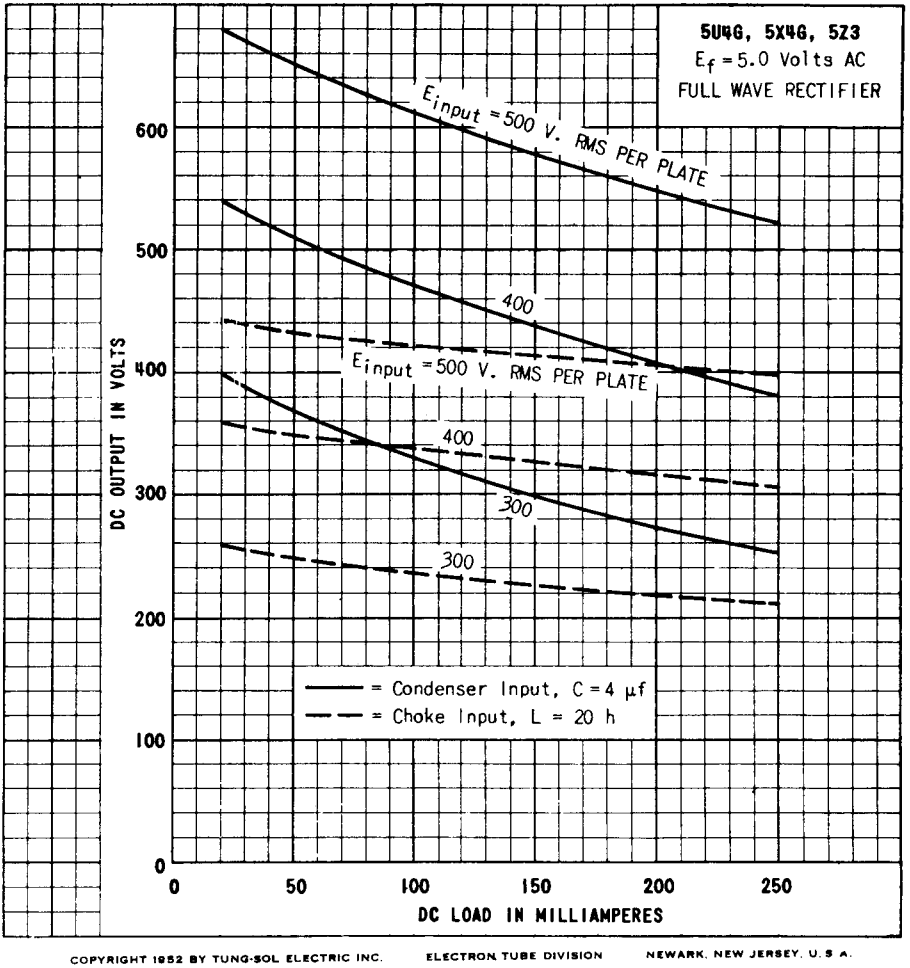


PLATE
688-1

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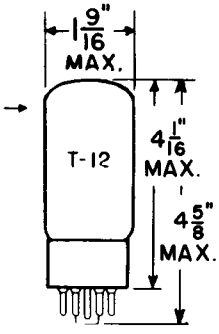
TUNG-SOL

DOUBLE DIODE



GLASS BULB

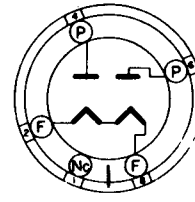
COATED FILAMENT

5.0 VOLTS 3.0 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 1 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

MEDIUM SHELL
5 PIN OCTAL
5T

THE 5U4GB IS A FILAMENTARY FULL-WAVE HIGH VACUUM RECTIFIER DESIGNED FOR USE IN THE POWER SUPPLY OF TELEVISION RECEIVERS AND OTHER EQUIPMENT WHICH HAS HIGH OUTPUT CURRENT REQUIREMENTS. IT IS A REPLACEMENT FOR THE 5U4G; HOWEVER, THE 5U4GB HAS A STRAIGHT SIDED T-12 ENVELOPE AND HAS HIGHER CURRENT RATINGS THAN THE 5U4G.

RATINGS

INTEPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE[A]

FILAMENT VOLTAGE		5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE		1550	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (EACH PLATE) RMS (SEE RATING CHART #1)		550	VOLTS
MAXIMUM DC OUTPUT CURRENT (SEE RATING CHART #1)		---	
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE))SEE RATING CHART #2		1.0	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE) SEE RATING CHART #3		4.6	AMP
TUBE VOLTAGE DROP			
TUBE CONDUCTING:	225 MA. EACH PLATE	44	VOLTS
	275 MA. EACH PLATE	50	VOLTS
	300 MA. EACH PLATE	54	VOLTS

[A] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CYCLES PER SECOND.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

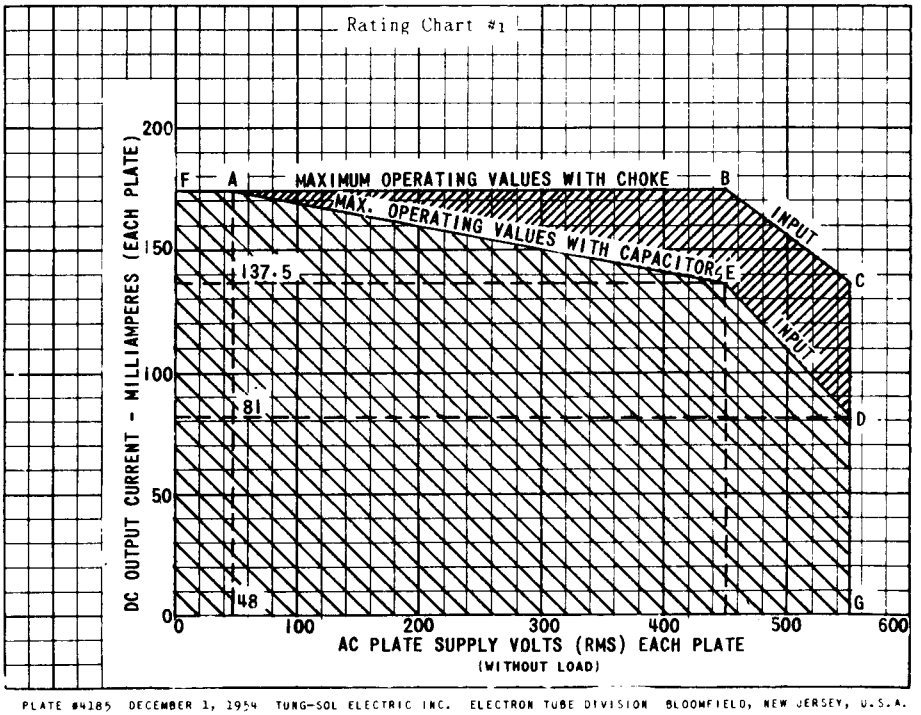
FULL-WAVE RECTIFIER – CAPACITOR INPUT FILTER

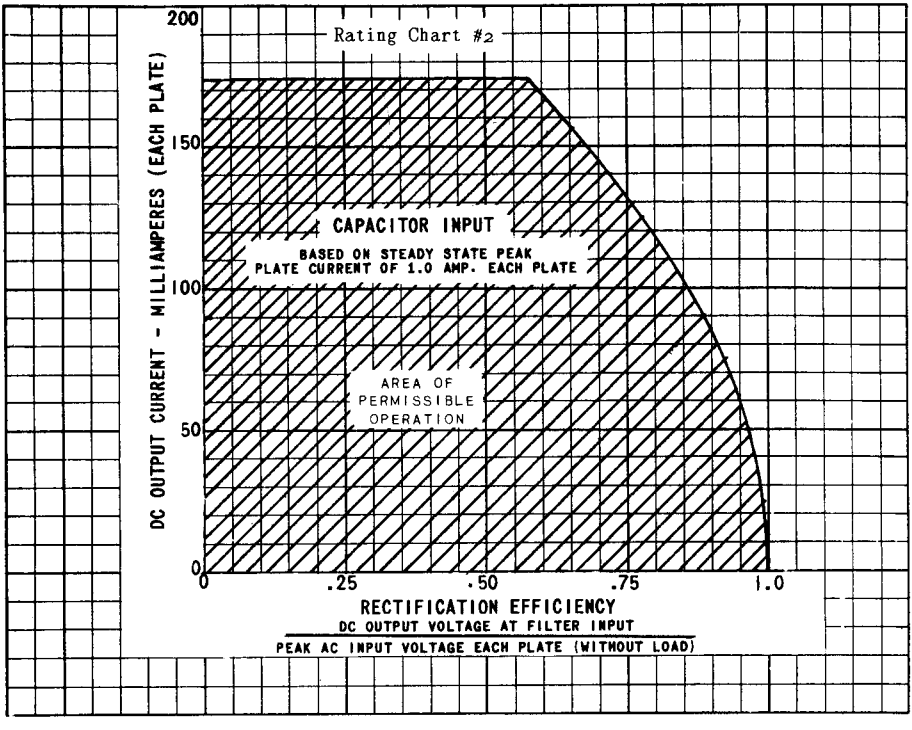
FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.0		AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[B]	300	450	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE-SUPPLY RESISTANCE (EACH PLATE)	21	67	OHMS
DC OUTPUT CURRENT	300	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	290	460	VOLTS

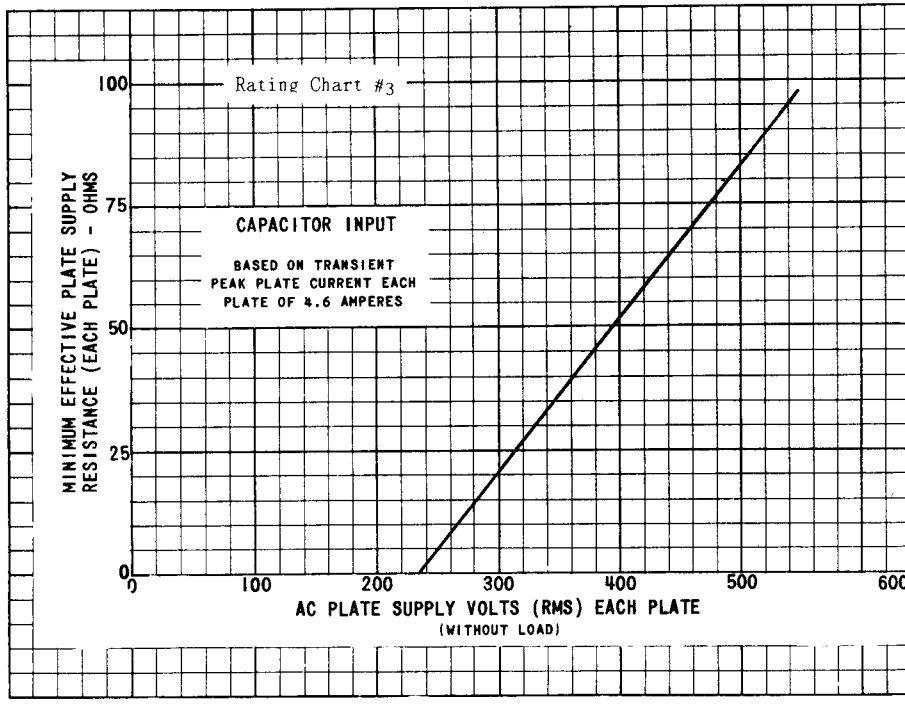
FULL-WAVE RECTIFIER – CHOKE INPUT FILTER

FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	3.0	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[B]	550	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	275	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	420	VOLTS

[B] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

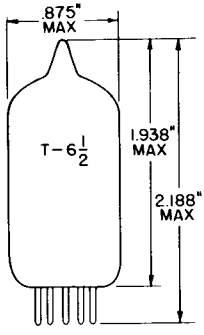



Rating Chart #2
DC OUTPUT CURRENT - MILLIAMPERES (EACH PLATE)
200
150
100
50
0
CAPACITOR INPUT
BASED ON STEADY STATE PEAK
PLATE CURRENT OF 1.0 AMP. EACH PLATE
AREA OF
PERMISSIBLE
OPERATION
0
.25
.50
.75
1.0
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


Rating Chart #3
MINIMUM EFFECTIVE PLATE SUPPLY
RESISTANCE (EACH PLATE) - OHMS
100
75
50
25
0
CAPACITOR INPUT
BASED ON TRANSIENT
PEAK PLATE CURRENT EACH
PLATE OF 4.6 AMPERES
0
100
200
300
400
500
600
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE
(WITHOUT LOAD)

TUNG-SOL

TRIODE PENTODE
MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

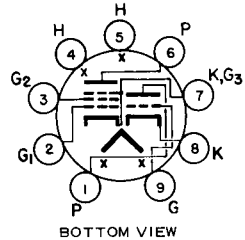
COATED UNIPOTENTIAL CATHODE

FOR

APPLICATION IN FM

OR TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AE

THE 5U8 COMBINES TWO ELECTRICALLY INDEPENDENT SECTIONS-A TRIODE AND A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGH FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR-PENTODE MIXER IN FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS OF SUCH RECEIVERS. IN

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP) MAX.	→ 0.007	→ 0.015	pf
PENTODE INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	5.0	5.0	pf
PENTODE OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	3.5	2.6	pf
PENTODE CATHODE TO HEATER: H TO (PK+PG3+I.S.)	3.0[B]	3.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	1.8	1.8	pf
TRIODE INPUT: TG TO (TK+H+PK+PG3+I.S.)	2.8	2.8	pf
TRIODE OUTPUT: TP TO (TK+H+PK+PG3+I.S.)	2.0	1.5	pf
TRIODE CATHODE TO HEATER (TK TO H)	3.0[B]	3.0	pf
PENTODE GRID TO TRIODE PLATE (PG TO TP) (MAX.)	0.20	0.2	pf
PENTODE PLATE TO TRIODE PLATE (PP TO TP) (MAX.)	0.02	0.1	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS: CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE: (EACH UNIT)			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION: *		
FOR VOLTAGES UP TO 165 VOLTS	0.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS
PENTODE GRID 1 CIRCUIT RESISTANCE:*		
WITH CATHODE BIAS	1.0	MEGOHM
WITH FIXED BIAS	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

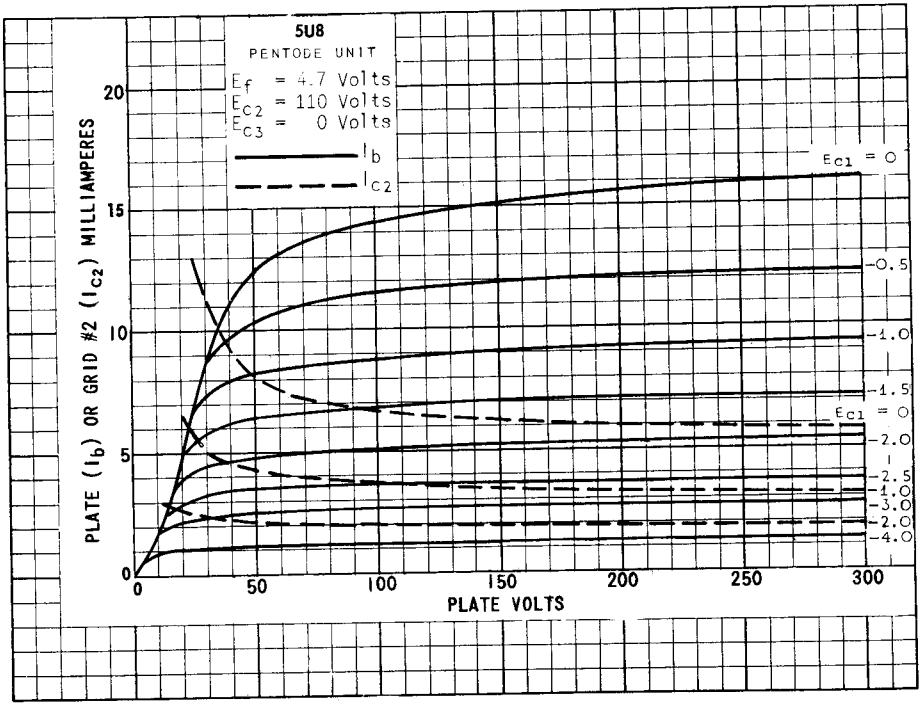
	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	----	110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	7500	5000	μMHOS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT	----	3.5	MA.
PLATE RESISTANCE (APPROX.)	----	0.2	MEGOHM
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-8	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V; Ec2=70 V)*	----	5500	μMHOS

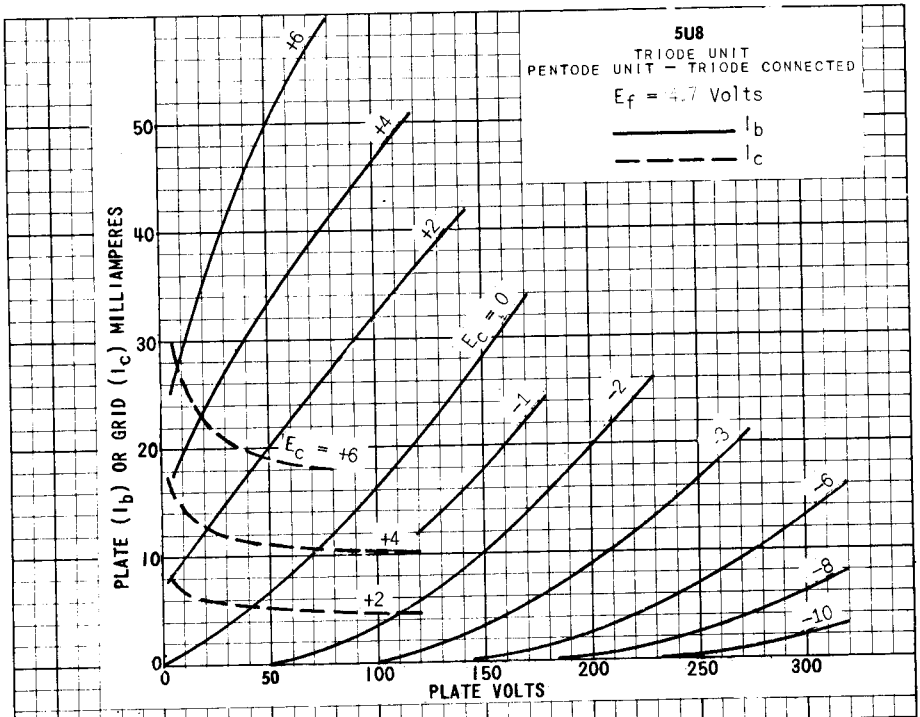
A
EXTERNAL SHIELD 315 CONNECTED TO PIN 4.

B
EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

C
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.
* INDICATES AN ADDITION.





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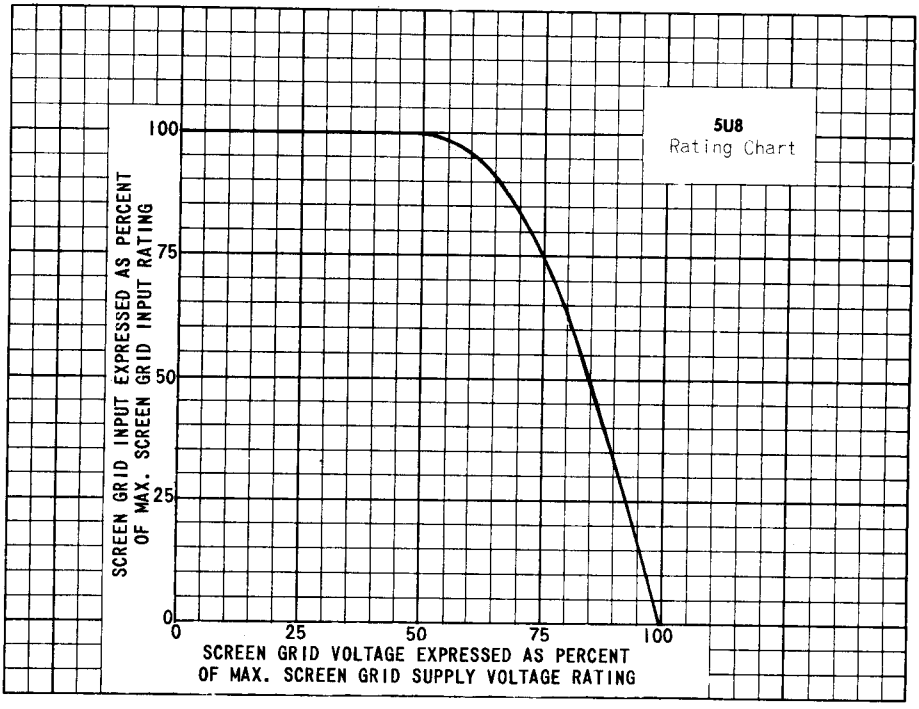
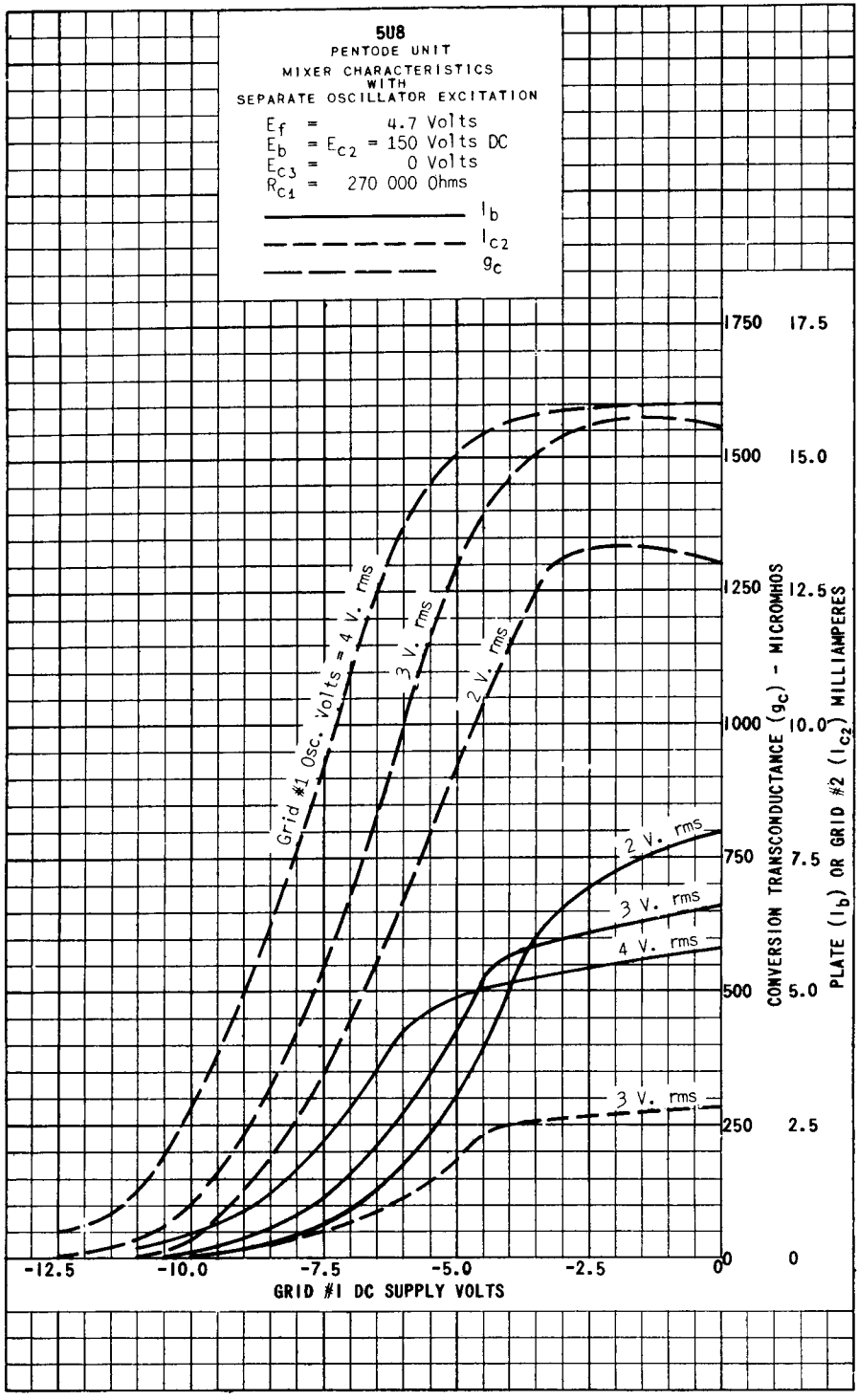
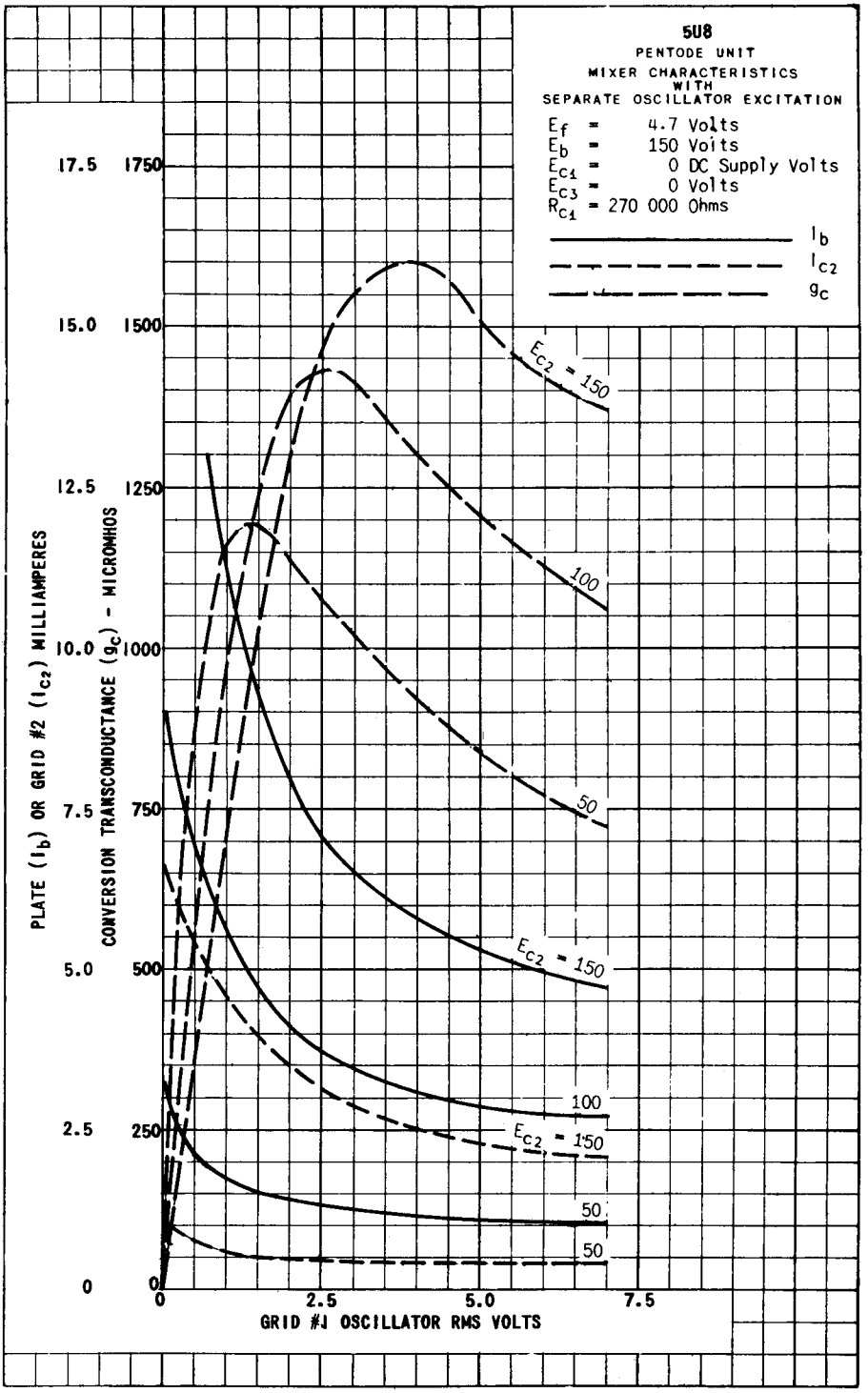

5U8
Rating Chart
SCREEN GRID INPUT EXPRESSED AS PERCENT OF MAX. SCREEN GRID INPUT RATING
100
75
50
25
0
0
25
50
75
100
SCREEN GRID VOLTAGE EXPRESSED AS PERCENT OF MAX. SCREEN GRID SUPPLY VOLTAGE RATING

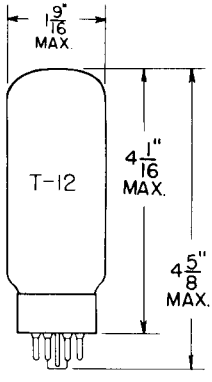


PRINTED IN U. S. A.


5U8
PENTODE UNIT
MIXER CHARACTERISTICS
WITH
SEPARATE OSCILLATOR EXCITATION
Ef = 4.7 Volts
Eb = 150 Volts
Ec1 = 0 DC Supply Volts
Ec3 = 0 Volts
Rc1 = 270 000 Ohms
Ib
Ic2
gc
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
CONVERSION TRANSCONDUCTANCE (gc) - MICROMHOS
GRID #1 OSCILLATOR RMS VOLTS
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
1750
1500
1250
1000
750
500
250
0
2.5
5.0
7.5
Ec2 = 150
100
50
Ec2 = 150
100
Ec2 = 150
50
50

TUNG-SOL

TWIN DIODE



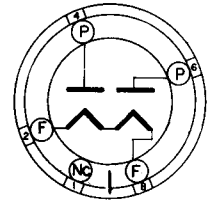
GLASS BULB

COATED FILAMENT

5.0 VOLTS 3.8 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT-MEDIUM SHELL
8 PIN OCTAL
5T

THE 5V3 IS A FILAMENTARY, FULL-WAVE, HIGH VACUUM RECTIFIER DESIGNED FOR SERVICE IN THE POWER SUPPLY OF COLOR TELEVISION RECEIVERS OR OTHER EQUIPMENT REQUIRING HIGH CURRENT.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE [B]

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS (SEE RATING CHART #1)	500	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE) (SEE RATING CHART #2)	1.2	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE) (SEE RATING CHART #3)	5.5	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	

[B] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CPS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER – CAPACITOR INPUT FILTER

FILAMENT VOLTAGE	5.0		VOLTS
FILAMENT CURRENT	3.8		AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS [C]	300	425	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE SUPPLY RESISTANCE (EACH PLATE)	24	56	OHMS
DC OUTPUT CURRENT	380	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	285	430	VOLTS

[C] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

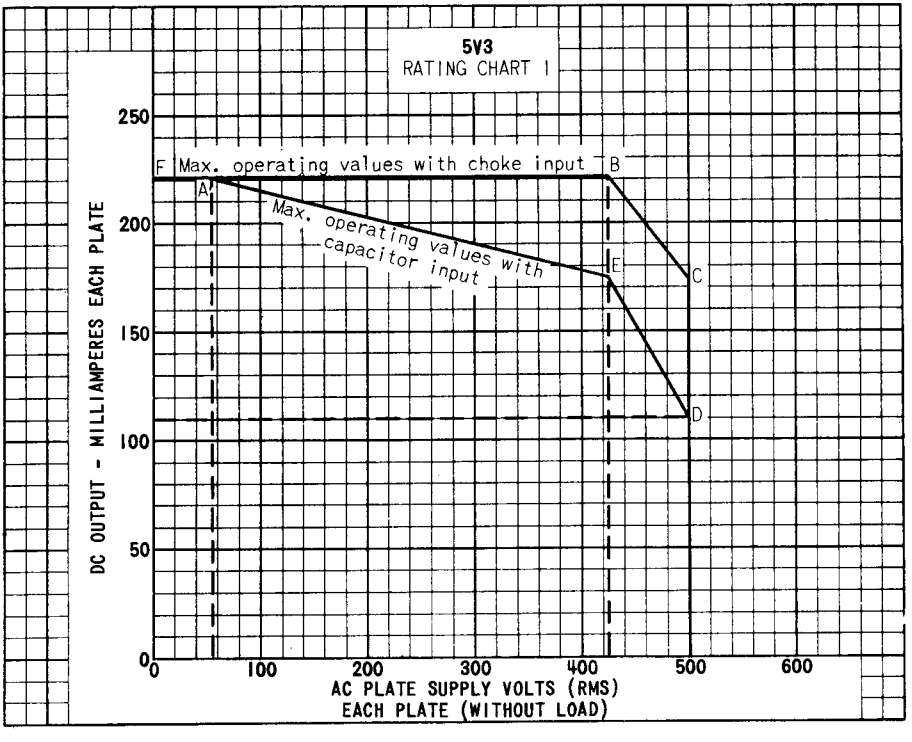
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

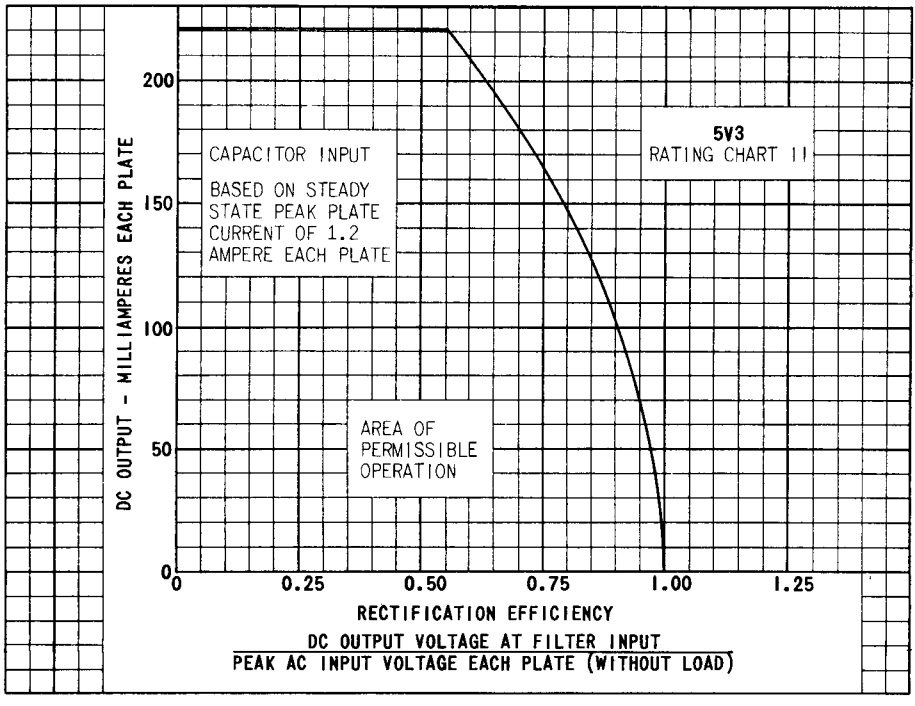
FULL WAVE RECTIFIER – CHOKE INPUT FILTER

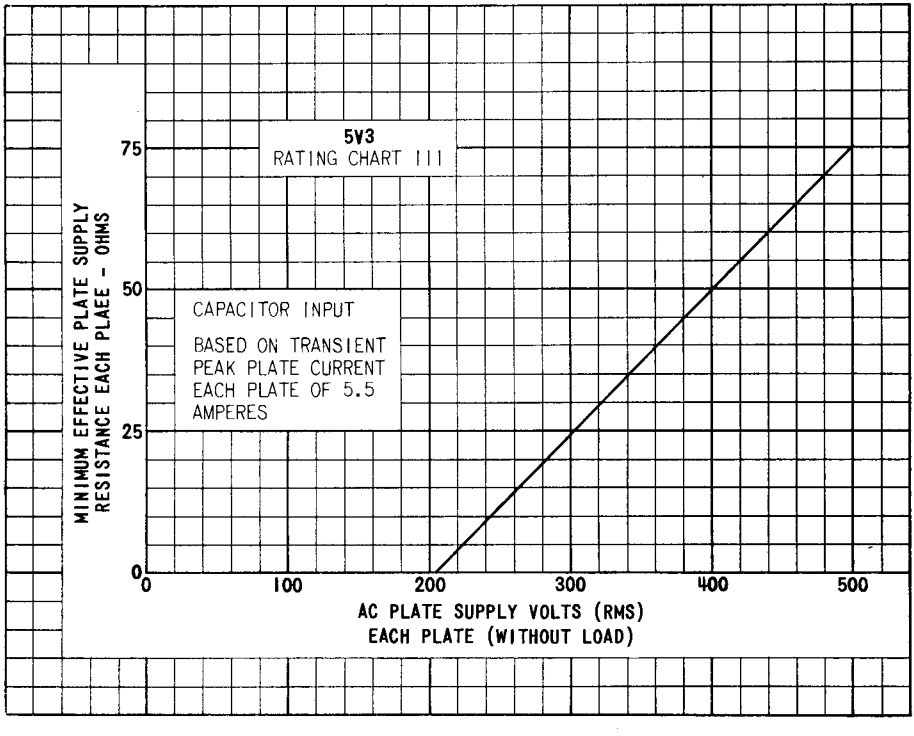
FILAMENT VOLTAGE	5.0	VOLTS
FILAMENT CURRENT	3.8	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[C]	500	VOLTS
FILTER INPUT CHOKE	10	HENRYS
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	385	VOLTS
TUBE VOLTAGE DROP TUBE CONDUCTING 350 MA. (EACH PLATE)*	47	VOLTS

[C] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

* INDICATES AN ADDITION.

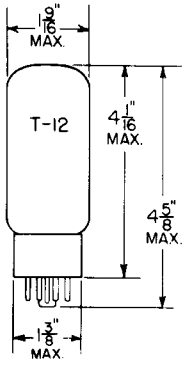



DC OUTPUT - MILLIAMPERES EACH PLATE
200
150
100
50
0
CAPACITOR INPUT
BASED ON STEADY STATE PEAK PLATE CURRENT OF 1.2 AMPERE EACH PLATE
5V3
RATING CHART II
AREA OF PERMISSIBLE OPERATION
0
0.25
0.50
0.75
1.00
1.25
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLAEE - OHMS
75
50
25
0
5V3
RATING CHART III
CAPACITOR INPUT
BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 5.5 AMPERES
0
100
200
300
400
500
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)

TUNG-SOL

TWIN DIODE



GLASS BULB

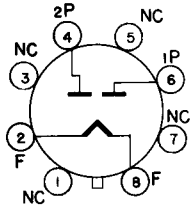
TUBE OUTLINE
JEDEC 12-16

COATED FILAMENT

5.0 VOLTS 3.0 AMP.

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

SHORT MEDIUM SHELL
8 PIN OCTAL
WITH BARRIER

BASING DIAGRAM

JEDEC 5T

THE 5V3A IS A FILAMENTARY FULL WAVE, HIGH VACUUM RECTIFIER DESIGNED FOR SERVICE IN THE POWER SUPPLY OF TELEVISION RECEIVERS OR OTHER EQUIPMENT REQUIRING HIGH CURRENTS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

RECTIFIER SERVICE[C]

FILAMENT VOLTAGE	5.0±0.5	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1550	VOLTS
MAXIMUM RMS AC PLATE SUPPLY VOLTAGE (EACH PLATE)	550	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT(EA. PLATE)	1.4	AMP.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE)	6.6	AMP.
MAXIMUM DC OUTPUT CURRENT (CONDENSER INPUT) WITH AC PLATE SUPPLY VOLTAGE OF 470 VOLTS (RMS)	415	MA.
MAXIMUM BULB TEMPERATURE	240	°C
TUBE VOLTAGE DROP, TUBE CONDUCTING 350MA (EA. PLATE)	42	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER–CAPACITOR INPUT FILTER

AC PLATE SUPPLY VOLTAGE (EA. PLATE)RMS[D]	300	425	VOLTS
FILTER INPUT CAPACITOR	40	40	μf
EFFECTIVE PLATE SUPPLY RESISTANCE (EA. PLATE)	20	50	OHMS
DC OUTPUT CURRENT	380	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	300	440	VOLTS

FULL WAVE RECTIFIER–CHOKE INPUT FILTER

AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS[D]	500	VOLTS
FILTER INPUT CHOKE	10	HENRY
DC OUTPUT CURRENT	350	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	390	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

NOTES

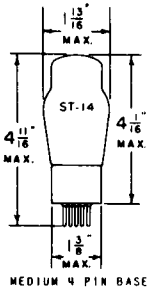
[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] FOR USE WITH SINUSOIDAL SUPPLY VOLTAGES WITHIN THE FREQUENCY RANGE OF 25 TO 1000 CYCLES.

[D] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

[E] FILAMENT CURRENT AT 5.0 VOLTS.

TUNG-SOL



MEDIUM 4 PIN BASE
83V

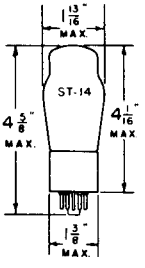
FULL WAVE

HIGH VACUUM RECTIFIER

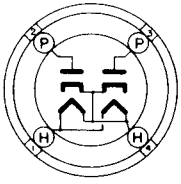
UNIPOTENTIAL CATHODE

HEATER
5.0 VOLTS 2.0 AMPERES
AC

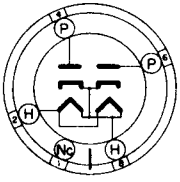
GLASS BULB



MEDIUM 5 PIN OCTAL BASE
5V4G



4L
BOTTOM VIEW



G-5L
BOTTOM VIEW

THE TUNG-SOL 5V4G AND 83V ARE POWER RECTIFIERS WITH LOW INTERNAL VOLTAGE DROPS. THEY ARE DESIGNED FOR SERVICE IN AC OPERATED RECEIVERS THAT REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1400	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	525	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	375	VOLTS
DC OUTPUT CURRENT MAX.	175	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. A	65	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	500	VOLTS
DC OUTPUT CURRENT MAX.	175	MA.
VALUE OF INPUT CHOKE MIN. A	4.0	HENRYS
TUBE VOLTAGE DROP AT 175 MA. PER PLATE	23	VOLTS

PLATE 699-2

FEB. 15 1940

A WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

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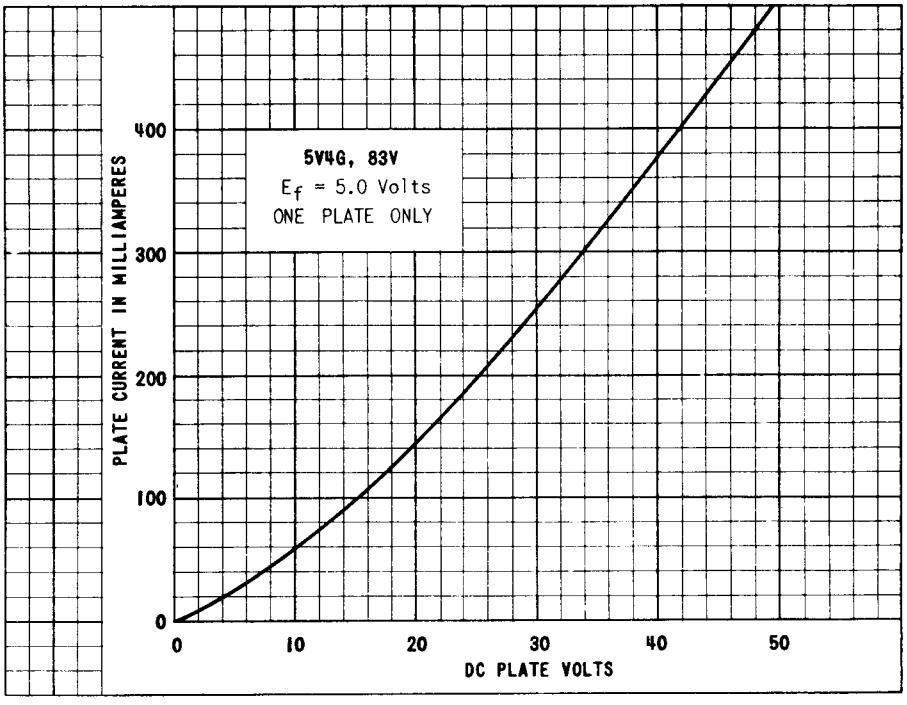
5V4G (83V)



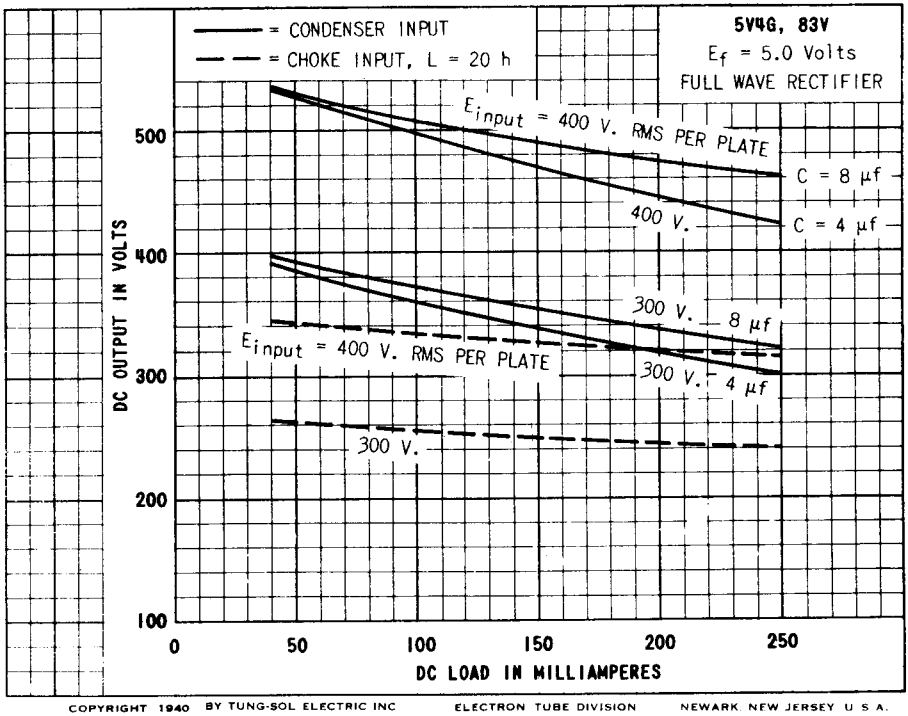


PLATE 700-1

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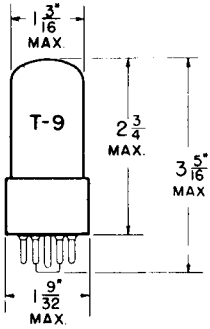
TUNG-SOL

BEAM PENTODE

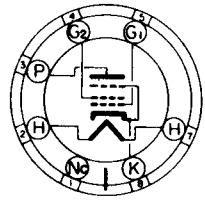


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
4.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7S

THE 5V6GT IS A BEAM POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF 600 MA. SERIES HEATER OPERATED TV RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6V6GT.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	9.0	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER - TRIODE CONNECTION[AB]

HEATER VOLTAGE	4.7	VOLTS
MAXIMUM DC PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	1200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	35	MA.
MAXIMUM PEAK CATHODE CURRENT	105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	4.7	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	-13.0	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	4.5	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	4	7	6	MA.
PLATE RESISTANCE (APPROX.)	50 000	50 000	80 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	µMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	2	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	8	8	12	PERCENT

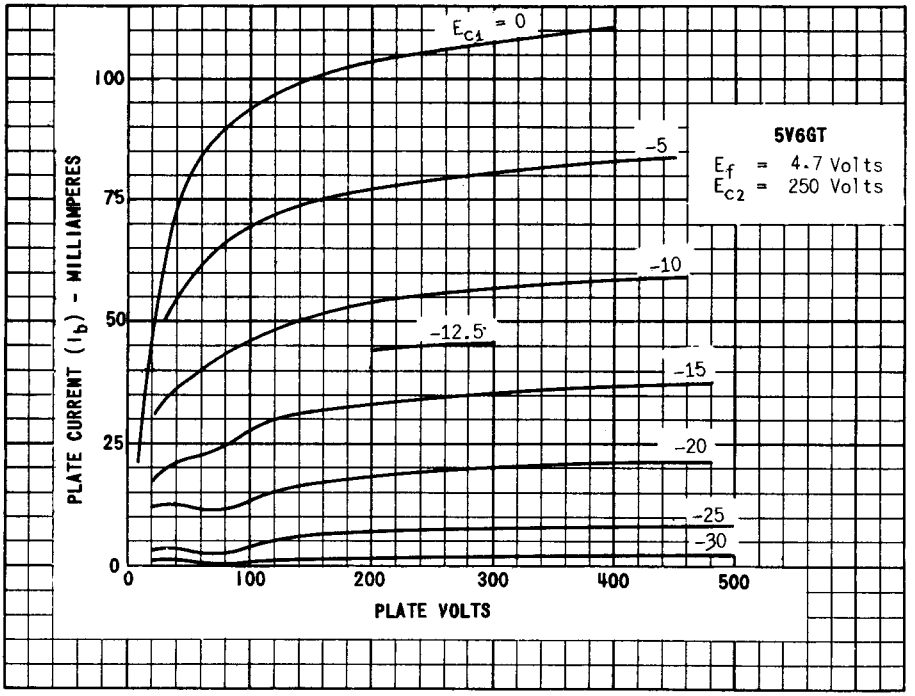
CLASS A_1 AMPLIFIER – PUSH-PULL

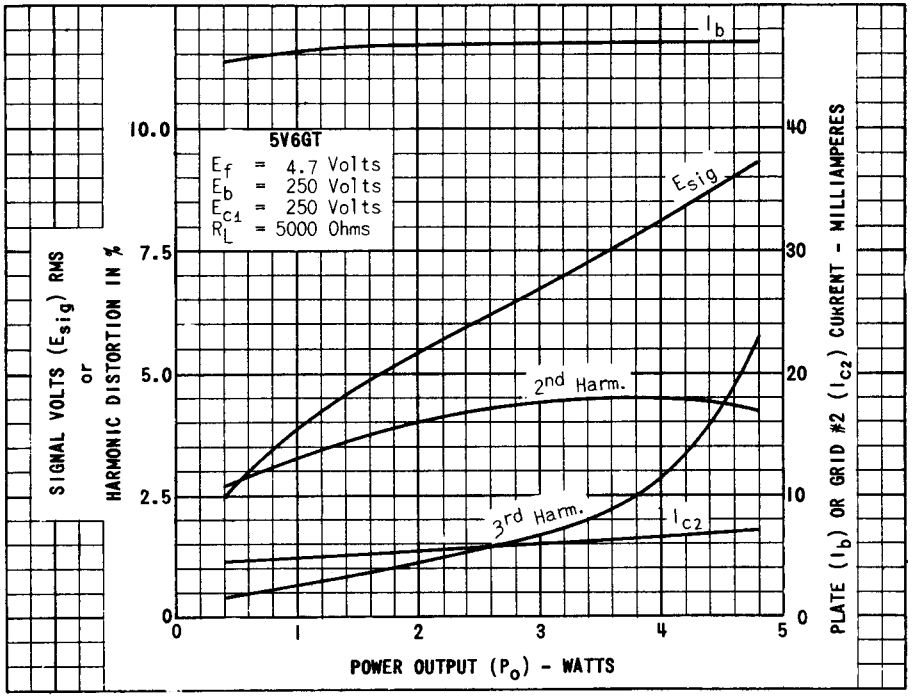
UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

HEATER VOLTAGE	4.7	4.7	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	250	285	VOLTS
GRID #2 VOLTAGE	250	285	VOLTS
GRID #1 VOLTAGE	-15	-19	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	30	38	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	70	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	92	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	13	13.5	MA.
PLATE-TO-PLATE LOAD RESISTANCE	10 000	8 000	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	10	14	WATTS
TOTAL HARMONIC DISTORTION	5	3.5	PERCENT

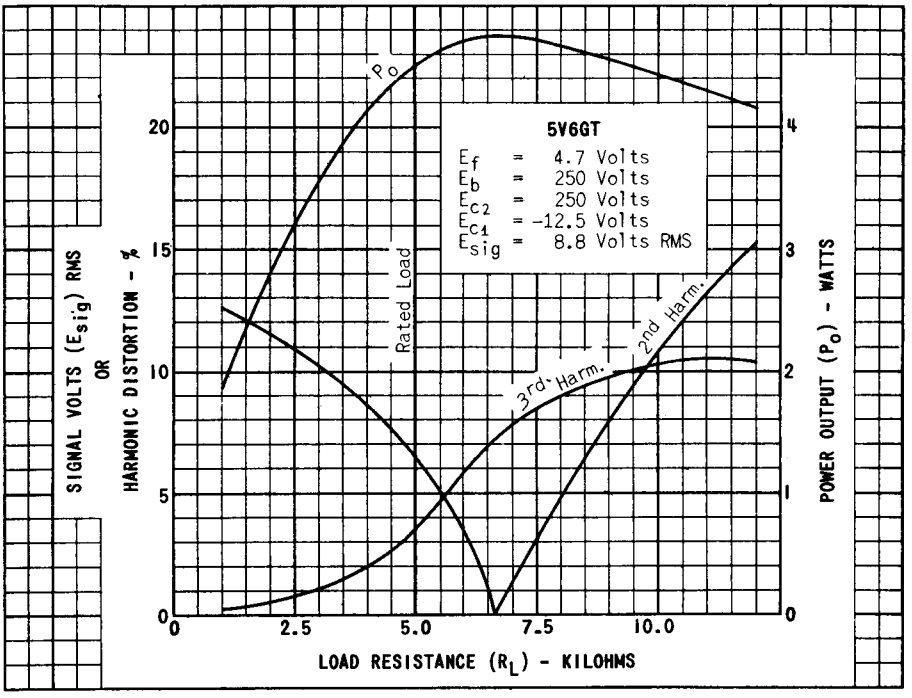
CLASS A_1 AMPLIFIER – TRIODE CONNECTION

HEATER VOLTAGE	4.7	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	5 000	µMHOS
AMPLIFICATION FACTOR	9.8	
PLATE RESISTANCE (APPROX.)	1 960	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-36	VOLTS


E_{c1} = 0
-5
-10
-12.5
-15
-20
-25
-30
5V6GT
E_f = 4.7 Volts
E_{c2} = 250 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
100
200
300
400
500


5V6GT
E_f = 4.7 Volts
E_b = 250 Volts
E_{c1} = 250 Volts
R_L = 5000 Ohms
I_b
E_{sig}
2nd Harm.
3rd Harm.
I_{c2}
SIGNAL VOLTS (E_{sig}) RMS
or
HARMONIC DISTORTION IN %
PLATE (I_b) OR GRID #2 (I_{c2}) CURRENT - MILLIAMPERES
POWER OUTPUT (P_o) - WATTS
0
2.5
5.0
7.5
10.0
0
10
20
30
40
0
1
2
3
4
5

5V6GT



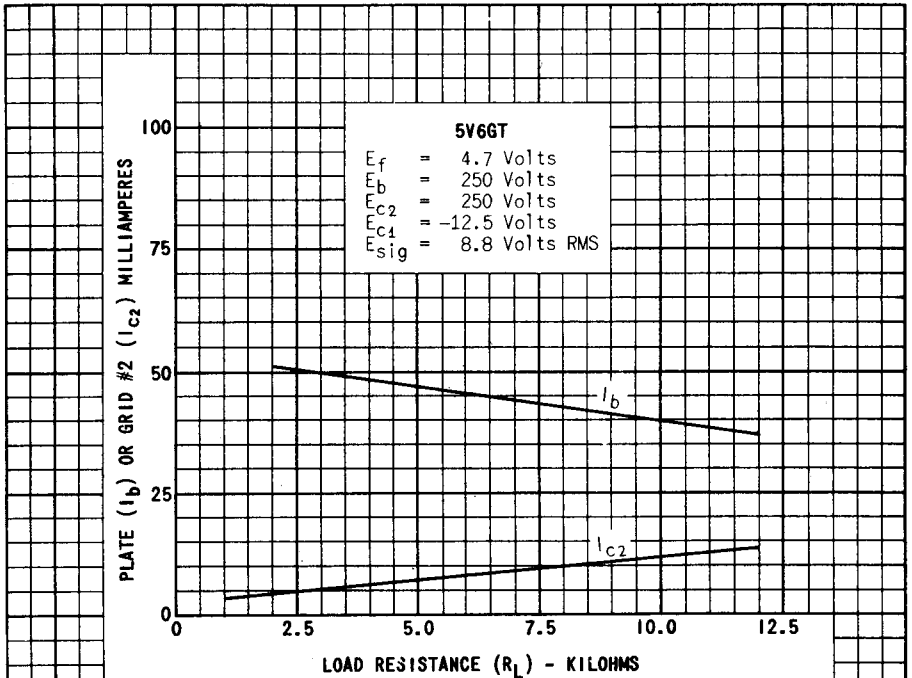
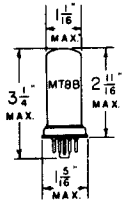


PLATE #4033 OCTOBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

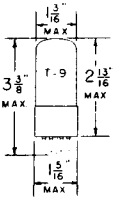
TUNG-SOL



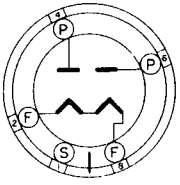
METAL SHELL
5 PIN OCTAL BASE
5W4

FULL WAVE
HIGH VACUUM RECTIFIER

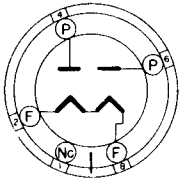
COATED FILAMENT
5.0 VOLTS 1.5 AMPERES
AC



GLASS BULB
INTERMEDIATE 5 PIN OCTAL BASE
5W4GT/G



5T
BOTTOM VIEW
5W4



G-5Ta
BOTTOM VIEW
5W4GT/G

THE TUNG-SOL 5W4 AND 5W4GT/G ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS) CONDENSER INPUT PER PLATE	350	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS) CHOKE INPUT PER PLATE	500	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1400	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	300	MA.
TUBE VOLTAGE DROP AT 100 MA. PER PLATE	45	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)	350	VOLTS
DC OUTPUT CURRENT MAX.	100	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	25	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)	500	VOLTS
DC OUTPUT CURRENT MAX.	100	MA.
VALUE OF INPUT CHOKE MIN.	6	HENRYS

A WHEN FILTER CONDENSERS LARGER THAN 40 MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 991-2

JAN.-31 1941

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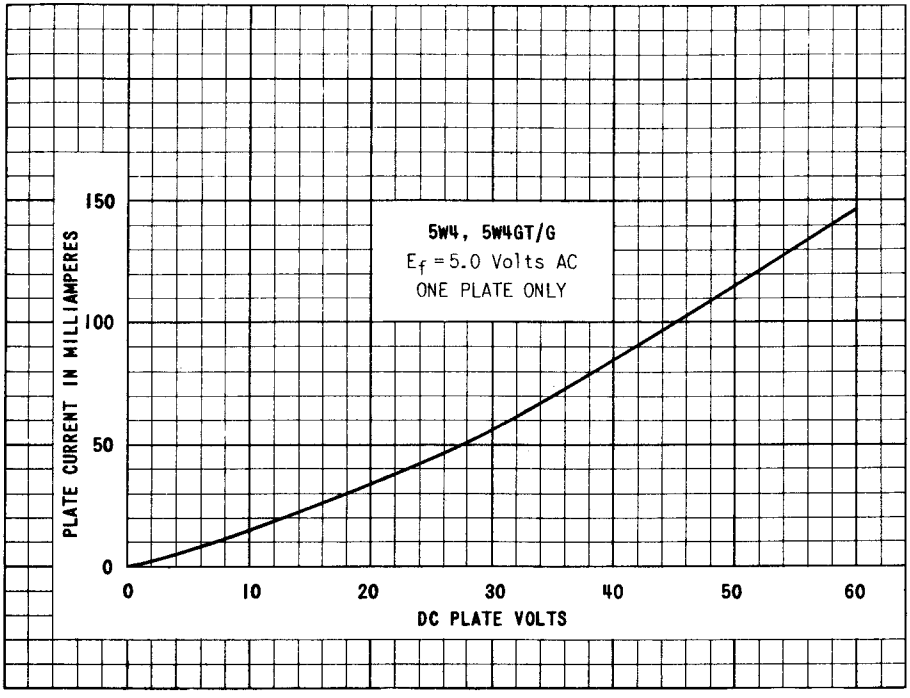
5W4, 5W4GT/G



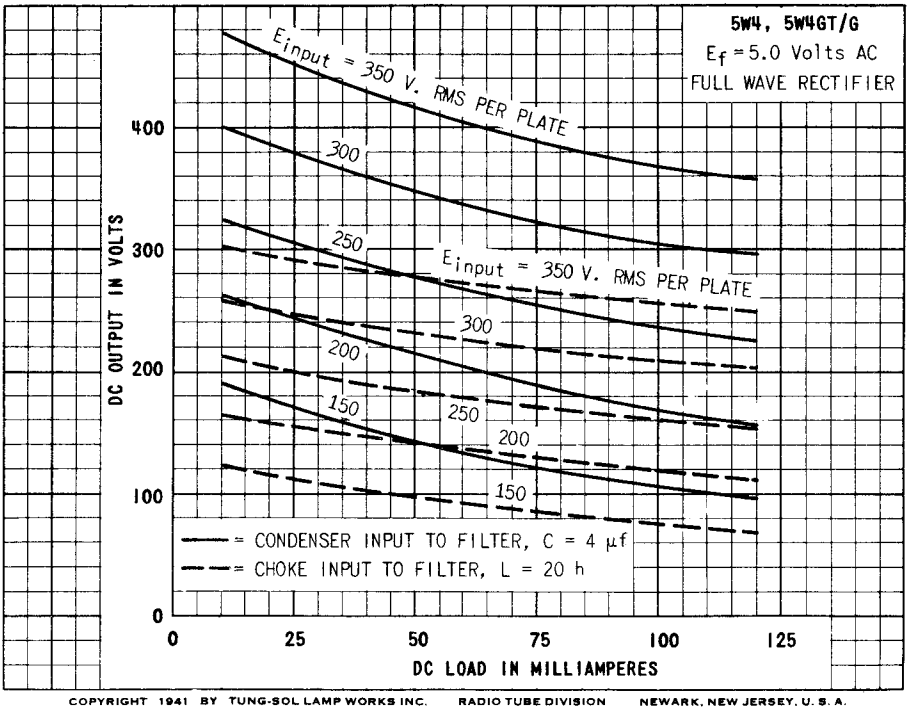


PLATE
992-2

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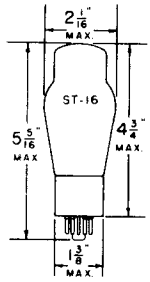
TUNG-SOL



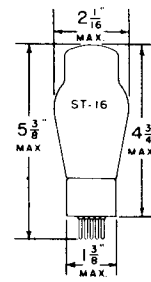
5U4G – MEDIUM 5 PIN OCTAL BASE
5X4G – MEDIUM 8 PIN OCTAL BASE

FULL WAVE
HIGH VACUUM RECTIFIER

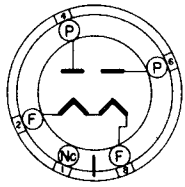
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

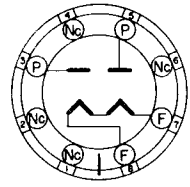
GLASS BULB



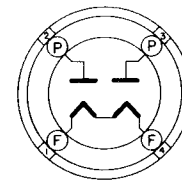
5Z3 – MEDIUM 4 PIN BASE



G-5Ta
BOTTOM VIEW
5U4G



G-5Q
BOTTOM VIEW
5X4G



4C
BOTTOM VIEW
5Z3

THE TUNG-SOL 5U4G, 5X4G AND 5Z3 ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS WHICH REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	675	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	75	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
VALUE OF INPUT CHOKE MIN.	3	HENRYS
TUBE VOLTAGE DROP AT 225 MA. PER PLATE	58	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

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PLATE 689-2

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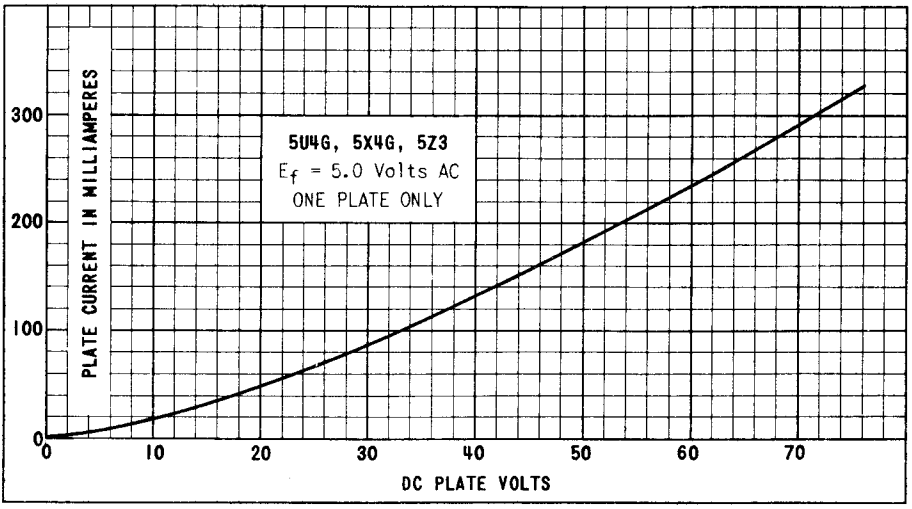
5X4G (5U4G, 5Z3)



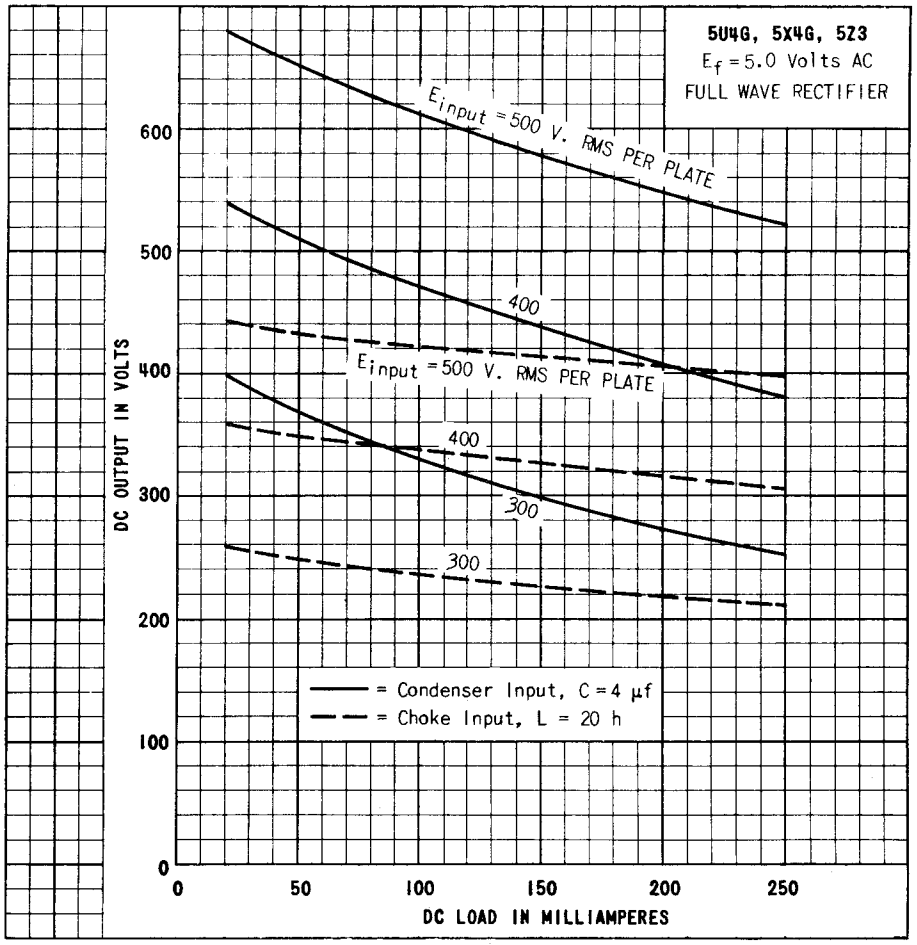


PLATE
690-1

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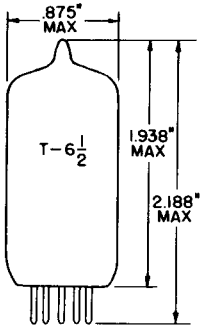
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

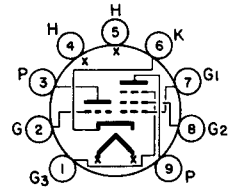
COATED UNIPOTENTIAL CATHODE

FOR USE AS A COMBINED

OSCILLATOR AND MIXER

IN AM-FM RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AK

THE 5X8 IS A MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A MEDIUM-MU TRIODE AND A SHARP CUTOFF PENTODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS A COMBINED OSCILLATOR AND MIXER TUBE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC/S. IT IS ESPECIALLY USEFUL IN AM/FM RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE:			
PG1 TO PP MAX.	0.06	0.09	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)	4.8	4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG2+PG3)	1.6	0.9	pf
CATHODE TO HEATER: K TO H	6.0[B]	6.0	pf
TRIODE GRID TO TRIODE PLATE: TG TO TP	1.5	1.5	pf
TRIODE INPUT: TG TO (H+K)	2.4	2.0	pf
TRIODE OUTPUT: TP TO (H+K)	1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE:			
PG1 TO TP MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: PP TO TP MAX.	0.008	0.05	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

[B] EXTERNAL SHIELD 315 CONNECTED TO PIN 9.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	4.7 VOLTS	600	MA.
HEATER WARM-UP TIME[C]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION - SEE RATING CHART	0.45	WATT
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS

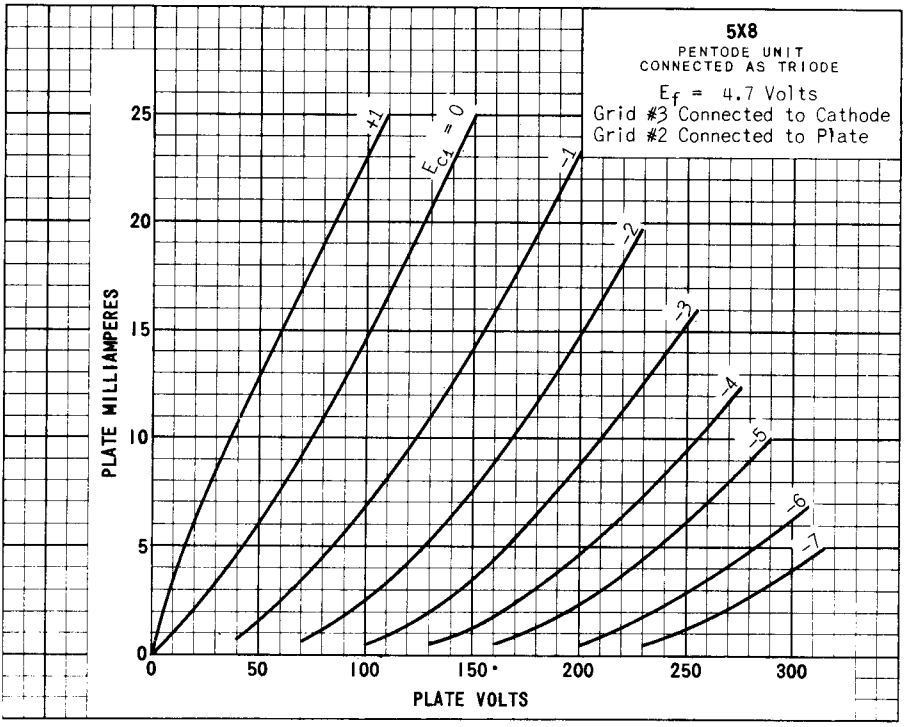
TYPICAL OPERATING CHARACTERISTICS

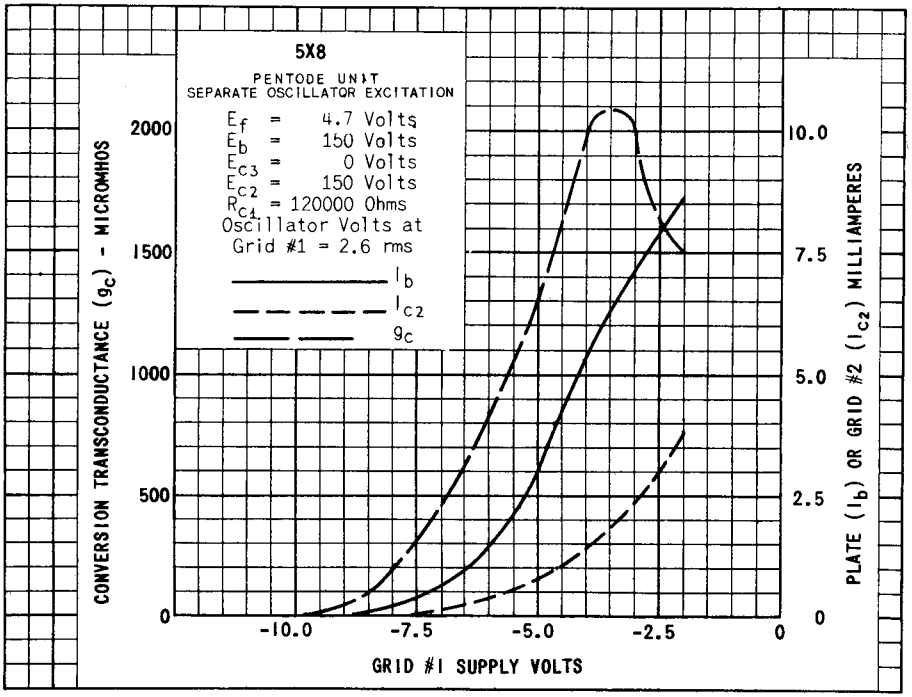
CLASS A1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO PIN 6 AT SOCKET		
GRID 2 VOLTAGE	-----	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
GRID 2 CURRENT	-----	2.2	MA.
PLATE CURRENT	12.0	9.0	MA.
TRANSCONDUCTANCE	6500	5500	μMHOS
AMPLIFICATION FACTOR	40	-----	
PLATE RESISTANCE (APPROX.)	6000	300,000	OHMS
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA.	-7	-6.5	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V., Ec2=70 V)	-----	5700	μMHOS

C

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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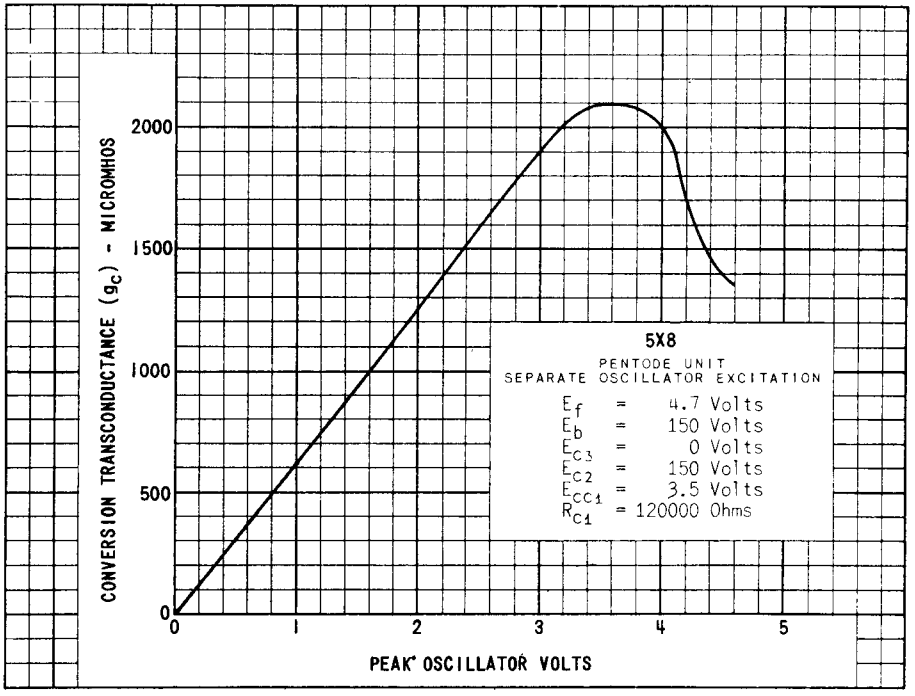
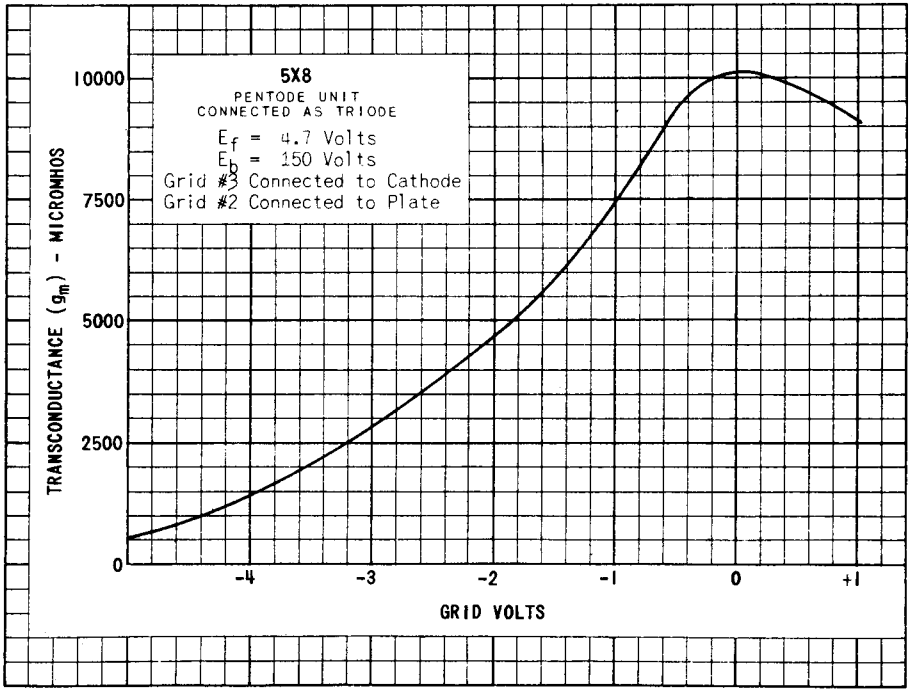
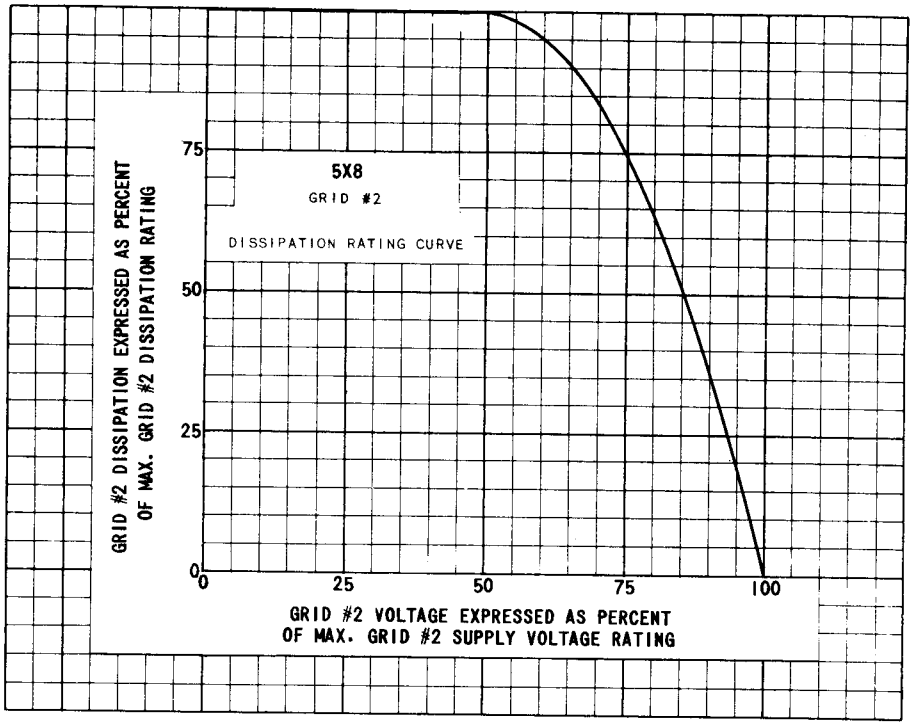

CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
5X8
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 4.7 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
E_{cc_1} = 3.5 Volts
R_{c_1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS
5X8
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 4.7 Volts
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate



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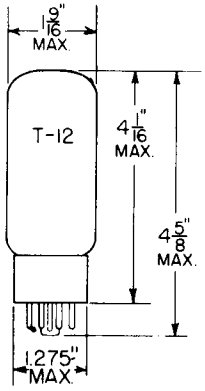
TUNG-SOL

TWIN DIODE

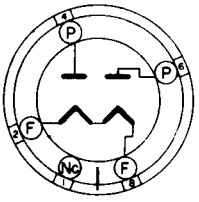


GLASS BULB

COATED FILAMENT
5.0 VOLTS 2.0 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS 1 AND 4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM SHELL
5 PIN OCTAL
5T

THE 5Y3GA IS A FILAMENTARY, FULL WAVE, GENERAL PURPOSE RECTIFIER EMPLOYING A T-12 ENVELOPE. ELECTRICALLY, IT IS IDENTICAL TO THE TYPE 5Y3G. EXCEPT FOR BASING, IT IS IDENTICAL TO THE TYPE 5Y4GA.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE	SEE RATING CHART	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	400	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	2.2	AMPERES
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE	SEE RATING CHART	
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 125 MA. EACH PLATE)	60	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER SERVICE

	CAPACITOR INPUT	CHOKE INPUT	
FILAMENT VOLTAGE	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	AMPERES
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	350	500	VOLTS
INPUT CAPACITOR	10		μf
INPUT CHOKE		10	HENRYS
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50		OHMS
DC OUTPUT CURRENT	125	125	MA.
DC OUTPUT VOLTAGE	350	390	VOLTS

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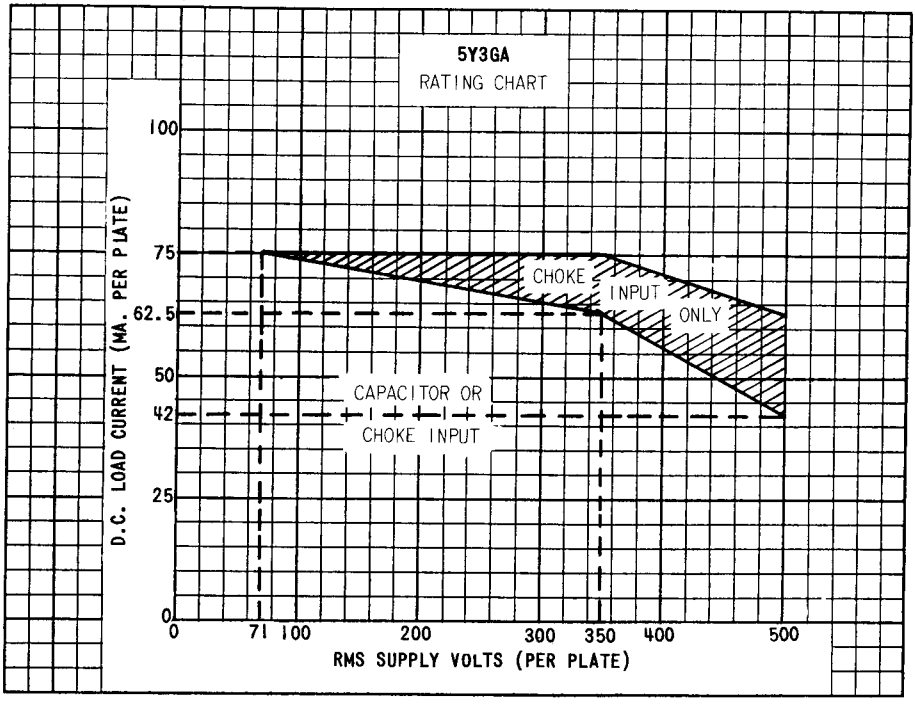
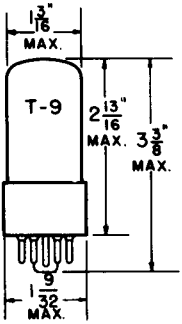

5Y3GA
RATING CHART
D.C. LOAD CURRENT (MA. PER PLATE)
100
75
62.5
50
42
25
0
CHOKE INPUT ONLY
CAPACITOR OR CHOKE INPUT
0
71
100
200
300
350
400
500
RMS SUPPLY VOLTS (PER PLATE)

TUNG-SOL

DOUBLE DIODE



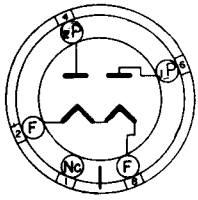
GLASS BULB

COATED FILAMENT

5.0 VOLTS 2.0 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

5Y3GT - HORIZONTAL OPERATION PERMITTED ← IF PINS #2 AND #4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
INTERMEDIATE SHELL
5 PIN OCTAL
5T

THE 5Y3GT IS DESIGNED FOR USE AS A POWER RECTIFIER IN AC OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	SEE CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE [A]	440	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE [B]	2.5	AMP.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 125 MA. EACH PLATE)	50	VOLTS
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE	SEE CHART #1	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	INPUT TO FILTER CAPACITOR	INPUT TO FILTER CHOKE	
FILAMENT VOLTAGE	5.0	5.0	VOLTS
FILAMENT CURRENT	2.0	2.0	AMP.
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	350	500	VOLTS
INPUT CAPACITOR	20	—	μf
INPUT CHOKE	—	10	HENRIES
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50	—	OHMS
DC OUTPUT CURRENT	125	125	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	360	380	VOLTS

AC PLATE SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

[A] SEE CHART #2

[B] SEE CHART #3

SIMILAR TYPE REFERENCE: Electrically similar to 5Y4G and 80.

→ INDICATES A CHANGE.

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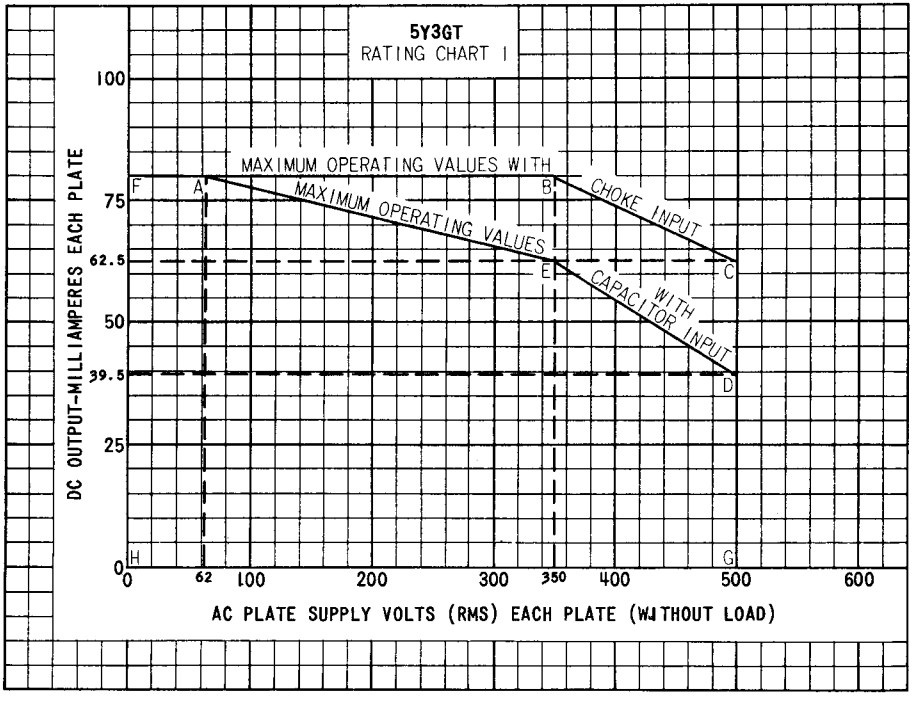
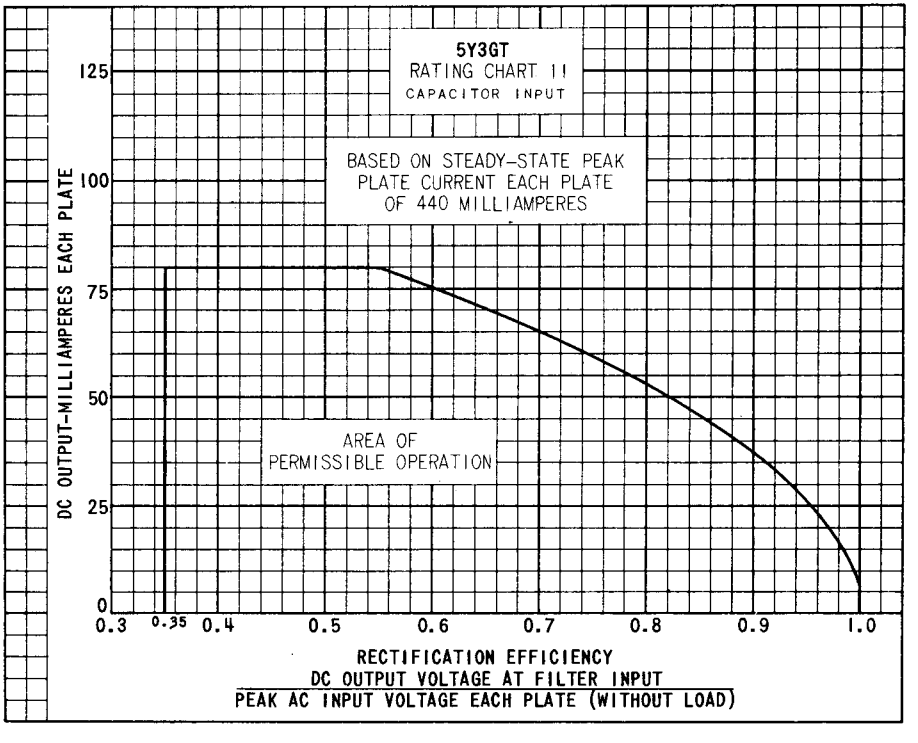
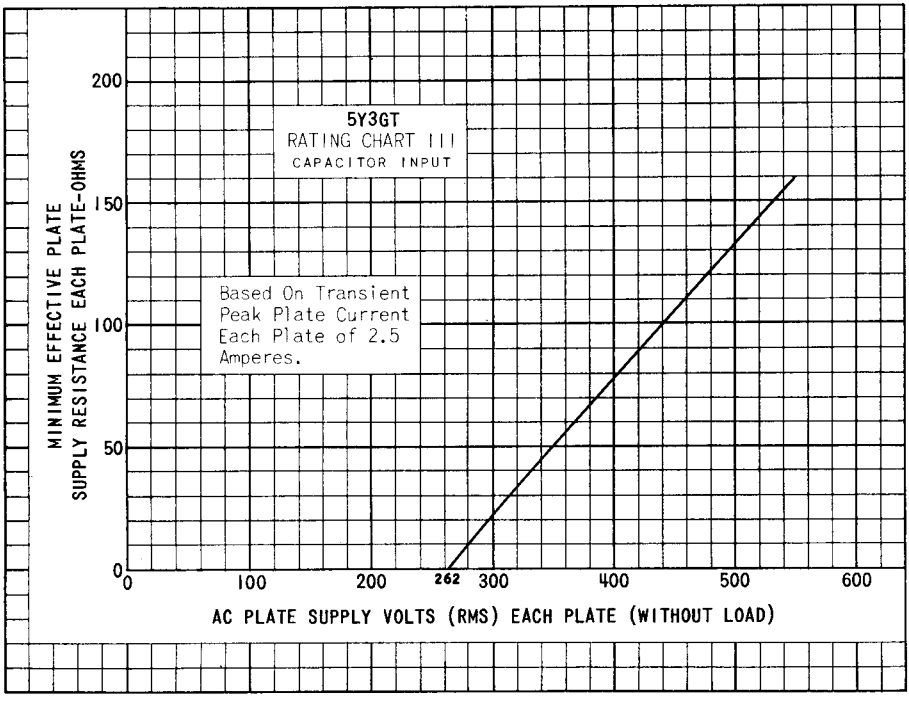
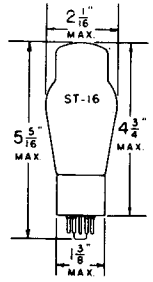
5Y3GT (5Y4G, 80)






5Y3GT
RATING CHART III
CAPACITOR INPUT
Based On Transient Peak Plate Current Each Plate of 2.5 Amperes.
MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE-OHMS
200
150
100
50
0
0
100
200
262
300
400
500
600
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE (WITHOUT LOAD)

TUNG-SOL



5U4G - MEDIUM 5 PIN OCTAL BASE
5X4G - MEDIUM 8 PIN OCTAL BASE

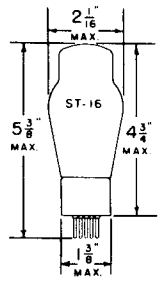
FULL WAVE

HIGH VACUUM RECTIFIER

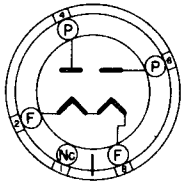
COATED FILAMENT

5.0 VOLTS 3.0 AMPERES
AC

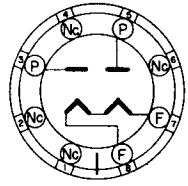
GLASS BULB



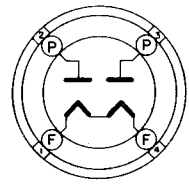
5Z3 - MEDIUM 4 PIN BASE



G-5Ta
BOTTOM VIEW
5U4G



G-5Q
BOTTOM VIEW
5X4G



4C
BOTTOM VIEW
5Z3

THE TUNG-SOL 5U4G, 5X4G AND 5Z3 ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS WHICH REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	675	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. A	75	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	VOLTS
DC OUTPUT CURRENT MAX.	225	MA.
VALUE OF INPUT CHOKE MIN.	3	HENRYS
TUBE VOLTAGE DROP AT 225 MA. PER PLATE	58	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μfds ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CONTINUED NEXT PAGE

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PLATE 691-2

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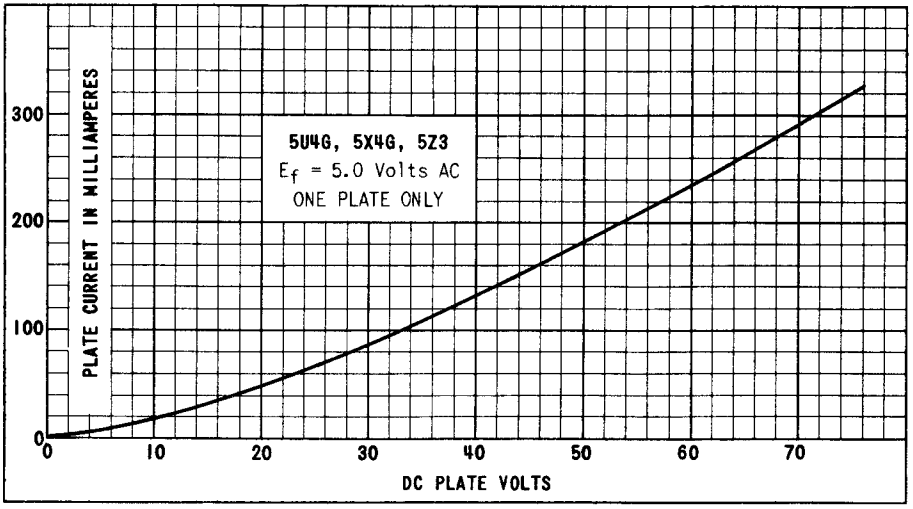
5Z3 (5U4G, 5X4G)



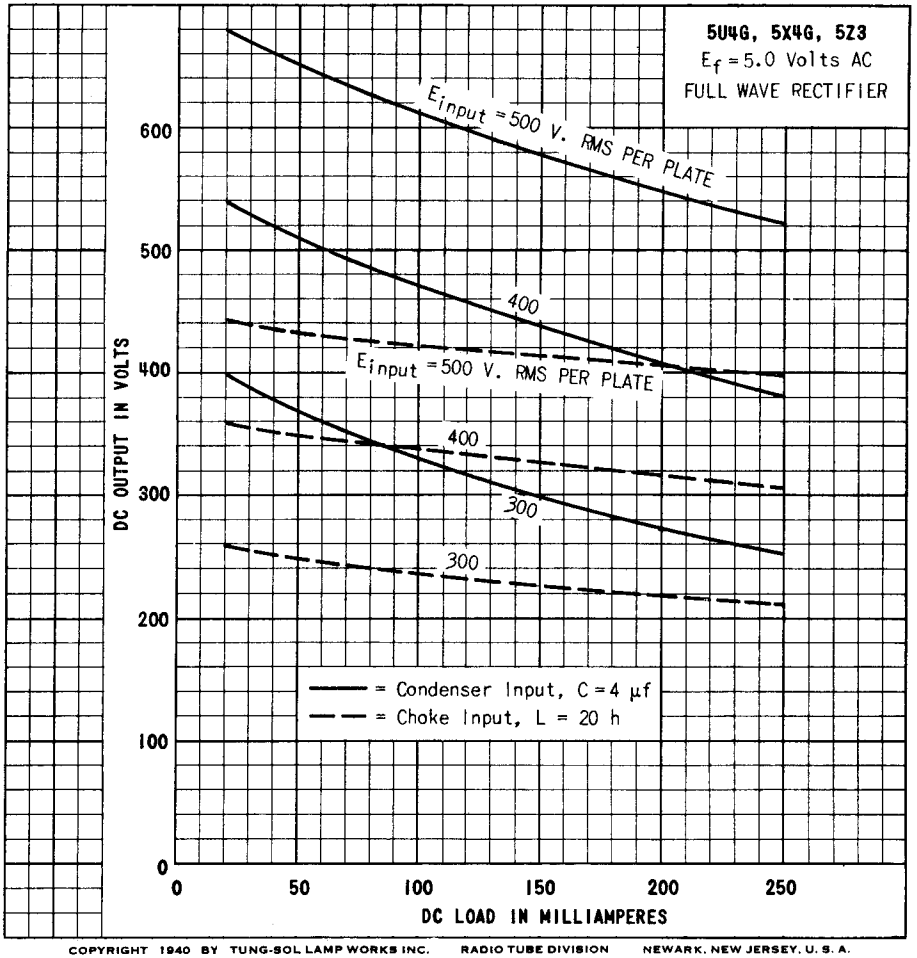


PLATE 692-1

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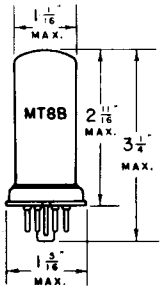
TUNG-SOL

FULL WAVE

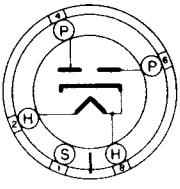
HIGH VACUUM RECTIFIER



UNIPOTENTIAL CATHODE

HEATER
5.0 VOLTS 2.0 AMPERES
AC

METAL SHELL



5L

BOTTOM VIEW

5 PIN OCTAL BASE

THE TUNG-SOL 5Z4 IS DESIGNED FOR SERVICE AS A POWER RECTIFIER IN AC OPERATED RECEIVERS.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1400	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	375	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	350	VOLTS
DC OUTPUT CURRENT MAX.	125	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. A	30	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	500	VOLTS
DC OUTPUT CURRENT MAX.	125	MA.
VALUE OF INPUT CHOKE MIN.	5	HENRYS
TUBE VOLTAGE DROP AT 125 MA. PER PLATE	20	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

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PLATE 705-2

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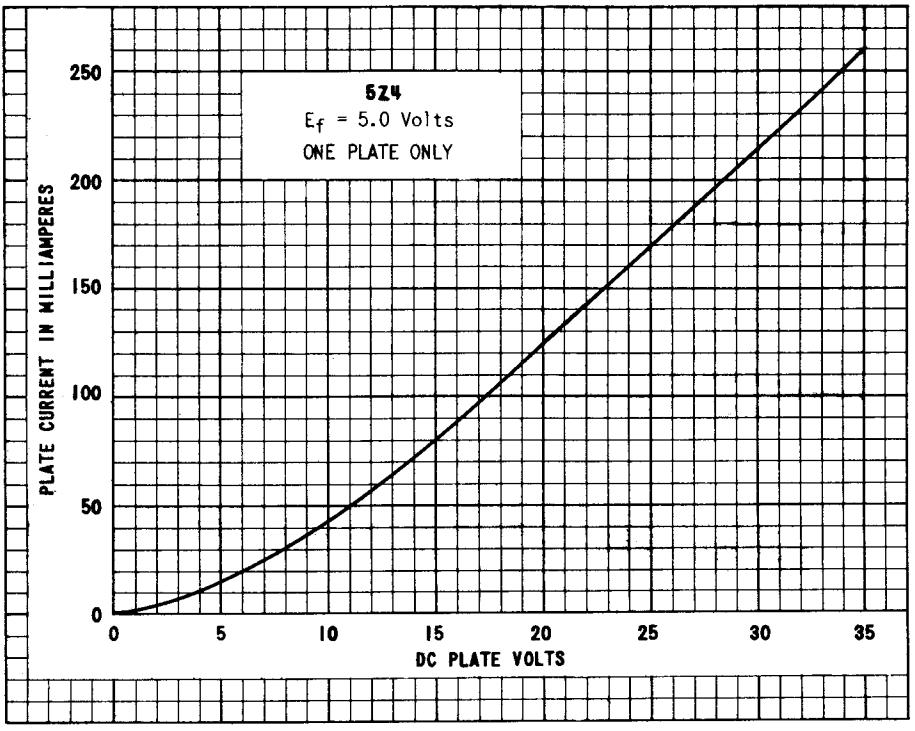
5Z4



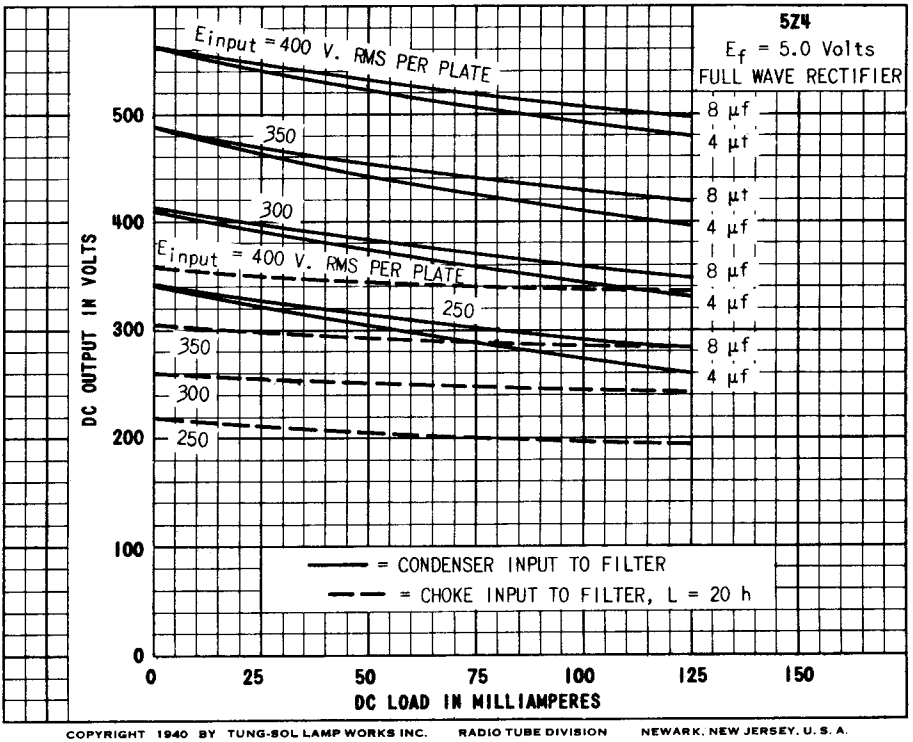


PLATE
706-1

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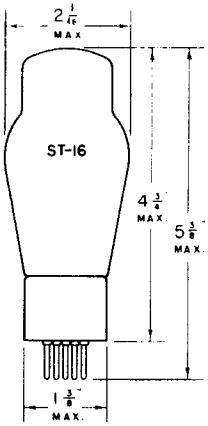
TUNG-SOL



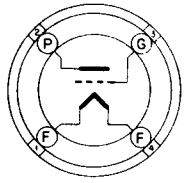
TRIODE POWER AMPLIFIER

COATED FILAMENT

6.3 VOLTS 1.0 AMPERE
AC OR DC

GLASS BULB

MEDIUM 4 PIN BASE



4D
BOTTOM VIEW

THE TUNG-SOL 6A3 IS A FILAMENT TYPE TRIODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AUDIO AMPLIFIERS WHERE HIGH OUTPUT AND LOW HARMONIC DISTORTION ARE DESIRED. ITS RATINGS AND CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 2A3 AND 6B4G.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER – ONE TUBE

PLATE VOLTAGE MAX.	250	VOLTS
GRID VOLTAGE [G]	–45	VOLTS
GRID CIRCUIT RESISTANCE MAX.		
FIXED BIAS	0.05	MEGOHM
SELF BIAS	0.5	MEGOHM
PLATE CURRENT	60	MA.
PLATE RESISTANCE	800	OHMS
TRANSCONDUCTANCE	5250	μMHOS
AMPLIFICATION FACTOR	4.2	
LOAD RESISTANCE	2500	OHMS
POWER OUTPUT	3.2	WATTS
SECOND HARMONIC DISTORTION	5	PER CENT

CLASS AB1 PUSH – PULL AMPLIFIER

VALUES FOR TWO TUBES

	FIXED BIAS	SELF BIAS	
PLATE VOLTAGE MAX.	325	325	VOLTS
GRID VOLTAGE [G]	–68	–	VOLTS
SELF BIAS RESISTOR	–	850	OHMS
ZERO-SIGNAL PLATE CURRENT PER TUBE	40	40	MA.
LOAD RESISTANCE PER TUBE	750	1250	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	3000	5000	OHMS
TOTAL HARMONIC DISTORTION	2.5	5	PER CENT
POWER OUTPUT	15	10	WATTS

[G] GRID VOLTAGE MEASURED FROM MID-POINT OF AC OPERATED FILAMENT.

PLATE 893-2
NOV. 8 1940

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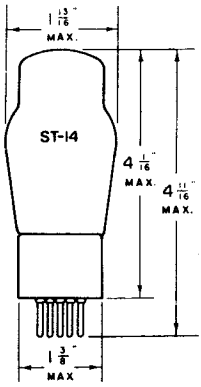
6A4/LA

TUNG-SOL



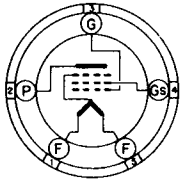
PENTODE POWER AMPLIFIER

COATED FILAMENT

6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

MEDIUM 5 PIN BASE



5B

BOTTOM VIEW

THE TUNG-SOL 6A4/LA IS A FILAMENT TYPE POWER OUTPUT PENTODE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	180 MAX.	VOLTS
SCREEN VOLTAGE	135	180 MAX.	VOLTS
CONTROL GRID VOLTAGE[A]	-9	-12	VOLTS
PLATE CURRENT	14	22	MA.
SCREEN CURRENT	2.5	3.9	MA.
PLATE RESISTANCE APPROX.	52600	45500	OHMS
TRANSCONDUCTANCE	1900	2200	μMHOS
AMPLIFICATION FACTOR APPROX.	100	100	
LOAD RESISTANCE	9500	8000	OHMS
TOTAL HARMONIC DISTORTION	9	9	PER CENT
POWER OUTPUT	0.7	1.4	WATTS

[A] GRID VOLTAGE MEASURED FROM NEGATIVE END OF DC OPERATED FILAMENT. IF THE FILAMENT IS AC OPERATED, THE TABULATED VALUES OF GRID VOLTAGE SHOULD BE INCREASED BY 4 VOLTS, AND THEY SHOULD BE REFERRED TO THE MID-POINT OF THE FILAMENT.

PLATE
894-1

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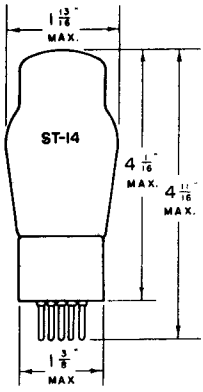
TUNG-SOL



TWIN TRIODE

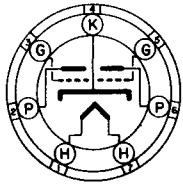
POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.8 AMPERE
AC OR DC

GLASS BULB

MEDIUM 7 PIN BASE



7B

BOTTOM VIEW

THE TUNG-SOL 6A6 IS A TWIN TRIODE DESIGNED FOR SERVICE AS A CLASS B POWER AMPLIFIER AND AS A CLASS A1 DRIVER. WITH THE EXCEPTION OF HEATER RATINGS, ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL TO THOSE OF TYPES 6N7, 6N7G, 6N7GT AND 53.

RATINGS

CLASS A1 AMPLIFIER

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	125	MA.
MAXIMUM AVERAGE DISSIPATION PER PLATE	1.0	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER – TRIODES CONNECTED IN PARALLEL

PLATE VOLTAGE	250	294	VOLTS
CONTROL GRID VOLTAGE	−5	−6	VOLTS
PLATE CURRENT	6	7	MA.
PLATE RESISTANCE	11300	11000	OHMS
TRANSCONDUCTANCE	3100	3200	μMHOS
AMPLIFICATION FACTOR	35	35	

RATINGS

CLASS B POWER AMPLIFIER

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK PLATE CURRENT	125	MA.
MAXIMUM AVERAGE DISSIPATION PER PLATE	5.5	WATTS

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PLATE 1139-2

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6A6

TUNG-SOL

OPERATING CONDITIONS AND CHARACTERISTICS[A]

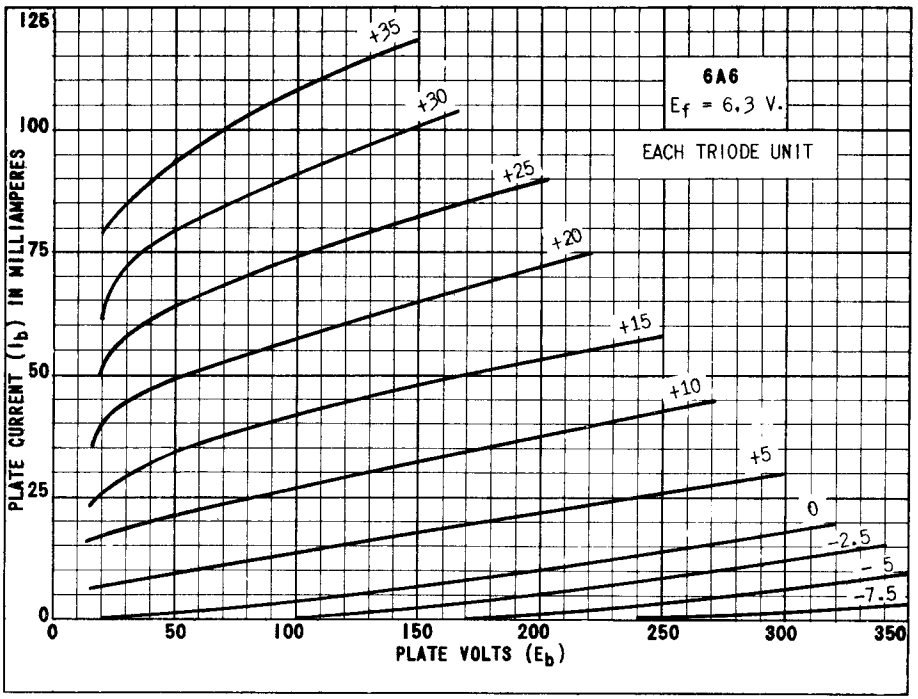
CLASS B AMPLIFIER	IDEAL	TYPICAL	
ZERO SIGNAL PLATE VOLTAGE	300	300	VOLTS
DC GRID VOLTAGE	0	0	VOLT
PEAK AF SIGNAL VOLTAGE PER GRID[B]	29	41[C]	VOLTS
MAXIMUM SIGNAL PEAK GRID CURRENT PER GRID	20	22	MA.
ZERO SIGNAL PLATE CURRENT PER PLATE	17.5	17.5	MA.
MAXIMUM SIGNAL DC PLATE CURRENT PER PLATE	35	35	MA.
GRID IMPEDANCE AT 400 CYCLES	0	516[D]	OHMS
PLATE SUPPLY IMPEDANCE	0	1000	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	8000	8000	OHMS
TOTAL HARMONIC DISTORTION	4	8	PER CENT
THIRD HARMONIC DISTORTION	3.5	7.5	PER CENT
FIFTH HARMONIC DISTORTION	1.5	2.5	PER CENT
POWER OUTPUT	10	10	WATTS

[A] UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR BOTH UNITS

[B] FOR POWER OUTPUT SHOWN.

[C] INCLUDES PEAK GRID IMPEDANCE VOLTAGE DROP.

[D] THE 516 OHMS IMPEDANCE CONSISTS OF A 50 MH. INDUCTANCE AND A 500 OHM RESISTANCE.



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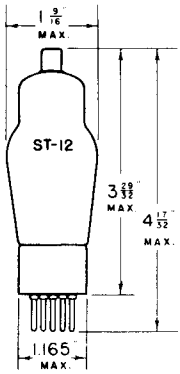
TUNG-SOL



PENTAGRID CONVERTER

UNIPOTENTIAL CATHODE

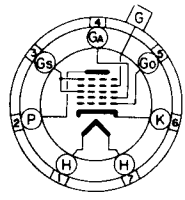
HEATER

2A7 – 2.5 VOLTS 0.8 AMPERE

6A7 – 6.3 VOLTS 0.3 AMPERE

AC OR DC

GLASS BULB



7C

BOTTOM VIEW

SMALL 7 PIN BASE

THE TUNG-SOL 2A7 AND 6A7 ARE PENTAGRID CONVERTERS DESIGNED FOR SERVICE AS OSCILLATORS AND MIXERS IN AC OPERATED AND AC-DC OPERATED RECEIVERS. WITH THE EXCEPTION OF HEATER RATINGS, THEY HAVE IDENTICAL RATINGS AND ELECTRICAL CHARACTERISTICS.

RATINGS

MAXIMUM PLATE (P) VOLTAGE	300	VOLTS
MAXIMUM SCREEN (G_S) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM OSCILLATOR ANODE VOLTAGE	200	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM OSCILLATOR ANODE DISSIPATION	0.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 918-2

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID (G) TO MIXER PLATE (P)[S]	0.3	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)[S]	0.15	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)[S]	0.15	μμf
OSCILLATOR GRID (G_O) TO OSCILLATOR ANODE (G_A)	1.0	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	8.5	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_O) TO ALL OTHER ELECTRODES	7.0	μμf μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES	5.5	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	9.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE (P) VOLTAGE	100	250	VOLTS
SCREEN (G_S) VOLTAGE	50	100	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	-1.5	-3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE[A]	–	250	VOLTS
OSCILLATOR ANODE VOLTAGE	100	–	VOLTS
OSCILLATOR GRID (G_O) RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.1	3.5	MA.
SCREEN CURRENT	1.3	2.7	MA.
OSCILLATOR ANODE CURRENT	2.0	4.0	MA.
OSCILLATOR GRID CURRENT	0.25	0.4	MA.
TOTAL CATHODE CURRENT	4.6	10.6	MA.
PLATE RESISTANCE APPROX.	0.6	0.36	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -1.5 V.	360	–	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -3 V.	180	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -6 V.	50	325	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -10 V.	–	100	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -20 V.	3	–	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -35 V.	–	6	μMHOS

[A] APPLIED THROUGH A 20 000 OHM DROPPING RESISTOR

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PLATE 919-2

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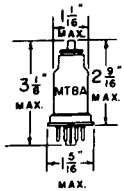
TUNG-SOL

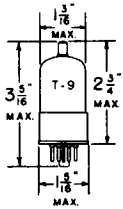
PENTAGRID CONVERTER

UNIPOTENTIAL CATHODE

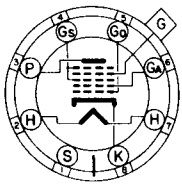
HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC



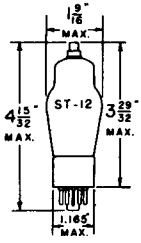
METAL SHELL
8 PIN OCTAL BASE
6A8



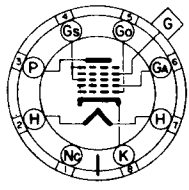
GLASS BULB
8 PIN OCTAL BASE
WITH METAL SHELL
6A8GT



BOTTOM VIEW
6A8, 6A8GT



GLASS BULB
SMALL 8 PIN OCTAL BASE
6A8G



BOTTOM VIEW
6A8G

THE TUNG-SOL 6A8, 6A8G, AND 6A8GT ARE PENTAGRID CONVERTERS DESIGNED FOR SERVICE AS COMBINED OSCILLATORS AND MIXERS IN AC, STORAGE BATTERY, AND AC – DC OPERATED RECEIVERS. WITH THE EXCEPTION OF CAPACITANCES, THEIR RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6A7.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN (Gs) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (Ga) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM OSCILLATOR ANODE VOLTAGE	200	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM OSCILLATOR ANODE DISSIPATION	.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE
1078-3

JULY 28
1941

CONTINUED NEXT PAGE

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES [S]

	6A8	6A8G, 6A8GT	
CONTROL GRID (G) TO MIXER PLATE (P)	0.06	.26	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)	0.1	.19	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)	0.09	.16	μμf
OSCILLATOR GRID (G_O) TO OSCILLATOR ANODE (G_A)	0.8	1.1	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	12.0	9.5	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_O) TO ALL OTHER ELECTRODES	6.5	6.0	μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES	5	4.6	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	12	12	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE (P) VOLTAGE	100	250	VOLTS
SCREEN (G_S) VOLTAGE	50	100	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	-1.5	-3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE [A]	-	250	VOLTS
OSCILLATOR ANODE VOLTAGE	100	-	VOLTS
OSCILLATOR GRID (G_O) RESISTOR	50000	50000	OHMS
PLATE CURRENT	1.1	3.5	MA.
SCREEN CURRENT	1.3	2.7	MA.
OSCILLATOR ANODE CURRENT	2.0	4.0	MA.
OSCILLATOR GRID CURRENT	0.25	0.4	MA.
TOTAL CATHODE CURRENT	4.6	10.6	MA.
PLATE RESISTANCE	0.6	0.36	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -1.5 V.	360	-	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -3 V.	180	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -6 V.	50	325	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -10 V.	-	100	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -20 V.	3	-	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -35 V.	-	6	μMHOS

[A] APPLIED THROUGH A 20 000 OHM DROPPING RESISTOR

[S] WITH EXTERNAL SHIELD OR SHELL CONNECTED TO CATHODE

PLATE 1079-1

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TUNG-SOL

TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

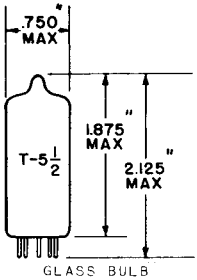
HEATER

6.3 VOLTS 150 MA.

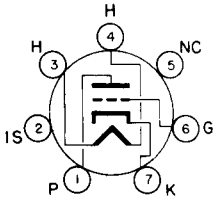
AC OR DC

ANY MOUNTING POSITION

IT IS RECOMMENDED THAT PIN #2 BE GROUNDED.



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5CE

THE 6AB4 IS A TRIODE USING THE MINIATURE CONSTRUCTION. ITS LOW CAPACITANCE AND HIGH RATIO OF PLATE CURRENT TO TRANSCONDUCTANCE ADAPT IT TO USE AS A HIGH FREQUENCY OSCILLATOR AND MIXER AT FREQUENCIES BELOW APPROXIMATELY 300 MC OR AS A GROUNDED GRID RADIO FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #316	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	1.5	1.5	pf
INPUT: G TO (H+K)	2.2	2.2	pf
OUTPUT: P TO (H+K)	1.4	0.5	pf
HEATER TO CATHODE: (H+K)	2.9	2.9	pf
GROUNDED GRID			
PLATE TO CATHODE: (P TO K)	0.2	0.24	pf
INPUT: K TO (H+G)	5.2	5	pf
OUTPUT: P TO (H+G)	2.6	1.7	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	-50	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
CATHODE RESISTOR	270	200	OHMS
PLATE CURRENT	3.7	10	MA.
PLATE RESISTANCE	15 000	10 900	OHMS
TRANSCONDUCTANCE	4 000	5 500	µMHOS
AMPLIFICATION FACTOR	60	60	
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	-5	-12	VOLTS

SIMILAR TYPE REFERENCE: Somewhat similar to each unit of type 12AT7.

→ INDICATES A CHANGE.

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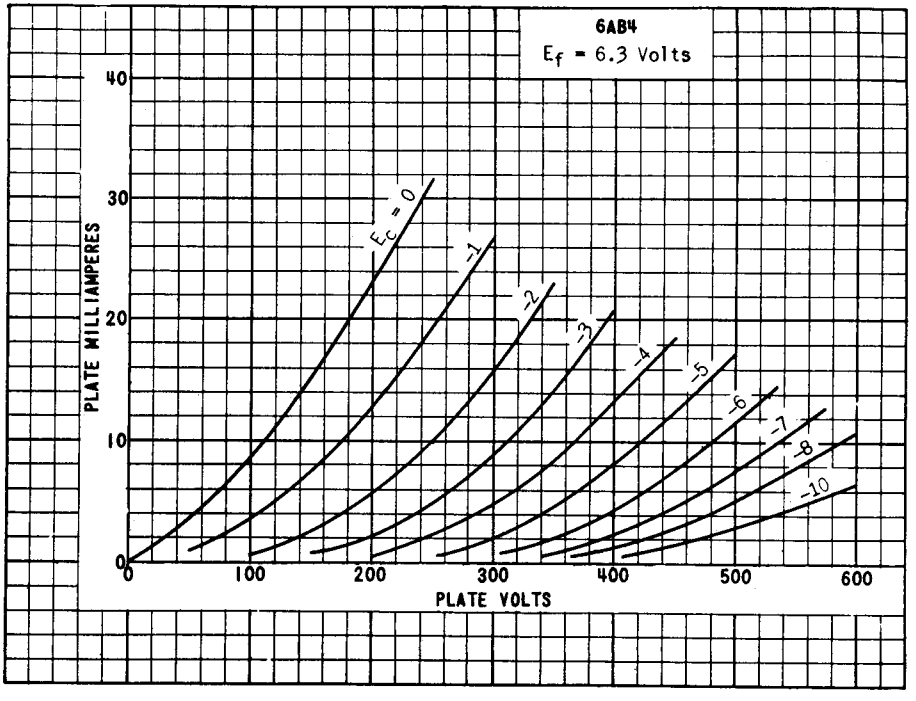
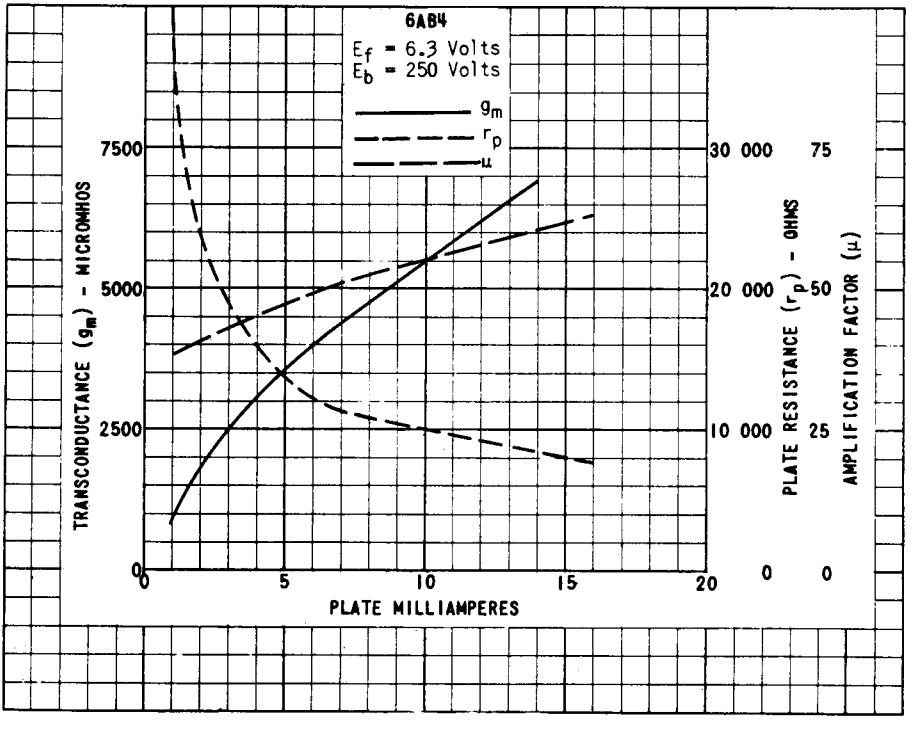
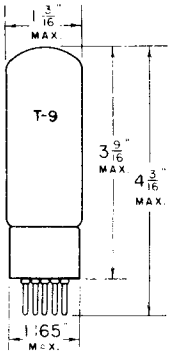
6AB4


6AB4
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c = 0
-1
-2
-3
-4
-5
-6
-7
-8
-10
0
10
20
30
40
0
100
200
300
400
500
600


6AB4
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - OHMS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
2500
5000
7500
0
10 000
20 000
30 000
0
25
50
75
0
5
10
15
20

TUNG-SOL

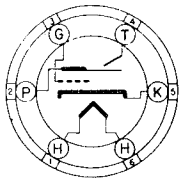


CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



6R
BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 6AB5/6N5 CONSISTS OF A CIRCULAR FLUORESCENT SCREEN WITH AN INDICATING SHADOW ANGLE, WHICH IS CONTROLLED BY AN INTERNALLY CONNECTED AMPLIFIER. WHEN THE 6AB5/6N5 IS USED AS A TUNING INDICATOR, AVC VOLTAGE IS APPLIED TO THE TRIODE GRID. IT IS RECOMMENDED FOR APPLICATIONS WHICH REQUIRE A HEATER OF LOW CURRENT DRAIN.

RATINGS

MAXIMUM PLATE SUPPLY VOLTAGE	180	VOLTS
MAXIMUM TARGET VOLTAGE	180	VOLTS
MINIMUM TARGET VOLTAGE	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE AND TARGET SUPPLY VOLTAGE	135	VOLTS
SERIES TRIODE PLATE RESISTOR	0.25	MEGOHM
TRIODE GRID VOLTAGE (0^{o} SHADOW ANGLE)	−10 APPROX.	VOLTS
TRIODE GRID VOLTAGE (90^{o} SHADOW ANGLE)	0 APPROX.	VOLTS
TRIODE PLATE CURRENT (TRIODE GRID V. = 0)	0.5 [A]	MA.
TARGET CURRENT (TRIODE GRID V. = 0)	2.0 [A]	MA.

[A] SUBJECT TO WIDE VARIATION

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

NOTE: THIS DOUBLE-BRANDED TUBE, 6AB5/6N5, REPLACES EITHER THE 6AB5 OR THE 6N5.

CONTINUED NEXT PAGE

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PLATE
872-1

OCT. 21
1940

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6AB5/6N5

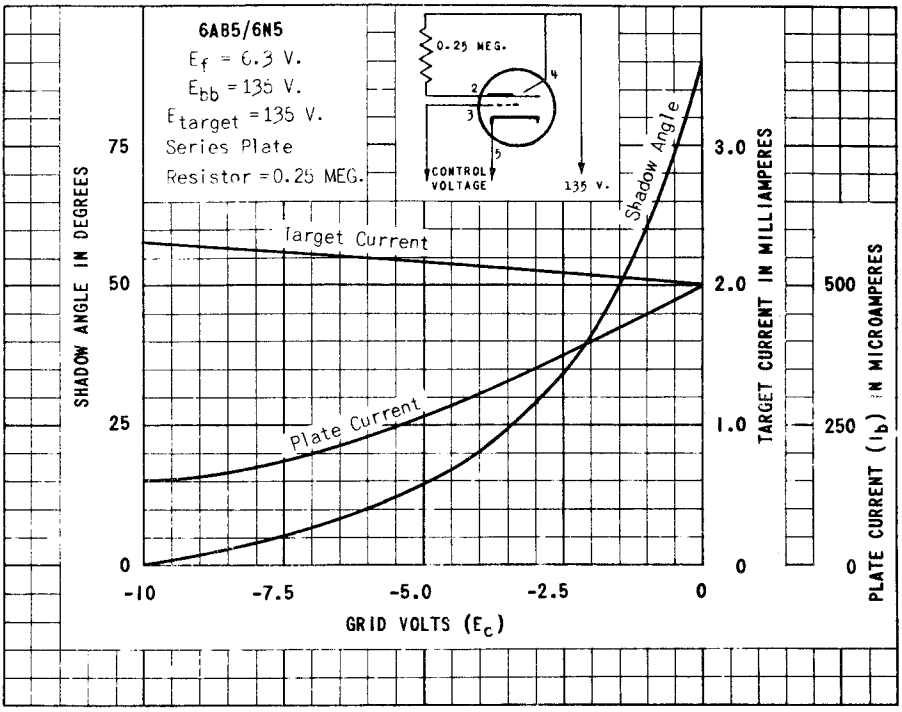

PLATE
873-1

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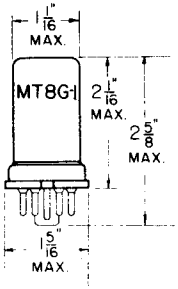
TUNG-SOL

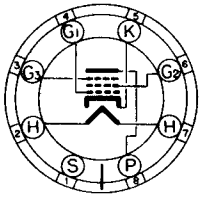
TELEVISION AMPLIFIER PENTODE



COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMPERE
AC OR DC

ANY MOUNTING POSITION



METAL SHELL

BOTTOM VIEW
SMALL WAFER
8-PIN OCTAL

THE 6AB7/1853 IS A HIGH TRANSCONDUCTANCE SEMI-REMOTE CUT-OFF AMPLIFIER TUBE. THIS TUBE IS DESIGNED FOR TELEVISION RF AND IF AMPLIFIER SERVICE. PRECAUTIONS SHOULD BE TAKEN NOT TO EXCEED DISSIPATION RATING WITH EXPECTED LINE-VOLTAGE FLUCTUATIONS, ESPECIALLY WITH FIXED-BIAS OPERATION.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
MAX. PLATE VOLTAGE	300	VOLTS
MAX. SCREEN VOLTAGE	200	VOLTS
MAX. SCREEN SUPPLY VOLTAGE	300	VOLTS
MAX. PLATE DISSIPATION	3.75	WATTS
MAX. SCREEN DISSIPATION	0.65	WATT
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE	

DIRECT INTERELECTRODE CAPACITANCES

WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE (MAX.)	0.015	μμf
INPUT	8	μμf
OUTPUT	5	μμf

CONTINUED ON FOLLOWING PAGE

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PLATE 1602
OCT. 15, 1945

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	WITH FIXED SCREEN SUPPLY	WITH SERIES SCREEN RESISTOR	
HEATER VOLTAGE	6.3	6.3	VOLTS
PLATE VOLTAGE	300	300	VOLTS
SCREEN SUPPLY VOLTAGE[A]	200	300	VOLTS
GRID VOLTAGE (MIN.)[B]	-3	-3	VOLTS
SUPPRESSOR VOLTAGE[C]	0	0	VOLTS
PLATE CURRENT	12.5	12.5	MA.
SCREEN CURRENT	3.2	3.2	MA.
PLATE RESISTANCE (APPROX.)	0.7	0.7	MEGOHM
SERIES SCREEN RESISTOR		30 000	OHMS
GRID RESISTOR (MAX.)			
FIXED BIAS	0.25	0.25	MEGOHM
CATHODE BIAS	0.25	0.5	MEGOHM
TRANSCONDUCTANCE	5000	5000	µMHOS
AMPLIFICATION FACTOR (APPROX.)	3500	3500	
GRID BIAS FOR TRANSCONDUCTANCE OF 50 µMHOS	-15	-22.5	VOLTS

[A] SCREEN SUPPLY VOLTAGES GREATER THAN 200 VOLTS REQUIRE THE USE OF A SERIES DROPPING RESISTOR TO LIMIT THE VOLTAGE AT THE SCREEN TO 200 VOLTS WITH NORMAL PLATE CURRENT OF 12.5 MA.

[B] THE GRID BIAS MAY BE OBTAINED FROM A CATHODE BIAS RESISTOR HAVING A VALUE OF 190 OHMS MINIMUM.

[C] IN RF AND IF STAGES, THE SUPPRESSOR SHOULD BE CONNECTED DIRECTLY TO GROUND TO MINIMIZE FEEDBACK.

NOTE: PRECAUTIONS MUST BE TAKEN IN HIGH FREQUENCY CIRCUITS TO MINIMIZE THE CHARACTERISTICALLY LARGE VARIATION OF INPUT CAPACITANCE AND INPUT CONDUCTANCE WITH PLATE CURRENT.

SIMILAR TYPE REFERENCE: Somewhat similar to type 6SG7.

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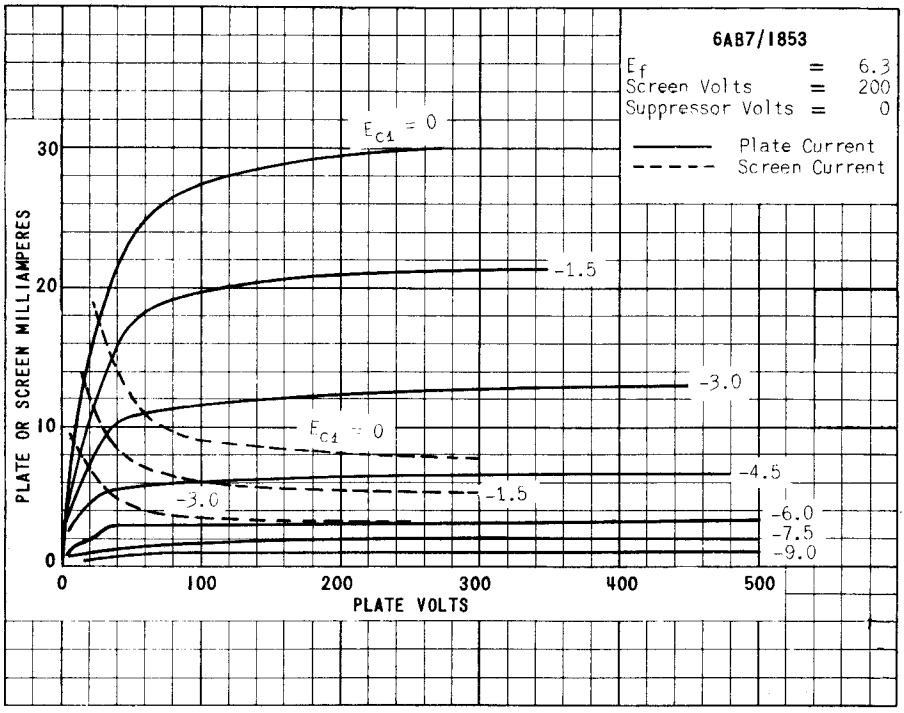

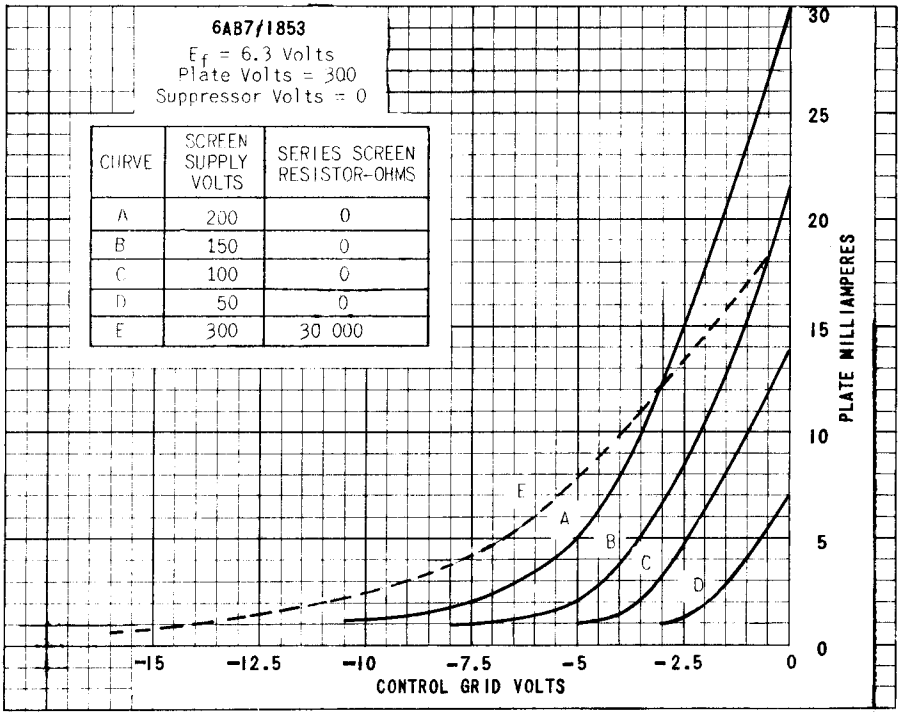

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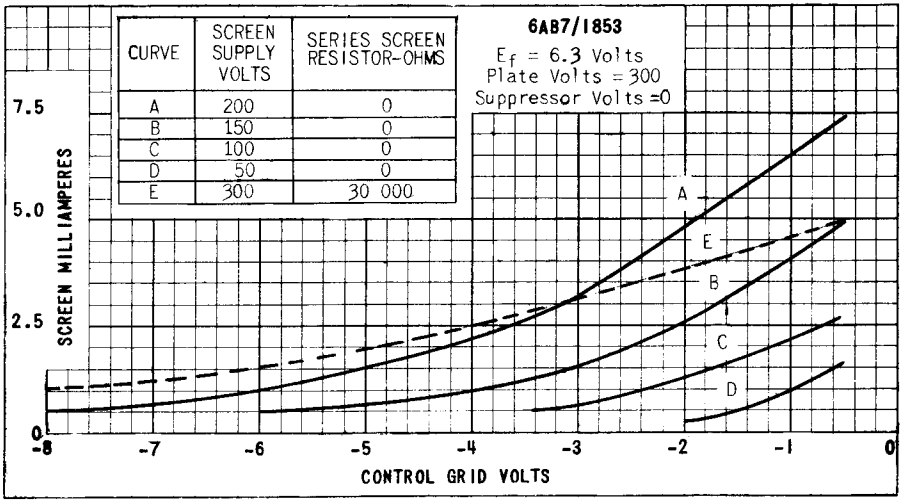
6AB7/1853



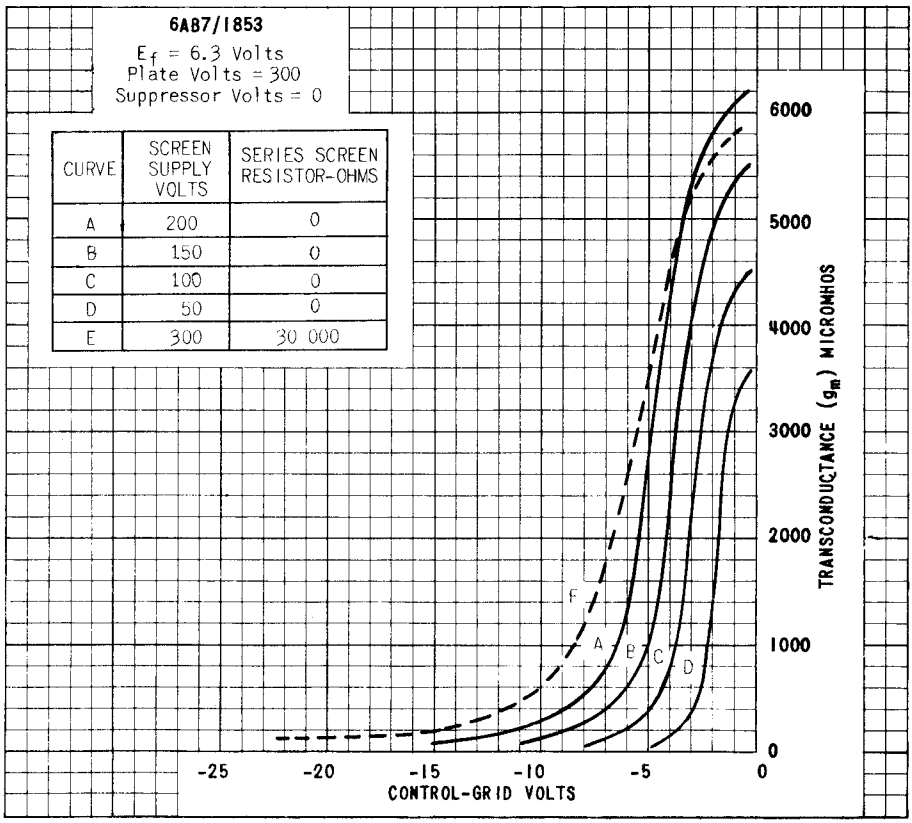


PLATE
1691
FEB. 15
1946

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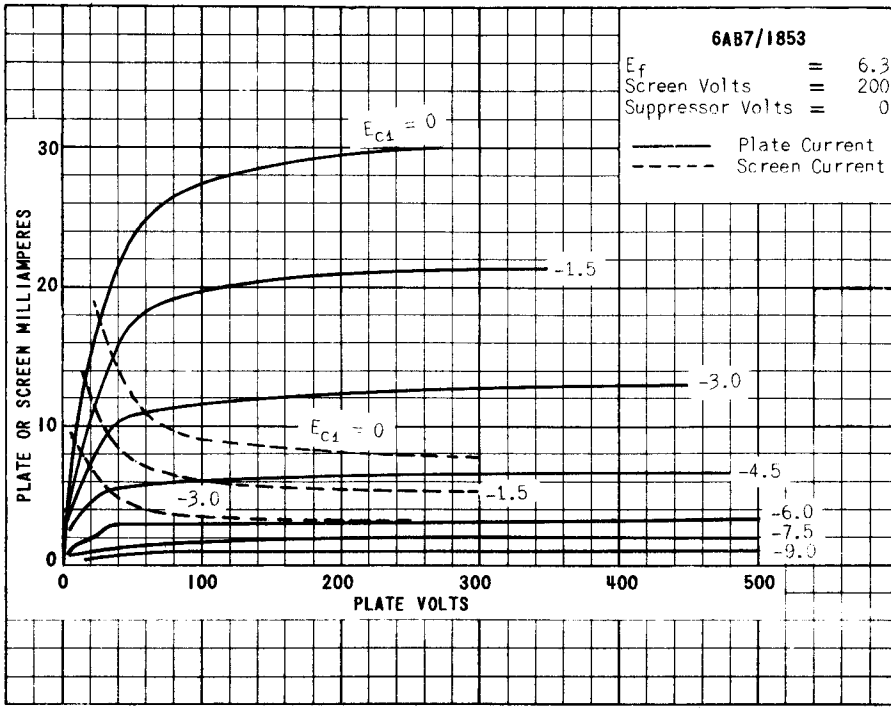

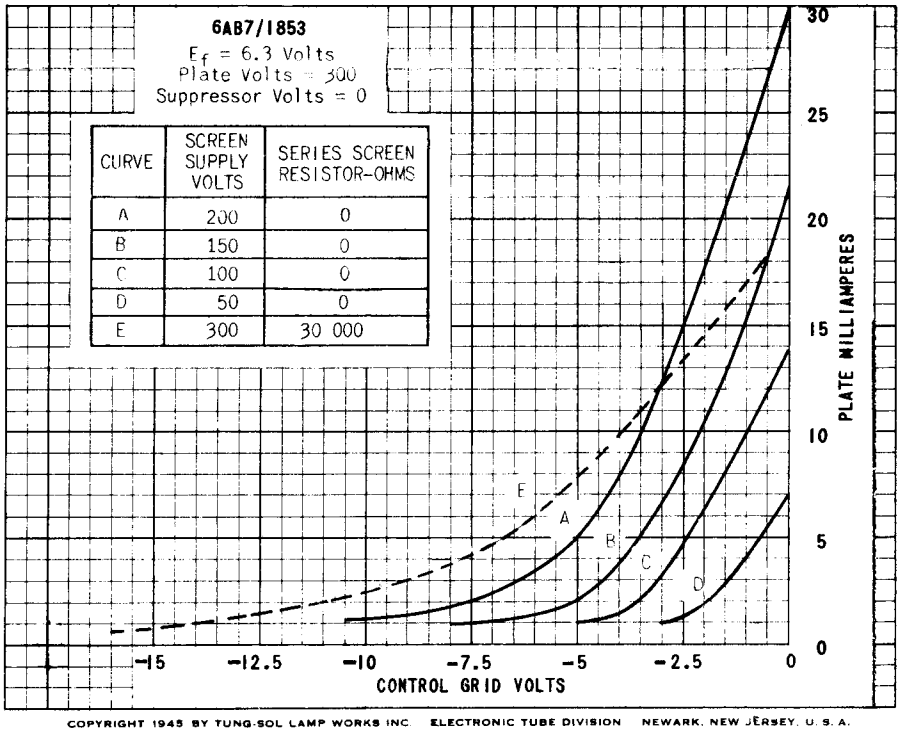

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NOV. 30 1945

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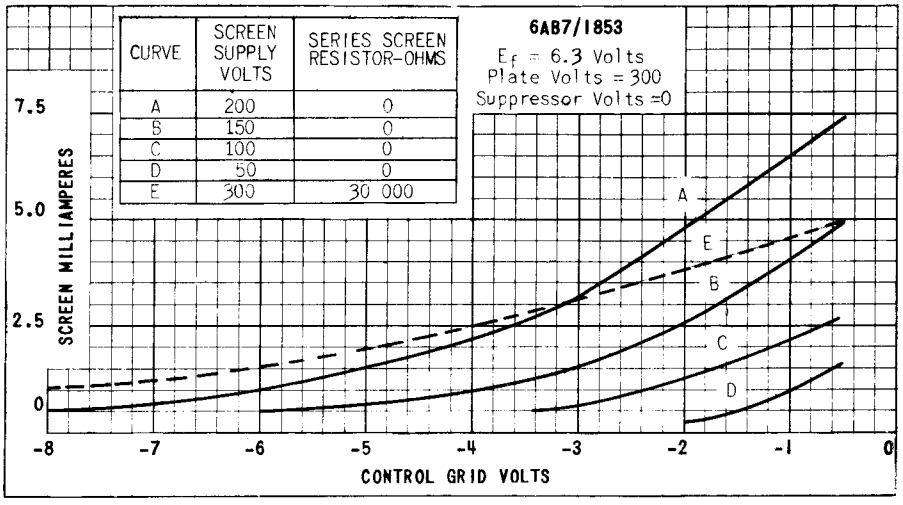
6AB7/1853



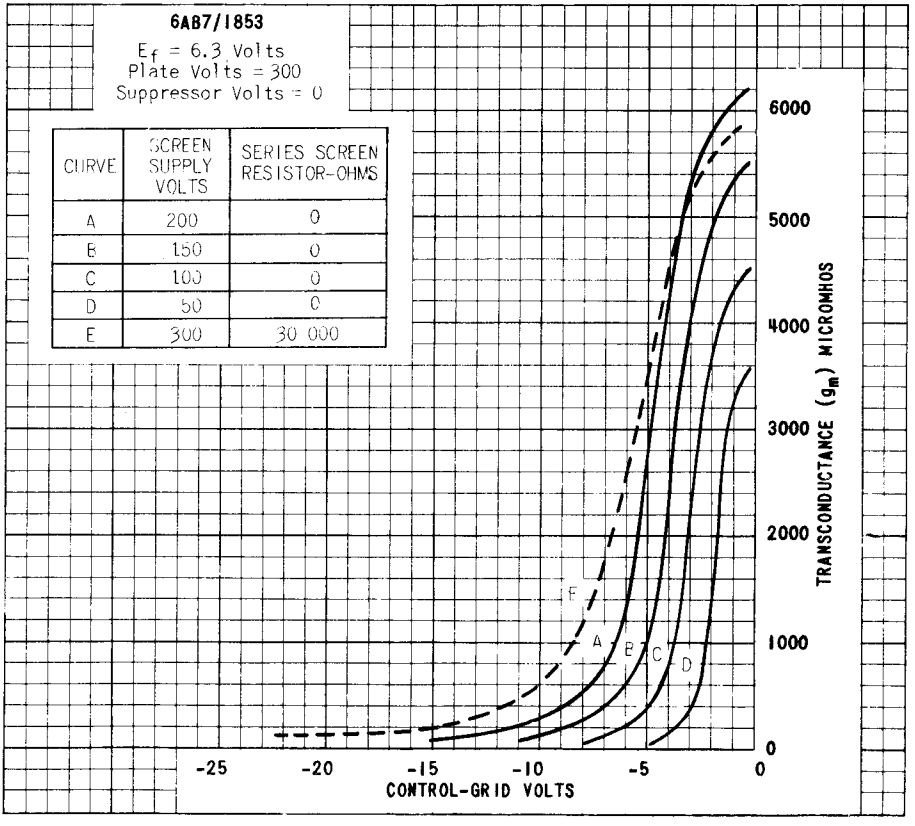


PLATE 1623
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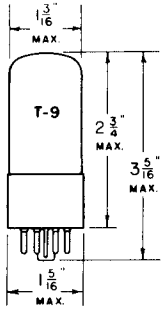
TUNG-SOL

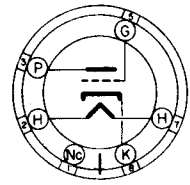


HIGH-MU
TRIODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMPERE
AC OR DC

GLASS BULB



6Q-0-0

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 6AC5GT/G IS A HIGH MU POWER OUTPUT TRIODE DESIGNED FOR SERVICE IN DYNAMIC COUPLED CIRCUITS USING A TYPE 76, 6P5GT/G OR 6J5GT/G AS A DRIVER. TWO TUNG-SOL 6AC5GT/G'S MAY BE USED AS A ZERO BIAS CLASS B AMPLIFIER.

RATINGS

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PEAK PLATE CURRENT	110	MA.
MAXIMUM AVERAGE PLATE DISSIPATION	10	WATTS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE	+13	VOLTS
PLATE CURRENT	32	MA.
GRID CURRENT	5	MA.
PLATE RESISTANCE	36 700	OHMS
TRANSCONDUCTANCE	3400	μMHOS
AMPLIFICATION FACTOR	125	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS B POWER AMPLIFIER

VALUES ARE FOR TWO TUBES UNLESS OTHERWISE SPECIFIED

PLATE VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PEAK AF SIGNAL VOLTAGE GRID TO GRID	70	VOLTS
ZERO-SIGNAL PLATE CURRENT	5	MA.
PEAK PLATE CURRENT PER TUBE	110	MA.
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	10 000	OHMS
PEAK POWER INPUT	.950	WATT
POWER OUTPUT APPROX.	8	WATTS

CONTINUED NEXT PAGE

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TUNG-SOL

TYPICAL OPERATION

DYNAMIC COUPLED CLASS A1 AMPLIFIER

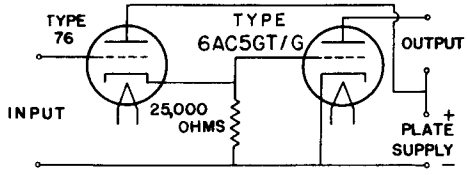
WITH TYPE 6P5GT/G OR 76 AS DRIVER

PLATE SUPPLY VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE [A]	0	VOLT
DRIVER GRID RESISTOR MAX.	1.0	MEGOHM
ZERO-SIGNAL PLATE CURRENT	32	MA.
AVERAGE PLATE CURRENT OF DRIVER	5.5	MA.
INPUT SIGNAL TO DRIVER (RMS)	16.5	VOLTS
LOAD RESISTANCE	7000	OHMS
TOTAL HARMONIC DISTORTION	10	PER CENT
POWER OUTPUT [B]	3.7	WATTS

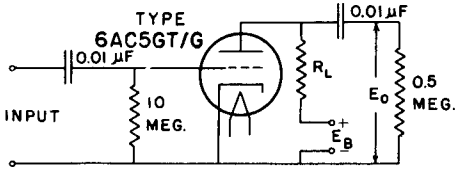
[A] BIAS VOLTAGE FOR BOTH THE 6AC5GT/G AND THE DRIVER TUBE IS DEVELOPED BY THE "DYNAMIC COUPLED" CIRCUIT CONNECTION SHOWN BELOW. THE 25 000 OHM RESISTOR IS CONNECTED BETWEEN GRID AND CATHODE OF THE 6AC5GT/G TO PREVENT A CURRENT SURGE OCCURRING WHEN THE TUBE IS HEATING.

[B] AT THE POINT WHERE DRIVER GRID CURRENT BEGINS TO FLOW, THE POWER OUTPUT IS 4.3 WATTS WITH 16% DISTORTION.

DYNAMIC – COUPLED CONNECTION



RESISTANCE COUPLED AMPLIFIER OPERATION
ZERO CATHODE RESISTOR CIRCUIT



THE CIRCUITS SHOWN HEREIN ARE FOR YOUR INFORMATION. TUNG-SOL LAMP WORKS INC. ASSUMES NO LIABILITY WITH RESPECT TO THEIR USE IN THE INFRINGEMENT OF ANY PATENT.

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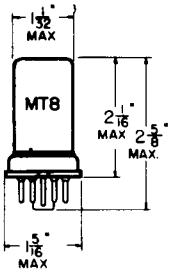
TUNG-SOL

PENTODE



METAL SHELL

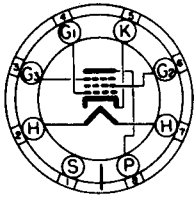
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL WAFER
8-PIN OCTAL

THE 6AC7/1852 INCORPORATES FEATURES MAKING IT SUITABLE FOR HIGH GAIN AMPLIFIER CIRCUITS. IT HAS A HIGH RATIO OF TRANSCONDUCTANCE TO PLATE CURRENT, MAINTAINING REASONABLE LOW CAPACITANCE AND CLOSE ELECTRODE SPACING.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.015	μμf
INPUT: G_1 TO (H + K + G_2 + G_3 + S)	11	μμf
OUTPUT: P TO (H + K + G_2 + G_3 + S)	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
→ MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	3.02	WATTS
MAXIMUM SCREEN DISSIPATION	0.38	WATT

CONTINUED ON FOLLOWING PAGE

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PLATE 1867
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→ INDICATES A CHANGE OR ADDITION

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	CONDITION 1[A]	CONDITION 2[B]	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	300	300	VOLTS
GRID #3 VOLTAGE[C]	0	0	VOLTS
GRID #2 SUPPLY VOLTAGE[D]	150	300	VOLTS
GRID #2 SERIES RESISTOR	---	60 000	OHMS
CATHODE-BIAS RESISTOR (MIN.)[E]	160	160	OHMS
PLATE RESISTANCE (APPROX.)	1.0	1.0	MEGOHM
TRANSCONDUCTANCE	9 000	9 000	µMHOS
PLATE CURRENT	10	10	MA.
GRID #2 CURRENT	2.5	2.5	MA.

[A] CONDITION 1 WITH FIXED SCREEN SUPPLY GIVES A SHARP CUT-OFF CHARACTERISTIC.

[B] CONDITION 2 WITH SERIES SCREEN RESISTOR GIVES AN EXTENDED CUT-OFF CHARACTERISTIC FOR APPLICATIONS WHERE GAIN IS CONTROLLED BY VARIATION OF GRID BIAS.

[C] TO MINIMIZE FEEDBACK THE SUPPRESSOR SHOULD BE CONNECTED DIRECTLY TO GROUND IF USED IN RF AND IF STAGES.

[D] SCREEN SUPPLY VOLTAGES IN EXCESS OF 150 VOLTS REQUIRE THE USE OF A SERIES-DROPPING RESISTOR TO LIMIT THE VOLTAGE AT THE SCREEN TO 150 VOLTS WHEN THE PLATE CURRENT IS AT ITS NORMAL VALUE OF 10 MILLIAMPERES.

[E] CATHODE BIAS RESISTOR SHOULD BE ADJUSTED TO GIVE A PLATE CURRENT OF 10 MILLIAMPERES. THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 0.25 MEGOHM WHEN THE SCREEN VOLTAGE IS OBTAINED FROM A FIXED SOURCE. WHEN A SERIES SCREEN RESISTOR IS USED WITH FULL CATHODE BIAS, THE DC RESISTANCE IN THE GRID CIRCUIT MAY BE AS HIGH AS 0.5 MEGOHM.

→ INDICATES A CHANGE OR ADDITION.

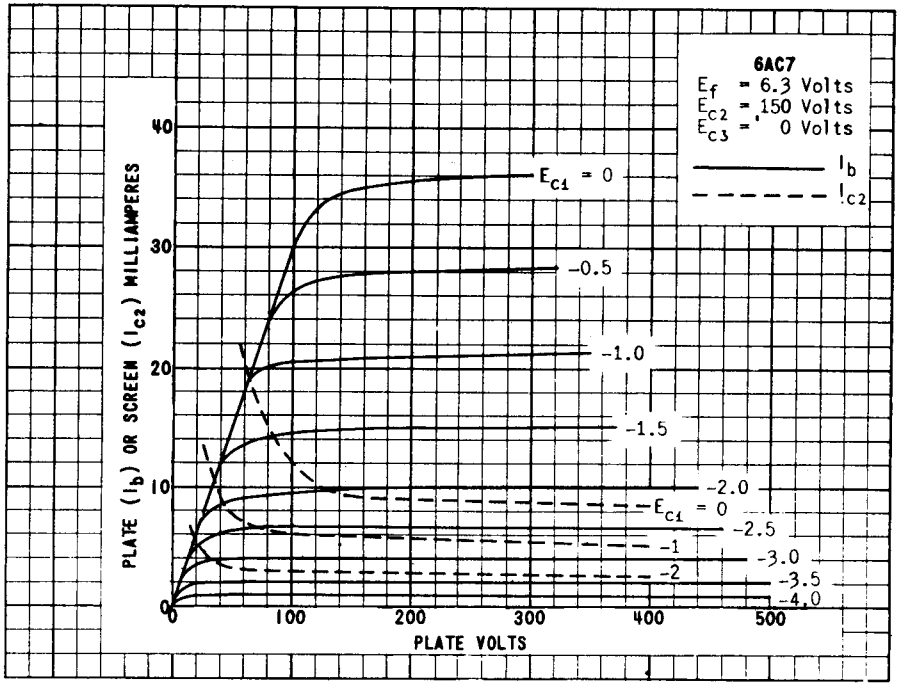

PLATE 1868
SEPT. 2 1947

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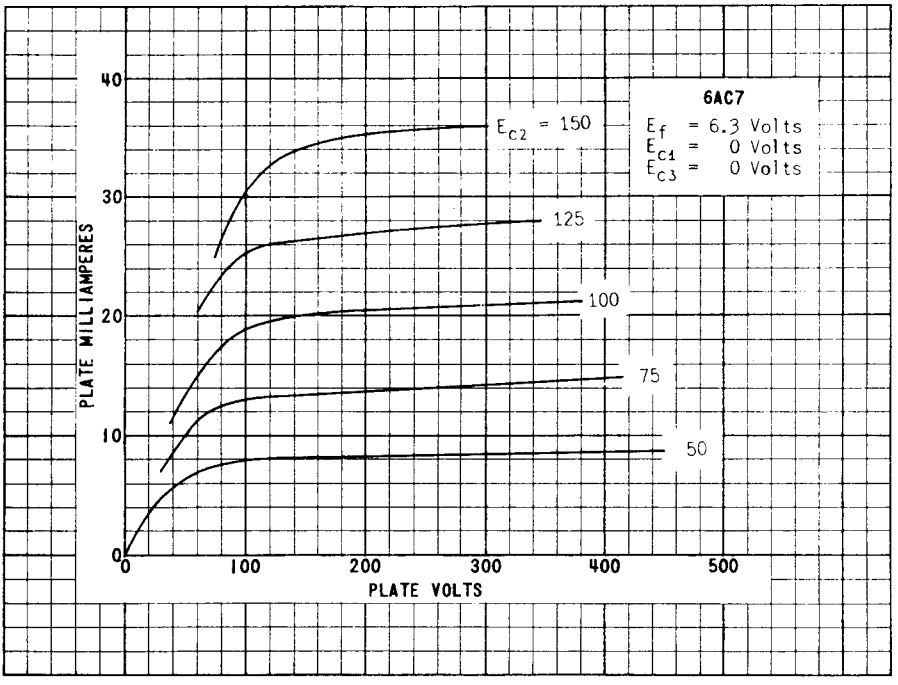

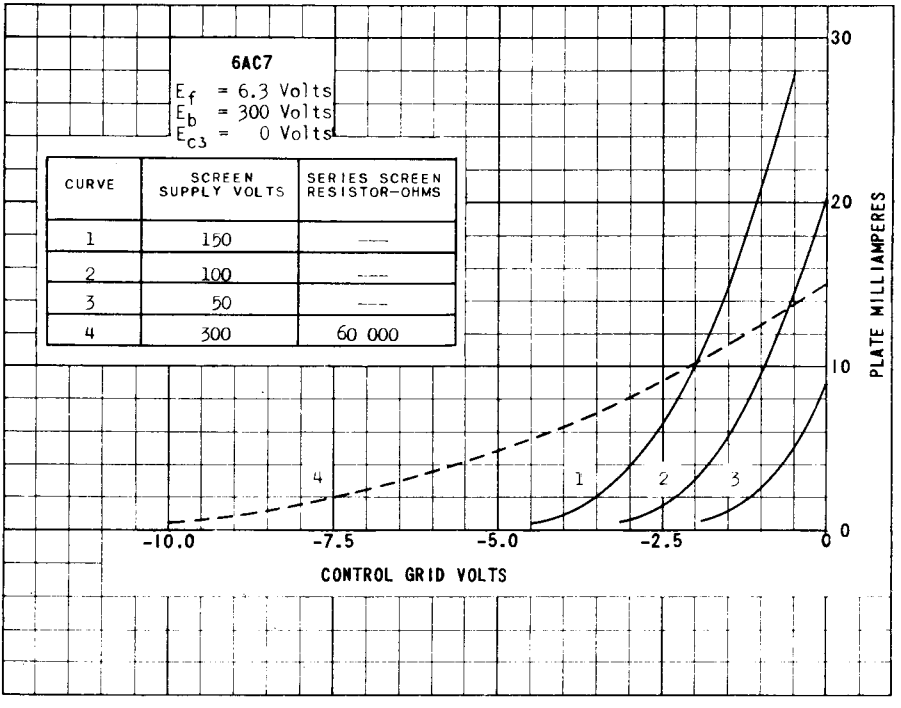

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR—OHMS
1	150	—
2	100	—
3	50	—
4	300	60 000

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PLATE
1869
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1947

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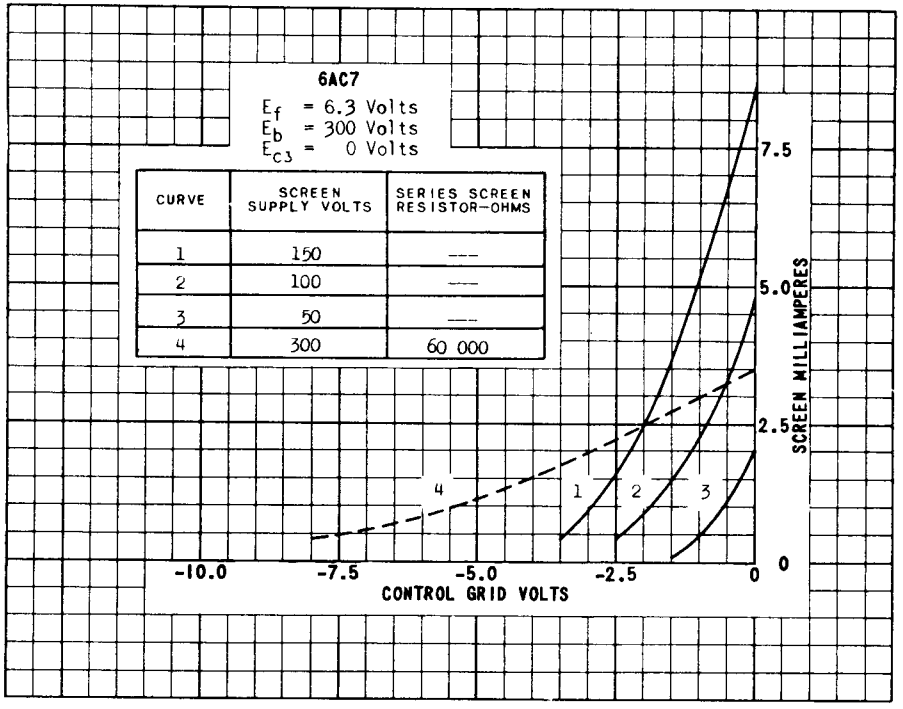
6AC7/1852



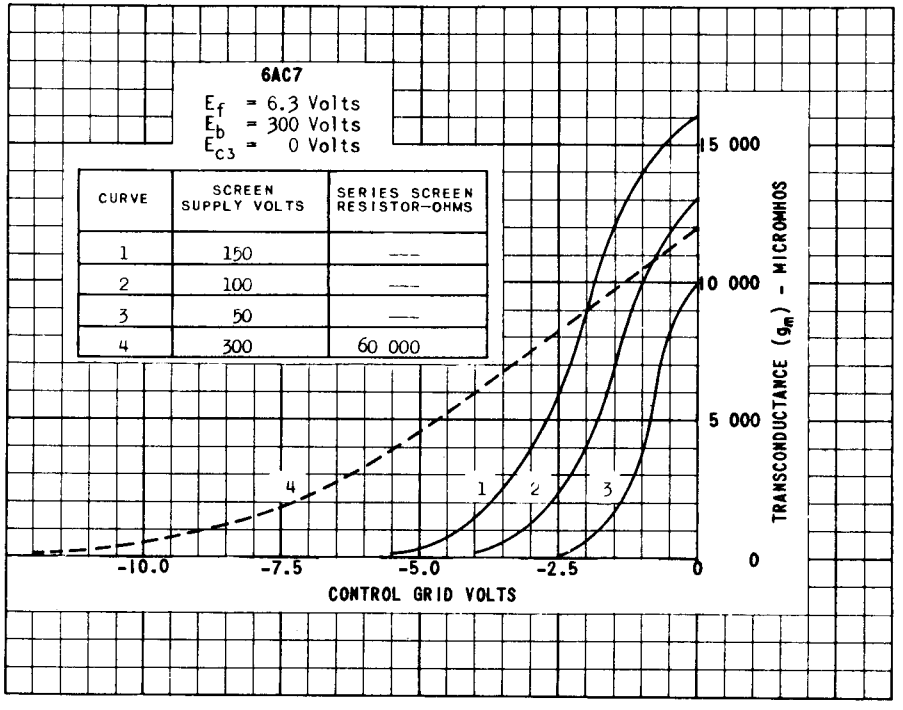


PLATE 1870
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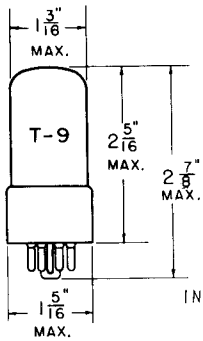


ELECTRON-RAY TUBE

TWIN INDICATOR TYPE

COATED UNIPOTENTIAL CATHODE

HEATER

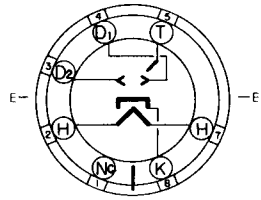
6.3 VOLTS 0.15 AMPERE

AC OR DC

GLASS BULB

INTERMEDIATE SHELL OCTAL 7-PIN BASE

MOUNTING POSITION – ANY [A]



BOTTOM VIEW

THE 6AD6G IS A TUNING INDICATOR WITH A CIRCULAR FLUORESCENT SCREEN WITH TWO INDEPENDENT INDICATING SHADOW ANGLES. EACH SHADOW ANGLE IS CONTROLLED BY A RAY-CONTROL ELECTRODE. WHEN THE TUBE IS USED AS A TUNING INDICATOR, ITS RAY-CONTROL ELECTRODES MAY BE CONNECTED IN PARALLEL TO PRODUCE TWO IDENTICAL SHADOWS, OR EACH RAY-CONTROL ELECTRODE MAY BE SUPPLIED WITH A SEPARATE CONTROLLING VOLTAGE FROM A 6AE6G TUBE.

RATINGS

INDICATOR SERVICE

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM TARGET VOLTAGE	150	VOLTS
MINIMUM TARGET VOLTAGE	100	VOLTS
MAXIMUM RAY-CONTROL ELECTRODE SUPPLY VOLTAGE	150	VOLTS
MAXIMUM HEATER-CATHODE POTENTIAL	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TUNING INDICATOR

TARGET VOLTAGE	100	150		VOLTS
TARGET CURRENT (APPROX.) [B]	1.5	3.0		MA.
TARGET CURRENT (APPROX.) [C]	1.0	2.0		MA.
TARGET CURRENT (APPROX.) [D]	0.8	1.2		MA.
RAY-CONTROL ELECTRODE VOLTAGE [B]	45	75	APPROX.	VOLTS
RAY-CONTROL ELECTRODE VOLTAGE [C]	0	8.0	APPROX.	VOLTS
RAY-CONTROL ELECTRODE VOLTAGE [D]	-23	-50	APPROX.	VOLTS

[A] THE PLANE OF THE RAY-CONTROL ELECTRODES PASSES THROUGH THE LINE E-E ON THE SOCKET CONNECTION DIAGRAM.

[B] FOR SHADOW ANGLE OF 0° PRODUCED BY EITHER RAY-CONTROL ELECTRODE.

[C] FOR SHADOW ANGLE OF 90° PRODUCED BY EITHER RAY-CONTROL ELECTRODE.

[D] FOR SHADOW ANGLE OF 135° PRODUCED BY EITHER RAY-CONTROL ELECTRODE.

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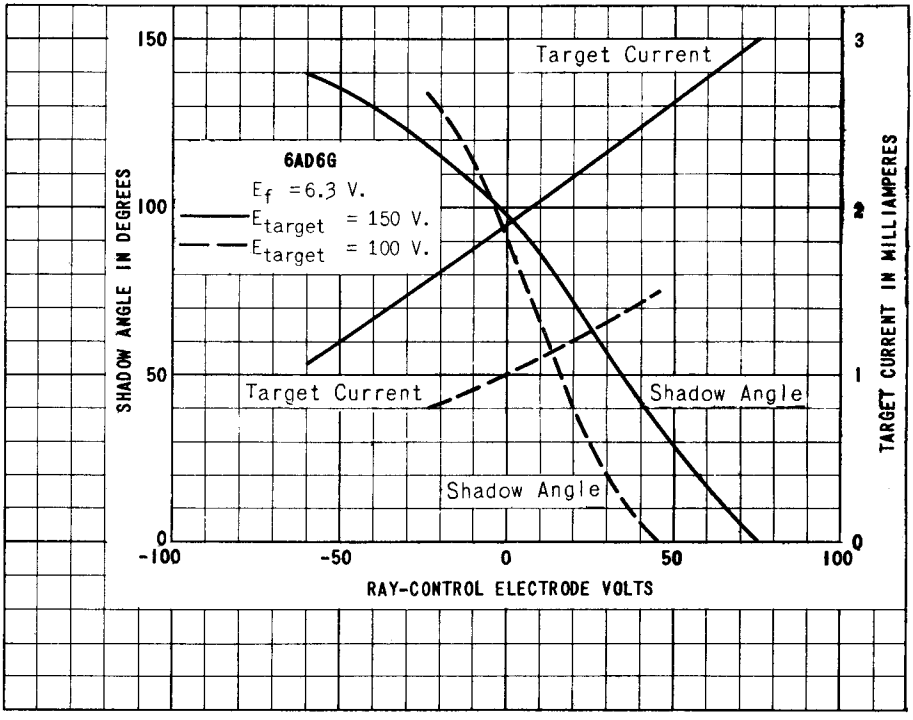
6AD6G



CIRCUIT FOR OPERATING A TYPE 6AD6G ON BOTH WEAK AND STRONG SIGNALS

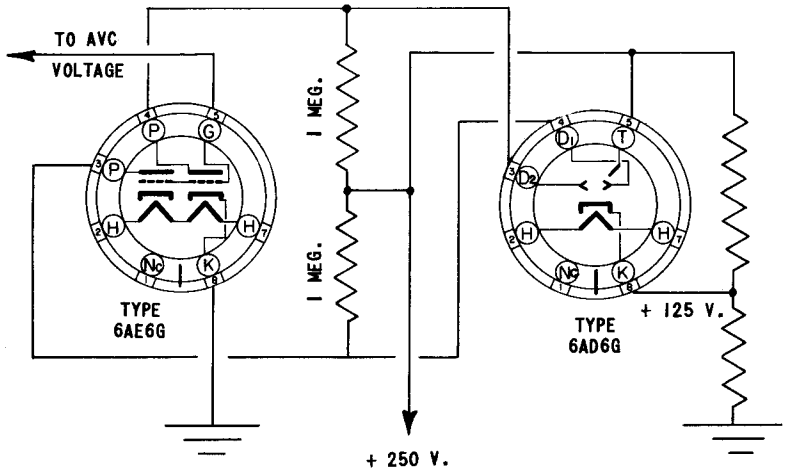


PLATE 1514
OCT. 31 1944

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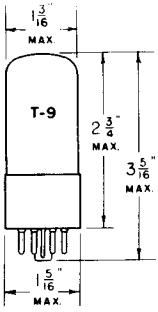
TUNG-SOL



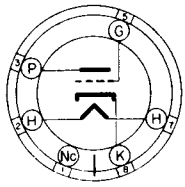
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



6Q-0-0

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 6AE5GT/G IS A GENERAL PURPOSE LOW-MU TRIODE. IT IS DESIGNED PRIMARILY FOR SERVICE AS A "DYNAMIC-COUPLED" DRIVER TO A 25AC5GT/G IN AC – DC OPERATED RECEIVERS.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	95	VOLTS
CONTROL GRID VOLTAGE[A]	-15	VOLTS
PLATE CURRENT	7	MA.
PLATE RESISTANCE	3500	OHMS
TRANSCONDUCTANCE	1200	μMHOS
AMPLIFICATION FACTOR	4.2	

[A] THE DC RESISTANCE IN THE GRID CIRCUIT OF THE 6AE5GT/G SHOULD NOT EXCEED 1.0 MEGOHM UNDER MAXIMUM RATED CONDITIONS.

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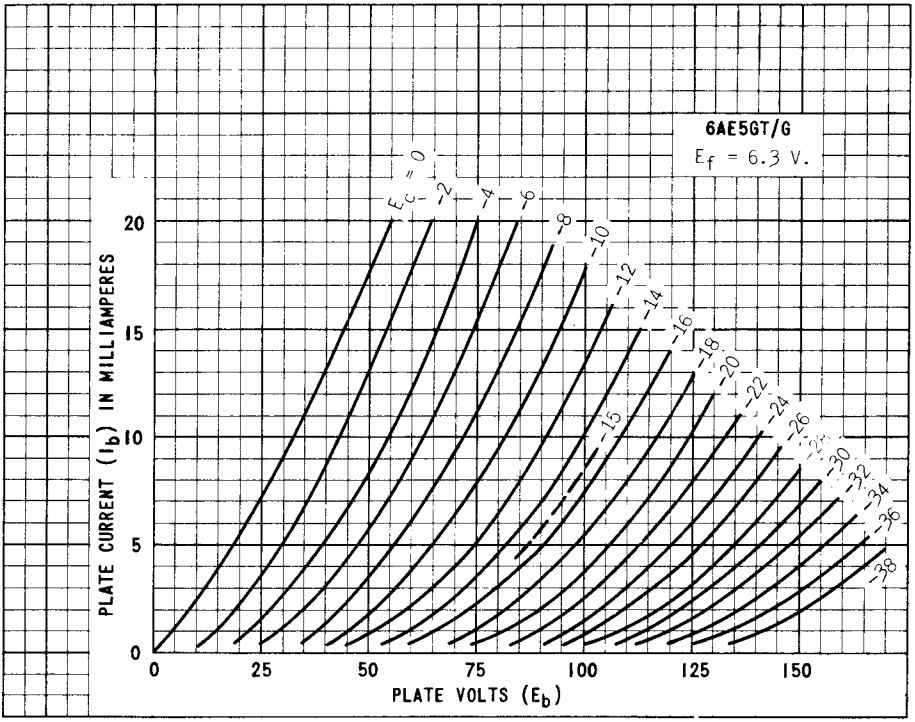
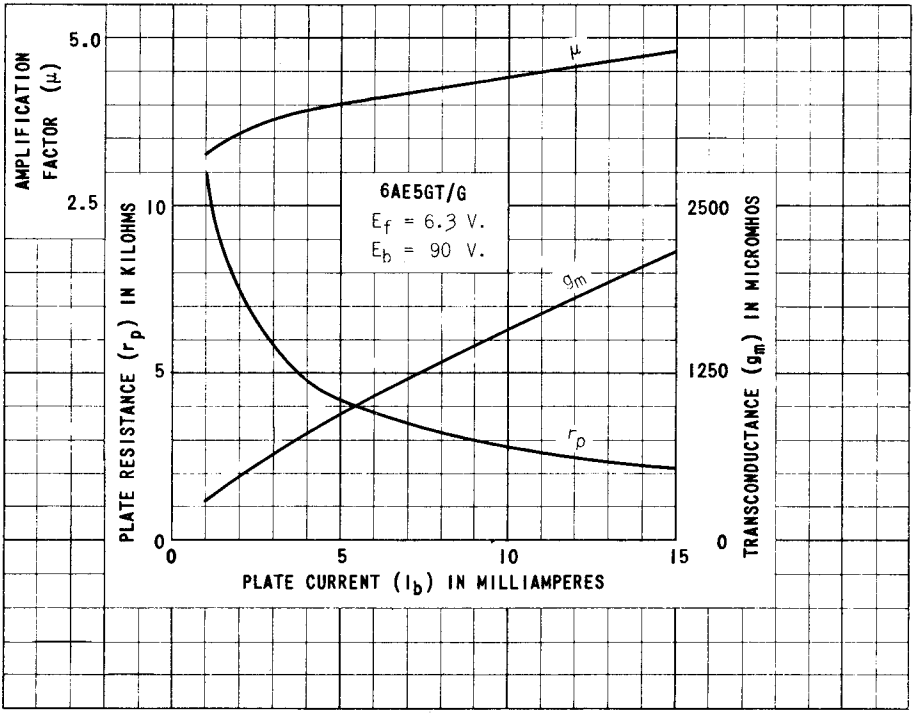
6AE5GT/G





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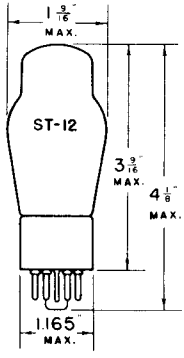


SINGLE GRID - TWIN PLATE

CONTROL TUBE

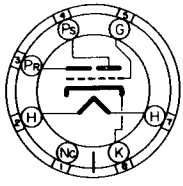
UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.15 AMPERE

AC OR DC

GLASS BULB



G-7AH

BOTTOM VIEW

SMALL 7 PIN OCTAL BASE

THE TUNG-SOL 6AE6G CONSISTS OF A REMOTE CUT-OFF SECTION AND A SHARP CUT-OFF SECTION WHICH HAVE A COMMON CATHODE AND GRID FOR CONTROLLING ELECTRON-RAY TUNING INDICATORS. IN CONJUNCTION WITH EITHER TYPES 6AD6G OR 6AF6G, THE REMOTE CUT-OFF SECTION IS SENSITIVE TO STRONG SIGNALS, AND THE SHARP CUT-OFF SECTION IS SENSITIVE TO WEAK SIGNALS.

OPERATING CONDITIONS AND CHARACTERISTICS

REMOTE CUT-OFF SECTION (PIN #3)

PLATE VOLTAGE	250	250	250	250	VOLTS
GRID VOLTAGE	-35	-15	-6	-1.5	VOLTS
PLATE CURRENT	0.01	0.8	2.8	6.5	MA.
TRANSCONDUCTANCE				1000	µMHOS
AMPLIFICATION FACTOR				25	

SHARP CUT-OFF SECTION (PIN #4)

PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	-9.5	-1.5	VOLTS
PLATE CURRENT	0.01	4.5	MA.
TRANSCONDUCTANCE		950	µMHOS
AMPLIFICATION FACTOR		33	

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 730-1

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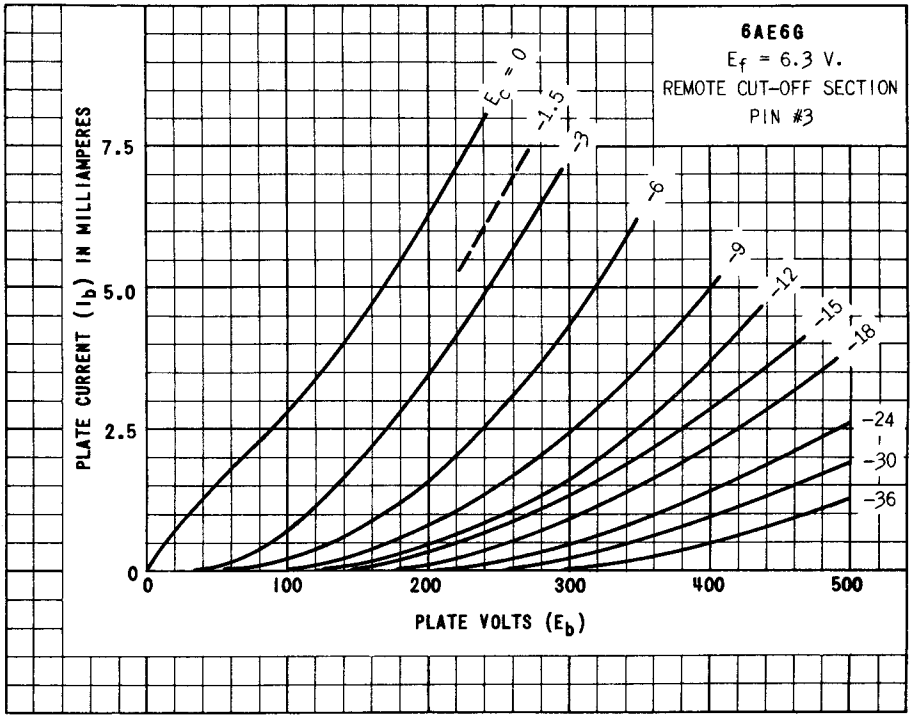
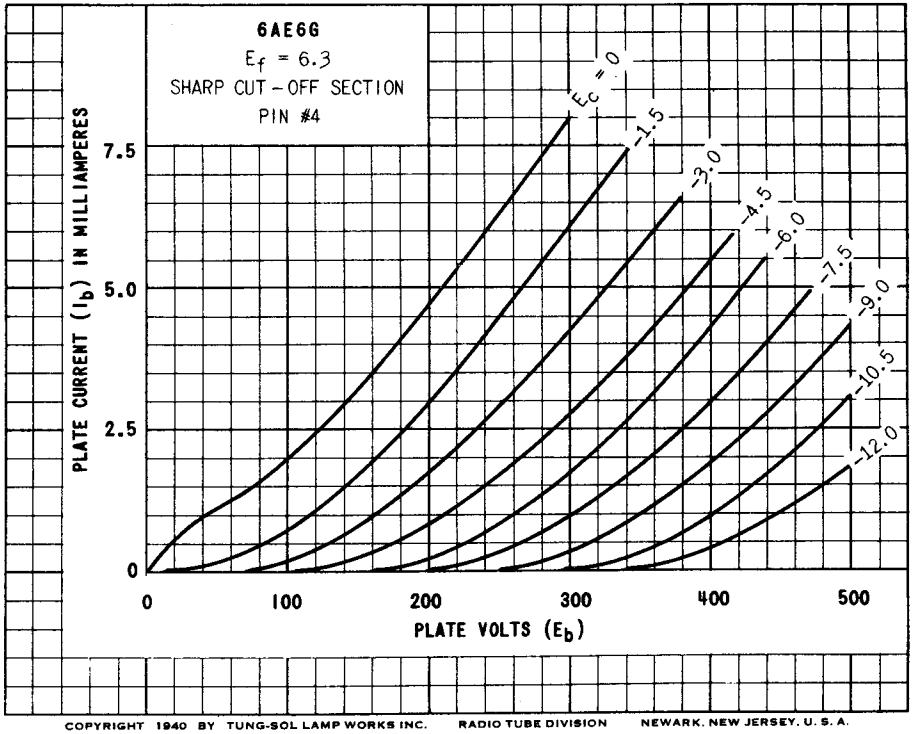
6AE6G





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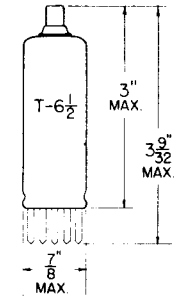


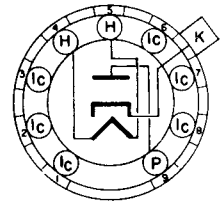
GLASS BULB
SKIRTED MINIATURE

DIODE
MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON
9 PIN NOVAL
9CB

THE 6AF3 IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

HEATER TO CATHODE H TO K	2.8	μμf
CATHODE TO PLATE AND HEATER K TO (P + H)	9.0	μμf
PLATE TO CATHODE AND HEATER P TO (K + H)	6.0	μμf

RATINGS[A]
INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM[BC]

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	1000	VOLTS
TOTAL DC AND PEAK	4500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	4500	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PAEK PLATE CURRENT	750	MA.
MAXIMUM PLATE DISSIPATION	6.0	WATTS
MAXIMUM BULB TEMPERATURE	210	°C

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT =340 MA.)	30	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE CUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B]UNLESS OTHERWISE STATED.

[C]DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST EXTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE

MINIATURE TYPES

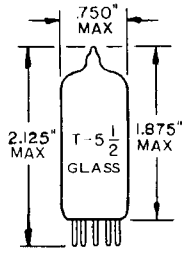
FOR

UHF TELEVISION SERVICE

COATED UNIPOTENTIAL CATHODE

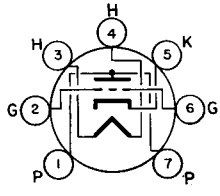
ANY MOUNTING POSITION

6AF4
OUTLINE
JEDEC 5-2



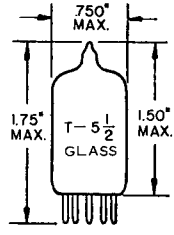
BASE 7 PIN BUTTON
JEDEC E7-1

BASING DIAGRAM
JEDEC 7DK



BOTTOM VIEW

6AF4A
OUTLINE
JEDEC 5-1



BASE 7 PIN BUTTON
JEDEC E7-1

THE 6AF4 AND 6AF4A ARE MEDIUM MU TRIODES IN THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR LOCAL OSCILLATOR SERVICE IN TELEVISION RECEIVERS WHICH OPERATE IN THE UHF REGION. INTERNAL LEAD INDUCTANCE IS REDUCED BY EMPLOYING DOUBLE CONNECTIONS TO THE PLATE AND GRID. ELECTRICALLY, THE 6AF4 IS IDENTICAL TO THE 6AF4A AND DIFFERS IN ENVELOPE SIZE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE EXCEPT AS NOTED

GRID TO PLATE	1.9	pf
GRID TO CATHODE AND HEATER	2.2	pf
PLATE TO CATHODE AND HEATER	1.4	pf
HEATER TO CATHODE - SEE NOTE BELOW	2.2	pf

NOTE: WITH EXTERNAL SHIELD #316 CONNECTED TO PLATE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	225	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		50	VOLTS
DC COMPONENT		25	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID CURRENT	2	mA
CATHODE CURRENT	24	mA

CHARACTERISTICS

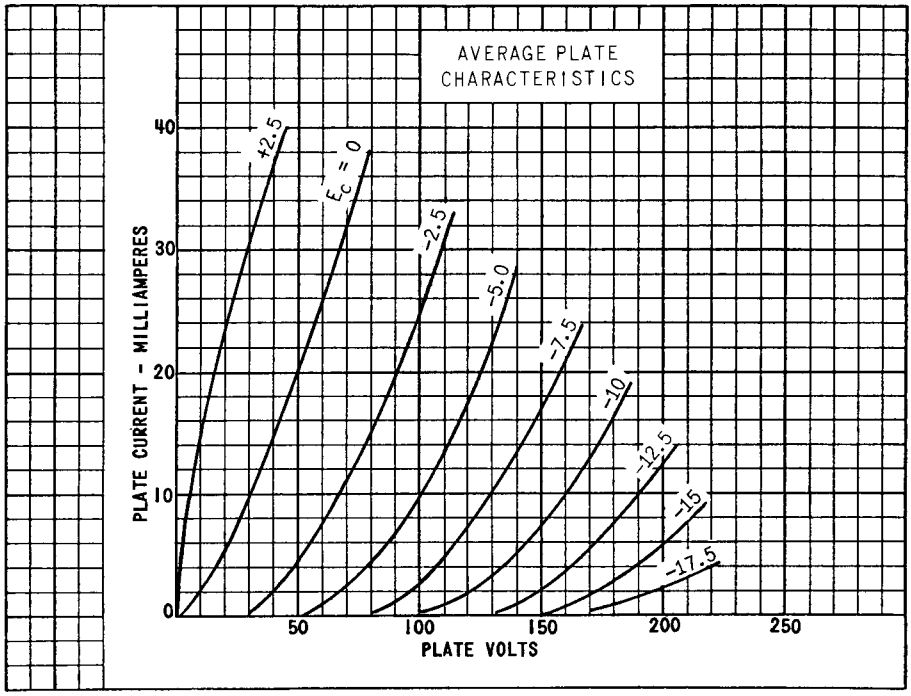
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	80	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	17.5	mA
TRANSCONDUCTANCE	6,500	μMHOS
AMPLIFICATION FACTOR	13.5	
PLATE RESISTANCE	APPROX. 2,100	OHMS

TYPICAL OPERATION

AT FREQUENCY OF 1.000 MC/S

PLATE VOLTAGE	100	VOLTS
PLATE RESISTOR	220	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	17	mA
GRID CURRENT	APPROX. 750	μA



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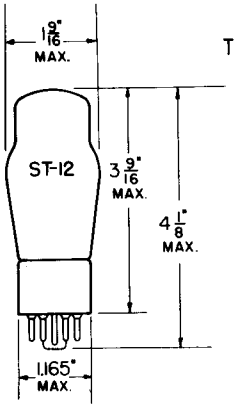


TRIODE VOLTAGE AMPLIFIER

UNIPOTENTIAL CATHODE

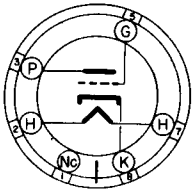
HEATER

6.3 VOLTS 0.3 AMP.

AC OR DC

GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL OCTAL 6 PIN BASE

TYPE 6AF5G IS A TRIODE DESIGNED SPECIFICALLY AS THE DRIVER FOR EITHER TYPE 6AC5GT OR 25AC5G WHEN USED IN DIRECT COUPLED AMPLIFIER CIRCUITS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	180	VOLTS
GRID VOLTAGE	-18	VOLTS
PLATE CURRENT	7.0	MA.
TRANSCONDUCTANCE	1 500	µMHOS
AMPLIFICATION FACTOR	7.4	
PLATE RESISTANCE	4 900	OHMS

TYPE 6AF5G DIRECT COUPLED TO 6AC5GT OR 25AC5G

PLATE-SUPPLY VOLTAGE	165	VOLTS
POWER TUBE PLATE CURRENT	46	MA.
DRIVER TUBE PLATE CURRENT	6.6	MA.
INPUT SIGNAL (RMS)	18	VOLTS
LOAD RESISTANCE	3 500	OHMS
POWER OUTPUT (10% TOTAL DISTORTION)	3.3	WATTS

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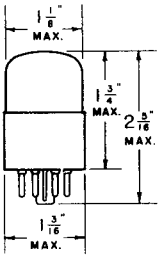

CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

G-7A

GLASS BULB

SMALL 7 PIN OCTAL BASE

THE TUNG-SOL 6AF6G CONSISTS OF A CIRCULAR FLUORESCENT SCREEN WITH TWO INDEPENDENT INDICATING SHADOW ANGLES, EACH CONTROLLED BY A RAY-CONTROL ELECTRODE. WHEN THE 6AF6G IS USED AS A TUNING INDICATOR THE SHADOW ANGLE IS CONTROLLED BY POSITIVE VOLTAGES APPLIED TO THE RAY CONTROL ELECTRODES.

OPERATING CONDITIONS AND CHARACTERISTICS

TARGET VOLTAGE MAX.	135	VOLTS
TARGET VOLTAGE MIN.	90	VOLTS
RAY-CONTROL ELECTRODE SUPPLY VOLTAGE MAX.	135	VOLTS

TUNING INDICATOR

TARGET VOLTAGE	100	135	VOLTS
TARGET CURRENT [T]	0.9	1.5	MA.
RAY-CONTROL ELECTRODE VOLTAGE [P]	60	81	APPROX. VOLTS
RAY-CONTROL ELECTRODE VOLTAGE [PP]	0	0	APPROX. VOLTS

[T] WITH 0 VOLTS ON RAY-CONTROL ELECTRODES. SUBJECT TO WIDE VARIATION.
[P] FOR 0° SHADOW ANGLE PRODUCED BY EITHER RAY-CONTROL ELECTRODE.
[PP] FOR 100° SHADOW ANGLE PRODUCED BY EITHER RAY-CONTROL ELECTRODE.
THE PLANE OF THE CONTROL ELECTRODES PASSES THROUGH PINS #3 AND #7.

NOTE: A DOUBLE TRIODE, SUCH AS THE 6C8G OR THE 6F8G, CAN BE USED TO OBTAIN TWO SENSITIVITIES FOR A TUNING INDICATOR BY APPLYING FULL A.V.C. VOLTAGE TO ONE TRIODE AND 1/10 OF THE A.V.C. VOLTAGE TO THE OTHER.

IN AC-DC SUPERHETERODYNE RECEIVERS A SHADOW ANGLE VARIATION OF 0 TO 90° WITH A.V.C. ACTION MAY BE OBTAINED WITHOUT AN AMPLIFIER TUBE BY RAISING THE CATHODE OF THE 6AF6G TO +30 VOLTS, SUPPLYING I F TUBE SCREEN THROUGH A 50 000 OHM RESISTOR AND CONNECTING THE CONTROL ELECTRODES TO THE SCREEN.

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PLATE
238-1

DEC.12
1938

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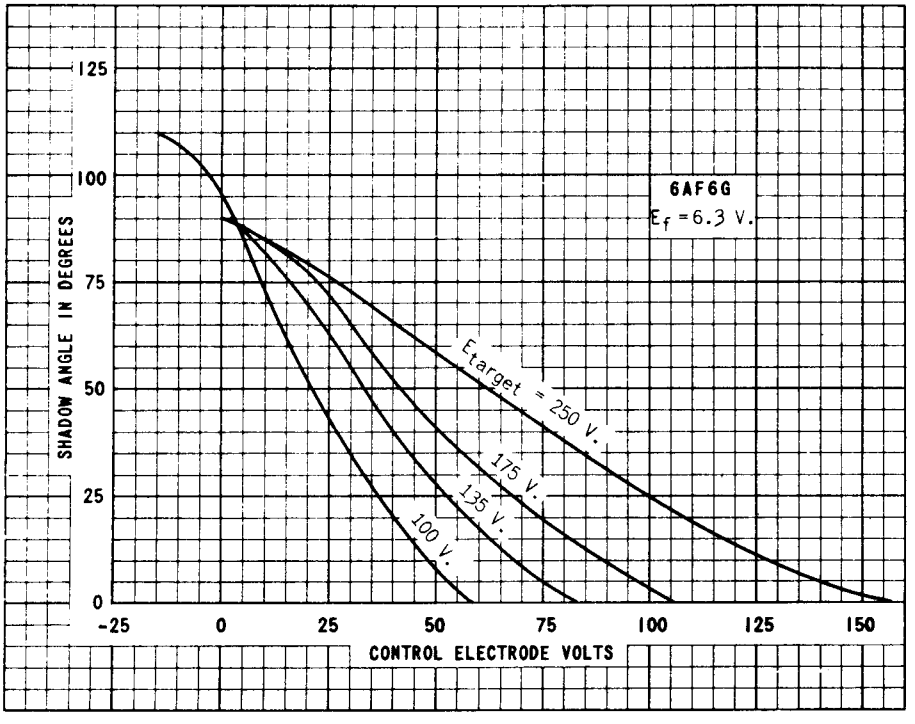

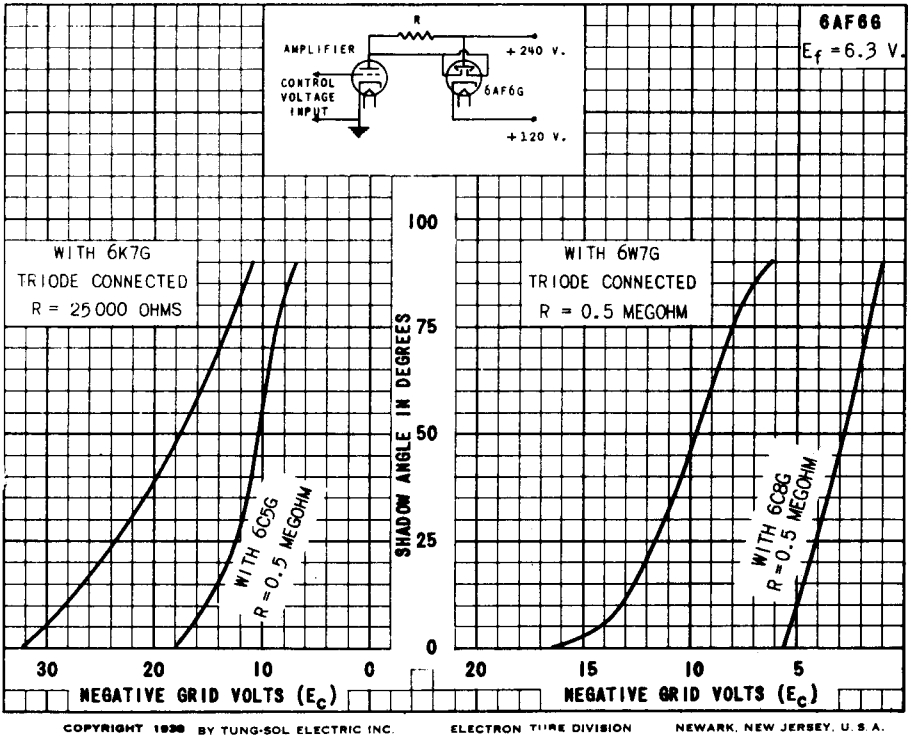

PLATE 283-1

JAN. 3 1939

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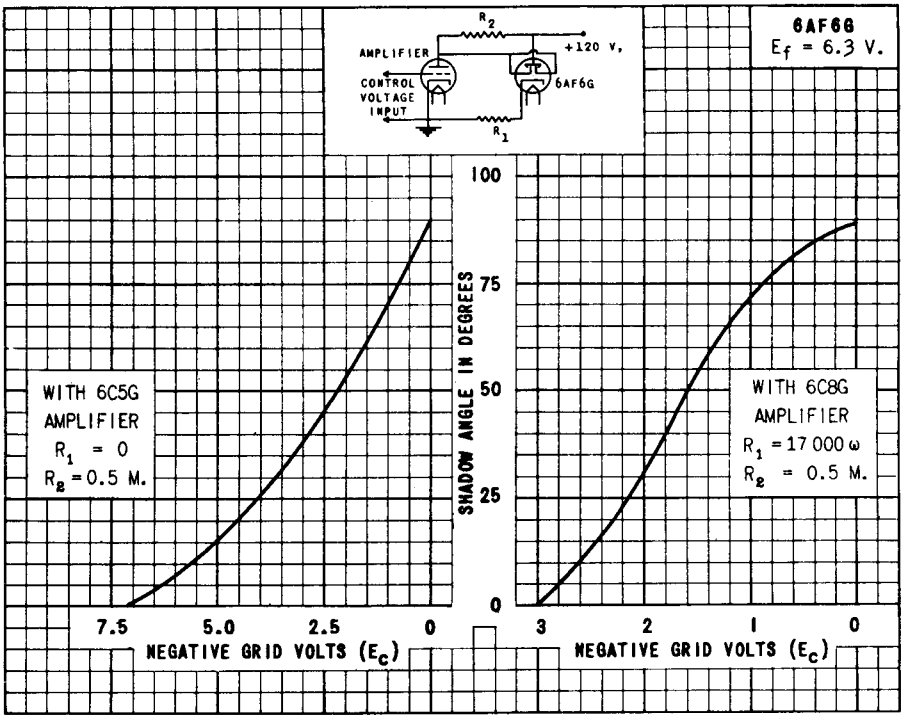
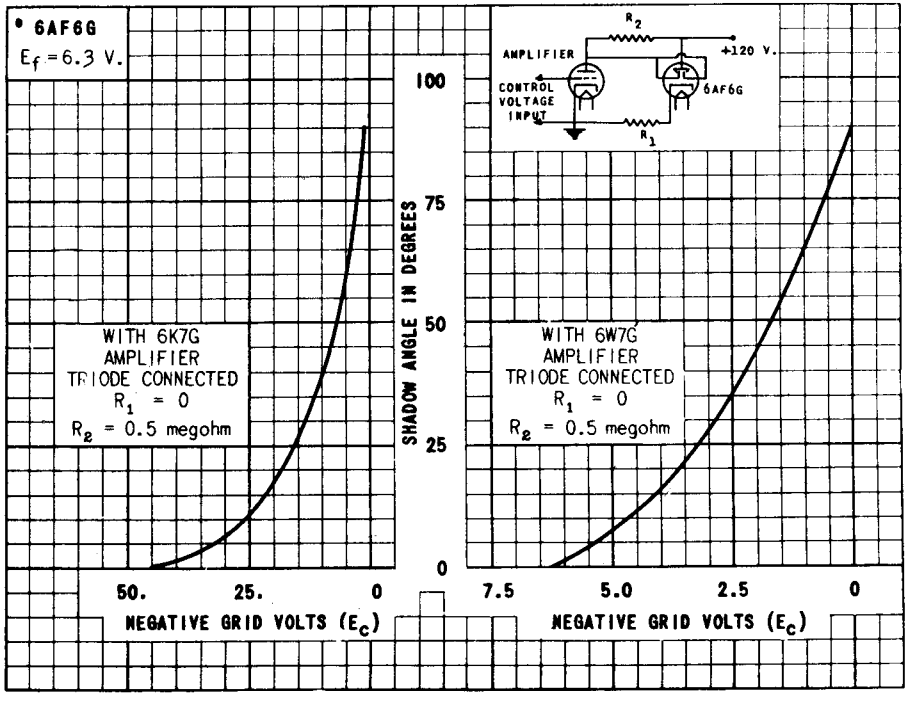
6AF6 G





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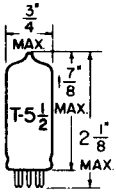
PENTODE

MINIATURE TYPE

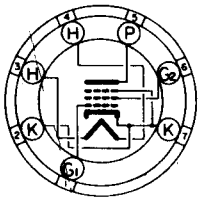


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
I8D

THE 6AG5 IS A MINIATURE TYPE RF PENTODE HAVING A SHARP CUT-OFF CHARACTERISTIC AND A HIGH VALUE OF TRANSCONDUCTANCE. IN COMPACT, LIGHT-WEIGHT EQUIPMENT IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MEGACYCLES, AND AS A HIGH-FREQUENCY, INTERMEDIATE AMPLIFIER. IT HAS LOW INPUT CAPACITANCE AND LOW OUTPUT CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION			
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.6	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	3.1	1.8	μμf
TRIODE CONNECTION (G_2 TIED TO PLATE)			
GRID TO PLATE: G TO (P+G_2)	2.5	2.5	μμf
INPUT: G TO (H+K+G_3&IS)	3.6	3.6	μμf
OUTPUT: P+G_2 (H+K+G_3&IS)	4.3	3	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	TRIODE CONNECTION[B]	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	PLATE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	PLATE		SEE J5-C4
MAXIMUM PLATE DISSIPATION	2.5	2	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS

[B] TRIODE CONNECTION – GRID #2 CONNECTED TO PLATE.

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PLATE
2950
JUNE 1
1952

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	300	300	300	MA.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE RESISTOR	180	100	180	OHMS
TRANSCONDUCTANCE	4 500	5 100	5 000	µMHOS
PLATE CURRENT	4.5	7.2	6.5	MA.
GRID #2 CURRENT	1.4	2.1	2	MA.
PLATE RESISTANCE (APPROX.)	0.6	0.5	0.8	MEGOHM
GRID #1 VOLTAGE FOR i_b = 10 µA. (APPROX.)	-5	-6	-8	VOLTS

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	250	180	VOLTS
GRID #2 VOLTAGE	PLATE	PLATE	
CATHODE RESISTOR	820	330	OHMS
TRANSCONDUCTANCE	3 800	5 700	µMHOS
PLATE CURRENT	5.5	7	MA.
PLATE RESISTANCE (APPROX.)	0.01	0.008	MEGOHM
AMPLIFICATION FACTOR	42	45	

[C] GRID #2 TIED TO PLATE.

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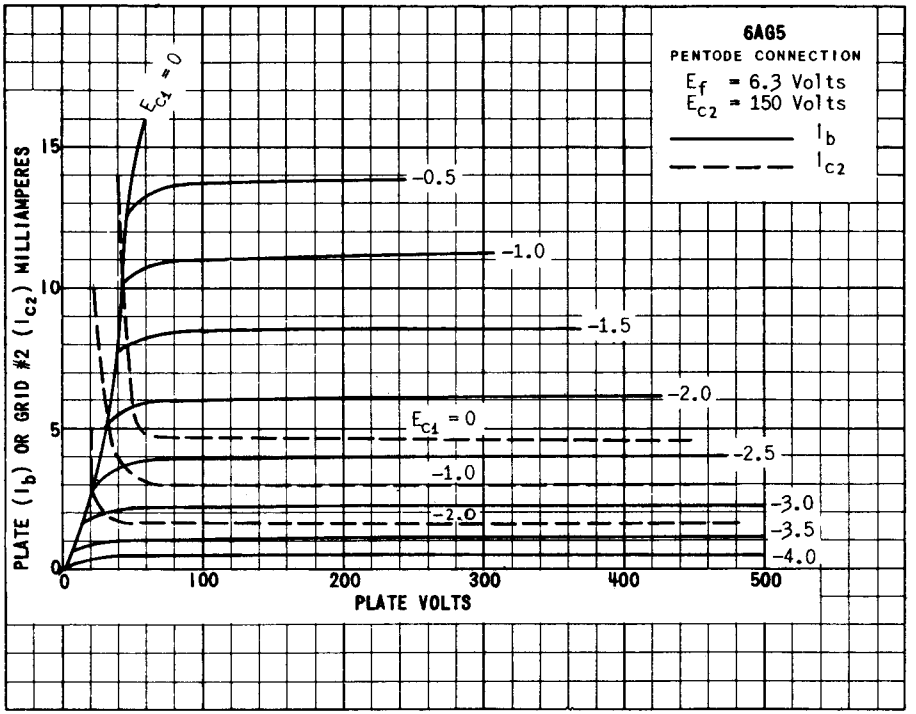

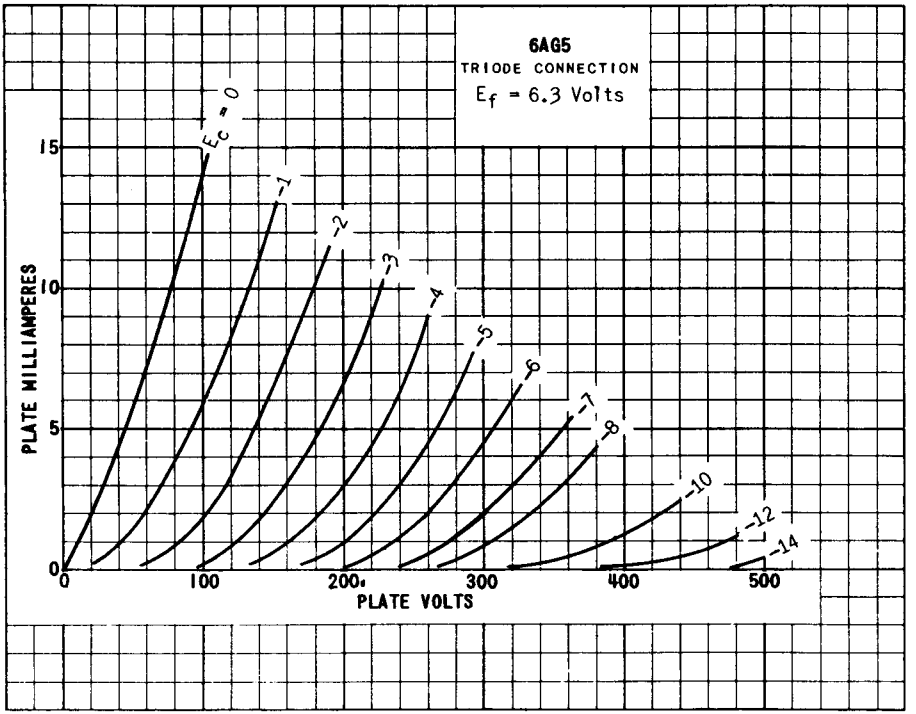

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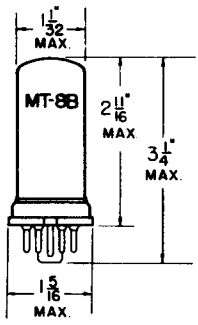
PENTODE

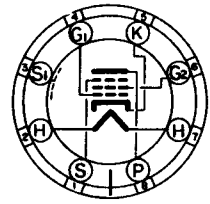


METAL SHELL

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.65 AMPERE
AC OR DC

VERTICAL MOUNTING POSITION
HORIZONTAL OPERATION PERMITTED IF PINS 2 & 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL

THE 6AG7 IS A POWER OUTPUT PENTODE USING THE OCTAL BASE AND METAL SHELL CONSTRUCTION. IT HAS HIGH PERVEANCE, LOW CAPACITANCES, AND THE POWER REQUIREMENTS NECESSARY FOR EITHER STRAIGHT VIDEO OUTPUT AMPLIFIER OR CATHODE FOLLOWER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHELL AND INTERLEAD SHIELD CONNECTED TO CATHODE

GRID TO PLATE: (G TO P) MAX.	0.06	μμf
INPUT: G TO (H+K+G_2+G_3&S+IS)	13	μμf
OUTPUT: P TO (H+K+G_2+G_3&S+IS)	7.5	μμf
GRID #1 TO GRID #2: (G_1 TO G_2) APPROX.	5.8	μμf
GRID #1 TO CATHODE: (G_1 TO K) APPROX.	5.2	μμf
HEATER TO CATHODE: (H TO K) APPROX.	10.7	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (SHOULD NOT DEVIATE MORE THAN 10%)	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MINIMUM NEGATIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	9	WATTS
MAXIMUM SCREEN DISSIPATION	1.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.25	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	1	MEGOHM

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE (SHOULD NOT DEVIATE MORE THAN 10%)	6.3	VOLTS
HEATER CURRENT	0.65	AMP.
PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-3	VOLTS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	7	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30.5	MA.
MAXIMUM-SIGNAL SCREEN CURRENT (NOMINAL)	9	MA.
PLATE RESISTANCE (APPROX.)	0.13	MEGOHM
TRANSCONDUCTANCE	11 000	μMHOS
LOAD RESISTANCE	10 000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
POWER OUTPUT	3	WATTS

VIDEO VOLTAGE AMPLIFIER - CLASS A_1

4 MC BANDWIDTH

	GRID LEAK BIAS[A]	CATHODE BIAS	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.65	0.65	AMP.
PLATE SUPPLY VOLTAGE	300	300	VOLTS
GRID #2 VOLTAGE	115[B]	125[C]	VOLTS
GRID #1 VOLTAGE	0[D]	-2	VOLTS
GRID #1 RESISTOR (MINIMUM)	0.25	---	MEGOHM
GRID #1 RESISTOR (MAXIMUM)	0.5	---	MEGOHM
CATHODE RESISTOR (BY-PASSED BY 250 μF APPROX.)	---	57	OHMS
ZERO-SIGNAL PLATE CURRENT	45	28	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	13	7	MA.
LOAD RESISTANCE	3 500	3 500	OHMS
PEAK TO PEAK GRID SIGNAL SWING	4	4	VOLTS
PEAK TO PEAK VOLTAGE OUTPUT	135	140	VOLTS
INTERLEAD SHIELD		CONNECTED TO GROUND	

[A] TO BE USED WHERE RESISTORATION IS ACCOMPLISHED IN THE GRID CIRCUIT.

[B] OBTAINED FROM SUPPLY HAVING GOOD REGULATION.

[C] OBTAINED PREFERABLY FROM THE 300 VOLT PLATE SUPPLY THROUGH A 25000 OHM SERIES SCREEN RESISTOR.

[D] ZERO-SIGNAL VALUE.

PLATE 1959
FEB. 2, 1948

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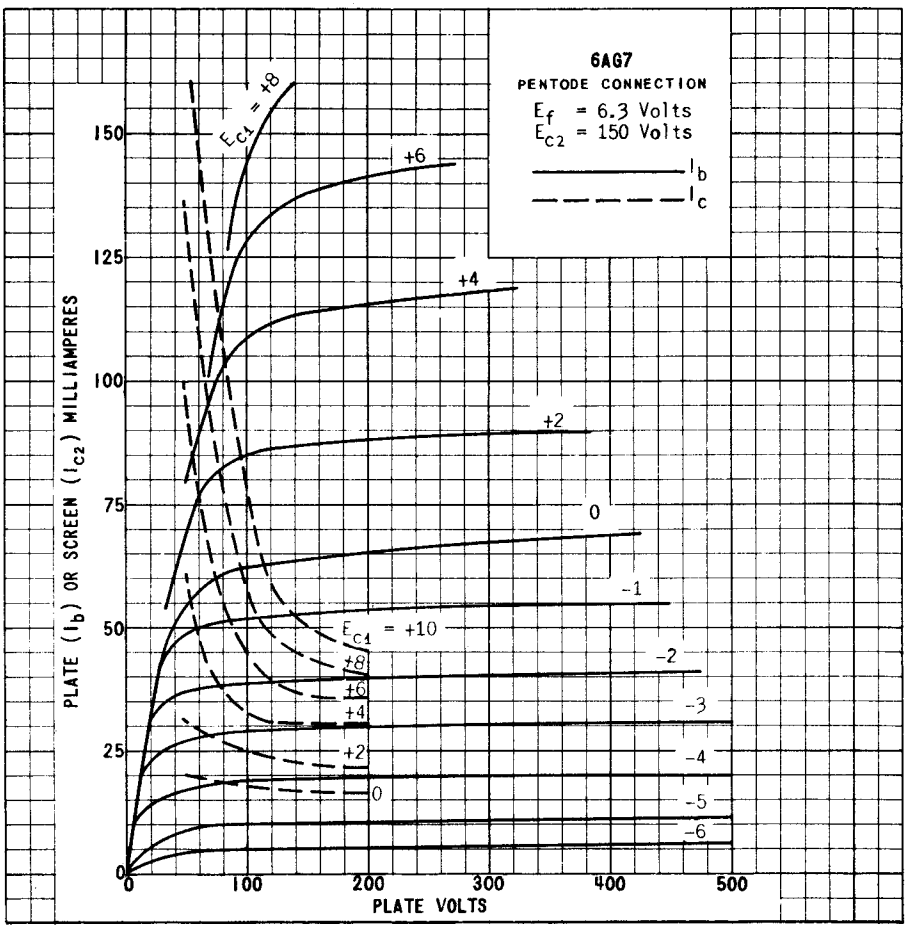

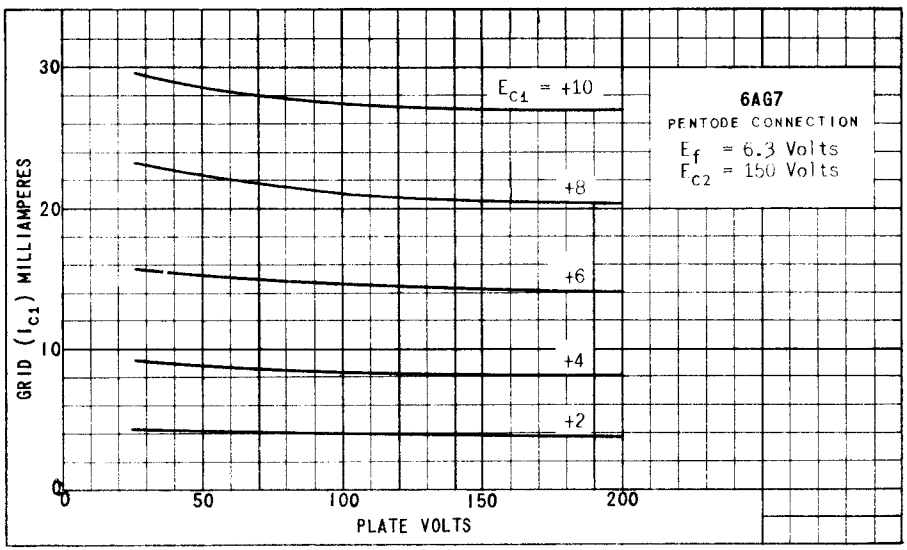

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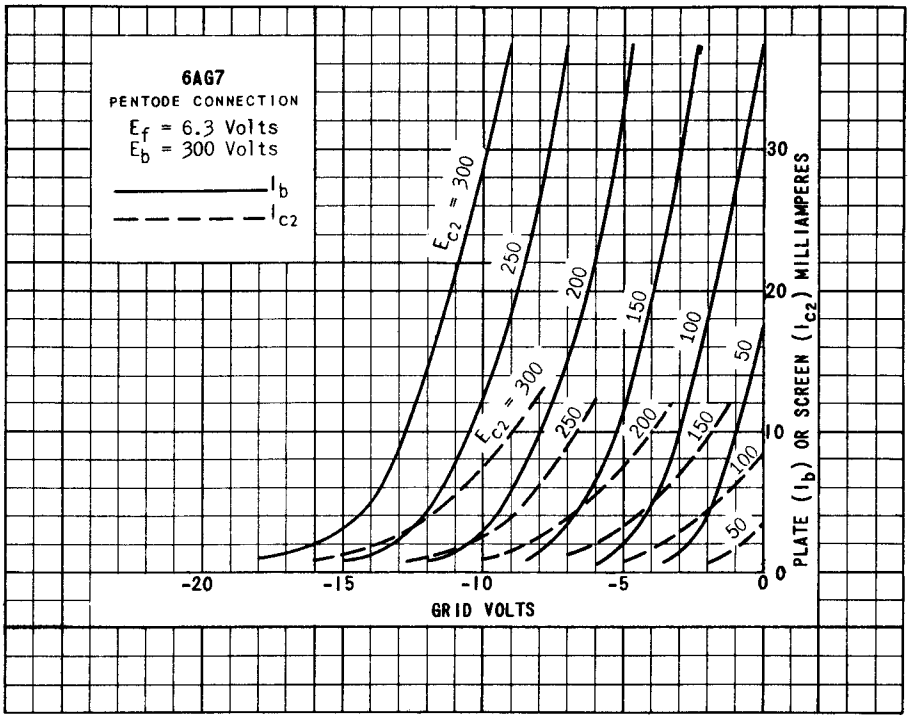
6AG7



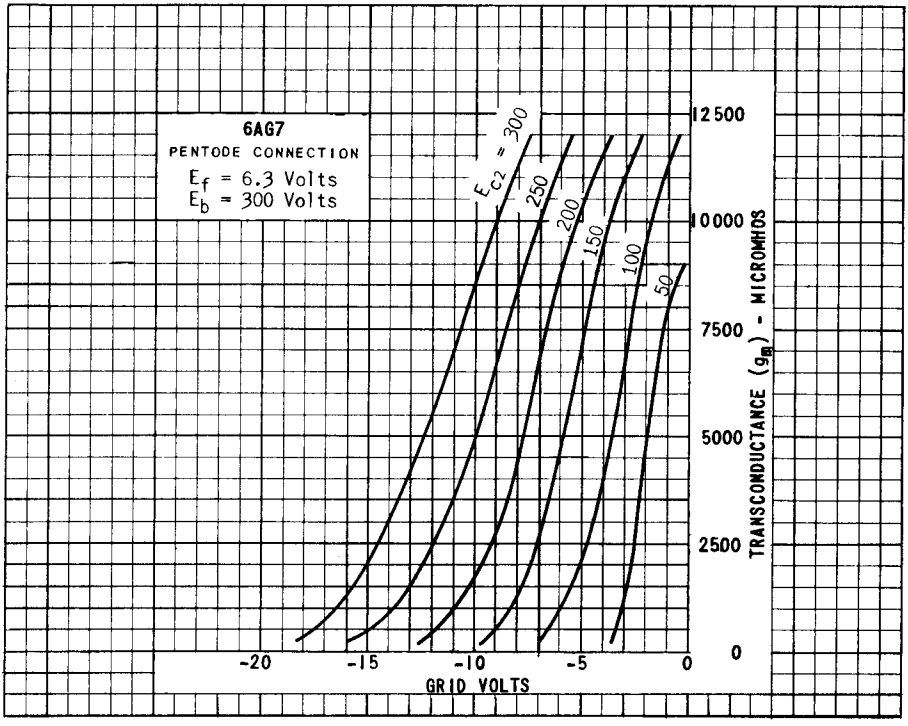


PLATE
1957
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1948

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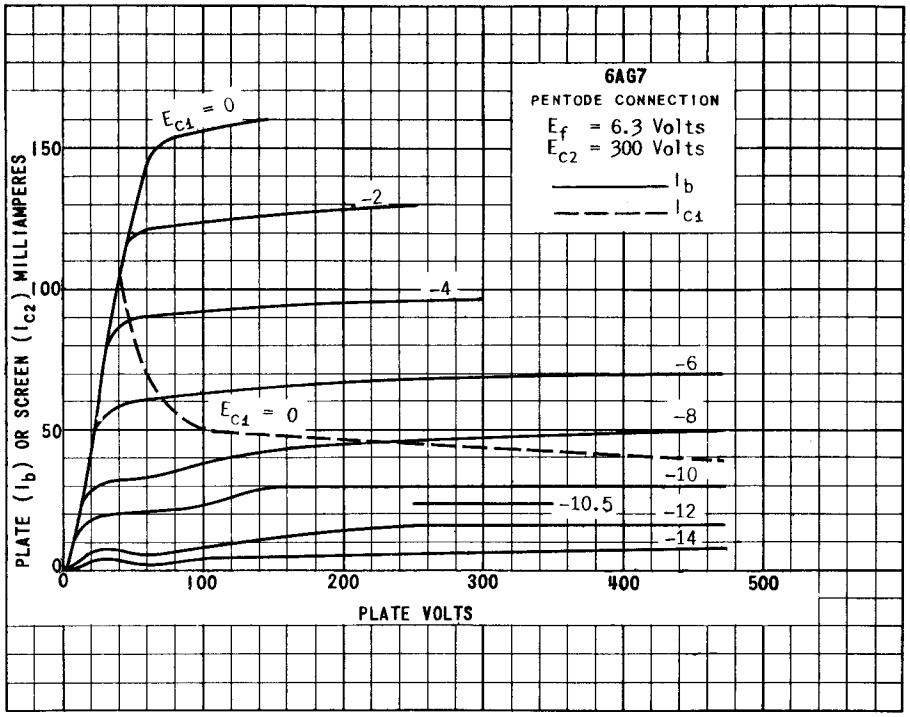

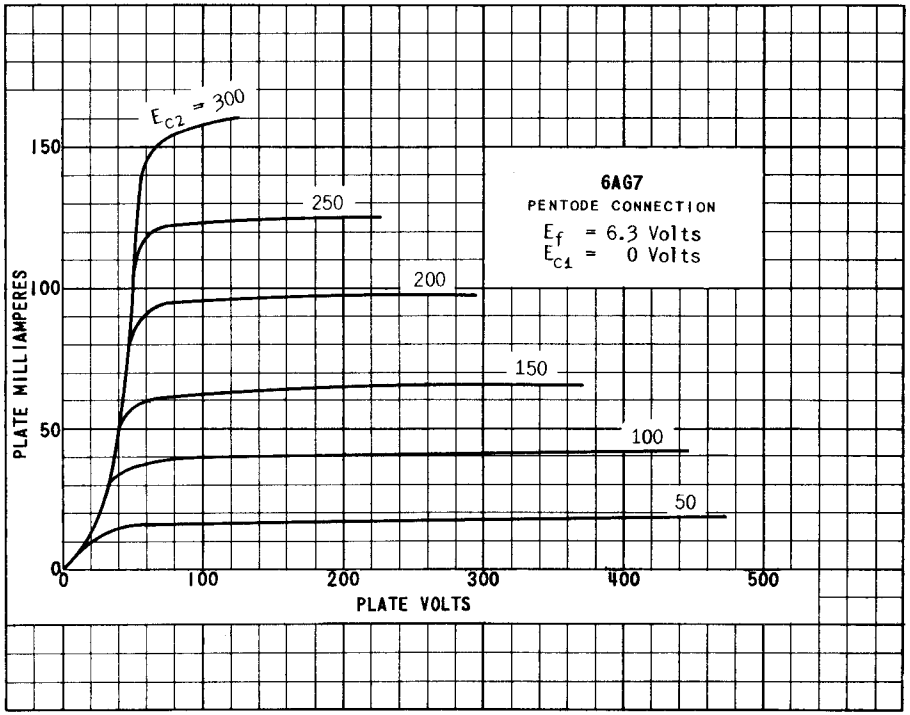

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PLATE
1958
FEB. 2,
1948

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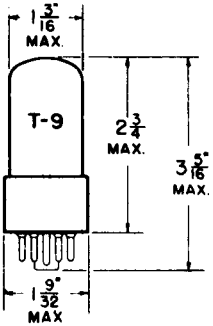
TRIODE

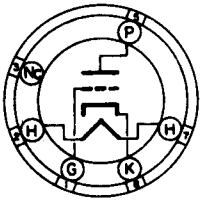


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 750 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
8EL

THE 6AH4GT IS A HIGH PERVEANCE TRIODE DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE: (G TO P)	4.4	4.2	μμf
INPUT: G TO (H+K)	7	7.5	μμf
OUTPUT: P TO (H+K)	1.7	3.2	μμf

[A] EXTERNAL SHIELD #308 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

VERTICAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	500	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE	2 000	VOLTS
MAXIMUM PLATE DISSIPATION[C]	7.5	WATTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	-200	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	60	MA.
MAXIMUM PEAK CATHODE CURRENT	180	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	MEGOHMS

[B] FOR OPERATION ON A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE IN TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DURATION OF THE VOLTAGE PULSE IS NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

[C] AN ADEQUATE BIAS RESISTOR OR OTHER MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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PLATE 2953
JUNE 1 1952

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	750	750	MA.
PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	-33	-23	VOLTS
PLATE CURRENT	5	30	MA.
TRANSCONDUCTANCE	4 500		µMHOS
AMPLIFICATION FACTOR	8		
PLATE RESISTANCE	1 780		OHMS
GRID VOLTAGE FOR 0.5 MA. PLATE CURRENT (APPROX.)	-40		VOLTS

PLATE 2954
JUNE 1 1952

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TUNG-SOL

PENTODE

MINIATURE TYPE

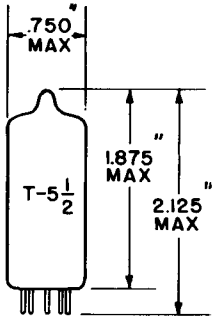
COATED UNIPOTENTIAL CATHODE

FOR

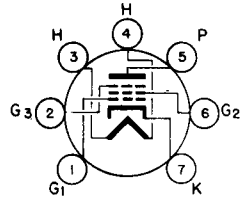
VOLTAGE AMPLIFIER

SERVICE IN T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM

JEDEC 7CC

THE 6AH6 IS A SHARP CUT-OFF VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY A VERY HIGH TRANSCONDUCTANCE AND MODERATELY LOW INTERELECTRODE CAPACITANCES WHICH ADAPT IT TO WIDE BAND VIDEO AND INTERMEDIATE FREQUENCY AMPLIFIER SERVICE.

→ DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #316 CONNECTED TO PIN 7

GRID TO PLATE: (G1 TO P)	0.020	pf
INPUT: G1 TO (H+K+G2+G3)	10	pf
OUTPUT: P TO (H+K+G2+G3)	3.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
PLATE DISSIPATION	3.2	WATTS
GRID #2 DISSIPATION	0.4	WATTS
CATHODE CURRENT	13	MA.
GRID #2 SUPPLY VOLTAGE	→ 300	VOLTS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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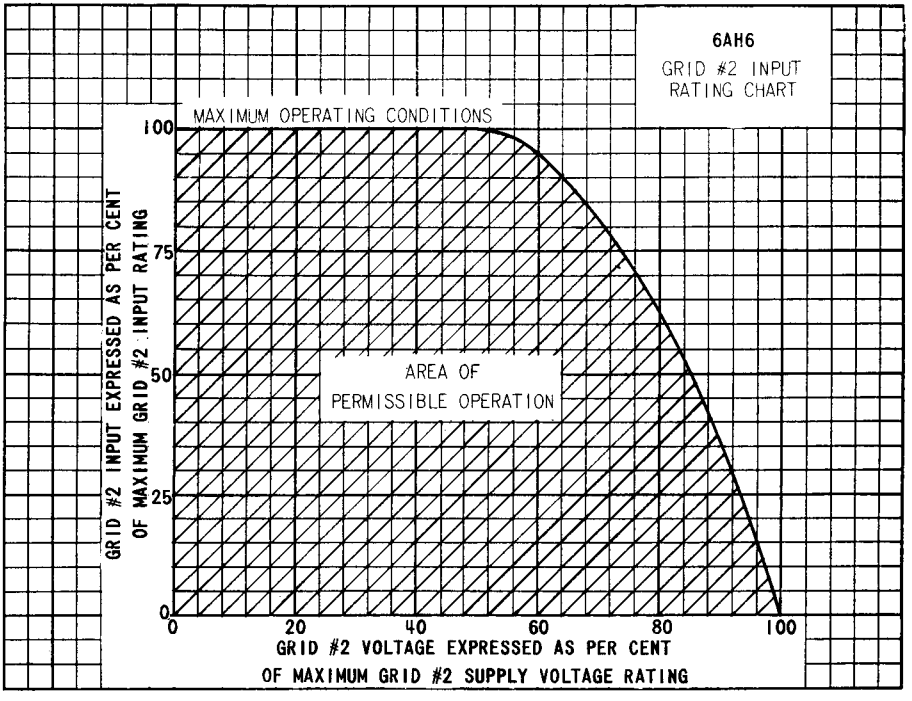
TYPICAL OPERATING CHARACTERISTICS

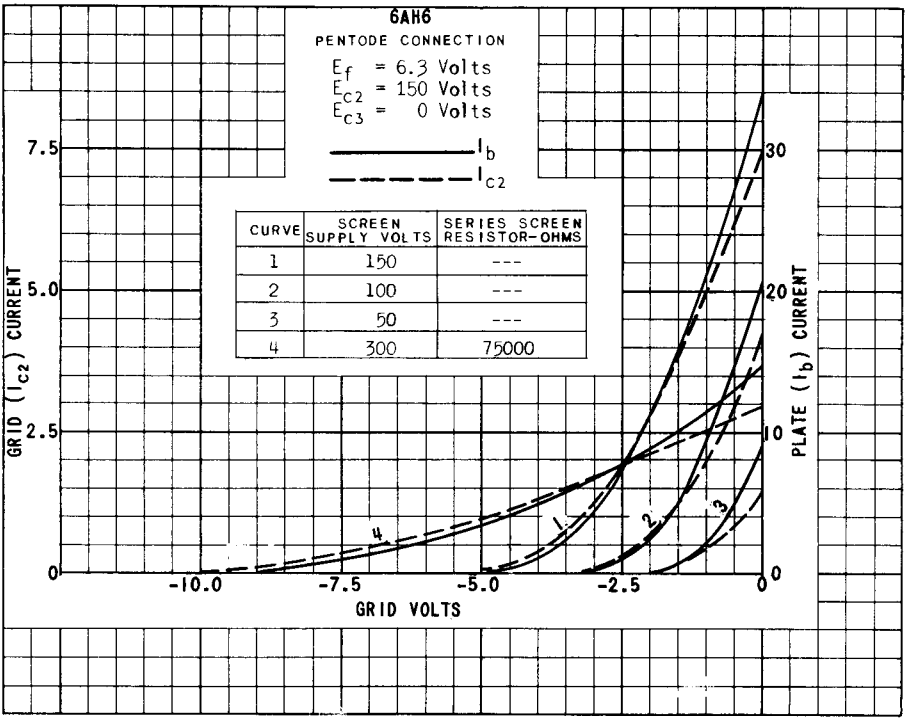
	PENTODE CONNECTED	TRIODE CONNECTED	
PLATE VOLTAGE	300	150	VOLTS
GRID #2 VOLTAGE	150	→ 150	VOLTS
GRID #3 VOLTAGE*	A	150	VOLTS
CATHODE RESISTOR	160	160	OHMS
PLATE RESISTANCE (APPROX.)	0.5	0.0036	MEGOHMS
TRANSCONDUCTANCE	9000	11000	μMHOS
TRANSCONDUCTANCE (GRID #3 TO PLATE)	B	---	
AMPLIFICATION FACTOR	---	40	
PLATE CURRENT	10	12.5	MA.
GRID #2 CURRENT	2.5	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA.	-7	-7	VOLTS

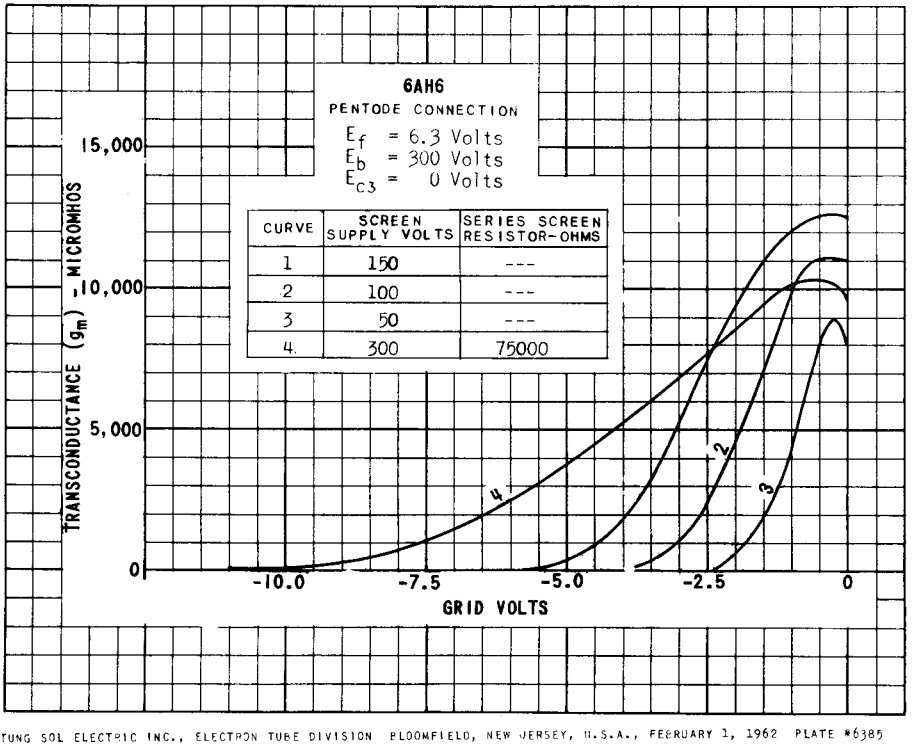
A
PIN #2 CONNECTED TO #7 AT SOCKET.

B
GRID #3 HAS PRACTICALLY NO CONTROL CHARACTERISTIC AND IT IS NOT INTENDED TO BE USED AS A CONTROL ELECTRODE. ITS TRANSCONDUCTANCE TO THE PLATE IS APPROXIMATELY 2 μMHOS AND THE MU IS 0.7 TO 1.0.

* INDICATES AN ADDITION.
→ INDICATES A CHANGE.







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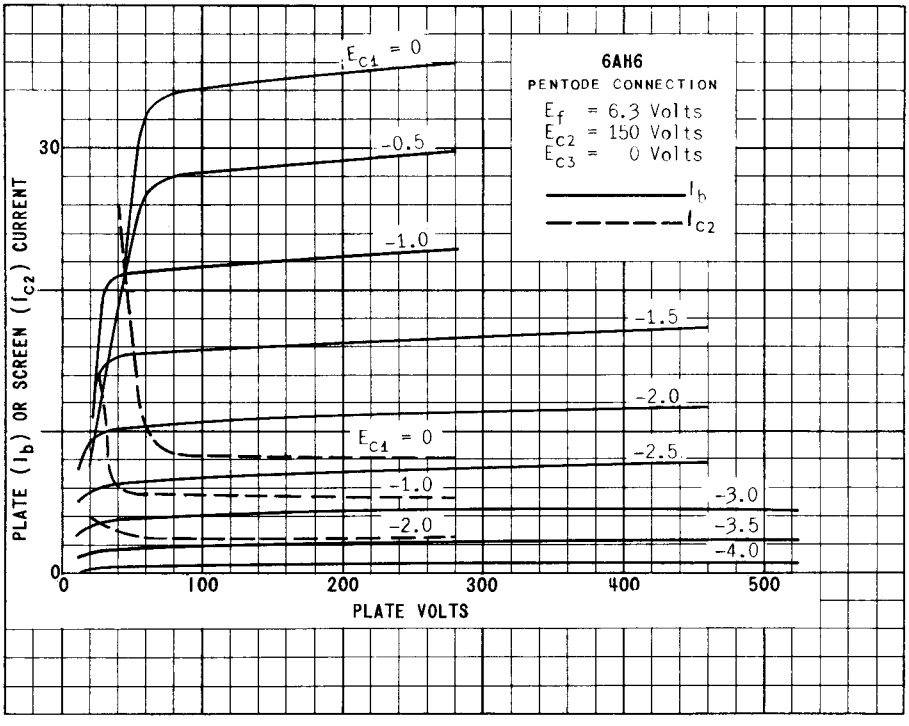
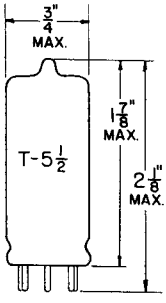
6AH6


6AH6
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
E_{c1} = 0
-1.0
-2.0
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT
PLATE VOLTS
0
30
100
200
300
400
500

TUNG-SOL

PENTODE

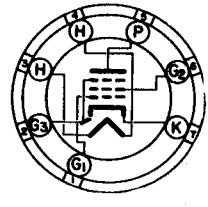
MINIATURE TYPE



GLASS BULB
6-2

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
78K

THE 6AH6WA IS A HEATER-CATHODE TYPE, HIGH TRANSCONDUCTANCE, SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A WIDE BAND OR IF AMPLIFIER IN MOBILE AND AIRCRAFT APPLICATIONS.

RATINGS
MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR FATIGUE TEST-NOTE #4)	2.5	G
MAXIMUM BULB TEMPERATURE	180	°C

RATINGS
AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORMAL TEST CONDITIONS (NOTE 6)	NORMAL OPERATION (NOTE 5)	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 7)	Ef:	5.7	6.3	6.3	6.9	VOLTS
PLATE VOLTAGE	Eb:	---	300	300	330	Vdc
GRID #1 VOLTAGE	Ec1:	---	0	0	---	Vdc
GRID #2 VOLTAGE	Ec2:	---	150	150	165	Vdc
GRID #3 VOLTAGE	Ec3:	---	0	0	---	Vdc
PLATE DISSIPATION	Pp:	---	---	3.0	3.3	W
GRID #2 DISSIPATION	Pg2:	---	---	0.38	0.45	W
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	v
CATHODE CURRENT	Ik:	---	---	12.5	28	mAdc
CATHODE RESISTANCE	Rk:	---	160	160	---	OHMS
PLATE CURRENT (1)	Ib(1):	---	---	10	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.5	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	9000	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.5	---	MEG.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1		COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES							
HEATER CURRENT:	0.65	If:	420	432	450	468	480	36	mA
HEATER-CATHODE LEAKAGE:									
Ehk=+100 Vdc	0.65	Ihk:	---	---	---	---	15	---	μAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	15	---	μAdc
GRID CURRENT:									
Rg1= 1.0 MEG.	0.65	Ic(1):	---	---	---	---	-2.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	7.5	8.7	10.0	11.3	12.5	2.5	mAdc
PLATE CURRENT (2):									
Ec1=10.0 Vdc	0.65	Ib(2):	---	---	---	---	30	---	μAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	7000	8000	9000	10000	11000	12000	μMHOS
SCREEN GRID CURRENT:	0.65	Ic2:	1.5	1.9	2.5	3.1	3.5	1.4	mAdc
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL:	---	---	---	---	---	---	---	---	---
ENVELOPE T-5½ (6-2)									
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES: Ef=6.3V									
Eg1-ALL=-100 Vdc	2.5	Rg1-all:	100	---	---	---	---	---	MEG.
Ep-ALL=-300 Vdc		Rp-all:	100	---	---	---	---	---	MEG
PLATE CURRENT (3):									
Ec1=-5.0 Vdc	2.5	Ib(3):	5	---	---	---	---	---	μAdc
TRANSCONDUCTANCE (2):									
Ef=5.7 (NOTE 8)	2.5	Δ_{Ef} Sm(2):	---	---	---	---	15	---	PERCENT
GRID EMISSION: Ef=7.5V; PREHEAT 5 MINUTES AT Ec1= 0 Vdc; TEST AT Ec1= =-10 Vdc	2.5	Ic1(2):	---	---	---	---	-2.0	---	μAdc
RF NOISE: Esig=35 mVac; Ck= 0.2 μf	2.5	EB:	---	---	---	---	5	---	VU
NOISE AND MICROPHONICS: Ef=6.3 Vac; Ebb=Ecc2= 300 Vdc; Ec1=0; Rk= 200 OHMS; Ec3 to GROUND; Rp=10,000 OHMS; Rg2=60,000 OHMS; Cg2=2 μf; Ck= 1000 μf: Eca1=300 mVac.	2.5	EB:	---	---	---	---	17	---	VU

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2- cont'd.		COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES							
CAPACITANCE		Cgp:	---	---	---	---	0.035	---	pf
CAPACITANCE(NOTE 2)	6.5	Cin:	8.0	---	10	---	12	---	pf
CAPACITANCE		Cout:	3.0	---	4.5	---	6	---	pf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE=55±5mmHg; VOLTAGE =500 VAC.	6.5	---	---	---	---	---	---	---	---
VIBRATION (2): F=25 cps; G=2.5: Rp=2000 OHMS; Ck= 1000 μf	2.5	Ep:	---	---	---	---	100	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SHOCK: HAMMER ANGLE=30°; Ehk=+100 Vdc; (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE: 96 HRS; G=2.5 FIXED FREQUENCY; F=25 min.,60 max. (NOTE 4)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS:									
VIBRATION (2): F=25cps; G=2.5; Rp=2000 ohms; Ck= 1000 μf	---	Ep:	---	---	---	---	200	---	mVac
HEATER-CATHODE LEAKAGE:									
Ehk=+100 Vdc		Ihk:	---	---	---	---	30	---	μAdc
Ehk=-100 Vdc	---	Ihk:	---	---	---	---	30	---	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	---	Δ_t Sm(1):	---	---	---	---	20	---	PERCENT
GRID CURRENT(1):	---	Ic1:	---	---	---	---	-4.0	---	μAdc
MINIATURE TUBE BASE STRAIN:	---	---	---	---	---	---	---	---	---
GLASS STRAIN (THERMAL SHOCK)	2.5	---	---	---	---	---	---	---	---
ACCEPTANCE LIFE TESTS									
HEATER CYCLING LIFE TEST: Ef=7.5V; Eb=Ec1= Ec2=Ec3=0V; Ehk=+ 100 Vdc; 1min on, 4 min. off.	1.0	---	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST ACCEPTANCE LIFE TESTS	ALLOW. DEF. per CHARAC. 1st SAMP.	ALLOW. DEF. per CHARAC. COMB. SAMP.	AQL &	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
HEATER CYCLING LIFE							
TEST END POINTS:							
HEATER-CATHODE							
LEAKAGE:							
Ehk=+100 Vdc			---	Ihk:	---	30	μAdc
Ehk=-100 Vdc			---	Ihk:	---	30	μAdc
1 HOUR STABILITY							
LIFE TEST:							
TA=ROOM; Ehk=+ 135Vdc; Rgi=0.1 meg. min.			---	---	---	---	---
1 HOUR STABILITY							
LIFE TEST END							
POINTS;							
CHANGE IN TRANS-CONDUCTANCE (1) OF INDIVIDUAL TUBES:							
(TYPICAL SAMPLE SIZE=50 TUBES)			1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL							
RATE LIFE TEST:							
TA=ROOM;Ehk=+135 Vdc; Rgi=0.1meg. min.			---	---	---	---	---
100 HOUR SURVIAL RATE							
LIFE TEST END POINTS:							
(TYPICAL SAMPLE SIZE=200 TUBES)			---	---	---	---	---
CONTINUITY AND SHORTS (INOPERATIVES):			0.65	---	---	---	---
TRANSCONDUCTANCE (1):			1.0	Sm(1):	6300	---	μMHOS
INTERMITTENT HIGH							
TEMPERATURE LIFE TEST:							
T BULB=+180°C; Ehk=+ 135 Vdc; Rgi=0.1meg.min.			---	---	---	---	---
500 HOUR INTERMITTENT							
HIGH TEMPERATURE LIFE							
TEST END POINTS:							
(TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)							
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	0	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	410	490	MA
CHANGE IN TRANSCON-DUCTANCE (1) OF IN-DIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 8)	2	5	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE							
LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc

CONTINUED ON FOLLOWING PAGE

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEF. PER CHARACTER.		AQL	MIL-E-1			MIL-E-1
ACCEPTANCE LIFE TESTS - cont'd.	1st SAMP.	COMB. SAMP.	%	SYMBOL	MIN.	MAX.	UNITS
ELECTRODE INSULATION:							
g1-all	2	5	---	$R_{g1\text{-}all}$:	50	---	MEG.
p-all			---	$R_{p\text{-}all}$:	50	---	MEG.
TRANSCONDUCTANCE (1) AVG. CHANGE:	---	---	---	$Avg.\Delta_t Sm(1)$:	---	15	PERCENT
TOTAL DEFECTIVES	4	8	---	---	---	---	---
1000 HOUR INTERMITTENT LIFE TEST END POINTS: (TYPICAL SAMPLE SIZES= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	2	5	---	---	---	---	---
GRID CURRENT (1):	2	5	---	$I_{c1}(1)$:	0	-2.0	μAdc
HEATER CURRENT:	2	5	---	I_f:	410	490	MA.
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	2	5	---	$\Delta_t Sm(1)$:	---	20	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	2	5	---	I_{hk}:	---	20	μAdc
Ehk=-100 Vdc			---	I_{hk}:	---	20	μAdc
TOTAL DEFECTIVES:	5	10	---	---	---	---	---
500 HOUR CATHODE INTERFACE RESISTANCE LIFE TEST: TA=ROOM; Ef=7.5 Vac; Ehk=0; g1, g2, g3 and P FLOATING	---	---	---	---	---	---	---
500 HOUR CATHODE INTERFACE RESISTANCE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE) INTERFACE RESISTANCE:	1	3	---	r_i:	---	25	OHMS

NOTES

1. CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES" AND MIL-STD-105A.

2. WITH CYLINDRICAL SHIELD #316 CONNECTED TO CATHODE LEAD.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES – CONT'D.

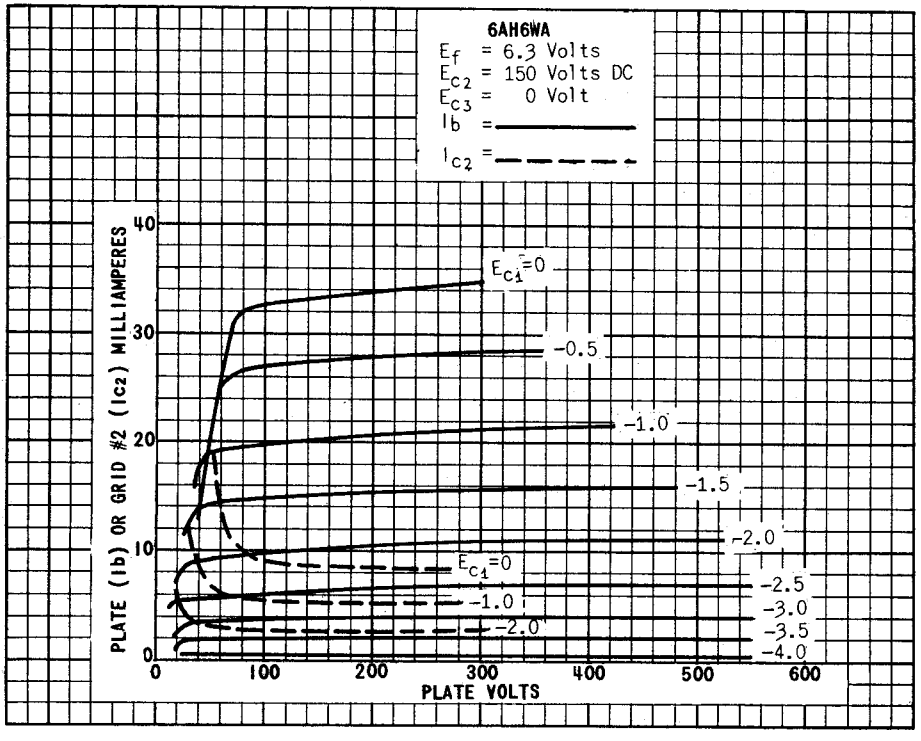
4. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

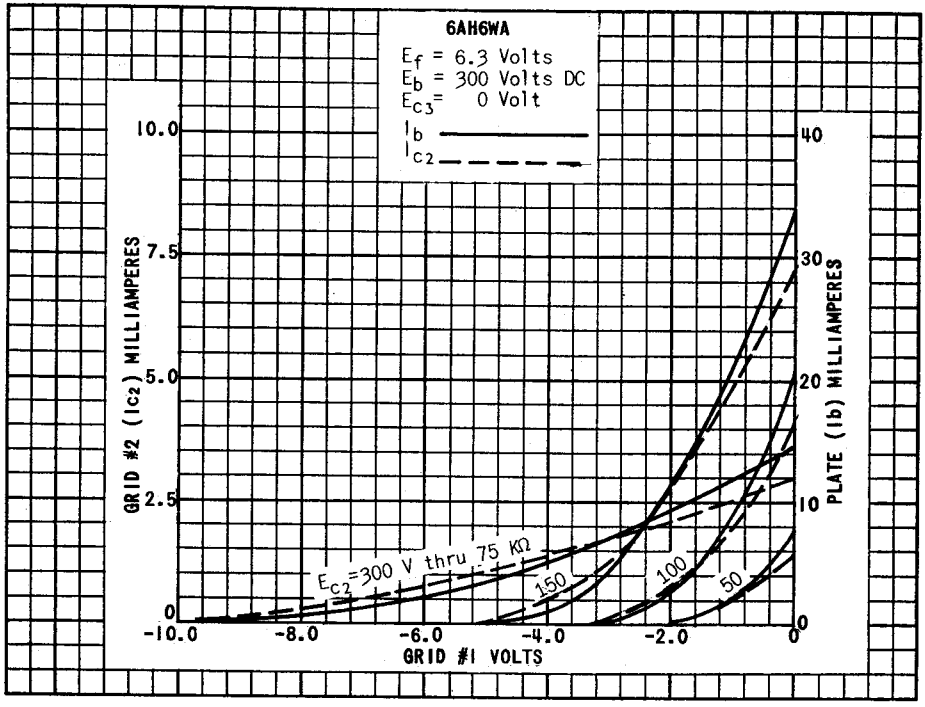
5. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

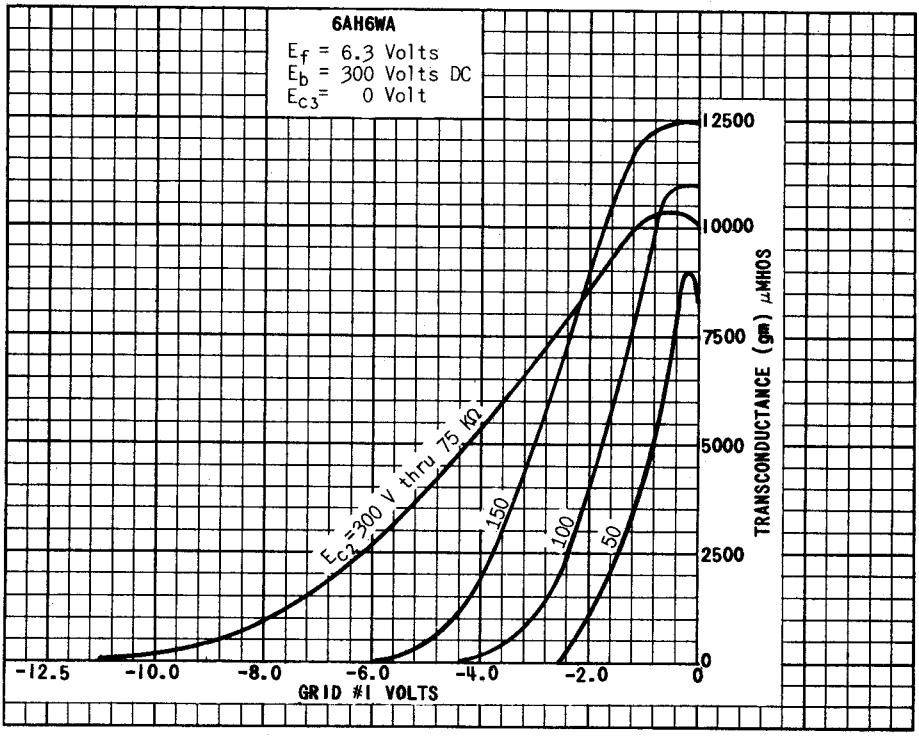
6. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER INDIVIDUAL TEST ITEMS.

7. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

8. CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef=6.3 TO THAT VALUE MEASURED AT Ef=5.7 V.







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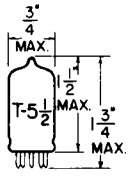
PENTODE

MINIATURE TYPE

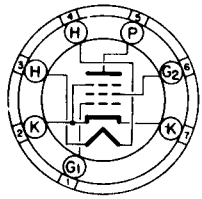


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

THE 6AJ5 IS A SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE, LOW CAPACITANCES, AND HIGH INPUT IMPEDANCE. ITS LOW TRIODE-MU ADAPTS IT TO SERVICE WHERE THE PLATE AND SCREEN SUPPLY POTENTIALS ARE LOW OR TO APPLICATIONS AS A SMALL POWER AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	4	4	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	2.8	2.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	18	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	175	MA.
PLATE VOLTAGE	28	VOLTS
GRID #2 VOLTAGE	28	VOLTS
GRID #1 VOLTAGE	-1	VOLT
PLATE RESISTANCE (APPROX.)	0.1	MEGOHM
TRANSCONDUCTANCE	2 500	μMHOS
PLATE CURRENT	2.7	MA.
GRID #2 CURRENT	1	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA.	-4.5	VOLTS

→INDICATES A CHANGE OR ADDITION.

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PLATE 2694
JULY 1 1951

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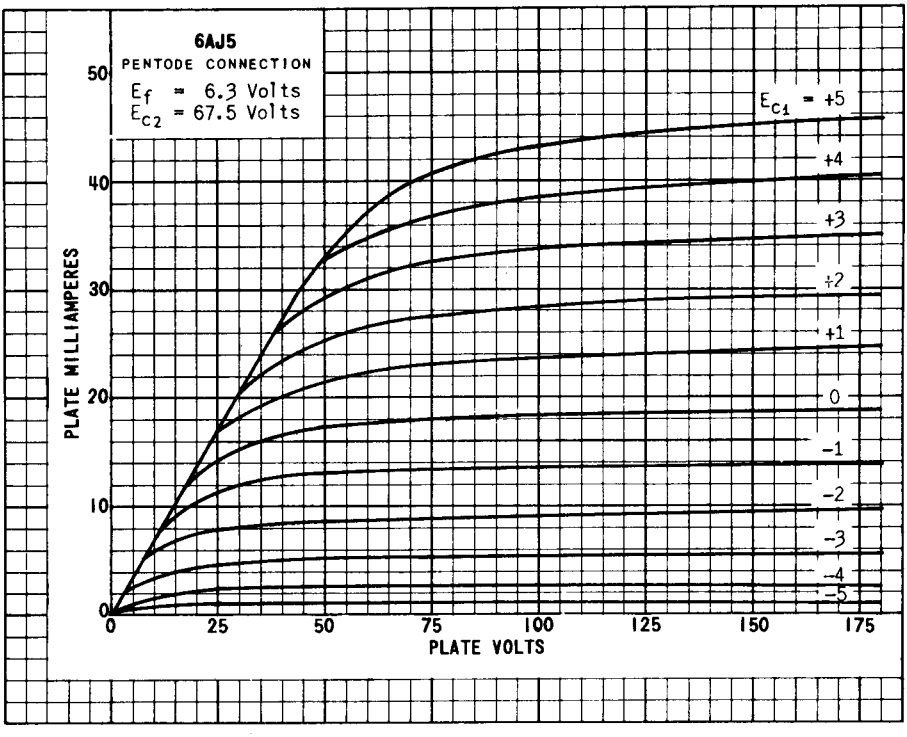
6AJ5



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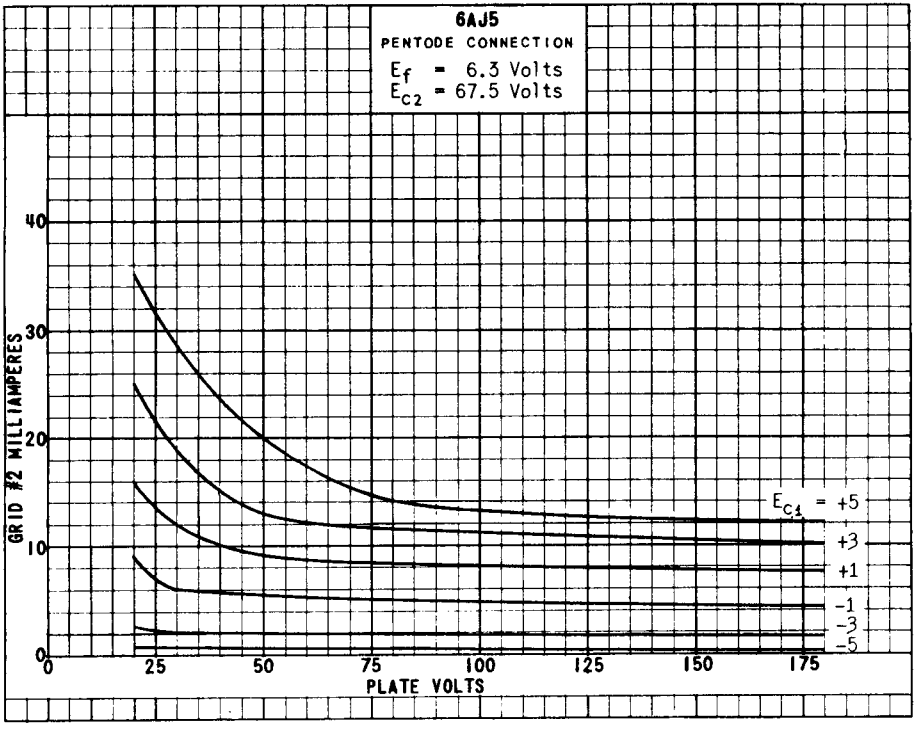

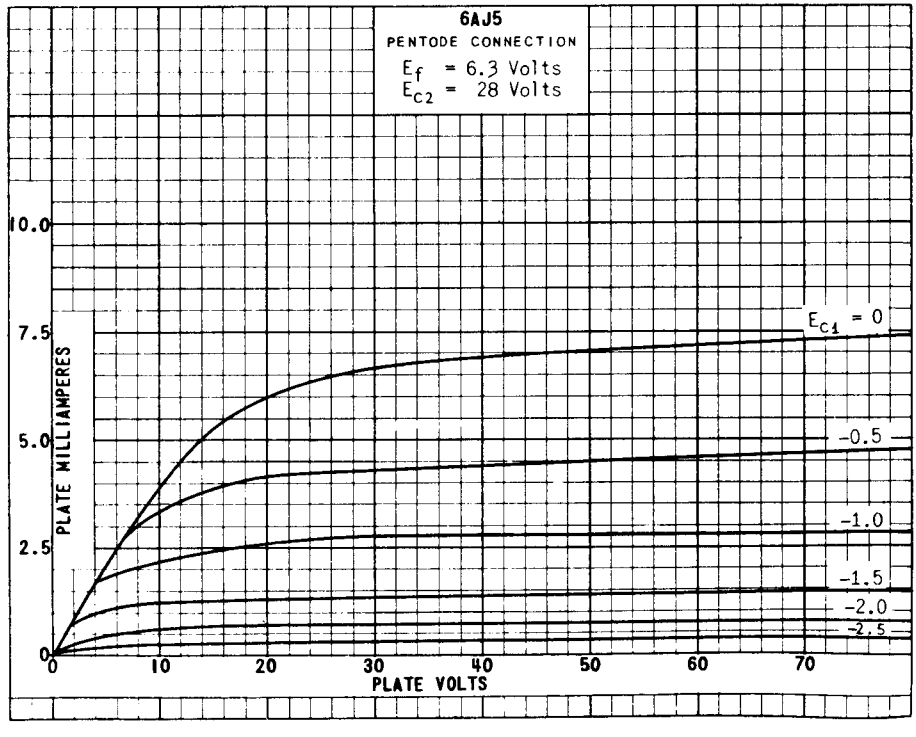

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1948

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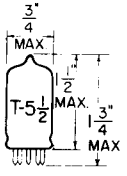
TUNG-SOL

PENTODE

MINIATURE TYPE

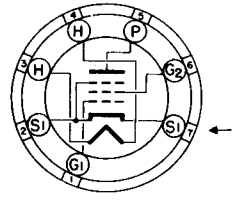


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

THE 6AK5 IS A SHARP CUT-OFF VOLTAGE AMPLIFIER USING THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE AND INPUT IMPEDANCE, AND LOW INTERELECTRODE CAPACITANCES AND LEAD INDUCTANCES. THESE RESULT IN A HIGHLY FAVORABLE MERIT FACTOR FOR HIGH FREQUENCY WIDE-BAND APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.02	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	4	4	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	2.8	2.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	120 ←	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4 ←	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	18	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	175	175	MA.
PLATE VOLTAGE	120	180	VOLTS
GRID #2 VOLTAGE	120	120	VOLTS
CATHODE RESISTOR	180	180	OHMS
PLATE RESISTANCE (APPROX.)	0.3	0.5	MEGOHM
TRANSCONDUCTANCE	5000	5100	μMHOS
PLATE CURRENT	7.5	7.7	MA.
GRID #2 CURRENT	2.5	2.4	MA.
GRID #2 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-8.5	-8.5	VOLTS

→ INDICATES A CHANGE.

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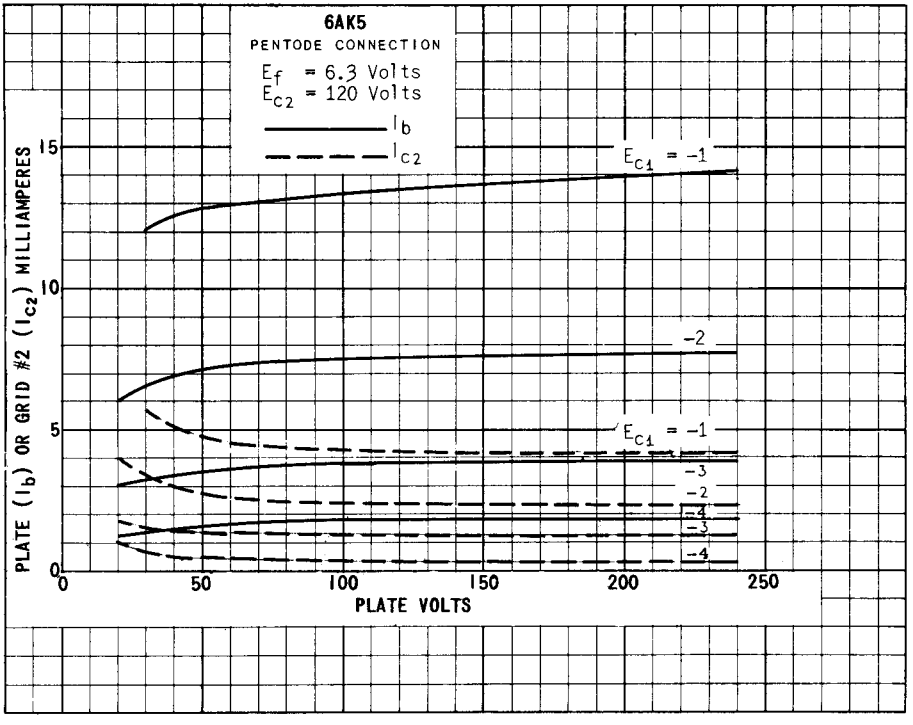
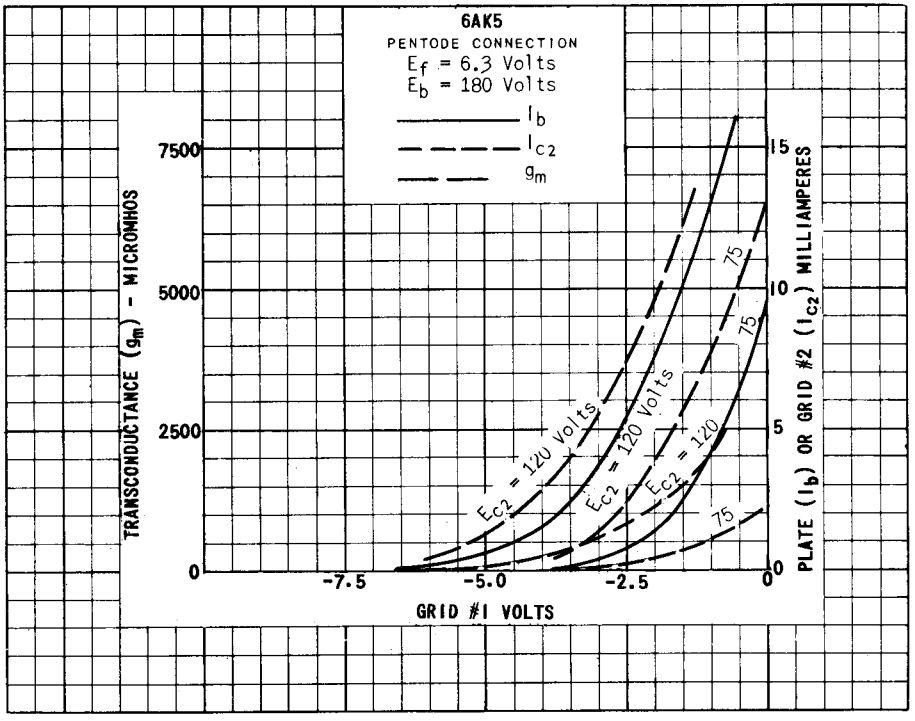
6AK5


6AK5
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 120 Volts
I_b
I_{c2}
E_{c1} = -1
-2
E_{c1} = -1
-3
-2
-4
-3
-4
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
50
100
150
200
250


6AK5
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 180 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 VOLTS
E_{c2} = 120 Volts
E_{c2} = 120 Volts
E_{c2} = 120
75
75
75
0
2500
5000
7500
0
5
10
15
-7.5
-5.0
-2.5
0

TUNG-SOL

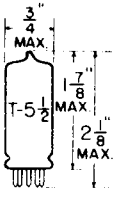
POWER AMPLIFIER PENTODE

MINIATURE TYPE

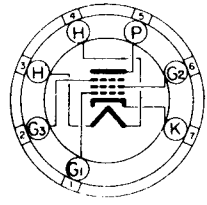
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6AK6 IS A HEATER-CATHODE TYPE OF TUBE INTENDED FOR USE IN COMPACT, LIGHT-WEIGHT EQUIPMENT. BECAUSE OF ITS SMALL SIZE, THE 6AK6 CAN BE USED SINGLY OR IN PUSH-PULL TO EFFECT A MORE COMPACT DESIGN OF POWER-LINE RECEIVERS.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	100	VOLTS

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH NO EXTERNAL SHIELD

GRID TO PLATE	0.12	μμf
INPUT	3.6	μμf
OUTPUT	4.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	180	VOLTS
SCREEN VOLTAGE	180	VOLTS
SUPPRESSOR VOLTAGE	0	VOLTS
GRID VOLTAGE	-9	VOLTS
PEAK AF GRID VOLTAGE	9	VOLTS
ZERO-SIGNAL PLATE CURRENT	15	MA.
ZERO-SIGNAL SCREEN CURRENT	2.5	MA.
GRID RESISTOR (MAX.):		
FOR FIXED BIAS	0.1	MEGOHM
FOR CATHODE BIAS	0.5	MEGOHM
LOAD RESISTANCE	10 000	OHMS
PLATE RESISTANCE	0.2	MEGOHM
TRANSCONDUCTANCE	2 300	μMHOS
MAXIMUM-SIGNAL POWER OUTPUT	1.1	WATTS
TOTAL HARMONIC DISTORTION	10	PERCENT

SIMILIAR TYPE REFERENCE: *Rating and characteristics identical to 6066.*

→ INDICATES A CHANGE OR ADDITION

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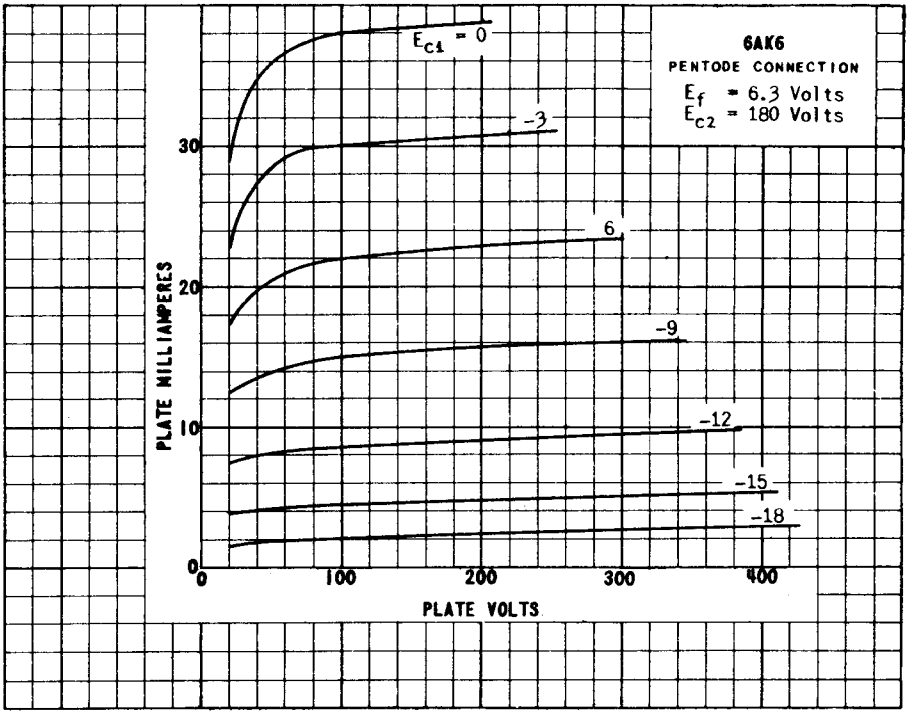
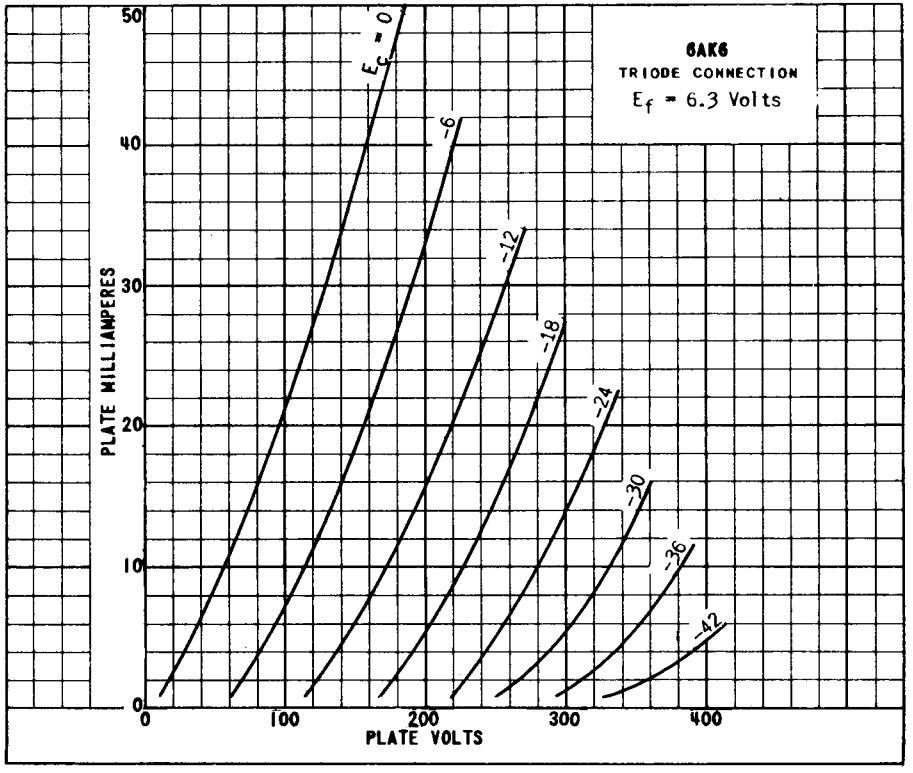
6AK6





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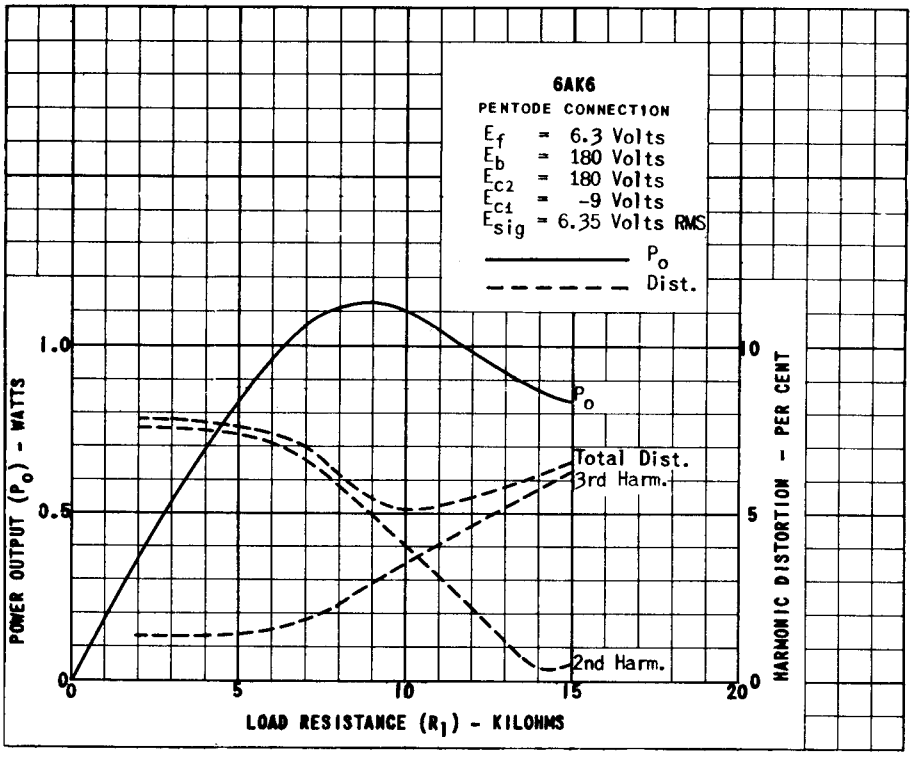

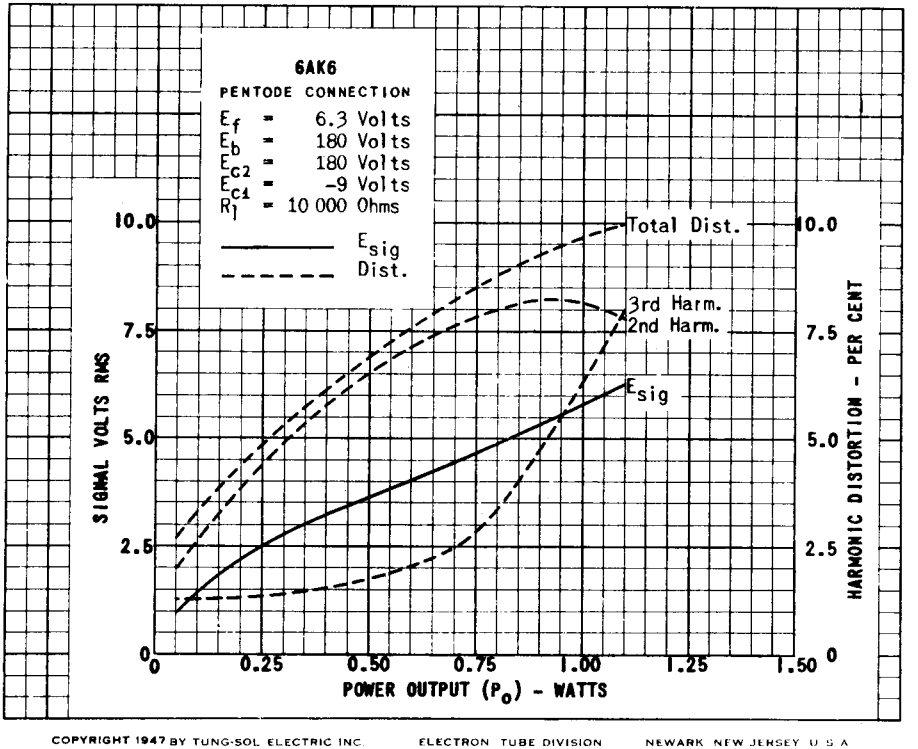

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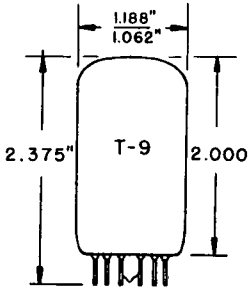
TUNG-SOL

DOUBLE PENTODE

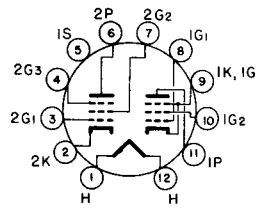
COMPACTRON



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

DISSIMILAR DOUBLE PENTODE
FOR
USE AS AN FM DETECTOR
AND AUDIO-FREQUENCY OUTPUT
AMPLIFIER IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BU

THE 6AL11 IS A SHARP-CUTOFF, DUAL-CONTROL PENTODE (SECTION 2) AND A POWER PENTODE (SECTION 1) IN THE T-9 COMPACTRON CONSTRUCTION. THE DUAL-CONTROL PENTODE IS INTENDED FOR USE AS AN FM DETECTOR AND THE POWER PENTODE AS AN AUDIO-FREQUENCY OUTPUT AMPLIFIER IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

SECTION 1		
GRID 1 TO PLATE: (1 G1 TO 1P)	0.26	pf
INPUT: 1G1 TO (H+ 1K + 1G2 + 1G3 + I.S.)	11	pf
OUTPUT: 1P TO (H + 1K + 1G2 + 1G3 + I.S.)	12	pf
SECTION 2		
GRID 1 TO PLATE: (2G1 TO 2P)	0.034	pf
GRID 3 TO PLATE: (2 G3 TO 2P)	3.2	pf
GRID 1 TO ALL EXCEPT PLATE: 2_{G1} TO (H + 2K + 2G2 + 2G3 + I.S.)	6.5	pf
GRID 3 TO ALL: 2_{G3} TO (H + 2K + 2G1 + 2G2 + 2P + I.S.)	7.5	pf
GRID 1 TO GRID 3: (2 G1 TO 2G3)	0.24	pf
PLATE TO PLATE: (1P TO 2P)	0.12	pf

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	900	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE	SECTION 1	SECTION 2	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	SECTION 1	SECTION 2	
PLATE VOLTAGE	275	330	VOLTS
GRID 2 VOLTAGE	275	SEE RATING CHART	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 3 (SUPPESSOR) VOLTAGE		28	VOLTS
POSITIVE DC GRID 1 VOLTAGE		0	VOLTS
PLATE DISSIPATION	10	1.7	WATTS
GRID 2 DISSIPATION	2.0	1.1	WATTS
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25		MEGOHMS
WITH CATHODE BIAS	0.5		MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

SECTION 1

PLATE VOLTAGE		250	VOLTS
GRID 2 VOLTAGE		250	VOLTS
GRID 1 VOLTAGE		-8.0	VOLTS
PEAK AF GRID 1 VOLTAGE		8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT		35	MA.
MAXIMUM-SIGNAL PLATE CURRENT		39	MA.
ZERO-SIGNAL GRID 2 CURRENT		2.5	MA.
MAXIMUM SIGNAL GRID 2 CURRENT		7.0	MA.
MAXIMUM-SIGNAL POWER OUTPUT		4.2	WATTS
TRANSCONDUCTANCE		6,500	MICROMHOS
PLATE RESISTANCE	Approx.	100,000	OHMS
LOAD RESISTANCE		5,000	OHMS
TOTAL HARMONIC DISTORTION	Approx.	10	PERCENT

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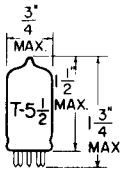
TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

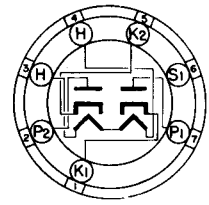


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 6AL5 COMBINES TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM DETECTOR SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
PLATE INPUT: P TO (H+K+IS) EACH UNIT	2.5	3.2	μμf
COUPLING: 1P TO 2P (MAX.)	0.068	0.026	μμf
CATHODE INPUT: K TO (P+H+IS) EACH UNIT	3.4	3.6	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

→ RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	330[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM AC PLATE VOLTAGE (EACH PLATE) RMS	117	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	54	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	9	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	OHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.3	AMP.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	60	MA.

THE RESONANT FREQUENCY OF EACH UNIT OF THE 6AL5 IS 700 MC. (APPROX.)

[A] DC COMPONENT MUST NOT EXCEED 330 VOLTS

[B] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

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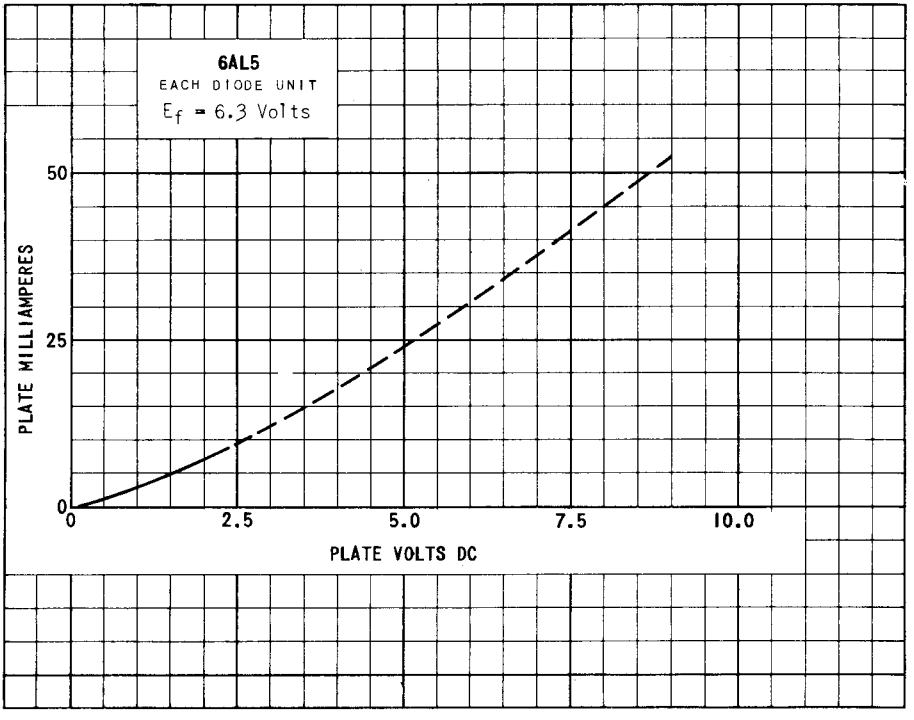
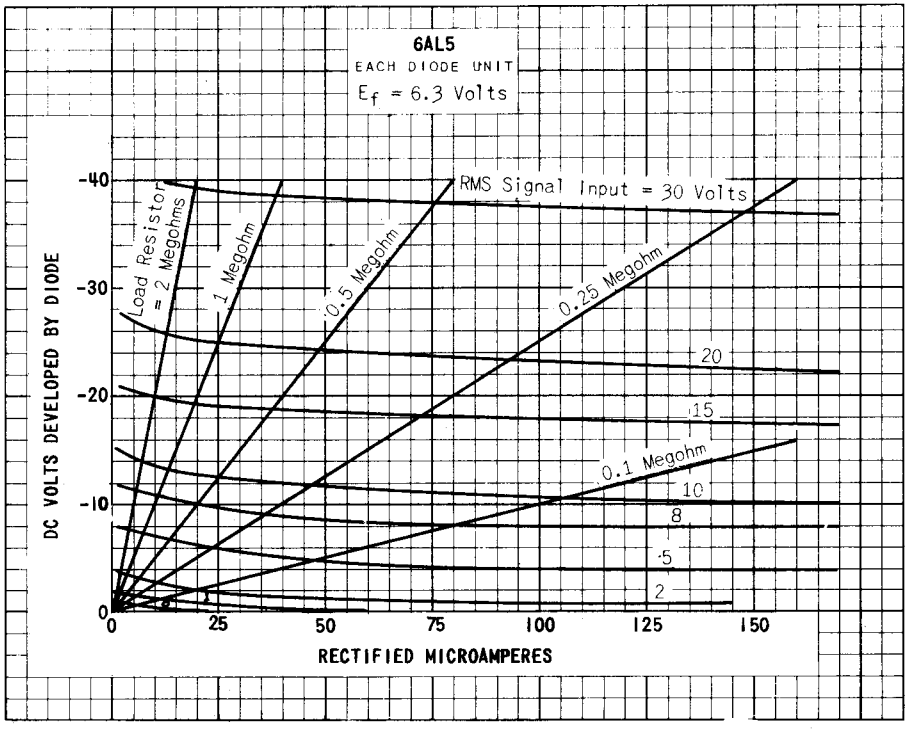
6AL5


6AL5
EACH DIODE UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
50
25
0
0
2.5
5.0
7.5
10.0
PLATE VOLTS DC

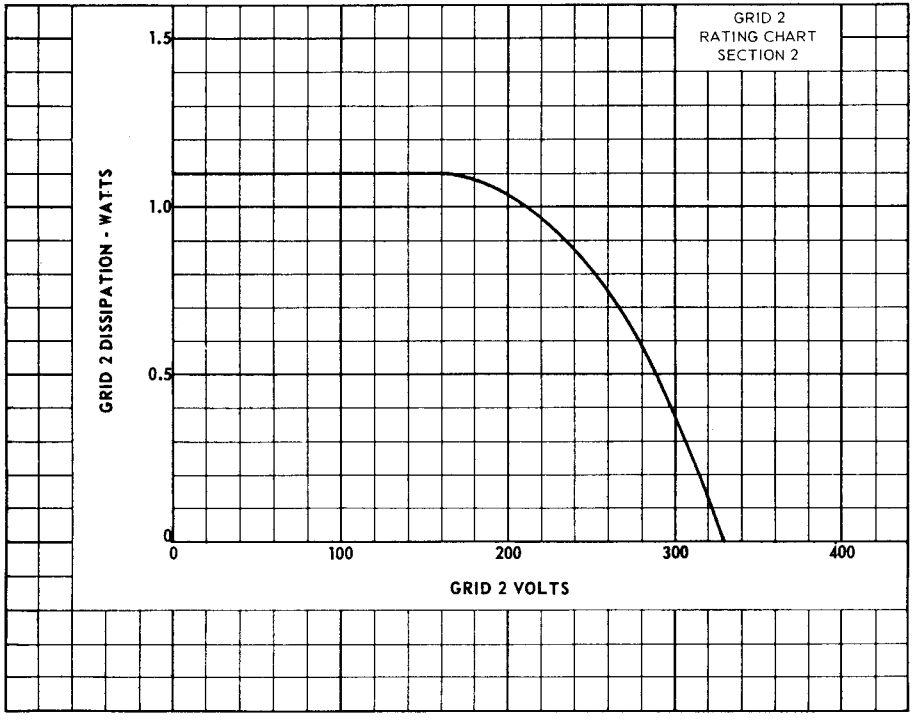

6AL5
EACH DIODE UNIT
E_f = 6.3 Volts
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
Load Resistor = 2 Megohms
1 Megohm
0.5 Megohm
0.25 Megohm
0.1 Megohm
RMS Signal Input = 30 Volts
20
15
10
8
5
2
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

AVERAGE CHARACTERISTICS - SECTION 2

PLATE VOLTAGE		150	VOLTS
GRID 2 VOLTAGE		100	VOLTS
GRID 3 VOLTAGE		0	VOLTS
CATHODE-BIAS RESISTOR		560	OHMS
PLATE CURRENT		1.3	MA.
GRID 2 CURRENT		2.1	MA.
GRID 1 TRANSCONDUCTANCE		1,000	MICROMHOS
GRID 3 TRANSCONDUCTANCE		400	MICROMHOS
PLATE RESISTANCE	Approx.	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA	Approx.	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 50 μA	Approx.	-4.5	VOLTS



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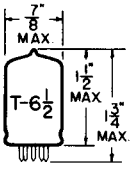
TRIODE

MINIATURE TYPE

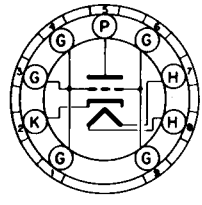


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
98X

THE 6AM4 IS A HIGH-MU TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. ITS SHARP CUT-OFF AND HIGH TRANSCONDUCTANCE, COUPLED WITH ITS EXCELLENT ISOLATION BETWEEN INPUT AND OUTPUT MAKE IT WELL SUITED FOR GROUNDED-GRID MIXER SERVICE OVER THE ENTIRE RANGE OF VHF/UHF TELEVISION FREQUENCIES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PLATE TO CATHODE: P TO K	0.16	0.16	μμf
CATHODE TO GRID AND HEATER: K TO (G&H)	4.6	4.4	μμf
PLATE TO GRID AND HEATER: P TO (G&H)	2.8	2.4	μμf
HEATER TO CATHODE: H TO K	1.8	1.8	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO GRID.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]	80	VOLTS
MAXIMUM PLATE VOLTAGE	200 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS

[B] WHEN THE 6AM4 IS OPERATED IN SERIES DC WITH A SECOND TUBE, AS FOR EXAMPLE IN CASCODE OR DIRECT-COUPLED CIRCUITS, THE HEATER-CATHODE VOLTAGE OF THE 6AM4 MAY BE AS HIGH AS 250 VOLTS MAXIMUM UNDER CUT-OFF CONDITIONS WITH THE HEATER NEGATIVE WITH RESPECT TO THE CATHODE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.225		AMP.
PLATE VOLTAGE	200	←	VOLTS
CATHODE BIAS RESISTOR[C]	100		OHMS
AMPLIFICATION FACTOR	85	←	
PLATE RESISTANCE (APPROX.)	8 700	←	OHMS
TRANSCONDUCTANCE	9 800	←	μMHOS
PLATE CURRENT	10	←	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	−6.5	←	VOLTS

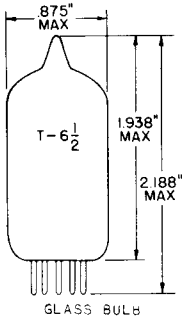
[C] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

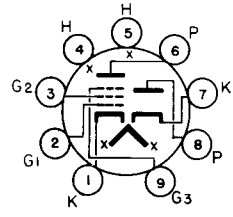


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CY

THE 6AM8A IS A DIODE PENTODE EXPECIALLY DESIGNED FOR USE AS A VIDEO DETECTOR AND IF AMPLIFIER IN TELEVISION RECEIVERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE			
GRID #1 TO PLATE (MAX.)	0.015	0.015	pf
INPUT	6.0	6.5	pf
OUTPUT	3.4	2.6	pf
DIODE			
INPUT: P TO (H+K)	2.3	1.8	pf
CATHODE TO (H+P)	3.0	3.0	pf
COUPLING (DIODE PLATE TO PENTODE PLATE)	0.035	0.10	pf
COUPLING (DIODE PLATE TO GRID #1)	0.005	0.006	pf
COUPLING (DIODE CATHODE TO PENTODE PLATE)	0.15	0.15	pf

[A] SHIELD #315 CONNECTED TO GROUND.

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RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

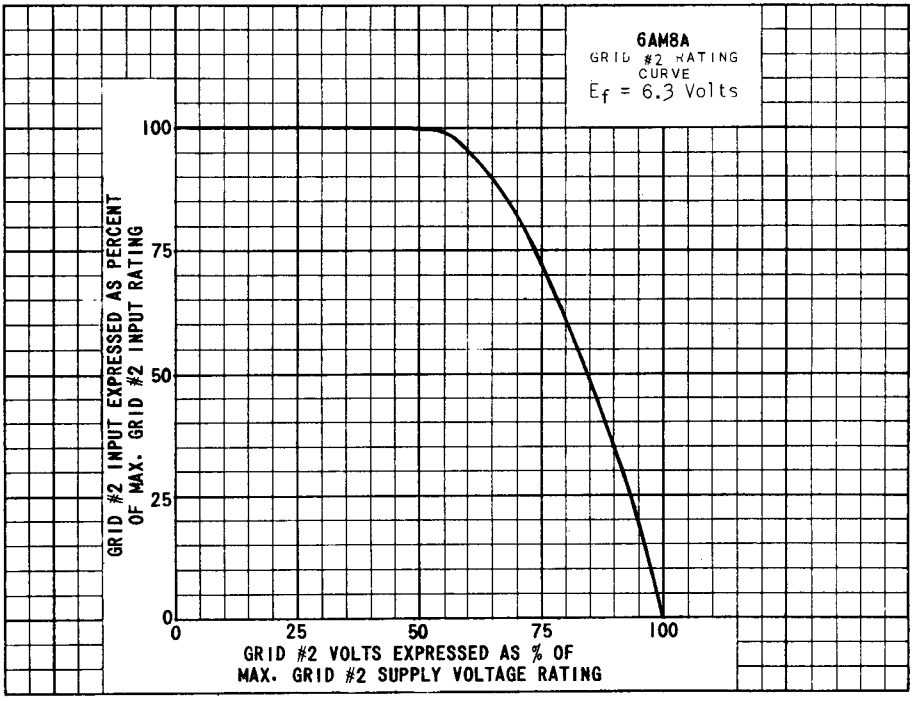
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	3.2	WATTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS	1.0	MEGOHM
FIXED BIAS	0.25	MEGOHM
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION	5.0	MA.
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

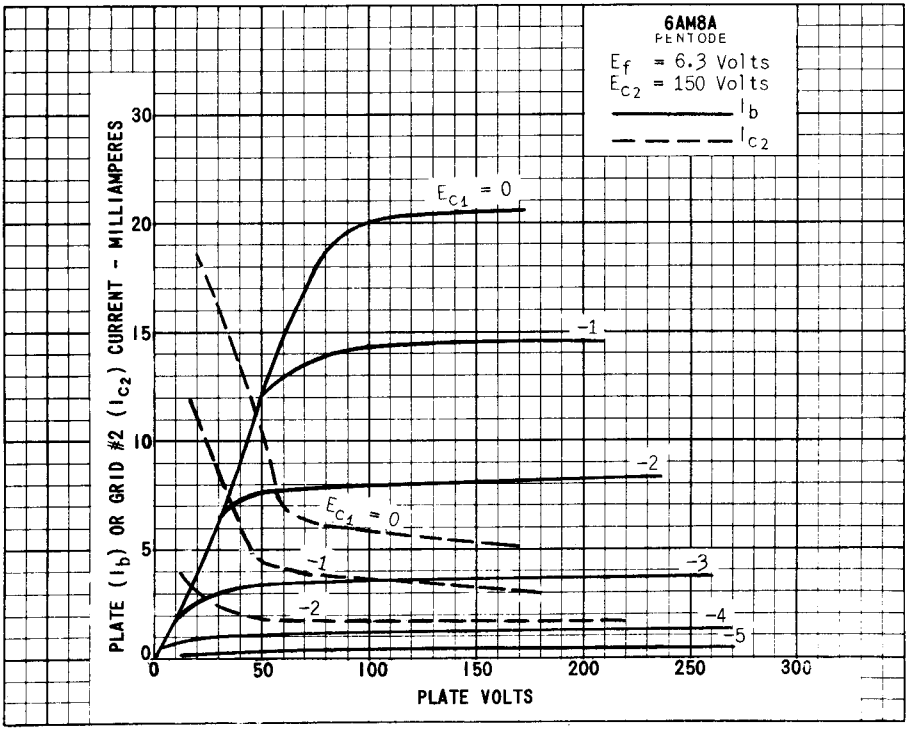
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	0	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE CURRENT	12.5	MA.
GRID #2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	7 800	μMHOS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHM
GRID #1 VOLTAGE FOR I_b = 20 μA. (APPROX.)	−6	VOLTS
PLATE CURRENT AT E_{c1}=−3V., R_k =0	2.0	MA.
DIODE PLATE VOLTAGE FOR		
DIODE CURRENT = 50 MA.	10	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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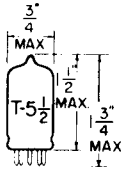
TRIODE

MINIATURE TYPE

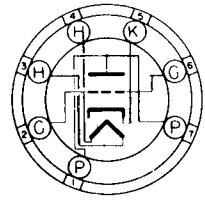


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7DK

THE 6AN4 IS A HIGH-MU TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A GROUNDED-GRID AMPLIFIER OR MIXER IN UHF TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G TO P)	1.7	μμf
INPUT: G TO (H+K)	2.8	μμf
OUTPUT: P TO (H+K)	0.28	μμf
HEATER TO CATHODE: (H TO K)	3.4	μμf
GROUNDED GRID		
INPUT	6.0	μμf
OUTPUT	1.8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM CATHODE CURRENT	30	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

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→INDICATES A CHANGE.

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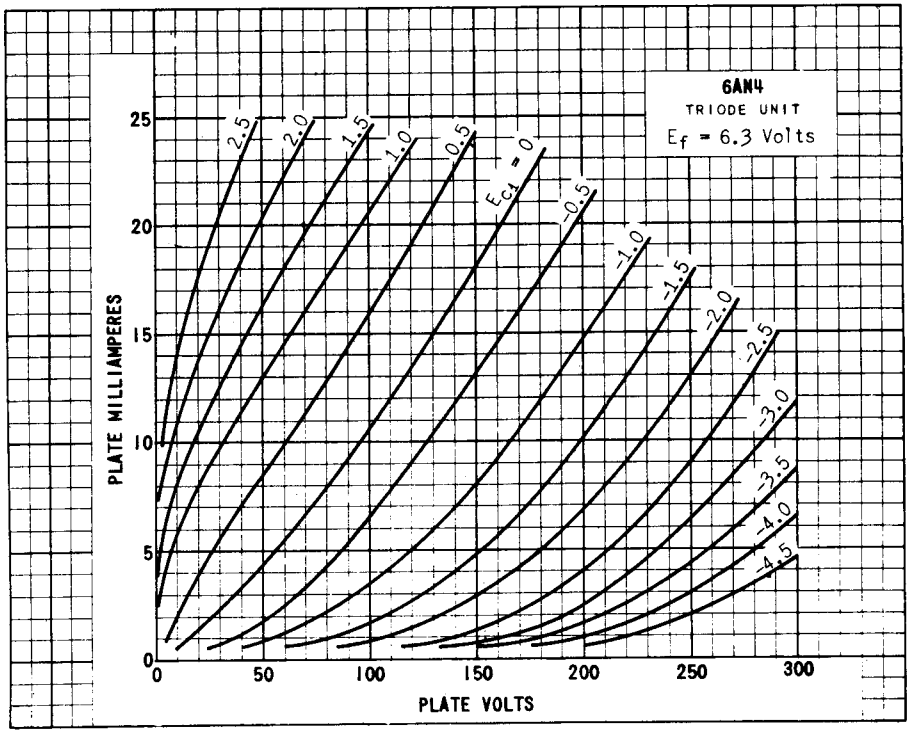
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

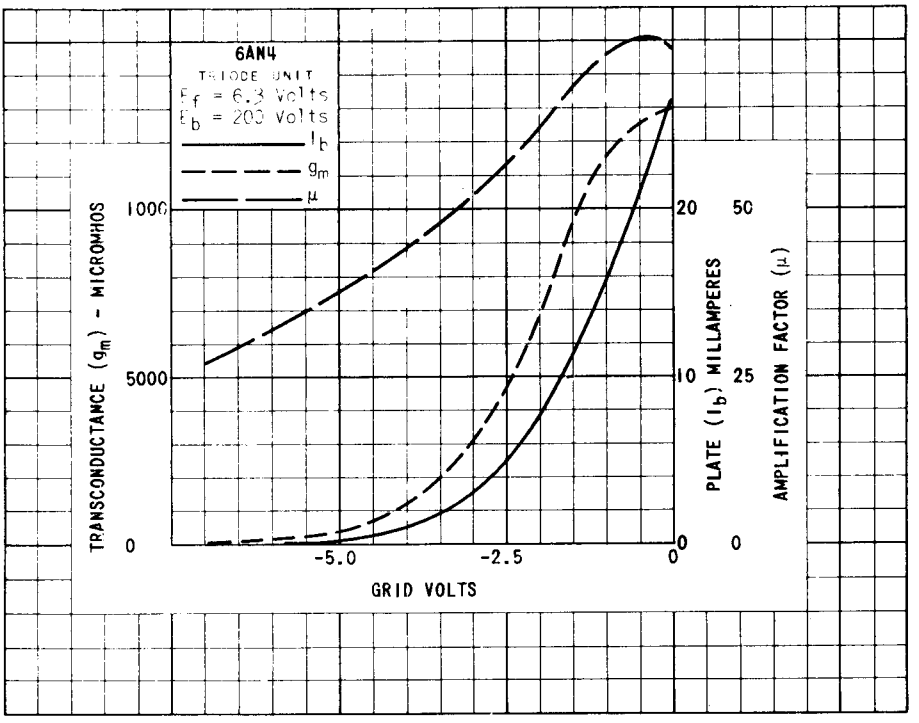
CLASS A_1 AMPLIFIER

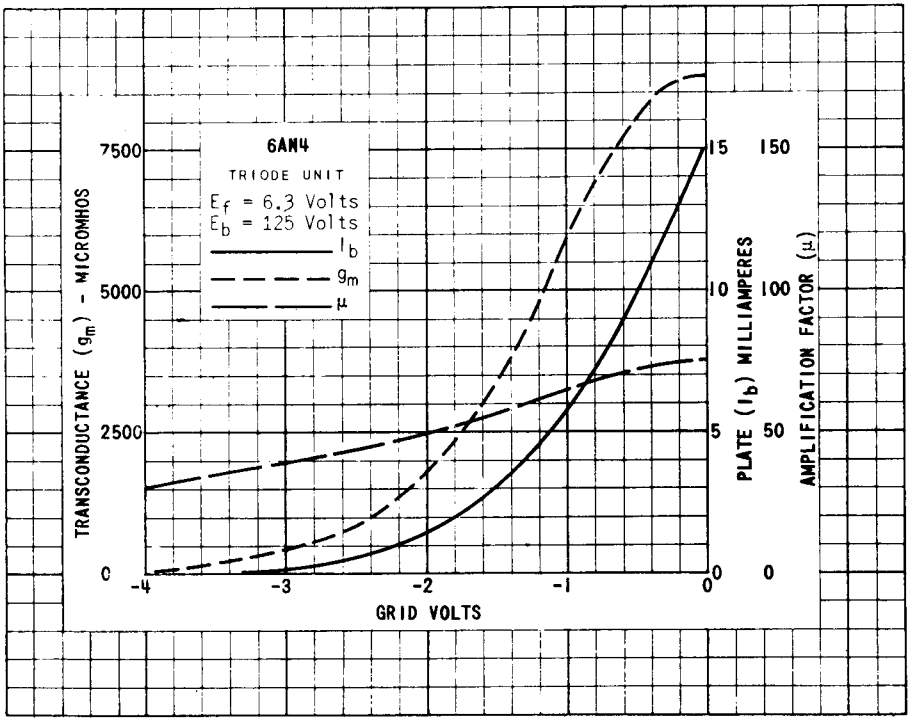
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	200	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	13	MA.
TRANSCONDUCTANCE	10 000	µMHOS
AMPLIFICATION FACTOR	70	
GRID VOLTAGE FOR 20 µA. PLATE CURRENT	−7	VOLTS

MIXER SERVICE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	270	OHMS
PLATE CURRENT	7	MA.
OSCILLATOR INJECTOR VOLTAGE (RMS)	1.4	VOLTS
CONVERSION CONDUCTANCE	2 900	µMHOS







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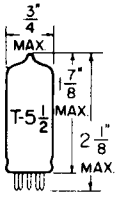
PENTODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

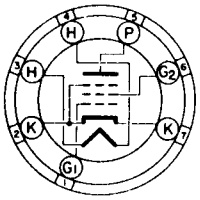
HEATER

6.3 VOLTS 450 MA.

AC OR DC

HEATER VOLTAGE SHOULD NOT DEVIATE MORE THAN ±10 PERCENT OF THE RATED VALUE.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

7BD

THE 6AN5 IS A HIGH EFFICIENCY POWER PENTODE IN THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW INTERELECTRODE CAPACITANCES AND HIGH PERVEANCE WHICH ADAPT IT WELL TO HIGH FREQUENCY OR WIDE-BAND SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.075	μμf
INPUT: G_1 TO ($H+K\&G_3+G_2$)	.9	μμf
OUTPUT: P TO ($H+K\&G_3+G_2$)	4.8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	90	VOLTS
MAXIMUM PLATE VOLTAGE	120	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	120	300	VOLTS
MAXIMUM PLATE DISSIPATION	4.2	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	0.56	WATTS
MAXIMUM CATHODE CURRENT	50	20	MA.
MAXIMUM BULB TEMPERATURE	140	140	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE RESISTOR[A]	120	OHMS
PLATE RESISTANCE (APPROX.)	12 500	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	35	MA.
GRID #2 CURRENT	12	MA.
LOAD RESISTANCE	2 500	OHMS
POWER OUTPUT	1.3	WATTS
GRID #1 VOLTAGE FOR I_b = 1 MA. MAX.	-20	VOLTS

[A] FIXED BIAS OPERATION IS RECOMMENDED ONLY WHEN THE PLATE AND SCREEN DISSIPATION IS LESS THAN 70 PERCENT OF THE DESIGN CENTER MAXIMUM RATING. THE DC GRID CIRCUIT RESISTANCE SHOULD NOT EXCEED 100,000 OHMS FOR SELF BIAS OPERATION OR FOR THE LIMITED FIXED BIAS OPERATION DEFINED ABOVE. THE GRID CIRCUIT RESISTANCE SHOULD NOT EXCEED 250,000 FOR SELF BIAS OPERATION IN APPLICATIONS WHERE THE ABSOLUTE MAXIMUM HEATER VOLTAGE IS 6.6 VOLTS.

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PLATE 2153

MAR. 1, 1949

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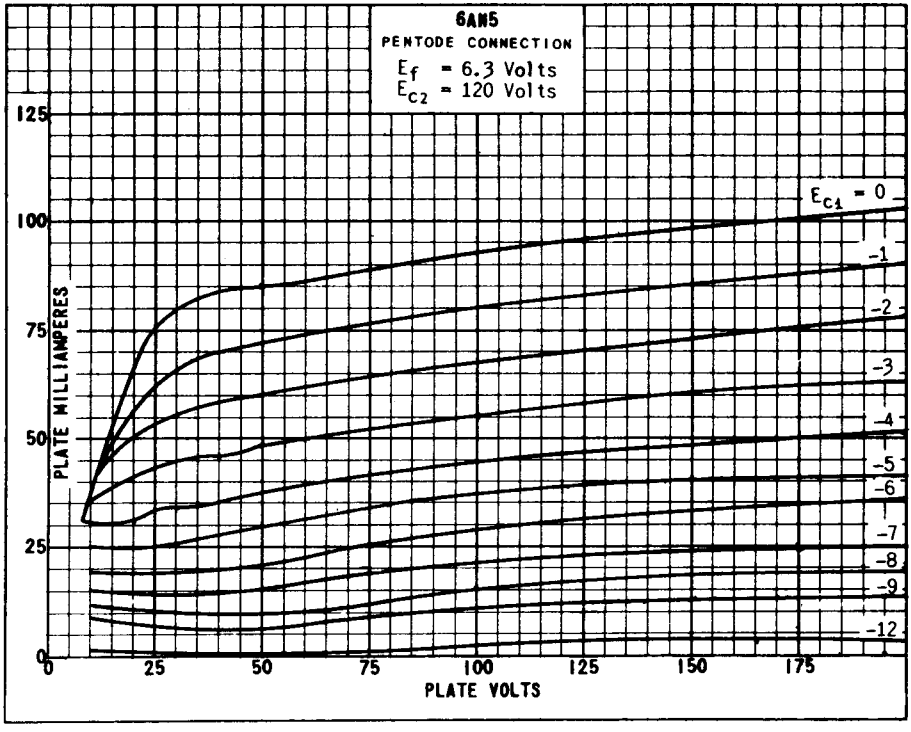
6AN5



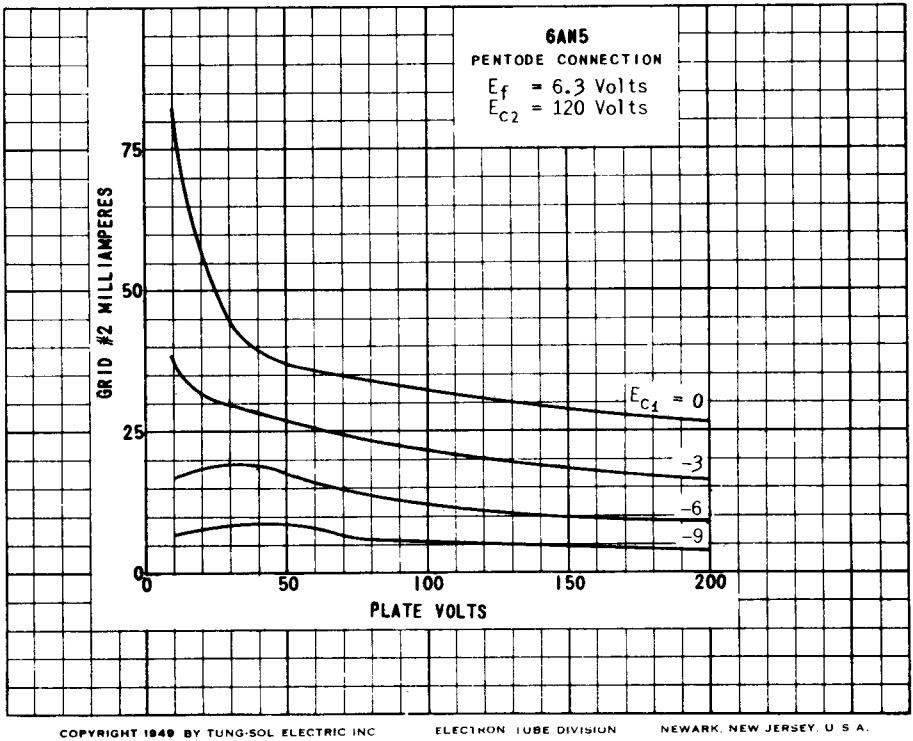


PLATE 2156
MAR. 1, 1949

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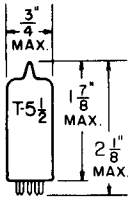
QUADRUPLE DIODE

MINIATURE TYPE



GLASS BULB

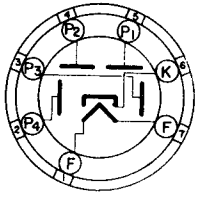
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.20 AMPERE

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 6AN6 IS A QUADRUPLE DIODE. IT IS DESIGNED FOR USE IN COMPACT, LIGHT-WEIGHT, PORTABLE EQUIPMENT WHERE THE RECTIFICATION OF FOUR SEPARATE VOLTAGES IS REQUIRED. IT IS RECOMMENDED THAT NO MATERIAL BE PERMITTED TO OBSTRUCT THE HOLE IN THE BASE SOCKET AS THIS TYPE MAY BE MANUFACTURED WITH THE EXHAUST-TUBE TIP AT THE BASE END.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.20	AMP.
MAXIMUM PEAK INVERSE PLATE VOLTAGE PER PLATE	210	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	45	MA.
MAXIMUM DC OUTPUT CURRENT PER PLATE	8.0	MA.
TUBE VOLTAGE DROP PER PLATE AT 6.6 MA.	9.0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

PLATE 1 TO PLATES 2, 3 AND 4	1.2	μμf
PLATE 2 TO PLATES 1, 3 AND 4	1.1	μμf
PLATE 3 TO PLATES 1, 2 AND 4	1.1	μμf
PLATE 4 TO PLATES 1, 2 AND 3	1.3	μμf
PLATE TO CATHODE PER PLATE	0.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

PLATE VOLTAGE (RMS)	75	VOLTS
DC OUTPUT CURRENT PER PLATE	3.3	MA.

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PLATE 1747
NOV. 1 1946

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6AN6

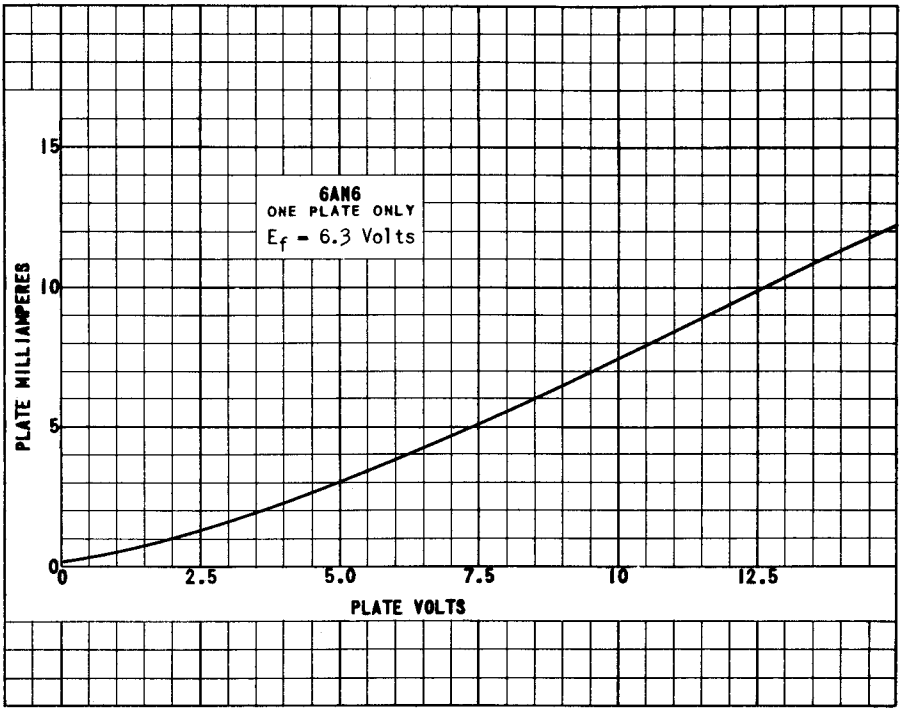

PLATE 1748
NOV. 1, 1946

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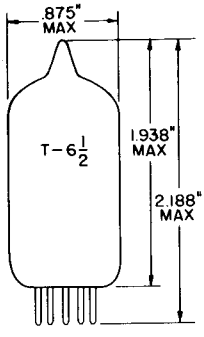
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



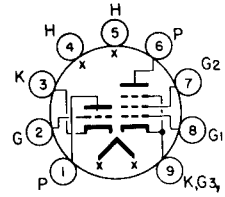
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR GENERAL PURPOSE

APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9DA

THE 6AN8 IS A MEDIUM MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION MAY BE USED AS AN IF AMPLIFIER OR A REACTANCE TUBE WHILE THE TRIODE SECTION IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR, SYNC CLIPPER, SYNC SEPARATOR AND PHASE SPLITTER CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

TRIODE UNIT:		
GRID TO PLATE: (TG TO TP)	1.5	pf
INPUT: TG TO (H+TK)	2.0	pf
OUTPUT: TP TO (H+TK)	→ 0.26	pf
PENTODE UNIT:		
GRID 1 TO PLATE: (PG1 TO PP) MAX.	0.04	pf
INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	7.0	pf
OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	→ 2.4	pf
COUPLING:		
TRIODE GRID TO PENTODE PLATE: (TG TO PP) MAX.	→ 0.02	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	→ 0.02	pf
PENTODE PLATE TO TRIODE PLATE: (F_P TO TP) MAX.	→ 0.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	2.8	2.3	WATTS
GRID 2 DISSIPATION	----	0.55	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE: [B]			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

→ TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
PLATE SUPPLY VOLTAGE	150	125	VOLTS
GRID 2 SUPPLY VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-3	0	VOLTS
CATHODE BIAS RESISTOR	0	56	OHMS
AMPLIFICATION FACTOR	21	- -	
TRANSCONDUCTANCE	4500	7800	μMHOS
PLATE CURRENT	15	12	MA.
PLATE RESISTANCE (APPROX)	4700	170,000	OHMS
GRID 2 CURRENT	----	3.8	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-17	----	VOLTS
PLATE CURRENT AT Ec1=-3 V., Rk=0	----	1.6	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA.	----	-6	VOLTS

[B] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

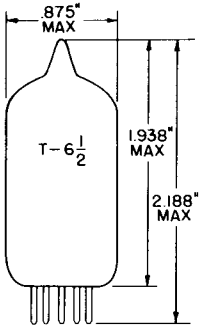
THE 6AN8A CURVES ALSO APPLY FOR THE 6AN8.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



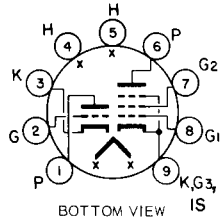
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR GENERAL PURPOSE

APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DA

THE 6AN8A IS A MEDIUM MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION MAY BE USED AS AN IF AMPLIFIER OR A REACTANCE TUBE WHILE THE TRIODE SECTION IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR, SYNC CLIPPER, SYNC SEPARATOR AND PHASE SPLITTER CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

TRIODE UNIT:		
GRID TO PLATE: (TG TO TP)	1.5	pf
INPUT: TG TO (H+TK)	2.0	pf
OUTPUT: TP TO (H+TK)	→ 0.26	pf
PENTODE UNIT:		
GRID 1 TO PLATE: (PG1 TO PP) MAX.	0.04	pf
INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	7.0	pf
OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	→ 2.4	pf
COUPLING:		
TRIODE GRID TO PENTODE PLATE: (TG TO PP) MAX.	→ 0.02	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	→ 0.02	pf
PENTODE PLATE TO TRIODE PLATE: (P_P TO TP) MAX.	→ 0.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	2.8	2.3	WATTS
GRID 2 DISSIPATION	----	0.55	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE: [B]			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

→ TYPICAL OPERATING CHARACTERISTICS

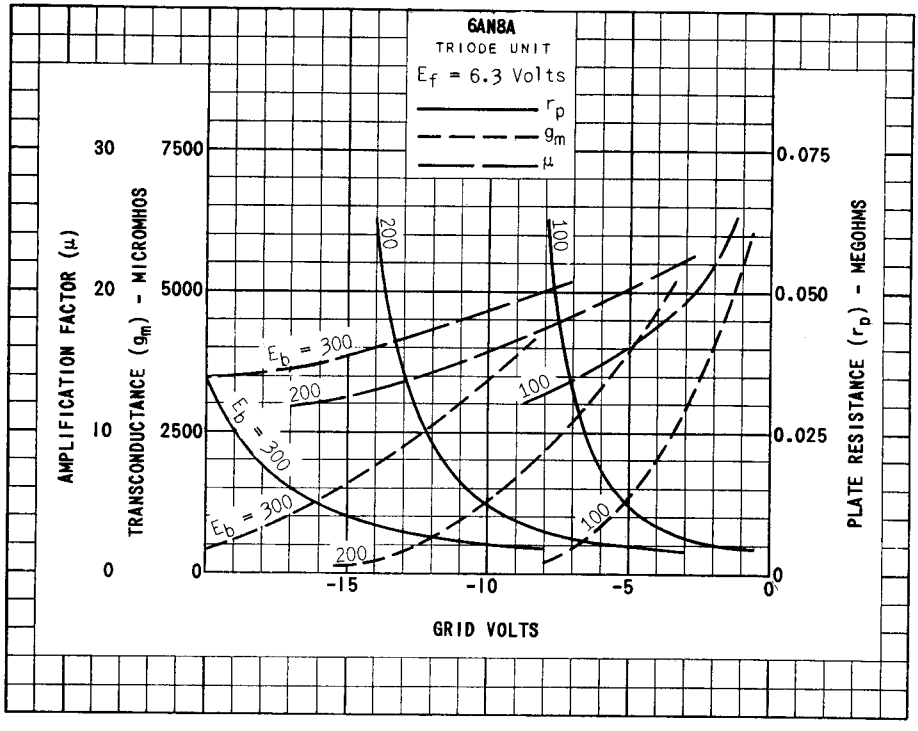
CLASS A_1 AMPLIFIER

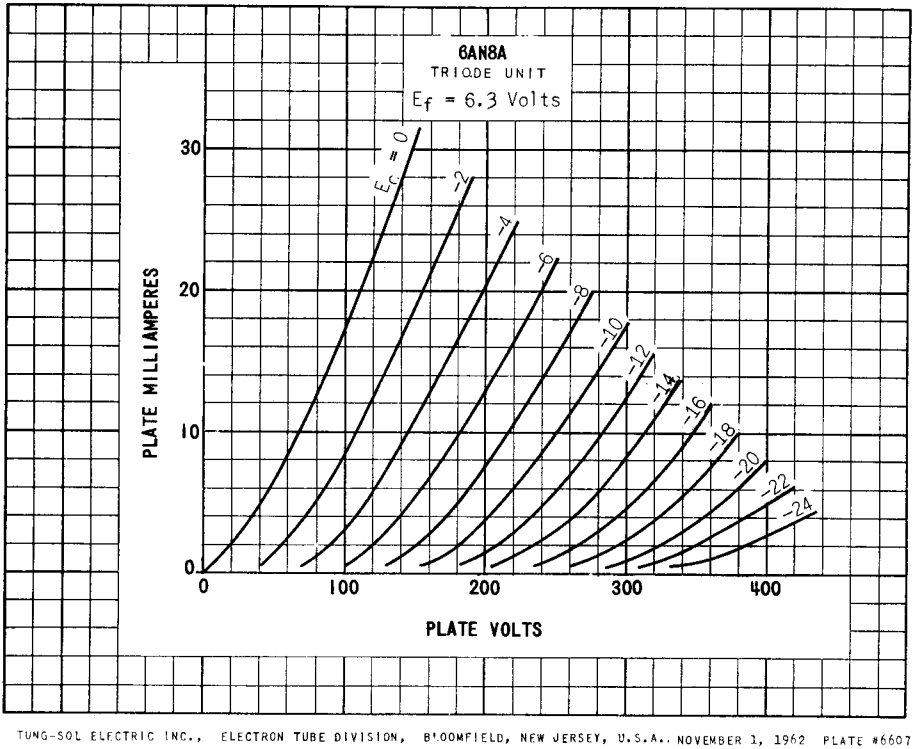
	TRIODE	PENTODE	
PLATE SUPPLY VOLTAGE	150	125	VOLTS
GRID 2 SUPPLY VOLTAGE	----	125	VOLTS
GRID 1 VOLTAGE	-3	0	VOLTS
CATHODE BIAS RESISTOR	0	56	OHMS
AMPLIFICATION FACTOR	21	----	
TRANSCONDUCTANCE	4500	7800	μMHOS
PLATE CURRENT	15	12	MA.
PLATE RESISTANCE (APPROX)	4700	170,000	OHMS
GRID 2 CURRENT	----	3.8	MA.
GRID 1 VOLTAGE (APPROX.) FOR I_b=20 μA	-17	----	VOLTS
PLATE CURRENT AT E_{c1}=-3 V., Rk=0	----	1.6	MA.
GRID 1 VOLTAGE (APPROX.) FOR I_b=20 μA.	----	-6	VOLTS

[A] **HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.**

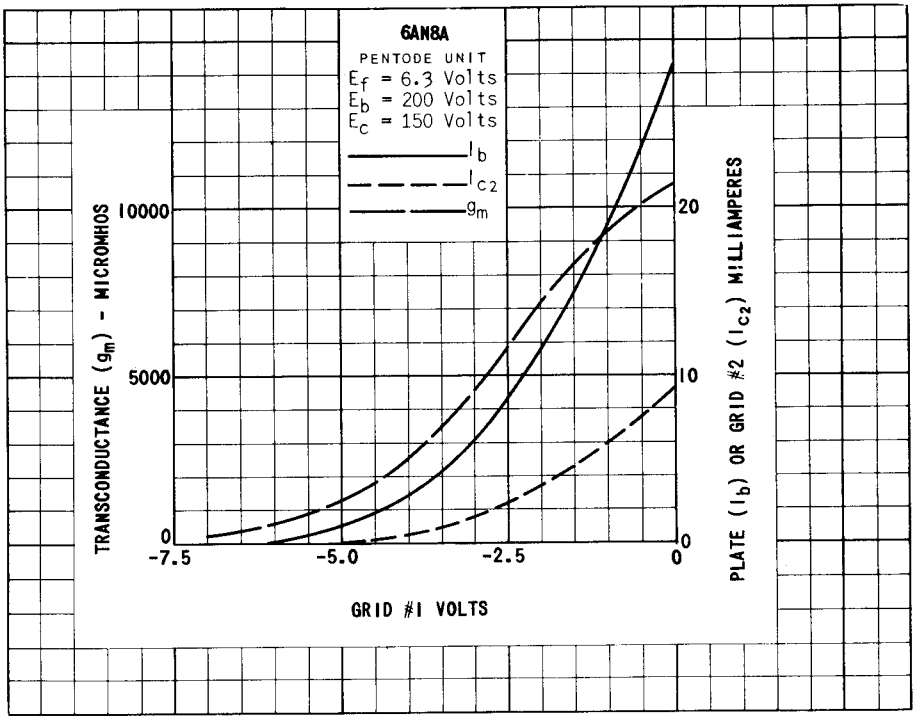
[B] IF EITHER UNIT IS OPERATING AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.

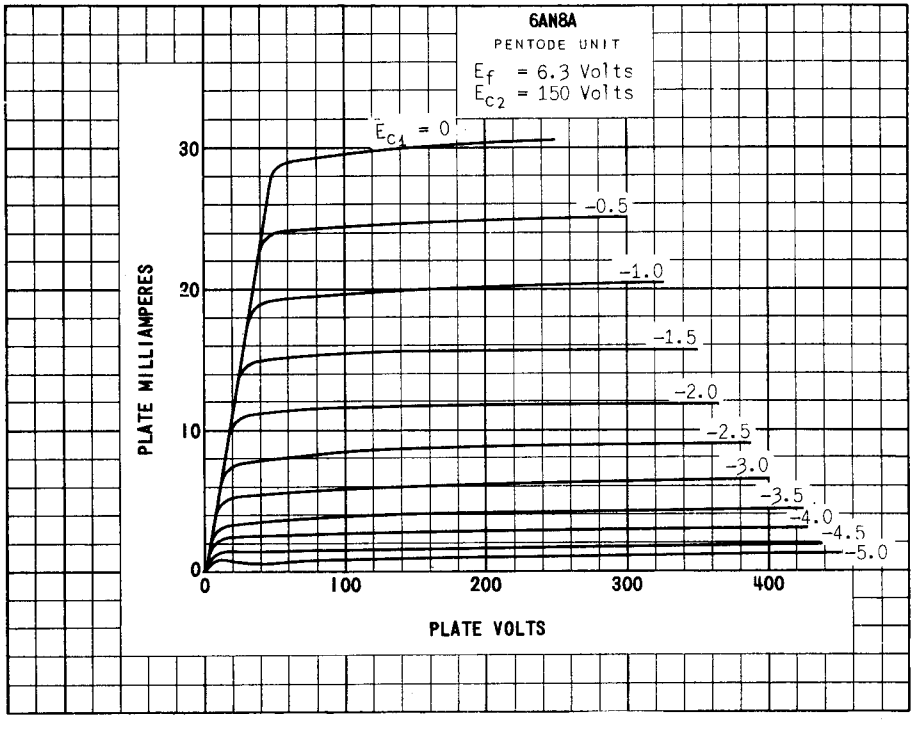
→ INDICATES A CHANGE.

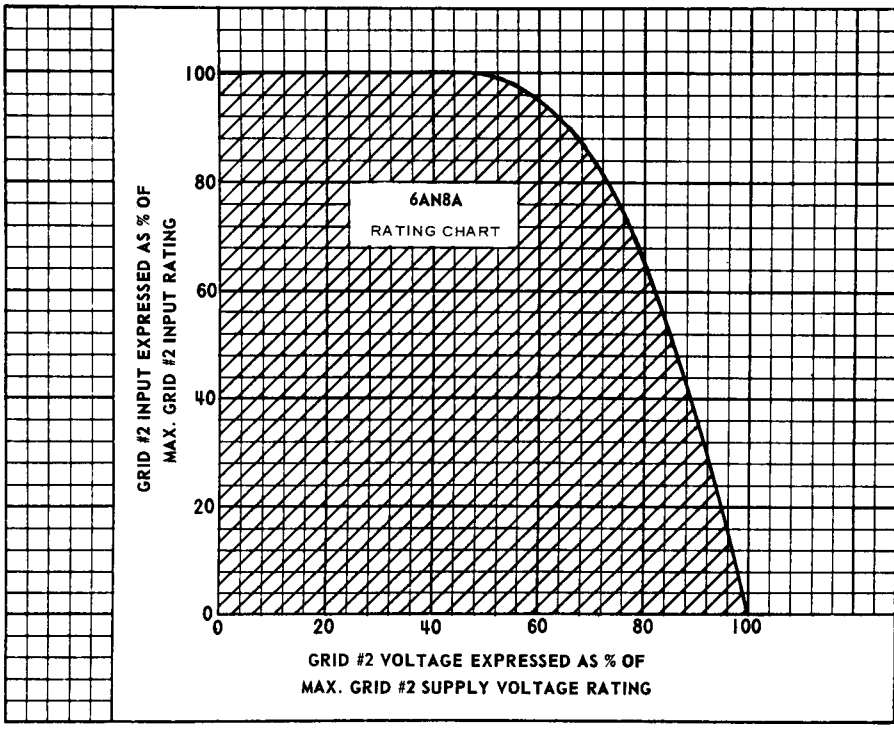




TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.. NOVEMBER 1, 1962 PLATE #6607


6AN8A
PENTODE UNIT
E_f = 6.3 Volts
E_b = 200 Volts
E_c = 150 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
5000
0
20
10
0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES


6AN8A
PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS


6AN8A
RATING CHART
GRID #2 INPUT EXPRESSED AS % OF
MAX. GRID #2 INPUT RATING
100
80
60
40
20
0
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAX. GRID #2 SUPPLY VOLTAGE RATING

TUNG-SOL

BEAM PENTODE

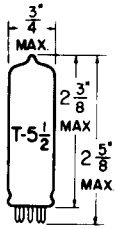
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

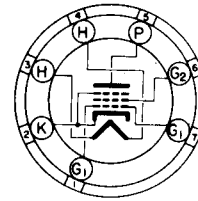
HEATER

6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BZ

THE 6AQ5 AND 6AQ5A ARE BEAM POWER AMPLIFIERS USING THE 7 PIN MINIATURE CONSTRUCTION. THEY ARE DESIGNED FOR SERVICE IN TELEVISION RECEIVERS WHERE HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT IS DESIRED. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6AQ5A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME OF THE 6AQ5A, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES — APPROX. ←

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.4	μμf
INPUT	8.0	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	275 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	275 ←	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 INPUT	2	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)[A]	250	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHMS
CATHODE BIAS OPERATION	0.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)* (6AQ5A ONLY)	11.0	SECONDS

[A] HIGH AMBIENT TEMPERATURE AND SHIELDING MAY NECESSITATE A REDUCTION IN OPERATING DISSIPATION. WHEN TUBE SHIELDS ARE USED, IT IS ADVISABLE TO PAINT THE INSIDE AND OUTSIDE SURFACES OF THE TUBE SHIELD A DULL BLACK AND TO PROVIDE VENTILATION SLOTS TO REDUCE OPERATING TEMPERATURE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B,C]*

GRID #2 CONNECTED TO PLATE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	275	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABS. MAX.)	1100	VOLTS
MAXIMUM PLATE DISSIPATION[D]	10	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	275	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	40	MA.
MAXIMUM PEAK CATHODE CURRENT	115	MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER[E]

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	3	4.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	4	7	MA.
PLATE RESISTANCE (APPROX.)	58 000	52 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	μMHOS
LOAD RESISTANCE	5 500	5 000	OHMS
TOTAL HARMONIC DISTORTION	8	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.0	4.5	WATTS

[E] SINGLE TUBE.

AVERAGE CHARACTERISTICS - TRIODE CONNECTED*

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	4800	μMHOS
AMPLIFICATION FACTOR	9.5	
PLATE RESISTANCE (APPROX.)	1970	OHMS
GRID VOLTAGE (APPROX.) FOR I_b=0.5 MA.	-37	VOLTS

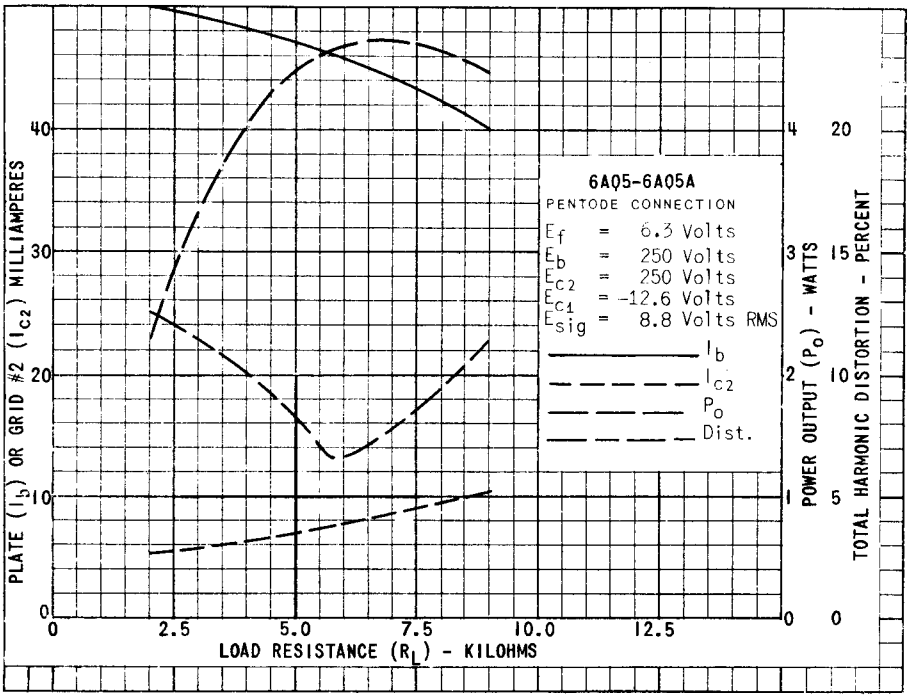
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

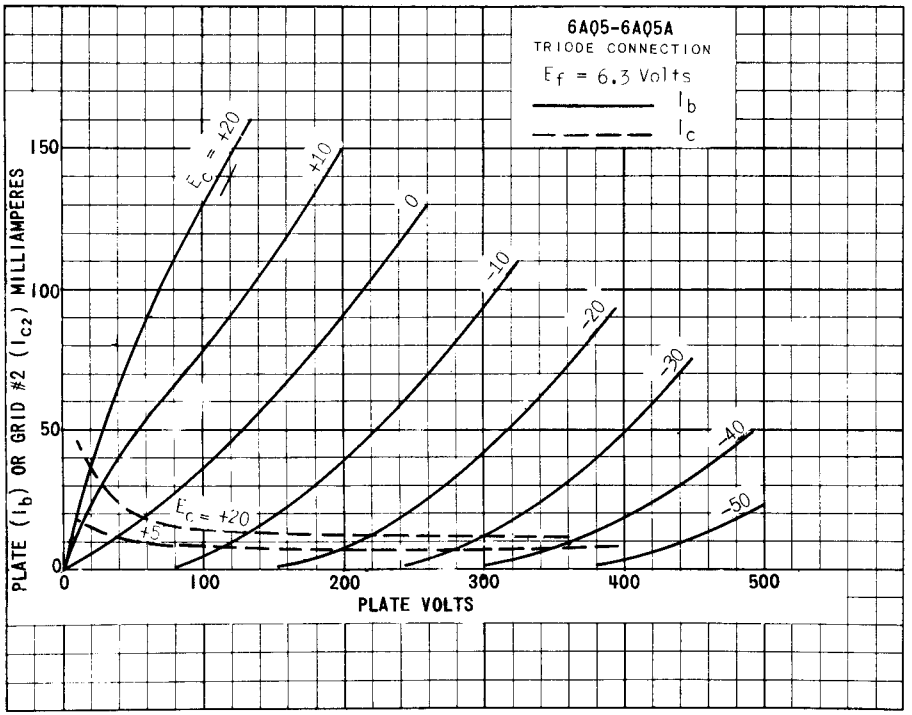
[C] TRIODE CONNECTED.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*INDICATES AN ADDITION.

→ INDICATES A CHANGE.





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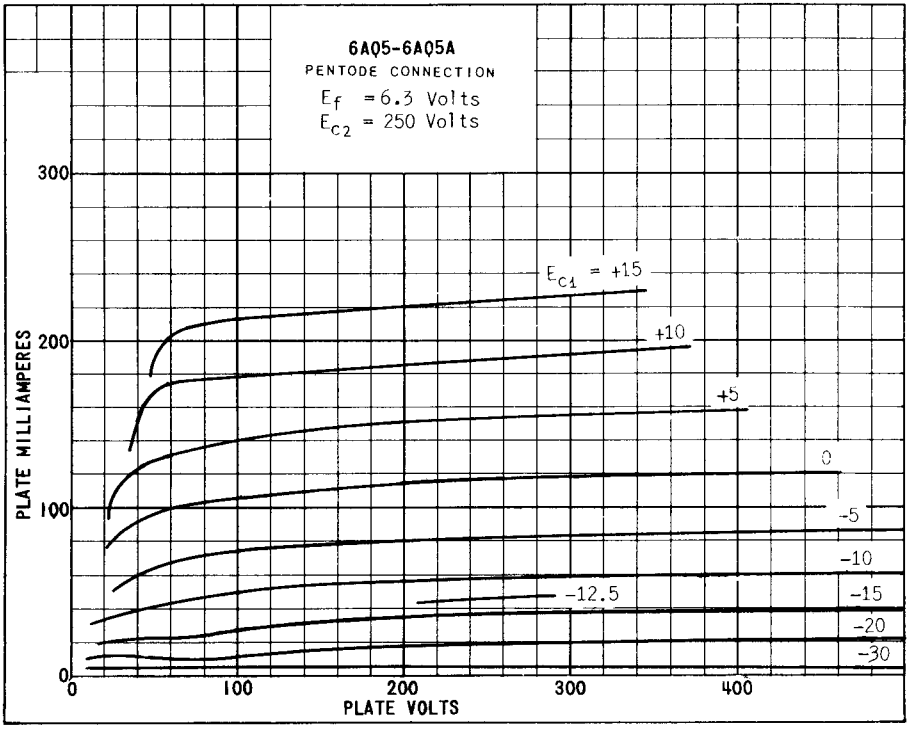
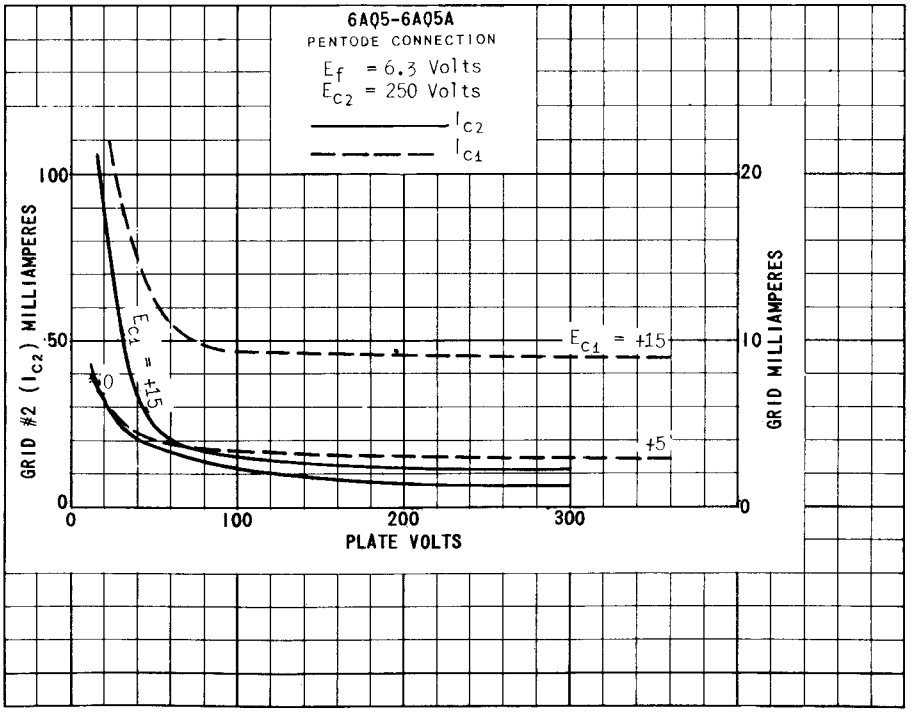

6AQ5-6AQ5A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1} = +15
+10
+5
0
-5
-10
-12.5
-15
-20
-30
0
100
200
300
400


6AQ5-6AQ5A
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
I_{c2}
I_{c1}
GRID #2 (I_{c2}) MILLIAMPERES
GRID MILLIAMPERES
PLATE VOLTS
E_{c1} = +15
0
+5
0
50
100
0
10
20
0
100
200
300

TUNG-SOL

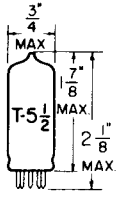
DOUBLE-DIODE TRIODE

MINIATURE TYPE

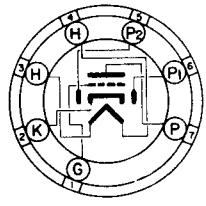
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6AQ6 COMBINES TWO DIODES AND A HIGH-MU TRIODE VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. THE THREE SECTIONS USE A COMMON CATHODE BUT ARE ADEQUATELY SHIELDED TOPROVIDE FOR SIMULTANEOUS SERVICE AS DETECTORS, AVC RECTIFIER, AND AUDIO VOLTAGE AMPLIFIER. THIS TUBE IS PARTICULARLY USEFUL IN DESIGNS REQUIRING ECONOMY OF HEATER POWER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT - CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1.0	MA.
PLATE RESISTANCE	61 000	58 000	OHMS
TRANSCONDUCTANCE	1 150	1 200	µMHOS
AMPLIFICATION FACTOR	70	70	

DIODE UNITS - TWO

THE DIODE UNITS ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE SLEEVE. DIODE BIASING OF THE TRIODE IS NOT SUITABLE.

SIMILAR TYPE REFERENCE: *Ratings and Characteristics somewhat similar to 6AT6, 6Q7, 6Q7GT, 6SQ7, 6SQ7GT, 7B6, 7C6.*

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PLATE
2036
JULY 1,
1948

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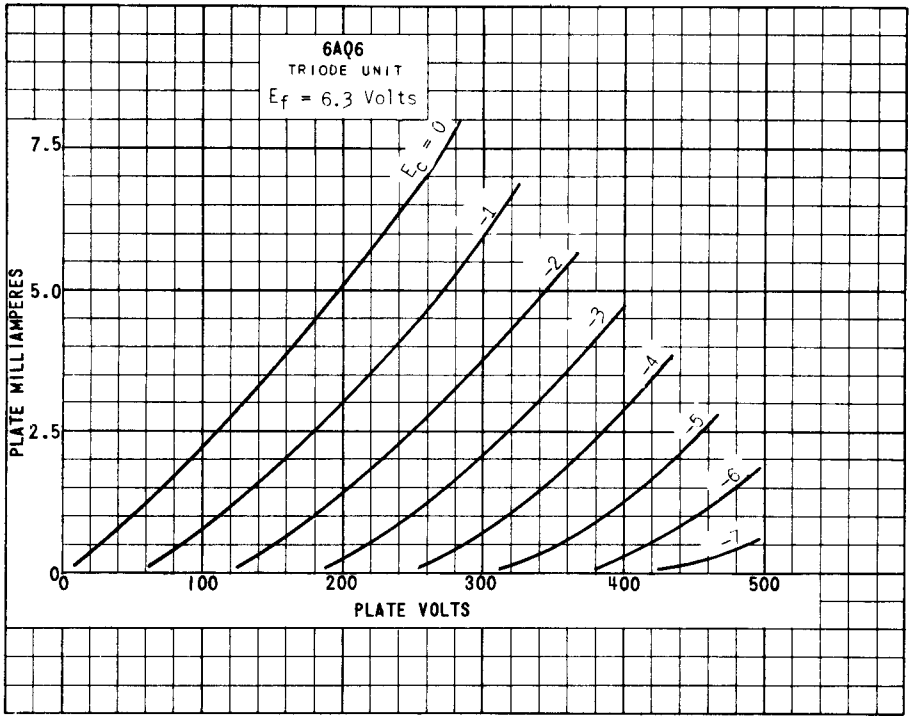
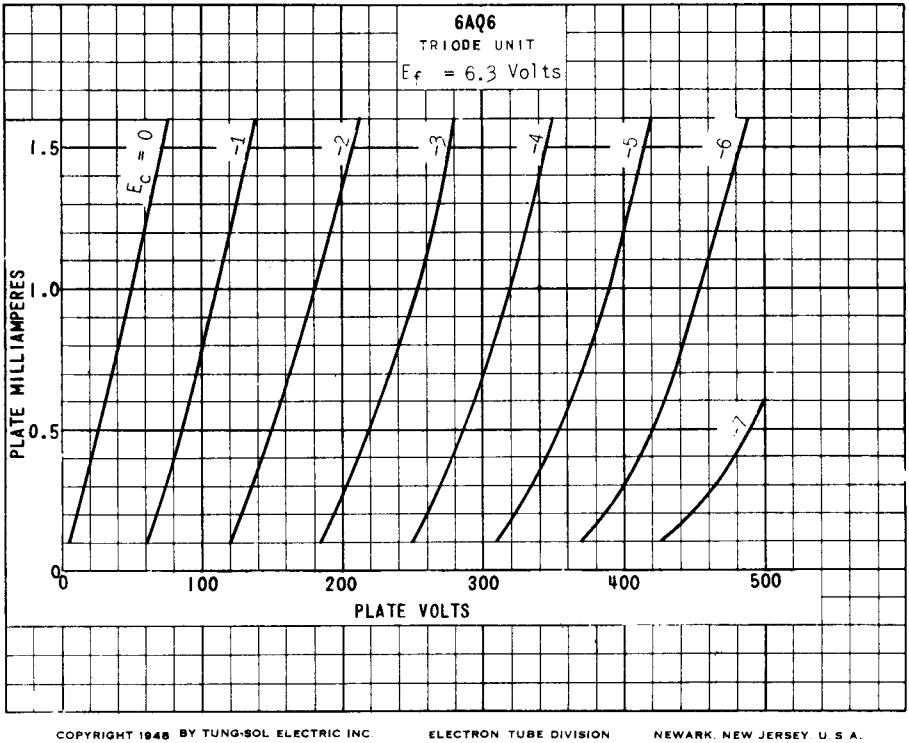
6AQ6





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JULY 1, 1948

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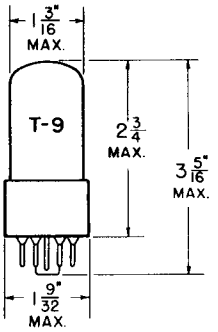
TUNG-SOL

DOUBLE DIODE-TRIODE

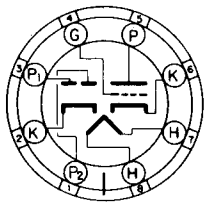


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8CK

THE 6AQ7GT COMBINES TWO HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE WITH SEPARATE CATHODES FOR THE TRIODE AND DOUBLE DIODE SECTIONS. IT IS DESIGNED FOR USE AS A SECOND DETECTOR AND FIRST AUDIO AMPLIFIER IN CIRCUITS WHERE THE DIODE AND TRIODE CATHODES ARE SEPARATE.

DIRECT INTERELECTRODE CAPACITANCES

WITH CLOSE FITTING EXTERNAL SHIELD CONNECTED TO CATHODE

GRID TO TRIODE PLATE: (G TO P)	3	μμf
GRID TO TRIODE CATHODE: (G TO K)	2.8	μμf
TRIODE PLATE TO TRIODE CATHODE: (P TO K)	3.2	μμf
GRID TO DIODE CATHODE: (G TO K) MAX.[A]	0.25	μμf
DIODE PLATE 1 TO DIODE CATHODE: (1P TO K)	2.2	μμf
DIODE PLATE 2 TO DIODE CATHODE: (2P TO K)	2.4	μμf
DIODE PLATE 1 TO DIODE PLATE 2: (1P TO 2P)	0.5	μμf

[A] SHIELD GROUNDED

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
DIODE OPERATION CURRENT PER PLATE	0.9	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	300	MA.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE RESISTANCE (APPROX.)	44 000	OHMS
TRANSCONDUCTANCE	1 600	μMHOS
AMPLIFICATION FACTOR	70	
PLATE CURRENT	2.3	MA.

CONTINUED ON FOLLOWING PAGE

PLATE 2239
SEPT. 1 1949

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

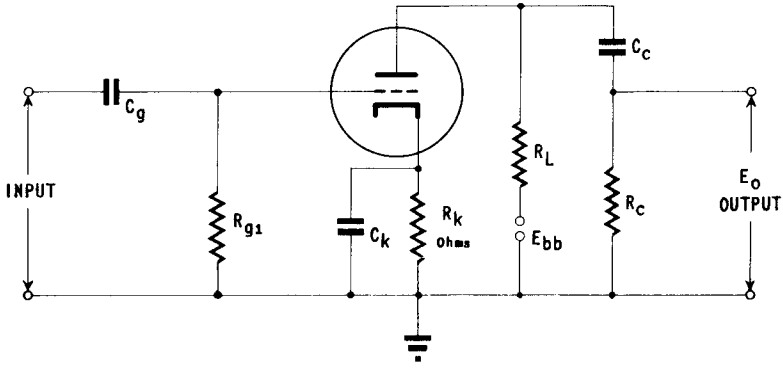
RESISTANCE COUPLED AMPLIFIER

R_1 MEG.	R_{g1} MEG.	R_c MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	4300	21	6.0	2200	27	20	1800	30	36
0.10	A	0.24	4700	25	7.5	2400	32	26	2200	34	49
0.24	A	0.24	7100	28	8.5	4300	36	26	3600	38	47
0.24	A	0.51	7800	32	11	4700	40	30	3900	42	56
0.51	A	0.51	11500	33	10	7500	42	28	6200	45	51
0.51	A	1.0	12500	38	12	8200	45	35	6800	48	60
0.24	10	0.24	---	32	5.0	----	40	19	----	43	38
0.24	10	0.51	---	36	7.0	----	45	25	----	49	48
0.51	10	0.51	---	37	6.5	----	47	23	----	50	43
0.51	10	1.0	---	40	9.5	----	49	28	----	53	53

[A] VALUE OF R_{g1} IS NOT CRITICAL.

GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.

E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

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SEPT. 1 1949

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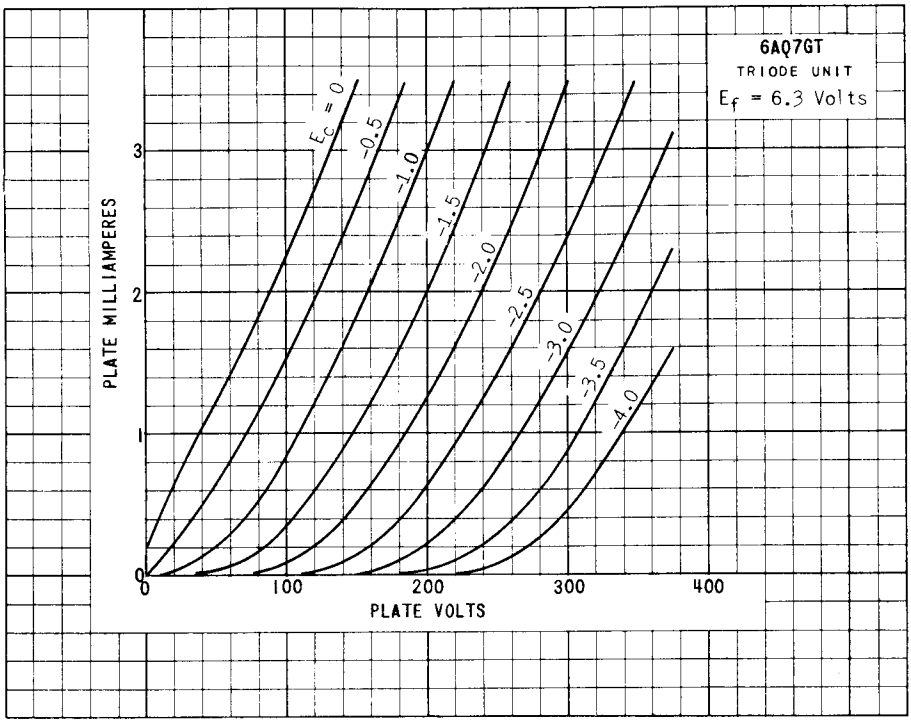

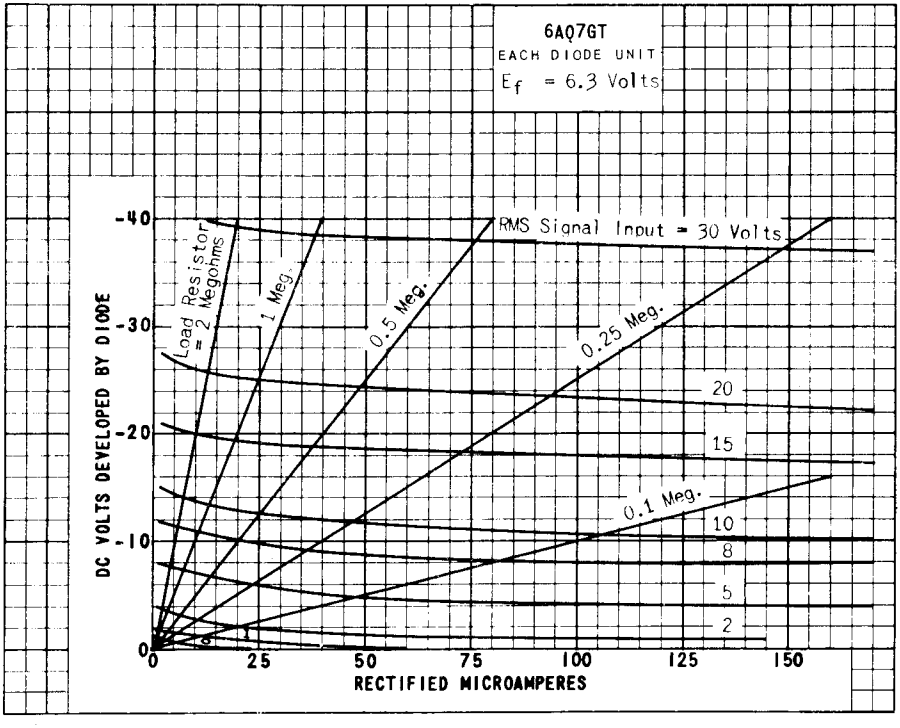

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PLATE
2241
SEPT. 1
1949

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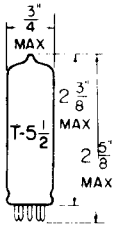
TUNG-SOL

PENTODE

MINIATURE TYPE

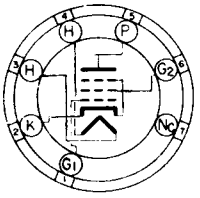


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 400 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6AR5 IS A PENTODE POWER AMPLIFIER USING THE MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE IN AC AND STORAGE BATTERY OPERATED RECEIVERS WHERE MODERATE POWER SENSITIVITY AND POWER OUTPUT IS DESIRED.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	400	400	MA.
PLATE VOLTAGE	250	250	VOLTS
GRID #2 VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	-16.5	-18	VOLTS
PEAK AF GRID #1 VOLTAGE	16.5	18	VOLTS
PLATE RESISTANCE (APPROX.)	65 000	68 000	OHMS
TRANSCONDUCTANCE	2 400	2 300	µMHOS
ZERO-SIGNAL PLATE CURRENT	34	32	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	5.7	5.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	35	33	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (NOMINAL)	10	10	MA.
LOAD RESISTANCE	7 000	7 600	OHMS
TOTAL HARMONIC DISTORTION	7	11	PERCENT
POWER OUTPUT	3.2	3.4	WATTS

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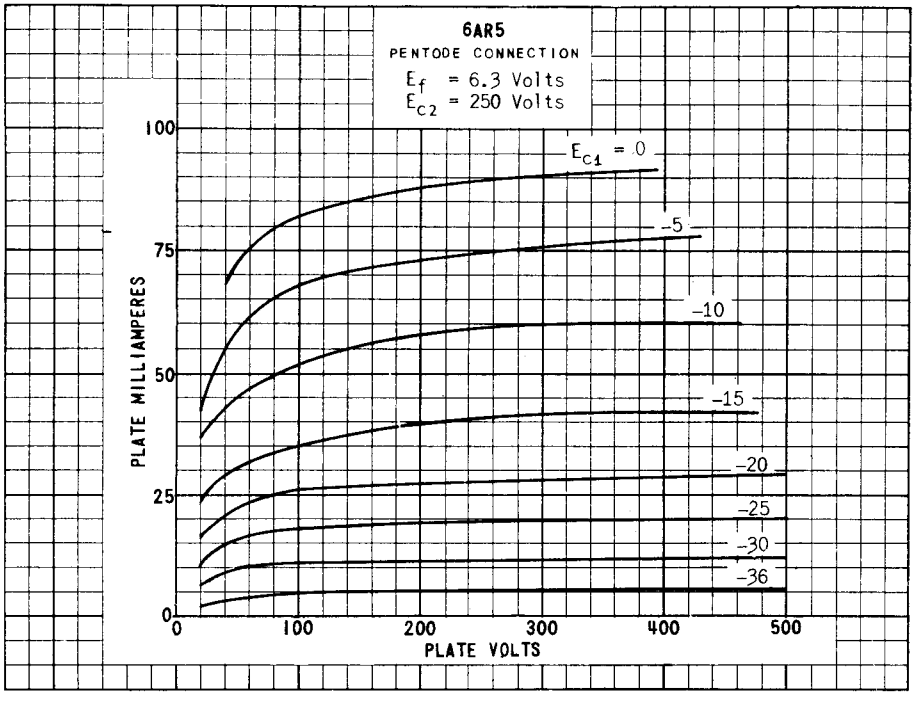

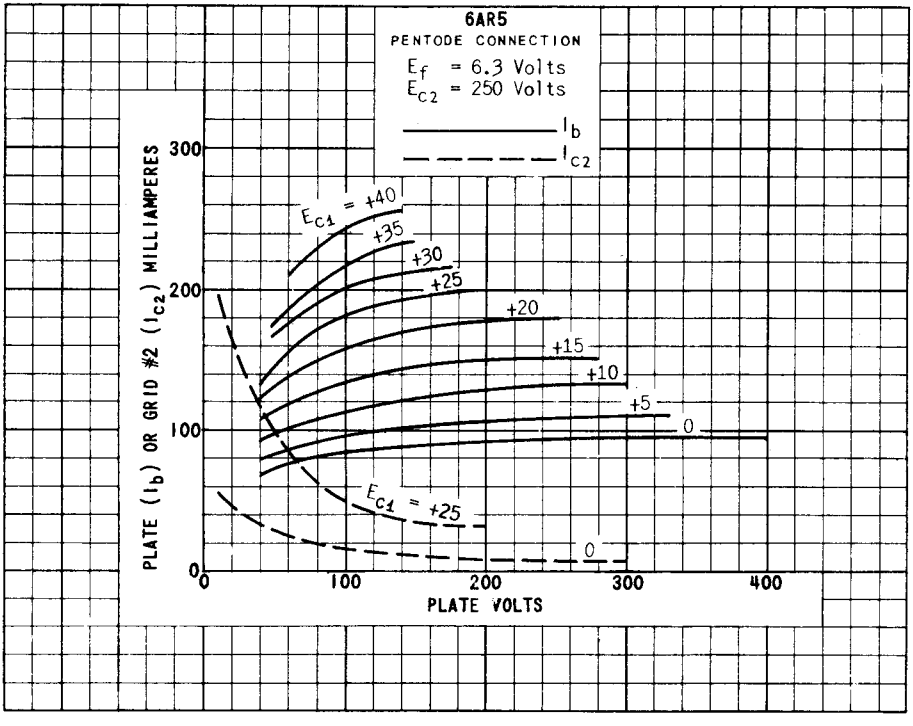

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PLATE
2242
SEPT. 1
1949

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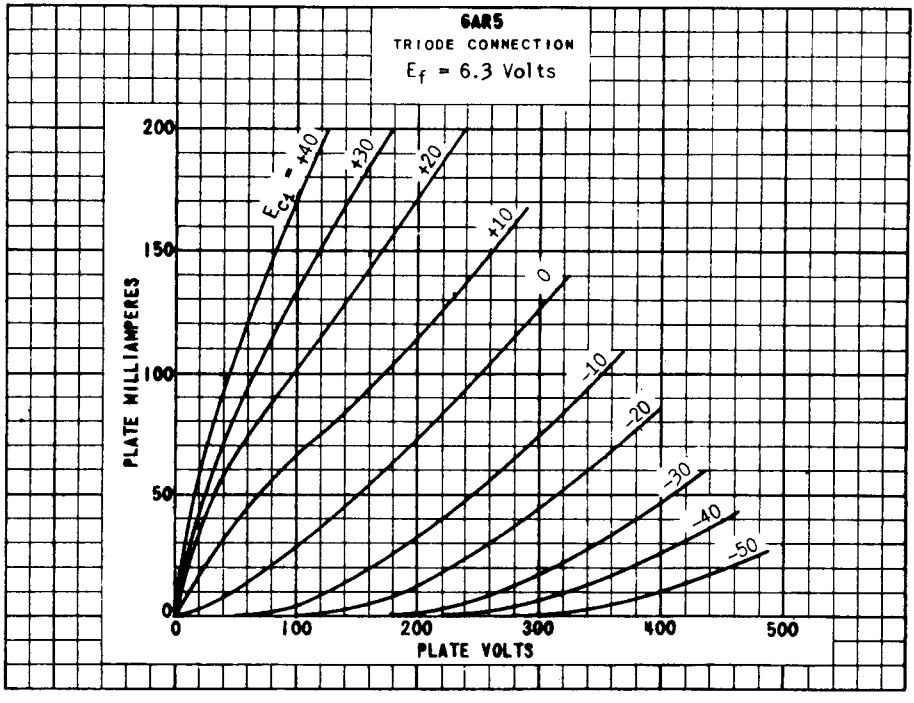
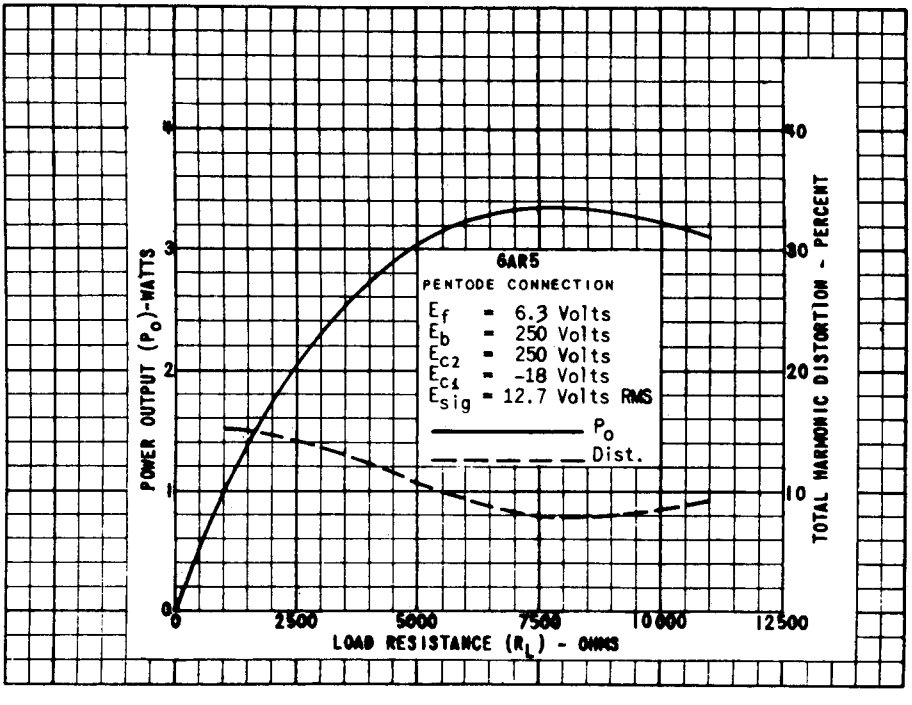
6AR5





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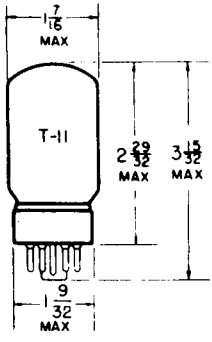
BEAM PENTODE



GLASS BULB

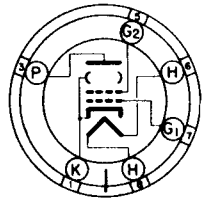
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE (SHORT) SHELL 6 PIN OCTAL LOW LOSS PHENOLIC BASE

6B0

THE 6AR6 IS A BEAM POWER AMPLIFIER DESIGNED SPECIFICALLY FOR APPLICATIONS REQUIRING RELATIVELY HIGH PEAK PLATE CURRENTS AT NEGATIVE GRID POTENTIALS. IT IS CONSTRUCTED TO WITHSTAND RELATIVELY HIGH PLATE POTENTIALS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: (G_1 TO P)	0.55	μμf
INPUT: G_1 TO (H+K+G_2)	11	μμf
OUTPUT: P TO (H+K+G_2)	7	μμf
HEATER TO CATHODE: (H TO K)	10	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM DC PLATE VOLTAGE	565	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-300 TO 0	VOLTS
MAXIMUM PLATE DISSIPATION	19	WATTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM DC PLATE CURRENT	115	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
DC PLATE VOLTAGE	200	250	VOLTS
DC GRID #2 VOLTAGE	TIED TO PLATE	250	VOLTS
DC GRID #1 VOLTAGE	-12.5	-22.5	VOLTS
GRID #1 CIRCUIT RESISTANCE (MAX.)	100 000	100 000	OHMS
DC PLATE CURRENT	90	77	MA.
GRID #2 CURRENT	TIED TO PLATE	5	MA.
PLATE RESISTANCE (APPROX.)	1 000	21 000	OHMS
TRANSCONDUCTANCE	6 000	5 400	μMHOS
DC GRID #1 VOLTAGE FOR PLATE CURRENT CUTOFF	---	-65	VOLTS

→INDICATES A CHANGE OR ADDITION.

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PLATE 2891

MAR. 1 1952

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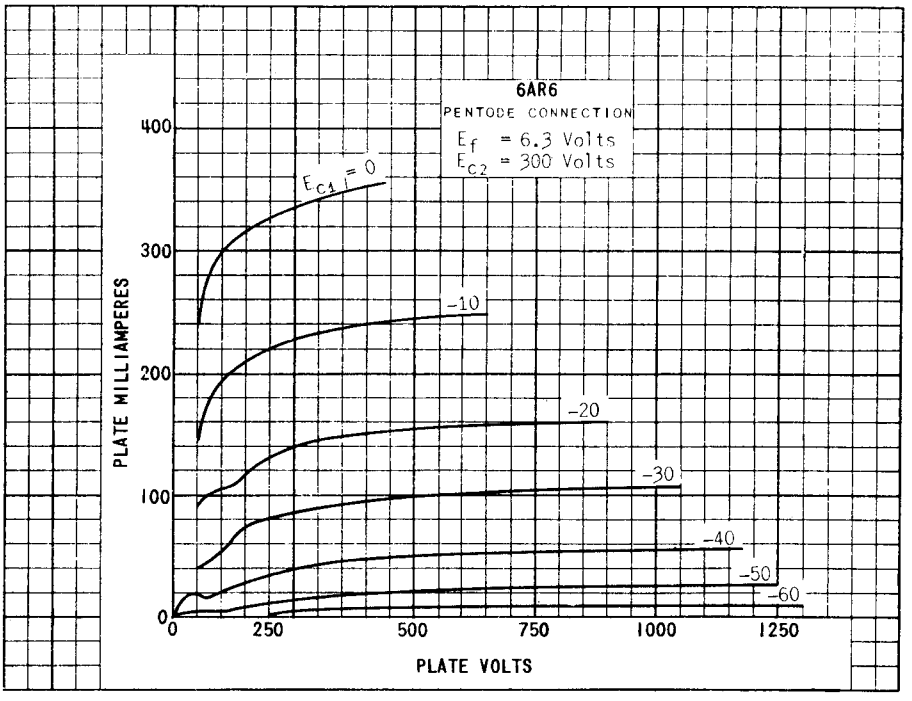
6AR6



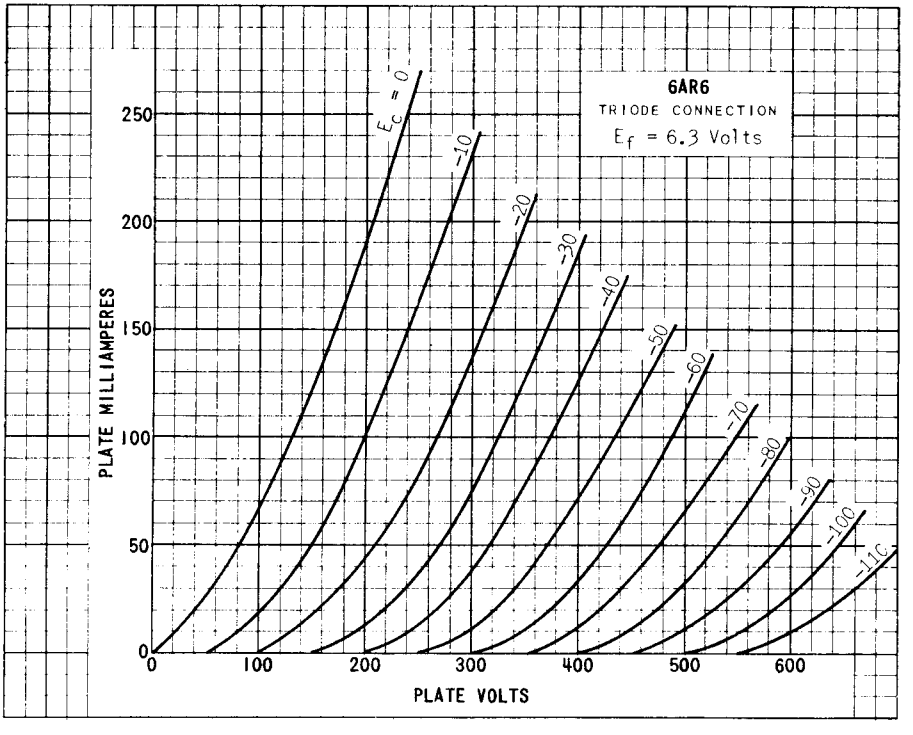


PLATE
2882
MAR. 1
1952

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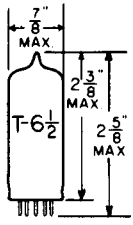
TUNG-SOL

SHEET-BEAM TUBE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9DP

PIN #5 SHOULD BE CONNECTED DIRECTLY TO GROUND.

THE 6AR8 IS A DOUBLE-PLATE SHEET-BEAM TUBE CONTAINING A PAIR OF BALANCED DEFLECTORS TO DIRECT THE ELECTRON BEAM TO EITHER OF THE TWO PLATES AND A CONTROL GRID TO VARY THE INTENSITY OF THE BEAM. IT IS DESIGNED FOR USE AS A SYNCHRONOUS DETECTOR IN COLOR TELEVISION RECEIVERS. IT IS ALSO SUITABLE IN THE BURST GATE CIRCUIT OF COLOR TELEVISION AND A VARIETY OF OTHER SWITCHING AND GATING APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.
WITH NO EXTERNAL SHIELD

DEFLECTOR #1 TO ALL	4.8	μμf
DEFLECTOR #2 TO ALL	4.8	μμf
GRID #1 TO ALL EXCEPT PLATES	7.5	μμf
PLATE #1 TO ALL	5.0	μμf
PLATE #2 TO ALL	5.0	μμf
GRID #1 TO DEFLECTOR #1	0.040	μμf
GRID #1 TO DEFLECTOR #2	0.060	μμf
PLATE #1 TO PLATE #2	0.4	μμf
DEFLECTOR #1 TO DEFLECTOR #2	0.38	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE #2 VOLTAGE	300	VOLTS
MAXIMUM ACCELERATOR VOLTAGE	300	VOLTS
MAXIMUM PEAK POSITIVE DEFLECTOR #1 VOLTAGE	150	VOLTS
MAXIMUM PEAK NEGATIVE DEFLECTOR #1 VOLTAGE	150	VOLTS
MAXIMUM PEAK POSITIVE DEFLECTOR #2 VOLTAGE	150	VOLTS
MAXIMUM PEAK NEGATIVE DEFLECTOR #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE #1 DISSIPATION	2.0	WATTS
MAXIMUM PLATE #2 DISSIPATION	2.0	WATTS
MAXIMUM DC CATHODE CURRENT	30	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.25	MEGOHM

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→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DEFLECTORS GROUNDED

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE #1 VOLTAGE	250	VOLTS
PLATE #2 CONNECTED TO PLATE #1 ACCELERATOR VOLTAGE	250	VOLTS
DEFLECTOR #1 VOLTAGE	0	VOLTS
DEFLECTOR #2 VOLTAGE	0	VOLTS
CATHODE-BIAS RESISTOR	300	OHMS
TOTAL PLATE CURRENT	10	MA.
ACCELERATOR CURRENT	0.4	MA.
GRID #1 TRANSCONDUCTANCE	4 000	μMHOS
GRID #1 VOLTAGE (APPROX.) I_b = 10 μAMP.	−14	VOLTS

DEFLECTOR CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE #1 VOLTAGE	250	VOLTS
PLATE #2 VOLTAGE	250	VOLTS
ACCELERATOR VOLTAGE	250	VOLTS
CATHODE-BIAS RESISTOR	300	OHMS
DEFLECTING SWITCHING VOLTAGE (MAX.)	20	VOLTS
DEFLECTOR-BIAS VOLTAGE FOR MINIMUM DEFLECTOR SWITCHING VOLTAGE[A]	−8	VOLTS
VOLTAGE DIFFERENCE BETWEEN DEFLECTORS FOR $I_{b1} = I_{b2}$ (APPROX.)	0	VOLTS
PLATE #1 CURRENT (MAX.) E_{d1} = −15 VOLTS, E_{d2} = +15 VOLTS	1.0	MA.
PLATE #2 CURRENT (MAX.) E_{d1} = +15 VOLTS, E_{d2} = −15 VOLTS	1.0	MA.
DEFLECTOR #1 CURRENT (MAX.) E_{d1} = +25 VOLTS, E_{d2} = −25 VOLTS	0.5	MA.
DEFLECTOR #2 CURRENT (MAX.) E_{d1} = −25 VOLTS, E_{d2} = +25 VOLTS	0.5	MA.

[A] DEFLECTOR SWITCHING VOLTAGE IS DEFINED AS THE TOTAL VOLTAGE CHANGE ON EITHER DEFLECTOR WITH AN EQUAL AND OPPOSITE CHANGE ON THE OTHER DEFLECTOR REQUIRED TO SWITCH THE PLATE CURRENT FROM ONE PLATE TO THE OTHER.

NOTE: THE 6AR8 SHOULD BE SO LOCATED IN THE RECEIVER THAT IT IS NOT SUBJECTED TO STRAY MAGNETIC FIELDS.

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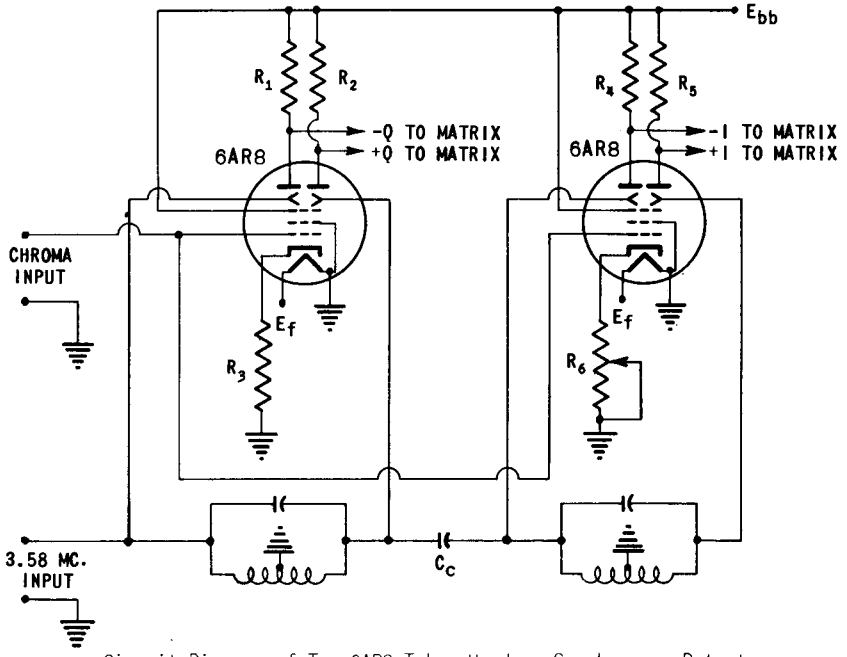
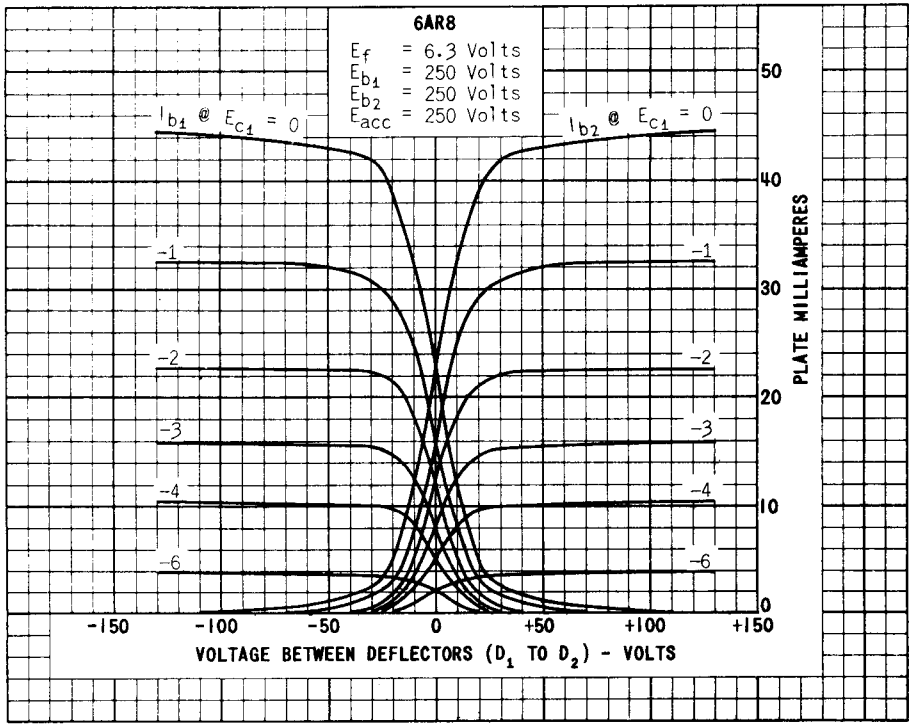
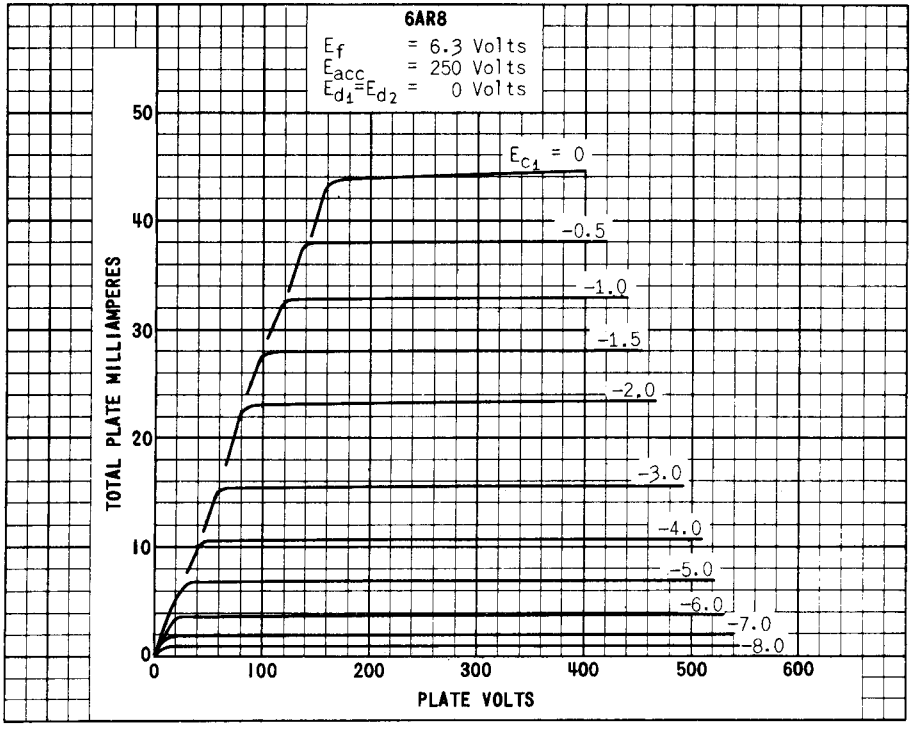


Circuit Diagram of Two 6AR8 Tubes Used as Synchronous Detectors



6AR8



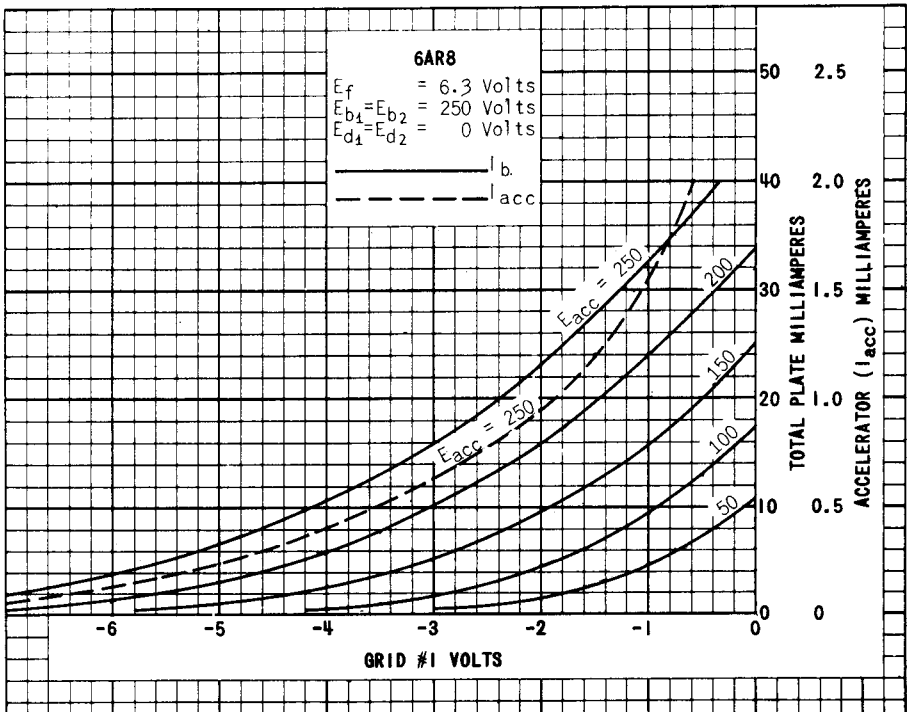


PLATE #4278 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

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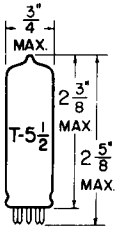
PENTODE

MINIATURE TYPE



GLASS BULB

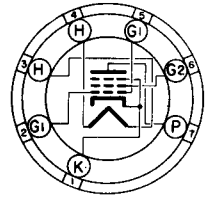
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.8 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7CV

THE 6AS5 IS A HEATER-CATHODE, BEAM PENTODE POWER AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN OUTPUT TUBE IN AUTOMOBILE AND AC OPERATED RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS, THE 6AS5 IS IDENTICAL TO THE 12AS5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.6	μμf
INPUT: G1 TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	9.0 ←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 RATING CURVE	
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100 ←	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100 ←	VOLTS

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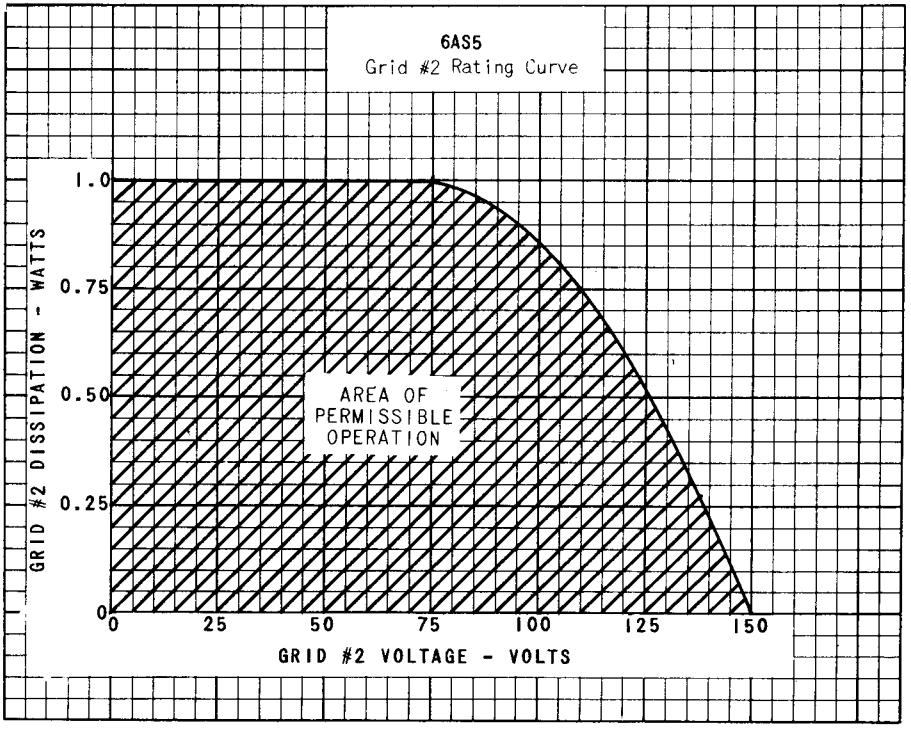
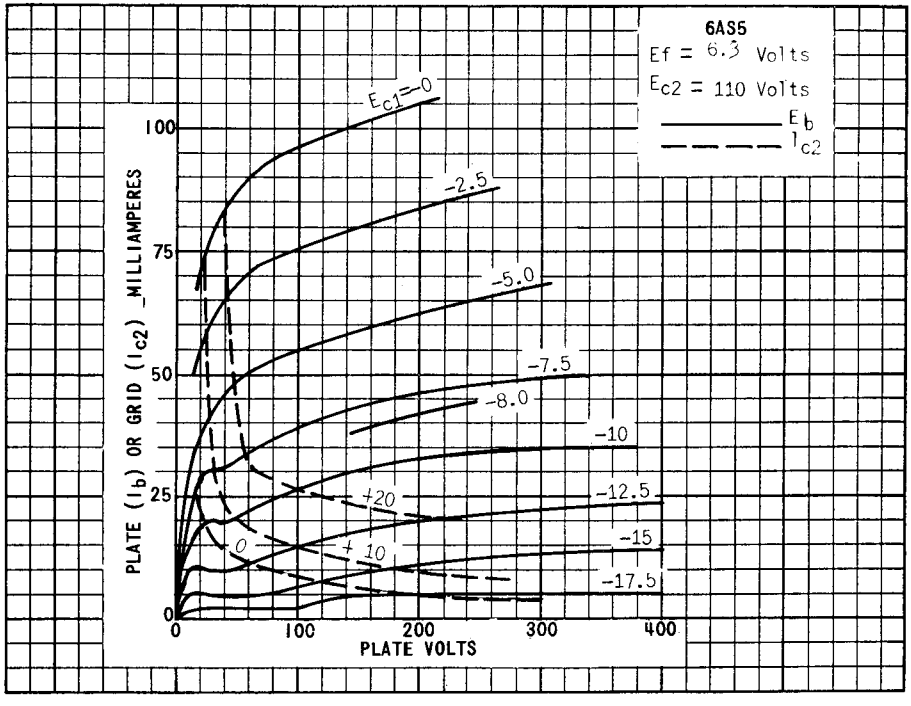
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

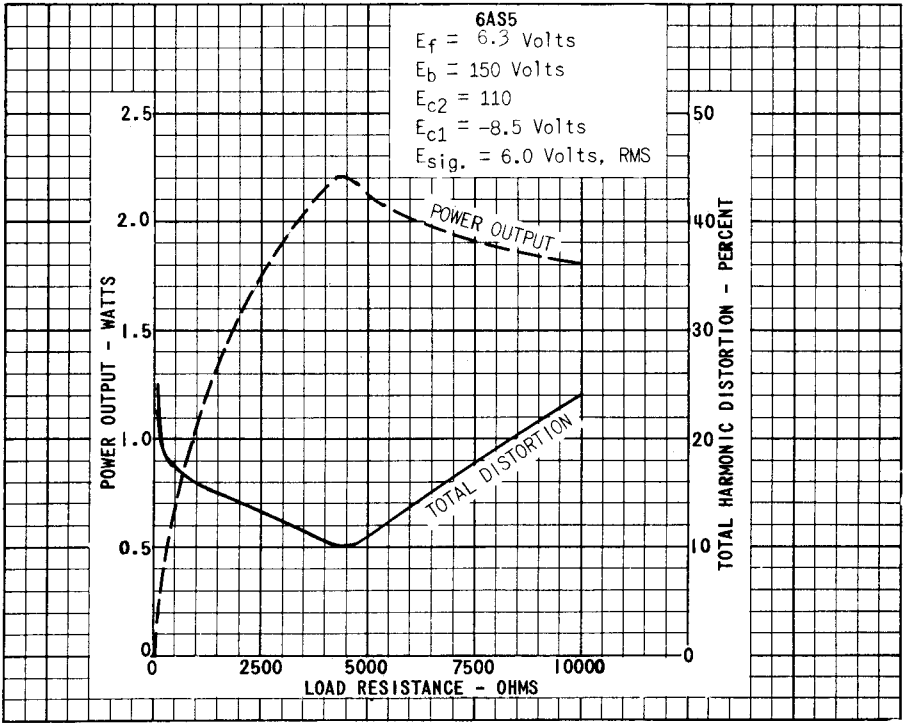
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.8	VOLTS
PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE[A]	-8.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAX. SIGNAL PLATE CURRENT	36	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	2	MA.
MAX.-SIGNAL GRID #2 CURRENT (APPROX.)	6.5	MA.
TRANSCONDUCTANCE	5600	μMHOS
LOAD RESISTANCE	4500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	2.2	WATTS

[A]UNDER MAX. RATED CONDITIONS THE DC RESISTANCE OF THE GRID #1 CIRCUIT SHOULD NOT EXCEED 0.1 MEG. FOR FIXED BIAS OPERATION OR 0.5 MEG. FOR CATHODE BIAS OPERATION.




6AS5
Ef = 6.3 Volts
Ec2 = 110 Volts
Eb
Ic2
Ec1=-0
-2.5
-5.0
-7.5
-8.0
-10
-12.5
-15
-17.5
+20
0
+10
PLATE (Ib) OR GRID (Ic2) _MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
100
200
300
400


6AS5
Ef = 6.3 Volts
Eb = 150 Volts
Ec2 = 110
Ec1 = -8.5 Volts
Esig. = 6.0 Volts, RMS
POWER OUTPUT
TOTAL DISTORTION
POWER OUTPUT - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE - OHMS
0
0.5
1.0
1.5
2.0
2.5
0
10
20
30
40
50
0
2500
5000
7500
10000

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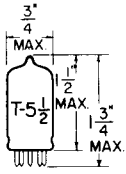
PENTODE (DUAL CONTROL)

MINIATURE TYPE

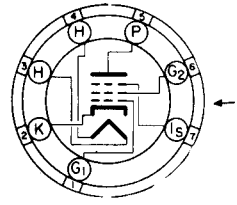


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6AS6 IS A SHARP CUT-OFF VOLTAGE AMPLIFIER PENTODE USING THE MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY AN EFFICIENT HEATER, LOW CAPACITANCES AND HIGH TRANSCONDUCTANCE. THE SUPPRESSOR GRID IS TERMINATED IN A SEPARATE BASE CONNECTION AND IS INTENDED TO BE USED AS AN ADDITIONAL CONTROL GRID IN GATING, SWITCHING, OR MIXER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (1): G_1 TO P (MAX.)	0.02	0.025	μμf
GRID TO PLATE (2): G_3 TO P	0.7	0.7	μμf
INPUT (1): G_1 TO (H+K+G_2+G_3+P+IS)	4	3.9	μμf
INPUT (2): G_3 TO (H+K+G_1+G_2+P+IS)	3.4	3.3	μμf
OUTPUT: P TO (H+K+G_1+G_2+G_3+IS)	3	2.2	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.15	0.15	μμf

[A] EXTERNAL SHIELD CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	27	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATT

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→ INDICATES A CHANGE.

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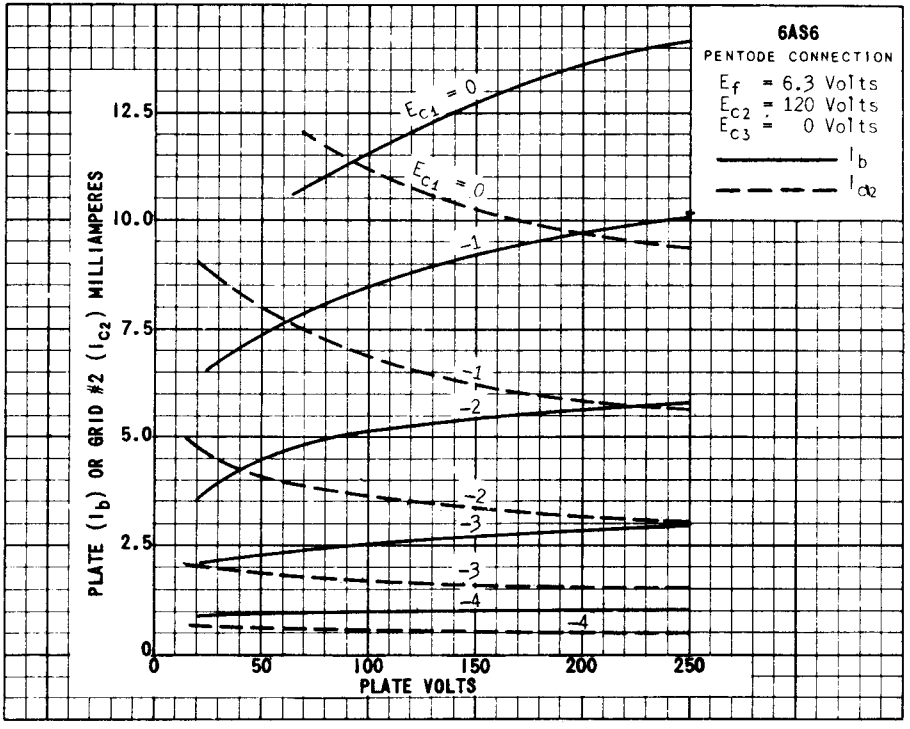
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	175	175	MA.
PLATE VOLTAGE	120	120	VOLTS
GRID #3 VOLTAGE	−3	0[B]	VOLTS
GRID #2 VOLTAGE	120	120	VOLTS
GRID #1 VOLTAGE	−2	−2	VOLTS
PLATE RESISTANCE (APPROX.)	---	0.11	MEGOHM
GRID #1 TRANSCONDUCTANCE	1 850	3 200	µMHOS
GRID #3 TRANSCONDUCTANCE	810	470	µMHOS
PLATE CURRENT	3.6	5.2	MA.
GRID #2 CURRENT	4.8	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 µA. (APPROX.)	---	−7.5	VOLTS
GRID #3 VOLTAGE FOR I_b = 10 µA. (APPROX.)	−10	---	VOLTS

[B] GRID #3 CONNECTED TO CATHODE.



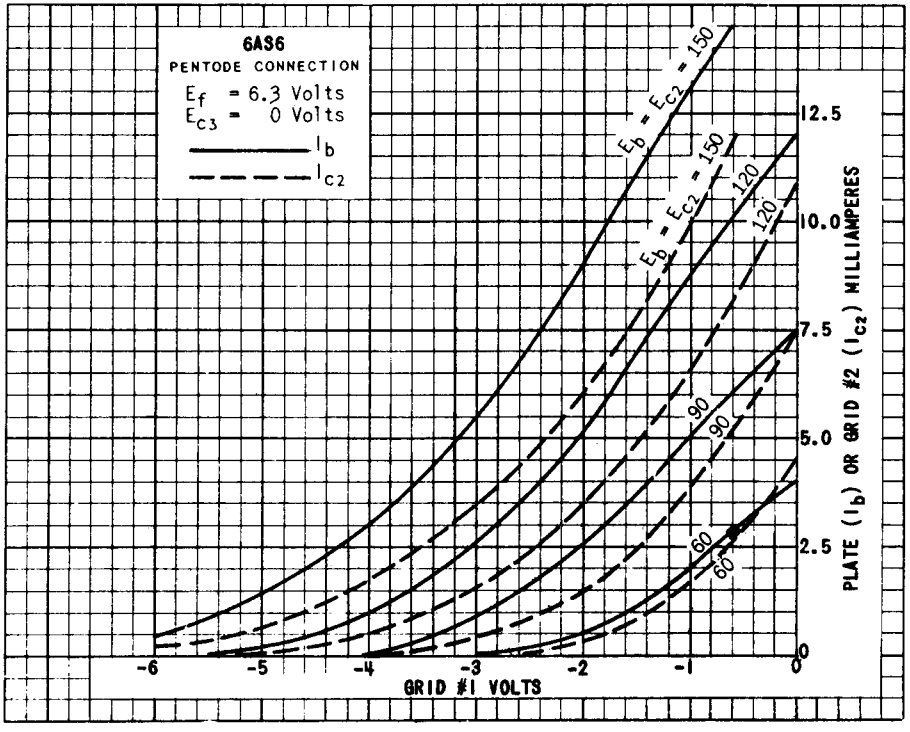


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PLATE
2957
JUNE 1
1952

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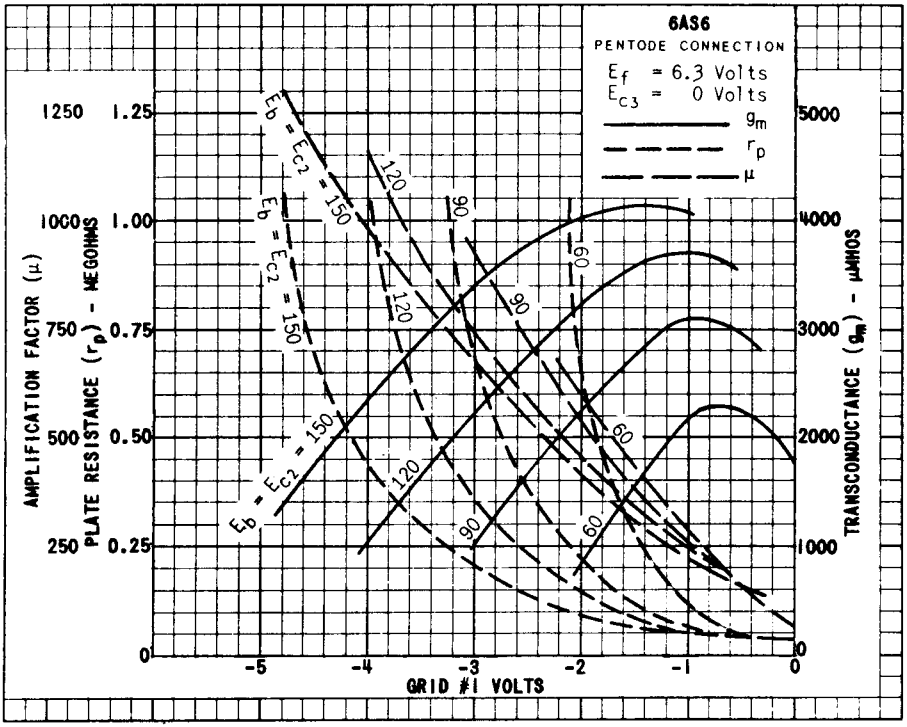
6AS6



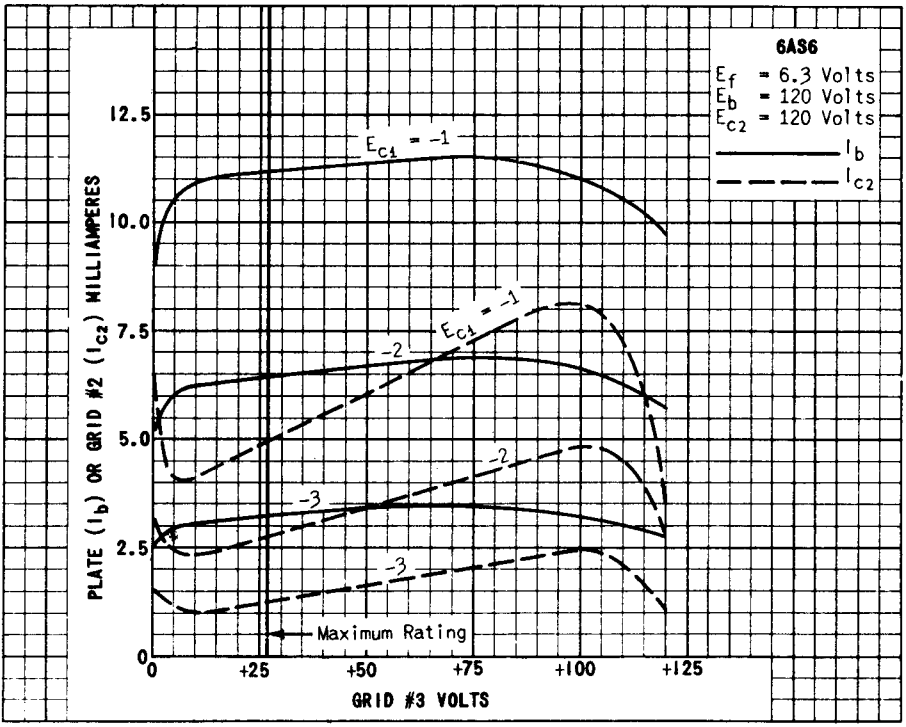


PLATE 2958
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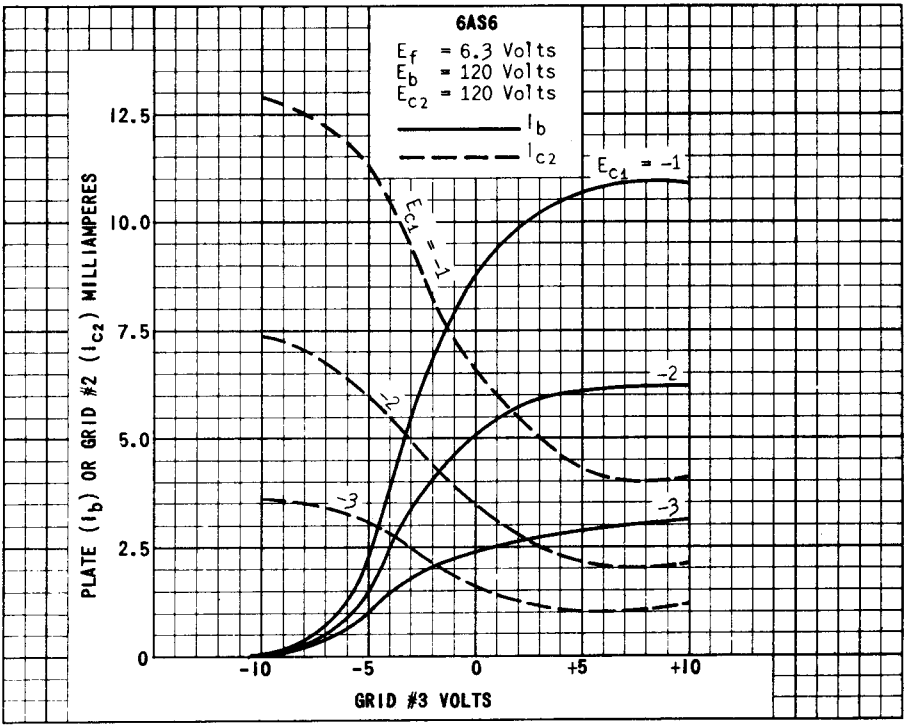

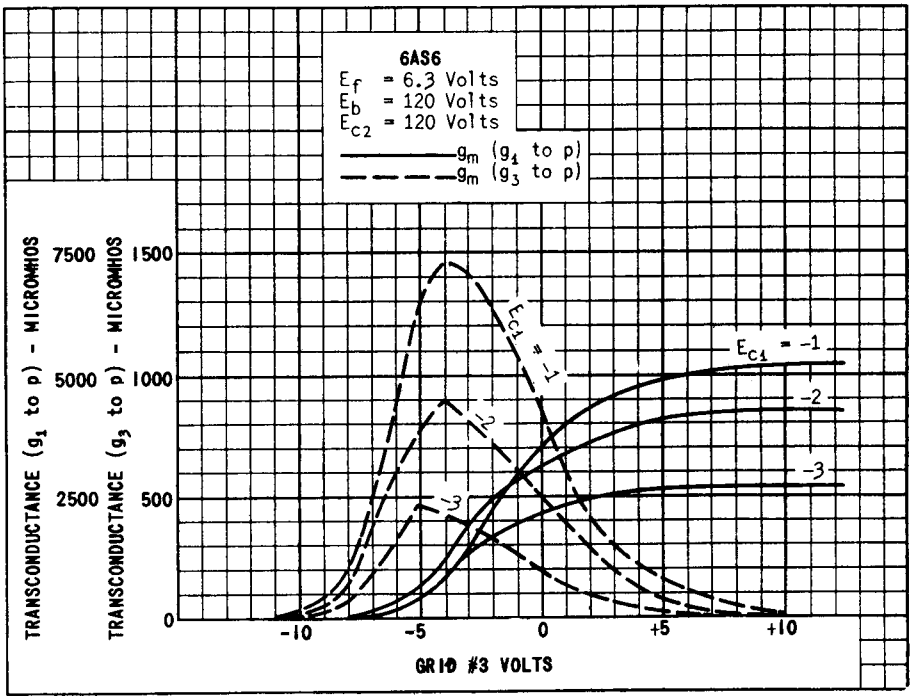

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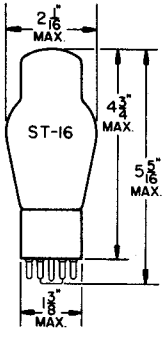
TWIN TRIODE



GLASS BULB

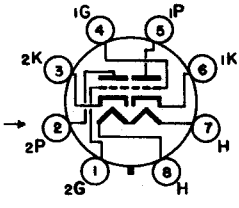
MEDIUM SHELL
8 PIN OCTAL B8-11

HEATER

6.3±10% VOLTS 2.5 AMP.

ANY MOUNTING POSITION

(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE GRID PLANE BE VERTICAL.)



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 6AS7G IS A HIGH CURRENT, TWIN POWER TRIODE WIDELY USED IN ELECTRONICALLY REGULATED POWER SUPPLIES. THE HIGH PERVEANCE OF THIS TUBE PERMITS IT TO PASS LARGE CURRENTS AT LOW PLATE VOLTAGES, THUS PROVIDING FOR EFFICIENT SERIES REGULATION.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	2.5	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	7 000	μMHOS
AMPLIFICATION FACTOR	2.0	
INTER ELECTRODE CAPACITANCES PER TRIODE SECTION:		
GRID TO CATHODE	6.2	μμf
GRID TO PLATE	8.4	μμf
CATHODE TO PLATE	2.2	μμf
HEATER TO CATHODE	7.0	μμf
INTER ELECTRODE CAPACITIES BETWEEN TRIODE SECTIONS:		
SECTION 1 GRID TO SECTION 2 GRID	0.9	μμf
SECTION 1 PLATE TO SECTION 2 PLATE	2.2	μμf

MECHANICAL DATA

MOUNTING POSITION	ANY	
BULB	ST-16	
BASE	MEDIUM SHELL OCTAL 8 PIN B8-11 PHENOLIC	
AVERAGE NET WEIGHT	2.5	OUNCES
MAXIMUM VIBRATION RATING (D=.08" @ 25 CPS)	2.5	G

→ INDICATES A CHANGE.

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RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
HEATER VOLTAGE	5.7	6.9	VOLTS
PLATE VOLTAGE (DC)	---	275	VOLTS
GRID VOLTAGE (DC)	---	0	VOLTS
HEATER-CATHODE VOLTAGE (DC)	-300	+300	VOLTS
GRID CURRENT PER GRID	---	0	MA.
PLATE CURRENT PER PLATE (DC)	---	125	MA.
(IF SEVERAL TUBE SECTIONS ARE TO BE USED IN PARALLEL WITH EACH OTHER, IT IS RECOMMENDED NOT TO EXCEED 100 MA. PER PLATE)			
POWER DISSIPATION PER PLATE	---	14	WATTS
ENVELOPE TEMPERATURE	---	200	°C
ALTITUDE FOR FULL RATINGS	---	10 000	FEET
CIRCUIT VALUES[A]			
GRID CIRCUIT RESISTANCE FOR CATHODE BIAS OPERATION	---	1.0	MEGOHM
GRID CIRCUIT RESISTANCE FOR FIXED BIAS OR COMBINATION FIXED AND CATHODE BIAS OPERATION	---	0.1	MEGOHM

RANGE OF VALUES

CONDITIONS: E_f =6.3V; E_b =135V; E_c =0: $R_{k/k}$ =250 Ω.
BOTH SECTIONS OPERATING.
EACH SECTION READ SEPARATELY.

INDIVIDUAL PLATE CURRENT (DC)	100	150	MA.
INDIVIDUAL SECTION TRANSCONDUCTANCE	5 800	8 200	μMHOS
AMPLIFICATION FACTOR	1.4	2.6	

CONDITIONS: E_f =6.3: E_b =250 VDC. E_c =-200 VDC. $R_{k/k}$=0.

INDIVIDUAL PLATE CURRENT (DC)		10	MA.

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APPLICATION NOTES

THE 6AS7G IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED , HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE THIRD THE VALUE $(\frac{R}{U+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE THIRD THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (LESS THAN ONE WATT) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATED OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.

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TUNG-SOL

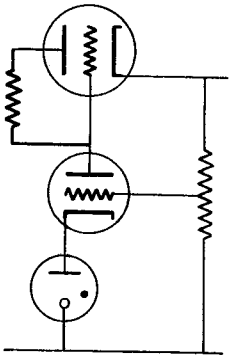


FIGURE 1

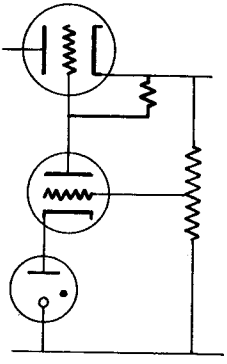


FIGURE 2

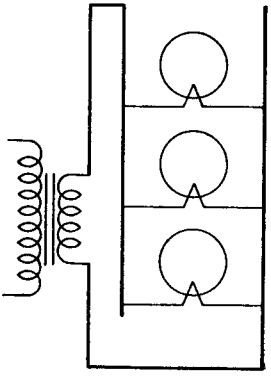
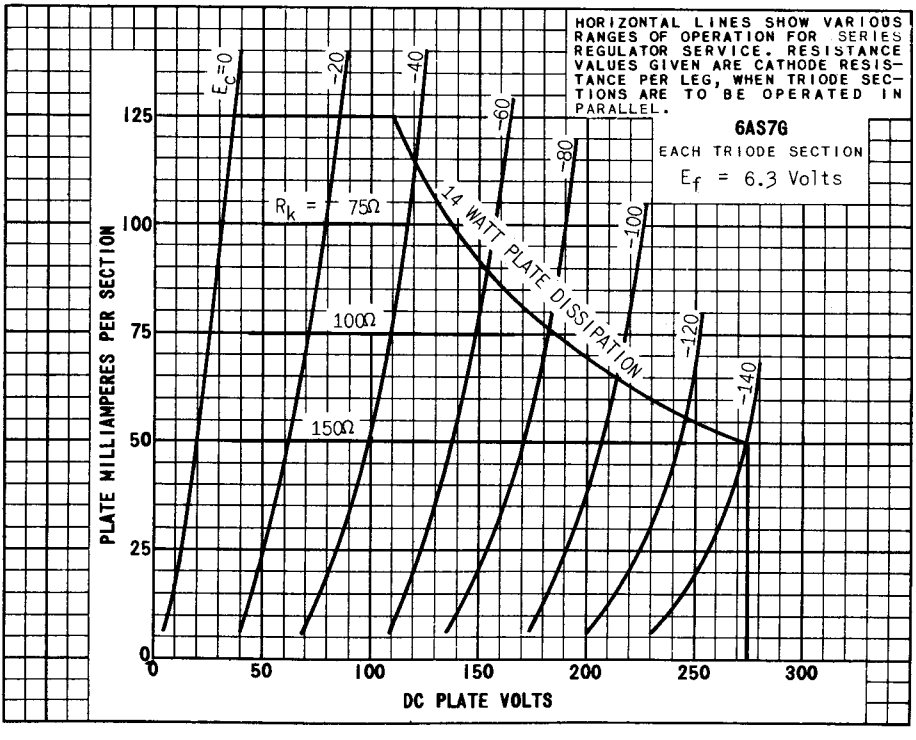
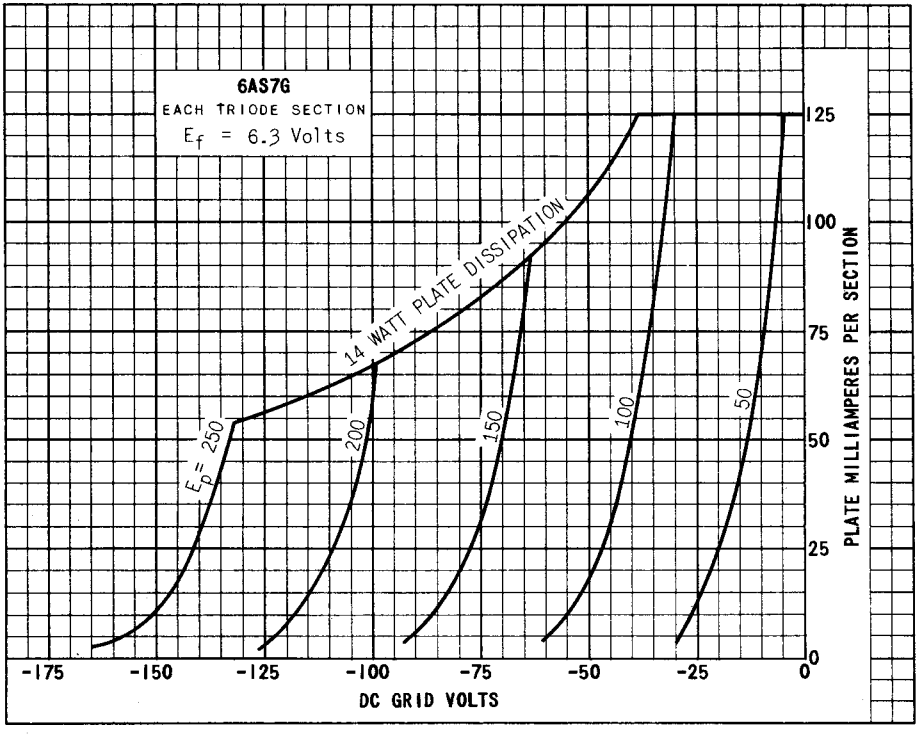
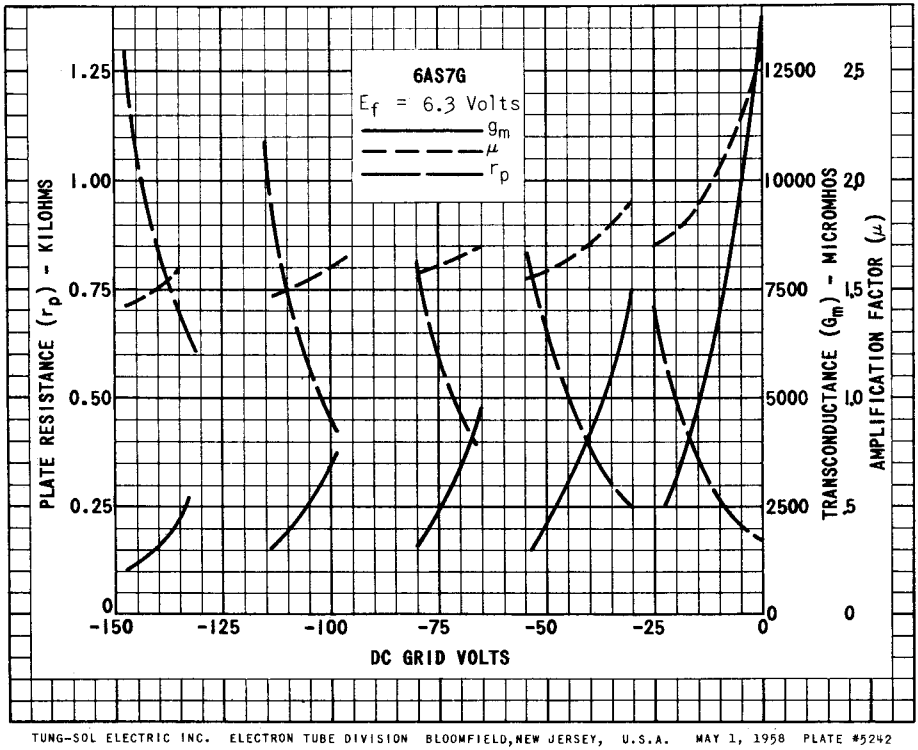


FIGURE 3

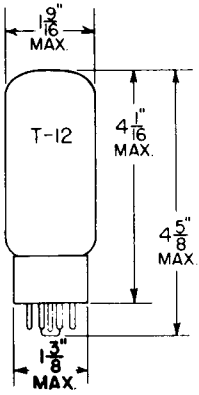



6AS7G
EACH TRIODE SECTION
E_f = 6.3 Volts
14 WATT PLATE DISSIPATION
E_p = 250
200
150
100
50
125
100
75
50
25
0
PLATE MILLIAMPERES PER SECTION
-175
-150
-125
-100
-75
-50
-25
0
DC GRID VOLTS


6AS7G
E_f = 6.3 Volts
g_m
μ
r_p
PLATE RESISTANCE (r_p) - KILOHMS
1.25
1.00
0.75
0.50
0.25
0
TRANSCONDUCTANCE (G_m) - MICROMHOS
12500
10000
7500
5000
2500
0
AMPLIFICATION FACTOR (μ)
25
20
15
10
5
0
-150
-125
-100
-75
-50
-25
0
DC GRID VOLTS

TUNG-SOL

TWIN TRIODE

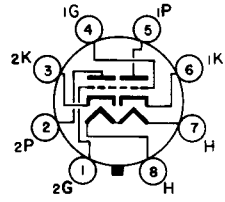


SHORT MEDIUM-SHELL
8 PIN OCTAL B8-110
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BASING DIAGRAM
JEDEC 8BD
BOTTOM VIEW

THE 6AS7GA IS A LOW-MU TWIN TRIODE DESIGNED PRIMARILY FOR SERVICE AS A SERIES REGULATOR TUBE IN D-C POWER SUPPLIES. EXCEPT FOR THE USE OF A T-12 ENVELOPE, THE 6AS7GA IS IDENTICAL TO THE 6AS7G.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE (EACH SECTION)	7.5	μμf
INPUT (EACH SECTION)	6.5	μμf
OUTPUT (EACH SECTION)	2.2	μμf
HEATER TO CATHODE (EACH SECTION)	7.0	μμf
GRID TO GRID	0.5	μμf
PLATE TO PLATE	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DC AMPLIFIER SERVICE-EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	13	WATTS
MAXIMUM PLATE CURRENT	125	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	300	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE:		
WITH CATHODE-BIAS[A]	1.0	MEGOHM

BOOSTER SCANNING SERVICE-EACH SECTION

MAXIMUM PEAK INVERSE PLATE VOLTAGE	1700	VOLTS
MAXIMUM PLATE DISSIPATION	13	WATTS
MAXIMUM PLATE CURRENT	125	MA.

[A] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

BOOSTER SCANNING SERVICE-EACH SECTION[B]

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	300	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE: WITH CATHODE-BIAS[C]	1.0	MEGOHM

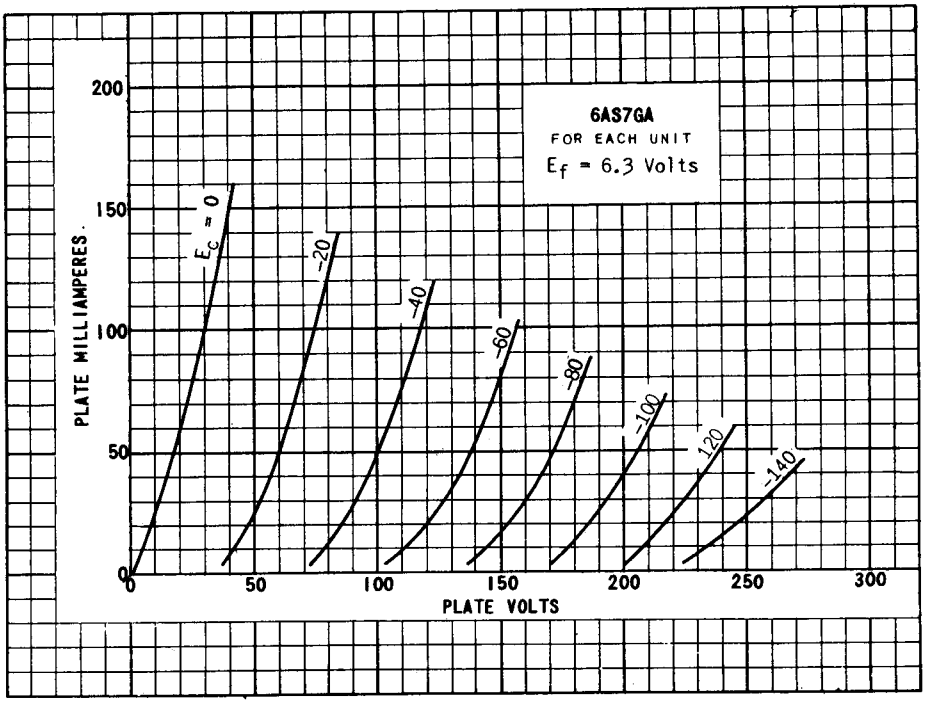
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	2.5	AMP.
PLATE VOLTAGE	135	VOLTS
CATHODE-BIAS RESISTOR	250	OHMS
AMPLIFICATION FACTOR	2.0	
PLATE RESISTANCE (APPROX.)	280	OHMS
TRANSCONDUCTANCE	7000	μMHOS
PLATE CURRENT	125	MA.

[B]FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCASTING STATIONS: FEDERAL COMMUNICATIONS COMMISSION." THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C]OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.



TUNG-SOL

DIODE PENTODE

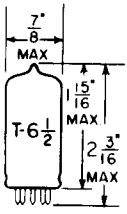
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

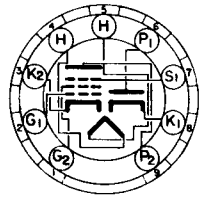
HEATER

6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9DS

THE 6AS8 IS A GENERAL-PURPOSE, MULTIUNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A HIGH PERVEANCE DIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE. IT IS INTENDED FOR DIVERSIFIED APPLICATIONS IN TELEVISION AND RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

DIODE UNIT		
PLATE TO HEATER & CATHODE & INTERNAL SHIELD	3.0	pf
PENTODE UNIT		
GRID #1 TO PLATE (MAX.)	→ 0.03	pf
INPUT	7.0	pf
OUTPUT	2.4	pf
PENTODE GRID TO DIODE PLATE (MAX.)	0.005	pf
PENTODE PLATE TO DIODE CATHODE (MAX.)	0.15	pf
PENTODE PLATE TO DIODE PLATE (MAX.)	0.10	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	PENTODE UNIT	
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE SECOND CURVE	
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 INPUT	0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS OPERATION	1.0	MEGOHM
FIXED BIAS OPERATION	0.25	MEGOHM

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CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

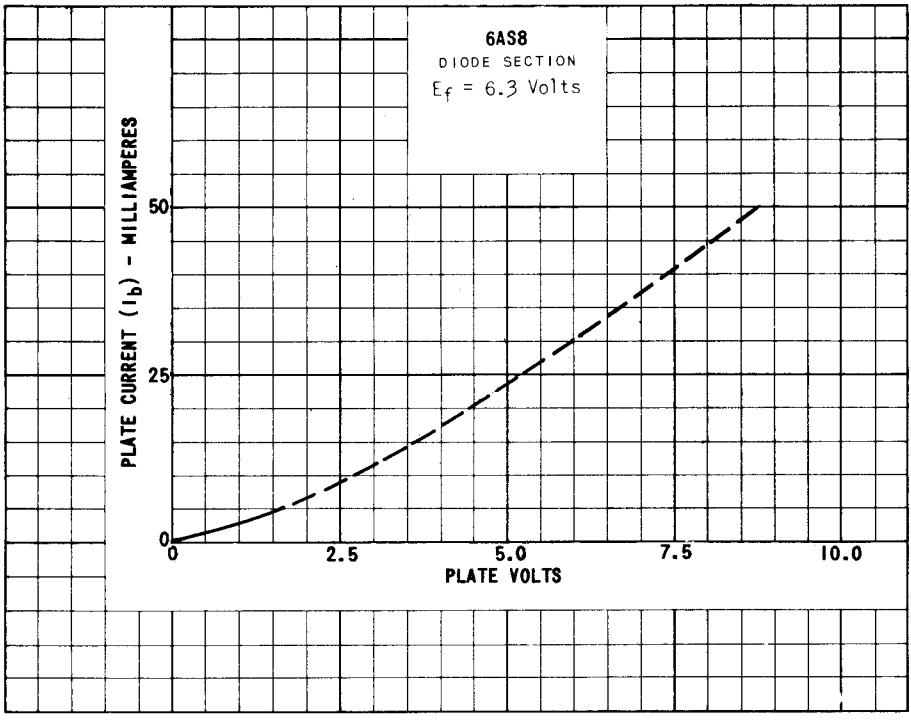
	DIODE UNIT	
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK PLATE CURRENT	50	MA.
MAXIMUM DC PLATE CURRENT	5	MA.

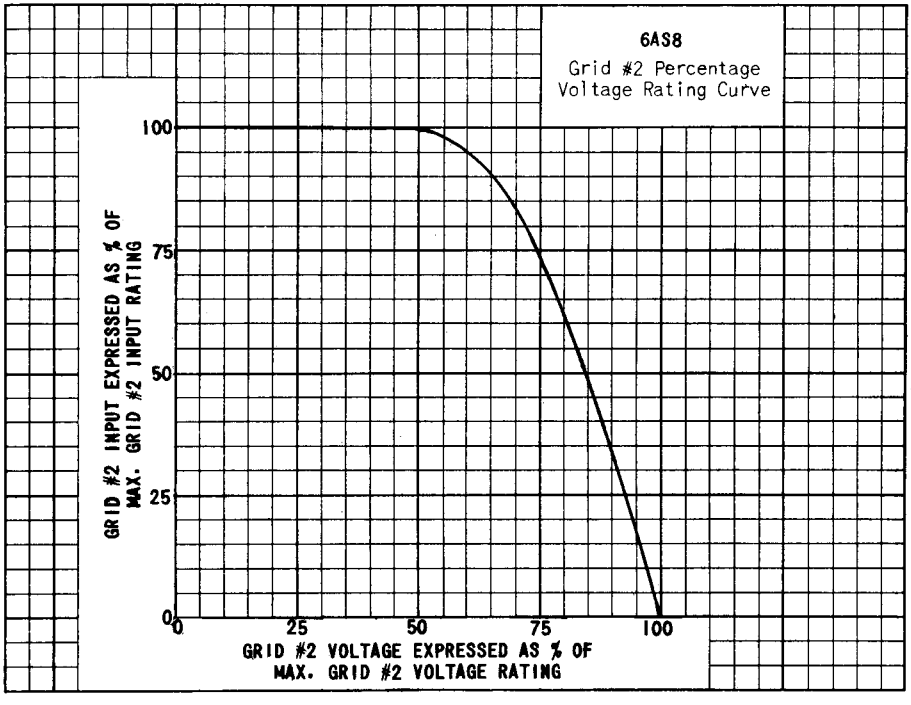
[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE SUPPLY VOLTAGE	200	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	180	OHMS
PLATE RESISTANCE (APPROX.)	300 000	OHMS
TRANSCONDUCTANCE	6 200	μMHOS
GRID #1 BIAS (APPROX.) FOR I_b = 10 μAMP.	−8	VOLTS
PLATE CURRENT	9.5	MA.
GRID #2 CURRENT	3	MA.

→ INDICATES A CHANGE





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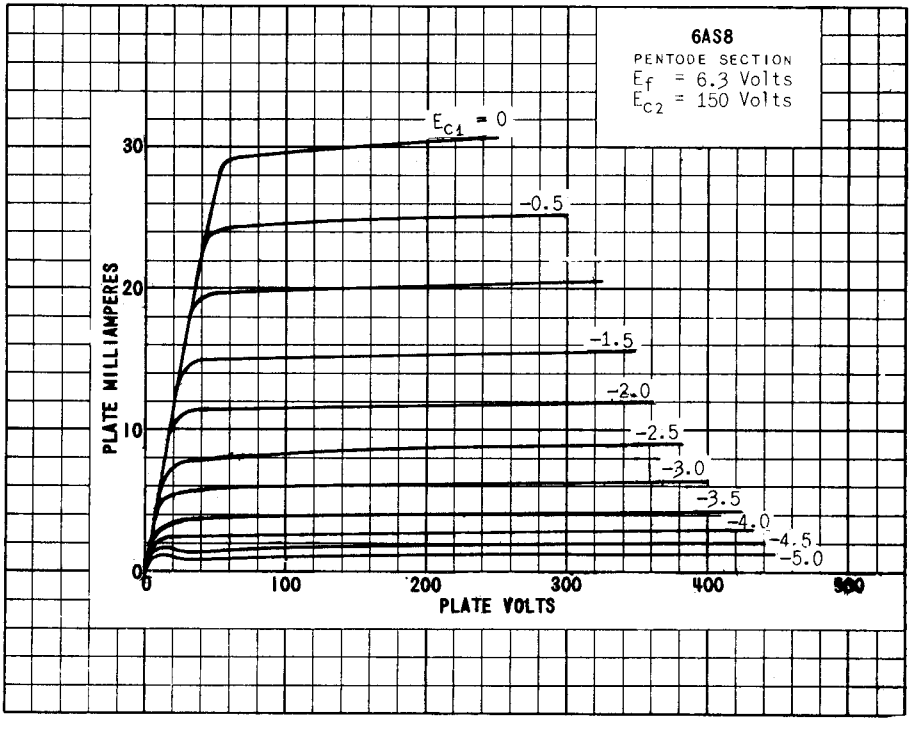
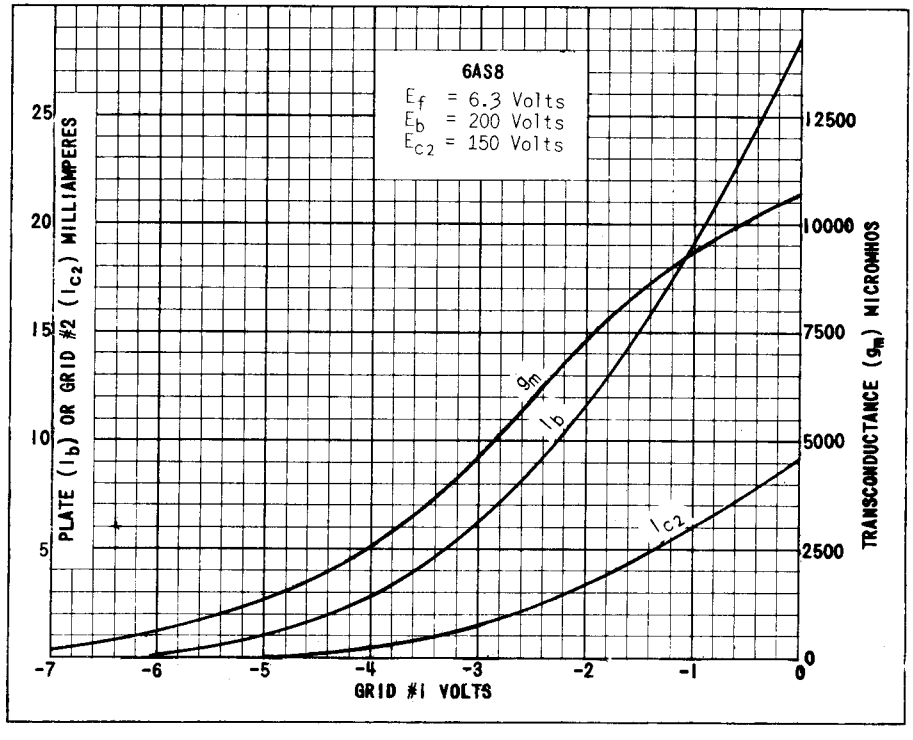

6AS8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c1} = 0
-0.5
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400
500


6AS8
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
g_m
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) MICROMHOS
GRID #1 VOLTS
5
10
15
20
25
2500
5000
7500
10000
12500
-7
-6
-5
-4
-3
-2
-1
0

TUNG-SOL

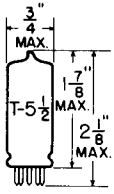
DOUBLE-DIODE TRIODE

MINIATURE TYPE

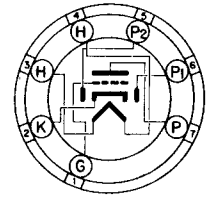
UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6AT6 IS A COMBINED HIGH-MU VOLTAGE AMPLIFIER AND DOUBLE-DIODE DETECTOR USING THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE OUTPUT VOLTAGE ADEQUATE FOR FULL POWER OUTPUT OF MOST BEAM-POWER TUBES.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	2.1	μμf
INPUT: G TO (H + K)	2.3	μμf
OUTPUT: P TO (H + K)	1.1	μμf
DIODE PLATE #2 TO TRIODE GRID: (P_2 TO G)(MAX.)	0.025	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED	0.8	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT - CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1.0	MA.
PLATE RESISTANCE	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	

DIODE UNITS - TWO

THE DIODE UNITS ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE SLEEVE.

SIMILAR TYPE REFERENCE: Ratings and characteristics somewhat similar to 6Q7, 6Q7GT, 6SQ7, 6SQ7GT, 7H6, 7C6.

→ INDICATES A CHANGE OR ADDITION:

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PLATE
1840
JULY 1,
1947

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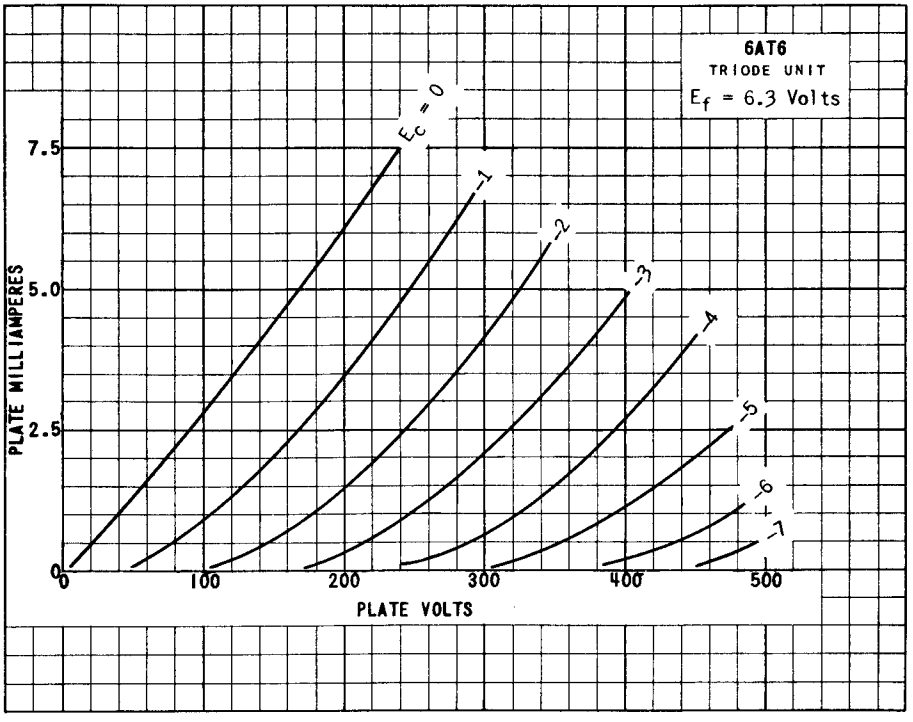
6AT6



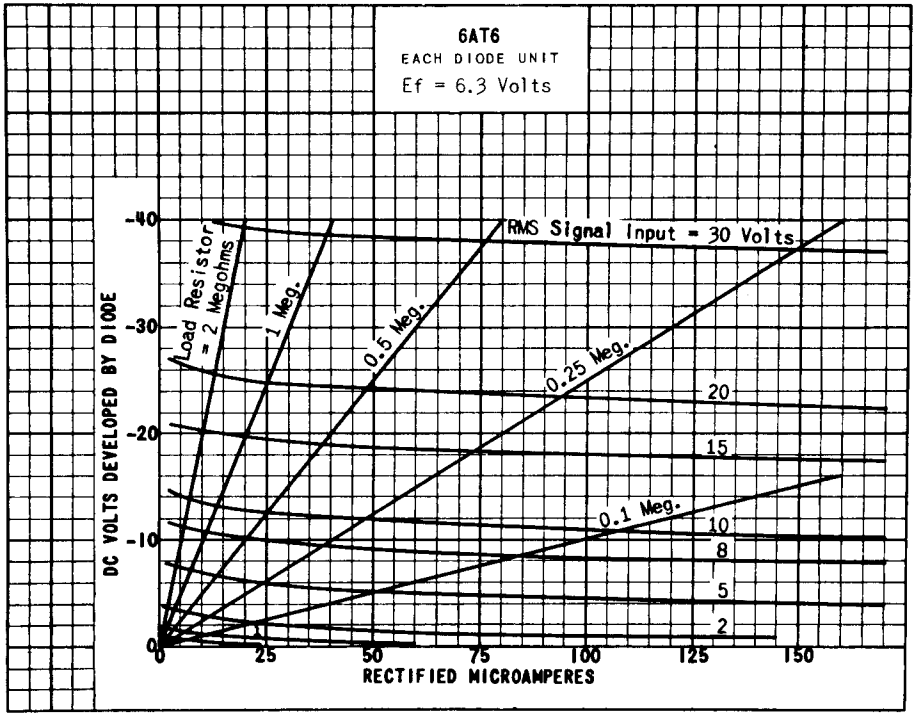


PLATE 1841
JULY 1, 1947

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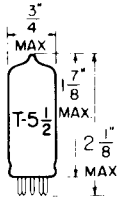
TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

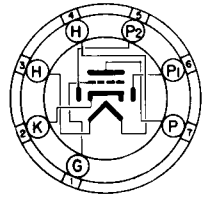


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 6AT6 IS A COMBINED HIGH-MU VOLTAGE AMPLIFIER AND DOUBLE-DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE OUTPUT VOLTAGE ADEQUATE FOR FULL POWER OUTPUT OF MOST BEAM POWER TUBES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO TRIODE PLATE)	2.0	2.0	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf
COUPLING: #1 DIODE PLATE TO GRID (MAX.)*		0.07	μμf
#2 DIODE PLATE TO HEATER AND CATHODE *		0.95	μμf
#1 DIODE PLATE TO HEATER AND CATHODE *		0.66	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT (EACH UNIT) FOR CONTINOUS OPERATION	1.0	MA.

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
PLATE RESISTANCE	54 000	58 000	OHMS
AMPLIFICATION FACTOR	70	70	
TRANSCONDUCTANCE	1 300	1 200	µMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

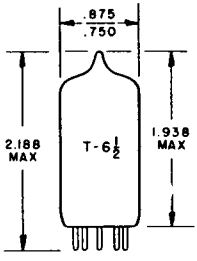
TRIODE UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	8	34	VOLTS
VOLTAGE GAIN AT 400 CPS.	35	46	

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

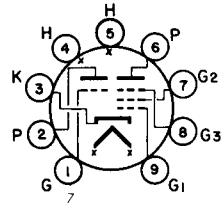
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR

CONVERTER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DW

THE 6AT8A IS A MULTI-UNIT TUBE USING THE 9 PIN MINIATURE CONSTRUCTION. IT CONTAINS A MEDIUM-MU TRIODE AND A SHARP CUT-OFF PENTODE WITH A COMMON CATHODE IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

		WITH SHIELD #315	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE:(PG1 TO PP)	MAX.	→ 0.03	→ 0.06	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)		→ 4.8	→ 4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG3+PG2)		1.6	0.9	pf
CATHODE TO HEATER (K TO H)		→ 6.0	→ 6.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)		1.5	1.5	pf
TRIODE INPUT: TG TO (H + K)		2.4	2.0	pf
TRIODE OUTPUT: TP TO (H + K)		1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP)	MAX.	0.04	0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP)	MAX.	0.008	0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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HEATER CHARACTERISTICS AND RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	→ 200	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

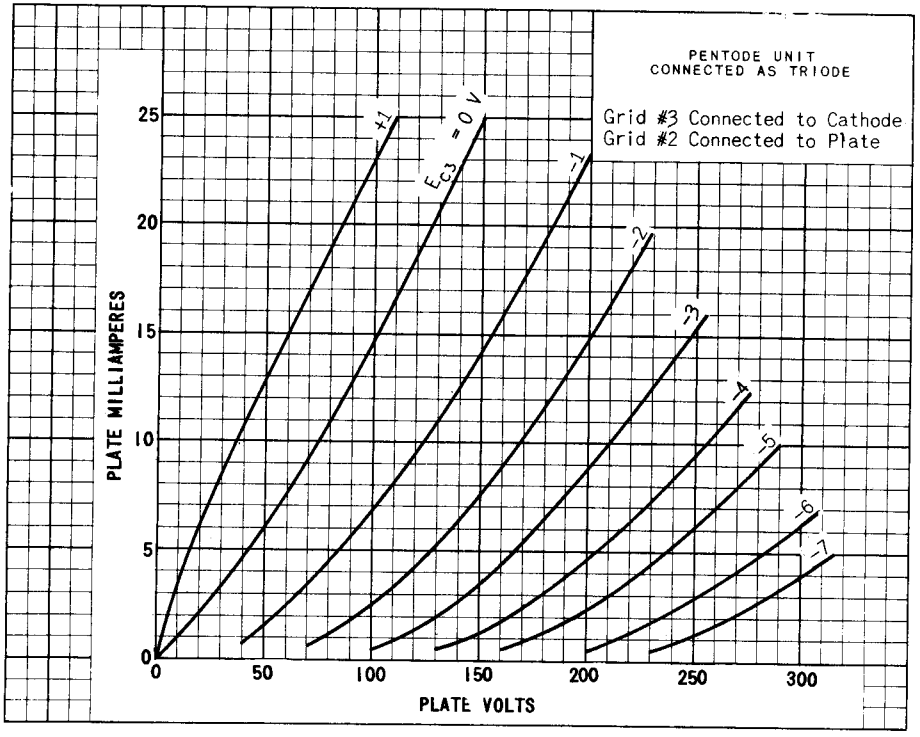
PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	VOLTS

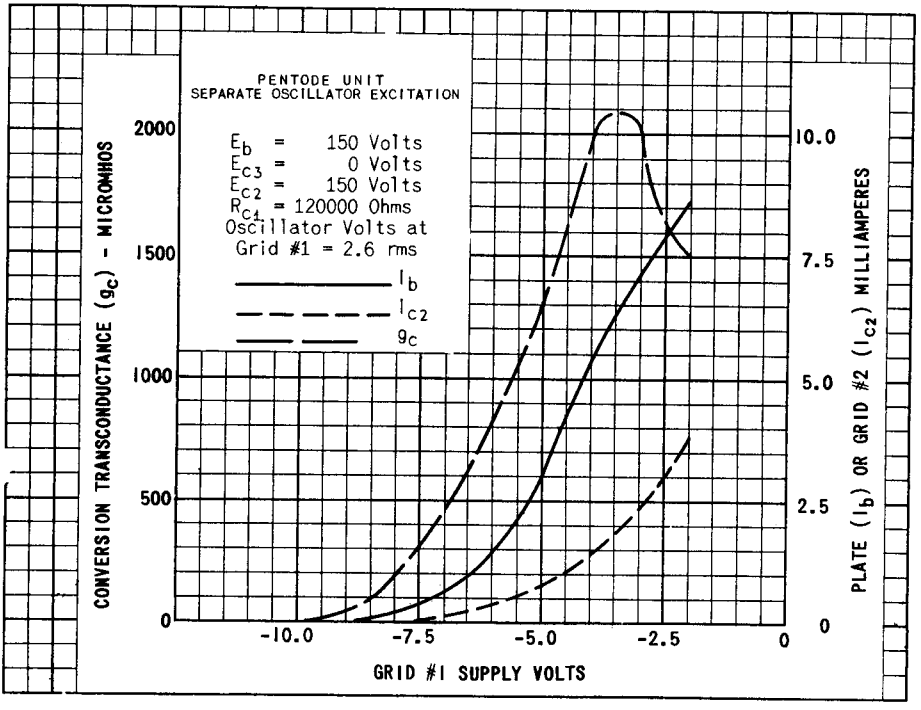
TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

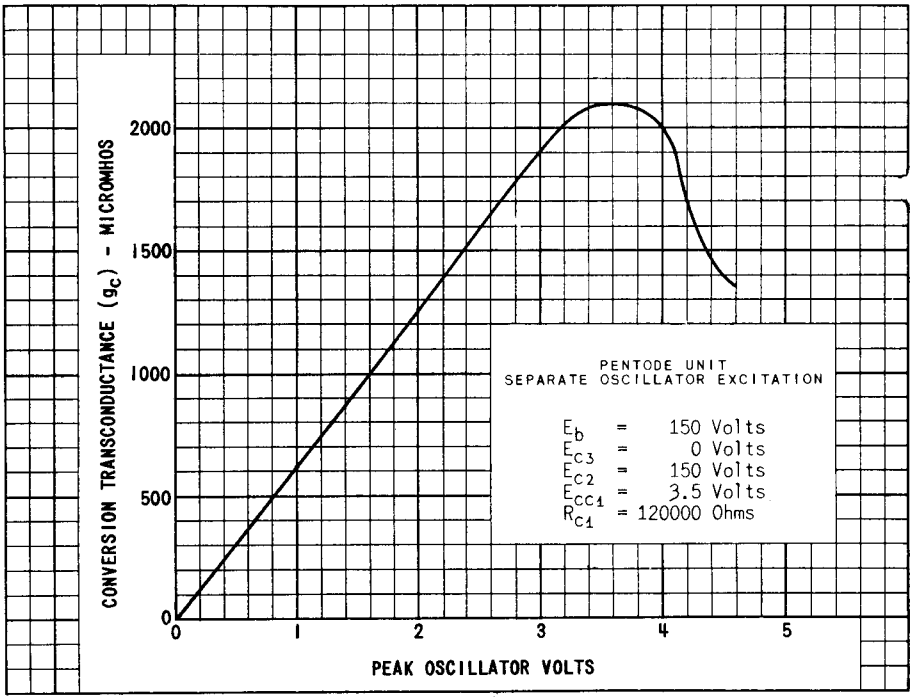
		PENTODE	TRIODE	
PLATE VOLTAGE		125	125	VOLTS
GRID 3 VOLTAGE		Connected to pin 3 at socket		
GRID 2 VOLTAGE		125	-----	
GRID 1 VOLTAGE		-1.0	-1.0	VOLTS
PLATE CURRENT		9.0	12.0	MA.
GRID 2 CURRENT		2.2	-----	MA.
TRANSCONDUCTANCE		5,500	6,500	μMHOS
PLATE RESISTANCE	(APPROX.)	300,000	6,000	OHMS
AMPLIFICATION FACTOR		-----	40	
GRID 1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	-7	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb = 100 V; Ec2 = 70 V)		5,700	-----	μMHOS

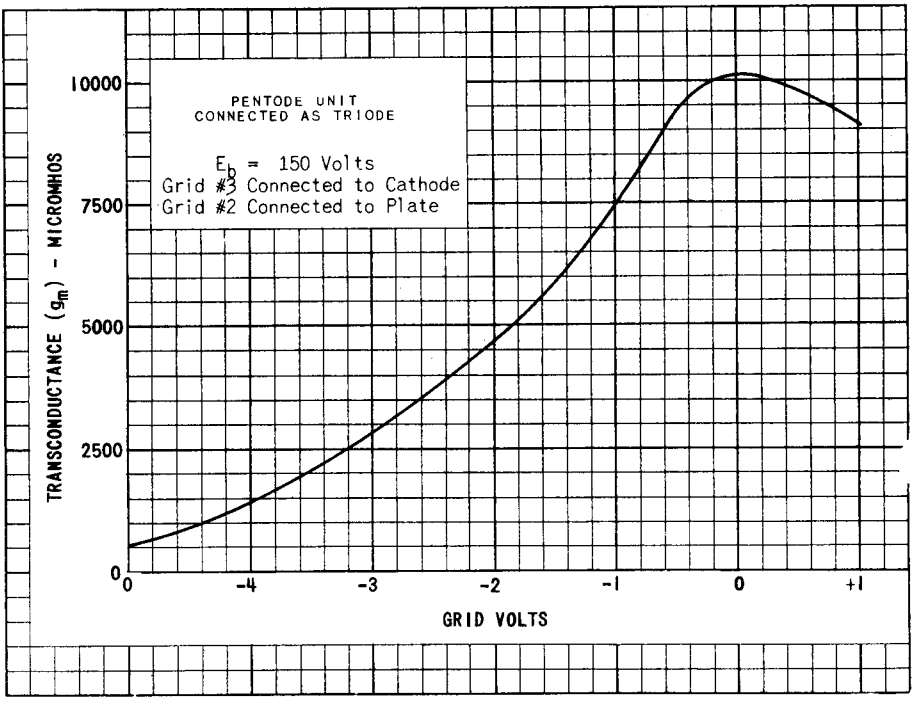
→ INDICATES A CHANGE

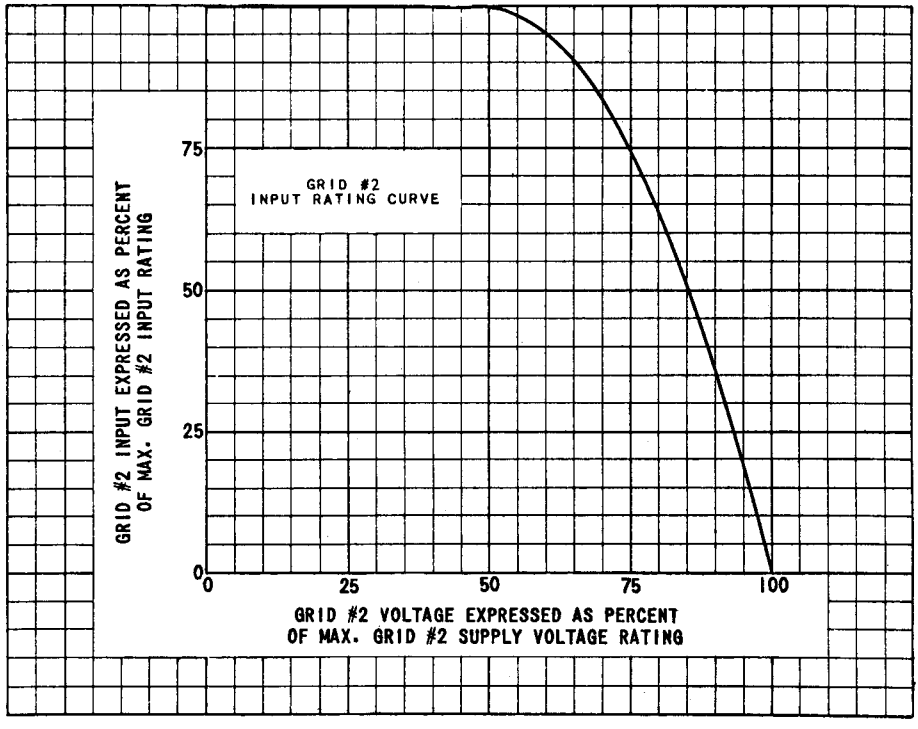


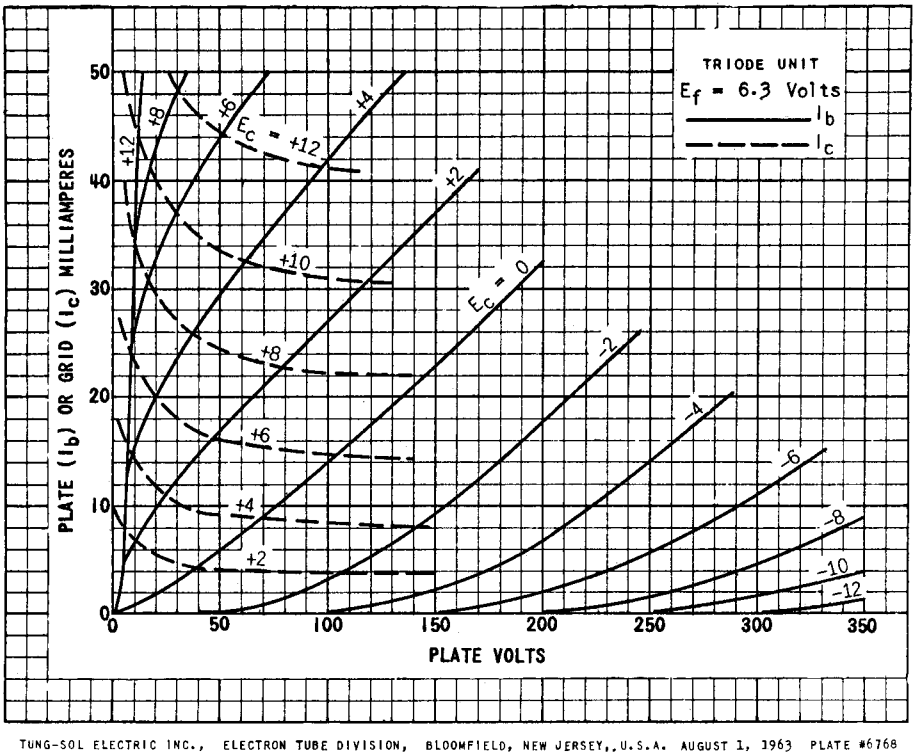


TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. AUGUST 1, 1963 PLATE #6767


CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
E_{cc1} = 3.5 Volts
R_{c1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
0
-4
-3
-2
-1
0
+1
GRID VOLTS
PENTODE UNIT
CONNECTED AS TRIODE
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate





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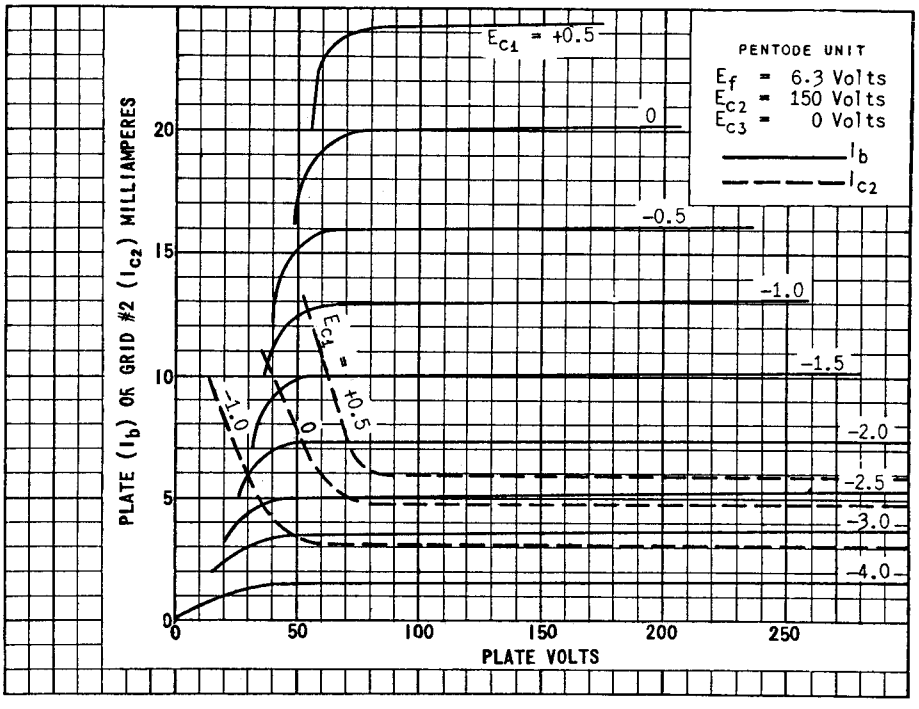
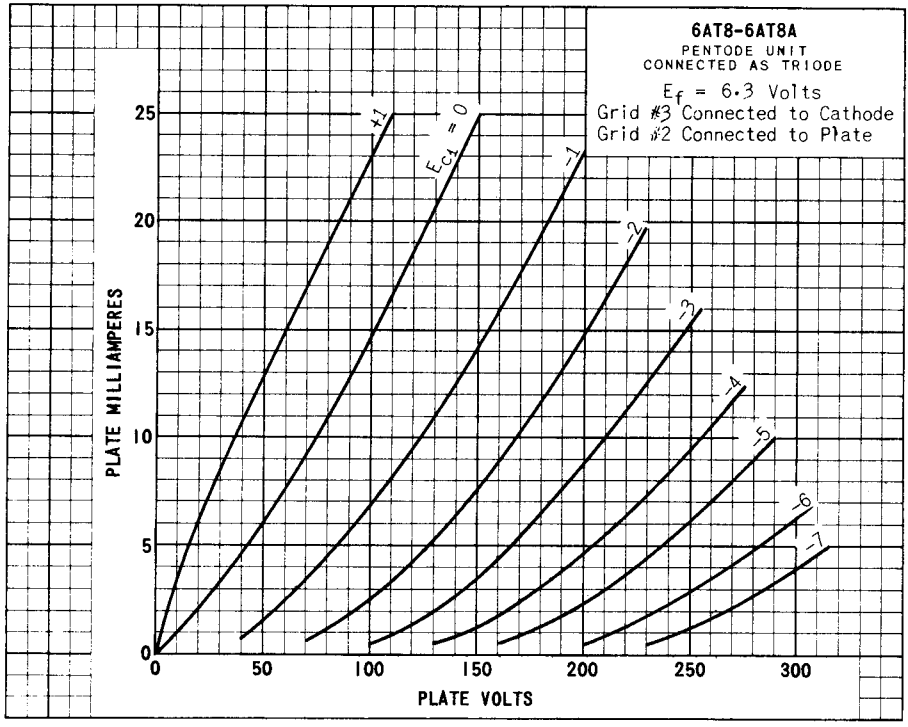
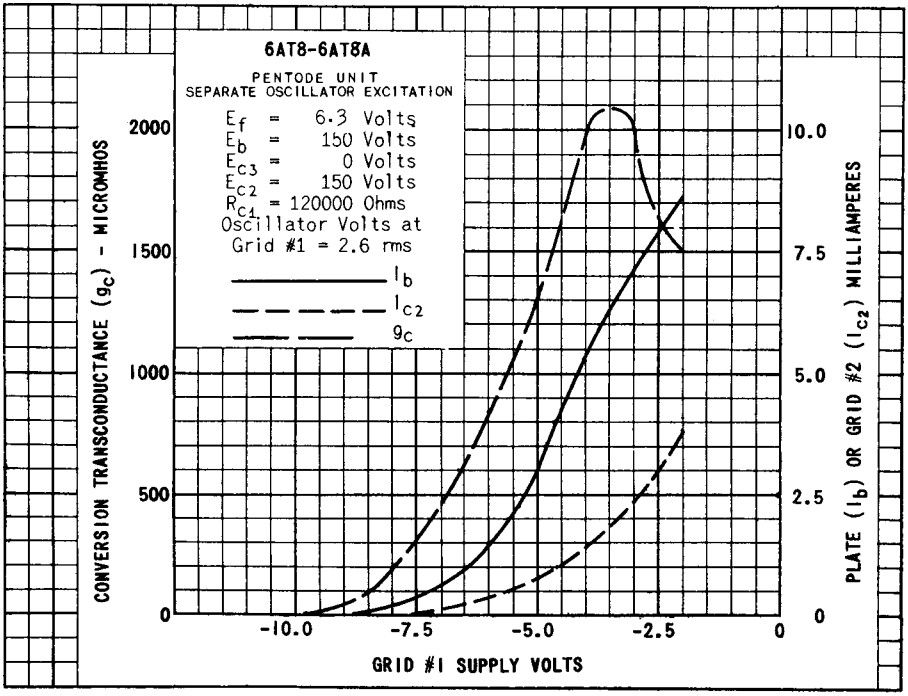
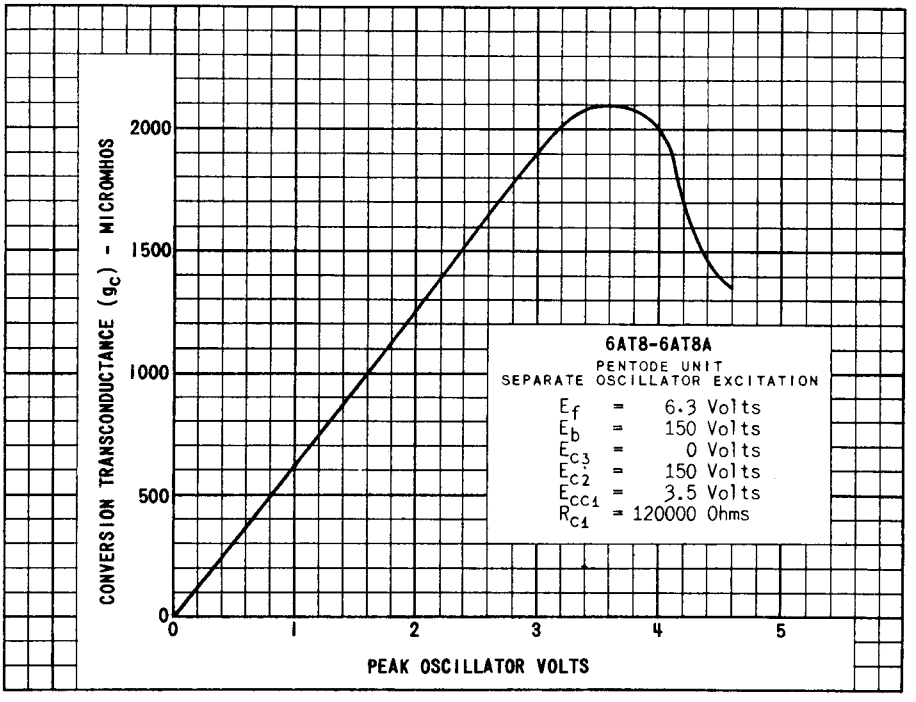
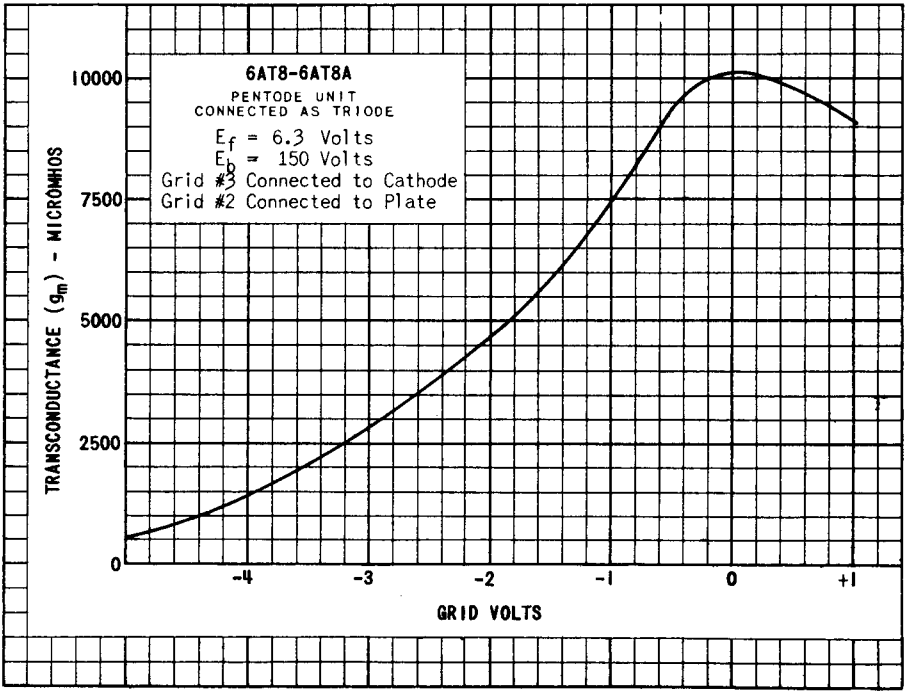
6AT8A


PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
50
100
150
200
250


6AT8-6AT8A
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 6.3 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
+1
-1
-2
-3
-4
-5
-6
-7
0
5
10
15
20
25
0
50
100
150
200
250
300

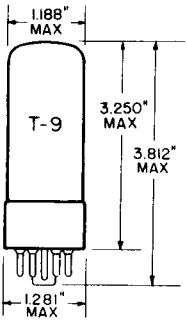

6AT8-6AT8A
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
R_{c1} = 120000 Ohms
Oscillator Volts at
Grid #1 = 2.6 rms
I_b
I_{c2}
g_c
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 SUPPLY VOLTS
0
500
1000
1500
2000
2.5
5.0
7.5
10.0
-10.0
-7.5
-5.0
-2.5
0


CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
6AT8-6AT8A
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
E_{cc1} = 3.5 Volts
R_{c1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS
6AT8-6AT8A
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 6.3 Volts
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate

TUNG-SOL

DIODE



GLASS BULB
SHORT INTERMEDIATE
SHELL 5 OR 6 PIN OCTAL
WITH
EXTERNAL BARRIERS
BASE B5-B5 OR B6-60

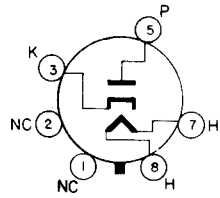
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMPS.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 4CG

SOCKET TERMINALS #1, #2, #4 AND #6 SHOULD NOT BE USED AS TIE POINTS. PIN #1 OMITTED ON 5-PIN BASE.

4CG

THE 6AU4GTA IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT-DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE:	(H TO K)	4.0	pf
PLATE TO CATHODE AND HEATER:	P TO (H+K)	8.5	pf
CATHODE TO PLATE AND HEATER:	K TO (P+H)	11.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER DIODE[B]

MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	4 500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	4 500	VOLTS
MAXIMUM DC PLATE CURRENT	→ 210	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	→ 1300	MA.
MAXIMUM PLATE DISSIPATION	→ 6.5	WATTS
AVERAGE TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 350 MA.)	25	VOLTS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE, NOT TO EXCEED 15% OF SCANNING CYCLE.

→ INDICATES A CHANGE.

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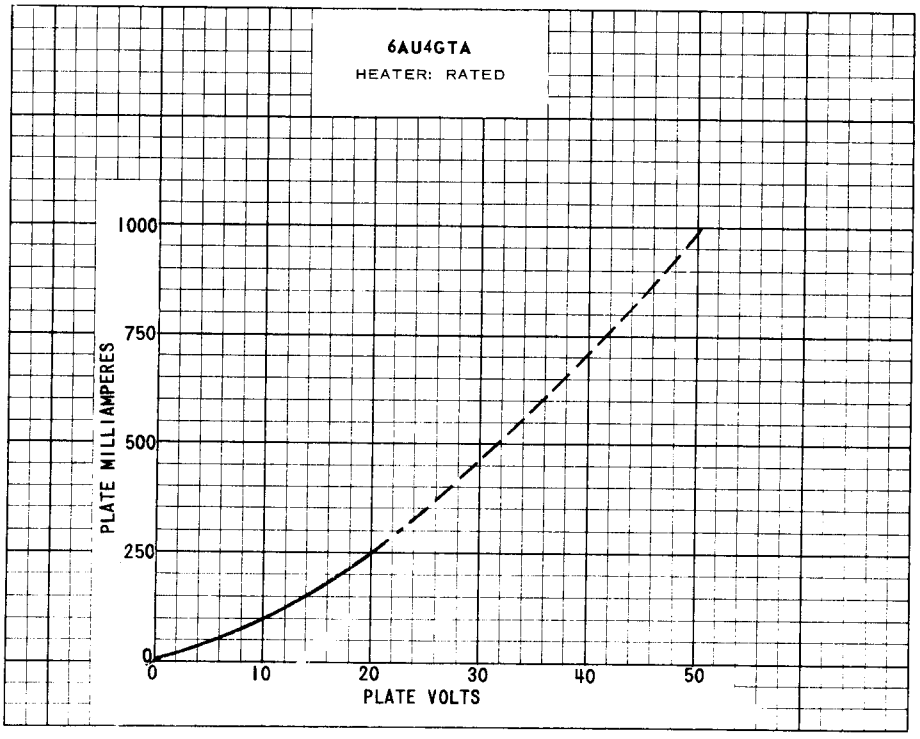
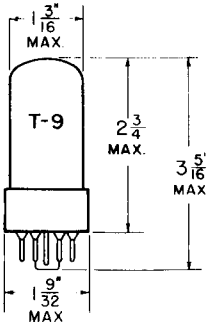
6AU4GTA


6AU4GTA
HEATER: RATED
PLATE MILLIAMPERES
1000
750
500
250
0
0
10
20
30
40
50
PLATE VOLTS

TUNG-SOL

BEAM PENTODE

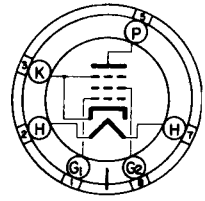


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.25 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
6CK

THE 6AU5GT IS A HIGH PERVEANCE SINGLE-ENDED, BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN LOW-COST, HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. IT IS PARTICULARLY EFFECTIVE WHEN THE PLATE SUPPLY POTENTIAL IS LIMITED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.5	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	11.3	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	10	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210°	CENTIGRADE

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.25	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	60	MA.
GRID #2 CURRENT	6.8	MA.
TRANSCONDUCTANCE	5 600	µMHOS
PLATE RESISTANCE	6 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	210	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-45	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	5.9	

[C] WITH E_b = 115 VOLTS, E_{C2} = 175 VOLTS AND E_{C1} = -20 VOLTS

[D] WITH E_b = 60 VOLTS AND E_{C2} = 175 VOLTS.

[E] FOR I_b = 1 MA. WITH E_b = 115 VOLTS AND E_{C2} = 150 VOLTS.

[F] WITH E_b = E_{C2} = 100 VOLTS AND E_{C1} = -4.5 VOLTS

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

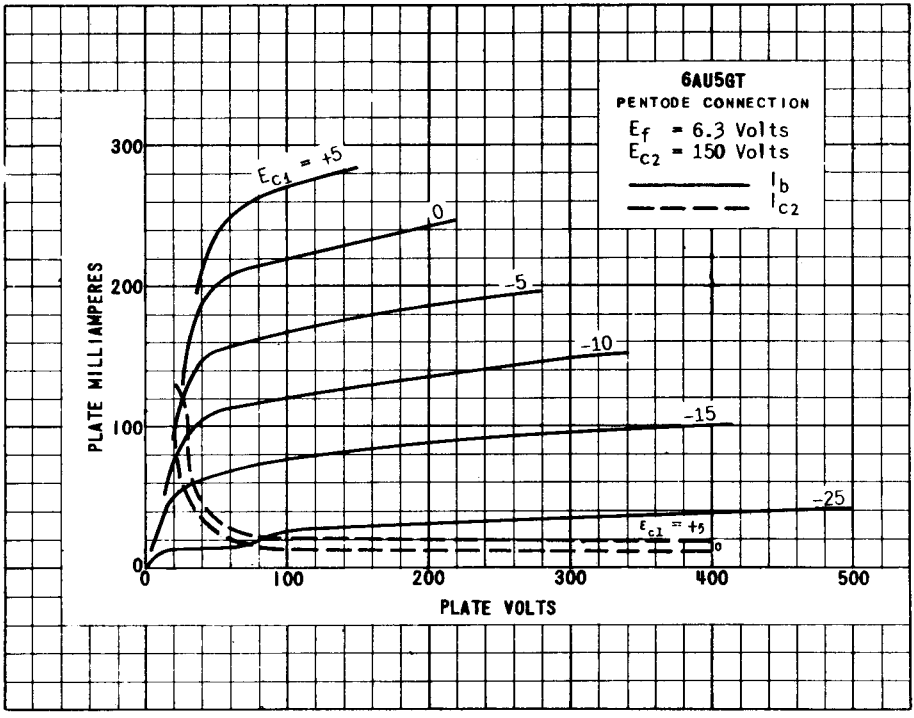
VOLTAGE REGULATOR SERVICE

TRIODE CONNECTION--GRID NO. 2 CONNECTED TO PLATE

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VALUE	125	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	110	MA.
MAXIMUM TOTAL PLATE & GRID #2 DISSIPATION	10	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* INDICATES AN ADDITION.



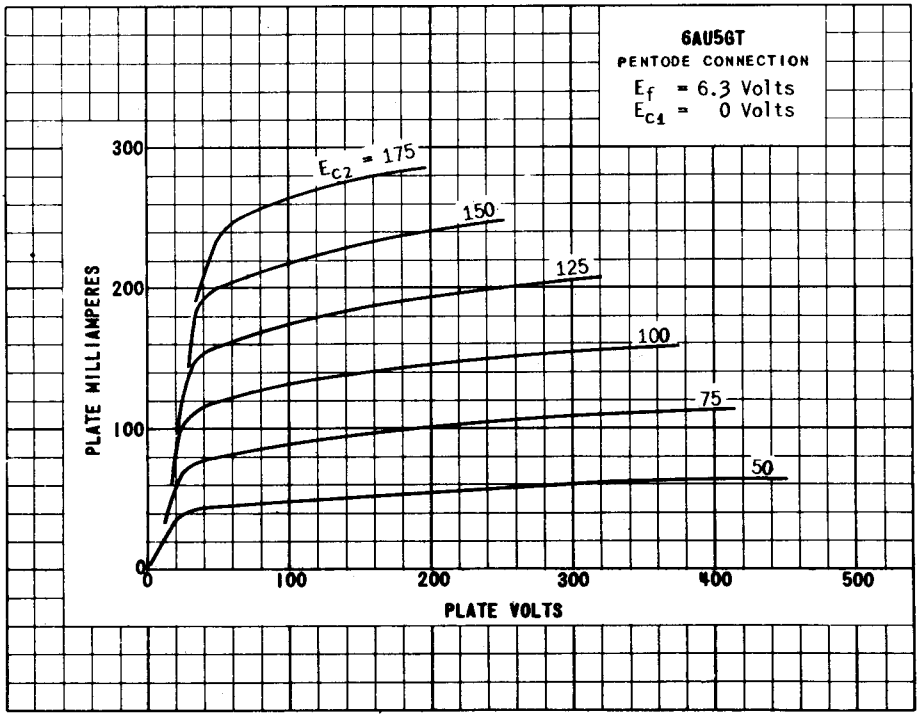


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PLATE
2376

APR. 1
1950

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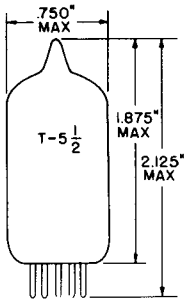
TUNG-SOL



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

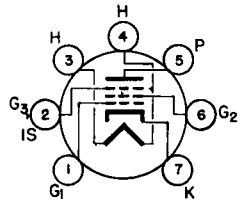
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3± 0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 6AU6 AND 6AU6A ARE PENTODE AMPLIFIERS HAVING A SHARP CUTOFF CONTROL CHARACTERISTIC. WITH HIGH TRANSCONDUCTANCE AND LOW GRID TO PLATE CAPACITANCE THEY ARE INTENDED FOR SERVICE AS EITHER RF OR AF AMPLIFIERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER OF THE 6AU6A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HIGHER HEATER-CATHODE VOLTAGE RATINGS OF THE 6AU6A, THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	0.003	0.003	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	pf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	pf
INPUT: G_1 TO (H+K)	3.2	3.2	pf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	8.5	1.2	pf

[A] SHIELD #316 CONNECTED TO PIN #7.

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[C]	PENTODE CONNECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200●	200●	VOLTS
MAXIMUM PLATE VOLTAGE	275	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE J5-C4-2	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.5	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	---	WATTS
MAXIMUM GRID #2 INPUT: *			VOLTS
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.75	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS *	---	SEE J5-C4-2	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
HEATER WARM-UP TIME (APPROX.) * (6AU6A ONLY)		11.0	SECONDS

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	µMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA.	-4.2	-5.5	-6.5	VOLTS

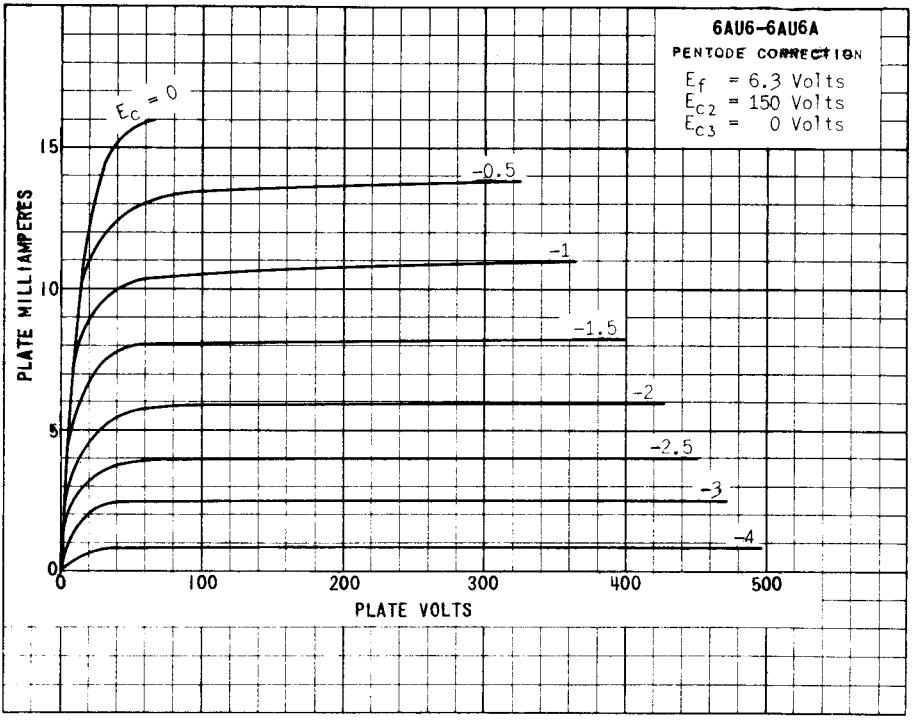
CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

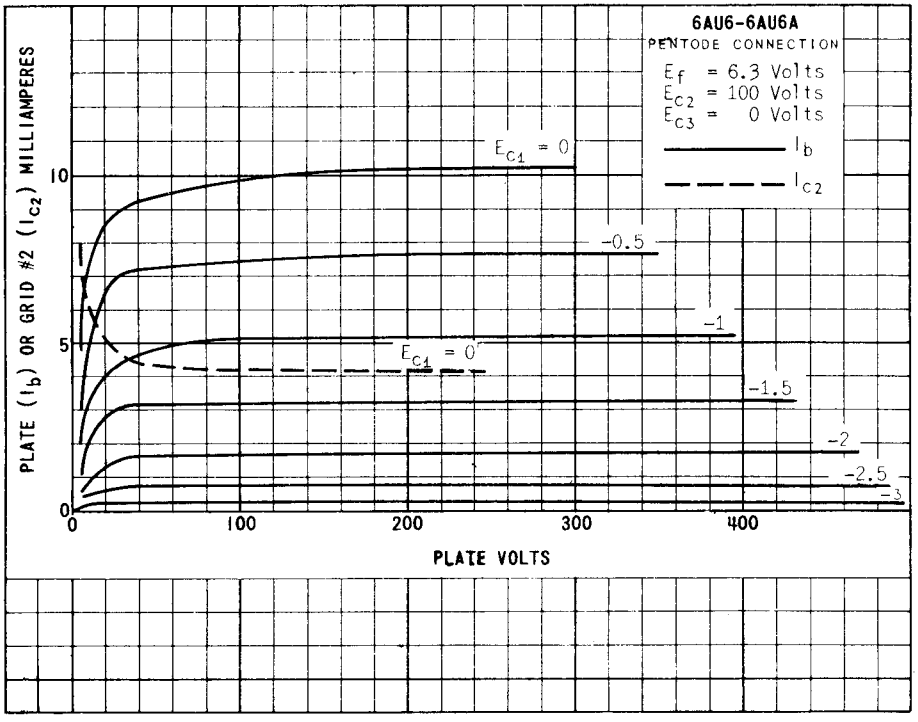
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	µMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.





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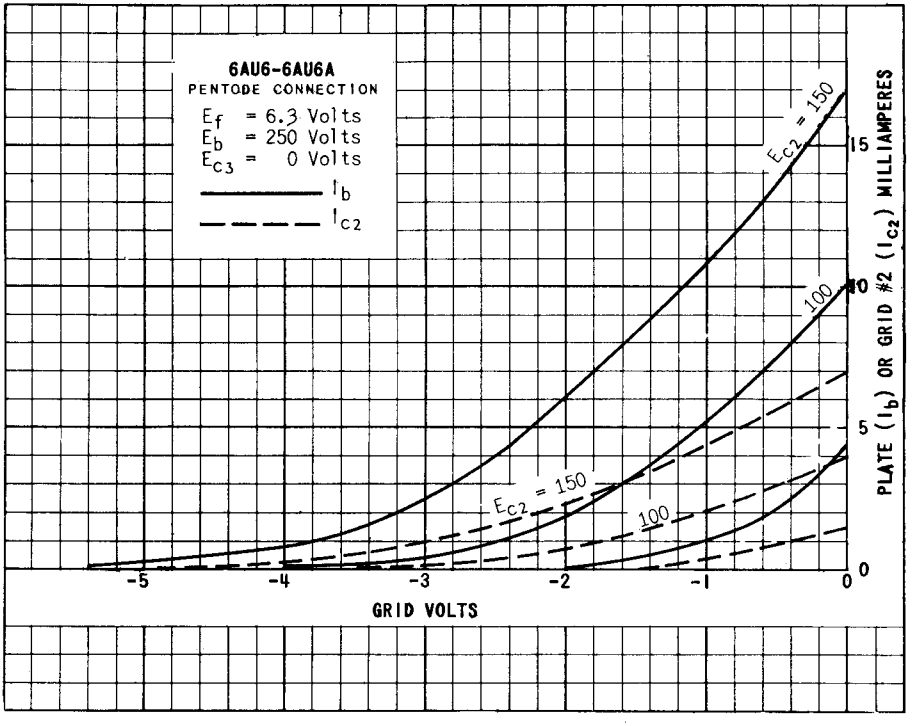
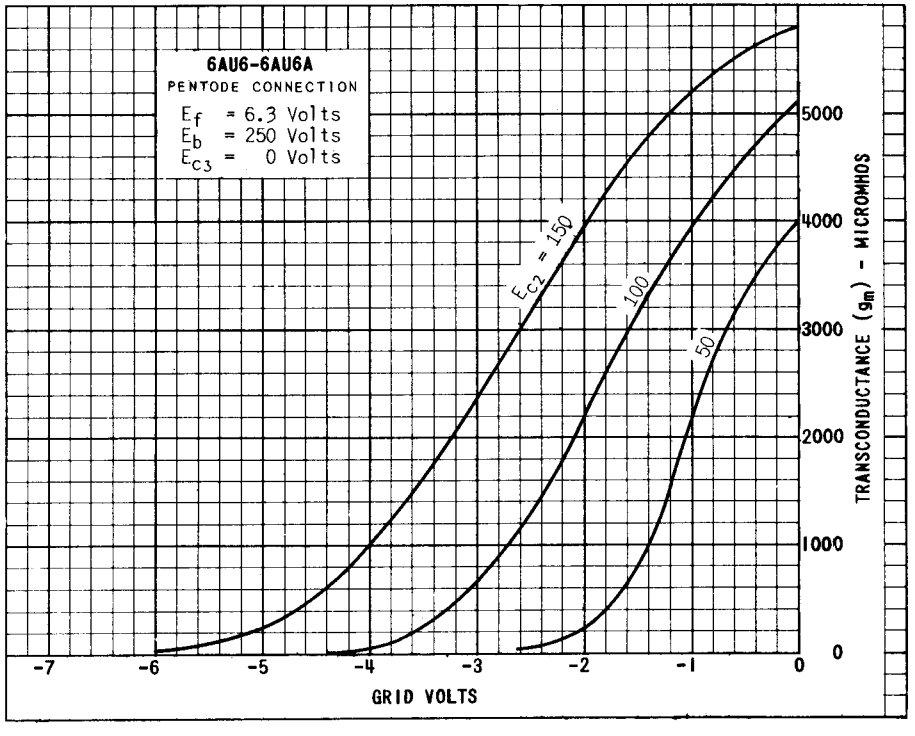

6AU6-6AU6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c2} = 150
100
E_{c2} = 150
100
-5
-4
-3
-2
-1
0
15
10
5
0
GRID VOLTS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES


6AU6-6AU6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 150
100
50
-7
-6
-5
-4
-3
-2
-1
0
5000
4000
3000
2000
1000
0
GRID VOLTS
TRANSCONDUCTANCE (g_m) - MICROMHOS

TUNG-SOL

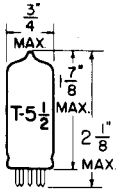
PENTODE

MINIATURE TYPE

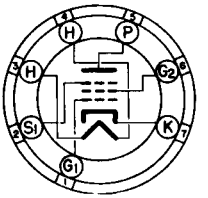
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 6AU6WA IS A RUGGEDIZED SHARP CUT-OFF PENTODE AMPLIFIER IN THE 7-PIN MINIATURE CONSTRUCTION. THE TUBE HAS HIGH TRANSCONDUCTANCE AND LOW GRID-PLATE CAPACITANCE AND IS INTENDED FOR USE AS A VOLTAGE AMPLIFIER OVER THE AF, IF AND RF FREQUENCY RANGES. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, SCREEN CURRENT, TRANSCONDUCTANCE, INPUT CAPACITANCE AND OUTPUT CAPACITANCE, ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6AU6WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIR-BORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH* SHIELD	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE	---	.0035	μμf
INPUT (RATED)	5.5	5.5	μμf
MAXIMUM	---	7.2	μμf
MINIMUM	---	4.8	μμf
OUTPUT (RATED)	5.0	5.0	μμf
MAXIMUM	---	5.9	μμf
MINIMUM	---	3.9	μμf

*SHIELD #316 CONNECTED TO PIN #7.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	165	VOLTS
MAXIMUM DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATT
MAXIMUM HEATER CATHODE VOLTAGE	±100	VOLTS
MAXIMUM BULB TEMPERATURE	165	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	450	G/1 msec

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

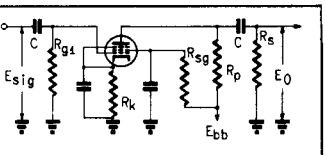
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3900	4500	5200	μMHOS
PLATE CURRENT	5	7.6	10.6	mA
GRID #2 CURRENT	2.1	3	4.3	mA
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA	−4.2	−5.5	−6.5	VOLTS

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4800	μMHOS
PLATE CURRENT	12.2	mA
AMPLIFICATION FACTOR	36	

CLASS A RESISTANCE-COUPLED AMPLIFIER

Rp Meg.	Rs Meg.	Rg1 Meg.	Ebb = 90 Volts Rk	Rsg	Gain	Eo	Ebb = 180 Volts Rk	Rsg	Gain	Eo	Ebb = 300 Volts Rk	Rsg	Gain	Eo
0.10	0.10	0.1	960	0.14	68	13	610	0.19	96	27	480	0.17	117	47
0.10	0.24	0.1	1000	0.16	93	16	630	0.21	127	35	480	0.16	153	60
0.24	0.24	0.1	2900	0.35	88	12	1700	0.46	115	25	820	0.59	200	44
0.24	0.51	0.1	3600	0.39	108	14	1800	0.53	171	31	960	0.73	229	53
0.51	0.51	0.1	5300	0.92	108	10	4000	0.97	156	23	2100	1.10	227	38
0.51	1.0	0.1	4600	1.10	122	12	3800	1.10	198	25	1800	1.30	296	44
0.24	0.24	10	0	0.42	100	12	0	0.53	157	25	0	0.45	212	44
0.24	0.51	10	0	0.46	118	14	0	0.59	184	31	0	0.70	271	52
0.51	0.51	10	0	0.92	116	11	0	1.10	197	22	0	1.20	280	38
0.51	1.0	10	0	1.00	145	12	0	1.10	238	25	0	1.30	348	42



Note: Coupling capacitors (C) should be adjusted to give desired frequency response. Rk and Rsg should be adequately by-passed.

NOTES: 1. EO IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION. 2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT. 3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_{c3}[B], E_f = 6.3, E_b = 250Vdc, E_{c1} = 0Vdc, R_k = 68 OHMS[C], E_{c2} = 150Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	289	311	275	325	mA
HEATER-CATHODE LEAKAGE (E_{hk} =±100 Vdc)	---	±10	---	±2	---	±10	μAdc
#1 GRID CURRENT (E_{c1}=-1Vdc, R_{g1}= 0.25MEG)	---	-1.0	---	-0.2	---	-1.0	μAdc
PLATE CURRENT (1)	8.0	13.5	9.1	12.1	---	---	mAdc
TRANSCONDUCTANCE (1)	4150	6250	4620	5780	3600	6250	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	17	PERCENT
INSULATION OF ELECTRODES[D] (E_f =6.3V, E(g-all). -100Vdc, E(p-all)=-300Vdc)							
R(g1-all)	100	---	---	---	50	---	MEGOHMS
R(p-all)	100	---	---	---	50	---	MEGOHMS
PLATE CURRENT (2) (E_{c1}=-9Vdc, R_p=0.1 MEG, R_k=0, C_k=0)	---	35	---	---	---	---	μAdc
SCREEN GRID CURRENT	2.6	6.0	3.5	5.1	---	---	mAdc
TRANSCONDUCTANCE (2)[E] (E_f = 5.5V)	3900	---	4200	---	---	---	μMHOS
#1 GRID EMISSION[F] (E_f=7.5V, E_{c1}=-10Vdc, R_{g1}= 0.25 MEG, R_k=0, C_k=0)	---	-2.0	---	---	---	---	μAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[G] (R_p = 2000)	---	300	mVac
VIBRATIONAL FATIGUE[H]	---	---	
MINIATURE TUBE BASE STRAIN[K] (NO VOLTAGES)	---	---	
STABILIZATION INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
SHOCK[L] (HAMMER ANGLE=30°, E_{hk}=100Vdc, R_{g1}=0.1 MEG, C_k=0)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (1)	3600	---	μMHOS
#1 GRID CURRENT	---	-2.0	μAdc
SHORT AND CONTINUITY[M]	---	---	
RF NOISE[N] (E_{c1}=-1.0Vdc, E_{sig}=15mVac, R_k=0, C_k=0)	---	---	
LOW FREQUENCY VIBRATION[P] (R_p = 2000)	---	300	mVac
INTERMITTENT LIFE TEST (E_b=300Vdc, E_{c2}=150Vdc, E_{hk}=135Vdc. R_{g1}=0.5MEG, R_k=80, C_k=0, 20 TUBES)	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_b=E_{c2}=0, E_{hk}=135Vdc)	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINT HEATER CATHODE LEAKAGE	---	20	μAdc

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

A GRID #2 AND GRID #3 CONNECTED TO PLATE

B TIE GRID #3 TO NEGATIVE TERMINAL OF CATHODE RESISTOR.

C THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS AT 60 CYCLES PER SECOND.

D SEE MIL-E-1C 4.8.2

E PREHEAT ALL TUBES UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=5.5V, E_b=300Vdc, E_{c1}=0, E_{c2}=150Vdc, E_{c3}=0, R_k=80, R_{g1}=0.5 MEG.

F PREHEAT ALL TUBES UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=7.5V, E_b=300Vdc, E_{c1}=0, E_{c2}=150Vdc, E_{c3}=0, R_k=80, R_{g1}=0.5MEG. TWO (2) SECONDS SHALL BE THE MAXIMUM TIME BETWEEN PREHEAT AND TEST.

G SEE MIL-E-1C 4.9.20.3

H SEE MIL-E-1C 4.9.20.6

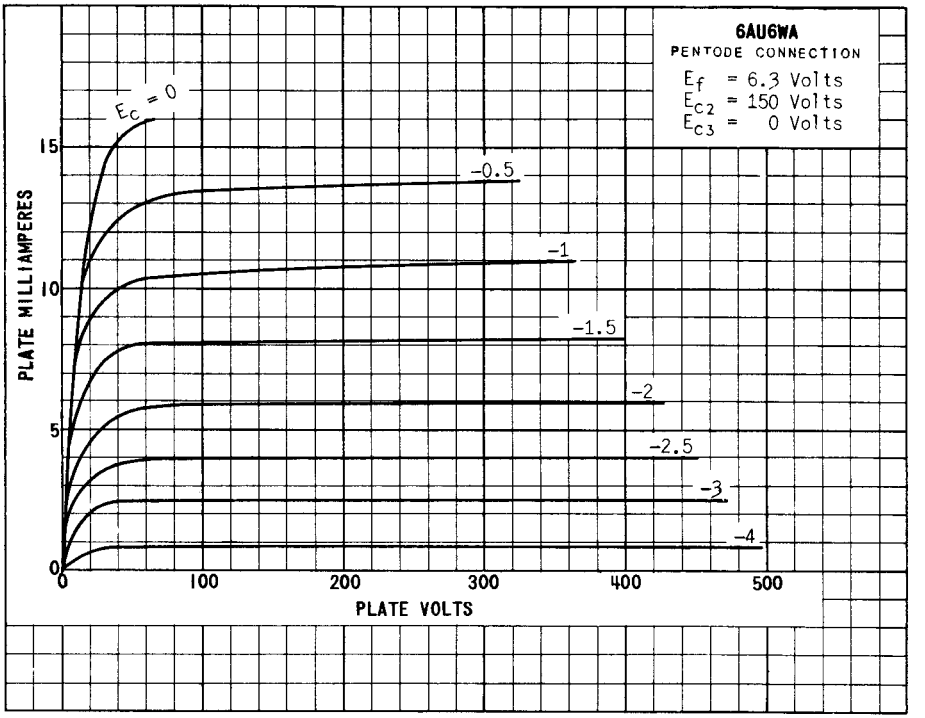
K SEE MIL-E-1C 4.9.6.1

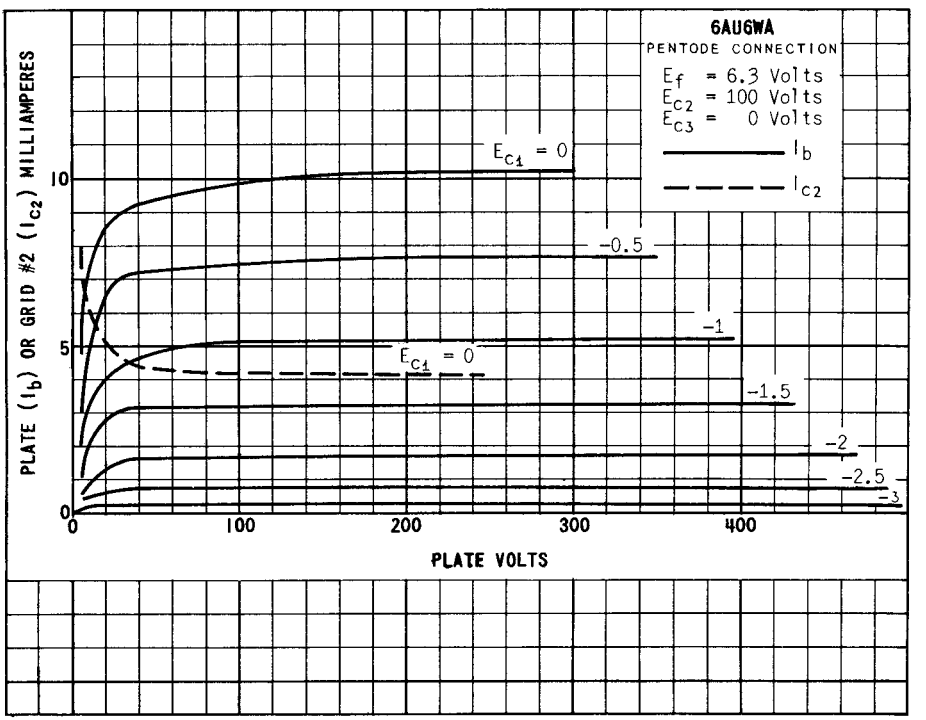
L SEE MIL-E-1C 4.9.20.5

M SEE MIL-E-1C 4.7.5

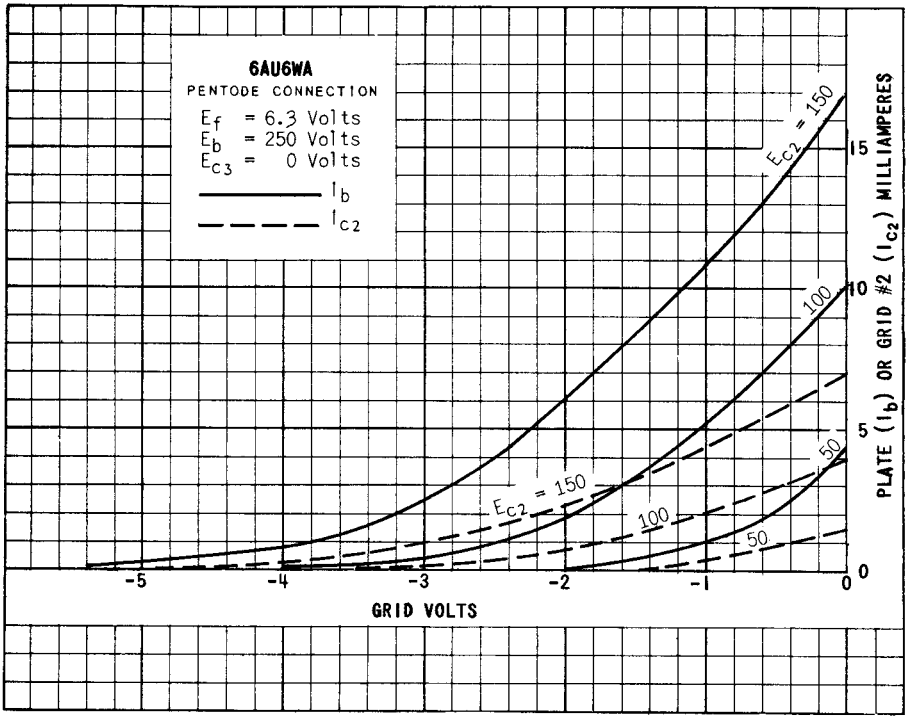
N SEE MIL-E-1C 4.10.3.1

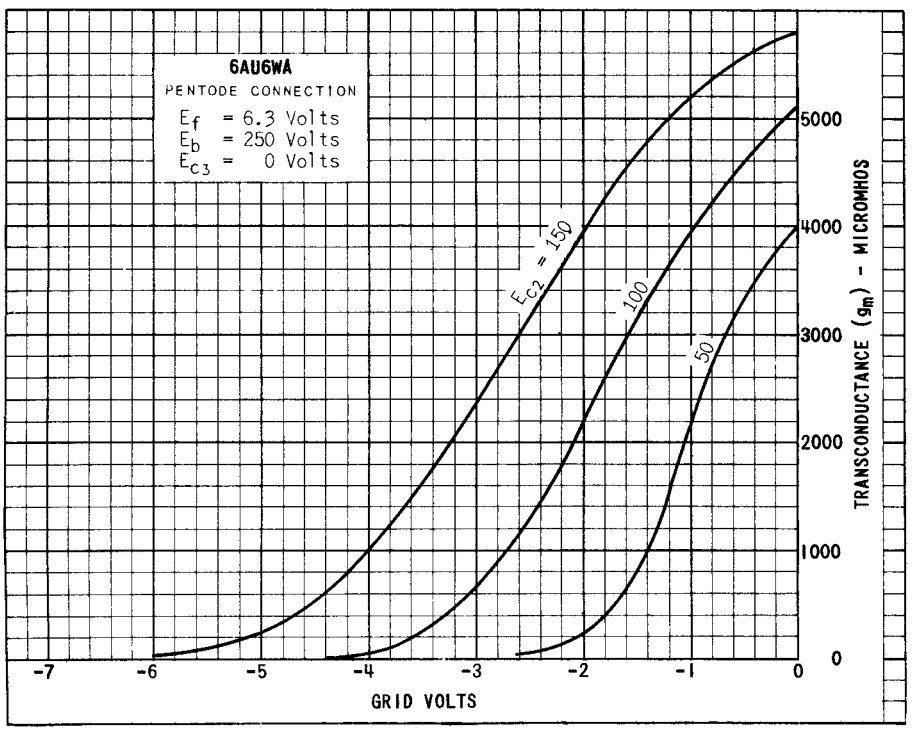
P SEE MIL-E-1C 4.9.20.4


6AU6WA
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
E_c = 0
-0.5
-1
-1.5
-2
-2.5
-3
-4
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400
500


6AU6WA
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
E_{c1} = 0
-0.5
-1
-1.5
-2
-2.5
-3
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
100
200
300
400

6AU6WA
PREMIUM TUBE



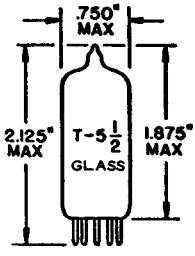


TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-2



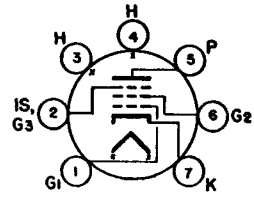
BASE 7 PIN MINIATURE BUTTON
JEDEC E7-1

FOR
INDUSTRIAL AND COMMERCIAL
APPLICATIONS WITH A HIGH
DEGREE OF RELIABILITY

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7BK



BOTTOM VIEW

THE 6AU6WB IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LONG LIFE AND STABLE PERFORMANCE UNDER SEVERE CONDITIONS OF SHOCK, VIBRATION, HIGH TEMPERATURE AND HIGH ALTITUDE. THE TUBE MAY ALSO BE OPERATED UNDER STAND-BY CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	MAX.	0.0035	pf
INPUT		6.0	pf
OUTPUT		4.9	pf

HEATER CHARACTERISTICS AND RATINGS
ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	mA
LIMITS OF APPLIED VOLTAGE – AC OR DC		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		100	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE - DC	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PLATE DISSIPATION	3.1	WATTS
GRID 2 DISSIPATION	0.7	WATT
GRID 3 VOLTAGE	0	VOLTS
GRID 1 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	50	VOLTS
GRID 1 CURRENT	1.0	mA
ENVELOPE TEMPERATURE	165	° C
ALTITUDE	60,000	FEET
GRID 1 CIRCUIT RESISTANCE	0.5	MEGOHMS

CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	150	VOLTS
GRID 3 VOLTAGE - CONNECTED TO NEGATIVE END OF CATHODE RESISTOR	0	VOLTS
CATHODE RESISTOR	68	OHMS
PLATE CURRENT	10.6	mA
GRID 2 CURRENT	4.3	mA
TRANSCONDUCTANCE	5,200	μMHOS
PLATE RESISTANCE	1.0	MEGOHMS
GRID 1 VOLTAGE FOR $I_b = 35\ \mu A$ MAX.	−9.0	VOLTS

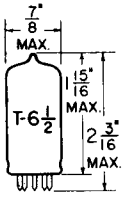
SPECIAL TESTS

LOW - FREQUENCY VIBRATION
VIBRATION FATIGUE
SHOCK TEST
HEATER - CYCLING LIFE TEST
INTERMITTENT LIFE TEST
INTERFACE LIFE TEST

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

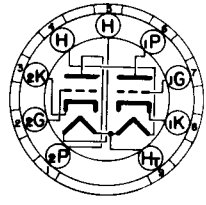
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
6.3 VOLTS	3.15 VOLTS
0.3 AMP.	0.6 AMP.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 6AU7 IS A MEDIUM-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN 600 MILLIAMPERE SERIES STRING TV APPLICATIONS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6AU7 IS IDENTICAL TO THE 12AU7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE UNIT 1			
GRID TO PLATE: (G TO P)	1.5	1.5	μμf
INPUT: G TO (H+K)	1.8	1.6	μμf
OUTPUT: P TO (H+K)	2.0	0.40	μμf
TRIODE UNIT 2			
GRID TO PLATE: (G TO P)	1.5	1.5	μμf
INPUT: G TO (H+K)	1.8	1.6	μμf
OUTPUT: P TO (H+K)	2.0	0.32	μμf

[A] EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

	CLASS A_1[B] AMPLIFIER	VERTICAL[B] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3	3.15	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE:			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1200	VOLTS
MAXIMUM PLATE DISSIPATION:[C]			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	60	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
FIXED BIAS OPERATION	0.25	---	MEGOHM
CATHODE BIAS OPERATION	1.0	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS (CONT'D)

EACH TRIODE UNIT

	VERTICAL[D] DEFLECTION OSCILLATOR	HORIZONTAL[D] DEFLECTION OSCILLATOR	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE:			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM DC PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	60	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

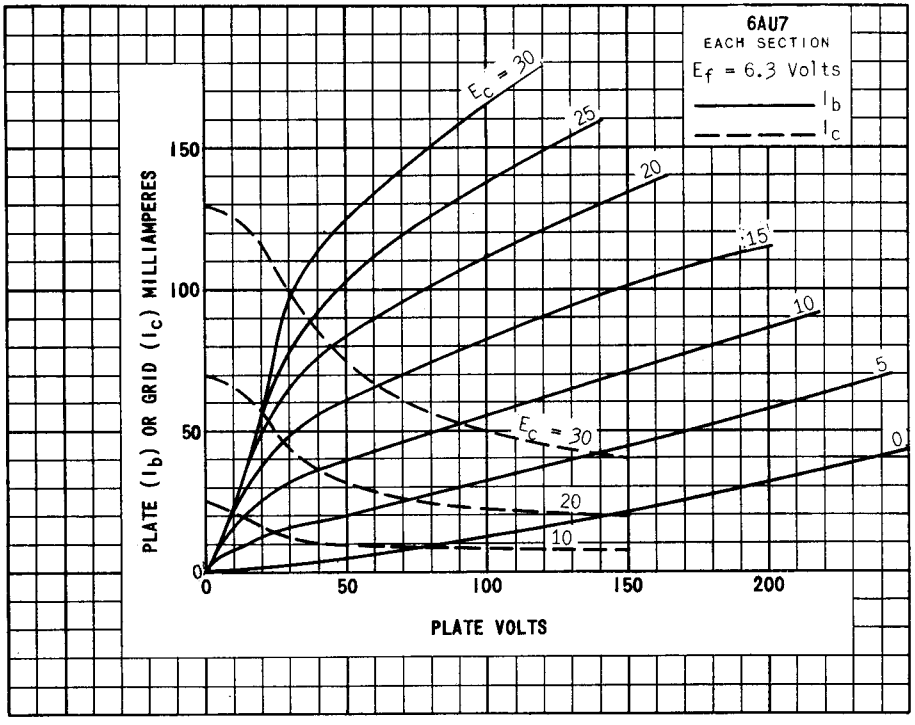
[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

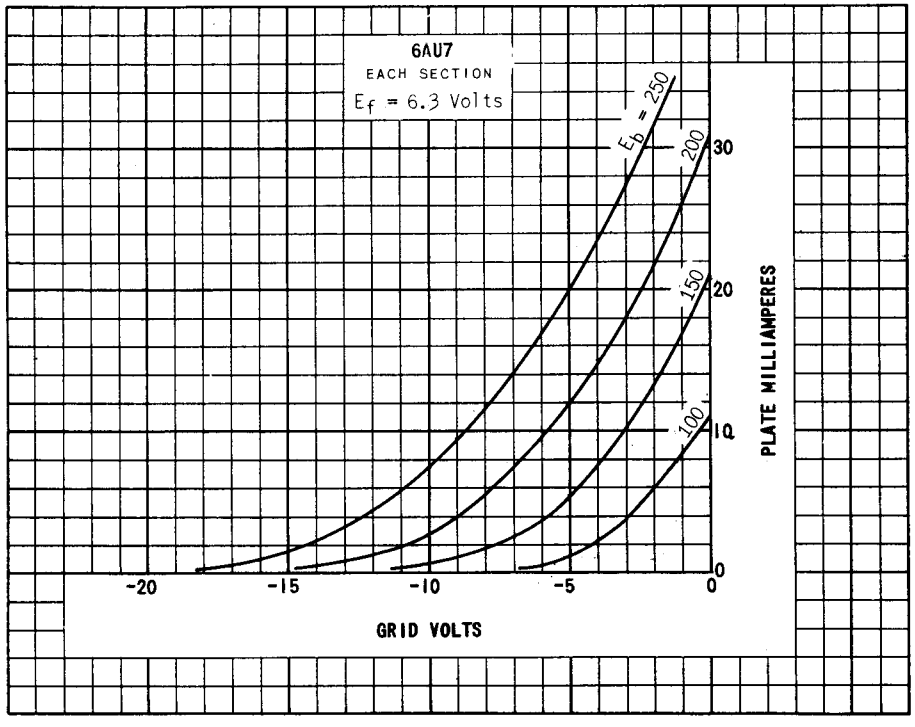
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

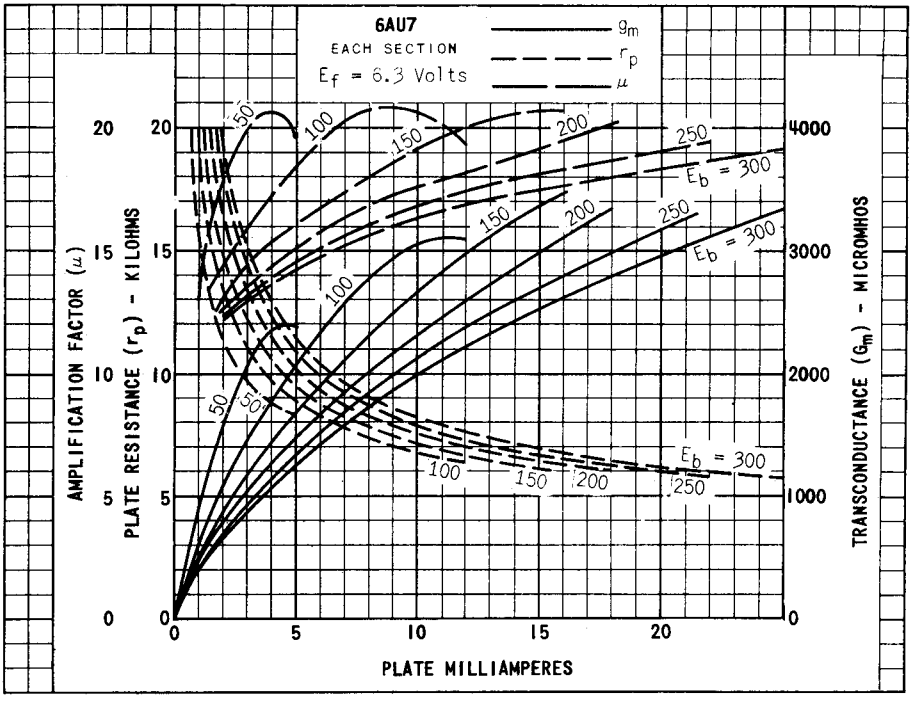
CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

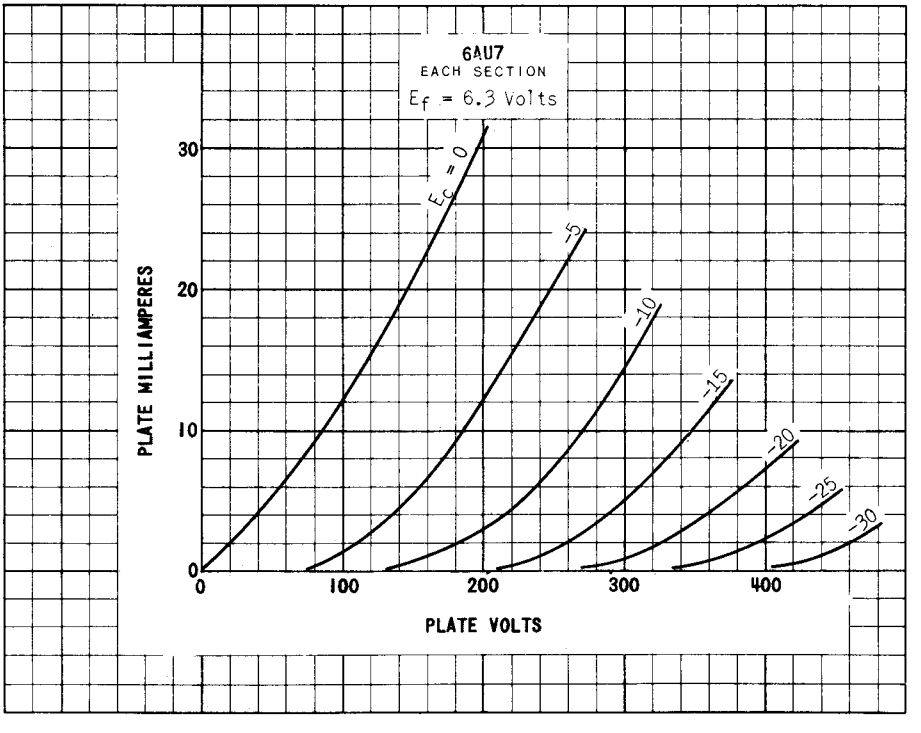
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	−8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
PLATE RESISTANCE (APPROX.)	6 500	7 700	OHMS
TRANSCONDUCTANCE	3 100	2 200	µMHOS
AMPLIFICATION FACTOR	20	17	
GRID VOLTAGE FOR I_b = 10 µA. (APPROX.)	---	− 24	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


6AU7
EACH SECTION
Ef = 6.3 Volts
Ib
Ic
Ec = 30
25
20
15
10
5
0
Ec = 30
20
10
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
150
100
50
0
0
50
100
150
200
PLATE VOLTS


6AU7
EACH SECTION
Ef = 6.3 Volts
Eb = 250
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS


6AU7
EACH SECTION
Ef = 6.3 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (Gm) - MICROMHOS
PLATE MILLIAMPERES
Eb = 300
50
100
150
200
250


6AU7
EACH SECTION
Ef = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
Eg = 0
-5
-10
-15
-20
-25
-30

TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

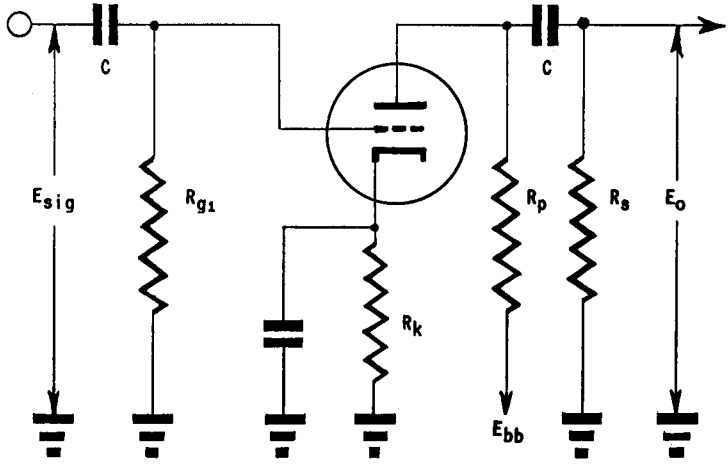
EACH SECTION

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	0.24	0.10	3600	14	16	2700	15	33	2200	15	51
0.24	0.24	0.10	7500	14	16	5100	15	30	4300	15	44
0.24	0.51	0.10	9100	14	19	6800	15	39	5100	15	54
0.51	0.51	0.10	13000	14	16	9100	15	30	6800	16	40
0.51	1.0	0.10	15000	14	19	10000	16	32	7500	16	45
0.24	0.24	10	0	15	13	0	16	33	0	17	46
0.24	0.51	10	0	16	17	0	17	38	0	18	62
0.51	0.51	10	0	16	14	0	18	32	0	18	53
0.51	1.0	10	0	17	18	0	18	41	0	19	68

NOTES: 1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION.

2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.

3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE.
R_k SHOULD BE ADEQUATELY BY-PASSED

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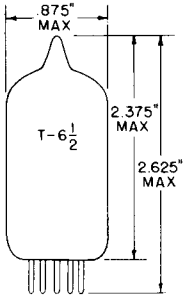
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



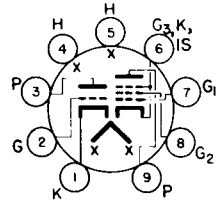
GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

OCATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6AU8 IS A GENERAL-PURPOSE MINIATURE TUBE CONTAINING A SHARP CUT-OFF PENTODE AND A MEDIUM-MU TRIODE IN ONE ENVELOPE. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES THAT ARE SIMILARLY CONTROLLED. THE PENTODE SECTION IS PARTICULARLY SUITED FOR USE AS A VIDEO AMPLIFIER, VIDEO IF AMPLIFIER AND SOUND IF AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR OR CLIPPER OR AS A SWEEP OSCILLATOR.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID TO PLATE	0.044	2.2	pf
INPUT	7.5	2.6	pf
OUTPUT	2.4	0.34	pf
PENTODE GRID #1 TO TRIODE PLATE	0.005		pf
TRIODE GRID TO PENTODE PLATE	0.002		pf
PENTODE PLATE TO TRIODE PLATE	0.12		pf

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RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

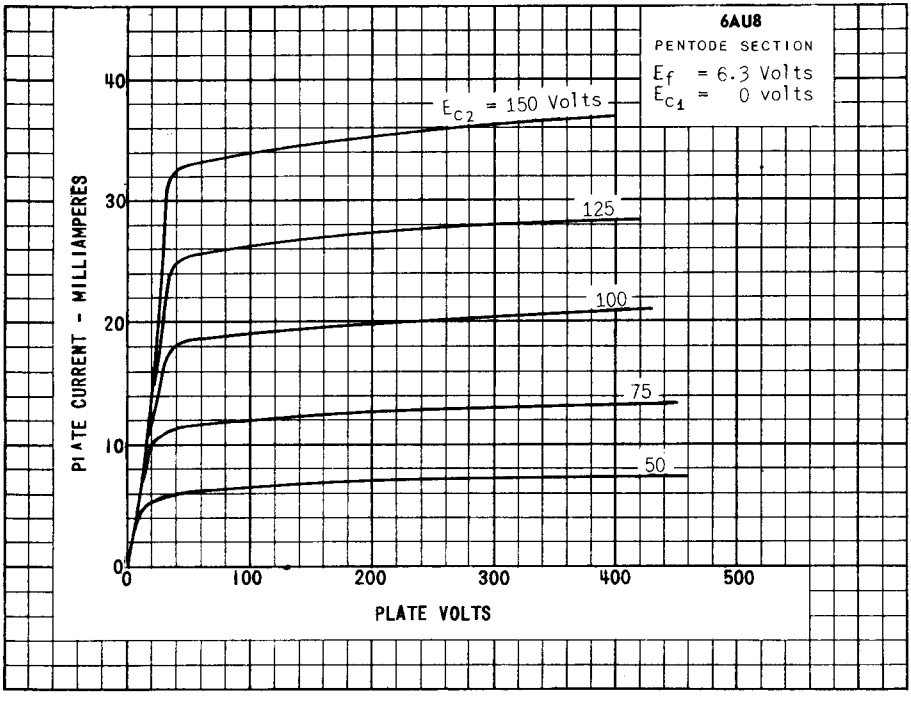
	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	---	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.25	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

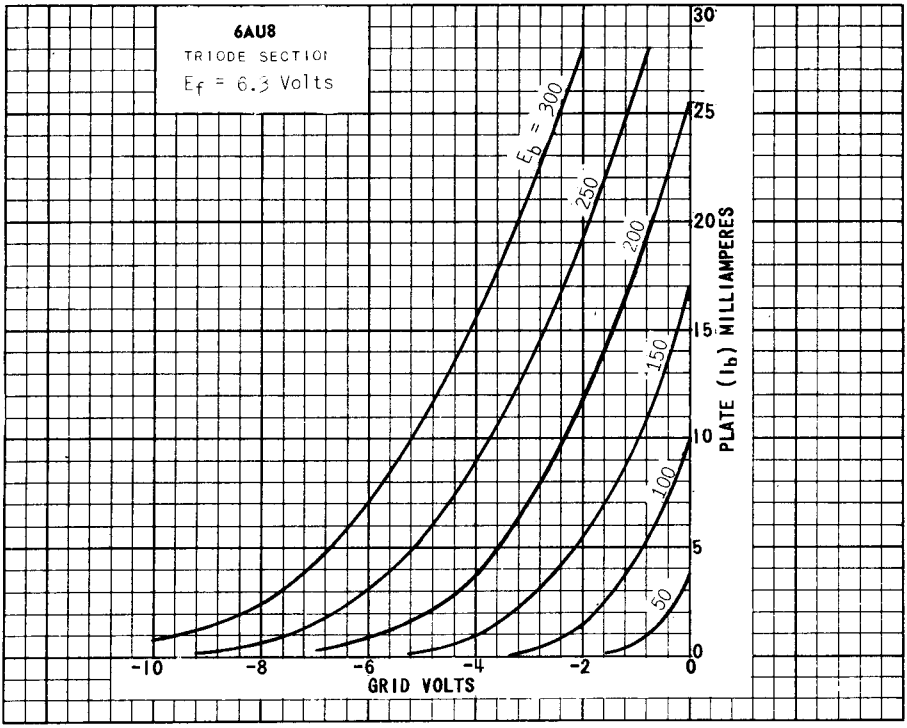
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	150	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	150 000	8 200	OHMS
TRANSCONDUCTANCE	7 000	4 900	μMHOS
PLATE CURRENT	15	9.0	MA.
GRID #2 CURRENT	3.4	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMP.	-8	-6.5	VOLTS





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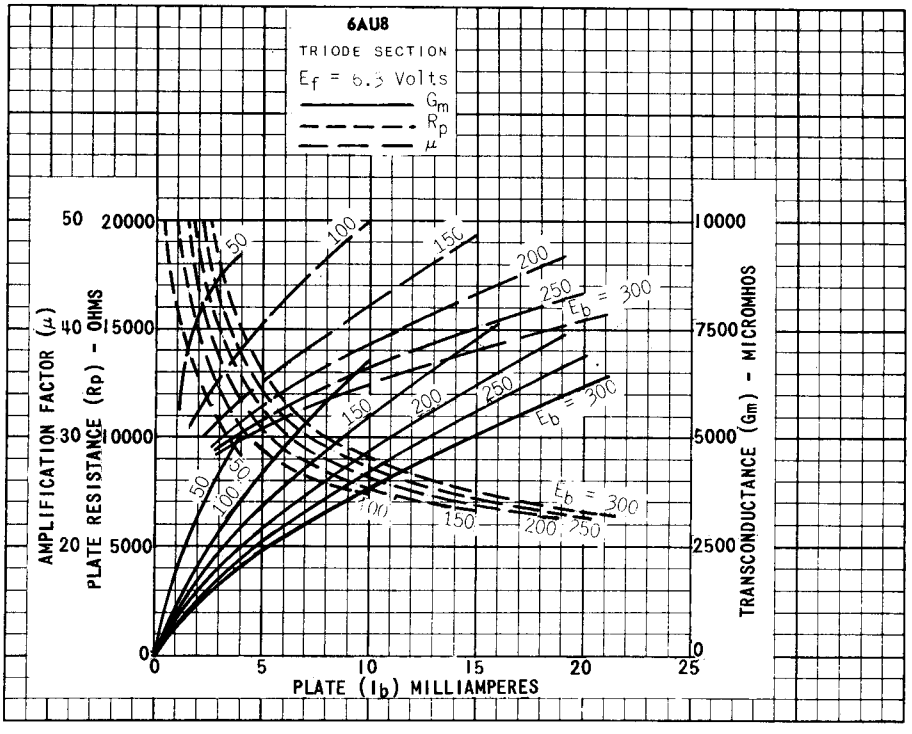
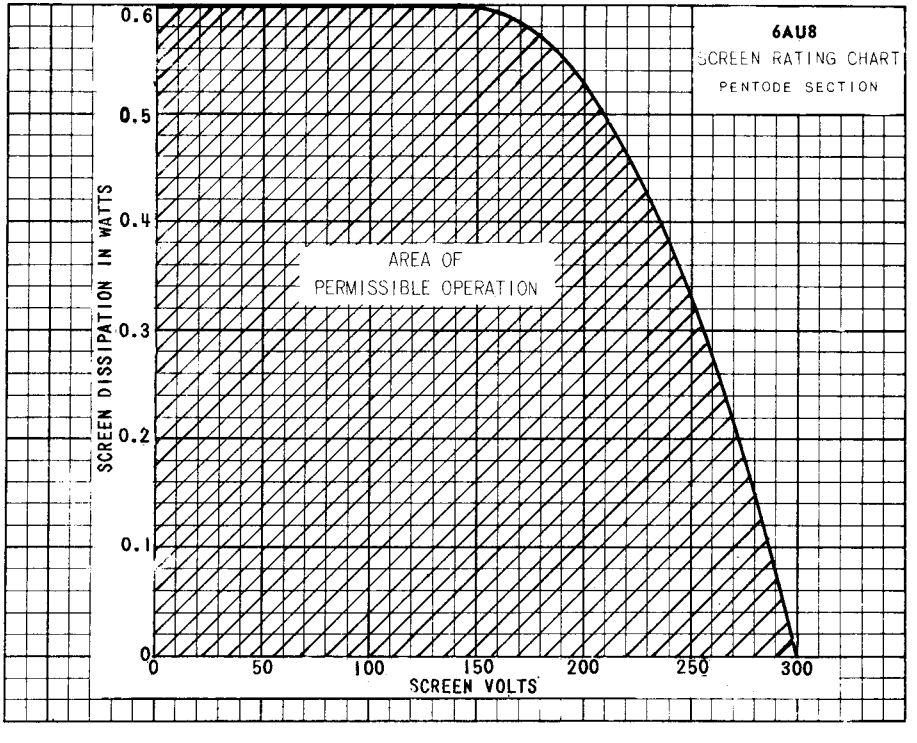
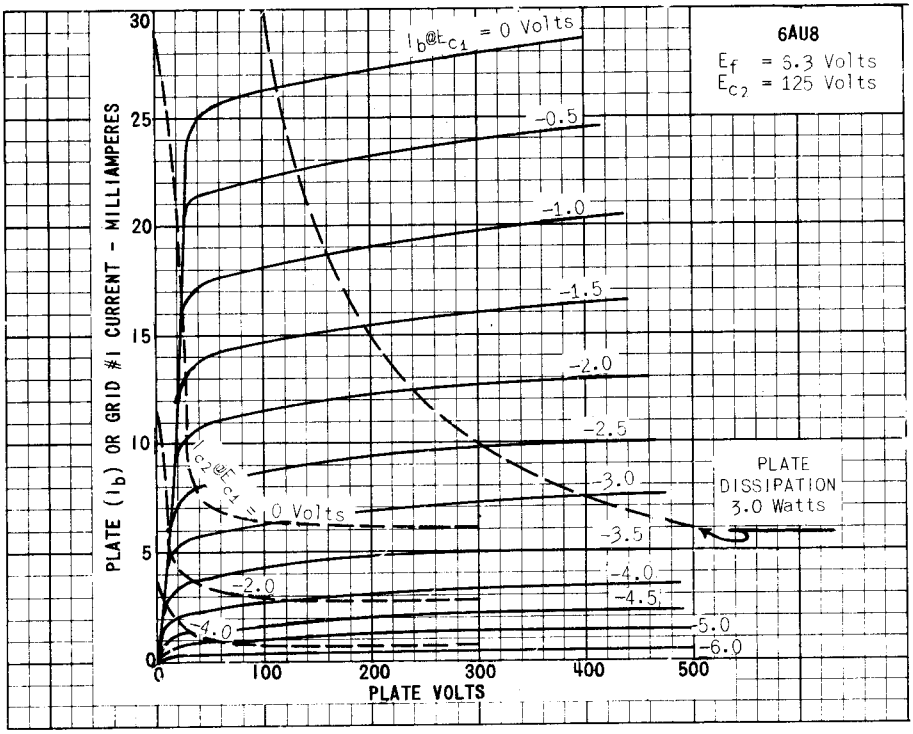
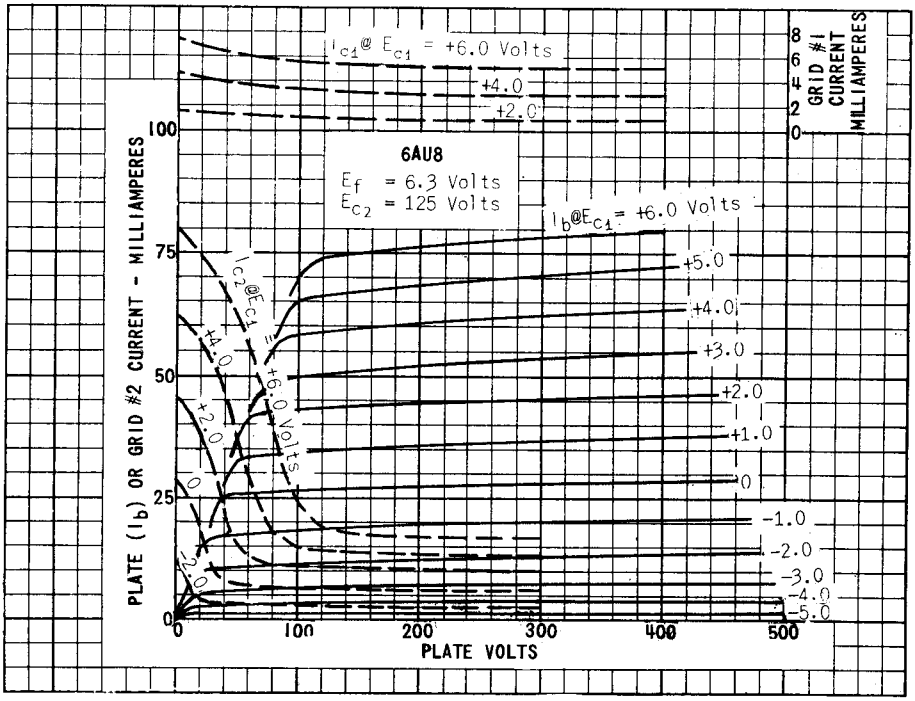
6AU8

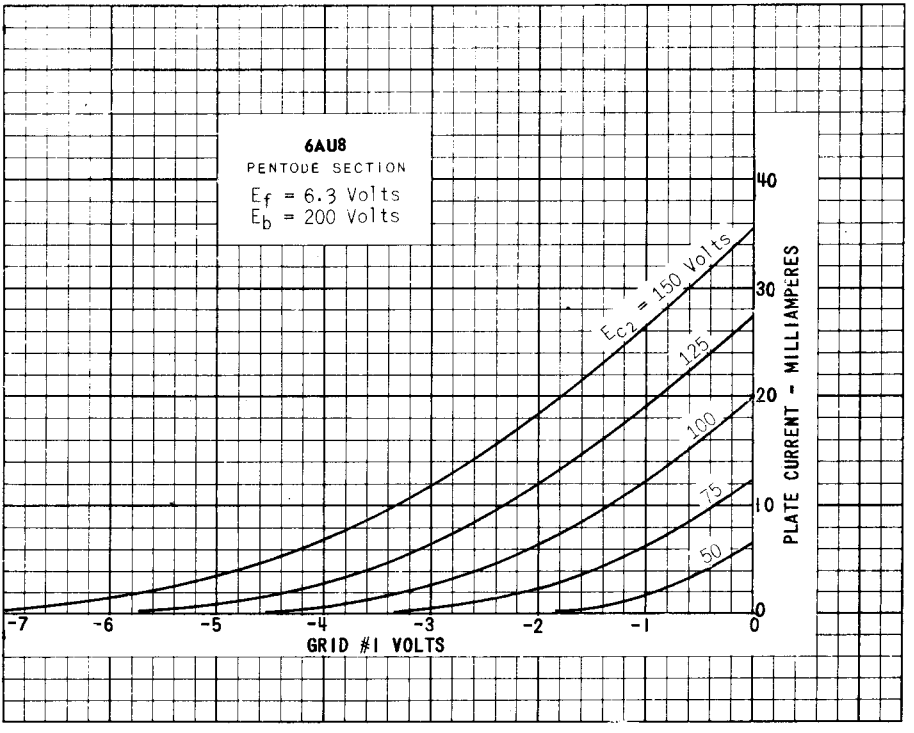

6AU8
TRIODE SECTION
E_f = 6.3 Volts
G_m
R_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) - OHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
E_b = 300
50
100
150
200
250

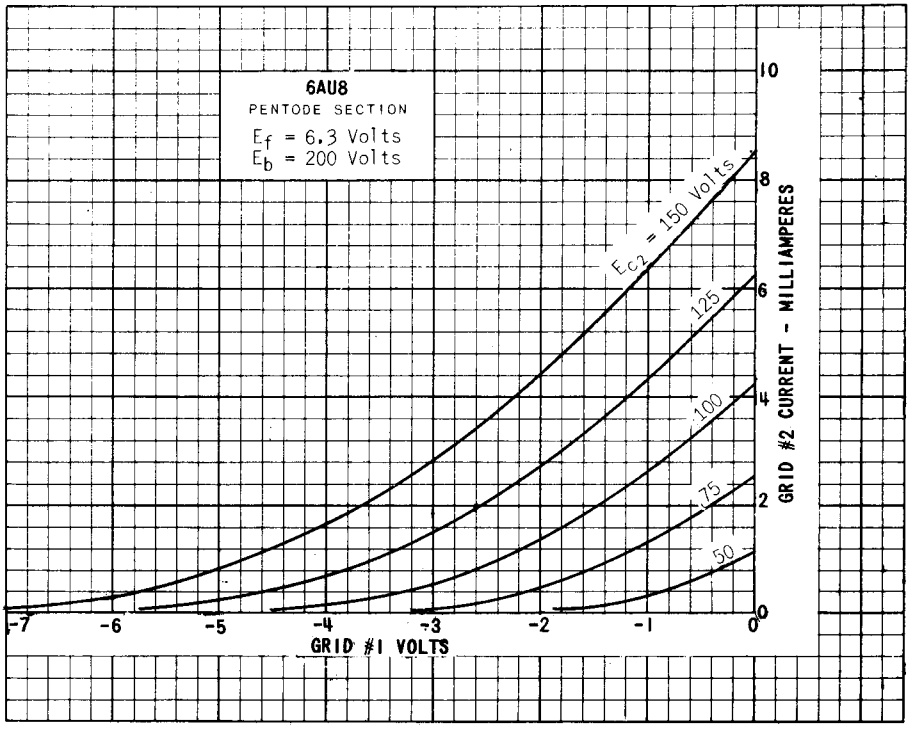

6AU8
SCREEN RATING CHART
PENTODE SECTION
AREA OF
PERMISSIBLE OPERATION
SCREEN DISSIPATION IN WATTS
SCREEN VOLTS

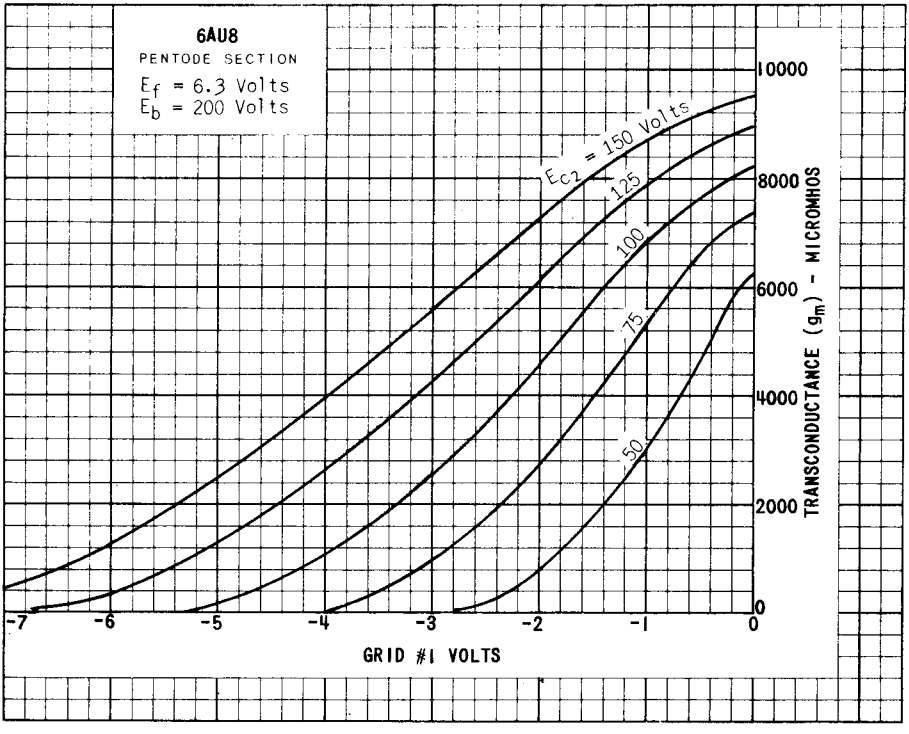

6AU8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b@E_{c_1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-6.0
I_{c_2}@E_{c_1} = 0 Volts
-2.0
-4.0
PLATE DISSIPATION 3.0 Watts
PLATE (I_b) OR GRID #1 CURRENT - MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
30
100
200
300
400
500

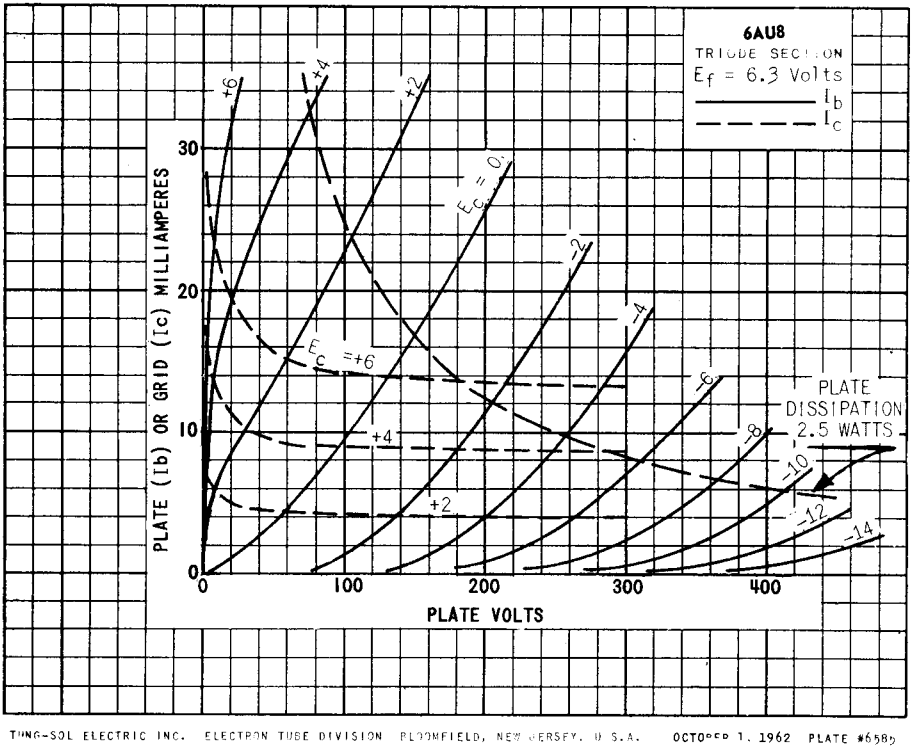

I_{c_1}@ E_{c_1} = +6.0 Volts
+4.0
+2.0
6AU8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b@E_{c_1} = +6.0 Volts
+5.0
+4.0
+3.0
+2.0
+1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
I_{c_2}@E_{c_1} = +6.0 Volts
+4.0
+2.0
0
-2.0
GRID #1 CURRENT MILLIAMPERES
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS
0
2
4
6
8
25
50
75
100
200
300
400
500

6AU8


6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
40
30
20
10
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
PLATE CURRENT - MILLIAMPERES


6AU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
10
8
6
4
2
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
GRID #2 CURRENT - MILLIAMPERES





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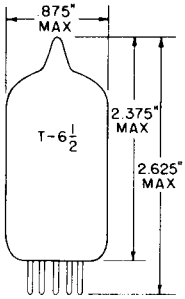
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

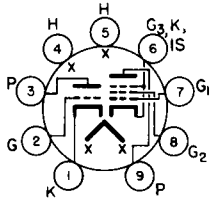


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR
600 MA. SERIES HEATER OPERATED
MONOCHROME AND COLOR
TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DX

THE 6AU8A IS A GENERAL-PURPOSE MINIATURE TUBE CONTAINING A SHARP CUT-OFF PENTODE AND A MEDIUM-MU TRIODE IN ONE ENVELOPE. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES THAT ARE SIMILARLY CONTROLLED. THE PENTODE SECTION IS PARTICULARLY SUITED FOR USE AS A VIDEO AMPLIFIER, VIDEO IF AMPLIFIER AND SOUND IF AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR OR CLIPPER OR AS A SWEEP OSCILLATOR.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID TO PLATE	0.06	2.2	pf
INPUT	7.5	2.6	pf
OUTPUT	3.4	0.34	pf

PENTODE GRID 2 TO TRIODE PLATE (MAX.)	0.006	pf
TRIODE GRID TO PENTODE PLATE (MAX.)	→ 0.022	pf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.12	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

TUNG-SOL

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.8	3.3	WATTS
GRID 2 INPUT:			
FOR GRID 2 VOLTAGES UP TO 165 VOLTS	----	1.0	WATT
FOR GRID 2 VOLTAGES BETWEEN 165 & 330 V.	----	SEE RATING CHART	
GRID 1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.5	0.25	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A 1 AMPLIFIER

	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	200	150	VOLTS
GRID 2 VOLTAGE	125	----	VOLTS
CATHODE BIAS RESISTOR	82	150	OHMS
AMPLIFICATION FACTOR	----	40	
TRANSCONDUCTANCE	7000	4900	μMHOS
PLATE CURRENT	15	9.0	MA.
PLATE RESISTANCE (APPROX.)	150,000	8200	OHMS
GRID 2 CURRENT	2.4	----	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib =100 μAMP.	-8	-6.5	VOLTS
ZERO BIAS: *			
(WITH Eb=40 V., Ec2=125, instantaneous value)			
PLATE CURRENT	28	----	MA.
GRID 2 CURRENT	10	----	MA.

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 85% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

NOTE:

THE TRIODE SECTION OF THE 6AU8A MAY BE DIODE-CONNECTED AND EMPLOYED AS A HIGH-PERVEANCE DIODE IN VIDEO-DETECTOR APPLICATIONS. THE DIODE OPERATION CAN BE OBTAINED EITHER WITH THE TRIODE GRID CONNECTED TO THE TRIODE PLATE AND THE COMBINATION OPERATED AS THE PLATE OF THE DIODE, OR WITH THE TRIODE PLATE GROUNDED AND THE TRIODE GRID OPERATED AS THE PLATE OF THE DIODE.

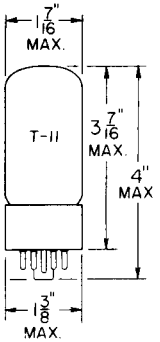
THE 6AU8 CURVES, ALSO, APPLY FOR THE 6AU8A.

→ INDICATES A CHANGE.

*INDICATES AN ADDITION.

TUNG-SOL

PENTODE



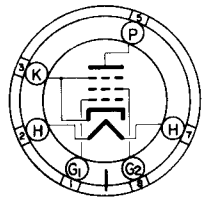
GLASS BULB

THE MAX. DIAMETER OF THE T-12 BULB IS 1 9/16"

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
6 PIN OCTAL
6CK

THE 6AV5GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT USES EITHER A T-11 OR T-12 BULB.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	14	μμf
OUTPUT	7.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAX.)	5 500[C]	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[D]	11	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

[C] THIS VALUE MUST NOT BE EXCEEDED.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATION RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

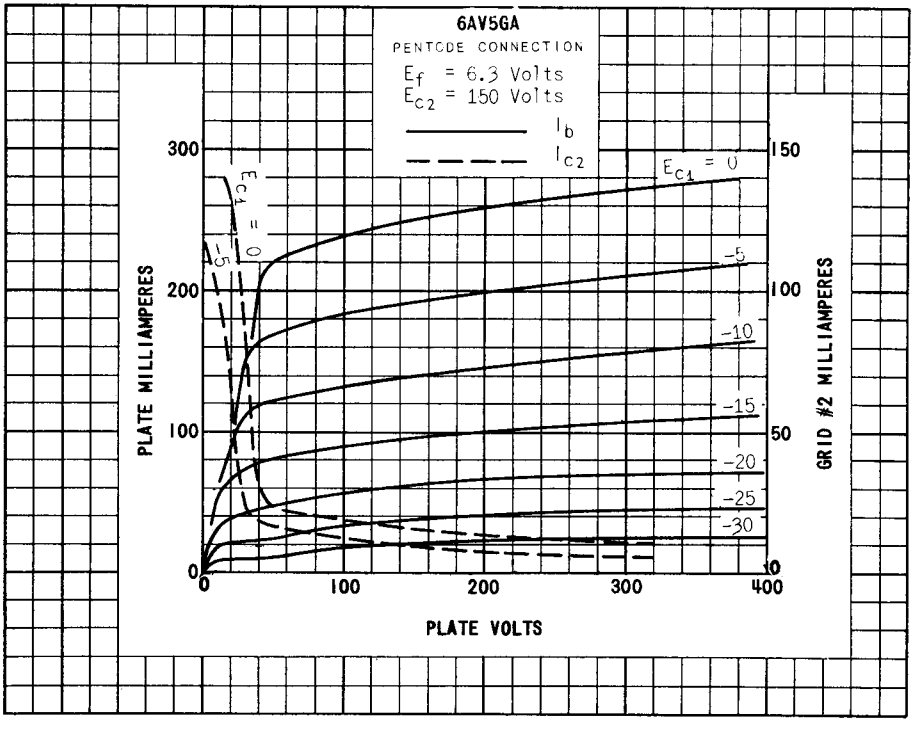
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	1.2		AMP.
PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0[E]	-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	14 500 ←	OHMS
TRANSCONDUCTANCE	---	5 900 ←	μMHOS
PLATE CURRENT	260 ←	57 ←	MA.
GRID #2 CURRENT	26 ←	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	-43 ←	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	---	4.3	

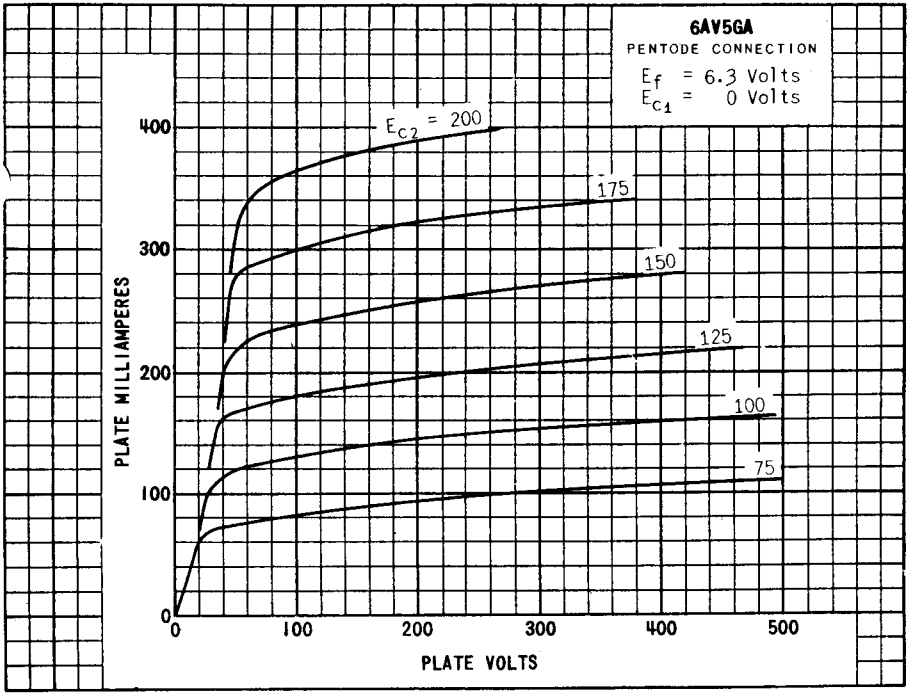
[E] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

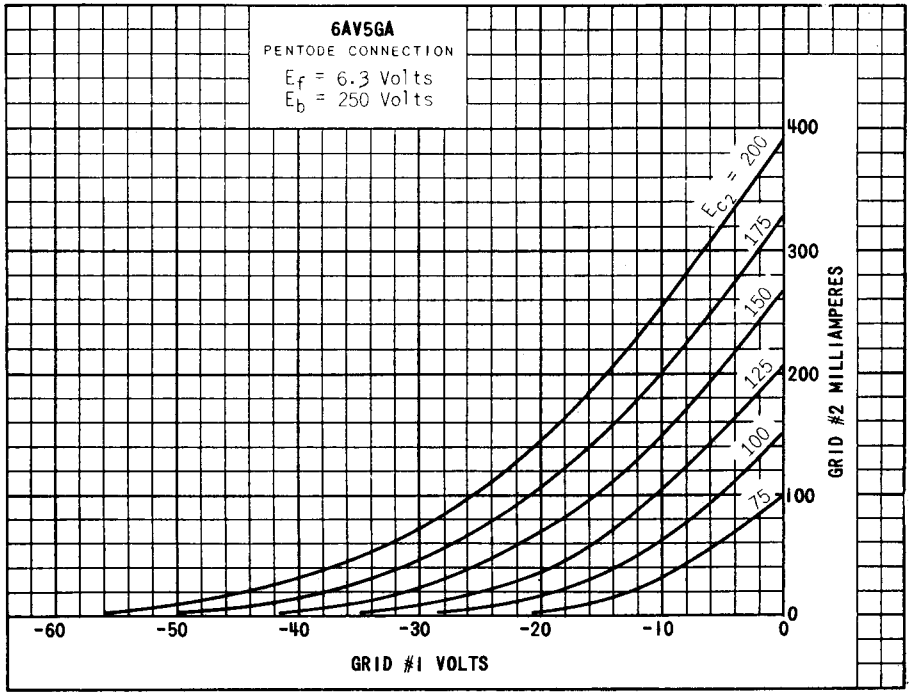
[F] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 6AV5GA is identical to the 12AV5GA, 17AV5GA & the 25AV5GA.

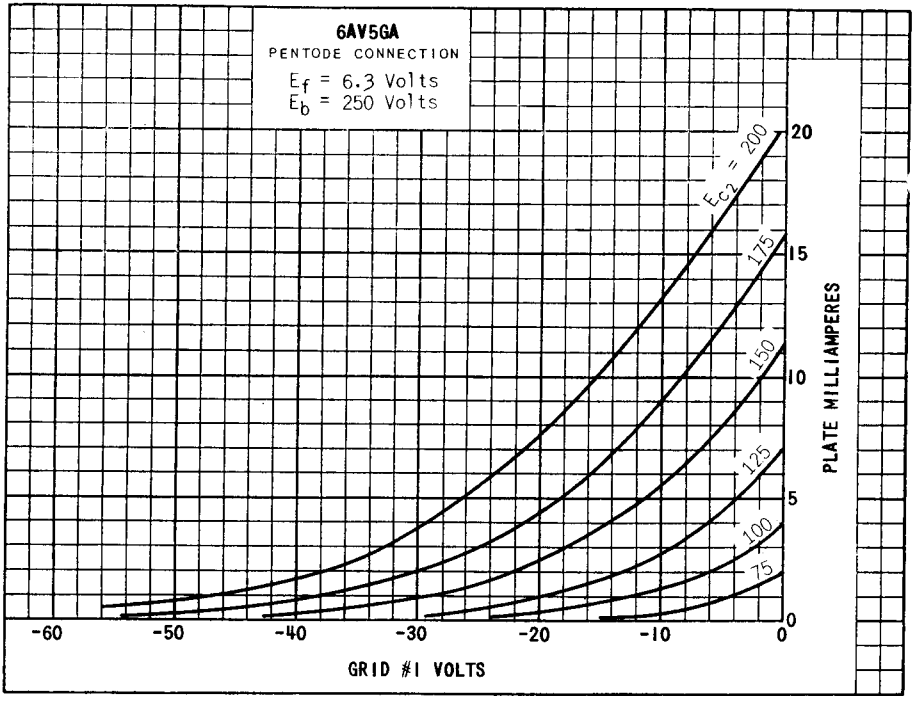
→ INDICATES A CHANGE.




6AV5GA
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c1} = 0 Volts
E_{c2} = 200
175
150
125
100
75
PLATE MILLIAMPERES
0
100
200
300
400
0
100
200
300
400
500
PLATE VOLTS

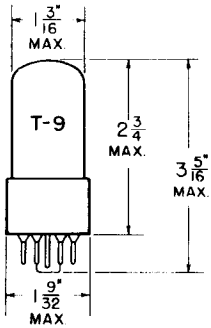

6AV5GA
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 200
175
150
125
100
75
GRID #2 MILLIAMPERES
0
100
200
300
400
-60
-50
-40
-30
-20
-10
0
GRID #1 VOLTS

6AV5GA (25AV5GA)



TUNG-SOL

BEAM PENTODE

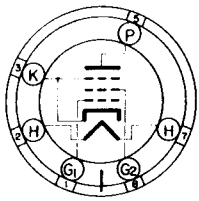


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL
6CK

THE 6AV5GT IS A BEAM POWER AMPLIFIER INTENDED PRIMARILY FOR OPERATION WITH RELATIVELY LOW SUPPLY VOLTAGE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH-SURGE PLATE VOLTAGES FOR RELATIVELY SHORT PERIODS OF TIME. IT CAN BE USED WITH DIRECT OR WITH TRANSFORMER HORIZONTAL-YOKE DRIVE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	180	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE[AB]	5 500	VOLTS
MAXIMUM GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE	-100	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE[A]	-400	VOLTS
MAXIMUM PLATE DISSIPATION	11	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM PLATE CURRENT	100	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE[C]	1	MEGOHM

[A] THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND THE DURATION OF THE PULSE MUST BE LIMITED TO 10 MICROSECONDS.

[B] VALUE GIVEN IS TO BE CONSIDERED AS THE ABSOLUTE VOLTAGE BEYOND WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED.

[C] THE USE OF A CATHODE RESISTOR OR OTHER SUITABLE PROTECTIVE DEVICE IS NECESSARY TO PROTECT THE TUBE IN EVENT OF LOSS OF EXCITATION AND CONSEQUENT LOSS OF DEVELOPED BIAS.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
TRANSCONDUCTANCE	5 800	μMHOS
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
GRID #2 TO GRID #1 AMPLIFICATION FACTOR[D]	4.5	

[D] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS.

HORIZONTAL DEFLECTION AMPLIFIER

	8AP4A	12KP4A	16KP4	
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	1.2	AMP.
TOTAL PLATE VOLTAGE	240	370	410	VOLTS
PLATE SUPPLY VOLTAGE	150	250	250	VOLTS
BOOST VOLTAGE	90	120	160	VOLTS
GRID #2 SUPPLY VOLTAGE	150	250	—	VOLTS
GRID #2 RESISTOR	1000	10 000	—	OHMS
GRID #2 VOLTAGE	135	165	122	VOLTS
CATHODE BIAS RESISTOR	0	0	0	OHMS
GRID #1 RESISTOR	0.22	0.47	1	MEGOHM
PEAK-TO-PEAK GRID SIGNAL VOLTAGE (APPROX.)	90	90	220	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE (APPROX.)	2.9	3.6	4.3	KV.
PLATE CURRENT	84	89	87	MA.
GRID #2 CURRENT	15	8.5	15	MA.
GRID #1 CURRENT	66	40	64	μA.
PICTURE TUBE ANODE VOLTAGE	8.7[E]	10.8[F]	12.8[F]	KV.
DEFLECTION ANGLE	54	54	65	DEGREES
SWEEP WIDTH	7 3/4	11 1/2	13 1/2	INCHES

[E] MEASURED WITH 75 MICROAMPERES TOTAL PICTURE TUBE DRAIN.

[F] MEASURED WITH 100 MICROAMPERES TOTAL PICTURE TUBE DRAIN.

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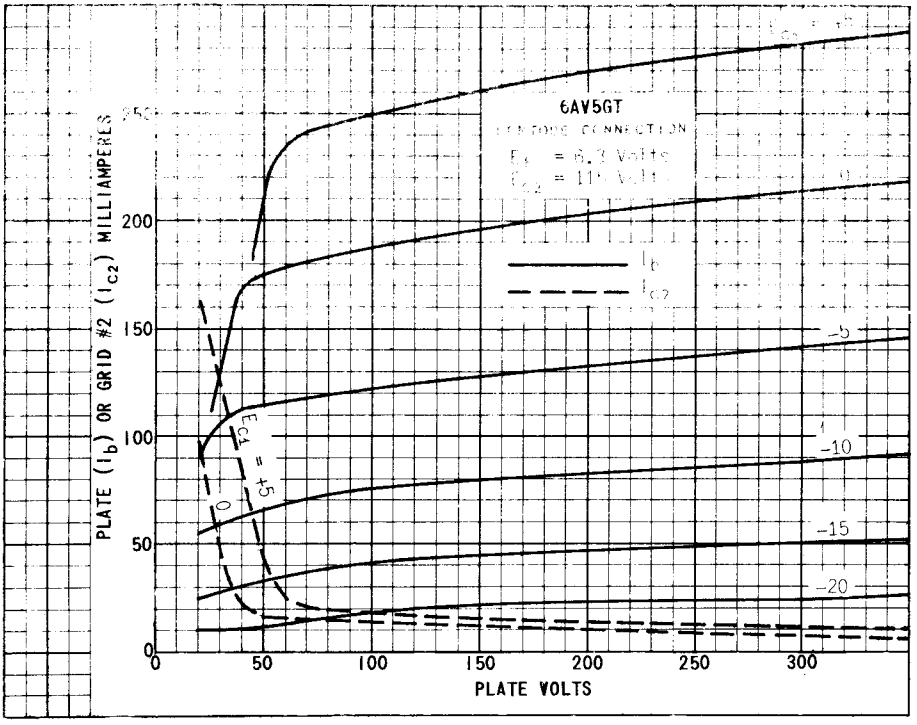

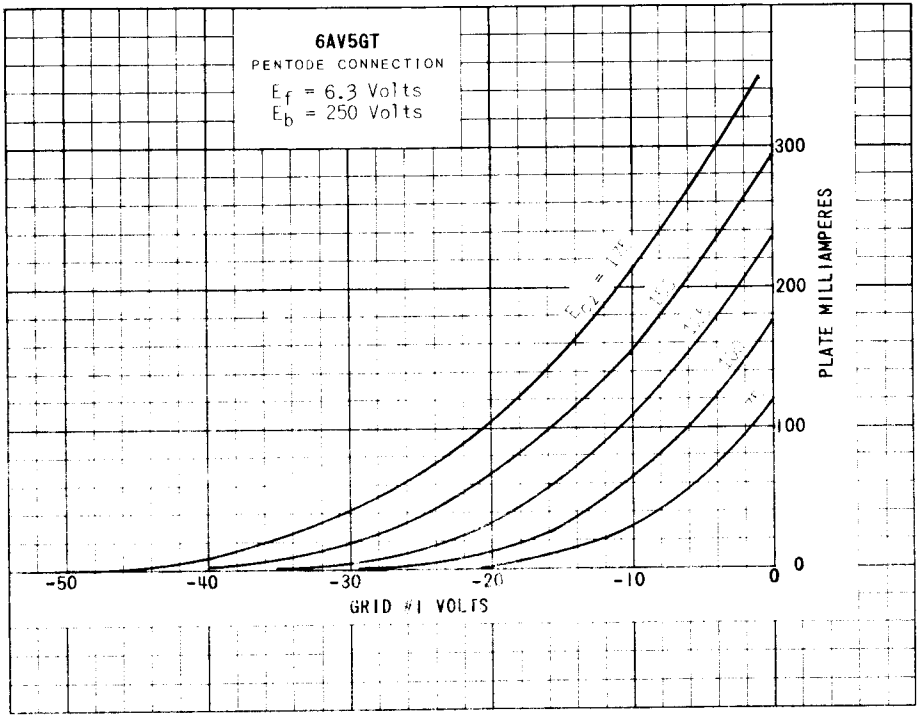

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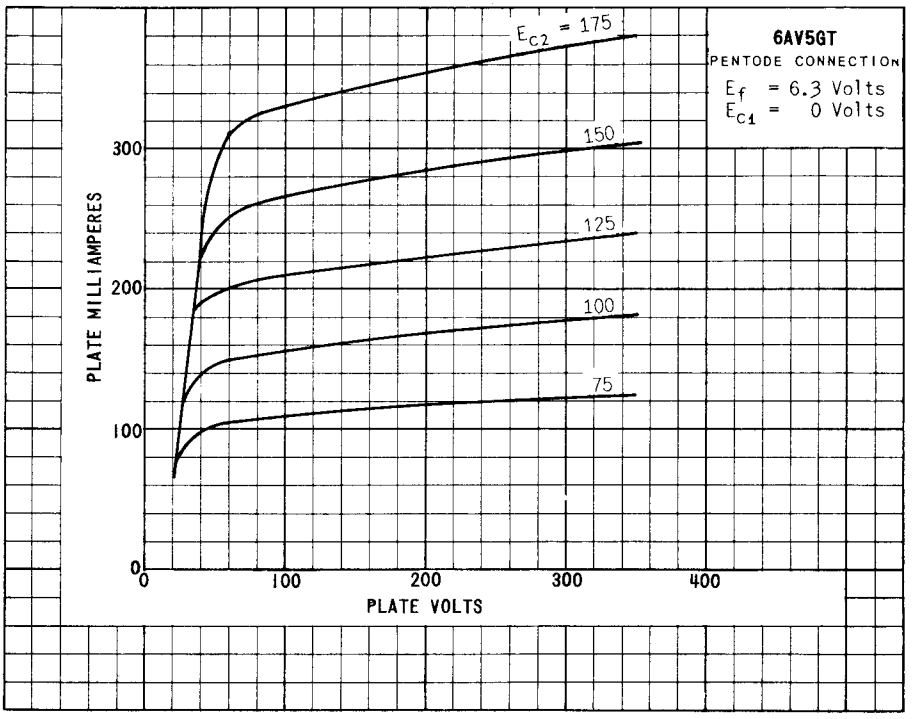
6AV5GT(25AV5GT)



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2522
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1950

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TUNG-SOL

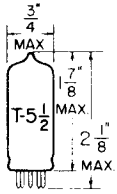
DOUBLE-DIODE TRIODE

MINIATURE TYPE

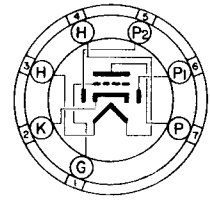
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6AV6 COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7-PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1.0	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT - CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	6.3	6.3	VOLTS
FILAMENT CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
AMPLIFICATION FACTOR	100	100	

DIODE UNITS - TWO

THE DIODE UNITS ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE SLEEVE.

DIODE BIASING OF THE TRIODE UNIT IS NOT SUITABLE.

SIMILIAR TYPE REFERENCE: Ratings and characteristics somewhat similiar to 6AT6 except for the use of more thorough shielding of the diode units from the triode.

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1959
FEB. 2,
1948

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CONTINUED FROM PRECEDING PAGE

RESISTANCE COUPLED AMPLIFIER

R_L MEG.	R_C MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
		R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.1	0.22	4700	35[A]	4	2000	47	18	1500	52	40
0.22	0.47	7400	45[B]	6	3500	59	24	2800	65	49
0.47	1.0	13000	52[C]	8	6700	66	28	5200	73	54

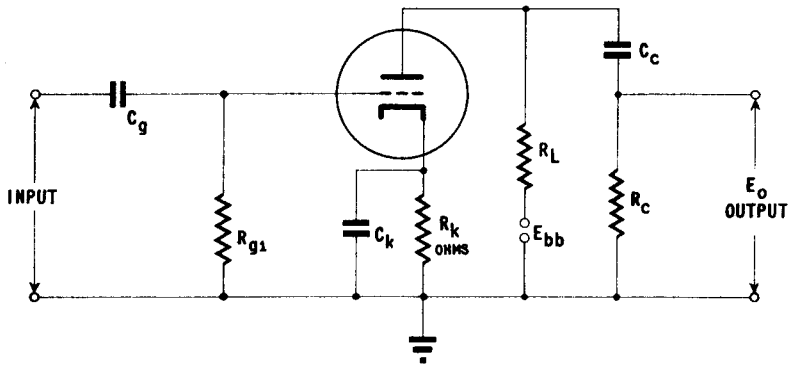
E_o IS RMS OUTPUT AT GRID CURRENT POINT.

GAIN MEASURED AT 5.0 VOLTS RMS OUTPUT EXCEPT AS INDICATED.

[A] OUTPUT VOLTAGE OF 2 VOLTS RMS.

[B] OUTPUT VOLTAGE OF 3 VOLTS RMS.

[C] OUTPUT VOLTAGE OF 4 VOLTS RMS.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PLATE 1960

FEB. 2, 1948

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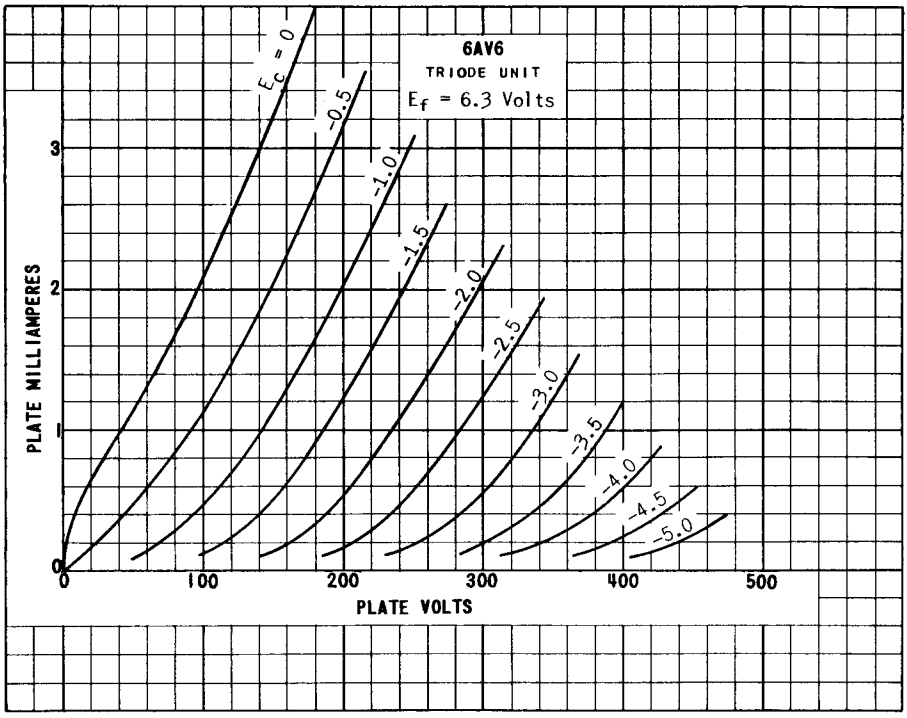

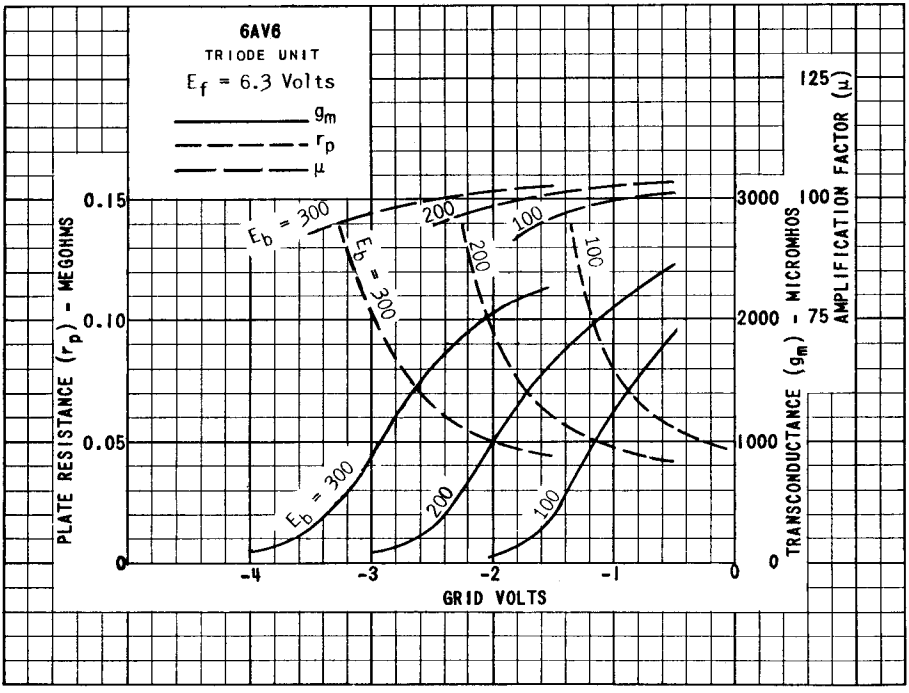

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PLATE
1961
FEB. 2,
1948

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6AV6

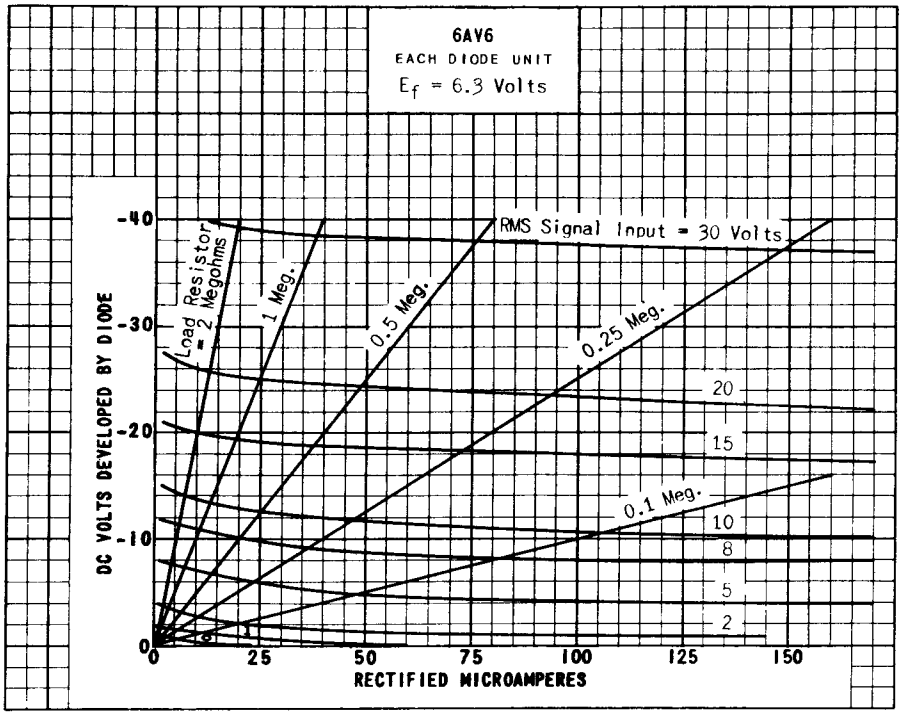

PLATE 1962
FEB. 2, 1948

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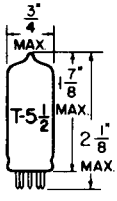
TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

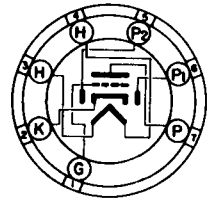
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BT

THE 6AV6 COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1	MA.

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

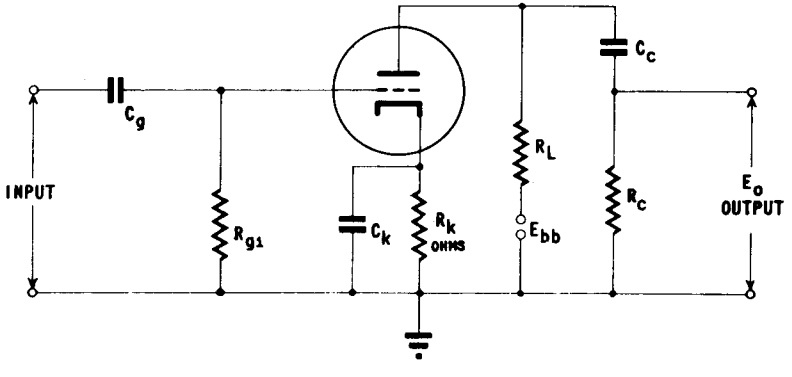
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	−1	−2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

TRIODE UNIT

PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	

→INDICATES A CHANGE OR ADDITION.

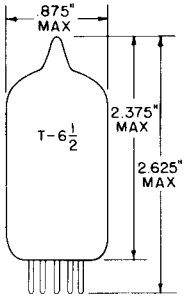


NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



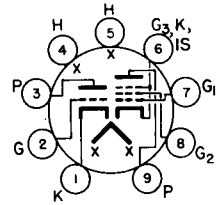
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR USE AS A SYNC SEPARATOR

AND VIDEO AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6AW8A IS A SHARP CUT-OFF PENTODE AND A HIGH MU TRIODE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC FOR THE PENTODE SECTION. THE TRIODE SECTION MAY BE USED AS A SYNC SEPARATOR WHILE THE PENTODE SECTION IS DESIGNED TO SERVE AS A VIDEO AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE (PG1 TO PP) MAX.	→ 0.05	→ 0.06	pf
PENTODE INPUT: PG TO (H+PG2+PK,G3,I.S.)	10	10	pf
PENTODE OUTPUT: PP TO (H+ PG2+PK,G3,I.S.)	4.5	3.6	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	2.2	2.2	pf
TRIODE INPUT: TG TO (H+TK=PK, PG3, I.S.)	3.4	3.2	pf
TRIODE OUTPUT: TP TO (H+TK-PK, PG3, I.S,)	3.0	1.8	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	.005	.008	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX.	.025	.150	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 4 AND PIN 5.

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME [B]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (PARALLEL HEATER OPERATION)		6.3±0.6	VOLTS
CURRENT OPERATION (SERIES HEATER OPERATION)		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE J5-C4-2	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	1.1	3.75	WATTS
GRID 2 DISSIPATION		1.1	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED BIAS OPERATION	0.5	0.25	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

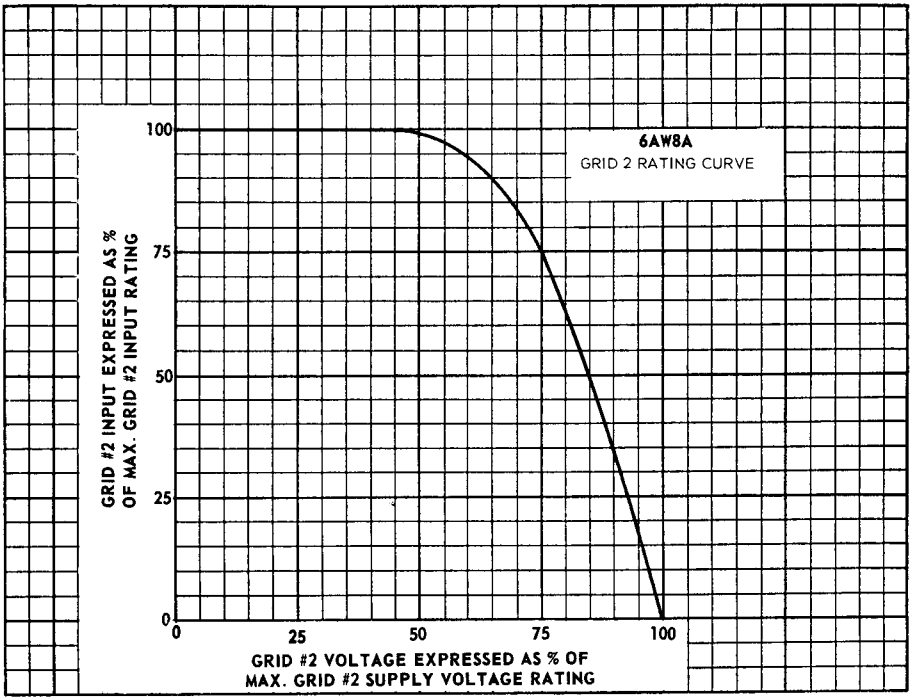
CLASS A1 AMPLIFIER

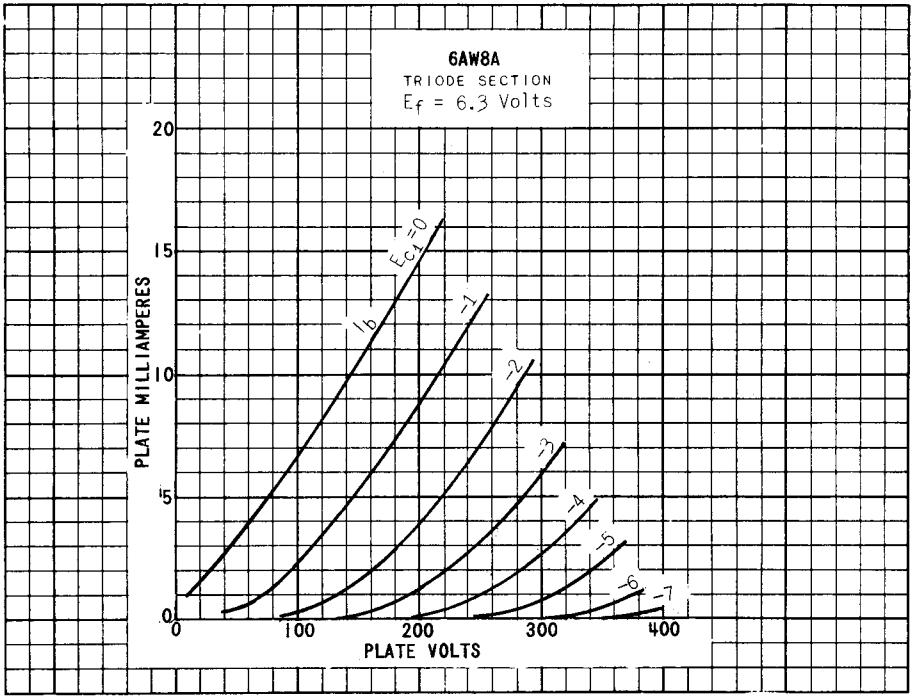
	TRIODE	PENTODE		
PLATE SUPPLY VOLTAGE	200	65	150	VOLTS
GRID 2 SUPPLY VOLTAGE		150	150	VOLTS
GRID 1 VOLTAGE	-2	0		VOLTS
CATHODE BIAS RESISTOR	----	----	150	OHMS
AMPLIFICATION FACTOR	70	----	----	
PLATE RESISTANCE (APPROX.)		----	200	KOHMS
TRANSCONDUCTANCE	4000	----	9500	μMHOS
PLATE CURRENT	4.0	46	15.0	MA.
GRID 2 CURRENT		15	3.5	MA.
GRID 1 VOLTAGE (APPROX.)				
FOR Ib = 20 μA	-5		-8	VOLTS

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] FOR PARALLEL HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER VOLTAGE IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT HEATER CURRENT IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.





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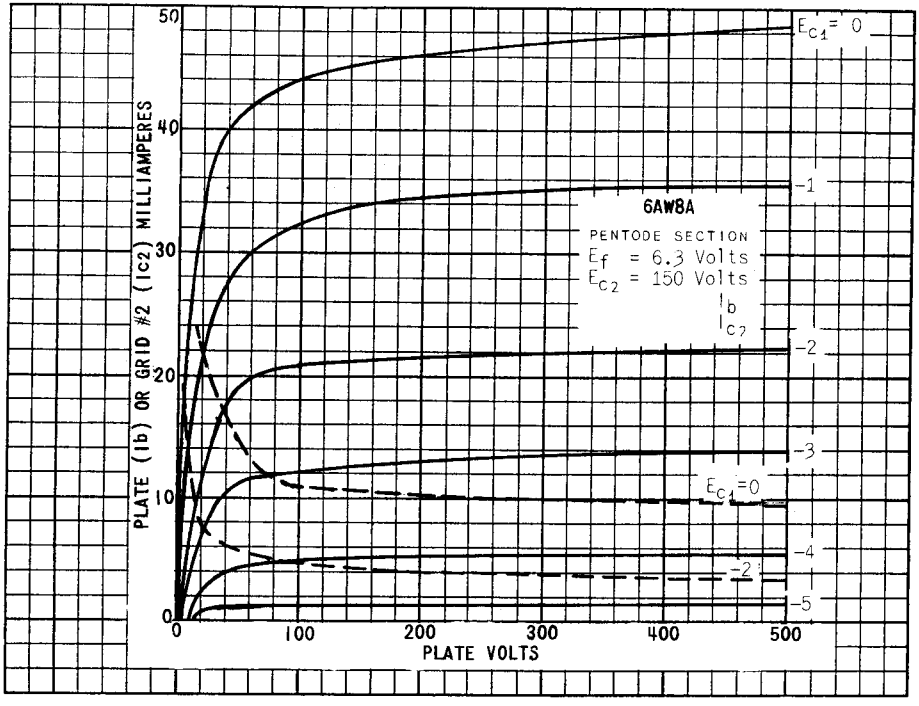
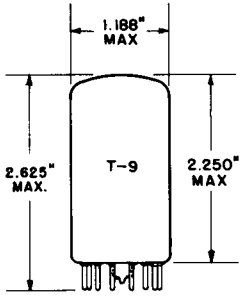
6AW8A


6AW8A
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
E_{c1}= 0
-1
-2
-3
E_{c1}=0
-4
-2
-5
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
0
10
20
30
40
50
0
100
200
300
400
500
PLATE VOLTS

TUNG-SOL

DIODE



GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-59

COATED UNIPOTENTIAL CATHODE

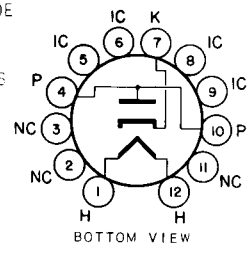
FOR

DAMPING DIODE APPLICATIONS

IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

THE 6AX3 IS A HEATER-CATHODE SINGLE DIODE IN THE COMPACT 12 PIN T-9 CONSTRUCTION. ITS HIGH HEATER AND CATHODE INSULATION IS DESIGNED FOR USE AS A DAMPING DIODE IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+H)	7.5	pf
PLATE TO CATHODE AND HEATER: P TO (K+H	5.5	pf
HEATER TO CATHODE: (H TO K)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION[A]		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT		900	VOLTS
TOTAL DC AND PEAK		5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

[A] THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT SO THAT THE HEATER VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS[B]

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

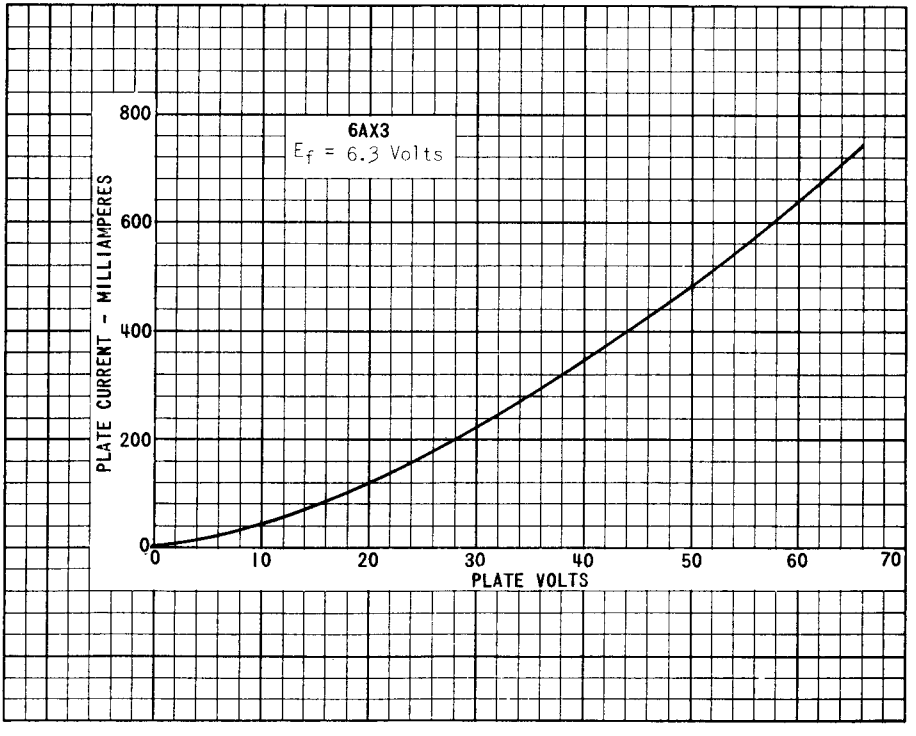
TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	3.3	WATTS
STEADY-STATE PEAK PLATE CURRENT	1000	MA.
DC OUTPUT	165	MA.

AVERAGE CHARACTERISTICS

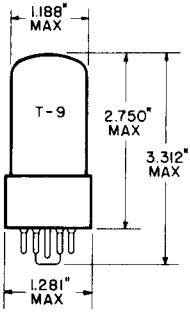
TUBE VOLTAGE DROP		
I_b = 250 MILLIAMPERES DC	32	VOLTS

[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.



TUNG-SOL

DIODE



GLASS BULB

INTERMEDIATE SHELL
5 PIN OCTAL
B5-82, B5-85 OR B5-147

SHORT INTERMEDIATE SHELL
6 PIN OCTAL B6-60

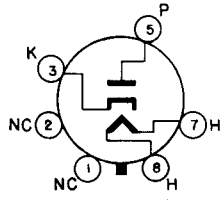
OUTLINE DRAWING
JEDEC 9-11 OR 9-41

FOR DAMPER SERVICE

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG
PINS 1,2,4, & 6 SHALL NOT BE
USED AS TIE POINTS.
PIN 1 IS OMITTED ON
BASE B5-82, B5-85 & B5-147

THE 6AX4GT IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN 'DIRECT-DRIVE' CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.[A]

WITHOUT EXTERNAL SHIELD

HEATER TO CATHODE: H TO K	4.0	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	5.0	pf
CATHODE TO PLATE AND HEATER: K TO (P + H)	8.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC			900	VOLTS
TOTAL DC AND PEAK			4400	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

DAMPER SERVICE[B]

PEAK INVERSE PLATE VOLTAGE	4400	VOLTS
DC PLATE CURRENT	→ 137	MA.
PEAK PLATE CURRENT	→ 825	MA.
PLATE DISSIPATION	→ 5.0	WATTS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP		
WITH TUBE CONDUCTING 250 MA	32	VOLTS

A

FOR THE MEASUREMENT OF PLATE TO CATHODE PLUS HEATER AND CATHODE TO PLATE PLUS HEATER CAPACITIES, UNUSED PINS, METAL PARTS, ETC. SHALL BE CONNECTED TO THE HEATER.

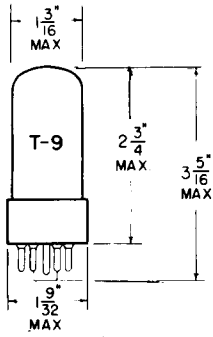
B

FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION.' THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE. POWER RECTIFIER OPERATION IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

TUNG-SOL

DIODE



GLASS BULB

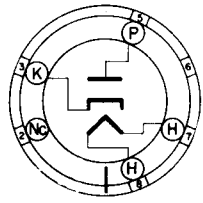
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 1.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE-SHELL
5 PIN OCTAL

4CG

THE 6AX4GTA IS A HEATER-CATHODE-TYPE SINGLE DIODE INTENDED FOR USE AS THE DAMPING DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. IT IS PARTICULARLY USEFUL IN AUTOTRANSFORMER DEFLECTION SYSTEMS IN WHICH HIGH PULSE VOLTAGES ARE APPLIED TO THE CATHODE OF THE DAMPER TUBE.

EXCEPT FOR HEATER RATINGS, THE 6AX4GTA IS IDENTICAL TO THE 12AX4GTB AND IS UNILATERALLY INTERCHANGEABLE WITH THE 6AX4GT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER	8.5	μμf
PLATE TO CATHODE AND HEATER	5.0	μμf
HEATER TO CATHODE	4.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

TV DAMPER SERVICE

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	4400	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1000	MA.
MAXIMUM DC OUTPUT CURRENT	165	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	4400	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

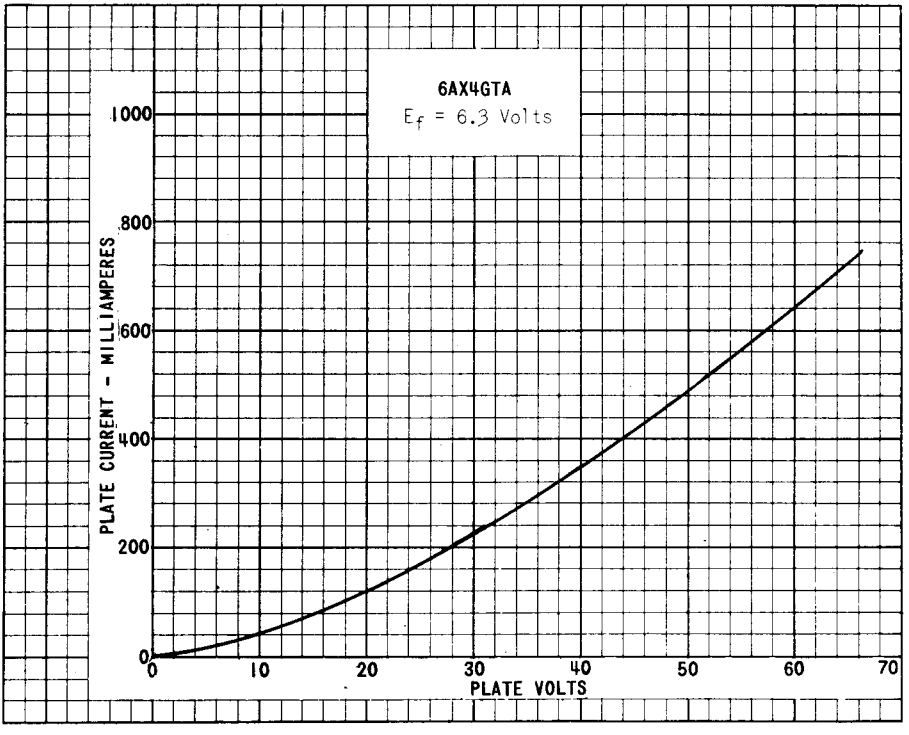
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	1.2	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

NOTE:

OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

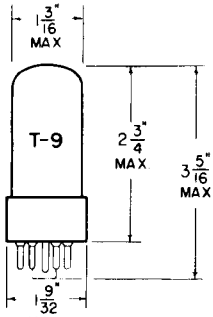
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



TUNG-SOL

DIODE



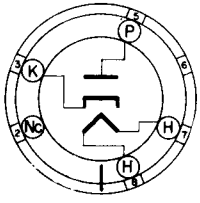
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

1 6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE-SHELL
5 PIN OCTAL
4CG

THE 6AX4GTB IS A SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. IT WAS DESIGNED TO WITHSTAND HIGH PULSE VOLTAGES BETWEEN THE PLATE AND CATHODE WHICH MAKES THE TUBE PARTICULARLY USEFUL IN AUTOTRANSFORMER DEFLECTION SYSTEMS IN WHICH HIGH PULSE VOLTAGES ARE APPLIED TO THE CATHODE OF THE DAMPER TUBE.

THE 6AX4GTB IS UNILATERALLY INTERCHANGEABLE WITH THE 6AX4GT AND 6AX4GTA; HOWEVER, IT DIFFERS FROM THE 6AX4GTA IN HAVING A HIGHER PEAK INVERSE PLATE VOLTAGE RATING.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER	8.5	μμf
PLATE TO CATHODE AND HEATER	5.0	μμf
HEATER TO CATHODE	4.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

TV DAMPER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1000	MA.
MAXIMUM DC OUTPUT CURRENT	165	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

NOTE:

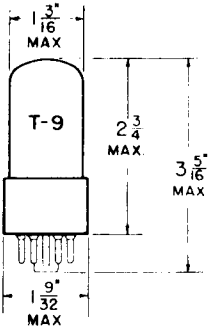
OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DOUBLE DIODE



GLASS BULB

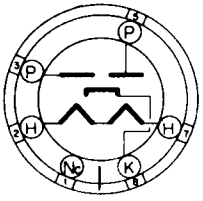
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT INTERMEDIATE SHELL 6 PIN OCTAL

6S

THE 6AX5GT IS A FULL-WAVE RECTIFIER OF THE HEATER-CATHODE TYPE INTENDED FOR USE IN AC OPERATED AND AUTOMOBILE RECEIVERS. BECAUSE OF ITS HEATER-CATHODE CONSTRUCTION IT HAS THE SAME HEATING TIME AS THAT OF OTHER HEATER-CATHODE TYPES IN THE RECEIVER. USE OF THIS TUBE PREVENTS EXCESSIVE VOLTAGES FROM APPEARING ACROSS FILTER CONDENSERS DURING WARM-UP PERIOD.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1250	VOLTS
MAXIMUM PEAK PLATE CURRENT EACH PLATE	375	MA.
MAXIMUM HOT-SWITCHING TRANSIENT PLATE CURRENT[A]	2.6	AMP.
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	SEE RATING CHART	
MAXIMUM DC OUTPUT CURRENT EACH PLATE (RMS)	SEE RATING CHART	

[A] FOR DURATION OF 0.2 SECOND MAX.

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PLATE 2721
SEPT. 1 1951

→ INDICATES A CHANGE OR ADDITION.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
AC PLATE VOLTAGE EACH PLATE (RMS)	350	450	VOLTS
FILTER INPUT CONDENSER[B]	10	10	µf
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50	105	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):			
AT 62.5 MA. (HALF LOAD)	395	---	VOLTS
AT 40 MA. (HALF LOAD)	---	540	VOLTS
AT 125 MA. (FULL LOAD)	350	---	VOLTS
AT 80 MA. (FULL LOAD)	---	490	VOLTS
VOLTAGE REGULATION (APPROX.):			
HALF-LOAD TO FULL-LOAD CURRENT	45	50	VOLTS

[B] HIGHER VALUES OF CAPACITANCE THAN INDICATED MAY BE USED BUT THE EFFECTIVE PLATE SUPPLY IMPEDANCE MAY HAVE TO BE INCREASED TO PREVENT EXCEEDING THE MAXIMUM RATING FOR HOT-SWITCHING TRANSIENT PLATE CURRENT.

FULL-WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
AC PLATE VOLTAGE EACH PLATE (RMS)	350	450	VOLTS
FILTER INPUT CHOKE	10	10	HENRIES
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):			
AT 75 MA. (HALF LOAD)	270	---	VOLTS
AT 62.5 MA. (HALF LOAD)	---	365	VOLTS
AT 150 MA. (FULL LOAD)	250	---	VOLTS
AT 125 MA. (FULL LOAD)	---	350	VOLTS
VOLTAGE REGULATION (APPROX.):			
HALF-LOAD TO FULL-LOAD CURRENT	20	15	VOLTS

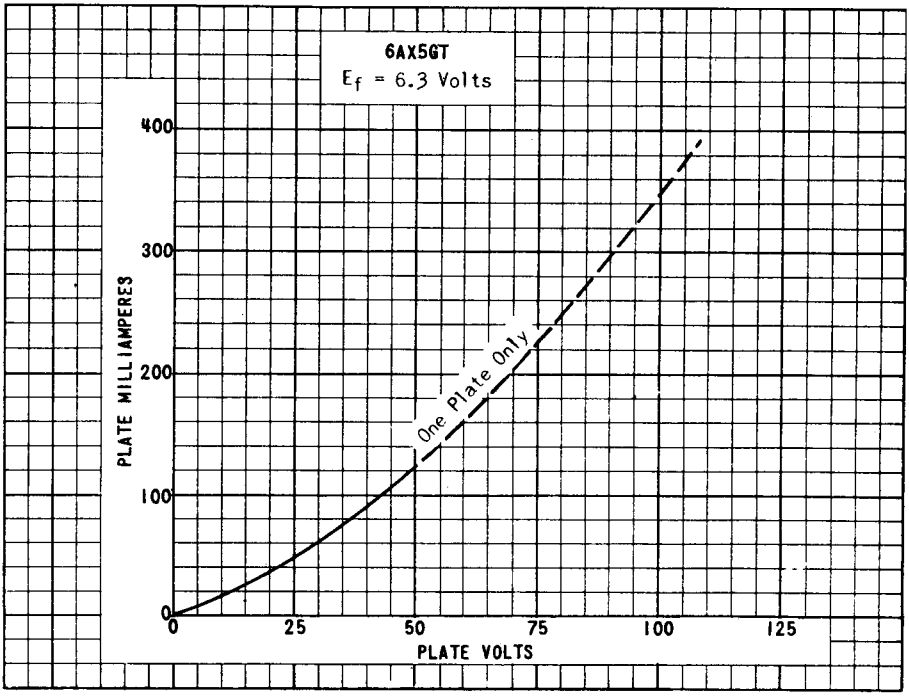

PLATE 2722
SEPT. 1 1951

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RATING CHART

6AX5GT

E_f = 6.3 Volts

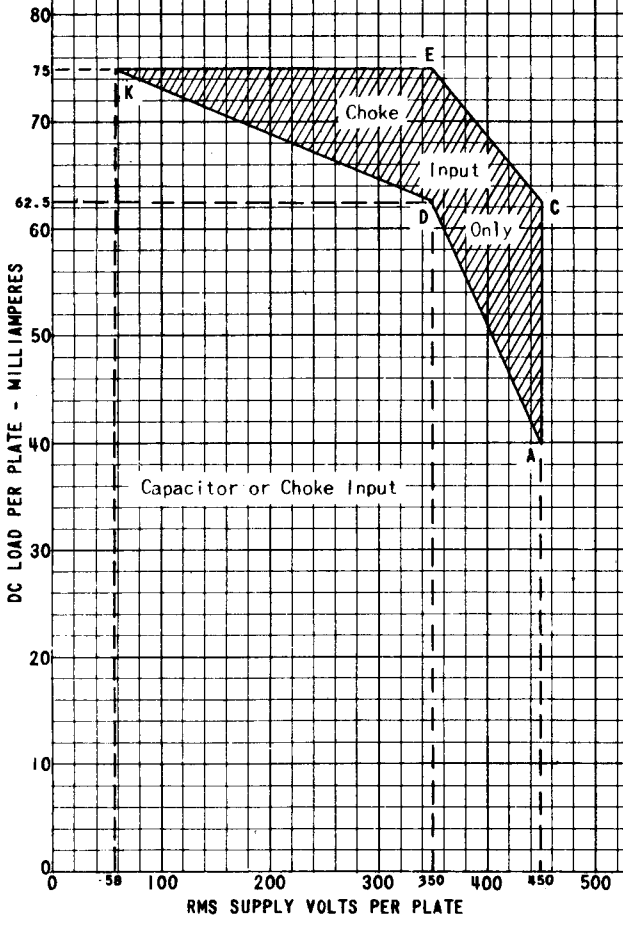

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PLATE 2379
APR. 1 1950

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6AX5GT

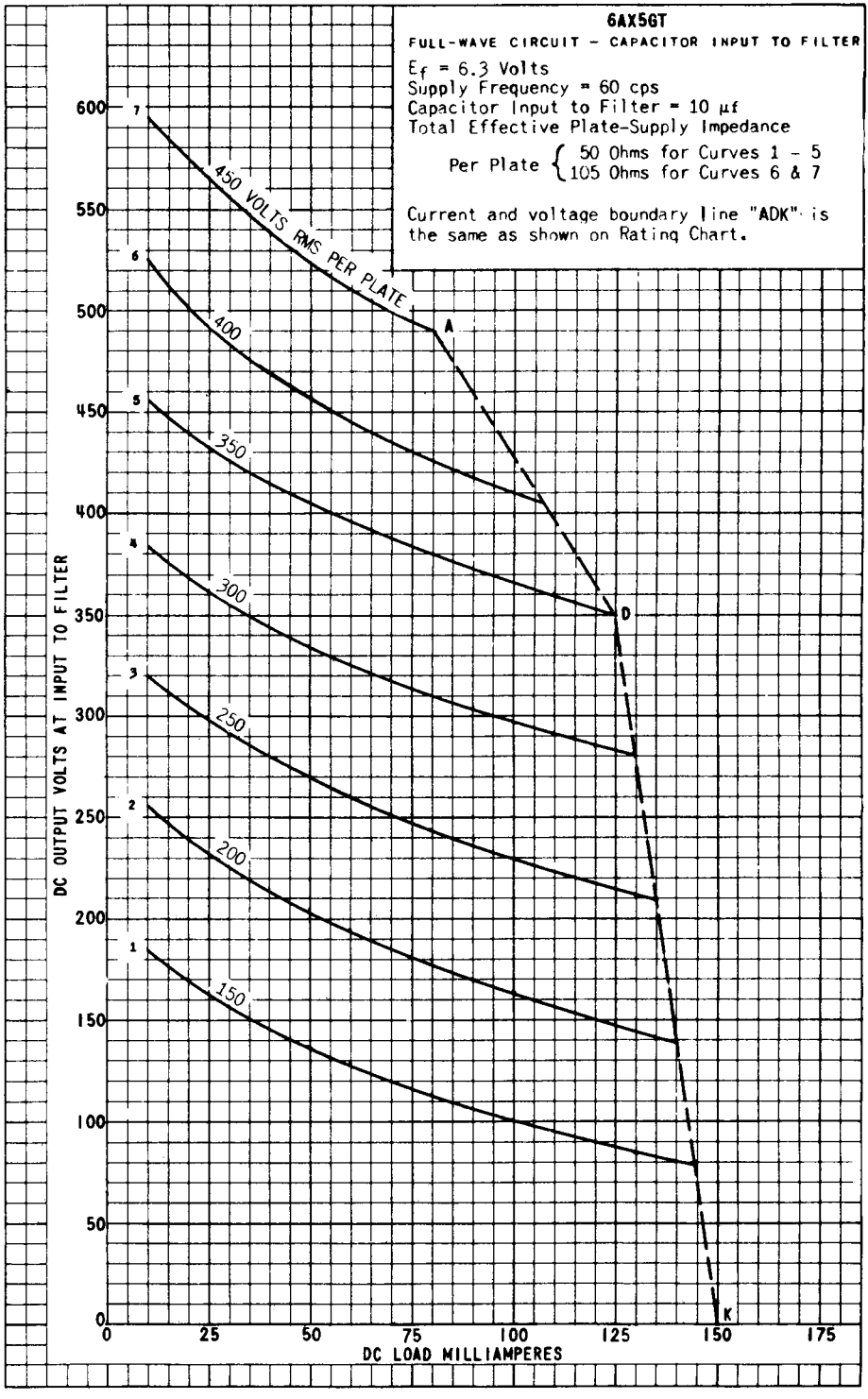

PLATE 2380
APR. 1 1950

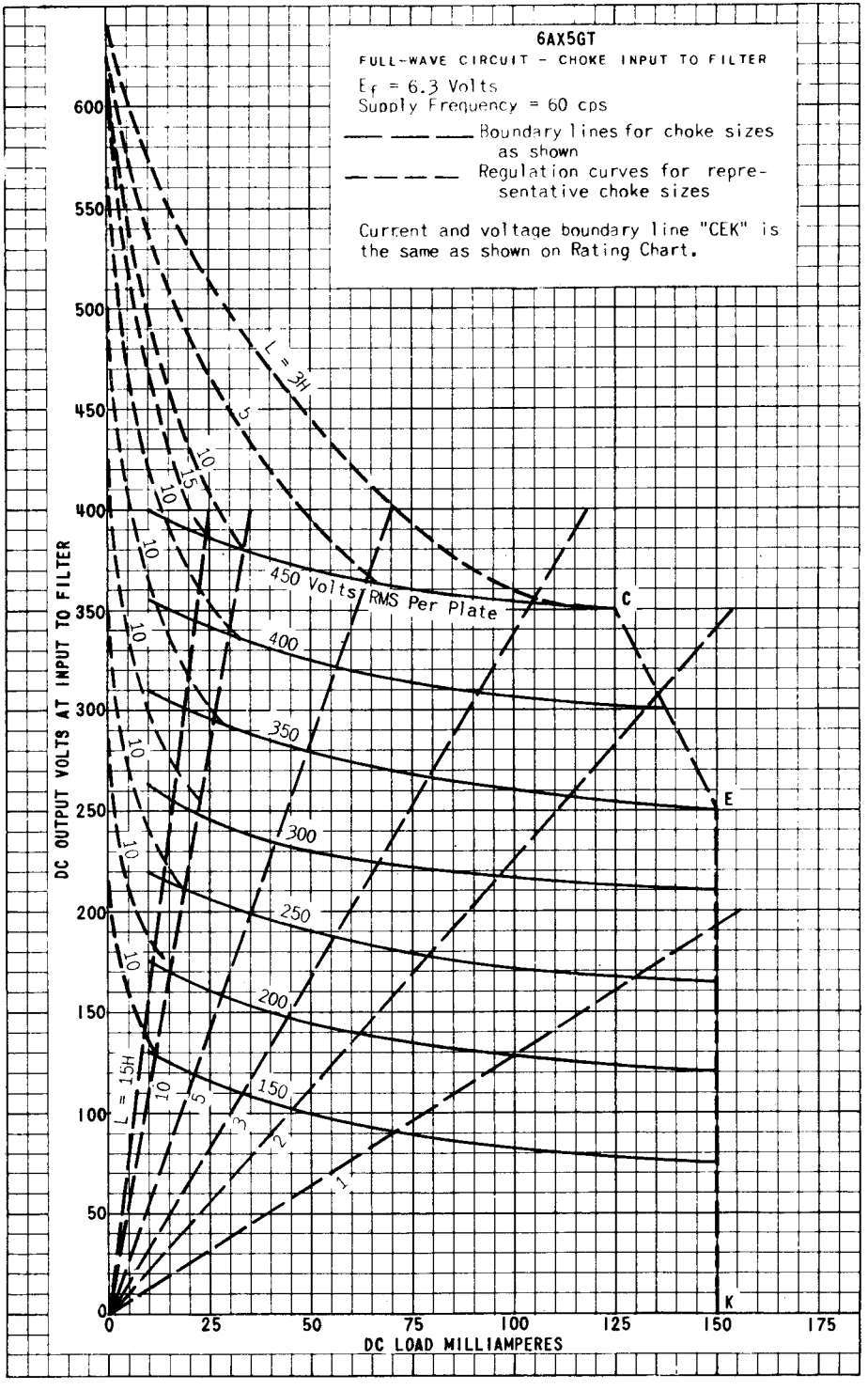

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PLATE 2381

APR. 1 1950

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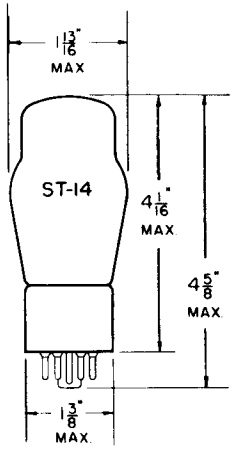
TUNG-SOL

DOUBLE DIODE

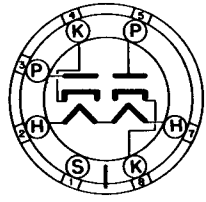


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM SHELL
7 PIN OCTAL
7Q

THE 6AX6G IS A FULL-WAVE HIGH VACUUM RECTIFIER DESIGNED FOR DAMPER SERVICE IN TELEVISION DEFLECTION CIRCUITS. IT CAN ALSO BE USED IN CONVENTIONAL RECTIFIER APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	2.5	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE (PER PLATE):		
RECTIFIER SERVICE	1250	VOLTS
DAMPER SERVICE[A]	2000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	600	MA.
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE	125	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 250 MA. EACH PLATE)	21	VOLTS

[A] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER - CONDENSER INPUT

AC VOLTAGE EACH PLATE (RMS)	350	VOLTS
DC OUTPUT CURRENT	250	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE[B]	145	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):		
AT HALF-LOAD CURRENT OF 125 MA.	395	VOLTS
AT FULL-LOAD CURRENT OF 250 MA.	350	VOLTS

[B] WHEN FILTER CAPACITORS LARGER THAN 40 μf ARE USED IT MAY BE NECESSARY TO INCREASE PLATE SUPPLY IMPEDANCE ABOVE THE VALUE SHOWN.

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PLATE
2433
JULY 1
1950

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TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

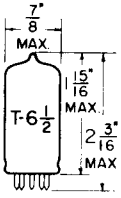
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
6.3 VOLTS	3.15 VOLTS
0.3 AMP.	0.6 AMP.

AC OR DC

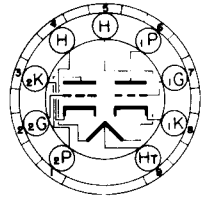
ANY MOUNTING POSITION



GLASS BULB

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

CONTROL OF HEATER CHARACTERISTICS APPLIES ONLY TO 600 MA. HEATER CONNECTION.



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9A

THE 6AX7 COMBINES TWO COMPLETELY INDEPENDENT HIGH-MU TRIODES IN THE SMALL 9 PIN BUTTON CONSTRUCTION AND IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS ADAPTABLE TO APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATION, SUCH AS VOLTAGE AMPLIFIERS; PHASE INVERTERS AND MULTIVIBRATORS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 12AX7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	1.7	1.7	μμf
INPUT	1.8	1.6	μμf
OUTPUT (SECTION 1)	1.9	0.46	μμf
OUTPUT (SECTION 2)	1.9	0.34	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

	3.15	6.3	
HEATER VOLTAGE			VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE		50	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE		0	VOLTS
MAXIMUM PLATE DISSIPATION		1	WATT
HEATER WARM-UP TIME (APPROX.)*		11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

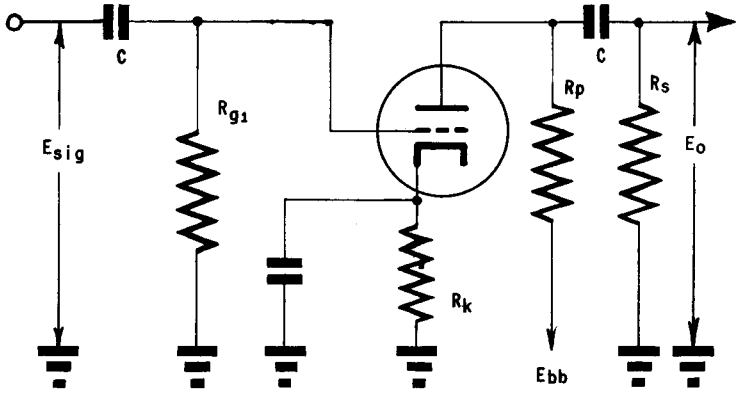
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE (PARALLEL CONNECTION)	3.15	3.15	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−2	VOLTS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
PLATE CURRENT	0.5	1.2	MA.

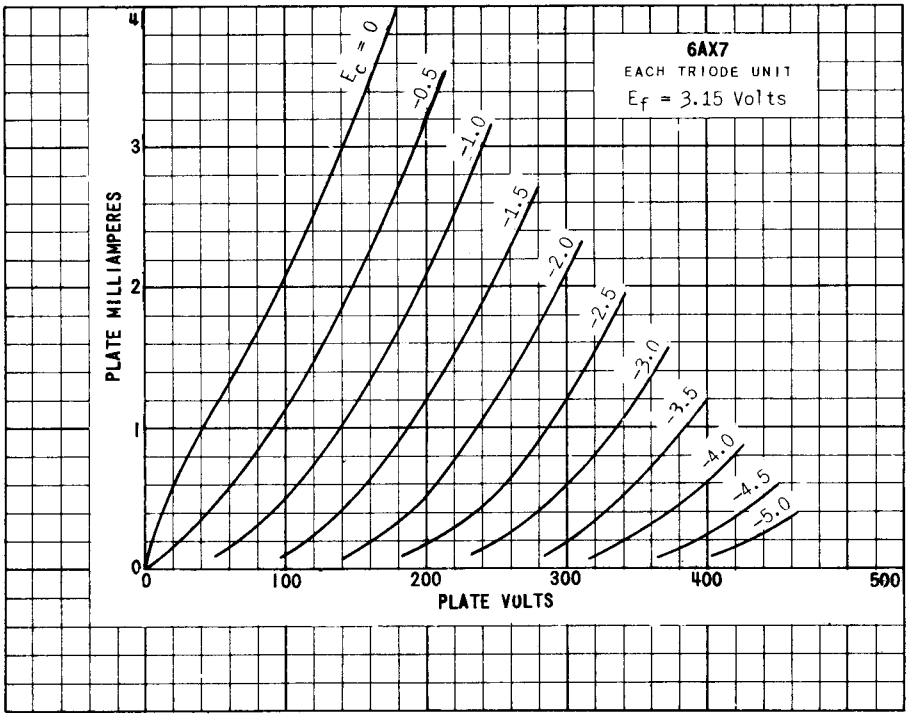
RESISTANCE COUPLED AMPLIFIER

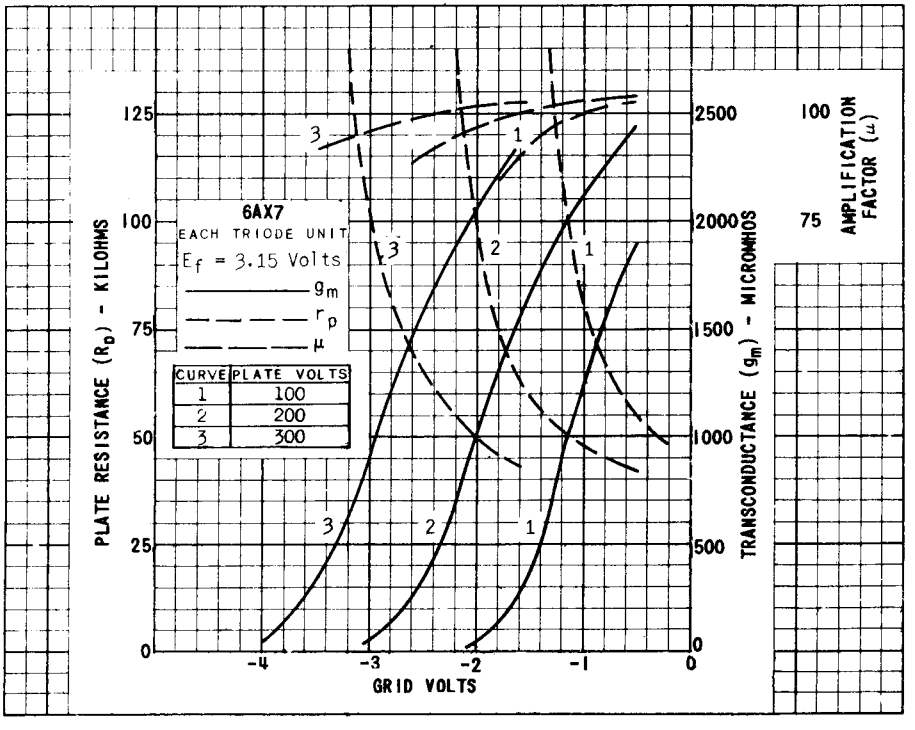
R_p MEG.	R_S MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	.0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.





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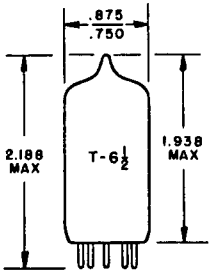
TRIODE – PENTODE

MINIATURE – TYPE

OUTLINE DRAWING
JEDEC 6-2



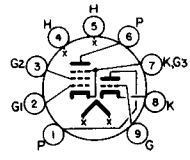
BUTTON BASE
9 PIN JEDEC E9-1

FOR
VIDEO AMPLIFIER
AND
SYNC SEPARATOR USE
IN TV APPLICATIONS

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9AE



BOTTOM VIEW

THE 6AX8 IS A TRIODE AND PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS SPECIFICALLY DESIGNED FOR VIDEO AMPLIFIER AND SYNC SEPARATOR SERVICE IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST

TRIODE UNIT:			
GRID TO PLATE		1.8	pf
GRID TO CATHODE AND HEATER		2.5	pf
PLATE TO CATHODE AND HEATER		1	pf
PENTODE UNIT:			
GRID 1 TO PLATE	MAX.	0.006	pf
GRID 1 TO CATHODE & GRID 3 & INTERNAL SHIELD, GRID 2, AND HEATER		5	pf
PLATE TO CATHODE & GRID 3 & INTERNAL SHIELD, GRID 2, AND HEATER		3.5	pf
HEATER TO CATHODE – EACH UNIT		3.5 ×	pf

X - EXTERNAL SHIELD #315 CONNECTED TO GROUND

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
PEAK HEATER – CATHODE VOLTAGE: EACH UNIT			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

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MAXIMUM RATINGS

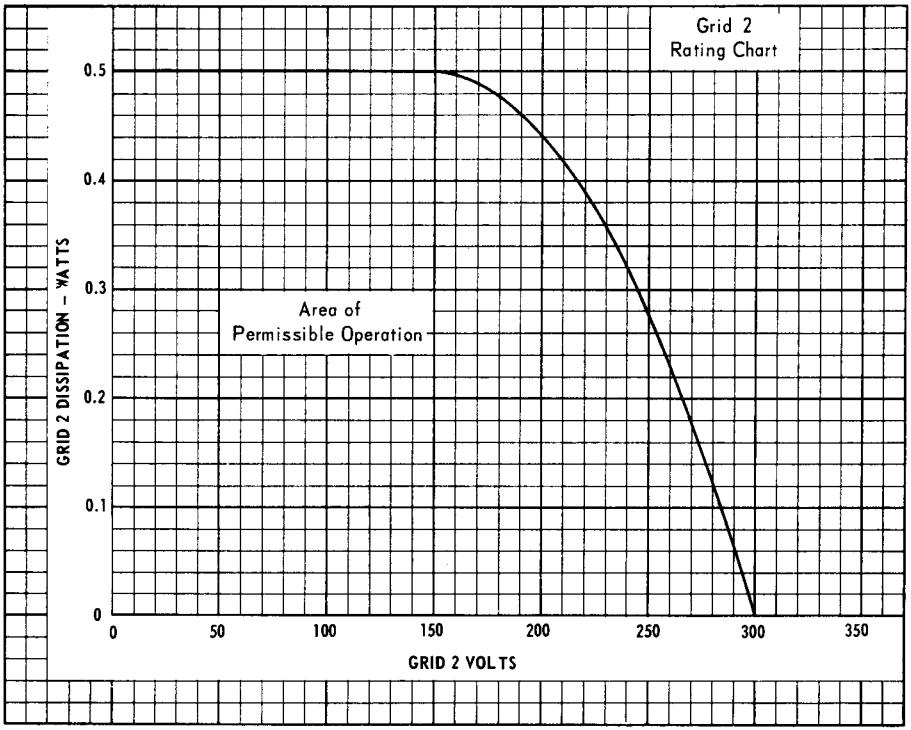
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 SUPPLY VOLTAGE	–	300	VOLTS
GRID 2 VOLTAGE	–	SEE RATING CHART	
GRID 1 VOLTAGE – POSITIVE – BIAS VALUE	0	0	VOLTS
GRID 2 DISSIPATION:			
FOR GRID 2 VOLTAGES UP TO 150 VOLTS	–	0.5	WATT
FOR GRID 2 VOLTAGES BETWEEN 150 AND 300 VOLTS	–	SEE RATING CHART	
PLATE DISSIPATION	2.7	2.8	WATTS
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED – BIAS OPERATION	0.1	0.1	MEGOHM
FOR CATHODE – BIAS OPERATION	0.5	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

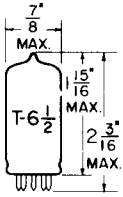
CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
PLATE SUPPLY VOLTAGE	150	250	VOLTS
GRID 2 SUPPLY VOLTAGE	–	110	VOLTS
CATHODE RESISTOR	56	120	OHMS
PLATE CURRENT	18	10	mA
GRID 2 CURRENT	–	3.5	mA
TRANSCONDUCTANCE	8,500	4,800	μMHOS
AMPLIFICATION FACTOR	40	–	
PLATE RESISTANCE – APPROX.	0.005	0.4	MEGOHM
GRID 1 VOLTAGE (APPROX.) FOR I_b = 10μA	–12	–12	VOLTS


Grid 2
Rating Chart
GRID 2 DISSIPATION – WATTS
0.5
0.4
0.3
0.2
0.1
0
Area of
Permissible Operation
0
50
100
150
200
250
300
350
GRID 2 VOLTS

TUNG-SOL

TRIODE PENTODE

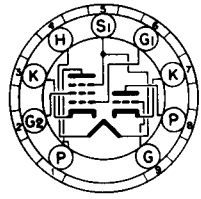


GLASS BULB

UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON NOVAL
9 PIN BASE
9ED

THE 6AZ8 IS A MEDIUM MU TRIODE AND A SEMI-REMOTE CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR GENERAL PURPOSE APPLICATIONS IN BOTH MONOCHROME AND COLOR TELEVISION RECEIVERS. THE PENTODE UNIT HAS HIGH TRANSCONDUCTANCE AND A SEMI REMOTE CUTOFF CHARACTERISTIC WHICH MINIMIZES CROSS-MODULATION EFFECTS AND OVERLOAD DISTORTION IN PICTURE IF STAGES. IT MAY BE USED AS AN INTERMEDIATE FREQUENCY AMPLIFIER, VIDEO AMPLIFIER, AGC AMPLIFIER, AND AS A REACTANCE TUBE. THE TRIODE UNIT, WHICH HAS A RELATIVELY HIGH ZERO-BIAS PLATE CURRENT, IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR SYNC-SEPARATOR, SYNC-CLIPPER, AND PHASE SPLITTER CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE UNIT:		
GRID TO PLATE	1.7	μμf
GRID TO HEATER & INTERNAL SHIELD, & CATHODE	2	μμf
PLATE TO HEATER & INTERNAL SHIELD, & CATHODE	1.7	μμf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.02	μμf
GRID #1 TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, AND CATHODE	6.5	μμf
PLATE TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, AND CATHODE	2.2	μμf
TRIODE GRID TO PENTODE PLATE (MAX.)	0.027	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.020	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.045	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	---	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE: POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6 ←	2	WATTS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
MAXIMUM GRID #2 INPUT:			
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	---	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300 VOLTS	---	SEE RATING CHART	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	A	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	A	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

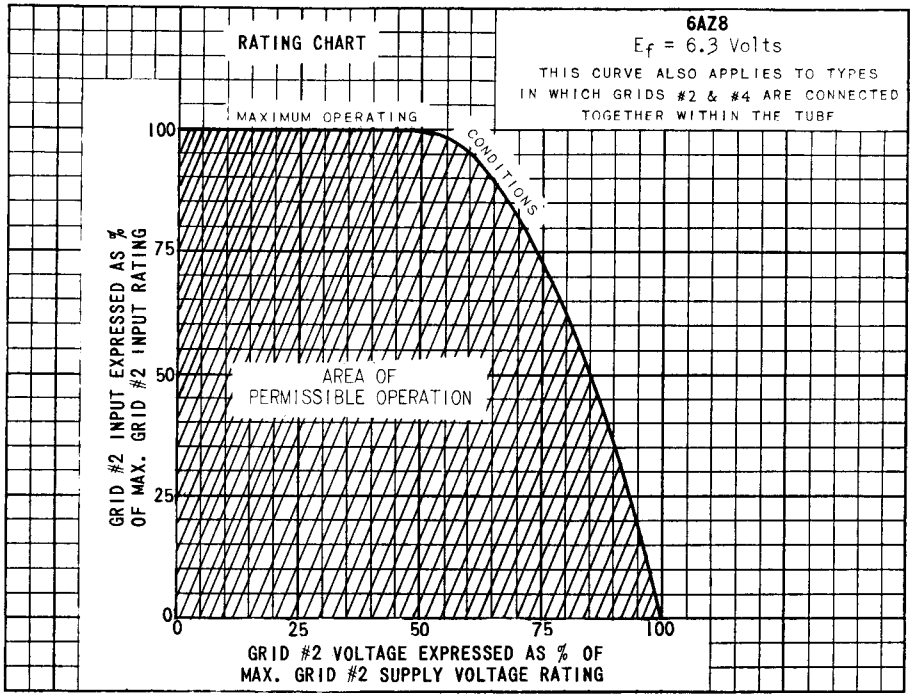
CLASS A_1 AMPLIFIER

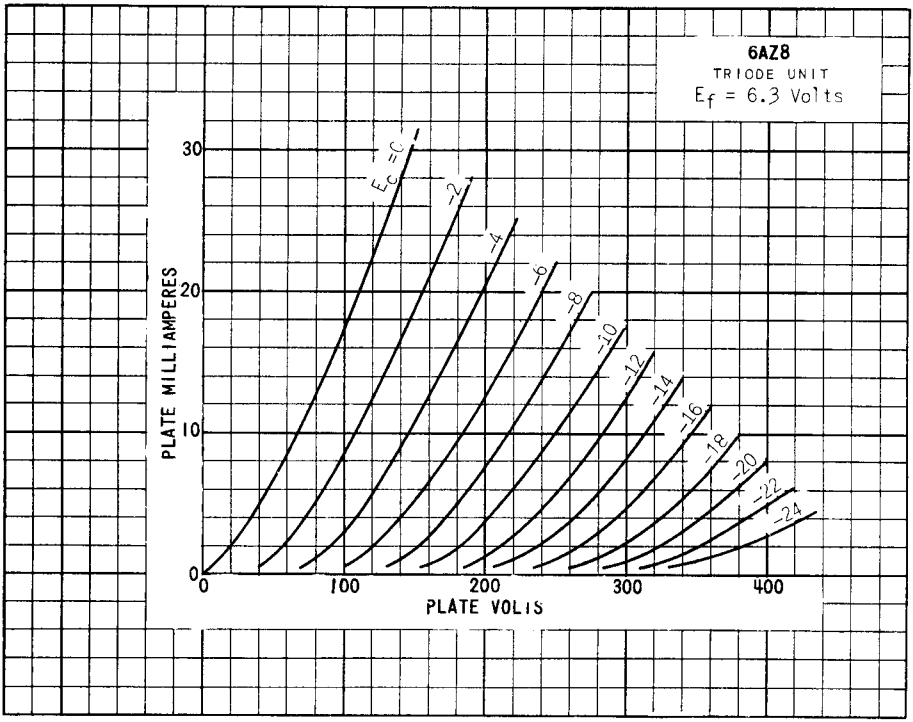
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE-BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	3 300	6 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-19	---	VOLTS
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE OF 100 μMHOS	---	-12.5	VOLTS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	3	MA.
GRID #1 CIRCUIT RESISTANCE (MAX.)[C]			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

[A] THE HEATER-CATHODE VOLTAGE SHOULD NOT EXCEED THE VALUE OF THE OPERATING CATHODE BIAS BECAUSE THE VOLTAGE BETWEEN THE HEATER AND CATHODE IS ALSO APPLIED BETWEEN THE CATHODE AND GRID #3, THE NET RESULT IS TO MAKE GRID #3 NEGATIVE WITH RESPECT TO CATHODE WITH POSSIBLE CHANGE IN TUBE CHARACTERISTICS.

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[C] IF EITHER UNIT IS OPERATED AT MAXIMUM RATED CONDITIONS, GRID #1 CIRCUIT RESISTANCES FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.





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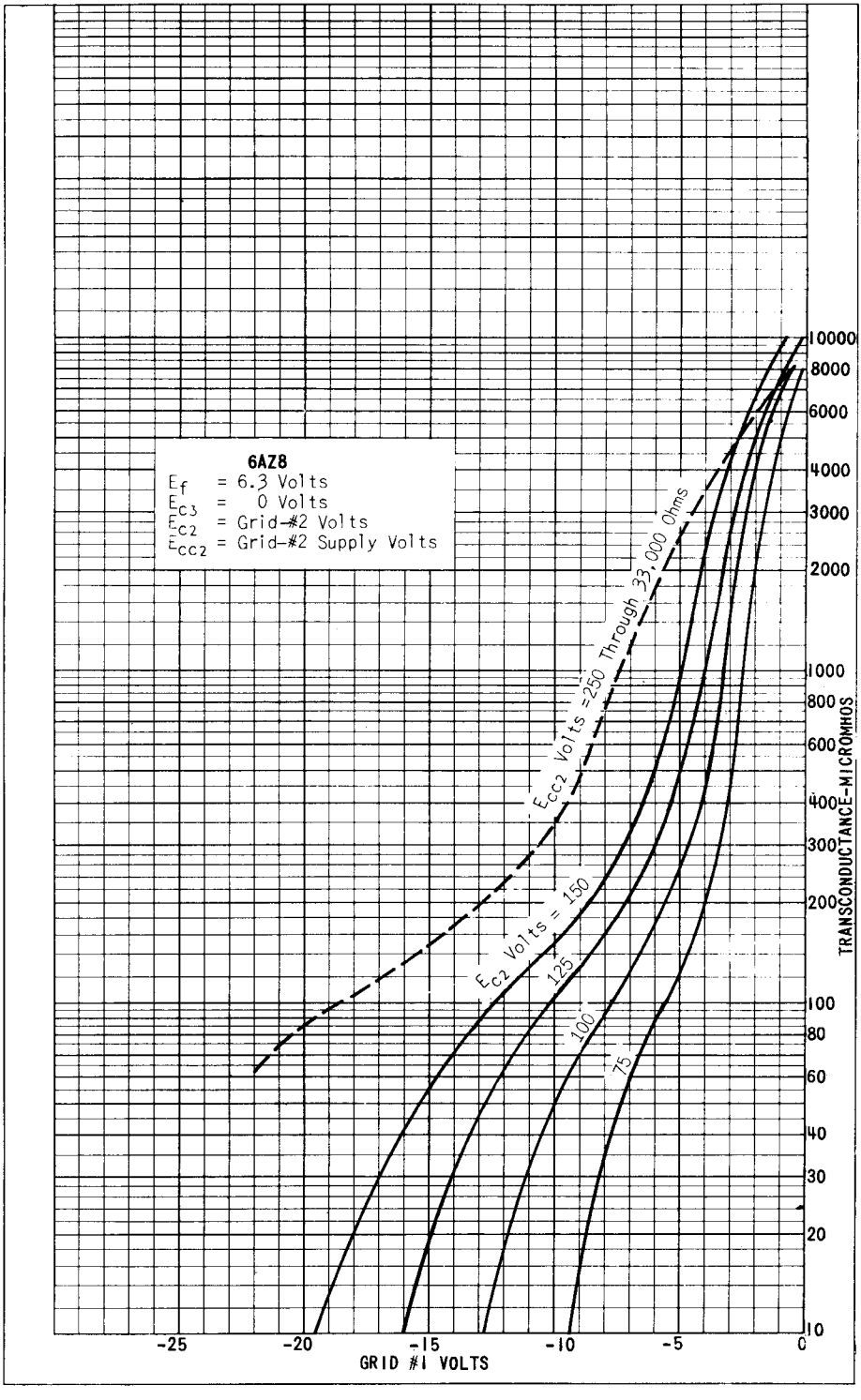
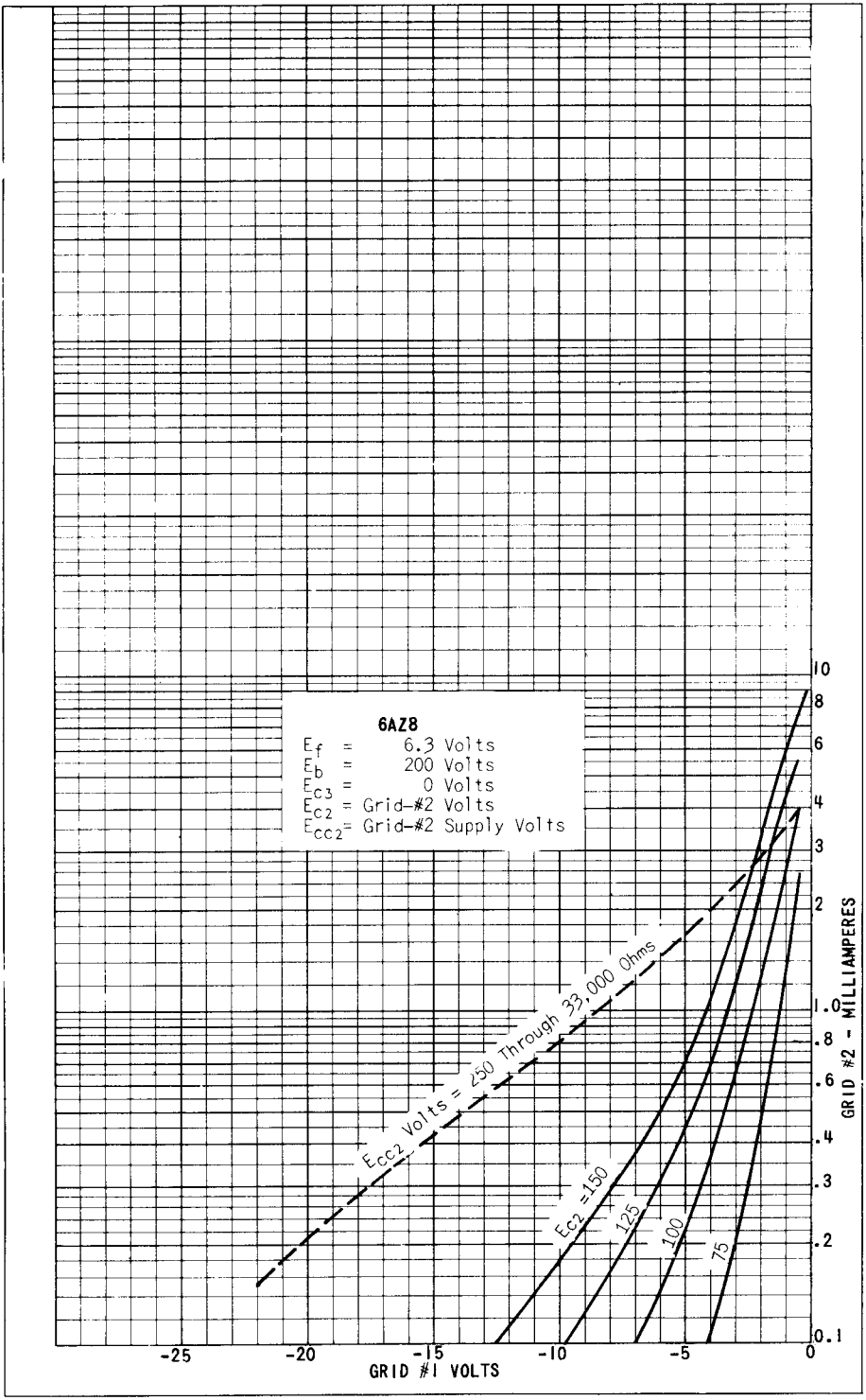

6AZ8
E_f = 6.3 Volts
E_{c3} = 0 Volts
E_{c2} = Grid-#2 Volts
E_{cc2} = Grid-#2 Supply Volts
E_{cc2} Volts = 250 Through 33,000 Ohms
E_{c2} Volts = 150
125
100
75
10000
8000
6000
4000
3000
2000
1000
800
600
400
300
200
100
80
60
40
30
20
10
TRANSCONDUCTANCE-MICROMHOS
-25
-20
-15
-10
-5
0
GRID #1 VOLTS



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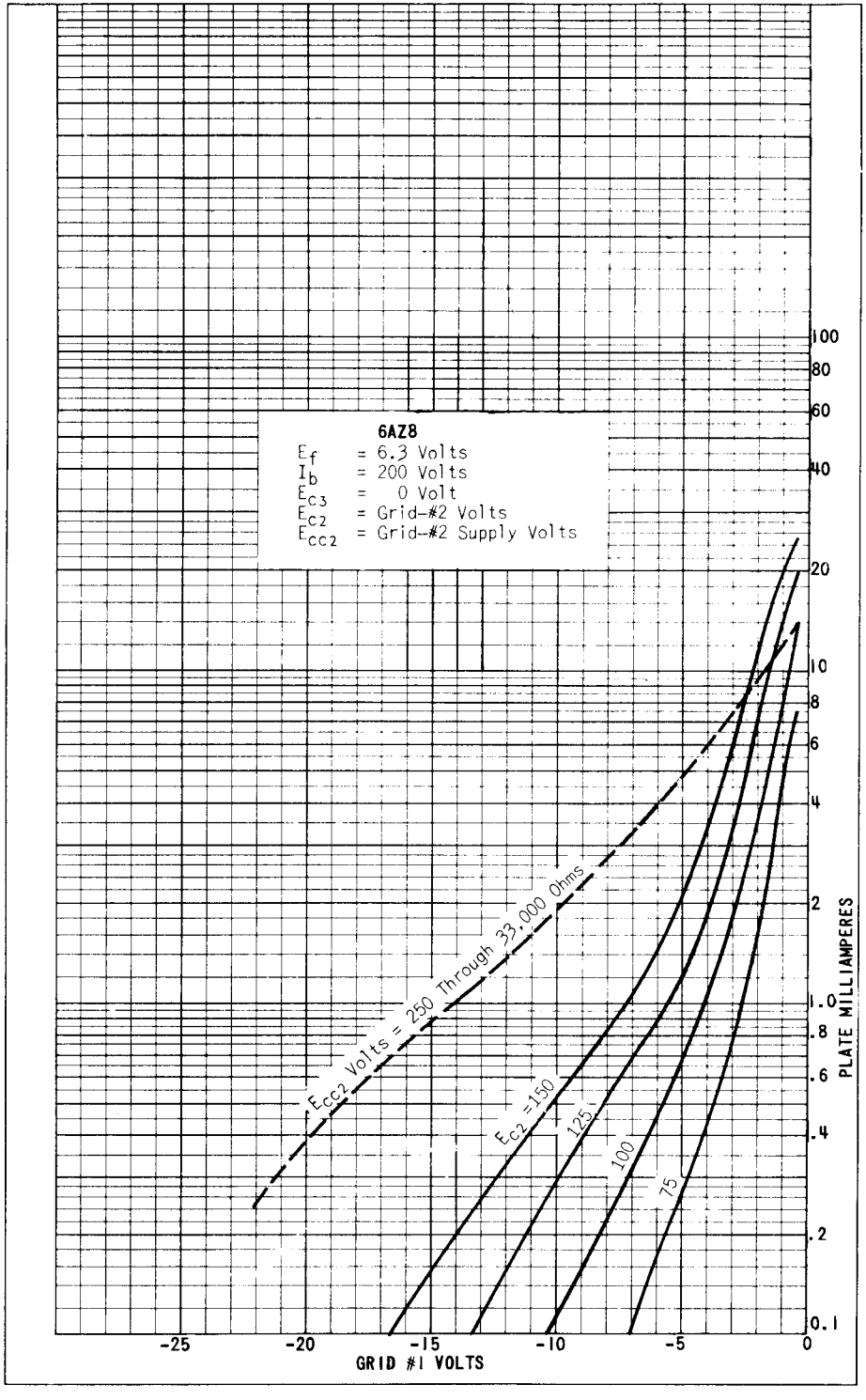
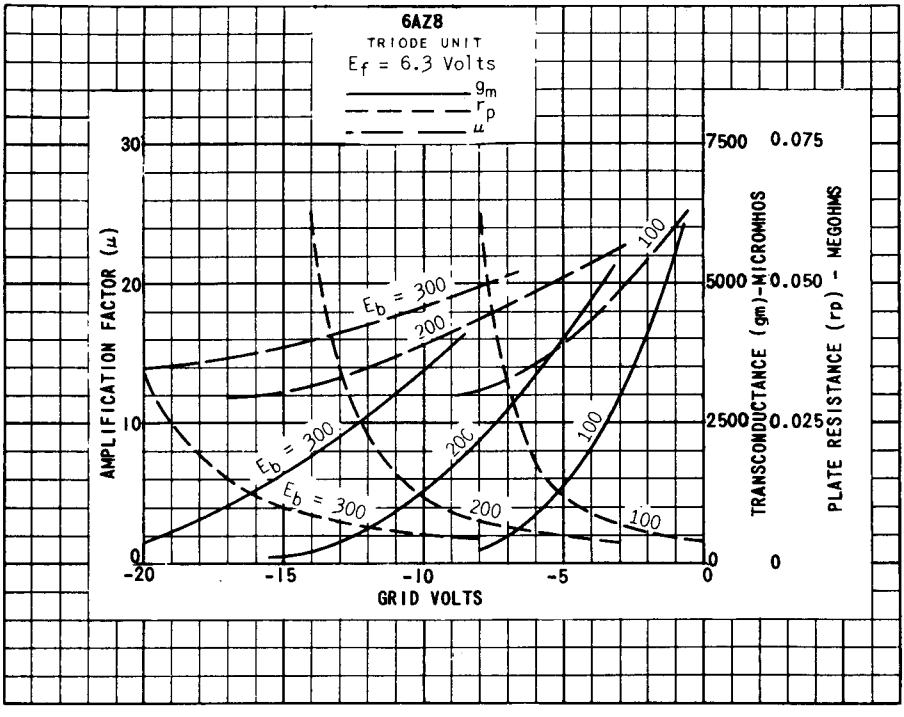
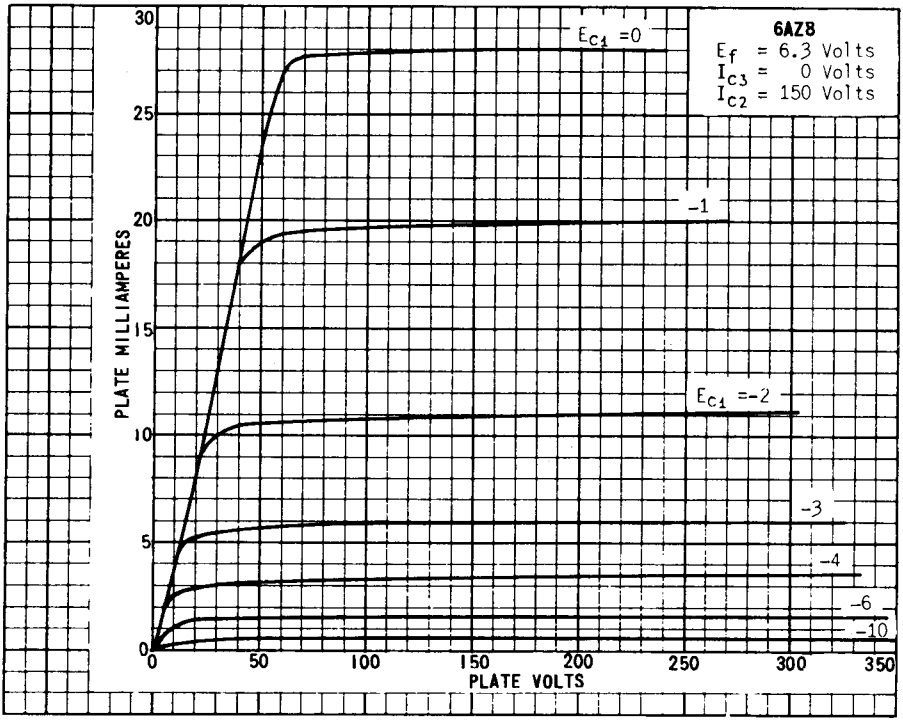
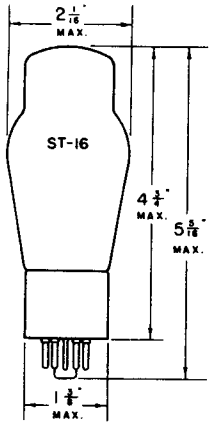

6AZ8
E_f = 6.3 Volts
I_b = 200 Volts
E_{c3} = 0 Volt
E_{c2} = Grid-#2 Volts
E_{cc2} = Grid-#2 Supply Volts
E_{cc2} Volts = 250 Through 33,000 Ohms
E_{c2} = 150
125
100
75
PLATE MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
.8
.6
.4
.2
0.1
-25
-20
-15
-10
-5
0
GRID #1 VOLTS


6AZ8
TRIODE UNIT
Ef = 6.3 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm)-MICROMHOS
PLATE RESISTANCE (rp) - MEGOHMS
GRID VOLTS
Eb = 300
200
100
30
20
10
0
7500
5000
2500
0.075
0.050
0.025
-20
-15
-10
-5


6AZ8
Ef = 6.3 Volts
Ic3 = 0 Volts
Ic2 = 150 Volts
Ec1 =0
-1
Ec1 =-2
-3
-4
-6
-10
PLATE MILLIAMPERES
PLATE VOLTS
30
25
20
15
10
5
0
50
100
150
200
250
300
350

TUNG-SOL



TRIODE POWER AMPLIFIER

COATED FILAMENT

6.3 VOLTS 1.0 AMPERE
AC OR DC

GLASS BULB

MEDIUM 8 PIN OCTAL BASE

G-5S

THE TUNG-SOL 6B4G IS A FILAMENT TYPE TRIODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AUDIO AMPLIFIERS WHERE HIGH OUTPUT AND LOW HARMONIC DISTORTION ARE DESIRED. ITS RATINGS AND CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 2A3 AND 6A3.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER – ONE TUBE

PLATE VOLTAGE MAX.	250	VOLTS
GRID VOLTAGE G	–45	VOLTS
GRID CIRCUIT RESISTANCE MAX.		
FIXED BIAS	0.05	MEGOHM
SELF BIAS	0.5	MEGOHM
PLATE CURRENT	60	MA.
PLATE RESISTANCE	800	OHMS
TRANSCONDUCTANCE	5250	μMHOS
AMPLIFICATION FACTOR	4.2	
LOAD RESISTANCE	2500	OHMS
POWER OUTPUT	3.2	WATTS
SECOND HARMONIC DISTORTION	5	PER CENT

CLASS AB1 PUSH – PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

	FIXED BIAS	SELF BIAS	
PLATE VOLTAGE MAX.	325	325	VOLTS
GRID VOLTAGE G	–68	–	VOLTS
SELF BIAS RESISTOR	–	750	OHMS
ZERO-SIGNAL PLATE CURRENT PER TUBE	40	40	MA.
LOAD RESISTANCE PER TUBE	750	1250	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	3000	5000	OHMS
TOTAL HARMONIC DISTORTION	2.5	5	PER CENT
POWER OUTPUT	15	10	WATTS

PLATE 174-1

G GRID VOLTAGE MEASURED FROM MID-POINT OF AC OPERATED FILAMENT.

CONTINUED NEXT PAGE

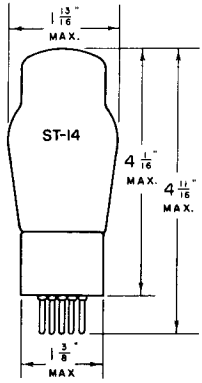
TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

GRID TO FILAMENT	7	μμf
PLATE TO FILAMENT	5	μμf
GRID TO PLATE	16	μμf

PLATE
175-1

TUNG-SOL



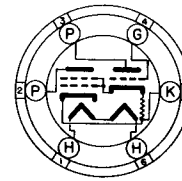
DYNAMIC COUPLED POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.8 AMPERE
AC OR DC

GLASS BULB

MEDIUM 6 PIN BASE



6Db

THE TUNG-SOL 6B5 CONSISTS OF TWO DYNAMICALLY COUPLED TRIODES AND IS DESIGNED FOR SERVICE IN THE POWER OUTPUT STAGE OF AC AND STORAGE BATTERY OPERATED RECEIVERS. ALL NECESSARY BIASES ARE SUPPLIED INTERNALLY. ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6N6G.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

OUTPUT PLATE (2) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT PLATE (3) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT GRID (4) VOLTAGE	0	0	0	VOLTS
GRID CIRCUIT RESISTANCE MAX.	0.5	0.5	0.5	MEGOHM
OUTPUT PLATE CURRENT	33	45	51	MA.
INPUT PLATE CURRENT	6.5	8	9	MA.
PLATE RESISTANCE		24 100		OHMS
TRANSCONDUCTANCE		2400		µMHOS
AMPLIFICATION FACTOR		58		
LOAD RESISTANCE	7000	7000	7000	OHMS
SIGNAL VOLTS (RMS)$	13.5	15	17	VOLTS
TOTAL HARMONIC DISTORTION	5	5	5	PER CENT
POWER OUTPUT	2.5	4	5.2	WATTS

(2) BASE PIN #2 (3) BASE PIN #3 (4) BASE PIN #4

$ FOR RATED POWER OUTPUT

NOTE: THE VOLTAGE BETWEEN HEATER AND CATHODE SHOULD NOT EXCEED 50 VOLTS AND IN NO CASE SHOULD THE HEATER BE LEFT FLOATING.

PLATE
219-1

CONTINUED NEXT PAGE

6B5

TUNG-SOL

CLASS A1 PUSH – PULL AMPLIFIER

UNLESS SPECIFIED, VALUES ARE FOR TWO TUBES

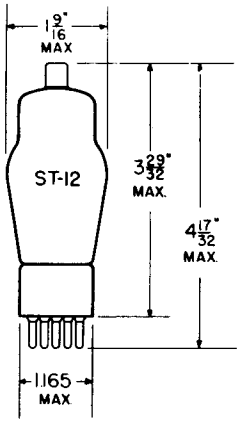
OUTPUT PLATE (2) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT PLATE (3) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT GRID (4) VOLTAGE	0	0	0	VOLTS
GRID CIRCUIT RESISTANCE MAX.	0.5	0.5	0.5	MEGOHM
OUTPUT PLATE CURRENT PER TUBE	33	45	51	MA.
INPUT PLATE CURRENT PER TUBE	6.5	8	9	MA.
LOAD RESISTANCE PLATE TO PLATE	10 000	10 000	10 000	OHMS
SIGNAL VOLTS (RMS) S. GRID TO GRID	38	38	42	VOLTS
TOTAL HARMONIC DISTORTION	5	5	5	PER CENT
POWER OUTPUT	8.5	10	13.5	WATTS

(2) BASE PIN #2 (3) BASE PIN #3 (4) BASE PIN #4

[5] FOR RATED POWER OUTPUT

PLATE
220-1

TUNG-SOL



2A6, 75

SMALL METAL CAP

DUO-DIODE HIGH-MU TRIODE AMPLIFIER

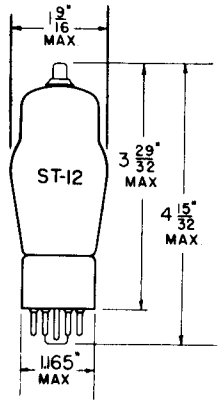
COATED UNIPOTENTIAL CATHODE

2A6	2.5 VOLTS	0.8 AMPERE
75	6.3 VOLTS	0.3 AMPERE
6B6G	6.3 VOLTS	0.3 AMPERE

AC OR DC

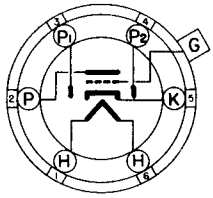
GLASS BULB

ANY MOUNTING POSITION



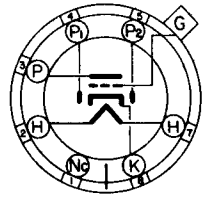
6B6G

SKIRTED MINIATURE CAP



BOTTOM VIEW

SMALL 6-PIN BASE



BOTTOM VIEW

SMALL 7-PIN OCTAL BASE

THE 2A6, 6B6G AND 75 COMBINE TWO DIODES AND A HIGH-MU TRIODE IN A SINGLE BULB, USING A COMMON CATHODE. THEY ARE DESIGNED FOR USE AS DIODE DETECTORS, AVC RECTIFIERS AND RESISTANCE COUPLED AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.
MAXIMUM CATHODE VOLTAGE	100	VOLTS

CONTINUED ON NEXT PAGE

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PLATE 1548
JAN. 15 1945

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE.

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

TRIODE UNIT

GRID TO PLATE	1.7	μμf
INPUT	1.7	μμf
OUTPUT	3.8	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE UNIT

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2.0	VOLTS
PLATE CURRENT	0.9	MA.
PLATE RESISTANCE	91 000	OHMS
TRANSCONDUCTANCE	1 100	μMHOS
AMPLIFICATION FACTOR	100	

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	100	100	250	VOLTS
PLATE LOAD RESISTOR	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	0.0	10 000	4 000	OHMS
GRID CIRCUIT RESISTOR	6.0	1.0	1.0	MEGOHMS
GRID COUPLING CONDENSER	0.01	0.05	0.05	μf
VOLTAGE GAIN	35	35	52	

PLATE
1549
JAN. 15
1945

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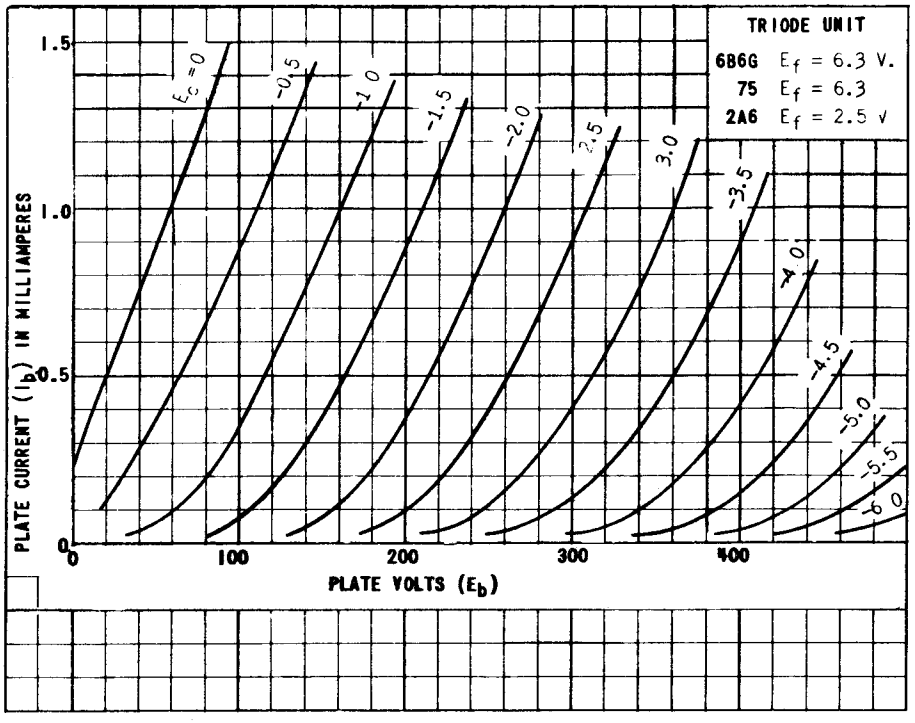

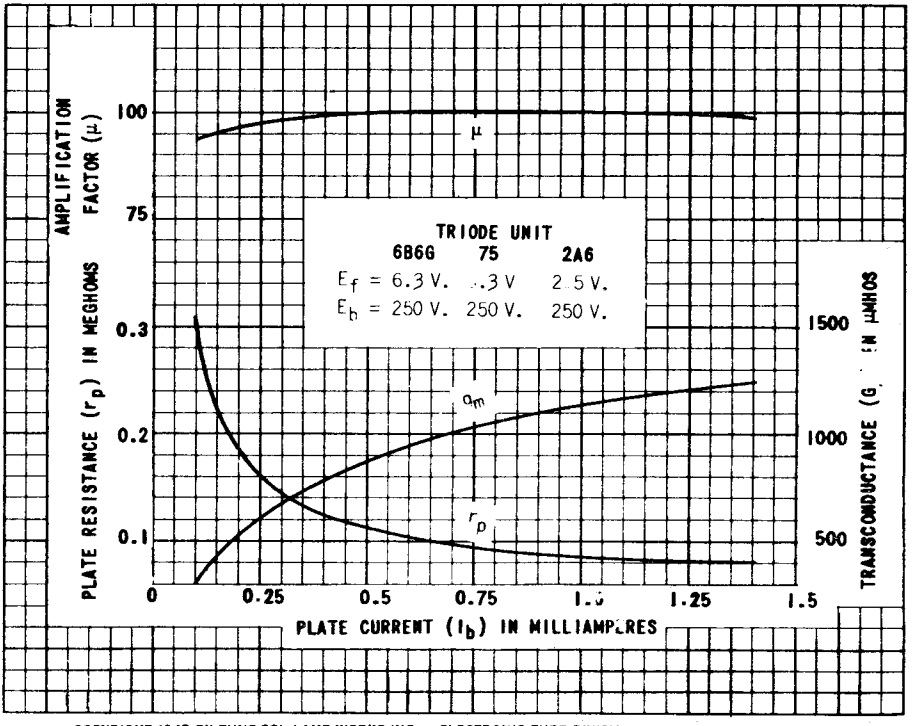

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PLATE
1550
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1945

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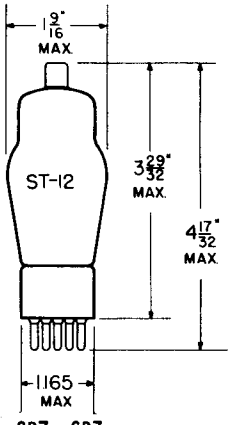
TUNG-SOL



2B7, 6B7

SMALL METAL CAP

DUO-DIODE PENTODE AMPLIFIER

COATED UNIPOTENTIAL CATHODE

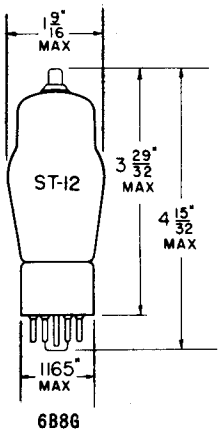
2B7 - 2.5 VOLTS 0.8 AMPERE

6B7 - 6.3 VOLTS 0.3 AMPERE

6B8G - 6.3 VOLTS 0.3 AMPERE

AC OR DC

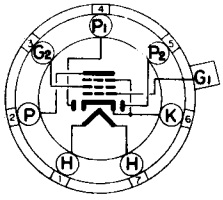
GLASS BULB



6B8G

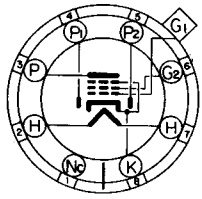
SKIRTED MINIATURE CAP

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL 7-PIN BASE



BOTTOM VIEW

SMALL SHELL 8-PIN OCTAL BASE

THE 2B7, 6B7, AND 6B8G CONSIST OF TWO DIODES AND A PENTODE UTILIZING A COMMON CATHODE. THEY ARE DESIGNED FOR SERVICE AS COMBINED DETECTORS, AVC RECTIFIERS AND PENTODE AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC	0.8	MA.
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PENTODE UNIT

	2B7, 6B7	6B8G	
INPUT: G1 TO (F+K+G2+G3)	3.5	3.6	μμf
OUTPUT: P TO (F+K+G2+G3)	9.5	9.5	μμf
CONTROL GRID TO PLATE	0.007 (MAX.)	0.01 (MAX.)	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	100	180	250	250	VOLTS
SCREEN VOLTAGE	100	75	100	125	VOLTS
CONTROL GRID VOLTAGE	-3.0	-3.0	-3.0	-3.0	VOLTS
PLATE CURRENT	5.8	3.4	6.0	9.0	MA.
SCREEN CURRENT	1.7	0.9	1.5	2.3	MA.
PLATE RESISTANCE (APPROX.)	0.3	1.0	0.8	0.6	MEGOHM
TRANSCONDUCTANCE	950	840	1 000	1 125	μMHOS
GRID BIAS (FOR CATHODE CURRENT CUT-OFF, APPROX.)	-17	-13	-17	-21	VOLTS

PLATE 1552
JAN. 15 1945

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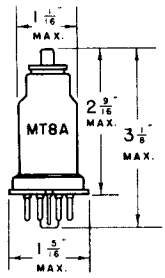
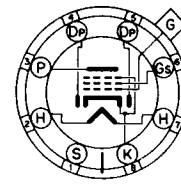


DUO-DIODE PENTODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

METAL SHELL



8E

BOTTOM VIEW

8 PIN OCTAL BASE

THE TUNG-SOL 6B8 COMBINES TWO DIODES AND A PENTODE UTILIZING A COMMON CATHODE. IT IS DESIGNED FOR SERVICE AS A COMBINED DETECTOR. AVC RECTIFIER AND PENTODE AMPLIFIER.

OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE UNIT AS CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	335 MAX.	VOLTS
SCREEN VOLTAGE	125 MAX.	110	VOLTS
CONTROL GRID VOLTAGE	-3	-3	VOLTS
GRID CIRCUIT RESISTANCE	1	1	MEGOHM
PLATE CURRENT	10	8.5	MA.
SCREEN CURRENT	2.3	1.8	MA.
PLATE RESISTANCE APPROX.	0.6	0.96	MEGOHM
TRANSCONDUCTANCE	1325	1250	μMHOS
AMPLIFICATION FACTOR APPROX.	800	1200	
CONTROL GRID VOLTAGE APPROX. FOR CATHODE CURRENT CUT-OFF	-21	-19	VOLTS

PENTODE UNIT AS RESISTANCE COUPLED AMPLIFIER

PLATE, SCREEN SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.1	0.5	0.1	0.5	MEGOHM
CATHODE RESISTOR	2000	4800	1000	2800	OHMS
SCREEN RESISTOR	0.6	2.6	0.6	2.5	MEGOHMS
VOLTAGE GAIN	39	65	50	90	

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	6	μμf
PLATE TO CATHODE	9	μμf
CONTROL GRID TO PLATE	.005 MAX.	μμf

[S] WITH SHELL CONNECTED TO CATHODE

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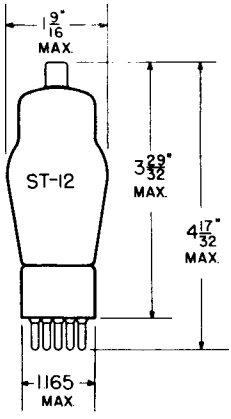


2B7, 6B7

SMALL METAL CAP

DUO-DIODE PENTODE AMPLIFIER

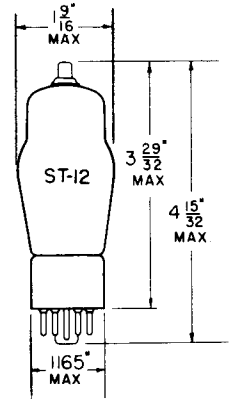
COATED UNIPOTENTIAL CATHODE

2B7	2.5 VOLTS	0.8 AMPERE
6B7	6.3 VOLTS	0.3 AMPERE
6B8G	6.3 VOLTS	0.3 AMPERE

AC OR DC

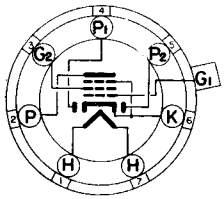
GLASS BULB

ANY MOUNTING POSITION



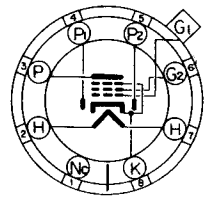
6B8G

SKIRTED MINIATURE CAP



BOTTOM VIEW

SMALL 7-PIN BASE



BOTTOM VIEW

SMALL SHELL 8-PIN OCTAL BASE

THE 2B7, 6B7, AND 6B8G CONSIST OF TWO DIODES AND A PENTODE UTILIZING A COMMON CATHODE. THEY ARE DESIGNED FOR SERVICE AS COMBINED DETECTORS, AVC RECTIFIERS AND PENTODE AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC	0.8	MA.
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATTS

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PLATE 1553
JAN. 15 1945

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TUNG-SOL

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DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PENTODE UNIT

	2B7, 6B7	6B8G	
INPUT: G1 TO (F+K+G2+G3)	3.5	3.6	μμf
OUTPUT: P TO (F+K+G2+G3)	9.5	9.5	μμf
CONTROL GRID TO PLATE	0.007 (MAX.)	0.01 (MAX.)	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	100	180	250	250	VOLTS
SCREEN VOLTAGE	100	75	100	125	VOLTS
CONTROL GRID VOLTAGE	-3.0	-3.0	-3.0	-3.0	VOLTS
PLATE CURRENT	5.8	3.4	6.0	9.0	MA.
SCREEN CURRENT	1.7	0.9	1.5	2.3	MA.
PLATE RESISTANCE (APPROX.)	0.3	1.0	0.8	0.6	MEGOHM
TRANSCONDUCTANCE	950	840	1 000	1 125	μMHOS
GRID BIAS (FOR CATHODE CURRENT CUT-OFF, APPROX.)	-17	-13	-17	-21	VOLTS

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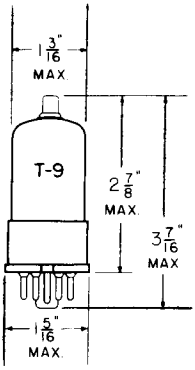
TUNG-SOL

DUO-DIODE PENTODE AMPLIFIER



MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

GLASS BULB

ANY MOUNTING POSITION

BOTTOM VIEW

SMALL WAFER OCTAL 8 PIN BASE

THE 6B8GT COMBINES TWO DIODES AND A PENTODE UTILIZING A COMMON CATHODE. IT IS DESIGNED FOR SERVICE AS A COMBINED DETECTOR, AVC RECTIFIER AND A PENTODE AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO CATHODE

GRID TO PLATE	0.005	μμf
INPUT	4.5	μμf
OUTPUT	10	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	125	VOLTS
GRID VOLTAGE	-3.0	VOLTS
PLATE RESISTANCE	0.6	MEGOHM
TRANSCONDUCTANCE	1 325	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	2.3	MA.
GRID BIAS (FOR CATHODE CURRENT CUT-OFF APPROXIMATE)	-21	MA.

DIODE UNITS - TWO

MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.

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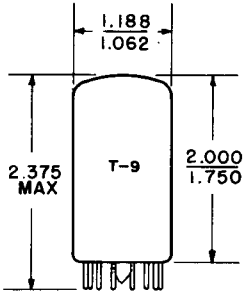
TRIODE - TWIN PENTODE

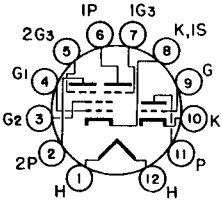


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

COATED UNIPOTENTIAL CATHODE

FOR
VERTICAL DEFLECTION OSCILLATOR
AND COMBINED SYNC-AGC
APPLICATIONS IN TV CIRCUITS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12ER

THE 6BA11 IS A TRIODE-TWIN PENTODE IN A COMPACTRON STRUCTURE. THE MEDIUM MU TRIODE MAY BE USED AS A VERTICAL DEFLECTION OSCILLATOR. THE TWIN PENTODE CONSISTS OF A COMMON CATHODE, FIRST CONTROL GRID AND SCREEN GRID, WITH SEPARATE SECOND CONTROL GRIDS AND PLATES AND IS INTENDED FOR COMBINED SYNC-AGC APPLICATIONS IN TV CIRCUITS. AN INTERNAL GRID SHIELD IS CONNECTED TO THE GRID 2 OF THE PENTODES. AN INTERSECTION SHIELD BETWEEN PENTODES AND TRIODE IS CONNECTED TO PIN 8.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

PENTODE:		
GRID 3 TO PLATE, EACH SECTION	2.0	pf
GRID 1 TO ALL	6.0	pf
GRID 3 (EACH PENTODE) TO ALL	3.6	pf
PLATE (EACH PENTODE) TO ALL	3.0	pf
GRID 3 (PENTODE 1) TO GRID 3 (PENTODE 2) MAX.	0.026	pf
TRIODE:		
GRID TO PLATE, G TO P	2.0	pf
INPUT: G TO (K+H)	2.0	pf
OUTPUT: P TO (K+H+I.S.)	1.9	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME ●		11	SECONDS
LIMITS OF APPLIED VOLTAGE		6.3±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE (BOTH SECTIONS)			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SECTION:	TRIODE	PENTODE	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 VOLTAGE	-----	150	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-----	3.0	VOLTS
NEGATIVE DC GRID 3 VOLTAGE	-----	50	VOLTS
PEAK POSITIVE GRID 3 VOLTAGE	-----	50	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	-----	50	VOLTS
PLATE DISSIPATION (EACH PLATE)	1.5	1.1	WATTS
GRID 2 DISSIPATION	-----	0.75	WATTS
DC CATHODE CURRENT	20	12	MA.
GRID 3 CIRCUIT RESISTANCE (EACH GRID)	-----	0.5	MEGOHMS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.25	0.5	MEGOHMS
CATHODE BIAS	1.0	0.5	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

	TRIODE	PENTODE				
		EACH SECTION[A] SEPARATELY		BOTH SECTIONS[C] OPERATING		
PLATE VOLTAGE	250	100	100	100	100	VOLTS
GRID 2 VOLTAGE	-----	67.5	67.5	67.5	67.5	VOLTS
GRID 3 VOLTAGE	0	0	0	-10	0	VOLTS
GRID 1 VOLTAGE	-11	0	B	B	B	VOLTS
PLATE CURRENT	5.0	-----	2.5	0	2.5	MA.
GRID 2 CURRENT	-----	-----	-----	7.0	4.4	MA.
GRID 1 TRANSCONDUCTANCE	1800	1700	-----	-----	-----	μMHOS
AMPLIFICATION FACTOR	18	-----	-----	-----	-----	
GRID 3 TRANSCONDUCTANCE	-----	-----	450	-----	-----	μMHOS
GRID 1 VOLTAGE (APPROX.) FOR Ib = 100 μA.	-18	2.3	-----	-----	-----	VOLTS
GRID 3 VOLTAGE (APPROX.) FOR Ib = 100 μA.	-----	-----	-3.2	-----	-----	VOLTS

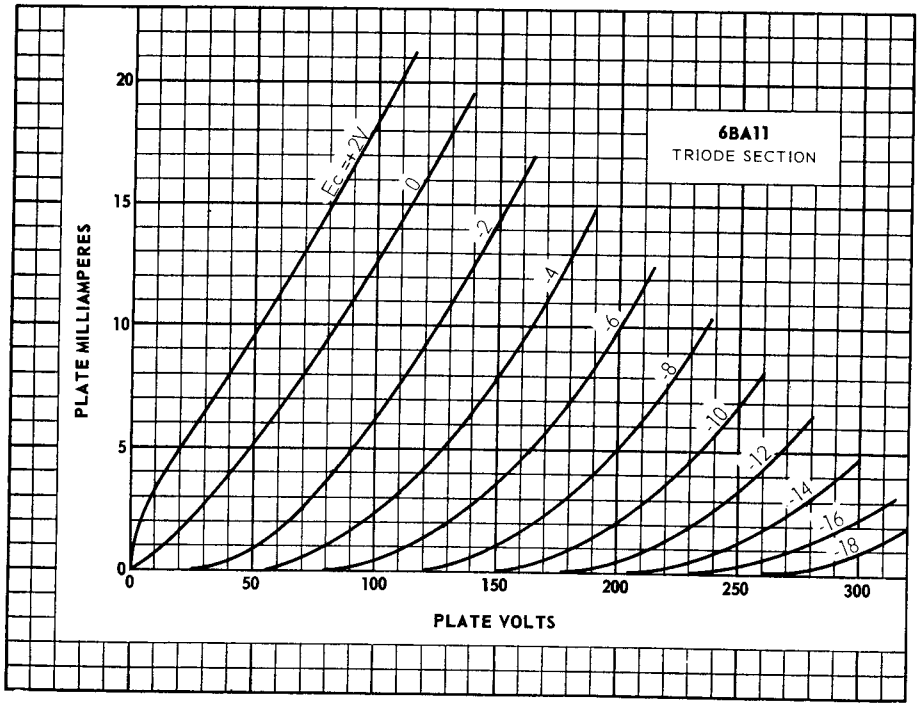
•

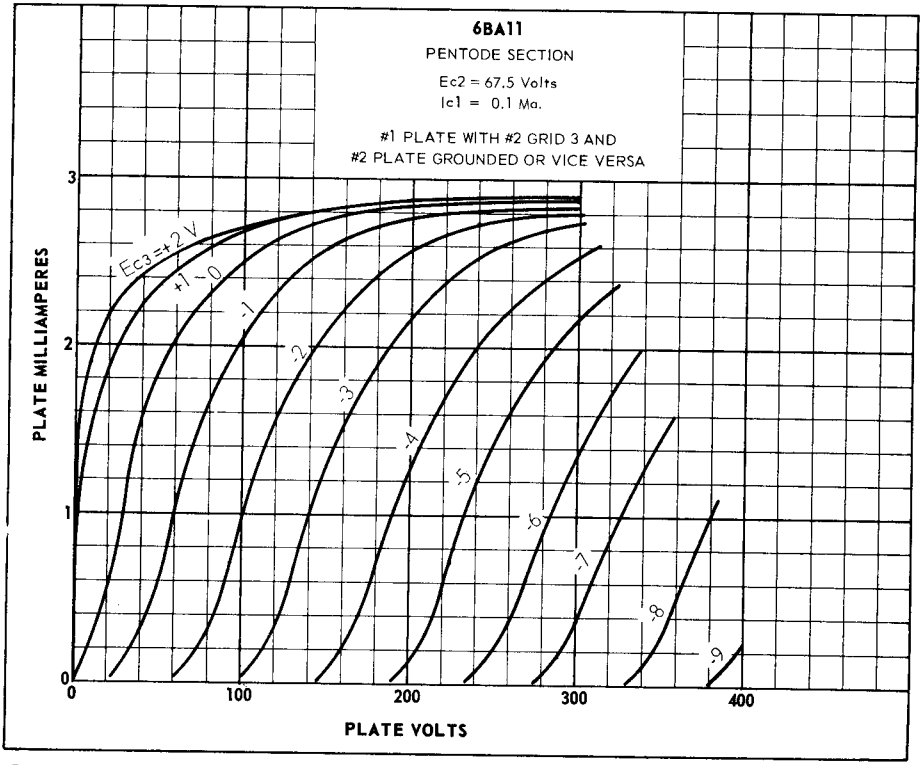
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

A. PLATE AND GRID 3 OF OPPOSITE SECTION GROUNDED.

B. GRID 1 VOLTAGE ADJUSTED SO THAT Ic1 = 100 μA DC.

C. VOLTAGES AND PLATE CURRENT APPLY TO EACH SECTION.





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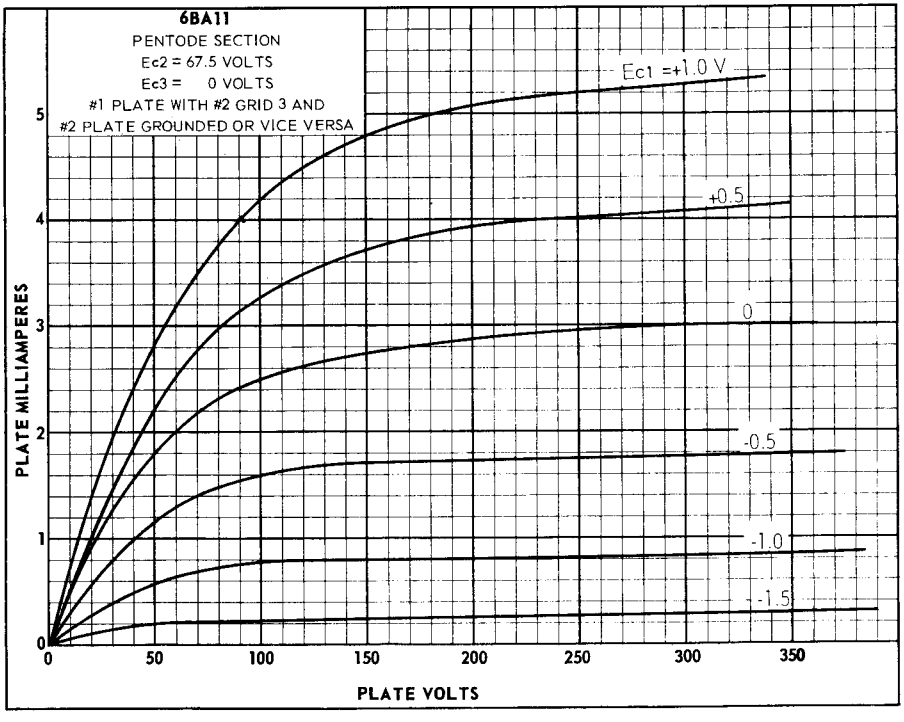
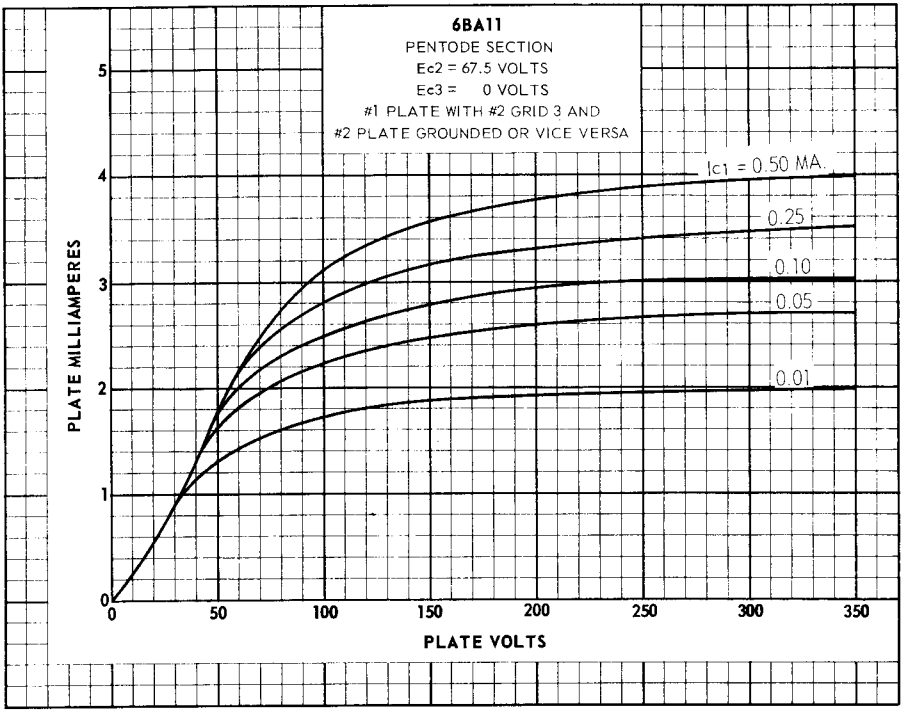
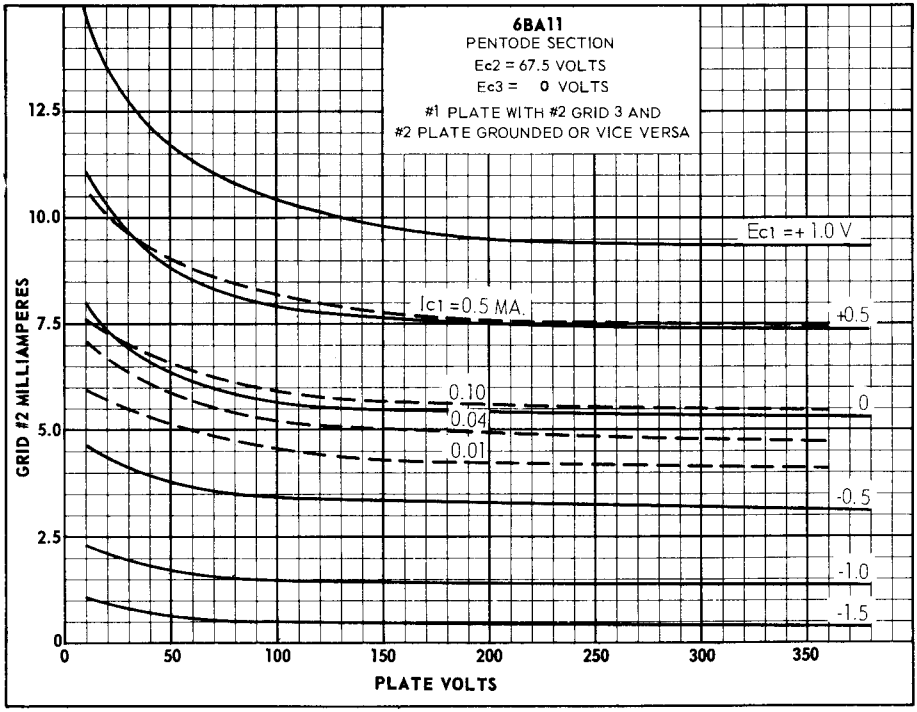
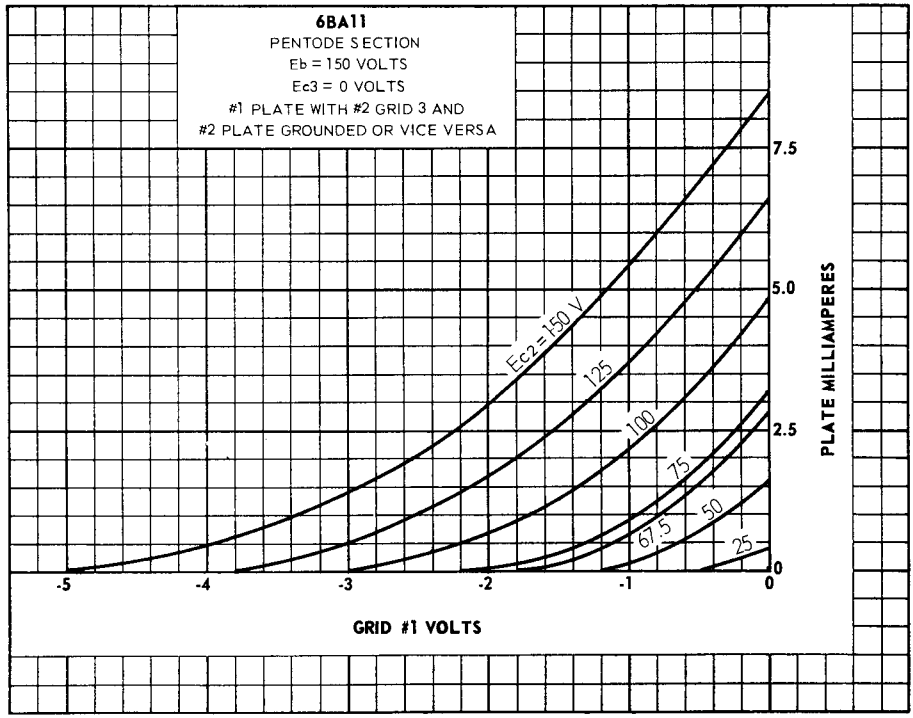

6BA11
PENTODE SECTION
Ec2 = 67.5 VOLTS
Ec3 = 0 VOLTS
#1 PLATE WITH #2 GRID 3 AND
#2 PLATE GROUNDED OR VICE VERSA
Ec1 =+1.0 V
+0.5
0
-0.5
-1.0
-1.5
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
350


6BA11
PENTODE SECTION
Ec2 = 67.5 VOLTS
Ec3 = 0 VOLTS
#1 PLATE WITH #2 GRID 3 AND
#2 PLATE GROUNDED OR VICE VERSA
Ic1 = 0.50 MA.
0.25
0.10
0.05
0.01
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300
350





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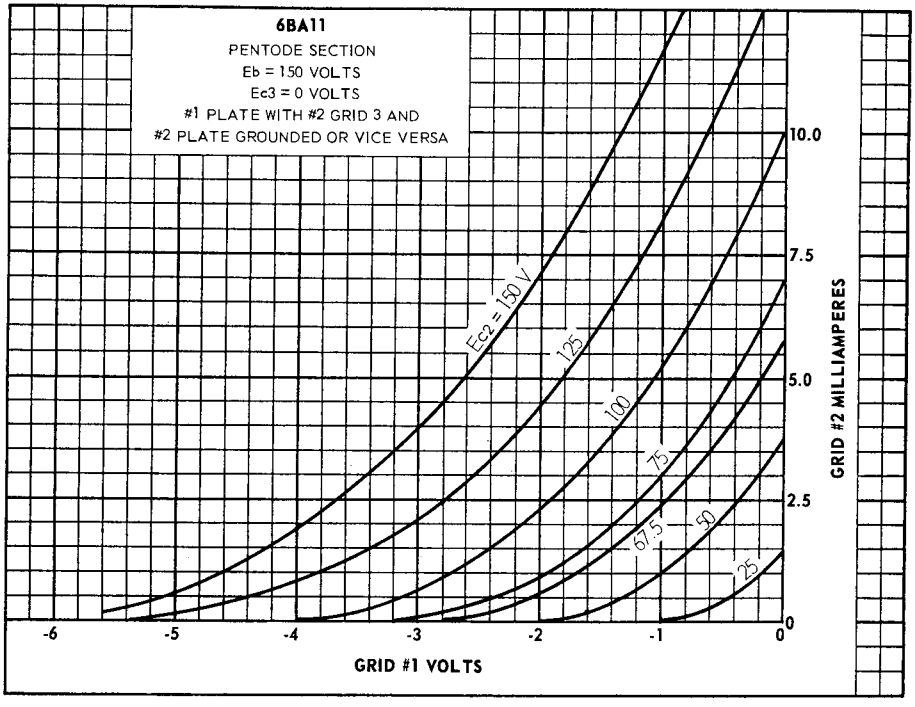
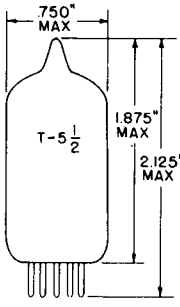

6BA11
PENTODE SECTION
Eb = 150 VOLTS
Ec3 = 0 VOLTS
#1 PLATE WITH #2 GRID 3 AND
#2 PLATE GROUNDED OR VICE VERSA
Ec2 = 150 V
125
100
75
67.5
50
25
10.0
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL



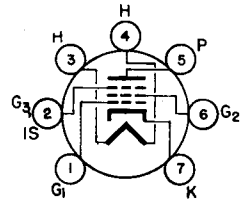
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-2
OUTLINE DRAWING
JEDEC 5-2

PENTODE
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 6BA6 IS A PENTODE AMPLIFIER HAVING REMOTE CONTROL GRID CHARACTERISTIC AND UTILIZING THE MINIATURE CONSTRUCTION. AS AN RF AMPLIFIER IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW GRID-PLATE CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.0035	0.0035	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE (PIN #2 CONNECTED TO PIN #7 AT SOCKET)		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.4	WATTS
MAXIMUM GRID #2 DISSIPATION:		
FOR VOLTAGES UP TO 165 VOLTS	0.7	WATT
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE J5-C4	

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	μMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 μMHOS	-20	-20	VOLTS

→ INDICATES A CHANGE.

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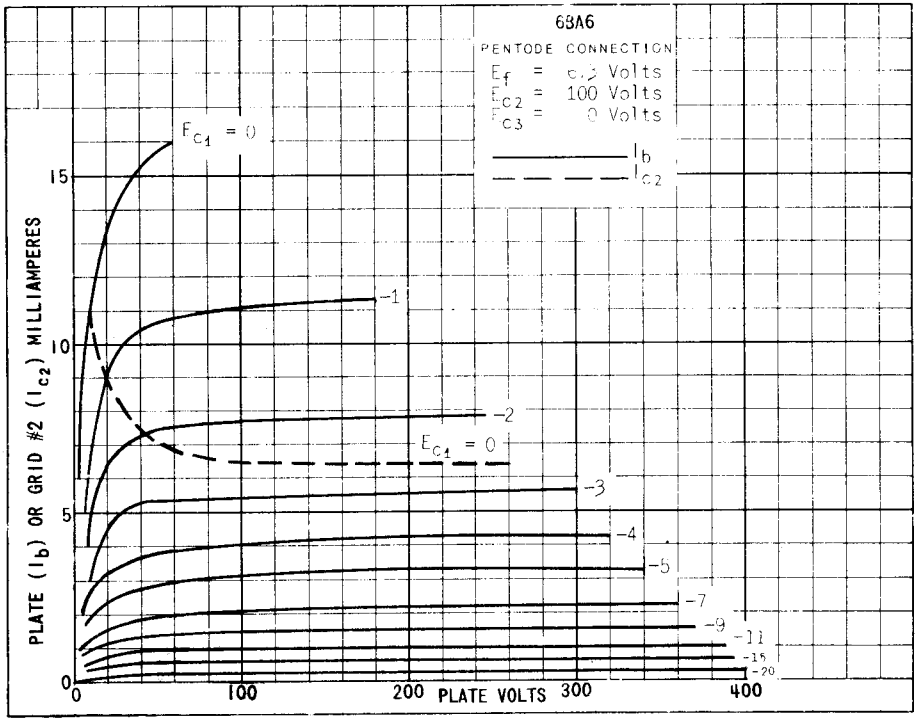
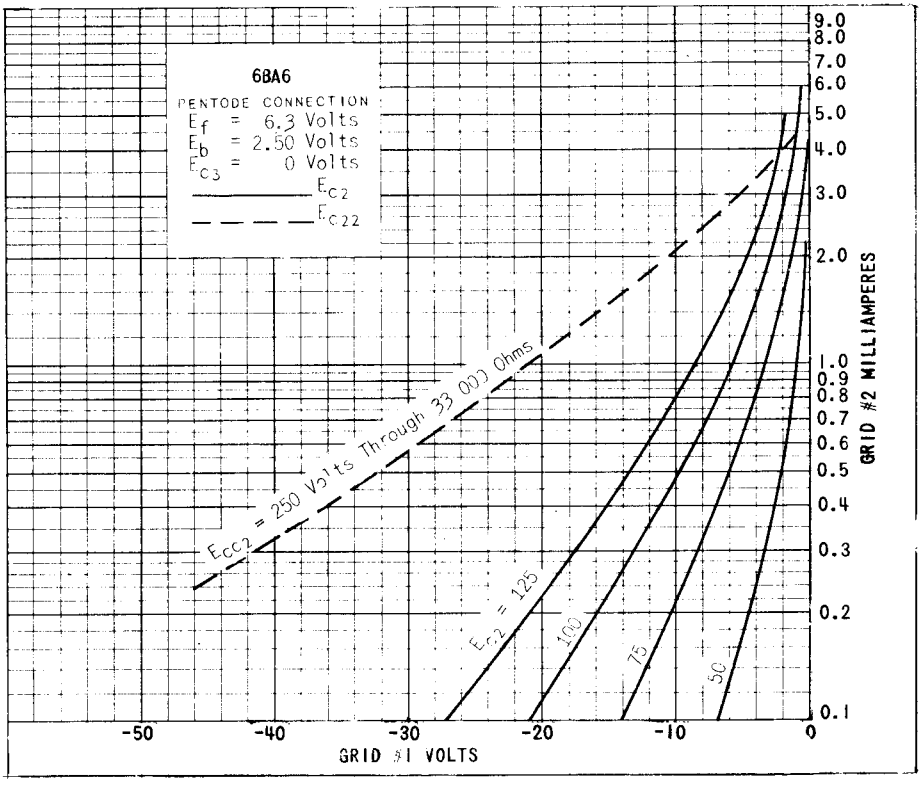
6BA6


6BA6
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
E_{c1} = 0
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
15
0
100
200
300
400
PLATE VOLTS


6BA6
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2}
E_{c22}
E_{cc2} = 250 Volts Through 33 000 Ohms
E_{c2} = 125
100
75
50
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
GRID #2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID #1 VOLTS

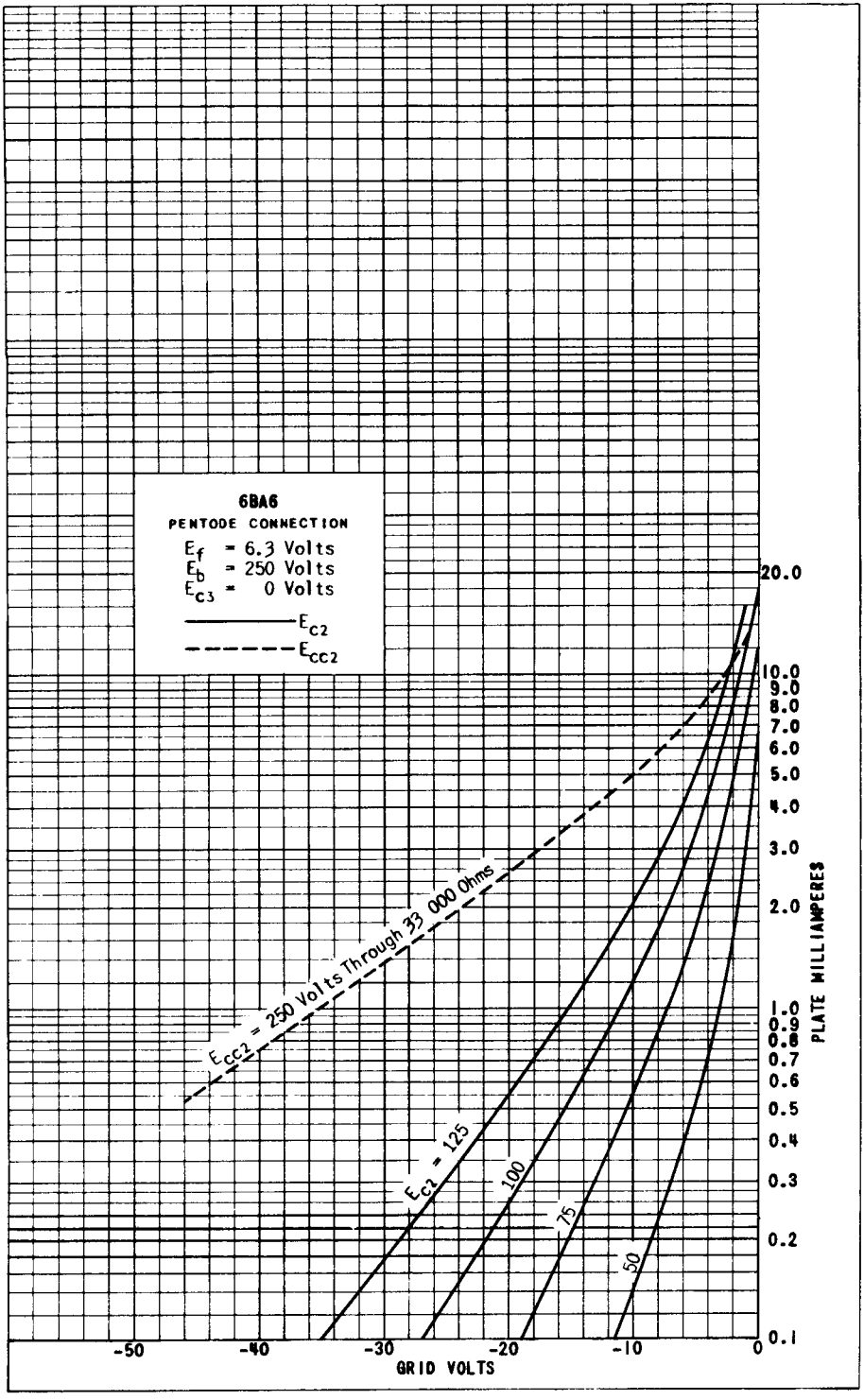


PLATE
1791
MAY 1
1947

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6BA6

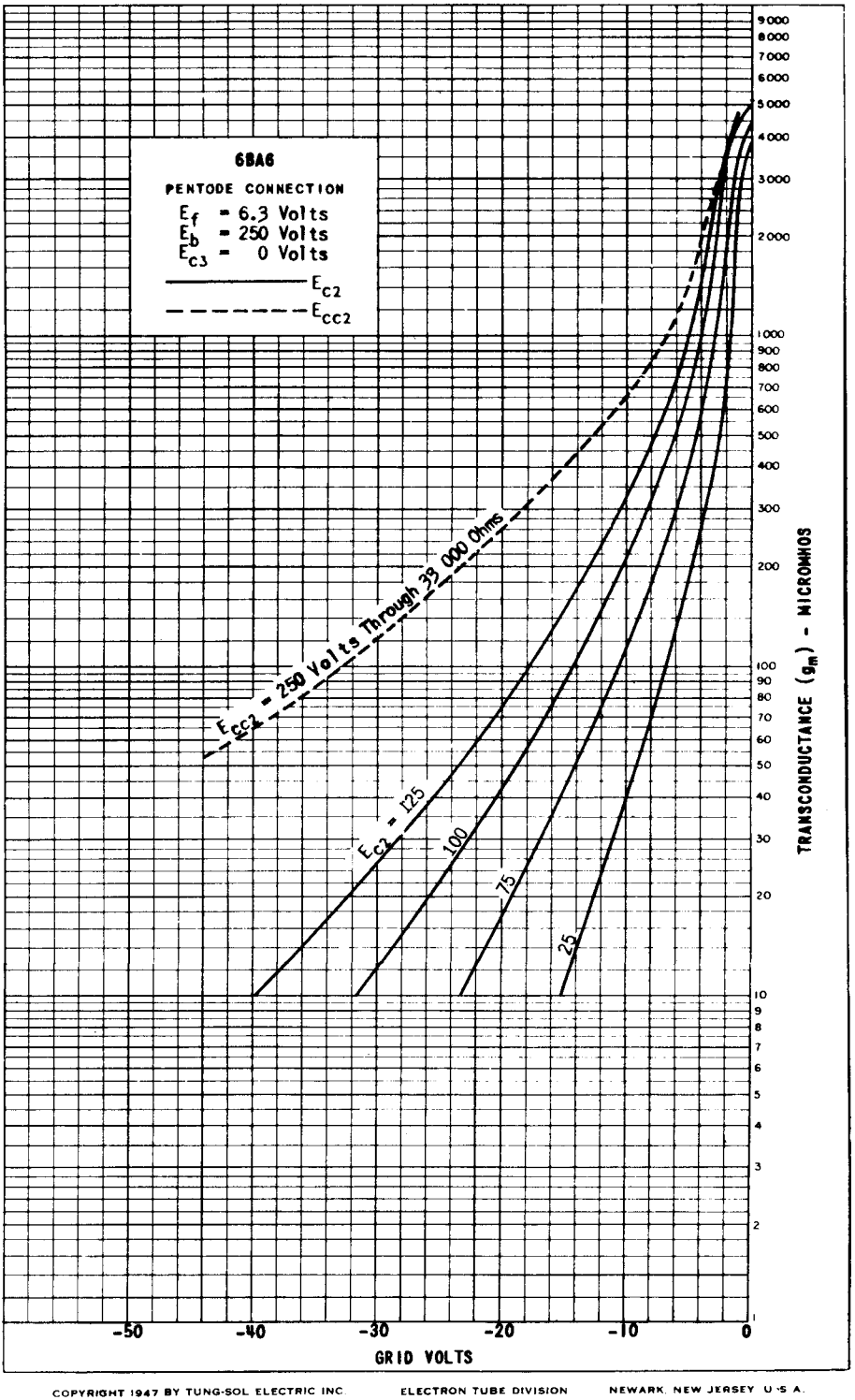

PLATE
1792
MAY
1947

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TUNG-SOL

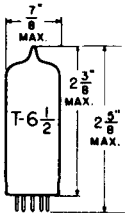
HEPTODE

MINIATURE TYPE

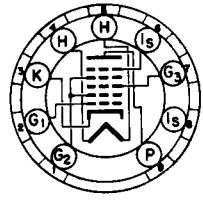
UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

THE 6BA7 IS A CATHODE TYPE HIGH GAIN PENTAGRID CONVERTER IN THE SMALL 9-PIN BUTTON CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A COMBINED LOCAL OSCILLATOR AND MIXER AT HIGH FREQUENCIES, ESPECIALLY IN THE FM BROADCAST BAND.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #3 TO PLATE: (G_3 TO P) MAX.	0.19	μμf
GRID #1 TO GRID #3: (G_1 TO G_3) MAX.	0.1	μμf
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.05	μμf
GRID #1 TO CATHODE: (G_1 TO K)	3.3	μμf
GRID #1 TO ALL EXCEPT CATHODE: G_1 TO (H+G_2&G_4+G_3+G_5+P+IS)	3.4	μμf
CATHODE TO ALL EXCEPT GRID #1: K TO (H+G_2&G_4+G_3+G_5+P+IS)	4	μμf
RF INPUT: G_3 TO (H+K+G_1+G_2&G_4+G_5+P+IS)	9.5	μμf
OSCILLATOR INPUT: G_1 TO (H+K+G_2&G_4+G_3+G_5+P+IS)	6.7	μμf
MIXER OUTPUT: P TO (H+K+G_1+G_2&G_4+G_3+G_5+IS)	8.3	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE GRID #3 VOLTAGE	100	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #5 & INTERNAL SHIELD VOLTAGE[A]	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM GRIDS #2 & #4 DISSIPATION	1.5	WATTS
MAXIMUM CATHODE CURRENT	22	MA.

[A] INTERNAL SHIELD (PINS #6 AND #8) CONNECTED DIRECTLY TO GROUND.

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PLATE
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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE - SEPARATE EXCITATION

THE CHARACTERISTICS SHOWN WITH SEPARATE EXCITATION CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATOR CIRCUIT OPERATING WITH ZERO BIAS.

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	100	VOLTS
GRID #3 VOLTAGE	-1	-1	VOLTS
GRID #5 AND INTERNAL SHIELD[A]	CONNECTED DIRECTLY TO GROUND		
GRID #1 RESISTOR	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1	MEGOHM
CONVERSION TRANSCONDUCTANCE	900	950	µMHOS
PLATE CURRENT	3.6	3.8	MA.
GRIDS #2 & #4 CURRENT	10.2	10	MA.
GRID #1 CURRENT	0.35	0.35	MA.
TOTAL CATHODE CURRENT	14.2	14.2	MA.
CONVERSION TRANSCONDUCTANCE WITH E_{c3} = -20 VOLTS	3.5	3.5	µMHOS

[A] INTERNAL SHIELD (PINS #6 AND #8) CONNECTED DIRECTLY TO GROUND.

OSCILLATOR TRANSCONDUCTANCE

NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRIDS #2 & #4 CONNECTED TO PLATE	100	VOLTS
PLATE CURRENT	32	MA.
TRANSCONDUCTANCE BETWEEN GRID #1 & GRIDS #2 & #4 CONNECTED TO PLATE	8 000	µMHOS
AMPLIFICATION FACTOR	16.5	

SIMILAR TYPE REFERENCE: Ratings and Characteristics similar to 6SB7Y.

PLATE 2080
OCT. 1, 1948

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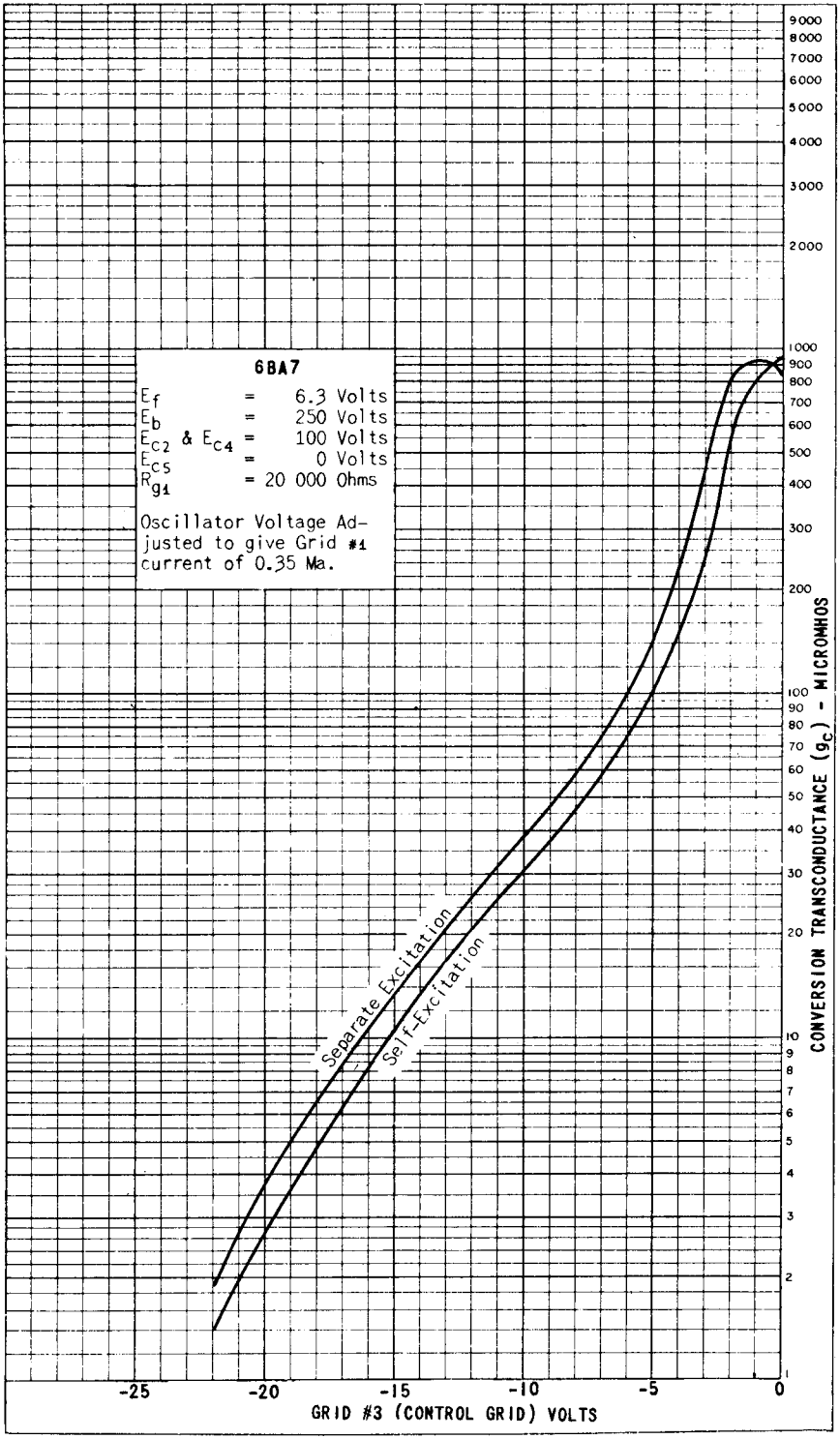

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OCT. 1, 1948

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6BA7

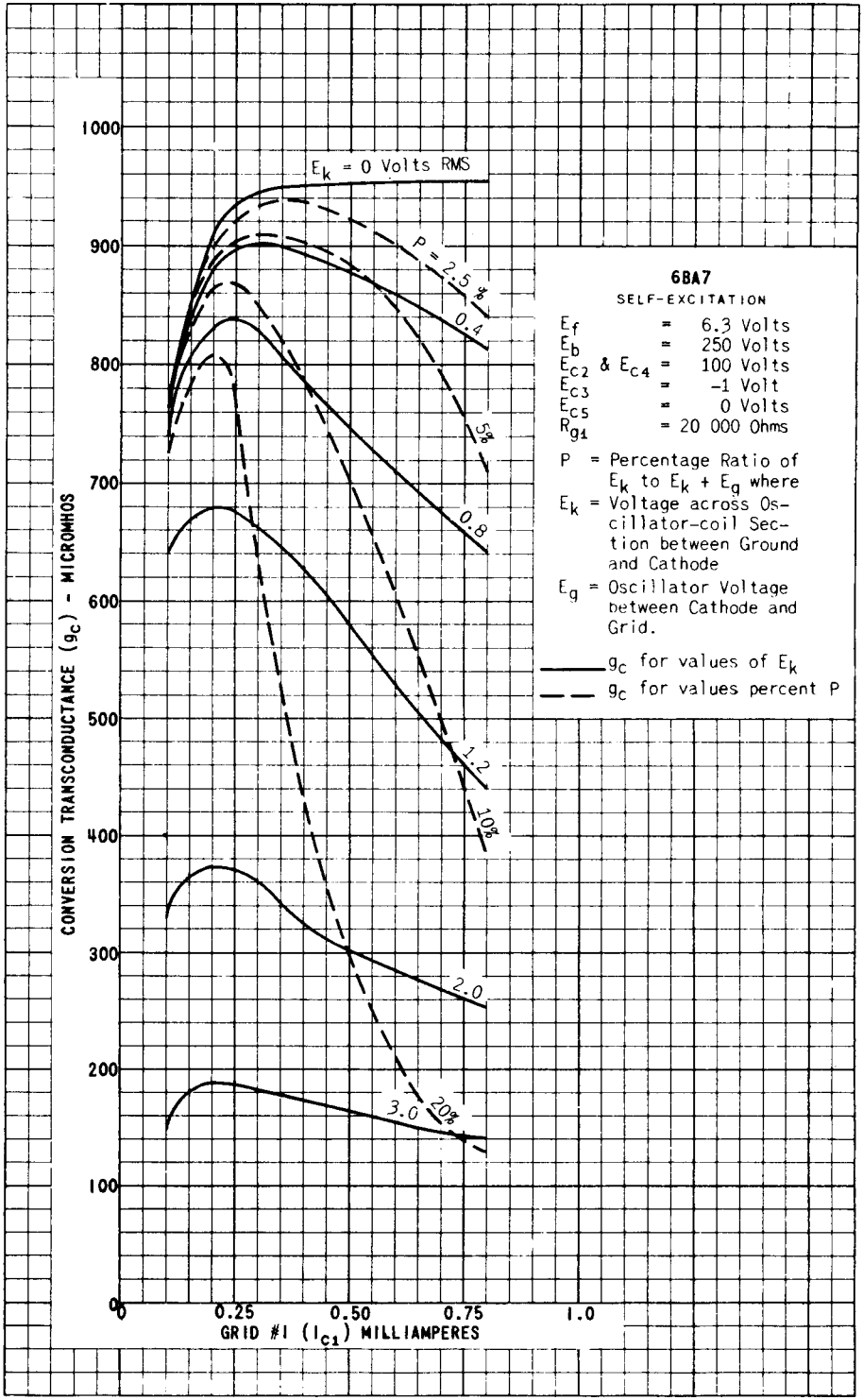

PLATE 2082
OCT. 1, 1948

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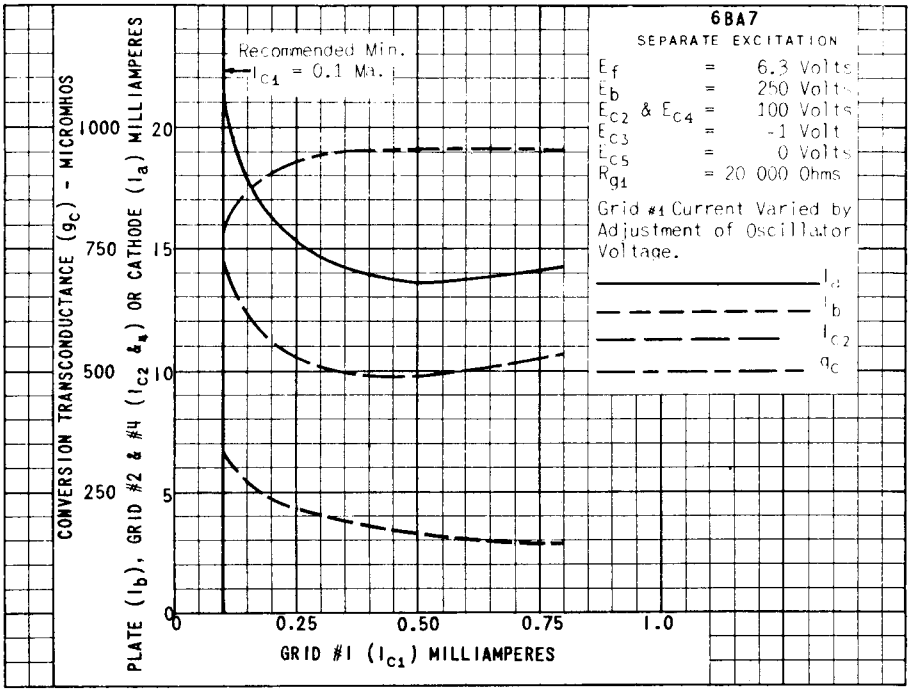

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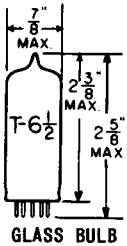
TRIODE PENTODE

MINIATURE TYPE

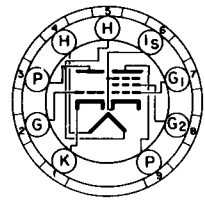


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 6BA8 IS A MEDIUM-MU TRIODE AND SHARP CUT-OFF PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE			
GRID TO PLATE	2.2	2.2	μμf
INPUT	2.7	2.5	μμf
OUTPUT	→ 1.9	→ 0.4	μμf
PENTODE			
GRID TO PLATE (MAX.)	.030	0.036	μμf
INPUT	→ 9.5	→ 9.5	μμf
OUTPUT	3.6	2.8	μμf
COUPLING			
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	→ .010	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	.012	.022	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	.050	0.20	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.0	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.0	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	---	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[B]	11.0		SECONDS

[A] SHIELD #315 TIED TO CATHODE BASE PIN OF SECTION UNDER TEST.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE

CONTINUED ON FOLLOWING PAGE

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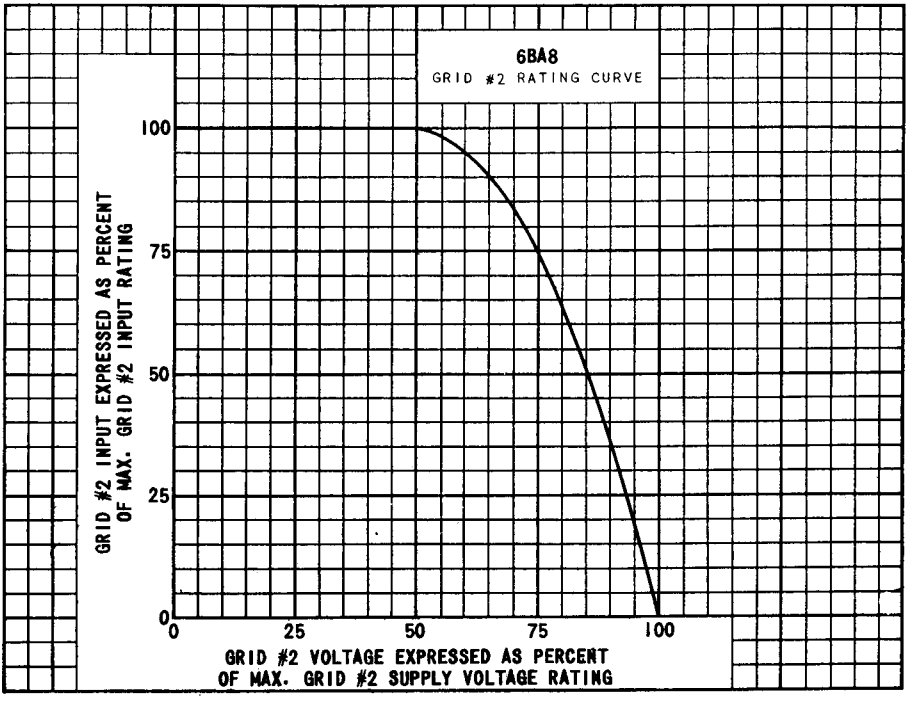
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-8	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	18	---	
PLATE RESISTANCE (APPROX.)	6 700	400 000	OHMS
TRANSCONDUCTANCE	2 700	9 000	μMHOS
PLATE CURRENT	8.0	13	MA.
GRID #2 CURRENT	---	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	-16	-10	VOLTS



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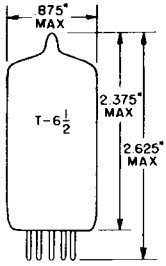


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

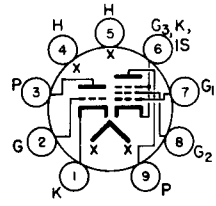
TRIODE PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6BA8A IS A MINIATURE MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE WHICH HAS A CONTROLLED PLATE KNEE CHARACTERISTIC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE			
GRID TO PLATE: (G TO P)	2.2	2.2	pf
INPUT: G TO (H + K)	2.7	2.5	pf
OUTPUT: P TO (H + K)	1.9	0.4	pf
PENTODE			
GRID TO PLATE: (G_1 TO P)	→ 0.05	→ 0.06	pf
INPUT: G TO (H+K+G_2+G_3+I.S.)	10.0	10.0	pf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	4.5	3.6	pf
COUPLING			
PENTODE GRID #1 TO TRIODE PLATE	0.003	0.006	pf
PENTODE PLATE TO TRIODE GRID	0.006	0.016	pf
PENTODE PLATE TO TRIODE PLATE	0.050	0.200	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.0	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.0	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	---	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[B]	11.0		SECONDS

[A] SHIELD #315 TIED TO CATHODE BASE PIN OF SECTION UNDER TEST.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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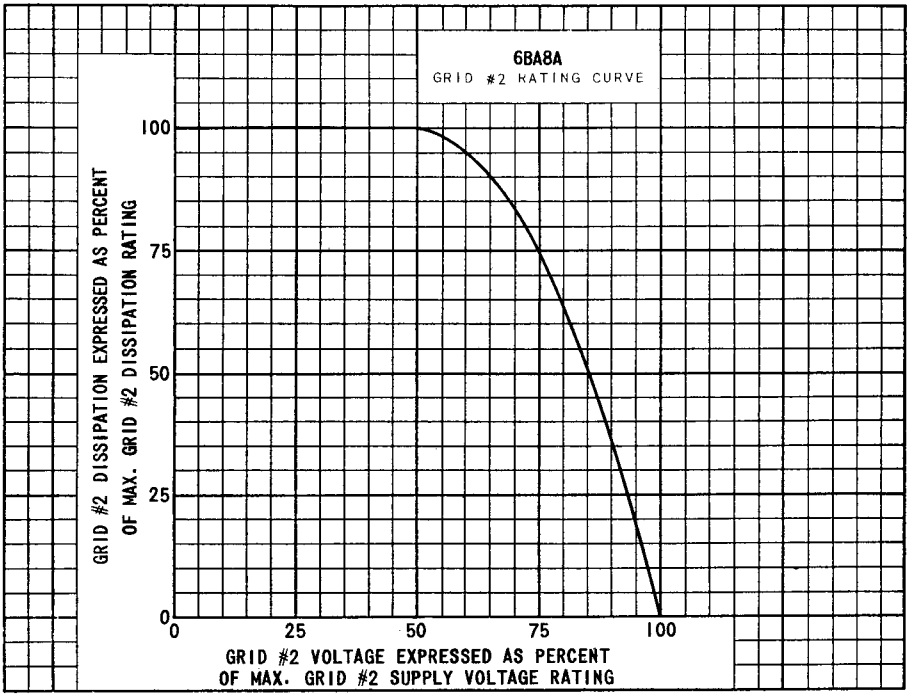
TUNG-SOL

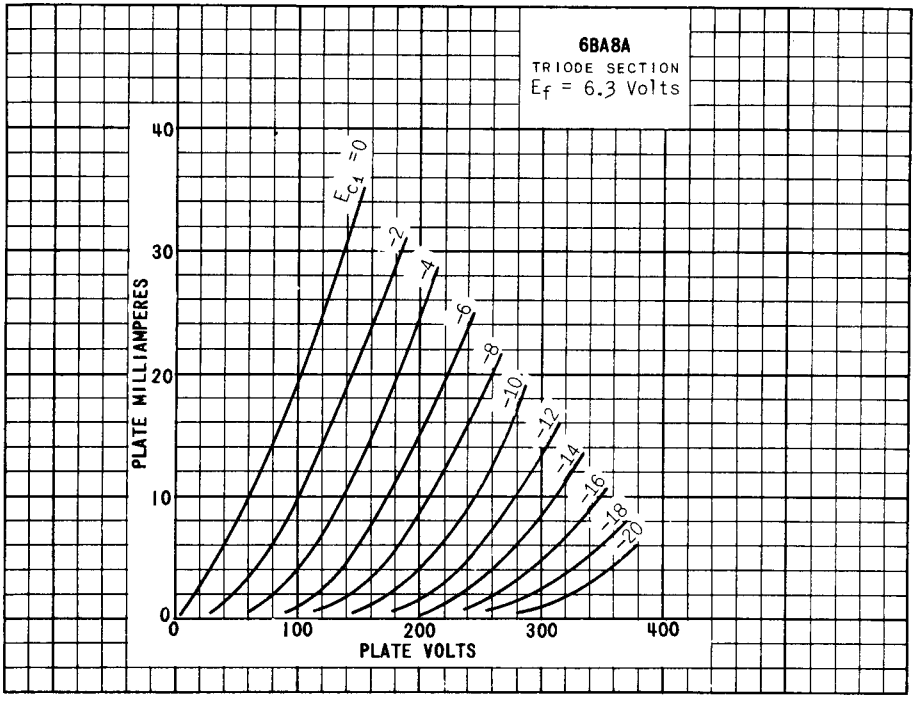
CONTINUED FROM PRECEDING PAGE

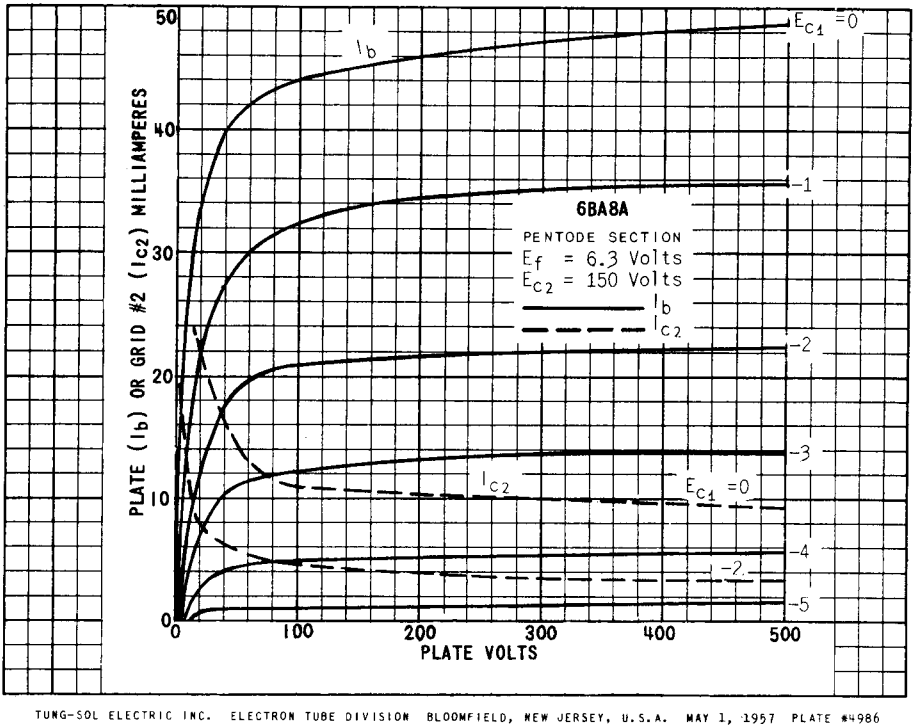
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-8	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	18	---	
PLATE RESISTANCE (APPROX.)	6 700	400 000	OHMS
TRANSCONDUCTANCE	2 700	9 000	μMHOS
PLATE CURRENT	8.0	13	MA.
GRID #2 CURRENT	---	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	-16	-10	VOLTS
ZERO BIAS: WITH E_b =65V., AND E_{c2} =150 V., (INSTANTANEOUS VALUES)			
PLATE CURRENT		42	MA.
GRID #2 CURRENT		12.5	MA.







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TUNG-SOL

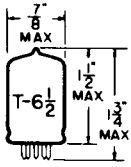
TRIODE

MINIATURE TYPE

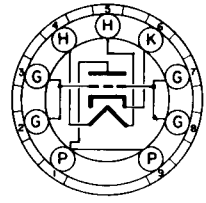
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.225 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9DR

THE 6BC4 IS A UHF MEDIUM-MU TRIODE OF THE 9-PIN MINIATURE TYPE UTILIZING A VERY SHORT BULB. IT IS DESIGNED FOR USE AS AN RF AMPLIFIER IN THE CATHODE-DRIVE CIRCUITS OF UHF TELEVISION TUNERS COVERING THE FREQUENCY RANGE OF 470 TO 890 MEGACYCLES PER SECOND.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH NO EXTERNAL SHIELD

GRID TO PLATE	1.6	μμf
GRID TO HEATER AND CATHODE	2.9	μμf
PLATE TO HEATER AND CATHODE	0.26	μμf
HEATER TO CATHODE	2.7	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	75	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	75	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM CATHODE CURRENT	25	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM
FOR FIXED-BIAS OPERATION	NOT RECOMMENDED	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	100	OHMS
AMPLIFICATION FACTOR	48	
PLATE RESISTANCE	4800	OHMS
TRANSCONDUCTANCE	10000	μMHOS
GRID BIAS (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-10	VOLTS
PLATE CURRENT	14.5	MA

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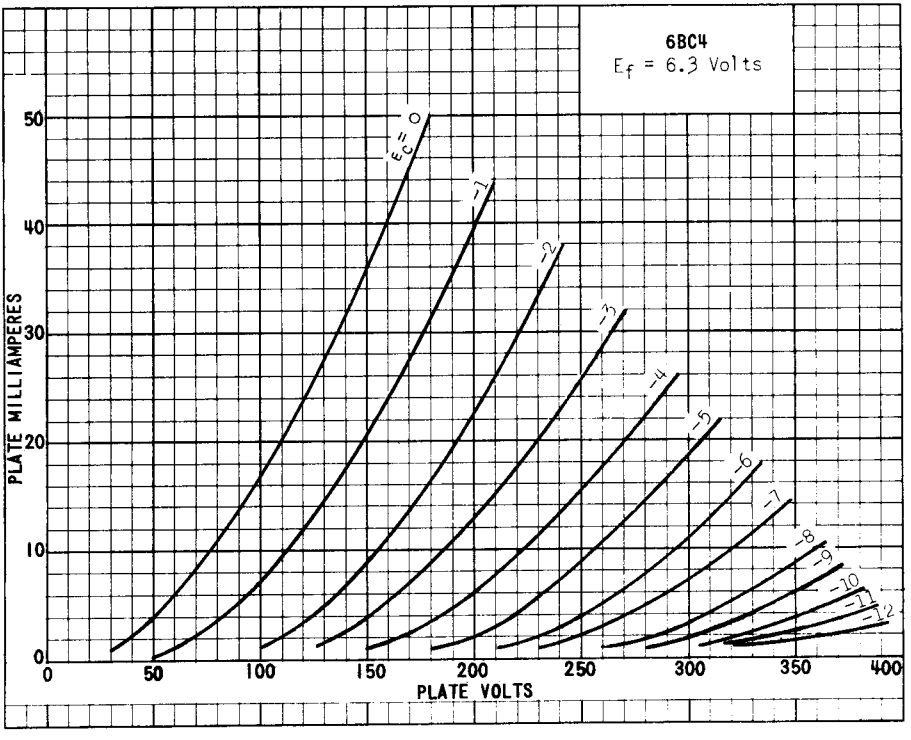
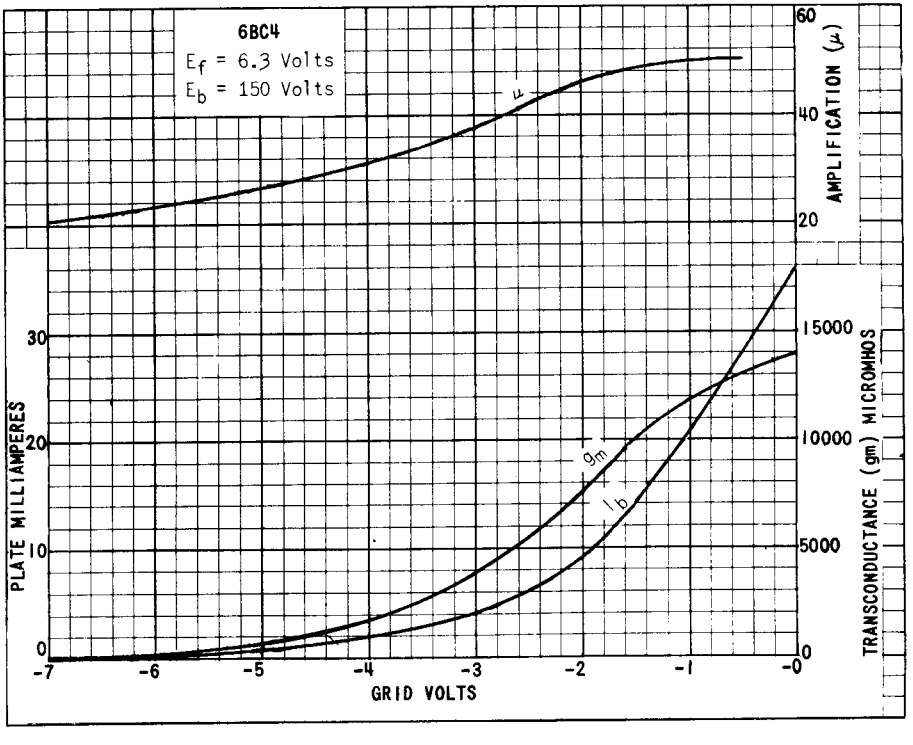
6BC4

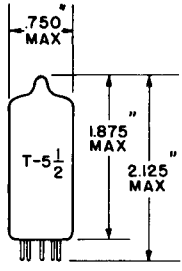

6BC4
E_f = 6.3 Volts
E_c = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
0
50
100
150
200
250
300
350
400


6BC4
E_f = 6.3 Volts
E_b = 150 Volts
μ
g_m
I_b
AMPLIFICATION (μ)
TRANSCONDUCTANCE (gm) MICROMHOS
PLATE MILLIAMPERES
GRID VOLTS
0
10
20
30
-7
-6
-5
-4
-3
-2
-1
-0
20
40
60
0
5000
10000
15000

TUNG-SOL

PENTODE

MINIATURE TYPE

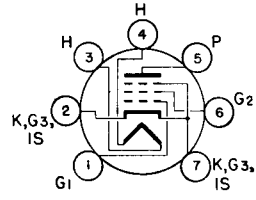


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HIGH FREQUENCY INTERMEDIATE AND RF AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
BASING DIAGRAM
JEDEC 7BD

THE 6BC5 IS A HIGH TRANSCONDUCTANCE PENTODE VOLTAGE AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MC. AND AS A HIGH-FREQUENCY INTERMEDIATE AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G1 TO P) MAX.	→ 0.020	→ 0.030	pf
INPUT: G1 TO (H+K+G2+G3 & I.S.)	6.6	6.5	pf
OUTPUT: P TO (H+K+G2+G3& I.S.)	→ 2.6	1.8	pf
TRIODE CONNECTION: (G2 TIED TO PLATE)			
GRID TO PLATE: G1 TO (P+G2)	2.5	2.5	pf
INPUT: G1 TO (H+K+G3 & I.S.)	→ 4.0	3.9	pf
OUTPUT: (P+G2) TO (H+K+G3 & I.S.)	4.3	→ 3.0	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS

[B] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE [C]	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID #2 VOLTAGE	PLATE	SEE RATING CHART	
GRID #2 SUPPLY VOLTAGE	PLATE	330	VOLTS
PLATE DISSIPATION	2.9 [C]	2.3	WATTS
GRID #2 DISSIPATION	---		WATT
GRID #1 VOLTAGE (POSITIVE BIAS VALUE)	0	0	VOLT
GRID #2 DISSIPATION			
FOR VOLTAGES UP TO 165 V.	---	.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 V.	---	SEE RATING CHART	

→ TYPICAL OPERATING CHARACTERISTICS

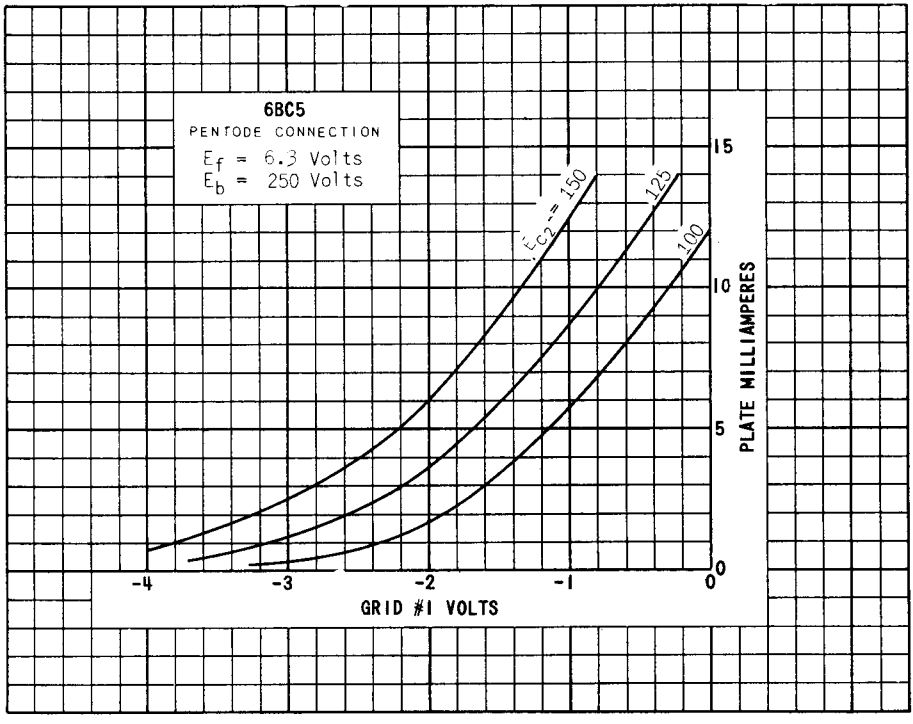
CLASS A_1 AMPLIFIER

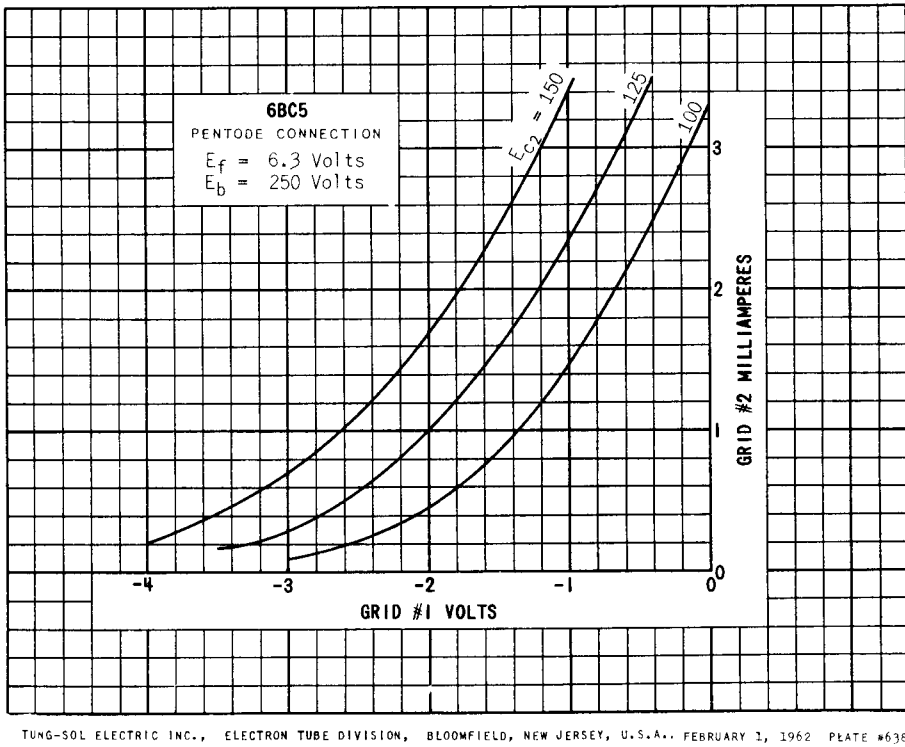
	TRIODE [C]		PENTODE			
PLATE VOLTAGE	250	180	100	125	250	VOLTS
GRID #2 VOLTAGE	PLATE	PLATE	100	125	150	VOLTS
CATHODE RESISTOR	820	330	180	100	180	OHMS
TRANSCONDUCTANCE	4400	6000	4900	6100	5700	μMHOS
PLATE RESISTANCE (APPROXIMATELY)	.009	.006	0.6	0.5	0.8	MEGOHM
AMPLIFICATION FACTOR	40	42	---	---	---	
PLATE CURRENT	6.0 [D]	8.0 [D]	4.7	8.0	7.5	MA.
GRID #2 CURRENT	---	---	1.4	2.4	2.1	MA.
GRID #1 VOLTAGE (APPROX.)						
FOR Ib = 10 μA.	---	---	-5	-6	-8	VOLTS

[C] G2 TIED TO PLATE.

[D] TOTAL CURRENT FLOWING TO PLATE + G2.

→ INDICATES A CHANGE.





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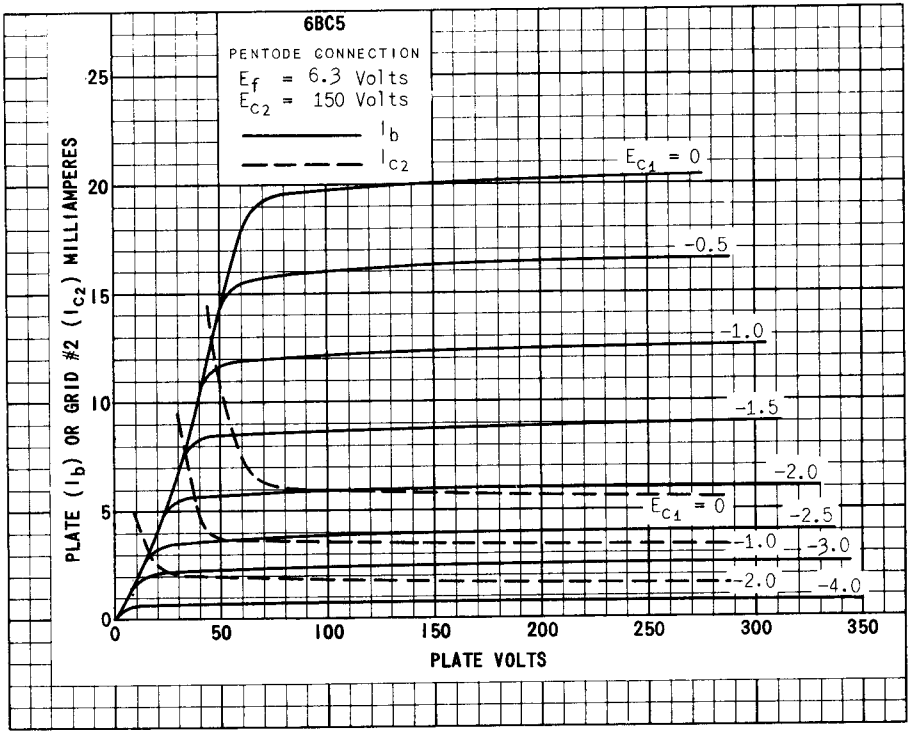
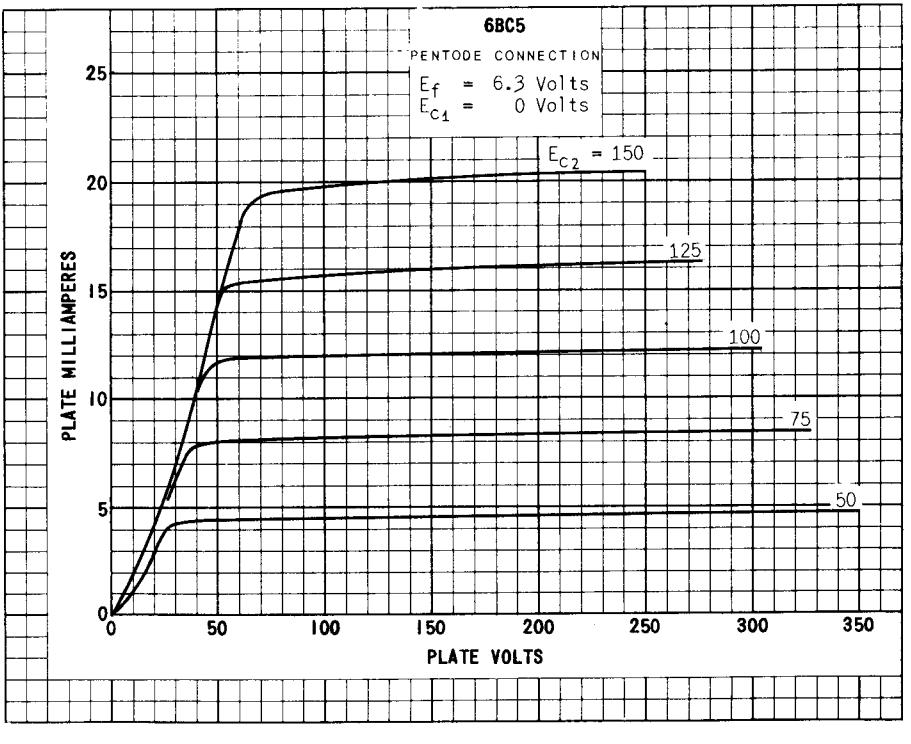
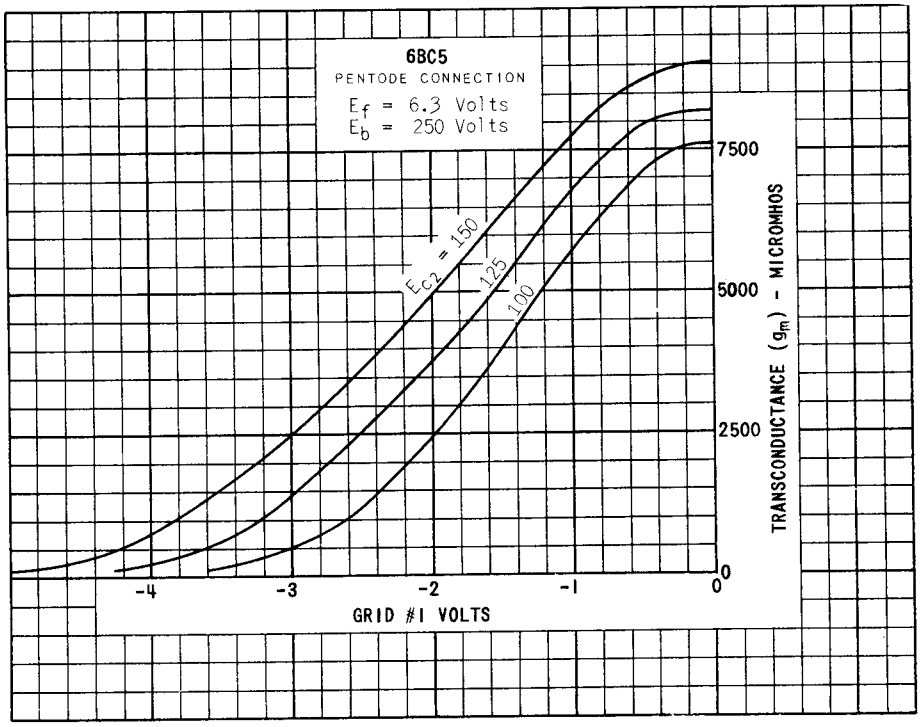
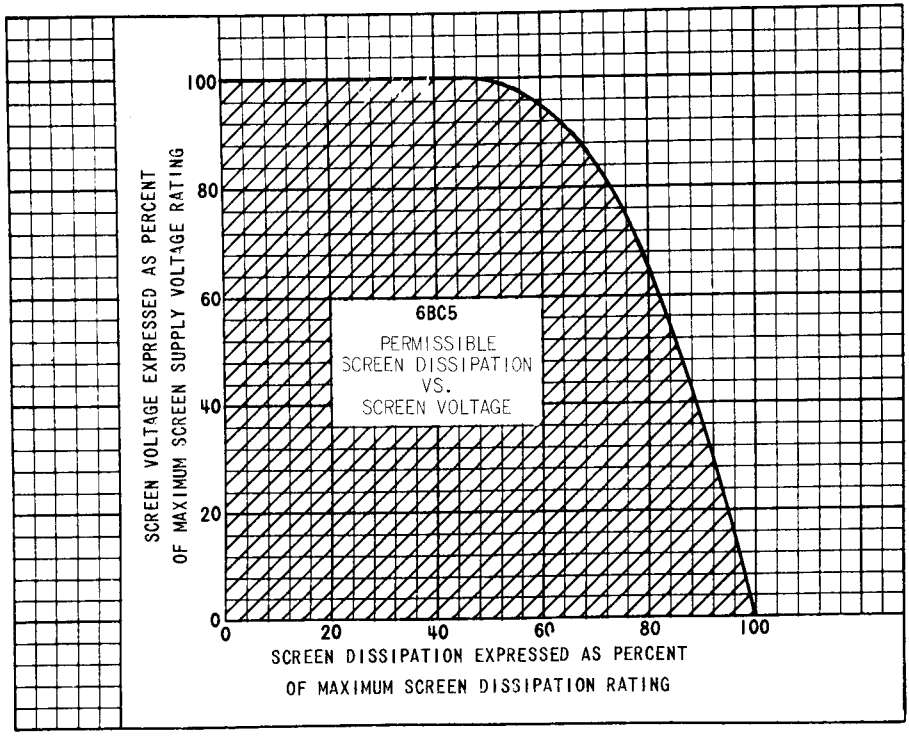
6BC5


6BC5
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c_2} = 150 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
E_{c_1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
0
5
10
15
20
25
50
100
150
200
250
300
350


6BC5
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c_1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c_2} = 150
125
100
75
50
0
5
10
15
20
25
50
100
150
200
250
300
350


6BC5
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 150
125
100
7500
5000
2500
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID #1 VOLTS


6BC5
PERMISSIBLE
SCREEN DISSIPATION
VS.
SCREEN VOLTAGE
SCREEN VOLTAGE EXPRESSED AS PERCENT
OF MAXIMUM SCREEN SUPPLY VOLTAGE RATING
100
80
60
40
20
0
0
20
40
60
80
100
SCREEN DISSIPATION EXPRESSED AS PERCENT
OF MAXIMUM SCREEN DISSIPATION RATING

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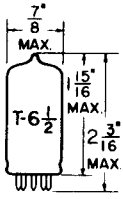
TRIPLE DIODE

MINIATURE TYPE

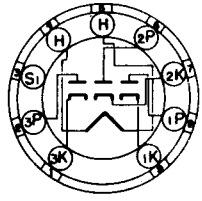


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AX

THE 6BC7 COMPRISES THREE SEPARATE HIGH PERVEANCE DIODES IN THE 9 PIN MINIATURE CONSTRUCTION. THE ELEMENTS OF EACH DIODE ARE BROUGHT OUT SEPARATELY. IT CAN BE USED AS A COMBINED FM/AM DETECTOR WITHOUT THE NEED FOR ADDITIONAL SWITCHING. TWO OF THE DIODES ARE BALANCED FOR USE IN BALANCED DETECTOR APPLICATIONS. THE THREE SEPARATE AND INDEPENDENT DIODES ALLOW FOR A MULTIPLICITY OF CIRCUIT ARRANGEMENTS IN TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

PLATE OF DIODE #1 TO ALL OTHER ELEMENTS	3.5	μμf
PLATE OF DIODE #2 TO ALL OTHER ELEMENTS	5.5	μμf
PLATE OF DIODE #3 TO ALL OTHER ELEMENTS	3.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
DIODE OPERATION CURRENT PER PLATE	12	MA.
PEAK HEATER–CATHODE VOLTAGE	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH DIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
AVERAGE CURRENT DIODES #1 AND #3 WITH 5 VOLTS DC APPLIED	35	MA.
ZERO VOLTAGE CURRENT OF EACH DIODE SECTION THRU 40,000 OHMS	21	μA.

NOTE: RATIO OF $\frac{103}{101}$ AND/OR $\frac{101}{103}$ SHALL NOT BE GREATER THAN 1.3 AT E_b = 5 VOLTS.

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OCT. 1 1950

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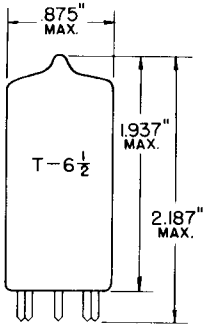
TWIN TRIODE

MINIATURE TYPE

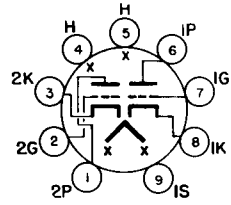


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

CASCODE AMPLIFIER
FOR SERIES STRING VHF
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 6BC8 IS A MEDIUM-MU, SEMI-REMOTE CUT-OFF TWIN TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A CASCODE AMPLIFIER IN VHF TELEVISION RECEIVER TUNERS.

DIRECT INTERELECTRODE CAPACITANCES

EXTERNAL SHIELD #315 CONNECTED TO PIN 9

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	→1.2	→ 1.2	pf
PLATE TO CATHODE (P TO K)		→ 0.12	pf
HEATER TO CATHODE (H TO K)	→2.8	→ 2.8	pf
#1 INPUT: G1 TO (H+K+I.S.)	→2.6		pf
#2 INPUT: K TO (H+G+I.S.)[A]		→ 5.5	pf
#1 OUTPUT: P TO (H+K+I.S.)	1.3		pf
#2 OUTPUT: P TO (H+G+I.S.)[A]		→ 2.4	pf
#1 PLATE TO #2 PLATE (1P TO 2P)(MAX.)	→.02		pf
#2 PLATE TO #1 PLATE AND GRID:(2P TO 1P+1G) MAXIMUM	→.04		pf

[A] READ AS GROUNDED GRID AMPLIFIER.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	400	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE[B]			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.2	WATTS
CATHODE CURRENT	→ 22	MA.
GRID CIRCUIT RESISTANCE	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

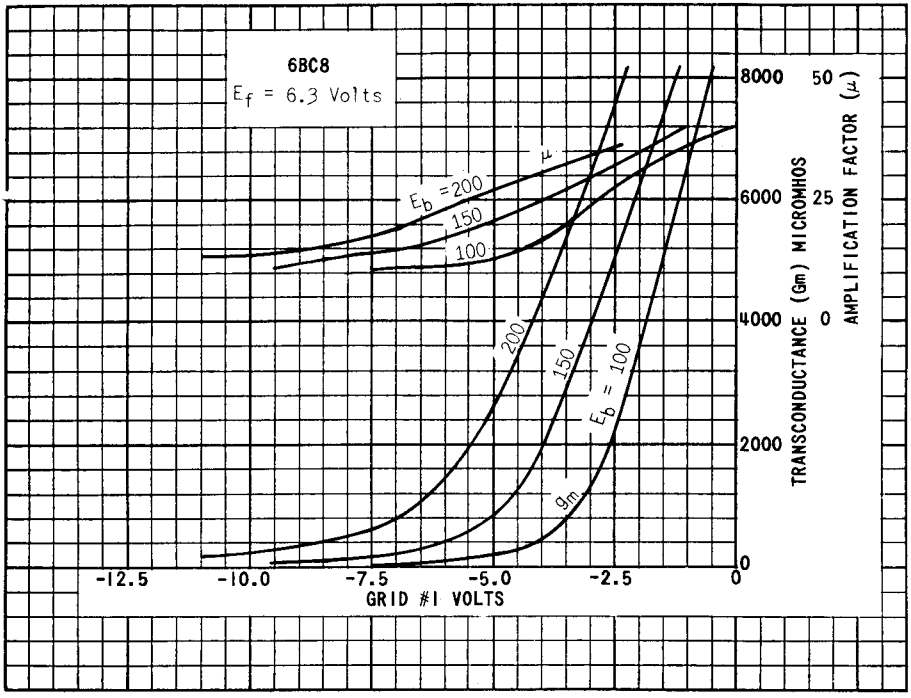
CLASS A_1 AMPLIFIER

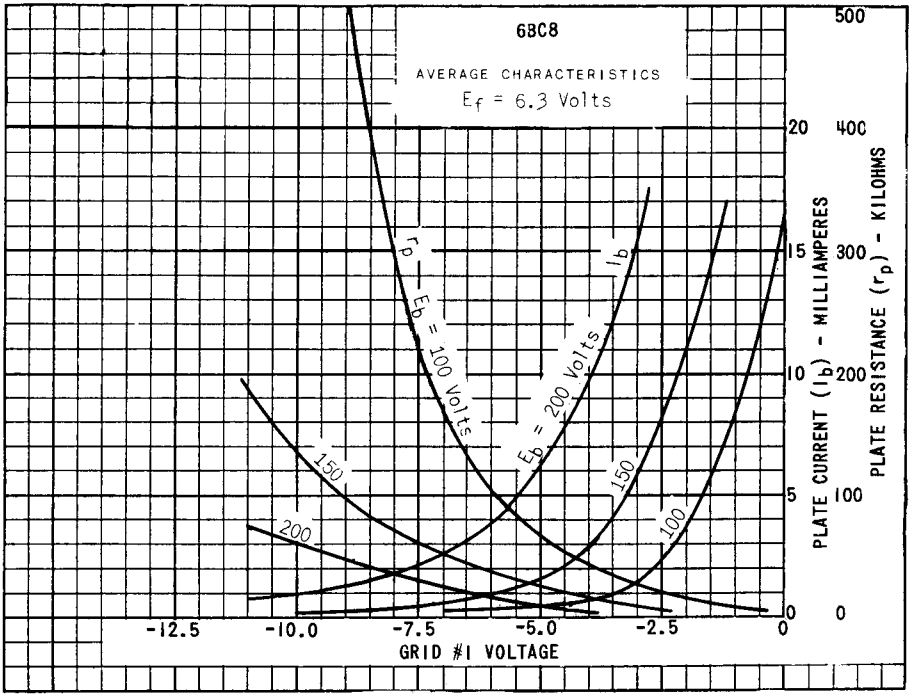
EACH UNIT

PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR	220	OHMS
PLATE RESISTANCE*	5300	OHMS
TRANSCONDUCTANCE	6200	μMHOS
AMPLIFICATION FACTOR	35	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR GM =50 μMHOS	-13	VOLTS

[B] THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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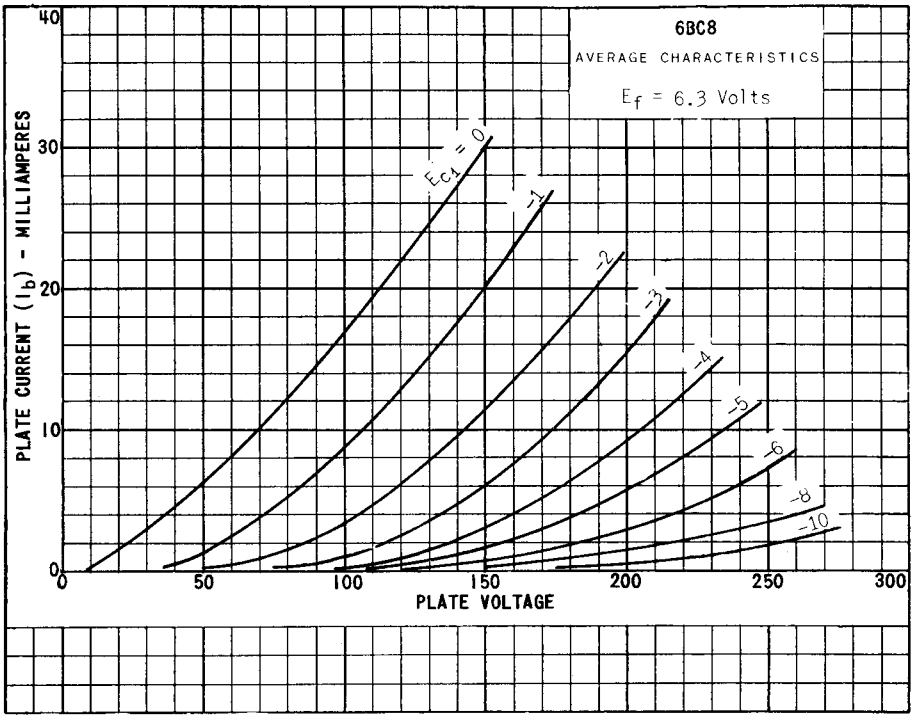
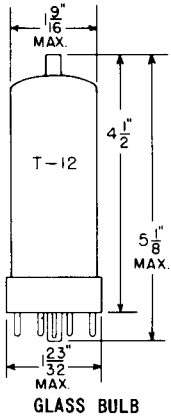
6BC8


6BC8
AVERAGE CHARACTERISTICS
E_f = 6.3 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
0
10
20
30
40
0
50
100
150
200
250
300

TUNG-SOL

BEAM TRIODE

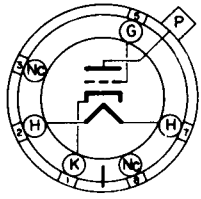


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT JUMBO-SHELL
6 PIN OCTAL

THE 6BD4 IS A LOW CURRENT, SHARP-CUTOFF BEAM TRIODE. IT IS DESIGNED SPECIFICALLY FOR THE VOLTAGE REGULATION OF HIGH VOLTAGE, LOW CURRENT DC POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	1.0	μμf
INPUT	3.8	μμf
OUTPUT (MAX.)	0.04	μμf

RATINGS

INTERPRETED ACCORDING TO RETMA STANDARD M8-210

VOLTAGE CONTROL SERVICE – DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM DC PLATE VOLTAGE	20 000	VOLTS
MAXIMUM UNREGULATED DC SUPPLY VOLTAGE	40 000	VOLTS
MAXIMUM GRID VOLTAGE:		
DC VALUE	-125	VOLTS
PEAK VALUE	-550	VOLTS
MAXIMUM DC PLATE CURRENT	1.5	MA.
MAXIMUM PLATE DISSIPATION	20	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:		
WITH UNREGULATED SUPPLY HAVING AN EQUIVALENT RESISTANCE OF AT LEAST 8 MEGOHMS	3	MEGOHMS
WITH UNREGULATED SUPPLY HAVING AN EQUIVALENT RESISTANCE LESS THAN 8 MEGOHMS	SEE CURVE #1	

CONTINUED ON FOLLOWING PAGE

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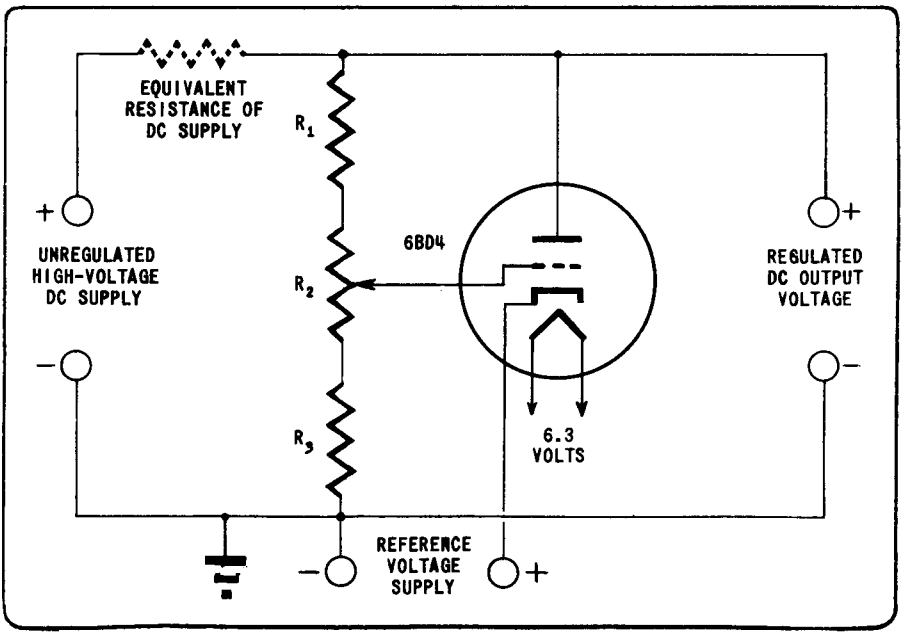
TUNG-SOL

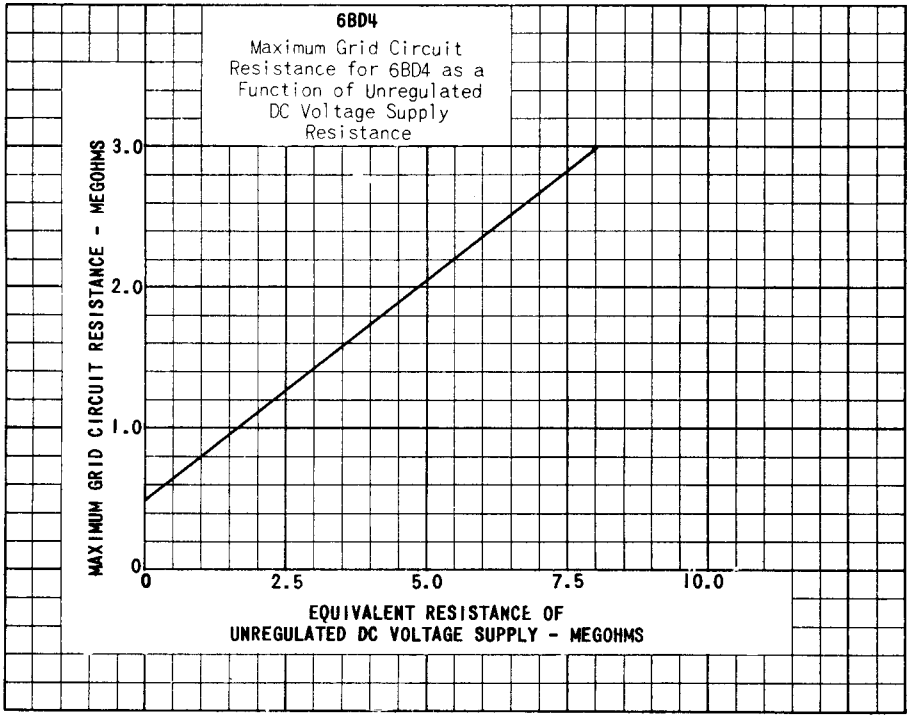
CONTINUED FROM PRECEDING PAGE

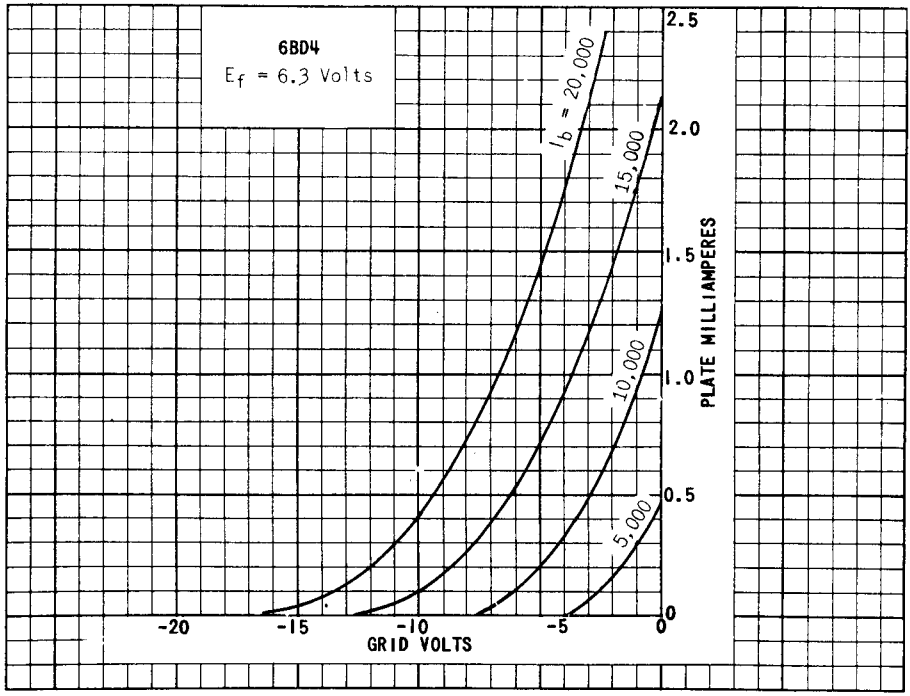
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AS A SHUNT VOLTAGE-REGULATOR TUBE IN ACCOMPANYING CIRCUIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
UNREGULATED SUPPLY:		
DC VOLTAGE	29 800	VOLTS
EQUIVALENT RESISTANCE	8	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	120	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (1/2 WATT)	2	MEGOHMS
REFERENCE VOLTAGE SUPPLY:		
DC VALUE	500	VOLTS
EQUIVALENT RESISTANCE	1 000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	138	µMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF 0 MA.	1 055	µAMP.
FOR LOAD CURRENT OF 1 MA.	100	µAMP.
AMPLIFICATION FACTOR	1 650	
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF 0 MA.	20 000	VOLTS
FOR LOAD CURRENT OF 1 MA.	19 700	VOLTS







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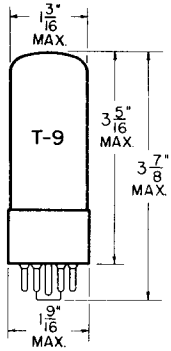
TUNG-SOL

BEAM PENTODE

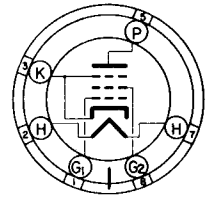


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

MOUNTING POSITION
VERTICAL - BASE UP OR DOWN.
HORIZONTAL - PLANE OF PINS 2 & 7 VERTICAL.



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL
6CK

THE 6BD5GT IS A BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN LOW COST, HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	135	VOLTS
MAXIMUM DC PLATE VOLTAGE	325	VOLTS
MAXIMUM PEAK POSITIVE SURGE PLATE VOLTAGE[A]	4000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	325	VOLTS
MAXIMUM PEAK NEGATIVE SURGE GRID #1 VOLTAGE[A]	-200	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	3	WATTS
MAXIMUM DC CATHODE CURRENT	100	MA.
MAXIMUM PEAK CATHODE CURRENT	300	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

[A] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 10 MICROSECONDS, OR 15% OF THE PULSE RECURRENCE PERIOD WHICHEVER IS SMALLER.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
DC PLATE AND GRID #2 VOLTAGE	200	VOLTS
DC GRID #1 VOLTAGE	-12	VOLTS
TRANSCONDUCTANCE	5000	µMHOS

HORIZONTAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
DC PLATE AND GRID #2 SUPPLY VOLTAGE	310	VOLTS
PEAK POSITIVE SURGE PLATE VOLTAGE (APPROX.)	2500	VOLTS
PEAK NEGATIVE SURGE GRID #1 VOLTAGE (APPROX.)	-200	VOLTS
DC CATHODE CURRENT	90	MA.

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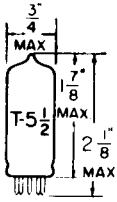
PENTODE

MINIATURE TYPE

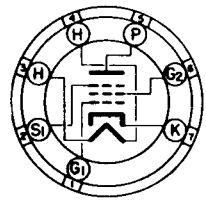
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 6BD6 IS A MINIATURE REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A RADIO-FREQUENCY OR INTERMEDIATE-FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE (MAX.)	0.005	0.004	μμf
INPUT	4.3	4.3	μμf
OUTPUT	5.0	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	90	VOLTS *
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS *
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS ←
MAXIMUM GRID #2 DISSIPATION	0.4	WATT
MAXIMUM CATHODE CURRENT	14	MA.

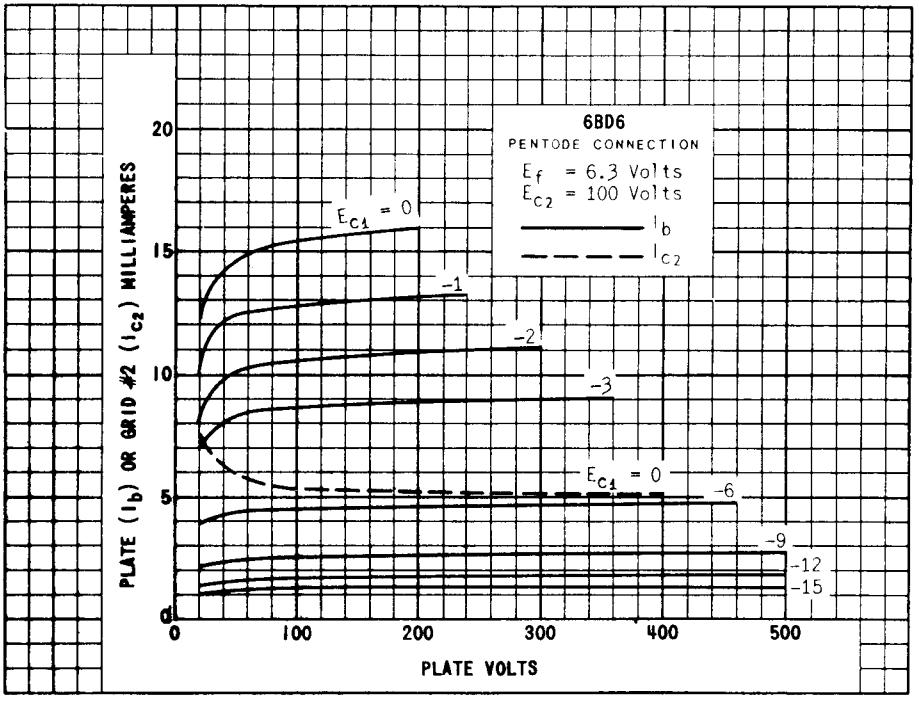
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS *

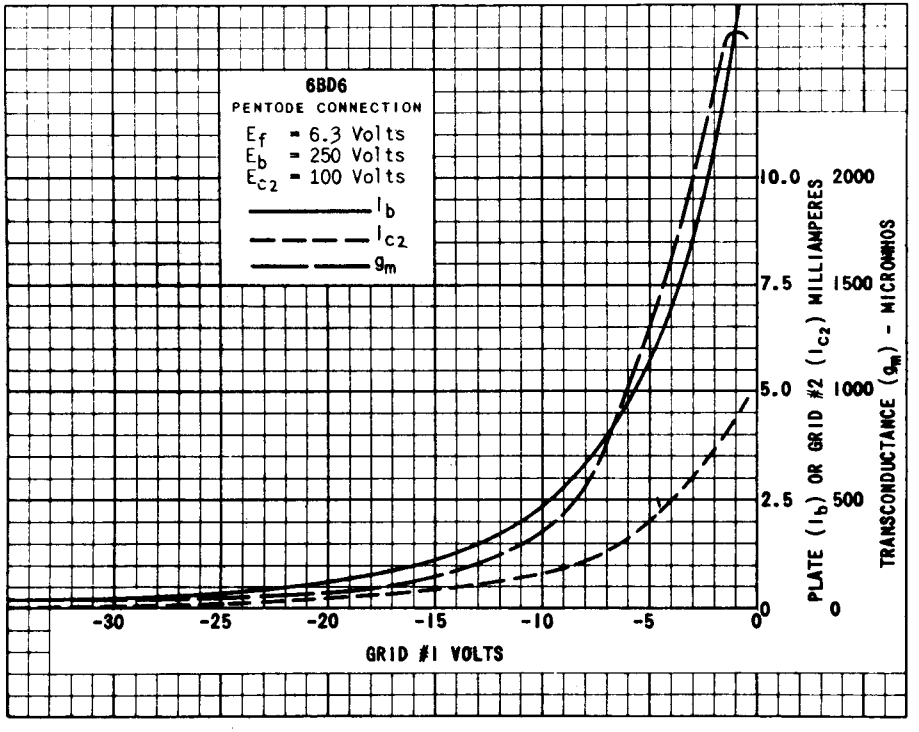
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET			
GRID #2 VOLTAGE	100	125	100	VOLTS
GRID #1 VOLTAGE	-1	-3	-3	VOLTS
PLATE CURRENT	13	13	9	MA.
GRID #2 CURRENT	5	5	3.0	MA.
PLATE RESISTANCE	0.15	0.18	0.8	MEGOHM
TRANSCONDUCTANCE	2 550	2 350	2 000	μMHOS
GRID VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	-35	-45	-35	VOLTS

→INDICATES A CHANGE.
*INDICATES AN ADDITION.

6BD6

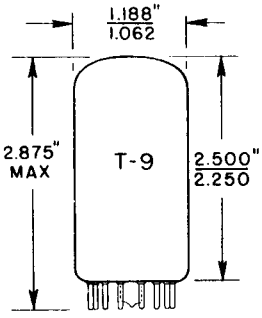

6BD6
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
-6
-9
-12
-15
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
0
100
200
300
400
500


6BD6
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
GRID #1 VOLTS
-30
-25
-20
-15
-10
-5
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
2.5
5.0
7.5
10.0
0
500
1000
1500
2000

TUNG-SOL

DIODE

COMPACTRON

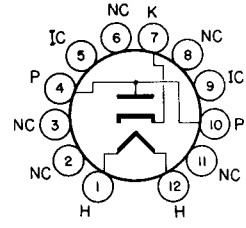


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-60

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA ←
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 6BE3 IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6BE3 IS IDENTICAL TO THE 12BE3 AND THE 17BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES [B] - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	25	VOLTS

* INDICATES AN ADDITION.

→ INDICATES A CHANGE.

B

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TUNG-SOL

DIODE

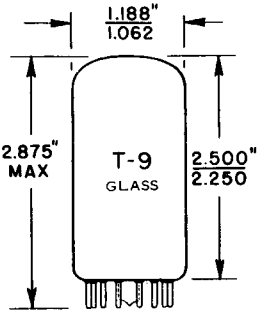
COMPACTRON

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

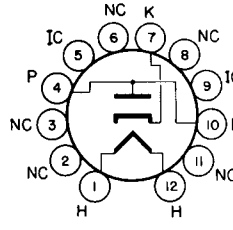
ANY MOUNTING POSITION

OUTLINE DRAWING
JEDEC 9-60



BASE 12 PIN BUTTON
JEDEC E12-70

BASING DIAGRAM
JEDEC 12GA



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 6BE3A IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6BE3A IS IDENTICAL TO THE 12BE3A AND THE 17BE3A. THE VOLTAGE DROP OF THIS TYPE IS LOWER THAN THAT OF THE 6BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION - AC OR DC			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE SEE BELOW

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

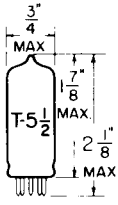
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	22.5	VOLTS

TUNG-SOL

HEPTODE

MINIATURE TYPE



GLASS BULB

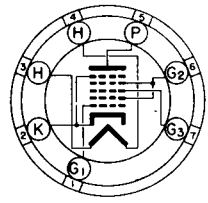
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CH

THE 6BE6 IS A PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	0.30	μμf
MIXER GRID TO OSCILLATOR GRID; (G_3 TO G_1) MAX.	0.15	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	7.0	7.0	μμf
OSCILLATOR INPUT: G_1 TO (H+K+$G_{2\&4}$+G_3+G_5+P)	5.5	5.5	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	13	8.0	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G_5)	3.0	3.0	μμf
OSCILLATOR OUTPUT: K TO (H+$G_{2\&4}$+G_3+P)	20	15	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.05	0.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	110	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	-55	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	WATT
MAXIMUM GRIDS #2 AND #4 DISSIPATION	1.1	WATT
MAXIMUM CATHODE CURRENT	15.5	MA.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SEPARATE EXCITATION[B]

HEATER VOLTAGE	6.3±10%		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	-1.5	-1.5	VOLTS
GRIDS #2 AND #4 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	10	10	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.4	1.0	MEGOHMS
GRID #1 CURRENT (OSCILLATOR GRID)	0.5	0.5	MA.
CONVERSION TRANSCONDUCTANCE	455	475	µMHOS
PLATE CURRENT	2.6	2.9	MA.
GRIDS #2 AND #4 CURRENT	7.0	6.8	MA.
CATHODE CURRENT	10.1	10.2	MA.
GRID #3 VOLTAGE FOR G_C = 10 µMHOS (APPROX.)	-30	-30	VOLTS
GRID #3 VOLTAGE FOR G_C = 100 µMHOS (APPROX.)	-6	-6	VOLTS

[B] CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

OSCILLATOR CHARACTERISTICS
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	7 250	µMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	20	
CATHODE CURRENT	25	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA	-11	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings, the 6BE6 is identical to the 12BE6.

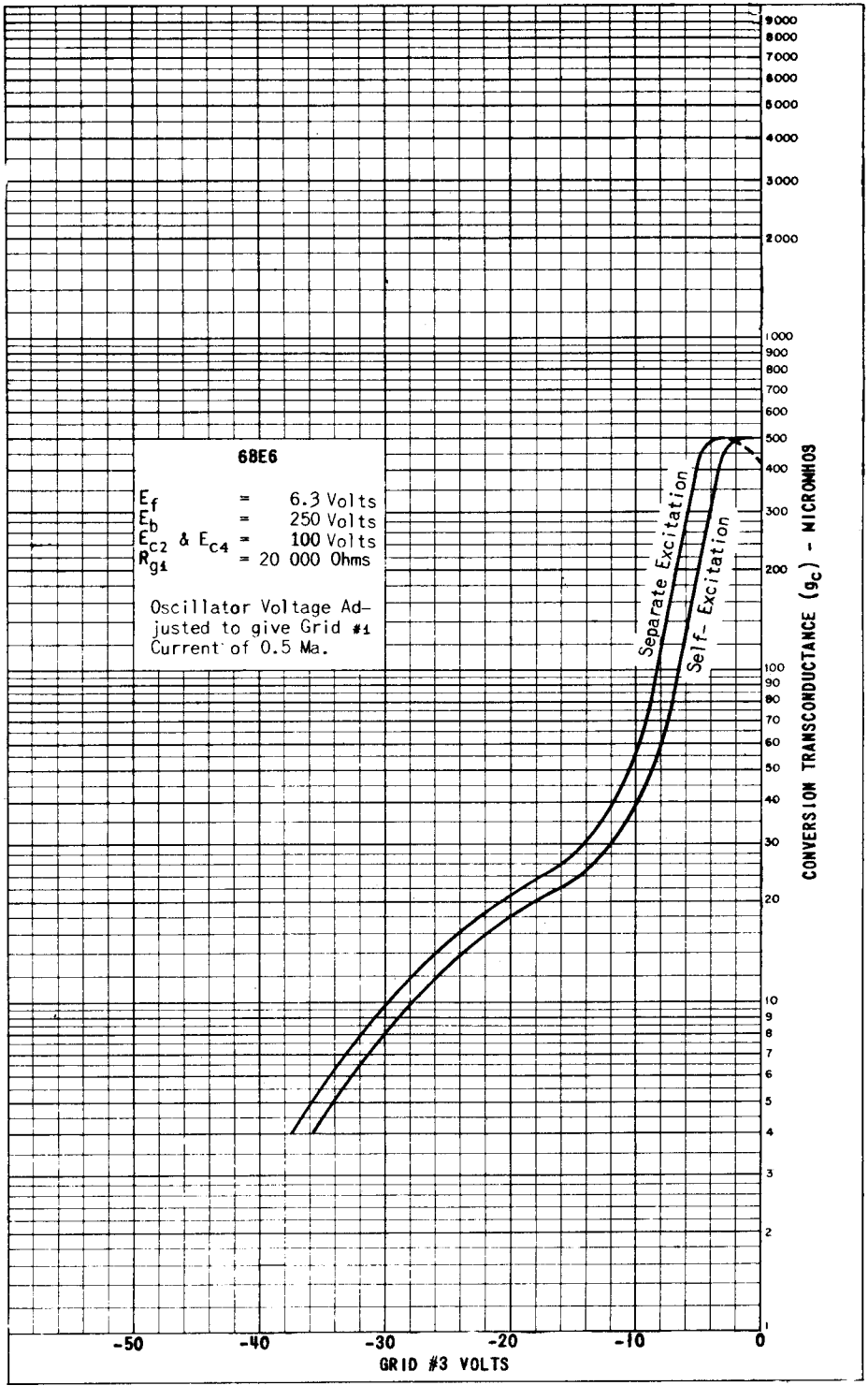

PLATE 2050
AUG. 2, 1948

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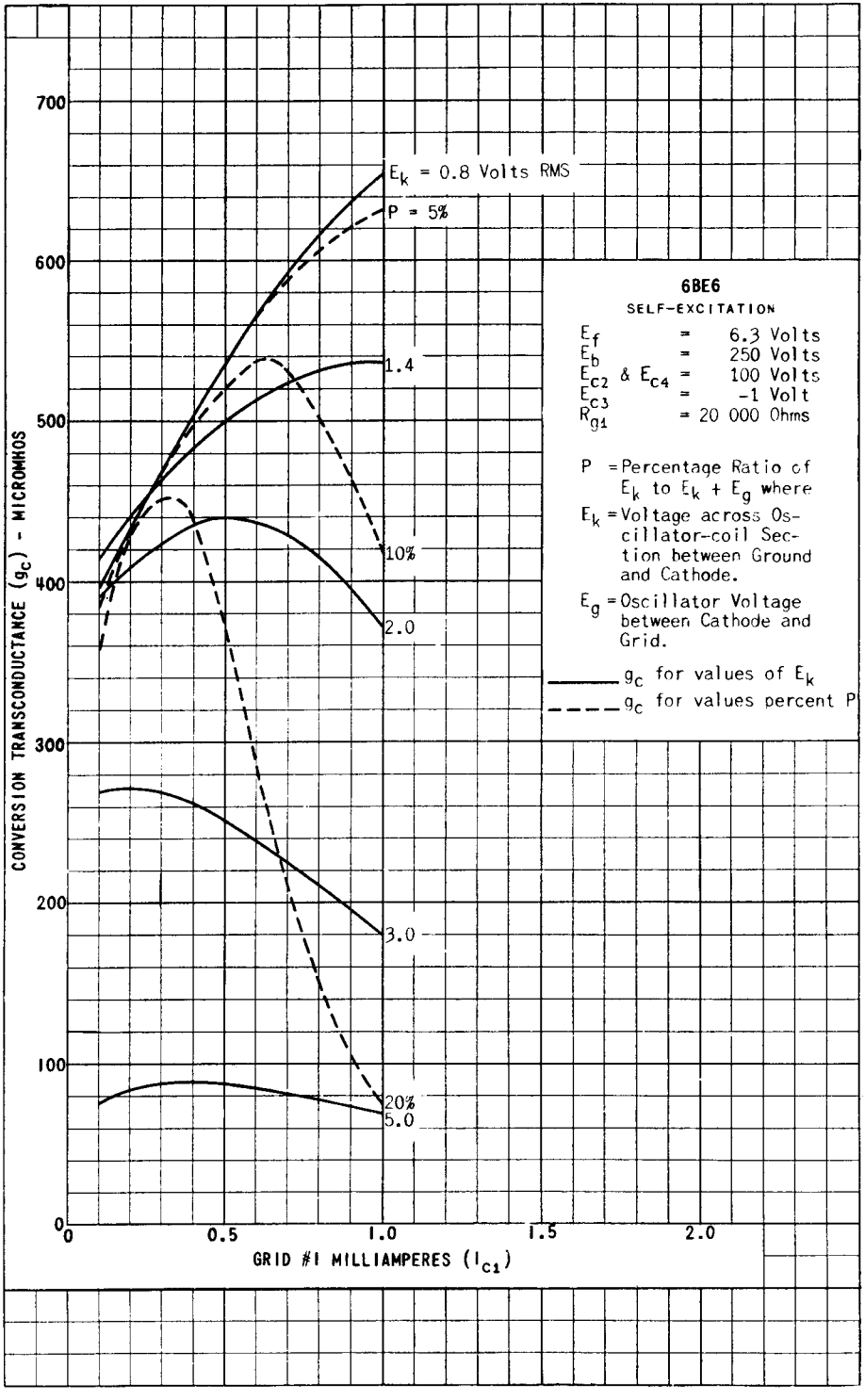
6BE6 (12BE6)



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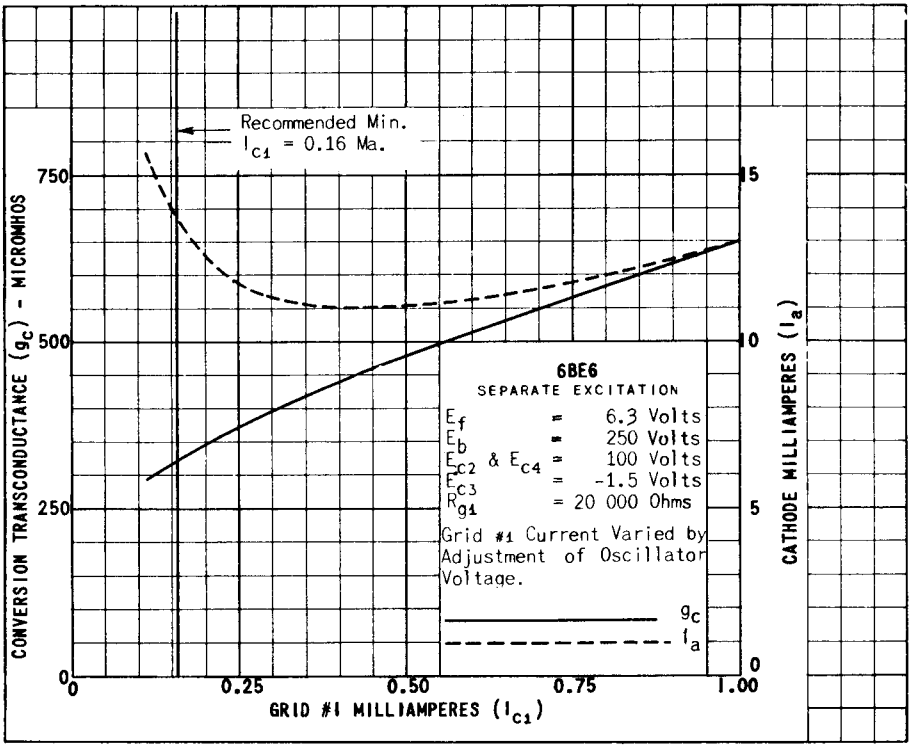

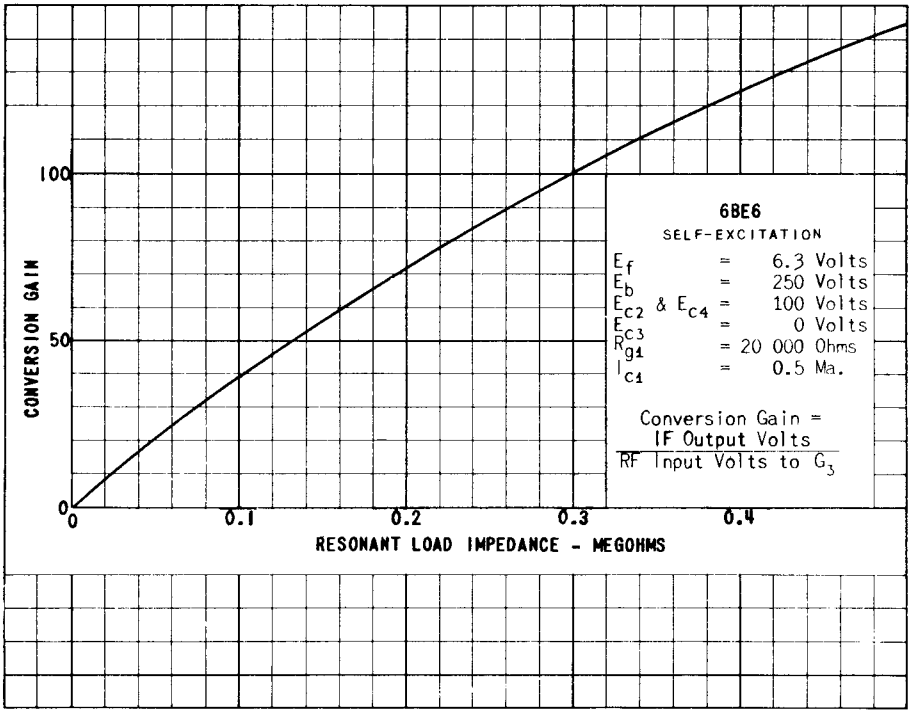

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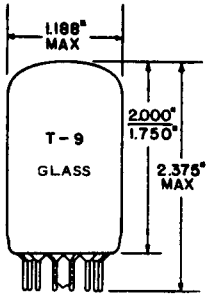
TUNG-SOL

DUAL PENTODE

COMPACTRON

OUTLINE
JEDEC 9-58

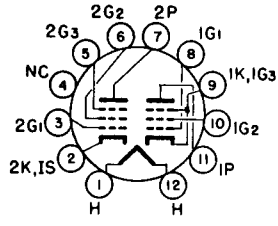


BASE 12 PIN BUTTON
JEDEC E12-70

FOR
FM DETECTOR
AND AUDIO OUTPUT
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12EZ



BOTTOM VIEW

THE TUNG-SOL 6BF11 IS A 12-PIN T-9 COMPACTRON CONTAINING TWO DISSIMILAR PENTODES. SECTION 1 IS A POWER PENTODE FOR AUDIO APPLICATION. SECTION 2 IS A DUAL CONTROL PENTODE INTENDED FOR USE AS FM DETECTOR IN TV CIRCUITS. ELECTRICALLY, SECTION 2 IS SIMILAR TO TYPE 6DT6. EXCEPT FOR HEATER CHARACTERISTICS, THE 6BF11 IS IDENTICAL TO THE 17BF11.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

PENTODE 1 - GRID 1 TO PLATE	0.24	pf
INPUT: (G1 TO H + K + I.S. + G_2)	13	pf
OUTPUT: (P TO H + K + I.S. + G_2)	10	pf
PENTODE 2 - GRID 1 TO PLATE	0.036	pf
GRID 1 TO ALL (G1 TO H + K + I.S. + G_2 + G_3 + P)	6.5	pf
GRID 3 TO PLATE	3.2	pf
GRID 3 TO ALL (G_3 TO H + K + I.S. + G_1 + G_2 + P)	8.0	pf
GRID 1 TO GRID 3	0.11	pf
COUPLING - PLATE TO PLATE	0.13	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.2	AMPS.
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE-BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

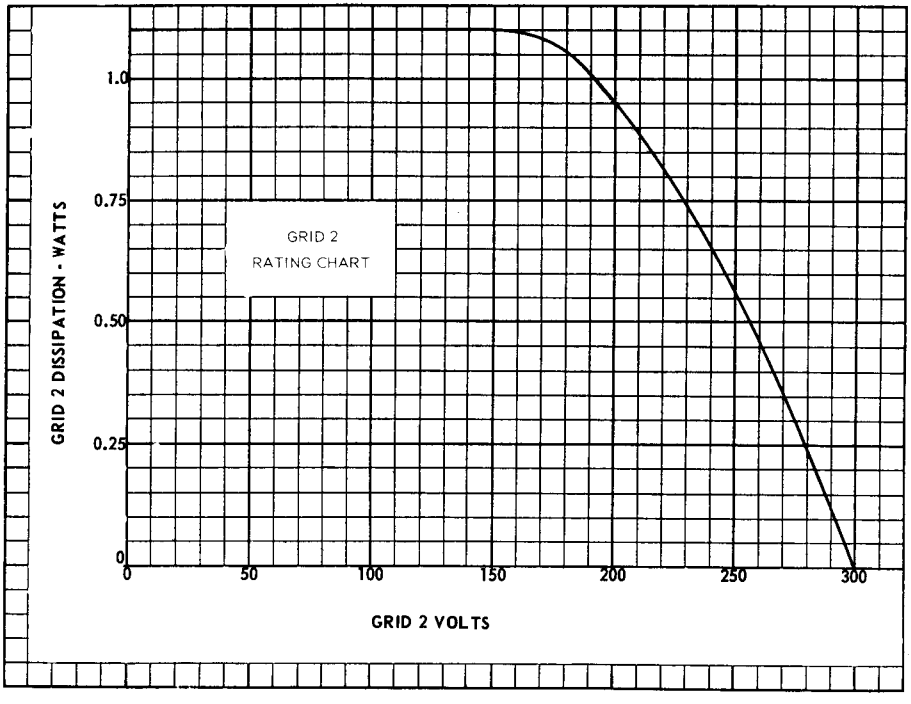
	SECTION 1	SECTION 2	
PLATE VOLTAGE	165	330	VOLTS
GRID 2 VOLTAGE	150	-	VOLTS
GRID 2 SUPPLY VOLTAGE	-	330	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-	28	VOLTS
PLATE DISSIPATION	6.5	1.7	WATTS
GRID 2 DISSIPATION	1.8	SEE CHART	WATTS
UP TO 150 VOLTS	-	1.1	WATTS
CATHODE CURRENT	65	-	MA
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.25	-	MEGOHMS
SELF BIAS	0.5	-	MEGOHMS

AVERAGE CHARACTERISTICS

	SECTION 1	SECTION 2	
PLATE VOLTAGE	145	150	VOLTS
GRID 2 VOLTAGE	110	100	VOLTS
GRID 3 VOLTAGE	-	0	VOLTS
GRID 1 VOLTAGE	-6.0	0	VOLTS
CATHODE RESISTOR	-	560	OHMS
PLATE CURRENT	36	1.3	MA
GRID 2 CURRENT	3.0	2.0	MA
TRANSCONDUCTANCE GRID 1 TO PLATE	8,600	1,000	μMHOS
GRID 3 TO PLATE	-	400	μMHOS
PLATE RESISTANCE - APPROX.	0.03	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS

TYPICAL OPERATION - CLASS A1 POWER AMPLIFIER

	SECTION 1	
PLATE VOLTAGE	145	VOLTS
GRID 2 VOLTAGE	110	VOLTS
GRID 1 VOLTAGE	-6.0	VOLTS
PEAK AUDIO GRID 1 VOLTAGE	6.0	VOLTS
LOAD RESISTANCE	3,000	OHMS
MAXIMUM SIGNAL PLATE CURRENT	40	MA
MAXIMUM SIGNAL GRID 2 CURRENT	9.0	MA
TOTAL HARMONIC DISTORTION	10	%
POWER OUTPUT	2.4	WATTS



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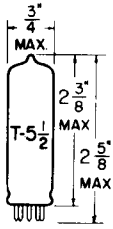
TUNG-SOL

PENTODE

MINIATURE TYPE

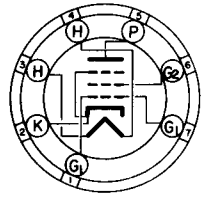


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7B2

THE 6BF5 IS A BEAM PENTODE POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.65	μμf
INPUT: G_1 TO (H+K+G_2)	14	μμf
OUTPUT: P TO (H+K+G_2)	6	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	250	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	900	VOLTS
MAXIMUM PLATE DISSIPATION[B]	5.0	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250	VOLTS
MAXIMUM CATHODE CURRENT (AVERAGE)	40	MA.
MAXIMUM PEAK CATHODE CURRENT	120	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	MEGOHMS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	36	MA.
MAXIMUM SIGNAL PLATE CURRENT	39	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	10.5	MA.
PLATE RESISTANCE (APPROX.)	12 000	OHMS
TRANSCONDUCTANCE	7 500	µMHOS
LOAD RESISTANCE	2 500	OHMS
MAXIMUM SIGNAL POWER OUTPUT	1.9	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT

TRIODE CONNECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	-30	VOLTS
PLATE CURRENT	10	MA.
TRANSCONDUCTANCE	2 700	µMHOS
AMPLIFICATION FACTOR	6.7	
PLATE RESISTANCE	2 500	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-40	VOLTS

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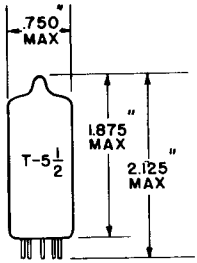
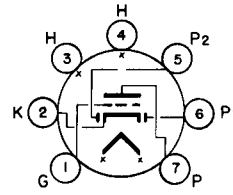


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

DOUBLE-DIODE TRIODE
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE
VOLTAGE AMPLIFIER
AND
DETECTOR

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BT

THE 6BF6 IS A COMBINED LOW-MU VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. THE LOW AMPLIFICATION FACTOR OF THE TRIODE PERMITS LARGE VALUES OF OUTPUT SIGNAL WITH LOW DISTORTION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE SECTION:			
GRID TO PLATE: (G TO TP)	1.9	1.9	pf
INPUT: G TO (H+K)	1.8	1.9	pf
OUTPUT: TP TO (H+K)	0.7	1.2	pf
DIODE SECTION:			
#1 DIODE PLATE TO GRID: (1DP TO G) MAX.	0.07	0.06	pf
#2 DIODE PLATE TO GRID: (2DP TO G) MAX.	0.06	0.05	pf
#2 DIODE PLATE TO HEATER AND CATHODE	0.95		pf
#1 DIODE PLATE TO HEATER AND CATHODE	0.66		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
CURRENT OPERATION		300±20	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

[A] EXTERNAL SHIELD 316 CONNECTED TO PIN#2.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

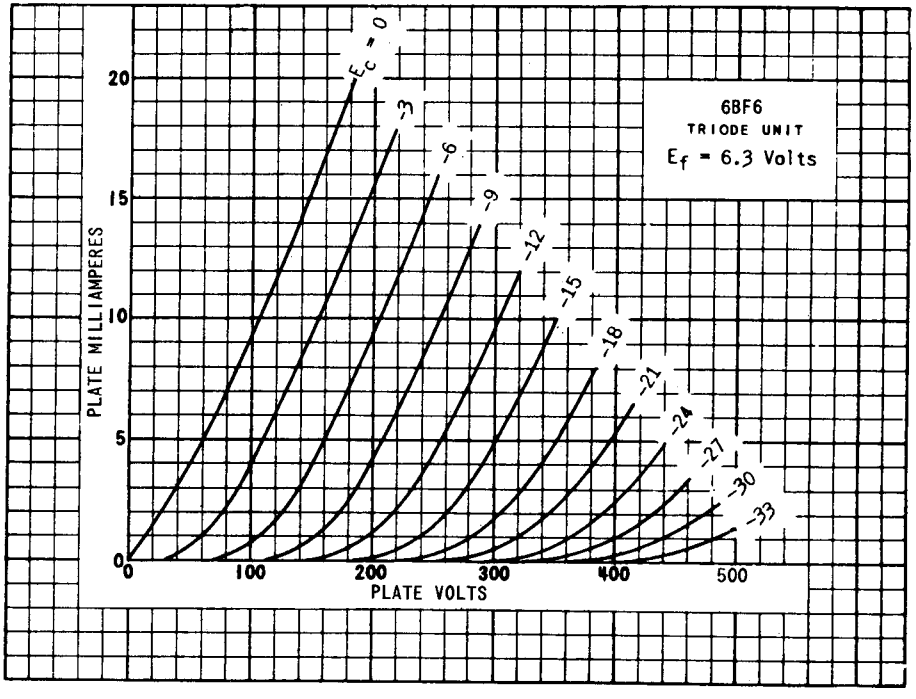
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

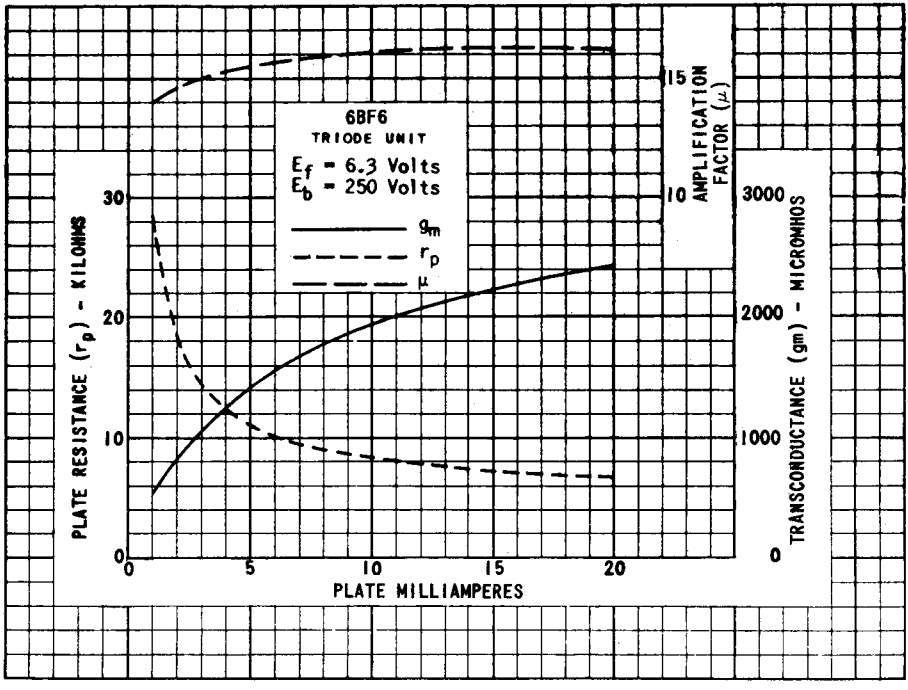
PLATE VOLTAGE	300	VOLTS
PLATE DISSIPATION	2.5	WATTS
AVERAGE DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1.0	MA.

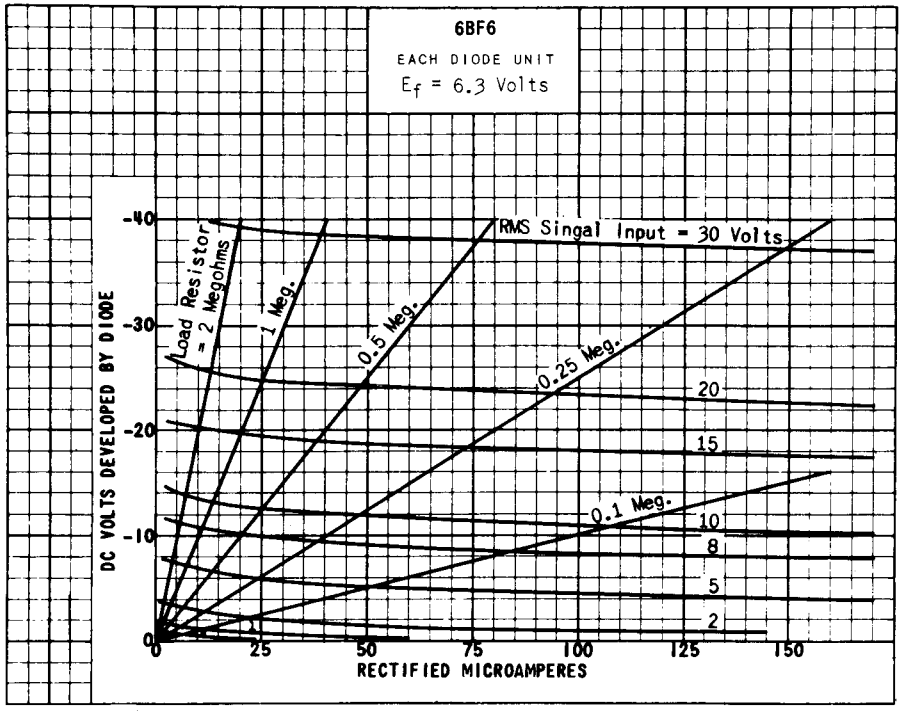
TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-9	VOLTS
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	
PLATE CURRENT	9.5	MA.
LOAD RESISTANCE	10000	OHMS
TOTAL HARMONIC DISTORTION	6.5	PERCENT
POWER OUTPUT	300	MW.
DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED (MIN.)	0.8	MA.







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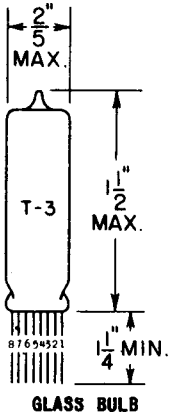
DOUBLE TRIODE

SUBMINIATURE TYPE

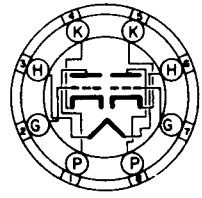


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
8DG

THE 6BF7 IS A GENERAL PURPOSE TRIODE IN THE SUBMINIATURE CONSTRUCTION. IT IS SIMILAR IN FUNCTION TO TYPE 6J6, BUT PROVIDES ADDED FLEXIBILITY FROM THE USE OF SEPARATE CATHODE LEADS AND THE COMPACTNESS OF THE SUBMINIATURE CONSTRUCTION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (EACH SECTION)	1.5	1.5	μμf
INPUT (EACH SECTION)	2.0	2.0	μμf
OUTPUT:			
SECTION 1	1.6	0.28	μμf
SECTION 2	2.0	0.3	μμf
GRID TO GRID	0.008	0.009	μμf
PLATE TO PLATE	0.55	0.75	μμf

[A] EXTERNAL SHIELD OF 0.405 INCH DIAMETER CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.0	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	8.0	MA.
AMPLIFICATION FACTOR	35	
TRANSCONDUCTANCE	4 800	μMHOS
PLATE RESISTANCE	7 000	OHMS
GRID VOLTAGE FOR 10 μAMP. PLATE CURRENT	-7.5	VOLTS

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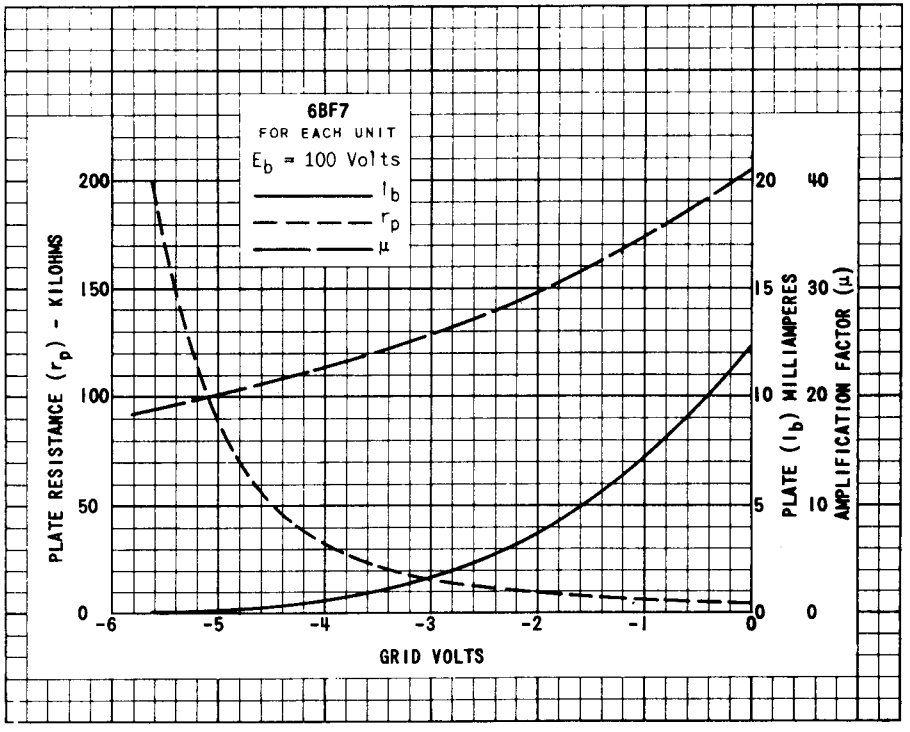
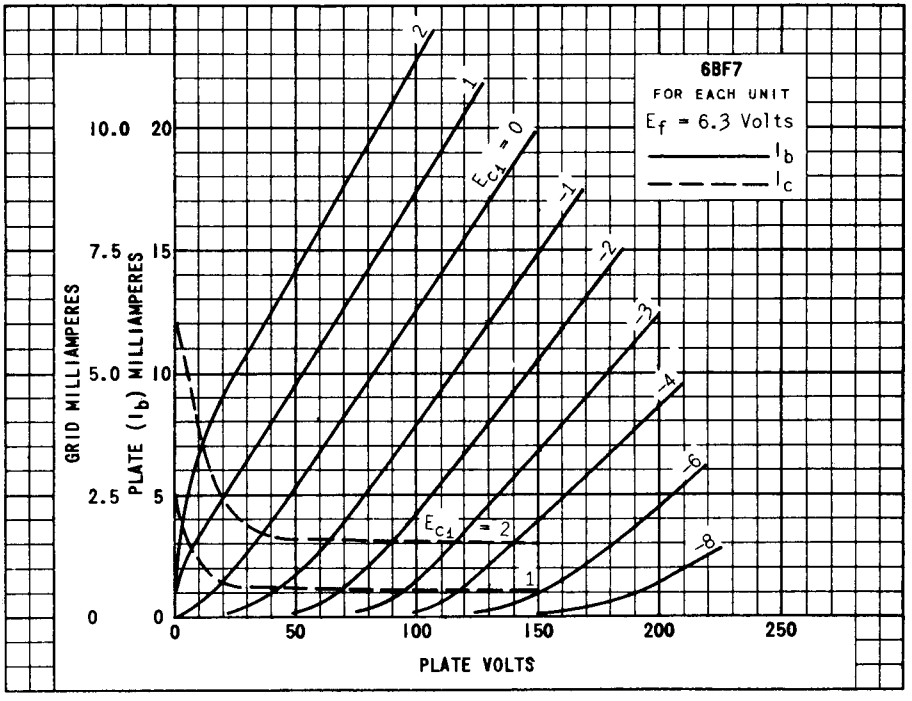

6BF7
FOR EACH UNIT
E_b = 100 Volts
I_b
r_p
μ
PLATE RESISTANCE (r_p) - KILOHMS
PLATE (I_b) MILLIAMPERES
AMPLIFICATION FACTOR (μ)
GRID VOLTS
200
150
100
50
0
20
15
10
5
0
40
30
20
10
0
-6
-5
-4
-3
-2
-1
0


6BF7
FOR EACH UNIT
E_f = 6.3 Volts
I_b
I_c
GRID MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-1
-2
-3
-4
-6
-8
E_{c1} = 2
1
10.0
7.5
5.0
2.5
0
20
15
10
5
0
0
50
100
150
200
250

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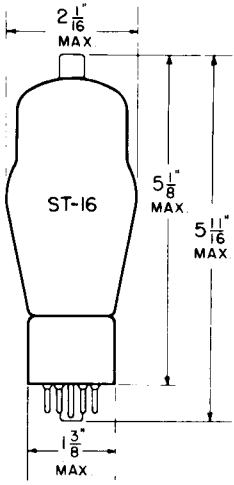
BEAM PENTODE

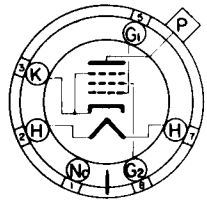


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

MOUNTING POSITION
VERTICAL - BASE UP OR DOWN.
HORIZONTAL - PLANE OF PINS 2 & 7 VERTICAL



BOTTOM VIEW
MEDIUM SHELL
6 PIN OCTAL
58T

THE 6BG6G IS ESSENTIALLY A MECHANICAL REDESIGN OF TYPE 6L6G TO PERMIT OPERATION AS A HORIZONTAL DEFLECTION AMPLIFIER FOR TELEVISION SERVICE. IT USES A TOP CAP CONNECTION AND ADDITIONAL INSULATION FOR THE PLATE STRUCTURE TO WITHSTAND THE HIGH PEAK PLATE VOLTAGE ENCOUNTERED IN SUCH CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: (G_1 TO P) MAX.	0.34 ←	μμf
INPUT: G_1 TO (H+K+G_2+IS)	12 ←	μμf
OUTPUT: P TO (H+K+G_2+IS)	6.5	μμf

RATINGS ←
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE :		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST +DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABS. MAX.)	6600	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1500	VOLTS
MAXIMUM PLATE DISSIPATION[B]	20	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	350	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

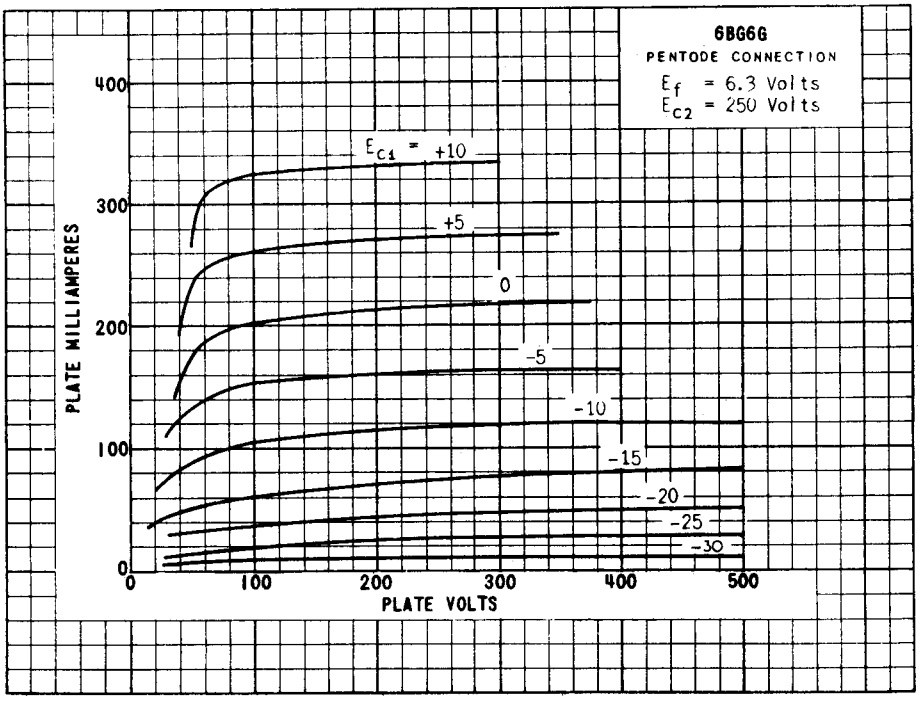
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PENTODE OPERATION: WITH E_b=250 ., E_{c2}=250V., & E_{c1}=-15V.		
PLATE CURRENT	75	MA.
GRID #2 CURRENT	4	MA.
TRANSCONDUCTANCE	6 000	μMHOS
PLATE RESISTANCE	25 000	OHMS
ZERO BIAS: WITH E_b =60V. & E_{c2}=250V.(INSTANTANEOUS VALUES)		
PLATE CURRENT	180	MA.
GRID #2 CURRENT	18	MA.
CUTOFF: FOR I_b=1 MA. WITH E_b=250 V. & E_{c2}=250 V.		
GRID #1 VOLTAGE (APPROX.)	-45	VOLTS
TRIODE μ: WITH E_b = E_{c2}=250V. & E_{c1} =-15V.	8.0	

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[F] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

SIMILAR TYPE REFERENCE: Except for heater ratings the 6BG6G is identical to the 19BG6G.

→INDICATES A CHANGE.



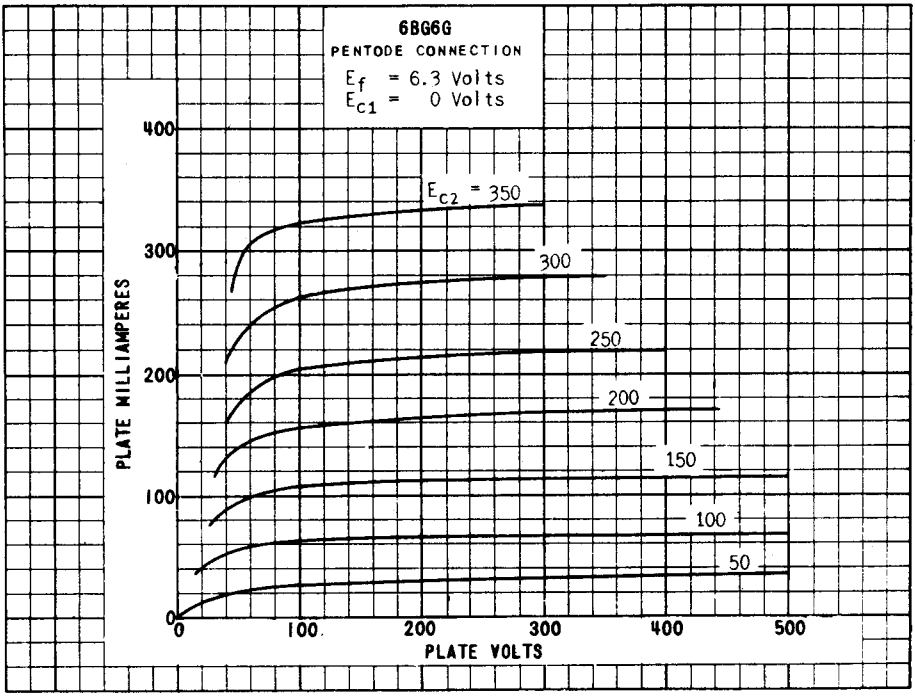


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PLATE
2166
APR. 1,
1949

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6BG6G

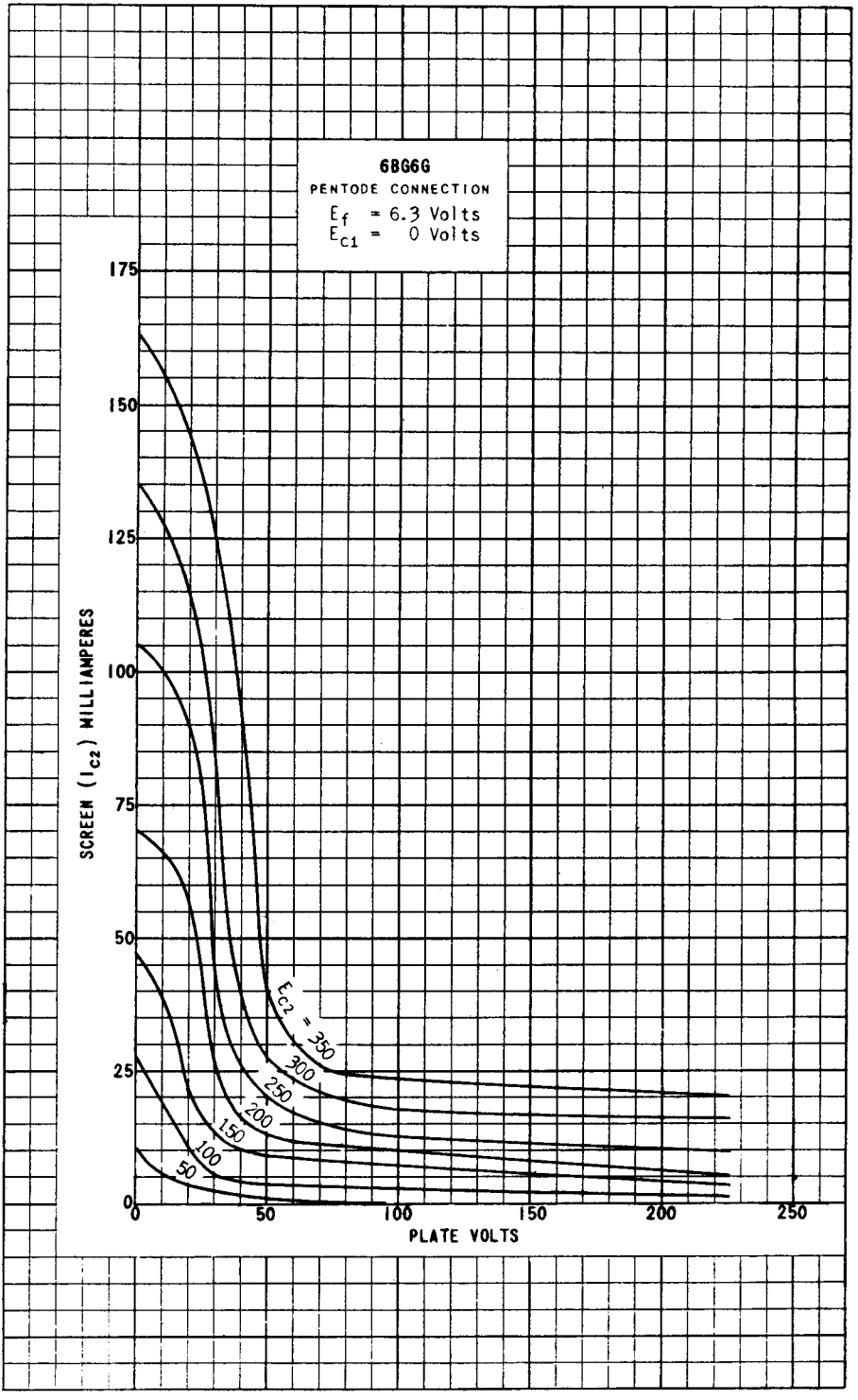

PLATE 2167
APR. 1, 1949

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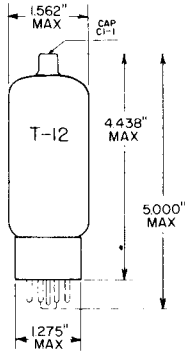
TUNG-SOL

BEAM POWER PENTODE



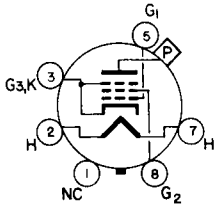
GLASS BULB
B8-110 OR B8-120 OR B8-123 ←
SHORT MEDIUM SHELL
5 PIN OCTAL WITH
EXTERNAL BARRIERS

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS #2 AND #7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BT

THE 6BG6GA IS A BEAM-POWER PENTODE DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ELECTRICALLY AND PHYSICALLY, THE 6BG6GA IS A REPLACEMENT FOR THE 6BG6G; IT DIFFERS PRIMARILY FROM THE 6BG6G BY EMPLOYING A STRAIGHT-SIDED T-12 ENVELOPE.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.8	pf
INPUT	11.0	pf
OUTPUT	6.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

MAXIMUM DC PLATE SUPPLY VOLTAGE	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	6600	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
MAXIMUM PLATE DISSIPATION[B]	20	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	350	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM DC CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

RATINGS — CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

MAXIMUM HEATER—CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	250	250	VOLTS
PLATE CURRENT	180	75	MA.
GRID #2 CURRENT	18	4.0	MA.
GRID #1 VOLTAGE	0	-15	VOLTS
PLATE RESISTANCE (APPROX.)		25 000	OHMS
TRANSCONDUCTANCE		6 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b=1.0 MA.		-45	VOLTS
TRIODE AMPLIFICATION FACTOR[C]		8.0	

[C] TRIODE CONNECTED (GRID #2 TIED TO PLATE): Eb =Ec2 =250 VOLTS AND Ec1 =-15VOLTS.

TUNG-SOL

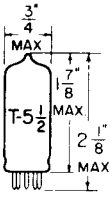
PENTODE

MINIATURE TYPE

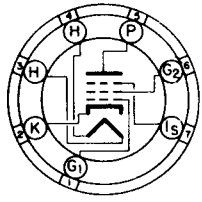
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BH6 IS A SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER IN THE MINIATURE CONSTRUCTION. IT FEATURES HIGH TRANSCONDUCTANCE, LOW CAPACITANCES, AND ECONOMY OF HEATER POWER AND IS USEFUL AS A GENERAL PURPOSE AMPLIFIER AT BOTH LOW AND HIGH FREQUENCIES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P) MAX.	0.0035	0.0035	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.4	5.4	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	4.4	4.4	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
GRID #2 VOLTAGE	100	150	VOLTS
GRID #1 VOLTAGE	-1	-1	VOLT
PLATE RESISTANCE (APPROX.)	0.7	1.4	MEGOHMS
TRANSCONDUCTANCE	3 400	4 600	μMHOS
PLATE CURRENT	3.6	7.4	MA.
GRID #2 CURRENT	1.4	2.9	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA.	-5	-7.7	VOLTS

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PLATE 2669
JUNE 1 1951

→ INDICATES A CHANGE OR ADDITION.

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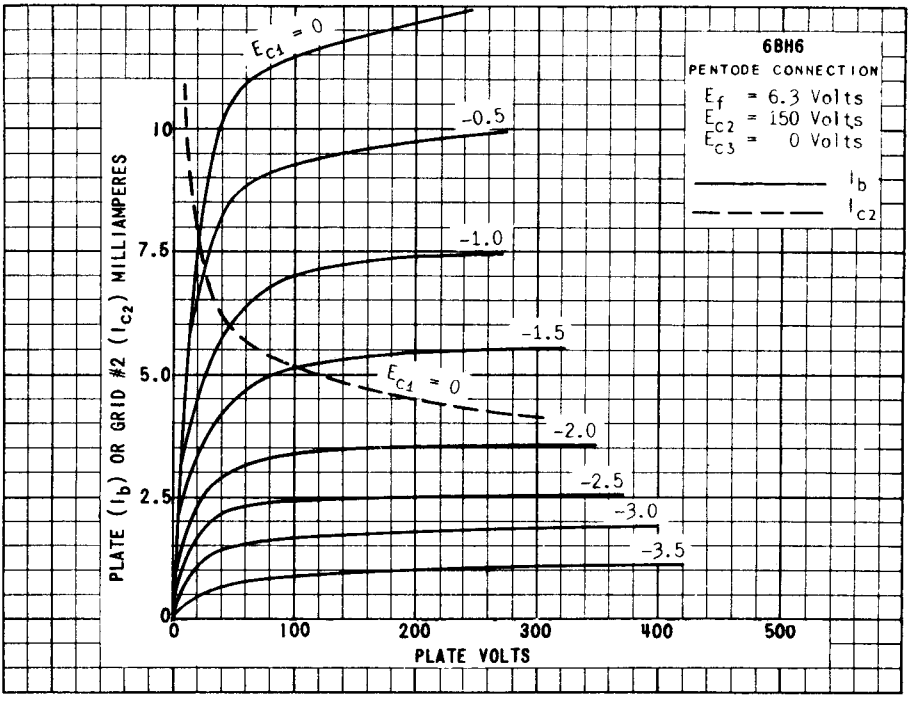
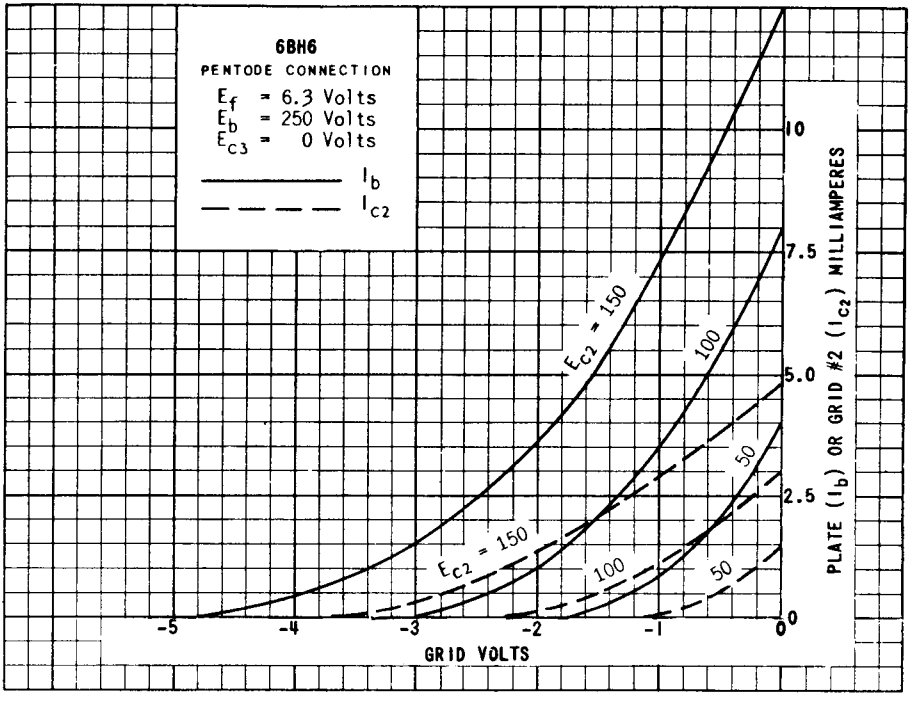
6BH6





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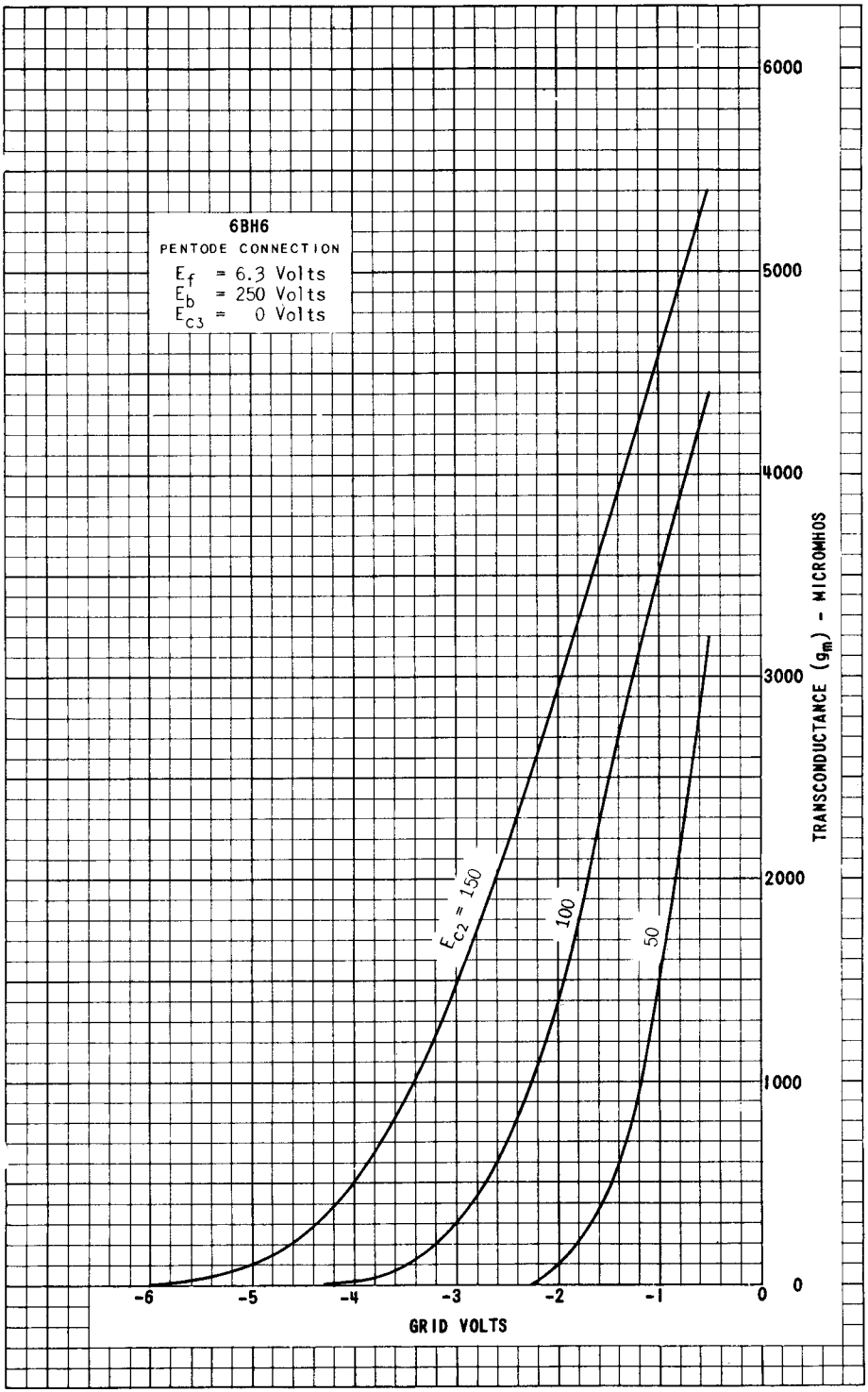

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DEC. 1, 1947

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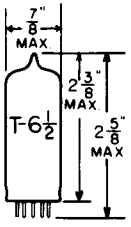
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

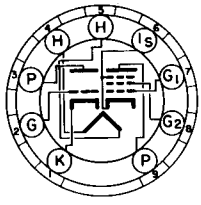


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 6BH8 IS A SHARP CUTOFF PENTODE AND A MEDIUM MU TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE TUBE IS SUITABLE FOR GENERAL PURPOSE APPLICATIONS IN BOTH MONOCHROME AND COLOR TELEVISION RECEIVERS. THE HIGH FIGURE OF MERIT OF THE PENTODE SECTION MAKES IT PARTICULARLY SUITED FOR SERVICE AS A VIDEO AMPLIFIER, VIDEO INTERMEDIATE FREQUENCY AMPLIFIER AND SOUND INTERMEDIATE FREQUENCY AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR, OR CLIPPER OR AS A SWEEP OSCILLATOR. THE TRIODE SECTION MAY ALSO BE CONNECTED AS A DIODE FOR VIDEO-DETECTOR APPLICATIONS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID #1 TO PLATE	0.046	2.4	μμf
INPUT	7	2.6	μμf
OUTPUT	2.4	0.38	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.004		μμf
TRIODE GRID TO PENTODE PLATE	0.016		μμf
PENTODE PLATE TO TRIODE PLATE	0.095		μμf

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	---	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.25	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

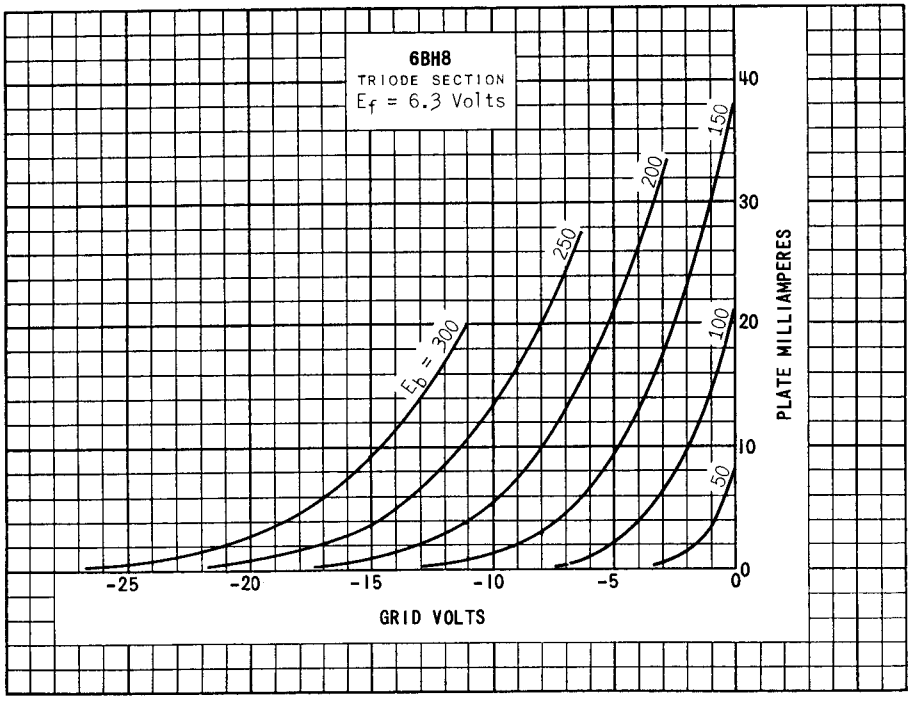
CLASS A_1 AMPLIFIER

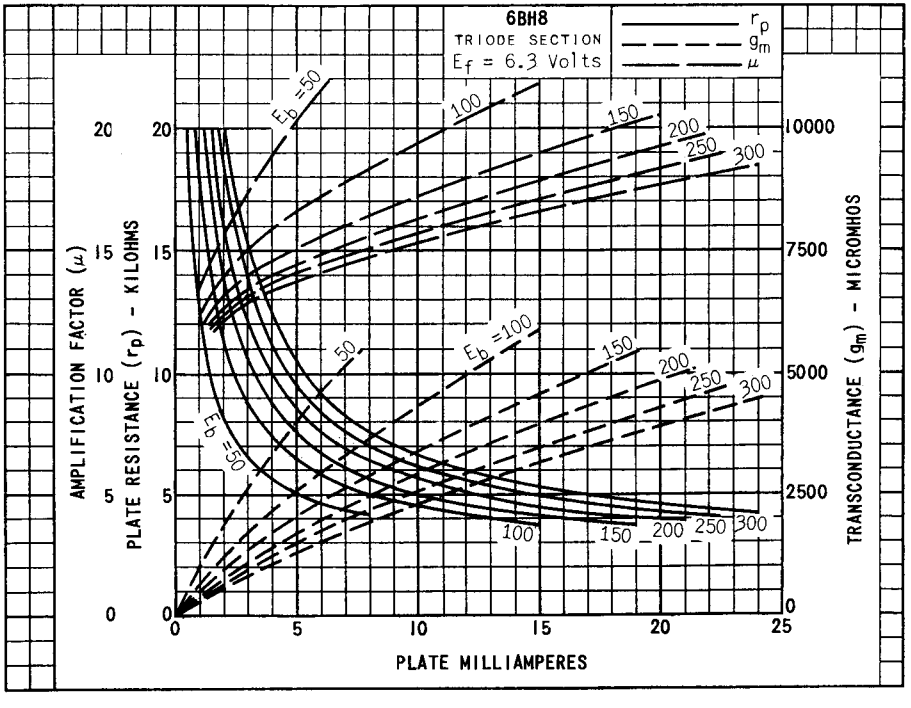
	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	---	OHMS
AMPLIFICATION FACTOR	---	17	
PLATE RESISTANCE (APPROX.)	150 000	5 150	OHMS
TRANSCONDUCTANCE	7 000	3 300	μMHOS
PLATE CURRENT	15	9.5	MA.
GRID #2 CURRENT	3.4	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMP.	-8	-14	VOLTS
GRID #1 VOLTAGE	---	-5	VOLTS

NOTE:

THE TRIODE SECTION OF THE 6BH8 MAY BE DIODE-CONNECTED AND EMPLOYED AS A HIGH-PERVEANCE DIODE IN VIDEO-DETECTOR APPLICATIONS. THE DIODE OPERATION CAN BE OBTAINED EITHER WITH THE TRIODE GRID CONNECTED TO THE TRIODE PLATE AND THE COMBINATION OPERATED AS THE PLATE OF THE DIODE, OR WITH THE TRIODE PLATE GROUNDED AND THE TRIODE GRID OPERATED AS THE PLATE OF THE DIODE.

SIMILAR TYPE REFERENCE: EXCEPT FOR THE ELECTRICAL CHARACTERISTICS OF THE TRIODE SECTION, THE 6BH8 IS IDENTICAL TO THE 6AU8.





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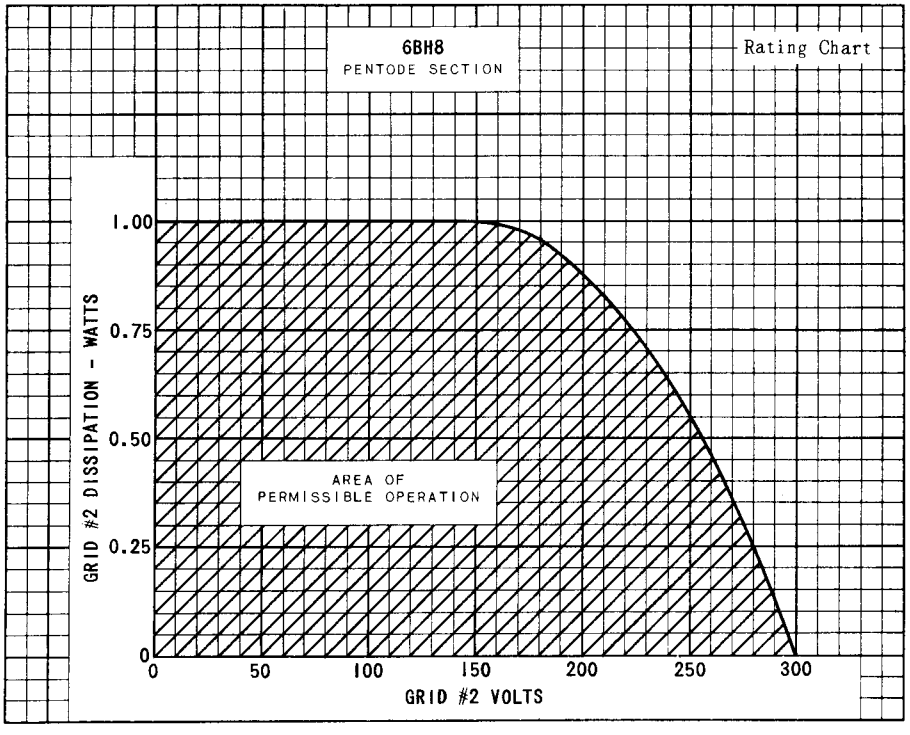
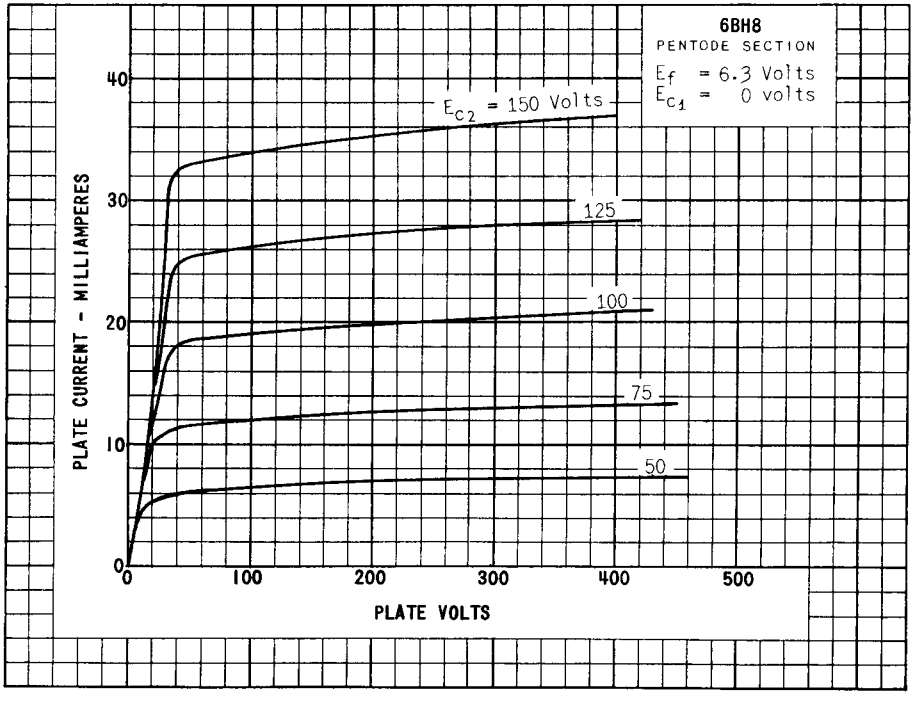
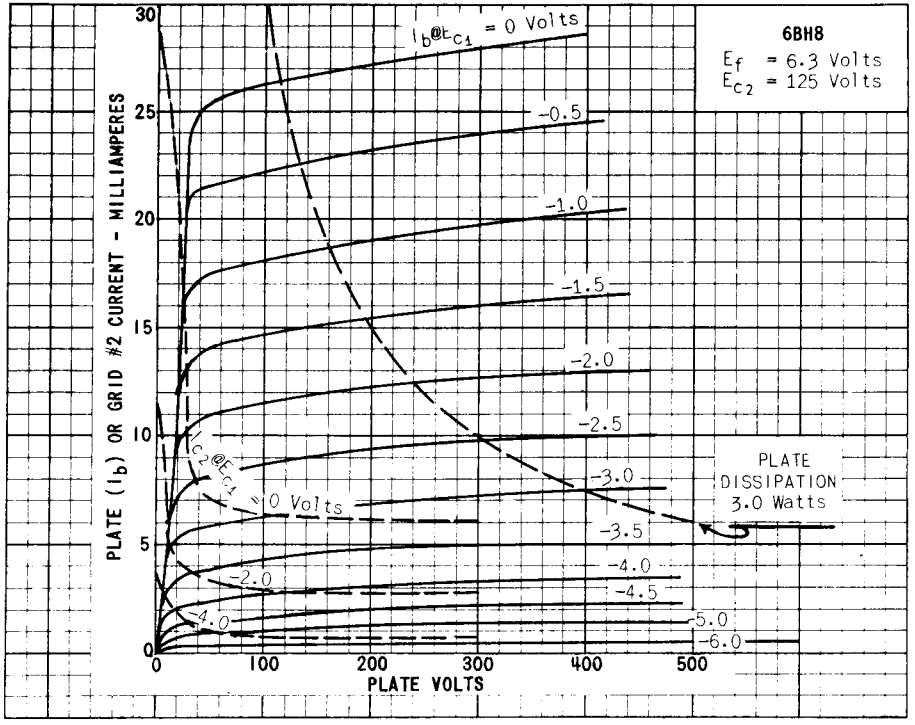
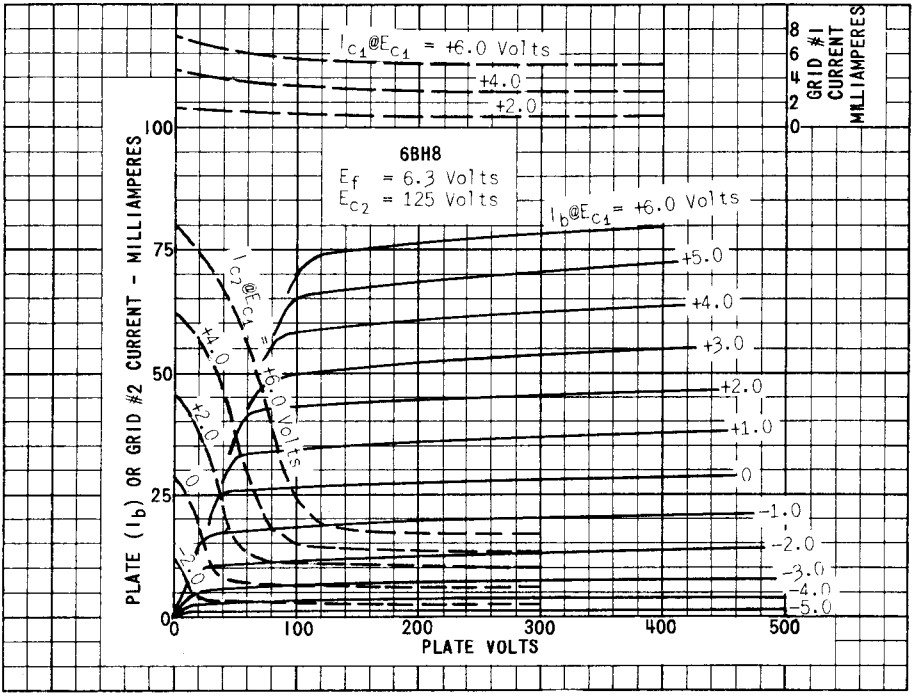
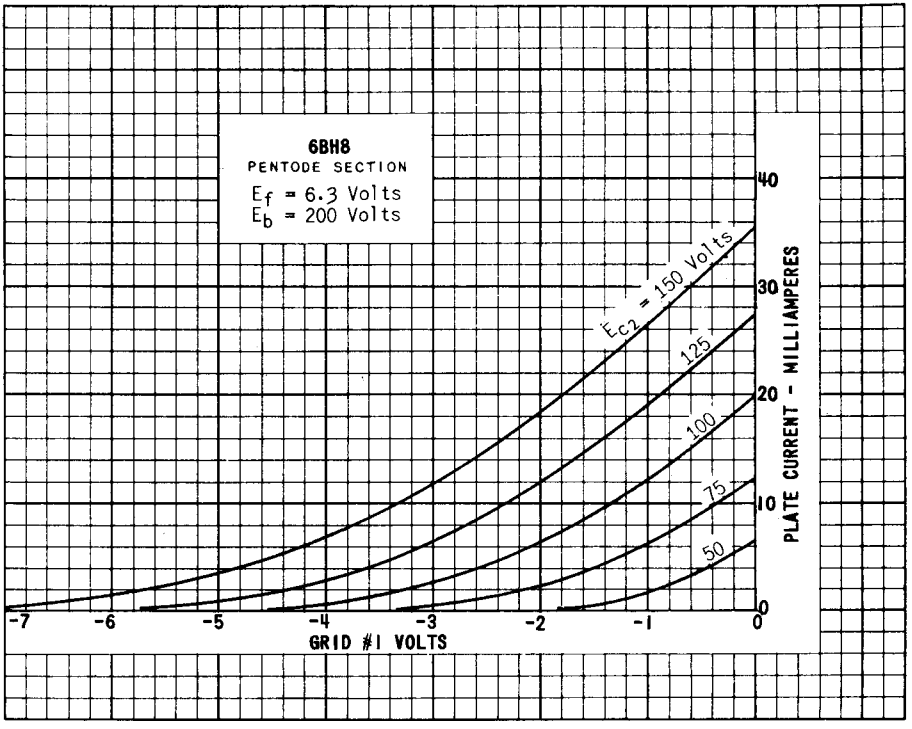
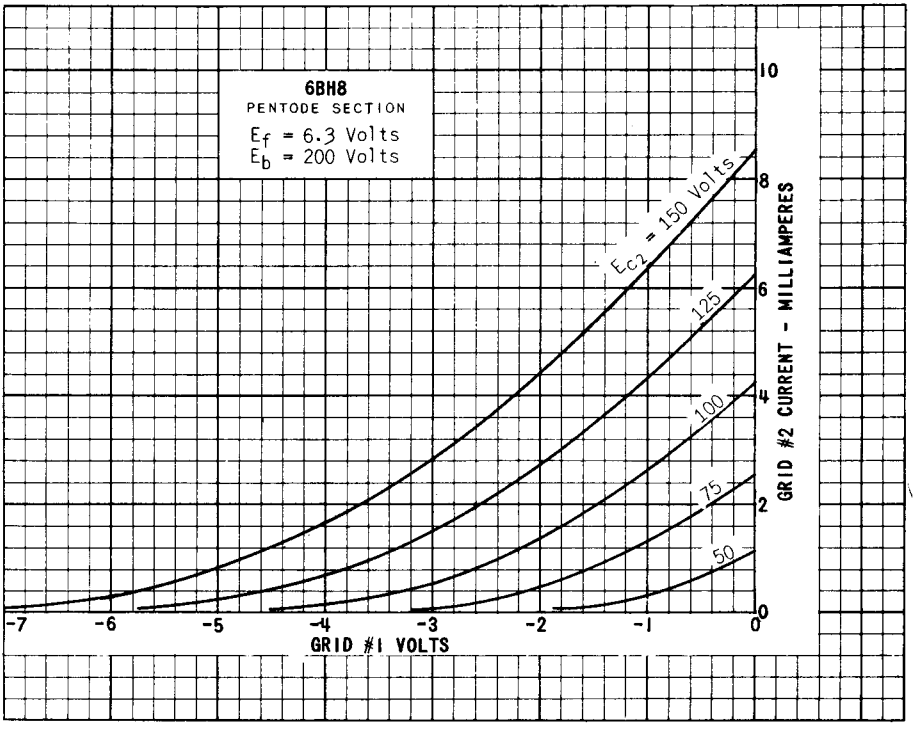

6BH8
PENTODE SECTION
Rating Chart
GRID #2 DISSIPATION - WATTS
1.00
0.75
0.50
0.25
0
AREA OF
PERMISSIBLE OPERATION
0
50
100
150
200
250
300
GRID #2 VOLTS

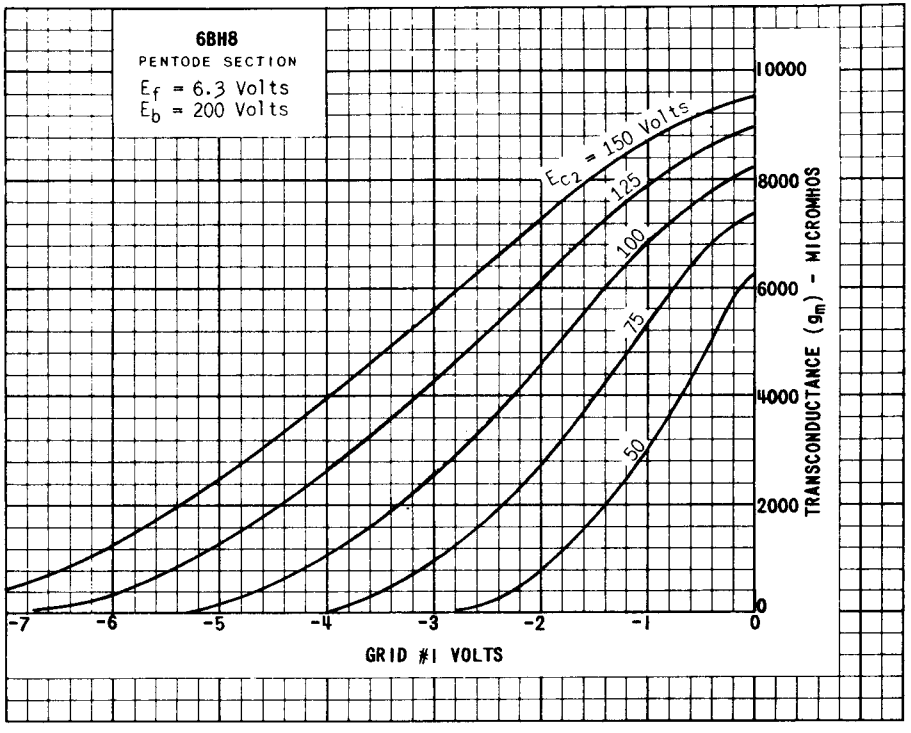

6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_{c_1} = 0 volts
E_{c_2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
40
30
20
10
0
0
100
200
300
400
500
PLATE VOLTS

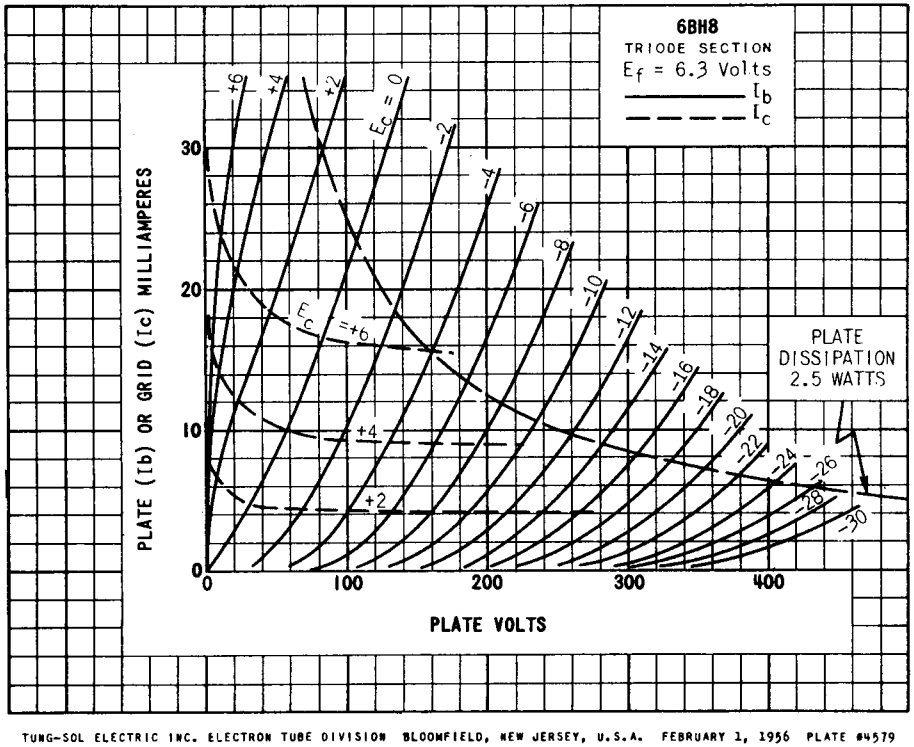

6BH8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b@E_{c_1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-6.0
I_{c_2}@E_{c_1} = 0 Volts
-2.0
-4.0
PLATE DISSIPATION 3.0 Watts
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
30
100
200
300
400
500


I_{c_1}@E_{c_1} = +6.0 Volts
+4.0
+2.0
GRID #1 CURRENT MILLIAMPERES
0
2
4
6
8
6BH8
E_f = 6.3 Volts
E_{c_2} = 125 Volts
I_b@E_{c_1} = +6.0 Volts
+5.0
+4.0
+3.0
+2.0
+1.0
0
-1.0
-2.0
-3.0
-4.0
-5.0
I_{c_2}@E_{c_1} = +6.0 Volts
+4.0
+2.0
0
-2.0
PLATE (I_b) OR GRID #2 CURRENT - MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500


6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
PLATE CURRENT - MILLIAMPERES
40
30
20
10
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
GRID #2 CURRENT - MILLIAMPERES
10
8
6
4
2
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

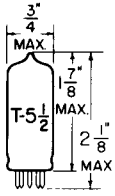

6BH8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
10000
8000
6000
4000
2000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


6BH8
TRIODE SECTION
E_f = 6.3 Volts
I_b
I_c
+6
+4
+2
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
E_c = +6
+4
+2
PLATE DISSIPATION 2.5 WATTS
30
20
10
0
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

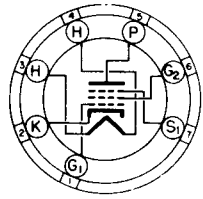


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BJ6, 6BJ6A ARE PENTODE VOLTAGE AMPLIFIERS WITH REMOTE CONTROL CHARACTERISTICS UTILIZING THE MINIATURE CONSTRUCTION. THEY ARE CHARACTERIZED BY HIGH TRANSCONDUCTANCE, LOW GRID-PLATE CAPACITANCE, AND AN EXTREMELY HIGH EFFICIENCY CATHODE ADAPTING THEM TO APPLICATION WHERE CONSERVATION OF HEATER POWER IS IMPORTANT.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P) MAX.	0.0035	0.0035	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	4.5	4.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5.5	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PINS #2 AND #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.25	1.3	MEGOHMS
TRANSCONDUCTANCE	3 650	3 600	μMHOS
PLATE CURRENT	9	9.2	MA.
GRID #2 CURRENT	3.5	3.3	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS	-20	-20	VOLTS

THE INTERFACE IMPEDANCE CONTROL CONSISTS OF A LIFE TEST CONDUCTED FOR 500 HOURS WITH THE FILAMENT OPERATING WITH 6.9 VOLTS IMPOSED. THE OTHER TUBE ELEMENTS ARE UNCONNECTED SIMULATING OPERATION AT CUTOFF CONDITIONS. FOLLOWING LIFE TEST THE SAMPLE TUBES ARE MEASURED AT CONDITIONS Ef=5.7V; Eb= Ec2= Ec3= 70Vdc; AND Ec1 ADJUSTED FOR Ib=4.0 mAdc. THE MAXIMUM ALLOWABLE VALUE FOR INTERFACE IMPEDANCE IS 70 OHMS. **(NOTE IS FOR 6BJ6A ONLY)**

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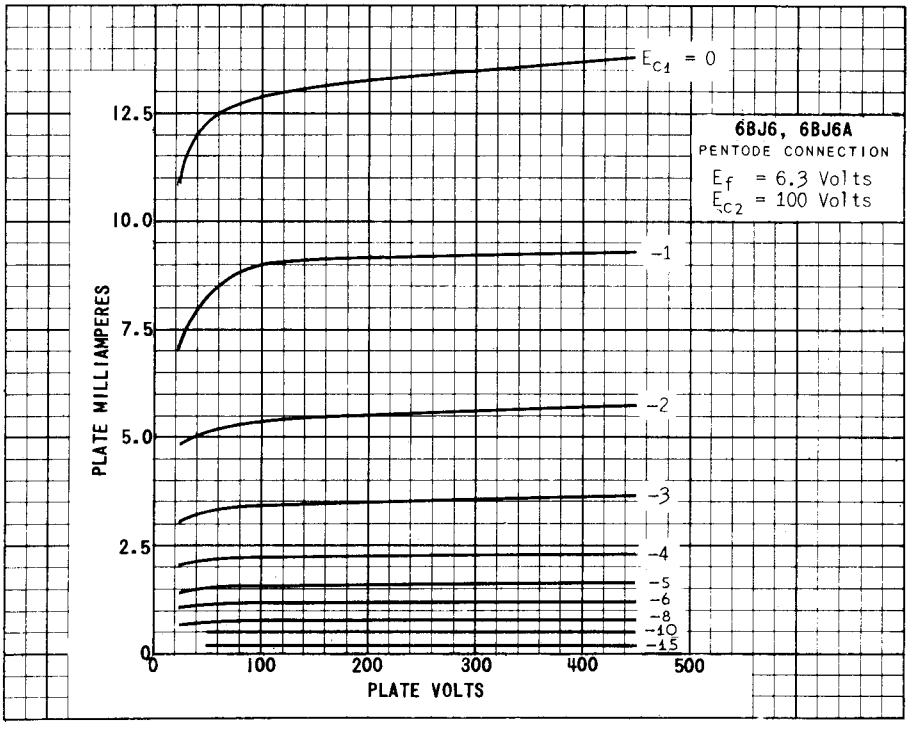

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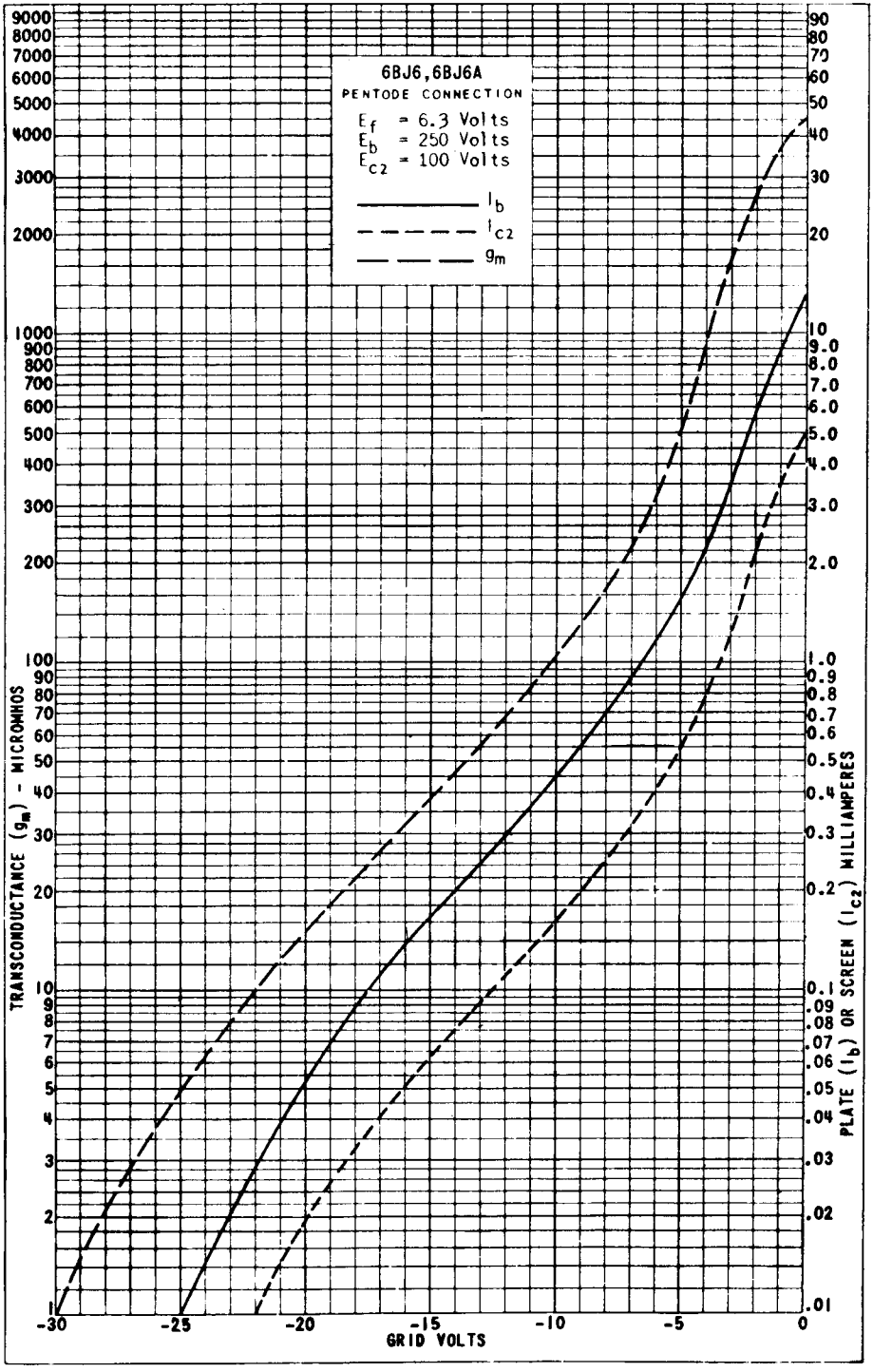
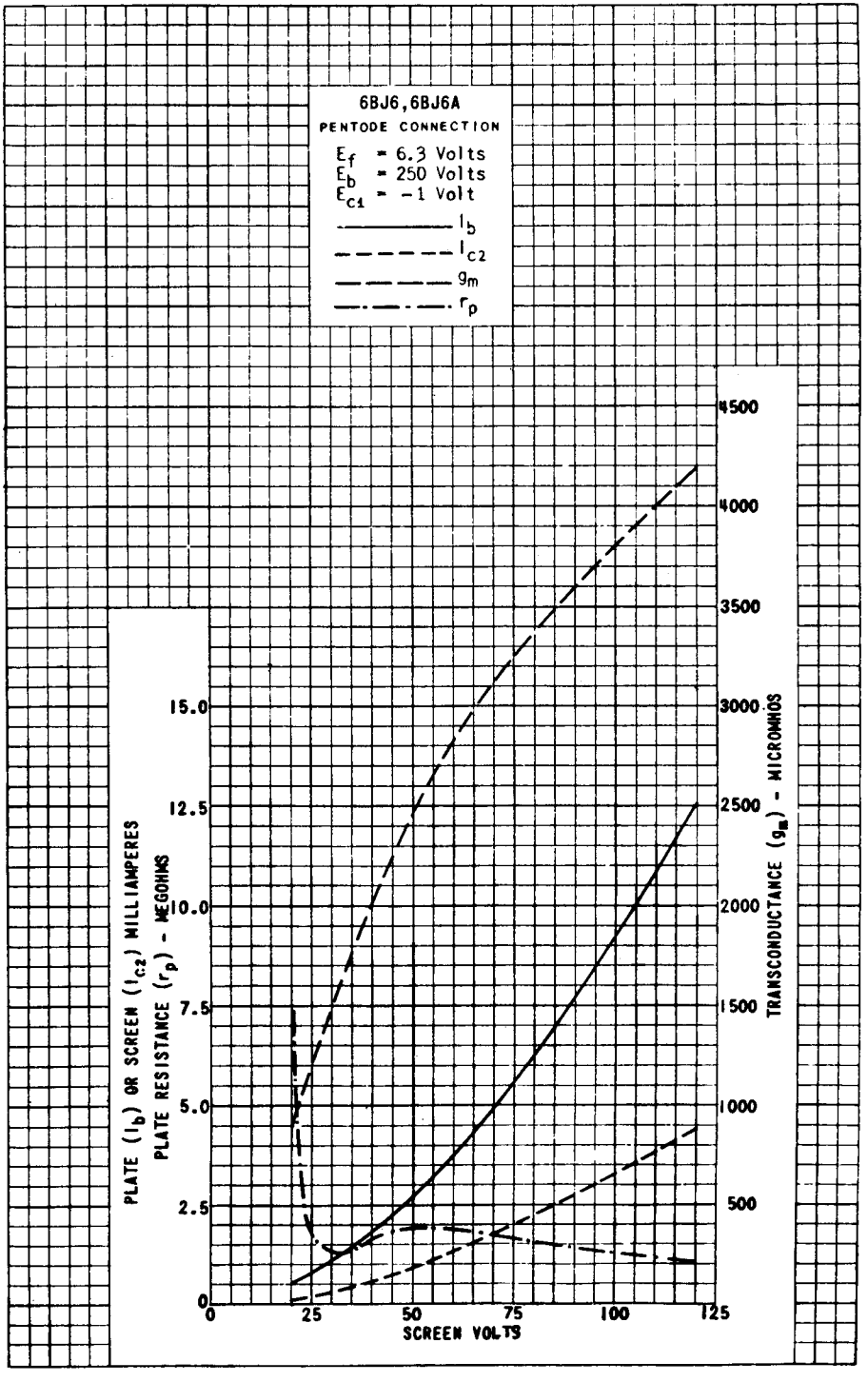
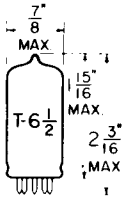

6BJ6,6BJ6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
GRID VOLTS
-30
-25
-20
-15
-10
-5
0


6BJ6, 6BJ6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c1} = −1 Volt
I_b
I_{c2}
g_m
r_p
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
SCREEN VOLTS
0
2.5
5.0
7.5
10.0
12.5
15.0
500
1000
1500
2000
2500
3000
3500
4000
4500
25
50
75
100
125

TUNG-SOL

TRIPLE DIODE

MINIATURE TYPE

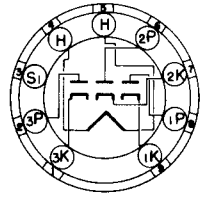


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AX

THE 6BJ7 IS A TRIPLE DIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR USE AS A DC RESTORER IN EACH OF THE THREE SIGNAL CHANNELS OF COLOR TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

PLATE #1 TO CATHODE #1, HEATER & INTERNAL SHIELD	3.0	μμf
PLATE #2 TO CATHODE #2, HEATER & INTERNAL SHIELD	2.6	μμf
PLATE #3 TO CATHODE #3, HEATER & INTERNAL SHIELD	2.6	μμf
CATHODE #1 TO PLATE #1, HEATER & INTERNAL SHIELD	4.0	μμf
CATHODE #2 TO PLATE #2, HEATER & INTERNAL SHIELD	3.8	μμf
CATHODE #3 TO PLATE #3, HEATER & INTERNAL SHIELD	4.0	μμf
PLATE #1 TO PLATE #2	0.055	μμf
PLATE #2 TO PLATE #3	0.036	μμf
PLATE #3 TO PLATE #1	0.036	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

TV DC RESTORER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	330	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK PLATE CURRENT (EACH PLATE)	10	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	1.0	MA.
TUBE VOLTAGE DROP (EACH SECTION) I_b = 10 MA. (DC)	2.7	VOLTS

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→ INDICATES A CHANGE.

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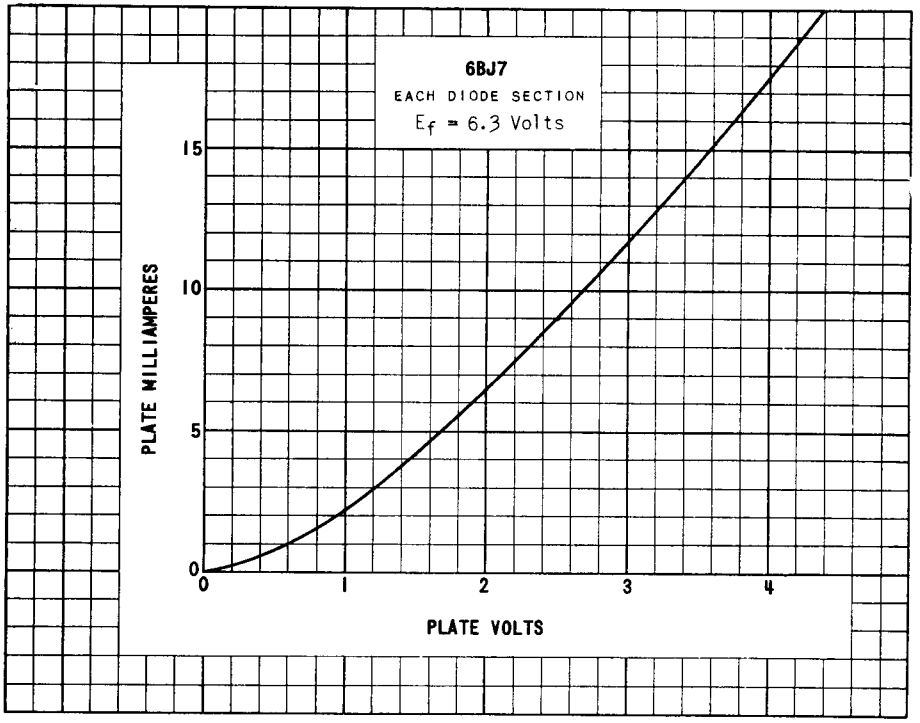
6BJ7


6BJ7
EACH DIODE SECTION
E_f = 6.3 Volts
PLATE MILLIAMPERES
15
10
5
0
0
1
2
3
4
PLATE VOLTS

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

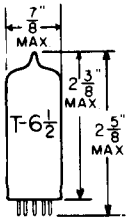
COATED UNIPOTENTIAL CATHODE

HEATER

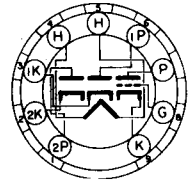
6.3 VOLTS 0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9ER

THE 6BJ8 IS A MEDIUM-MU TRIODE AND A DOUBLE DIODE IN ONE ENVELOPE USING THE 9 PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE. IT IS DESIGNED FOR USE AS A PHASE SPLITTER, PHASE COMPARATOR AND HORIZONTAL DEFLECTION OSCILLATOR IN 600 MA. SERIES HEATER OPERATED RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE: G TO P	2.6	μμf
INPUT: G TO (H+TK)	2.8	μμf
OUTPUT: P TO (H+TK)	0.31	μμf
DIODE SECTION		
#1 PLATE TO TRIODE GRID (MAX.)	.070	μμf
#2 PLATE TO TRIODE GRID (MAX.)	.11	μμf
#1 CATHODE TO ALL: $_1$DK TO (H+TK+$_2$DK+TP+$_1$DP+TG+$_2$DP)	4.8	μμf
#2 CATHODE TO ALL: $_2$DK TO (H+TK+$_1$DK+TP+$_1$DP+$_2$DP+TG)	4.8	μμf
#1 PLATE TO #2 PLATE (MAX.)	.060	μμf
#1 PLATE TO #1 CATHODE + HEATER: $_1$DP TO ($_1$DK+H)	1.9	μμf
#2 PLATE TO #2 CATHODE + HEATER: $_2$DP TO ($_2$DK+H)	1.9	μμf
#1 CATHODE TO #1 PLATE+HEATER: $_1$DK TO ($_1$DP+H)	4.6	μμf
#2 CATHODE TO #2 PLATE+HEATER: $_2$DK TO ($_2$DP+H)	4.6	μμf
#1 PLATE TO ALL: $_1$DP TO (H+TK+$_1$DK+$_2$DK+TP+$_2$DP+TG)	3.0	μμf
#2 PLATE TO ALL: $_2$DP TO (H+TK+$_1$DK+$_2$DK+TP+$_1$DP+TG)	3.0	μμf

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RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

	CLASS A_1 AMPLIFIER	VERTICAL[B] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
HEATER WARM–UP TIME (APPROX.)[C]	11.0		SECONDS
TRIODE SECTION			
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	---	VOLTS
MAXIMUM POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PLATE DISSIPATION[D]	4.0	4.0	WATTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	---	275	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	22	22	MA.
MAXIMUM PEAK CATHODE CURRENT	---	77	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
SELF BIAS	---	2.2	MEGOHMS
DIODE SECTION			
MAXIMUM PEAK PLATE CURRENT (EACH PLATE)	54		MA.
MAXIMUM DC CURRENT (EACH PLATE)	9		MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3 ←		VOLTS
HEATER CURRENT	0.6±6% ←		AMP.
TRIODE SECTION			
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−9	VOLTS
PLATE RESISTANCE (APPROX.)	4 700	7 150	OHMS
TRANSCONDUCTANCE	4 700	2 800	μMHOS
AMPLIFICATION FACTOR	22	20	
PLATE CURRENT	13.5	8.0	MA.
PLATE CURRENT AT E_c = −12.5 VOLTS (DC)	---	1.7	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μAMP.	−7	−18	VOLTS
DIODE SECTION			
AVERAGE CURRENT (EACH PLATE) AT 10 VOLTS (DC)		50	MA.
VOLTAGE DROP (EACH SECTION) AT I_b = 9 MA. (DC)		2.6	VOLTS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

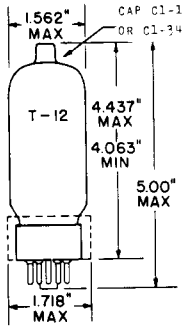
[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF TS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

[D] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE

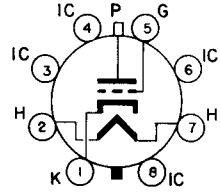


GLASS BULB
SMALL CAP
SHORT MEDIUM SHELL
8 PIN OCTAL B8-228 OR B8-71
OUTLINE DRAWING
JEDEC 10-34

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 200 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8GC

THE 6BK4 IS A SHARP CUT-OFF BEAM TRIODE. IT IS DESIGNED FOR THE VOLTAGE REGULATION OF HIGH VOLTAGE, LOW CURRENT DC POWER SUPPLIES IN COLOR TELEVISION.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	0.03	pf
GRID TO CATHODE AND HEATER	2.6	pf
PLATE TO CATHODE AND HEATER	1.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VOLTAGE CONTROL SERVICE

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	220	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	NOT RECOMMENDED	
MAXIMUM DC PLATE VOLTAGE	27 000	VOLTS
MAXIMUM UNREGULATED DC SUPPLY VOLTAGE	60 000	VOLTS
MAXIMUM GRID VOLTAGE:		
DC VALUE	-135	VOLTS
PEAK VALUE (FOR DURATION OF 20 SEC. MAX. DURING EQUIPMENT WARM-UP)	-440	VOLTS
MAXIMUM DC PLATE CURRENT	1.6	MA.
MAXIMUM PLATE DISSIPATION	25	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE[A]	3	MEGOHMS

[A] FOR USE WITH "FLYBACK TRANSFORMER" HIGH VOLTAGE SUPPLY.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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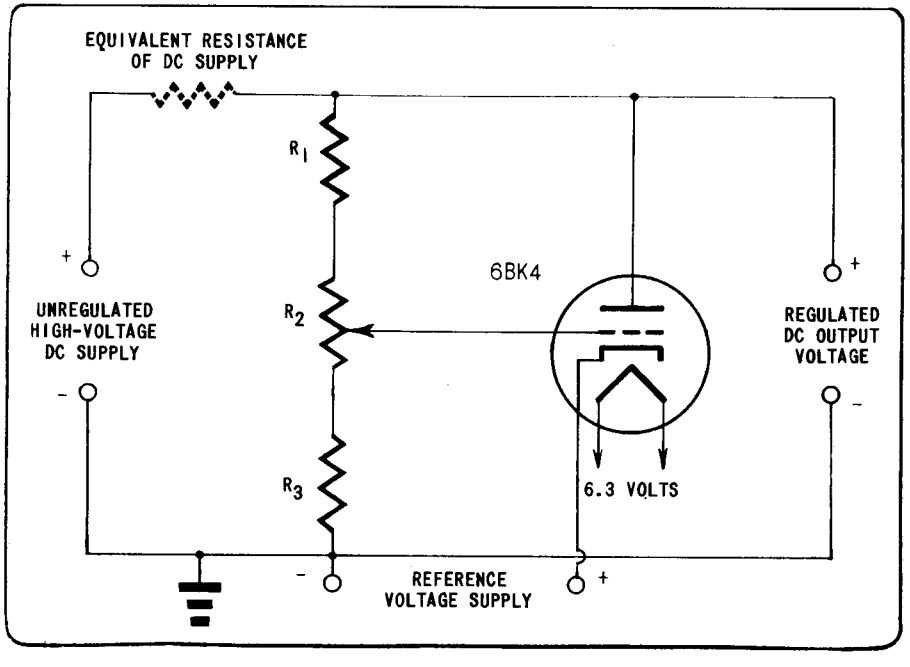
TUNG-SOL

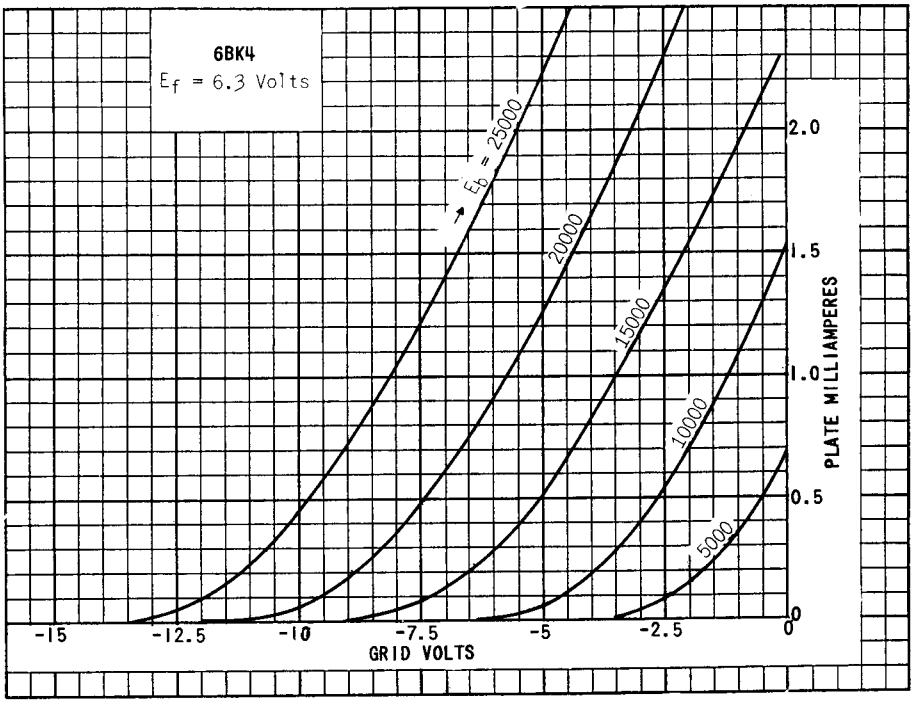
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SHUNT VOLTAGE-REGULATOR TUBE
IN ACCOMPANYING CIRCUIT

UNREGULATED SUPPLY:		
DC VOLTAGE	→ 36 000	VOLTS
EQUIVALENT RESISTANCE	11	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	220	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (1/2 WATT)	820 000	OHMS
REFERENCE VOLTAGE SUPPLY:		
DC VALUE	200	VOLTS
EQUIVALENT RESISTANCE	1 000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	200	μMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF 0 MA.	1 000	μAMP.
FOR LOAD CURRENT OF 1 MA.	45	μAMP.
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF 0 MA.	25 000	VOLTS
FOR LOAD CURRENT OF 1 MA.	24 500	VOLTS
AMPLIFICATION FACTOR (APPROX.)	2 000	





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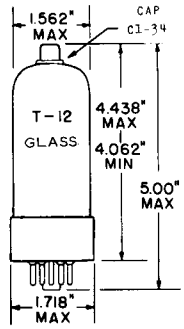
TUNG-SOL

TRIODE

OUTLINE DRAWING

JEDEC 12-36

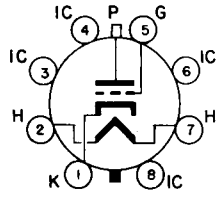


BASE SHORT MEDIUM SHELL
8 PIN OCTAL
JEDEC B8-118

FOR HIGH - VOLTAGE
SHUNT REGULATOR SERVICE

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8GC



BOTTOM VIEW

THE 6BK4A IS A SHARP CUT-OFF BEAM TRIODE FOR HIGH-VOLTAGE, LOW-CURRENT APPLICATION SHUNT REGULATION OF THE HIGH VOLTAGE, DC POWER SUPPLIED IN COLOR TELEVISION RECEIVERS. EXCEPT FOR ALLOWABLE PLATE DISSIPATION, THIS TYPE IS THE SAME AS THE 6BK4

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G TO P	0.03	pf
GRID TO CATHODE AND HEATER: G TO (K + H)	2.6	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	200	MA
LIMITS OF APPLIED VOLTAGE - AC OR DC			6.3 ± 0.6	VOLTS
MAXIMUM HEATER - CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			NOT RECOMMENDED	

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MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

MAXIMUM DC PLATE VOLTAGE	27,000	VOLTS
MAXIMUM UNREGULATED DC SUPPLY VOLTAGE	60,000	VOLTS
MAXIMUM NEGATIVE GRID VOLTAGE:		
DC VALUE	135	VOLTS
PEAK VALUE (FOR DURATION OF 20 SEC. MAX. DURING EQUIPMENT WARM-UP)	440	VOLTS
MAXIMUM PLATE DISSIPATION	30	WATTS
MAXIMUM DC PLATE CURRENT	1.6	MA
MAXIMUM GRID CIRCUIT RESISTANCE	3	MEGOHMS

FOR USE WITH "FLYBACK TRANSFORMER" HIGH VOLTAGE SUPPLY.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SHUNT VOLTAGE - REGULATOR TUBE

IN ACCOMPANYING CIRCUIT

UNREGULATED SUPPLY:		
DC VOLTAGE	36,000	VOLTS
EQUIVALENT RESISTANCE	11	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	220	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (½ WATT)	820,000	OHMS
REFERENCE VOLTAGE:		
DC VALUE	200	VOLTS
EQUIVALENT RESISTANCE OF SUPPLY	1,000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	200	μMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF OMA.	1,000	μAMP.
FOR LOAD CURRENT OF 1 MA.	45	μAMP.
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF O MA.	25,000	VOLTS
FOR LOAD CURRENT OF 1 MA.	24,500	VOLTS

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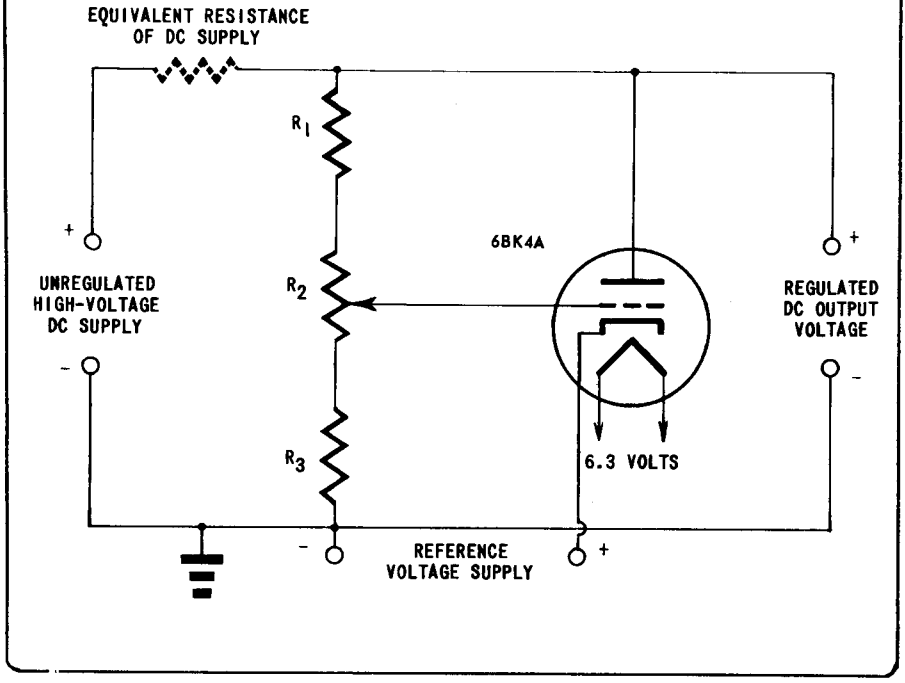

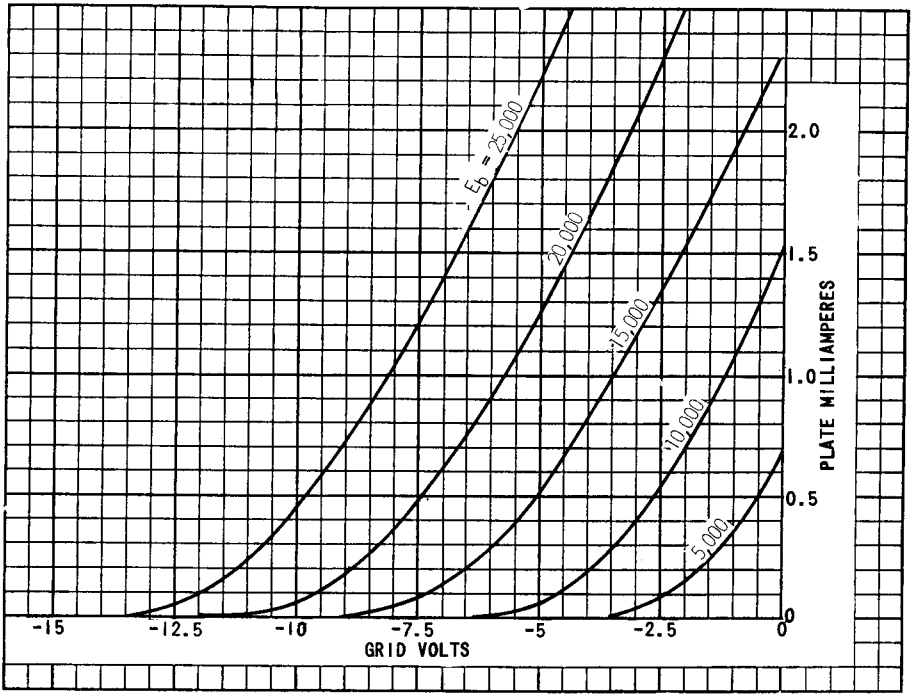

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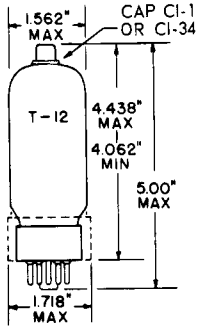
OUTLINE DRAWING
JEDEC 12-36



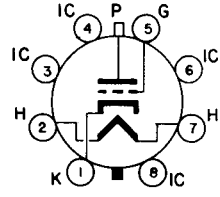
GLASS BULB
BASE 8 PIN OCTAL
JEDEC B8-71
OR B 8-118

BEAM TRIODE
FOR
D.C. POWER SUPPLIES
IN
COLOR TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8GC



BOTTOM VIEW
PINS 3, 4, 6 AND 8 SHOULD NOT BE USED AS TIE POINTS

THE 6BK4B IS A HIGH-VOLTAGE, LOW-CURRENT BEAM TRIODE IN A DOUBLE-ENDED T-12 GLASS ENVELOPE. IT IS ESPECIALLY DESIGNED FOR USE AS A SHUNT VOLTAGE-REGULATOR IN THE HIGH-VOLTAGE POWER SUPPLY CIRCUITS OF COLOR TELEVISION RECEIVERS. EXCEPT FOR HIGHER PLATE DISSIPATION AND PEAK HEATER-CATHODE VOLTAGE CAPABILITY, THE 6BK4B IS ELECTRICALLY AND MECHANICALLY SIMILAR TO THE 6BK4A, AND IS UNILATERALLY INTERCHANGEABLE WITH THE 6BK4 AND THE 6BK4A.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	0.03	pf
GRID TO CATHODE AND HEATER	2.6	pf
PLATE TO CATHODE AND HEATER	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	200	mA
LIMITS OF APPLIED VOLTAGE-AC OR DC		6.3±0.6	VOLTS
HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		NOT RECOMMENDED	

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

SHUNT VOLTAGE-REGULATOR SERVICE

DC PLATE VOLTAGE	27,000	VOLTS
UNREGULATED DC SUPPLY VOLTAGE	60,000	VOLTS
GRID VOLTAGE:		
NEGATIVE DC VALUE	135	VOLTS
NEGATIVE PEAK VALUE FOR 20 SECONDS MAX. DURING EQUIPMENT WARM-UP	440	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS (Continued)

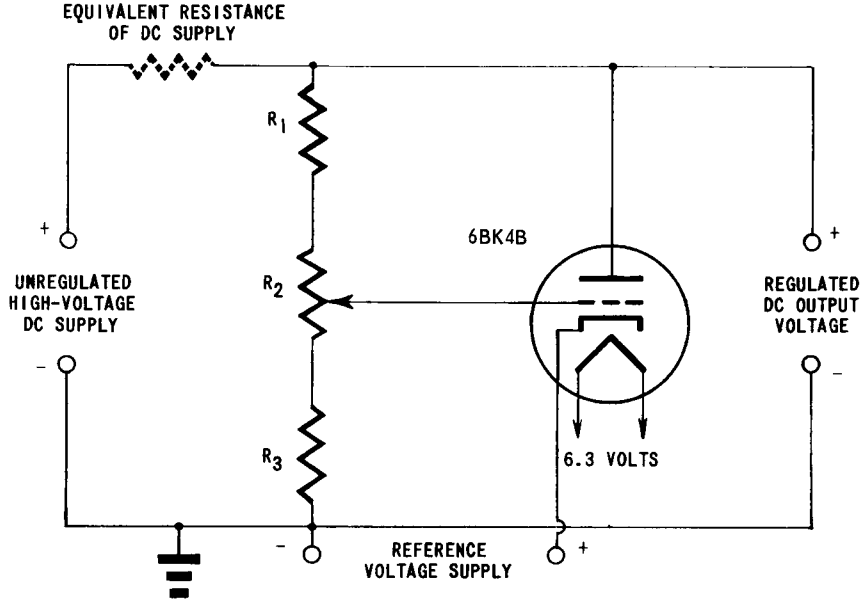
DC PLATE CURRENT	1.6	VOLTS
PLATE DISSIPATION	40	WATTS
GRID-CIRCUIT RESISTANCE	3	MEGOHMS

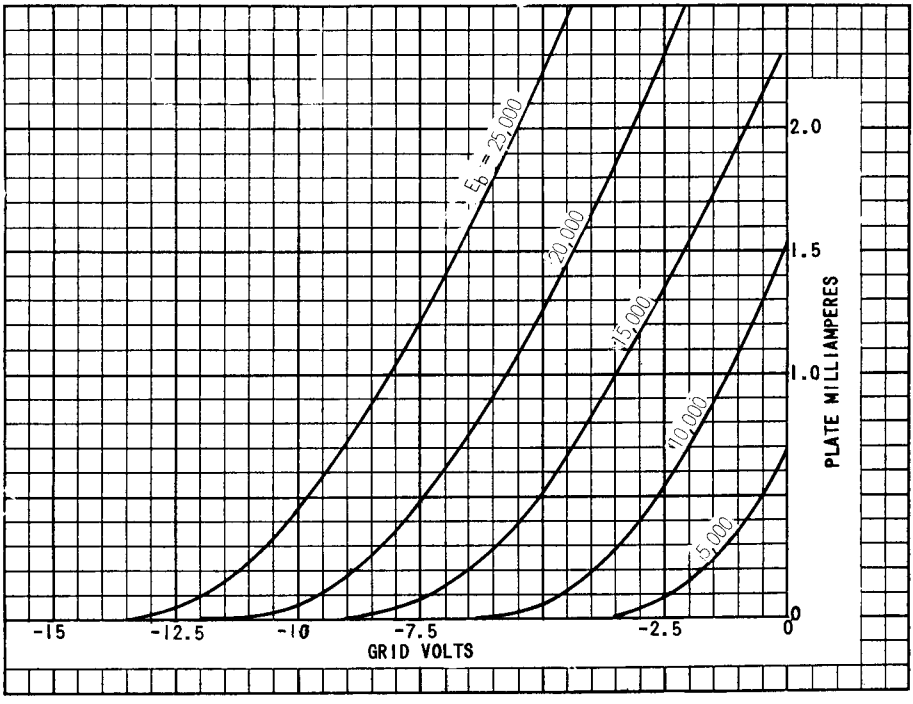
TYPICAL OPERATION

AS SHUNT VOLTAGE-REGULATOR TUBE IN ACCOMPANYING CIRCUIT

UNREGULATED SUPPLY:		
DC VOLTAGE	36,000	VOLTS
EQUIVALENT RESISTANCE	11	MEGOHMS
VOLTAGE DIVIDER VALUES:		
R_1 (5 WATTS)	220	MEGOHMS
R_2 (2 WATTS)	1	MEGOHM
R_3 (1/3 WATT)	0.82	MEGOHM
REFERENCE VOLTAGE SUPPLY:		
DC VALUE	200	VOLTS
EQUIVALENT RESISTANCE	1,000	OHMS
EFFECTIVE GRID-PLATE TRANSCONDUCTANCE	200	μMHOS
DC PLATE CURRENT:		
FOR LOAD CURRENT OF 0 mA	1,000	μA
FOR LOAD CURRENT OF 1 mA	45	μA
REGULATED DC OUTPUT VOLTAGE:		
FOR LOAD CURRENT OF 0 mA	25,000	VOLTS
FOR LOAD CURRENT OF 1 mA	24,500	VOLTS

SHUNT VOLTAGE-REGULATOR CIRCUIT

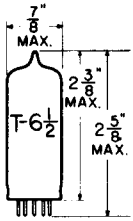



E_b = 25,000
20,000
15,000
10,000
5,000
2.0
1.5
1.0
0
PLATE MILLIAMPERES
-15
-12.5
-10
-7.5
-2.5
0
GRID VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

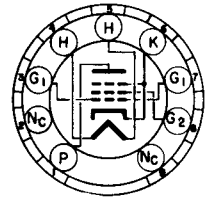


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9BQ

THE 6BK5 IS A BEAM POWER AMPLIFIER UTILIZING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE POWER OUTPUT STAGE OF TELEVISION AND RADIO RECEIVERS. IN WHICH ONLY SMALL DRIVING VOLTAGES ARE AVAILABLE. IT CAN ALSO BE USED AS A VIDEO AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: G_1 TO P	0.06	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	13	μμf
OUTPUT: P TO (H+K+G_2+G_3)	5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE: ←		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	9	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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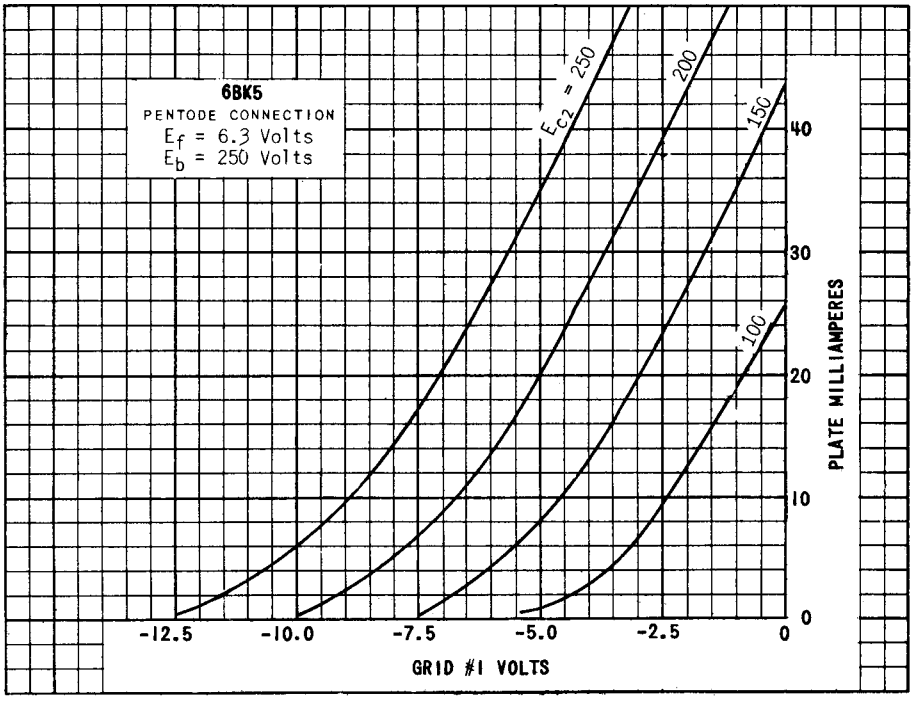
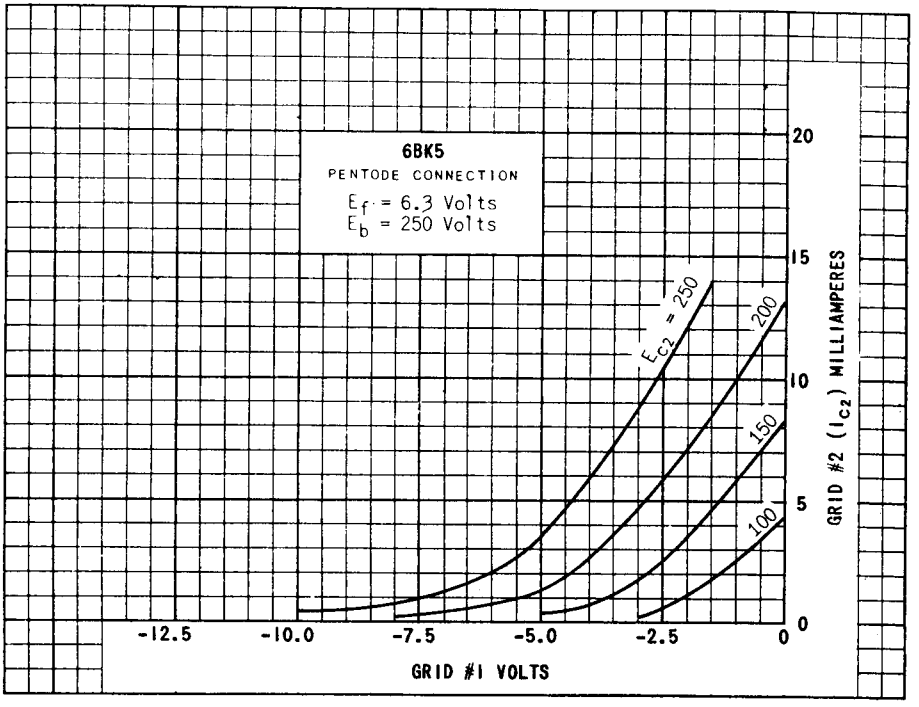
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−5	VOLTS
PEAK AF GRID #1 VOLTAGE	5	VOLTS
PLATE RESISTANCE (APPROX.)	100 000	OHMS
TRANSCONDUCTANCE	8 500	µMHOS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	37	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	10	MA.
LOAD RESISTANCE	6 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	7	PERCENT
POWER OUTPUT	3.5	WATTS





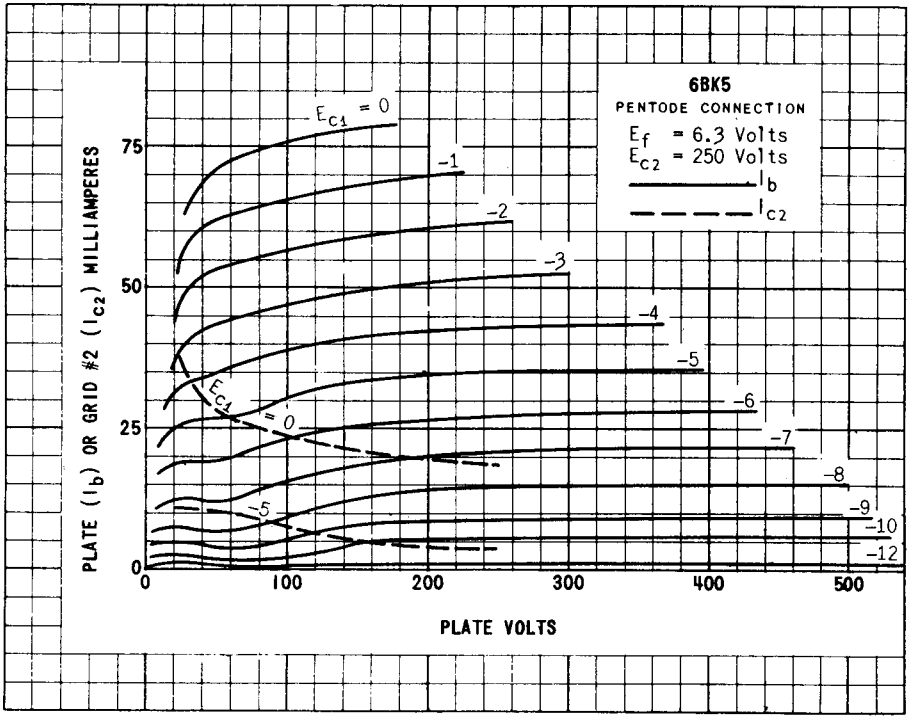


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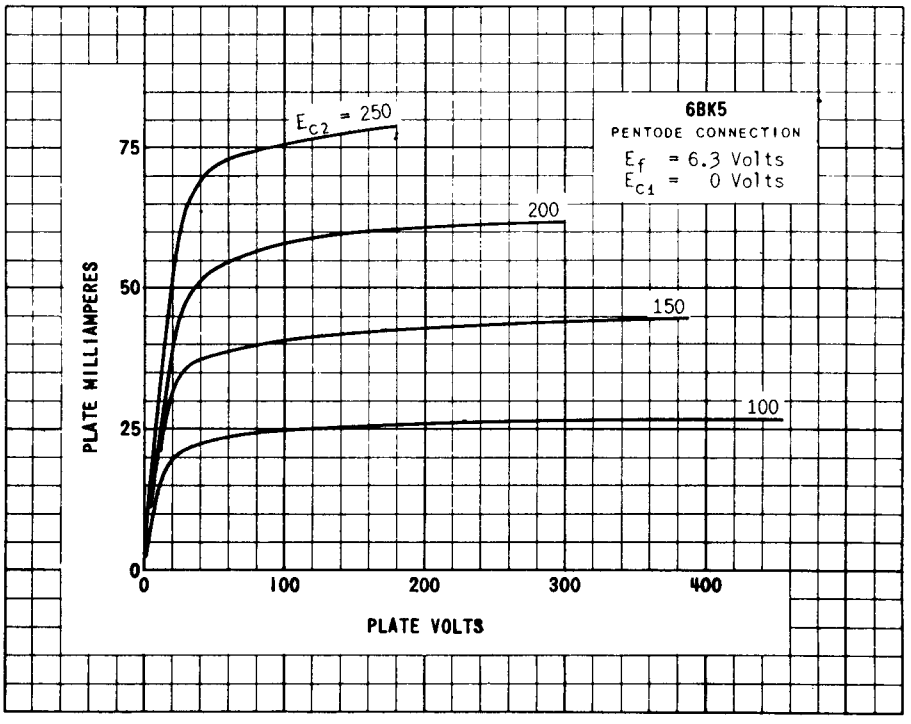
PLATE 3187

6BK5 (25BK5)



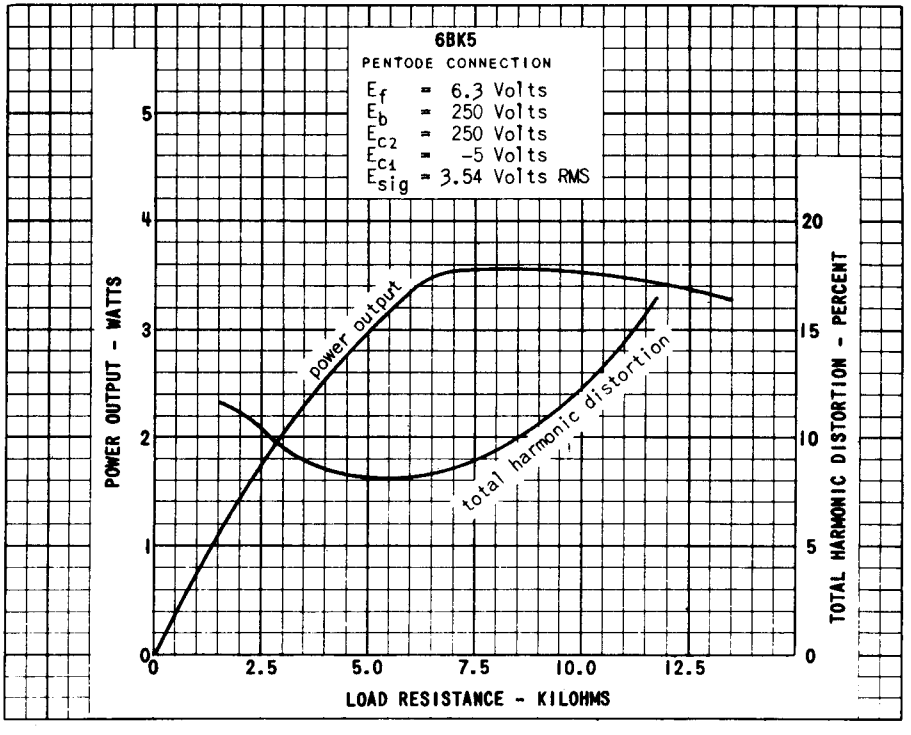
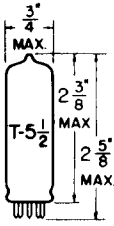


PLATE 3188

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

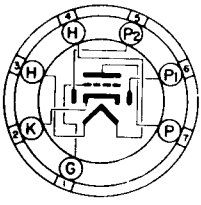


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 6BK6 IS A HIGH-MU DOUBLE DIODE TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
DIODE #1 OR DIODE #2 TO CATHODE: (1P OR 2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.013	0.01	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
AMPLIFICATION FACTOR	100	100	

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PLATE 2332
FEB. 1 1950

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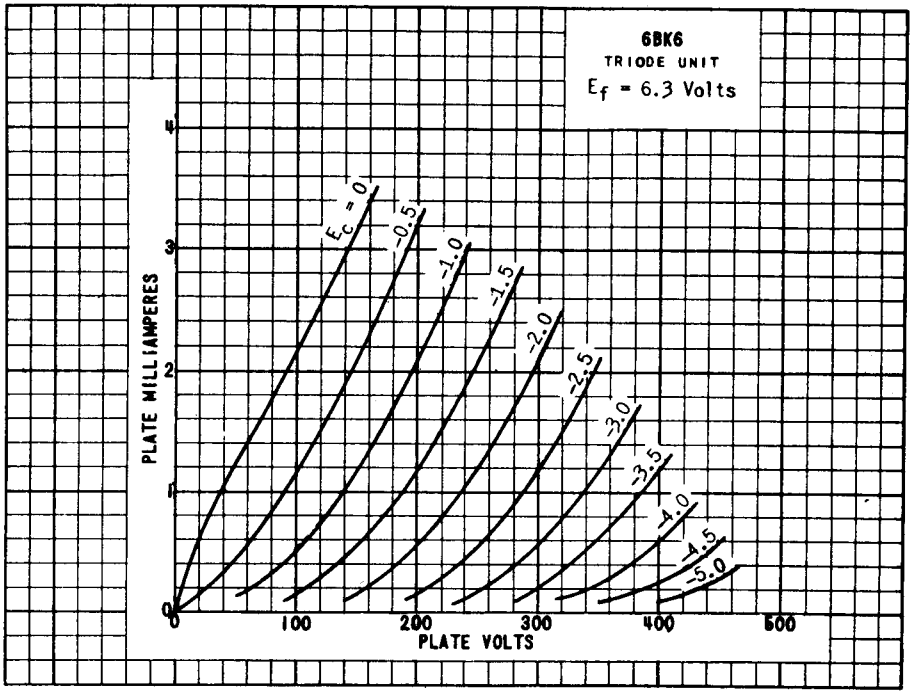
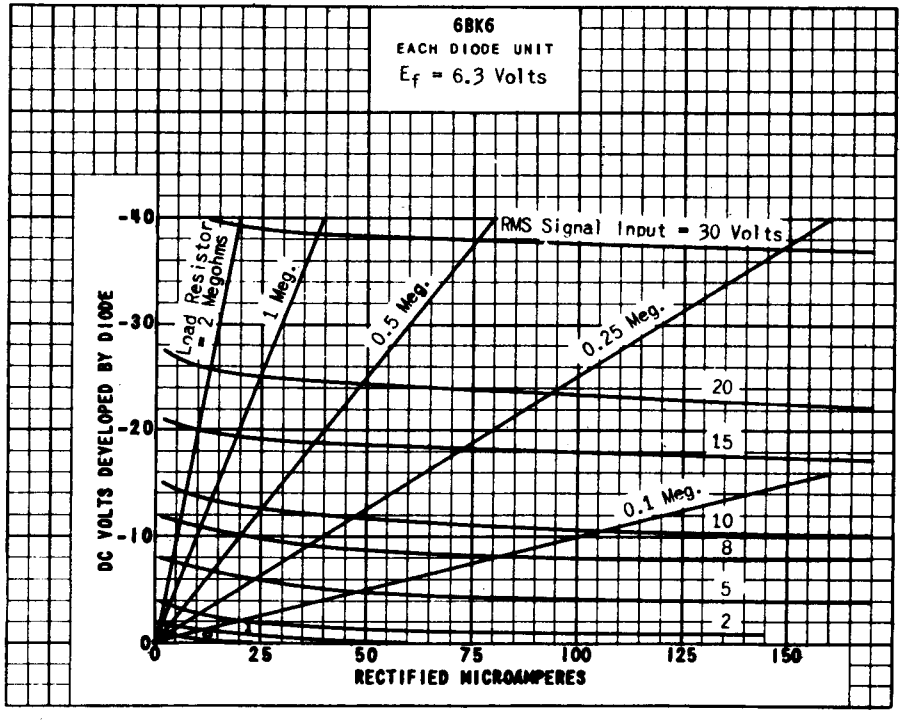
6BK6 (12BK6, 26BK6)





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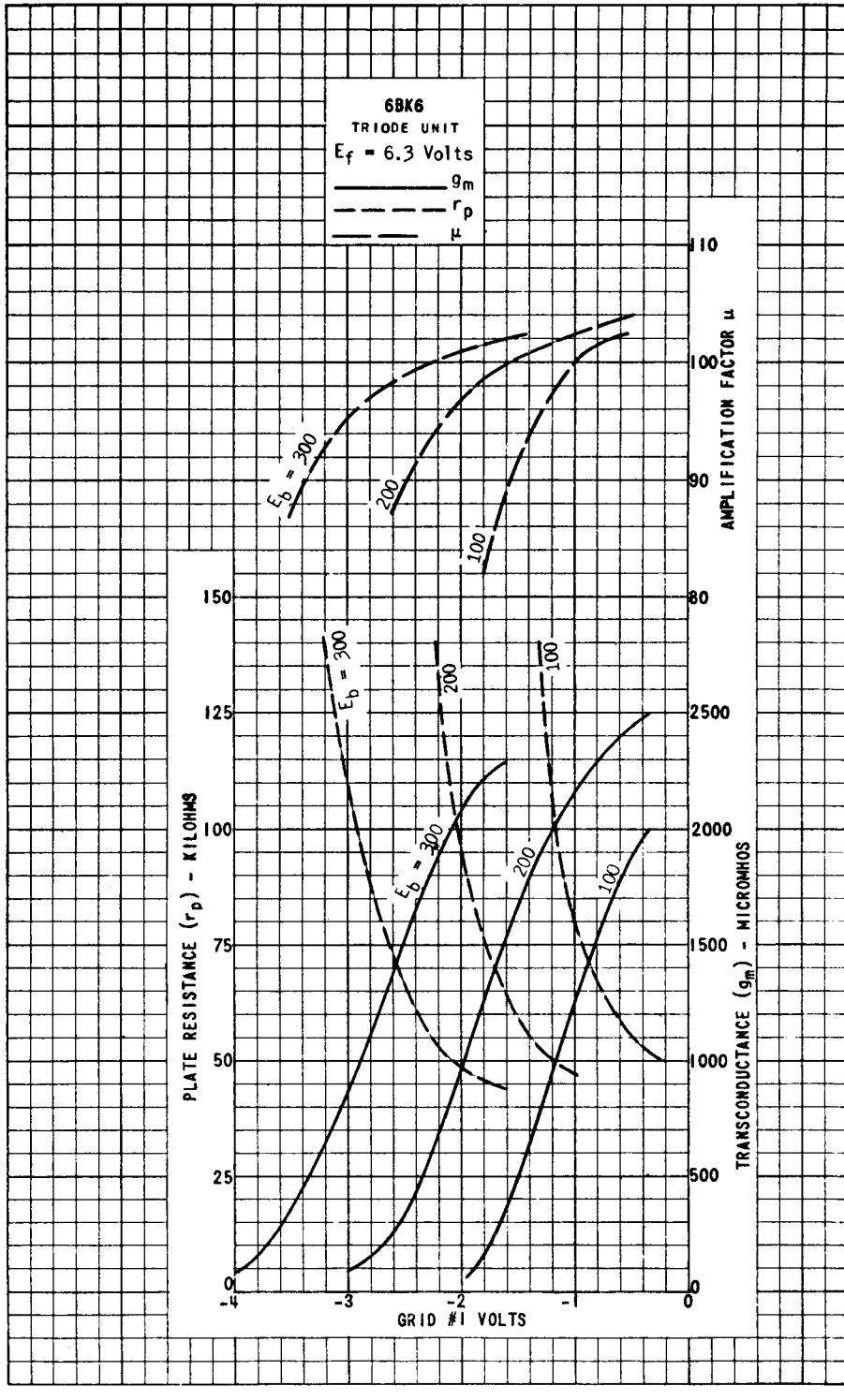

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PLATE
2334
FEB. 1
1950

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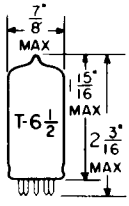
TWIN TRIODE

MINIATURE TYPE

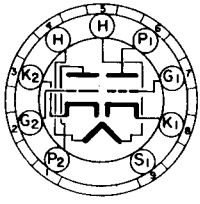


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ
IT IS RECOMMENDED THAT PIN #9 BE GROUNDED

THE 6BK7A AND 6BK7B ARE MINIATURE DOUBLE TRIODES DESIGNED PRIMARILY FOR USE AS CASCODE AMPLIFIERS AT FREQUENCIES BELOW APPROXIMATELY 300 MEGACYCLES. THE PERFORMANCE OF THE TUBES AS CASCODE AMPLIFIERS IS CHARACTERIZED BY HIGH GAIN AND A LOW NOISE FIGURE. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6BK7B ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER WARM-UP TIME AND HEATER-CATHODE VOLTAGE RATINGS, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	1.8	1.8	μμf
INPUT	3.0	3.0	μμf
OUTPUT	1.0	0.9	μμf
HEATER TO CATHODE	2.8	3.0	μμf
GRID TO GRID (MAX.)	0.004		μμf
PLATE TO PLATE (MAX.)	0.075		μμf
GROUNDED GRID OPERATION			
PLATE TO CATHODE	0.22	0.22	μμf
INPUT	6.0	6.0	μμf
OUTPUT	2.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:[A] ←		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	WATTS
HEATER WARM-UP TIME (APPROX.)* (6BK7B ONLY)	11.0	SECONDS

[A] WHEN THE 6BK7A IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES; THE HEATER-CATHODE VOLTAGE OF THE GROUNDED-GRID STAGE MAY BE AS HIGH AS 250 VOLTS MAXIMUM WITH RESPECT TO THE CATHODE AND AS HIGH AS 300 VOLTS MAXIMUM FOR THE 6BK7B.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ HEATER CATHODE VOLTAGE FOR 6BK7A, NOW IDENTICAL TO 6BK7B.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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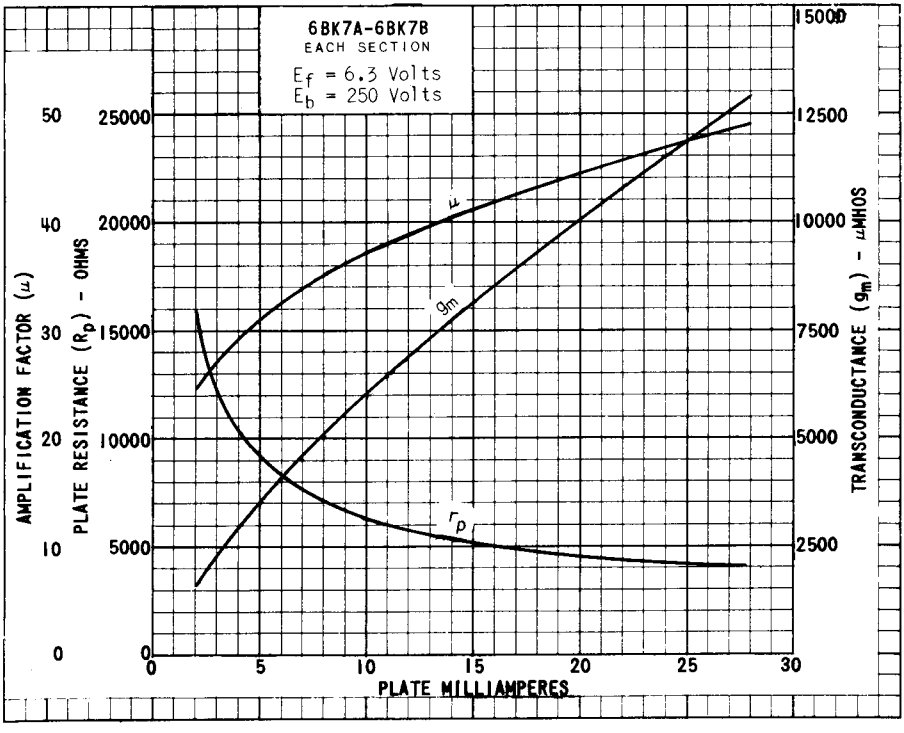
CONTINUED FROM PRECEDING PAGE

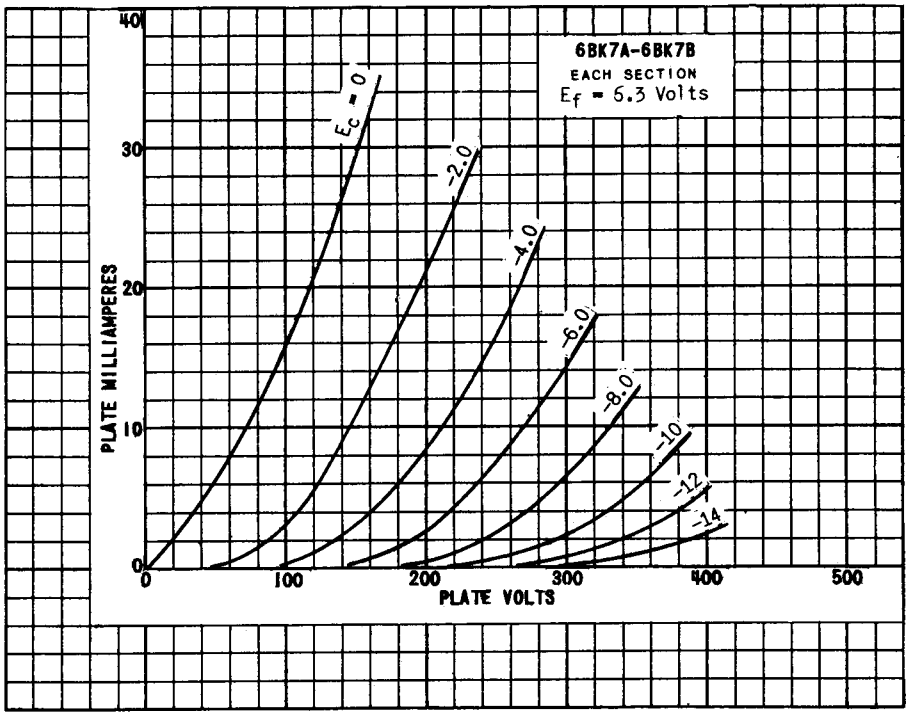
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

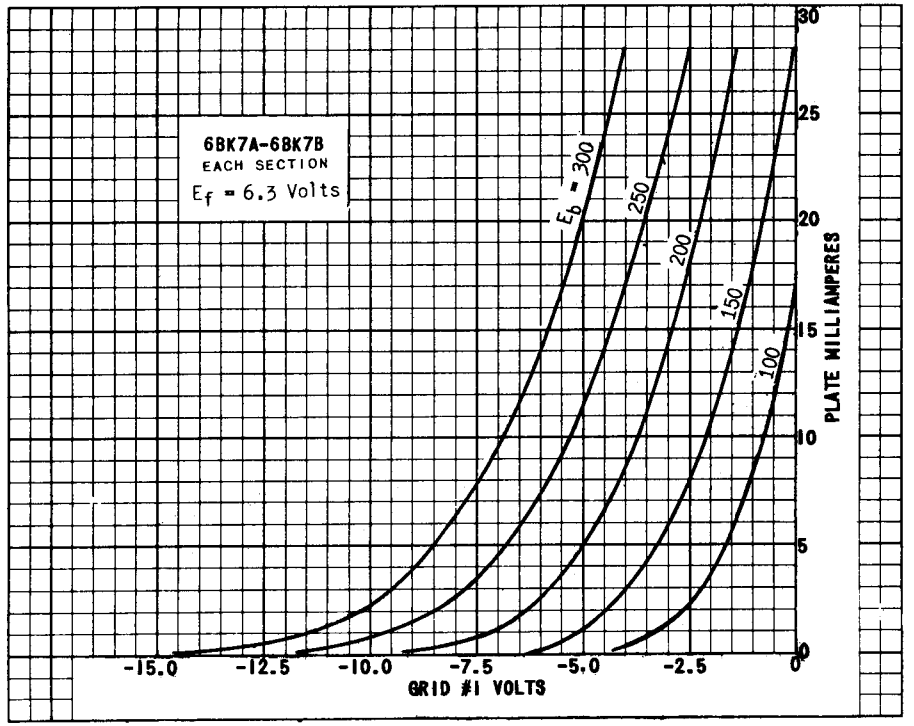
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.)	4 600	OHMS
TRANSCONDUCTANCE	9 300	µMHOS
PLATE CURRENT	18	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	-11	VOLTS
NOISE FIGURE[B]	7	DECIBELS

[B] AS MEASURED IN A CASCODE AMPLIFIER WHICH OPERATES AT A PLATE SUPPLY VOLTAGE OF 250 VOLTS, A PLATE CURRENT OF 18 MA., A FREQUENCY OF 200 MEGACYCLES, A STAGE BANDWIDTH OF 7 MEGACYCLES, AND AN EFFECTIVE NOISE BANDWIDTH OF 3.5 MEGACYCLES.




6BK7A-6BK7B
EACH SECTION
Ef = 6.3 Volts
Ec = 0
-2.0
-4.0
-6.0
-8.0
-10
-12
-14
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
100
200
300
400
500


6BK7A-6BK7B
EACH SECTION
Ef = 6.3 Volts
Eb = 300
250
200
150
100
PLATE MILLIAMPERES
GRID #1 VOLTS
0
5
10
15
20
25
30
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5

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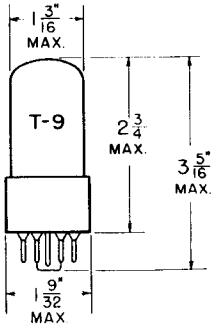
DOUBLE TRIODE

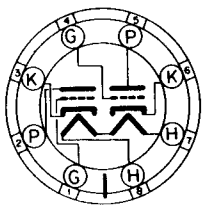


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 8 PIN OCTAL
8BD

THE 6BL7GT COMBINES TWO INDEPENDENT HIGH PERVEANCE LOW-MU TRIODES IN ONE ENVELOPE. IT IS SUITABLE FOR USE AS A COMBINED VERTICAL DEFLECTION SWEEP GENERATOR AND DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING PICTURE TUBES WITH WIDE DEFLECTION ANGLES.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT 1	TRIODE UNIT 2	
WITHOUT SHIELD			
GRID TO PLATE: (G TO P)	4.2	4	μμf
INPUT: G TO (H+K)	4.4	4.8	μμf
OUTPUT: P TO (H+K)	1.1	1.2	μμf
GRID TO GRID: (1G TO 2G)	0.022		μμf
PLATE TO PLATE: (1P TO 2P)	1.5		μμf
WITH SHIELD[A]			
GRID TO PLATE: (G TO P)	4.2	4	μμf
INPUT: G TO (H+K)	5	5	μμf
OUTPUT: P TO (H+K)	3.4	3.2	μμf
GRID TO GRID: (1G TO 2G)	0.022		μμf
PLATE TO PLATE: (1P TO 2P)	1.2		μμf

[A] EXTERNAL SHIELD #308 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

VERTICAL DEFLECTION AMPLIFIER

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM DC PLATE VOLTAGE	500	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE	600	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE[C]	2000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	-200	VOLTS
MAXIMUM TOTAL PLATE DISSIPATION (EACH SECTION)	10	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (BOTH SECTIONS)	12	WATTS
MAXIMUM DC CATHODE CURRENT (EACH SECTION)	60	MA.
MINIMUM CATHODE BIAS RESISTOR[D]	220	OHMS
MAXIMUM GRID CIRCUIT RESISTANCE	4.7	MEGOHMS

[B] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS". FEDERAL COMMUNICATIONS COMMISSION.

[C] RATING GIVEN IS TO BE CONSIDERED AN ABSOLUTE MAXIMUM VALUE BEYOND WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED. THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM 15 PERCENT OF ONE SCANNING CYCLE IS 2.5 MILLISECONDS

[D] INDICATED MINIMUM VALUE OF THIS RESISTOR IS REQUIRED TO PROTECT THE TUBE IN THE EVENT OF TEMPORARY FAILURE OF EXCITATION AND RESULTANT LOSS IN DEVELOPED BIAS.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.5	AMP.
DC PLATE VOLTAGE	250	VOLTS
DC GRID VOLTAGE	−9	VOLTS
PLATE CURRENT	40	MA.
AMPLIFICATION FACTOR	14	
TRANSCONDUCTANCE	7 000	µMHOS
PLATE RESISTANCE	2 000	OHMS
GRID VOLTAGE FOR 10 µA. PLATE CURRENT	−28	VOLTS
GRID VOLTAGE FOR 10 µA. PLATE CURRENT WITH 600 VOLTS PLATE VOLTAGE	−75	VOLTS

VERTICAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.5	AMP.
PLATE VOLTAGE	450	VOLTS
CATHODE BIAS RESISTOR	1 200	OHMS
GRID INPUT VOLTAGE (APPROX.)		
PEAK TO PEAK SAWTOOTH COMPONENT	36	VOLTS
NEGATIVE PEAKING COMPONENT	44	VOLTS
DC PLATE CURRENT	11	MA.
PLATE OUTPUT VOLTAGE (APPROX.):		
PEAK TO PEAK SAWTOOTH COMPONENT	270	VOLTS
PEAK POSITIVE PULSE COMPONENT	600	VOLTS

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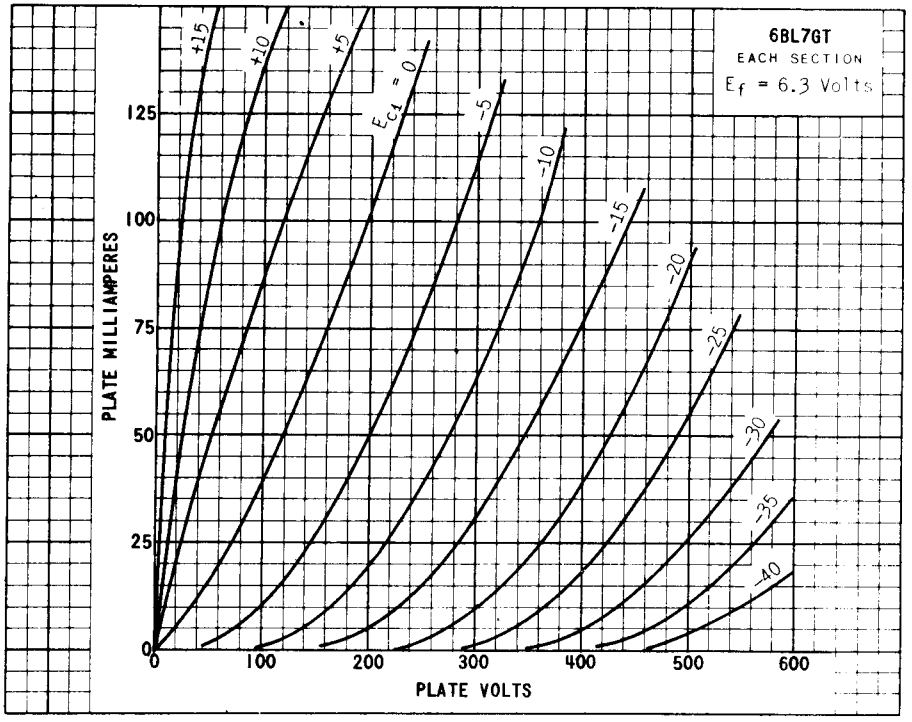

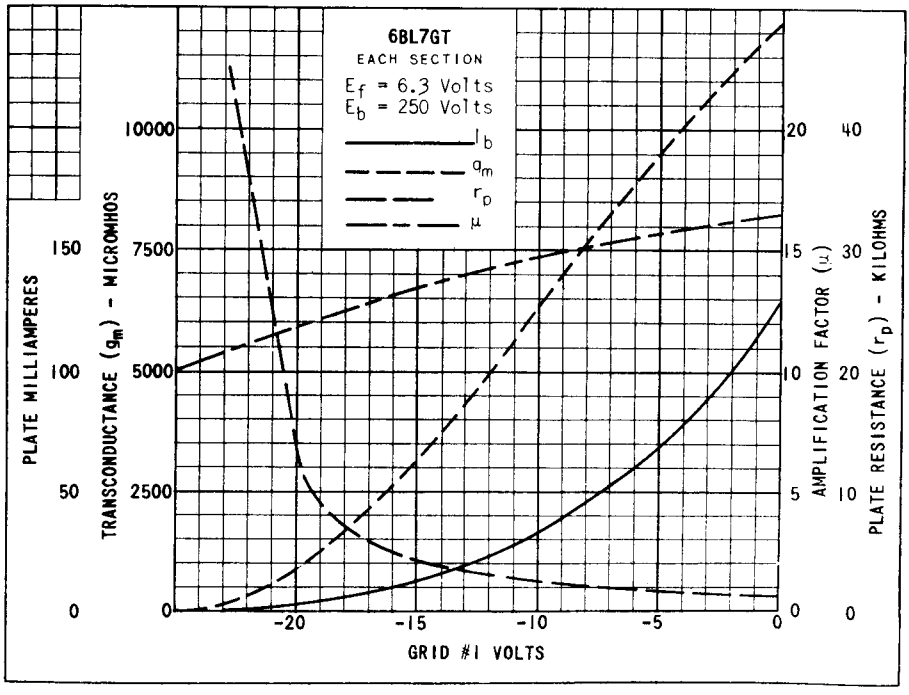

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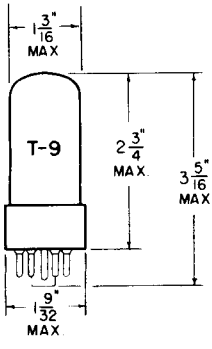
TWIN TRIODE

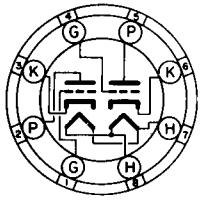


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT INTERMEDIATE-SHELL
8 PIN OCTAL

88D

THE 6BL7GTA COMBINES TWO INDEPENDENT HIGH PERVEANCE LOW-MU TRIODES IN ONE ENVELOPE. IT IS SUITABLE FOR USE AS A COMBINED VERTICAL DEFLECTION SWEEP GENERATOR AND DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING PICTURE TUBES WITH WIDE DEFLECTION ANGLES. IT IS INTERCHANGEABLE WITH THE 6BL7GT BUT DIFFERS FROM IT IN HAVING AN IMPROVED SECTION 1 FOR INCREASED LIFE AS AN OSCILLATOR, AND CONTROLLED ZERO-BIAS PLATE CURRENT IN BOTH SECTIONS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

	SEC. #1	SEC. #2	
GRID TO PLATE	6.0	6.0	μμf
INPUT	4.2	4.6	μμf
OUTPUT	0.9	0.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

	VERTICAL[AB] OSCILLATOR SERVICE	VERTICAL[B] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	500	500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	2 000[C]	VOLTS
MAXIMUM PEAK NEGATIVE GRID-VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION (EACH PLATE)	10	10[D]	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (BOTH PLATES)	12	12	WATTS
MAXIMUM DC CATHODE CURRENT	60	60	MA.
MAXIMUM PEAK CATHODE CURRENT	210	210	MA.
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

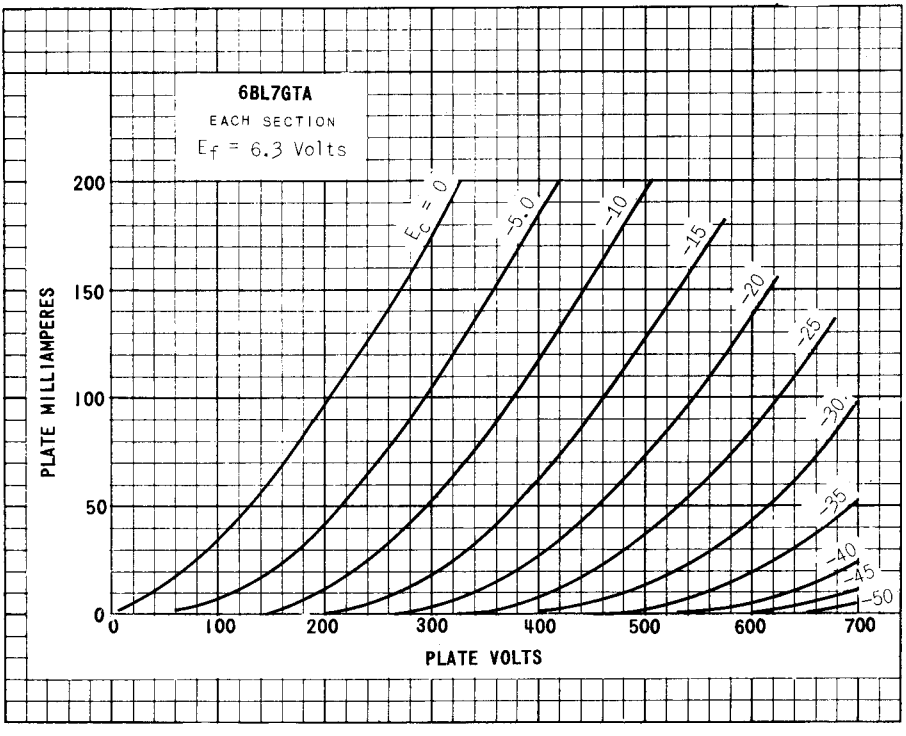
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	1.5	1.5	1.5	AMP.
PLATE VOLTAGE	150	250	250	VOLTS
GRID VOLTAGE	0	-17	-9.0	VOLTS
AMPLIFICATION FACTOR	---	---	15	
PLATE RESISTANCE (APPROX.)	---	---	2 150	OHMS
TRANSCONDUCTANCE	---	---	7 000	μMHOS
PLATE CURRENT	65	4.0	40	MA.
GRID VOLTAGE (APPROX.) I_b = 50 μAMPS.	---	---	-23	VOLTS

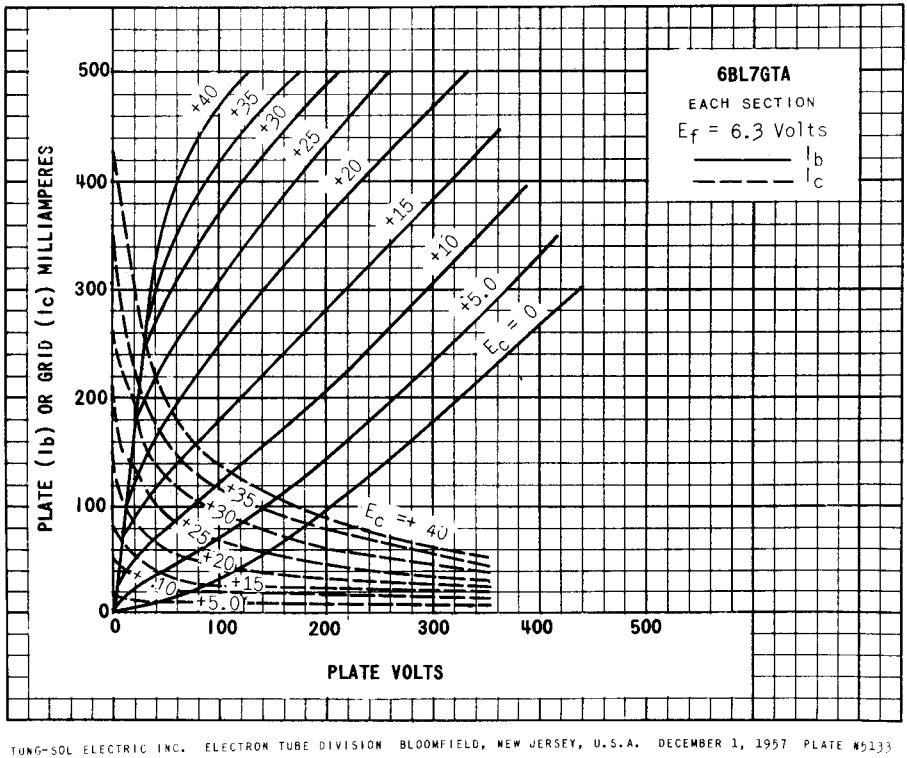
[A] SECTION 1 IS RECOMMENDED FOR VERTICAL OSCILLATOR SERVICE.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] ABSOLUTE-MAXIMUM VALUE.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.





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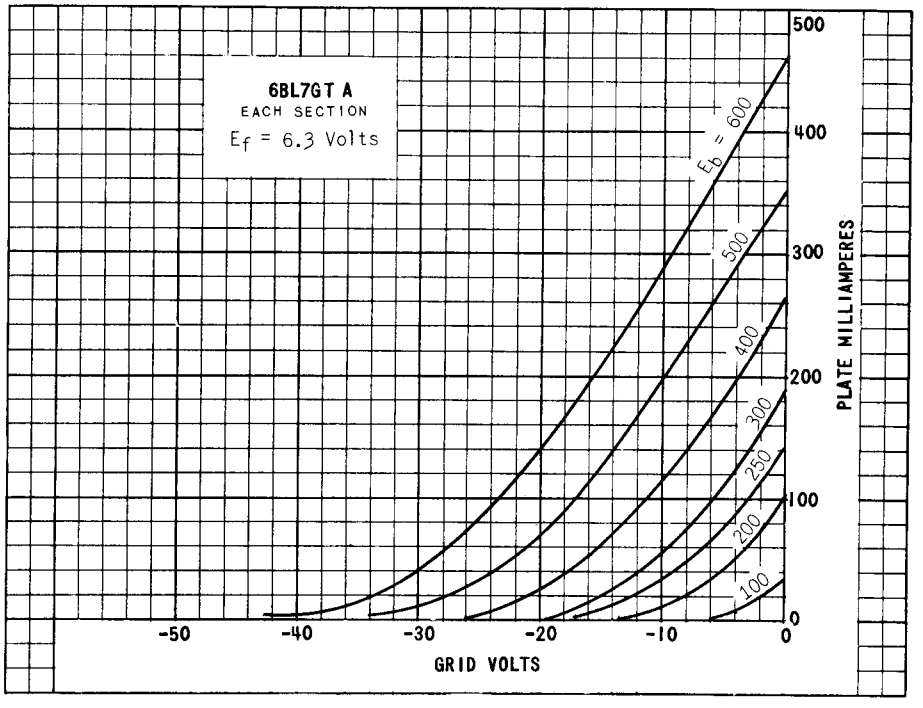
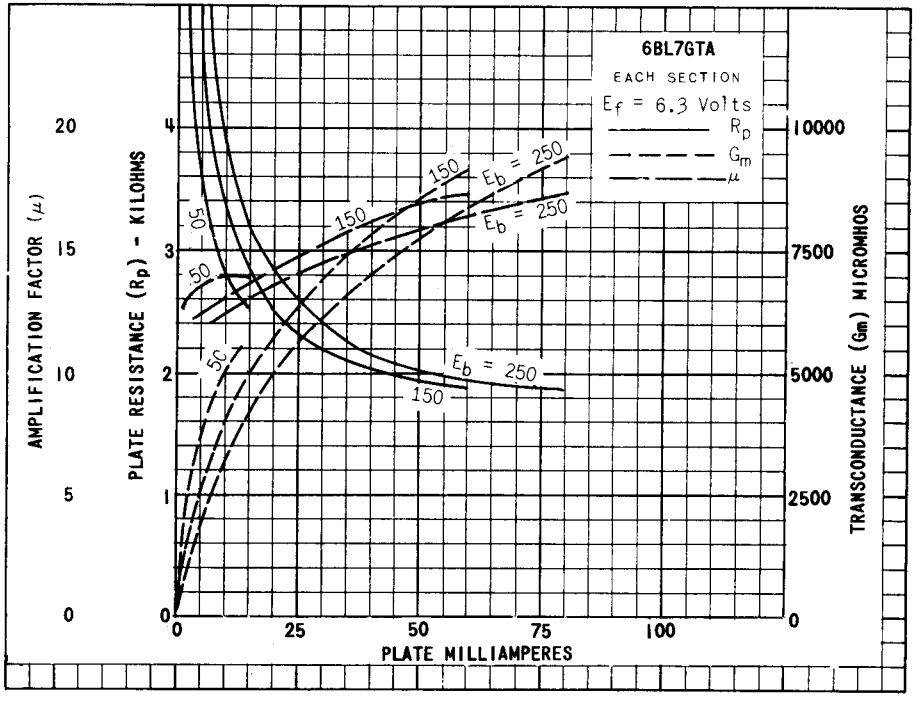

6BL7GTA
EACH SECTION
Ef = 6.3 Volts
Eb = 600
500
400
300
250
200
100
PLATE MILLIAMPERES
GRID VOLTS
-50
-40
-30
-20
-10
0
500
400
300
200
100
0


6BL7GTA
EACH SECTION
Ef = 6.3 Volts
Rp
Gm
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (Rp) - KILOHMS
TRANSCONDUCTANCE (Gm) MICROMHOS
PLATE MILLIAMPERES
Eb = 250
150
50
0
25
50
75
100
20
15
10
5
4
3
2
1
10000
7500
5000
2500

TUNG-SOL

TRIODE PENTODE

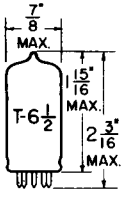
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

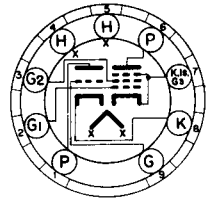
HEATER

6.3 VOLTS 0.45 AMP.

ANY MOUNTING POSITION



GLASS BULB
6-2



BOTTOM VIEW

9DC

THE 6BL8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A FREQUENCY CHANGER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE SECTION	PENTODE SECTION	
INPUT CAPACITANCE	2.5	5.5	pf
OUTPUT CAPACITANCE	1.8	3.8	pf
PLATE TO GRID #1 (MAX.)		0.025	pf
PLATE TO GRID	1.5		pf
BETWEEN PENTODE AND TRIODE SECTIONS:			
PENTODE PLATE TO TRIODE PLATE (MAX.)		0.07	pf
PENTODE PLATE TO TRIODE GRID (MAX.)		0.02	pf
PENTODE GRID TO TRIODE PLATE (MAX.)		0.16	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM PLATE VOLTAGE	250	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	1.7	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5		MEGOHM
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT OF 14 MAMPS		175	VOLTS
MAXIMUM GRID #2 VOLTAGE AT A CATHODE CURRENT LESS THAN 10 MAMPS		200	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT		550	VOLTS
MAXIMUM GRID #2 DISSIPATION AT A PLATE DISSIPATION MORE THAN 1.2 WATTS		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS		1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS		0.5	MEGOHM
MAXIMUM CATHODE CURRENT	14	14	MAMPS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	100	VOLTS

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TYPICAL CHARACTERISTICS

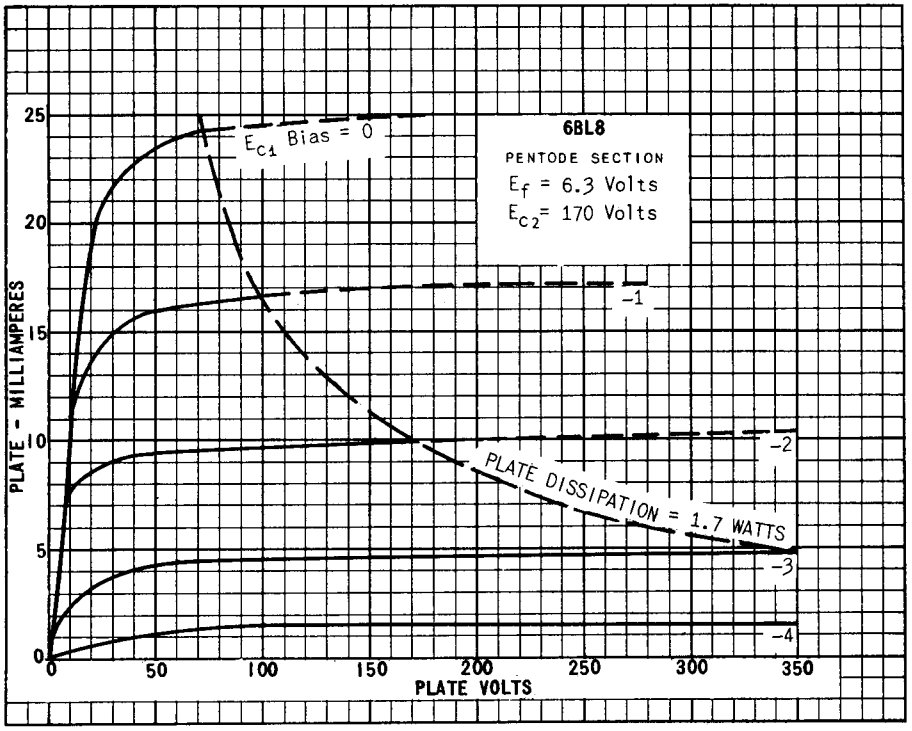
	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	100	170	VOLTS
GRID #1 VOLTAGE	−2	−2	VOLTS
PLATE CURRENT	14	10	MAMPS
GRID #2 CURRENT		2.8	MAMPS
TRANSCONDUCTANCE	5000	6200	μMHOS
PLATE RESISTANCE		0.4	MEGOHM
AMPLIFICATION FACTOR	20		
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1		47	
INPUT RESISTANCE AT 50 MC		10 000	OHMS
EQUIVALENT NOISE RESISTANCE		1 500	OHMS
GRID #2 VOLTAGE		170	VOLTS

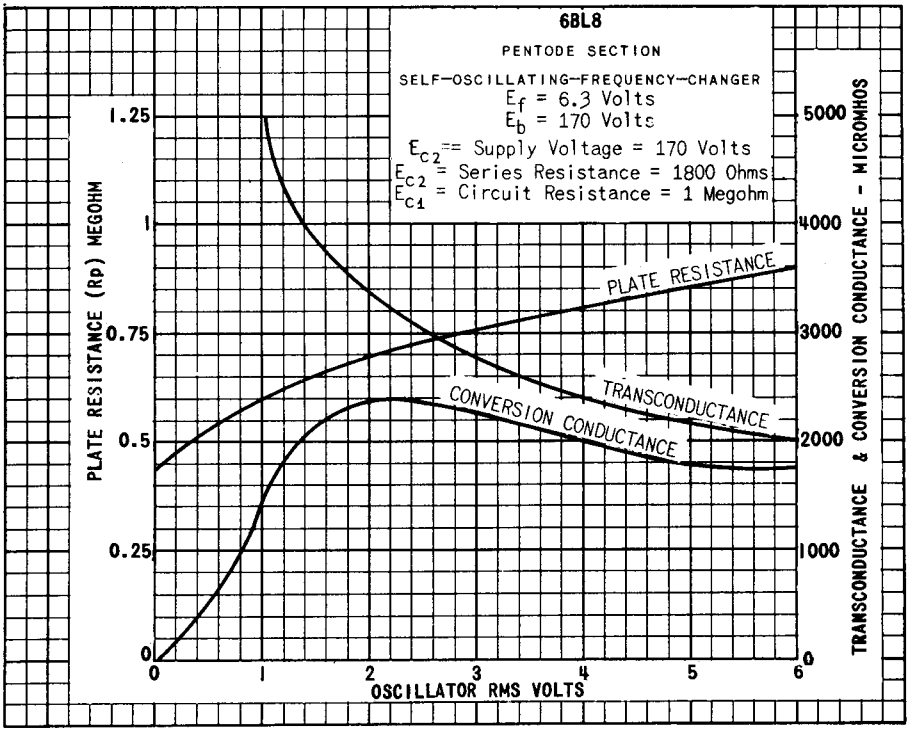
OPERATING CHARACTERISTICS

FOR USE AS MIXER

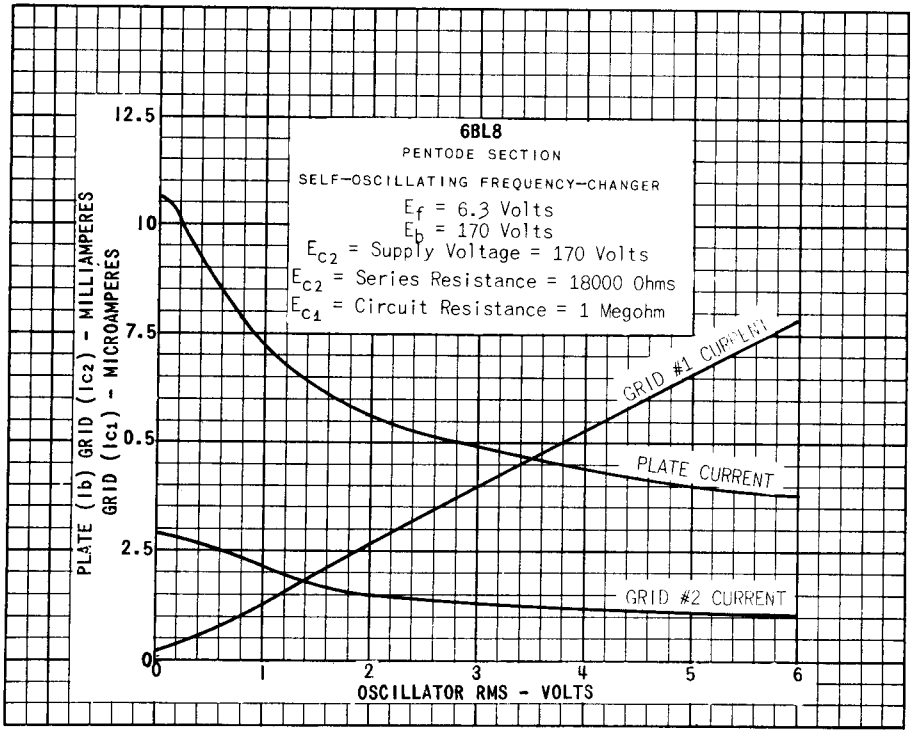
PLATE VOLTAGE	170	170	VOLTS
GRID #2 VOLTAGE	170	170	VOLTS
GRID #1 CIRCUIT RESISTANCE	0.1	0.1	MEGOHM
CATHODE RESISTOR	330	820	OHMS
OSCILLATOR VOLTAGE , RMS	3.5	3.5	VOLTS
PLATE CURRENT	6.5	5.2	MAMPS
GRID #2 CURRENT	2.0	1.5	MAMPS
GRID #1 CURRENT	25	0	μAMP
CONVERSION CONDUCTANCE	2200	2100	μMHOS
PLATE RESISTANCE	0.8	0.87	MEGOHM

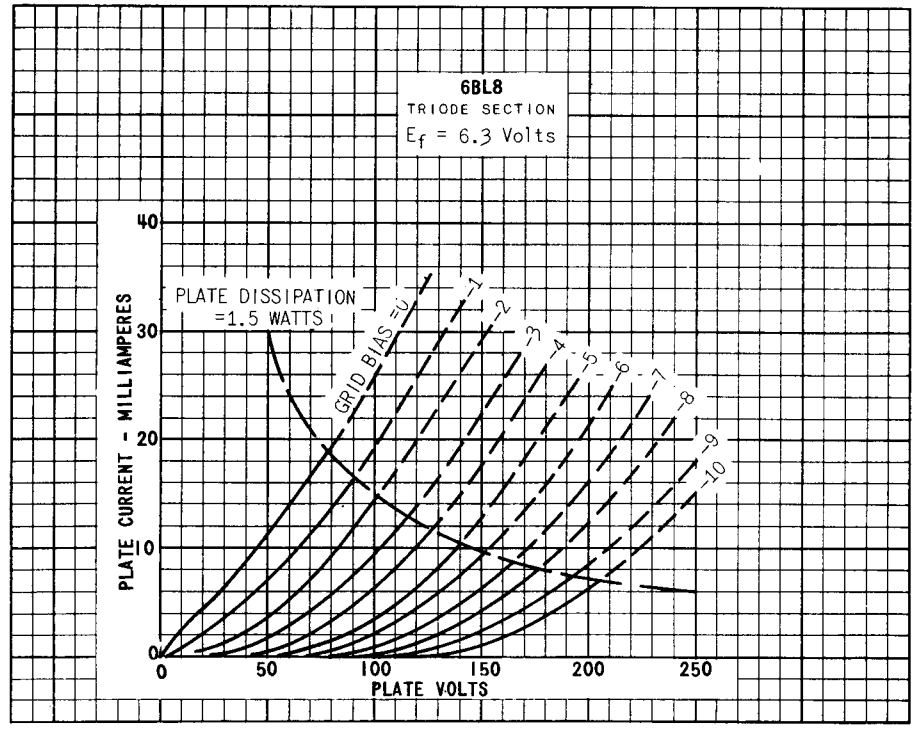
OPTIMUM PEAK CATHODE CURRENT OF THE TRIODE SECTION IS FRAME OUTPUT APPLICATION. TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE CURRENT OF 100 MA IT STILL OPERATES SATISFACTORILY. IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY.

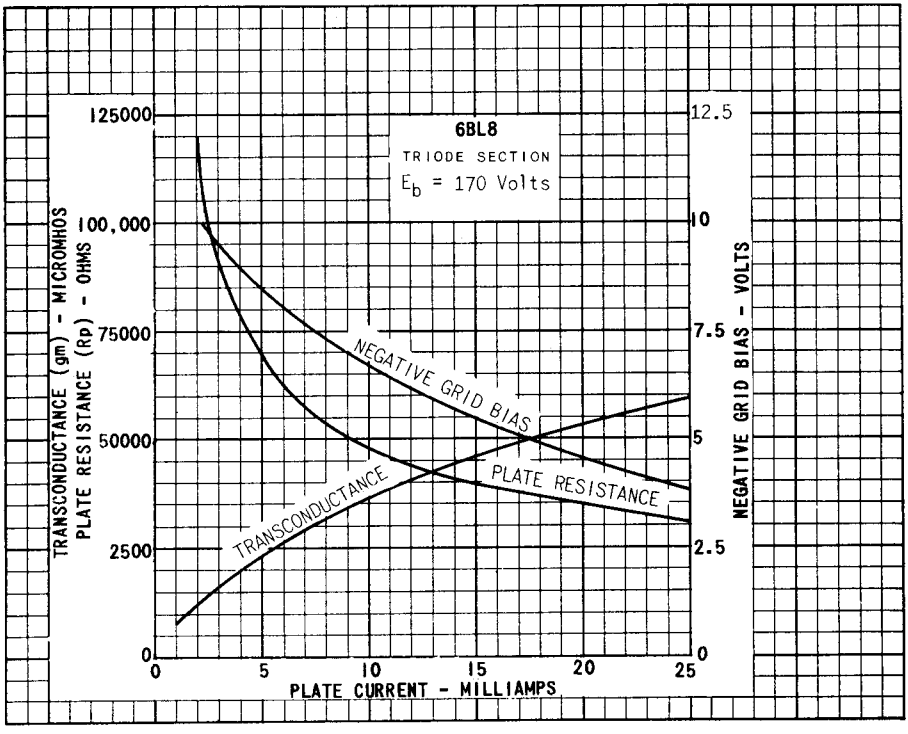

6BL8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2} = 170 Volts
E_{c1} Bias = 0
-1
-2
-3
-4
PLATE DISSIPATION = 1.7 WATTS
PLATE - MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
100
150
200
250
300
350


6BL8
PENTODE SECTION
SELF-OSCILLATING-FREQUENCY-CHANGER
E_f = 6.3 Volts
E_b = 170 Volts
E_{c2} = Supply Voltage = 170 Volts
E_{c2} = Series Resistance = 1800 Ohms
E_{c1} = Circuit Resistance = 1 Megohm
PLATE RESISTANCE
TRANSCONDUCTANCE
CONVERSION CONDUCTANCE
PLATE RESISTANCE (Rp) MEGOHM
TRANSCONDUCTANCE & CONVERSION CONDUCTANCE - MICROMHOS
OSCILLATOR RMS VOLTS
0
0.25
0.5
0.75
1
1.25
1000
2000
3000
4000
5000
1
2
3
4
5
6

TENTATIVE DATA






6BL8
TRIODE SECTION
E_b = 170 Volts
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (Rp) - OHMS
NEGATIVE GRID BIAS - VOLTS
PLATE CURRENT - MILLIAMPS
NEGATIVE GRID BIAS
TRANSCONDUCTANCE
PLATE RESISTANCE
125000
100,000
75000
50000
2500
0
12.5
10
7.5
5
2.5
0
0
5
10
15
20
25

missing pages

TUNG-SOL

NOTES

A MAXIMUM PULSE DURATION 4% OF ONE CYCLE WITH A MAXIMUM OF 0.8 MILLI SECOND.

B PEAK PLATE CURRENT OF THE PENTODE SECTION IN VERTICAL OUTPUT APPLICATION.
TO ALLOW FOR TUBE SPREAD AND FOR DETERIORATION DURING LIFE THE CIRCUIT SHOULD BE DESIGNED AROUND A PEAK PLATE CURRENT NOT EXCEEDING 85 MAMPS AT A PLATE VOLTAGE OF 50 VOLTS AND A GRID #2 VOLTAGE OF 170 VOLTS. AT UNDERHEATING (HEATER VOLTAGE 5.3 VOLTS) A PEAK ANODE CURRENT OF 70 MAMPS SHOULD BE TAKEN INTO CONSIDERATION AT A PLATE VOLTAGE OF 50 VOLTS AND A GRID #2 VOLTAGE OF 170 VOLTS. AND A PEAK ANODE CURRENT OF 80 MAMPS AT A PLATE VOLTAGE OF 50 VOLTS AND A GRID #2 OF 190 VOLTS. THE PEAK PLATE CURRENT OF AN AVERAGE NEW TUBE IS 135 MAMPS AT A PLATE VOLTAGE OF 50 VOLTS, A GRID #2 VOLTAGE OF 170 VOLTS AND A GRID #1 CURRENT OF 0.3 MICROAMPERES.

C OPTIMUM PEAK CATHODE CURRENT AS FRAME OSCILLATOR.
TO ALLOW FOR TUBE SPREAD, FOR DETERIORATION DURING LIFE AND FOR EMISSION DROP AT UNDERHEATING THE SET SHOULD BE DESIGNED SO THAT WITH A PEAK CATHODE OF 100 MILLIAMPS IT STILL OPERATES SATISFACTORILY (MAX. PULSE DURATION 4% OF A CYCLE, WITH A MAXIMUM OF 0.8 MILLISEC). IT IS RECOMMENDED THAT THE AMPLITUDE OF THE PEAK CURRENTS OCCURRING WITH FRESH TUBES BE LIMITED AUTOMATICALLY TO THIS MAX. VALUE OF 100 MILLI-AMPS (e. g. BY NON-BYPASSED RESISTOR IN THE GRID OR ANODE LEAD.

D WITH GRID CURRENT BIASING THE MAXIMUM PERMISSABLE VALUE OF THE GRID CIRCUIT RESISTANCE IS 22 MEGOHMS.
MAXIMUM A.F. OUTPUT VOLTAGE.

MICROPHONY AND HUM.

THE TRIODE SECTION CAN BE USED WITHOUT SPECIAL PRECAUTIONS AGAINST MICROPHONY AND HUM IN CIRCUITS WITH A 5% LOUDSPEAKER WHEN THE INPUT VOLTAGE REQUIRED FOR AN OUTPUT POWER OF 50 MWATTS OF THE OUTPUT TUBE IS HIGHER THAN 10 MVOLTS. THE A.C. VOLTAGE BETWEEN HEATER PIN 4 AND THE CATHODE SHOULD NOT EXCEED 6.3 VOLTS (RMS) IN THIS CASE AND THE GRID CIRCUIT IMPEDANCE AT 50 C/S SHOULD NOT EXCEED 0.5 MEGOHM.

→ INDICATES A CHANGE.

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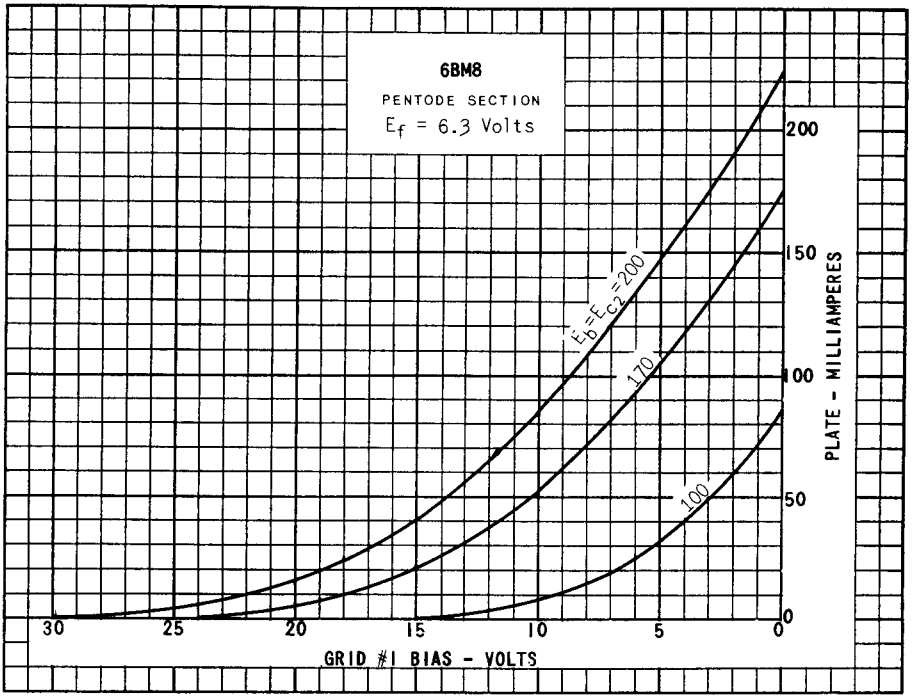
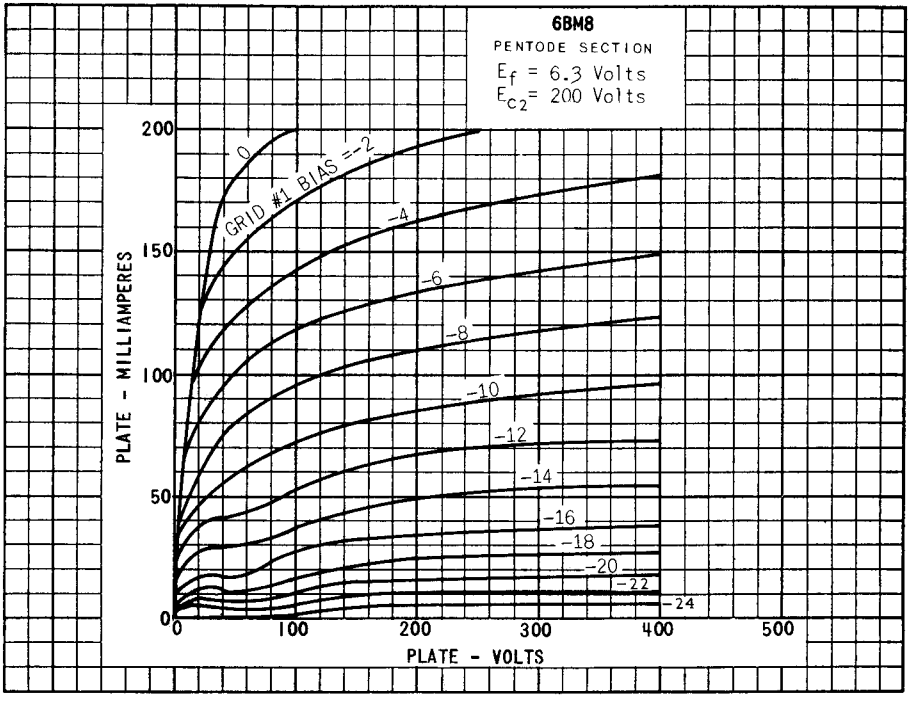
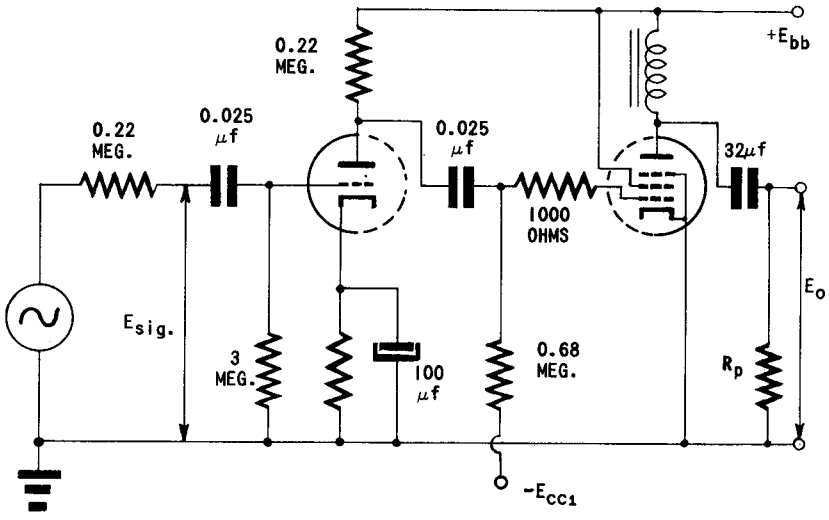

6BM8
PENTODE SECTION
E_f = 6.3 Volts
E_b=E_{c2}=200
170
100
200
150
100
50
0
PLATE - MILLIAMPERES
30
25
20
15
10
5
0
GRID #1 BIAS - VOLTS


6BM8
PENTODE SECTION
E_f = 6.3 Volts
E_{c2}= 200 Volts
GRID #1 BIAS =
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
200
150
100
50
0
PLATE - MILLIAMPERES
0
100
200
300
400
500
PLATE - VOLTS

TUNG-SOL



CIRCUIT DIAGRAM OF TRIODE SECTION AS A.F. AMPLIFIER AND PENTODE SECTION AS TRANSFORMER-LESS AUDIO OUTPUT TUBE.

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TUNG-SOL

TRIODE

MINIATURE TYPE

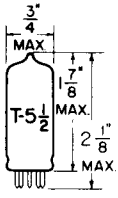
COATED UNIPOTENTIAL CATHODE

HEATER

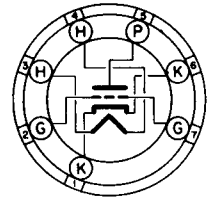
6.3±10% VOLTS 0.2 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7EG

THE 6BN4 AND 6BN4A ARE MINIATURE MEDIUM-MU TRIODES DESIGNED FOR USE AS RADIO-FREQUENCY AMPLIFIERS IN VHF TELEVISION TUNERS. EXCEPT FOR THE HIGHER TRANSCONDUCTANCE AND LOWER PLATE RESISTANCE OF THE 6BN4A, THE TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #316

GRID TO PLATE	1.2	μμf
INPUT	3.2	μμf
OUTPUT	1.4	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS
HEATER WARM-UP TIME*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

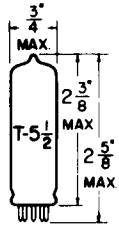
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	43	
PLATE RESISTANCE (APPROX.) FOR 6BN4	6 300	OHMS
PLATE RESISTANCE (APPROX.) FOR 6BN4A	5 400	OHMS
TRANSCONDUCTANCE (FOR 6BN4)	6 800	μMHOS
TRANSCONDUCTANCE (FOR 6BN4A)	7700 ←	μMHOS
PLATE CURRENT	9.0	MA.
GRID VOLTAGE (APPROX.) I_b = 100 μAMPS.	-6	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

MINIATURE TYPE

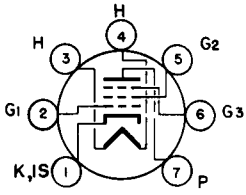


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 6BN6 IS A GATED BEAM DISCRIMINATOR TUBE USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN FM RECEIVERS WITH HEATER TRANSFORMER OR WITH 300 MA. SERIES STRING HEATER SUPPLY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	
CURRENT OPERATION		300±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	1.25	1.25	1.25	VOLTS
DC PLATE CURRENT	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

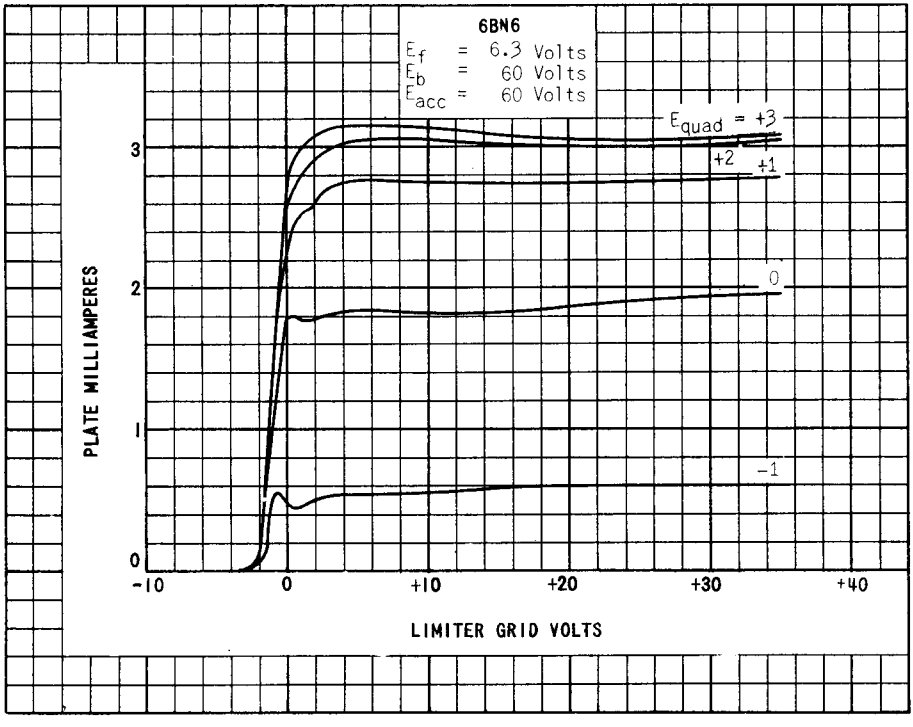
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

→ INDICATES A CHANGE.



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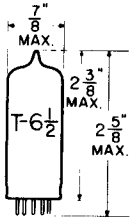
DOUBLE TRIODE

MINIATURE TYPE

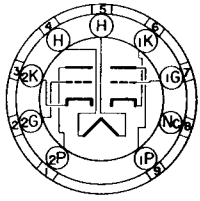


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 6BN7 COMBINES TWO INDEPENDENT TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS SPECIFICALLY DESIGNED FOR SERVICE AS A COMBINED VERTICAL OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. THE TWO TRIODES HAVE DIFFERENT ELECTRICAL RATINGS AND CAPABILITIES, ALLOWING ONE SECTION TO BE USED AS THE GENERATOR AND THE OTHER TO BE USED AS THE AMPLIFIER AND OUTPUT SECTION. THE DESIGN IS SUCH AS TO PERMIT SATISFACTORY OPERATION WITH LOW POWER SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION #2	SECTION #1	
GRID TO PLATE: (G TO P)	0.7	3	μμf
GRID TO CATHODE: (G TO K)	1.4	5.5	μμf
PLATE TO CATHODE: (P TO K)	0.3	1.6	μμf
HEATER TO CATHODE: (H TO K)	2.8	4.2	μμf
PLATE TO PLATE: (P TO P) APPROX.	1.2		μμf
GRID TO GRID: (G TO G) APPROX.	0.03		μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE (EACH SECTION)	200	VOLTS
MAXIMUM PLATE VOLTAGE (EACH SECTION)	400	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (SECTION #1 ONLY)[A]	1500	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE (EACH SECTION)	-50	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE (EACH SECTION)	-200	VOLTS
MAXIMUM PLATE DISSIPATION (SECTION #1)	7.5	WATTS
MAXIMUM PLATE DISSIPATION (SECTION #2)	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE (EACH SECTION)	2.2	MEGOHMS

[A] REFERS ONLY TO PULSE DURATION TYPICAL OF 525-LINE, 30-FRAME SYSTEM WHEREIN THE PULSE IS LIMITED TO 15% OF ONE SCANNING CYCLE OR APPROXIMATELY 2.5 MILLISECONDS.

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PLATE 2459
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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	SECTION #2		SECTION #1	
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		0.75		AMP.
PLATE VOLTAGE	120		250	VOLTS
GRID VOLTAGE	-1		-15	VOLTS
PLATE CURRENT	5		24	MA.
TRANSCONDUCTANCE	2 000		5 500	µMHOS
AMPLIFICATION FACTOR	28		12	
PLATE RESISTANCE	14 000		2 200	OHMS
GRID VOLTAGE (APPROX.) FOR I_b = 100 µA.	-7		-35	VOLTS

VERTICAL DEFLECTION CIRCUIT

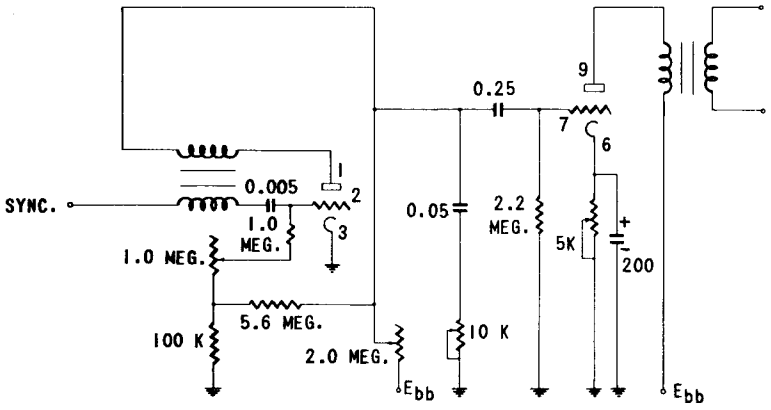
SECTION #2 - (BASE PINS 1, 2 AND 3) AS OSCILLATOR-DISCHARGE TUBE
SECTION #1 - (BASE PINS 6, 7 AND 9) AS VERTICAL AMPLIFIER

	CONDITION I[B]	CONDITION II[C]	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.75	0.75	AMP.
SECTION #2			
DC PLATE SUPPLY VOLTAGE	360	250	VOLTS
DC PLATE CURRENT (APPROX.)	200	125	µA.
SECTION #1			
DC PLATE VOLTAGE	360	250	VOLTS
CATHODE RESISTOR (APPROX.)	330	330	OHMS
DC PLATE CURRENT	21	20	MA.
PEAK TO PEAK SAWTOOTH GRID VOLTAGE (APPROX.)	75	45	VOLTS
NEGATIVE PEAK GRID VOLTAGE (APPROX.)	15	15	VOLTS

[B] FOR 15" VERTICAL DEFLECTION OF WIDE-ANGLE (70°) PICTURE TUBE OPERATION WITH 14 KV. SECOND ANODE VOLTAGE. TRANSFORMER 11.4 : 1 TURNS RATIO TO YOKE OF 50 OHMS IMPEDANCE AT 1000 CYCLES.

[C] FOR 11" VERTICAL DEFLECTION OF WIDE-ANGLE (70°) PICTURE TUBE OPERATION WITH 14 KV. SECOND ANODE VOLTAGE. TRANSFORMER 10 : 1 TURNS RATIO TO YOKE OF 50 OHMS IMPEDANCE AT 1000 CYCLES.

TYPICAL CIRCUIT FOR CONDITIONS I AND II



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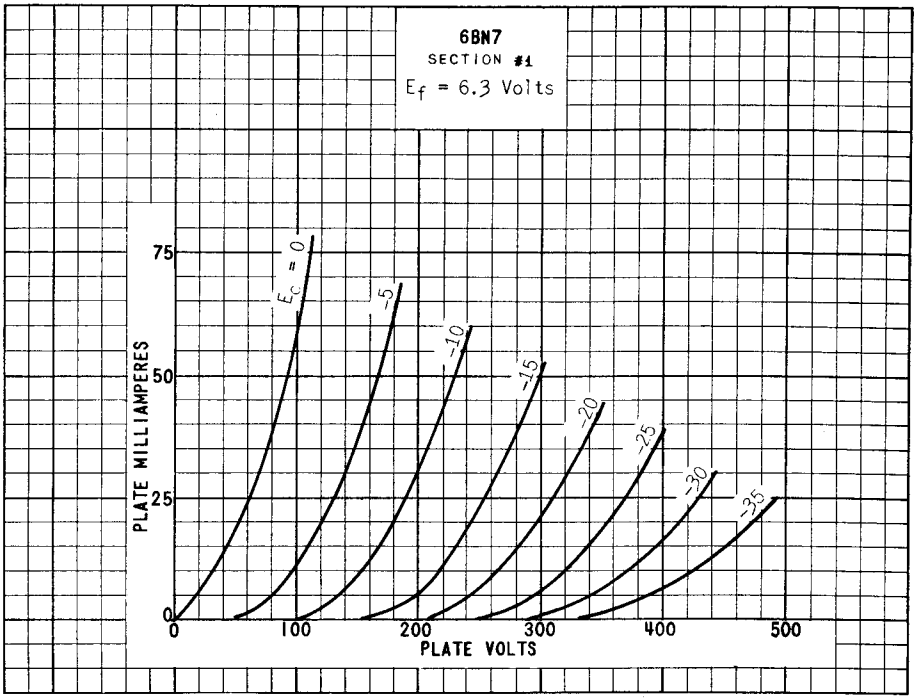

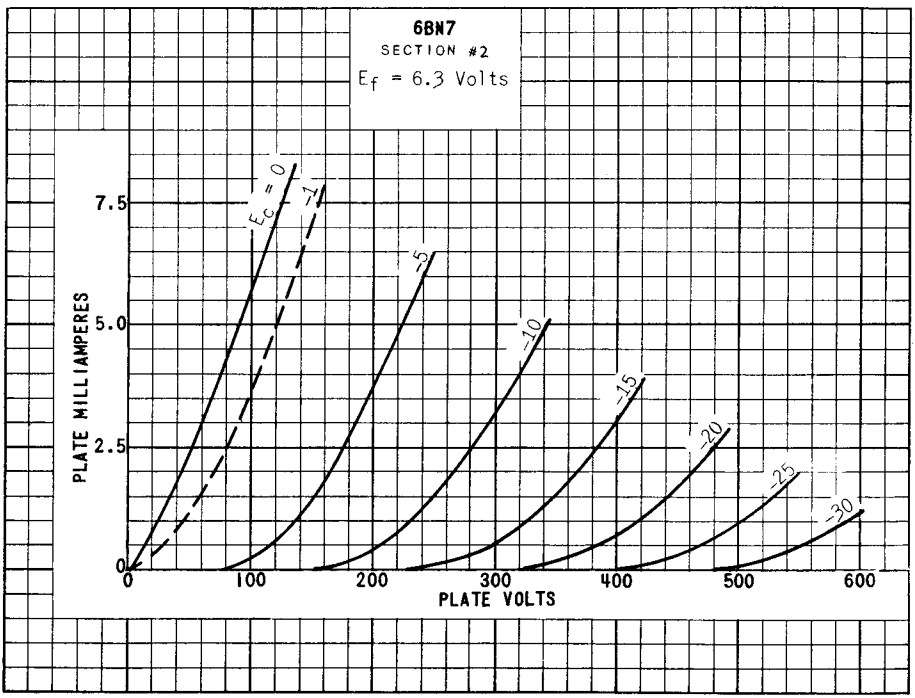

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TUNG-SOL

DOUBLE-DIODE TRIODE

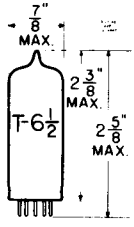
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

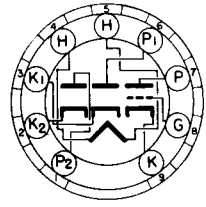
HEATER

6.3±10% VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9ER

THE 6BN8 IS A HIGH MU TRIODE DOUBLE DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TUBE HAS SEPARATE CATHODE CONNECTIONS FOR EACH SECTION AND IS INTENDED FOR APPLICATIONS IN BOTH MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE: (G TO P)	2.5	μμf
INPUT: G TO (H +TK)	3.6	μμf
OUTPUT: P TO (H +TK)	0.25	μμf
DIODE SECTION		
#1 PLATE TO TRIODE GRID (MAX.)	0.060	μμf
#2 PLATE TO TRIODE GRID (MAX.)	0.10	μμf
#1 CATHODE TO ALL: 1DK TO (H+TK+2DK+TP+1DP+TG+2DP)	5.0	μμf
#2 CATHODE TO ALL: 2DK TO (H+TK+1DK+TP+1DP+2DP+TG)	5.0	μμf
#1 PLATE TO #2 PLATE (MAX.)	0.070	μμf
#1 PLATE TO #1 CATHODE + HEATER: 1DP TO (1DK+ H)	1.9	μμf
#2 PLATE TO #2 CATHODE + HEATER: 2DP TO (2DK+ H)	1.9	μμf
#1 CATHODE TO #1 PLATE + HEATER: 1DK TO (1DP+ H)	4.8	μμf
#2 CATHODE TO #2 PLATE + HEATER: 2DK TO (2DP+ H)	4.8	μμf
#1 PLATE TO ALL: 1DP TO (H+TK+1DK+2DK+TP+2DP+TG)	3.0	μμf
#2 PLATE TO ALL: 2DP TO (H+TK+1DK+2DK+TP+1DP+TG)	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	→ 6.3±10%	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME [A]	11	SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

TRIODE SECTION		
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
DIODE SECTION		
MAXIMUM PEAK PLATE CURRENT, (EACH PLATE)	54	MA.
MAXIMUM DC CURRENT, (EACH PLATE)	9	MA.

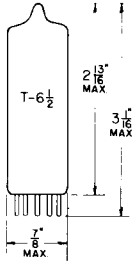
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE SECTION			
HEATER VOLTAGE	→ 6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−3	VOLTS
PLATE RESISTANCE (APPROX.)	21 000	28 000	OHMS
TRANSCONDUCTANCE	3 500	2 500	μMHOS
AMPLIFICATION FACTOR	75	70	
PLATE CURRENT	1.5	1.6	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	−2.5	−5.5	VOLTS
DIODE SECTION			
AVERAGE CURRENT (EACH PLATE) AT 10 VOLTS DC		50	MA.
VOLTAGE DROP (EACH SECTION) AT I_b=9 MA DC		2.6	VOLTS

TUNG-SOL

PENTODE



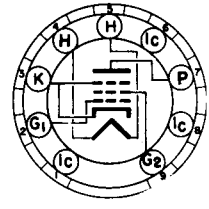
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.76 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
9 PIN BASE
9CV

THE 6BQ5 IS AN OUTPUT PENTODE DESIGNED FOR APPLICATION IN MEDIUM POWER HI-FI AMPLIFIERS. A PAIR OF TUBES IN CLASS AB, PUSH-PULL CONVENTIONAL OPERATION YIELDS AN OUTPUT OF UP TO 17 WATTS AT 4% DISTORTION (WITHOUT FEEDBACK). IN SINGLE-ENDED OPERATION A POWER OUTPUT OF 5.7 WATTS CAN BE OBTAINED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS	10.8	μμf
PLATE TO ALL OTHER ELEMENTS	6.5	μμf
PLATE TO GRID #1 (MAX.)	0.5	μμf
GRID #1 TO HEATER (MAX.)	0.25	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE[A]	300	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION[A]	12	WATTS
MAXIMUM GRID #2 VOLTAGE [A]	300	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #2 PEAK DISSIPATION	4	WATTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	100	VOLTS
MAXIMUM GRID CURRENT STARTING POINT		
MAXIMUM GRID #1 VOLTAGE WHEN GRID #1 CURRENT IS 0.3 μAMP.	-1.3	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	0.3	MEGOHM
MAXIMUM CATHODE CURRENT	65	MA.
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A, ONE TUBE

HEATER VOLTAGE			6.3			VOLTS
HEATER CURRENT			0.76			AMP.
PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			-7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			5200			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3	3.4	4.3	4.7	VOLTS
PLATE CURRENT	48	---	---	49.5	49.2	MA.
GRID #2 CURRENT	5.5	---	---	10.8	11.6	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	μMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	6.8	10	---	PERCENT
SECOND HARMONIC[B]	---	---	3.0	2.0	---	PERCENT
THIRD HARMONIC[B]	---	---	5.8	9.5	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			-7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			4500			OHMS
INPUT A.F. VOLTAGE (RMS)	0	0.3	3.5	4.4	4.8	VOLTS
PLATE CURRENT	48	---	---	50.6	50.5	MA.
GRID #2 CURRENT	5.5	---	---	10	11	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	μMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	7.5	10	---	PERCENT
SECOND HARMONIC[B]	---	---	5.7	5.0	---	PERCENT
THIRD HARMONIC[B]	---	---	4.5	8	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			-8.4			VOLTS
CATHODE RESISTOR			210			OHMS
PLATE LOAD RESISTANCE			7000			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3		3.5	5.5	VOLTS
PLATE CURRENT	36	---		36.8	36	MA.
GRID #2 CURRENT	4.1	---		8.5	14.6	MA.
TRANSCONDUCTANCE	10000	---		---	---	μMHOS
PLATE RESISTANCE	40000	---		---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---		---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05		4.2	5.6[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---		10	---	PERCENT
SECOND HARMONIC[B]	---	---		1.7	---	PERCENT
THIRD HARMONIC[B]	---	---		8.7	---	PERCENT

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A, ONE TUBE - CONT'D.

PLATE VOLTAGE			250		VOLTS
GRID #2 VOLTAGE			210		VOLTS
GRID #1 BIAS			-6.4		VOLTS
CATHODE RESISTOR			160		OHMS
PLATE LOAD RESISTANCE			7000		OHMS
INPUT A.F. VOLTAGE(RMS.)	0	0.3	3.4	3.8	VOLTS
PLATE CURRENT	36	---	36.6	36.5	MA.
GRID #2 CURRENT	3.9	---	7.3	8.0	MA.
TRANSCONDUCTANCE	10400	---	---	---	μMHOS
PLATE RESISTANCE	40000	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	OHMS
MAX. SIGNAL POWER OUTPUT [B]	0	0.05	4.3	4.7[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	.10	---	PERCENT
SECOND HARMONIC[B]	---	---	1.8	---	PERCENT
THIRD HARMONIC[B]	---	---	9.3	---	PERCENT

CLASS B, TWO TUBES

PLATE VOLTAGE	250		300		VOLTS
GRID #2 VOLTAGE	250		300		VOLTS
GRID #1 BIAS	-11.6		-14.7		VOLTS
LOAD RESISTANCE, PLATE TO PLATE	8000		8000		
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x10	2x37.5	2x7.5	2x46	MA.
GRID #2 CURRENT	2x1.1	2x7.5	2x0.8	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENT

CLASS AB, TWO TUBES

PLATE VOLTAGE	250		300		VOLTS
GRID #2 VOLTAGE	250		300		VOLTS
COMMON CATHODE RESISTOR	130		130		OHMS
LOAD RESISTANCE, PLATE TO PLATE	8000		8000		OHMS
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x31	2x37.5	2x36	2x46	MA.
GRID #2 CURRENT	2x3.5	2x7.5	2x4	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A IN TRIODE CONNECTION

(GRID #2 CONNECTED TO PLATE)

PLATE VOLTAGE	250	VOLTS
CATHODE RESISTOR	270	OHMS
PLATE LOAD RESISTANCE	3500	OHMS
ZERO-SIGNAL PLATE CURRENT	34	MA.
INPUT A.F. VOLTAGE (RMS)	6.7	VOLTS
MAX. SIGNAL PLATE CURRENT	36	MA.
MAX. SIGNAL POWER OUTPUT	1.95	WATTS
TOTAL HARMONIC DISTORTION	9	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	1.0	VOLT

CLASS AB, TWO TUBES IN TRIODE CONNECTION

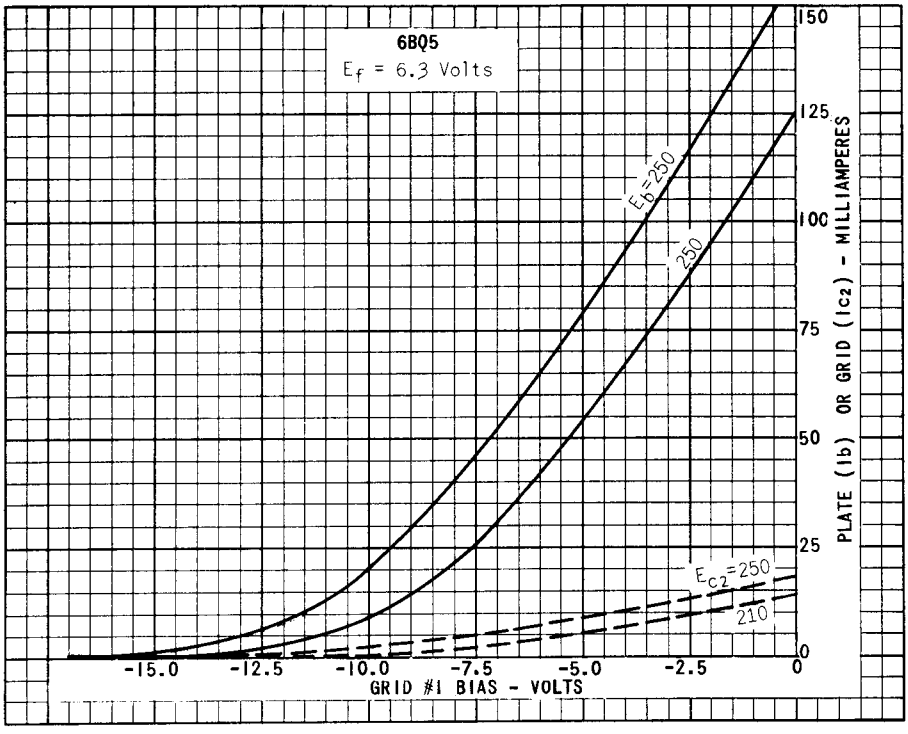
(GRID #2 CONNECTED TO PLATES)

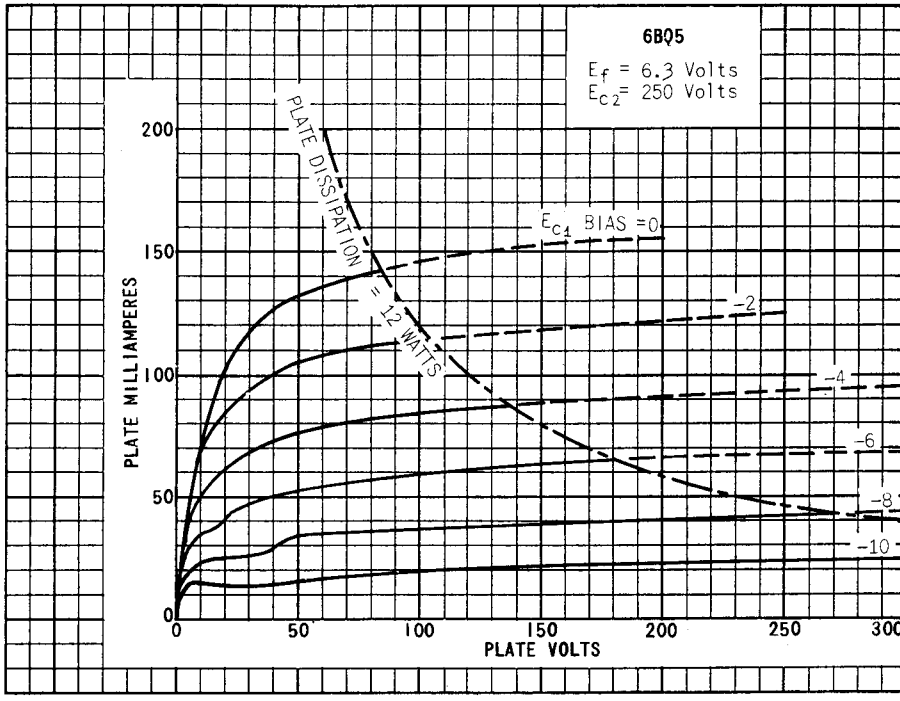
PLATE VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE (PLATE TO PLATE)	10 000	10 000	OHMS
ZERO-SIGNAL PLATE CURRENT	2x20	2x24	MA.
INPUT A.F. VOLTAGE (RMS)	8.3	10	VOLTS
MAX. SIGNAL PLATE CURRENT	2x21.7	2x26	MA.
MAX. SIGNAL POWER OUTPUT	3.4	5.2	WATTS
TOTAL HARMONIC DISTORTION	2.5	2.5	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS.)	0.95	0.9	VOLTS

[A] WHEN THE HEATER AND POSITIVE VOLTAGES ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR, THE MAX. VALUES OF THE PLATE AND GRID #2 VOLTAGES ARE 250 VOLTS AND THAT OF THE PLATE DISSIPATION 9 WATTS.

[B] MEASURED WITH FIXED BIAS.

[C] POWER OUTPUT AT START OF POSITIVE GRID CURRENT.





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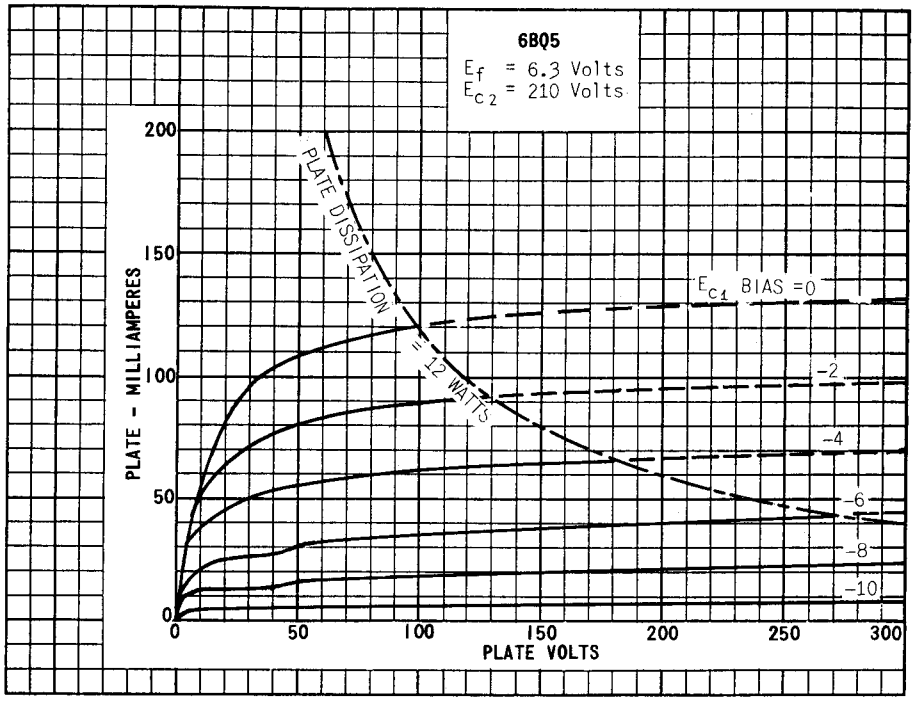
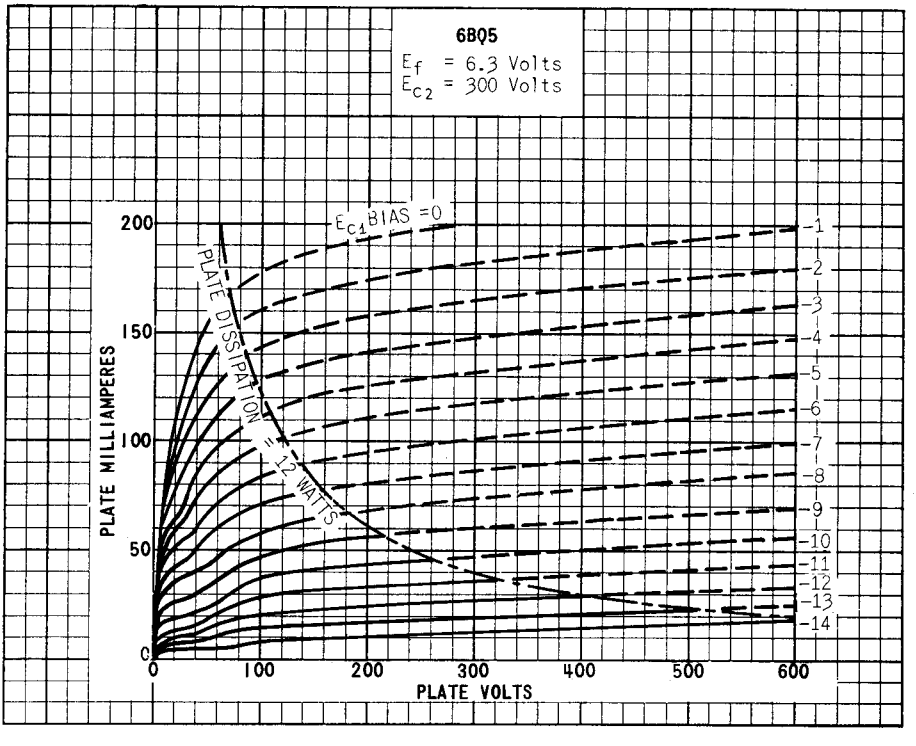
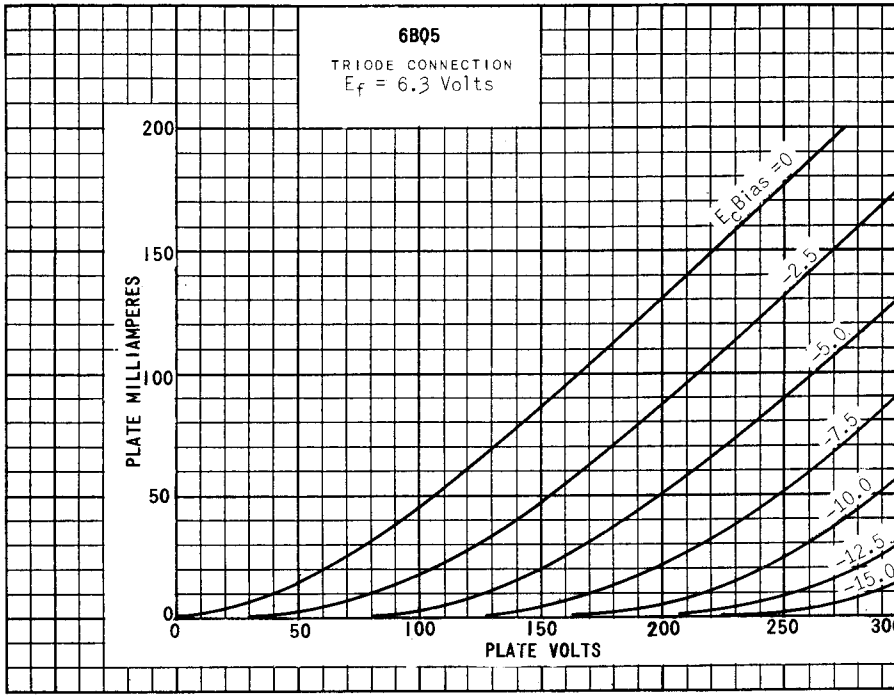
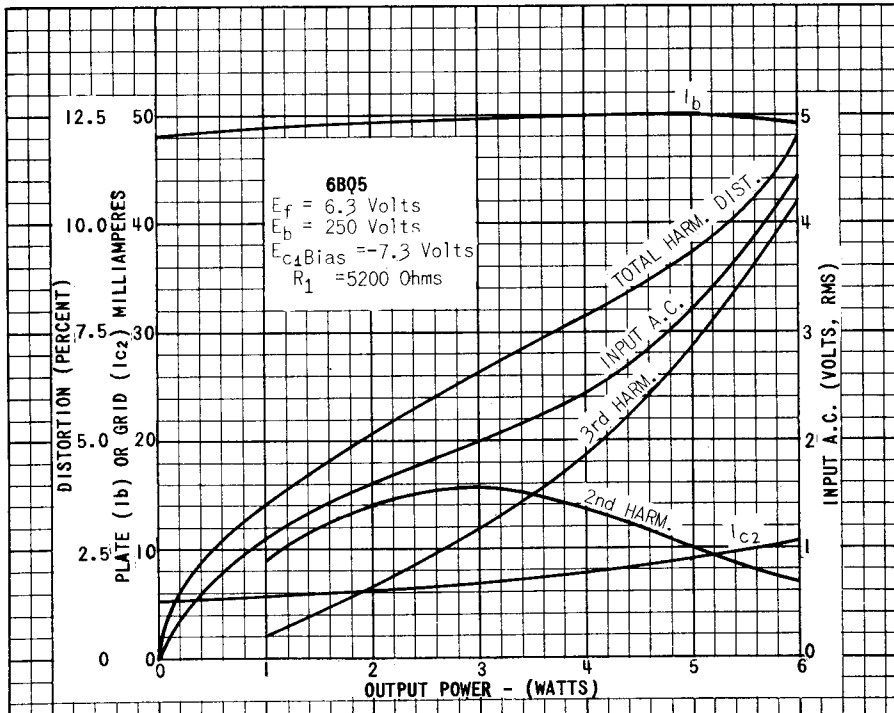
TENTATIVE DATA









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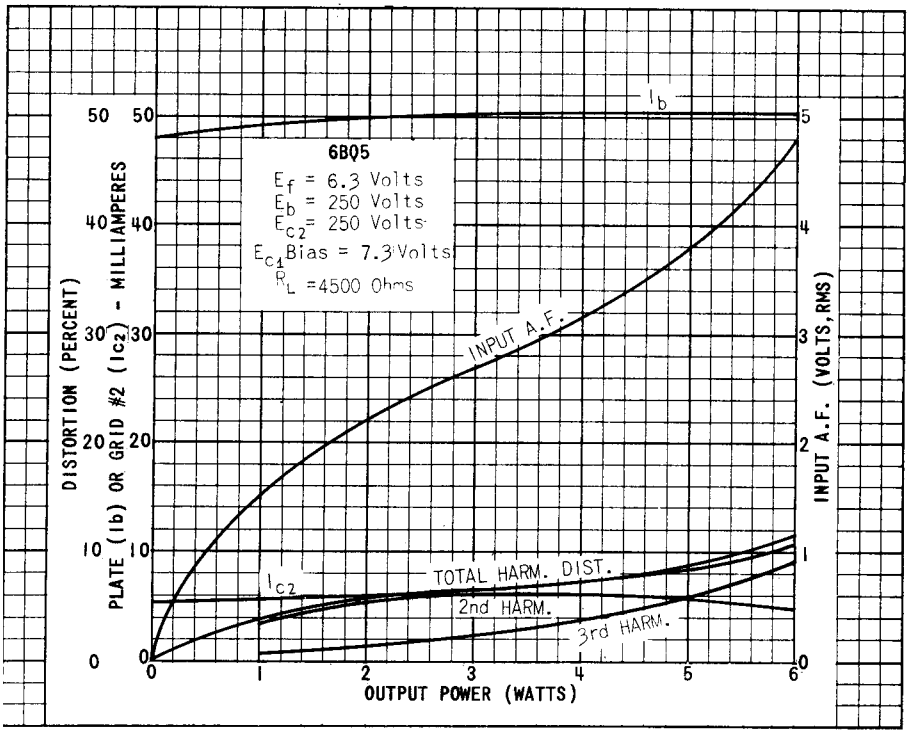
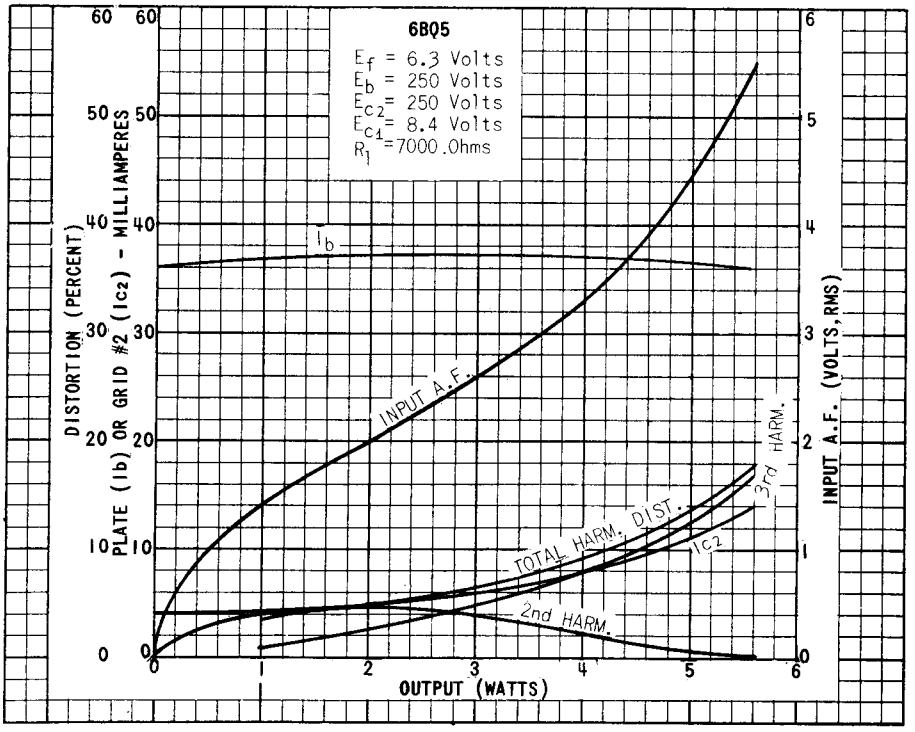
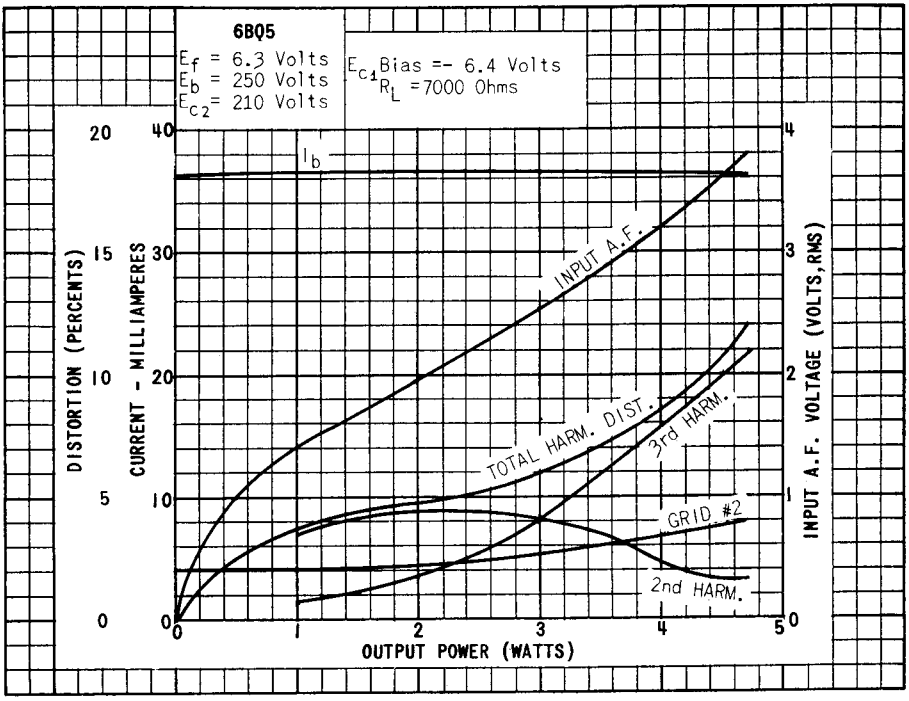
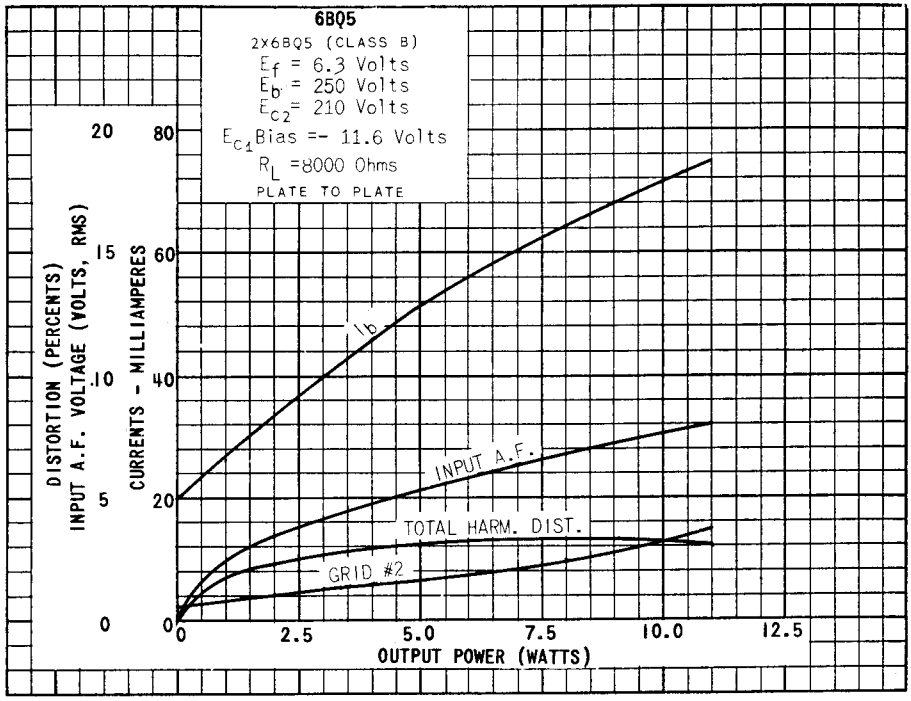
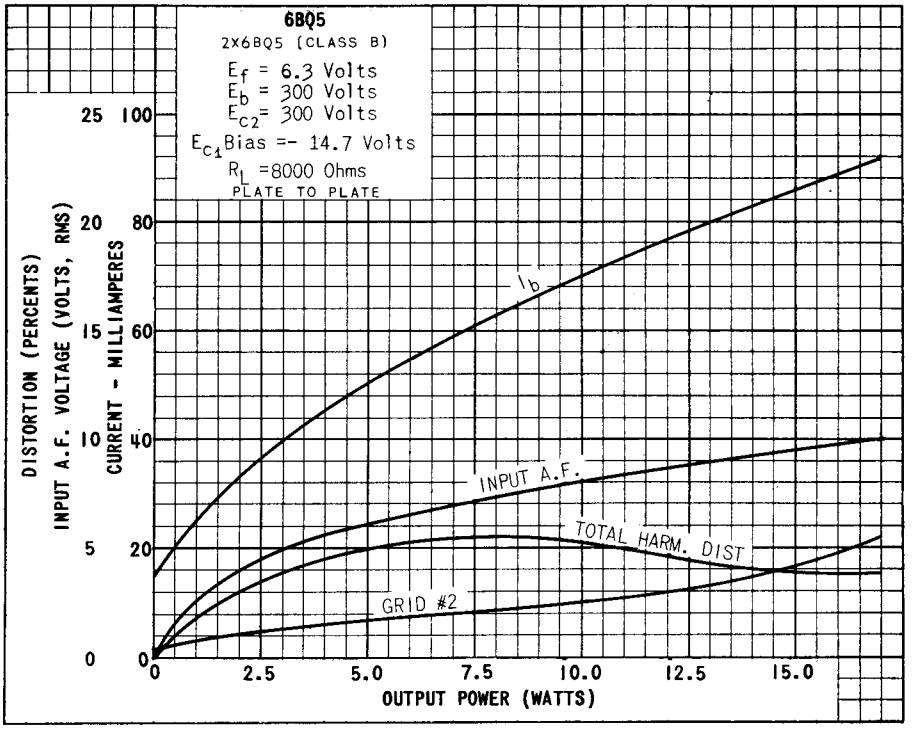

6BQ5
E_f = 6.3 Volts
E_b = 250 Volts
E_{c_2} = 250 Volts
E_{c_1} Bias = 7.3 Volts
R_L = 4500 Ohms
I_b
INPUT A.F.
I_{c_2}
TOTAL HARM. DIST.
2nd HARM.
3rd HARM.
DISTORTION (PERCENT)
PLATE (I_b) OR GRID #2 (I_{c_2}) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT POWER (WATTS)

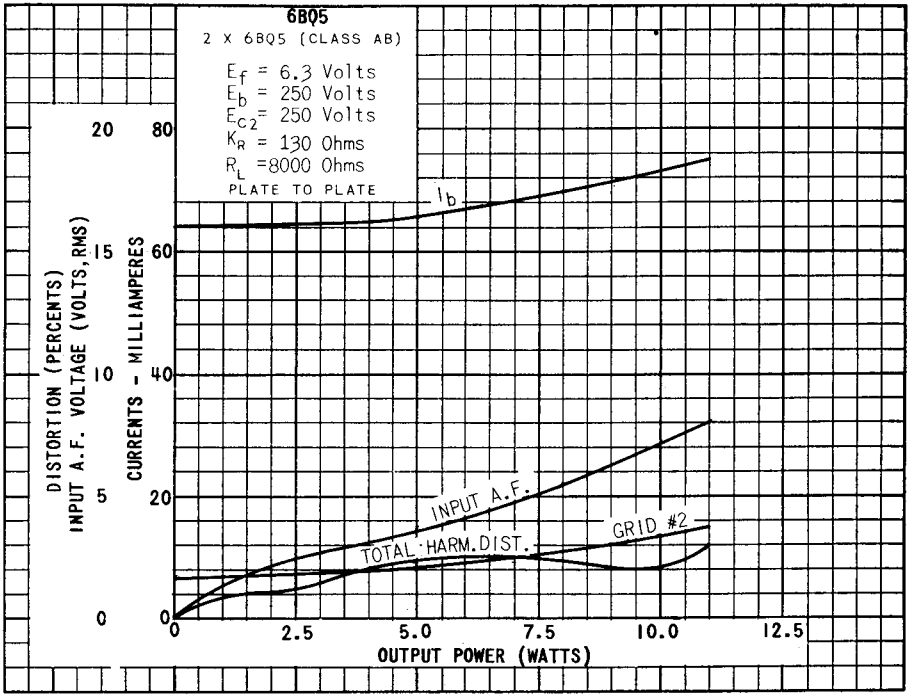

6BQ5
E_f = 6.3 Volts
E_b = 250 Volts
E_{c_2} = 250 Volts
E_{c_1} = 8.4 Volts
R_1 = 7000 Ohms
I_b
INPUT A.F.
3rd HARM.
TOTAL HARM. DIST.
I_{c_2}
2nd HARM.
DISTORTION (PERCENT)
PLATE (I_b) OR GRID #2 (I_{c_2}) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT (WATTS)

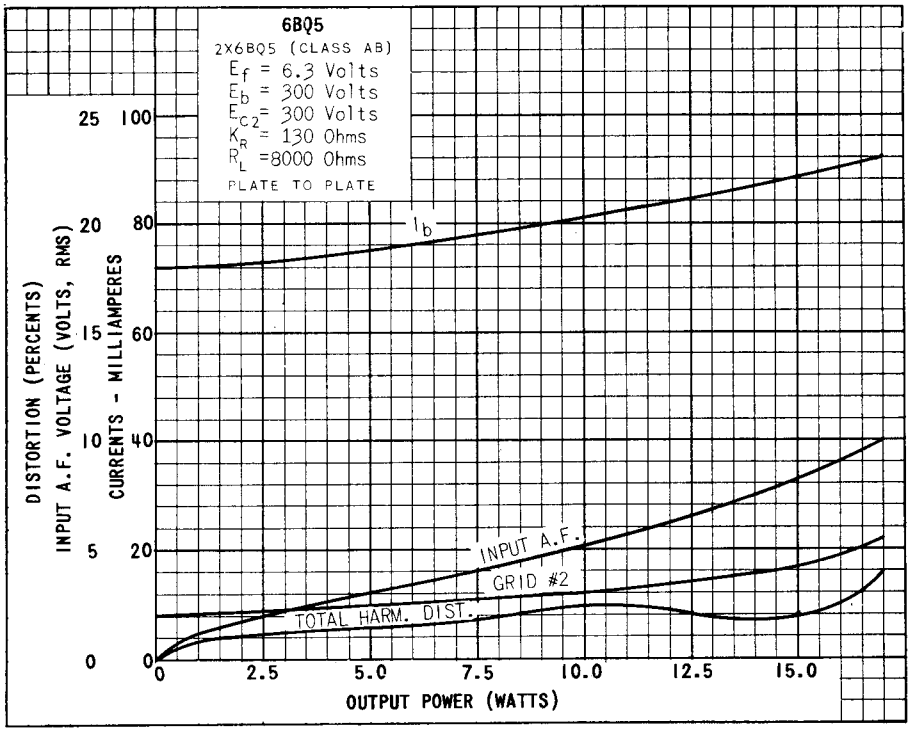

6BQ5
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 210 Volts
E_{c1} Bias =- 6.4 Volts
R_L =7000 Ohms
I_b
INPUT A.F.
TOTAL HARM. DIST.
3rd HARM.
GRID #2
2nd HARM.
DISTORTION (PERCENTS)
CURRENT - MILLIAMPERES
INPUT A.F. VOLTAGE (VOLTS,RMS)
OUTPUT POWER (WATTS)

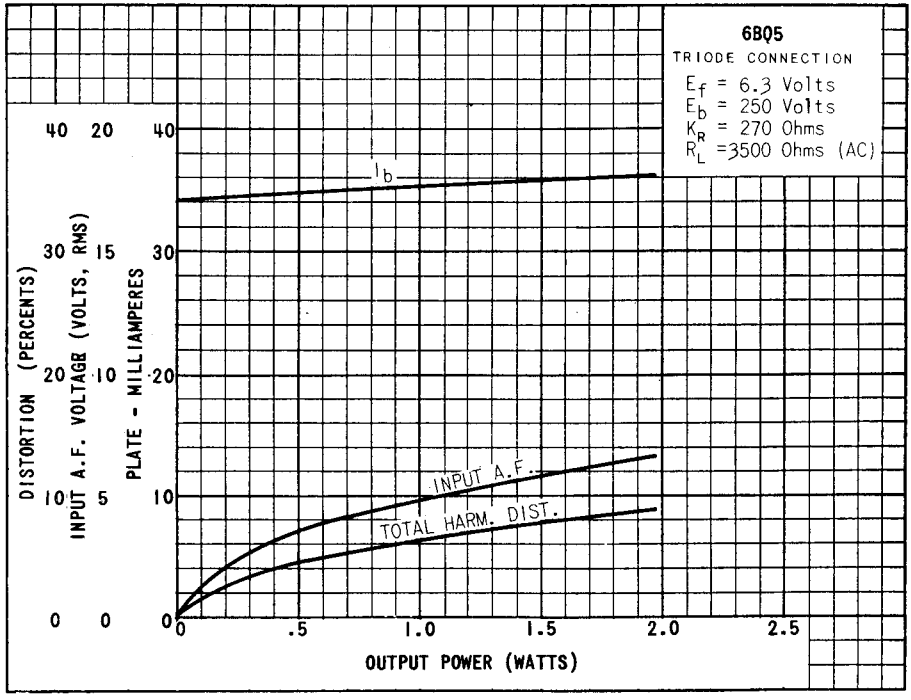

6BQ5
2X6BQ5 (CLASS B)
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 210 Volts
E_{c1} Bias =- 11.6 Volts
R_L =8000 Ohms
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
GRID #2
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
OUTPUT POWER (WATTS)

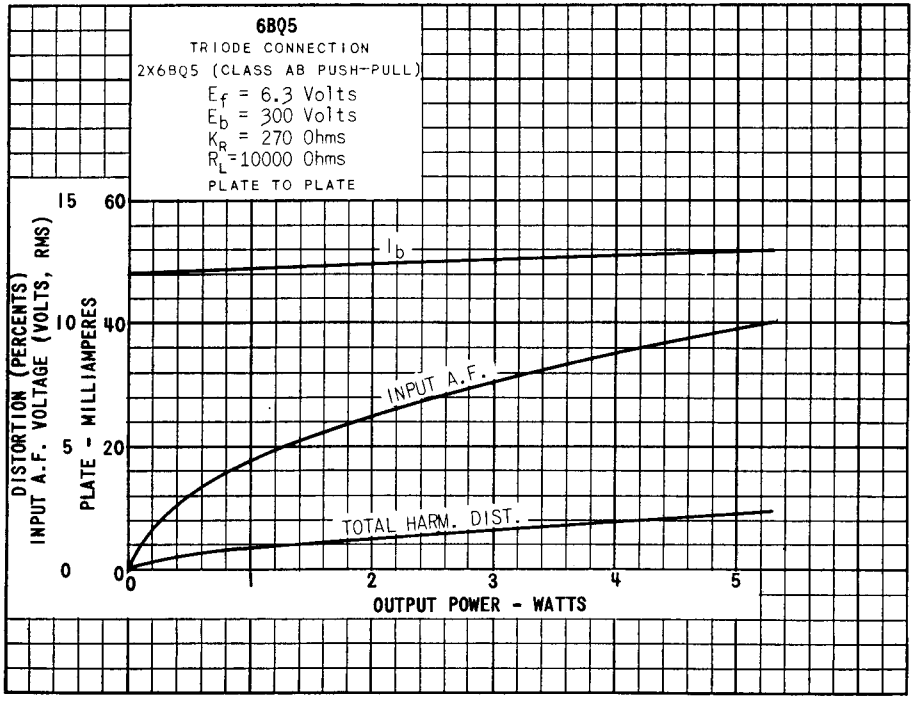
TENTATIVE DATA

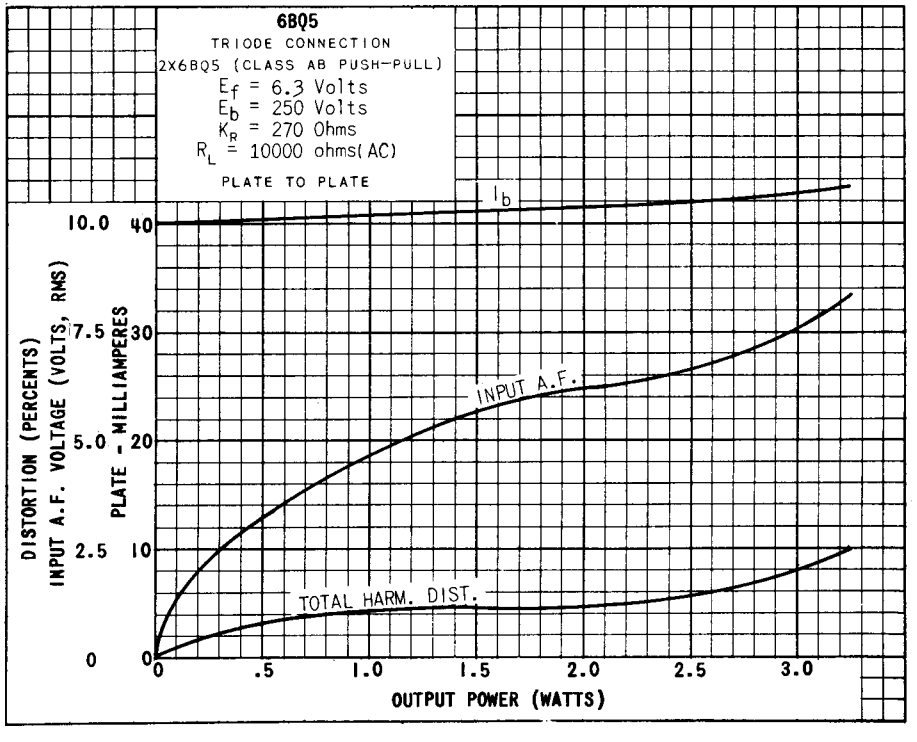





6BQ5
2X6BQ5 (CLASS AB)
E_f = 6.3 Volts
E_b = 300 Volts
E_{c2} = 300 Volts
K_R = 130 Ohms
R_L =8000 Ohms
PLATE TO PLATE
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
I_b
INPUT A.F.
GRID #2
TOTAL HARM. DIST.
OUTPUT POWER (WATTS)

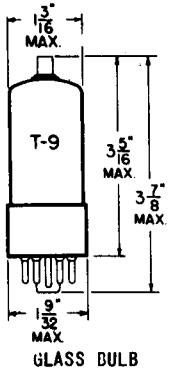

6BQ5
TRIODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
K_R = 270 Ohms
R_L =3500 Ohms (AC)
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
I_b
INPUT A.F.
TOTAL HARM. DIST.
OUTPUT POWER (WATTS)


6BQ5
TRIODE CONNECTION
2X6BQ5 (CLASS AB PUSH-PULL)
E_f = 6.3 Volts
E_b = 300 Volts
K_R = 270 Ohms
R_L = 10000 Ohms
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER - WATTS
0
1
2
3
4
5
0
5
10
15
20
40
60


6BQ5
TRIODE CONNECTION
2X6BQ5 (CLASS AB PUSH-PULL)
E_f = 6.3 Volts
E_b = 250 Volts
K_R = 270 Ohms
R_L = 10000 ohms(AC)
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER (WATTS)
0
.5
1.0
1.5
2.0
2.5
3.0
0
2.5
5.0
7.5
10.0
10
20
30
40

TUNG-SOL

BEAM PENTODE

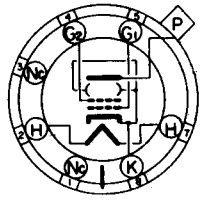


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 6BQ6GT IS A BEAM PENTODE DESIGNED SPECIFICALLY FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING MAGNETIC DEFLECTION. THE PLATE IS BROUGHT OUT TO A TOP CAP FOR ISOLATION OF THE HIGH VOLTAGE AND CONVENIENCE IN CIRCUIT LAYOUT. ITS ELECTRICAL CHARACTERISTICS ARE SUCH AS TO PROVIDE GOOD PERFORMANCE WHERE THE SUPPLY VOLTAGES ARE LIMITED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.6	μμf
INPUT: G_1 TO (H+K+G_2+BP)	15	μμf
OUTPUT: P TO (H+K+G_2+BP)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220°	CENTIGRADE

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 3142
FEB. 1 1953

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PENTODE CONNECTION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	µMHOS
PLATE RESISTANCE	20 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

[C] WITH E_b = 250 VOLTS, E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

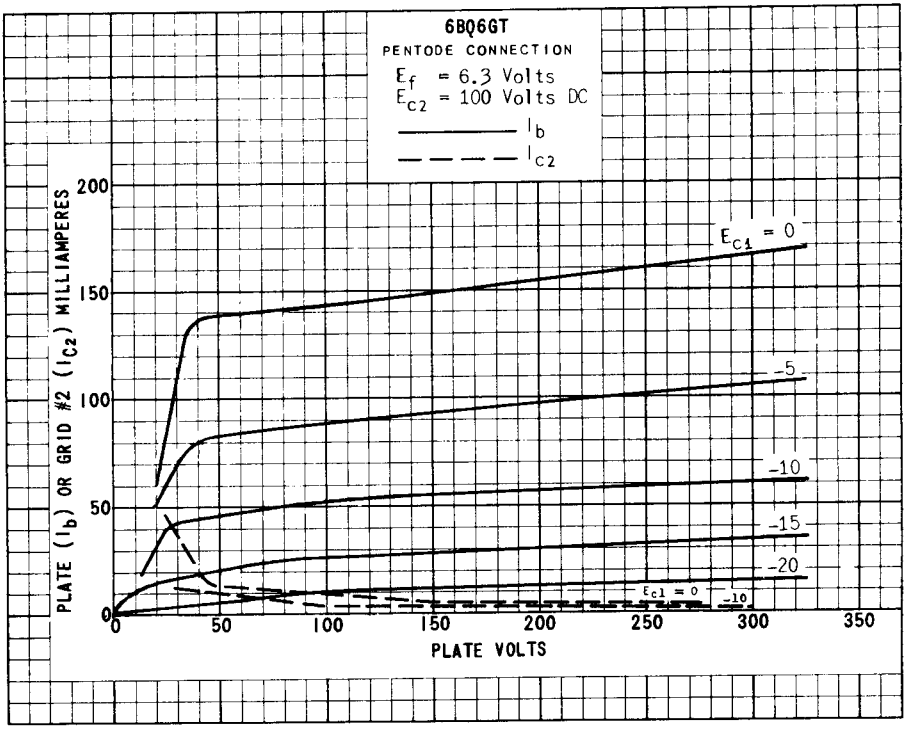
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS.

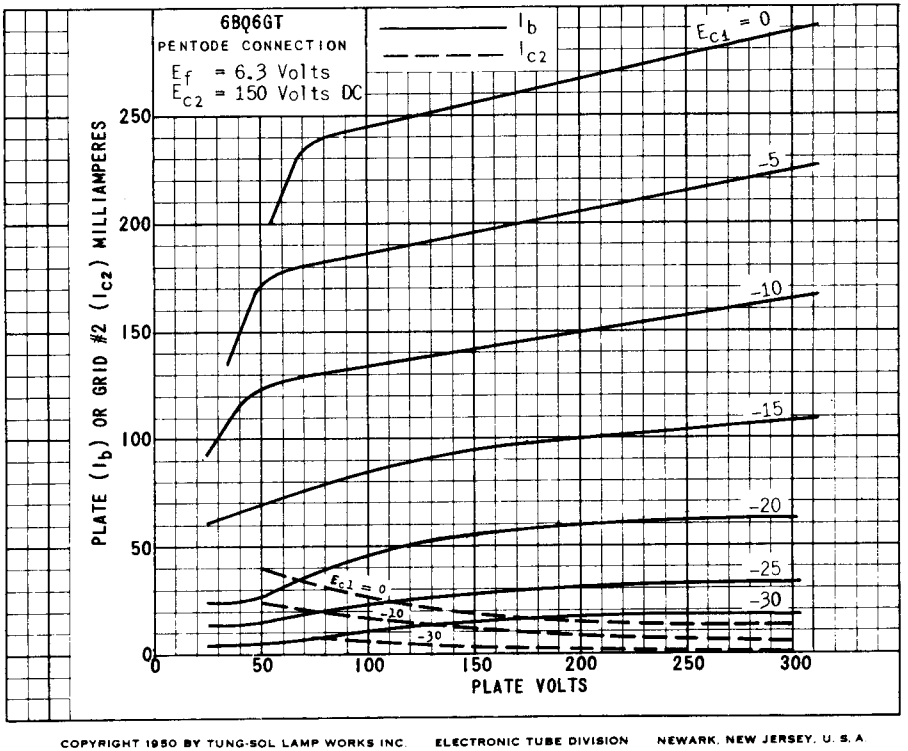
[E] FOR I_b = 1 MA. WITH E_b = 250 VOLTS AND E_{C2} = 150 VOLTS

[F] WITH E_b = E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

→ INDICATES A CHANGE OR ADDITION.

PLATE
3143
FEB. 1
1953





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2337
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1950

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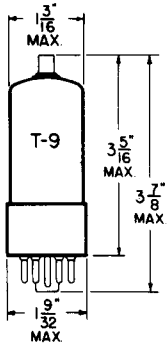
PENTODE

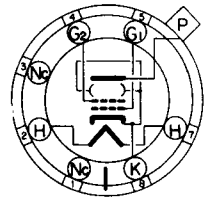


GLASS BULB
SKIRTED
MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 6BQ6GTB IS A BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE	0.6	μμf
INPUT	15	μμf
OUTPUT	7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES
(UNLESS OTHERWISE SPECIFIED)

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	600	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAX.)	6 000	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	57	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 900	μMHOS
PLATE RESISTANCE	14 500	OHMS
ZERO BIAS:[D]		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	26	MA.
CUTOFF:[E]		
GRID #1 VOLTAGE (APPROX.)	−43	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 6BQ6GTB is identical to the 17BQ6GTB.

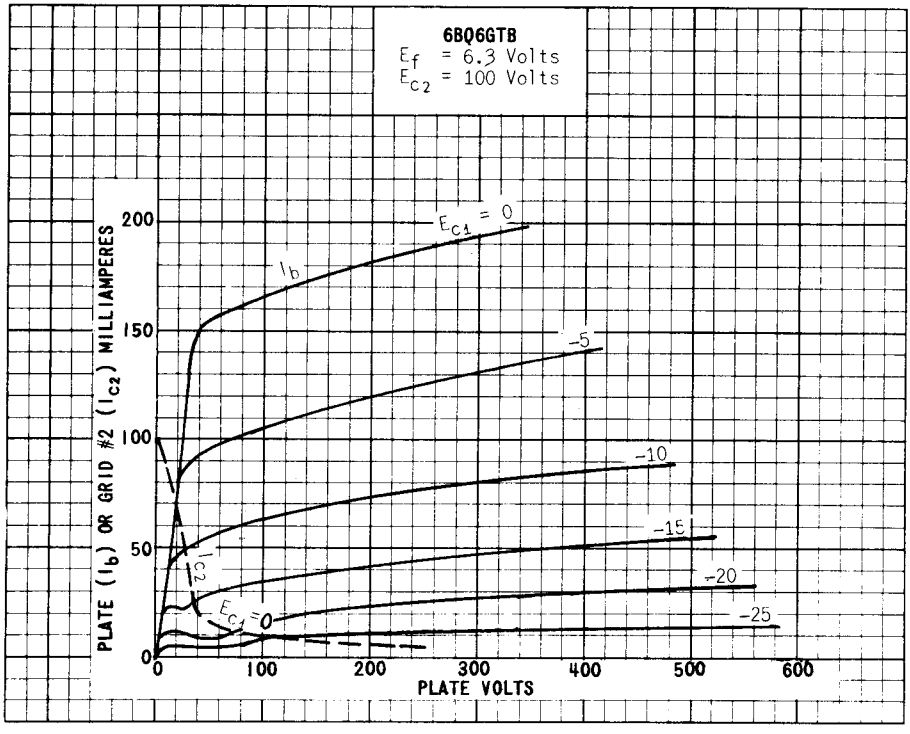
THE ELECTRICAL DATA AND PIN CONNECTION FOR TYPE 6BQ6GTB ARE IDENTICAL WITH THOSE OF TYPES 6BQ6GA AND 6CU6.

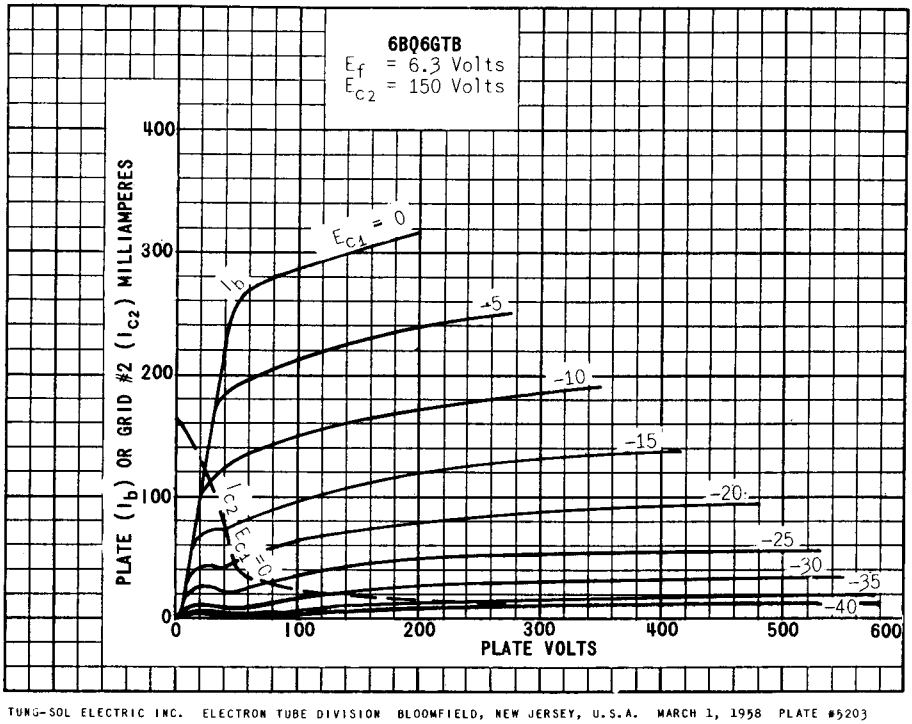
[C] WITH E_b = 250V, E_{c2} = 150V, AND E_{c1} = −22.5V.

[D] WITH E_B = 60V. AND E_{C2} = 150V. (INSTANTANEOUS VALUES)

[E] FOR I_b = 1 MA. WITH E_b = 250V. AND E_{c2} = 150V.

[F] WITH E_b = E_{c2} = 150V. AND E_{c1} = −22.5V.





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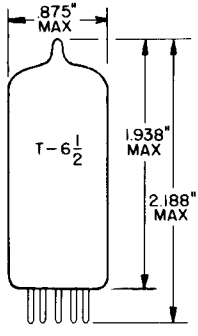
DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

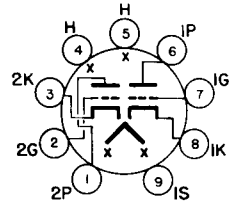
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR USE AS

VHF VOLTAGE AMPLIFIER

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AJ

THE 6BQ7 COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. LOW INTERELECTRODE CAPACITANCES, HIGH TRANSCONDUCTANCE AND SHIELDING BETWEEN THE TWO SECTIONS ADAPT IT FOR USE IN THE GROUNDED-CATHODE INPUT/GROUNDED-GRID OUTPUT OR CASCODE CIRCUIT PROVIDING LOW TUBE NOISE AND GOOD STABILITY AS A VHF VOLTAGE AMPLIFIER.

→ DIRECT INTERELECTRODE CAPACITANCES [A]

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE: (G TO P)	1.15	1.15	pf
PLATE TO CATHODE: (P TO K) MAX.	0.15	0.15	pf
HEATER TO CATHODE: (H TO K)	2.20	2.30	pf
#1 TRIODE INPUT: G TO (H + K + I.S.)	2.85	------	pf
#2 TRIODE INPUT: K TO (H + G + I.S.) [B]	------	4.95	pf
#1 TRIODE OUTPUT: P TO (H + K + I.S.)	1.35	------	pf
#2 TRIODE OUTPUT: P TO (H + G + I.S.) [B]	------	2.27	pf
#1 TRIODE PLATE TO #2 TRIODE PLATE: (1P TO 2P) MAX.	0.010		pf
#2 TRIODE PLATE TO #1 TRIODE PLATE & GRID: (2P TO 1P + 1G) MAX.	0.024		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	400	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE [C]			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200	VOLTS

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MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE[C]	250	VOLTS
PLATE DISSIPATION	2	WATTS
CATHODE CURRENT	20	MA.
GRID CIRCUIT RESISTANCE *	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH UNIT

PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
PLATE CURRENT	9	MA.
AMPLIFICATION FACTOR	35	
TRANSCONDUCTANCE	6000	μMHOS
PLATE RESISTANCE	5800	OHMS
GRID VOLTAGE (APPROX.)		
FOR Ib = 10 μA	−10	VOLTS

A
EXTERNAL SHIELD 315 CONNTECTED TO CATHODE

B
READ AS GROUNDED GRID AMPLIFIER.

C
THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS, IN GROUNDED-GRID CIRCUIT WITH DIRECT COUPLED DRIVE.

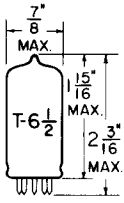
* INDICATES AN ADDITION

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

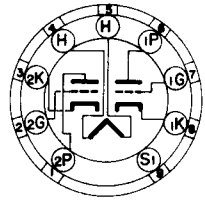


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN NOVAL
9AJ

THE 6BQ7A IS A MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS THE FIRST RF AMPLIFIER TUBE IN TUNERS OF VHF TELEVISION RECEIVERS OR AS A LOW NOISE IF PRE-AMPLIFIER TUBE IN UHF TELEVISION RECEIVERS EMPLOYING A CRYSTAL MIXER. HIGH TRANSCONDUCTANCE, LOW INPUT CAPACITANCE, LOW INPUT LOADING AND LOW PLATE TO CATHODE CAPACITANCE MAKES IT ESPECIALLY USEFUL IN THE DIRECT-COUPLED RF STAGE OF TELEVISION RECEIVERS UTILIZING A DRIVEN RF-GROUNDED-GRID AMPLIFIER OR THE CASCODE TYPE OF CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT #1	UNIT #2	
GRID TO PLATE	1.15	1.15	μμf
INPUT	2.85	----	μμf
INPUT (GROUNDED GRID)	----	4.95	μμf
OUTPUT	1.35	----	μμf
OUTPUT (GROUNDED GRID)	----	2.27	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.65	2.70	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2 (MAX.)	0.010		μμf
PLATE OF UNIT #2 TO PLATE AND GRID OF UNIT #1 (MAX.)	0.024		μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM PLATE VOLTAGE	250[A]	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

[A] UNDER CUT-OFF CONDITIONS, IN RF-GROUNDED-GRID CIRCUITS WITH DIRECT-COUPLED DRIVE, IT IS PERMISSIBLE FOR THIS VOLTAGE TO BE AS HIGH AS 300 VOLTS.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

	DESIGN CENTER VALUES	
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6 100	OHMS
TRANSCONDUCTANCE	6 400	µMHOS
PLATE CURRENT	9	MA.
GRID VOLTS (APPROX.) FOR I_b = 10 µAMP.	−10	VOLTS

PUSH–PULL RF GROUNDED GRID CIRCUIT – EACH UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE (OBTAINED FROM CATHODE RESISTOR)	−2	VOLTS
CATHODE RESISTOR (COMMON TO BOTH UNITS)	100	OHMS
PLATE CURRENT	10	MA.

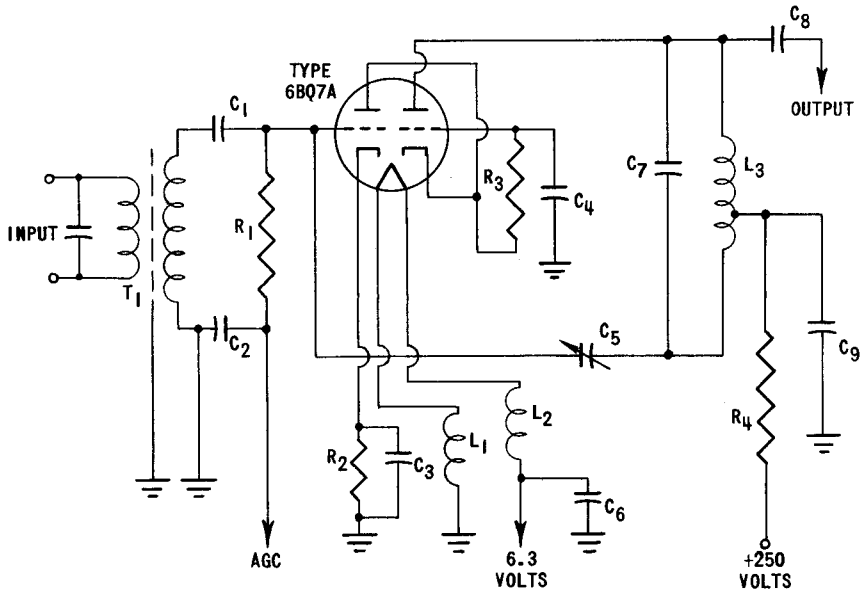
RF GROUNDED GRID CIRCUIT WITH DIRECT–COUPLED DRIVE

UNIT #1 (DRIVER TUBE) IS DIRECTLY COUPLED TO UNIT #2 (DRIVEN RF-GROUNDED-GRID AMPLIFIER TUBE) AS SHOWN IN ACCOMPANYING CIRCUIT.

	UNIT #1	UNIT #2	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.4	0.4	AMP.
PEAK HEATER CATHODE VOLTAGE: HEATER NEGATIVE WITH RESPECT TO CATHODE	1	250	VOLTS
PLATE SUPPLY VOLTAGE	250	250	VOLTS
PLATE VOLTAGE	135	115	VOLTS
GRID VOLTAGE	−1	---	VOLTS
GRID RESISTOR	---	0.5	MEGOHM
PLATE CURRENT	10	10	MA.
GRID CURRENT	0	0	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−14	---	VOLTS

→INDICATES A CHANGE.

TUNG-SOL

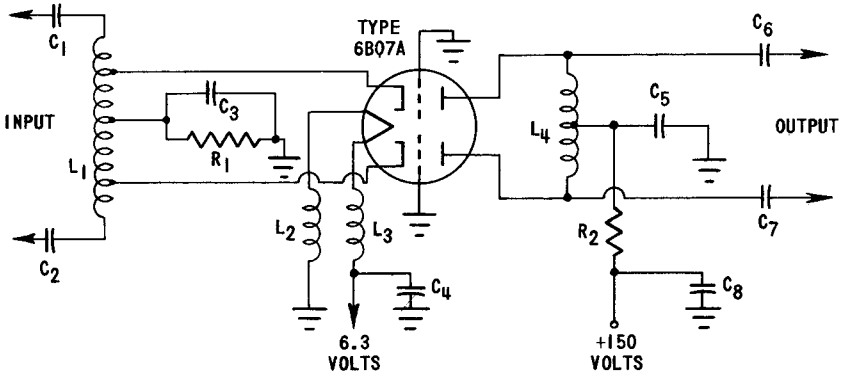


C1: 33 uuf, 400 VOLTS
C2: 1000 uuf, 400 VOLTS
C3: 1000 uuf, 400 VOLTS
C4: 1000 uuf, 400 VOLTS
C5: 0.5 to 1.5 uuf, 400 VOLTS
C6: 1000 uuf, 400 VOLTS
C7: 2 uuf, 400 VOLTS
C8: 33 uuf, 400 VOLTS
C9: 1000 uuf, 400 VOLTS

L1, L2: BIFILAR CHOKES, EACH 10 TURNS NO. 18 ENAMEL WIRE 1/4" COIL FORM
L3: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES. TO DETERMINE TAP POINT, TAP DOWN TO 80 TO 90% OF TOTAL NUMBER OF TURNS

R1: 10000 OHMS, 0.5 WATT
R2: 100 OHMS, 0.5 WATT
R3: 500000 OHMS, 0.5 WATT
R4: 100 OHMS, 0.5 WATT
T1: TUNED CIRCUIT ELEMENT OF TUNER. VALUE DEPENDS ON DISTRIBUTED CIRCUIT CAPACITANCES.

DRIVEN RF-GROUNDED GRID AMPLIFIER CIRCUIT WITH DIRECT COUPLED DRIVE



C1 C2 C3 C4 C5: 1000 uuf, 400 VOLTS
C6 C7: 100 uuf, 400 VOLTS
C8: 1000 uuf, 400 VOLTS

L1 L4: TUNED CIRCUIT ELEMENTS OF TUNER. VALUES DEPEND ON DISTRIBUTED CIRCUIT CAPACITANCES.

L2 L3: BIFILAR CHOKES, EACH 10 TURNS OF NO. 18 ENAMEL WIRE, 1/4" COIL FORM.
R1 R2: 100 OHMS, 0.5 WATT

PUSH-PULL RF GROUNDED-GRID CIRCUIT

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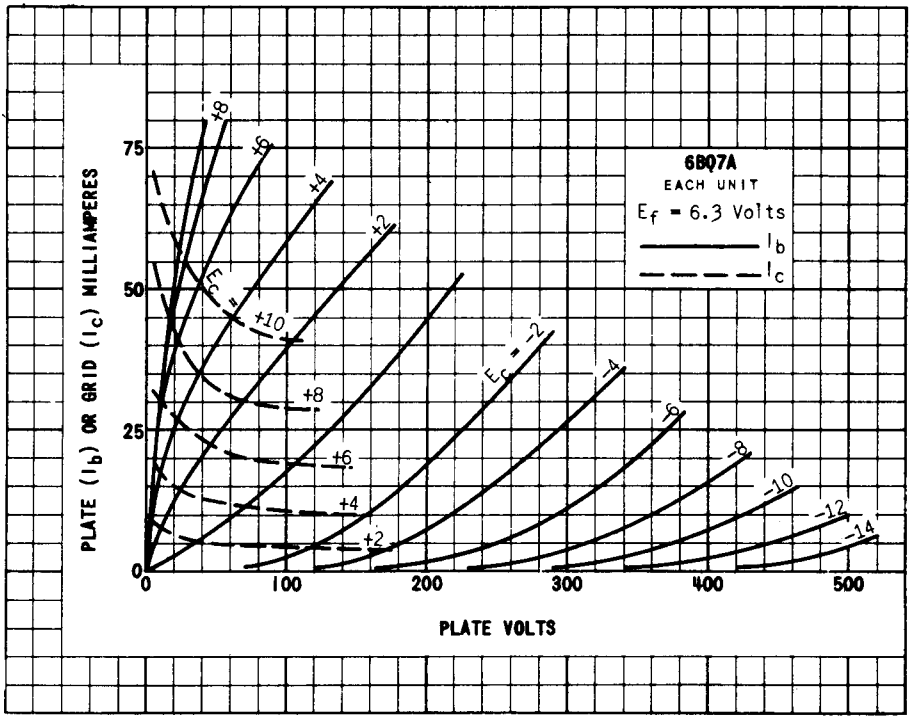
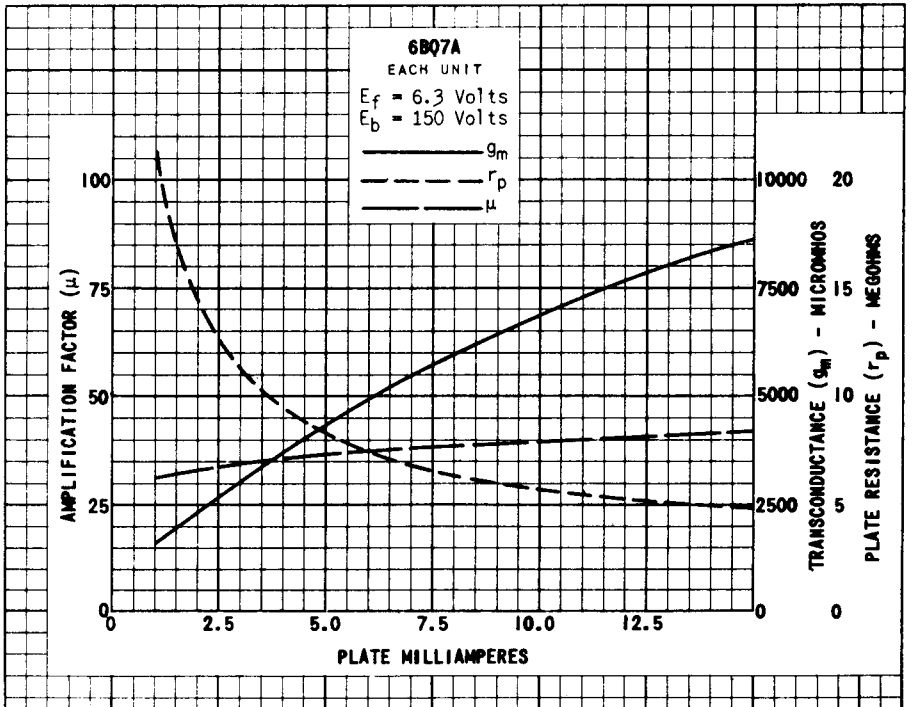
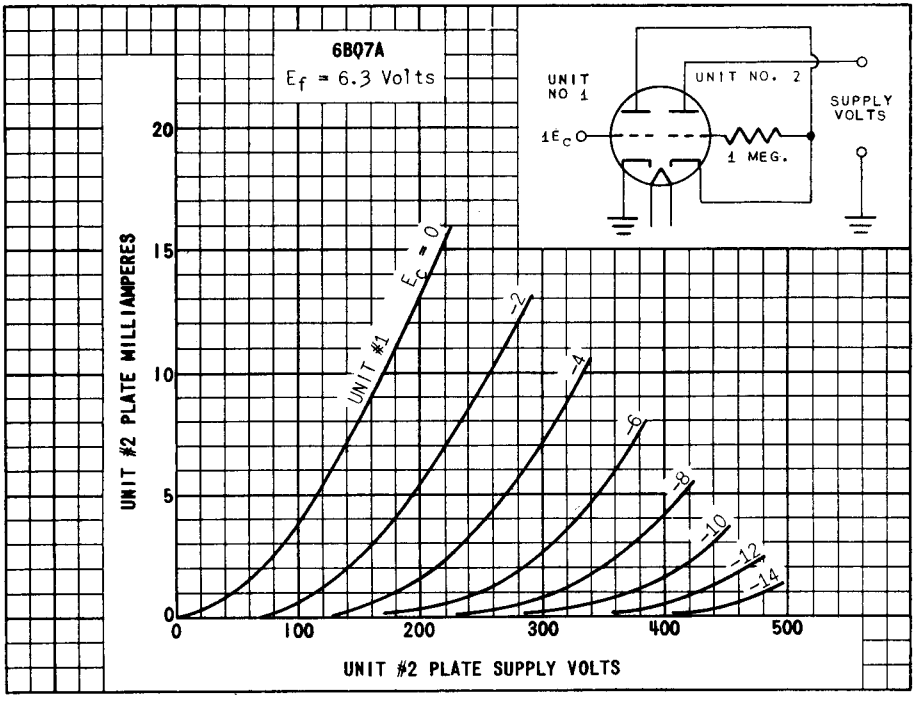
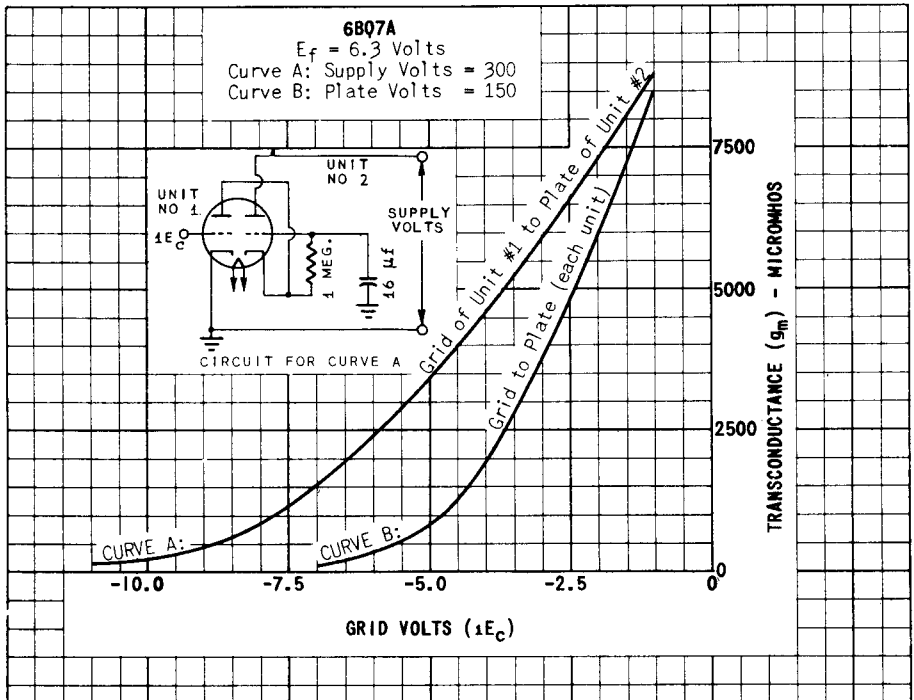
6BQ7A


6BQ7A
EACH UNIT
E_f = 6.3 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
200
300
400
500
+8
+6
+4
+2
+10
E_c = +12
E_c = -2
-4
-6
-8
-10
-12
-14


6BQ7A
EACH UNIT
E_f = 6.3 Volts
E_b = 150 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - MEGOHMS
PLATE MILLIAMPERES
0
25
50
75
100
2500
5000
7500
10000
5
10
15
20
2.5
5.0
7.5
10.0
12.5

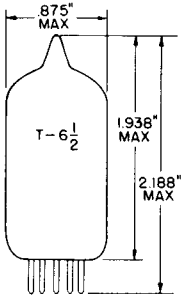

6BQ7A
E_f = 6.3 Volts
UNIT NO. 1
UNIT NO. 2
SUPPLY VOLTS
1 MEG.
UNIT #2 PLATE MILLIAMPERES
UNIT #2 PLATE SUPPLY VOLTS
UNIT #1
E_c = 0
-2
-4
-6
-8
-10
-12
-14
0
5
10
15
20
100
200
300
400
500


6BQ7A
E_f = 6.3 Volts
Curve A: Supply Volts = 300
Curve B: Plate Volts = 150
UNIT NO 1
UNIT NO 2
SUPPLY VOLTS
1 MEG.
16 µf
CIRCUIT FOR CURVE A
Grid of Unit #1 to Plate of Unit #2
Grid to Plate (each unit)
CURVE A:
CURVE B:
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID VOLTS ($1E_c$)
7500
5000
2500
0
-10.0
-7.5
-5.0
-2.5
0

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



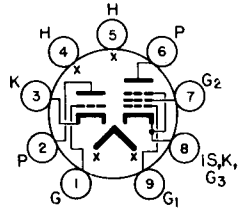
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR USE IN

FM AND TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9FA

THE 6BR8A IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR PENTODE MIXER FOR FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS IN SUCH RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED RROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE (Pg1 TO Pp) MAX.	0.010	0.020	pf
PENTODE INPUT: Pg1 TO (H+Pg2+Pk,g3,i.s.)	4.6	4.6	pf
PENTODE OUTPUT: Pp TO (H+Pg2+Pk,g3,i.s.)	3.2	2.4	pf
PENTODE CATHODE TO HEATER: H TO (Pk,g3,i.s.)	2.4[B]	2.4	pf
TRIODE GRID TO TRIODE PLATE: (Tg TO Tp)	1.8	1.8	pf
TRIODE INPUT: Tg TO (Tk+H+Pk,g3,i.s.)	2.8	2.8	pf
TRIODE OUTPUT: Tp TO (Tk+H+Pk,g3,i.s.)	2.0	1.5	pf
TRIODE CATHODE TO HEATER (Tk TO H)	2.4[B]	2.4	pf
PENTODE GRID TO TRIODE PLATE (Pg TO Tp) (MAX.)	0.20	0.20	pf
PENTODE PLATE TO TRIODE PLATE (Pp TO Tp) (MAX)	.02	0.10	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 4.

[B] EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

* INDICATES AN ADDITION.

INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (HEATER IN PARALLEL)		6.3±0.6	VOLTS
CURRENT OPERATION (HEATER IN SERIES)		450±25	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE J5-C4-2	
PENTODE PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION	0.55	WATT
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	----	110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	7500	5000	μMHOS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT	----	3.5	MA.
PLATE RESISTANCE (APPROX.)	----	0.2	MEGOHM
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-9	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V; Ec2=70V)	----	6000	μMHOS

[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

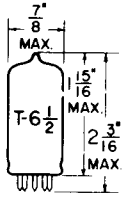
TUNG-SOL

TWIN TRIODE

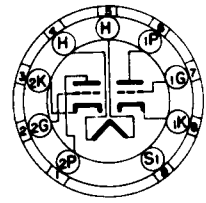
MINIATURE TYPE
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL-BUTTON NOVAL
9 PIN BASE
9AJ

THE 6BS8 IS A 9-PIN MINIATURE TWIN TRIODE DESIGNED FOR USE AS A LOW-NOISE VHF AMPLIFIER IN CASCODE OPERATION. THIS TYPE HAS HIGH GAIN AND HIGH CASCODE TRANSCONDUCTANCE. IT IS DESIGNED FOR OPERATION WITH SECTION 2 (PINS 1, 2, AND 3) AS INPUT SECTION OF THE CASCODE CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	UNIT 1	UNIT 2	
GRID TO PLATE	1.15	1.15	μμf
PLATE TO CATHODE (MAX.)	0.15	0.15	μμf
HEATER TO CATHODE	2.60	2.6	μμf
INPUT	2.60		μμf
OUTPUT	1.2		μμf
PLATE OF UNIT 1 TO PLATE OF UNIT 2 (MAX.)		0.010	μμf
PLATE OF UNIT 2 TO PLATE AND GRID OF UNIT 1 (MAX.)		0.024	μμf
GROUNDED GRID OPERATION:			
INPUT		5.0	μμf
OUTPUT		2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER-EACH UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM CIRCUIT VALUE: (EACH UNIT)		
GRID CIRCUIT RESISTANCE	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMPERE
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE	5000	OHMS
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA	−7 (SEC. 2 ONLY)	VOLTS
TRANSCONDUCTANCE	7200	μMHOS

CONTINUED ON FOLLOWING PAGE

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TYPICAL CASCODE CONDITIONS AND CHARACTERISTICS

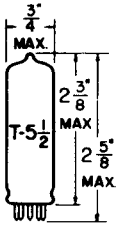
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMPERE
PLATE SUPPLY VOLTAGE	250	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	16	MA.
GRID VOLTAGE (APPROX.) FOR G_m = 50 μMHOS	-6	VOLTS
TRANSCONDUCTANCE	10 000	μMHOS

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

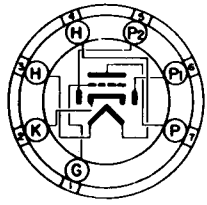


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 6BT6 IS A COMBINED HIGH-MU TRIODE VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE ADEQUATE OUTPUT VOLTAGE TO DRIVE MOST BEAM POWER TUBES TO FULL POWER OUTPUT. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNAL LEVELS AND THE LOW DIODE TO TRIODE GRID CAPACITANCE REDUCES TROUBLE FROM AUDIO COUPLING BETWEEN THE TWO SECTIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
DIODE #1 TO CATHODE: (1P TO K)	1	1	μμf
DIODE #2 TO CATHODE: (2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.01	0.013	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1	MA.
PLATE RESISTANCE	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	

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PLATE 2302
JAN. 1 1950

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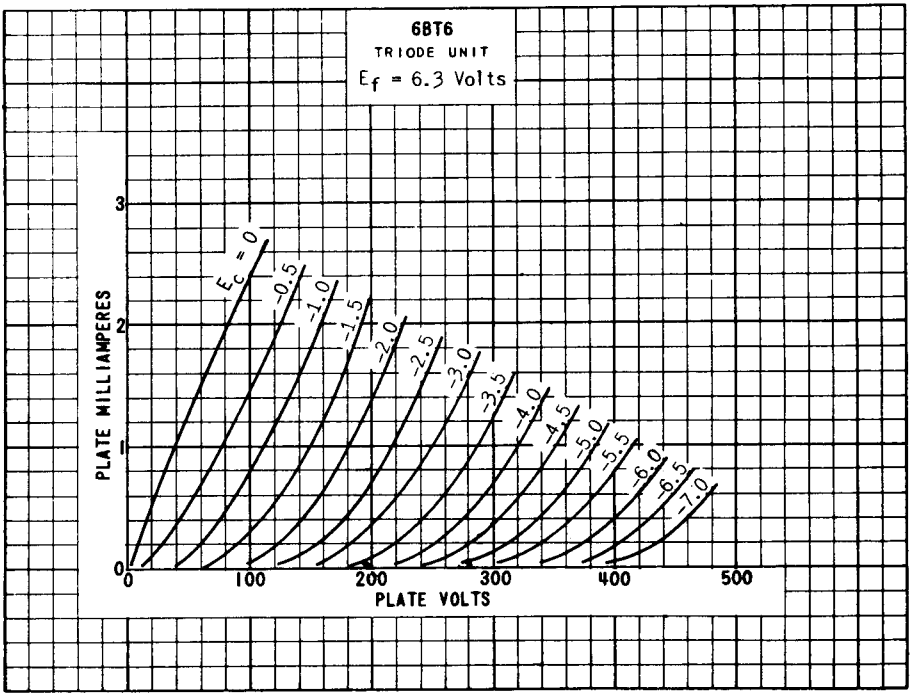
6BT6 (12BT6)



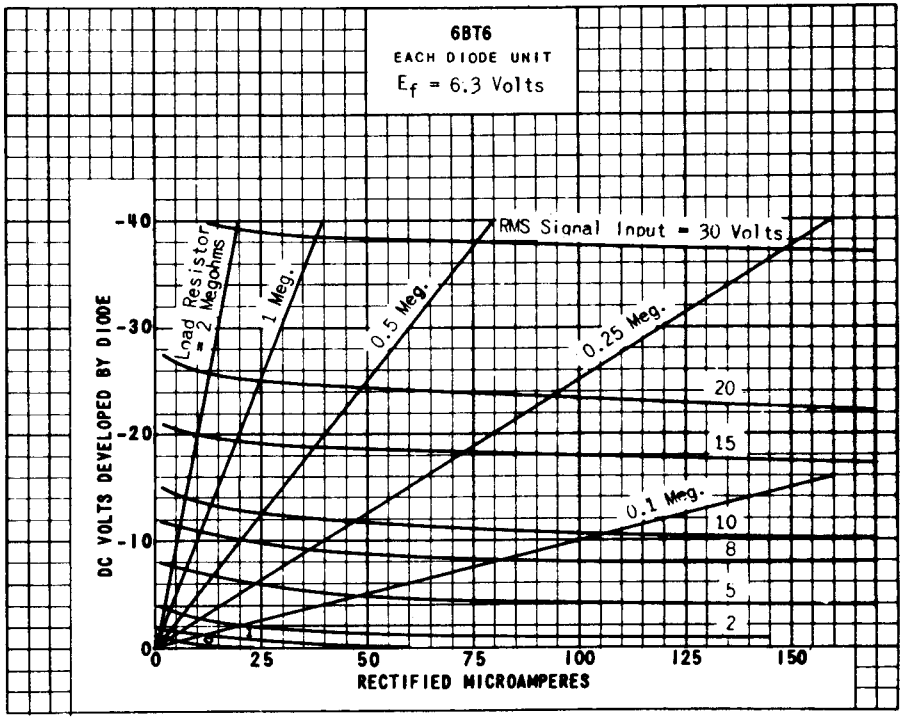


PLATE 2303
JAN. 1 1950

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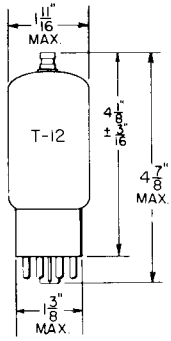
TUNG-SOL



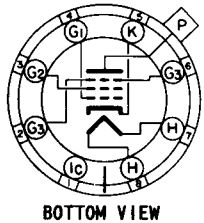
GLASS BULB
SMALL CAP
WITH GROOVE

PENTODE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM-SHELL
8 PIN OCTAL

THE 6BU5 IS A HIGH VOLTAGE BEAM PENTODE DESIGNED PRIMARILY FOR USE AS A SHUNT VOLTAGE REGULATOR IN THE HIGH VOLTAGE POWER SUPPLY OF COLOR TELEVISION RECEIVERS. IT HAS LOW CURRENT REQUIREMENTS AND EXHIBITS A SHARP CUT-OFF CHARACTERISTIC.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.024	μμf
INPUT	3.0	μμf
OUTPUT	0.9	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

TV HIGH VOLTAGE REGULATOR SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	20 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	20	WATTS
MAXIMUM GRID #2 DISSIPATION	0.1	WATT
MAXIMUM CATHODE CURRENT	2.5	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	SEE RATING CHART	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	20 000	20 000	VOLTS
SUPPRESSOR VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	70	70	VOLTS
GRID #1 VOLTAGE	-3.4	-2.4	VOLTS
PLATE CURRENT	0.55	1.0	MA.
GRID #2 CURRENT	---	0.4	MA.
GRID #1 VOLTAGE (APPROX.) I_b = 30 μAMP.	---	-6.5	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

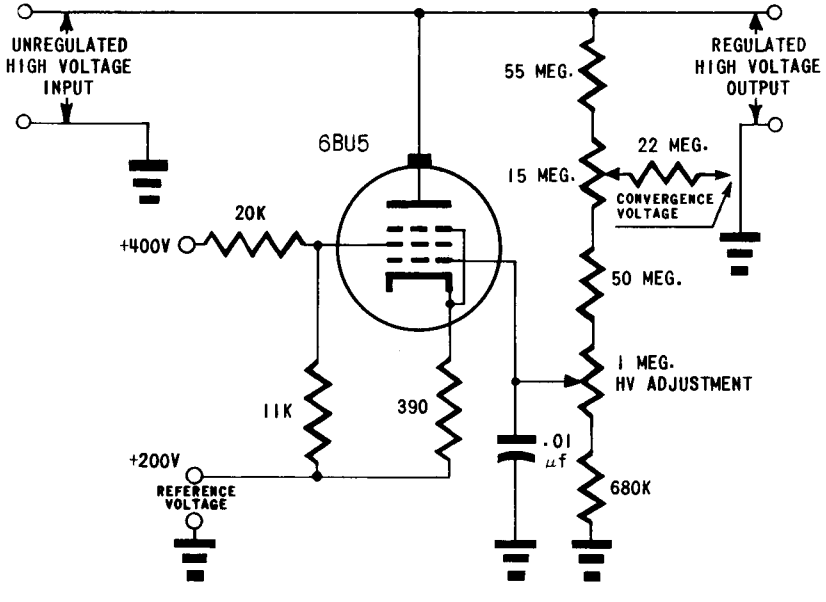
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

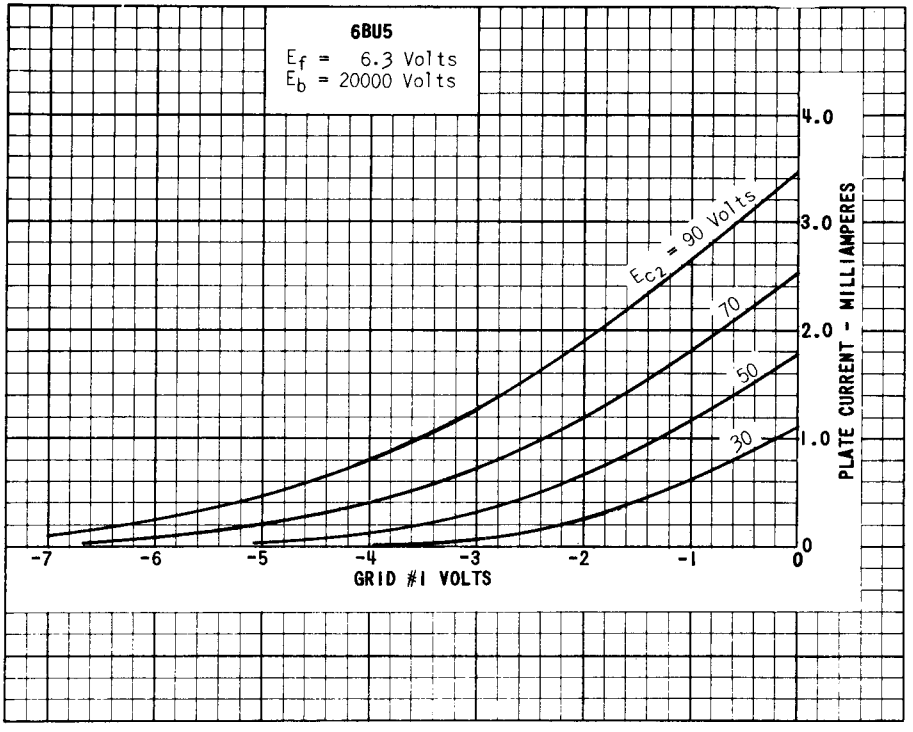
TV HIGH-VOLTAGE REGULATOR SERVICE

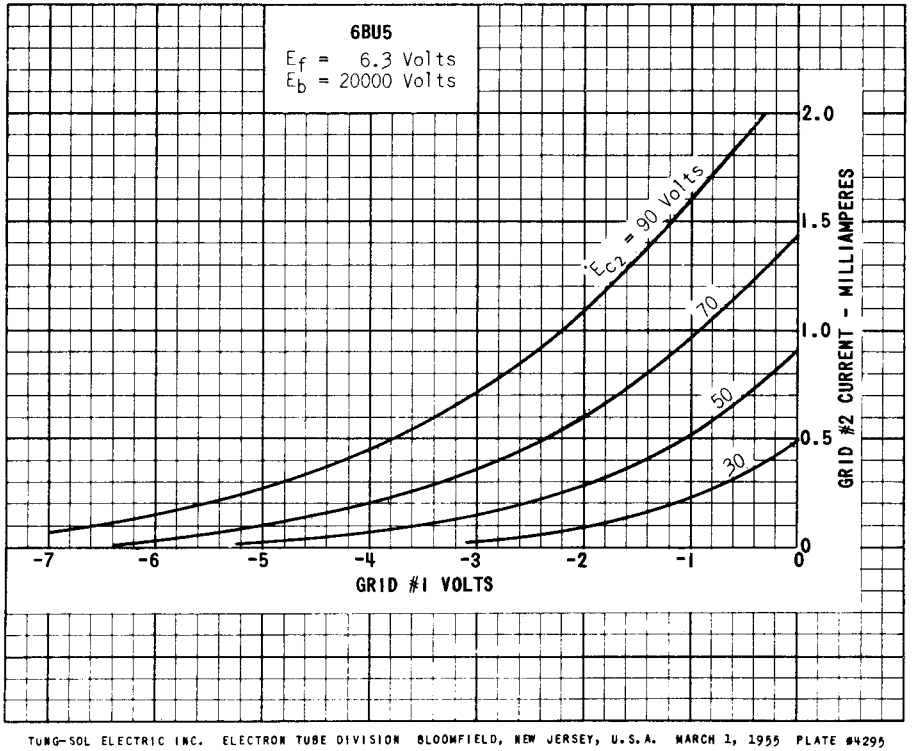
SEE CIRCUIT DIAGRAM

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.15		AMP.
UNREGULATED DC SUPPLY VOLTAGE	29 900		VOLTS
EQUIVALENT RESISTANCE OF UNREGULATED SUPPLY	8.5		MEGOHMS
GRID #2 VOLTAGE	70		VOLTS
DC REFERENCE VOLTAGE	200		VOLTS
SUPPRESSOR VOLTAGE	0		VOLTS
DC LOAD CURRENT	0	1.0	MA.
DC PLATE CURRENT	1.0	0.05	MA.
DC GRID #2 CURRENT	0.5	0.03	MA.
REGULATED DC OUTPUT VOLTAGE	20 000	19 600	VOLTS

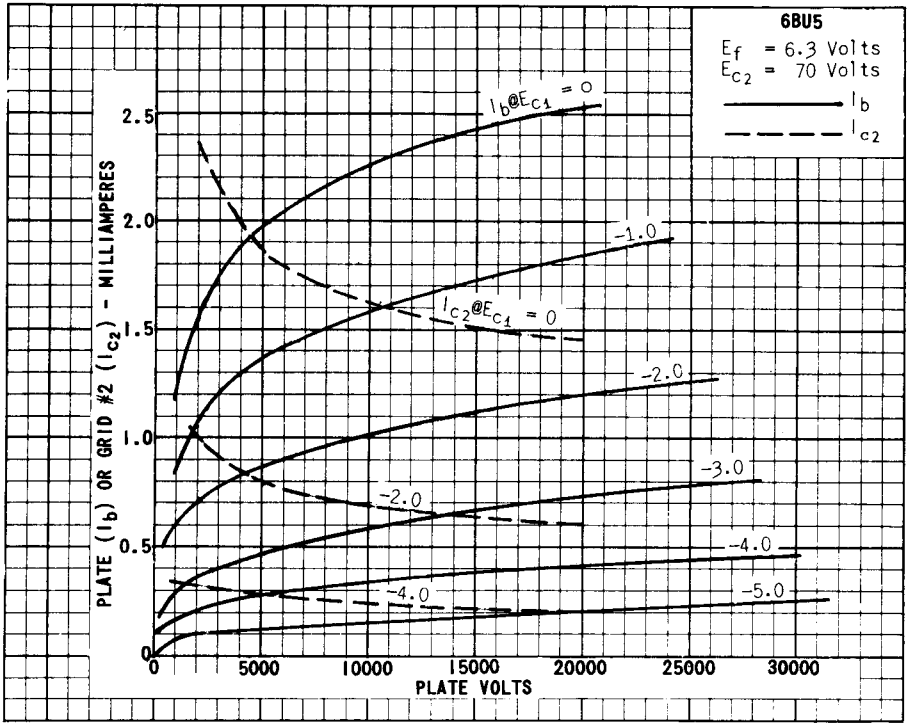
NOTE: HIGH VOLTAGE OPERATION OF THE 6BU5 CAN RESULT IN THE PRODUCTION OF X-RAYS WHICH CAN CONSTITUTE A HEALTH HAZARD UNLESS THESE TUBES ARE ADEQUATELY SHIELDED. THE NEED FOR THIS PRECAUTION SHOULD BE CONSIDERED IN EQUIPMENT DESIGN. RELATIVELY SIMPLE SHIELDING SHOULD PROVE ADEQUATE.




6BU5
E_f = 6.3 Volts
E_b = 20000 Volts
E_{c2} = 90 Volts
70
50
30
4.0
3.0
2.0
1.0
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
PLATE CURRENT - MILLIAMPERES


6BU5
E_f = 6.3 Volts
E_b = 20000 Volts
E_{c2} = 90 Volts
70
50
30
2.0
1.5
1.0
0.5
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
GRID #2 CURRENT - MILLIAMPERES

6BU5



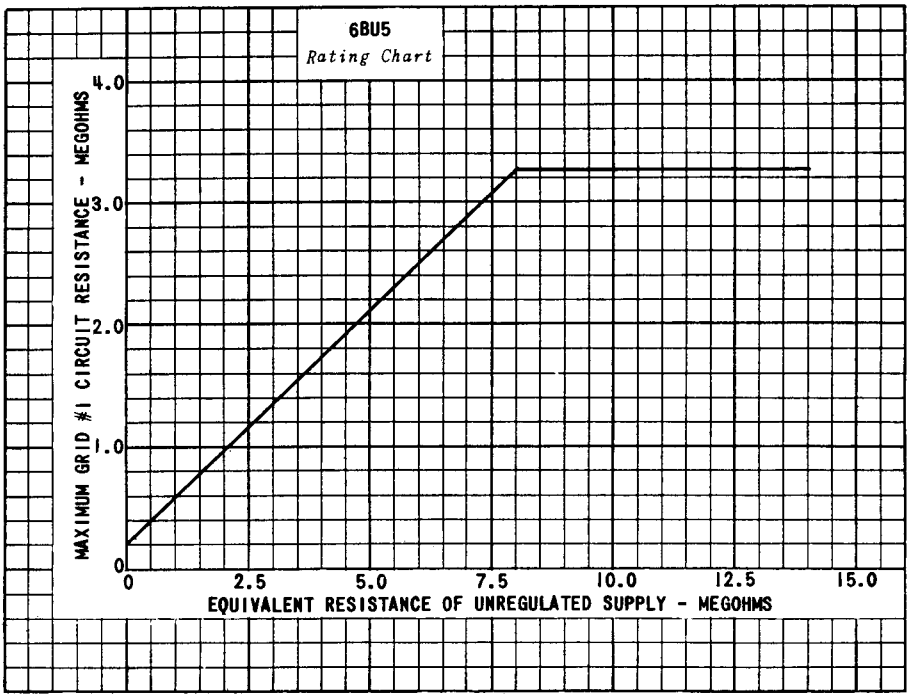
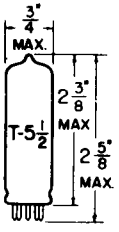


PLATE #4296 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

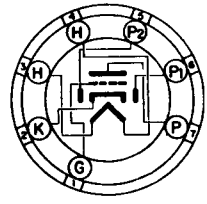


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 6BU6 IS A COMBINED LOW-MU TRIODE VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. THE LOW AMPLIFICATION FACTOR OF THE TRIODE PERMITS LARGE VALUES OF OUTPUT SIGNAL WITH LOW DISTORTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
DIODE #1 OR DIODE #2 TO CATHODE	1	1	μμf
DIODE #1 TO GRID	0.01	0.013	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
AVERAGE DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-3	-9	VOLTS
SELF BIAS RESISTOR	770	950	OHMS
PLATE CURRENT	3.9	9.5	MA.
PLATE RESISTANCE	11 000	8 500	OHMS
TRANSCONDUCTANCE	1 500	1 900	μMHOS
AMPLIFICATION FACTOR	16.5	16	
LOAD RESISTANCE	---	10 000	OHMS
TOTAL HARMONIC DISTORTION	---	6.5	PERCENT
POWER OUTPUT	---	300	MW.

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PLATE 2304
JAN. 1 1950

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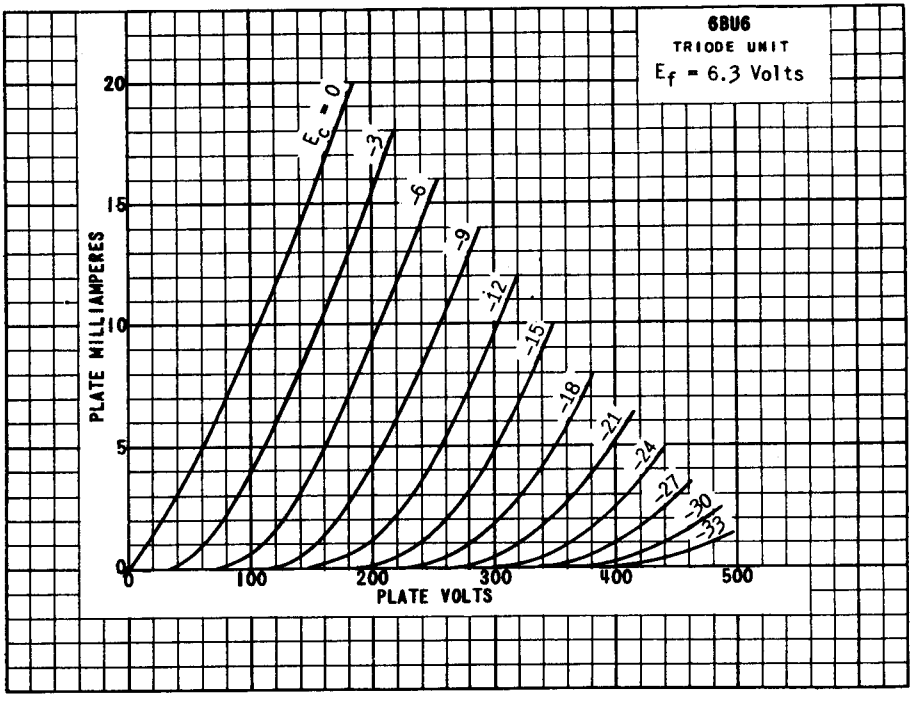
6BU6 (12BU6)



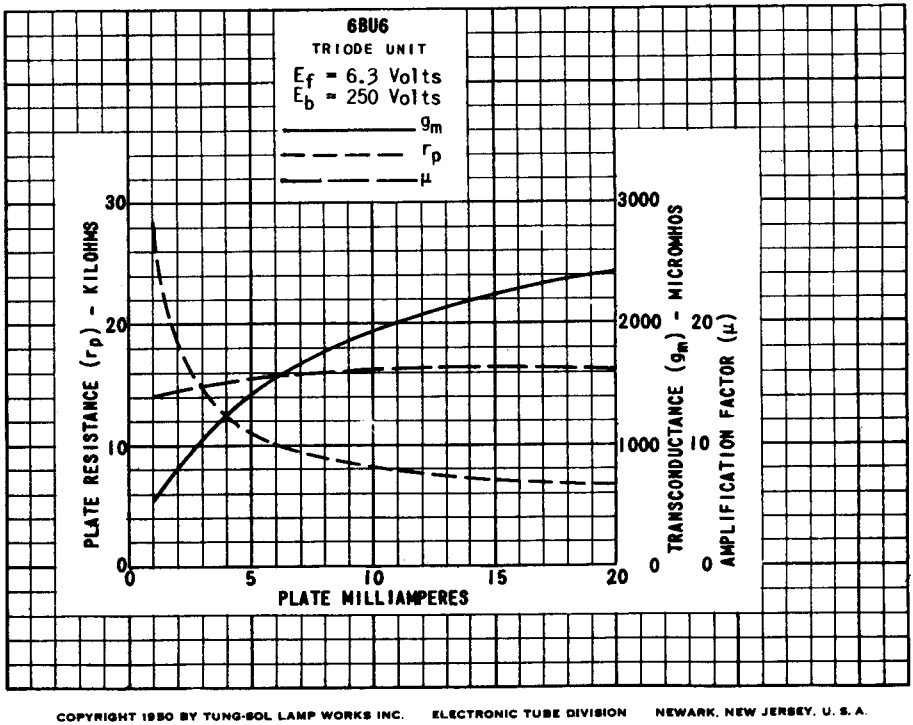


PLATE 2309
JAN. 1 1950

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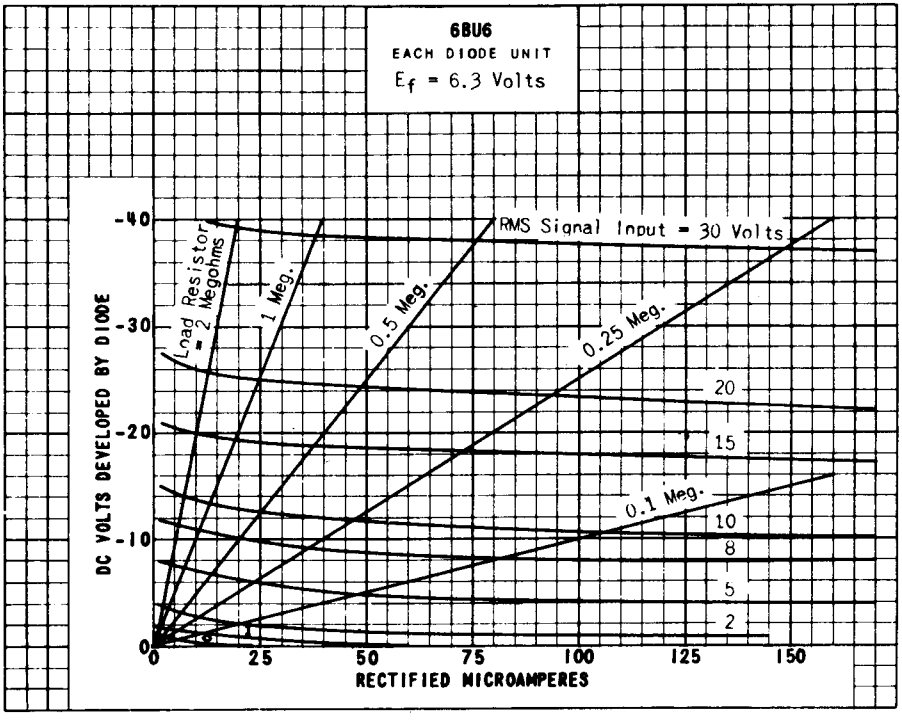

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PRATE
2306
JAN. 1
1950

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TUNG-SOL

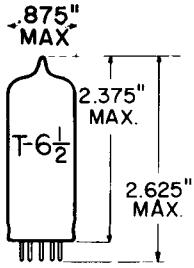
TWIN PENTODE

MINIATURE TYPE

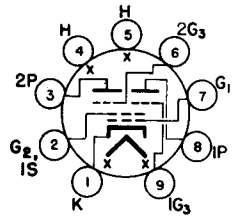
COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 6BU8 IS A MINIATURE MULTISECTION TUBE WHICH INCORPORATES SEPARATE PLATES AND NUMBER 3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, NUMBER 1 GRID, AND CATHODE. THE TUBE IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS. IN THIS SERVICE, WHEN USED IN CONJUNCTION WITH SUITABLE CIRCUITRY, ONE SECTION OF THE 6BU8 FUNCTIONS AS SYNC SEPARATOR AND SYNC CLIPPER, WHILE THE OTHER SECTION IS USED TO GENERATE THE AUTOMATIC-GAIN-CONTROL VOLTAGE. IN ADDITION, BY UTILIZING THE COMMON, #1 GRID, NOISE PULSES CAN BE SUPPRESSED FROM BOTH SYNCHRONIZING AND AUTOMATIC-GAIN-CONTROL CIRCUITS. EXCEPT FOR HEATER RATINGS, THE 6BU8 IS IDENTICAL TO THE 3BU8.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, (EACH SECTION)	1.9	pf
GRID #1 TO ALL	6.0	pf
GRID #3 TO ALL (EACH SECTION)	3.6	pf
PLATE TO ALL (EACH SECTION)	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2) MAX.	0.015	pf

RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHMS
HEATER WARM–UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	–10	0	VOLTS
GRID #1 VOLTAGE	**	**	
PLATE CURRENT (EACH SECTION)		2.2	MA.
SCREEN CURRENT	6.5	3.3	MA.
CATHODE CURRENT	6.6	7.8	MA.

EACH SECTION SEPARATELY [A]

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	**	VOLTS
GRID #3 TRANSCONDUCTANCE	---	180	μMHOS
GRID #1 TRANSCONDUCTANCE	1 500	---	μMHOS
PLATE CURRENT	---	2.2	MA.
GRID #3 VOLTAGE (APPROX.) I_b=100μAMPS	---	–4.5	VOLTS
GRID #1 VOLTAGE (APPROX.) I_b=100μAMPS	---	2.3	VOLTS

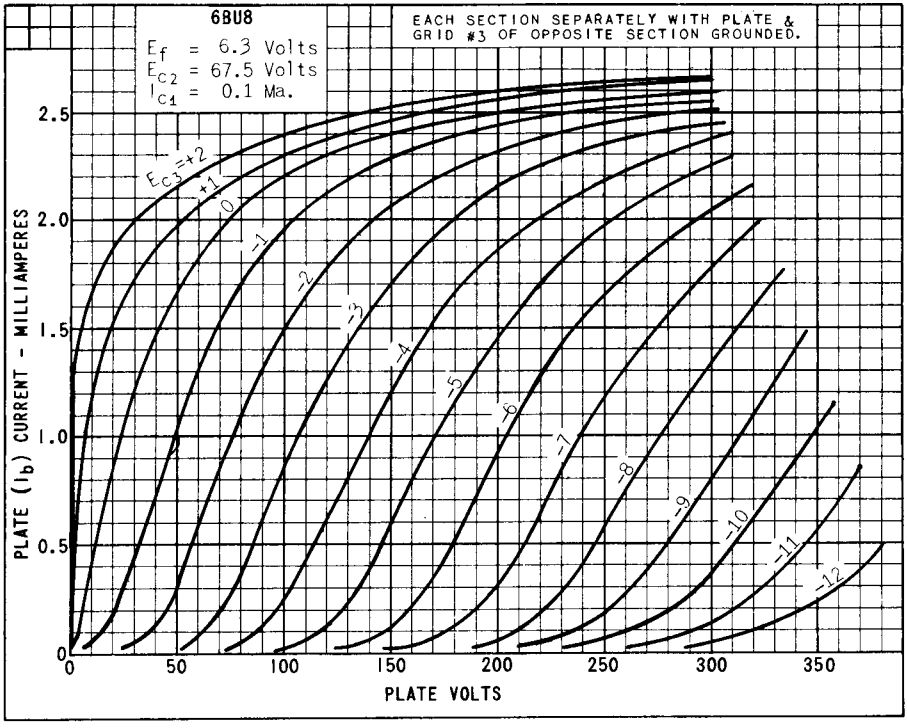
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

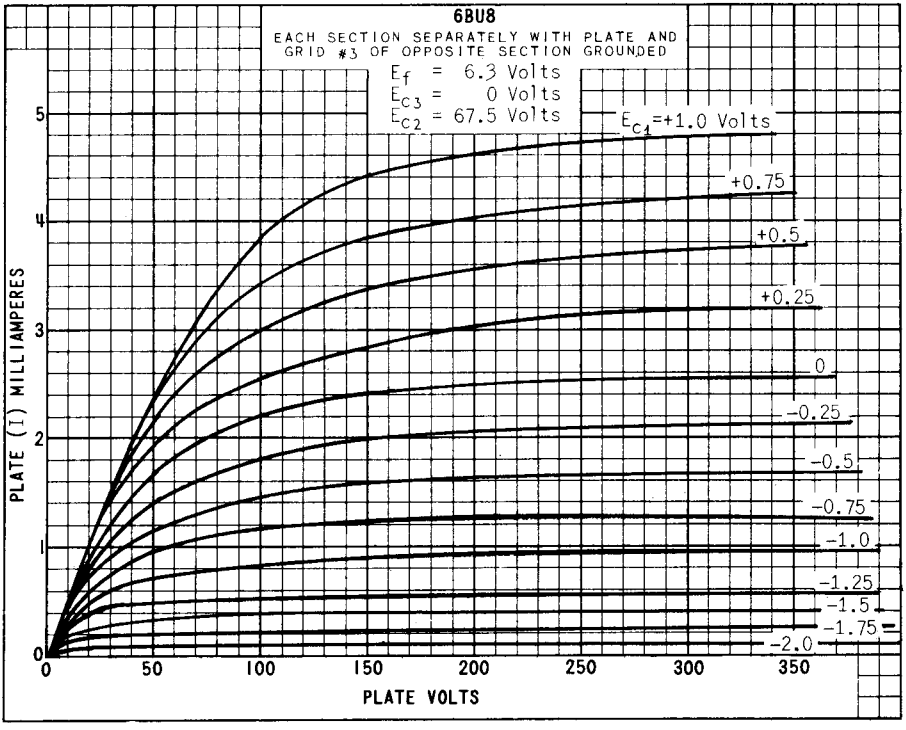
** WITH GRID CURRENT ADJUSTED FOR 100 μAMPS D-C.

A WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 6BU8 is identical to the 3BU8.*





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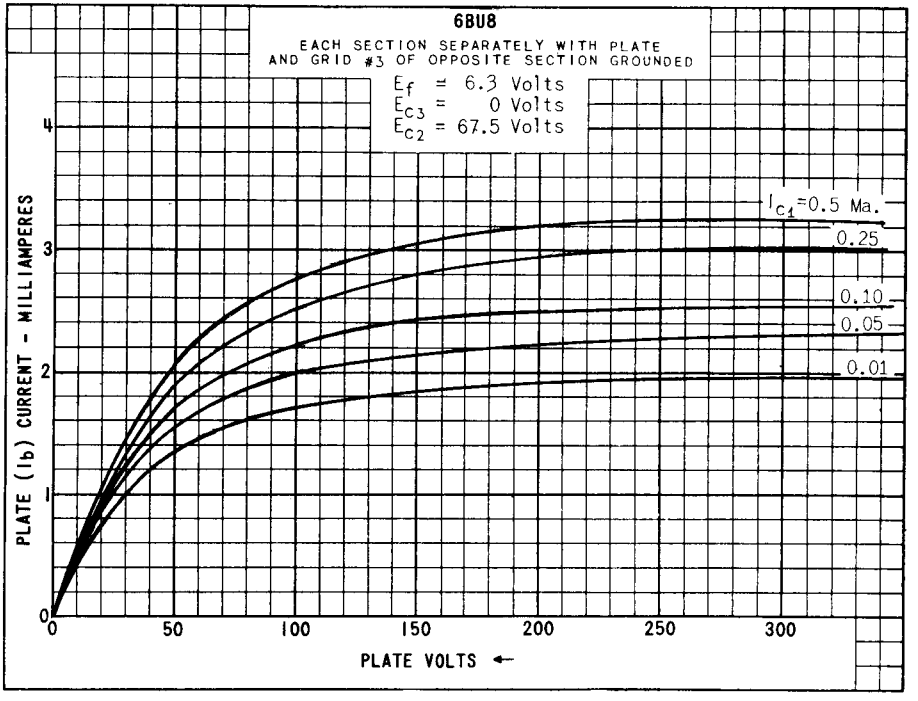
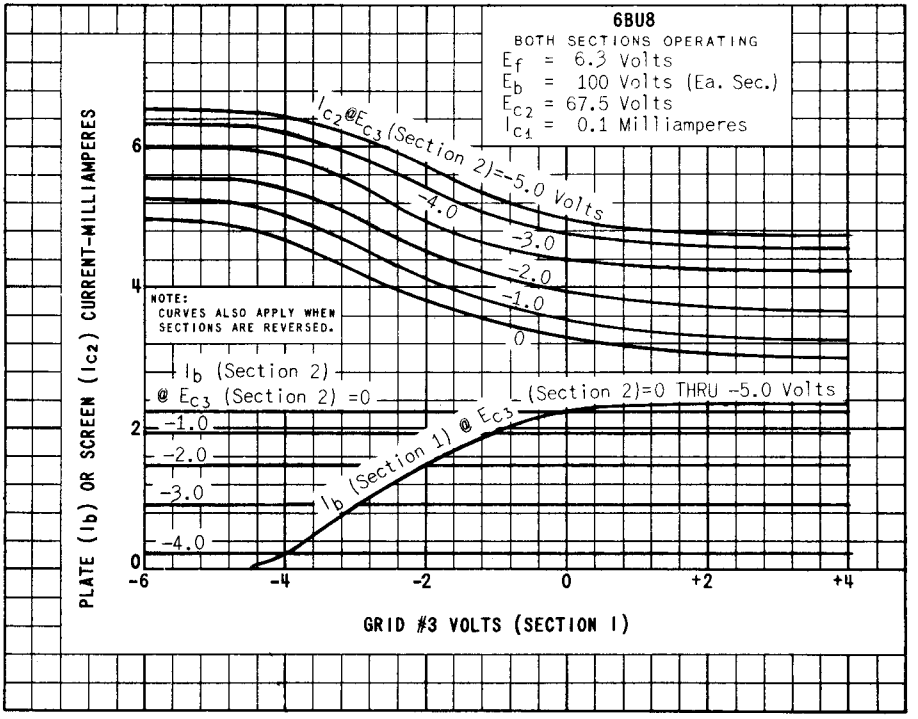
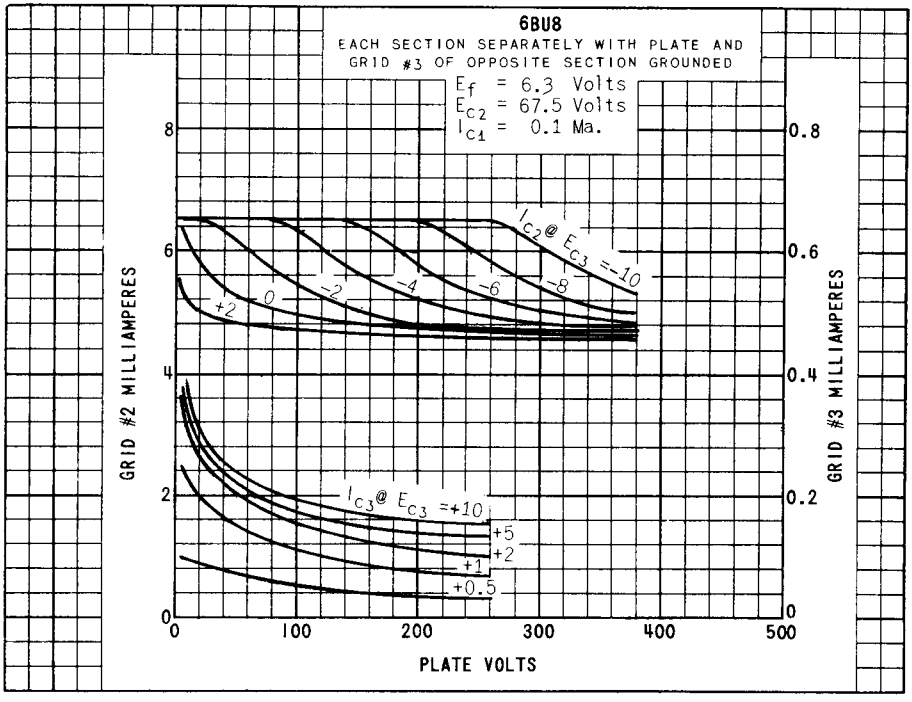
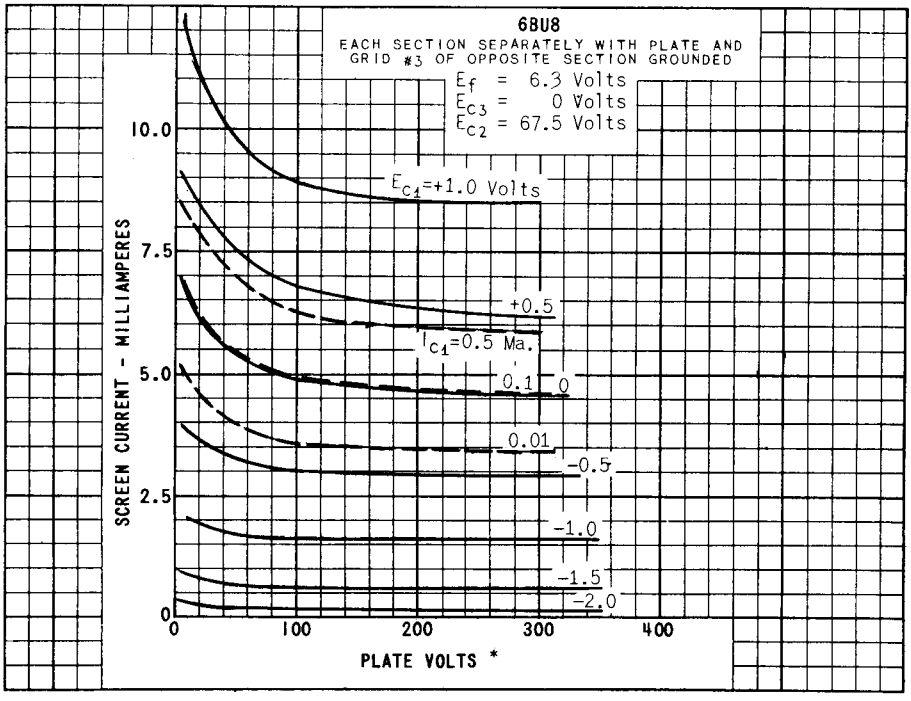
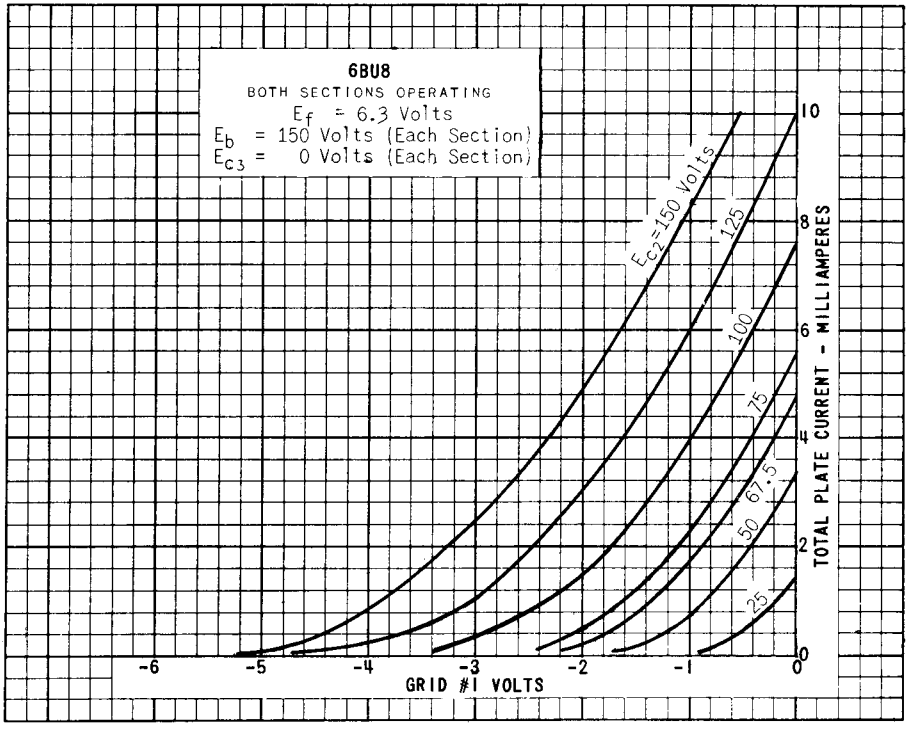
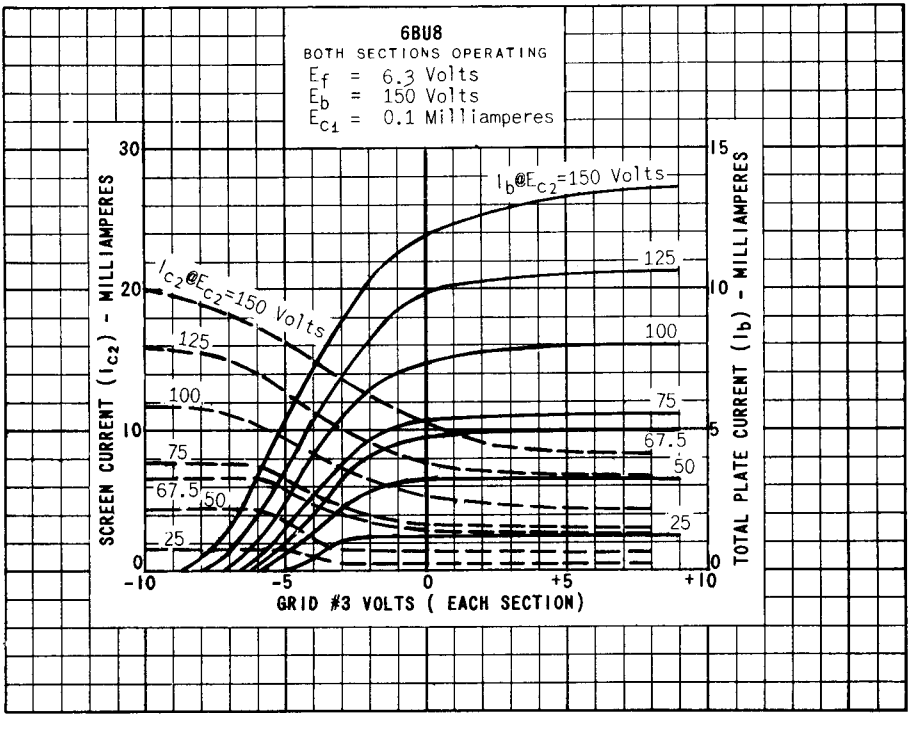

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_{c3} = 0 Volts
E_{c2} = 67.5 Volts
I_{c1}=0.5 Ma.
0.25
0.10
0.05
0.01
PLATE (Ib) CURRENT - MILLIAMPERES
PLATE VOLTS ←
0
50
100
150
200
250
300
1
2
3
4

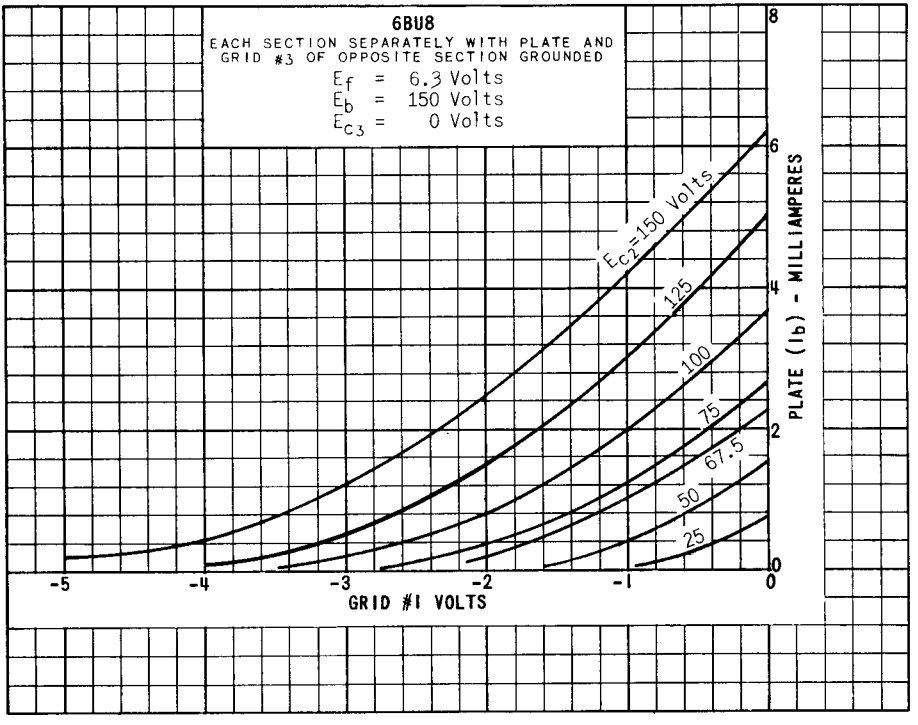

6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 100 Volts (Ea. Sec.)
E_{c2} = 67.5 Volts
I_{c1} = 0.1 Milliamperes
I_{c2}@E_{c3} (Section 2)=-5.0 Volts
-4.0
-3.0
-2.0
-1.0
0
NOTE:
CURVES ALSO APPLY WHEN SECTIONS ARE REVERSED.
I_b (Section 2) @ E_{c3} (Section 2) =0
-1.0
-2.0
-3.0
-4.0
I_b (Section 1) @ E_{c3} (Section 2)=0 THRU -5.0 Volts
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT-MILLIAMPERES
GRID #3 VOLTS (SECTION 1)
-6
-4
-2
0
+2
+4
2
4
6

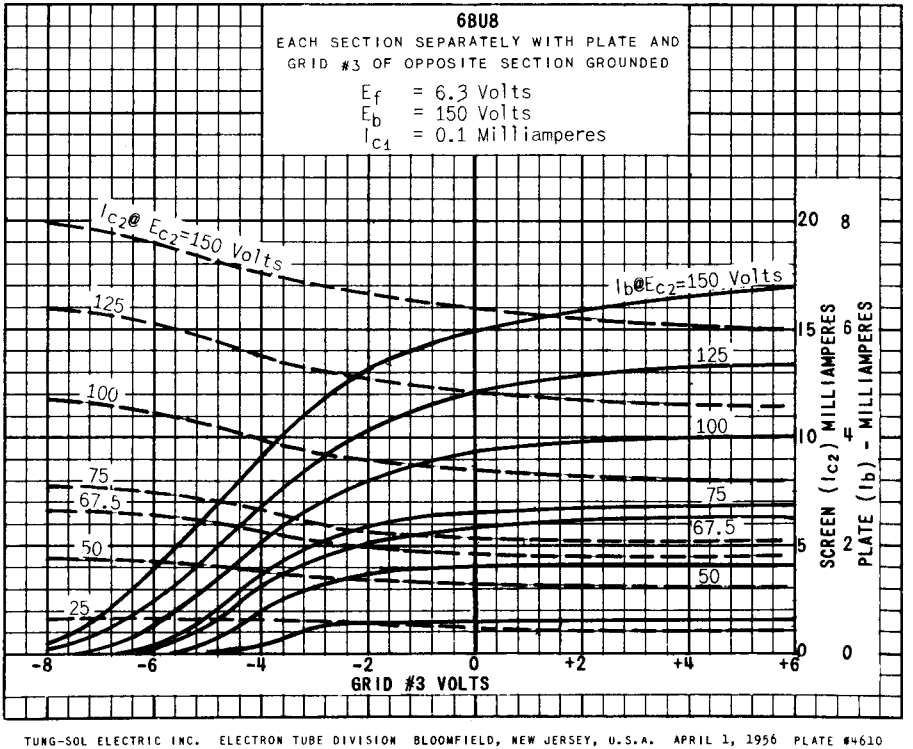

6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_{C2} = 67.5 Volts
I_{C1} = 0.1 Ma.
I_{C2} @ E_{C3} = -10
-8
-6
-4
-2
0
+2
I_{C3} @ E_{C3} = +10
+5
+2
+1
+0.5
GRID #2 MILLIAMPERES
GRID #3 MILLIAMPERES
PLATE VOLTS
0
2
4
6
8
0.2
0.4
0.6
0.8
100
200
300
400
500


6BU8
EACH SECTION SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_{C3} = 0 Volts
E_{C2} = 67.5 Volts
E_{C1} = +1.0 Volts
+0.5
I_{C1} = 0.5 Ma.
0.1
0
0.01
-0.5
-1.0
-1.5
-2.0
SCREEN CURRENT - MILLIAMPERES
PLATE VOLTS *
0
2.5
5.0
7.5
10.0
100
200
300
400


6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
TOTAL PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10


6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 150 Volts
E_{c1} = 0.1 Milliamperes
I_b@E_{c2}=150 Volts
I_{c2}@E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
TOTAL PLATE CURRENT (I_b) - MILLIAMPERES
GRID #3 VOLTS (EACH SECTION)
-10
-5
0
+5
+10
10
20
30
5
15





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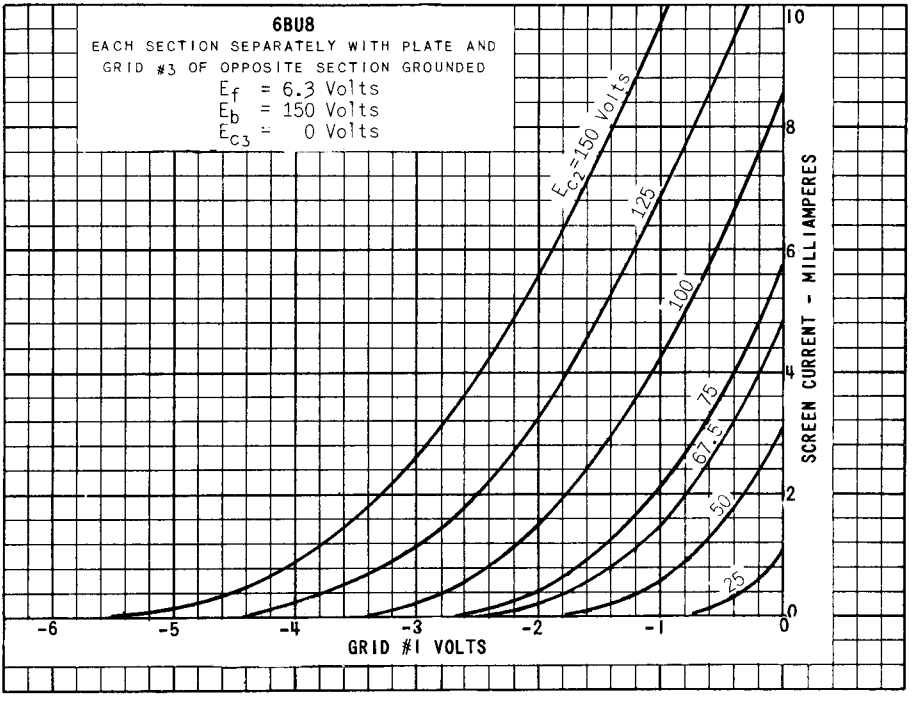
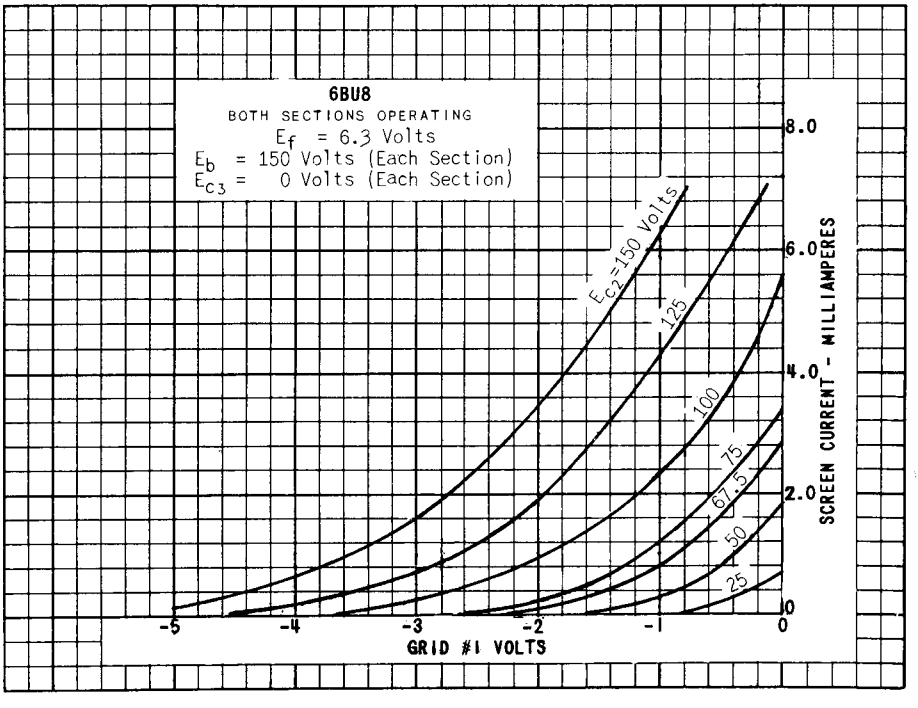
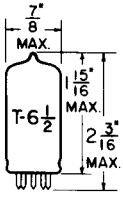

6BU8
EACH SECTION SEPARATELY WITH PLATE AND
GRID #3 OF OPPOSITE SECTION GROUNDED
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-6
-5
-4
-3
-2
-1
0
2
4
6
8
10


6BU8
BOTH SECTIONS OPERATING
E_f = 6.3 Volts
E_b = 150 Volts (Each Section)
E_{c3} = 0 Volts (Each Section)
E_{c2}=150 Volts
125
100
75
67.5
50
25
SCREEN CURRENT - MILLIAMPERES
GRID #1 VOLTS
-5
-4
-3
-2
-1
0
2.0
4.0
6.0
8.0

TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

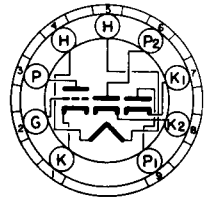
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 ± 10% VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9FJ

THE 6BV8 IS A MINIATURE DUPLEX-DIODE MEDIUM MU TRIODE IN WHICH SEPARATE CATHODE AND PLATE CONNECTIONS ARE PROVIDED FOR EACH DIODE SECTION. THE TUBE IS INTENDED PRIMARILY FOR SERVICE AS A COMBINED SYNCHRONOUS DETECTOR AND CHROMINANCE AMPLIFIER IN COLOR TELEVISION RECEIVERS. THE HIGH PERVEANCE CHARACTERISTIC OF THE TRIODE SECTION ADAPTS THE TUBE PARTICULARLY TO THIS SERVICE. IT IS ALSO SUITABLE FOR USE AS A COMBINED FM DETECTOR AND AUDIO-FREQUENCY VOLTAGE AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	2.0	μμf
TRIODE INPUT	3.6	μμf
TRIODE OUTPUT	0.4	μμf
GRID TO DIODE #1 PLATE (MAX.)	0.03	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.07	μμf
DIODE #1 PLATE TO DIODE #1 CATHODE & HEATER	2.4	μμf
DIODE #2 PLATE TO DIODE #2 CATHODE & HEATER	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.7	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHMS
CATHODE BIAS	0.5	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA.DIODE)	10	MA.
HEATER WARM-UP TIME*	11.0	SECONDS

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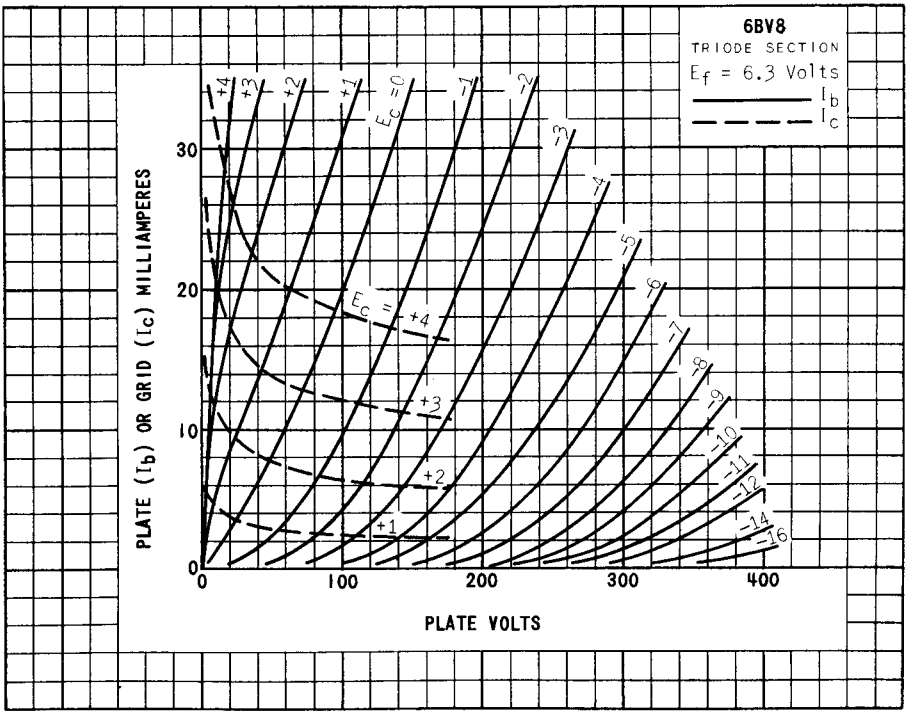
CONTINUED FROM PRECEDING PAGE

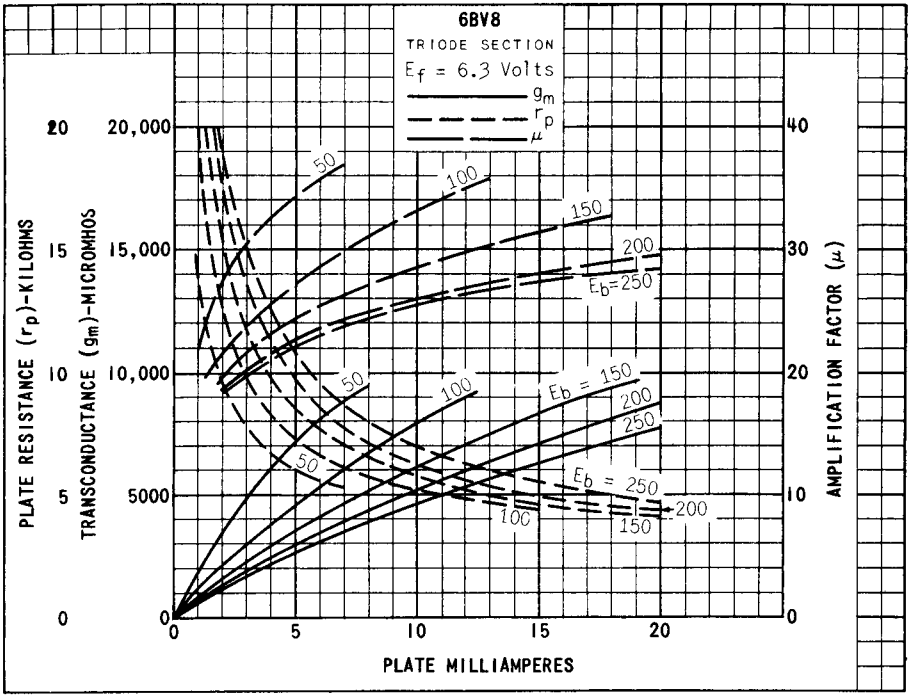
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

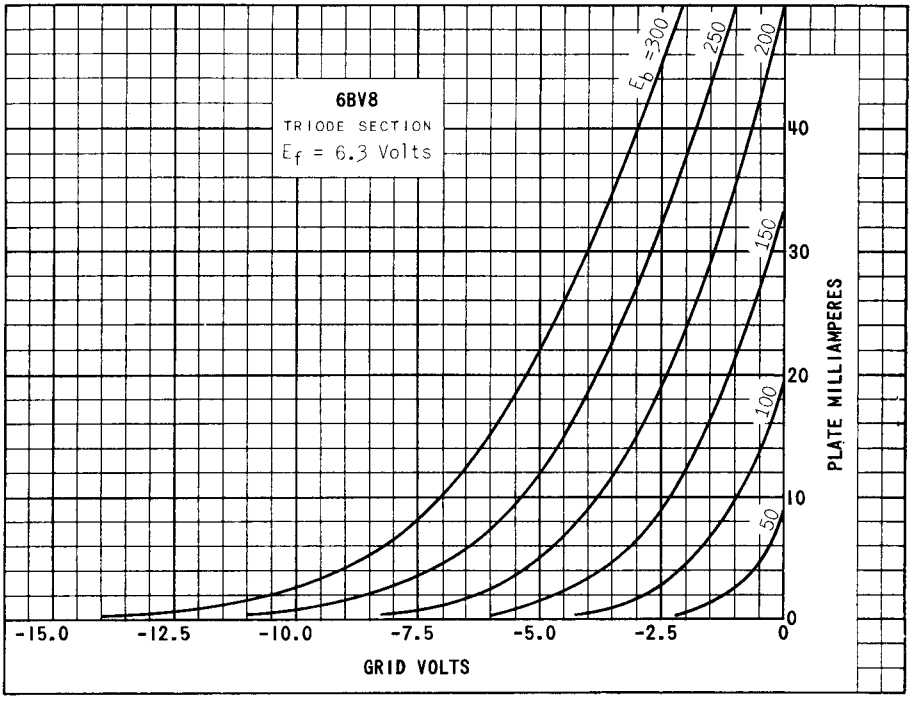
HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	75	200	VOLTS
GRID VOLTAGE	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	330	OHMS
AMPLIFICATION FACTOR	---	33	
PLATE RESISTANCE (APPROX.)	---	5 900	OHMS
TRANSCONDUCTANCE	---	5 600	μMHOS
PLATE CURRENT	14	11	MA.
GRID VOLTAGE (APPROX.) I_b = 100 μAMPS	---	-11	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5.0 VOLTS DC APPLIED	---	23	MA.

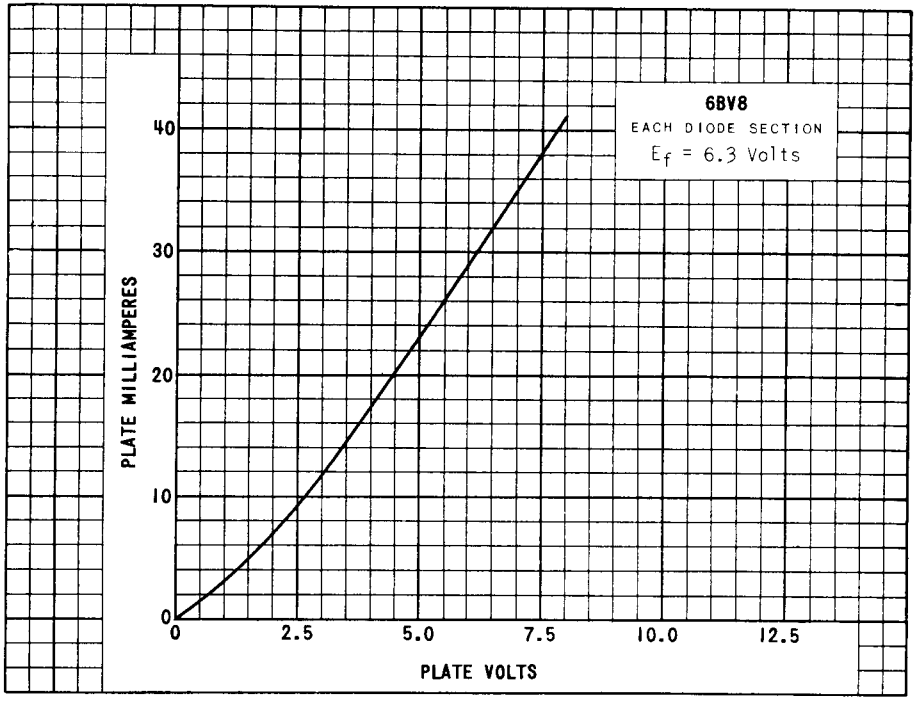
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.




6BV8
TRIODE SECTION
E_f = 6.3 Volts
g_m
r_p
μ
PLATE RESISTANCE (r_p)-KILOHMS
TRANSCONDUCTANCE (g_m)-MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
20
15
10
5
0
20,000
15,000
10,000
5000
0
40
30
20
10
0
5
10
15
20
50
100
150
200
E_b=250
E_b = 150
200
250
E_b = 250
200
100
150


6BV8
TRIODE SECTION
E_f = 6.3 Volts
E_b =300
250
200
150
100
50
PLATE MILLIAMPERES
GRID VOLTS
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
40
30
20
10
0



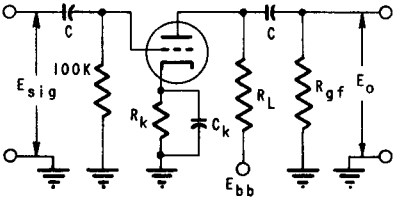
CLASS A RESISTANCE-COUPLED AMPLIFIER

TRIODE SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)										
R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1600	7.5	18	1500	16	20	1500	28	21
0.10	0.24	1900	7.8	19	1900	22	21	1900	38	21
0.24	0.24	4200	9.4	18	3600	19	19	3600	33	20
0.24	0.51	5100	12	19	4300	26	20	4200	42	22
0.51	0.51	9200	10	18	7800	22	19	7500	36	20
0.51	1.0	11000	13	18	10000	28	19	9400	46	20
HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)										
R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	11	17	1400	24	20	1100	39	22
0.10	0.24	2500	15	18	1800	31	21	1600	53	22
0.24	0.24	5300	13	18	3700	28	20	3200	45	21
0.24	0.51	6100	16	18	4700	33	20	4100	57	21
0.51	0.51	8100	14	17	8000	28	19	7100	48	20
0.51	1.0	13000	17	18	10000	34	19	9300	59	20

NOTES:

1. E_o is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. R_k is in ohms; R_L and R_{gf} are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. R_k should be adequately by-passed.



TUNG-SOL

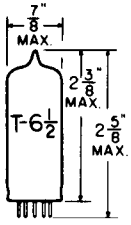
DOUBLE DIODE

MINIATURE TYPE

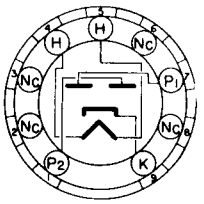
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 900 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DJ

THE 6BW4 IS A MINIATURE CATHODE TYPE FULL WAVE RECTIFIER FEATURING RELATIVELY HIGH OUTPUT CURRENT CAPABILITIES. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 12BW4.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1275	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS) (SEE RATING CHART #1)	450	VOLTS
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #2)	350	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #3)	2.0	AMP.
MAXIMUM HEATER CATHODE VOLTAGE: HEATER NEGATIVE, DC	450	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER

	CAPACITOR INPUT FILTER	CHOKE INPUT FILTER	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	900	900	MA.
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)[A]	325	450	VOLTS
FILTER INPUT CAPACITOR	40	---	μf
FILTER INPUT CHOKE	---	10	HENRYS
EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE	82	---	OHMS
DC OUTPUT CURRENT	100	100	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	330	360	VOLTS
TUBE VOLTAGE DROP TUBE CONDUCTING: 100 MA. EACH PLATE	40	40	VOLTS

[A] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

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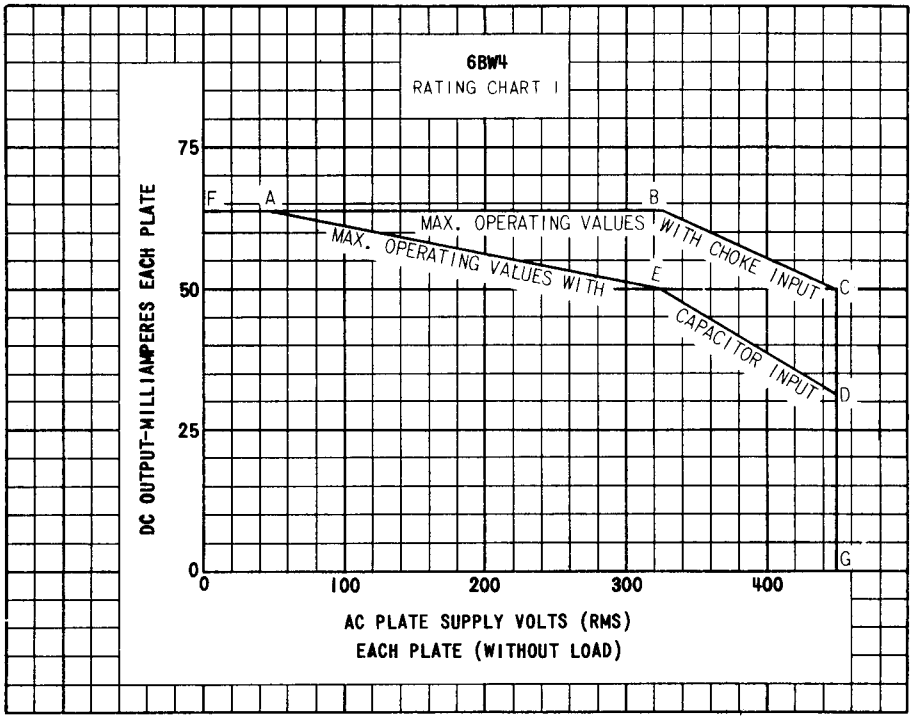
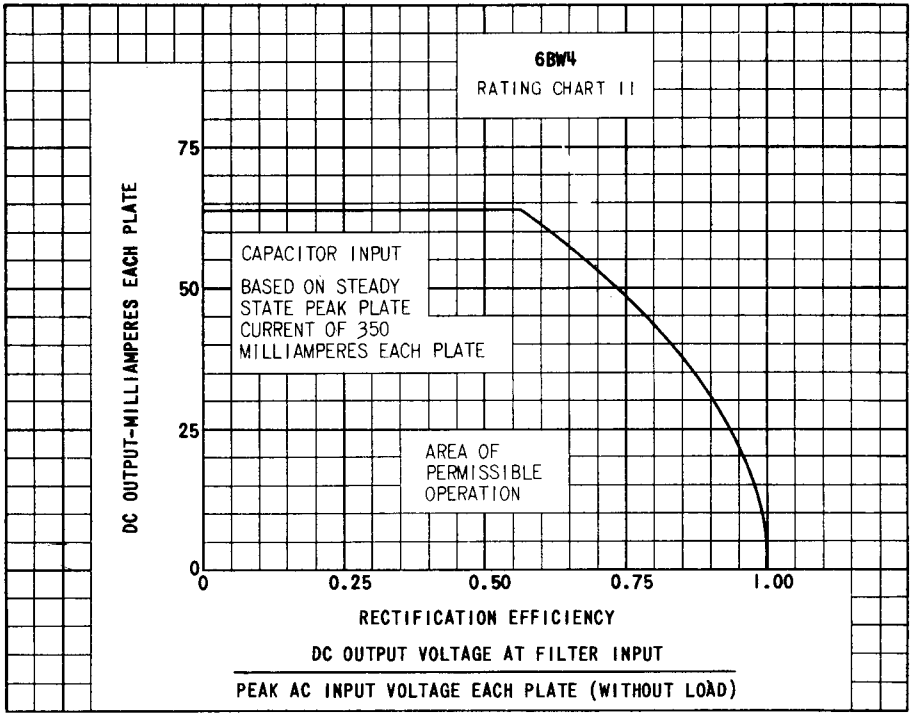
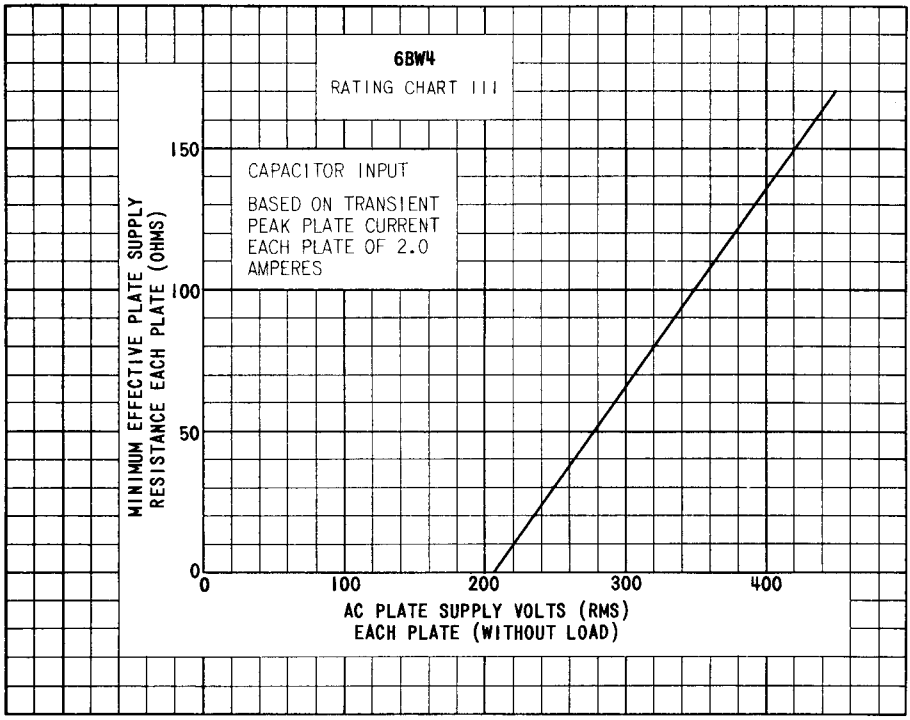

6BW4
RATING CHART I
DC OUTPUT-MILLIAMPERES EACH PLATE
75
50
25
0
F
A
B
C
D
E
G
MAX. OPERATING VALUES WITH CHOKE INPUT
MAX. OPERATING VALUES WITH CAPACITOR INPUT
0
100
200
300
400
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)

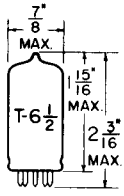

6BW4
RATING CHART II
DC OUTPUT-MILLIAMPERES EACH PLATE
75
50
25
0
CAPACITOR INPUT
BASED ON STEADY STATE PEAK PLATE CURRENT OF 350 MILLIAMPERES EACH PLATE
AREA OF PERMISSIBLE OPERATION
0
0.25
0.50
0.75
1.00
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


6BW4
RATING CHART III
CAPACITOR INPUT
BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 2.0 AMPERES
MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE (OHMS)
150
100
50
0
0
100
200
300
400
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE (WITHOUT LOAD)

TUNG-SOL

DOUBLE-DIODE PENTODE

MINIATURE TYPE

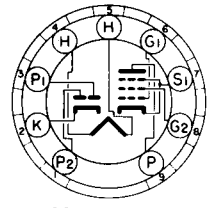


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9HK

THE 6BW8 IS A DOUBLE-DIODE PENTODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE TWO SECTIONS. THE DIODE SECTIONS ARE INTENDED FOR USE PRIMARILY AS A HORIZONTAL PHASE DETECTOR IN TELEVISION RECEIVERS. THE PENTODE SECTION IS SUITABLE FOR USE AS A SOUND IF AMPLIFIER, SOUND LIMITER, AND AUTOMATIC-GAIN-CONTROL KEYER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE GRID #1 TO PLATE (MAX.)	0.020	μμf
PENTODE INPUT	4.8	μμf
PENTODE OUTPUT	2.6	μμf
GRID #1 TO EACH DIODE PLATE (MAX.)	0.006	μμf
DIODE #1 PLATE TO DIODE CATHODE & HEATER	1.3	μμf
DIODE #2 PLATE TO DIODE CATHODE & HEATER	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3 ±6%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. SEC.)	5.0	MA.

CONTINUED ON FOLLOWING PAGE

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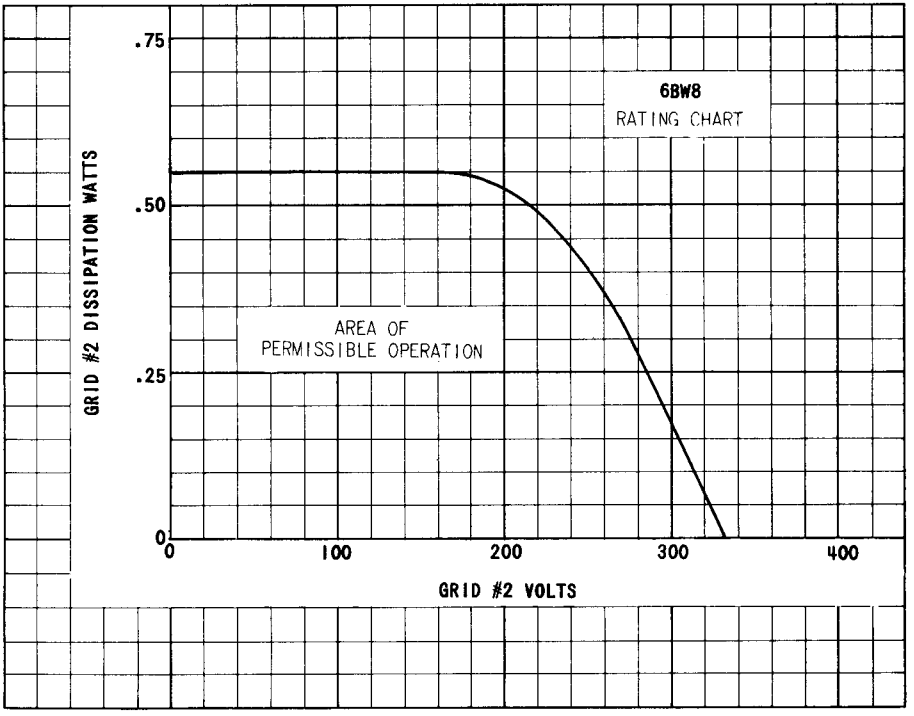
TUNG-SOL

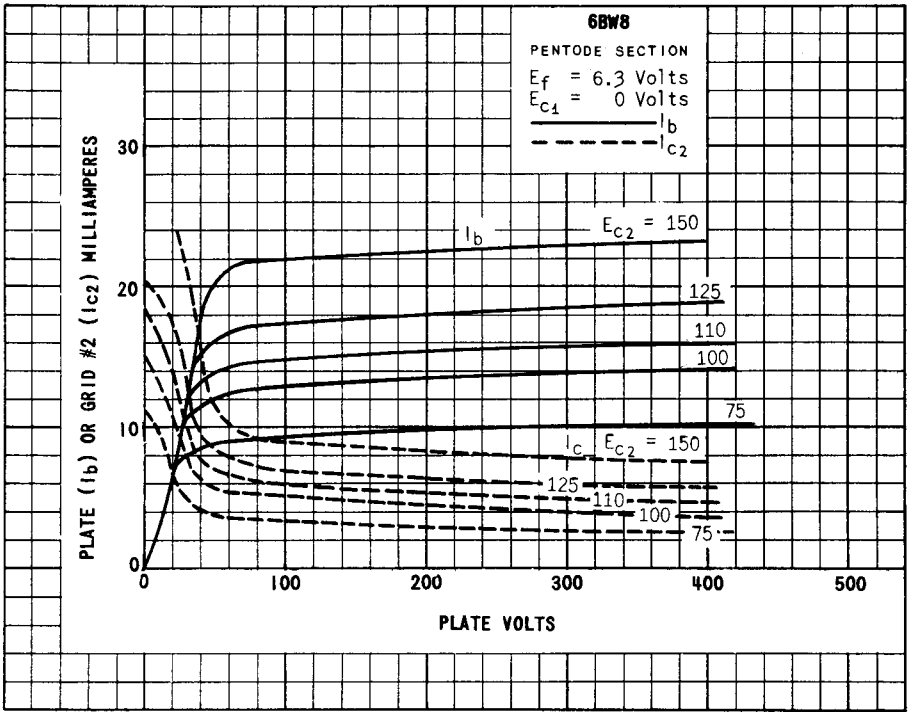
CONTINUED FROM PRECEDING PAGE

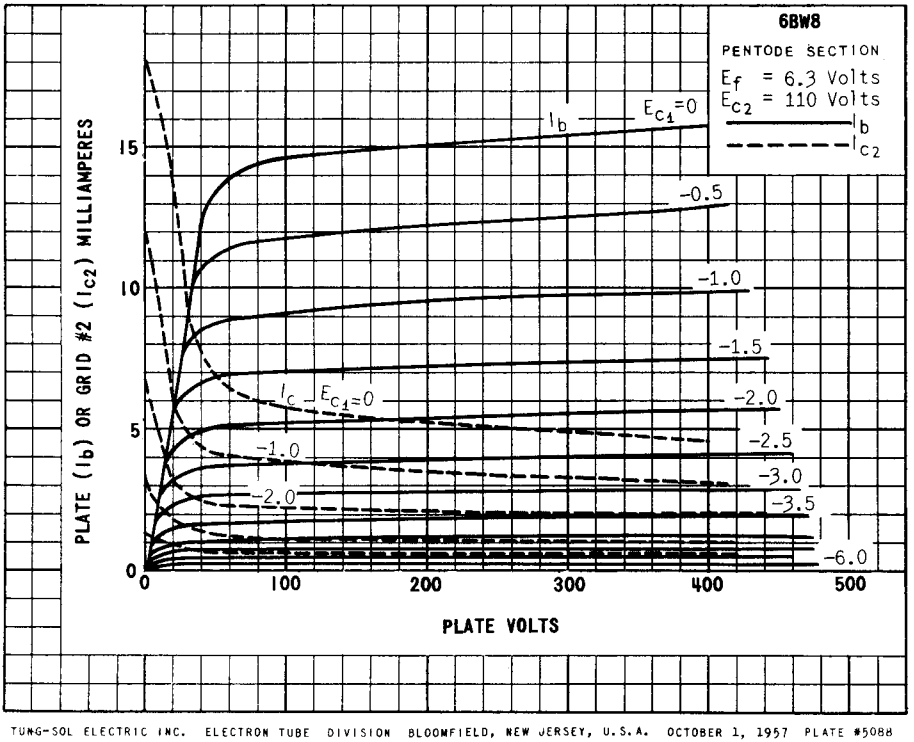
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3±6%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	5200	μMHOS
PLATE CURRENT	10	MA.
SCREEN CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) I_b=10 μAMPS	-10	VOLTS
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5 VOLTS DC APPLIED	20	MA.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.







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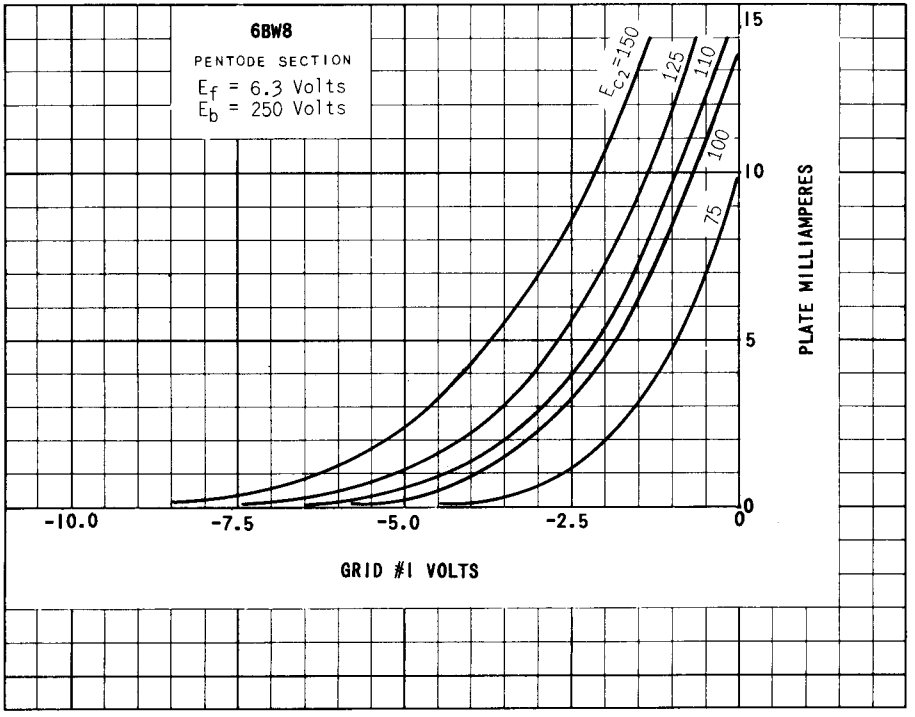
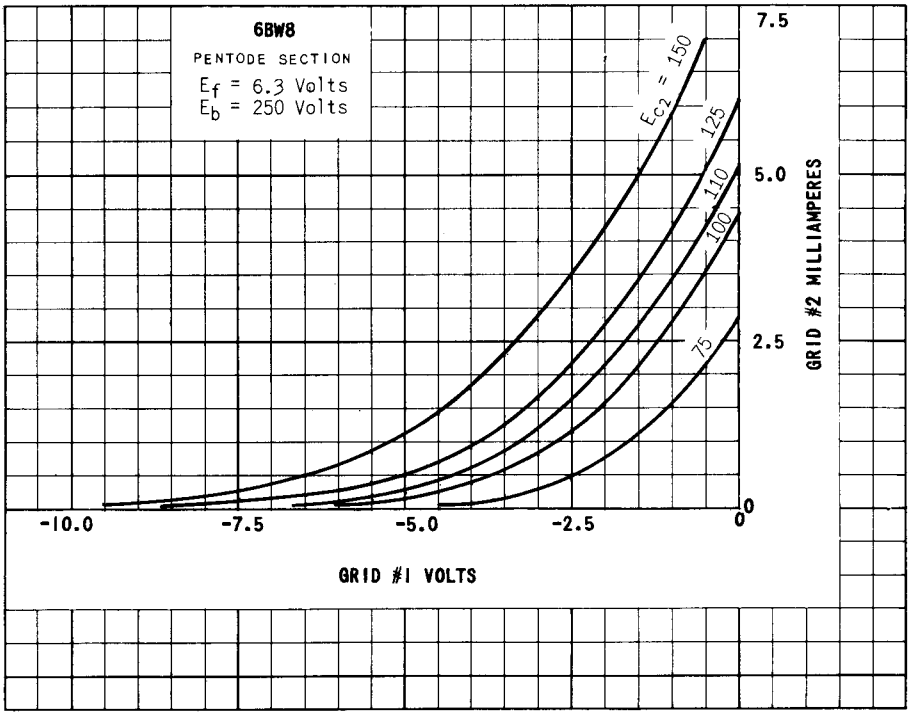
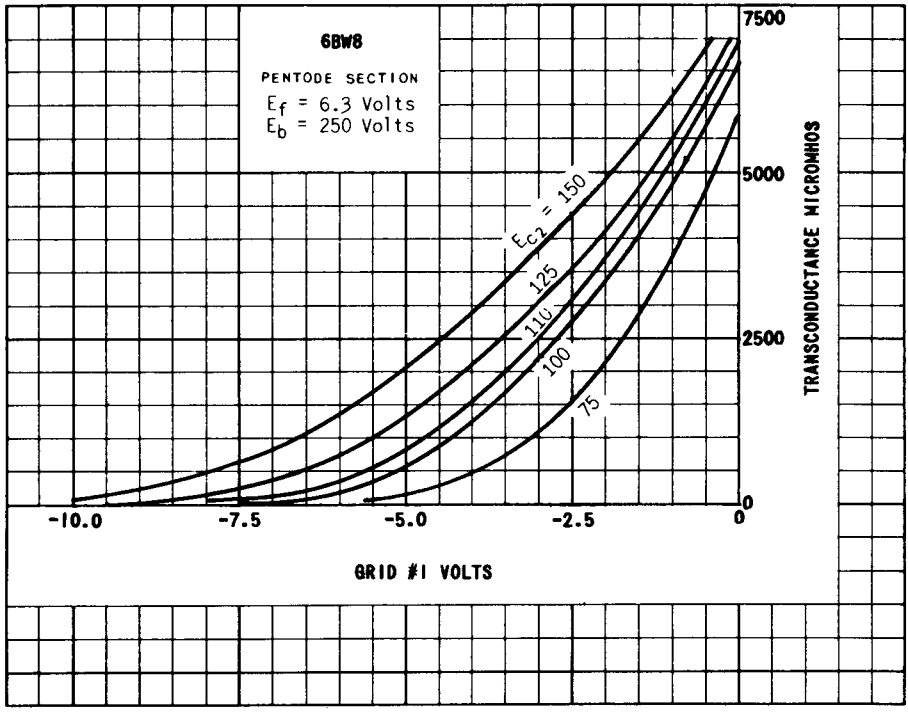
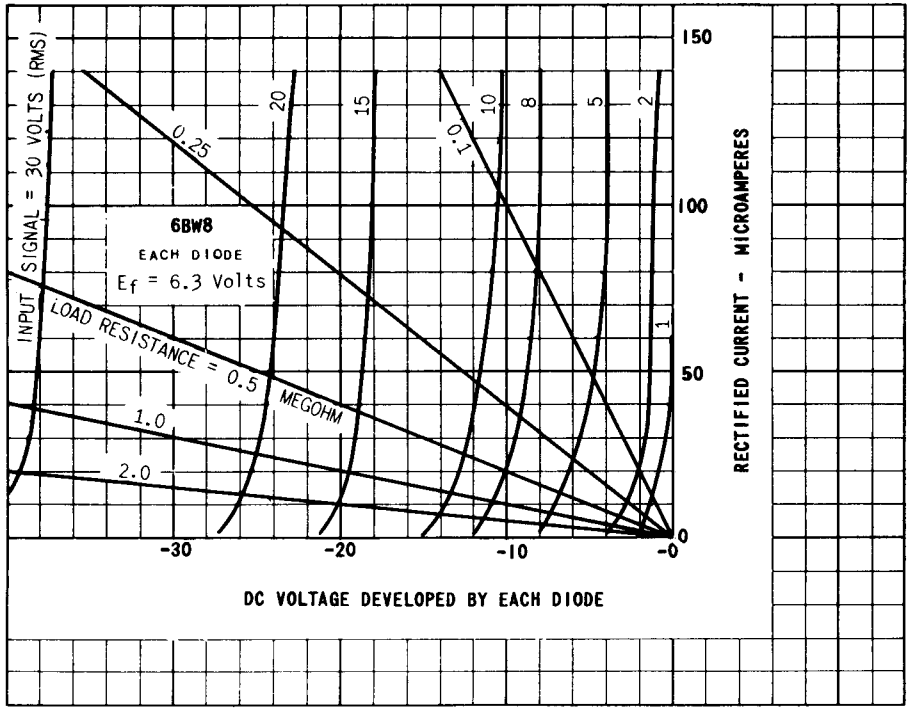

6BW8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2}=150
125
110
100
75
15
10
5
0
PLATE MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6BW8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 150
125
110
100
75
7.5
5.0
2.5
0
GRID #2 MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS





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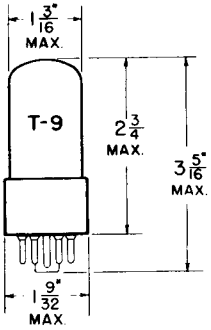
TUNG-SOL

DOUBLE TRIODE

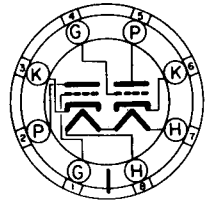


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 1.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM-VIEW
SHORT INTERMEDIATE SHELL 8 PIN OCTAL
8B0

THE 6BX7GT IS A HIGH PERVEANCE DOUBLE TRIODE DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER AND OSCILLATOR IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

	WITHOUT SHIELD	WITH SHIELD[A]	
SECTION I			
GRID TO PLATE: (G TO P)	4.2	4.2	μμf
INPUT: G TO (H+K)	4.4	5	μμf
OUTPUT: P TO (H+K)	1.1	3.4	μμf
SECTION II			
GRID TO PLATE: (G TO P)	4	4	μμf
INPUT: G TO (H+K)	4.8	5	μμf
OUTPUT: P TO (H+K)	1.2	3.2	μμf
GRID TO GRID: (G TO G)	0.11	0.1	μμf
PLATE TO PLATE: (P TO P)	1.5	1.2	μμf

[A] EXTERNAL SHIELD #308 CONNECTED TO CATHODE OF SECTION UNDER TEST.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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CONTINUED FROM PRECEDING PAGE

RATINGS ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER AND OSCILLATOR[BC]

	OSCILLATOR		AMPLIFIER	
HEATER VOLTAGE		6.3		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE:				
DC		200		VOLTS
TOTAL DC AND PEAK		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:				
DC		100		VOLTS
TOTAL DC AND PEAK		200		VOLTS
MAXIMUM DC PLATE VOLTAGE	500		500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---		2000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400		250	VOLTS
MAXIMUM DC POSITIVE GRID VOLTAGE	0		0	VDC
MAXIMUM PLATE DISSIPATION[D]	10		10	WATTS
MAXIMUM TOTAL PLATE DISSIPATION		12		WATTS
MAXIMUM AVERAGE CATHODE CURRENT	60		60	MA.
MAXIMUM PEAK CATHODE CURRENT	180		180	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	2.2		2.2	MEGOHMS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE IN TELEVISION BROADCASTING STATIONS, FEDERAL COMMUNICATIONS COMMISSION". THE DURATION OF THE VOLTAGE PULSE IS NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

[C] WHEN ONE SECTION IS OPERATED AS AN OSCILLATOR IT IS RECOMMENDED THAT SECTION #1 (PINS 4, 5 AND 6) BE USED.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

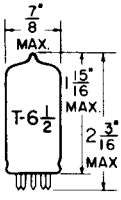
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		1.5		AMP.
PLATE VOLTAGE	100		250	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	0		390	OHMS
PLATE CURRENT	80		42	MA.
TRANSCONDUCTANCE	---		7600	μMHOS
AMPLIFICATION FACTOR	---		10	
PLATE RESISTANCE (APPROX.)	---		1300	OHMS
GRID VOLTAGE FOR I_b = 50 μA	---		−40	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

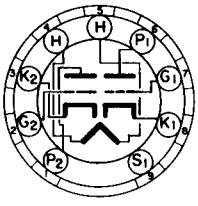


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9AJ

THE 6BX8 IS A MINIATURE TWIN TRIODE DESIGNED FOR OPERATION AS A CASCODE (VHF) AMPLIFIER IN TELEVISION RECEIVERS WHERE LOW SUPPLY VOLTAGES ARE EMPLOYED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6BX8 IS IDENTICAL TO THE 4BX8.

DIRECT INTERELECTRODE CAPACITANCES[A]

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	1.4	1.4	μμf
PLATE TO CATHODE (P TO K)	.165	.165	μμf
#2 INPUT: G TO (H+K+I.S.)	---	2.4	μμf
#1 INPUT: K TO (H+G+I.S.)[B]	4.9	---	μμf
#2 OUTPUT: P TO (H+K+I.S.)	---	1.25	μμf
#1 OUTPUT: P TO (H+G+I.S.)[B]	2.6	---	μμf

RATINGS[C]

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES
EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	150	VOLTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM CIRCUIT VALUE: (EACH UNIT)		
GRID CIRCUIT RESISTANCE	0.5	MEGOHM
HEATER WARM-UP TIME*	11.0	SECONDS

[A] EXTERNAL SHIELD #315 CONNECTED TO PIN 9.

[B] READ AS GROUNDED GRID AMPLIFIER.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

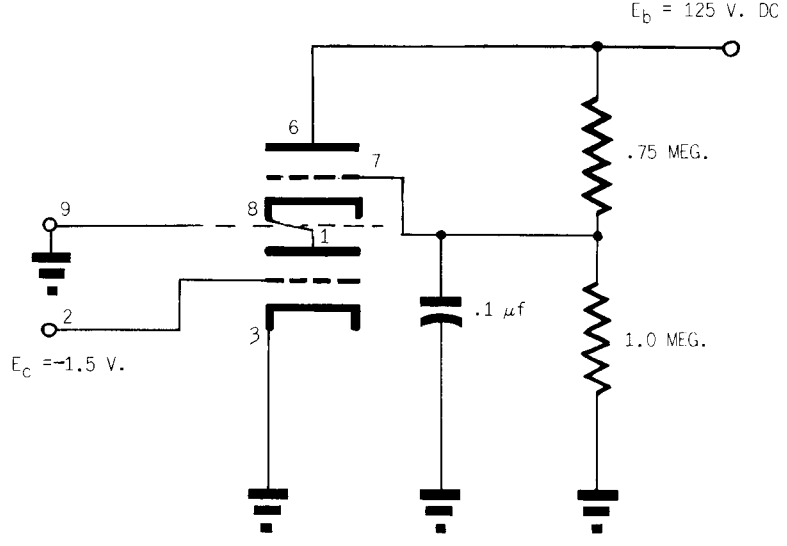
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	65	VOLTS
GRID VOLTAGE	-1.0	VOLTS
AMPLIFICATION FACTOR	25	
PLATE CURRENT	9	MA.
GRID VOLTAGE (APPROX.) FOR Ib = 10 μA	-7	VOLTS
TRANSCONDUCTANCE	6 700	μMHOS

AVERAGE CHARACTERISTICS -- CASCODE OPERATION

PLATE SUPPLY VOLTAGE	125	VOLTS
GRID VOLTAGE	-.5	VOLTS
PLATE CURRENT	11	MA.
TRANSCONDUCTANCE	7 500	μMHOS

[C] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



CASCODE TEST CIRCUIT.

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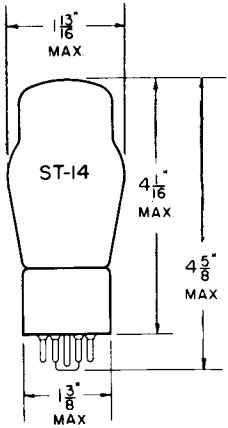
DOUBLE DIODE

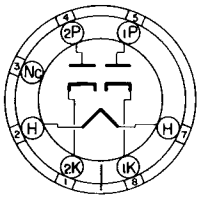


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM SHELL
7 PIN OCTAL
6CN

THE 6BY5G IS A FULL-WAVE HIGH-VACUUM RECTIFIER DESIGNED FOR DAMPER SERVICE IN TELEVISION DEFLECTION CIRCUITS. IT CAN ALSO BE USED IN CONVENTIONAL RECTIFIER APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.6	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE (EACH PLATE):		
RECTIFIER SERVICE	1400	VOLTS
DAMPER SERVICE[A]	2500	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	525	MA.
MAXIMUM DC OUTPUT CURRENT	175	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER - CONDENSER INPUT

AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS	375	VOLTS
FILTER INPUT CONDENSER	8	µf
EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	100	OHMS
DC OUTPUT VOLTAGE	380	VOLTS
DC OUTPUT CURRENT	175	MA.
TUBE VOLTAGE DROP MEASURED WITH TUBE CONDUCTING 175 MA. EACH PLATE	32	VOLTS

[A] THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND ITS DURATION MUST BE LIMITED TO 10 MICROSECONDS.

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OCT. 1 1950

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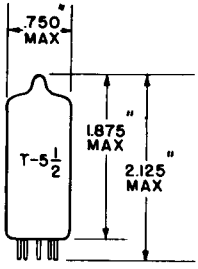
HEPTODE

MINIATURE TYPE



GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

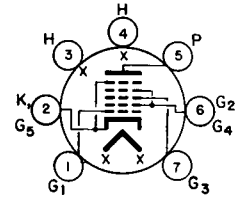
COATED UNIPOTENTIAL CATHODE

FOR USE

AS A GATED AMPLIFIER IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 6BY6 IS A PENTAGRID AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE AS A GATED AMPLIFIER IN TV RECEIVERS. IN SUCH SERVICE, IT MAY BE USED AS A COMBINED SYNC SEPARATOR AND SYNC CLIPPER.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.08	pf
GRID #3 TO PLATE (MAX.)	0.35	pf
GRID #1 TO GRID #3 (MAX.)	0.22	pf
GRID #1 TO ALL OTHER ELECTRODES AND HEATER	5.4	pf
GRID #3 TO ALL OTHER ELECTRODES AND HEATER	6.9	pf
PLATE TO ALL OTHER ELECTRODES AND HEATER	7.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[B]	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

PLATE VOLTAGE	→ 330	VOLTS
GRID #2 & #4 VOLTAGE	SEE RATING CHART	
GRID #2 & #4 SUPPLY VOLTAGE	→ 330	VOLTS
GRID #3 VOLTAGE:		
NEGATIVE BIAS VALUE	→ 55	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
POSITIVE PEAK VALUE	→ 27	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS - CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AMPLIFIER SERVICE

GRID #1 VOLTAGE:		
NEGATIVE BIAS VALUE	→110	VOLTS
PLATE DISSIPATION	→2.3	WATTS
GRID #3 INPUT	0.1	WATT
GRIDS #2 & #4 INPUT:*		
FOR GRIDS #2 & #4 VOLTAGES UP TO 165 VOLTS	1.1	WATTS
FOR GRIDS #2 & #4 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS	SEE RATING CHART	
GRID #1 INPUT	0.1	WATT
GRID #1 OR GRID #3 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.5	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

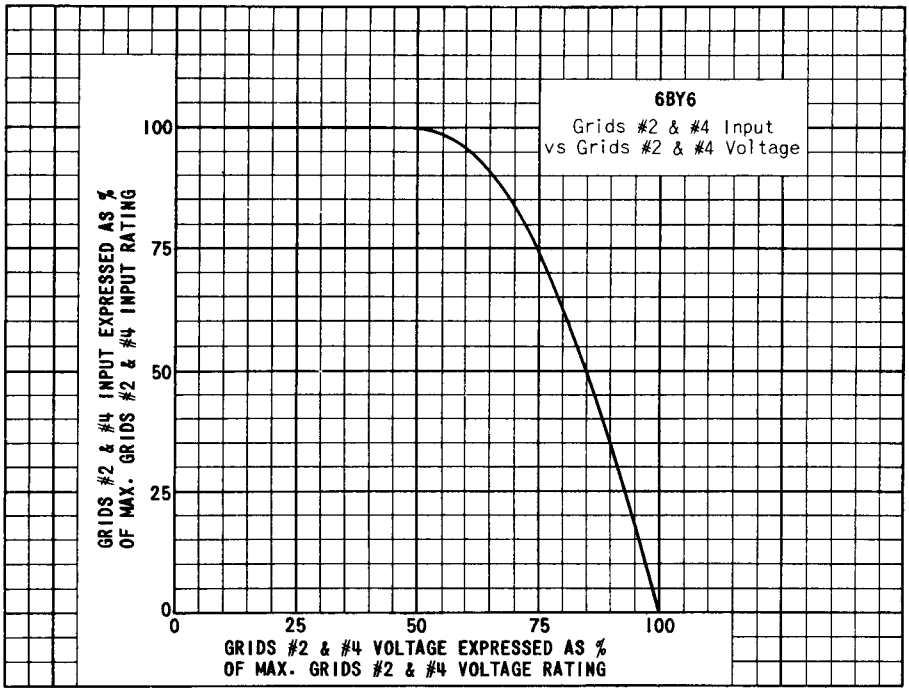
PLATE VOLTAGE	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-2.5	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
GRID #3 TO PLATE TRANSCONDUCTANCE	500	μMHOS
GRID #1 TO PLATE TRANSCONDUCTANCE	1 900	μMHOS
PLATE CURRENT	6.5	MA.
GRID #2 & #4 CURRENT	9	MA.
GRID #3 VOLTS (APPROX.) FOR I_b = 35 μAMP. AND GRID #1 VOLTS = -4	-15	VOLTS
GRID #1 VOLTS (APPROX.) FOR I_b = 35 μAMP. AND GRID #3 VOLTS = 0	-12	VOLTS

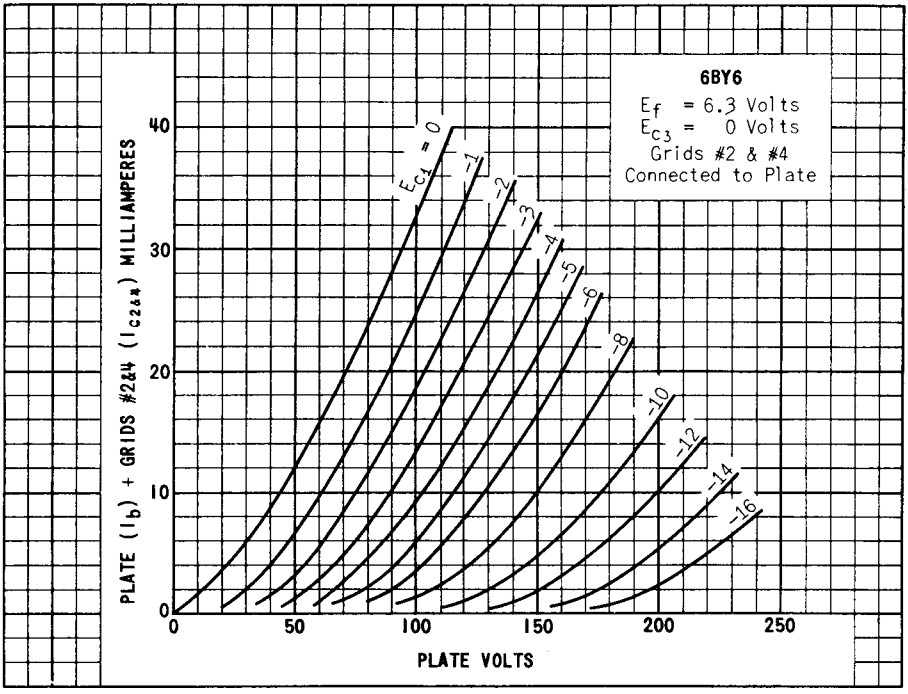
SYNC SEPARATOR AND SYNC CLIPPER

PLATE VOLTAGE	10	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 & #4 VOLTAGE	25	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.4	MA.
GRIDS #2 & #4 CURRENT	3.5	MA.
GRID #3 BIAS VOLTS (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #1 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 μAMP.	-2.5	VOLTS
GRID #1 BIAS VOLTAGE (APPROX.) FOR PLATE VOLTAGE OF 25 VOLTS, GRIDS #2 & #4 VOLTAGE OF 25 VOLTS, GRID #3 VOLTAGE OF 0 VOLTS AND PLATE CURRENT OF 50 μAMP.	-2.3	VOLTS

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE. * INDICATES AN ADDITION.





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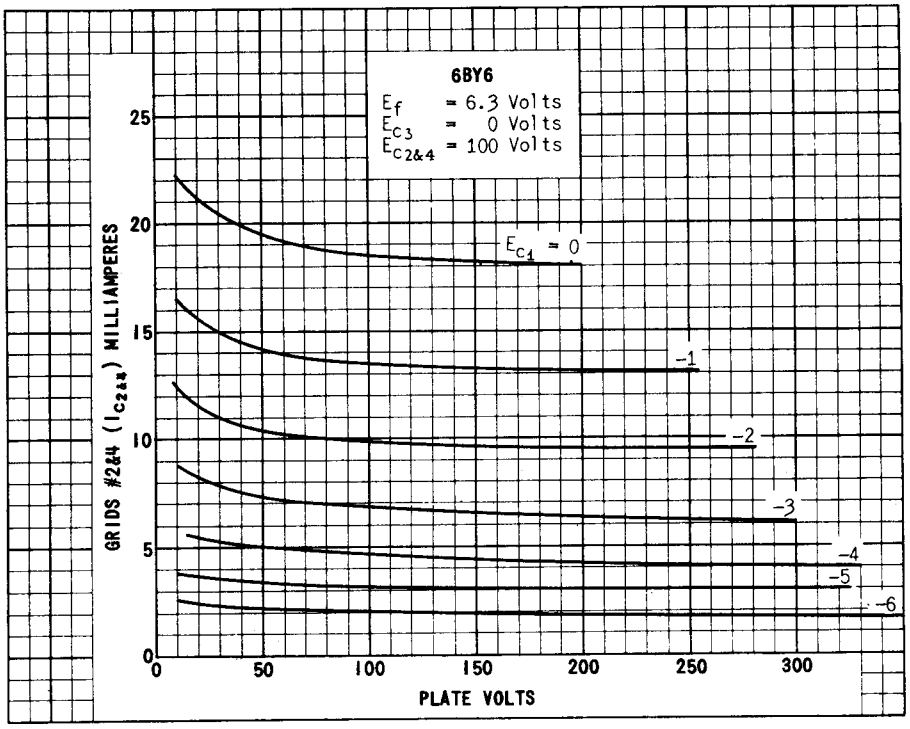
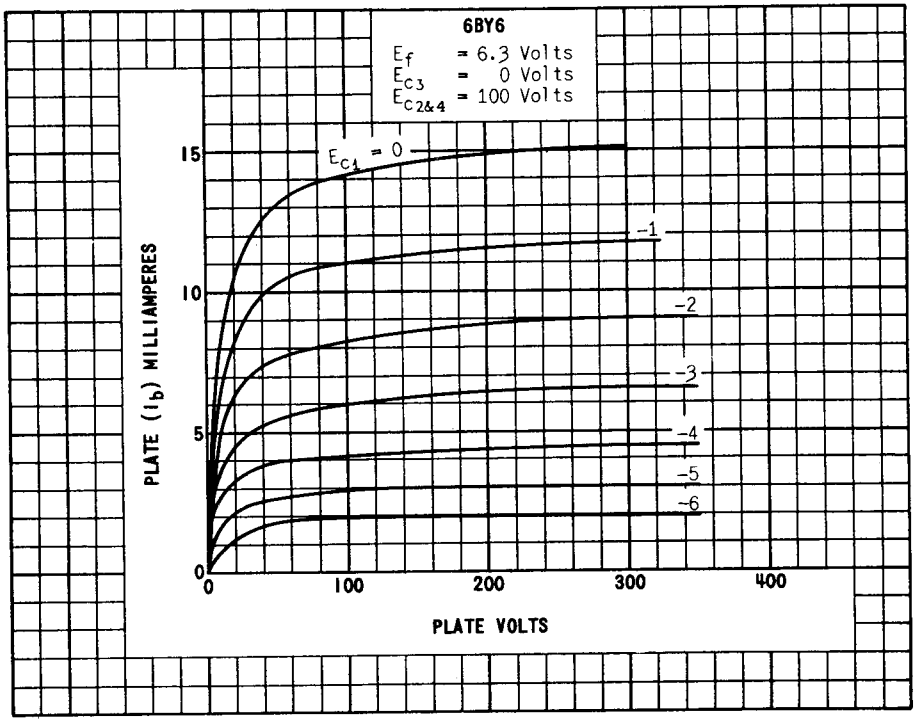
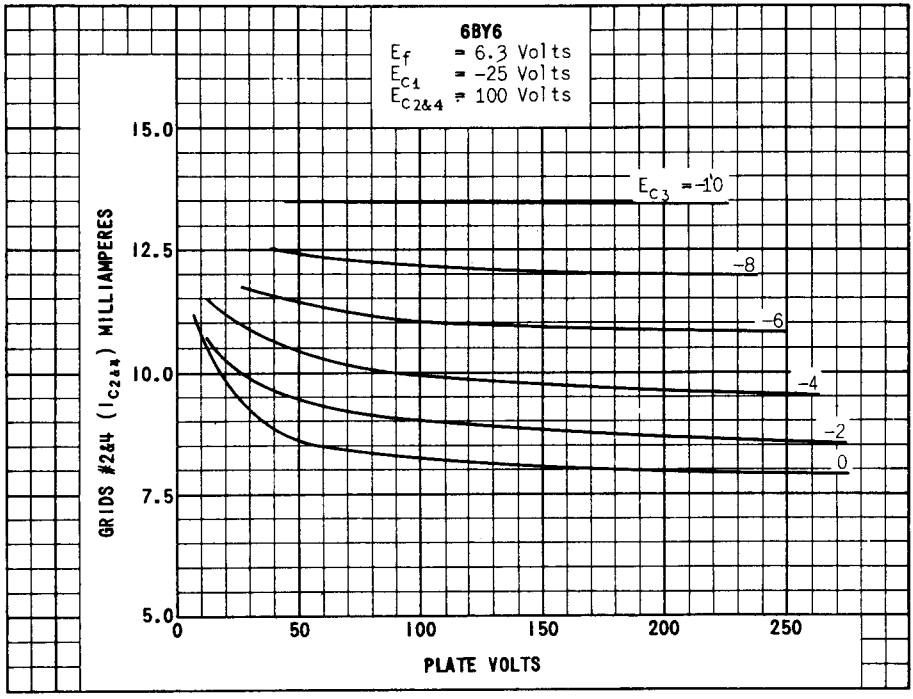
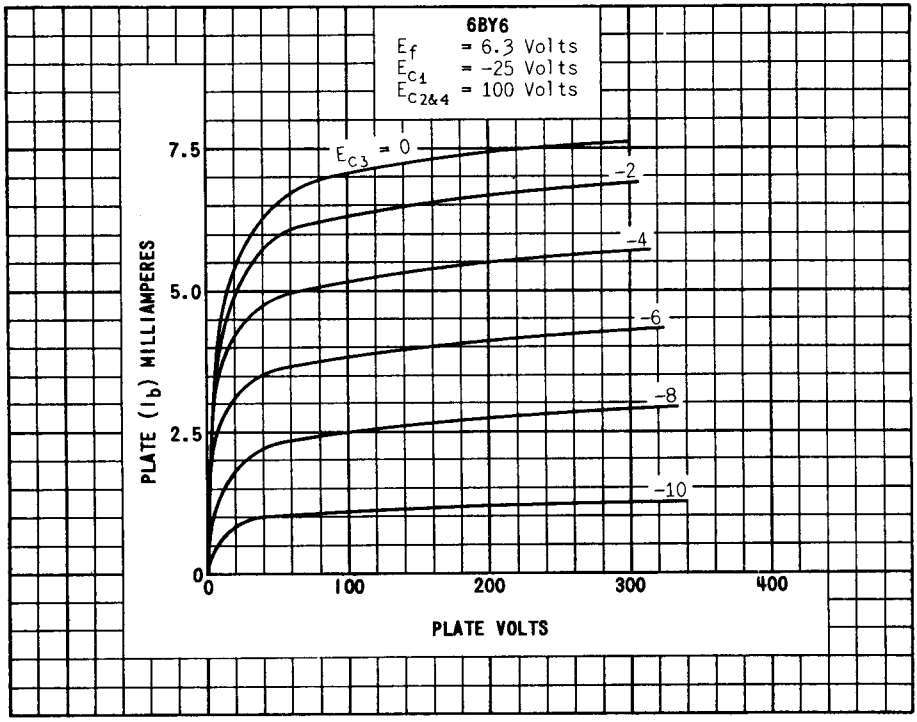
6BY6


6BY6
E_f = 6.3 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
PLATE VOLTS


6BY6
E_f = 6.3 Volts
E_{c3} = 0 Volts
$E_{c2\&4}$ = 100 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
PLATE (I_b) MILLIAMPERES
0
5
10
15
0
100
200
300
400
PLATE VOLTS

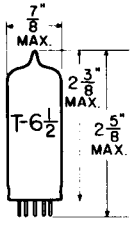

6BY6
E_f = 6.3 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = -10
-8
-6
-4
-2
0
15.0
12.5
10.0
7.5
5.0
0
50
100
150
200
250
GRIDS #2&4 ($I_{c2\&4}$) MILLIAMPERES
PLATE VOLTS


6BY6
E_f = 6.3 Volts
E_{c1} = -25 Volts
$E_{c2\&4}$ = 100 Volts
E_{c3} = 0
-2
-4
-6
-8
-10
7.5
5.0
2.5
0
0
100
200
300
400
PLATE (I_b) MILLIAMPERES
PLATE VOLTS

TUNG-SOL

DIODE-PENTODE

MINIATURE TYPE

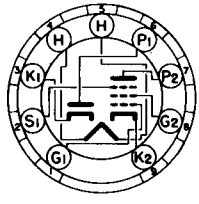


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL GLASS BUTTON
9 PIN BASE

THE 6BY8 IS A MINIATURE HIGH PERVEANCE DIODE, SHARP CUTOFF PENTODE WHOSE DESIGN LENDS ITSELF FOR USE AS AN AMPLIFIER ALONG WITH A HIGH PERVEANCE DIODE SUITABLE FOR USE AS A LIMITER OR A DETECTOR. THE PENTODE SECTION IS SIMILAR TO THE TYPE 6AU6. THE DIODE IS SIMILAR TO ONE SECTION OF A TYPE 6AL5. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES[A]

PENTODE GRID #1 TO PENTODE PLATE (G_1 TO P) (MAX.)	.0035	μμf
PENTODE INPUT: G_1 TO (H+K+G_2+G_3,SH)	5.5	μμf
PENTODE OUTPUT: P TO (H+K+G_2+G_3,SH)	5.0	μμf
DIODE PLATE TO ALL: DP TO (H+Kd+Kp+G_1+G_2+G_3,SH,+P)	4.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

PENTODE SECTION		
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	.65	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

A EXTERNAL SHIELD #315 CONNECTED TO PIN #9.

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CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DIODE SECTION

MAXIMUM PEAK INVERSE PLATE VOLTAGE	430	VOLTS
MAXIMUM PEAK PLATE CURRENT	180	MA.
MAXIMUM DC CURRENT	45	MA.
MAXIMUM HEATER–CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	150	VOLTS
GRID #3 VOLTAGE	PIN 2 CONNECTED TO PIN 9 AT SOCKET		
CATHODE BIAS RESISTOR	150	68	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
TRANSCONDUCTANCE	3900	5200	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR I_b = 10 μA	−4.2	−6.5	VOLTS
PLATE CURRENT	5.0	10.6	MA.
GRID #2 CURRENT	2.1	4.3	MA.

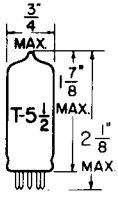
TYPICAL CHARACTERISTICS – DIODE SECTION

AVERAGE DIODE CURRENT AT 10V DC	60	MA.

TUNG-SOL

PENTODE

MINIATURE TYPE

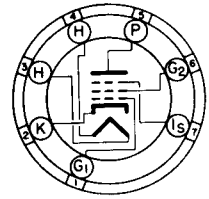


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 300 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 3BZ6.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.0	7.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	6.3±10% ←	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55 ←	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE*	0	VOLTS
		MEGOHM

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.
* INDICATES AN ADDITION.

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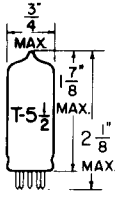
TUNG-SOL

PENTODE

MINIATURE TYPE

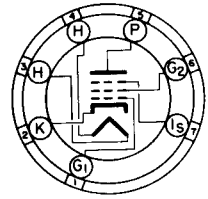


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF AMPLIFIER IN 300 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 3BZ6.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.0	7.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	6.3±10% ←	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55 ←	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE*	0	VOLTS
		MEGOHM

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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→ INDICATES A CHANGE.
* INDICATES AN ADDITION.

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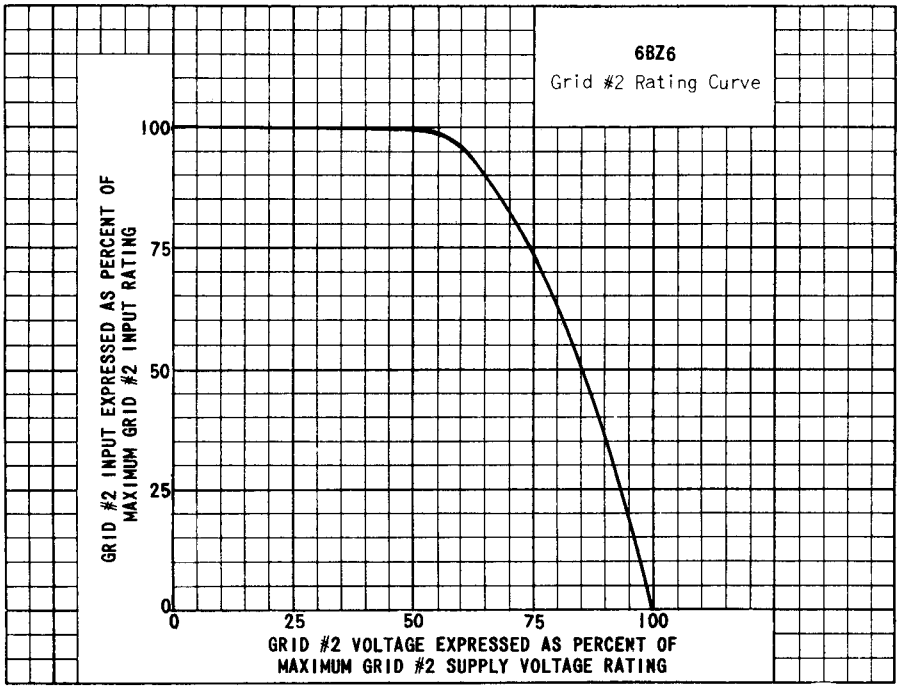
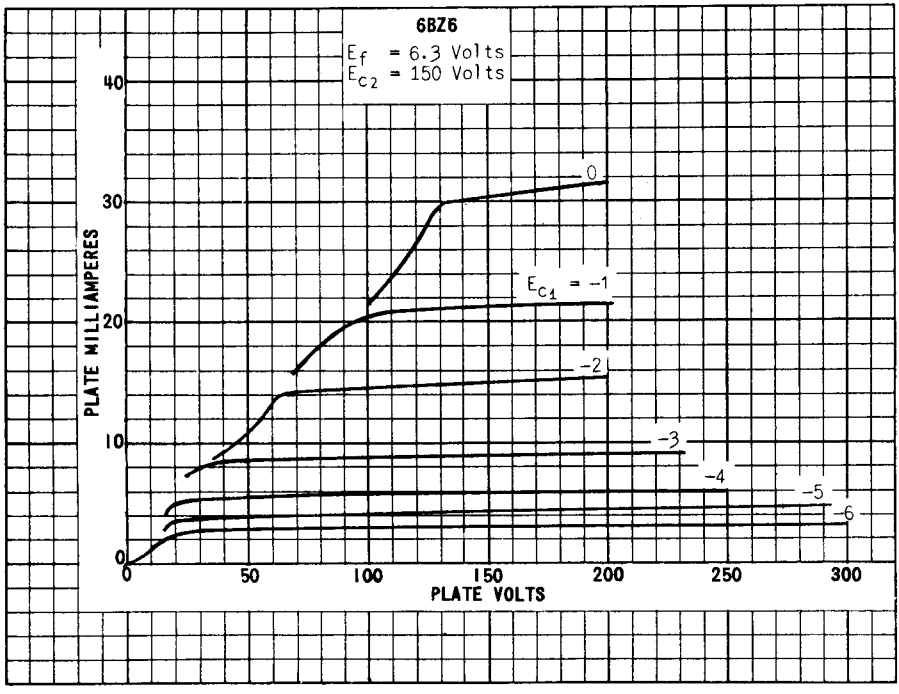

6BZ6
Grid #2 Rating Curve
GRID #2 INPUT EXPRESSED AS PERCENT OF MAXIMUM GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAXIMUM GRID #2 SUPPLY VOLTAGE RATING


6BZ6
E_f = 6.3 Volts
E_{c2} = 150 Volts
PLATE MILLIAMPERES
40
30
20
10
0
0
E_{c1} = 0
-1
-2
-3
-4
-5
-6
50
100
150
200
250
300
PLATE VOLTS

6BZ6

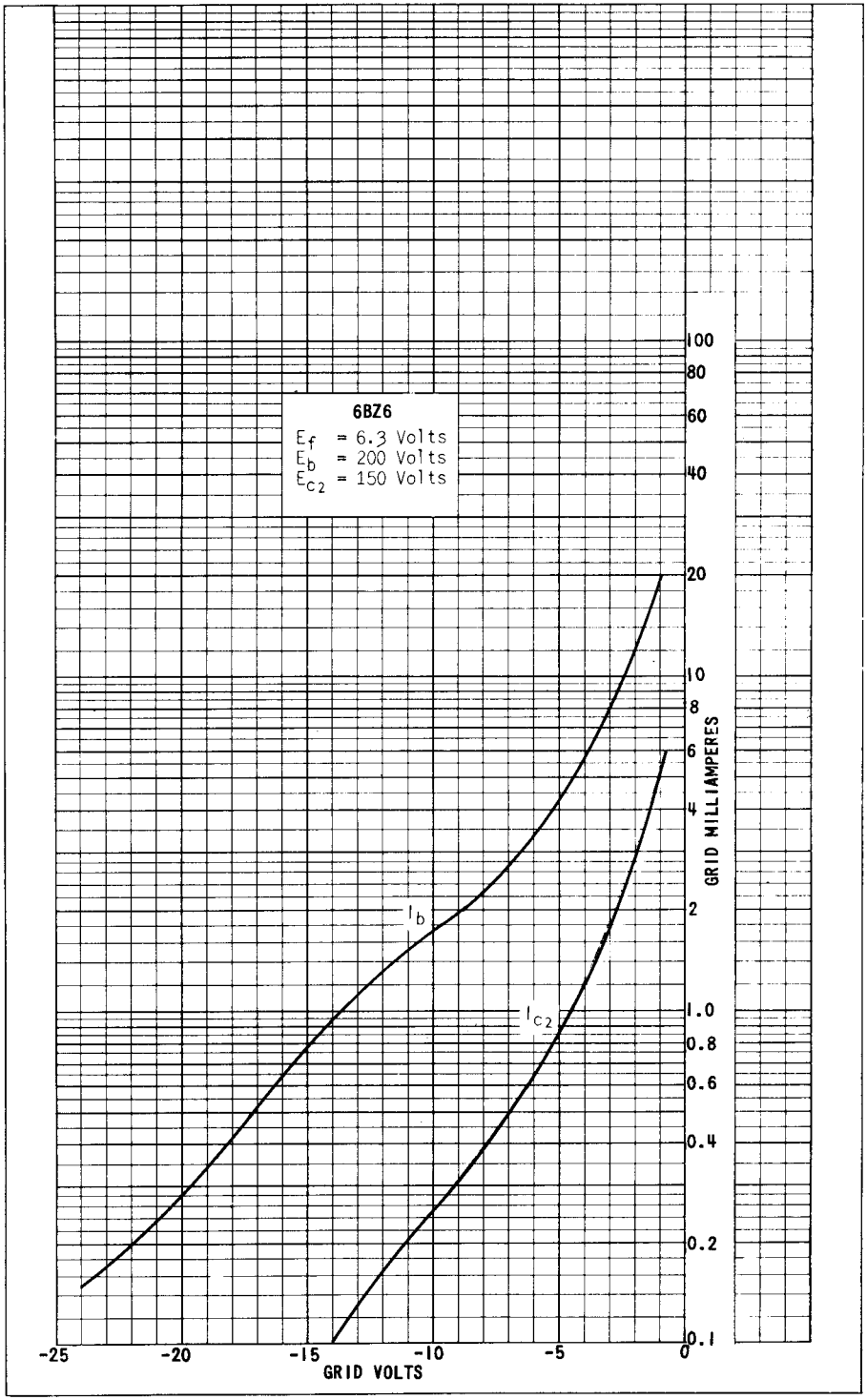
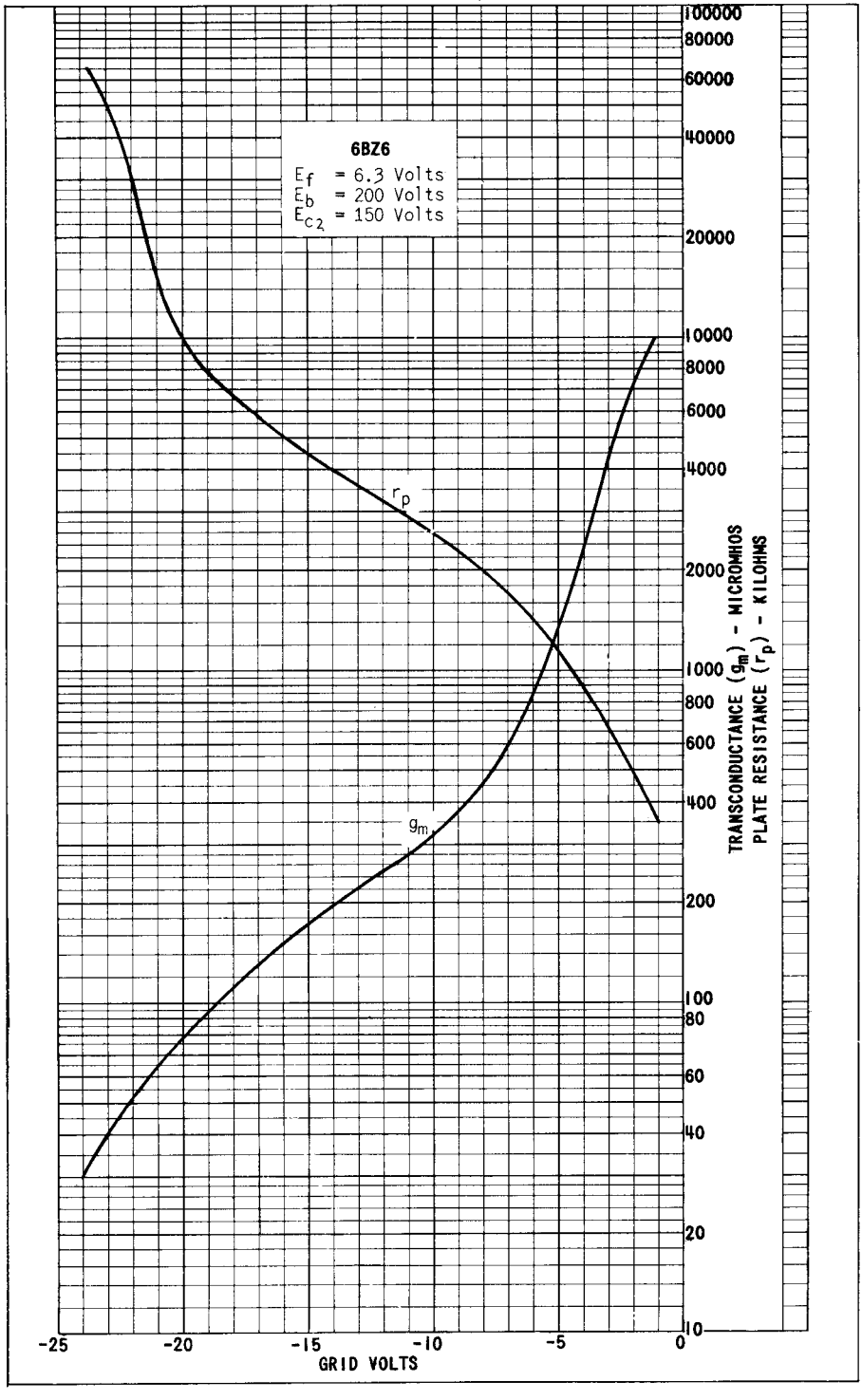


PLATE #3839 JULY 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.



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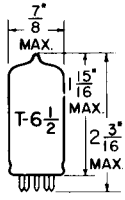
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

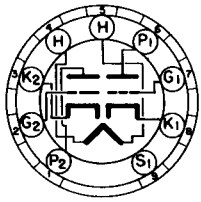


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

THE 6BZ7 IS A MEDIUM MU DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN LOW NOISE VHF CASCODE AMPLIFIER APPLICATIONS.

→ DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

	TRIODE UNIT #1		TRIODE UNIT #2	
GRID TO PLATE: (G TO P)	1.2		1.2	μμf
PLATE TO CATHODE: (P TO K)	0.12		0.12	μμf
HEATER TO CATHODE: (H TO K)	2.6		2.6	μμf
#1 INPUT: G TO (H+K+I.S.)	2.6		---	μμf
#2 INPUT: K TO (H+G+I.S.)*	---		5.0	μμf
#1 OUTPUT: P TO (H+K+I.S.)	1.2		---	μμf
#2 OUTPUT: P TO (H+G+I.S.)*	---		2.2	μμf
#1 PLATE TO #2 PLATE: (1P TO 2P) (MAX.)		0.010		μμf
#2 PLATE TO #1 PLATE & GRID: (2P TO 1P+1G) (MAX.)		0.024		μμf

*READ AS GROUNDED GRID AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE:**		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE **	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

**
THIS RATING MAY BE AS HIGH AS 300 VOLTS UNDER CUTOFF CONDITIONS, WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE	→ 5 300	OHMS
TRANSCONDUCTANCE	6 800	μMHOS
PLATE CURRENT	10	MA.
GRID VOLTAGE FOR I_b = 100 μA (APPROX.)	→ −7	VOLTS

TUNG-SOL

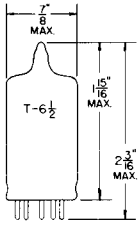
TWIN TRIODE

MINIATURE TYPE

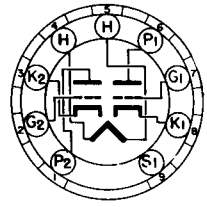
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AJ

THE 6BZ8 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN LOW NOISE VHF AMPLIFIER CASCODE OPERATION WITH THE SECTION #1 AS THE INPUT SECTION OF THE CASCODE CIRCUIT. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, THE 6BZ8 IS IDENTICAL TO THE 4BZ8.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD #315

	#1 TRIODE	#2 TRIODE	
GRID TO PLATE (G TO P)	1.15	---	μμf
PLATE TO CATHODE (P TO K)	---	0.15	μμf
#1 TRIODE PLATE TO #2 TRIODE PLATE P_1 TO P_2	.010	---	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	0.1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	125	VOLTS
CATHODE RESISTOR	100	OHMS
PLATE RESISTANCE	5 600	OHMS
TRANSCONDUCTANCE	8 000	μMHOS
AMPLIFICATION FACTOR	45	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR Gm = 50 μMHOS	-13	VOLTS
CASCODE TRANSCONDUCTANCE (E_b 250V E_{c1} -0.5V)	10 000	μMHOS
CASCODE PLATE CURRENT (E_b 250V E_{c1} -0.5V)	15	MA.

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TUNG-SOL

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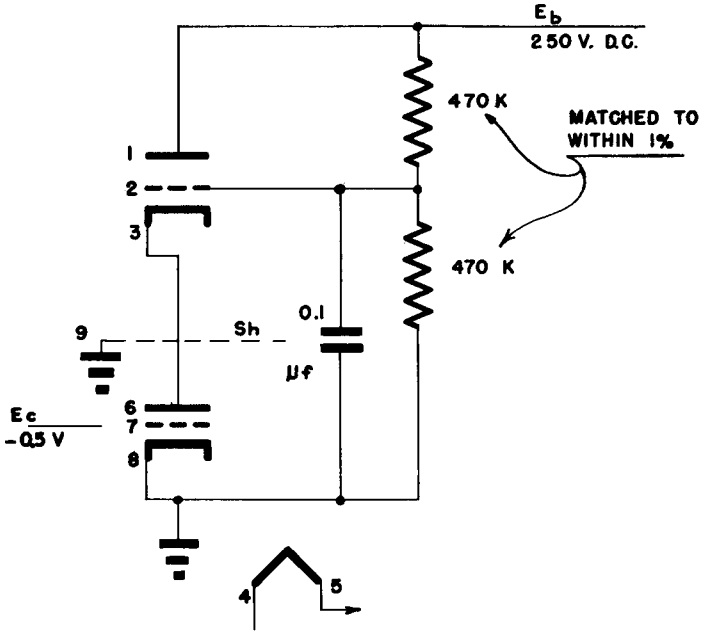
CASCODE TRANSCONDUCTANCE TEST CIRCUIT



TUNG-SOL

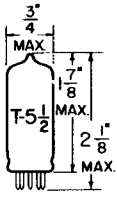
TRIODE

MINIATURE TYPE

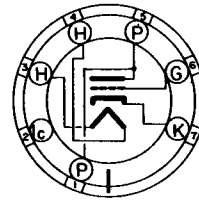
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6C4 IS A LOW-MU TRIODE VOLTAGE AMPLIFIER OF THE MINIATURE TYPE. IT IS PARTICULARLY USEFUL AS A HIGH FREQUENCY LOW-POWER OSCILLATOR DUE TO ITS HIGH TRANSCONDUCTANCE, LOW CAPACITANCES AND LEAD INDUCTANCES. LOW HEATER POWER REQUIREMENTS MAKE IT ATTRACTIVE FOR USE IN PORTABLE AND ALSO IN SERIES-HEATER CONNECTED CIRCUITS. ←

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	1.6	μμf
INPUT: G TO (H+K)	1.8	μμf
OUTPUT: P TO (H+K)	1.3	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

	AF AMPLIFIER	RF AMPLIFIER	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	90	VOLTS ←
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	---	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (FIXED BIAS)	0.25	---	MEG.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1	---	MEG.
MAXIMUM DC PLATE CURRENT	---	25	MA.
MAXIMUM DC GRID CURRENT	---	8	MA.
PLATE DISSIPATION	3.5	5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE[A]	0	-8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
PLATE RESISTANCE	6 250	7 700	OHMS
TRANSCONDUCTANCE	3 100	2 200	μMHOS
AMPLIFICATION FACTOR	19.5	17	

[A] THE TYPE OF INPUT COUPLING USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID CIRCUIT. TRANSFORMER OR IMPEDANCE COUPLING DEVISES ARE RECOMMENDED.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 1963
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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

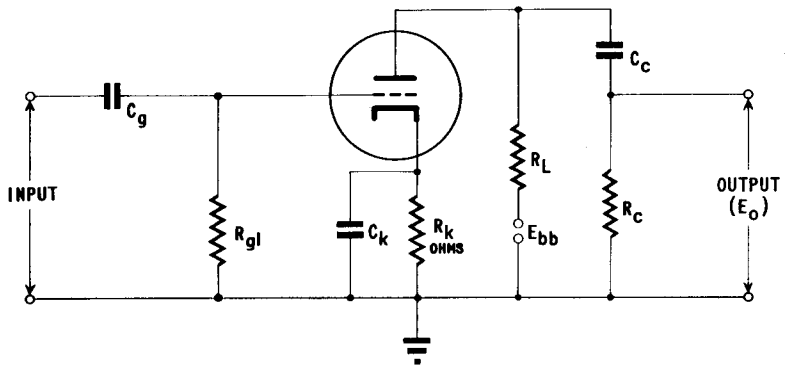
RF POWER AMPLIFIER AND OSCILLATOR - CLASS C TELEGRAPHY
AS AN OSCILLATOR AT 150 MC APPROXIMATELY 2.5 WATTS CAN BE OBTAINED WITH A GRID RESISTOR OF 10000 OHMS AND MAXIMUM RATED INPUT.

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	150	MA.
DC PLATE VOLTAGE	300	VOLTS
DC GRID VOLTAGE	-27	VOLTS
DC PLATE CURRENT	25	MA.
DC GRID CURRENT (APPROX.)	7	MA.
DRIVING POWER (APPROX.)	0.35	WATT
POWER OUTPUT (APPROX.)	5.5	WATTS

RESISTANCE COUPLED AMPLIFIER

R_L MEG.	R_{g1} MEG.	R_c MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3000	11	12	2000	12	23	1600	13	34
0.10	A	0.24	3300	12	15	2400	12	30	1800	13	40
0.24	A	0.24	7500	12	14	4700	13	25	3600	13	37
0.24	A	0.51	8200	12	16	6200	13	32	4300	13	43
0.51	A	0.51	12000	12	13	8200	13	24	6200	13	33
0.51	A	1.0	13000	12	15	9100	13	28	6800	13	36
0.24	10	0.24	---	13	12	----	15	24	----	16	35
0.24	10	0.51	---	14	15	----	16	28	----	17	49
0.51	10	0.51	---	14	13	----	15	25	----	17	40
0.51	10	1.0	---	14	16	----	16	32	----	17	54

A VALUE OF R_{g1} IS NOT CRITICAL.
GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.
E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

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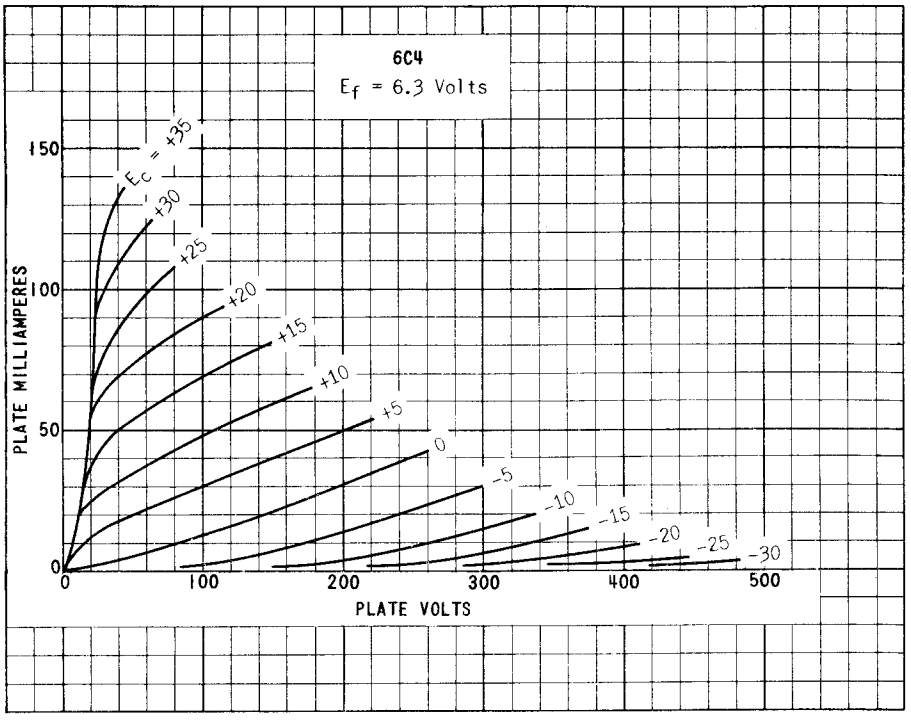

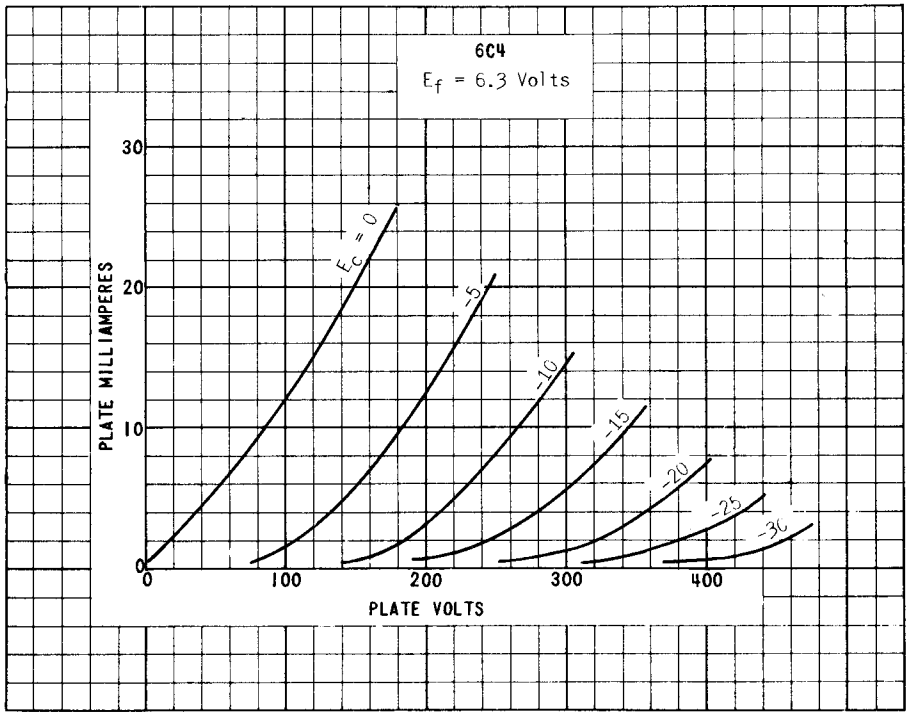

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PLATE
1965
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1948

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6C4

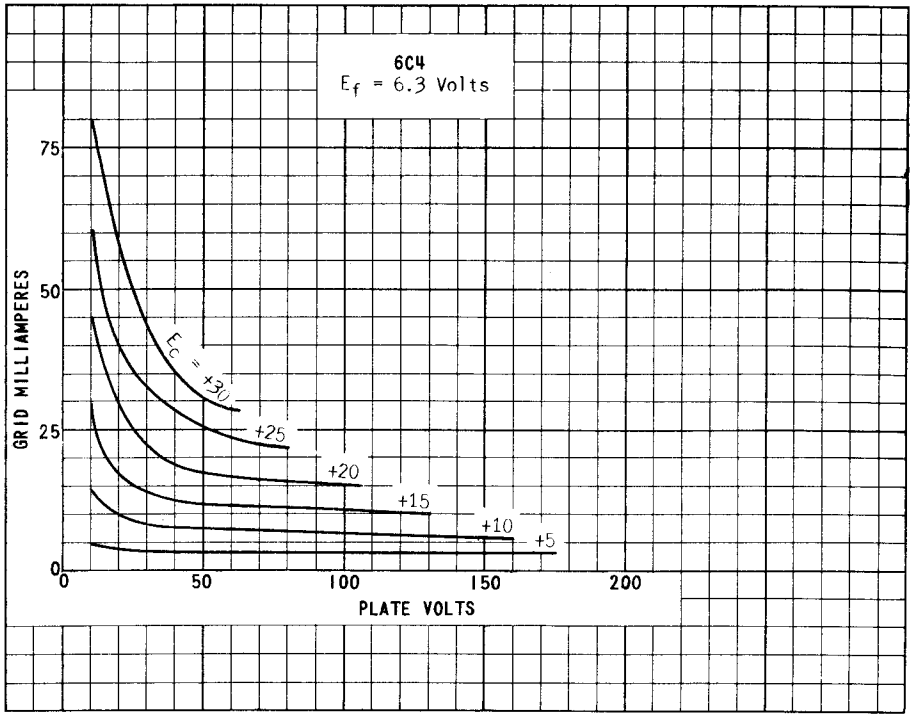

PLATE 1966
FEB. 2, 1948

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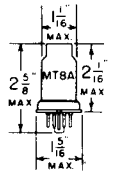
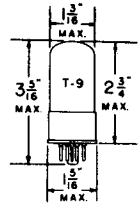


METAL SHELL
6 PIN OCTAL BASE
6C5

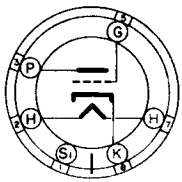
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

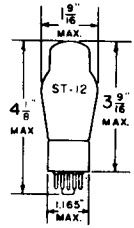


GLASS BULB
6 PIN OCTAL BASE
WITH METAL SHELL
6C5GT

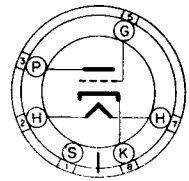


G-6Qb

BOTTOM VIEW
6C5G



GLASS BULB
SMALL 6 PIN OCTAL BASE
6C5G



6Q

BOTTOM VIEW
6C5 6C5GT

THE TUNG-SOL 6C5, 6C5G AND 6C5GT ARE GENERAL PURPOSE TRIODES DESIGNED FOR SERVICE AS OSCILLATORS, DETECTORS OR AMPLIFIERS. WITH THE EXCEPTION OF CAPACITANCES, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL. THEY ARE SIMILAR IN CHARACTERISTICS TO THE 6C6, 6J7 AND 57 WITH TRIODE CONNECTION.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MINIMUM GRID VOLTAGE	0	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE [A]	−8	VOLTS
PLATE CURRENT	8	MA.
PLATE RESISTANCE	10 000	OHMS
TRANSCONDUCTANCE	2000	μMHOS
AMPLIFICATION FACTOR	20	

[A] THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM.

CONTINUED NEXT PAGE

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PLATE
625-2

NOV. 20
1939

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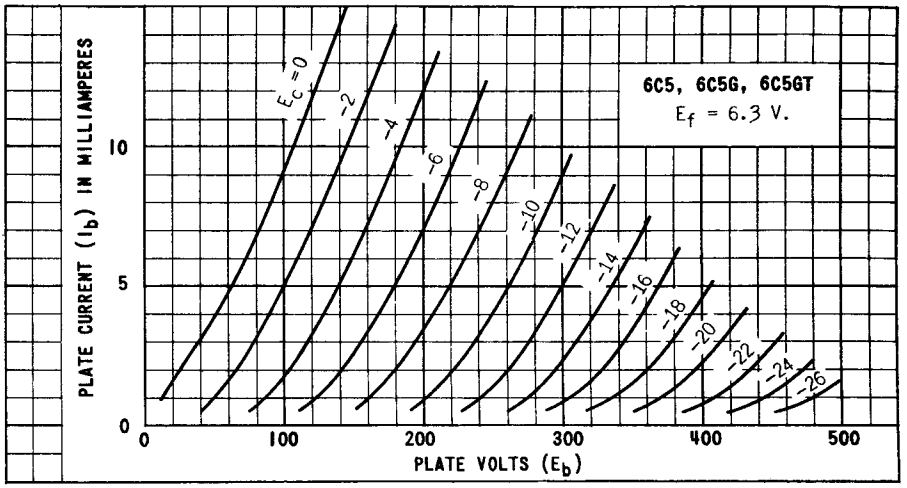
6C5, 6C5G, 6C5GT

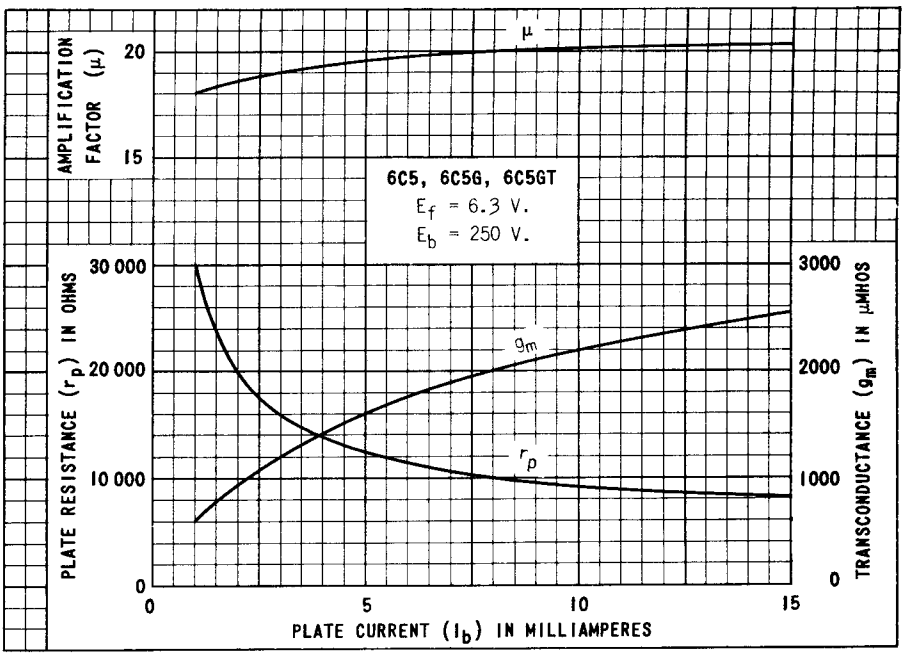
TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES[B]

	6C5	6C5G	6C5GT	
GRID TO CATHODE	3.0	4.4	3.6	μμf
PLATE TO CATHODE	11	12	11	μμf
GRID TO PLATE	2.0	2.2	1.6	μμf

[B] WITH SHELL OR SHIELD CONNECTED TO THE CATHODE





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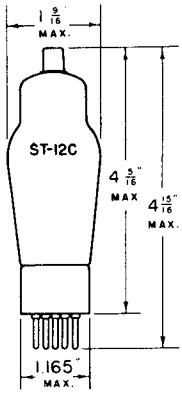


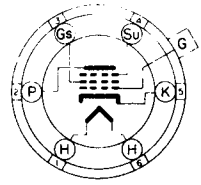
TRIPLE GRID
DETECTOR AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN BASE



6F

BOTTOM VIEW

THE TUNG-SOL 6C6 IS A TRIPLE GRID GENERAL PURPOSE DETECTOR AMPLIFIER. WITH THE EXCEPTION OF CAPACITANCES, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6J7G AND THE 6J7GT.

RATINGS

	TRIODE CONNECTION [D]	PENTODE CONNECTION	
MAXIMUM PLATE VOLTAGE	250	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	PLATE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	PLATE	125	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.75	0.75	WATTS
MAXIMUM SCREEN DISSIPATION	–	0.10	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE CONNECTION		PENTODE CONNECTION		
PLATE VOLTAGE	180	250	100	250	VOLTS
SCREEN VOLTAGE	PLATE	PLATE	100	100	VOLTS
CONTROL GRID VOLTAGE [A]	−5.3	−8	−3	−3	VOLTS
SUPPRESSOR GRID VOLTAGE	PLATE	PLATE	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	5.3	6.5	2.0	2.0	MA.
SCREEN CURRENT	–	–	0.5	0.5	MA.
PLATE RESISTANCE	.0110	.0105	1.0	– [B]	MEGOHM
TRANSCONDUCTANCE	1800	1900	1185	1225	μMHOS
AMPLIFICATION FACTOR	20	20	–	–	
CONTROL GRID BIAS [C]	–	–	−7	−7	VOLTS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM.

[B] GREATER THAN 1.0 MEGOHM

[C] FOR CATHODE CURRENT CUT-OFF

[D] SUPPRESSOR GRID AND SCREEN TIED TO PLATE

CONTINUED NEXT PAGE

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PLATE
895-4

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1940

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES[5]

	TRIODE CONNECTION	PENTODE CONNECTION	
CONTROL GRID TO CATHODE	3.0	5.0	μμf
PLATE TO CATHODE	10.5	6.5	μμf
CONTROL GRID TO PLATE MAX.	2.0	.007	μμf

[5] MEASURED WITH AN EXTERNAL SHIELD. THE INTERNAL SHIELD WITHIN THE DOME OF THE 6C6 IS CONNECTED TO THE CATHODE WITHIN THE TUBE.

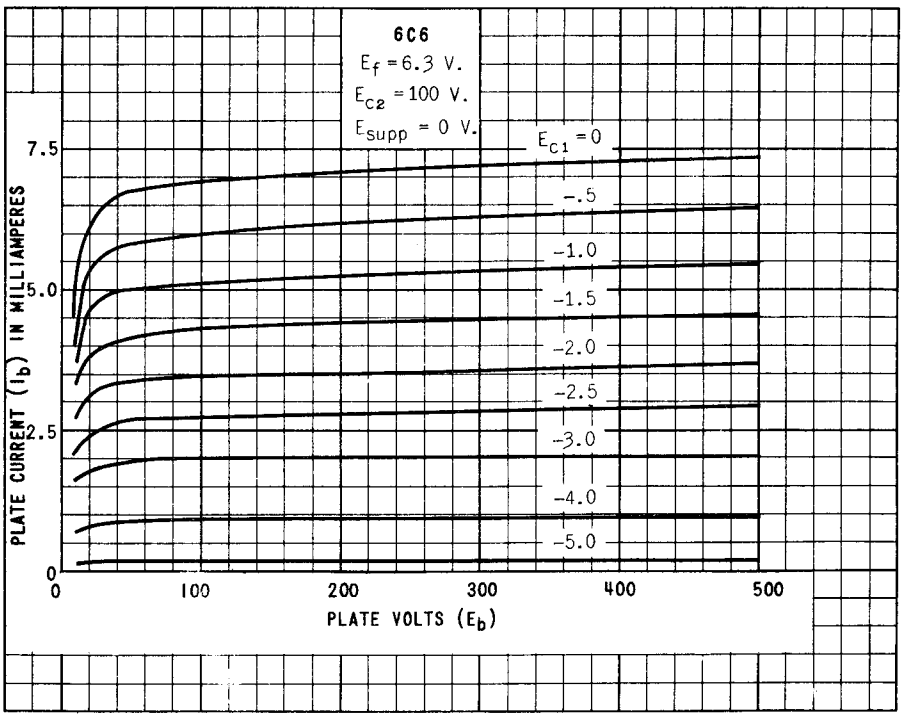

PLATE 896-2

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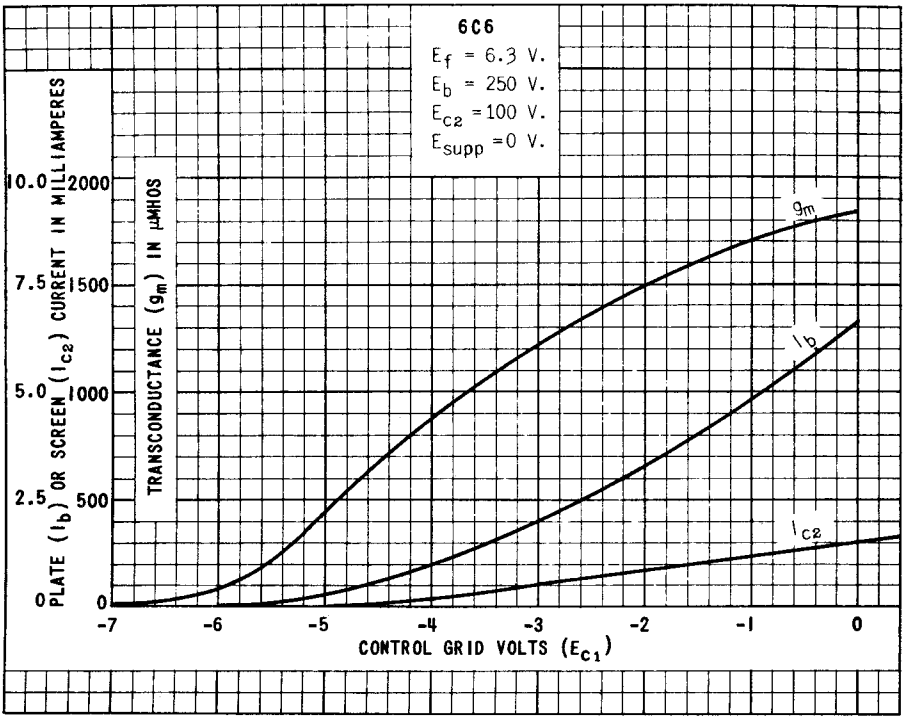

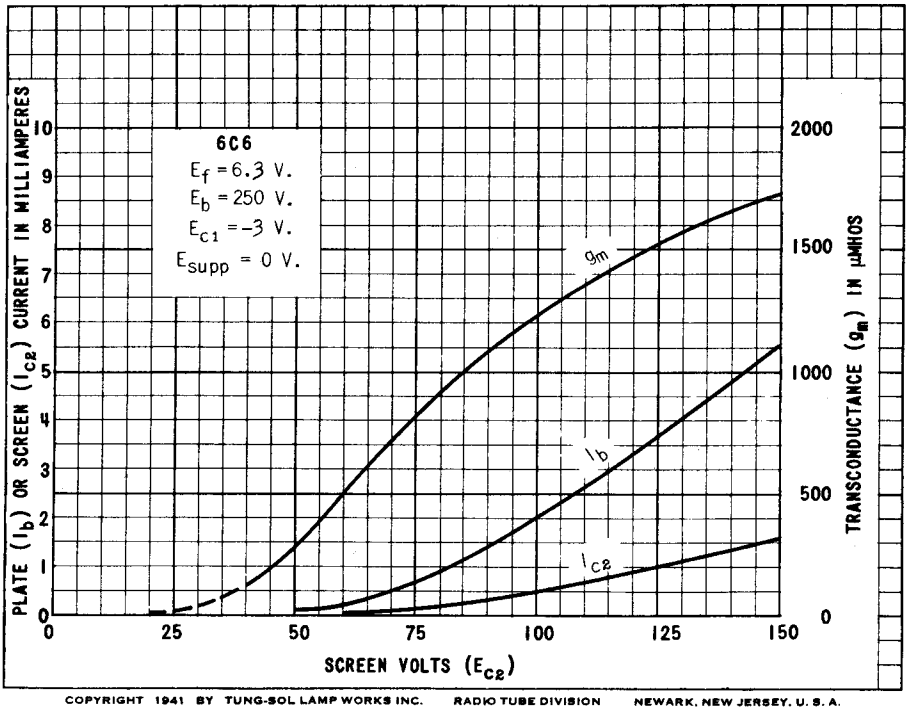

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PLATE
897-2

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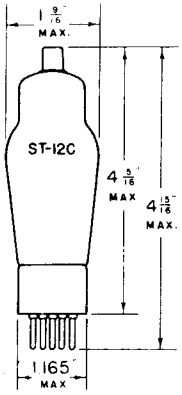
6C7

TUNG-SOL

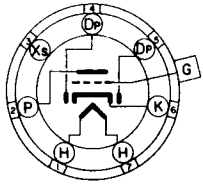


DUO-DIODE TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



7 G
BOTTOM VIEW

SMALL 7 PIN BASE

THE TUNG-SOL 6C7 CONSISTS OF TWO DIODES AND A TRIODE WITH A COMMON CATHODE. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6R7, 6R7G, AND THE 6R7GT.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-9.0	VOLTS
PLATE CURRENT	4.5	MA.
PLATE RESISTANCE	16 000	OHMS
TRANSCONDUCTANCE	1250	μMHOS
AMPLIFICATION FACTOR	20	

PLATE
898-1

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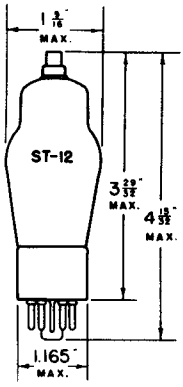
TUNG-SOL



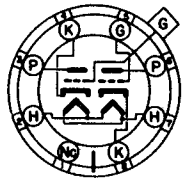
TWIN TRIODE AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 8 PIN OCTAL BASE



G-8G
BOTTOM VIEW

THE TUNG-SOL 6C8G IS A GENERAL PURPOSE TWIN TRIODE HAVING TWO INDEPENDENT UNITS, WITH ALL ELECTRODES BROUGHT OUT TO SEPARATE TERMINALS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE

PLATE VOLTAGE	250 MAX.	VOLTS
GRID VOLTAGE	−4.5	VOLTS
PLATE CURRENT	3.2	MA.
PLATE RESISTANCE	22 500	OHMS
TRANSCONDUCTANCE	1600	μMHOS
AMPLIFICATION FACTOR	36	

RESISTANCE COUPLED AMPLIFIER AND PHASE INVERTER

VALUES ARE FOR SINGLE TRIODE SECTION

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.1	0.5	0.1	0.5	MEGOHM
CATHODE RESISTOR	3500	12 000	3000	10 000	OHMS
VOLTAGE GAIN	20	22	22	26	

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE B	TRIODE T	
GRID TO CATHODE	3.4	2.5	μμf
PLATE TO CATHODE	3.5	3.9	μμf
GRID TO CATHODE	2.5	2.4	μμf
GRID TO GRID	0.1		μμf
PLATE TO PLATE	1.5		μμf

TRIODE B – TRIODE HAVING GRID BROUGHT OUT TO BASE PIN.
TRIODE T – TRIODE HAVING GRID BROUGHT OUT TO TOP CAP.
NOTE: THIS TUBE NOT RECOMMENDED FOR OPERATION IN SERIES WITH OTHER 0.3 AMPERE TUBES AS THE SURGE CURRENT MAY CAUSE HEATER BURNOUTS.

PLATE
459-2

JUNE 1
1939

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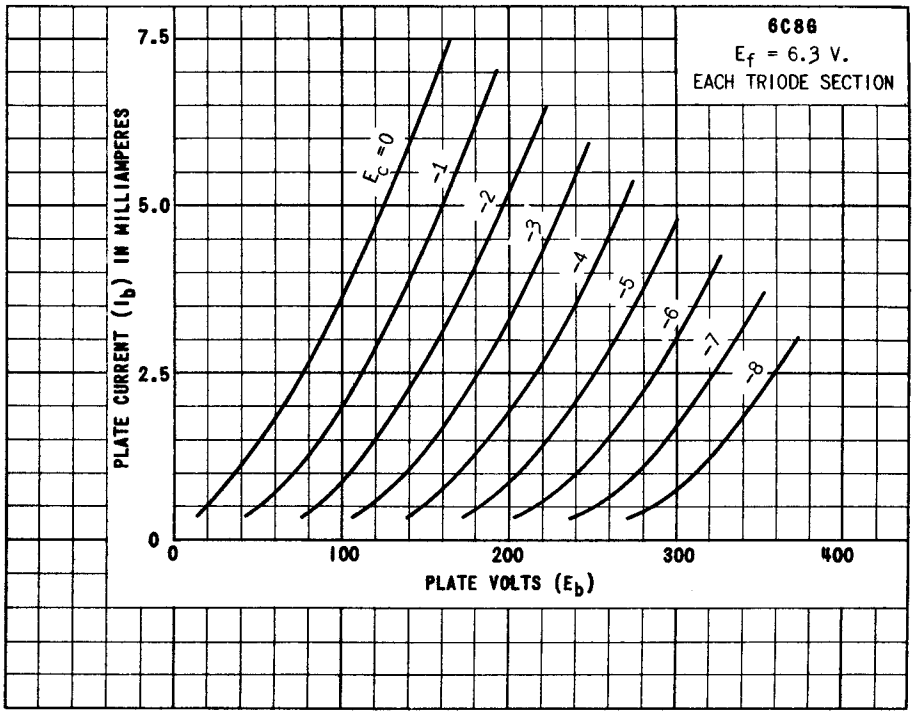
6C8G



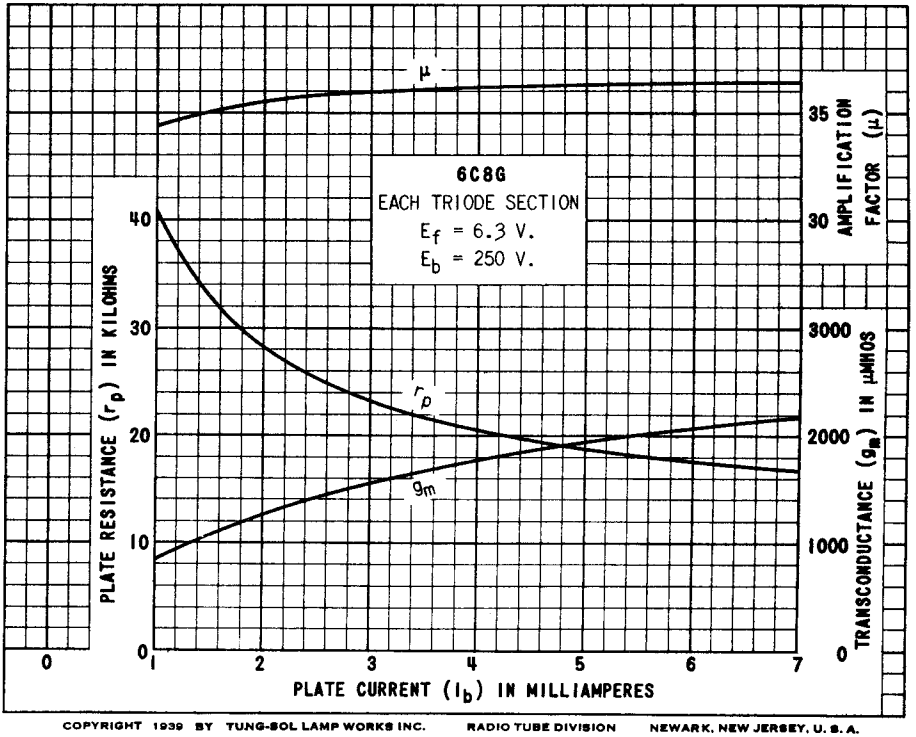


PLATE 460-1

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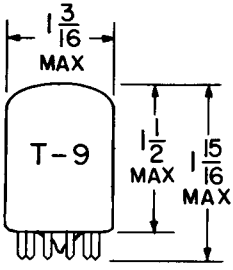
TUNG-SOL

TRIPLE TRIODE



GLASS BULB

BUTTON
12 PIN BASE E12-70

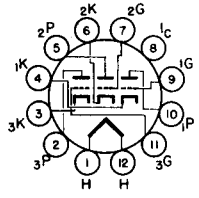
OUTLINE DRAWING
JEDEC 9-62

COATED UNIPOTENTIAL CATHODE

→HEATER NOMINAL

6.3 VOLTS 0.6±0.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BQ

THE 6C10 CONTAINS THREE HIGH-MU TRIODES WITH SEPARATE PIN CONNECTIONS FOR ALL THREE CATHODES, GRIDS AND PLATES IN A COMPACT T-9 GLASS ENVELOPE WITH THE NOVEL 12 PIN BASE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (EACH SECTION)	1.7	pf
INPUT (EACH SECTION)	1.6	pf
OUTPUT (SECTION 1)	0.30	pf
OUTPUT (SECTION 2)	0.24	pf
OUTPUT (SECTION 3)	0.34	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3±0.6	VOLTS
HEATER CURRENT	0.6±0.04	AMP.
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE	1.0	WATTS
MAXIMUM TOTAL PLATE DISSIPATION, ALL PLATES	3.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME*	11*	SECONDS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER
EACH SECTION

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1.0	-2.0	VOLTS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
PLATE CURRENT	0.5	1.2	MA.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] HEATER VOLTAGE SUPPLY VARIATIONS TO MAINTAIN HEATER VOLTAGE OR CURRENT WITHIN THE SPECIFIED RATINGS.

[*] THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO 3 TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

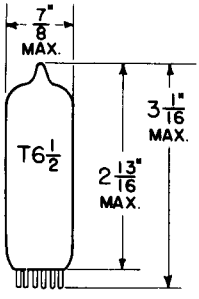
*INDICATES AN ADDITION.

→ INDICATES A CHANGE.

TUNG-SOL

TWIN DIODE

MINIATURE TYPE



GLASS BULB

6-4

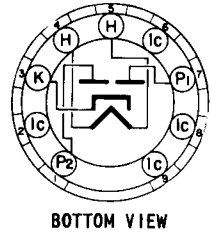
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 1.0 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN, BASE
9M

THE 6CA4 IS A HEATER-CATHODE TWIN DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR FULL-WAVE RECTIFIER OPERATION, AND ESPECIALLY SUITABLE FOR COMPACT AMPLIFIER DESIGNS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RECTIFIER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	1200	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT PER PLATE	500	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE, MAXIMUM DURATION 0.2 SECONDS	1.85	AMP.
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	500	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

AC PLATE VOLTAGE PER PLATE, RMS	250	300	350	VOLTS
FILTER INPUT CAPACITOR	50	50	50	μf
TOTAL PLATE-SUPPLY RESISTANCE PER PLATE	150	200	240	OHMS
DC OUTPUT CURRENT	150	150	150	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	245	293	347	VOLTS
TUBE VOLTAGE DROP				
I_b= 150 MA. DC PER PLATE			20	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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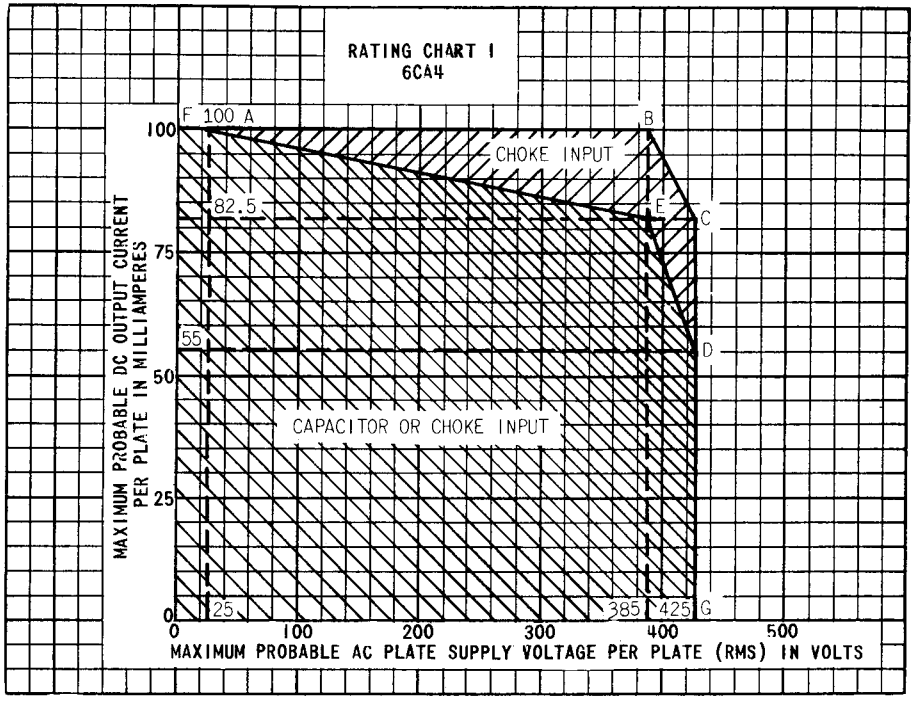
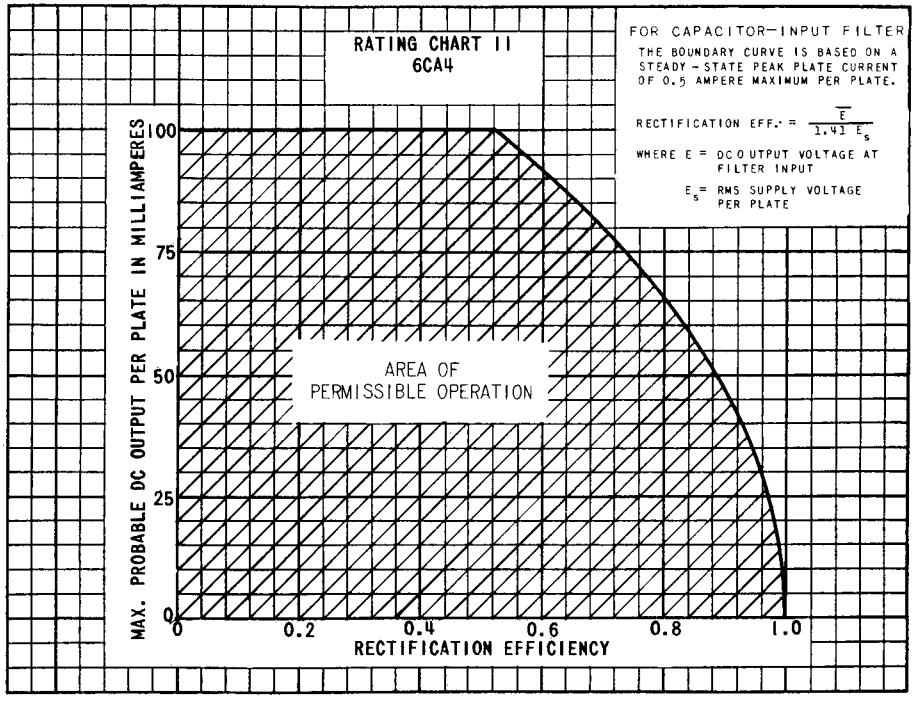
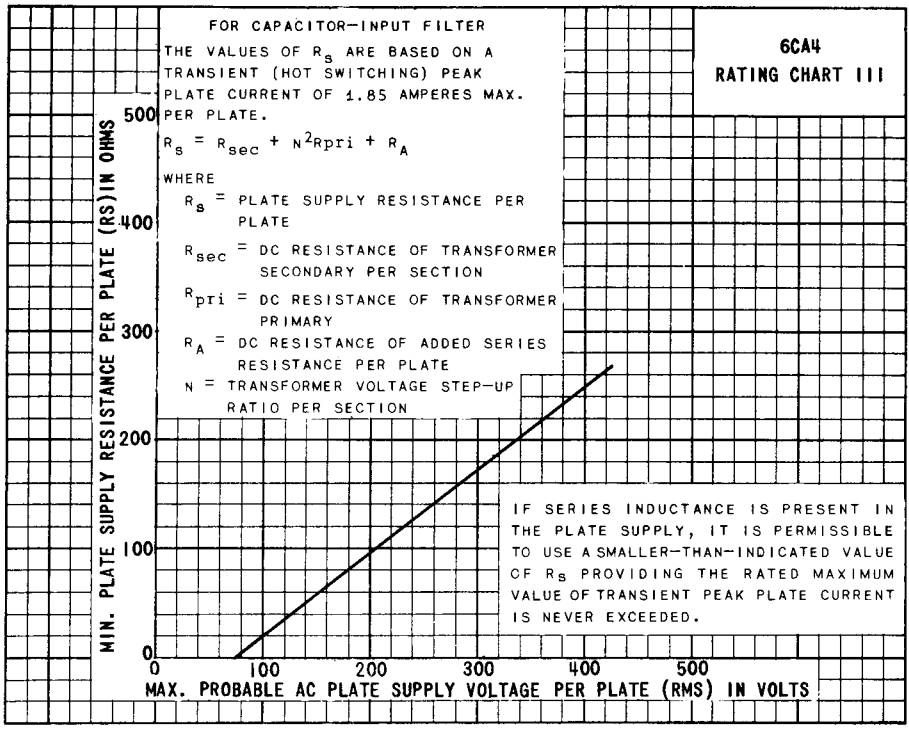
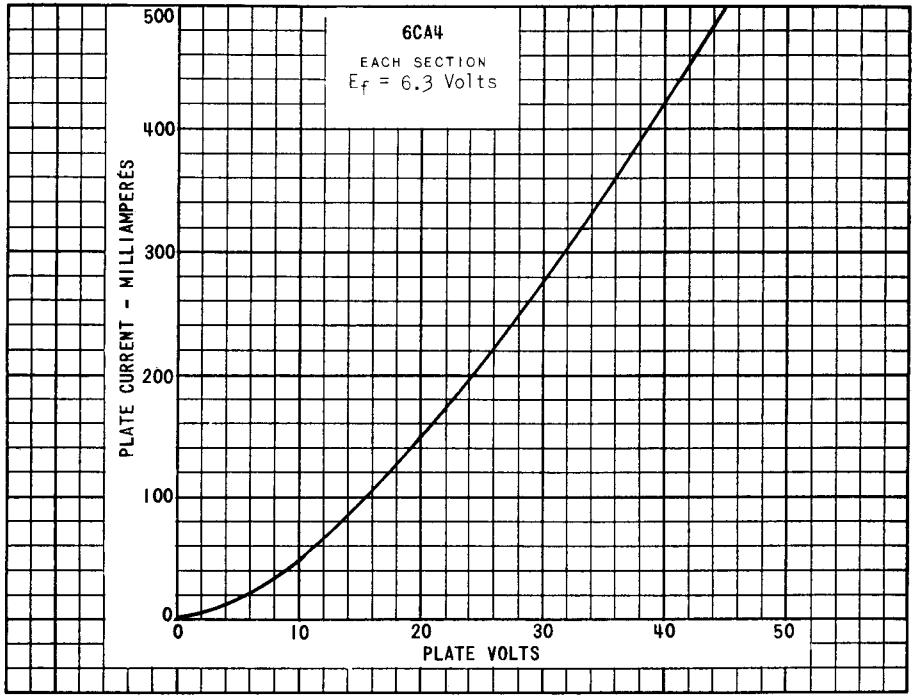
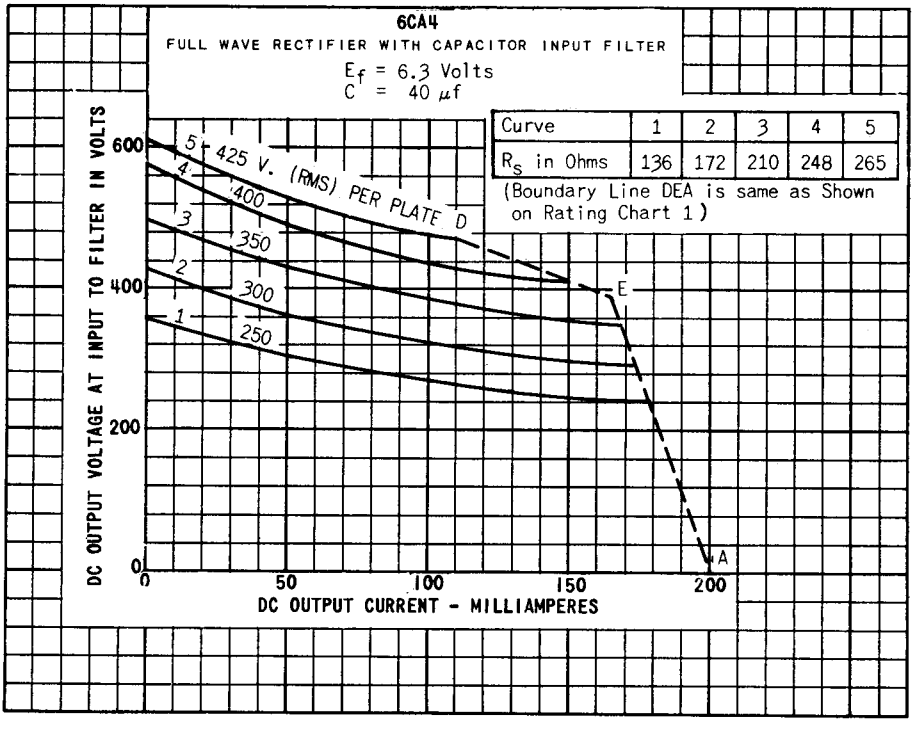
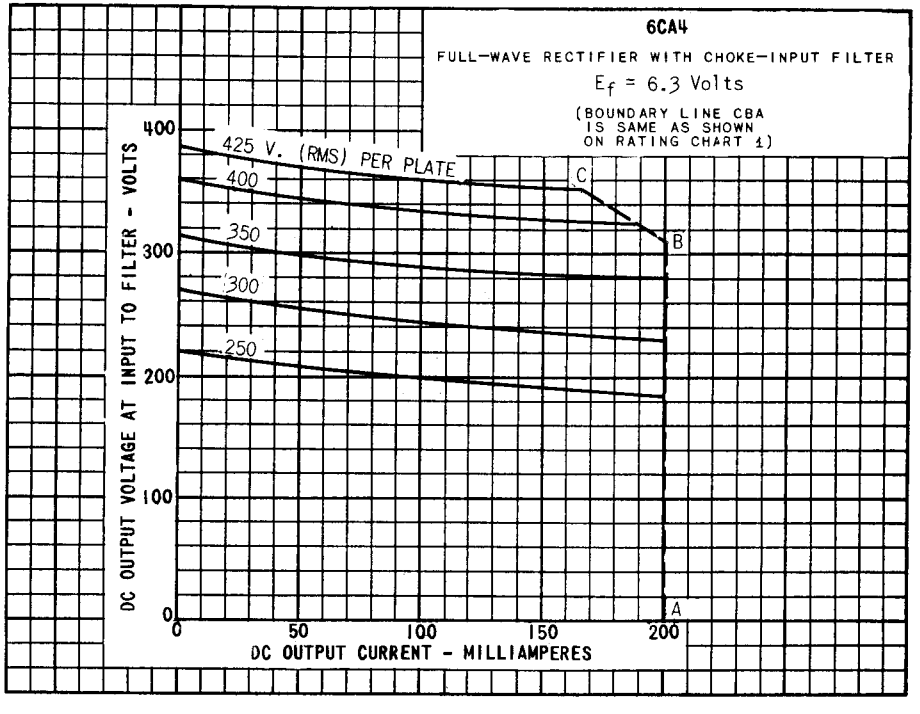

RATING CHART I
6CA4
F 100 A
B
CHOKE INPUT
82.5
E
C
55
D
CAPACITOR OR CHOKE INPUT
25
385
425
G
MAXIMUM PROBABLE DC OUTPUT CURRENT PER PLATE IN MILLIAMPERES
100
75
50
25
0
0
100
200
300
400
500
MAXIMUM PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) IN VOLTS


RATING CHART II
6CA4
FOR CAPACITOR-INPUT FILTER
THE BOUNDARY CURVE IS BASED ON A STEADY-STATE PEAK PLATE CURRENT OF 0.5 AMPERE MAXIMUM PER PLATE.
RECTIFICATION EFF. = $\frac{\overline{E}}{1.41\ E_s}$
WHERE $\overline{E}$ = DC OUTPUT VOLTAGE AT FILTER INPUT
E_s = RMS SUPPLY VOLTAGE PER PLATE
AREA OF PERMISSIBLE OPERATION
MAX. PROBABLE DC OUTPUT PER PLATE IN MILLIAMPERES
100
75
50
25
0
0
0.2
0.4
0.6
0.8
1.0
RECTIFICATION EFFICIENCY


FOR CAPACITOR-INPUT FILTER
THE VALUES OF R_s ARE BASED ON A TRANSIENT (HOT SWITCHING) PEAK PLATE CURRENT OF 1.85 AMPERES MAX. PER PLATE.
$R_s = R_{sec} + N^2R_{pri} + R_A$
WHERE
R_s = PLATE SUPPLY RESISTANCE PER PLATE
R_{sec} = DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION
R_{pri} = DC RESISTANCE OF TRANSFORMER PRIMARY
R_A = DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE
N = TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION
6CA4
RATING CHART III
IF SERIES INDUCTANCE IS PRESENT IN THE PLATE SUPPLY, IT IS PERMISSIBLE TO USE A SMALLER-THAN-INDICATED VALUE OF R_s PROVIDING THE RATED MAXIMUM VALUE OF TRANSIENT PEAK PLATE CURRENT IS NEVER EXCEEDED.
MIN. PLATE SUPPLY RESISTANCE PER PLATE (RS) IN OHMS
0
100
200
300
400
500
0
100
200
300
400
500
MAX. PROBABLE AC PLATE SUPPLY VOLTAGE PER PLATE (RMS) IN VOLTS


6CA4
EACH SECTION
E_f = 6.3 Volts
PLATE CURRENT - MILLIAMPERES
0
100
200
300
400
500
0
10
20
30
40
50
PLATE VOLTS

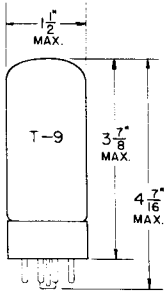

6CA4
FULL WAVE RECTIFIER WITH CAPACITOR INPUT FILTER
E_f = 6.3 Volts
C = 40 μf
Curve | 1 | 2 | 3 | 4 | 5
R_s in Ohms | 136 | 172 | 210 | 248 | 265
(Boundary Line DEA is same as Shown on Rating Chart 1)
DC OUTPUT VOLTAGE AT INPUT TO FILTER IN VOLTS
600
400
200
0
5
4
3
2
1
425 V. (RMS) PER PLATE
400
350
300
250
D
E
A
0
50
100
150
200
DC OUTPUT CURRENT - MILLIAMPERES


6CA4
FULL-WAVE RECTIFIER WITH CHOKE-INPUT FILTER
E_f = 6.3 Volts
(BOUNDARY LINE CBA IS SAME AS SHOWN ON RATING CHART 1)
DC OUTPUT VOLTAGE AT INPUT TO FILTER - VOLTS
400
300
200
100
0
425 V. (RMS) PER PLATE
400
350
300
250
C
B
A
0
50
100
150
200
DC OUTPUT CURRENT - MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

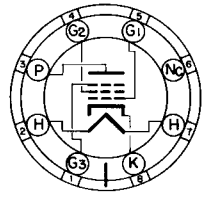
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.5 AMPS.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
8 PIN OCTAL

8ET

THE 6CA7 IS A POWER PENTODE OF THE GLASS OCTAL TYPE. THIS TUBE IS SUITABLE FOR ALL APPLICATIONS WHICH REQUIRE PEAK POWERS OF UP TO 11 WATTS FROM A SINGLE TUBE OR UP TO 100 WATTS FROM TWO TUBES IN THE NORMAL PUSH-PULL ARRANGEMENT. IT IS EQUALLY SUITABLE FOR DOMESTIC AMPLIFIERS AND PUBLIC ADDRESS EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT PLATE	15.5	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	7.2	μμf
PLATE TO GRID #1 (MAX.)	1.0	μμf
GRID #1 TO HEATER (MAX.)	1.0	μμf
HEATER TO CATHODE	11	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	800	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	2000	VOLTS
MAXIMUM PLATE DISSIPATION	25	WATTS
MAXIMUM PLATE DISSIPATION WITHOUT INPUT SIGNAL	27.5	WATTS
MAXIMUM GRID #2 VOLTAGE	425	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT PLATE CURRENT	800	VOLTS
MAXIMUM GRID #2 DISSIPATION	8	WATTS
CATHODE CURRENT	150	MAMPS
MAXIMUM GRID CURRENT STARTING POINT. GRID #1 VOLTAGE WHEN GRID #1 CURRENT IS 0.3μAMP	-1.3	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CLASS A & AB)	0.7	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CLASS B)	0.5	MEGOHM
MAXIMUM EXTERNAL RESISTANCE BETWEEN HEATER AND CATHODE	20000	OHMS
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A - ONE TUBE

HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		1.5		AMPS.
SUPPLY VOLTAGE	265		265	VOLTS
PLATE VOLTAGE	250		250	VOLTS
GRID #2 SERIES RESISTOR	2000		0	OHMS
GRID #3 VOLTAGE	0		0	VOLT
GRID #1 BIAS	−14.5		−13.5	VOLTS
PLATE CURRENT	70		100	MAMPS
GRID #2 CURRENT	10		15	MAMPS
TRANSCONDUCTANCE	9000		11000	μMHOS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	11		11	
PLATE RESISTANCE	18000		15000	OHMS
PLATE LOAD RESISTANCE	3000		2000	OHMS
INPUT VOLTAGE (RMS)	9.3		8.7	VOLTS
MAX. SIGNAL POWER OUTPUT	8		11	WATTS
TOTAL HARMONIC DISTORTION	10		10	PERCENTS
INPUT VOLTAGE FOR POWER OUTPUT OF 50 MWATTS (RMS)	0.65		0.5	VOLT

CLASS B - TWO TUBES

SUPPLY VOLTAGE 425 VOLTS

COMMON GRID #2 RESISTOR		1000		OHMS
GRID #1 BIAS		−38		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT BOLTAGE (RMS)	0	27	27	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	−	3400	4000	OHMS
SUPPLY VOLTAGE	425	425	400	VOLTS
PLATE VOLTAGE	420	400	375	VOLTS
PLATE CURRENT	2X30	2X120	2X100	MAMPS
GRID #2 CURRENT	2X4.4	2X25	2X25	MAMPS
MAX. SIGNAL POWER OUTPUT	0	55	45	WATTS
TOTAL HARMONIC DISTORTION	−	5	6	PERCENTS

CLASS B - TWO TUBES

SUPPLY BOLTAGE 375 VOLTS

COMMON GRID #2 RESISTOR		470		OHMS
GRID #1 BIAS		−32		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT VOLTAGE (RMS)	0	22.7	22.7	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	−	2800	3800	OHMS
SUPPLY VOLTAGE	375	375	350	VOLTS
PLATE VOLTAGE	370	350	325	VOLTS
PLATE CURRENT	2X35	2X120	2X93	MAMPS
GRID #2 CURRENT	2X4.7	2X25	2X25	MAMPS
MAX. SIGNAL POWER OUTPUT	0	44	36	WATTS
TOTAL HARMOINIC DISTORTION	−	5	6	PERCENTS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

(CONT'D.)

CLASS B - TWO TUBES

SUPPLY VOLTAGE 500/400 VOLTS

COMMON GRID #2 RESISTOR		750		OHMS
GRID #1 BIAS		-36		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT VOLTAGE (RMS)	0	25.8	25.8	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	-	4000	5000	OHMS
PLATE SUPPLY VOLTAGE	500	500	475	VOLTS
PLATE VOLTAGE	495	475	450	VOLTS
GRID #2 SUPPLY VOLTAGE	400	400	375	VOLTS
PLATE CURRENT	2X30	2X125	2X102	MAMPS
GRID #2 CURRENT	2X4	2X25	2X25	MAMPS
MAX. SIGNAL POWER OUTPUT	0	70	58	WATTS
TOTAL HARMONIC DISTORTION	-	5	6	PERCENTS

CLASS B - TWO TUBES

SUPPLY VOLTAGE 800/400 VOLTS

COMMON GRID #2 RESISTOR		750		OHMS
GRID #1 BIAS		-39		VOLTS
GRID #3 VOLTAGE		0		VOLT
INPUT VOLTAGE (RMS)	0	23.4	23.4	VOLTS
LOAD RESISTANCE, PLATE TO PLATE	-	11000	11000	OHMS
PLATE SUPPLY VOLTAGE	800	800	750	VOLTS
PLATE VOLTAGE	795	775	725	VOLTS
GRID #2 SUPPLY VOLTAGE	400	400	375	VOLTS
PLATE CURRENT	2X25	2X91	2X84	MAMPS
GRID #2 CURRENT	2X3	2X19	2X19	MAMPS
MAX. SIGNAL POWER OUTPUT	0	100	90	WATTS
TOTAL HARMONIC DISTORTION	-	5	6	PERCENTS

CLASS AB - TWO TUBES

SUPPLY VOLTAGE 375 VOLTS

LOAD RESISTANCE, PLATE TO PLATE		3400	OHMS
COMMON GRID #2 RESISTOR		470	OHMS
CATHODE RESISTOR		130	OHMS
GRID #3 VOLTAGE		0	VOLT
INPUT VOLTAGE (RMS)	0	21	VOLTS
SUPPLY VOLTAGE	375	375	VOLTS
PLATE VOLTAGE +VOLTAGE ACROSS CATHODE RESISTOR	355	350	VOLTS
PLATE CURRENT	2X75	2X95	MAMPS
GRID #2 CURRENT	2X11.5	2X22.5	MAMPS
MAX. SIGNAL POWER OUTPUT	0	35	WATTS
TOTAL HARMONIC DISTORTION	-	5	PERCENTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

(CONT'D.)

IN TRIODE CONNECTION

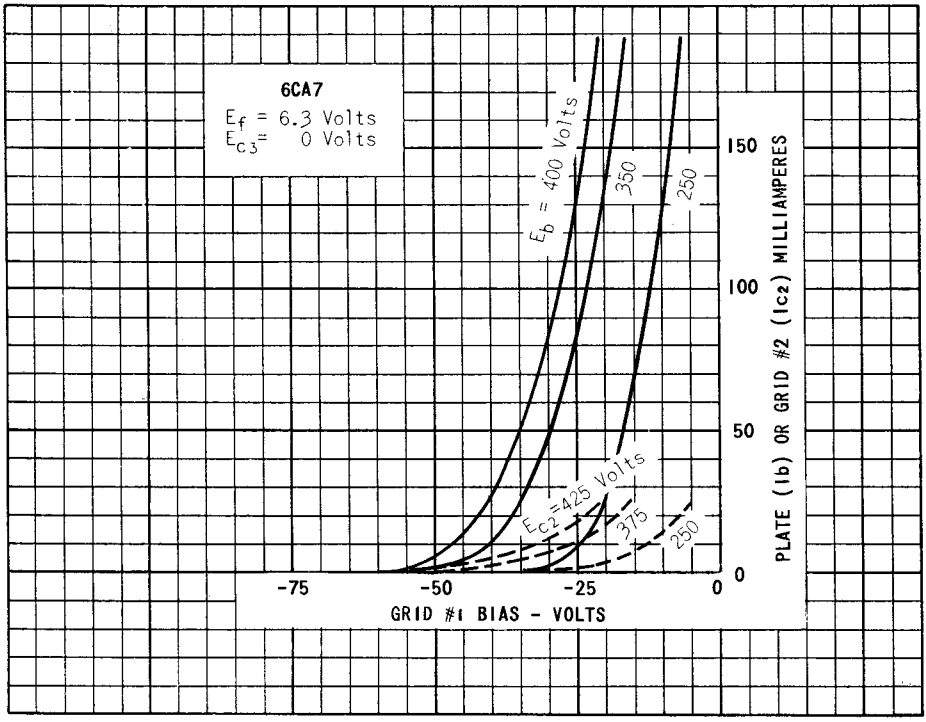
(GRID #2 CONNECTED TO PLATE)
CLASS A, ONE TUBE, SUPPLY VOLTAGE 375 VOLTS

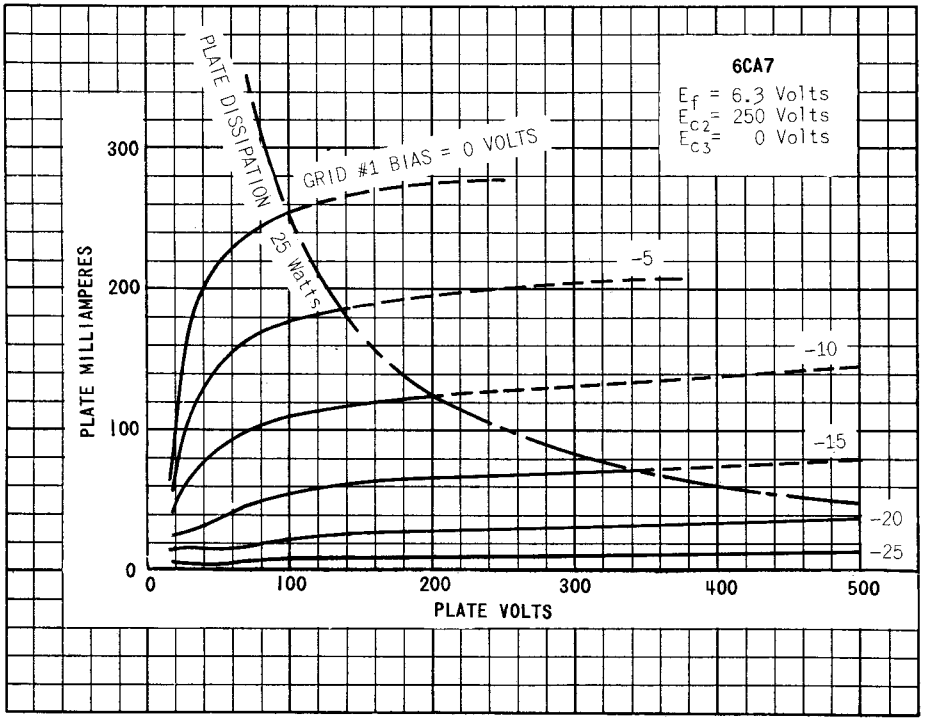
SUPPLY VOLTAGE	375	VOLTS
GRID #3 VOLTAGE	0	VOLT
CATHODE RESISTOR	370	OHMS
LOAD RESISTANCE	3000	OHMS
INPUT VOLTAGE (RMS)	18.9	VOLTS
PLATE CURRENT	70	MAMPS
MAX. SIGNAL POWER OUTPUT	6	WATTS
TOTAL HARMONIC DISTORTION	8	PERCENTS
INPUT VOLTAGE FOR POWER OUTPUT OF 50 MILLIWATTS (RMS)	1.7	VOLTS

IN TRIODE CONNECTION

(GRID #2 CONNECTED TO PLATE)
CLASS AB, TWO TUBES, SUPPLY VOLTAGE 400 VOLTS

SUPPLY VOLTAGE	400		VOLTS
GRID #3 VOLTAGE	0		VOLT
CATHODE RESISTOR	220		OHMS
LOAD RESISTANCE, PLATE TO PLATE	5000		OHMS
INPUT VOLTAGE (RMS)	0	22	VOLTS
PLATE CURRENT	2X65	2X71	MAMPS
MAX. SIGNAL POWER OUTPUT	0	16.5	WATTS
TOTAL HARMONIC DISTORTION	–	3	PERCENTS





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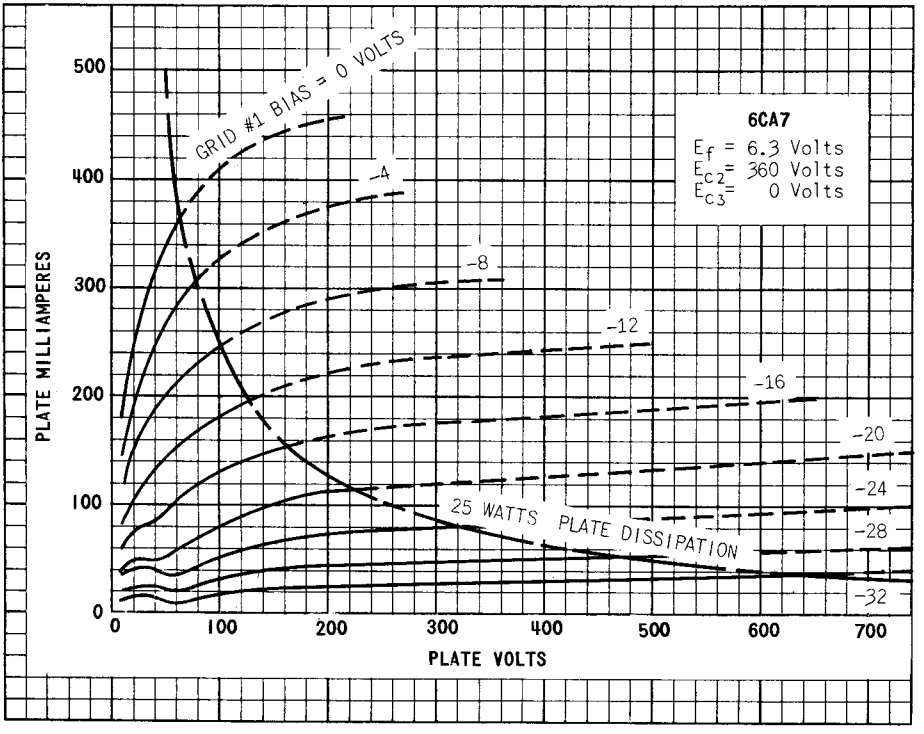
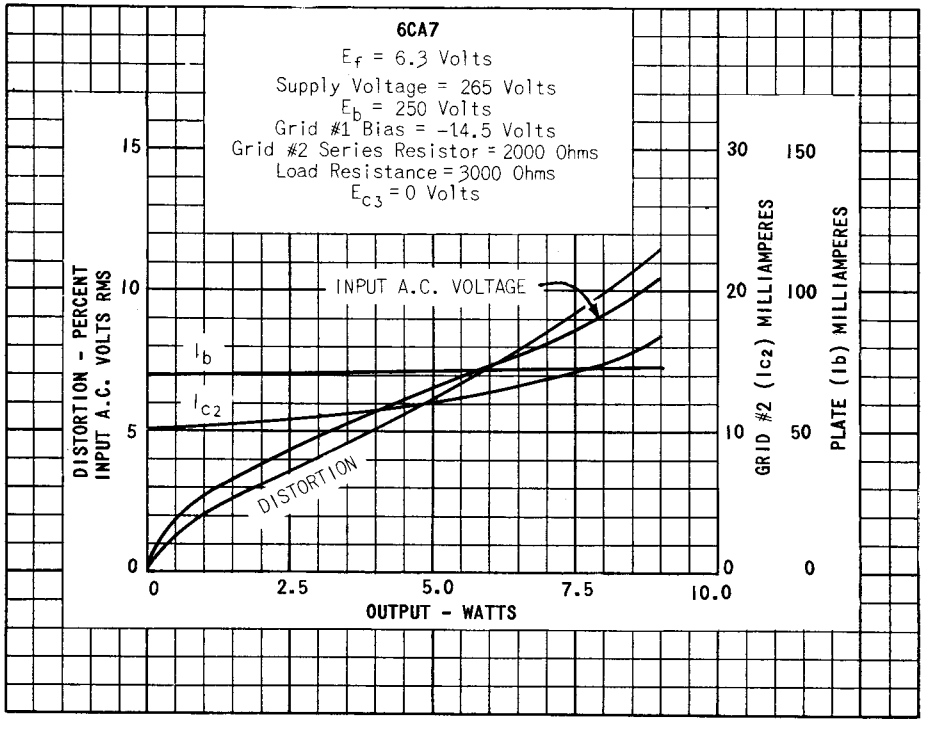
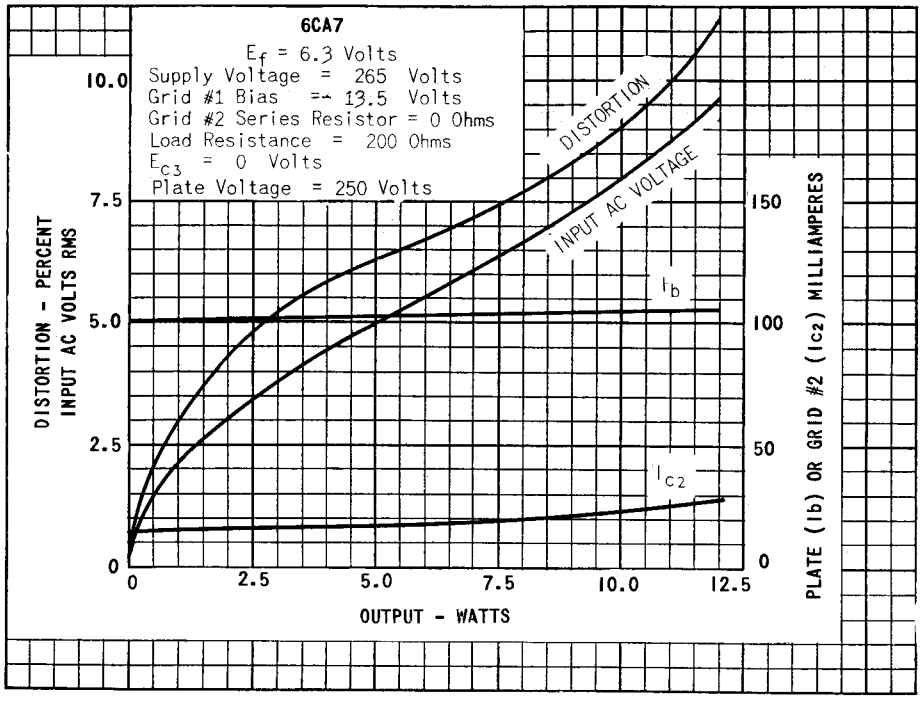
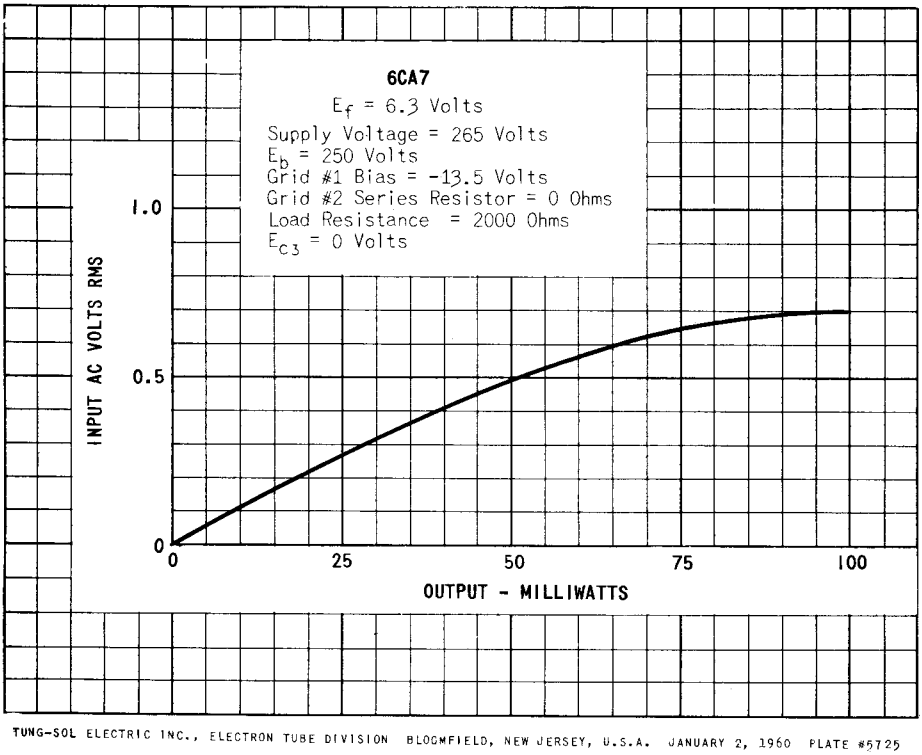
TENTATIVE DATA









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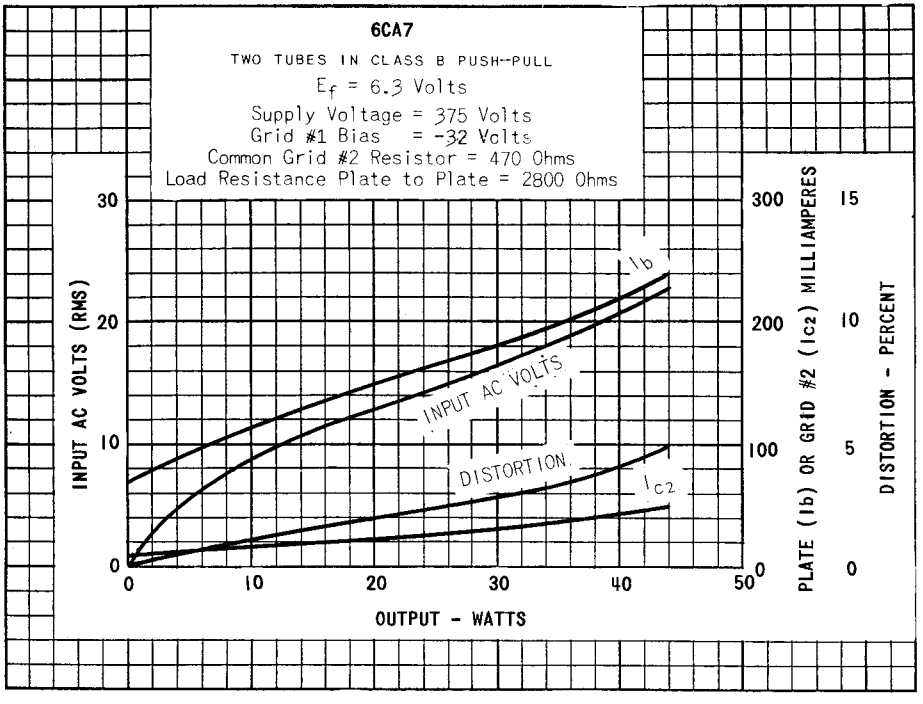
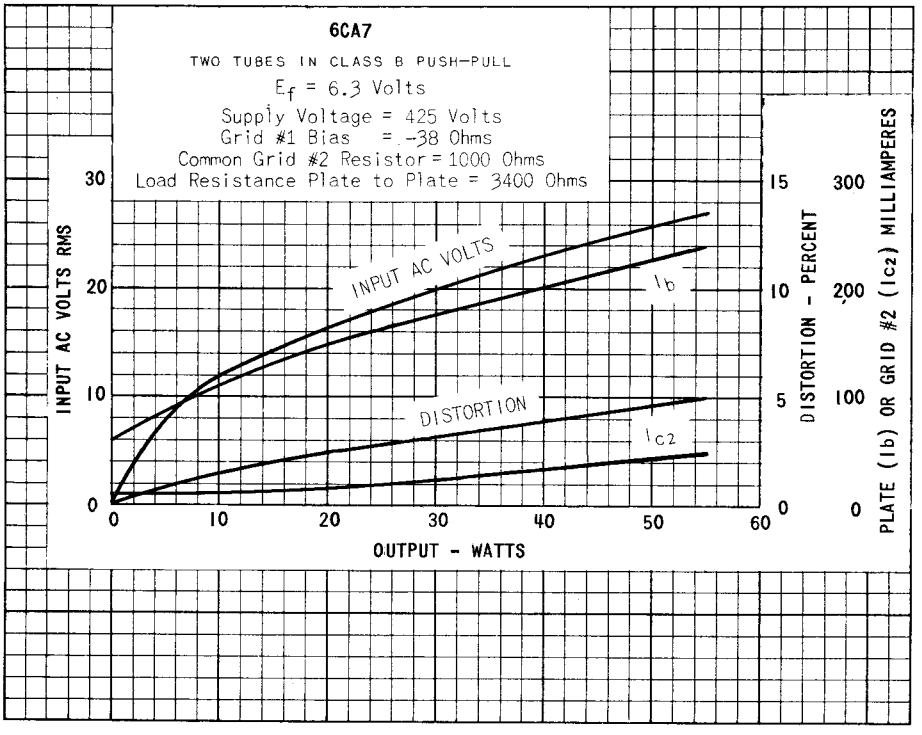
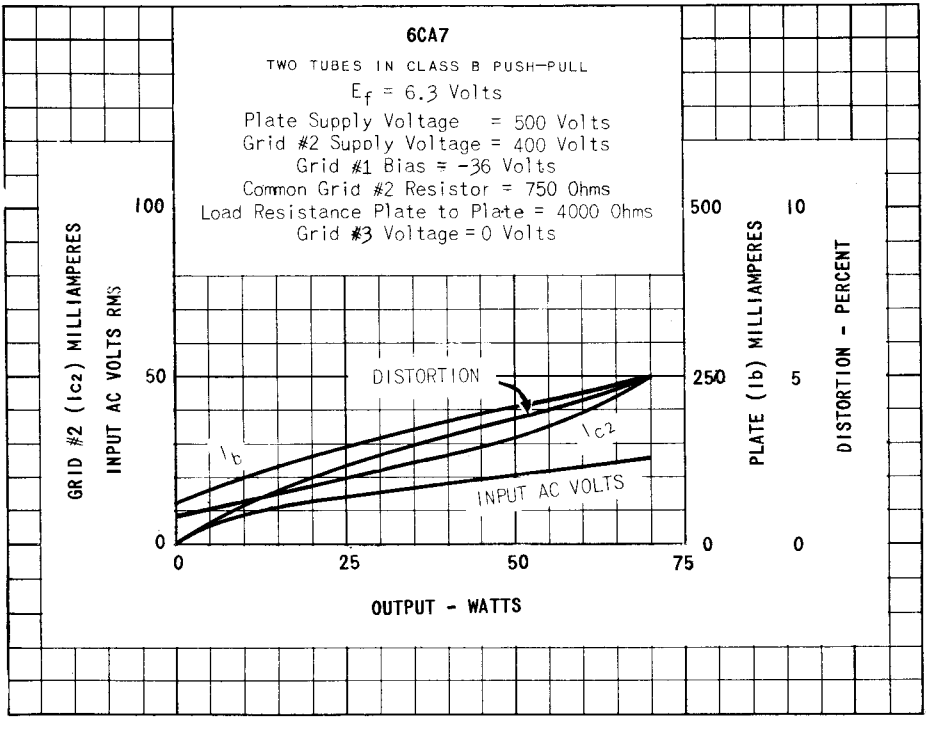
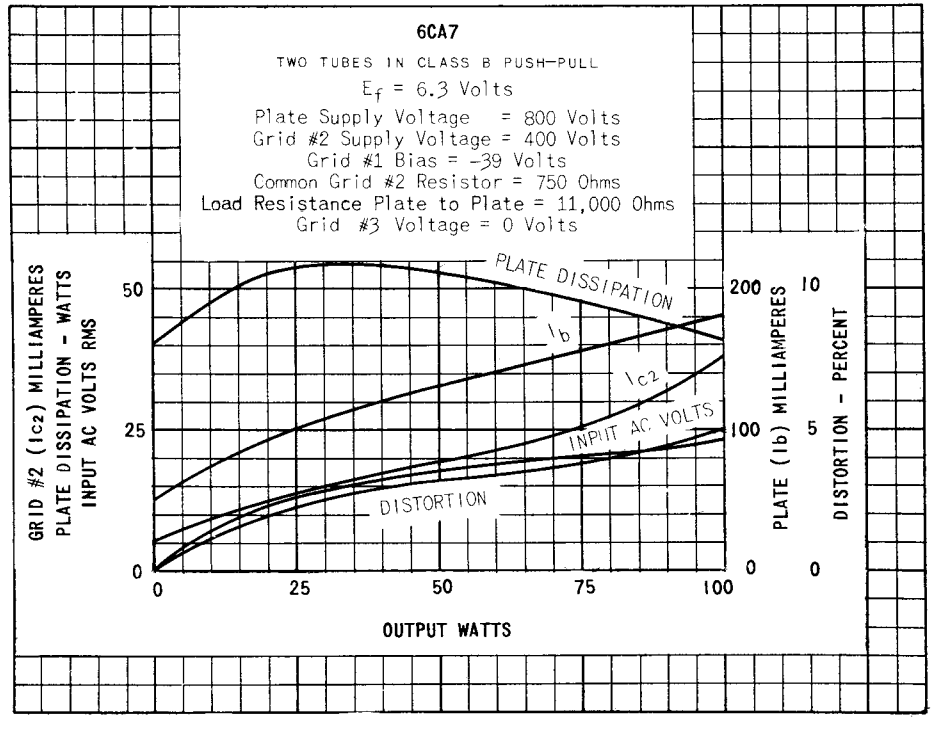

6CA7
TWO TUBES IN CLASS B PUSH-PULL
E_f = 6.3 Volts
Supply Voltage = 375 Volts
Grid #1 Bias = -32 Volts
Common Grid #2 Resistor = 470 Ohms
Load Resistance Plate to Plate = 2800 Ohms
INPUT AC VOLTS (RMS)
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
DISTORTION - PERCENT
INPUT AC VOLTS
DISTORTION
I_b
I_{c2}
OUTPUT - WATTS


6CA7
TWO TUBES IN CLASS B PUSH-PULL
E_f = 6.3 Volts
Supply Voltage = 425 Volts
Grid #1 Bias = -38 Ohms
Common Grid #2 Resistor = 1000 Ohms
Load Resistance Plate to Plate = 3400 Ohms
INPUT AC VOLTS RMS
DISTORTION - PERCENT
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
INPUT AC VOLTS
DISTORTION
I_b
I_{c2}
OUTPUT - WATTS





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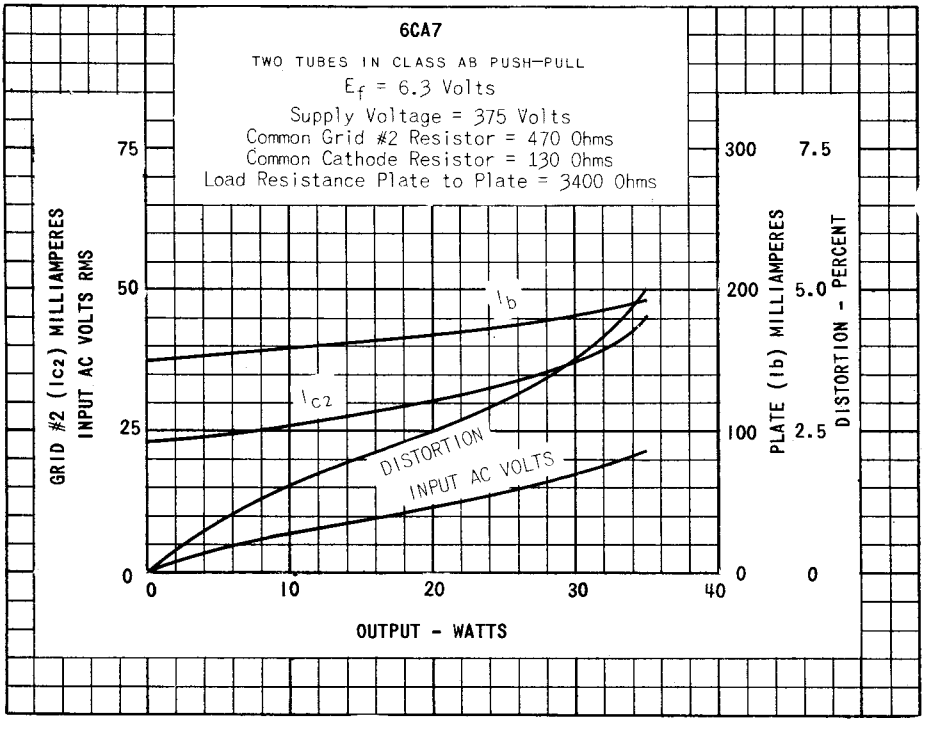
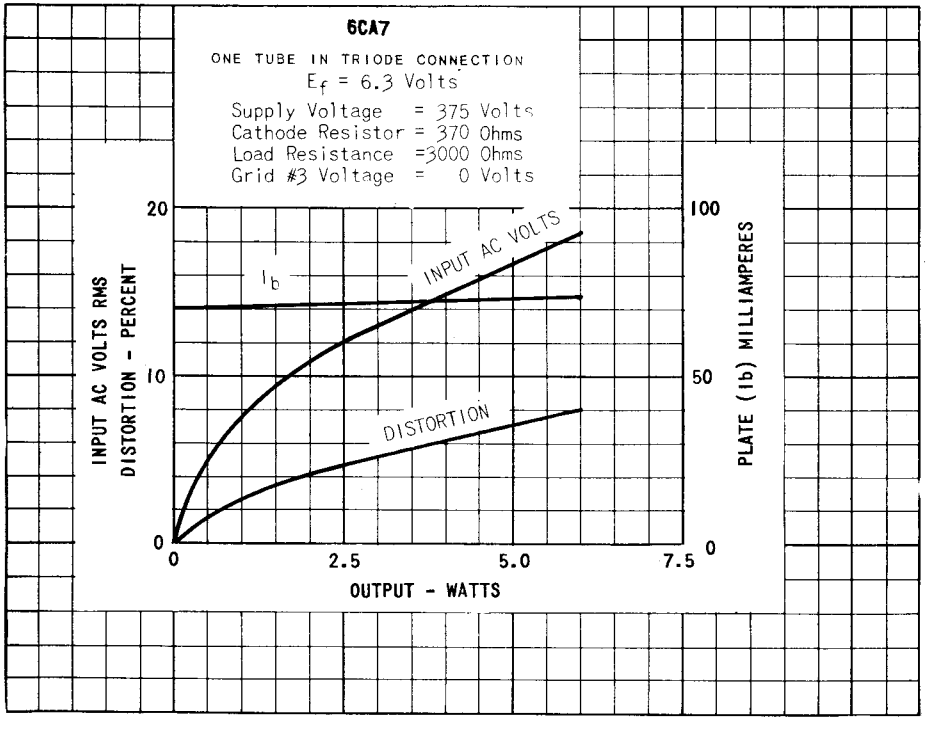
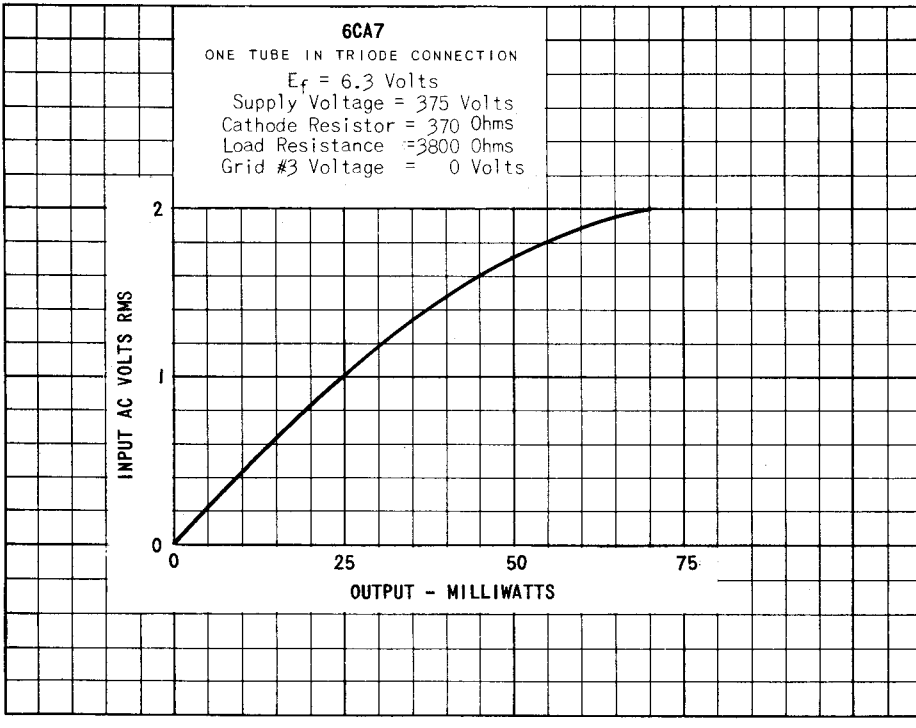
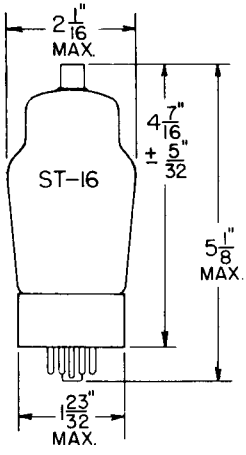

6CA7
TWO TUBES IN CLASS AB PUSH-PULL
E_f = 6.3 Volts
Supply Voltage = 375 Volts
Common Grid #2 Resistor = 470 Ohms
Common Cathode Resistor = 130 Ohms
Load Resistance Plate to Plate = 3400 Ohms
GRID #2 (I_{c2}) MILLIAMPERES
INPUT AC VOLTS RMS
PLATE (I_b) MILLIAMPERES
DISTORTION - PERCENT
I_b
I_{c2}
DISTORTION
INPUT AC VOLTS
OUTPUT - WATTS
0
10
20
30
40
25
50
75
100
200
300
2.5
5.0
7.5


6CA7
ONE TUBE IN TRIODE CONNECTION
E_f = 6.3 Volts
Supply Voltage = 375 Volts
Cathode Resistor = 370 Ohms
Load Resistance =3000 Ohms
Grid #3 Voltage = 0 Volts
INPUT AC VOLTS RMS
DISTORTION - PERCENT
PLATE (I_b) MILLIAMPERES
I_b
INPUT AC VOLTS
DISTORTION
OUTPUT - WATTS
0
2.5
5.0
7.5
10
20
50
100


6CA7
ONE TUBE IN TRIODE CONNECTION
E_f = 6.3 Volts
Supply Voltage = 375 Volts
Cathode Resistor = 370 Ohms
Load Resistance =3800 Ohms
Grid #3 Voltage = 0 Volts
INPUT AC VOLTS RMS
2
1
0
0
25
50
75
OUTPUT - MILLIWATTS

TUNG-SOL

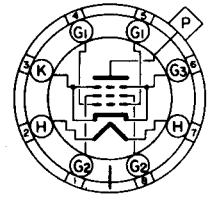


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT JUMBO SHELL
8 PIN OCTAL
8GD

THE 6CB5 IS A HIGH-PERVEANCE BEAM POWER TUBE. IT IS DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER TUBE IN COLOR TELEVISION. ITS FEATURES INCLUDE LOW AMPLIFICATION, HIGH PLATE CURRENT AT LOW PLATE VOLTAGE, AND A HIGH OPERATING RATIO OF PLATE CURRENT TO GRID #2 CURRENT.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.8	μμf
INPUT	24	μμf
OUTPUT	10	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK-HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (DC AND BOOST)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	6 800[D]	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	-1 500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	-200	VOLTS
MAXIMUM DC PLATE CURRENT	200	MA.
MAXIMUM GRID #2 INPUT	3.6	WATTS
MAXIMUM PLATE DISSIPATION	23	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM

[A] EXCEPT AS NOTED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[C] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

[D] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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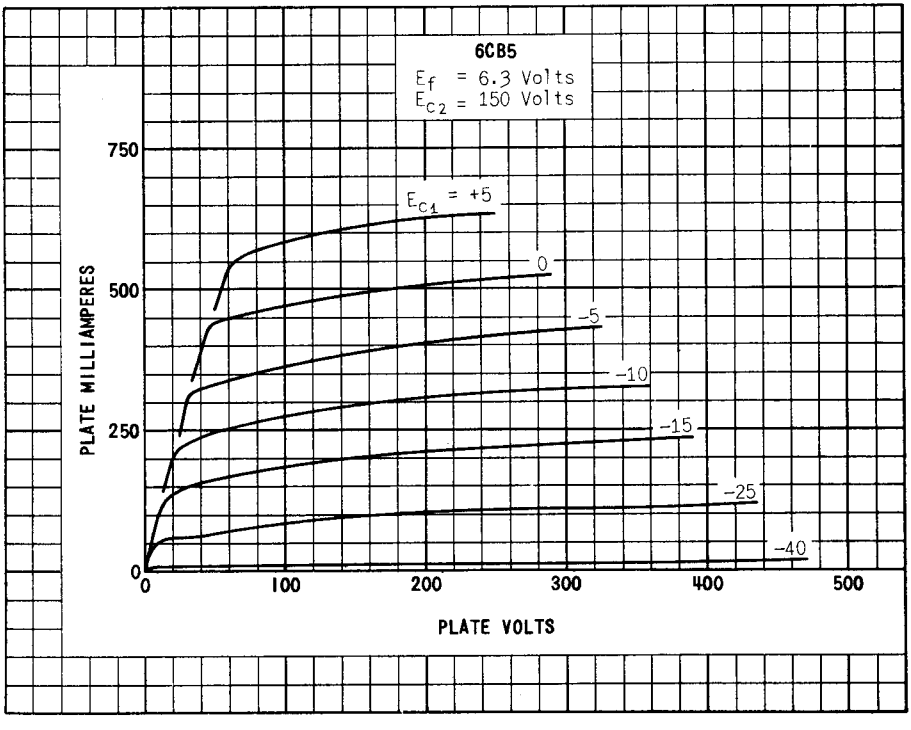
TUNG-SOL

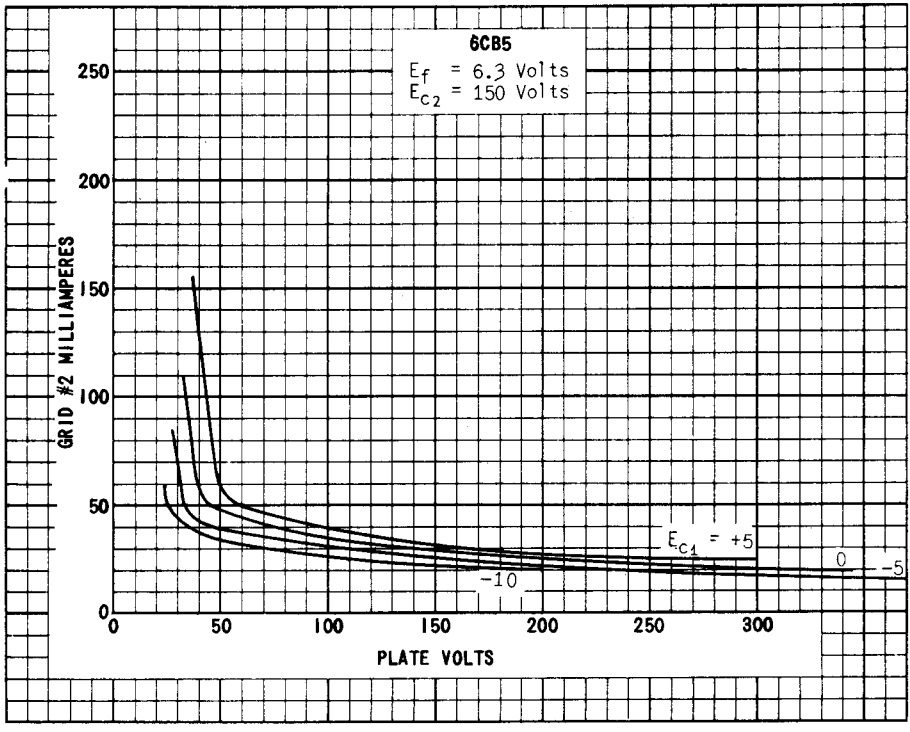
CONTINUED FROM PRECEDING PAGE

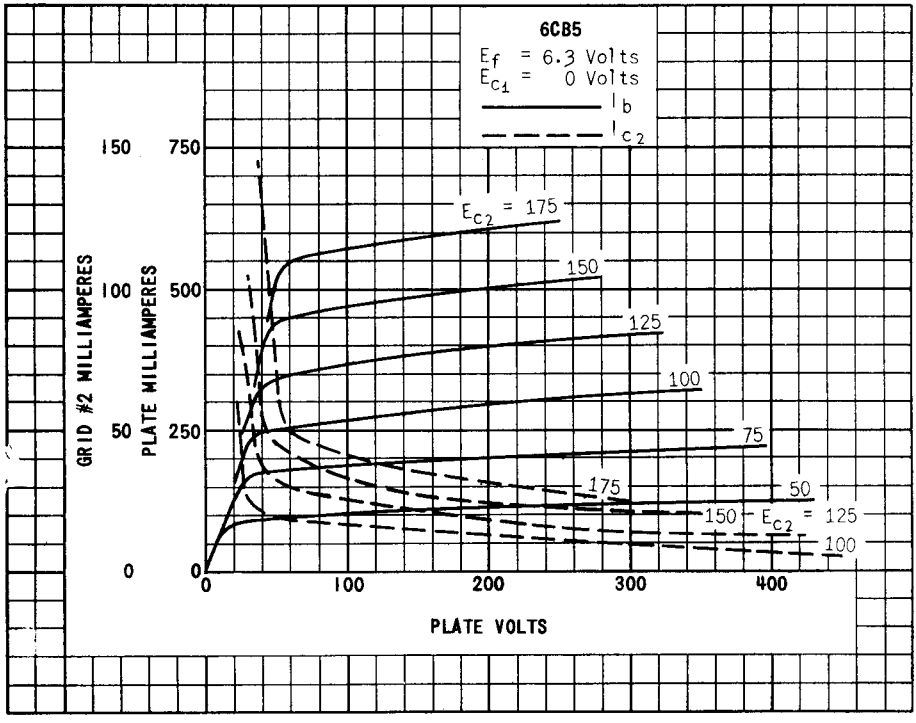
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	2.5	AMP.
PLATE VOLTAGE	175	VOLTS
GRID #2 VOLTAGE	175	VOLTS
GRID #1 VOLTAGE	−30	VOLTS
AMPLIFICATION FACTOR (G_2 TO G_1)	3.8	
PLATE RESISTANCE (APPROX.)	5 000	OHMS
TRANSCONDUCTANCE	8 800	μMHOS
GRID BIAS (APPROX.) FOR I_b = 1 MA.	−60	VOLTS
PLATE CURRENT	90	MA.
GRID #2 CURRENT	6	MA.




6CB5
E_f = 6.3 Volts
E_{c_2} = 150 Volts
GRID #2 MILLIAMPERES
250
200
150
100
50
0
0
50
100
150
200
250
300
PLATE VOLTS
E_{c_1} = +5
0
-5
-10

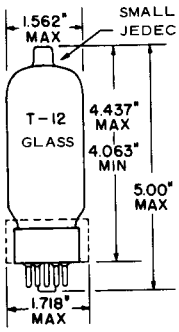

6CB5
E_f = 6.3 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
GRID #2 MILLIAMPERES
PLATE MILLIAMPERES
150
100
50
0
750
500
250
0
0
100
200
300
400
PLATE VOLTS
E_{c_2} = 175
150
125
100
75
50
175
150
125
100
E_{c_2}

TUNG-SOL

BEAM POWER PENTODE

OUTLINE DRAWING

JEDEC 12-36



SHORT JUMBO-SHELL
OCTAL 8 PIN BASE
JEDEC B8-71
OR
MEDIUM-SHELL
OCTAL 8 PIN BASE
JEDEC B8-118

FOR

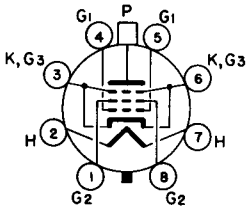
COLOR T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM

JEDEC 8GD



BOTTOM VIEW

THE 6CB5A IS A HIGH PERVENCE BEAM POWER PENTODE IN A T-12 GLASS ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN COLOR TELEVISION RECEIVERS. THE 6CB5A IS UNILATERALLY INTERCHANGEABLE WITH THE 6CB5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.4	pf
GRID 1 TO CATHODE AND GRID 3, GRID 2, AND HEATER	22	pf
PLATE TO CATHODE AND GRID 3, GRID 2, AND HEATER	10	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	2.5	AMP.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER - CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL - DEFLECTION AMPLIFIER SEE NOTE 1

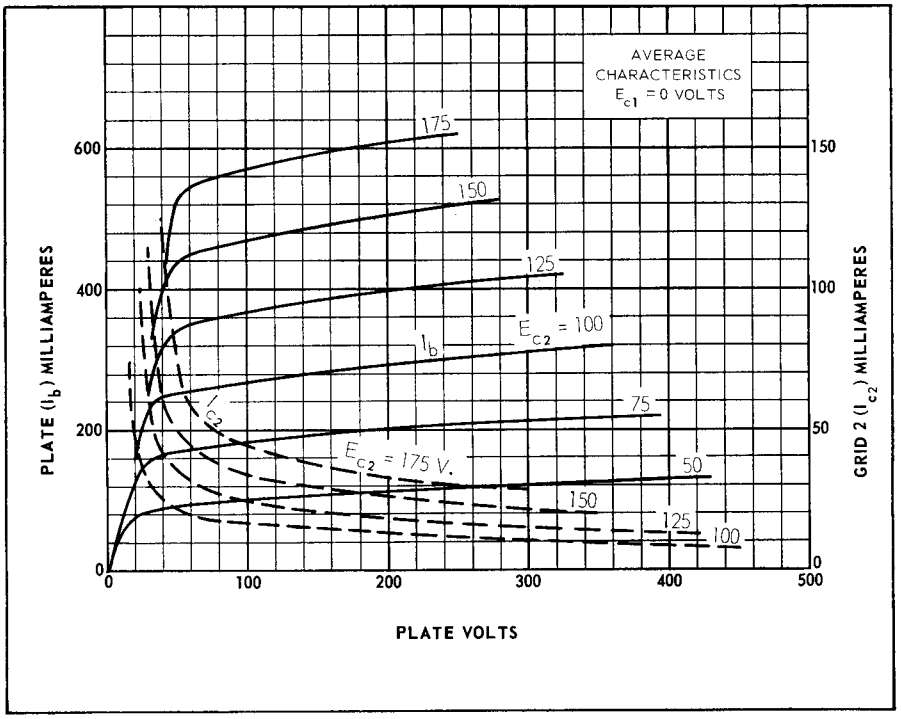
DC PLATE VOLTAGE - INCLUDING BOOST	880	VOLTS
PEAK POSITIVE - PULSE PLATE VOLTAGE	6,800	VOLTS
PEAK NEGATIVE - PULSE PLATE VOLTAGE	1,650	VOLTS
DC GRID 2 VOLTAGE	220	VOLTS
DC GRID 1 VOLTAGE	−55	VOLTS
PEAK NEGATIVE - PULSE GRID 1 VOLTAGE	220	VOLTS
PLATE DISSIPATION SEE NOTE 2	26	WATTS
GRID 2 INPUT	4	WATTS
CATHODE CURRENT:		
PEAK	850	mA
DC	240	mA
GRID 1 CIRCUIT RESISTANCE:		
FOR GRID - RESISTOR - BIAS OPERATION	0.47	MEGOHM

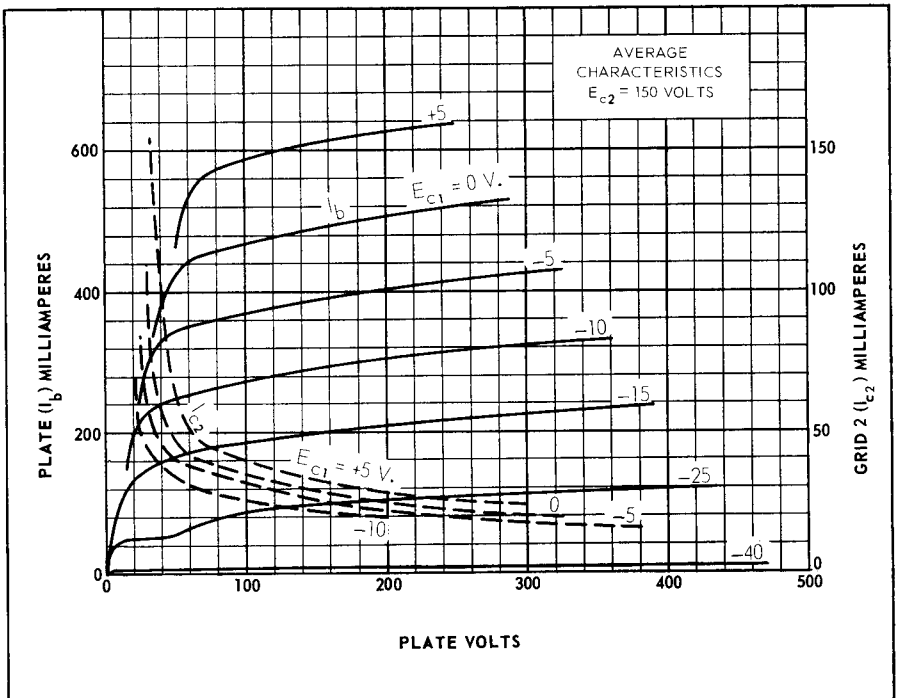
1. FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE IS 10μSEC.
2. AN ADEQUATE BIAS RESISTOR OR OTHER MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	75	175	VOLTS
GRID 2 VOLTAGE	150	175	VOLTS
GRID 1 VOLTAGE	0	−30	VOLTS
PLATE CURRENT	460	90	mA
GRID 2 CURRENT	42	6	mA
TRANSCONDUCTANCE	--	8,800	μMHOS
MU FACTOR, GRID 2 TO GRID 1	–	3.8	
PLATE RESISTANCE	–	Approx.5,000	OHMS
GRID 1 VOLTAGE FOR I_b = 1mA	–	Approx. −60	VOLTS





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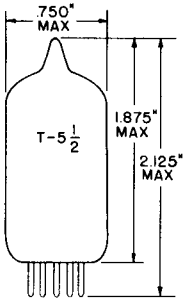
TUNG-SOL



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

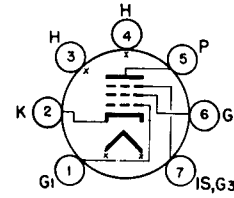
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6CB6 AND 6CB6A ARE SHARP CUTOFF PENTODES USING THE MINIATURE BUTTON 7 PIN BASE. THEY ARE ESPECIALLY DESIGNED FOR USE AS IF AMPLIFIERS OPERATING AT FREQUENCIES ABOVE 20MC, BUT THEY ARE ALSO WELL SUITED FOR USE AS RF AMPLIFIERS IN VHF TELEVISION TUNERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE 6CB6A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.025	.015	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	6.5	6.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	2.0	3.0	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4-2	
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)* (6CB6A ONLY)	11.0	SECONDS

→ INDICATES A CHANGE.

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TUNG-SOL

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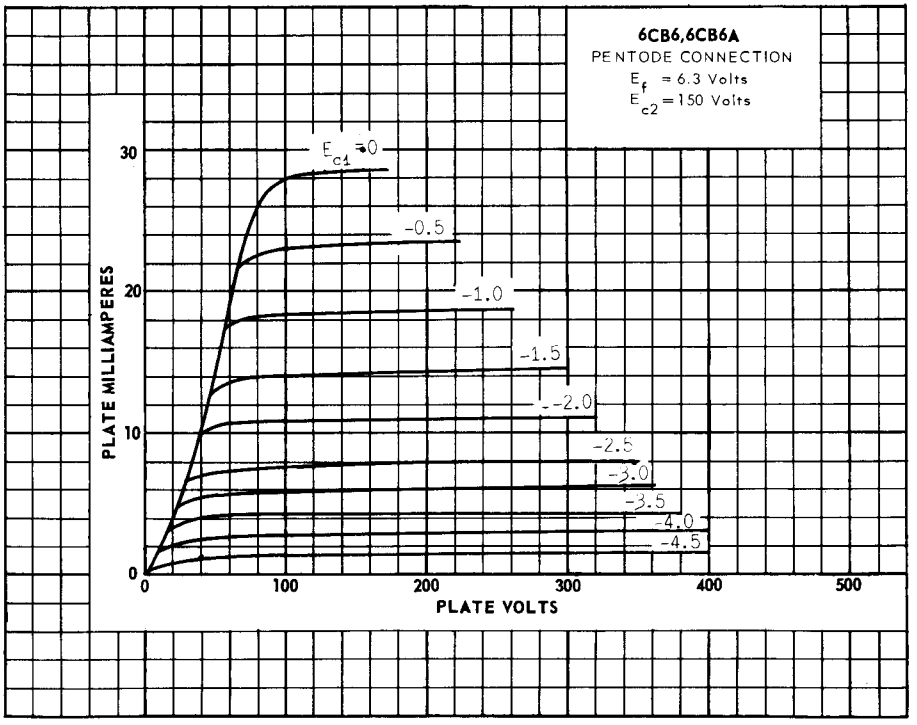
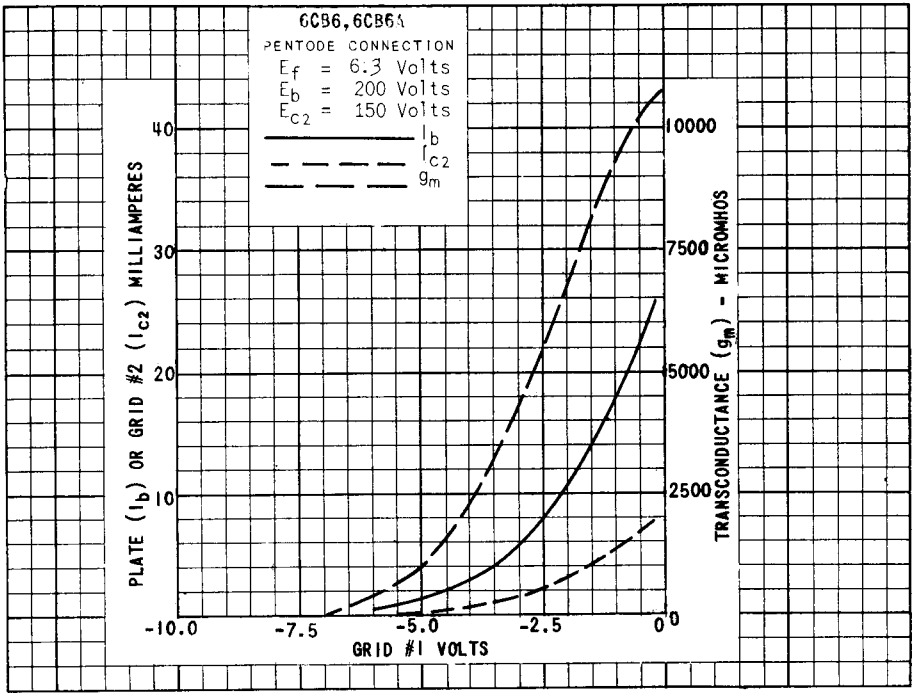
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE		
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.28	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	13.0	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b=20 μA.	-6.5	VOLTS
PLATE CURRENT AT E_{c1}=-3V., R_k=0	2.8	MA.

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



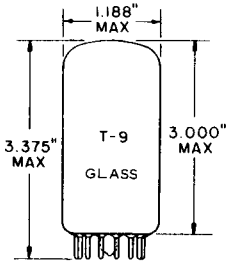

6CB6, 6CB6A
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
g_m
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
40
30
20
10
TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL

DIODE

COMPACTRON

OUTLINE



BASE 12 PIN BUTTON
JEDEC E12-70

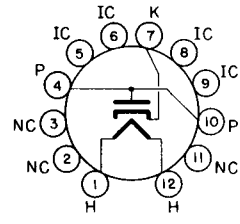
FOR

T.V. DAMPER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12FX



BOTTOM VIEW

THE TUNG-SOL 6CD3 IS AN INDIRECTLY-HEATED DIODE IN COMPACTRON CONSTRUCTION. IT IS INTENDED FOR USE IN DAMPER SERVICE OF TELEVISION HORIZONTAL DEFLECTION CIRCUITS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS. ITS HIGH CURRENT CAPABILITY MAKES IT PARTICULARLY SUITABLE FOR COLOR TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+ H)	16	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	14	pf
HEATER TO CATHODE: H TO K	4.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	2.5	AMPS.
LIMITS OF APPLIED VOLTAGE -AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE *			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		1,000	VOLTS
TOTAL DC AND PEAK		6,000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

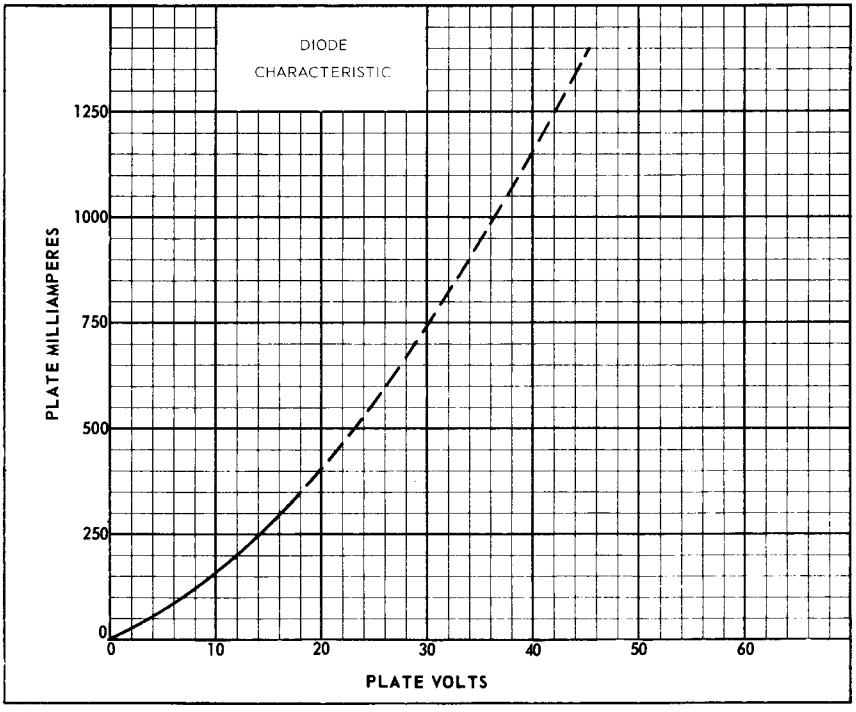
DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

DAMPER DIODE SERVICE *		
PEAK INVERSE PLATE VOLTAGE	6,000	VOLTS
DC OUTPUT CURRENT	350	MA.
STEADY STATE PEAK PLATE CURRENT	1,500	MA.
PLATE DISSIPATION	12	WATTS

AVERAGE CHARACTERISTICS

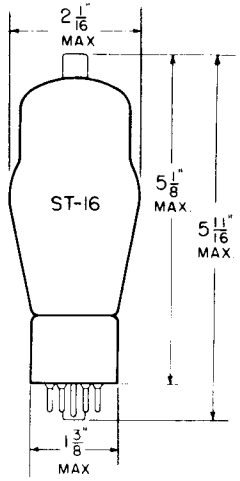
TUBE VOLTAGE DROP	SEE GRAPH BELOW

* FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE IS NOT EXCEED 15 PER CENT OF A SCANNING CYCLE.



TUNG-SOL

BEAM PENTODE

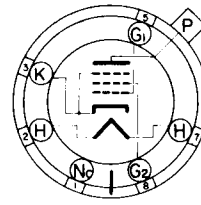


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

MOUNTING POSITION
VERTICAL - BASE UP OR DOWN
HORIZONTAL - PLANE OF PINS 2 & 7 VERTICAL



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL
5BT

THE 6CD6G IS A HIGH PERVEANCE, BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. IT IS PARTICULARLY ADAPTABLE TO DRIVE CATHODE RAY PICTURE TUBES WHICH REQUIRE WIDE ANGLE DEFLECTION.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P) MAX.	1	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	26	μμf
OUTPUT: P TO (H+K&G_3+G_2)	10	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	135	VOLTS
MAXIMUM DC PLATE VOLTAGE	700	VOLTS
MAXIMUM PEAK POSITIVE-PULSE PLATE VOLTAGE	6000	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE PLATE VOLTAGE	-1500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	-150	VOLTS
MAXIMUM DC PLATE CURRENT	170	MA.
MAXIMUM PLATE DISSIPATION	15	WATTS
MAXIMUM GRID #2 INPUT	3	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HORIZONTAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	2.5	AMP.
DC PLATE SUPPLY VOLTAGE:		
FROM DC POWER SUPPLY[B]	350	VOLTS
FROM DC BOOSTS SUPPLIED BY 6W4GT (APPROX.)	150	VOLTS
TOTAL SUPPLY VOLTAGE (APPROX.)[C]	500	VOLTS
GRID #2 VOLTAGE	170	VOLTS
CATHODE BIAS RESISTOR	300	OHMS
GRID #1 INPUT VOLTAGE:		
PEAK-TO-PEAK SAWTOOTH-COMPONENT	75	VOLTS
NEGATIVE PEAKING COMPONENT	55	VOLTS
DC PLATE CURRENT	90	MA.
DC GRID #2 CURRENT	15.5	MA.
PEAK POSITIVE-PULSE PLATE OUTPUT VOLTAGE (APPROX.): FOR KINESCOPE ANODE CURRENT OF 0 UA.	5500	VOLTS

[B] MEASURED TO GROUND.

[C] MEASURED TO CATHODE AND IS PREFERABLY OBTAINED THROUGH A SERIES DROPPING RESISTOR FOR SUFFICIENT VALUE TO LIMIT THE GRID #2 INPUT TO THE RATED MAXIMUM VALUE.

PLATE 2385

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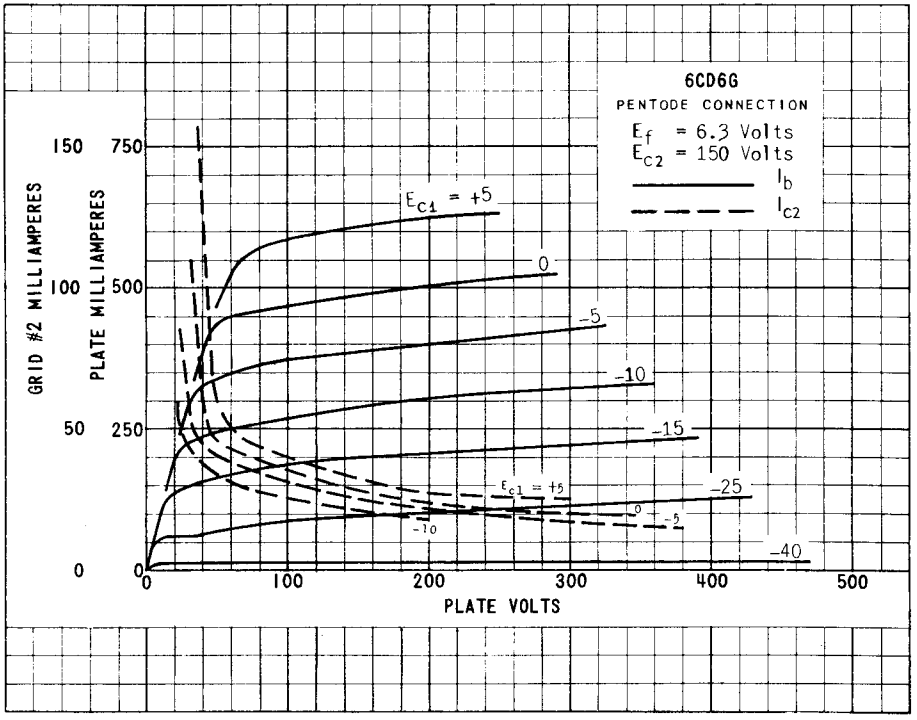

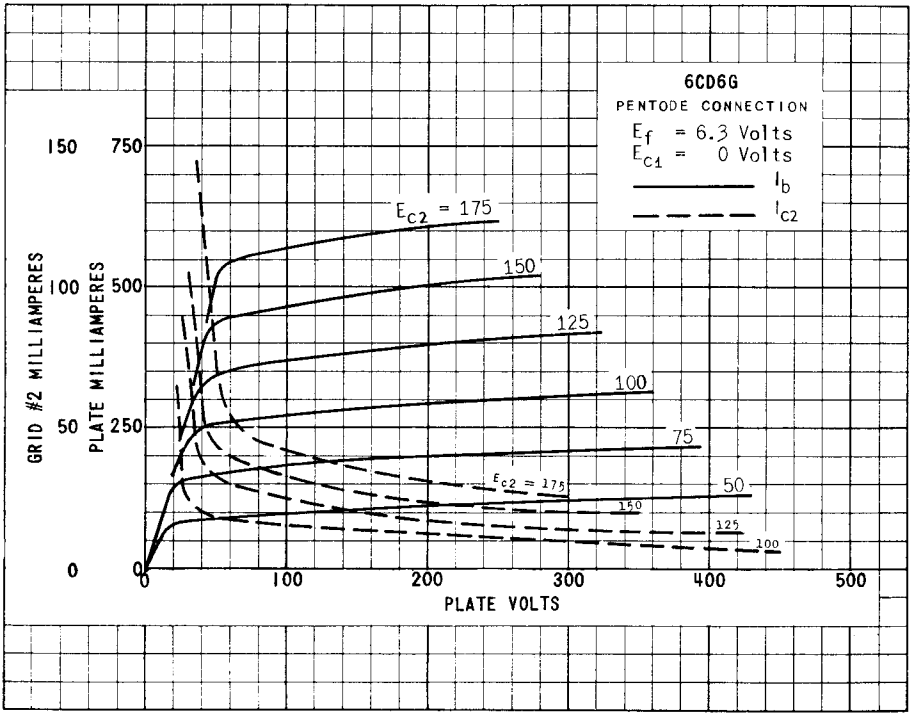

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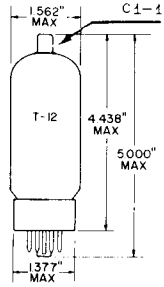
BEAM PENTODE

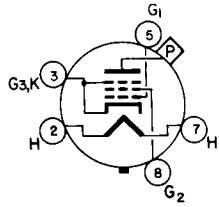


GLASS BULB
B8-110 OR B5-123
SHORT MEDIUM SHELL
5-PIN WITH
EXTERNAL BARRIERS

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 2.5 AMP.
AC OR DC

VERTICAL MOUNTING POSITION
HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BT

THE 6CD6GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES AND A HIGH RATIO OF PLATE TO SCREEN CURRENT.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	1.1	pf
INPUT	22	pf
OUTPUT	8.5	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	7 000	VOLTS
MAXIMUM NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	20	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM DC CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERALL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

→ INDICATES A CHANGE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	60	175	VOLTS
GRID #2 VOLTAGE	100	175	VOLTS
GRID #1 VOLTAGE	0[D]	−30	VOLTS
PLATE RESISTANCE (APPROX.)	---	7 200	OHMS
TRANSCONDUCTANCE	---	7 700	μMHOS
PLATE CURRENT	230	75	MA.
GRID #2 CURRENT	21	5.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	−55	VOLTS
TRIODE AMPLIFICATION FACTOR[E]	---	3.9	

[D] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

[E] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH E_b = E_{c2} = 175 VOLTS AND E_{c1} = −30 VOLTS.

SIMILAR TYPE REFERENCE: *The 6CD6GA may be used as a replacement for the 6CD6G; it differs from the 6CD6G by employing a straight-sided T-12 envelope and incorporating increased maximum ratings for plate dissipation, pulse plate voltage, and bulb temperature.*

TUNG-SOL

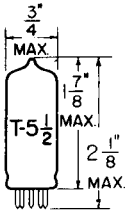
PENTODE

MINIATURE TYPE

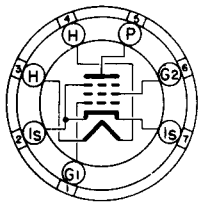
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BD

THE 6CE5 IS AN RF PENTODE HAVING HIGH TRANSCONDUCTANCE COUPLED WITH CLOSELY CONTROLLED GRID CUTOFF CHARACTERISTICS IN THE MINIATURE SEVEN PIN CONSTRUCTION. DESIGNED TO OBTAIN BETTER PERFORMANCE OF LOW COST VHF TELEVISION TUNERS AND TELEVISION IF STAGES, THE 6CE5 IMPROVES AUTOMATIC GAIN CONTROL WITH RESULT THAT SIGNAL CAPACITY IS INCREASED. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (MAX.)	0.030	μμf
INPUT	6.5	μμf
OUTPUT	1.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
* MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
* MAXIMUM GRID #2 VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS
* MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)[A]	11.0	SECONDS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

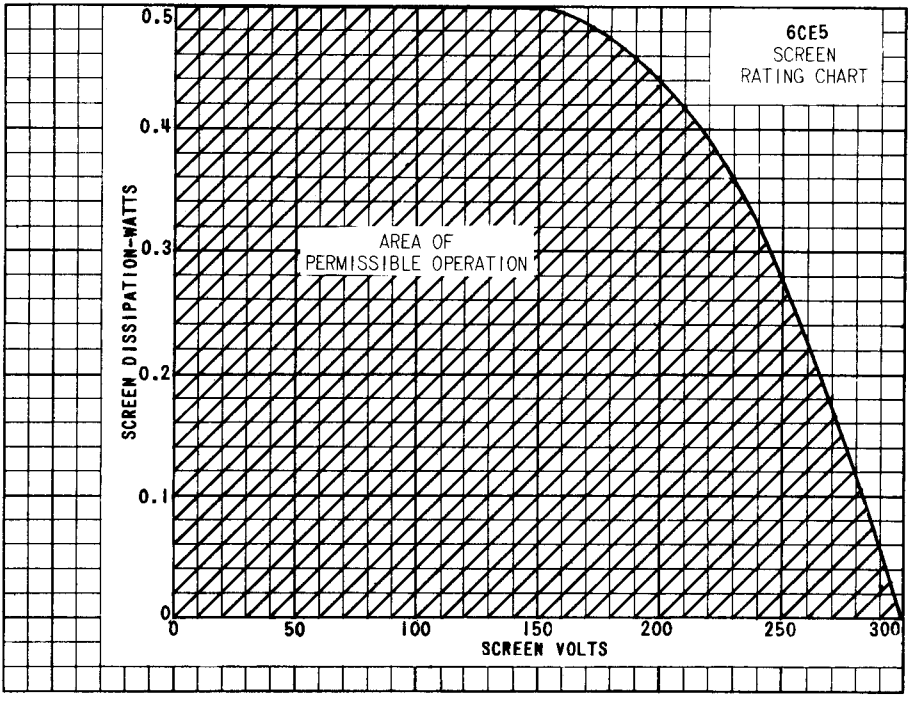
CLASS A_1 AMPLIFIER

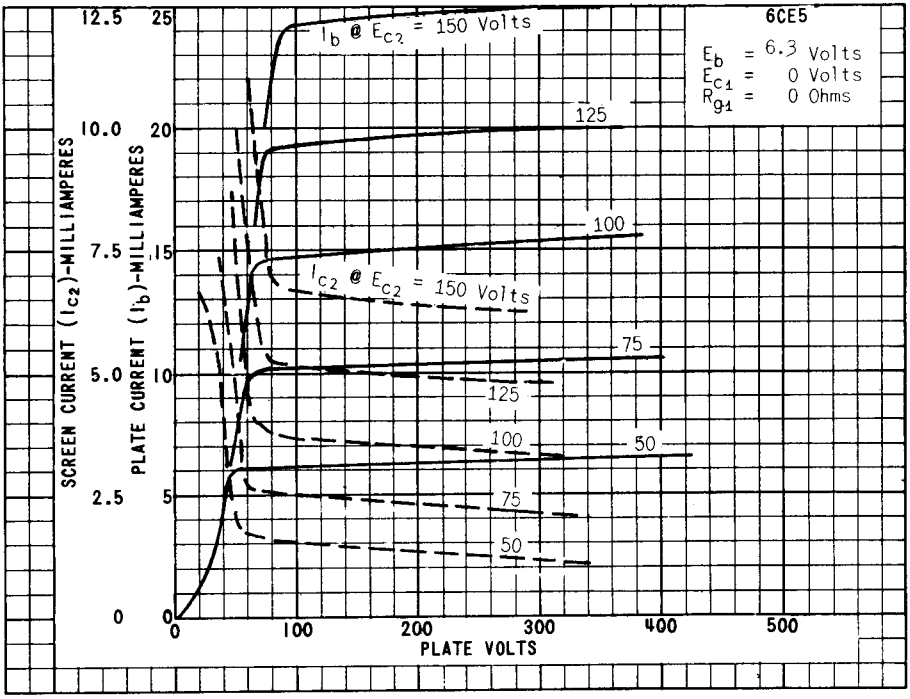
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	125	VOLTS
SCREEN VOLTAGE	125	VOLTS
* GRID #1 SUPPLY VOLTAGE	-1.0	VOLTS
GRID #1 RESISTOR (BYPASSED)	1.0	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHMS
TRANSCONDUCTANCE	7 600	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	2.8 ←	MA.
GRID #1 VOLTAGE (APPROX.) Ib = 35 μAMPS.	-5.0	VOLTS

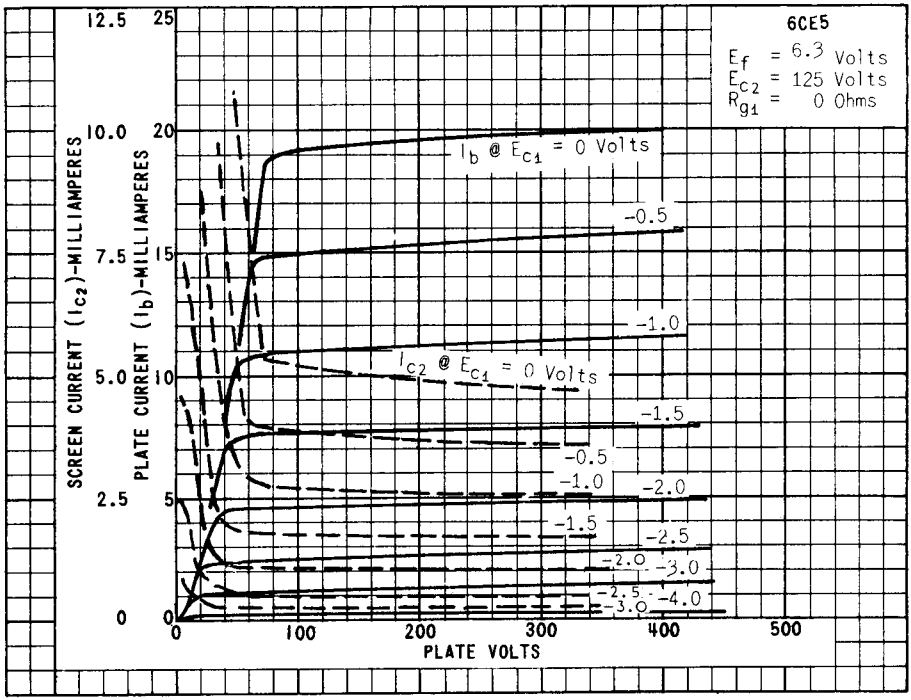
SIMILAR TYPE REFERENCE: *Except for heater ratings, the 6CE5 is identical to the 3CE5 and the 4CE5.*

→ INDICATES A CHANGE.

* INDICATES AN ADDITION.







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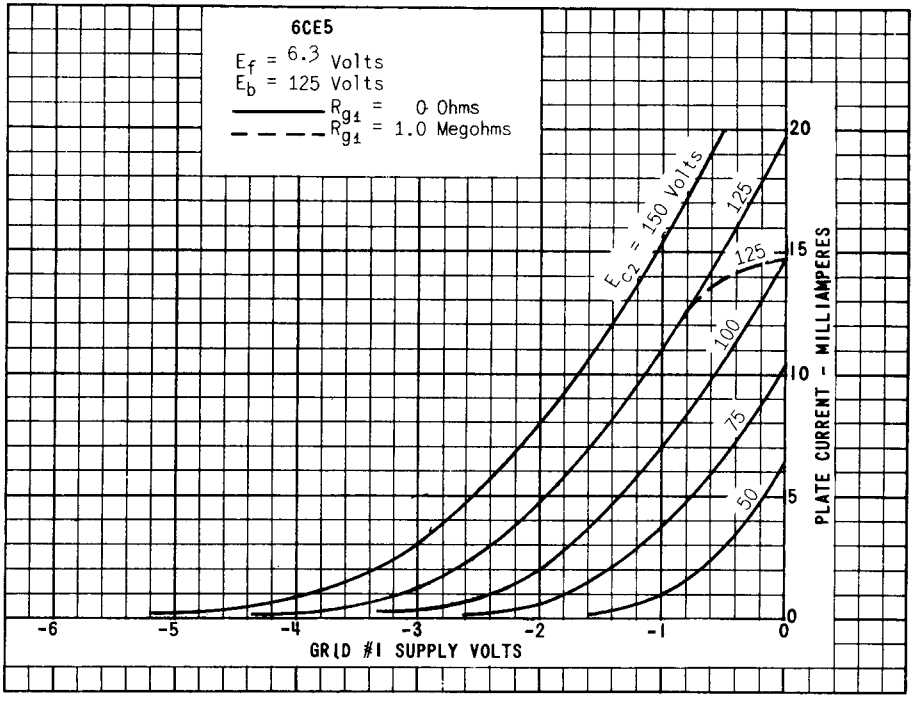
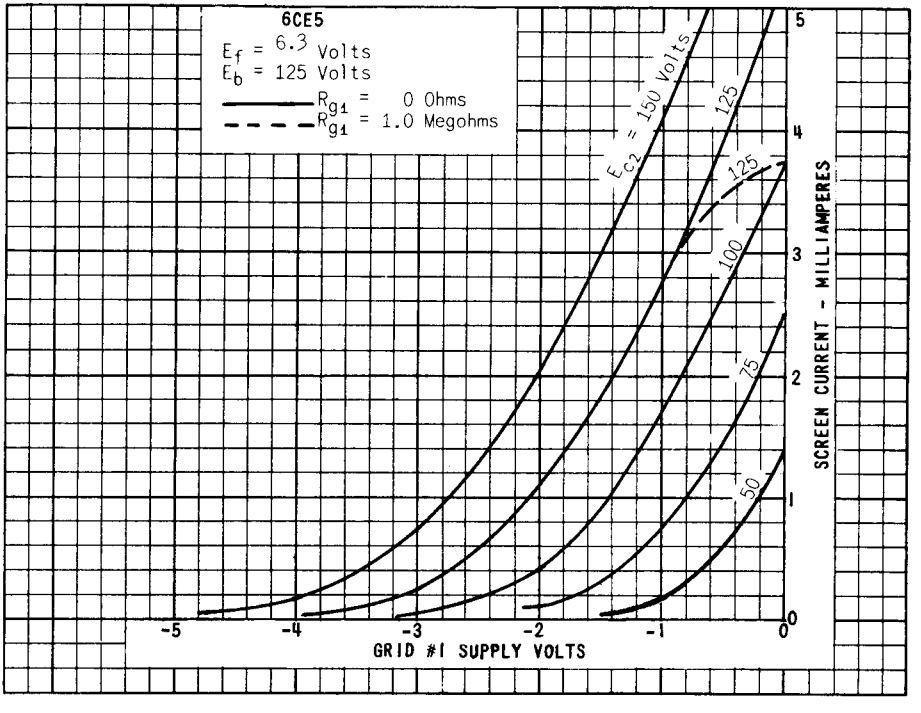
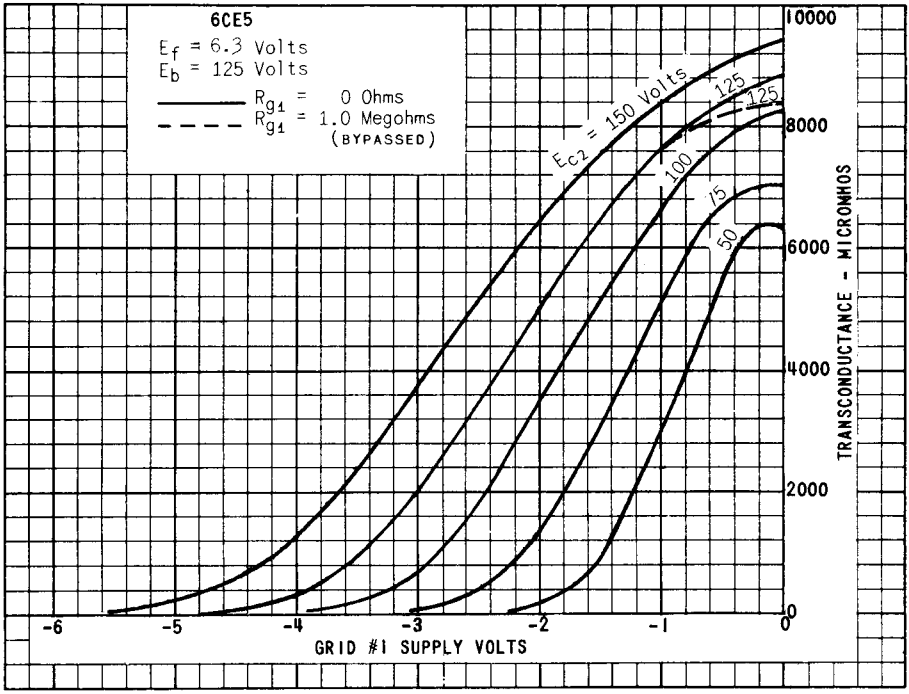

6CE5
E_f = 6.3 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
20
15
10
5
0
-6
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
PLATE CURRENT - MILLIAMPERES


6CE5
E_f = 6.3 Volts
E_b = 125 Volts
R_{g1} = 0 Ohms
R_{g1} = 1.0 Megohms
E_{c2} = 150 Volts
125
125
100
75
50
5
4
3
2
1
0
-5
-4
-3
-2
-1
0
GRID #1 SUPPLY VOLTS
SCREEN CURRENT - MILLIAMPERES



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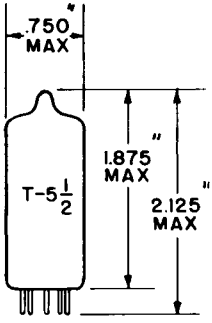
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

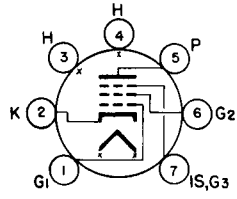
COATED UNIPOTENTIAL CATHODE

FOR

IF AND RF APPLICATIONS IN

T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6CF6 IS A SHARP CUT-OFF PENTODE ESPECIALLY DESIGNED FOR USE IN GAIN CONTROLLED VIDEO *IF* STAGES OPERATING AT FREQUENCIES IN THE ORDER OF 40 MEGACYCLES. IT IS ALSO WELL SUITED FOR USE AS AN *RF* AMPLIFIER IN *VHF* TELEVISION TUNERS. IT FEATURES CONTROLLED PLATE-CURRENT CUT-OFF AND VERY HIGH TRANSCONDUCTANCE COMBINED WITH LOW CAPACITANCE VALUES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G1 TO P) MAX.	→ 0.015	→ 0.025	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	6.5	6.5	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3.0	2.0	pf

[A] EXTERNAL SHIELD 316 CONNECTED TO PIN 2.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		→ 100	VOLTS
TOTAL DC AND PEAK		→ 200	VOLTS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

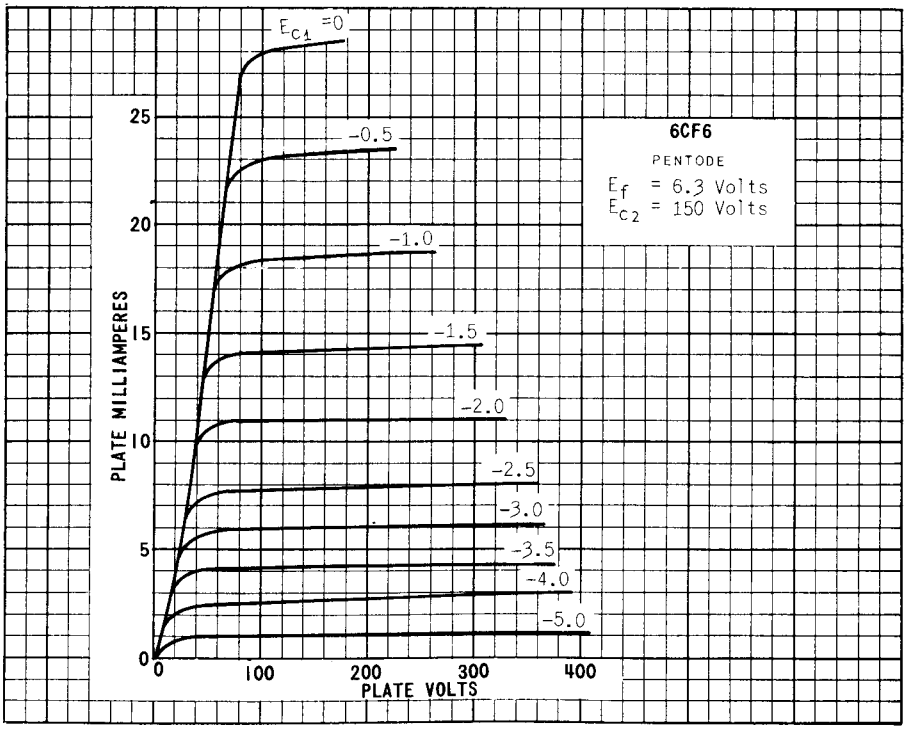
PLATE VOLTAGE	330	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
GRID #2 SUPPLY VOLTAGE	330	VOLTS
PLATE DISSIPATION	→ 2.3	WATTS
GRID #2 DISSIPATION	0.55	WATT
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS

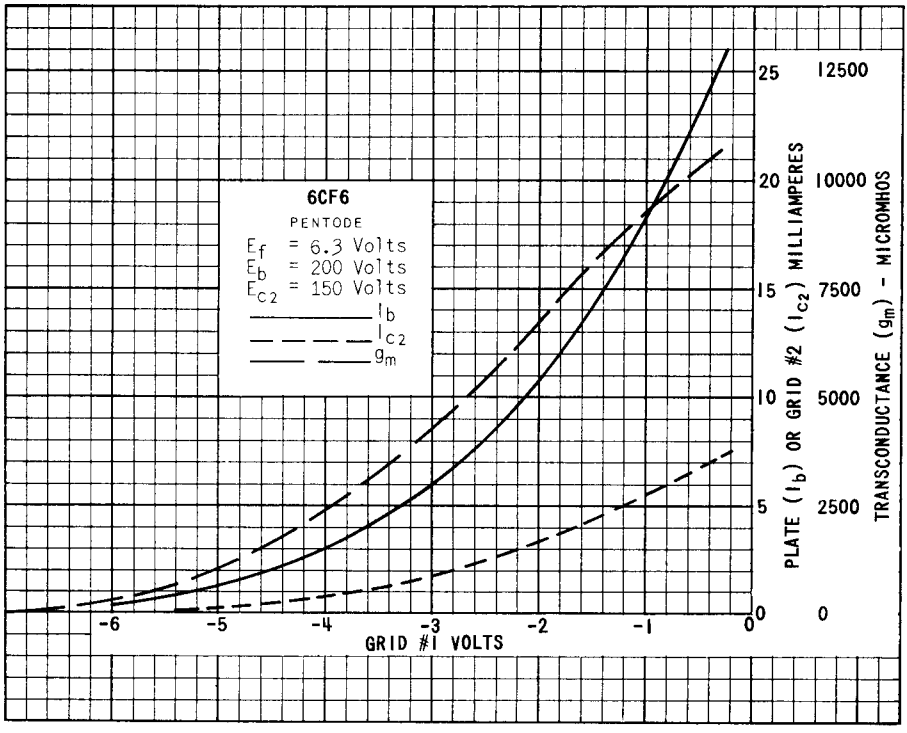
→ TYPICAL OPERATING CHARACTERISTICS

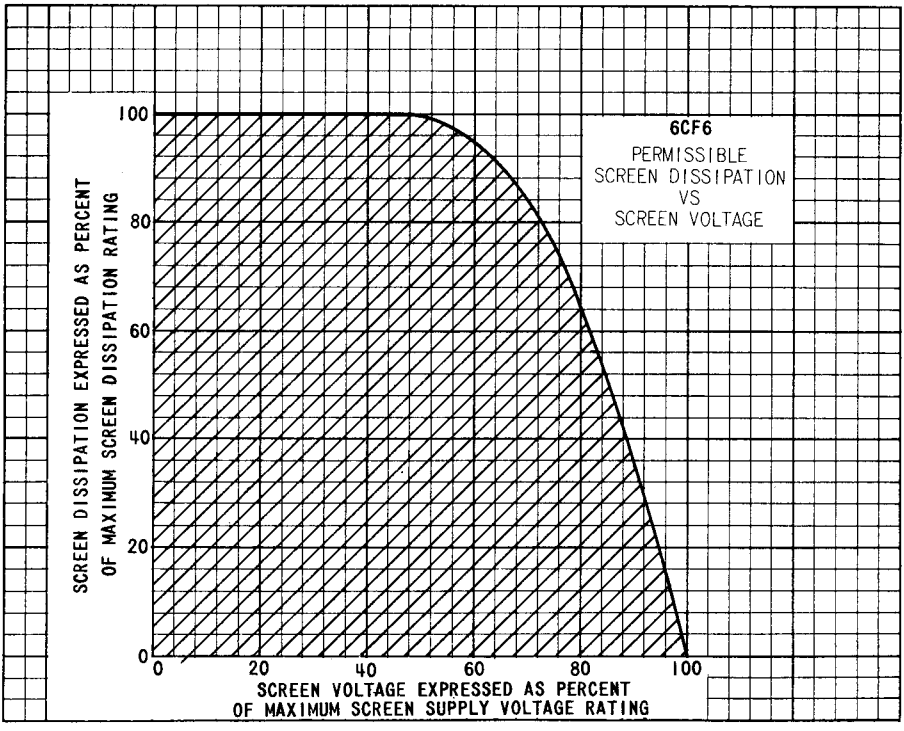
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN 7 CONNECTED TO PIN 2 AT SOCKET	
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.3	MEGOHM
TRANSCONDUCTANCE	7800	μMHOS
PLATE CURRENT	12.5	MA.
GRID #2 CURRENT	3.7	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b =20 μA	-6.0	VOLTS
PLATE CURRENT AT E_{c1}=-3V., Rk =0	2.2	MA.

→ INDICATES A CHANGE.




6CF6
PENTODE
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
g_m
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
25
20
15
10
5
0
12500
10000
7500
5000
2500
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) - MICROMHOS


6CF6
PERMISSIBLE
SCREEN DISSIPATION
VS
SCREEN VOLTAGE
100
80
60
40
20
0
SCREEN DISSIPATION EXPRESSED AS PERCENT
OF MAXIMUM SCREEN DISSIPATION RATING
0
20
40
60
80
100
SCREEN VOLTAGE EXPRESSED AS PERCENT
OF MAXIMUM SCREEN SUPPLY VOLTAGE RATING

TUNG-SOL

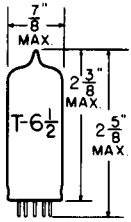
DOUBLE TRIODE

MINIATURE TYPE

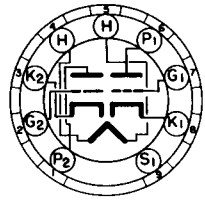
COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9AJ

THE 6CG7 IS A GENERAL PURPOSE, MEDIUM-MU TWIN TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED PARTICULARLY FOR USE AS A VERTICAL DEFLECTION OSCILLATOR AND HORIZONTAL DEFLECTION OSCILLATOR IN TELEVISION RECEIVERS. THIS TYPE IS DESIGNED WITH A 600 MA. HEATER HAVING A CONTROLLED WARM-UP TIME TO INSURE DEPENDABLE PERFORMANCE IN TELEVISION RECEIVERS EMPLOYING A SINGLE SERIES-CONNECTED HEATER STRING INCLUDING THE HEATER OF THE PICTURE TUBE. IT MAY ALSO BE USED AS A PHASE INVERTER, MULTIVIBRATOR, SYNCHRONIZING SEPARATOR AND AMPLIFIER, AND RESISTANCE COUPLED AMPLIFIER IN ELECTRONIC EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

	UNIT 1	UNIT 2	
GRID TO PLATE: G TO P	4.0	4.0	μμf
INPUT: G TO (K+H&IS)	2.3	2.3	μμf
OUTPUT: P TO (K+H&IS)	2.2	2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH UNIT

	CLASS A_1 AMPLIFIER	
HEATER VOLTAGE	6.3±10% ←	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	200	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION:		
EACH PLATE	4.0 ←	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7 ←	WATTS
MAXIMUM CATHODE CURRENT	22 ←	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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RATINGS[C]– CONT'D

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH UNIT

	VERTICAL DEFLECTION OSCILLATOR	HORIZONTAL DEFLECTION OSCILLATOR	
HEATER VOLTAGE	6.3±10% ←		VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]		VOLTS
MAXIMUM DC PLATE VOLTAGE	330 ←	330 ←	VOLTS
MAXIMUM NEGATIVE PULSE GRID VOLTAGE	440[E] ←	660[F] ←	VOLTS
MAXIMUM CATHODE CURRENT:			
PEAK	77 ←	330 ←	MA.
DC	22 ←	22 ←	MA.
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	4.0 ←	4.0 ←	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7 ←	5.7 ←	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS, GRID-RESISTOR BIAS OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[G]	11.0		SECONDS

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[E] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM; 15 PERCENT OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

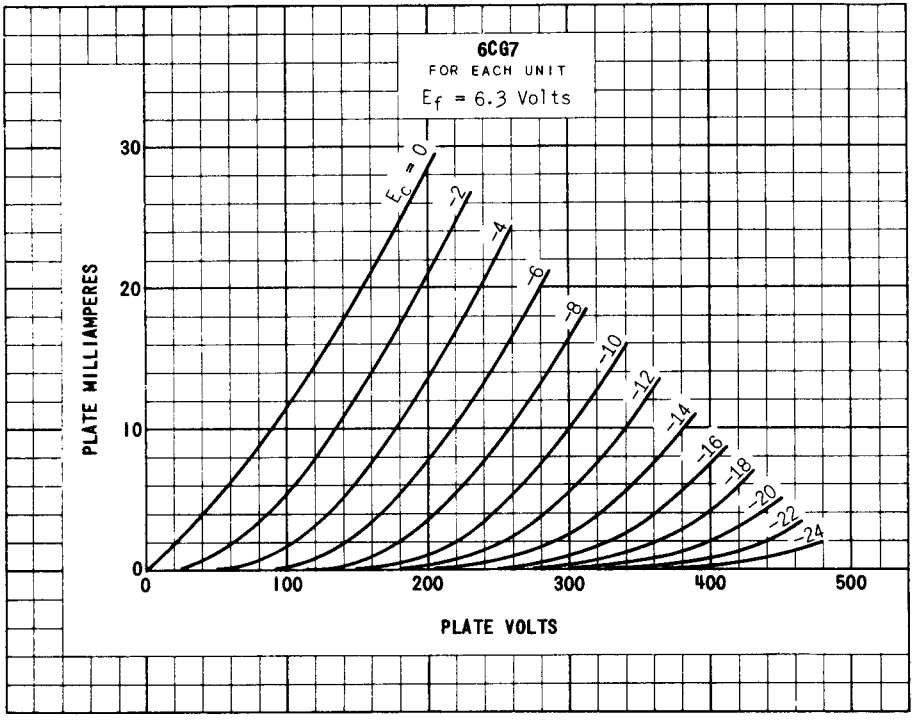
[F] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE IN A 525-LINE, 30-FRAME SYSTEM; 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

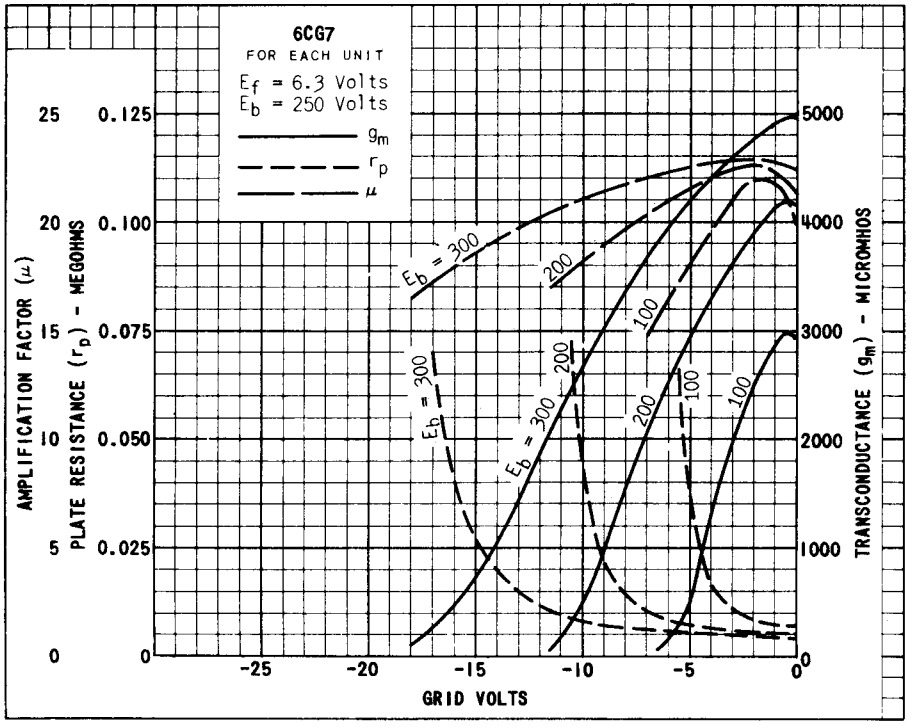
[G] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

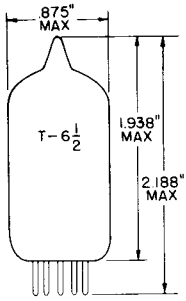
EACH UNIT

	CLASS A_1 AMPLIFIER		
HEATER VOLTAGE	6.3±10%		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6700	7700	OHMS
TRANSCONDUCTANCE	3000	2600	μMHOS
GRID VOLTAGE (APPROX.)			
FOR I_b = 10 μAMP.	-7	-18	VOLTS
PLATE CURRENT OR GRID VOLTAGE OF -12.5 VOLTS	---	1.3	MA.
PLATE CURRENT	10	9	MA.


6CG7
FOR EACH UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
0
10
20
30
100
200
300
400
500


6CG7
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID VOLTS
E_b = 300
200
100
0
5
10
15
20
25
0.025
0.050
0.075
0.100
0.125
1000
2000
3000
4000
5000
-25
-20
-15
-10
-5

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

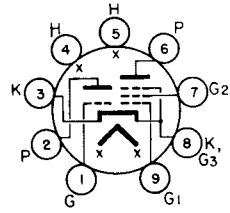
TRIODE PENTODE

MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450±30 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GF

THE 6CG8A CONTAINS A MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A COMBINED OSCILLATOR AND MIXER IN TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXTERNAL SHIELD	WITH[A] EXTERNAL SHIELD	
TRIODE UNIT:			
GRID TO PLATE	1.5	1.5	pf
GRID TO CATHODE & HEATER	2.6	3	pf
PLATE TO CATHODE & HEATER	0.05	1	pf
PENTODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.03	0.016	pf
GRID #1 TO CATHODE & GRID #3, GRID #2, AND HEATER	4.8	5	pf
PLATE TO CATHODE & GRID #3, GRID #2, AND HEATER	0.9	1.6	pf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.05	0.04	pf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.05	0.007	pf
HEATER TO CATHODE	5.5	5.5[B]	pf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE. [B] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID #2 SUPPLY VOLTAGE	275	VOLTS
GRID #2 VOLTAGE	SEE J5-C4-2	
PENTODE PLATE DISSIPATION	2.3	WATTS
GRID #2 DISSIPATION:		
FOR GRID #2 VOLTAGES UP TO 137.5 V.	0.45	WATTS
FOR GRID #2 VOLTAGES BETWEEN 137.5 & 275 V.	SEE J5-C4-2	

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS - cont'd.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

POSITIVE DC PENTODE GRID #1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	1.7	WATTS
HEATER-CATHODE VOLTAGE;		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME	11	SECONDS

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TYPICAL OPERATION

	TRIODE UNIT[E] AS 250-MC OSCILLATOR	PENTODE[D] AS UNIT MIXER	
PLATE VOLTAGE	150	150	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
MIXER GRID #1 SUPPLY VOLTAGE	---	-3.5	VOLTS
OSCILLATOR VOLTAGE AT MIXER GRID #1 (RMS)	---	2.6	VOLTS
MIXER GRID #1 CIRCUIT RESISTANCE	---	120 000	OHMS
OSCILLATOR GRID RESISTOR	2700	---	OHMS
CONVERSION TRANSCONDUCTANCE	---	2 100	μMHOS
PLATE CURRENT	13	6.2	MA.
GRID #2 CURRENT	---	1.8	MA.
GRID #1 CURRENT	3.6	---	MA.
GRID #1 CURRENT	---	2	μAMP
OSCILLATOR POWER OUTPUT (APPROX.)	0.5	---	WATT

MAXIMUM CIRCUIT VALUES:

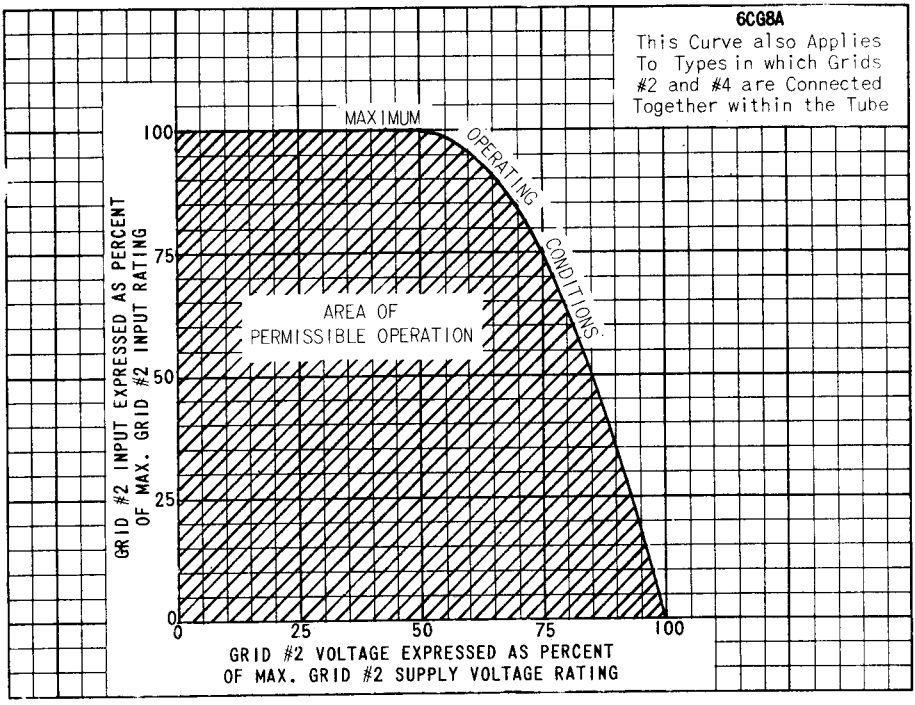
GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM

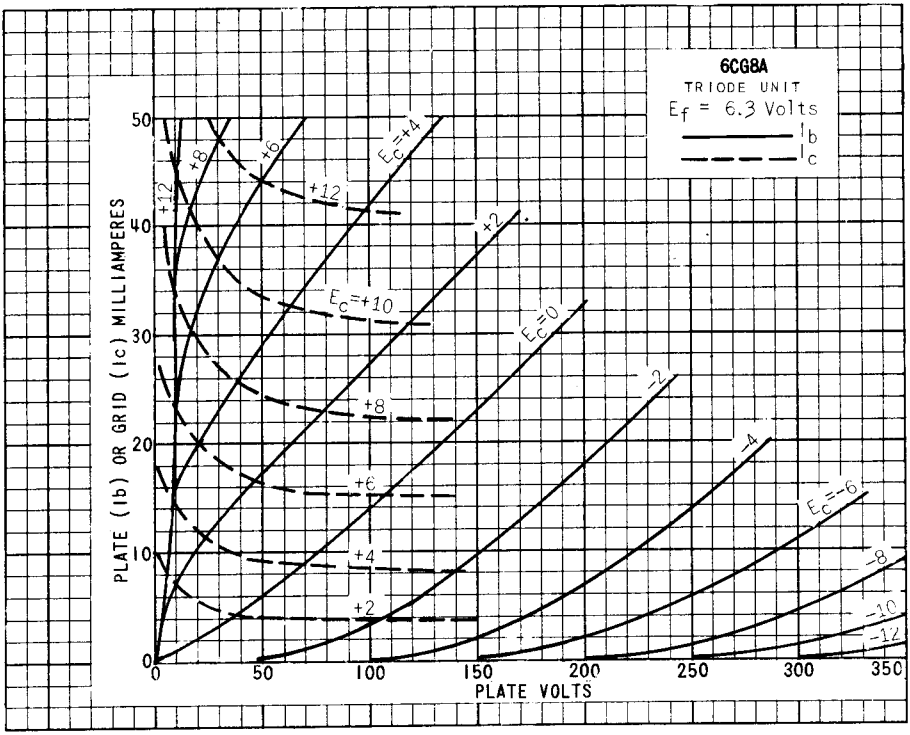
CHARACTERISTICS

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
CATHODE-BIAS RESISTOR	100	200	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	6900	750 000	OHMS
TRANSCONDUCTANCE	5800	4 600	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR PLATE CURRENT OF 10 μAMP	-10	-10	VOLTS
PLATE CURRENT	8.5	7.7	MA.
GRID #2 CURRENT	---	1.6	MA.

[D] WITH SEPARATE EXCITATION AND TRIODE UNIT GROUNDED.

[E] IN TV OR FM RECEIVERS, IT IS GENERALLY DESIRABLE TO OPERATE THE OSCILLATOR WITH LESS POWER INPUT THAN SHOWN IN THE TABULATED DATA IN ORDER TO AVOID OVER-EXCITATION AND EXCESSIVE OSCILLATOR RADIATION.





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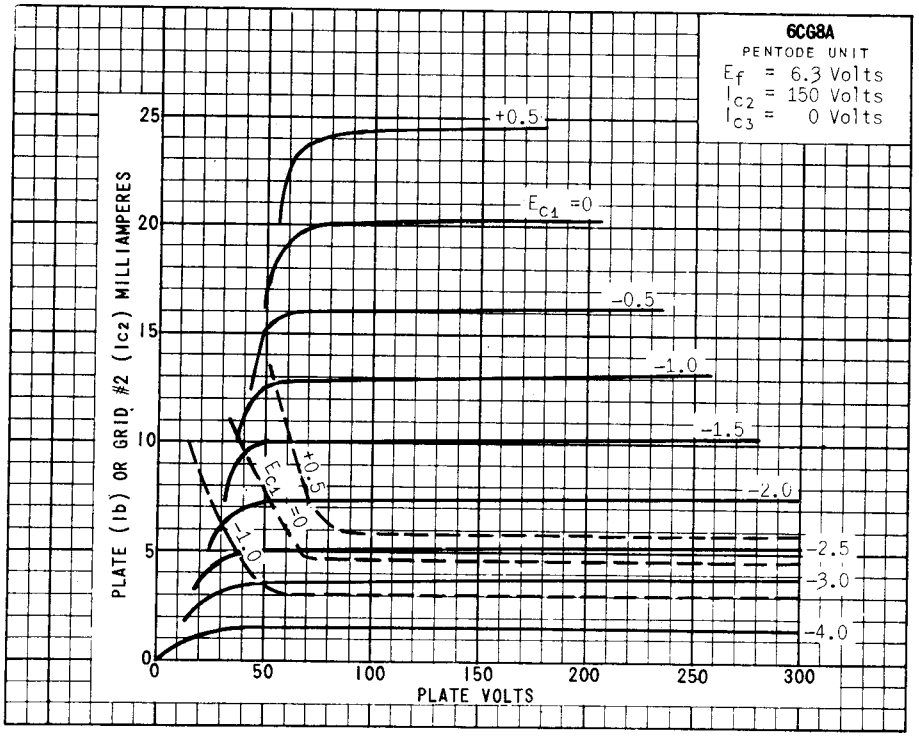
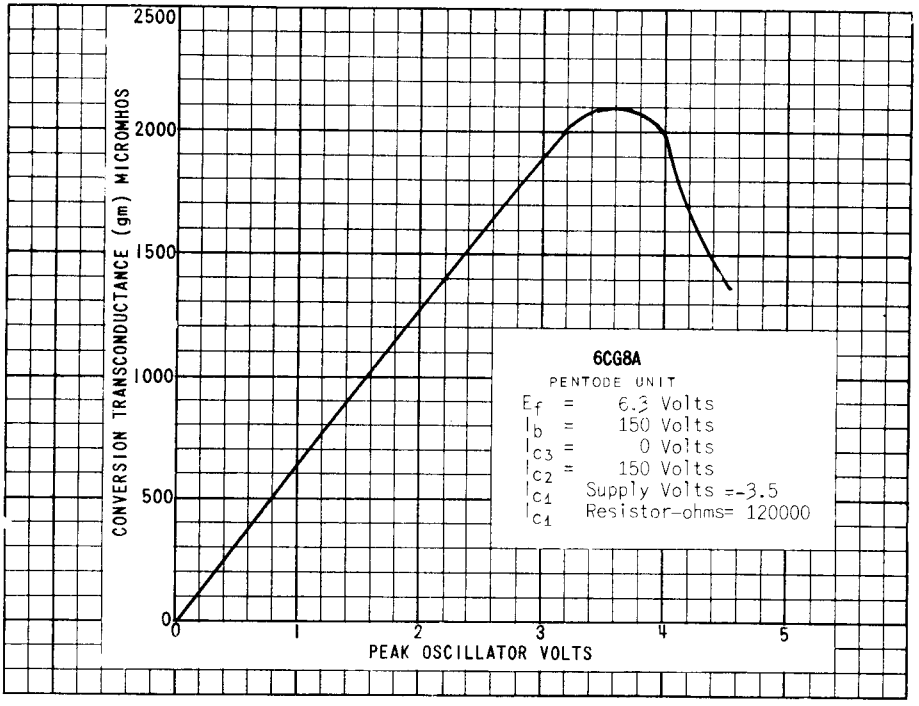
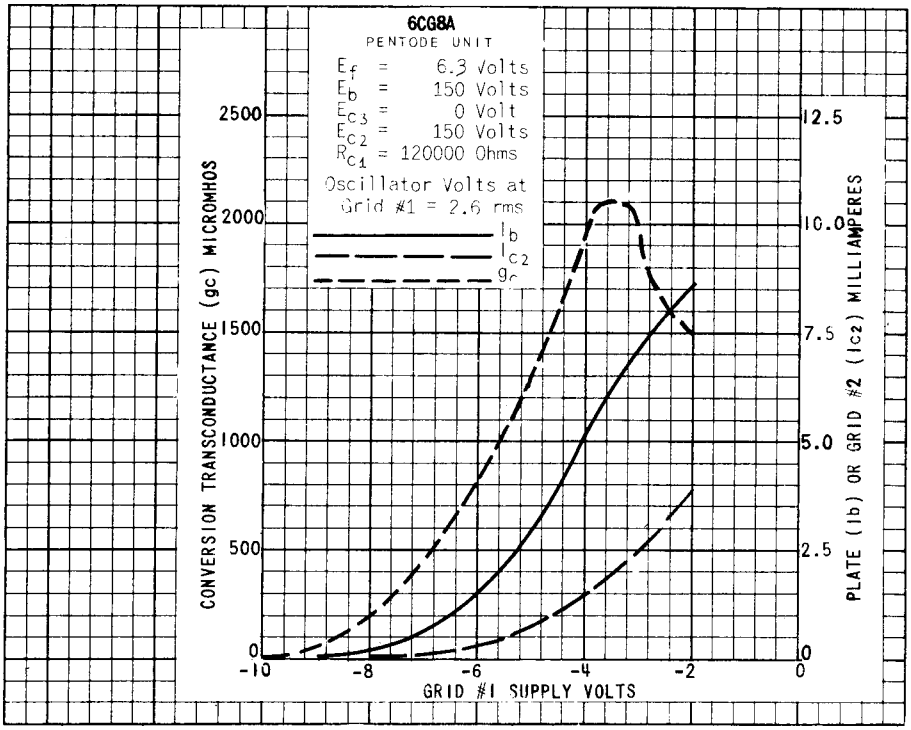
6CG8A


6CG8A
PENTODE UNIT
E_f = 6.3 Volts
I_{c2} = 150 Volts
I_{c3} = 0 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
+0.5
E_{c1} =0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
E_{c1} +0.5 =0 -1.0
0
5
10
15
20
25
50
100
150
200
250
300


CONVERSION TRANSCONDUCTANCE (gm) MICROMHOS
PEAK OSCILLATOR VOLTS
6CG8A
PENTODE UNIT
E_f = 6.3 Volts
I_b = 150 Volts
I_{c3} = 0 Volts
I_{c2} = 150 Volts
I_{c1} Supply Volts =-3.5
I_{c1} Resistor-ohms= 120000
0
500
1000
1500
2000
2500
1
2
3
4
5



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TUNG-SOL

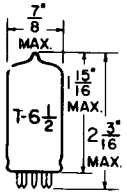
TWIN TRIODE

MINIATURE TYPE

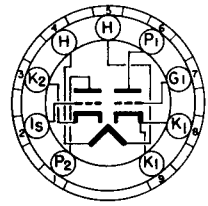
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9FC ←

BECAUSE OF THE CONNECTION OF THE INTERNAL SHIELD, SECTION 1 (PINS 6, 7, 8, AND 9) MUST BE USED AS THE INPUT OR GROUNDED-CATHODE SECTION.

THE 6CH7 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A CASCODE RF AMPLIFIER IN VHF TELEVISION TUNERS. THE ELECTRICAL CHARACTERISTICS OF THE TUBE ARE ESSENTIALLY EQUIVALENT TO THOSE OF THE 6BZ7 FROM WHICH IT DIFFERS PRIMARILY IN BASING. BECAUSE OF THE REVISED BASING, THE 6CH7 EXHIBITS AN IMPROVED NOISE FIGURE IN CASCODE SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO HEATER UNLESS OTHERWISE SPECIFIED

	SECTION #1		SECTION #2	
GRID TO PLATE	1.1		---	μμf
INPUT	2.4		---	μμf
OUTPUT	0.8		---	μμf
HEATER TO CATHODE	2.8[A]		2.8[A]	μμf
GRID TO GRID (MAX.)		0.15		μμf
PLATE TO PLATE (MAX.)		0.015		μμf
PLATE TO CATHODE (MAX.)	0.15		0.15	μμf
GROUNDED-GRID INPUT	---		5.5	μμf
GROUNDED-GRID OUTPUT	---		2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	250[B]	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200[B]	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHMS

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

[B] THIS RATING MAY BE AS HIGH AS 300 VOLTS MAXIMUM UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER AND THE TWO SECTIONS ARE CONNECTED IN SERIES.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

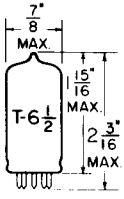
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	36	
PLATE RESISTANCE (APPROXIMATE)	5 300	OHMS
TRANSCONDUCTANCE	6 800	μMHOS
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROXIMATE) I_b=100 μAMP.	-7	VOLTS

SIMILAR TYPE REFERENCE: 6BZ7

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

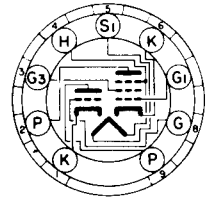


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON NOVAL
9 PIN BASE
9FT

THE 6CH8 IS A GENERAL PURPOSE MULTIUNIT TUBE OF THE 9 PIN MINIATURE CONSTRUCTION CONTAINING A MEDIUM MU TRIODE AND SHARP CUTOFF PENTODE IN ONE ENVELOPE. IT IS INTENDED FOR A WIDE VARIETY OF APPLICATIONS IN BLACK AND WHITE AND COLOR TELEVISION RECEIVERS. THE PENTODE UNIT MAY BE USED AS AN INTERMEDIATE FREQUENCY AMPLIFIER, VIDEO AMPLIFIER, AGC AMPLIFIER AND AS A REACTANCE TUBE WHILE THE TRIODE UNIT IS WELL SUITED FOR USE IN LOW-FREQUENCY OSCILLATOR, SYNC-SEPARATOR, SYNC-CLIPPER, AND PHASE-SPLITTER CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

TRIODE UNIT:		
GRID TO PLATE	1.6	μμf
GRID TO CATHODE, HEATER & GRID #3 AND INTERNAL SHIELD	1.9	μμf
PLATE TO CATHODE, HEATER & GRID #3 AND INTERNAL SHIELD	1.6	μμf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.025	μμf
GRID #1 TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, & CATHODE	7	μμf
PLATE TO HEATER & INTERNAL SHIELD & GRID #3, GRID #2, & CATHODE	2.25	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.02	μμf
PENTODE PLATE TO TRIODE PLATE	0.04	μμf
TRIODE GRID TO PENTODE PLATE	0.005	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #3 VOLTAGE POSITIVE VALUE	---	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	---	SEE FIGURE #1	

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS — CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.6	2	WATTS
MAXIMUM GRID #2 INPUT:			
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	---	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300V.	---	SEE FIGURE 1	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	---[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:*			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION	0.5	0.25	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

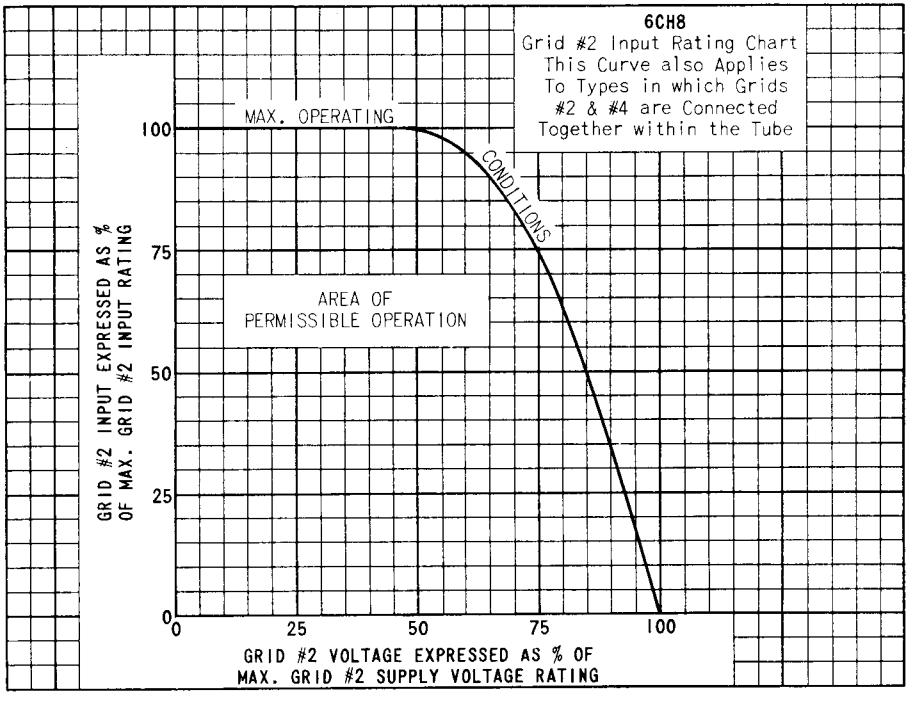
CLASS A_1 AMPLIFIER

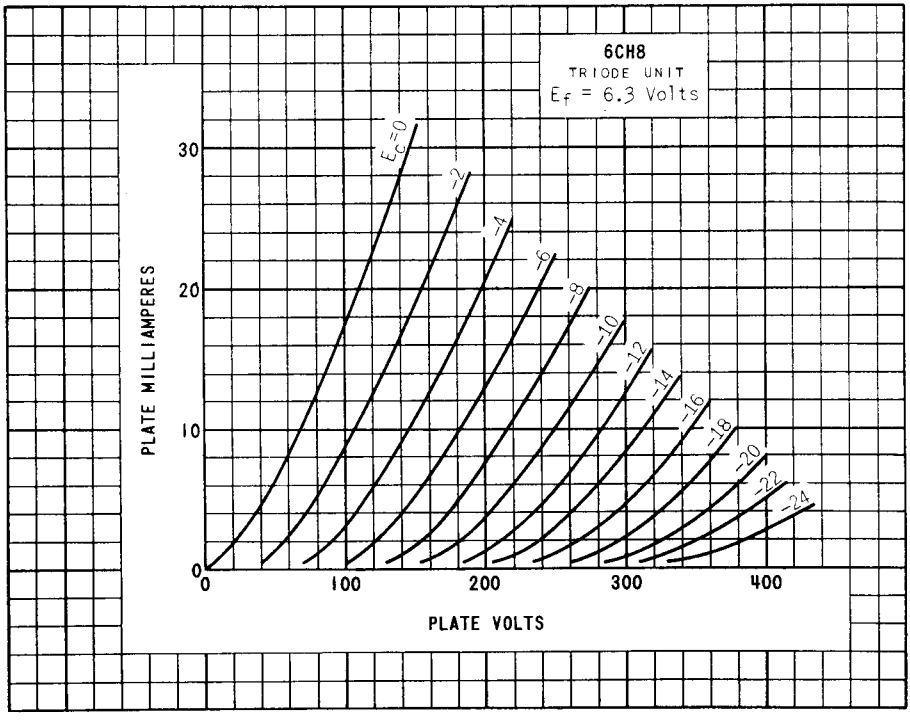
	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE SUPPLY VOLTAGE	200	200	VOLTS
GRID #3 SUPPLY VOLTAGE	---	0	VOLTS
GRID #2 SUPPLY VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-6	---	VOLTS
CATHODE-BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	19	---	
PLATE RESISTANCE (APPROX.)	5 750	300 000	OHMS
TRANSCONDUCTANCE	3 300	6 200	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-19	-8	VOLTS
PLATE CURRENT	13	9.5	MA.
GRID #2 CURRENT	---	2.8	MA.

[A] THE HEATER-CATHODE VOLTAGE SHOULD NOT EXCEED THE VALUE OF THE OPERATING CATHODE BIAS BECAUSE THE VOLTAGE BETWEEN THE HEATER AND CATHODE IS ALSO APPLIED BETWEEN THE CATHODE AND GRID #3. THE NET RESULT IS TO MAKE GRID #3 NEGATIVE WITH RESPECT TO CATHODE WITH POSSIBLE CHANGE IN TUBE CHARACTERISTICS.

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* IF EITHER UNIT IS OPERATED AT MAXIMUM RATED CONDITIONS, GRID-#1-CIRCUIT RESISTANCE FOR BOTH UNITS SHOULD NOT EXCEED THE STATED VALUES.





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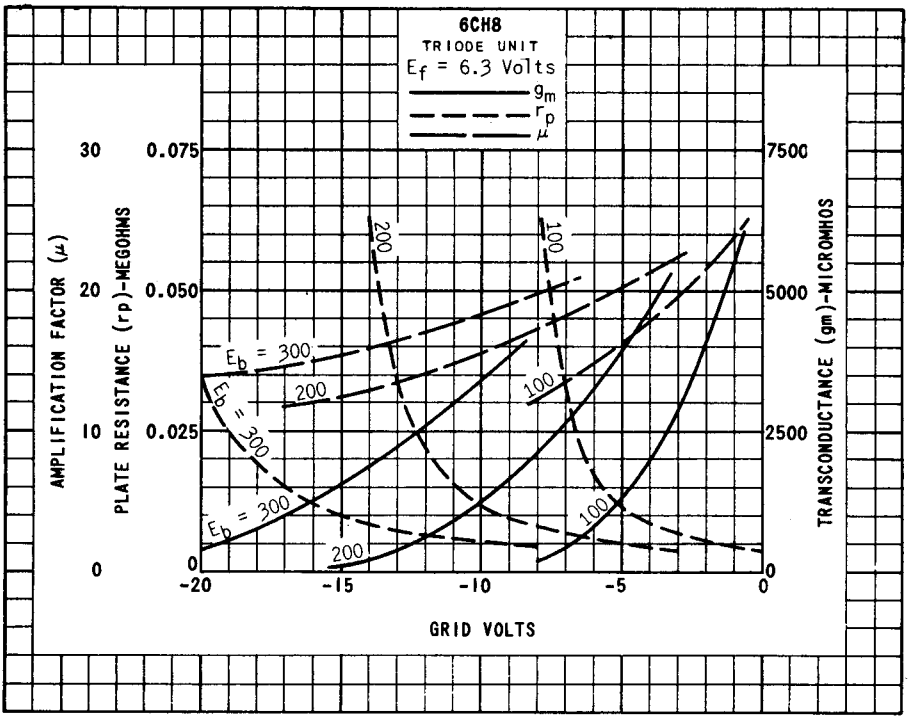
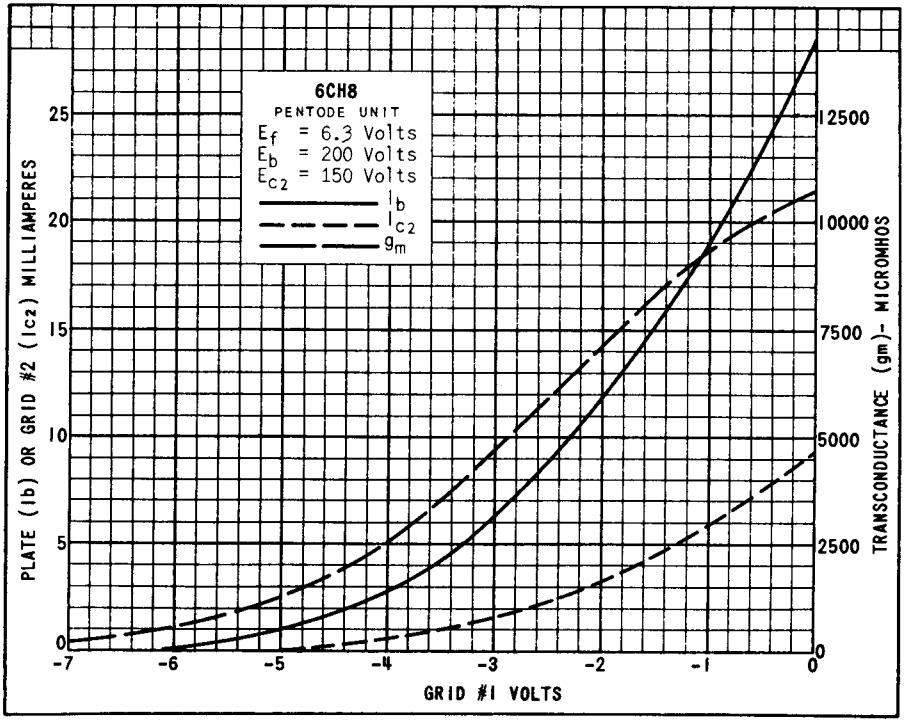
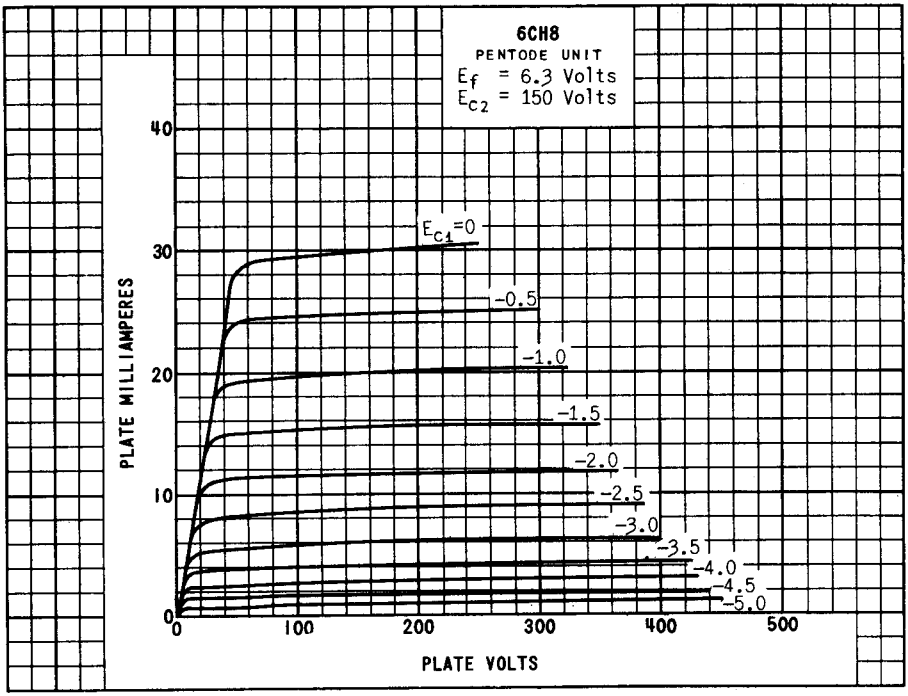
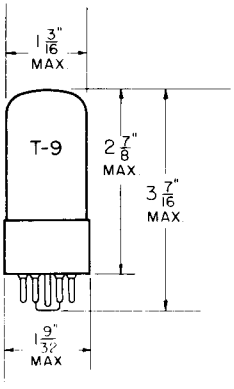

6CH8
TRIODE UNIT
Ef = 6.3 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp)-MEGOHMS
TRANSCONDUCTANCE (gm)-MICROMHOS
GRID VOLTS
Eb = 300
200
100
30
20
10
0
0.075
0.050
0.025
7500
5000
2500
-20
-15
-10
-5
0


6CH8
PENTODE UNIT
Ef = 6.3 Volts
Eb = 200 Volts
Ec2 = 150 Volts
Ib
Ic2
gm
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (gm)- MICROMHOS
GRID #1 VOLTS
25
20
15
10
5
0
12500
10000
7500
5000
2500
-7
-6
-5
-4
-3
-2
-1
0


6CH8
PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1}=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
0
10
20
30
40
0
100
200
300
400
500

TUNG-SOL

TRIODE

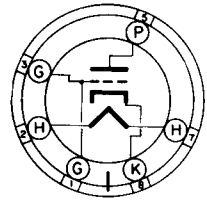


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.25 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
8J8

THE 6CK4 IS A LOW MU TRIODE INTENDED FOR USE PRIMARILY AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. CONTAINED IN A T-9 ENVELOPE, THE TUBE HAS A HIGH ZERO-BIAS PLATE CURRENT.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (G TO P)	6.5	μμf
INPUT: G TO (H+K)	8.0	μμf
OUTPUT: P TO (H+K)	1.8	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	12.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	100	MA.
MAXIMUM PEAK CATHODE CURRENT	350	MA.
MAXIMUM GRID CIRCUIT RESISTANCE		
SELF BIAS	2.2	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.25	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−28 ←	VOLTS
PLATE CURRENT	40 ←	MA.
TRANSCONDUCTANCE	5 500 ←	μMHOS
AMPLIFICATION FACTOR	6.6 ←	
PLATE RESISTANCE (APPROX.)	1 200 ←	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA.	−50	VOLTS
PLATE CURRENT AT E_c =−38 Vdc.	10	MA.
ZERO BIAS PLATE CURRENT: E_b =100 V; E_c =0 (INSTANTANEOUS VALUES)	125	MA.

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

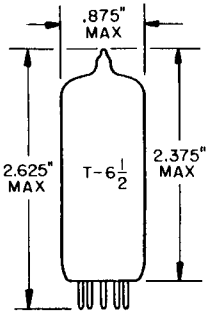
[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-3

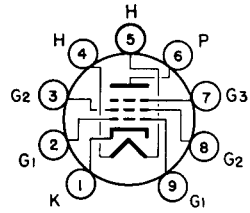
FOR

USE IN VIDEO STAGE

OF TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9BV

THE 6CL6 IS A POWER PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE IN THE FINAL VIDEO STAGE OF TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE LOW CAPACITANCES AND HIGH OUTPUT CAPABILITY. IT IS ALSO USEFUL AS A WIDE-BAND AMPLIFIER TUBE IN INDUSTRIAL AND LABORATORY EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.12	pf
INPUT	11	pf
OUTPUT	5.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	650	MA.

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	⟶100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	⟶100	VOLTS

MAXIMUM RATINGS

⟶ DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID 3 VOLTAGE	0	VOLTS
GRID 2 SUPPLY VOLTAGE	300	VOLTS
GRID 2 VOLTAGE	⟶150	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS - CONT'D.

→ DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

GRID 1 VOLTAGE:		
POSITIVE BIAS VOLTAGE	0	VOLTS
NEGATIVE BIAS VOLTAGE	50	VOLTS
PLATE DISSIPATION	7.5	WATTS
GRID 2 INPUT	1.7	WATTS
BULB TEMPERATURE AT HOTTEST POINT ON BULB SURFACE	200°	C
GRID 1 CIRCUIT RESISTANCE *		
FOR FIXED BIAS OPERATION	0.1	MEGOHM
FOR CATHODE BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE		250	VOLTS
GRID 3 VOLTAGE - CONNECTED TO CATHODE AT SOCKET			
GRID 2 VOLTAGE		150	VOLTS
GRID 1 VOLTAGE		−3	VOLTS
PEAK AF GRID 1 SIGNAL VOLTAGE		3	VOLTS
ZERO SIGNAL DC PLATE CURRENT		30	MA.
MAXIMUM SIGNAL DC PLATE CURRENT		31	MA.
ZERO SIGNAL DC GRID 2 CURRENT		7	MA.
MAXIMUM SIGNAL DC GRID 2 CURRENT		7.2	MA.
PLATE RESISTANCE	(APPROX.)	0.9 ←	MEGOHMS
TRANSCONDUCTANCE		11,000	μMHOS
LOAD RESISTANCE		7,500	OHMS
TOTAL HARMONIC DISTORTION		8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT		2.8	WATTS
GRID 1 VOLTAGE FOR PLATE CURRENT OF 10 μAMP.	(APPROX.)	−14	VOLTS

4 MC. BANDWIDTH VIDEO AMPLIFIER

PLATE SUPPLY VOLTAGE	300	VOLTS
GRID 3 VOLTAGE - CONNECTED TO CATHODE AT SOCKET		
GRID 2 SUPPLY VOLTAGE	300	VOLTS
GRID 1 BIAS VOLTAGE	−2	VOLTS
PEAK TO PEAK GRID 1 SIGNAL VOLTAGE	3	VOLTS
GRID 2 RESISTOR	24,000	OHMS
GRID 1 RESISTOR	0.1	MEGOHM
LOAD RESISTOR	3,900	OHMS
ZERO SIGNAL PLATE CURRENT	30	MA.
ZERO SIGNAL GRID 2 CURRENT	7.0	MA.
PEAK TO PEAK VOLTAGE OUTPUT	132	VOLTS

→ INDICATES A CHANGE.

* INDICATES AN ADDITION.

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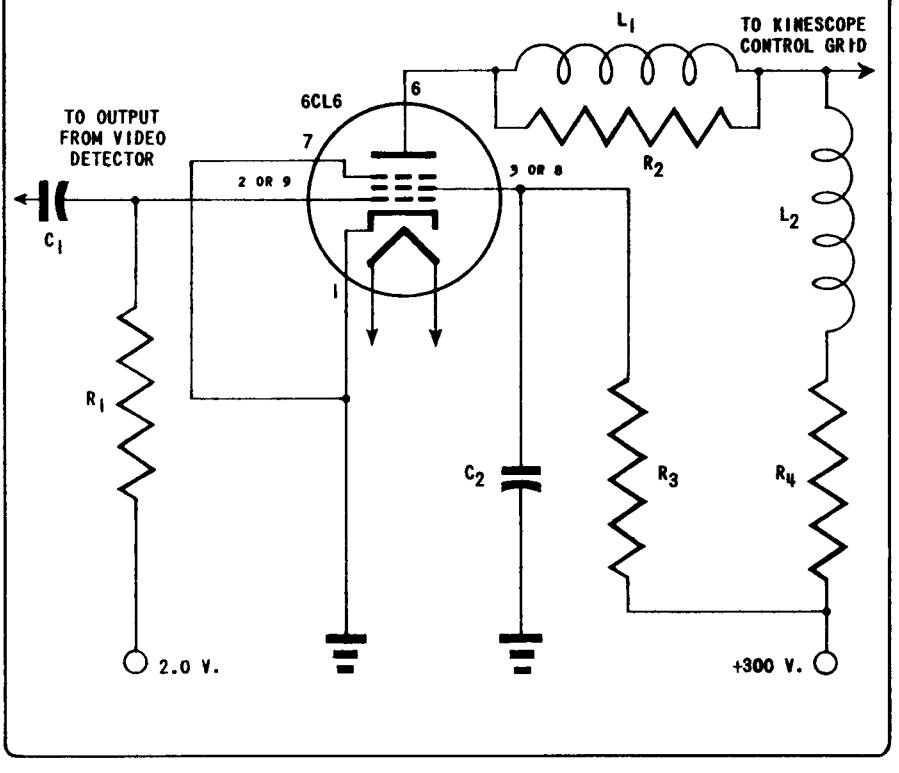

PLATE 3021
SEPT. 1 1952

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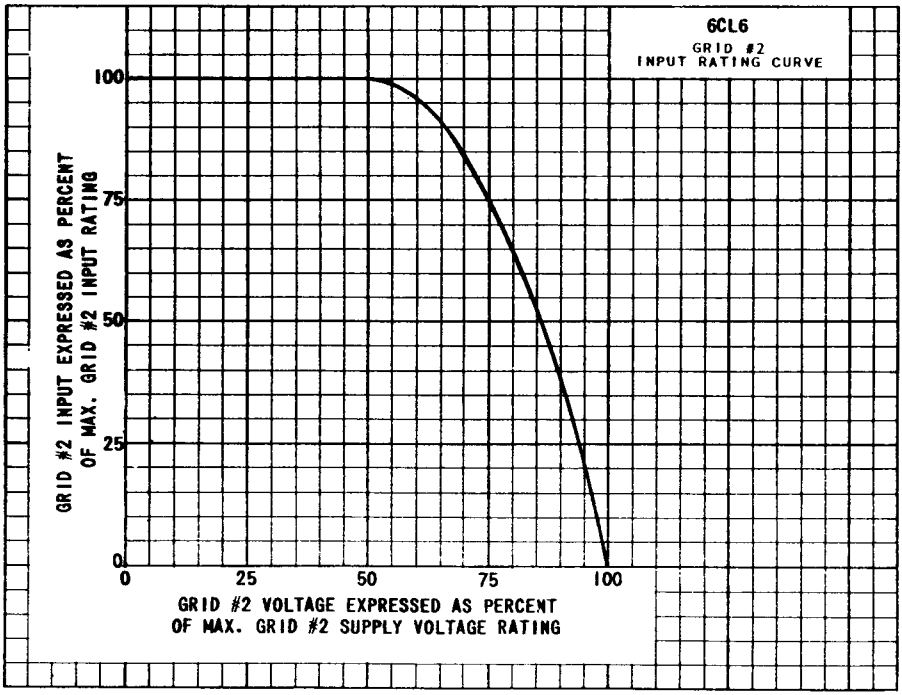
6CL6



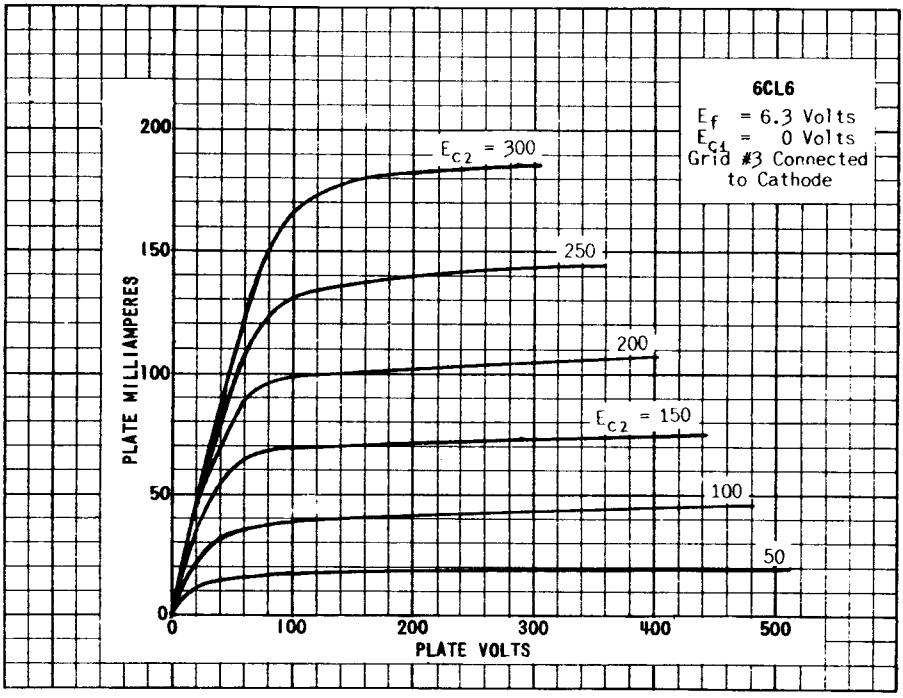


PLATE
3022
SEPT. 1
1952

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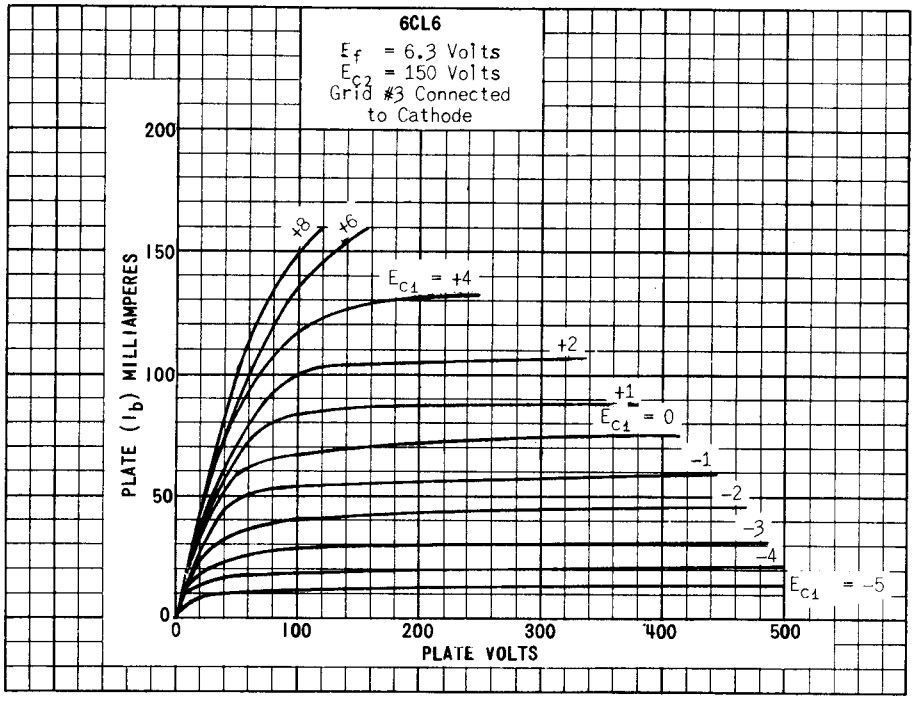

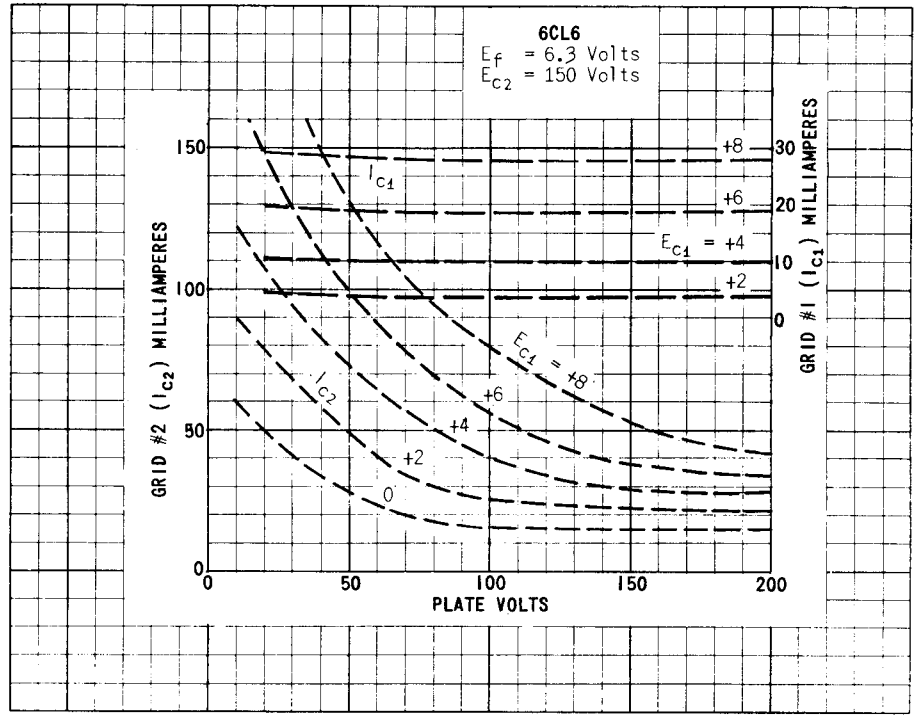

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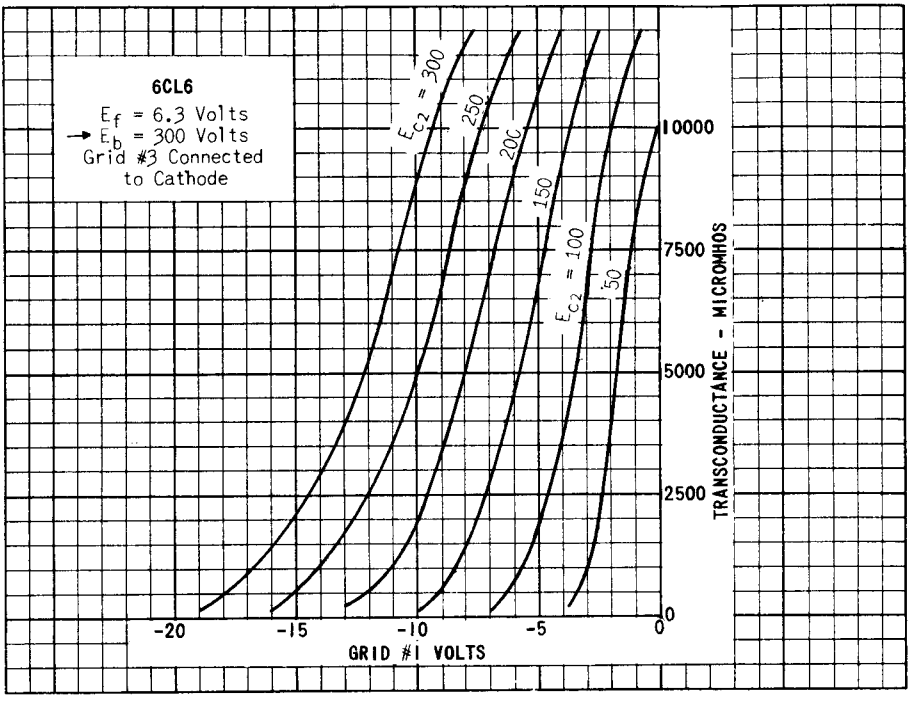
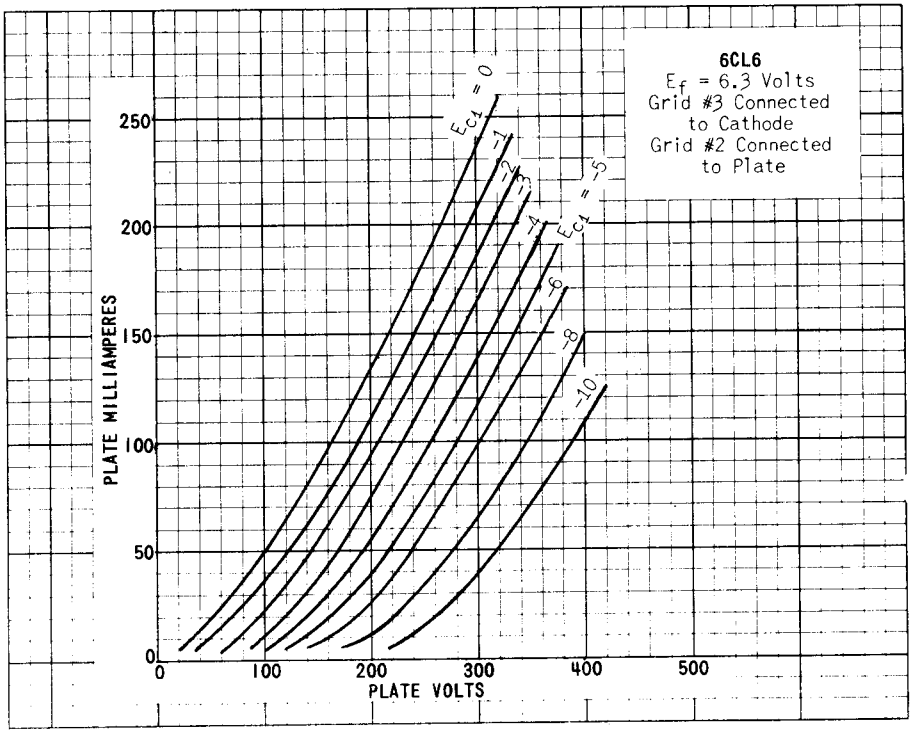
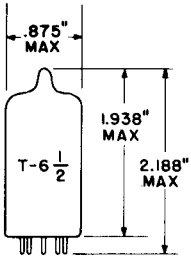

6CL6
E_f = 6.3 Volts
E_b = 300 Volts
Grid #3 Connected to Cathode
E_{c2} = 300
250
200
150
E_{c2} = 100
50
10000
7500
5000
2500
0
TRANSCONDUCTANCE - MICROMHOS
-20
-15
-10
-5
0
GRID #1 VOLTS


6CL6
E_f = 6.3 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-8
-10
250
200
150
100
50
0
PLATE MILLIAMPERES
0
100
200
300
400
500
PLATE VOLTS

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

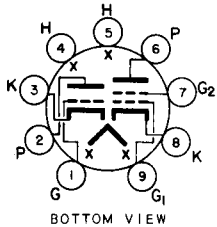
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR

VHF TELEVISION TUNER
APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9FX

THE 6CL8A IS A SHARP CUTOFF TETRODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE, PRIMARILY AS A COMBINED TRIODE OSCILLATOR AND TETRODE MIXER IN VHF TELEVISION TUNERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. IT IS UNILATERALLY INTERCHANGEABLE, BOTH ELECTRICALLY AND MECHANICALLY, WITH THE 6CL8 AND DIFFERS PRIMARILY FROM THE 6CL8 IN HAVING A TETRODE SECTION WITH LOWER GRID-PLATE CAPACITANCE AND HIGHER TRANSCONDUCTANCE. EXCEPT FOR HEATER RATINGS, THE 6CL8A IS IDENTICAL TO THE 5CL8A.

→ DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TETRODE:			
GRID #1 TO PLATE: (G1 TO P) (MAX.)	0.01	0.02	pf
INPUT: G1 TO (K+G2+H+I.S.)	5.0	5.0	pf
OUTPUT: P TO (K+G2+H+I.S.)	3.0	2.0	pf
CATHODE TO HEATER: (K TO H)	3.0[B]	3.0	pf
TRIODE:			
GRID TO PLATE: (G TO P)	1.8	1.8	pf
INPUT: G TO (TK+TEK+H+I.S.)	2.8	2.8	pf
OUTPUT: G TO (TK+TEK+H+I.S.)	2.0	1.5	pf
CATHODE TO HEATER: (TK TO H)	3.0[B]	3.0	pf
TETRODE GRID #1 TO TRIODE PLATE (TEG1 TO TP) (MAX.)	0.01	0.015	pf
TETRODE PLATE TO TRIODE PLATE (TEP TO TP) (MAX.)	0.03	0.15	pf

[A] EXTERNAL SHIELD #315 CONNECTED TO PIN #4.

[B] EXTERNAL SHIELD #315 CONNECTED TO PIN #6.

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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±27	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME[A]		11	SECONDS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TETRODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID #2 SUPPLY VOLTAGE	330	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
TETRODE PLATE DISSIPATION	3.0	WATTS
GRID #2 DISSIPATION	0.55	WATT
POSITIVE DC TETRODE GRID #1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS
TETRODE GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.25	MEGOHM
CATHODE BIAS	1.0	MEGOHM
TRIODE GRID CIRCUIT RESISTANCE:		
FIXED BIAS	0.5	MEGOHM
CATHODE BIAS	1.0	MEGOHM

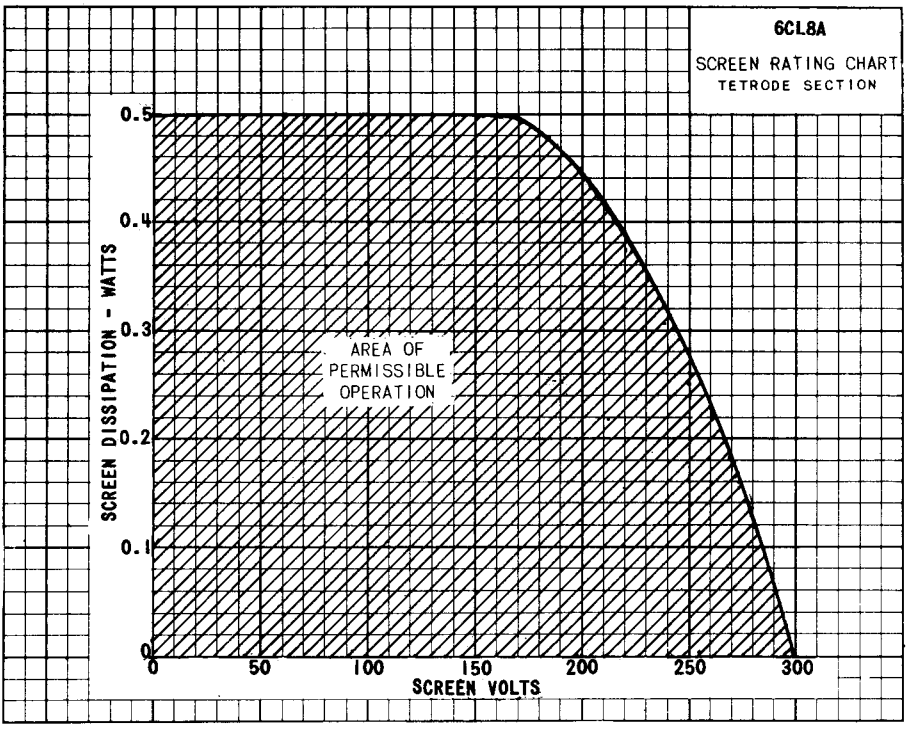
→ TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	TETRODE	
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	8000	6500	μMHOS
PLATE CURRENT	14.0	12.0	MA.
GRID #2 CURRENT	---	4.0	MA.
PLATE RESISTANCE (APPROX.)	5000Ω	0.2	MEGOHM
AMPLIFICATION FACTOR	40	---	
GRID #1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-9	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb =100 V, Ec2 =70 V.)	---	7000	μMHOS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES THE RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

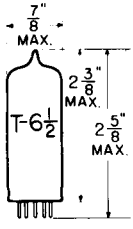
→ INDICATES A CHANGE.


6CL8A
SCREEN RATING CHART
TETRODE SECTION
SCREEN DISSIPATION - WATTS
0.5
0.4
0.3
0.2
0.1
0
AREA OF
PERMISSIBLE
OPERATION
0
50
100
150
200
250
300
SCREEN VOLTS

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

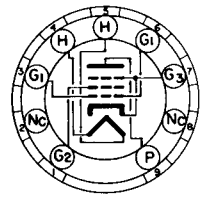


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9CK

THE 6CM6 IS A BEAM POWER AMPLIFIER USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A GENERAL PURPOSE AUDIO POWER AMPLIFIER OR VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVER SWEEP CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G TO P	0.7	μμf
INPUT: G_1 TO (H+K+G_2&G_3)	8.0	μμf
OUTPUT: P TO (H+K+G_2&G_3)	8.5	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

	PENTODE CONNECTION	TRIODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAX.)	2	2	KV.
MAXIMUM DC GRID #2 VOLTAGE	285	---	VOLTS
MAXIMUM PLATE DISSIPATION[C]	8	→9.0	WATTS
MAXIMUM GRID #2 DISSIPATION[C]	1.75	---	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	250	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	40	40	MA.
MAXIMUM PEAK CATHODE CURRENT	120	120	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	2.2	MEGOHMS

[A] THESE ARE DESIGN CENTER VALUES EXCEPT WHERE ABSOLUTE MAXIMUM IS INDICATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCASTING STATIONS: FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE IS NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH A GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CLASS A_1 AMPLIFIER

MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

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→ INDICATES A CHANGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER -- SINGLE TUBE

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	-13.0	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.0	4.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	4.0	7.0	6.0	MA.
PLATE RESISTANCE	50	50	80	KILOHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	µMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
POWER OUTPUT (MAXIMUM SIGNAL)	2.0	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION	8	8	12	PERCENT

TRIODE CONNECTED*

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	5 000	µMHOS
AMPLIFICATION FACTOR	9.8	
PLATE RESISTANCE (APPROX.)	1 960	OHMS
GRID VOLTAGE (APPROX.) FOR I_b = 0.5 MA	-37	VOLTS

*INDICATES AN ADDITION.

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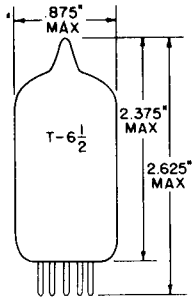
DOUBLE TRIODE

MINIATURE TYPE

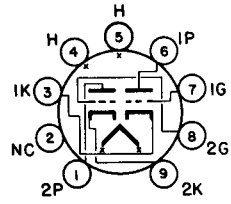


GLASS BULB
SMALL BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 600±40 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9ES

THE 6CM7 IS A MEDIUM-MU DOUBLE TRIODE OF THE 9 PIN MINIATURE TYPE CONTAINING TWO DISSIMILAR TRIODES IN ONE ENVELOPE. IT IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

	UNIT #1 OSCILLATOR	UNIT #2 AMPLIFIER	
GRID TO PLATE	3.8	3	pf
GRID TO CATHODE AND HEATER	2	3.5	pf
PLATE TO CATHODE AND HEATER	0.5	0.4	pf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

	UNIT #1 VERTICAL DEFLECTION OSCILLATOR		UNIT #2 VERTICAL DEFLECTION AMPLIFIER	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[C]		VOLTS
MAXIMUM DC PLATE VOLTAGE	→ 550		550	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID VOLTAGE[D]	→ 220		220	VOLTS
MAXIMUM PEAK POSITIVE-PULSE PLATE VOLTAGE[D]			2200	VOLTS
MAXIMUM CATHODE CURRENT:				
PEAK	→ 77		77	MA.
AVERAGE	→ 17		22	MA.
MAXIMUM PLATE DISSIPATION	→ 1.45		6.0	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:				
CATHODE BIAS	2.2		2.5	MEGOHMS
FIXED BIAS	2.2		1.0	MEGOHMS
GRID RESISTOR BIAS	2.2		---	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[F]		11.0		SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[D] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM 15% OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

[F] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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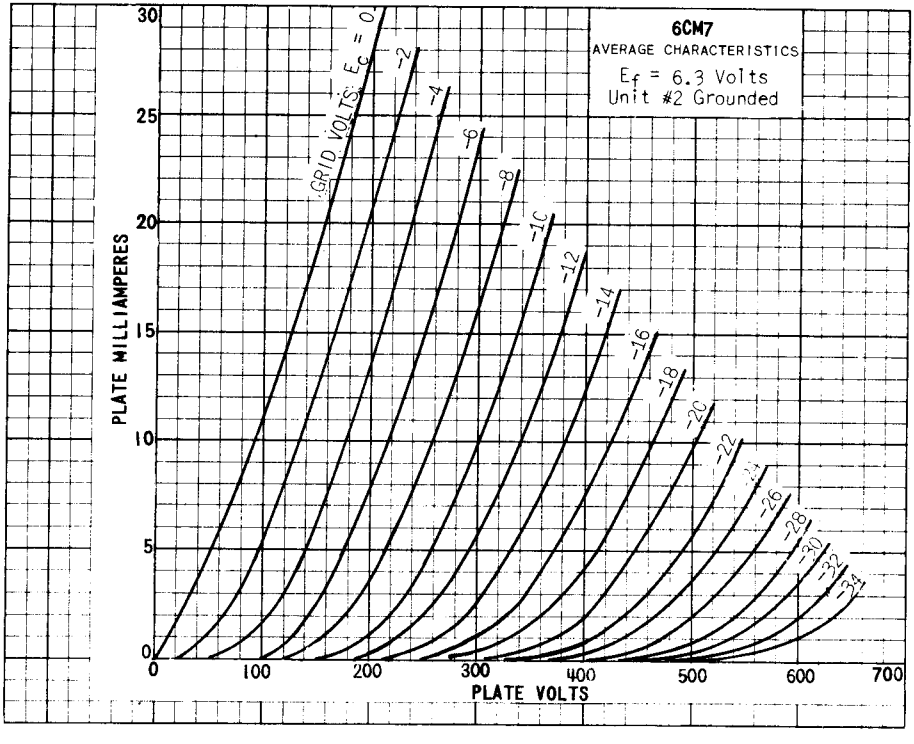
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

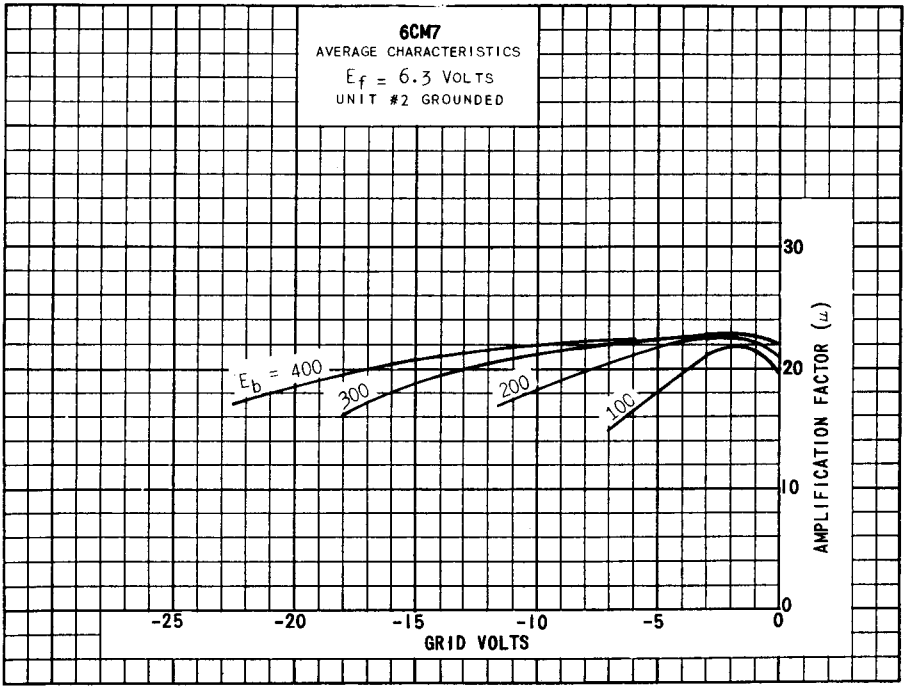
CLASS A_1 AMPLIFIER

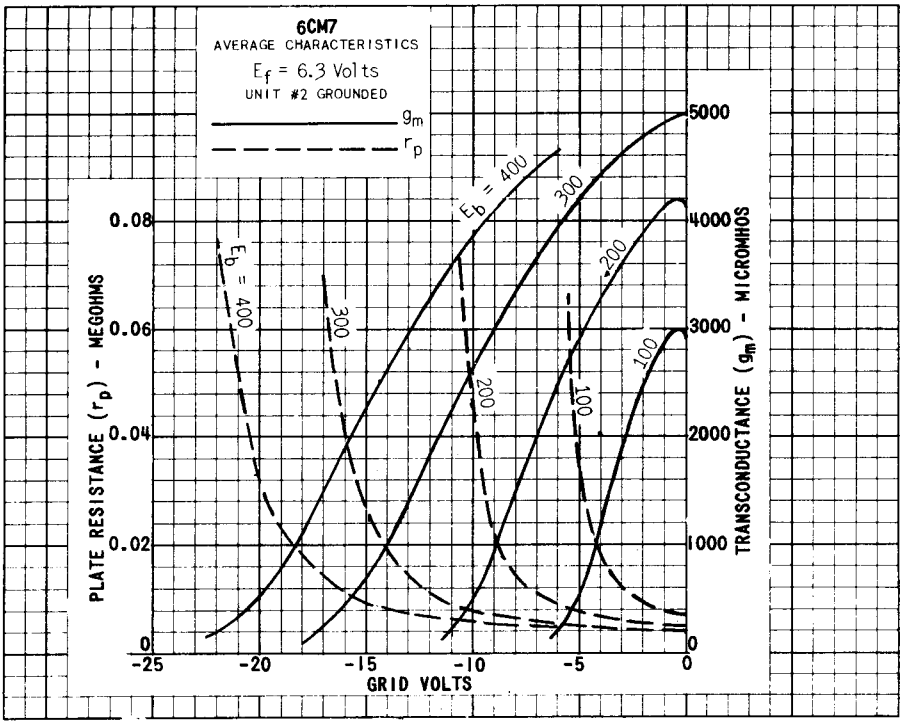
	UNIT #1 OSCILLATOR	UNIT #2 AMPLIFIER	
PLATE VOLTAGE	200	250	VOLTS
GRID VOLTAGE	−7	−8	VOLTS
AMPLIFICATION FACTOR	21	18	
PLATE RESISTANCE (APPROX.)	10 500	4 100	OHMS
TRANSCONDUCTANCE	2 000	4 400	μMHOS
PLATE CURRENT†	5	20	MA.
PLATE CURRENT FOR GRID VOLTAGE OF −10 VOLTS	1	---	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	14	---	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings, the 6CM7 is identical to the 8CM7.

→ INDICATES A CHANGE.







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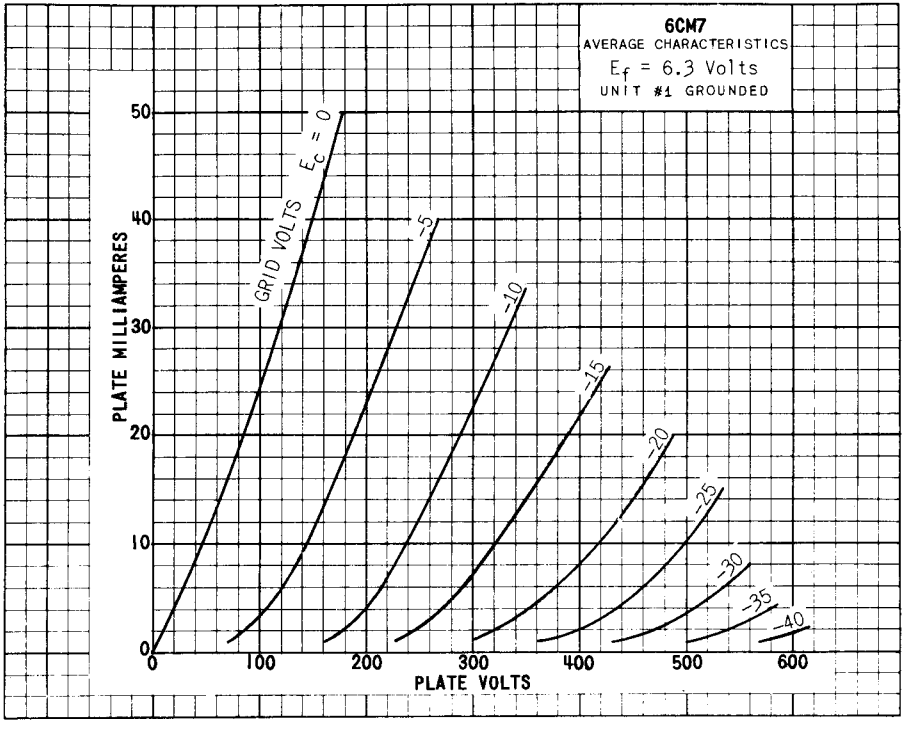
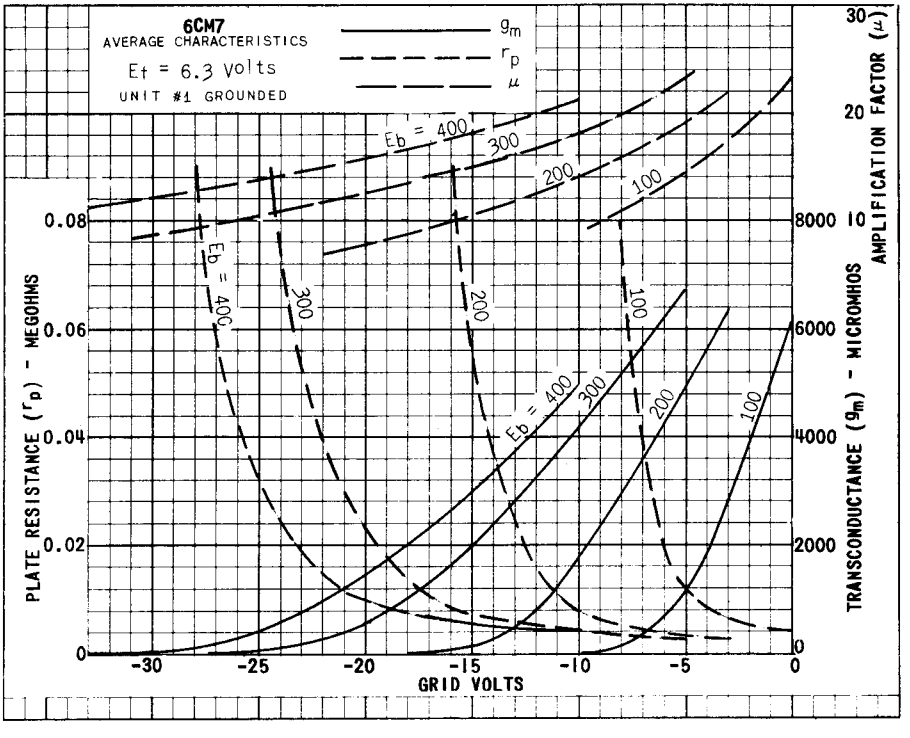

6CM7
AVERAGE CHARACTERISTICS
Ef = 6.3 Volts
UNIT #1 GROUNDED
PLATE MILLIAMPERES
PLATE VOLTS
GRID VOLTS
Ec = 0
-5
-10
-15
-20
-25
-30
-35
-40
0
10
20
30
40
50
100
200
300
400
500
600


6CM7
AVERAGE CHARACTERISTICS
Et = 6.3 Volts
UNIT #1 GROUNDED
gm
rp
μ
Eb = 400
300
200
100
PLATE RESISTANCE (rp) - MEGOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0.08
0.06
0.04
0.02
0
8000
6000
4000
2000
30
20
10
-30
-25
-20
-15
-10
-5

TUNG-SOL

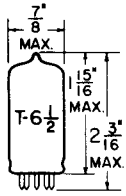
TRIODE PENTODE

MINIATURE TYPE

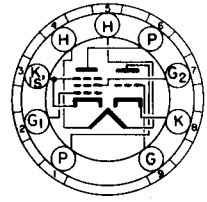
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9FZ

THE 6CM8 IS A MULTIUNIT TUBE OF THE 9-PIN MINIATURE CONSTRUCTION CONTAINING A HIGH-MU TRIODE AND SHARP CUTOFF PENTODE IN ONE ENVELOPE. THE PENTODE SECTION MAY BE USED AS AN INTERMEDIATE FREQUENCY AMPLIFIER, AGC AMPLIFIER AND REACTANCE TUBE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CM8 IS IDENTICAL TO THE 5CM8.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

TRIODE SECTION		
GRID TO PLATE G TO P	1.9	μμf
INPUT G TO (H+K)	1.6	μμf
OUTPUT P TO (H+K)	0.22	μμf
PENTODE SECTION		
GRID #1 TO PLATE G_1 TO P (MAX.)	0.04 ←	μμf
INPUT: G_1 TO (H+K+G_2+G_3+I.S.)	6.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	2.6	μμf
COUPLING		
PENTODE PLATE TO TRIODE GRID (MAX.)	0.01	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.15	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.10	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
SELF BIAS		1.0	MEGOHM
FIXED BIAS		0.25	MEGOHM

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TUNG-SOL

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RATINGS — CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
MAXIMUM HEATER–CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM–UP TIME (APPROX.)*	11.0		SECONDS

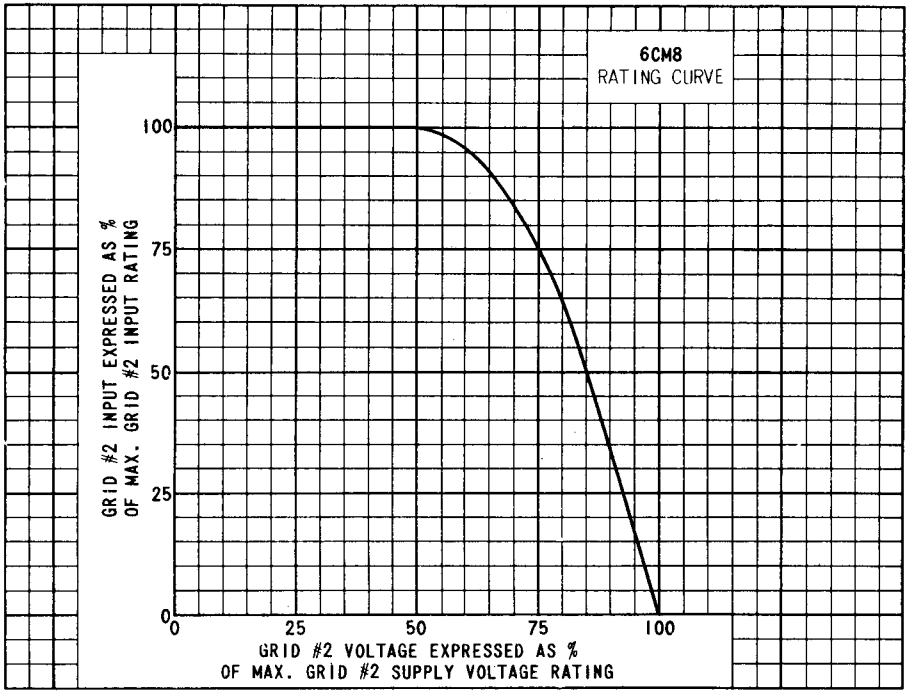
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE SUPPLY VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		150	VOLTS
GRID #1 VOLTAGE	−2	0	VOLTS
CATHODE BIAS RESISTOR		180	OHMS
PLATE CURRENT	1.8	9.5	MA.
GRID #2 CURRENT		2.8	MA.
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE (APPROX.)	50 000	600 000	OHMS
TRANSCONDUCTANCE	2 000	6 200	μMHOS
GRID #1 VOLTAGE FOR Ib=10μA (APPROX.)		−8	VOLTS

*HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.



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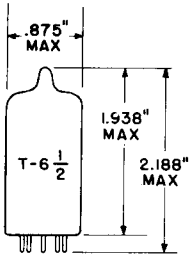
TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

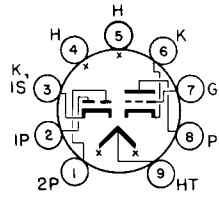
HEATER

SERIES	PARALLEL
6.3±0.6 VOLTS	6.15 VOLTS
300 MA.	600±40 MA.

AC OR DC

ANY MOUNTING POSITION

CONTROL OF HEATER WARM-UP TIME APPLIES ONLY TO PARALLEL CONNECTION.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9EN

THE 6CN7 IS A DUPLEX DIODE HIGH-MU TRIODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE DIODE AND TRIODE SECTIONS. IT IS INTENDED PRIMARILY FOR SERVICE AS A COMBINED HORIZONTAL PHASE DETECTOR AND REACTANCE TUBE IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 6CN7 IS IDENTICAL TO THE 8CN7.

DIRECT INTERELELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	1.8	pf
TRIODE INPUT	1.5	pf
TRIODE OUTPUT	0.5	pf
GRID TO EACH DIODE PLATE	0.006	pf
DIODE #1 PLATE TO DIODE CATHODE AND HEATER	3.6	pf
DIODE #2 PLATE TO DIODE CATHODE AND HEATER	3.6	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM PLATE VOLTAGE	→ 330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	→ 1.1	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO EITHER CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO EITHER CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION, (EACH DIODE)	→ 5.5	MA.
HEATER WARM-UP TIME*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

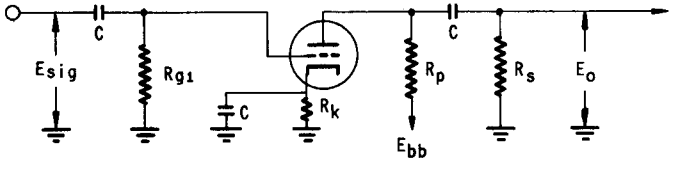
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1.0	−3.0	VOLTS
AMPLIFICATION FACTOR	70	70	
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5.0 VOLTS DC APPLIED		20	MA.

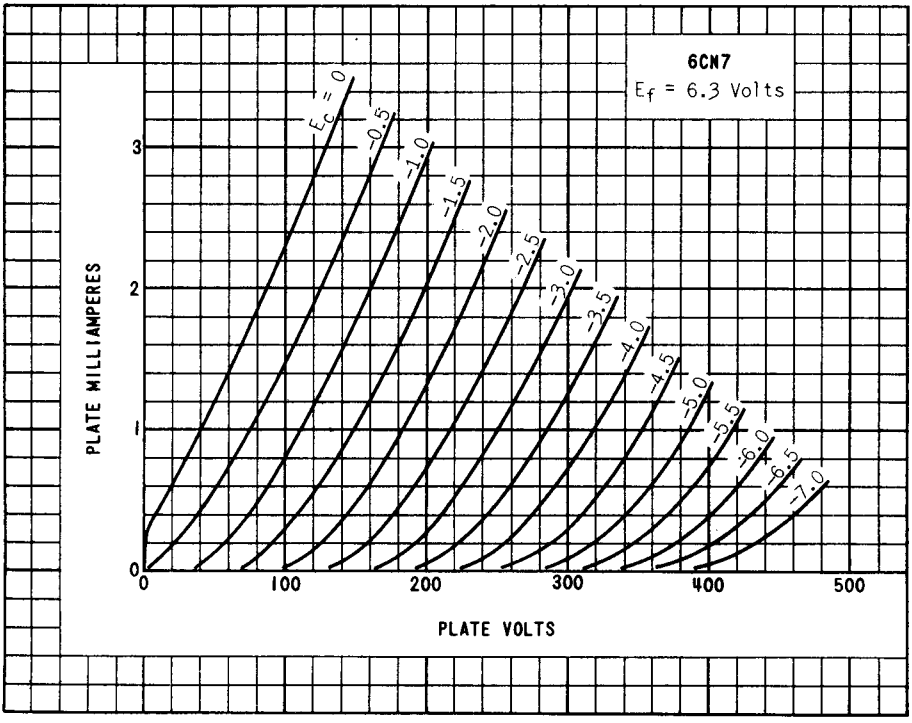
CLASS A RESISTANCE - COUPLED AMPLIFIER

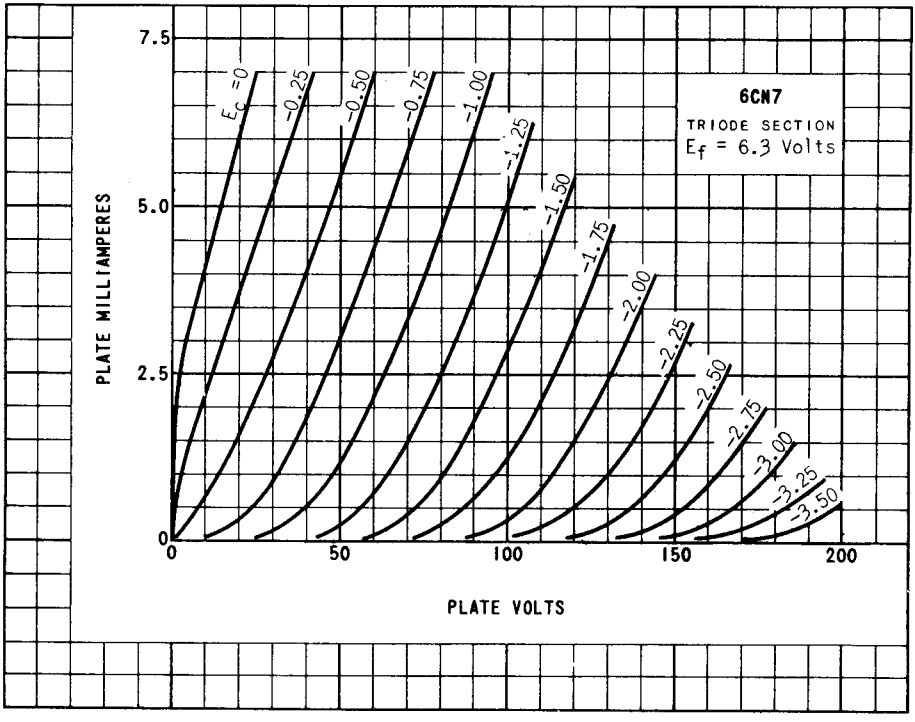
Rp Meg.	Rs Meg.	R_{g1} Meg.	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
			Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56

Eo IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

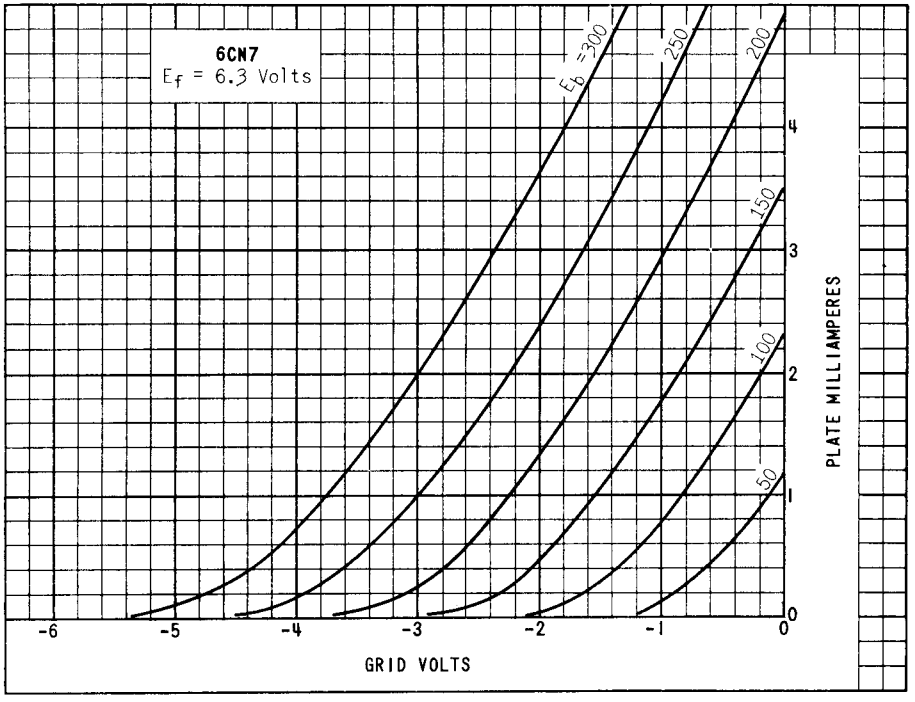


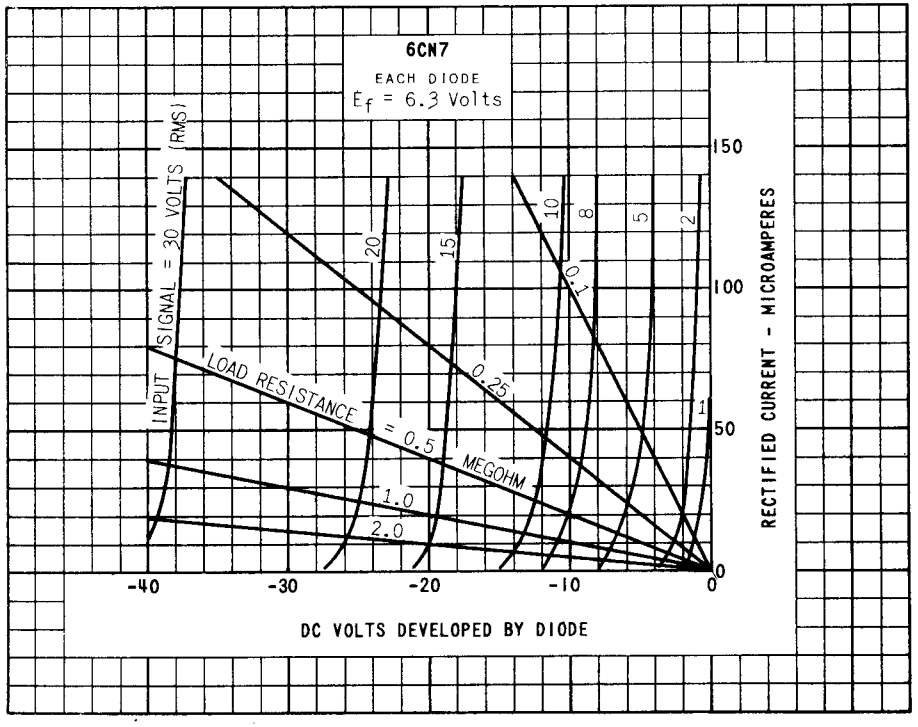
NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

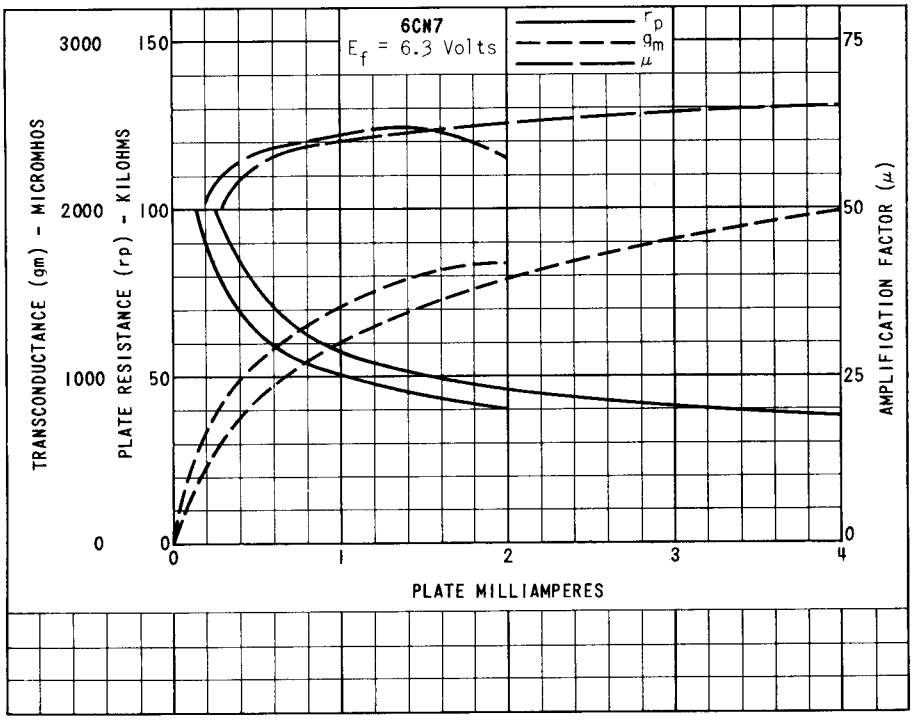

6CN7
E_f = 6.3 Volts
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
PLATE MILLIAMPERES
0
1
2
3
0
100
200
300
400
500
PLATE VOLTS


6CN7
TRIODE SECTION
E_f = 6.3 Volts
E_c =0
-0.25
-0.50
-0.75
-1.00
-1.25
-1.50
-1.75
-2.00
-2.25
-2.50
-2.75
-3.00
-3.25
-3.50
PLATE MILLIAMPERES
0
2.5
5.0
7.5
0
50
100
150
200
PLATE VOLTS

6CN7


6CN7
E_f = 6.3 Volts
E_b = 300
250
200
150
100
50
PLATE MILLIAMPERES
0
1
2
3
4
-6
-5
-4
-3
-2
-1
0
GRID VOLTS


6CN7
EACH DIODE
E_f = 6.3 Volts
INPUT SIGNAL = 30 VOLTS (RMS)
LOAD RESISTANCE
= 0.5 MEGOHM
0.25
1.0
2.0
20
15
10
8
5
2
1
0.1
150
100
50
0
RECTIFIED CURRENT - MICROAMPERES
-40
-30
-20
-10
0
DC VOLTS DEVELOPED BY DIODE



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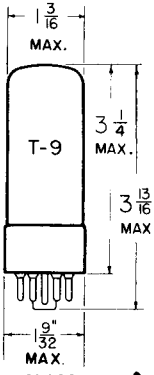
TUNG-SOL

DIODE



GLASS BULB[•]

SHORT INTERMEDIATE SHELL
OCTAL JEDEC B5-85

OR

INTERMEDIATE SHELL
OCTAL JEDEC B5-147

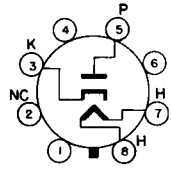
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 1.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 6CQ4 IS AN INDIRECTLY-HEATED HALF-WAVE RECTIFIER DESIGNED PRIMARILY FOR TELEVISION DAMPING DIODE SERVICE IN HORIZONTAL DEFLECTION CIRCUITS. TUBE VOLTAGE DROP AND DC PLATE CURRENT RATINGS HAVE BEEN ESTABLISHED WHICH PERMITS SINGLE TUBE OPERATION IN LOW B+ AS WELL AS WIDE DEFLECTION ANGLE TV SYSTEMS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

HEATER-TO-CATHODE	4.0	pf
PLATE-TO-CATHODE AND HEATER	8.5	pf
CATHODE-TO-PLATE AND HEATER	11.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

DAMPER SERVICE[B]

HEATER VOLTAGE	6.3±0.6	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5500	VOLTS
MAXIMUM PEAK PLATE CURRENT	1200	MA.
MAXIMUM DC PLATE CURRENT	190	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	5500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS

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AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP Ib = 250 MA. DC	25	VOLTS

A

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

B

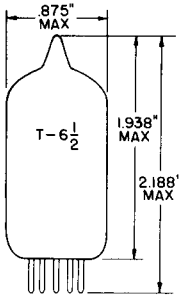
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

THE JEDEC B5 - 85 AND B5-147 BASES SPECIFIED FOR USE WITH THE 6CQ4, DO NOT HAVE PINS IN BASE POSITIONS #1, #4 & #6, HOWEVER POSITIONS 1 & 6 HAVE INTERNAL CONNECTIONS TERMINATING IN STEM LEADS. BASE TERMINAL POSITION 2 HAS A BASE PIN WHICH MAY BE CONNECTED TO A STEM LEAD. BECAUSE OF THE CLOSE PROXIMITY OF STEM LEADS TO THE SOCKET PIN CLIPS WHEN THE TUBE IS SEATED IN THE SOCKET, CIRCUIT TIE POINTS SHOULD NOT BE MADE TO SOCKET TERMINALS 1, 2, 4 & 6 UNLESS ADEQUATE PRECAUTIONS ARE TAKEN AGAINST VOLTAGE BREAKDOWN IN BOTH THE TUBE BASE AND THE SOCKET. TO REDUCE THE POSSIBILITY OF ARCOVER, IT IS RECOMMENDED SOCKET CLIPS FOR POSITIONS 1, 2, 4 & 6 BE REMOVED FROM THE DAMPER TUBE SOCKET.

TUNG-SOL

TRIODE-TETRODE

MINIATURE TYPE

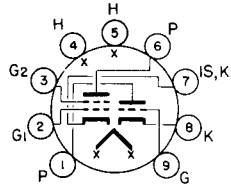


GLASS BULB
SMALL-BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450±30 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GE

THE 6CQ8 IS A MEDIUM-MU TRIODE AND SHARP CUTOFF TETRODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT MAY BE USED IN A WIDE VARIETY OF APPLICATIONS IN BLACK AND WHITE AND COLOR TELEVISION RECEIVERS, PARTICULARLY AS A COMBINED VHF OSCILLATOR AND MIXER IN TUNERS OF SUCH RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THE TETRODE UNIT IS INTENDED FOR USE AS A MIXER TUBE, BUT IT IS ALSO USEFUL AS A VIDEO INTERMEDIATE-FREQUENCY AMPLIFIER TUBE AND AS A SOUND INTERMEDIATE FREQUENCY AMPLIFIER TUBE. THE TRIODE UNIT IS SUITABLE FOR USE NOT ONLY AS A VHF OSCILLATOR, BUT ALSO AS A PHASE SPLITTER, SYNC-CLIPPER, SYNC-SEPARATOR, AND RF AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXTERNAL SHIELD	WITH[A] EXTERNAL SHIELD	
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	pf
GRID TO CATHODE & HEATER	2.7	2.7	pf
PLATE TO CATHODE AND HEATER	0.4	1.2	pf
TETRODE UNIT:			
GRID #1 TO PLATE (MAX.)	0.019	0.015	pf
GRID #1 TO CATHODE & I.S., GRID #2 & HEATER	5.0	5.0	pf
PLATE TO CATHODE & I.S., GRID #2 & HEATER	2.5	3.3	pf
TETRODE PLATE TO TRIODE PLATE (MAX.)	0.07	0.01	pf
HEATER TO CATHODE	3.0	3.0[B]	pf

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM ←

CONVERTER SERVICE

	TRIODE UNIT AS OSC.	TETRODE UNIT AS MIXER	
MAXIMUM PLATE VOLTAGE	330 ←	330 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	---	SEE FIGURE #2	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1 ←	3.2 ←	WATTS
MAXIMUM GRID #2 INPUT:			
→ FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.7 ←	WATT
→ FOR GRID #2 VOLTAGES BETWEEN 165 & 300V.	---	SEE FIGURE #2	
MAXIMUM GRID #1 INPUT	0.55 ←	---	WATT
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[C]	200	200[C]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

MAXIMUM CIRCUIT VALUES

	TRIODE UNIT	TETRODE UNIT	
GRID #1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION (MAX.)	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION (MAX.)	0.5	0.25	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	TETRODE UNIT	
PLATE SUPPLY VOLTAGE	125	125	VOLTS
GRID #2 SUPPLY VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	---	-1	VOLT
CATHODE-BIAS RESISTOR	56	---	OHMS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	5 000	140 000	OHMS
TRANSCONDUCTANCE	8 000	5 800	μMHOS
GRID #1 VOLTAGE (APPROX.)			
FOR PLATE CURRENT OF 100 μAMP	-7	-7	VOLTS
PLATE CURRENT	15	12	MA.
GRID #2 CURRENT	---	4.2	MA.

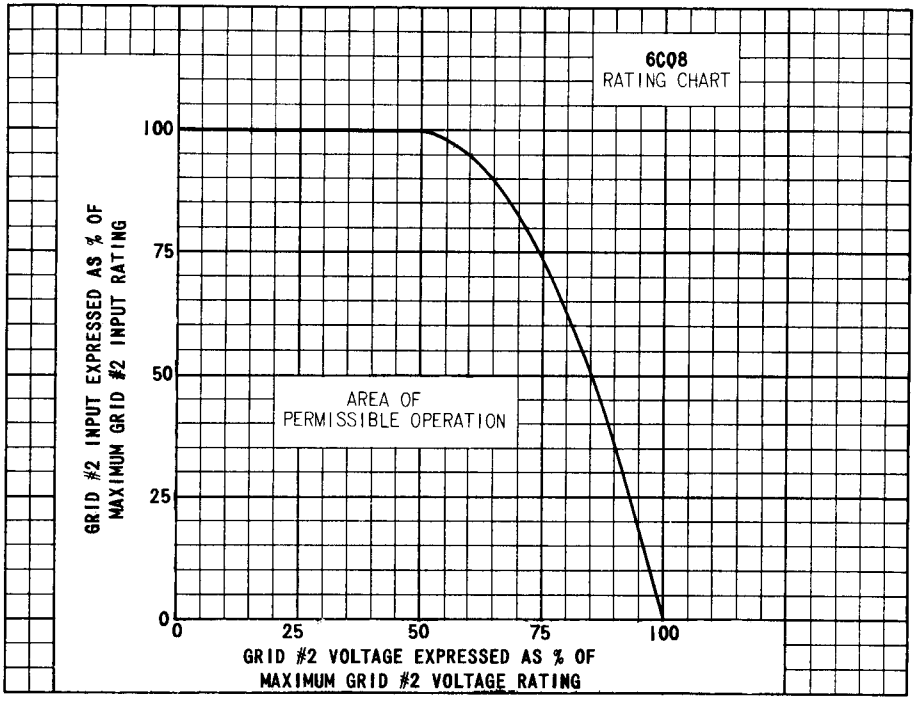
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

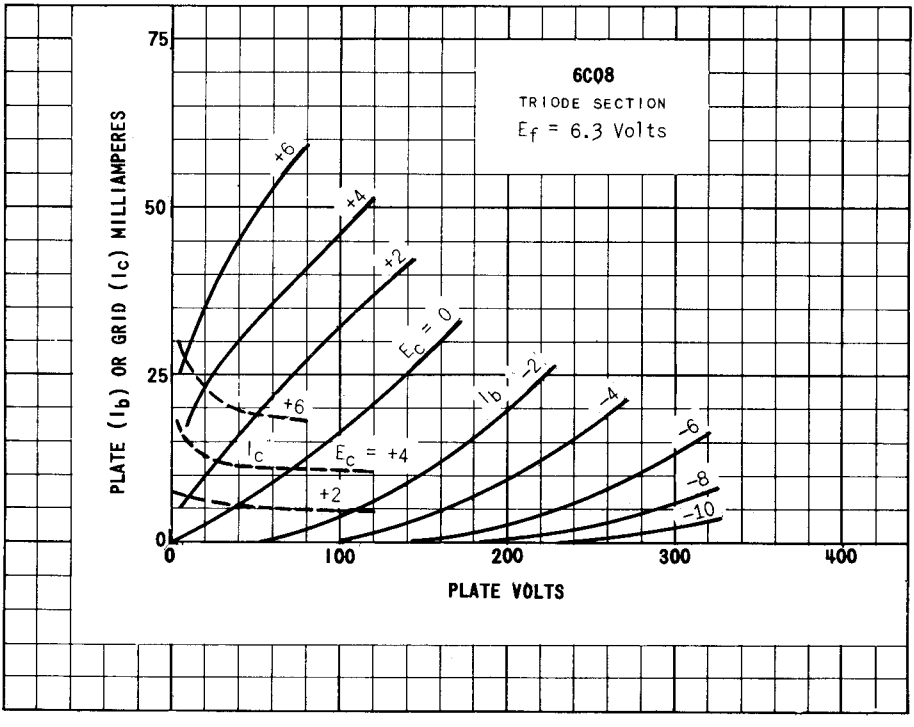
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO GROUND.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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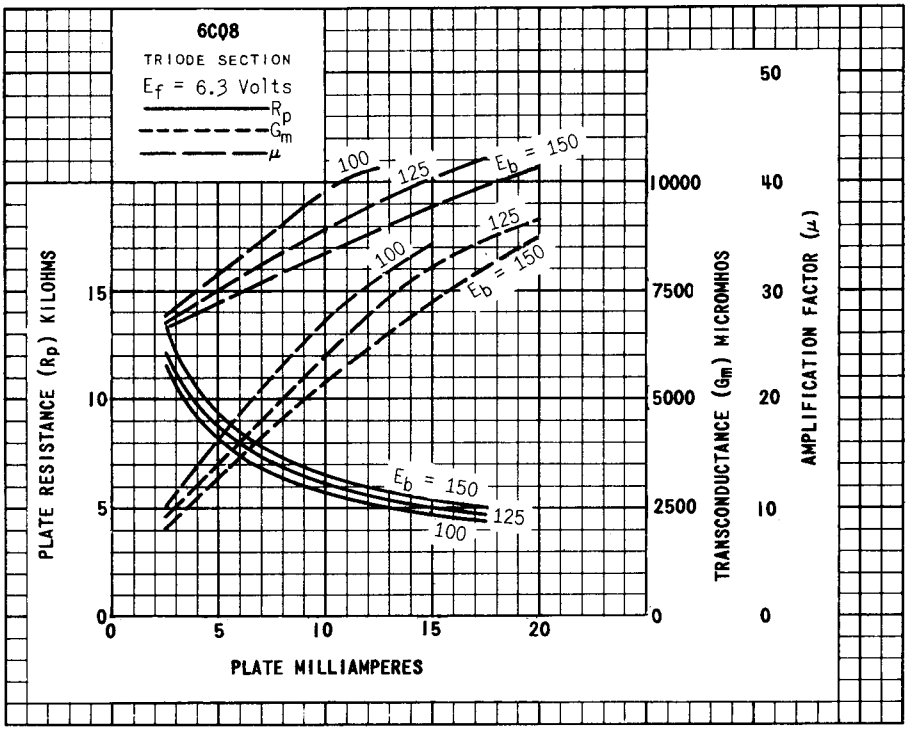
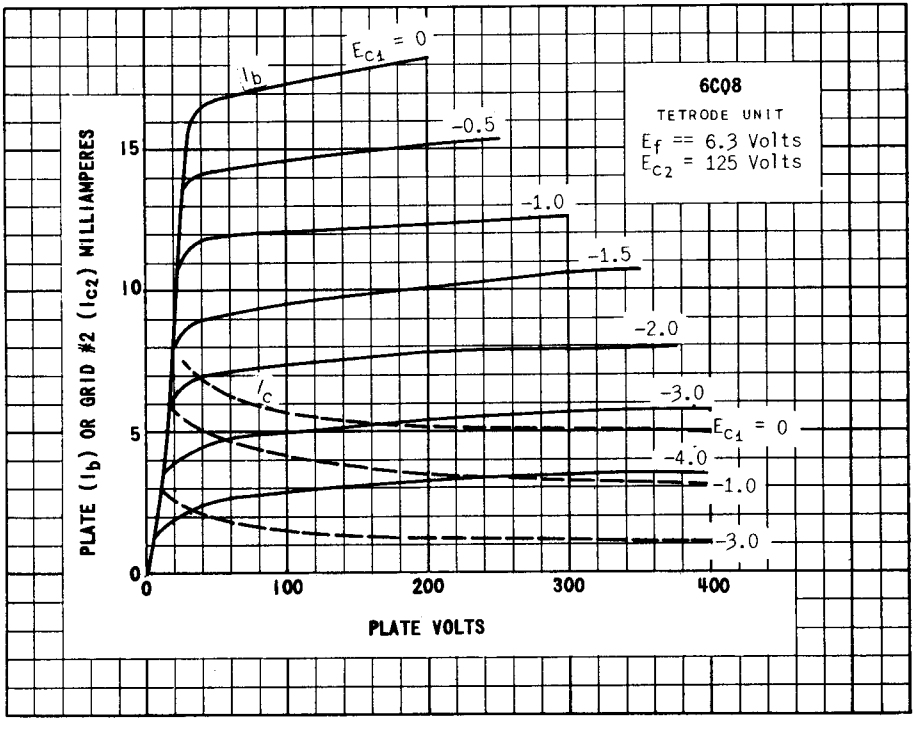
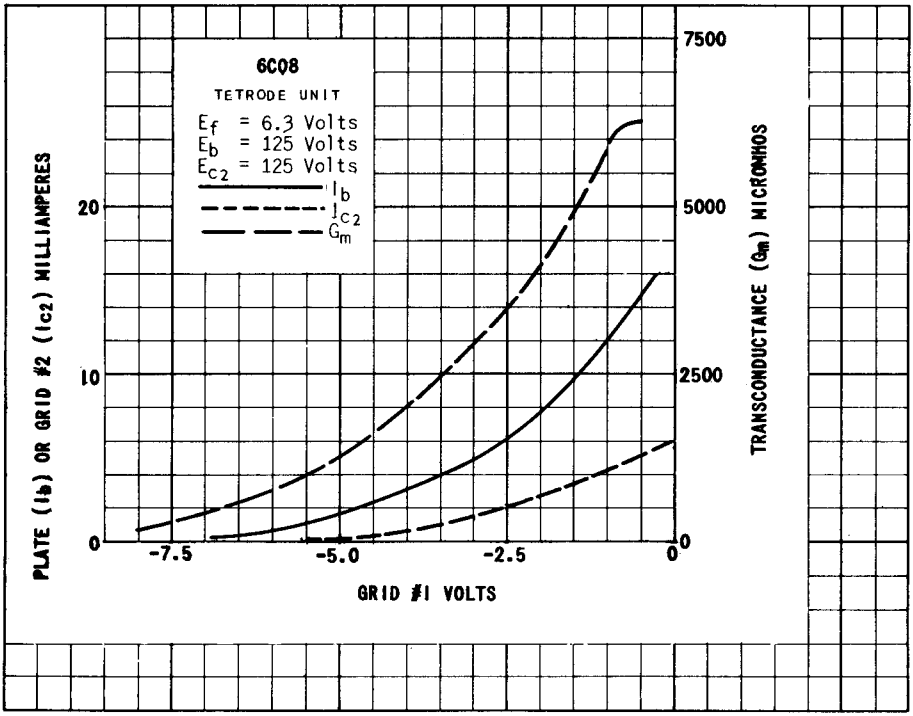

6CQ8
TRIODE SECTION
E_f = 6.3 Volts
R_p
G_m
μ
100
125
E_b = 150
PLATE RESISTANCE (R_p) KILOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
5
10
15
20
2500
5000
7500
10000
30
40
50

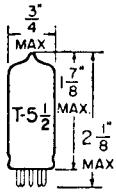

6CQ8
TETRODE UNIT
E_f = 6.3 Volts
E_{c_2} = 125 Volts
E_{c_1} = 0
I_b
I_c
-0.5
-1.0
-1.5
-2.0
-3.0
-4.0
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
5
10
15


6CQ8
TETRODE UNIT
E_f = 6.3 Volts
E_b = 125 Volts
E_{c_2} = 125 Volts
I_b
I_{c_2}
G_m
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
TRANSCONDUCTANCE (G_m) MICROMHOS
GRID #1 VOLTS
0
10
20
2500
5000
7500
-7.5
-5.0
-2.5
0

TUNG-SOL

DIODE PENTODE

MINIATURE TYPE

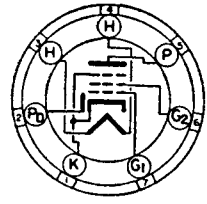


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7EA

THE 6CR6 IS A COMBINED SINGLE DETECTOR DIODE AND REMOTE CUT-OFF PENTODE WITH A COMMON CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN AUDIO AMPLIFIER IN WHICH AVC VOLTAGE IS APPLIED TO THE CONTROL GRID FOR IMPROVED OVER-ALL RECEIVER AVC.

RATINGS

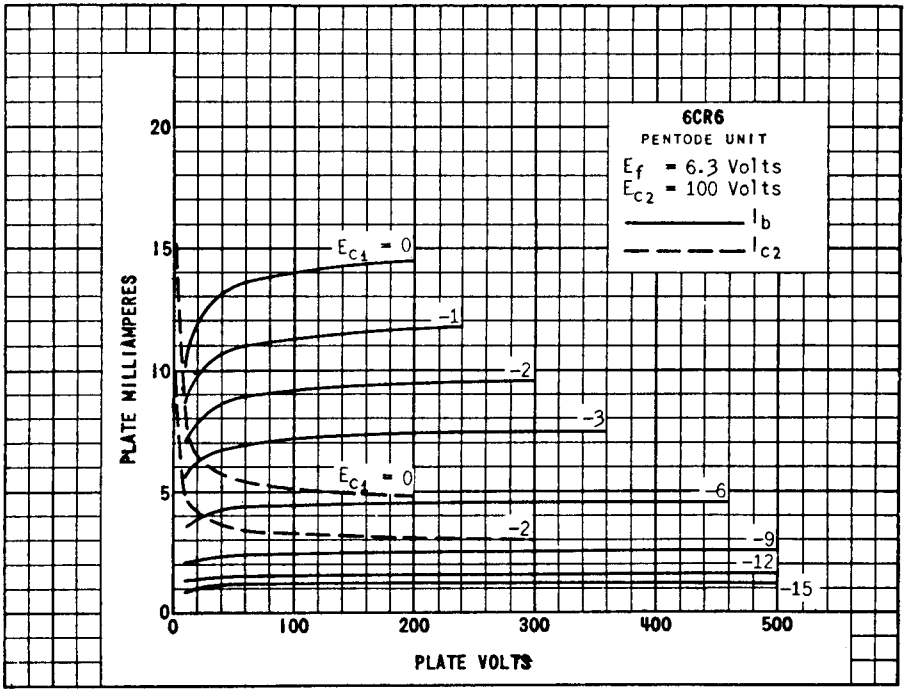
INTERPRETED ACCORDING TO RMA STANDARD M8-210

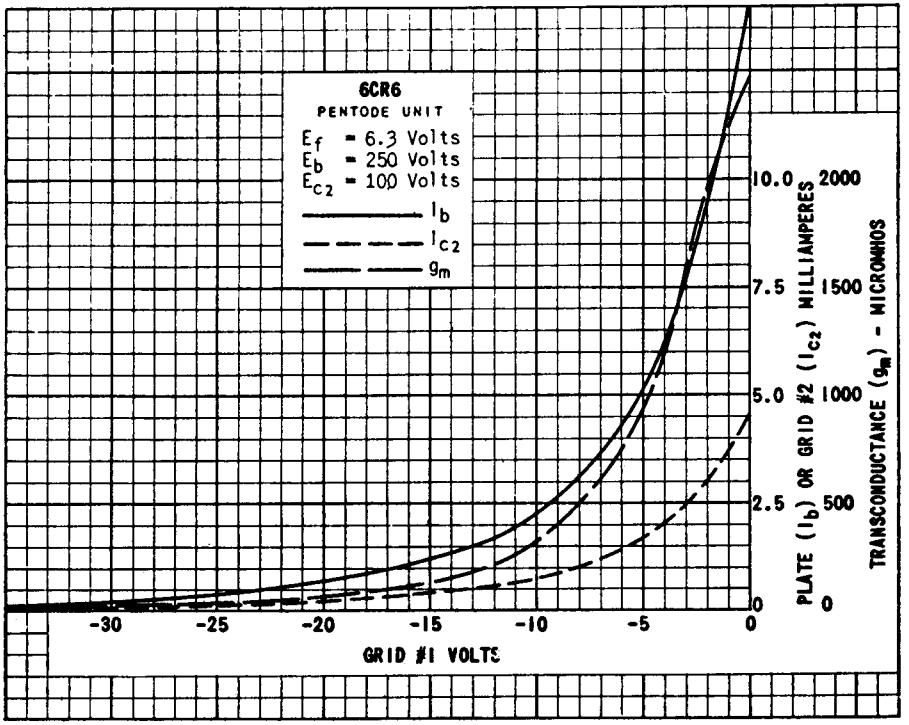
HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.3	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM
AVERAGE DIODE CURRENT WITH 10 VOLTS DC APPLIED	2.0	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #1 VOLTAGE	−2	VOLTS
PLATE CURRENT	9.5	MA.
GRID #2 CURRENT	3.0	MA.
TRANSCONDUCTANCE	1950	μMHOS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	−40	VOLTS

6CR6

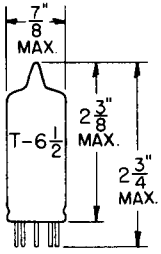

6CR6
PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-1
-2
-3
-6
-9
-12
-15
0
100
200
300
400
500
5
10
15
20


6CR6
PENTODE UNIT
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
GRID #1 VOLTS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) - MICROMHOS
-30
-25
-20
-15
-10
-5
0
2.5
5.0
7.5
10.0
500
1000
1500
2000

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



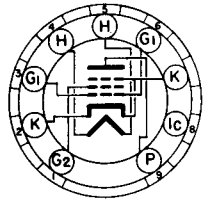
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9CK

THE 6CS5 IS A MINIATURE BEAM PENTODE DESIGNED FOR USE IN AUDIO POWER OUTPUT STAGES WHERE THE SUPPLY VOLTAGE IS FURNISHED DIRECTLY FROM THE POWER LINES BY THE USE OF A SINGLE DIODE RECTIFIER. ELECTRICALLY THE 6CS5 IS SIMILAR TO THE 6W6GT AND IS CAPABLE OF DEVELOPING THE SAME POWER OUTPUT. EXCEPT FOR HEATER RATINGS, THE 6CS5 IS IDENTICAL TO THE 12CS5.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G_1 TO P	0.5	μμf
INPUT: G_1 TO (K+H+G_2+B.P.)	15	μμf
OUTPUT: P TO (K+H+G_2+B.P.)	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM
MAXIMUM PEAK HEATER–CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE*	200	VOLTS

*DC COMPONENT MUST NOT EXCEED 100 VOLTS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

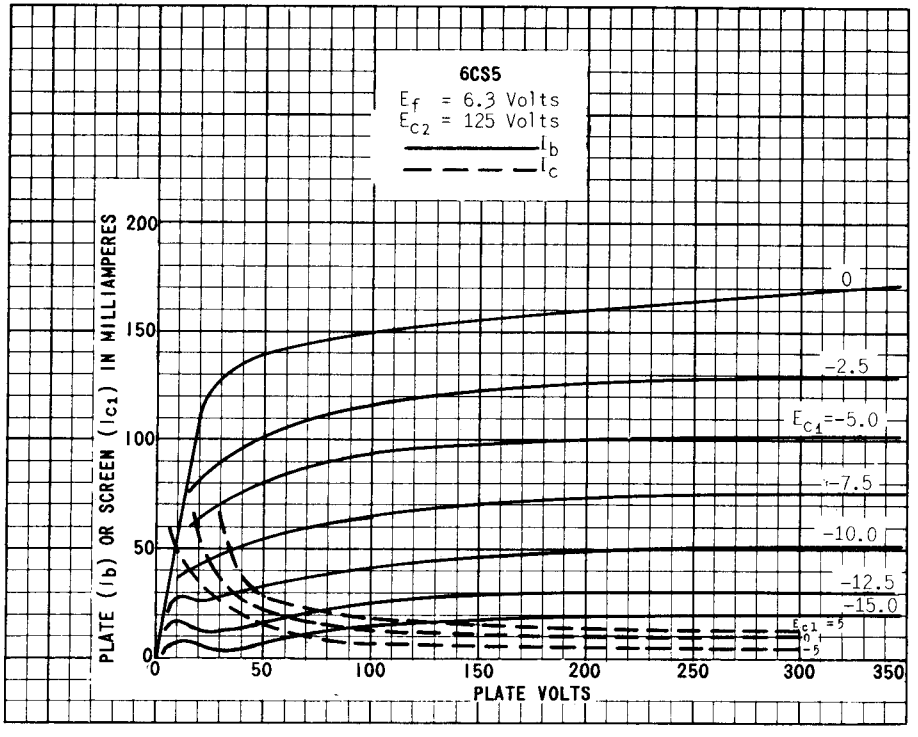
CLASS A_1 AMPLIFIER

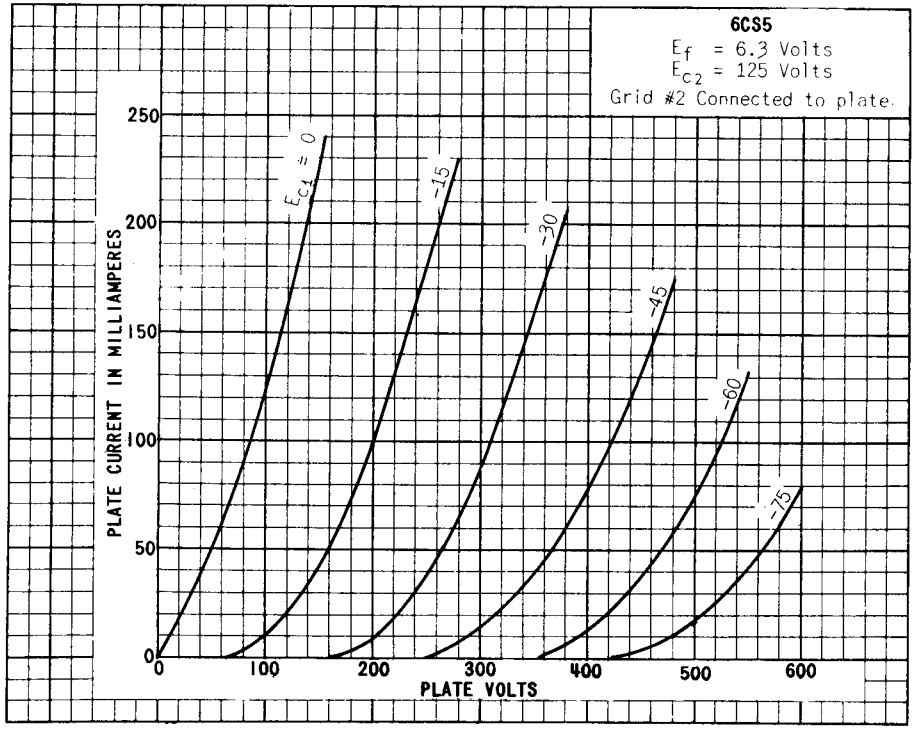
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 (SCREEN) VOLTAGE	110	125	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-7.5	---	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	μMHOS
GRID #1 INPUT VOLTAGE, PEAK AF	7.5	8.5	VOLTS
PLATE CURRENT, ZERO SIGNAL	49	46	MA.
PLATE CURRENT, (MAX. SIGNAL)	50	47	MA.
GRID #2 CURRENT, ZERO SIGNAL	4	2.2	MA.
GRID #2 CURRENT, (MAX. SIGNAL)	10	8.5	MA.
LOAD RESISTANCE IMPEDANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT, (MAX. SIGNAL)	2.1	3.8	WATTS

TRIODE CONNECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE & GRID #2 VOLTAGE ($P+G_2$ TIED TOGETHER)	225	VOLTS
GRID #1 VOLTAGE	-30	VOLTS
PLATE RESISTANCE	1 500	OHMS
TRANSCONDUCTANCE	3 800	μMHOS
PLATE CURRENT	22	MA.
AMPLIFICATION FACTOR	6.2	
GRID #1 VOLTAGE (APPROX.) FOR I_b = 0.5 MA.	-42	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings and heater warm-up time the 6CS5 is identical to the 12CS5.

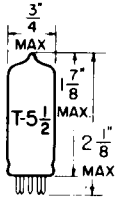

6CS5
E_f = 6.3 Volts
E_{c2} = 125 Volts
I_b
I_c
PLATE (I_b) OR SCREEN (I_{c1}) IN MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
300
350
0
-2.5
E_{c1}=-5.0
-7.5
-10.0
-12.5
-15.0
E_{c1} = 5
0
-5


6CS5
E_f = 6.3 Volts
E_{c2} = 125 Volts
Grid #2 Connected to plate
PLATE CURRENT IN MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
0
100
200
300
400
500
600
E_{c1} = 0
-15
-30
-45
-60
-75

TUNG-SOL

HEPTODE

MINIATURE TYPE

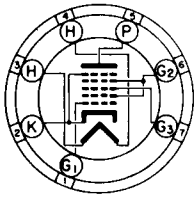


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6CS6 IS A MINIATURE DUAL CONTROL PENTAGRID TUBE INTENDED FOR USE IN SYNC SEPARATOR CIRCUITS. IN THESE CIRCUITS IT PROVIDES IMPROVED NOISE IMMUNITY. BOTH CONTROL GRIDS HAVE SHARP CUT-OFF CHARACTERISTICS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE: G_1 TO P (MAX.)	0.05	μμf
GRID #3 TO PLATE: G_3 TO P (MAX)	0.36	μμf
#1 INPUT: G_1 TO (H+K+G_2+$G_{3\&5}$)	5.5	μμf
#3 INPUT: G_3 TO (H+K+G_1+$G_{2\&5}$)	7.0	μμf
OUTPUT: P TO (H+K+G_1+G_2+$G_{3\&5}$)	7.5	μμf
COUPLING: G_1 TO G_3 (MAX.)	0.22	μμf

RATINGS ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 & #4 VOLTAGE[A]		
MAXIMUM GRID #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & #4 DISSIPATION:		
FOR GRID #2 & GRID #4 VOLTAGES UP TO 150 VOLTS	1.0	VOLTS
FOR GRID #2 & GRID #4 VOLTAGES BETWEEN 150 & 300V.[A]		
MAXIMUM CATHODE CURRENT	14	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS

[A] SEE SCREEN DISSIPATION RATING CHART JEDEC #J5-C4-2.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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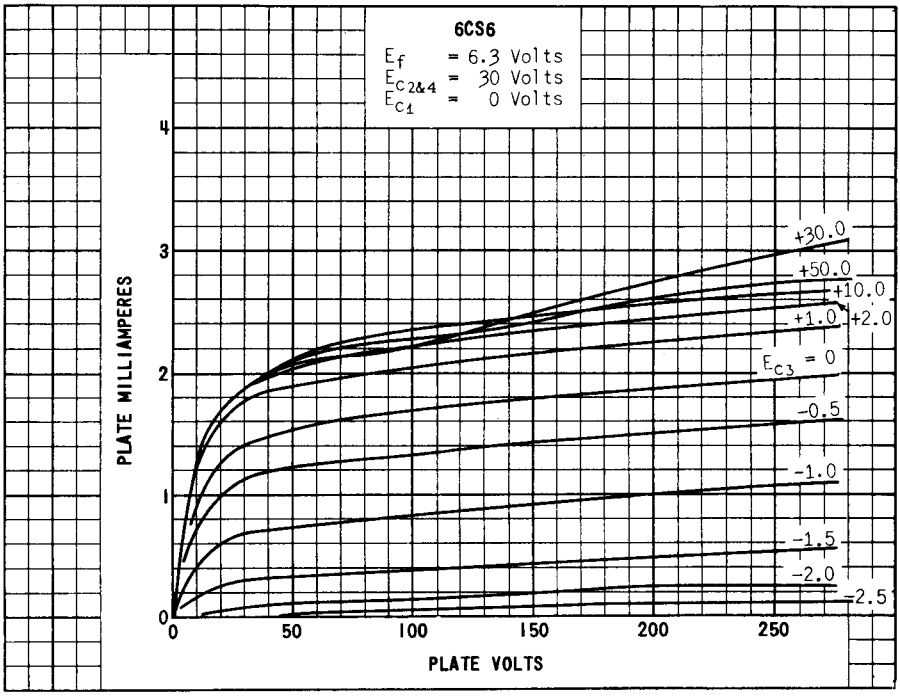
TUNG-SOL

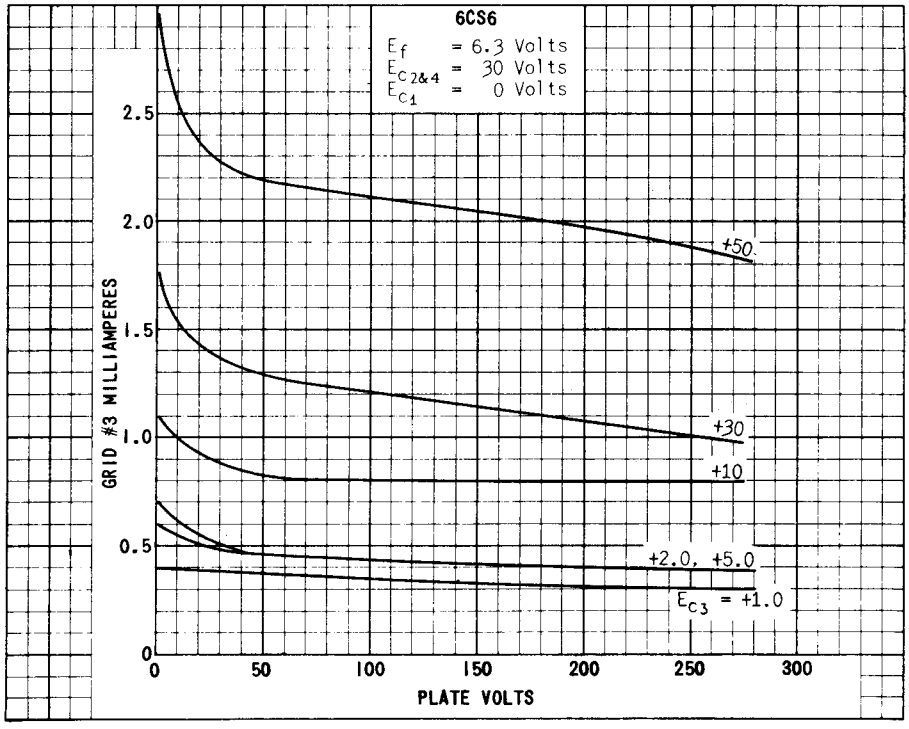
CONTINUED FROM PRECEDING PAGE

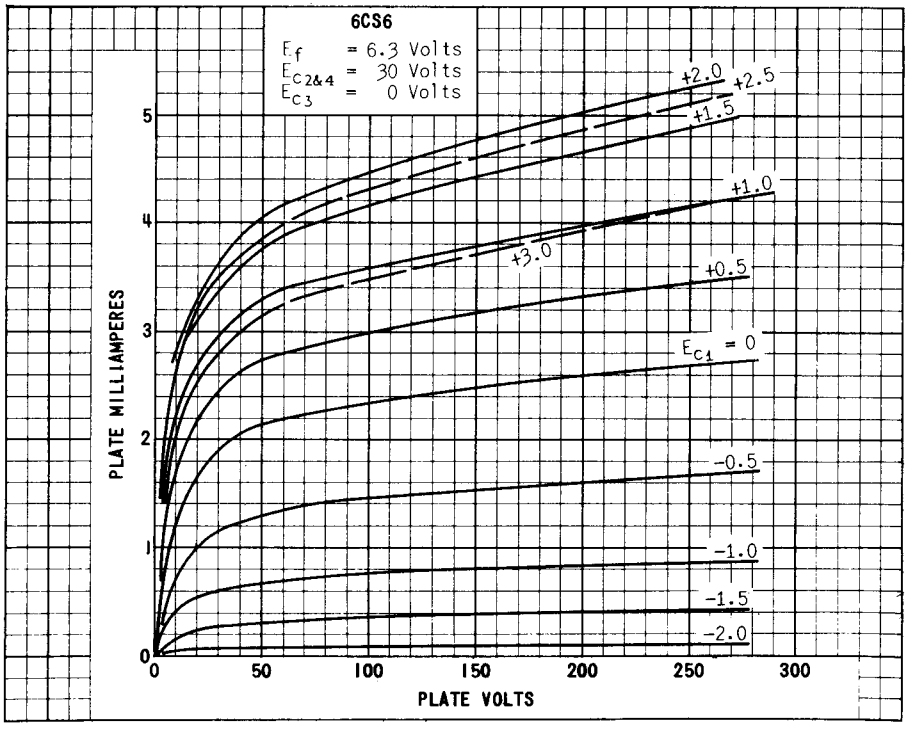
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	0.3	AMP.
PLATE VOLTAGE	10	100	100	VOLTS
GRID #2 & #4 VOLTAGE	30	30	30	VOLTS
GRID #1 VOLTAGE	0	0	-1	VOLTS
GRID #3 VOLTAGE	0	-1	0	VOLTS
PLATE CURRENT	2.0	0.8	1.0	MA.
GRID #2 & #4 CURRENT	4.5	5.5	1.3	MA.
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #1 AND PLATE)	---	---	100	μMHOS
TRANSCONDUCTANCE (MEASURED BETWEEN GRID #3 AND PLATE)	---	1 500	---	μMHOS
PLATE RESISTANCE (APPROX.)	---	0.7	1.0	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR I_b=50 μA	---	---	-2.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR I_b=50 μA	---	-2.2	---	VOLTS







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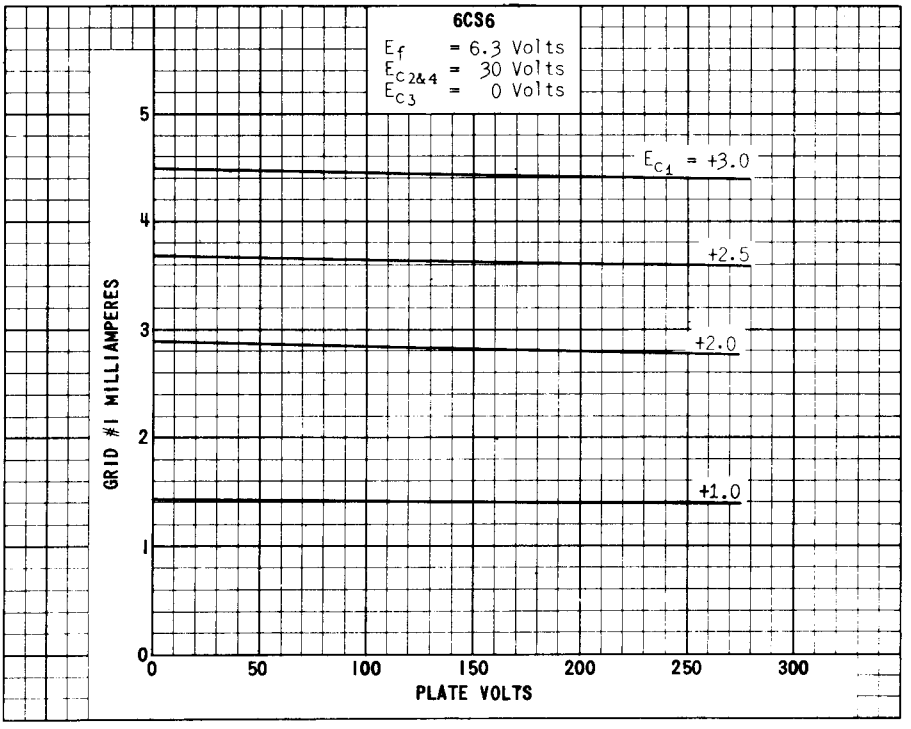
6CS6 (12CS6)



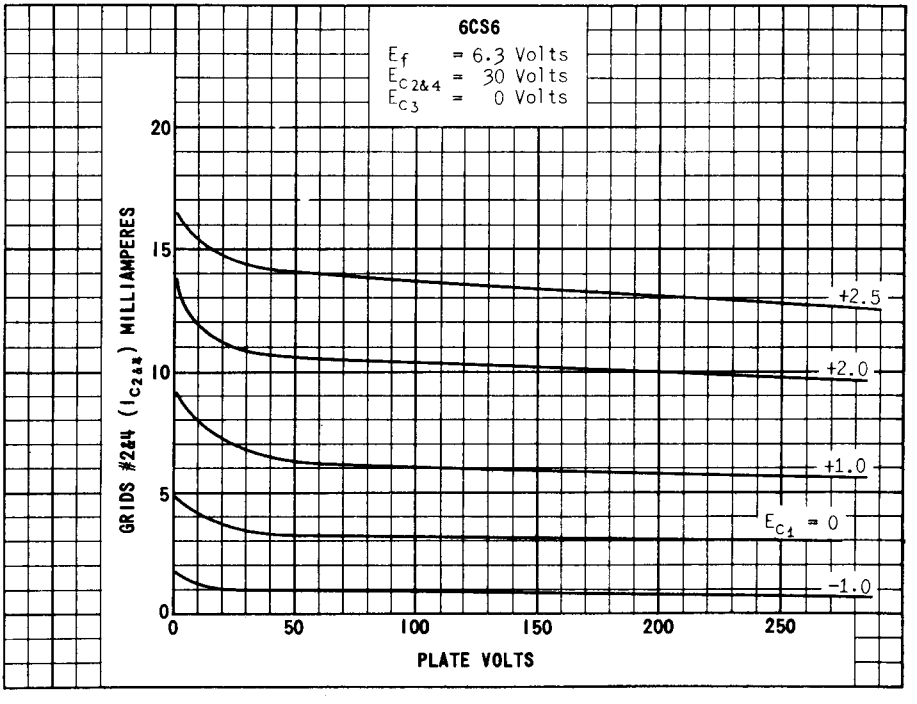
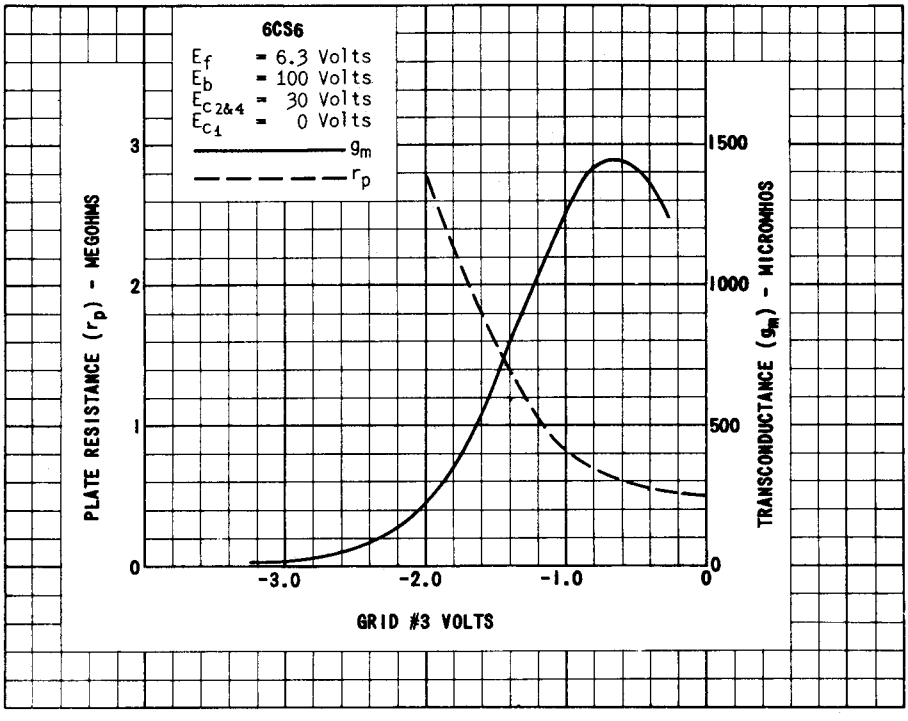
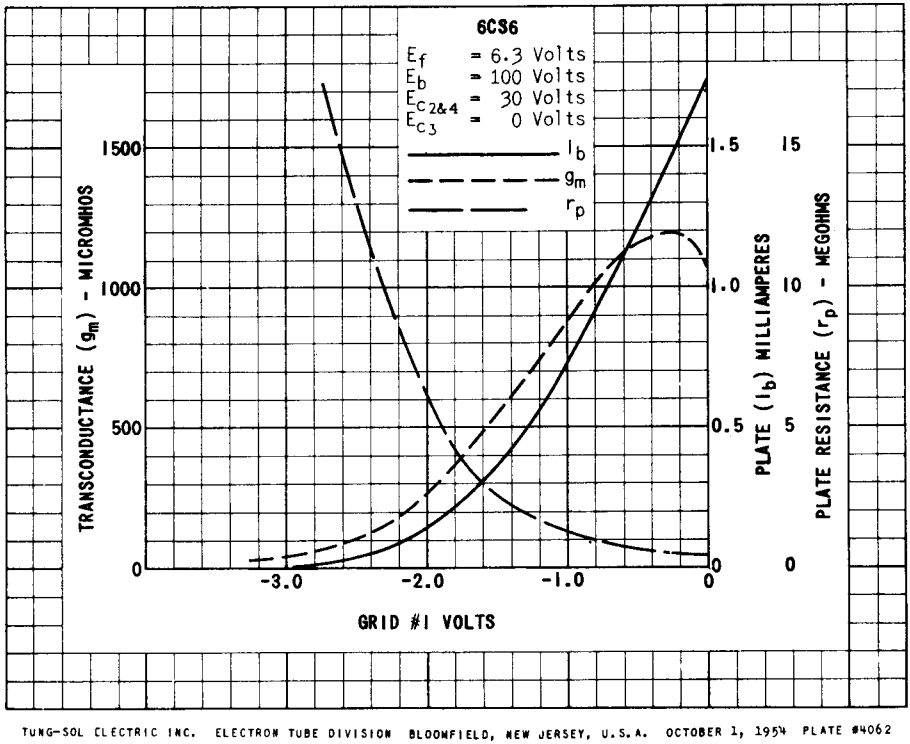
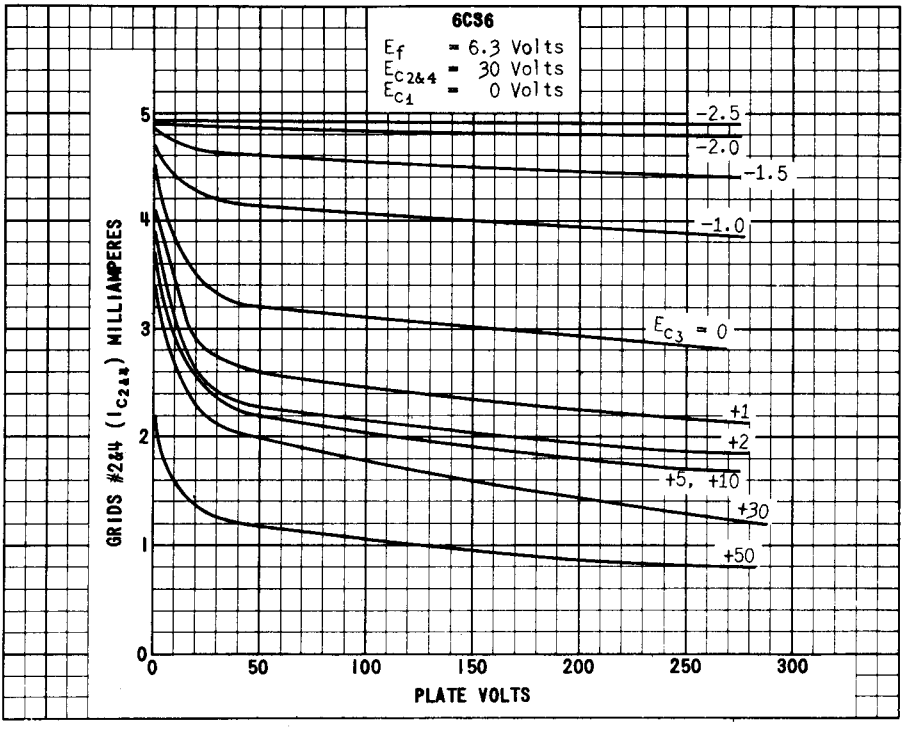


PLATE #4061 OCTOBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.


6CS6
E_f = 6.3 Volts
E_b = 100 Volts
$E_{c2\&4}$ = 30 Volts
E_{c1} = 0 Volts
g_m
r_p
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID #3 VOLTS
0
1
2
3
500
1000
1500
-3.0
-2.0
-1.0
0


6CS6
E_f = 6.3 Volts
E_b = 100 Volts
$E_{c2\&4}$ = 30 Volts
E_{c3} = 0 Volts
I_b
g_m
r_p
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
PLATE RESISTANCE (r_p) - MEGOHMS
GRID #1 VOLTS
0
500
1000
1500
0.5
1.0
1.5
5
10
15
-3.0
-2.0
-1.0
0

6CS6(12CS6)


6CS6
E_f = 6.3 Volts
$E_{C2\&4}$ = 30 Volts
E_{C1} = 0 Volts
-2.5
-2.0
-1.5
-1.0
E_{C3} = 0
+1
+2
+5, +10
+30
+50
GRIDS #2&4 ($I_{C2\&4}$) MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
0
50
100
150
200
250
300

TUNG-SOL

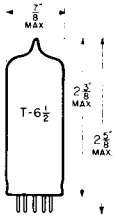
DOUBLE TRIODE

MINIATURE TYPE

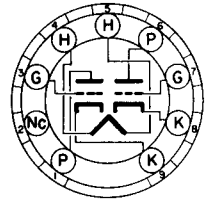
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9EF

THE 6CS7 IS A DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR OPERATION AS A VERTICAL DEFLECTION OSCILLATOR AND SECTION #2 AS A VERTICAL DEFLECTION AMPLIFIER. THERMAL CHARACTERISTICS ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	TRIODE #1[A]	TRIODE #2	
GRID TO PLATE (G TO P)	2.6	2.6	μμf
INPUT: G TO (K+H+E.S.)	1.8	3.0	μμf
OUTPUT: P TO (K+H+E.S.)	0.5	0.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[B]

	TRIODE #1[A] OSCILLATOR		TRIODE #2 AMPLIFIER	
HEATER VOLTAGE		6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC		100		VOLTS
TOTAL DC AND PEAK		200		VOLTS
MAXIMUM DC PLATE VOLTAGE	500		500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAX.)			2 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400		250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.25		6.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20		30	MA.
MAXIMUM PEAK CATHODE CURRENT	70		105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2		2.2	MEGOHMS
HEATER WARM-UP TIME[D]		11		SECONDS

[A] TRIODE #1 CONNECTS TO PINS #6, #7 AND #8. TRIODE #2 CONNECTS TO PINS #1, #3 AND #9.

[B] FOR OPERATION IN A 525 LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS: FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 25% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN ABSENCE OF EXCITATION.

[D] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1[A]	TRIODE #2	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	-8.5	-10.5	VOLTS
PLATE CURRENT	10.5	19.0	MA.
TRANSCONDUCTANCE	2 200	4 500	μMHOS
AMPLIFICATION FACTOR	17.0	15.5	
PLATE RESISTANCE	7 700	3 450	OHMS
PLATE CURRENT AT E_c=-16 VOLTS		3.0	MA.
GRID VOLTAGE FOR I_b=10μA	-24		VOLTS
GRID VOLTAGE FOR I_b=50μA		-22	VOLTS

[A] TRIODE #1 CONNECTS TO PINS #6, #7 AND #8. TRIODE #2 CONNECTS TO PINS #1, #3 AND #9.

TUNG-SOL

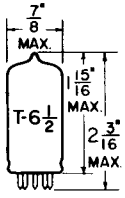
TRIODE-PENTODE

MINIATURE TYPE

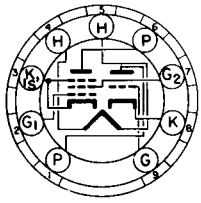
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC.

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FZ

THE 6CS8 IS A TRIODE-PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS DESIGNED FOR TELEVISION IF AND THE TRIODE FOR GENERAL PURPOSE SERVICE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF THE BASING AND THE "DIRECT INTERELECTRODE CAPACITANCES", THE 6CS8 IS IDENTICAL TO THE 6CR8.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

TRIODE:		
GRID TO PLATE: G TO P	1.6	μμf
INPUT: G TO (H + K)	1.9	μμf
OUTPUT: P TO (H + K)	0.26	μμf
PENTODE:		
GRID #1 TO PLATE: G_1 TO P (MAX.)	0.020	μμf
INPUT: G_1 TO (H+K+G_2+G_3+I.S.)	6.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	2.8	μμf
COUPLING:		
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.12	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	0.15	μμf
PENTODE PLATE TO TRIODE GRID (MAX.)	0.012	μμf

RATINGS[A]
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		

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RATINGS - CONT'D[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5		MEGOHM
SELF BIAS	1.0		MEGOHM
HEATER WARM-UP TIME*	11.0		SECONDS

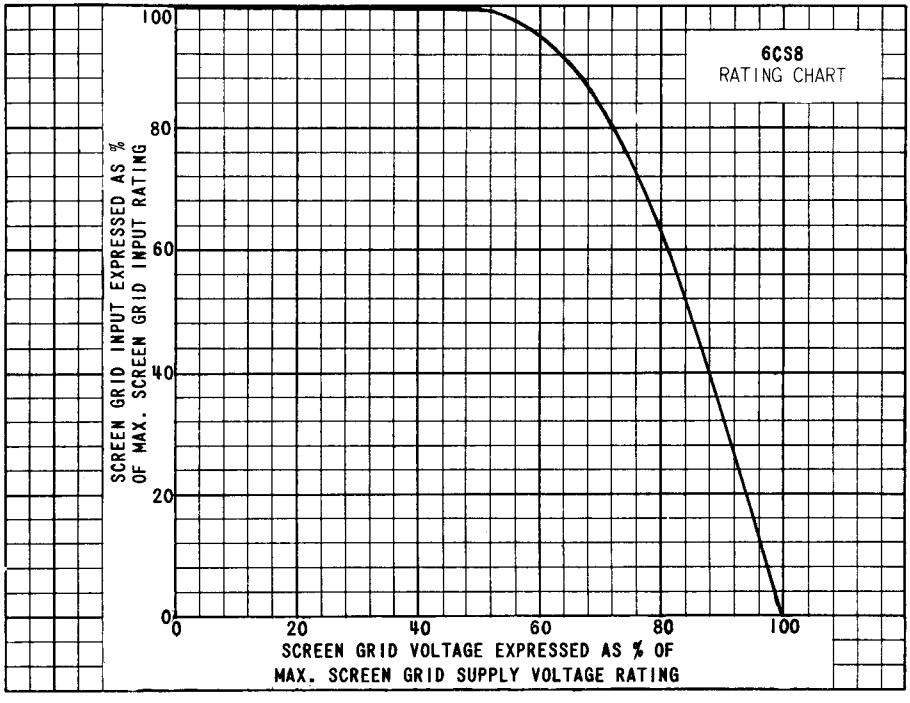
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2	0	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT	12	13	MA.
GRID #2 CURRENT		3	MA.
AMPLIFICATION FACTOR	22		
TRANSCONDUCTANCE	4 000	7 700	μMHOS
PLATE RESISTANCE (APPROX.)	5 500	300 000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA	-13		VOLTS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 20 μA		-6.5	VOLTS
PLATE CURRENT WITH E_{c1} =-3 Vdc, RK=0		2.8	MA.

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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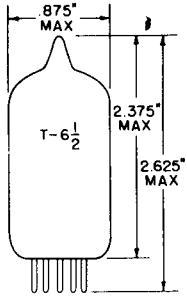


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 6-3

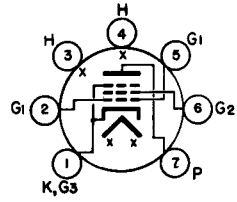
BEAM PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 1200 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 6CU5 IS A MINIATURE BEAM POWER PENTODE DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF TELEVISION RECEIVERS. HIGH-POWER SENSITIVITY AND HIGH EFFICIENCY AT LOW PLATE AND SCREEN VOLTAGES ENABLE THE 6CU5 TO PROVIDE RELATIVELY HIGH POWER OUTPUT. EXCEPT FOR HEATER RATINGS, THE 6CU5 IS IDENTICAL TO THE 12CU5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO CATHODE & GRID #3, HEATER, AND GRID #2	13.0	pf
PLATE TO CATHODE & GRID #3, HEATER, AND GRID #2	8.5	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE [A]	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	130	VOLTS
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	7	WATTS
MAXIMUM GRID #2 INPUT	1.4	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C

INDICATES A CHANGE.

[A] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

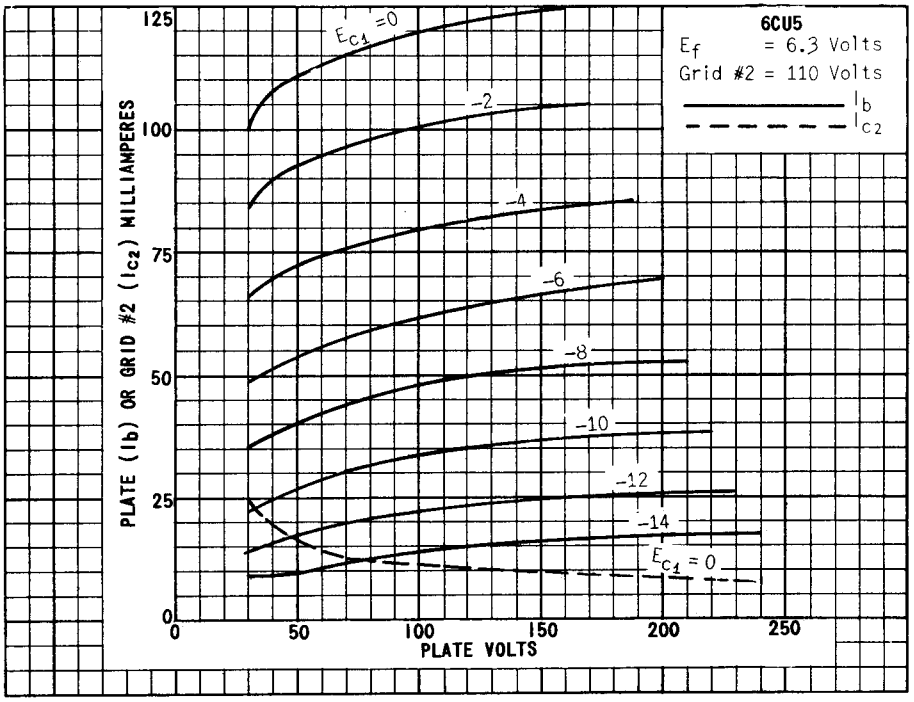
CLASS A_1 AMPLIFIER

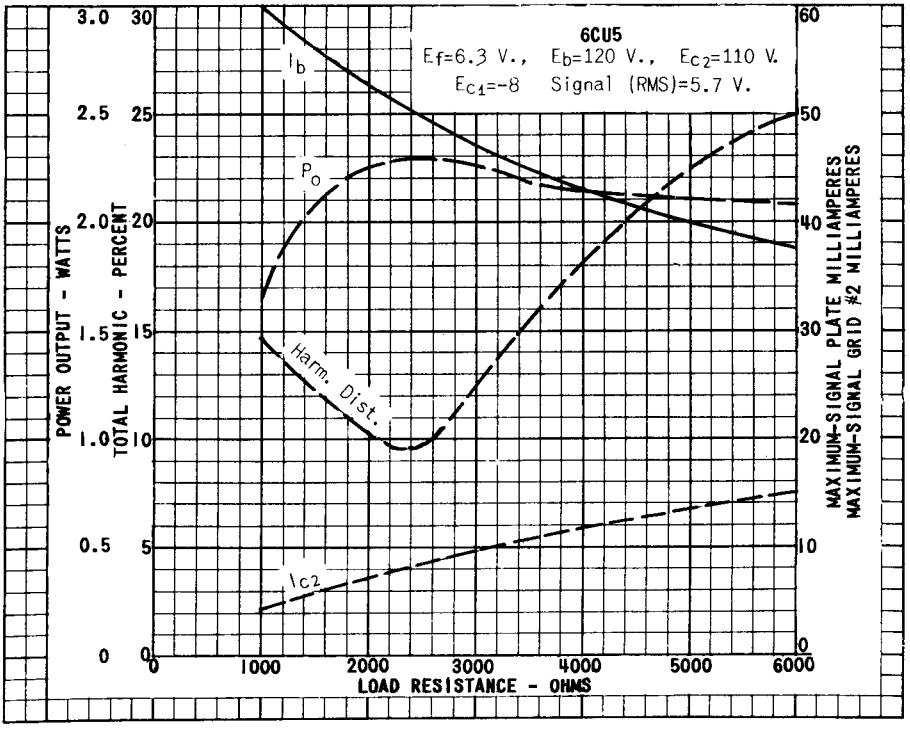
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-8	VOLTS
PEAK AF GRID #1 VOLTAGE	8	VOLTS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	8.5	MA.
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
SIGNAL POWER OUTPUT (MAX.)	2.3	WATTS

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM

SIMILAR TYPE REFERENCE: *Except for heater warm-up time and heater ratings, the 6CU5 is identical to the 12CU5.*





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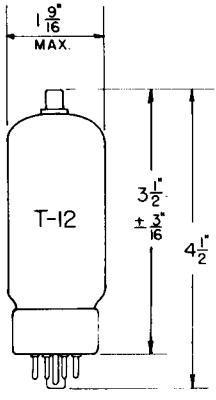
PENTODE

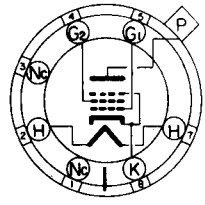


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
6AM

THE 6CU6 IS A BEAM-POWER TUBE INTENDED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS DESIGNED TO PROVIDE LONGER LIFE AT HIGH-LINE CONDITIONS AND INCREASED RUGGEDNESS TO WITHSTAND MOMENTARY OVERLOADS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: G_1 TO P	0.6 ←	μμf
INPUT: G_1 TO (H+K+G_2+BP)	15 ←	μμf
OUTPUT: P TO (H+K+G_2+BP)	7 ←	μμf

RATINGS[A]

INTERPRETED ACCORDING TO RETMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST+POWER SUPPLY)	600 ←	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	6 000	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200 ←	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C

[A] DESIGN CENTER VALUES EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% (10 MICROSECONDS) OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE.

→INDICATES A CHANGE.

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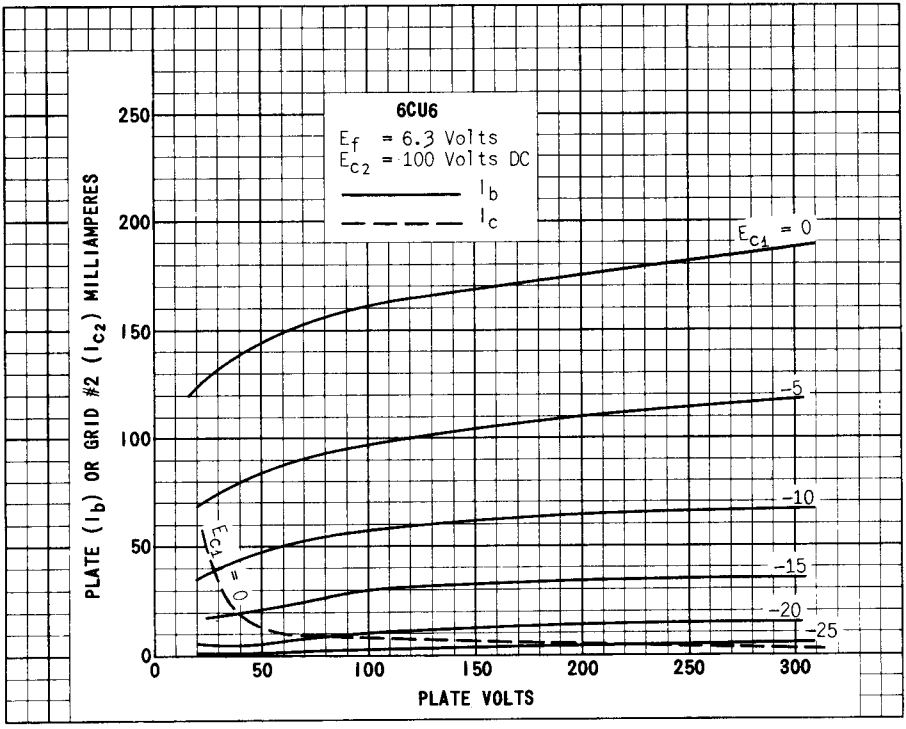
CONTINUED FROM PRECEDING PAGE

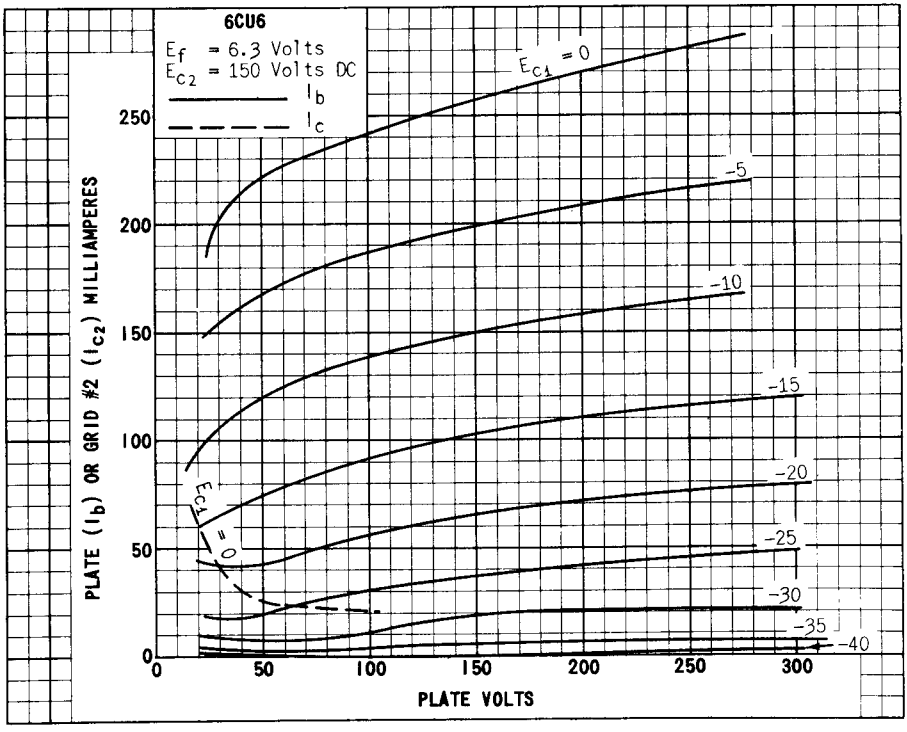
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

PENTODE OPERATION: WITH E_b = 250V., E_{c2} = 150V. AND E_{c1} = -22.5V.		
PLATE CURRENT	57	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 900	μMHOS
PLATE RESISTANCE (APPROX.)	14 500	OHMS
ZERO BIAS: WITH E_b = 60V. AND E_{c2} = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	26	MA.
CUT-OFF: FOR I_b = 1 MA., WITH E_b = 250V. AND E_{c2} = 150V.		
GRID #1 VOLTAGE (APPROX.)	-43	VOLTS
TRIODE μ: WITH E_b = E_{c2} = 150V. AND E_{c1} = -22.5V.	4.3	

SIMILAR TYPE REFERENCE. Except for heater operation the 6CU6 is identical to the 12CU6 and 25CU6. It is a rugged replacement for the 6BQ6GT.

→INDICATES A CHANGE.





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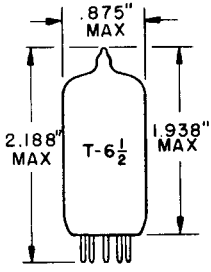
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

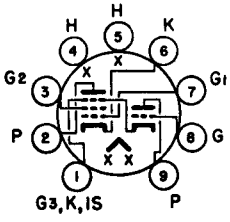
FOR

COLOR AND BLACK AND WHITE

T.V. APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9GM

THE 6CU8 IS A GENERAL-PURPOSE MEDIUM-MU TRIODE AND SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR A WIDE VARIETY OF APPLICATIONS IN BLACK-AND-WHITE AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE GRID 1 TO PENTODE PLATE: (PG TO PP)	max.	0.025	pf
PENTODE INPUT: PG1 TO (H+PK+PG3+TK+I.S.+PG2)		7	pf
PENTODE OUTPUT: PP TO (H+PK+PG3+TK+I.S.+PG2)		2.4	pf
TRIODE GRID TO TRIODE PLATE: TG TO TP		1.6	pf
TRIODE INPUT: TG TO (TK+H+PG3+I.S.)		1.9	pf
TRIODE OUTPUT: TP TO (TK+H+PG3+I.S.)		1.6	pf
PENTODE GRID 1 TO TRIODE PLATE (PG1 TO TP)	max.	0.03 ←	pf
PENTODE PLATE TO TRIODE PLATE (PP TO TP)	max.	0.07 ←	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239 ←

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT			450 ±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	→ 330	VOLTS
TRIODE PLATE VOLTAGE	→ 330	VOLTS
GRID 2 SUPPLY VOLTAGE	→ 330	VOLTS
GRID 2 VOLTAGE	See rating chart	
PENTODE PLATE DISSIPATION	→ 2.3	WATTS
TRIODE PLATE DISSIPATION	→ 2.8	WATTS
GRID 2 DISSIPATION	→ 0.55	WATT
POSITIVE DC PENTODE GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS

→ TYPICAL OPERATING CHARACTERISTICS

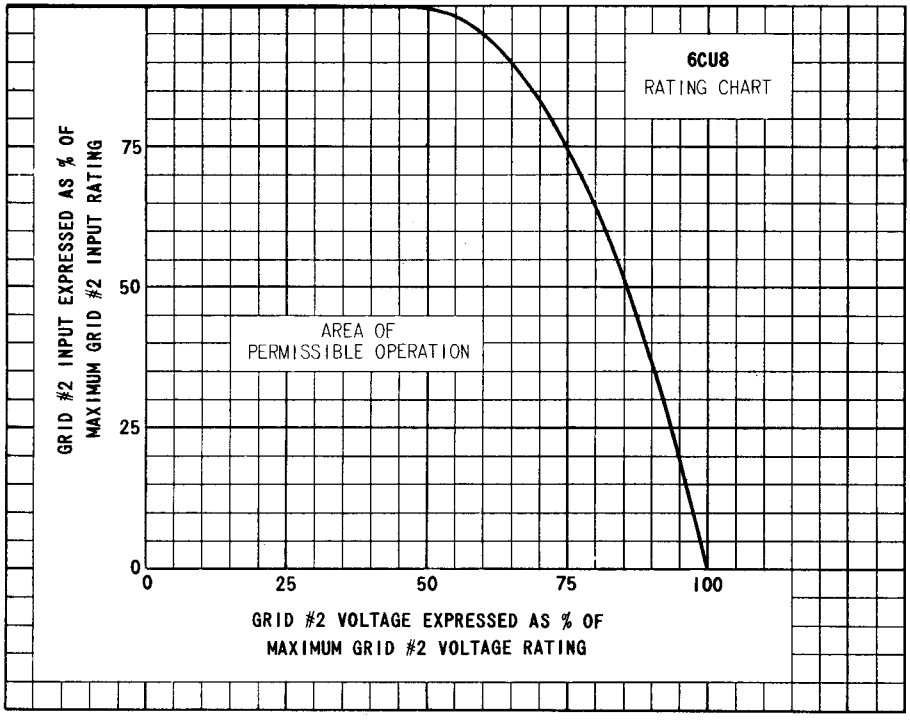
CLASS A1 AMPLIFIER

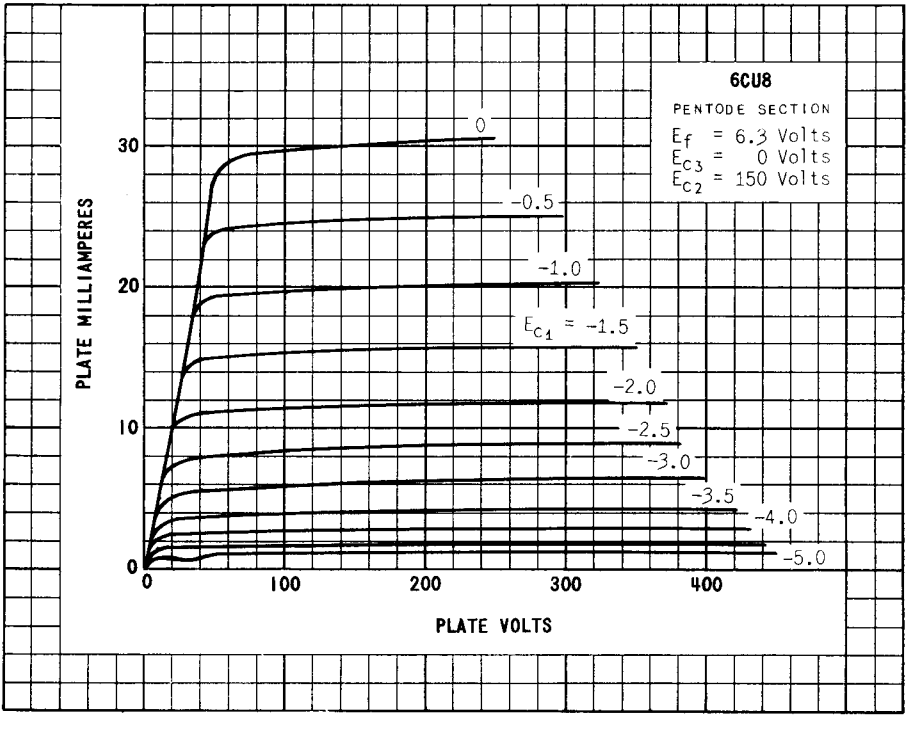
		TRIODE	PENTODE	
PLATE VOLTAGE		125	125	VOLTS
GRID 2 VOLTAGE		------	125	VOLTS
GRID 1 VOLTAGE		−1.0	0	VOLTS
CATHODE BIAS RESISTOR		0	56	OHMS
PLATE CURRENT		17	12	MA.
GRID 2 CURRENT		------	3.8	MA.
TRANSCONDUCTANCE		5,800	7,800	μMHOS
AMPLIFICATION FACTOR		24	------	
PLATE RESISTANCE	APPROX.	4.1	170	KOHMS
PLATE CURRENT AT Ec1 =-3; Rk =0		------	1.6	MA.
GRID 1 VOLTAGE, APPROX. FOR Ib = 20 μA		12	−6	MA.

→ INDICATES A CHANGE.

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER HEATER OPERATING RESISTANCE.





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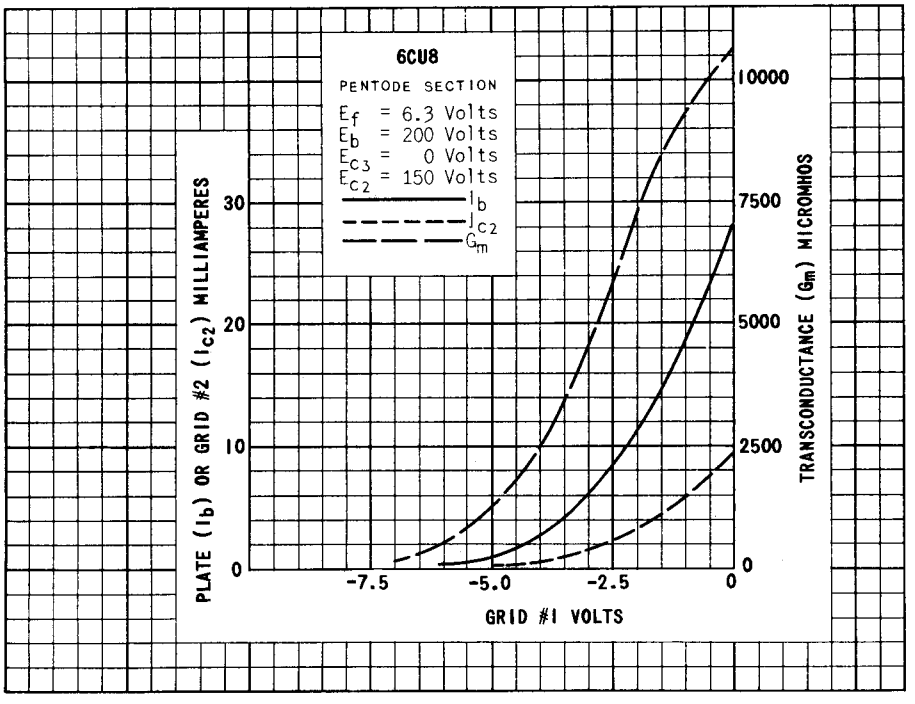
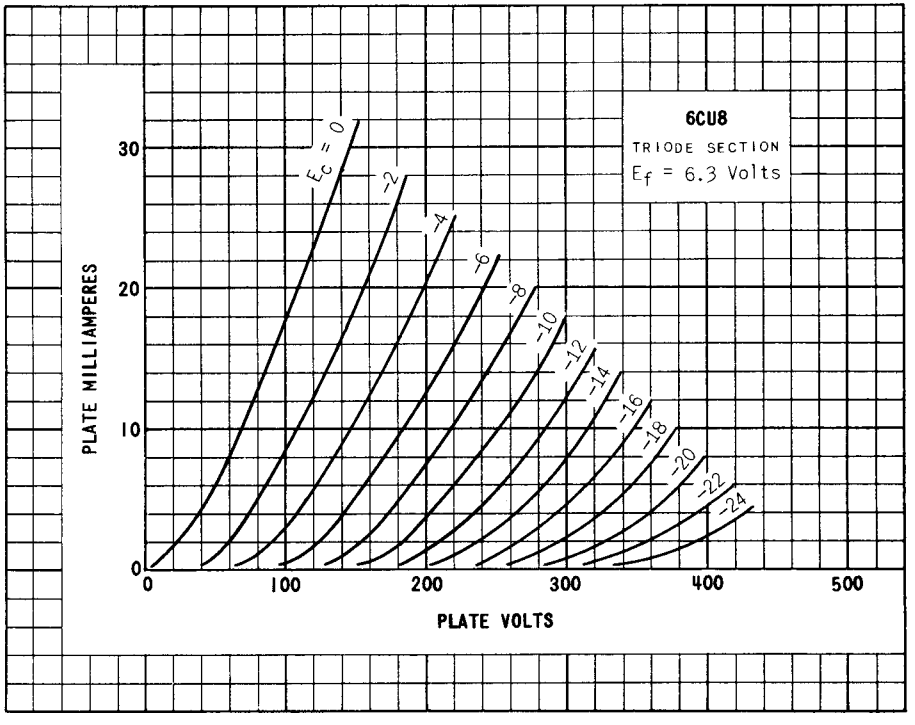
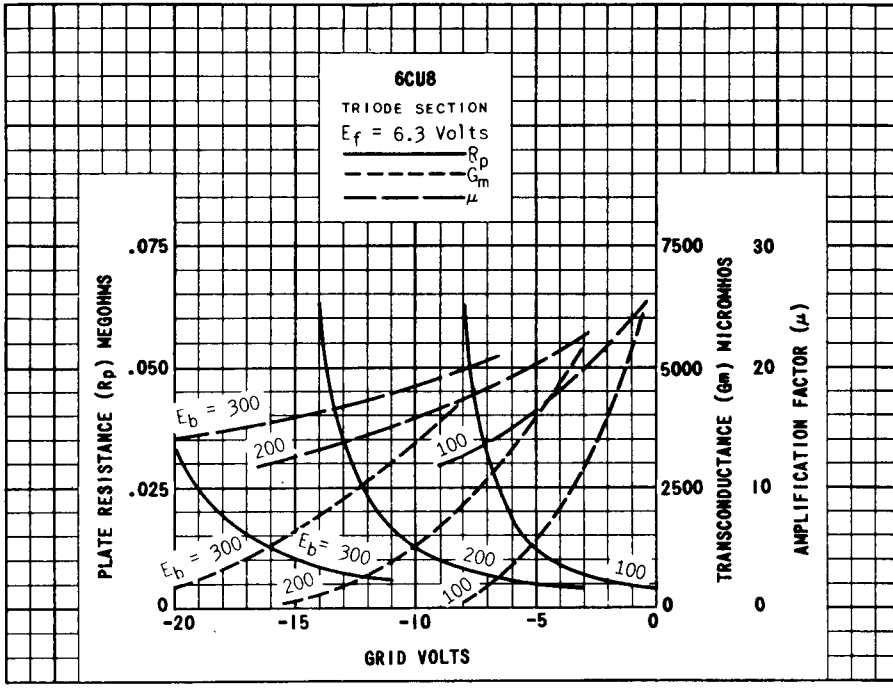
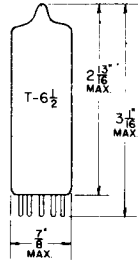

6CU8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
G_m
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (G_m) MICROMHOS
GRID #1 VOLTS
0
10
20
30
2500
5000
7500
10000
-7.5
-5.0
-2.5
0


6CU8
TRIODE SECTION
E_f = 6.3 Volts
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
0
10
20
30
100
200
300
400
500


6CU8
TRIODE SECTION
E_f = 6.3 Volts
R_p
G_m
μ
PLATE RESISTANCE (R_p) MEGOHMS
.075
.050
.025
0
TRANSCONDUCTANCE (G_m) MICROMHOS
7500
5000
2500
0
AMPLIFICATION FACTOR (μ)
30
20
10
0
E_b = 300
200
100
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

PENTODE



GLASS BULB
E9-1 BASE

OUTLINE DRAWING
JEDEC 6-4

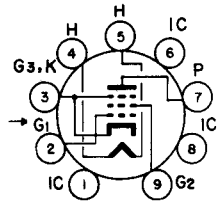
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.76 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9CV

THE 6CW5 IS AN A.F. OUTPUT PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN SINGLE-ENDED PUSH-PULL OUTPUT STAGES.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS	12	μμf
PLATE TO ALL OTHER ELEMENTS	6.0	μμf
PLATE TO GRID #1 (MAX.)	0.6	μμf
GRID #1 TO HEATER (MAX.)	0.25	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #2 PEAK DISSIPATION	6	WATTS
MAXIMUM CATHODE CURRENT	100	MAMPS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
MAXIMUM PEAK CATHODE TO HEATER VOLTAGE (CATHODE POSITIVE WITH RESPECT TO THE HEATER)	300	VOLTS
DC COMPONENT OF SAME	150	VOLTS
MAXIMUM CATHODE TO HEATER VOLTAGE (CATHODE NEGATIVE WITH RESPECT TO HEATER)	100	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN HEATER AND CATHODE	20 000	OHMS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
PLATE VOLTAGE	170	VOLTS
GRID #2 VOLTAGE	170	VOLTS
GRID #1 VOLTAGE	-12.5	VOLTS
PLATE CURRENT	70	MAMPS
GRID #2 CURRENT	5	MAMPS
TRANSCONDUCTANCE	10 000	μMHOS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	8	
PLATE RESISTANCE	23 000	OHMS

OPERATING CHARACTERISTICS

CLASS A, ONE TUBE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
PLATE VOLTAGE	170	VOLTS
GRID #2 VOLTAGE	170	VOLTS
GRID #1 BIAS	-12.5	VOLTS
LOAD RESISTANCE	2400	OHMS
ZERO-SIGNAL PLATE CURRENT	70	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	5	MAMPS
INPUT AF VOLTAGE (RMS)	7.0	VOLTS
MAX. SIGNAL PLATE CURRENT	70	MAMPS.
MAX. SIGNAL GRID #2 CURRENT	22	MAMPS
MAX. POWER OUTPUT	5.6	WATTS
TOTAL HARMONIC DISTORTION AT MAX. POWER OUTPUT	10	PERCENTS
INPUT AF VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	0.5	VOLTS

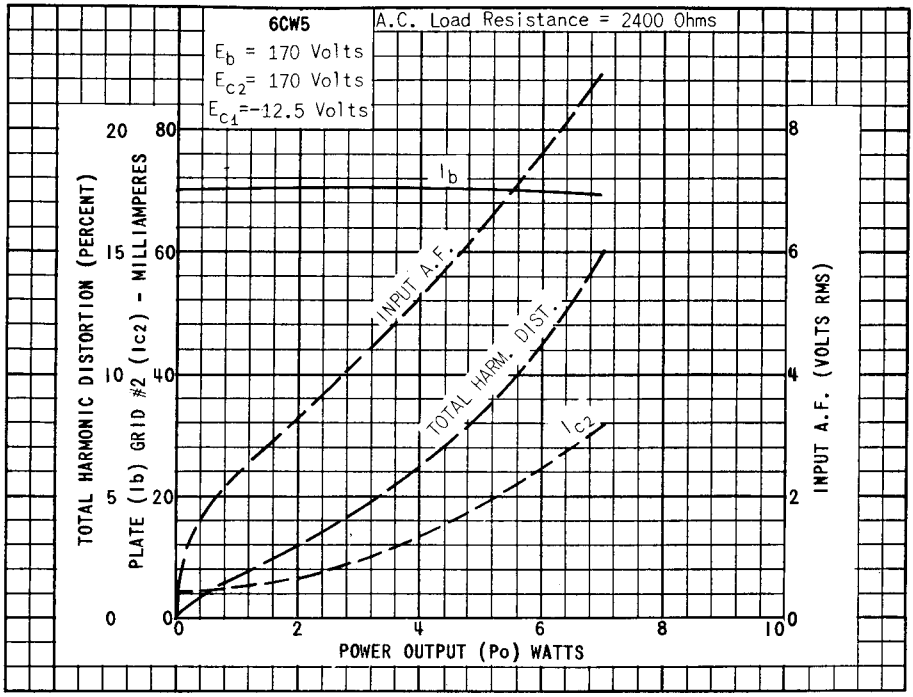
SINGLE-ENDED PUSH-PULL; TWO TUBES, SINGLE TONE[A]

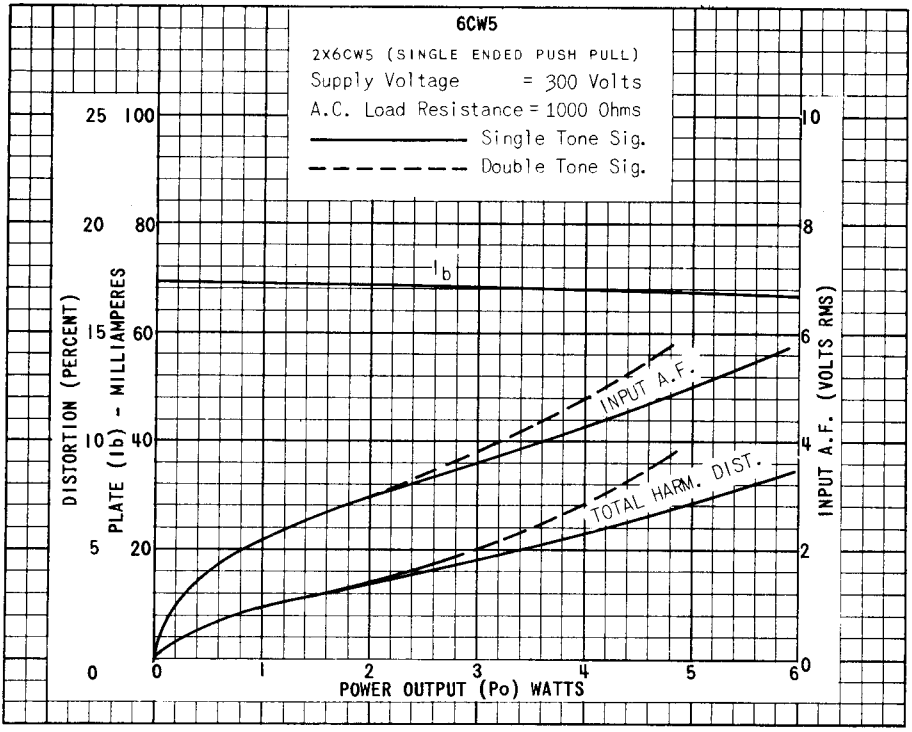
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
SUPPLY VOLTAGE	300	VOLTS
LOAD RESISTANCE	1000	OHMS
ZERO-SIGNAL CATHODE CURRENT	69	MAMPS
INPUT AF VOLTAGE (RMS)	5.7	VOLTS
MAX. SIGNAL CATHODE CURRENT	67	MAMPS
MAX. POWER OUTPUT	4.8	WATTS
TOTAL HARMONIC DISTORTION AT MAX. POWER OUTPUT	9.3	PERCENTS
INPUT AF VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	0.55	VOLTS

SINGLE-ENDED PUSH-PULL; TWO TUBES, DOUBLE TONE[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
SUPPLY VOLTAGE	300	VOLTS
LOAD RESISTANCE	1000	OHMS
ZERO-SIGNAL CATHODE CURRENT	69	MAMPS
INPUT AF VOLTAGE FOR EACH TONE SEPARATELY (RMS)	2.85	VOLTS
MAX. SIGNAL CATHODE CURRENT	67	MAMPS
MAX. POWER OUTPUT	5.9	WATTS
TOTAL HARMONIC DISTORTION AT MAX. POWER OUTPUT	8.5	PERCENTS

[A] SEE CIRCUIT DIAGRAM AND REMARK ON FOLLOWING PAGE





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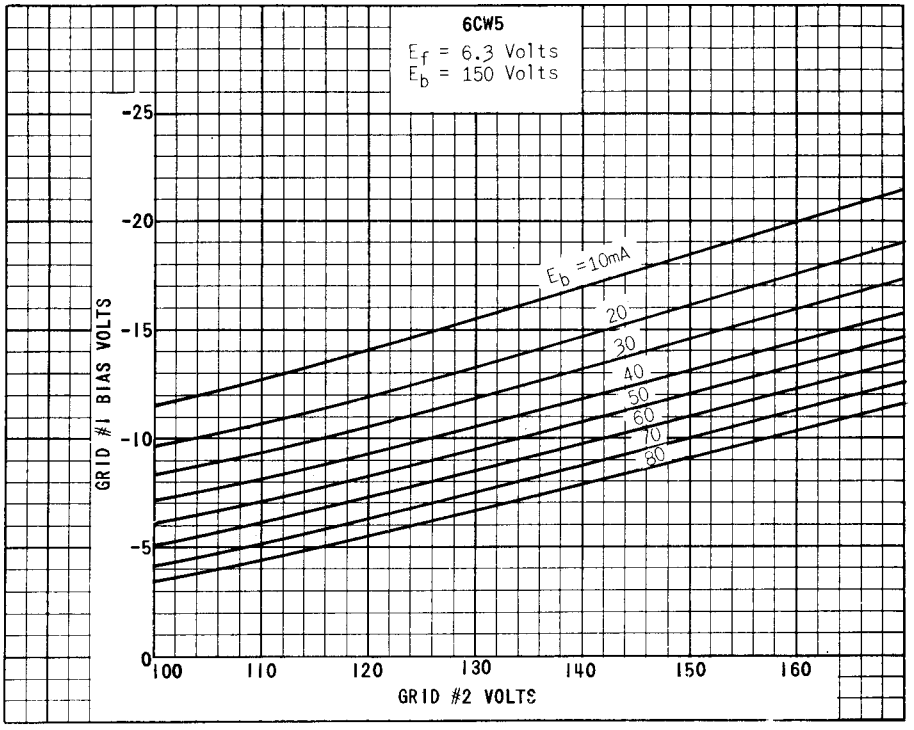
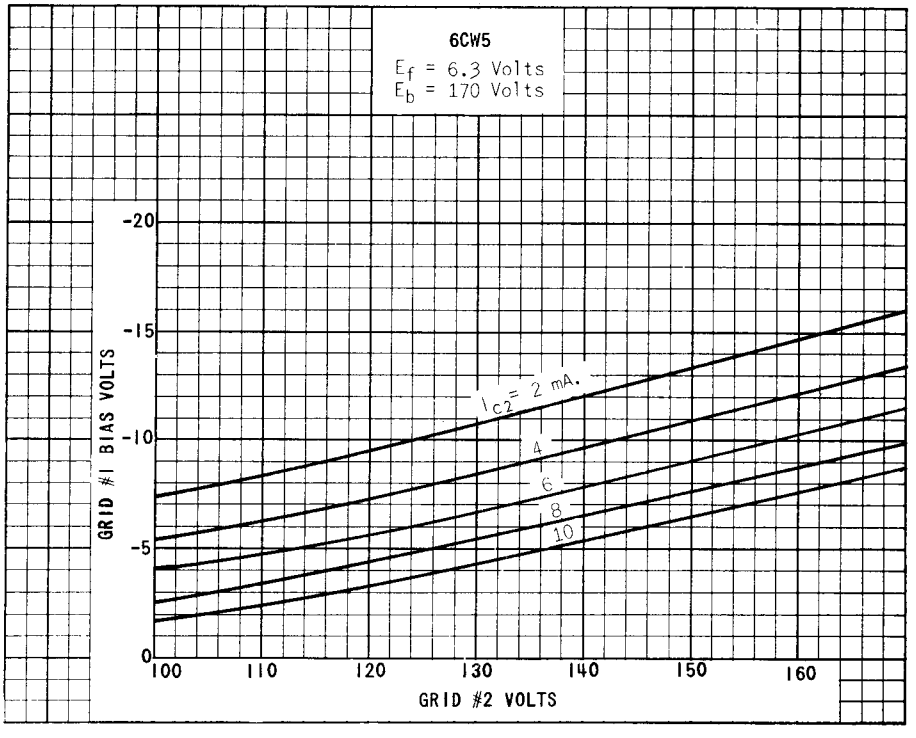

6CW5
E_f = 6.3 Volts
E_b = 150 Volts
GRID #1 BIAS VOLTS
-25
-20
-15
-10
-5
0
100
110
120
130
140
150
160
GRID #2 VOLTS
E_b = 10mA
20
30
40
50
60
70
80


6CW5
E_f = 6.3 Volts
E_b = 170 Volts
GRID #1 BIAS VOLTS
-20
-15
-10
-5
0
100
110
120
130
140
150
160
GRID #2 VOLTS
I_{c2} = 2 mA.
4
6
8
10

TUNG-SOL

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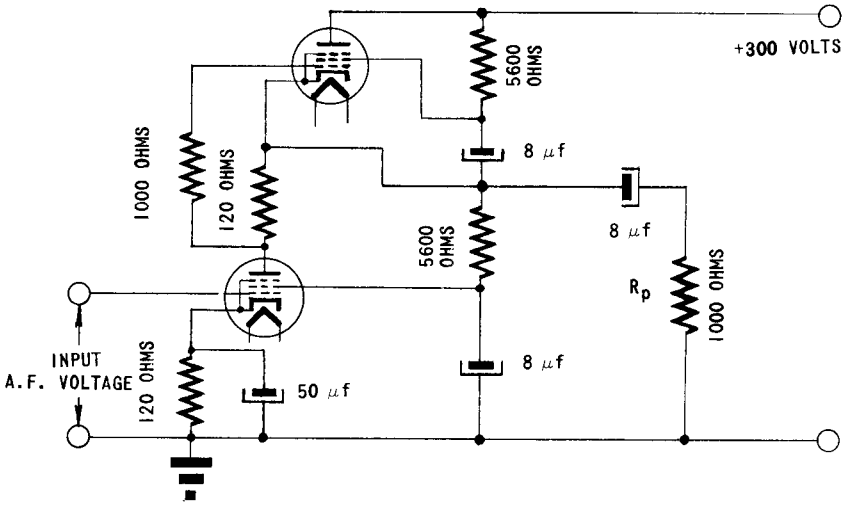
CIRCUIT DIAGRAM
OF
SINGLE-ENDED PUSH-PULL OUTPUT STAGE



REMARK

SINGLE TONE DATA ARE OBTAINED WITH A PURE SINUSOIDAL INPUT VOLTAGE. HOWEVER, SUCH AN INPUT VOLTAGE IS IN GENERAL NOT REPRESENTATIVE FOR THE REPRODUCTION OF MUSIC AND SPEECH, SINCE A PURELY SINUSOIDAL TONE SELDOM OCCURS. THE DOUBLE TONE DATA ARE OBTAINED WITH TWO SINUSOIDAL SIGNALS OF DIFFERENT FREQUENCIES BUT OF THE SAME AMPLITUDE. THIS APPEARS TO BE FAR BETTER IN AGREEMENT WITH PRACTICE. IN THE CASE OF FULL DRIVE WITH TWO SINUSOIDAL SIGNALS DIFFERENT IN FREQUENCY BUT HAVING THE SAME AMPLITUDE THE OUTPUT POWER IS ABOUT HALF THE VALUE OBTAINED AT FULL DRIVE WITH A SINGLE SINUSOIDAL INPUT VOLTAGE OF TWICE THIS AMPLITUDE. TO MAKE COMPARISON POSSIBLE THE OBTAINED OUTPUT POWER WITH DOUBLE TONE IS THEREFORE MULTIPLIED BY 2.

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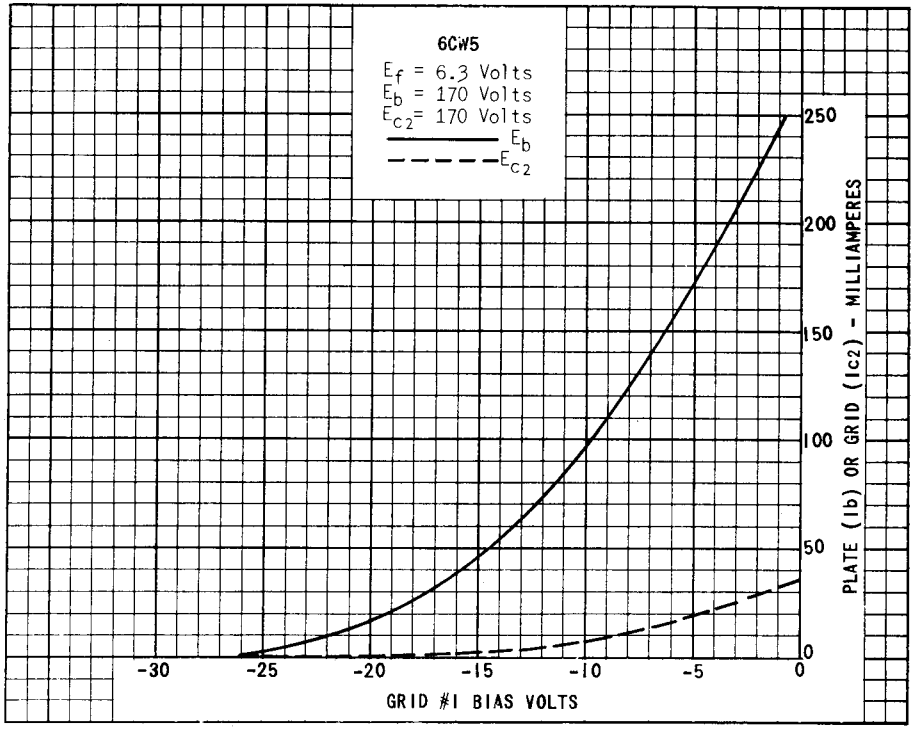
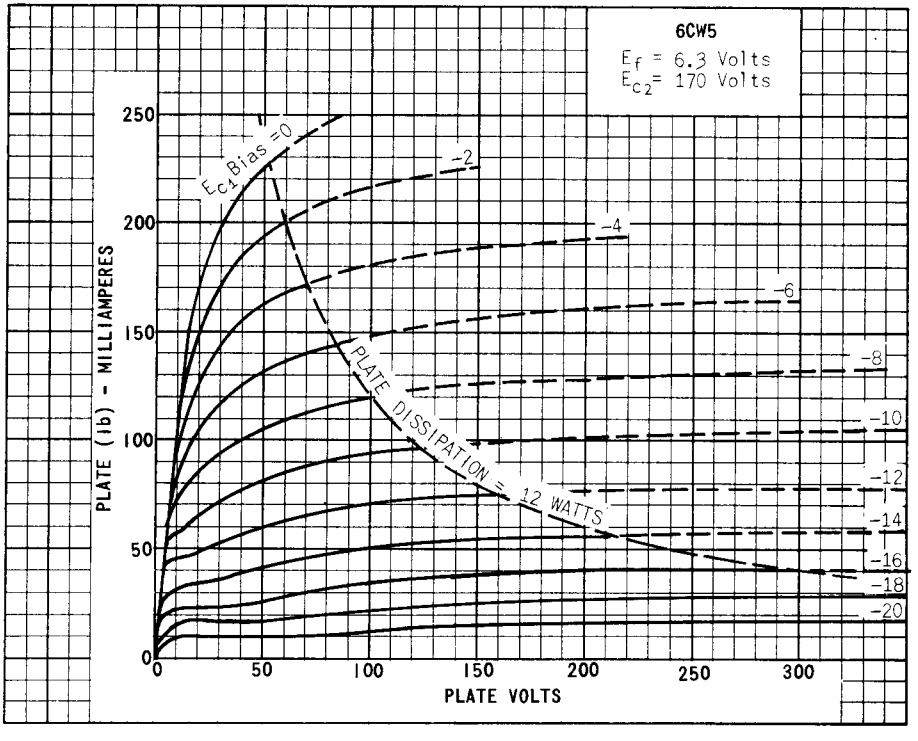

6CW5
E_f = 6.3 Volts
E_b = 170 Volts
E_{c_2}= 170 Volts
E_b
E_{c_2}
250
200
150
100
50
0
PLATE (Ib) OR GRID (Ic2) - MILLIAMPERES
-30
-25
-20
-15
-10
-5
0
GRID #1 BIAS VOLTS


6CW5
E_f = 6.3 Volts
E_{c_2}= 170 Volts
E_{c_1} Bias =0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
PLATE DISSIPATION = 12 WATTS
250
200
150
100
50
0
PLATE (Ib) - MILLIAMPERES
0
50
100
150
200
250
300
PLATE VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

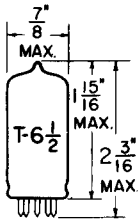
COATED UNIPOTENTIAL CATHODE

HEATER

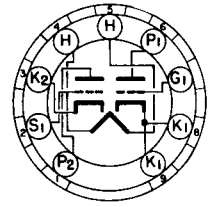
6.3 VOLTS 0.4 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9FC

THE 6CX7 IS A MEDIUM MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR OPERATION AS A CASCODE (VHF) AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, IT IS IDENTICAL TO THE 4CX7.

DIRECT INTERELECTRODE CAPACITANCES

SHIELD #315 CONNECTED TO HEATER UNLESS SPECIFIED DIFFERENTLY

	SECTION #1		SECTION #2	
GRID TO PLATE: (G TO P)	1.2		----	μμf
INPUT: G TO (H+K+E.S.)	2.4		----	μμf
OUTPUT: P TO (H+K+E.S.)	1.3		----	μμf
HEATER TO CATHODE: (H TO K) [A]	2.4		2.2	μμf
PLATE TO CATHODE: (P TO K) (MAX)	0.17		0.17	μμf
#2 PLATE TO #1 PLATE AND #1 GRID:				
#2 P TO (#1P+#1G) (MAX.)		.027		μμf
PLATE TO PLATE: (#1 P TO #2 P) (MAX.)		.017		μμf
GROUNDED GRID OPERATION:				
INPUT: K TO (G+I.S.+H+E.S.)	---		4.2	μμf
OUTPUT: P TO (G+I.S.+H+E.S.)	---		1.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK [C]	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE[C]	250	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS

[A] SHIELD #315 CONNECTED TO GROUND.

[C] UNDER CUTOFF CONDITIONS WHEN THE TUBE IS USED AS A CASCODE AMPLIFIER, THIS RATING MAY BE AS HIGH AS 300 VOLTS MAXIMUM.

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TUNG-SOL

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

CATHODE CURRENT (MAX.)	20	MA.
GRID CIRCUIT RESISTANCE (MAX.)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

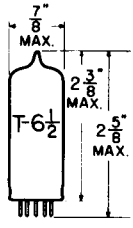
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE	0	VOLTS
CATHODE BIAS RESISTOR	220	OHMS
PLATE CURRENT	9.0	MA.
TRANSCONDUCTANCE	6 400	μMHOS
AMPLIFICATION FACTOR	39	
GRID VOLTAGE FOR I_b =10 μA (APPROX.)	−10	VOLTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



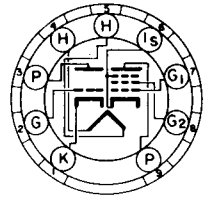
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
90X

THE 6CX8 IS A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED PRIMARILY FOR USE AS A VIDEO AMPLIFIER. THE TRIODE SECTION IS SUITABLE FOR A 4.5 MEGACYCLE SOUND IF AMPLIFIER, SWEEP OSCILLATOR, SYNC SEPARATOR, SYNC AMPLIFIER, OR SYNC CLIPPER. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CX8 IS IDENTICAL TO THE 8CX8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION:		
GRID #1 TO PLATE	0.06	μμf
INPUT	9.0	μμf
OUTPUT	4.4	μμf
TRIODE SECTION:		
GRID TO PLATE	4.4	μμf
INPUT	2.2	μμf
OUTPUT	0.38	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	1.1	---	WATTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

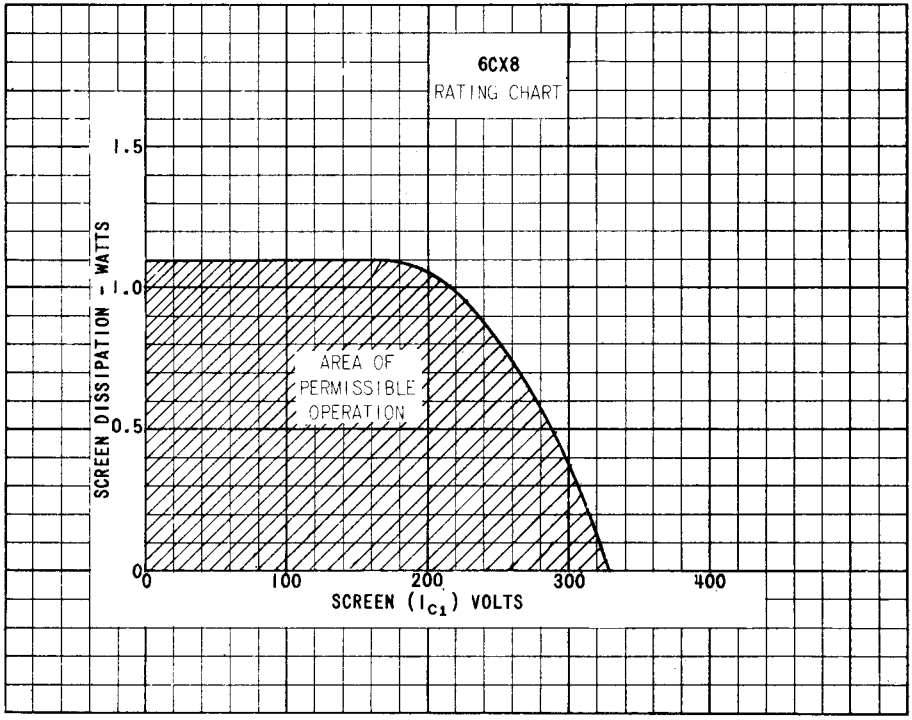
	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

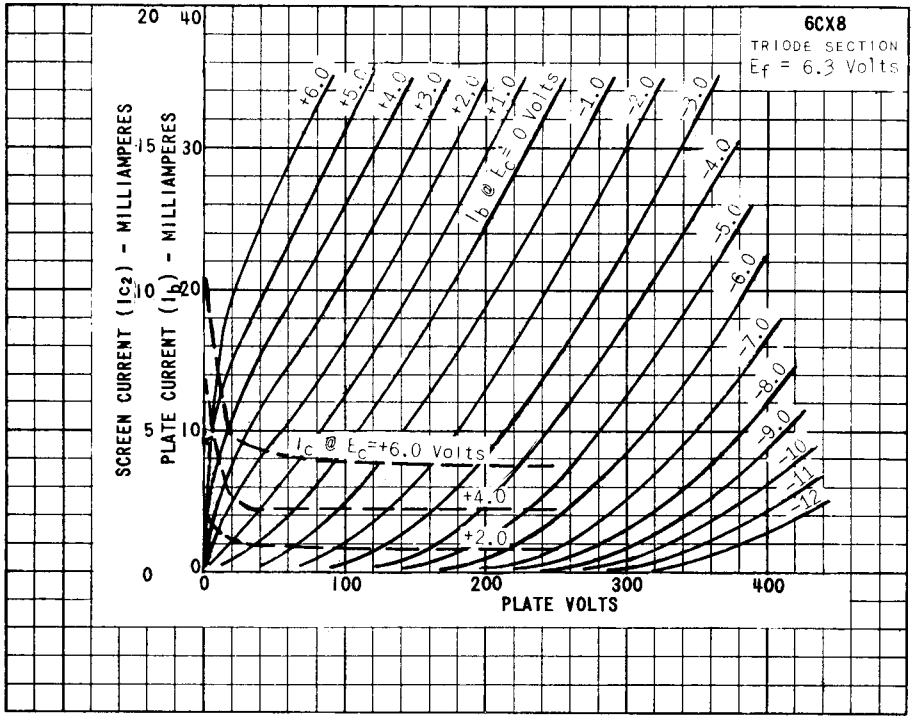
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

		PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3±10%	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.75	0.75	0.75	AMP.
PLATE VOLTAGE	40	200	150	VOLTS
SCREEN VOLTAGE	125	125	---	VOLTS
GRID #1 VOLTAGE	0[A]	---	---	VOLTS
CATHODE-BIAS RESISTOR	---	68	150	OHMS
AMPLIFICATION FACTOR	---	---	40	
PLATE RESISTANCE (APPROX.)	---	70 000	8 700	OHMS
TRANSCONDUCTANCE	---	10 000	4 600	μMHOS
PLATE CURRENT	40	24	9.2	MA.
SCREEN CURRENT	15.5	5.2	---	MA.
GRID #1 VOLTAGE (APPROX.)				
I_b = 100 μA.	---	-8.5	-5.0	VOLTS

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.





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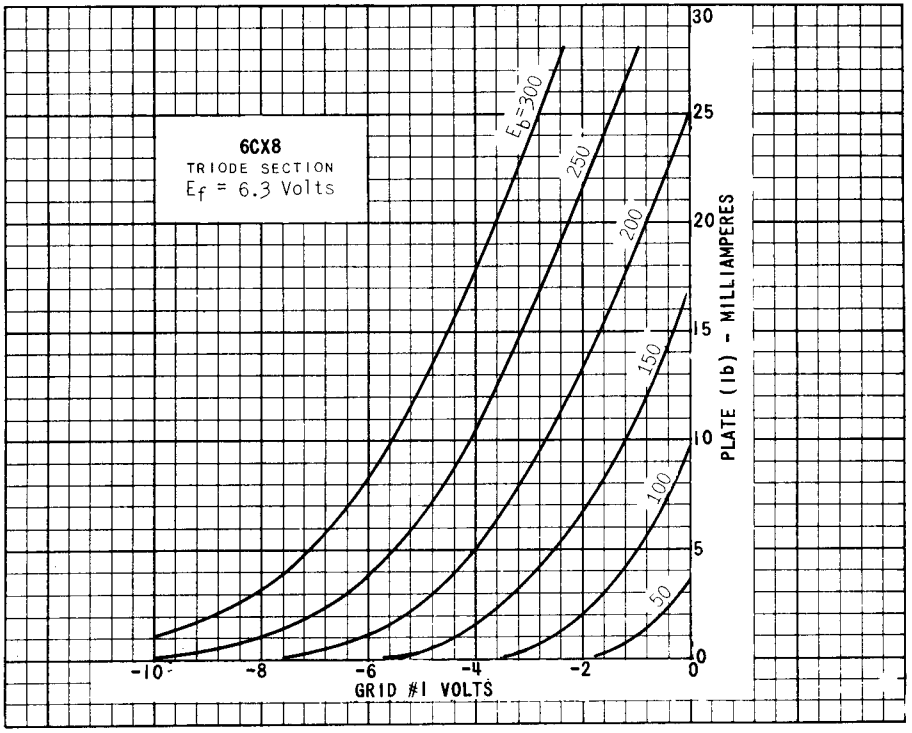
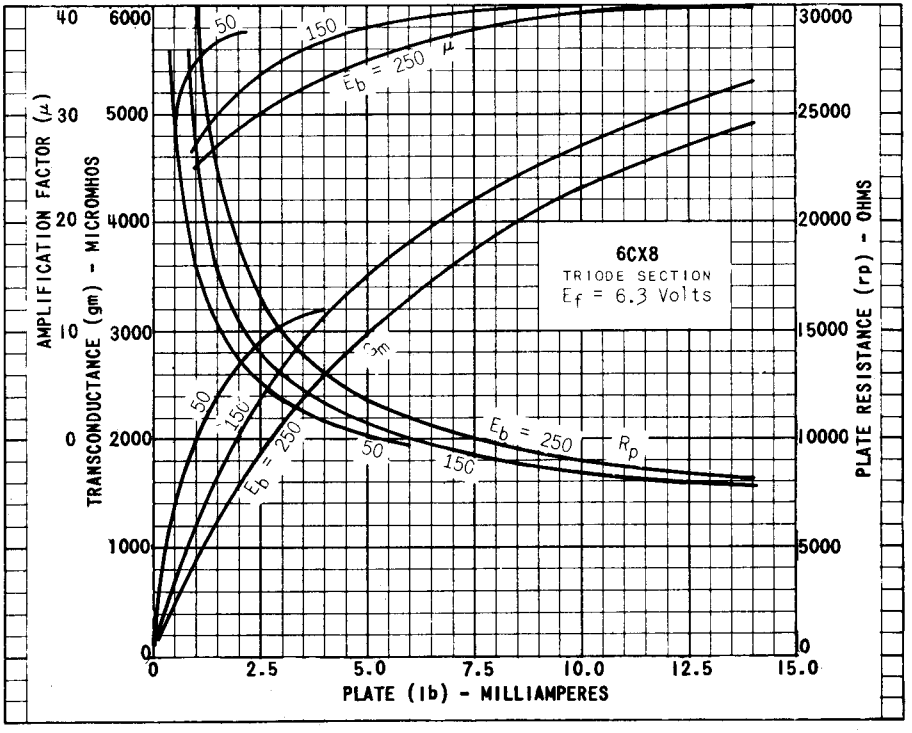
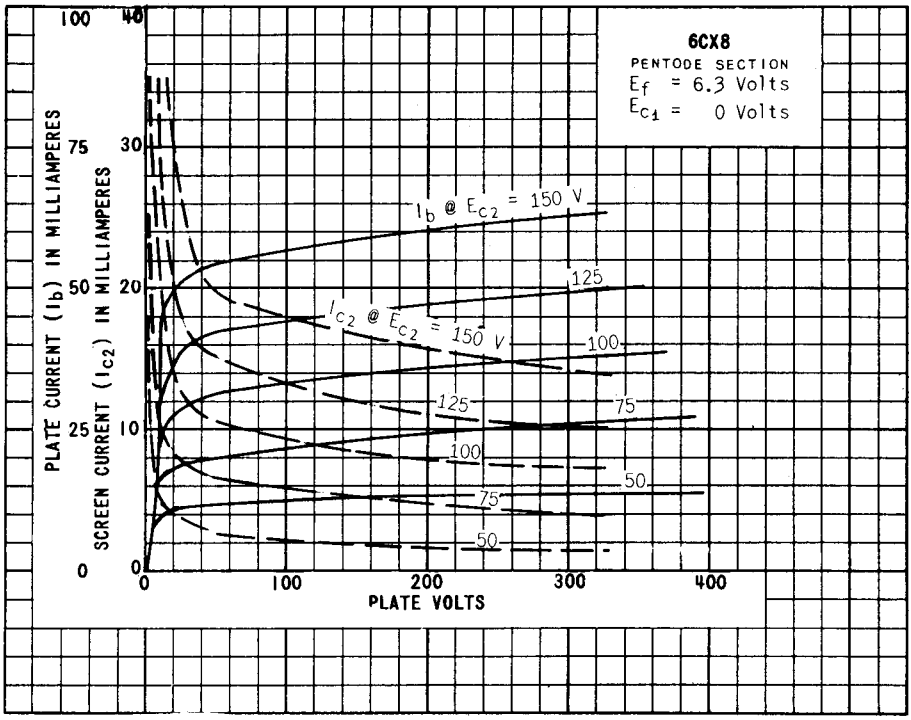
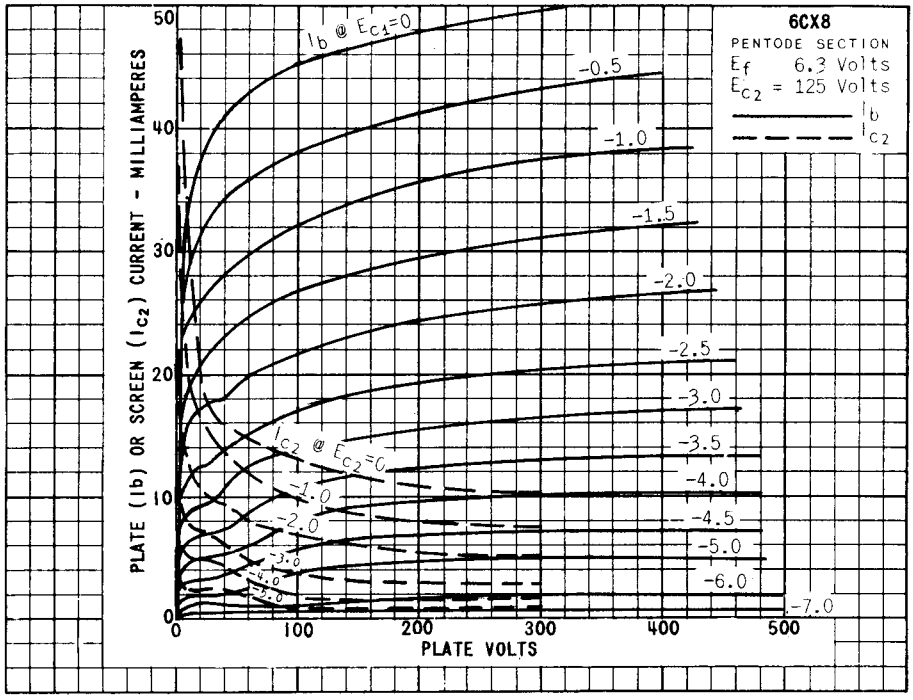
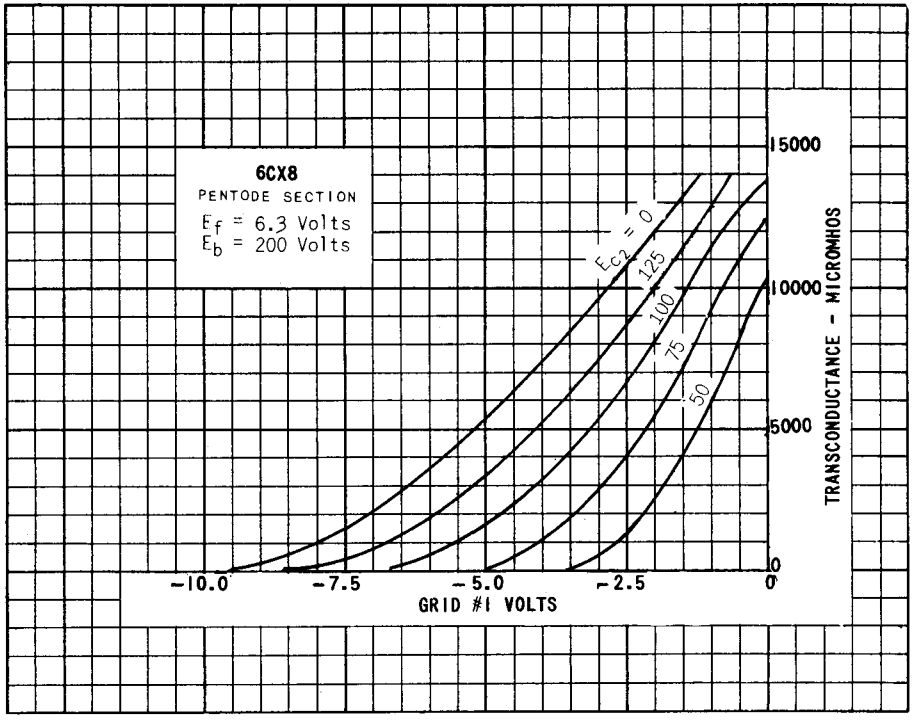
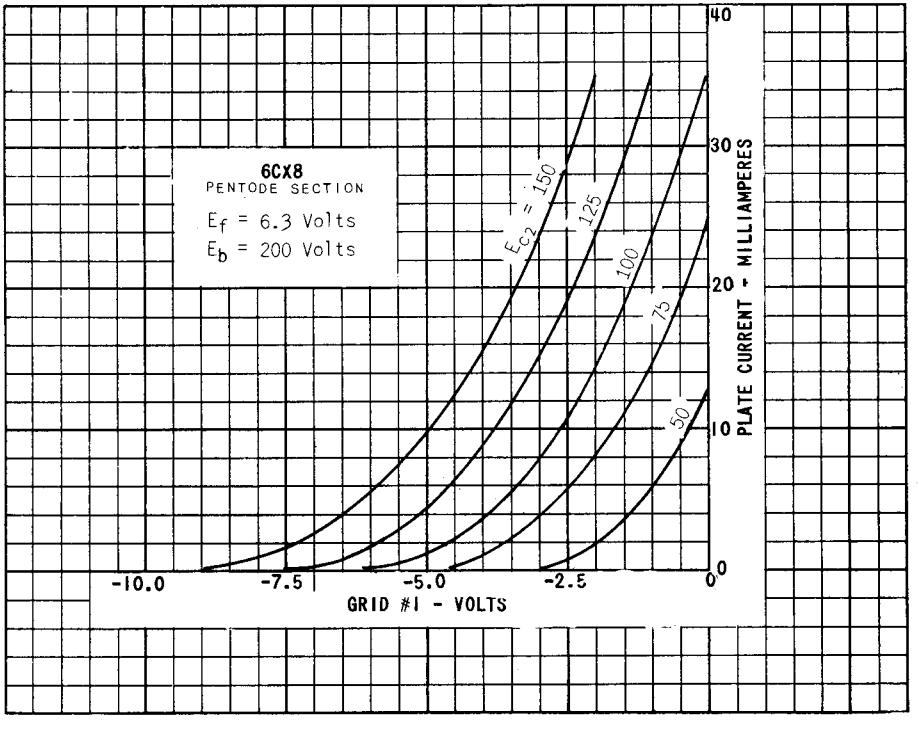

6CX8
TRIODE SECTION
Ef = 6.3 Volts
Eb=300
250
200
150
100
50
PLATE (Ib) - MILLIAMPERES
GRID #1 VOLTS
-10
-8
-6
-4
-2
0
5
10
15
20
25
30

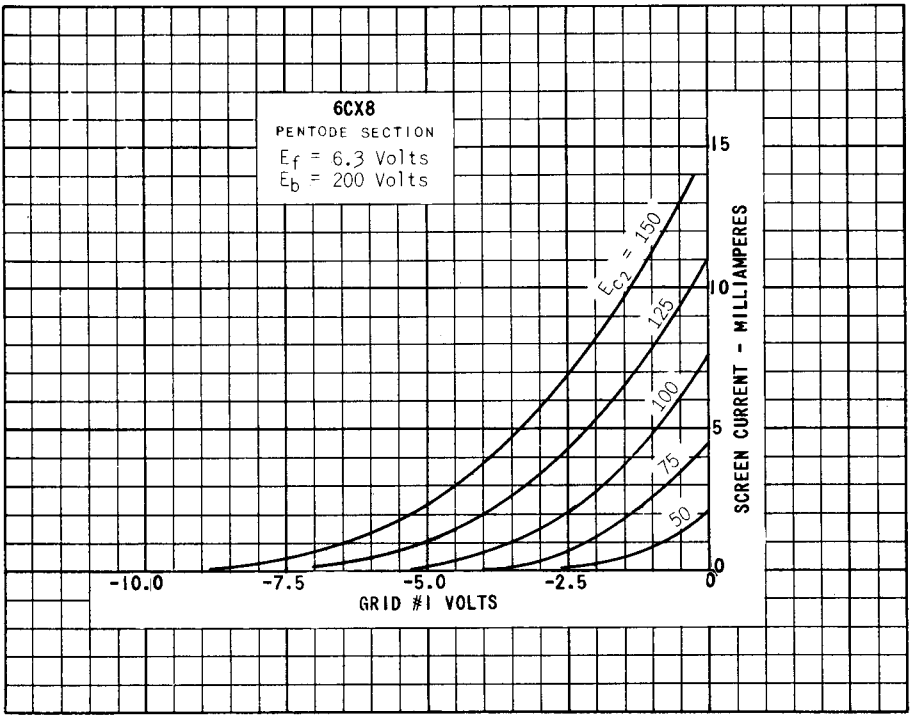

6CX8
TRIODE SECTION
Ef = 6.3 Volts
Eb = 250 μ
Eb = 250 gm
Eb = 250 Rp
50
150
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - OHMS
PLATE (Ib) - MILLIAMPERES
0
2.5
5.0
7.5
10.0
12.5
15.0
1000
2000
3000
4000
5000
6000
10000
15000
20000
25000
30000
10
20
30
40


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_{c_1} = 0 Volts
PLATE CURRENT (I_b) IN MILLIAMPERES
SCREEN CURRENT (I_{c_2}) IN MILLIAMPERES
PLATE VOLTS
I_b @ E_{c_2} = 150 V
I_{c_2} @ E_{c_2} = 150 V
125
100
75
50
0
100
200
300
400

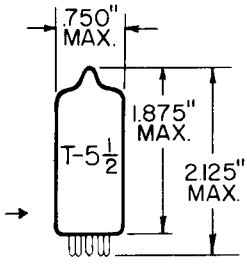

6CX8
PENTODE SECTION
E_f 6.3 Volts
E_{c_2} = 125 Volts
I_b
I_{c_2}
PLATE (Ib) OR SCREEN (I_{c_2}) CURRENT - MILLIAMPERES
PLATE VOLTS
I_b @ E_{c_1}=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-6.0
-7.0
I_{c_2} @ E_{c_2}=0
0
100
200
300
400
500


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 0
125
100
75
50
15000
10000
5000
0
TRANSCONDUCTANCE - MICROMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150
125
100
75
50
40
30
20
10
0
PLATE CURRENT - MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 - VOLTS


6CX8
PENTODE SECTION
E_f = 6.3 Volts
E_b = 200 Volts
E_{c2} = 150
125
100
75
50
15
10
5
0
SCREEN CURRENT - MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

TETRODE

MINIATURE TYPE

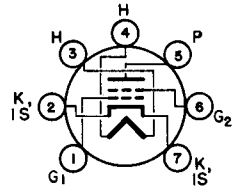
COATED UNIPOTENTICAL CATHODE

HEATER

6.3±0.6 VOLTS 0.2 AMP. ←

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EW

THE 6CY5 IS A SHARP-CUTOFF TETRODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CY5 IS IDENTICAL TO THE 2CY5, 3CY5 AND 4CY5.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE	0.03	μμf
INPUT	4.5	μμf
OUTPUT	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 (SCREEN) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 (CONTROL GRID) VOLTAGE		
POSITIVE VALUE	0	MA.
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS

[A] WITH SHIELD #316 CONNECTED TO CATHODE.

→ INDICATES A CHANGE.

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TUNG-SOL

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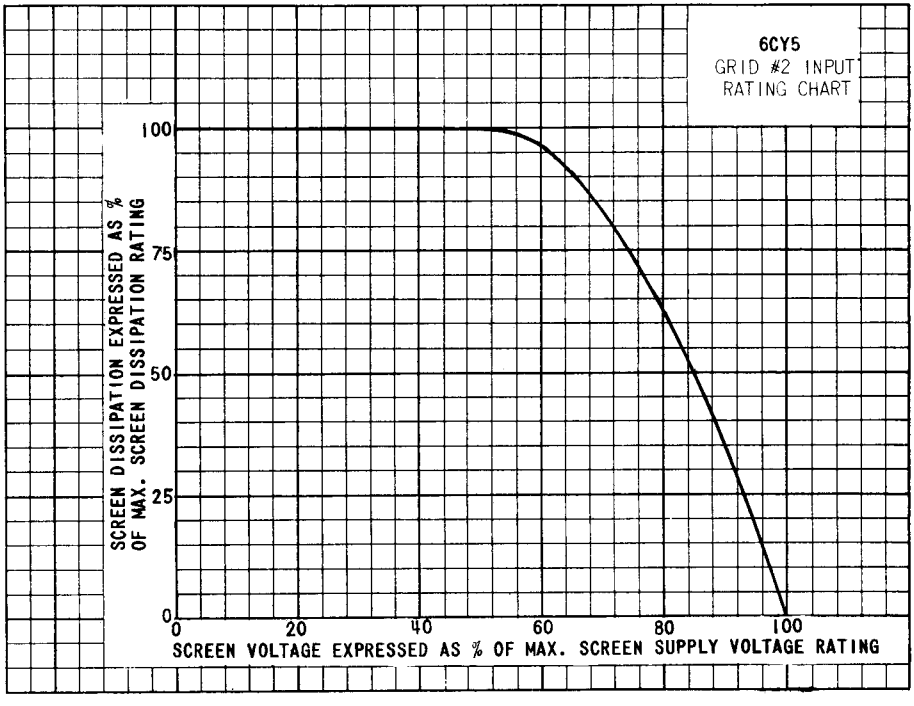
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	125	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	−1	VOLTS
PLATE RESISTANCE	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 CUTOFF BIAS[C]	−6	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.

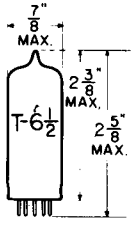
[C] PLATE CURRENT 20 μA.



TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

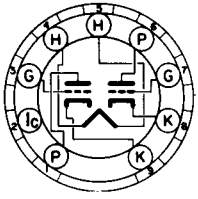


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

9LG ←

THE 6CY7 IS A DISSIMILAR DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS A COMBINED VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6CY7 IS IDENTICAL TO THE 8CY7.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.®

	SEC. 1	SEC. 2	
GRID TO PLATE	1.8	4.4	μμf
INPUT	1.5	5.0	μμf
OUTPUT	0.30	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	VERTICAL-[B] OSCILLATOR SERVICE (SEC. 1)	VERTICAL-[B] DEFLECTION AMPLIFIER (SEC. 2)	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	350	350	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1 800	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.5[A]	WATTS
MAXIMUM DC CATHODE CURRENT	---	35	MA.
MAXIMUM DC PEAK CATHODE CURRENT	---	120	MA.
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS.
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE			
WITH FIXED BIAS	2.2	---	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

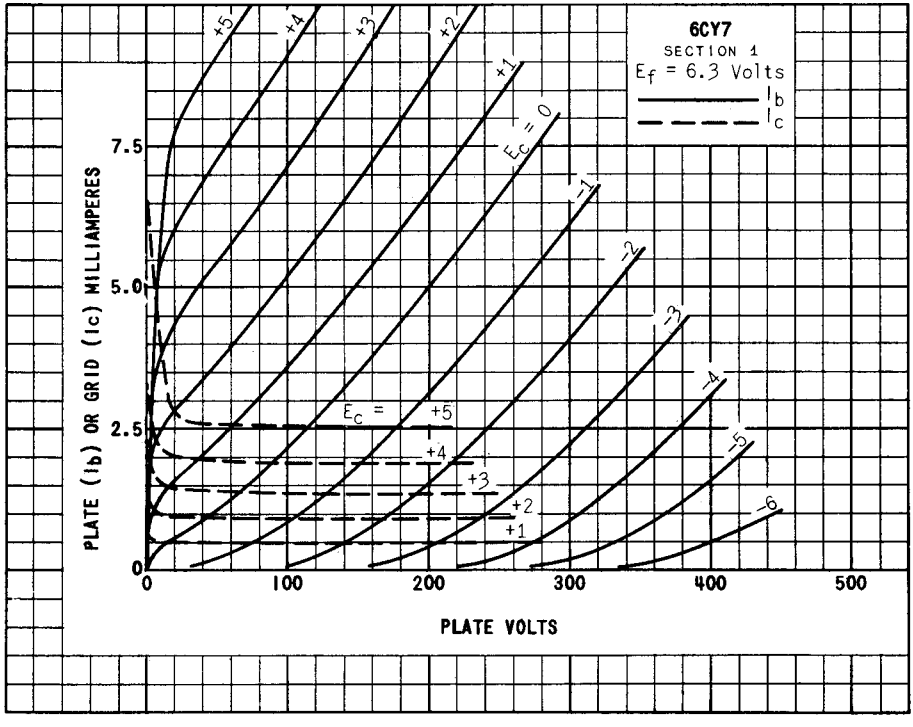
	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.75	0.75	0.75	AMP.
PLATE VOLTAGE	250	60	150	VOLTS
GRID VOLTAGE	-3.0	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	620	OHMS
AMPLIFICATION FACTOR	68	---	5.0	
PLATE RESISTANCE (APPROX.)	52 000	---	920	OHMS
TRANSCONDUCTANCE	1 300	---	5 400	μMHOS
PLATE CURRENT	1.2	80	30	MA.
PLATE CURRENT (APPROX.) E_c=-30V.	---	---	3.5	MA.
GRID VOLTAGE (APPROX.) I_b=200 μA.	---	---	-40	VOLTS
GRID VOLTAGE (APPROX.) I_b=10 μA.	-5.5	---	---	VOLTS

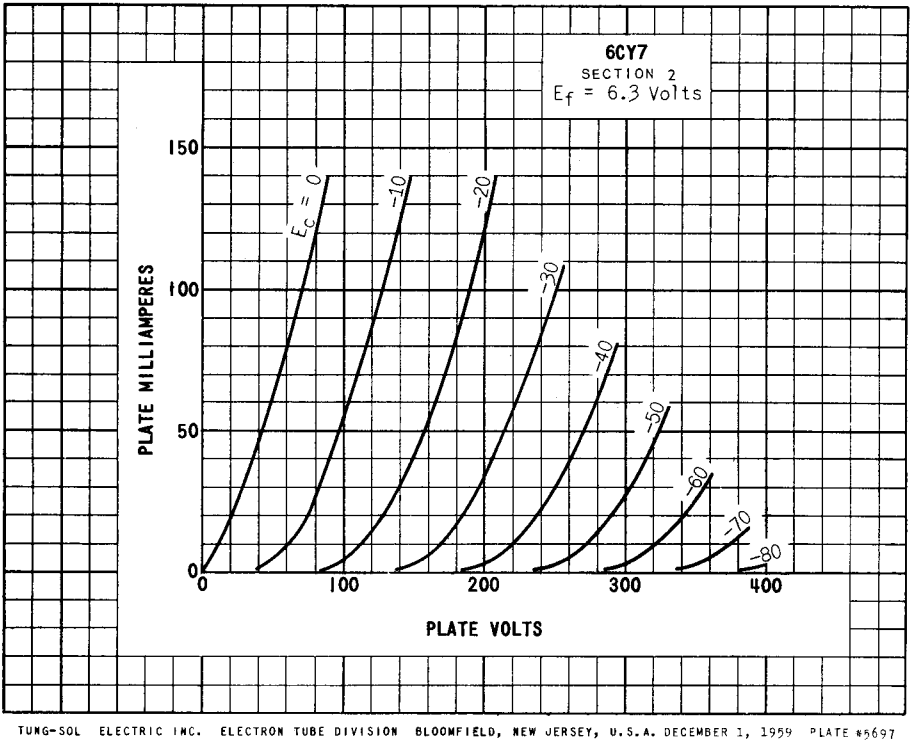
⊕ WITHOUT EXTERNAL SHIELD.

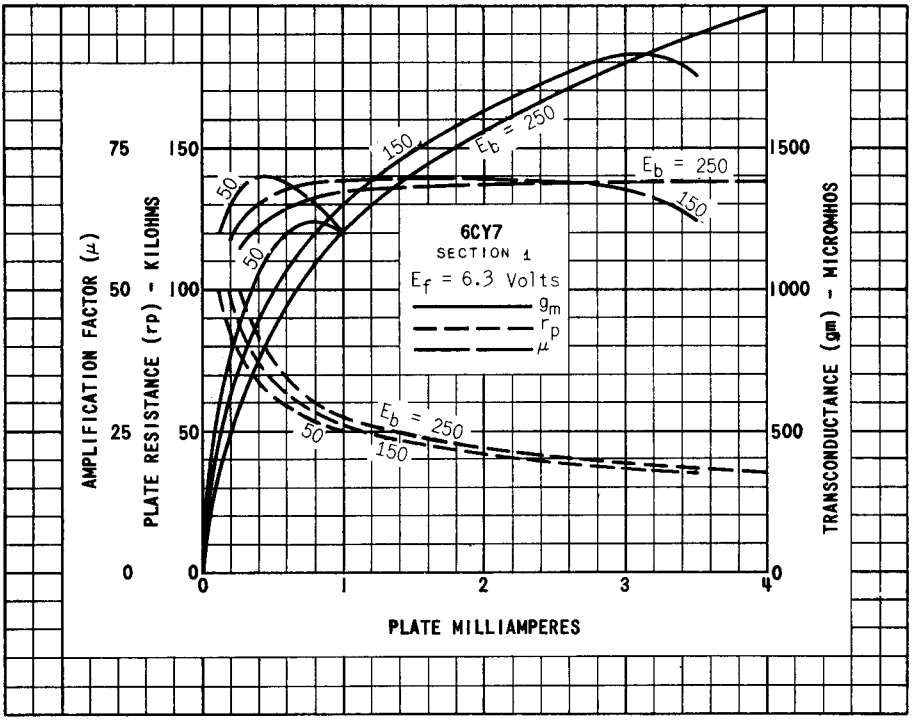
A IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

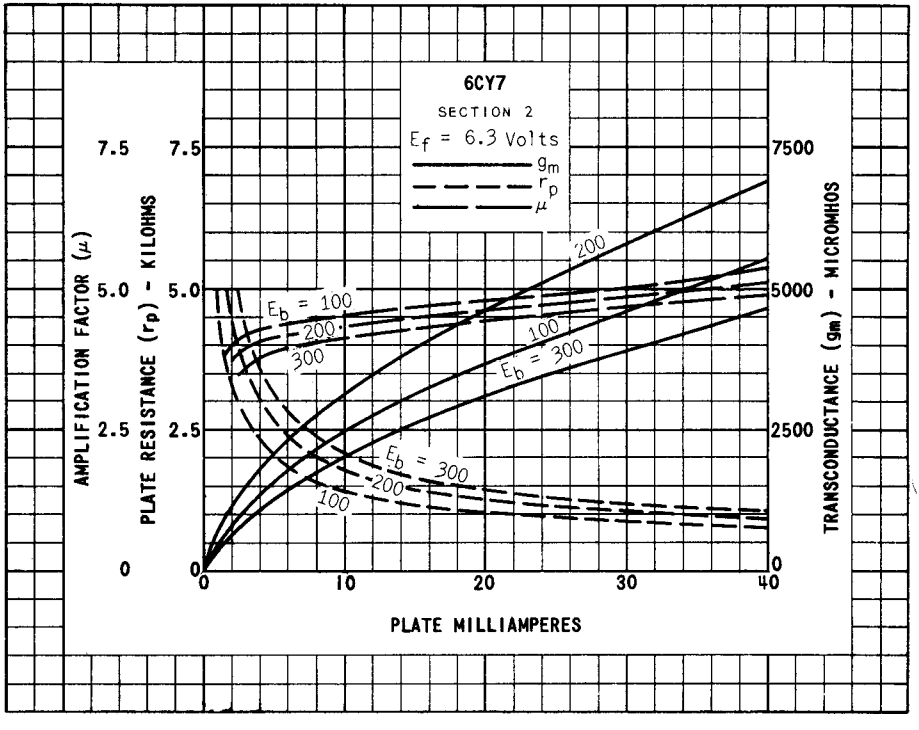
B FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

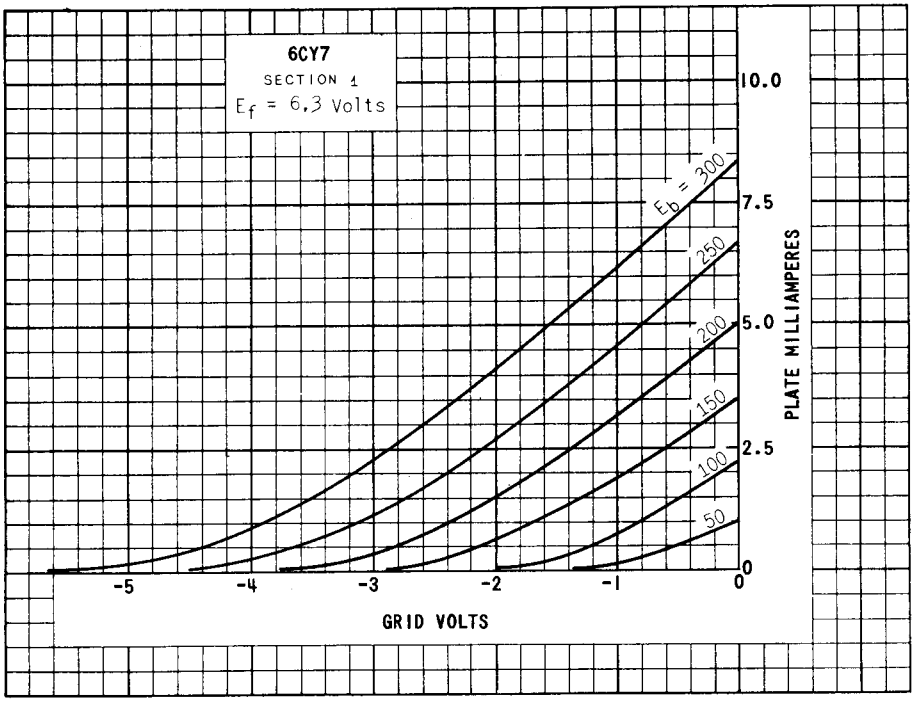
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

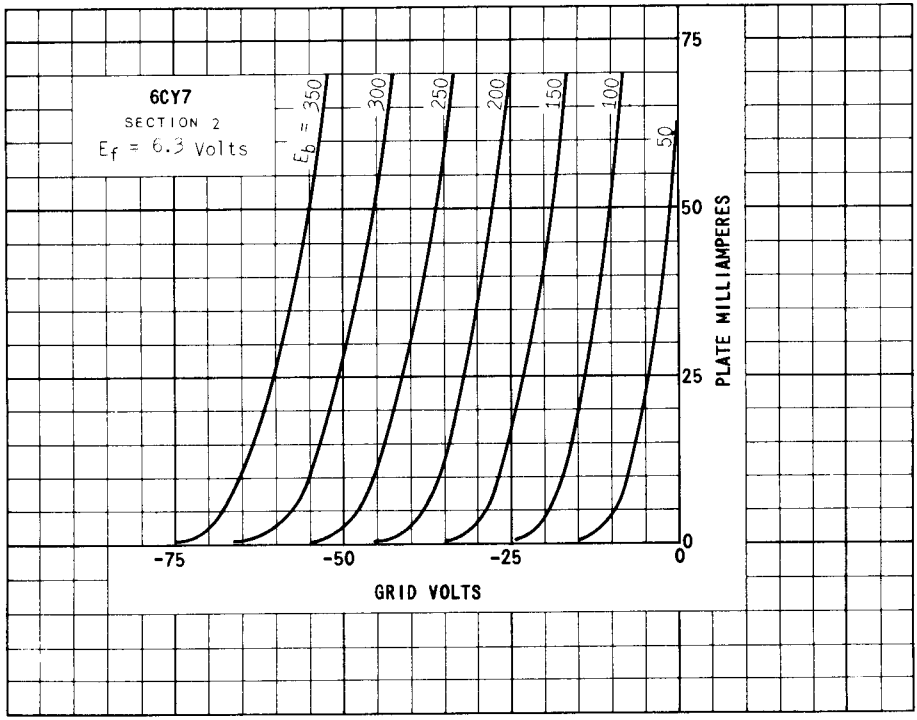

6CY7
SECTION 1
Ef = 6.3 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
Ec = 0
+1
+2
+3
+4
+5
-1
-2
-3
-4
-5
-6
Ec =
0
2.5
5.0
7.5
100
200
300
400
500


6CY7
SECTION 2
Ef = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
Ec = 0
-10
-20
-30
-40
-50
-60
-70
-80
0
50
100
150
100
200
300
400


6CY7
SECTION 1
Ef = 6.3 Volts
gm
rp
μ
Eb = 250
150
50
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
0
25
50
75
100
150
500
1000
1500
1
2
3
4


6CY7
SECTION 2
Ef = 6.3 Volts
gm
rp
μ
Eb = 100
200
300
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
0
2.5
5.0
7.5
2500
5000
7500
10
20
30
40

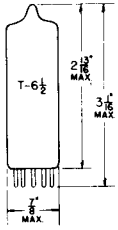

6CY7
SECTION 1
E_f = 6.3 Volts
E_b = 300
250
200
150
100
50
10.0
7.5
5.0
2.5
0
PLATE MILLIAMPERES
-5
-4
-3
-2
-1
0
GRID VOLTS


6CY7
SECTION 2
E_f = 6.3 Volts
E_b = 350
300
250
200
150
100
50
75
50
25
0
PLATE MILLIAMPERES
-75
-50
-25
0
GRID VOLTS

TUNG-SOL

BEAM POWER PENTODE

MINIATURE TYPE

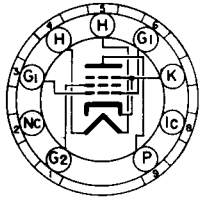


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN NOVAL

9HN

THE 6CZ5 IS A HIGH PERVEANCE BEAM POWER PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A VERTICAL-DEFLECTION AMPLIFIER TUBE IN HIGH-EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS UTILIZING PICTURE TUBES HAVING DIAGONAL DEFLECTION ANGLES OF 110 DEGREES AND OPERATING AT VOLTAGES UP TO 18,000 VOLTS. IT IS ALSO USEFUL IN THE AUDIO OUTPUT STAGES OF TELEVISION AND RADIO RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.4	μμf
GRID #1 TO: (K+G_3+G_2+H)	9.0 ←	μμf
PLATE TO: (K+G_3+G_2+H)	6.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	**VOLTS**
MAXIMUM PLATE VOLTAGE:		
DC	315	VOLTS
PEAK POSITIVE PULSE (ABS. MAX.)[B]	2 200[C]	VOLTS
MAXIMUM GRID #2 VOLTAGE	315 ←	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	-275 ←	VOLTS
MAXIMUM CATHODE CURRENT:		
PEAK	155 ←	MA.
AVERAGE	45 ←	MA.
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 INPUT	2.2 ←	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION AMPLIFIER[A]

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	75	250	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	0	-14	VOLTS
PLATE RESISTANCE (APPROX.)	---	73 000	OHMS
TRANSCONDUCTANCE	---	4 800	μMHOS
PLATE CURRENT	130[G]	46	MA.
GRID #2 CURRENT	16[G]	4.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 100 μAMP.	---	-40 ←	VOLTS

NOTES

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[B] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PER CENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE SCANNING CYCLE IS 2.5 MILLISECONDS.

[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[E] SUBSCRIPT 1 INDICATES THAT GRID #1 CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

[F] THE TYPE OF INPUT COUPLING NETWORK USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT. TRANSFORMER OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED

[G] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

THYRATRON

MINIATURE TYPE

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIP. CATHODE	PIN CONNECTIONS	
BASE MIN. BUTTON 7-PIN	PIN 1 GRID	PIN 7 PLATE
CAP ———	PIN 2 NO CONNECTION	PIN 8 NONE
BULB T-5½	PIN 3 HEATER	
MAX. DIAMETER 3/4"	PIN 4 HEATER	MOUNTING POS. ANY
MAX. SEATED HEIGHT 1 7/8"	PIN 5 CATHODE	
MAX. OVERALL LENGTH 2 1/8"	PIN 6 NO CONNECTION	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.250	AMPERE
MINIMUM HEATING TIME	30	SECONDS
MAXIMUM VOLTAGE BETWEEN ELEMENTS	450	VOLTS
PEAK ANODE CURRENT	100	MA.
AVERAGE ANODE CURRENT[A]	25	MA.
TUBE VOLTAGE DROP AT 25 MA. (APPROX.)	16	VOLTS

[A] AVERAGED OVER PERIOD OF 30 SECONDS MAXIMUM.

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PLATE 1679
FEB. 15 1946

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6D4

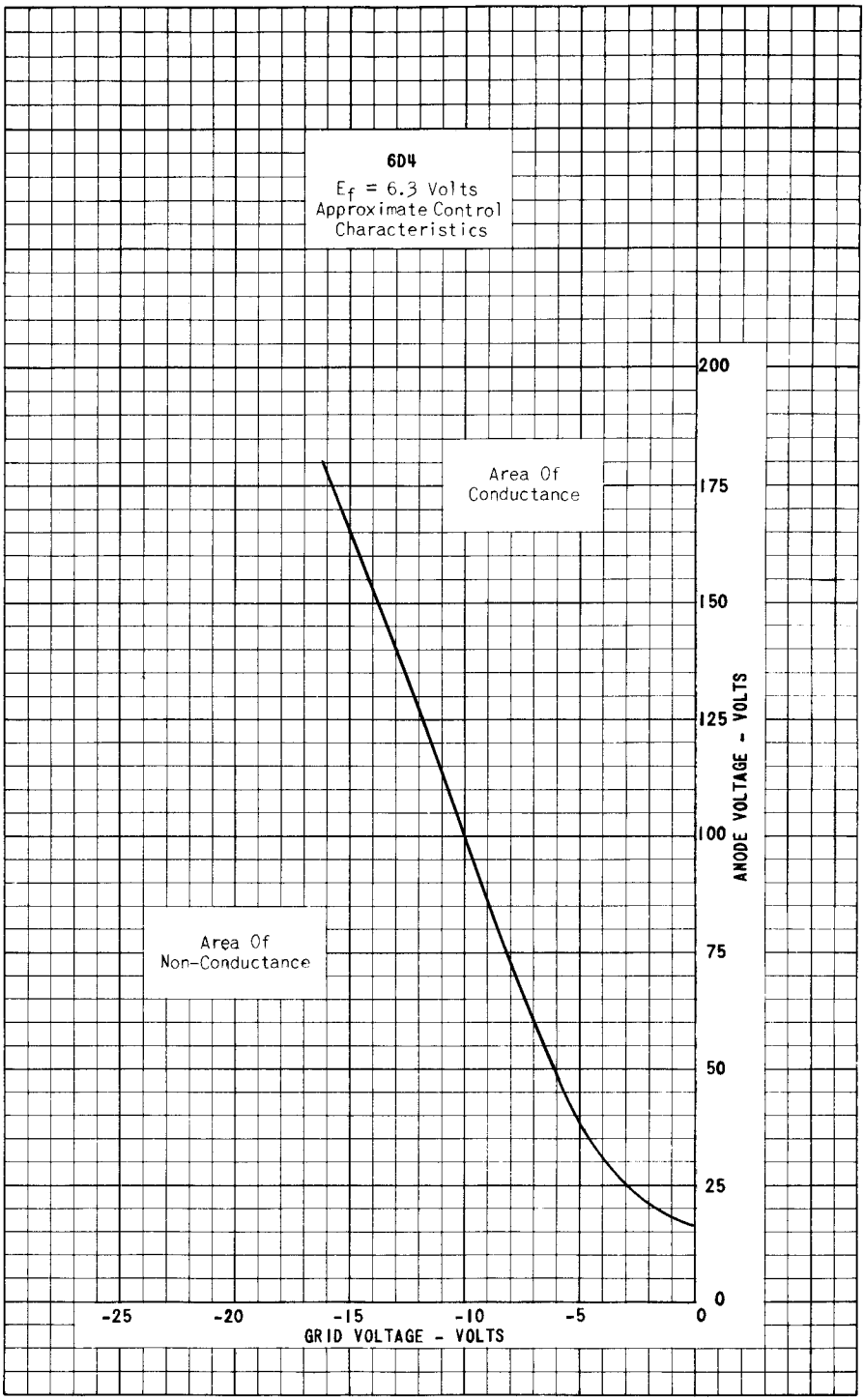

PLATE
1680
FEB. 15
1946

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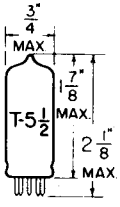
TUNG-SOL

ARGON THYRATRON

MINIATURE TYPE

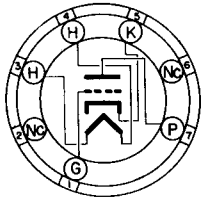


GLASS BULB

HEATER

6.3±10% VOLTS 0.25 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL MINIATURE BUTTON
7 PIN BASE

5AY

THE 6D4 IS AN ARGON FILLED TRIODE THYRATRON WITH NEGATIVE CONTROL GRID CHARACTERISTICS. ALTHOUGH THE 6D4 HAS FOUND USE AS A RELAY TUBE AND SAW TOOTH OSCILLATOR, ITS PRINCIPAL APPLICATION HAS BEEN AS AN RF NOISE GENERATOR. BECAUSE OF ITS SMALL SIZE, LIGHT WEIGHT, AND RELATIVE FREEDOM FROM TEMPERATURE RESTRICTIONS, THIS TUBE IS SUITED PARTICULARLY FOR USE IN COMPACT OR PORTABLE EQUIPMENT.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 VOLTS)	0.25	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	2.6	μμfd
CONTROL GRID TO CATHODE CAPACITANCE	1.2	μμfd
ANODE TO CATHODE CAPACITANCE	1.0	μμfd
HEATER TO CATHODE CAPACITANCE	2.9	μμfd
ANODE VOLTAGE DROP (AT 100 MA dc) (APPROX.)	12	VOLTS
NOISE OUTPUT (VIDEO BAND WIDTH 4 MC. FIG.2 CONDITIONS WITH E_{dc}=250V DC AND R=33,000 OHM) (P TO P)(MIN.)	9	VOLTS

MECHANICAL DATA

MOUNTING POSITION	ANY	
AVERAGE WEIGHT	0.3	OZ.
MAXIMUM VIBRATION RATING (D = .08", 25 CPS)	2.5	G.
BULB	T-5 1/2	
BASE	7 PIN MINIATURE BUTTON	

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

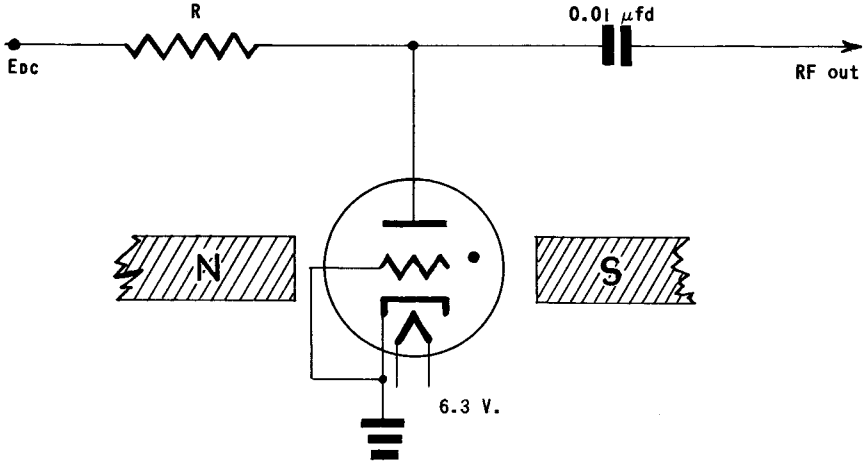
RATINGS
ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
PEAK ANODE VOLTAGE			
FORWARD		350	VOLTS
INVERSE		350	VOLTS
DC PLATE SUPPLY VOLTAGE		250	VOLTS
CATHODE CURRENT			
PEAK		110	MA.
AVERAGE		25	MA.
AVERAGING TIME		30	SECONDS
NEGATIVE CONTROL GRID VOLTAGE	-150		
HEATER CATHODE VOLTAGE	-110	0	
AMBIENT TEMPERATURE	-55	90	°C
CONTROL GRID CIRCUIT RESISTANCE		0.5	MEGOHM

APPLICATION NOTES

THE TUBE CAN BE USED IN CONJUNCTION WITH A 375 GAUSS MAGNET AS AN R.F. NOISE GENERATOR. THE MAGNETIC FIELD IS APPLIED PERPENDICULAR TO THE NORMAL ELECTRON PATH IN SUCH A WAY AS TO DEFLECT THE ELECTRONS UPWARD (NORTH POLE OF THE MAGNET AT PIN 7). MINIMUM OUTPUT FIGURES LISTED, ARE AS MEASURED THROUGH A TUNED FILTER, 1000 CPS BANDWIDTH AT 3 db POINTS, WITH R = 56,000 OHMS, E_{dc} = 300 V DC.

TUNG-SOL



FREQUENCY IN MEGACYCLES	MINIMUM NOISE VOLTAGE IN MICROVOLTS RMS
0.1	10,000
0.2	14,000
0.5	25,000
1.0	22,000
2.0	7,000
5.0	500.
10.0	70

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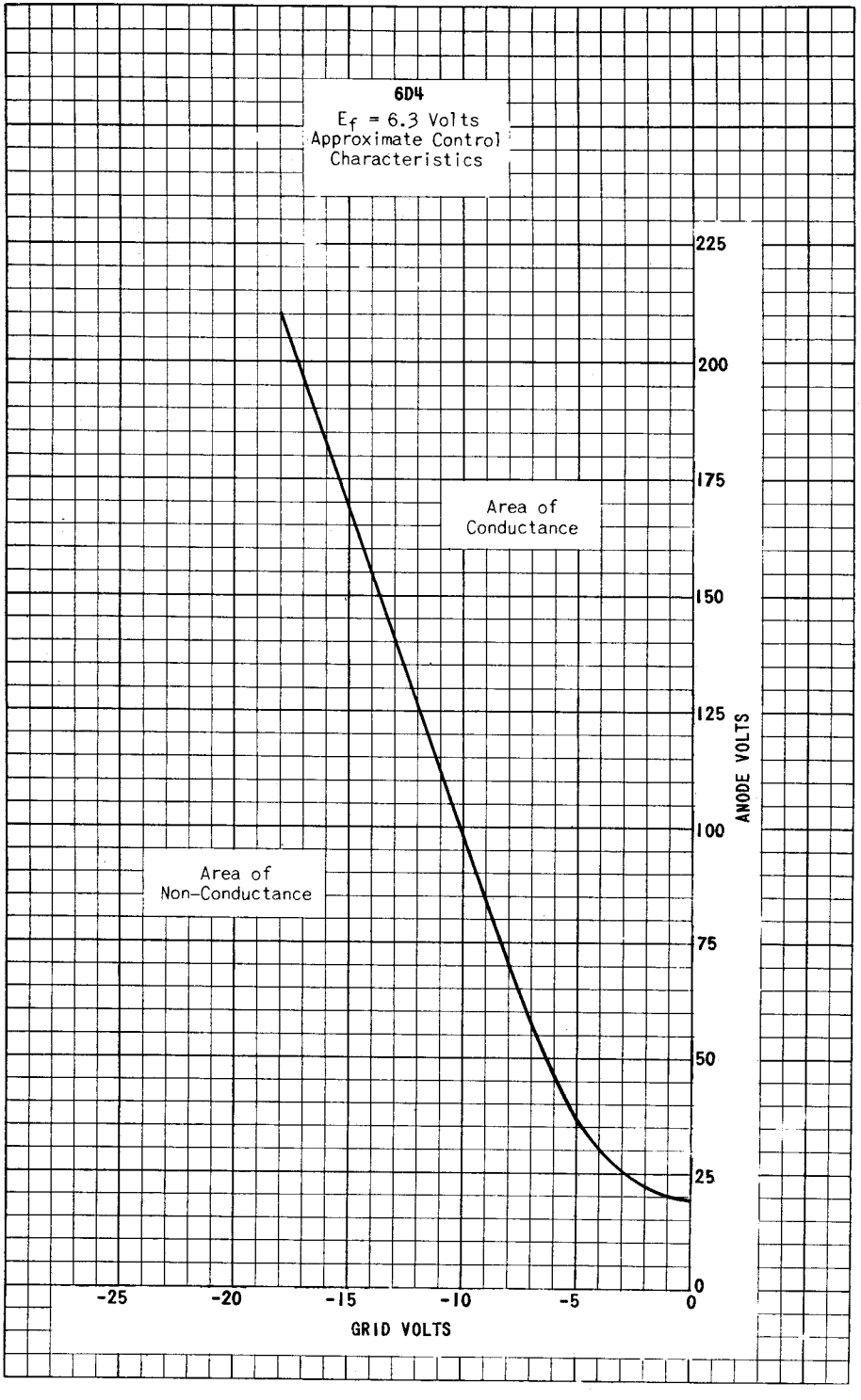
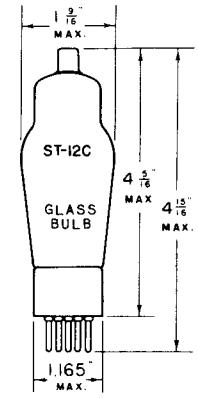
TENATIVE DATA



TUNG-SOL



SMALL 6 PIN BASE

TRIPLE GRID

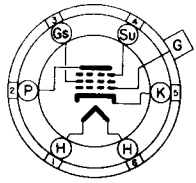
REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMPERE

AC OR DC



6F

BOTTOM VIEW

THE TUNG-SOL 6D6 IS A TRIPLE GRID VARIABLE MU AMPLIFIER. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS, AS IT MINIMIZES CROSS MODULATION. WITH THE EXCEPTION OF CAPACITANCES AND HEATER RATINGS, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6U7G AND THE 58.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLT
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.25	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	−3	−3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	8.0	8.2	MA.
SCREEN CURRENT	2.2	2.0	MA.
PLATE RESISTANCE APPROX.	0.25	0.8	MEGOHM
TRANSCONDUCTANCE	1500	1600	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	−50	−50	VOLTS

TYPICAL OPERATING CONDITIONS WITH VARIABLE BIAS AS MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
CONTROL GRID VOLTAGE APPROX. [A]	−10	−10	VOLTS

[A] MINIMUM FOR AN OSCILLATOR PEAK VOLTAGE OF 7 VOLTS. THESE VALUES ARE OPTIMUM.

CONTINUED NEXT PAGE

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PLATE 579-4

OCT. 20 1939

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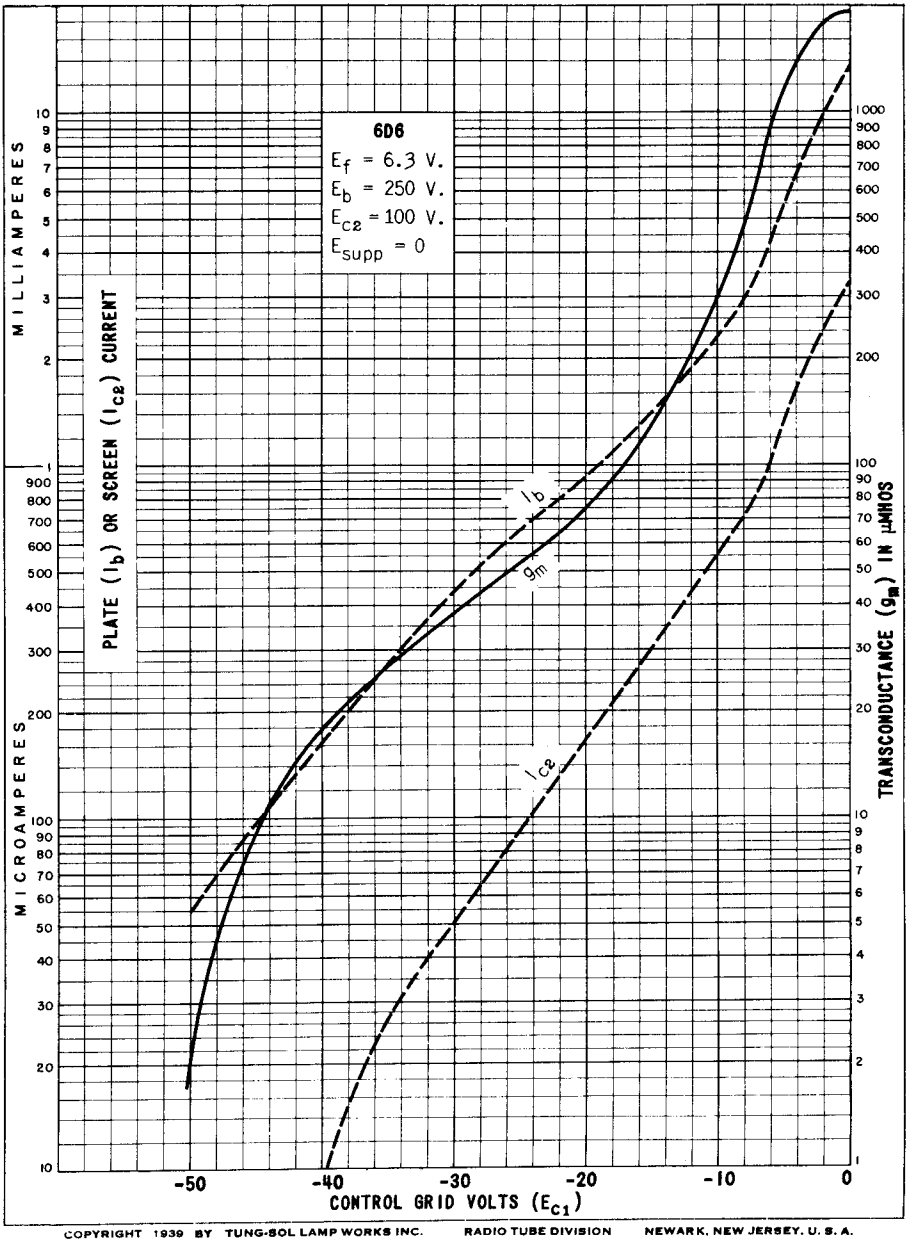
6D6

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	4.7	μμf
PLATE TO CATHODE	6.5	μμf
GRID TO PLATE[S]	.007 MAX.	μμf

[S] WITH SHIELD. THE INTERNAL SHIELD WITHIN THE DOME OF THE 6D6 IS CONNECTED INTERNALLY TO THE CATHODE.



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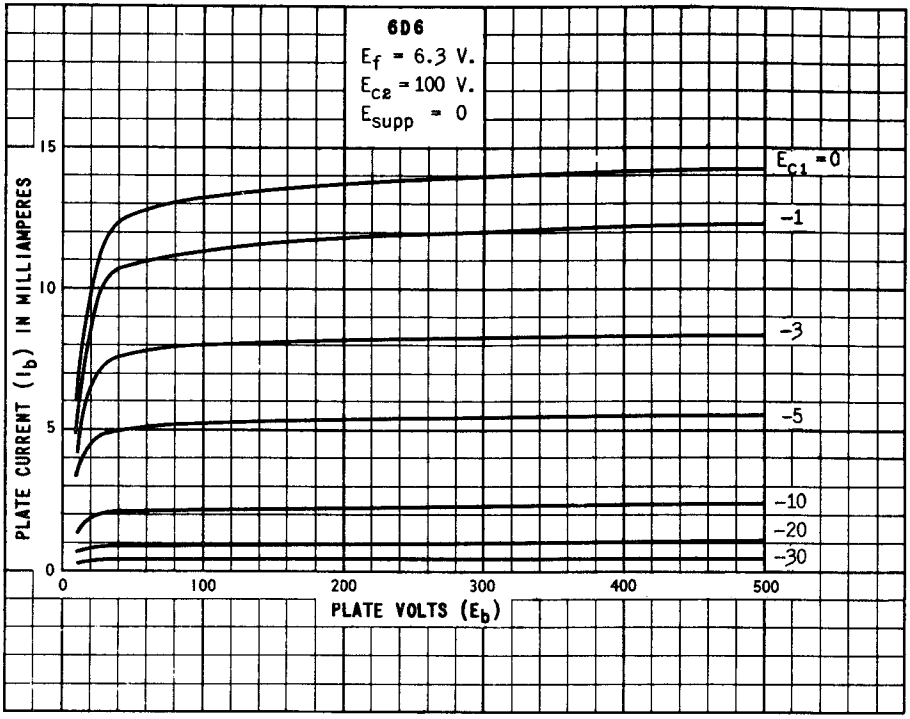

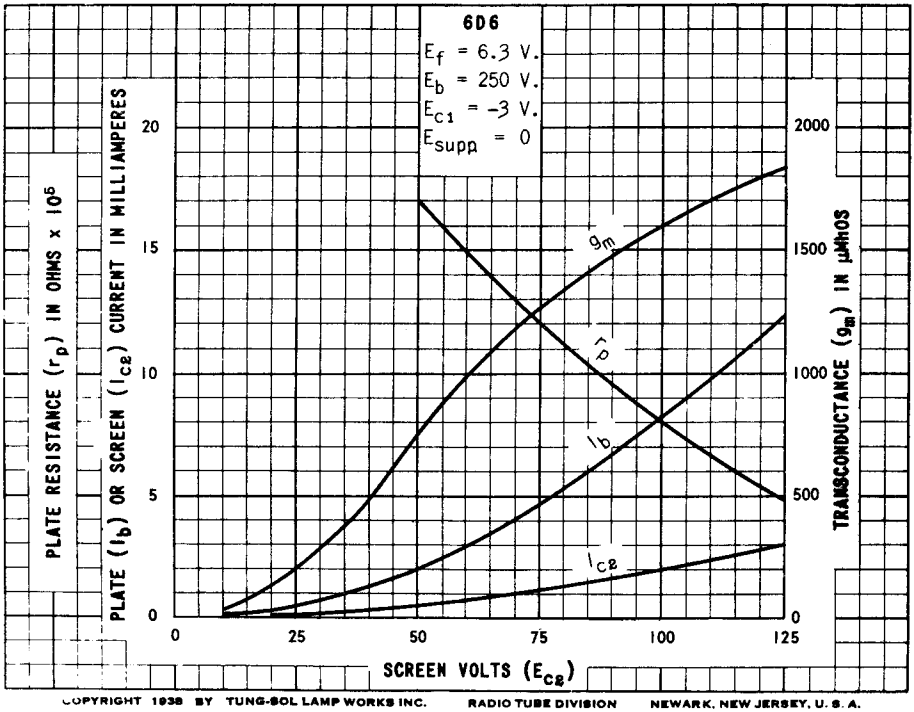

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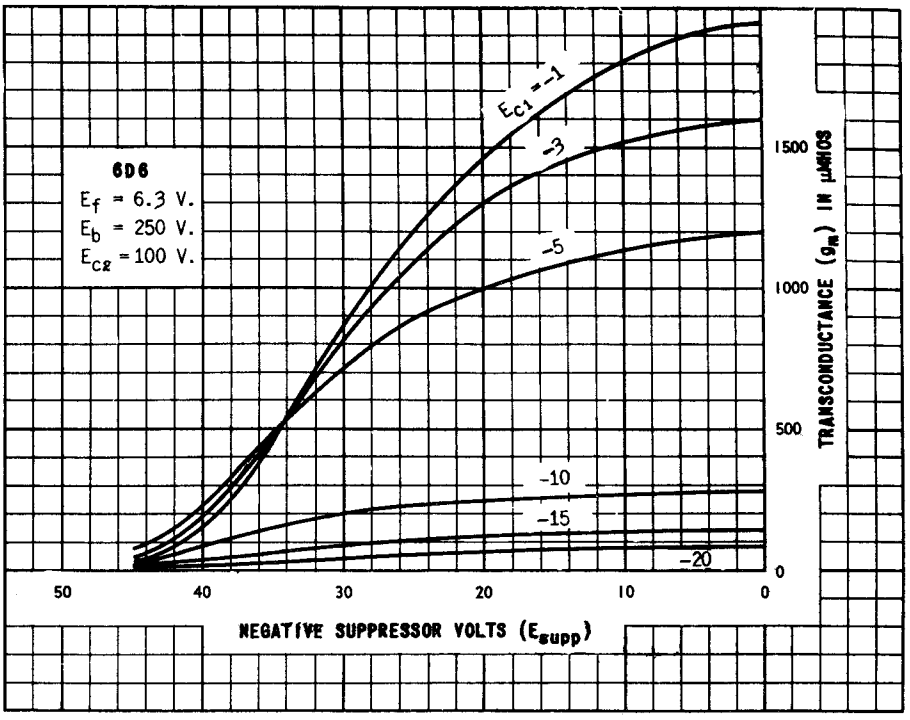
6D6



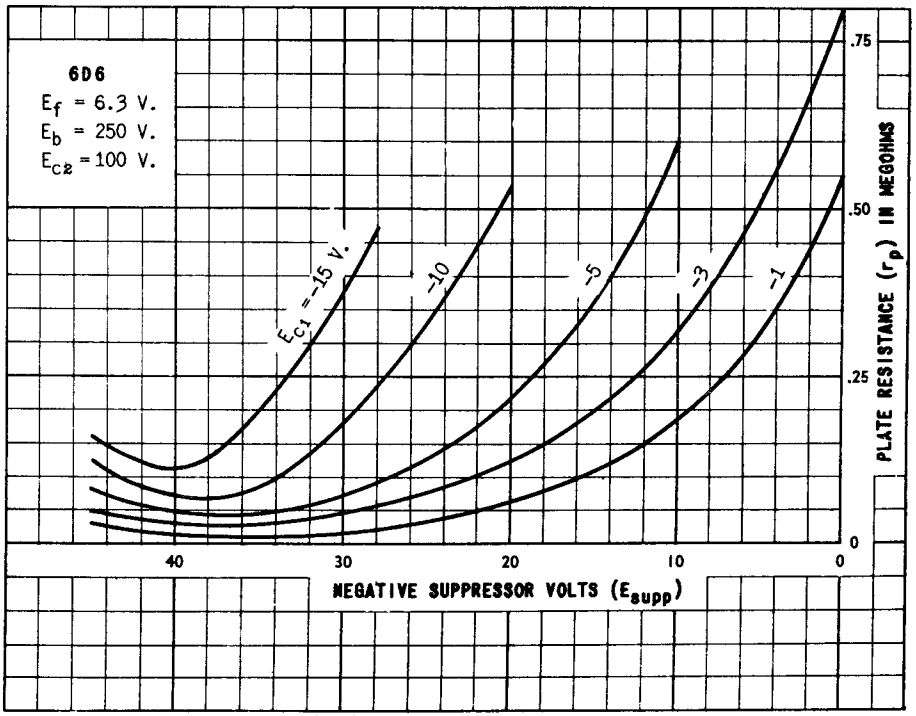


PLATE
249-1

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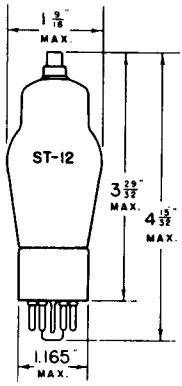
TUNG-SOL

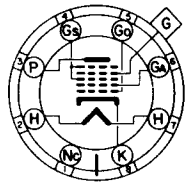


PENTAGRID CONVERTER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



G-8A
BOTTOM VIEW

SMALL 8 PIN OCTAL BASE

THE TUNG-SOL 6D8G IS A PENTAGRID CONVERTER DESIGNED FOR SERVICE AS AN OSCILLATOR AND MIXER IN SUPERHETERODYNE CIRCUITS. IT IS RECOMMENDED FOR USE WHERE ECONOMY OF HEATER CURRENT IS IMPORTANT.

RATINGS

MAXIMUM PLATE (P) VOLTAGE	300	VOLTS
MAXIMUM SCREEN (G_S) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM OSCILLATOR ANODE VOLTAGE	200	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	13	MA.
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM OSCILLATOR ANODE DISSIPATION	0.75	WATT

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FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

PLATE
920-2

DEC. 30
1940

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DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID (G) TO MIXER PLATE (P)	0.20	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)	0.20	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_0)	0.16	μμf
OSCILLATOR GRID (G_0) TO OSCILLATOR ANODE (G_A)	1.1	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	8.0	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_0) TO ALL ELECTRODES EXCEPT OSCILLATOR ANODE (G_A)	5.5	μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES EXCEPT OSCILLATOR GRID (G_0)	4.6	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	11	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

PLATE (P) VOLTAGE	135	250	VOLTS
SCREEN (G_S) VOLTAGE	67.5	100	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	-3	-3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE[A]	–	250	VOLTS
OSCILLATOR ANODE VOLTAGE	135	–	VOLTS
OSCILLATOR GRID (G_0) RESISTOR	50000	50000	OHMS
PLATE CURRENT	1.5	3.5	MA.
SCREEN CURRENT	1.7	2.6	MA.
OSCILLATOR ANODE CURRENT	3.0	4.3	MA.
OSCILLATOR GRID CURRENT	0.2	0.4	MA.
TOTAL CATHODE CURRENT	6.4	10.8	MA.
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -2 V.	450	–	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -3 V.	325	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -6 V.	75	275	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -10 V.	35	100	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -25 V.	5	–	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -35 V.	–	6	μMHOS

[A] APPLIED THROUGH A 20 000 OHM DROPPING RESISTOR
[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PLATE 921-2

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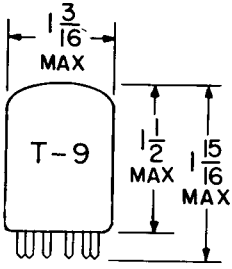
TUNG-SOL

TRIPLE TRIODE



GLASS BULB
9-62

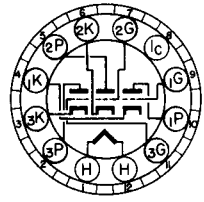
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BUTTON
12 PIN BASE
12BQ

THE 6D10 IS A COMPACTRON, CONTAINING THREE HIGH-MU TRIODES WITH SEPARATE PIN CONNECTIONS FOR ALL THREE CATHODES, GRIDS, AND PLATES IN A COMPACT T-9 GLASS ENVELOPE. IT IS ESPECIALLY DESIGNED FOR USE AS AN OSCILLATOR-MIXER, GROUNDED-GRID AMPLIFIER, AND AUTOMATIC FREQUENCY CONTROL SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (EACH SECTION)	1.5	pf
INPUT (EACH SECTION)	2.2	pf
OUTPUT (EACH SECTION)	0.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE	2.0	WATTS
MAXIMUM TOTAL PLATE DISSIPATION, ALL PLATES	6.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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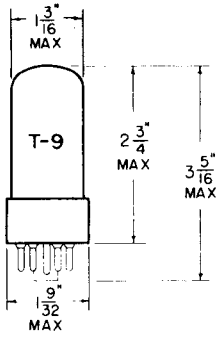
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS – EACH SECTION

PLATE VOLTAGE	125	VOLTS
GRID VOLTAGE	−1.0	VOLTS
AMPLIFICATION FACTOR	57	
PLATE RESISTANCE (APPROX.)	13 600	OHMS
TRANSCONDUCTANCE	4 200	μMHOS
PLATE CURRENT	4.2	MA.
GRID VOLTAGE (APPROX.)		
Ib = 20 μAMPERES	−4	VOLTS

TUNG-SOL

DIODE

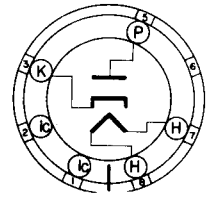


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
8 PIN OCTAL
4CG

THE 6DA4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 1200 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

HEATER TO CATHODE	3.0	μμf
PLATE TO CATHODE & HEATER[A]	6.0	μμf
CATHODE TO PLATE & HEATER[A]	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM - UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2 ←	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK	4 400	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A] TIE UNUSED PINS AND METAL PART TO HEATER.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

→ INDICATES A CHANGE.

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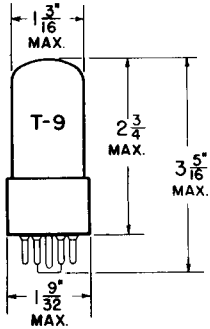
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DIODE



GLASS BULB

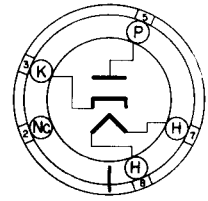
UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 1.2 AMP.

ANY MOUNTING POSITION

[A] SOCKET PINS 1, 2, 4 & 6 MUST NOT BE USED AS TIE POINTS.



BOTTOM VIEW[A]

SHORT INTERMEDIATE SHELL
5 PIN OCTAL
WITH BARRIERS
4CG

THE 6DA4A IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

HEATER TO CATHODE: H TO K	3.0	μμf
CATHODE TO PLATE AND HEATER: K TO (P+ H)	9.0	μμf
PLATE TO CATHODE AND HEATER: P TO (K +H)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE[C]	6.3±0.6	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	8.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE[D]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	1000	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3±0.6	VOLTS
HEATER CURRENT	1.2	AMP.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT --340 MA.)	30	VOLTS

[B]

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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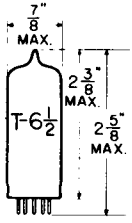
[C] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER CURRENT IS AT THE SPECIFIED BOGIE VALUE. HEATER SUPPLY VARIATIONS SHOULD BE RESTRICTED SO THAT THE HEATER CURRENT WILL BE MAINTAINED WITHIN THE SPECIFIED TOLERANCE.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF G OD ENGINEERING PRACTICE FOR TELEVISION BROAD AST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TUNG-SOL

DOUBLE TRIODE

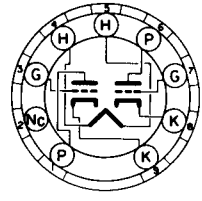
MINIATURE TYPE



COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.0 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9EF

THE 6DA7 IS A MINIATURE 9-PIN DOUBLE TRIODE WITH DISSIMILAR SECTIONS. ONE IS A MEDIUM-MU TRIODE INTENDED FOR VERTICAL OSCILLATOR SERVICE; THE OTHER IS A LOW-MU TRIODE WITH HIGH PLATE DISSIPATION FOR VERTICAL AMPLIFIER SERVICE. THE 6DA7, THEREFORE, COMBINES THE FUNCTION OF OSCILLATOR AND HIGH CURRENT OUTPUT AMPLIFIER FOR VERTICAL SWEEP OF LARGE 90° PICTURE TUBES.

DIRECT INTERELECTRODE CAPACITANCES

	SECTION #1	SECTION #2	
GRID TO PLATE: G_1 TO P	2.3	6.9	μμf
INPUT: G_1 TO K+H	2.0	5.5	μμf
OUTPUT: P TO K+H	0.415	0.82	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE		6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	500	VOLTS
MAXIMUM PLATE VOLTAGE, PEAK POSITIVE PULSE*		1800	VOLTS
MAXIMUM CONTROL-GRID VOLTAGE, PEAK NEGATIVE PULSE*	-400	-400	VOLTS
MAXIMUM CONTROL-GRID VOLTAGE, NEG., DC	-50	-50	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	6.0	WATTS
MAXIMUM CATHODE CURRENT	20	40	MA.
MAXIMUM CONTROL-GRID CIRCUIT RESISTANCE SELF BIAS		2.2	MEGOHMS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[B]		200	VOLTS
HEATER WARM-UP TIME (APPROX.)[A]		11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	SECTION #1	SECTION #2	
HEATER VOLTAGE		6.3	VOLTS
HEATER CURRENT		1.0	VOLTS
PLATE VOLTAGE	250	150	VOLTS
CONTROL-GRID VOLTAGE	-8	-17.5	VOLTS
PLATE RESISTANCE (APPROX.)	7700	1100	OHMS
TRANSCONDUCTANCE	2600	5700	μMHOS
AMPLIFICATION FACTOR	20	6.3	
PLATE CURRENT	9.0	40	MA.
CONTROL-GRID VOLTAGE (APPROX.) FOR Ib = 0.5 MA.		-42	VOLTS
CONTROL-GRID VOLTAGE (APPROX.) FOR gm = 30 μMHOS AND Ib = 50 μA	-16.5		VOLTS
ZERO BIAS PLATE CURRENT FOR Eb = 60 VOLTS		80	MA.

SIMILAR TYPE REFERENCE: *Except for heater ratings, and heater warm-up time, the 6AD7 is identical to the 10AD7.*

*FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B DC COMPONENT MUST NOT EXCEED 100 VOLTS MAX.

TUNG-SOL

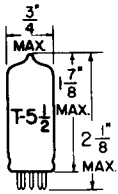
PENTODE

MINIATURE TYPE

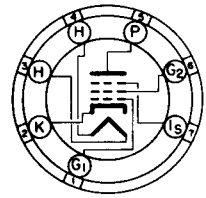
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6DC6 IS A SEMI-REMOTE CUTOFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE PARTICULARLY IN THE GAIN CONTROLLED PICTURE IF STAGES OF COLOR TELEVISION RECEIVERS. IT IS ALSO USEFUL AS A RADIO-FREQUENCY AMPLIFIER IN THE TUNERS OF SUCH RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.02	μμf
INPUT	6.5	μμf
OUTPUT	2	μμf

RATINGS
INTERPRETED ACCORDING TO RETMA STANDARD M6-210

CLASS A_1 AMPLIFIER - DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE CURVE #1	
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM GRID #2 INPUT	0.5	WATT
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.25	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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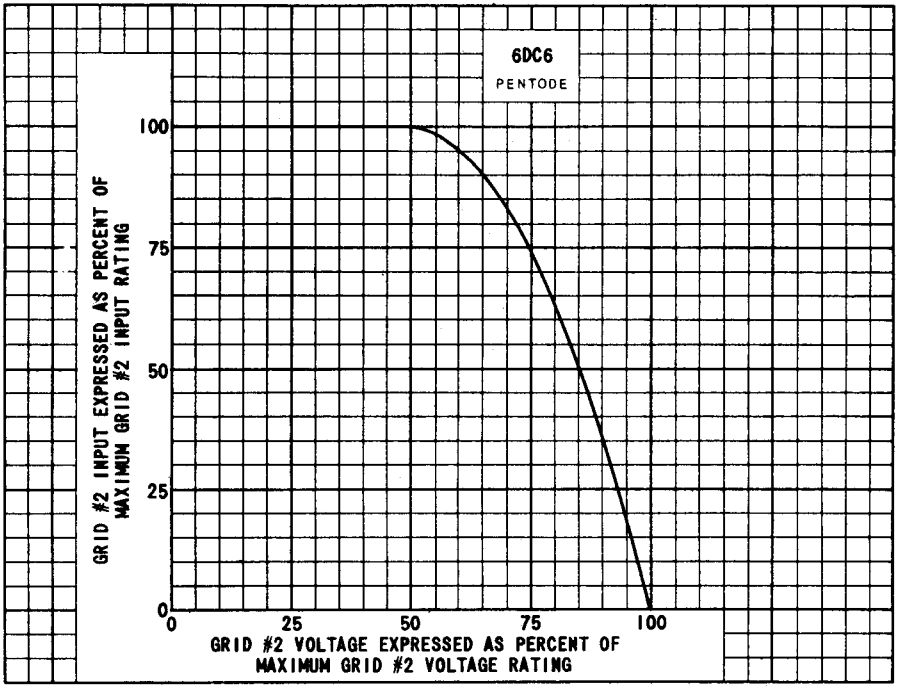
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

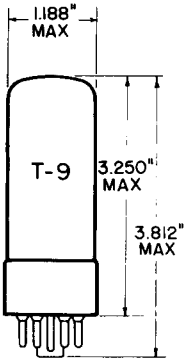
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	180	OHMS
PLATE RESISTANCE (APPROX.)	0.5	MEGOHM
TRANSCONDUCTANCE	5 500	μMHOS
GRID #1 BIAS (APPROX.) FOR TRANSCONDUCTANCE OF 50 μMHOS	-12.5	VOLTS
PLATE CURRENT	9	MA.
GRID #2 CURRENT	3	MA.



TUNG-SOL

HALF-WAVE VACUUM RECTIFIER



GLASS BULB
JEDEC GROUP 1 B5-85
SHORT
INTERMEDIATE-SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS

PINS 1, 4, & 6 ARE OMITTED

OUTLINE DRAWING
JEDEC 9-44

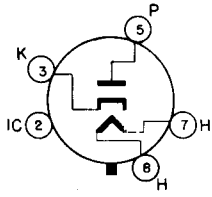
UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 1.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 6DE4 IS A HALF-WAVE VACUUM RECTIFIER OF THE GLASS-OCTAL TYPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS.

EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6DE4 IS IDENTICAL TO THE 17DE4 AND 22DE4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	μμf
CATHODE TO HEATER AND PLATE	11.5	μμf
HEATER TO CATHODE	4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	→ 5500[A]	VOLTS
MAXIMUM PEAK PLATE CURRENT	1100	MA.
MAXIMUM DC PLATE CURRENT	→ 180	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	→ 5500[B]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	300[C]	VOLTS

→ INDICATES A CHANGE.

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TUNG-SOL

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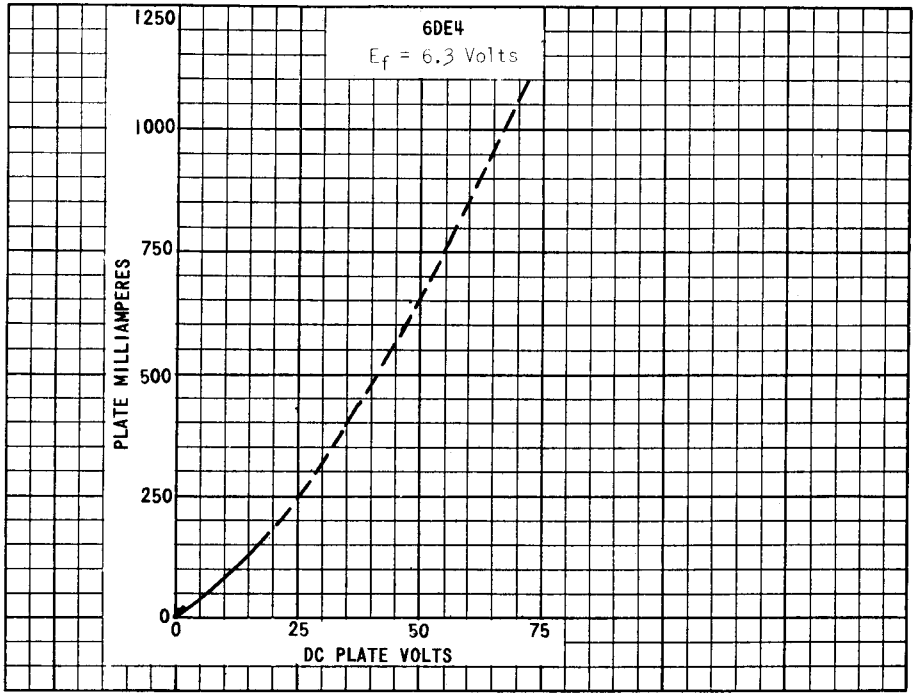
NOTES

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

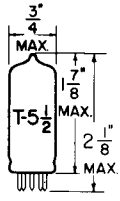
[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.



TUNG-SOL

PENTODE

MINIATURE TYPE

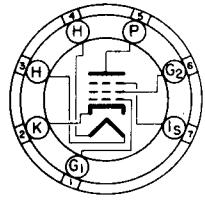


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 6DE6 IS A SHARP-CUTOFF PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN 40 MAGACYCLE GAIN-CONTROLLED VIDEO IF STAGES.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) (MAX.)	.015	.025	μμf
INPUT: G_1 TO (H+K+G_2+G_3+i.s.)	6.5	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3+i.s.)	3.0	2.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS[B] ←

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE CURVE
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS

[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

→ INDICATES A CHANGE.

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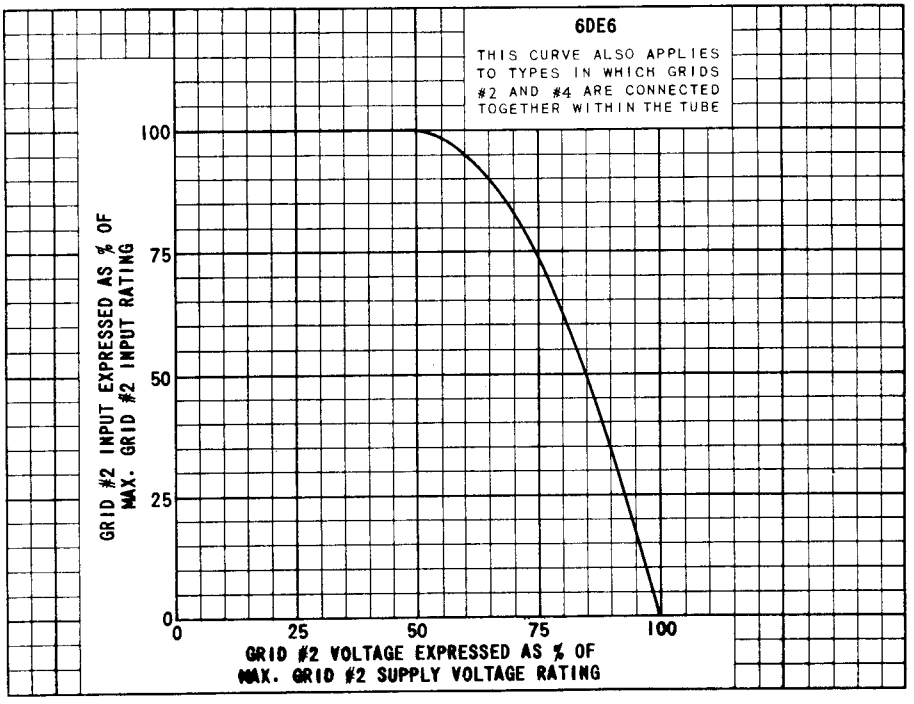
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS ←

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #3 VOLTAGE	PIN 7 CONNECTED TO PIN 2 AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 20 μA	-9	VOLTS
TRANSCONDUCTANCE (Ec1 = - 5.5V., Rk = 0)	700	μMHOS
PLATE CURRENT	15.5	MA.
GRID #2 CURRENT	4.2	MA.

→ INDICATES A CHANGE.



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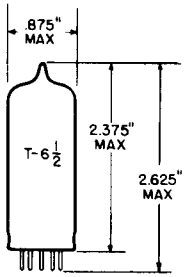
DOUBLE TRIODE

MINIATURE TYPE

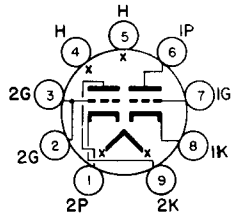


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.90 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9HF

THE 6DE7 IS A MINIATURE DOUBLE TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR HAVING MEDIUM MU AND SECTION #2 IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER WITH LOW MU. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 6DE7 IS IDENTICAL TO THE 10DE7 AND 13DE7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.0	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.52	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM ←

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
MAXIMUM HEATER-CATHODE VOLTAGE[B]			VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS

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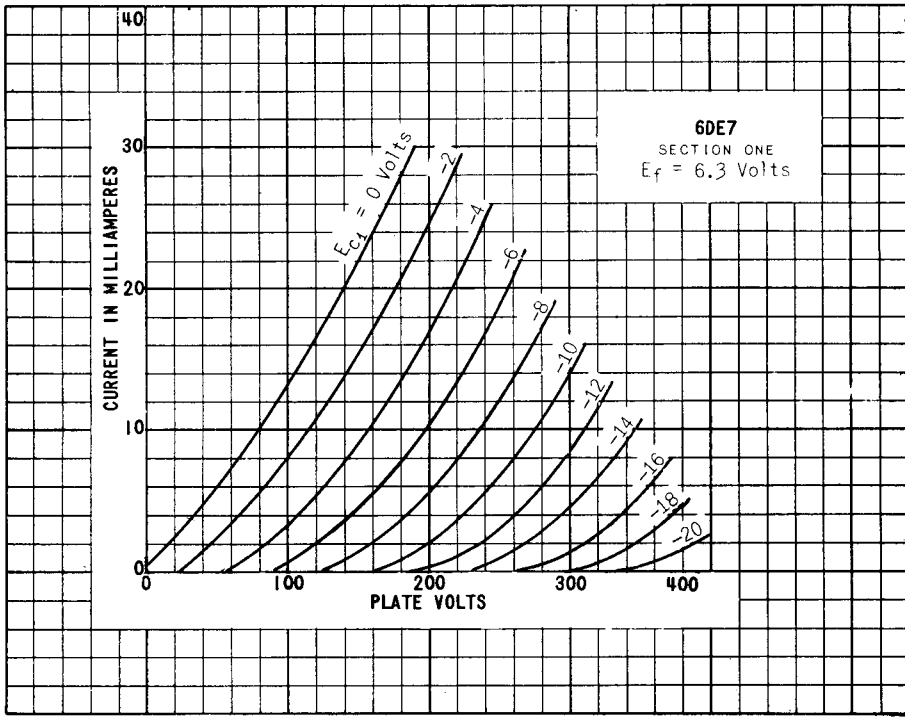
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

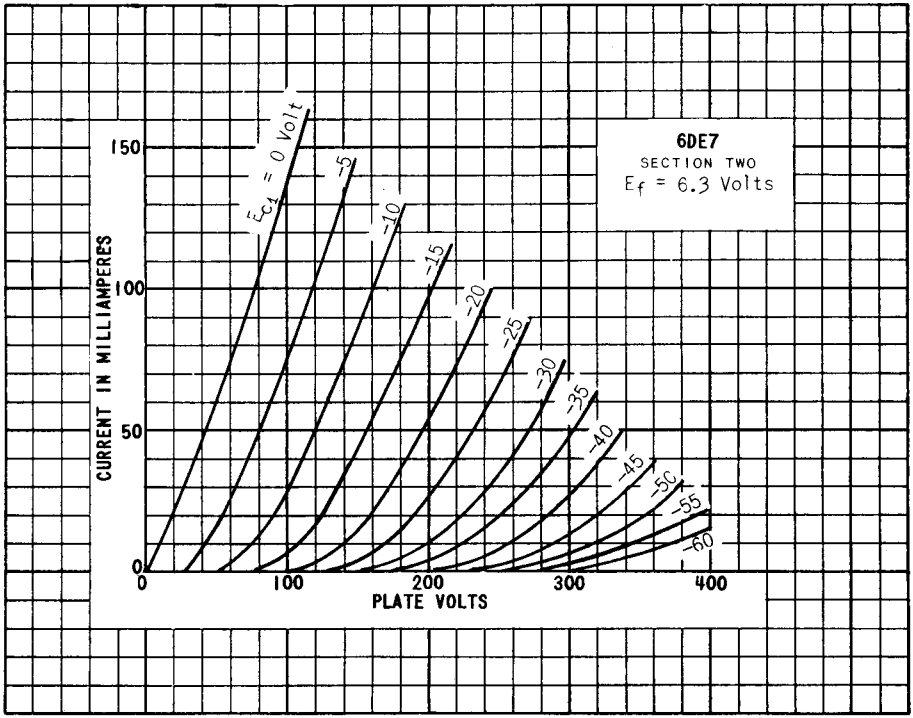
	TRIODE #1	TRIODE #2	
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	35	MA.
TRANSCONDUCTANCE	2000	6500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	925	
GRID VOLTAGE FOR Ib = 10 μA	-20	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES))	---	80	MA.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.


6DE7
SECTION ONE
Ef = 6.3 Volts
CURRENT IN MILLIAMPERES
PLATE VOLTS
Ec1 = 0 Volts
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
100
200
300
400


6DE7
SECTION TWO
Ef = 6.3 Volts
CURRENT IN MILLIAMPERES
PLATE VOLTS
Ec1 = 0 Volt
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
0
50
100
150
100
200
300
400

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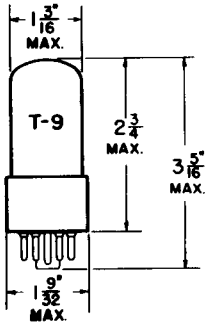
BEAM PENTODE

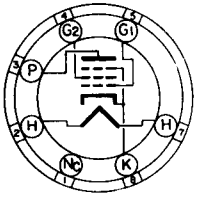


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
OR
6 PIN OCTAL
PIN #1 NO CONNECTION
OR OMITTED

7S

THE 6DG6GT IS A HEATER-CATHODE TYPE BEAM PENTODE POWER AMPLIFIER DESIGNED PRIMARILY FOR USE AS AN OUTPUT TUBE IN AUDIO APPLICATIONS.

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE-BIAS	0.5	MEGOHM
FIXED-BIAS	0.1	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		1.2		AMP.
PLATE VOLTAGE	110		200	VOLTS
GRID #2 VOLTAGE	110		125	VOLTS
GRID #1 VOLTAGE	-7.5		0	VOLTS
CATHODE BIAS RESISTOR	0		180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5		8.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	49		46	MA.
MAX.-SIGNAL PLATE CURRENT	50		47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4		2.2	MA.
MAX.-SIGNAL GRID #2 CURRENT	10		8.5	MA.
PLATE RESISTANCE (APPROX.)	13 000		28 000	OHMS
TRANSCONDUCTANCE	8 000		8 000	μMHOS
LOAD RESISTANCE	2 000		4 000	OHMS
TOTAL HARMONIC DISTORTION	10		10	PERCENT
MAX.-SIGNAL POWER OUTPUT	2.1		3.8	WATTS

SIMILAR TYPE REFERENCE: 6DG6G.

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TUNG-SOL

PENTODE

MINIATURE TYPE

SHARP-CUTOFF PENTODE

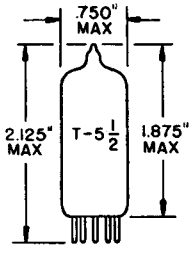
FOR

USE AS AN IF AMPLIFIER

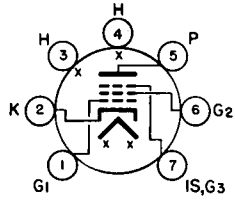
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6DK6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER AND IS PARTICULARLY SUITABLE FOR USE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6DK6 IS IDENTICAL TO THE 3DK6 AND THE 4DK6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	MAX.	0.025	pf
INPUT		6.3	pf
OUTPUT		1.9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS *	6.3	VOLTS	300	MA.
LIMITS OF APPLIED VOLTAGE			6.3 ± 0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

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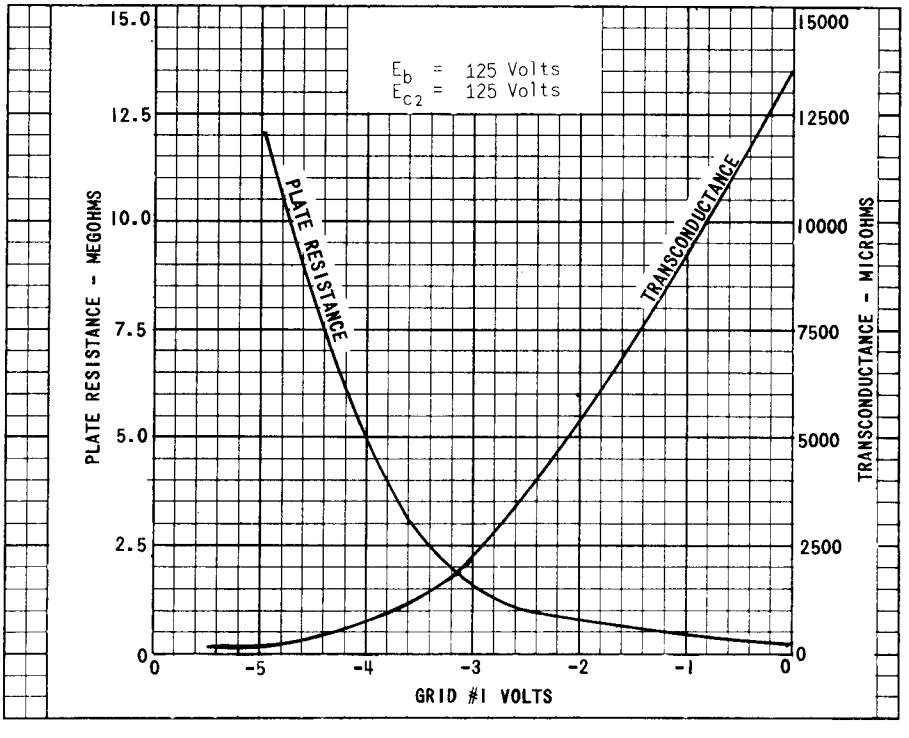
MAXIMUM RATINGS

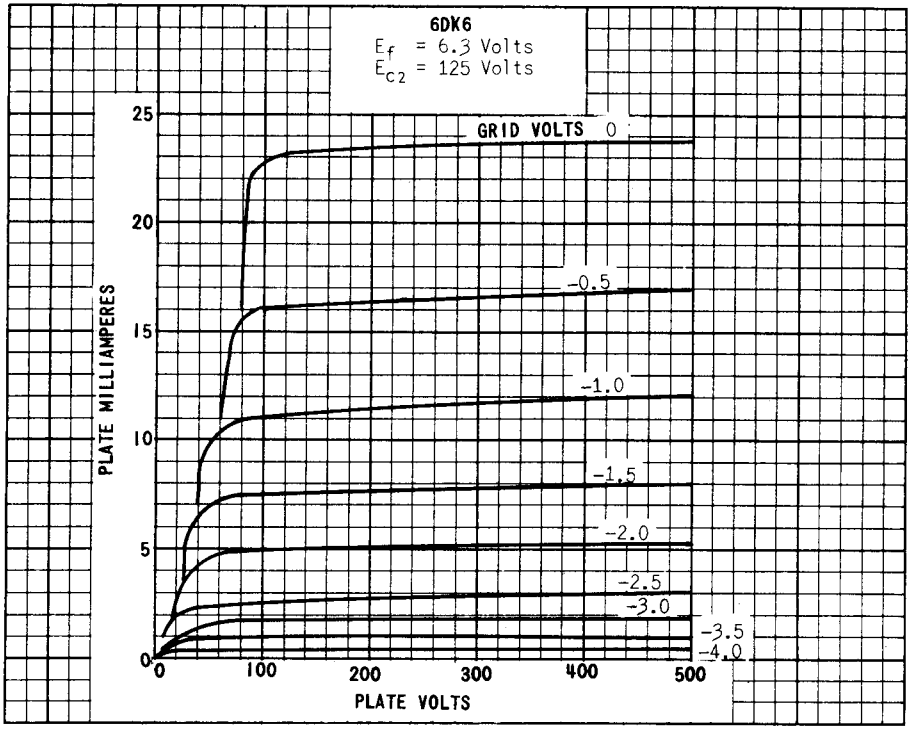
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

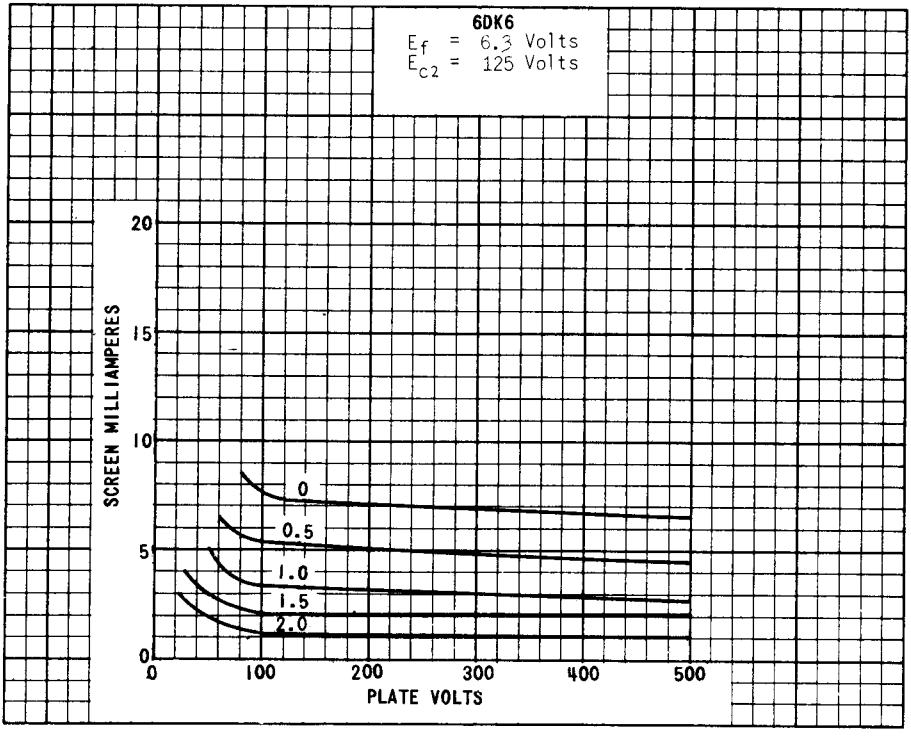
PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
PLATE DISSIPATION	2.3	WATTS
GRID 2 DISSIPATION	0.55	WATTS
GRID 1 VOLTAGE - POSITIVE VALUE	0	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE		125	VOLTS
GRID 3 (SUPPRESSOR)	Connected To Cathode At Socket		
GRID 2 VOLTAGE		125	VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT		12.0	MA.
GRID 2 CURRENT		3.8	MA.
TRANSCONDUCTANCE		9 800	μMHOS
PLATE RESISTANCE	APPROX.	0.35	MEGOHMS
GRID 1 VOLTAGE FOR Ib = 20 μA		-6.5	VOLTS







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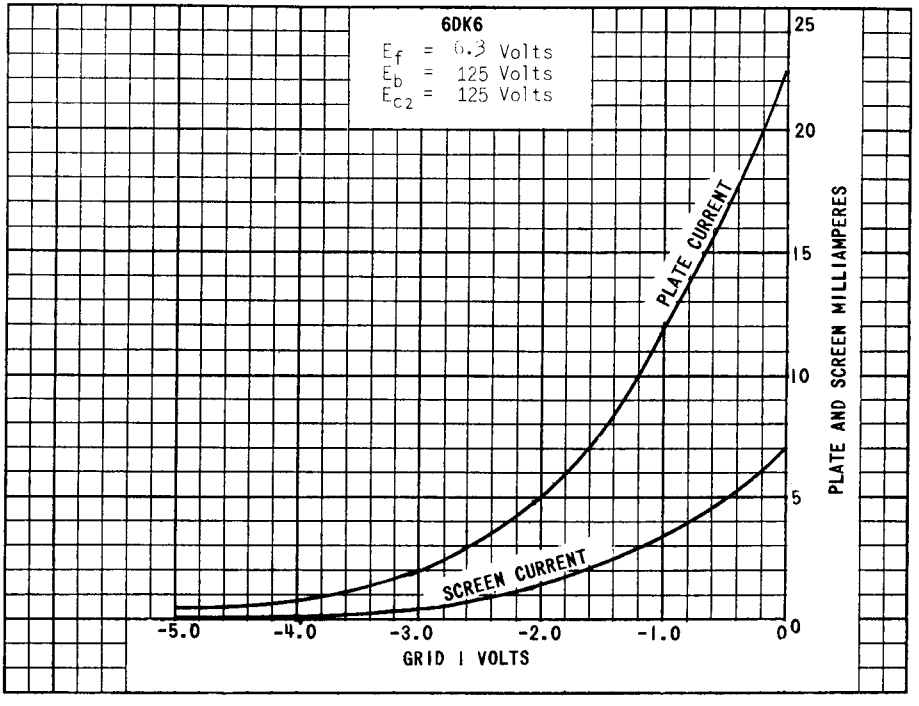
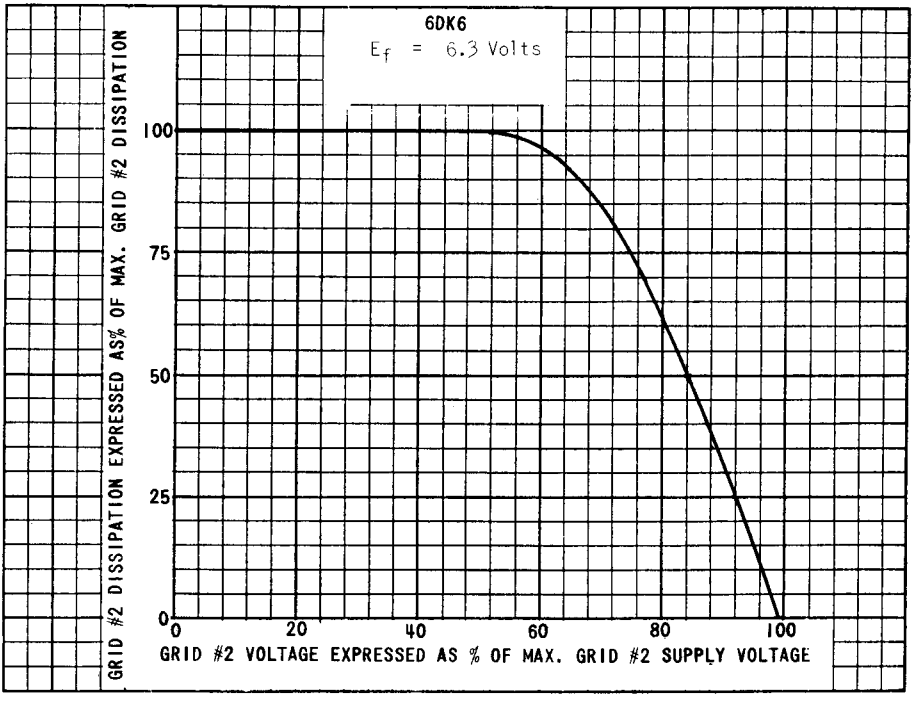

6DK6
E_f = 6.3 Volts
E_b = 125 Volts
E_{c2} = 125 Volts
PLATE CURRENT
SCREEN CURRENT
PLATE AND SCREEN MILLIAMPERES
25
20
15
10
5
0
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID 1 VOLTS


6DK6
E_f = 6.3 Volts
GRID #2 DISSIPATION EXPRESSED AS% OF MAX. GRID #2 DISSIPATION
100
75
50
25
0
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

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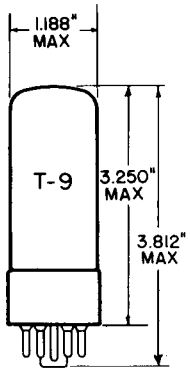
DIODE



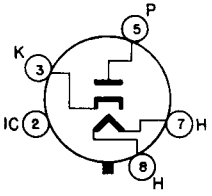
GLASS BULB
SHORT INTERMEDIATE SHELL
5 PIN OCTAL WITH
EXTERNAL BARRIERS
B5 - B5
OUTLINE DRAWING
JEDEC 9-44

UNIPOTENTIAL CATHODE

FOR DAMPER SERVICE IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 4CG

THE 6DM4 IS A HALF-WAVE VACUUM RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 6DM4 IS IDENTICAL TO THE 12DM4 AND THE 17DM4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	pf
CATHODE TO HEATER AND PLATE	11.5	pf
HEATER TO CATHODE	4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		5000[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		300[B]	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIUM VALUES - SEE EIA STANDARD RS-239

DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000[D]	VOLTS
PEAK PLATE CURRENT	1100	MA.
DC PLATE CURRENT	175	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

TUBE VOLTAGE DROP FOR PLATE CURRENT OF 400 MA. APPROXIMATE	35	VOLTS

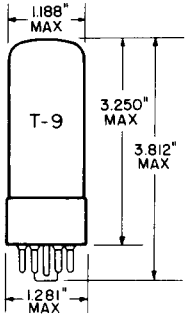
[A] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE. (15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.)

TUNG-SOL

DIODE



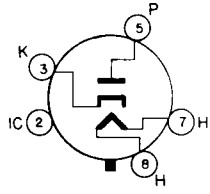
GLASS BULB

SHORT INTERMEDIATE SHELL
5 PIN OCTAL BASE B5-85
OUTLINE DRAWING
JEDEC 9-44

FOR DAMPER SERVICE IN
TELEVISION RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

SOCKET TERMINALS 1,2,4 & 6,
SHOULD NOT BE USED AS
TIE POINTS.

THE 6DM4A IS AN INDIRECTLY-HEATED HALF-WAVE RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6DM4A IS IDENTICAL TO THE 12DM4A AND THE 17DM4A.

ALSO, THE 6DM4A IS IDENTICAL TO THE 6DM4 EXCEPT FOR HIGHER PLATE CURRENT RATINGS.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE	4	pf
PLATE TO CATHODE	8.5	pf
CATHODE TO PLATE AND HEATER	11.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	
TOTAL DC AND PEAK			300	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

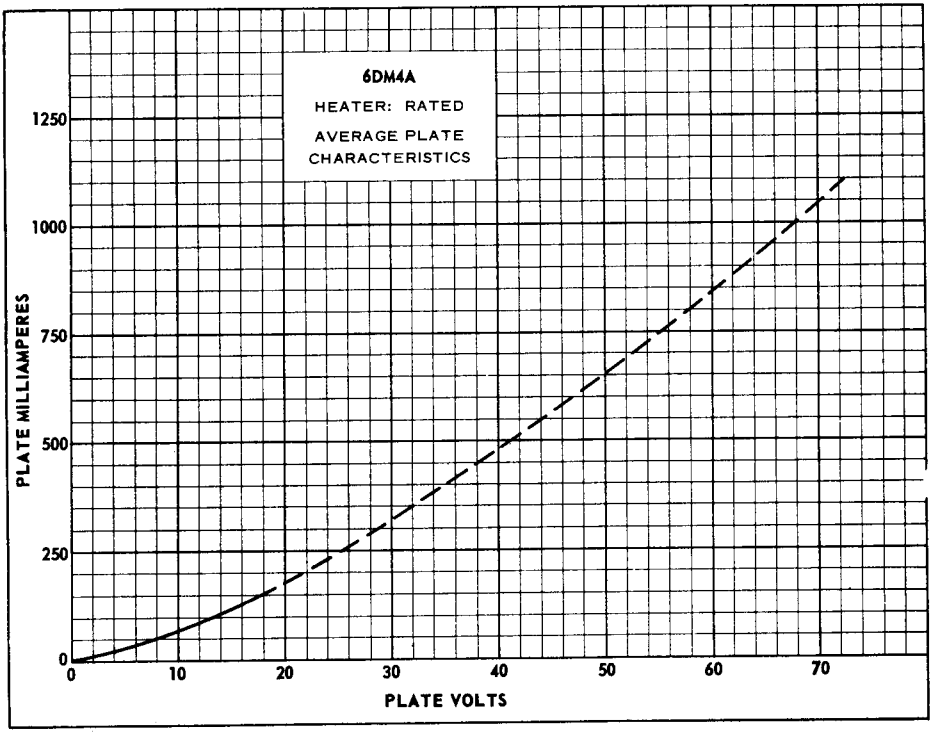
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	DAMPER SERVICE[B]	
PEAK INVERSE VOLTAGE	5000	VOLTS
PEAK PLATE CURRENT	1200	MA.
DC PLATE CURRENT	200	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

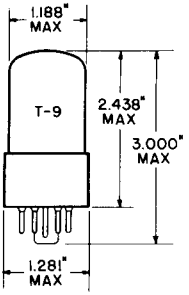
VOLTAGE DROP AT Ib = 400 MA.	35	VOLTS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.



TUNG-SOL

→ DOUBLE TRIODE



GLASS BULB
INTERMEDIATE-SHELL
8 PIN OCTAL B8-142
OUTLINE DRAWING
JEDEC 9-5

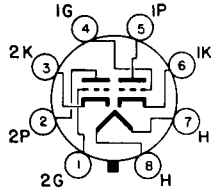
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.9 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BD

THE 6DN7 IS A DOUBLE TRIODE WITH DISSIMILAR SECTIONS. SECTION #1 IS DESIGNED FOR USE AS A VERTICAL-DEFLECTION OSCILLATOR IN TELEVISION RECEIVERS AND SECTION #2 FOR USE AS A VERTICAL DEFLECTION AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

	SEC. #1	SEC. #2	
GRID TO PLATE	4.0	5.5	pf
INPUT	2.2	4.6	pf
OUTPUT	0.7	1.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

	VERT. OSC. SERV. (SEC.1)	VERT. DEFL. AMP. (SEC.2)	
MAXIMUM DC PLATE VOLTAGE	350	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	2500	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	10^B	WATTS
MAXIMUM DC CATHODE CURRENT	---	50	MA.
MAXIMUM PEAK CATHODE CURRENT	---	150	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE			
WITH FIXED BIAS	2.2	2.2	MEGOHMS
WITH CATHODE BIAS	2.2	---	MEGOHMS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
PLATE VOLTAGE	250	150	250	VOLTS
GRID VOLTAGE	-8.0	0[C]	-9.5	VOLTS
AMPLIFICATION FACTOR	22.5	---	15.4	
PLATE RESISTANCE (APPROX.)	9000	---	2000	OHMS
TRANSCONDUCTANCE	2500	---	7700	μMHOS
PLATE CURRENT	8.0	68	41	MA.
GRID VOLTAGE (APPROX.) I_b = 10 μAMPS.	-18	---	---	VOLTS
GRID VOLTAGE (APPROX.) I_b = 50 μAMPS.	---	---	-23	VOLTS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE CUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

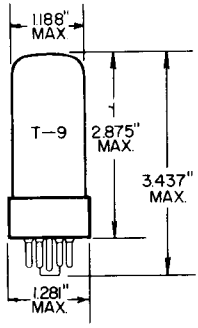
[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DIODE



GLASS BULB
SHORT INTERMEDIATE SHELL
5 PIN OCTAL 85-85
OUTLINE DRAWING
JEDEC 9-43

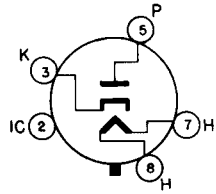
FOR

HORIZONTAL FREQUENCY DAMPER

SERVICE IN T.V. RECEIVERS

ANY MOUNTING POSITION

SOCKET TERMINALS, NUMBERS 1, 2, 4 & 6
SHALL NOT BE USED AS TIE POINTS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 6DQ4 IS A HEATER-CATHODE TYPE DIODE DESIGNED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE IN TELEVISION RECEIVERS. IN OPERATION, THE TUBE CAN WITHSTAND HIGH VOLTAGE PULSES OF HORIZONTAL LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS, SUCH AS NORMALLY ENCOUNTERED IN "DIRECT-DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

HEATER TO CATHODE	4.0	pf
PLATE TO CATHODE AND HEATER	5.0	pf
CATHODE TO PLATE AND HEATER	8.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT		900	VOLTS
TOTAL DC AND PEAK		5500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

FOR TV DAMPER SERVICE [A,B]

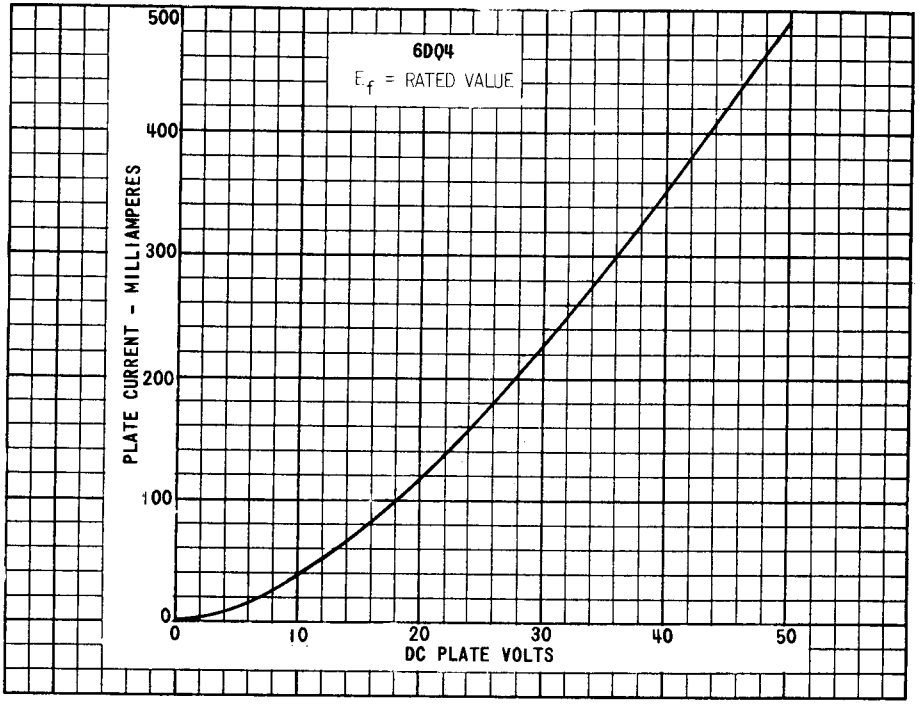
PEAK INVERSE PLATE VOLTAGE	5500	VOLTS
STEADY STATE PEAK PLATE CURRENT	1000	MA.
DC OUTPUT CURRENT	175	MA.
PLATE DISSIPATION	6.0	WATTS

CHARACTERISTICS

TUBE VOLTAGE DROP (TUBE CONDUCTING AT 250 MA.) SEE CHART	32	VOLTS

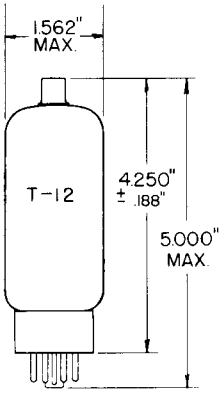
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND ITS DURATION IS LIMITED TO 10 MICRO SECONDS.

[B] OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.



TUNG-SOL

BEAM POWER PENTODE

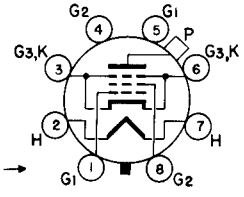


GLASS BULB
SMALL CAP
SMALL MEDIUM-SHELL
8 PIN OCTAL 88-118
WITH EXTERNAL BARRIERS
STYLE 8
OUTLINE DRAWING
JEDEC 12-22

UNIPOTENTIAL CATHODE

HEATER
6.3±0.6 VOLTS 2.5 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8JC

THE 6DQ5 IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN COLOR TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
GRID #1 TO: (K+G_3+H & G_2)	23	μμf
PLATE TO: (K+G_3+H & G_2)	11	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER

MAXIMUM PLATE VOLTAGE:		
DC (INCLUDING BOOST)	990	VOLTS
PEAK POSITIVE-PULSE (ABS. MAX.)[B]	6 500[C]	VOLTS
PEAK NEGATIVE-PULSE[B]	1 100	VOLTS
MAXIMUM DC GRID #2 (SCREEN-GRID) VOLTAGE	190	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 (CONTROL-GRID) VOLTAGE	250	VOLTS
MAXIMUM CATHODE CURRENT:		
DC	315	MA.
PEAK	1 100	MA.
MAXIMUM GRID #2 INPUT	3.2	WATTS
MAXIMUM PLATE DISSIPATION[D]	24	WATTS

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→ INDICATES A CHANGE.

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TUNG-SOL

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RATINGS — CONT'D.[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[E]	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR GRID RESISTOR-BIAS OPERATION[D]	0.47	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	125	70	175	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	125	125	125	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-25	0	-25	VOLTS
MU-FACTOR, GRID #2 TO GRID #1	3.3	---	---	
PLATE RESISTANCE (APPROX.)	---	---	5 500	OHMS
TRANSCONDUCTANCE	---	---	10 500	μMHOS
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 1 MA.	---	---	-55	VOLTS
PLATE CURRENT	---	560[F]	110	MA.
GRID #2 CURRENT	---	42[F]	5	MA.

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

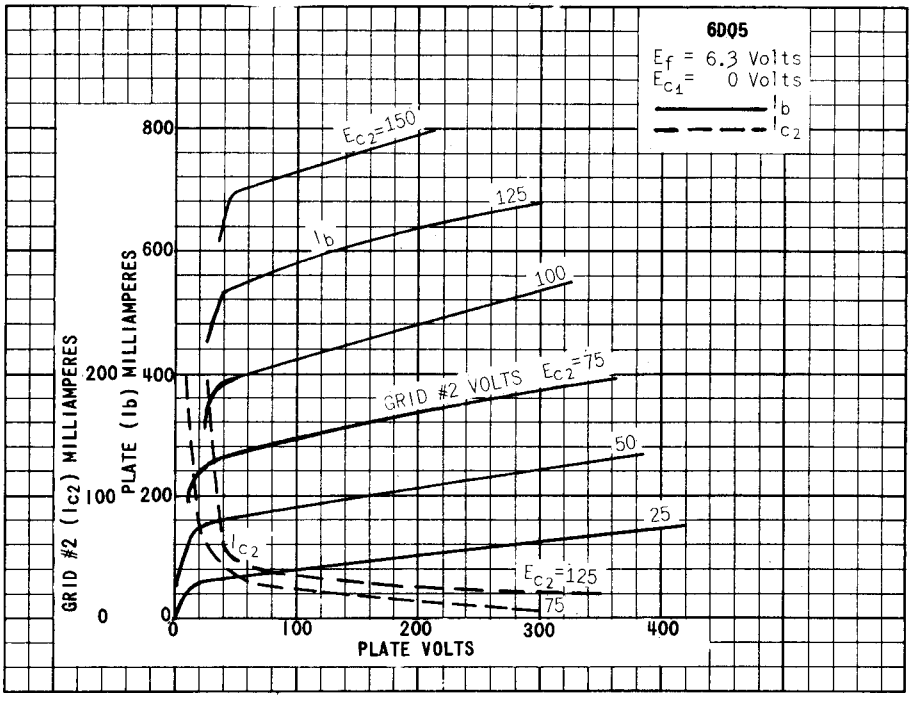
[B] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE IS 10 μSECONDS.

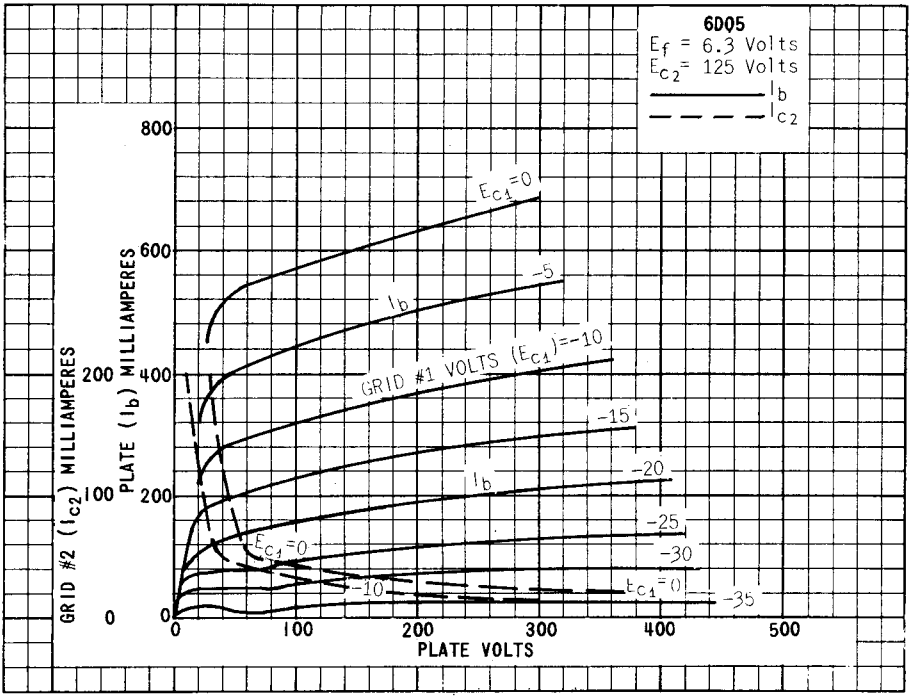
[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

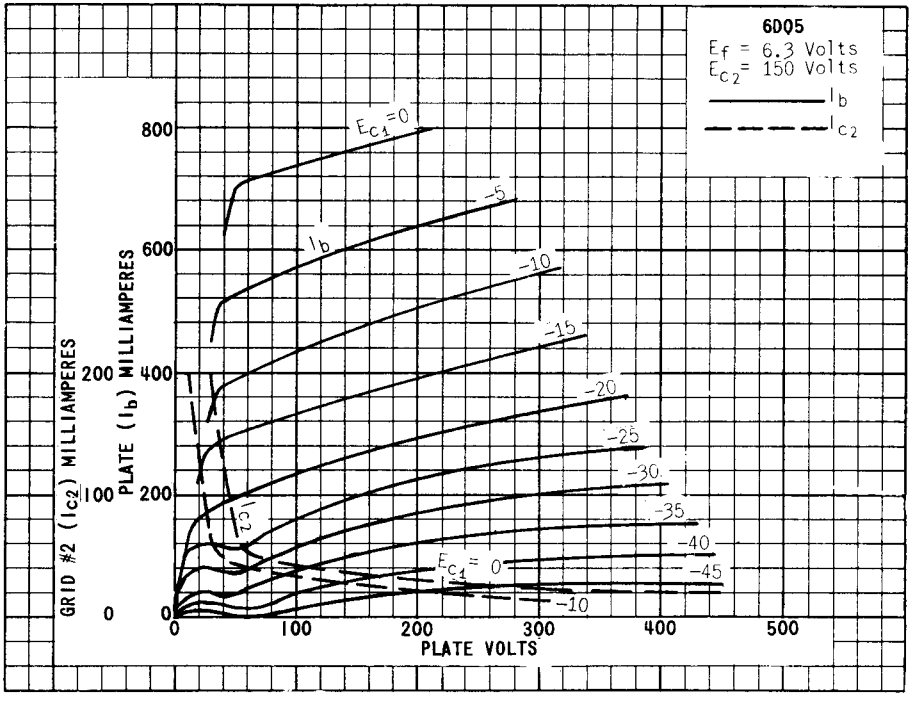
[D] IT IS ESSENTIAL THAT THE PLATE DISSIPATION BE LIMITED IN THE EVENT OF LOSS OF GRID SIGNAL. FOR THIS PURPOSE, SOME PROTECTIVE MEANS SUCH AS A CATHODE RESISTOR OF SUITABLE VALUE SHOULD BE EMPLOYED.

[E] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[F] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

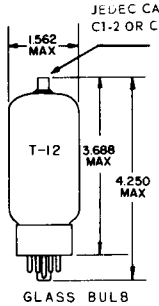

6DQ5
Ef = 6.3 Volts
Ec1 = 0 Volts
Ib
Ic2
Ec2=150
125
100
GRID #2 VOLTS Ec2=75
50
25
Ec2=125
75
Ib
Ic2
GRID #2 (Ic2) MILLIAMPERES
PLATE (Ib) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
0
100
200
400
600
800


6DQ5
Ef = 6.3 Volts
Ec2 = 125 Volts
Ib
Ic2
Ec1=0
-5
Ib
GRID #1 VOLTS (Ec1)=-10
-15
-20
Ib
-25
-30
Ec1=0
-10
Ec1=0
-35
GRID #2 (Ic2) MILLIAMPERES
PLATE (Ib) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
0
100
200
400
600
800


6DQ5
Ef = 6.3 Volts
Ec2 = 150 Volts
Ib
Ic2
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 = 0
-5
-10
-15
-20
-25
-30
-35
-40
-45
0
100
200
300
400
500
800
600
400
200
100
0

TUNG-SOL

BEAM PENTODE



GLASS BULB

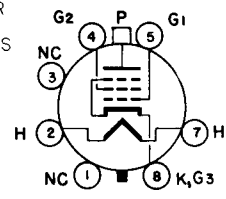
SKIRTED MINIATURE
SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B5-190 ←—
OUTLINE DRAWING
JEDEC 12-51

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #1 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 6DQ6A IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER TUBE IN HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 6DQ6A IS IDENTICAL TO THE 12DQ6A.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6000	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	155	MA.
CATHODE CURRENT, PEAK	540	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

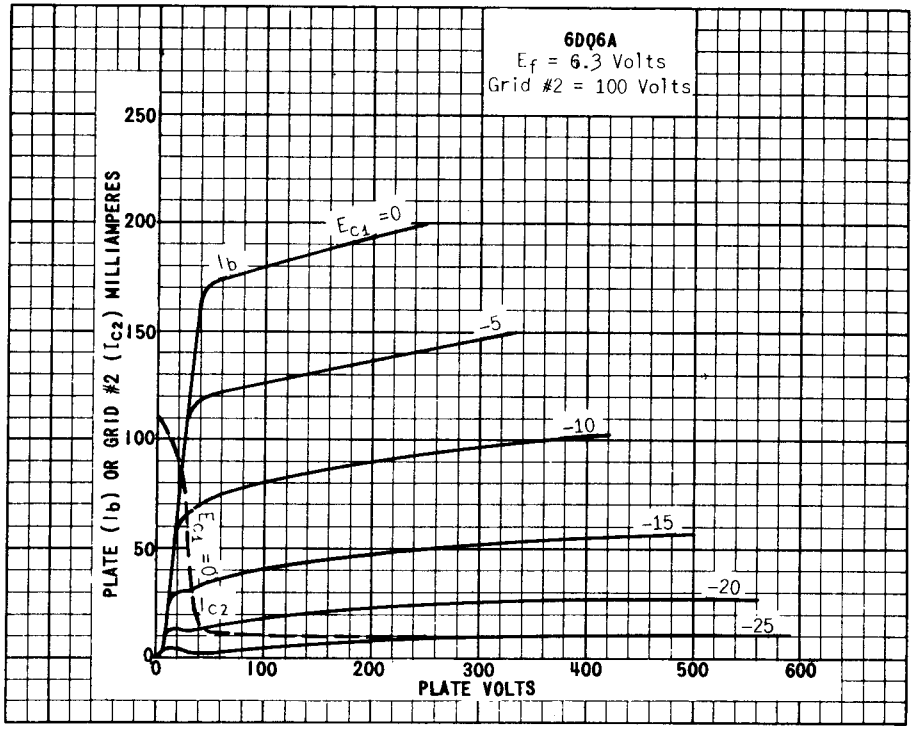
AVERAGE CHARACTERISTICS

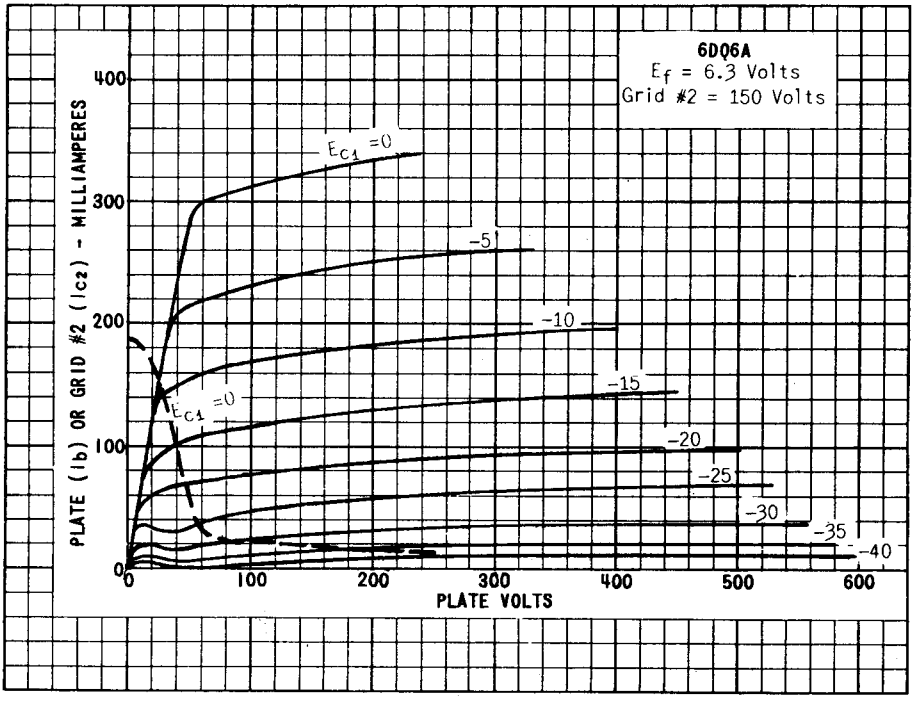
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	1.5	MA.
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE, APPROX.	20,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	315	MA.
GRID #2 CURRENT	25	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-40	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.5	

→ INDICATES A CHANGE.

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.





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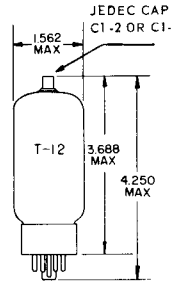
TUNG-SOL

BEAM PENTODE



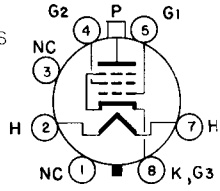
SKIRTED MINIATURE
SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B6-190 ←
OUTLINE DRAWING
JEDEC 72-62

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #1 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 6DQ6B IS A BEAM-POWER PENTODE PRIMARILY DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ITS HIGH ZERO-BIAS PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES MAKES THE TUBE WELL SUITED FOR USE IN RECEIVERS THAT OPERATE AT LOW PLATE-SUPPLY VOLTAGES. IT DIFFERS FROM THE 6DQ6A IN HAVING HIGHER RATINGS AND HIGHER ZERO-BIAS PLATE CURRENT.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6500	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	175	MA.
CATHODE CURRENT, PEAK	610	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

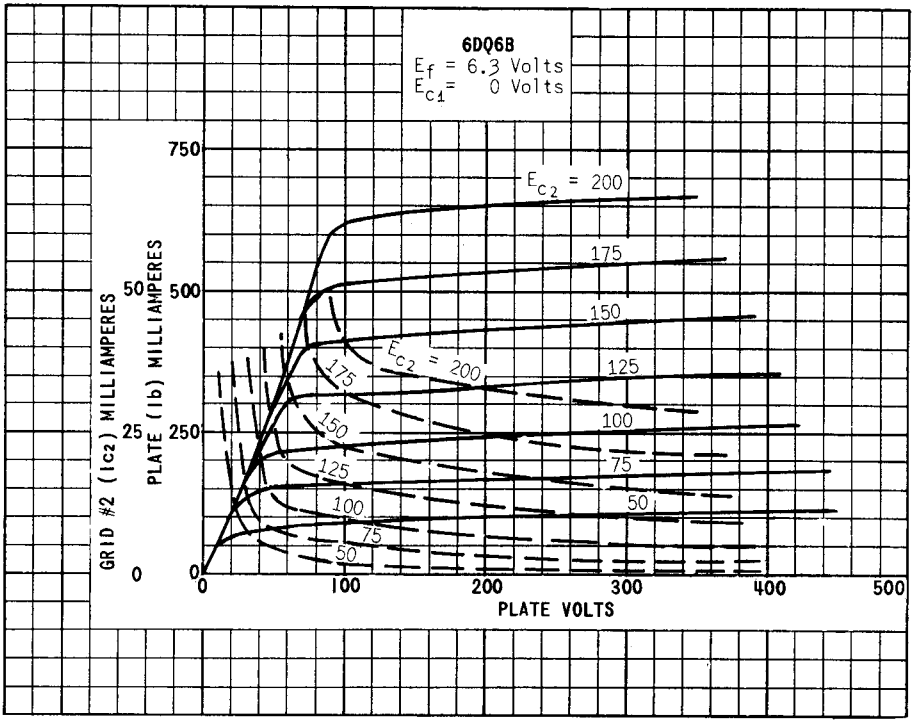
AVERAGE CHARACTERISTICS

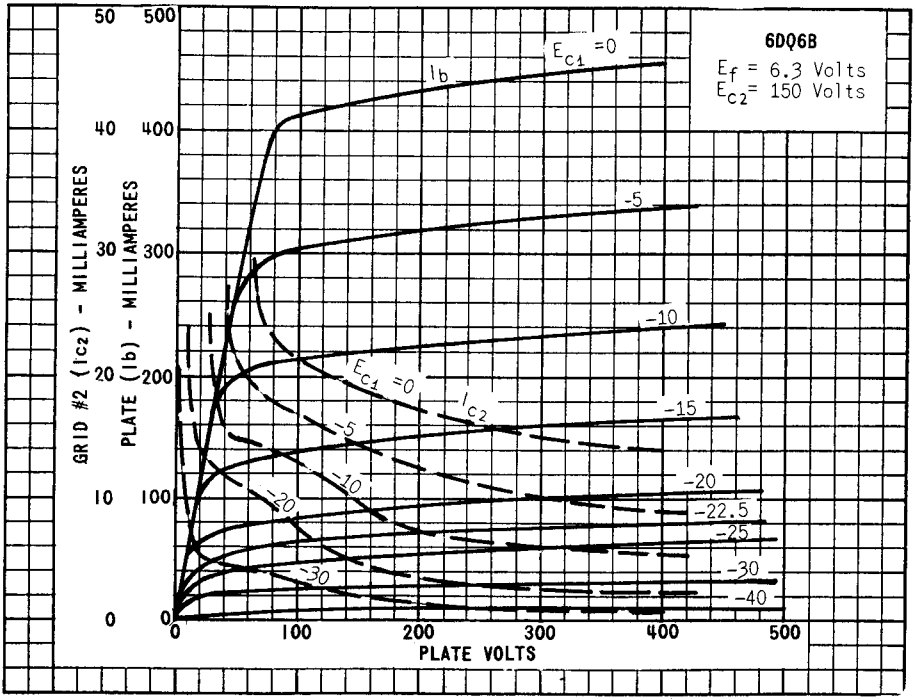
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	65	MA.
GRID #2 CURRENT	1.8	MA.
TRANSCONDUCTANCE	7300	μMHOS
PLATE RESISTANCE, APPROX.	18,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	27	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-42	VOLTS
CUTOFF: Ib = 1 MA, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.4	

→ INDICATES A CHANGE.

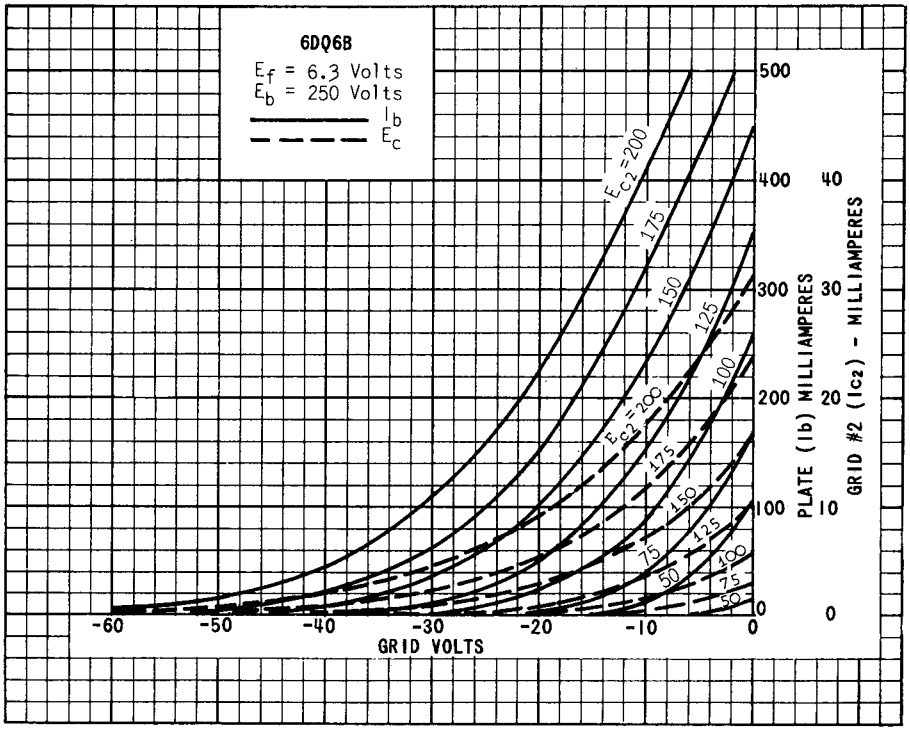
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.


6DQ6B
Ef = 6.3 Volts
Ec1 = 0 Volts
GRID #2 (Ic2) MILLIAMPERES
PLATE (Ib) MILLIAMPERES
PLATE VOLTS
Ec2 = 200
175
150
125
100
75
50
0
100
200
300
400
500
250
750


6DQ6B
Ef = 6.3 Volts
Ec2 = 150 Volts
GRID #2 (Ic2) - MILLIAMPERES
PLATE (Ib) - MILLIAMPERES
PLATE VOLTS
Ec1 = 0
Ib
Ic2
-5
-10
-15
-20
-22.5
-25
-30
-40
0
100
200
300
400
500

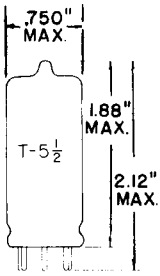
6DQ6B


6DQ6B
E_f = 6.3 Volts
E_b = 250 Volts
I_b
E_c
E_{c2}=200
175
150
125
100
75
50
-60
-50
-40
-30
-20
-10
0
GRID VOLTS
500
400
300
200
100
0
40
30
20
10
0
PLATE (Ib) MILLIAMPERES
GRID #2 (I_{c2}) - MILLIAMPERES

TUNG-SOL

TRIODE

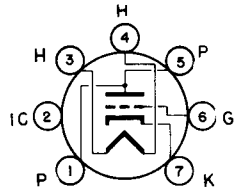
MINIATURE TYPE



GLASS BULB
OUTLINE DRAWING
JEDEC 5-2
BASE - E7-1

COATED UNIPOTENTIAL CATHODE

HIGH VOLTAGE-GAIN APPLICATIONS



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6BG

THE 6DR4 IS A HIGH-MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A VOLTAGE AMPLIFIER, PHASE INVERTER, AND OTHER HIGH VOLTAGE-GAIN APPLICATIONS. THE 6DR4 IS ELECTRICALLY EQUIVALENT TO ONE SECTION OF THE 12AX7.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.7	pf
INPUT	1.6	pf
OUTPUT	0.46	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
POSITIVE DC GRID VOLTAGE	0	VOLTS
NEGATIVE DC GRID VOLTAGE	55	VOLTS
PLATE DISSIPATION	1.2	WATTS

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TYPICAL OPERATING CHARACTERISTICS

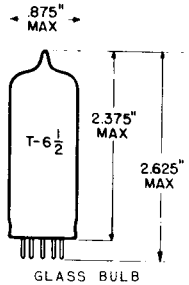
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1.0	-2.0	VOLTS
PLATE CURRENT	0.5	1.2	MA.
PLATE RESISTANCE (APPROX.)	80 000	62 500	OHMS
TRANSCONDUCTANCE	1250	1600	μMHOS
AMPLIFICATION FACTOR	100	100	

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1

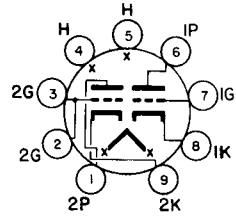
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 900 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9HF

THE 6DR7 IS A DOUBLE TRIODE WITH DISSIMILAR SECTION IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION #2 HAS A LOW MU AND IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. SECTION #2 OF THE 6DR7 IS IDENTICAL TO SECTION #2 OF THE 6DE7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.5	8.5	pf
INPUT: G TO (H+K)	2.2	5.5	pf
OUTPUT: P TO (H+K)	0.34	1.0	pf

RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
MAXIMUM HEATER–CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.0	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20	50	MA.
MAXIMUM PEAK CATHODE CURRENT	70	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-17.5	VOLTS
PLATE CURRENT	1.4	35	MA.
TRANSCONDUCTANCE	1600	6500	μMHOS
AMPLIFICATION FACTOR	64 ←	6.0	
PLATE RESISTANCE (APPROX.)	40 000	925	
GRID VOLTAGE FOR Ib = 10 μA	5.5	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

→ INDICATES A CHANGE.

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

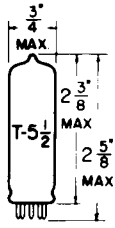
C IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

SIMILAR TYPE REFERENCE: *The 6DR7 is identical to the 10DR7 except for heater ratings and heater warm-up time of the 10DR7.*

TUNG-SOL

PENTODE

MINIATURE TYPE

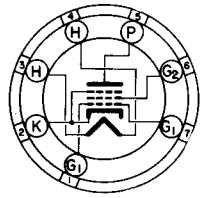


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.8 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

THE 6DS5 IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE PRIMARILY IN THE AUDIO OUTPUT STAGES OF TELEVISION AND RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.19	μμf
GRID #1 TO CATHODE & GRID #3, HEATER & GRID #2	9.5	μμf
PLATE TO CATHODE & GRID #3, HEATER & GRID #2	6.3	μμf

→ RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	275	VOLTS
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLT
MAXIMUM PLATE DISSIPATION	9	WATTS
MAXIMUM GRID #2 INPUT	2.2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CATHODE-BIAS OPERATION

HEATER VOLTAGE	6.3±10%		VOLTS
HEATER CURRENT	0.8		AMP.
PLATE SUPPLY VOLTAGE	200	250	VOLTS
GRID #2 VOLTAGE	200	200	VOLTS
CATHODE-BIAS RESISTOR	180	270	OHMS
PEAK AF GRID-NO.1 VOLTAGE	7.5	9.2	VOLTS
ZERO-SIGNAL PLATE CURRENT	34.5	27	MA.
MAX.-SIGNAL PLATE CURRENT	32.5	25	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	3	MA.
MAX.-SIGNAL GRID #2 CURRENT	9	9	MA.
PLATE RESISTANCE (APPROX.)	28 000	28 000	OHMS
TRANSCONDUCTANCE	6 000	5 800	μMHOS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
LOAD RESISTANCE	6 000	8 000	OHMS
MAX.-SIGNAL POWER OUTPUT	2.8	3.6	WATTS

→ INDICATES A CHANGE.

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TUNG-SOL

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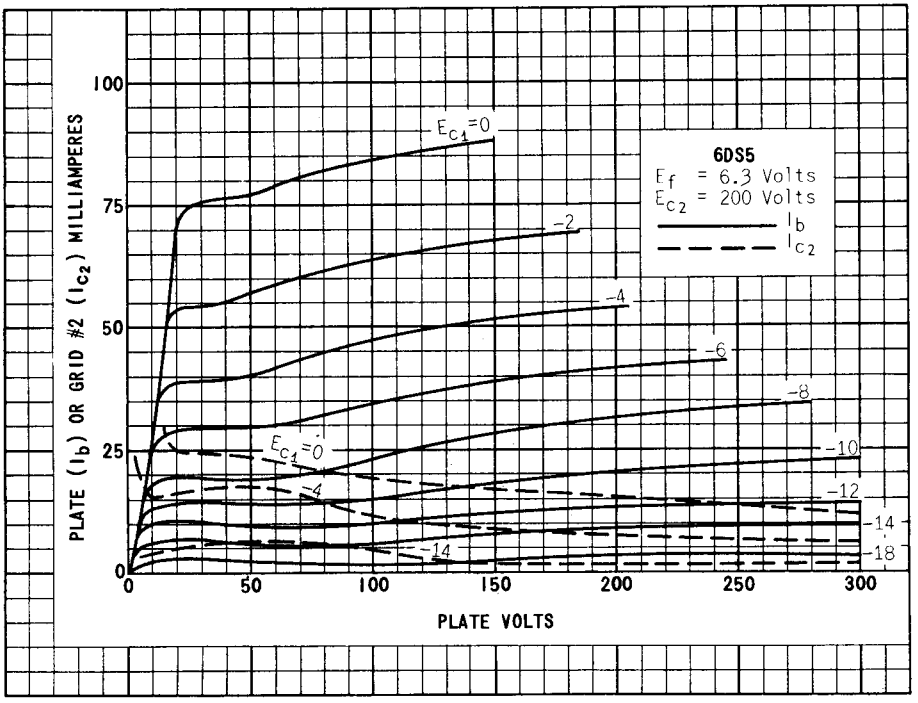
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

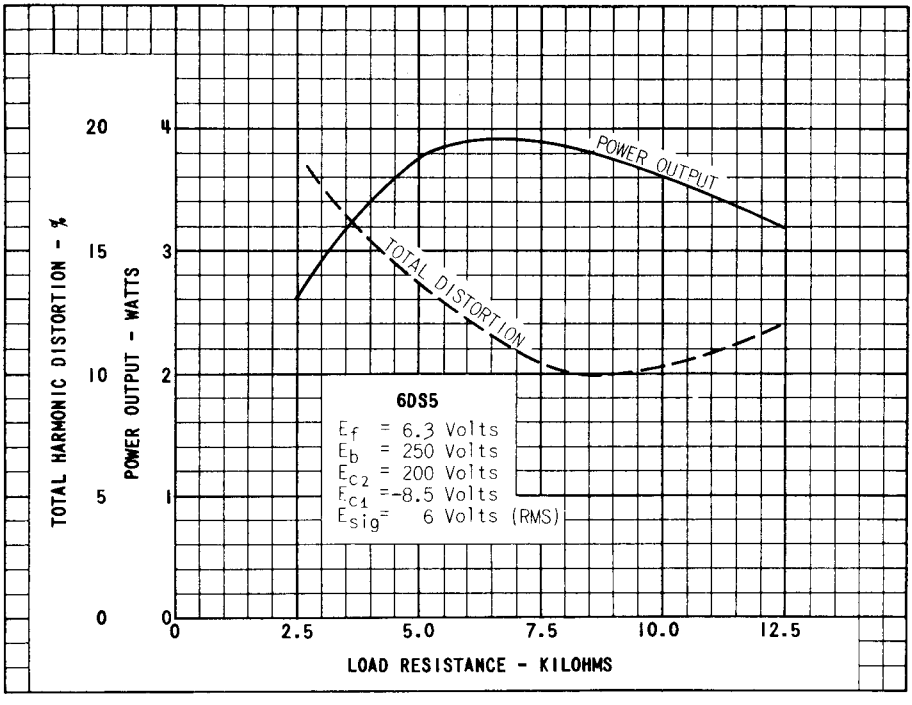
FIXED-BIAS OPERATION

HEATER VOLTAGE		6.3±10%	VOLTS
HEATER CURRENT		0.8	AMP.
PLATE VOLTAGE	200	250	VOLTS
GRID #2 VOLTAGE	200	200	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-7.5	-8.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	29	MA.
MAX.-SIGNAL PLATE CURRENT	36	32	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	3	MA.
MAX.-SIGNAL GRID #2 CURRENT	9	10	MA.
PLATE RESISTANCE (APPROX.)	28 000	28 000	OHMS
TRANSCONDUCTANCE	6 000	5 800	μMHOS
LOAD RESISTANCE	6 000	8 000	OHMS
TOTAL HARMONIC DISTORTION	9	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	3	3.8	WATTS

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	1.0	MEGOHM





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TUNG-SOL

DIODE

DIODE

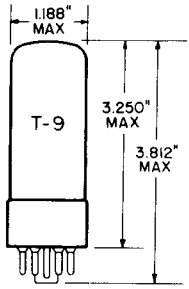
FOR

DAMPER SERVICE

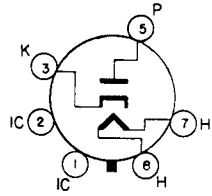
IN COLOR

T.V. RECEIVERS

ANY MOUNTING POSITION



GLASS BULB
SHORT INTERMEDIATE
SHELL OCTAL 5 PIN
BASE B5-85
OUTLINE DRAWING
JEDEC 9-44



JEDEC 4CG
SOCKET TERMINALS
1,2,4 AND 6
SHOULD NOT BE USED AS
TIE POINTS

THE 6DT4 IS A HEATER-CATHODE TYPE DIODE DESIGNED FOR USE AS THE DAMPER DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF COLOR TELEVISION RECEIVERS. IT IS CAPABLE OF HANDLING THE HIGHER DISSIPATIONS AND VOLTAGES OF COLOR APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

HEATER TO CATHODE	3.5	pf
PLATE TO CATHODE AND HEATER	7.5	pf
CATHODE TO PLATE AND HEATER	10.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.2	AMPS.
MAXIMUM HEATER - CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE:			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:			
DC COMPONENT		900	VOLTS
TOTAL DC AND PEAK		5,500	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

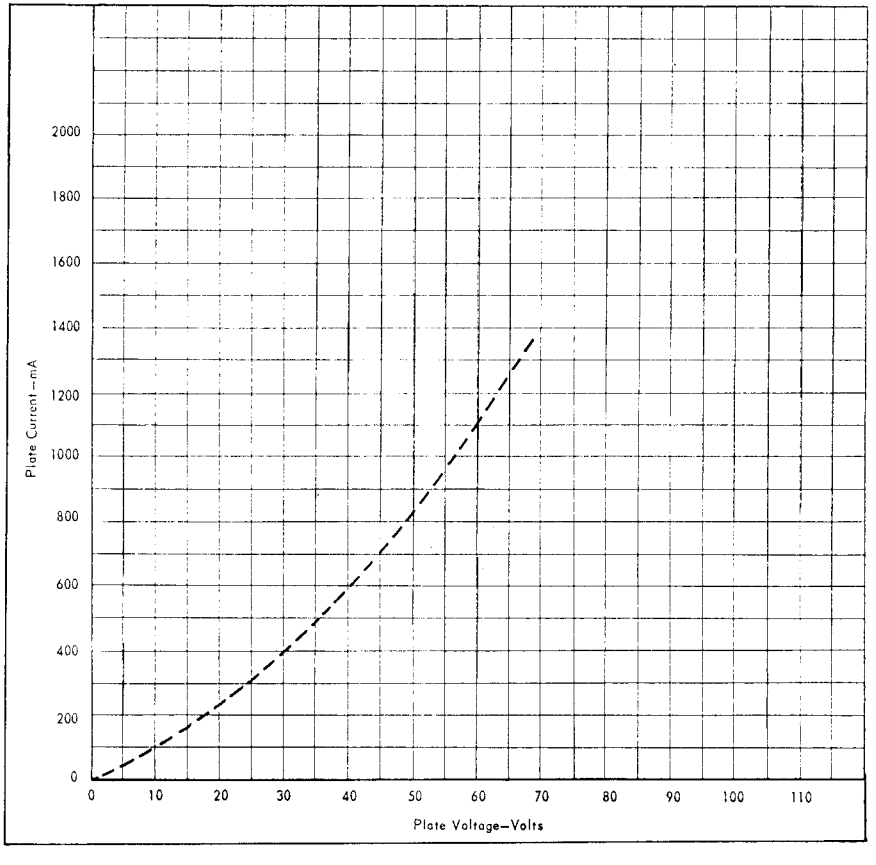
TV DAMPER SERVICE

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

PEAK INVERSE PLATE VOLTAGE	5,500	VOLTS
PEAK PLATE CURRENT	1,450	MA
DC PLATE CURRENT	235	MA
PLATE DISSIPATION	7.5	WATTS

CHARACTERISTICS

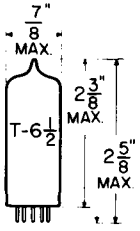
TUBE VOLTAGE DROP AT I_b = 350 MA	28	VOLTS



TUNG-SOL

BEAM-POWER PENTODE

MINIATURE TYPE

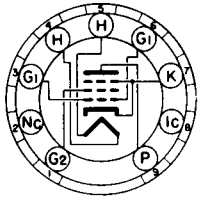


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE
SMALL-BUTTON
9 PIN BASE
9HN

THE 6DT5 IS A BEAM POWER PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A VERTICAL DEFLECTION OUTPUT AMPLIFIER IN TELEVISION RECEIVERS UTILIZING A 110° DEFLECTION ANGLE PICTURE TUBE AND A B+ SUPPLY VOLTAGE OF 250 VOLTS. IT HAS HIGH ZERO BIAS PLATE CURRENT AND A HIGH PLATE CURRENT TO GRID #2 CURRENT RATIO. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 6DT5 IS IDENTICAL TO THE 12DT5 & 25DT5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.57	μμf
INPUT	12.5	μμf
OUTPUT	4.9	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION SERVICE[B]

DEFLECTING 110° PICTURE TUBE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 200	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	-250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9.0	WATTS
MAXIMUM GRID #2 DISSIPATION	2.0	WATTS
MAXIMUM CATHODE CURRENT:		
AVERAGE	55	MA.
PEAK	190	MA.
MAXIMUM HEATER POSITIVE OR NEGATIVE WITH RESPECT TO CATHODE (TOTAL DC AND PEAK)	200	VOLTS
MAXIMUM GRID #1 CIRCUIT VALUES		
FIXED BIAS	0.5	MEGOHM
CATHODE BIAS	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	1.2	AMP.
PLATE VOLTAGE	60	80 ←	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	150	250	250	VOLTS
GRID #1 VOLTAGE	0[E]	0[E]	-16.5	VOLTS
TRANSCONDUCTANCE	---	---	6 200	μMHOS
PLATE CURRENT	→ 95	195[F]	44	MA.
GRID #2 CURRENT	→ 8.5	19[F]	1.5	MA.
GRID #1 CUTOFF VOLTAGE[G]	---	---	-35	VOLTS

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[E] APPLIED FOR SHORT INTERVAL (MAXIMUM OF 2 SECONDS) SO AS NOT TO DAMAGE TUBE.

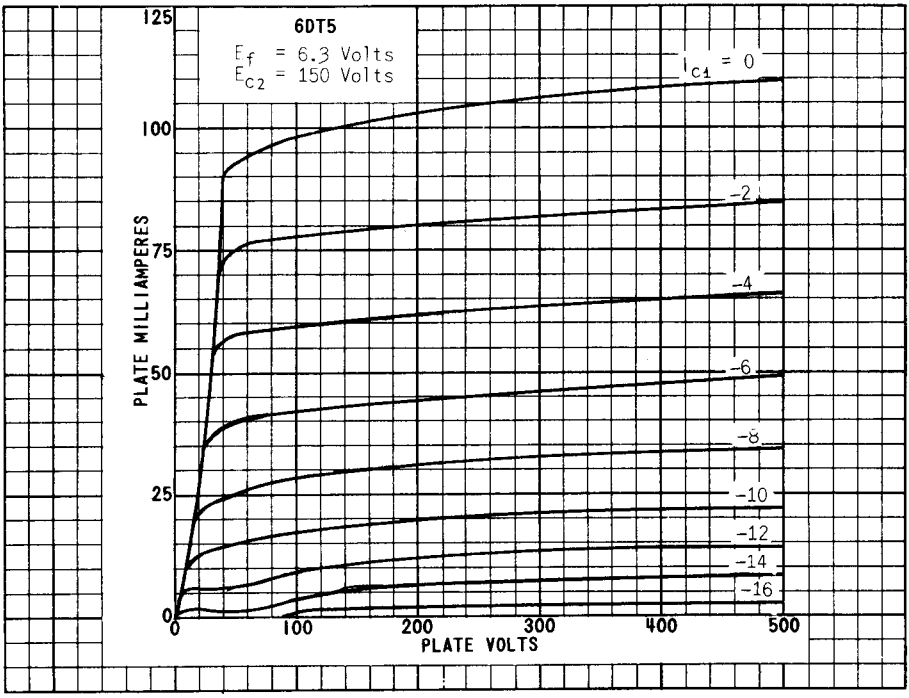
[F] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

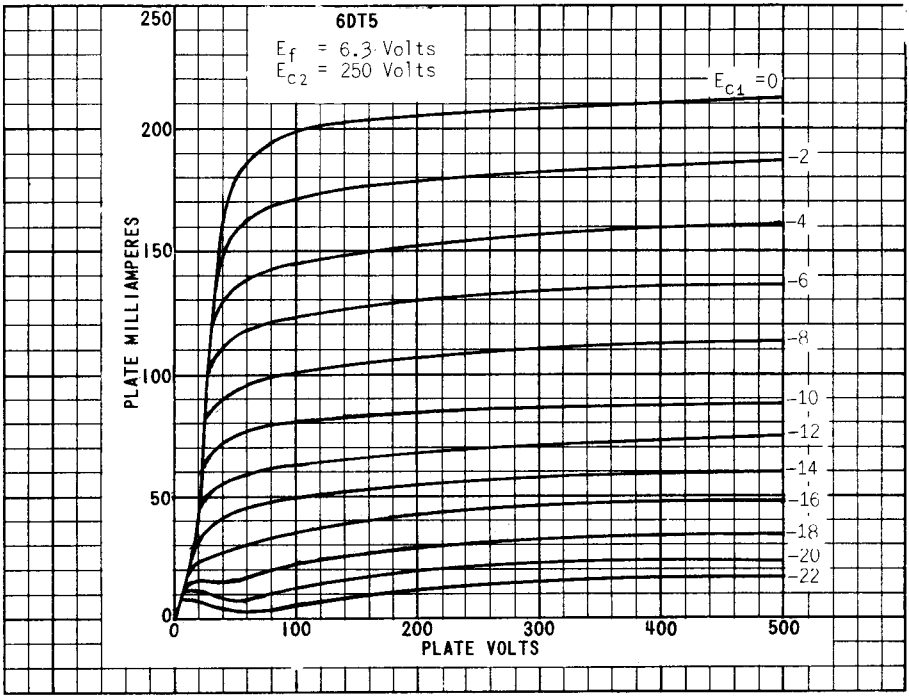
[G] FOR PLATE CURRENT OF 100 μAMPERES.

[*] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[⊕] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.





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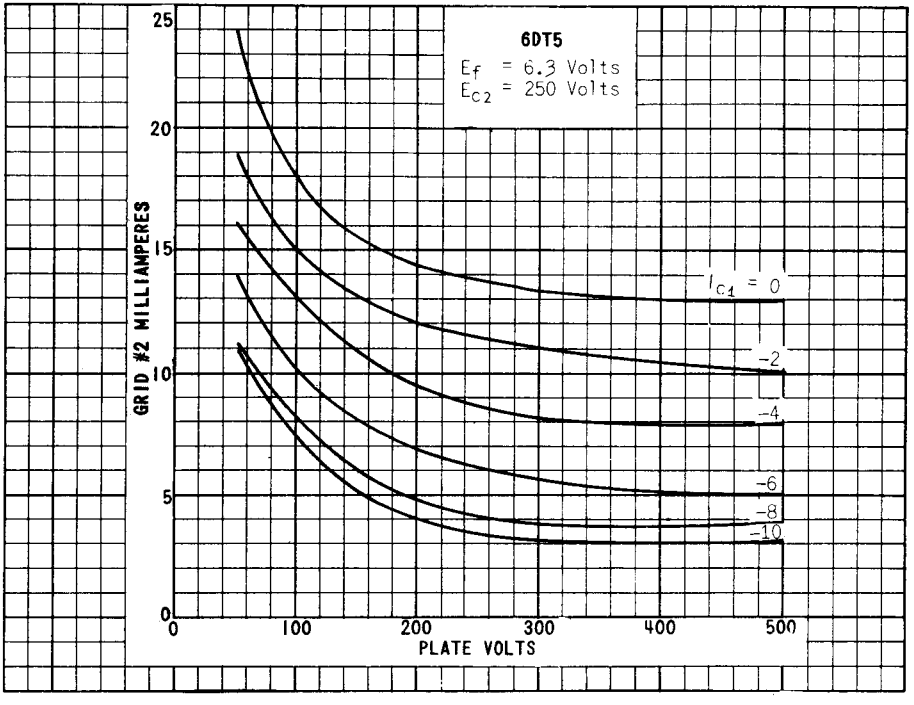
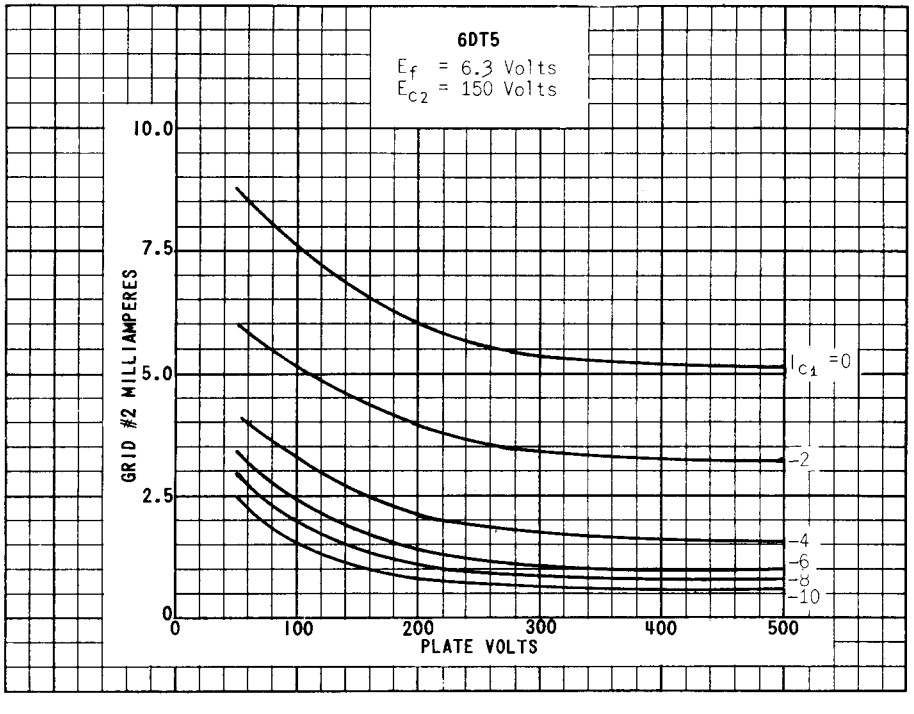
6DT5


6DT5
E_f = 6.3 Volts
E_{c2} = 250 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
I_{c1} = 0
-2
-4
-6
-8
-10
0
5
10
15
20
25
100
200
300
400
500


6DT5
E_f = 6.3 Volts
E_{c2} = 150 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
I_{c1} =0
-2
-4
-6
-8
-10
0
2.5
5.0
7.5
10.0
100
200
300
400
500

TUNG-SOL

PENTODE

MINIATURE TYPE

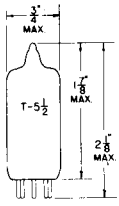
UNIPOTENTIAL CATHODE

HEATER

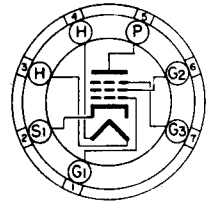
6.3±10% VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

7EM

THE 6DT6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN FM DETECTOR IN TELEVISION RECEIVERS. DESIGNED SO THAT GRID #1 AND GRID #3 CAN EACH BE USED AS INDEPENDENT SHARP CUTOFF CONTROL ELECTRODES, THE TUBE MAY ALSO BE USED IN DELAY CIRCUITS, GAIN-CONTROLLED AMPLIFIER CIRCUITS, AND MIXER CIRCUITS. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, IT IS IDENTICAL TO THE 3DT6.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH EXTERNAL SHIELD, #316, CONNECTED TO CATHODE

GRID #1 TO PLATE	0.02	μμf
GRID #1 TO GRID #3	0.1	μμf
GRID #3 TO ALL OTHER ELECTRODES	6.1	μμf
GRID #1 TO GRID #2, GRID #3, HEATER, AND INTERNAL SHIELD AND CATHODE	5.8	μμf
GRID #3 TO PLATE	1.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FM DETECTOR SERVICE

HEATER VOLTAGE	6.3±10% ←	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	28 ←	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330 ←	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7 ←	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	1.1 ←	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	→ 6.3±10%	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	560	OHMS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHM
TRANSCONDUCTANCE:		
GRID #1 TO PLATE	800	μMHOS
GRID #3 TO PLATE	515	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10μAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10μAMP	-3.5	VOLTS
PLATE CURRENT	1.1	MA.
GRID #2 CURRENT	2.1	MA.

TYPICAL OPERATION IN THE ACCOMPANYING LOCKED-OSCILLATOR, QUADRATURE-GRID FM DETECTOR CIRCUIT AT A CARRIER FREQUENCY OF 4.5 MC:

INPUT SIGNAL TO GRID OF DRIVER TUBE	**15**	**200**	**500**	**MV RMS**
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	0.22	0.21	MA.
GRID #2 CURRENT	3.4	5.5	6	MA.
GRID #1 CURRENT	0.013	0.6	0.8	MA.
BANDWIDTH:				
FOR A TOTAL HARMONIC DISTORTION OF 10 PERCENT	65	120	118	KC
AM REJECTION (APPROX.)[B]	33	29	28	DB
AUDIO OUTPUT VOLTAGE (RMS, APPROX.):				
WITH ± 7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	5.5	6.5	7.5	VOLTS
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	17	21	23	VOLTS
TOTAL HARMONIC DISTORTION:				
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	2	3	4	PERCENT
SENSITIVITY:				
WITH ±7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			5[C]	MILLIVOLTS
WITH ±25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			15[C]	MILLIVOLTS
MAXIMUM CIRCUIT VALUES:				
GRID #1 CIRCUIT RESISTANCE:				
FOR FIXED-BIAS OPERATION			0.25	MEGOHM
FOR CATHODE-BIAS OPERATION			0.5	MEGOHM

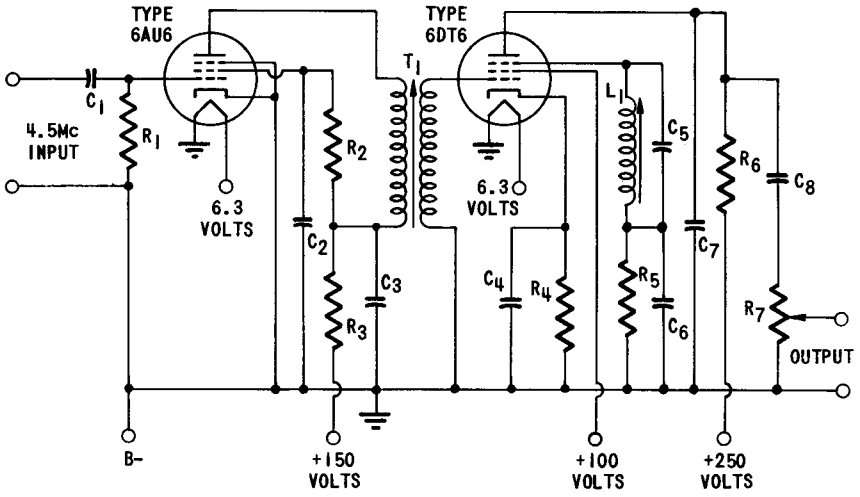
[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

→ INDICATES A CHANGE.

TUNG-SOL

LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT
UTILIZING TYPE 6DT6



C_1: 47μμf, 400 VOLTS
C_2 C_3: 0.01μf, 400 VOLTS
C_4: 0.01μf, 200 VOLTS
C_5: 18μμf, 200 VOLTS
C_6: 0.05μf, 200 VOLTS
C_7: 100 TO 1000μμf, 400 VOLTS
C_8: 0.01μf, 400 VOLTS

L_1: SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC.

R_1: 100000 OHMS, 0.5 WATT
R_2: 12000 OHMS, 0.5 WATT
R_3: 1000 OHMS, 0.5 WATT
R_4: 560 OHMS, 0.5 WATT
R_5: 560000 OHMS, 0.5 WATT
R_6: 270000 OHMS, 0.5 WATT
R_7: 0.5 MEGOHM POTENTIOMETER

T_1: SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q>60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE.

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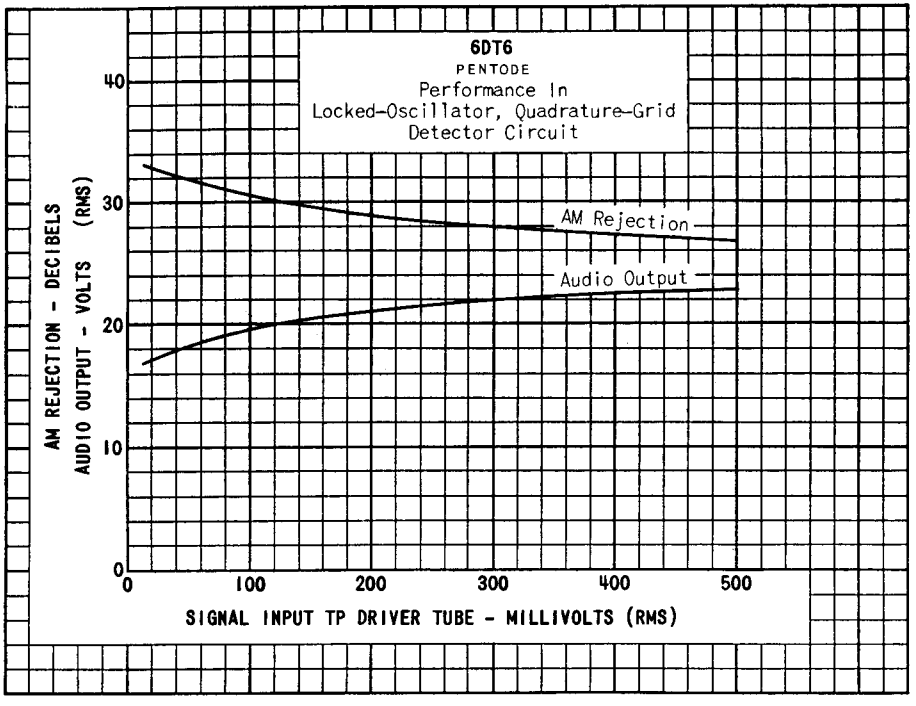
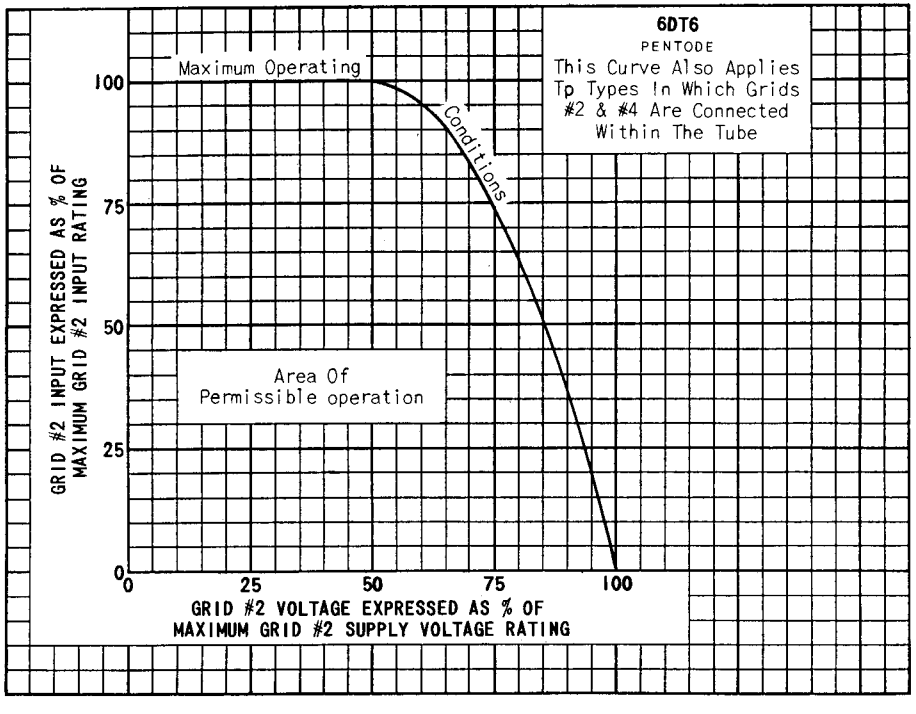
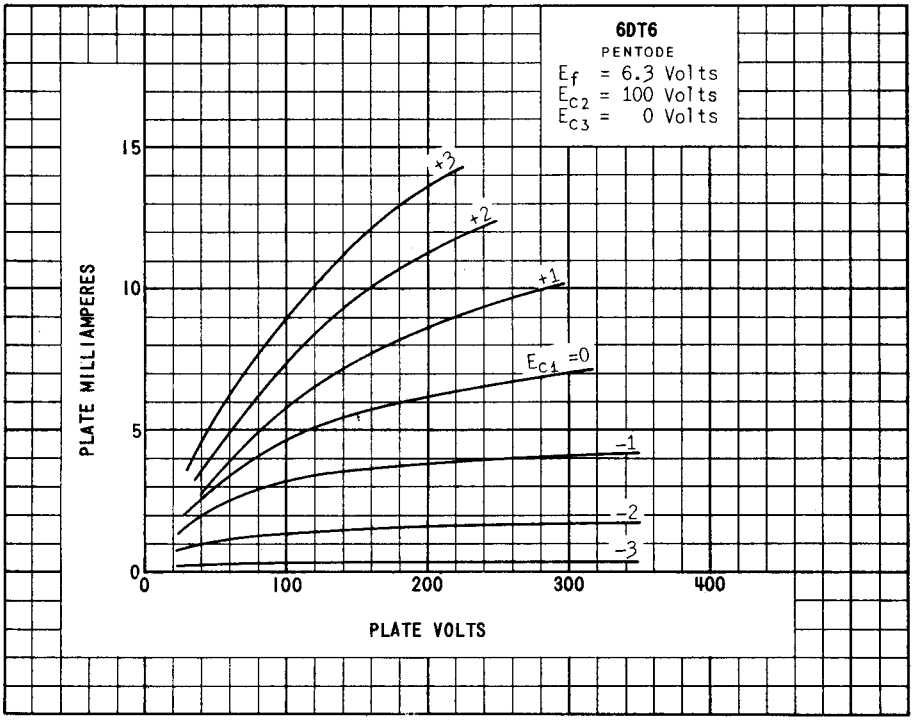
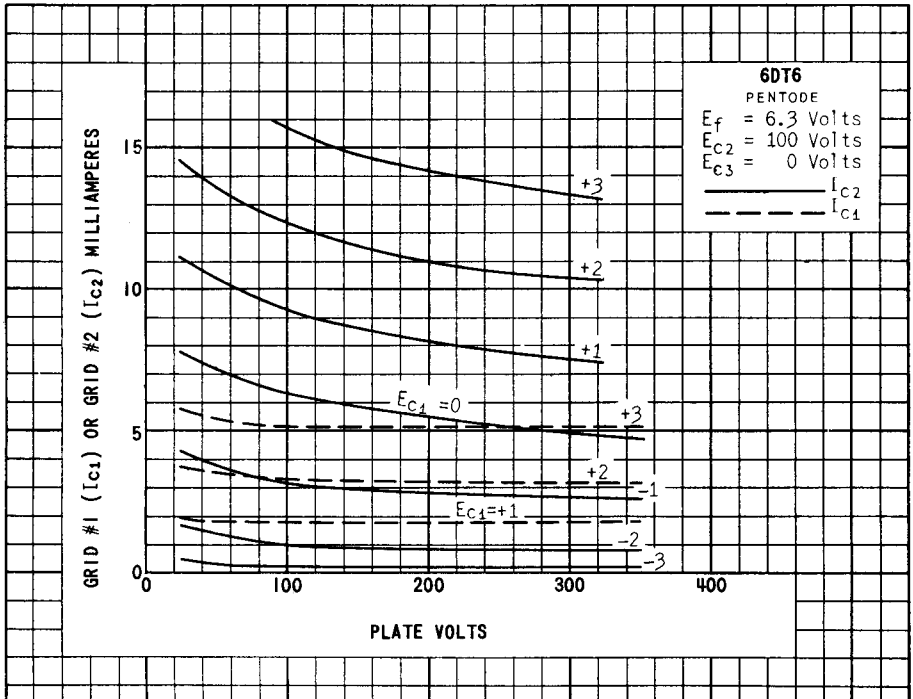
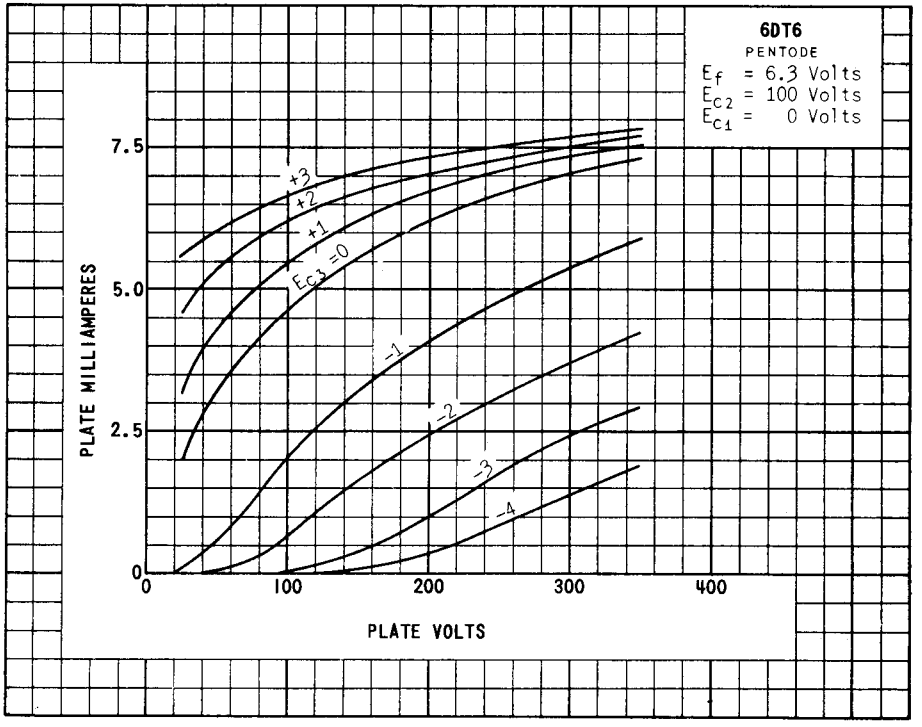
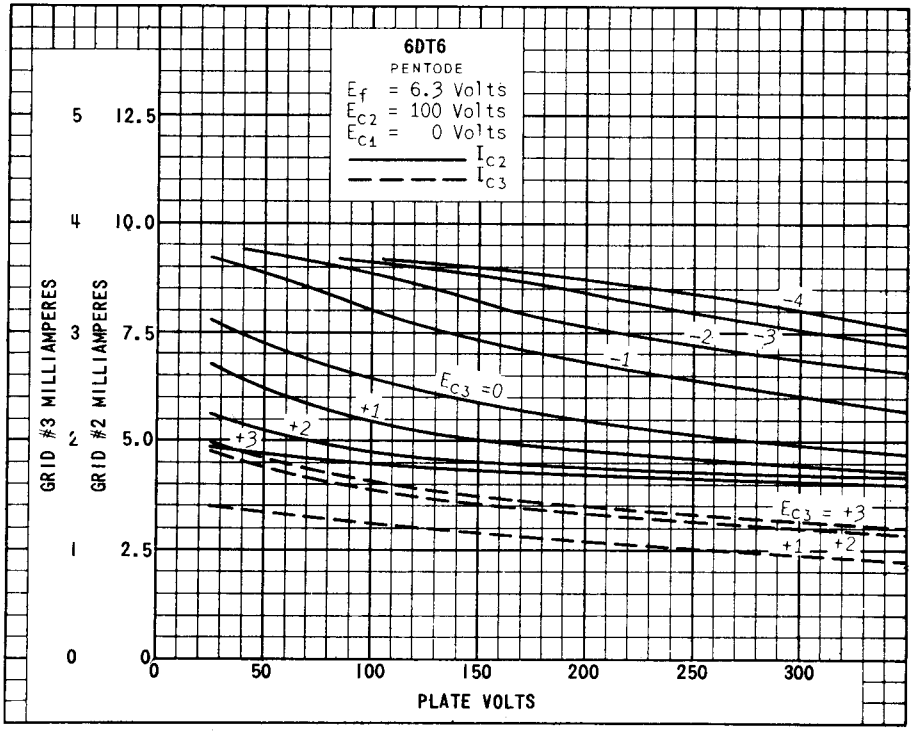

6DT6
PENTODE
Performance In
Locked-Oscillator, Quadrature-Grid
Detector Circuit
AM Rejection
Audio Output
AM REJECTION - DECIBELS
AUDIO OUTPUT - VOLTS (RMS)
0
10
20
30
40
0
100
200
300
400
500
SIGNAL INPUT TP DRIVER TUBE - MILLIVOLTS (RMS)

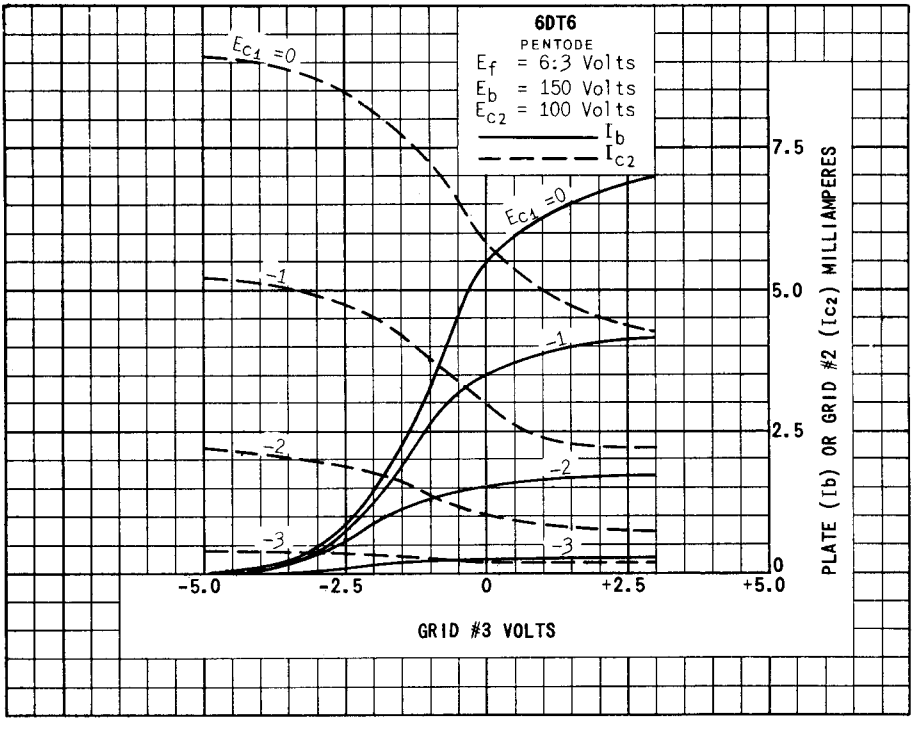

6DT6
PENTODE
This Curve Also Applies
Tp Types In Which Grids
#2 & #4 Are Connected
Within The Tube
Maximum Operating
Conditions
Area Of
Permissible operation
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 SUPPLY VOLTAGE RATING

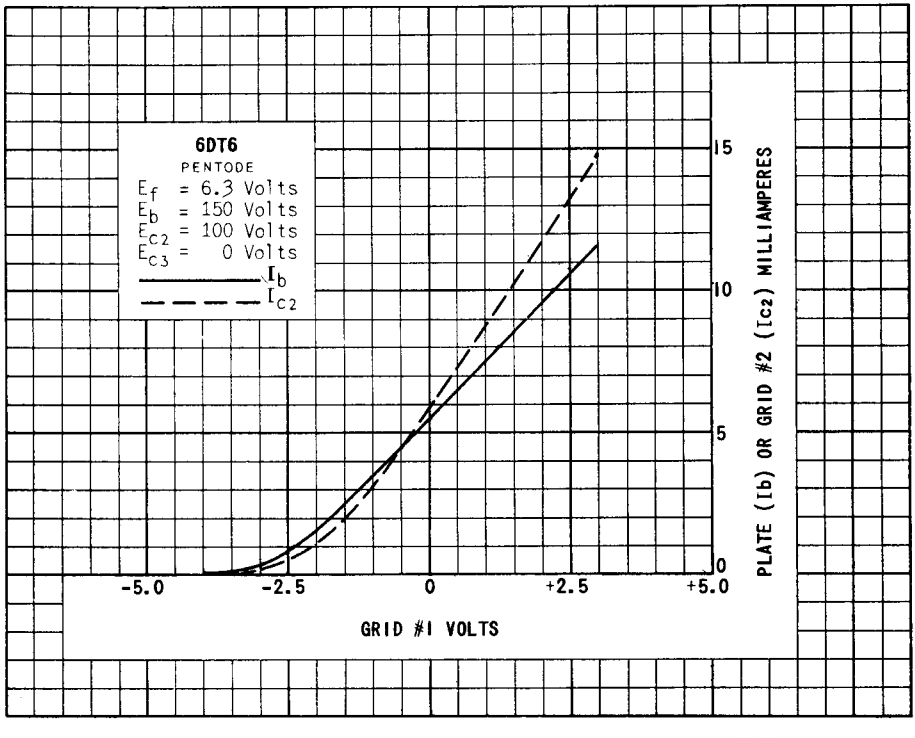

6DT6
PENTODE
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
+3
+2
+1
E_{c1} =0
-1
-2
-3
0
5
10
15
0
100
200
300
400


6DT6
PENTODE
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_{c2}
I_{c1}
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
+3
+2
+1
E_{c1} =0
+3
+2
-1
E_{c1}=+1
-2
-3
0
5
10
15
0
100
200
300
400


6DT6
PENTODE
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
PLATE MILLIAMPERES
7.5
5.0
2.5
0
+3
+2
+1
E_{c3} =0
-1
-2
-3
-4
0
100
200
300
400
PLATE VOLTS


6DT6
PENTODE
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
I_{c2}
I_{c3}
GRID #3 MILLIAMPERES
GRID #2 MILLIAMPERES
5
4
3
2
1
0
12.5
10.0
7.5
5.0
2.5
0
-4
-2
-3
-1
E_{c3} =0
+1
+2
+3
E_{c3} = +3
+2
+1
0
50
100
150
200
250
300
PLATE VOLTS

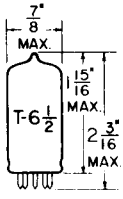

6DT6
PENTODE
Ef = 6.3 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ib
Ic2
Ec1 =0
-1
-2
-3
7.5
5.0
2.5
0
-5.0
-2.5
0
+2.5
+5.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
GRID #3 VOLTS


6DT6
PENTODE
Ef = 6.3 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
15
10
5
0
-5.0
-2.5
0
+2.5
+5.0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
GRID #1 VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

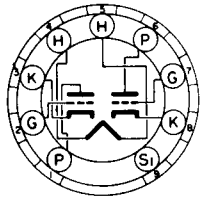


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON
9-PIN NOVAL
9DE

THE 6DT8 IS A GENERAL-PURPOSE HIGH-MU TWIN TRIODE OF THE 9-PIN MINIATURE TYPE INTENDED FOR USE AS AN RF AMPLIFIER AND AS A COMBINED OSCILLATOR-MIXER IN FM TUNERS. THIS TUBE IS ALSO USEFUL IN A WIDE VARIETY OF APPLICATIONS IN RADIO AND TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACTANCES - APPROX.
WITH EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID-DRIVE OPERATION:[A]			
GRID TO PLATE	1.6	1.6	μμf
GRID TO CATHODE, HEATER & I.S.	2.7	2.7	μμf
PLATE TO CATHODE, HEATER & I.S.	1.6	1.6	μμf
HEATER TO CATHODE	3.0	3.0	μμf
CATHODE-DRIVE OPERATION:[B]			
CATHODE TO GRID, HEATER, & I.S.	---	5.3	μμf
PLATE TO GRID, HEATER, & I.S.	---	2.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A1 AMPLIFIER
EACH UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE BIAS VALUE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.25	MEGOHM
FOR CATHODE-BIAS OPERATION	1	MEGOHM

[A] WITH EXTERNAL SHIELD, #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

[B] WITH EXTERNAL SHIELD, #315, CONNECTED TO GRID OF UNIT UNDER TEST.

[C] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

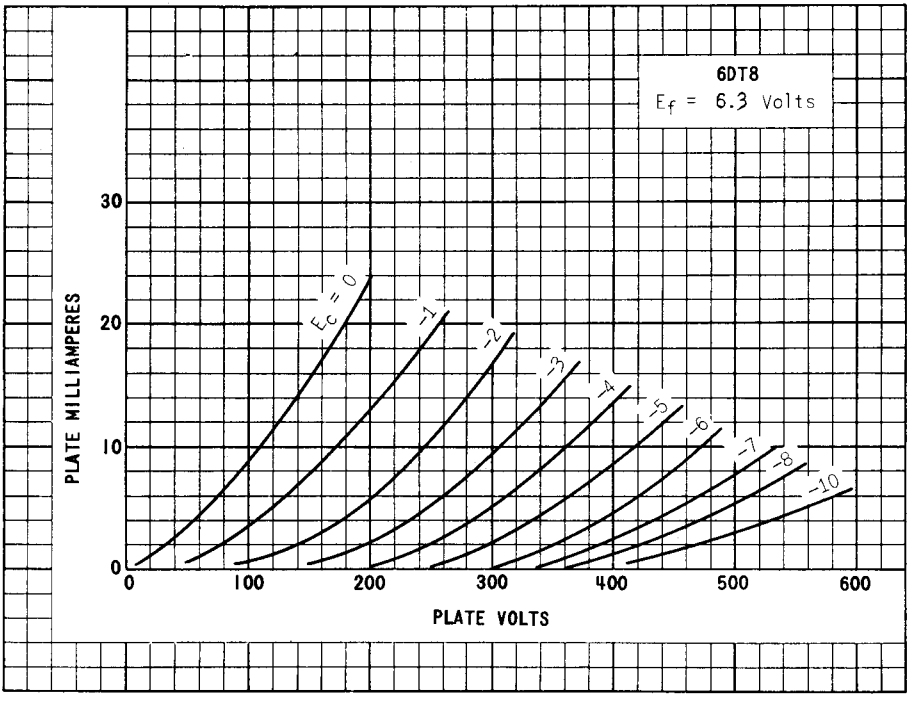
CONTINUED FROM PRECEDING PAGE

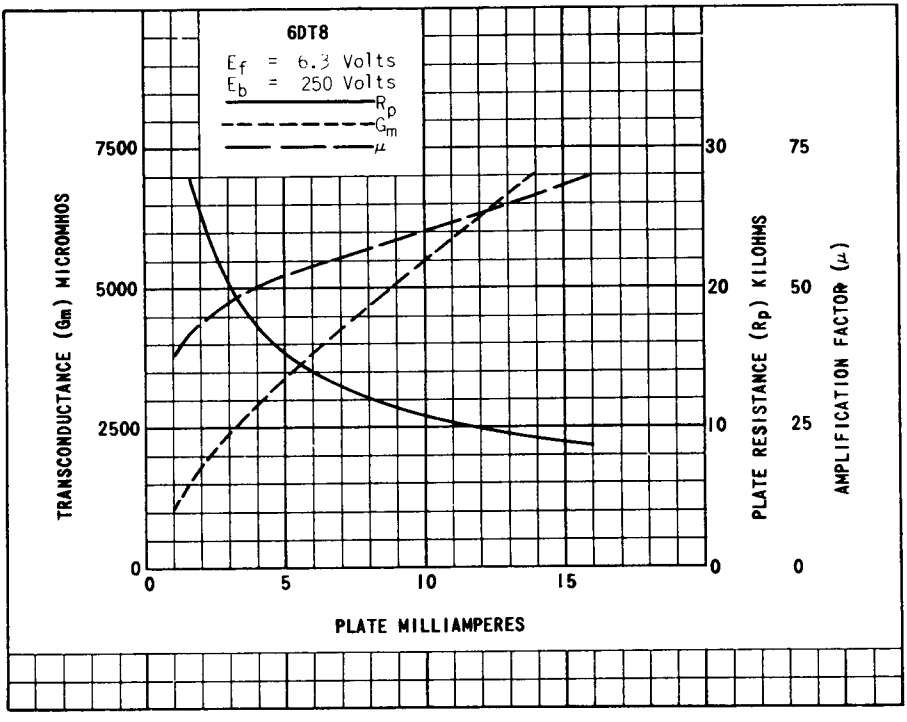
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE-SUPPLY VOLTAGE	100	250	VOLTS
CATHODE-BIAS RESISTOR	270	200	OHMS
AMPLIFICATION FACTOR	60	60	
PLATE RESISTANCE (APPROX.)	15 000	10 900	OHMS
TRANSCONDUCTANCE	4 000	5 500	μMHOS
PLATE CURRENT	3.7	10	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μA.	−5	−12	VOLTS

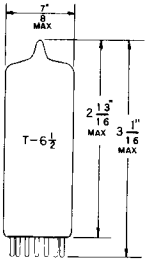



6DT8
Ef = 6.3 Volts
Eb = 250 Volts
Rp
Gm
μ
TRANSCONDUCTANCE (Gm) MICROMHOS
PLATE RESISTANCE (Rp) KILOHMS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
2500
5000
7500
0
5
10
15
0
10
20
30
0
25
50
75

TUNG-SOL

BEAM POWER PENTODE

MINIATURE TYPE



GLASS BULB

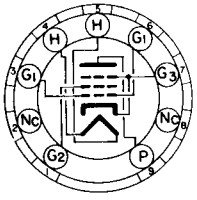
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE
9CK

THE 6DW5 IS A BEAM POWER PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR VERTICAL DEFLECTION AMPLIFIER SERVICE IN TELEVISION RECEIVERS EMPLOYING 110° DEFLECTION SYSTEMS. IT HAS A HIGH ZERO BIAS PLATE CURRENT AND IS DESIGNED TO OPERATE AT RELATIVELY LOW B SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 6DW5 IS IDENTICAL TO THE 12DW5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P)	0.5	μμf
INPUT: (G_1 TO H+K)	14	μμf
OUTPUT: (P TO H+K)	9	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

(PENTODE CONNECTED)

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	220	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	11	WATTS
MAXIMUM GRID #2 DISSIPATION[C]	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	65	MA.
MAXIMUM PEAK CATHODE CURRENT	225	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
SELF BIAS	2.2	MEGOHMS

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

(PENTODE CONNECTED)

MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VERTICAL DEFLECTION AMPLIFIER[B]

(PENTODE CONNECTED)

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
GRID #2 VOLTAGE	150	VOLTS
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.0	MA.
TRANSCONDUCTANCE	5 500	μMHOS
PLATE RESISTANCE (APPROX.)	15 000	OHMS
GRID VOLTAGE FOR I_b = 0.1 MA.	-55	VOLTS
ZERO BIAS WITH E_b =60VDC; E_{c1} =0; E_{c2} =150VDC (INSTANTANEOUS VALUES)		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	20	MA.
TRIODE AMPLIFICATION FACTOR WITH E_b =E_{c2}=150 V; E_{c1}=-22.5	4.3	

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

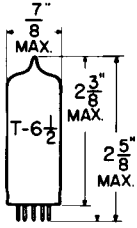
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



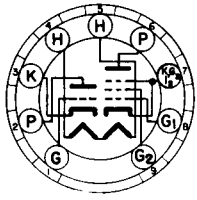
GLASS BULB
6-3

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.72 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9HX

THE 6DX8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE IN CIRCUITS FOR KEYED A.G.C. SYNC-SEPARATION, SYNC-AMPLIFICATION AND NOISE SUPPRESSION; THE PENTODE SECTION IS DESIGNED FOR USE AS A VIDEO AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	PENTODE SECTION	TRIODE SECTION	
GRID #1 TO ALL OTHER ELEMENTS EXCEPT PLATE	9.0	4.0	pf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	4.5	2.3	pf
PLATE TO GRID #1 (MAX.)	0.1	2.7	pf
GRID #1 TO HEATER (MAX.)	0.1	0.1	pf

BETWEEN TRIODE AND PENTODE SECTION:

TRIODE PLATE TO PENTODE GRID #1 (MAX.)	0.01	pf
TRIODE GRID TO PENTODE GRID #1 (MAX.)	0.01	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	300	300[A]	VOLTS
MAXIMUM PEAK PULSE PLATE VOLTAGE AT PLATE CURRENT MAX. 0.1 MAMP [B]		600	VOLTS
MAXIMUM PLATE DISSIPATION	4	1	WATTS
MAXIMUM GRID #2 VOLTAGE	300		VOLTS
MAXIMUM GRID #2 DISSIPATION	1.7		WATTS
MAXIMUM CATHODE CURRENT	40	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	1	1	MEG.
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH CATHODE RESISTOR	2	3	MEG.
MAXIMUM VOLTAGE BETWEEN HEATER & CATHODE	200	200	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN HEATER & CATHODE	20,000	20,000	OHMS

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TUNG-SOL

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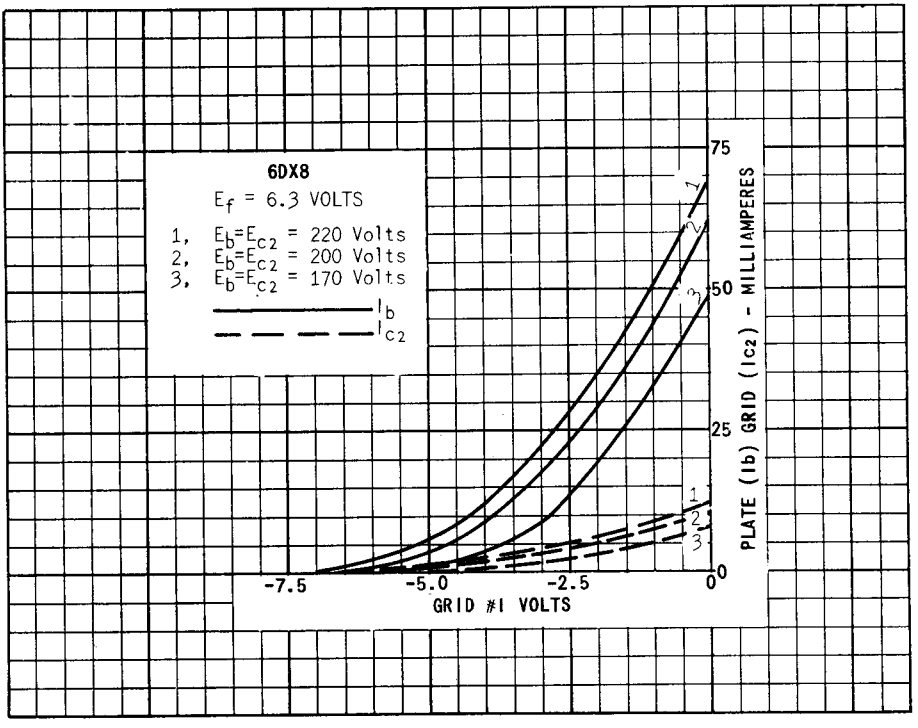
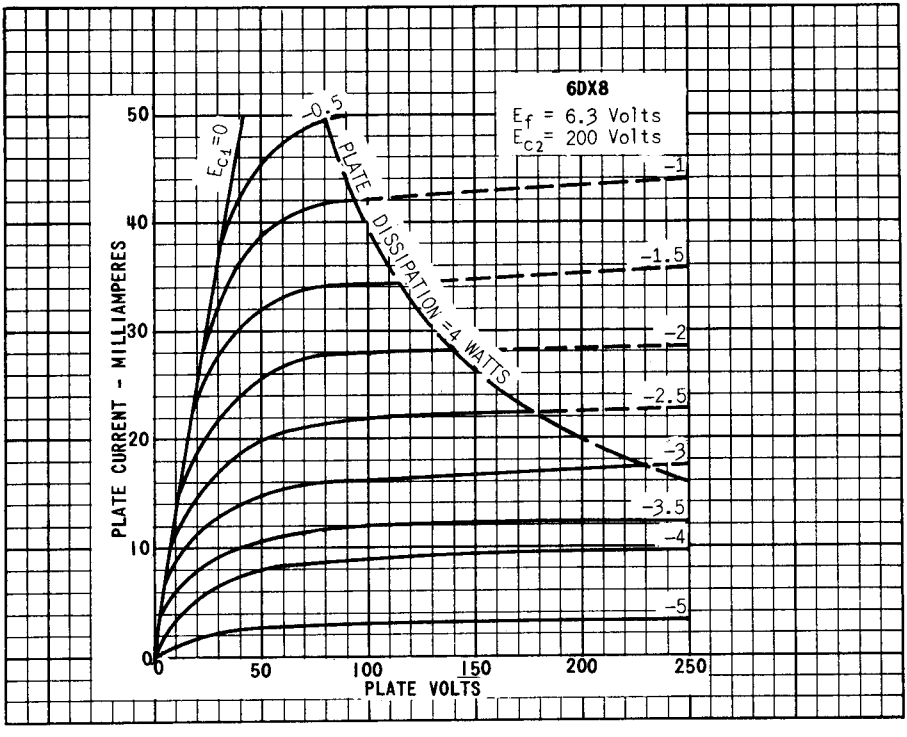
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

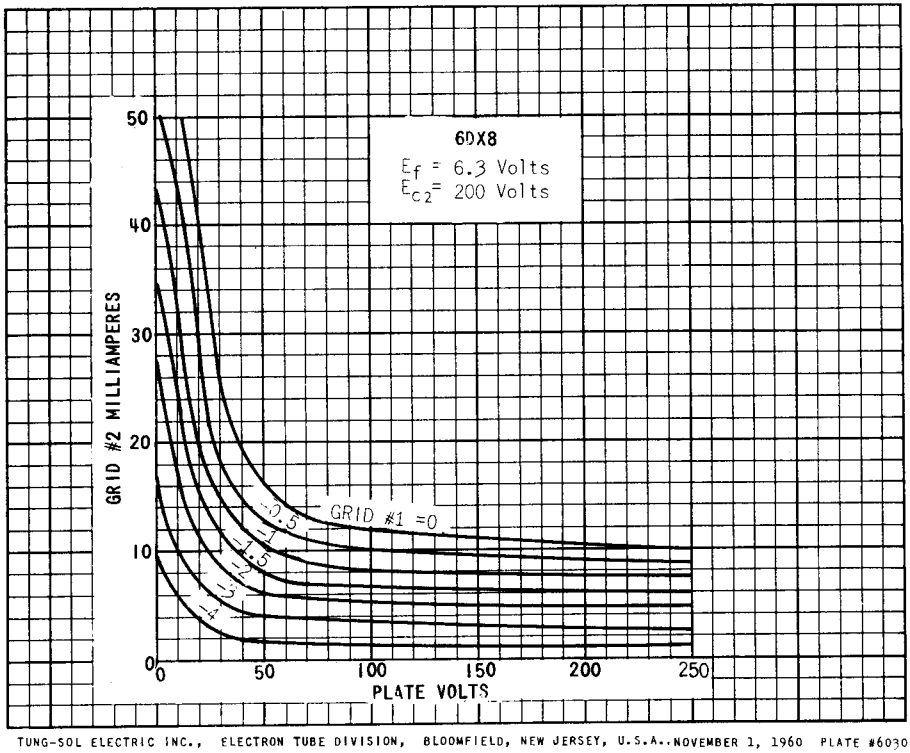
	TRIODE SECTION	PENTODE SECTION			
PLATE VOLTAGE	200	170	200	220	VOLTS
GRID #2 VOLTAGE		170	200	220	VOLTS
GRID #1 BIAS	-1.7	-2.1	-2.9	-3.4	VOLTS
PLATE CURRENT	3	18	18	18	MAM
GRID #2 CURRENT		3	3	3	MA.
TRANSCONDUCTANCE	4000	11000	10400	10000	μMHOS
PLATE RESISTANCE		0.1	0.13	0.15	MEG.
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1		36	36	36	
AMPLIFICATION FACTOR	65				

[A] POSITIVE AND NEGATIVE.

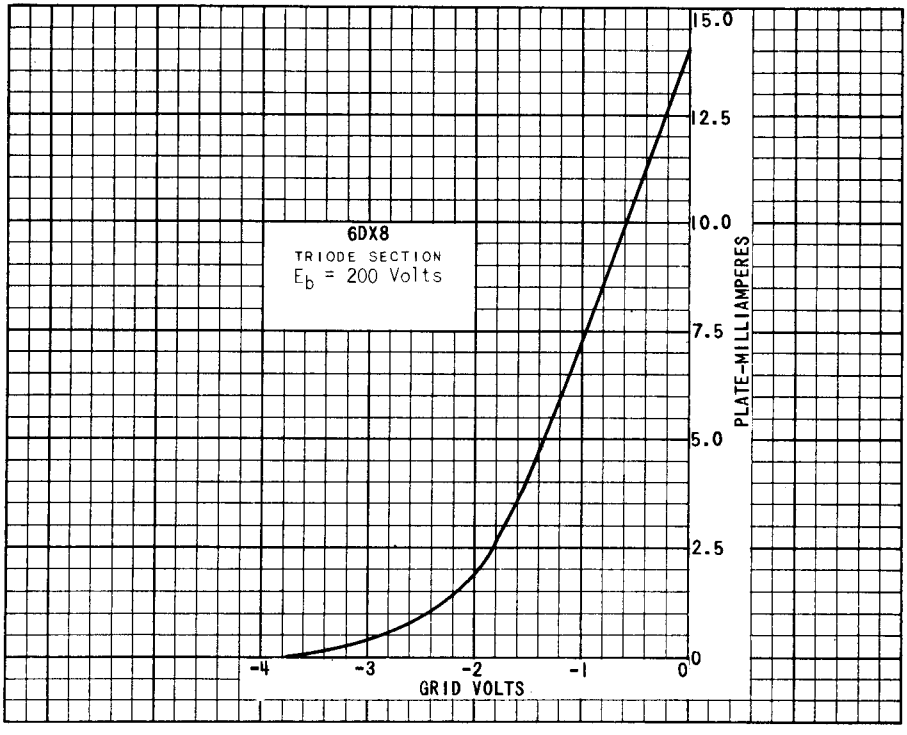
[B] MAX. PULSE DURATION 18% OF A CYCLE WITH A MAXIMUM OF 18 MICROSECONDS.




6DX8
E_f = 6.3 Volts
E_{c2} = 200 Volts
PLATE CURRENT - MILLIAMPERES
PLATE VOLTS
E_{c1}=0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-5
PLATE DISSIPATION =4 WATTS
0
10
20
30
40
50
50
100
150
200
250

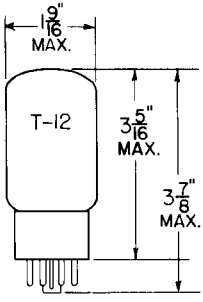

6DX8
E_f = 6.3 Volts
E_{c2}= 200 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
GRID #1 =0
-0.5
-1
-1.5
-2
-3
-4
0
10
20
30
40
50
50
100
150
200
250

TENTATIVE DATA



TUNG-SOL

DUAL PENTODE



GLASS BULB

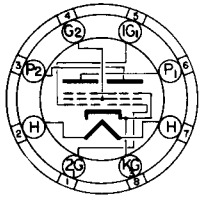
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT MEDIUM SHELL
8 PIN OCTAL

8JP

THE 6DY7 IS A DUAL BEAM POWER PENTODE IN THE 8 PIN OCTAL CONSTRUCTION. IT IS DESIGNED FOR APPLICATION IN STEREOPHONIC SOUND SYSTEMS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	400	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	15	WATTS
MAXIMUM GRID #2 DISSIPATION	2.0	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.47	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS - EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMPS.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-12.5	VOLTS
PLATE CURRENT	50	MA.
GRID #2 CURRENT	3.0	MA.
TRANSCONDUCTANCE	6 000	μMHOS
PLATE RESISTANCE (APPROX.)	28 000	OHMS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

CLASS AB_1 AMPLIFIER (TWO SECTIONS IN PUSH-PULL)

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
PLATE VOLTAGE	250	400	VOLTS
GRID #2 VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	-16	-20	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	40	VOLTS
ZERO SIGNAL PLATE CURRENT	77	58	MA.
MAXIMUM SIGNAL PLATE CURRENT	74	74	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	1.7	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	15.5	14.0	MA.
LOAD RESISTANCE (PLATE TO PLATE)	9 000	14 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	11	20	WATTS
TOTAL HARMONIC DISTORTION	2.5	2.0	PERCENT

CLASS A_1 – SINGLE SECTION [B]

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-12.5	VOLTS
PEAK AF SIGNAL VOLTAGE	12.5	VOLTS
ZERO SIGNAL PLATE CURRENT	50	MA.
MAXIMUM SIGNAL PLATE CURRENT	45	MA.
ZERO SIGNAL GRID #2 CURRENT	3.0	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	9.0	MA.
LOAD RESISTANCE	5 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	5.0	WATTS
TOTAL HARMONIC DISTORTION	9.0	PERCENT

[A]

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

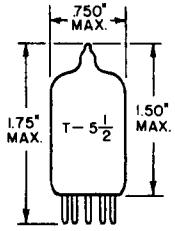
[B] THE EFFECTS OF CROSS-COUPLING BETWEEN SECTIONS, WITH BOTH SECTIONS OPERATING SIMULTANEOUSLY AS SINGLE CHANNEL CLASS A1 AMPLIFIERS, IS 50 db DOWN.

TUNG-SOL

TRIODE

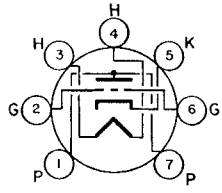
MINIATURE TYPE

MEDIUM MU TRIODE
FOR
UHF OSCILLATOR SERVICE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
7 DK

THE 6DZ4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR UHF OSCILLATOR SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6DZ4 IS IDENTICAL TO THE 2DZ4 AND THE 3DZ4.

DIRECT INTERELECTRODE CAPACITANCES
WITH SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K + E.S.)	2.2	pf
OUTPUT: P TO (H + K + E.S.)	1.3	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	225	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		50	VOLTS
HEATER POSITIVE WITH-RESPECT TO CATHODE			
DC		25	VOLTS
TOTAL DC AND PEAK		50	VOLTS

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MAXIMUM RATINGS
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

UHF OSCILLATOR SERVICE

PLATE VOLTAGE	135	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.3	WATTS
CATHODE CURRENT	20	MA.
GRID CURRENT	2	MA.

CHARACTERISTICS AND TYPICAL OPERATION
CLASS A1 AMPLIFIER

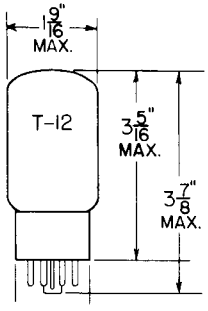
PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
PLATE CURRENT	15	MA.
TRANSCONDUCTANCE	6,700	μMHOS
AMPLIFICATION FACTOR	14	
PLATE RESISTANCE	APPROX. 2,000	OHMS
GRID VOLTAGE FOR I_b = 20 μA	APPROX. -11	VOLTS

OSCILLATOR AT 1000 Mc/s
MEASURED IN JEDEC STANDARD OSCILLATOR NO. 400

PLATE SUPPLY VOLTAGE	80	VOLTS
PLATE DROPPING RESISTOR	2,700	OHMS
GRID RESISTOR	10,000	OHMS
PLATE CURRENT	15.5	MA.
GRID CURRENT	APPROX. 800	μA

TUNG-SOL

TWIN PENTODE



GLASS BULB

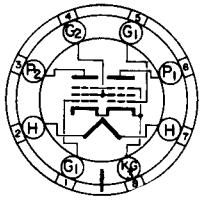
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 1.52 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT MEDIUM SHELL
8 PIN OCTAL

8JP

THE 6DZ7 IS A TWIN POWER PENTODE ESPECIALLY SUITABLE FOR COMPACT STEREO SYSTEMS. IT IS DESIGNED FOR USE IN THE OUTPUT STAGE OF HIGH-FIDELITY AUDIO AMPLIFIERS.

DIRECT INTERELECTRODE CAPACITANCES - approx.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	.07	0.5	μμf
INPUT	11	11	μμf
OUTPUT	5.0	5.0	μμf
GRID #1, SECTION 1 TO GRID #1, SECTION 2	0.03		μμf
PLATE, SECTION 1 TO PLATE, SECTION 2	1.5		μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	440	VOLTS
MAXIMUM SCREEN VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	13.2	WATTS
MAXIMUM SCREEN DISSIPATION, TOTAL	4.0	WATTS

[A] EACH SECTION UNLESS OTHERWISE INDICATED.

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TUNG-SOL

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.27	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS - EACH SECTION

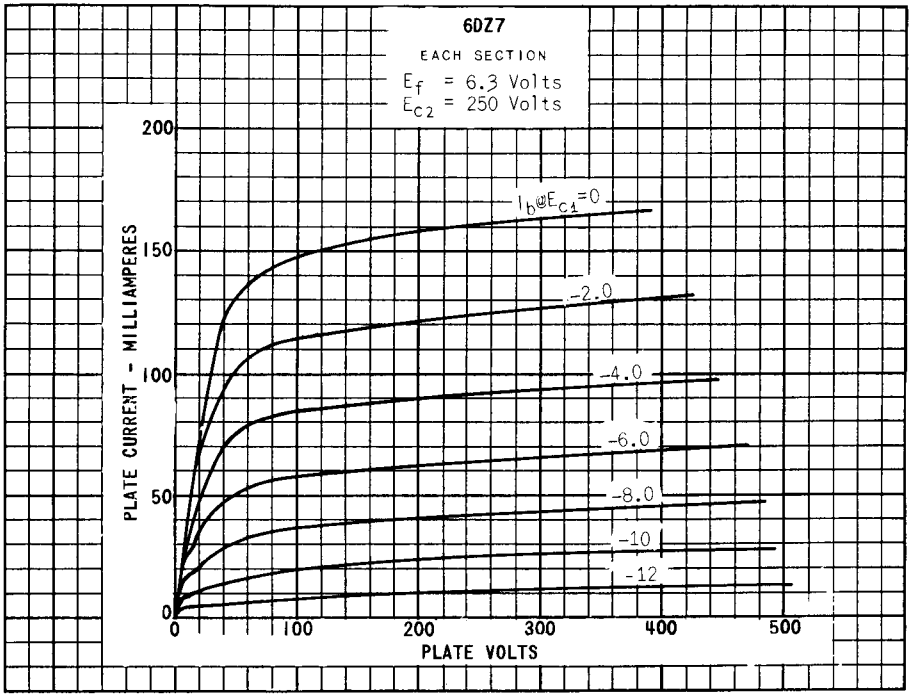
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.52	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−7.3	VOLTS
PLATE RESISTANCE (APPROX.)	38000	OHMS
TRANSCONDUCTANCE	11300	μMHOS
PLATE CURRENT	48	MA.
SCREEN CURRENT	5.5	MA.

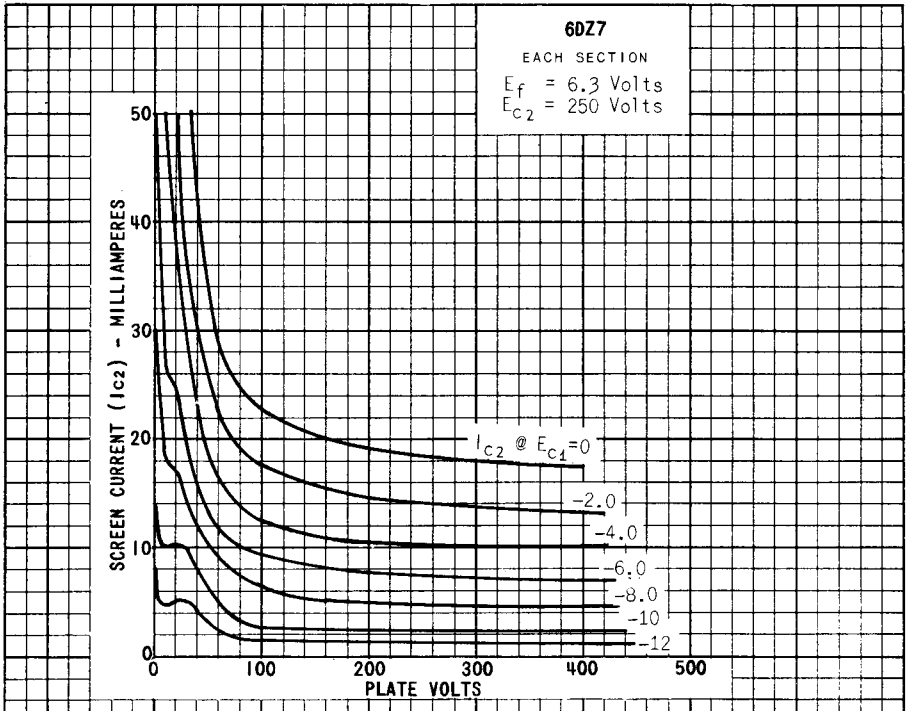
PUSH-PULL CLASS AB_1 AMPLIFIER - SINGLE TUBE

	FIXED BIAS	CATHODE BIAS	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	1.52		AMP.
PLATE VOLTAGE	400	300	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	−11	---	VOLTS
CATHODE-BIAS RESISTOR	---	120	OHMS
PEAK AF GRID-TO-GRID VOLTAGE	22	22	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	66	MA.
MAXIMUM-SIGNAL PLATE CURRENT	100	80	MA.
ZERO-SIGNAL SCREEN CURRENT	4.0	7.0	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	13	15	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	9000	9000	OHMS
TOTAL HARMONIC DISTORTION	2.5	3.5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	18	12	WATTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE TUBE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN TUBE CHARACTERISTICS THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] EACH SECTION UNLESS OTHERWISE INDICATED.





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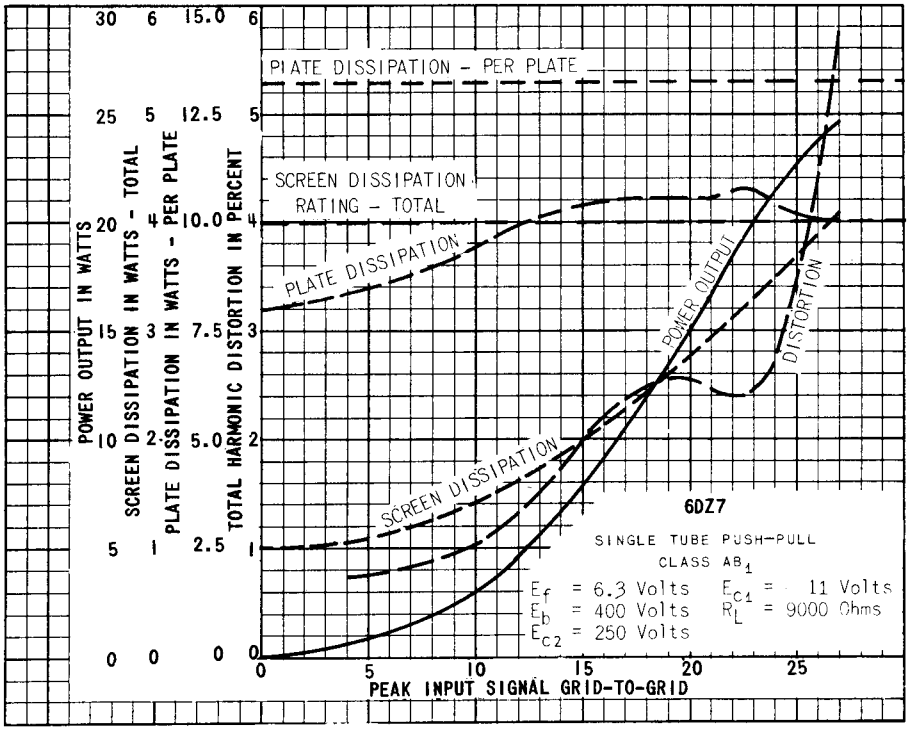


PLATE DISSIPATION - PER PLATE
SCREEN DISSIPATION RATING - TOTAL
PLATE DISSIPATION
SCREEN DISSIPATION
POWER OUTPUT
DISTORTION
POWER OUTPUT IN WATTS
SCREEN DISSIPATION IN WATTS - TOTAL
PLATE DISSIPATION IN WATTS - PER PLATE
TOTAL HARMONIC DISTORTION IN PERCENT
PEAK INPUT SIGNAL GRID-TO-GRID
6DZ7
SINGLE TUBE PUSH-PULL
CLASS AB1
Ef = 6.3 Volts
Eb = 400 Volts
Ec2 = 250 Volts
Ec1 = -11 Volts
RL = 9000 Ohms

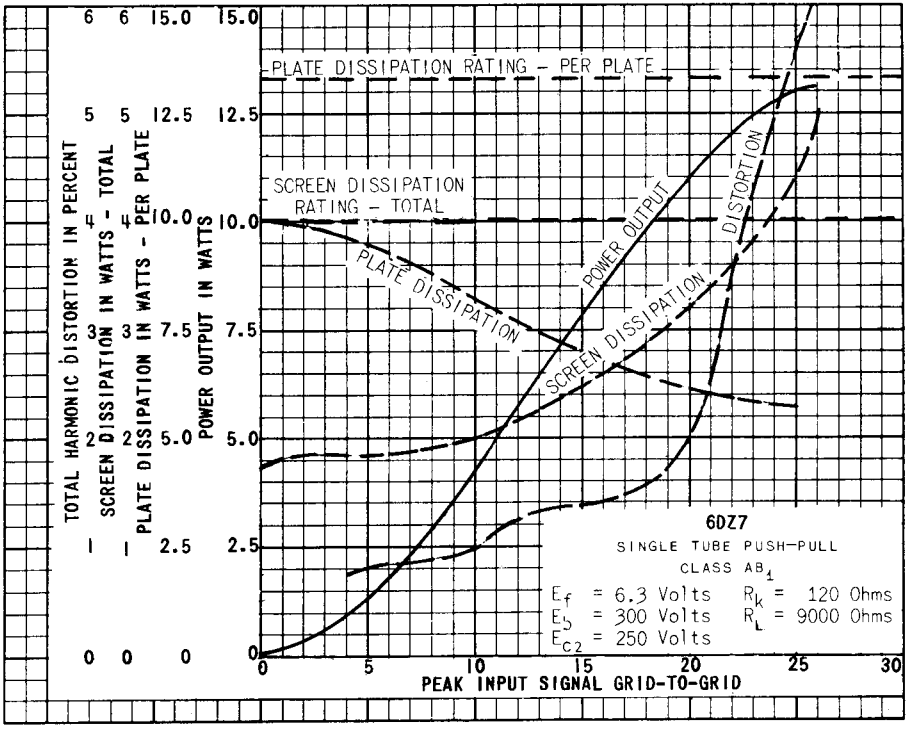
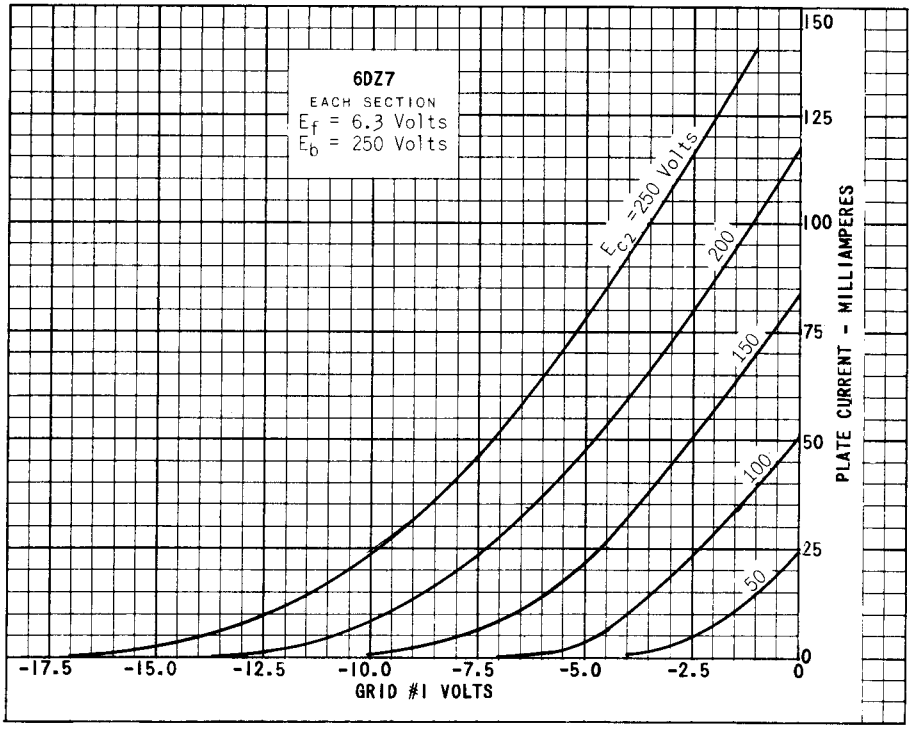
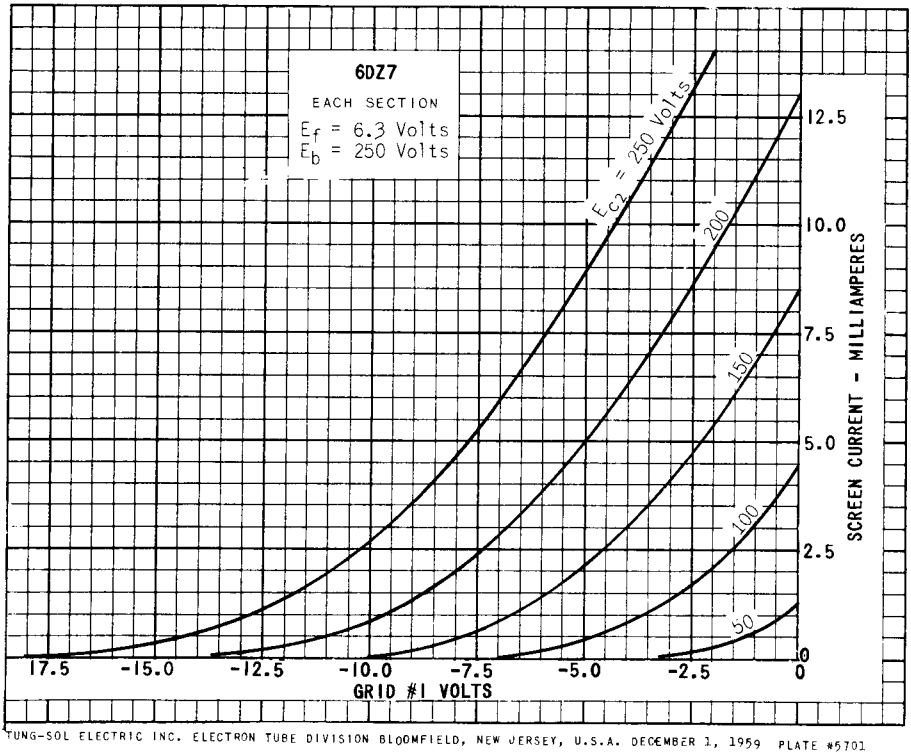


PLATE DISSIPATION RATING - PER PLATE
SCREEN DISSIPATION RATING - TOTAL
PLATE DISSIPATION
POWER OUTPUT
SCREEN DISSIPATION
DISTORTION
TOTAL HARMONIC DISTORTION IN PERCENT
SCREEN DISSIPATION IN WATTS - TOTAL
PLATE DISSIPATION IN WATTS - PER PLATE
POWER OUTPUT IN WATTS
PEAK INPUT SIGNAL GRID-TO-GRID
6DZ7
SINGLE TUBE PUSH-PULL
CLASS AB1
Ef = 6.3 Volts
Eb = 300 Volts
Ec2 = 250 Volts
RK = 120 Ohms
RL = 9000 Ohms





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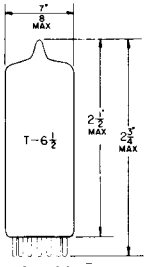
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

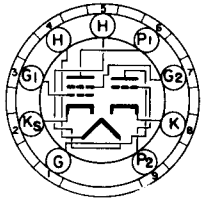
COATED UNIPOTNETIAL CATHODE

HEATER

6.3 VOLTS 0.90 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 6DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE		PENTODE	
HEATER VOLTAGE		6.3		VOLTS
MAXIMUM PLATE VOLTAGE	150		150	VOLTS
MAXIMUM PLATE DISSIPATION	.75		6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---		135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---		1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110		110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0		0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0		60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE		6.3		VOLTS
HEATER CURRENT		0.90		AMP.
PLATE VOLTAGE	120	---	145	VOLTS
GRID #2 VOLTAGE	---		120	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	1500		180	OHMS
PLATE CURRENT	0.8		45	MA.
GRID #2 CURRENT	---		6	MA.
TRANSCONDUCTANCE	1400		7500	μMHOS
LOAD RESISTANCE	---		2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5		---	VOLTS
AMPLIFICATION FACTOR	100		---	
POWER OUTPUT	---		2.0	WATTS

SIMILAR TYPE REFERENCE: *Except for heater ratings the 6DZ8 is identical to the 9DZ8, 12DZ8, 18DZ8, and the 35DZ8.*

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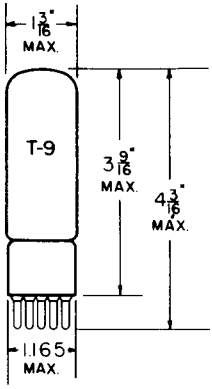
TUNG-SOL

TRIODE INDICATOR



GLASS BULB

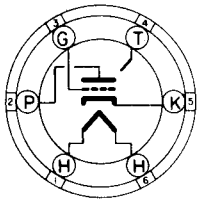
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL 6 PIN BASE

6R

THE 6E5 CONSISTS OF A CIRCULAR FLUORESCENT TARGET WITH AN INDICATING SHADOW ANGLE CONTROLLED BY AN INTERNALLY CONNECTED SHARP CUT-OFF AMPLIFIER. WHEN THE 6E5 IS USED AS A TUNING INDICATOR AVC VOLTAGE IS APPLIED TO THE TRIODE GRID.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE	250	VOLTS
MAXIMUM TARGET VOLTAGE	250	VOLTS
MINIMUM TARGET VOLTAGE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE AND TARGET SUPPLY VOLTAGE	200	250	VOLTS
SERIES TRIODE-PLATE RESISTOR	1	1	MEGOHM
TARGET CURRENT (SUBJECT TO WIDE VARIATION)[A]	3	4	MA.
TRIODE-PLATE CURRENT[A]	0.19	0.24	MA.
GRID BIAS (APPROX.) FOR SHADOW ANGLE = 0°	-6.5	-8.0	VOLTS
GRID BIAS (APPROX.) FOR SHADOW ANGLE = 90°	0	0	VOLTS

[A] MEASURED AT ZERO GRID BIAS.

→ INDICATES A CHANGE OR ADDITION.

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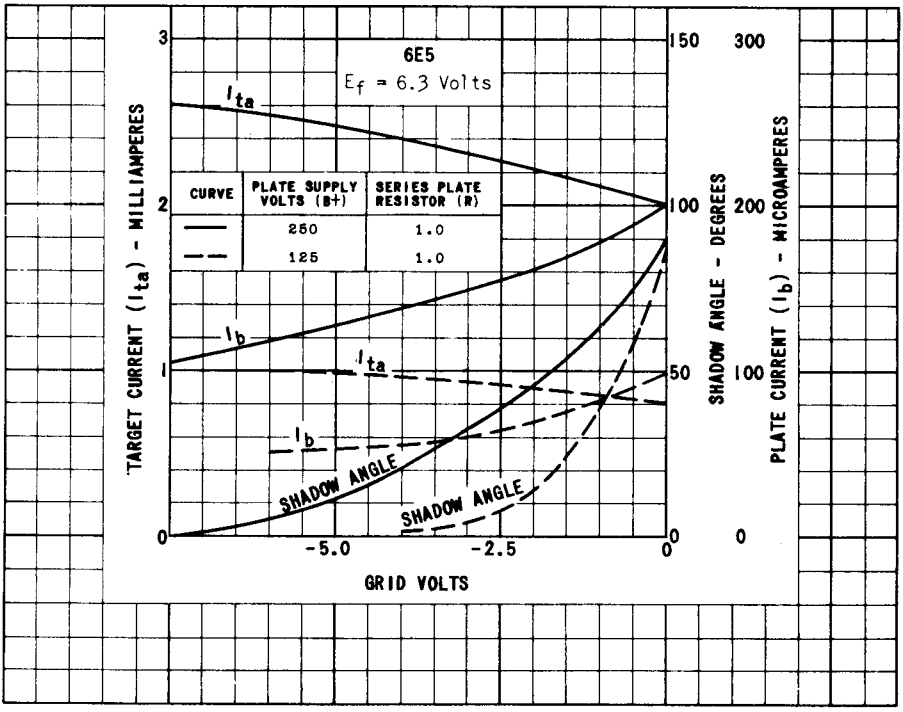
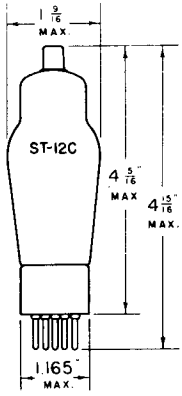
(2E5) 6E5


6E5
E_f = 6.3 Volts
CURVE
PLATE SUPPLY VOLTS (B+)
SERIES PLATE RESISTOR (R)
250
1.0
125
1.0
I_{ta}
I_b
I_{ta}
I_b
SHADOW ANGLE
SHADOW ANGLE
TARGET CURRENT (I_{ta}) - MILLIAMPERES
SHADOW ANGLE - DEGREES
PLATE CURRENT (I_b) - MICROAMPERES
GRID VOLTS
3
2
1
0
150
100
50
0
300
200
100
0
-5.0
-2.5
0

6E7

TUNG-SOL



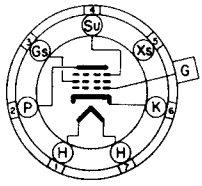
TRIPLE GRID

REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



7H
BOTTOM VIEW

SMALL 7 PIN BASE

THE TUNG-SOL 6E7 IS A TRIPLE GRID REMOTE CUT-OFF AMPLIFIER. IT IS SUITABLE FOR SERVICE WITH AVC IN RF AND IF AMPLIFIERS. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6D6, 6U7G AND THE 58.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS B_2 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	-3.0	-3.0	VOLTS
PLATE CURRENT	8.0	8.2	MA.
SCREEN CURRENT	2.2	2.0	MA.
PLATE RESISTANCE	0.25	0.8	MEGOHM
TRANSCONDUCTANCE	1500	1600	μMHOS
AMPLIFICATION FACTOR	375	1280	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	-	-42.5	VOLTS

SUPPRESSOR GRID CONNECTED TO CATHODE AT SOCKET

PLATE
900-1

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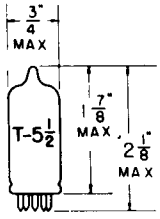
TUNG-SOL

TETRODE

MINIATURE TYPE



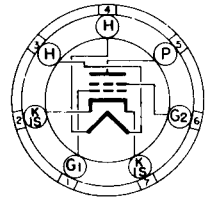
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.20 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7EW

THE 6EA5 IS A SHARP CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR HIGH PLATE VOLTAGE OPERATION AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS, AND WARM-UP TIME THE 6EA5 IS IDENTICAL TO THE 2EA5 AND THE 3EA5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (G1 TO P) (MAX.)	0.05	0.06	μμf
INPUT: G1 TO (H+K+G2+I.S.)	4.5	3.8	μμf
OUTPUT: P TO (H+K+G2+I.S.)	3.0	2.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	6.3±10%	6.3±10%	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	250	250	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.25	3.25	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	0.5	0.5	WATTS
MAXIMUM CATHODE CURRENT (DC)	20	20	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC	100	100	100	VOLTS
TOTAL DC AND PEAK	200	200	200	VOLTS

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

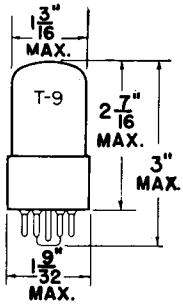
HEATER VOLTAGE	6.3±10%	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.20	0.20	0.20	AMPS.
PLATE VOLTAGE	250	250	250	VOLTS
GRID #2 VOLTAGE	140	140	140	VOLTS
GRID #1 VOLTAGE	−1.0	−1.0	−1.0	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.15	0.15	MEGOHM
TRANSCONDUCTANCE	8000	8000	8000	μMHO
PLATE CURRENT	10	10	10	MA.
GRID #2 CURRENT	0.95	0.95	0.95	MA.
GRID #1 VOLTAGE FOR GM LESS THAN 100 μMHO	−6	−6	−6	VOLTS

B

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DOUBLE-TRIODE

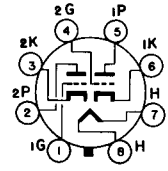


GLASS BULB
INTERMEDIATE SHELL
8 PIN OCTAL 88-6
OUTLINE DRAWING
JEDEC 9-5

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.05 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 6EA7 IS A DISSIMILAR DOUBLE-TRIODE DESIGNED FOR USE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. SECTION ONE, A HIGH-MU TRIODE, IS INTENDED FOR SERVICE AS AN OSCILLATOR; SECTION TWO, A LOW-MU, HIGH PERVEANCE TRIODE, IS INTENDED FOR SERVICE AS AN AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	4.0	8.0	μμf
INPUT	2.2	6.0	μμf
OUTPUT	0.6	1.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	VERTICAL OSCILLATOR SERVICE (SECTION 1)[A]	VERTICAL DEFLECTION AMPLIFIER (SECTION 2)[A]	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM ALLOWABLE HEATER VOLTAGE	5.7 to 6.9		VOLTS
MAXIMUM DC PLATE VOLTAGE	350	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	10[B]	WATTS
MAXIMUM DC CATHODE CURRENT	---	50	MA.
MAXIMUM PEAK CATHODE CURRENT	---	175	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
WITH FIXED BIAS	1.0	1.0	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS ←

	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
PLATE VOLTAGE	250	60	175	VOLTS
GRID VOLTAGE	-3.0	0[C]	-25	VOLTS
AMPLIFICATION FACTOR	66	---	5.5	
PLATE RESISTANCE (APPROX.)	30 000	---	920	OHMS
TRANSCONDUCTANCE	2 200	---	6 000	μMHOS
PLATE CURRENT	2.0	100	40	MA.
GRID VOLTAGE (APPROX.)				
I_b = 20 μAMPS.	5.3	---	---	VOLTS
GRID VOLTAGE (APPROX.)				
I_b = 200 μAMPS.	---	---	-45	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

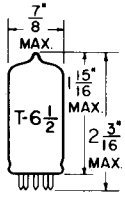
[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

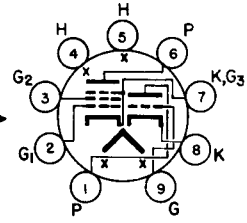


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AE

THE 6EA8 IS A SHARP CUTOFF PENTODE AND A TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE IS INTENDED PRIMARILY FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 6EA8 IS IDENTICAL TO THE 5EA8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.01	0.02	pf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.0	5.0	pf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	pf
HEATER TO CATHODE: (Pk TO h)	3.0[B]	3.0	pf
TRIODE SECTION:			
GRID TO PLATE: (Tg TO Tp)	1.7	1.7	pf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.2	3.0	pf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	1.9	1.4	pf
HEATER TO CATHODE: (Tk TO H)	3.0[B]	3.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE			
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS

→ INDICATES A CHANGE.

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM–UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	125	150	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	---	
CATHODE–BIAS RESISTOR	---	56	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	200 000	5 000	OHMS
TRANSCONDUCTANCE	6 400	8 500	μAMPS
PLATE CURRENT	12	18	MA.
SCREEN CURRENT	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-9	-12	VOLTS

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

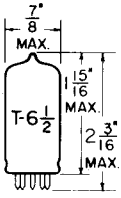
* HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

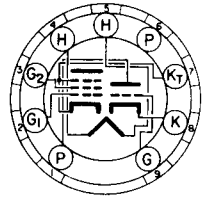
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.45±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9AE

THE 6EA8 IS A SHARP CUTOFF PENTODE AND A TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE IS INTENDED PRIMARILY FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 6EA8 IS IDENTICAL TO THE 5EA8.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH[A] SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.01	0.02	μμf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.0	5.0	μμf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	μμf
HEATER TO CATHODE:(Pk TO h)	3.0[B]	3.0	μμf
TRIODE SECTION:			
GRID TO PLATE: (Tg TO Tp)	1.7	1.7	μμf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.2	3.0	μμf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	1.9	1.4	μμf
HEATER TO CATHODE: (Tk TO H)	3.0[B]	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE			
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS

→ INDICATES A CHANGE.

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM–UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

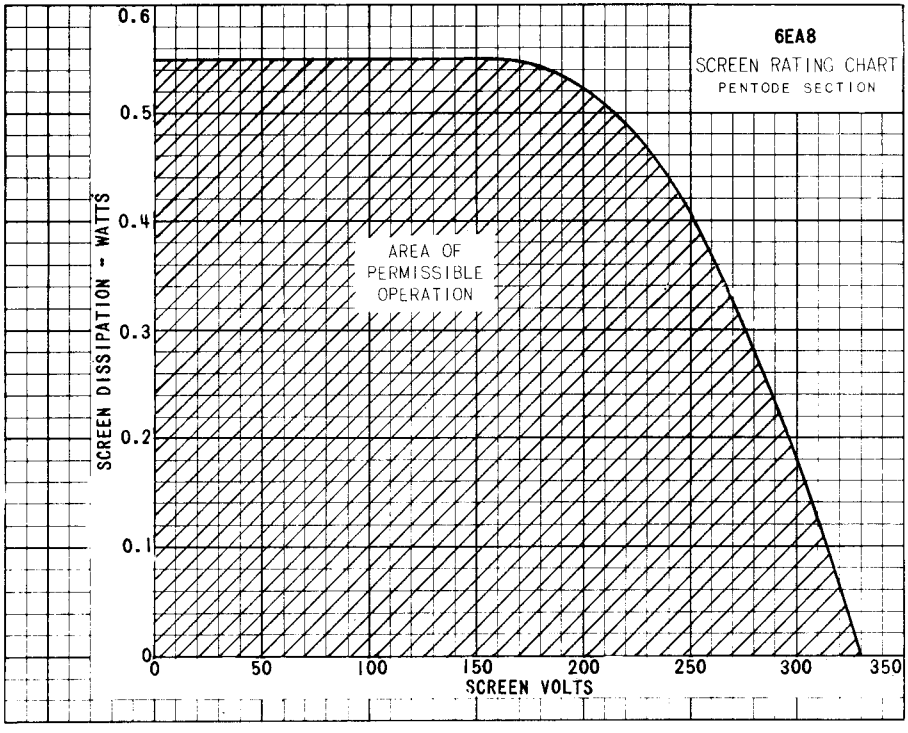
AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	125	150	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	---	
CATHODE–BIAS RESISTOR	---	56	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	80 000	5 000	OHMS
TRANSCONDUCTANCE	6 400	8 500	μAMPS
PLATE CURRENT	12	18	MA.
SCREEN CURRENT	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-9	-12	VOLTS

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

*HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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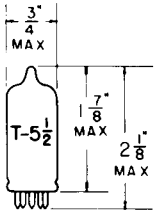
DOUBLE DIODE

MINIATURE TYPE



GLASS BULB

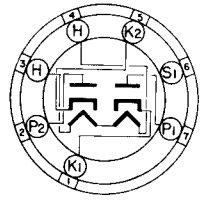
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.30 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

6BT

THE 6EB5 IS A DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR LOW CURRENT AND HIGH PEAK INVERSE VOLTAGE IN VOLTAGE DOUBLER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PLATE INPUT: P TO (K+H+I.S.)	2.4	1.7	μμd
CATHODE INPUT: K TO (P+H+I.S.) EACH UNIT	2.8	2.6	μμf
COUPLING: PLATE TO PLATE (1P TO 2P) (MAX.)	0.04	0.10	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	550	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	40	MA.
MAXIMUM DC OUTPUT CURRENT, EACH PLATE	5.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	200	VOLTS
TOTAL DC AND PEAK	330	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.30	AMP.
DIODE VOLTAGE DROP WITH DIODE CONDUCTING 11 MA. EACH PLATE (APPROX.)	10	VOLTS

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NOTES

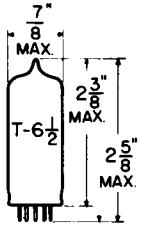
A. WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 6.

B. DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACEPTABLE SERVICEABILITY OF THE DEVICE TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

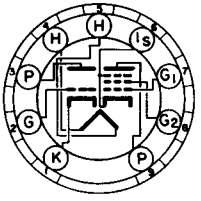


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 6EB8 IS A HIGH-MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9 PIN-MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER WHILE THE PENTODE SECTION HAS A CONTROLLED PLATE KNEE CHARACTERISTIC AND IS DESIGNED FOR USE AS A VIDEO AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION:		
GRID TO PLATE	4.4	μμf
INPUT: G TO (H + K)	2.4	μμf
OUTPUT: P TO(H + K)	0.36	μμf
PENTODE SECTION:		
GRID #1 TO PLATE (MAX.)	0.1	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$+I.S.)	11	μμf
OUTPUT: P TO ($H+K+G_2+G_3$+I.S.)	4.2	μμf
COUPLING:		
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE			
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION		1.1	WATTS

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TUNG-SOL

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.75	0.75	AMP.
PLATE VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2		VOLTS
CATHODE BIAS RESISTOR		68	OHMS
PLATE CURRENT	2	25	MA.
GRID #2 CURRENT		7	MA.
TRANSCONDUCTANCE	2 700	12 500	μMHOS
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE (APPROX.)	37 000	75 000	OHMS
GRID #1 VOLTAGE FOR I_b= 100 μA (APPROX.)		-9	VOLTS
GRID #1 VOLTAGE FOR I_b= 20 A (APPROX.)	-5		

PLATE KNEE CHARACTERISTICS - INSTANTANEOUS VALUES

E_b = 45 VOLTS, E_{c2} = 125 VOLTS AND E_{c1} = 0 VOLTS

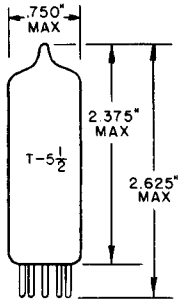
PLATE CURRENT	40	MA.
GRID #2 CURRENT	15	MA.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

PENTODE

MINIATURE TYPE

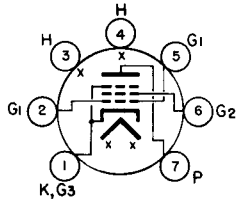


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

FOR USE IN
AUDIO OUTPUT STAGES OF
RADIO AND TV RECEIVERS
AND PHONOGRAPHS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 6EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS BEEN SPECIFICALLY DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS AND PHONOGRAPHS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, IT IS IDENTICAL TO THE 12EH5, 25EH5 AND THE 50EH5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.65	pf
GRID 1 TO CATHODE & GRID 3, HEATER & GRID 2	17	pf
PLATE TO CATHODE & GRID 3, HEATER & GRID 2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200 [B]	VOLTS

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AMPLIFIER

PLATE VOLTAGE	→ 150	VOLTS
GRID 2 (SCREEN-GRID) VOLTAGE	→ 130	VOLTS
PLATE DISSIPATION	→ 5.5	WATTS
GRID 2 INPUT	→ 2	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

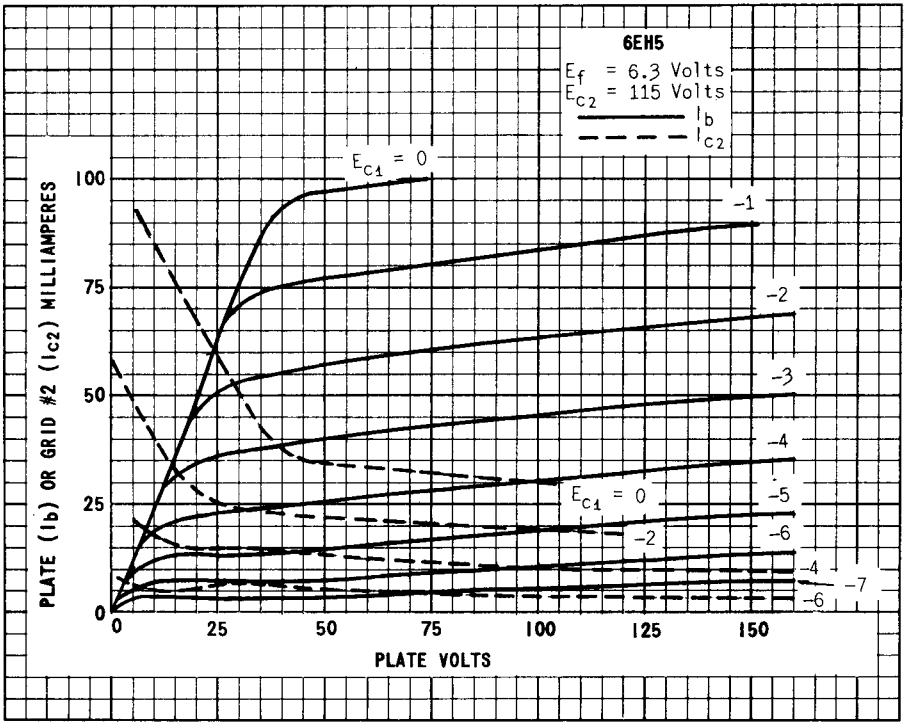
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID 2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID 1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	42	MA.
SIGNAL PLATE CURRENT (MAX.)	42	MA.
ZERO-SIGNAL GRID 2 CURRENT	11.5	MA.
SIGNAL GRID 2 CURRENT (MAX.)	14.5	MA.
TRANSCONDUCTANCE	14,600	μMHOS
PLATE RESISTANCE (APPROX.)	11,000	OHMS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
SIGNAL POWER OUTPUT (MAX.)	1.4	WATTS

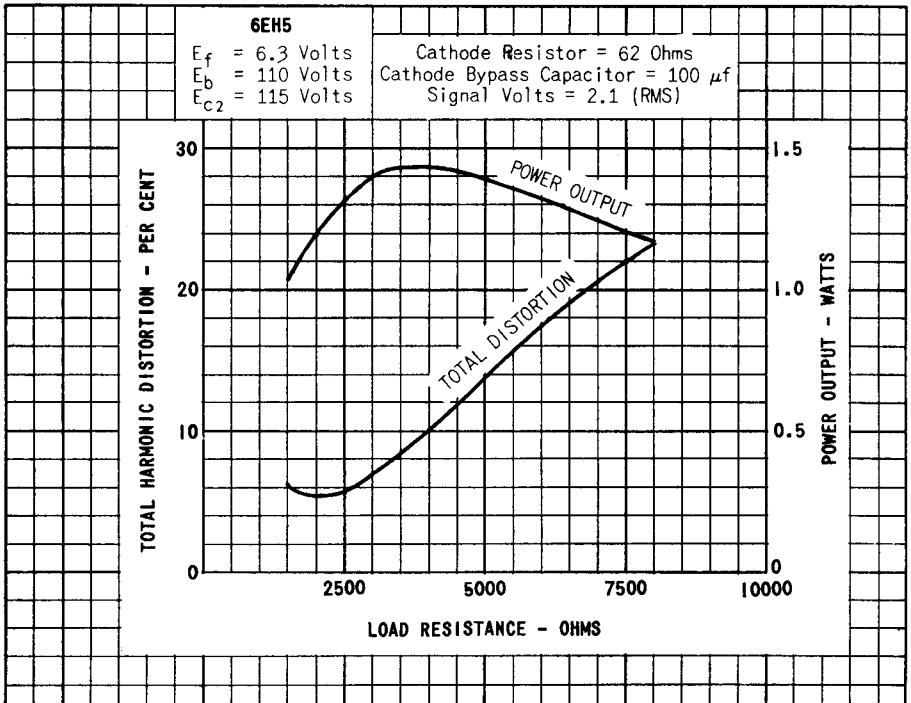
PUSH-PULL AF POWER AMPLIFIER - CLASS AB1

VALUES ARE FOR TWO TUBES

PLATE SUPPLY VOLTAGE	140	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR	68	OHMS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	9.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL GRID 2 CURRENT	11	MA.
MAX.-SIGNAL GRID 2 CURRENT	17.7	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAX.-SIGNAL POWER OUTPUT	3.8	WATTS.

→ INDICATES A CHANGE.





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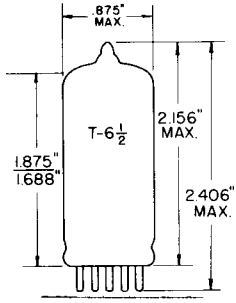
TUNG-SOL

REMOTE-CUTOFF PENTODE

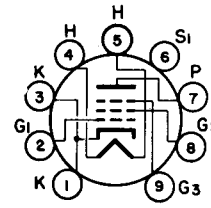
MINIATURE TYPE



GLASS BULB
MINIATURE
9 PIN BASE E9-1

UNIPOTENTIAL CATHODE

HIGH Gm, SMALL SIGNAL
RF & IF AMPLIFIER
WITH GAIN CONTROL



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AQ

THE 6EH7 IS A REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT FEATURES VERY HIGH Gm WITH A REMOTE CUTOFF AND IS DESIGNED FOR FREQUENCIES INTO THE VHF RANGE. ITS CHIEF APPLICATION IS IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P) MAX.	0.0055	pf
INPUT: G1 TO (H+G2+G3+K+IS)	9.5	pf
OUTPUT: P TO (H+G2+G3+K+IS)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
CURRENT OPERATION		300±20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		165	VOLTS

MAXIMUM RATINGS

DESING CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 VOLTAGE	250	VOLTS
GRID #2 DISSIPATION	0.65	WATTS
CATHODE CURRENT	20	MA
GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

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TUNG-SOL

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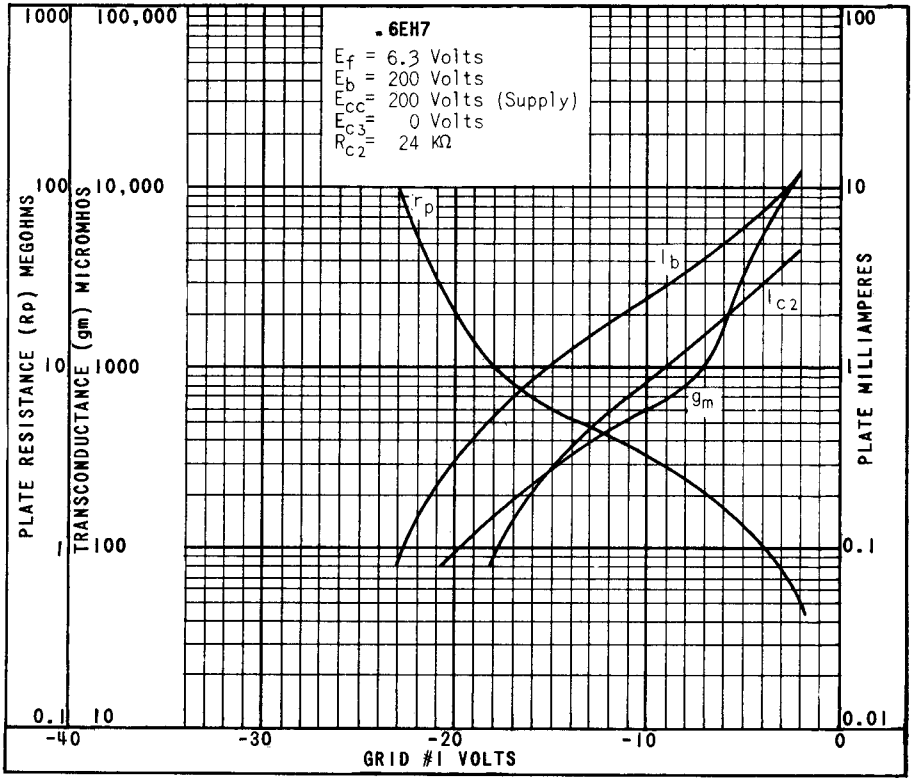
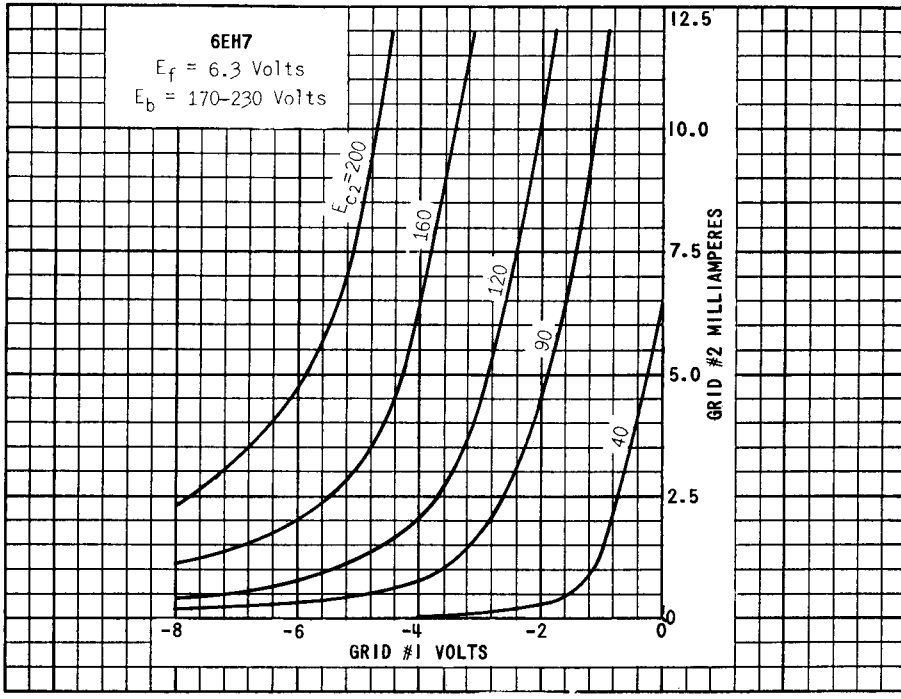
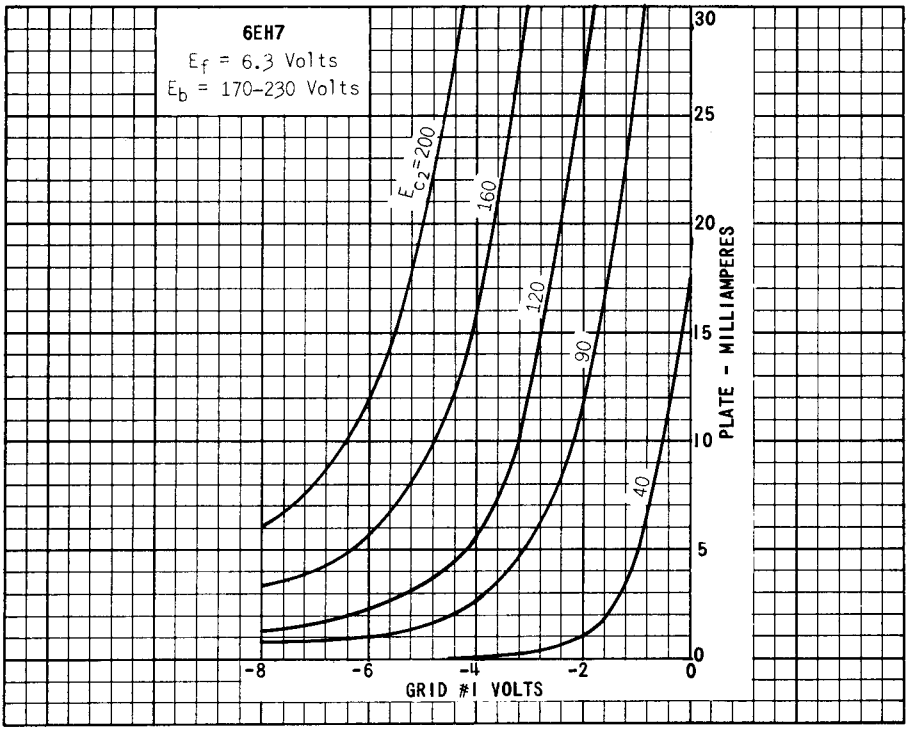
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	200	200	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE (SUPPLY)	90	200	VOLTS
GRID #2 SERIES RESISTOR	0	24	KILOHMS
GRID #1 VOLTAGE	−2	−2	VOLTS
PLATE CURRENT	12	---	MA.
GRID #2 CURRENT	4.5	---	MA.
TRANSCONDUCTANCE	12500	12500	μMHOS
PLATE RESISTANCE	0.5	---	MEGOHMS
GRID #1 IMPEDANCE AT 40 MC	13	---	KILOHMS
GRID #1 CUTOFF: E_{c1} =−6.5		1250	μMHOS
E_{c1} =−9.5		625	μMHOS
E_{c1}=−19.5		125	μMHOS
GRID #1 VOLTAGE FOR A CROSS-MODULATION FACTOR OF 1%:			
E_{c1} =−6.5		100	MV.
E_{c1} =−9.5		160	MV.
E_{c1}=−19.5		450	MV.







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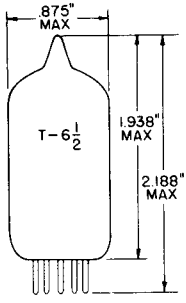


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TRIODE PENTODE

MINIATURE TYPE

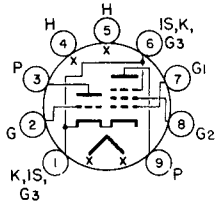
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9JG

THE 6EH8 IS A MEDIUM MU-TRIODE AND A SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT THE HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
TRIODE:*			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H+K+P_K+P_{G3}+I.S.)	2.8	2.8	pf
OUTPUT: P TO (H+K+P_K+P_{G3}+I.S.)	2.2	1.7	pf
PENTODE:*			
GRID #1 TO PLATE (MAX.)	.012	.020	pf
INPUT: G_1 TO (H+K+G_2+G_3+TK+I.S.)	4.8	4.8	pf
OUTPUT: P TO (H+K+G_2+G_3+TK+I.S.)	3.2	2.4	pf
CATHODE TO HEATER: H TO (TK+PK+PG+P_{G3}+I.S)	8.5	8.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE			
MAXIMUM PLATE DISSIPATION	2.5	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION		0.5	WATT

*INDICATES AN ADDITION.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [A]

	TRIODE SECTION	PENTODE SECTION	
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.5	0.25	MEGOHM
WITH SELF BIAS	1.0	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM-UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE SECTION	PENTODE SECTION		
PLATE VOLTAGE	125	100	125	VOLTS
GRID #2 VOLTAGE		70	125	VOLTS
GRID #1 VOLTAGE	-1.0	0	-1.0	VOLTS
PLATE CURRENT	13.5		12	MA.
GRID #2 CURRENT			4.0	MA.
TRANSCONDUCTANCE	7500	6500	6000	μMHOS
AMPLIFICATION FACTOR	40			
PLATE RESISTANCE (APPROX.)			0.17	MEGOHM
GRID #1 VOLTAGE FOR I_b=20 μA (APPROX.)	-9		-10	VOLTS

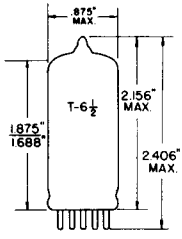
[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

TUNG-SOL

SHARP CUTOFF PENTODE

-MINIATURE TYPE



MINIATURE BUTTON 9 PIN BASE E9-1

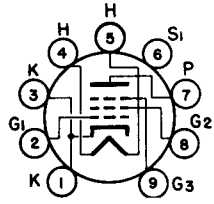
OUTLINE DRAWING SPECIAL

GLASS BULB

COATED UNIPOTENTIAL CATHODE

FOR IF CIRCUITS IN TV RECEIVERS

ANY MOUNTING POSITION



BASING DIAGRAM

JEDEC 9AQ

BOTTOM VIEW

THE 6EJ7 IS A HIGH TRANSCONDUCTANCE SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN IF AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.005	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	10	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		150	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239[B]

PLATE VOLTAGE WITH I_b = O MA.	550	VOLTS
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE WITH I_{c2} = O MA	550	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID #2 DISSIPATION	0.9	WATTS
CATHODE CURRENT	25	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHM

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TUNG-SOL

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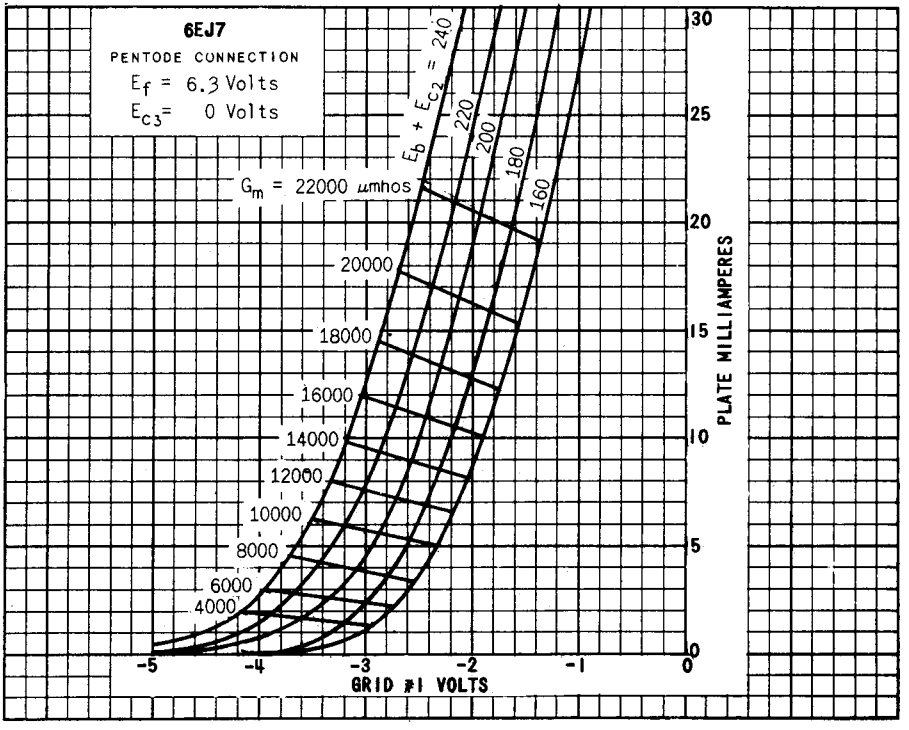
TYPICAL OPERATING CHARACTERISTICS

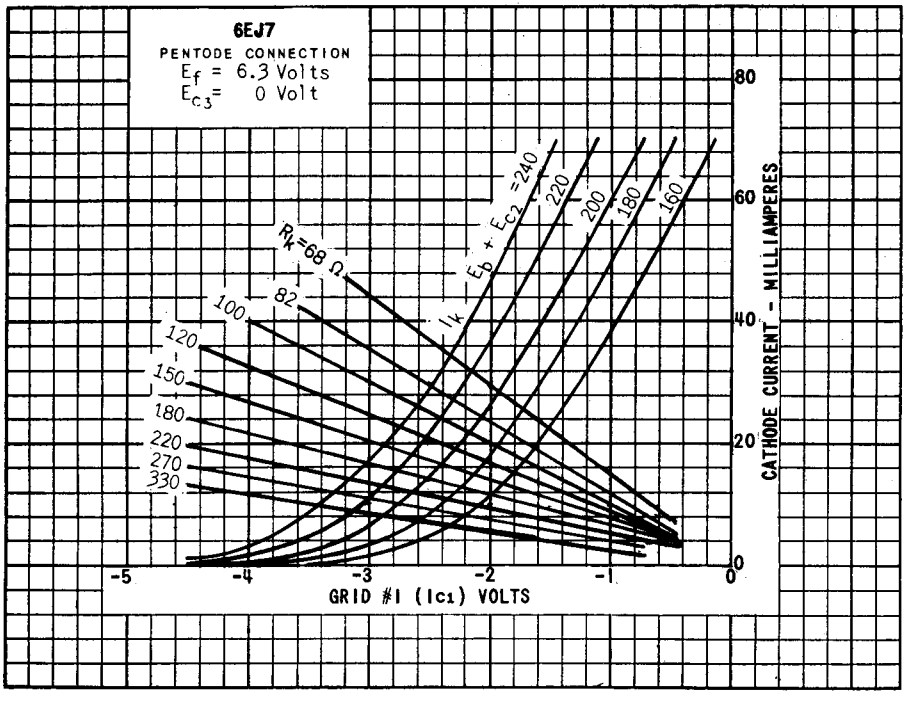
CLASS A_1 AMPLIFIER

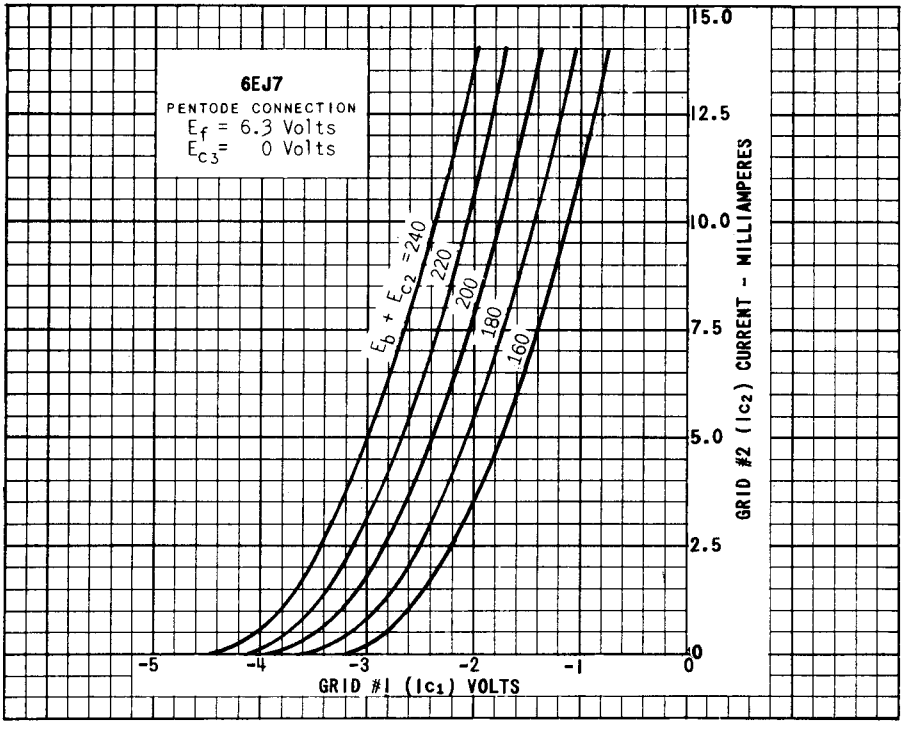
PLATE VOLTAGE	200	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-2.5	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	4.1	MA.
TRANSCONDUCTANCE	15000	μMHOS
AMPLIFICATION FACTOR (G2 TO G1)	60	
PLATE RESISTANCE (APRROX)	0.35	MEGOHM
GRID #1 IMPEDANCE AT 40MC	30000	OHMS[C]

[B] FOR PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER VOLTAGE.

[C] INPUT DAMPING OF TUBE AND TYPICAL CERAMIC SOCKET WITH BOTH CATHODE LEADS TIED DIRECTLY TO GROUND IS ABOUT 10,000 OHMS.







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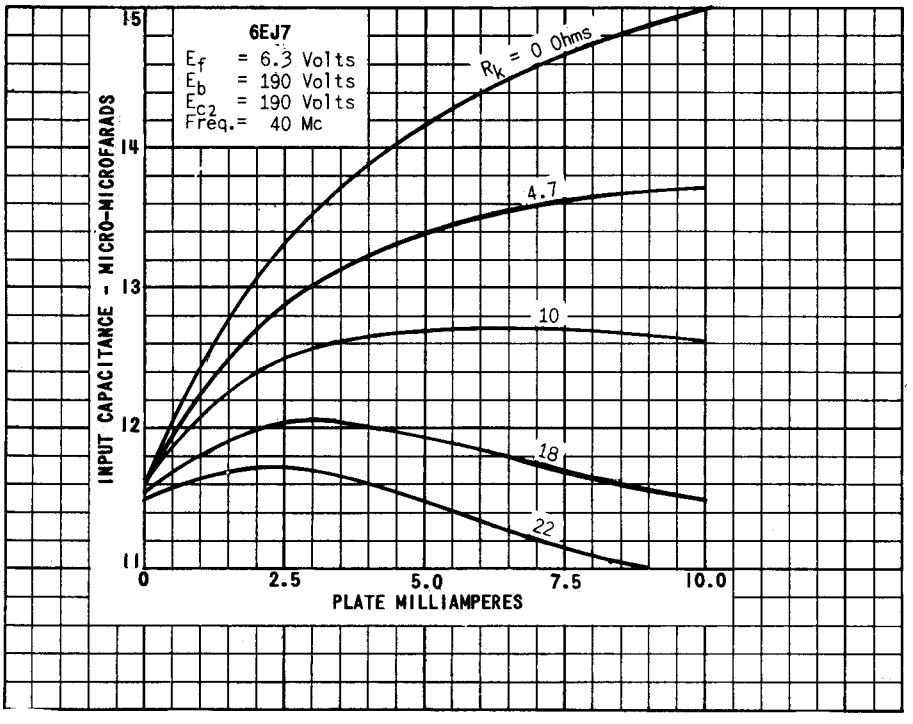
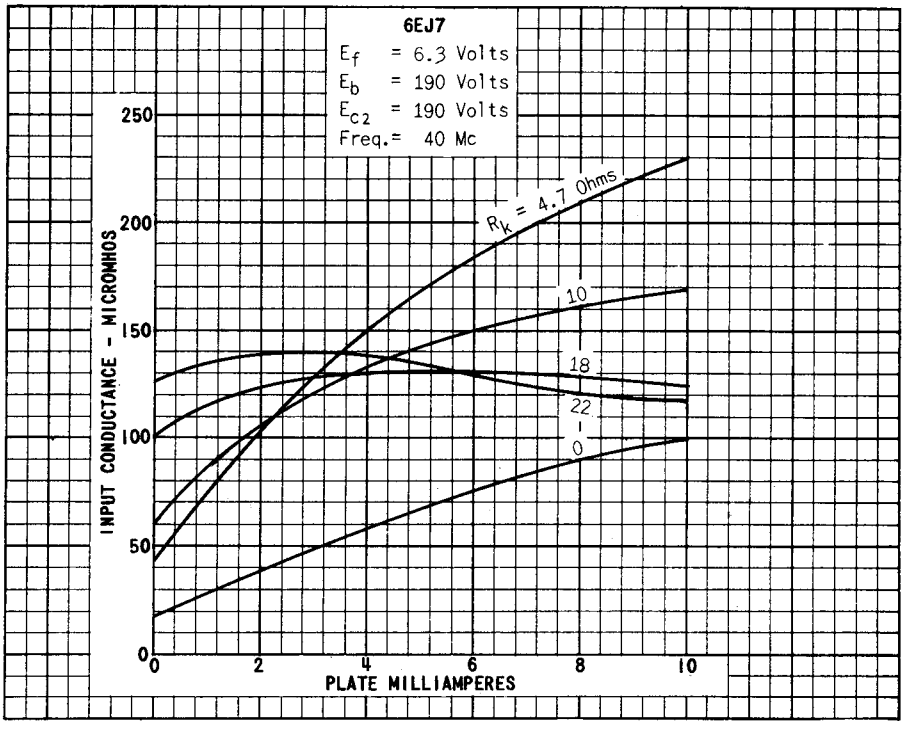
6EJ7

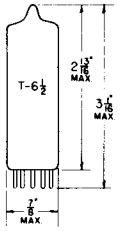

6EJ7
Ef = 6.3 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 0 Ohms
4.7
10
18
22
INPUT CAPACITANCE - MICRO-MICROFARADS
15
14
13
12
11
0
2.5
5.0
7.5
10.0
PLATE MILLIAMPERES


6EJ7
Ef = 6.3 Volts
Eb = 190 Volts
Ec2 = 190 Volts
Freq.= 40 Mc
Rk = 4.7 Ohms
10
18
22
0
INPUT CONDUCTANCE - MICROMHOS
250
200
150
100
50
0
0
2
4
6
8
10
PLATE MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

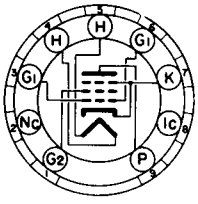
UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.8 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9HN

THE 6EM5 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS THE VERTICAL DEFLECTION AMPLIFIER IN HIGH-EFFICIENCY DEFLECTION CIRCUITS OF TV RECEIVERS WHICH USE PICTURE TUBES WITH A 110° DIAGONAL DEFLECTION ANGLE. WITH THE EXCEPTION OF HEATER RATINGS AND HEATER WARM-UP TIME, THE 6EM5 IS IDENTICAL TO THE 8EM5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.7	μμf
GRID #1 TO CATHODE & G3, G2, AND HEATER	10	μμf
PLATE TO CATHODE & G3, G2, AND HEATER	5.1	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE:		
DC	315	VOLTS
PEAK POSITIVE PULSE (ABS. MAX.)[B]	2 200[C]	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	-250	VOLTS
MAXIMUM CATHODE CURRENT:		
PEAK	210	MA.
AVERAGE	60	MA.
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 INPUT	1.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	2.2	MEGOHMS
FOR CATHODE-BIAS OPERATION	2.2	MEGOHMS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.8	0.8	AMP.
PLATE VOLTAGE	60	250	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	0	-18	VOLTS
MU-FACTOR, GRID #1 TO GRID #2	---	8.7	
TRANSCONDUCTANCE	---	5100	μMHOS
PLATE CURRENT	180[E]	40	MA.
GRID #2 CURRENT	30[E]	3	MA.
PLATE RESISTANCE (APPROX.)●		50 000	OHMS
GRID #1 VOLTAGE FOR PLATE CURRENT 0.2 MA.	---	-37	

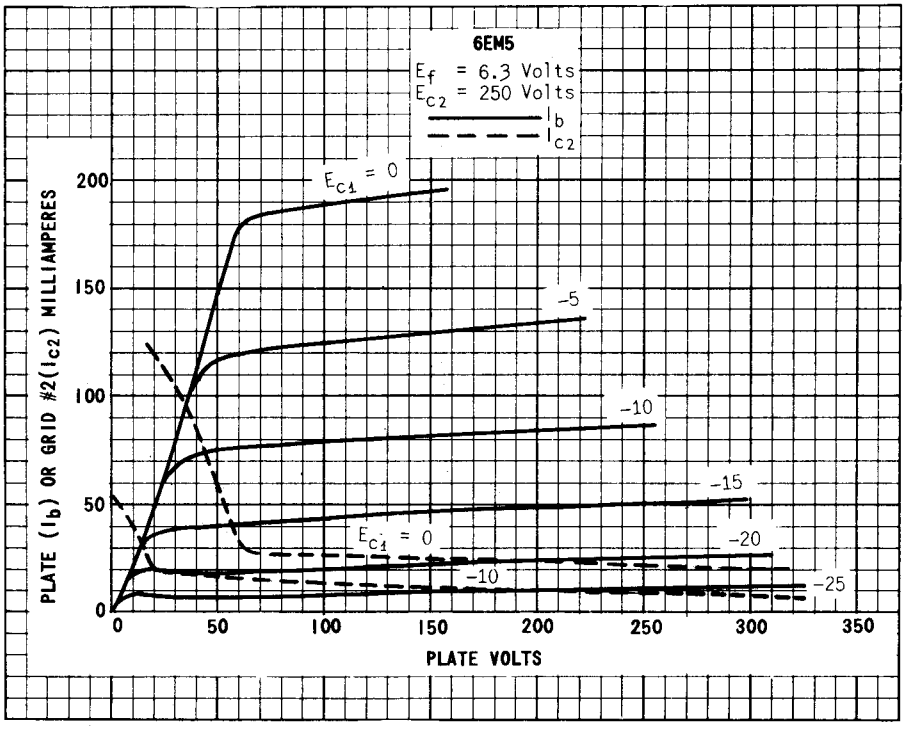
● INDICATES AN ADDITION.

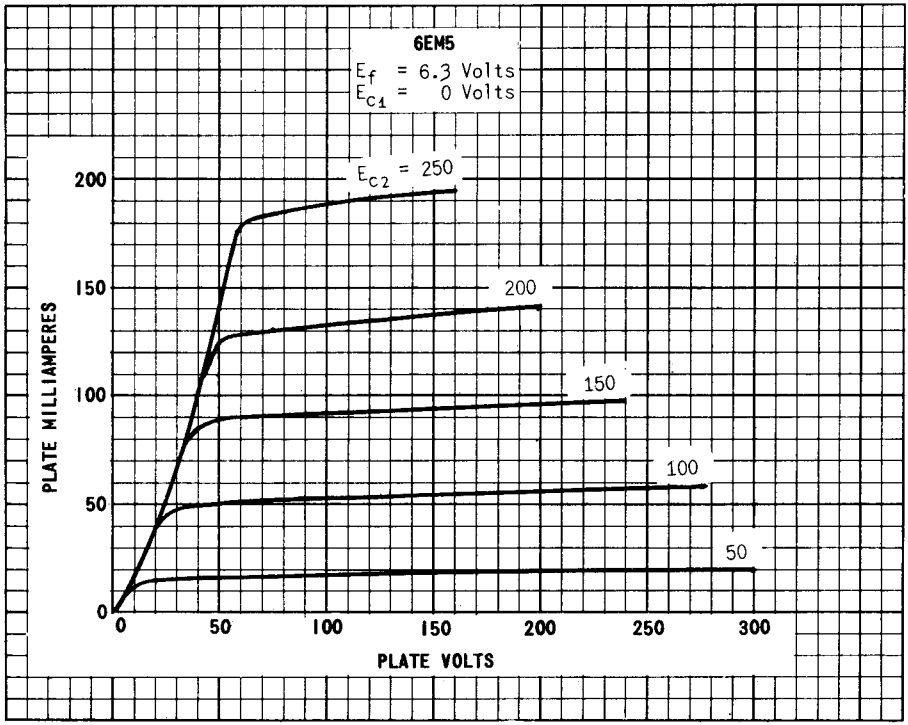
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

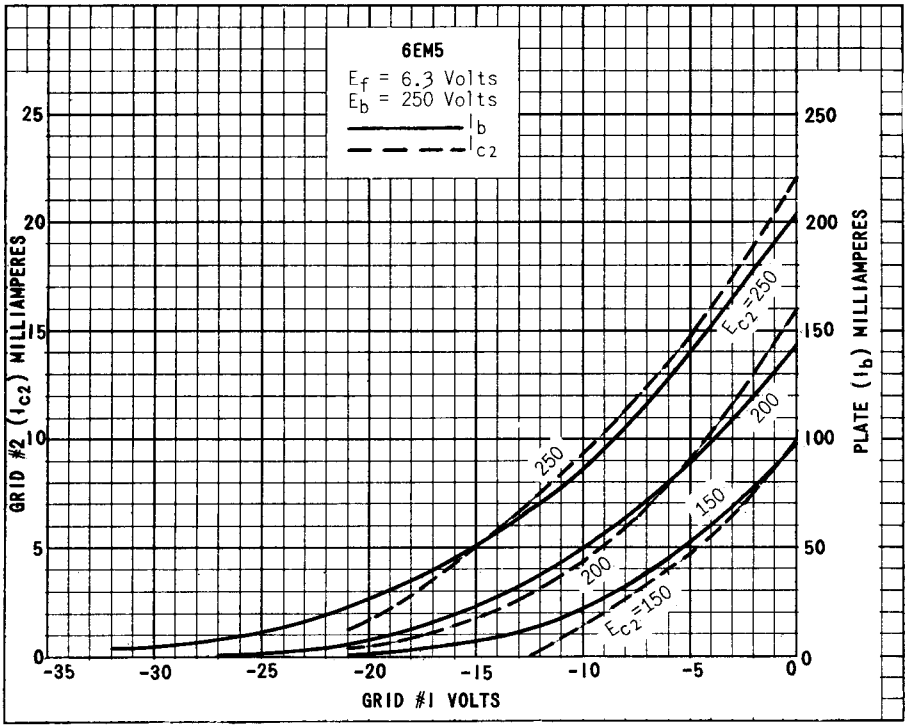
[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS

[E] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.







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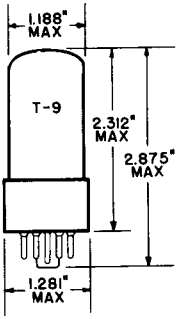
DOUBLE TRIODE



GLASS BULB
SHORT INTERMEDIATE SHELL
8 PIN OCTAL B8-58
OUTLINE DRAWING
JEDEC 9-37

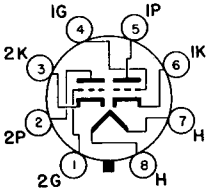
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 925 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BD

THE 6EM7 CONTAINS TWO DISSIMILAR TRIODES IN ONE ENVELOPE. SECTION 1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION 2 HAS A LOW MU AND IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS, THE 6EM7 IS IDENTICAL TO THE 13EM7.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SEC.#1 [D]	SEC.#2 [D]	
GRID TO PLATE	4.8	10	pf
INPUT: G TO (H + K)	2.2	7.0	pf
OUTPUT: P TO (H + K)	0.6	1.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
(EXCEPT AS NOTED)

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	SEC.#1 [D] OSCILLATOR	SEC.#2 [D] AMPLIFIER	
MAXIMUM DC PLATE VOLTAGE	330	330	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE(ABS.MAX)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	10	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESING MAXIMUM SYSTEM
(EXCEPT AS NOTED)

VERTICAL DEFLRCTION OSCILLATOR AND AMPLIFIER[A]

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

AVERAGE CHARACTERISTICS

	SEC. #1[D]	SEC. #2[D]	
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-20	VOLTS
PLATE CURRENT	1.4	50	MA.
TRANSCONDUCTANCE	1 600	7 200	μMHOS
AMPLIFICATION FACTOR	64 ←	5.4	
PLATE RESISTANCE (APPROX.)	40 000	750	OHMS
Ec FOR Ib =10 μA (APPROX.)	-5.5	---	VOLTS
Ec FOR Ib =100μA (APPROX.)	---	-45	VOLTS
Ib AT Ec =-28 Vdc APPROX.	---	10	MA.

INSTANTANEOUS PLATE KNEE VALUES (SECTION #2)
Eb = 60 V; Ec = 0
Ib = 95 MA.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DE ICE MA UFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

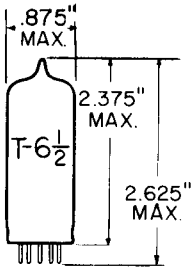
[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D] SECTION #1 CONNECTS TO PINS 4, 5 AND 6.

TUNG-SOL

DIODE-REMOTE-CUTOFF PENTODE

MINIATURE TYPE



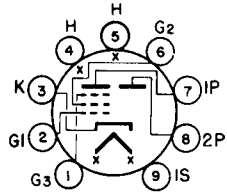
GLASS BULB
SMALL BUTTON
9 PIN NOVAL E9-1

OUTLINE DRAWING
JEDEC 6-3

UNIPOTENTIAL CATHODE

FOR AM AND AM/FM
BROADCAST RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9LQ

THE 6EQ7 IS A DIODE AND A REMOTE-CUTOFF PENTODE WITH A COMMON CATHODE OF THE 9 PIN MINIATURE TYPE ESPECIALLY DESIGNED FOR USE AS COMBINED IF-AMPLIFIER AND AM-DETECTOR TUBES IN AM AND AM/FM BROADCAST RECEIVERS. THE PENTODE UNIT MAY ALSO BE USED AS AN RF OR IF-AMPLIFIER TUBE; THE DIODE UNIT MAY BE USED FOR AUTOMATIC VOLUME CONTROL OR DETECTION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.002	pf
GRID #1 TO K, H, G2, G3, & I.S.	5.5	pf
PLATE TO K, H, G2, G3, & I.S.	5.0	pf
GRID #1 TO DIODE PLATE (MAX.)	0.0015	pf
PENTODE PLATE TO DIODE PLATE	.095	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER-PENTODE UNIT

PLATE VOLTAGE	300	VOLTS
GRID #3 VOLTAGE:		
POSITIVE VALUE	300	VOLTS
NEGATIVE VALUE	300	VOLTS
GRID #2 SUPPLY VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
GRID #1 VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
NEGATIVE BIAS VALUE	50	VOLTS
PLATE DISSIPATION	3	WATTS
GRID #3 INPUT	0.2	WATT
GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	0.6	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300 VOLTS	SEE RATING CHART	
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	150	°C

DIODE UNIT

PLATE CURRENT	1.0	MA.

TYPICAL OPERATING CHARACTERISTICS

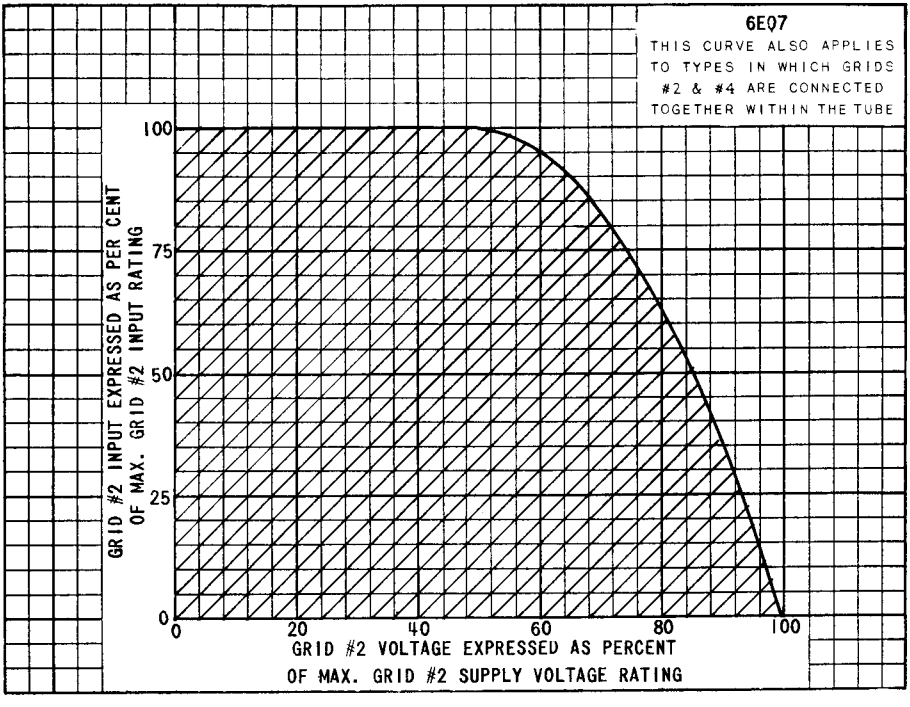
CLASS A_1 AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	100	VOLTS
GRID #3	CONNECT TO CATHODE AT SOCKET	
INTERNAL SHIELD	CONNECT TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
GRID #1 SUPPLY VOLTAGE	0	VOLT
GRID #1 RESISTOR (BYPASSED)	2.2	MEGOHMS
TRANSCONDUCTANCE	3800	μMHOS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
PLATE CURRENT	9	MA.
GRID #2 CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE OF 40 μMHOS	-20	VOLTS

DIODE UNIT - AVERAGE CHARACTERISTICS

PLATE VOLTAGE	10	VOLTS
PLATE CURRENT	2	MA.



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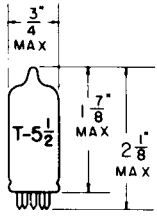
TUNG-SOL

TETRODE

MINIATURE TYPE



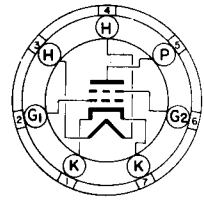
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.18 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

THE 6ER5 IS A REMOTE CUT-OFF FRAME GRID TETRODE DESIGNED ESPECIALLY FOR V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE; THE SCREEN GRID IS DESIGNED PRIMARILY AS A SHIELD TO REDUCE DIRECT GRID TO PLATE CAPACITANCE. EXCEPT FOR HEATER RATINGS THE 6ER5 IS IDENTICAL TO THE 2ER5 AND 3ER5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD	
INPUT	4.4	4.4	μμf
OUTPUT	3.0	4.0	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.24	0.20	μμf
CATHODE TO GRID	3.1	3.1	μμf
CATHODE TO HEATER	2.8	2.8	μμf
PLATE TO GRID	0.38	0.36	μμf

RATINGS

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM SUPPLY VOLTAGE	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM HEATER CATHODE VOLTAGE	100	VOLTS
MAXIMUM HEATER CATHODE RESISTANCE	20 000	OHMS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS

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TUNG-SOL

TRIODE

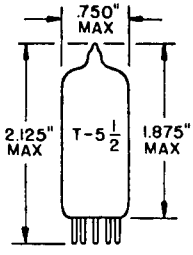
MINIATURE TYPE

FOR

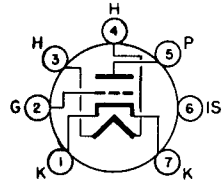
V.H.F. TELEVISION TUNERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7FP

THE 6ER5 IS A SEMI-REMOTE CUTOFF HIGH-MU SHIELDED TRIODE DESIGNED ESPECIALLY FOR V.H.F. TELEVISION TUNERS. SEPARATE CATHODE LEADS PROVIDE LOW LEAD INDUCTANCE. THE SHIELD REDUCES DIRECT GRID TO PLATE CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #315	
INPUT	4.4	4.4	pf
OUTPUT	3.0	4.0	pf
GRID TO HEATER (MAX.)	0.28	0.28	pf
PLATE TO CATHODE	0.24	0.20	pf
CATHODE TO GRID	3.1	3.1	pf
CATHODE TO HEATER	2.8	2.8	pf
PLATE TO GRID	0.38	0.36	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	180	MA.
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE;				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

SUPPLY VOLTAGE	550	VOLTS
PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.2	WATTS
NEGATIVE GRID VOLTAGE	50	VOLTS
GRID CIRCUIT RESISTANCE	1	MEGOHM
DC CATHODE CURRENT	20	MA.

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TUNG-SOL

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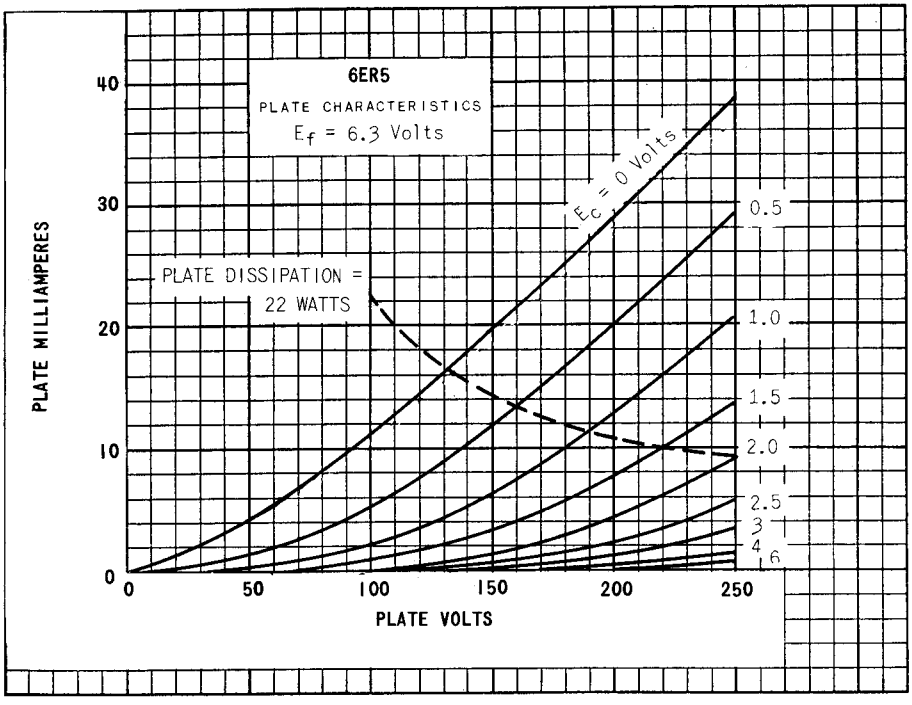
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.18	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-1.2	VOLTS
GRID #2 VOLTAGE	0	VOLTS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	0	MA.
PLATE RESISTANCE	8000	OHMS
TRANSCONDUCTANCE	10500	μMHOS
AMPLIFICATION FACTOR	80	
NEGATIVE GRID VOLTAGE (S = 5000 μMHOS)	3.8	VOLTS
NEGATIVE GRID VOLTAGE (S = 1000 μMHOS)	5.6	VOLTS

CROSS MODULATION

AC INPUT VOLTAGE (K = 1% S = 10,500 μMHOS)[A] (MIN.)	100	MV
AC INPUT VOLTAGE (K = 1% S = 5,000 μMHOS)[A]	100	MV
AC INPUT VOLTAGE (K = 1% S = 1,000 μMHOS)[A] (MIN.)	100	MV

[A] K = CROSS MODULATION FACTOR.



TUNG-SOL

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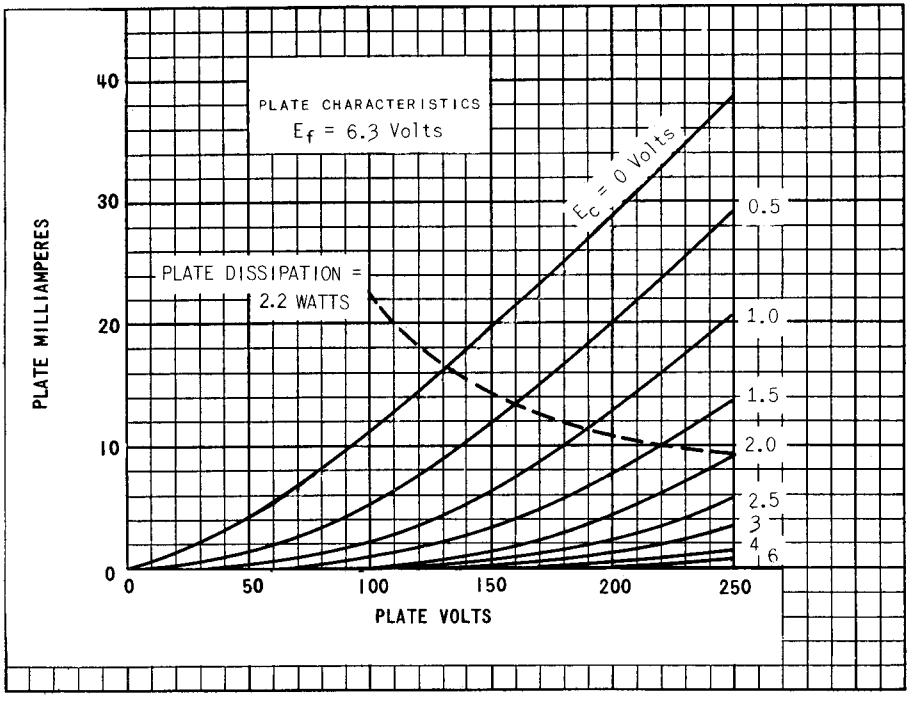
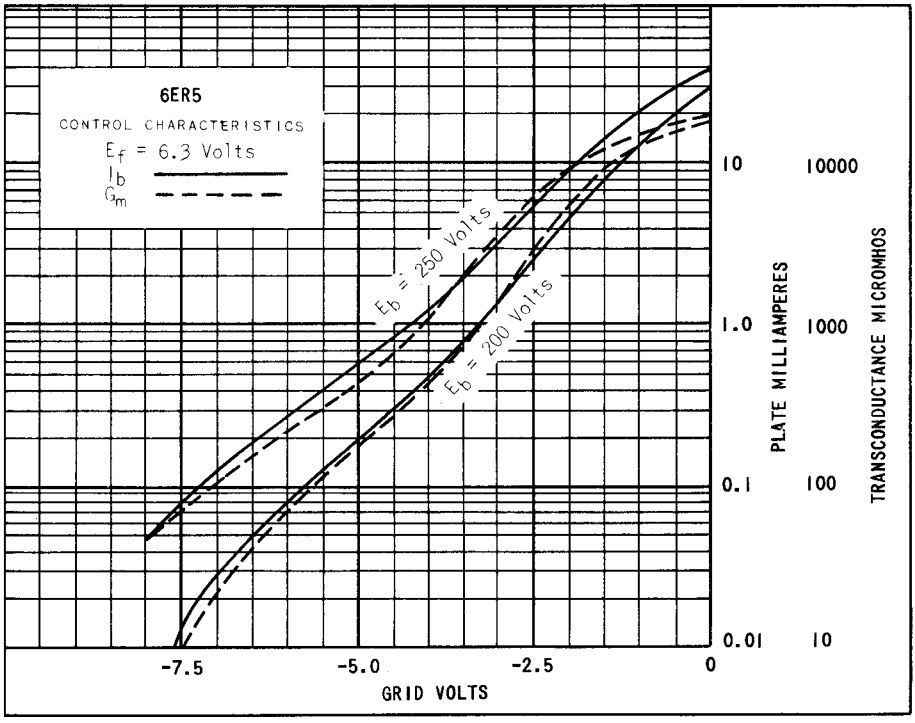
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	−1.2	VOLTS
PLATE CURRENT	10	MA.
TRANSCONDUCTANCE	10,500	μMHOS
AMPLIFICATION FACTOR	80	
PLATE RESISTANCE	8,000	OHMS
NEGATIVE GRID VOLTAGE (Gm = 5,000 μMHOS)	3.8	VOLTS
NEGATIVE GRID VOLTAGE (Gm = 1,000 μMHOS)	5.6	VOLTS





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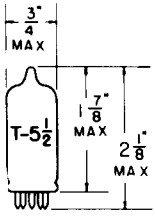
TUNG-SOL

TRIODE

MINIATURE TYPE



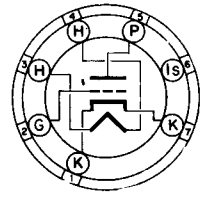
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.20 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
7 PIN BASE

7FP

THE 6ES5 IS A TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6ES5 IS IDENTICAL TO THE 2ES5 AND THE 3ES5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.)	0.5	0.5	μμf
INPUT: G TO (H+K+I.S.)	3.2	3.2	μμf
OUTPUT: P TO(H+K+I.S.)	4.0	3.2	μμf

[A]WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: (TOTAL DC AND PEAK)		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.20	AMP.
PLATE VOLTAGE	200	VOLTS
GRID VOLTAGE	-1.0	VOLT
PLATE RESISTANCE (APPROX.)	8000	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	75	
PLATE CURRENT	10	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	-6.0	VOLTS

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

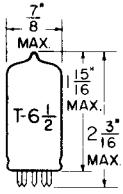
UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9LS

THE 6EU7 IS A HIGH-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR USE IN HIGH-GAIN RESISTANCE-COUPLED LOW-LEVEL AUDIO-AMPLIFIER APPLICATIONS, SUCH AS PREAMPLIFIERS FOR MONOPHONIC AND STEREOPHONIC PHONOGRAPHS, AND MICROPHONE AMPLIFIERS. THE BASING ARRANGEMENT ENABLES THE CIRCUIT DESIGNER TO OBTAIN GOOD ISOLATION BETWEEN CHANELS WHEN THE TUBE IS USED IN A STEREO SYSTEM.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID TO PLATE	1.5	1.5	$\mu\mu f$
GRID TO CATHODE AND HEATER	1.6	1.6	$\mu\mu f$
PLATE TO CATHODE AND HEATER	0.2	0.2	$\mu\mu f$

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

AMPLIFIER - CLASS A_1

VALUES ARE FOR EACH UNIT

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE BIAS VALUE	55	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−2	VOLTS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE (APPROX.)	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
PLATE CURRENT	0.5	1.2	MA.

EQUIVALENT NOISE AND HUM VOLTAGE

REFERENCED TO GRID, EACH UNIT

AVERAGE VALUE●	RMS	1.8	μVOLTS

● MEASURED IN "TRUE RMS" UNITS UNDER THE FOLLOWING CONDITIONS; HEATER VOLTAGE OF 6.3 VOLTS AC; CENTER TAP OF HEATER TRANSFORMER GROUNDED; PLATE SUPPLY VOLTAGE, 250 VOLTS DC; PLATE LOAD RESISTOR, 100,000 OHMS; CATHODE RESISTOR, 2700 OHMS BYPASSED BY 100-μf CAPACITOR GRID RESISTOR, 0 OHMS; AND AMPLIFIER COVERING FREQUENCY RANGE BETWEEN 25 AND 10,000 CPS.

B. DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPES ATING CONDITIONS DUE TO VARIA- IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS,

OPERATING CONDITIONS AS RESISTANCE COUPLED AMPLIFI ER

EACH UNIT

PLATE SUPPLY VOLTAGE	90			180			300			VOLTS
PLATE LOAD RESISTOR	0.1	0.22	0.47	0.1	0.22	0.47	0.1	0.22	0.47	MEGOHM
GRID RESISTOR (OF FOLLOWING STAGE)	0.22	0.47	1.0	0.22	0.47	1.0	0.22	0.47	1.0	MEGOHMS
CATHODE RESISTOR	4700	7400	13000	2000	8500	6700	1500	2800	5200	OHMS
PEAK OUTPUT VOLTAGE	6	9	11	25	34	39	57	69	77	VOLTS
VOLTAGE GAIN	35[C]	45[D]	52[E]	47	59	66	52	65	73	

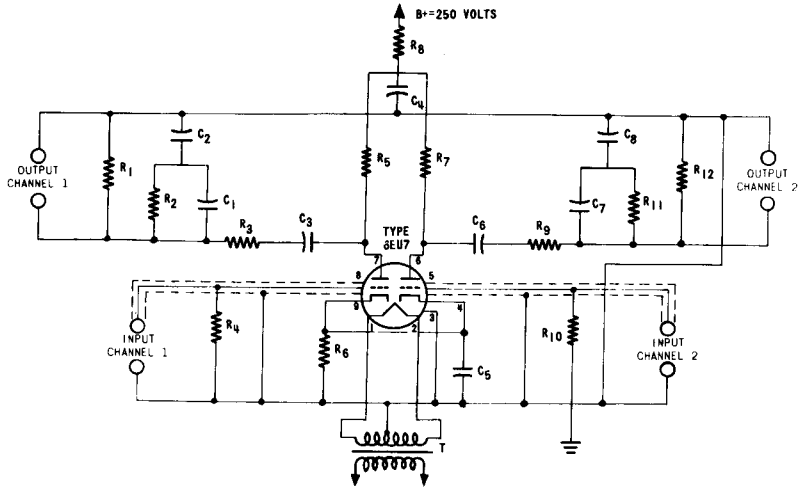
[C] AT 2 VOLTS (RMS) OUTPUT

[D] AT 3 VOLTS (RMS) OUTPUT

[E] AT 4 VOLTS (RMS) OUTPUT

NOTE: COUPLING CAPACITORS SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. CATHODE RESISTORS SHOULD BE ADEQUATELY BYPASSED.

TUNG-SOL



C_1, C_7: 0.0035μf, 600 volts

C_2, C_8: 0.01μf, 600 volts

C_3, C_6: 0.1μf, 600 volts

C_4: 20μf, 450 volts

C_5: 50 μf, 25 volts

R_1, R_{12}: 680000±10% ohms, 1/2 watt

R_2, R_{11}: 22000±10% ohms 1/2 watt

R_3, R_9: 470000±10% ohms, 1/2 watt

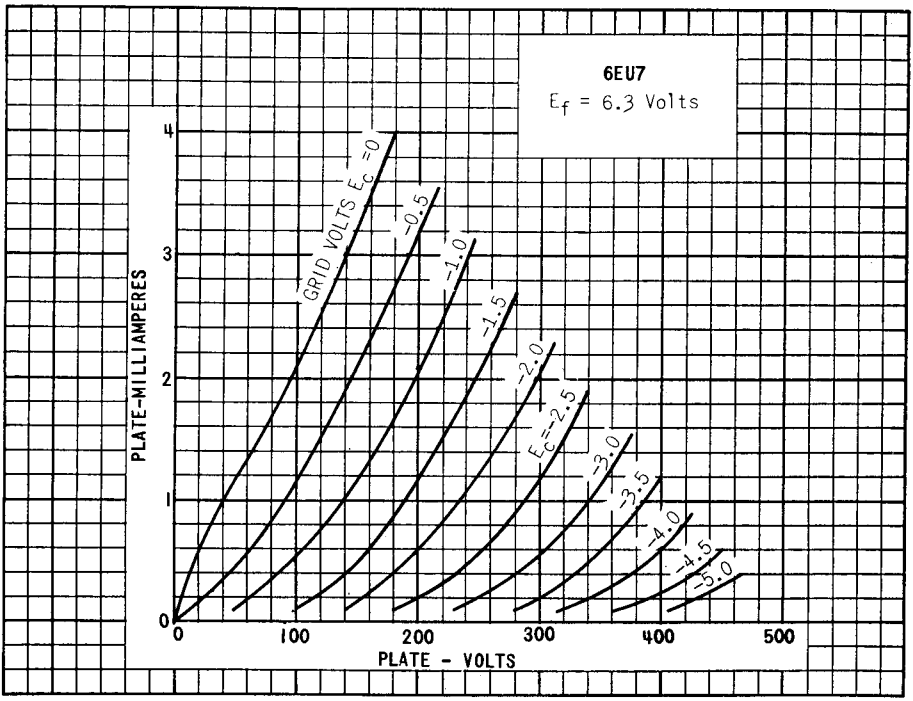
R_4, R_{10}: Value depends on type of magnetic pickup used. Follow pickup manufacturers recommendations.

R_5, R_7: 100000±20% ohms, 1/2 watt

R_6: 1200±20% ohms, 1/2 watt

R_8: 3900±20% ohms, 1 watt

T: 6.3-volt, center-tapped heater transformer.



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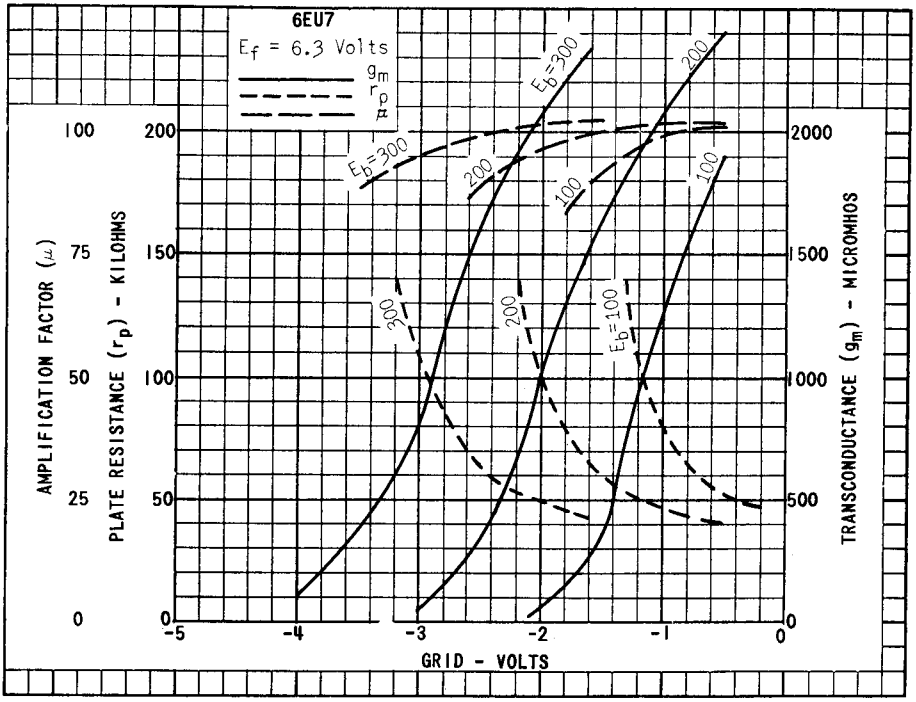
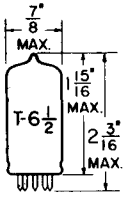

6EU7
E_f = 6.3 Volts
g_m
r_p
μ
E_b=300
200
100
E_b=100
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID - VOLTS
100
75
50
25
0
200
150
100
50
0
2000
1500
1000
500
0
-5
-4
-3
-2
-1
0

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



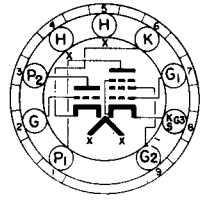
GLASS BULB

HEATER

6.3 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9JF

THE 6EU8 IS A HEATER-CATHODE TYPE TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR THE USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THE TRIODE HAS A CONTROLLED CATHODE WARM-UP CHARACTERISTIC. EXCEPT FOR HEATER CHARACTERISTICS, THE 6EU8 IS IDENTICAL TO THE 5EU8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (G1 TO P) (MAX.)	0.10	0.02	μμf
INPUT: G1 TO (H+K)	5.0	5.0	μμf
OUTPUT: P TO (H+K)	3.4	2.6	μμf
TRIODE SECTION:			
GRID TO PLATE: (G TO P)	1.7	1.7	μμf
INPUT: G TO (H+K)	3.2	3.0	μμf
OUTPUT: P TO (H+K+S)	1.1	1.6	μμf
CATHODE TO HEATER (EACH SECTION): (K TO H)	3.60	3.60	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	3.1	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.55	WATTS
MAXIMUM GRID #1 RESISTANCE	100	100	KILOHMS

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TUNG-SOL

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

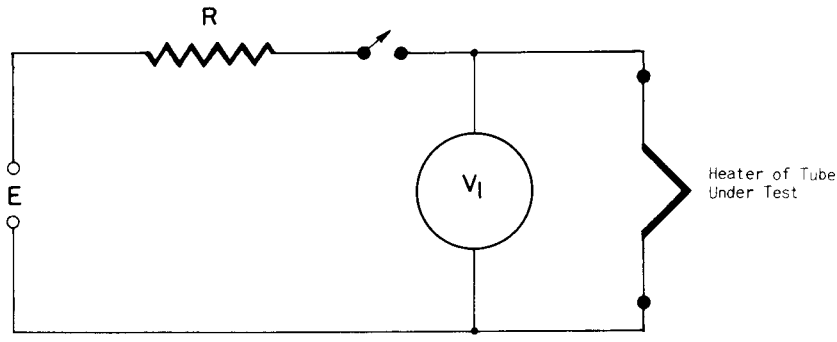
	TRIODE	PENTODE	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	150	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
CATHODE RESISTOR	56	---	OHMS
GRID #1 VOLTAGE	---	-1.0	VOLT
AMPLIFICATION FACTOR	40.0	---	
TRANSCONDUCTANCE	8500	6400	μMHOS
PLATE RESISTANCE (APPROX.)	5000	80000	OHMS
PLATE CURRENT	18.0	12.0	MA.
GRID #2 CURRENT	---	4.0	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib=10 μA	-12.0	-9.0	VOLTS
CATHODE WARM-UP TIME[A]	35	---	SECONDS

* HEATER WARM UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE FROM ZERO TO THE HEATER TEST VOLTAGE (V_1).

FOR TYPE	6EU8
$E_=$	25.2 VOLTS (RMS OR DC).
$V_{1=}$	5.0 VOLTS (RMS OR DC).
$R_=$	31.5 OHMS

A. CATHODE WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR TRANSCONDUCTANCE TO REACH 6500 μMHOS WHEN A TUBE IS OPERATED FROM A COLD START AT A PLATE POTENTIAL OF 100 VOLTS DC, ZERO GRID BIAS, AND AT A CONSTANT HEATER CURRENT OF 560 MILLIAMPERES FOR 5EU8 OR A HEATER POTENTIAL OF 5.5 VOLTS FOR THE 6EU8.

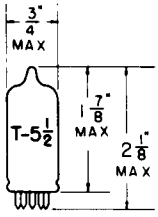
TUNG-SOL



TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

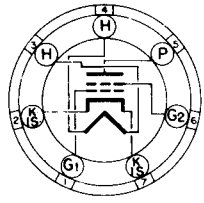
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.20 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
7 PIN BASE
7EW

THE 6EV5 IS A HIGH GAIN, SHARP-CUTOFF SEVEN PIN TETRODE DESIGNED PARTICULARLY FOR SERVICE IN V.H.F. TELEVISION TUNERS. IT HAS HIGH TRANSCONDUCTANCE, EXTREMELY LOW SCREEN CURRENT AND HIGH INPUT IMPEDANCE AT 200 MC. RESULTING IN IMPROVED NOISE FIGURE. THE 6EV5 IS SIMILAR TO THE 2EV5 AND THE 3EV5.

DIRECT INTERELECTRODE CAPACITANCES[A]

WITH EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.035	μμf
INPUT	4.50	μμf
OUTPUT	2.90	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 INPUT RATING CHART	
MAXIMUM PLATE DISSIPATION	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	0.2	WATTS
MAXIMUM GRID #1 VOLTAGE:		
POSITIVE VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	50	VOLTS
TOTAL DC AND PEAK	100	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

[A] WITH SHIELD #316 CONNECTED TO PIN #2.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABEE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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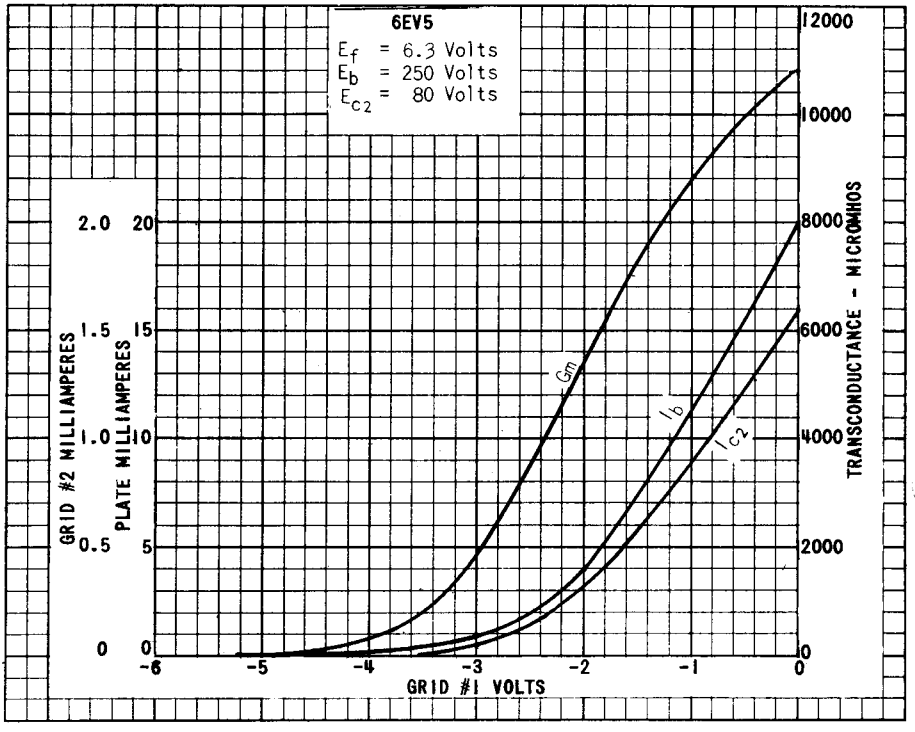
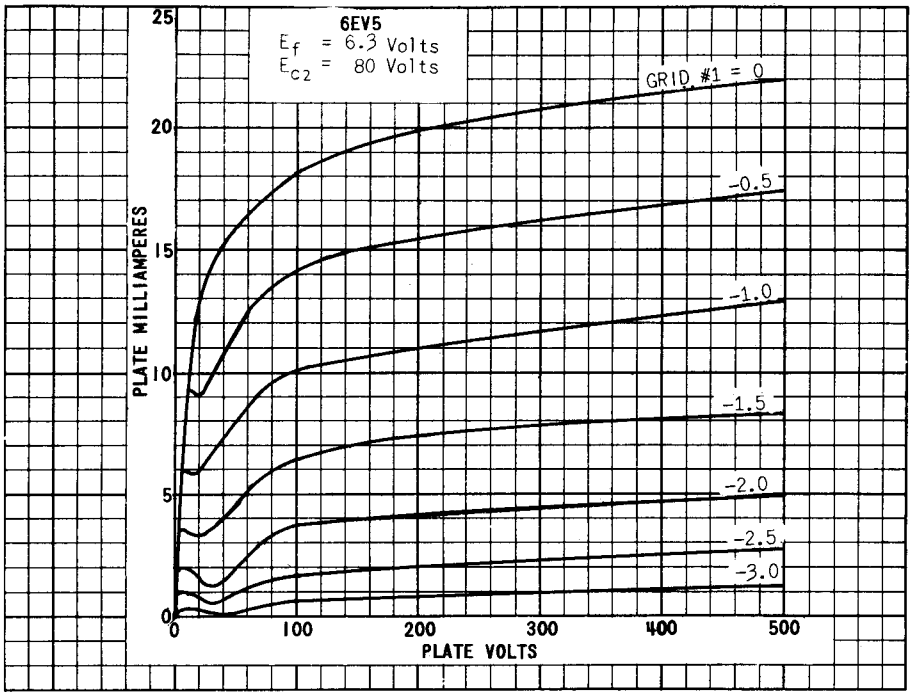
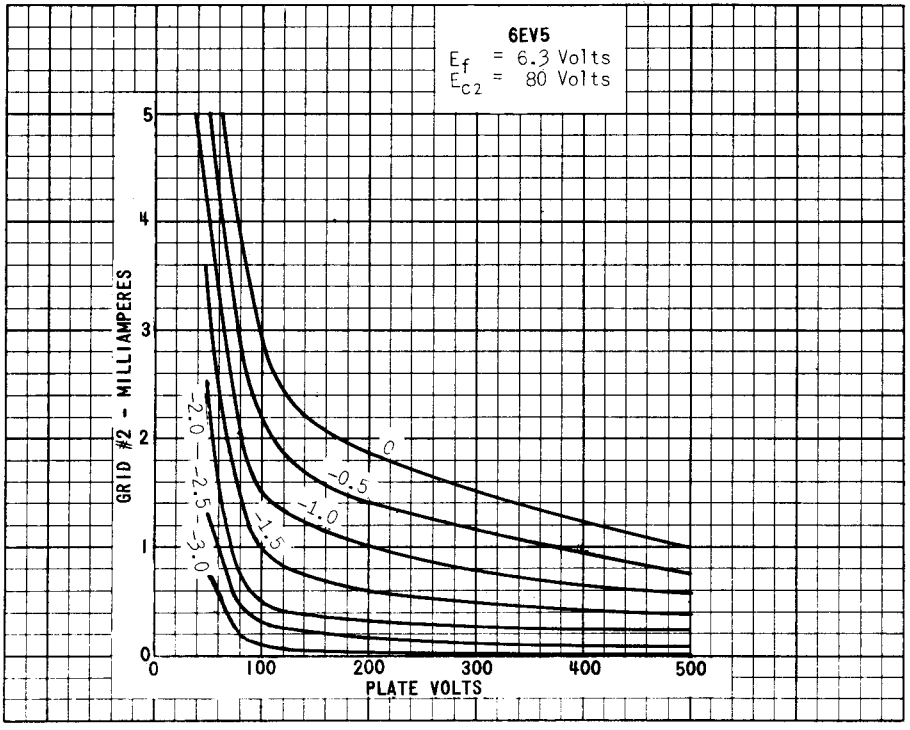
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

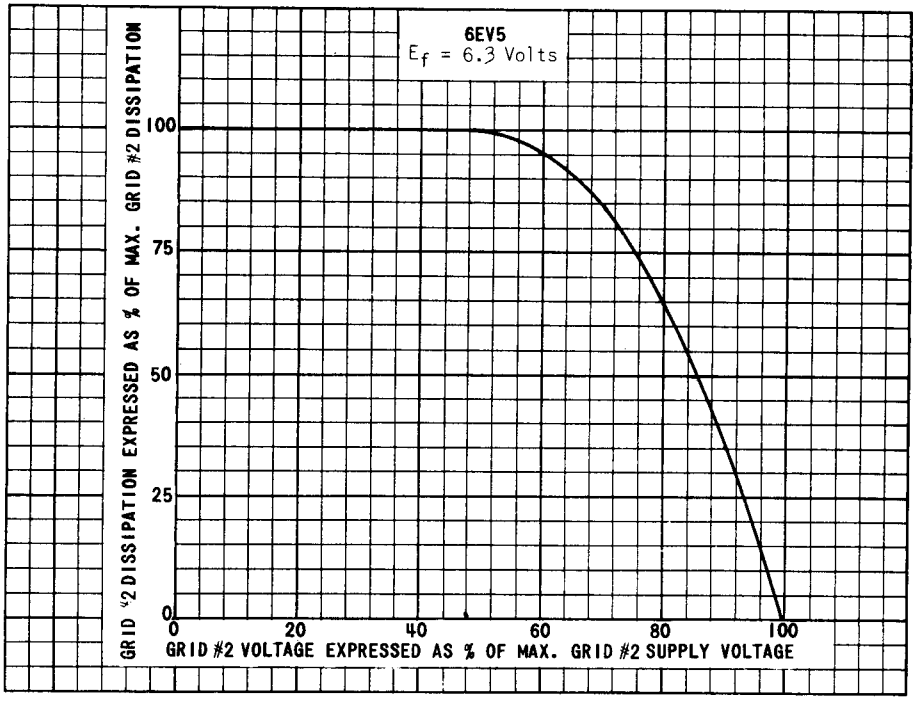
HEATER VOLTAGE	2.4	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	80	VOLTS
GRID #1 VOLTAGE	-1	VOLTS
PLATE RESISTANCE	0.150	MEGOHM
TRANSCONDUCTANCE	8800	μMHOS
GRID #1 CUTOFF BIAS[C]	4.5	VOLTS
PLATE CURRENT	11.5	MA.
GRID #2 CURRENT	0.90	MA.

[C] FOR TRANSCONDUCTANCE OF 100 μMHOS.




6EV5
E_f = 6.3 Volts
E_{c2} = 80 Volts
GRID #1 = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
100
200
300
400
500

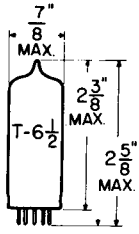

6EV5
E_f = 6.3 Volts
E_{c2} = 80 Volts
GRID #2 - MILLIAMPERES
PLATE VOLTS
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
0
1
2
3
4
5
100
200
300
400
500


6EV5
E_f = 6.3 Volts
GRID #2 DISSIPATION EXPRESSED AS % OF MAX. GRID #2 DISSIPATION
100
75
50
25
0
0
20
40
60
80
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

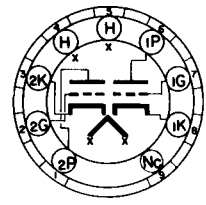
UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9LP

THE 6EV7 IS A HIGH-MU TWIN TRIODE DESIGNED FOR USE AS A RELAY-CONTROL TUBE IN REMOTE-CONTROL TUNING UNITS OF TELEVISION RECEIVERS. IT IS PROCESSED SPECIFICALLY FOR OPERATION UNDER STANDBY CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES

(APPROX.)

WITHOUT EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID TO PLATE	3.4	3.4	μμf
GRID TO CATHODE AND HEATER	3	3	μμf
PLATE TO CATHODE AND HEATER	0.33	0.33	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

RELAY-CONTROL SERVICE

VALUES ARE FOR EACH UNIT

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID VOLTAGE. POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION		
WHEN THE "ON" TIME EXCEEDS 30 SECONDS IN ANY 2-MINUTE INTERVAL	2.5	WATTS
WHEN THE "ON" TIME DOES NOT EXCEED 30 SECONDS IN ANY 2-MINUTE INTERVAL	4.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE	3.9	MEGOHMS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

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TYPICAL OPERATION

WITH 2500-OHM RELAY LOAD – EACH UNIT

RELAY-CONTROL SERVICE

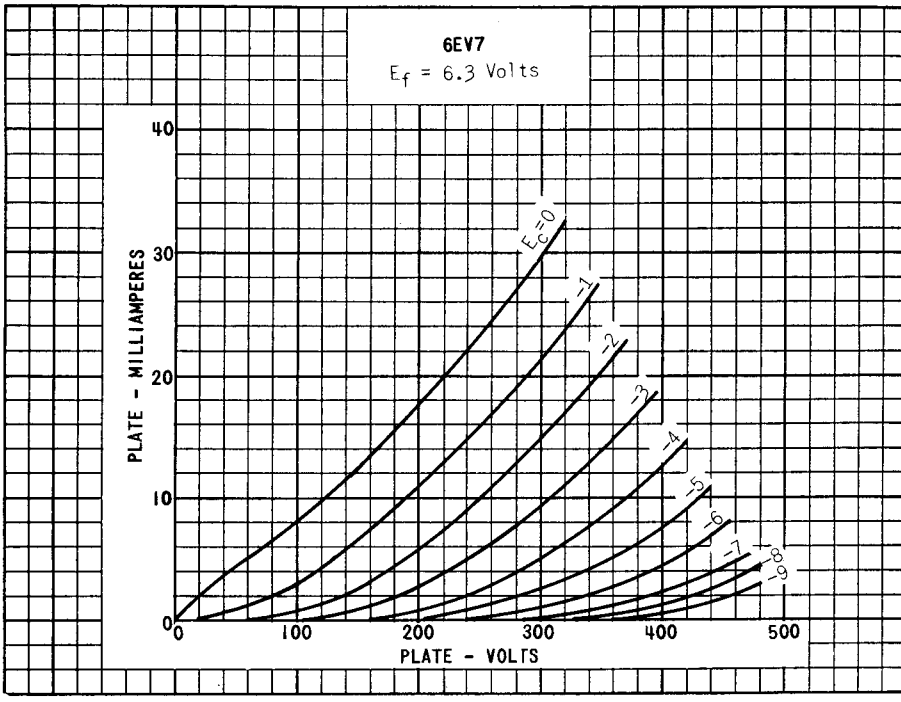
VALUES ARE FOR EACH UNIT

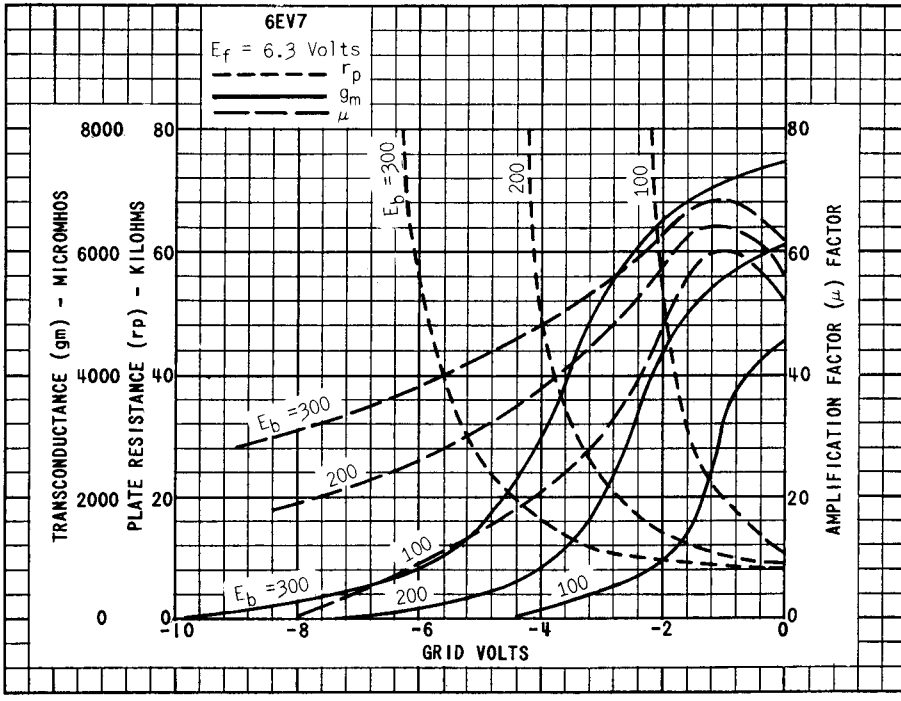
	"ON" TIME MORE THAN 30sec. IN ANY 2 MIN. INTERVAL	"ON" TIME UP TO 30sec. IN ANY 2 MIN. INTERVAL	
PLATE SUPPLY VOLTAGE	150	250	VOLTS
ZERO-BIAS PLATE CURRENT	10	18.5	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 100 μA.	−5	−9	VOLTS

CHARACTERISTICS

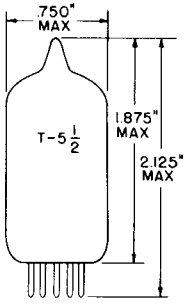
CLASS A_1 AMPLIFIER – EACH UNIT

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−2	VOLTS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	11 500	OHMS
TRANSCONDUCTANCE	5 200	μMHOS
PLATE CURRENT	9.2	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 100 μA.	−9	VOLTS


6EV7
E_f = 6.3 Volts
PLATE - MILLIAMPERES
PLATE - VOLTS
E_c=0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
10
20
30
40
100
200
300
400
500


6EV7
E_f = 6.3 Volts
r_p
g_m
μ
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - KILOHMS
AMPLIFICATION FACTOR (μ) FACTOR
GRID VOLTS
E_b =300
200
100
0
2000
4000
6000
8000
20
40
60
80
-10
-8
-6
-4
-2
0

TUNG-SOL



GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1

OUTLINE DRAWING JEDEC 5-2

PENTODE

MINIATURE TYPE

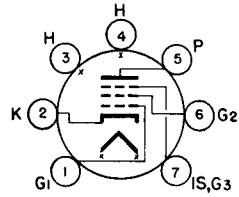
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 400 MA. ←

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM JEDEC 7CM

THE 6EW6 IS A SHARP CUTOFF PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR INTERMEDIATE AMPLIFIER SERVICE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.03	0.04	pf
INPUT	10.0	10.0	pf
OUTPUT	3.4	2.4	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES

MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH EXTERNAL SHIELD (EIA 316) CONNECTED TO CATHODE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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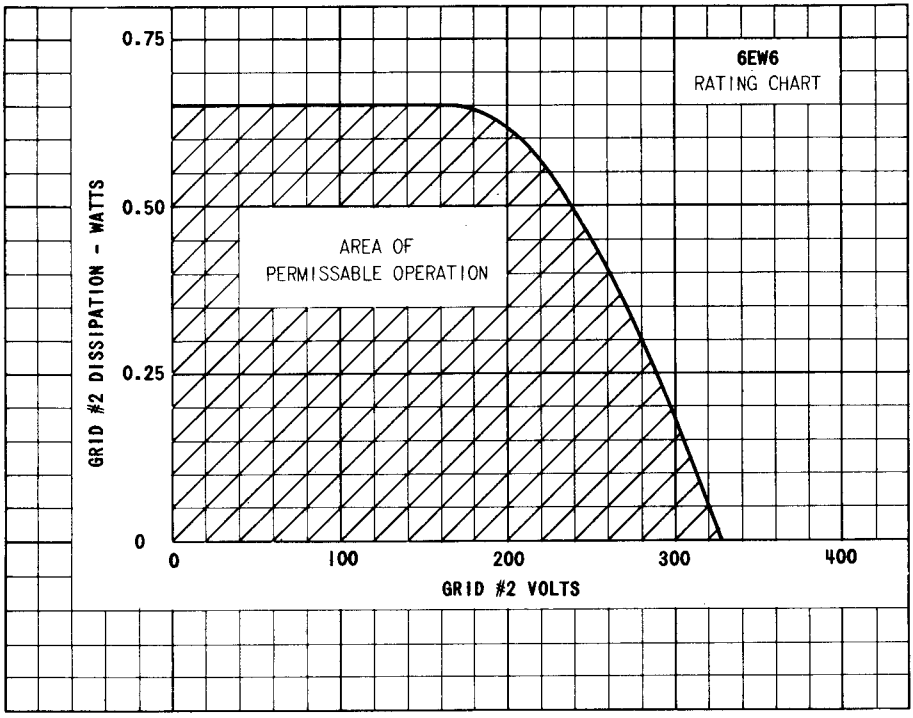
TUNG-SOL

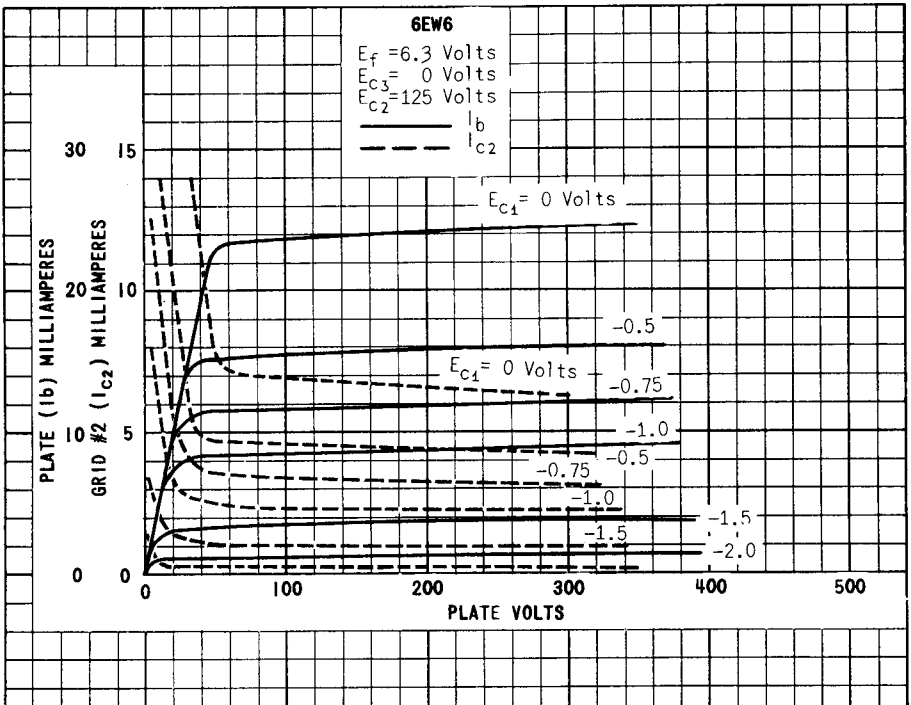
CONTINUED FROM PRECEDING PAGE

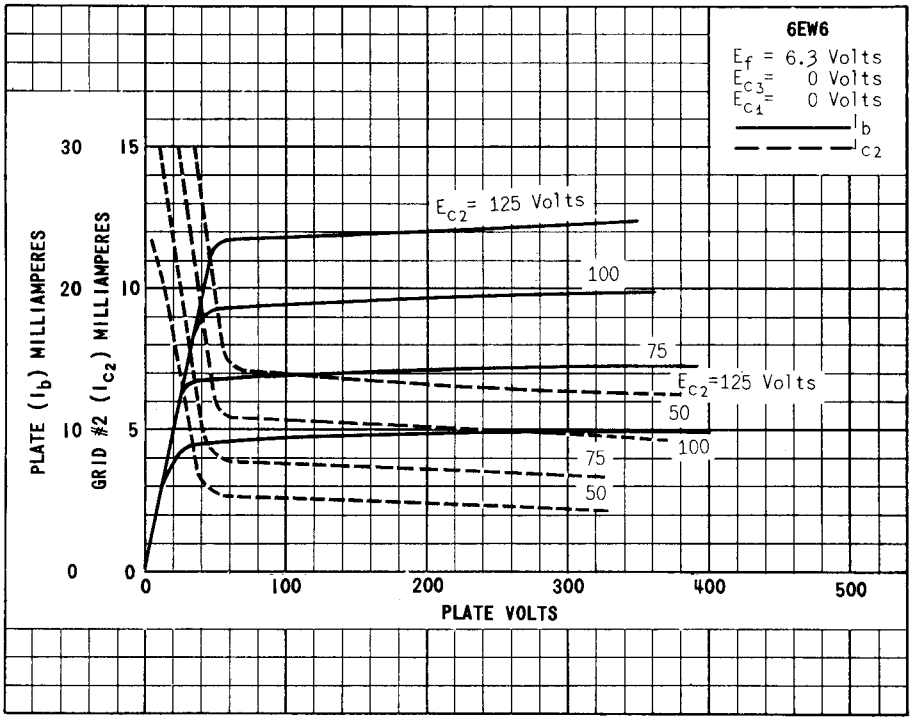
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

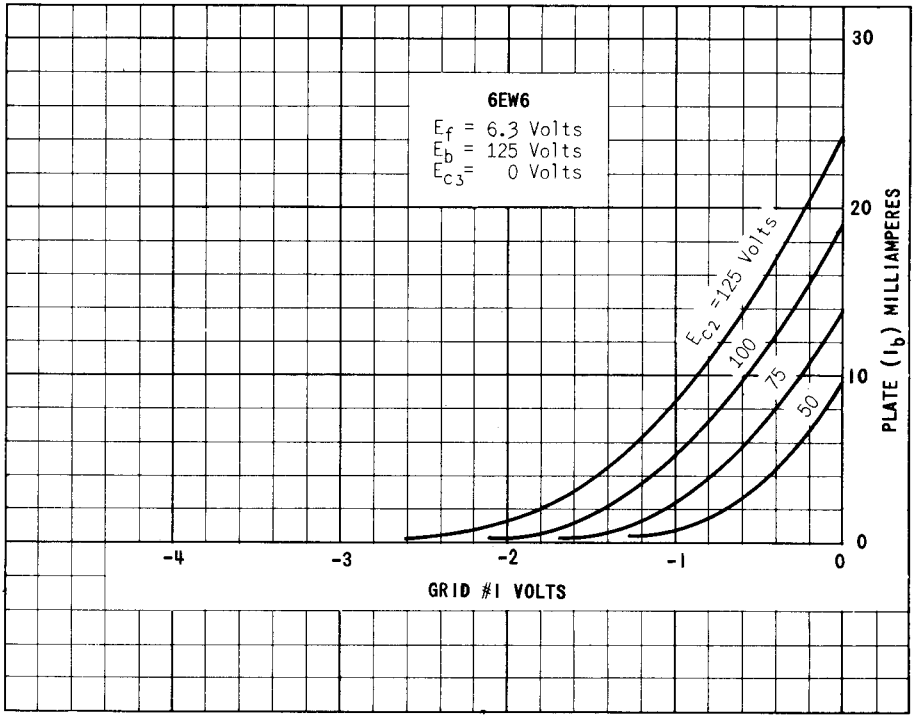
CLASS A_1 AMPLIFIER

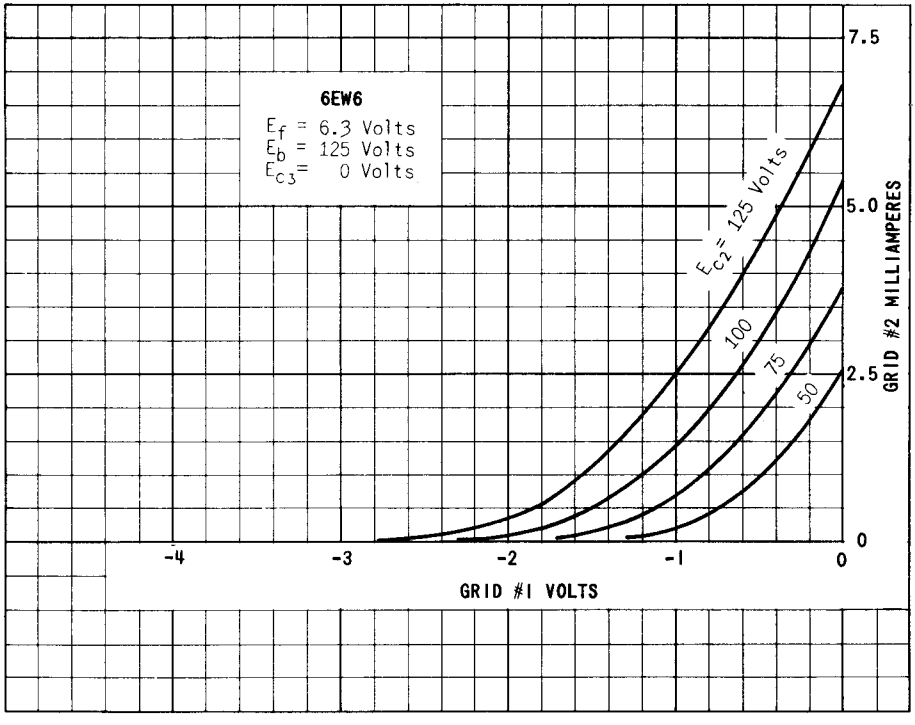
PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	-3.5	VOLTS

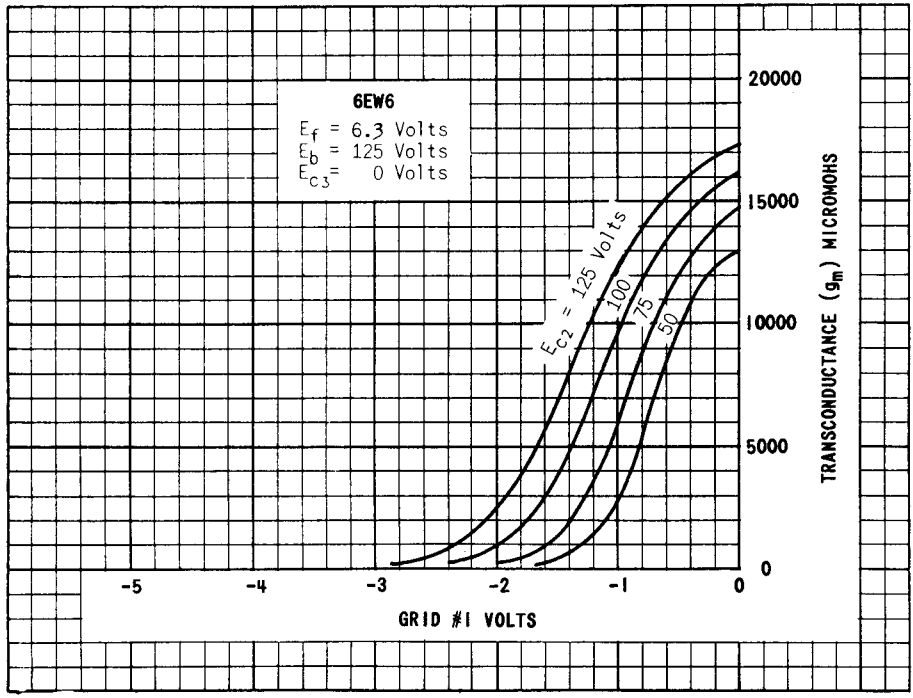

6EW6
RATING CHART
AREA OF
PERMISSABLE OPERATION
GRID #2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
GRID #2 VOLTS


6EW6
Ef =6.3 Volts
Ec3= 0 Volts
Ec2=125 Volts
Ib
Ic2
Ec1= 0 Volts
-0.5
-0.75
-1.0
-1.5
-2.0
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
30
20
10
0
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS


6EW6
E_f = 6.3 Volts
E_{c_3} = 0 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
E_{c_2} = 125 Volts
100
75
50
E_{c_2} = 125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
30
20
10
0
15
10
5
0


6EW6
E_f = 6.3 Volts
E_b = 125 Volts
E_{c_3} = 0 Volts
E_{c_2} = 125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
30
20
10
0





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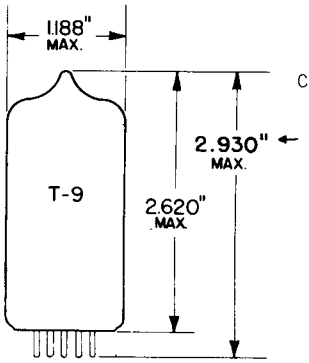
TUNG-SOL

DOUBLE TRIODE



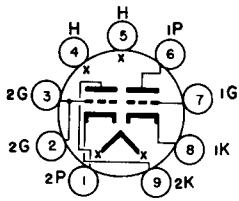
GLASS BULB
BASE E9-68
JEDEC OUTLINE 9-70

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.90 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9HF

THE 6EW7 IS A DISSIMILAR DOUBLE TRIODE UTILIZING THE 9T9 BULB AND PIN CONFIGURATION. THE TUBE IS DESIGNED TO SERVE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 6EW7 IS IDENTICAL TO THE 10EW7.

THE 9T9 DESIGN UTILIZES A T-9(1 1/8" DIAM.) BULB BASED TO FIT MOST STANDARD 9 PIN MINIATURE SOCKETS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SECT #1	SECT. 2	
GRID TO PLATE	4.2	9.0	μμf
INPUT: G TO (H+K)	2.2	7.0	μμf
OUTPUT: P TO (H+K)	0.4	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER [C]

	SECT. #1 OSCILLATOR [D]	SECT. #2 AMPLIFIER [D]	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION [E]	1.5	10	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
SELF BIAS	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[C]

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

AVERAGE CHARACTERISTICS

	SECT. #1[D]	SECT. #2[D]	
HEATER VOLTAGE [A]		6.3	VOLTS
HEATER CURRENT		0.90	AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	45	MA.
TRANSCONDUCTANCE	2000	7500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	800	OHMS
E_c FOR I_b = 10 μA (APPROX.)	-20	---	VOLTS
E_c FOR I_b = 100 μA (APPROX.)	---	-40	VOLTS
I_b AT E_c =-25 VDC	---	8	MA.
I_b WITH E_b =60 V AND E_c=0 V (INSTANTANEOUS VALUES)		95	MA.

[A] FOR PARALLEL HEATER OPERATION, EQUIPMENT SHOULD BE SO DESIGNED SO THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER VOLTAGE.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

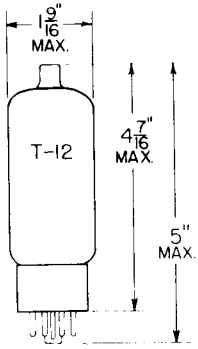
[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[D] SECTION #1 CONNECTS TO PINS 6, 7 AND 8. SECTION #2 CONNECTS TO PINS 1, 2, 3 AND 9.

[E] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

TUNG-SOL

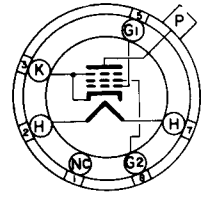
BEAM PENTODE



GLASS BULB

HEATER
6.3 VOLTS 2.25 AMP.
AC OR DC
VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE



BOTTOM VIEW
SHORT MEDIUM-SHELL
5 PIN OCTAL
WITH
EXTERNAL BARRIERS
5BT

THE 6EX6 IS A BEAM-POWER PENTODE DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS WHICH INCORPORATE LARGE-DEFLECTION-ANGLE PICTURE TUBES. FEATURES OF THE TUBE INCLUDE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES, AND A HIGH RATIO OF PLATE TO SCREEN CURRENT. EXCEPT FOR HEATER RATINGS, THE 6EX6 IS IDENTICAL TO THE 21EX6.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	7000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE (ABS. MAX.)	1500	VOLTS
MAXIMUM SCREEN VOLTAGE	195	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	220	VOLTS
MAXIMUM PLATE DISSIPATION[B]	22	WATTS
MAXIMUM SCREEN DISSIPATION	3.5	WATTS
MAXIMUM DC CATHODE CURRENT	220	MA.
MAXIMUM PEAK CATHODE CURRENT	770	MA.
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	225	°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	.225	.225	.225	AMP.
PLATE VOLTAGE	60	60	175	VOLTS
SCREEN VOLTAGE	125	150	175	VOLTS
GRID #1 VOLTAGE	0[C]	0[C]	-30	VOLTS
PLATE RESISTANCE (APPROX.)			8500	OHMS
TRANSCONDUCTANCE			7700	μMHOS
PLATE CURRENT	360	460	67	MA.
SCREEN CURRENT	30	45	3.3	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.			-50	VOLTS
TRIODE AMPLIFICATION FACTOR WITH $E_b = E_{c2} = 175V.$			4.2	
GRID #1 VOLTAGE WITH $E_b = 5000V.$ FOR $I_b = 1.0$ MA.	-88	-94	-101	VOLTS

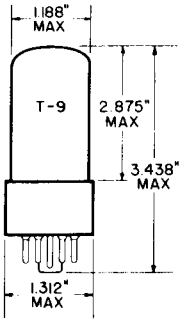
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[C] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

TUNG-SOL

PENTODE

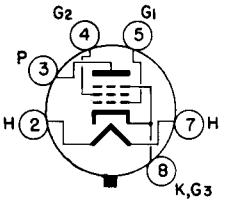


GLASS BULB
INTERMEDIATE-SHELL
6 PIN OCTAL
B6-81 AND B6-84
OUTLINE DRAWING
JEDEC 9-15

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.68 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 6EY6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS THE VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS EMPLOYING 110° DEFLECTION PICTURE TUBES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.7	pf
INPUT	8.5	pf
OUTPUT	7.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

VERTICAL-DEFLECTION AMPLIFIER SERVICE[A]

MAXIMUM DC PLATE VOLTAGE	350	VOLTS
MAXIMUM PEAK PULSE PLATE VOLTAGE	2 500	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE*	250	VOLTS
MAXIMUM SCREEN VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM SCREEN DISSIPATION[B]	2.75	WATTS
MAXIMUM DC CATHODE CURRENT	60	MA.
MAXIMUM PEAK CATHODE CURRENT	180	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH CATHODE BIAS	2.2	MEGOHMS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	1.0	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	200	°C
HEATER WARM-UP TIME (APPROX.)	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	50	250	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	0[C]	-17.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	60 000	OHMS
TRANSCONDUCTANCE	---	4 400	μMHOS
PLATE CURRENT	153	44	MA.
SCREEN CURRENT	21	3.0	MA.
GRID #1 VOLTAGE (APPROX.) I_b = 100 μAMPS.		-48	VOLTS

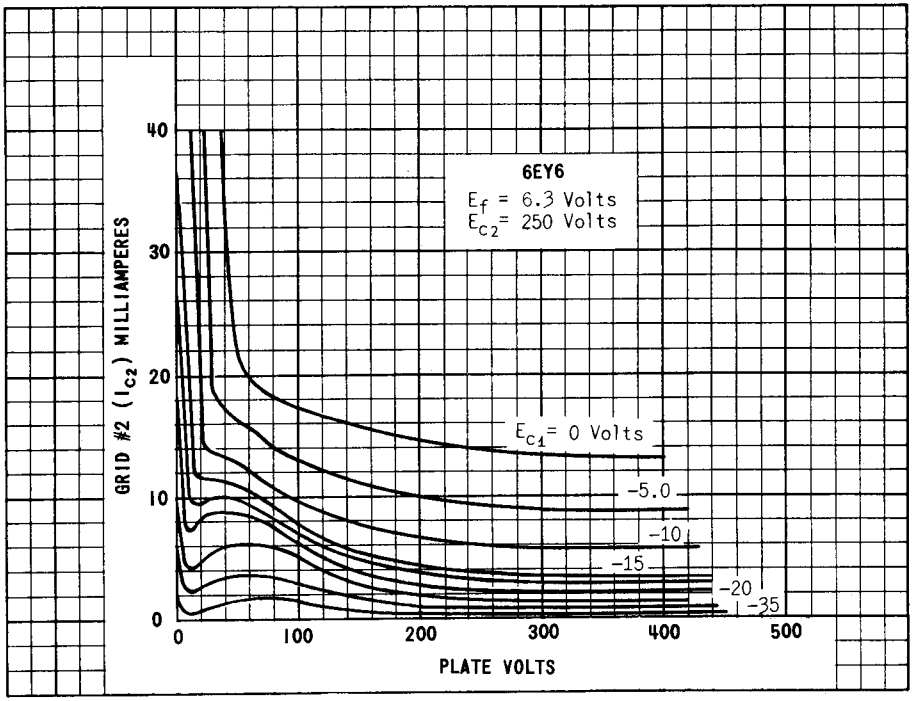
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS, WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

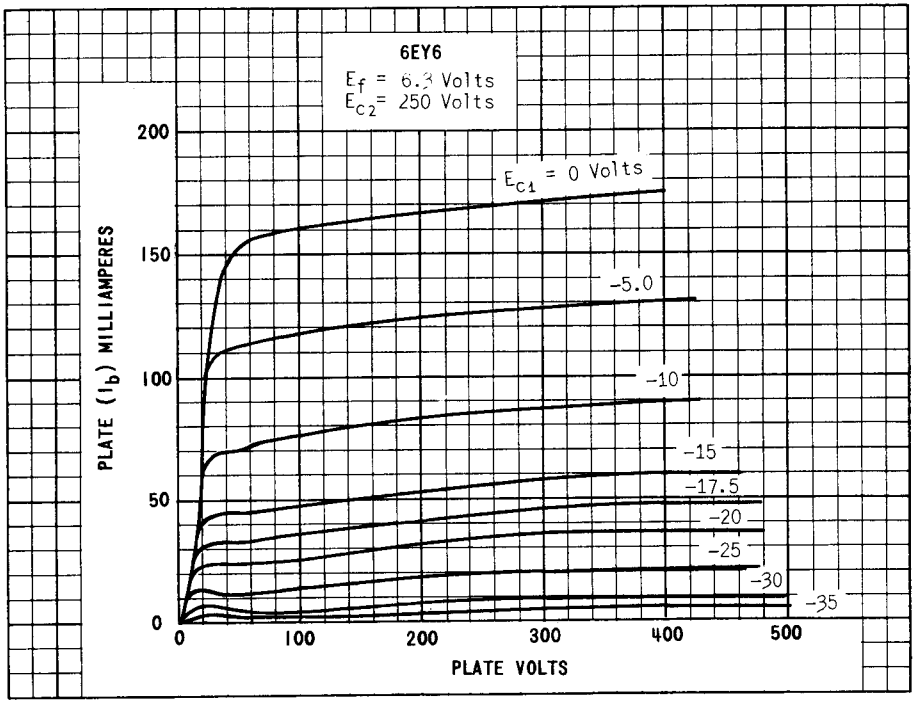
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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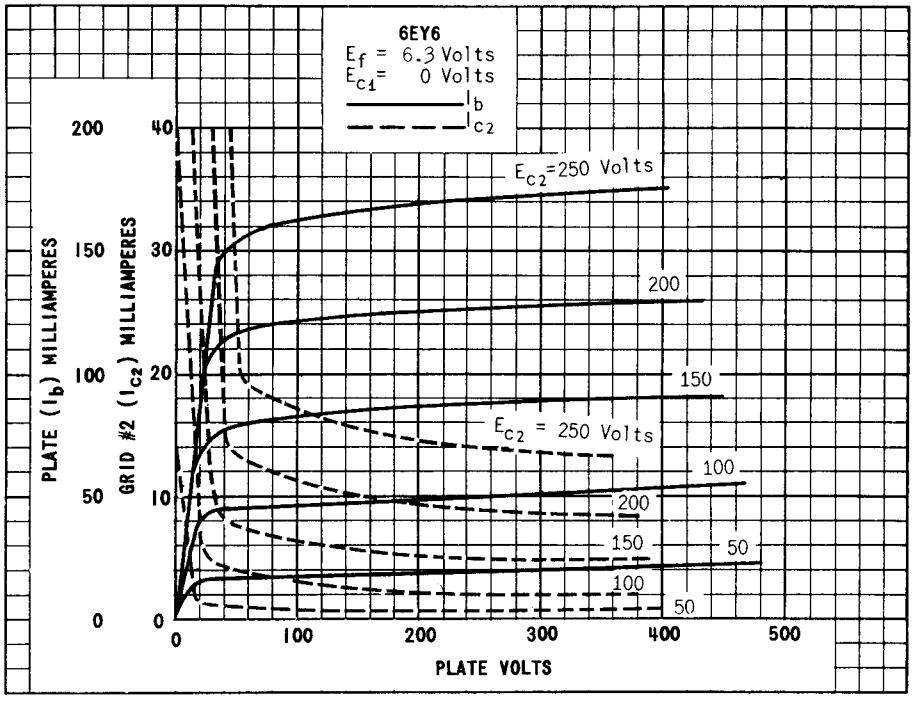
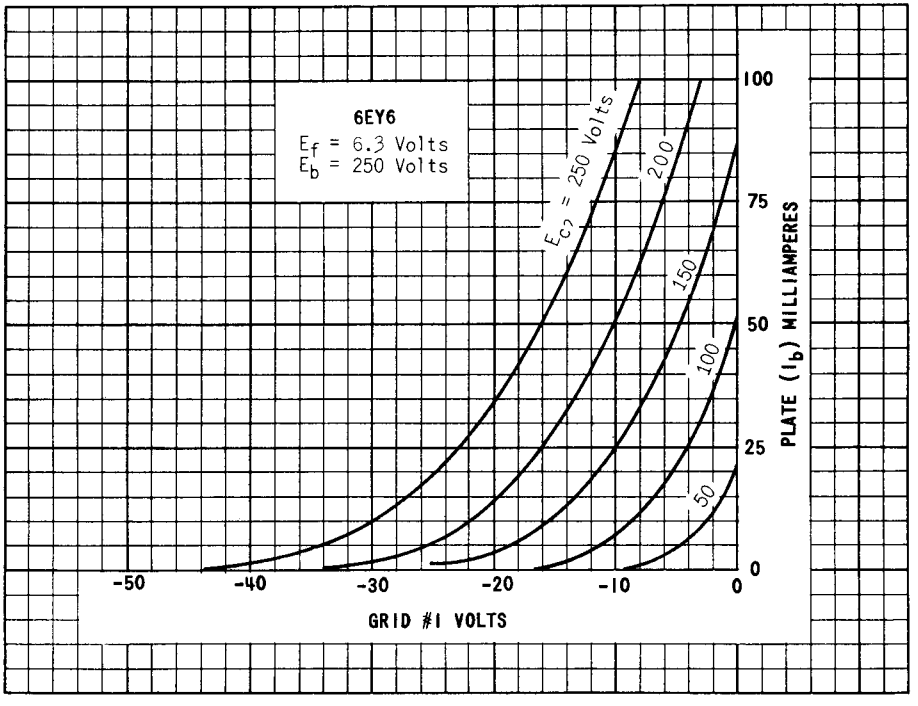
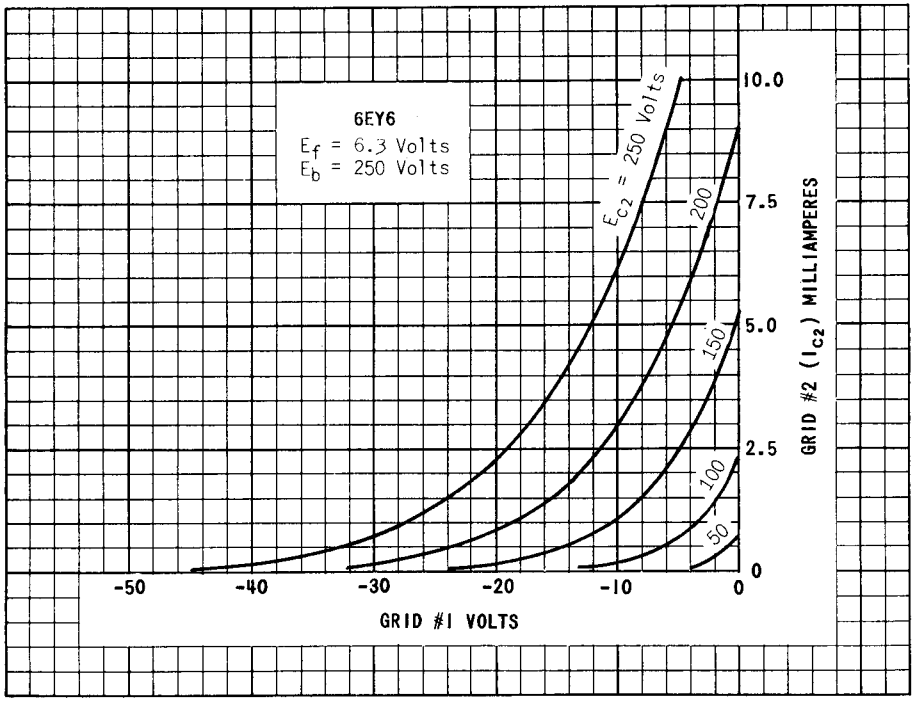

6EY6
E_f = 6.3 Volts
E_{c1} = 0 Volts
I_b
I_{c2}
E_{c2}=250 Volts
200
150
100
50
E_{c2} = 250 Volts
200
150
100
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
0
50
100
150
200
0
10
20
30
40


6EY6
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
200
150
100
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-50
-40
-30
-20
-10
0
0
25
50
75
100



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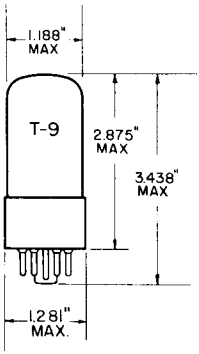
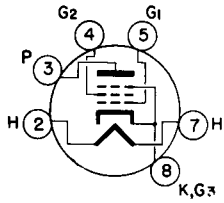
TUNG-SOL

BEAM-POWER PENTODE



GLASS BULB
INTERMEDIATE - SHELL
6 PIN OCTAL B6-81
OUTLINE DRAWING
JEDEC 9-15

COATED UNIPOTENTIAL CATHODE
HEATER
6.3±10% VOLTS 0.8 AMP.
AC OR DC
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 6EZ5 IS A BEAM-POWER PENTODE DESIGNED FOR USE AS THE VERTICAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS THAT EMPLOY 110-DEGREE DEFLECTION PICTURE TUBES. FEATURES OF THE TUBE INCLUDE HIGH PERVEANCE AND HIGH PLATE DISSIPATION.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT	9.0	μμf
OUTPUT	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL-DEFLECTION-AMPLIFIER SERVICE[A]

MAXIMUM DC PLATE VOLTAGE	350	VOLTS
MAXIMUM PEAK PULSE PLATE VOLTAGE	2500	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE*	250	VOLTS
MAXIMUM SCREEN VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[B]	12	WATTS
MAXIMUM SCREEN DISSIPATION[B]	2.75	WATTS
MAXIMUM DC CATHODE CURRENT	75	MA.
MAXIMUM PEAK CATHODE CURRENT	260	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
WITH CATHODE BIAS	2.2	MEGOHMS
WITH FIXED BIAS	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	200	C

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
HEATER CURRENT	0.8	0.8	AMP.
PLATE VOLTAGE	60	250	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	0[C]	−20	VOLTS
PLATE RESISTANCE (APPROX.)	---	50 000	OHMS
TRANSCONDUCTANCE	---	4 100	μMHOS
PLATE CURRENT	180	43	MA.
SCREEN CURRENT	26	3.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMPS.	---	−50	VOLTS

[A] FOR OPERATION IN A 525 LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIPLE TRIODE

MINIATURE TYPE

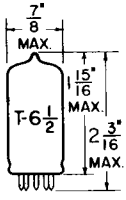
COATED UNIPOTENTIAL CATHODE

HEATER

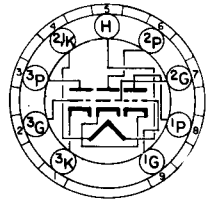
6.3±10% VOLTS 0,45 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9KA

THE 6EZ8 IS A HIGH-MU, TRIPLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE CATHODES OF SECTION 1 AND 2 HAVE A COMMON CONNECTION WITH ONE SIDE OF THE HEATER. IT WAS DESIGNED PRIMARILY FOR USE AS AN FM TUNER TUBE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE, EACH SECTION	1.5	1.5	μμf
INPUT, EACH SECTION	2.6	2.4	μμf
OUTPUT, SECTION 1	1.4	0.21	μμf
OUTPUT, SECTION 2	1.2	0.4	μμf
OUTPUT, SECTION 3	1.2	0.36	μμf
HEATER TO CATHODE, SECTION 3	0.15	0.17	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
EACH SECTION

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE	2.0	WATTS
MAXIMUM TOTAL PLATE DISSIPATION, ALL PLATES	5.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE (SECTION 3):		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TUNG-SOL

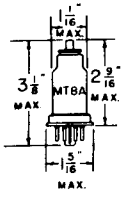
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	125	VOLTS
GRID VOLTAGE	−1.0	VOLTS
AMPLIFICATION FACTOR	57	
PLATE RESISTANCE (APPROX.)	13600	OHMS
TRANSCONDUCTANCE	4200	μMHOS
PLATE CURRENT	4.2	MA.
GRID VOLTAGE (APPROX.) Ib = 20 μAMPS.	−4	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE TUNE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN TUBE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL



METAL SHELL
SMALL WAFER
5 PIN OCTAL BASE

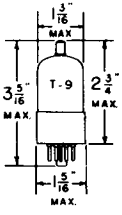
6F5

HIGH-MU TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

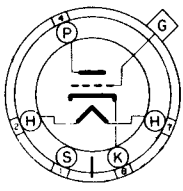
HEATER

6.3 VOLTS 0.3 AMPERE
AC OR DC



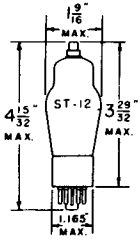
GLASS BULB
INTERMEDIATE
5 PIN OCTAL BASE

6F5GT



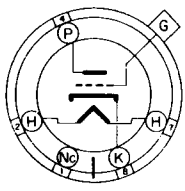
5M-0-1

6F5



GLASS BULB
SMALL 5 PIN
OCTAL BASE

6F5G



5M-0-0

6F5G, 6F5GT

THE TUNG-SOL 6F5, 6F5G AND 6F5GT ARE GENERAL PURPOSE HIGH-MU TRIODES. THEY ARE DESIGNED FOR SERVICE AS HIGH GAIN RESISTANCE COUPLED AMPLIFIERS IN AC AND AC-DC OPERATED RECEIVERS.

RATINGS

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.3	AMPERE
MAXIMUM PLATE VOLTAGE	300	VOLTS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	85 000	66 000	OHMS
TRANSCONDUCTANCE	1150	1500	μMHOS
AMPLIFICATION FACTOR	100	100	

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

PLATE
1192-1
FEB. 28
1942

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ZERO BIAS, RESISTANCE COUPLED, CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	100		300		VOLTS
PLATE LOAD RESISTOR	0.25		0.25		MEGOHM
GRID RESISTOR	10		10		MEGOHMS
COUPLING CONDENSER	.01 TO .005		.01 TO .005		µf
GRID RESISTOR FOR FOLLOWING TUBE	.5 TO	1.0	.5 TO	1.0	MEGOHM
EXTERNAL GRID CIRCUIT IMPEDANCE	0	0	0	0	MEGOHM
VOLTAGE GAIN	48	52	66	71	
VOLTAGE OUTPUT (RMS)[A]	7.0	8.5	44	50	VOLTS

[A] AT FIVE PER CENT TOTAL HARMONIC DISTORTION.

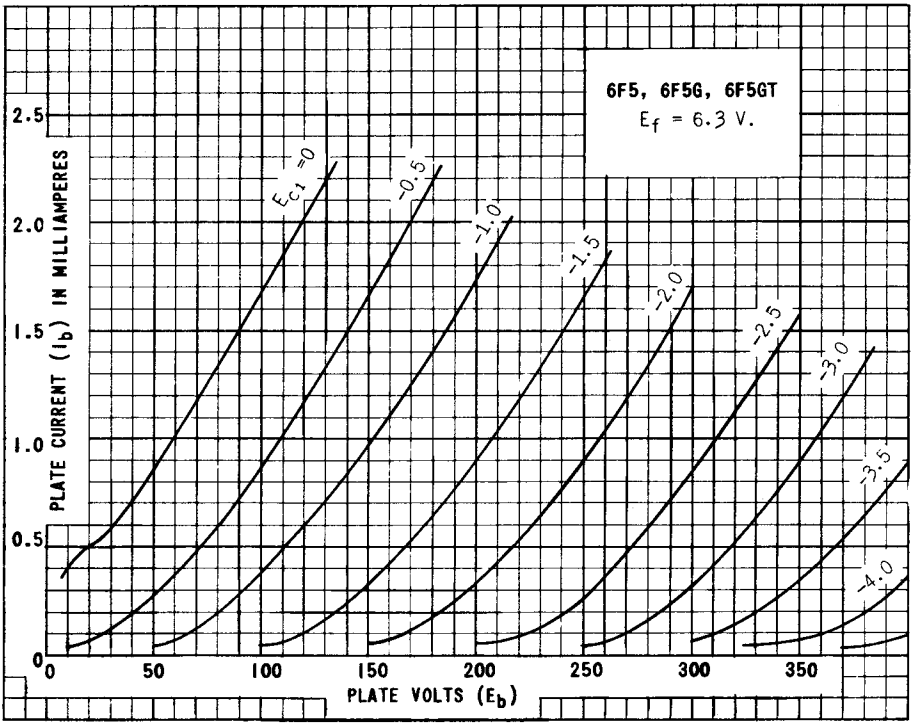

PLATE 1193-1

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TUNG-SOL

PENTODE POWER AMPLIFIER

COATED UNIPOTENTIAL CATHODE

HEATERS

6F6, 6F6GT/G, 42 – 6.3 V., 0.7 AMPERE
2A5 – 2.5 V., 1.75 AMPERES

TYPES 6F6, 6F6GT/G, 2A5 AND 42 ARE PENTODE AMPLIFIERS DESIGNED FOR APPLICATION IN POWER OUTPUT STAGES OF RECEIVERS. WITH THE EXCEPTION OF HEATER RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

MAXIMUM RATINGS

	PENTODE CONNECTION	TRIODE CONNECTION	
MAXIMUM PLATE VOLTAGE	375	350	VOLTS
MAXIMUM SCREEN VOLTAGE	285	–	VOLTS
MAXIMUM PLATE DISSIPATION	11	–	WATTS
MAXIMUM SCREEN DISSIPATION	3.75	–	WATTS
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION	–	10	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE [C]

	PENTODE CONNECTION		TRIODE CONNECTION	
PLATE VOLTAGE	250	285	250	VOLTS
SCREEN VOLTAGE	250	285	–	VOLTS
CONTROL GRID VOLTAGE [A]	-16.5	-20	-20	VOLTS
PEAK AF SIGNAL VOLTAGE	16.5	20	20	VOLTS
ZERO-SIGNAL PLATE CURRENT	34	38	31	MA.
ZERO-SIGNAL SCREEN CURRENT	6.5	7	–	MA.
MAXIMUM-SIGNAL PLATE CURRENT	36	40	34	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	10.5	13	–	MA.
PLATE RESISTANCE (APPROX.)	80000	78000	2600	OHMS
TRANSCONDUCTANCE	2500	2550	2600	μMHOS
AMPLIFICATION FACTOR	–	–	6.8	
LOAD RESISTANCE	7000	7000	4000	OHMS
TOTAL HARMONIC DISTORTION	8	9	6.5	PER CENT
POWER OUTPUT	3.2	4.8	0.85	WATTS

PUSH-PULL AMPLIFIER - TWO TUBES [F]

	CLASS A_1 AMPLIFIER [C]	CLASS AB_2 AMPLIFIER [D]		
	PENTODE CONNECTION	PENTODE CONNECTION	TRIODE CONNECTION	
PLATE VOLTAGE	315	375	350	VOLTS
SCREEN VOLTAGE	285	250	–	VOLTS
CONTROL GRID VOLTAGE	-24 [A]	-26	-38	VOLTS
PEAK AF SIGNAL VOLTAGE (GRID TO GRID)	48	82	123	VOLTS
ZERO-SIGNAL PLATE CURRENT	62	34	48	MA.
ZERO-SIGNAL SCREEN CURRENT	12	5	–	MA.
MAXIMUM-SIGNAL PLATE CURRENT	80	82	92	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	19.5	19.5	–	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	10000	10000	6000	OHMS
TOTAL HARMONIC DISTORTION	4	3.5	2	PER CENT
POWER OUTPUT	11	18.5	13	WATTS

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PLATE 1385-1
DEC. 15 1943

(CONTINUED NEXT PAGE)

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6F6, 6F6GT/G (2A5, 42)

TUNG-SOL

TYPICAL OPERATING CONDITIONS FOR CATHODE BIAS

	CLASS A_1 AMPLIFIER [C]			CLASS AB_2 AMPLIFIER [D]			
	SINGLE TUBE AMPLIFIER		PUSH-PULL AMPLI.	PUSH-PULL AMPLI.			
	Pentode Conn.	Triode Conn.	Pentode Conn. [F]	Pentode Conn. [F]	Triode Conn. [F]		
Plate	250	285	250	315	375	350	Volts
Screen	250	285	-	285	250	-	Volts
Cathode Resistor	410	-	650	320	340 [B]	730 [E]	Ohms
Peak A-F Grid Voltage	18.5	20	20	-	-	-	Volts
Peak A-F Grid-to-Grid Voltage	-	-	-	58	94	132	Volts
Zero-Sig. Plate Cur.	34	38	31	62	54	50	Ma.
Max.-Sig. Plate Cur.	35	38	32	73	77	60	Ma.
Zero-Sig. Screen Cur.	6.5	7	-	12	8	-	Ma.
Max.-Sig. Screen Cur.	9.7	12	-	18	18	-	Ma.
Load Resistance	7000	7000	4000	-	-	-	Ohms
Effective Load Resis. (plate to plate)	-	-	-	10000	10000	10000	Ohms
Total Harmonic Dist.	8.5	9	6.5	3	5	3	%
Max.-Sig. Power Output	3.1	4.5	0.8	10.5	19	9	Watts

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER RATED MAXIMUM CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED-BIAS OPERATION.

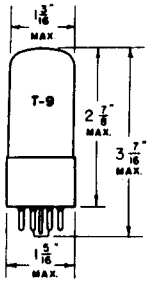
[B] THE VALUE GIVEN FOR THE CATHODE RESISTOR IS DETERMINED FOR A GRID BIAS OF -21 VOLTS.

[C] SUBSCRIPT 1 INDICATES THAT GRID CURRENT DOES NOT FLOW DURING ANY PART OF INPUT CYCLE.

[D] SUBSCRIPT 2 INDICATES THAT GRID CURRENT FLOWS DURING SOME PART OF INPUT CYCLE.

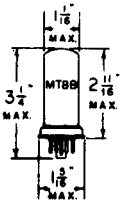
[E] THE VALUE GIVEN FOR THE CATHODE RESISTOR IS DETERMINED FOR A GRID BIAS OF -36.5 VOLTS.

[F] UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR 2 TUBES.



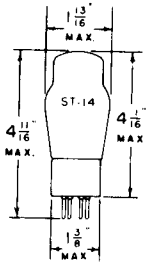
GLASS BULB

6F6GT/G



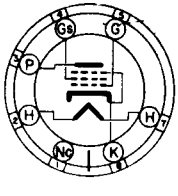
METAL SHELL

6F6

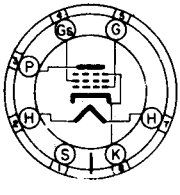


GLASS BULB

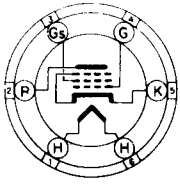
2A5 - 42



MEDIUM 7 PIN OCTAL BASE



7 PIN OCTAL BASE



MEDIUM 6 PIN BASE

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DEC. 15 1943

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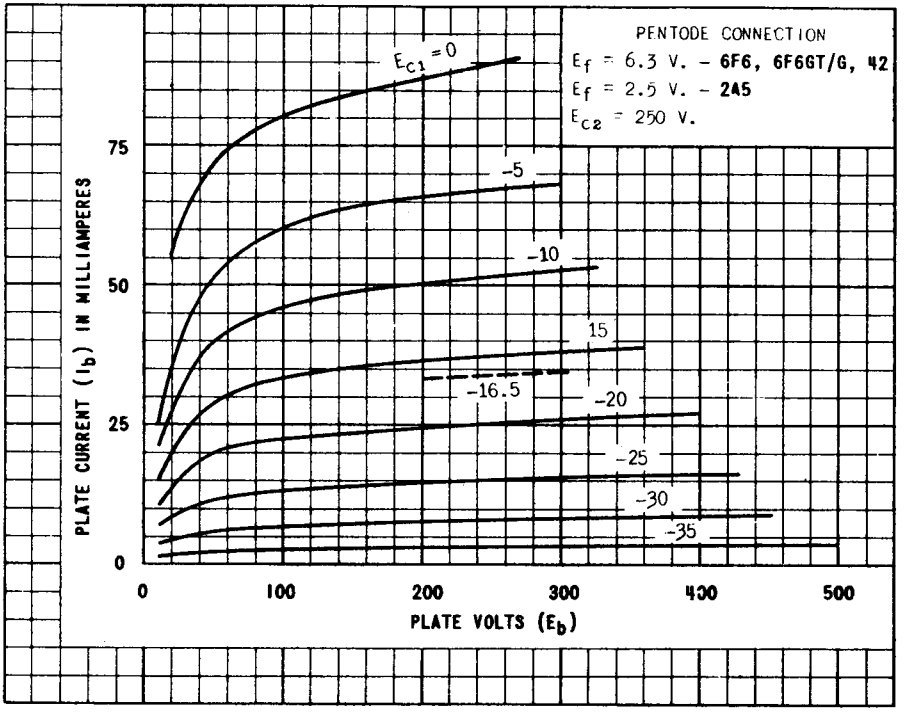

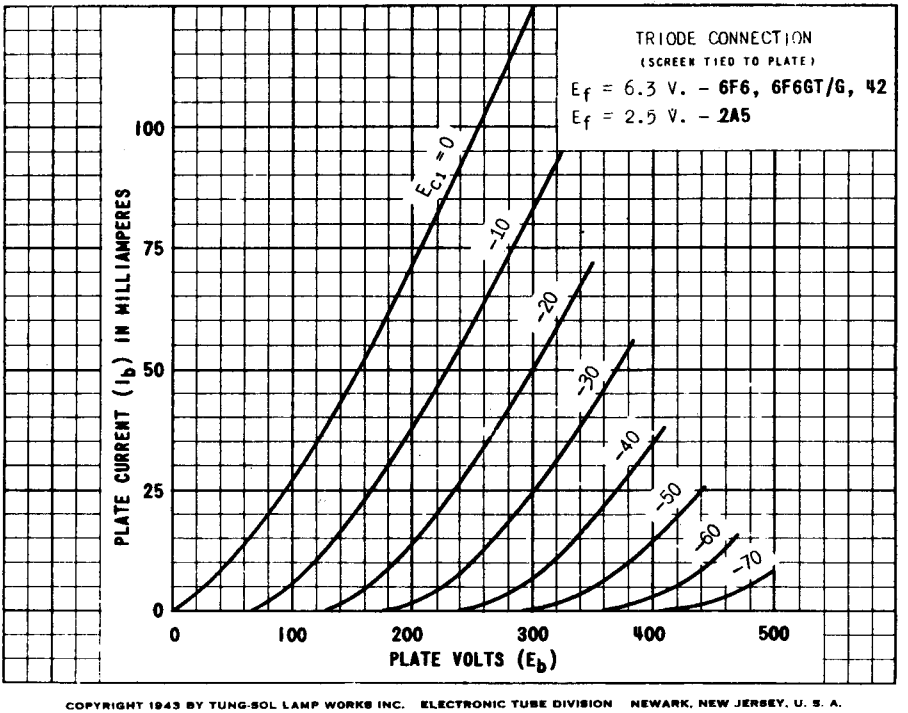

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OCT. 25 1943

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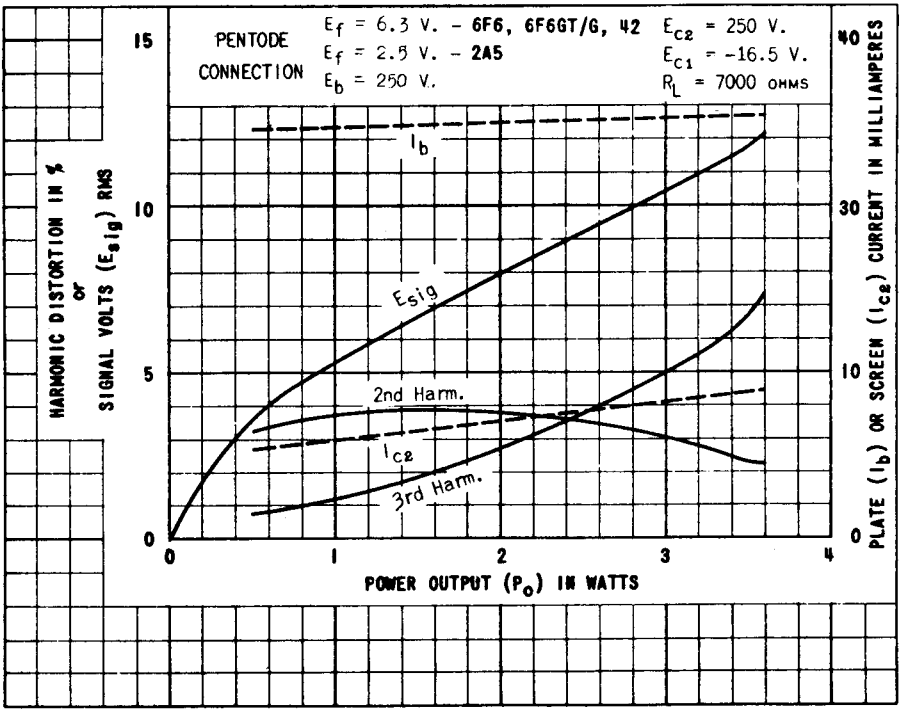
6F6, 6F6GT/G (2A5,42)



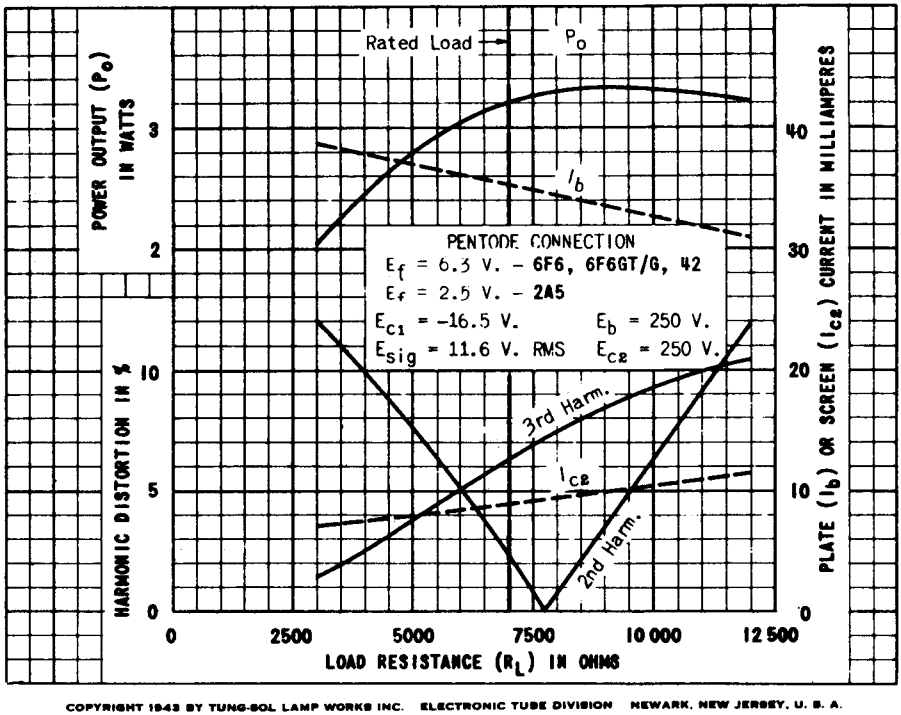


PLATE 1340-1
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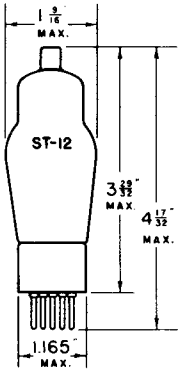
TUNG-SOL

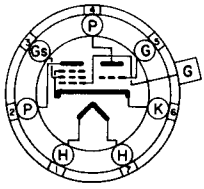


TRIODE PENTODE
AMPLIFIER AND CONVERTER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



7E

BOTTOM VIEW

SMALL 7 PIN BASE

THE TUNG-SOL 6F7 COMBINES A TRIODE AND A REMOTE CUT-OFF PENTODE, UTILIZING A COMMON CATHODE, IN A SINGLE BULB.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT		
PLATE VOLTAGE	100 MAX.	100	250 MAX.	VOLTS
SCREEN VOLTAGE MAX.	–	100	100	VOLTS
CONTROL GRID VOLTAGE MIN.	-3	-3	-3	VOLTS
PLATE CURRENT	3.5	6.3	6.5	MA.
SCREEN CURRENT	–	1.6	1.5	MA.
PLATE RESISTANCE	0.016	0.29 A	0.85 A	MEGOHM
TRANSCONDUCTANCE	500	1050	1100	μMHOS
AMPLIFICATION FACTOR	8	300 A	900 A	
TRANSCONDUCTANCE AT -35 VOLTS BIAS	–	9	10	μMHOS

A APPROXIMATE

CONVERTER SERVICE

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE MAX.	100	250	VOLTS
SCREEN VOLTAGE MAX.	–	100	VOLTS
CONTROL GRID VOLTAGE	L	-3 MIN. G	VOLTS
OSCILLATOR PLATE CURRENT (AVERAGE)	4 MAX.	–	MA.

G GRID BIAS SHOULD BE AT LEAST 3 VOLTS GREATER THAN THE PEAK OSCILLATOR VOLTAGE APPLIED TO THE PENTODE GRID.

L OBTAINED BY MEANS OF A GRID LEAK.

CONTINUED NEXT PAGE

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PLATE 371-2

APR. 14 1939

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TYPICAL OPERATION

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	100[P]	250	VOLTS
SCREEN VOLTAGE	–	100	VOLTS
GRID BIAS	[L]	−10[B]	VOLTS
PLATE CURRENT	2.4	2.8	MA.
SCREEN CURRENT	–	0.6	MA.
GRID CURRENT	0.15	0	MA.
PLATE RESISTANCE	–	2	MEGOHMS
CONVERSION CONDUCTANCE	–	300	μMHOS
OSCILLATOR PEAK VOLTAGE INPUT	–	7	VOLTS

[B] OBTAINED BY MEANS OF A 1700 OHMS CATHODE RESISTOR.

[L] OBTAINED BY MEANS OF A GRID LEAK.

[P] MAY BE OBTAINED FROM 250 VOLT SOURCE THROUGH 60 000 OHM DROPPING RESISTOR.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT	PENTODE UNIT	
CONTROL GRID TO CATHODE	2.4	3.2	μμf
PLATE TO CATHODE	3.0	13	μμf
CONTROL GRID TO PLATE	2.0	.007 MAX. [S]	μμf

[S] WITH SHIELD

PLATE
372-2

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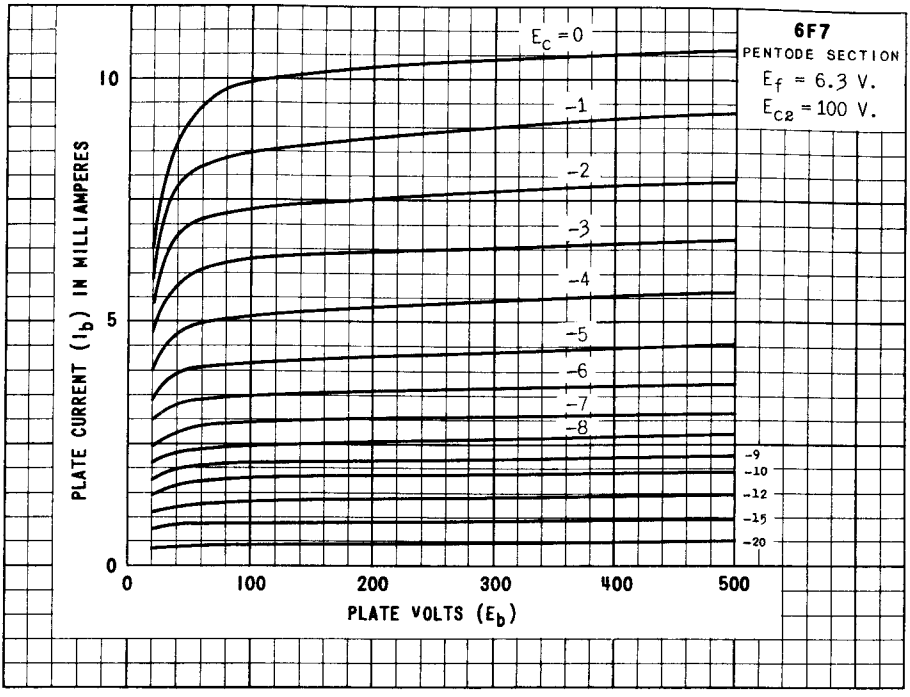

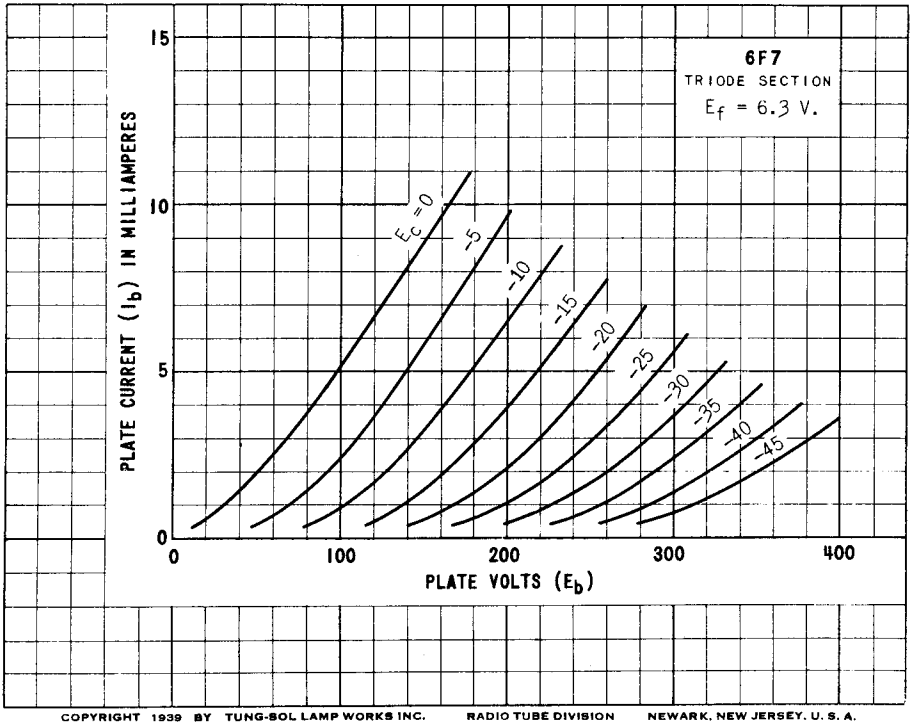

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PLATE
482-1

JUNE 26
1939

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6F7

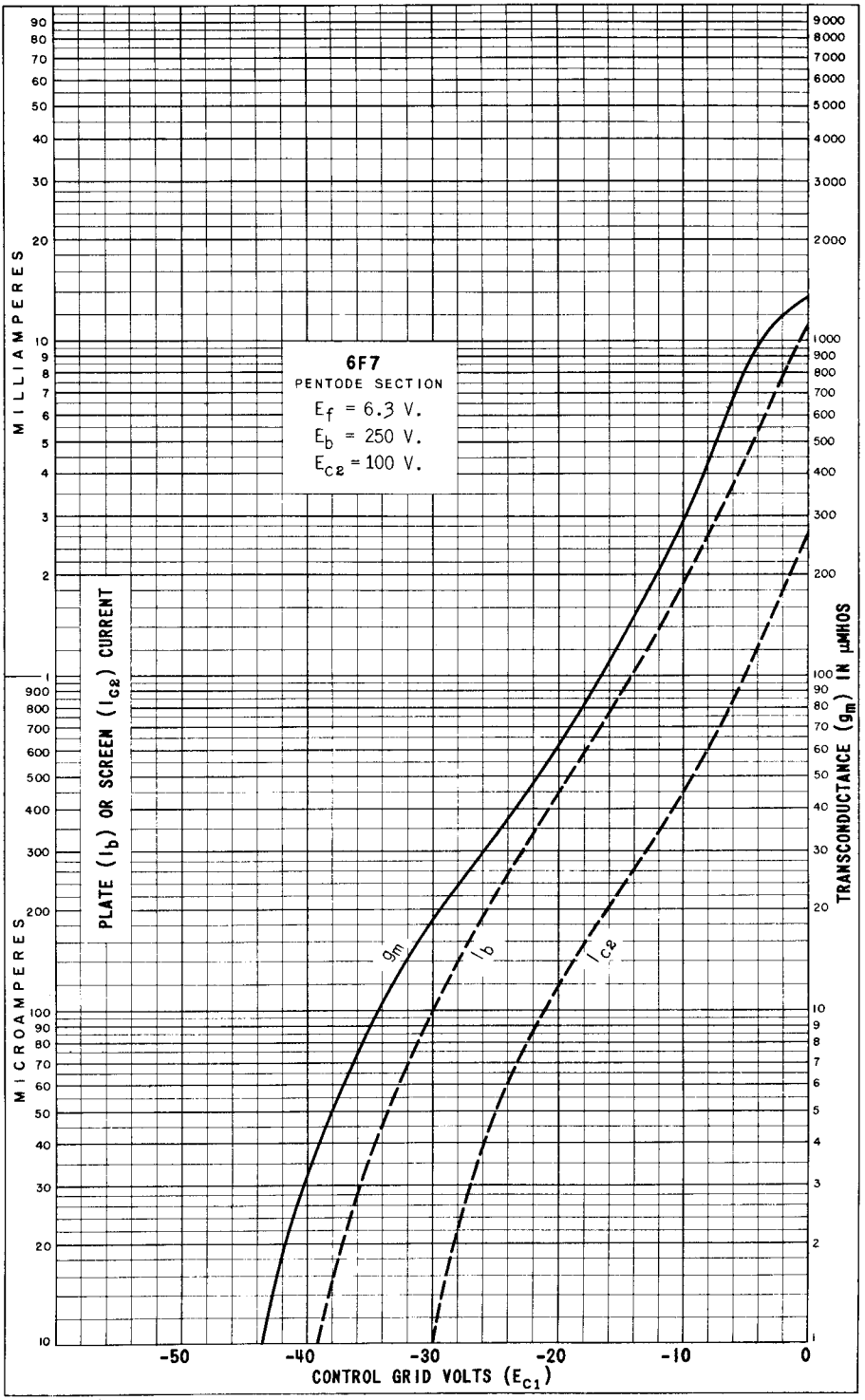

PLATE 483-1

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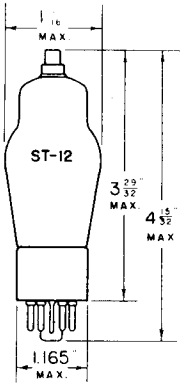

TWIN TRIODE AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

GLASS BULB

SMALL 8 PIN OCTAL BASE

G-8G
BOTTOM VIEW

THE TUNG-SOL 6F8G IS A GENERAL PURPOSE TWIN TRIODE VOLTAGE AMPLIFIER HAVING TWO COMPLETELY INDEPENDENT TRIODE UNITS IN ONE BULB. WITH THE EXCEPTION OF CAPACITANCES, THE ELECTRICAL CHARACTERISTICS OF EACH TRIODE SECTION ARE IDENTICAL TO THOSE OF THE 6J5, 6J5G AND 6J5GT.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION PER UNIT	2.5	WATTS
MINIMUM CONTROL GRID VOLTAGE	0	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER (EACH UNIT)

PLATE VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10.0	9.0	MA.
PLATE RESISTANCE	6700	7700	OHMS
TRANSCONDUCTANCE	3000	2600	μMHOS
AMPLIFICATION FACTOR	20	20	

DIRECT INTERELECTRODE CAPACITANCES[A]

	TRIODE UNIT 1		TRIODE UNIT 2	
GRID TO CATHODE	3.2		3.0	μμf
PLATE TO CATHODE	3.2		3.8	μμf
GRID TO PLATE	4.0		3.6	μμf
GRID 1 TO GRID 2		0.2		μμf
PLATE 1 TO PLATE 2		0.4		μμf
GRID 2 TO PLATE 1		0.1		μμf

[A] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

TRIODE 1 - TRIODE HAVING GRID BROUGHT OUT TO BASE PIN.

TRIODE 2 - TRIODE HAVING GRID BROUGHT TO THE TOP CAP.

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PLATE 1106-2

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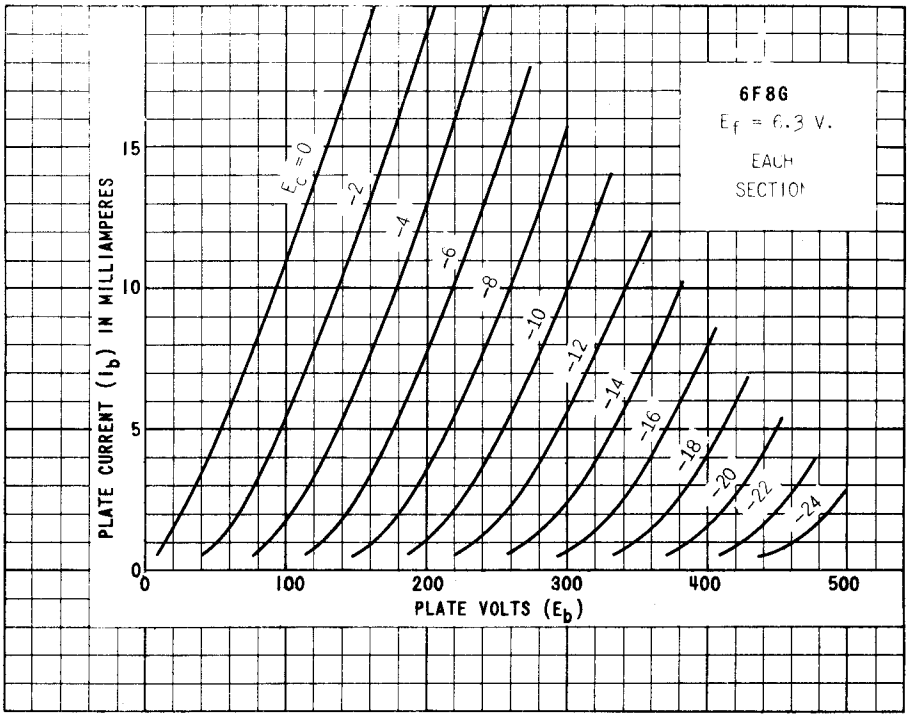
6F8G



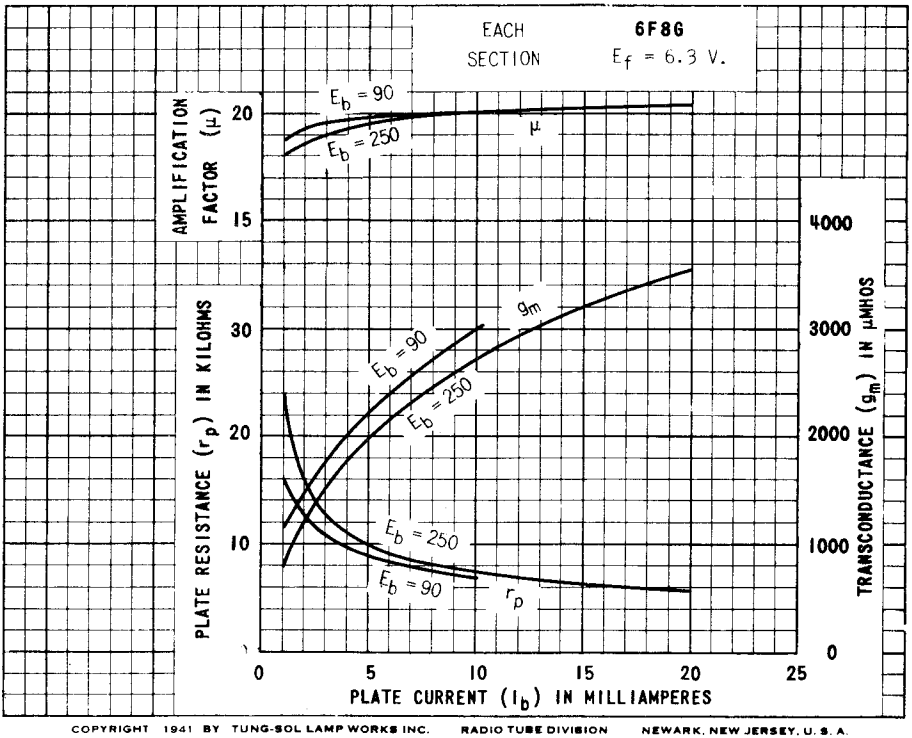


PLATE
1107-1

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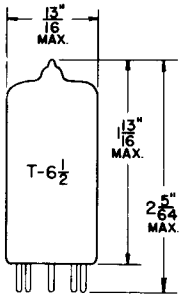
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



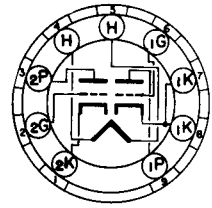
GLASS BULB

HEATER

6.3 VOLTS 0.34 AMP.

ANY MOUNTING POSITION

THE TRIODE ON PINS 6,7,8 & 9 SHOULD HAVE GROUNDED CATHODE CONNECTION, AND THAT ON PINS 1,2, & 3 SHOULD HAVE GROUNDED GRID CONNECTION. IT IS RECOMMENDED THAT PINS 7 & 8 BE STRAPPED.



BOTTOM VIEW

MINIATURE

9 PIN BASE

9DD

THE 6FC7 IS A FRAME GRID DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A CASCODE AMPLIFIER AT FREQUENCIES UP TO 220 MEGACYCLES PER SECOND. EXCEPT FOR HEATER RATINGS, THE 6FC7 IS IDENTICAL TO THE 7FC7.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

PLATE #1 TO PLATE #2 (MAX.)	0.015	μμf
GRID #1 TO PLATE #2 (MAX.)	0.005	μμf
GROUNDED CATHODE SECTION:		
PLATE TO GRID	1.9	μμf
INPUT	3.8	μμf
OUTPUT	2.5	μμf
GRID TO HEATER (MAX.)	0.3	μμf
GROUNDED GRID SECTION:		
PLATE TO GRID	4.1	μμf
PLATE TO CATHODE	0.2	μμf
INPUT	6.3	μμf
OUTPUT	4.5	μμf
CATHODE TO HEATER	2.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	1.8	WATTS
MAXIMUM CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (GROUNDED CATHODE SECT.)	1.0	MEGOHMS
MAXIMUM GRID CIRCUIT RESISTANCE (GROUNDED GRID SECT.)	500	KOHMS
MAXIMUM HEATER TO CATHODE VOLTAGE (RMS)	50	VOLTS
MAXIMUM HEATER TO CATHODE VOLTAGE (HEATER NEGATIVE)[A]	180	VOLTS

[A] MAXIMUM DC COMPONENT 130 V.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS

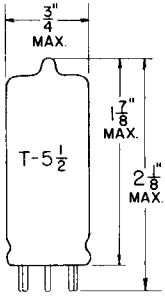
EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.34	AMP.
PLATE VOLTAGE	90	VOLTS
PLATE CURRENT	15	MA.
GRID VOLTAGE	-1.2	VOLTS
MUTUAL CONDUCTANCE	12 000	μMHOS
NOISE FACTOR (IN CASCODE CIRCUIT)	5.5	dB

TUNG-SOL

PENTODE

MINIATURE TYPE

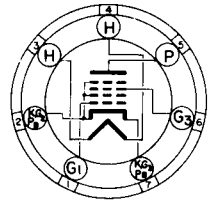


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3±10% VOLTS 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7GA

THE 6FG5 IS A "SHADOW GRID" BEAM PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS AN INTERNALLY CONNECTED GRID BETWEEN THE CONTROL GRID AND THE SCREEN GRID WHICH SERVES TO REDUCE THE RATIO OF SCREEN CURRENT TO PLATE CURRENT. THE TUBE IS DESIGNED FOR USE AS A RADIO-FREQUENCY AMPLIFIER IN VHF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHELD

GRID #1 TO PLATE (MAX.) (G1 TO P)	0.02	μμf
INPUT: G1 TO (H+K+G2+G3+B.P.)	4.2	μμf
OUTPUT: P TO (H+K+G2+G3+B.P.)	2.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM SCREEN VOLTAGE	275	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.15	WATTS
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	3.3	MEGOHMS

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TUNG-SOL

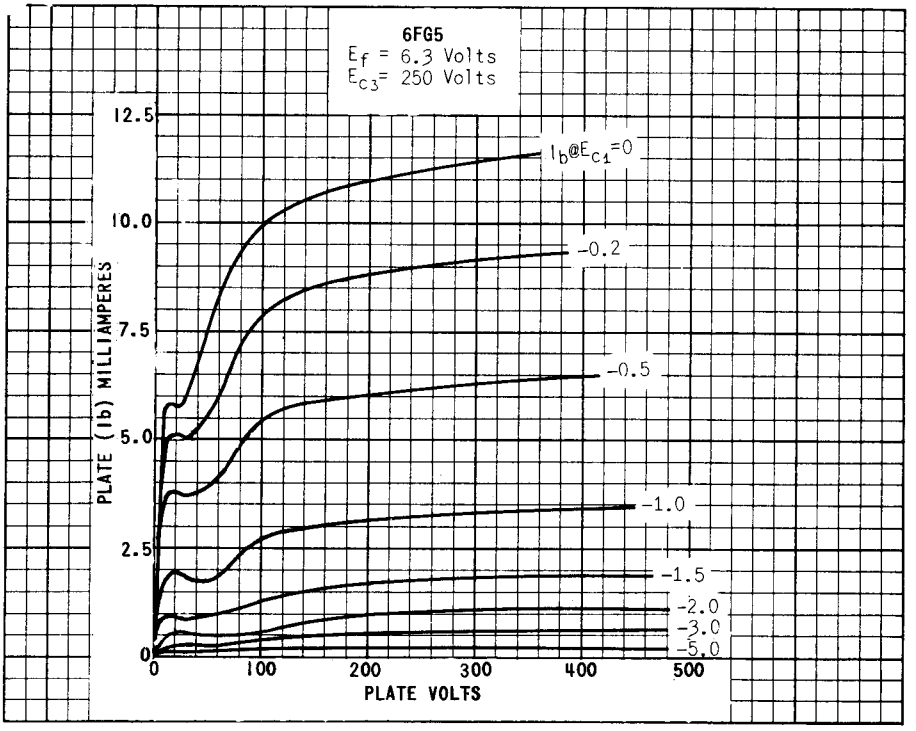
CONTINUED FROM PRECEDING PAGE

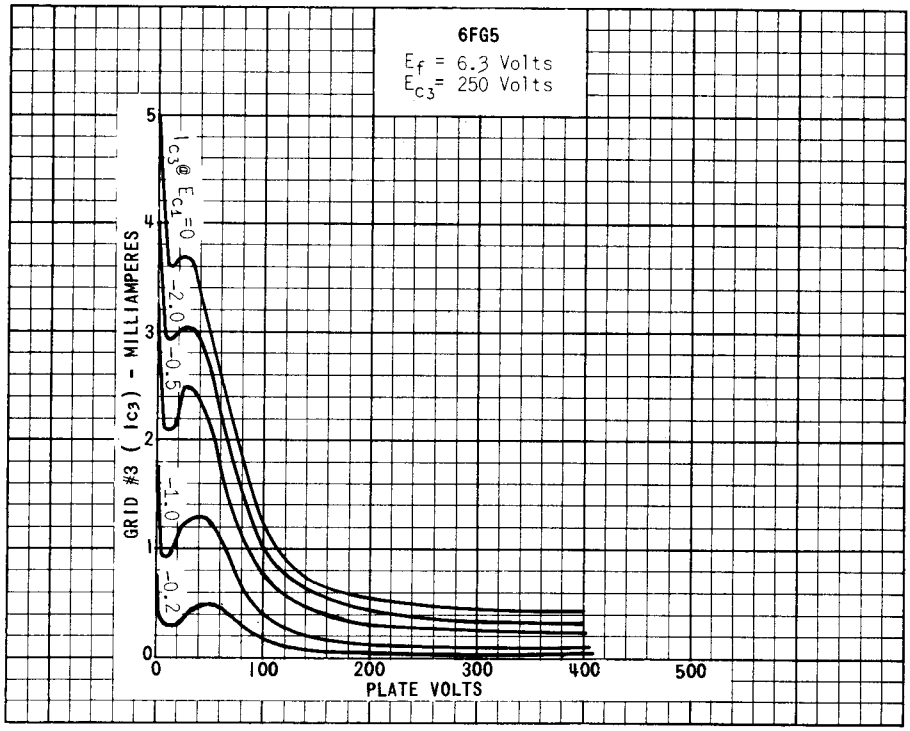
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

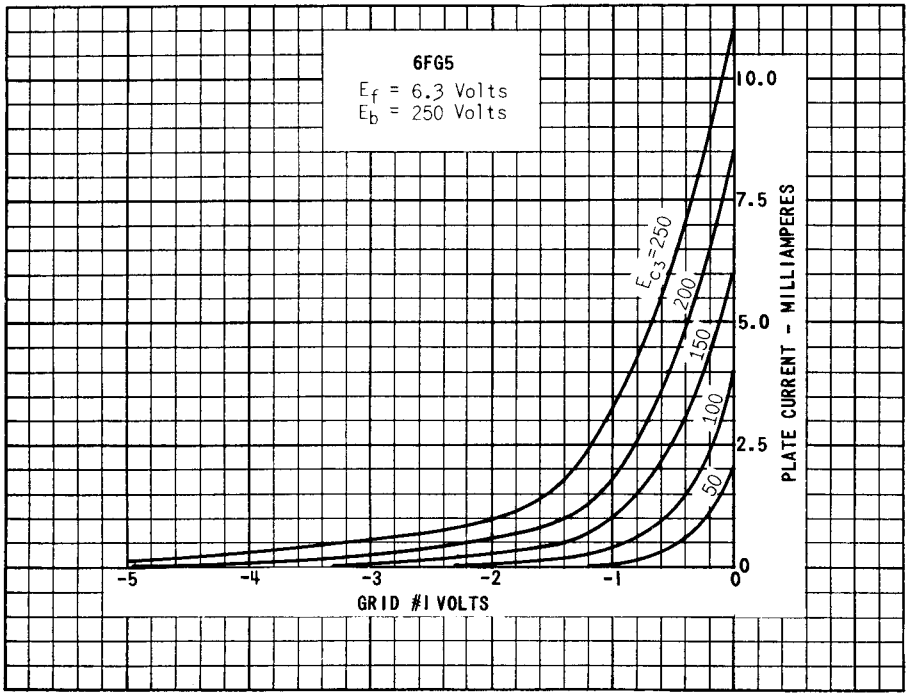
AVERAGE CHARACTERISTICS

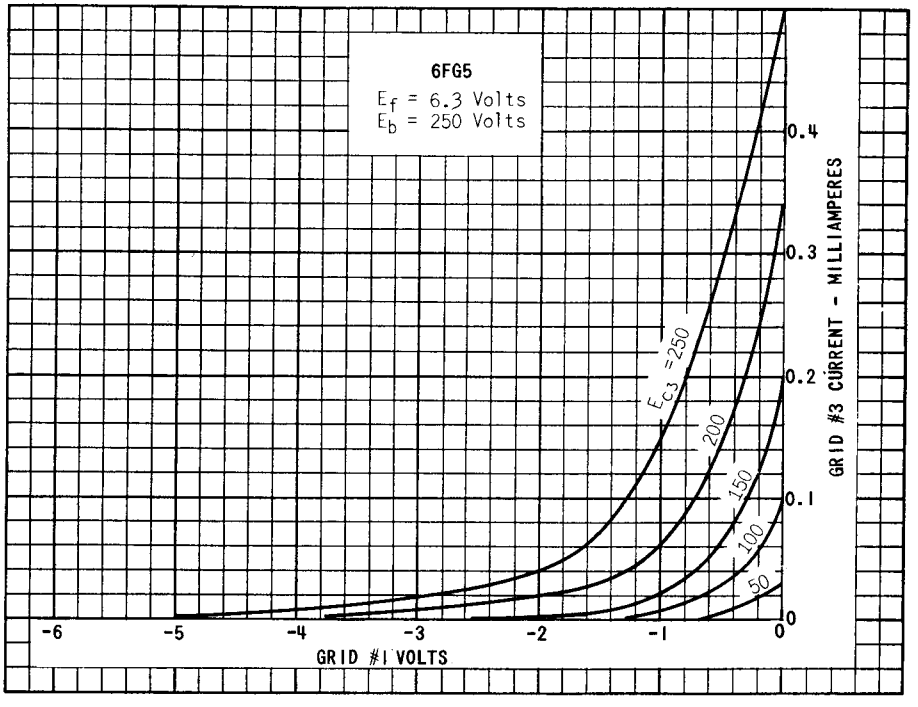
HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-0.2	VOLTS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHMS
TRANSCONDUCTANCE	9500	μMHOS
PLATE CURRENT	9.0	MA.
SCREEN CURRENT	0.42	MA.
GRID #1 VOLTAGE (APPROX.) Gm = 100 μMHOS	-5	VOLTS

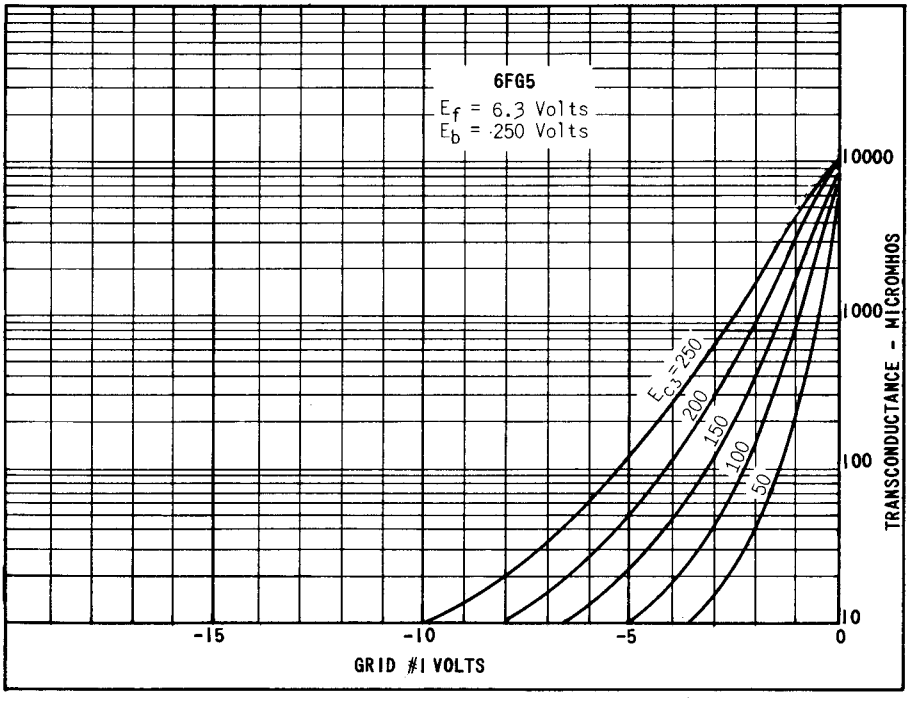
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.




6FG5
E_f = 6.3 Volts
E_{c3} = 250 Volts
I_{c3} @ E_{c1}=0
-2.0
-0.5
-1.0
-0.2
GRID #3 (I_{c3}) - MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
1
2
3
4
5


6FG5
E_f = 6.3 Volts
E_b = 250 Volts
E_{c3}=250
200
150
100
50
PLATE CURRENT - MILLIAMPERES
GRID #1 VOLTS
10.0
7.5
5.0
2.5
0
-5
-4
-3
-2
-1


6FG5
E_f = 6.3 Volts
E_b = 250 Volts
E_{C3} = 250
200
150
100
50
0.4
0.3
0.2
0.1
0
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
GRID #3 CURRENT - MILLIAMPERES

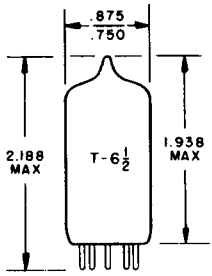

6FG5
E_f = 6.3 Volts
E_b = 250 Volts
E_{C3} = 250
200
150
100
50
10000
1000
100
10
-15
-10
-5
0
GRID #1 VOLTS
TRANSCONDUCTANCE - MICROMHOS

TUNG-SOL

TRIODE - PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



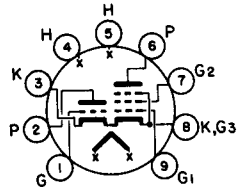
BASE 9 PIN BUTTON
JEDEC E9-1

FOR
USE IN VHF
TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9GF



BOTTOM VIEW

THE 6FG7 IS A MEDIUM-MU TRIODE AND SHARP-CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN VHF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6FG7 IS IDENTICAL TO THE 5FG7.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	SHIELD #315 CONNECTED TO CATHODE	
TRIODE UNIT:			
GRID TO PLATE	1.8	1.8	pf
GRID TO CATHODE AND PENTODE GRID 3 & HEATER 3	3	3	pf
PLATE TO CATHODE & PENTODE GRID 3 & HEATER	1.3	1.9	pf
PENTODE UNIT:			
GRID 1 TO PLATE - MAX.	0.02	0.01	pf
GRID 1 TO CATHODE & GRID 2, GRID 2, AND HEATER	5	5	pf
PLATE TO CATHODE & GRID, GRID 2, AND HEATER	2.4	3.4	pf
HEATER TO CATHODE & PENTODE GRID 3	6	6 [A]	pf

A - SHIELD #315 CONNECTED TO GROUND

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER - CATHODE VOLTAGE - EACH UNIT:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

MAXIMUM RATINGS

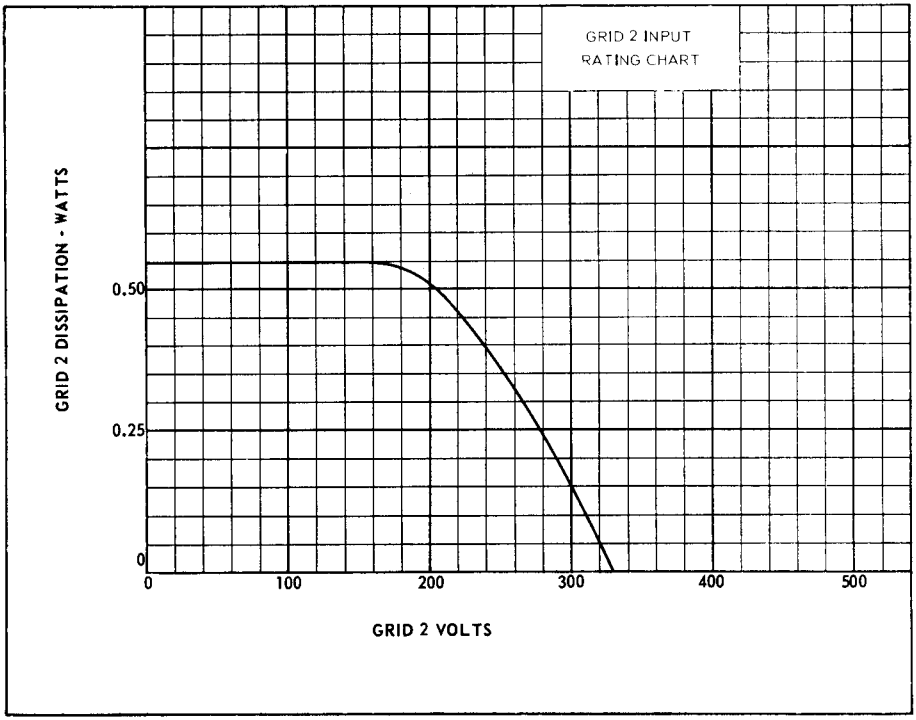
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART		
GRID 1 VOLTAGE:			
POSITIVE - BIAS VALUE	0	0	VOLTS
GRID 2 INPUT:			
FOR GRID 2 VOLTAGES UP TO 165 VOLTS		0.55	WATT
FOR GRID 2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART		
PLATE DISSIPATION	2.5	3	WATTS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT		
PLATE VOLTAGE	125	100	125	VOLTS
GRID 2 VOLTAGE	–	100	125	VOLTS
GRID 1 VOLTAGE	−1	0	−1	VOLTS
PLATE CURRENT	13		11	mA
GRID 2 CURRENT	–	–	4	mA
TRANSCONDUCTANCE	7,500	7,400	6,000	μMHOS
AMPLIFICATION FACTOR	43			
PLATE RESISTANCE - APPROX.	5.7	–	180	KOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA - APPROX.	−6.5	–	−7.5	VOLTS



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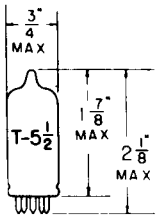
TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

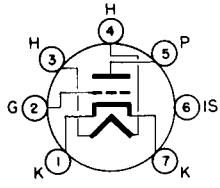
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 6FH5 IS A NEUTRODE TRIODE TUNER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN GROUNDED CATHODE RF AMPLIFIERS, WITH THE NEUTRODE CONSTRUCTION PROVIDING A LOWER GRID TO PLATE CAPACITANCE WITH CONSEQUENT EASE OF NEUTRALIZATION. THE CONVENTIONAL GRID RESULTS IN LOW INPUT CAPACITANCE. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6FH5 IS IDENTICAL TO THE 2FH5 AND 3FH5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: G TO P (MAX.) (BOGEY)	→ 0.52	→0.52	pf
INPUT: G TO (H+K+I.S.)	3.2	3.2	pf
OUTPUT: P TO (H+K+I.S.)	4.0	3.2	pf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #1.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID VOLTAGE (POSITIVE)	0	VOLT
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEGOHM
→ MAXIMUM DC HEATER-CATHODE VOLTAGE: TOTAL DC AND PEAK:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

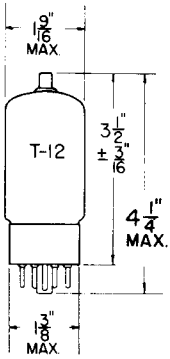
CLASS A AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.0	VOLT
PLATE RESISTANCE (APPROX.)	5600	OHMS
TRANSCONDUCTANCE	9000	μMHOS
AMPLIFICATION FACTOR	50	
PLATE CURRENT	11	MA.
GRID VOLTAGE (APPROX.) FOR 100 μA PLATE CURRENT	-5.5	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

PENTODE

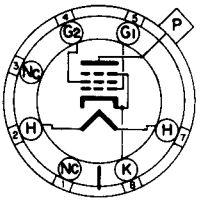


GLASS BULB
SKIRTED MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
6AM

THE 6FH6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.4	μμf
INPUT	33	μμf
OUTPUT	8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]
HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + DC POWER VOLTAGE)	770	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE	6 000	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM PLATE DISSIPATION[C]	17	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	220	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.6	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	155	MA.
MAXIMUM PEAK CATHODE CURRENT	500	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEG.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	240	°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
PLATE CURRENT	75	MA.
GRID #2 CURRENT	1.7	MA.
TRANSCONDUCTANCE	6 000	μMHOS
TRIODE AMPLIFICATION FACTOR[D]	4.3	
PLATE RESISTANCE	12 000	OHMS
E_{c1} FOR I_b = 1.0 MA.	-53	VOLTS

ZERO BIAS CHARACTERISTICS

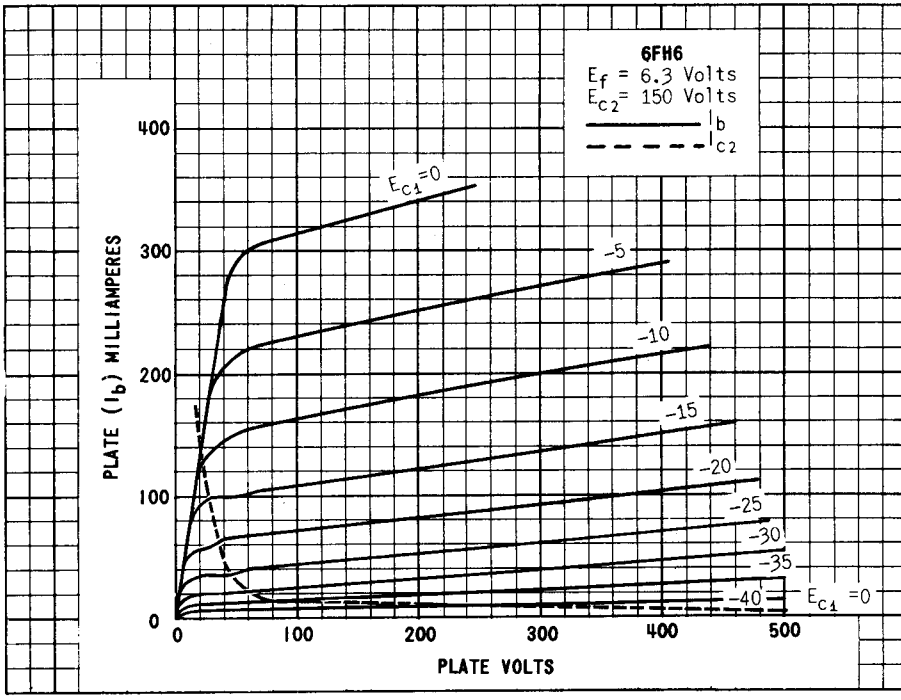
PLATE VOLTAGE	60	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT (INSTANTANEOUS VALUE)	300	MA.
GRID #2 CURRENT (INSTANTANEOUS VALUE)	15	MA.

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D] E_B TIED TO E_{C2} WITH 150 VDC APPLIED AND E_{C1} =-22.5.



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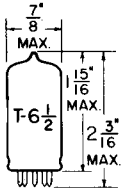
TUNG-SOL

TRIODE TETRODE

MINIATURE TYPE



GLASS BULB

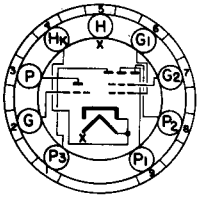
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON
9 PIN NOVAL
9KP

THE 6FH8 IS A MEDIUM-MU TRIODE AND A SHARP CUTOFF TETRODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN HARMONIC-GENERATOR APPLICATIONS, WITH THE TETRODE UNIT EMPLOYING THREE PLATES.

DIRECT INTERELECTRODE CAPACITANCES[A]

TRIODE UNIT:		
GRID TO PLATE	1.4	μμf
GRID TO CATHODE AND HEATER	2.6	μμf
PLATE TO CATHODE AND HEATER	1	μμf
TETRODE UNIT:		
GRID #1 TO PLATE #1 (MAX.)	0.060	μμf
GRID #1 TO CATHODE, HEATER, GRID #2, PLATE #2 &#3	4.5	μμf
PLATE #1 TO CATHODE,HEATER,GRID #2,PLATE #2 & #3	1.4	μμf
TETRODE GRID #1 TO TRIODE PLATE (MAX.)	0.35	μμf
TETRODE PLATE #1 TO TRIODE PLATE (MAX.)	0.008	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HARMONIC-GENERATOR SERVICE

	TRIODE UNIT	TETRODE UNIT	
HEATER VOLTAGE	6.3±10%		VOLTS
MAXIMUM PLATE VOLTAGE (MAX.)	275	---	VOLTS
MAXIMUM PLATE #1 VOLTAGE	---	275	VOLTS
MAXIMUM PLATE #2 VOLTAGE	---	200	VOLTS
MAXIMUM PLATE #3 VOLTAGE	---	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	275	VOLTS

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TUNG-SOL

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RATINGS - cont'd.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HARMONIC-GENERATOR SERVICE

	TRIODE UNIT	TETRODE UNIT	
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE		SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
NEGATIVE-BIAS VALUE	40	40	VOLTS
POSITIVE-BIAS VALUE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	---	WATTS
MAXIMUM PLATE #1 DISSIPATION	---	2.3	WATTS
MAXIMUM PLATE #2 DISSIPATION	---	0.3	WATT
MAXIMUM PLATE #3 DISSIPATION	---	0.3	WATT
MAXIMUM GRID #2 INPUT:			
FOR GRID #2 VOLTAGES UP TO 137.5 VOLTS	---	0.45	WATT
FOR GRID #2 VOLTAGES BETWEEN 137.5 AND 275 VOLTS		SEE RATING CHART	
MAXIMUM CIRCUIT VALUES:			
GRID #1 CIRCUIT RESISTANCE:			
FOR FIXED-BIAS OPERATION	0.5	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CHARACTERISTICS - CLASS A_1 AMPLIFIER

TRIODE UNIT

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLT
AMPLIFICATION FACTOR	40	
PLATE RESISTANCE (APPROX.)	7400	OHMS
TRANSCONDUCTANCE	5400	μMHOS
PLATE CURRENT	7.9	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 100 μA	-7	VOLTS

TETRODE UNIT

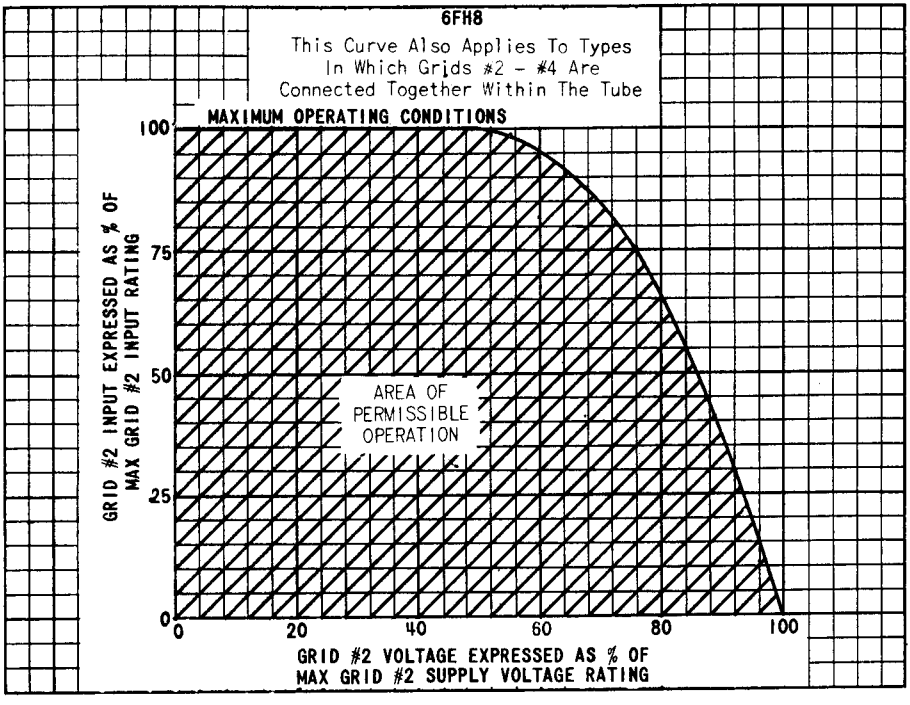
WITH PLATE #2 & #3 CONNECTED TO CATHODE

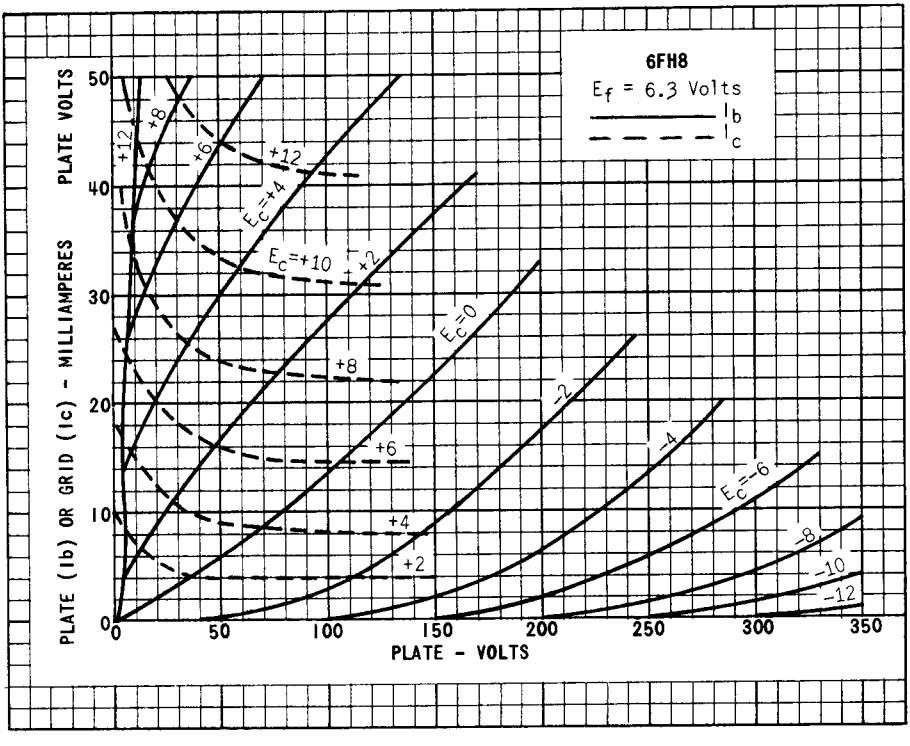
PLATE #1 VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-2	VOLTS
PLATE #1 RESISTANCE (APPROX.)	750 000	OHMS
TRANSCONDUCTANCE, GRID #1 TO PLATE #1	4400	μMHOS
PLATE #1 CURRENT	7.3	MA.
GRID #2 CURRENT	1.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE #1 CURRENT OF 100μA	-7	VOLTS

HARMONIC-GENERATOR SERVICE

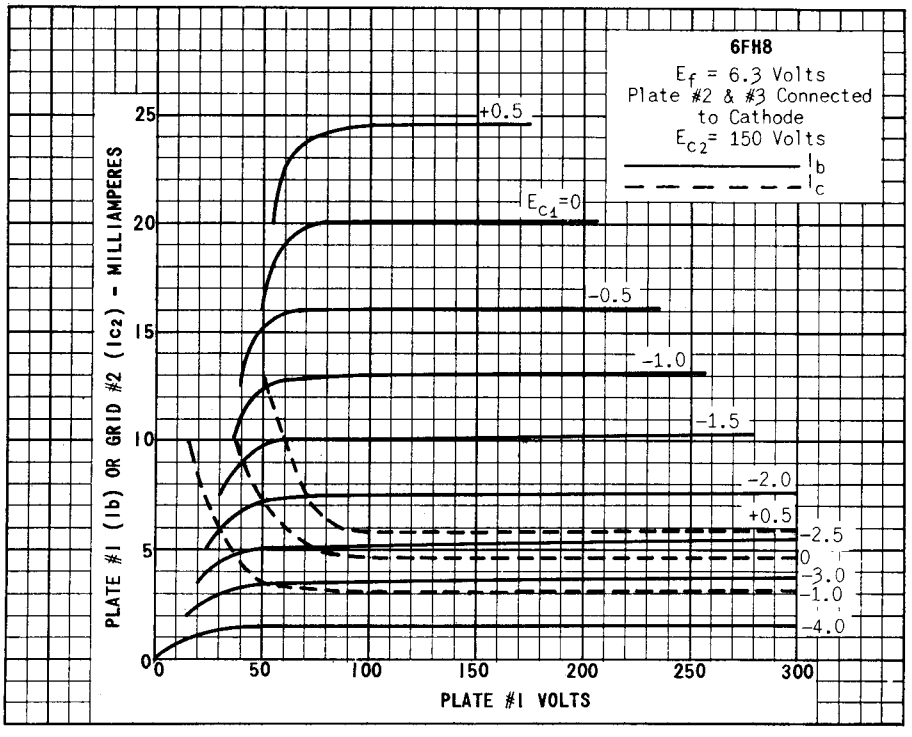
TYPICAL OPERATION WITH SEPARATE PLATE OPERATION

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATES #1, #2 & #3 VOLTAGE	100	VOLTS
GRID #2 VOLTAGE	50	VOLTS
GRID #1 VOLTAGE	-1	VOLT
PLATE #1 CURRENT	1.6	MA.
PLATE #2 CURRENT	0.04	MA.
PLATE #3 CURRENT	0.04	MA.
GRID #2 CURRENT	0.3	MA.
TRANSCONDUCTANCE (APPROX.):		
GRID #1 TO PLATE #1	2500	μMHOS
GRID #1 TO PLATE #2	70	μMHOS
GRID #1 TO PLATE #3	70	μMHOS


6FH8
This Curve Also Applies To Types
In Which Grids #2 - #4 Are
Connected Together Within The Tube
MAXIMUM OPERATING CONDITIONS
AREA OF
PERMISSIBLE
OPERATION
GRID #2 INPUT EXPRESSED AS % OF
MAX GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS % OF
MAX GRID #2 SUPPLY VOLTAGE RATING
0
25
50
75
100
0
20
40
60
80
100


6FH8
Ef = 6.3 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) - MILLIAMPERES
PLATE VOLTS
PLATE - VOLTS
Ec=+4
Ec=+10
Ec=0
Ec=-6
+12
+8
+6
+2
-2
-4
-8
-10
-12
0
10
20
30
40
50
0
50
100
150
200
250
300
350

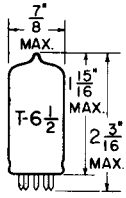
TENTATIVE DATA



TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

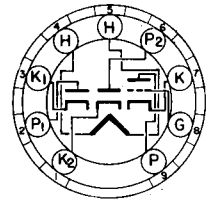
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9KR

THE 6FM8 IS A DUPLEX-DIODE, HIGH-MU TRIODE WITH SEPARATE CATHODES FOR EACH OF THE DIODE SECTIONS AND THE TRIODE SECTION. THE TUBE IS DESIGNED PRIMARILY FOR USE AS AN FM DETECTOR AND AF VOLTAGE AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	1.8	μμf
TRIODE INPUT	1.5	μμf
TRIODE OUTPUT	0.16	μμf
GRID TO DIODE #1 PLATE	0.05	μμf
GRID TO DIODE #2 PLATE	0.04	μμf
DIODE #1 INPUT	2.4	μμf
DIODE #2 INPUT	2.2	μμf
DIODE #1 CATHODE TO ALL	4.6	μμf
DIODE #2 CATHODE TO ALL	4.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE;		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EACH DIODE)	5.0	MA.

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TYPICAL OPERATING CONDITION AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−3.0	VOLTS
AMPLIFICATION FACTOR	70	
PLATE RESISTANCE (APPROX.)	58000	OHMS
TRANSCONDUCTANCE	1200	μMHOS
PLATE CURRENT	1.0	MA.
AVERAGE DIODE CURRENT, EACH DIODE WITH 5.0 VOLTS DC APPLIED	20	MA.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

RESISTANCE COUPLED AMPLIFIER

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.

FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

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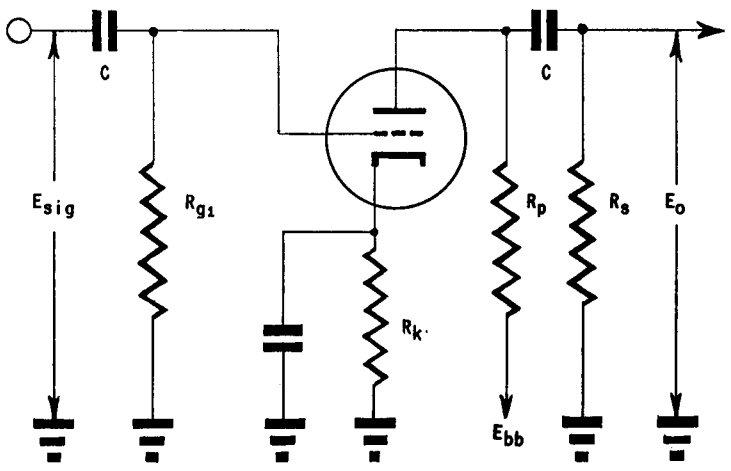
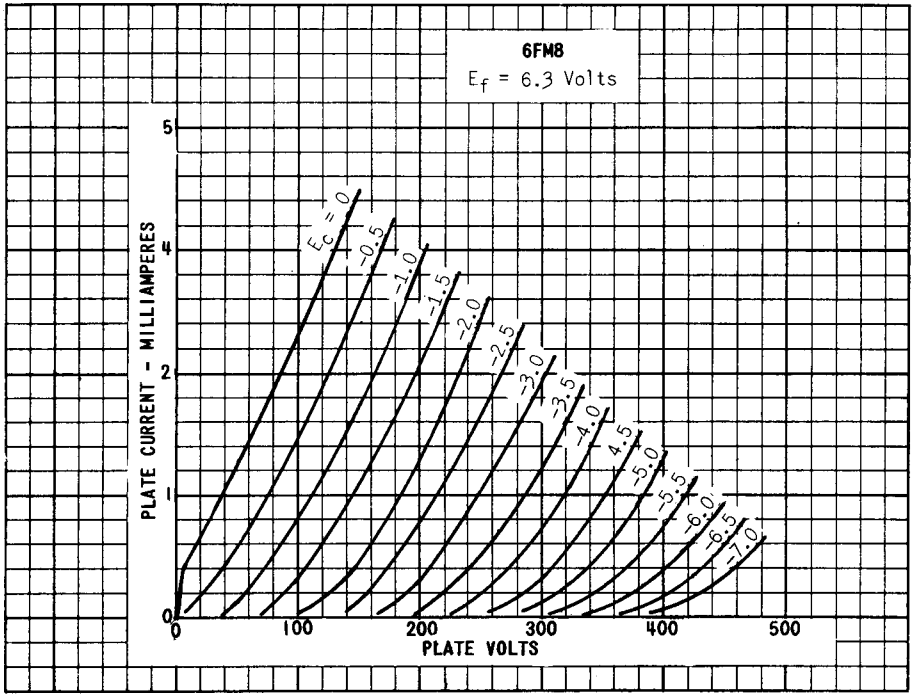
TUNG-SOL



NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE.
R_k SHOULD BE ADEQUATELY BY-PASSED



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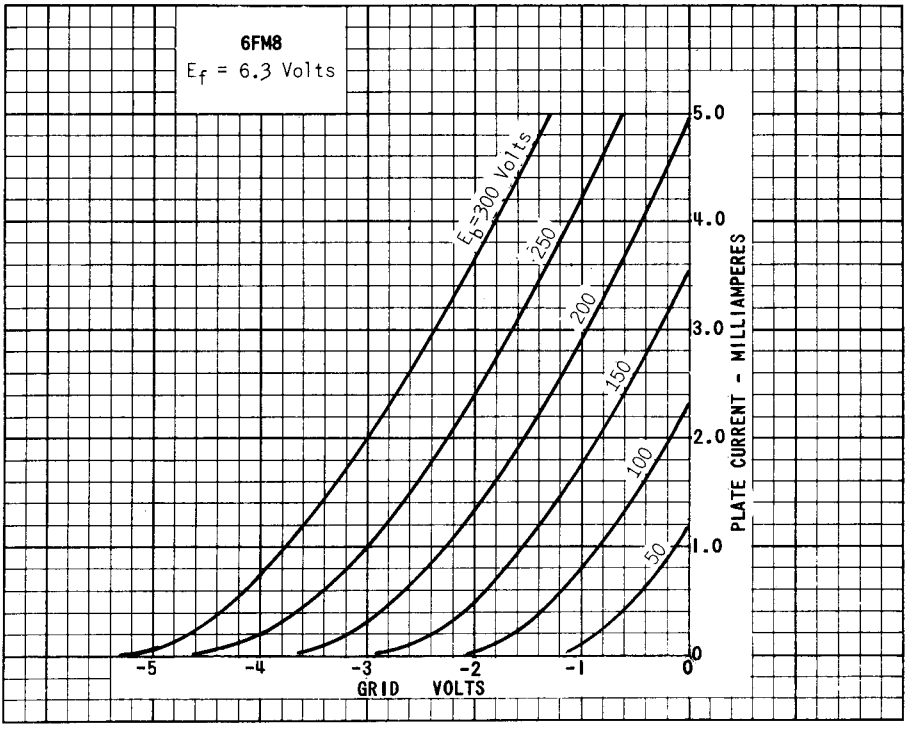
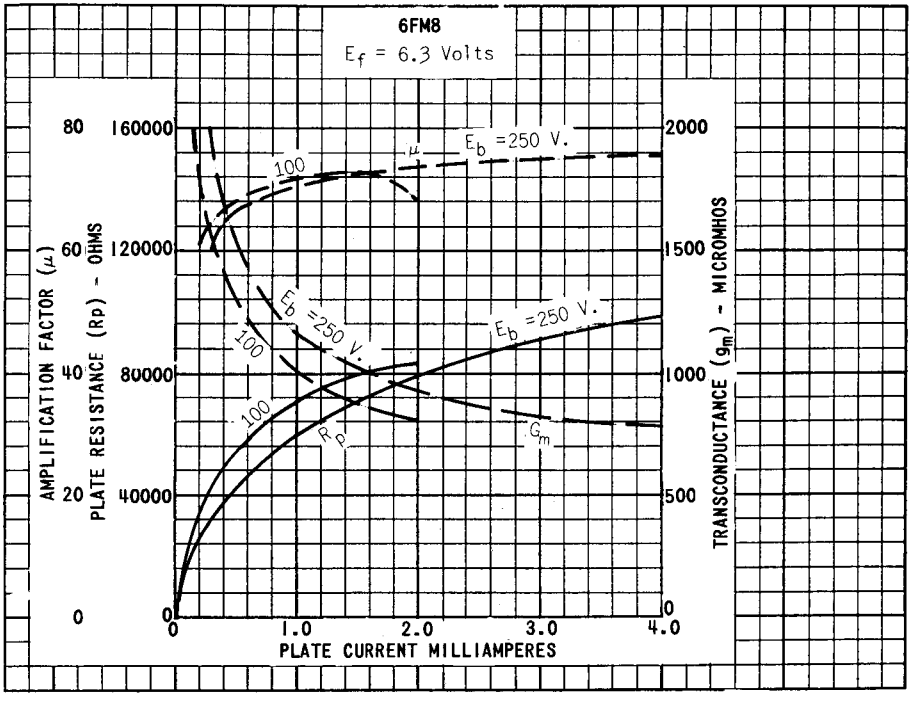
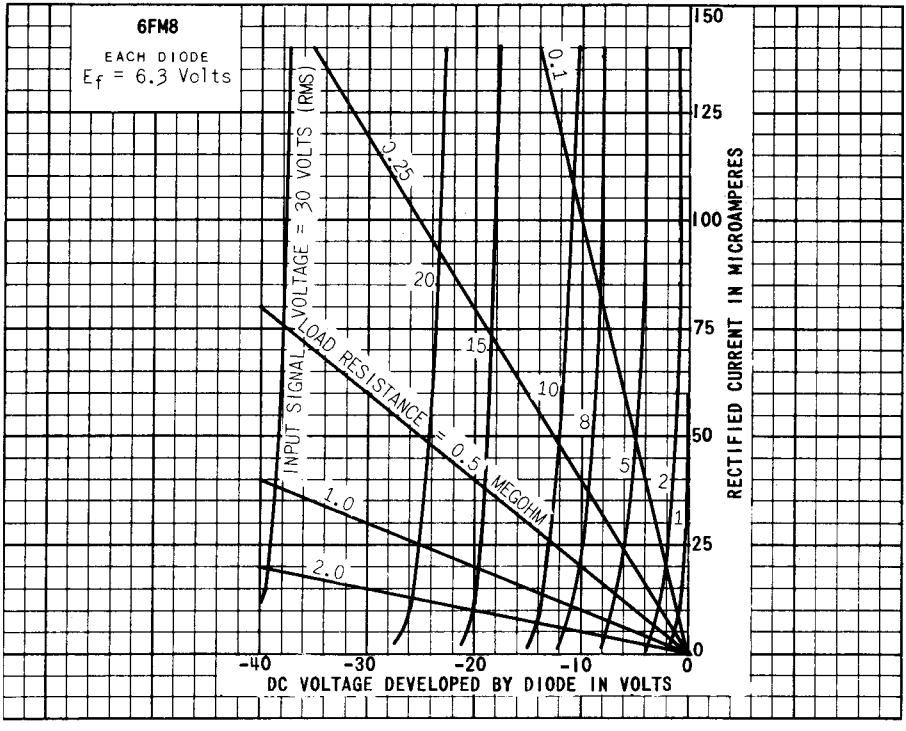

6FM8
E_f = 6.3 Volts
E_b=300 Volts
250
200
150
100
50
5.0
4.0
3.0
2.0
1.0
0
-5
-4
-3
-2
-1
0
GRID VOLTS
PLATE CURRENT - MILLIAMPERES

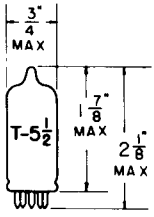

6FM8
E_f = 6.3 Volts
80
60
40
20
0
160000
120000
80000
40000
0
2000
1500
1000
500
0
1.0
2.0
3.0
4.0
E_b =250 V.
100
μ
R_p
G_m
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (Rp) - OHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE CURRENT MILLIAMPERES


6FM8
EACH DIODE
E_f = 6.3 Volts
INPUT SIGNAL VOLTAGE = 30 VOLTS (RMS)
LOAD RESISTANCE = 0.5 MEGOHM
2.25
20
15
10
8
5
2
1
0.1
1.0
2.0
150
125
100
75
50
25
0
-40
-30
-20
-10
0
DC VOLTAGE DEVELOPED BY DIODE IN VOLTS
RECTIFIED CURRENT IN MICROAMPERES

TUNG-SOL

TRIODE

MINIATURE TYPE



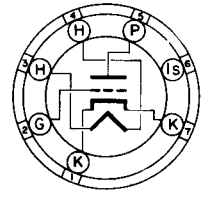
GLASS BULB
5-2

COATED UNIPOTENTIAL CATHODE

HEATER

6.3[B] VOLTS 0.18[A] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7FP

THE 6FQ5 IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6FQ5 IS IDENTICAL TO THE 2FQ5 AND THE 3FQ5.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT: G TO (H+K+I.S.+E.S.)	4.8	μμf
OUTPUT: P TO (H+K+I.S.+E.S.)	4.0	μμf
HEATER TO CATHODE	2.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[D]	6.3±0.6	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	6.3±0.6	VOLTS
HEATER CURRENT[D]	0.18[A]	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	11.5	MA.
TRANSCONDUCTANCE	11 000	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	5 500	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-5	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

NOTES

A THE BOGEY VALUE OF VOLTAGE/CURRENT PRECEDING THIS NOTE IS OBTAINED WHEN OPERATING THE HEATER WITH THE SPECIFIED VALUE OF CURRENT/VOLTAGE.

B FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

C DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

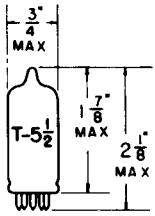
D HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

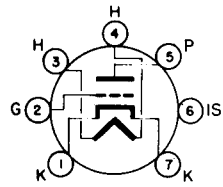
MINIATURE BUTTON 7 PIN BASE E7-1 OUTLINE DRAWING JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER

6.3[B] VOLTS 0.18 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM JEDEC 7FP

THE 6FQ5A IS A SEMI-REMOTE CUTOFF TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF AND RF AMPLIFIER AT A B+ OF 135 VOLTS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6FQ5A IS IDENTICAL TO THE 2FQ5A AND THE 3FQ5A.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H+K+I.S.+E.S.)	5.0	pf
OUTPUT: P TO (H+K+I.S.+E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[C]

HEATER VOLTAGE[D]	6.3±0.6	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[D]	6.3±0.6	VOLTS
HEATER CURRENT[D]	0.18	AMP.
PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.2	VOLTS
PLATE CURRENT	8.9	MA.
TRANSCONDUCTANCE	12000	μMHOS
AMPLIFICATION FACTOR	74	
PLATE RESISTANCE (APPROX.)	6300	OHMS
Ec FOR Ib = 100 μA (APPROX.)	-4.5	VOLTS

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NOTES

[B] FOR SERIES/PARALLEL OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER/CURRENT VOLTAGE.

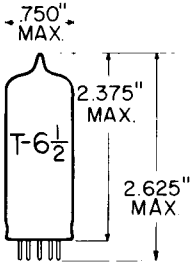
[C] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE/CURRENT WITHIN THE SPECIFIED TOLERANCE.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

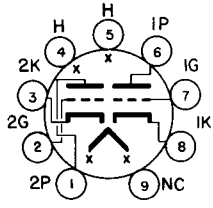


GLASS BULB
SMALL-BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR SERIES STRING OPERATION
IN TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9LP

THE 6FQ7 IS A GENERAL PURPOSE, MEDIUM-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A VERTICAL-DEFLECTION OSCILLATOR AND HORIZONTAL-DEFLECTION OSCILLATOR IN TELEVISION RECEIVERS. THE 6FQ7 MAY ALSO BE USED IN PHASE-INVERTER, MULTIVIBRATOR, SYNC-SEPARATOR, SYNC-AMPLIFIER, AND IN RESISTANCE-COUPLED AF AMPLIFIER CIRCUITS OF ELECTRONIC EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID TO PLATE	3.6	3.8	pf
GRID TO CATHODE AND HEATER	2.4	2.4	pf
PLATE TO CATHODE AND HEATER	0.34	0.26	pf
PLATE OF UNIT #1 TO PLATE OF UNIT #2	1.0		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
CURRENT OPERATION		600±36	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200●	VOLTS
HEATER WARM-UP TIME (APPROX.) *		11	SECONDS

● THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

VALUES ARE FOR EACH UNIT

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
CATHODE CURRENT	22	MA.
PLATE DISSIPATION:		
EITHER PLATE	4	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7	WATTS
MAX. CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE:		
FOR FIXED -BIAS OPERATION	1	MEGOHM

HORIZONTAL-DEFLECTION OSCILLATOR [B]

VALUES ARE FOR EACH UNIT

DC PLATE VOLTAGE	330	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE[C]	660	VOLTS
CATHODE CURRENT:		
PEAK	330	MA.
DC	22	MA.
PLATE DISSIPATION:		
EITHER PLATE	4	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7	WATTS
MAX. CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE	2.2	MEGOHM

VERTICAL-DEFLECTION OSCILLATOR [B]

VALUES ARE FOR EACH UNIT

DC PLATE VOLTAGE	330	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE[D]	440	VOLTS
CATHODE CURRENT:		
PEAK	77	MA.
DC	22	MA.
PLATE DISSIPATION:		
EITHER PLATE	4	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7	WATTS
MAX. CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE	2.2	MEGOHMS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH UNIT

PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6700	7700	OHMS
TRANSCONDUCTANCE	3000	2600	μMHOS
PLATE CURRENT	10	9	MA.
PLATE CURRENT FOR GRID VOLTS =-12.5	---	1.3	MA.
GRID VOLTAGE (APPROX.)FOR PLATE μA=10	-7	-18	VOLTS

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NOTES

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS." FEDERAL COMMUNICATIONS COMMISSION.

[C] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

[D] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DORS NOT EXCEED 15 PER CENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

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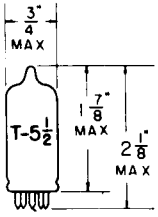
TUNG-SOL

TETRODE

MINIATURE TYPE



GLASS BULB

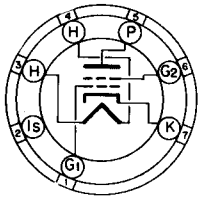
UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.2 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE

7 PIN BASE

7FQ

THE 6FV6 IS A SHARP-CUTOFF TETRODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN RF AMPLIFIER IN VHF TUNERS OF TELEVISION RECEIVERS. THIS TUBE FEATURES HIGH TRANSCONDUCTANCE AND A HIGH RATIO OF PLATE CURRENT TO GRID #2 CURRENT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH EXTERNAL SHIELD #316 CONNECTED TO CATHODE

GRID #1 TO PLATE (MAX.)	0.03	μμf
GRID #1 TO CATHODE, I.S., G2, & H.	4.5	μμf
PLATE TO CATHODE, I.S., G2, & H.	3	μμf
CATHODE TO HEATER	2.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) SUPPLY VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE FIG.#3	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 90 VOLTS	0.5	WATT
FOR GRID #2 VOLTAGES BETWEEN 90 & 180 VOLTS	SEE FIG.#3	
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

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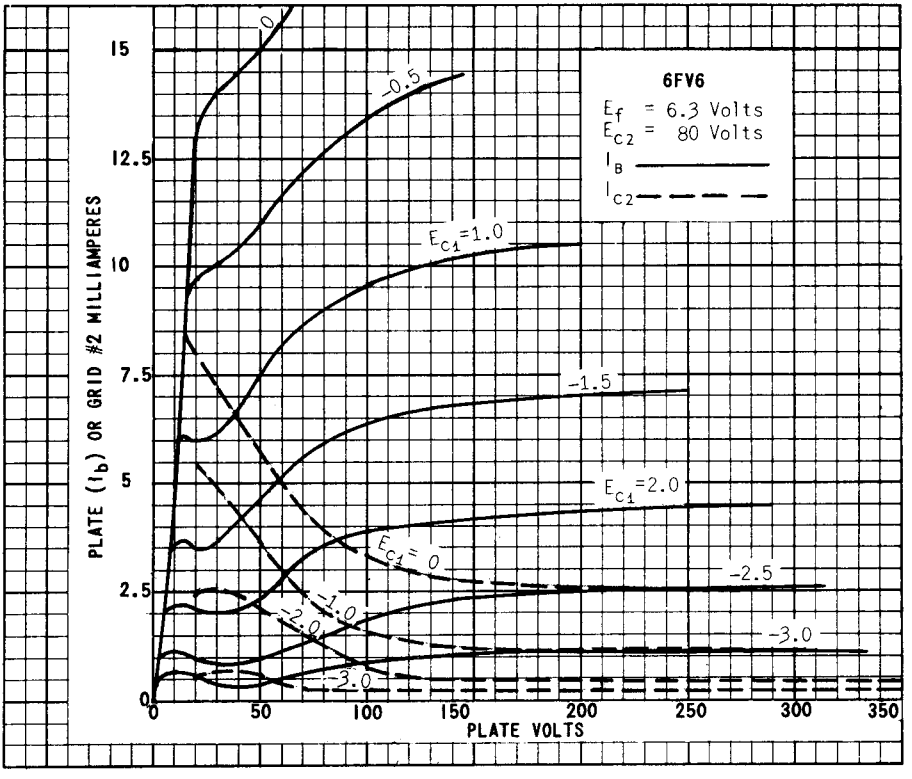
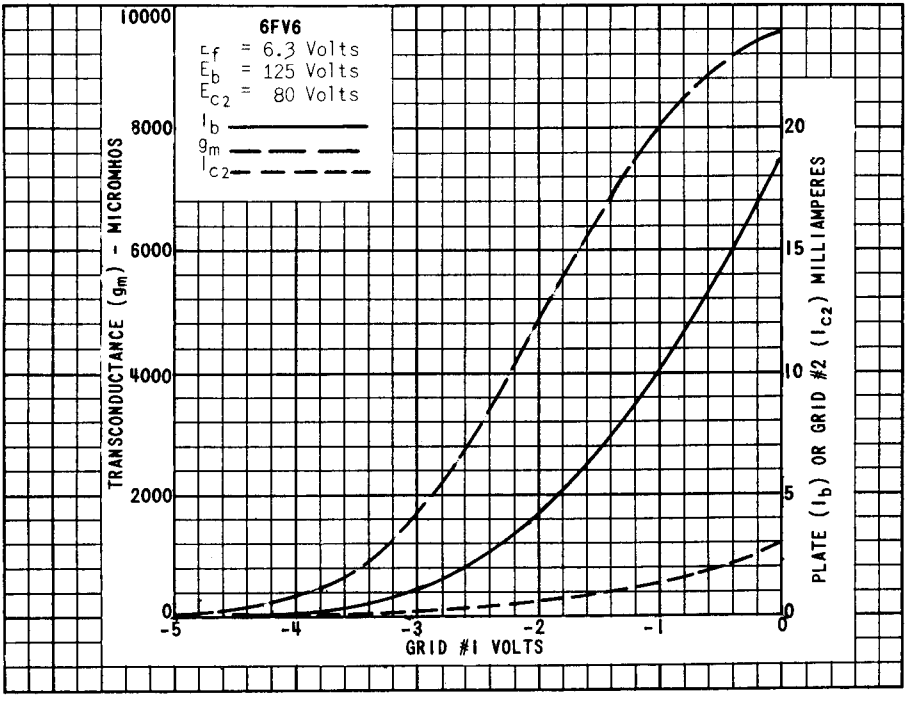
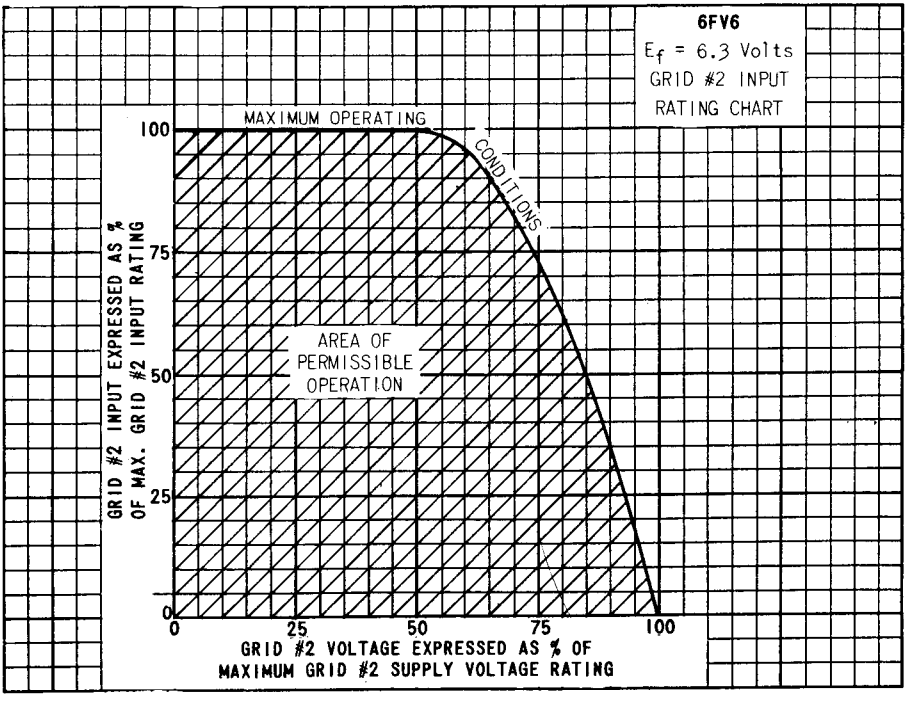
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	125	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	80	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-1	VOLTS
PLATE RESISTANCE (APPROX.)	0.1	MEGOHM
TRANSCONDUCTANCE	8 000	μMHOS
PLATE CURRENT	10	MA.
GRID #2 CURRENT	1.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 20 μA.	-6	VOLTS







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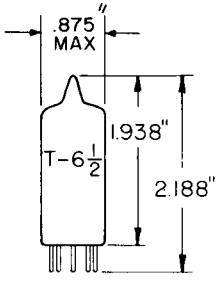
TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-9

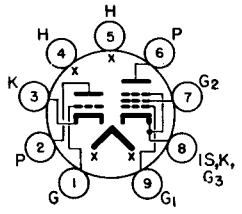
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FA

THE 6FV8 IS A TRIODE-PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR SERVICE IN TELEVISION RECEIVERS WITH THE TRIODE SERVING AS A VERTICAL DEFLECTION OSCILLATOR, AND THE PENTODE SERVING AS A GENERAL PURPOSE OR *IF* AMPLIFIER. DESIGN OF THE TUBE IS SUCH THAT HIGH VALUES OF INTERELEMENT LEAKAGE RESISTANCE ARE MAINTAINED THROUGHOUT LIFE. EXCEPT FOR HEATER RATINGS, THE 6FV8 IS IDENTICAL TO THE 5FV8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
TRIODE SECTION:			
GRID TO PLATE	1.8	1.8	μμf
INPUT: G TO (H+TK+I.S.)	2.8	2.8	μμf
OUTPUT: P TO (H+TK+I.S.)	2.0	1.5	μμf
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	.010	.020	μμf
INPUT: G1 TO (H+PK+G2+G3+I.S.)	5.0	5.0	μμf
OUTPUT: P TO (H+PK+G2+G3+I.S.)	3.0	2.0	μμf
PENTODE PLATE TO TRIODE PLATE((MAX.)	0.03	0.15	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[B] SECTION VER-DEF OSC.	PENTODE SECTION CLASS A AMPLIFIER	
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE		0	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250		VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20		MA.
MAXIMUM PEAK CATHODE CURRENT	70		MA.
MAXIMUM PLATE DISSIPATION	2.0	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS		0.25	MEGOHM
SELF BIAS	3.0[C]	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	8 000	6 500	μMHOS
PLATE CURRENT	14.0	12.0	MA.
GRID #2 CURRENT		4.0	MA.
PLATE RESISTANCE (APPROX.)	5 000	200,000	OHMS
AMPLIFICATION FACTOR	40		
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA.	-9	-9	VOLTS

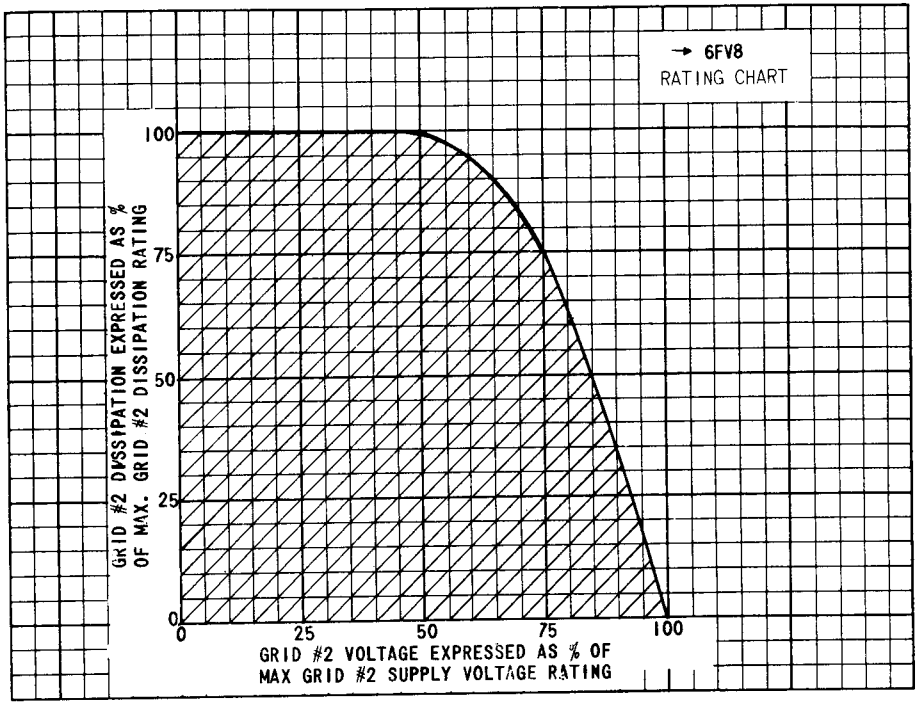
[A] SHIELD #315 TIED TO PIN #4.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[*] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THO DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



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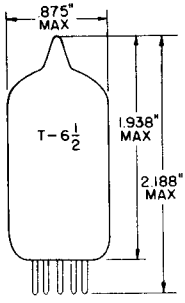
TUNG-SOL



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TRIODE-PENTODE

MINIATURE TYPE

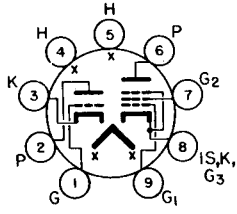
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9FA

THE 6FV8A IS A TRIODE-PENTODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR SERVICE IN TELEVISION RECEIVERS WITH THE TRIODE SERVING AS A VERTICAL DEFLECTION OSCILLATOR, AND THE PENTODE SERVING AS A GENERAL PURPOSE OR IF AMPLIFIER. DESIGN OF THE TUBE IS SUCH THAT HIGH VALUES OF INTERELEMENT LEAKAGE RESISTANCE ARE MAINTAINED THROUGHOUT LIFE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
TRIODE SECTION:			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H+TK+I.S.)	2.8	2.8	pf
OUTPUT: P TO (H+TK+I.S.)	2.0	1.5	pf
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	.010	.020	pf
INPUT: G1 TO (H+PK+G2+G3+I.S.)	5.0	5.0	pf
OUTPUT: P TO (H+PK+G2+G3+I.S.)	3.0	2.0	pf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.03	0.15	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[B] SECTION VER.-DEF OSC.	PENTODE SECTION CLASS A AMPLIFIER	
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE		0	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250		VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20		MA.
MAXIMUM PEAK CATHODE CURRENT	70		MA.
MAXIMUM PLATE DISSIPATION	2.0	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION		0.55	WATT
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS		0.25	MEGOHM
SELF BIAS	3.0[C]	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	8 000	6 500	μMHOS
PLATE CURRENT	12	12	MA.
GRID #2 CURRENT		4.0	MA.
PLATE RESISTANCE (APPROX.)	3600	200,000	OHMS
AMPLIFICATION FACTOR	45		
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA.	-7.5	-9	VOLTS

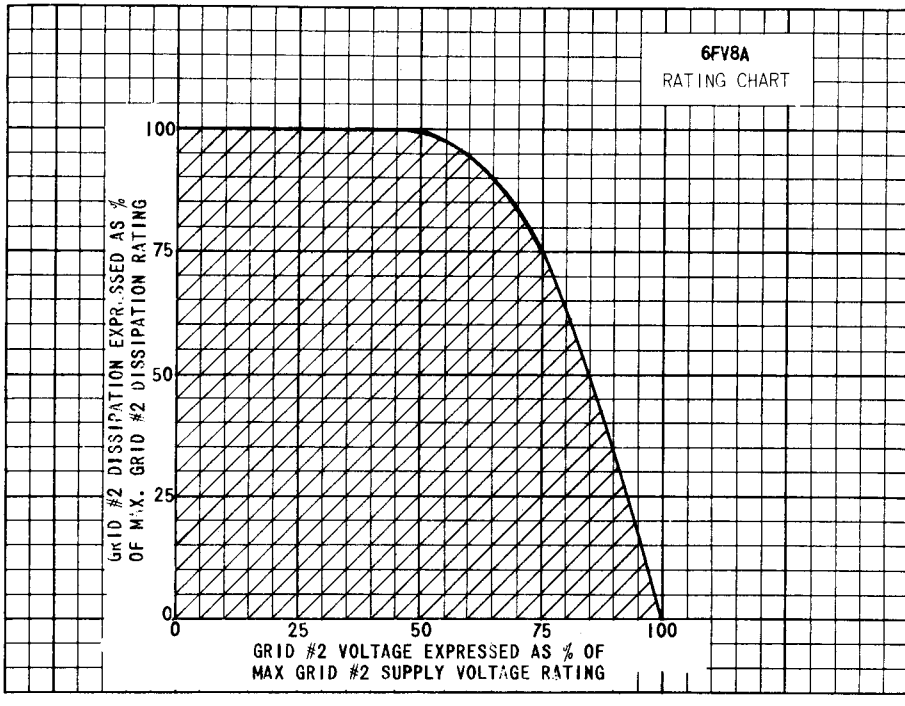
[A] SHIELD #315 TIED TO PIN #4.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THD DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



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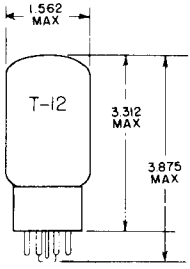
TUNG-SOL

BEAM PENTODE



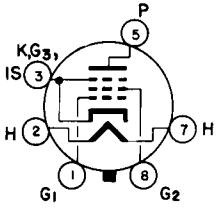
GLASS BULB
SHORT MEDIUM SHELL
6 PIN OCTAL B6-112

OUTLINE DRAWING
JEDEC 12-14

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6CK

THE 6FW5 IS A BEAM-POWER PENTODE PRIMARILY DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ITS HIGH ZERO-BIAS PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES MAKES THE TUBE WELL SUITED FOR USE IN RECEIVERS THAT OPERATE AT LOW PLATE-SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.5	pf
INPUT: G1 TO (H+K+G2+B.P.)	15	pf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

DC PLATE-SUPPLY VOLTAGE (BOOST+DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
SCREEN VOLTAGE	220	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID #1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[B]	18	WATTS
SCREEN DISSIPATION	3.6	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	610	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

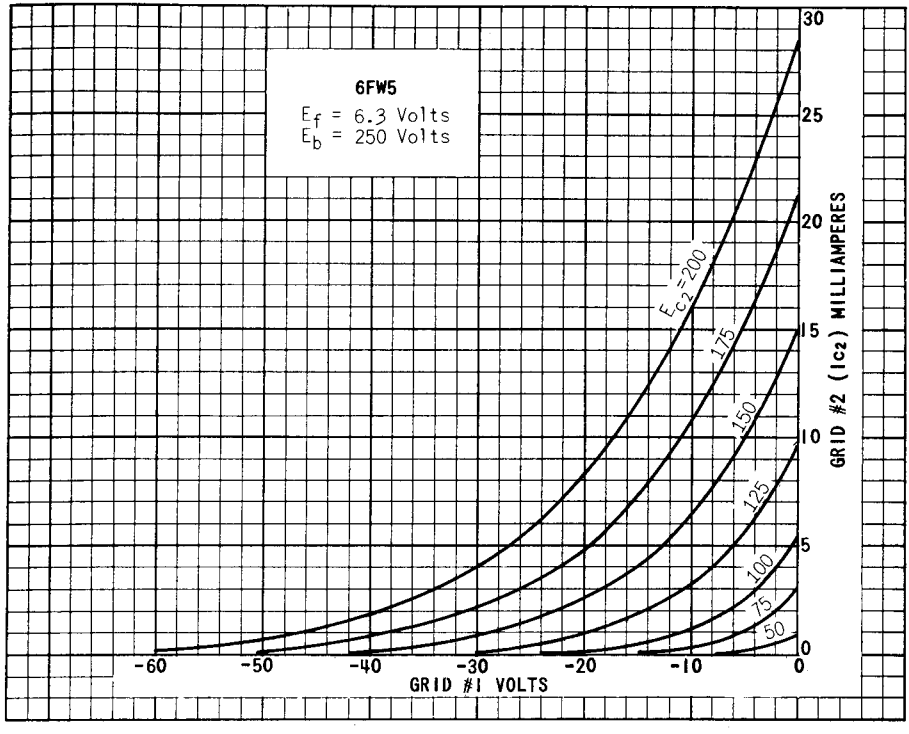
PLATE VOLTAGE	5000	60	250	VOLTS
SCREEN VOLTAGE	150	150	150	VOLTS
GRID #1 VOLTAGE	---	0[C]	-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	---	18000	OHMS
TRANSCONDUCTANCE	---	---	7300	μMHOS
PLATE CURRENT	---	345	65	MA.
SCREEN CURRENT	---	27	1.8	MA.
GRID #1 VOLTAGE (APPROX.)				
Ib = 1.0 MA.	-100	---	-42	VOLTS
TRIODE AMPLIFICATION FACTOR[D]	---	---	4.4	

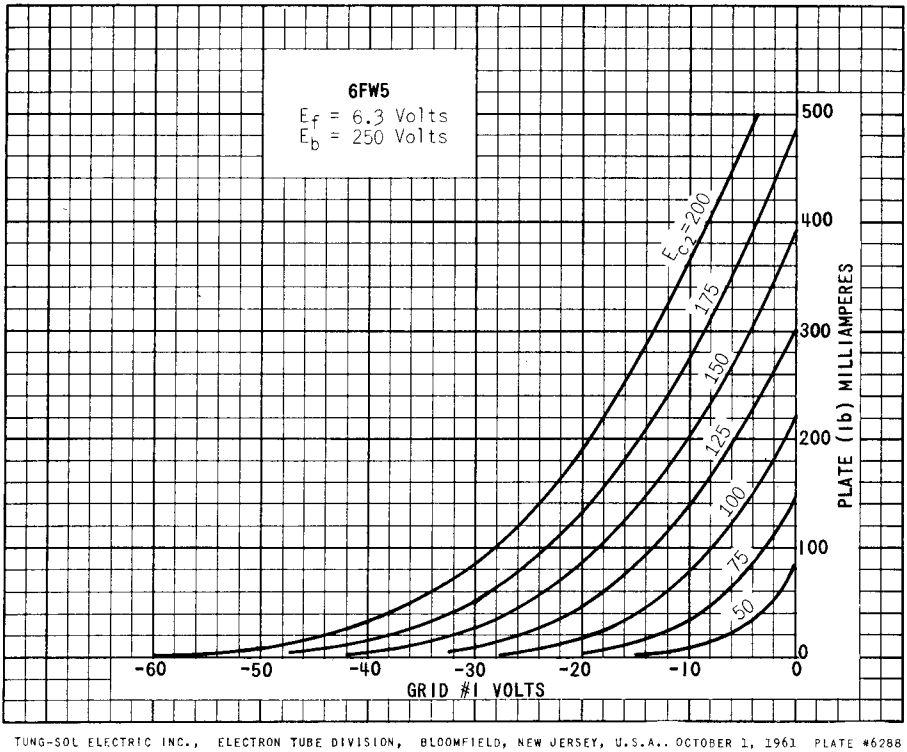
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

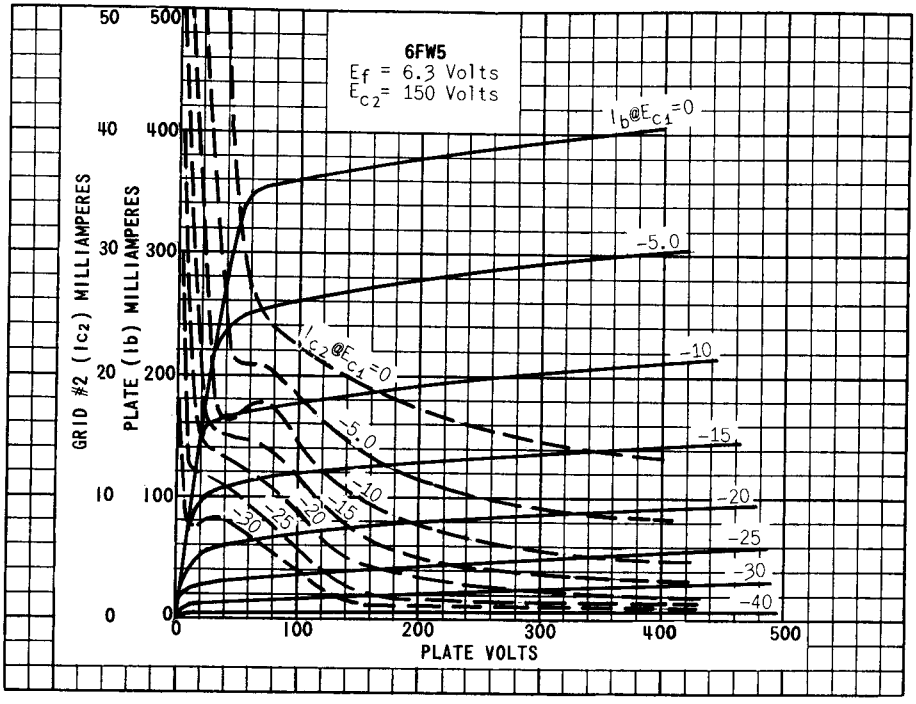
[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

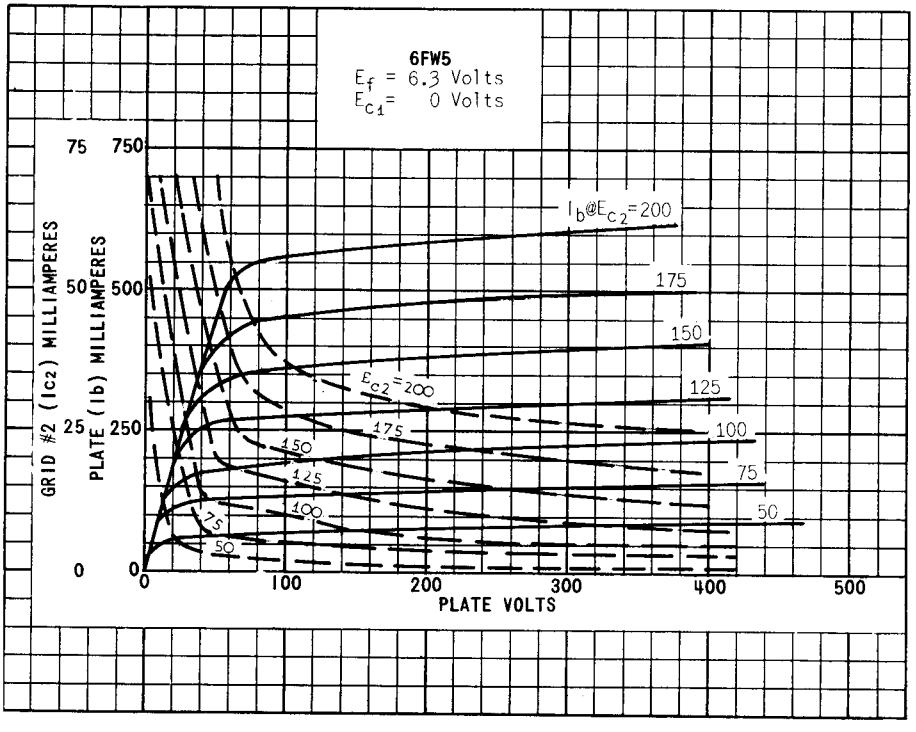
[D] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb=Ec2=150 VOLTS AND Ec1=-22.5 VOLTS.


6FW5
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2}=200
175
150
125
100
75
50
30
25
20
15
10
5
0
GRID #2 (Ic2) MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID #1 VOLTS


6FW5
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2}=200
175
150
125
100
75
50
500
400
300
200
100
0
PLATE (Ib) MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID #1 VOLTS

6FW5


6FW5
Ef = 6.3 Volts
Ec2 = 150 Volts
Ib@Ec1=0
-5.0
-10
-15
-20
-25
-30
-40
Ic2@Ec1=0
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
10
20
30
40
50


6FW5
Ef = 6.3 Volts
Ec1 = 0 Volts
Ib@Ec2=200
175
150
125
100
75
50
Ec2=200
175
150
125
100
75
50
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
25
50
75

TUNG-SOL

TRIODE

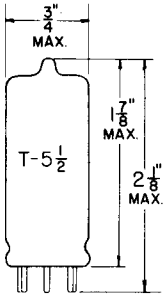
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

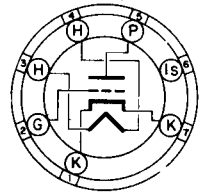
HEATER
PARALLEL SUPPLY

6.3 VOLTS 0.20 AMP.

ANY MOUNTING POSITION



GLASS BULB
5-2



BOTTOM VIEW
7FP

THE 6FY5 IS A REMOTE CUT-OFF, FRAME GRID SHIELDED TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR SERVICE IN VHF TUNERS OF TELEVISION RECEIVERS, AND IS CONTROLLED FOR LOW NOISE FIGURE AT 220 MC/S AND OPERATION AT LOW SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 6FY5 IS IDENTICAL TO THE 2FY5 AND THE 3FY5.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXT. SHIELD	WITH EXT. SHIELD	
INPUT	4.75	4.75	μμf
OUTPUT	3.3	4.3	μμf
GRID TO HEATER (MAX.)	0.28	0.28	μμf
PLATE TO CATHODE	0.25	0.21	μμf
GRID TO CATHODE	3.2	3.2	μμf
CATHODE TO HEATER	2.5	2.5	μμf
PLATE TO GRID	0.50	0.48	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE (ZERO PLATE CURRENT)	550	VOLTS
MAXIMUM PLATE DISSIPATION	2.2	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM CATHODE-HEATER VOLTAGE	100	VOLTS
MAXIMUM CATHODE-HEATER CIRCUIT RESISTANCE	20 000	OHMS

TYPICAL OPERATION

HEATER VOLTAGE		6.3			VOLTS
HEATER CURRENT		0.20			AMP.
PLATE VOLTAGE	135	135	135	135	VOLTS
NEGATIVE GRID BIAS	1	3.1	5	4.5	VOLTS
PLATE CURRENT	11			0.1	MA.
TRANSCONDUCTANCE	13 000	625	125	---	μMHOS
AMPLIFICATION FACTOR	70				

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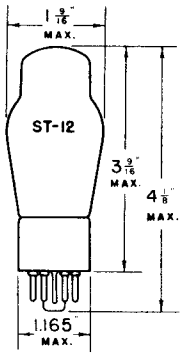
TUNG-SOL

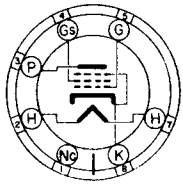


PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



G-7S

BOTTOM VIEW

SMALL 7 PIN OCTAL BASE

THE TUNG-SOL 6G6G IS A PENTODE POWER AMPLIFIER DESIGNED FOR SERVICE WHERE ECONOMY IN CURRENT CONSUMPTION IS DESIRED.

MAXIMUM RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	180	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.50	WATT

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE	PENTODE		
PLATE VOLTAGE	180	135	180	VOLTS
SCREEN VOLTAGE	–	135	180	VOLTS
GRID VOLTAGE	−12	−6	−9	VOLTS
PEAK AF SIGNAL VOLTAGE	12	6	9	VOLTS
ZERO-SIG. PLATE CURRENT	11	11.5	15	MA.
ZERO-SIG. SCREEN CURRENT	–	2.0	2.5	MA.
PLATE RESISTANCE	4730	170 000	175 000	OHMS
TRANSCONDUCTANCE	2000	2100	2300	μMHOS
AMPLIFICATION FACTOR	9.5	360	400	
LOAD RESISTANCE	12 000	12 000	10 000	OHMS
TOTAL HARMONIC DISTORTION	5	7.5	10	PER CENT
POWER OUTPUT	0.25	0.6	1.1	WATTS

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	6	μμf
PLATE TO CATHODE	10	μμf
CONTROL GRID TO PLATE	0.2	μμf

[S] WITH SHIELD

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PLATE 468-3

JUNE 26 1939

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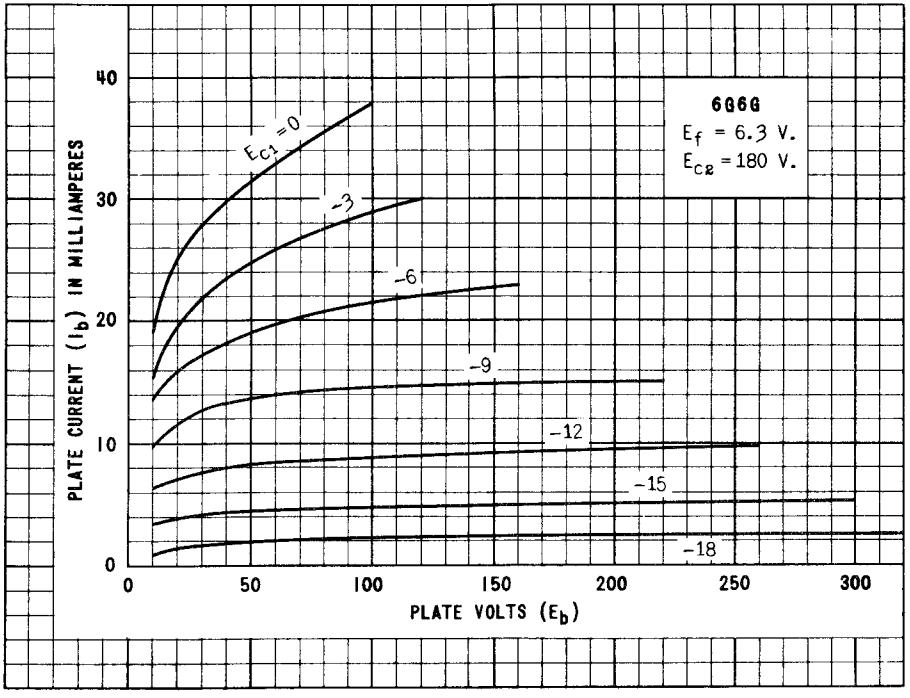
6G6G



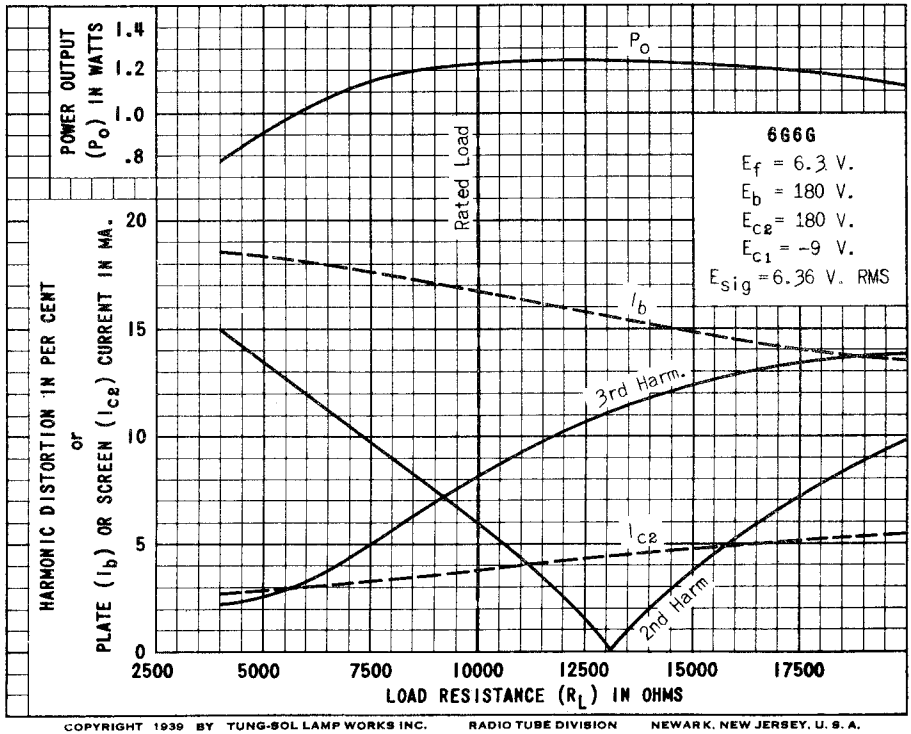


PLATE 469-1

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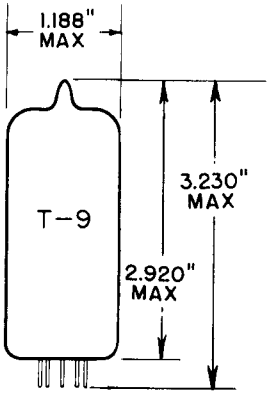
TUNG-SOL

BEAM PENTODE



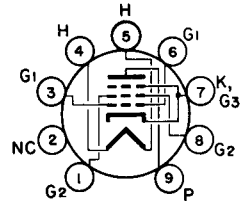
GLASS BULB

BASE E9-68
OUTLINE DRAWING
JEDEC 9-71

COATED UNIPOTENTIAL CATHODE

AUDIO POWER AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9EU

THE 6GC5 IS A BEAM-POWER PENTODE UTILIZING A T-9 ENVELOPE BASED TO FIT A STANDARD 9-PIN MINIATURE SOCKET. IT FEATURES HIGH POWER SENSITIVITY AS AN AUDIO AMPLIFIER. IN CLASS A1 OPERATION, THE 6GC5 CAN DELIVER 2.1 WATTS OF POWER WITH A B+ VOLTAGE OF ONLY 110 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO PLATE	0.9	pf
INPUT: G1 TO (H+K, G3 +G2)	18	pf
OUTPUT: P TO (H+K, G3 +G2)	7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.2	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	220	VOLTS
GRID #2 VOLTAGE	140	VOLTS
PLATE DISSIPATION	12	WATTS
GRID #2 DISSIPATION	1.4	WATTS
GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

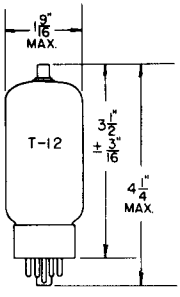
CLASS A_1 AMPLIFIER

(SINGLE TUBE)

PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	---	VOLTS
CATHODE RESISTOR	---	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
ZERO SIGNAL PLATE CURRENT	49	46	MA.
MAX. SIGNAL PLATE CURRENT	50	47	MA.
ZERO SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAX. SIGNAL GRID #2 CURRENT	10	8.5	MA.
TRANSCONDUCTANCE	8000	8000	μMHOS
PLATE RESISTANCE, APPROX.	13,000	28,000	OHMS
LOAD RESISTANCE	2000	4000	OHMS
MAX. SIGNAL POWER OUTPUT	2.1	3.8	WATTS
TOTAL HARMONIC DISTORTION, APPROX.	10	10	PERCENT

TUNG-SOL

PENTODE



GLASS BULB

HEATER

6.3 VOLTS 1.2 AMP.

ANY MOUNTING POSITION

BOTTOM VIEW

SHORT MEDIUM OCTAL
WITH EXTERNAL BARRIERS

8JX

THE 6GC6 IS A HEATER-CATHODE TYPE BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT HAS EXTREMELY HIGH PERVEANCE, SUCH THAT THE DESIGN OF WIDE-ANGLE DEFLECTION SYSTEMS IS MADE POSSIBLE WITHOUT THE NECESSITY OF USING AN EXPENSIVE DEFLECTION AMPLIFIER TUBE. EXCEPT FOR HEATER CHARACTERISTICS, THE 6GC6 IS IDENTICAL TO THE 12GC6.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G1 TO P)	0.55	μμf
INPUT: G1 TO (H+K+G2+B.P.)	15	μμf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
MAXIMUM GRID #2 VOLTAGE	220	VOLTS
MAXIMUM PLATE DISSIPATION[B]	17.5	WATTS
MAXIMUM GRID #2 DISSIPATION	4.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	175	MA.
MAXIMUM PEAK CATHODE CURRENT	550	MA
MAXIMUM PEAK POSITIVE PLATE VOLTAGE	6500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1500	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	330	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.0	MEG.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
PLATE CURRENT	75	MA.
GRID #2 CURRENT	2.4	MA.
TRIODE AMPLIFICATION FACTOR [C]	4.1	
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE	20000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR Ib = 1 MA. (APPROX.)	-46	VOLTS
ZERO-BIAS: WITH Eb= 60 VOLTS, AND Ec2 = 150 V (INSTANTANEOUS VALUE)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	30	MA.
CUTOFF: FOR Ib = 1 MA. WITH Eb= 5000 V. AND Ec2=150 V. (APPROX. VALUE)	-100	VOLTS

A. FOR OPERATION IN A 525 LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

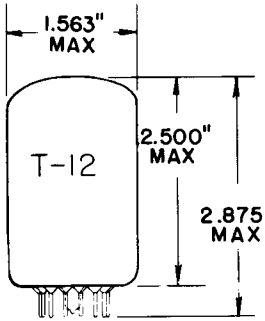
B. IN STAGES OPERATING GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

C. Eb=Ec2=150 VOLTS.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN - MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY - VOLTAGE VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

BEAM PENTODE
COMPACTRON



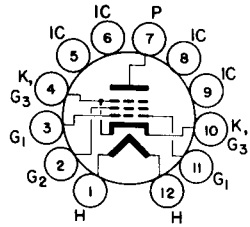
GLASS BULB

BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS IN T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BJ

THE 6GE5 IS A BEAM-POWER PENTODE UTILIZING A T-12 ENVELOPE AND A 12 PIN BASE. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.34	pf
INPUT: G1 TO ($H+K+G2+B.P.$)	16	pf
OUTPUT: P TO ($H+K+G2+B.P.$)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE•

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY))	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
GRID #2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID #1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[A]	17.5	WATTS
GRID #2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

	*			
PLATE VOLTAGE	5000	60	250	VOLTS
GRID #2 VOLTAGE	150	150	150	VOLTS
GRID #1 VOLTAGE	---	0[B]	-22.5	VOLTS
PLATE RESISTANCE, APPROX.	---	---	18,000 ←	OHMS
TRANSCONDUCTANCE	---	---	7,300 ←	μMHOS
PLATE CURRENT	---	345	65 ←	MA.
GRID #2 CURRENT	---	27 ←	1.8 ←	MA.
GRID #1 VOLTAGE, APPROX. I_b = 1.0 MA.	-100	---	-42 ←	VOLTS
TRIODE AMPLIFICATION FACTOR G2 TIED TO PLATE, $E_b = E_{c2}$ =150 V., E_{c1} =-22.5 V.	---	---	4.4 ←	

•FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

A
IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

B
APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

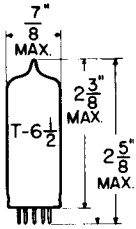
→INDICATES A CHANGE.

*INDICATES AN ADDITION.

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



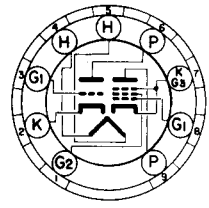
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.90 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

THE 6GE8 IS A COMBINED LOW MU, HIGH PERVEANCE TRIODE AND A SHARP CUT-OFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PARTICULARLY SUITABLE FOR VOLTAGE REGULATION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION:

GRID TO PLATE	7.5	μμf
INPUT: G TO (H+K)	5.5	μμf
OUTPUT: P TO(H+K)	1.3	μμf

PENTODE SECTION:

GRID #1 TO PLATE	.02	μμf
INPUT: G1 TO (H+K+G2+G3)	8.0	μμf
OUTPUT: P TO (H+K+G2+G3)	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	SEC. #1 PENTODE	SEC. #2 TRIODE	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	275		VOLTS
MAXIMUM PLATE DISSIPATION	1.0	7.0	WATTS
MAXIMUM GRID #2 INPUT	0.5		WATTS
MAXIMUM AVERAGE CATHODE CURRENT		50	MA.
MAXIMUM PEAK CATHODE CURRENT		175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
SELF BIAS	2.2	2.2	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100		VOLTS

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TUNG-SOL

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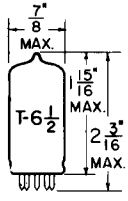
AVERAGE CHARACTERISTICS

	PENTODE	TRIODE	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.90		AMP.
PLATE VOLTAGE	150	150	VOLTS
GRID #2 VOLTAGE	150		VOLTS
PLATE CURRENT	5.5	35	MA.
GRID #2 CURRENT	1.7		MA.
GRID #1 VOLTAGE	-2	-21	VOLTS
TRANSCONDUCTANCE	3200	5000	μMHOS
AMPLIFICATION FACTOR		5.4	
PLATE RESISTANCE	340 000	1 080	OHMS
GRID #1 VOLTAGE FOR I_b=50 μA	-8		VOLTS
GRID #1 VOLTAGE FOR I_b=500μA		-42	VOLTS
ZERO BIAS PLATE CURRENT AT E_b=50V, E_{c1}=0 V.		70	MA.
PLATE RESISTANCE AT E_b=100, E_{c2}=50 V & I_b =100 μA	>7		MEGOHMS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

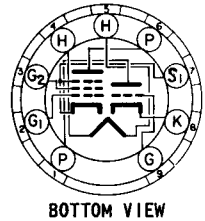


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9AE

THE 6GH8 IS A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE CONTAINED IN A 9 PIN MINIATURE ENVELOPE. EACH SECTION HAS A SEPARATE CATHODE AND IS ELECTRICALLY INDEPENDENT. THE PENTODE SECTION IS INTENDED PRIMARILY FOR SERVICE AS AN OSCILLATOR IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS, THE 6GH8 IS IDENTICAL TO THE 5GH8.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE: (Pg1 TO Pp) (MAX.)	0.015	0.02	μμf
INPUT: Pg1 TO (H+Pk+Pg2+Pg3+I.S.)	5.5	5.5	μμf
OUTPUT: Pp TO (H+Pk+Pg2+Pg3+I.S.)	3.4	2.6	μμf
HEATER TO CATHODE (Pk TO H)	3.0[B]	3.0	μμf
TRIODE SECTION:			
GRID TO PLATE:(Tg TO Tp)	1.6	1.6	μμf
INPUT: Tg TO (Tk+H+Pk+Pg3+I.S.)	3.6	3.4	μμf
OUTPUT: Tp TO (Tk+H+Pk+Pg3+I.S.)	2.2	1.7	μμf
HEATER TO CATHODE: (Tk TO H)	3.0[B]	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION (HORIZONTAL OSCILLATOR SERVICE)[C]	TRIODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM ALLOWABLE HEATER CURRENT	0.42 to 0.48		AMP.
MAXIMUM DC PLATE VOLTAGE	350	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PEAK NEGATIVE DC GRID #1 VOLTAGE	175	---	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS
MAXIMUM DC CATHODE CURRENT	20	---	MA.
MAXIMUM PEAK CATHODE CURRENT	300	---	MA.

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→ INDICATES A CHANGE.

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TUNG-SOL

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION (HORIZONTAL OSCILLATOR SERVICE)[C]		TRIODE SECTION	
HEATER VOLTAGE	6.3		6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT	100		100	VOLTS
TOTAL DC AND PEAK	200		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK	200		200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE				
WITH FIXED BIAS	2.2		2.2	MEGOHMS
WITH CATHODE BIAS	2.2		2.2	MEGOHMS
HEATER WARM–UP TIME (APPROX.)*		11.0		SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	125	125	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
AMPLIFICATION FACTOR	---	46	
PLATE RESISTANCE (APPROX.)	200 000	5400	OHMS
TRANSCONDUCTANCE	7500	8500	μMHOS
PLATE CURRENT	12	13.5	MA.
SCREEN CURRENT	4.0	----	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-8	-8	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TUNG-SOL

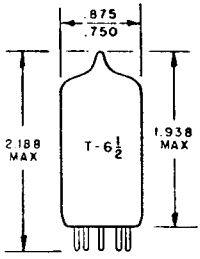
TRIODE-PENTODE

MINIATURE TYPE

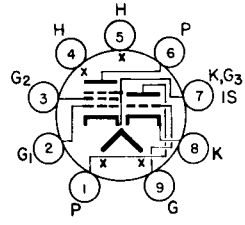
MEDIUM-MU TRIODE
AND
SHARP-CUTOFF PENTODE
FOR
HORIZONTAL-DEFLECTION
OSCILLATOR CIRCUITS
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9 AE

THE 6GH8A IS A MEDIUM-MU TRIODE AND SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN MULTIVIBRATOR-TYPE HORIZONTAL-DEFLECTION OSCILLATOR CIRCUITS IN TELEVISION RECEIVERS. THE TUBE IS ALSO SUITABLE FOR USE AS AN AGC AMPLIFIER OR SYNC SEPARATOR IN SUCH RECEIVERS.

THE 6GH8A IS CONTROLLED TO ASSURE LOW INTERELECTRODE LEAKAGE. IT HAS A MINIMUM LEAKAGE RESISTANCE OF 100 MEGOHMS BETWEEN GRID#1 OF EACH UNIT AND ALL OTHER ELECTRODES TIED TOGETHER, AND 100 MEGOHMS BETWEEN THE PLATE OF EACH UNIT AND ALL OTHER ELECTRODES TIED TOGETHER.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT EXTERNAL SHIELD	WITH EXTERNAL SHIELD	
TRIODE UNIT			
GRID TO PLATE (Tg TO Tp)	1.7	1.7 [A]	pf
GRID TO (H+ Pg3 + TK + PK + I.S.)	3	3.2 [A]	pf
PLATE TO (H + Pg3 + TK + PK + I.S.)	1.4	1.9 [A]	pf
HEATER TO CATHODE (TK TO H)	3	3 [B]	pf
PENTODE UNIT			
GRID 1 TO PLATE (Pg1 TO Pp)	MAX. 0.02	MAX. 0.01 [C]	pf
GRID 1 TO (Pk + Pg3 + Pg2 + H + I.S.)	5	5 [C]	pf
PLATE TO (PK + Pg3 + Pg2 + H + I.S.)	2.6	3.4 [C]	pf
HEATER TO (Pk + Pg3 + I.S.)	3	3 [B]	pf

A- EXTERNAL SHIELD #315 CONNECTED TO TRIODE CATHODE.
B- EXTERNAL SHIELD #315 CONNECTED TO GROUND.
C- EXTERNAL SHIELD # 315 CONNECTED TO PENTODE CATHODE.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME - AVERAGE		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.

PEAK HEATER-CATHODE VOLTAGE	TRIODE UNIT	PENTODE UNIT	
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	200	VOLTS
DC COMPONENT	100	100	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL - DEFLECTION - OSCILLATOR SERVICE

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	330	350	VOLTS
GRID 2 VOLTAGE	-	330	VOLTS
GRID 1 VOLTAGE			
POSITIVE-BIAS VALUE	0	0	VOLTS
PEAK NEGATIVE VALUE	-	175	VOLTS
PLATE DISSIPATION	2.5	2.5	WATTS
GRID 2 INPUT	-	0.55	WATTS
CATHODE CURRENT			
PEAK	-	330	MA.
DC	-	20	MA.
GRID 1 CIRCUIT RESISTANCE			
FOR FIXED-BIAS OPERATION	2.2	2.2	MEGOHMS
FOR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

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TUNG-SOL

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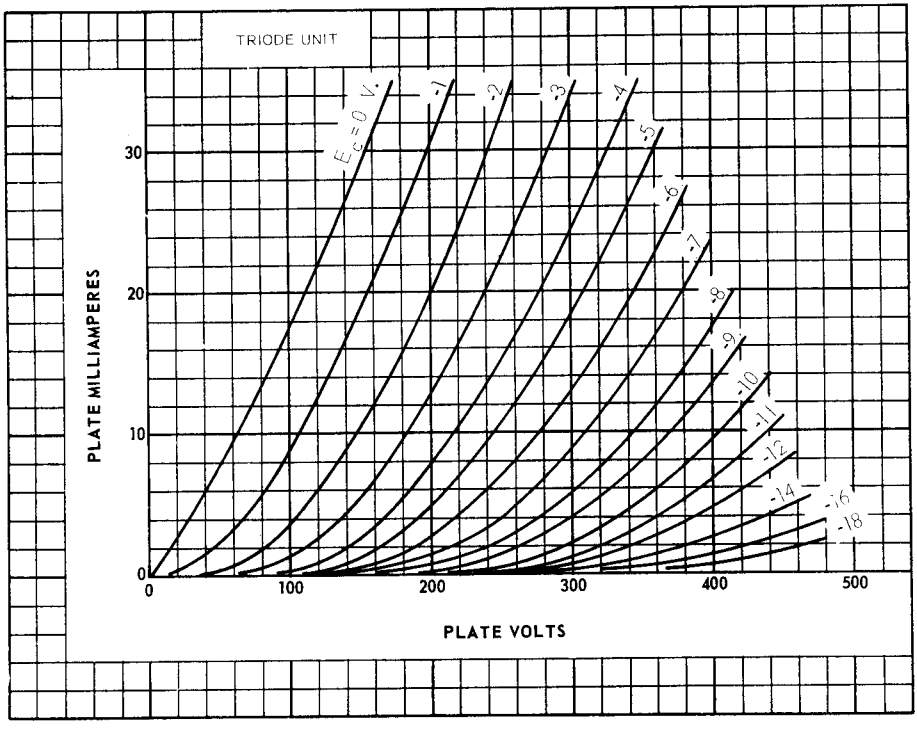
CHARACTERISTICS

CLASS AI AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	-	125	VOLTS
GRID 1 VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	13.5	12	MA.
GRID 2 CURRENT	-	4.0	MA.
AMPLIFICATION FACTOR	46	-	
TRANSCONDUCTANCE	8,500	7,500	μMHOS
PLATE RESISTANCE	5,400	200,000	OHMS
GRID 1 VOLTAGE FOR I = 10 μA (APPROX.)	-8	-8	VOLTS



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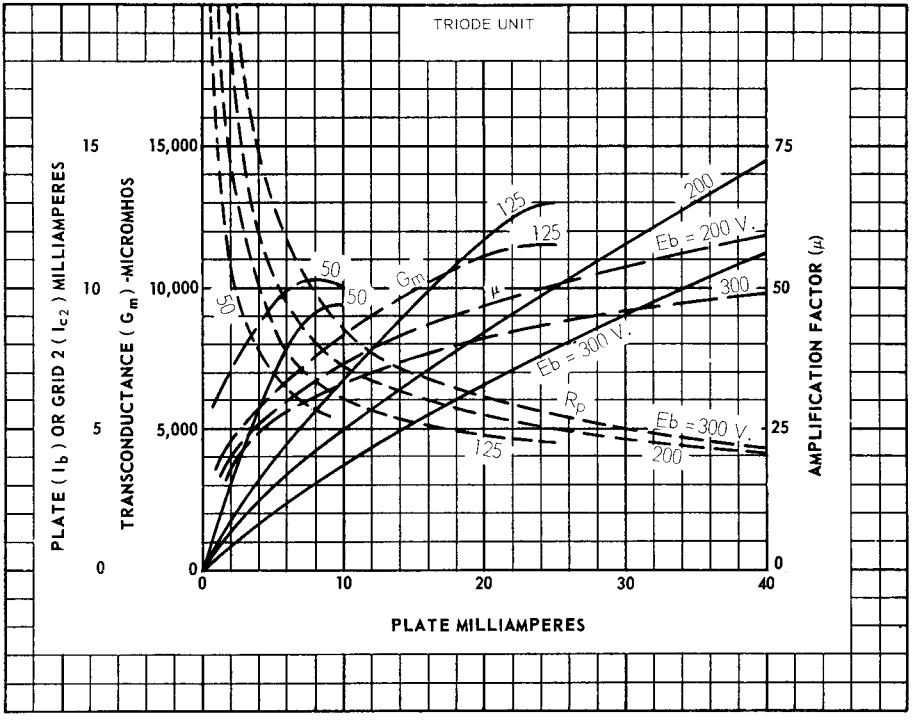
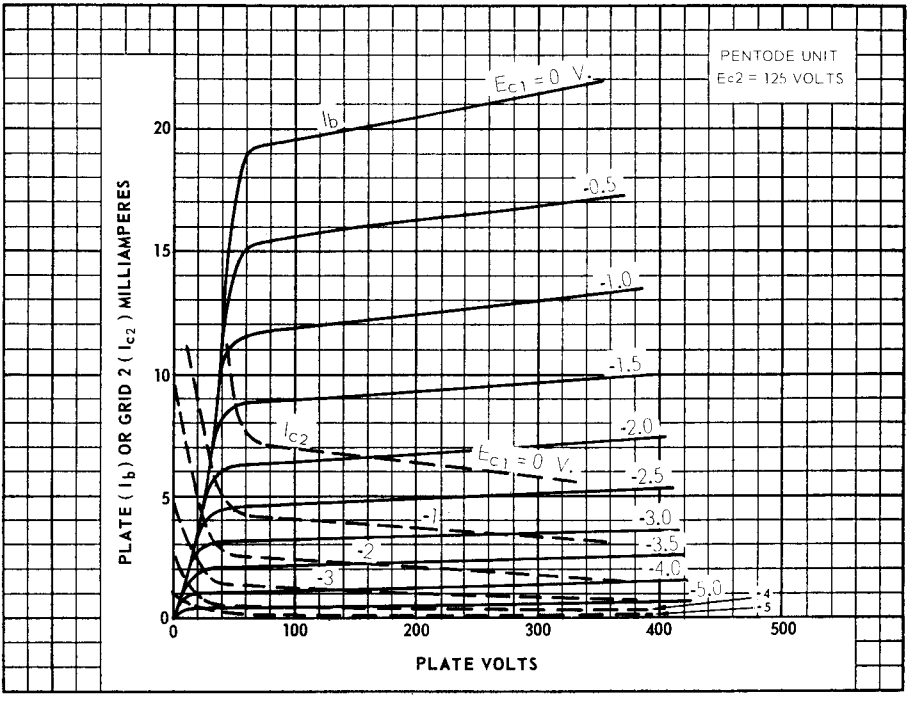
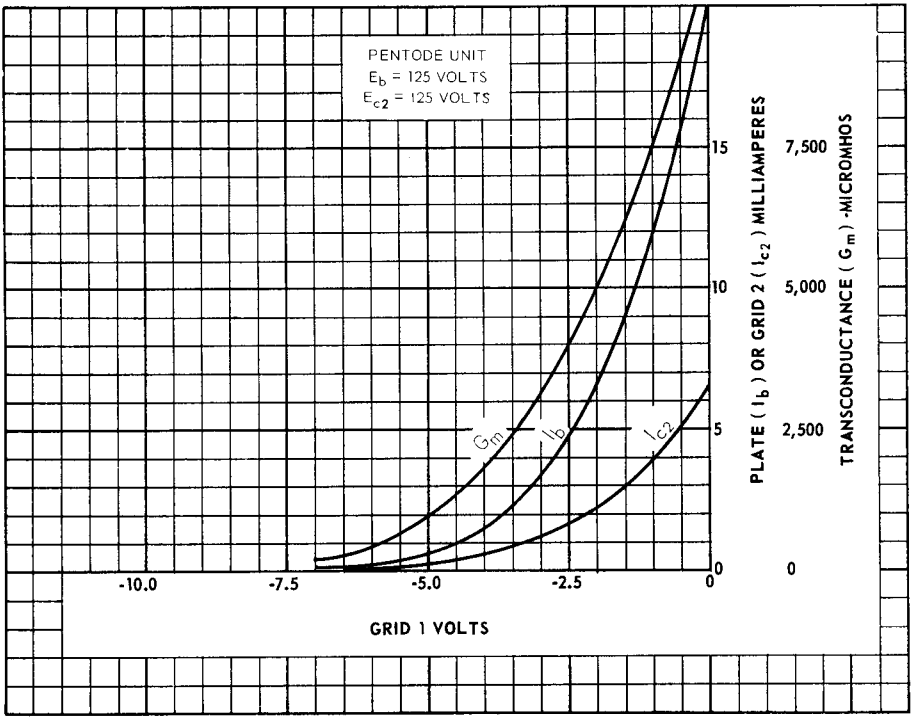

TRIODE UNIT
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (G_m) -MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
15
10
5
0
15,000
10,000
5,000
0
75
50
25
0
0
10
20
30
40
Gm
μ
R_p
Eb = 200 V.
Eb = 300 V.
Eb = 300 V.
125
125
200
300
200
125
50
50
50


PENTODE UNIT
Ec2 = 125 VOLTS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
20
15
10
5
0
0
100
200
300
400
500
Ib
I_{c2}
E_{c1} = 0 V.
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-5.0
-1
-2
-3
-4
-5



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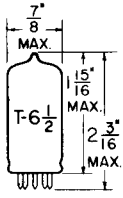
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



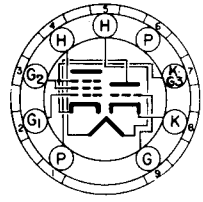
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9AE

THE 6GJ8 IS A SHARP CUTOFF PENTODE AND A MEDIUM MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED PRIMARILY FOR SERVICE AS AN OSCILLATOR IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE SECTION:			
GRID TO PLATE	2.6	2.6	μμf
INPUT: G TO (H+K+Pk,G3,I.S.)	3.6	3.4	μμf
OUTPUT: P TO (H+K+Pk, G3,I.S.)	2.4	1.6	μμf
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	0.025	0.036	μμf
INPUT: G1 TO (H+K G3, I.S.+G2)	8.0	8.0	μμf
OUTPUT: P TO (H+K G3, I.S.+G2)	3.2	2.4	μμf

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM POSITIVE GRID VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2.5	VOLTS
MAXIMUM GRID #2 DISSIPATION	---	0.55	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	1.0	---	MEGOHM
SELF BIAS	2.2	---	MEGOHM

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TUNG-SOL

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[B]	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME* (APPROX.)	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE[B]	6.3		VOLTS
HEATER CURRENT[C]	0.60		AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE CURRENT	13.5	12	MA.
GRID #2 CURRENT	---	4.5	MA.
TRANSCONDUCTANCE	8500	7500	μMHOS
AMPLIFICATION FACTOR	40	---	
PLATE RESISTANCE (APPROX.)	5000	150 000	OHMS
E_{c1} FOR I_b = 20 μA (APPROX.)	-9	-6.5	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

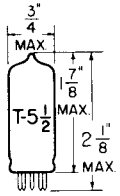
[B] FOR PARALLEL HEATER OPERATION, EQUIPMENT SHOULD BE SO DESIGNED SO THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER VOLTAGE.

[C] FOR SERIES HEATER OPERATION, EQUIPMENT SHOULD BE SO DESIGNED SO THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

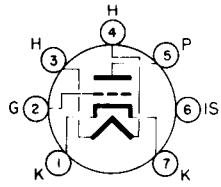
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

LOW INPUT CAPACITANCE
HIGHER INPUT IMPEDANCE
DUAL CATHODE LEADS
PARTIAL SHIELD BETWEEN
THE GRID AND PLATE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FP

THE 6GK5 IS A FRAME GRID GAIN CONTROLLED SHIELDED TRIODE IN THE SEVEN PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF RF AMPLIFIER AT A B+ OF 135 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

GRID TO PLATE	0.52	pf
INPUT: G TO (H+K+I.S.+E.S.)	5.0	pf
OUTPUT: P TO (H+K+I.S. + E.S.)	3.5	pf
HEATER TO CATHODE	2.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	180	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
PLATE DISSIPATION	2.5	WATTS
DC CATHODE CURRENT	22	MA.
NEGATIVE GRID VOLTAGE	50	VOLTS
GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	MEGOHMS

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TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	-1.0	VOLTS
PLATE CURRENT	11.5	MA.
TRANSCONDUCTANCE	15 000	μMHOS
AMPLIFICATION FACTOR	78	
PLATE RESISTANCE (APPROX.)	5400	OHMS
Ec FOR Gm = 150 μMHOS (APPROX.)	-4.2	VOLTS
Ec FOR Gm = 1500 μMHOS (APPROX.)	-2.5	VOLTS
HOT INPUT RESISTANCE (200 Mc) [C]	275	OHMS
HOT INPUT CAPACITANCE (200 Mc) [C]	11.2	pf
NOISE FIGURE (200 Mc) [D]	4.7	db

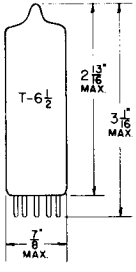
[C] MEASURED UNDER GROUNDED PLATE CONDITIONS.

[D] OPTIMIZED NEUTRALIZED TRIODE RF AMPLIFIER STAGE, NOISE MATCHED.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

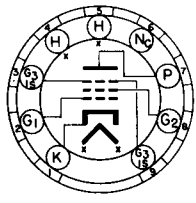
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.76 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE
9GK

THE 6GK6 IS POWER PENTODE DESIGNED FOR USE EITHER IN AUDIO OUTPUT AMPLIFIER STAGES OR IN VIDEO POWER OUTPUT AMPLIFIER STAGES OF TELEVISION RECEIVERS. THE TUBE FEATURES AN EXTRA RESERVE OF SCREEN DISSIPATION RATING AND A NEW BASING ARRANGEMENT THAT GIVES A LOWER GRID TO PLATE CAPACITY FOR THE SAME HIGH TRANSCONDUCTANCE OF PROTOTYPE TUBES.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G1 TO P (MAX.)	.14	μμf
INPUT: G1 TO ALL	10.0	μμf
OUTPUT: P TO ALL	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330[A]	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE	605	VOLTS
MAXIMUM GRID #2 VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	605	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	13.2[A]	WATTS
MAXIMUM GRID #2 DISSIPATION (AVERAGE)	2	WATTS
MAXIMUM GRID #2 DISSIPATION, PEAK	4	WATTS
MAXIMUM CATHODE CURRENT (AVERAGE)	65	MA.
MAXIMUM GRID #1 VOLTAGE FOR GRID CURRENT STARTING POINT WITH Ic1 = 0.3 μA.	-1.3	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS	0.3	MEG.
SELF BIAS	1.0	MEG.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE TO CATHODE	100	VOLTS
HEATER POSITIVE TO CATHODE	100	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.76	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	250	VOLTS
GRID 1 (CONTROL-GRID) VOLTAGE	−7.3	VOLTS
CATHODE BIAS RESISTOR	135	OHMS
PLATE RESISTANCE (APPROX.)	38000	OHMS
TRANSCONDUCTANCE	11300	μMHOS
PLATE CURRENT ZERO SIGNAL	48	MA.
GRID #2 CURRENT, ZERO SIGNAL	5.5	MA.
LOAD RESISTANCE	5200	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	5.7	WATTS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1 ZERO SIGNAL	19	

PUSH PULL AMPLIFIER - VALUE FOR TWO TUBES

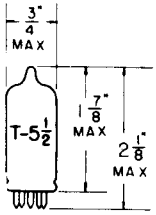
	CLASS AB		CLASS B		
PLATE VOLTAGE	250	300	250	300	VOLTS
GRID #2 (SCREEN) VOLTAGE	250	300	250	300	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	---	---	−11.6	−14.7	VOLTS
CATHODE BIAS RESISTOR	130	130	---	---	OHMS
GRID TO GRID INPUT VOLTAGE PEAK A-F	22.4	28	22.4	28	VOLTS
PLATE CURRENT, ZERO SIGNAL	62	72	20	15	MA.
PLATE CURRENT, MAXIMUM SIGNAL	75	92	75	92	MA.
GRID #2 CURRENT, ZERO SIGNAL	7	8	2.2	1.6	MA.
GRID #2 CURRENT, MAXIMUM SIGNAL	15	22	15	22	MA.
LOAD RESISTANCE, PLATE-TO-PLATE	8000	8000	8000	8000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	3	4	3	4	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	11	17	11	17	WATTS

A. WHEN THE HEATER AND POSITIVE VOLTAGE ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR, THE MAXIMUM VALUES OF THE PLATE AND GRID 2 VOLTAGES ARE 275 VOLTS AND THE PLATE DISSIPATION IS 9.9 WATTS.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

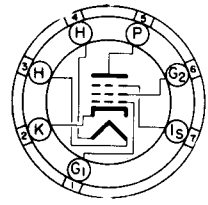
UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.4 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

7CM

THE 6GM6 IS A SEMIREMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR USE IN GAIN-CONTROLLED PICTURE-IF STAGES OF TELEVISION RECEIVERS OPERATING AT INTERMEDIATE FREQUENCIES OF THE ORDER OF 40 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.036	μμf
GRID #1 TO CATHODE, INTERNAL SHIELD & G3,G2 & H.	10	μμf
PLATE TO CATHODE, INTERNAL SHIELD & G3, G2 & H.	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	0.65	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS (SEE JEDEC INPUT RATING CHART J5-C4-2)		
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE SUPPLY VOLTAGE	125	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET	
GRID #2 SUPPLY VOLTAGE	125	VOLTS
CATHODE RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	13 000	μMHOS
PLATE CURRENT	14	MA.
GRID #2 CURRENT	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANCONDUCTANCE = 60 μMHOS	-15	VOLTS

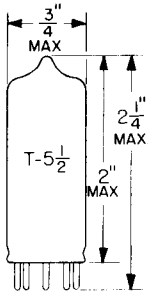
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SER ICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WROST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time, the 6GM6 is identical to the 4GM6 and the 5GM6.*

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

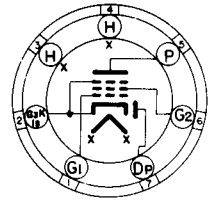
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7FW

THE 6GN6 IS A REMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A HIGH GAIN R.F. OR I.F. AMPLIFIER AND A DEMODULATOR DIODE BOTH ON A COMMON CATHODE. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 6GN6 IS IDENTICAL TO THE 12GN6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH [A] SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	.0035	.0035	μμf
INPUT	5.5	5.5	μμf
OUTPUT	5.5	5.0	μμf
COUPLING DIODE PLATE TO GRID (MAX.)	.05	.05	μμf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.6	WATTS
MAXIMUM DIODE CURRENT (CONTINUOUS OPERATION)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC PLUS PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC PLUS PEAK	200	VOLTS
HEATER WARM-UP TIME* (APPROX.)	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

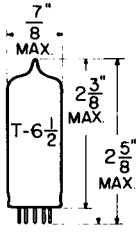
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	100	250	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET			
SCREEN VOLTAGE	100	100	VOLTS
CATHODE-BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHMS
TRANSCONDUCTANCE	4300	4400	μMHOS
PLATE CURRENT	10.8	11	MA.
SCREEN CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.)			
G_m = 40 μMHOS	-20	-20	VOLTS
AVERAGE DIODE CURRENT AT 10V D.C.	1.5	1.5	MA.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



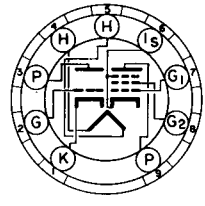
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.75 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9DX

THE 6GN8 IS A HIGH MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER OR SYNC-SEPARATOR. THE PENTODE SECTION IS DESIGNED FOR VIDEO AMPLIFIER SERVICE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6GN8 IS IDENTICAL TO THE 8GN8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE	4.4	μμf
INPUT: G TO (H+K)	2.4	μμf
OUTPUT: P TO (H+K)	0.36	μμf
PENTODE SECTION		
GRID #1 TO PLATE (MAX)	0.1	μμf
INPUT: G1 TO (H+K+G2+G3+I.S.)	11	μμf
OUTPUT: P TO (H+K+G2+G3+I.S.)	4.2	μμf
COUPLING		
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS

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TUNG-SOL

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION		1.1	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.75		AMP
PLATE VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		150	VOLTS
GRID #1 VOLTAGE	-2		VOLTS
CATHODE BIAS RESISTOR		100	OHMS
PLATE CURRENT	2	25	MA.
GRID #2 CURRENT		5.5	MA.
TRANSCONDUCTANCE	2700	11500	μMHOS
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE	37000	60000	OHMS
Ec1 FOR Ib = 100 μA (APPROX.)		-10	VOLTS
Ec1 FOR Ib = 20 μA (APPROX.)	-5		VOLTS

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

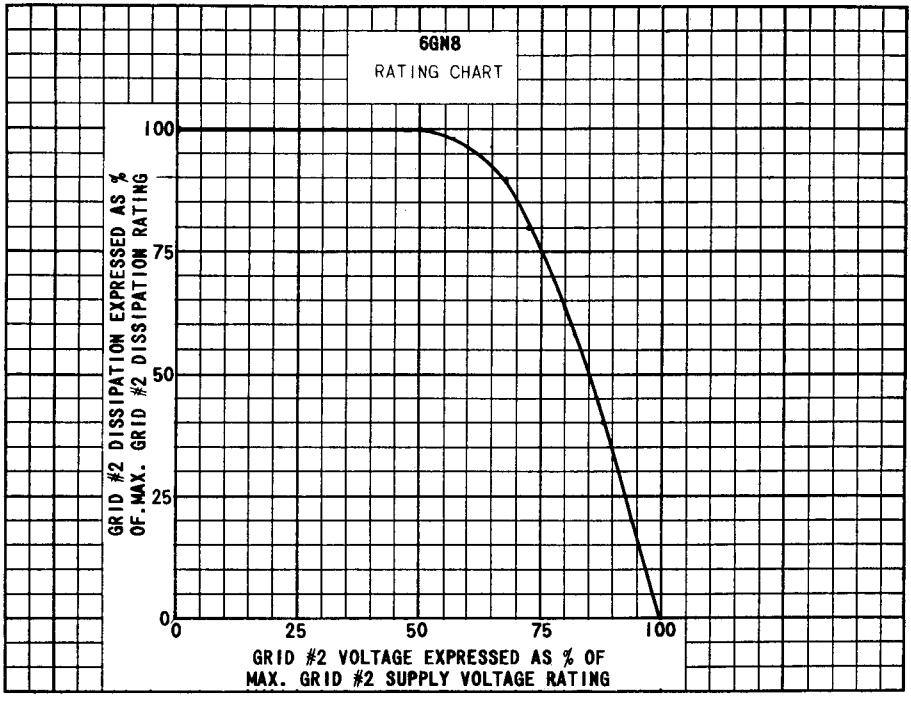
PENTODE SECTION

Eb = 60 VOLTS, Ec2 = 150 VOLTS AND Ec1 = 0 VOLTS
Ib = 55 MA AND Ic2 = 18 MA.

A. DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS.

THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS.

THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION AND ENVIRONMENTAL CONDITIONS.

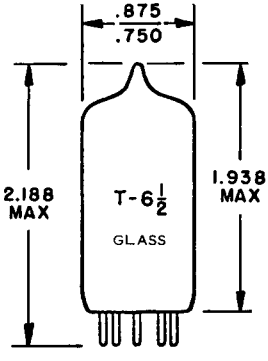

6GN8
RATING CHART
GRID #2 DISSIPATION EXPRESSED AS % OF MAX. GRID #2 DISSIPATION RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING

TUNG-SOL

TRIPLE DIODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



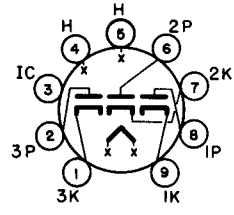
BUTTON 9 PIN BASE
JEDEC E9-1

FOR
AM AND FM
DETECTION

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9QM



BOTTOM VIEW

THE 6GQ7 IS A TRIPLE HIGH PERVEANCE DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN AM DETECTOR AND FM RADIO-DETECTOR OR DISCRIMINATOR.

DIRECT INTERELECTRODE CAPACITANCES

PLATE INPUT EACH UNIT: P TO (K +H)	2.05	pf
CATHODE INPUT EACH UNIT: K TO (P + H)	3.10	pf
PLATE, UNIT #1 TO PLATE, UNIT #2	0.47	pf
PLATE, UNIT #1 TO PLATE, UNIT #3	0.47	pf
PLATE, UNIT #2 TO PLATE, UNIT #3	0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		330	VOLTS
DC COMPONENT		330	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

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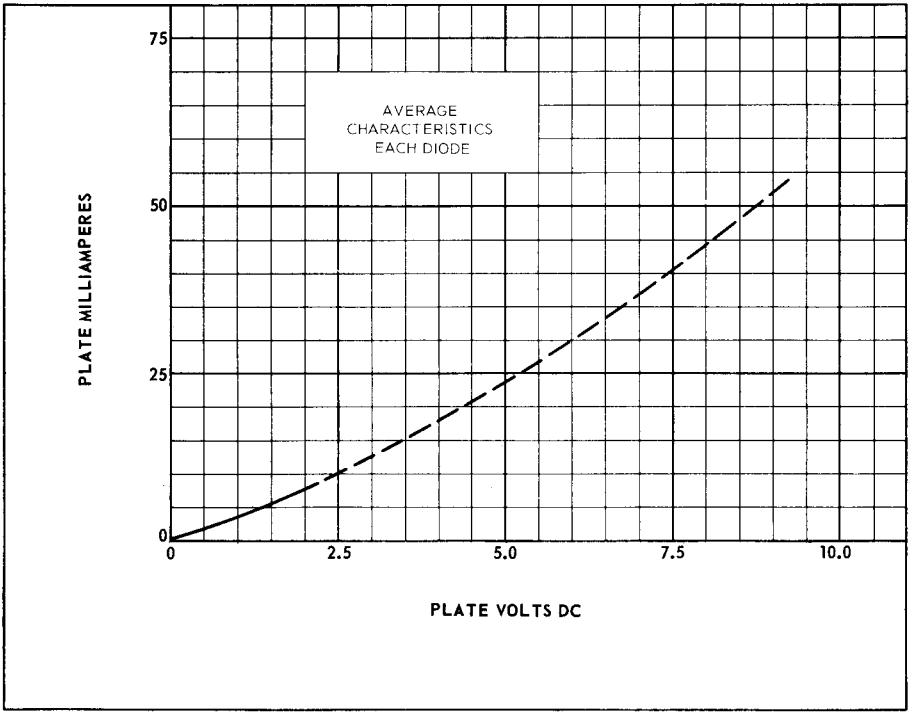
MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE VOLTAGE	330	VOLTS
AC PLATE VOLTAGE RMS - EACH PLATE	117	VOLTS
STEADY STATE PEAK PLATE CURRENT - EACH PLATE	54	mA
DC OUTPUT CURRENT - EACH PLATE	9	mA
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDENCE - EACH PLATE	300	OHMS

CHARACTERISTICS

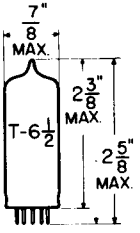
TUBE VOLTAGE DROP AT 60 mA	10	VOLTS
RESONANT FREQUENCY - EACH UNIT	APPROX. 700	Mc/s



TUNG-SOL

DUAL PENTODE

MINIATURE TYPE



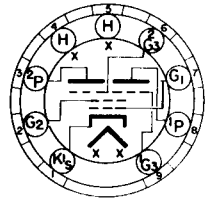
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.30 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON

9 PIN BASE

9LW

THE 6GS8 IS A DUAL PENTODE WITH A SEPARATE PLATE AND A SEPARATE #3 GRID IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PRIMARILY INTENDED FOR SERVICE AS A COMBINED SYNC SEPARATOR-CLIPPER AND AGC TUBE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 6GS8 IS IDENTICAL TO THE 3GS8 AND THE 4GS8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE (EACH SECTION)	2.0	μμf
GRID #1 TO ALL	6.0	μμf
GRID #3 (EACH SECTION) TO ALL	3.8	μμf
PLATE (EACH SECTION) TO ALL	3.2	μμf
GRID #3 (SECTION #1) TO GRID #3 (SECTION 2) (MAX.)	0.015	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE (EACH SECTION)	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE (EACH SECTION)	3.0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM PEAK POSITIVE GRID #3 VOLTAGE (EACH SECTION)	50	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM GRID #2 DISSIPATION	0.75	WATTS
MAXIMUM DC CATHODE CURRENT	12	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
MAXIMUM GRID #3 CIRCUIT RESISTANCE (EACH SECTION)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BOTH SECTIONS OPERATING

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.30		AMP.
PLATE VOLTAGE (EACH SECTION)	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE (EACH SECTION)	-10	0	VOLTS
GRID #1 VOLTAGE	NOTE B	NOTE B	
PLATE CURRENT (EACH SECTION)		2.0	MA.
GRID #2 CURRENT	6.0	3.6	MA.
CATHODE CURRENT	6.1	7.7	MA.

EACH SECTION OPERATING SEPARATELY WITH PLATE AND GRID #3 OF OPPOSITE SECTION GROUNDED.

PLATE VOLTAGE	100	100	VOLTS
GRID #2 VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	NOTE B	
PLATE CURRENT		2.0	MA.
GRID #3 TRANSCONDUCTANCE		270	μMHOS
GRID #1 TRANSCONDUCTANCE	1200		μMHOS
E_{c3} FOR I_b = 100 μA (APPROX.)		-3.7	VOLTS
E_{c1} FOR I_b = 100 μA (APPROX.)		-2.0	VOLTS

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST-PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

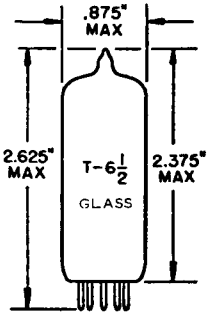
[B] GRID CURRENT ADJUSTED FOR 100 μA DC.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-3



BASE 9 PIN BUTTON
JEDEC E9-1

FOR

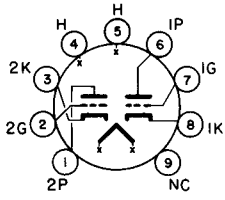
USE IN MATRIXING CIRCUITS

OF COLOR T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9 LP



BOTTOM VIEW

THE 6GU7 IS A MEDIUM-MU TWIN TRIODE IN THE 9 PIN T-6½ ENVELOPE. IT IS DESIGNED FOR USE IN THE MATRIXING CIRCUITS OF COLOR T.V. RECEIVERS. THE 6GU7 CAN ALSO BE USED IN PHASE-INVERTER AND MUTIVIBRATOR CIRCUITS OR AS A GENERAL-PURPOSE AMPLIFIER TUBE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID TO PLATE	3.0	3.0	pf
GRID TO CATHODE AND HEATER	3.4	3.6	pf
PLATE TO CATHODE AND HEATER	0.44	0.34	pf
PLATE OF UNIT #1 TO PLATE OF UNIT #2	1.0	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES • SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	mA
HEATER WARM-UP TIME		APPROX. 11	SECONDS
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
LIMITS OF SUPPLIED CURRENT		600 ± 40	mA
PEAK HEATER CATHODE VOLTAGE • EACH UNIT			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

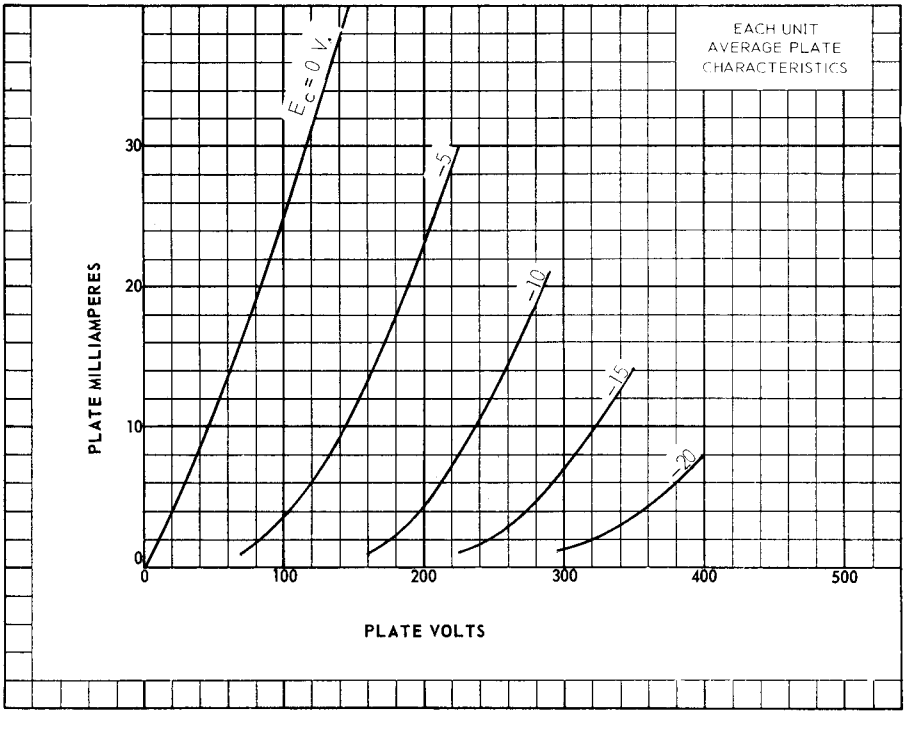
CLASS A, AMPLIFIER - EACH UNIT

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
PLATE DISSIPATION	3	WATTS
GRID - CIRCUIT RESISTANCE:		
FOR FIXED BIAS OPERATION	1	MEGOHM

CHARACTERISTICS

CLASS A, AMPLIFIER - EACH UNIT

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−10.5	VOLTS
PLATE CURRENT	11.5	mA
TRANSCONDUCTANCE	3,100	μMHOS
AMPLIFICATION FACTOR	17	
PLATE RESISTANCE	APPROX. 5,500	OHMS
PLATE CURRENT AT E_c = −14 VOLTS	4	mA
GRID VOLTAGE FOR I_b = 50 μA	APPROX. −23	VOLTS



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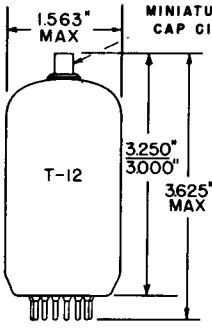
BEAM PENTODE



GLASS BULB
BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-79

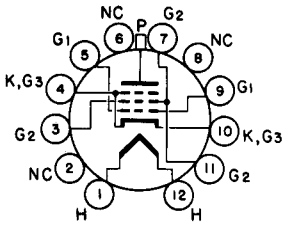
FOR

TV HORIZONTAL DEFLECTION

AMPLIFIER APPLICATIONS

ANY MOUNTING POSITION

COATED UNIPOTENTIAL CATHODE



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12DR

THE 6GV5 IS A COMPACTRON BEAM-POWER PENTODE EMPLOYING A 12 PIN T-12 ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.6	pf
INPUT: G1 TO (H+K+G2+B.P)	16	pf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	1200	MA,
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[B]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	5000	60	250	VOLTS
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	----	0[C]	-22.5	VOLTS
PLATE RESISTANCE, APPROX.	----	----	18000	OHMS
TRANSCONDUCTANCE	----	----	7300	μMHOS
PLATE CURRENT	----	345	65	MA.
GRID 2 CURRENT	----	27	1.8	MA.
GRID 1 VOLTAGE, APPROX. Ib=1.0 MA.	-100	----	-42	VOLTS
TRIODE AMPLIFICATION FACTOR[D]	----	----	4.4	

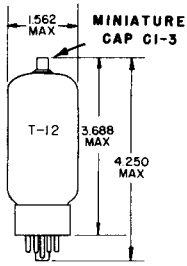
B
IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

C
APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

D
TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb=Ec2=150 VOLTS AND Ec1=-22.5 VOLTS

TUNG-SOL

BEAM PENTODE



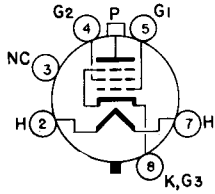
GLASS BULB

SHORT MEDIUM SHELL
5 OR 6 PIN OCTAL WITH
EXTERNAL BARRIERS
STYLE B: B6-122 OR B5-190

FOR
HORIZONTAL-DEFLECTION-AMPLIFIER
CIRCUITS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #3 IS OMITTED WHEN B5-190 BASE IS USED



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AM

THE 6GW6 IS A BEAM POWER PENTODE EMPLOYING A T-12 ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE IN HORIZONTAL-DEFLECTION-AMPLIFIER CIRCUITS OF TELEVISION RECEIVERS WHICH OPERATE WITH LOW PLATE SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	pf
GRID #1 TO CATHODE, GRID #3, GRID #2 & HEATER	17	pf
PLATE TO CATHODE, GRID #3, GRID #2 & HEATER	7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE-PULSE PLATE VOLTAGE[B]	6500	VOLTS
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1500	VOLTS
DC GRID #2 VOLTAGE	220	VOLTS
DC GRID #1 VOLTAGE	-55	VOLTS

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MAXIMUM RATINGS-CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	330	VOLTS
CATHODE CURRENT:		
PEAK	550	MA.
AVERAGE	175	MA.
PLATE DISSIPATION[C]	17.5	WATTS
GRID #2 INPUT	3.5	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	240	°C
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE[C]	1.0	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	VOLTS
MU-FACTOR, GRID #2 TO GRID #1 WITH PLATE CONNECTED TO GRID #2, PLATE VOLTS = GRID #2 VOLTS =150, AND GRID #1 VOLTS =-22.5	---	4.4	
PLATE RESISTANCE (APPROX.)	---	15000	OHMS
TRANSCONDUCTANCE	---	7100	μMHOS
PLATE CURRENT	→390[D]	70	MA.
GRID #2 CURRENT	32[D]	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 1 MA.		42	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE POLSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

[C] IN STAGES OPERATING WITH GRID-RESISTOR BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVE FORM SUCH THAT THE CATHODE CURRENT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

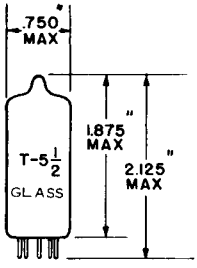
→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-2



BASE 7 PIN BUTTON
JEDEC E7-1

FOR

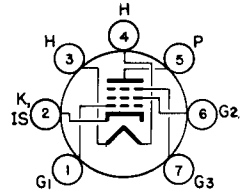
FM SOUND DETECTOR

SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7EN



BOTTOM VIEW

THE 6GX6 IS A SHARP-CUTOFF PENTODE WITH DUAL CONTROL GRIDS IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR FM SOUND DETECTOR - SERVICE. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6GX6 IS IDENTICAL TO THE 5GX6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.26	pf
GRID 1 TO (K & I.S., G3, G2, H)	8	pf
GRID 1 TO GRID 3	0.12	pf
GRID 3 TO PLATE	1.6	pf
GRID 3 TO (K & I.S., P, G2, G1, H)	6.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
HEATER WARM - UP TIME - AVERAGE		11	SECONDS
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± .6	VOLTS
LIMITS OF SUPPLIED CURRENT - AC OR DC		450 ± 30	mA
PEAK HEATER - CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

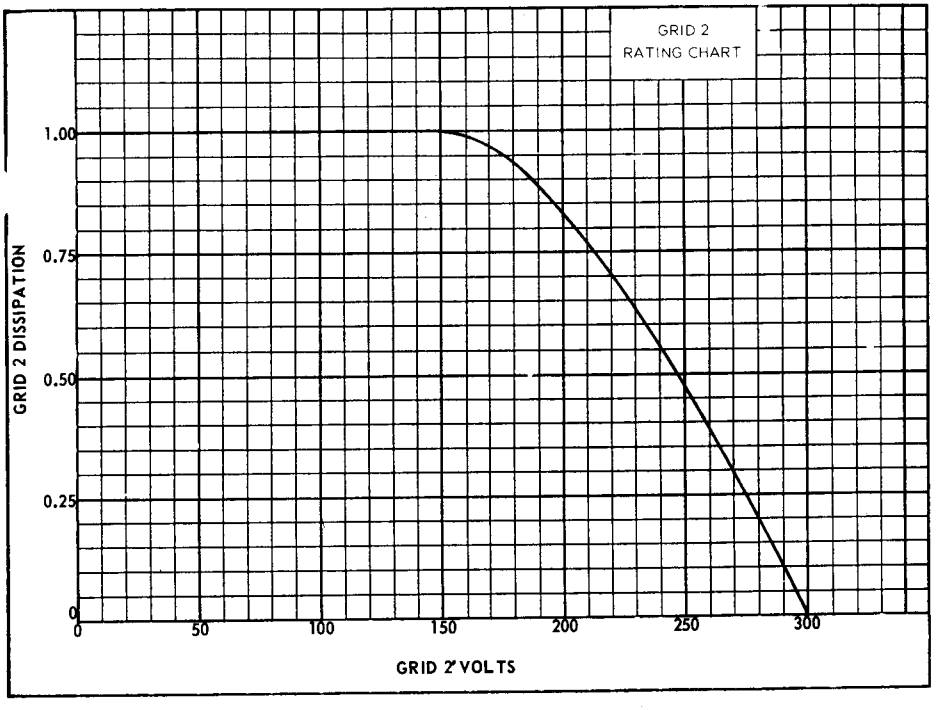
FM SOUND DETECTOR SERVICE

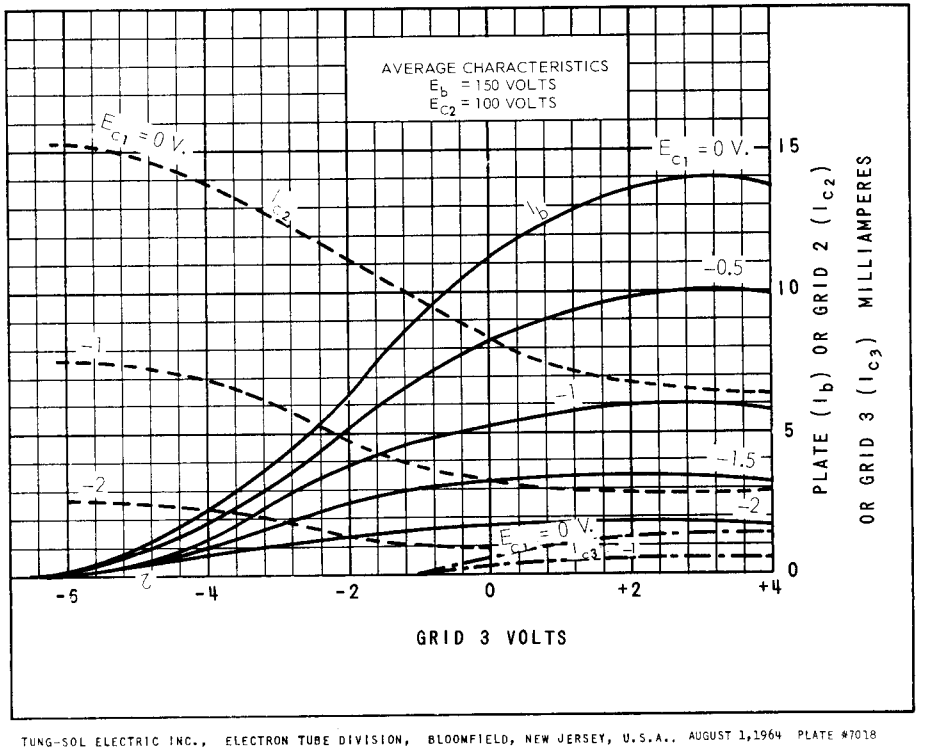
PLATE VOLTAGE		300	VOLTS
GRID 3 VOLTAGE:			
NEGATIVE VALUE - DC AND PEAK		100	VOLTS
POSITIVE VALUE - DC AND PEAK		25	VOLTS
GRID 2 SUPPLY VOLTAGE		300	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
GRID 1 VOLTAGE:			
NEGATIVE - BIAS VALUE		50	VOLTS
POSITIVE - BIAS VALUE		0	VOLTS
GRID 3 INPUT		0.1	WATT
GRID 2 INPUT - UP TO 150 VOLTS		1	WATT
- BETWEEN 150 VOLTS AND 300 VOLTS		SEE RATING CHART	
PLATE DISSIPATION		1.7	WATTS
GRID 3 CIRCUIT RESISTANCE		0.68	MEGOHM
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED - BIAS OPERATION		0.22	MEGOHM
FOR CATHODE - BIAS OPERATION		0.47	MEGOHM

CHARACTERISTICS

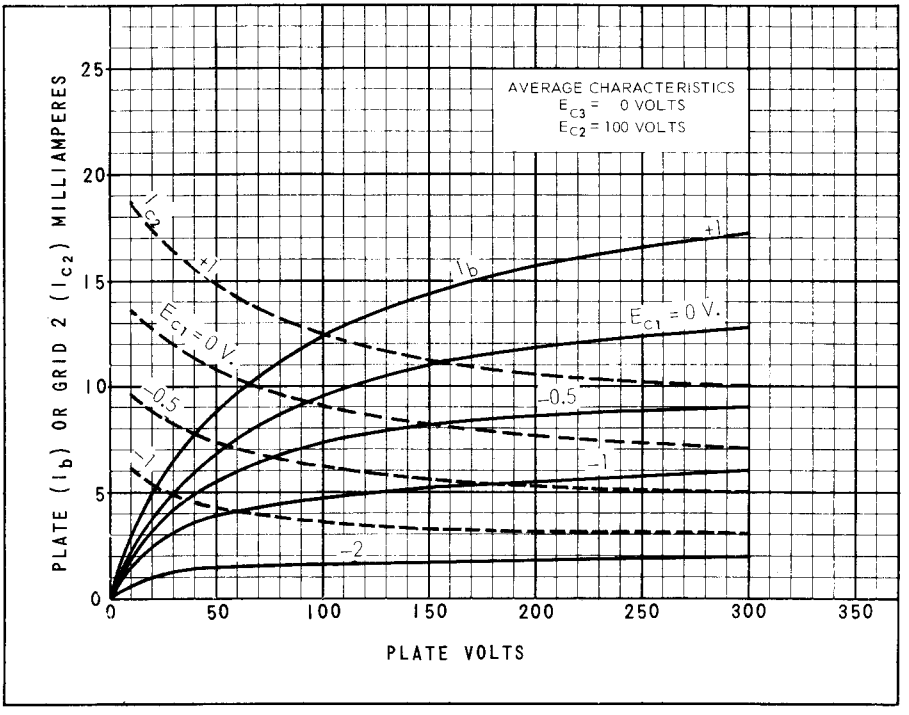
CLASS A_1 AMPLIFIER

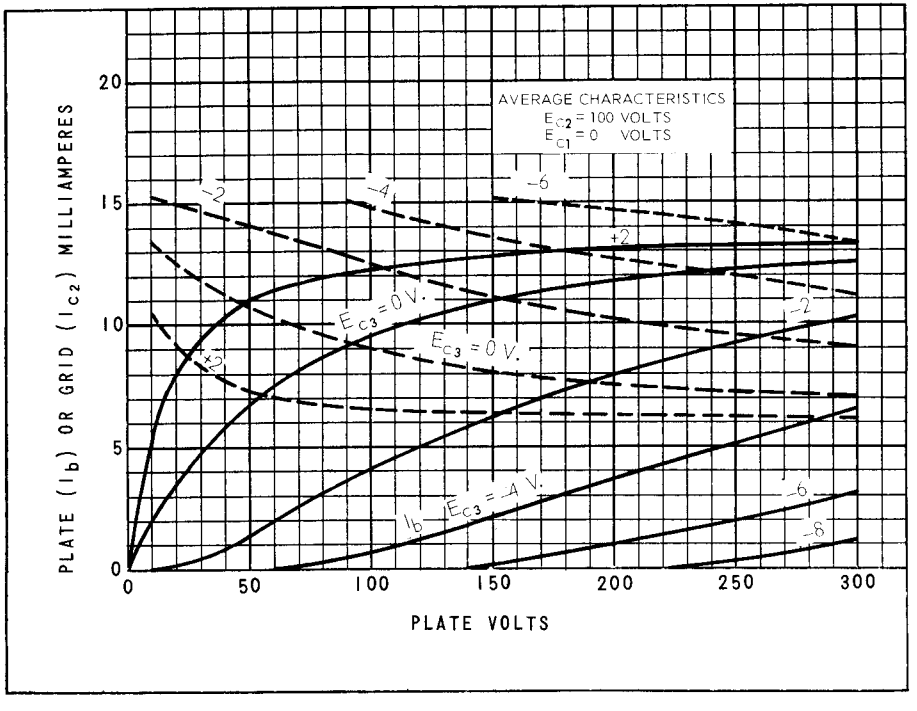
PLATE SUPPLY VOLTAGE		150	VOLTS
GRID 3 SUPPLY VOLTAGE		0	VOLTS
GRID 2 SUPPLY VOLTAGE		100	VOLTS
GRID 1 SUPPLY VOLTAGE		0	VOLTS
CATHODE RESISTOR		180	OHMS
PLATE CURRENT		3.7	mA
GRID 2 CURRENT		3.0	mA
TRANSCONDUCTANCE - GRID 1 TO PLATE		3,700	μMHOS
TRANSCONDUCTANCE - GRID 3 TO PLATE		750	μMHOS
PLATE RESISTANCE	APPROX.	0.14	MEGOHM
GRID 1 VOLTAGE FOR I_b = 20 μA	APPROX.	−4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 20 μA	APPROX.	−7	VOLTS

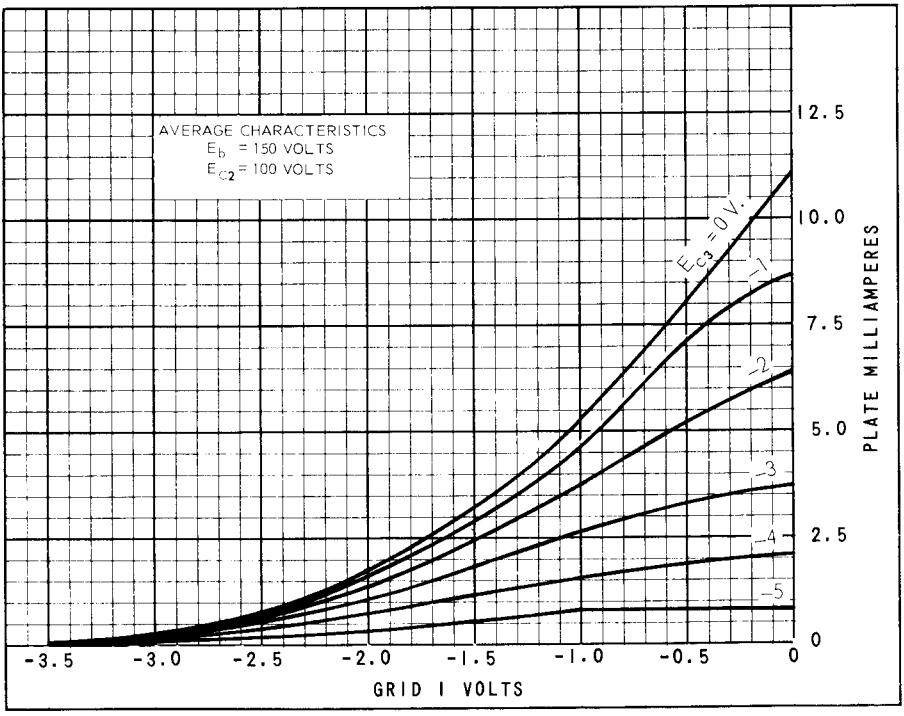

GRID 2
RATING CHART
GRID 2 DISSIPATION
1.00
0.75
0.50
0.25
0
0
50
100
150
200
250
300
GRID 2 VOLTS

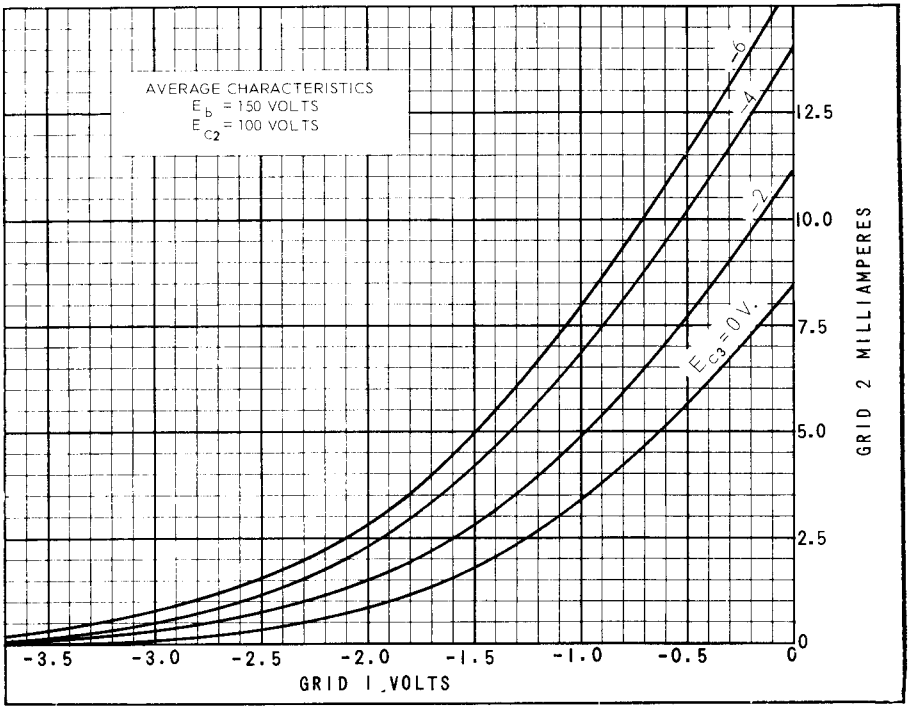

AVERAGE CHARACTERISTICS
E_b = 150 VOLTS
E_{C2} = 100 VOLTS
E_{C1} = 0 V.
I_{C2}
I_b
-0.5
-1
-1.5
-2
I_{C3}
PLATE (I_b) OR GRID 2 (I_{C2})
OR GRID 3 (I_{C3}) MILLIAMPERES
15
10
5
0
-6
-4
-2
0
+2
+4
GRID 3 VOLTS

6GX6


AVERAGE CHARACTERISTICS
E_{c3} = 0 VOLTS
E_{c2} = 100 VOLTS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_{c2}
I_b
+1
E_{c1} = 0 V.
-0.5
-1
-2
0
5
10
15
20
25
50
100
150
200
250
300
350


AVERAGE CHARACTERISTICS
E_{c2} = 100 VOLTS
E_{c1} = 0 VOLTS
PLATE (I_b) OR GRID (I_{c2}) MILLIAMPERES
PLATE VOLTS
-2
-4
-6
+2
E_{c3} = 0 V.
+1
I_b
E_{c3} = -4 V.
-8
0
5
10
15
20
50
100
150
200
250
300


AVERAGE CHARACTERISTICS
E_b = 150 VOLTS
E_{C2} = 100 VOLTS
E_{C3} = 0 V.
-1
-2
-3
-4
-5
12.5
10.0
7.5
5.0
2.5
0
PLATE MILLIAMPERES
-3.5
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID 1 VOLTS

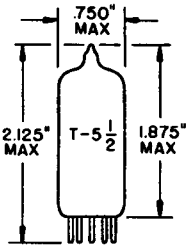

AVERAGE CHARACTERISTICS
E_b = 150 VOLTS
E_{C2} = 100 VOLTS
-6
-4
-2
E_{C3} = 0 V.
12.5
10.0
7.5
5.0
2.5
0
GRID 2 MILLIAMPERES
-3.5
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID 1 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

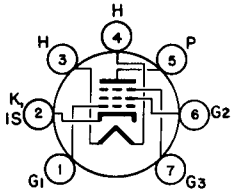
SHARP-CUTOFF PENTODE
WITH
DUAL CONTROL GRIDS



GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7EN

THE 6GY6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN GATED AGC AMPLIFIER AND NOISE-INVERTER SERVICE. PLATE CURRENT IS CONTROLLED BY THE ACTIONS OF GRID 1 AND GRID 3.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.026	pf
GRID 1 TO CATHODE & I.S., GRID 3, GRID 2 & HEATER	8	pf
GRID 1 TO GRID 3	0.12	pf
GRID 3 TO PLATE	1.6	pf
GRID 3 TO CATHODE & I.S., PLATE, GRID 2, GRID 1 & HEATER	6.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES • SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER WARM-UP TIME			11	SECONDS
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200	VOLTS
DC COMPONENT			100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

GATED AGC AMPLIFIER AND NOISE-INVERTER SERVICE

PLATE VOLTAGE, DC	300	VOLTS
PEAK POSITIVE-PULSE PLATE VOLTAGE [A]	600	VOLTS
GRID 3 (CONTROL-GRID) VOLTAGE:		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	100	VOLTS
GRID 2 (SCREEN-GRID) SUPPLY VOLTAGE	300	VOLTS
GRID 1 (CONTROL-GRID) VOLTAGE:		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	50	VOLTS
PLATE DISSIPATION	1.7	WATTS
GRID 2 INPUT:		
FOR GRID 2 VOLTAGES UP TO 150 VOLTS	1.0	WATTS
FOR GRID 2 VOLTAGES BETWEEN 150 VOLTS AND 300 VOLTS	See Rating Chart	

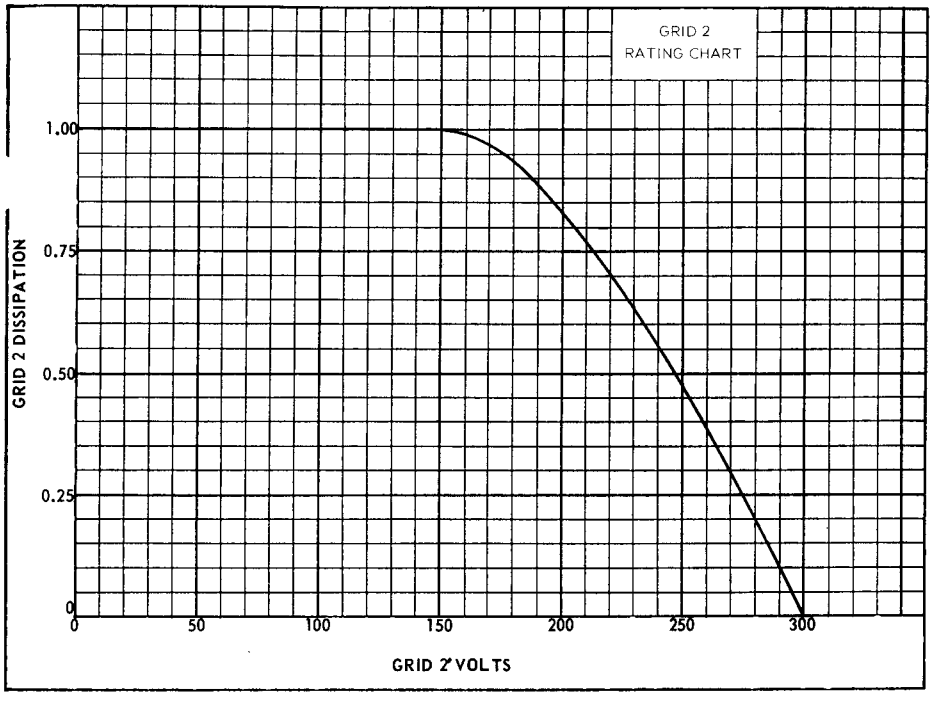
MAXIMUM CIRCUIT VALUES

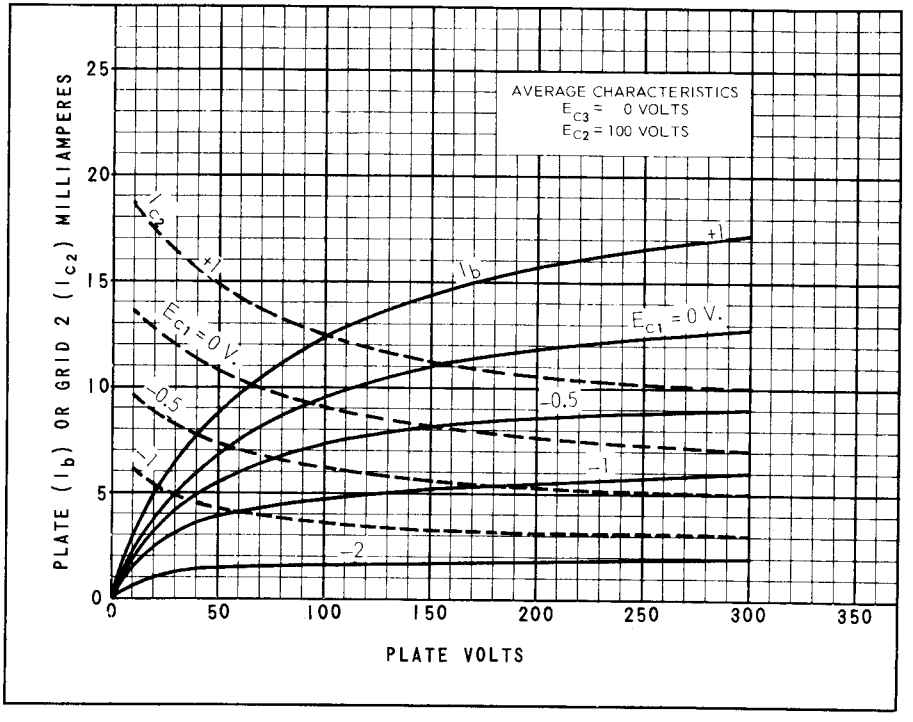
GRID 3 CIRCUIT RESISTANCE	0.68	MEGOHM
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.22	MEGOHM
FOR CATHODE-BIAS OPERATION	0.47	MEGOHM

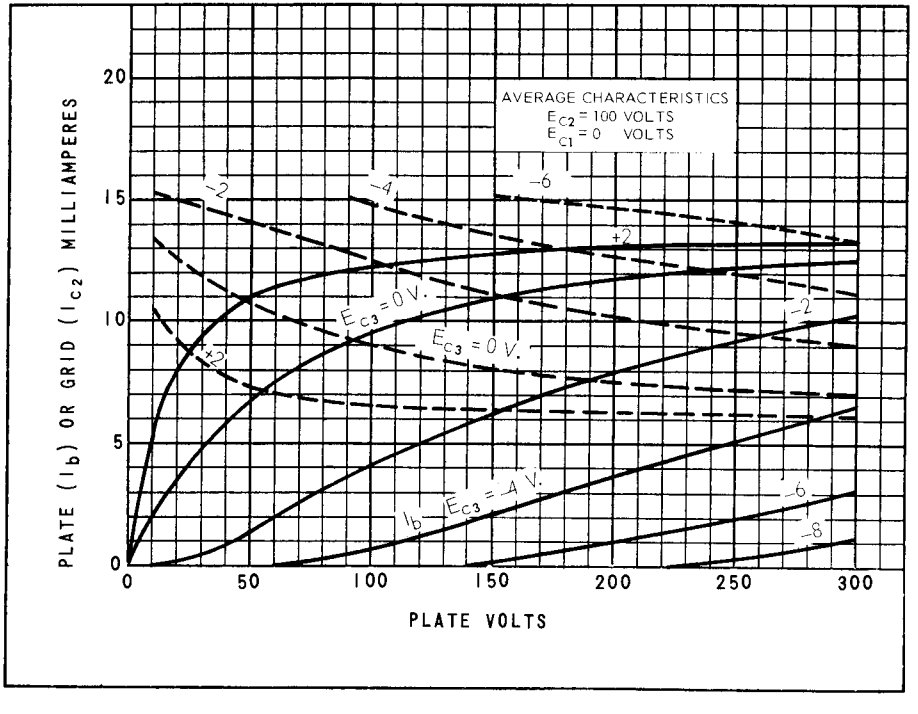
CHARACTERISTICS

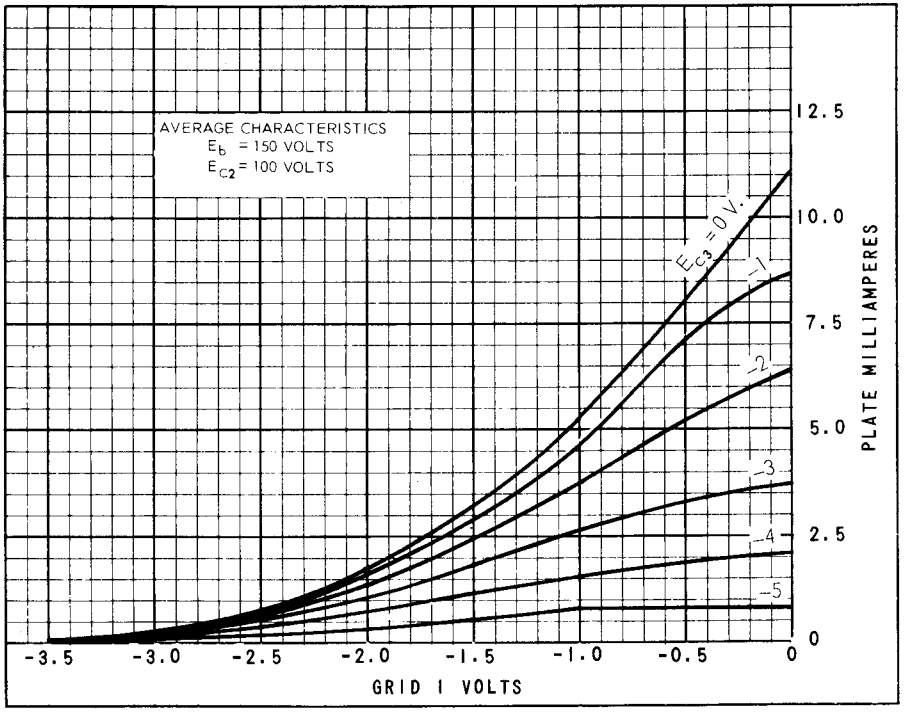
PLATE SUPPLY VOLTAGE		150	VOLTS
GRID 3 SUPPLY VOLTAGE		0	VOLTS
GRID 2 SUPPLY VOLTAGE		100	VOLTS
GRID 1 SUPPLY VOLTAGE		0	VOLTS
CATHODE BIAS RESISTOR		180	OHMS
PLATE CURRENT		3.7	MA.
GRID 2 CURRENT		3	MA.
TRANSCONDUCTANCE, GRID 1 TO PLATE		3700	μMHOS
TRANSCONDUCTANCE, GRID 3 TO PLATE		750	μMHOS
PLATE RESISTANCE	(APPROX.)	0.14	MEGOHM
GRID 1 SUPPLY VOLTAGE FOR I_b = 20 μA	(APPROX.)	-4.5	VOLTS
GRID 3 SUPPLY VOLTAGE FOR I_b = 20 μA	(APPROX.)	-7	VOLTS

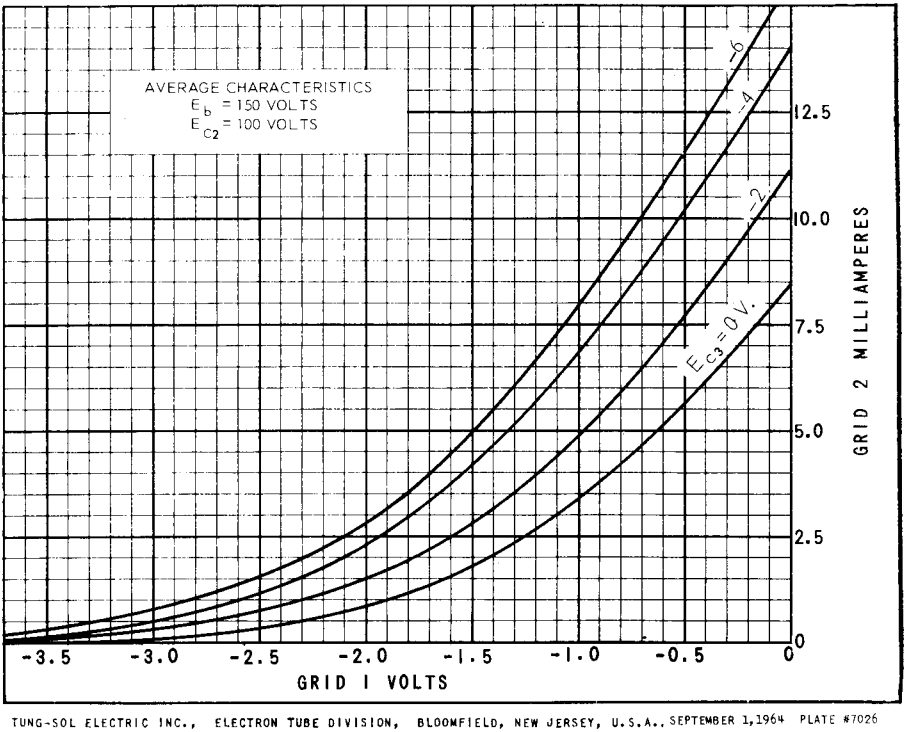
[A] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.


GRID 2
RATING CHART
GRID 2 DISSIPATION
1.00
0.75
0.50
0.25
0
0
50
100
150
200
250
300
GRID 2 VOLTS


AVERAGE CHARACTERISTICS
E_{C3} = 0 VOLTS
E_{C2} = 100 VOLTS
PLATE (I_b) OR GRID 2 (I_{C2}) MILLIAMPERES
PLATE VOLTS
I_{C2}
I_b
+1
E_{C1} = 0 V.
-0.5
-1
-2
0
5
10
15
20
25
50
100
150
200
250
300
350


AVERAGE CHARACTERISTICS
E_{C2} = 100 VOLTS
E_{C1} = 0 VOLTS
PLATE (I_b) OR GRID (I_{C2}) MILLIAMPERES
PLATE VOLTS
-2
-4
-6
+2
E_{C3} = 0 V.
I_b
E_{C3} = -4 V.
-8
0
5
10
15
20
50
100
150
200
250
300

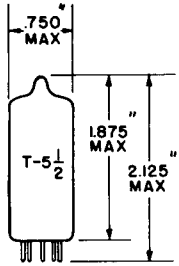

AVERAGE CHARACTERISTICS
E_b = 150 VOLTS
E_{C2} = 100 VOLTS
E_{C3} = 0 V.
-1
-2
-3
-4
-5
12.5
10.0
7.5
5.0
2.5
0
PLATE MILLIAMPERES
-3.5
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID 1 VOLTS


AVERAGE CHARACTERISTICS
E_b = 150 VOLTS
E_{C2} = 100 VOLTS
-6
-4
-2
E_{C3} = 0 V.
12.5
10.0
7.5
5.0
2.5
0
GRID 2 MILLIAMPERES
-3.5
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID 1 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

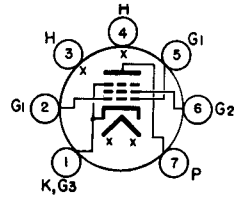


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

FOR AUDIO OUTPUT
STAGE APPLICATIONS
IN RADIO AND T.V.
RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 6GZ5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS. ITS HEATER IS DESIGNED FOR TRANSFORMER OPERATION.

EXCEPT FOR HEATER CHARACTERISTICS, THE 6GZ5 IS IDENTICAL TO THE 4GZ5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: G1 TO P	0.24	pf
INPUT: G1 TO (H+K+G2)	8.5	pf
OUTPUT: P TO (H+K+G2)	3.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	380	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	300	VOLTS
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	4.8	WATTS
GRID #2 DISSIPATION - CONTINUOUS	1:1	WATTS
CATHODE CURRENT- AVERAGE	30	MA.
GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	.5	MEGOHM
SELF BIAS	1.0	MEGOHM
BULB TEMPERATURE	200	°C

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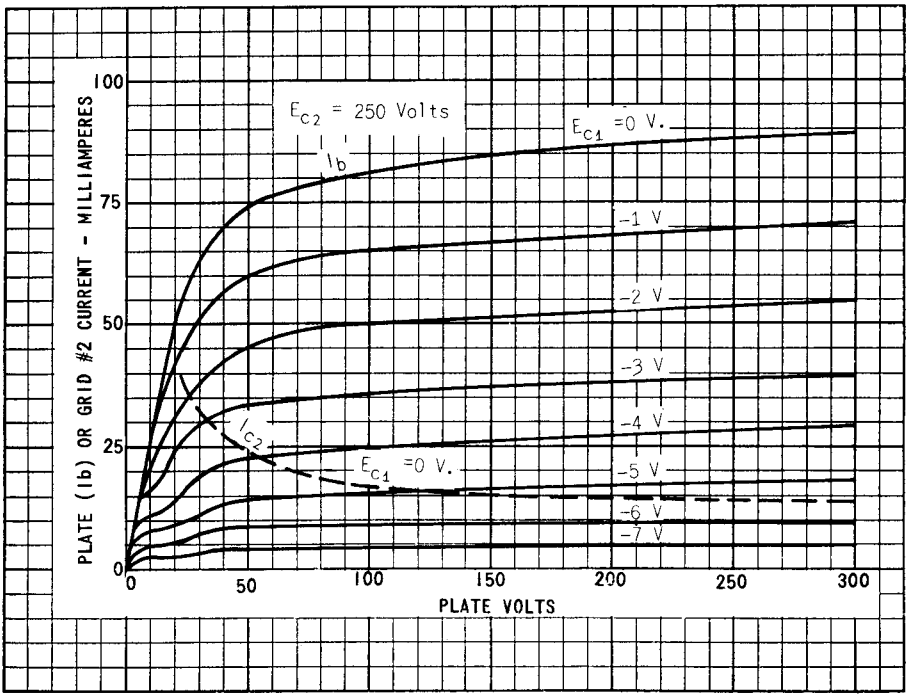
TUNG-SOL

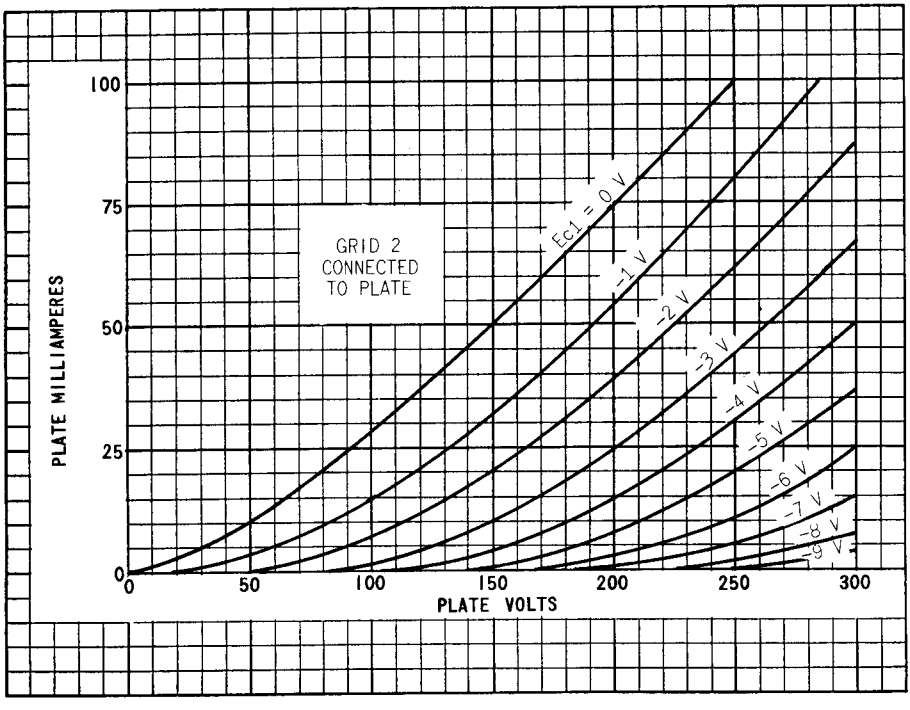
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AUDIO AMPLIFIER

PLATE SUPPLY VOLTAGE	250	250	VOLTS
GRID #2 SUPPLY VOLTAGE	250	250	VOLTS
CATHODE RESISTOR	270	270	OHMS
BYPASSING	NONE	CONDENSER	
PEAK AUDIO GRID #1 VOLTAGE	9.8	2.0	VOLTS
ZERO SIGNAL PLATE CURRENT	16	16	MA.
MAXIMUM SIGNAL PLATE CURRENT	16	16	MA.
ZERO SIGNAL GRID #2 CURRENT	2.7	2.7	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	5.0	5.0	MA.
TRANSCONDUCTANCE	---	8400	μMHOS
PLATE RESISTANCE (APPROX.)	---	.15	MEGOHMS
LOAD RESISTANCE	15 000	15 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	1.8	1.1	WATTS





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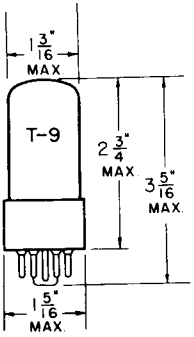
TUNG-SOL



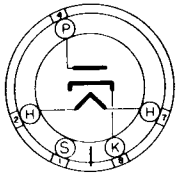
DIODE

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.150 AMP.

AC OR DC



BOTTOM VIEW

INTERMEDIATE OCTAL
5 PIN BASE

GLASS BULB

ANY MOUNTING POSITION

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	100	VOLTS
MAXIMUM DC OUTPUT CURRENT	4.0	MA.
MAXIMUM PEAK PLATE CURRENT	18	MA.
PLATE RESISTANCE AT 0.25 MA. (APPROX.)	1 000	OHMS

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PLATE
1577
FEB. 28
1945

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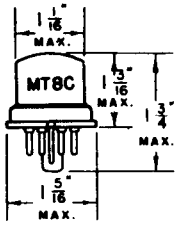
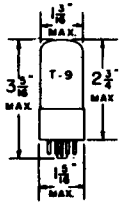
TUNG-SOL



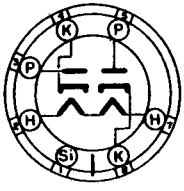
TWIN DIODE

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC



METAL SHELL
7 PIN OCTAL BASE
6H6



GLASS BULB
INTERMEDIATE
7 PIN OCTAL BASE
6H6GT/G

BOTTOM VIEWS

THE TUNG-SOL 6H6 AND 6H6GT/G ARE DESIGNED FOR USE AS DIODE DETECTORS, AVC RECTIFIERS, AND POWER RECTIFIERS IN LOW DRAIN APPLICATIONS. TWO SEPARATE RECTIFIER SECTIONS ALLOW CONSIDERABLE FLEXIBILITY IN THEIR APPLICATION. WITH THE EXCEPTION OF CAPACITANCES, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM AC PLATE VOLTAGE PER PLATE (RMS)	150	VOLTS
MAXIMUM DC OUTPUT CURRENT PER PLATE	8	MA.
TUBE VOLTAGE DROP AT 16 MA. DC PER PLATE	11	VOLTS

DIRECT INTERELECTRODE CAPACITANCES [A]

	6H6	6H6GT/G	
PLATE (1) TO CATHODE (1)	3.0	3.0	μμf
PLATE (2) TO CATHODE (2)	3.4	4.0	μμf
PLATE TO PLATE	0.1 MAX.	0.1 MAX.	μμf

[A] WITH EXTERNAL SHIELD OR SHELL CONNECTED TO CATHODE

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1341-1
OCT. 25
1943

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6H6, 6H6GT/G

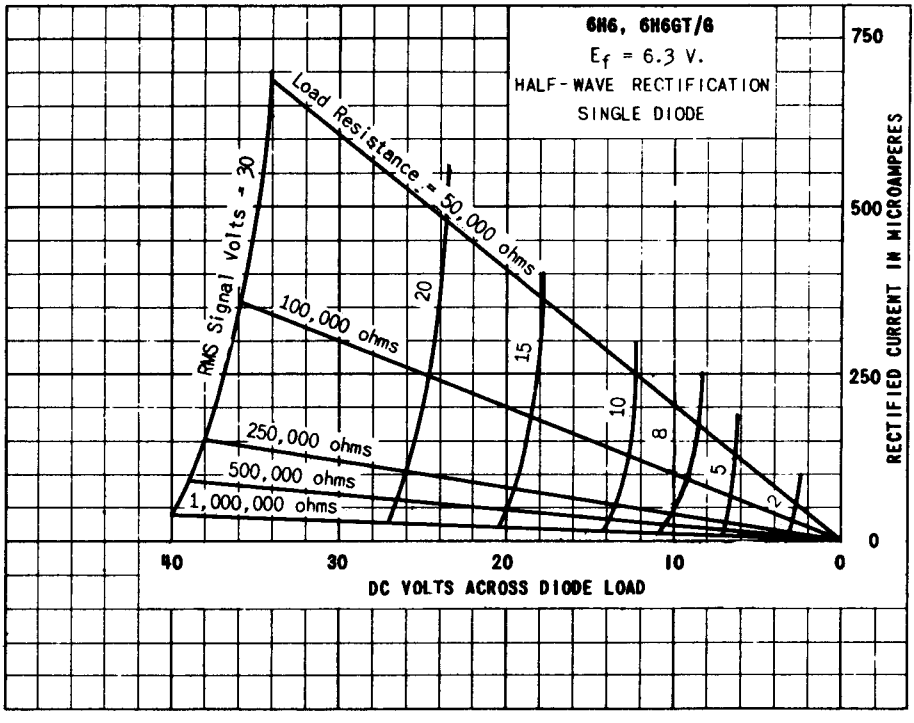

PLATE
1342-1
OCT. 25
1943

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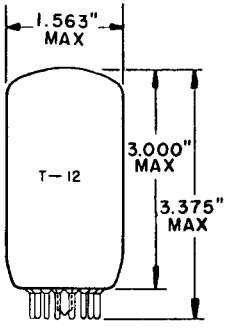
TUNG-SOL

PENTODE

COMPACTRON

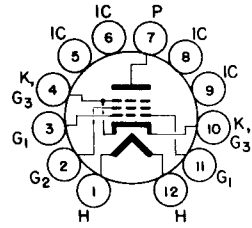


GLASS BULB

BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-58

BEAM PENTODE
FOR
HORIZONTAL-DEFLECTION
AMPLIFIER
APPLICATIONS
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12 BJ

THE 6HB5 IS A BEAM PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN T.V. RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6HB5 IS IDENTICAL TO THE 21HB5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.4	pf
INPUT: G1 TO (H + K + G2 + G3)	22	pf
OUTPUT: P TO (H + K + G3 + G3)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.5	AMPS
LIMITS OF APPLIED VOLTAGE	6.3 ± 0.6		VOLTS
HEATER - CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED ON PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	18	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	230	MA.
PEAK CATHODE CURRENT	800	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

A- IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 [B]	-20	VOLTS
PLATE CURRENT	-	410	50	MA.
GRID 2 CURRENT	-	24	1.75	MA.
TRANSCONDUCTANCE	-	-	9,100	μMHOS
PLATE RESISTANCE	-	-	Approx. 11,000	OHMS
GRID 1 VOLTAGE FOR I_b = 1.0 MA. -APPROX.	-66	-	-33	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	-	-	4.7	

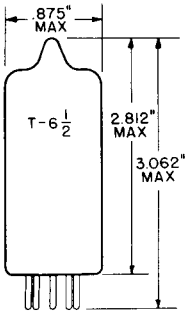
B- APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

C- TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} = 130$ VOLTS AND $E_{c1} = -20$ VOLTS.

TUNG-SOL

POWER PENTODE

MINIATURE TYPE



GLASS BULB

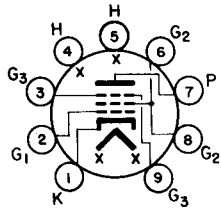
MINIATURE
9 PIN BASE E 9-1
OUTLINE DRAWING
JEDEC 6-4

POWER PENTODE

FOR VERTICAL DEFLECTION

AND VIDEO AMPLIFIER

SERVICE



BOTTOM VIEW

BASING DIAGRAM

JEDEC 9NW ←

THE 6HB6 IS A POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER FOR TELEVISION RECEIVERS WITH WIDE ANGLE PICTURE TUBES.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE (G1 TO P)	0.18	pf
INPUT G1 TO (H+K+G2+G3)	13	pf
OUTPUT P TO (H+K+G2+G3)	8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	760	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAX. PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE TO CATHODE		200	VOLTS
HEATER POSITIVE TO CATHODE		200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	350	VOLTS
PLATE PULSE (POSITIVE) VOLTAGE	2500	VOLTS
GRID #2 VOLTAGE	300	VOLTS
NEGATIVE GRID #1 VOLTAGE	-100	VOLTS
PLATE DISSIPATION	10	WATTS
GRID #2 DISSIPATION	2	WATTS
GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	1.0	MEGOHM
SELF BIAS	2.2	MEGOHM

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→ INDICATES A CHANGE.

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TUNG-SOL

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AVERAGE CHARACTERISTICS

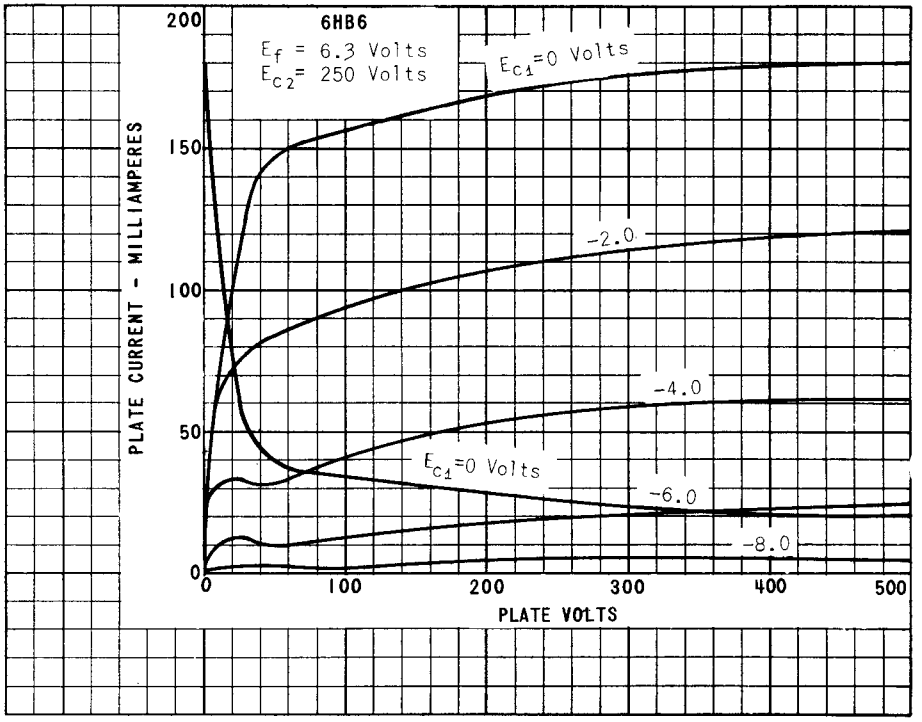
PLATE VOLTAGE	250	250	VOLTS
GRID #2 VOLTAGE	125	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
CATHODE RESISTOR	33	100	OHMS
PLATE CURRENT	40	40	MA.
GRID #2 CURRENT	4.2	6.2	MA.
MU-FACTOR: GRID #1 TO GRID #2		33	
TRANSCONDUCTANCE	24000	20000	μMHOS
PLATE RESISTANCE	28	24	KOHMS
GRID #1 VOLTAGE FOR Ib =100 μA (APPROX.)	-6.4	-13	VOLTS

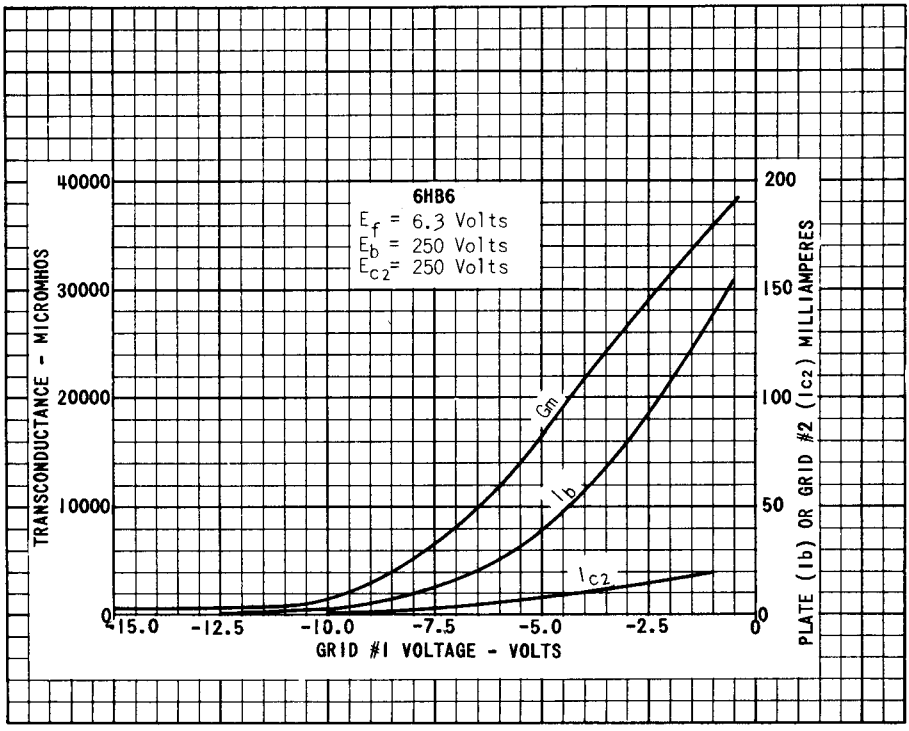
PLATE KNEE CHARACTERISTICS

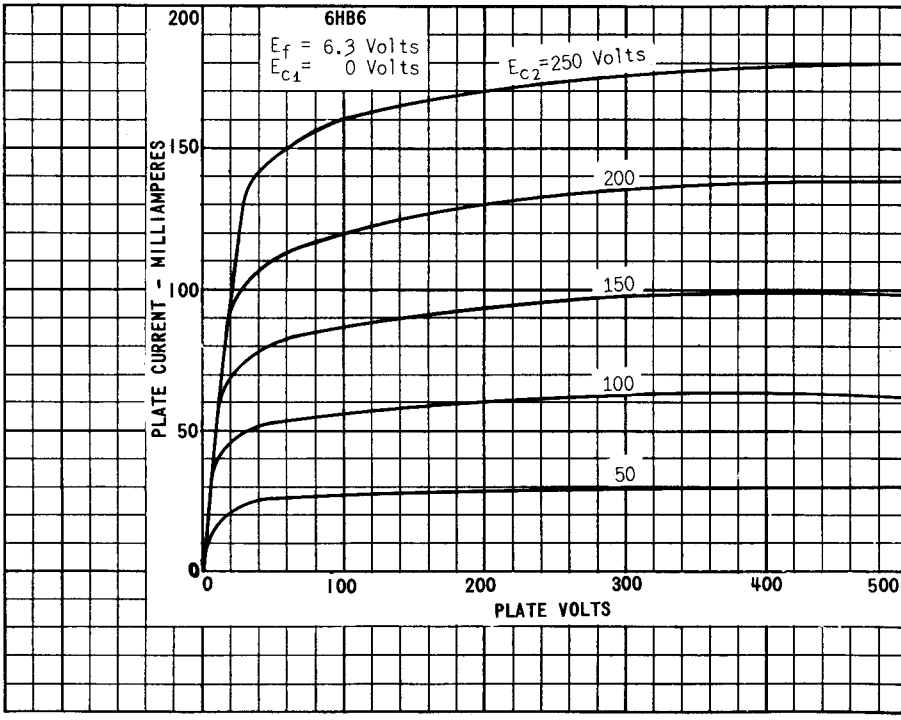
INSTANTANEOUS READINGS

Eb= 60 v. Ec2=250 v., Ec1=0 v.

PLATE CURRENT	150	MA.
GRID #2 CURRENT	37	MA.







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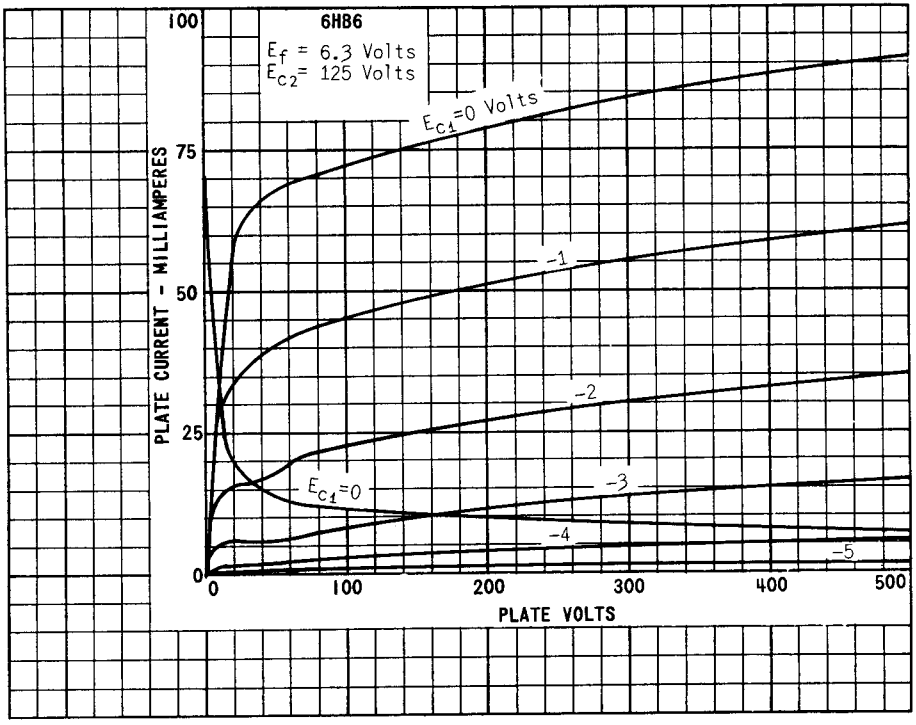
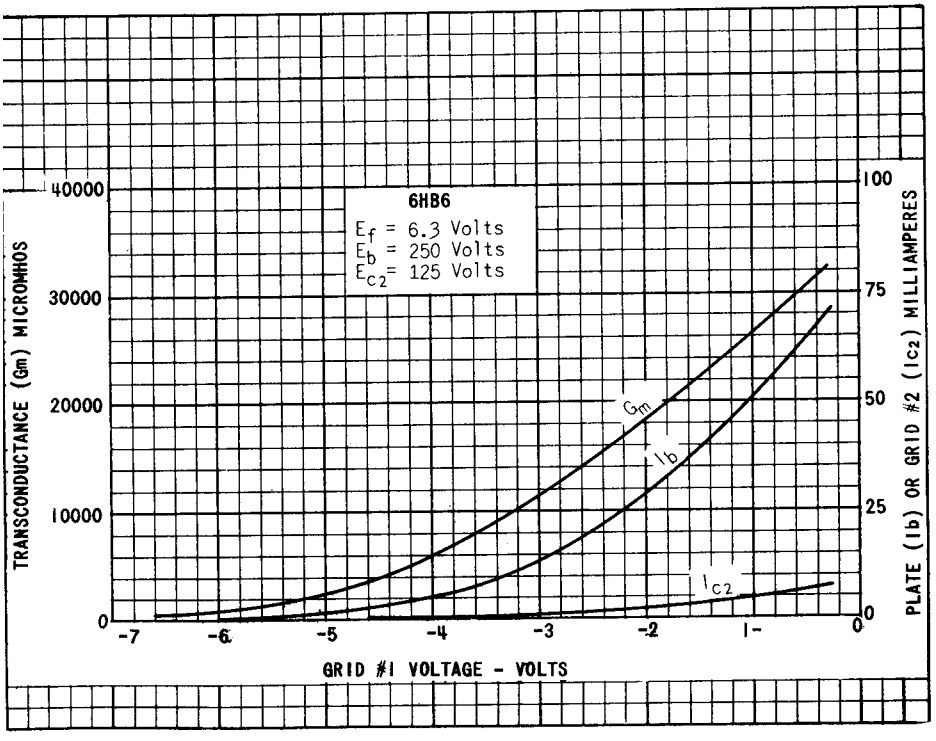
6HB6

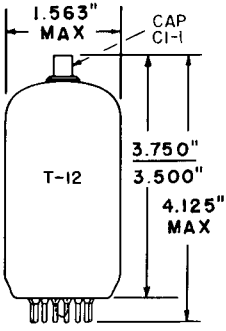

6HB6
E_f = 6.3 Volts
E_{c2} = 125 Volts
E_{c1}=0 Volts
-1
-2
E_{c1}=0
-3
-4
-5
PLATE CURRENT - MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
100
200
300
400
500


6HB6
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 125 Volts
Gm
I_b
I_{c2}
TRANSCONDUCTANCE (Gm) MICROMHOS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 VOLTAGE - VOLTS
0
10000
20000
30000
40000
0
25
50
75
100
-7
-6
-5
-4
-3
-2
-1
0

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB

BUTTON 12 PIN BASE E 12-74
OUTLINE DRAWING
JEDEC 12-89

BEAM PENTODE

FOR

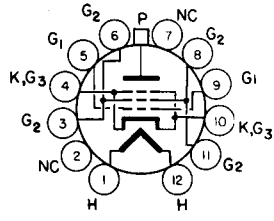
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TELEVISION RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12 FB

THE 6HF5 IS A BEAM-POWER PENTODE IN THE 12 PIN COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN COLOR TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE (G1 TO P)	0.56	pf
INPUT: G1 TO (H + K + G2 + G3)	24	pf
OUTPUT: P TO (H + K + G2 + G3)	10	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	6.3 VOLTS	2.25	AMPS.
LIMITS OF APPLIED VOLTAGE-AC OR DC		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

DC PLATE-SUPPLY VOLTAGE - BOOST + DC POWER SUPPLY	990	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE - ABSOLUTE MAX. VALUE	7,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,100	VOLTS
GRID 2 VOLTAGE	190	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	250	VOLTS
PLATE DISSIPATION [A]	28	WATTS
GRID 2 DISSIPATION	5.5	WATTS
DC CATHODE CURRENT	315	MA
PEAK CATHODE CURRENT	1,100	MA
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	225	^{0}C

A- IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CHARACTERISTICS AN TYPICAL OPERATION

PLATE VOLTAGE	5,000	70	175	VOLTS
GRID 2 VOLTAGE	125	125	125	VOLTS
GRID 1 VOLTAGE	-	0	-25	VOLTS
PLATE CURRENT	-	570 [B]	125	MA
GRID 2 CURRENT	-	34 [B]	4.5	MA
TRANSCONDUCTANCE	-	-	11,300	μMHOS
PLATE RESISTANCE - APPROX.	-	-	5,600	OHMS
GRID 1 VOLTAGE FOR I_b = 1.0 MA-APPROX.	-140	-	-54	VOLTS
TRIODE AMPLICATION FACTOR [C]	-	-	3	

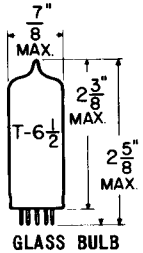
B- VALUES MEASURED BY A METHOD INVOLVING A RECURRENT WAVE FORM SUCH THAT THE PLATE AND GRID 2 DISSIPATIONS WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

C- GRID 2 TIED TO PLATE - E_b = E_{c2} = 125 VOLTS, E_{c1} = -25 VOLTS

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

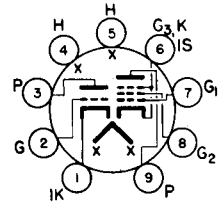
SMALL-BUTTON NOVAL
9 PIN BASE E9-1

UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DX

THE 6HF8 IS A HIGH-MU TRIODE AND A SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN COLOR AND BLACK-AND-WHITE TELEVISION RECEIVERS.
THE PENTODE UNIT IS ESPECIALLY USEFUL AS A VIDEO OUTPUT AMPLIFIER AND THE TRIODE UNIT IS USEFUL IN VOLTAGE-AMPLIFIER APPLICATIONS SUCH AS SYNC-SEPARATOR, SYNC-CLIPPER AND PHASE-INVERTER CIRCUITS.
EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 6HF8 IS IDENTICAL TO THE 10HF8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE UNIT:		
GRID TO PLATE	3.5	pf
GRID TO TRIODE-CATHODE, PK,G3,I.S. & H.	2.8	pf
PLATE TO TRIODE CATHODE, PK,G3,I.S. & H.	2.6	pf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.1	pf
GRID #1 TO K,I.S.,G3,G2 &H	10	pf
PLATE TO K, I.S., G3, G2 & H.	4.2	pf
TRIODE GRID TO PENTODE PLATE (MAX.)	0.015	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	6.3±0.6		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	---	SEE INPUT RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE-BIAS VALUE	0	0	VOLTS

CONTINUED ON FOLLOWING PAGE

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
MAXIMUM PLATE DISSIPATION	1	5	WATTS
MAXIMUM GRID #2 INPUT			
FOR GRID #2 VOLTAGES UP TO 165 V.	---	1.1	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE INPUT RATING CHART		
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

CHARACTERISTICS

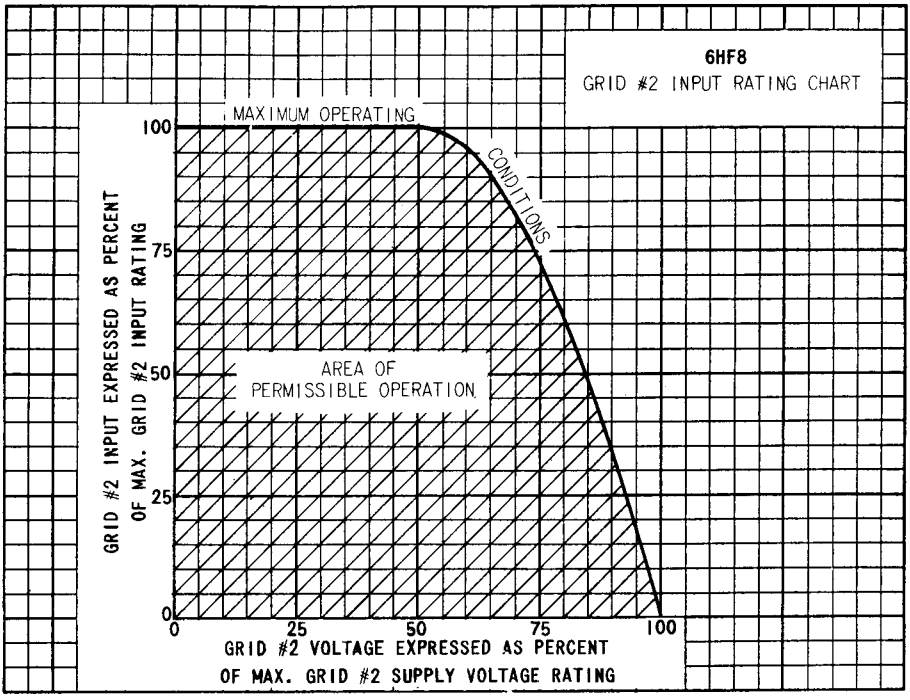
CLASS A_1 AMPLIFIER

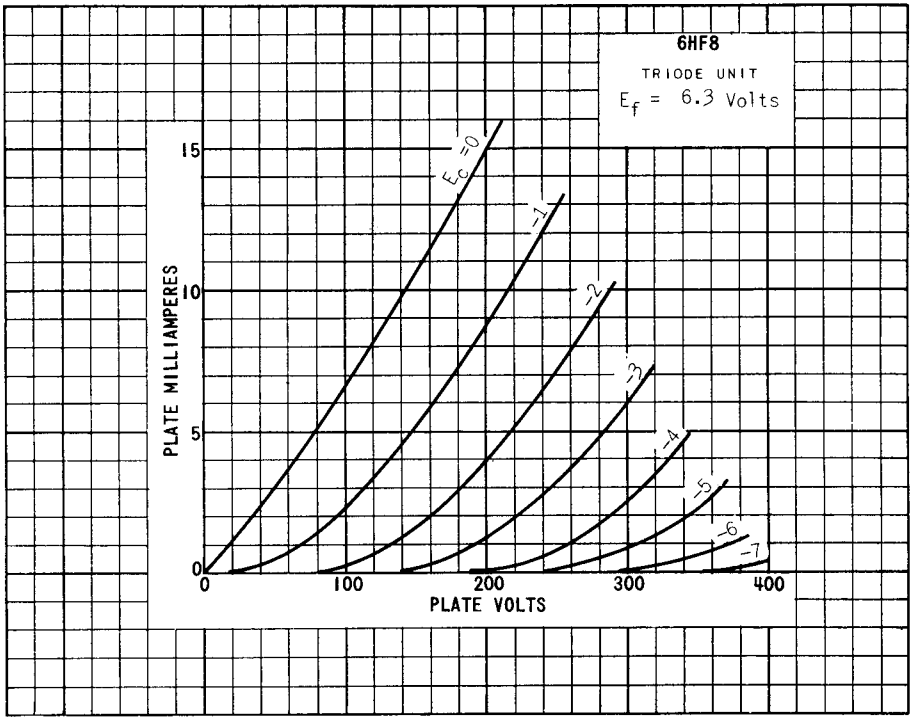
	TRIODE UNIT	PENTODE UNIT		
PLATE-SUPPLY VOLTAGE	200	45	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	125	125	VOLTS
GRID #1 VOLTAGE	-2	0	---	VOLTS
CATHODE RESISTOR	---	---	68	OHMS
AMPLIFICATION FACTOR	70	---	---	
PLATE RESISTANCE (APPROX.)	17500	---	75000	OHMS
TRANSCONDUCTANCE	4000	---	12500	μMHOS
PLATE CURRENT	4	40[B]	25	MA.
GRID #2 CURRENT	---	15[B]	7	MA.
GRID #1 VOLTAGE (APPROX.)				
FOR PLATE CURRENT OF 100 μA	---	---	-9	VOLTS
GRID #1 VOLTAGE (APPROX.)				
FOR PLATE CURRENT OF 20 μA	-6	---	---	VOLTS

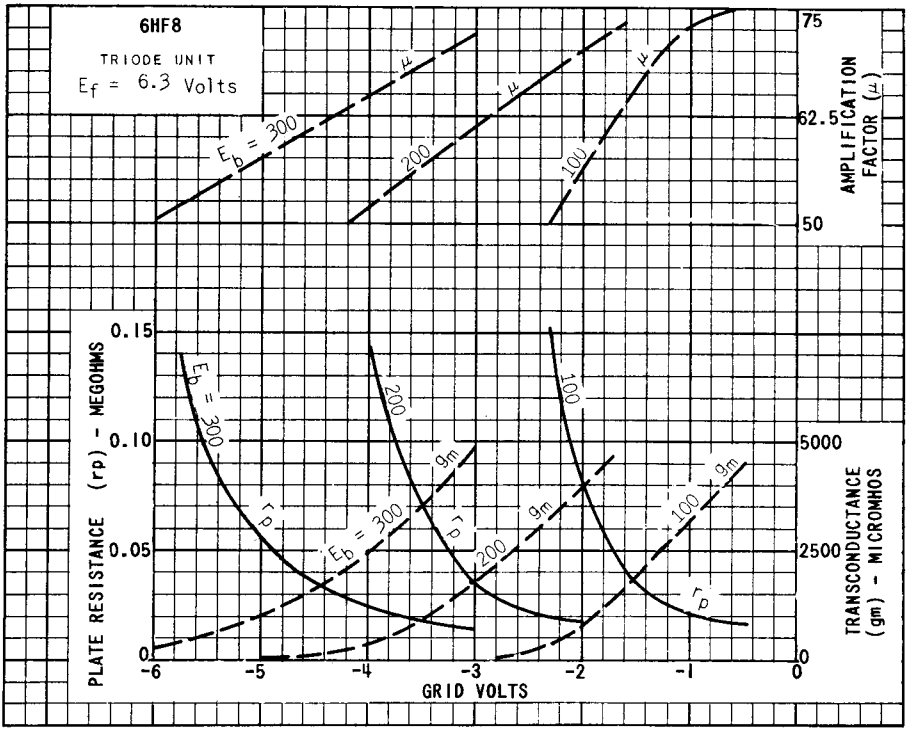
MAXIMUM CIRCUIT VALUES

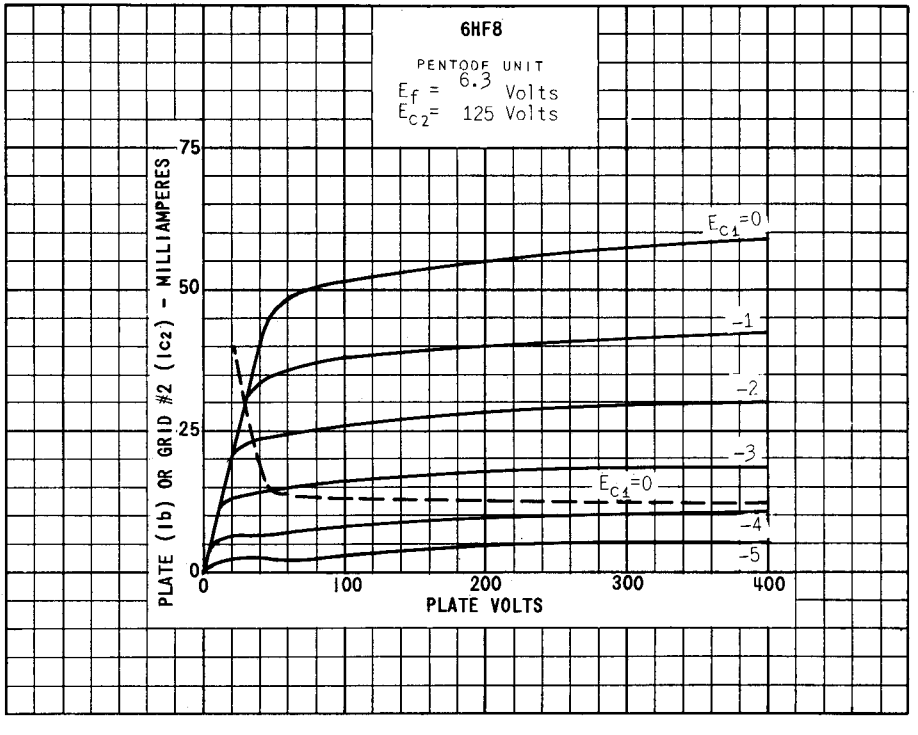
	TRIODE UNIT	PENTODE UNIT	
GRID #1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION (MAX.)	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION (MAX.)	0.5	0.25	MEGOHM

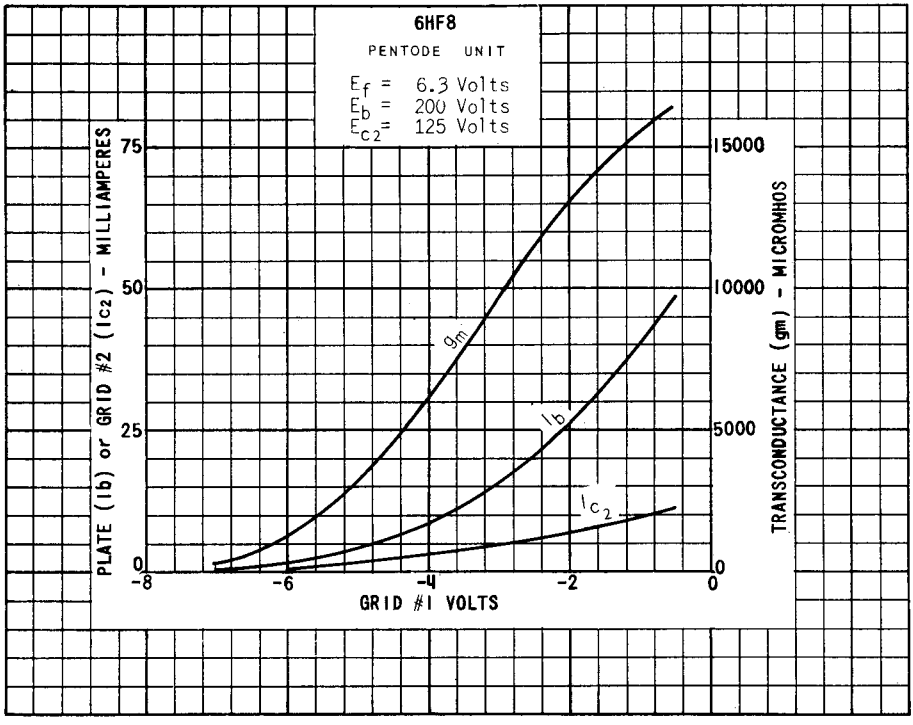
[B] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVEFORM SUCH THAT PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.


6HF8
GRID #2 INPUT RATING CHART
MAXIMUM OPERATING
CONDITIONS
AREA OF
PERMISSIBLE OPERATION
GRID #2 INPUT EXPRESSED AS PERCENT
OF MAX. GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT
OF MAX. GRID #2 SUPPLY VOLTAGE RATING


6HF8
TRIODE UNIT
E_f = 6.3 Volts
E_c =0
-1
-2
-3
-4
-5
-6
-7
PLATE MILLIAMPERES
15
10
5
0
0
100
200
300
400
PLATE VOLTS


6HF8
TRIODE UNIT
Ef = 6.3 Volts
Eb = 300
200
100
μ
AMPLIFICATION FACTOR (μ)
75
62.5
50
PLATE RESISTANCE (rp) - MEGOHMS
0.15
0.10
0.05
0
rp
gm
TRANSCONDUCTANCE (gm) - MICROMHOS
5000
2500
0
-6
-5
-4
-3
-2
-1
0
GRID VOLTS


6HF8
PENTODE UNIT
Ef = 6.3 Volts
Ec2 = 125 Volts
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
75
50
25
0
Ec1=0
-1
-2
-3
-4
-5
0
100
200
300
400
PLATE VOLTS



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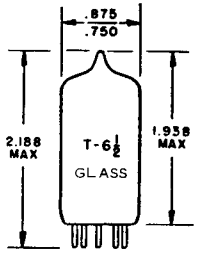
DIODE - PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



BASE 9 PIN BUTTON
JEDEC E9-1

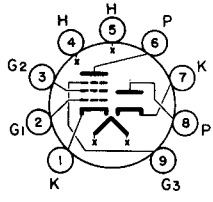
FOR

VIDEO DETECTOR

AND IF AMPLIFIER

APPLICATIONS IN T.V. RECEIVERS

BASING DIAGRAM
JEDEC 9CY



BOTTOM VIEW

THE 6HJ8 IS A DIODE AND SHARP-CUTOFF PENTODE WITH SEPARATE CATHODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED ESPECIALLY FOR USE AS A VIDEO DETECTOR AND IF AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315

DIODE SECTION:			
PLATE TO CATHODE AND HEATER		2.4	pf
CATHODE TO PLATE AND HEATER		3.0	pf
PENTODE SECTION:			
GRID 1 TO PLATE	MAX.	0.015	pf
GRID 1 TO CATHODE, GRID 3 & INTERNAL SHIELD, GRID 2, & HEATER		7.0	pf
PLATE TO CATHODE, GRID 3 & INTERNAL SHIELD, GRID 2, & HEATER		3.2	pf
DIODE PLATE TO PENTODE GRID 1	MAX.	0.005	pf
DIODE CATHODE TO PENTODE PLATE	MAX.	0.015	pf
DIODE PLATE TO PENTODE PLATE	MAX.	0.035	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
HEATER WARM-UP TIME - AVERAGE		11	SECONDS
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
LIMITS OF SUPPLIED CURRENT - AC OR DC		450 ± 30	mA
PEAK HEATER - CATHODE VOLTAGE - EACH SECTION			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE SECTION - CLASS A_1 AMPLIFIER

PLATE VOLTAGE	330	VOLTS
PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
GRID 1 VOLTAGE:		
POSITIVE - BIAS VALUE	0	VOLTS
PLATE DISSIPATION	3.2	WATTS
GRID 2 DISSIPATION:		
FOR GRID 2 VOLTAGE UP TO 165 VOLTS	0.55	WATTS
FOR GRID 2 VOLTAGE BETWEEN 165 AND 330 VOLTS	SEE RATING CHART	
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED - BIAS OPERATION	0.25	MEGOHM
FOR CATHODE - BIAS OPERATION	1	MEGOHM

DIODE SECTION

DC PLATE CURRENT	5	mA

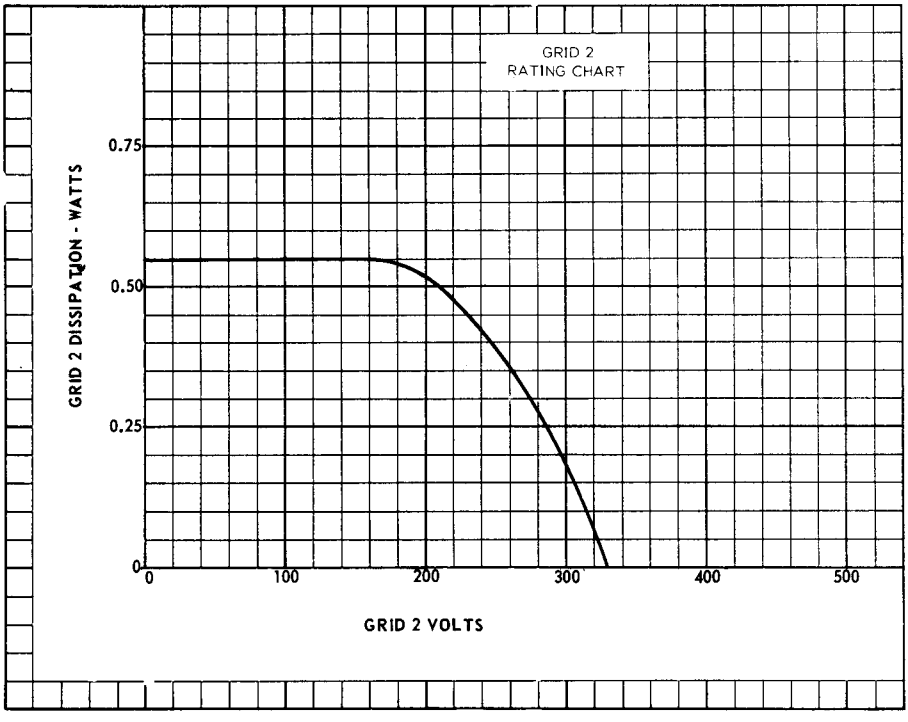
CHARACTERISTICS

PENTODE SECTION - CLASS A_1 AMPLIFIER

PLATE VOLTAGE		125	VOLTS
GRID 3	CONNECTED TO CATHODE AT SOCKET		
GRID 2 VOLTAGE		125	VOLTS
CATHODE RESISTOR		56	OHMS
PLATE CURRENT		11.5	mA
GRID 2 CURRENT		3.6	mA
TRANSCONDUCTANCE		9,300	μMHOS
PLATE RESISTANCE	APPROX.	0.2	MEGOHM
GRID 1 VOLTAGE FOR I_b = 20 μA	APPROX.	−6	VOLTS
GRID 1 VOLTAGE FOR I_b = 2 mA AND R_k = 0 OHMS	APPROX.	−3	VOLTS

DIODE SECTION - INSTANTANEOUS VALUE

VOLTAGE DROP AT 50 mA	10	VOLTS

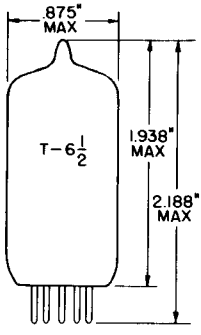


TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., SEPTEMBER 1, 1964 PLATE #7028

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

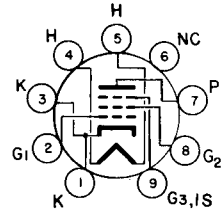
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SHARP-CUTOFF PENTODE

FOR

IF AMPLIFIER STAGES

IN TV RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9PM

THE 6HM6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6HM6 IS IDENTICAL TO THE 3HM6 AND THE 4HM6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315 CONNECTED TO CATHODE	WITHOUT SHIELD	
GRID TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS		300	MA.
LIMITS OF APPLIED VOLTAGE				6.3±0.6	VOLTS
HEATER-CATHODE VOLTAGE:					
HEATER NEGATIVE WITH RESPECT TO CATHODE					
TOTAL DC AND PEAK			MAX.	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE					
TOTAL DC AND PEAK			MAX.	200	VOLTS

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MAXIMUM RATINGS

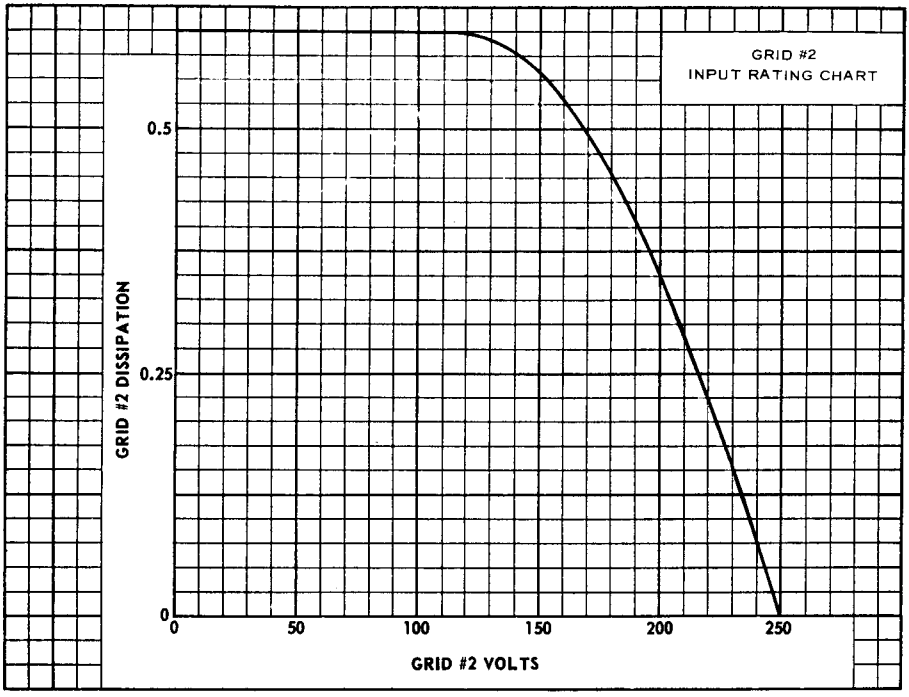
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

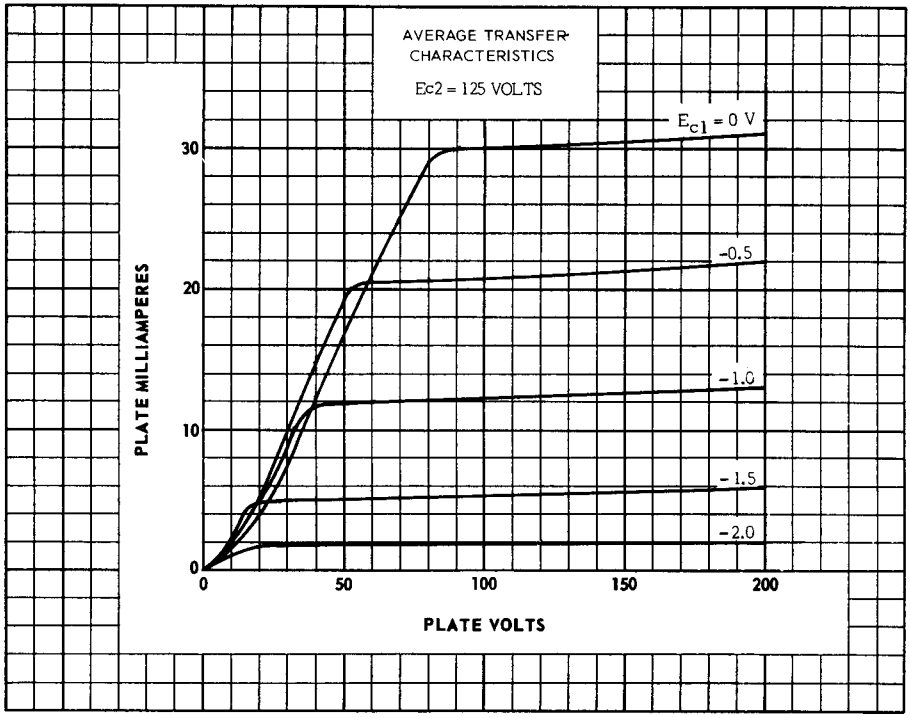
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
NEGATIVE GRID 1 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 125 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCE:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	MA.
GRID 2 CURRENT	3.2	MA.
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.156	MEGOHM
HOT INPUT RESISTANCE [A]	13,000	OHMS
HOT INPUT CAPACITANCE [A]	7.4	pf
GRID 1 VOLTAGE AT Gm = 100 μMHOS	-3.0	VOLTS

[A] MEASURED AT 44 MC/S WITH UNBYPASSED 56 OHM CATHODE RESISTOR.





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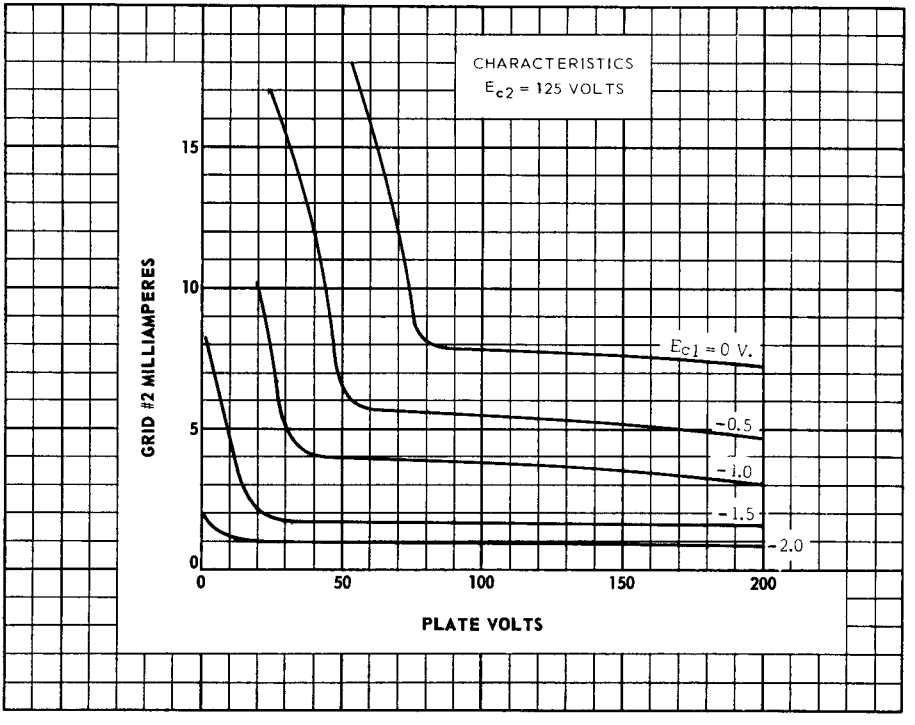
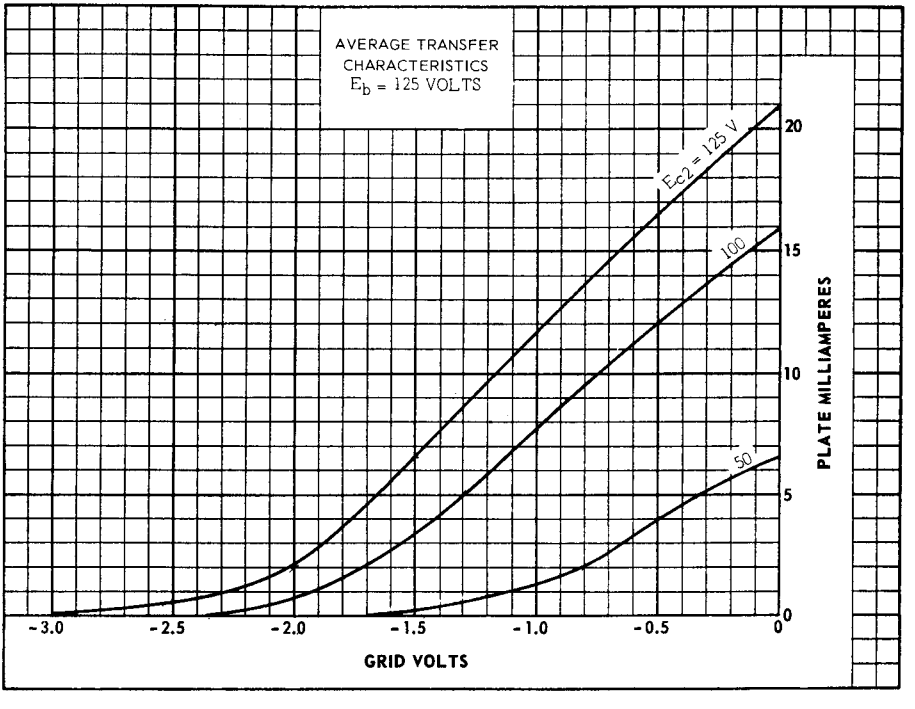
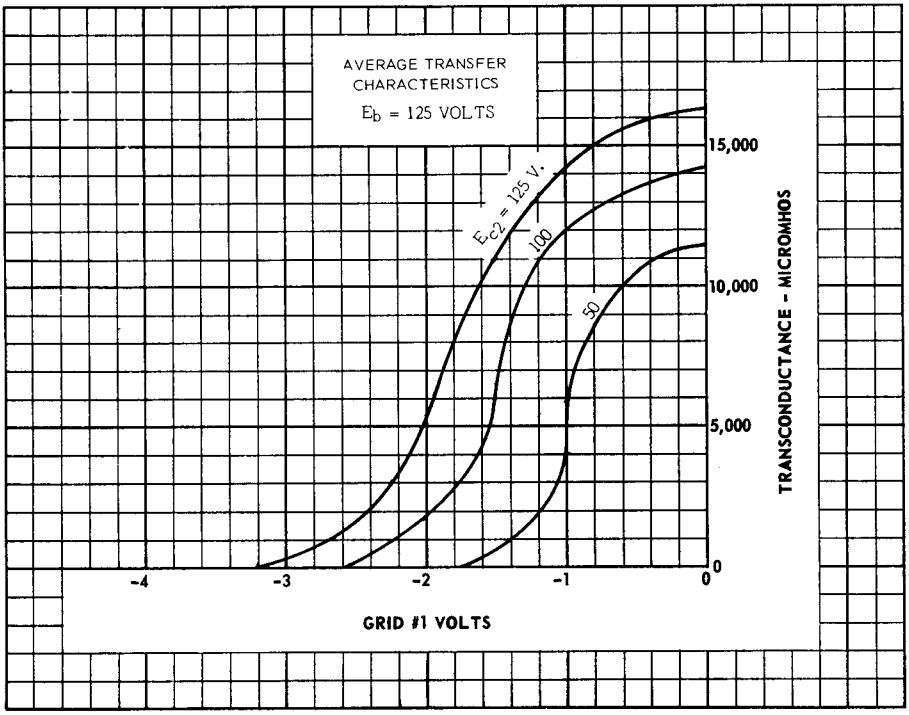
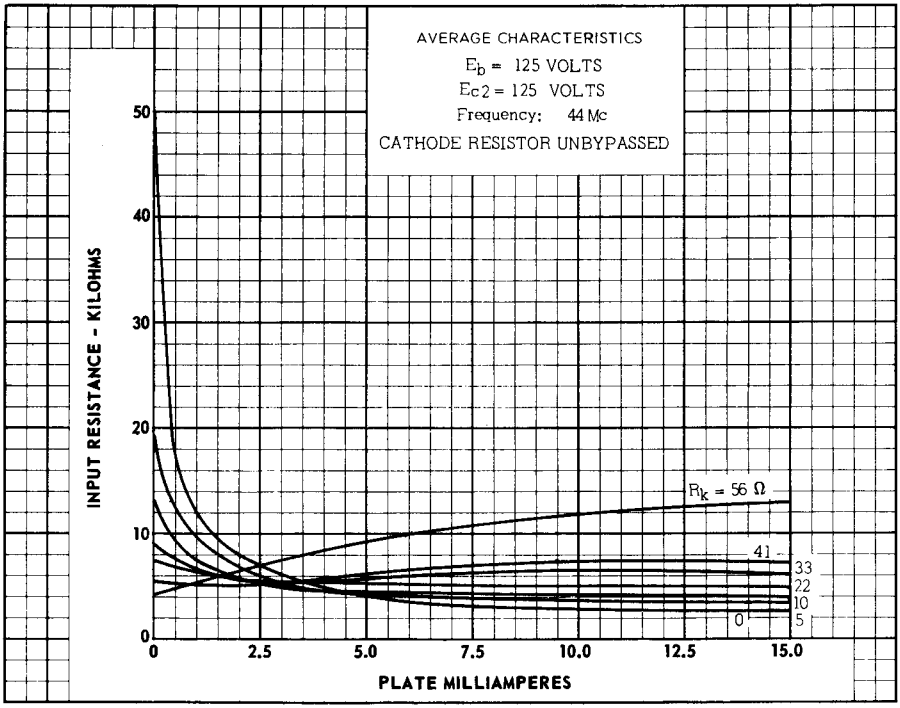

CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
15
10
5
0
E_{c1} = 0 V.
-0.5
-1.0
-1.5
-2.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 V
100
50
20
15
10
5
0
PLATE MILLIAMPERES
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID VOLTS





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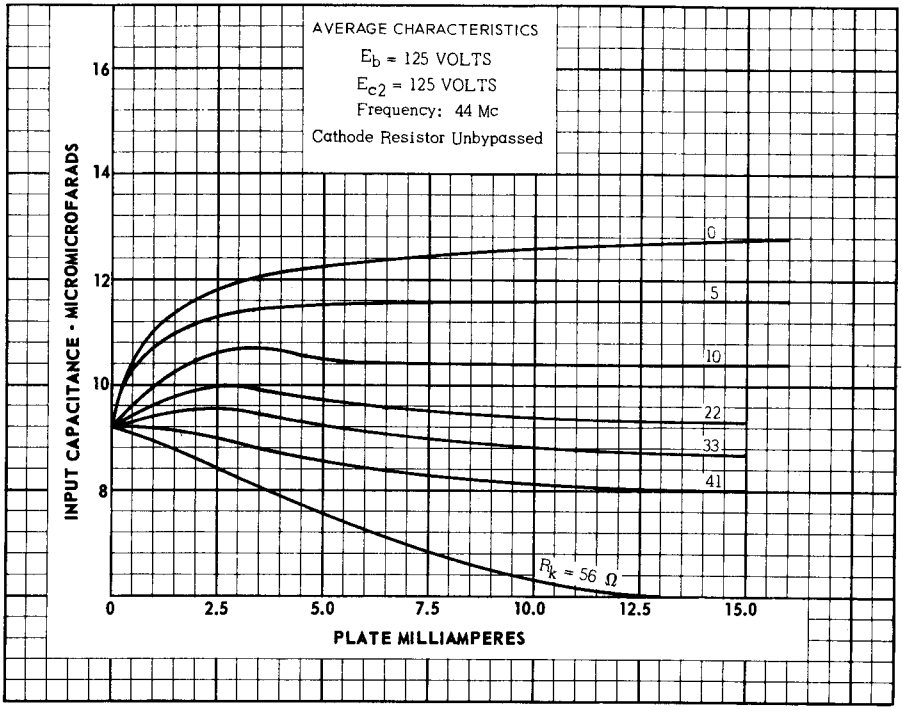
6HM6


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency: 44 Mc
Cathode Resistor Unbypassed
INPUT CAPACITANCE - MICROMICROFARADS
16
14
12
10
8
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES
0
5
10
22
33
41
R_k = 56 Ω

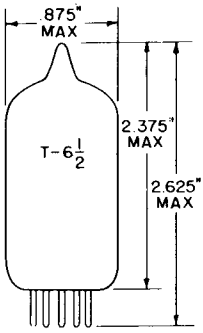
TUNG-SOL

TWIN PENTODE
MINIATURE TYPE

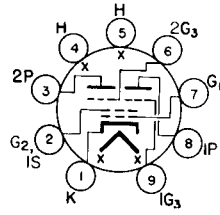
COATED UNIPOTENTIAL CATHODE

FOR T.V. APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FG

THE 6HS8 IS A MINIATURE TWIN PENTODE THAT INCORPORATES SEPARATE PLATES AND #3 GRIDS FOR THE TWO SECTIONS TOGETHER WITH A COMMON SCREEN, #1 GRID, AND CATHODE. IT IS INTENDED FOR USE AS A COMBINED SYNC-AGC TUBE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

GRID #3 TO PLATE, EACH SECTION	2.0	pf
GRID #1 TO ALL	6.0	pf
GRID #3 (EACH SECTION) TO ALL	3.6	pf
PLATE (EACH SECTION) TO ALL	3.0	pf
GRID #3 (SECTION 1) TO GRID #3 (SECTION 2), MAX.	0.015	pf

HEATER RATINGS AND CHARACTERISTICS
DESIGN-MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, EACH SECTION	300	VOLTS
SCREEN VOLTAGE	150	VOLTS
POSITIVE DC GRID #3 VOLTAGE, EACH SECTION	3.0	VOLTS
NEGATIVE DC GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
PEAK POSITIVE GRID #3 VOLTAGE, EACH SECTION	50	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS
SCREEN DISSIPATION	0.75	WATT
DC CATHODE CURRENT	12	MA.
GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
GRID #3 CIRCUIT RESISTANCE, EACH SECTION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS - BOTH SECTIONS OPERATING

PLATE VOLTAGE, EACH SECTION	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE, EACH SECTION	-10	0	VOLTS
GRID #1 VOLTAGE [B]			
PLATE CURRENT, EACH SECTION	---	2.0	MA.
SCREEN CURRENT	7.0	4.4	MA.
CATHODE CURRENT	7.1	8.5	MA.

AVERAGE CHARACTERISTICS - EACH SECTION SEPARATELY

WITH PLATE & GRID #3 OF OPPOSITE SECTION GROUNDED

PLATE VOLTAGE	100	100	VOLTS
SCREEN VOLTAGE	67.5	67.5	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #1 VOLTAGE	0	B	VOLTS
GRID #3 TRANSCONDUCTANCE	---	450	μMHOS
GRID #1 TRANSCONDUCTANCE	1100	---	μMHOS
PLATE CURRENT	---	2.0	MA.
GRID #3 VOLTAGE, (APPROX.)			
AT Ib = 100 μA ←	---	-3.5 ←	VOLTS
GRID #1 VOLTAGE, (APPROX.)			
Ib = 100 μAMPS.	---	-2.3	VOLTS

[B] WITH GRID CURRENT ADJUSTED FOR 100 MICROAMPERES DC.

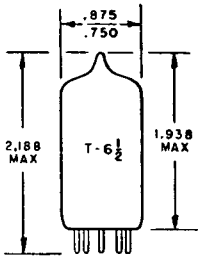
SIMILAR TYPE REFERENCE: Except for heater characteristics, the 6HS8 is identical to the 4HS8

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SEMI-REMOTE-CUTOFF PENTODE

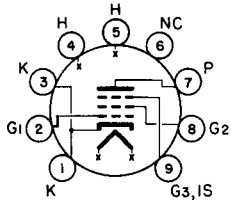
FOR

I.F. AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9 PM

THE 6HT6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6HT6 IS IDENTICAL TO THE 3HT6 AND THE 4HT6.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO GROUND	UNSHIELDED	
GRID 1 TO PLATE	0.024	0.031	pf
INPUT	8.70	8.70	pf
OUTPUT	3.00	2.15	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

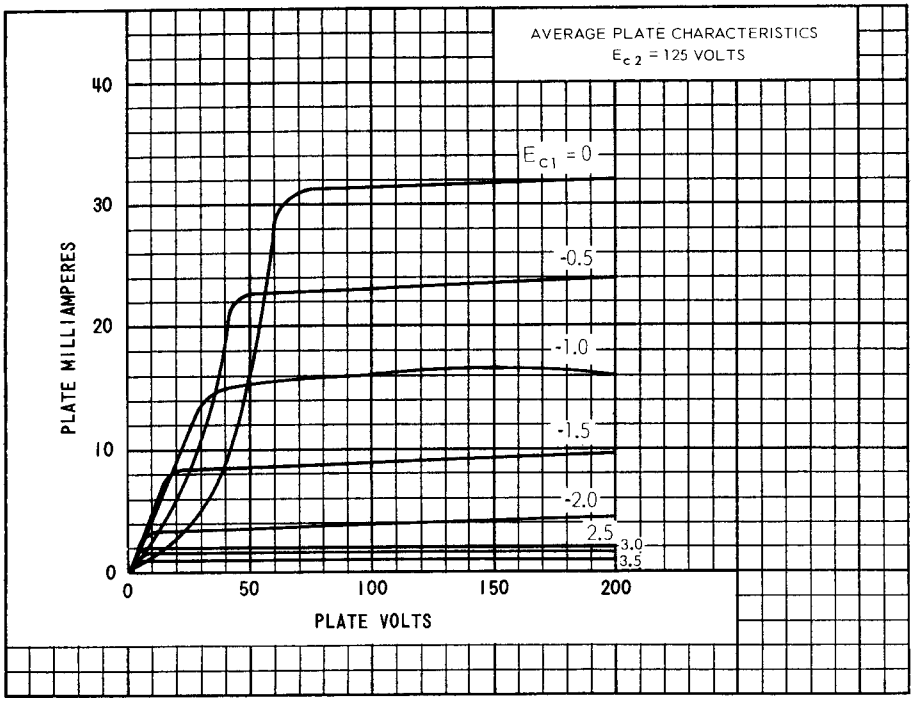
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

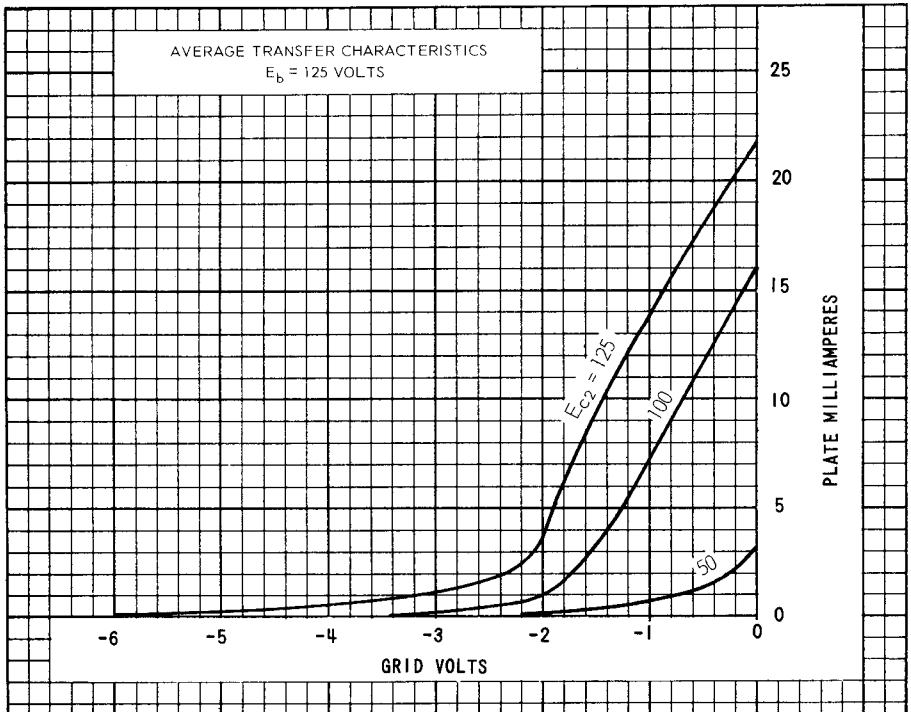
PLATE VOLTAGE	250	VOLTS
GRID 2 SUPPLY VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
GRID 1 VOLTAGE	-50	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION	0.6	WATTS
CATHODE CURRENT	25	MA.
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	MA.
GRID 2 CURRENT	4.0	MA.
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.143	MEGOHM
GRID 1 CUTOFF BIAS FOR G_m = 50 μMHOS	-6.7	VOLTS
CUTOFF TRANSCONDUCTANCE:		
FOR E_{c1} = -1.5	12,000	μMHOS
FOR E_{c1} = -3.5	300	μMHOS
HOT INPUT RESISTANCE [A]	12,700	OHMS
HOT INPUT CAPACITANCE [A]	7.45	pf

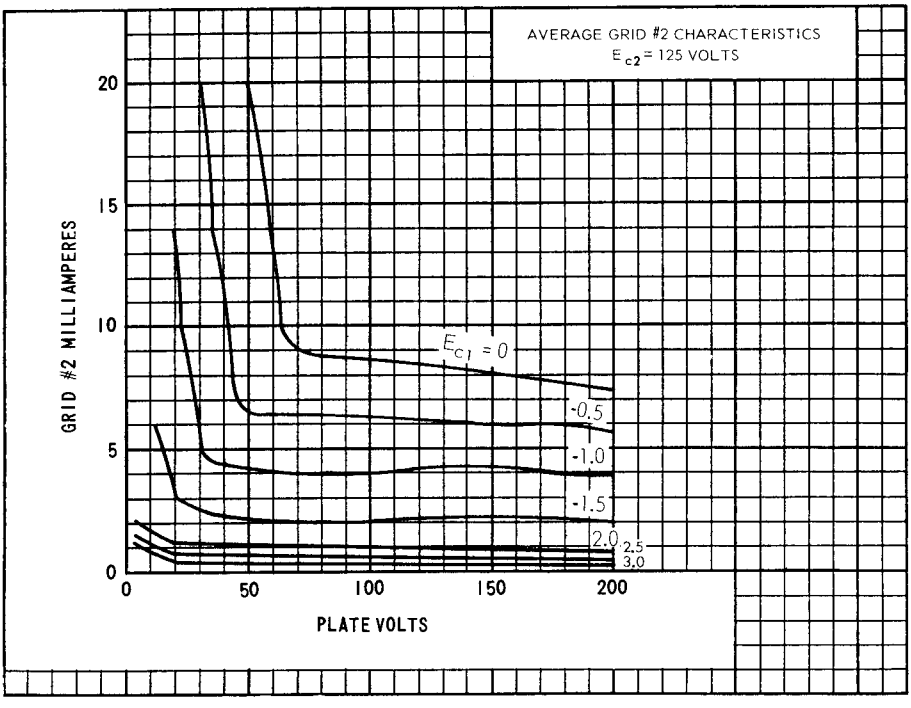
A - MEASURED 44 Mc/s WITH UNBYPASSED 56 OHM CATHODE RESISTANCE

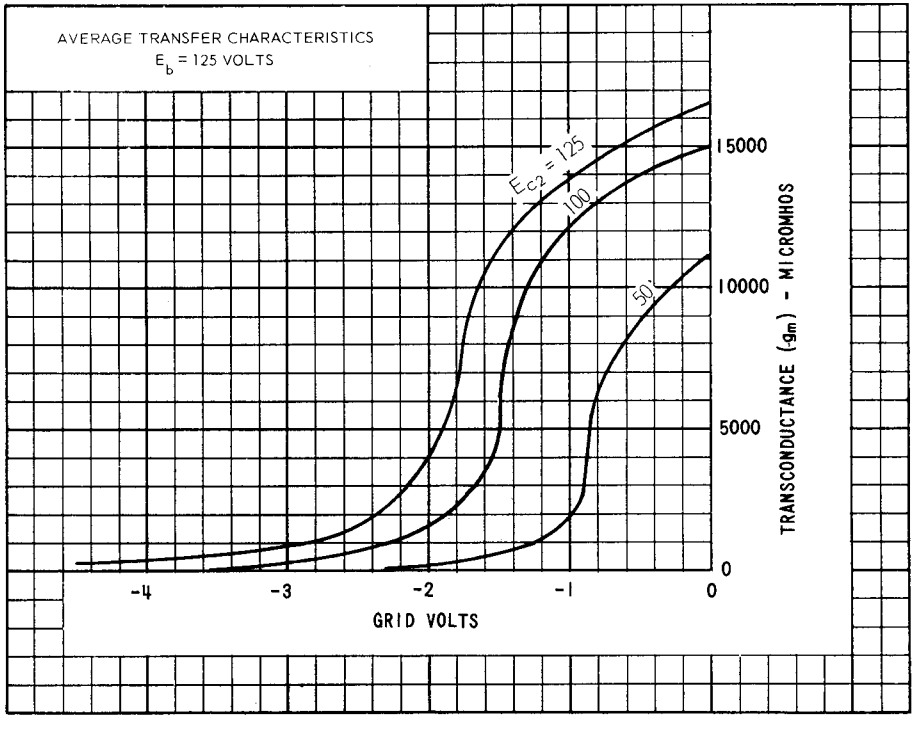


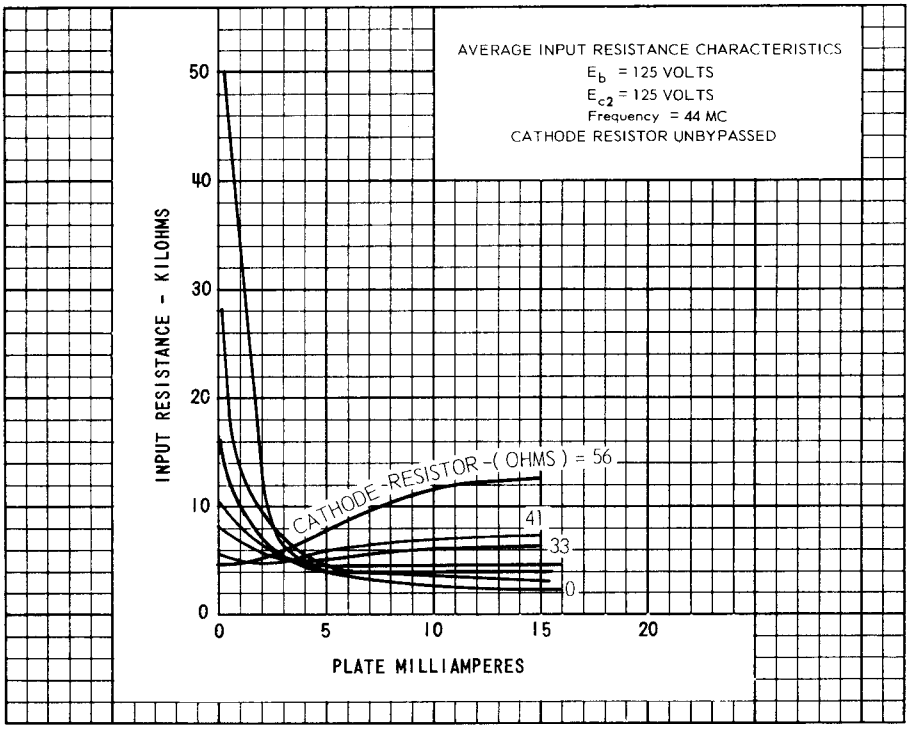


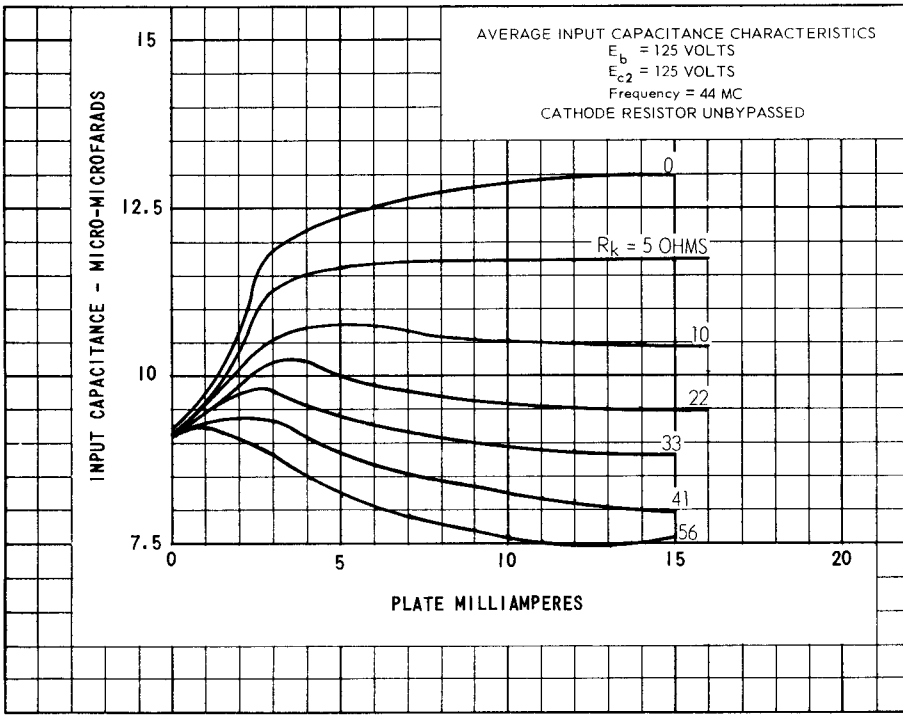
TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., JANUARY 1, 1964 PLATE #6853

6HT6


AVERAGE GRID #2 CHARACTERISTICS
E_{c2} = 125 VOLTS
GRID #2 MILLIAMPERES
20
15
10
5
0
E_{c1} = 0
-0.5
-1.0
-1.5
2.0
2.5
3.0
0
50
100
150
200
PLATE VOLTS


AVERAGE TRANSFER CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125
100
50
15000
10000
5000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-4
-3
-2
-1
0
GRID VOLTS


AVERAGE INPUT RESISTANCE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency = 44 MC
CATHODE RESISTOR UNBYPASSED
INPUT RESISTANCE - KILOHMS
50
40
30
20
10
0
CATHODE-RESISTOR-(OHMS) = 56
41
33
0
0
5
10
15
20
PLATE MILLIAMPERES

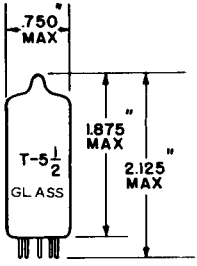

AVERAGE INPUT CAPACITANCE CHARACTERISTICS
E_b = 125 VOLTS
E_{c2} = 125 VOLTS
Frequency = 44 MC
CATHODE RESISTOR UNBYPASSED
INPUT CAPACITANCE - MICRO-MICROFARADS
15
12.5
10
7.5
0
R_k = 5 OHMS
10
22
33
41
56
0
5
10
15
20
PLATE MILLIAMPERES

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-2

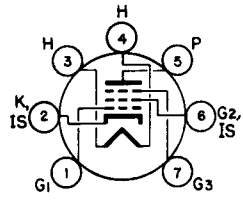


BASE 7 PIN BUTTON
JEDEC E7-1

FOR
FM SOUND DETECTOR
SERVICE

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7EN



BOTTOM VIEW

THE 6HZ6 IS A SHARP-CUTOFF PENTODE WITH DUAL CONTROL GRIDS IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR FM SOUND DETECTOR SERVICE.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.023	pf
GRID 1 TO (K & I.S., G3, G2 & I.S., H)	8.2	pf
GRID 1 TO GRID 3	0.09	pf
GRID 3 TO PLATE	1.6	pf
GRID 3 TO (K&I.S., P, G2 & I.S., G1, H)	7.2	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
HEATER WARM - UP TIME - AVERAGE		11	SECONDS
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± .6	VOLTS
LIMITS OF SUPPLIED CURRENT - AC OR DC		450 ± 30	mA
PEAK HEATER - CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

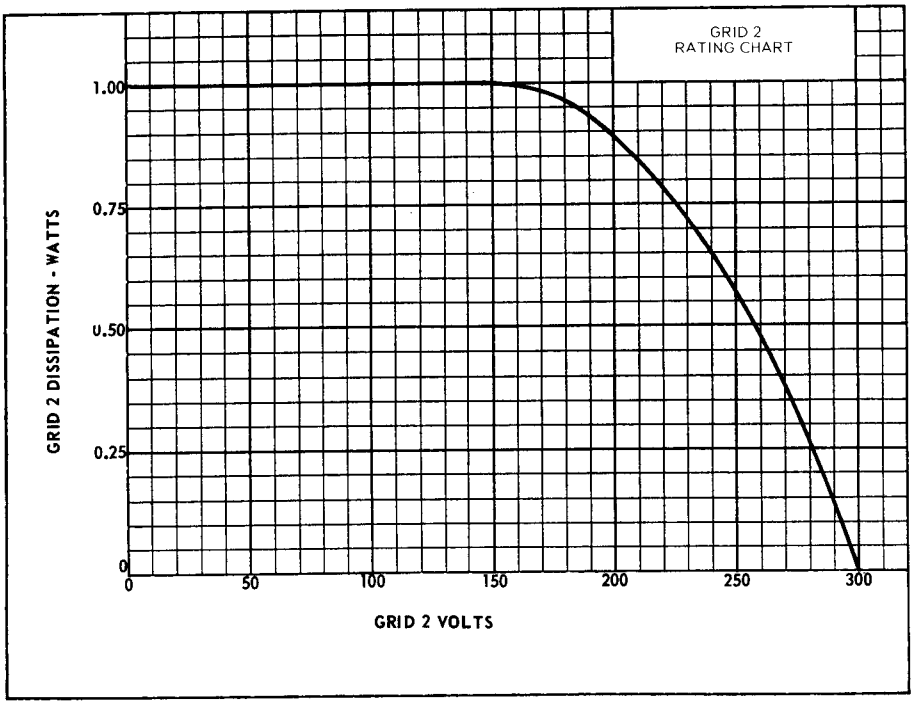
FM SOUND DETECTOR SERVICE

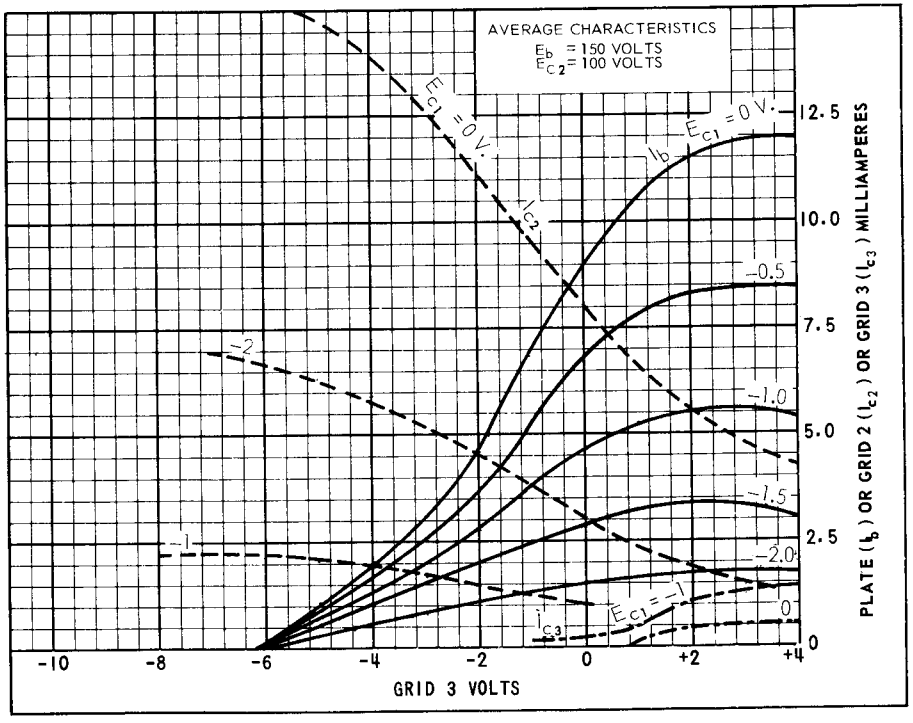
PLATE VOLTAGE		300	VOLTS
GRID 3 VOLTAGE:			
NEGATIVE VALUE - DC AND PEAK		100	VOLTS
POSITIVE VALUE - DC AND PEAK		25	VOLTS
GRID 2 SUPPLY VOLTAGE		300	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
GRID 1 VOLTAGE:			
NEGATIVE - BIAS VALUE		50	VOLTS
POSITIVE - BIAS VALUE		0	VOLTS
GRID 3 INPUT		0.1	WATT
GRID 2 INPUT - UP TO 150 VOLTS		1	WATT
- BETWEEN 150 VOLTS AND 300 VOLTS		SEE RATING CHART	
PLATE DISSIPATION		1.7	WATTS
GRID 3 CIRCUIT RESISTANCE		0.68	MEGOHM
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED - BIAS OPERATION		0.22	MEGOHM
FOR CATHODE - BIAS OPERATION		0.47	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE SUPPLY VOLTAGE		150	VOLTS
GRID 3 SUPPLY VOLTAGE		0	VOLTS
GRID 2 SUPPLY VOLTAGE		100	VOLTS
GRID 1 SUPPLY VOLTAGE		0	VOLTS
CATHODE RESISTOR		180	OHMS
PLATE CURRENT		3.2	mA
GRID 2 CURRENT		3.2	mA
TRANSCONDUCTANCE - GRID 1 TO PLATE		3,400	μMHOS
TRANSCONDUCTANCE - GRID 3 TO PLATE		600	μMHOS
PLATE RESISTANCE	APPROX.	0.11	MEGOHM
GRID 1 VOLTAGE FOR I_b = 20 μA	APPROX.	−4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 20 μA	APPROX.	−7	VOLTS





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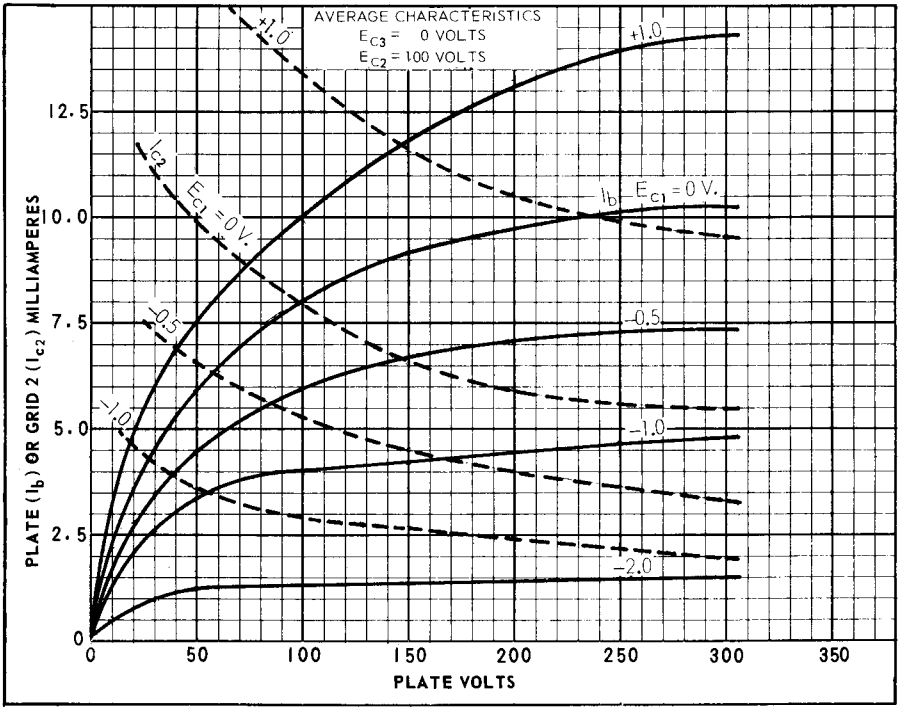
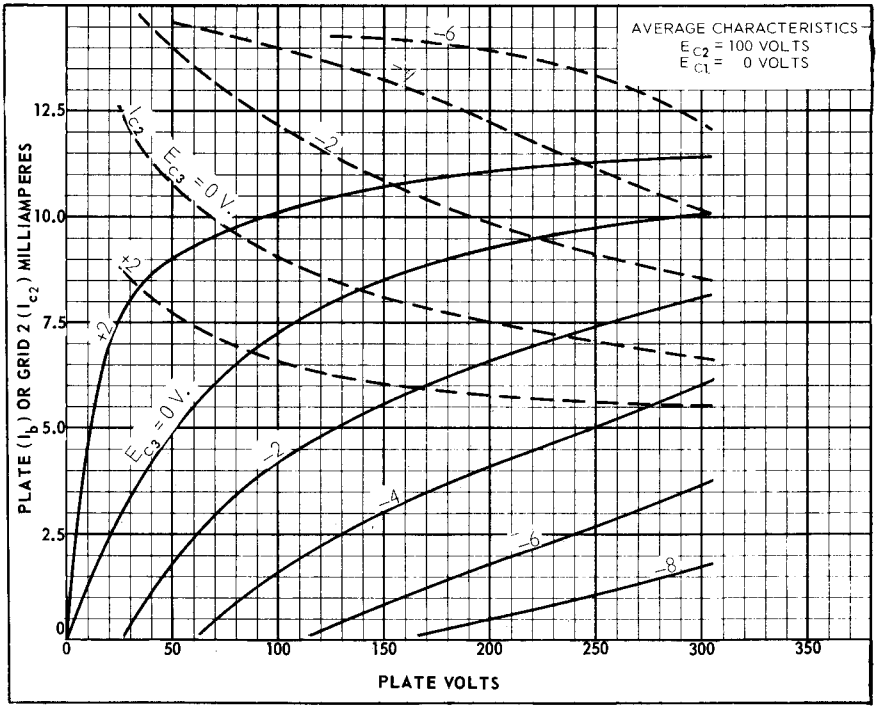
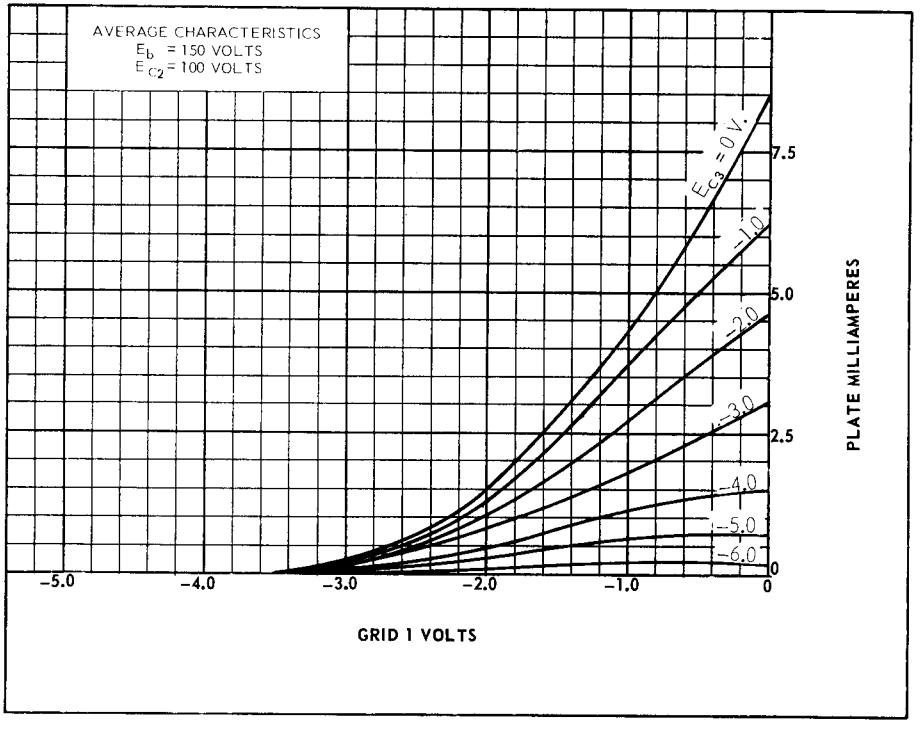
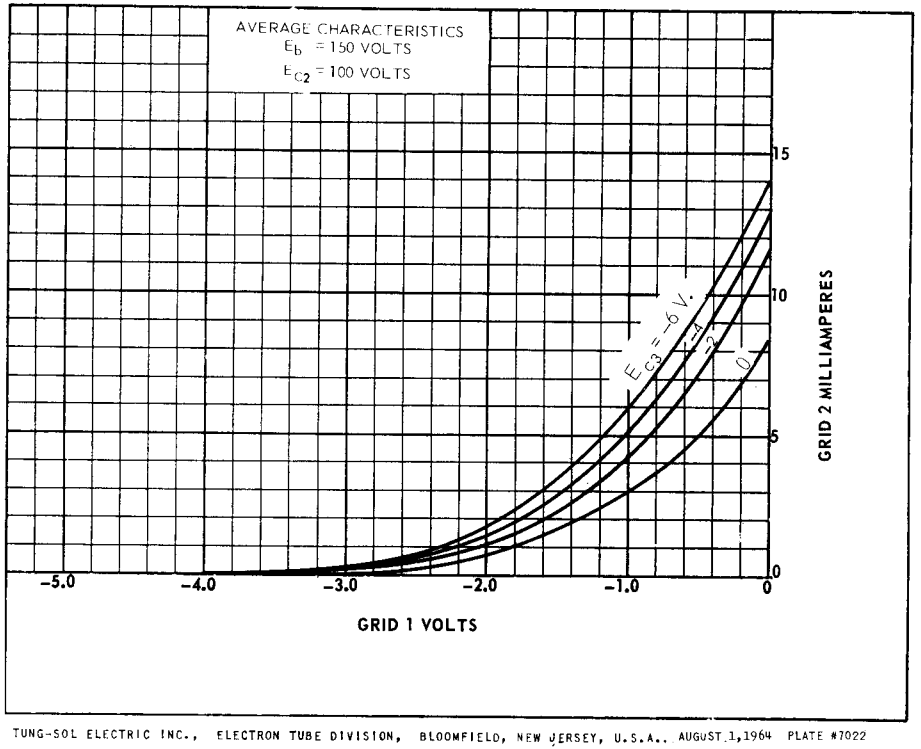

AVERAGE CHARACTERISTICS
E_{c3} = 0 VOLTS
E_{c2} = 100 VOLTS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_{c2}
E_{c1} = 0 V.
I_b E_{c1} = 0 V.
+1.0
-0.5
-1.0
-2.0
0
2.5
5.0
7.5
10.0
12.5
50
100
150
200
250
300
350


AVERAGE CHARACTERISTICS
E_{c2} = 100 VOLTS
E_{c1} = 0 VOLTS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_{c2}
E_{c3} = 0 V.
+2
-2
-4
-6
-8
0
2.5
5.0
7.5
10.0
12.5
50
100
150
200
250
300
350





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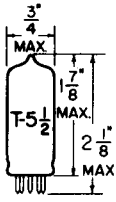
TUNG-SOL

TRIODE

MINIATURE TYPE

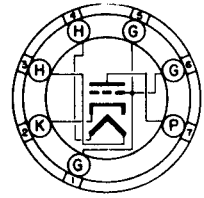


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7B9

THE 6J4 IS A TRIODE USING THE MINIATURE CONSTRUCTION AND INTENDED FOR USE PRIMARILY AS A GROUNDED-GRID UHF AMPLIFIER AT FREQUENCIES UP TO APPROXIMATELY 500 MEGACYCLES. ITS DESIGN FEATURES AN AMPLIFICATION FACTOR OF 55 COMBINED WITH AN EXTREMELY HIGH TRANSCONDUCTANCE OF 12000 MICROMHOS, AND PERMITS GROUNDED-GRID OPERATION WITH A HIGH SIGNAL-TO-NOISE RATIO. IT MAY ALSO BE USED IN CONVENTIONAL TRIODE CIRCUITS WITH UNGROUNDED GRID.

DIRECT INTERELECTRODE CAPACITANCES
GROUNDED GRID OPERATION

	WITH SHIELD[A]	
Ck-p SHIELD TIED TO GROUND	0.12	μμf
INPUT Ck TO (G+H+SHIELD)	7.5	μμf
OUTPUT Cp TO (G+H+SHIELD)	3.9	μμf
Ch-k SHIELD TIED TO GROUND	3.7	μμf

[A] EXTERNAL SHIELD #316.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM PLATE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	0.25	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - GROUNDED-GRID

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.4	0.4	AMP.
PLATE VOLTAGE	100	150	VOLTS
CATHODE RESISTOR[B]	100	100	OHMS
PLATE CURRENT	10	15	MA.
TRANSCONDUCTANCE	11 000	12 000	μMHOS
AMPLIFICATION FACTOR	55	55	

[B] NOT RECOMMENDED FOR FIXED BIAS OPERATION.

→ INDICATES A CHANGE OR ADDITION.

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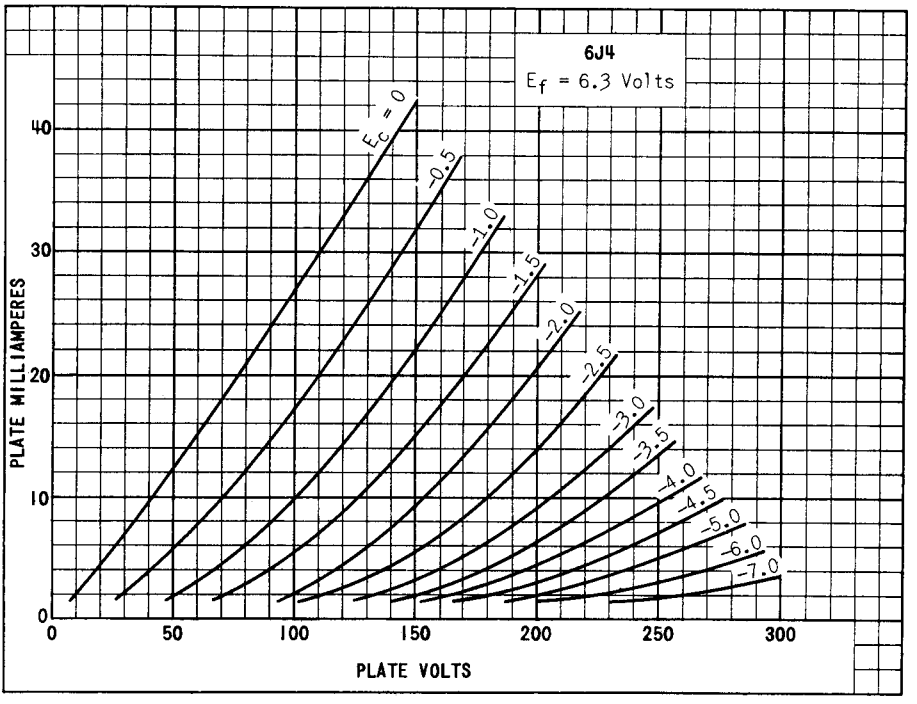
6J4



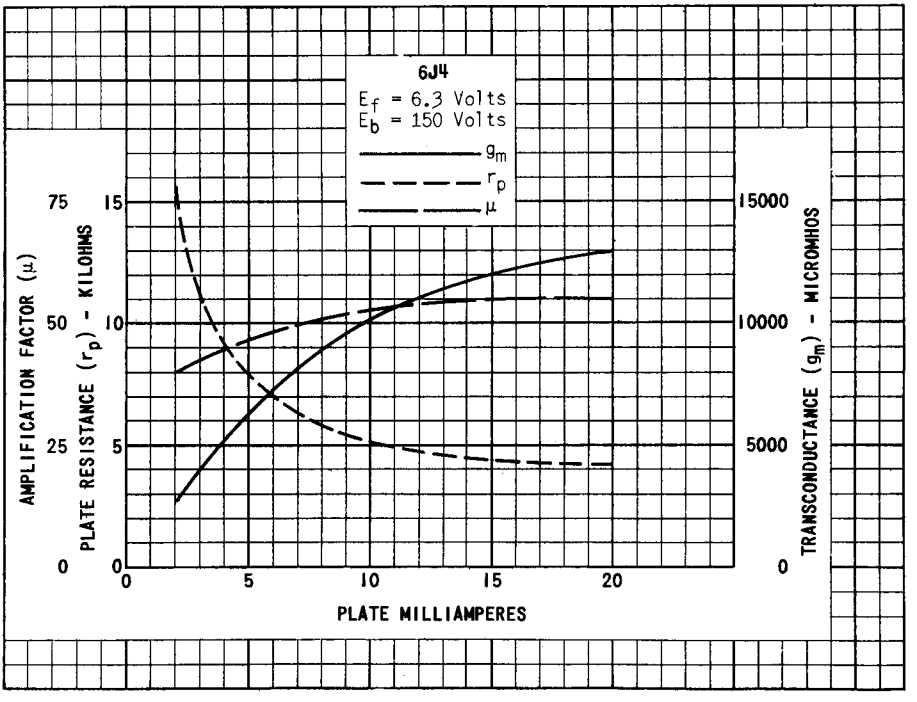
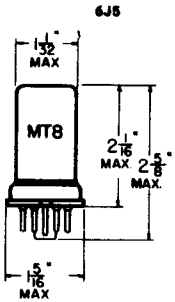


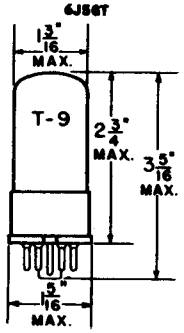
PLATE #4067 OCTOBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

TRIODE



METAL SHELL

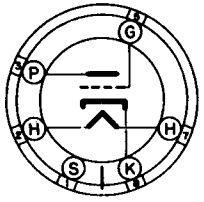


GLASS BULB

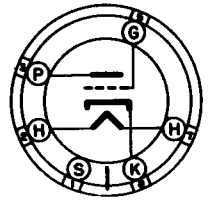
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
6 PIN OCTAL



BOTTOM VIEW
SMALL WAFER
6 PIN OCTAL
METAL SLEEVE

THE 6J5 AND 6J5GT ARE GENERAL PURPOSE MEDIUM-MU TRIODES. THEY ARE USEFUL FOR SERVICE AS OSCILLATORS OR AUDIO-FREQUENCY AMPLIFIERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

	6J5[A]	6J5GT[B]	
GRID TO PLATE: (G TO P)	3.4	3.8	μμf
INPUT: G TO (H+K)	3.4	4.2	μμf
OUTPUT: P TO (H+K)	3.6	5	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

[B] WITH CLOSE-FITTING SHIELD CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM NEGATIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEG.
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM CATHODE CURRENT	20	MA.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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PLATE 1944

JAN. 2, 1948

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10	9	MA.
PLATE RESISTANCE	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	

SIMILIAR TYPE REFERENCE: Ratings and characteristics are identical to 744.

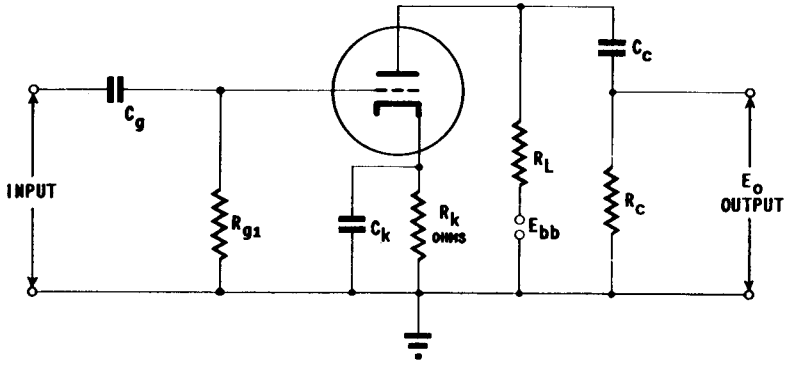
→ **RESISTANCE COUPLED AMPLIFIER**

R_1 MEG.	R_{g1} MEG.	R_s MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	A	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	A	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	A	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	A	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	A	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	---	15	13	---	16	33	-----	17	46
0.24	10	0.51	---	16	17	---	17	38	-----	18	62
0.51	10	0.51	---	16	14	---	18	32	-----	18	53
0.51	10	1.0	---	17	18	---	18	41	-----	19	68

[A] VALUE OF R_{g1} IS NOT CRITICAL.

GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.

E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

→ INDICATES A CHANGE OR ADDITION

PLATE 1945
JAN. 2, 1948

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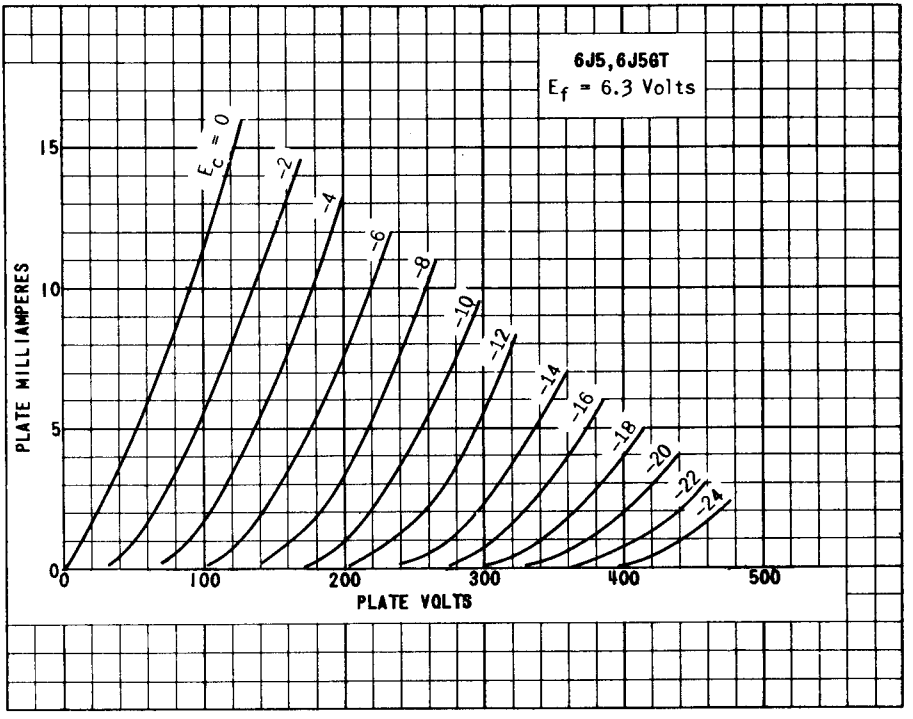

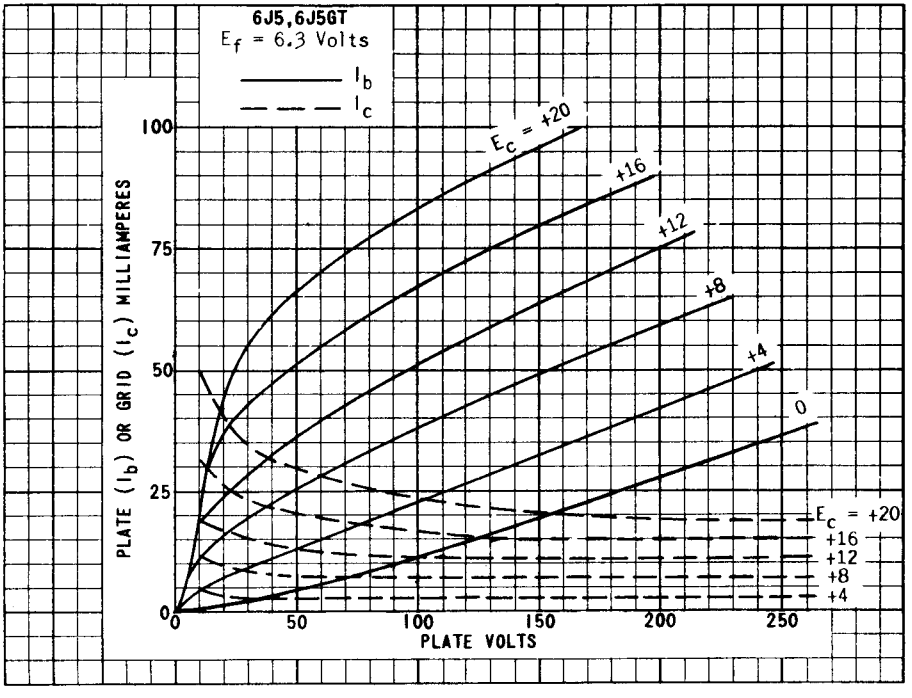

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1946
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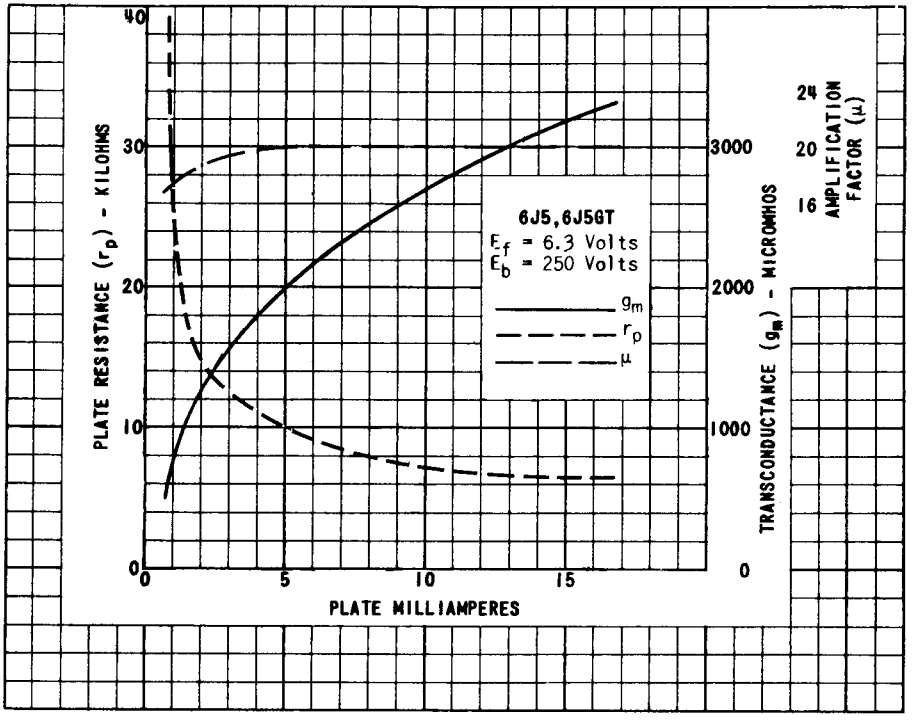
6J5,6J5GT



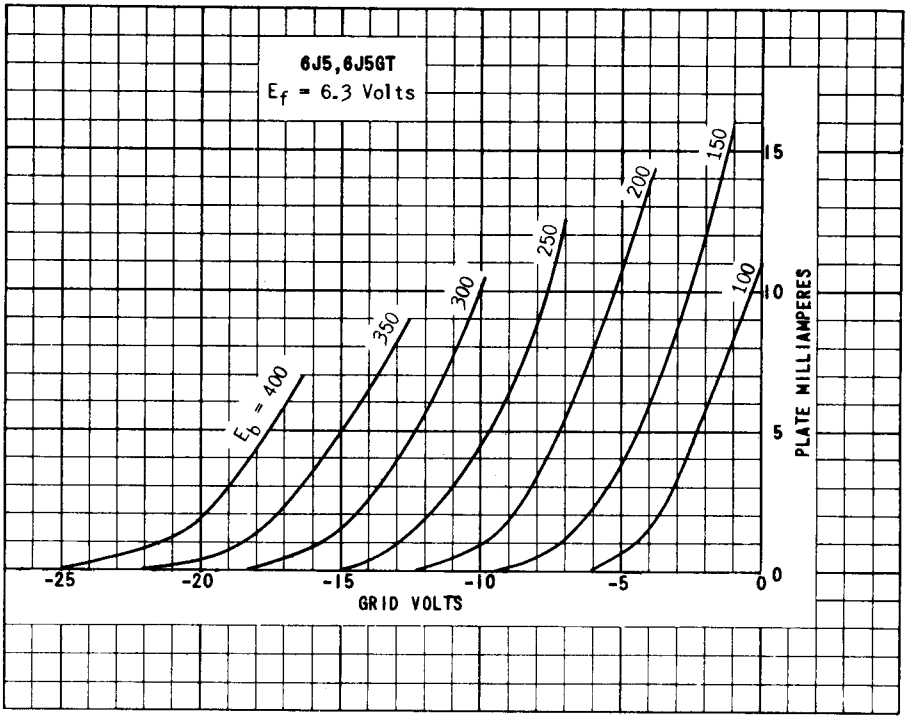


PLATE 1947
JAN. 2, 1948

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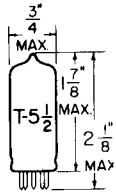
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

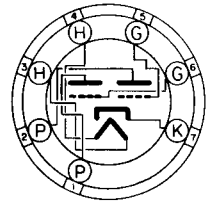


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BF

THE 6J6 AND 6J6A ARE TWIN TRIODES IN THE 7-PIN MINIATURE CONSTRUCTION. THEY MAY BE OPERATED IN PARALLEL OR PUSH-PULL. WITH THE GRIDS IN A PUSH-PULL ARRANGEMENT AND THE PLATES IN PARALLEL, THE TUBES ARE PARTICULARLY ADAPTABLE FOR SERVICE AS MIXERS AT FREQUENCIES AS HIGH AS 600 MEGACYCLES. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6J6A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME OF THE 6J6A, THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE (EACH SECTION)	1.6	1.5	μμf
INPUT (EACH SECTION)	2.2	2.6	μμf
OUTPUT (SECTION 1)	0.4	1.6	μμf
OUTPUT (SECTION 2)	0.4	1.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

	AF AMPLIFIER	RF AMPLIFIER	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±100	±100	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	---	-40	VOLTS
MAXIMUM PLATE INPUT	---	4.5	WATTS
MAXIMUM PLATE DISSIPATION	1.5	1.5	WATTS
MAXIMUM PLATE CURRENT	---	15	MA.
MAXIMUM GRID CURRENT	---	8	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	0.5	---	MEGOHMS
HEATER WARM-UP TIME (APPROX.)* (6J6A ONLY)	11.0		SECONDS

*HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR (BOTH SECTIONS)[B]	50	OHMS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	7 100	OHMS
TRANSCONDUCTANCE	5 300	μMHOS
PLATE CURRENT	8.5	MA.

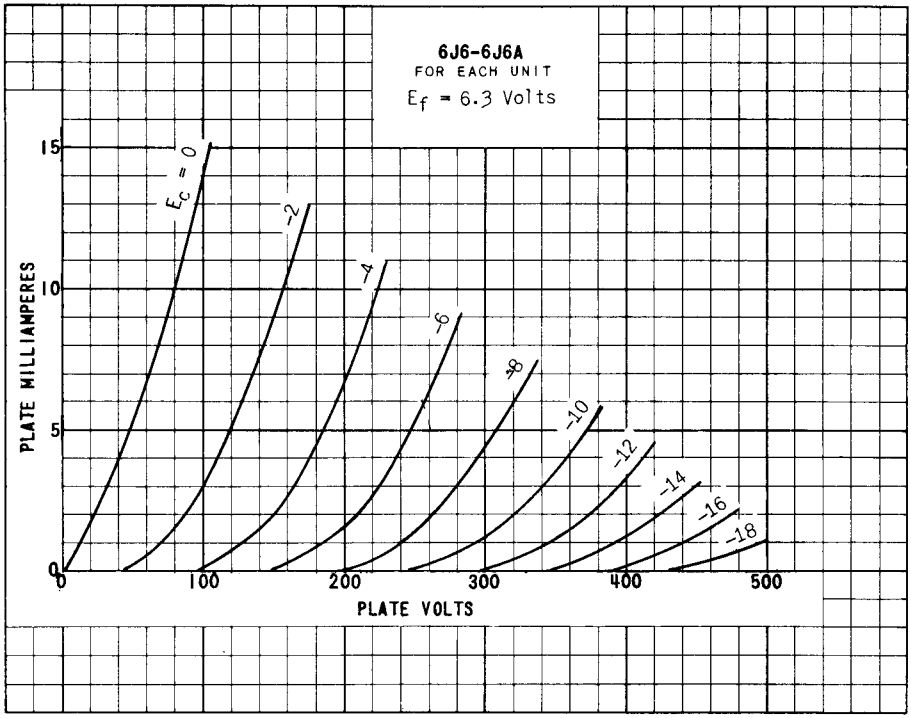
[B] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.

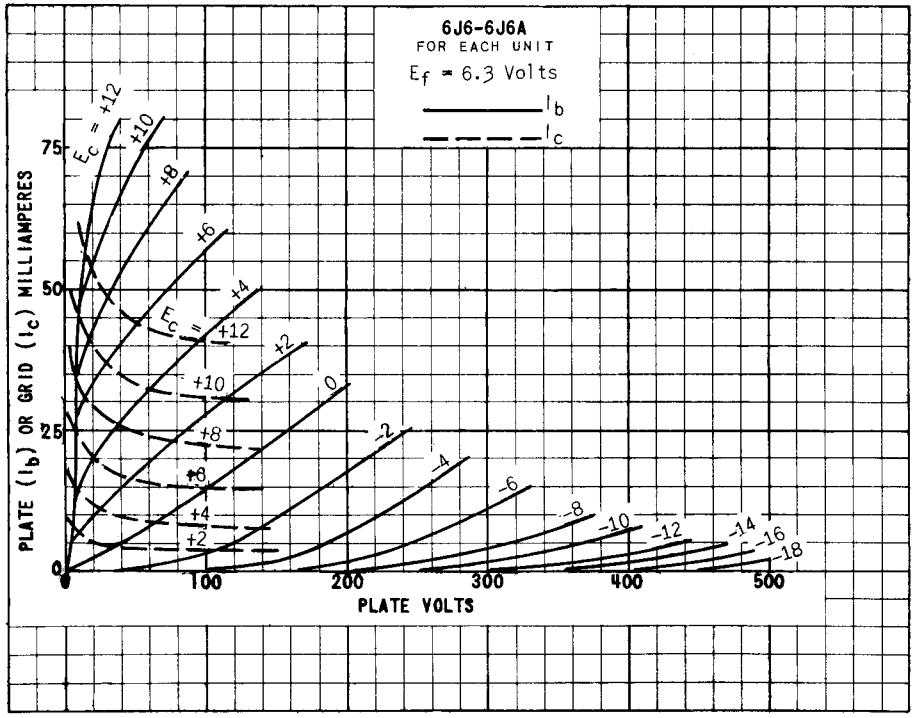
CLASS C TELEGRAPHY – RF POWER AMPLIFIER AND OSCILLATOR

BOTH SECTIONS IN PUSH PULL

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
DC PLATE VOLTAGE	150	VOLTS
DC GRID VOLTAGE[C]	-10	VOLTS
DC PLATE CURRENT	30	MA.
DC GRID CURRENT (APPROX.)	16	MA.
DRIVING POWER (APPROX.)	0.35	WATT
POWER OUTPUT (APPROX.)	3.5	WATTS

[C] OBTAINED BY A 525-OHMS GRID RESISTOR, A 220-OHMS CATHODE RESISTOR, OR A FIXED VOLTAGE SUPPLY.





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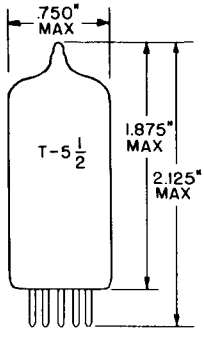
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

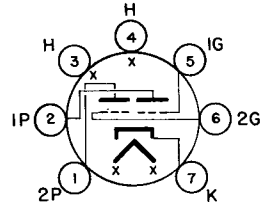


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

FOR MILITARY AND
INDUSTRIAL APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BF

THE 6J6WA IS A MEDIUM-MU TWIN TRIODE WITH A COMMON CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE TUBE IS PARTICULARLY ADAPTABLE FOR SERVICE AS A MIXER-OSCILLATOR AT FREQUENCIES UP TO 600 MEGACYCLES PER SECOND. IT INCORPORATES DISTINCTIVE MECHANICAL DESIGN FEATURES FOR HIGHLY RELIABLE OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	1.3	pf
INPUT	2.1	pf
OUTPUT: (SECTION 1)	0.4	pf
OUTPUT: (SECTION 2)	0.45	pf
HEATER TO CATHODE	6.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			+180	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	300	VOLTS
PLATE DISSIPATION	1.1	WATTS
PLATE CURRENT	12.5	MA.
ENVELOPE TEMPERATURE	165	°C
ALTITUDE	60,000	FT.
GRID CURRENT RESISTANCE (CATHODE BIAS)	0.25	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

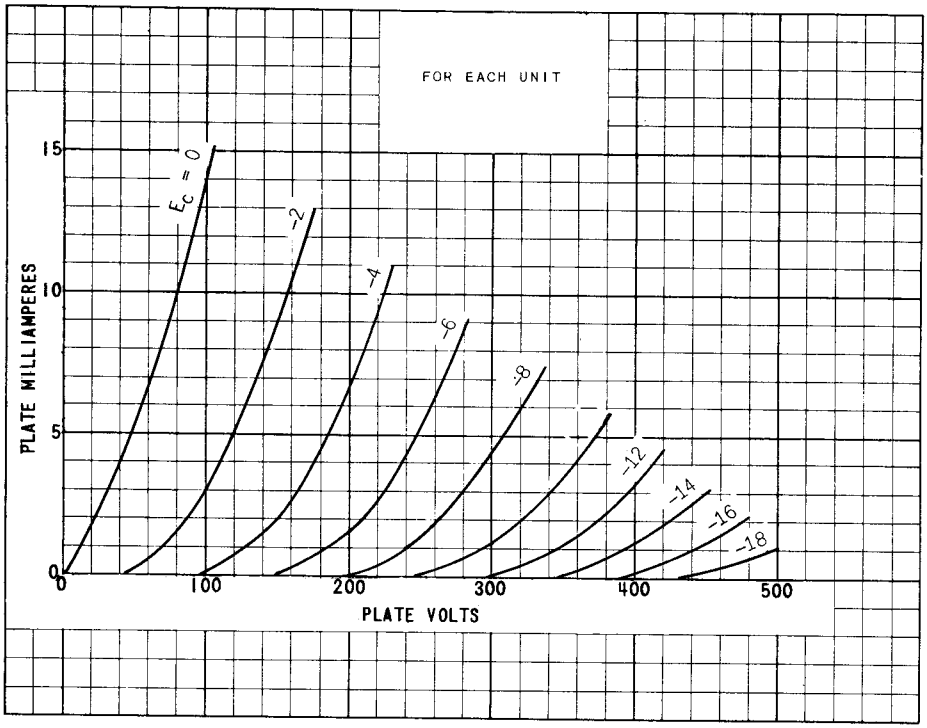
CLASS A1 AMPLIFIER - EACH SECTION

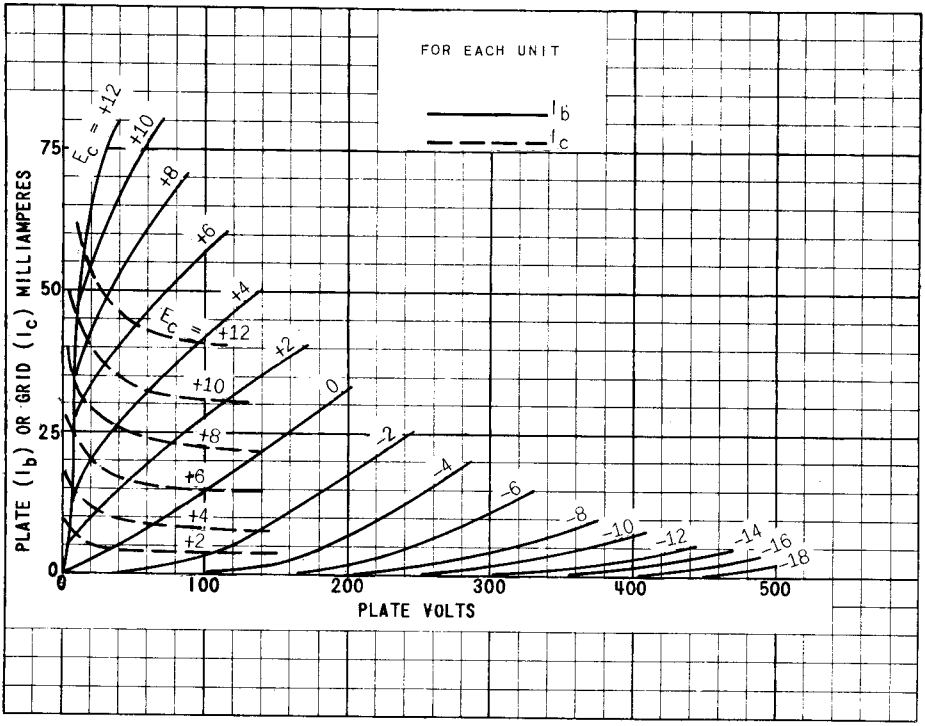
PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR (BOTH SECTIONS) [A]	50	OHMS
PLATE CURRENT	9.0	MA.
TRANSCONDUCTANCE	6,000	μMHOS
AMPLIFICATION FACTOR	38	
PLATE RESISTANCE	6,300	OHMS

SPECIAL TESTS AND CONTROLS

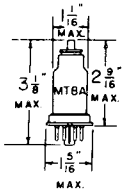
HEATER-CYCLING LIFE TEST
LOW PRESSURE VOLTAGE BREAKDOWN
SHOCK
FATIGUE

[A] OPERATION WITH FIXED BIAS IS NOT RECOMMENDED.


FOR EACH UNIT
PLATE MILLIAMPERES
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS
Ec = 0
-2
-4
-6
-8
-12
-14
-16
-18


FOR EACH UNIT
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
75
50
25
0
0
100
200
300
400
500
PLATE VOLTS
Ec = +12
+10
+8
+6
+4
+2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18

TUNG-SOL



TRIPLE GRID

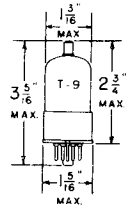
DETECTOR AMPLIFIER

UNIPOTENTIAL CATHODE

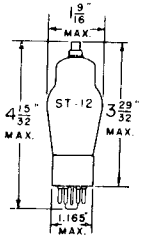
HEATER

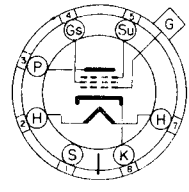
6.3 VOLTS 0.3 AMPERE

AC OR DC



G-7Ra





7R

THE TUNG-SOL 6J7, 6J7G, 6J7GT AND THE 12J7GT ARE SHARP CUT-OFF GENERAL PURPOSE AMPLIFIERS. WITH THE EXCEPTION OF HEATER AND CAPACITANCE RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6C6.

RATINGS

	TRIODE[A] CONNECTION	PENTODE CONNECTION	
MAXIMUM PLATE VOLTAGE	250	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	—	300	VOLTS
MAXIMUM SCREEN VOLTAGE	—	125	VOLTS
MINIMUM EXTERNAL CONTROL GRID BIAS VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.75	0.75	WATT
MAXIMUM SCREEN DISSIPATION	—	0.10	WATT

[A] SUPPRESSOR GRID AND SCREEN TIED TO PLATE

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 1004-3

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

TRIODE CONNECTION

	6J7	6J7G	6J7GT 12J7GT
CONTROL GRID TO CATHODE	5[B]	2.6[C]	2.6[C]
PLATE TO CATHODE	14	17	17
CONTROL GRID TO PLATE	2.0	1.8	1.8

PENTODE CONNECTION

CONTROL GRID TO CATHODE	7[B]	4.6[D]	4.6[D]
PLATE TO CATHODE	12	12	12
CONTROL GRID TO PLATE MAX.	0.005	0.007	0.005

[B] WITH SHELL CONNECTED TO CATHODE
[C] WITHOUT EXTERNAL SHIELD
[D] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE CONNECTION		PENTODE CONNECTION		
PLATE VOLTAGE	180	250	100	250	VOLTS
SCREEN VOLTAGE	PLATE	PLATE	100	100	VOLTS
CONTROL GRID VOLTAGE [E]	-5.3	-8	-3	-3	VOLTS
SUPPRESSOR GRID	PLATE	PLATE	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	5.3	6.5	2.0	2.0	MA.
SCREEN CURRENT	—	—	0.5	0.5	MA.
PLATE RESISTANCE APPROX.	0.0110	0.0105	1.0	— [F]	MEGOHM
TRANSCONDUCTANCE	1800	1900	1185	1225	µMHOS
CONTROL GRID VOLTAGE FOR CATHODE CURRENT CUT-OFF	—	—	-7	-7	VOLTS

[E] THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM

[F] GREATER THAN 1 MEGOHM

PLATE 1005-3

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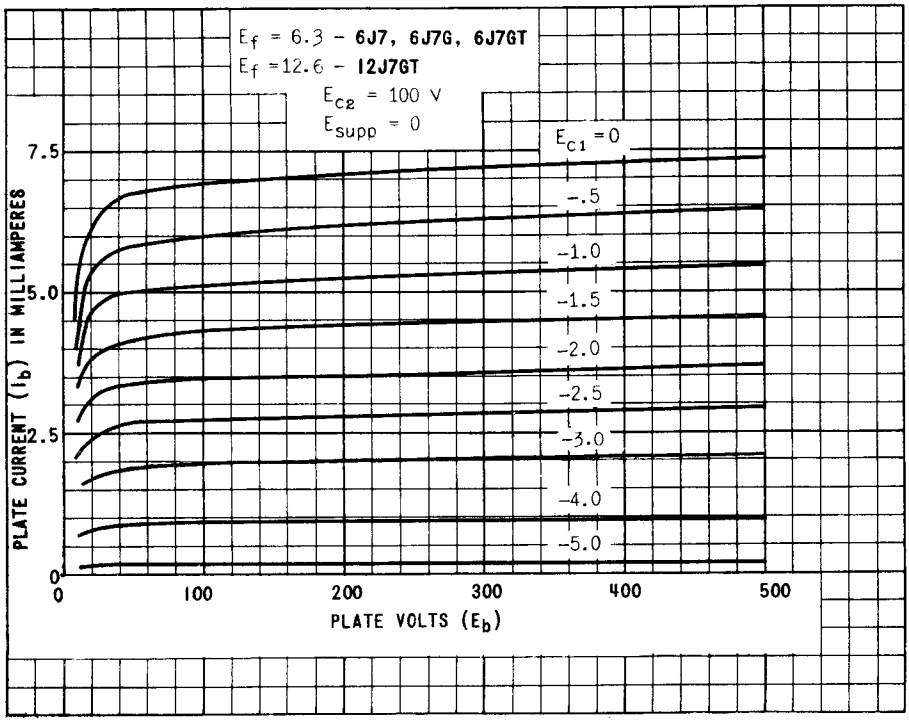

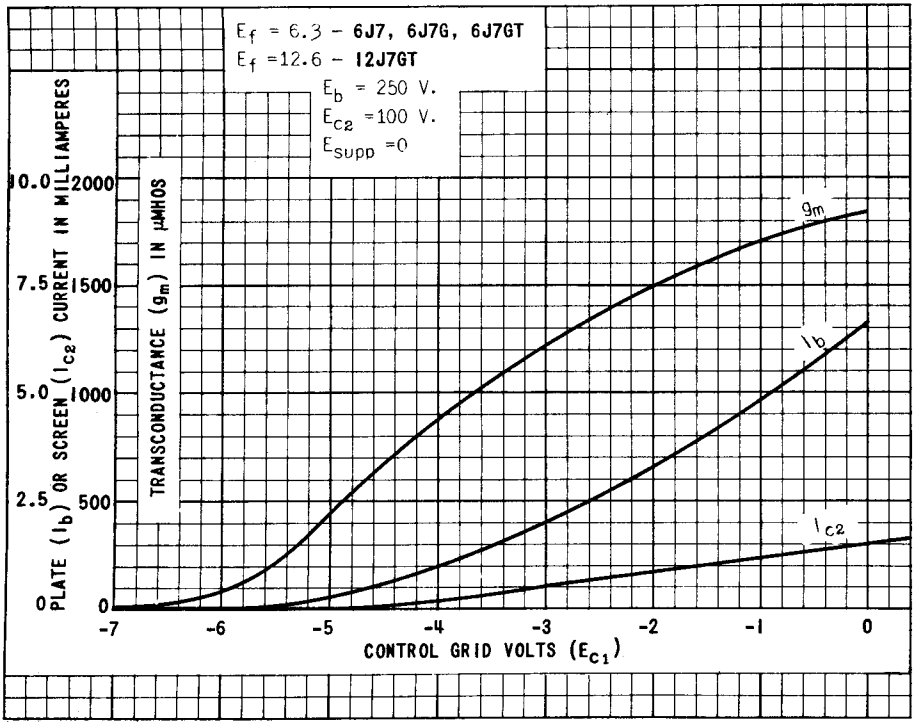

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PLATE
1006-2

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12J7GT 6J7, 6J7G, 6J7GT

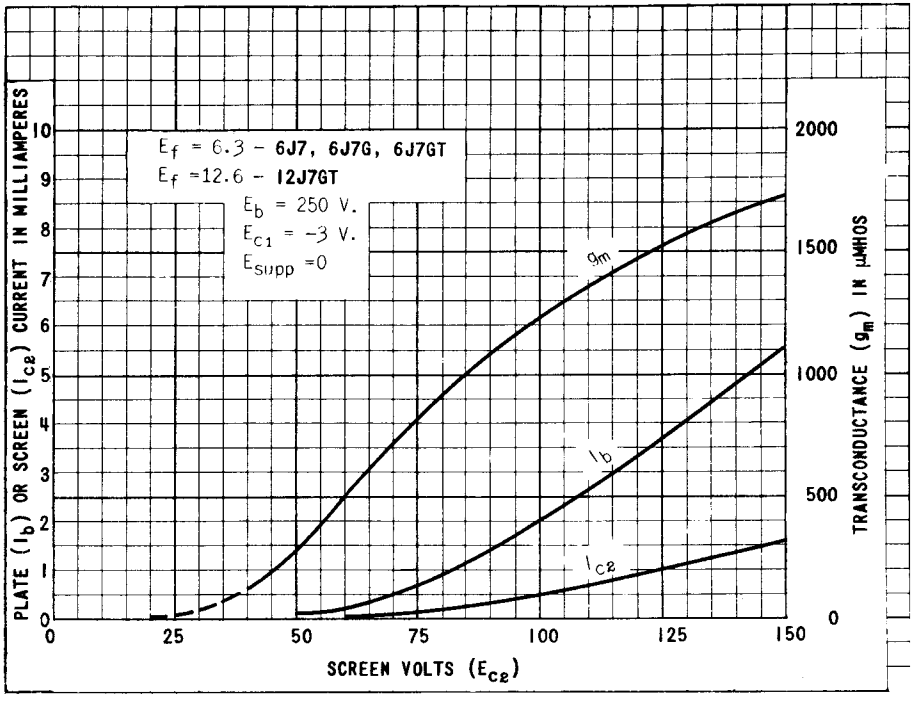

PLATE
1007-2

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1941

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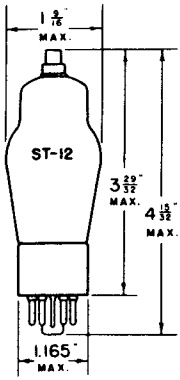
TUNG-SOL



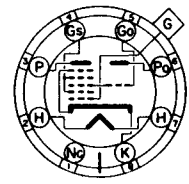
TRIODE HEPTODE CONVERTER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 8 PIN OCTAL BASE.



G-8H

THE TUNG-SOL 6J8G IS A CONVERTER TUBE DESIGNED FOR STABLE OPERATION OVER AN EXTENDED FREQUENCY RANGE. IT CONSISTS OF A HEPTODE MIXER AND A TRIODE OSCILLATOR, HAVING A COMMON CATHODE. THE INJECTOR GRID OF THE HEPTODE IS INTERNALLY CONNECTED TO THE TRIODE GRID.

OPERATING CONDITIONS AND CHARACTERISTICS

HEPTODE PLATE VOLTAGE	100	250 MAX.	VOLTS
HEPTODE CONTROL GRID VOLTAGE	-3	-3	VOLTS
HEPTODE SCREEN VOLTAGE	100 MAX.	100 MAX.	VOLTS
HEPTODE PLATE CURRENT	1.4	1.3	MA.
HEPTODE SCREEN CURRENT	3.0	2.9	MA.
TRIODE PLATE VOLTAGE	100	250 MAX. R	VOLTS
TRIODE PLATE CURRENT	3	5	MA.
TRIODE GRID RESISTOR	50 000	50 000	OHMS
TRIODE GRID CURRENT	0.3	0.4	MA.
HEPTODE PLATE RESISTANCE	0.9	4.0	MEGOHMS
CONVERSION CONDUCTANCE	250	290	μMHOS
HEPTODE CONTROL GRID VOLTAGE FOR 2 μMHOS CONVERSION CONDUCTANCE	-20	-20	VOLTS

R APPLIED THROUGH 20 000 OHMS DROPPING RESISTOR.

STATIC CHARACTERISTICS OF TRIODE SECTION

PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	7	MA.
PLATE RESISTANCE	10 600	OHMS
TRANSCONDUCTANCE	1600 APPROX.	μMHOS
AMPLIFICATION FACTOR	17 APPROX.	

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DIRECT INTERELECTRODE CAPACITANCES[5]

CONTROL GRID (G) AND HEPTODE PLATE (P)	0.01 MAX.	μμf
CONTROL GRID (G) AND TRIODE PLATE (P_o)	0.16	μμf
CONTROL GRID (G) AND TRIODE GRID (G_o)	0.14	μμf
CONTROL GRID (G) AND ALL OTHER ELECTRODES	4.4	μμf
TRIODE GRID (G_o) AND TRIODE PLATE (P_o)	2.2	μμf
TRIODE GRID (G_o) AND ALL OTHER ELECTRODES	12.0	μμf
TRIODE PLATE (P_o) AND ALL OTHER ELECTRODES	5.5	μμf
HEPTODE PLATE (P) AND ALL OTHER ELECTRODES	9.0	μμf

[5] WITH STANDARD TUBE SHIELD (NOT CLOSE FITTING)

NOTE: VARIATION OF THE OSCILLATOR FREQUENCY, CAUSED BY AVC VOLTAGE AND REGULATION OF THE POWER SUPPLY, IS LESS IN THE 6J8G THAN IN THE PENTAGRID CONVERTER. THIS IMPROVEMENT IN FREQUENCY STABILITY IS DUE TO THE USE OF A SEPARATE TRIODE UNIT. THE HIGH INPUT IMPEDANCE RESULTING FROM THE LOW SIGNAL GRID TO PLATE CAPACITANCE AND THE HIGH PLATE RESISTANCE, MAINTAINS THE Q OF ASSOCIATED HIGH GAIN CIRCUITS. THE COUPLING EFFECTS WITHIN THE TUBE BETWEEN THE OSCILLATOR AND SIGNAL CIRCUITS ARE SMALL.

THE OSCILLATOR GRID CURRENT SHOULD EXCEED 150 MICROAMPERES THROUGH A 50 000 OHM GRID RESISTOR, AND THE PLATE LOAD IMPEDANCE SHOULD EXCEED 0.2 MEGOHM TO OBTAIN CONVERSION GAIN COMPARABLE TO THAT OF PENTAGRID CONVERTERS. THE HIGH PLATE LOAD IMPEDANCE MAY BE OBTAINED MORE ECONOMICALLY BY USING HIGHER L-C RATIOS THAN BY HIGHER Q COILS, AS A LOWER VALUE OF TUNING CAPACITY MAY BE USED THAN IS PERMISSIBLE WITH PENTAGRID CONVERTERS. OSCILLATOR CIRCUITS THAT REDUCE THE VOLTAGE ON THE TRIODE PLATE TO LESS THAN 100 VOLTS SHOULD BE AVOIDED.

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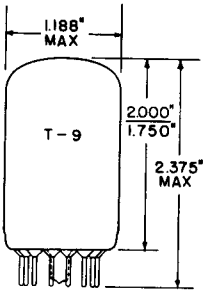
DUAL PENTODE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

COMPACTRON

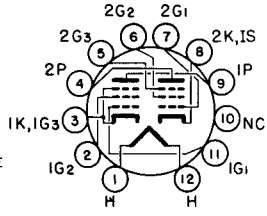
FOR

DISCRIMINATOR AND

AUDIO POWER OUTPUT SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BT

THE 6J10 IS A GATED-BEAM DISCRIMINATOR PENTODE AND A BEAM PENTODE IN THE T-9 COMPACTRON CONSTRUCTION. SECTION 2 THE GATED-BEAM DISCRIMINATOR PENTODE IS SUITABLE FOR FM AND TV LIMITER AND DISCRIMINATOR APPLICATIONS AND SECTION 1 THE BEAM PENTODE FOR AUDIO POWER OUTPUT SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DISCRIMINATOR SECTION: (SECTION 2)		
GRID 1 TO GRID 3	0.01	pf
GRID 1 TO ALL	4.0	pf
GRID 3 TO ALL	3.2	pf
OUTPUT SECTION: (SECTION 1)		
GRID 1 TO PLATE	0.2	pf
INPUT:	11	pf
OUTPUT:	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	950	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER CATHODE VOLTAGE	DISCRIMINATOR SECTION	OUTPUT SECTION	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

OUTPUT SECTION 1

PLATE VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	275	VOLTS
PLATE DISSIPATION	10	WATTS
GRID 2 DISSIPATION	2.0	WATTS
GRID 1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.25	MEGOHM
WITH CATHODE BIAS	0.5	MEGOHM

DISCRIMINATOR SECTION 2

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	110	VOLTS
PEAK POSITIVE GRID 1 VOLTAGE	60	VOLTS
CATHODE CURRENT - DC	13	MA.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

OUTPUT SECTION 1

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID - NUMBER 1 VOLTAGE	-8.0	VOLTS
PEAK AF GRID - NUMBER 1 VOLTAGE	8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAXIMUM - SIGNAL PLATE CURRENT	39	MA.
ZERO-SIGNAL GRID 2 CURRENT	2.5	MA.
MAXIMUM - SIGNAL GRID 2 CURRENT	7.0	MA.
TRANSCONDUCTANCE	6,500	μMHOS
PLATE RESISTANCE, APPROXIMATE	100,000	OHMS
LOAD RESISTANCE	5,000	OHMS
TOTAL HARMONIC DISTORTION, APPROXIMATE	10	PERCENT
MAXIMUM - SIGNAL POWER OUTPUT	4.2	WATTS

DISCRIMINATOR SECTION 2

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	Mc/s
FREQUENCY DEVIATION	±75	±75	±25	Kc/s
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	62	122	121	VOLTS
GRID 2 VOLTS	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) SEE BELOW	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85,000	330,000	330,000	OHMS
PLATE LINEARITY RESISTOR	470	1,500	1,000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μF
COUPLING CAPACITOR	0.25	0.01	0.25	μF
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION-RMS	1.25	1.25	1.25	VOLTS
AT SIGNAL LEVELS ABOVE THIS VALUE, LIMITING IS WITHIN ± 3 dbs				
PLATE CURRENT-DC	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT	1.25	2.0	2.0	VOLTS
AM REJECTION AT ESIG = 2.0 VOLTS, RMS	31	20	25	DECIBELS
AM REJECTION AT ESIG = 3.0 VOLTS, RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF THE LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

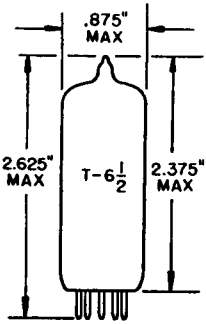
STANDARD DE-EMPHASIS REQUIREMENTS FOR FM ARE INCLUDED.

THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS(RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10pf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

TUNG-SOL

TRIODE - PENTODE

MINIATURE TYPE

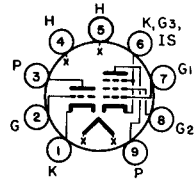


GLASS BULB
SMALL BUTTON 9 PIN
BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

FOR COLOR
AND BLACK-AND-WHITE
T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6JA8 IS A HIGH-MU TRIODE AND A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE UNIT IS DESIGNED FOR SERVICE AS A SYNC SEPARATOR, SYNC CLIPPER AND PHASE INVERTER WHILE THE PENTODE UNIT IS DESIGNED FOR OPERATION AS A VIDEO AMPLIFIER. EXCEPT FOR HEATER RATINGS AND CHARACTERISTICS, THE 6JA8 IS IDENTICAL TO THE 10JA8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

		TRIODE UNIT	PENTODE UNIT	
GRID 1 TO PLATE		4.6	MAX. 0.1	pf
INPUT		2.6	11	pf
OUTPUT		2.6	4.4	pf
COUPLING:				
PENTODE GRID1 TO TRIODE PLATE	MAX.	0.005		pf
PENTODE PLATE TO TRIODE GRID	MAX.	0.018		pf
PENTODE PLATE TO TRIODE PLATE	MAX.	0.17		pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES -SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	750	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE:	TRIODE UNIT	PENTODE UNIT	
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS

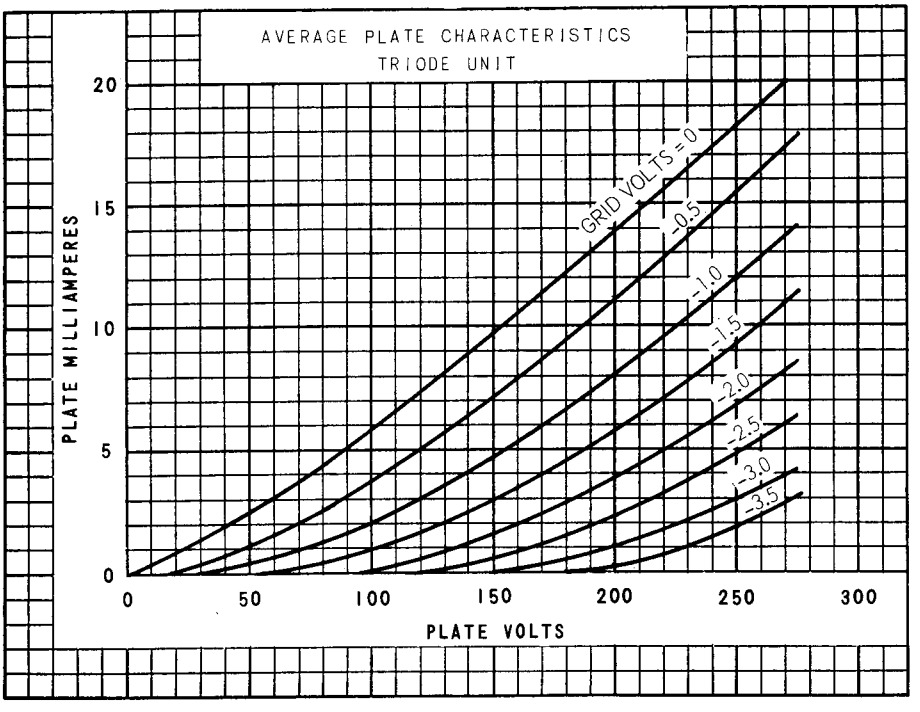
MAXIMUM RATINGS

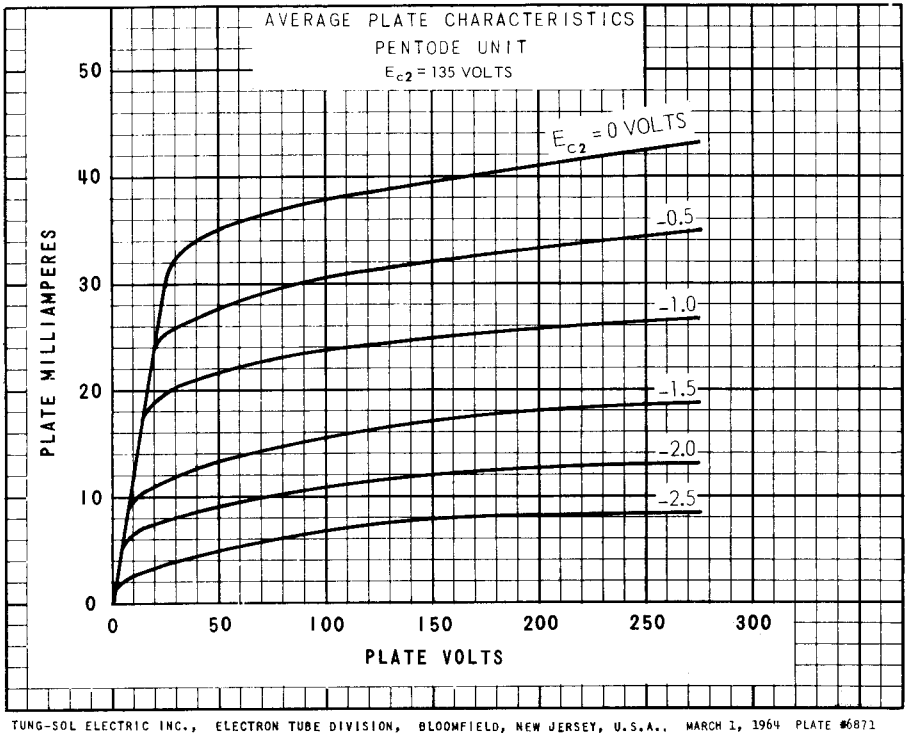
DESIGN MAXIMUM RATINGS-SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	300	300	VOLTS
GRID2 SUPPLY VOLTAGE	-	330	VOLTS
GRID2 VOLTAGE		SEE RATING CHART	
PLATE DISSIPATION	1	5	WATTS
GRID2 DISSIPATION	-	1.5	WATTS
POSITIVE GRID1 BIAS VOLTAGE	0	0	VOLTS
GRID1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE RESISTOR BIAS	1.0	1.0	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

TRIODE UNIT:				
PLATE VOLTAGE		135	200	VOLTS
GRID VOLTAGE		-2	-2	VOLTS
PLATE CURRENT		1	3.5	MA.
TRANSCONDUCTANCE		1,550	3,700	μMHOS
AMPLIFICATION FACTOR		60	70	
PLATE RESISTANCE		39,000	19,000	OHMS
GRID 1 VOLTAGE FOR I_b = 10 μA		-4.8	-7	VOLTS
PENTODE UNIT:				
PLATE VOLTAGE	30	135	200	VOLTS
GRID 2 VOLTAGE	135	135	135	VOLTS
GRID1 VOLTAGE	0	-1.5	-1.5	VOLTS
PLATE CURRENT	32	17	18	MA.
GRID 2 CURRENT	14	4.2	4	MA.
TRANCONDUCTANCE	-	12,600	14,000	μMHOS
PLATE RESISTANCE	-	66,000	70,000	OHMS
GRID 1 VOLTAGE FOR I_b = 10 μA	-	-5	-5	VOLTS





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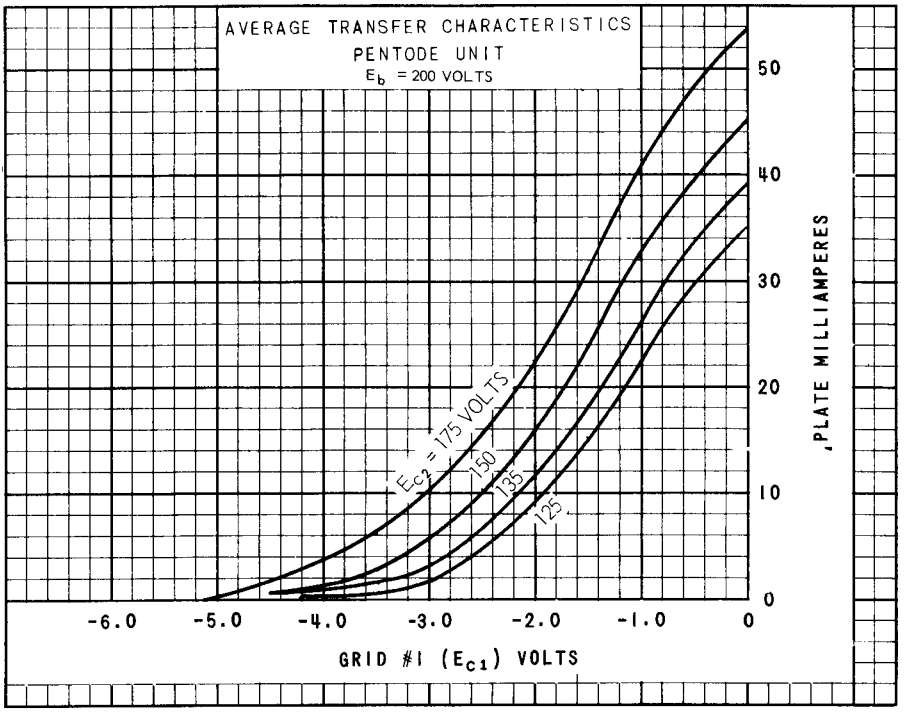
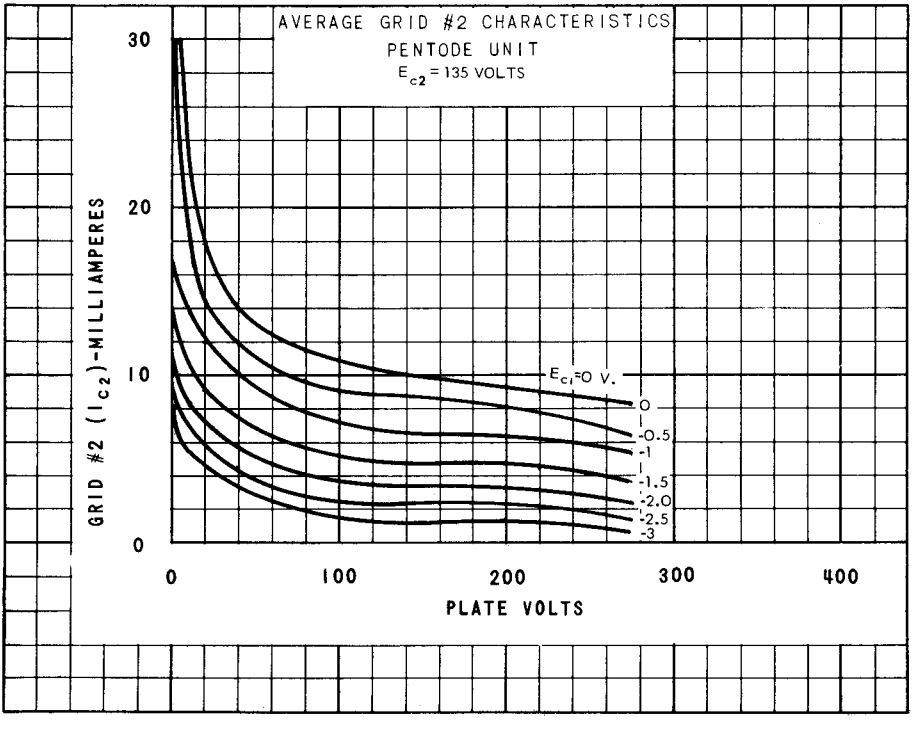
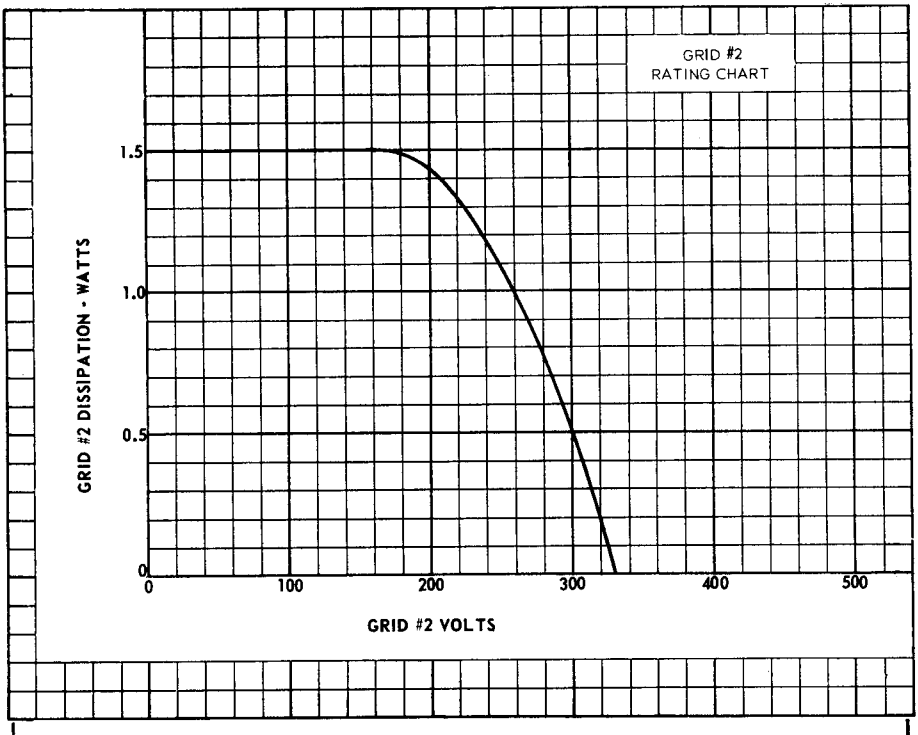

AVERAGE TRANSFER CHARACTERISTICS
PENTODE UNIT
E_b = 200 VOLTS
E_{c2} = 175 VOLTS
150
135
125
50
40
30
20
10
0
PLATE MILLIAMPERES
-6.0
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID #1 (E_{c1}) VOLTS


AVERAGE GRID #2 CHARACTERISTICS
PENTODE UNIT
E_{c2} = 135 VOLTS
30
20
10
0
GRID #2 (I_{c2})-MILLIAMPERES
E_{c1}=0 V.
0
-0.5
-1
-1.5
-2.0
-2.5
-3
0
100
200
300
400
PLATE VOLTS

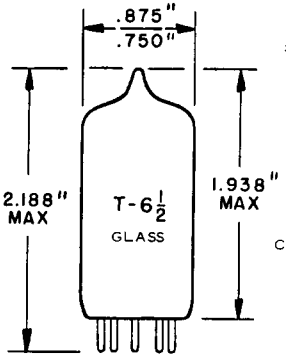

GRID #2
RATING CHART
GRID #2 DISSIPATION - WATTS
1.5
1.0
0.5
0
0
100
200
300
400
500
GRID #2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2

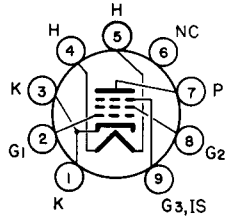


BASE 9 PIN BUTTON
JEDEC E9-1

SEMI-REMOTE-CUTOFF PENTODE
FOR
I.F. AMPLIFIER STAGES
IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 6JC6 IS A FRAME-GRID, SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6JC6 IS IDENTICAL TO THE 3JC6 AND THE 4JC6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	.019	pf
INPUT (G1 TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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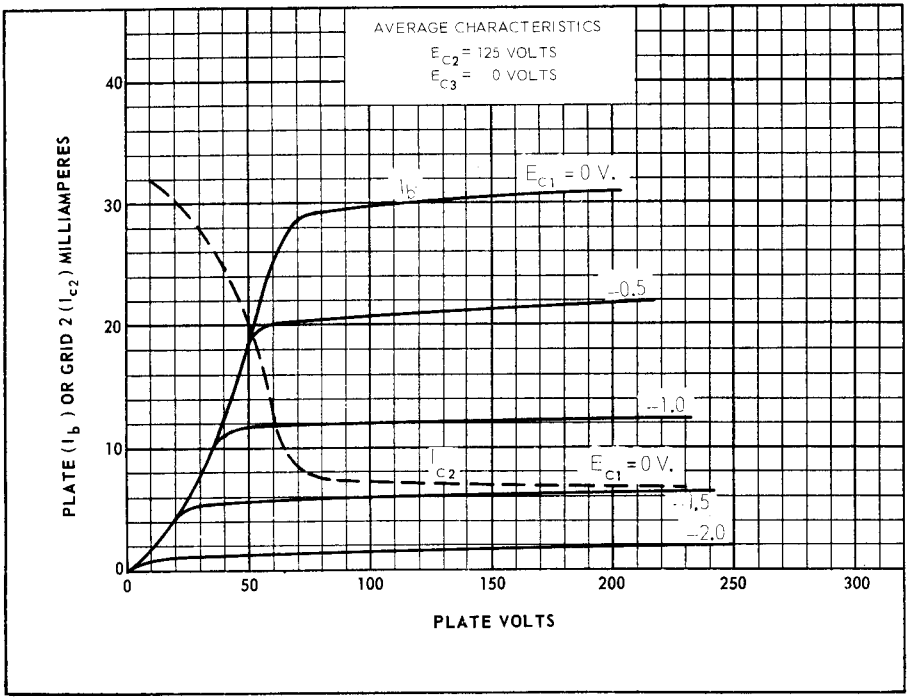
MAXIMUM RATINGS

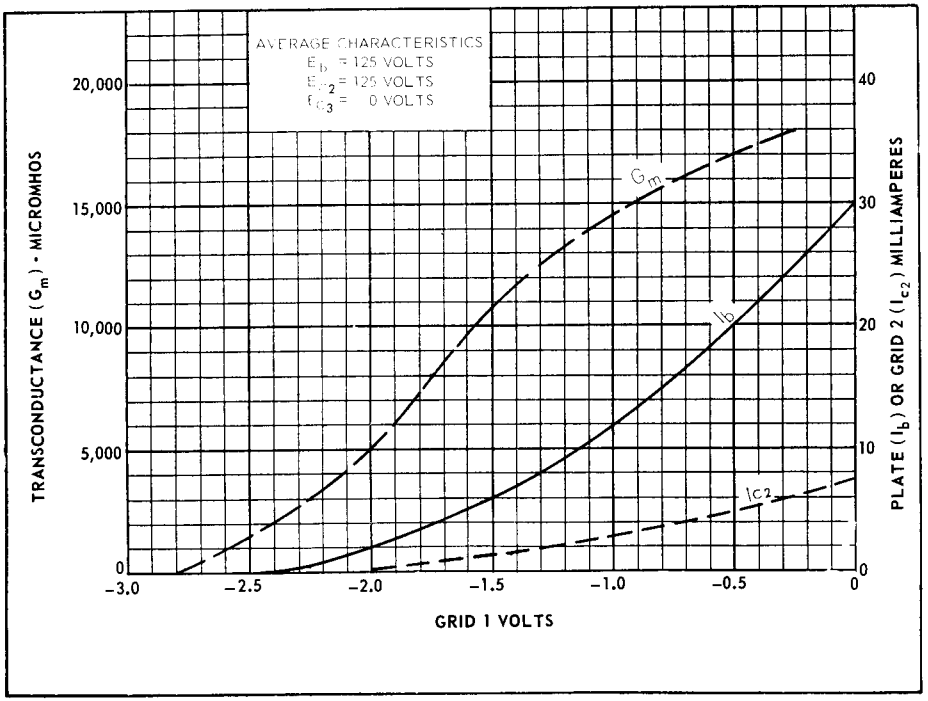
DESIGN MAXIMUM VALUES • SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATT
GRID 1 CIRCUIT RESISTANCES:		
CATHODE-BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

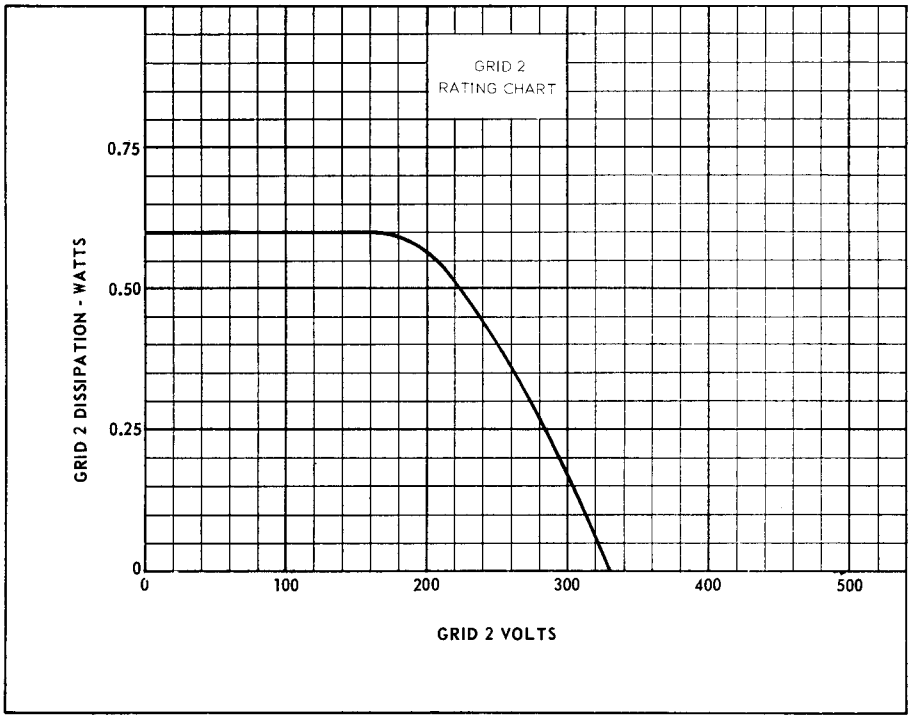
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	Connected To Cathode At Socket	
GRID 2 VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE CURRENT	13	mA
GRID 2 CURRENT	3.2	mA
TRANSCONDUCTANCE	15,000	μMHOS
PLATE RESISTANCE	0.18	MEGOHM
GRID 1 VOLTAGE FOR I_b = 100 mA	-3.0	VOLTS


AVERAGE CHARACTERISTICS
E_{c_2} = 125 VOLTS
E_{c_3} = 0 VOLTS
I_b
E_{c_1} = 0 V.
-0.5
-1.0
I_{c_2}
E_{c_1} = 0 V.
-1.5
-2.0
PLATE (I_b) OR GRID 2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
0
50
100
150
200
250
300


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c_2} = 125 VOLTS
E_{c_3} = 0 VOLTS
G_m
I_b
I_{c_2}
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) OR GRID 2 (I_{c_2}) MILLIAMPERES
GRID 1 VOLTS
0
5,000
10,000
15,000
20,000
0
10
20
30
40
-3.0
-2.5
-2.0
-1.5
-1.0
-0.5
0

6JC6

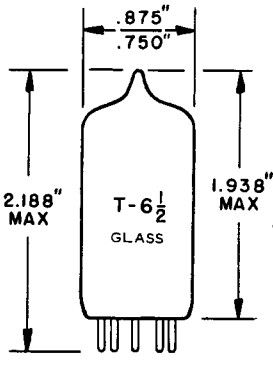

GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

OUTLINE
JEDEC 6-2



BASE 9 PIN BUTTON
JEDEC E9-1

SHARP-CUTOFF PENTODE

FOR

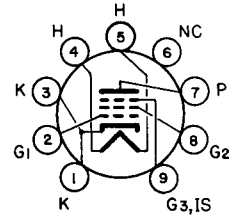
IF AMPLIFIER STAGES

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PM



BOTTOM VIEW

THE 6JD6 IS A SEMI-REMOTE-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN TELEVISION RECEIVER I.F. AMPLIFIER STAGES. THE SEMI-REMOTE CUTOFF CHARACTERISTICS IS DESIRABLE FOR USE IN AGC CONTROLLED STAGES. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6JD6 IS IDENTICAL TO THE 3JD6 AND THE 4JD6.

DIRECT INTERELECTROCE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - MAX.	0.019	pf
INPUT (G TO H + K + G3 + I.S. + G2)	8.2	pf
OUTPUT (P TO H + K + G3 + I.S. + G2)	3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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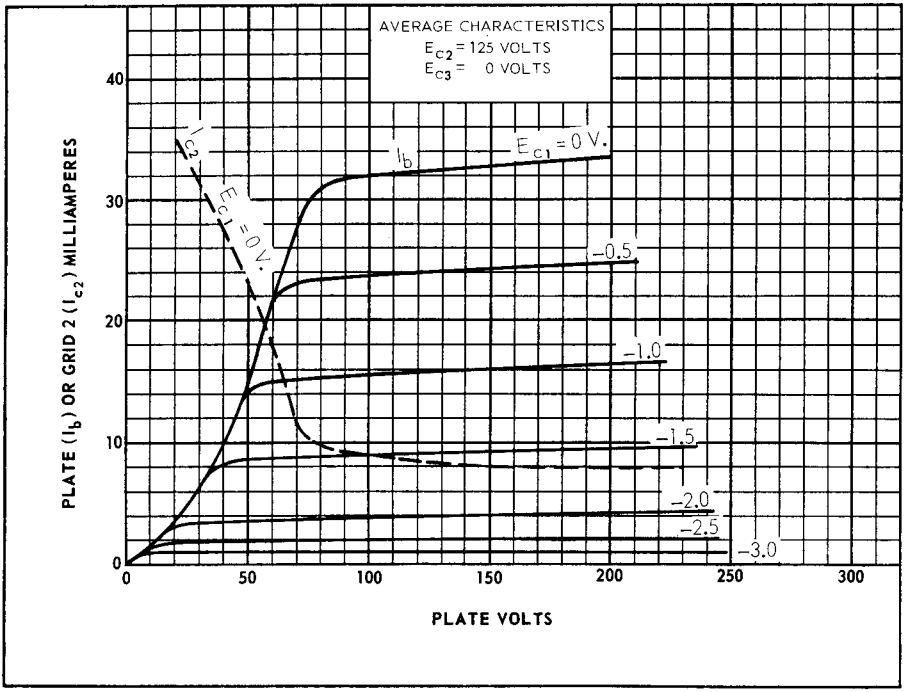
MAXIMUM RATINGS

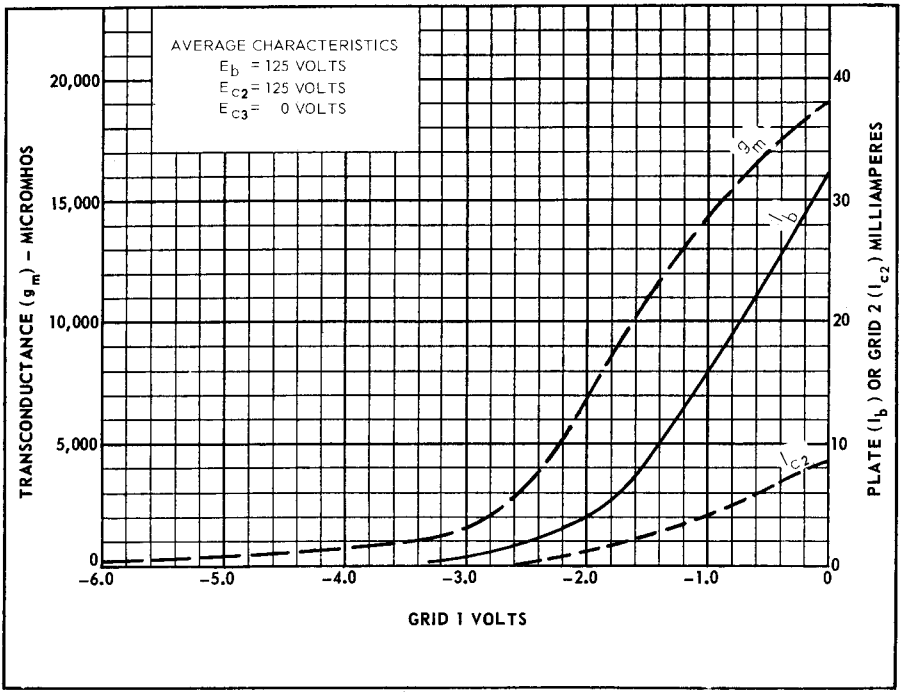
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	2.5	WATTS
GRID 2 DISSIPATION - UP TO 165 VOLTS	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE:		
CATHODE BIAS RESISTOR	1	MEGOHM
FIXED BIAS	0.25	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID 2 VOLTAGE	125	VOLTS
CATHODE BIAS RESISTOR	56	OHMS
PLATE CURRENT	15	mA
GRID 2 CURRENT	4	mA
TRANSCONDUCTANCE	14,000	μMHOS
PLATE RESISTANCE	0.16	MEGOHM
GRID 1 VOLTAGE FOR G_m = 600 μMHOS	−4.5	VOLTS





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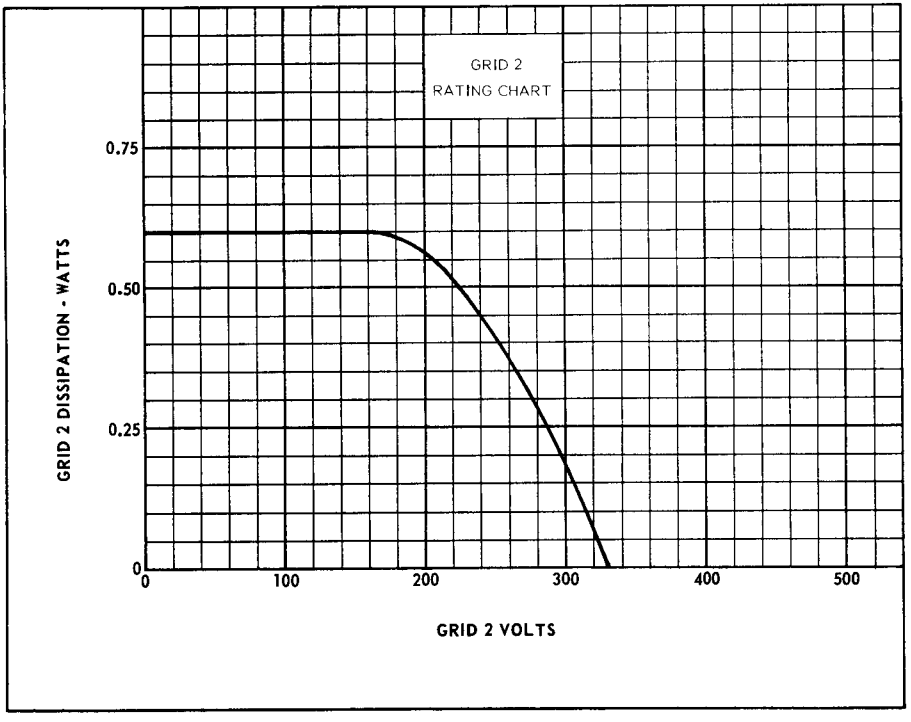
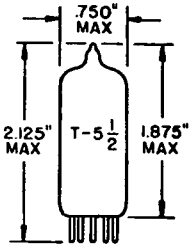
6JD6


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
500
GRID 2 VOLTS

TUNG-SOL

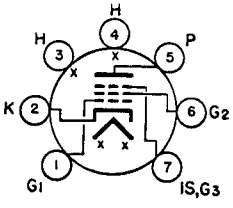
PENTODE

MINIATURE TYPE



GLASS BULB
SMALL-BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

SEMIREMOTE-CUTOFF PENTODE
FOR
USE IN THE GAIN-CONTROLLED
PICTURE-IF AMPLIFIER STAGES
OF COLOR T.V. RECEIVERS



BOTTOM VIEW
BASING DIAGRAM
7 CM

THE 6JH6 IS A SEMIREMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE GAIN-CONTROLLED PICTURE-IF AMPLIFIER STAGES OF TELEVISION RECEIVERS. BECAUSE OF ITS CONTROLLED SEMIREMOTE-CUTOFF CHARACTERISTIC, THE 6JH6 CAN SUBSTANTIALLY REDUCE THE EFFECTS OF CROSS MODULATION IN THE IF STAGES OF COLOR T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD NO. 316 CONNECTED TO CATHODE	
GRID 1 TO PLATE	MAX. 0.025	MAX. 0.015	pf
G1 TO (H + K + G2 + G3 + I.S.)	7	7	pf
P TO (H + K + G2 + G3 + I.S.)	2	3	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

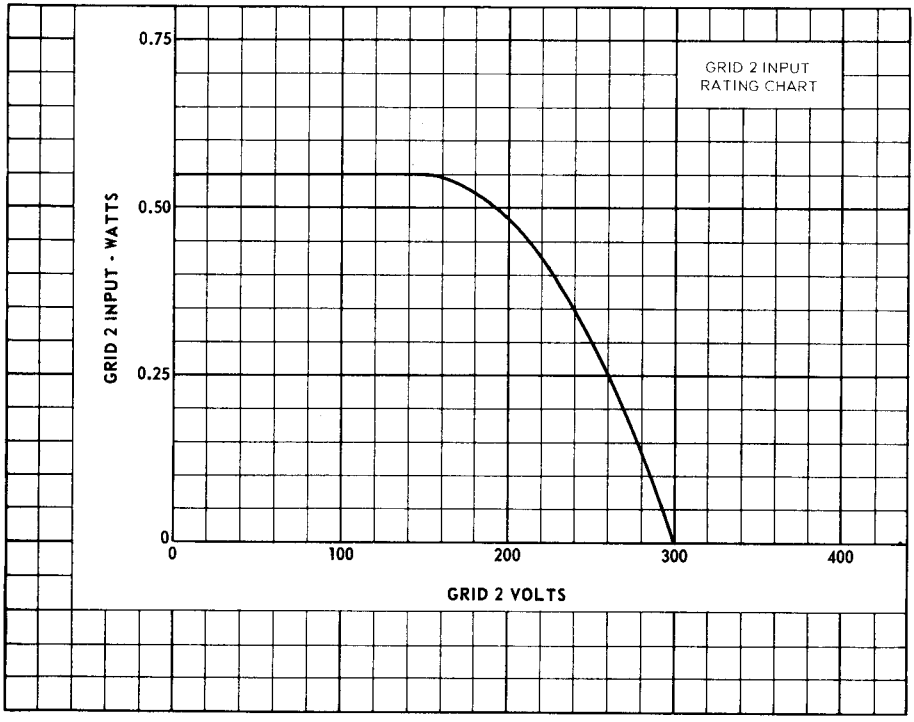
CLASS AI AMPLIFIER

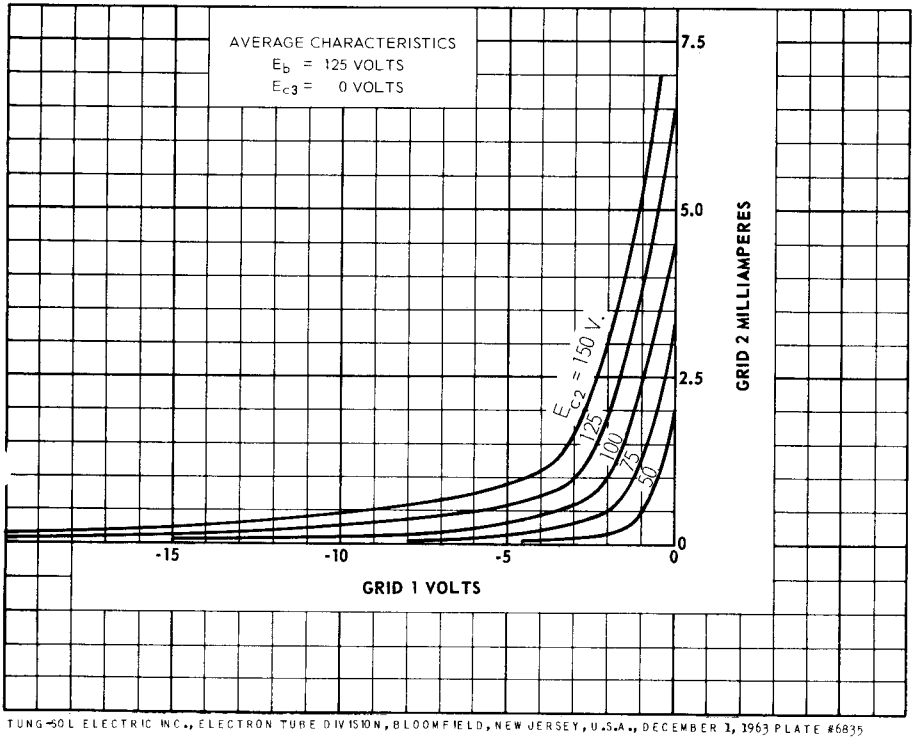
PLATE VOLTAGE		300	VOLTS
GRID 3 VOLTAGE		0	VOLTS
GRID 2 SUPPLY VOLTAGE		300	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
GRID 1 VOLTAGE			
POSITIVE BIAS VALUE		0	VOLTS
GRID 2 INPUT			
FOR GRID 2 VOLTAGES UP TO 150 VOLTS		0.55	VOLTS
FOR GRID 2 VOLTAGES BETWEEN 150 AND 300 VOLTS		SEE RATING CHART	
PLATE DISSIPATION		2.3	WATTS
GRID 1 CIRCUIT RESISTANCE:			
FOR FIXED-BIAS OPERATION	MAX.	0.25	MEGOHM
FOR CATHODE-BIAS OPERATION	MAX.	1	MEGOHM

CHARACTERISTICS

CLASS AI AMPLIFIER

PLATE VOLTAGE		125	VOLTS
GRID 3 VOLTAGE - CONNECTED TO CATHODE AT SOCKET			
GRID 2 VOLTAGE		125	VOLTS
CATHODE RESISTOR		56	OHMS
PLATE CURRENT		14	MA.
GRID 2 CURRENT		3.6	MA.
TRANSCONDUCTANCE		8,000	μMHOS
PLATE RESISTANCE	APPROX.	0.26	MEGOHM
GRID 1 VOLTAGE FOR G_m = 50 μMHOS		-19	VOLTS
TRANCONDUCTANCE RANGE AT E_{C1} = 4.5 V. AND R_k = 56 Ω		400-900	μMHOS





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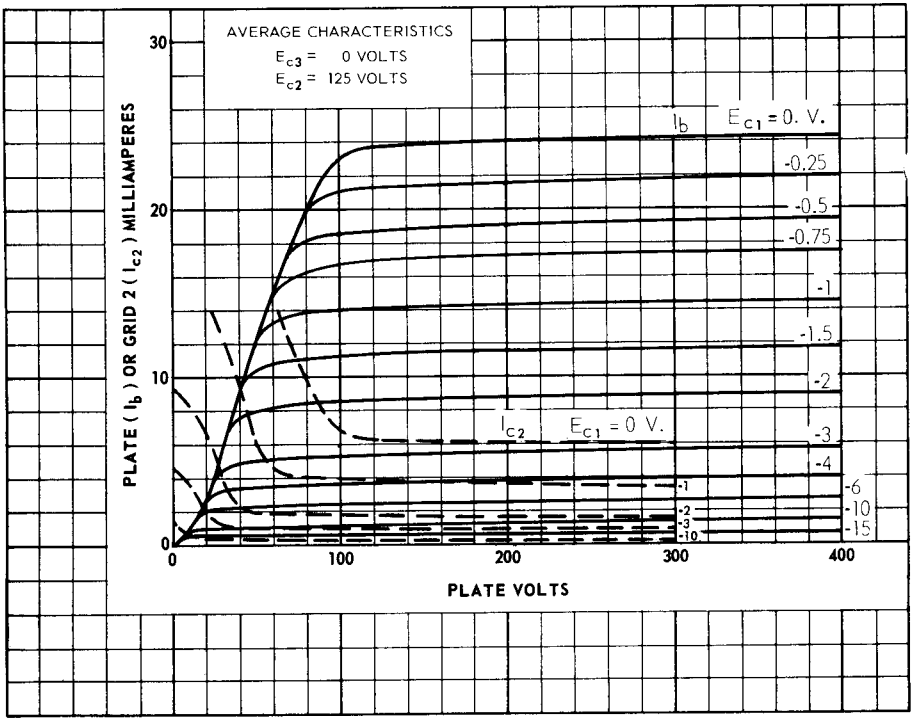
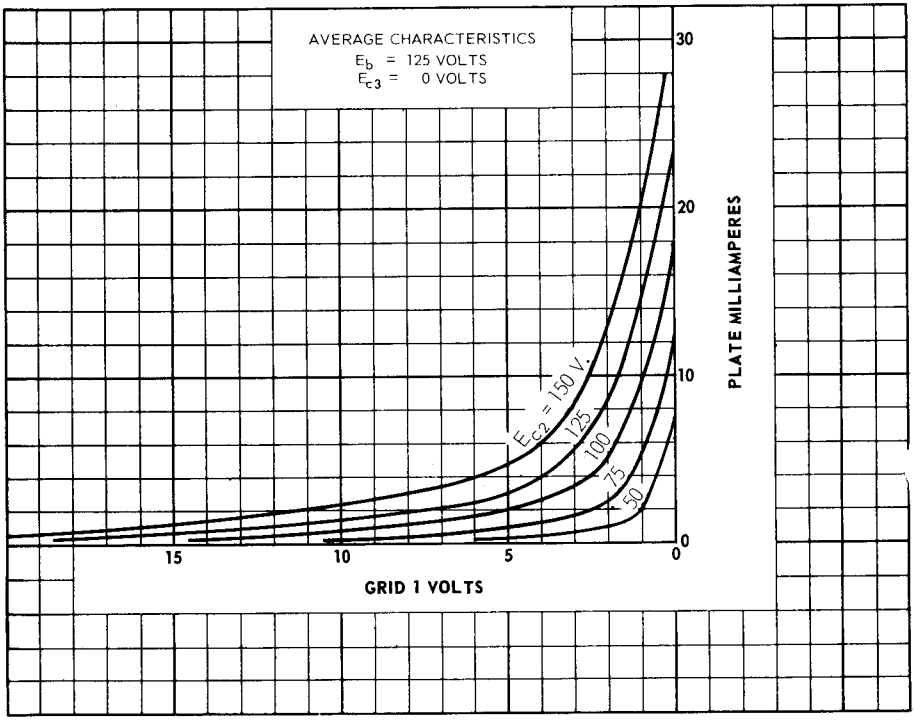
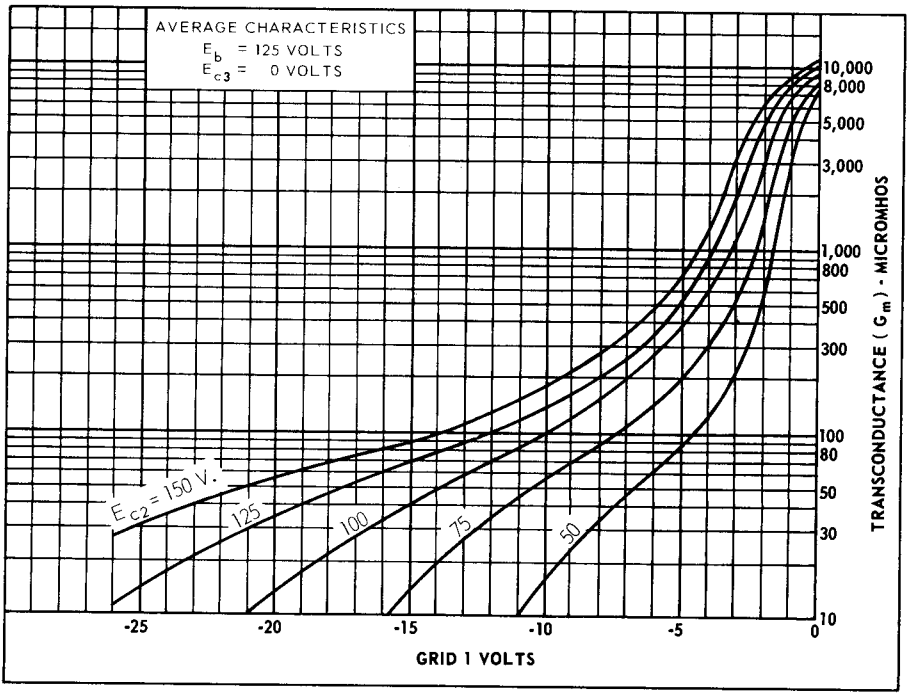
6JH6


AVERAGE CHARACTERISTICS
E_{c3} = 0 VOLTS
E_{c2} = 125 VOLTS
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_b E_{c1} = 0. V.
-0.25
-0.5
-0.75
-1
-1.5
-2
-3
-4
-6
-10
-15
I_{c2} E_{c1} = 0 V.
-1
-2
-3
-10
0
10
20
30
100
200
300
400


AVERAGE CHARACTERISTICS
E_b = 125 VOLTS
E_{c3} = 0 VOLTS
PLATE MILLIAMPERES
GRID 1 VOLTS
E_{c2} = 150 V.
125
100
75
50
0
10
20
30
15
10
5
0

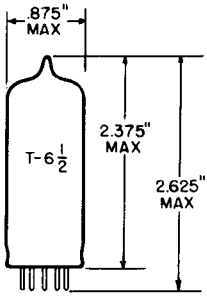


TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., DECEMBER 1, 1963 PLATE #6836

TUNG-SOL

SHEET-BEAM TUBE

MINIATURE TYPE



GLASS BULB

SMALL BUTTON
9 PIN BASE E9-1

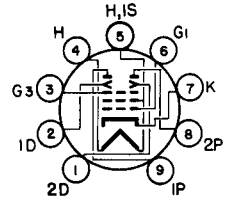
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR

COLOR TELEVISION APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 90P

PIN 5 SHOULD BE CONNECTED DIRECTLY TO GROUND.

THE 6JH8 IS A DOUBLE-PLATE SHEET-BEAM TUBE IN THE 9 PIN MINIATURE CONSTRUCTION. IT INCORPORATES A PAIR OF BALANCED DEFLECTORS TO DIRECT THE ELECTRON BEAM TO EITHER OF THE TWO PLATES AND A CONTROL GRID TO VARY THE INTENSITY OF THE BEAM. THE RESULTING UNIQUE CHARACTERISTICS OF THIS TUBE MAKE IT ESPECIALLY SUITED FOR SERVICE AS A SYNCHRONOUS DETECTOR IN COLOR TELEVISION RECEIVERS. THE 6JH8 IS ALSO SUITABLE FOR SERVICE IN THE BURST GATE CIRCUIT OF COLOR TV RECEIVERS AND A VARIETY OF OTHER SWITCHING AND GATING APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

DEFLECTOR #1 TO ALL	4.8	pf
DEFLECTOR #2 TO ALL	4.8	pf
GRID #1 TO ALL EXCEPT PLATES	7.5	pf
PLATE #1 TO ALL	5.0	pf
PLATE #2 TO ALL	5.0	pf
GRID #1 TO DEFLECTOR #1 (MAX.)	0.04	pf
GRID #1 TO DEFLECTOR #2 (MAX.)	0.07	pf
PLATE #1 TO PLATE #2	0.4	pf
DEFLECTOR #1 TO DEFLECTOR #2	0.38	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RE-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, EACH PLATE	330	VOLTS
ACCELERATOR VOLTAGE	330	VOLTS
PEAK POSITIVE DEFLECTOR VOLTAGE	165	VOLTS
PEAK NEGATIVE DEFLECTOR VOLTAGE	165	VOLTS
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
PLATE DISSIPATION, EACH PLATE	3.0	WATTS
ACCELERATOR DISSIPATION	1.0	WATTS
DC CATHODE CURRENT	33	MA.
GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.25	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS WITH DEFLECTORS GROUNDED

PLATE #1 VOLTAGE	250	VOLTS
PLATE #2 CONNECTED TO PLATE #1		
ACCELERATOR VOLTAGE	250	VOLTS
DEFLECTOR #1 VOLTAGE	0	VOLTS
DEFLECTOR #2 VOLTAGE	0	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
TOTAL PLATE CURRENT	14	MA.
ACCELERATOR CURRENT	1.5	MA.
GRID #1 TRANSCONDUCTANCE	4400	μMHOS
GRID #1 VOLTAGE, APPROXIMATE		
Ib (TOTAL) = 10 μAMPS.	-13	VOLTS

AVERAGE DEFLECTOR CHARACTERISTICS

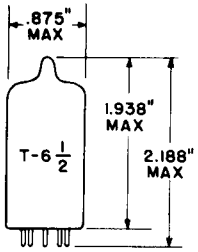
PLATE #1 VOLTAGE	250	VOLTS
PLATE #2 VOLTAGE	250	VOLTS
ACCELERATOR VOLTAGE	250	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
DEFLECTOR SWITCHING VOLTAGE, MAX.[A]	20	VOLTS
DEFLECTOR BIAS VOLTAGE FOR MINIMUM DEFLECTOR SWITCHING VOLTAGE[A]	-14	VOLTS
VOLTAGE DIFFERENCE BETWEEN DEFLECTORS FOR Ib = Ib2, APPROX.	0	VOLTS
PLATE #1 CURRENT, MAXIMUM Ed1 = -15 VOLTS, Ed2 = +15 VOLTS	0.7	MA.
PLATE #2 CURRENT, MAXIMUM Ed1 = +15VOLTS, Ed2 = -15 VOLTS	0.7	MA.
DEFLECTOR-#1 CURRENT, MAXIMUM Ed1 = +25VOLTS, Ed2 = -25 VOLTS	0.1	MA.
DEFLECTOR #2 CURRENT, MAXIMUM Ed1 = -25 VOLTS, Ed2 = +25 VOLTS	0.1	MA.

[A]DEFLECTOR SWITCHING VOLTAGE IS DEFINED AS THE TOTAL VOLTAGE CHANGE ON EITHER DEFLECTOR WITH AN EQUAL AND OPPOSITE CHANGE ON THE OTHER DEFLECTOR REQUIRED TO SWITCH THE PLATE CURRENT FROM ONE PLATE TO THE OTHER.

NOTE: THE 6JH8 SHOULD BE SO LOCATED IN THE EQUIPMENT THAT IT IS NOT SUBJECTED TO STRAY MAGNETIC FIELDS.

TUNG-SOL

DUO TRIODE
MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON 9 PIN E9-1

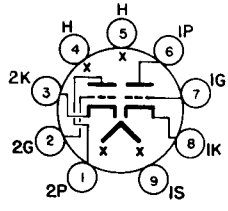
OUTLINE DRAWING

JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FRAME GRID RF AMPLIFIER AND OSCILLATOR MIXER

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 9AJ

THE 6JK8 IS A DISSIMILAR DUO TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR FM TUNERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD

	SECTION #1		SECTION #2	
GRID TO PLATE	1.4		.60	pf
INPUT: G TO (H+K+I.S.+E.S.)	3.0		5.0	pf
OUTPUT: P TO(H+K+I.S.+E.S.)	1.0		4.0	pf
HEATER TO CATHODE	2.8		2.8	pf
GRID TO GRID (MAX.)		.003		pf
PLATE TO PLATE (MAX.)		.009		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	400	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION[B]		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	OSCILLATOR SECTION #1	R-F AMP. SECTION #2	
PLATE VOLTAGE	165	200	VOLTS
PLATE DISSIPATION	1.0	2.0	WATTS
DC CATHODE CURRENT	22	22	MA.
NEGATIVE GRID VOLTAGE	50	50	VOLTS
GRID CIRCUIT RESISTANCE (SELF BIAS)	1.0	1.0	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

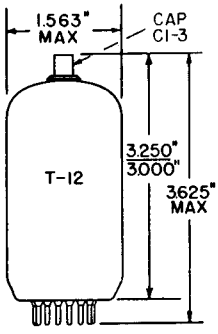
	OSCILLATOR SECTION #1	R-F AMP. SECTION #2	
PLATE VOLTAGE	100	135	VOLTS
GRID VOLTAGE	-1.0	-1.2	VOLTS
PLATE CURRENT	5.3	10	MA.
TRANSCONDUCTANCE	6800	13 000	μMHOS
AMPLIFICATION FACTOR	55	70	
PLATE RESISTANCE (APPROX.)	8000	5400	OHMS
Ec FOR Ib = 20 μA. (APPROX.)	-4.4	---	VOLTS
Ec FOR Gm = 150 μMHOS (APPROX.)	---	-5.5	VOLTS
Ec FOR Gm = 1500 μMHOS APPROX.)	---	-2.8	VOLTS

[B] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED VALUES.

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BEAM PENTODE

FOR

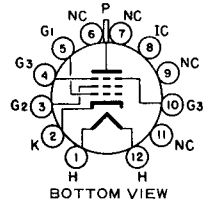
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FK

THE 6JM6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMZE "SNIVETS"
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6JM6 IS IDENTICAL TO THE 17JM6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.34	pf
INPUT: G1 TO (H + K + G2 + G3)	16	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.2	AMPS.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEG. W/ RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POS. W/ RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE - SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY).	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

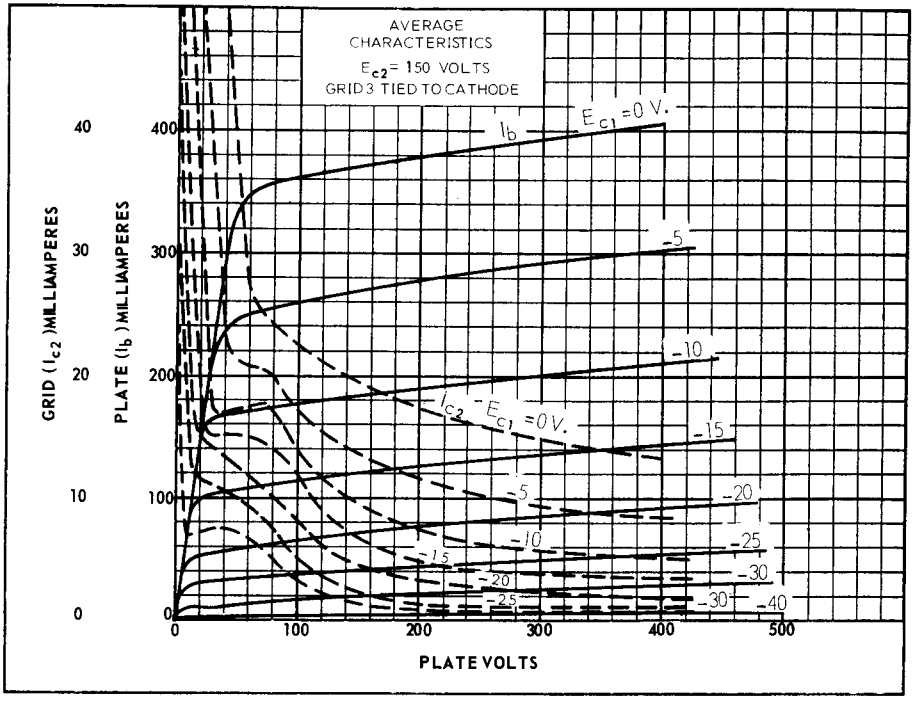
A - IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

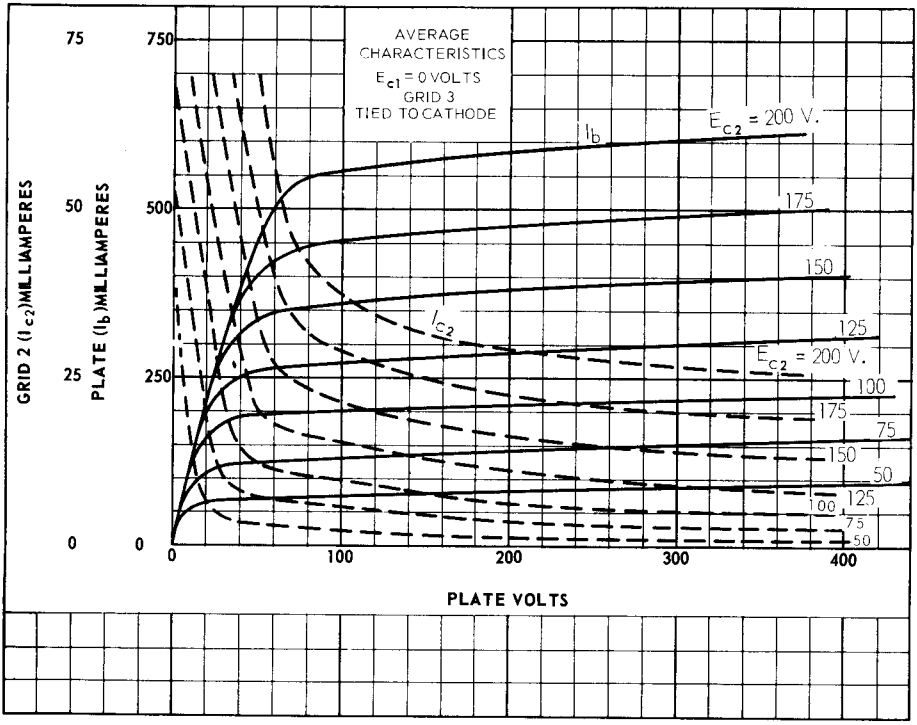
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	250	VOLTS
GRID 3 - CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	–	0 [B]	–22.5	VOLTS
PLATE CURRENT	–	345	65	MA.
GRID 2 CURRENT	–	27	1.8	MA.
TRANSCONDUCTANCE	–	–	7,300	μMHOS
PLATE RESISTANCE - APPROX.	–	–	18,000	OHMS
GRID 1 VOLTAGE AT I_b = 1.0 MA. - APPROX.	–100	–	–42	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	–	–	4.4	

B - APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

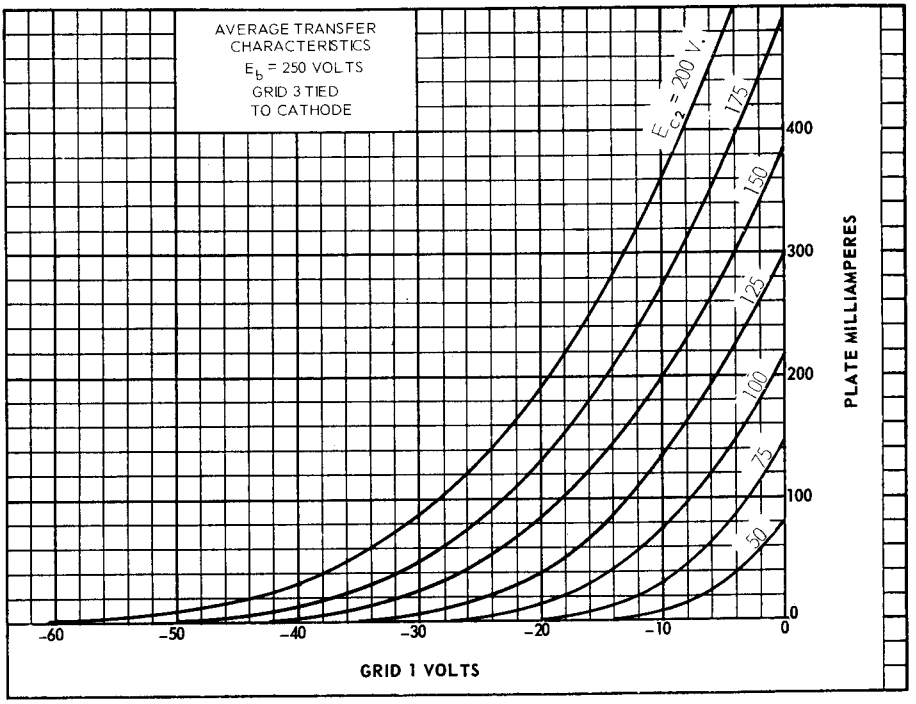
C - TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2}$ = 150 VOLTS AND E_{c1} = -22.5 VOLTS

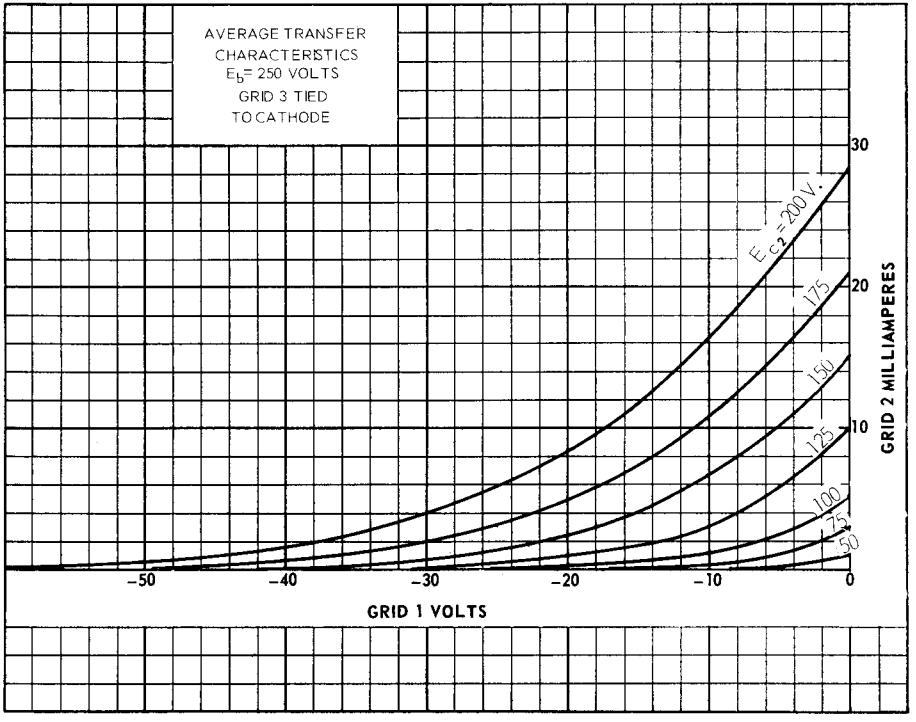




TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., APRIL 1, 1964 PLATE #6879 PLATE #6881

6JM6

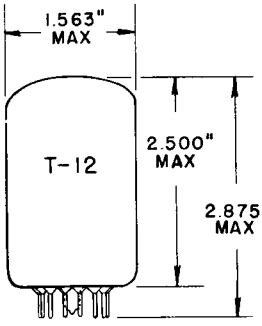

AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
400
300
200
100
0
PLATE MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID 1 VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b= 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
30
20
10
GRID 2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BEAM PENTODE

FOR

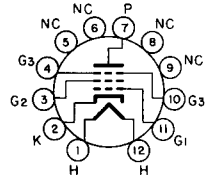
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FK

THE 6JN6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMZE "SNIVETS".
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6JN6 IS IDENTICAL TO THE 12JN6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.34	pf
INPUT: G1 TO (H + K + G2 + G3)	16	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.2	AMPS.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEG. W/ RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POS. W/ RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE - SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY).	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

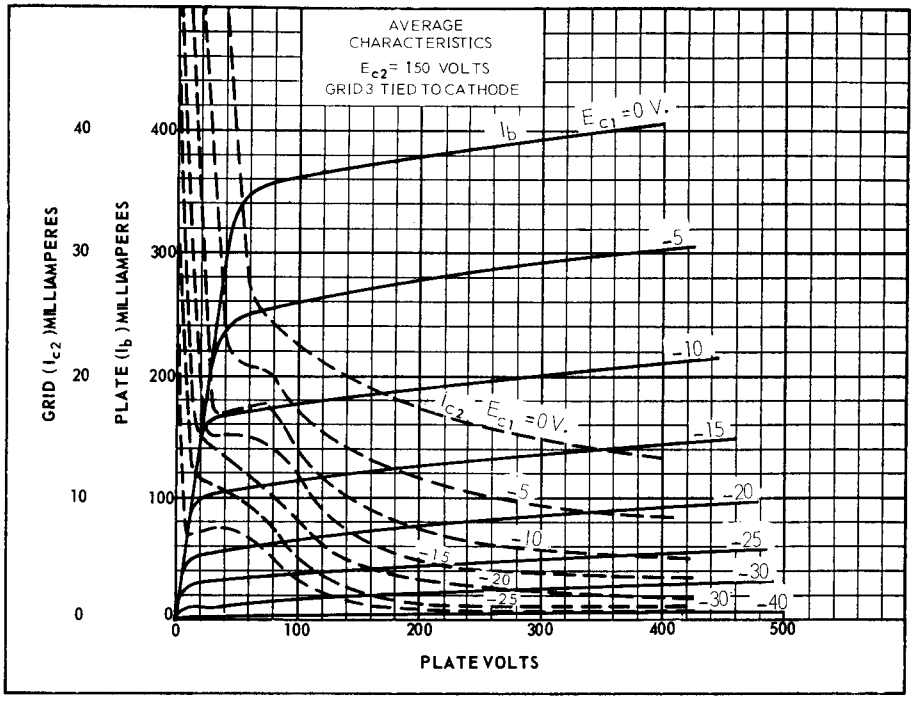
A - IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

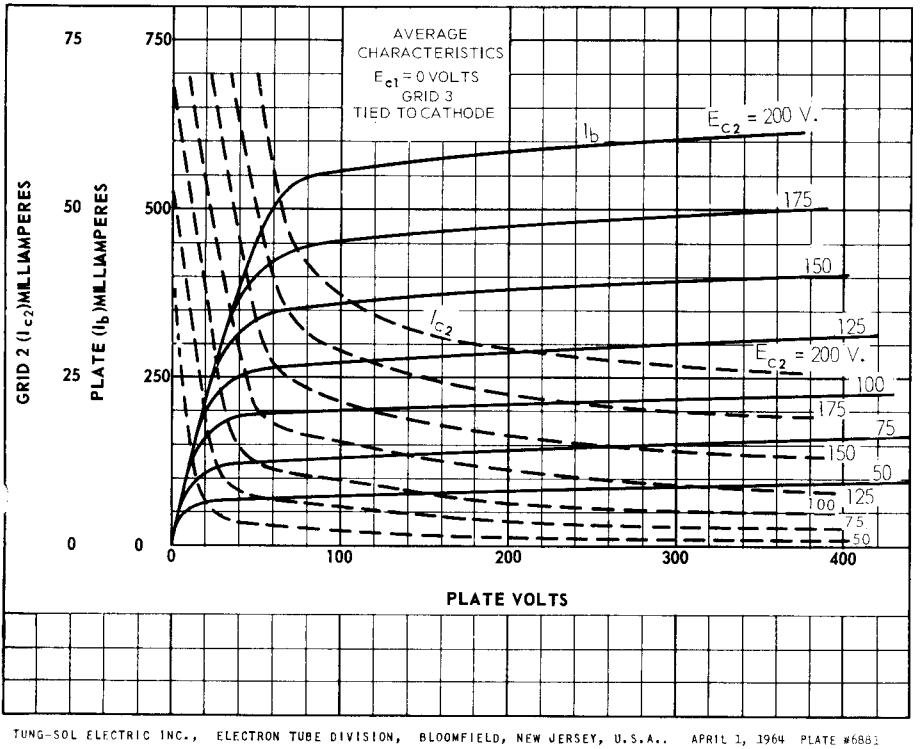
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	250	VOLTS
GRID 3 - CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	–	0 [B]	−22.5	VOLTS
PLATE CURRENT	–	345	65	MA.
GRID 2 CURRENT	–	27	1.8	MA.
TRANSCONDUCTANCE	–	–	7,300	μMHOS
PLATE RESISTANCE - APPROX.	–	–	18,000	OHMS
GRID 1 VOLTAGE AT I_b = 1.0 MA. - APPROX.	−100	–	−42	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	–	–	4.4	

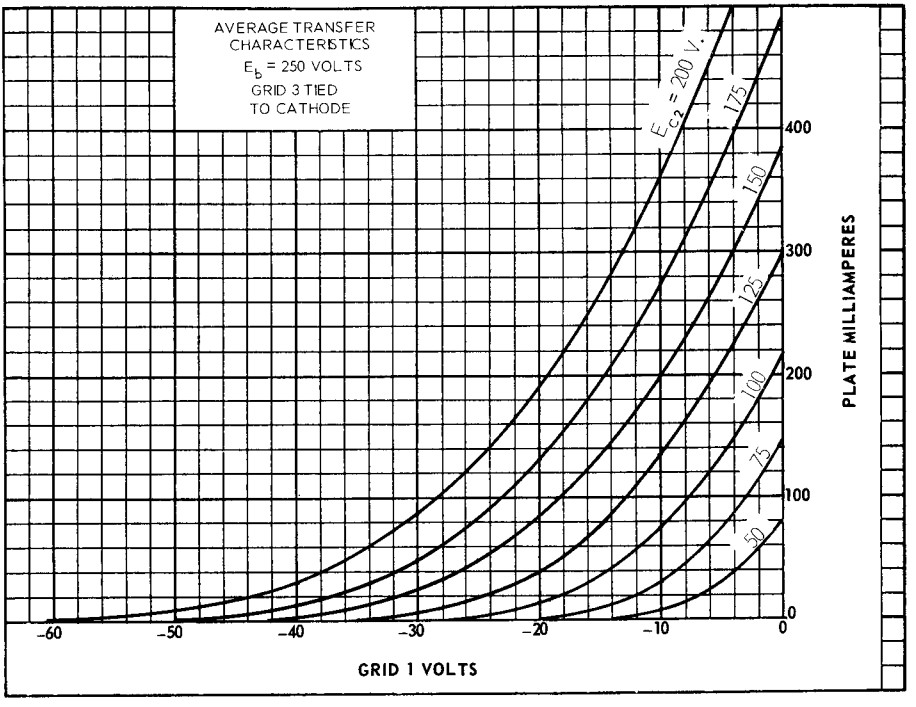
B - APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

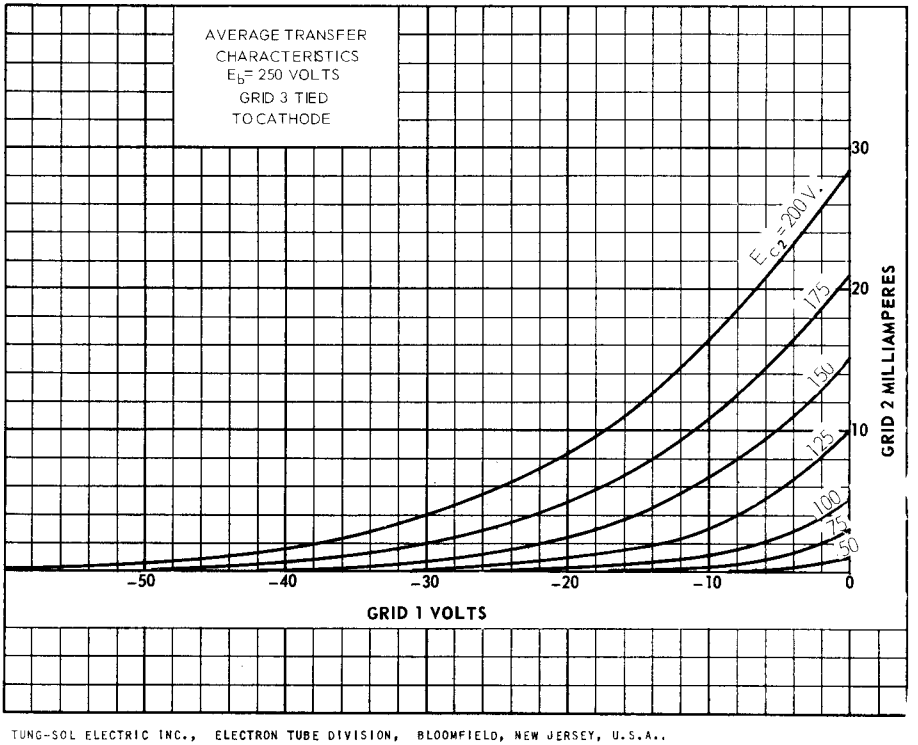
C - TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} =$ 150 VOLTS AND $E_{c1} =$ -22.5 VOLTS


AVERAGE
CHARACTERISTICS
E_{c2} = 150 VOLTS
GRID 3 TIED TO CATHODE
GRID (I_{c2}) MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
I_b
E_{c1} = 0 V.
-5
-10
-15
I_{c2}
E_{c1} = 0 V.
-5
-10
-15
-20
-25
-30
-40
0
10
20
30
40
100
200
300
400
500


AVERAGE
CHARACTERISTICS
E_{c1} = 0 VOLTS
GRID 3
TIED TO CATHODE
GRID 2 (I_{c2}) MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
I_b
E_{c2} = 200 V.
175
150
125
100
75
50
I_{c2}
E_{c2} = 200 V.
175
150
125
100
75
50
0
25
50
75
250
500
750
100
200
300
400

6JN6


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
400
300
200
100
0
PLATE MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

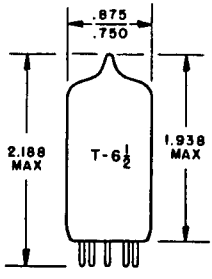

AVERAGE TRANSFER
CHARACTERISTICS
E_b= 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
30
20
10
GRID 2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2

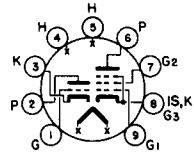


SMALL BUTTON BASE
9 PIN JEDEC E9-1

FOR
APPLICATIONS IN
FM OR TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9FA



BOTTOM VIEW

THE 6JN8 IS A SHARP-CUTOFF PENTODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR OSCILLATOR SERVICE IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 6JN8 IS IDENTICAL TO THE 19JN8.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE

PENTODE SECTION:			
GRID 1 TO PLATE: (G1 TO P)	MAX.	0.01	pf
INPUT: G_1 TO (H + K + G_2 + G_3 + I.S.)		5.5	pf
OUTPUT: P TO (H + K + G_2 + G_3 + I.S.)		3.4	pf
TRIODE SECTION:			
GRID TO PLATE: (G TO P)		1.7	pf
INPUT: G TO (H + TK + PK + PG3 + I.S.)		3.2	pf
OUTPUT: P TO (H + TK + PK + PG3 + I.S.)		2.2	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	mA
AVERAGE HEATER WARM-UP		11	SECONDS
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
HEATER-CATHODE VOLTAGE: EACH SECTION:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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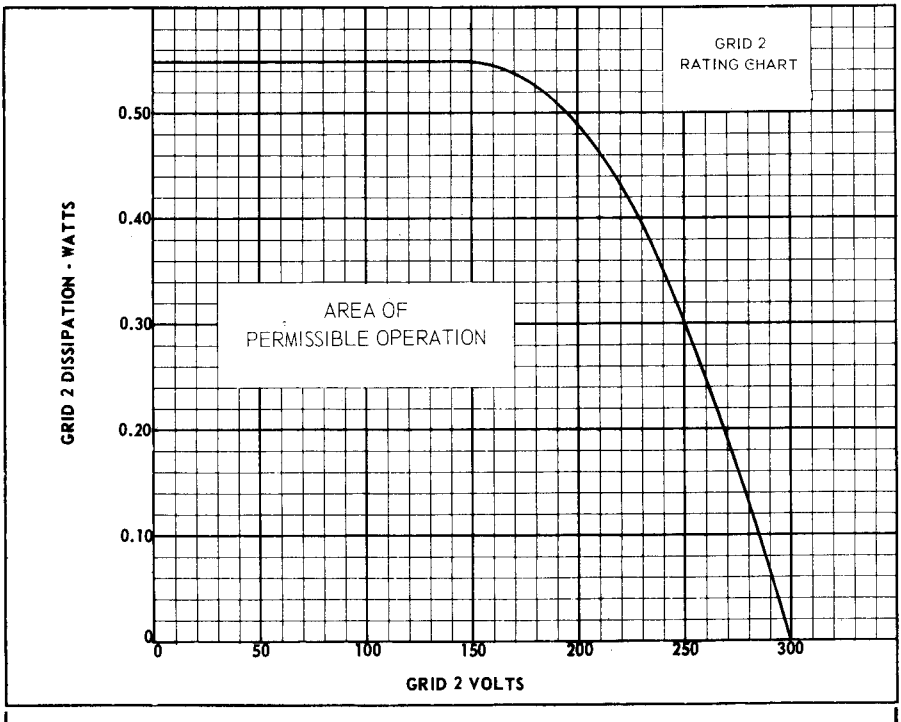
MAXIMUM RATINGS

DESIGN • MAXIMUM VALUES • SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 SUPPLY VOLTAGE	–	300	VOLTS
GRID 2 VOLTAGE	–	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.5	2.5	WATTS
GRID 2 DISSIPATION	–	0.55	WATTS
GRID 1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	2.2	2.2	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS

AVERAGE CHARACTERISTICS AND TYPICAL OPERATION

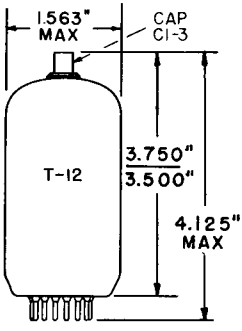
	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	–	125	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE CURRENT	13.5	12	mA
GRID 2 CURRENT	–	4.0	mA
TRANSCONDUCTANCE	8,500	7,500	μMHOS
AMPLIFICATION FACTOR	46	–	
PLATE RESISTANCE	5,400	200,000	OHMS
GRID 1 VOLTAGE (APPROX.) FOR I_b = 10 μA	-8	-8	VOLTS


GRID 2
RATING CHART
AREA OF
PERMISSIBLE OPERATION
GRID 2 DISSIPATION - WATTS
0.50
0.40
0.30
0.20
0.10
0
0
50
100
150
200
250
300
GRID 2 VOLTS

TUNG-SOL

PENTODE

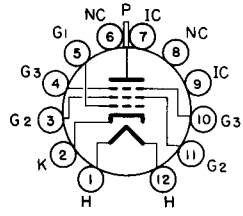
COMPACTRON



GLASS BULB
BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-89

BEAM PENTODE
FOR
TV HORIZONTAL-DEFLECTION
AMPLIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FY

THE 6JS6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMIZE "SNIVETS".

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.7	pf
INPUT: G1 TO (H + K + G2 + G3)	0.24	pf
OUTPUT: P TO (H + K + G2 + G3)	0.10	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	6.3 VOLTS	2.25	AMPS.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL - DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	990	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE - ABSOLUTE MAXIMUM	7,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,100	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	190	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	250	VOLTS
PLATE DISSIPATION [A]	28	WATTS
GRID 2 DISSIPATION	5.5	WATTS
DC CATHODE CURRENT	315	MA.
PEAK CATHODE CURRENT	1,100	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT ON BULB	225	° C

A- IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	70	175	VOLTS
GRID 3 CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	125	125	125	VOLTS
GRID 1 VOLTAGE	-	0	-25	VOLTS
PLATE CURRENT	-	570 [B]	125	MA.
GRID 2 CURRENT	-	34 [B]	4.5	MA.
GRID 1 VOLTAGE FOR I_b = 1.0 MA. - APPROX.	-140	-	-54	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	-	-	3	

B- VALUES MEASURED BY A METHODE INVOLVING A RECURRENT WAVEFORM SUCH THAT THE PLATE AND GRID 2 DISSIPATIONS WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

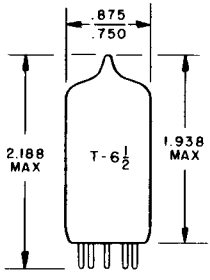
C- TRIODE CONNECTION (Grid 2 tied to plate) WITH $E_b = E_{c2} = 125$ VOLTS, AND $E_{c1} = -25$ VOLTS.

TUNG-SOL

QUADRUPLE DIODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2



BASE 9 PIN
BUTTON JEDEC E9-1

FOR

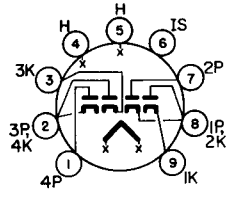
FM STEREO MULTIPLEX

EQUIPMENT AND COLOR

T.V. RECEIVERS

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9PQ



BOTTOM VIEW

THE 6JU8A IS A GENERAL-PURPOSE QUADRUPLE DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN PHASE-DETECTOR AND NOISE-IMMUNE COLOR-KILLER CIRCUITS OF COLOR-TELEVISION RECEIVERS AND PARTICULARLY FOR USE IN BRIDGE-MATRIXING CIRCUITS SUCH AS THOSE USED IN FM STERO MULTIPLEX EQUIPMENT. EXCEPT FOR A SMALLER T-6½ ENVELOPE, THE 6JU8A IS IDENTICAL TO THE 6JU8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PLATE OF UNIT 1 & CATHODE OF UNIT 2 TO CATHODE OF UNIT 1	1.8	pf
PLATE OF UNIT 1 & CATHODE OF UNIT 2 TO PLATE OF UNIT 2	2.2	pf
PLATE OF UNIT 2 TO INTERNAL SHIELD AND HEATER	0.62	pf
PLATE OF UNIT 3 & CATHODE OF UNIT 4 TO CATHODE OF UNIT 3	1.9	pf
PLATE OF UNIT 3 & CATHODE OF UNIT 4 TO PLATE OF UNIT 4	2.2	Pf
PLATE OF UNIT 4 TO INTERNAL SHIELD AND HEATER	0.94	pf
CATHODE OF UNIT 1 TO INTERNAL SHIELD AND HEATER	1.8	pf
CATHODE OF UNIT 3 TO INTERNAL SHIELD AND HEATER	1.9	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
PEAK HEATER - CATHODE VOLTAGE - EACH UNIT:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		300	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH UNIT

PEAK INVERSE PLATE VOLTAGE	300	VOLTS
PEAK PLATE CURRENT	54	mA
DC OUTPUT CURRENT	9	mA

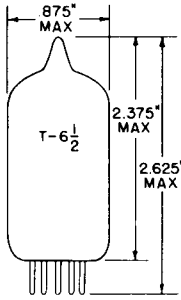
CHARACTERISTICS - INSTANTANEOUS VALUE

EACH UNIT

PLATE CURRENT FOR E_b = 10 VOLTS	60	mA

TUNG-SOL

TRIODE PENTODE
MINIATURE TYPE

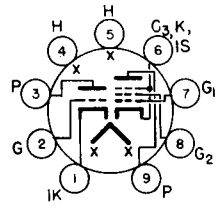


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR COMBINED VIDEO AMPLIFIER AND GENERAL PURPOSE T.V. APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6JV8 IS A TRIODE PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE IN SOUND IF, KEYED A.G.C., SYNC-SEPARATION, SYNC-AMPLIFICATION OR NOISE SUPPRESSION CIRCUITS; THE PENTODE SECTION IS DESIGNED FOR USE AS A VIDEO AMPLIFIER. THE HEATER MAY BE OPERATED FROM A TRANSFORMER OR IN A SERIES STRING.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

TRIODE:		
GRID TO PLATE: Tg TO Tp	2.2	pf
INPUT Tg TO (h+Tk+Pk, Pg3, i.s.)	3.0	pf
OUTPUT: Tp TO (h+Tk+Pk, Pg3, i.s.)	2.0	pf
PENTODE:		
GRID 1 TO PLATE: Pg1 to Pp (MAX)	0.08	pf
INPUT: Pg1 TO (h+Pg2+Pk, Pg3, i.s.)	8.0	pf
OUTPUT: Pp TO (h+Pg2+Pk, Pg3, i.s.)	3.2	pf
COUPLING:		
PENTODE GRID 1 TO TRIODE PLATE: Pg1 TO Tp (MAX.)	0.012	pf
PENTODE PLATE TO TRIODE PLATE: Pp TO Tp (MAX.)	0.24	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF APPLIED VOLTAGE		6.3±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE - BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION	1.1	4,0	WATTS
GRID 2 VOLTAGE	----	330	VOLTS
GRID 2 DISSIPATION	----	1.7	WATTS
NEGATIVE GRID 1 VOLTAGE	50	50	VOLTS
POSITIVE GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHMS
FOR FIXED BIAS OPERATION	0.5	0.25	MEGOHM

AVERAGE CHARACTERISTICS

	TRIODE	PENTODE		
PLATE VOLTAGE	200	125	200	VOLTS
GRID 2 VOLTAGE	----	125	200	VOLTS
GRID 1 VOLTAGE	-2.0	-1.0	-2.9	VOLTS
PLATE CURRENT	4	22	22	MA.
GRID 2 CURRENT	----	4	4	MA.
TRANSCONDUCTANCE	4,000	11,500	10,700	μMHOS
PLATE RESISTANCE - APPROX.	17.5	100	150	KOHMS
AMPLIFICATION FACTOR	70	----	----	
GRID 1 VOLTAGE FOR I_b=20μA (APPROX.)	-5	-5.5	-9	VOLTS

KNEE CHARACTERISTICS

E_{c1} = 0 INSTANTANEOUSLY

PLATE VOLTAGE	----	40	60	VOLTS
GRID 2 VOLTAGE	----	125	200	VOLTS
PLATE CURRENT	----	28	51	MA.
GRID 2 CURRENT	----	9	14	MA.

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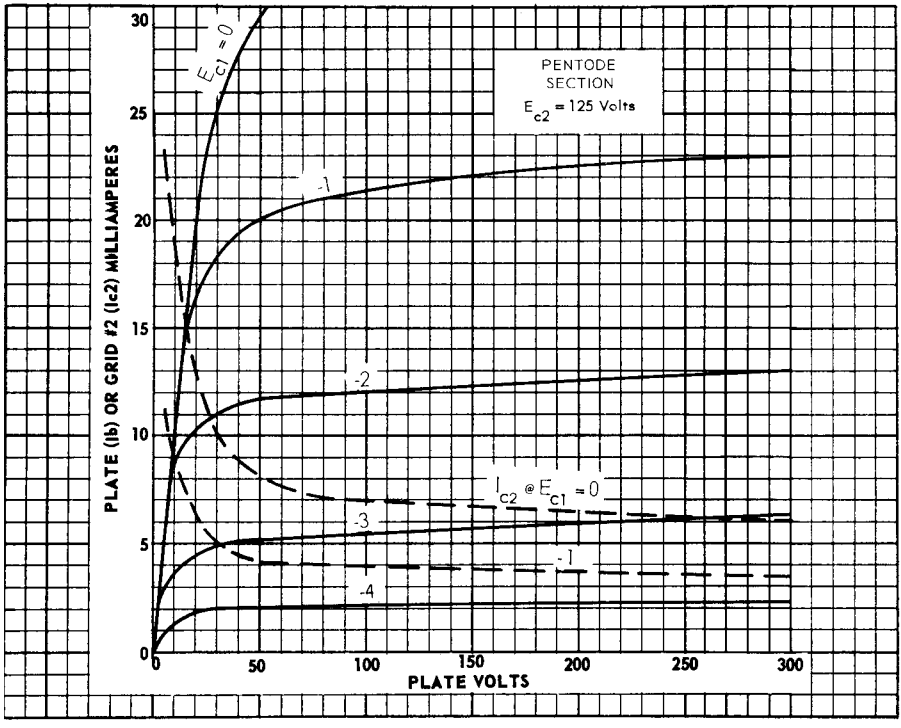

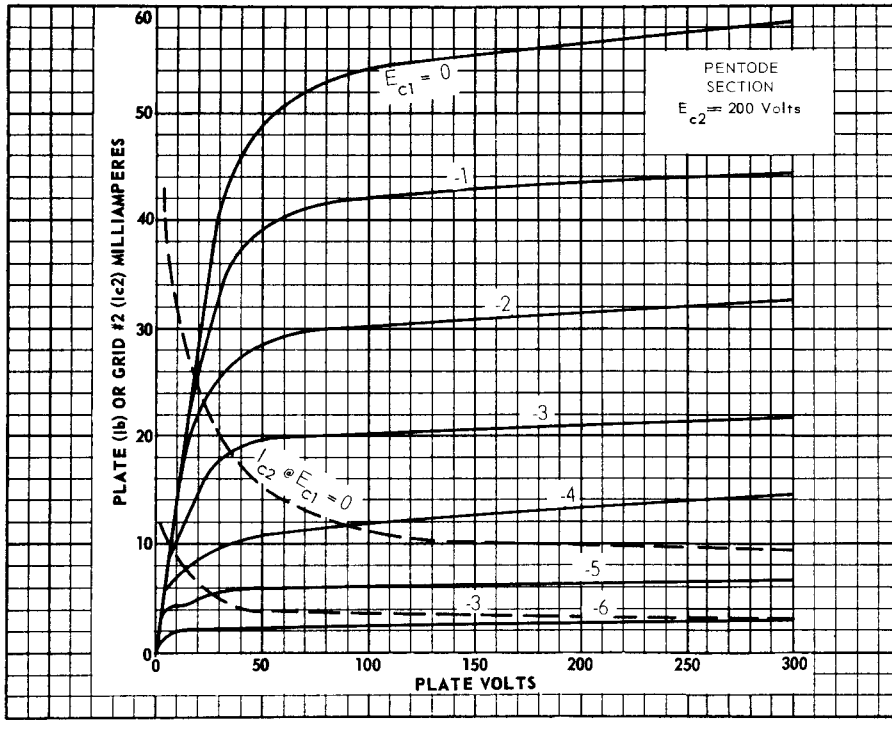

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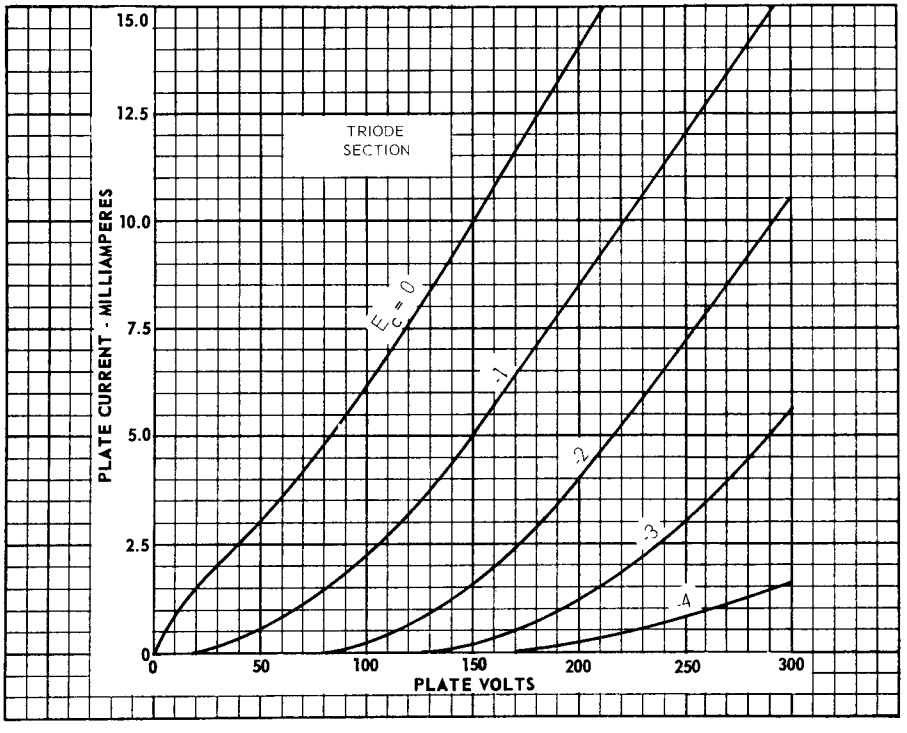
6JV8

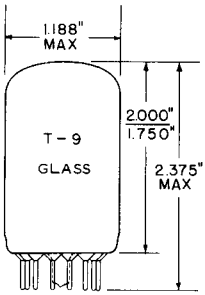

TRIODE
SECTION
PLATE CURRENT - MILLIAMPERES
15.0
12.5
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
300
PLATE VOLTS
Ec = 0
-.1
-.2
-.3
-.4

TUNG-SOL

TRIODE-PENTODE

COMPACTRON

OUTLINE DRAWING
JEDEC 9-58



BASE 12 PIN BUTTON
JEDEC E12-70

MEDIUM-MU TRIODE AND BEAM PENTODE

FOR

VERTICAL-DEFLECTION OSCILLATOR

AND VERTICAL-DEFLECTION AMPLIFIER

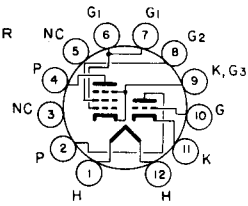
SERVICE

IN T.V. APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12DZ



BOTTOM VIEW

THE 6JZ8 IS A MEDIUM - MU TRIODE AND A BEAM PENTODE IN THE 12 PIN COMPACTRON CONSTRUCTION. THE TRIODE IS DESIGNED FOR SERVICE AS A VERTICAL-DEFLECTION OSCILLATOR AND THE PENTODE AS A VERTICAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION	
GRID 1 TO PLATE (g TO p)	0.34 pf
INPUT: G1 TO (H + K + G_2 + G_3)	11 pf
OUTPUT: P TO (H + K + G_2 + G_3)	7.0 pf
TRIODE SECTION	
GRID TO PLATE (G TO P)	3.6 pf
INPUT: G TO (H + K)	2.2 pf
OUTPUT: P TO (H + K)	0.7 pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUE - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1,200	MA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.6	VOLTS
HEATER-CATHODE VOLTAGE:			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
	VERTICAL OSCILLATOR [A] SERVICE	VERTICAL DEFLECTION [A] AMPLIFIER SERVICE	
PLATE VOLTAGE - DC	250	250	VOLTS
PEAK PULSE PLATE VOLTAGE		2,000	VOLTS
GRID 2 VOLTAGE		200	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	400	150	VOLTS
PLATE DISSIPATION	1.0	7.0 [B]	WATTS
GRID 2 DISSIPATION		1.8	WATTS
CATHODE CURRENT - DC	20	70	MA
PEAK CATHODE CURRENT	70	245	MA
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	1.0	1.0	MEGOHMS
WITH CATHODE BIAS	2.0	2.0	MEGOHMS

A FOR OPERATION IN A 525 - LINE, 30 - FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE.

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CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION		
PLATE VOLTAGE	150	45	120	VOLTS
GRID 2 VOLTAGE		110	110	VOLTS
GRID 1 VOLTAGE	-5.0	0 C	-8.0	VOLTS
PLATE CURRENT	5.5	122	46	MA
GRID 2 CURRENT		16.5	3.5	MA
AMPLIFICATION FACTOR	20			
TRANSCONDUCTANCE	2,350		7,100	μMHOS
PLATE RESISTANCE - APPROX.	8.5		11.7	KOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA APPROX.	-11		-25	VOLTS

C APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

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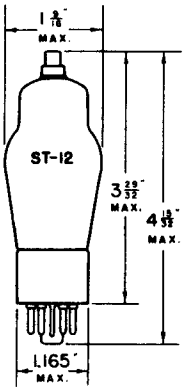

GENERAL PURPOSE

HIGH-MU TRIODE

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

G-5U

BOTTOM VIEW

SMALL 7 PIN OCTAL BASE

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1.5	−3	VOLTS
PLATE CURRENT	0.35	1.1	MA.
PLATE RESISTANCE	78 000	50 000	OHMS
TRANSCONDUCTANCE	900	1400	μMHOS
AMPLIFICATION FACTOR	70	70	

DIRECT INTERELECTRODE CAPACITANCES[5]

GRID TO CATHODE	3.0	μμf
PLATE TO CATHODE	5.5	μμf
GRID TO PLATE	2.2	μμf

[5] WITH SHIELD

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PLATE 399-2

MAY 8 1939

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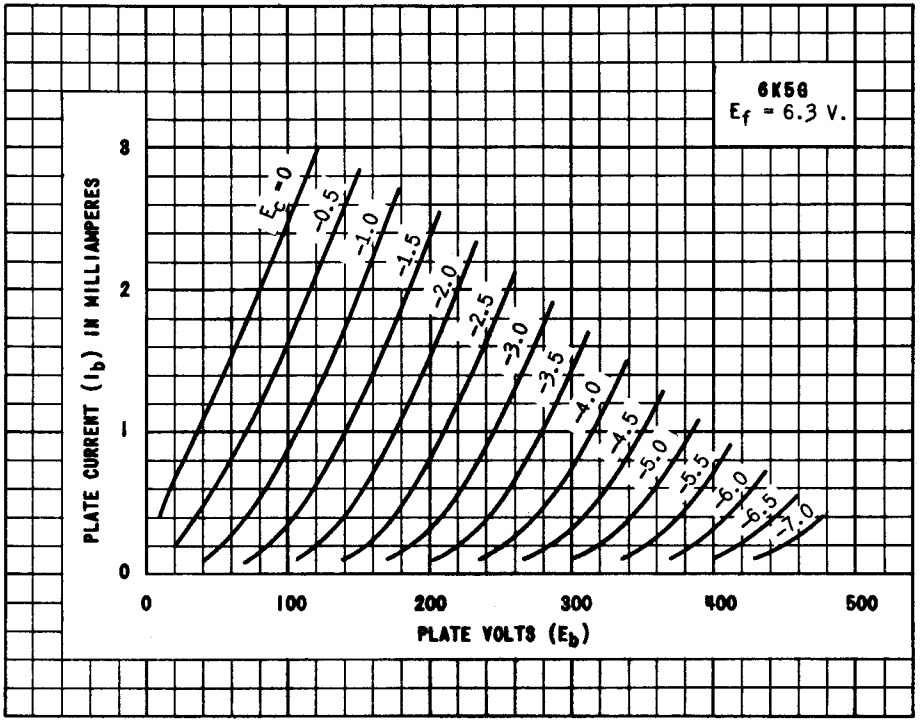
6K5 G



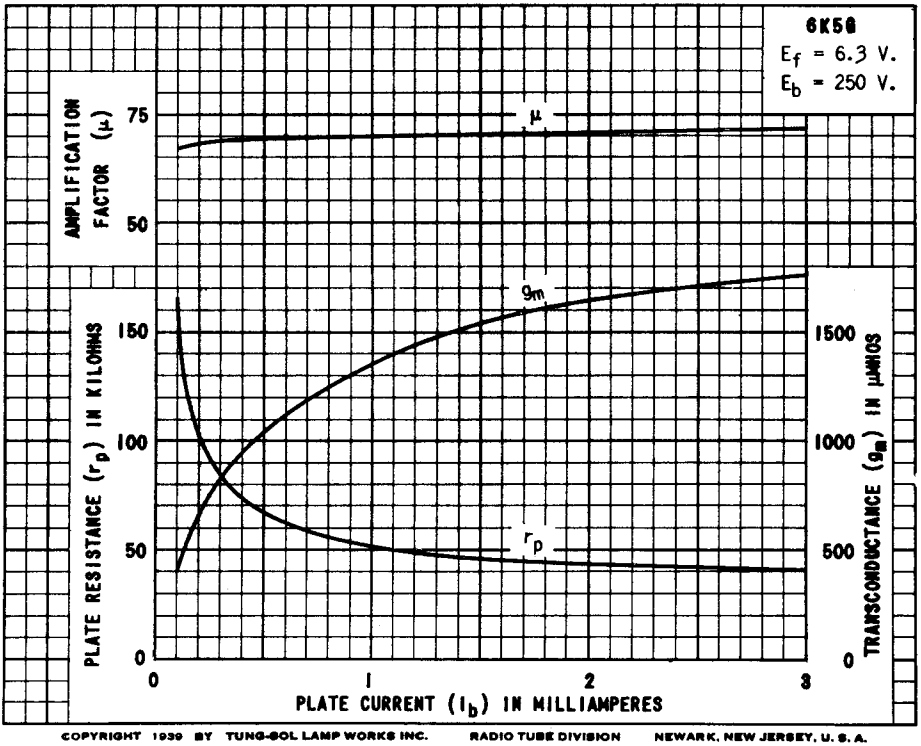


PLATE 398-1

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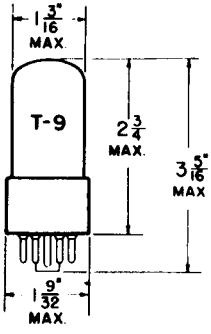
PENTODE

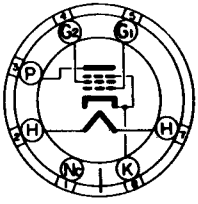


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7S

THE 6K6GT IS AN INDIRECTLY HEATED CATHODE TYPE POWER AMPLIFIER PENTODE DESIGNED FOR SERVICE IN THE OUTPUT STAGES OF AC, AC/DC AND STORAGE BATTERY OPERATED RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G_1 TO P)	0.5	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	5.5	μμf
OUTPUT: P TO (H+K+G_2+G_3)	6.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	CLASS A_1 AMPLIFIER	VERTICAL DEFLECTION AMPLIFIER[AB]	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	315	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	---	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	8.5	7	WATTS
MAXIMUM GRID #2 DISSIPATION	2.8	---	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	---	25	MA.
MAXIMUM PEAK CATHODE CURRENT	---	75	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS OPERATION	0.1	---	MEGOHM
CATHODE BIAS OPERATION	0.5	2.2	MEGOHMS

[A] TRIODE CONNECTION.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 3094
DEC. 1 1952

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.4	0.4	0.4	AMP.
PLATE VOLTAGE	100	250	315	VOLTS
GRID #2 VOLTAGE	100	250	250	VOLTS
GRID #1 VOLTAGE	-7	-18	-21	VOLTS
PEAK AF GRID #1 VOLTAGE	7	18	21	VOLTS
ZERO-SIGNAL PLATE CURRENT	9	32	25.5	MA.
MAXIMUM-SIGNAL PLATE CURRENT	9.5	33	28	MA.
ZERO-SIGNAL GRID #2 CURRENT	1.6	5.5	4.0	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	3	10	9	MA.
PLATE RESISTANCE (APPROX.)	104 000	90 000	110 000	OHMS
TRANSCONDUCTANCE	1 500	2 300	2 100	µMHOS
LOAD RESISTANCE	12 000	7 600	9 000	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	0.35	3.4	4.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	11	11	15	PERCENT

CLASS A_1 AMPLIFIER – PUSH-PULL[D]

	FIXED BIAS	CATHODE BIAS	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.4	0.4	AMP.
PLATE VOLTAGE	235	285	VOLTS
GRID #2 VOLTAGE	285	285	VOLTS
GRID #1 VOLTAGE	-25.5	---	VOLTS
CATHODE RESISTOR	---	400	OHMS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	51	51	VOLTS
ZERO-SIGNAL PLATE CURRENT	55	55	MA.
MAXIMUM-SIGNAL PLATE CURRENT	72	61	MA.
ZERO-SIGNAL GRID #2 CURRENT	9	9	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	17	13	MA.
PLATE-TO-PLATE LOAD RESISTANCE	12 000	12 000	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	10.5	9.8	WATTS
TOTAL HARMONIC DISTORTION	6	4	PERCENT

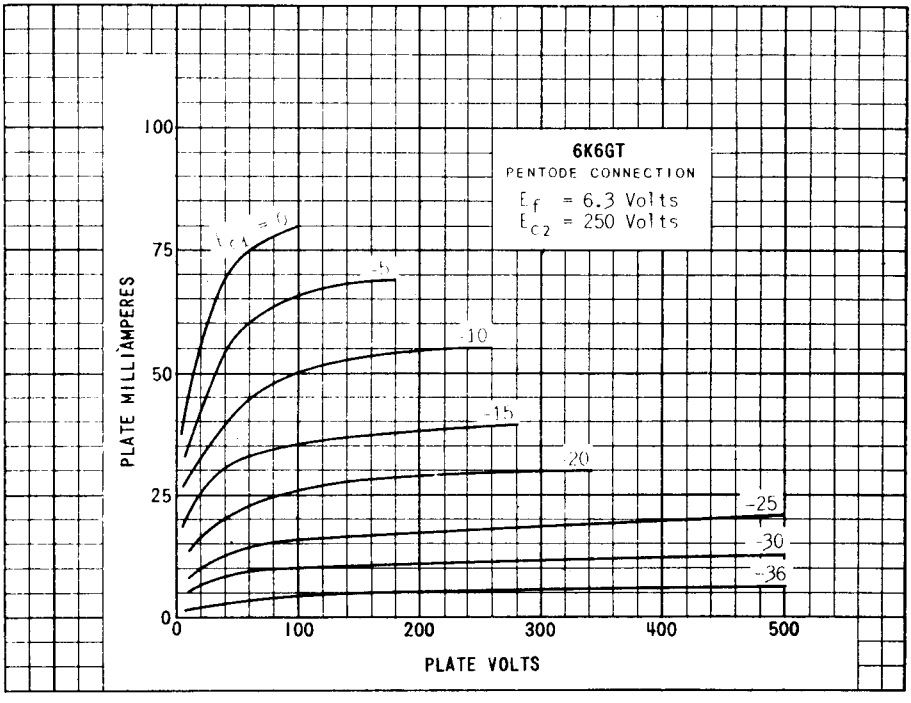
[D] UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

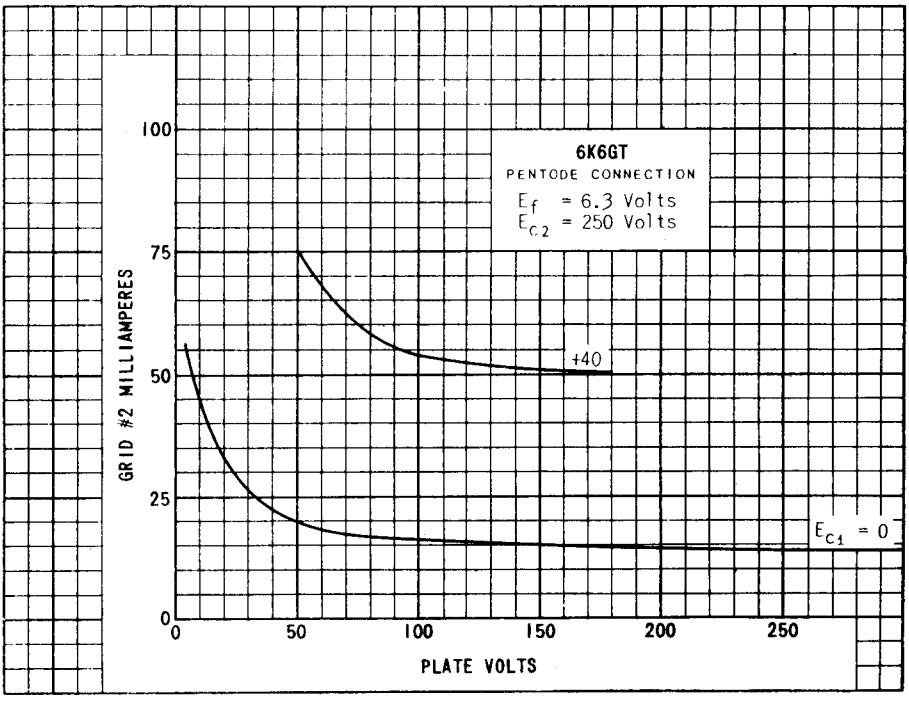
CLASS A_1 AMPLIFIER – TRIODE CONNECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-18	VOLTS
PLATE CURRENT	37.5	MA.
TRANSCONDUCTANCE	2 700	µMHOS
AMPLIFICATION FACTOR	6.8	
PLATE RESISTANCE (APPROX.)	2 500	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-48	VOLTS

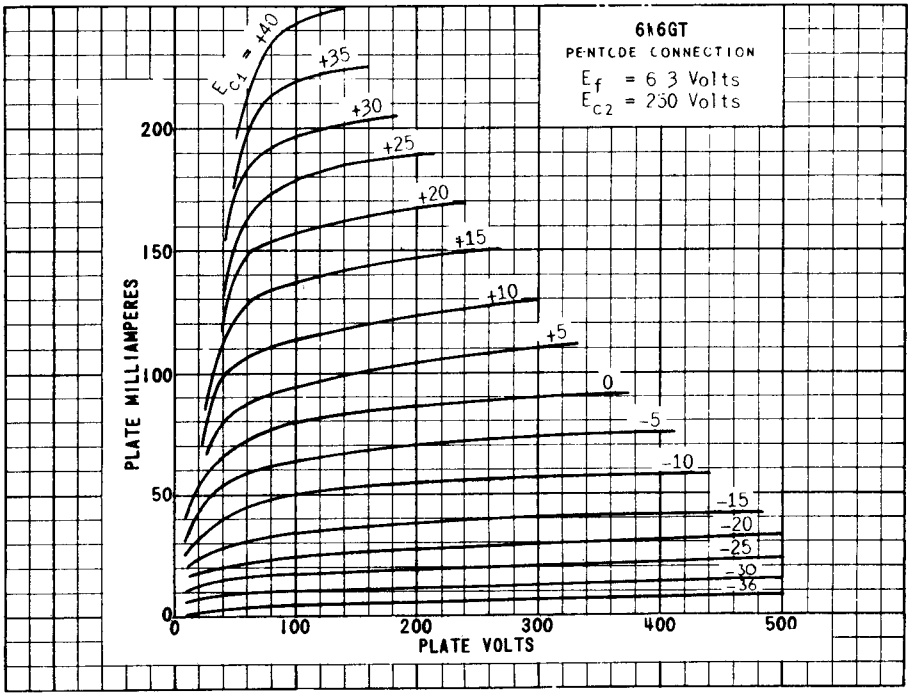
PLATE 3095
DEC. 1 1952

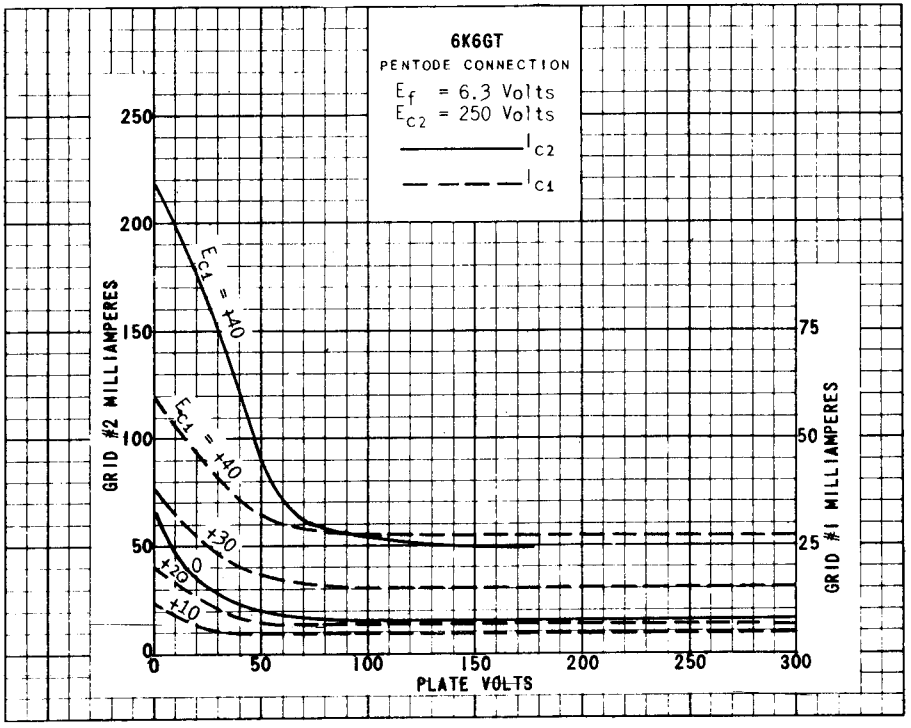
→ INDICATES A CHANGE OR ADDITION.


6K6GT
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
E_{c1} = 0
-5
-10
-15
-20
-25
-30
-36
PLATE MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
100
200
300
400
500


6K6GT
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
+40
E_{c1} = 0
GRID #2 MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
50
100
150
200
250

6K6GT (7B5, 41)





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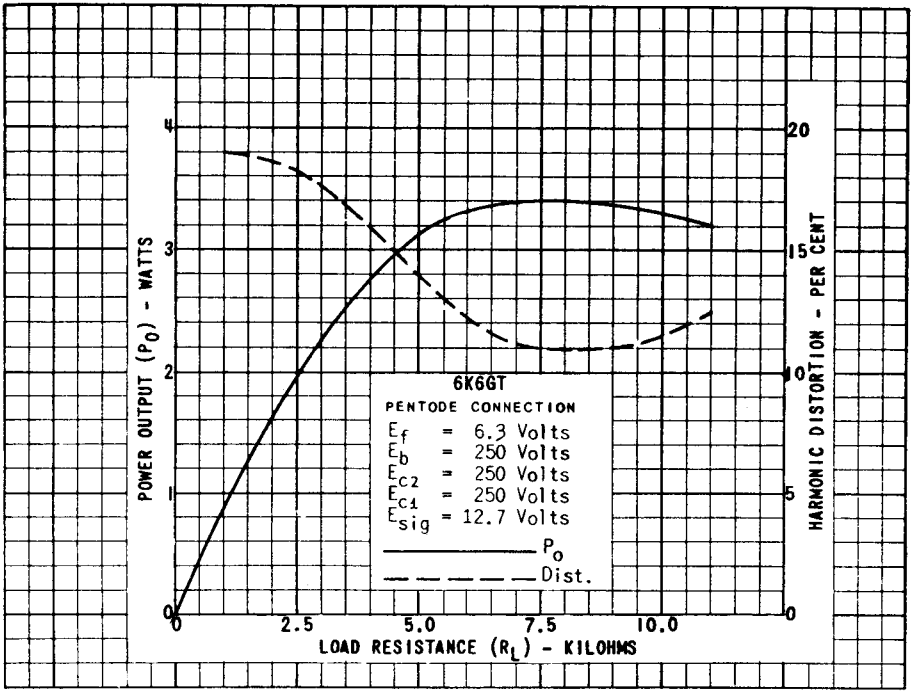

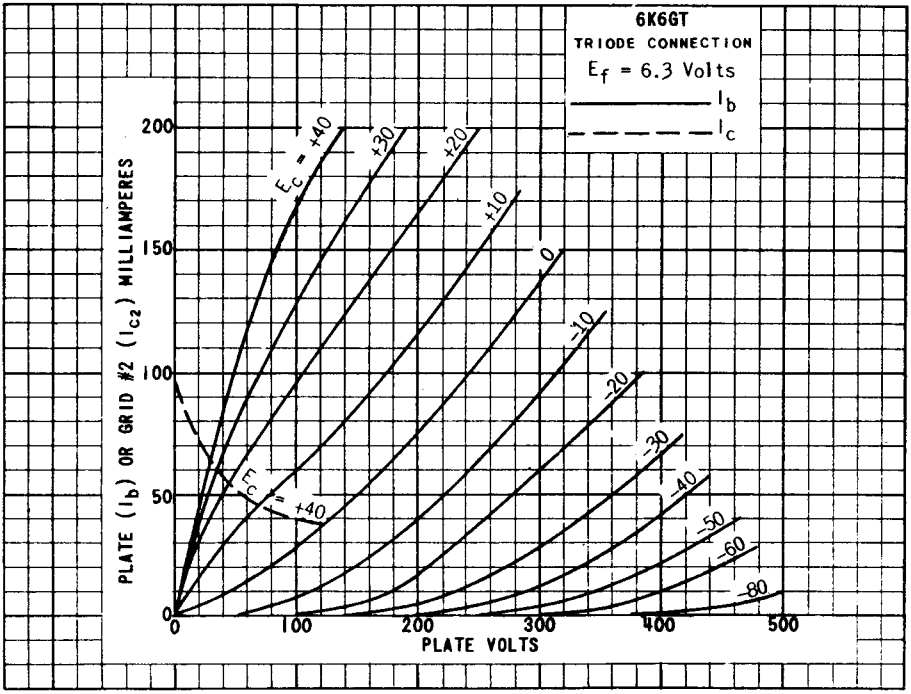

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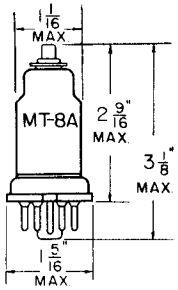
3098
DEC. 1
1952

TUNG-SOL

PENTODE

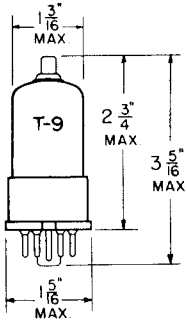


METAL SHELL

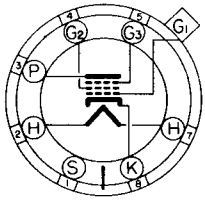
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

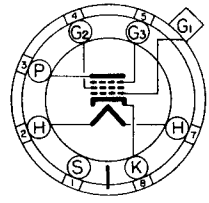
ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
7R



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
METAL SLEEVE
7R

THE 6K7,6K7GT IS A VARIABLE MU PENTODE AMPLIFIER IN THE OCTAL METAL (GLASS) CONSTRUCTION. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS AND MINIMIZES CROSS MODULATION.

DIRECT INTERELECTRODE CAPACITANCES

	6K7[A]	6K7GT[B]	
GRID TO PLATE: (G TO P) MAX.	0.005	0.005	μμf
INPUT: G_1 TO (H+K+G_2+G_3+S+IS)	7	4.6	μμf
OUTPUT: P TO (H+K+G_2+G_3+S+IS)	12	12	μμf

[A] WITH SHELL CONNECTED TO CATHODE
[B] WITH EXTERNAL SHIELD #308 CONNECTED TO PIN #1 AND PIN #8.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM GRID #2 DISSIPATION	0.35	WATT

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	300	300	300	MA.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #3 VOLTAGE	PIN #5 CONNECTED TO PIN #8 AT SOCKET			
GRID #2 VOLTAGE	100	100	125	VOLTS
GRID #1 VOLTAGE	-1	-3	-3	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.8	0.6	MEGOHM
TRANSCONDUCTANCE	1 650	1 450	1 650	µMHOS
PLATE CURRENT	9.5	7	10.5	MA.
GRID #2 CURRENT	2.7	1.7	2.6	MA.
GRID #1 VOLTAGE FOR G_m = 2 µMHOS (APPROX.)	-38.5	-42.5	-52.5	VOLTS

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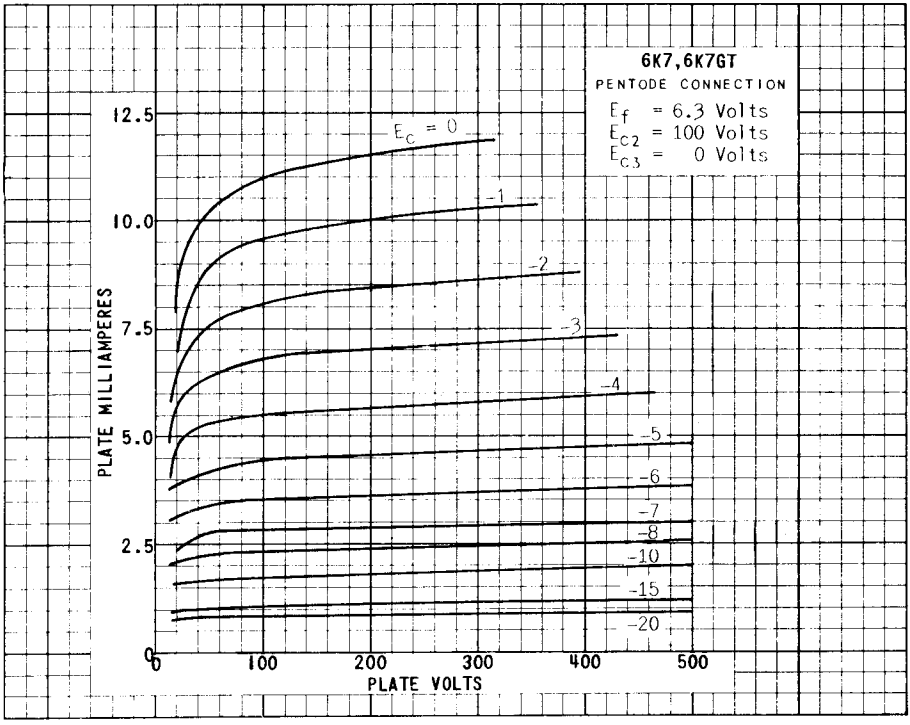

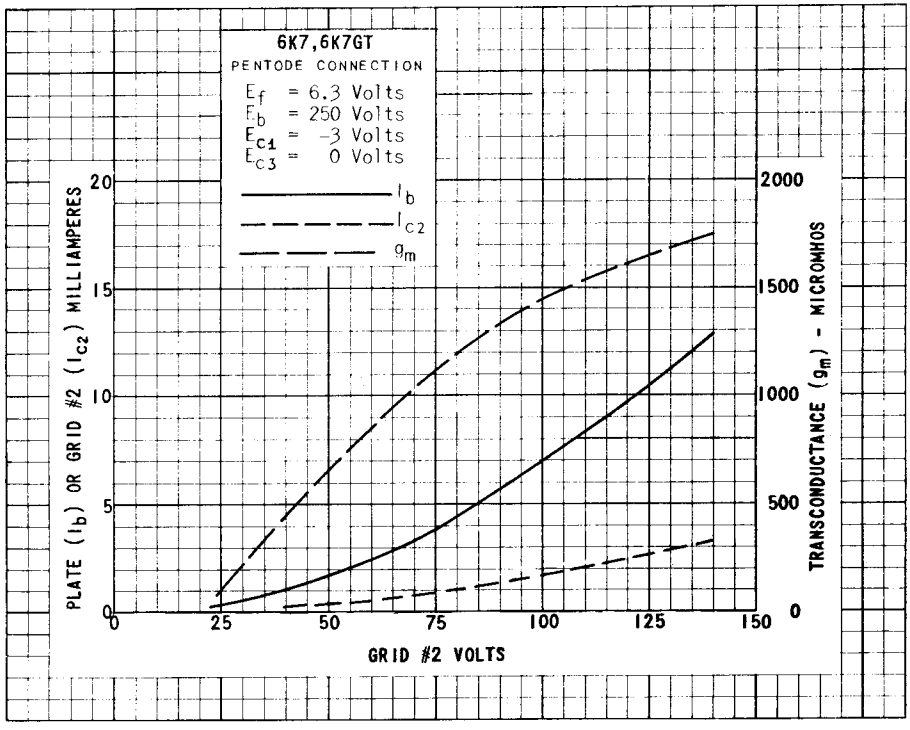

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6K7, 6K7GT (12K7GT)

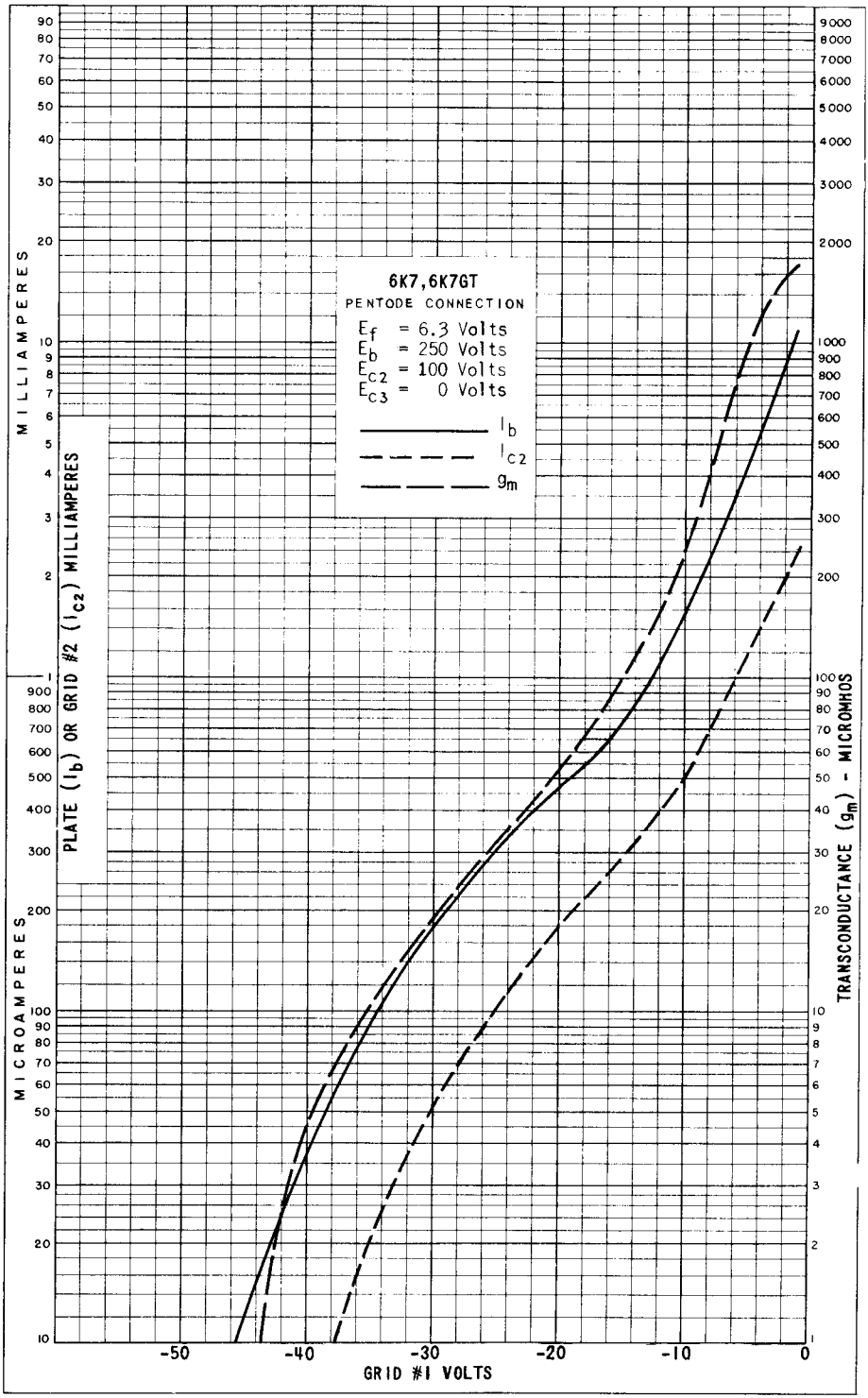

PLATE 2222

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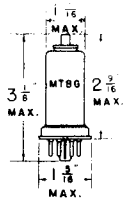
TUNG-SOL

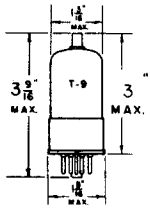


METAL TUBE
SMALL WAFER
8 PIN OCTAL BASE
6K8

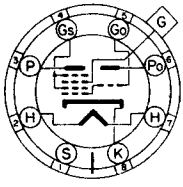
TRIODE HEXODE CONVERTER

UNIPOTENTIAL CATHODE

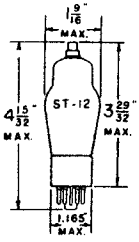
HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC



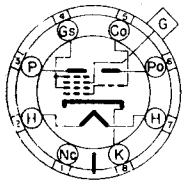
GLASS BULB
8 PIN OCTAL BASE
WITH METAL SHELL
6K8GT



8K
6K8, 6K8GT



GLASS BULB
SMALL 8 PIN OCTAL BASE
6K8G



G-8K
6K8G

THE TUNG-SOL 6K8, 6K8G AND 6K8GT CONSIST OF A TRIODE OSCILLATOR AND A HEXODE MIXER IN A COMMON ENVELOPE. THE PHYSICAL DESIGN OF THESE TUBES REDUCES INTERACTION BETWEEN THE OSCILLATOR AND MIXER SECTIONS AND MAKES FOR STABLE OPERATION IN SUPERHETERODYNE RECEIVERS ON THE HIGH FREQUENCIES AS WELL AS THE BROADCAST BAND.

RATINGS

MAXIMUM HEXODE PLATE (P) VOLTAGE	300	VOLTS
MAXIMUM HEXODE SCREEN (G_S) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM HEXODE SCREEN (G_S) VOLTAGE	150	VOLTS
MAXIMUM HEXODE PLATE DISSIPATION	0.75	WATT
MAXIMUM HEXODE SCREEN DISSIPATION	0.7	WATT
MAXIMUM TOTAL CATHODE CURRENT	16	MA.
MINIMUM EXTERNAL SIGNAL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (P_O) VOLTAGE	125	VOLTS
MAXIMUM OSCILLATOR ANODE DISSIPATION	0.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1108-1
SEPT. 17
1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEXODE PLATE (P) VOLTAGE	100	250	VOLTS
HEXODE SCREEN (G_S) VOLTAGE	100	100	VOLTS
HEXODE CONTROL GRID (G) VOLTAGE	−3	−3	VOLTS
OSCILLATOR ANODE (P_O) VOLTAGE	100	100	VOLTS
HEXODE PLATE CURRENT	2.3	2.5	MA.
HEXODE SCREEN CURRENT	6.2	6.0	MA.
OSCILLATOR ANODE CURRENT	3.8	3.8	MA.
OSCILLATOR GRID (G_O) CURRENT	0.15	0.15	MA.
TOTAL CATHODE CURRENT	12.5	12.5	MA.
OSCILLATOR GRID RESISTOR	50 000	50 000	OHMS
CONVERSION TRANSCONDUCTANCE	325	350	μMHOS
HEXODE PLATE RESISTANCE APPROX.	0.4	0.6	MEGOHM
HEXODE CONTROL GRID VOLTAGE APPROX. FOR CONVERSION TRANSCONDUCTANCE = 2 μMHOS	−30	−30	VOLTS

DIRECT INTERELECTRODE CAPACITANCES[5]

	6K8	6K8G 6K8GT	
SIGNAL GRID TO MIXER PLATE (G TO P)	0.03 MAX.	0.08 MAX.	μμf
SIGNAL GRID TO OSCILLATOR PLATE (G TO P_O)	0.02 MAX.	0.05 MAX.	μμf
SIGNAL GRID TO OSCILLATOR GRID (G TO G_O)	0.2 MAX.	0.2 MAX.	μμf
OSCILLATOR GRID TO OSCILLATOR PLATE (G_O TO P_O)	1.1	1.8	μμf
SIGNAL INPUT: G_O TO ALL OTHER ELECTRODES	6.6	4.6	μμf
OSCILLATOR INPUT: G_O TO ALL OTHER ELECTRODES EXCEPT P_O	6.0	6.5	μμf
OSCILLATOR OUTPUT: P_O TO ALL OTHER ELECTRODES EXCEPT G_O	3.2	3.4	μμf
MIXER OUTPUT: P TO ALL OTHER ELECTRODES	3.5	4.8	μμf
OSCILLATOR GRID TO MIXER PLATE (G_O TO P)	0.1 MAX.	0.15 MAX.	μμf

[A] WITH EXTERNAL SHIELD OR SHELL CONNECTED TO CATHODE.

NOTE: THE TRANSCONDUCTANCE OF THE OSCILLATOR SECTION (NOT OSCILLATING) IS APPROXIMATELY 3000 UMHOS WHEN THE TRIODE PLATE VOLTAGE IS 100 VOLTS, AND THE TRIODE GRID VOLTAGE IS ZERO VOLTS.

PLATE 1109-1

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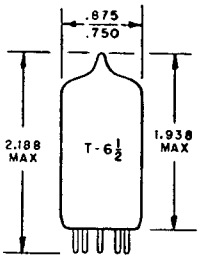
TUNG-SOL

TRIODE-PENTODE

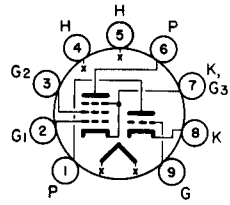
MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR
USE AS A COMBINED
VHF OSCILLATOR AND MIXER

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9 AE

THE 6KD8 IS A MEDIUM MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9 PIN MINATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER IN TELEVISION RECEIVERS.
GRID 1 (CONTROL GRID) TO CATHODE SPACING ON THE 6KD8 IS OF SUCH LOW ORDER OF MAGNITUDE AS TO PRECLUDE THE USE OF VOLTAGE BETWEEN THESE ELEMENTS OF MORE THAN 100 VOLTS DC OR PEAK AC IN COMMERCIAL TUBE CHECKERS AND SHORTS INDICATING DEVICES, PARTICULARLY WHERE MECHANICAL EXCITATION OF THE TUBE IS EMPLOYED.

DIRECT INTERELECTRODE CAPACITANCES

	SHIELD 315 CONNECTED TO PIN 4	UNSHIELDED	
PENTODE SECTION			
GRID 1 TO PLATE	Max. .007	Max. .015	pf
INPUT: G1 TO (H+ K + G2 + G3 + I.S.)	5.0	5.0	pf
OUTPUT: P TO (H + K + G2 + G3 + I.S.)	3.5	2.6	pf
CATHODE TO HEATER	3.0 [A]	3.0	pf
TRIODE SECTION			
GRID TO PLATE	1.8	1.8	pf
INPUT: G TO (H + PK + TK + G3 + I.S.)	2.8	2.8	pf
OUTPUT: P TO (H + PK + TK + G3 + I.S.)	2.0	1.5	pf
CATHODE TO HEATER	3.0 [A]	3.0	pf
COUPLING			
PENTODE GRID 1 TO TRIODE PLATE	Max. 0.2	Max. 0.2	pf
PENTODE PLATE TO TRIODE PLATE	Max. .02	Max. 0.1	pf

A- SHIELD 315 CONNECTED TO PIN 6.

CONTINUED ON THE FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	400	MA.
HEATER-CATHODE VOLTAGE - TRIODE AND PENTODE SECTIONS				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

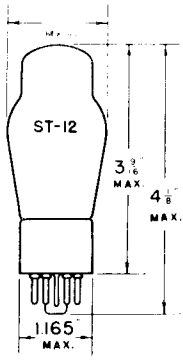
DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE		SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.5	3.0	WATTS
GRID 2 DISSIPATION		0.55	WATTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS		0.5	MEGOHM
SELF BIAS		1.0	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE		110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT		3.5	MA.
TRANSCONDUCTANCE	7,500	5,000	μMHOS
AMPLIFICATION FACTOR	40		
PLATE RESISTANCE		Approx. 0.2	MEGOHM
E_{c1} FOR I_b = 20 μA	Approx. -9	Approx. -8	VOLTS
G_m AT E_{c1} = 0 V., E_b = 100 V., E_{c2} = 70 V.		5,500	μMHOS

TUNG-SOL



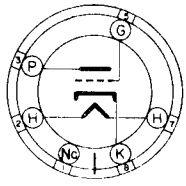
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN OCTAL BASE



G-6Qa
BOTTOM VIEW

THE TUNG-SOL 6L5G IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER. IT IS RECOMMENDED FOR USE WHERE ECONOMY OF HEATER CURRENT IS IMPORTANT.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	250 MAX.	VOLTS
GRID VOLTAGE	-5	-9	VOLTS
PLATE CURRENT	3.5	8	MA.
PLATE RESISTANCE	11 300	9000	OHMS
TRANSCONDUCTANCE	1500	1900	μMHOS
AMPLIFICATION FACTOR	17	17	
GRID VOLTAGE APPROX. FOR CATHODE CURRENT CUT-OFF	-11	-20	VOLTS

RESISTANCE COUPLED AMPLIFIER

PLATE AND SCREEN SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.05	0.25	0.05	0.25	MEGOHM
CATHODE RESISTOR	2800	10 000	2600	9000	OHMS
VOLTAGE GAIN	11	12	12	13	

DIRECT INTERELECTRODE CAPACITANCES[S]

GRID TO CATHODE	2.8	μμf
PLATE TO CATHODE	5.0	μμf
GRID TO PLATE	2.8	μμf

[S] WITH SHIELD

PLATE
421-2

MAY 8
1939

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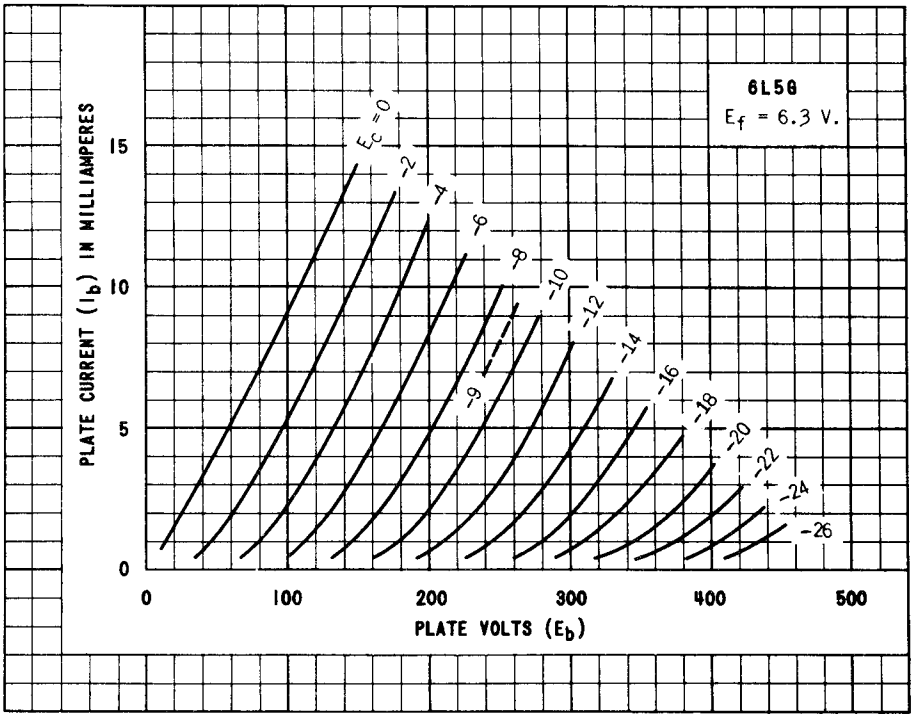
6L5 G



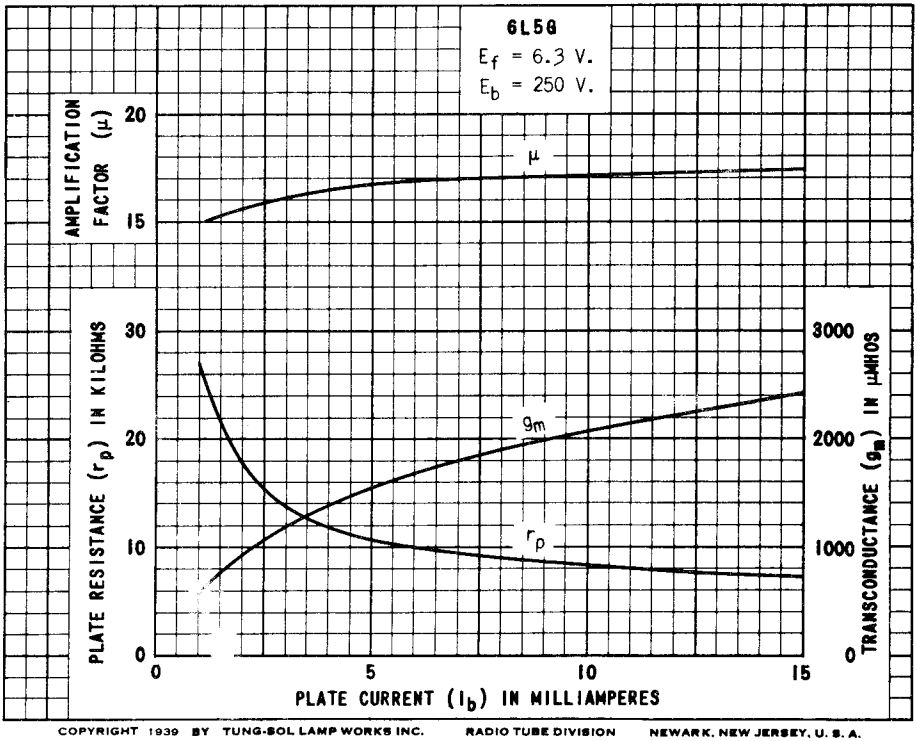


PLATE
422-1

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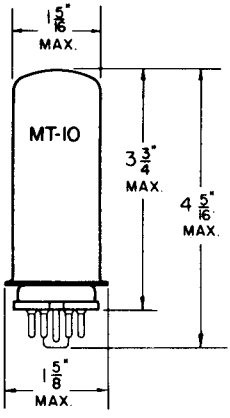
TUNG-SOL

BEAM PENTODE

6L6



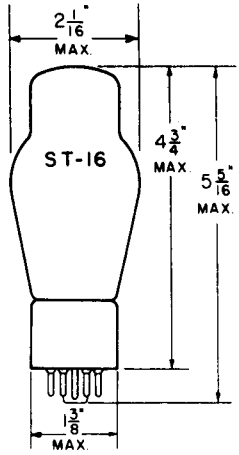
METAL SHELL

COATED UNIPOTENTIAL CATHODE

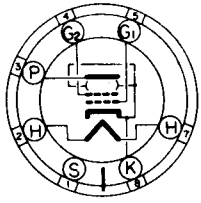
HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

ANY MOUNTING POSITION

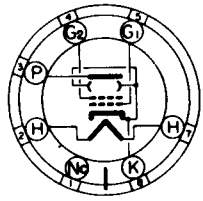
6L6G



GLASS BULB



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
7AC



BOTTOM VIEW
MEDIUM SHELL
7 PIN OCTAL
7AC

THE 6L6 AND 6L6G ARE DESIGNED WITH HIGH POWER SENSITIVITY AND HIGH EFFICIENCY FOR SERVICE IN THE OUTPUT STAGES OF AC RECEIVERS. THEY ARE CAPABLE OF DELIVERING AN OUTPUT AT ALL POWER LEVELS WITH A VERY LOW PERCENTAGE OF HARMONIC DISTORTION.

DIRECT INTERELECTRODE CAPACITANCES

	6L6	6L6G	
GRID TO PLATE	0.4	0.9	μμf
INPUT	10	11.5	μμf
OUTPUT	12	9.5	μμf

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3025
SEPT. 1
1952

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CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	TRIODE[A] CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE	180	180	VOLTS
MAXIMUM PLATE VOLTAGE	275	360	VOLTS ←
MAXIMUM GRID #2 VOLTAGE	PLATE	270	VOLTS
MAXIMUM PLATE DISSIPATION	19	19	WATTS
MAXIMUM GRID #2 DISSIPATION	---	2.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS OPERATION	0.1	0.1	MEGOHM ←
CATHODE BIAS OPERATION	0.5	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	0.9	AMP.
PLATE VOLTAGE	250	300	350	VOLTS
GRID #2 VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	-14	-12.5	-18	VOLTS
PEAK AF SIGNAL VOLTAGE	14	12.5	18	VOLTS
TRANSCONDUCTANCE	6 000	5 300	5 200	μMHOS
PLATE RESISTANCE	22 500	35 000	33 000	OHMS
ZERO SIGNAL PLATE CURRENT	72	48	54	MA.
MAXIMUM SIGNAL PLATE CURRENT	79	55	66	MA.
ZERO SIGNAL GRID #2 CURRENT	5	2.5	2.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	7.3	4.7	7	MA.
LOAD RESISTANCE	2 500	4 500	4 200	OHMS
POWER OUTPUT	6.5	6.5	10.8	WATTS
TOTAL HARMONIC DISTORTION	10	11	15	PERCENT

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
GRID #1 VOLTAGE	-20	VOLTS
PEAK AF SIGNAL VOLTAGE	20	VOLTS
TRANSCONDUCTANCE	4 700	VOLTS
PLATE RESISTANCE	1 700	OHMS
AMPLIFICATION FACTOR	8	
ZERO SIGNAL PLATE CURRENT	40	MA.
MAXIMUM SIGNAL PLATE CURRENT	44	MA.
LOAD RESISTANCE	5 000	OHMS
POWER OUTPUT	1.4	WATTS
TOTAL HARMONIC DISTORTION	5	PERCENT

[A] GRID #2 CONNECTED TO PLATE

CONTINUED ON FOLLOWING PAGE

PLATE 3026
SEPT. 1 1952

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CONTINUED FROM PRECEDING PAGE

CLASS A_1 PUSH-PULL AMPLIFIER – PENTODE CONNECTION

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	250	270	VOLTS
GRID #2 VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	VOLTS
TRANSCONDUCTANCE (EACH TUBE)	5 500	5 700	μMHOS
PLATE RESISTANCE (EACH TUBE)	24 500	23 500	OHMS
ZERO SIGNAL PLATE CURRENT	120	134	MA.
MAXIMUM SIGNAL PLATE CURRENT	140	155	MA.
ZERO SIGNAL GRID #2 CURRENT	10	11	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	16	17	MA.
LOAD RESISTANCE	5 000	5 000	OHMS
POWER OUTPUT	14.5	17.5	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CLASS AB_1 PUSH-PULL AMPLIFIER – PENTODE CONNECTION

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	270	270	VOLTS
GRID #1 VOLTAGE	-22.5	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	45	45	VOLTS
ZERO SIGNAL PLATE CURRENT	88	88	MA.
MAXIMUM SIGNAL PLATE CURRENT	132	140	MA.
ZERO SIGNAL GRID #2 CURRENT	5	5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	15	11	MA.
LOAD RESISTANCE	6 600	3 800	OHMS
POWER OUTPUT	26.5	18	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CLASS AB_2 PUSH-PULL AMPLIFIER – PENTODE CONNECTION

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	52	72	VOLTS
ZERO SIGNAL PLATE CURRENT	78	88	MA.
MAXIMUM SIGNAL PLATE CURRENT	142	205	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11	16	MA.
LOAD RESISTANCE	6 000	3 800	OHMS
POWER OUTPUT	31	47	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

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PLATE
3027
EPT. 1
1952

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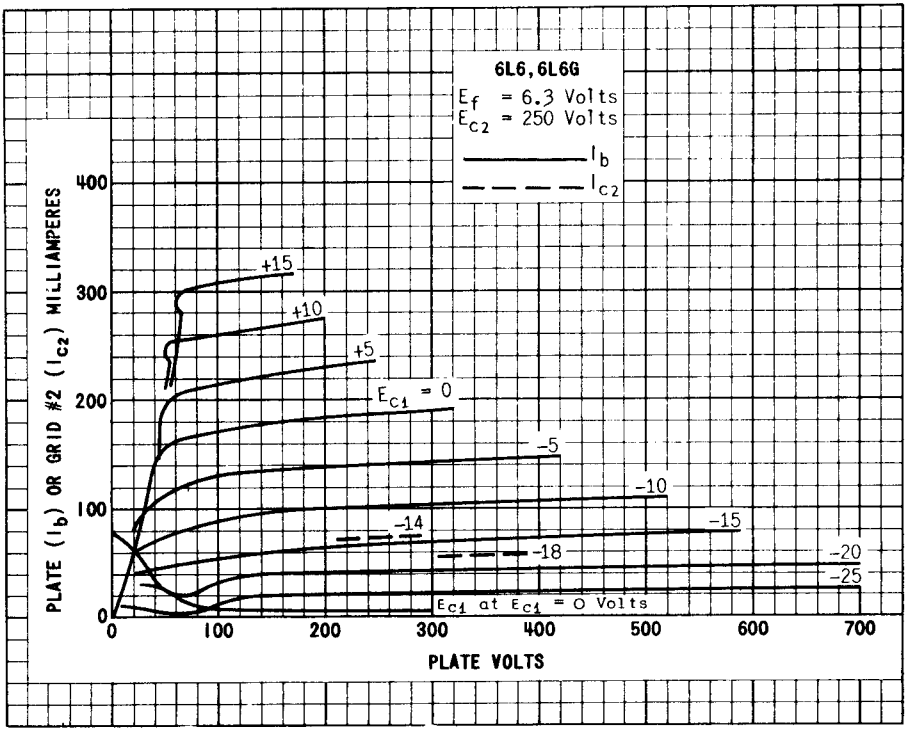
6L6, 6L6G



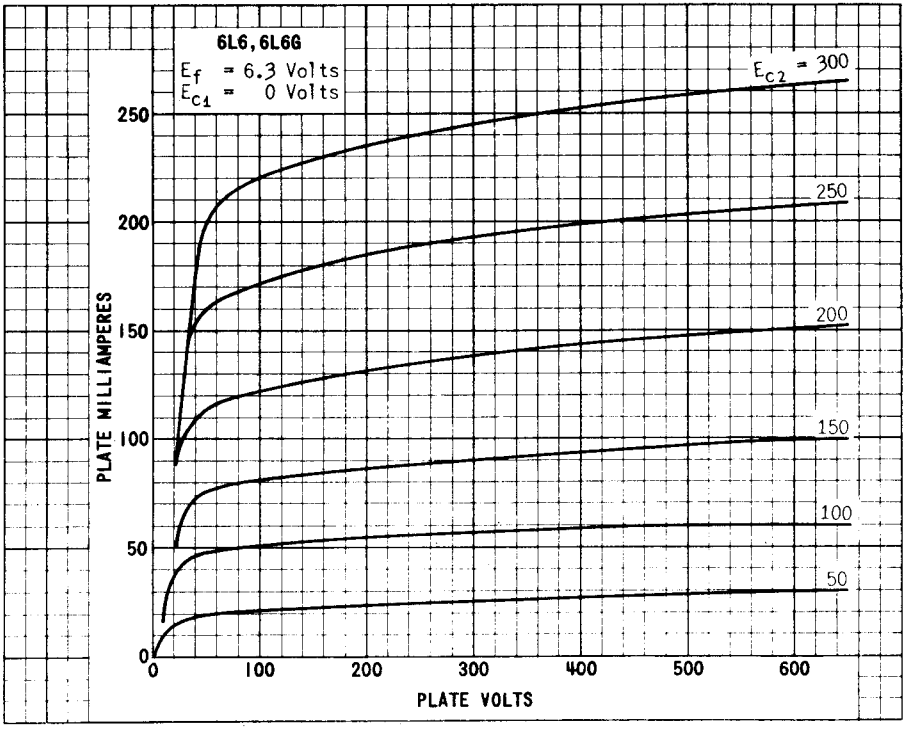


PLATE
3028
SEPT. 1
1952

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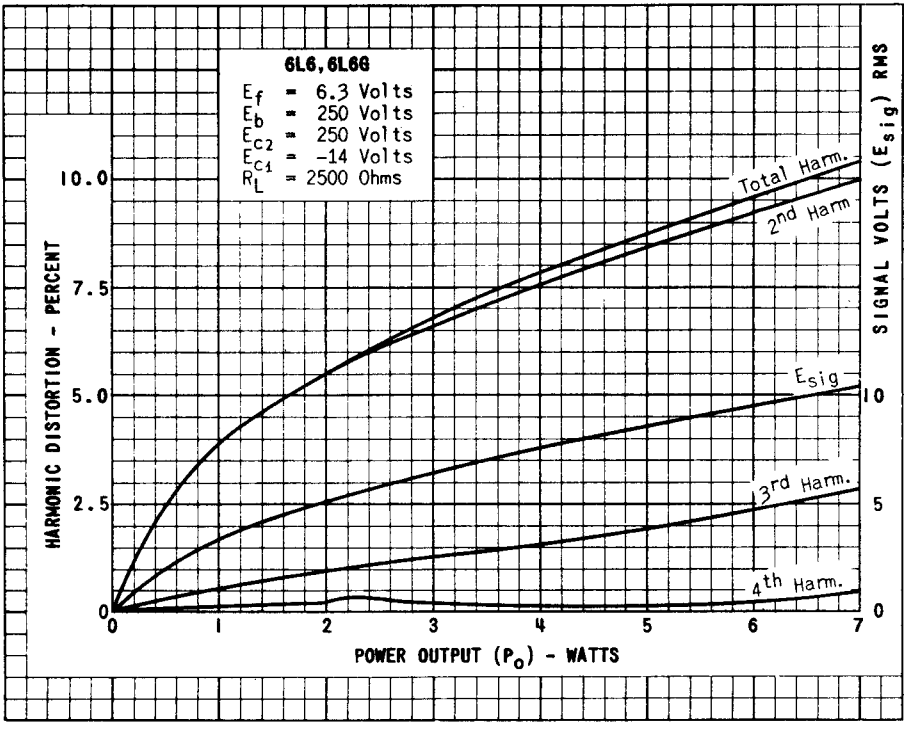

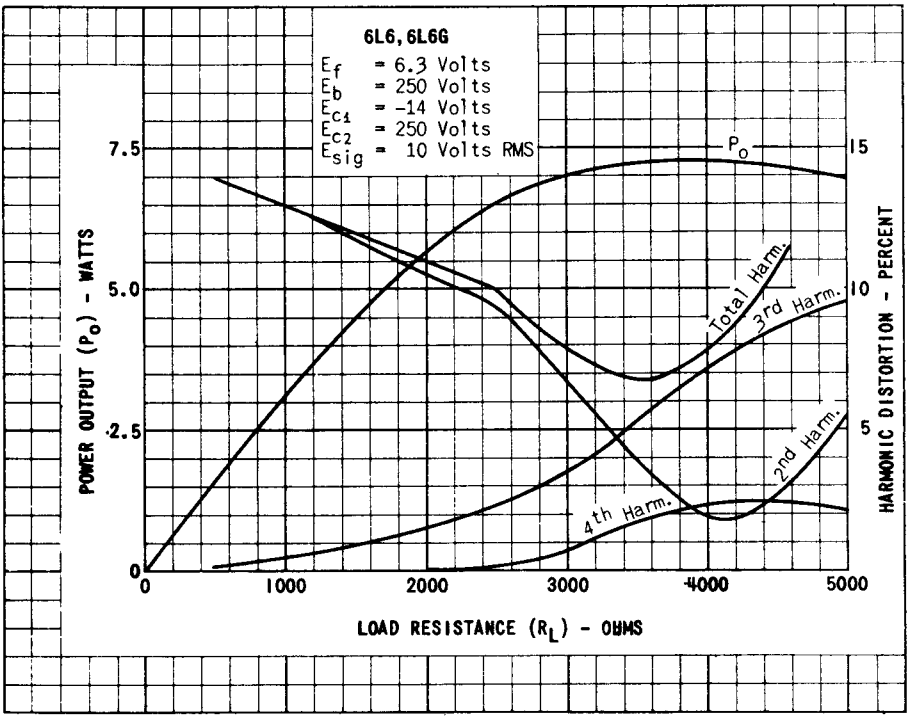

PLATE 3029 SEPT. 1 1952

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6L6, 6L6G

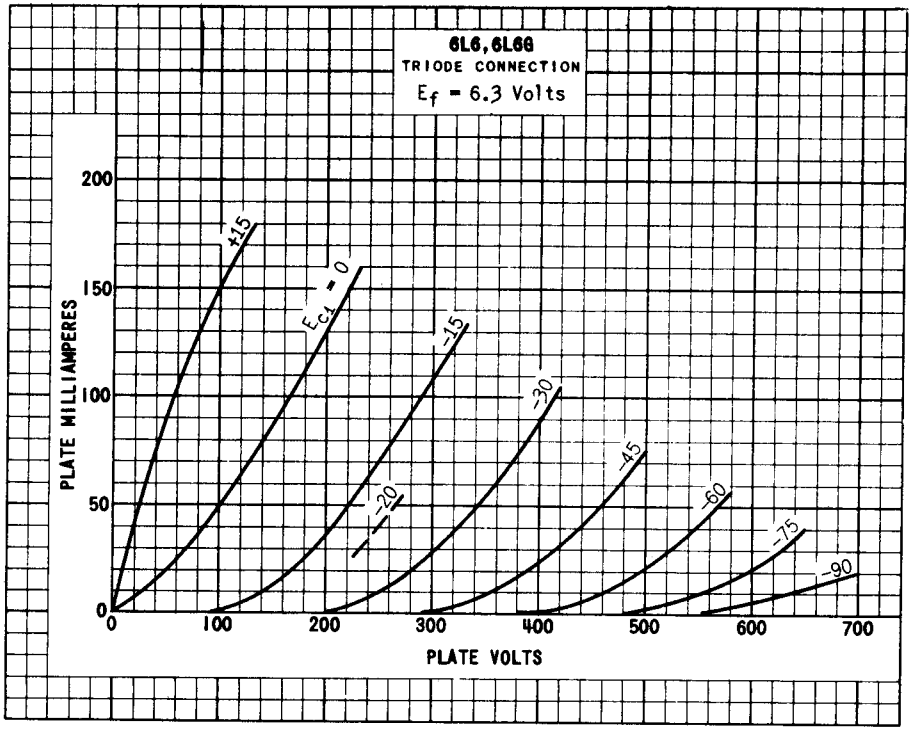

PLATE
3030
SEPT. 1
1952

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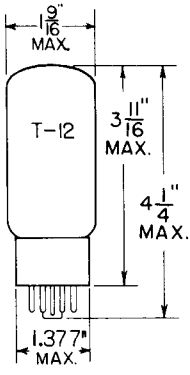
TUNG-SOL

BEAM PENTODE



GLASS BULB

MEDIUM SHELL OR SHORT MEDIUM SHELL 7 PIN OCTAL B7-12

OUTLINE DRAWING JEDEC 12-15

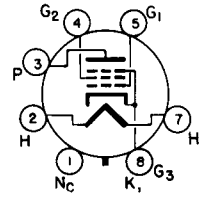
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 0.9 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 7S

THE 6L6GB IS A BEAM PENTODE DESIGNED WITH HIGH POWER SENSITIVITY AND HIGH EFFICIENCY FOR SERVICE IN THE OUTPUT STAGES OF AC RECEIVERS. IT IS CAPABLE OF DELIVERING AN OUTPUT AT ALL POWER LEVELS WITH A VERY LOW PERCENTAGE OF HARMONIC DISTORTION.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G TO P	0.9	pf
INPUT: G_1 TO (H+K+G_2+BP)	11.5	pf
OUTPUT: P TO (H+K+G_2+BP)	9.5	pf

→ RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[A] CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3±0.6		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
DC	100		VOLTS
MAXIMUM PLATE VOLTAGE	300	400	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	300	VOLTS
MAXIMUM PLATE DISSIPATION	22	22	WATTS
MAXIMUM GRID #2 DISSIPATION	---	2.8	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.1	0.1	MEGOHM
SELF BIAS	0.5	0.5	MEGOHM

[A] GRID #2 CONNECTED TO PLATE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

PLATE VOLTAGE	250	300	350	VOLTS
GRID #2 VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	−14	−12.5	−18	VOLTS
PEAK AF SIGNAL VOLTAGE	14	12.5	18	VOLTS
TRANSCONDUCTANCE	6 000	5 300	5 200	μMHOS
PLATE RESISTANCE	22 500	35 000	33 000	OHMS
ZERO SIGNAL PLATE CURRENT	72	48	54	MA.
MAXIMUM SIGNAL PLATE CURRENT	79	55	66	MA.
ZERO SIGNAL GRID #2 CURRENT	5	2.5	2.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	7.3	4.7	7	MA.
LOAD RESISTANCE	2 500	4 500	4 200	OHMS
POWER OUTPUT	6.5	6.5	10.8	WATTS
TOTAL HARMONIC DISTORTION	10	11	15	PERCENT

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[A]

PLATE VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−20	VOLTS
PEAK AF SIGNAL VOLTAGE	20	VOLTS
TRANSCONDUCTANCE	4 700	VOLTS
PLATE RESISTANCE	1 700	OHMS
AMPLIFICATION FACTOR	8	
ZERO SIGNAL PLATE CURRENT	40	MA.
MAXIMUM SIGNAL PLATE CURRENT	44	MA.
LOAD RESISTANCE	5 000	OHMS
POWER OUTPUT	1.4	WATTS
TOTAL HARMONIC DISTORTION	5	PERCENT

[A] GRID #2 CONNECTED TO PLATE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CLASS A_1 PUSH-PULL AMPLIFIER - PENTODE CONNECTION

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	250	270	VOLTS
GRID #2 VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	VOLTS
TRANSCONDUCTANCE (EACH TUBE)	5 500	5 700	µMHOS
PLATE RESISTANCE (EACH TUBE)	24 500	23 500	OHMS
ZERO SIGNAL PLATE CURRENT	120	134	MA.
MAXIMUM SIGNAL PLATE CURRENT	140	155	MA.
ZERO SIGNAL GRID #2 CURRENT	10	11	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	16	17	MA.
LOAD RESISTANCE	5 000	5 000	OHMS
POWER OUTPUT	14.5	17.5	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CLASS AB_1 PUSH-PULL AMPLIFIER - PENTODE CONNECTION

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	270	270	VOLTS
GRID #1 VOLTAGE	-22.5	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	45	45	VOLTS
ZERO SIGNAL PLATE CURRENT	88	88	MA.
MAXIMUM SIGNAL PLATE CURRENT	132	140	MA.
ZERO SIGNAL GRID #2 CURRENT	5	5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	15	11	MA.
LOAD RESISTANCE	6 600	3 800	OHMS
POWER OUTPUT	26.5	18	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CLASS AB_2 PUSH-PULL AMPLIFIER - PENTODE CONNECTION

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	52	72	VOLTS
ZERO SIGNAL PLATE CURRENT	78	88	MA.
MAXIMUM SIGNAL PLATE CURRENT	142	205	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11	16	MA.
LOAD RESISTANCE	6 000	3 800	OHMS
POWER OUTPUT	31	47	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

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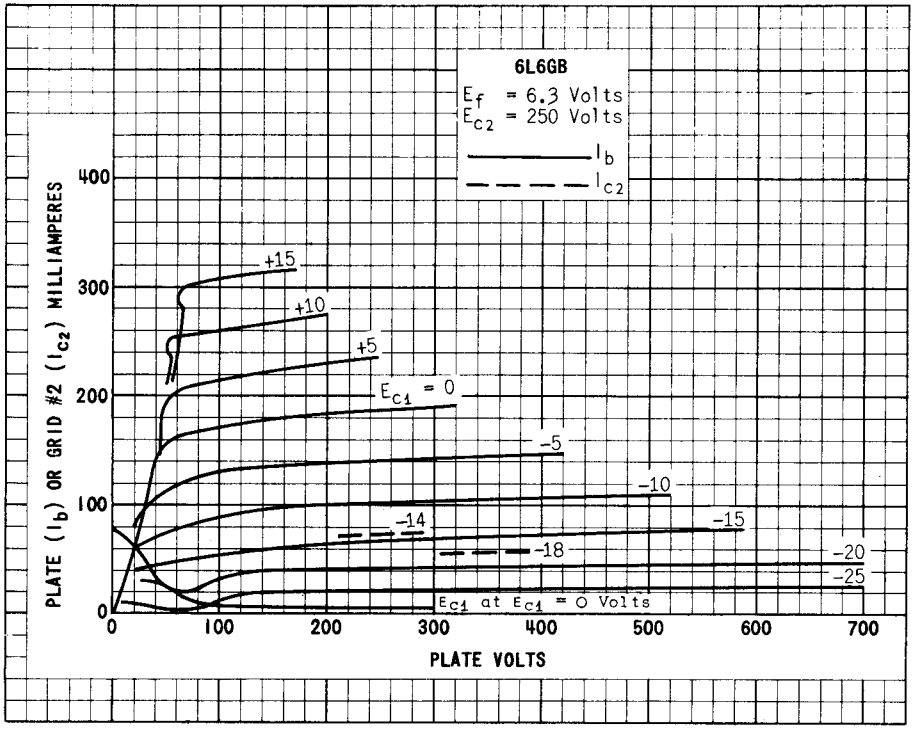
6L6GB



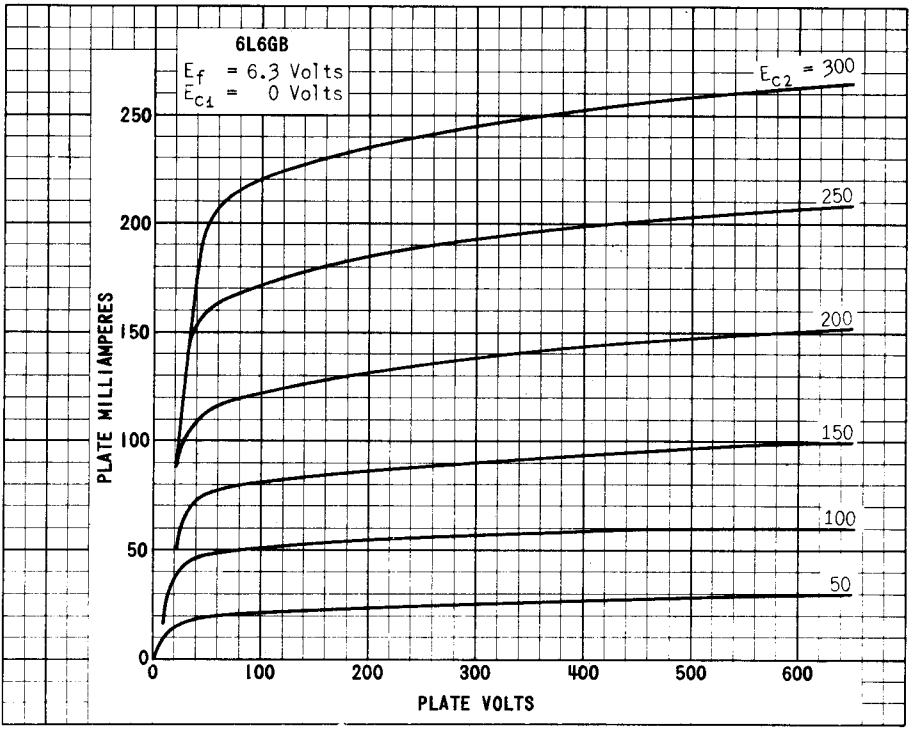
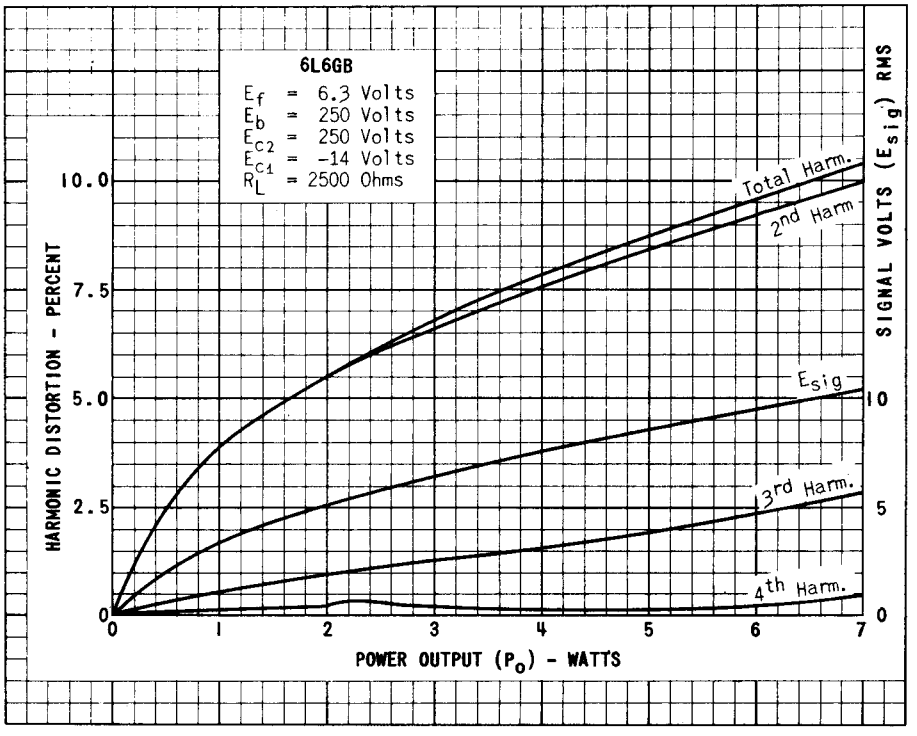


PLATE #4307 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.



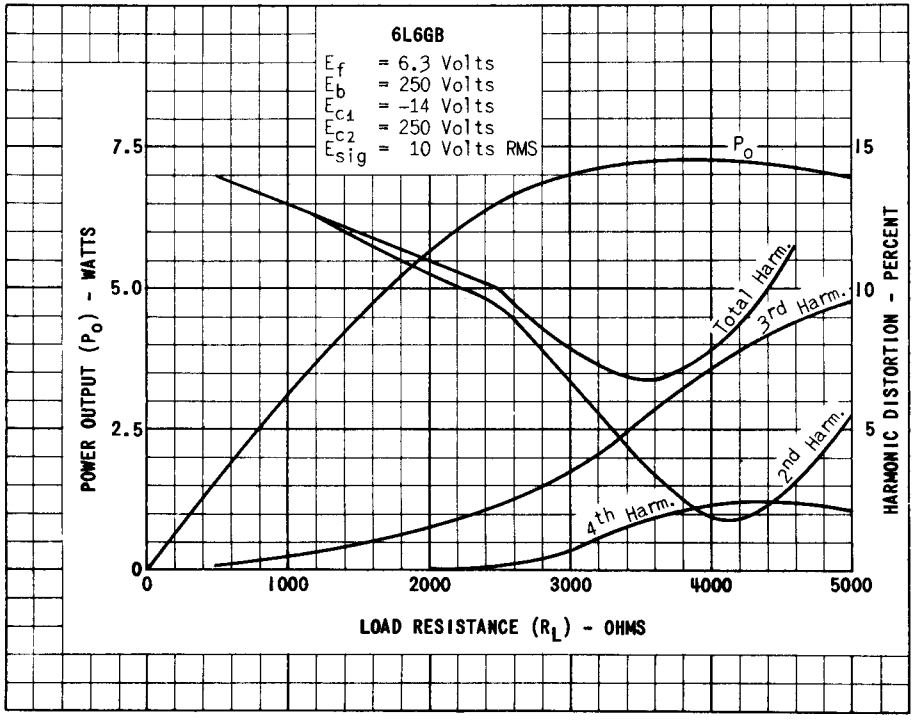


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PLATE 559-3

6L6GB

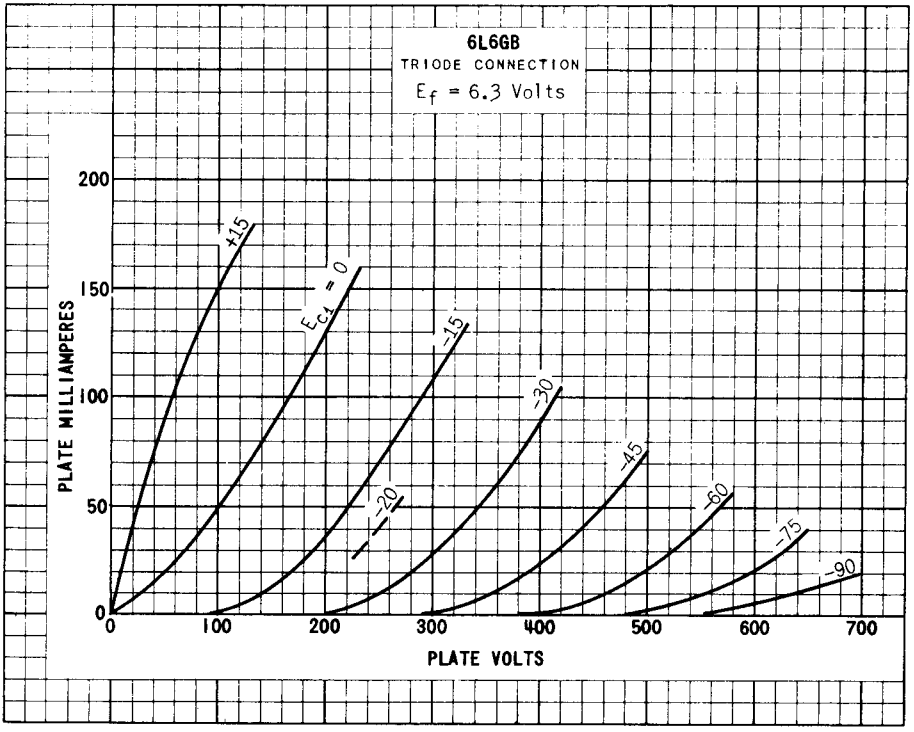
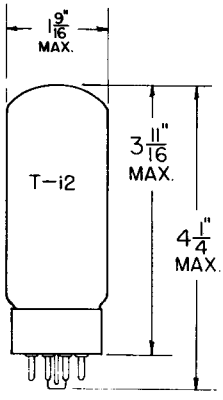


PLATE #4309 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

PENTODE



GLASS BULB

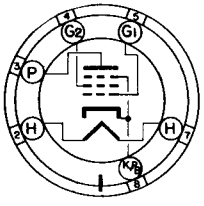
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.9 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT MEDIUM SHELL
6 PIN OCTAL

SHORT MEDIUM SHELL
7 PIN OCTAL

MEDIUM SHELL
7 PIN OCTAL

7AC

THE 6L6GC IS A BEAM-POWER PENTODE PRIMARILY DESIGNED FOR USE IN AUDIO-FREQUENCY POWER AMPLIFIER APPLICATIONS. THE 6L6GC HAS THE SAME CHARACTERISTICS AS THE 6L6GB. HOWEVER, THE HIGHER POWER RATINGS OF THE 6L6GC ARE ADVANTAGEOUS WHERE GREATER POWER-HANDLING CAPABILITY IS REQUIRED.

DIRECT INTERELECTRODE CAPACITANCES -approx.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT	10	μμf
OUTPUT	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE[B] CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	450	500	VOLTS
MAXIMUM SCREEN VOLTAGE		450[A]	
MAXIMUM PLATE DISSIPATION	30	30	WATTS
MAXIMUM SCREEN DISSIPATION		5.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.1	0.1	MEG.
WITH CATHODE BIAS	0.5	0.5	MEG.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE CONNECTION[B]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−20	VOLTS
PEAK AF GRID #1 VOLTAGE	20	VOLTS
AMPLIFICATION FACTOR	8	
PLATE RESISTANCE, APPROX.	1700	OHMS
TRANSCONDUCTANCE	4700	μMHOS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAXIMUM-SIGNAL PLATE CURRENT	44	MA.
LOAD RESISTANCE	5000	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	1.4	WATTS

CLASS A_1 AMPLIFIER - PENTODE CONNECTION

PLATE VOLTAGE	250	300	350	VOLTS
SCREEN VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	−14	−12.5	−18	VOLTS
PEAK AF GRID #1 VOLTAGE	14	12.5	18	VOLTS
PLATE RESISTANCE, APPROX.	22500	35000	33000	OHMS
TRANSCONDUCTANCE	6000	5300	5200	μMHOS
ZERO-SIGNAL PLATE CURRENT	72	48	54	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	55	66	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	2.5	2.5	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	7.3	4.7	7.0	MA.
LOAD RESISTANCE	2500	4500	4200	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	10	11	15	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	6.5	6.5	10.8	WATTS

PUSH-PULL CLASS A_1 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	250	270	VOLTS
SCREEN VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	−16	−17.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	VOLTS
ZERO-SIGNAL PLATE CURRENT	120	134	MA.
MAXIMUM SIGNAL PLATE CURRENT	140	155	MA.
ZERO-SIGNAL SCREEN CURRENT	10	11	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	16	17	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	5000	5000	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	14.5	17.5	WATTS

PUSH-PULL CLASS AB_1 AMPLIFIER -VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	450	VOLTS
SCREEN VOLTAGE	270	270	400	VOLTS
GRID #1 VOLTAGE	−22.5	−22.5	−37	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	45	45	70	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS -cont'd.

PUSH-PULL CLASS AB_1 AMPLIFIER -VALUES FOR TWO TUBES
CONTINUED

ZERO-SIGNAL PLATE CURRENT	88	88	116	MA.
MAXIMUM-SIGNAL PLATE CURRENT	132	140	210	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	5.0	5.6	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	15	11	22	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	6600	3800	5600	OHMS
TOTAL HARMONIC DISTORTION	2	2	1.8	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	26.5	18	55	WATTS

PUSH-PULL CLASS AB_2 AMPLIFIER -VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	VOLTS
SCREEN VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	52	72	VOLTS
ZERO-SIGNAL PLATE CURRENT	78	88	MA.
MAXIMUM-SIGNAL PLATE CURRENT	142	205	MA.
ZERO-SIGNAL SCREEN CURRENT	3.5	5.0	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	11	16	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	6000	3800	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	31	47	WATTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE TUBE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN TUBE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

A. THE MAXIMUM SCREEN VOLTAGE RATING IS 500 VOLTS IN PUSH-PULL CIRCUITS WHERE THE SCREEN OF EACH TUBE IS CONNECTED TO A TAP ON THE PLATE WINDING OF THE OUTPUT TRANSFORMER.

B. WITH SCREEN CONNECTED TO PLATE.

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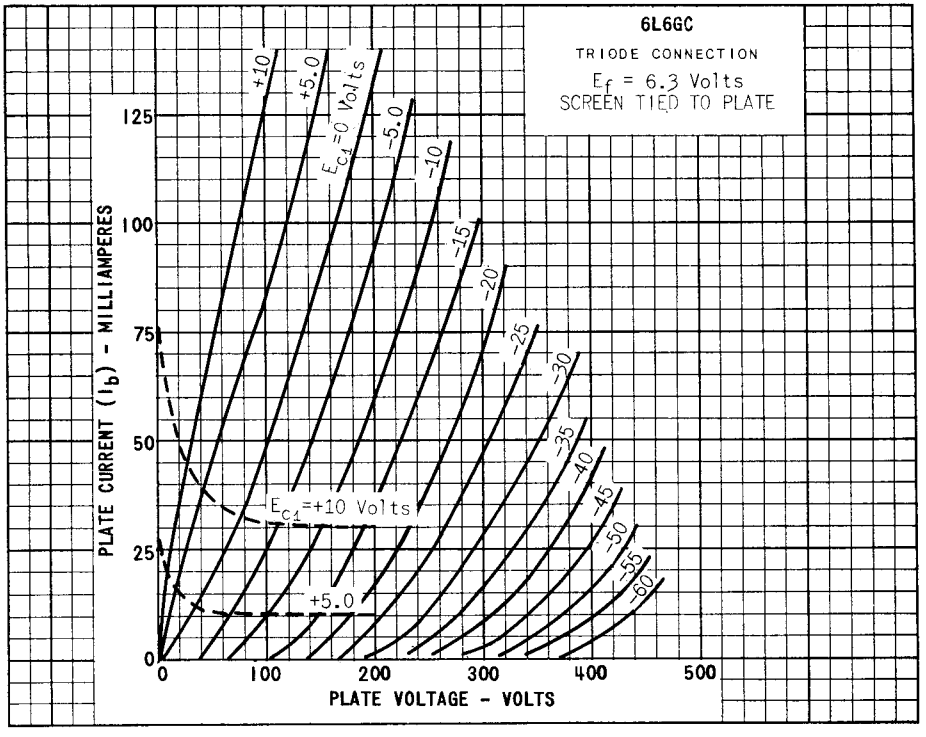
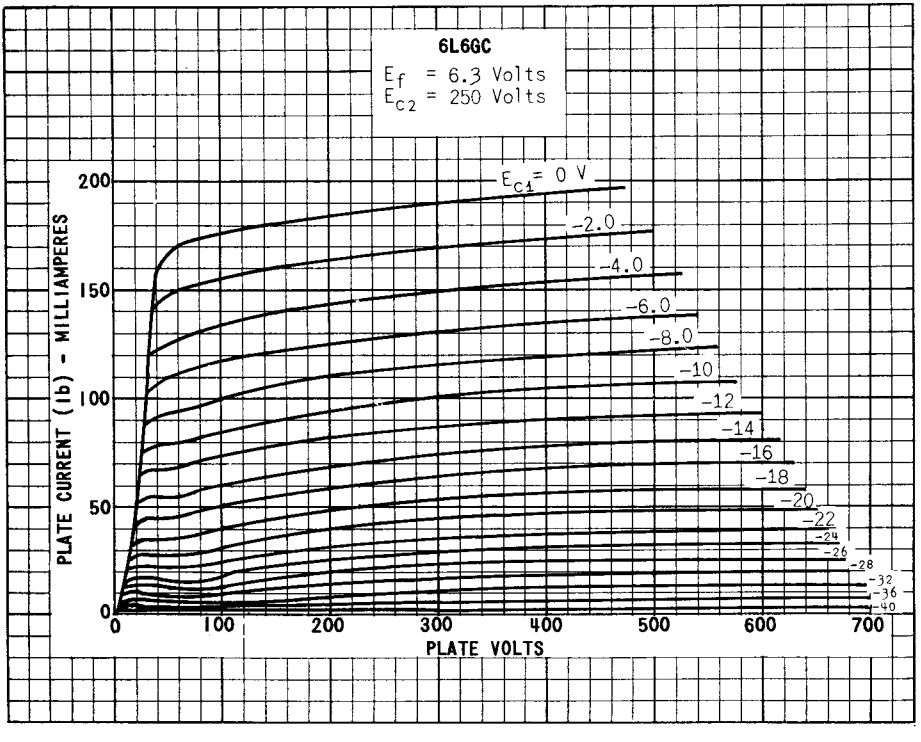
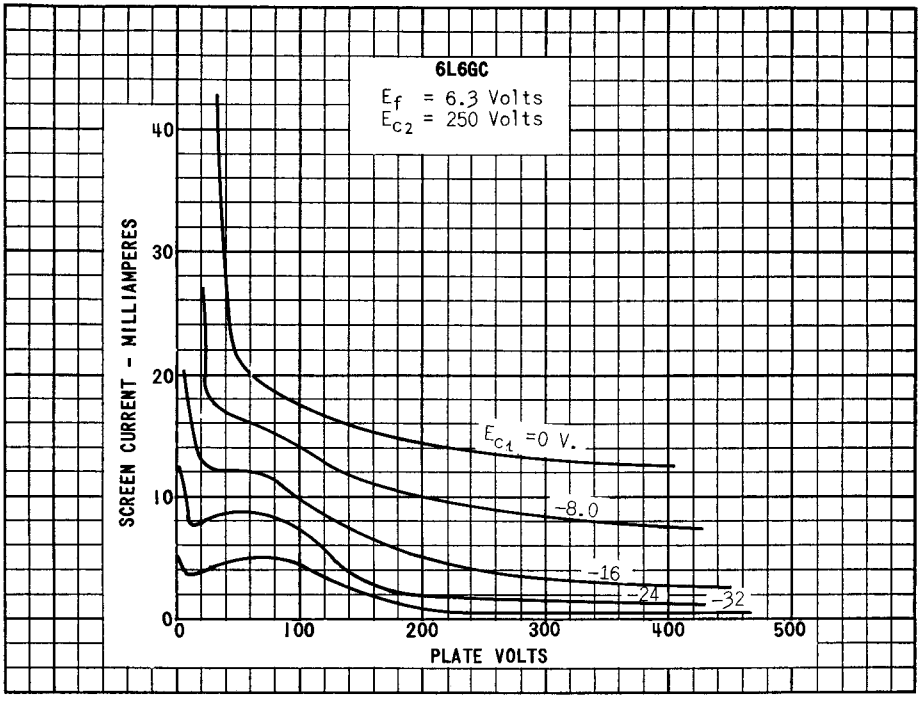
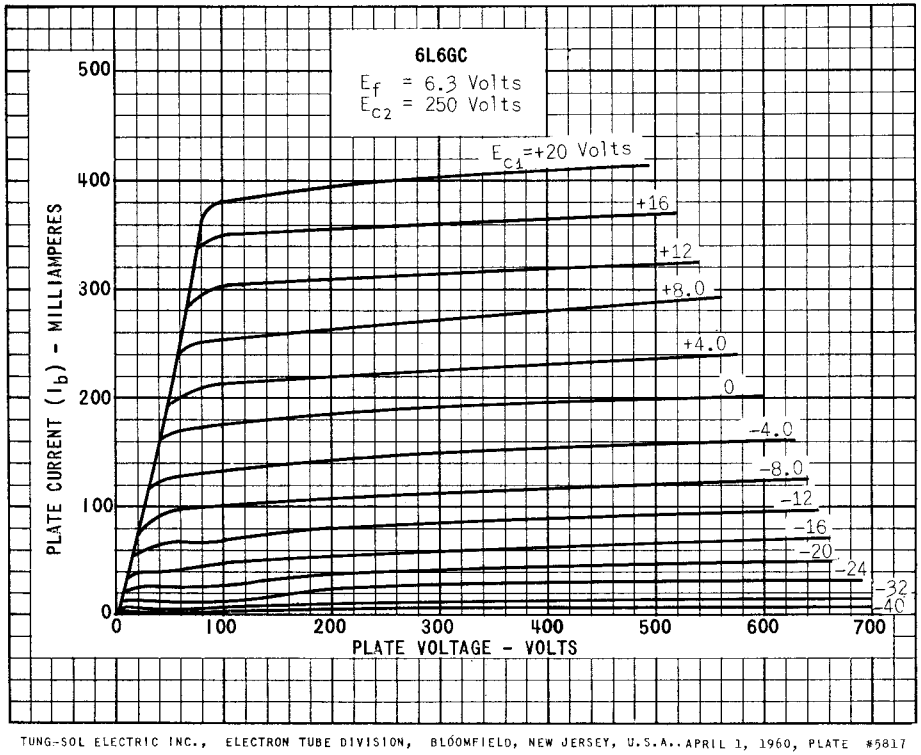
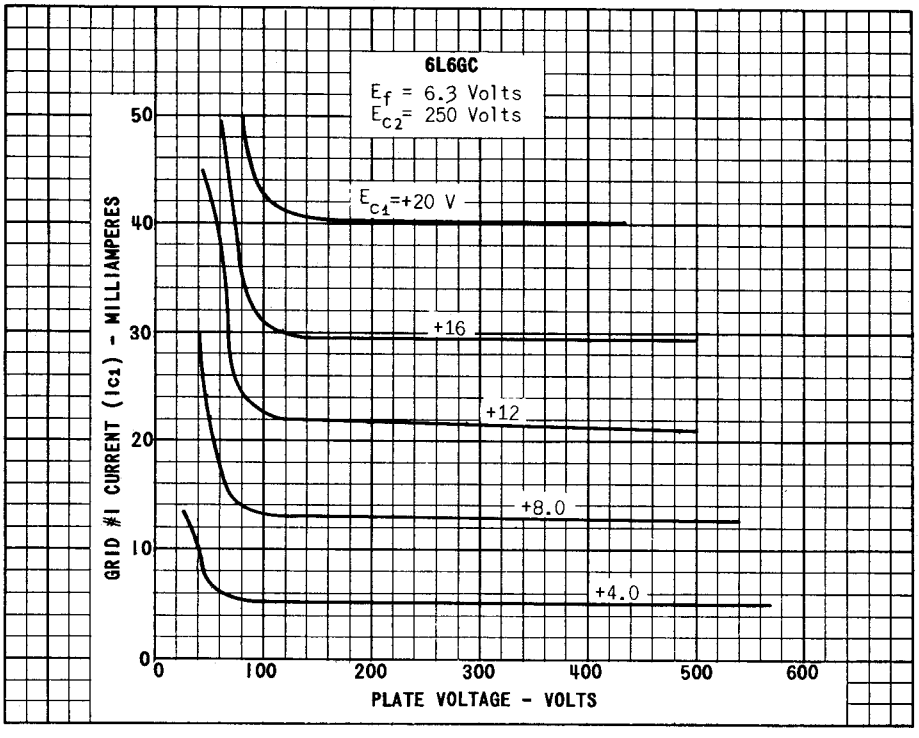
TENTATIVE DATA

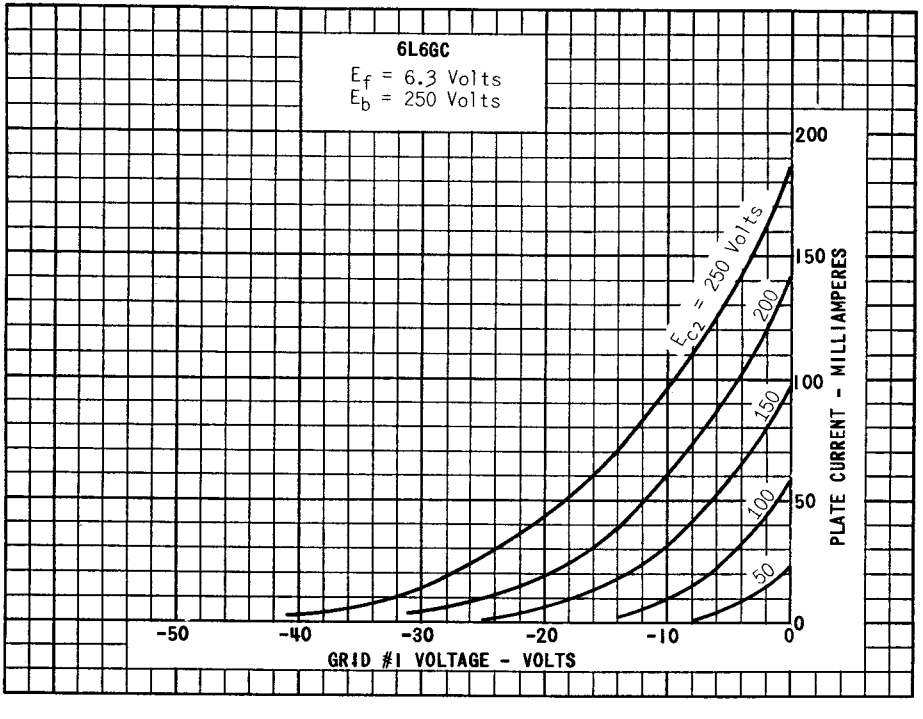


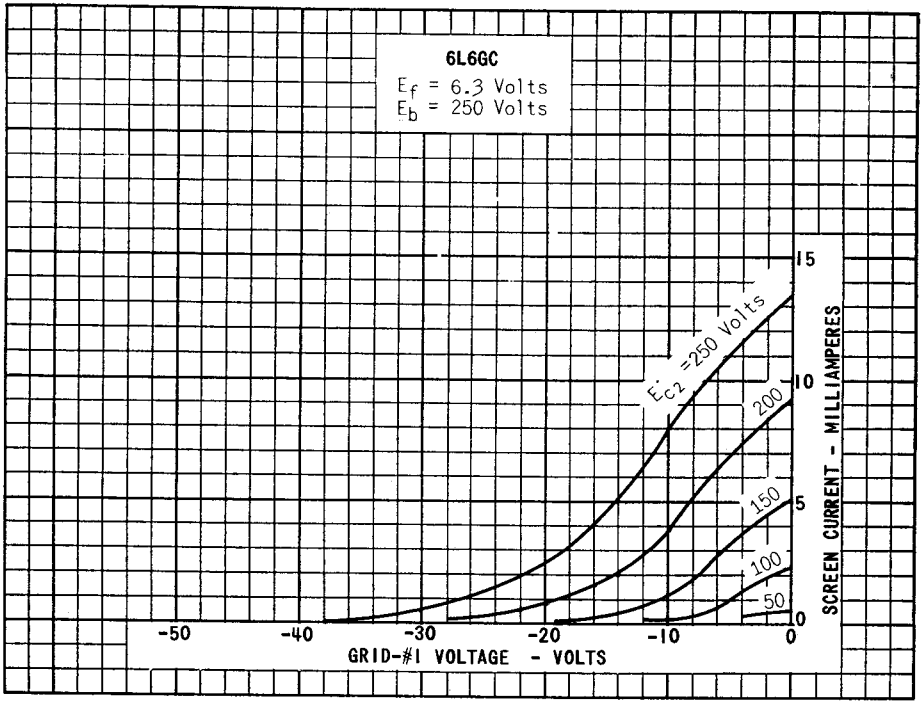


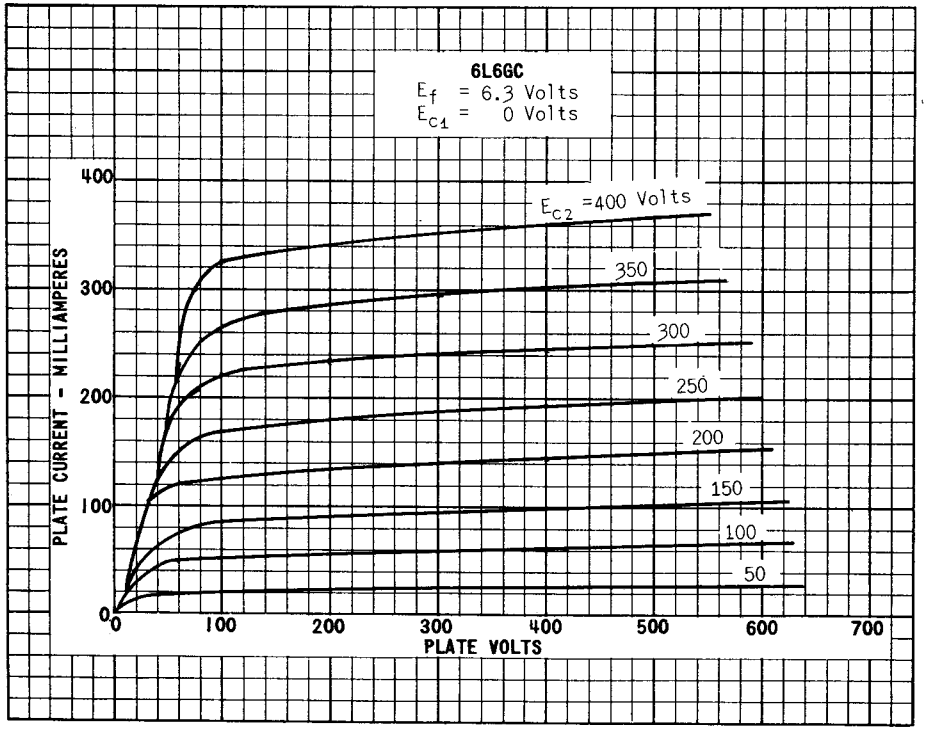

6L6GC
E_f = 6.3 Volts
E_{c2} = 250 Volts
SCREEN CURRENT - MILLIAMPERES
PLATE VOLTS
E_{c1} =0 V.
-8.0
-16
-24
-32
0
10
20
30
40
0
100
200
300
400
500


6L6GC
E_f = 6.3 Volts
E_{c2} = 250 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE - VOLTS
E_{c1} =+20 Volts
+16
+12
+8.0
+4.0
0
-4.0
-8.0
-12
-16
-20
-24
-32
-40
0
100
200
300
400
500
600
700


6L6GC
E_f = 6.3 Volts
E_{c2} = 250 Volts
E_{c1}=+20 V
+16
+12
+8.0
+4.0
GRID #1 CURRENT (I_{c1}) - MILLIAMPERES
0
10
20
30
40
50
0
100
200
300
400
500
600
PLATE VOLTAGE - VOLTS


6L6GC
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
200
150
100
50
PLATE CURRENT - MILLIAMPERES
0
50
100
150
200
-50
-40
-30
-20
-10
0
GRID #1 VOLTAGE - VOLTS





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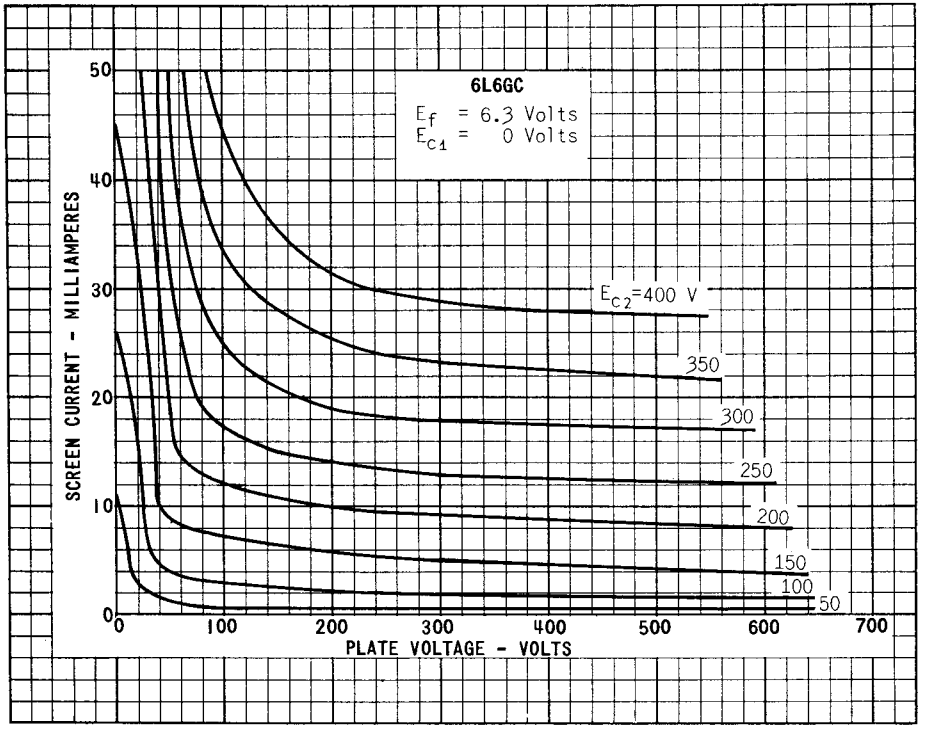
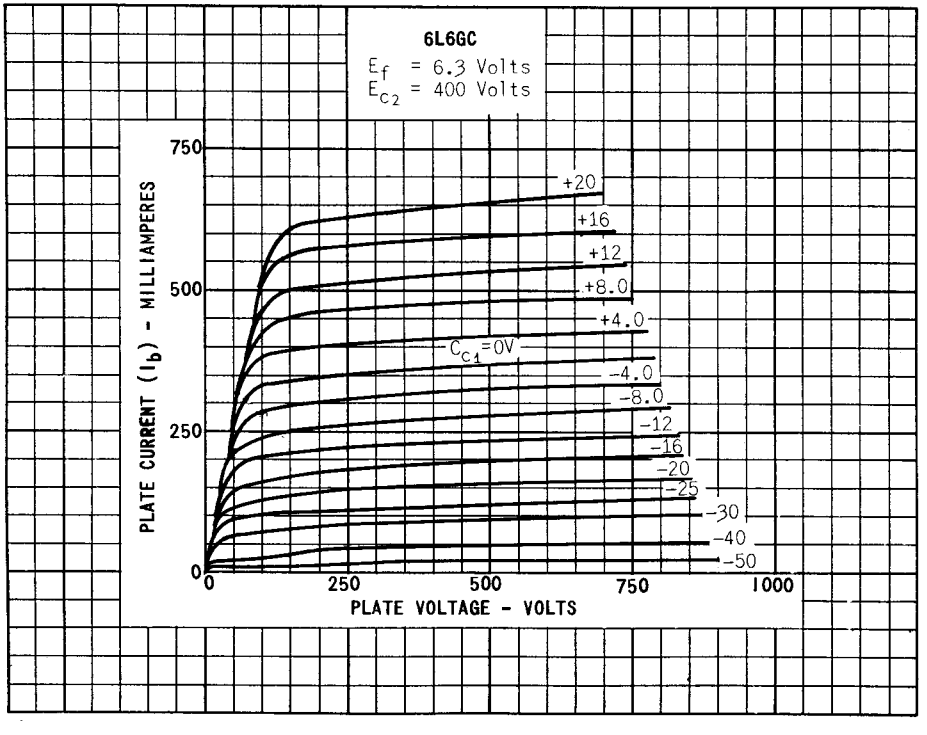
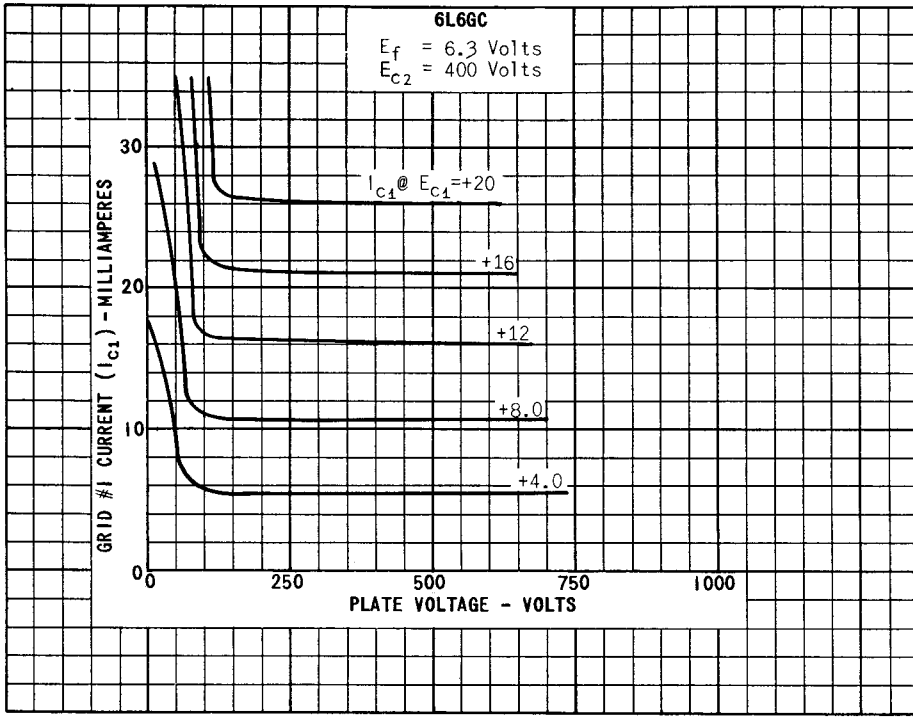
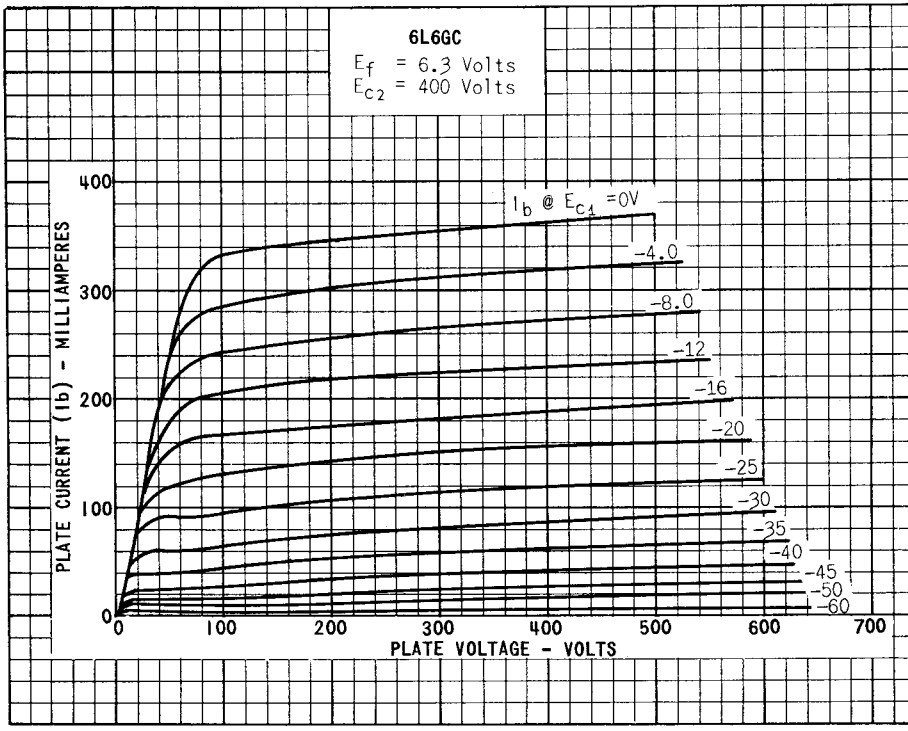
TENTATIVE DATA









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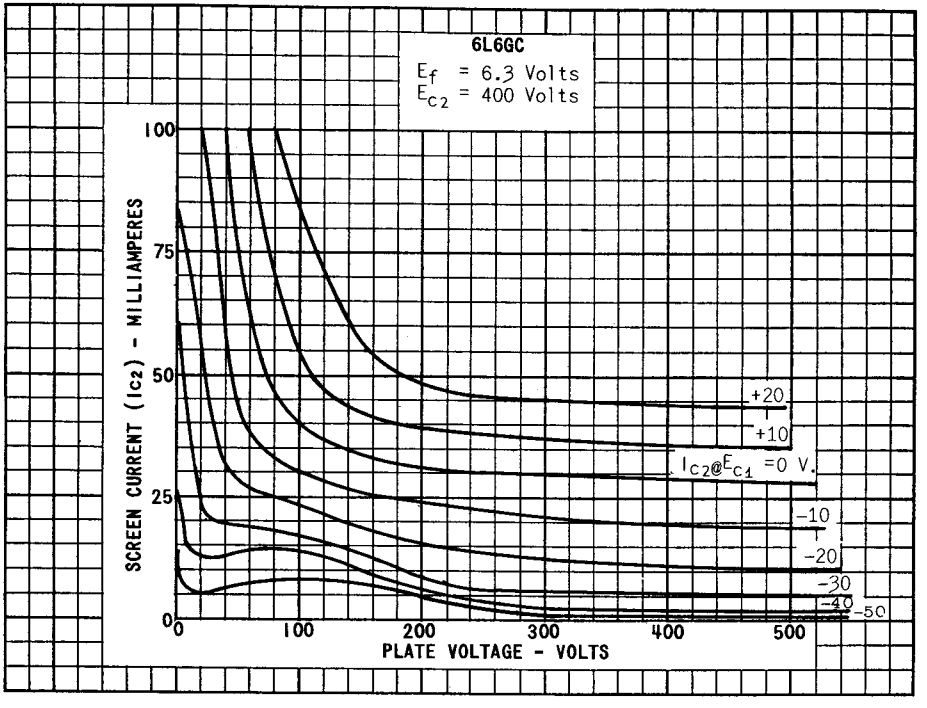

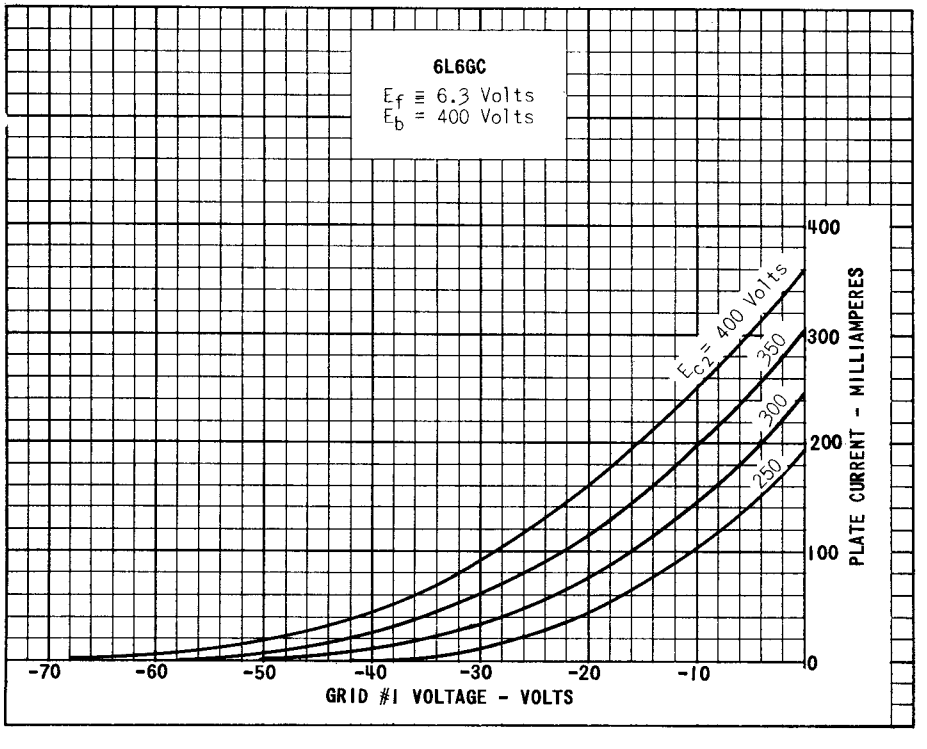

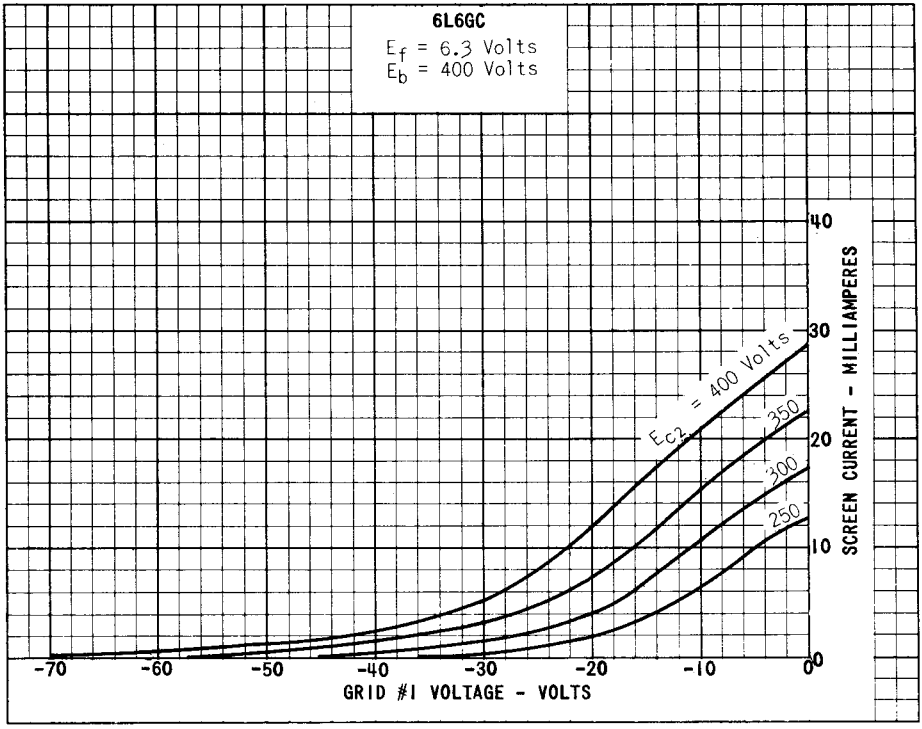

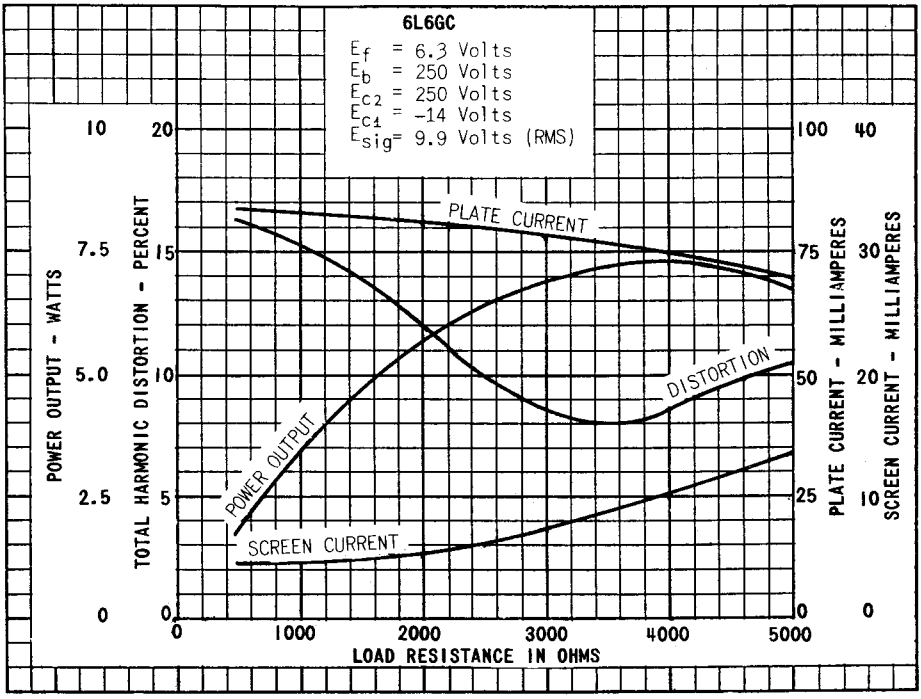

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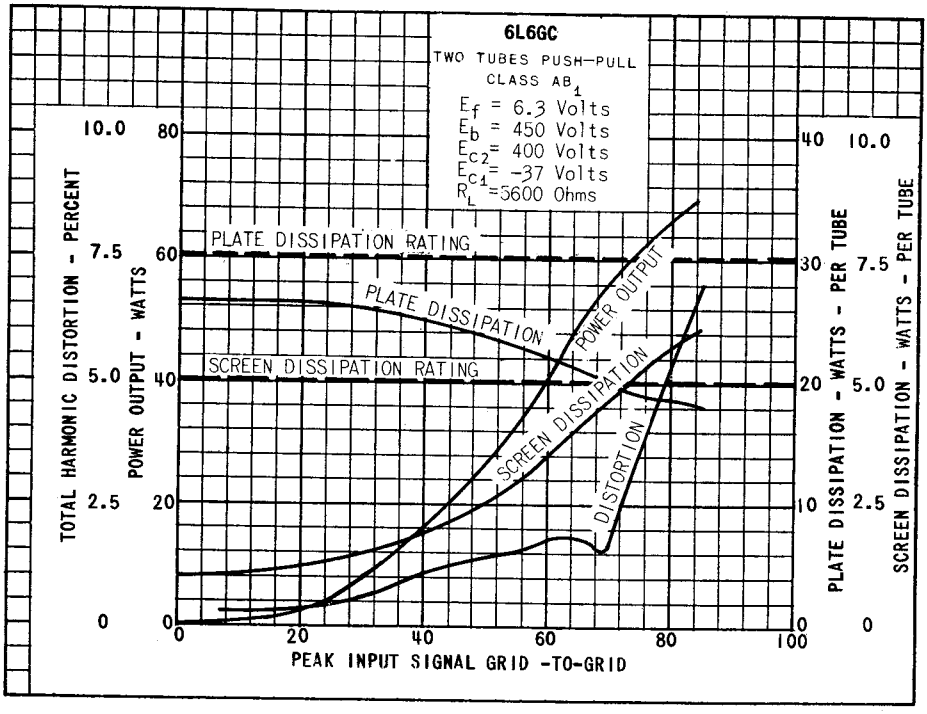
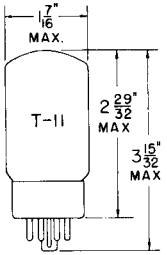
6L6GC


6L6GC
TWO TUBES PUSH-PULL
CLASS AB1
Ef = 6.3 Volts
Eb = 450 Volts
Ec2 = 400 Volts
Ec1 = -37 Volts
RL = 5600 Ohms
PLATE DISSIPATION RATING
PLATE DISSIPATION
SCREEN DISSIPATION RATING
POWER OUTPUT
SCREEN DISSIPATION
DISTORTION
TOTAL HARMONIC DISTORTION - PERCENT
POWER OUTPUT - WATTS
PLATE DISSIPATION - WATTS - PER TUBE
SCREEN DISSIPATION - WATTS - PER TUBE
PEAK INPUT SIGNAL GRID -TO-GRID
10.0
7.5
5.0
2.5
0
80
60
40
20
0
40
30
20
10
0
100

TUNG-SOL

PENTODE

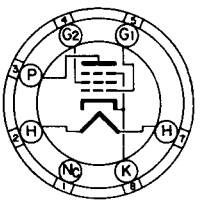


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.9 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE
SHELL 7 PIN
LOW LOSS PHENOLIC
7S

THE 6L6WGB IS A RUGGEDIZED BEAM PENTODE OF THE SINGLE ENDED CONSTRUCTION USED PRIMARILY IN AUDIO POWER OUTPUT STAGES. IT IS ELECTRICALLY EQUIVALENT TO TYPES 6L6 AND 6L6G, EXCEPT THAT PLATE AND SCREEN DISSIPATIONS HAVE BEEN INCREASED APPROXIMATELY 20%. THE USE OF SPECIALLY COATED GRIDS AND ANODES GREATLY INCREASES ITS ABILITY TO WITHSTAND OVERLOAD CONDITIONS FOR SHORT PERIODS OF TIME AND PROVIDES IMPROVEMENT IN CONTINUITY OF SERVICE. THE 6L6WGB EMPLOYS A MICANOL BARRIER BASE WHICH ABSORBS LESS MOISTURE AND REDUCES THE CHANCE OF VOLTAGE BREAKDOWN BETWEEN ADJACENT PINS. SINCE THIS TUBE MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6L6WGB IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION, SUCH AS AIRBORNE EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE (RATED)	0.9	μμf
INPUT (RATED)	11.5	μμf
OUTPUT (RATED)	9.5	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	400	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	26	WATTS
MAXIMUM GRID #2 DISSIPATION	3.5	WATTS
MAXIMUM HEATER CATHODE VOLTAGE	±200	VOLTS
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	450	G

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

SINGLE TUBE

	TRIODE*		PENTODE		
HEATER VOLTAGE	6.3	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	0.9	0.9	AMP.
PLATE VOLTAGE	250	250	300	350	VOLTS
GRID #2 VOLTAGE	---	250	200	250	VOLTS
GRID #1 VOLTAGE	-20	-14	-12.5	-18	VOLTS
PEAK AF GRID #1 VOLTAGE	20	14	12.5	18	VOLTS
ZERO SIGNAL PLATE CURRENT	40	72	48	54	mA
ZERO SIGNAL GRID #2 CURRENT	---	5	2.5	2.5	mA
MAXIMUM SIGNAL GRID #2 CURRENT	---	7.3	4.7	7.0	mA
TRANSCONDUCTANCE	4700	6000	5300	5200	µMHOS
PLATE RESISTANCE	1700	22 500	35 500	33 000	OHMS
AMPLIFICATION FACTOR	8	---	---	---	OHMS
LOAD RESISTANCE	5000	2500	4500	4200	OHMS
MAXIMUM SIGNAL POWER OUTPUT	1.4	6.5	6.5	10.8	WATTS
TOTAL HARMONIC DISTORTION (APPROX)	5	10	11	15	PERCENT
MAXIMUM SIGNAL PLATE CURRENT	44	79	55	66	mA

PUSH-PULL AMPLIFIER

VALUES FOR TWO TUBES

	CLASS A1		CLASS AB1		CLASS AB2		
HEATER VOLTAGE	6.3	6.3	6.3	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	0.9	0.9	0.9	0.9	AMP.
PLATE VOLTAGE	250	270	360	360	360	360	VOLTS
GRID #2 VOLTAGE	250	270	270	270	225	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	-22.5	-22.5	-18	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	45	45	52	72	VOLTS
ZERO SIGNAL PLATE CURRENT	120	134	88	88	78	88	mA
MAX. SIGNAL PLATE CURRENT	140	155	132	140	142	205	mA
ZERO SIGNAL GRID #2 CURRENT	10	11	5	5	3.5	5	mA
MAX. SIGNAL GRID #2 CURRENT	16	17	15	11	11	16	mA
TRANSCONDUCTANCE (EA. TUBE)	5500	5700	---	---	---	---	µMHOS
PLATE RESISTANCE (EA. TUBE)	24500	23500	---	---	---	---	OHMS
LOAD RESISTANCE	5000	5000	6600	3800	6000	3800	OHMS
POWER OUTPUT	14.5	17.5	26.5	18	31	47	WATTS
TOTAL HARMONIC DISTORTION	2	2	2	2	2	2	PERCENT

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 250Vdc, E_{c2} = 250Vdc, E_{c1} = -14Vdc

EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	840	960	---	---	---	---	mA
HEATER CATHODE LEAKAGE	0	75	---	---	---	---	µAdc
GRID #1 CURRENT (E_b=400Vdc, E_{c2}=300Vdc E_{c1}=-19Vdc)	0	-3.0	---	---	---	---	µAdc
PLATE CURRENT (E_b=400Vdc, E_{c2}=300Vdc, E_{c1}=-22Vdc)	50	80	---	---	---	---	mAdc
SCREEN GRID CURRENT (E_b=400Vdc, E_{c2}=300Vdc E_{c1}=-22Vdc)	0	5.0	---	---	---	---	mAdc

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN – CONT'D.

E_f = 6.3V, E_b = 250Vdc, E_{c2} = 250Vdc, E_{c1} = −14Vdc
EXCEPT AS MODIFIED BELOW

TRANSCONDUCTANCE	5200	6800	---	---	---	---	μMHOS
POWER OUTPUT (E_{sig}=9.8 Vac, R_p= 2500 OHMS)	5.4	---	---	---	---	---	WATTS
GRID EMISSION (E_b=E_{c1}=E_{c2}=50Vdc)	275	---	---	---	---	---	mAdc

SPECIAL REQUIREMENTS

VARIABLE FREQUENCY VIBRATION[A] (R_p=2000 OHMS, E_{c1}=−27Vdc)	---	1000	mVac
LOW FREQUENCY VIBRATION[B] (R_p=2000 OHMS, E_{c1}=−27Vdc)	---	1000	mVac
SHOCK[C] (HAMMER ANGLE = 30°, E_f=−6.3V)	---	---	
VIBRATIONAL FATIGUE[D]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	1000	Vac
HEATER CATHODE LEAKAGE	0	100	μAdc
TRANSCONDUCTANCE	4500	---	μMHOS
MECHANICAL RESONANCE[E]	---	---	
AF NOISE[F] (E_{sig} = 280mVac, R_p = 2000 OHMS)	---	17	VU
LIFE TEST END POINT			
POWER OUTPUT	4.0	---	WATTS
TRANSCONDUCTANCE	4500	---	μMHOS

NOTES

*GRID #2 CONNECTED TO PLATE

[A] SEE MIL-E-1C 4.9.20.3

[B] SEE MIL-E-1C 4.9.20.4

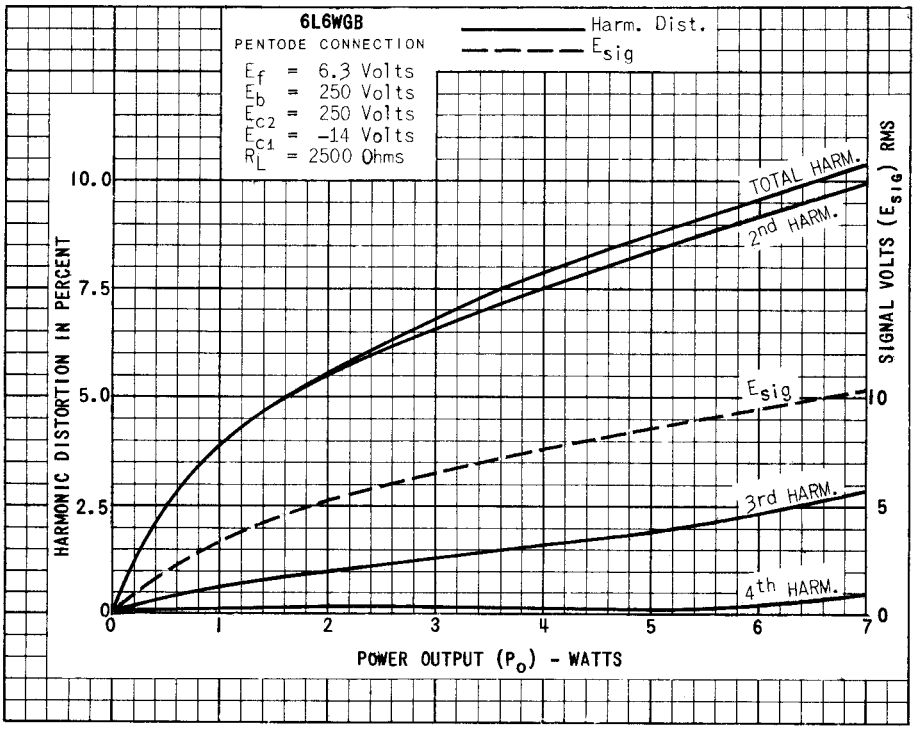
[C] SEE MIL-E-1C 4.9.20.5

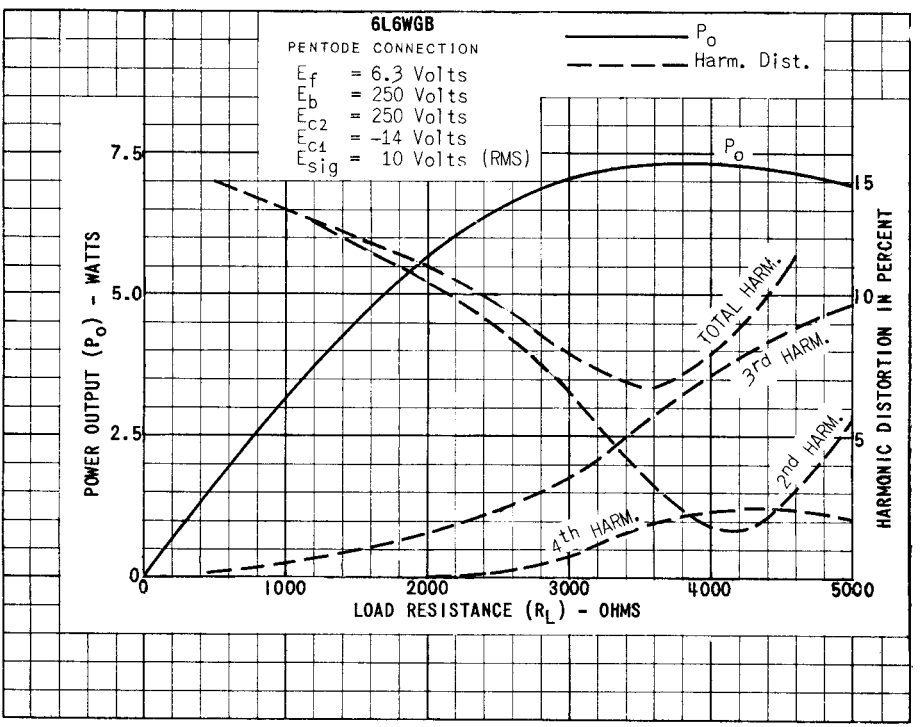
[D] SEE MIL-E-1C 4.9.20.6

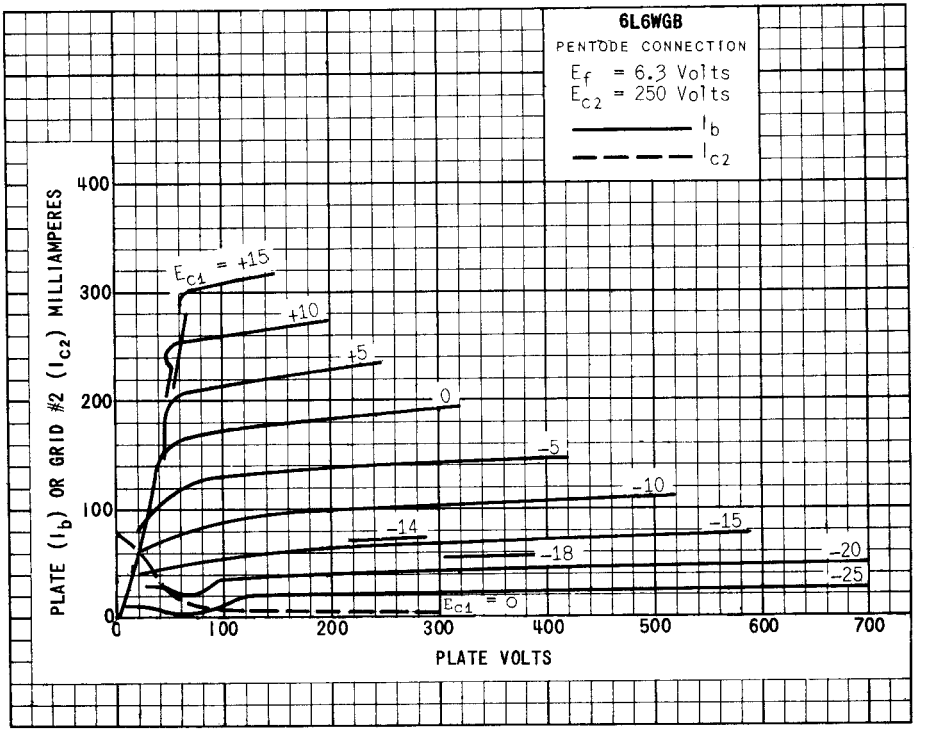
[E] THE MOUNT SHALL SHOW NO PRONOUNCED MECHANICAL RESONANCE BELOW 100 CPS.

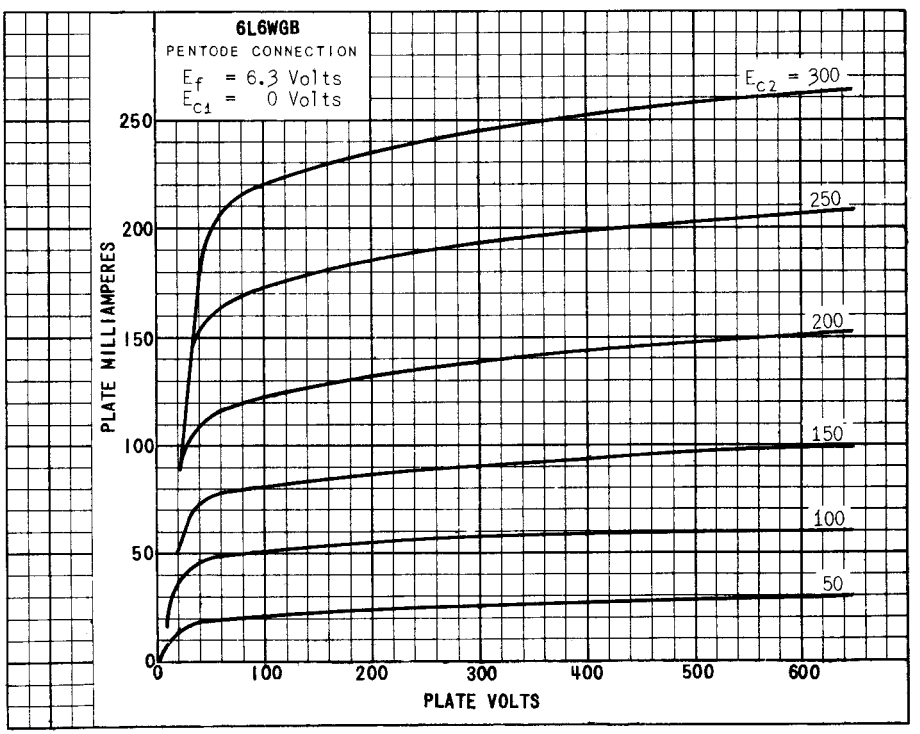
[F] SEE MIL-E-1C 4.10.3.2

6L6WGB
PREMIUM TUBE

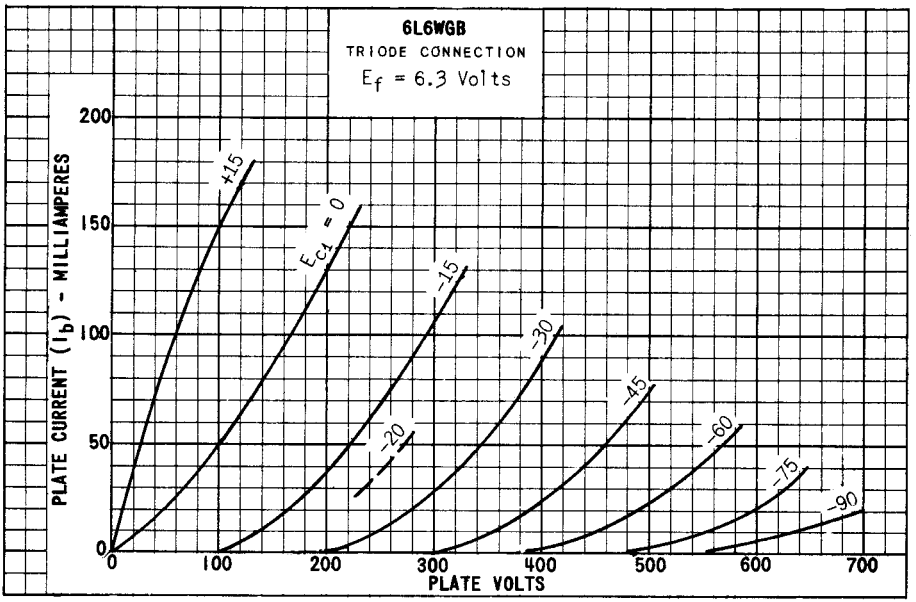




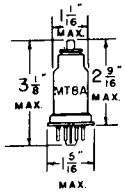

6L6WGB
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 250 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = +15
+10
+5
0
-5
-10
-14
-15
-18
-20
-25
E_{c1} = 0
0
100
200
300
400
500
600
700


6L6WGB
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c1} = 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_{c2} = 300
250
200
150
100
50
0
50
100
150
200
250
0
100
200
300
400
500
600

6L6WGB
PREMIUM TUBE



TUNG-SOL

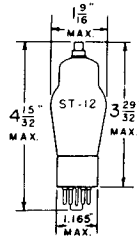


METAL SHELL
7 PIN OCTAL BASE
6L7

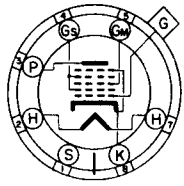
PENTAGRID MIXER

UNIPOTENTIAL CATHODE

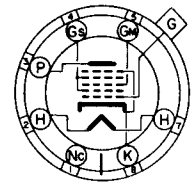
HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC



GLASS BULB
SMALL 7 PIN OCTAL BASE
6L7G



7T
BOTTOM VIEW
6L7



G-7T
BOTTOM VIEW
6L7G

THE TUNG-SOL 6L7 AND 6L7G IS A MIXER TUBE DESIGNED FOR SERVICE WITH A SEPARATE OSCILLATOR AS THE FIRST DETECTOR IN SUPERHETERODYNE RECEIVERS. THE CONTROL GRID (G) IS OF THE REMOTE CUT-OFF TYPE WHICH ALLOWS THE USE OF A.V.C. AND MINIMIZES CROSS-MODULATION. THE CONTROL GRID (GM) IS OF THE SHARP CUT-OFF TYPE. THE TUBE MAY BE USED AS A VOLUME EXPANDER OR AS A DOUBLY CONTROLLED GENERAL PURPOSE AMPLIFIER.

RATINGS

CLASS A1 AMPLIFIER

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.0	WATT

MIXER

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	1.5	WATTS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
922-2

DEC. 30
1940

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
SCREEN (G_S) VOLTAGE	100	VOLTS
CONTROL GRID (G_M) VOLTAGE	-3	VOLTS
CONTROL GRID (G) VOLTAGE	-3	VOLTS
PLATE CURRENT	5.3	MA.
SCREEN CURRENT	6.5	MA.
PLATE RESISTANCE APPROX.	0.6	MEGOHM
TRANSCONDUCTANCE [A]	1100	µMHOS
AMPLIFICATION FACTOR APPROX.	670	
TRANSCONDUCTANCE [A]	475	µMHOS
FOR CONTROL GRIDS (G & G_M) VOLTAGES =-6 VOLTS		
TRANSCONDUCTANCE [A]	75	µMHOS
FOR CONTROL GRIDS (G & G_M) VOLTAGES =-10 VOLTS		
TRANSCONDUCTANCE [A] APPROX.	5	µMHOS
FOR CONTROL GRIDS (G & G_M) VOLTAGES =-15 VOLTS		

[A] TRANSCONDUCTANCE BETWEEN THE CONTROL GRID (G) AND THE PLATE (P).

MIXER

PLATE VOLTAGE	250	250	VOLTS
SCREEN (G_S) VOLTAGE	100	150	VOLTS
OSCILLATOR GRID (G_M) VOLTAGE	-10	-15	VOLTS
PEAK OSCILLATOR VOLTAGE APPLIED TO (G_M) MIN.	12	18	VOLTS
CONTROL GRID (G) VOLTAGE MIN.	-3	-6	VOLTS
PLATE CURRENT	2.4	3.3	MA.
SCREEN CURRENT	7.1	9.2	MA.
PLATE RESISTANCE	GREATER THAN 1.0 MEGOHM		
CONVERSION TRANSCONDUCTANCE	375	-	µMHOS
FOR CONTROL GRID (G) VOLTAGE =-3 VOLTS			
CONVERSION TRANSCONDUCTANCE	225	350	µMHOS
FOR CONTROL GRID (G) VOLTAGE =-6 VOLTS			
CONVERSION TRANSCONDUCTANCE	30	75	µMHOS
FOR CONTROL GRID (G) VOLTAGE =-15 VOLTS			
CONVERSION TRANSCONDUCTANCE	5	15	µMHOS
FOR CONTROL GRID (G) VOLTAGE =-30 VOLTS			
CONVERSION TRANSCONDUCTANCE	-	5	µMHOS
FOR CONTROL GRID (G) VOLTAGE =-45 VOLTS			

PLATE 923-2

CONTINUED NEXT PAGE

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

	6L7[A]	6L7G[B]	
GRID (G) TO GRID (G_M) MAX.	0.20	0.20	μμf
GRID (G) TO PLATE MAX.	0.001	0.005	μμf
GRID (G_M) TO PLATE	0.10 MAX.	0.24	μμf
GRID (G) TO ALL OTHER ELECTRODES	7.5	6	μμf
GRID (G_M) TO ALL OTHER ELECTRODES	10	12	μμf
PLATE TO ALL OTHER ELECTRODES	11	10	μμf

[A] WITH SHELL CONNECTED TO CATHODE

[B] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

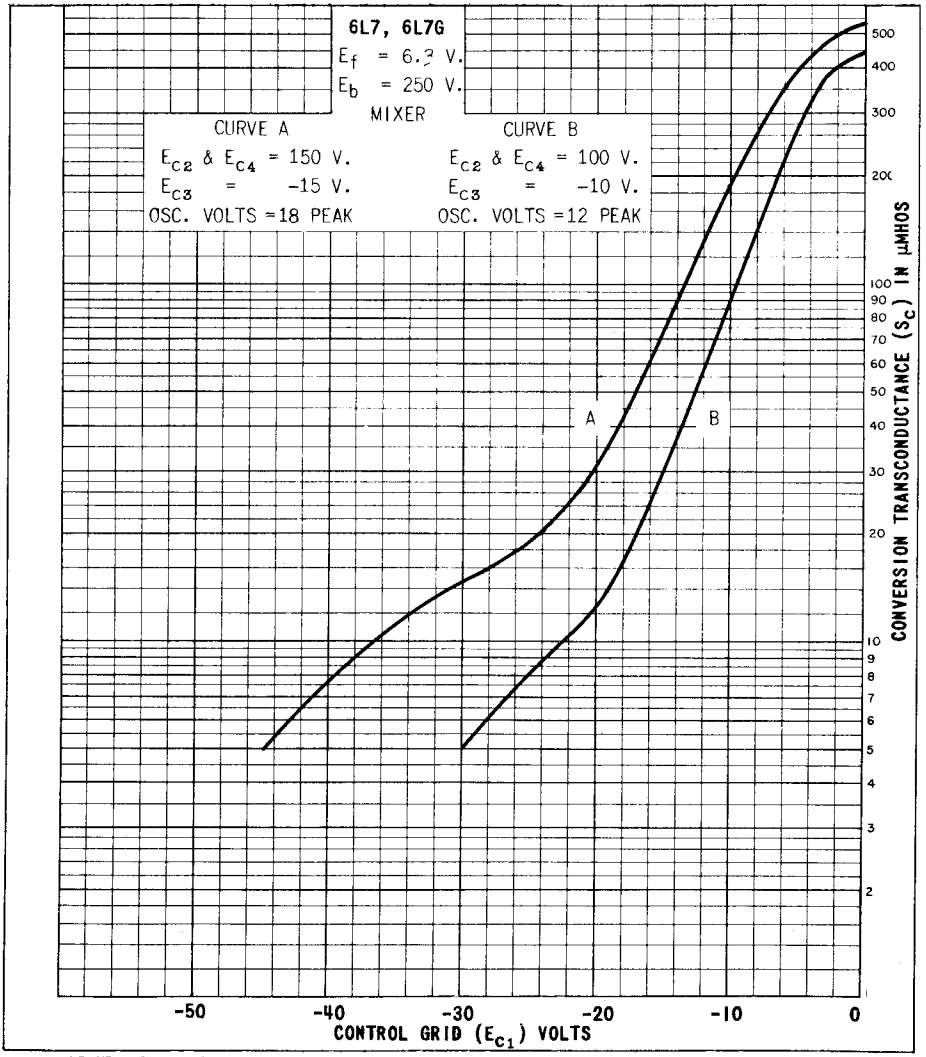

PLATE 924-1

DEC. 30 1940

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6L7, 6L7G

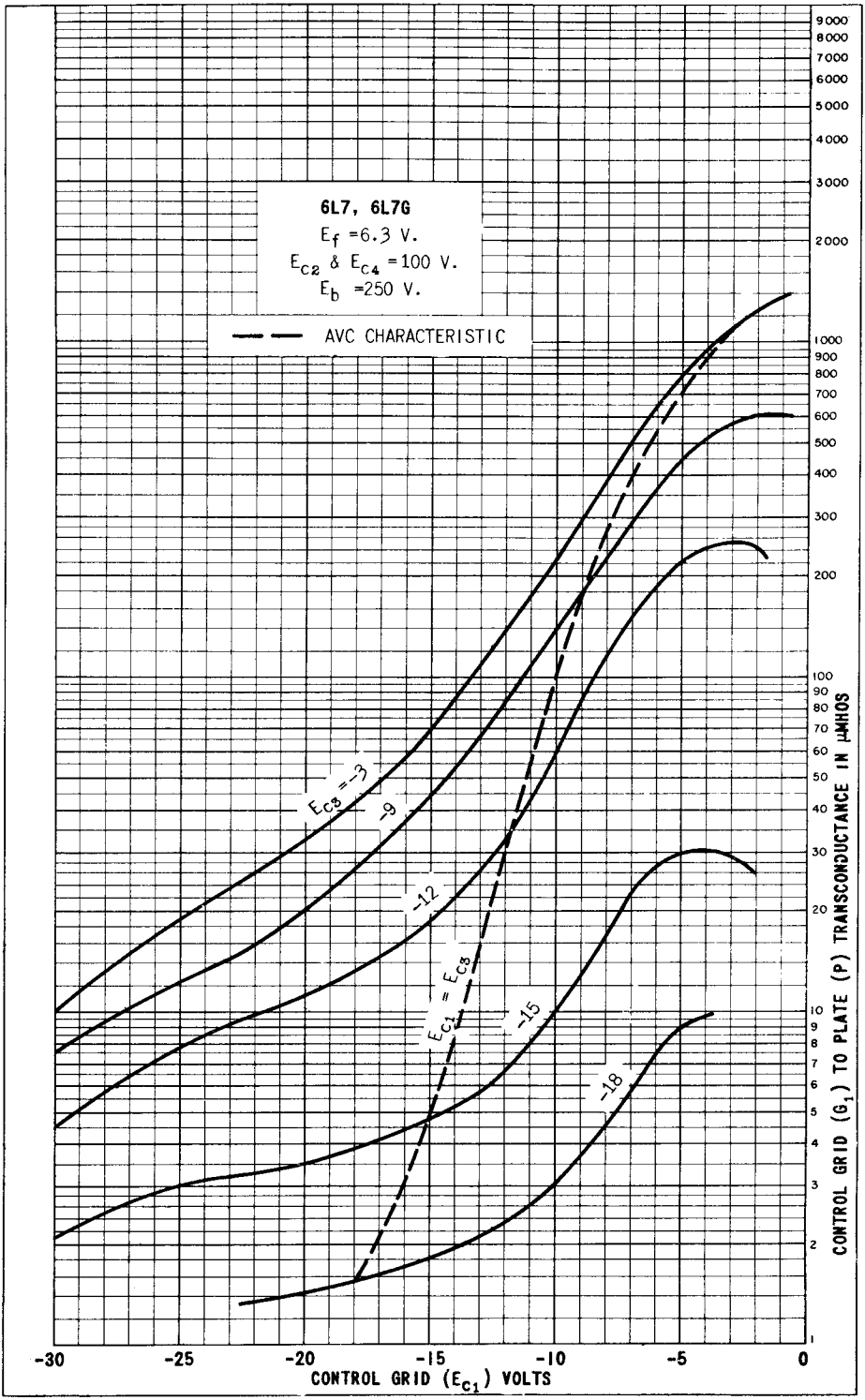

PLATE
925-1

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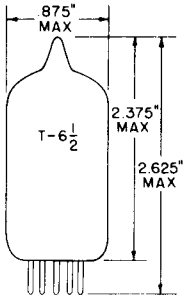
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



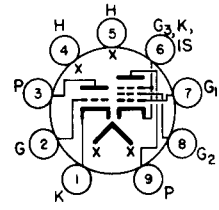
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR USE AS A SYNC SEPARATOR

AND VIDEO AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 6LF8 IS A SHARP CUT-OFF PENTODE AND A HIGH MU TRIODE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC FOR THE PENTODE SECTION. THE TRIODE SECTION MAY BE USED AS A SYNC SEPARATOR WHILE THE PENTODE SECTION IS DESIGNED TO SERVE AS A VIDEO AMPLIFIER.
THE 6LF8 IS SIMILAR TO THE 6AW8A.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE (PG1 TO PP) MAX.	→ 0.05	→ 0.06	pf
PENTODE INPUT: PG TO (H+PG2+PK,G3,I.S.)	10	10	pf
PENTODE OUTPUT: PP TO (H+ PG2+PK,G3,I.S.)	4.5	3.6	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	2.2	2.2	pf
TRIODE INPUT: TG TO (H+TK=PK, PG3, I.S.)	3.4	3.2	pf
TRIODE OUTPUT: TP TO (H+TK=PK, PG3, I.S,)	3.0	1.8	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	.005	.008	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX.	.025	.150	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 4 AND PIN 5.

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
LIMITS OF SUPPLIED CURRENT - AC OR DC		600 ± 40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

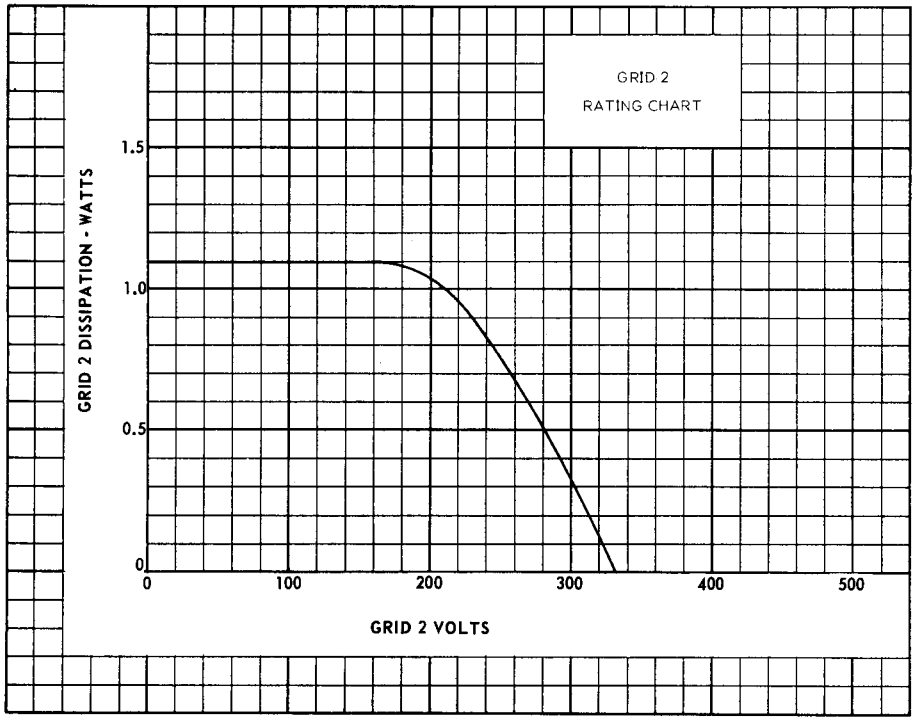
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

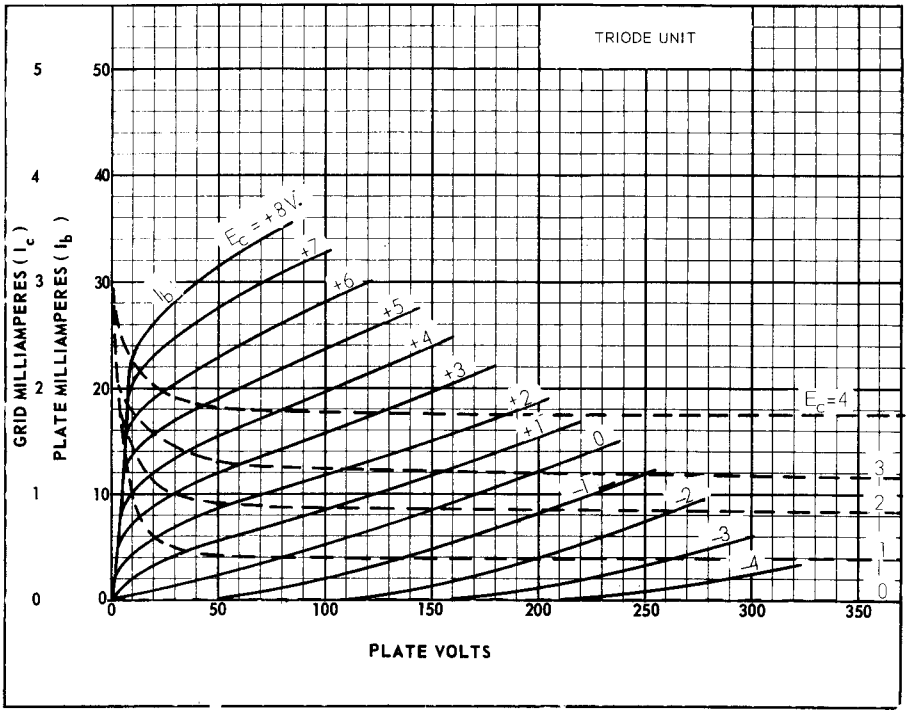
	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE RATING CHART	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	1.1	3.75	WATTS
GRID 2 DISSIPATION UP TO 165 VOLTS		1.1	WATTS
POSITIVE DC GRID 1 VOLTAGE	4	0	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	55	VOLTS
GRID 1 CIRCUIT RESISTANCE			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED BIAS OPERATION	0.5	0.25	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

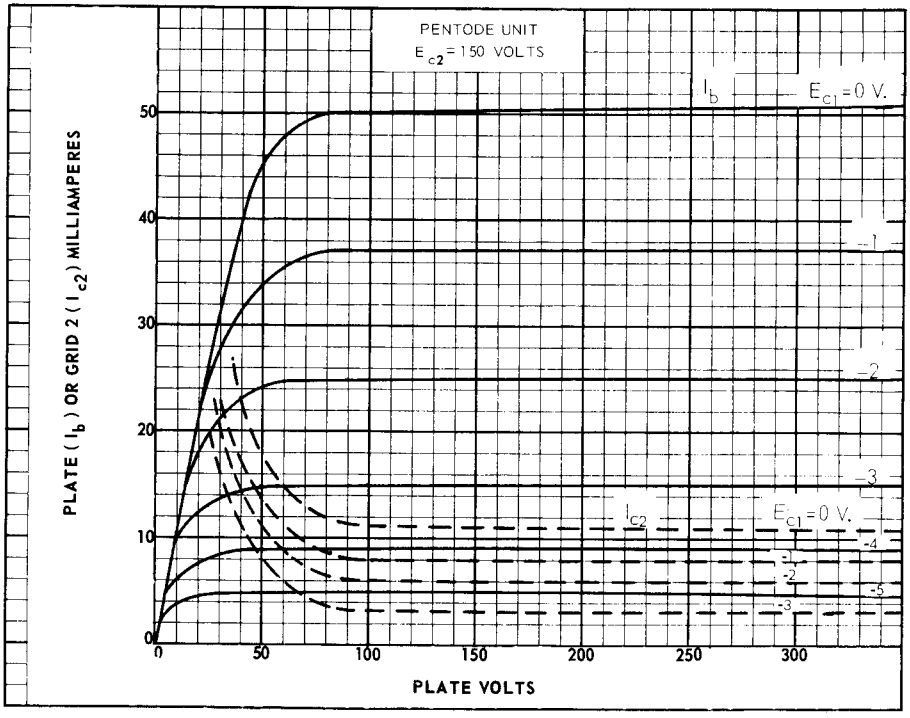
CLASS A1 AMPLIFIER

	TRIODE		PENTODE		
PLATE VOLTAGE	200	40	75	100	VOLTS
GRID 2 VOLTAGE	–	–	150	150	VOLTS
GRID 1 VOLTAGE	–2	+3	0	–2.5	VOLTS
PLATE CURRENT	4	11	50	20	MA.
GRID 1 CURRENT	0	2.7	0	0	MA.
GRID 2 CURRENT	–	–	12	5	MA.
TRANSCONDUCTANCE	4,000	4,000		11,000	μMHOS
AMPLIFICATION FACTOR	70	40	–	–	–
PLATE RESISTANCE (APPROX.)	17.5	10.0	–	200	KOHMS
GRID 1 VOLTAGE (APPROX.) FOR I_b = 20 μA	–5			–8	VOLTS


GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
1.5
1.0
0.5
0
0
100
200
300
400
500
GRID 2 VOLTS


TRIODE UNIT
GRID MILLIAMPERES (I_c)
PLATE MILLIAMPERES (I_b)
5
4
3
2
1
0
50
40
30
20
10
0
E_c = +8 V.
+7
+6
+5
+4
+3
+2
+1
0
-1
-2
-3
-4
I_b
E_c = 4
3
2
1
0
0
50
100
150
200
250
300
350
PLATE VOLTS

6LF8


PENTODE UNIT
E_{c2} = 150 VOLTS
I_b
E_{c1} = 0 V.
-1
-2
-3
I_{c2}
E_{c1} = 0 V.
-1
-2
-3
-4
-5
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
0
50
100
150
200
250
300

TUNG-SOL

U-H-F AMPLIFIER - OSCILLATOR TRIODE

MINIATURE TYPE

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE MIN. BUTTON 7-PIN	PIN 1 GRID	PIN 7 GRID
CAP ———	PIN 2 CATHODE	PIN 8 NONE
BULB T-5½	PIN 3 HEATER	
MAXIMUM DIAMETER 3/4"	PIN 4 HEATER	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH 1 3/4"	PIN 5 PLATE	
MAXIMUM SEATED HEIGHT 1 1/2"	PIN 6 CATHODE	

MAXIMUM HEIGHT TO CIRCLE OF 7/16" DIAMETER - 1 1/8±3/32"

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.200	AMP.
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE		VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION		WATTS

CAPACITANCES (APPROX.)

WITH CLOSE-FITTING SHIELD CONNECTED TO GRID

GRID TO PLATE	2.35	μμf
INPUT	3.10	μμf
OUTPUT	0.55	μμf
HEATER TO CATHODE	3.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

HEATER OR FILAMENT VOLTAGE	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.200	AMPS.
PLATE VOLTAGE	180	VOLTS
SCREEN VOLTAGE		VOLTS
CONTROL GRID VOLTAGE	-3.5	VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
ZERO-SIGNAL PLATE CURRENT		MA.
ZERO-SIGNAL SCREEN CURRENT		MA.
PLATE CURRENT	12	MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE (APPROX.)	5400	OHMS
TRANSCONDUCTANCE (APPROX.)	6000	μMHOS
AMPLIFICATION FACTOR	32	
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS

NOTE: THE 6N4 IS A HEATER-CATHODE TYPE OF MINIATURE TRIODE ESPECIALLY APPLICABLE AS AN AMPLIFIER OR OSCILLATOR AT FREQUENCIES EXTENDING TO APPROXIMATELY 500 MEGACYCLES.

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PLATE 1681

FEB. 15 1946

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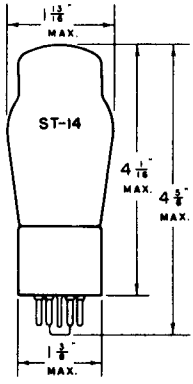


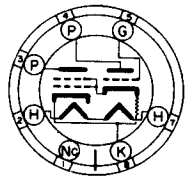
DYNAMIC COUPLED POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 0.8 AMPERE
AC OR DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE



G-7Wb

THE TUNG-SOL 6N6G CONSISTS OF TWO DYNAMICALLY COUPLED TRIODES AND IS DESIGNED FOR SERVICE IN THE POWER OUTPUT STAGE OF AC AND STORAGE BATTERY OPERATED RECEIVERS. ALL NECESSARY BIASES ARE SUPPLIED INTERNALLY. ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6B5.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

OUTPUT PLATE (3) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT PLATE (4) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT GRID (5) VOLTAGE	0	0	0	VOLTS
GRID CIRCUIT RESISTANCE MAX.	0.5	0.5	0.5	MEGOHM
OUTPUT PLATE CURRENT	33	45	51	MA.
INPUT PLATE CURRENT	6.5	8	9	MA.
PLATE RESISTANCE		24 100		OHMS
TRANSCONDUCTANCE		2400		μMHOS
AMPLIFICATION FACTOR		58		
LOAD RESISTANCE	7000	7000	7000	OHMS
SIGNAL VOLTS (RMS)[S]	13.5	15	17	VOLTS
TOTAL HARMONIC DISTORTION	5	5	5	PER CENT
POWER OUTPUT	2.5	4	5.2	WATTS

(3) BASE PIN #3 (4) BASE PIN #4 (5) BASE PIN #5

[S] FOR RATED POWER OUTPUT

NOTE: THE VOLTAGE BETWEEN HEATER AND CATHODE SHOULD NOT EXCEED 50 VOLTS AND IN NO CASE SHOULD THE HEATER BE LEFT FLOATING.

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PLATE 230-1

DEC. 5 1938

CONTINUED NEXT PAGE

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TUNG-SOL

CLASS A1 PUSH-PULL AMPLIFIER

UNLESS SPECIFIED, VALUES ARE FOR TWO TUBES

OUTPUT PLATE (3) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT PLATE (4) VOLTAGE	250	300	325 MAX.	VOLTS
INPUT GRID (5) VOLTAGE	0	0	0	VOLTS
GRID CIRCUIT RESISTANCE MAX.	0.5	0.5	0.5	MEGOHM
OUTPUT PLATE CURRENT PER TUBE	33	45	51	MA.
INPUT PLATE CURRENT PER TUBE	6.5	8	9	MA.
LOAD RESISTANCE PLATE TO PLATE	10 000	10 000	10 000	OHMS
SIGNAL VOLTS (RMS) GRID TO GRID	38	38	42	VOLTS
TOTAL HARMONIC DISTORTION	5	5	5	WATTS
POWER OUTPUT	8.5	10	13.5	WATTS

(3) BASE PIN #3 (4) BASE PIN #4 (5) BASE PIN #5

$ FOR RATED POWER OUTPUT

PLATE
231-1

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TUNG-SOL

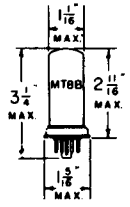
TWIN TRIODE AMPLIFIERS

COATED UNIPOTENTIAL CATHODE

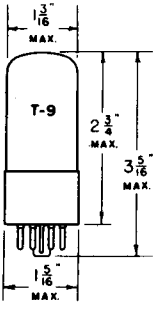
HEATER

6.3 VOLTS 0.8 AMPERE

AC OR DC



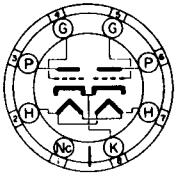
METAL SHELL
8 PIN OCTAL BASE



6N7

BOTTOM VIEW

6N7GT/G



BOTTOM VIEW

THE TUNG-SOL 6N7, 6N7GT/G ARE TWIN TRIODES DESIGNED PRIMARILY FOR SERVICE AS CLASS B AMPLIFIERS. THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	125	MA.
MAXIMUM AVERAGE DISSIPATION PER PLATE	5.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

TRIODES CONNECTED IN PARALLEL

PLATE VOLTAGE	250	294	VOLTS
GRID VOLTAGE	−5	−6	VOLTS
PLATE CURRENT	6	7	MA.
PLATE RESISTANCE	11 300	11 000	OHMS
TRANSCONDUCTANCE	3100	3200	μMHOS
AMPLIFICATION FACTOR	35	35	

RESISTANCE COUPLED AMPLIFIER AND PHASE INVERTER

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.1	0.5	0.1	0.5	MEGOHM
CATHODE RESISTOR	2500	7000	1800	5000	OHMS
VOLTAGE GAIN	20	22	23	24	

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PLATE
1343-1
OCT. 25
1943

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6N7, 6N7GT/G

TUNG-SOL

TYPICAL AND IDEAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS B_2 AMPLIFIER – PUSH-PULL

	IDEAL	TYPICAL	
ZERO-SIGNAL PLATE VOLTAGE	300	300	VOLTS
DC GRID VOLTAGE	0	0	VOLT
AF-PEAK SIGNAL VOLTAGE PER GRID [A]	29	41	VOLTS
MAXIMUM-PEAK-SIGNAL GRID CURRENT PER GRID	20	22	MA.
ZERO-SIGNAL PLATE CURRENT PER PLATE	17.5	17.5	MA.
MAXIMUM-SIGNAL DC PLATE CURRENT PER PLATE	35	35	MA.
GRID IMPEDANCE AT 400 CYCLES	0	516[B]	OHMS
PLATE SUPPLY IMPEDANCE	0	1000	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	8000	8000	OHMS
TOTAL HARMONIC DISTORTION	4	8	PER CENT
THIRD HARMONIC	3.5	7.5	PER CENT
FIFTH HARMONIC	1.5	2.5	PER CENT
POWER OUTPUT	10	10	WATTS

[A] FOR POWER OUTPUT SHOWN

[B] 500 OHMS AND 50 MH.

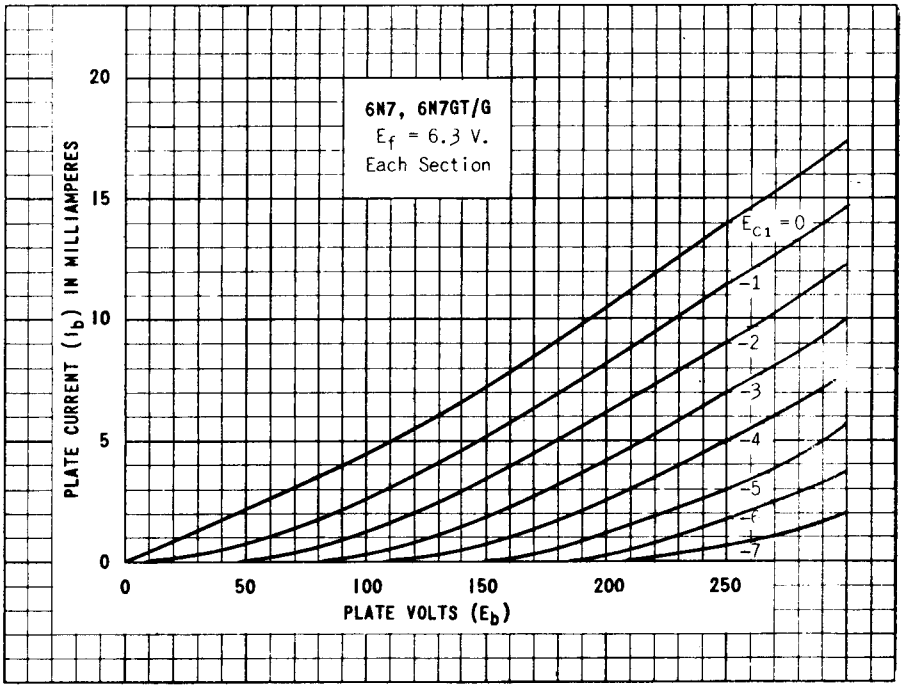

PLATE 1344-1
OCT. 25 1943

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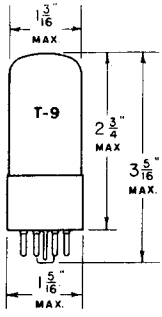
TUNG-SOL



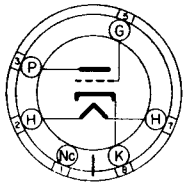
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



G-6Qa

BOTTOM VIEW

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 6P5GT/G IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER. ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 76.

RATINGS

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.25	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE[A]	-5	-13.5	VOLTS
PLATE CURRENT	2.5	5.0	MA.
PLATE RESISTANCE	12000	9500	OHMS
TRANSCONDUCTANCE	1150	1450	μMHOS
AMPLIFICATION FACTOR	13.8	13.8	

DIRECT INTERELECTRODE CAPACITANCES[S]

GRID TO CATHODE	3.4	μμf
PLATE TO CATHODE	5.5	μμf
GRID TO PLATE	2.6	μμf

[A] THE DC RESISTANCE IN THE GRID CIRCUIT OF THE 6P5GT/G, UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 1.0 MEGOHM.

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

CONTINUED NEXT PAGE

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PLATE 1141-1
NOV. 17 1941

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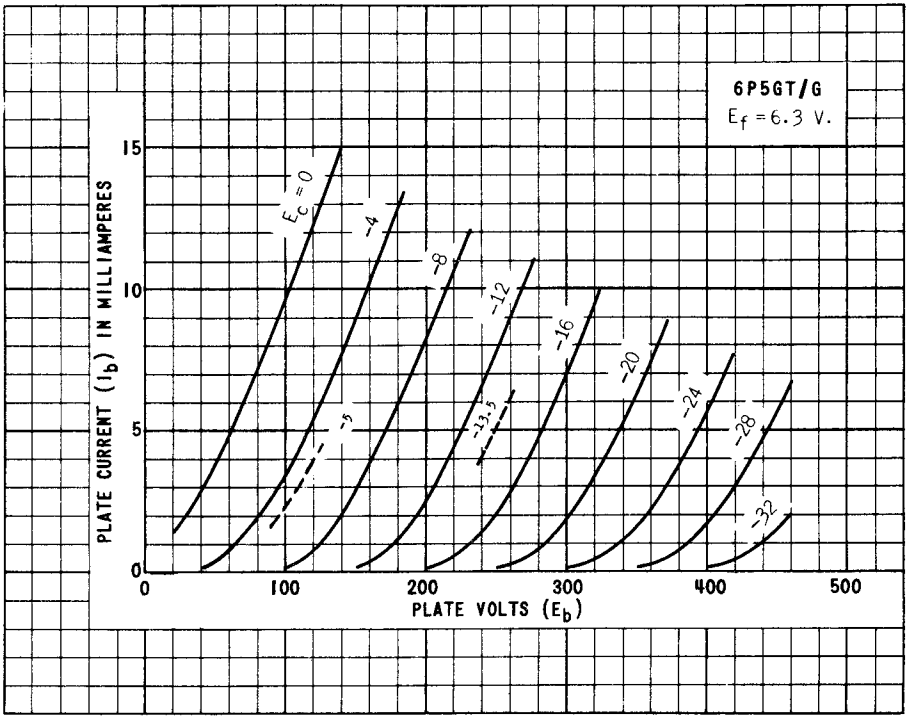
6P5GT/G



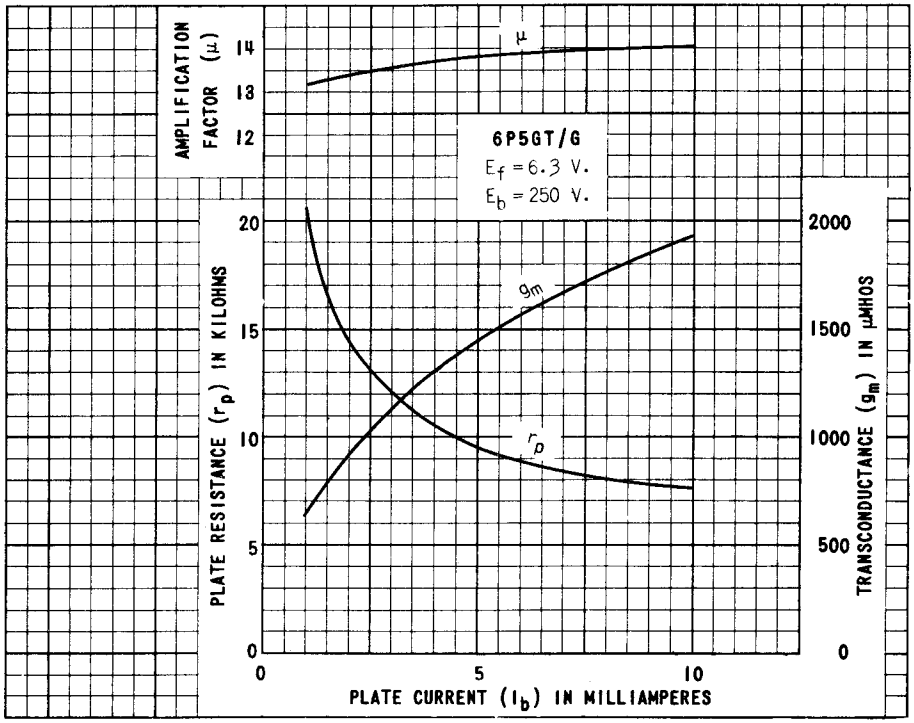


PLATE 1142-1

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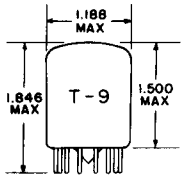
TUNG-SOL

THREE TRIODES

COATED UNIPOTENTIAL CATHODE

FOR SYNC CLIPPER AND
GATED AGC AMPLIFIER
SERVICE IN TV RECEIVERS

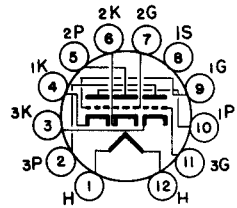
ANY MOUNTING POSITION



BUTTON
12 PIN BASE E12-70

OUTLINE DRAWING
JEDEC 9-56

GLASS BULB



BASING DIAGRAM
JEDEC 12BY

BOTTOM VIEW

THE 6Q11 CONSISTS OF THREE TRIODES IN A 12 PIN COMPACT CONSTRUCTION. TWO OF THE TRIODES HAVE A HIGH MU, THE OTHER HAS A MEDIUM MU. ONE OF THE HIGH MU SECTIONS IS ESPECIALLY SHIELDED FROM THE OTHER SECTIONS. EACH ELEMENT IS BROUGHT OUT TO A SEPARATE BASE PIN. THE 6Q11 IS DESIGNED FOR SYNC CLIPPER AND GATED AGC AMPLIFIER SERVICE IN TV RECEIVERS. THE HEATER MAY BE OPERATED FROM A TRANSFORMER OR IN A SERIES STRING.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	TRIODE 3	
GRID TO PLATE	1.8	2.0	2.0	pf
INPUT: G TO (H+K+I.S.)	1.9	1.8	1.8	pf
OUTPUT: P TO (H+K+I.S.)	1.7	0.6	1.7	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	0.60	AMPS
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (AC OR DC)		6.3±0.6	VOLTS
CURRENT OPERATION (AC OR DC)		0.60±.04	AMPS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

	TRIODE 1	TRIODE 2 & 3	
PLATE VOLTAGE	330	330	VOLTS
NEGATIVE DC GRID VOLTAGE	100	100	VOLTS
POSITIVE DC GRID VOLTAGE	0	0	VOLTS
POSITIVE TRANSIENT GRID VOLTAGE	60	---	VOLTS
POSITIVE STEADY STATE PULSE VOLTAGE[B]	5	---	VOLTS
PLATE DISSIPATION, EACH	3	1.2	WATTS
GRID RESISTANCE	5.0	5.0	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE 1	TRIODE 2 & 3 EACH		
PLATE VOLTAGE	150	100	250	VOLTS
GRID VOLTAGE	0	-1	-2	VOLTS
PLATE CURRENT	22	.5	1.2	MA.
TRANSCONDUCTANCE	2500	1250	1600	μMHOS
AMPLIFICATION FACTOR	18	100	100	
PLATE RESISTANCE	7000	80000	62500	OHMS
GRID VOLTAGE FOR Ib = 10 μA (APPROX.)	-13	---	-4.5	VOLTS

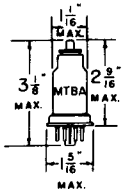
PULSE AMPLIFIER[B]

PLATE VOLTAGE	30	---	VOLTS
GRID VOLTAGE	30	---	VOLTS
PEAK CATHODE CURRENT	200	---	MA.
RATIO PLATE CURRENT TO GRID CURRENT	1.0	---	

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B]THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

TUNG-SOL



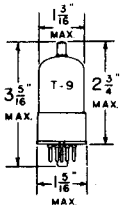
METAL SHELL
SMALL WAFER
7 PIN OCTAL BASE
6Q7

DUO-DIODE

HIGH-MU TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

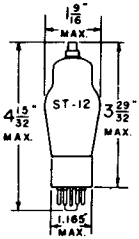
HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC



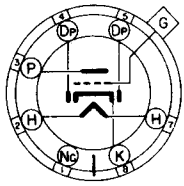
GLASS BULB
SMALL WAFER
7 PIN OCTAL BASE
5Q7GT

7V

BOTTOM VIEW
6Q7, 6Q7GT



GLASS BULB
SMALL 7 PIN
OCTAL BASE
6Q7G



G-7V

BOTTOM VIEW
6Q7G

THE TUNG-SOL 6Q7, 6Q7G AND 6Q7GT COMBINE TWO DIODES AND A HIGH-MU TRIODE IN A SINGLE ENVELOPE, USING A COMMON CATHODE. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS, AND AS HIGH GAIN RESISTANCE COUPLED AMPLIFIERS IN AC, STORAGE BATTERY, AND AC-DC OPERATED RECEIVERS.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED PER PLATE	0.8	MA.

AVERAGE CHARACTERISTICS OF TRIODE UNIT

PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1.0	MA.
PLATE RESISTANCE	58 000	58 000	OHMS
TRANSCONDUCTANCE	1200	1200	μMHOS
AMPLIFICATION FACTOR	70	70	

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PLATE
1116-4

SEPT. 17
1941

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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6Q7, 6Q7G, 6Q7GT

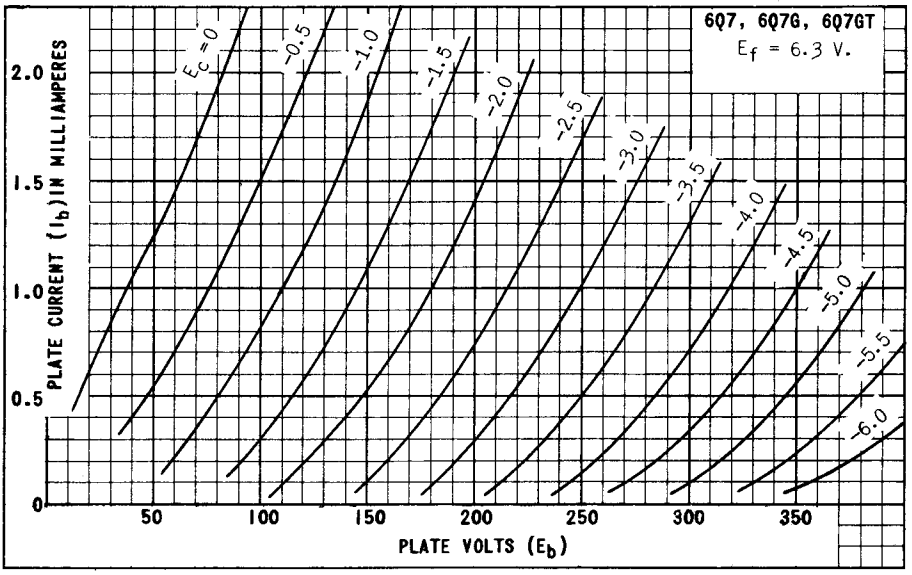
TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ZERO BIAS, RESISTANCE COUPLED, CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	100		300		VOLTS
PLATE LOAD RESISTOR	0.25		0.25		MEGOHM
GRID RESISTOR	10		10		MEGOHM
COUPLING CONDENSER	.01 TO .005		.01 TO .005		μf
GRID RESISTOR FOR FOLLOWING TUBE	.5 TO	1.0	.5 TO	1.0	MEGOHM
EXTERNAL GRID CIRCUIT IMPEDANCE	0	0	0	0	MEGOHM
VOLTAGE GAIN	40	42	50	56	
VOLTAGE OUTPUT (RMS)[A]	11	13	51	58	VOLTS

[A] AT 5% TOTAL HARMONIC DISTORTION.



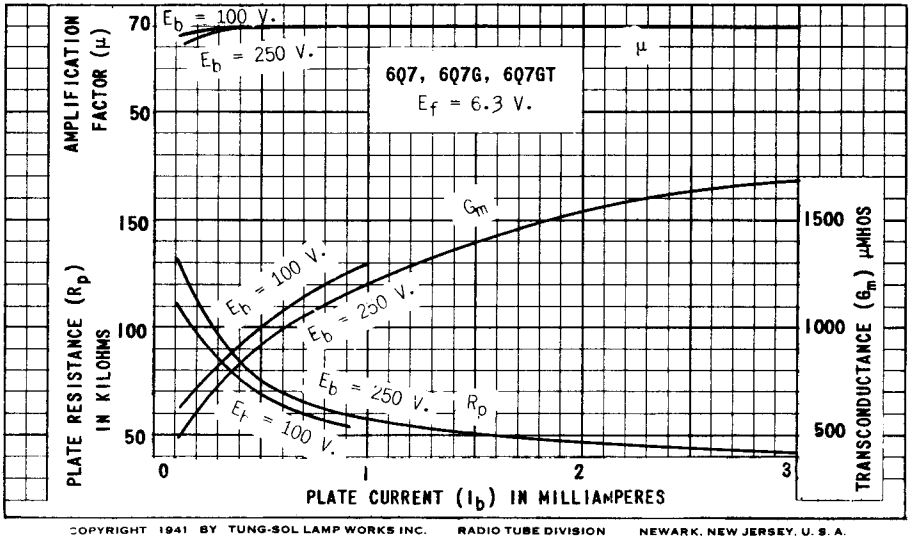


PLATE 1117-1

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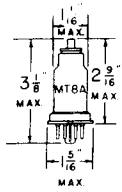
TUNG-SOL



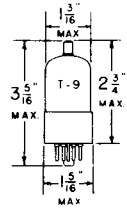
METAL SHELL
SMALL WAFER
7 PIN OCTAL BASE
6R7

DUO-DIODE

TRIODE AMPLIFIER

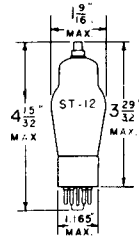
UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

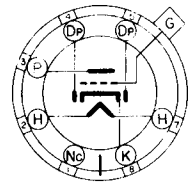


GLASS BULB
INTERMEDIATE
7 PIN OCTAL BASE
6R7GT

7V
BOTTOM VIEW
6R7



GLASS BULB
SMALL 7 PIN
OCTAL BASE
6R7G



G-7V
BOTTOM VIEW
6R7G, 6R7GT

THE TUNG-SOL 6R7, 6R7G AND 6R7GT COMBINE TWO DIODES AND A TRIODE IN A SINGLE ENVELOPE, USING A COMMON CATHODE. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS, AND AF AUDIO AMPLIFIERS IN AC, STORAGE BATTERY, AND AC – DC OPERATED RECEIVERS.

RATINGS

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED PER PLATE	0.8	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE[A]	-9	VOLTS
PLATE CURRENT	9.5	MA.
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	

[A] THE DC RESISTANCE IN THE GRID CIRCUIT UNDER MAXIMUM RATED CONDITIONS SHOULD NOT EXCEED 1.0 MEGOHM.

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PLATE 1054-S
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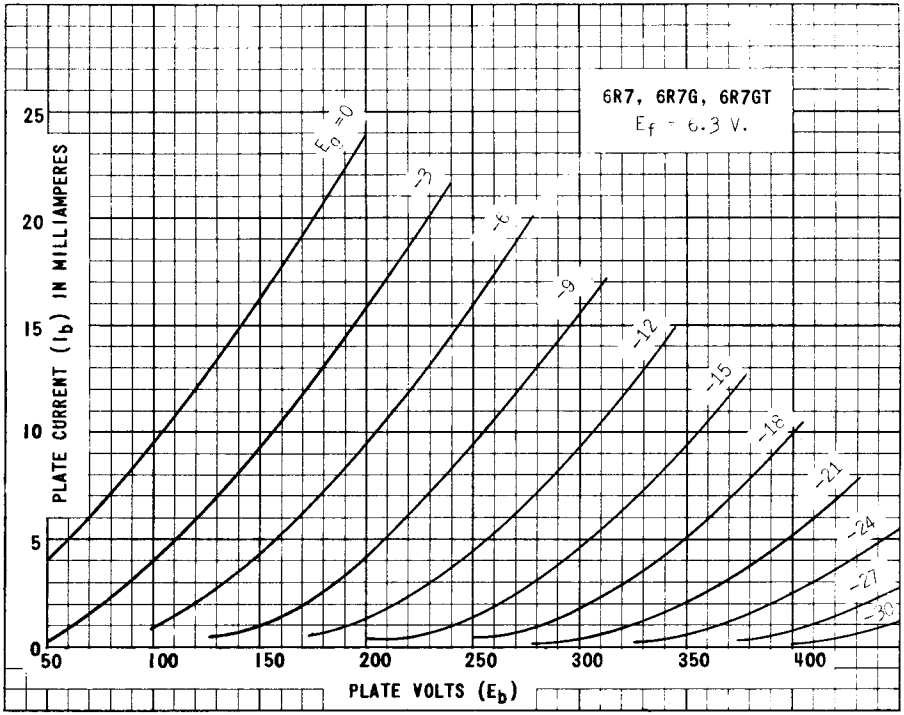
6R7, 6R7G, 6R7GT



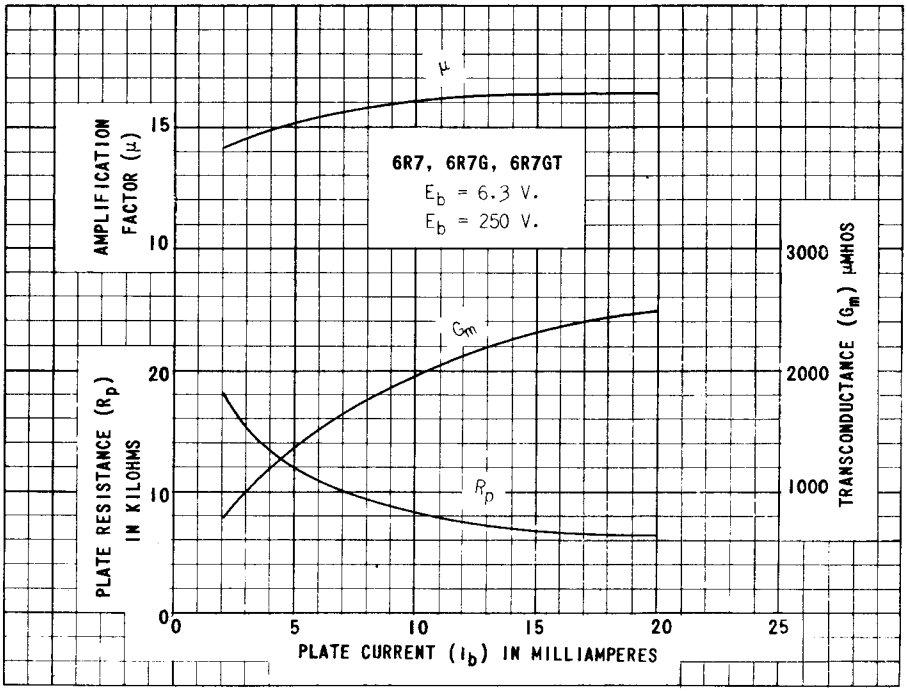


PLATE 1085-2

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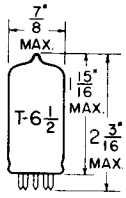
TUNG-SOL

TRIPLE-DIODE TRIODE

MINIATURE TYPE

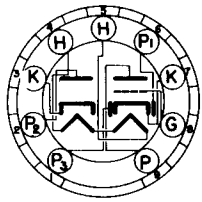


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9E

THE 6R8 IS A TRIPLE-DIODE LOW-MU TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A COMBINED AM/FM DETECTOR AND AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	2.4	μμf
GRID TO CATHODE: (G TO K)	1.5	μμf
PLATE TO CATHODE: (P TO K)	1.1	μμf
GRID TO EACH DIODE PLATE (MAX.)	0.035	μμf
DIODE #1 TO CATHODE: (1P TO 1K)	3.8	μμf
DIODE #3 TO CATHODE: (3P TO 1K)	3.8	μμf
DIODE #2 TO CATHODE #2: (2P TO 2K)	4.5	μμf
DIODE #2 TO ALL: D_2 TO (H+1K+2K+1P+3P+G+P)	8.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	5	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−9	VOLTS
PLATE RESISTANCE	8 500	OHMS
TRANSCONDUCTANCE	1 900	μMHOS
AMPLIFICATION FACTOR	16	
PLATE CURRENT	9.5	MA.
LOAD RESISTANCE	10 000	OHMS
POWER OUTPUT	300	MW.

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PLATE 2-50
AUG. 1 1950

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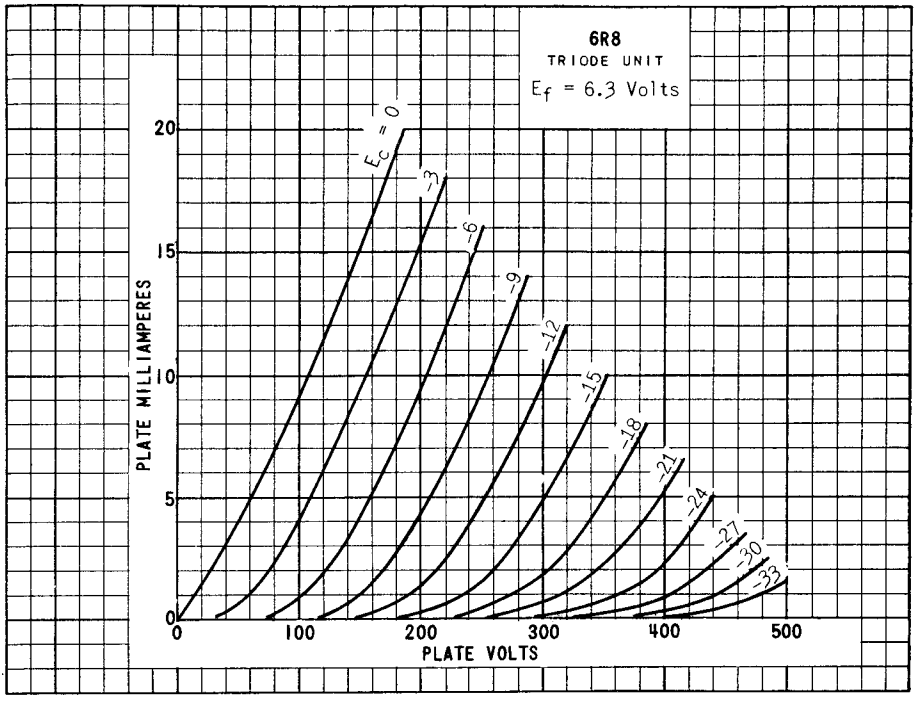
6R8



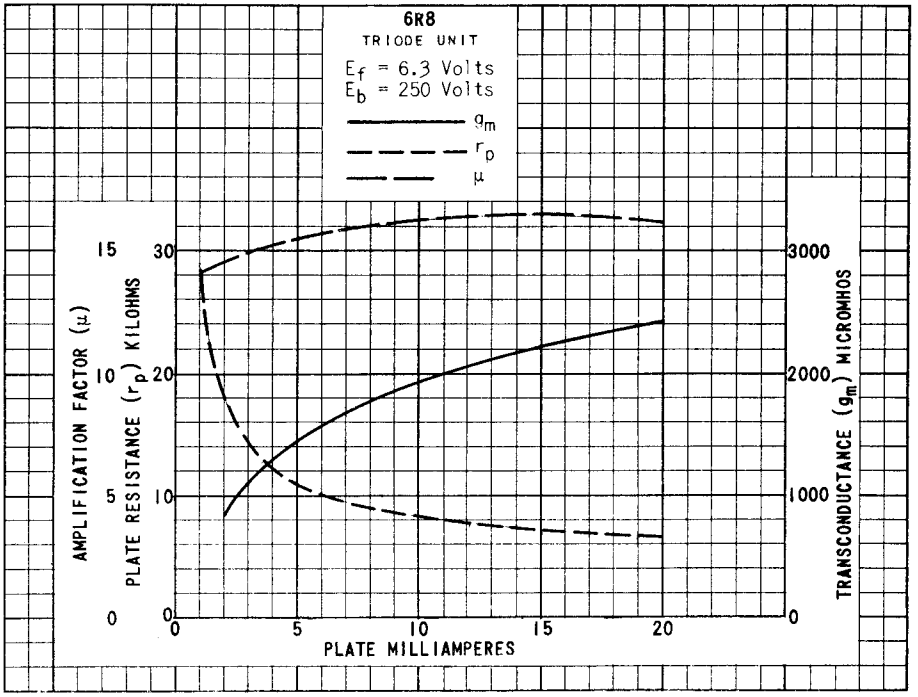


PLATE 2451
AUG. 1 1950

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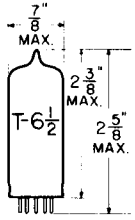
TUNG-SOL

TRIODE

MINIATURE TYPE

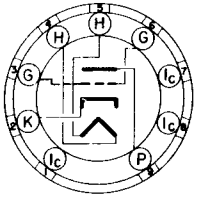


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AC

THE 6S4 IS A HIGH PERVEANCE TRIODE USING THE SMALL BUTTON 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM DC PLATE VOLTAGE	500	VOLTS
MAXIMUM DC PEAK POSITIVE-PULSE PLATE VOLTAGE[B]	2000	VOLTS
MAXIMUM DC GRID VOLTAGE	-50	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID VOLTAGE	-200	VOLTS
MAXIMUM DC CATHODE CURRENT	30	MA.
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	MEGOHMS
MINIMUM CATHODE BIAS RESISTANCE[C]	220	OHMS

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION.

[B] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PERCENT OF ONE SCANNING CYCLE IS 2.5 MILLISECONDS

[C] INDICATED MINIMUM VALUE OF THIS RESISTOR IS REQUIRED TO PROTECT THE TUBE IN THE EVENT OF TEMPORARY FAILURE OF EXCITATION AND RESULTANT LOSS IN DEVELOPED BIAS.

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PLATE
2524
DEC. 1
1950

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VERTICAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
DC PLATE VOLTAGE	450	VOLTS
CATHODE BIAS RESISTOR	820	OHMS
GRID INPUT VOLTAGE (APPROX.):		
PEAK-TO-PEAK SAWTOOTH COMPONENT	60	VOLTS
NEGATIVE PEAKING COMPONENT	48	VOLTS
DC PLATE CURRENT	18	MA.
PLATE OUTPUT VOLTAGE (APPROX.):		
PEAK POSITIVE PULSE COMPONENT	800	VOLTS
PEAK-TO-PEAK SAWTOOTH COMPONENT	350	VOLTS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-8	VOLTS
PLATE CURRENT	26	MA.
PLATE RESISTANCE (APPROX.)	3600	OHMS
TRANSCONDUCTANCE	4500	µMHOS
AMPLIFICATION FACTOR	16	

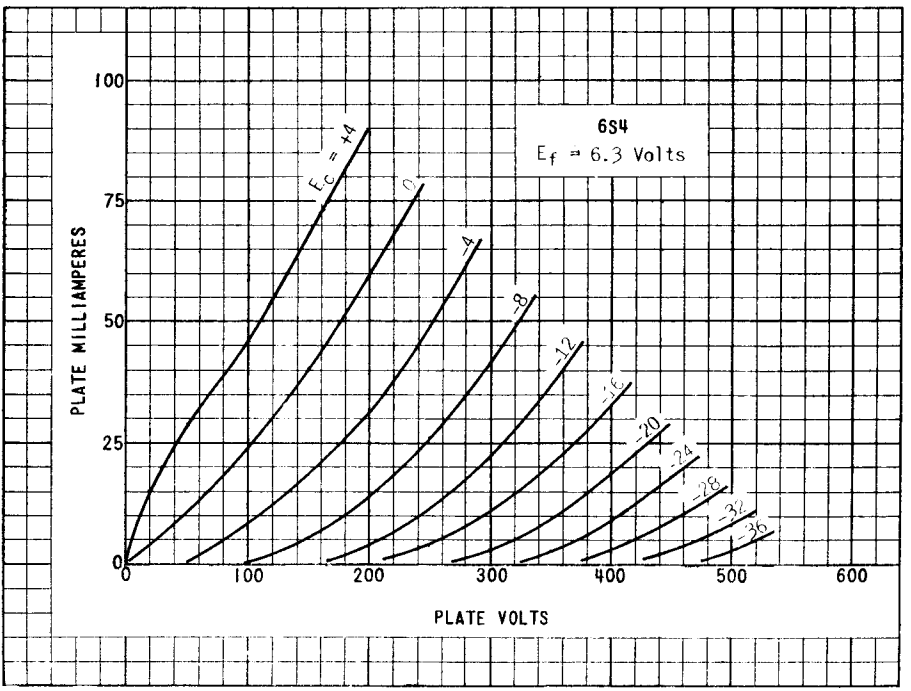

PLATE 2525
DEC. 1 1950

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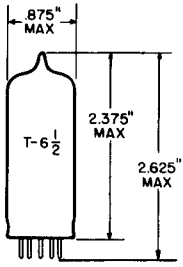
TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

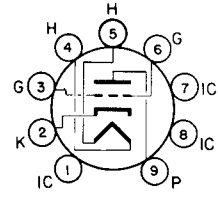
FOR

SERVICE AS VERTICAL

DEFLECTION AMPLIFIER IN

T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AC

THE 6S4A IS A HIGH PERVEANCE TRIODE USING THE SMALL BUTTON 9 PIN MINIATURE CONSTRUCTION. DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS INTENDED FOR SERVICE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR CONTROL OF THE HEATER THERMAL CHARACTERISTICS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6S4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID TO PLATE: (G TO P)	→2.4	pf
INPUT: G TO(H+K)	4.2	pf
OUTPUT: P TO (H+K)	→0.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER WARM-UP TIME[A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±36	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VERTICAL DEFLECTION AMPLIFIER [B]

DC PLATE VOLTAGE	→ 550	VOLTS
PEAK POSITVE PLATE VOLTAGE (ABS MAX.)	2200	VOLTS
PLATE DISSIPATION[C]	→ 8.5	WATTS
PEAK NEGATIVE GRID VOLTAGE	250	VOLTS
AVERAGE CATHODE CURRENT	30	MA.
PEAK CATHODE CURRENT	105	MA.
GRID CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	MEGOHMS

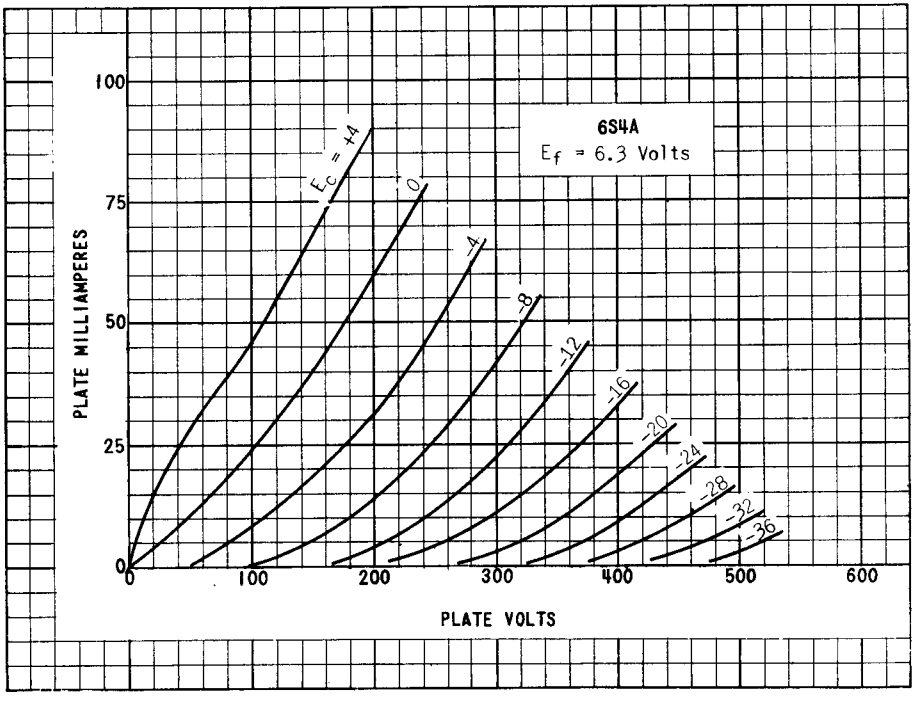
[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-8	VOLTS
PLATE CURRENT	→ 24	MA.
TRANSCONDUCTANCE	4500	μMHOS
AMPLIFICATION FACTOR	→ 16.5	
PLATE RESISTANCE (APPROX.)	→ 3700	OHMS
PLATE CURRENT AT Ec=-15 VOLTS	→ 4.0	MA.
GRID VOLTAGE (APPROX.) FOR Ib = 50 μA.	→ -22	VOLTS

→ INDICATES A CHANGE.


6S4A
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
100
75
50
25
0
0
100
200
300
400
500
600
E_c = +4
0
-4
-8
-12
-16
-20
-24
-28
-32
-36

TUNG-SOL

TRIPLE GRID

REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

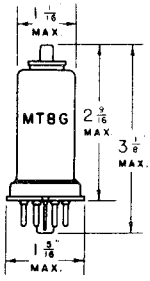
6.3 VOLTS 0.15 AMPERE

AC OR DC

7R

BOTTOM VIEW

7 PIN OCTAL BASE



METAL SHELL

THE TUNG-SOL 6S7 IS A TRIPLE GRID REMOTE CUT-OFF AMPLIFIER RECOMMENDED FOR USE IN APPLICATIONS WHICH REQUIRE A HEATER OF LOW CURRENT DRAIN. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS, AND IT MINIMIZES CROSS MODULATION. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6D6.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.25	WATT
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	250	VOLTS
SCREEN VOLTAGE	67.5	100	VOLTS
CONTROL GRID VOLTAGE MIN.	-3	-3	VOLTS
SUPPRESSOR GRID CONNECTED TO CATHODE AT SOCKET			
PLATE CURRENT	3.7	8.5	MA.
SCREEN CURRENT	0.9	2.0	MA.
PLATE RESISTANCE APPROX.	1.0	1.0	MEGOHM
TRANSCONDUCTANCE	1250	1750	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 10 μMHOS	-2.5	-38.5	VOLTS

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	6.5	μμf
PLATE TO CATHODE	10.5	μμf
CONTROL GRID TO PLATE	0.005 MAX.	μμf

[S] WITH SHELL CONNECTED TO CATHODE

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 876-1

OCT. 21 1940

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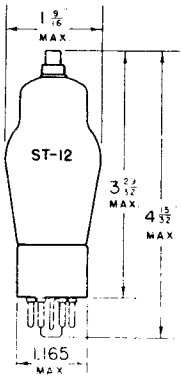
6S7G

TUNG-SOL



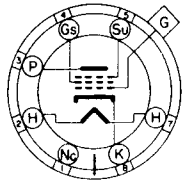
GLASS BULB

TRIPLE GRID

REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC



G-7Ra

BOTTOM VIEW
SMALL 7 PIN OCTAL BASE

THE TUNG-SOL 6S7G IS A TRIPLE GRID REMOTE CUT-OFF AMPLIFIER RECOMMENDED FOR USE WHERE LOW HEATER CURRENT DRAIN IS DESIRABLE. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS, AND IT MINIMIZES CROSS MODULATION. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6D6.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.25	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	250 MAX.	VOLTS
SCREEN VOLTAGE	67.5	100 MAX.	VOLTS
CONTROL GRID VOLTAGE MIN.	-3	-3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	3.7	8.5	MA.
SCREEN CURRENT	0.9	2.0	MA.
PLATE RESISTANCE APPROX.	1.0	1.0	MEGOHM
TRANSCONDUCTANCE	1250	1750	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 10 μMHOS	-25	-38.5	VOLTS

DIRECT INTERELECTRODE CAPACITANCES[A]

CONTROL GRID TO CATHODE	4.4	μμf
PLATE TO CATHODE	8.0	μμf
GRID TO PLATE	0.008 MAX.	μμf

PLATE
877-3

[A] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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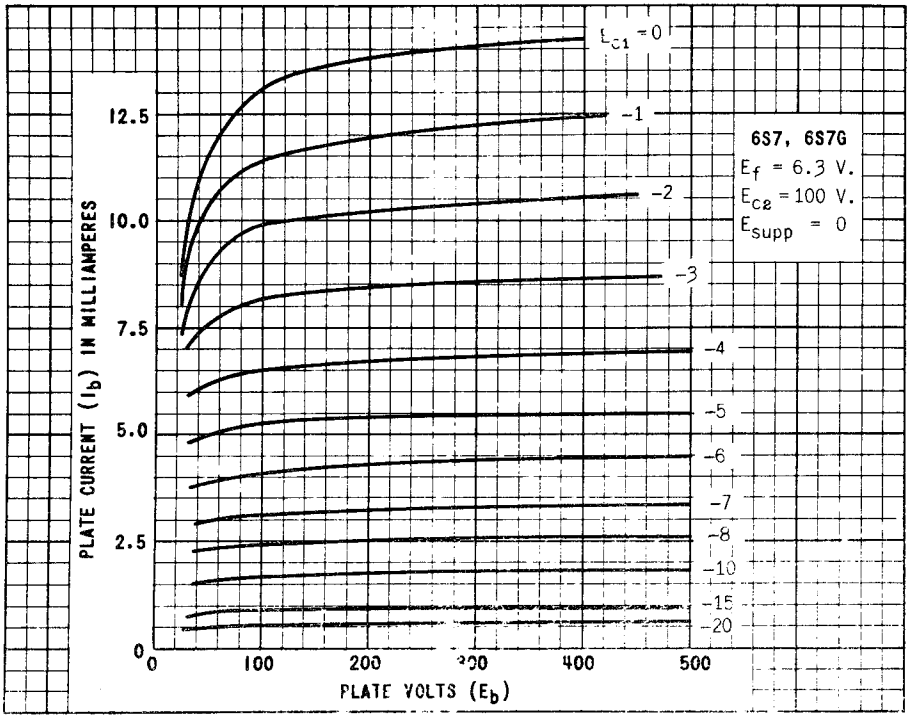

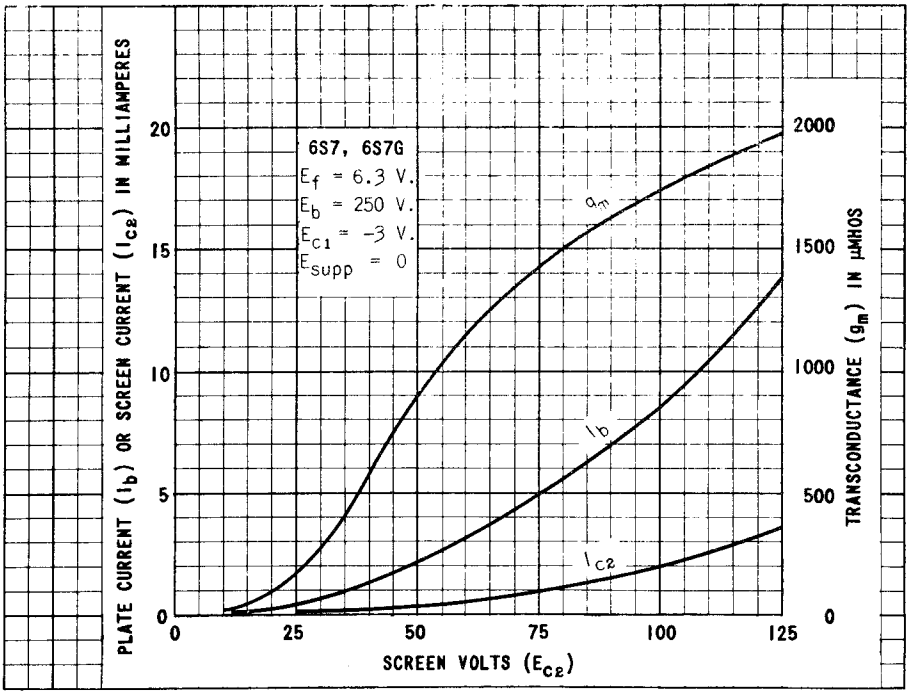

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PLATE
878-3

OCT. 21
1940

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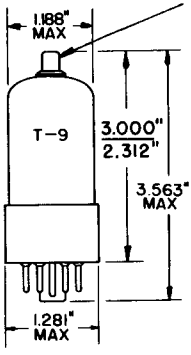
TUNG-SOL

TRIPLE DIODE TRIODE



GLASS BULB

INTERMEDIATE SHELL
8 PIN OCTAL B8-6

OR

SHORT INTERMEDIATE SHELL
8 PIN OCTAL B8-58

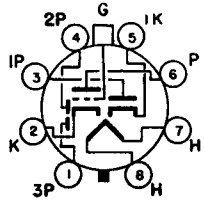
OUTLINE DRAWING
JEDEC 9-23 OR 9-48

FOR USE

IN AM/FM RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 8CB

THE 6S8GT COMBINES IN ONE ENVELOPE A HIGH-MU TRIODE AND THREE SEPARATE DIODES. ONE OF THE THREE DIODES HAS A SEPARATE CATHODE PERMITTING USE AS A BALANCED DISCRIMINATOR OR DETECTOR. IN COMBINATION FM/AM RECEIVERS THIS TUBE PROVIDES THE NECESSARY ELEMENTS FOR DETECTION OF BOTH TYPES OF SIGNAL WITHOUT NEED FOR ADDITIONAL SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD 308 CONNECTED TO PIN 2

GRID TO ANY DIODE PLATE: (G TO P)	MAX.	0.005	pf
DIODE INPUT: (EACH UNIT): (DP TO H+K)	APPROX.	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	300	MA.
MAXIMUM HEATER-CATHODE VOLTAGE			90	VOLTS
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

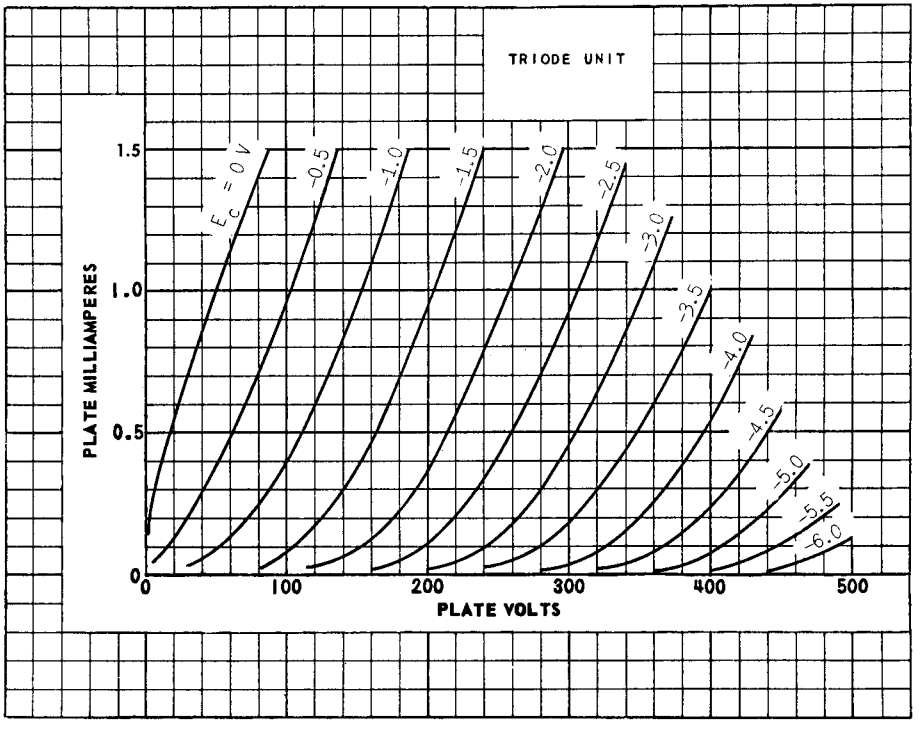
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

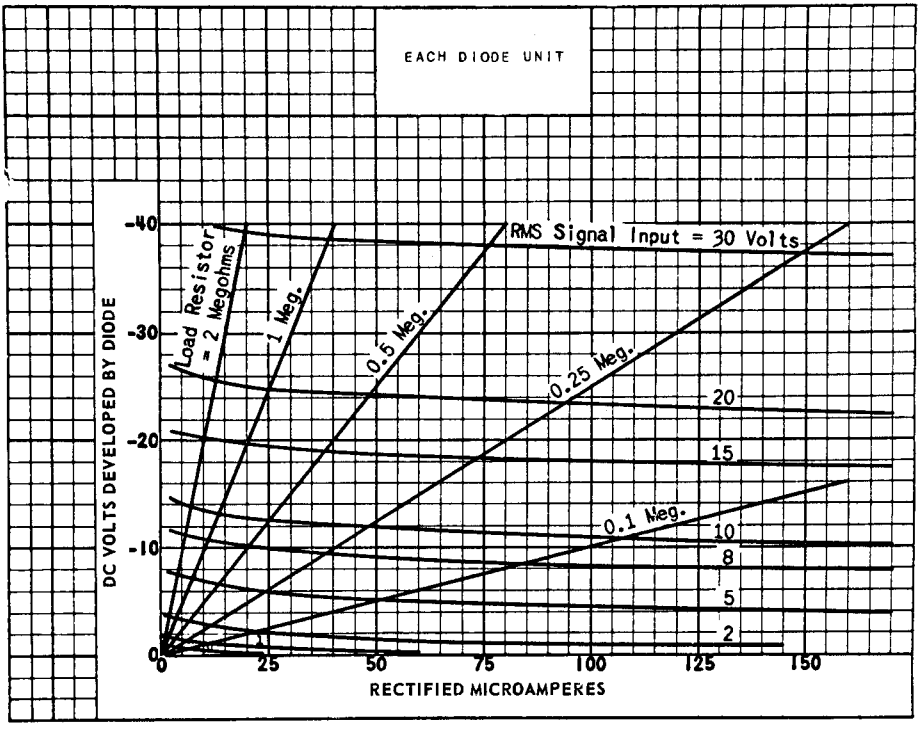
TRIODE PLATE VOLTAGE	300	VOLTS
TRIODE PLATE DISSIPATION	0.5	WATTS
CONTINUOUS DIODE CURRENT, EACH DIODE	1	MA.

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1.0	−2.0	VOLTS
PLATE CURRENT	0.4	0.9	MA.
TRANSCONDUCTANCE	900	1,100	μMHOS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE (APPROX.)	110	91	KOHMS
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED EACH DIODE	2.5	2.5	MA.

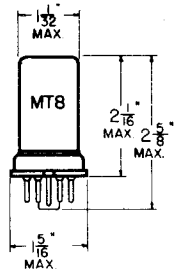



EACH DIODE UNIT
DC VOLTS DEVELOPED BY DIODE
-40
-30
-20
-10
0
Load Resistor = 2 Megohms
1 Meg.
0.5 Meg.
0.25 Meg.
0.1 Meg.
RMS Signal Input = 30 Volts
20
15
10
8
5
2
0
25
50
75
100
125
150
RECTIFIED MICROAMPERES

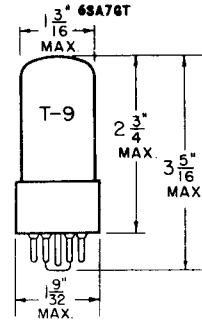
TUNG-SOL

HEPTODE

6SA7



6SA7GT

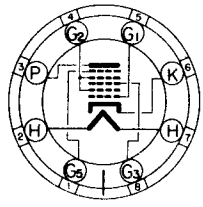


COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

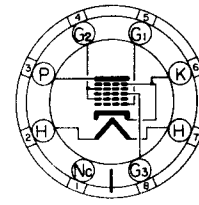
ANY MOUNTING POSITION

METAL SHELL



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL BASE

GLASS BULB



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL BASE

THE 6SA7 AND 6SA7GT ARE PENTAGRID CONVERTERS DESIGNED TO MINIMIZE FREQUENCY DRIFT. THEY ARE INTENDED FOR SERVICE AS COMBINED OSCILLATORS AND MIXERS IN AC, STORAGE BATTERY, AND AC/DC OPERATED SUPERHETERODYNES.

DIRECT INTERELECTRODE CAPACITANCES

	6SA7	6SA7GT	
RF INPUT: G_3 TO ($H+K+G_1+G_{2\&4}+G_5+P$)	9.5[A]	11[B]	μμf
OSC. INPUT: G_1 TO ($H+K+G_{2\&4}+G_3+G_5+P$)	7[A]	8[B]	μμf
MIXER OUTPUT: P TO ($H+K+G_1+G_{2\&4}+G_3+G_5$)	12[A]	11[B]	μμf
GRID #3 TO PLATE: (G_3 TO P) MAX.	0.13[A]	0.5[B]	μμf
GRID #3 TO GRID #1: (G_3 TO G_1) MAX.	0.15[A]	0.4[B]	μμf
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.06[A]	0.2[B]	μμf
GRID #1 TO ALL EXCEPT CATHODE: G_1 TO ($H+G_{2\&4}+G_3+S\&G_5+P$)	4.4	—	μμf
GRID #1 TO ALL EXCEPT CATHODE & GRID #5: G_1 TO ($H+G_{2\&4}+G_3+P$)	—	5	μμf
GRID #1 TO CATHODE: (G_1 TO K)	2.6	—	μμf
GRID #1 TO CATHODE AND GRID #5: (G_1 TO K & G_5)	—	3	μμf
CATHODE TO ALL EXCEPT GRID #1: K TO ($H+G_{2\&4}+G_3+S\&G_5+P$)	5	—	μμf
CATHODE AND GRID #5 TO ALL EXCEPT GRID #1: K & G_5 TO ($H+G_{2\&4}+G_3+P$)	—	14	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

[B] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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SEPT. 2 1947

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6SA7, 6SA7GT

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M6-210

MAXIMUM HEATER VOLTAGE	6.3	VOLTS
→ MAXIMUM HEATER–CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MINIMUM GRID #3 VOLTAGE[C]	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRIDS #2 & #4 DISSIPATION	1.0	WATT
MAXIMUM CATHODE CURRENT	14	MA.

[C] FOR SELF-EXCITED OSCILLATOR.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

	SELF EXCITATION[D]		SEPARATE EXCITATION		
→ HEATER VOLTAGE	6.3	6.3	6.3	6.3	VOLTS
HEATER CURRENT	300	300	300	300	MA.
PLATE VOLTAGE	100	250	100	250	VOLTS
GRIDS #2 &4 VOLTAGE	100	100	100	100	VOLTS
GRID #3 VOLTAGE	0	0	−2	−2	VOLTS
GRID #1 RESISTOR	20 000	20 000	20 000	20 000	OHMS
PLATE CURRENT	3.3	3.5	3.3	3.5	MA.
GRIDS #2 &#4 CURRENT	8.5	8.5	8.5	8.5	MA.
GRID #1 CURRENT	0.5	0.5	0.5	0.5	MA.
TOTAL CATHODE CURRENT	12.3	12.5	12.3	12.5	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.0	0.5	1.0	MEGOHM
CONVERSION TRANSCONDUCTANCE:					
WITH E_{g3}=−2 VOLTS	425	450	425	450	μMHOS
WITH E_{g3}=−6 VOLTS	---	---	310	325	μMHOS
WITH E_{g3}=−10 VOLTS	—	—	75	80	μMHOS
WITH E_{g3}=−35 VOLTS (APPROX.)	2	2	2	2	μMHOS

[D] HARTLEY OSCILLATOR CIRCUIT WITH A FEEDBACK OF APPROXIMATELY 2 VOLTS PEAK IN THE CATHODE CIRCUIT. VALUES ARE APPROXIMATE.

→ OSCILLATOR TRANSCONDUCTANCE
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRIDS #2 & 4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 & 4 CONNECTED TO PLATE	4 500	μMHOS

SIMILIAR TYPE REFERENCE: Ratings and characteristics somewhat similiar to 7Q7.

PLATE 1875
SEPT. 2 1947

→ INDICATES A CHANGE OR ADDITION.

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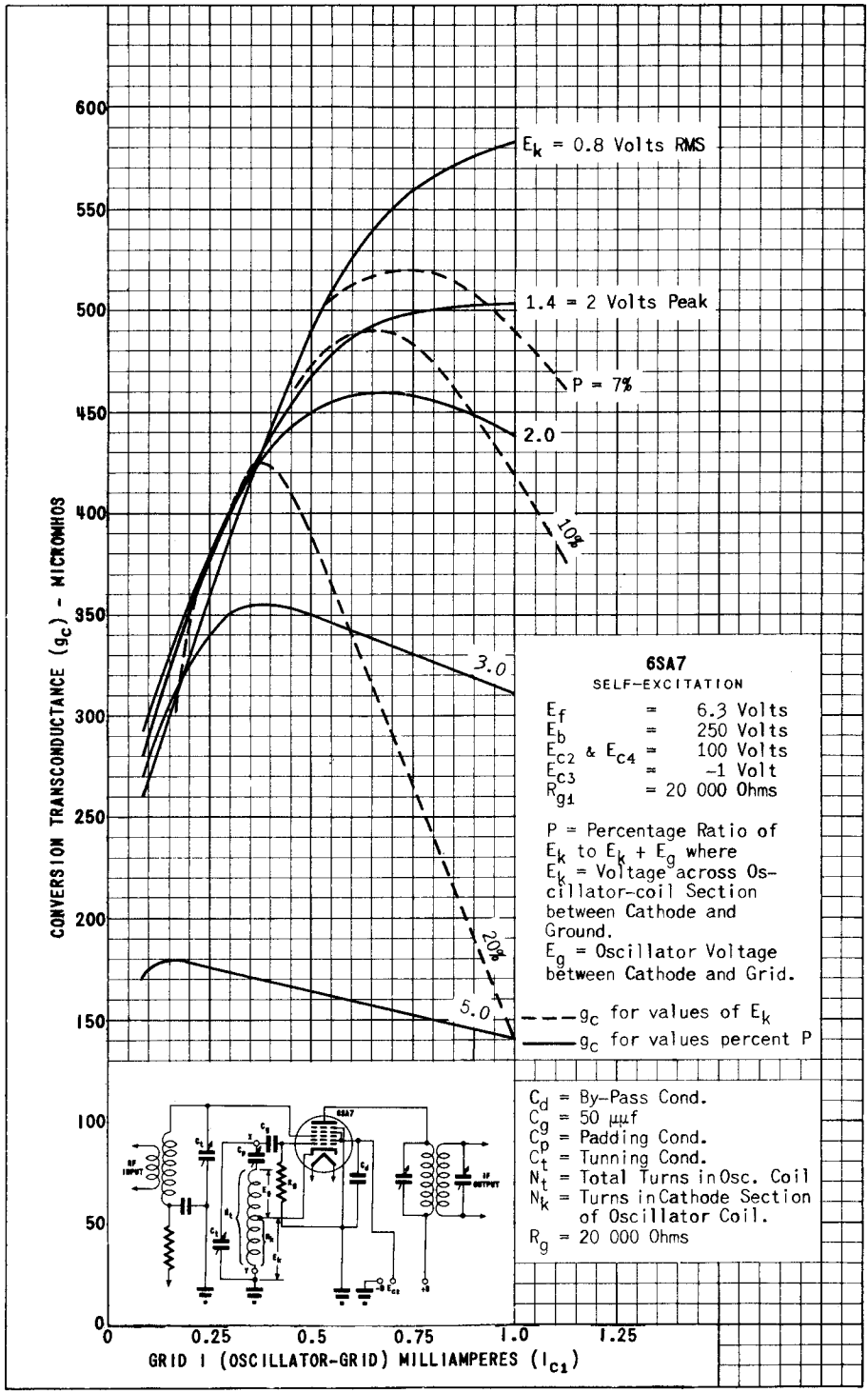

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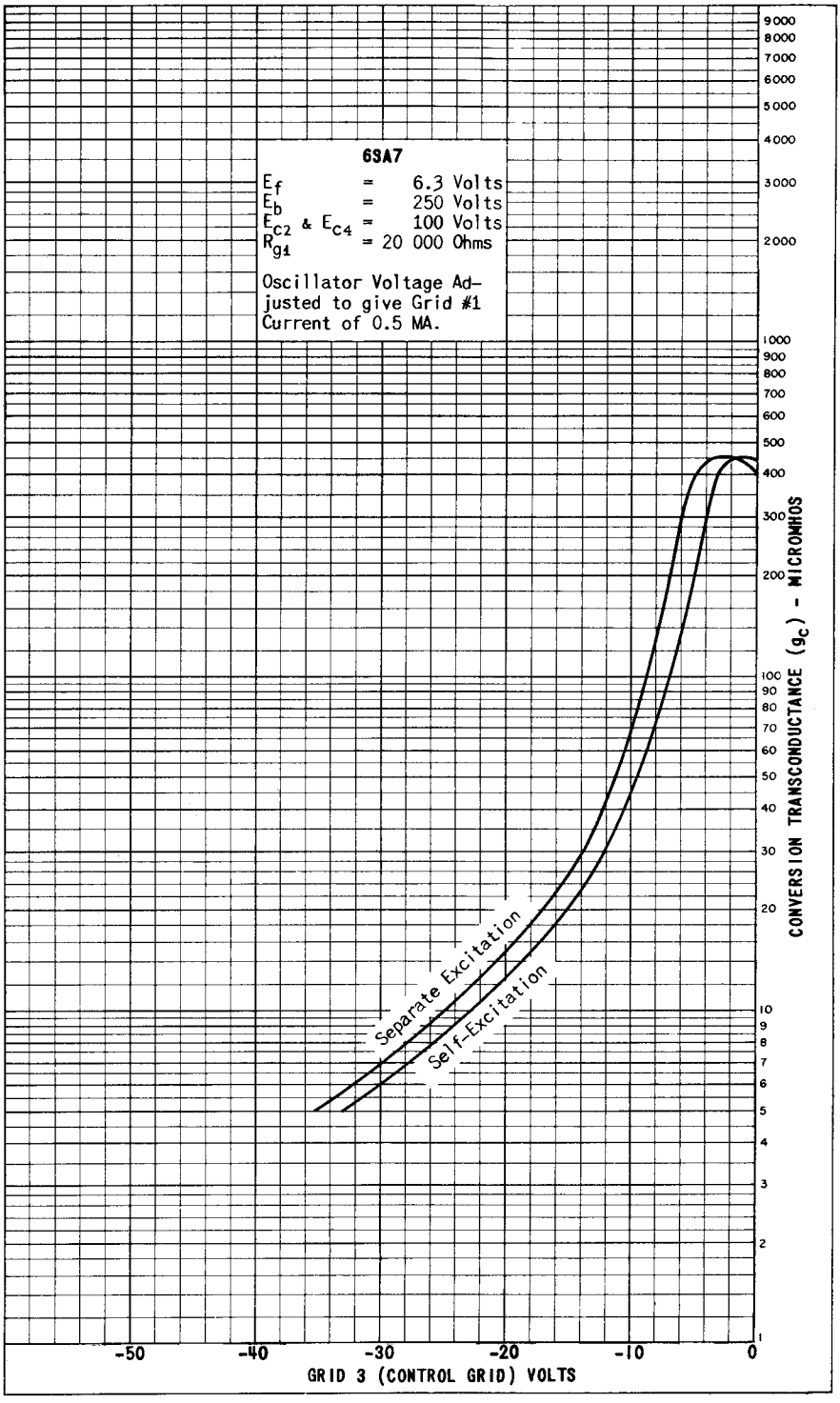
6SA7, 6SA7GT



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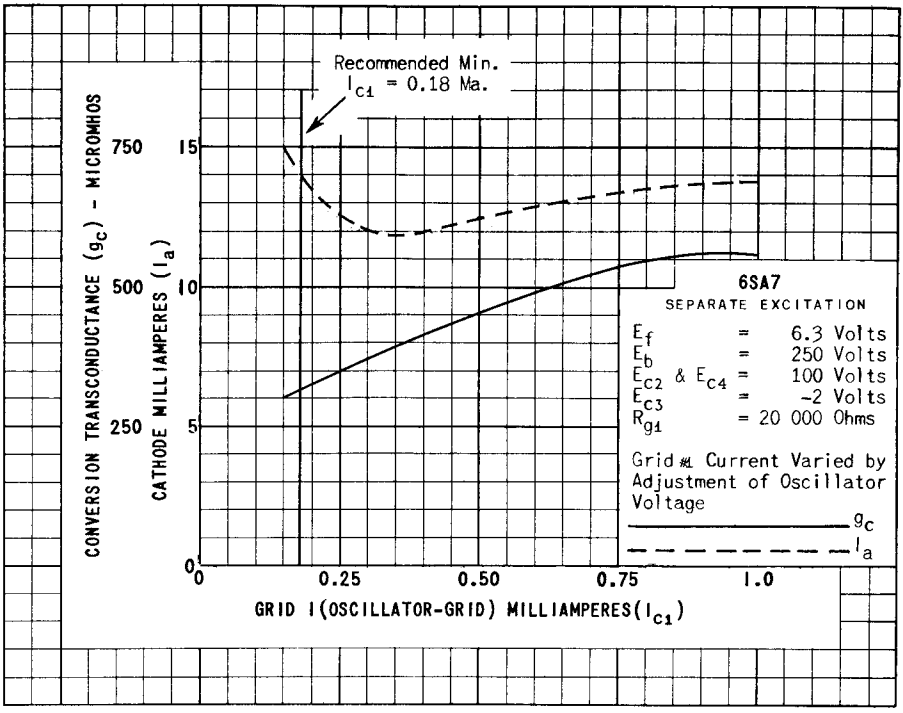

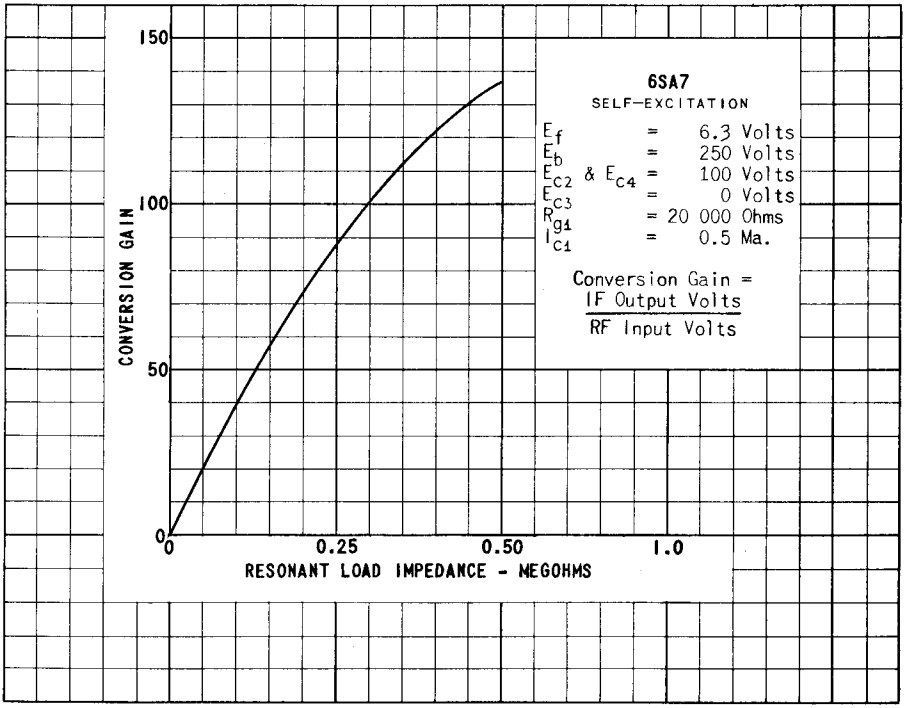

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1878
SEPT. 2
1947

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TUNG-SOL

PENTAGRID CONVERTER

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE		PIN CONNECTIONS	
BASE SMALL WAFER OCTAL 8-PIN		PIN 1 SHELL, G5	PIN 7 HEATER
MICANOL		PIN 2 HEATER	PIN 8 GRID 3
BULB MT-8G		PIN 3 PLATE	
MAXIMUM DIAMETER	1 5/16"	PIN 4 GRIDS 2 &4	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH	2 5/8"	PIN 5 GRID 1	
MAXIMUM SEATED HEIGHT	2 1/16"	PIN 6 CATHODE	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS 2 & 4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS 2 & 4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID 3 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	100	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEG. WITH RESPECT TO CATHODE	90	VOLTS
HEATER POS. WITH RESPECT TO CATHODE	90	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	22	MA.
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM GRIDS 2 & 4 DISSIPATION	1.5	WATTS

DIRECT INTERELECTRODE CAPACITANCES

GRID 3 TO ALL OTHER ELECTRODES (RF INPUT)[A] $[C_{G_3(H+K+G_1+G_2\&G_4+G_5+P)}]$	9.6	μμf
PLATE TO ALL OTHER ELECTRODES (MIXER OUTPUT)[A] $[C_{P(H+K+G_1+G_2\&G_4+G_3+G_5)}]$	9.2	μμf
GRID 1 TO ALL OTHER ELECTRODES (OSCILLATOR INPUT)[A] $[C_{G_1(H+K+G_2\&G_4+G_3+G_5+P)}]$	7.3	μμf
GRID 3 TO PLATE $[C_{G_3P}]$ (MAX.)[A]	0.15	μμf
GRID 1 TO GRID 3 $[C_{G_1G_3}]$ (MAX.)[A]	0.16	μμf
GRID 1 TO PLATE $[C_{G_1P}]$ (MAX.)[A]	0.06	μμf
GRID 1 TO ALL OTHER ELECTRODES AND SHELL EXCEPT CATHODE $[C_{G_1(S+H+G_2\&G_4+G_3+G_5+P)}]$	3.8	μμf
GRID 1 TO CATHODE $[C_{G_1K}]$	3.4	μμf
CATHODE TO ALL OTHER ELECTRODES AND SHELL EXCEPT GRID 1 $[C_{K(S+H+G_2\&G_4+G_3+G_5+P)}]$	4.5	μμf

[A] WITH SHELL CONNECTED TO CATHODE

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PLATE 1719
JUNE 17 1946

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SEPARATE EXCITATION

CHARACTERISTICS SHOWN WITH SEPARATE EXCITATION CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATOR CIRCUIT OPERATING WITH ZERO BIAS.

PLATE VOLTAGE	100	250	VOLTS
SCREEN (GRIDS 2 & 4) VOLTAGE	100	100	VOLTS
CONTROL GRID (GRID 3) VOLTAGE	-1.0	-1.0	VOLT
PLATE CURRENT	3.6	3.8	MA.
SCREEN (GRIDS 2 & 4) CURRENT	10.2	10	MA.
OSCILLATOR (GRID 1) CURRENT	0.35	0.35	MA.
TOTAL CATHODE CURRENT	14.2	14.2	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
OSCILLATOR GRID (GRID 1) RESISTOR	20 000	20 000	OHMS
CONVERSION TRANSCONDUCTANCE	900	950	MICROMHOS
CONVERSION TRANSCONDUCTANCE (APPROX.) FOR GRID 3 BIAS = -20 VOLTS	3.5	3.5	MICROMHOS

OSCILLATOR IN FM BAND (88-108 MC.)

PLATE VOLTAGE		250	VOLTS
SCREEN (GRIDS 2 & 4) SUPPLY VOLTAGE		250	VOLTS
SCREEN (GRIDS 2 & 4) RESISTOR		12 000	OHMS
OSCILLATOR GRID (GRID 1) RESISTOR		22 000	OHMS
SIGNAL FREQUENCY	88	108	MC.
OSCILLATION FREQUENCY	98.7	118.7	MC.
PLATE CURRENT	6.8	6.5	MA.
SCREEN (GRIDS 2 & 4) CURRENT	12.6	12.5	MA.
OSCILLATOR (GRID 1) CURRENT	0.130	0.140	MA.

OSCILLATOR TRANSCONDUCTANCE

GRID 3	CONNECTED TO GROUND	
GRIDS 2 & 4 CONNECTED TO PLATE (NOT OSCILLATING)	100	VOLTS
GRID 1 SIGNAL VOLTAGE	0	VOLTS
TRANSCONDUCTANCE (APPROX.) BETWEEN GRID 1 & PLATE WITH GRIDS 2 & 4 CONNECTED TO PLATE	8000	MICROMHOS
PLATE CURRENT	32	MA.
AMPLIFICATION FACTOR	16.5	
PLATE RESISTANCE (APPROX.)	2060	OHMS

PLATE 1720
JUNE 17 1946

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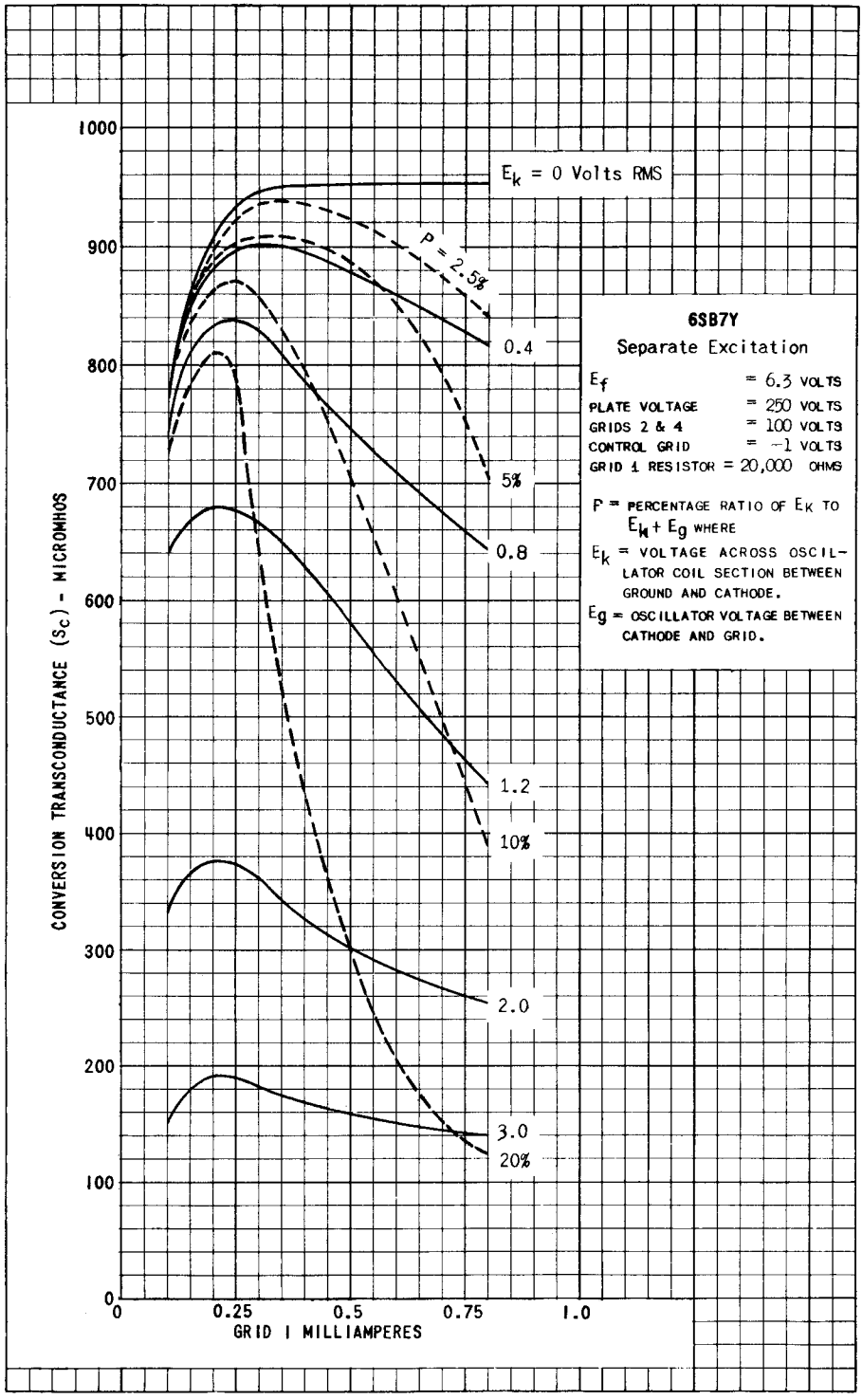
6SB7Y



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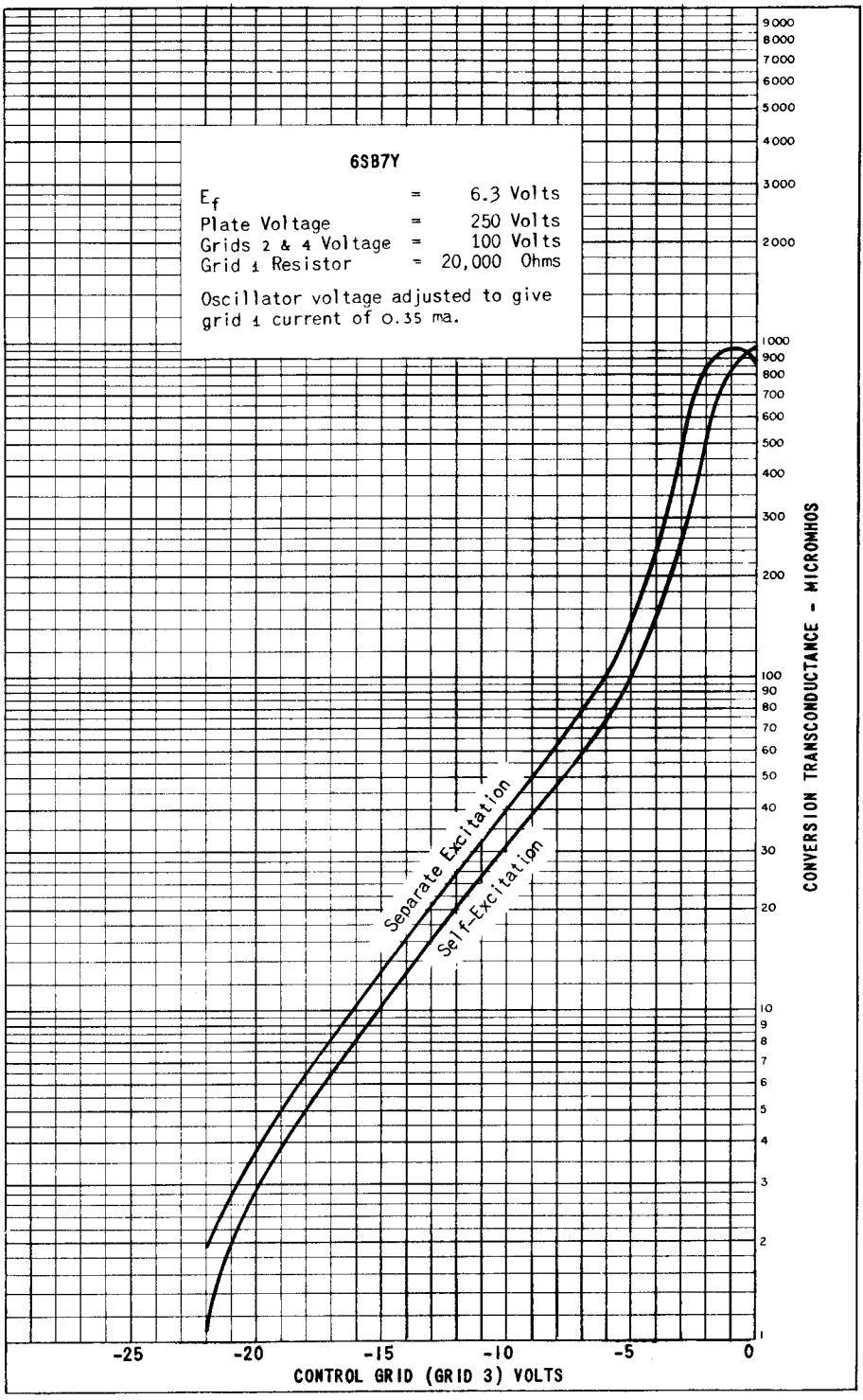

PLATE
1722
JUNE 17
1946

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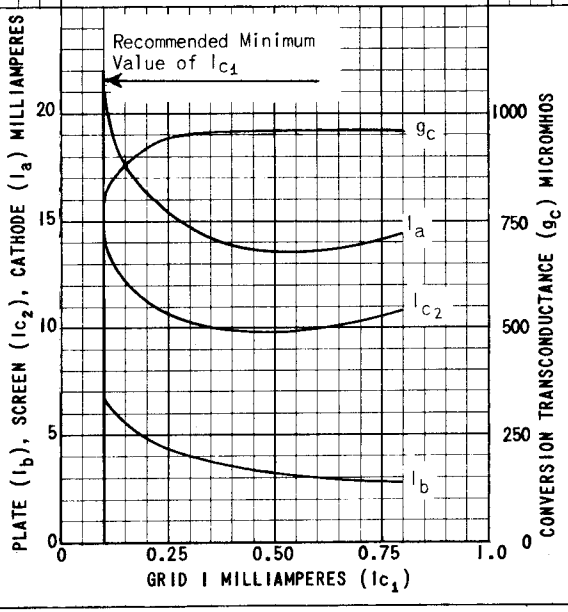
6SB7Y
Separate Excitation

E_f	=	6.3 Volts
Plate Voltage	=	250 Volts
Grids 2 & 4 Voltage	=	100 Volts
Grid 3 Voltage	=	1 Volt
Grid 1 Resistor	=	20,000 Ohms

Grid 1 current varied by adjustment of oscillator voltage.



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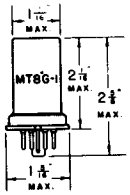
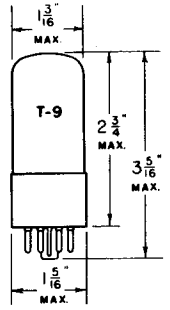


METAL SHELL

TWIN TRIODE AMPLIFIER

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS [1] 0.3 AMPERE
AC OR DC



GLASS BULB

SMALL WAFER 8 PIN OCTAL BASE

INTERMEDIATE 8 PIN OCTAL BASE

THE TUNG-SOL 6SC7 AND 6SC7GT ARE TWIN TRIODE AMPLIFIERS WITH HIGH AMPLIFICATION FACTORS. THEIR PRIMARY APPLICATION IS A PHASE INVERTER AND AUDIO AMPLIFIER.

RATINGS

MAXIMUM PLATE VOLTAGE	250	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

VALUES ARE FOR EACH TRIODE SECTION

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−2	VOLTS
PLATE CURRENT	2	MA.
PLATE RESISTANCE	53000	OHMS
TRANSCONDUCTANCE	1325	μMHOS
AMPLIFICATION FACTOR	70	

SHOULD NOT DEVIATE MORE THAN ± 10% FROM RATED VALUE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK

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PLATE
1345-1
OCT. 25
1943

SEE OTHER SIDE OF SHEET FOR CURVES

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6SC7, 6SC7GT

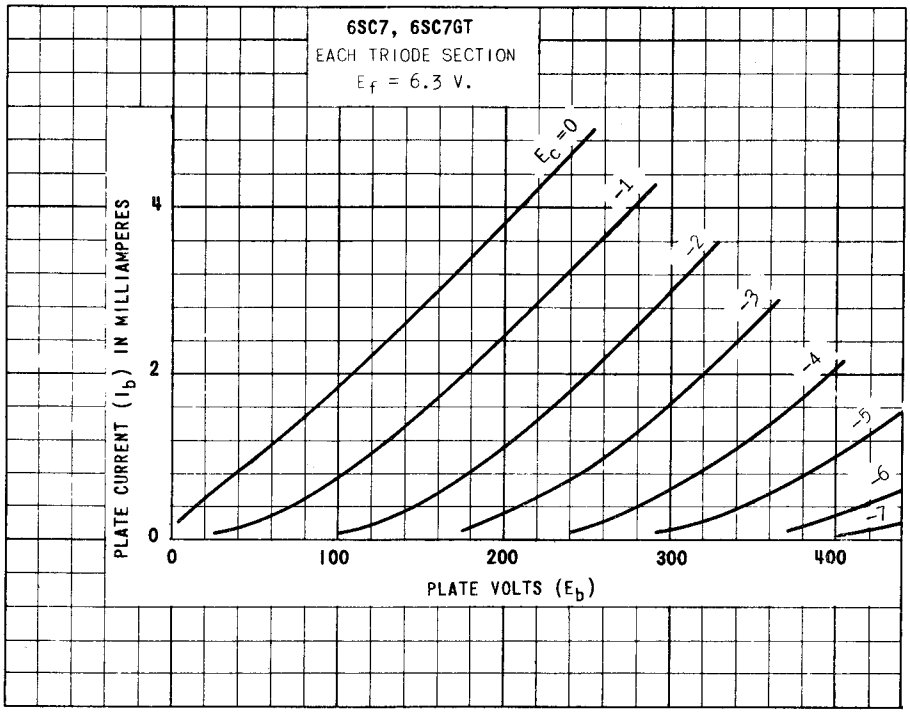

PLATE
1346-1
OCT. 25
1943

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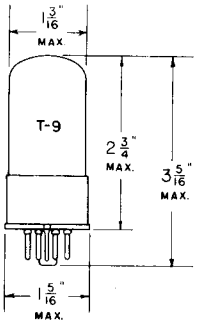
TUNG-SOL



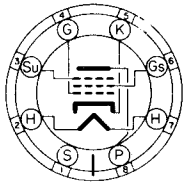
TRIPLE GRID

SEMI-REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMPERE
AC OR DC



8N

BOTTOM VIEW

GLASS BULB

SMALL WAFER 8 PIN OCTAL BASE WITH METAL SHELL

THE TUNG-SOL 6SD7GT IS A TRIPLE GRID SEMI-REMOTE CUT-OFF AMPLIFIER. IT IS DESIGNED FOR SERVICE AS A HIGH GAIN RF AND IF AMPLIFIER.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM SCREEN DISSIPATION	0.4	WATT

DIRECT INTERELECTRODE CAPACITANCES [S]

INPUT: CONTROL GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	9.0	μμf
OUTPUT: PLATE TO ALL OTHER ELECTRODES EXCEPT CONTROL GRID	7.5	μμf
CONTROL GRID TO PLATE	.0035 MAX.	μμf

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 1143-2

NOV. 17 1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	250	VOLTS
SCREEN SUPPLY VOLTAGE	100	100	250	VOLTS
SCREEN VOLTAGE	100	100	125[A]	VOLTS
CONTROL GRID VOLTAGE	-2	-2	-2	VOLTS
SUPPRESSOR GRID VOLTAGE	0	0	0	VOLT
PLATE CURRENT	5.7	6.0	9.5	MA.
SCREEN CURRENT	2.0	1.9	3.0	MA.
PLATE RESISTANCE APPROX.	0.25	1.0	0.7	MEGOHM
TRANSCONDUCTANCE	3350	3600	4250	µMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 20 µMHOS	-11	-11	-27	VOLTS

[A] OBTAINED THROUGH A SUITABLE VOLTAGE DROPPING RESISTOR.

PLATE 1144-1

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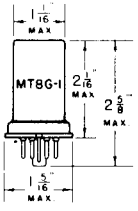
TUNG-SOL



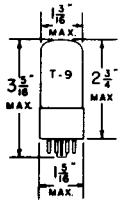
METAL SHELL
SMALL WAFER
6 PIN OCTAL BASE
6SF5

HIGH MU TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

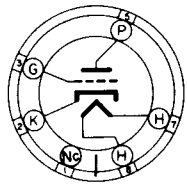
6.3 VOLTS 0.3 AMPERE
AC OR DC



GLASS BULB
INTERMEDIATE
6 PIN OCTAL BASE
6SF5GT

6AB

BOTTOM VIEWS



G-6AB

THE TUNG-SOL 6SF5 AND 6SF5GT ARE GENERAL PURPOSE HIGH MU TRIODES. THEY ARE DESIGNED FOR SERVICE AS HIGH GAIN RESISTANCE COUPLED AMPLIFIERS IN AC AND AC-DC OPERATED RECEIVERS.

RATINGS

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.3	AMPERE
MAXIMUM PLATE VOLTAGE	300	VOLTS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	85000	66000	OHMS
TRANSCONDUCTANCE	1150	1500	µMHOS
AMPLIFICATION FACTOR	100	100	

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE
1086-2

JULY 28
1941

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6SF5, 6SF5GT

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ZERO BIAS, RESISTANCE COUPLED, CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	100		300		VOLTS
PLATE LOAD RESISTOR	0.25		0.25		MEGOHM
GRID RESISTOR	10		10		MEGOHM
COUPLING CONDENSER	.01 TO .005		.01 TO .005		μμf
GRID RESISTOR FOR FOLLOWING TUBE	.5 TO 1.0		.5 TO 1.0		MEGOHM
EXTERNAL GRID CIRCUIT IMPEDANCE	0	0	0	0	MEGOHM
VOLTAGE GAIN	48	52	66	71	
VOLTAGE OUTPUT (RMS)[A]	7.0	8.5	44	50	VOLTS

[A] AT FIVE PER CENT TOTAL HARMONIC DISTORTION

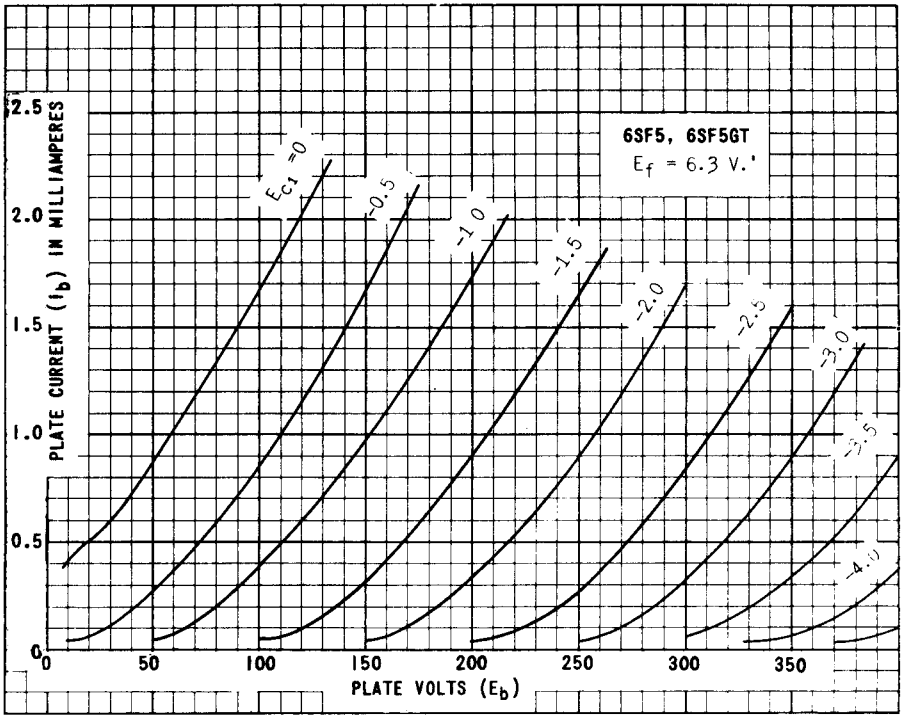

PLATE 1087-1

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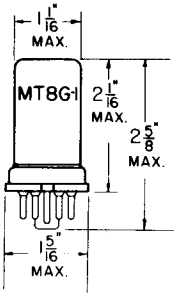
TUNG-SOL

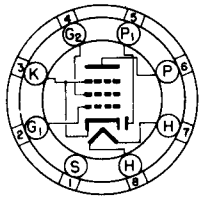
DIODE-SUPER-CONTROL AMPLIFIER PENTODE



COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

ANY MOUNTING POSITION



METAL SHELL

BOTTOM VIEW

SMALL WAFER
8-PIN OCTAL

THE 6SF7 COMBINES A DIODE AND PENTODE IN A SINGLE-ENDED CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A COMBINED IF AMPLIFIER, DETECTOR AND A.V.C. RECTIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

PENTODE UNIT

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
MAX. PLATE VOLTAGE	300	VOLTS
MAX. SCREEN VOLTAGE	100	VOLTS
MAX. SCREEN SUPPLY VOLTAGE	300	VOLTS
MIN. GRID VOLTAGE	0	VOLTS
MAX. PLATE DISSIPATION	3.5	WATTS
MAX. SCREEN DISSIPATION	0.5	WATT
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE	

DIRECT INTERELECTRODE CAPACITANCES

WITH SHELL CONNECTED TO CATHODE

PENTODE UNIT

GRID TO PLATE (MAX.)	0.004	μμf
INPUT	5.5	μμf
OUTPUT	6.0	μμf
PENTODE PLATE TO DIODE	0.8	μμf
PENTODE GRID TO DIODE (MAX.)	0.002	μμf

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OCT. 15, 1945

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE UNIT - CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
GRID VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	12	12.4	MA.
SCREEN CURRENT	3.4	3.3	MA.
PLATE RESISTANCE (APPROX.)	0.2	0.7	MEGOHM
TRANSCONDUCTANCE	1975	2050	µMHOS
GRID BIAS (APPROX.) FOR TRANSCONDUCTANCE OF 10 µMHOS	-35	-35	VOLTS

DIODE UNIT

THE DIODE UNIT IS PLACED AROUND THE CATHODE, THE SLEEVE OF WHICH IS COMMON TO THE PENTODE UNIT.

SIMILAR TYPE REFERENCE: Except for heater ratings, same characteristics and application as type 12SF7.

PLATE 1609
OCT. 15, 1945

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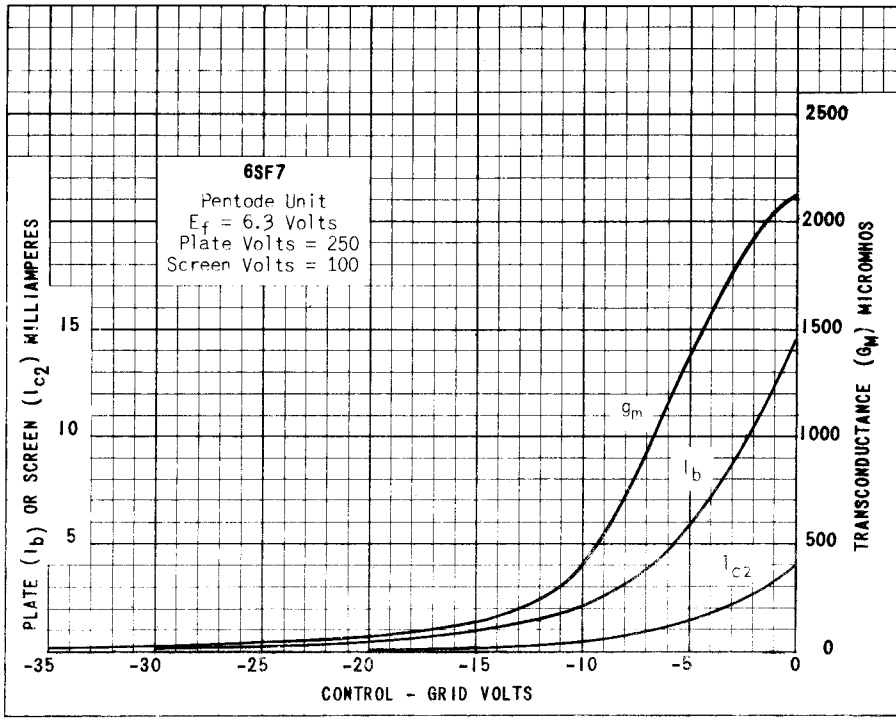

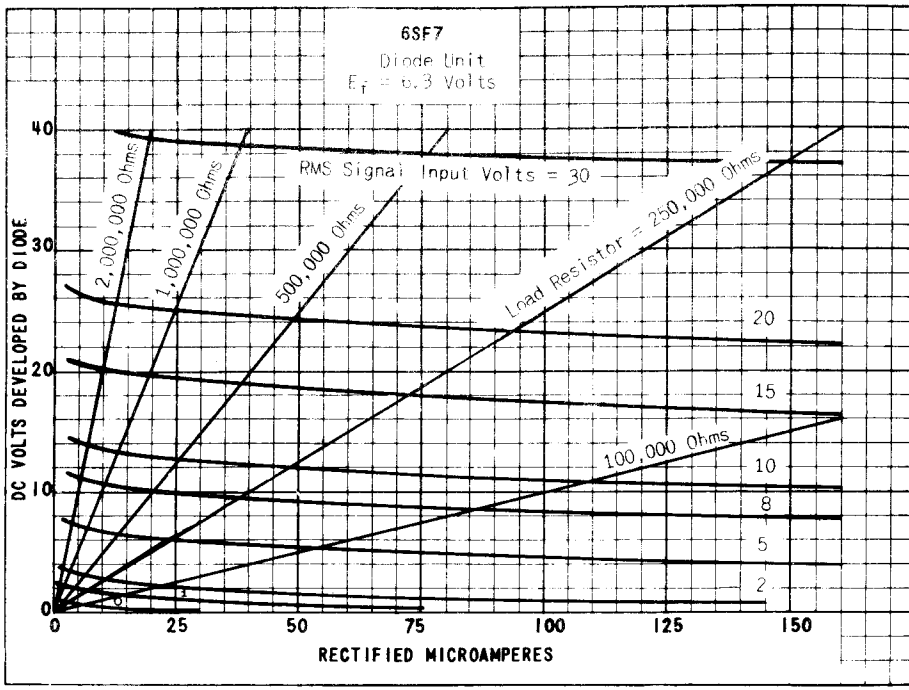

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PLATE
1610
OCT. 15
1945

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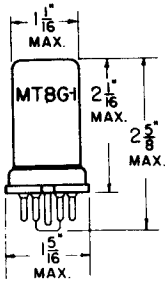
TUNG-SOL

PENTODE

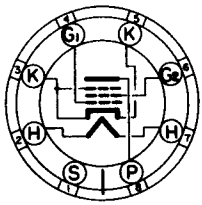


METAL SHELL

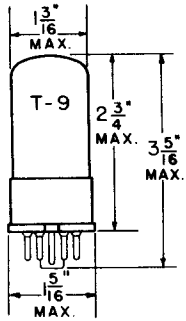
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL



GLASS BULB

THE 6SG7,6SG7GT IS A SEMI-REMOTE CUT OFF PENTODE VOLTAGE AMPLIFIER IN THE OCTAL METAL (GLASS) CONSTRUCTION. IT FEATURES HIGH TRANSCONDUCTANCE WITH LOW GRID-PLATE CAPACITANCE AND A DUAL CATHODE CONNECTION TO MINIMIZE EFFECTS OF COMMON CATHODE CIRCUIT COUPLING.

DIRECT INTERELECTRODE CAPACITANCES

	6SG7[A]	6SG7GT[B]	
GRID TO PLATE: (G TO P) MAX.	0.003	0.035	μμf
INPUT: G_1 TO $(H+K\&G_3+G_2)$	8.5	8.5	μμf
OUTPUT: P TO $(H+K\&G_3+G_2)$	7	7	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

[B] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATT

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PLATE 2053
AUG. 2, 1948

CONTINUED ON NEXT PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	300	300	300	MA.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
GRID #1 VOLTAGE	-1	-1	-2.5	VOLTS
SELF BIAS RESISTOR	90	60	190	OHMS
PLATE RESISTANCE (APPROX.)	0.25	0.9	[c]	MEGOHM
TRANSCONDUCTANCE	4100	4700	4000	µMHOS
PLATE CURRENT	8.2	11.8	9.2	MA.
GRID #2 CURRENT	3.2	4.4	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 40 µMHOS	-11.5	-14	-17.5	VOLTS

[c] GREATER THAN 1.0 MEGOHM.

PLATE 2054
AUG. 2, 1948

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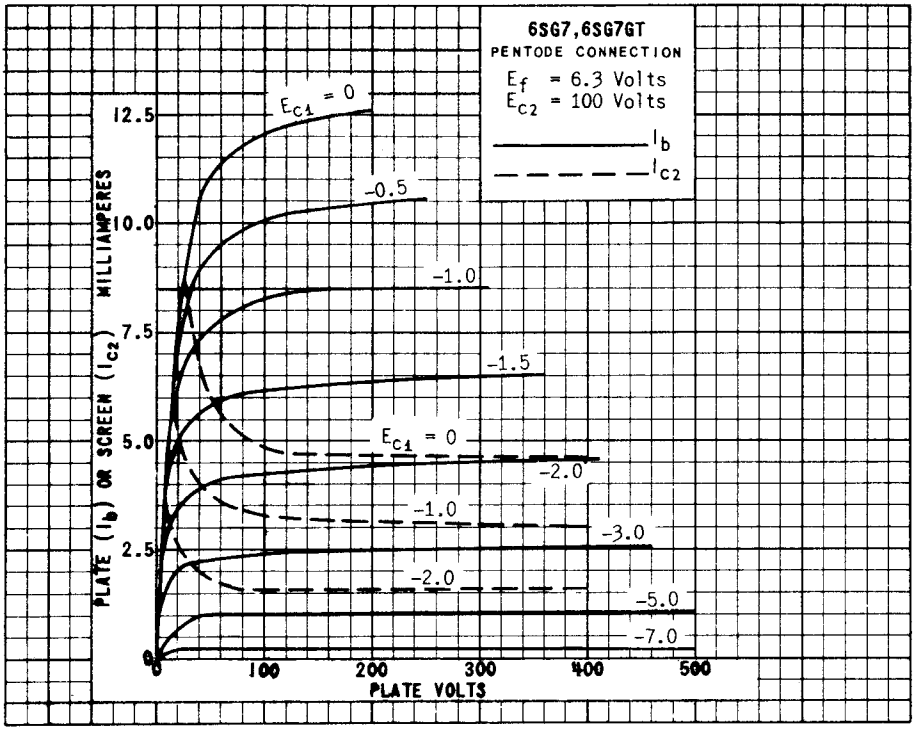

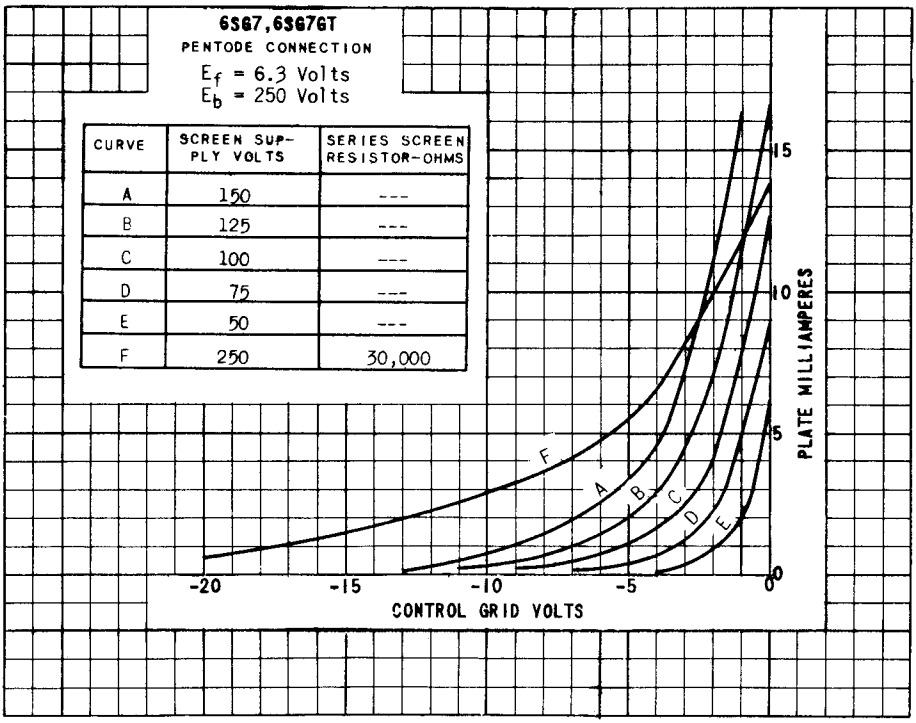

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000

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PLATE 2055
AUG. 2, 1948

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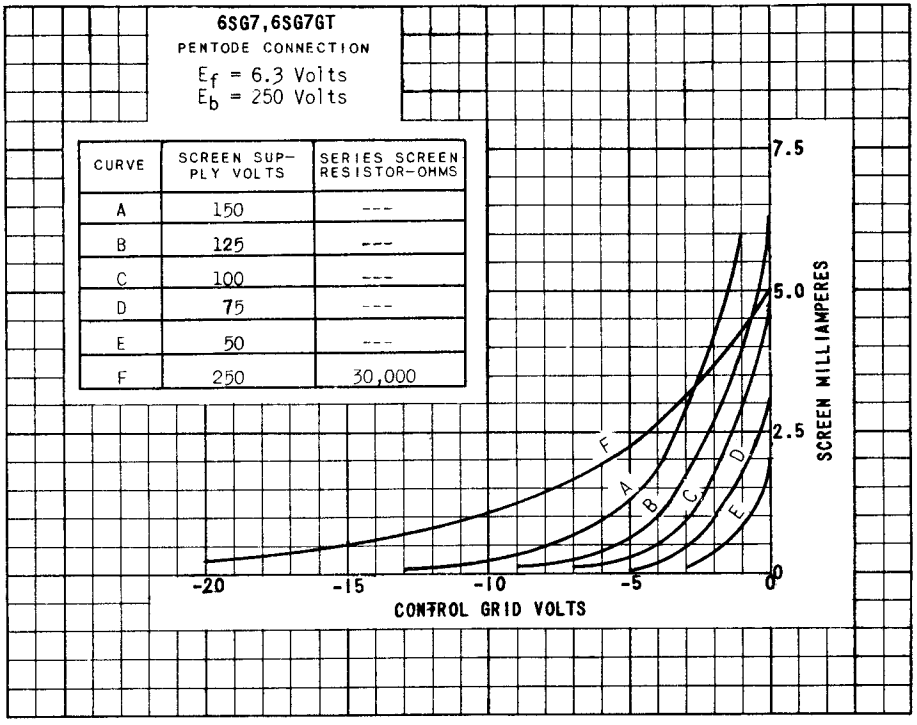
6SG7, 6SG7GT (12SG7)

6SG7, 6SG7GT
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000



6SG7, 6SG7GT
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000

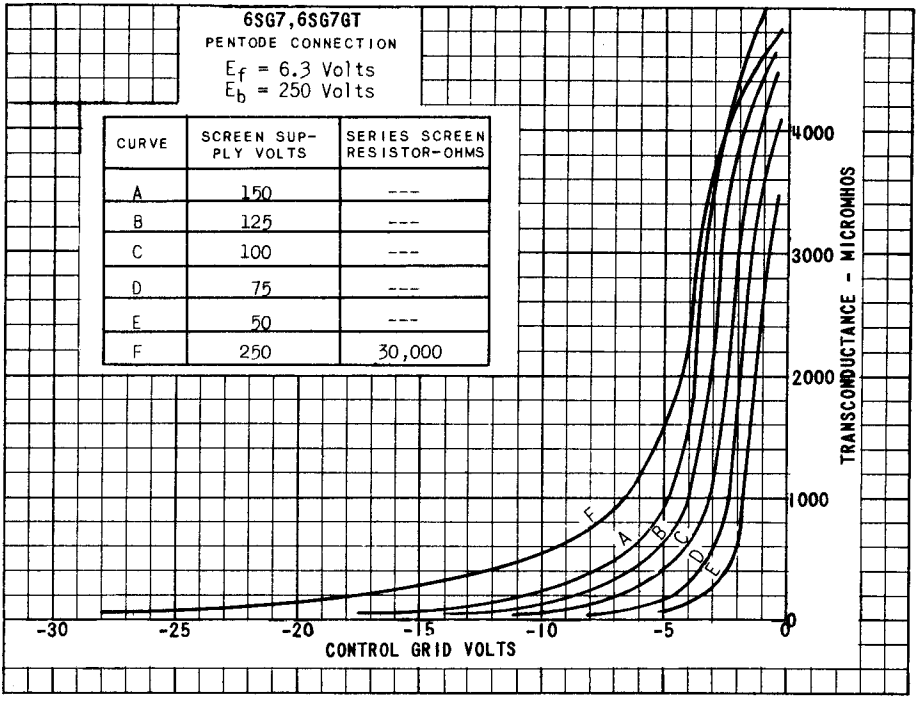


PLATE 2056
AUG. 2, 1948

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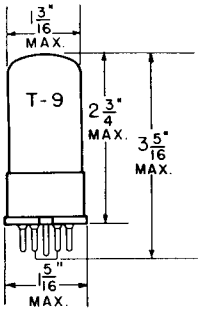
TUNG-SOL

SHARP CUT-OFF RF AMPLIFIER PENTODE

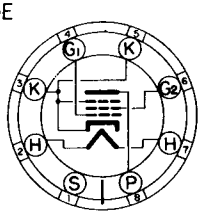


COATED UNIPOTENTIAL CATHODE
6.3 VOLTS 0.3 AMPERE
AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.

GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL WAFER 8 PIN
OCTAL AND METAL SHELL

THE 6SH7GT IS A TRIPLE GRID SHARP CUT-OFF AMPLIFIER. IT IS DESIGNED FOR SERVICE IN HIGH GAIN RF AND IF AMPLIFIER APPLICATIONS AND FOR LIMITER SERVICE IN FM RECEIVERS. THE DOUBLE CATHODE CONNECTION IS USEFUL IN REDUCING CATHODE CIRCUIT COUPLING.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD No-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.7	WATT

DIRECT INTERELECTRODE CAPACITANCES

WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE	0.003 MAX.	μμf
INPUT	8.5	μμf
OUTPUT	7.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	150	VOLTS
GRID VOLTAGE	-1.0	-1.0	VOLT
PLATE RESISTANCE (APPROX.)	0.35	0.90	MEGOHM
TRANSCONDUCTANCE	4 000	4 900	μMHOS
PLATE CURRENT	5.3	10.8	MA.
SCREEN CURRENT	2.1	4.1	MA.
GRID BIAS FOR PLATE CURRENT CUT-OFF (10 μA)	-4.0	-5.5	VOLTS

SIMILAR TYPE REFERENCE: Somewhat similar to type 7L7.

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PLATE 1581
JULY 31, 1945

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TENTATIVE DATA

6SH7L

TUNG-SOL

RF PENTODE AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE SMALL WAFER OCTAL 8-PIN	PIN 1 BASE SHELL,	INTERNAL SHIELD
METAL SHELL	PIN 2 HEATER	PIN 7 HEATER
BULB T-9	PIN 3 CATHODE, G3	PIN 8 PLATE
MAXIMUM DIAMETER 1 5/16"	PIN 4 GRID 1	
MAXIMUM OVERALL LENGTH 3"	PIN 5 CATHODE, G3	
MAXIMUM SEATED HEIGHT 2 15/32"	PIN 6 GRID 2	MOUNTING POS. ANY

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.300	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.7	WATT
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL CONTROL GRID VOLTAGE	0	VOLTS

CAPACITANCES

CONTROL GRID TO CATHODE	8.5	μμf
PLATE TO CATHODE	7.0	μμf
CONTROL GRID TO PLATE (MAX.)	0.0035	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE	6.3	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.300	0.300	AMP.
PLATE VOLTAGE (DC)	100	250	VOLTS
SCREEN VOLTAGE (DC)	100	150	VOLTS
CONTROL GRID VOLTAGE (DC)	-1	-1	VOLT
SUPPRESSOR VOLTAGE (DC)	0	0	VOLTS
PLATE CURRENT (DC)	5.3	10.8	MA.
SCREEN CURRENT (DC)	2.1	4.1	MA.
MAXIMUM-SIGNAL PLATE CURRENT			MA.
MAXIMUM-SIGNAL SCREEN CURRENT			MA.
PLATE RESISTANCE (APPROX.)	0.35	0.90	MEGOHM
TRANSCONDUCTANCE	4000	4900	μMHOS
AMPLIFICATION FACTOR			
LOAD RESISTANCE			OHMS
TOTAL HARMONIC DISTORTION			PER CENT
POWER OUTPUT			WATTS
CONTROL GRID VOLTAGE (DC) FOR I_b = 10 μA (DC)	-4	-5.5	VOLTS

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PLATE 1706

APRIL 15 1946

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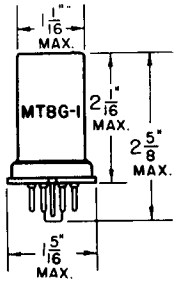
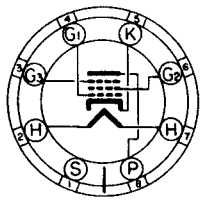
TUNG-SOL

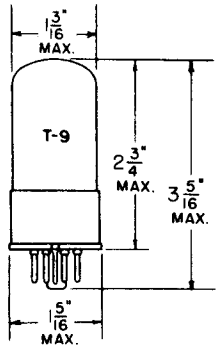
TRIPLE-GRID DETECTOR AMPLIFIER



METAL SHELL
SMALL WAFER OCTAL
8 PIN BASE
6SJ7, 12SJ7



BOTTOM VIEW
6SJ7, 6SJ7GT
12SJ7, 12SJ7GT



GLASS BULB
SMALL WAFER OCTAL 8 PIN
BASE WITH METAL SLEEVE
6SJ7GT, 12SJ7GT

UNIPOTENTIAL CATHODE

HEATER

6SJ7, 6SJ7GT - 6.3 V. 0.3 A.
12SJ7, 12SJ7GT - 12.6 V. 0.15 A.
AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN THE HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. UNDER NO CONDITIONS SHOULD IT EXCEED 100 VOLTS.

THESE TUBES ARE SINGLE ENDED PENTODES HAVING SHARP CUT-OFF CHARACTERISTICS. THEY MAY BE USED AS BIASED DETECTORS, RADIO FREQUENCY OSCILLATORS OR AS MIXER TUBES IN PROPERLY DESIGNED CIRCUITS. WITH THE EXCEPTION OF HEATER AND CAPACITANCE RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MINIMUM GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATTS

CONTINUED NEXT PAGE

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PLATE
1435
JUNE 15
1944

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6SJ7, 6SJ7GT (12SJ7, 12SJ7GT)

TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

SHELL CONNECTED TO CATHODE

	6SJ7-12SJ7	6SJ7GT-12SJ7GT	
GRID TO PLATE	0.005 MAX.	0.005 MAX.	μμf
INPUT	6.0	6.3	μμf
OUTPUT	7.0	10.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
GRID VOLTAGE	-3	-3	VOLTS
SUPPRESSOR	TIE TO CATHODE		
PLATE CURRENT	2.9	3.0	MA.
SCREEN CURRENT	0.9	0.8	MA.
PLATE RESISTANCE (APPROX.)	0.7	1.5	MEGOHMS
TRANSCONDUCTANCE	1575	1650	μMHOS
GRID VOLTAGE (FOR CATHODE CURRENT CUT-OFF)	-9	-9	VOLTS

PLATE
1436
JUNE 15
1944

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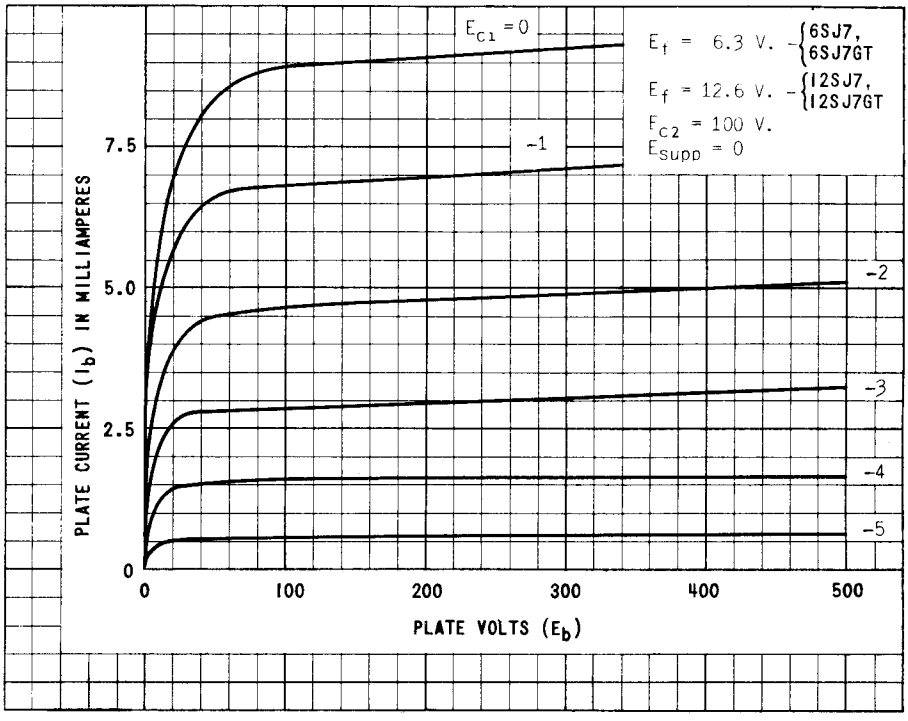
(12SJ7, 12SJ7GT) 6SJ7, 6SJ7GT



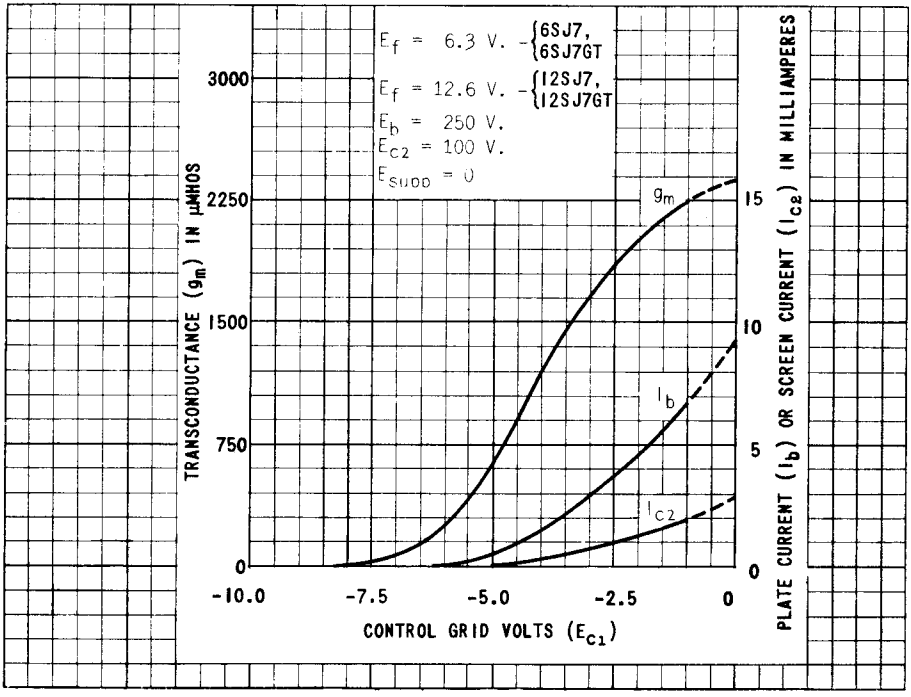


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PLATE 1437
JUNE 15 1944

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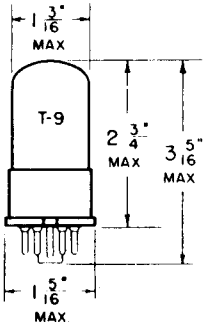
TUNG-SOL

PENTODE

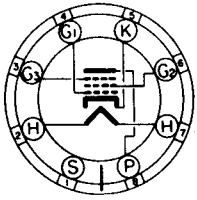


6SK7GT
GLASS BULB

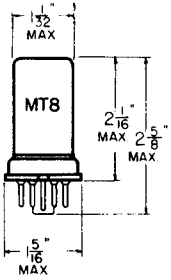
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL
8N



6SK7
METAL SHELL

THE 6SK7 AND 6SK7GT ARE TRIPLE GRID VARIABLE MU AMPLIFIERS. THEY ARE DESIGNED FOR USE WITH AVC IN RF AND IF AMPLIFIERS, AND THEY MINIMIZE CROSS MODULATION.

DIRECT INTERELECTRODE CAPACITANCES

	6SK7[A]	6SK7GT[B]	
GRID TO PLATE	0.003	0.005	μμf
INPUT	6.0	6.5	μμf
OUTPUT	7.0	7.5	μμf

[A] PIN #1 CONNECTED TO PIN #5.

[B] EXTERNAL SHIELD #308 CONNECTED TO PIN #5.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE J5-C4
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4.0	WATTS
MAXIMUM GRID #2 DISSIPATION	0.4	WATT

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.
* INDICATES AN ADDITION.

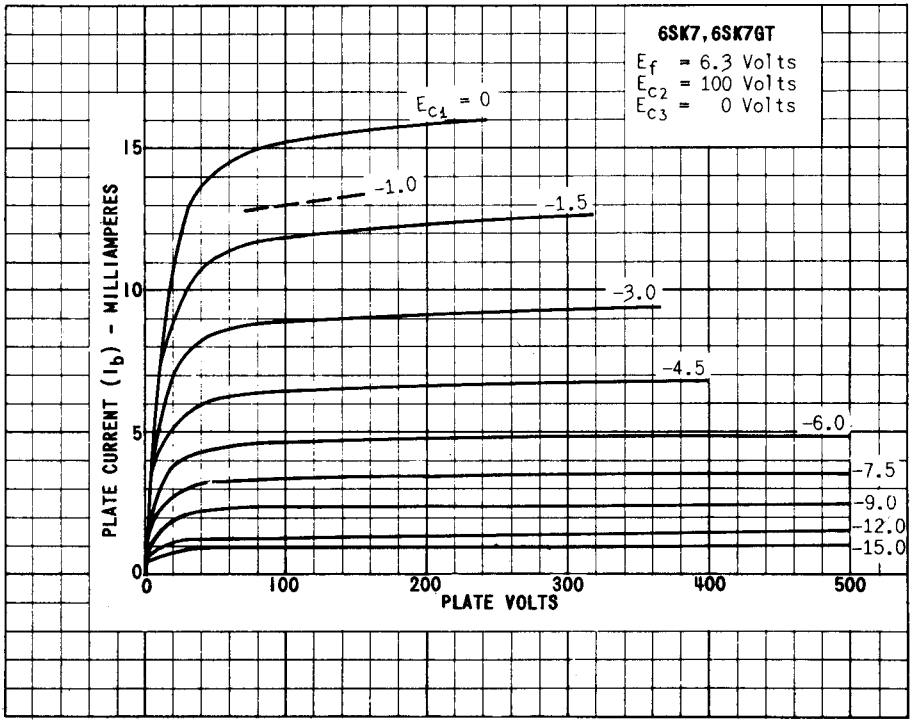
TUNG-SOL

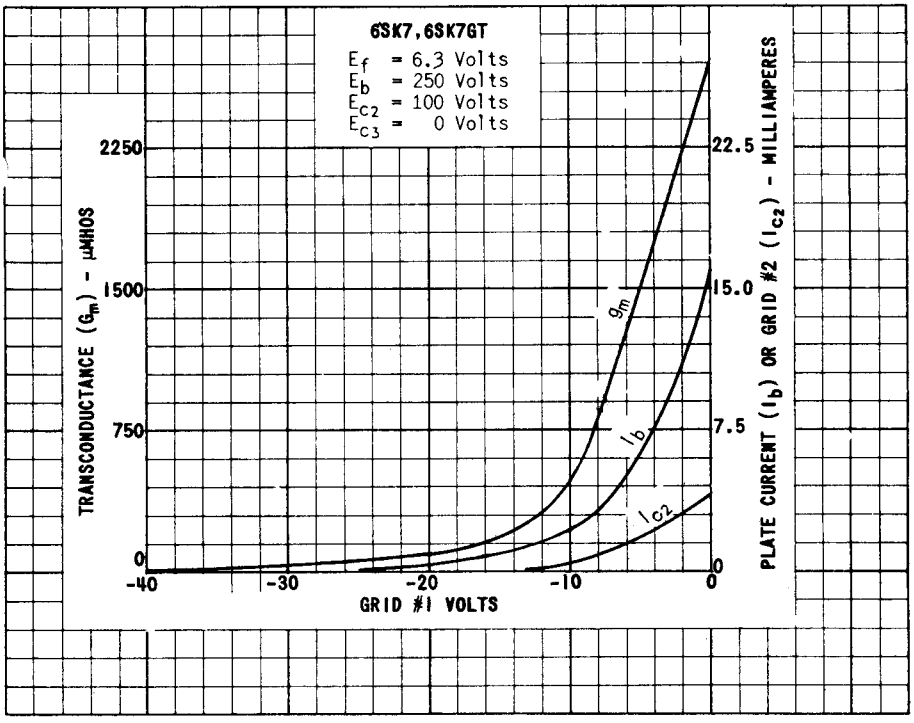
CONTINUED FROM PRECEDING PAGE

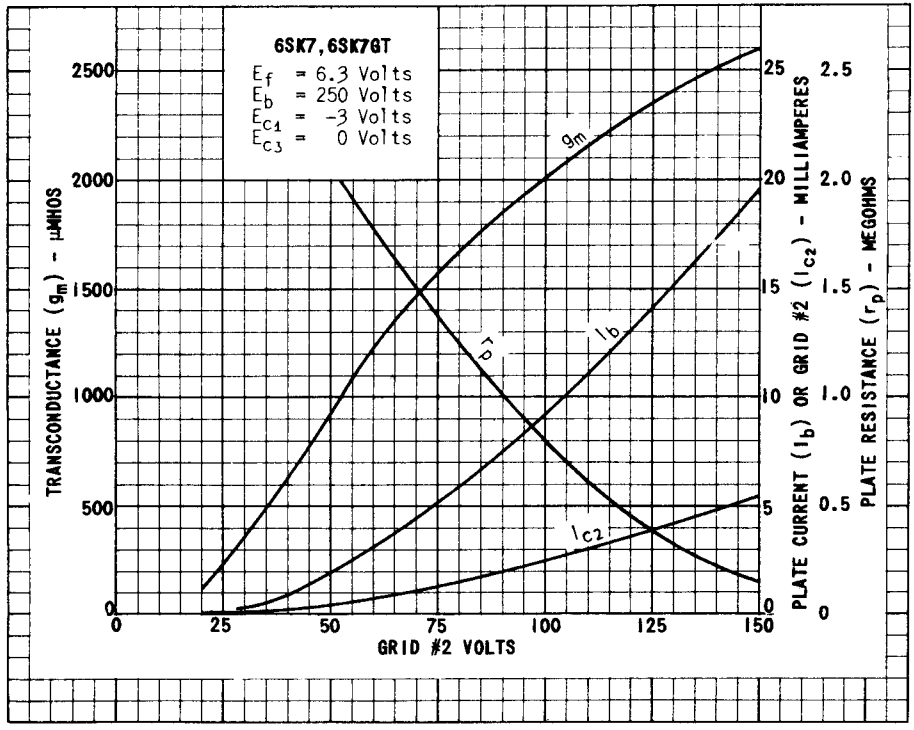
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
GRID #3 VOLTAGE	PIN #3 CONNECTED TO PIN #5 AT SOCKET		
PLATE CURRENT	13	9.2	MA.
GRID #2 CURRENT	4.0	2.6	MA.
PLATE RESISTANCE (APPROX.)	0.12	0.8	MEGOHM
TRANSCONDUCTANCE	2 350	2 000	µMHOS
GRID #1 VOLTAGE (APPROX.) FOR G_m = 10 µMHOS	-35	-35	VOLTS




6SK7, 6SK7GT
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
TRANSCONDUCTANCE (G_m) - µMHOS
2250
1500
750
0
22.5
15.0
7.5
0
PLATE CURRENT (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
g_m
I_b
I_{c2}
-40
-30
-20
-10
0
GRID #1 VOLTS


6SK7, 6SK7GT
E_f = 6.3 Volts
E_b = 250 Volts
E_{c1} = -3 Volts
E_{c3} = 0 Volts
TRANSCONDUCTANCE (g_m) - µMHOS
2500
2000
1500
1000
500
0
25
20
15
10
5
0
PLATE CURRENT (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
2.5
2.0
1.5
1.0
0.5
0
PLATE RESISTANCE (r_p) - MEGOHMS
g_m
r_p
I_b
I_{c2}
0
25
50
75
100
125
150
GRID #2 VOLTS

6SK7, 6SK7GT (12SK7, 12SK7GT)

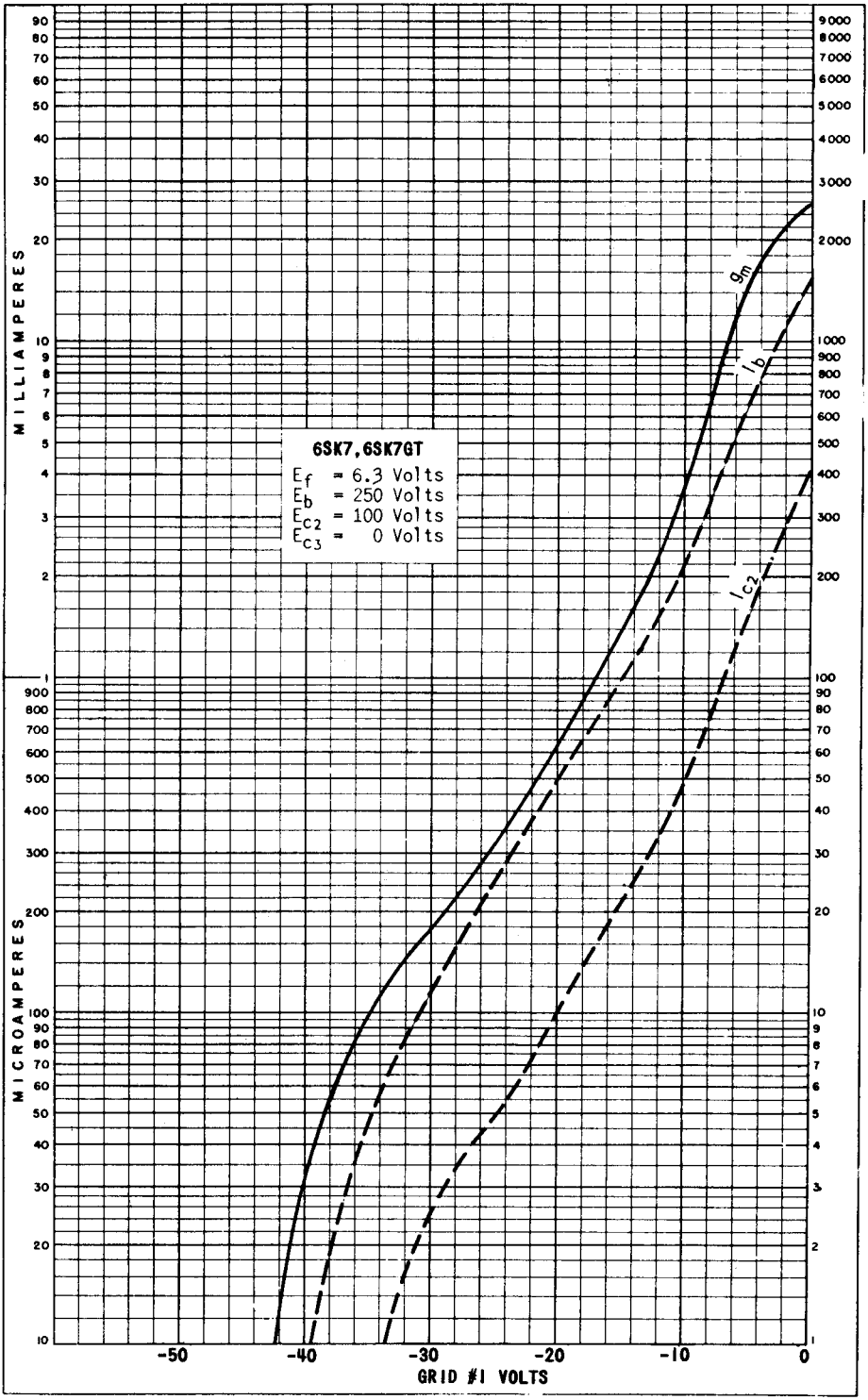
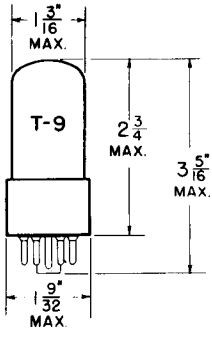


PLATE #3249 JUNE 1, 1953 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

TUNG-SOL

DOUBLE TRIODE

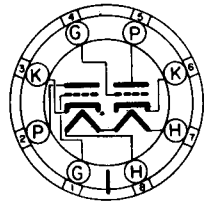


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8BD

THE 6SL7GT COMBINES TWO INDEPENDENT HIGH-MU TRIODES IN ONE ENVELOPE. IT IS DESIGNED PRIMARILY FOR PHASE INVERTER SERVICE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION (EACH UNIT)	1	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.30	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	2.3	MA.
PLATE RESISTANCE	44 000	OHMS
TRANSCONDUCTANCE	1 600	µMHOS
AMPLIFICATION FACTOR	70	

SIMILAR TYPE REFERENCE: Same characteristics as type 7F7. Except for heater ratings, same characteristics as types 12SL7GT and 14F7.

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TUNG-SOL

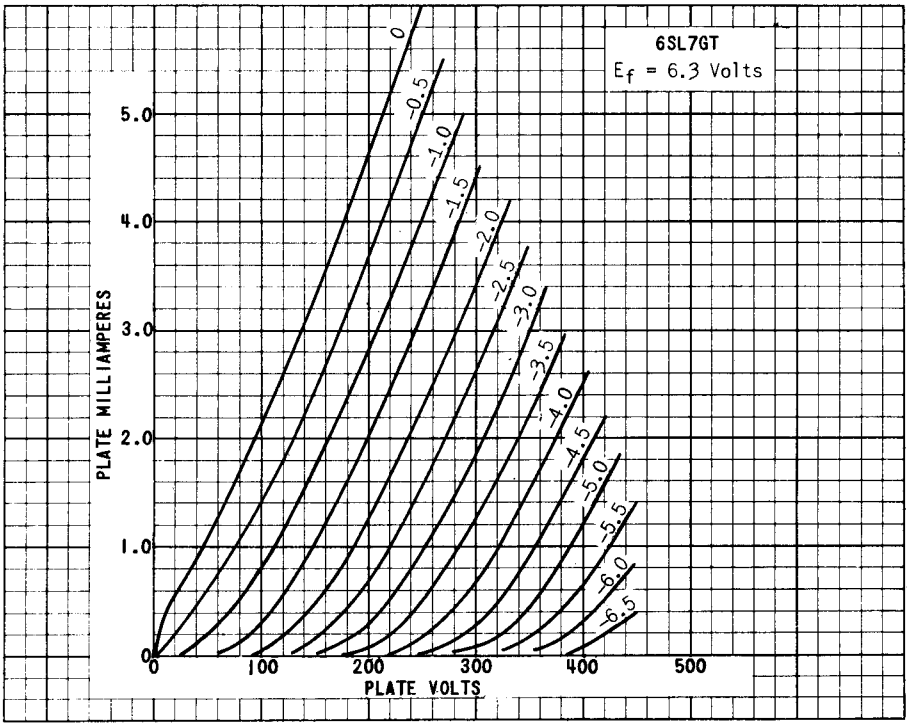
CONTINUED FROM PRECEDING PAGE

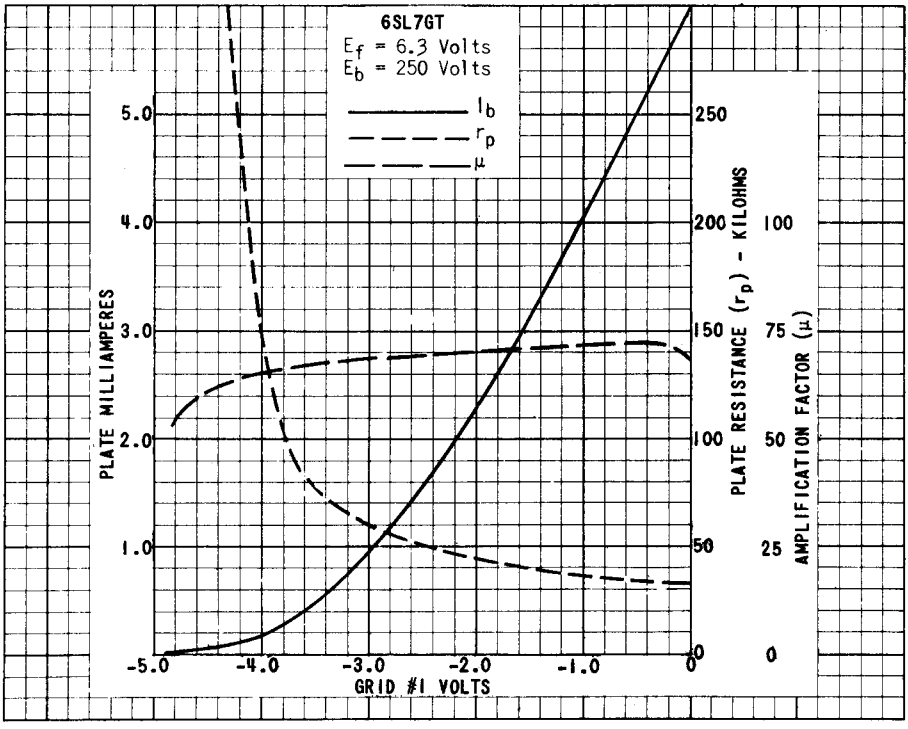
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

RESISTANCE COUPLED AMPLIFIER – EACH TRIODE UNIT*

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.30	0.30	AMP.
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	200 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	μf
OUTPUT CONDENSER	0.01	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	8.0	37	VOLTS
VOLTAGE GAIN AT 400 CPS.	34	45	

*INDICATES AN ADDITION.





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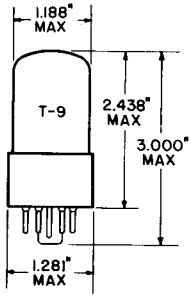
TUNG-SOL

TWIN TRIODE



GLASS BULB

INTERMEDIATE SHELL

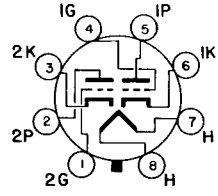
8 PIN OCTAL B8-6
LOW LOSS PHENOLIC
OUTLINE DRAWING
JEDEC 9-5

TWIN

HIGH MU TRIODES

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 6SL7WGT CONTAINS TWO INDEPENDENT HIGH MU TRIODES IN A T-9 ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS RESISTANCE COUPLED AMPLIFIERS. THE TUBE IS INTENDED FOR APPLICATIONS WHERE SEVERE CONDITIONS OF VIBRATION AND MECHANICAL SHOCK ARE ENCOUNTERED.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	300	MA.
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			±100	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, DC	275	VOLTS
PLATE DISSIPATION, EACH SECTION	1.1	WATTS

ADDITIONAL TESTS AND RATINGS [A]

IMPACT ACCELERATION TEST		
VIBRATIONAL ACCELERATION TEST		
ALTITUDE RATING	10,000	FEET

[A] LIMITATIONS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPAIRED.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CHARACTERISTICS

EACH SECTION

CONDITIONS:			
PLATE VOLTAGE, DC		250	VOLTS
GRID VOLTAGE, DC		-2	VOLTS
PLATE CURRENT		2.3	MA.
AMPLIFICATION FACTOR		70	
TRANSCONDUCTANCE		1,600	μMHOS
PLATE RESISTANCE		44,000	OHMS
GRID VOLTAGE FOR 10 μA PLATE CURRENT		-6.0	VOLTS
NOISE OUTPUT VOLTAGE[D]	MAX.	200	MV.

[D] ACROSS PLATE RESISTOR OF 2,000 OHMS, WITH APPLIED VIBRATIONAL ACCELERATION OF 2.5 g. SECTIONS TIED IN PARALLEL.

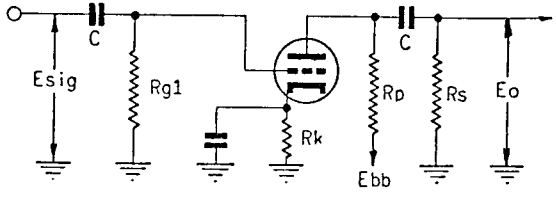
CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

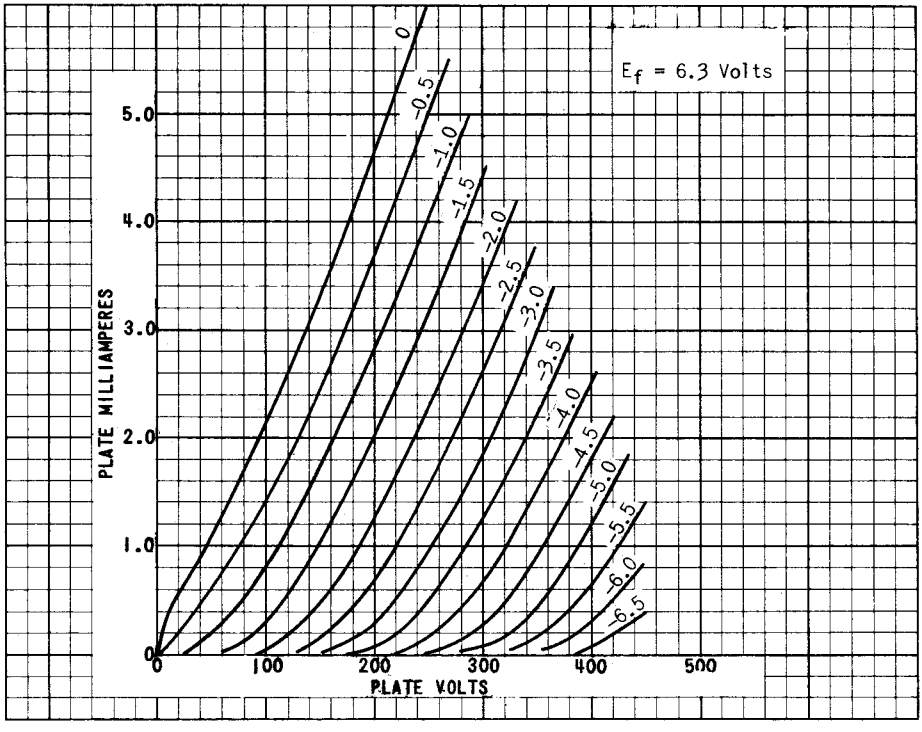
R_p Meg.	R_s Meg.	R_{g1} Meg.	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
			Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.10	1500	26	6.6	1200	30	19	1100	32	35
0.10	0.24	0.10	1700	31	9.5	1400	36	26	1300	37	47
0.24	0.24	0.10	3200	35	7.6	2200	40	24	2100	42	44
0.24	0.51	0.10	3800	39	10	2700	44	30	2500	46	54
0.51	0.51	0.10	7100	39	7.9	4400	45	23	3800	48	45
0.51	1.0	0.10	8000	41	9.9	5200	47	29	4700	50	53
0.24	0.24	10	0	34	6.0	0	42	21	0	45	42
0.24	0.51	10	0	38	8.3	0	46	28	0	48	52
0.51	0.51	10	0	38	6.8	0	47	22	0	50	43
0.51	1.0	10	0	41	8.7	0	50	27	0	53	52

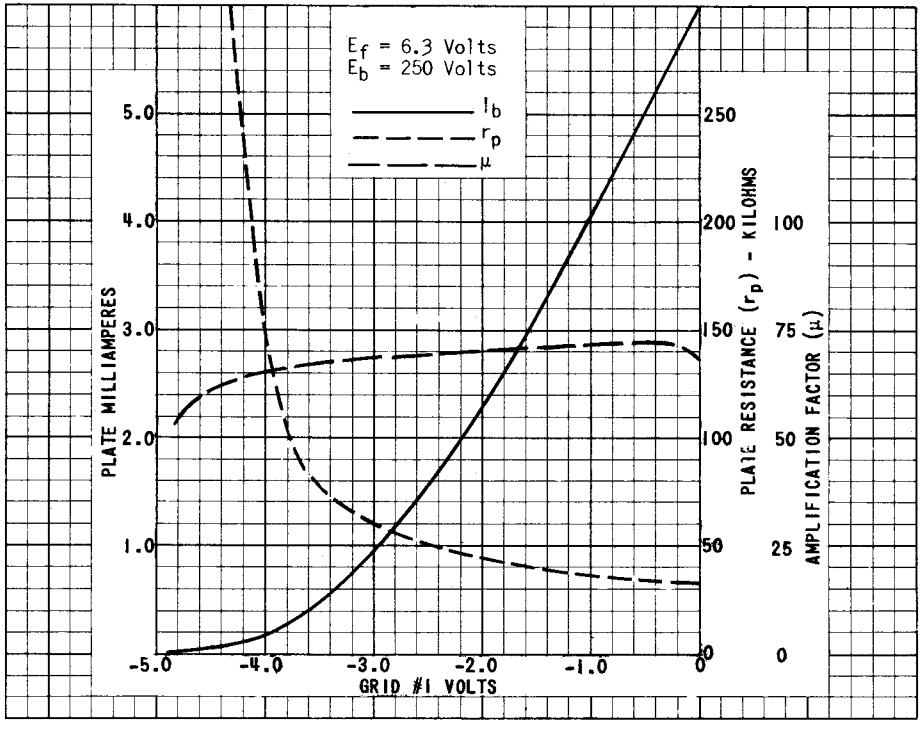
NOTES:

1. Eo MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) HARMONIC DISTORTION.
2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



Note: Coupling capacitors (C) should be selected to give desired frequency response. Rk should be adequately by-passed.





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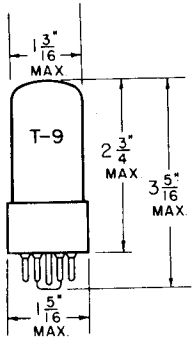
TWIN-TRIODE AMPLIFIER



COATED UNIPOTENTIAL CATHODE

6.3 VOLTS 0.6 AMPERE

AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.

GLASS BULB

ANY MOUNTING POSITION

BOTTOM VIEW

INTERMEDIATE SHELL

OCTAL 8 PIN BASE

THE 6SN7GT IS A TWIN LOW MU TRIODE WHOSE SECTIONS ARE ELECTRICALLY INDEPENDENT EXCEPT FOR THE COMMON HEATER. IT IS USEFUL AS OSCILLATOR, CONVERTER, MULTI-VIBRATOR, AS WELL AS AUDIO AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

AMPLIFIER - EACH UNIT

MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

WITH CLOSE-FITTING SHIELD CONNECTED TO CATHODE

	TRIODE UNIT T_1	TRIODE UNIT T_2	
GRID TO PLATE	3.8	4.0	μμf
GRID TO CATHODE	2.8	3.0	μμf
PLATE TO CATHODE	.8	1.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE[A]	0	-8	VOLTS
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
PLATE CURRENT	10	9	MA.

[A] THE D-C RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM UNDER MAXIMUM RATED CONDITIONS PER UNIT.

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PLATE 1584

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

RESISTANCE COUPLED AMPLIFIER

VALUES ARE FOR ONE TRIODE UNIT

PLATE-SUPPLY VOLTAGE	90	180	300	VOLTS
PLATE RESISTOR	0.1	0.1	0.1	MEGOHM
GRID RESISTOR (FOR FOLLOWING STAGE)	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	3 940	2 830	2 440	OHMS
CATHODE BY-PASS CONDENSER	1.29	1.35	1.42	µF
BLOCKING CONDENSER	0.012	0.012	0.0125	µF
VOLTAGE OUTPUT [B]	17	34	56	PEAK VOLTS
VOLTAGE GAIN[C]	13	14	14	

[B] VOLTAGE ACROSS GRID RESISTOR (FOR FOLLOWING STAGE) AT GRID-CURRENT POINT.

[C] AT 5.0 VOLTS (RMS) OUTPUT.

SIMILAR TYPE REFERENCE: *Same ratings, characteristics and application for each unit, as types 6J5, 6J5G, 6J5GT, 6P8G. Except for heater ratings, characteristics same as types 12SN7GT, 12J7GT, 1633.*

PLATE 1585

JULY 31, 1945

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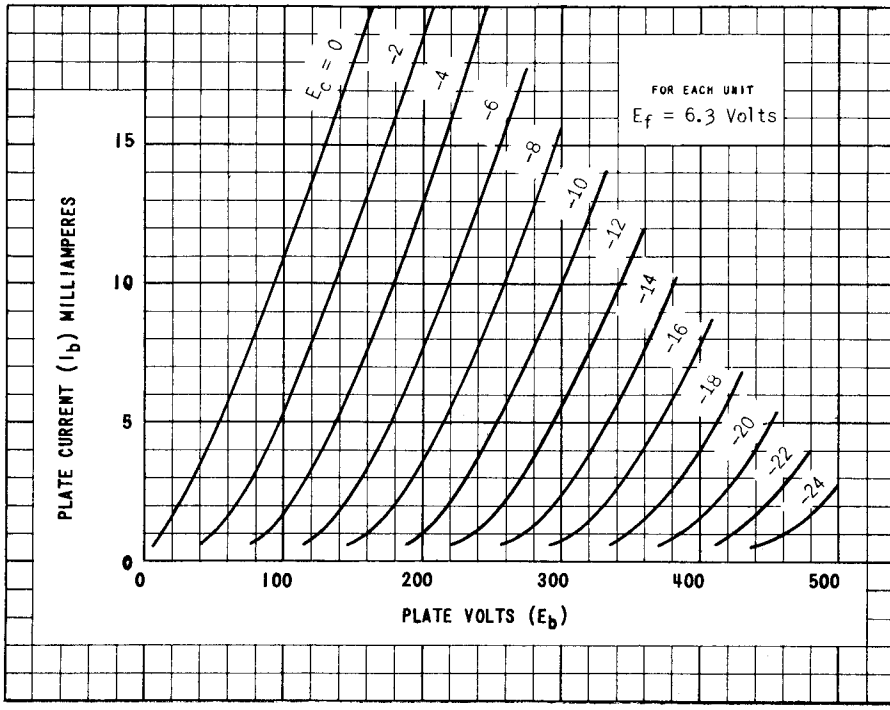

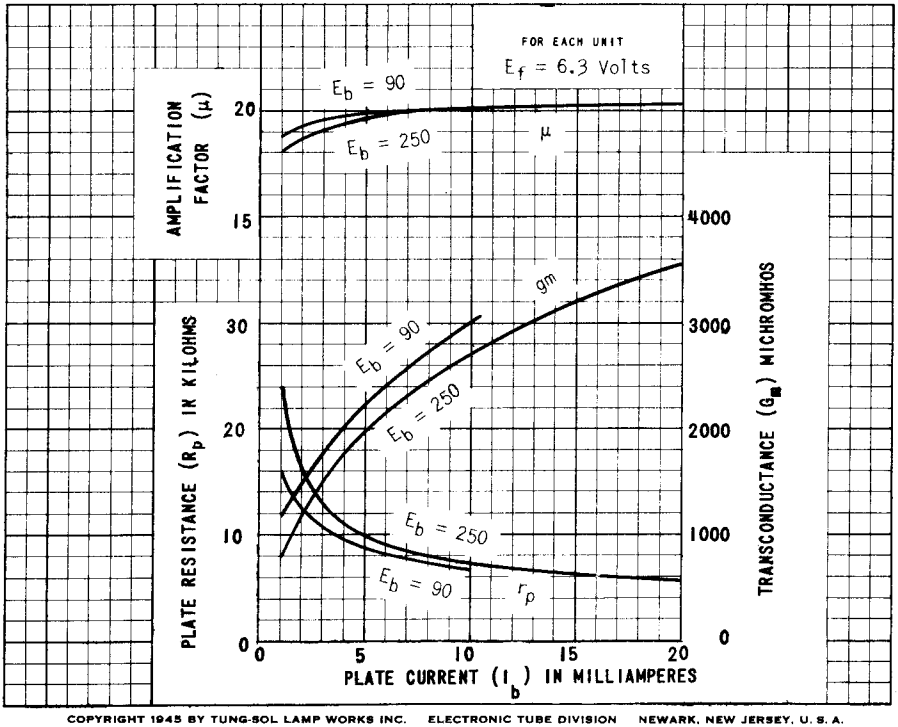

PLATE 1986
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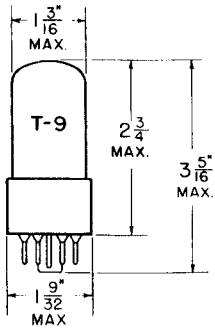
DOUBLE TRIODE



GLASS BULB

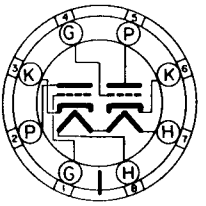
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
8 PIN OCTAL

8BD

THE 6SN7GTA IS A MEDIUM-MU TRIODE INTENDED FOR USE AS A COMBINED VERTICAL OSCILLATOR AND VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS ELECTRICALLY EQUIVALENT TO THE 6SN7GT BUT IT HAS HIGHER VOLTAGE AND DISSIPATION RATINGS AS COMPARED TO THE 6SN7GT.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE: (G TO P)	3.8	4	μμf
INPUT: G TO (H+K)	2.8	3	μμf
OUTPUT: P TO (H+K)	0.8	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	500	VOLTS
MAXIMUM PEAK POSITIVE SURGE PLATE VOLTAGE[A]	1250	VOLTS
MAXIMUM DC GRID VOLTAGE	-50	VOLTS
MAXIMUM PEAK NEGATIVE SURGE GRID VOLTAGE[A]	200	VOLTS
MAXIMUM PLATE DISSIPATION (EACH PLATE)	5	WATTS
MAXIMUM PLATE DISSIPATION (BOTH PLATES)	7.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:		
WITH CATHODE OR FIXED BIAS	1	MEGOHM
WITH CATHODE BIAS RESISTOR OF 470 OHMS (MIN.)	2.5	MEGOHMS

[A] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PERCENT OF ONE SCANNING CYCLE IS 2.5 MILLISECONDS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID BIAS VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10	9	MA.
PLATE RESISTANCE	6 700	7 700	OHMS
AMPLIFICATION FACTOR	20	20	
TRANSCONDUCTANCE	3 000	2 600	μMHOS
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	——	-18	VOLTS

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PLATE 2483
OCT. 1 1950

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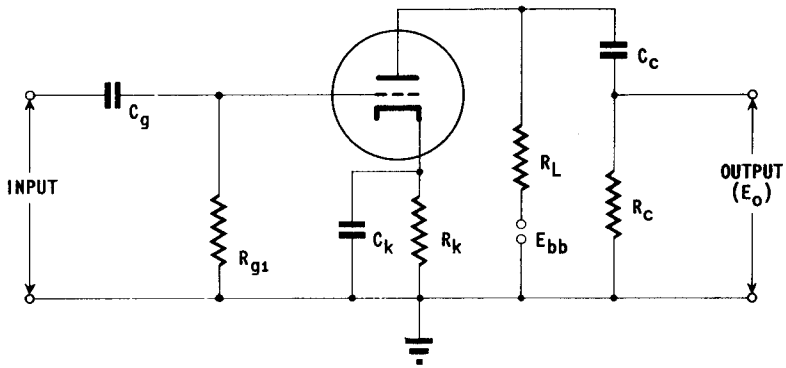
RESISTANCE-COUPLED AMPLIFIER

R_L MEG.	R_{g1} MEG.	R_s MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	A	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	A	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	A	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	A	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	A	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	0	15	13	0	16	33	0	17	46
0.24	10	0.51	0	16	17	0	17	38	0	18	62
0.51	10	0.51	0	16	14	0	18	32	0	18	53
0.51	10	1.0	0	17	18	0	18	41	0	19	68

[A] VALUE OF R_{g1} IS NOT CRITICAL.
GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.
E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

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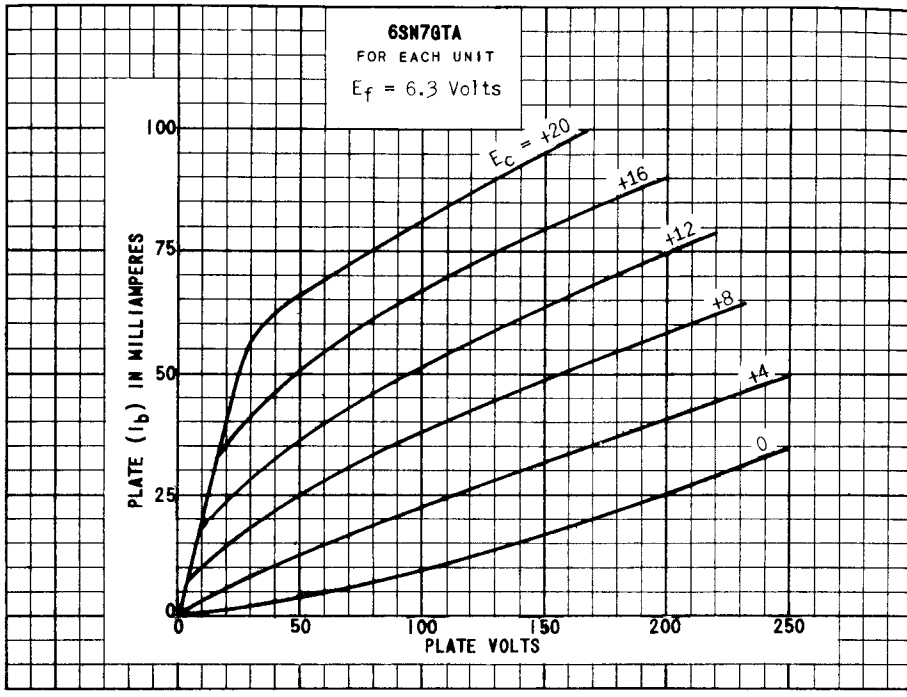

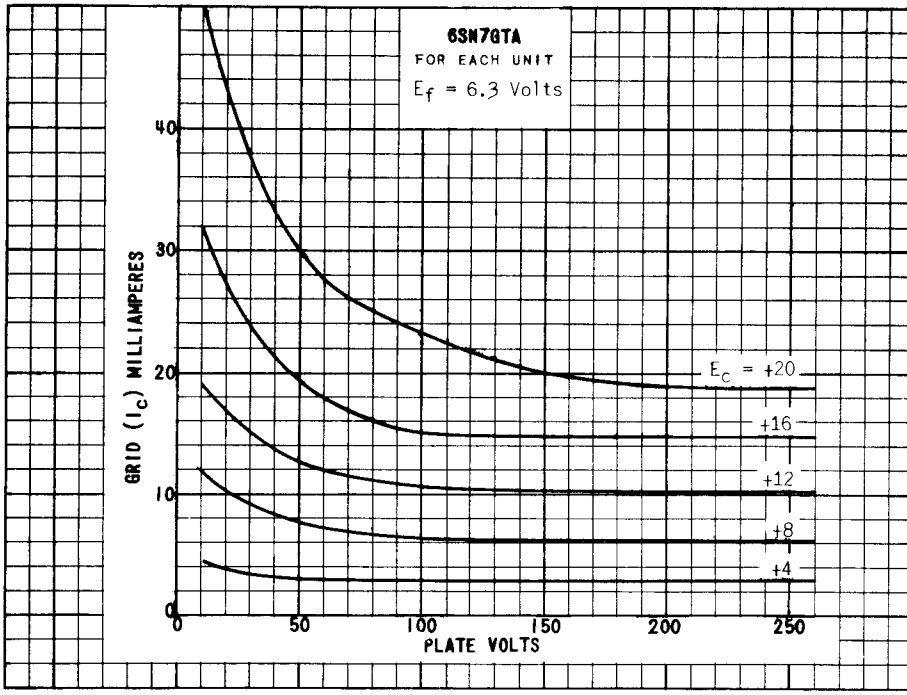

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PLATE
2526
DEC. 1
1950

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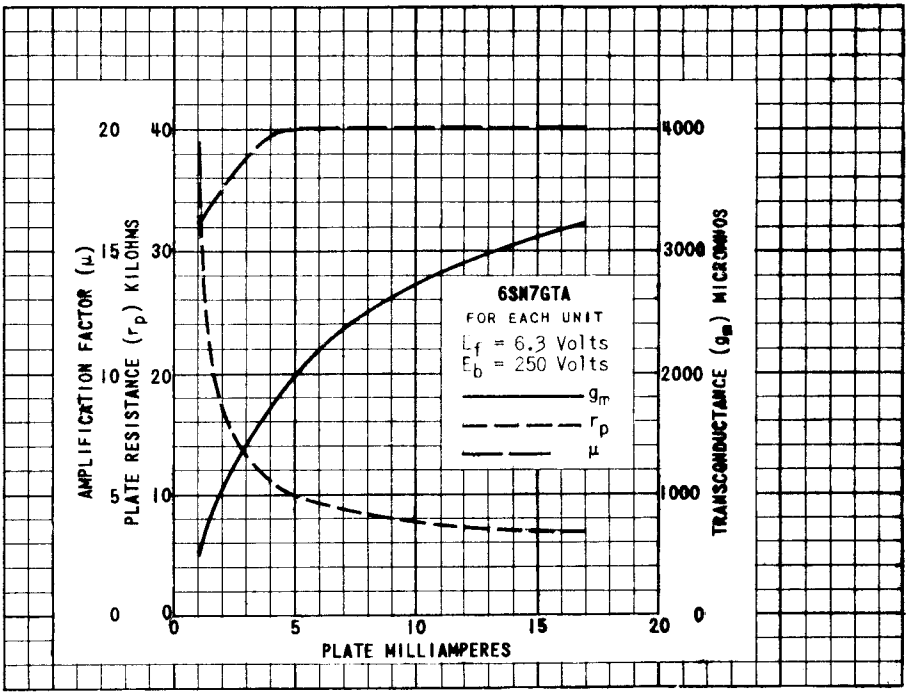
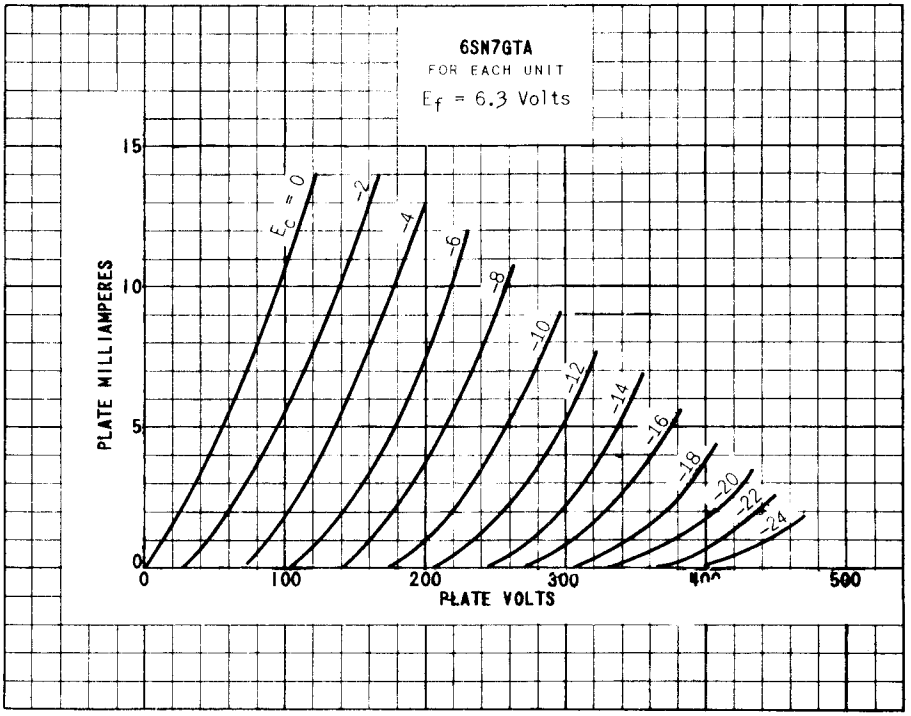
6SN7GTA





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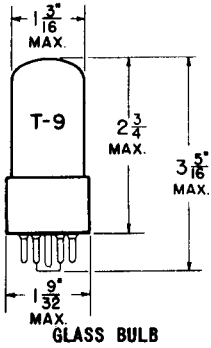
DOUBLE TRIODE

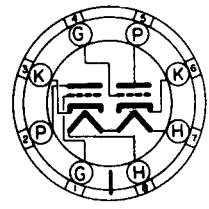


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8B0

THE 6SN7GTB IS A MEDIUM-MU TRIODE INTENDED FOR USE AS A COMBINED VERTICAL OSCILLATOR AND VERTICAL DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF CONTROL OF THE HEATER THERMAL CHARACTERISTICS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6SN7GTA.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE 1	TRIODE 2	
GRID TO PLATE: G TO P	4.0	3.8	μμf
INPUT: G TO (H+K)	2.2	2.6	μμf
OUTPUT: P TO (H+K)	0.7	0.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH UNIT

	CLASS A_1 AMPLIFIER	VERTICAL[A] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 500	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	5.0	5.0[B]	WATTS
BOTH PLATES	7.5	7.5[B]	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	7.0	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	1.0	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

	VERTICAL DEFLECTION OSCILLATOR[C]	HORIZONTAL DEFLECTION OSCILLATOR[C]	
HEATER VOLTAGE	6.3		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	5.0	5.0	WATTS
BOTH PLATES	7.5	7.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	70	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

'CLASS A_1 AMPLIFIER – EACH UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−8	VOLTS
PLATE CURRENT	10	9	MA.
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
PLATE CURRENT AT E_C = −12.5 VOLTS	---	1.3	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	−7.0	−18	VOLTS

TUNG-SOL

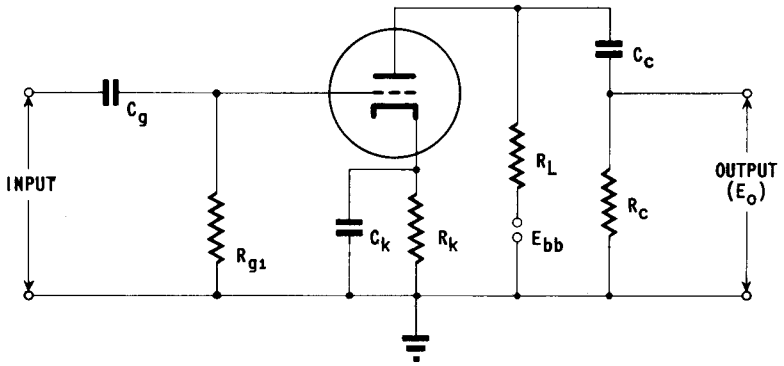
RESISTANCE-COUPLED AMPLIFIER

R_L MEG.	R_{g1} MEG.	R_s MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	A	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	A	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	A	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	A	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	A	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	0	15	13	0	16	33	0	17	46
0.24	10	0.51	0	16	17	0	17	38	0	18	62
0.51	10	0.51	0	16	14	0	18	32	0	18	53
0.51	10	1.0	0	17	18	0	18	41	0	19	68

[A] VALUE OF R_{g1} IS NOT CRITICAL.

GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.

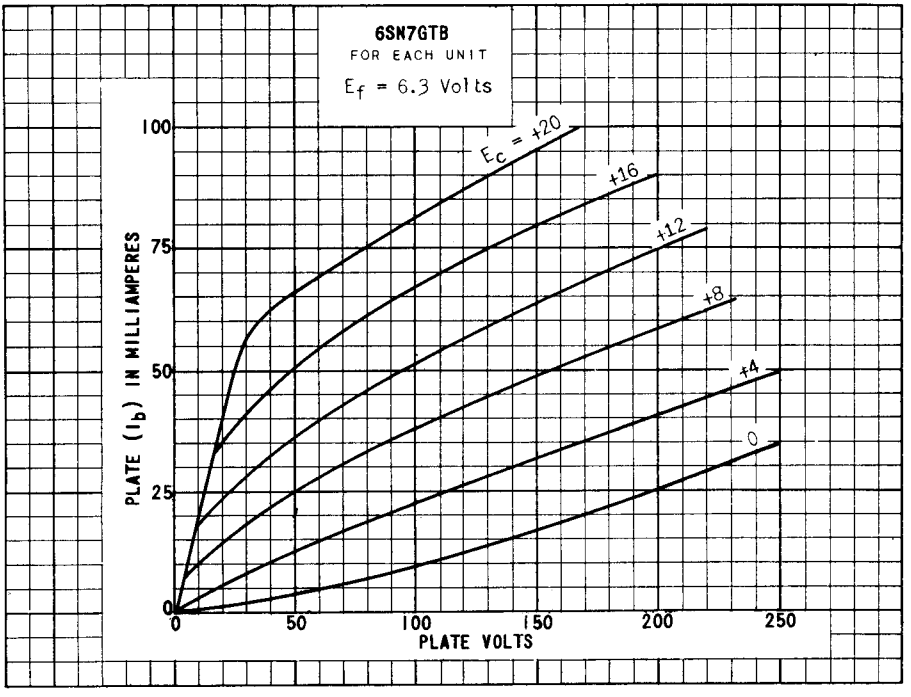
E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PRINTED IN U.S.A.

6SN7GTB



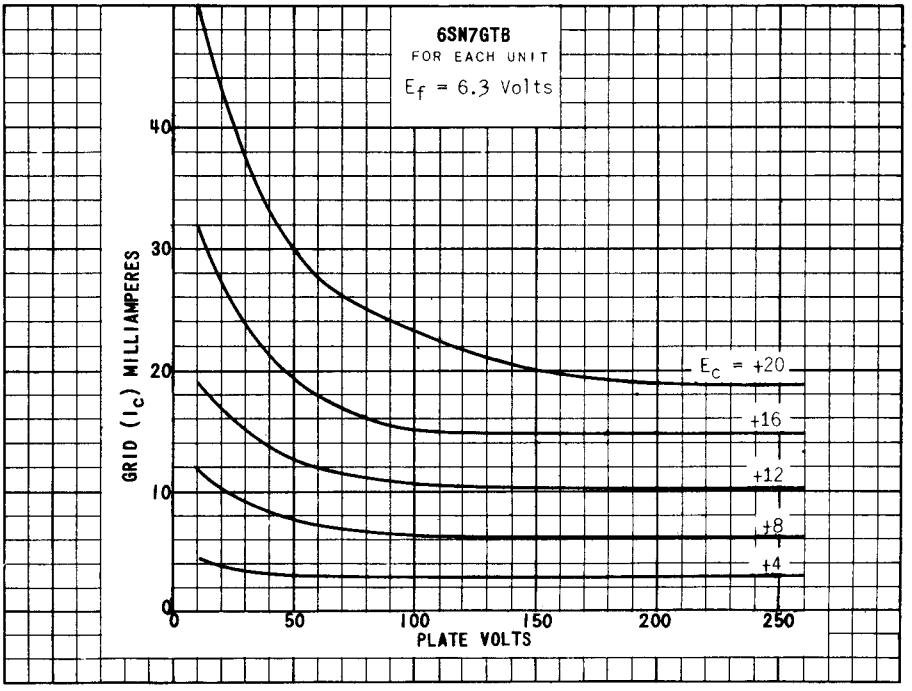
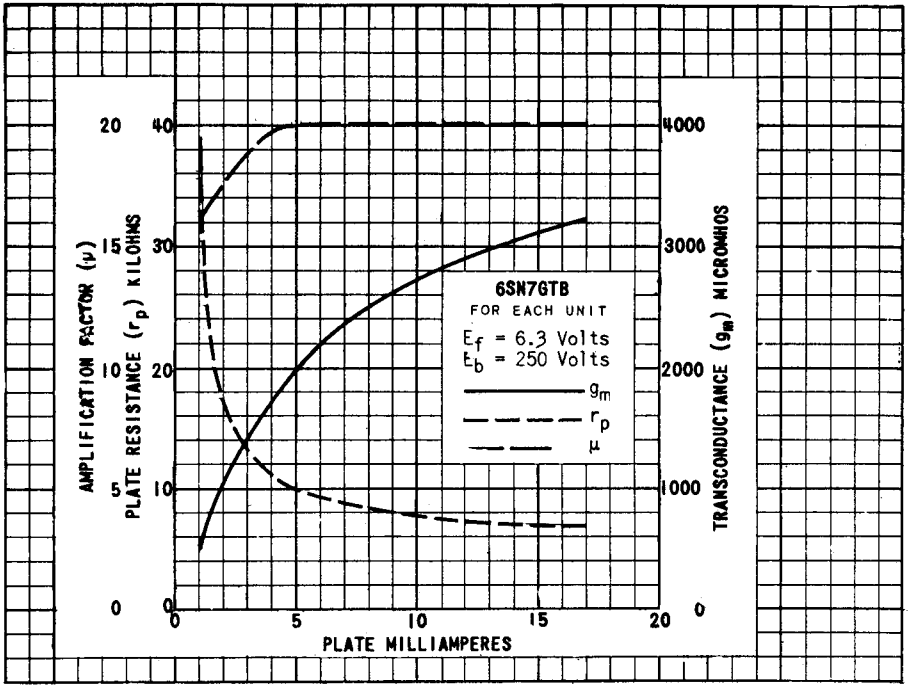
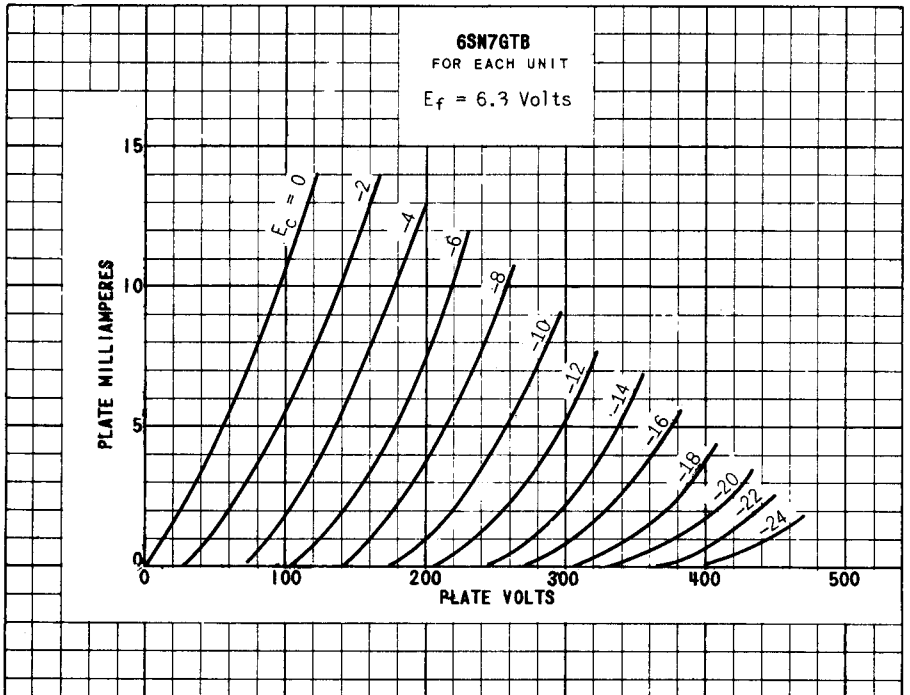


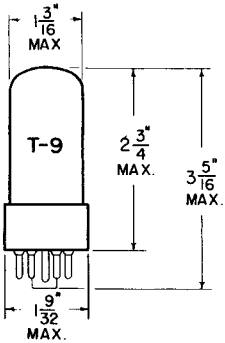
PLATE #3969 SEPTEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.


6SN7GTB
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) KILOHMS
TRANSCONDUCTANCE (g_m) MICROMHOS
PLATE MILLIAMPERES
0
5
10
15
20
30
40
1000
2000
3000
4000


6SN7GTB
FOR EACH UNIT
E_f = 6.3 Volts
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400
500

TUNG-SOL

TWIN TRIODE

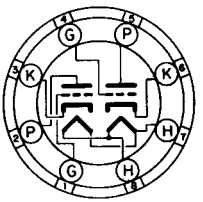


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
8 PIN OCTAL

8BD

THE 6SN7WGTA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE IN THE OCTAL BASE, BANTAM CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE TYPE IS SUITABLE FOR A WIDE RANGE OF GENERAL PURPOSE APPLICATIONS SUCH AS OSCILLATORS, MULTIVIBRATORS, RESISTANCE-COUPLED VOLTAGE AMPLIFIER, ETC. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6SN7WGTA IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

NO EXTERNAL SHIELD

	TRIODE #1	TRIODE #2	
GRID TO PLATE (RATED)	4.0	3.8	μμf
MAXIMUM	4.0	4.0	μμf
MINIMUM	3.0	3.0	μμf
INPUT (RATED)	2.2	2.6	μμf
MAXIMUM	2.7	2.7	μμf
MINIMUM	1.7	1.7	μμf
OUTPUT (RATED)	0.7	0.7	μμf
MAXIMUM	1.20	1.20	μμf
MINIMUM	0.60	0.60	μμf

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION (PER PLATE)	3.44	WATTS
MAXIMUM GRID RESISTANCE	1.1	MEGOHMS
MAXIMUM HEATER–CATHODE VOLTAGE	2.5	VOLTS
MAXIMUM DC PLATE CURRENT (PER PLATE)	20.0	mAdc
MAXIMUM BULB TEMPERATURE	200	°C
MAXIMUM ALTITUDE	60 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH UNIT

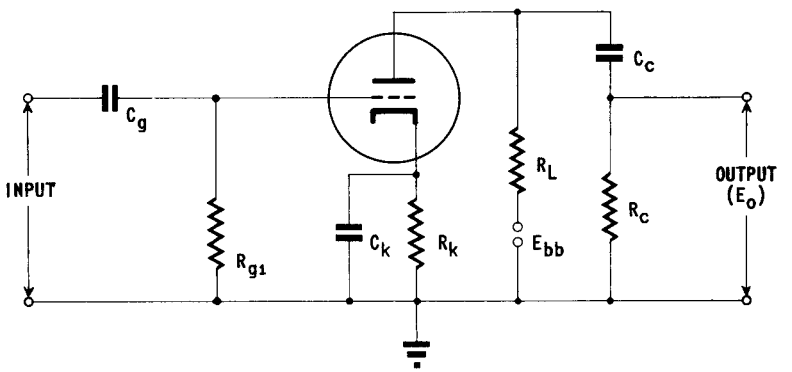
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−8	VOLTS
PLATE CURRENT	10	9	mA.
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
PLATE CURRENT @ E_c = − 12,5 VOLTS	---	1.3	mA.
GRID VOLTAGE FOR Ib = 10 μA (APPROX.)	−7.0	−18	VOLTS

CONTINUED ON FOLLOWING PAGE

RESISTANCE-COUPLED AMPLIFIER

R_L MEG.	R_{g1} MEG.	R_s MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	A	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	A	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	A	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	A	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	A	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	0	15	13	0	16	33	0	17	46
0.24	10	0.51	0	16	17	0	17	38	0	18	62
0.51	10	0.51	0	16	14	0	18	32	0	18	53
0.51	10	1.0	0	17	18	0	18	41	0	19	68

[A] VALUE OF R_{g1} IS NOT CRITICAL.
GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.
E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef=6.3V, Eb=250Vdc, Ec=-8Vdc, Ehk=0
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	550	650	---	---	550	650	mA.
HEATER-CATHODE LEAKAGE (Ehk=±250 Vdc)	---	±25	---	---	---	±25	μAdc
INSULATION OF ELECTRODES[B] (Ef=6.3V.)							
E(g-ALL)	100	---	---	---	50	---	MEGOHMS
E(p-ALL)	100	---	---	---	50	---	MEGOHMS
GRID CURRENT[A]	0	-1.5	---	---	0	-1.5	μAdc
PLATE CURRENT (1)	5.5	12.5	---	---	---	---	mAdc
PLATE CURRENT (2) (Ec=-21Vdc)	---	50	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	2075	3125	2400	2800	---	---	μMHOS
CHANGE IN INDIVIUAL TUBES	---	---	---	---	---	15	PERCENT
AVERAGE CHANGE	---	---	---	---	---	15	PERCENT
ΔTRANSCONDUCTANCE (2) (Ef=5.7V)	---	15	---	---	---	15	PERCENT
GRID EMISSION[E] (Ef=7.5V, Ec=21Vdc, Rg/g=1.0 MEG.)	0	-1.5	---	---	---	---	μAdc
PLATE CURRENT (3) (Ec=-14 Vdc)	---	---	---	---	---	---	μAdc
AF NOISE[EA] (Esig=70mVac, Rp=0.01MEG.)	---	17	---	---	---	---	VU
TRANSCONDUCTANCE (3) (Eb=90 Vdc, Ec=0)	2400	3600	---	---	---	---	μMHOS
AMPLIFICATION FACTOR[F]	18	23	---	---	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
CONTINUITY AND SHORTS[G] (INOPERATIVES)	---	---	
LOW PRESSURE VOLTAGE BREAKDOWN (PRESSURE =55±5mm HG; VOLTAGE =500Vac)	---	---	
LOW FREQUENCY VIBRATION[AHK] (Rp=2000 OHMS)	---	50	mVac
SHOCK[L] (HAMMER ANGLE =30°, Ehk=+100 Vdc)	---	---	
VIBRATIONAL FATIGUE[M] (G=2.5, FIXED FREQUENCY; F=25 MIN.,60 MAX.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	75	mVac
HEATER CATHODE LEAKAGE (Ehk=±250 Vdc)	---	±75	μAdc
PLATE CURRENT (2)	---	150	μAdc
ΔTRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
HEATER CYCLING LIFE TEST (Ef=7.5V, Eb=Ec=0, Ehk=+135 Vdc, 1 MIN. ON 4 MIN. OFF)	---	---	

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TUNG-SOL

SPECIAL REQUIREMENTS - CONT'D.

1 HOUR STABILITY LIFE TEST			
(Ehk=+250 Vdc, Rg/g=1.0 MEG, TA=ROOM)	---	---	
STABILITY LIFE TEST END POINTS			
ΔTRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	10	PERCENT
100 HOUR SURVIVAL-RATE LIFE TEST			
(STABILITY LIFE TEST CONDITIONS OR EQUIVALENT, TA = ROOM)	---	---	
100 HOUR SURVIVAL-RATE TEST END POINTS			
CONTINUITY AND SHORTS (INOPERATIVES)	---	---	
TRANSCONDUCTANCE (1)	1850	---	μMHOS
INTERMITTENT LIFE TEST			
STABILITY LIFE TEST CONDITIONS TA=ROOM	---	---	

NOTES

A TIE 1K TO 2K, 1g TO 2g; AND 1p TO 2p.

B SEE MIL-E-1C 4.8.2

C SEE MIL-E-1C

D PRIOR TO THIS TEST, TUBES SHALL BE PREHEATED 5 MINUTES WITH BOTH SECTIONS OPERATING SEPARATELY AT CONDITIONS INDICATED BELOW. THE TUBES SHALL BE TESTED IMMEDIATELY AFTER PREHEATING. THE THREE MINUTE TEST IS NOT PERMITTED. GRID EMISSION SHALL BE THE LAST TEST PERFORMED ON THE SAMPLE SELECTED FOR THE GRID EMISSION TEST. Ef=7.5Vdc, Ec1=-8Vdc, Eb=250Vdc, Rg=1.0 MEG.

E SEE MIL-E-1C 4.10.3.2

F SEE MIL-E-1C 4.10.11.1

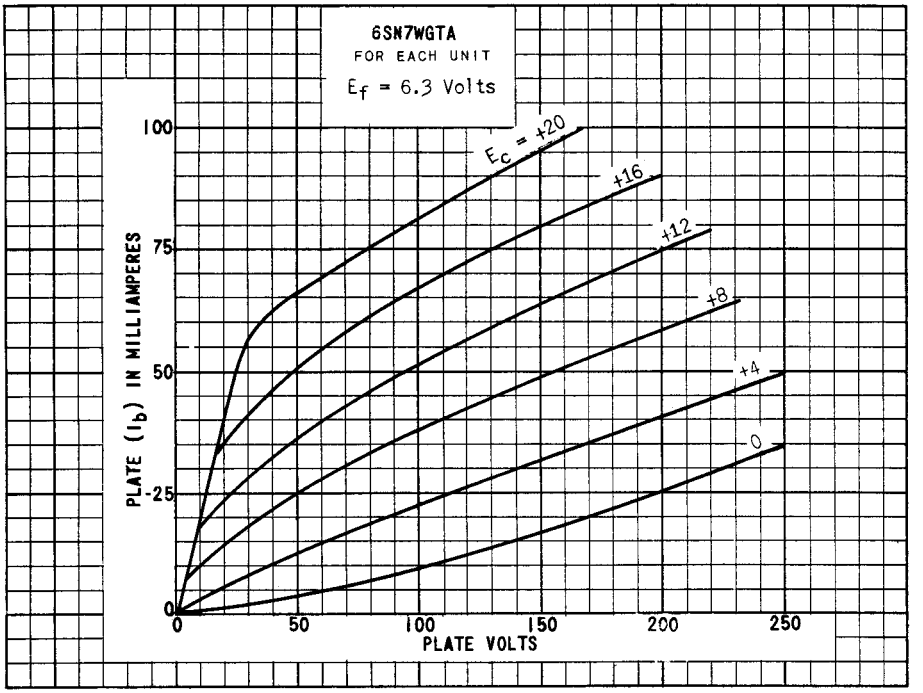
G SEE MIL-E-1C 4.7.5

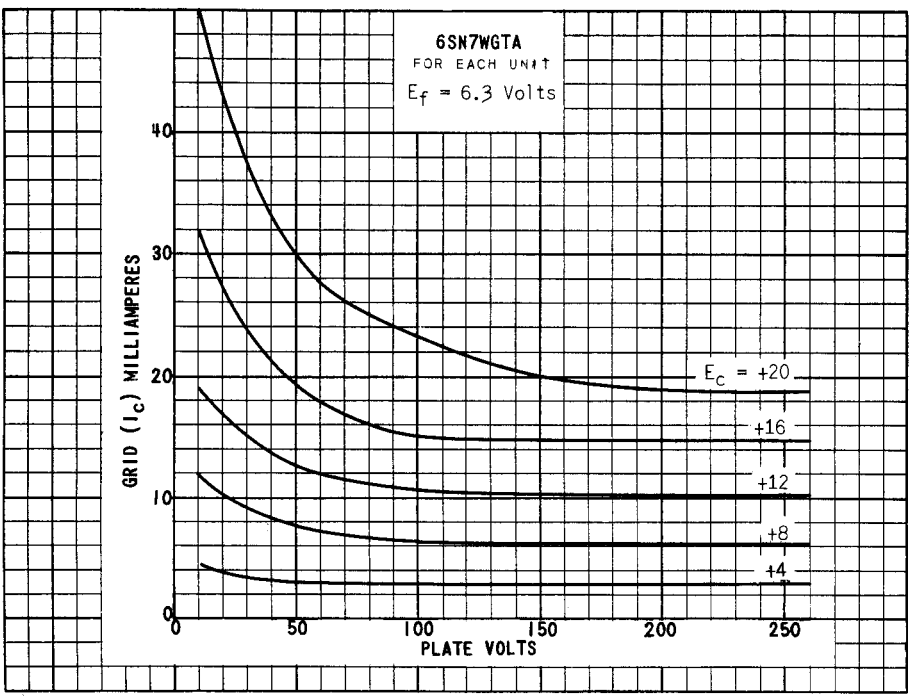
H SEE MIL-E-1C 4.19.9.1

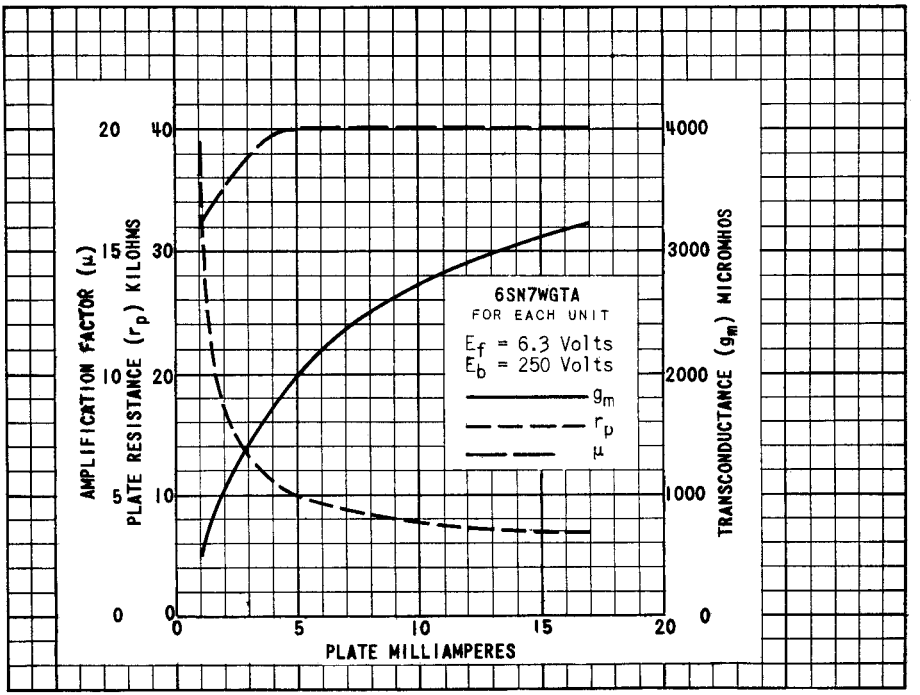
K THE IMPEDANCES OF THE PLATE VOLTAGE SUPPLIES SHALL NOT EXCEED THAT OF A 40μf CAPACITOR @ 10CPS.

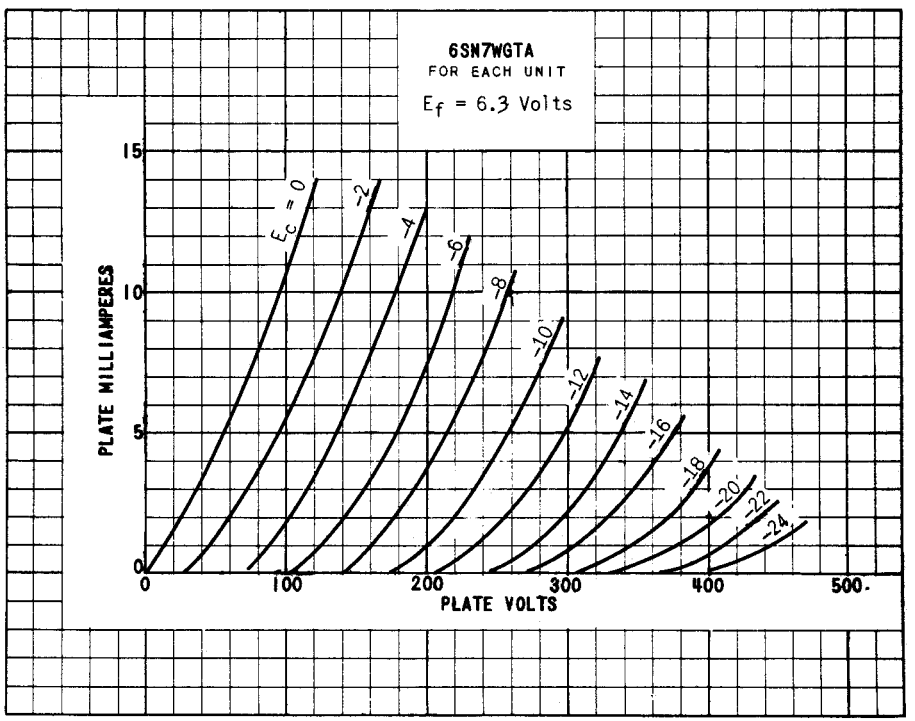
L SEE MIL-E-1C 4.9.20.5

6SN7WGTA
PREMIUM TUBE-NAVY





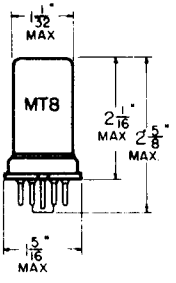

6SN7WGTA
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) KILOHMS
TRANSCONDUCTANCE (g_m) MICROMHOS
PLATE MILLIAMPERES
0
5
10
15
20
40
30
4000
3000
2000
1000


6SN7WGTA
FOR EACH UNIT
E_f = 6.3 Volts
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
5
10
15

TUNG-SOL

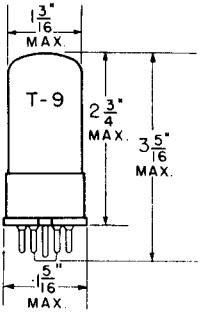
DOUBLE-DIODE TRIODE

6SQ7



METAL SHELL

6SQ7GT



GLASS BULB

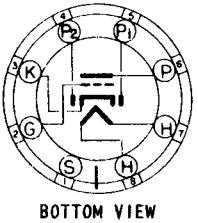
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 300 MA.

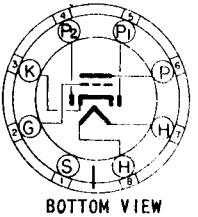
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL WAFER
8-PIN OCTAL



BOTTOM VIEW

SMALL WAFER
8-PIN OCTAL
METAL SLEEVE

THE 6SQ7 AND 6SQ7GT COMBINE TWO DIODE UNITS AND A HIGH-MU TRIODE IN A SINGLE ENVELOPE. EACH SECTION USES A COMMON CATHODE. IT IS INTENDED FOR SERVICE AS A COMBINED DETECTOR, AVC SOURCE, AND HIGH GAIN AUDIO AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

	6SQ7[A]	6SQ7GT[B]	
GRID TO PLATE: (G TO P)	1.6	1.8	μμf
INPUT: G TO (H + K)	3.2	4.2	μμf
OUTPUT: P TO (H + K)	3.0	3.4	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

[B] WITH NO EXTERNAL SHIELD.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM DIODE CURRENT EACH PLATE WITH 10 VOLTS APPLIED	0.8	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1.0	MA.

PLATE 1925
DEC. 1, 1947

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	110 000	91 000	OHMS
TRANSCONDUCTANCE	900	1 100	μMHOS
AMPLIFICATION FACTOR	100	100	

DIODE UNITS - TWO

THE TWO DIODE PLATES ARE PLACED AROUND THE CATHODE AND ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE.

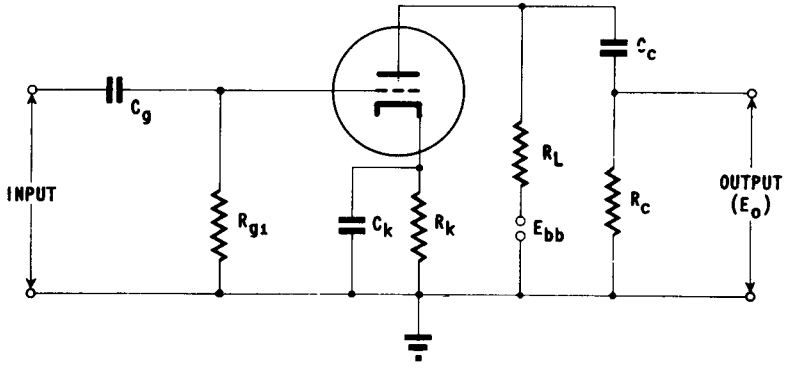
SIMILIAR TYPE REFERENCES: Ratings and characteristics identical to 7B6.

R_1 MEG.	R_{g1} MEG.	R_c MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	4300	22	5.0	2400	29	15	2000	31	28
0.10	A	0.24	4700	27	7.0	2700	35	20	2200	38	37
0.24	A	0.24	7500	31	7.5	4300	42	20	3300	46	36
0.24	A	0.51	8200	40	10	4700	50	26	3900	52	50
0.51	A	0.51	13000	39	9.5	7500	53	24	5600	58	47
0.51	A	1.0	15000	43	11	8200	58	31	6200	62	56
0.24	10	0.24	---	39	4.5	---	45	19	---	49	38
0.24	10	0.51	---	45	6.5	---	52	24	---	57	48
0.51	10	0.51	---	48	7.0	---	59	22	---	62	42
0.51	10	1.0	---	52	8.5	---	62	25	---	66	55

[A] VALUE OF R_{g1} IS NOT CRITICAL.

GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.

E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PLATE 1926

DEC. 1, 1947

→ INDICATES A CHANGE OR ADDITION

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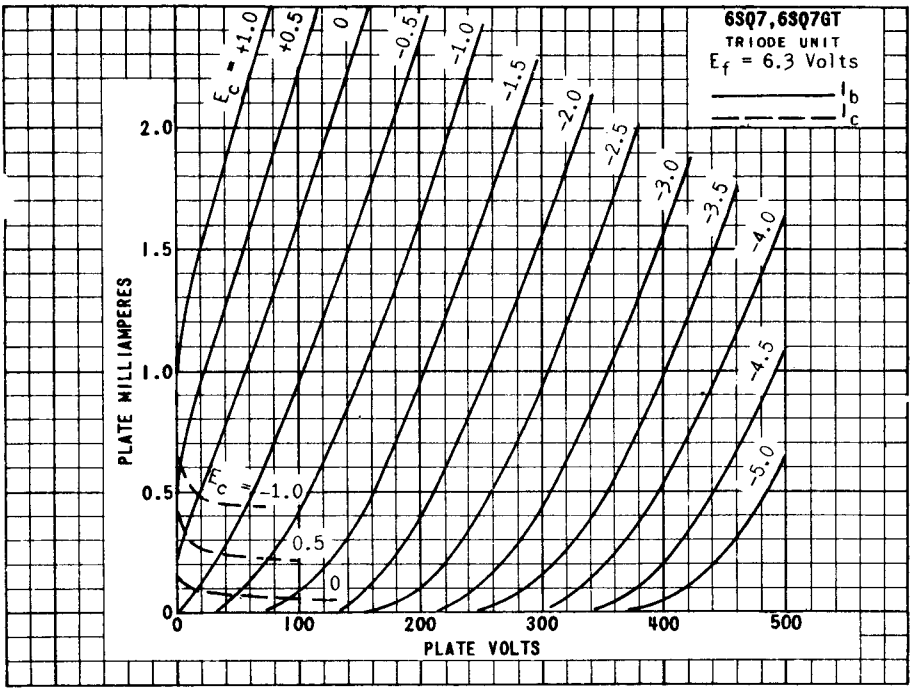

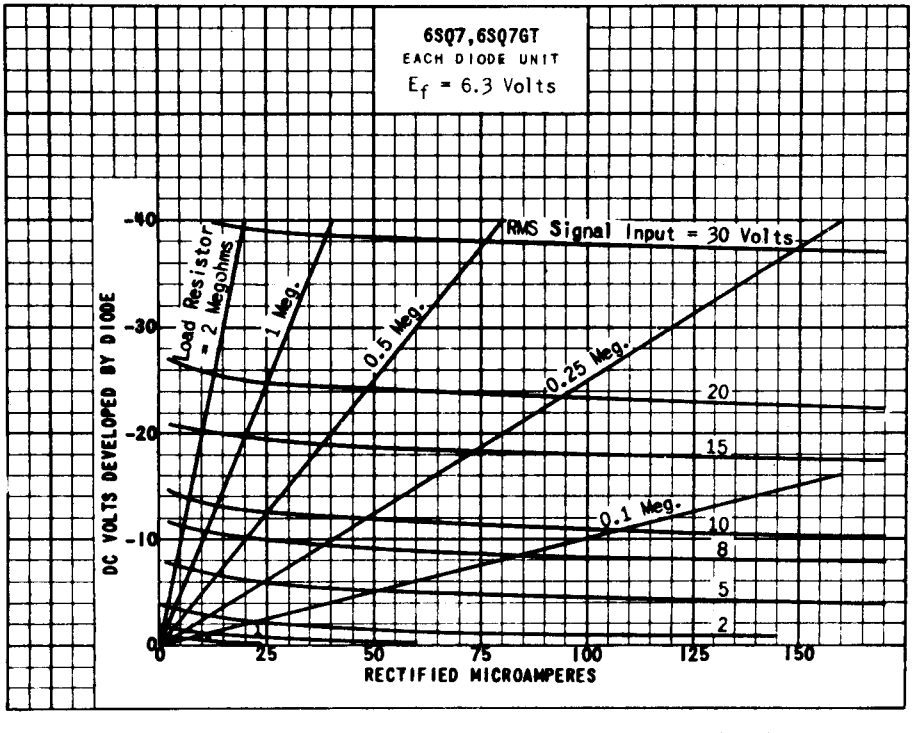

PLATE 1967
FEB. 2, 1948

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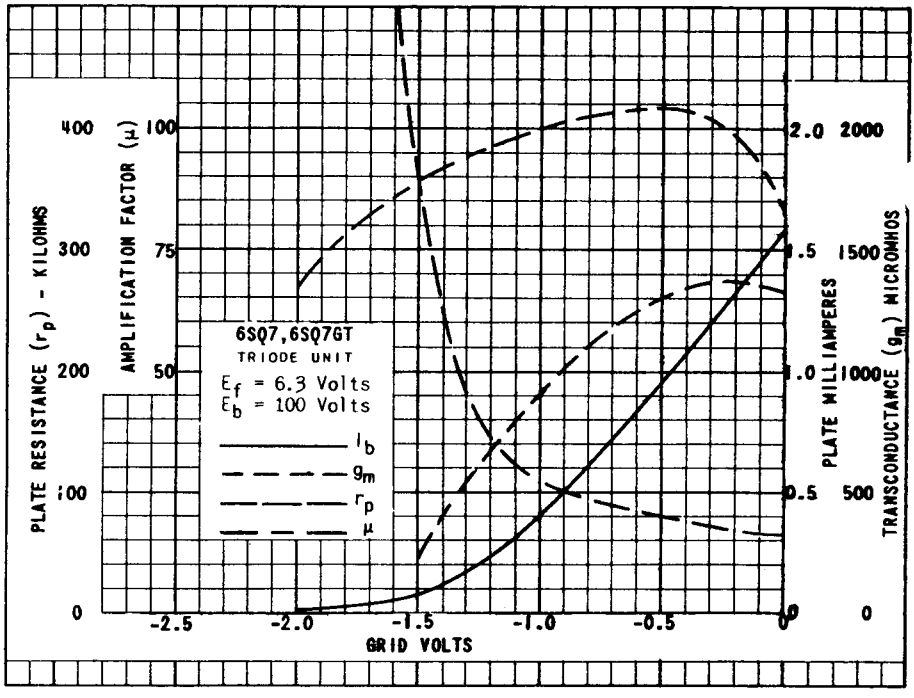
6SQ7, 6SQ7GT



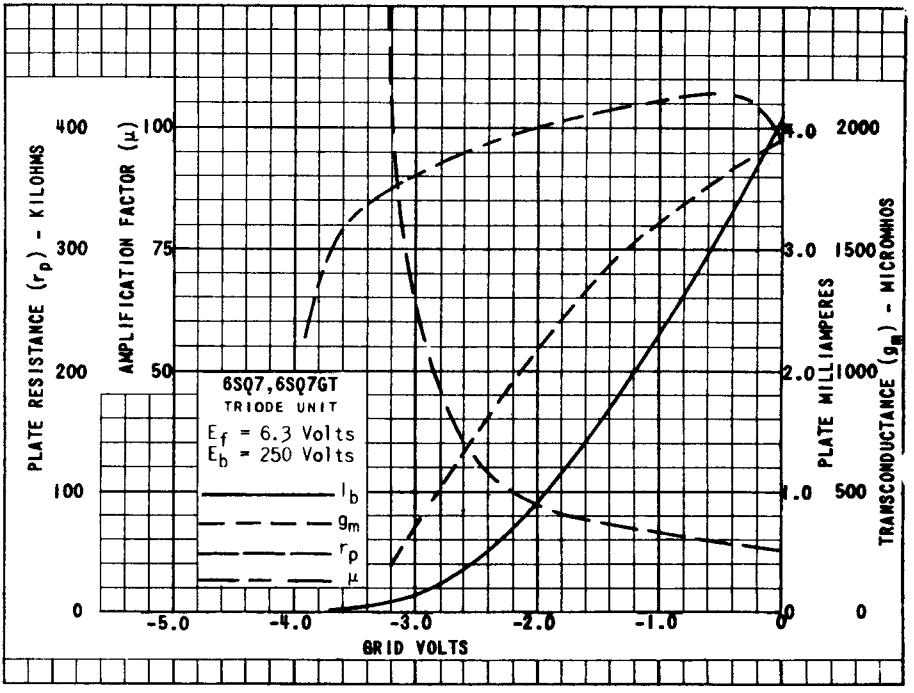


PLATE
1968
FEB. 2
1948

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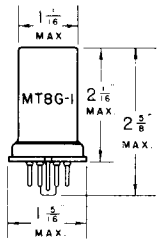
TUNG-SOL



METAL SHELL

DUO-DIODE

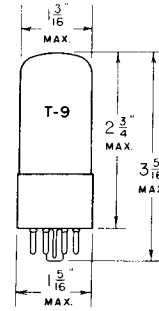
TRIODE AMPLIFIER

COATED UNIPOTENTIAL CATHODE

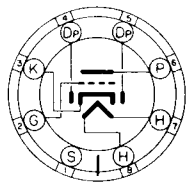
HEATER

6.3 VOLTS [4] 0.3 AMPERE

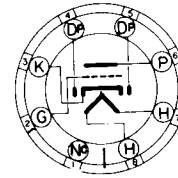
AC OR DC



GLASS BULB



SMALL WAFER 8 PIN OCTAL BASE



INTERMEDIATE 8 PIN OCTAL BASE

THE TUNG-SOL 6SR7 AND 6SR7GT COMBINE TWO DIODES AND A TRIODE IN A SINGLE ENVELOPE USING A COMMON CATHODE. THEY ARE DESIGNED FOR SERVICE AS DIODE DETECTORS, AVC RECTIFIERS AND AS AUDIO AMPLIFIERS IN AC, STORAGE BATTERY AND AC-DC OPERATED RECEIVERS.

RATINGS

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED PER PLATE	0.8	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE	-9	VOLTS
PLATE CURRENT	9.5	MA.
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	

[4] SHOULD NOT DEVIATE MORE THAN ± 10% FROM RATED VALUE.

SEE OTHER SIDE OF PAGE FOR CURVES

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PLATE 1347-1
OCT. 25 1943

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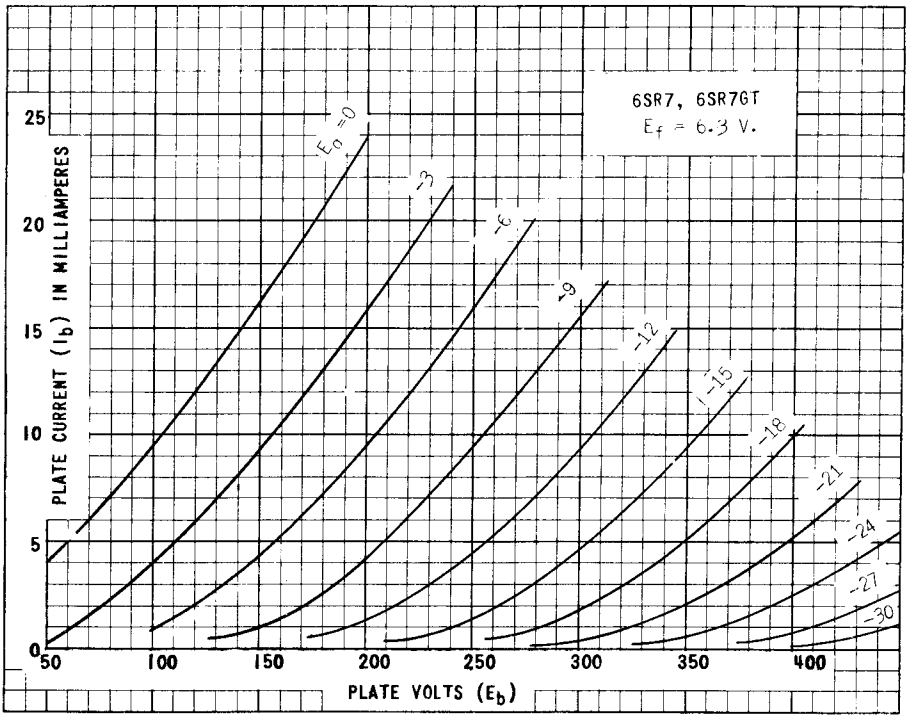
6SR7, 6SR7GT



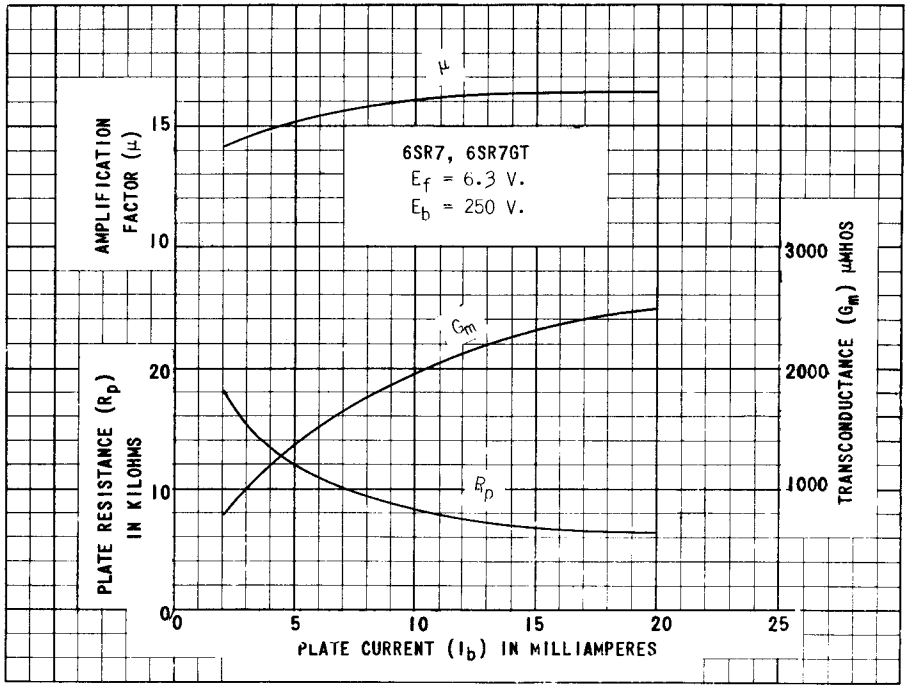


PLATE
1348-1
OCT. 28
1943

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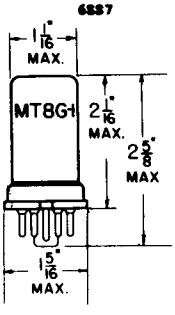
TUNG-SOL

PENTODE AMPLIFIER

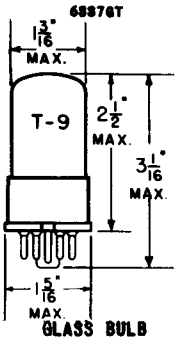


METAL SHELL

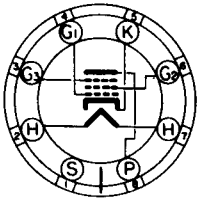
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

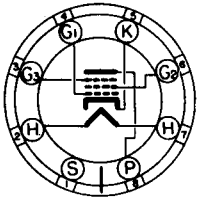
ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL
METAL SLEEVE

THE 6SS7 AND 6SS7GT ARE RF PENTODES WHICH HAVE REMOTE PLATE CURRENT CUT-OFF. THEY ARE SUITABLE FOR OPERATING WITH AVC IN RF AND IF AMPLIFIERS. THE USE OF THESE TUBES WILL REDUCE CROSS MODULATION EFFECTS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MINIMUM CONTROL GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.35	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

	6SS7 WITH SHELL CONNECTED TO CATHODE	6SS7GT WITH EXTERNAL SHIELD CONNECTED TO CATHODE	
GRID TO PLATE (MAX.)	0.004	0.004	μμf
INPUT	5.5	5	μμf
OUTPUT	7	6	μμf

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 1802
MAY 1 1947

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	6SS7	6SS7GT	6SS7 6SS7GT	
PLATE VOLTAGE	100	100	250	VOLTS
SCREEN VOLTAGE	100	100	100	VOLTS
CONTROL GRID VOLTAGE	-1	-1	-3	VOLTS
SUPPRESSOR VOLTAGE	0	0	0	VOLTS
PLATE CURRENT	12.2	12.2	9	MA.
SCREEN CURRENT	3.1	3.1	2	MA.
PLATE RESISTANCE (APPROX.)	0.12	0.12	1	MEGOHM
TRANSCONDUCTANCE	1 930	2 200	1 850	µMHOS
GRID VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 µMHOS	-35	-35	-35	VOLTS

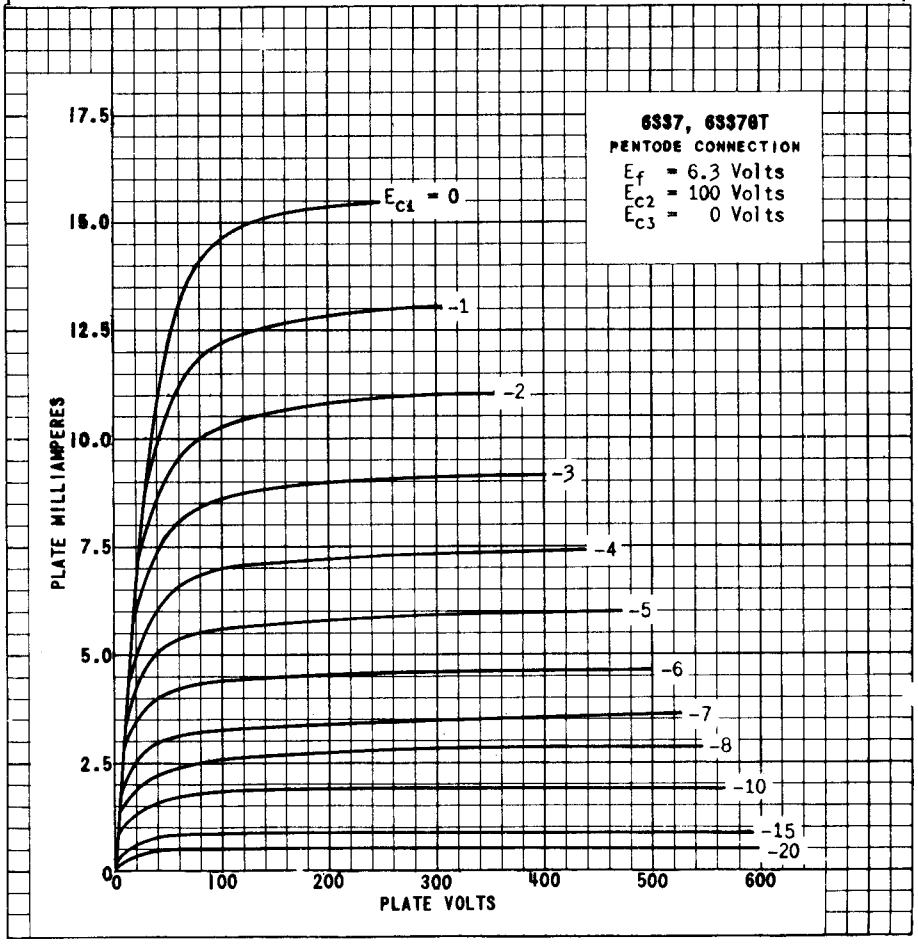

PLATE 1803
MAY 1 1947

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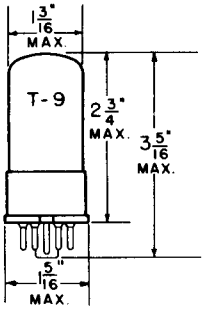
TUNG-SOL

HI-MU TWIN TRIODE AMPLIFIER



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW

INTERMEDIATE SHELL
8-PIN OCTAL MICANOL

THE TYPE 6SU7GTY IS A DOUBLE TRIODE HAVING THE SAME GENERAL CHARACTERISTICS AS THE 6SL7GT EXCEPT THAT IT HAS A LOW LOSS PHENOLIC BASE, HAS MINIMUM GAS AND LEAKAGE CURRENTS, AND IS SPECIALLY TESTED FOR PLATE CURRENT BALANCE BETWEEN THE TWO TRIODE UNITS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

AMPLIFIER - PER UNIT

HEATER VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
MAX. PLATE VOLTAGE	250	VOLTS
MIN. GRID VOLTAGE	0	VOLTS
MAX. PLATE DISSIPATION	1	WATT
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PER UNIT

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	2.3	MA.
PLATE RESISTANCE	44 000	OHMS
TRANSCONDUCTANCE	1600	µMHOS
AMPLIFICATION FACTOR	70	

SIMILAR TYPE REFERENCE: *Same characteristics as types 6SL7GT, 7F7; except for heater ratings same characteristics as types 12SL7GT, 14F7; somewhat similar to types 6SC7GT, 12SC7GT.*

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PLATE
1684
FEB. 15
1946

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6SU7GTY

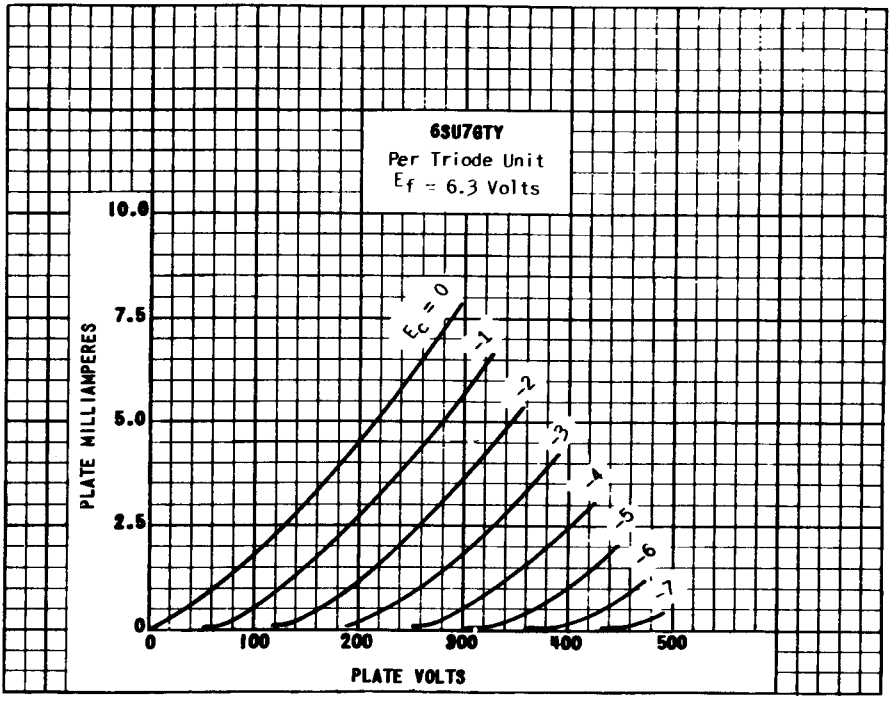

PLATE
1627
NOV. 30
1945

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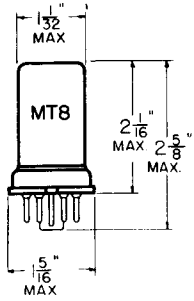
TUNG-SOL

DIODE PENTODE



METAL SHELL

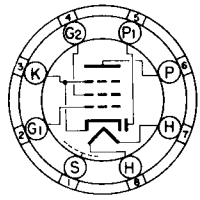
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 300 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL WAFER
8 PIN OCTAL
7AZ

THE 6SV7 COMBINES A DIODE AND SHARP CUT OFF RF AMPLIFIER PENTODE IN THE METAL CONSTRUCTION. IT IS DESIGNED FOR USE AS AN AM DETECTOR, VOLTAGE AMPLIFIER AND FM LIMITER BELOW 30 MC.

DIRECT INTERELECTRODE CAPACITANCES

MEASURED WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.004	µµf
INPUT: G_1 TO (H+K&G_3+G_2+S)	6.5	µµf
OUTPUT: P TO (H+K&G_3+G_2+S)	6	µµf
GRID TO DIODE PLATE: (G_1 TO 1P) MAX.	0.002	µµf
DIODE PLATE TO ALL: 1P TO (H+K&G_3+G_1+G_2+P+S)	5	µµf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATT
MAXIMUM GRID #1 CURRENT	1.8	MA.
MAXIMUM DIODE CURRENT	3	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	150	VOLTS
GRID #1 VOLTAGE	-1	-1	VOLT
PLATE RESISTANCE (APPROX.)	0.7	1.5	MEGOHMS
TRANSCONDUCTANCE	2 600	3 600	µMHOS
PLATE CURRENT	3.7	7.5	MA.
GRID #2 CURRENT	1.4	2.8	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA	-4.5	-7	VOLTS
AVERAGE DIODE CURRENT AT 10 VOLTS DC	15	15	MA.

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PLATE 2255
OCT. 1, 1949

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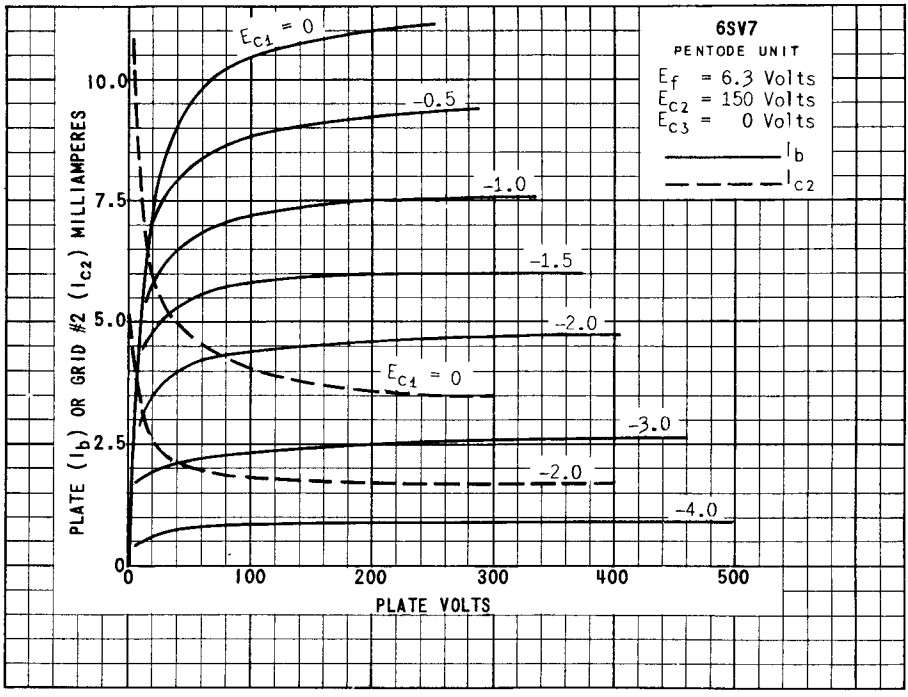
6SV7



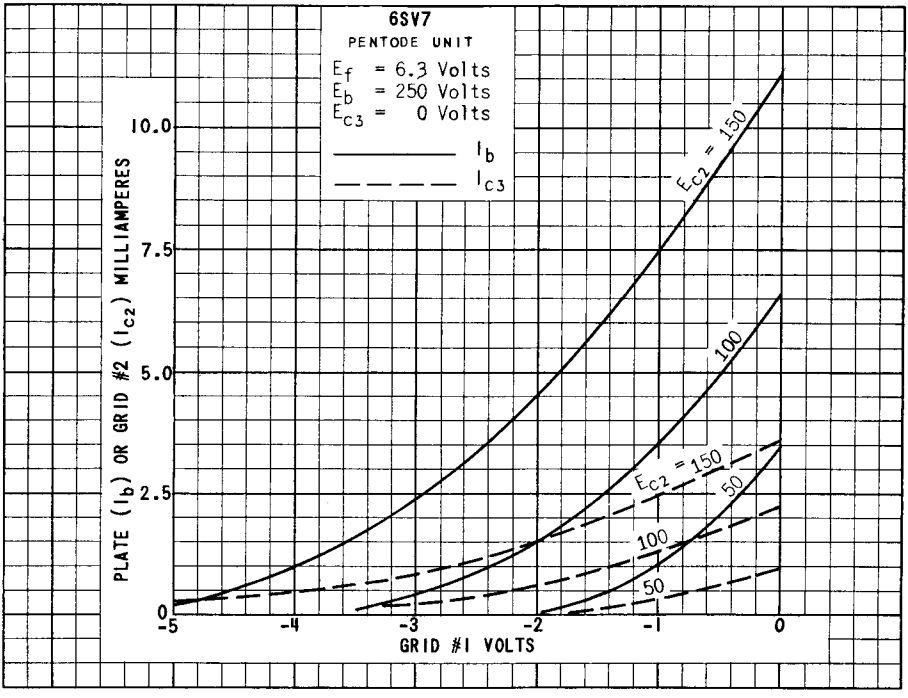


PLATE 2256
OCT. 1, 1949

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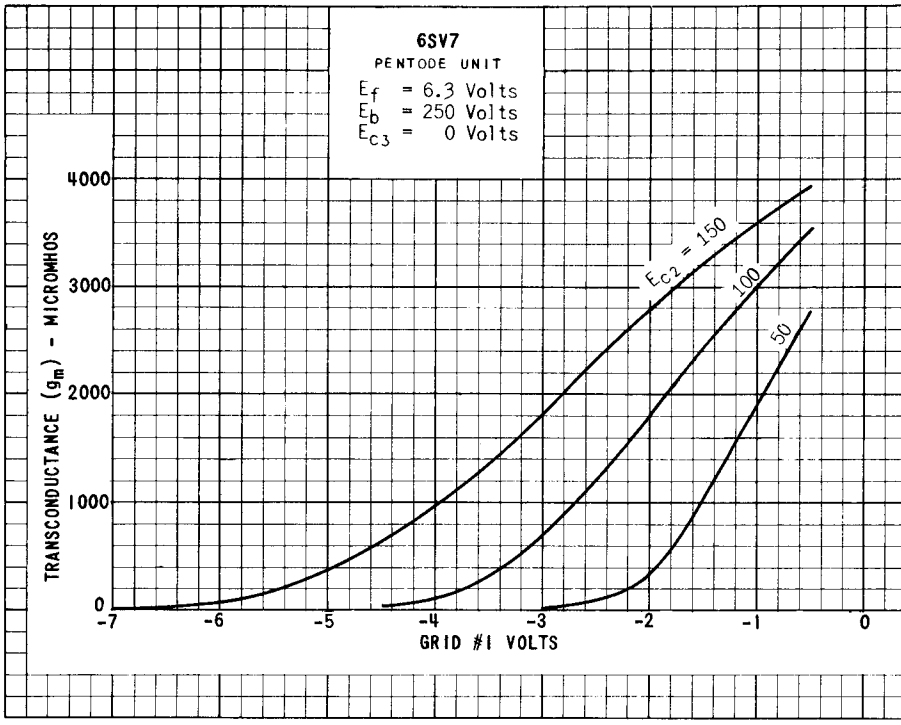

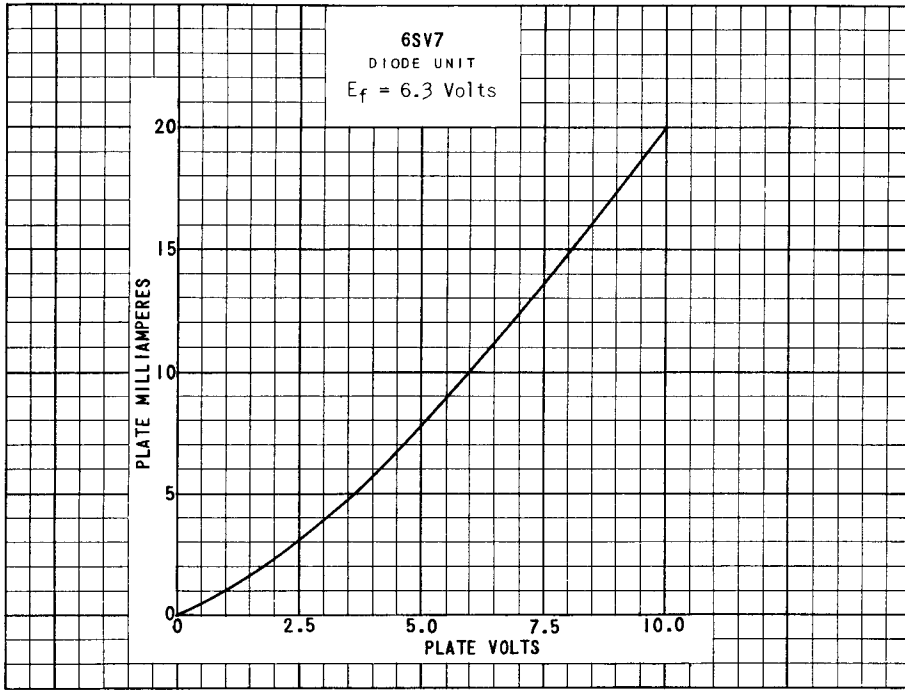

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PLATE 2257
OCT. 1, 1949

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TENTATIVE DATA

6SZ7

TUNG-SOL

DUPLEX-DIODE HIGH-MU TRIODE

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS	
BASE SMALL WAFER OCTAL 8-PIN	PIN 1 SHELL	PIN 7 HEATER
CAP ———	PIN 2 TRIODE GRID	PIN 8 HEATER
BULB MT-8G	PIN 3 CATHODE	
MAXIMUM DIAMETER 1 5/16"	PIN 4 D_P 2	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH 2 5/8"	PIN 5 D_P 1	
MAXIMUM SEATED HEIGHT 2 1/16"	PIN 6 TRI. PLATE	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE		VOLTS
MAXIMUM PLATE DISSIPATION		WATTS
MAXIMUM SCREEN DISSIPATION		WATTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:		
HEATER POS. WITH RESPECT TO CATHODE	90	VOLTS
HEATER NEG. WITH RESPECT TO CATHODE	90	VOLTS

CAPACITANCES - TRIODE UNIT (APPROX.)

WITH SHELL CONNECTED TO CATHODE

CONTROL GRID TO CATHODE	2.6	μμf
PLATE TO CATHODE	2.8	μμf
GRID TO PLATE	1.1	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE (AC OR DC)	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE		VOLTS
CONTROL GRID VOLTAGE	-3	VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
PLATE CURRENT	1	MA.
ZERO-SIGNAL SCREEN CURRENT		MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE (APPROX.)	58 000	OHMS
TRANSCONDUCTANCE	1 200	μMHOS
AMPLIFICATION FACTOR	70	
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE μMHOS		VOLTS

DIODE UNITS - TWO

THE TWO DIODE PLATES ARE PLACED AROUND A CATHODE, THE SLEEVE OF WHICH IS COMMON TO THE TRIODE UNIT. EACH DIODE PLATE HAS ITS OWN BASE PIN.

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PLATE 1685
FEB. 15 1946

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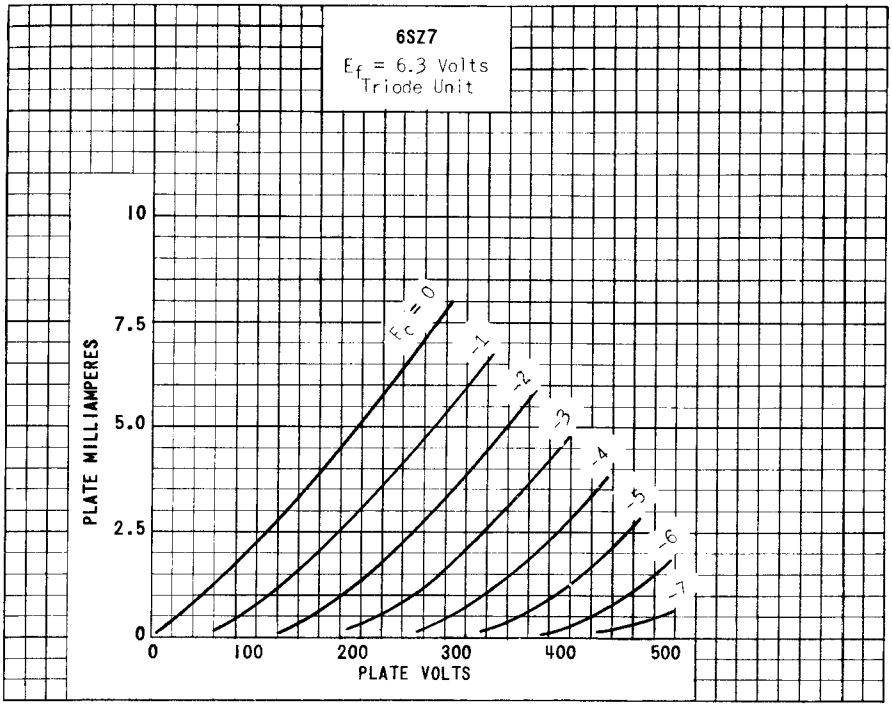
6SZ7



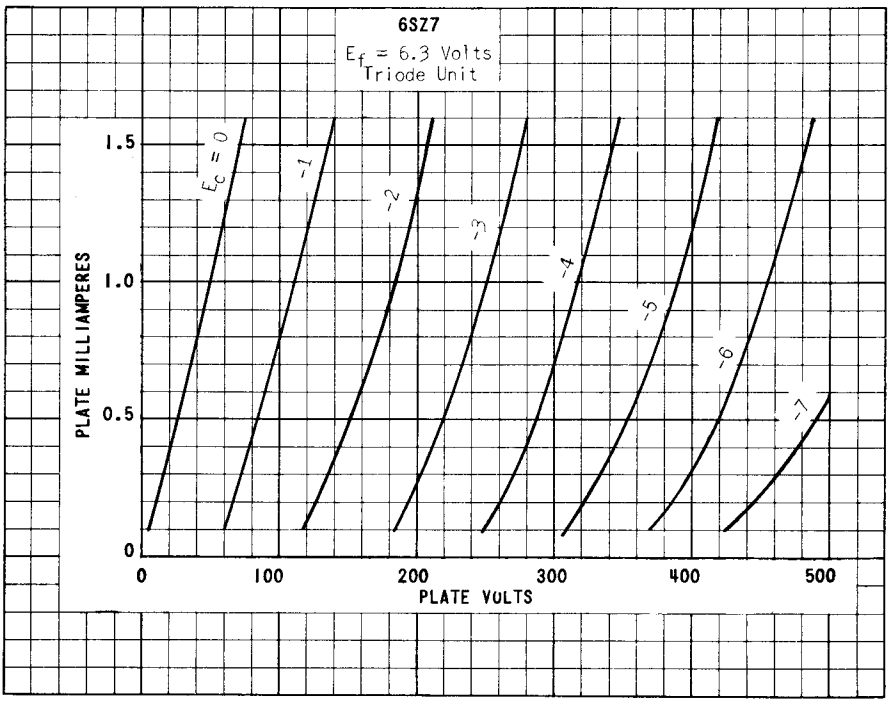


PLATE
1686
FEB. 15
1946

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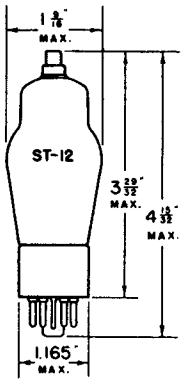
TUNG-SOL

DUO-DIODE
HIGH-MU TRIODE AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

SMALL 7 PIN OCTAL BASE

G-7V

THE TUNG-SOL 6T7G COMBINES TWO DIODES AND A TRIODE IN A SINGLE BULB, USING A COMMON CATHODE. IT IS QUITE SIMILAR TO THE 6Q7G AND IS DESIGNED FOR THE SAME TYPE OF SERVICE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE SECTION

PLATE VOLTAGE	135	250	VOLTS
GRID VOLTAGE	-1.5	-3	VOLTS
PLATE CURRENT	0.9	1.2	MA.
PLATE RESISTANCE	65 000	62 000	OHMS
TRANSCONDUCTANCE	1000	1050	μMHOS
AMPLIFICATION FACTOR	65	65	

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	1.2	μμf
PLATE TO CATHODE	3.7	μμf
GRID TO PLATE	2.0	μμf

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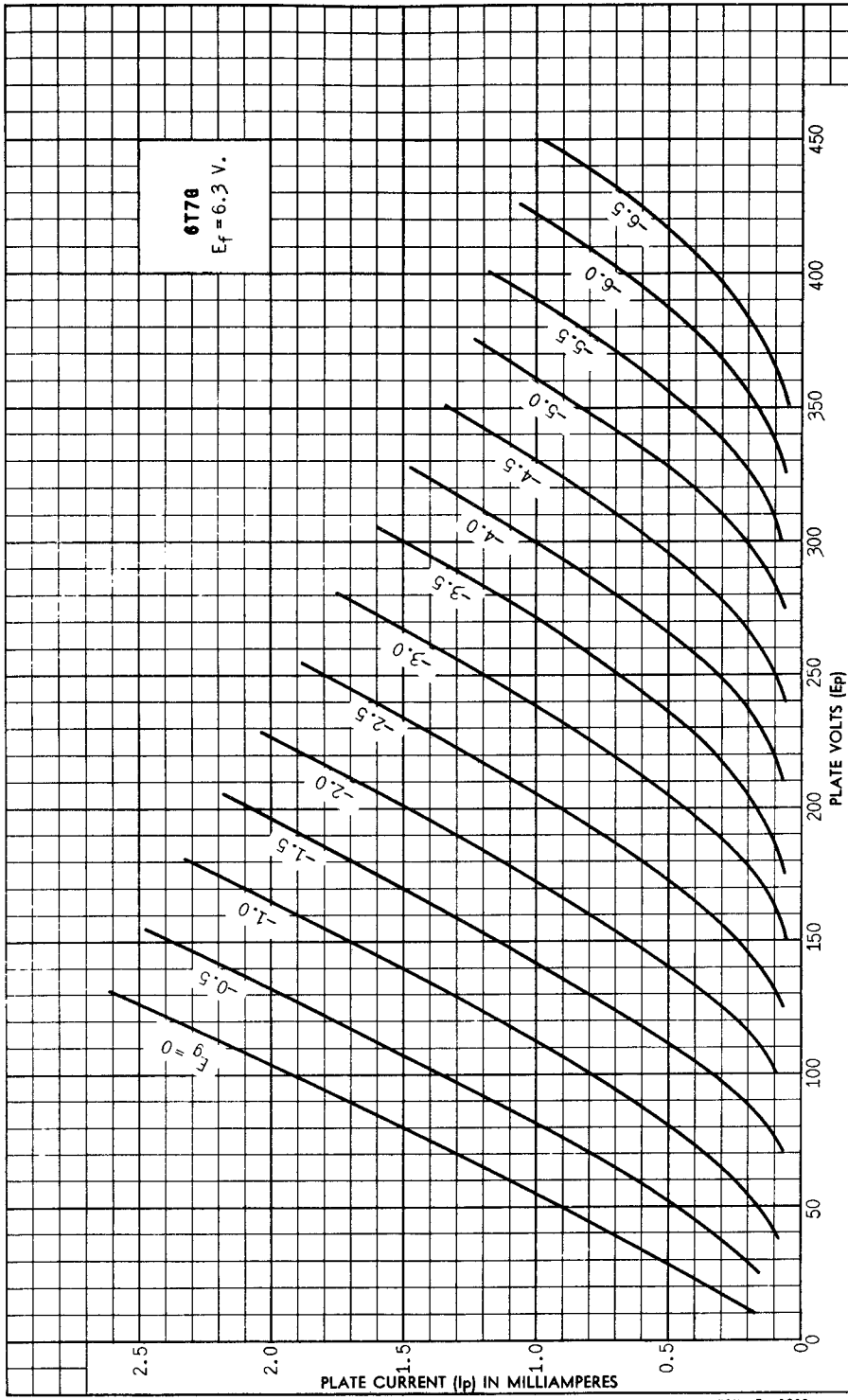

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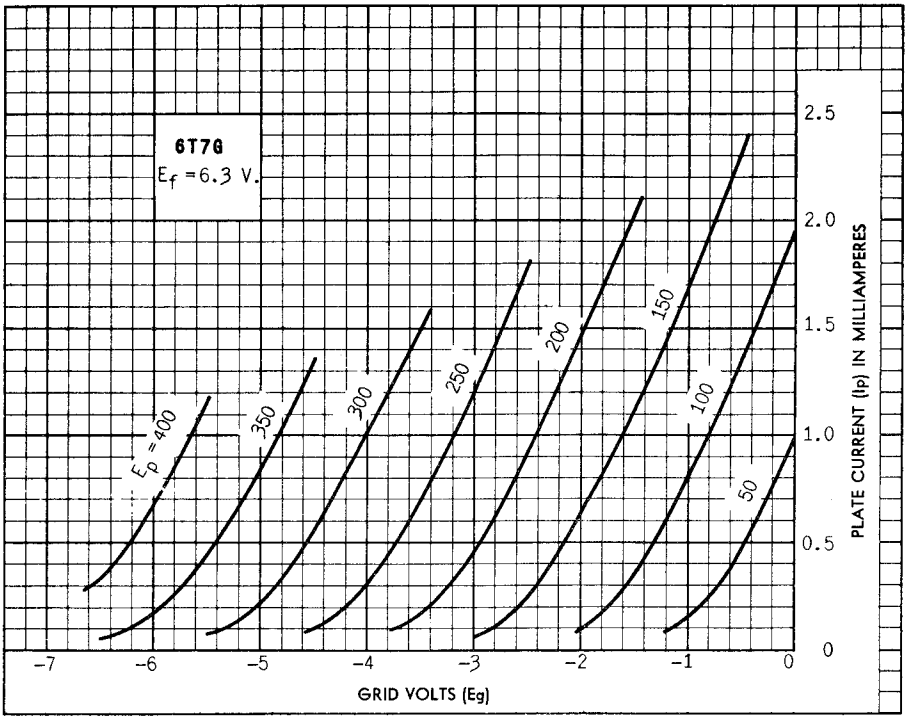
PLATE
162-1

TUNG-SOL LAMP WORKS INC. RADIO TUBE DIVISION NEWARK, NEW JERSEY, U. S. A. NOV. 7, 1938

6T7 G



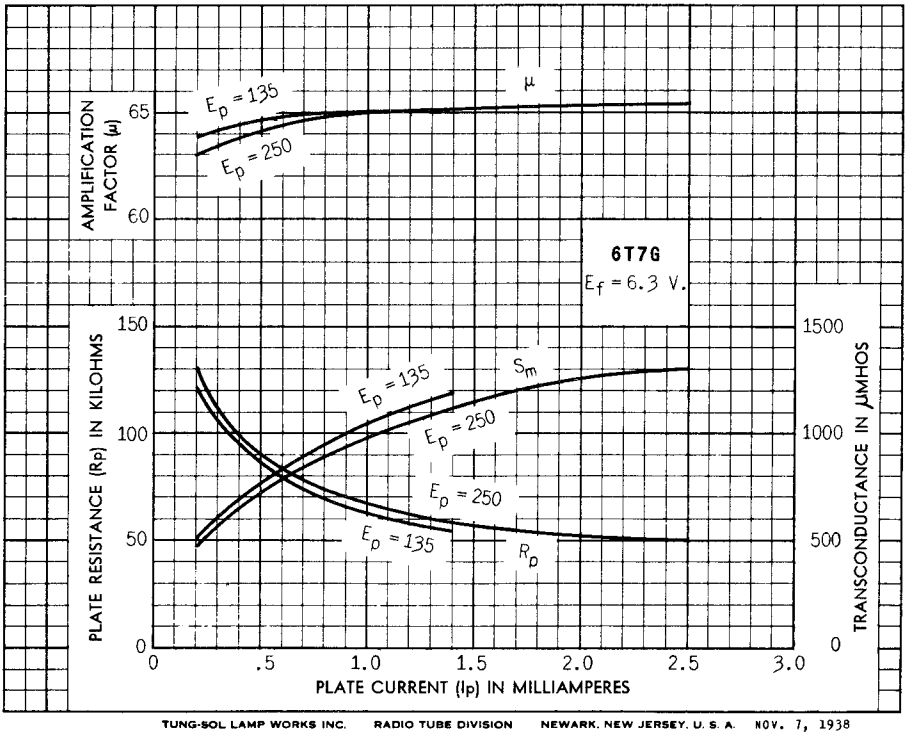


PLATE 163-1

TUNG-SOL

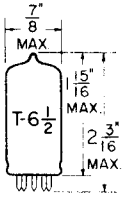
TRIPLE-DIODE TRIODE

MINIATURE TYPE

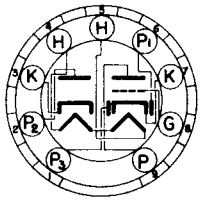
COATED UNIPOTENTIAL CATHODES

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

THE 6T8 COMPRISES THREE HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9-PIN MINIATURE CONSTRUCTION. ONE OF THE THREE DIODE PLATES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

GRID TO EACH DIODE PLATE (MAX.)	0.035	μμf
DIODE #1 INPUT: P_1 TO (H+K)	3.8	μμf
DIODE #2 INPUT: P_2 TO (H+K)	4.5	μμf
DIODE #3 INPUT: P_3 TO (H+K)	3.8	μμf
DIODE CATHODE TO ALL: K TO (H+K+P_1+P_2+P_3+P+G)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-310

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1	MA.
PLATE RESISTANCE	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	
AVERAGE DIODE CURRENT WITH 5 VOLTS DC APPLIED	20	20	MA.

ONE DIODE HAS A SEPARATE CATHODE, THE OTHER CATHODE IS COMMON TO TWO DIODES AND THE TRIODE UNIT.

IT IS RECOMMENDED THAT DIODE #2 (PIN 2) AND DIODE #3 (PIN 1) BE USED IN A RATIO-DETECTOR CIRCUIT FOR FM.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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PLATE 2084
OCT. 1, 1948

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CONTINUED FROM PRECEDING PAGE

RESISTANCE COUPLED AMPLIFIER

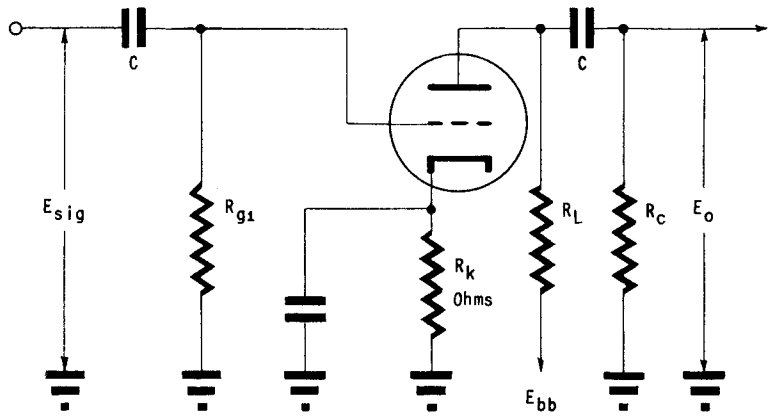
R1 MEG.	Rg1 MEG.	Rc MEG.	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
			Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	A	1	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	---	31	5	---	44	19	---	48	40
0.24	10	0.51	---	37	7	---	49	25	---	52	52
0.51	10	0.51	---	39	7.5	---	51	22	---	54	44
0.51	10	1	---	42	10	---	54	28	---	58	56

[A] VALUE OF Rg1 IS NOT CRITICAL.

Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.

Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

PLATE 2085

OCT. 1, 1948

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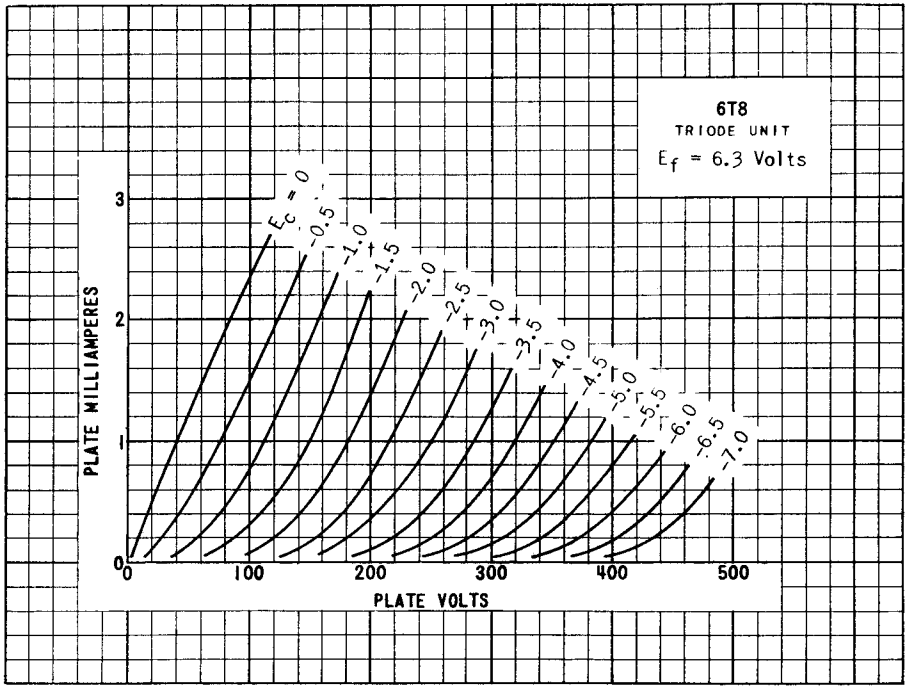

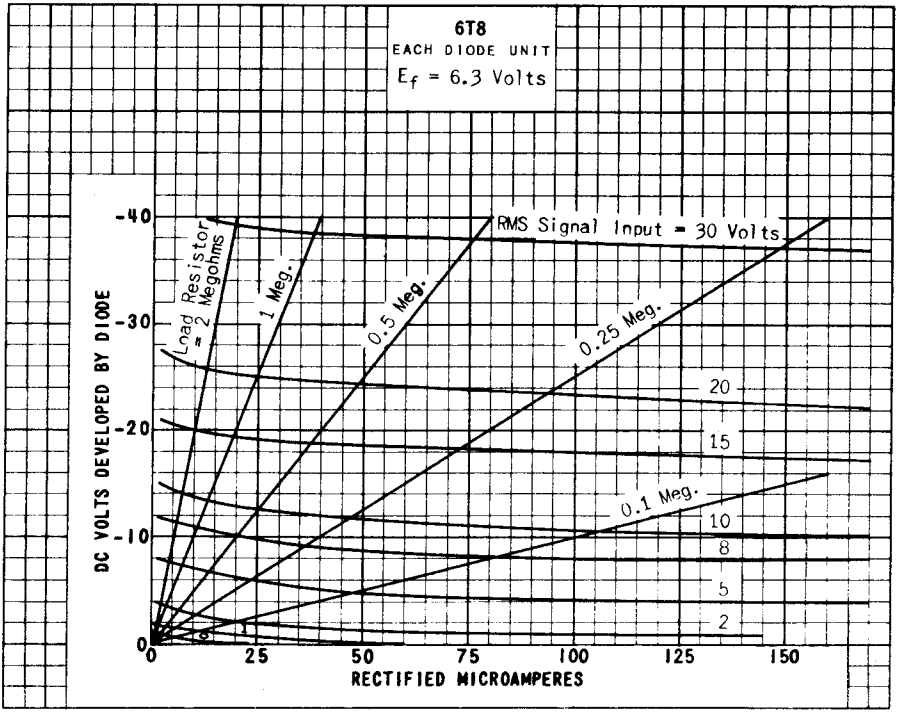

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PLATE
1891
OCT. 1,
1947

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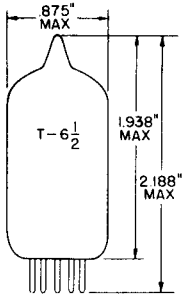
TUNG-SOL



GLASS BULB
MINIATURE GLASS BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TRIPLE-DIODE TRIODE

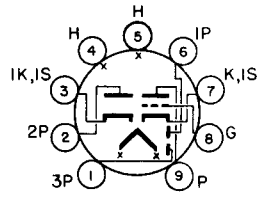
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODES

HEATER

6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9E

THE 6T8A COMBINES THREE HIGH PERVEANCE DIODES AND A HIGH MU TRIODE IN ONE ENVELOPE. ONE OF THE THREE DIODE PLATES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE GRID TO PLATE	1.7	1.7	pf
TRIODE INPUT	1.3	1.7	pf
TRIODE OUTPUT	1.2	2.4	pf
GRID TO ANY DIODE PLATE (MAX.)	.034	.034	pf
INPUT DIODE 1	3.8	3.8	pf
INPUT DIODE 2	3.8	3.8[B]	pf
INPUT DIODE 3	3.4	3.6	pf
DIODE 2 CATHODE TO ALL	7.5	8.5[C]	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	0.45	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	WATTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. PLATE)	5.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE (FOR 6T8A: 100 VOLTS)	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE (FOR 6T8A: 100 VOLTS)	90	VOLTS
HEATER WARM-UP TIME (APPROX.)**	11.0	SECONDS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
AMPLIFICATION FACTOR	70	70	
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT: (EACH SECTION) MEASURED WITH 5 VOLTS DC APPLIED		20	MA.

TRIODE UNIT AS RESISTANCE COUPLED AMPLIFIER

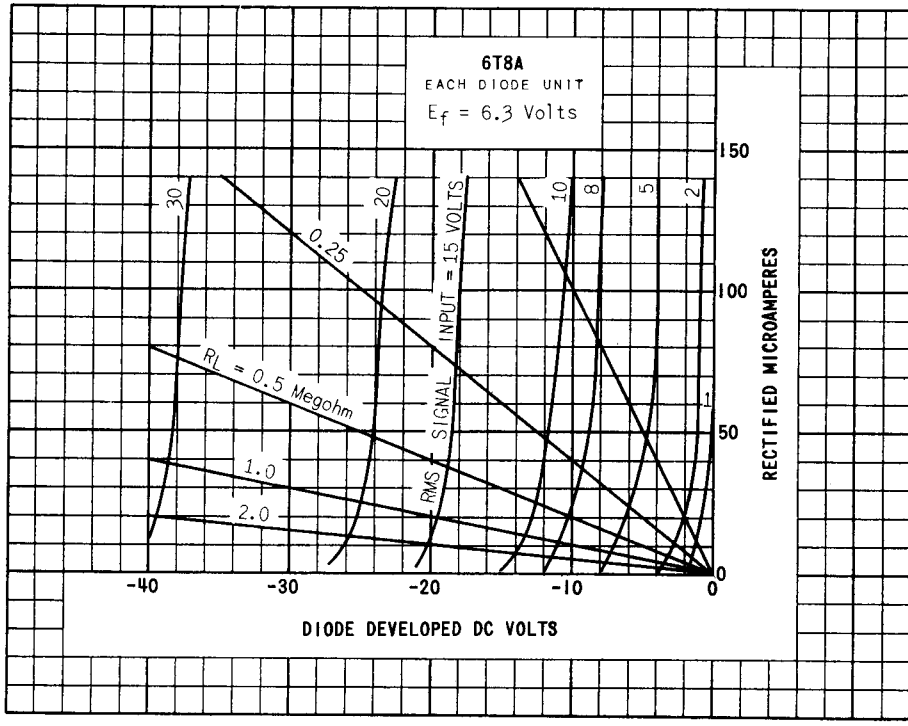
PLATE SUPPLY VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PLATE LOAD RESISTOR	220 000	OHMS
CONTROL GRID RESISTOR	10.0	MEGOHMS
INPUT CONDENSER	0.01	μf
OUTPUT CONDENSER	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	OHMS
DISTORTION	5	PERCENT
OUTPUT VOLTAGE	8.5	VOLTS
VOLTAGE GAIN AT 400 CPS	35	

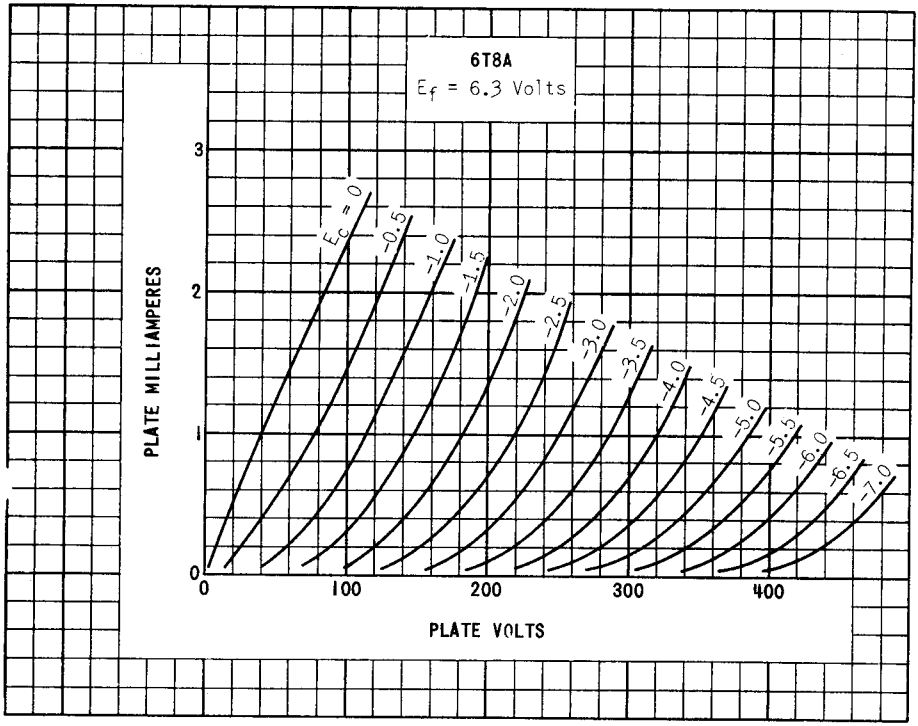
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #7, EXCEPT AS NOTED.

[B] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #3.

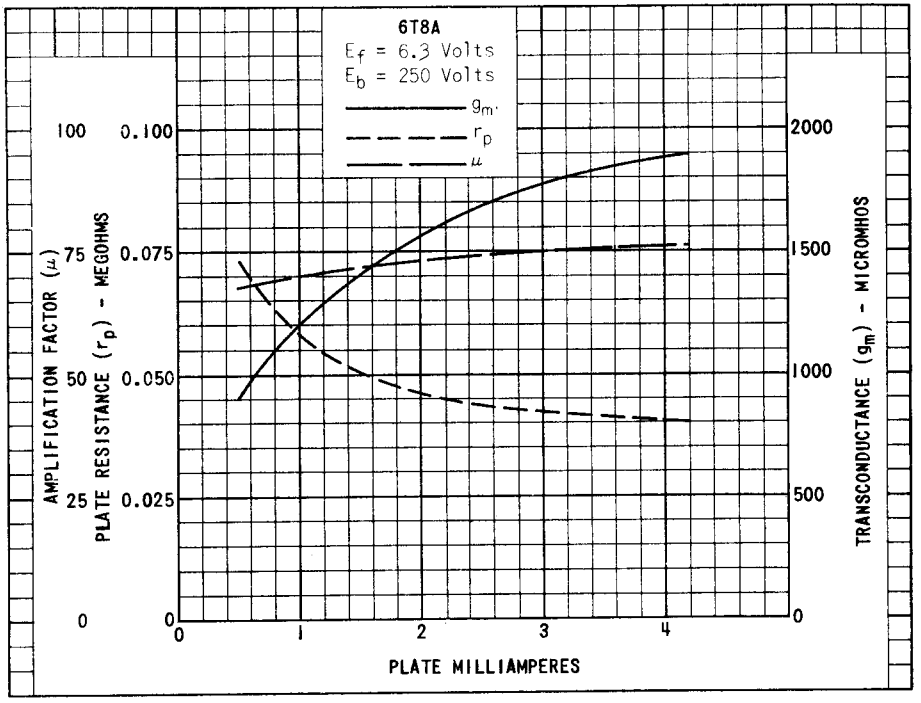
[C] WITH EXTERNAL SHIELD #315 CONNECTED TO PINS #4 AND #5.

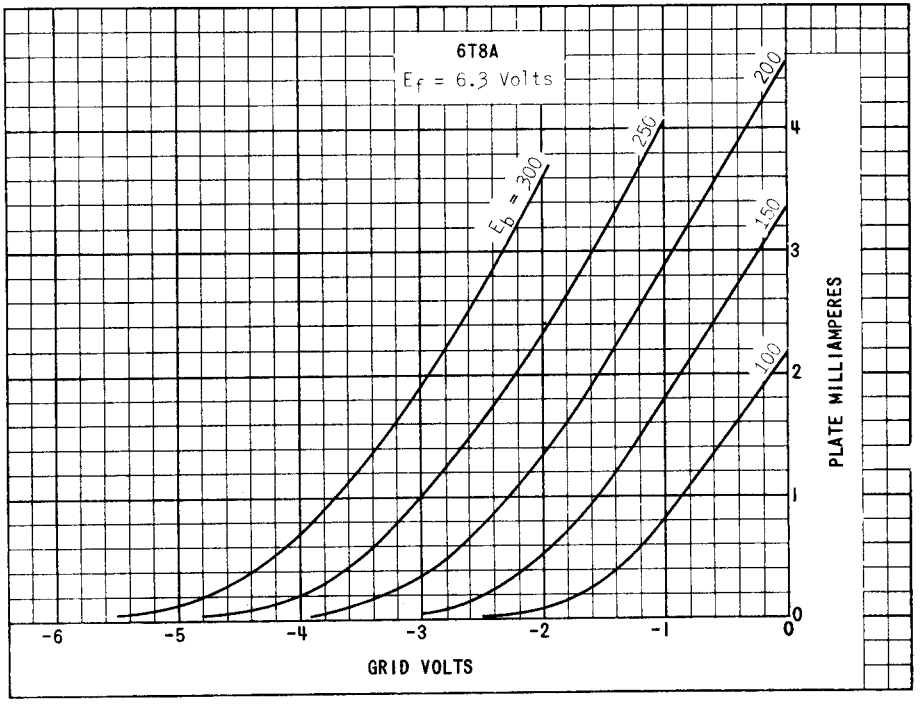
** HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


6T8A
EACH DIODE UNIT
E_f = 6.3 Volts
30
20
0.25
RL = 0.5 Megohm
1.0
2.0
SIGNAL INPUT = 15 VOLTS RMS
10
8
5
2
1
150
100
50
0
-40
-30
-20
-10
0
DIODE DEVELOPED DC VOLTS
RECTIFIED MICROAMPERES


6T8A
E_f = 6.3 Volts
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
3
2
1
0
0
100
200
300
400
PLATE VOLTS
PLATE MILLIAMPERES

6T8A


6T8A
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
100
75
50
25
0
0.100
0.075
0.050
0.025
0
2000
1500
1000
500
0
0
1
2
3
4


6T8A
E_f = 6.3 Volts
E_b = 300
250
200
150
100
PLATE MILLIAMPERES
GRID VOLTS
-6
-5
-4
-3
-2
-1
0
0
1
2
3
4

TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

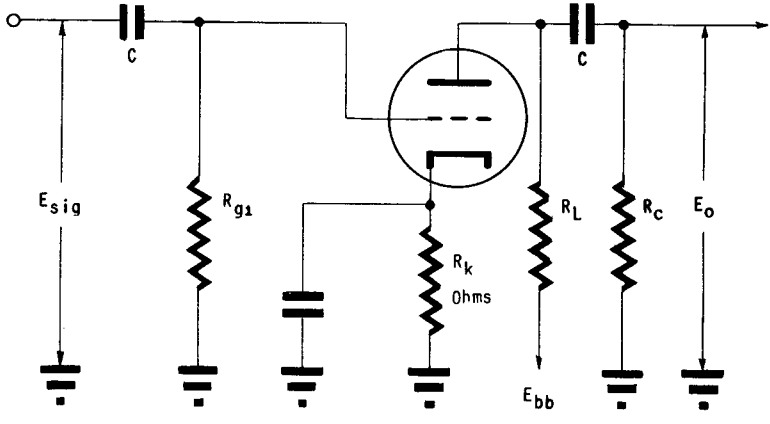
R1	Rg1	Rc	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
MEG.	MEG.	MEG.	Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	A	1	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	—	31	5.0	—	44	19	—	48	40
0.24	10	0.51	—	37	7.0	—	49	25	—	52	52
0.51	10	0.51	—	39	7.5	—	51	22	—	54	44
0.51	10	1	—	42	10	—	54	28	—	58	56

[A] VALUE OF Rg1 IS NOT CRITICAL.

[B] Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.

Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

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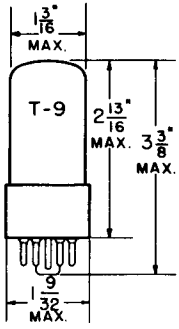
TUNG-SOL

DIODE

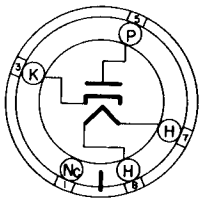


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
5 PIN OCTAL
4CG

THE 6U4GT IS A HALF-WAVE HIGH-VACUUM RECTIFIER DESIGNED ESPECIALLY FOR USE AS A DAMPING DIODE IN TELEVISION DEFLECTION CIRCUITS. A HIGH VOLTAGE HEATER-CATHODE INSULATION RATING ELIMINATES THE NECESSITY FOR A SEPARATE HEATER ISOLATION TRANSFORMER.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE: (H+K)	8.5	μμf

RATINGS - ABSOLUTE VALUES[A]

TELEVISION DAMPER SERVICE

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE[B]	3850	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	110	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[B]	3850	VOLTS
MAXIMUM PEAK PLATE CURRENT	660	MA.
MAXIMUM HOT-SWITCHING TRANSIENT PLATE CURRENT FOR DURATION OF 0.2 SEC. MAX.	3.85	AMP.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 250 MA.)	21	VOLTS
DC OUTPUT CURRENT	138	MA.

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	110	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1375	VOLTS
MAXIMUM PEAK PLATE CURRENT	660	MA.
MAXIMUM HOT-SWITCHING TRANSIENT PLATE CURRENT FOR DURATION OF 0.2 SEC. MAX.	3.85	AMP.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 250 MA.)	21	VOLTS
DC OUTPUT CURRENT	138	MA.

[A] ABSOLUTE MAXIMUM RATINGS ARE THE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED FROM THE VIEWPOINT OF LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED BY ANY USUAL CONDITION OF LINE VOLTAGE VARIATION MANUFACTURING VARIATION (INCLUDING COMPONENTS) IN THE EQUIPMENT ITSELF, OR ADJUSTMENT OF CONTROLS.

[B] THIS RATING IS APPLICABLE WHERE THE DUTY CYCLE OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE SCANNING CYCLE AND ITS DURATION IS LIMITED TO 10 MICROSECONDS.

CONTINUED ON FOLLOWING PAGE

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PLATE 2418
JUNE 1 1950

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
AC PLATE VOLTAGE (RMS)	350	VOLTS
DC OUTPUT VOLTAGE	335	VOLTS
DC OUTPUT CURRENT	125	MA.
FILTER INPUT CAPACITOR	20	µf
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	145	OHMS

PLATE 2419
JUNE 1 1950

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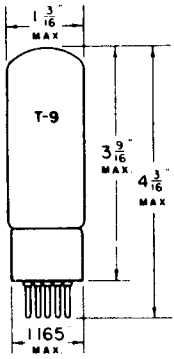
TUNG-SOL



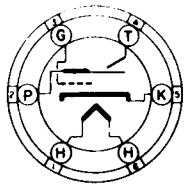
CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



6R

BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 6U5/6G5 CONSISTS OF A CIRCULAR FLUORESCENT TARGET WITH AN INDICATING SHADOW CONTROLLED BY AN INTERNALLY CONNECTED REMOTE CUT-OFF TRIODE AMPLIFIER. WHEN THE 6U5/6G5 IS USED AS A TUNING INDICATOR, AVC VOLTAGE IS APPLIED TO THE TRIODE GRID.

RATINGS

MAXIMUM PLATE SUPPLY VOLTAGE	285	VOLTS
MAXIMUM TARGET VOLTAGE	285	VOLTS
MINIMUM TARGET VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE AND TARGET SUPPLY VOLTAGE	100	200	250	VOLTS
TRIODE GRID VOLTAGE (0° SHADOW ANGLE)[A]	-8	-18.5	-22	VOLTS
TRIODE GRID VOLTAGE (90° SHADOW ANGLE)[A]	0	0	0	VOLTS
SERIES TRIODE-PLATE RESISTOR	0.5	1	1	MEGOHM
TRIODE PLATE CURRENT (TRIODE GRID V.= 0)	0.19	0.19	0.24	MA.
TARGET CURRENT (TRIODE GRID V.= 0.)[B]	1	3	4	MA.

[A] APPROXIMATE.

[B] SUBJECT TO WIDE VARIATIONS.

NOTE: THIS DOUBLE BRANDED TUBE, 6U5/6G5, TAKES THE PLACE OF EITHER THE 6U5 OR THE 6G5. IT IS IDENTICAL ELECTRICALLY TO BOTH OF THEM. IT IS ALSO USED TO REPLACE TYPES 6T5 AND 6H5.

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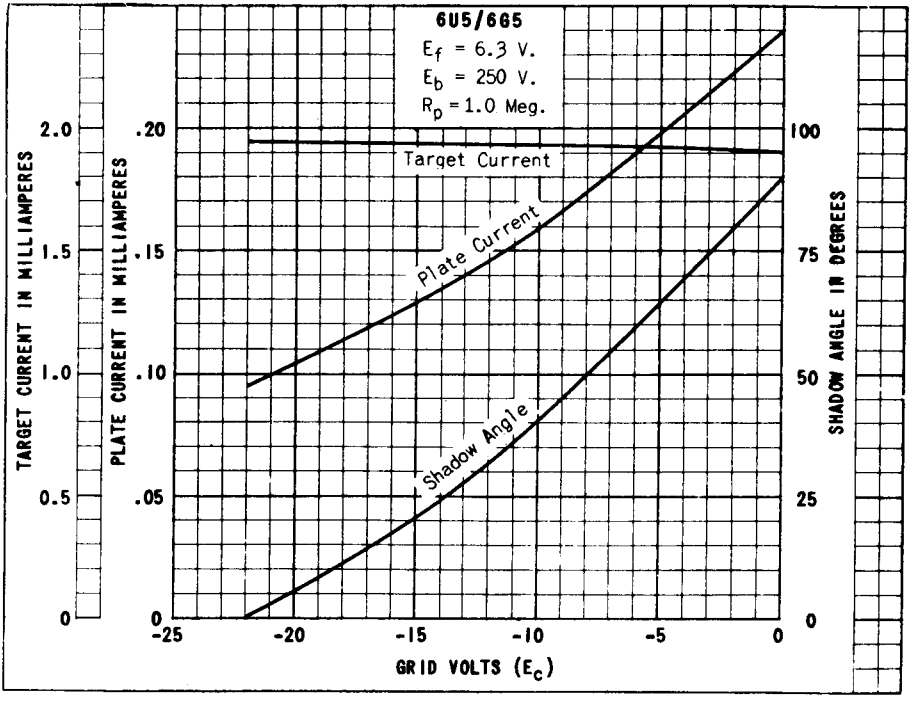
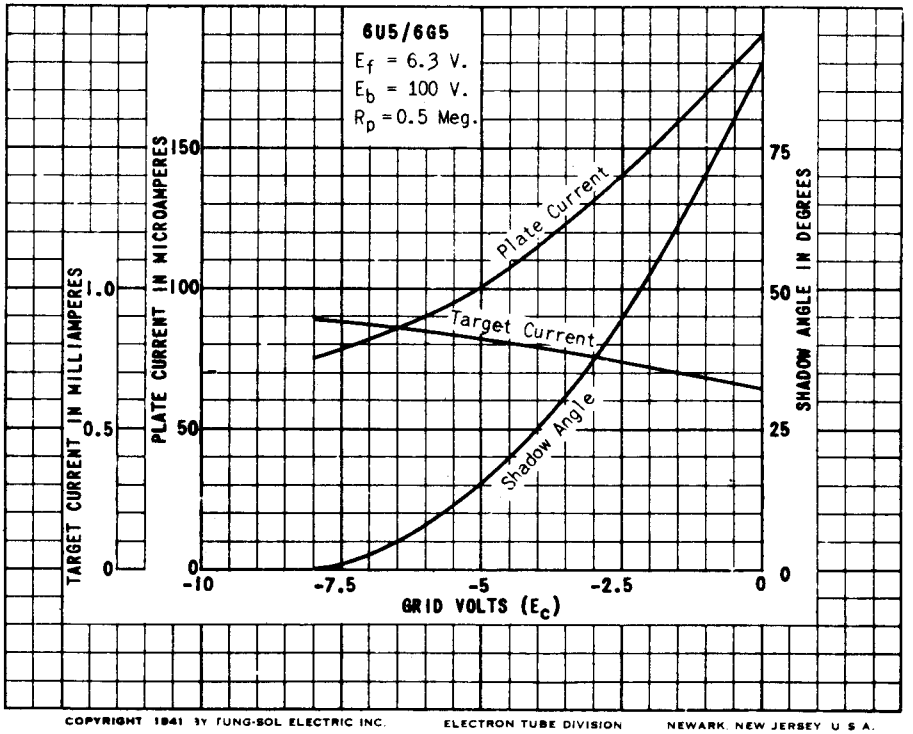
6U5/6G5





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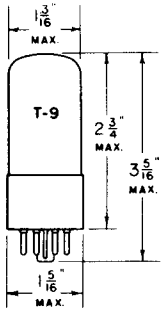


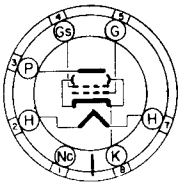
BEAM POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.75 AMPERE
AC OR DC

GLASS BULB



G-7AC
BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 6U6GT IS A BEAM POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF STORAGE BATTERY OPERATED RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW SUPPLY VOLTAGES.

RATINGS

MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	11	WATTS
MAXIMUM SCREEN DISSIPATION	2	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	110	135	200	VOLTS
SCREEN VOLTAGE	110	135	135	VOLTS
CONTROL GRID VOLTAGE	-10.5	-13.5	-14	VOLTS
PEAK AF SIGNAL VOLTAGE	10.5	13.5	14	VOLTS
ZERO SIGNAL PLATE CURRENT	44	55	55	MA.
ZERO SIGNAL SCREEN CURRENT (NOMINAL)	4	5	3	MA.
MAXIMUM SIGNAL PLATE CURRENT	47	60	62	MA.
MAXIMUM SIGNAL SCREEN CURRENT (NOM.)	11	15	13	MA.
PLATE RESISTANCE APPROX.	10 000	10 000	20 000	OHMS
TRANSCONDUCTANCE	5600	6200	6200	μMHOS
LOAD RESISTANCE	2000	2000	3000	OHMS
TOTAL HARMONIC DISTORTION	10	10	10	PER CENT
POWER OUTPUT	2.0	3.3	5.5	WATTS

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FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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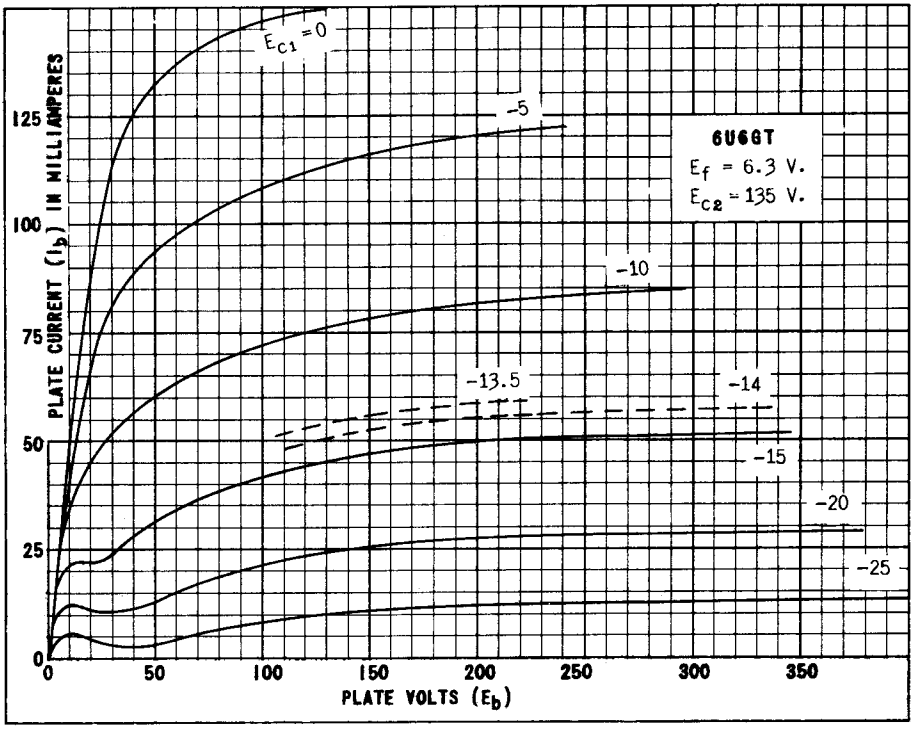
6U6GT



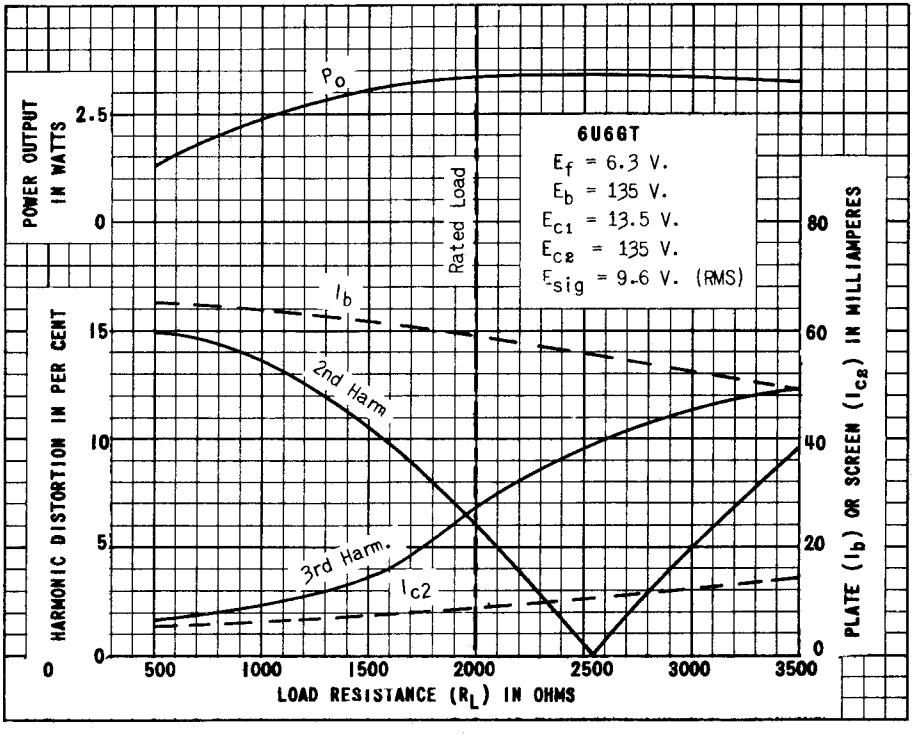


PLATE 1150-1

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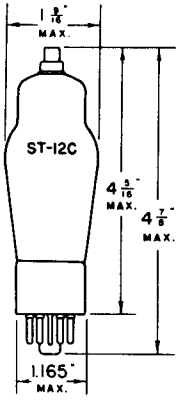
TUNG-SOL

TRIPLE GRID
REMOTE CUT-OFF AMPLIFIER

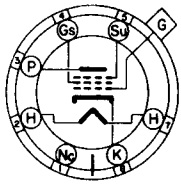


UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 7 PIN OCTAL BASE



G-7Ra
BOTTOM VIEW

THE TUNG-SOL 6U7G IS A TRIPLE GRID REMOTE CUT-OFF AMPLIFIER. IT IS SUITABLE FOR USE WITH A.V.C. IN RF AND IF AMPLIFIERS AND MINIMIZES CROSS MODULATION. ITS ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6D6.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	−3	−3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	8	8.2	MA.
SCREEN CURRENT	2.2	2	MA.
PLATE RESISTANCE APPROX.	0.25	0.8	MEGOHM
TRANSCONDUCTANCE	1500	1600	μMHOS

AS MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE APPROX. [A]	−10	−10	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		

[A] THE GRID BIAS SHOWN IS MINIMUM FOR AN OSCILLATOR PEAK VOLTAGE OF 7 VOLTS. THESE VALUES ARE OPTIMUM.

DIRECT INTERELECTRODE CAPACITANCES [S]

GRID TO CATHODE	5	μμf
PLATE TO CATHODE	9	μμf
GRID TO PLATE	.007 MAX.	μμf

[S] WITH SHIELD

NOTE: THE INTERNAL SHIELD IN THE DOME IS CONNECTED TO THE CATHODE WITHIN THE TUBE.

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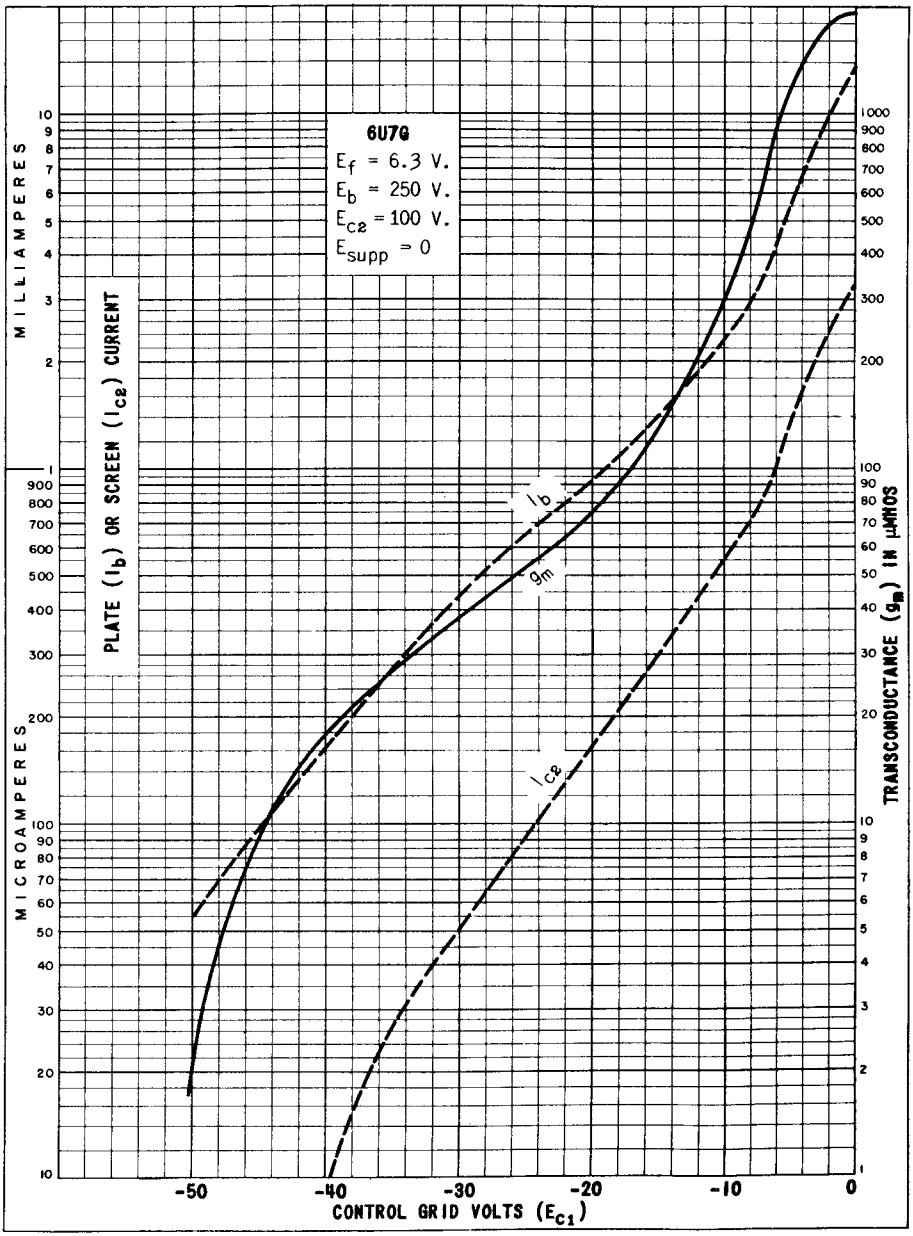
6U7 G

RATINGS		
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.25	WATT
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS



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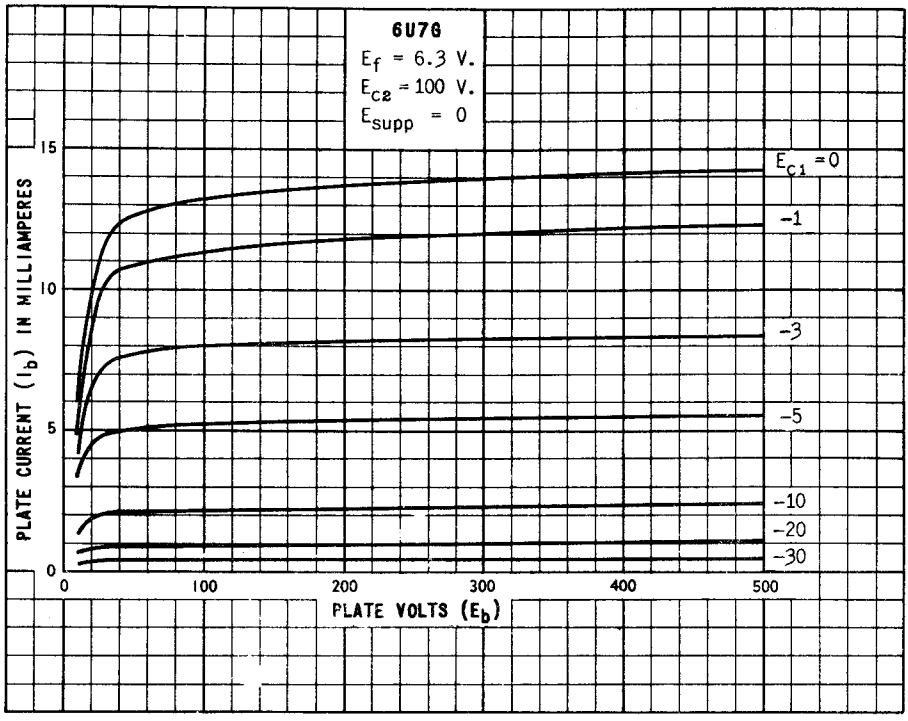

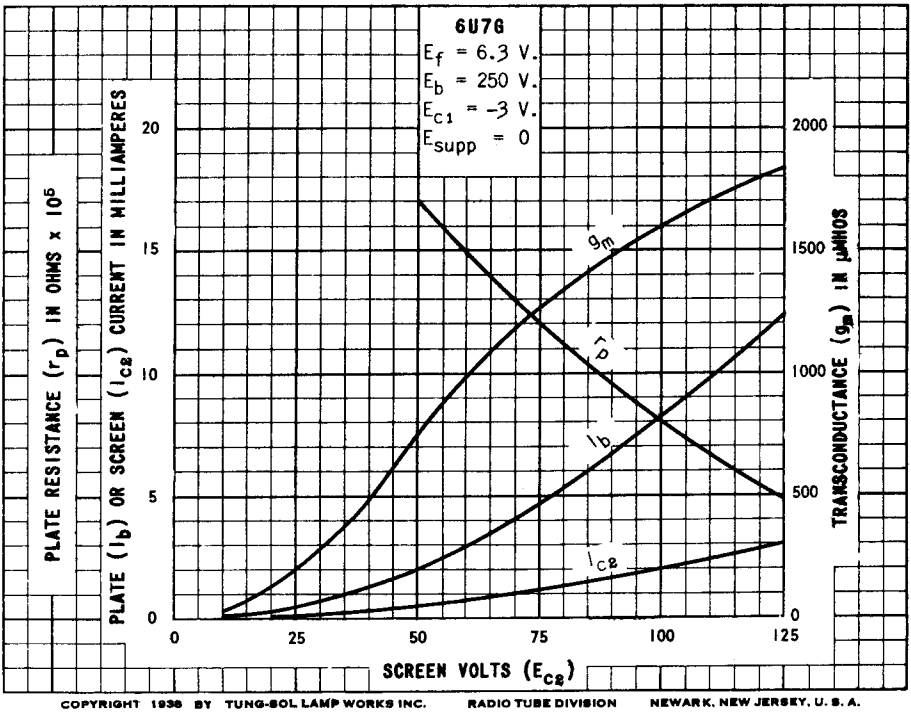

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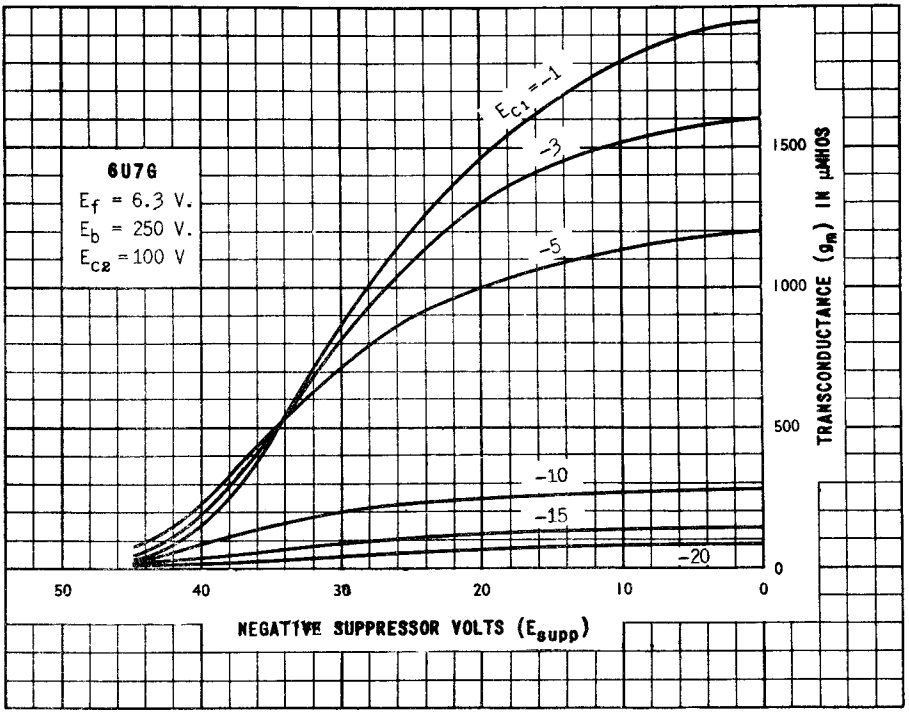
6U7 G



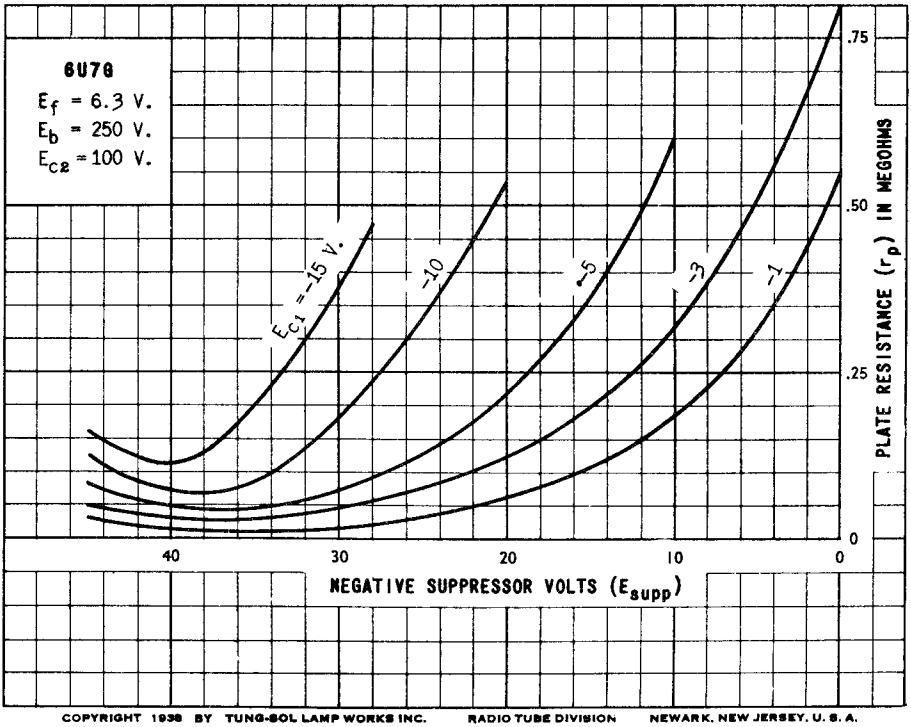


PLATE 267-1

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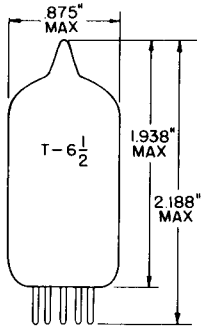
TUNG-SOL

TRIODE PENTODE
MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

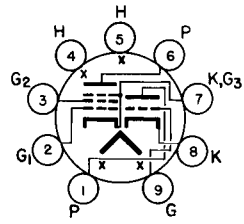
COATED UNIPOTENTIAL CATHODE

FOR

APPLICATION IN FM

OR TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AE

THE 6U8 COMBINES TWO ELECTRICALLY INDEPENDENT SECTIONS-A TRIODE AND A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGH FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR-PENTODE MIXER IN FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS OF SUCH RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP) MAX.	→ 0.007	→ 0.015	pf
PENTODE INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	5.0	5.0	pf
PENTODE OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	3.5	2.6	pf
PENTODE CATHODE TO HEATER: H TO (PK+PG3+I.S.)	3.0[B]	3.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	1.8	1.8	pf
TRIODE INPUT: TG TO (TK+H+PK+PG3+I.S.)	2.8	2.8	pf
TRIODE OUTPUT: TP TO (TK+H+PK+PG3+I.S.)	2.0	1.5	pf
TRIODE CATHODE TO HEATER (TK TO H)	3.0[B]	3.0	pf
PENTODE GRID TO TRIODE PLATE (PG TO TP) (MAX.)	0.20	0.2	pf
PENTODE PLATE TO TRIODE PLATE (PP TO TP) (MAX.)	0.02	0.1	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE: (EACH UNIT)			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION: *		
FOR VOLTAGES UP TO 165 VOLTS	0.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS
PENTODE GRID 1 CIRCUIT RESISTANCE:*		
WITH CATHODE BIAS	1.0	MEGOHM
WITH FIXED BIAS	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	----	110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	7500	5000	μMHOS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT	----	3.5	MA.
PLATE RESISTANCE (APPROX.)	----	0.2	MEGOHM
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-8	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V; Ec2=70 V)*	----	5500	μMHOS

A EXTERNAL SHIELD,315 CONNECTED TO PIN 4.

B EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

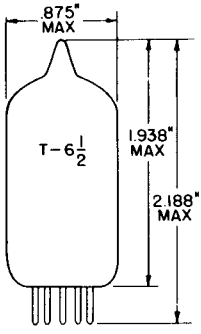
THE 6U8A CURVES ALSO APPLY FOR THE 6U8.

→ INDICATES A CHANGE.

* INDICATES AN ADDITION.

TUNG-SOL

TRIODE PENTODE
MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

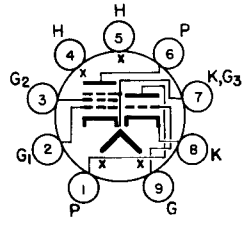
COATED UNIPOTENTIAL CATHODE

FOR

APPLICATION IN FM

OR TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9AE

THE 6U8A COMBINES TWO ELECTRICALLY INDEPENDENT SECTIONS-A TRIODE AND A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. BOTH UNITS ARE CAPABLE OF GOOD PERFORMANCE AT THE HIGH FREQUENCIES. THE TUBE MAY BE USED AS A LOCAL OSCILLATOR-PENTODE MIXER IN FM OR TELEVISION RECEIVERS OR IN THE MANY COMBINED FUNCTIONS OF SUCH RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THATHEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED,

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP) MAX.	→ 0.007	→ 0.015	pf
PENTODE INPUT: PG1 TO (H+PK+PG2+PG3+I.S.)	5.0	5.0	pf
PENTODE OUTPUT: PP TO (H+PK+PG2+PG3+I.S.)	3.5	2.6	pf
PENTODE CATHODE TO HEATER: H TO (PK+PG3+I.S.)	3.0[B]	3.0	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	1.8	1.8	pf
TRIODE INPUT: TG TO (TK+H+PK+PG3+I.S.)	2.8	2.8	pf
TRIODE OUTPUT: TP TO (TK+H+PK+PG3+I.S.)	2.0	1.5	pf
TRIODE CATHODE TO HEATER (TK TO H)	3.0[B]	3.0	pf
PENTODE GRID TO TRIODE PLATE (PG TO TP) (MAX.)	0.20	0.2	pf
PENTODE PLATE TO TRIODE PLATE (PP TO TP) (MAX.)	0.02	0.1	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME [C]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE: (EACH UNIT)			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	330	VOLTS
TRIODE PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION: *		
FOR VOLTAGES UP TO 165 VOLTS	0.55	WATTS
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS
TRIODE PLATE DISSIPATION	2.5	WATTS
PENTODE GRID 1 CIRCUIT RESISTANCE:*		
WITH CATHODE BIAS	1.0	MEGOHM
WITH FIXED BIAS	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

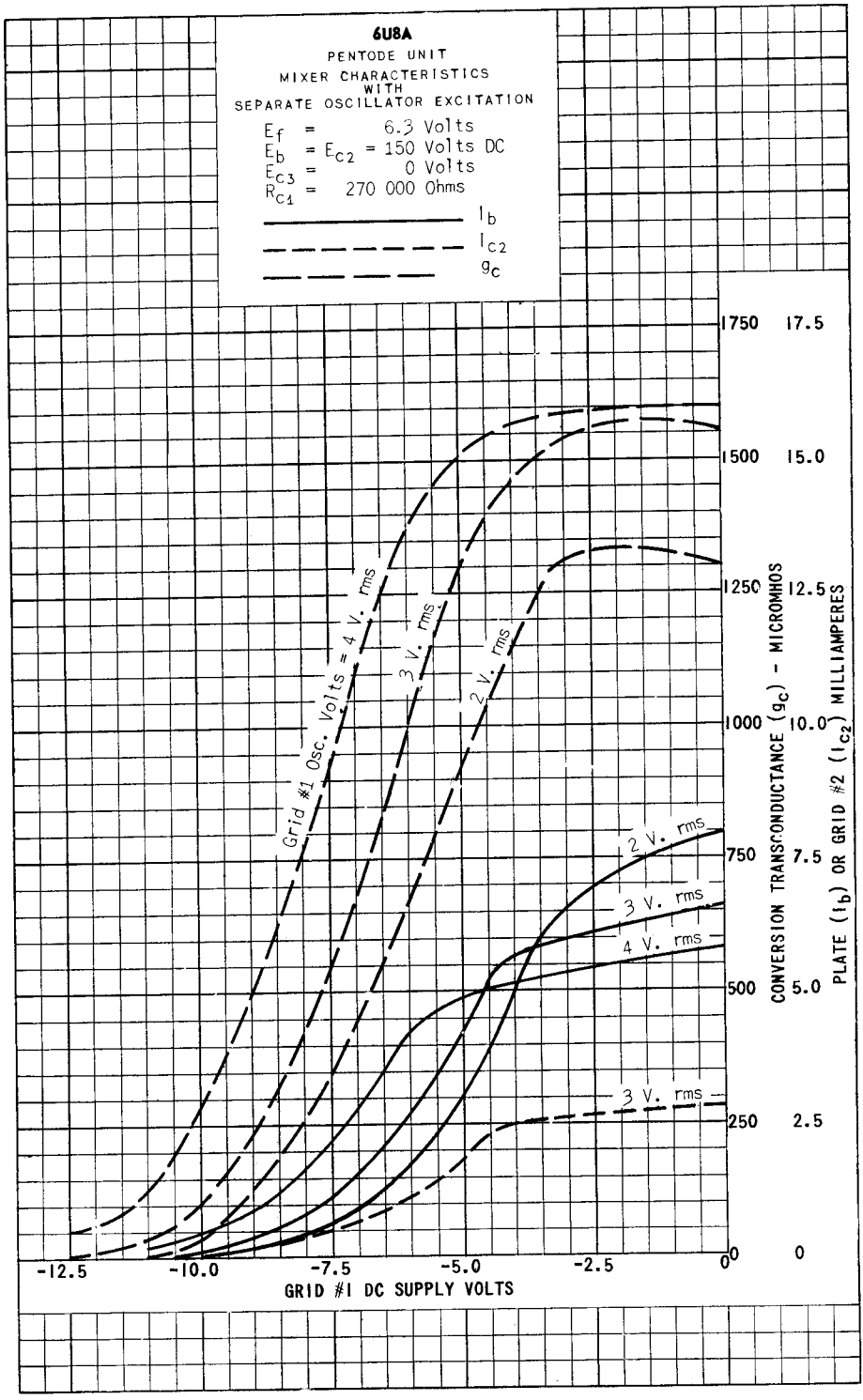
	TRIODE	PENTODE	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	----	110	VOLTS
GRID 1 VOLTAGE	-1.0	-1.0	VOLTS
TRANSCONDUCTANCE	7500	5000	μMHOS
PLATE CURRENT	13.5	9.5	MA.
GRID 2 CURRENT	----	3.5	MA.
PLATE RESISTANCE (APPROX.)	----	0.2	MEGOHM
AMPLIFICATION FACTOR	40	----	
GRID 1 VOLTAGE (APPROX.) FOR Ib=20 μA	-9	-8	VOLTS
ZERO BIAS TRANSCONDUCTANCE (WITH Eb=100 V; Ec2=70 V)*	----	5500	μMHOS

A
EXTERNAL SHIELD 315 CONNECTED TO PIN 4.

B
EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

C
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.
* INDICATES AN ADDITION.



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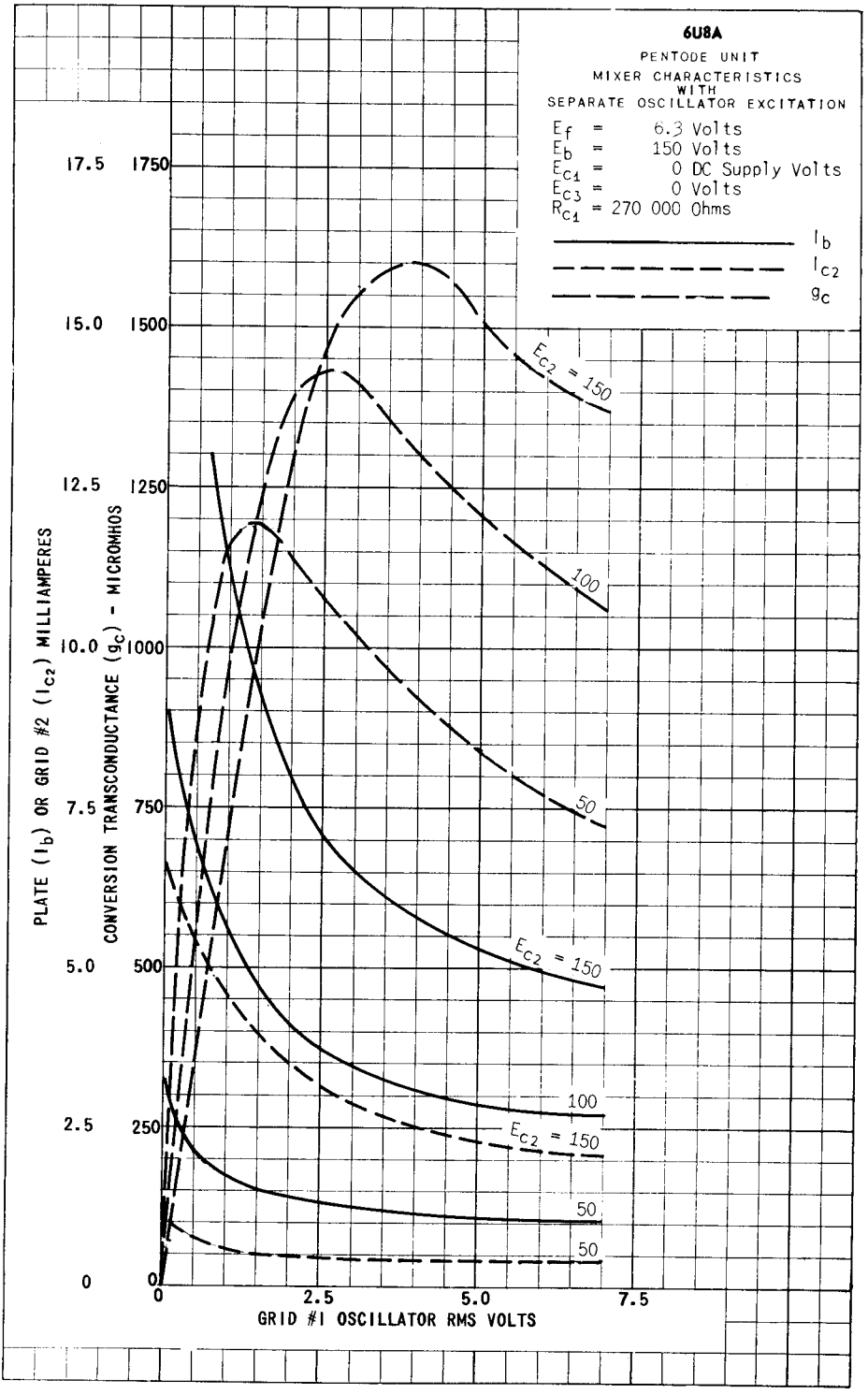
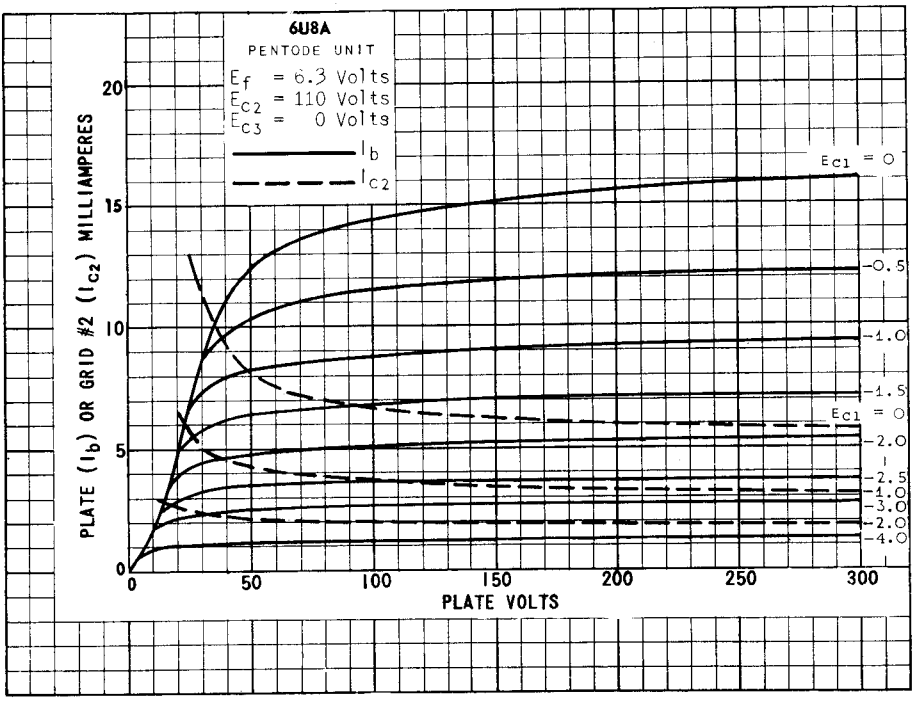
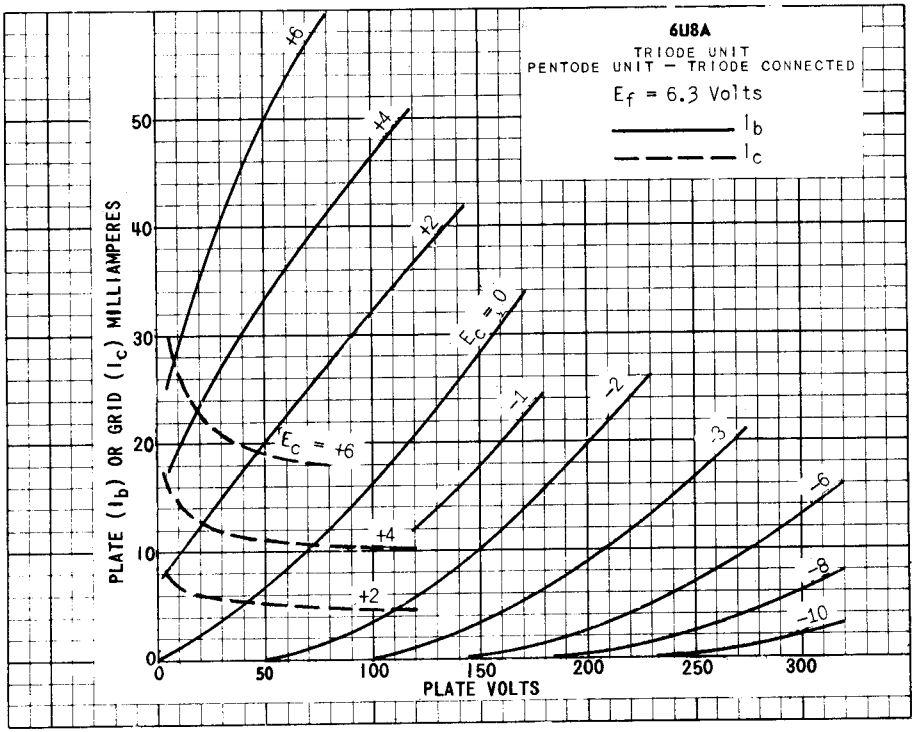
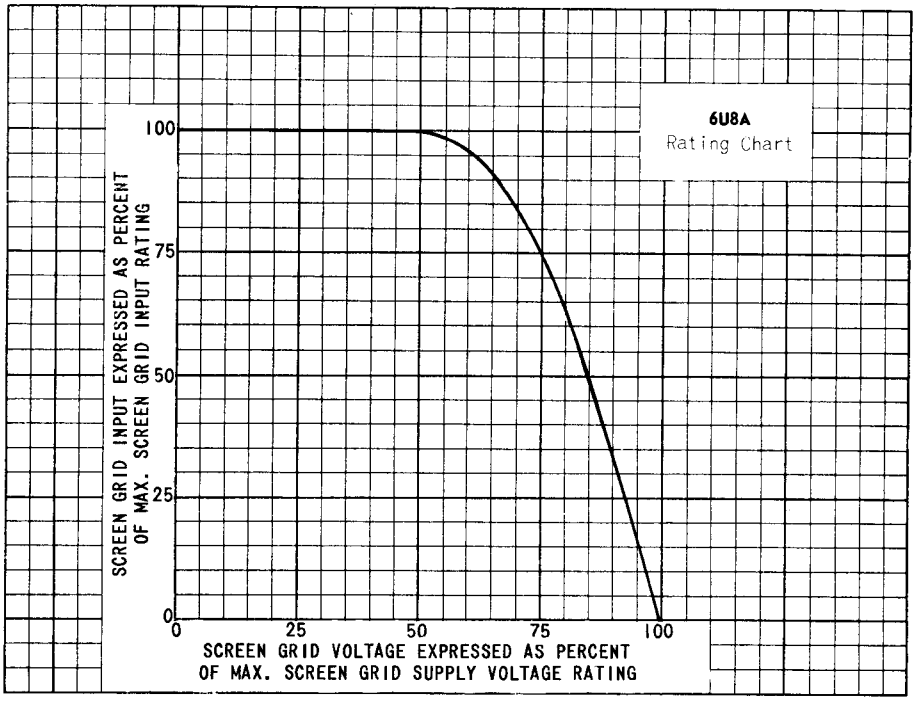
6U8A


6U8A
PENTODE UNIT
MIXER CHARACTERISTICS
WITH
SEPARATE OSCILLATOR EXCITATION
Ef = 6.3 Volts
Eb = 150 Volts
Ec1 = 0 DC Supply Volts
Ec3 = 0 Volts
Rc1 = 270 000 Ohms
Ib
Ic2
gc
Ec2 = 150
100
50
Ec2 = 150
100
Ec2 = 150
50
50
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
CONVERSION TRANSCONDUCTANCE (gc) - MICROMHOS
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0
1750
1500
1250
1000
750
500
250
0
0
2.5
5.0
7.5
GRID #1 OSCILLATOR RMS VOLTS





TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.. NOVEMBER 1, 1962 PLATE #6612


6U8A
Rating Chart
SCREEN GRID INPUT EXPRESSED AS PERCENT OF MAX. SCREEN GRID INPUT RATING
100
75
50
25
0
0
25
50
75
100
SCREEN GRID VOLTAGE EXPRESSED AS PERCENT OF MAX. SCREEN GRID SUPPLY VOLTAGE RATING

TUNG-SOL

DIODE

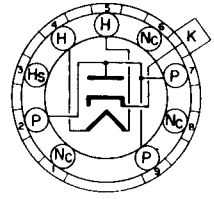
MINIATURE TYPE

GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9BD

THE 6V3A IS A HEATER CATHODE TYPE DIODE, DESIGNED FOR USE AS A DAMPING DIODE IN TELEVISION SWEEP CIRCUITS. IT MAY ALSO BE USED AS A HALF-WAVE RECTIFIER.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE	1.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DAMPER SERVICE[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE (HEATER NEGATIVE)[BC]	6 750	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE[BC]	6 000	VOLTS
MAXIMUM STEADY STATE PEAK CURRENT	600	MA.
MAXIMUM DC OUTPUT CURRENT	135	MA.

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS)	350	VOLTS
MAXIMUM DC OUTPUT CURRENT	125	MA.
AVERAGE TUBE DROP (AT 150 MA.)	14	VOLTS
FILTER INPUT CAPACITOR	20	μfd.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY VOLTAGE	145	OHMS

[A] ABSOLUTE MAXIMUM RATINGS ARE THE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED FROM THE VIEWPOINT OF LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS, THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED UNDER ANY USUAL CONDITION OF LINE VOLTAGE VARIATION, MANUFACTURING VARIATIONS (INCLUDING COMPONENTS) IN THE EQUIPMENT ITSELF, OR ADJUSTMENTS OF CONTROLS.

[B] DC COMPONENT OF HEATER-CATHODE VOLTAGE SHOULD NOT EXCEED 750 VOLTS WITH HEATER NEGATIVE WITH RESPECT TO CATHODE.

[C] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE SCANNING CYCLE OR 10 MICRO-SECONDS.

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TUNG-SOL

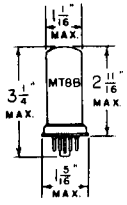
BEAM POWER AMPLIFIER

UNIPOTENTIAL CATHODE

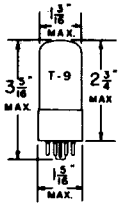
HEATER

6.3 VOLTS 0.45 AMPERE

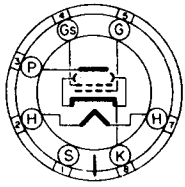
AC OR DC



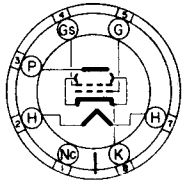
SMALL
7 PIN OCTAL BASE
METAL SHELL
6V6



INTERMEDIATE
7 PIN OCTAL BASE
GLASS BULB
6V6GT/G



7AC



G-7AC

BOTTOM VIEWS

THE TUNG-SOL 6V6 AND 6V6GT/G ARE BEAM POWER AMPLIFIERS, DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC AND STORAGE BATTERY OPERATED RECEIVERS. THEY HAVE HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGES.

RATINGS

MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM SCREEN VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM SCREEN DISSIPATION	2	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SINGLE TUBE CLASS A1 AMPLIFIER

PLATE VOLTAGE	180	250	315	VOLTS
SCREEN VOLTAGE	180	250	225	VOLTS
CONTROL GRID VOLTAGE[A]	-8.5	-12.5	-13	VOLTS
PEAK AF SIGNAL VOLTAGE	8.5	12.5	13	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
ZERO-SIGNAL SCREEN CURRENT (NOMINAL)	3	4.5	2.2	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	47	35	MA.
MAXIMUM-SIGNAL SCREEN CURRENT (NOMINAL)	4	7	6	MA.
PLATE RESISTANCE APPROX.	58000	52000	77000	OHMS
TRANSCONDUCTANCE	3700	4100	3750	μMHOS
LOAD RESISTANCE	5500	5000	8500	OHMS
TOTAL HARMONIC DISTORTION	8	8	12	PER CENT
POWER OUTPUT	2.0	4.5	5.5	WATTS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED BIAS OPERATION.

CONTINUED NEXT PAGE

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PLATE 1050-2

JUNE 6 1941

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6V6, 6V6GT/G

TUNG-SOL

PUSH-PULL CLASS AB1 AMPLIFIER

VALUES FOR 2 TUBES UNLESS OTHERWISE SPECIFIED

PLATE VOLTAGE	250	285	VOLTS
SCREEN VOLTAGE	250	285	VOLTS
CONTROL GRID VOLTAGE[A]	-15	-19	VOLTS
PEAK AF SIGNAL VOLTAGE GRID TO GRID	30	38	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	70	MA.
ZERO-SIGNAL SCREEN CURRENT (NOMINAL)	5.0	4.0	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	92	MA.
MAXIMUM-SIGNAL SCREEN CURRENT (NOMINAL)	13	13.5	MA.
PLATE RESISTANCE APPROX.	66000	65000	OHMS
TRANSCONDUCTANCE	3750	3600	μMHOS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	10000	8000	OHMS
TOTAL HARMONIC DISTORTION	5	3.5	PER CENT
POWER OUTPUT	10	14	WATTS

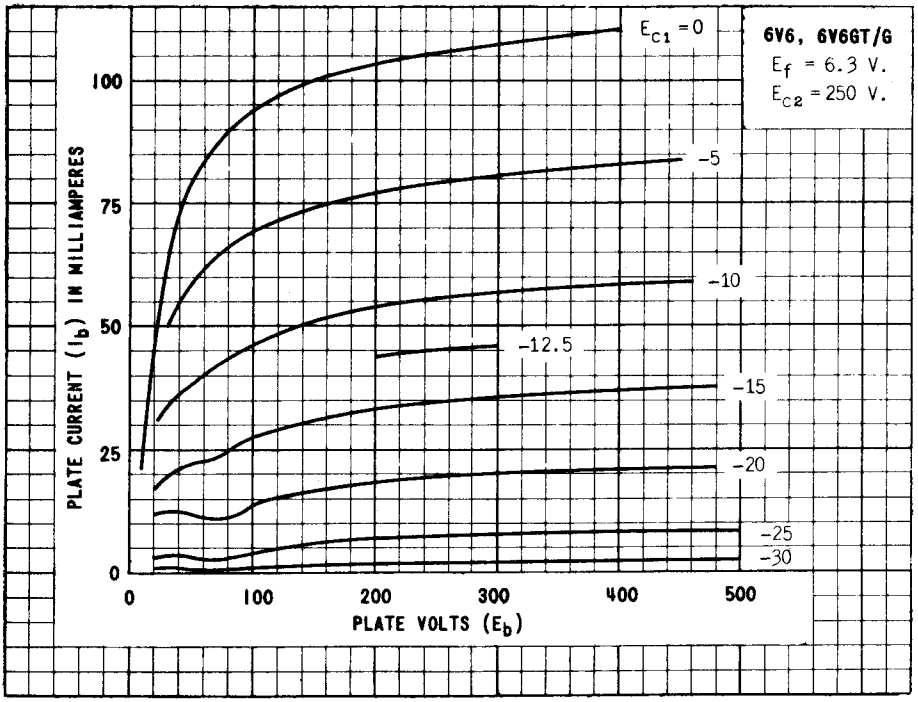

PLATE 1052-2

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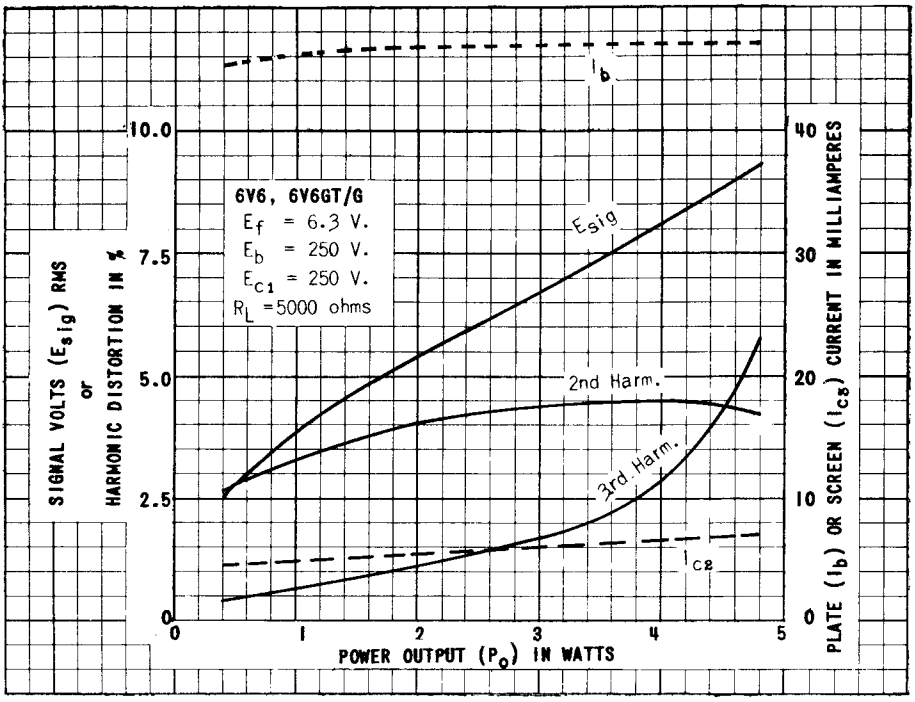

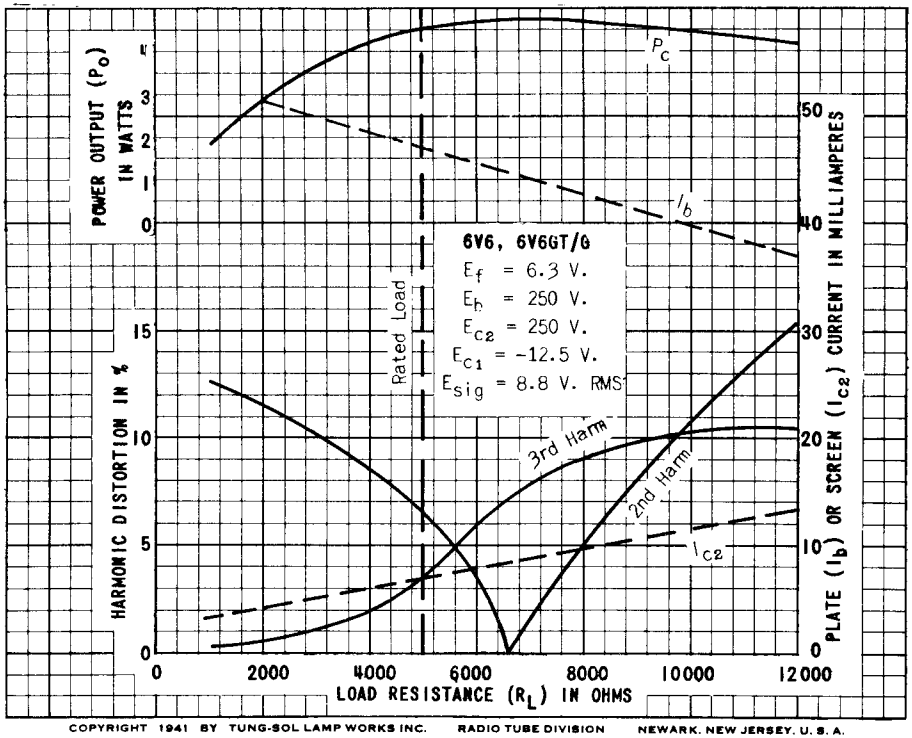

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PLATE 1052-2

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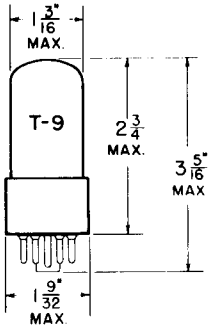
TUNG-SOL

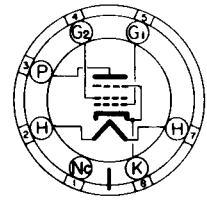
BEAM PENTODE



COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7S

GLASS BULB

THE 6V6GTA IS A BEAM POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF 450 MA. SERIES HEATER OPERATED TV RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6V6GT.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	9.0	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER - TRIODE CONNECTION[AB]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	1200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	35	MA.
MAXIMUM PEAK CATHODE CURRENT	105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	-13.0	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	4.5	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	4	7	6	MA.
PLATE RESISTANCE (APPROX.)	50 000	50 000	80 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	µMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	2	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	8	8	12	PERCENT

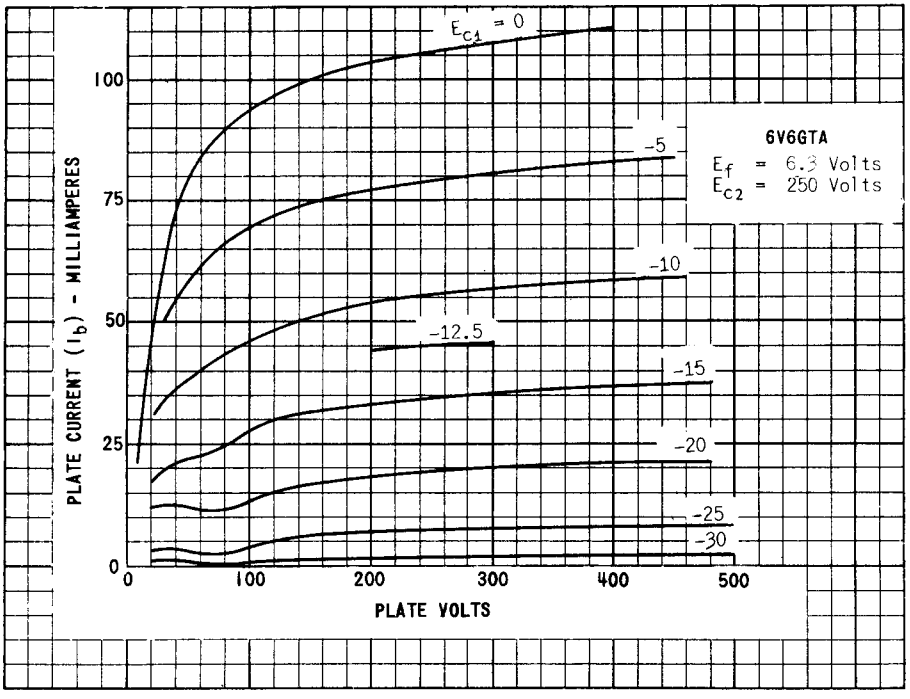
CLASS A_1 AMPLIFIER – PUSH-PULL

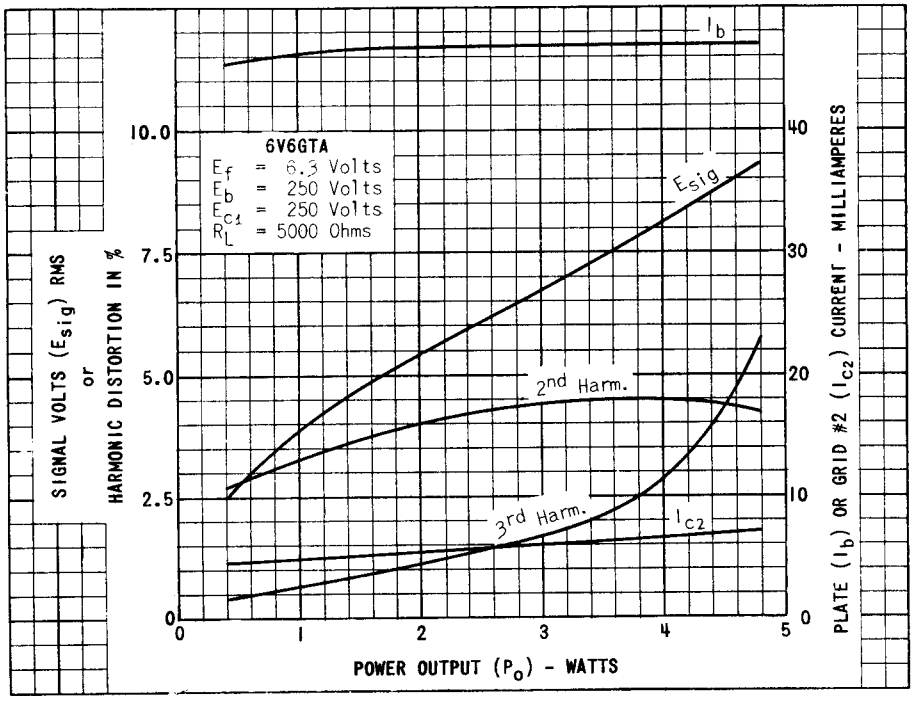
UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	250	285	VOLTS
GRID #2 VOLTAGE	250	285	VOLTS
GRID #1 VOLTAGE	-15	-19	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	30	38	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	70	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	92	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	13	13.5	MA.
PLATE-TO-PLATE LOAD RESISTANCE	10 000	8 000	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	10	14	WATTS
TOTAL HARMONIC DISTORTION	5	3.5	PERCENT

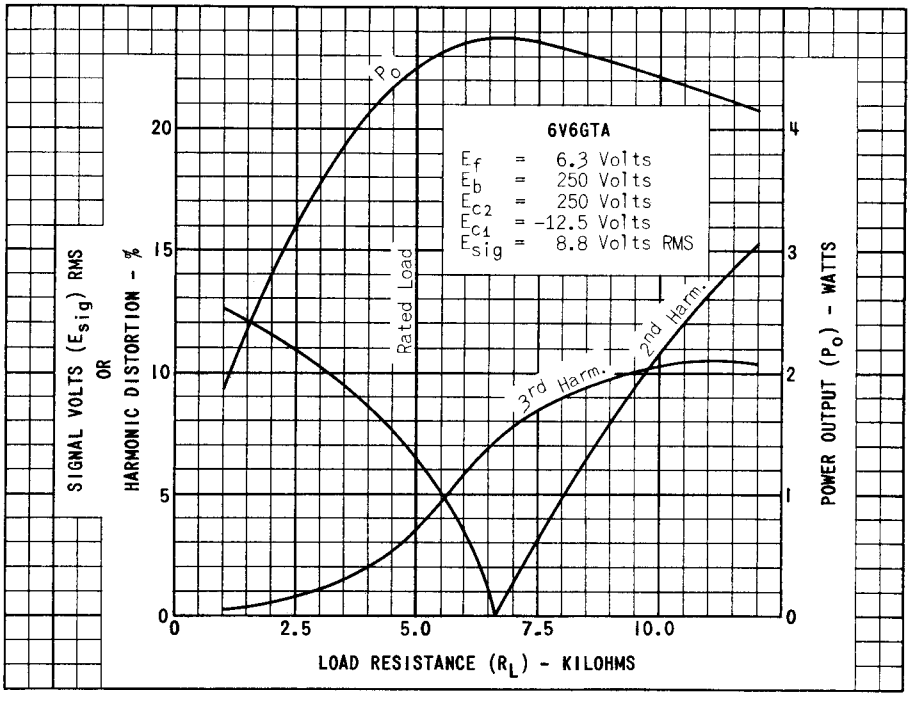
CLASS A_1 AMPLIFIER – TRIODE CONNECTION

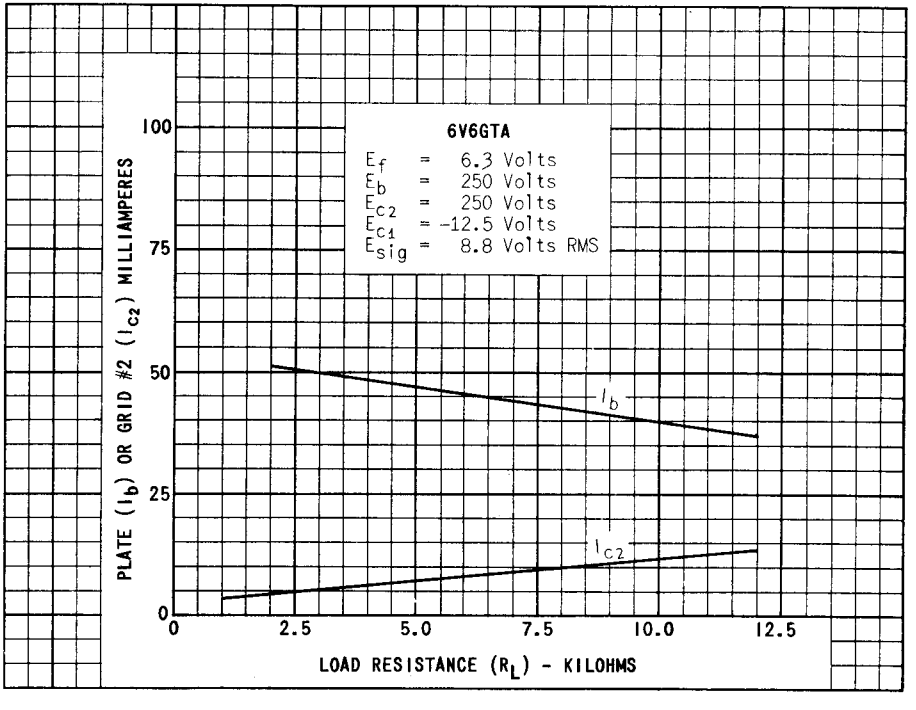
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	5 000	µMHOS
AMPLIFICATION FACTOR	9.8	
PLATE RESISTANCE (APPROX.)	1 960	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-36	VOLTS


E_{c1} = 0
-5
-10
-12.5
-15
-20
-25
-30
6V6GTA
E_f = 6.3 Volts
E_{c2} = 250 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
100
200
300
400
500


I_b
E_{sig}
2nd Harm.
3rd Harm.
I_{c2}
6V6GTA
E_f = 6.3 Volts
E_b = 250 Volts
E_{c1} = 250 Volts
R_L = 5000 Ohms
SIGNAL VOLTS (E_{sig}) RMS
or
HARMONIC DISTORTION IN %
PLATE (I_b) OR GRID #2 (I_{c2}) CURRENT - MILLIAMPERES
POWER OUTPUT (P_o) - WATTS
0
2.5
5.0
7.5
10.0
0
10
20
30
40
0
1
2
3
4
5

6V6GTA

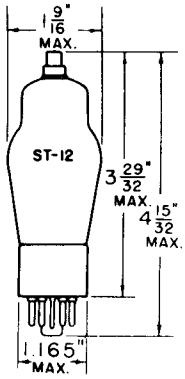

6V6GTA
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = -12.5 Volts
E_{sig} = 8.8 Volts RMS
Po
Rated Load
3rd Harm.
2nd Harm.
SIGNAL VOLTS (E_{sig}) RMS OR HARMONIC DISTORTION - %
POWER OUTPUT (P_o) - WATTS
LOAD RESISTANCE (R_L) - KILOHMS
0
5
10
15
20
1
2
3
4
2.5
5.0
7.5
10.0


6V6GTA
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = -12.5 Volts
E_{sig} = 8.8 Volts RMS
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
LOAD RESISTANCE (R_L) - KILOHMS
0
25
50
75
100
2.5
5.0
7.5
10.0
12.5

TUNG-SOL

DUPLEX-DIODE TRIODE

UNIPOTENTIAL CATHODE



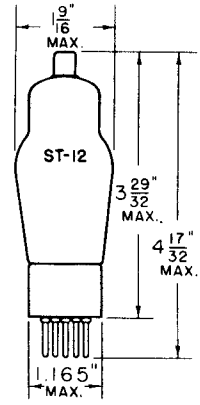
6V7G
SMALL 7 PIN OCTAL BASE

HEATER

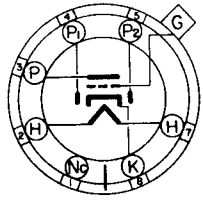
6V7G, 85	55
6.3 V.	2.5 V.
0.3 A.	1.0 A.

AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. UNDER NO CONDITIONS SHOULD IT EXCEED 100 VOLTS.

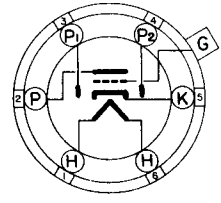


55, 85
SMALL 6 PIN BASE



6V7G

BOTTOM VIEWS



55, 85

THE 6V7G, 55 AND 85 ARE HEATER CATHODE TYPE TUBES CONSISTING OF TWO DIODES AND A TRIODE IN A SINGLE BULB. THEY ARE DESIGNED FOR USE AS COMBINED DETECTORS, AMPLIFIERS AND AUTOMATIC VOLUME CONTROL TUBES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	1.5	μμf
INPUT	1.5	μμf
OUTPUT	4.3	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	135	180	250	VOLTS
GRID VOLTAGE	-10.5	-13.5	-20	VOLTS
PLATE CURRENT	3.7	6.0	8.0	MA.
PLATE RESISTANCE	11000	8500	7500	OHMS
TRANSCONDUCTANCE	750	975	1100	μMHOS
AMPLIFICATION FACTOR	8.3	8.3	8.3	
LOAD RESISTANCE	25000	20000	20000	OHMS
POWER OUTPUT	75	160	350	MW.

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PLATE 1439
JUNE 15 1944

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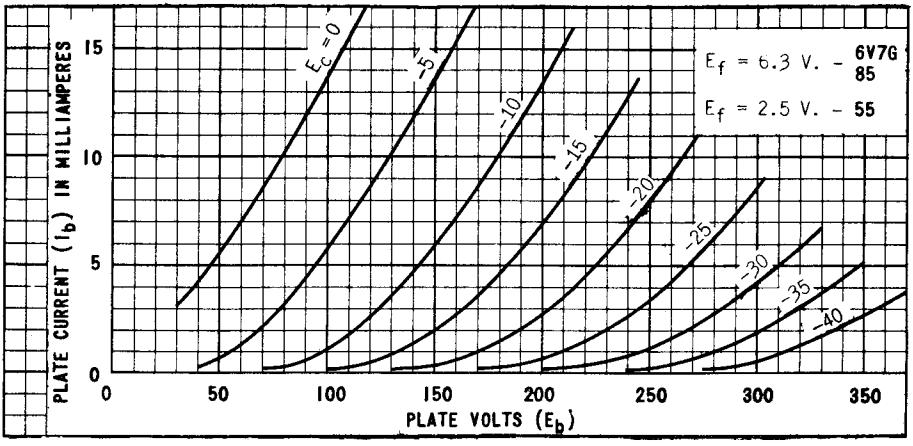
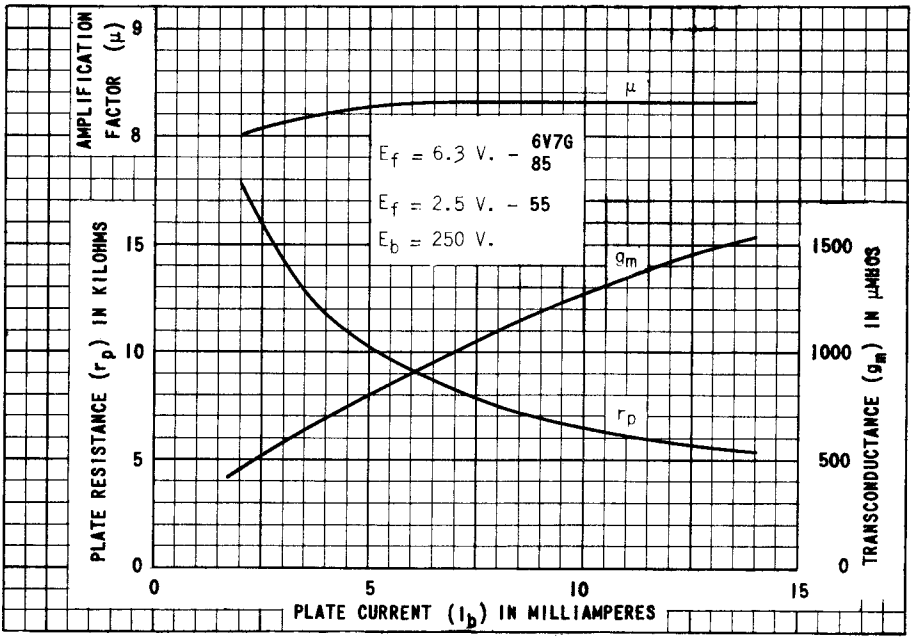
6V7G (55, 85)





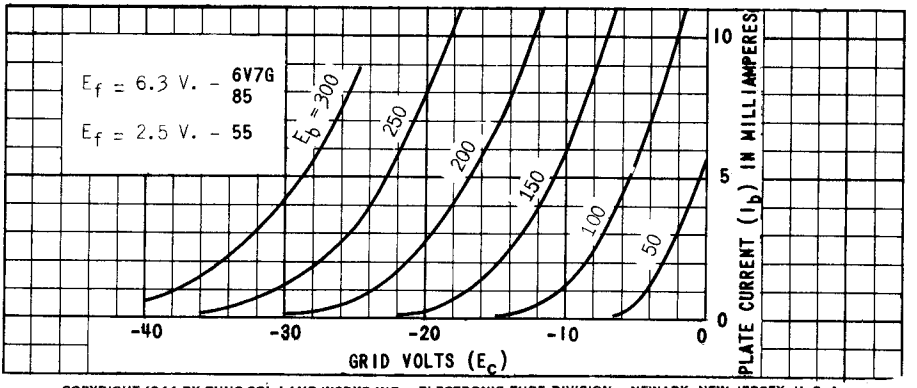


PLATE 1440
JUNE 15 1944

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TUNG-SOL

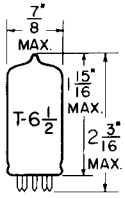
TRIPLE-DIODE TRIODE

MINIATURE TYPE

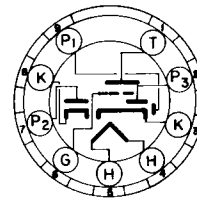
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AH

THE 6V8 COMPRISES TWO HIGH PERVEANCE DIODES, A MEDIUM PERVEANCE DIODE, AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE BASE. ONE OF THE HIGH PERVEANCE DIODES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

DIODE #1 TO GRID: (1P TO G) MAX.	0.1	μμf
DIODE #2 TO GRID: (2P TO G) MAX.	0.2	μμf
DIODE #3 TO GRID: (3P TO G) MAX.	0.02	μμf
DIODE #1 TO ALL: 1P TO (H+K+G+P+2P+3P)	1.3	μμf
DIODE #2 TO ALL: 2P TO (H+K+G+P+1P+3P)	5.3	μμf
DIODE #3 TO ALL: 3P TO (H+K+G+P+1P+2P)	5.3	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM DIODE #2, DIODE #3, CURRENT FOR CONTINUOUS OPERATION	10	MA.
MAXIMUM DIODE #1 CURRENT FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−3	VOLTS
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	
PLATE CURRENT	0.8	1	MA.
AVERAGE DIODE #2 OR DIODE #3 WITH 5 VOLTS DC APPLIED	40		MA.
RATIO OF $\frac{ID3}{ID2}$ OR $\frac{ID2}{ID3}$ WITH 5 VOLTS APPLIED (MAX.)	1.5		
DIODE #2 OR DIODE #3 CURRENT THROUGH 40,000 OHMS WITH NO VOLTAGE APPLIED (MAX.)	24		μA.
AVERAGE DIODE #1 CURRENT WITH 10 VOLTS DC APPLIED	2		MA.
HEATER TO ALL CATHODES WITH ± 100 VOLTS APPLIED (MAX.)	5		μA.

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PLATE 2528
DEC. 1 1950

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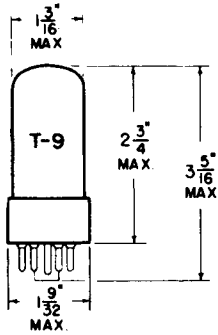
TUNG-SOL

DIODE

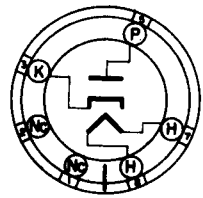


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
4CG
PINS #1, 2, 4 & 6 SHALL NOT BE USED AS TIE POINTS

THE 6W4GT IS A HALF-WAVE HIGH VACUUM RECTIFIER DESIGNED ESPECIALLY FOR USE AS A DAMPING DIODE IN TELEVISION DEFLECTION CIRCUITS. IT CAN ALSO BE USED IN CONVENTIONAL RECTIFIER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

HEATER TO CATHODE: H TO K	7.0	μμf
CATHODE TO PLATE AND HEATER: K TO (P+H)	13	μμf
PLATE TO CATHODE AND HEATER: P TO (K+H)	6.0	μμf

RATINGS[A]

INTERPRETED ACCORDING TO RMA STANDARD M6-210

DAMPER DIODE[B]

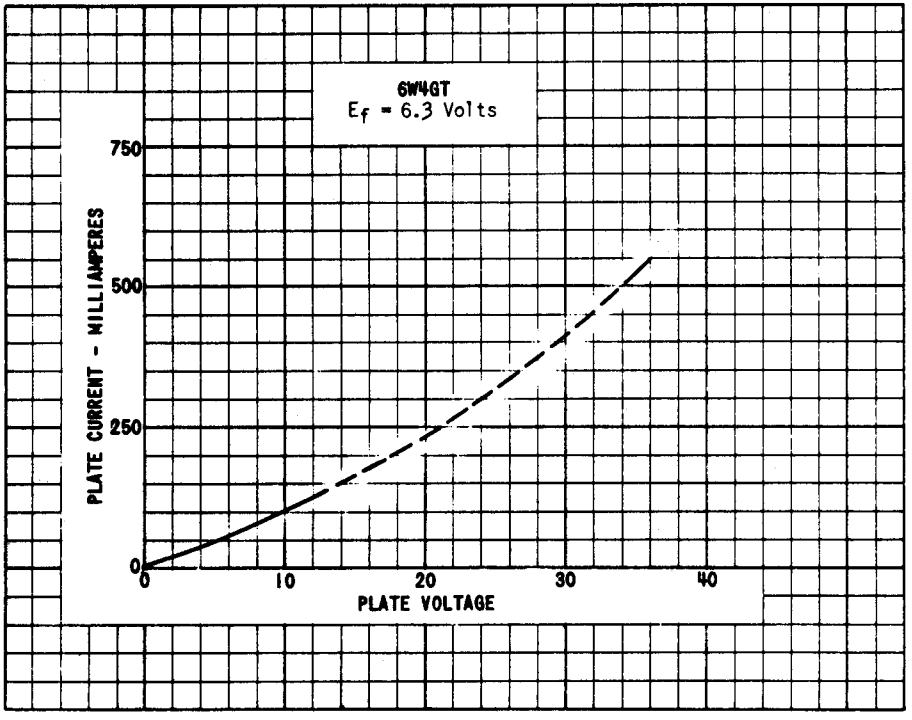
HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	3 850	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE (ABSOLUTE MAX.)		
DC	500	VOLTS
TOTAL DC AND PEAK	2 300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM DC PLATE CURRENT	125	MA.
MAXIMUM PEAK PLATE CURRENT	750	MA.
MAXIMUM PLATE DISSIPATION	3.5	WATTS
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 250 MA.)	21	VOLTS

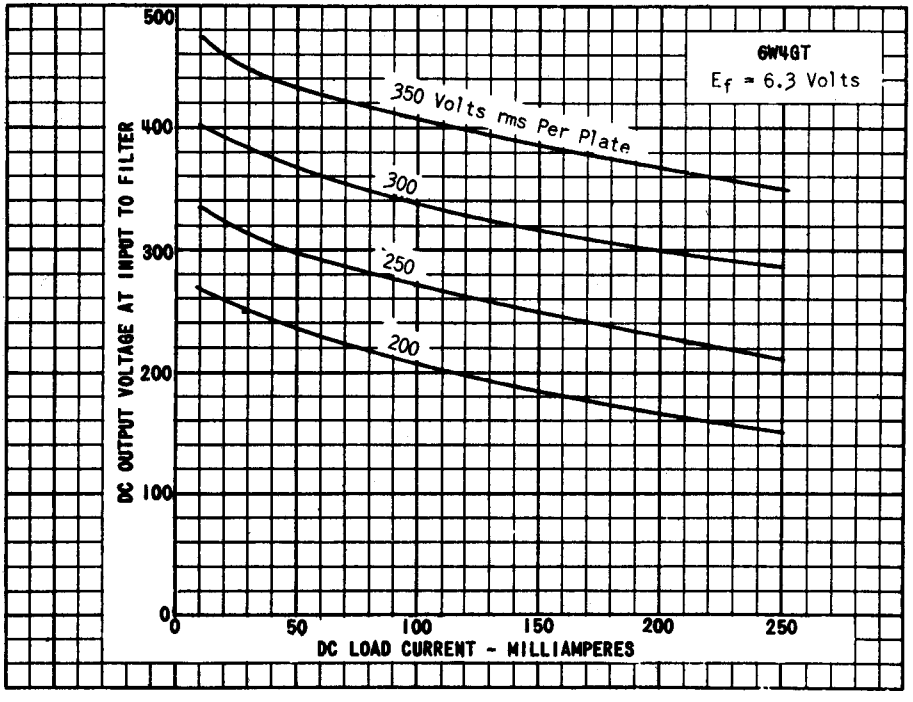
[A] DESIGN CENTER VALUES EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE. POWER RECTIFIER OPERATION IS NOT RECOMMENDED.

→ INDICATES A CHANGE.

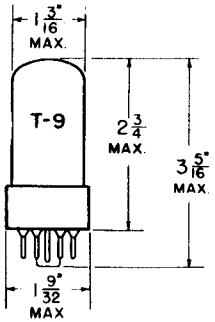
* INDICATES AN ADDITION.


6W4GT
Ef = 6.3 Volts
PLATE CURRENT - MILLIAMPERES
750
500
250
0
0
10
20
30
40
PLATE VOLTAGE


6W4GT
Ef = 6.3 Volts
350 Volts rms Per Plate
300
250
200
DC OUTPUT VOLTAGE AT INPUT TO FILTER
500
400
300
200
100
0
0
50
100
150
200
250
DC LOAD CURRENT - MILLIAMPERES

TUNG-SOL

BEAM PENTODE

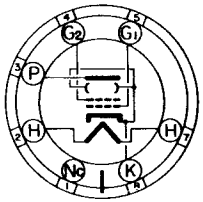


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 6W6GT IS A BEAM PENTODE POWER AMPLIFIER DESIGNED SPECIFICALLY FOR USE AS A VERTICAL SCANNING OUTPUT TUBE IN TELEVISION RECEIVERS. IT IS IDENTICAL IN CHARACTERISTICS AND DESIGN WITH THE 25L6GT.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G_1 TO P) MAX.	0.5	μμf
INPUT: G_1 TO (H+K+BP+G_2)	15	μμf
OUTPUT: P TO (H+K+BP+G_2)	9	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

VERTICAL DEFLECTION AMPLIFIER

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE[B]	1 000	VOLTS
MAXIMUM GRID #2 VOLTAGE[C]	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE[B]	-200	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS

[A] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS, FEDERAL COMMUNICATIONS COMMISSION.

[B] THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND ITS DURATION MUST BE LIMITED TO 2.5 MILLISECONDS.

[C] THE SCREEN VOLTAGE MAY EXCEED THIS VALUE PROVIDING THE SCREEN DISSIPATION IS KEPT WITHIN THE RATING SPECIFIED BY JETEC STANDARD J5-C4.

CONTINUED ON FOLLOWING PAGE

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PLATE 2551
JAN. 1 1950

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO SIGNAL PLATE CURRENT	49	46	MA.
ZERO SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	47	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	5 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

VERTICAL DEFLECTION AMPLIFIER – TRIODE CONNECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
DC PLATE VOLTAGE	225	VOLTS
TOTAL PEAK-TO-PEAK GRID INPUT VOLTAGE (APPROX.)	75	VOLTS
DC PLATE CURRENT (APPROX.)	10	MA.
TOTAL PEAK-TO-PEAK PLATE OUTPUT VOLTAGE (APPROX.)	800	VOLTS
GRID CIRCUIT RESISTANCE (MAX.)	3.3	MEGOHMS
CATHODE BIAS RESISTOR (MIN.)	470	OHMS

PLATE 2552
JAN. 1 1951

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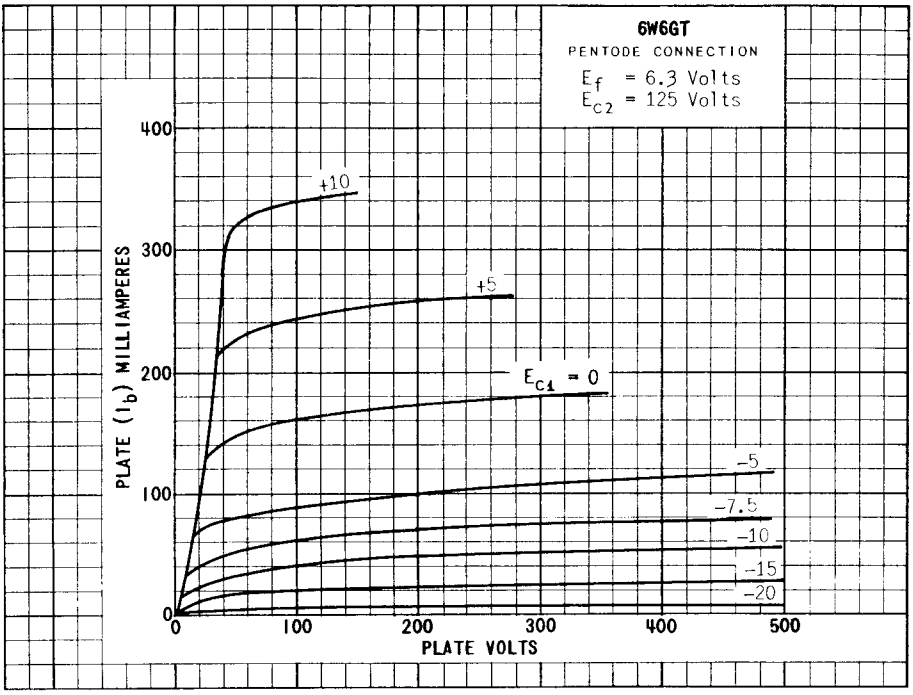

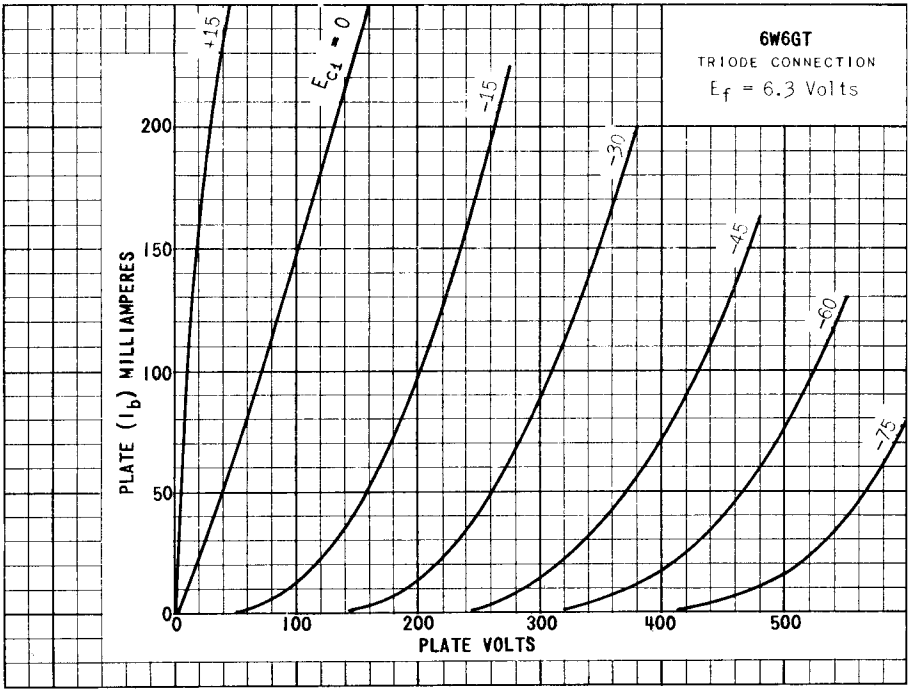

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PLATE
2553
JAN. 1
1951

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6W6GT

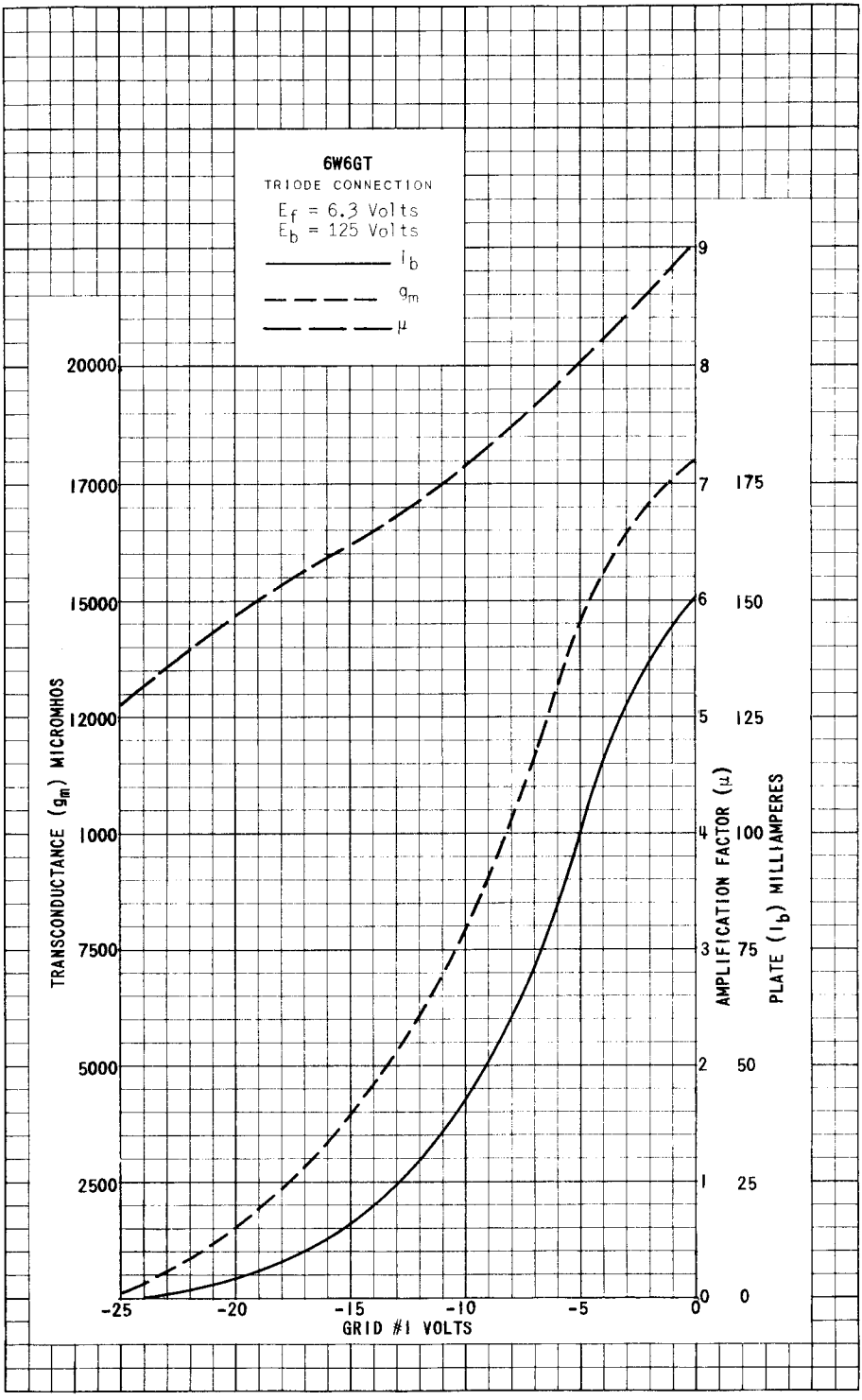

PLATE
2554
JAN. 1
1951

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TUNG-SOL

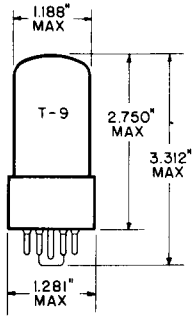
BEAM PENTODE

COATED UNIOPTENTIAL CATHODE

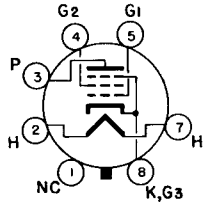
FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



GLASS BULB
INTERMEDIATE SHELL OCTAL
B6-81 OR B7-7
OR
SHORT INTERMEDIATE
SHELL OCTAL
B6-84 OR B7-59
OUTLINE DRAWING
JEDEC 9-11 OR 9-41



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 6W6GT IS A BEAM PENTODE POWER AMPLIFIER DESIGNED SPECIFICALLY FOR USE AS A VERTICAL SCANNING OUTPUT TUBE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE: (G1 TO P)	0.8	pf
INPUT: G1 TO (H+K+G2+G3)	15.0	pf
OUTPUT: P TO (H+K+G2+G3)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
CURRENT OPERATION		1200	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A1 AMPLIFIER

PLATE VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	165	VOLTS
PLATE DISSIPATION	12	WATTS
GRID 2 DISSIPATION	1.35	WATTS
GRID 1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER[A,B]

	TRIODE CONNECTED	PENTODE CONNECTED	
DC PLATE VOLTAGE	330	330	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	1200	1500	VOLTS
DC GRID 2 VOLTAGE		165	VOLTS
PLATE DISSIPATION	8.5	8	WATTS
GRID 2 DISSIPATION		1.2	WATT
PEAK NEGATIVE PULSE GRID 1 VOLTAGE	275	275	VOLTS
AVERAGE CATHODE CURRENT	65	65	MA.
PEAK CATHODE CURRENT	195	195	MA.
GRID 1 CIRCUIT RESISTANCE			
CATHODE BIAS	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE	110	200	VOLTS
GRID 2 VOLTAGE	110	125	VOLTS
GRID 1 VOLTAGE	-7.5	----	VOLTS
CATHODE BIAS RESISTOR	----	180	OHMS
PEAK AF GRID 1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTOR (APPROX.)	13,000	28,000	OHMS
TRANSCONDUCTANCE	8,000	8,000	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT (APPROX.)	50	47	MA.
ZERO-SIGNAL GRID 2 CURRENT	4.0	2.2	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (APPROX.)	10	8.5	MA.
LOAD RESISTANCE	2,000	4,000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

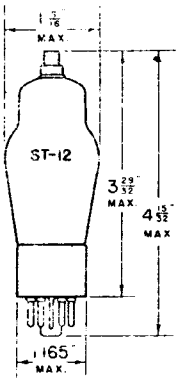
TRIODE CONNECTION

PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	-30	VOLTS
AMPLIFICATION FACTOR	6.2	
PLATE RESISTANCE (APPROX.)	1,600	OHMS
TRANSCONDUCTANCE	3,800	μMHOS
PLATE CURRENT	22	MA.
GRID VOLTAGE FOR Ib=0.5 MA. (APPROX.)	-42	VOLTS

[A] TRIODE CONNECTION - GRID #2 TIED TO PLATE.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TUNG-SOL



GLASS BULB

TRIPLE GRID

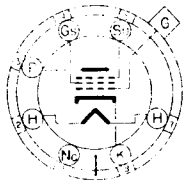
DETECTOR AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.15 AMPERE

AC OR DC



G-7Pa

BOTTOM VIEW

THE TUNG-SOL 6W7G IS A TRIPLE GRID GENERAL PURPOSE DETECTOR AMPLIFIER, WHICH IS DESIGNED FOR SERVICE IN APPLICATIONS THAT REQUIRE A LOW HEATER CURRENT.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID BIAS VOLTAGE	0	VOLT
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM SCREEN DISSIPATION	0.1	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	100	VOLTS
CONTROL GRID VOLTAGE	-3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET	
PLATE CURRENT	2.0	MA.
SCREEN CURRENT	0.5	MA.
PLATE RESISTANCE APPROX.	1.5	MEGOHMS
TRANSCONDUCTANCE	1225	MICROMHOS
CONTROL GRID VOLTAGE APPROX. FOR CATHODE CURRENT CUT-OFF	-7	VOLTS

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	5.0	μμf
PLATE TO CATHODE	8.5	μμf
CONTROL GRID TO PLATE	0.007 MAX.	μμf

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE. THE INTERNAL SHIELD WITHIN THE DOME OF THE 6W7G IS CONNECTED INTERNALLY TO THE CATHODE.

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PLATE 964-2

JAN. 6 1941

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK

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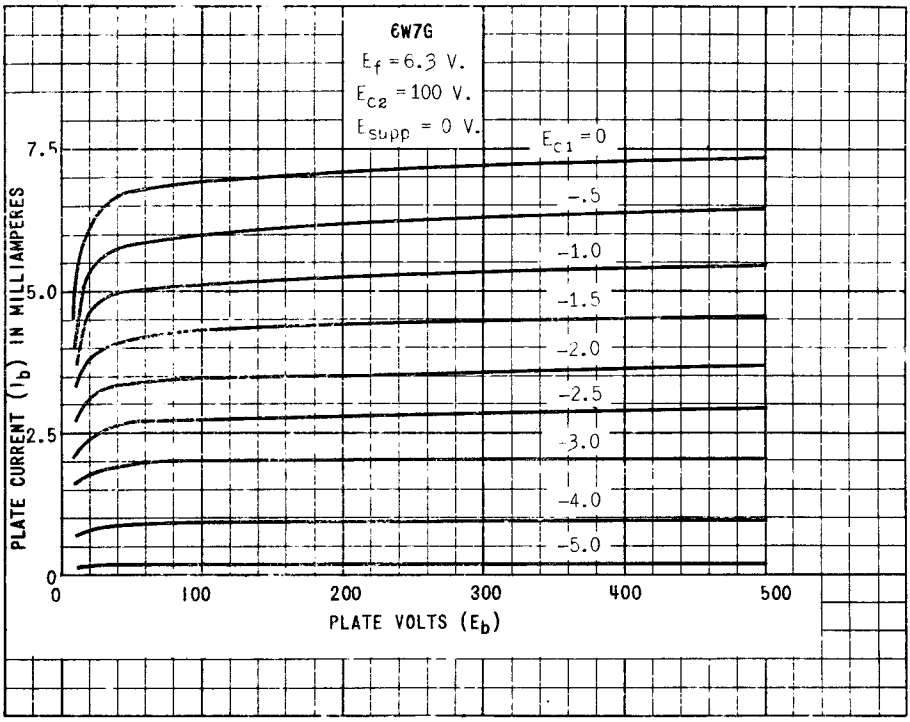
6W7G



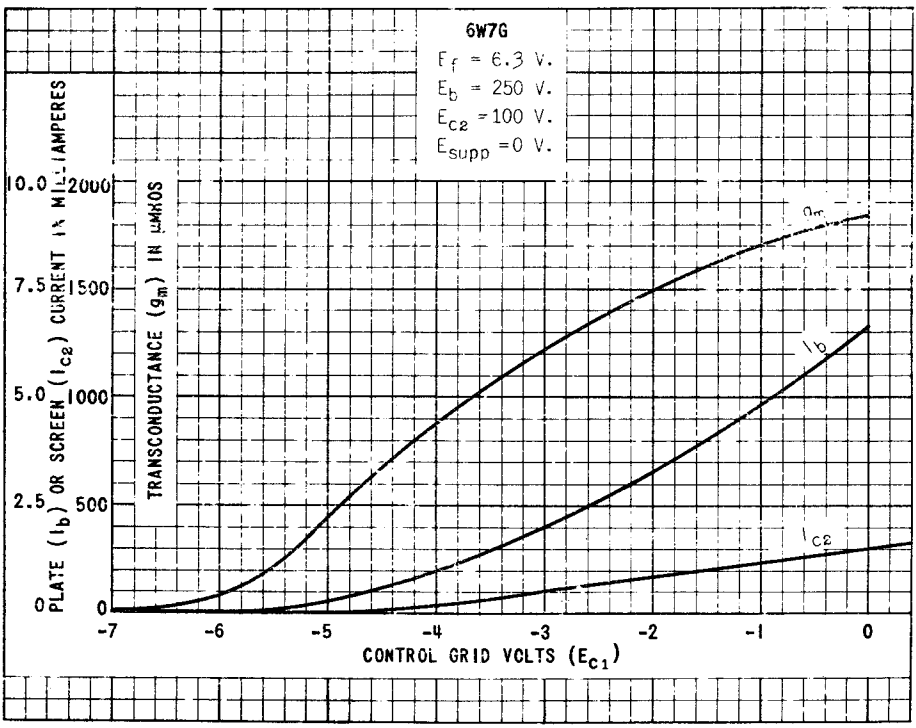


PLATE
965-2

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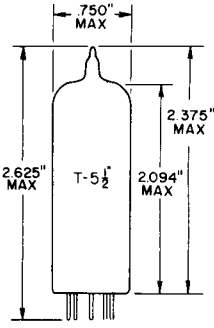
MINIATURE TYPE

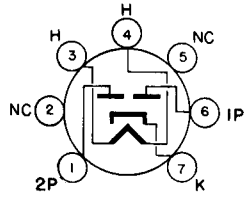


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

FULL WAVE RECTIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BS

THE 6X4 IS A HEATER-CATHODE TYPE POWER RECTIFIER IN THE MINIATURE CONSTRUCTION. ITS LOW VOLTAGE DROP AND SMALL SIZE ADAPT IT TO USE WITH VIBRATOR-TYPE INVERTERS IN AUTOMOBILE RECEIVERS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 70 MA EACH PLATE)		22	VOLTS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION [A]		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		450	VOLTS
TOTAL DC AND PEAK		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

→MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE PLATE VOLTAGE	1250	VOLTS
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	SEE CHART I	
DC OUTPUT CURRENT EACH PLATE	SEE CHART I	
STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE CHART II)	245	MA.
TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE CHART III)	1.1	AMP.
VIBRATOR OPERATION (MINIMUM DUTY CYCLE OF 75%)		
DC OUTPUT VOLTAGE (AT FILTER INPUT)	350	VOLTS
DC OUTPUT CURRENT EACH PLATE	45	MA.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ TYPICAL OPERATING CHARACTERISTICS

FULL-WAVE RECTIFIER

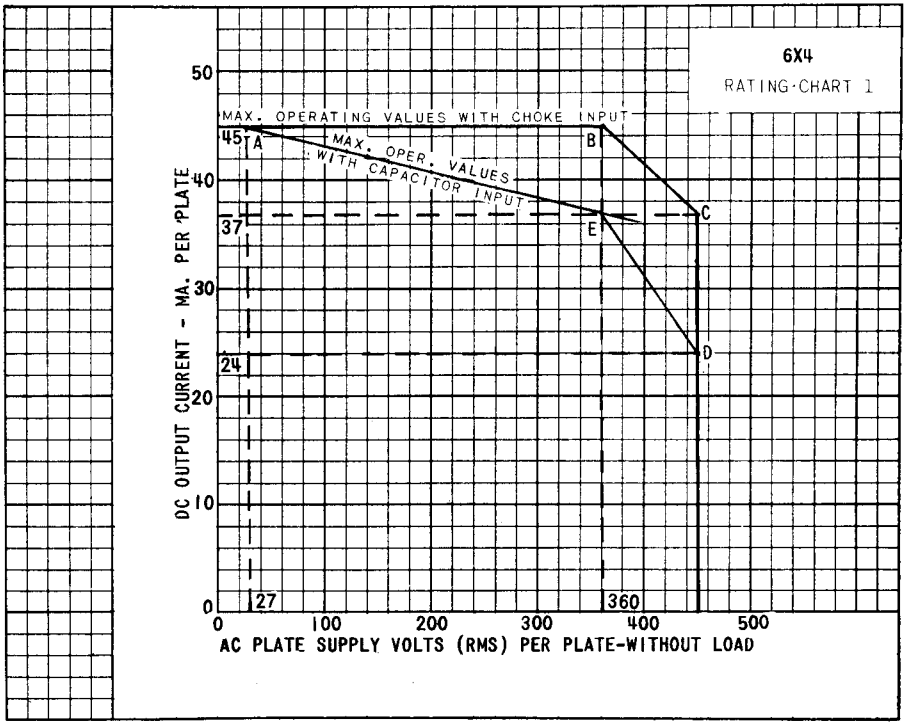
	SINE WAVE OPERATION INPUT TO FILTER		VIBRATOR OPERATION INPUT TO FILTER	
	CAPACITOR	CHOKE	CAPACITOR	
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)[B]	325	400	---	VOLTS
INPUT CAPACITOR	10	---	10	μf
INPUT CHOKE	---	10	---	HENRYS
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	525	---		OHMS
DC OUTPUT CURRENT	70	70	70	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	310	340	240	VOLTS

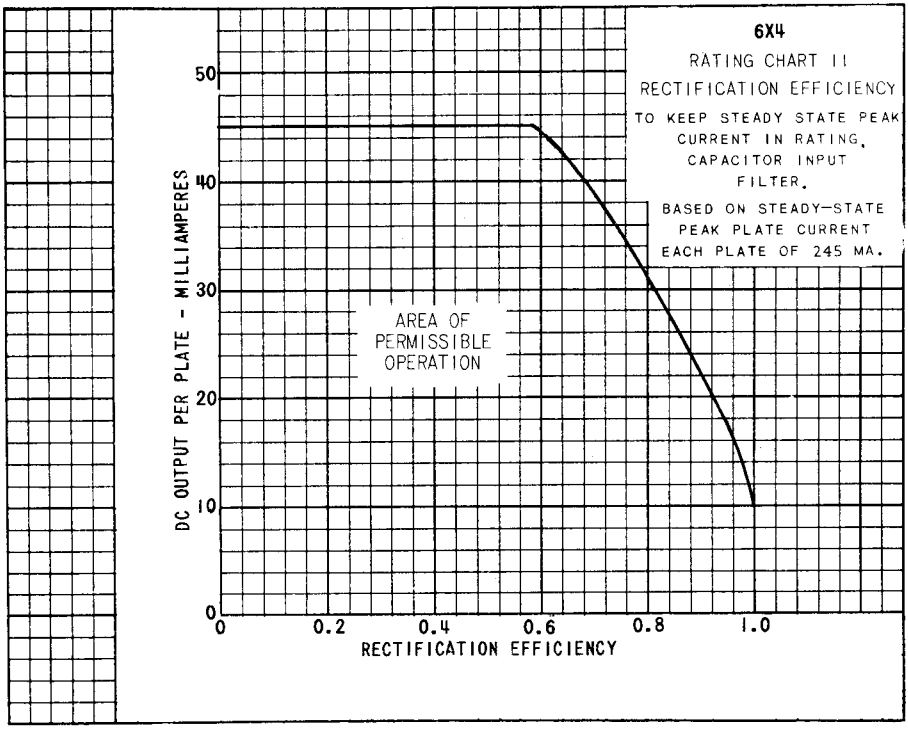
A
WHEN USED IN AUTOMOTIVE SERVICE FROM A 6 VOLT BATTERY SOURCE, THE PERMISSIBLE RANGE IN HEATER VOLTAGE IS FROM 5.0 TO 8.0 VOLTS.

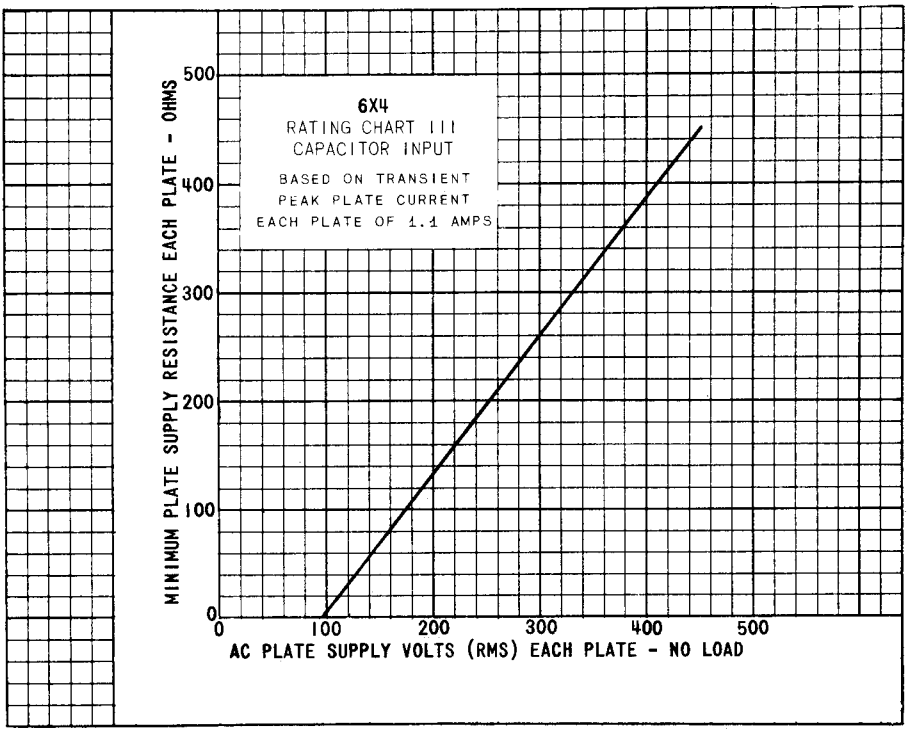
B
AC PLATE SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

→ INDICATES A CHANGE.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 6X4 is identical to the 12X4.







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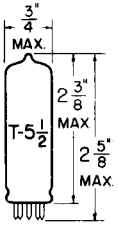
DOUBLE DIODE

MINIATURE TYPE

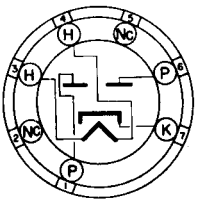


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
5BS

THE 6X4W IS A RUGGEDIZED HEATER-CATHODE TYPE DOUBLE DIODE USING THE SEVEN PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE IN HALF OR FULL WAVE RECTIFIER APPLICATIONS, SUCH AS ENCOUNTERED WHEN USED IN CONJUNCTION WITH VIBRATOR-TYPE INVERTERS. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6X4W IS ALSO SUITED FOR USE IN INDUSTRIAL AND MILITARY EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1375	VOLTS
MAXIMUM DC PLATE CURRENT	230	mA.
MAXIMUM DC OUTPUT CURRENT	75	mA.
MAXIMUM SURGE CURRENT	750	mA.
MAXIMUM HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	700	G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
FULL-WAVE RECTIFIER

	INPUT TO FILTER CAPACITOR	INPUT TO FILTER CHOKE	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE)	325	450	VOLTS
INPUT CONDENSER[A]	10	---	μfd
INPUT CHOKE	---	10	HENRYS
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	525	---	OHMS
DC OUTPUT CURRENT	70	70	mA.
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.)			
AT HALF-LOAD CURRENT (35 mA)	365	395	VOLTS
AT FULL-LOAD CURRENT (70 mA)	310	385	VOLTS
DIFFERENCE (VOLTAGE REGULATION)	55	10	VOLTS
PERCENTAGE REGULATION	15	2.5	PERCENT

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef=6.3V, Epp/p=400Vac, RL=5700 Ohms, CL=8μf
EXCEPT AS MODIFIED BELOW

	INITIAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	540	660	mA.
HEATER–CATHODE LEAKAGE (Ehk=Eo)	0	150	μAdc
HEATER–CATHODE LEAKAGE[B] OPERATION[CD]	-150	+150	μAdc
GRID EMISSION (1)[E] (E_{2b}=O, E_{1b}=50Vdc)	140	---	mAdc
GRID EMISSION (2)[E] (E_{1b}=O, E_{2b}=50Vdc)	140	---	mAdc

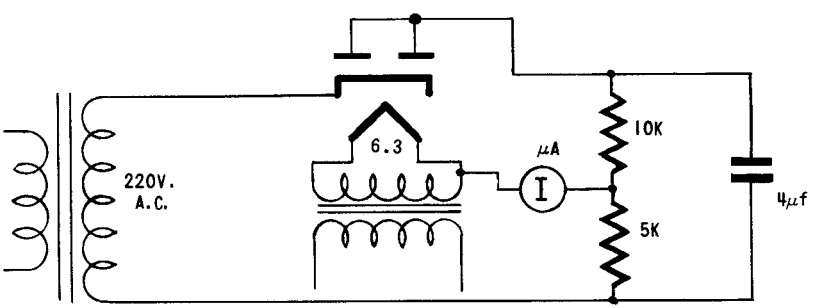
SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[F] (NO VOLTAGES)	---	---	
LOW FREQUENCY VIBRATION[G] (NO VOLTAGES)	---	---	
SHOCK[HJ] (HAMMER ANGLE = 48°)	---	---	
VIBRATIONAL FATIGUE[K]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
OPERATION	65	---	mAdc
HEATER–CATHODE LEAKAGE	0	150	mAdc
MECHANICAL RESONANCE[L]	---	---	
LIFE TEST (1)[M]	500	---	HOURS
HEATER CYCLING LIFE TEST[N] (Ef=7.5Vac, Ehk=100V, Ep=O)	2000	---	CYCLES
LIFE TEST END POINT (1)[P]			
OPERATION	60	---	mAdc
LIFE TEST END POINT (2)[R]	---	---	

NOTES

A HIGHER VALUES OF CAPACITANCE THAN INDICATED MAY BE USED, BUT THE EFFECTIVE PLATE-SUPPLY IMPEDANCE MAY HAVE TO BE INCREASED TO PREVENT EXCEEDING THE MAXIMUM RATING FOR HOT-SWITCHING TRANSIENT PLATE CURRENT.

B



TUNG-SOL

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NOTES – CONT'D.

C SEE MIL-E-1C 4.10.13

D IN A FULL-WAVE CIRCUIT ADJUST Zp/p SUCH THAT A TUBE HAVING Etd=22 Vdc AT 70 mAdc PER PLATE GIVES I_o=75 mAdc. THE TUBE MAY BE PREHEATED PRIOR TO THIS TEST PROVIDED TEST 4.11 IS CONDUCTED ACCORDING TO 4.11.5.

E SEE MIL-E-1C 4.10.1.1

F SEE MIL-E-1C 4.9.20.3

G SEE MIL-E-1C 4.9.20.4

H SEE MIL-E-1C 4.9.20.5

J AFTER SHOCK TESTS, THE TUBES SHALL MEET POST-SHOCK AND FATIGUE TEST END POINT REQUIREMENTS. IN ADDITION, THE TUBES SHALL NOT SHOW PERMANENT SHORTS OR OPEN CIRCUITS WHEN TESTED PER 4.7 (F-1e) AFTER SHOCK TESTS.

K SEE MIL-E-1C 4.9.20.6

L THE MOUNT SHALL EXHIBIT NO PRONOUNCED MECHANICAL RESONANCE BELOW 100 CPS.

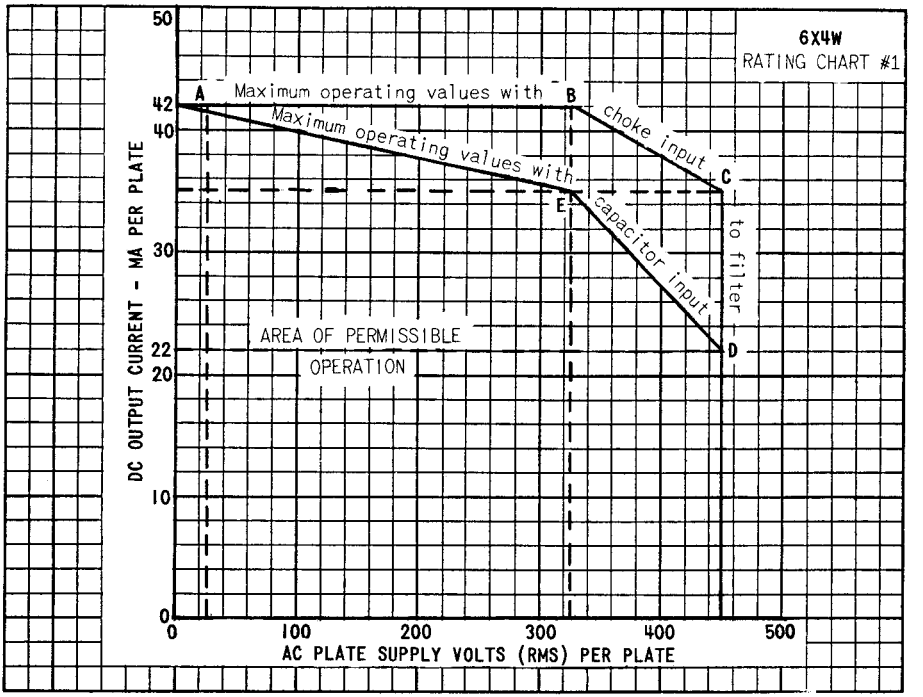
M IN LIFE TEST CONDITIONS THE VALUES OF RL AND CL GIVEN IN TEST CONDITIONS MAY BE CONSIDERED APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE Io = 75 mAdc WITH Ib GREATER THAN 205 mA; Ehk = Eo.

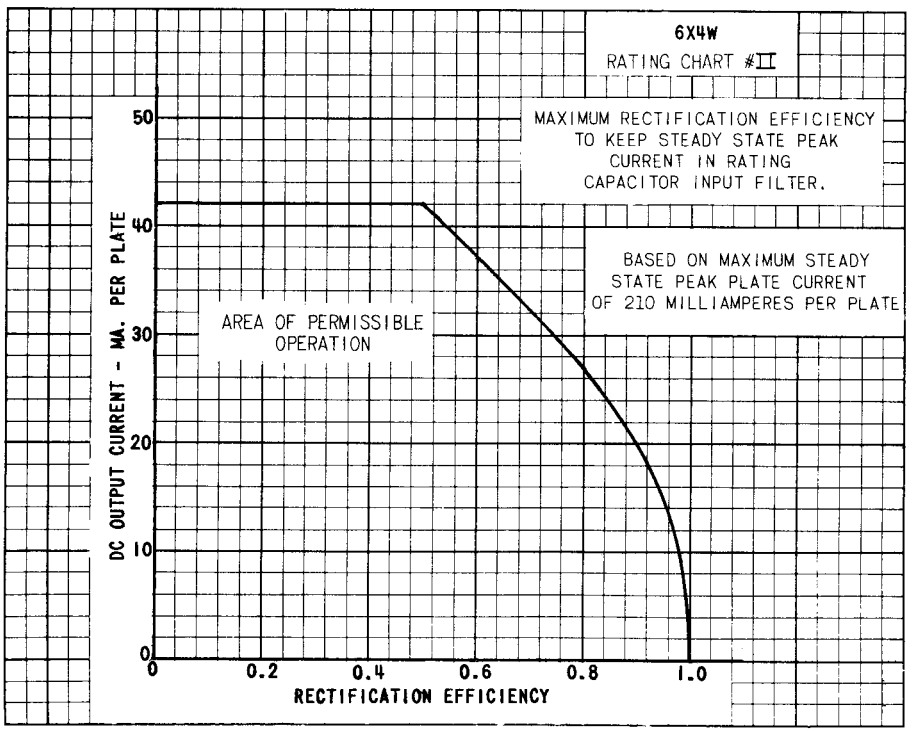
N SEE MIL-E-1C 4.11.7

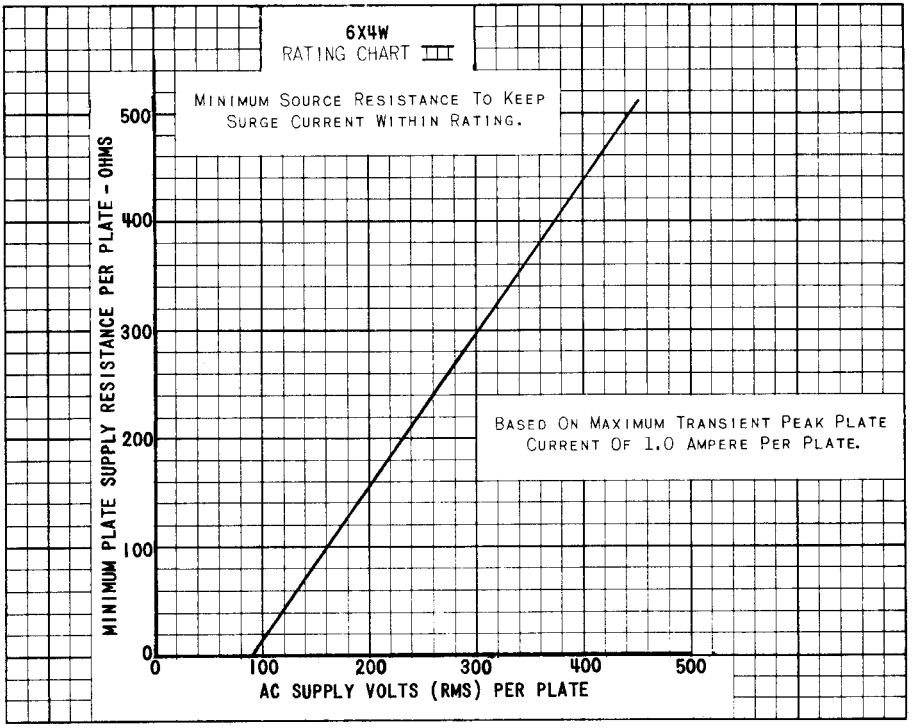
P SEE MIL-E-1C 4.11.4

R AN OPEN HEATER OR A HEATER-CATHODE SHORT CONSTITUTES A TUBE FAILURE. LOTS ARE ACCEPTABLE UNDER THIS TEST IF NO FAILURES OCCUR IN THE LIFE TEST SAMPLES, OR IF ONE TUBE FAILURE HAS OCCURED IN THE PREVIOUS TWENTY-FIVE (25) TUBES TESTED.

6X4W
PREMIUM TUBE






6X4W
RATING CHART III
MINIMUM SOURCE RESISTANCE TO KEEP SURGE CURRENT WITHIN RATING.
BASED ON MAXIMUM TRANSIENT PEAK PLATE CURRENT OF 1.0 AMPERE PER PLATE.
MINIMUM PLATE SUPPLY RESISTANCE PER PLATE - OHMS
0
100
200
300
400
500
AC SUPPLY VOLTS (RMS) PER PLATE

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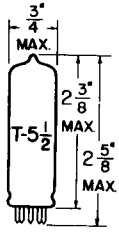
FULL-WAVE RECTIFIER

MINIATURE TYPE



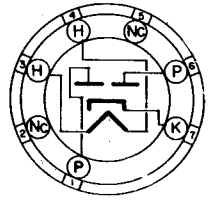
GLASS BULB
5-3

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
5BS

THE 6X4WA IS A FULL-WAVE RECTIFIER INTENDED FOR COMMERCIAL AND INDUSTRIAL APPLICATIONS WHERE A HIGH DEGREE OF RELIABILITY IS REQUIRED. IT IS CHARACTERIZED BY LONG LIFE AND STABLE PERFORMANCE UNDER CONDITIONS OF SEVERE VIBRATION, SHOCK, HIGH TEMPERATURE AND HIGH ALTITUDE.

DURABILITY CHARACTERISTICS

IMPACT ACCELERATION (1 MSEC DURATION) (MAX.)	450	G
FATIGUE (VIBRATIONAL ACCELERATION FOR EXTENDED PERIODS)(MAX.)	2.5	G

RATINGS[A]

ABSOLUTE MAXIMUM

HEATER VOLTAGE[B]	6.3±10%	VOLTS
AC PLATE SUPPLY VOLTAGE, RMS (EACH PLATE)	SEE RATING CHART 1	
STEADY STATE PEAK PLATE CURRENT, RATING CHART 2 (EACH PLATE)	220	MA.
TRANSIENT PEAK PLATE CURRENT, RATING CHART 3 (EACH PLATE)[D]	1.6	AMP.
DC OUTPUT CURRENT (EACH PLATE)	SEE RATING CHART 1	
HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
BULB TEMPERATURE	165	°C
ALTITUDE[C]	SEE RATING CHART 4	

CHARACTERISTICS[E]

FULL-WAVE RECTIFIER-CAPACITOR INPUT

AC PLATE SUPPLY VOLTAGE PER PLATE	400	VAC
FILTER INPUT CAPACITOR	8	μf
LOAD RESISTOR	8200	OHMS
DC OUTPUT CURRENT	55	MADC
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	435	VDC
TUBE VOLTAGE DROP[E] I_b = 50 MA EACH PLATE	22	VOLTS

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TUNG-SOL

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NOTES

[A] LIMITATIONS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPAIRED.

[B] IF ALTITUDE RATING IS EXCEEDED, REDUCTION OF INSTANTANEOUS VOLTAGES (Ef EXCLUDED) MAY BE REQUIRED.

[C] TUBE LIFE AND RELIABILITY OF PERFORMANCE ARE DIRECTLY RELATED TO THE DEGREE OF REGULATION OF THE HEATER VOLTAGE TO ITS CENTER-RATED VALUE.

[D] IF CAPACITOR INPUT CIRCUITS ARE TO BE USED, PROTECT THE CIRCUITS AGAINST THE POSSIBILITY OF HOT-SWITCHING AND DO NOT EXCEED A MAXIMUM PEAK CURRENT VALUE OF 1.6 AMPERE DURING THE INITIAL CYCLES OF THE HOT-SWITCHING TRANSIENT.

[E] TEST CONDITIONS ONLY.

INTERPRETATION OF RATING CHARTS

RATING CHARTS 1, 2 AND 3 REPRESENT BOUNDARY CONDITIONS BEYOND WHICH OPERATION IS NOT PERMITTED. WITH THE AID OF SIMPLE LABORATORY MEASUREMENTS AND THE USE OF THE THREE CHARTS, ANY APPLICATION MAY BE ANALYZED FOR PROPER RECTIFIER TYPE OPERATION.

THE BOUNDARIES OF RATING CHART 1 ARE BASED ON LIMITS OF SUPPLY VOLTAGE, PLATE DISSIPATION AND OUTPUT CURRENT. THESE BOUNDARIES DIFFER, DEPENDING UPON THE TYPE OF FILTER USED. WITH CAPACITOR INPUT, OPERATION IS CONFINED TO THE AREA BOUNDED BY FAEDG WHILE FOR CHOKE INPUT, THE ENTIRE AREA BOUNDED BY FABCG MAY BE USED.

THE BOUNDARY OF RATING CHART 2 DEFINES THE LIMIT OF STEADY-STATE PEAK CURRENT. OPERATION WITHIN THE BOUNDARY IS PERMITTED.

RATING CHART 3 DEFINES THE MINIMUM VALUE OF EFFECTIVE PLATE SUPPLY RESISTANCE, PER PLATE, FOR ANY GIVEN PLATE VOLTAGE SUPPLY WHICH WILL ASSURE THAT THE SURGE CURRENTS ARE WITHIN A SAFE VALUE.

$$Rs = N^2Rpri + Rsec + Ra$$

WHERE: N - VOLTAGE STEP UP RATIO OF PLATE TRANSFORMER:

$$N = \frac{N\ Secondary}{N\ Primary} \quad \text{for half-wave}$$

$$N = \frac{N\ Secondary}{2N\ Primary} \quad \text{for full-wave}$$

Rpri - DC RESISTANCE OF TRANSFORMER PRIMARY.

Rsec - AVERAGE DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION.

Ra - ADDED SERIES RESISTANCE.

FOR ANY APPLICATION, EACH CHART SHOULD BE CONSULTED. ON ALL CHARTS THE POINTS OF OPERATION SHOULD FALL WITHIN THE PROPER BOUNDARIES.

PLATE SUPPLY VOLTAGES ARE MEASURED WITH THE RECTIFIER TUBE NON-CONDUCTING, I.E., WITH THE TRANSFORMER UNLOADED. THIS UNLOADED VOLTAGE IS USED WITH CALCULATING RECTIFICATION EFFICIENCY.

THE RECTIFICATION EFFICIENCY IS DEFINED AS:

$$\frac{\text{DC OUTPUT VOLTAGE}}{\text{(UNLOADED RMS SUPPLY VOLTAGE PER PLATE)}}$$

THE DC OUTPUT VOLTAGE IS MEASURED AT THE INPUT TO THE FILTER

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TUNG-SOL

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ACCEPTANCE CRITERIA

TEST CONDITIONS:

HEATER VOLTAGE	6.3	VOLTS
PLATE SUPPLY VOLTAGE PER PLATE	400	VAC
LOAD RESISTANCE	8200	OHMS
LOAD CAPACITANCE	8	μf

FOR THE PURPOSE OF INSPECTION, USE APPLICABLE RELIABLE PARAGRAPHS OF MIL-E-1 AND INSPECTION INSTRUCTIONS FOR ELECTRON TUBES.

MEASUREMENTS ACCEPTANCE TESTS:	MIL-E-1 REF.	AQL %	LIMITS MIN.	LIMITS BOG.	LIMITS MAX.	UNITS
HEATER CURRENT:	4.10.8	1.0	540	600	660	MA.
HEATER-CATHODE LEAKAGE:						
Ehk=-450 Vdc	4.10.15	0.65	---	---	75	μAdc
OPERATION: NOTE 5 Io						
Ehk=Eo+ 117 Vac	4.10.13	0.65	51	55	---	mAdc
EMISSION (1): NOTE 2, Is						
Eb = 50 Vdc	4.10.1.1	1.0	100	---	---	mAdc
CONTINUITY AND SHORTS:						
NOTE 7	----	0.4	---	---	---	
MECHANICAL: ENVELOPE (6-5)	4.9.1	---	---	---	---	
INSULATION OF ELECTRODES:	4.8	2.5	---	---	---	
NOTE 2 Ep-all=-500 Vdc,						
Rp-all		---	100	---	---	MEG.
EMISSION (2): Is						
Ef =5.5 V; Eb=50 Vdc	4.10.1.1	2.5	90	---	---	mAdc
LOW PRESSURE VOLTAGE BREAKDOWN:						
PRESSURE =140±5 mm Hg;						
VOLTAGE = 980 Vac	4.9.12.1	6.5	---	---	---	
VIBRATION (1):						
NO VOLTAGES; F=40 cps; g=10	4.9.19.1	6.5	---	---	---	
DEGRADATION RATE ACCEPTANCE TESTS - NOTE 3						
SHOCK:						
HAMMER ANGLE =30° (450 G,						
1 msec DURATION); Epp/p=						
0 V; Ef = 6.3 V	4.9.20.5	20	---	---	---	
FATIGUE:						
G= 2.5; FIXED FREQUENCY;						
F = 25 cps min.; 60 max.	4.9.20.6	6.5	96	---	---	HOURS
POST SHOCK AND FATIGUE TEST						
END POINTS:						
HEATER-CATHODE LEAKAGE,						
Ehk=-450 Vdc	----	---	---	---	150	μAdc
OPERATION, Io; NOTE 5		---	48	---	---	mAdc
GLASS STRAIN	----	---	---	---	---	

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACCEPTANCE CRITERIA

ACCEPTANCE LIFE TESTS. NOTE 3	MIL-E-1 REF.	AQL %	ALLOWABLE DEF. PER CHARACT. 1st SAMP.	ALLOWABLE DEF. PER CHARACT. COMB. SAMP.	LIMITS MIN.	LIMITS MAX.	UNITS
HEATER CYCLING LIFE TEST (2000 CYCLES MIN.) Ef =7.5V; 1 min. on, 1 min. off; Ehk=+100 Vdc; Epp/p = O V	4.11.7	---	---	---	---	---	
HEATER CYCLING LIFE TEST END POINTS							
HEATER-CATHODE LEAKAGE, Ehk =-450 Vdc	4.11.4	---	---	---	---	150	μAdc
SURVIVAL RATE LIFE TEST: NOTES 6 & 8							
Ef = 6.3 V; Epp/p=400 Vac; RL = 8200 OHMS; EL =8 μf; TA = Room	4.11.3.1	---	---	---	100	---	HOURS
SURVIVAL RATE LIFE TEST END POINTS:	4.11.4						
INOPERATIVE (NOTE 1)		0.65	---	---	---	---	
EMISSION (1):		1.0	---	---	51	---	mAdc
INTERMITTENT LIFE TEST: NOTES 4 & 6							
SURVIVAL RATE LIFE TEST CONDITIONS: T ENVELOPE =+165°C min.; 1000 HOUR REQUIREMENTS DO NOT APPLY	4.11.3.1	---	---	---	500	---	HOURS
INTERMITTENT LIFE TEST END POINTS: (500 HOURS)	4.11.4						
INOPERATIVE (NOTE 1)		---	1	3	---	---	
OPERATION - CHANGE OF INDIVIDUALS Δ Io		---	1	3	---	8.5	PERCENT
HEATER CURRENT		---	1	3	540	670	mA
HEATER-CATHODE LEAKAGE		---	1	3	---	---	
Ehk =-450 Vdc		---	---	---	---	90	μAdc
TOTAL DEFECTIVES		---	2	5	---	---	

ACCEPTANCE CRITERIA NOTES

1. AN INOPERATIVE IS DEFINED AS A TUBE HAVING ONE OR MORE OF THE FOLLOWING DEFECTS: DISCONTINUITY OR SHORT (REF. NOTE 7 EXCEPT TUBES SHALL NOT BE TAPPED:) AIR LEAKS (REF. MIL E-1, PAR. 4.7.6).

2. TEST EACH SECTION SEPARATELY.

3. TUBES SUBJECTED TO THE FOLLOWING DESTRUCTIVE TESTS ARE NOT TO BE ACCEPTED UNDER THIS SPECIFICATION.

4.9.20.5	SHOCK
4.9.20.6	FATIGUE
4.11.7	HEATER CYCLING LIFE TEST
4.11.3.1	INTERMITTENT LIFE TEST

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACCEPTANCE CRITERIA NOTES – cont'd.

4. ENVELOPE TEMPERATURE IS DEFINED AS THE HIGHEST TEMPERATURE INDICATED WHEN USING A THERMOCOUPLE OF #40 BS OR SMALLER DIAMETER ELEMENTS WELDED TO A RING OF 0.025 INCH DIAMETER PHOSPHOR BRONZE PLACED IN CONTACT WITH THE ENVELOPE. ENVELOPE TEMPERATURE REQUIREMENT WILL BE SATISFIED IF A TUBE, HAVING BOGEY Ib (±5%) UNDER NORMAL TEST CONDITIONS, IS DETERMINED TO OPERATE AT MAXIMUM SPECIFIED TEMPERATURE AT ANY POSITION ON THE LIFE TEST RACK.

5. IN A FULL-WAVE CIRCUIT, ADJUST Zp/p SO THAT A BOGEY TUBE GIVES Io = 55 mAdc. A BOGEY TUBE HAS A TUBE DROP Etd = 22 Vdc AT Is = 50 mAdc PER PLATE.

6. IN A FULL-WAVE TEST CIRCUIT, THE VALUES SPECIFIED FOR RL & CL MAY BE CONSIDERED APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE NOT LESS THAN Io =55 mAdc AND Ib =200 MA PER PLATE WITH A BOGEY TUBE. Ehk=Eo +117 Vac.

7. ALL TUBES SHALL BE TESTED FOR CONTINUITY OF ALL CIRCUITS, INCLUDING DUPLICATE PIN CONNECTIONS TO THE SAME ELECTRODE; FOR SHORTS BETWEEN ANY OF THE TUBE ELEMENTS OR BETWEEN THE ELEMENTS AND THE NO-CONNECTION BASE PINS; AND FOR AIR LEAKS.

   TESTS FOR SHORTS SHALL BE PERFORMED USING AN AUTOMATIC TAPPER DESIGNED AND ADJUSTED TO DELIVER AN IMPULSE OF APPROXIMATELY ONE-HALF SINE WAVE OF 300±50 μSEC DURATION (MEASURED 10% FROM THE BASE OF THE TUBE UNDER TEST) AND HAVING A PEAK ACCELERATION OF 85 G'S AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DC DEVICE CAPABLE OF DETECTING AS SHORTS INTERELEMENT RESISTANCES WHICH PERSIST FOR A PERIOD OF TIME IN EXCESS OF THAT DETERMINED BY A CURVE OF RESISTANCE VERSUS TIME DURATION PASSING THROUGH THE FOLLOWING POINTS: 600,000 OHMS – CONSTANT VALUE (PERMANENT SHORT); 500,000 OHMS – 500 μsec; 100,000 OHMS – 100 μsec; AND 1,000 OHMS – 60 μsec.

   THE TUBE UNDER TEST SHALL BE CONNECTED TO THE SHORTS TEST EQUIPMENT WITH ELEMENTS IN SEQUENCE FOR SINGLE SECTION TUBES BUT LIKE ELEMENTS IN THE SECTIONS OF A MULTISECTION TUBE MAY BE PARALLELED, PROVIDING THE MECHANICAL ASSEMBLY OF THE TUBE STRUCTURE IS SUCH THAT THE POSSIBILITY OF A SHORT DUE TO SECTION CROSS JUMPERS IS REMOTE.

   TUBES HAVING PERMANENT SHORTS, OPENS AND AIR LEAKS SHALL BE REJECTED ON THE FIRST TEST. IF REJECTED FOR TAP-SHORT OR OPEN OCCURS ON FIRST SERIES OF TAPS REPEAT TAPPING CYCLE THREE TIMES. REJECT TUBE AS INOPERABLE IF REJECT OCCURS AT ANY TIME DURING THE THREE REPEAT TEST, OTHERWISE ACCEPT.

8. FOR SURVIVAL RATE LIFE TEST THE SAMPLING AND TESTING SHALL BE AS SPECIFIED IN 20.2.5.2 TO 20.2.5.4 INCLUSIVE OF APP. C. WITH THE FOLLOWING EXCEPTIONS: 20.2.5.3 – REPLACE THE LAST SENTENCE WITH "IF SUCH SELECTION RESULTS IN A SAMPLE CONTAINING ONE OR MORE TUBES WHICH ARE DEFECTIVE WHEN TESTED UNDER CONDITIONS OF INITIAL SHORT AND CONTINUITY TEST (REF. NOTE 7) SUCH TUBES SHALL BE REPLACED BY RANDOMLY SELECTED GOOD TUBES." 20.2.5.4(6): REPLACE WITH "UPON COMPLETION OF 100 HOURS, THE TUBES SHALL AGAIN BE SUBJECTED TO THE SHORT AND CONTINUITY TEST (REF. NOTE 7).

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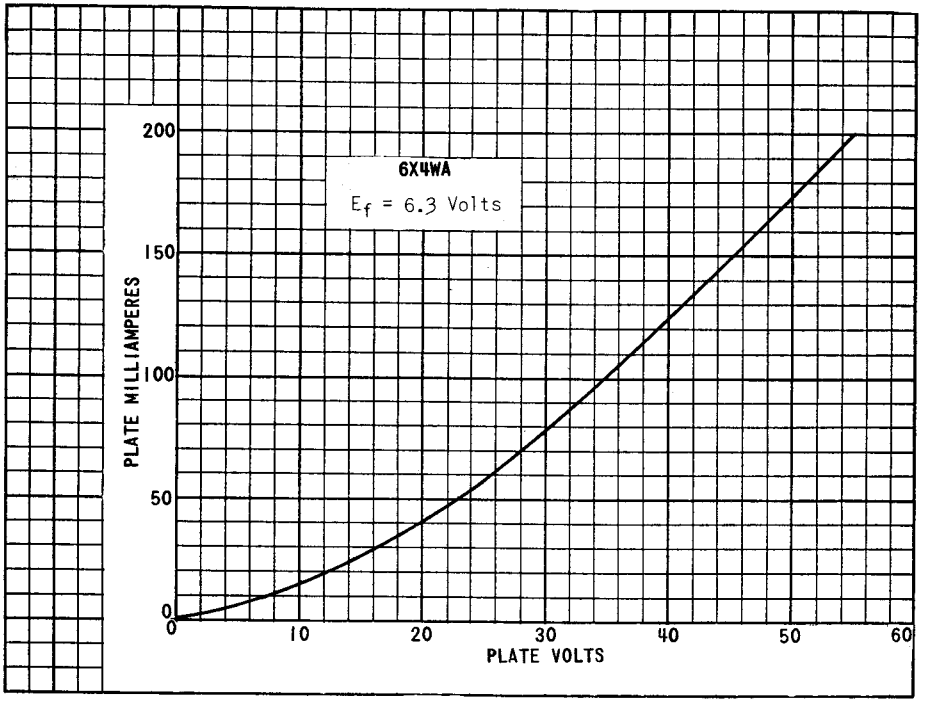
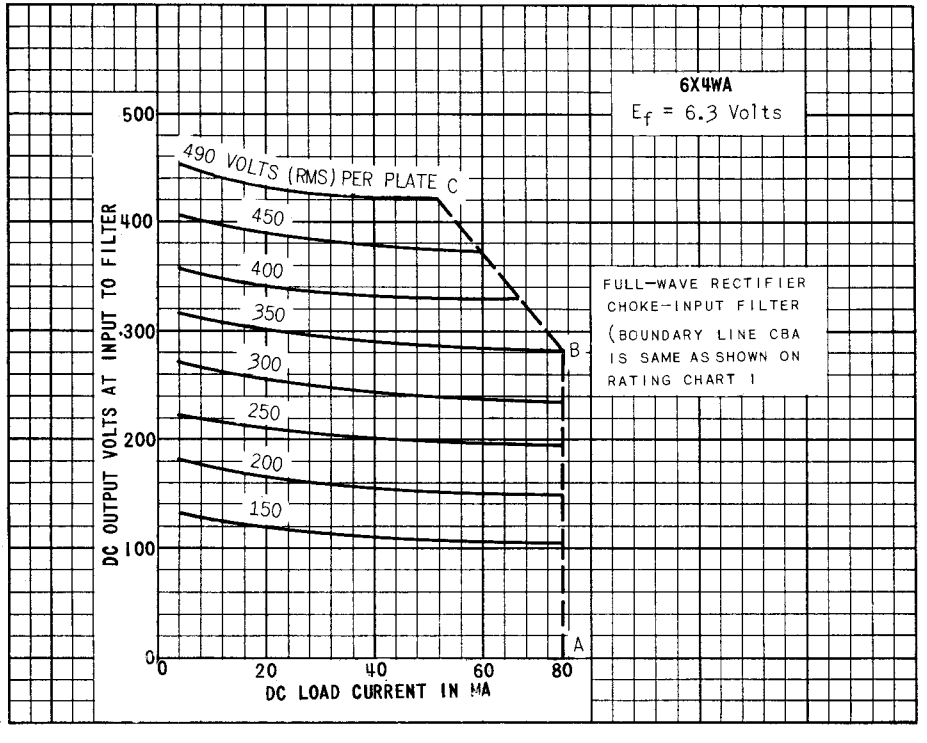
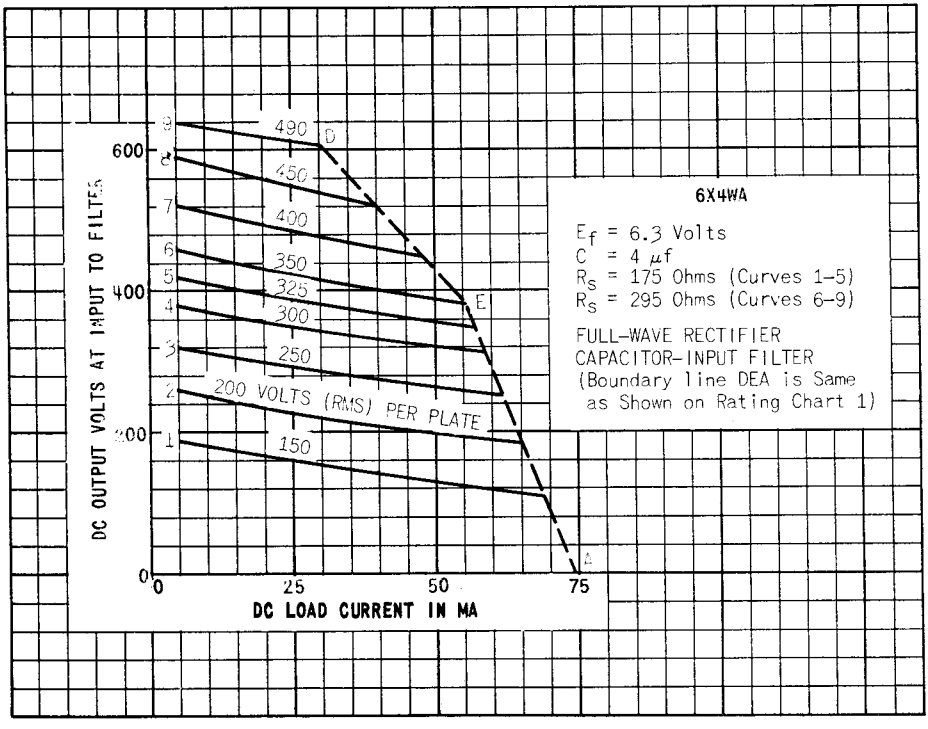
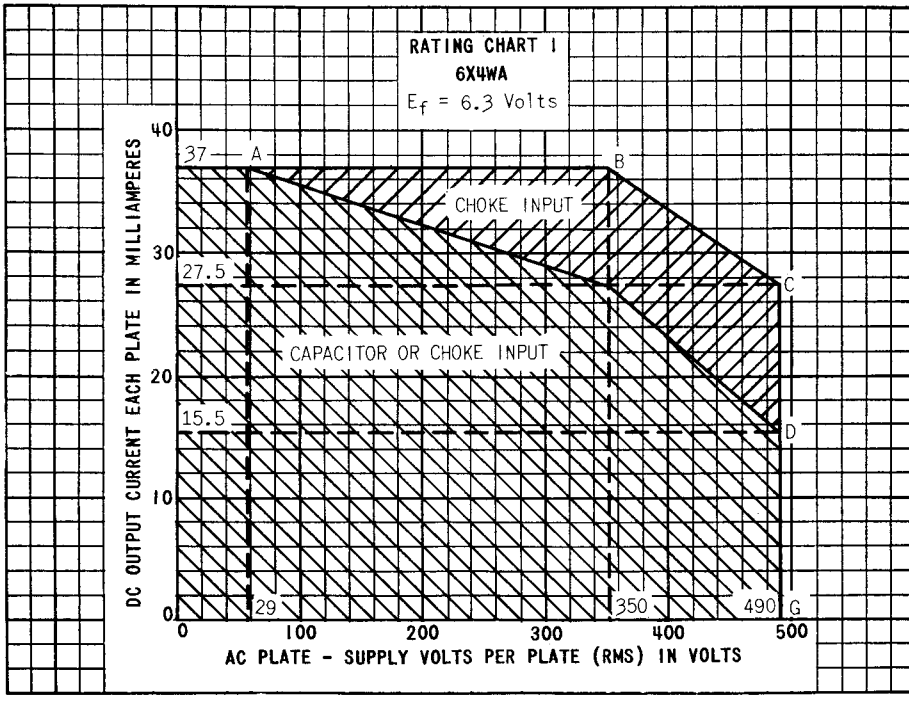
TENTATIVE DATA









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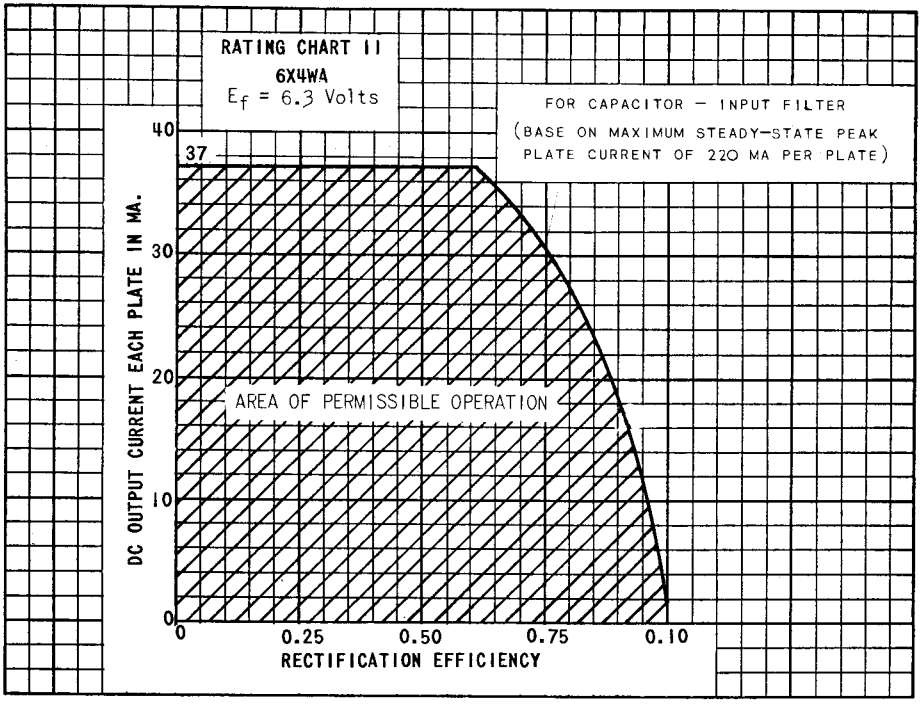

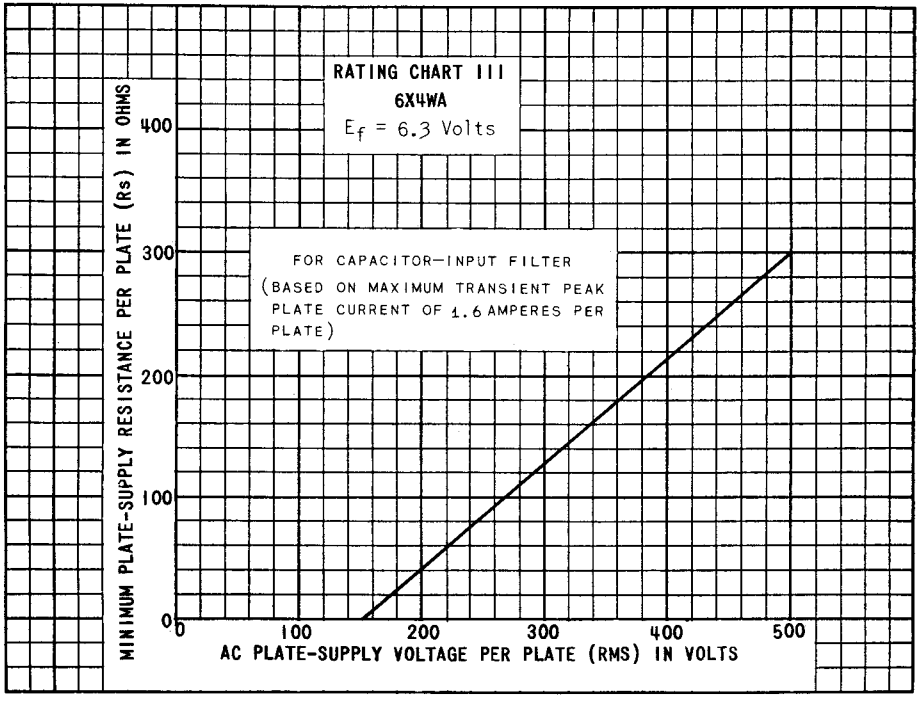

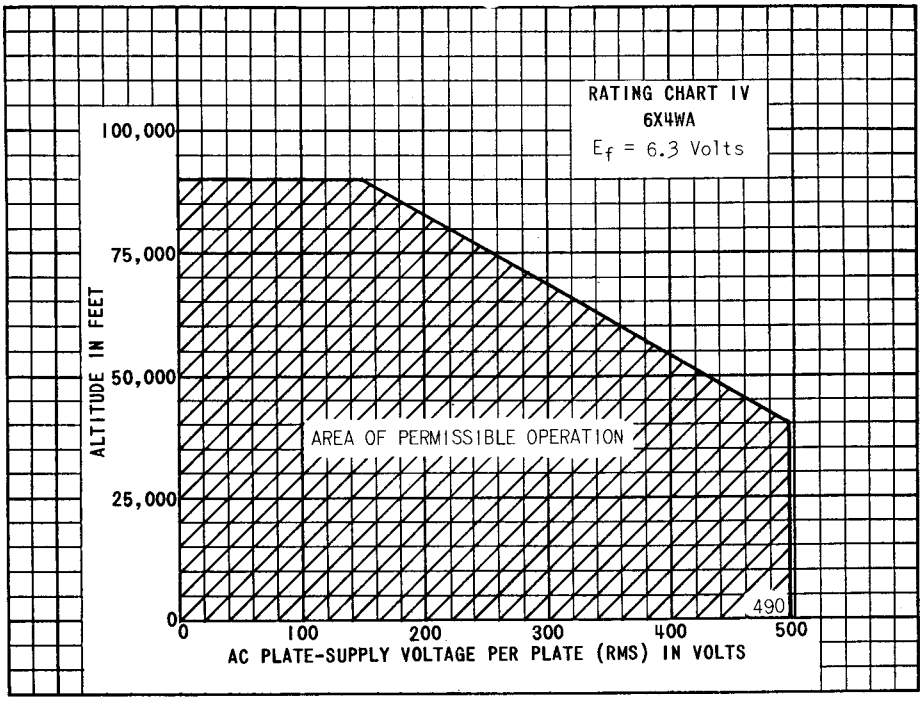

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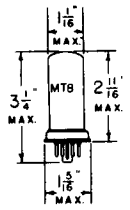
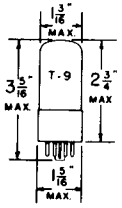


METAL SHELL
6 PIN OCTAL BASE
6X5

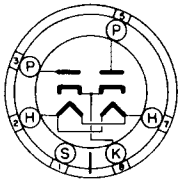
FULL WAVE
HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

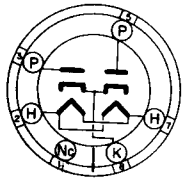
HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC



GLASS BULB
6 PIN OCTAL BASE
6X5GT/G



6S
BOTTOM VIEW
6X5



G-6S
BOTTOM VIEW
6X5GT/G

THE TUNG-SOL 6X5 AND 6X5GT/G ARE DESIGNED FOR SERVICE IN STORAGE BATTERY OR AC OPERATED RECEIVERS. THEIR CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM DC HEATER TO CATHODE POTENTIAL	450	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1250	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	210	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	325	VOLTS
DC OUTPUT CURRENT MAX.	70	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. [A]	150	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	70	MA.
VALUE OF INPUT CHOKE MIN.	8	HENRYS
TUBE VOLTAGE DROP AT 70 MA. PER PLATE	22	VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μFDS. ARE USED IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1008-2

APR. 21
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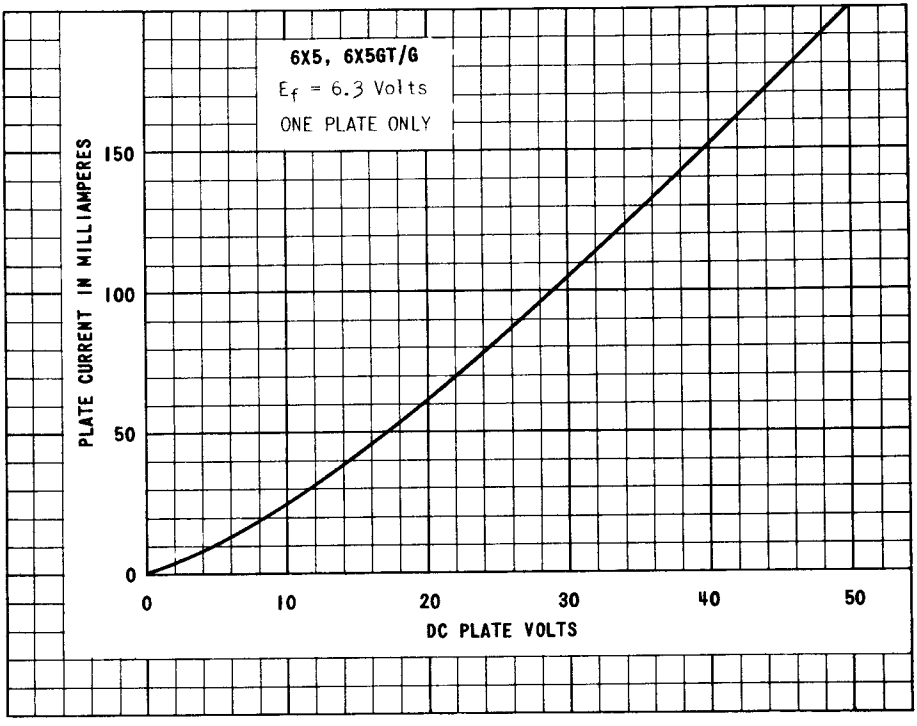
6X5 6X5GT/G



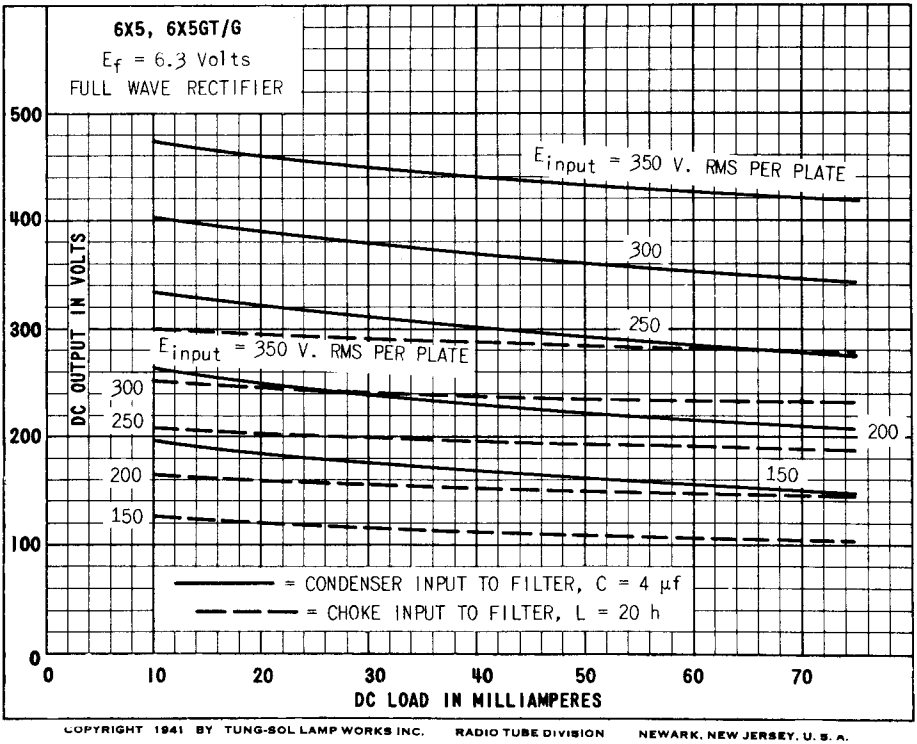


PLATE 1009-2

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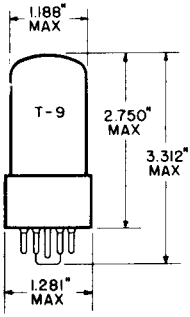
TUNG-SOL

FULL WAVE HIGH VACUUM RECTIFIER

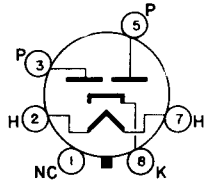


GLASS BULB
INTERMEDIATE SHELL
6 PIN OCTAL BASE E6-8
OUTLINE DRAWING
JEDEC 9-11

UNIPOTENTIAL CATHODE

FOR

RECTIFIER SERVICE IN
BATTERY OPERATED OR
AC RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6S

THE 6X5GT IS DESIGNED FOR SERVICE IN STORAGE BATTERY OR AC OPERATED RECEIVERS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		450	VOLTS
TOTAL DC AND PEAK		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE PLATE VOLTAGE		1250	VOLTS
STEADY-STATE PEAK PLATE CURRENT	(see rating chart 2)	245	MA.
TRANSIENT PEAK PLATE CURRENT PER PLATE	(see rating chart 3)	1.1	AMP.
DC OUTPUT CURRENT PER PLATE	(see rating chart 1)		
AC PLATE VOLTAGE PER PLATE (RMS):			
CAPACITOR INPUT	(see rating chart 1)		
CHOKE INPUT	(see rating chart 1)		
VIBRATOR OPERATION (MIN. DUTY CYCLE OF 75%):			
DC OUTPUT VOLTAGE AT FILTER INPUT		350	VOLTS
DC OUTPUT CURRENT PER PLATE		45	MA.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

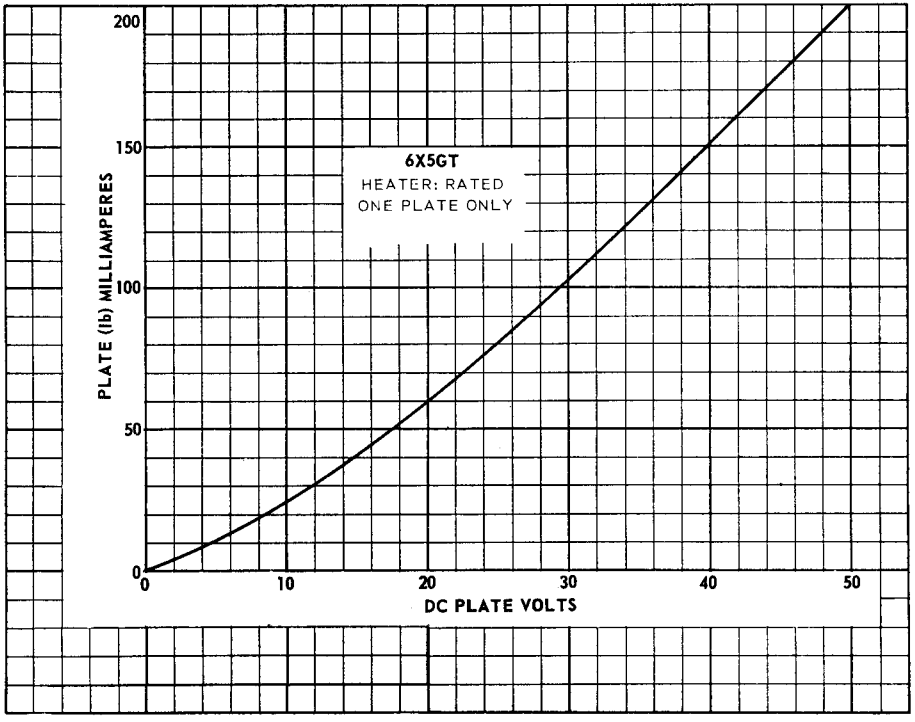
→ TYPICAL OPERATING CHARACTERISTICS

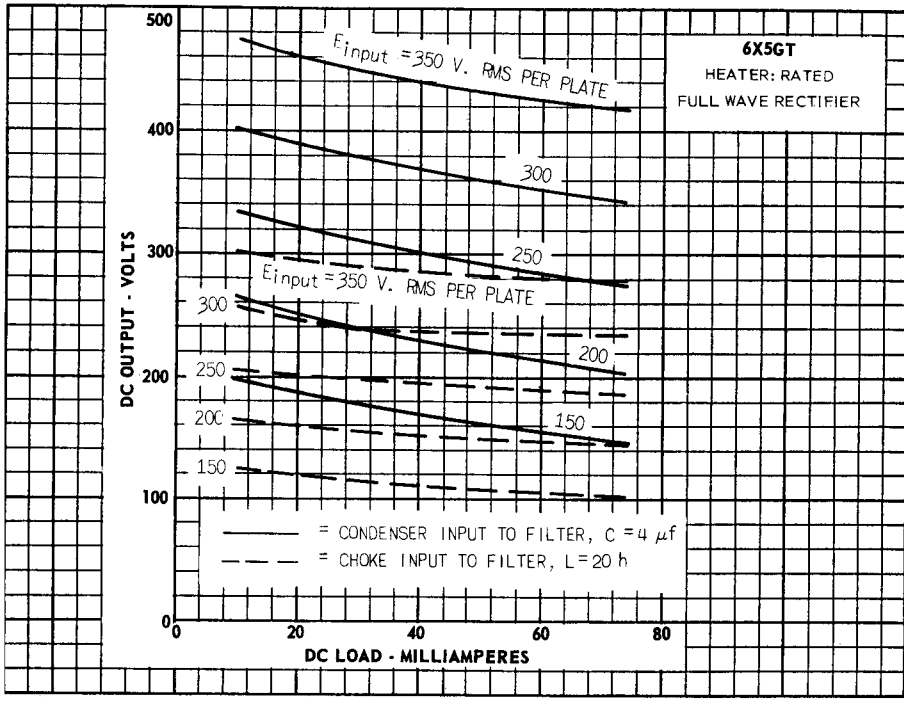
FULL-WAVE RECTIFIER

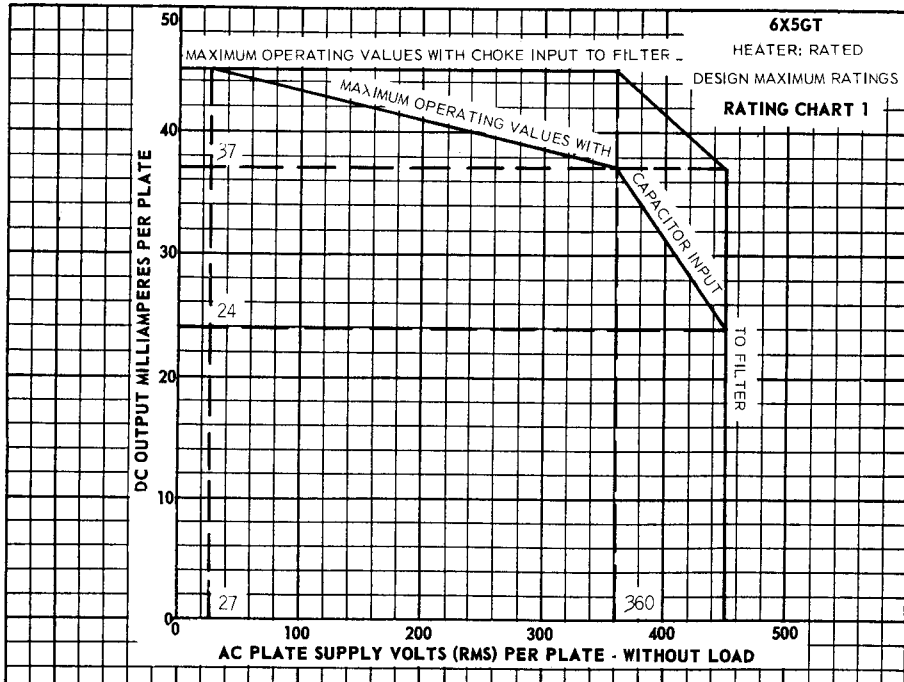
	SINE-WAVE OPERATION	VIBRATOR OPERATION	
CAPACITOR INPUT TO FILTER:			
AC PLATE VOLTAGE PER PLATE (RMS, NO LOAD)	325	----	VOLTS
INPUT CAPACITOR	10	10	μf
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	525	----	OHMS
DC OUTPUT CURRENT	70	70	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	310	240	VOLTS
CHOKE INPUT TO FILTER:			
AC PLATE VOLTAGE PER PLATE (RMS, NO LOAD)	400	----	VOLTS
INPUT CHOKE	10	----	HENRYS
DC OUTPUT CURRENT	70	----	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	340	----	VOLTS
TUBE VOLTAGE DROP AT 70 MA. PER PLATE	22	----	VOLTS

A
WHEN THE HEATER IS OPERATED IN AUTOMOTIVE SERVICE FROM A 6-VOLT BATTERY SOURCE, THE PERMISSIBLE RANGE IN HEATER VOLTAGE IS FROM 5.0 TO 8.0 VOLTS.

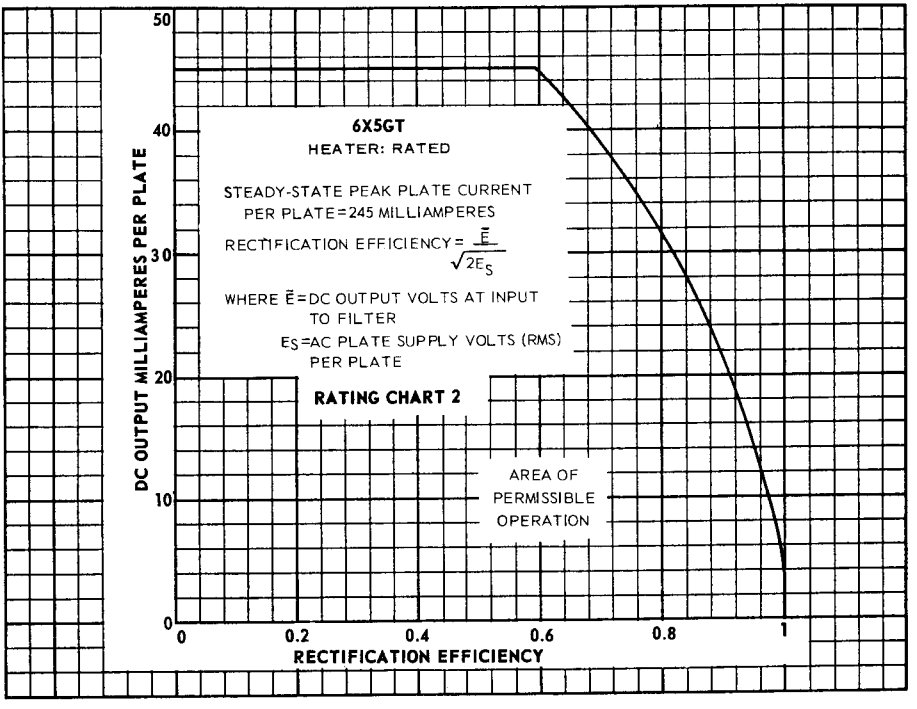
→ INDICATES A CHANGE.

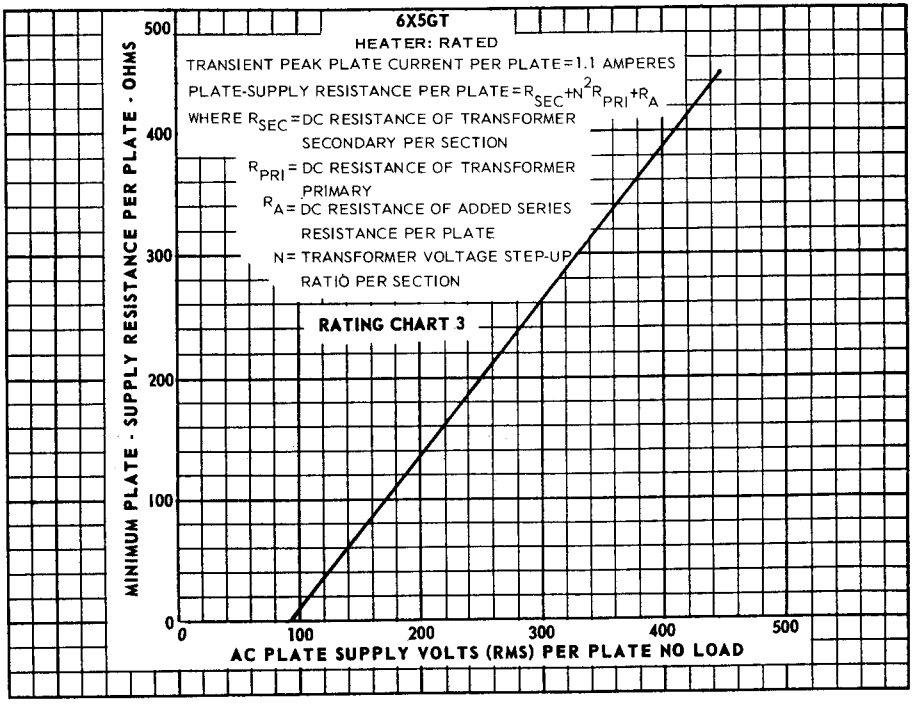



6X5GT
HEATER: RATED
FULL WAVE RECTIFIER
Einput = 350 V. RMS PER PLATE
300
250
Einput = 350 V. RMS PER PLATE
300
200
250
200
150
150
= CONDENSER INPUT TO FILTER, C = 4 μf
= CHOKE INPUT TO FILTER, L = 20 h
DC OUTPUT - VOLTS
DC LOAD - MILLIAMPERES
0
20
40
60
80
100
200
300
400
500


6X5GT
HEATER: RATED
DESIGN MAXIMUM RATINGS
RATING CHART 1
MAXIMUM OPERATING VALUES WITH CHOKE INPUT TO FILTER
MAXIMUM OPERATING VALUES WITH CAPACITOR INPUT TO FILTER
37
24
27
360
DC OUTPUT MILLIAMPERES PER PLATE
AC PLATE SUPPLY VOLTS (RMS) PER PLATE - WITHOUT LOAD
0
10
20
30
40
50
100
200
300
400
500

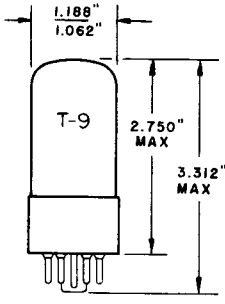
6X5GT


6X5GT
HEATER: RATED
STEADY-STATE PEAK PLATE CURRENT PER PLATE=245 MILLIAMPERES
RECTIFICATION EFFICIENCY = $\frac{\bar{E}}{\sqrt{2}E_S}$
WHERE $\bar{E}$=DC OUTPUT VOLTS AT INPUT TO FILTER
E_S=AC PLATE SUPPLY VOLTS (RMS) PER PLATE
RATING CHART 2
AREA OF PERMISSIBLE OPERATION
DC OUTPUT MILLIAMPERES PER PLATE
RECTIFICATION EFFICIENCY
0
10
20
30
40
50
0.2
0.4
0.6
0.8
1


6X5GT
HEATER: RATED
TRANSIENT PEAK PLATE CURRENT PER PLATE=1.1 AMPERES
PLATE-SUPPLY RESISTANCE PER PLATE=$R_{SEC}+N^2R_{PRI}+R_A$
WHERE R_{SEC}=DC RESISTANCE OF TRANSFORMER SECONDARY PER SECTION
R_{PRI}=DC RESISTANCE OF TRANSFORMER PRIMARY
R_A=DC RESISTANCE OF ADDED SERIES RESISTANCE PER PLATE
N=TRANSFORMER VOLTAGE STEP-UP RATIO PER SECTION
RATING CHART 3
MINIMUM PLATE-SUPPLY RESISTANCE PER PLATE - OHMS
AC PLATE SUPPLY VOLTS (RMS) PER PLATE NO LOAD
0
100
200
300
400
500

TUNG-SOL

TWIN DIODE



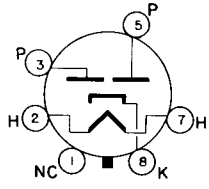
GLASS BULB

INTERMEDIATE SHELL
6 PIN OCTAL B6-8
LOW LOSS PHENOLIC
OUTLINE DRAWING
JEDEC 9-11

FULL - WAVE RECTIFIER

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6S

THE 6X5WGT IS A CATHODE TYPE FULL-WAVE RECTIFIER EMPLOYING A T-9 ENVELOPE WITH A LOW LOSS OCTAL BASE. IT IS DESIGNED FOR USE IN APPLICATIONS WHERE SEVERE CONDITIONS OF VIBRATION AND SHOCK ARE ENCOUNTERED.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	600	MA.
LIMITS OF APPLIED CURRENT			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			±450	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE VOLTAGE	1,375	VOLTS
STEADY-STATE PEAK PLATE CURRENT (EACH PLATE)	230	MA.
TRANSIENT PEAK PLATE CURRENT (EACH PLATE)	750	MA.
OUTPUT CURRENT (DC) (TOTAL)	75	MA.

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION
VIBRATIONAL ACCELERATION FOR EXTENDED PERIODS
MECHANICAL RESONANCE
ALTITUDE RATING

CONTINUED ON FOLLOWING PAGE

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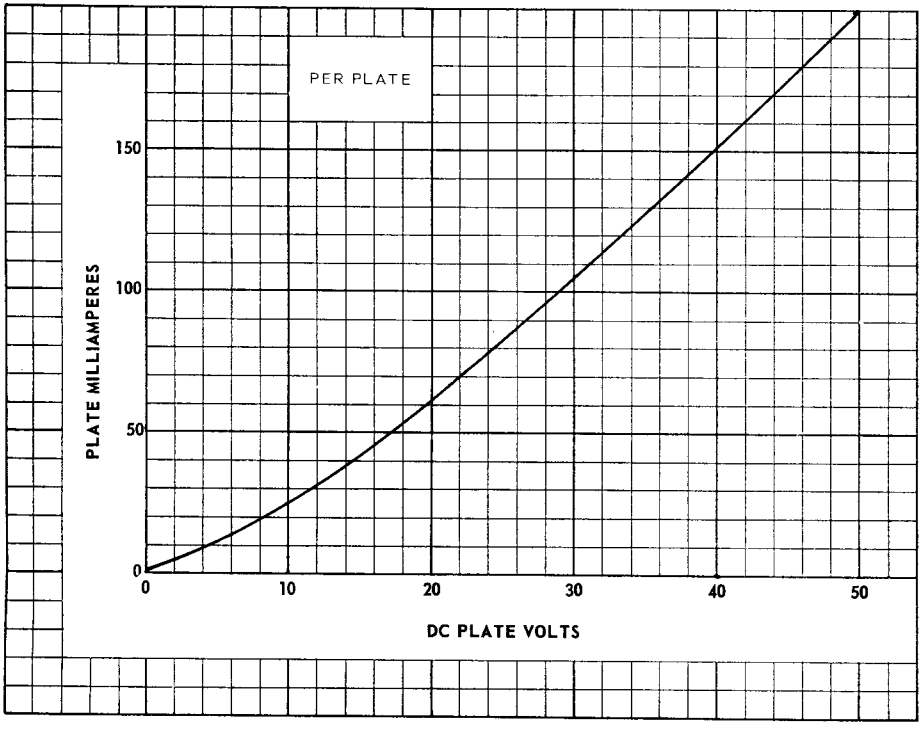
CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE (AC) PER PLATE	325	450	VOLTS RMS
FILTER INPUT CAPACITOR	8	-----	μf
FILTER INPUT CHOKE (MIN.)	-----	10	HENRIES
EFFECTIVE PLATE SUPPLY IMPEDANCE [A] EACH PLATE	150	-----	OHMS
OUTPUT CURRENT (DC)	70	70	MA.
TUBE VOLTAGE DROP @ 70 mADC PER PLATE		22	VOLTS

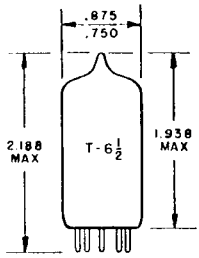
A
WHEN FILTER CONDENSERS LARGER THAN 40 μF ARE USED, IT MAY BE NECESSARY TO INCREASE THE SPECIFIED VALUE OF PLATE SUPPLY IMPEDANCE.



TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

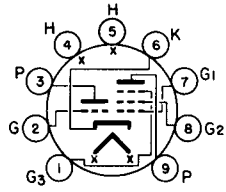
FOR

USE AS A COMBINED OSCILLATOR

AND MIXER TUBE IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AK

THE 6X8 AND 6X8A ARE MULTI-UNIT TUBES USING THE 9 PIN MINIATURE CONSTRUCTION. THEY CONTAIN A MEDIUM-MU TRIODE AND A SHARP-CUTOFF PENTODE IN ONE ENVELOPE. THEY ARE DESIGNED PRIMARILY FOR USE AS COMBINED OSCILLATORS AND MIXER TUBES IN TELEVISION RECEIVERS UTILIZING AN INTERMEDIATE FREQUENCY IN THE ORDER OF 40 MC. THEY ARE ESPECIALLY SUITABLE FOR USE IN AM/FM RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER OF THE 6X8A ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

		WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE: (PG1 TO PP)	MAX.	0.06	0.09	pf
PENTODE INPUT: PG1 TO (H+K+PG2+PG3)		→ 4.8	→ 4.6	pf
PENTODE OUTPUT: PP TO (H+K+PG2+PG3)		→ 1.6	→ 0.9	pf
CATHODE TO HEATER: (K TO H)		→ 6.5[B]	→ 6.5	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)		→ 1.5	→ 1.5	pf
TRIODE INPUT: TG TO (H+K)		→ 2.4	→ 2.0	pf
TRIODE OUTPUT: TP TO (H+K)		1.0	0.5	pf
PENTODE GRID 1 TO TRIODE PLATE (PG1 TO TP)	MAX.	→ 0.04	→ 0.05	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP)	MAX.	→ 0.008	→ 0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
HEATER WARM-UP TIME[C] (FOR 6X8A ONLY)			11	SECONDS
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT (6X8A ONLY)			600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			→ 200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			→ 100	VOLTS
TOTAL DC AND PEAK			→ 200	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PENTODE PLATE VOLTAGE	275	VOLTS
TRIODE PLATE VOLTAGE	275	VOLTS
GRID 2 SUPPLY VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
PENTODE PLATE DISSIPATION	2.3	WATTS
TRIODE PLATE DISSIPATION	1.7	WATTS
GRID 2 DISSIPATION - UP TO 138 VOLTS	0.45	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
POSITIVE DC TRIODE GRID VOLTAGE	0	VOLTS

→TYPICAL OPERATING CHARACTERISTICS

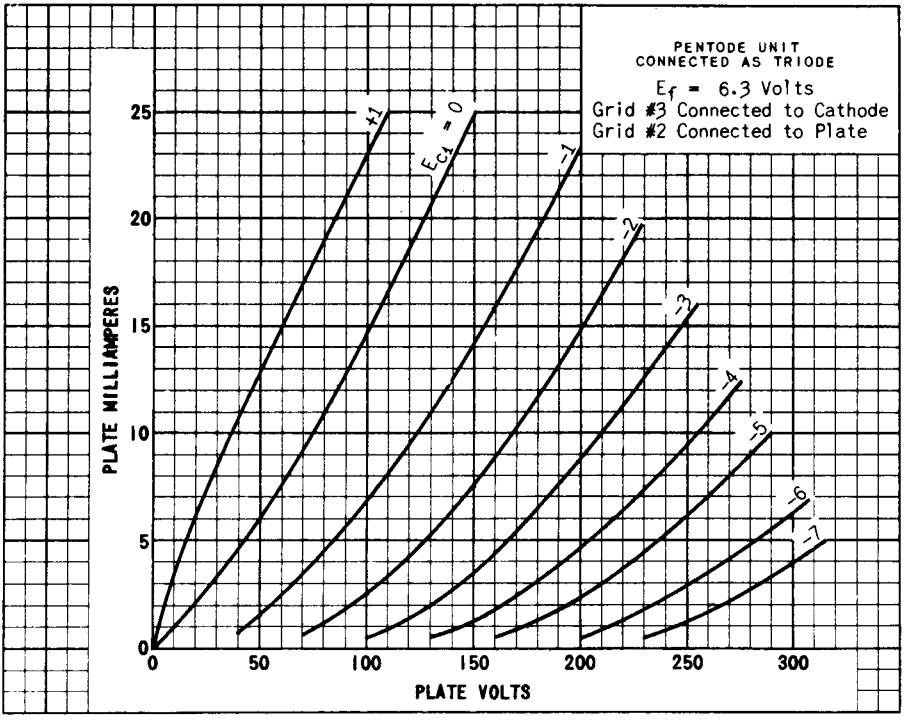
CLASS A1 AMPLIFIER

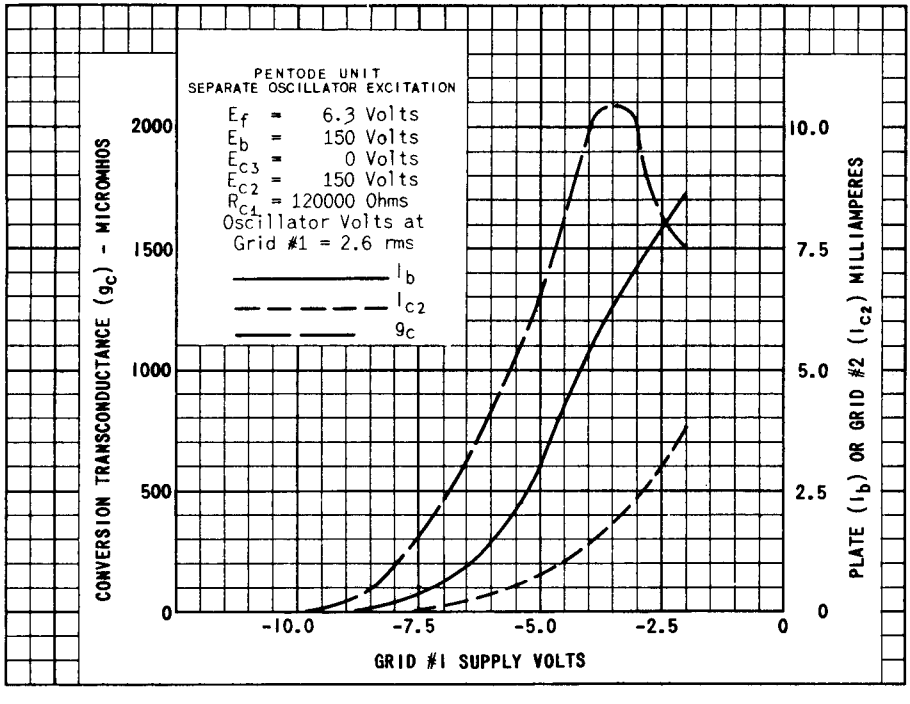
		TRIODE	PENTODE	
PLATE VOLTAGE		125	125	VOLTS
GRID 3 VOLTAGE	CONNECTED TO PIN 6 AT SOCKET			
GRID 2 VOLTAGE		-----	125	VOLTS
GRID 1 VOLTAGE		-1.0	-1.0	VOLTS
PLATE CURRENT		12.0	9.0	MA.
GRID 2 CURRENT		-----	2.2	MA.
TRANSCONDUCTANCE		6,500	5,500	μMHOS
PLATE RESISTANCE	APPROX.	6,000	300,000	OHMS
AMPLIFICATION FACTOR		40	-----	
GRID 1 VOLTAGE APPROX. FOR Ib = 20 μA.		-7	-6.5	VOLTS
ZERO BIAS TRANSCONDUCTANCE WITH Eb = 100 V; Ec2 = 70 V.		-----	5,700	μMHOS

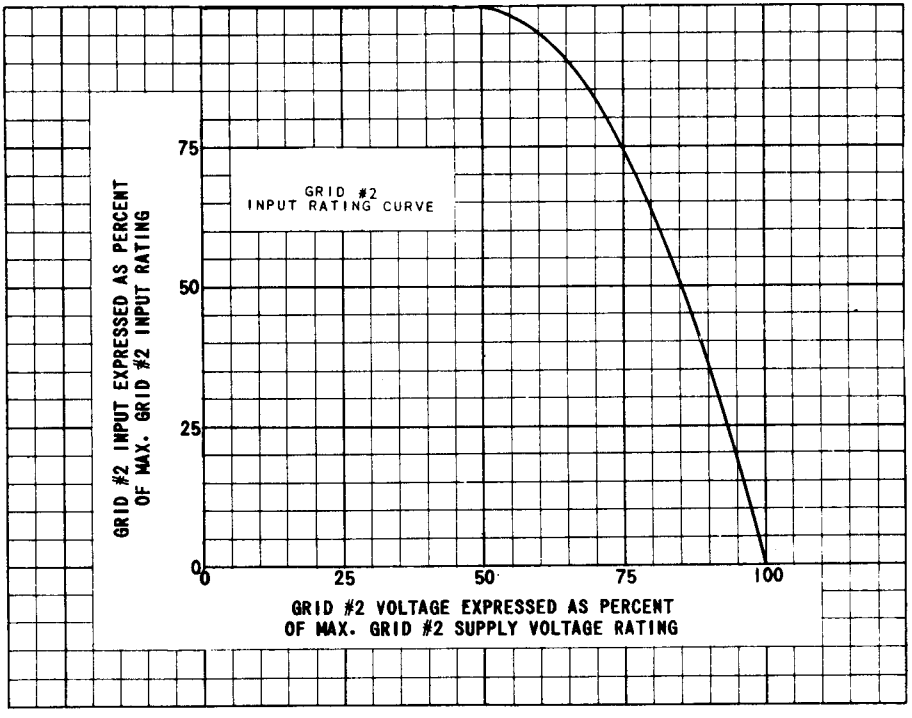
A
EXTERNAL SHIELD 315 CONNECTED TO PIN 6.

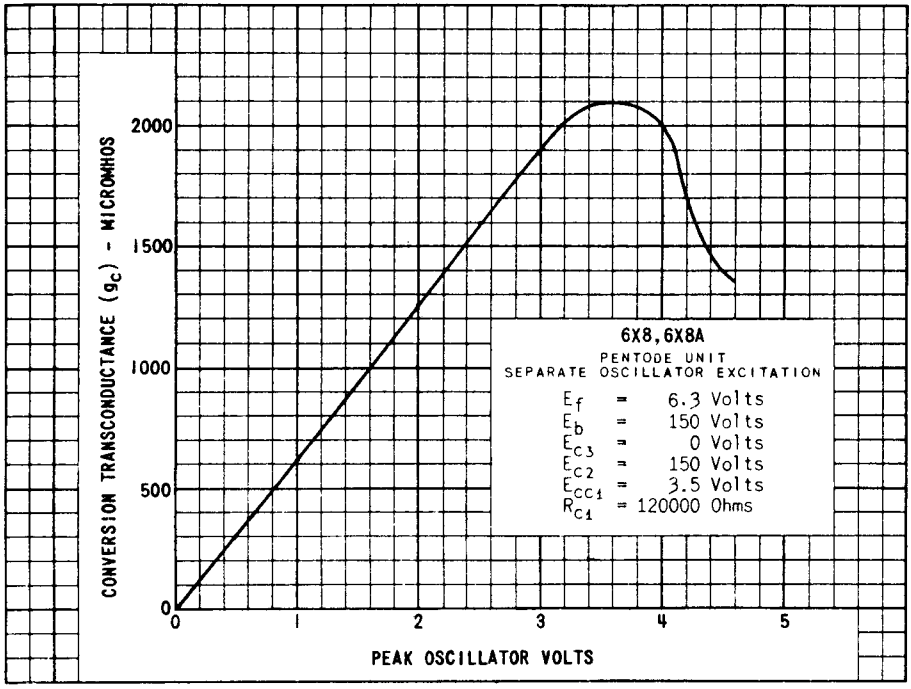
B
EXTERNAL SHIELD 315 CONNECTED TO PIN 9.

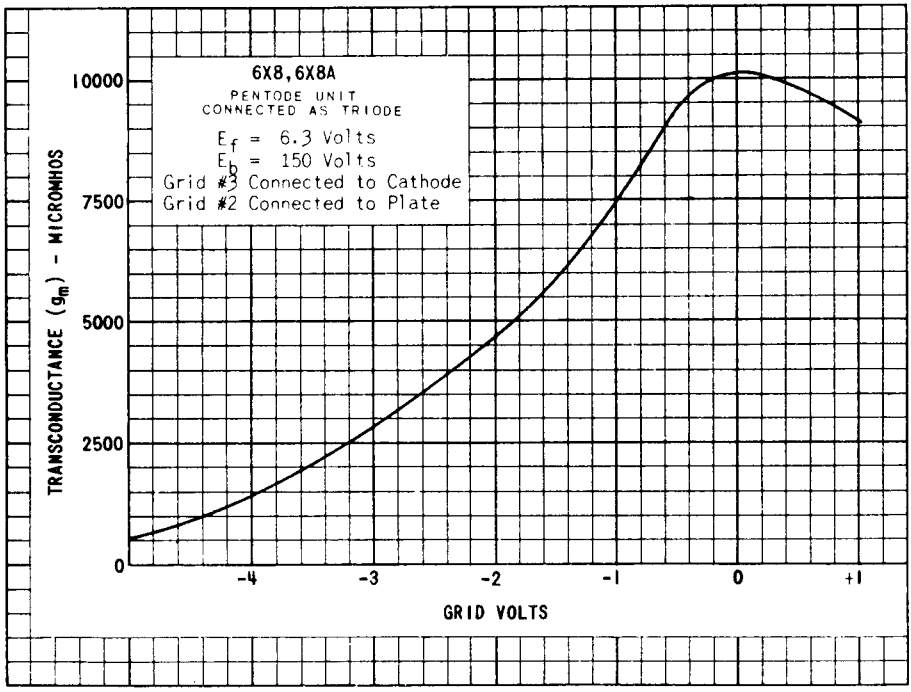
C
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

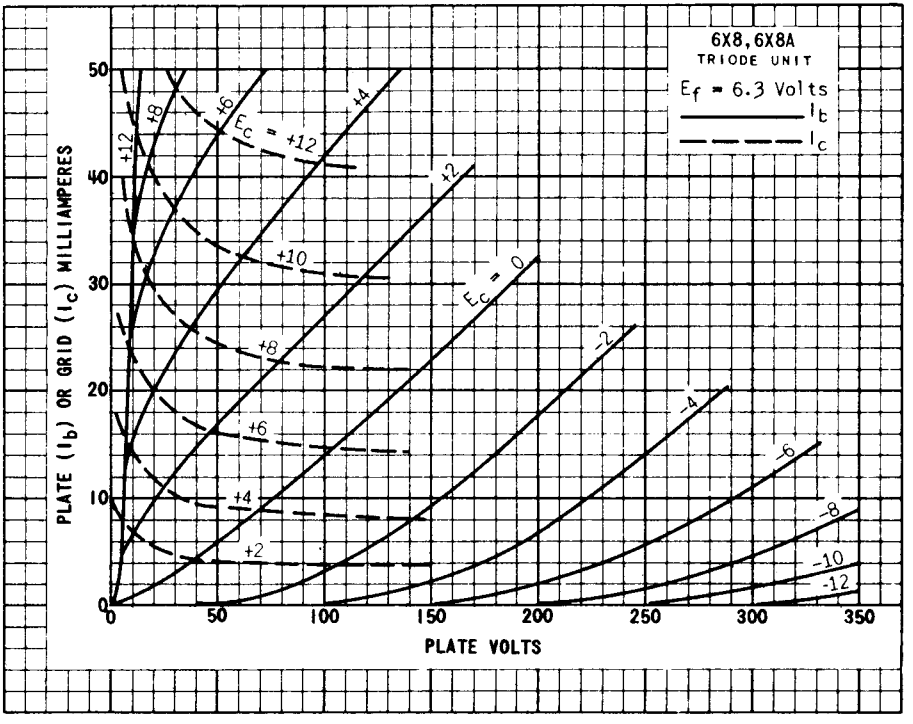

PENTODE UNIT
CONNECTED AS TRIODE
E_f = 6.3 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate
PLATE MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
+1
-1
-2
-3
-4
-5
-6
-7
0
5
10
15
20
25
50
100
150
200
250
300

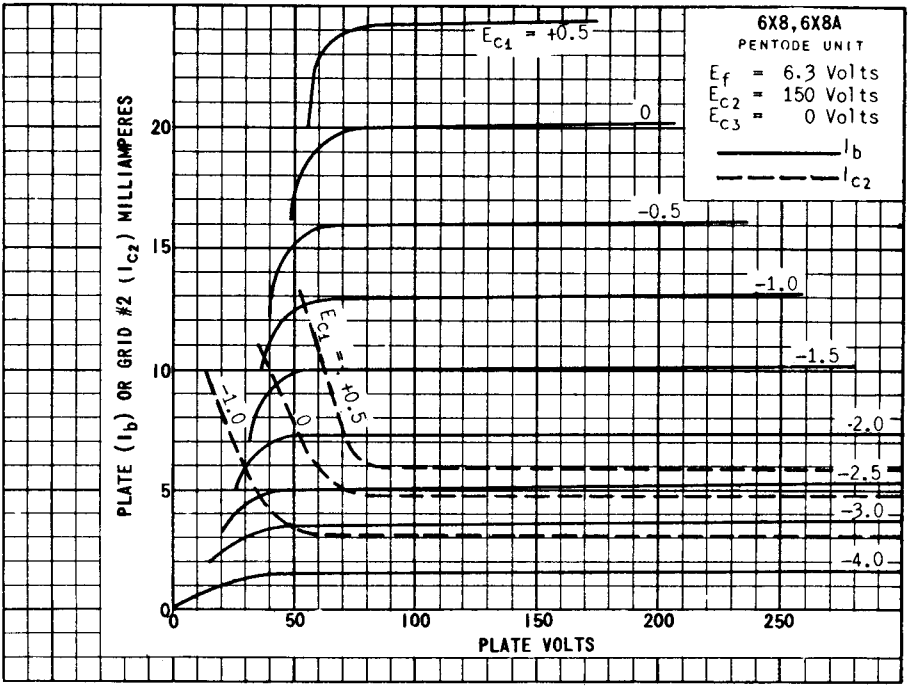

PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
R_{c1} = 120000 Ohms
Oscillator Volts at
Grid #1 = 2.6 rms
I_b
I_{c2}
g_c
CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 SUPPLY VOLTS
0
500
1000
1500
2000
2.5
5.0
7.5
10.0
-10.0
-7.5
-5.0
-2.5
0


GRID #2
INPUT RATING CURVE
GRID #2 INPUT EXPRESSED AS PERCENT
OF MAX. GRID #2 INPUT RATING
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT
OF MAX. GRID #2 SUPPLY VOLTAGE RATING

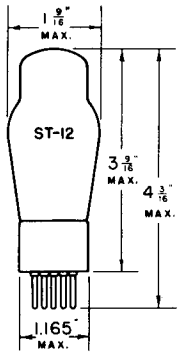

CONVERSION TRANSCONDUCTANCE (g_c) - MICROMHOS
2000
1500
1000
500
0
0
1
2
3
4
5
PEAK OSCILLATOR VOLTS
6X8, 6X8A
PENTODE UNIT
SEPARATE OSCILLATOR EXCITATION
E_f = 6.3 Volts
E_b = 150 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
E_{cc_1} = 3.5 Volts
R_{c_1} = 120000 Ohms


TRANSCONDUCTANCE (g_m) - MICROMHOS
10000
7500
5000
2500
0
-4
-3
-2
-1
0
+1
GRID VOLTS
6X8, 6X8A
PENTODE UNIT
CONNECTED AS TRIODE
E_f = 6.3 Volts
E_b = 150 Volts
Grid #3 Connected to Cathode
Grid #2 Connected to Plate


6X8, 6X8A
TRIODE UNIT
E_f = 6.3 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
E_c = +12
+8
+6
+4
+2
0
-2
-4
-6
-8
-10
-12
0
10
20
30
40
50
0
50
100
150
200
250
300
350


6X8, 6X8A
PENTODE UNIT
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = +0.5
0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-4.0
0
5
10
15
20
0
50
100
150
200
250

TUNG-SOL



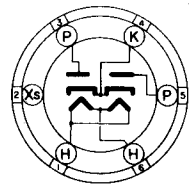
FULL-WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.80 AMPERE
AC OR DC

GLASS BULB



6J

BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 6Y5 IS A HEATER TYPE HIGH VACUUM FULL-WAVE RECTIFIER, WHICH IS DESIGNED FOR USE IN STORAGE BATTERY OR AC OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER – CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	350	VOLTS
DC OUTPUT CURRENT MAX.	50	MA.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 901-1

NOV. 8 1940

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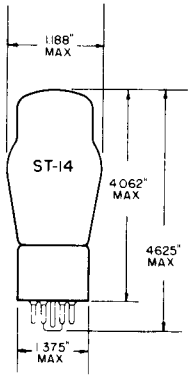
TUNG-SOL

BEAM POWER AMPLIFIER

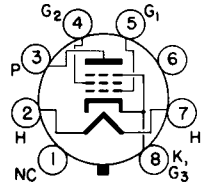


GLASS BULB
MEDIUM SHELL
7 PIN OCTAL 87-12
JEDEC 14-3

COATED UNIPOTENTICAL CATHODE

FOR AUDIO OUTPUT STAGES
OF RADIO RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7AC

THE 6Y6G IS A BEAM POWER AMPLIFIER HAVING HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW DC SUPPLY VOLTAGES.

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1250	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:*			
HEATER NEGATIVE WITH RESPECT TO CATHODE		180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		180	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID #2 SUPPLY VOLTAGE	→ 200	VOLTS
GRID #2 VOLTAGE *	SEE J5-C4	
PLATE DISSIPATION	12.5	WATTS
GRID #2 DISSIPATION	1.75	WATTS
GRID #1 CIRCUIT RESISTANCE *		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM

→INDICATES A CHANGE.

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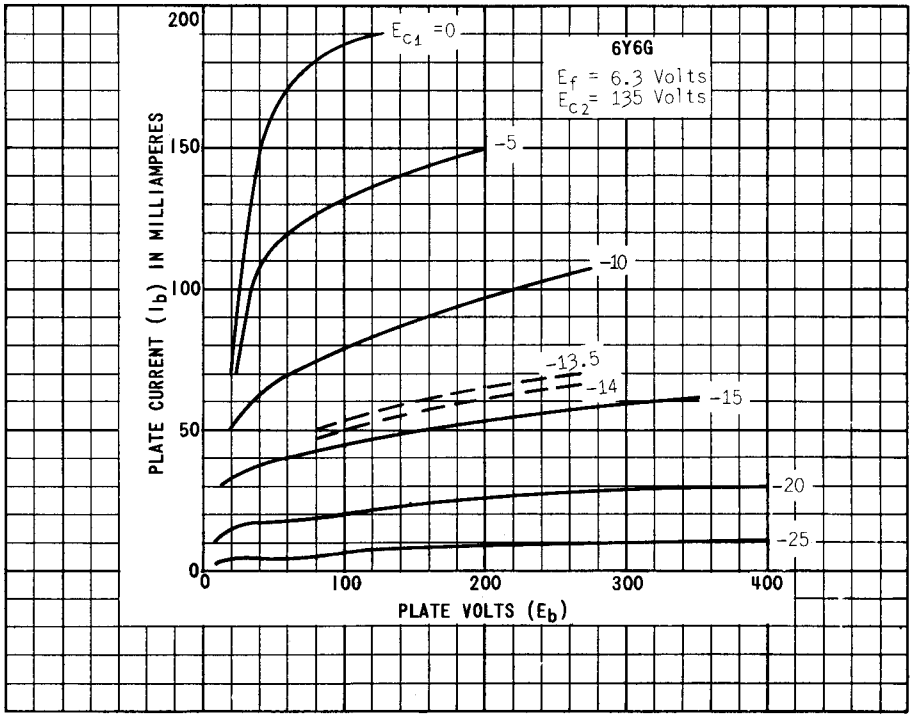
TUNG-SOL

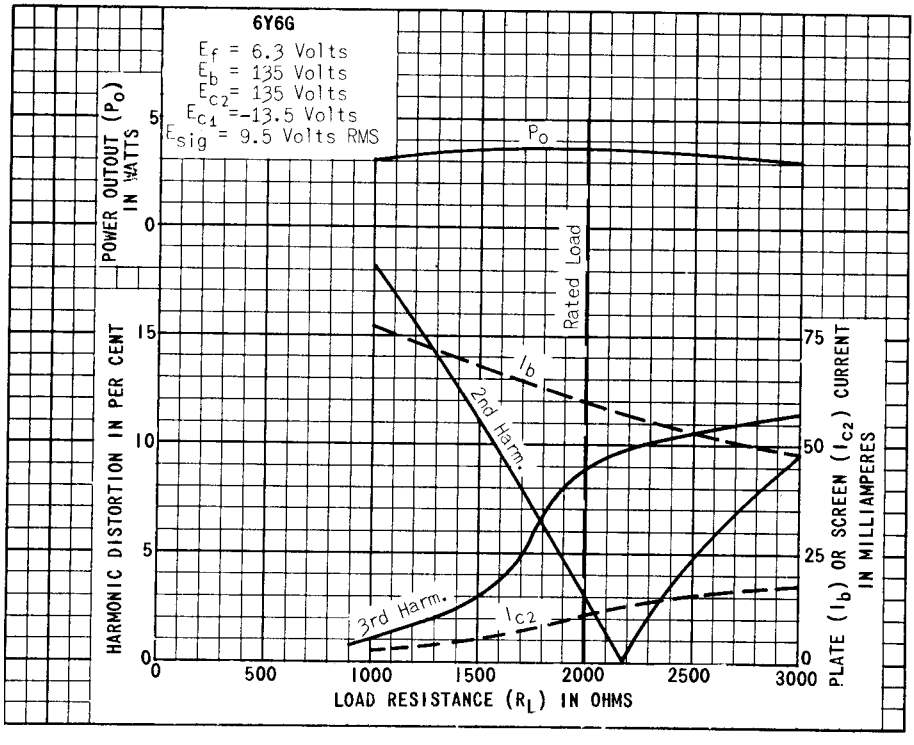
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	135	200	VOLTS
GRID #2 VOLTAGE	135	135	VOLTS
GRID #1 VOLTAGE	-13.5	-14	VOLTS
PEAK AF GRID #1 VOLTAGE	13.5	14	VOLTS
PLATE RESISTANCE (APPROX.)	9300	18 300	OHMS
TRANSCONDUCTANCE	7000	7100	μMHOS
ZERO-SIGNAL PLATE CURRENT	58	61	MA.
MAXIMUM-SIGNAL PLATE CURRENT	60	66	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	11.5	9	MA.
LOAD RESISTANCE	2000	2600	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	3.6	6	WATTS





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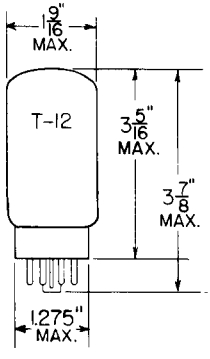
TUNG-SOL

BEAM PENTODE

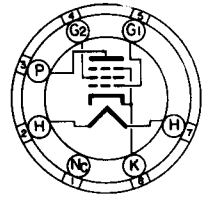


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.25 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
7S

THE 6Y6GA IS A BEAM POWER AMPLIFIER HAVING HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW DC SUPPLY VOLTAGES. EXCEPT FOR ITS T-12 ENVELOPE THE 6Y6GA IS IDENTICAL TO THE 6Y6G.

DIRECT INTERELECTRODE CAPACITANCES *

GRID #1 TO PLATE	0.7	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE		SEE J5-C4
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

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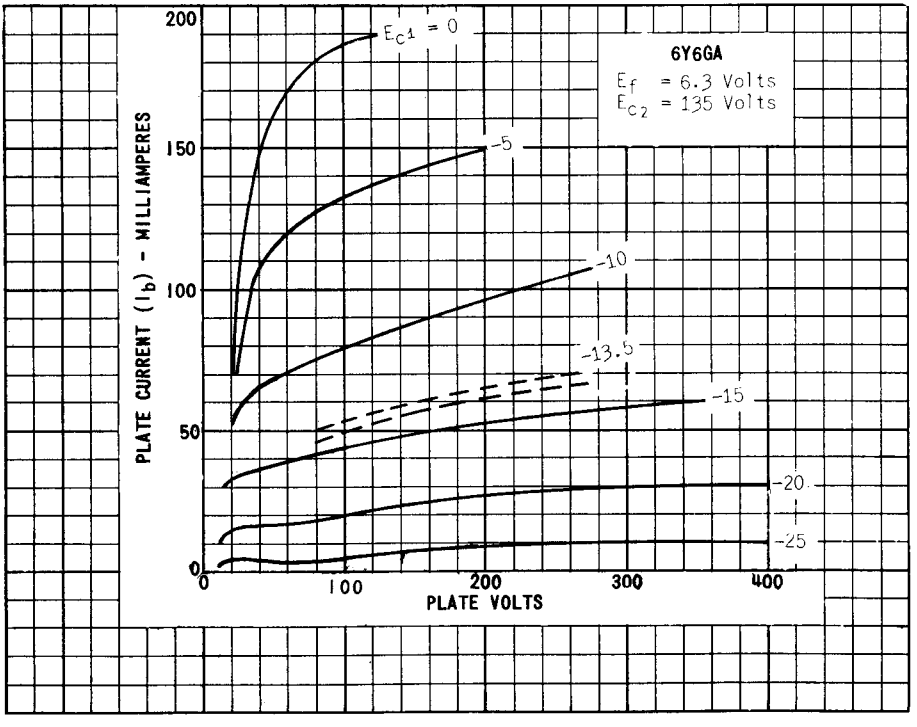
TUNG-SOL

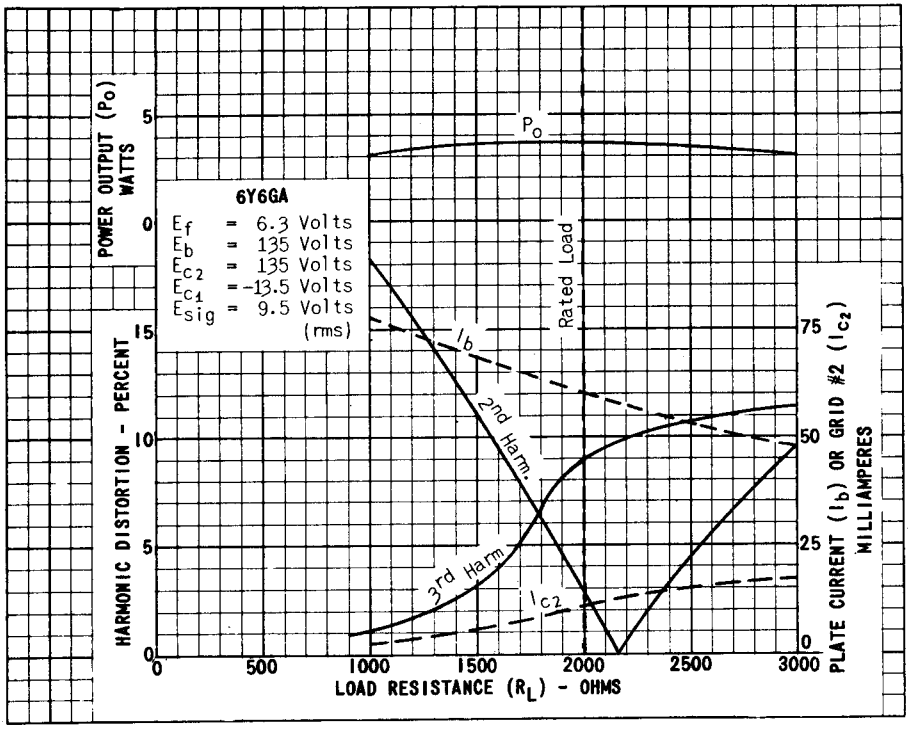
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

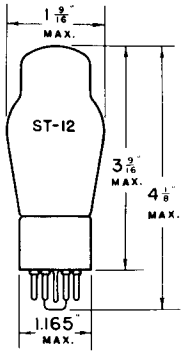
CLASS A_1 AMPLIFIER

			VOLTS
			AMP.
PLATE VOLTAGE	135	200	VOLTS
GRID #2 VOLTAGE	135	135	VOLTS
GRID #1 VOLTAGE	-13.5	-14	VOLTS
PEAK AF GRID #1 VOLTAGE	13.5	14	VOLTS
ZERO SIGNAL PLATE CURRENT	58	61	MA.
MAXIMUM SIGNAL PLATE CURRENT	60	66	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11.5	9	MA.
TRANSCONDUCTANCE	7 000	7 100	μMHOS
PLATE RESISTANCE (APPROX.)	9 300	18 300	OHMS
LOAD RESISTANCE	2 000	2 600	OHMS
MAXIMUM SIGNAL POWER OUTPUT	3.6	6	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT




6Y6GA
E_f = 6.3 Volts
E_b = 135 Volts
E_{c2} = 135 Volts
E_{c1} = -13.5 Volts
E_{sig} = 9.5 Volts (rms)
P_o
Rated Load
I_b
2nd Harm.
3rd Harm.
I_{c2}
POWER OUTPUT (P_o) WATTS
HARMONIC DISTORTION - PERCENT
PLATE CURRENT (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
LOAD RESISTANCE (R_L) - OHMS
0
500
1000
1500
2000
2500
3000
5
0
15
10
5
0
75
50
25
0

TUNG-SOL

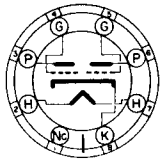


TWIN TRIODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

GLASS BULB



G-8B

SMALL 8 PIN OCTAL BASE

THE TUNG-SOL 6Y7G IS A TWIN TRIODE DESIGNED PRIMARILY FOR SERVICE AS A CLASS B POWER AMPLIFIER, VOLTAGE AMPLIFIER OR PHASE INVERTER. WITH THE EXCEPTION OF CAPACITANCES ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 79.

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE MAX.	250	VOLTS
PEAK PLATE CURRENT PER PLATE MAX.	90	MA.
AVERAGE PLATE DISSIPATION MAX.	11.5	WATTS

CLASS B_2 AMPLIFIER

PLATE VOLTAGE	180	250 MAX.	VOLTS
GRID BIAS	0	0	VOLTS
ZERO-SIGNAL PLATE CURRENT PER PLATE	3.8	5.3	MA.
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	7000	14000	OHMS
AVERAGE POWER INPUT GRID TO GRID	380	380	MILLIWATTS
POWER OUTPUT APPROX.	5.5	8.0	WATTS

RESISTANCE COUPLED AMPLIFIER AND PHASE INVERTER

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.1	0.5	0.1	0.5	MEGOHM
CATHODE RESISTOR	2000	6000	1200	3000	OHMS
VOLTAGE GAIN	30	35	35	43	

DIRECT INTERELECTRODE CAPACITANCES[S]

	TRIODE 2		TRIODE 1	
GRID TO CATHODE	3.6		3.6	μμf
PLATE TO CATHODE	4.6		4.6	μμf
GRID TO PLATE	2.6		2.6	μμf
GRID 1 TO GRID 2		0.3		μμf
PLATE 1 TO PLATE 2		1.7		μμf
GRID 1 TO PLATE 2		0.12		μμf
GRID 2 TO PLATE 1		0.12		μμf

TRIODE 2 IS TRIODE HAVING GRID BROUGHT OUT TO PIN #4.
TRIODE 1 IS TRIODE HAVING GRID BROUGHT OUT TO PIN #5.
[S] WITH SHIELD

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PLATE 348-2

MARCH 6 1939

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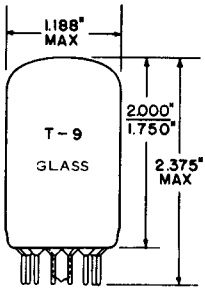
TUNG-SOL

DUAL PENTODE

COMPACTRON

OUTLINE
JEDEC 9-58

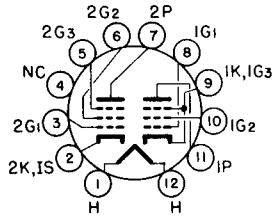


BASE 12 PIN BUTTON
JEDEC E12-70

FOR
FM DETECTOR
AND AUDIO APPLICATION
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSTION

BASING DIAGRAM
JEDEC 12EZ



BOTTOM VIEW

THE TUNG-SOL 6Y10 IS A 12-PIN T-9 COMPACTRON CONTAINING TWO DISSIMILAR PENTODES. SECTION 1 IS A POWER PENTODE FOR AUDIO APPLICATION. SECTION 2 IS A DUAL CONTROL PENTODE INTENDED FOR USE AS FM DETECTOR IN TV CIRCUITS. ELECTRICALLY, SECTION 1 IS SIMILAR TO TYPE 6GZ5, SECTION 2 IS SIMILAR TO TYPE 6GX6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE 1 - GRID 1 TO PLATE	0.24	pf
INPUT: (G1 TO H + K + I.S. + G_2)	7.5	pf
OUTPUT: (P TO H + K + I.S. + G_2)	6.0	pf
PENTODE 2 - GRID 1 TO PLATE	0.022	pf
GRID 1 TO ALL (G1 TO H + K + I.S. + G_2 + G_3 + P)	7.5	pf
GRID 3 TO PLATE	1.5	pf
GRID 3 TO ALL (G to H + K + I.S. + G_1 + G_2 + P)	6.5	pf
GRID 1 TO GRID 3	0.15	pf
COUPLING - PLATE TO PLATE	0.075	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	0.83	AMPS.
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE-BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

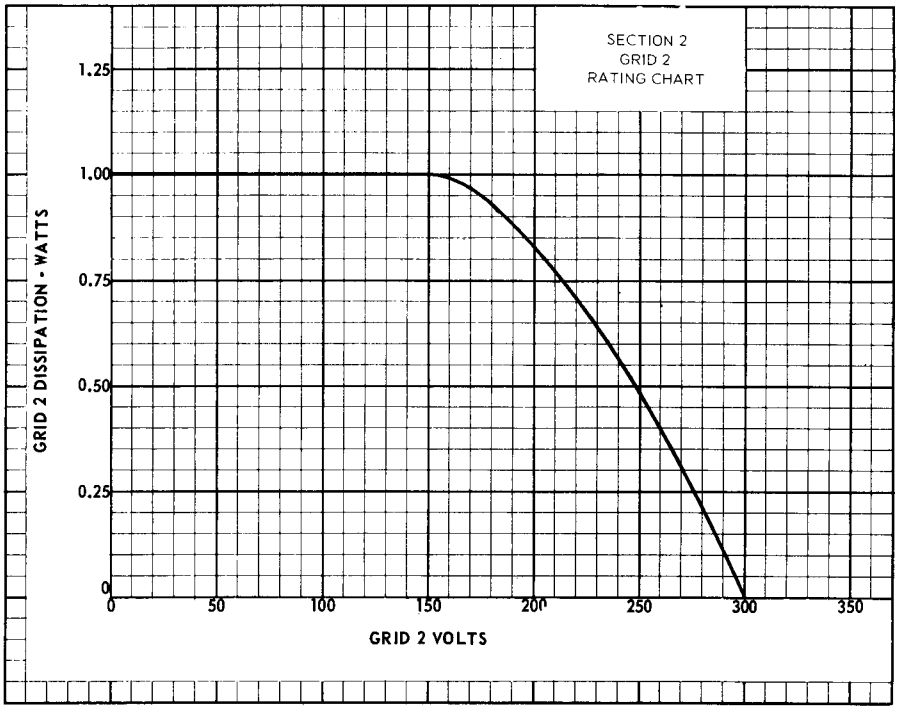
	SECTION 1	SECTION 2	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 VOLTAGE	300	-	VOLTS
GRID 2 SUPPLY VOLTAGE	-	300	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-	25	VOLTS
NEGATIVE DC GRID 3 VOLTAGE	-	100	VOLTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	-	50	VOLTS
PLATE DISSIPATION	4.8	1.7	WATTS
GRID 2 DISSIPATION	1.1	SEE CHART	WATTS
UP TO 150 VOLTS	-	1.0	WATTS
CATHODE CURRENT	30	20	MA.
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHMS
SELF BIAS	1.0	0.5	MEGOHMS
BULB TEMPERATURE	200		°C

AVERAGE CHARACTERISTICS

	SECTION 1	SECTION 2	
PLATE VOLTAGE	250	150	VOLTS
GRID 2 VOLTAGE	250	100	VOLTS
GRID 3 VOLTAGE	-	0	VOLTS
CATHODE RESISTOR	270	180	OHMS
PLATE CURRENT	16	3.7	MA.
GRID 2 CURRENT	2.7	3	MA.
TRANSCONDUCTANCE GRID 1 TO PLATE	8,400	3,700	μMHOS
GRID 3 TO PLATE	-	600	μMHOS
PLATE RESISTANCE - APPROX.	0.15	0.14	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 20 μA	-	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 20 μA	-	- 7	VOLTS

TYPICAL OPERATION - CLASS A1 POWER AMPLIFIER

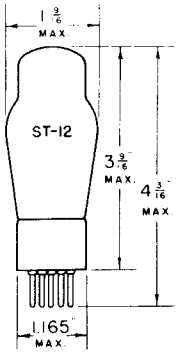
	SECTION 1		
PLATE VOLTAGE	250	250	VOLTS
GRID 2 VOLTAGE	250	250	VOLTS
CATHODE RESISTOR	270	270	OHMS
BYPASSING	NONE	CAPACITOR	
PEAK AUDIO GRID 1 VOLTAGE	9.8	2.0	VOLTS
LOAD RESISTANCE	15,000	15,000	OHMS
MAXIMUM SIGNAL PLATE CURRENT	16	16	MA.
MAXIMUM SIGNAL GRID 2 CURRENT	5	5	MA.
TOTAL HARMONIC DISTORTION	10	10	%
POWER OUTPUT	1.8	1.1	WATTS


SECTION 2
GRID 2
RATING CHART
GRID 2 DISSIPATION - WATTS
1.25
1.00
0.75
0.50
0.25
0
0
50
100
150
200
250
300
350
GRID 2 VOLTS

TUNG-SOL

FULL WAVE

HIGH VACUUM RECTIFIER



UNIPOTENTIAL CATHODE

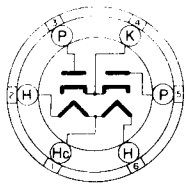
HEATER

6.3 VOLTS[A] 0.80 AMPERE

12.6 VOLTS[B] 0.40 AMPERE

AC OR DC

GLASS BULB



6K

BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 6Z5/12Z5 IS A HEATER TYPE HIGH VACUUM FULL WAVE RECTIFIER. THE HEATER IS CENTER TAPPED SO THAT IT MAY BE OPERATED ON EITHER 6.3 VOLTS OR 12.6 VOLTS.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER – CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)MAX.	230	VOLTS
DC OUTPUT CURRENTMAX.	60	MA.

[A] HEATERS CONNECTED IN PARALLEL

[B] HEATERS CONNECTED IN SERIES

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 903-1

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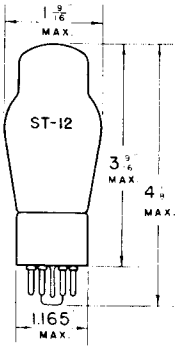
6Z7G

TUNG-SOL

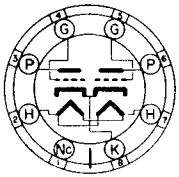


CLASS B TWIN TRIODE

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



G-8B

BOTTOM VIEW

SMALL 8 PIN OCTAL BASE

THE TUNG-SOL 6Z7G IS A TWIN TRIODE CLASS B POWER AMPLIFIER, DESIGNED PRIMARILY FOR SERVICE WHERE LOW HEATER CURRENT IS REQUIRED.

MAXIMUM OPERATING CONDITIONS

PLATE VOLTAGE	180 MAX.	VOLTS
PEAK PLATE CURRENT PER PLATE	60 MAX.	MA.
AVERAGE PLATE DISSIPATION	8 MAX.	WATTS

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS B_2 POWER AMPLIFIER

PLATE VOLTAGE	135	135	180	180	VOLTS
GRID VOLTAGE	0	0	0	0	VOLTS
ZERO SIGNAL PLATE CURRENT[P]	6	6	8.4	8.4	MA.
EFFECTIVE LOAD RESISTANCE[L]	15 000	9000	20 000	12 000	OHMS
AVERAGE POWER INPUT[G]	80	320	80	320	MILLIWATTS
POWER OUTPUT	1.5	2.5	2.2	4.2	WATTS

[P] BOTH PLATES [L] PLATE TO PLATE [G] GRID TO GRID

DIRECT INTERELECTRODE CAPACITANCES[S]

	TRIODE 1	TRIODE 2	
GRID TO CATHODE	4	4	μμf
PLATE TO CATHODE	5	5	μμf
GRID TO PLATE	5	5	μμf
GRID TO GRID	0.22		μμf
PLATE TO PLATE	0.8		μμf
GRID (2) TO PLATE (1)	0.1		μμf

TRIODE 1 IS TRIODE HAVING GRID BROUGHT OUT TO PIN #5.
TRIODE 2 IS TRIODE HAVING GRID BROUGHT OUT TO PIN #4.

[S] WITH SHIELD

CAPACITANCES BETWEEN ELEMENTS OF ONE TRIODE ARE MEASURED WITH THE ELEMENTS OF THE OTHER TRIODE GROUNDED.

PLATE 904-2

NOTE: THIS TUBE IS NOT RECOMMENDED FOR OPERATION IN SERIES WITH OTHER 0.3 AMPERE HEATER TUBES AS THE SURGE CURRENT MAY CAUSE HEATER BURNOUTS.

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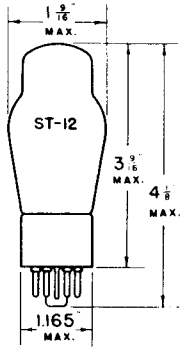
TUNG-SOL



FULL WAVE

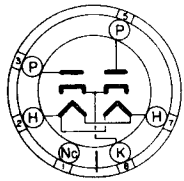
HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN OCTAL BASE



G-6S
BOTTOM VIEW

THE TUNG-SOL 6ZY5G IS DESIGNED FOR SERVICE IN RECEIVERS THAT REQUIRE SMALL LOAD CURRENTS, AND WHERE ECONOMY IS DESIRED IN HEATER CURRENT CONSUMPTION.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1250	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	450	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	120	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)$^{MAX.}$	325	VOLTS
DC OUTPUT CURRENT$^{MAX.}$	40	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE$^{MIN.A}$	225	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)$^{MAX.}$	450	VOLTS
DC OUTPUT CURRENT$^{MAX.}$	40	MA.
VALUE OF INPUT CHOKE $^{MIN.}$	13.5	HENRYS
TUBE VOLTAGE DROP AT 40 MA. PER PLATE	18	VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 709-2

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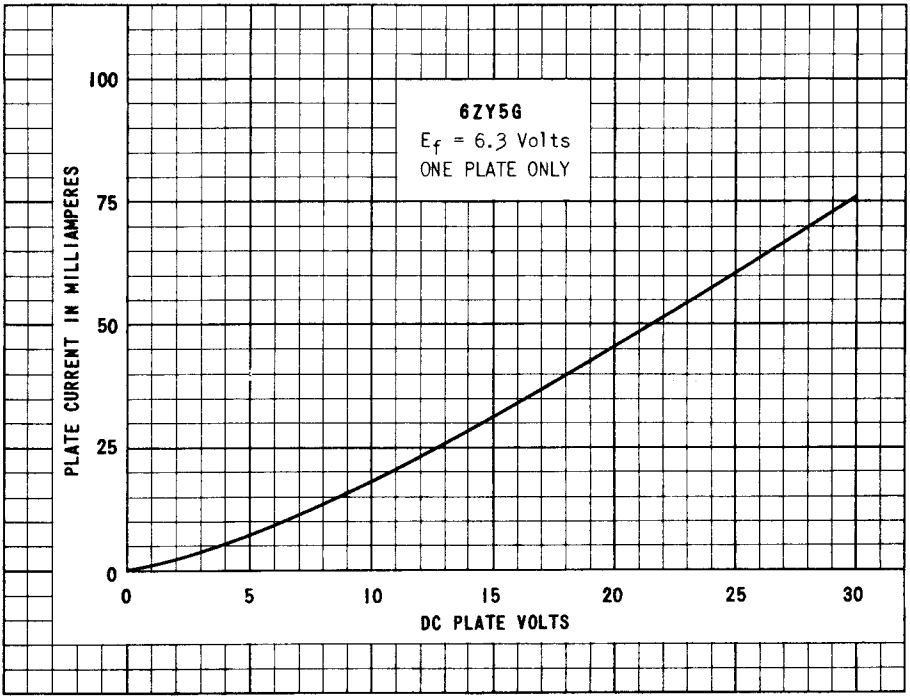
6ZY5G



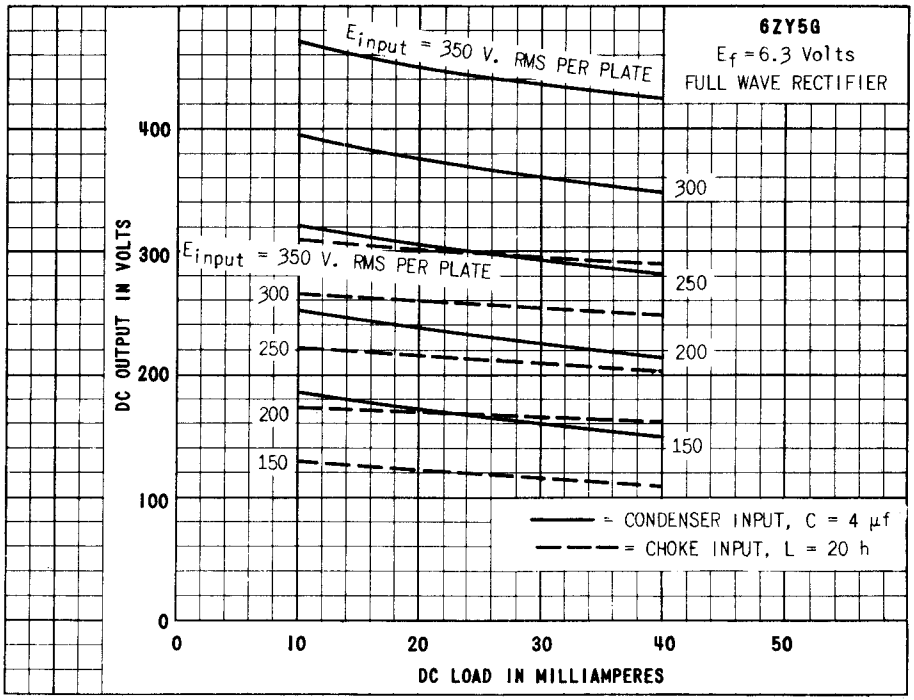


PLATE 710-1

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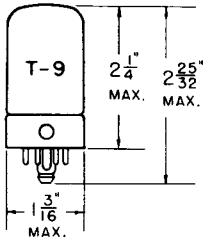
TUNG-SOL

TRIODE AMPLIFIER

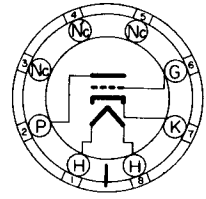


COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

LOCKING-IN 8-PIN BASE



BOTTOM VIEW

THE 7A4 IS A MEDIUM-MU GENERAL PURPOSE TRIODE AMPLIFIER WITH HIGH TRANSCONDUCTANCE. IT IS PARTICULARLY APPLICABLE IN ULTRA HIGH FREQUENCY CIRCUITS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MINIMUM GRID VOLTAGE	0	VOLTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	100	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO CATHODE

GRID TO PLATE	4.0	μμf
INPUT	3.4	μμf
OUTPUT	3.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE[A]	0	-8	VOLTS
PLATE CURRENT	10	9.0	MA.
PLATE RESISTANCE	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	

[A] THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1 MEGOHM

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PLATE 1475
AUG. 31 1944

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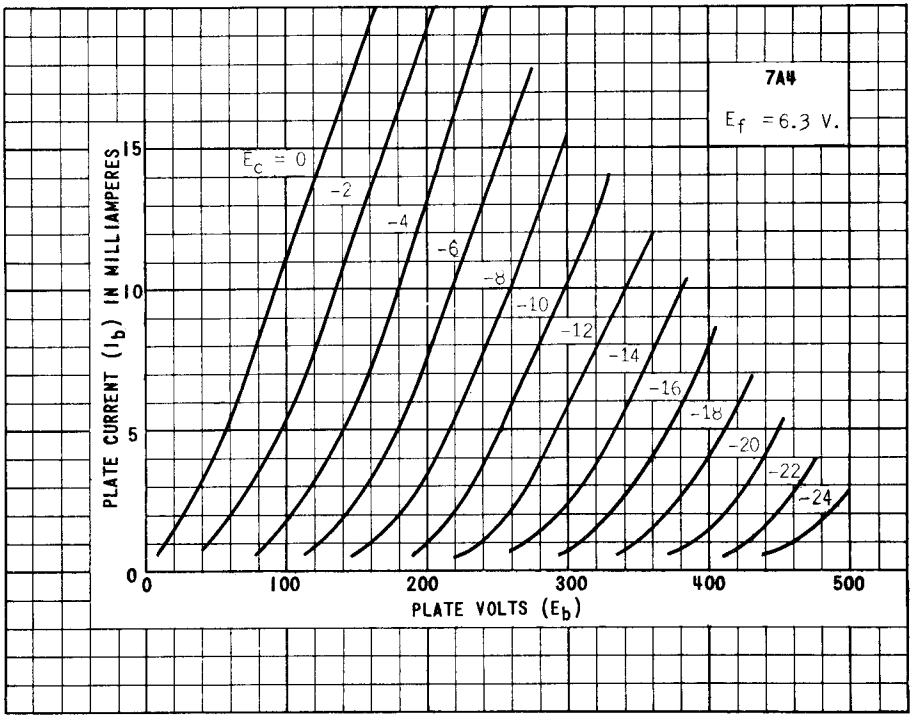
7A4



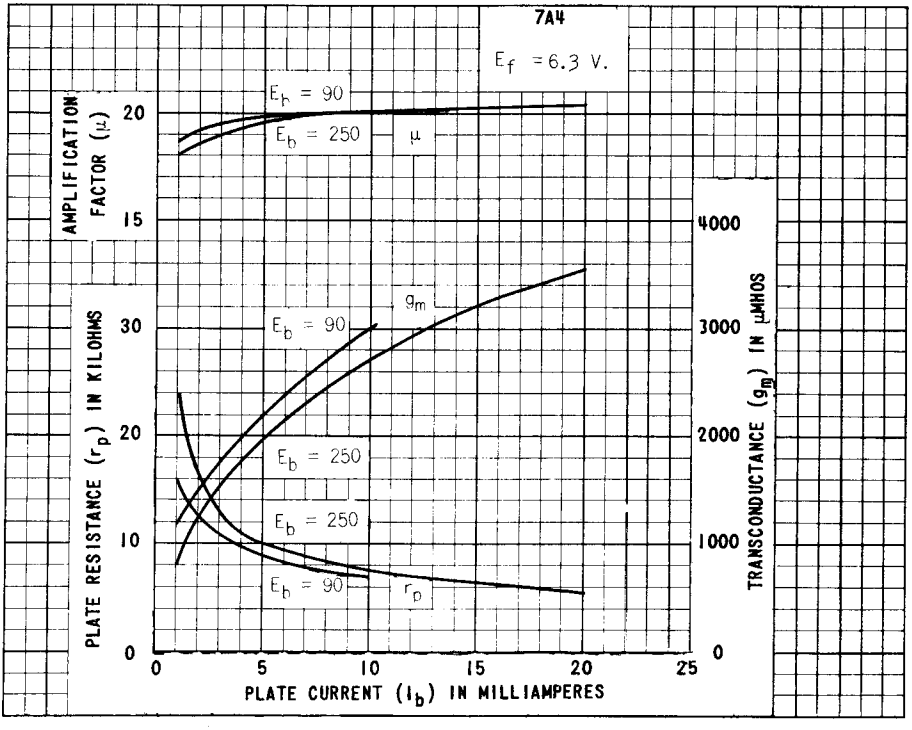


PLATE
1476
AUG. 31
1944

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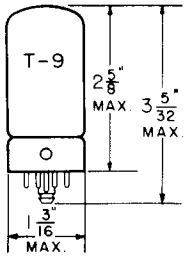
TUNG-SOL

BEAM PENTODE

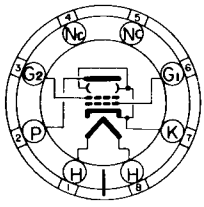


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.75 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
6AA

THE 7A5 IS A BEAM POWER AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC AND AUTO RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	125	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.2	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS ←
MAXIMUM GRID #1 CIRCUIT RESISTANCE (CATHODE BIAS)	0.5	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER ←

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.75	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK A-F GRID #1 VOLTAGE	7.5	VOLTS
PLATE RESISTANCE (APPROX.)	16 000	OHMS ←
TRANSCONDUCTANCE	5 800	μMHOS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAXIMUM-SIGNAL PLATE CURRENT	41	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	7	MA.
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
POWER OUTPUT	1.5	WATTS

→ INDICATES A CHANGE OR ADDITION.

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PLATE
2395
MAY 1
1950

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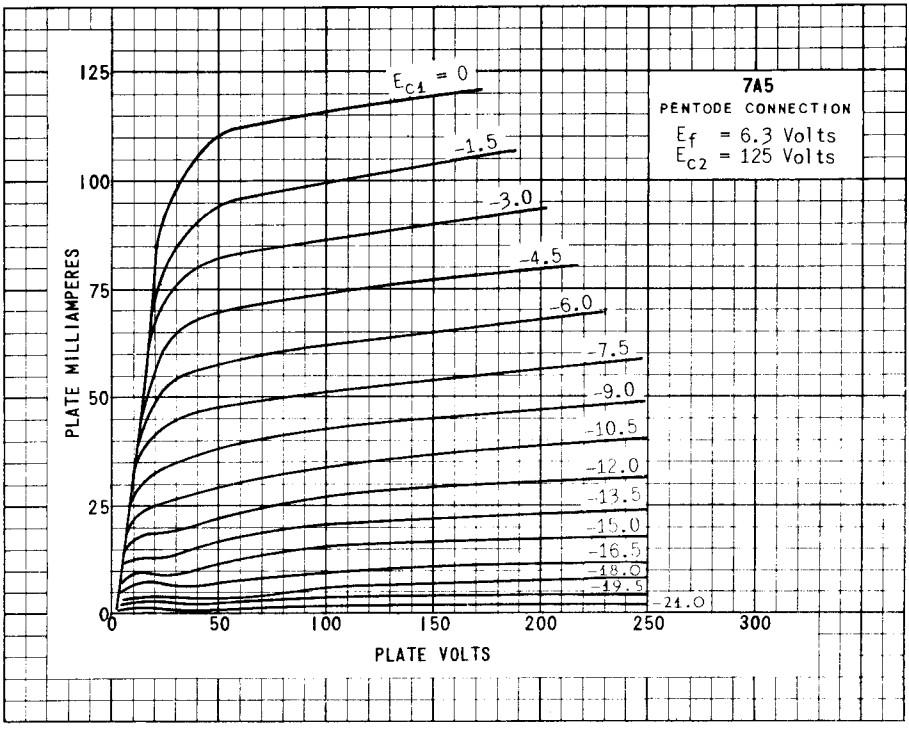
7A5



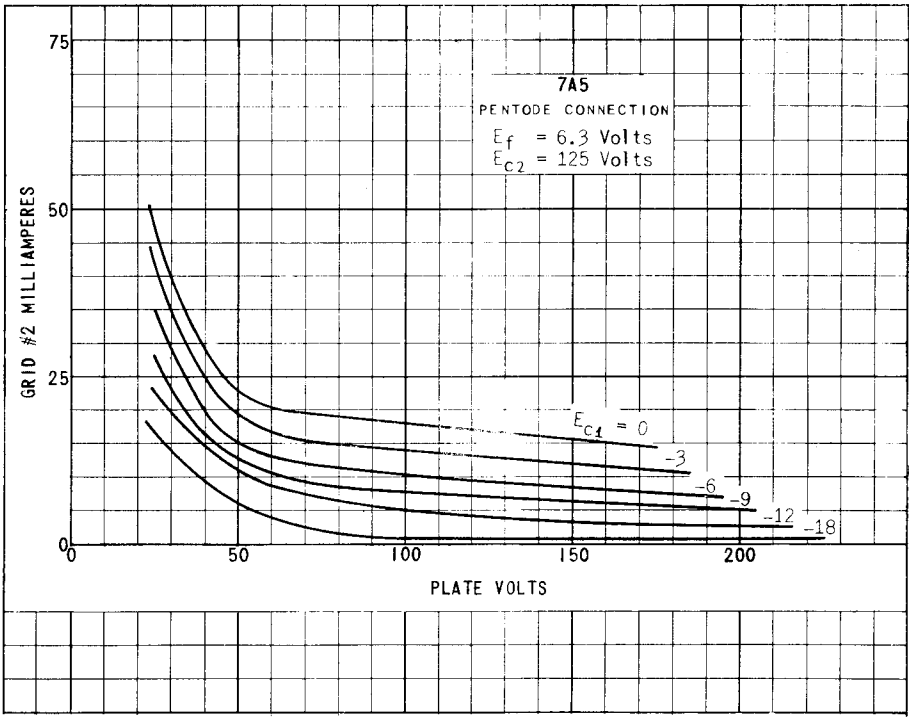


PLATE 2396
MAY 1 1950

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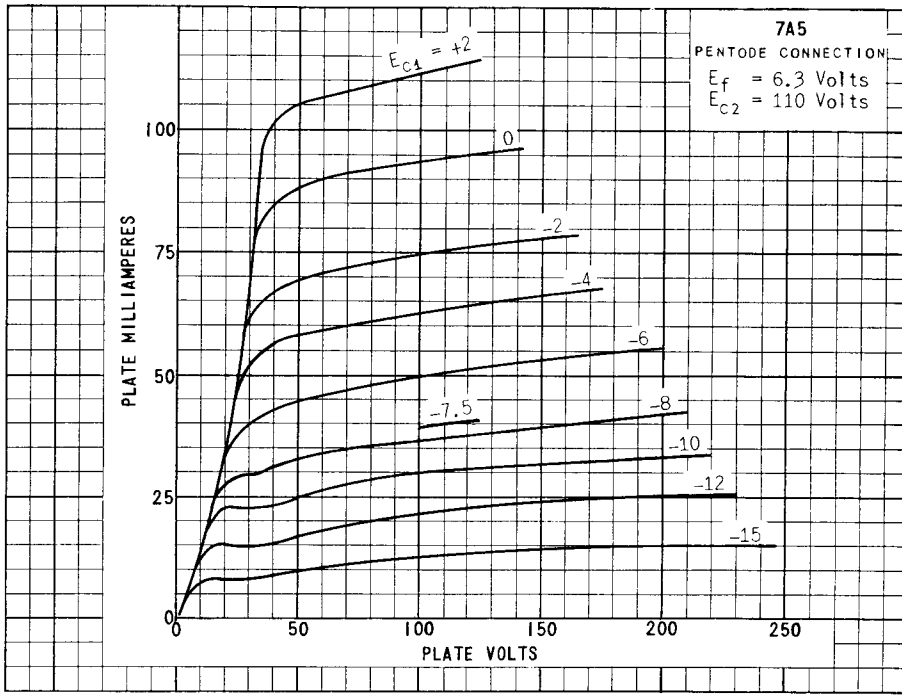

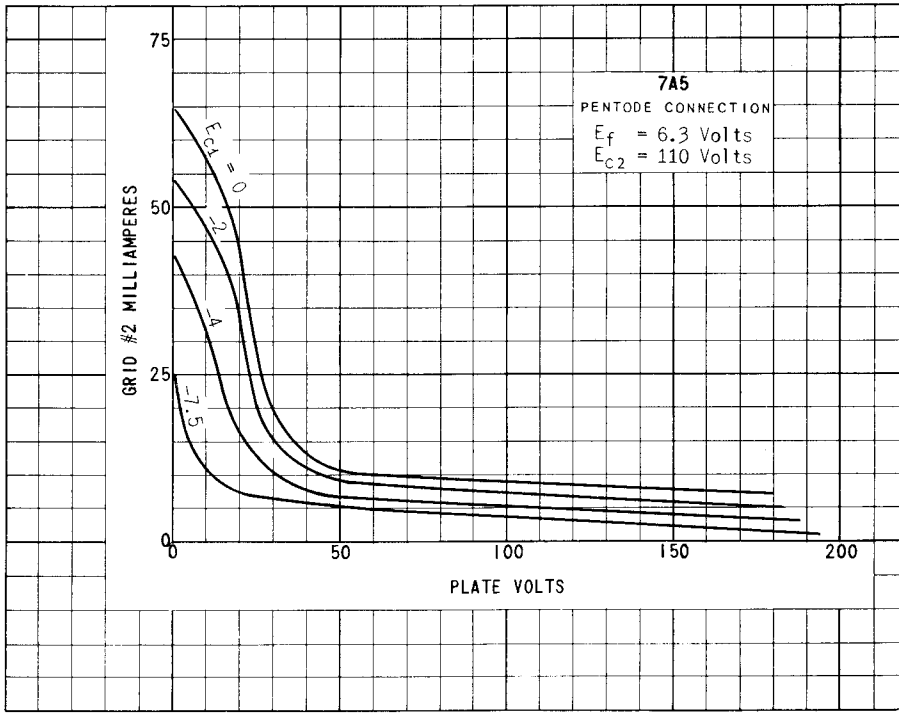

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PLATE
2397
MAY 1
1950

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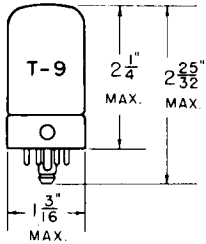
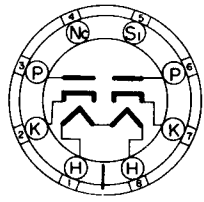
TUNG-SOL

TWIN DIODE



COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC



BOTTOM VIEW

GLASS BULB

LOCKING-IN 8-PIN BASE

THE 7A6 IS DESIGNED FOR USE AS A DIODE DETECTOR, AVC RECTIFIER AND POWER RECTIFIER IN LOW DRAIN APPLICATIONS. TWO SEPARATE RECTIFIER SECTIONS ALLOW CONSIDERABLE FLEXIBILITY IN THEIR APPLICATION. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6H6, 6H6GT/G.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210.

MAXIMUM AC VOLTAGE PER PLATE (RMS)	150	VOLTS
MAXIMUM HEATER-CATHODE POTENTIAL	330	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	420	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT PER PLATE	48	MA.
TUBE VOLTAGE DROP AT 16 MA. DC PER PLATE	11.0	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PLATE TO PLATE	0.05 MAX.	μμf

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.4	6.3	VOLTS
AC VOLTAGE PER PLATE (RMS)	117	150	VOLTS
MAXIMUM DC OUTPUT CURRENT PER PLATE	8.0	8.0	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	15	40[A]	OHMS

VOLTAGE DOUBLER

	HALF-WAVE	FULL-WAVE	
HEATER VOLTAGE	6.3	6.3	VOLTS
AC VOLTAGE PER PLATE (RMS)	117	117	VOLTS
MAXIMUM DC OUTPUT CURRENT	8.0	8.0	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	30	15	OHMS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 MFDS ARE USED IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

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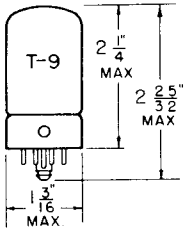
TUNG-SOL

PENTODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN
8 PIN BASE
8V

THE 7A7 IS A PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR RF OR IF SERVICE IN AC/DC RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P)	0.003	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	6	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	7	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.4	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #4 AND PIN #5 CONNECTED TO PIN #8		
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
SELF BIAS RESISTOR	60	260	OHMS
PLATE RESISTANCE (APPROX.)	0.12	0.8	MEGOHM
TRANSCONDUCTANCE	2350	2000	μMHOS
PLATE CURRENT	13	9.2	MA.
GRID #2 CURRENT	4	2.6	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS (APPROX.)	-35	-35	VOLTS

→ INDICATES A CHANGE OR ADDITION

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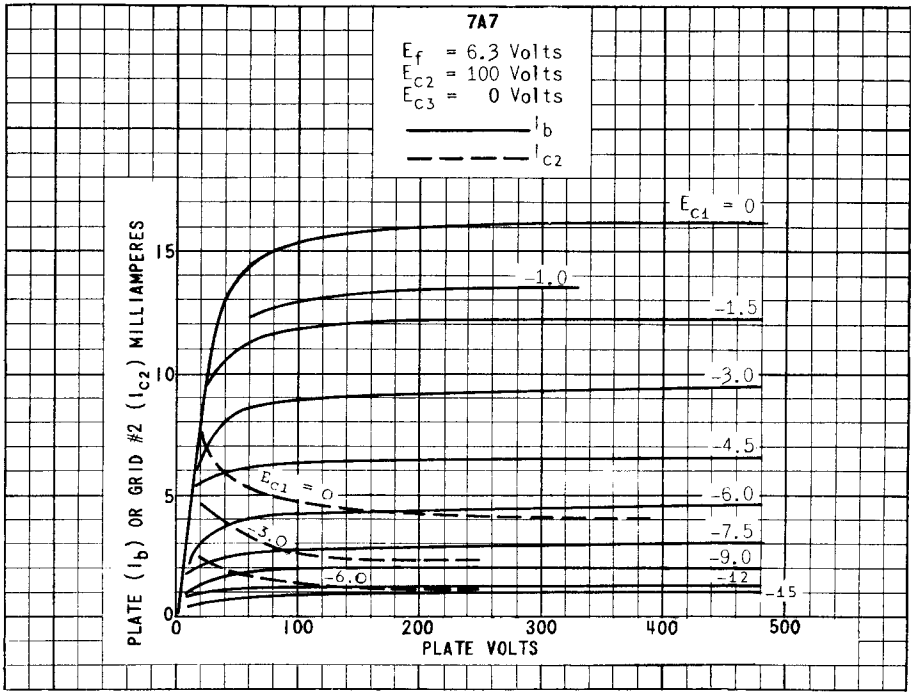
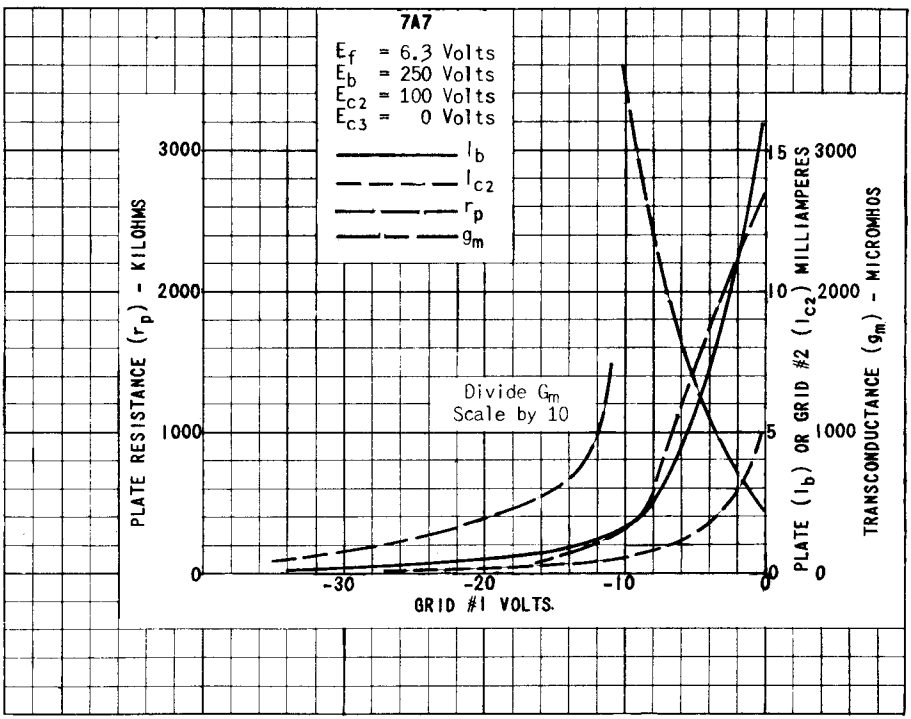
7A7 (14A7/12B7)





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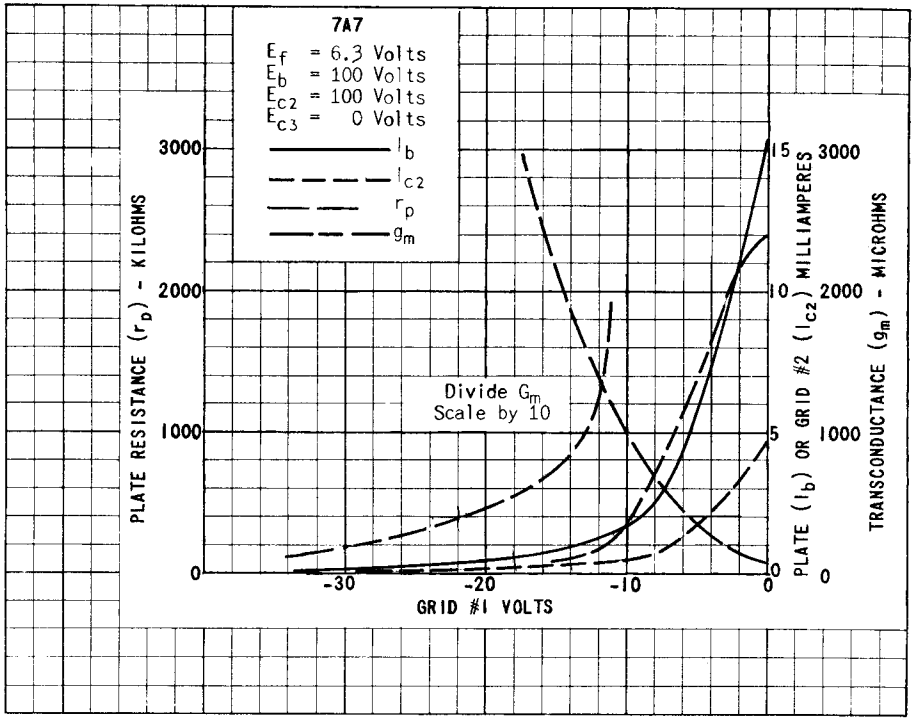

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MAY 1
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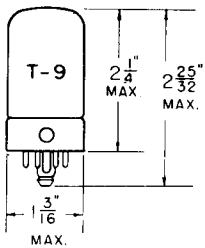
TUNG-SOL

OCTODE CONVERTER

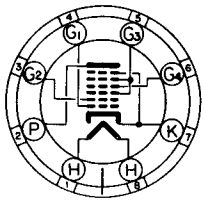
COATED UNIPOTENTIAL CATHODE



HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

LOCKING-IN 8-PIN BASE



BOTTOM VIEW

THE 7A8 IS A PENTAGRID CONVERTER DESIGNED FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER IN AC, STORAGE BATTERY, AND AC - DC OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CONVERTER SERVICE

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE (GRID #3 AND #5)	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM TOTAL CATHODE CURRENT	13	MA.
MAXIMUM ANODE-GRID VOLTAGE (GRID #2)	200	VOLTS
MAXIMUM ANODE-GRID SUPPLY VOLTAGE	250	VOLTS
MAXIMUM ANODE-GRID DISSIPATION	0.75	WATT
MINIMUM CONTROL-GRID (GRID #4) VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE POTENTIAL	100	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH CLOSE-FITTING SHIELD CONNECTED TO CATHODE

SIGNAL GRID TO MIXER PLATE (GRID #4 TO PLATE)	0.15 MAX.	μμf
SIGNAL GRID TO OSC. PLATE (GRID #4 TO GRID #2)	0.15 MAX.	μμf
SIGNAL GRID TO OSC. GRID (GRID #4 TO GRID #1)	0.15 MAX.	μμf
OSC. GRID TO OSC. PLATE (GRID #1 TO GRID #2)	0.60	μμf
SIGNAL INPUT (GRID #4 TO ALL OTHER ELECTRODES= R-F INPUT)	7.5	μμf
OSC. INPUT (GRID #1 TO ALL OTHER ELECTRODES EXCEPT GRID #2)	3.8	μμf
OSC. OUTPUT (GRID #2 TO ALL OTHER ELECTRODES EXCEPT GRID #1)	3.4	μμf
MIXER OUTPUT (PLATE TO ALL OTHER ELECTRODES)	9.0	μμf.

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1944

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	75	100	VOLTS
ANODE-GRID VOLTAGE	100	-	VOLTS
ANODE-GRID SUPPLY VOLTAGE[A]	-	250	VOLTS
CONTROL-GRID VOLTAGE	-3.0	-3.0	VOLTS
OSCILLATOR-GRID (GRID #1) RES.	50 000	50 000	OHMS
PLATE RESISTANCE	0.65	0.7 APPROX.	MEGOHM
CONVERSION TRANSCONDUCTANCE	375	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR GRID BIAS OF -30 VOLTS	-	2.0 APPROX.	μMHOS
PLATE CURRENT	1.8	3.0	MA.
SCREEN CURRENT	2.7	3.2	MA.
ANODE-GRID CURRENT	2.8	4.2	MA.
OSCILLATOR-GRID CURRENT	0.2	0.4	MA.
TOTAL CATHODE CURRENT	8.5	10.8	MA.

NOTE: THE TRANSCONDUCTANCE BETWEEN GRID #1 AND GRID #2 (NOT OSCILLATING) IS APPROXIMATELY 1600 MICROMHOS UNDER THE FOLLOWING CONDITIONS: PLATE VOLTS, 250; SCREEN VOLTS, 100; ANODE-GRID VOLTS, 180; OSCILLATOR-GRID VOLTS, 0; AND CONTROL-GRID CONNECTED TO CATHODE.

[A] APPLIED THROUGH A PROPERLY BY-PASSED 20 000 OHM VOLTAGE-DROPPING RESISTOR.

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1944

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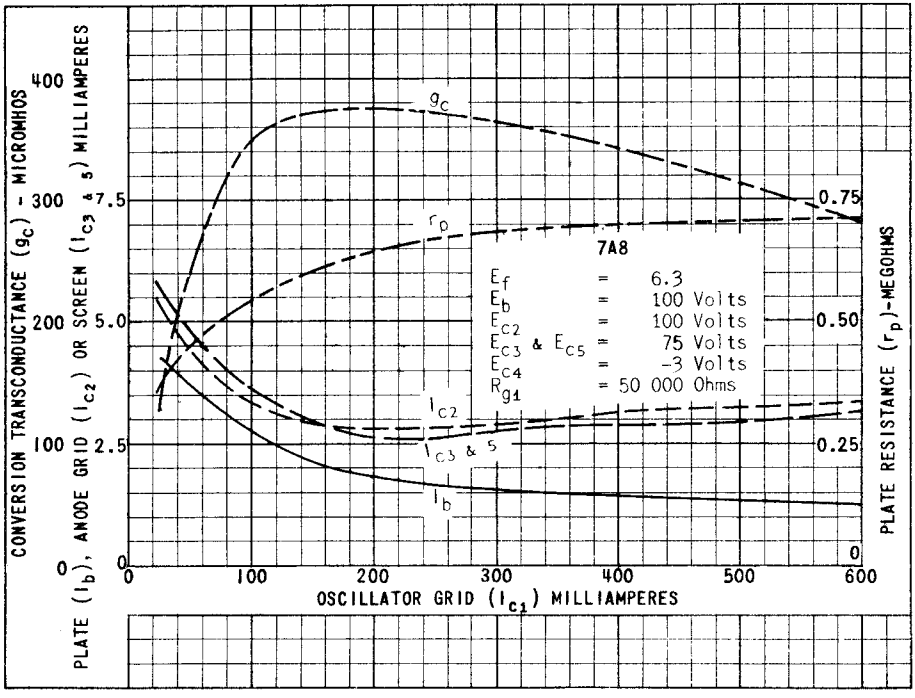

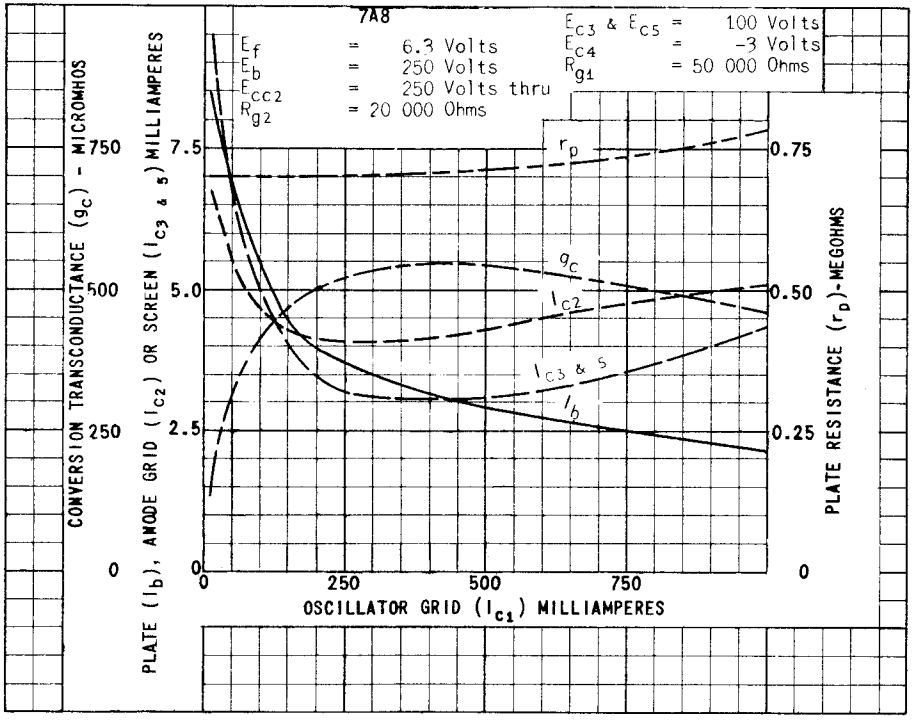

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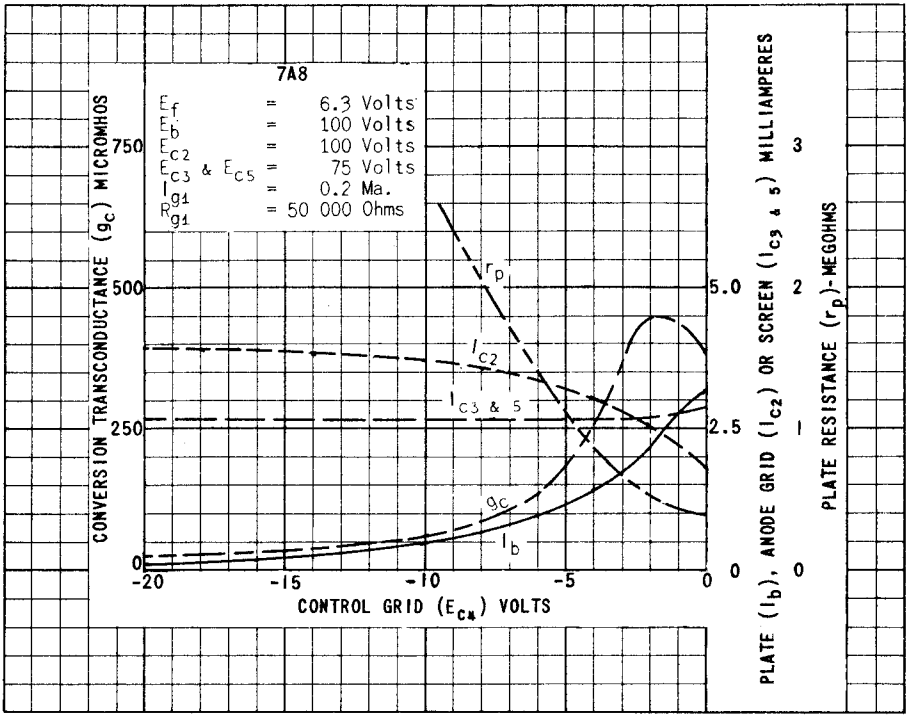
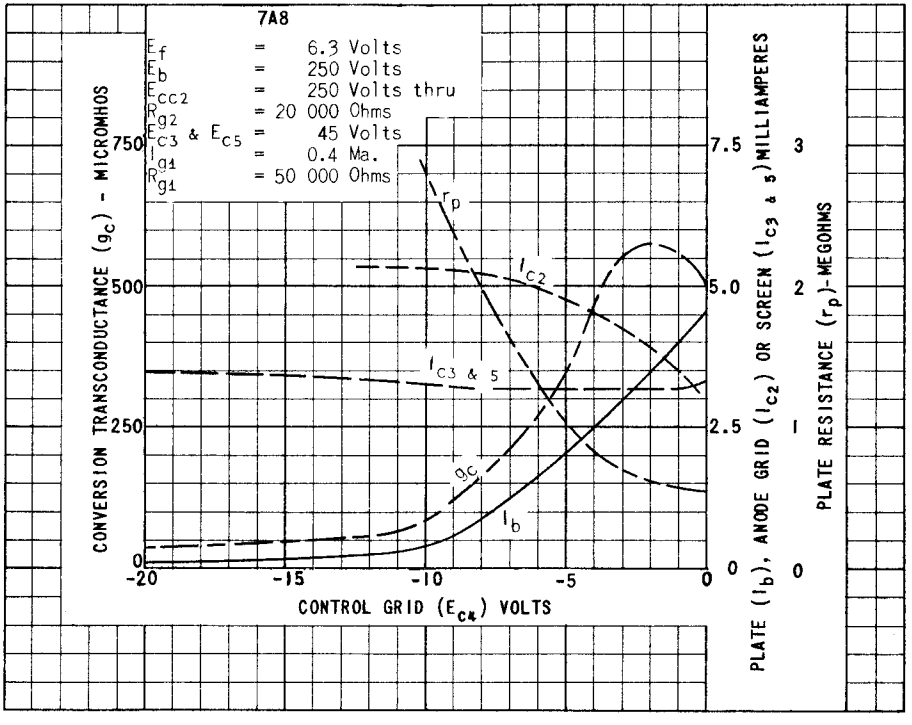
7A8





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TENTATIVE DATA

7AB7/1204

TUNG-SOL

SHARP CUT-OFF HIGH FREQUENCY RF PENTODE

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE LOCK-IN 8-PIN	PIN 1 GRID 2	PIN 7 HEATER
CAP ———	PIN 2 HEATER	PIN 8 GRID 3, K
BULB SHORT T-9	PIN 3 PLATE	
MAXIMUM DIAMETER 1 3/16"	PIN 4 GRID 3, K	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH 2 1/32"	PIN 5 GRID 1	
MAXIMUM SEATED HEIGHT 1 1/2"	PIN 6 GRID 3, K	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (NOMINAL)	7.0	VOLTS
HEATER OR FILAMENT CURRENT	0.160	AMP.
MAXIMUM PLATE VOLTAGE (DC)	300	VOLTS
MAXIMUM SCREEN VOLTAGE (DC)	100	VOLTS
MAXIMUM PLATE DISSIPATION	1.2	WATTS
MAXIMUM SCREEN DISSIPATION	0.15	WATT
MAXIMUM SCREEN SUPPLY VOLTAGE (DC)	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID VOLTAGE (DC)	0	VOLTS

CAPACITANCES

WITH RMA SHIELD NO. M8-308 CONNECTED TO CATHODE

GRID NO. 1 – PLATE (MAX.)	0.06	μμf
INPUT	3.5	μμf
OUTPUT	4.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER OR FILAMENT VOLTAGE	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.150	AMP.
PLATE VOLTAGE (DC)	250	VOLTS
SCREEN VOLTAGE (DC)	100	VOLTS
CONTROL GRID VOLTAGE (DC)	-2.0	VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
PLATE CURRENT (DC)	4.0	MA.
SCREEN GRID CURRENT (DC)	1.3	MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE	0.5	MEGOHM
TRANSCONDUCTANCE	1800	μMHOS
AMPLIFICATION FACTOR		
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS
CONTROL GRID VOLTAGE (DC) FOR I_b = 10 μAMPS	-9.0	VOLTS

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FEB. 15 1946

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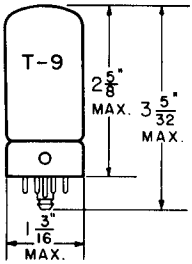
PENTODE



GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7AD7 IS A HEATER-CATHODE TYPE SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS CHARACTERIZED BY A HIGH VALUE OF TRANSCONDUCTANCE WHICH MAKES IT USEFUL IN WIDE-BAND INTERMEDIATE FREQUENCY OR VIDEO AMPLIFIERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD NO. 308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.03	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	11.5	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MINIMUM GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.25	MEG.
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF-BIAS)	1	MEG.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	300	VOLTS
GRID #3 VOLTAGE	PINS #4 AND #5 CONNECTED TO PIN #7 AT SOCKET	
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE[A]	-3	VOLTS
SELF BIAS RESISTOR	68	OHMS
PLATE RESISTANCE (APPROX.)	0.3	MEG.
TRANSCONDUCTANCE	9 500	μMHOS
ZERO SIGNAL PLATE CURRENT	28	MA.
ZERO SIGNAL GRID #2 CURRENT	7	MA.

[A] OBTAINED PREFERABLY BY SELF BIAS RESISTOR

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 TELEVISION AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE SUPPLY VOLTAGE	300	VOLTS
GRID #3 VOLTAGE	PINS #4 AND #5 CONNECTED TO PIN #7 AT SOCKET	
GRID #2 VOLTAGE	125	VOLTS
GRID #1 VOLTAGE	-3	VOLTS
SELF BIAS RESISTOR	68	OHMS
SIGNAL VOLTAGE (PEAK TO PLATE)	4	VOLTS
ZERO SIGNAL PLATE CURRENT	25	MA.
ZERO SIGNAL GRID #2 CURRENT	6	MA.
MAXIMUM SIGNAL VOLTAGE OUTPUT (PEAK TO PEAK)	135	VOLTS

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NOV. 1, 1948

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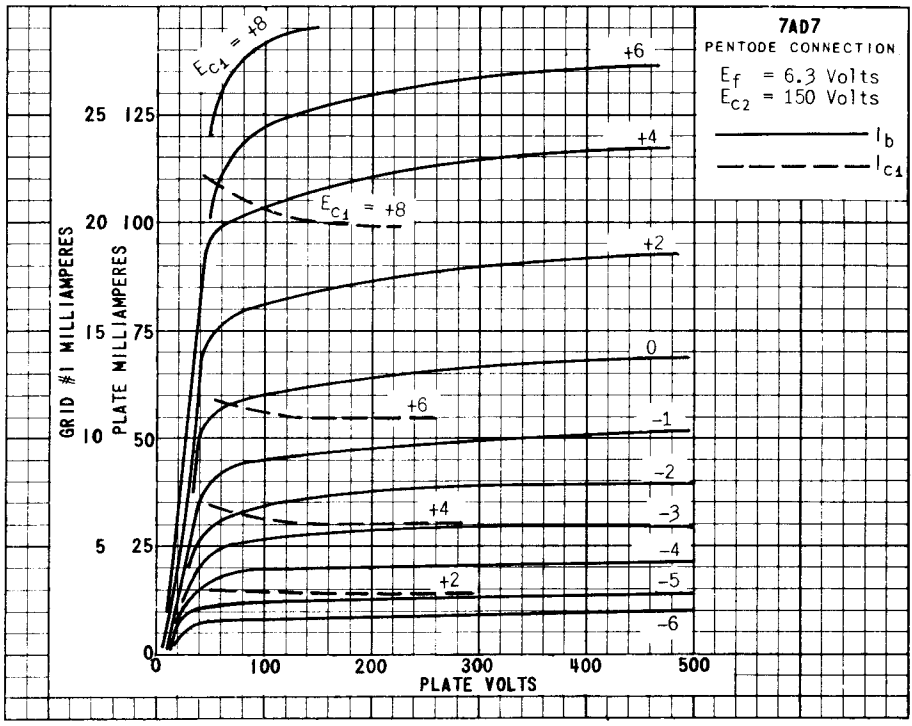

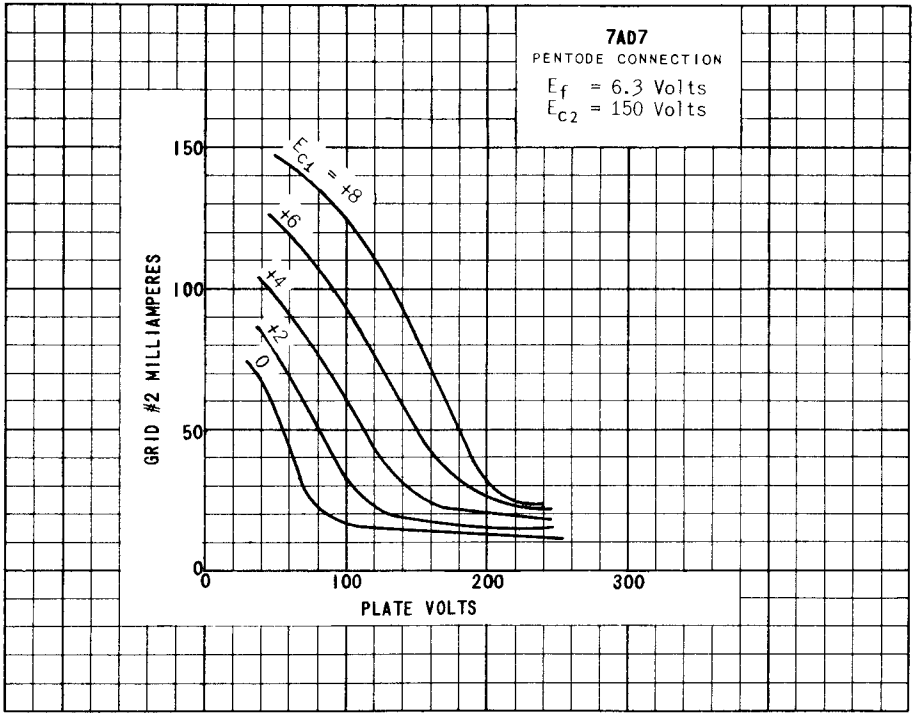

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1948

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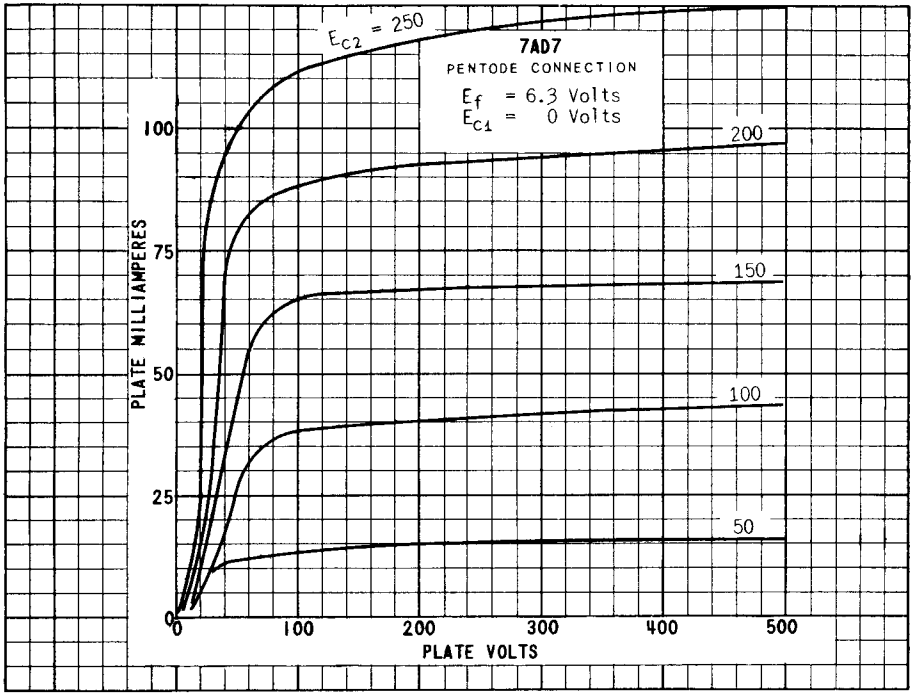
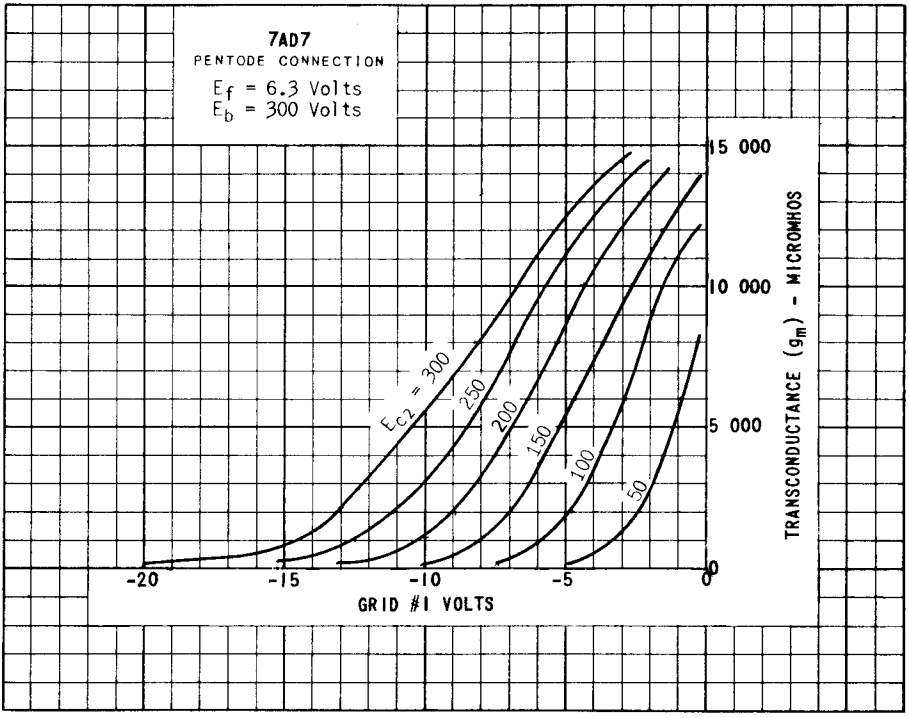
7AD7





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NOV. 1, 1948

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TENTATIVE DATA

7AG7

TUNG-SOL

SHARP CUT-OFF PENTODE AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER	COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE	LOCK-IN 8 PIN	PIN 1 HEATER	PIN 7 CATHODE
CAP	---	PIN 2 PLATE	PIN 8 HEATER
BULB	T-9	PIN 3 GRID 2	
MAXIMUM DIAMETER	1 3/16"	PIN 4 GRID 3	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH	2 25/32"	PIN 5 S_1	
MAXIMUM SEATED HEIGHT	2 1/4"	PIN 6 GRID 1	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (NOMINAL)	7.0	VOLTS
HEATER OR FILAMENT CURRENT (NOMINAL)	0.160	AMP.
MAXIMUM PLATE VOLTAGE (DC)	300	VOLTS
MAXIMUM SCREEN VOLTAGE (DC)	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.75	WATT
MINIMUM EXTERNAL CONTROL GRID VOLTAGE (DC)	-1.0	VOLTS

CAPACITANCES

RMA SHIELD M8-308 CONNECTED TO CATHODE

CONTROL GRID TO CATHODE	7.0	μμf
PLATE TO CATHODE	6.0	μμf
CONTROL GRID TO PLATE (MAX.)	0.005	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.150	AMP.
PLATE VOLTAGE (DC)	250	VOLTS
SCREEN VOLTAGE (DC)	250	VOLTS
CONTROL GRID VOLTAGE		VOLTS
SUPPRESOR VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
CATHODE BIAS RESISTOR	250	OHMS
PLATE CURRENT (DC)	6.0	MA.
SCREEN CURRENT (DC)	2.0	MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE	0.75	MEGOHM
TRANSCONDUCTANCE	4200	μMHOS
AMPLIFICATION FACTOR		
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS
CONTROL GRID VOLTAGE (DC) FOR I_b = 10 μA (DC)	-10	VOLTS

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PLATE 1707

APRIL 15 1946

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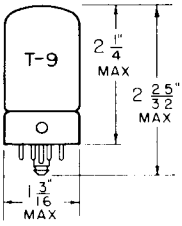
TUNG-SOL

PENTODE



GLASS BUB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7AH7 IS A HEATER-CATHODE TYPE SEMI-REMOTE CUT-OFF PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS CHARACTERIZED BY MODERATELY HIGH TRANSCONDUCTANCE AND LOW INTERELECTRODE CAPACITANCES AS WELL AS ECONOMY OF HEATER POWER.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.005	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTS	-1	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	250	VOLTS
GRID #3 VOLTAGE	PIN #4 CONNECTED TO PIN #7 AT SOCKET	
GRID #2 VOLTAGE	250	VOLTS
SELF BIAS RESISTOR[A]	250	OHMS
PLATE RESISTANCE (APPROX.)	1	MEGOHM
TRANSCONDUCTANCE	3 300	μMHOS
PLATE CURRENT	6.8	MA.
GRID #2 CURRENT	1.9	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 35 μMHOS	-20	VOLTS

[A] BIAS VOLTAGE IS APPROXIMATELY 2 VOLTS, BUT FIXED BIAS IS NOT RECOMMENDED.

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PLATE 2114
DEC. 1, 1948

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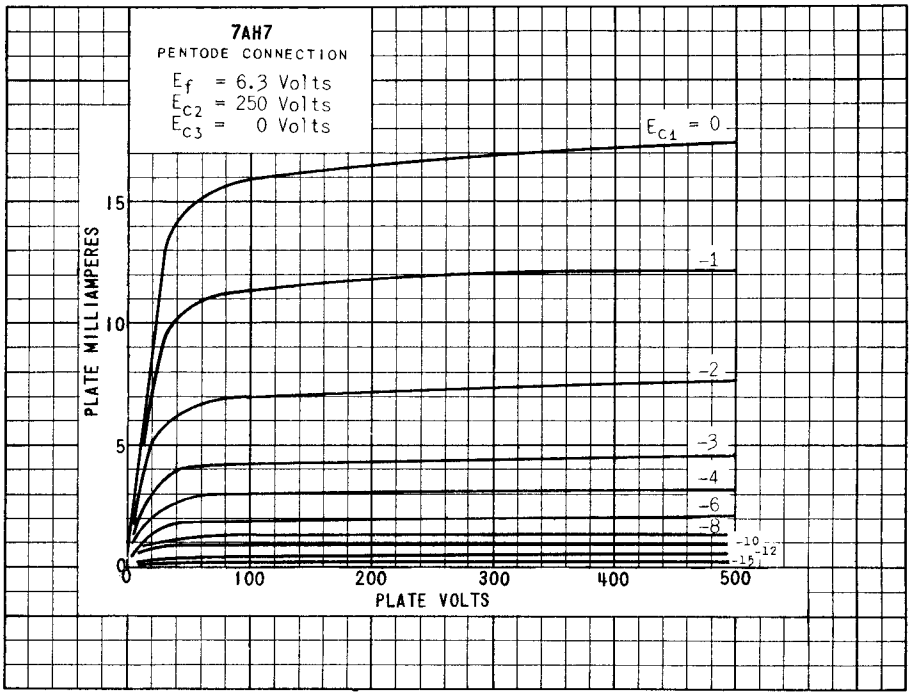
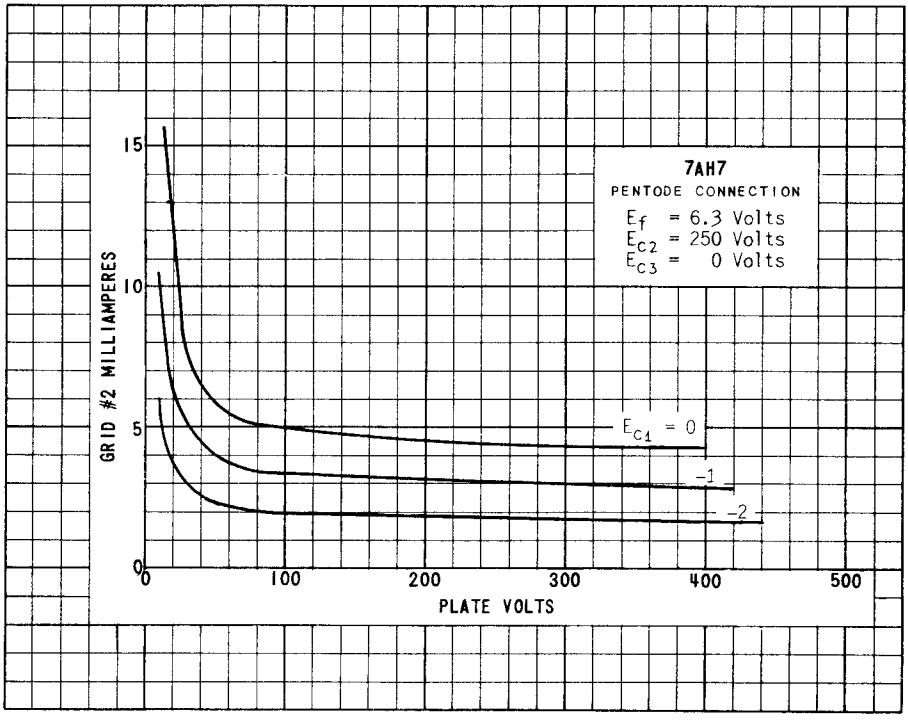
7AH7





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DEC. 1, 1948

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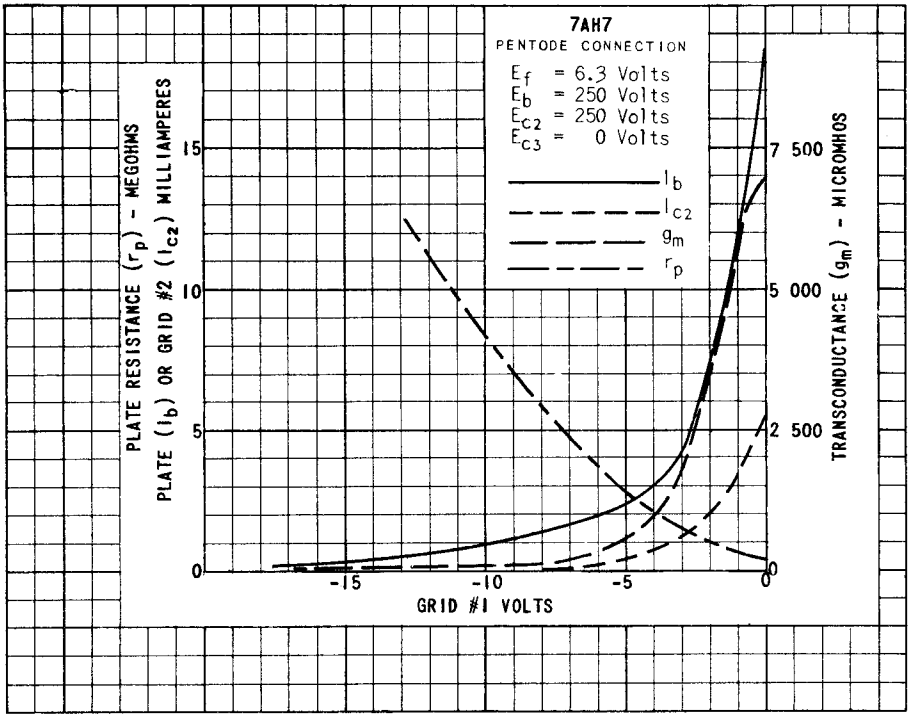

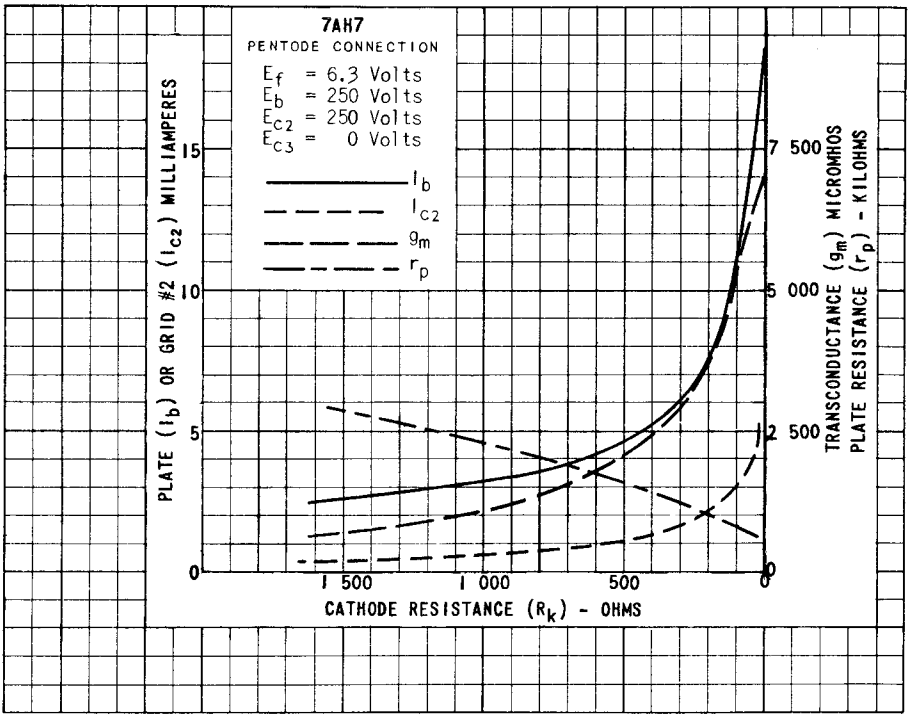

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PLATE
2116
DEC. 1,
1948

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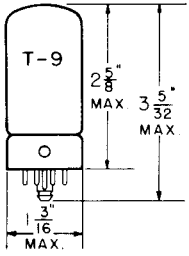
TUNG-SOL

PENTODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.8 AMP.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN
8 PIN BASE
8V

THE 7AK7 IS A SHARP CUT-OFF PENTODE USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED AND RATED FOR USE AS A GATING TUBE WITH AN ADDITIONAL CONTROL VOLTAGE ON THE SUPPRESSOR.

DIRECT INTERELECTRODE CAPACITANCES
EXTERNAL SHIELD #308 CONNECTED TO PIN #7

GRID TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	12	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	9.5	μμf
GRID #3 TO PLATE: (G_3 TO P)	4	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	100	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-100	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	-100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	0.8	0.8	0.8	AMP.
PLATE VOLTAGE	150	150	150	VOLTS
GRID #2 VOLTAGE	90	90	90	VOLTS
GRID #1 VOLTAGE	0	-11	0	VOLTS
GRID #3 VOLTAGE	0	0	-9.5	VOLTS
TRANSCONDUCTANCE	5 500	---	---	μMHOS
PLATE RESISTANCE (APPROX.)	11 500	---	---	OHMS
PLATE CURRENT (MAX.)	40	2.5 MAX.	2 MAX.	MA.
GRID #2 CURRENT (MAX.)	21	0.45	→60 MAX.	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-17.5	---	---	VOLTS

UNDER GATING OPERATION THE MOMENTARY GRID #2 DISSIPATION MAY APPROXIMATE 4 WATTS PROVIDED THE DISSIPATION AVERAGED OVER ANY 1 SECOND INTERVAL DOES NOT EXCEED THE RATING FOR MAXIMUM GRID #2 DISSIPATION.

→ INDICATES A CHANGE.

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7AK7

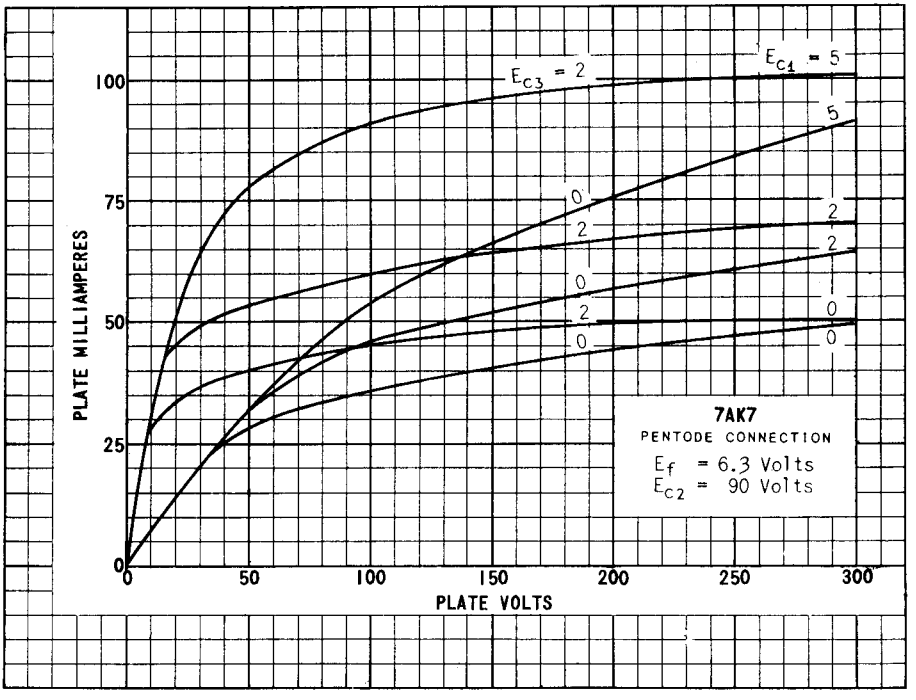
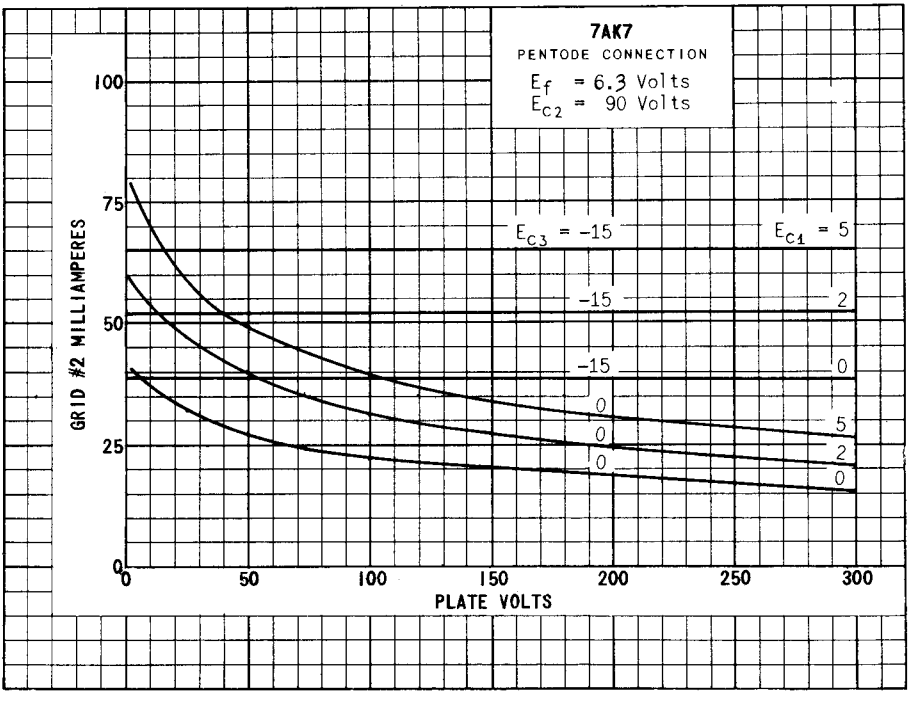
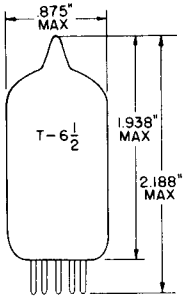


PLATE MILLIAMPERES
100
75
50
25
0
0
50
100
150
200
250
300
PLATE VOLTS
E_{c3} = 2
E_{c1} = 5
5
0
2
2
0
2
0
0
7AK7
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 90 Volts


GRID #2 MILLIAMPERES
100
75
50
25
0
0
50
100
150
200
250
300
PLATE VOLTS
7AK7
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 90 Volts
E_{c3} = -15
E_{c1} = 5
-15
2
-15
0
0
5
0
2
0
0

TUNG-SOL

TWIN TRIODE
MINIATURE TYPE

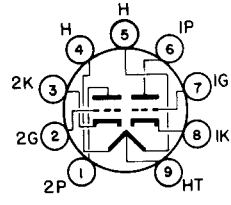


GLASS BULB
SMALL BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

FOR
AUDIO FREQUENCY AMPLIFIER
OR COMBINED OSCILLATOR AND
MIXER APPLICATIONS IN
T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 7AU7 COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATION EITHER AS AN AUDIO FREQUENCY AMPLIFIER OR AS A COMBINED OSCILLATOR AND MIXER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS AND HEATER WARM-UP TIME IT IS IDENTICAL TO THE 12AU7A.

→ DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT T_1	TRIODE UNIT T_2	
GRID TO PLATE	1.5	1.5	pf
GRID TO CATHODE	1.6	1.6	pf
PLATE TO CATHODE	0.50	0.35	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
HEATER IN SERIES	7.0 VOLTS	300	MA.
HEATER IN PARALLEL	3.5 VOLTS	600	MA.
HEATER WARM-UP TIME (IN PARALLEL)		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (HEATER IN SERIES)		7.0±0.7	VOLTS
CURRENT OPERATION (HEATER IN PARALLEL)		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT

	CLASS A1 AMPLIFIER	VERTICAL DEFLECTION OSCILLATOR	
PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION:			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
CATHODE CURRENT	22		MA.
PEAK NEGATIVE PULSE GRID VOLTAGE		440	VOLTS
AVERAGE CATHODE CURRENT		22	MA.
PEAK CATHODE CURRENT		66	MA.
MAXIMUM CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE:			
FOR FIXED BIAS, GRID-RESISTOR BIAS, OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

	HORIZONTAL DEFLECTION OSCILLATOR	VERTICAL DEFLECTION AMPLIFIER	
DC PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
PEAK POSITIVE-PULSE PLATE VOLTAGE		1200	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE	660	275	VOLTS
AVERAGE CATHODE CURRENT	22	22	MA.
PEAK CATHODE CURRENT	330	66	MEGOHMS
MAXIMUM CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE:			
FOR FIXED BIAS, GRID-RESISTOR BIAS, OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - EACH UNIT

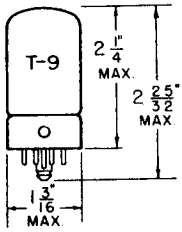
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
AMPLIFICATION FACTOR	→ 19.5	17	
PLATE RESISTANCE	→ 6250	7700	OHMS
TRANSCONDUCTANCE	3100	2200	μMHOS
PLATE CURRENT	11.8	10.5	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP.		-24	VOLTS

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

TUNG-SOL

HIGH MU-TRIODE



COATED UNIPOTENTIAL CATHODE

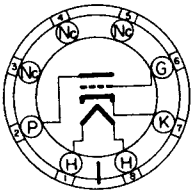
6.3 VOLTS 0.30 AMPERES

AC OR DC

In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible.

GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

LOCKING-IN 8 PIN BASE

THE 7B4 IS A GENERAL PURPOSE HIGH MU TRIODE USING THE LOCK-IN CONSTRUCTION AND IS SIMILAR TO THE 6F5GT SERIES. IT IS USEFUL AS A HIGH GAIN RESISTANCE COUPLED AUDIO AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	7.0	VOLTS
HEATER CURRENT	0.32	AMPERE
MAXIMUM PLATE VOLTAGE	300	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH M8-308 TUBE SHIELD CONNECTED TO CATHODE

GRID PLATE	1.6	μμF
INPUT	3.6	μμF
OUTPUT	3.4	μμF

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	85 000	66 000	OHMS
TRANSCONDUCTANCE	1 150	1 500	μMHOS
AMPLIFICATION FACTOR	100	100	

SIMILAR TYPE REFERENCE: *Same ratings, characteristics and application as types 6F5, 6F5G, 6F5GT, 6SF5, 6SF5GT. Somewhat similar to triode section of type 75.*

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PLATE 1587

JULY 31, 1945

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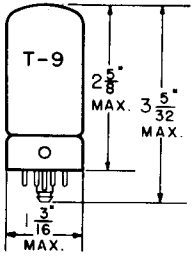
PENTODE

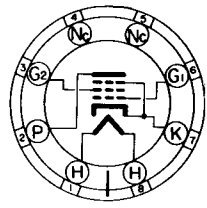


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 400 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
6AE

THE 785 IS AN INDIRECTLY HEATED CATHODE TYPE POWER AMPLIFIER PENTODE DESIGNED FOR SERVICE IN THE OUTPUT STAGES OF AC, AC/DC AND STORAGE BATTERY OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS ←
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS ←
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	2.8	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - SINGLE TUBE

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	400	400	400	MA.
PLATE VOLTAGE	100	250	315	VOLTS
GRID #2 VOLTAGE	100	250	250	VOLTS
GRID #1 VOLTAGE[A]	-7	-18	-21	VOLTS
PEAK AF GRID #1 VOLTAGE	7	18	21	VOLTS
ZERO SIGNAL PLATE CURRENT	9	32	25.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	9.5	33	28	MA.
ZERO SIGNAL GRID #2 CURRENT	1.6	5.5	4	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	3	10	9	MA.
PLATE RESISTANCE (APPROX.)	104 000	90 000	110 000	OHMS
TRANSCONDUCTANCE	1 500	2 300	2 100	µMHOS
LOAD RESISTANCE	12 000	7 600	9 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	0.35	3.4	4.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	11	11	15	PERCENT

[A] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR FIXED BIAS = 0.1 MEGOHM.

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PLATE 2311
JAN. 1 1950

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PUSH-PULL - TWO TUBES[B]

	FIXED BIAS	CATHODE BIAS	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	400	400	MA.
PLATE VOLTAGE	285	285	VOLTS
GRID #2 VOLTAGE	285	285	VOLTS
GRID #1 VOLTAGE	-25.5[A]	---	VOLTS
CATHODE RESISTOR	---	400[C]	OHMS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	51	51	VOLTS
ZERO SIGNAL PLATE CURRENT	55	55	MA.
MAXIMUM SIGNAL PLATE CURRENT	72	61	MA.
ZERO SIGNAL GRID #2 CURRENT	9	9	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	17	13	MA.
PLATE TO PLATE LOAD RESISTANCE	12 000	12 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	10.5	9.8	WATTS
TOTAL HARMONIC DISTORTION	6	4	PERCENT

[A] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR FIXED BIAS = 0.1 MEGOHM.

[B] UNLESS OTHERWISE SPECIFIED.

[C] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR CATHODE BIAS = 0.5 MEGOHM.

SIMILIAR TYPE REFERENCE: Ratings and characteristics are identical to types 6K6GT and 41.

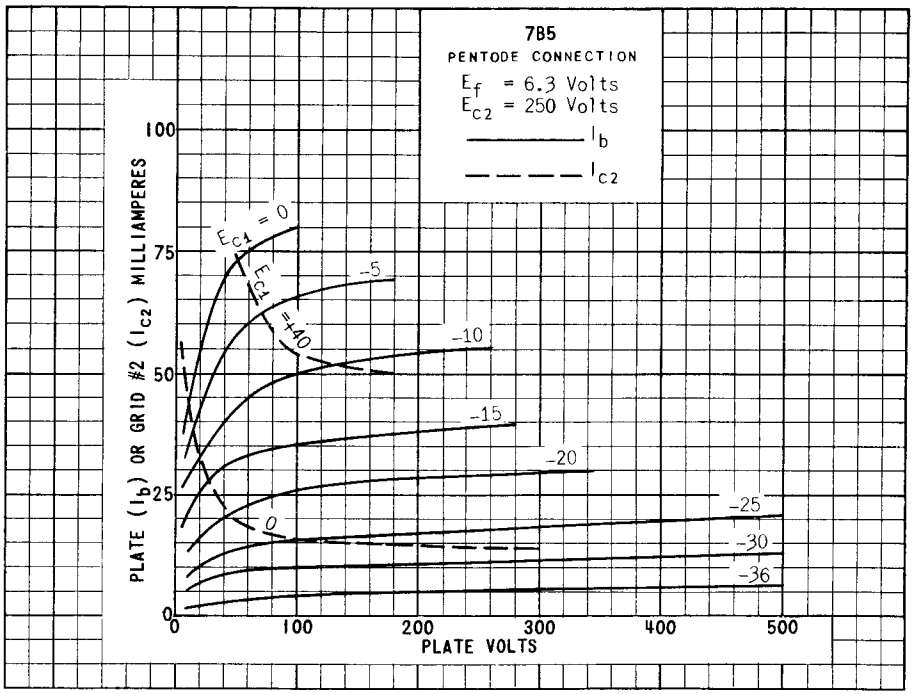

PLATE 2312

JAN. 1 1950

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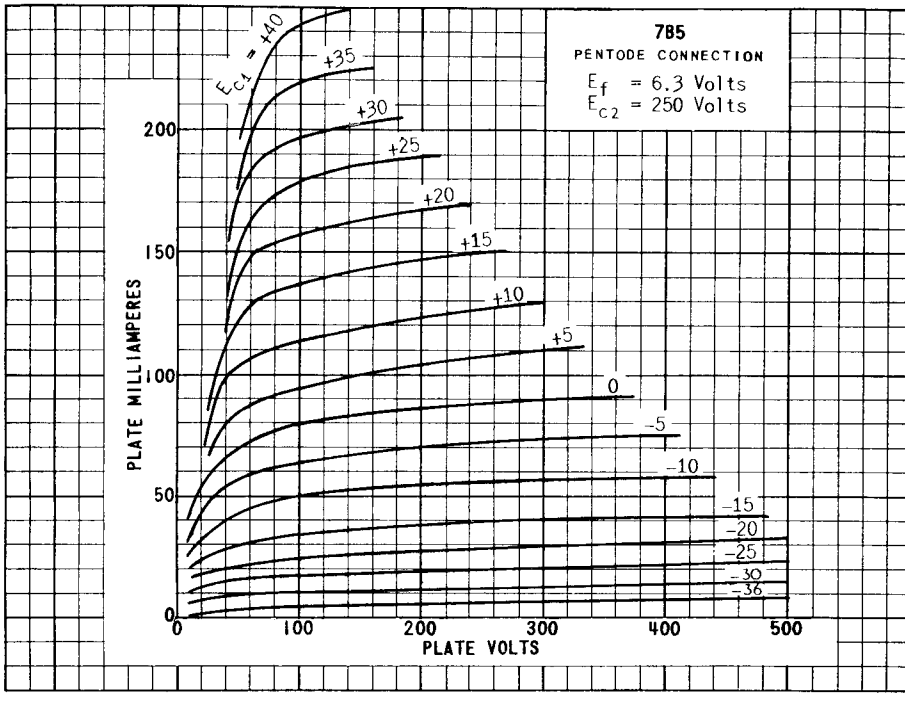

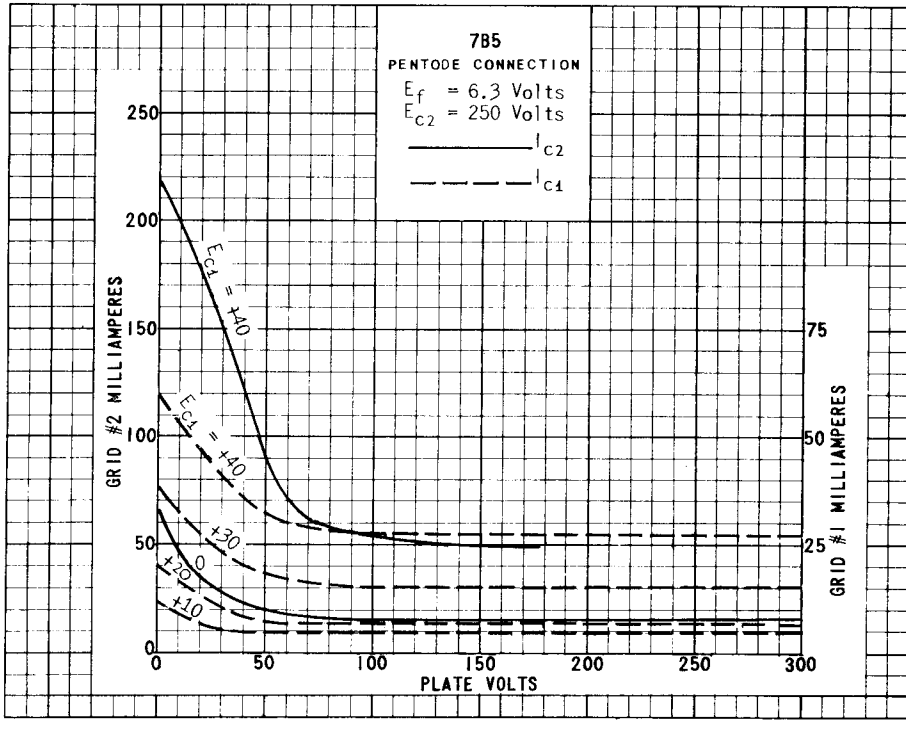

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PLATE
2313
JAN. 1
1950

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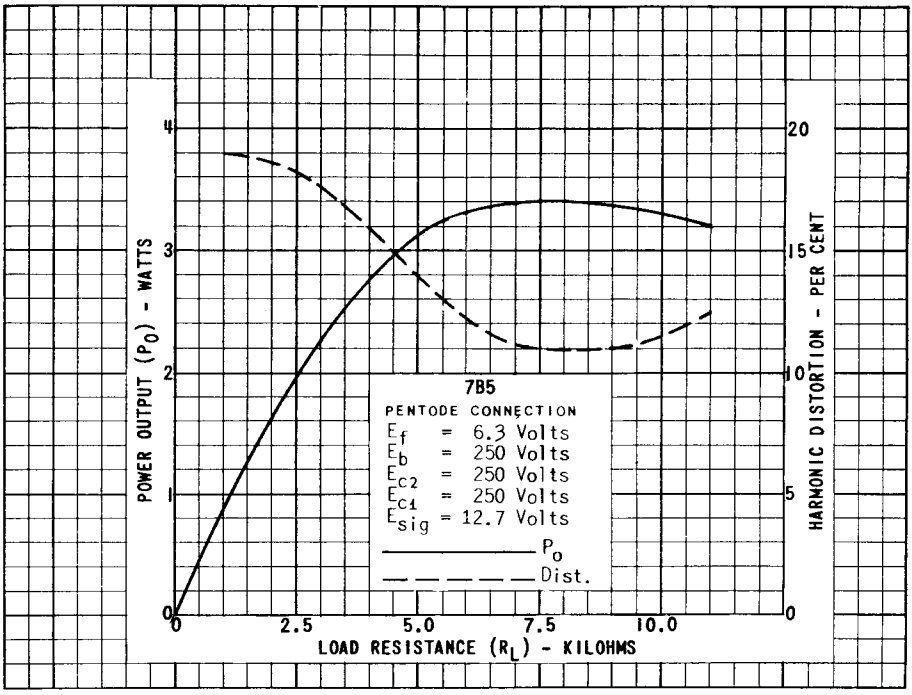
7B5 (6K6GT, 41)



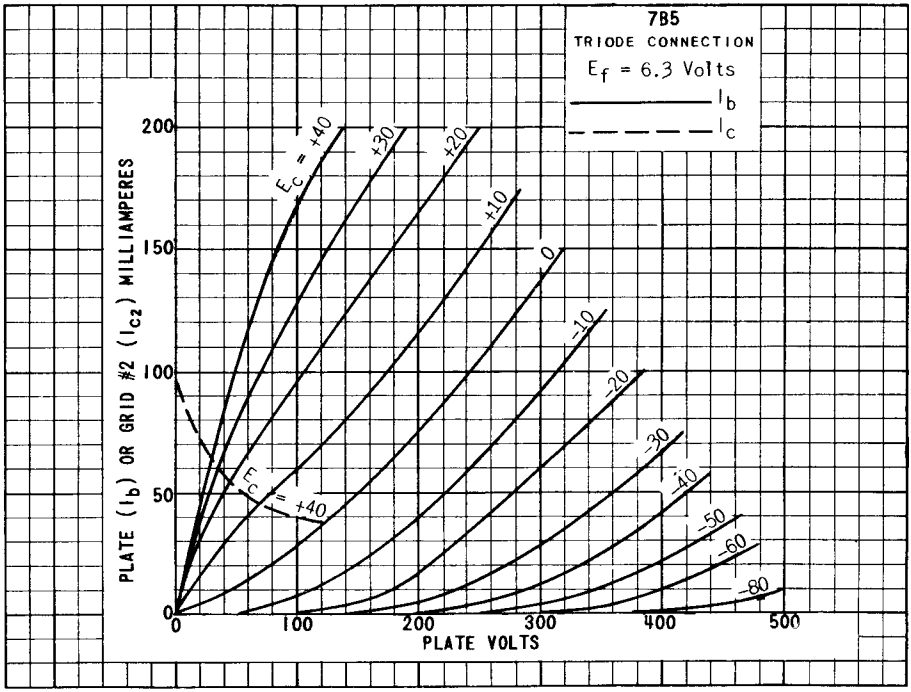


PLATE 2314
JAN. 1 1950

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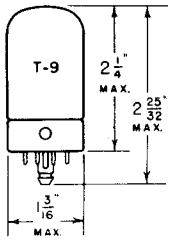
TUNG-SOL

DUO-DIODE

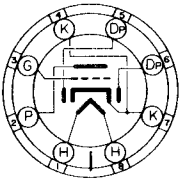
HIGH-MU TRIODE AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



8W

BOTTOM VIEW

8 PIN LOCKING-IN BASE

THE TUNG-SOL 7B6 CONSISTS OF TWO DIODES AND A HIGH-MU TRIODE WITH A COMMON CATHODE. IT IS DESIGNED FOR SERVICE AS A DIODE DETECTOR, AVC RECTIFIER AND AN IMPEDANCE OR RESISTANCE COUPLED AMPLIFIER. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6SQ7GT, 12SQ7GT, 75 AND THE 2A6.

RATINGS

NOMINAL HEATER VOLTAGE	7.0	VOLTS
NOMINAL HEATER CURRENT	0.32	AMP.
MAXIMUM PLATE VOLTAGE	250	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	0.9	MA.
PLATE RESISTANCE	91000	OHMS
TRANSCONDUCTANCE	1100	μMHOS
AMPLIFICATION FACTOR	100	

DIODE UNITS - TWO

MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.

PLATE 820-1

AUG. 30 1940

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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7B6

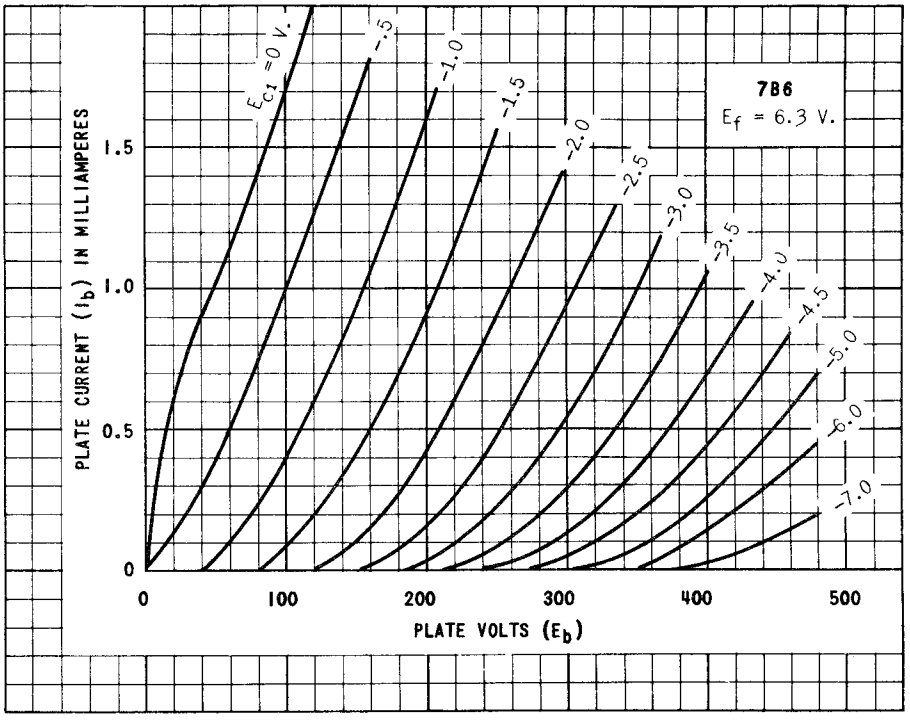

PLATE
821-1

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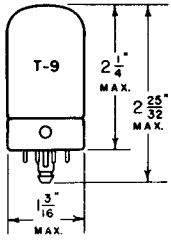
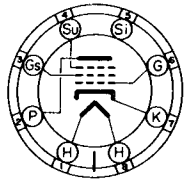
TUNG-SOL

TRIPLE GRID
REMOTE CUT-OFF AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC



8V
BOTTOM VIEW

GLASS BULB

8 PIN LOCKING-IN BASE

THE TUNG-SOL 7B7 IS A TRIPLE GRID REMOTE CUT-OFF AMPLIFIER. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS.

RATINGS

NOMINAL HEATER VOLTAGE	7.0	VOLTS
NOMINAL HEATER CURRENT	0.16	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.25	WATT
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLT

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	5.0	μμf
PLATE TO CATHODE	6.0	μμf
CONTROL GRID TO PLATE	0.007 MAX.	μμf

[S] WITH AN EXTERNAL SHIELD CONNECTED TO CATHODE

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

PLATE 822-1

AUG. 30 1940

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	−3	−3	VOLTS
SUPPRESSOR GRID AND PIN #5 CONNECTED TO CATHODE AT SOCKET			
PLATE CURRENT	8.2	8.5	MA.
SCREEN CURRENT	1.8	1.7	MA.
PLATE RESISTANCE	0.3	0.75	MEGOHM
TRANSCONDUCTANCE	1675	1750	µMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 10 µMHOS	−40	−40	VOLTS

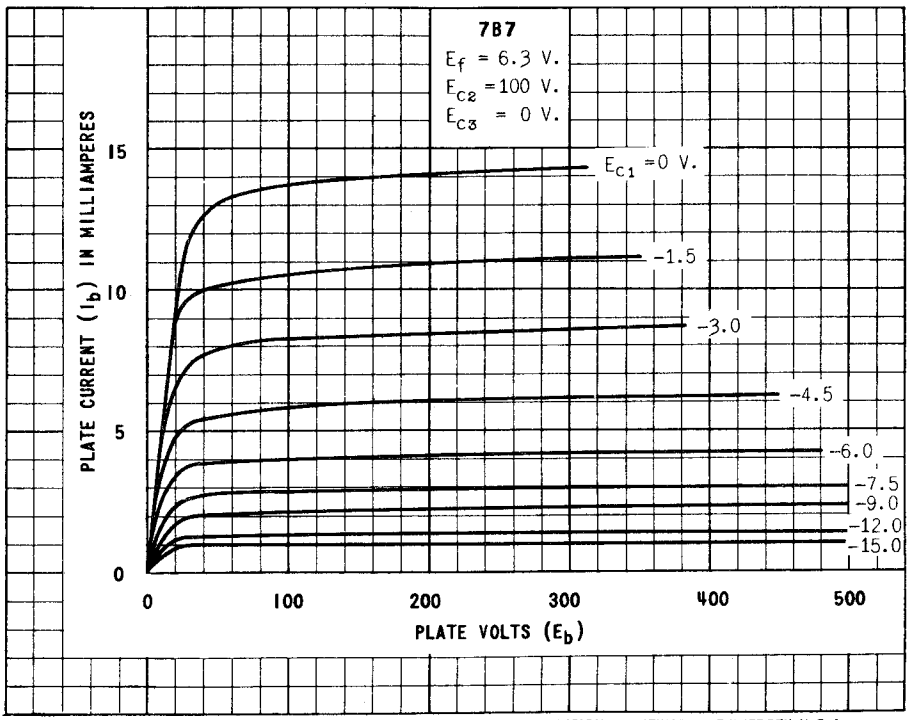

PLATE 823-1

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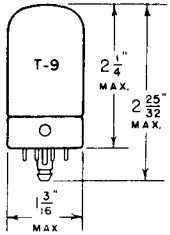
TUNG-SOL

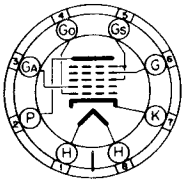
PENTAGRID CONVERTER



UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



8X

BOTTOM VIEW

LOCKING-IN 8 PIN BASE

THE TUNG-SOL 7B8 IS A PENTAGRID CONVERTER DESIGNED FOR SERVICE IN AC, AC-DC AND STORAGE BATTERY OPERATED RECEIVERS. ITS APPLICATIONS AND ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6A8, 6A8G AND 6A8GT.

RATINGS

NOMINAL HEATER VOLTAGE	7.0	VOLTS
NOMINAL HEATER CURRENT	0.32	AMPERE
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN (Gs) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN (Gs) VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (GA) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM OSCILLATOR ANODE (GA) VOLTAGE	200	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM OSCILLATOR ANODE (GA) DISSIPATION	.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1130-2

SEPT. 17
1941

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID (G) TO MIXER (P)	0.2 MAX.	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)	0.2 MAX.	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_O)	0.2 MAX.	μμf
OSCILLATOR GRID (G_O) TO OSCILLATOR ANODE (G_A)	0.9	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	10	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_O) TO ALL OTHER ELECTRODES	5.0	μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES	3.4	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	9.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMPERE
PLATE (P) VOLTAGE	100	250	VOLTS
SCREEN (G_S) VOLTAGE	50	100	VOLTS
CONTROL GRID (G) VOLTAGE	-1.5	-3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE[A]	–	250	VOLTS
OSCILLATOR ANODE (G_A) VOLTAGE	100	–	VOLTS
OSCILLATOR GRID (G_O) RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.1	3.5	MA.
SCREEN CURRENT	1.3	2.7	MA.
OSCILLATOR ANODE CURRENT	2.0	4.0	MA.
TOTAL CATHODE CURRENT	4.6	10.6	MA.
PLATE RESISTANCE APPROX.	0.6	0.36	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -1.5 V.	360	–	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -3 V.	180	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -6 V.	50	325	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = -10 V.	–	100	μMHOS
CONVERSION TRANCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -20 V.	3	–	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = -35 V.	–	6	μMHOS

[A] APPLIED THROUGH A PROPERLY BY-PASSED 20000 OHM DROPPING RESISTOR.

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

NOTE: THE TRANSCONDUCTANCE OF THE OSCILLATOR SECTION (NOT OSCILLATING IS APPROXIMATELY 1150 UMHOS, THE AMPLIFICATION FACTOR IS 75 AND THE OSCILLATOR ANODE CURRENT IS 4.0 MA. CONDITIONS: PLATE VOLTAGE = 250 V., OSCILLATOR ANODE VOLTAGE = 100 V., SCREEN VOLTAGE = 55 V., CONTROL GRID VOLTAGE = -2.0 V., AND THE OSCILLATOR GRID VOLTAGE = -1.0 V.

PLATE 1131-1

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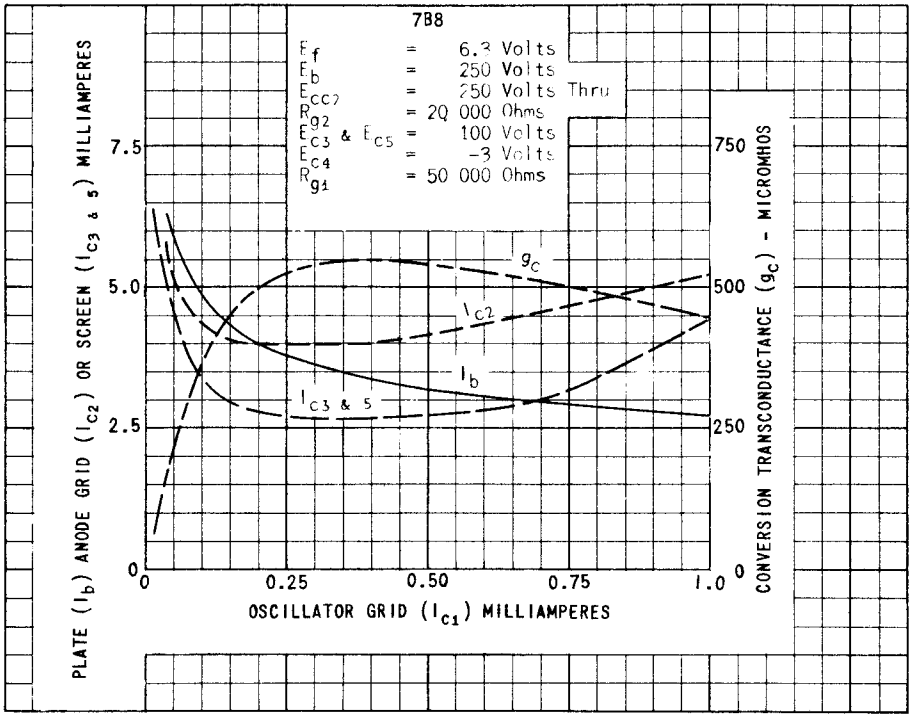

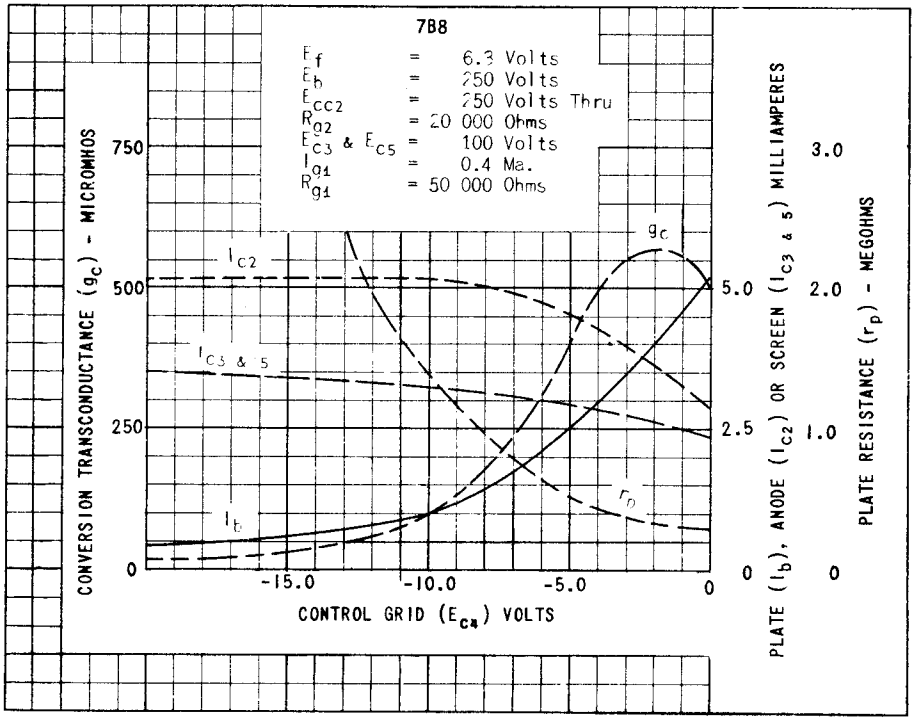

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PLATE
2000
APRIL 1
1948

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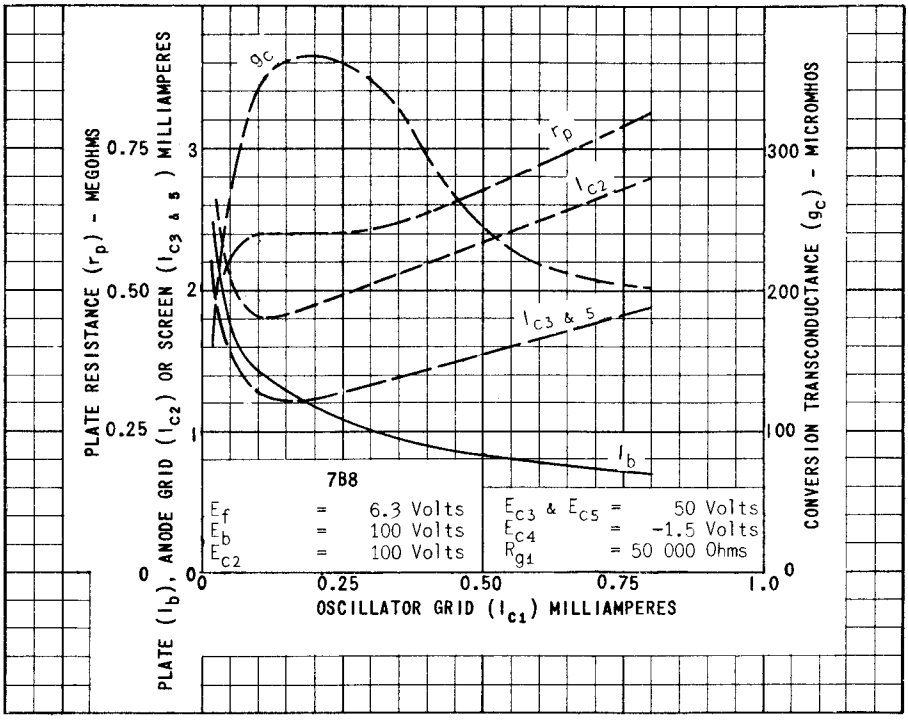
7B8



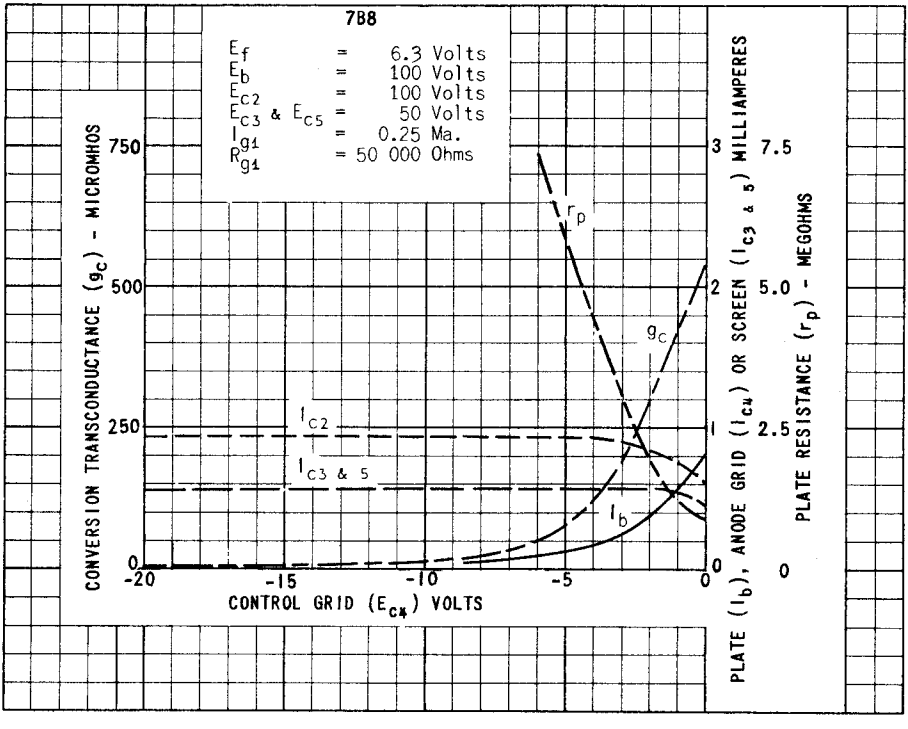


PLATE
2001
APRIL 1
1948

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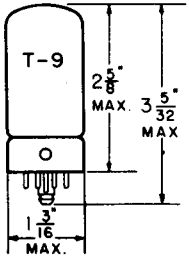
TUNG-SOL

BEAM PENTODE

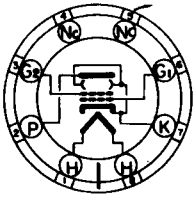


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
6AA

THE 7C5 IS A BEAM POWER AMPLIFIER, DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC AND STORAGE BATTERY OPERATED RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS

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PLATE
2833
JAN. 1
1952

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - SINGLE TUBE

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	450	450	450	MA.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE[A]	-8.5	-12.5	-13	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13	VOLTS
ZERO SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO SIGNAL GRID #2 CURRENT	3	4.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	4	7	6	MA.
PLATE RESISTANCE (APPROX.)	58 000	52 000	77 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	µMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
MAXIMUM SIGNAL POWER OUTPUT	2	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	8	8	12	PERCENT

CLASS AB_1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	250	285	VOLTS
GRID #2 VOLTAGE	250	285	VOLTS
GRID #1 VOLTAGE[A]	-15	-19	VOLTS
PEAK AF GRID TO GRID VOLTAGE	30	38	VOLTS
ZERO SIGNAL PLATE CURRENT	70	70	MA.
MAXIMUM SIGNAL PLATE CURRENT	79	92	MA.
ZERO SIGNAL GRID #2 CURRENT	5	4	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	13	13.5	MA.
PLATE TO PLATE LOAD RESISTANCE	10 000	8 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	10	14	WATTS
TOTAL HARMONIC DISTORTION	5	3.5	PERCENT

[A] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR FIXED BIAS = 0.1 MEGOHM.
MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR CATHODE BIAS = 0.5 MEGOHM.

PLATE 2834
JAN. 1 1952

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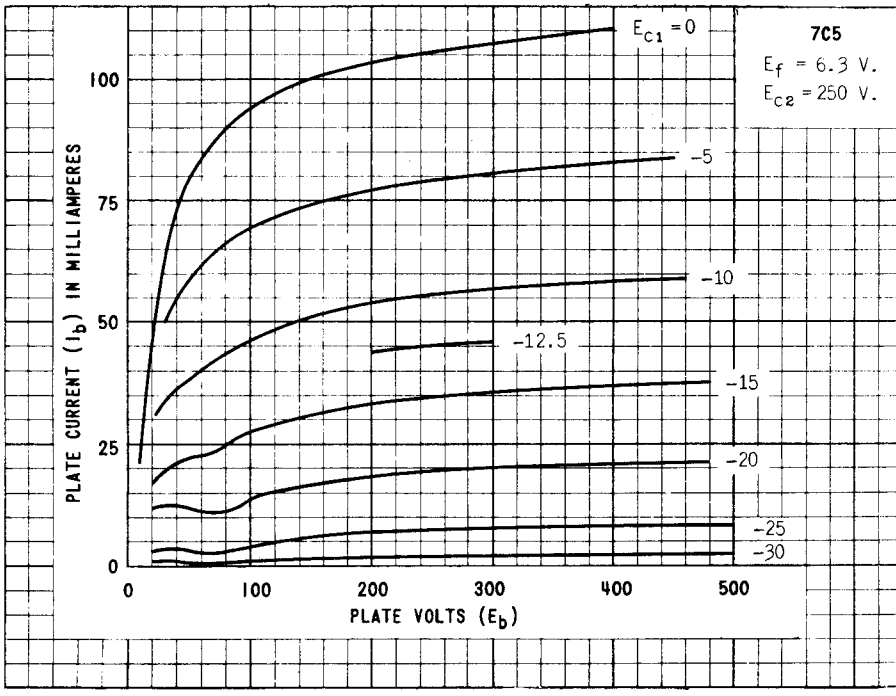

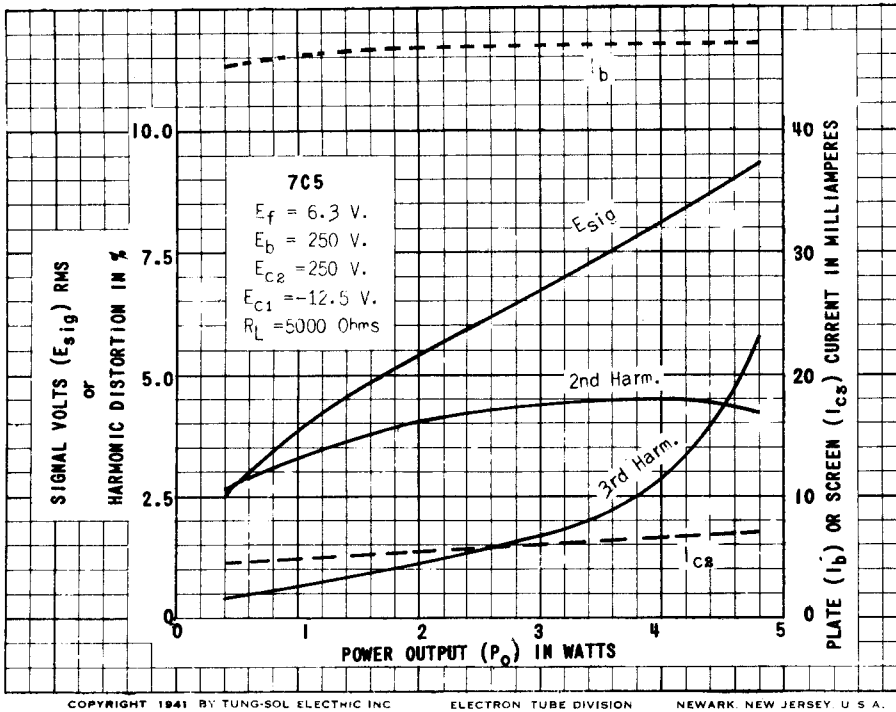

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PLATE
1090-1

JULY 28
1941

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7C5

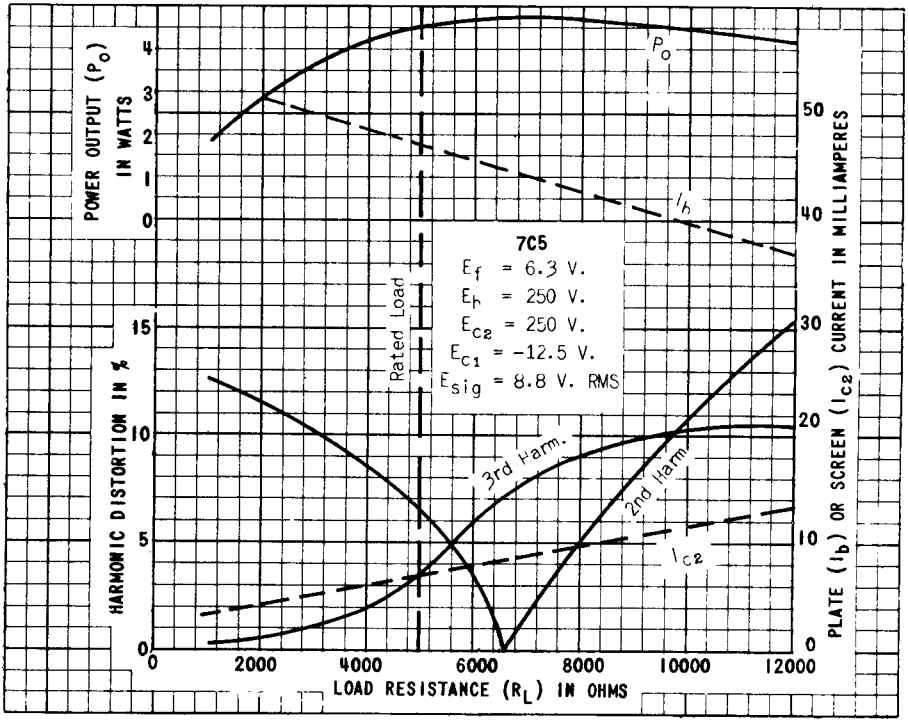

PLATE
1091-1

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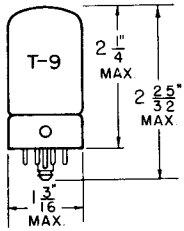
TUNG-SOL

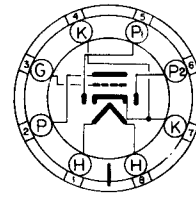
DOUBLE DIODE TRIODE



COATED UNIPOTENTIAL CATHODE

6.3 VOLTS 0.150 AMPERES
AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.



BOTTOM VIEW
LOCKING IN 8 PIN BASE

GLASS BULB

ANY MOUNTING POSITION

THE 7C6 IS A DOUBLE DIODE HIGH MU TRIODE USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A DETECTOR AND HIGH GAIN AUDIO AMPLIFIER. IT FEATURES A LOW DRAIN HEATER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3		6.3		VOLTS
PLATE SUPPLY VOLTAGE	100		300		VOLTS
GRID LEAK	10		10		MEGOHMS
LOAD RESISTANCE	0.25		0.25		MEGOHM
COUPLING CAPACITOR	.01	TO .005	.01	TO .005	μμF
GRID RESISTOR FOR FOLLOWING TUBE	.5	1.0	0.5	1.0	MEGOHM
EXTERNAL GRID CIRCUIT IMPEDANCE	0	0	0	0	MEGOHM
VOLTAGE GAIN	38	42	54	56	
VOLTAGE OUTPUT (RMS)	5	6	37	43	VOLTS
TOTAL HARMONIC DISTORTION	5	5	5	5	PER CENT

AVERAGE CHARACTERISTICS

TRIODE UNIT

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-1	VOLTS
AMPLIFICATION FACTOR	85	100	
PLATE RESISTANCE	0.1	0.1	MEGOHM
TRANSCONDUCTANCE	850	1,000	μMHOS
PLATE CURRENT	1.0	1.3	MA

CONTINUED ON FOLLOWING PAGE.

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PLATE 1590
JULY 31, 1945

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

DIODE UNITS

TWO

DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	1.0	MA.

SIMILAR TYPE REFERENCE: *Characteristics similar to type 75. Diode section similar to types 2B7, 6B7, 6B8G, 85, 55.*

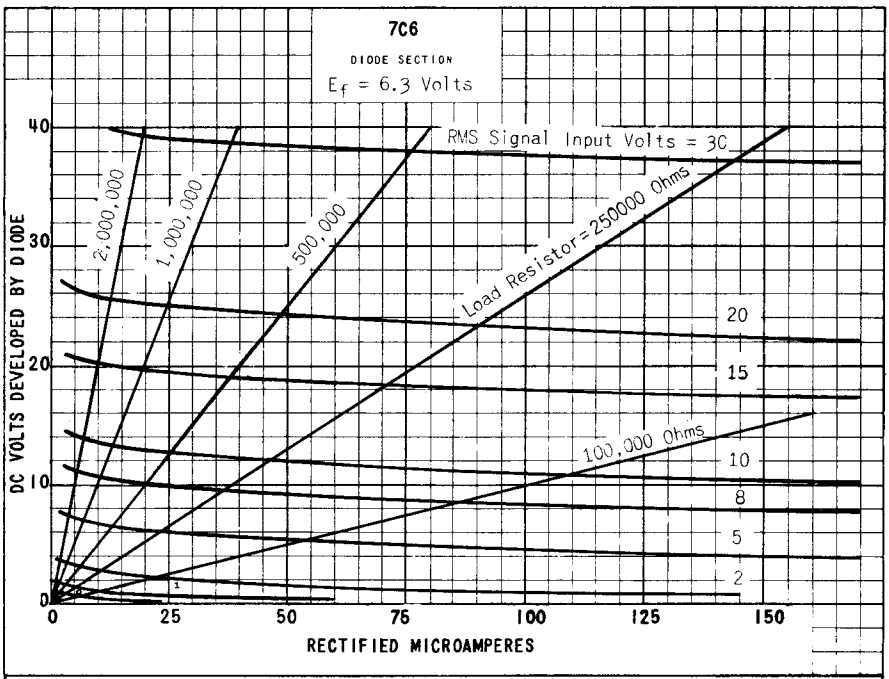

PLATE 1591

JULY 31, 1945

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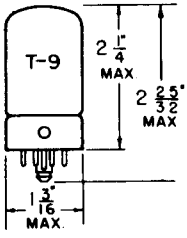
TUNG-SOL

PENTODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN
8 PIN BASE
8V

THE 7C7 IS A SHARP CUT-OFF GENERAL PURPOSE PENTODE AMPLIFIER. ←

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID #1 TO PLATE: (G_1 TO P)	0.007	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	6	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	6.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM GRID #2 DISSIPATION	0.1	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
SELF-BIAS RESISTOR	130	1 000	OHMS ←
GRID #3 VOLTAGE	PINS #4 AND #5 CONNECTED TO PIN #7 AT SOCKET		←
PLATE CURRENT	5.7	2.2	MA.
GRID #2 CURRENT	1.8	0.7	MA.
PLATE RESISTANCE (APPROX.)	0.4	1	MEGOHM ←
TRANSCONDUCTANCE	2 275	1 575	μMHOS
GRID VOLTAGE FOR CATHODE CURRENT CUTOFF	-7	-7	VOLTS ←

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PLATE
2835
JAN. 1
1952

→INDICATES A CHANGE OR ADDITION.

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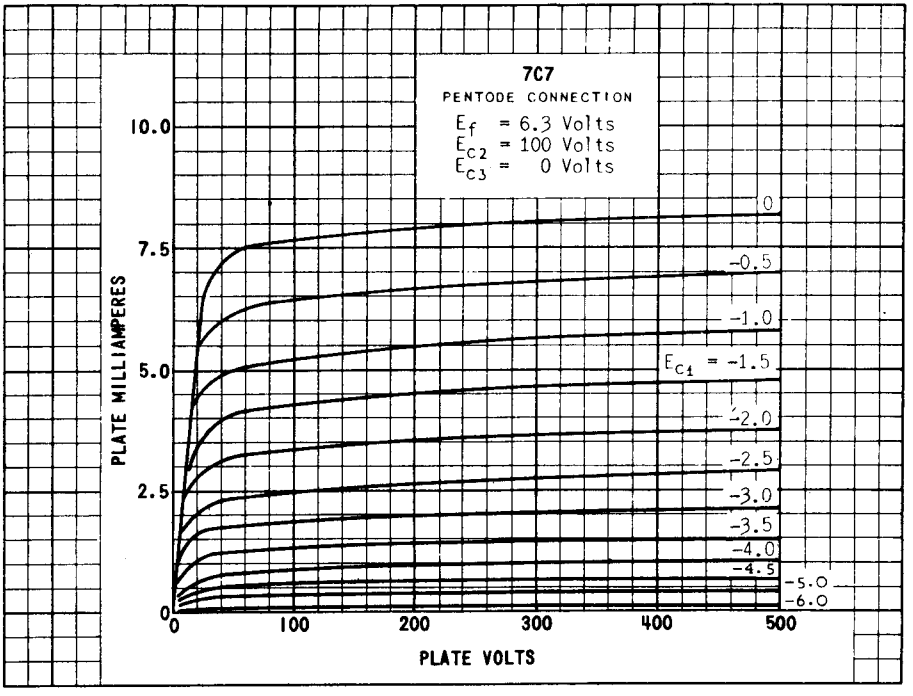
7C7(14C7)



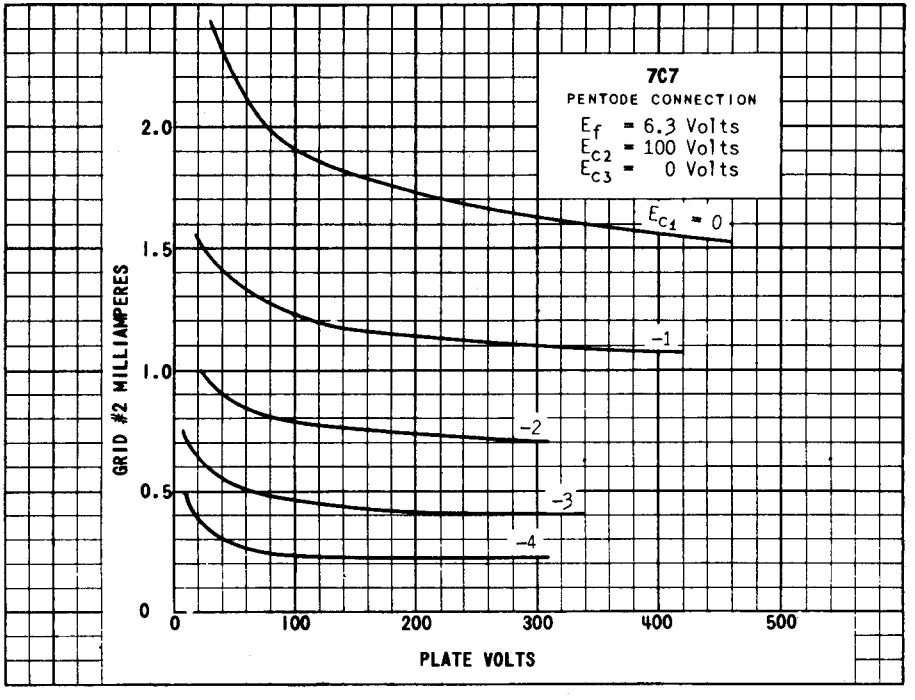


PLATE
2836
JAN. 1
1952

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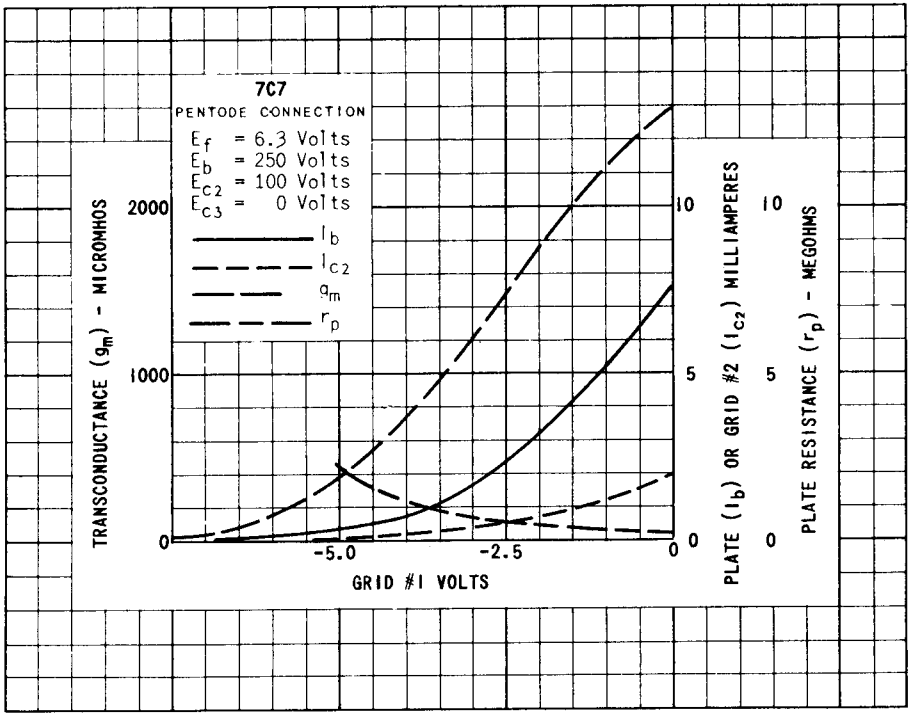

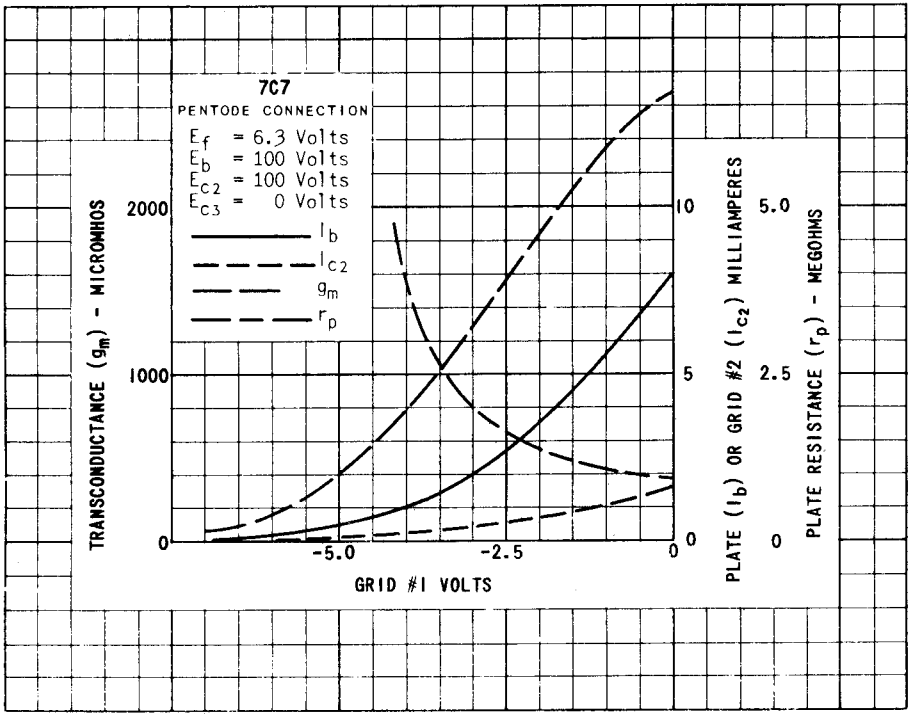

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PLATE
2837
JAN. 1
1952

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TUNG-SOL

CATHODE RAY

THE 7DP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ELECTROSTATIC FOCUS**
ROUND GLASS CONSTRUCTION — **MAGNETIC DEFLECTION**
EXTERNAL CONDUCTIVE COATING — **EXTERNAL DOUBLE FIELD ION TRAP**
4" X 5 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):	50	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	400	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE #2, GRID #3 VOLTAGE[A]	8 000	VOLTS
MAXIMUM DC ANODE #1 VOLTAGE	2 400	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE #2, GRID #3 VOLTAGE[B]	6 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
ANODE #1 VOLTAGE FOR FOCUS[D]	1215 TO 1645	VOLTS
DC GRID #1 VOLTAGE[C]	-27 TO -63	VOLTS
MAXIMUM ANODE #1 CURRENT RANGE	-15 TO +10	μAMP

[A] THE PRODUCT OF ANODE #2 VOLTAGE AND AVERAGE ANODE #2 CURRENT SHOULD NEVER EXCEED 6 WATTS.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE #2 VOLTAGE. IN GENERAL, ANODE #2 VOLTAGE SHOULD NOT BE LESS THAN 5,000 VOLTS.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] WITH COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 12 FOOT LAMBERTS ON A 4" BY 5 1/2" PICTURE SIZE.

CONTINUED ON FOLLOWING PAGE

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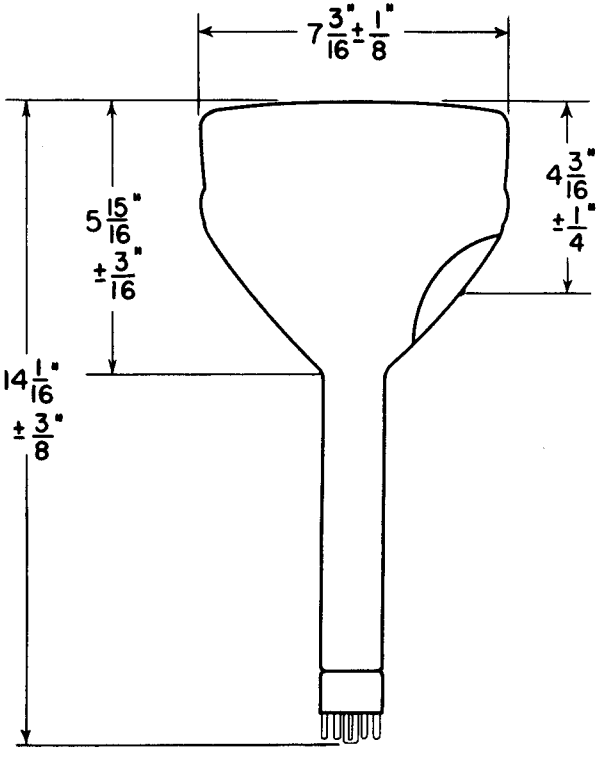
CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

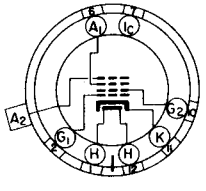
OVERALL LENGTH	14 1/16 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	7 3/16 ± 1/8	INCHES
MIN. USEFUL SCREEN DIAMETER	6	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 7 PIN	
BASING		12C

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #2 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – ANODE #1
PIN 7 – Ic DO NOT USE
PIN 10 – GRID #2
PIN 11 – CATHODE

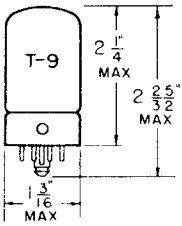


BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO.3

TUNG-SOL

TRIODE

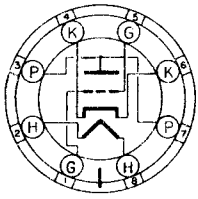


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7E5 IS A HEATER-CATHODE TYPE SHARP CUT-OFF VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS CHARACTERIZED BY MODERATELY HIGH TRANSCONDUCTANCE AND RELATIVELY LOW INTERELECTRODE CAPACITANCES AND LOAD INDUCTANCE MAKING IT SUITABLE FOR HIGH FREQUENCY CIRCUITS. IN ADDITION IT IS ECONOMICAL OF HEATER POWER.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G TO P)	1.5	μμf
INPUT: G TO (H+K)	3.6	μμf
OUTPUT: P TO (H+K)	2.8	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM-HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE CURRENT	16	MA.
MAXIMUM GRID CURRENT	6	MA.
MAXIMUM PLATE DISSIPATION	4	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	150	MA.
PLATE CURRENT	180	VOLTS
GRID VOLTAGE	-3	VOLTS
PLATE RESISTANCE	12 000	OHMS
TRANSCONDUCTANCE	3 000	μMHOS
AMPLIFICATION FACTOR	36	
PLATE CURRENT	5.5	MA.

CONTINUED ON FOLLOWING PAGE

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PLATE 2117
DEC. 1, 1948

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

UHF OSCILLATOR - 750 MEGACYCLE

HALF-WAVE FOUR-LINE OSCILLATOR IN WHICH THE LINE SHORTENING, DUE TO THE TUBE, IS APPROXIMATELY 45% OF A HALF-WAVE LENGTH.

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	200	250	VOLTS
GRID RESISTOR	10 000	20 000	OHMS
DEVELOPED BIAS	2.5	3.5	VOLTS
PLATE CURRENT	11	13	MA.

UHF OSCILLATOR OR POWER AMPLIFIER 300 MEGACYCLE

QUARTER WAVE FOUR-LINE OSCILLATOR IN WHICH THE LINE SHORTENING IS APPROXIMATELY 30% OF A QUARTER WAVE LENGTH.

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	150	MA.
PLATE SUPPLY VOLTAGE[A]	150	VOLTS
GRID RESISTOR (APPROX.)	1 700	OHMS
PLATE CURRENT	16	MA.
GRID CURRENT	6	MA.
POWER OUTPUT	0.2	WATT

[A] SUPPLIED THROUGH 3000 OHM DROPPING RESISTOR.

LOCAL OSCILLATOR FOR 300 MEGACYCLE MIXER DRIVING

QUARTER WAVE FOUR-LINE OSCILLATOR IN WHICH THE LINE SHORTENING IS APPROXIMATELY 30% OF A QUARTER WAVE LENGTH.

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	150	MA.
PLATE SUPPLY VOLTAGE[A]	90	VOLTS
GRID VOLTAGE	-7	VOLTS
GRID RESISTOR	3 000	OHMS
MIXER DEVELOPED BIAS	-5.3	VOLTS
PLATE CURRENT	7.8	MA.

[A] SUPPLIED THROUGH 3000 OHM DROPPING RESISTOR

PLATE 2118
DEC. 1, 1948

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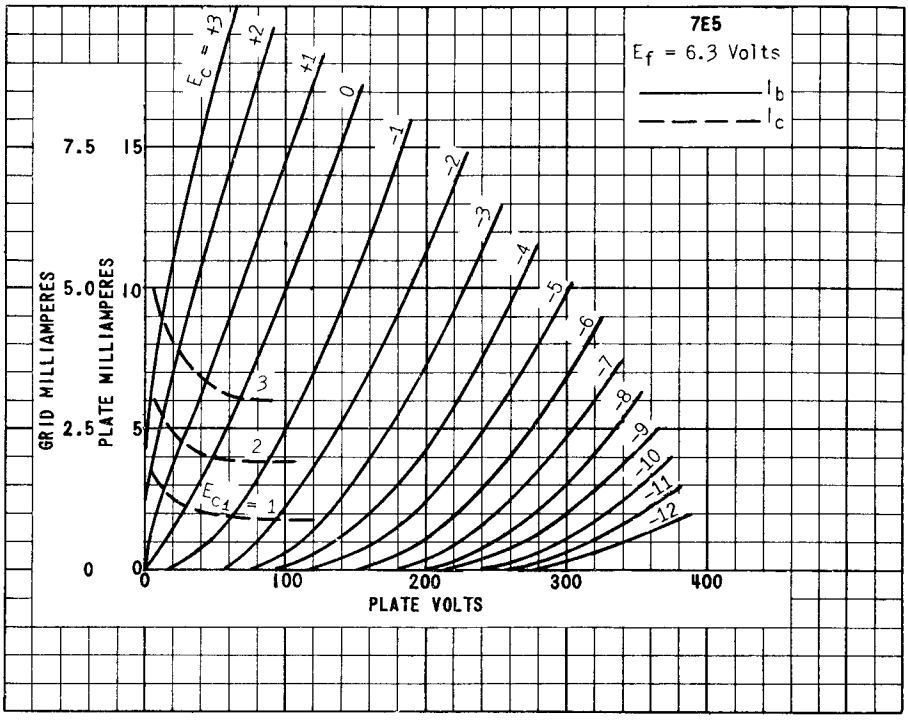

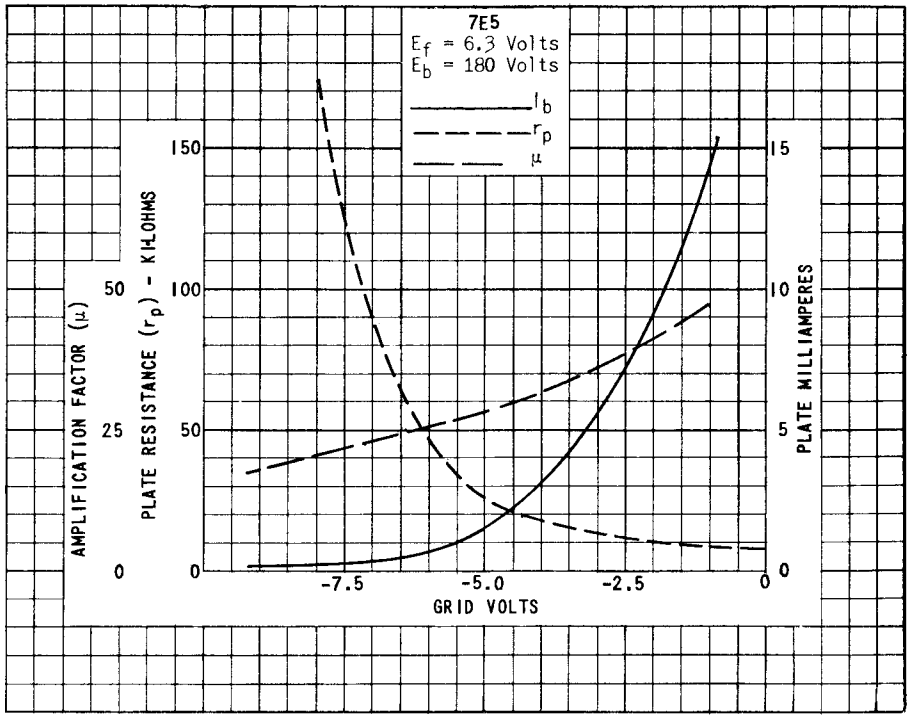

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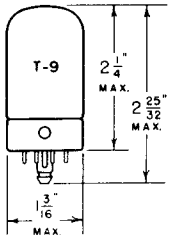
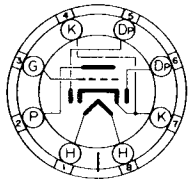
DUO-DIODE TRIODE AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



8W
BOTTOM VIEW

LOCKING-IN 8 PIN BASE

THE TUNG-SOL 7E6 CONSISTS OF TWO DIODES AND A TRIODE IN A SINGLE BULB, WITH A COMMON CATHODE. IT IS DESIGNED FOR SERVICE AS A DIODE DETECTOR, AVC RECTIFIER AND AN AUDIO AMPLIFIER. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6R7G AND THE 6R7GT.

RATINGS

HEATER VOLTAGE – NOMINAL	7.0	VOLTS
HEATER CURRENT – NOMINAL	0.32	AMPERE
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-9	VOLTS
PLATE CURRENT	9.5	MA.
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	

PLATE 854-1

SEPT. 23 1940

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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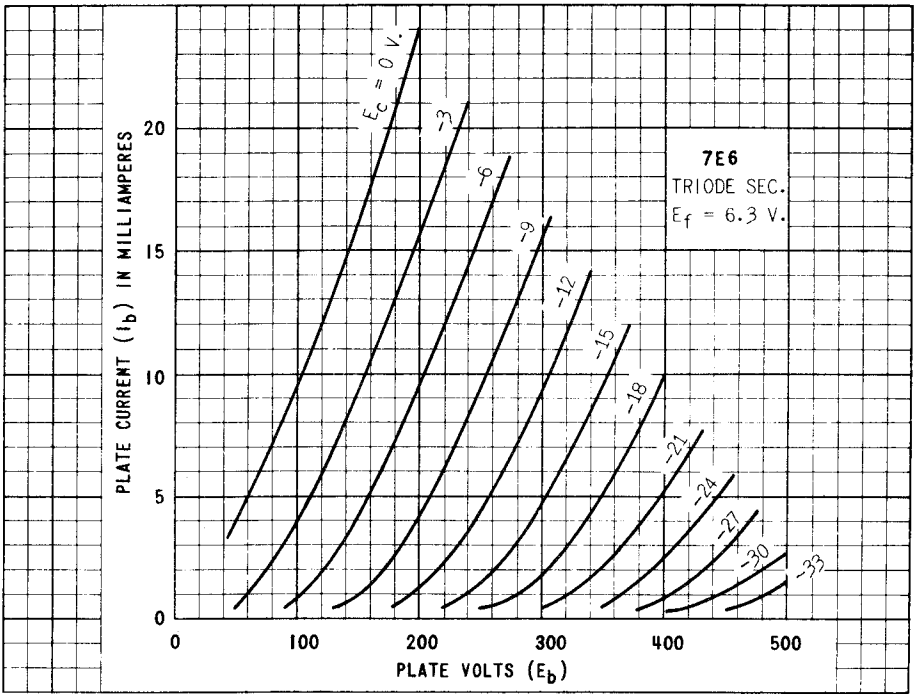
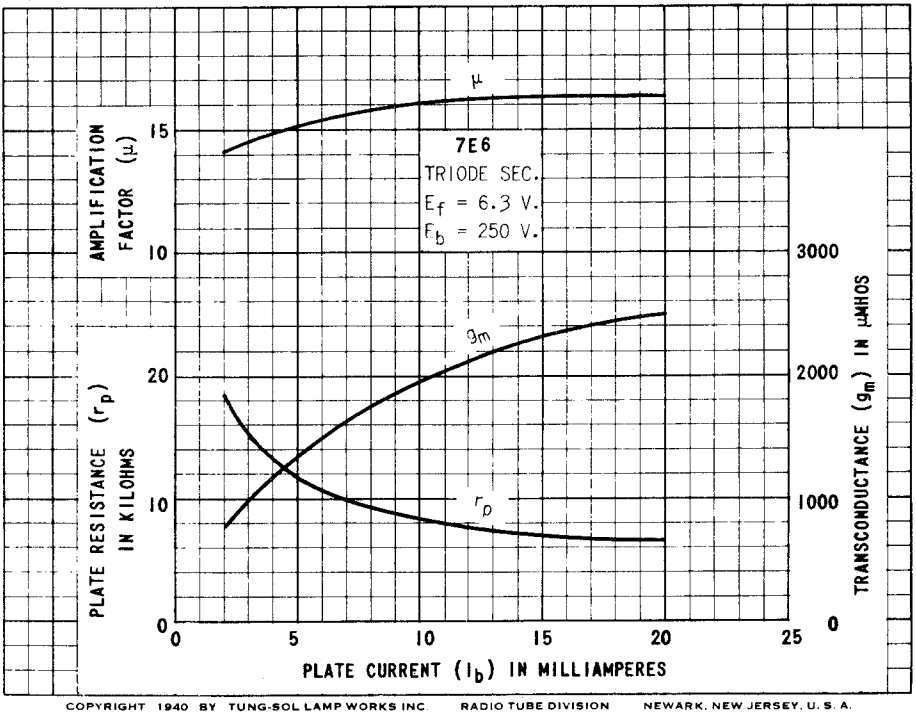
7E6





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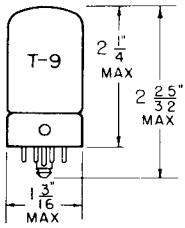
TUNG-SOL

DOUBLE-DIODE PENTODE

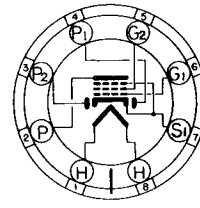


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8AE

THE 7E7 IS A COMBINED REMOTE CUT OFF PENTODE AND DOUBLE DIODE DETECTOR USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED DETECTOR, AVC RECTIFIER AND RF, IF OR AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.005	µµf
INPUT: G_1 TO (H+K+G_2+IS)	4.6	µµf
OUTPUT: P TO (H+K+G_2+IS)	5.5	µµf
DIODE #1 TO GRID (1P TO G_1) MAX.	0.013	µµf
DIODE #2 TO GRID (2P TO G_1) MAX.	0.003	µµf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM VOLTAGE DROP MEASURED WITH TUBE CONDUCTING 0.8 MA. EACH PLATE	10	VOLTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	RF OR IF AMPLIFIER		
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	10	7.5	MA.
GRID #2 CURRENT	2.7	1.6	MA.
PLATE RESISTANCE (APPROX.)	0.15	0.7	MEGOHM
TRANSCONDUCTANCE	1 600	1 300	µMHOS
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 2 µMHOS	-36	-42.5	VOLTS

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PLATE 2272
NOV. 1, 1949

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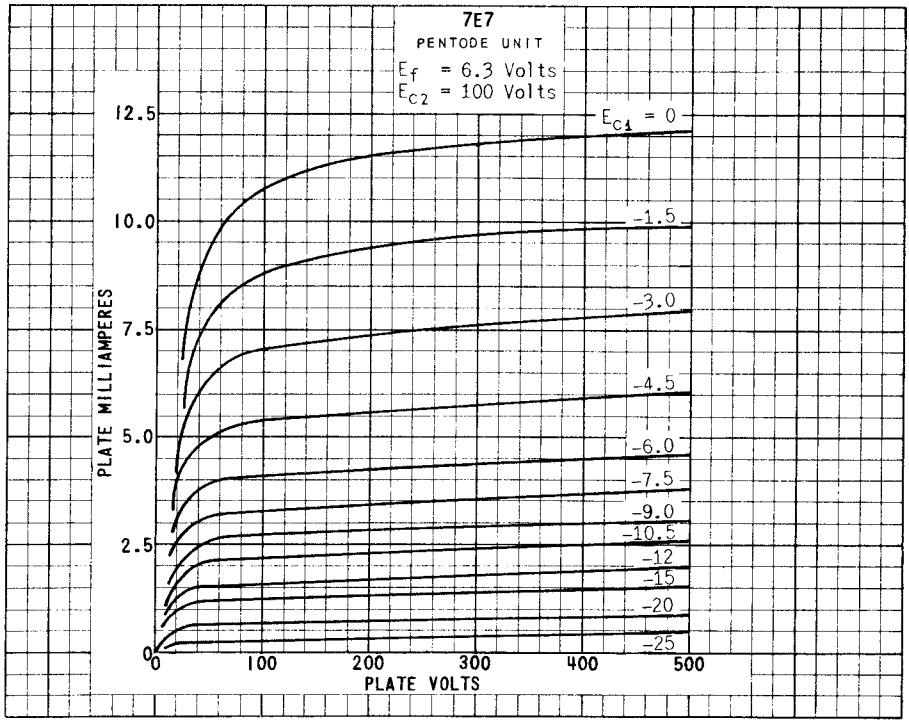
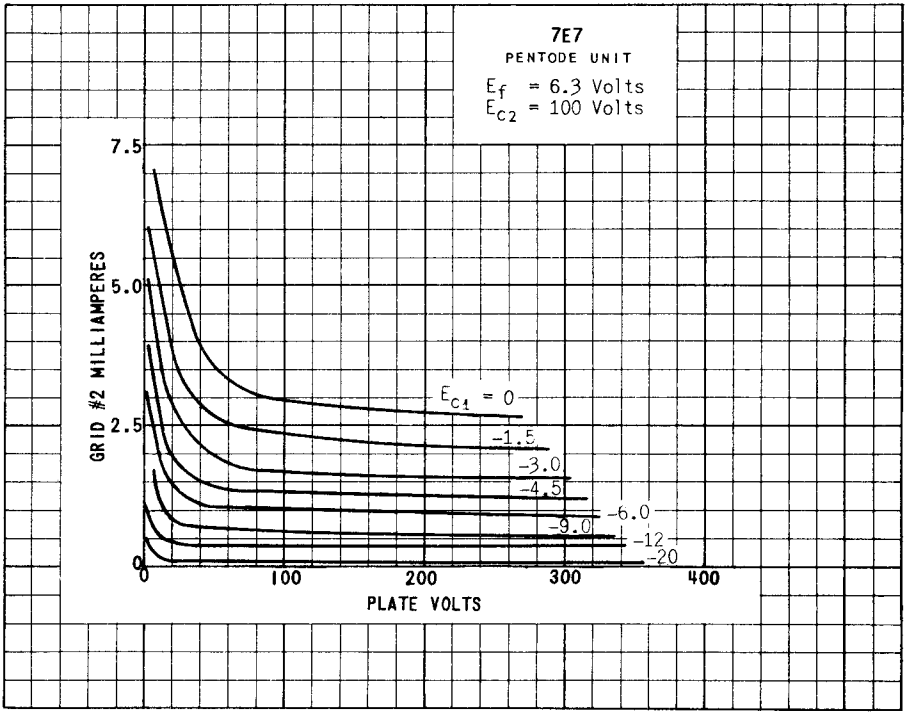
7E7 (14E7)





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NOV. 1, 1949

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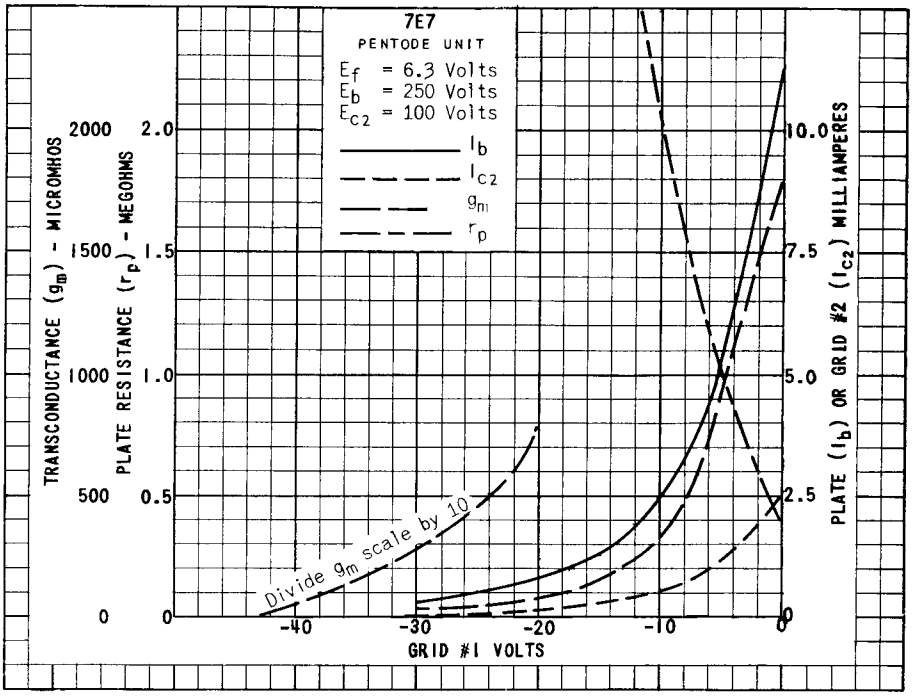

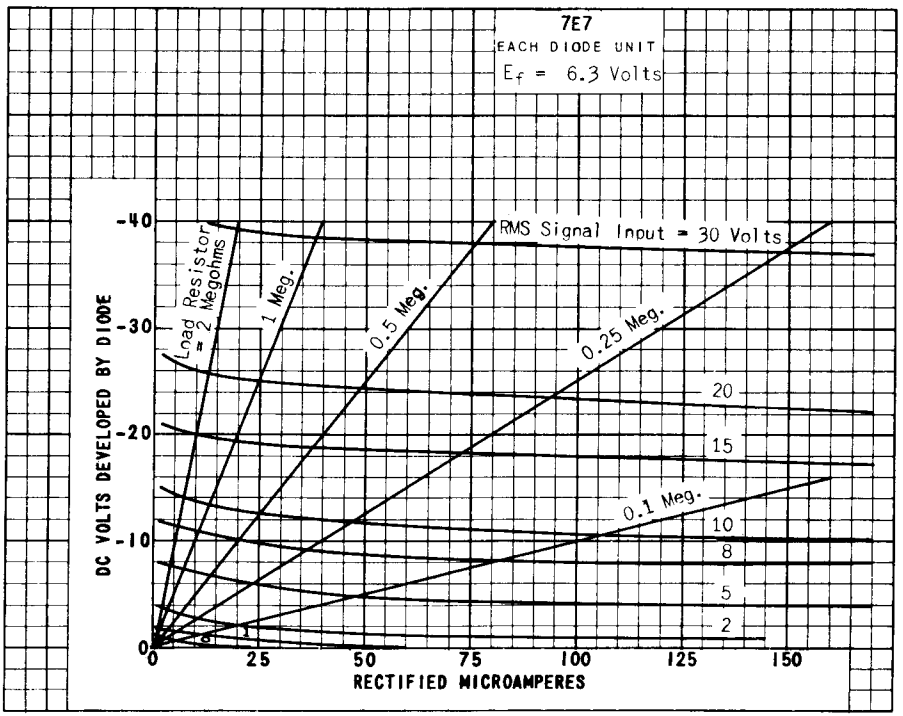

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PLATE 2274
NOV. 1, 1949

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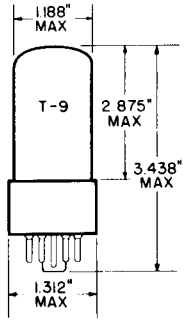
TUNG-SOL

PENTODE

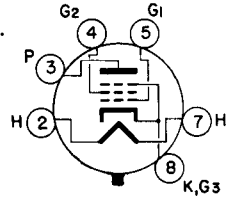


GLASS BULB
INTERMEDIATE-SHELL
6 PIN OCTAL
86-81 AND 86-84
OUTLINE DRAWING
JEDEC 9-15

COATED UNIPOTENTIAL CATHODE

HEATER
7.2 VOLTS 0.6±.04 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 7EY6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS THE VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS EMPLOYING 110° DEFLECTION PICTURE TUBES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.7	pf
INPUT	8.5	pf
OUTPUT	7.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

VERTICAL-DEFLECTION AMPLIFIER SERVICE[A]

MAXIMUM DC PLATE VOLTAGE	350	VOLTS
MAXIMUM PEAK PULSE PLATE VOLTAGE	2 500	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE*	250	VOLTS
MAXIMUM SCREEN VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM SCREEN DISSIPATION[B]	2.75	WATTS
MAXIMUM DC CATHODE CURRENT	60	MA.
MAXIMUM PEAK CATHODE CURRENT	180	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH CATHODE BIAS	2.2	MEGOHMS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	1.0	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	200	°C
HEATER WARM-UP TIME (APPROX.)●	11.0	SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	50	250	VOLTS
SCREEN VOLTAGE	250	250	VOLTS
GRID #1 VOLTAGE	0[C]	-17.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	60 000	OHMS
TRANSCONDUCTANCE	---	4 400	μMHOS
PLATE CURRENT	153	44	MA.
SCREEN CURRENT	21	3.0	MA.
GRID #1 VOLTAGE (APPROX.) I_b = 100 μAMPS.		-48	VOLTS

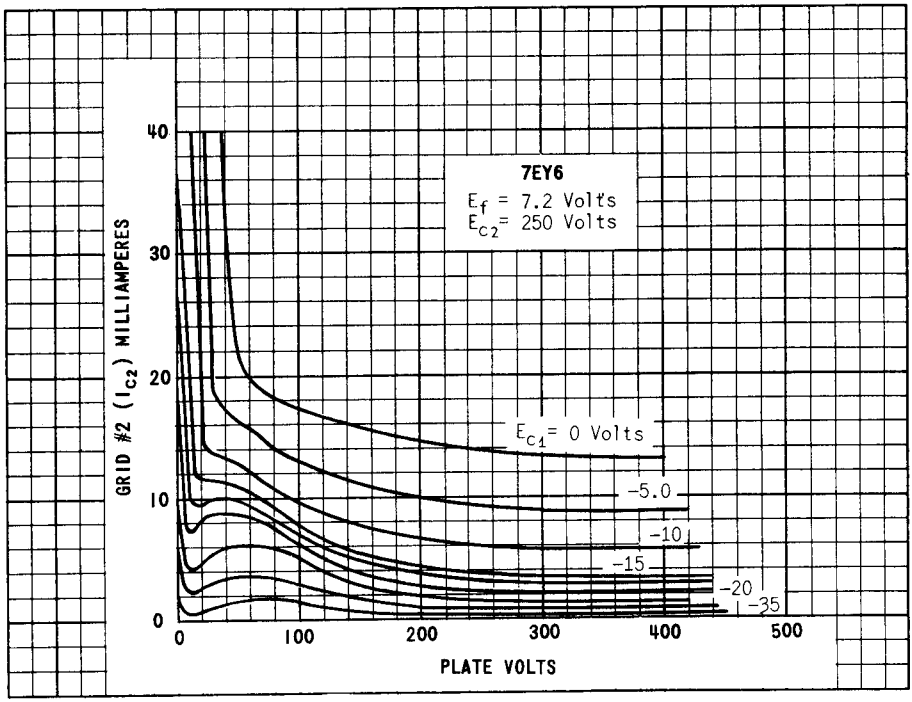
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

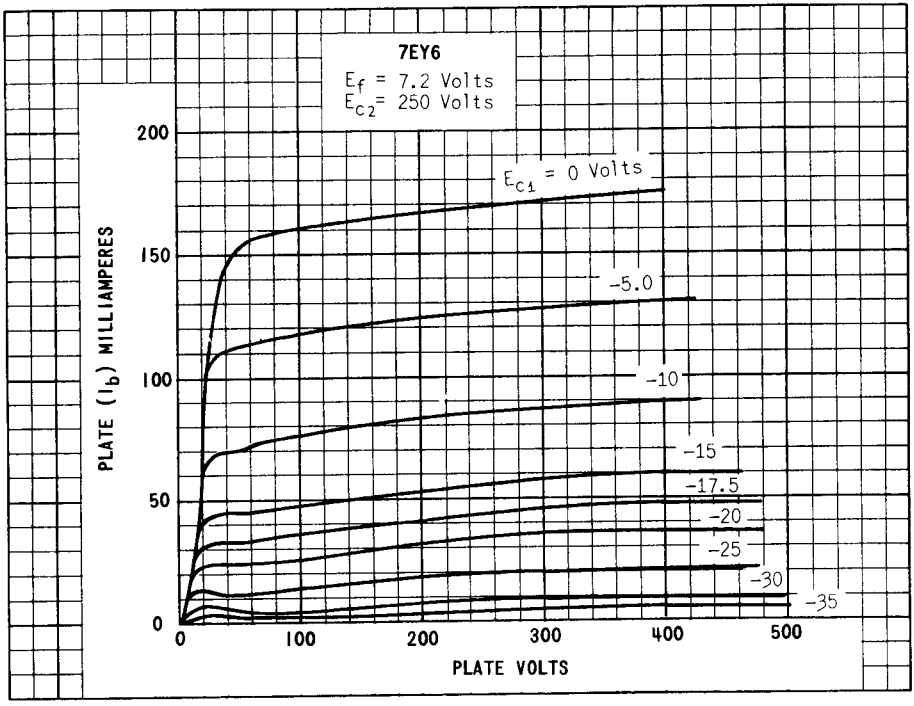
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

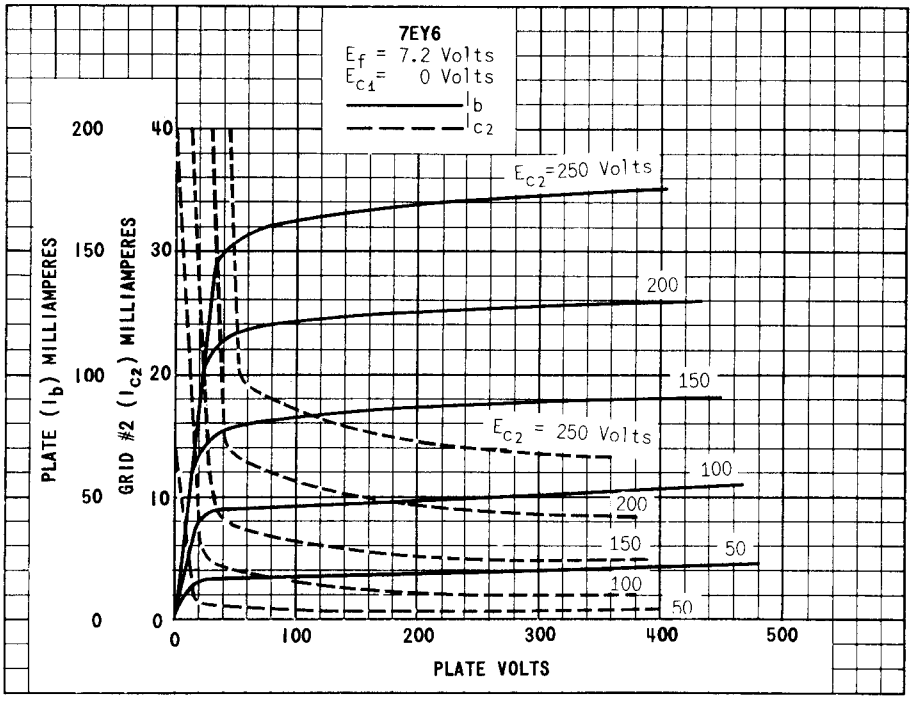
[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

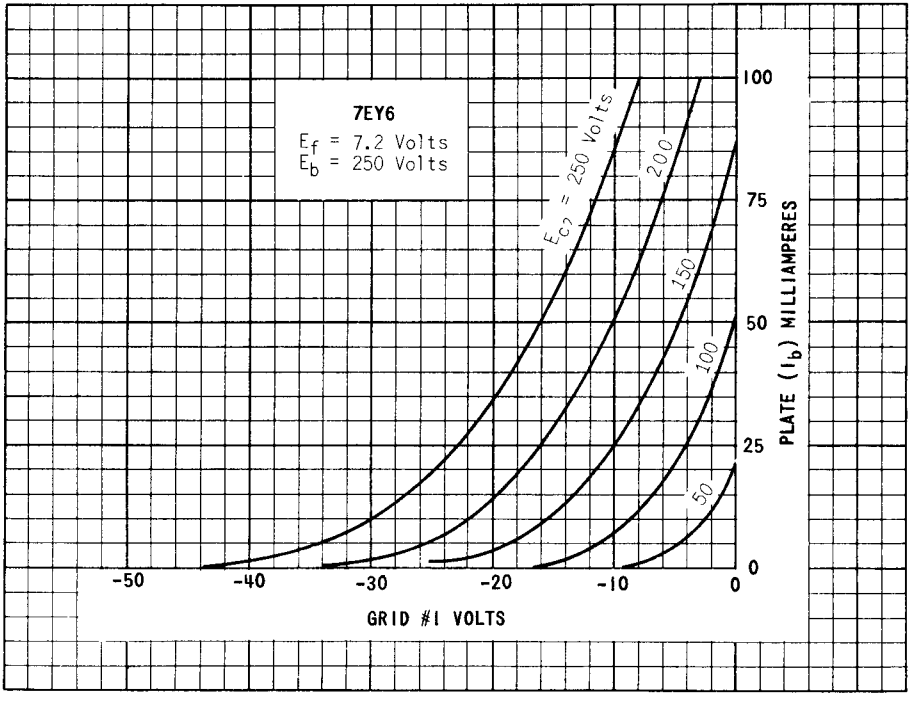
[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

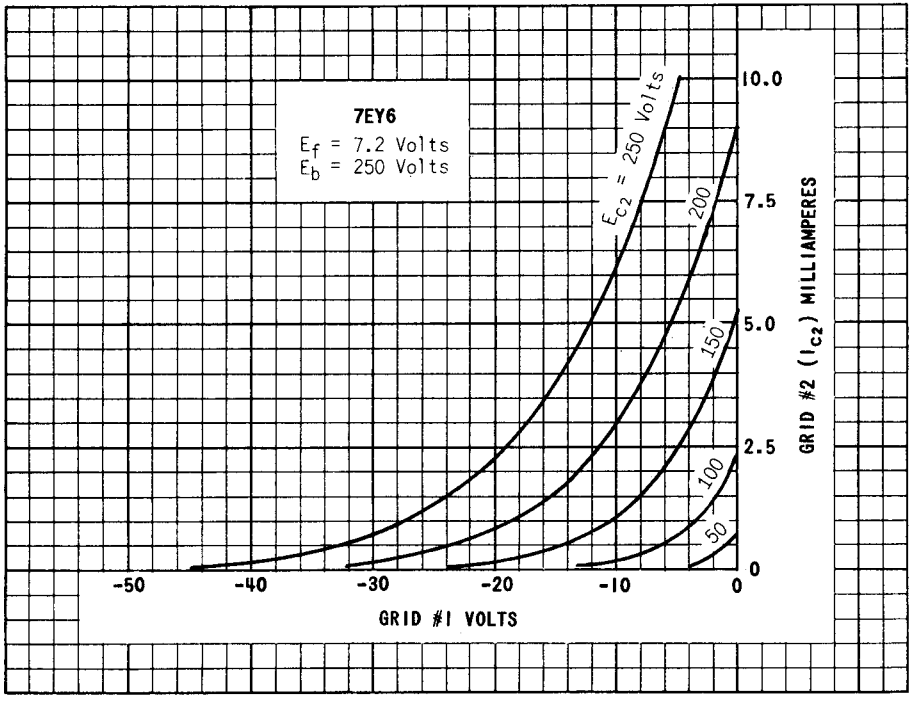
• HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


7EY6
E_f = 7.2 Volts
E_{c2} = 250 Volts
GRID #2 (I_{c2}) MILLIAMPERES
40
30
20
10
0
E_{c1} = 0 Volts
-5.0
-10
-15
-20
-35
0
100
200
300
400
500
PLATE VOLTS


7EY6
E_f = 7.2 Volts
E_{c2} = 250 Volts
PLATE (I_b) MILLIAMPERES
200
150
100
50
0
E_{c1} = 0 Volts
-5.0
-10
-15
-17.5
-20
-25
-30
-35
0
100
200
300
400
500
PLATE VOLTS


7EY6
E_f = 7.2 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
E_{c_2}=250 Volts
200
150
100
50
E_{c_2} = 250 Volts
200
150
100
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
200
150
100
50
0
40
30
20
10
0


7EY6
E_f = 7.2 Volts
E_b = 250 Volts
E_{c_2} = 250 Volts
200
150
100
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
100
75
50
25
0
-50
-40
-30
-20
-10
0



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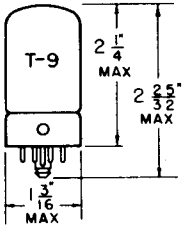
TUNG-SOL

DOUBLE TRIODE

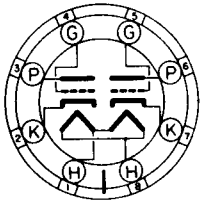


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8AC

THE 7F7 IS A TWIN HIGH-MU TRIODE USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER IN RESISTANCE COUPLED CASCADE OR PHASE INVERTER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA 6308 SHIELD CONNECTED TO CATHODE

	TRIODE UNIT 1		TRIODE UNIT 2	
GRID TO PLATE: (G TO P)	1.6		1.6	μμf
INPUT: G TO (H+K)	2.4		2.4	μμf
OUTPUT: P TO (H+K)	2.0		2.0	μμf
GRID TO GRID: (G TO G) MAX.		0.2		μμf
PLATE TO PLATE: (P TO P) MAX.		1.0		μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION PER UNIT	1	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.65	2.3	MA.
PLATE RESISTANCE	62 000	44 000	OHMS
TRANSCONDUCTANCE	1 125	1 600	μMHOS
AMPLIFICATION FACTOR	70	70	

SIMILAR TYPE REFERENCES: Characteristics are identical to type 6SL7GT.

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PLATE 2292
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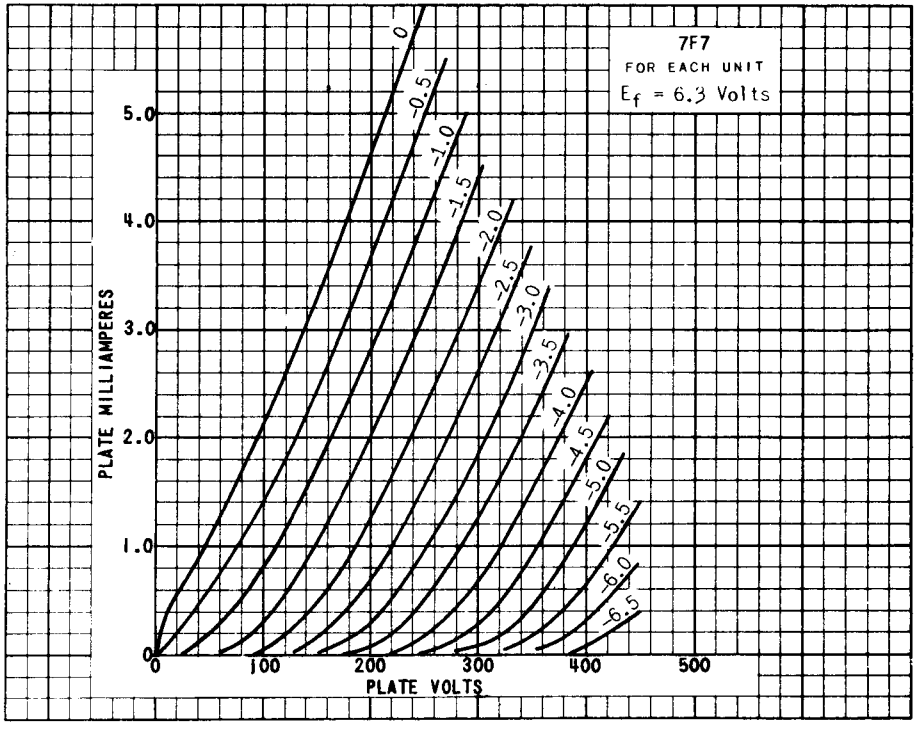
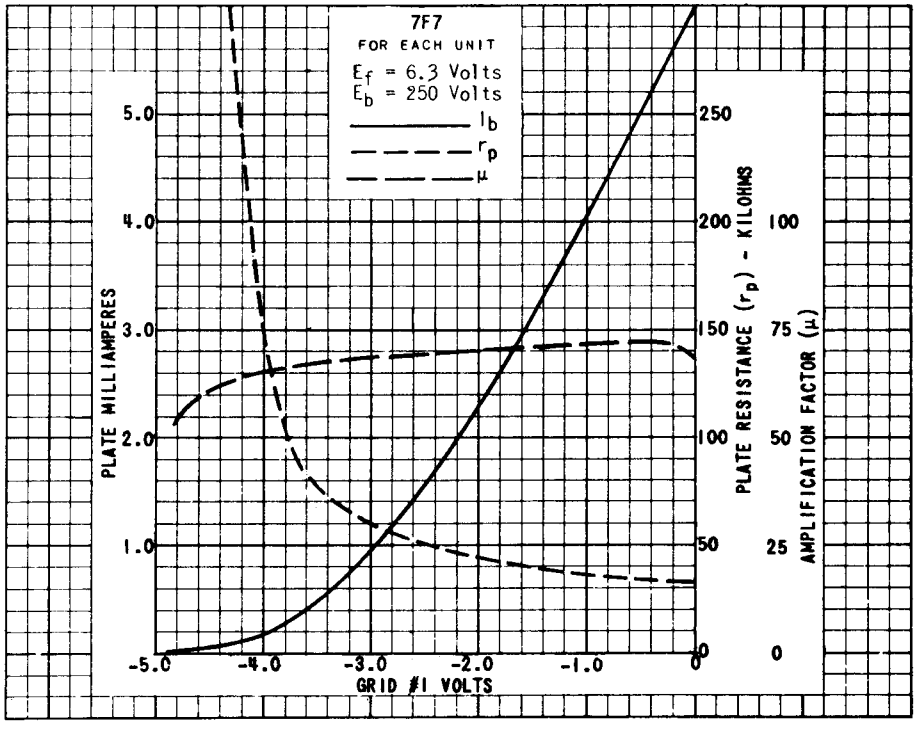
7F7 (14F7)





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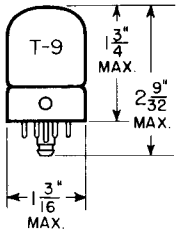
TUNG-SOL

DOUBLE TRIODE

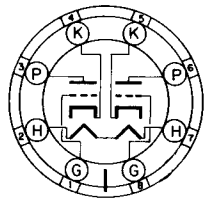


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8BW

THE 7F8 COMBINES TWO HIGH TRANSCONDUCTANCE TRIODES IN THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE AT FREQUENCIES UP TO 300 OR 400 MC. IT MAY ALSO BE USED AS A PUSH-PULL UHF AMPLIFIER AND IS PARTICULARLY WELL ADAPTED FOR USE AS A CONVERTER FOR THE NEW FM AND TELEVISION BANDS BECAUSE OF THE LOW EQUIVALENT NOISE RESISTANCE OBTAINED WITH A TRIODE CONVERTER.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G TO P) EACH UNIT	1.7	μμf
INPUT: G TO (H+K) EACH UNIT	2.8	μμf
OUTPUT: P TO (H+K) EACH UNIT	1.4	μμf
GRID TO GRID: (1G TO 2G) MAX.	0.1	μμf
PLATE TO PLATE: (1P TO 2P) MAX.	0.4	μμf
HEATER TO CATHODE:[A] (H TO K) EACH UNIT	2.8	μμf

[A] EXTERNAL SHIELD CONNECTED TO GROUND.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION[B]	3.5	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	0.5	MEGOHM

[B] MAXIMUM LIMITING VALUE FOR SINGLE TRIODE OPERATION OR TOTAL ALLOWABLE DISSIPATION FOR BOTH SECTIONS OPERATING SIMULTANEOUSLY.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	300	MA.
PLATE VOLTAGE	250	VOLTS
GRID RESISTOR (SELF BIAS)	500	OHMS
PLATE CURRENT	6	MA.
TRANSCONDUCTANCE	3300	μMHOS
AMPLIFICATION FACTOR	48	
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	-11	VOLTS

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PLATE 2258
OCT. 1, 1949

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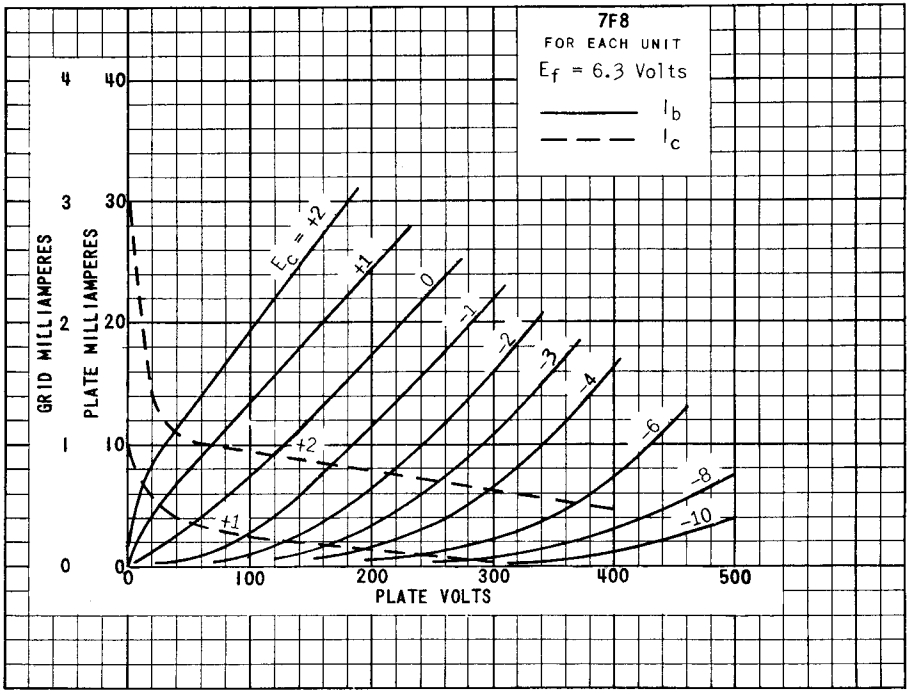
7F8



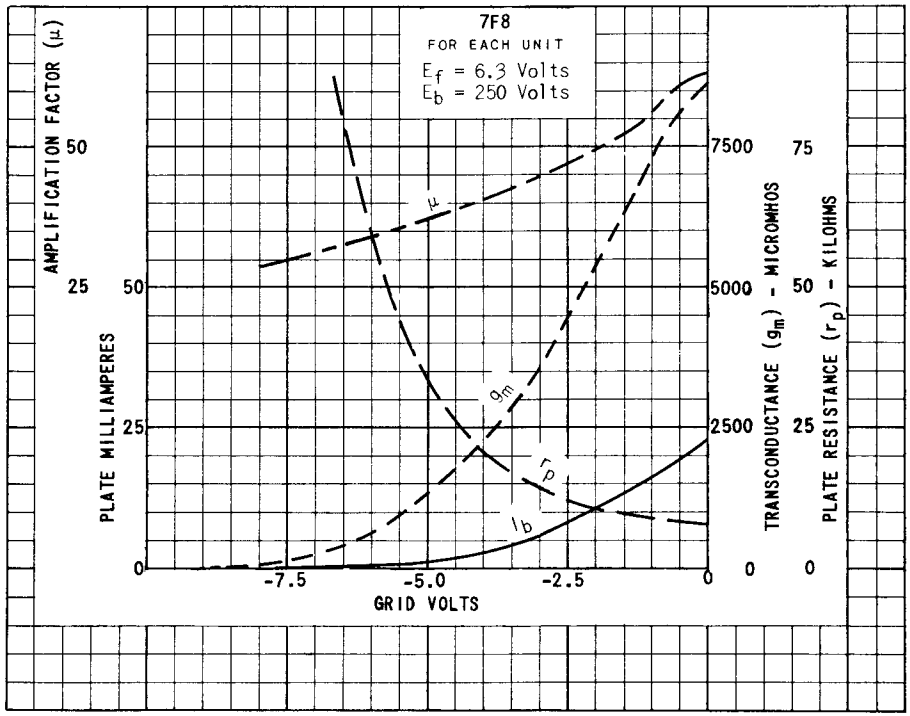


PLATE 2259
OCT. 1, 1949

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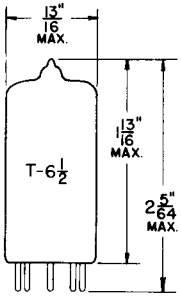
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



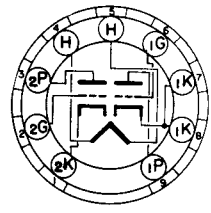
GLASS BULB

HEATER

7.2 VOLTS 0.30 AMP.

ANY MOUNTING POSITION

THE TRIODE ON PINS 6,7,8 & 9 SHOULD HAVE GROUNDED CATHODE CONNECTION, AND THAT ON PINS 1,2, & 3 SHOULD HAVE GROUNDED GRID CONNECTION. IT IS RECOMMENDED THAT PINS 7 & 8 BE STRAPPED.



BOTTOM VIEW

MINIATURE

9 PIN BASE

9DD

THE 7FC7 IS A FRAME GRID DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A CASCODE AMPLIFIER AT FREQUENCIES UP TO 220 MEGACYCLES PER SECOND. EXCEPT FOR HEATER RATINGS, THE 7FC7 IS IDENTICAL TO THE 6FC7.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD

PLATE #1 TO PLATE #2 (MAX.)	0.015	μμf
GRID #1 TO PLATE #2 (MAX.)	0.005	μμf
GROUNDED CATHODE SECTION:		
PLATE TO GRID	1.9	μμf
INPUT	3.8	μμf
OUTPUT	2.5	μμf
GRID TO HEATER (MAX.)	0.3	μμf
GROUNDED GRID SECTION:		
PLATE TO GRID	4.1	μμf
PLATE TO CATHODE	0.2	μμf
INPUT	6.3	μμf
OUTPUT	4.5	μμf
CATHODE TO HEATER	2.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH SECTION

HEATER VOLTAGE	7.2	VOLTS
MAXIMUM PLATE VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	1.8	WATTS
MAXIMUM CATHODE CURRENT	22	MA.
MAXIMUM NEGATIVE GRID VOLTAGE	50	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE (GROUNDED CATHODE SECT.)	1.0	MEGOHMS
MAXIMUM GRID CIRCUIT RESISTANCE (GROUNDED GRID SECT.)	500	KOHMS
MAXIMUM HEATER TO CATHODE VOLTAGE (RMS)	50	VOLTS
MAXIMUM HEATER TO CATHODE VOLTAGE (HEATER NEGATIVE)[A]	180	VOLTS

[A] MAXIMUM DC COMPONENT 130 V.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

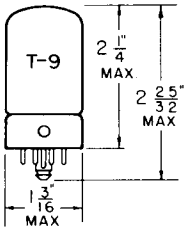
CHARACTERISTICS

EACH SECTION

HEATER VOLTAGE	7.2	VOLTS
HEATER CURRENT	0.30	AMP.
PLATE VOLTAGE	90	VOLTS
PLATE CURRENT	15	MA.
GRID VOLTAGE	-1.2	VOLTS
MUTUAL CONDUCTANCE	12 000	μMHOS
NOISE FACTOR (IN CASCODE CIRCUIT)	5.5	dB

TUNG-SOL

PENTODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN
8 PIN BASE
8V

THE 7G7/1232 IS A SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE IN TELEVISION OR OTHER HIGH-FREQUENCY AMPLIFIERS WHERE THE LOW IMPEDANCE CIRCUITS REQUIRED, RESULT IN LOW GAIN WHICH MAY BE PARTIALLY COMPENSATED FOR BY USE OF A HIGH TRANSCONDUCTANCE TUBE.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G TO P) MAX.	0.006	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	9	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	7	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.3	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	450	MA.
PLATE VOLTAGE	250	VOLTS
GRID #3 VOLTAGE AND PIN #5	PIN #4 AND PIN #5 CONNECTED TO PIN #7 AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
GRID #1 VOLTAGE	-2	VOLTS
PLATE RESISTANCE	0.8	MEGOHM
TRANSCONDUCTANCE	4 500	μMHOS
PLATE CURRENT	6	MA.
GRID #2 CURRENT	2	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-7	VOLTS

SIMILAR TYPE REFERENCES: Ratings and characteristics somewhat similar to types 7L7 and 1231.

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PLATE
2294
DEC. 1
1949

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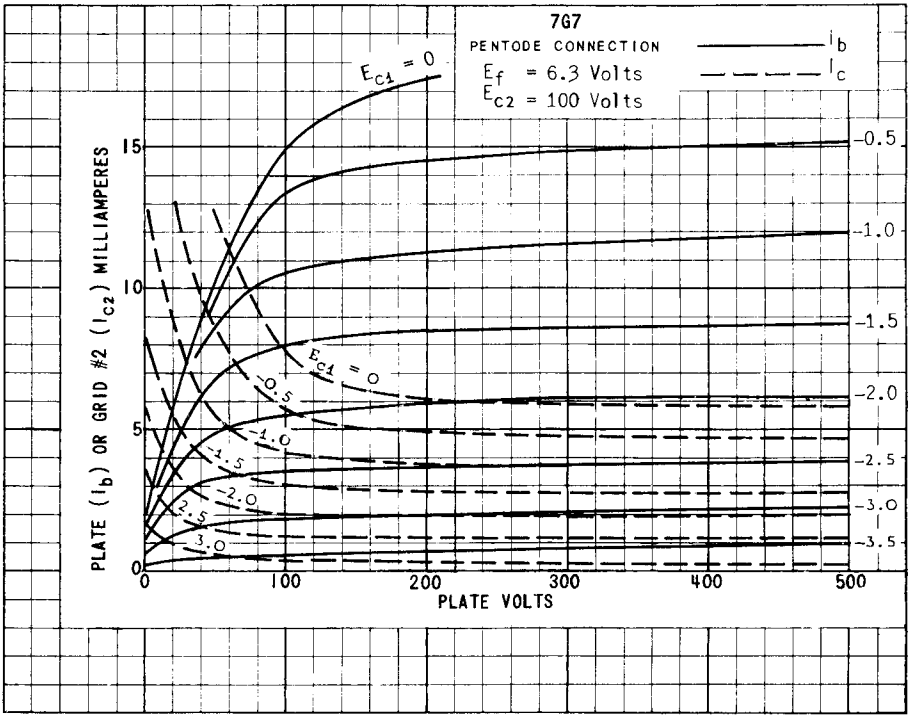
7G7/1232



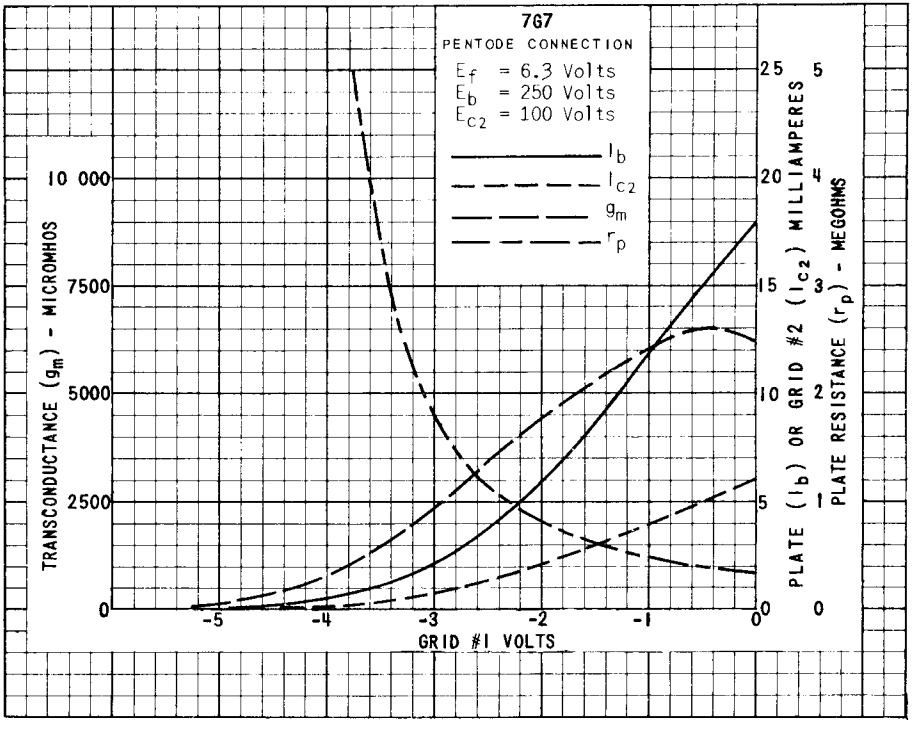


PLATE 2295
DEC. 1 1949

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TENTATIVE DATA

7G8/1206

TUNG-SOL

SHARP CUT-OFF DOUBLE TETRODE

PHYSICAL SPECIFICATIONS

		PIN CONNECTIONS			
EMITTER COATED UNIPOT. CATHODE			TETRODE NO.		TETRODE NO.
BASE	LOCK-IN 8-PIN	PIN 1 HEATER		PIN 7 PLATE	1
CAP	---	PIN 2 PLATE	2	PIN 8 HEATER	
BULB	SHORT T-9	PIN 3 GRID 2	1&2		
MAXIMUM DIAMETER	1 3/16"	PIN 4 GRID 1	2	MOUNTING POS.	ANY
MAXIMUM OVERALL LENGTH	2 1/32"	PIN 5 GRID 1	1		
MAXIMUM SEATED HEIGHT	1 1/2"	PIN 6 CATHODE	1&2		

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

HEATER OR FILAMENT VOLTAGE (NOMINAL) (AC OR DC)	7.0	VOLTS
HEATER OR FILAMENT CURRENT (NOMINAL)	0.320	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION (PER UNIT)	1.5	WATTS
MAXIMUM SCREEN DISSIPATION (PER UNIT)	.1	WATT
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL CONTROL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS

CAPACITANCES

WITH 1 5/16" DIAMETER SHIELD CONNECTED TO CATHODE

CONTROL GRID TO CATHODE	3.40	μμf
PLATE TO CATHODE	2.60	μμf
GRID TO PLATE (MAX.)	0.15	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PER UNIT

HEATER OR FILAMENT VOLTAGE	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.300	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	100	VOLTS
GRID VOLTAGE	-2.5	VOLTS
PLATE CURRENT	4.5	MA.
SCREEN CURRENT	0.8	MA.
ZERO-SIGNAL SCREEN CURRENT		MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE	225 000	OHMS
TRANSCONDUCTANCE	2 100	μMHOS
AMPLIFICATION FACTOR		
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS
CONTROL GRID VOLTAGE FOR I_b = 10 μA	-10	VOLTS

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PLATE 1708

APRIL 15 1946

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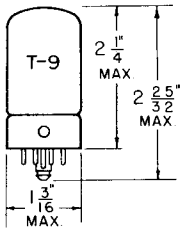
TUNG-SOL

PENTODE VOLTAGE AMPLIFIER



COATED UNIPOTENTIAL CATHODE
6.3 VOLTS 0.3 AMPERE
AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.

GLASS BULB

BOTTOM VIEW

LOCKING-IN 8-PIN BASE

ANY MOUNTING POSITION

THE 7H7 IS A TRIPLE GRID SEMI-REMOTE CUT-OFF HIGH TRANSCONDUCTANCE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS SIMILAR TO TYPES 6SD7GT AND 6SG7 AND IS USEFUL AS AN RF OR IF AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.5	WATT
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH M8-308 TUBE SHIELD CONNECTED TO CATHODE

GRID TO PLATE	0.007	μμf
INPUT	8.0	μμf
OUTPUT	7.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	150	VOLTS
GRID VOLTAGE	1.0	-2.5	VOLTS
SUPPRESSOR AND INTERNAL SHIELD (CONNECTED TO CATHODE AT SOCKET)	0	0	VOLTS
PLATE RESISTANCE (APPROX.)	0.25	0.8	MEGOHM
TRANSCONDUCTANCE	3 800	3 800	μMHOS
PLATE CURRENT	8.2	9.5	MA.
SCREEN CURRENT	3.3	3.5	MA.
GRID VOLTAGE FOR TRANSCONDUCTANCE = 35 μMHOS (APPROX.)	-12	-19	VOLTS

SIMILAR TYPE REFERENCE: Somewhat similar to types 6SD7GT and 6SG7.

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PLATE 1595
JULY 31, 1945

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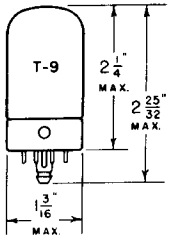
TUNG-SOL

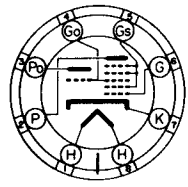
TRIODE HEXODE CONVERTER



UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



8AR
BOTTOM VIEW

LOCKING-IN 8 PIN BASE

THE TUNG-SOL 7J7 IS DESIGNED FOR SERVICE AS AN OSCILLATOR AND MIXER IN SUPERHETERODYNE CIRCUITS. IT CONSISTS OF A HEXODE MIXER AND A TRIODE OSCILLATOR WITH A COMMON CATHODE. THE INJECTOR GRID OF THE HEXODE IS INTERNALLY CONNECTED TO THE TRIODE GRID. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6J8G

RATINGS

HEATER VOLTAGE — NOMINAL	7.0	VOLTS
HEATER CURRENT — NOMINAL	0.32	AMPERE
MAXIMUM HEXODE PLATE VOLTAGE (P)	300	VOLTS
MAXIMUM HEXODE SCREEN VOLTAGE (G_S)	100	VOLTS
MAXIMUM HEXODE SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM TRIODE PLATE VOLTAGE (P_O)	150	VOLTS
MAXIMUM TRIODE PLATE SUPPLY VOLTAGE	300	VOLTS
MAXIMUM HEXODE PLATE DISSIPATION (P)	0.5	WATT
MAXIMUM HEXODE SCREEN DISSIPATION (G_S)	0.3	WATT
MAXIMUM TRIODE PLATE DISSIPATION (P_O)	1.25	WATTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MINIMUM EXTERNAL SIGNAL GRID BIAS VOLTAGE (G)	0	VOLT

DIRECT INTERELECTRODE CAPACITANCES[S]

HEXODE GRID (G) TO HEXODE PLATE (P)	$0.01^{MAX.}$ μμf
HEXODE GRID (G) TO TRIODE PLATE (P_O)	$0.1^{MAX.}$ μμf
HEXODE GRID (G) TO TRIODE GRID AND HEXODE GRID (G_O)	$0.2^{MAX.}$ μμf
TRIODE GRID (G_O) TO TRIODE PLATE (P_O)	1.0 μμf
SIGNAL INPUT: HEXODE GRID (G) TO ALL OTHER ELECTRODES	5.5 μμf
OSC. INPUT: TRIODE GRID AND HEXODE GRID (G_O) TO ALL OTHER ELECTRODES EXCEPT TRIODE PLATE (P_O)	8.5 μμf
OSC. OUTPUT: TRIODE PLATE (P_O) TO ALL OTHER ELECTRODES EXCEPT TRIODE GRID AND HEXODE GRID (G_O)	2.0 μμf
MIXER OUTPUT: HEXODE PLATE (P) TO ALL OTHER ELECTRODES	7.5 μμf

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

PLATE 858-1

SEPT. 23 1940

CONTINUED NEXT PAGE

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEXODE PLATE (P) VOLTAGE	100	250	VOLTS
HEXODE SCREEN (G_S) VOLTAGE	100	100	VOLTS
TRIODE PLATE (P_O) VOLTAGE	100	–	VOLTS
TRIODE PLATE (P_O) SUPPLY VOLTAGE	–	250[A]	VOLTS
HEXODE CONTROL GRID (G) VOLTAGE	−3	−3	VOLTS
HEXODE PLATE CURRENT	1.1	1.3	MA.
HEXODE SCREEN CURRENT	3.1	2.9	MA.
TRIODE PLATE CURRENT	3.7	5.4	MA.
TRIODE GRID (G_O) CURRENT	0.3	0.4	MA.
TOTAL CATHODE CURRENT	8.2	10.0	MA.
TRIODE GRID (G_O) RESISTOR	50000	50000	OHMS
HEXODE PLATE RESISTANCE	0.3	1.5	MEGOHMS
CONVERSION TRANSCONDUCTANCE	260	300	μMHOS
CONTROL GRID VOLTAGE	−20	−20	VOLTS
FOR CONVERSION TRANSCONDUCTANCE = 2 μMHOS			

[A] THIS VALUE OF TRIODE PLATE SUPPLY VOLTAGE APPLIED THROUGH A 20 000 OHM DROPPING RESISTOR.

STATIC CHARACTERISTICS OF TRIODE SECTION ONLY

PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE	−3	VOLTS
PLATE CURRENT	7.5	MA.
PLATE RESISTANCE	10400	OHMS
TRANSCONDUCTANCE	1350	μMHOS
AMPLIFICATION FACTOR	14	

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

PLATE
859-1

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

ANY MOUNTING POSITION

THE 7JP4 IS A DIRECTLY VIEWED PICTURE TUBE INTENDED FOR USE IN LOW COST TELEVISION RECEIVERS. IT IS ALSO SUITABLE FOR OSCILLOGRAPH APPLICATIONS. IT HAS A HIGH-EFFICIENCY, WHITE FLUORESCENT SCREEN AND USES ELECTROSTATIC FOCUS AND ELECTROSTATIC DEFLECTION TO PROVIDE PICTURES 4"X5 1/2"SIZE.

DESCRIPTION

FLUORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTION METHOD	ELECTROSTATIC
FOCUSING METHOD	ELECTROSTATIC

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

CATHODE TO ALL OTHER ELECTRODES: K TO ($H+G_1+G_2\&P_2+P_1+DJ_1+DJ_2+DJ_3+DJ_4+IC$)	9.5	μμf
GRID #1 TO ALL OTHER ELECTRODES: G_1 TO ($H+K+G_2\&P_2+P_1+DJ_1+DJ_2+DJ_3+DJ_4+IC$)	8.5	μμf
DJ_1 TO DJ_2	3.5	μμf
DJ_3 TO DJ_4	2.0	μμf
DJ_1 TO ALL OTHER ELECTRODES: DJ_1 TO ($H+K+G_1+G_2\&P_2+P_1+DJ_2+DJ_3+DJ_4+IC$)	11.0	μμf
DJ_2 TO ALL OTHER ELECTRODES: DJ_2 TO ($H+K+G_1+G_2\&P_2+P_1+DJ_1+DJ_3+DJ_4+I_C$)	11.0	μμf
DJ_3 TO ALL OTHER ELECTRODES: DJ_3 TO ($H+K+G_1+G_2\&P_2+P_1+DJ_1+DJ_2+DJ_4+IC$)	8.0	μμf
DJ_4 TO ALL OTHER ELECTRODES: DJ_4 TO ($H+K+G_1+G_2\&P_2+P_1+DJ_1+DJ_2+DJ_3+IC$)	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM ANODE #2 AND GRID #2 VOLTAGE	6 000	VOLTS
MAXIMUM ANODE #1 VOLTAGE	2 800	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	200	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK VOLTAGE BETWEEN ANODE #2 AND ANY DEFLECTING ELECTRODE	750	VOLTS
MAXIMUM PEAK-HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

CONTINUED ON FOLLOWING PAGE

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PLATE 2193
MAY 2 1949

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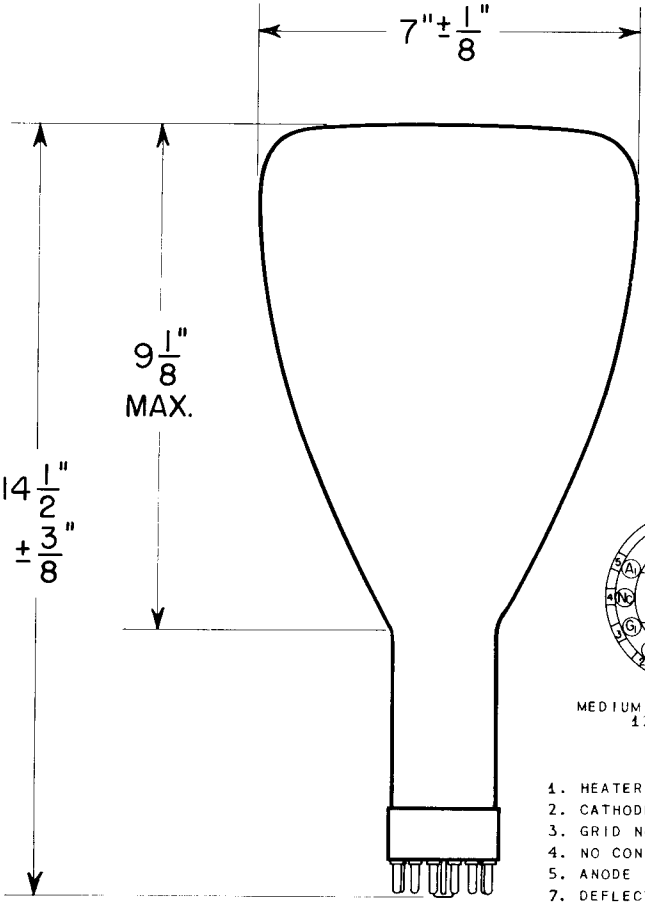
TUNG-SOL

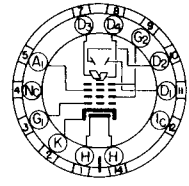
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE #2 VOLTAGE	6 000	VOLTS
ANODE #1 VOLTAGE FOR FOCUS (APPROX.)	2 000	VOLTS
GRID #1 VOLTAGE FOR VISUAL CUT-OFF (APPROX.)	-120	VOLTS
DEFLECTION FACTORS:		
DJ_1 AND DJ_2 (APPROX.)	216	VOLTS DC/IN.
DJ_3 AND DJ_4 (APPROX.)	177	VOLTS DC/IN.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM RESISTANCE IN ANY DEFLECTING-ELECTRODE CIRCUIT[A]	5	MEGOHMS

[A] IT IS RECOMMENDED THAT THE DEFLECTING-ELECTRODE-CIRCUIT RESISTANCES BE APPROXIMATELY EQUAL.





MEDIUM SHELL DIHEPTAL
12 PIN BASE
$14G_1$

1. HEATER
2. CATHODE
3. GRID NO. 1
4. NO CONNECTION
5. ANODE NO. 1
7. DEFLECTING ELECTRODE DJ_3
8. DEFLECTING ELECTRODE DJ_4
9. GRID NO. 2, ANODE NO. 2
10. DEFLECTING ELECTRODE DJ_2
11. DEFLECTING ELECTRODE DJ_1
12. INTERNAL CONNECTION
14. HEATER

PLATE 2194
MAY 2 1949

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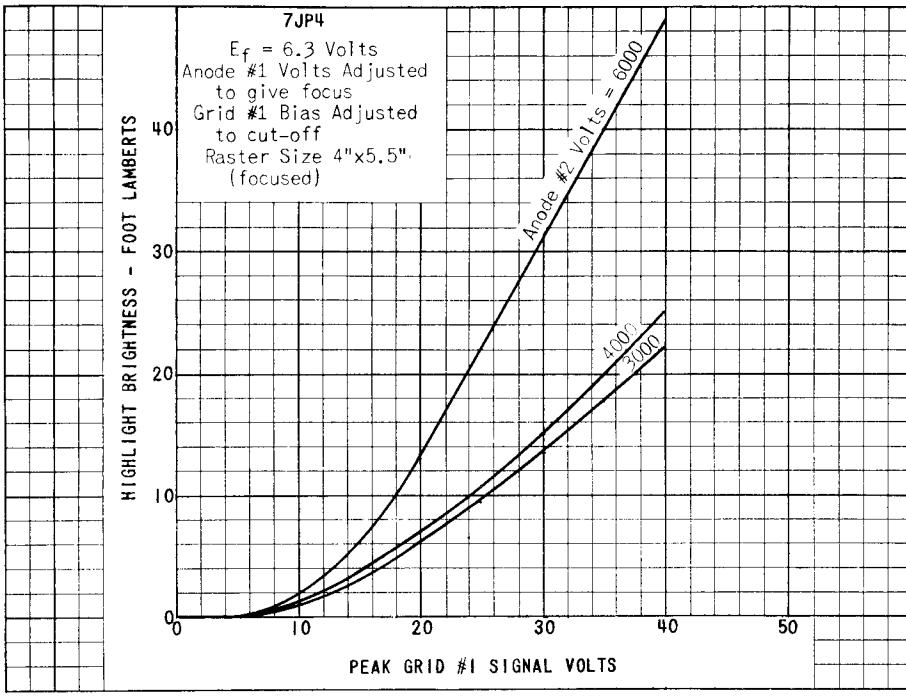

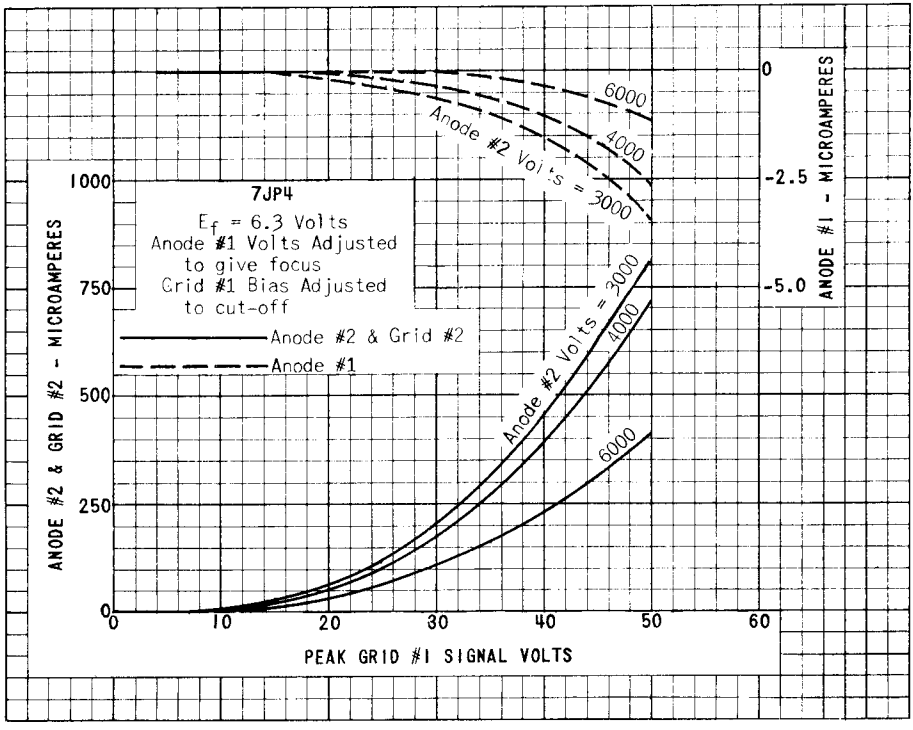

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PLATE
2195
MAY 2
1949

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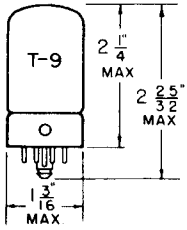
TUNG-SOL

DOUBLE-DIODE TRIODE

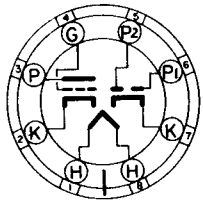


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8BF

THE 7K7 IS A DOUBLE DIODE HIGH-MU TRIODE UTILIZING THE LOCK-IN CONSTRUCTION. IT DIFFERS FROM THE USUAL DIODE TRIODE IN THAT IT HAS TWO SEPARATE CATHODES, ONE FOR THE TRIODE UNIT AND ONE FOR THE TWO DIODE UNITS.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G TO P)	1.7	μμf
INPUT: G TO (H+K)	2.4	μμf
OUTPUT: P TO (H+K)	2	μμf
DIODE 1 TO GRID: (P_1 TO G) MAX.	0.25	μμf
DIODE 2 TO GRID: (P_2 TO G) MAX.	0.25	μμf
DIODE CATHODE TO DIODE 1: (K TO P_1) MAX.	2	μμf
DIODE CATHODE TO DIODE 2: (K TO P_2) MAX.	2	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MINIMUM EXTERNAL GRID BIAS	0	VOLTS
MAXIMUM DIODE DROP FOR 1.5 MA. (EACH DIODE)	10	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	2.3	MA.
PLATE RESISTANCE (APPROX.)	44 000	OHMS
TRANSCONDUCTANCE	1 600	μMHOS
AMPLIFICATION FACTOR	70	

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PLATE
2452

AUG. 1
1950

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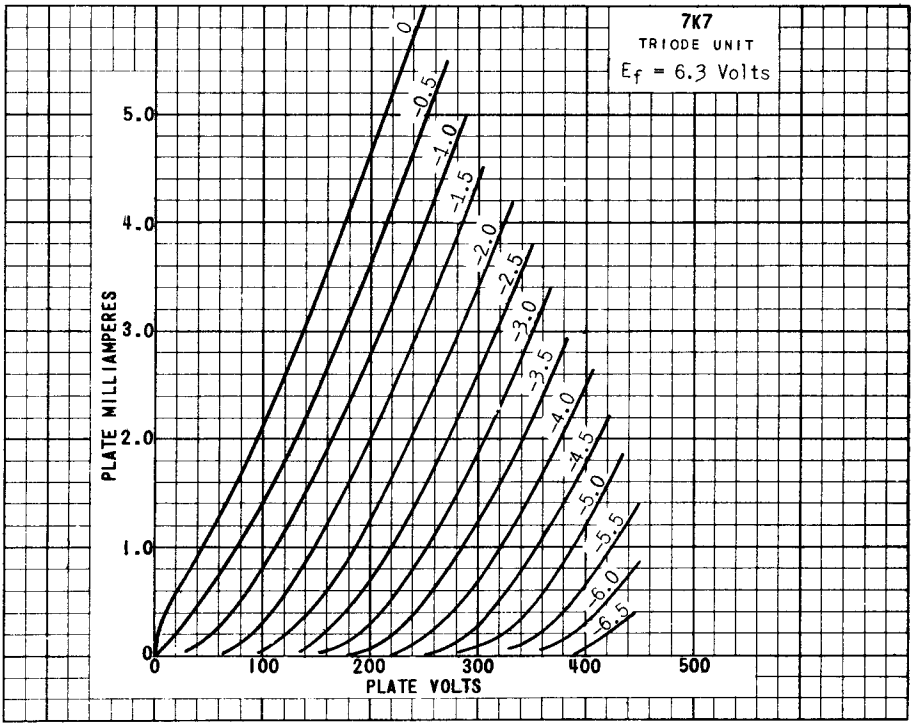
7K7



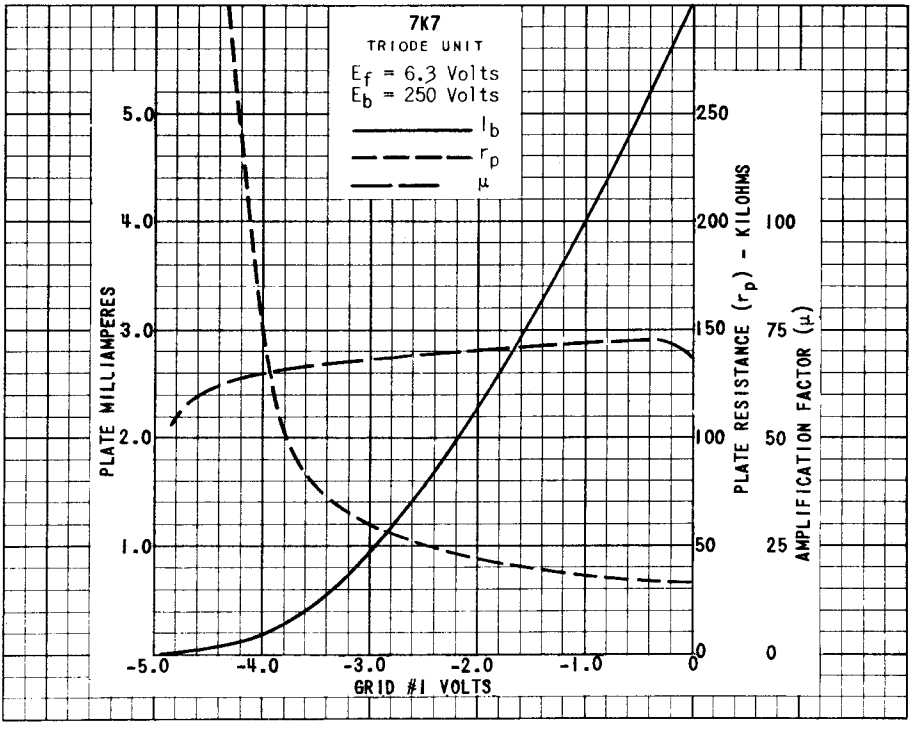


PLATE 2453

AUG. 1 1950

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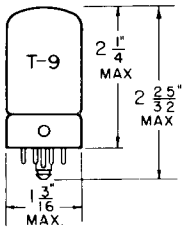
TUNG-SOL

PENTODE

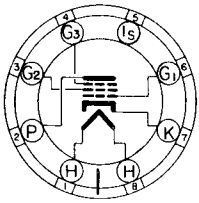


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK IN-
8 PIN BASE
8V

THE 7L7 IS A TRIPLE GRID SHARP CUT-OFF HIGH TRANSCONDUCTANCE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS USEFUL AS AN IF AMPLIFIER OR LIMITER IN FM EQUIPMENTS.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA TUBE SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.01	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	8.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.4	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PINS #4 & #5 CONNECTED TO PIN AT #7 SOCKET		
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-1.5	VOLTS
CATHODE BIAS RESISTOR	125	250	OHMS
GRID #1 VOLTAGE FOR I_b = 10 μA.	-6	-6	VOLTS
PLATE RESISTANCE (APPROX.)	0.1	1	MEG.
TRANSCONDUCTANCE	3 000	3 100	μMHOS
PLATE CURRENT	5.5	4.5	MA.
GRID #2 CURRENT	2.4	1.5	MA.

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PLATE 2190
MAY 2 1949

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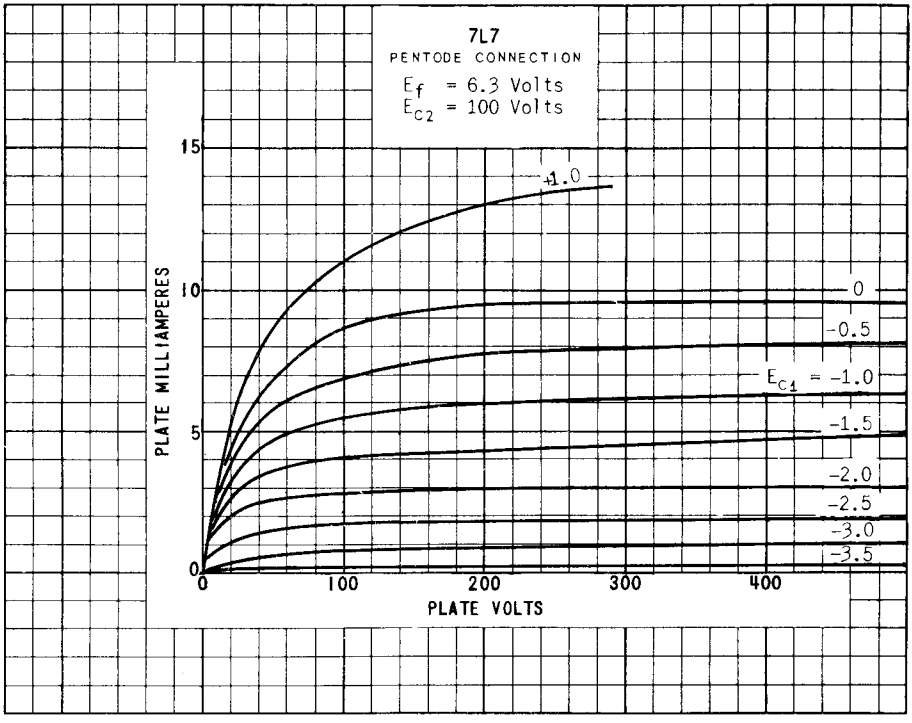

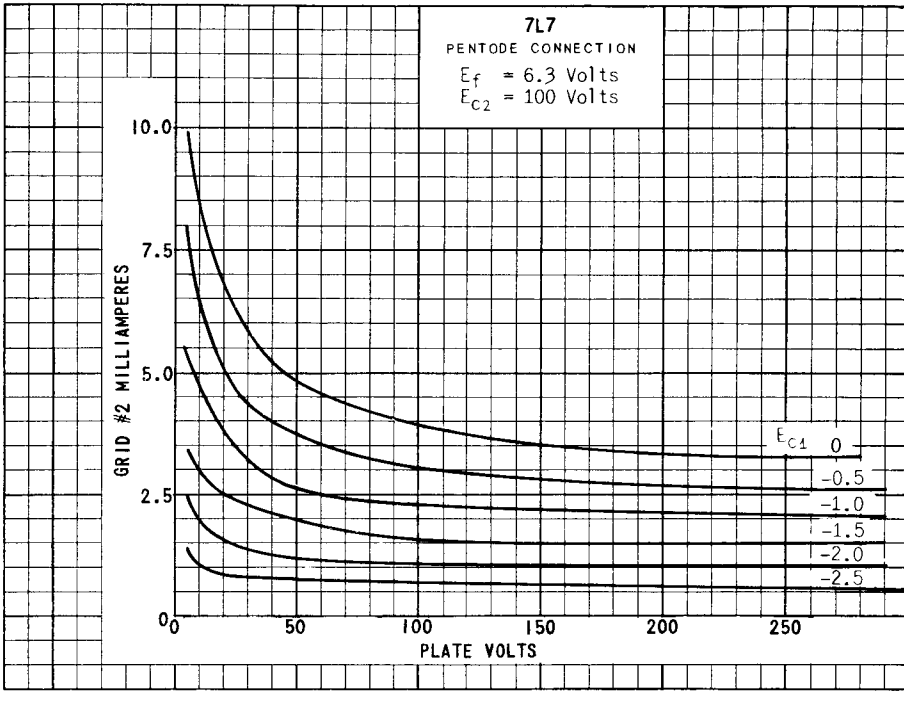

PLATE 2191
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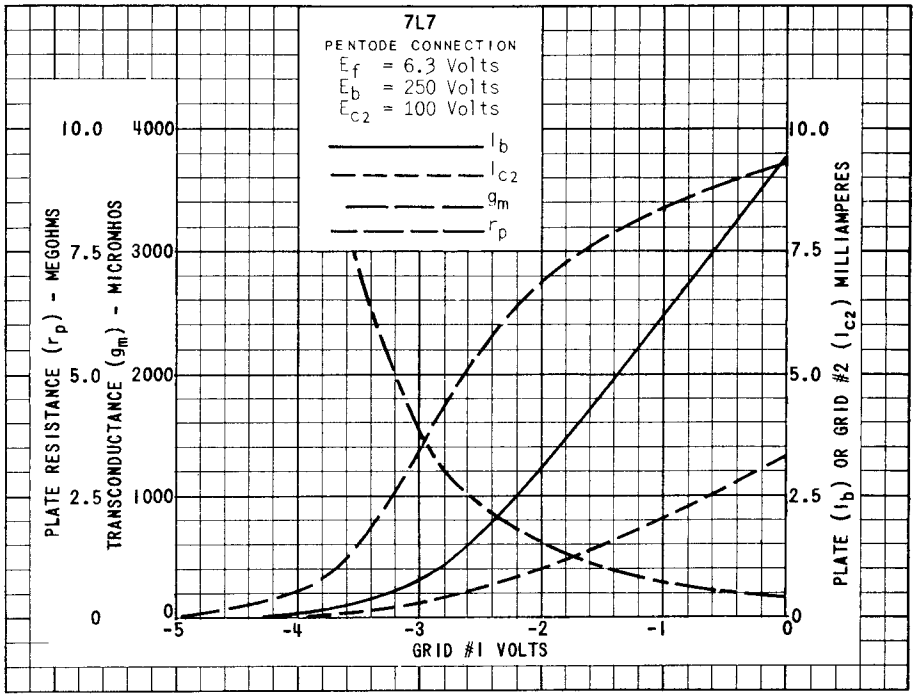

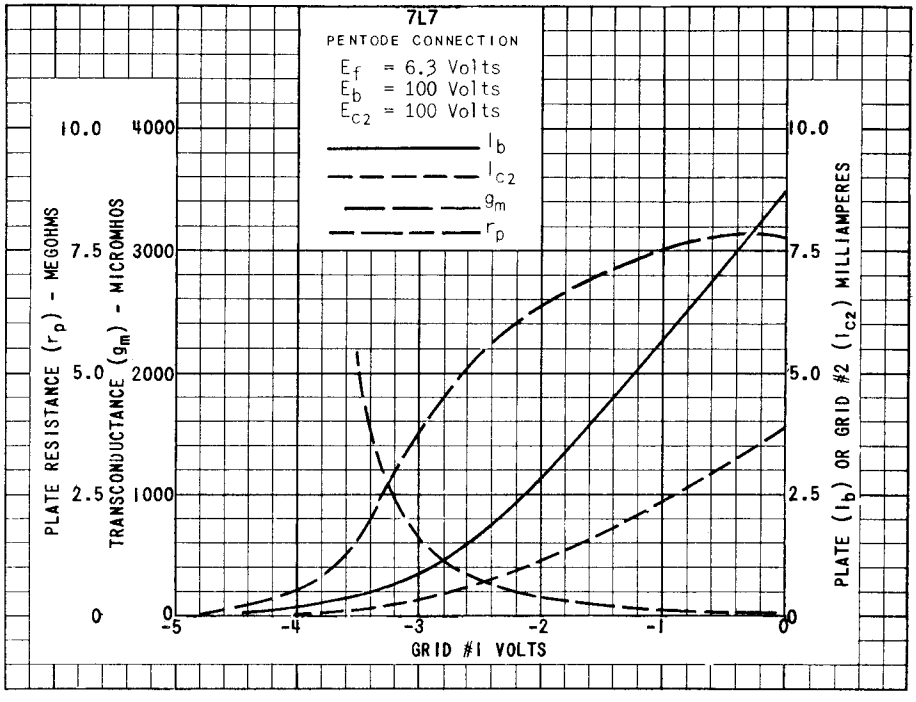

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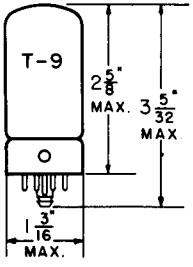
TUNG-SOL

DOUBLE TRIODE

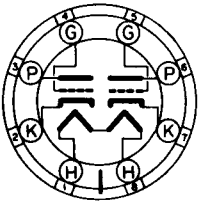


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8AC

THE 7N7 COMBINES TWO LOW-MU TRIODES IN THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE EITHER AS A PHASE INVERTER OR AS A VOLTAGE AMPLIFIER. ←

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED TO CATHODE

	TRIODE[A] UNIT I		TRIODE[B] UNIT II	
GRID TO PLATE: (G TO P)	3		3	μμf
INPUT: G TO (H+K)	3.4		2.9	μμf
OUTPUT: P TO (H+K)	2		2.4	μμf
GRID TO GRID: (1G TO 2G)		0.4		μμf
PLATE TO PLATE: (1P TO 2P)		0.34		μμf
GRID TO PLATE: (1G TO 2P)		0.08		μμf
GRID TO PLATE: (2G TO 1P)		0.06		μμf

[A] TRIODE I - CONNECTED TO PINS 5, 6, AND 7.

[B] TRIODE II - CONNECTED TO PINS 2, 3, AND 4.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS ←
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS ←
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	2.5	WATTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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APR. 1 1952

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

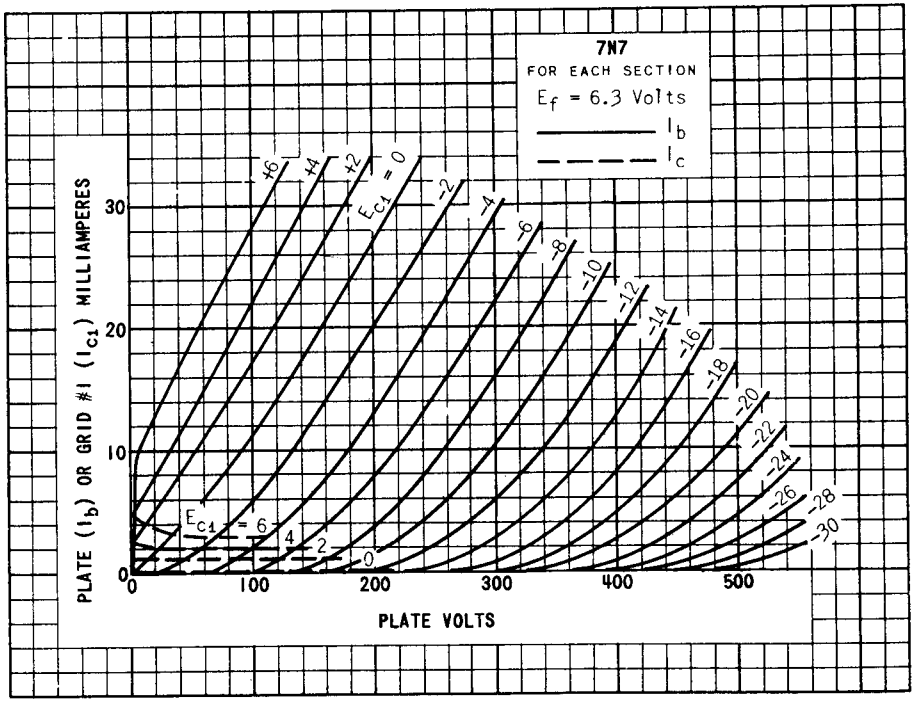
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	600	600	MA.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−8	VOLTS
SELF-BIAS RESISTOR	0	900	OHMS
PLATE CURRENT	10	9	MA.
PLATE RESISTANCE	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	µMHOS
AMPLIFICATION FACTOR	20	20	

PHASE INVERTER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	600	600	MA
PLATE SUPPLY VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-2.25	-5.5	VOLTS
PLATE RESISTOR	30 000	50 000	OHMS
SELF-BIAS RESISTOR	750	1 150	OHMS
MAXIMUM OUTPUT VOLTAGE (RMS)	20	65	VOLTS

→INDICATES A CHANGE OR ADDITION.



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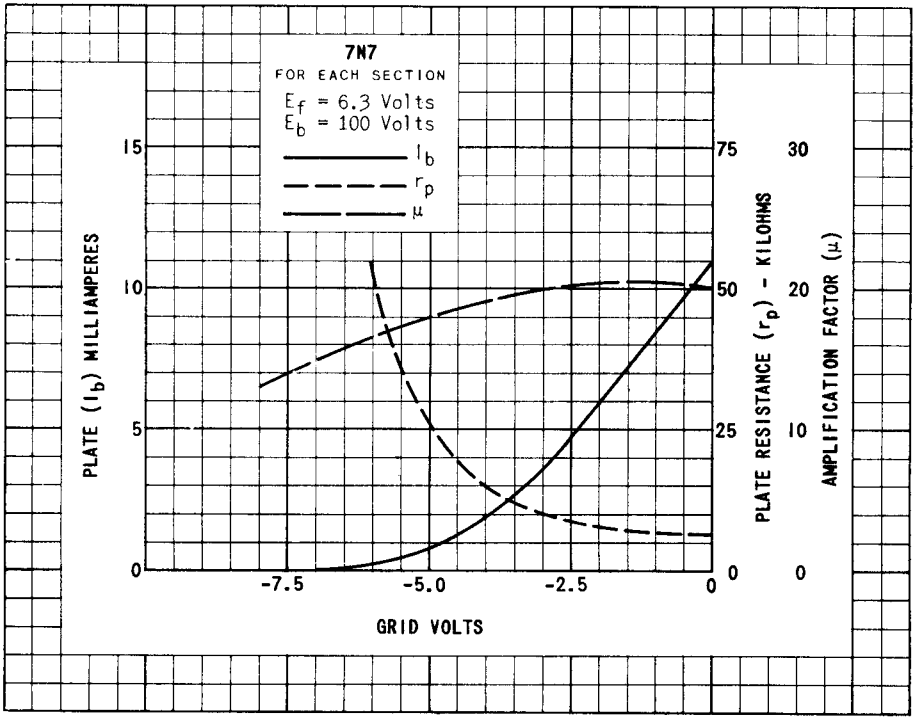

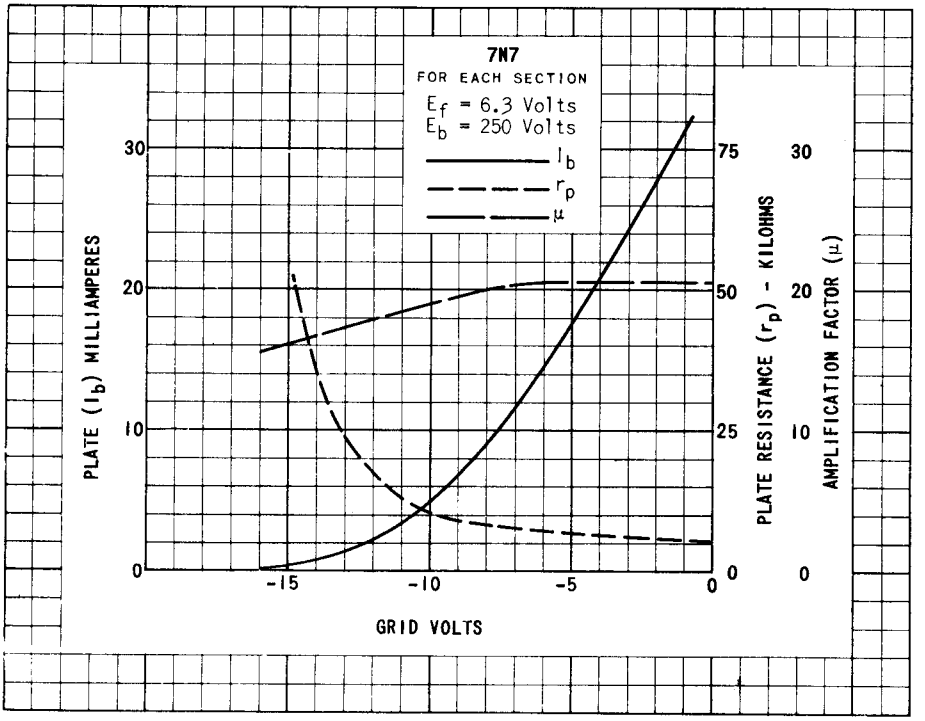

PLATE
2910
APR. 1
1952

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TUNG-SOL

PENTAGRID

PHYSICAL SPECIFICATIONS

EMITTER	UNIPOTENTIAL CATHODE	PIN CONNECTIONS			
BASE	LOCKING-IN - 8 PIN	PIN 1	HEATER	PIN 7	CATHODE
CAP	NONE	PIN 2	PLATE	PIN 8	HEATER
BULB	T-9	PIN 3	GRIDS #2 & #4		
MAXIMUM DIAMETER	1 3/16"	PIN 4	GRID #1		
MAXIMUM OVERALL LENGTH	2 25/32"	PIN 5	GRID #5	TOP CAP	NONE
MAXIMUM SEATED HEIGHT	2 1/4"	PIN 6	GRID #3		

RATINGS

HEATER OR FILAMENT VOLTAGE - NOMINAL (AC OR DC)	7.0	VOLTS
HEATER OR FILAMENT CURRENT - NOMINAL	0.32	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE (GRIDS #2 & #4)	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION		WATTS
MAXIMUM SCREEN DISSIPATION	1.0	WATT
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION	2.0	WATTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MINIMUM EXTERNAL SIGNAL GRID BIAS VOLTAGE* (GRID #3)	0	VOLTS
MAXIMUM ANODE-GRID VOLTAGE		VOLTS
MAXIMUM ANODE-GRID SUPPLY VOLTAGE		VOLTS
MAXIMUM ANODE-GRID DISSIPATION		WATT

* WITH SELF-EXCITATED OSCILLATOR

CAPACITANCES[S]

SIGNAL GRID TO MIXER PLATE (GRID #3 TO PLATE)	0.20 MAX.	μμf
SIGNAL GRID TO OSC. GRID (GRID #3 TO GRID #1)	0.20 MAX.	μμf
SIGNAL INPUT (GRID #3 TO ALL OTHER ELECTRODES)	9.0	μμf
OSC. GRID TO CATHODE (GRID #1 TO CATHODE)	2.2	μμf
OSC. GRID TO PLATE (GRID #1 TO PLATE)	0.15 MAX.	μμf
OSC. INPUT (GRID #1 TO ALL OTHER ELECTRODES)	7.0	μμf
OSC. GRID TO ALL OTHER ELECTRODES EXCEPT CATHODE	5.0	μμf
MIXER OUTPUT (PLATE TO ALL OTHER ELECTRODES)	9.0	μμf
CATHODE TO ALL OTHER ELECTRODES EXCEPT GRID #1	6.0	μμf

S WITH EXTERNAL SHIELD CONNECTED TO BASE SHELL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER OR FILAMENT VOLTAGE	6.3	6.3	VOLTS
HEATER OR FILAMENT CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	-2	-2	VOLTS
ANODE-GRID VOLTAGE			VOLTS
PLATE CURRENT	3.3	3.5	MA.
SCREEN CURRENT	8.5	8.5	MA.
ANODE-GRID CURRENT			MA.
OSCILLATOR-GRID CURRENT	0.5	0.5	MA.
TOTAL CATHODE CURRENT	12.3	12.5	MA.
OSCILLATOR-GRID RESISTOR	20000	20000	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
CONVERSION TRANSCONDUCTANCE	525	550	μMHOS
FOR CONTROL GRID VOLTAGE =-2 VOLTS			
CONVERSION TRANSCONDUCTANCE	275	300	μMHOS
FOR CONTROL GRID VOLTAGE =-6 VOLTS			
CONVERSION TRANSCONDUCTANCE (APPROX.)	2	2	μMHOS
FOR CONTROL GRID VOLTAGE =-35 VOLTS			
SUPPRESSOR GRID (GRID #5)	0	0	VOLTS

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PLATE T750-1

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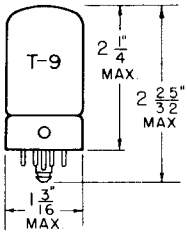
DOUBLE-DIODE PENTODE

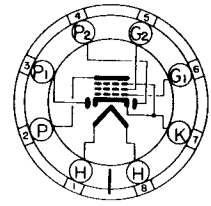


GLASS BULB

COATED UNIPOTENIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE

THE 7R7 COMBINES TWO DIODES AND ONE SEMI-REMOTE CUT-OFF PENTODE UNITS WITH A COMMON CATHODE IN ONE ENVELOPE. IT FEATURES LOW COUPLING CAPACITANCE BETWEEN THE DIODE AND PENTODE WHICH PERMITS USE OF THE TUBE AS A COMBINED INTERMEDIATE FREQUENCY AMPLIFIER, AVC RECTIFIER, AND DETECTOR. THE PENTODE UNIT MAY ALSO BE USED IN AUDIO AMPLIFIER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P)	0.004	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	5.6	μμf
OUTPUT: P TO (H+K&G_3+G_2)	5.3	μμf
DIODE #1 TO GRID #1: (P_1 TO G_1) MAX.	0.005	μμf
DIODE #2 TO GRID #1: (P_2 TO G_1) MAX.	0.002	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM NEGATIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM GRID #2 DISSIPATION	0.25	WATT
MAXIMUM DIODE VOLTAGE DROP (MEASURED WITH DIODES CONDUCTING 0.8 MA. EACH PLATE)	10	VOLTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	CLASS A_1 AMPLIFIER				
HEATER VOLTAGE	6.3	6.3	6.3	6.3	VOLTS
HEATER CURRENT	300	300	300	300	MA.
PLATE VOLTAGE	100	100	250	250	VOLTS
GRID #2 VOLTAGE	100	100	100	100	VOLTS
GRID #1 VOLTAGE	-2	-1	-2	-1	VOLTS
CATHODE BIAS RESISTOR	450	130	450	130	OHMS
PLATE RESISTANCE (APPROX.)	0.5	0.35	1.8	1.0	MEGOHMS
TRANSCONDUCTANCE	2 100	3 000	2 200	3 400	μMHOS
PLATE CURRENT	3.4	5.5	3.5	6.2	MA.
GRID #2 CURRENT	1.0	2.2	1.0	1.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 2 μMHOS	-16	-16	-20	-20	VOLTS

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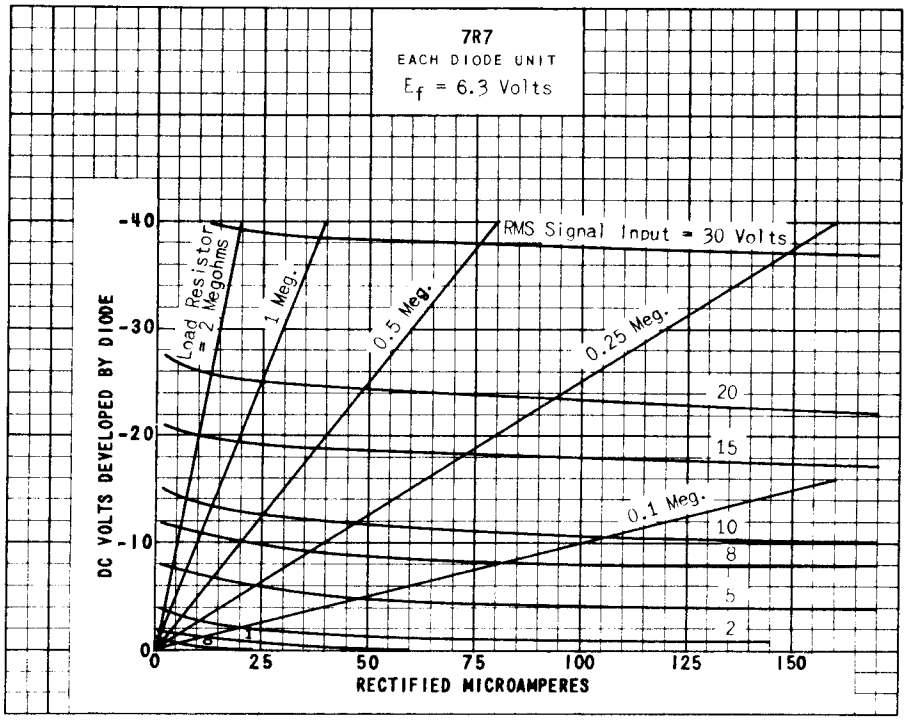
7R7



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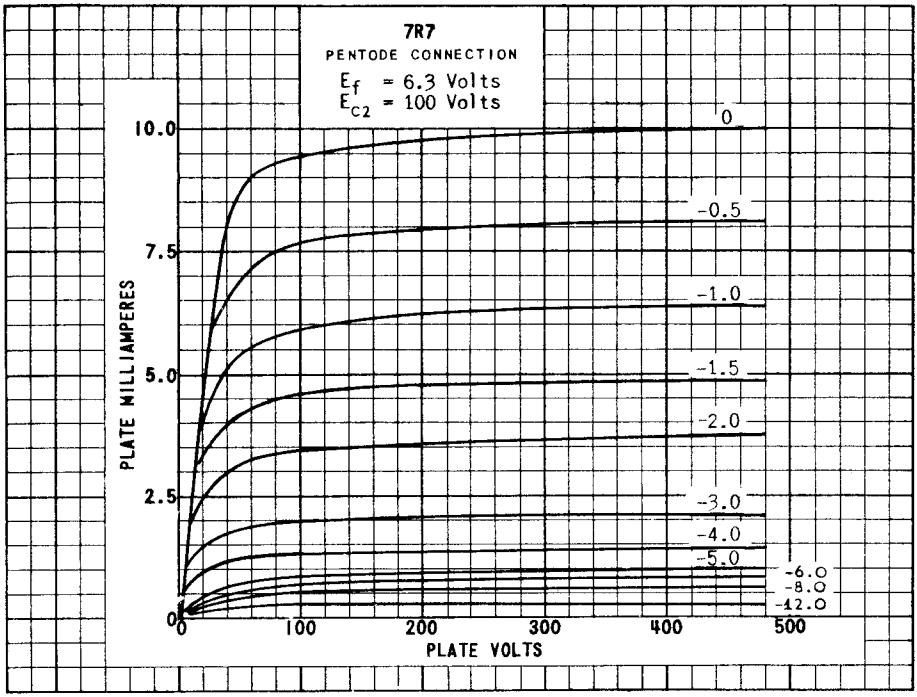

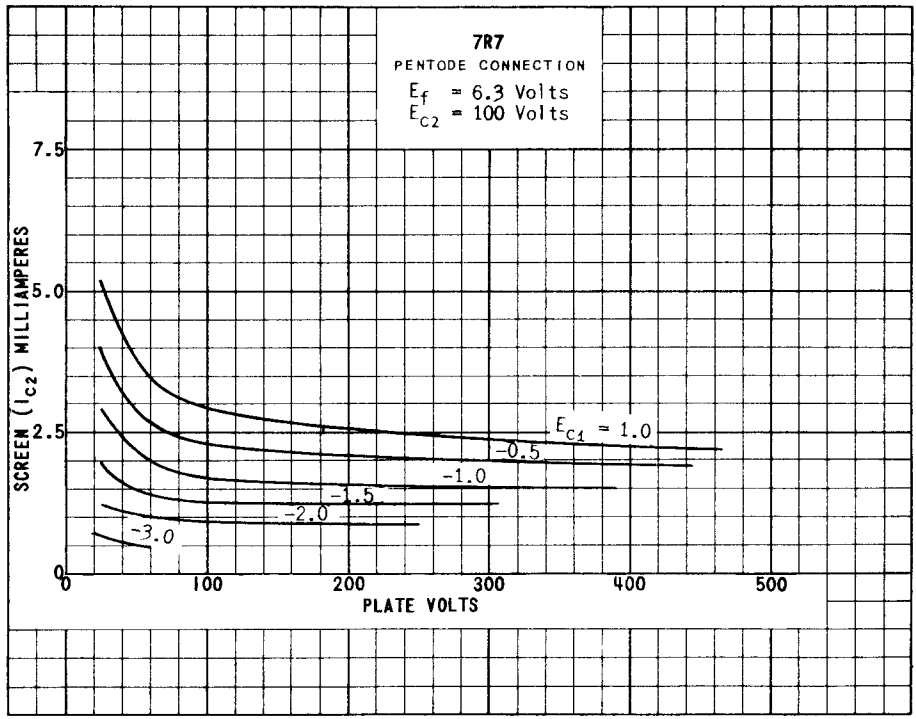

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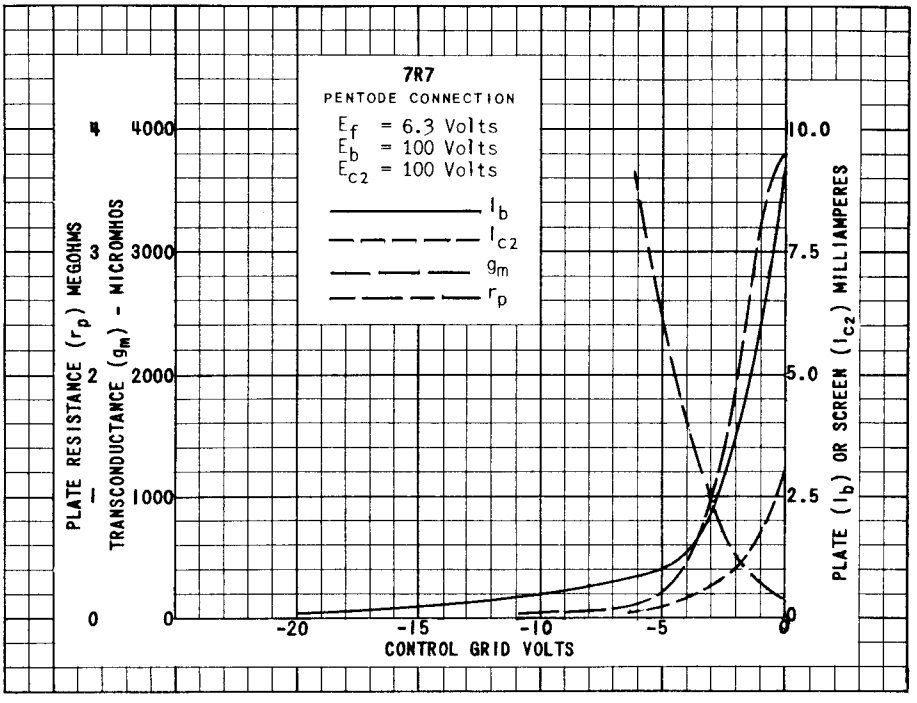
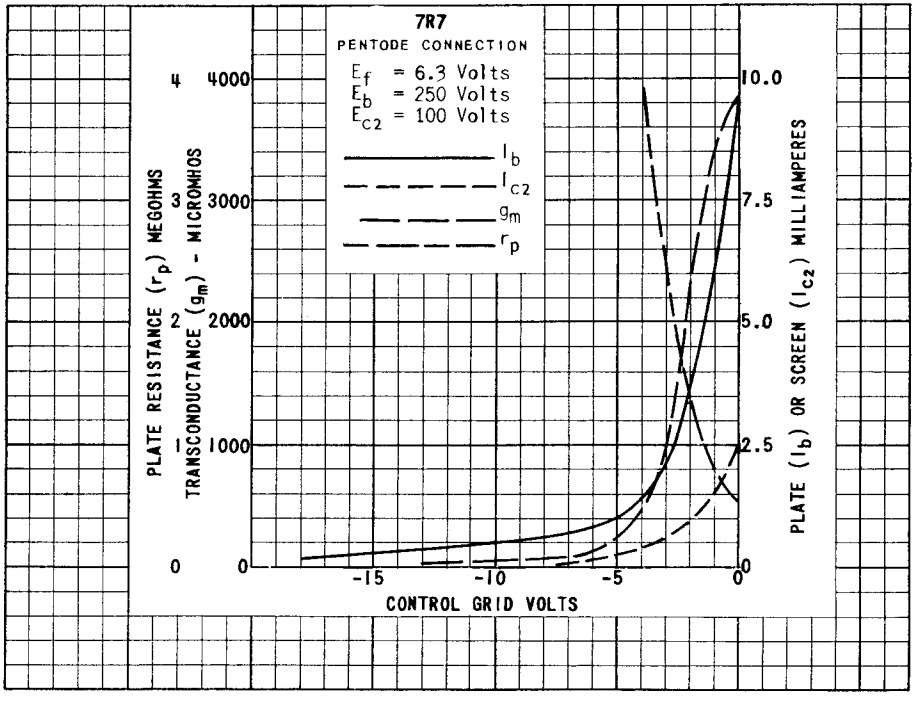
7R7





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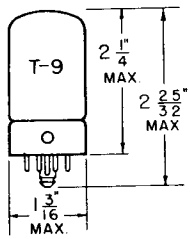
TRIODE-HEPTODE

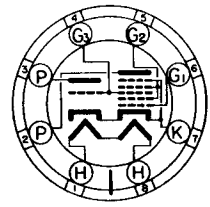


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE

THE 7S7 IS A HEATER-CATHODE TYPE COMBINING A TRIODE AND A HEPTODE IN THE LOCK-IN-CONSTRUCTION. THE TWO SECTIONS ARE INTERCONNECTED INTERNALLY TO PROVIDE FOR EFFICIENT LOCAL OSCILLATOR-MIXER SERVICE WITH A MINIMUM OF FREQUENCY SHIFT WITH VARIATION OF CONTROL GRID BIAS.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD CONNECTED TO CATHODE

HEPTODE GRID #1 TO PLATE: (G_1 TO P_h) MAX.	0.03	μμf
HEPTODE GRID #1 TO TRIODE PLATE: (G_1 TO P_t) MAX.	0.1	μμf
HEPTODE GRID #1 TO GRID #3: (G_1 TO G_3) MAX.	0.35	μμf
TRIODE GRID TO PLATE: (G_3 TO P_t)	1	μμf
SIGNAL INPUT: G_1 TO (H+K&G_5+G_2&G_4+G_3)	5	μμf
MIXER OUTPUT: P_h TO (H+K&G_5+G_2&G_4+G_3)	8	μμf
OSC. INPUT: G_3 TO (H+K&G_5+G_2&G_4)	7	μμf
OSC. OUTPUT: P_t TO (H+K&G_5+G_2&G_4)	3.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM HEPTODE PLATE VOLTAGE	300	VOLTS
MAXIMUM HEPTODE GRIDS #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM HEPTODE GRIDS #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MINIMUM HEPTODE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM TRIODE PLATE VOLTAGE	175	VOLTS
MAXIMUM TRIODE PLATE SUPPLY VOLTAGE	300	VOLTS
MAXIMUM HEPTODE PLATE DISSIPATION	0.6	WATT
MAXIMUM HEPTODE GRIDS #2 & #4 DISSIPATION	0.4	WATT
MAXIMUM TRIODE PLATE DISSIPATION	1	WATT
MAXIMUM CATHODE CURRENT	14	MA.

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PLATE 2038
JULY 1, 1948

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	300	300	MA.
HEPTODE PLATE VOLTAGE	100	250	VOLTS
HEPTODE GRIDS #2 & #4 VOLTAGE	100	100	VOLTS
TRIODE PLATE VOLTAGE	100	250[A]	VOLTS
HEPTODE GRID #1 VOLTAGE	-2	-2	VOLTS
SELF BIAS RESISTOR	240	195	OHMS
GRID #3 RESISTOR	50 000	50 000	OHMS
HEPTODE PLATE CURRENT	1.9	1.8	MA.
HEPTODE GRIDS #2 & 4 CURRENT	3	3	MA.
TRIODE PLATE CURRENT	3	5	MA.
GRID #3 CURRENT	0.3	0.4	MA.
HEPTODE PLATE RESISTANCE	0.5	1.25	MEGOHMS
CONVERSION TRANSCONDUCTANCE	500	525	µMHOS
CONVERSION TRANSCONDUCTANCE WITH E_c = -21 VOLTS	2	2	µMHOS
TOTAL CATHODE CURRENT	8.2	10.2	MA.

[A] APPLIED THROUGH 20,000 OHM DROPPING RESISTOR PROPERLY BY-PASSED.

TRIODE SECTION

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	300	MA.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	6.5	MA.
PLATE RESISTANCE	11 000	OHMS
TRANSCONDUCTANCE	1 650	µMHOS
AMPLIFICATION FACTOR	18	

SIMILAR TYPE REFERENCE: Ratings and Characteristics similar to type 7J7.

PLATE 2039
JULY 1, 1948

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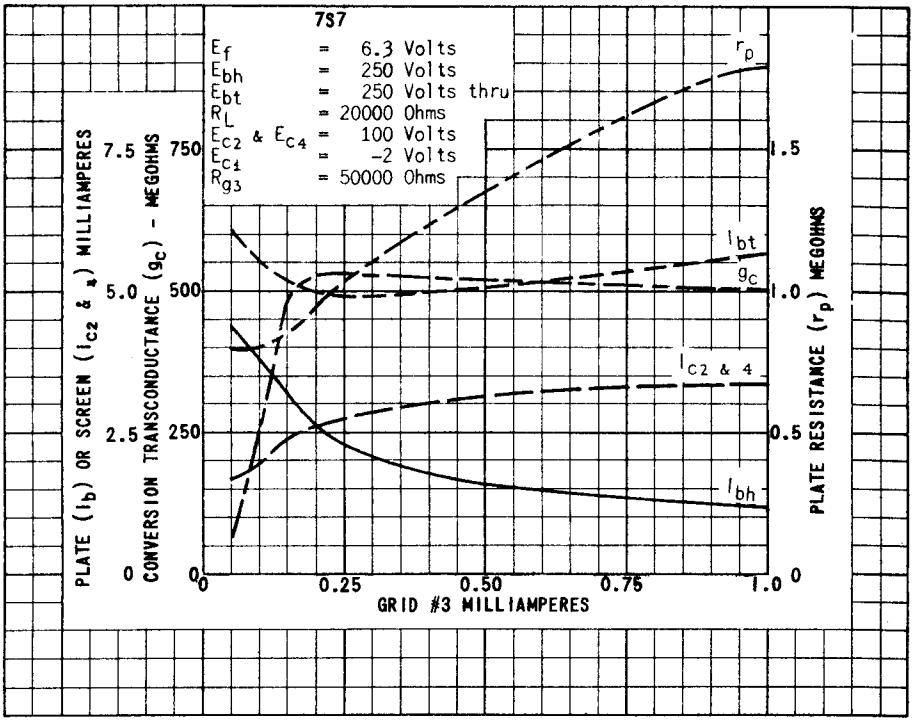

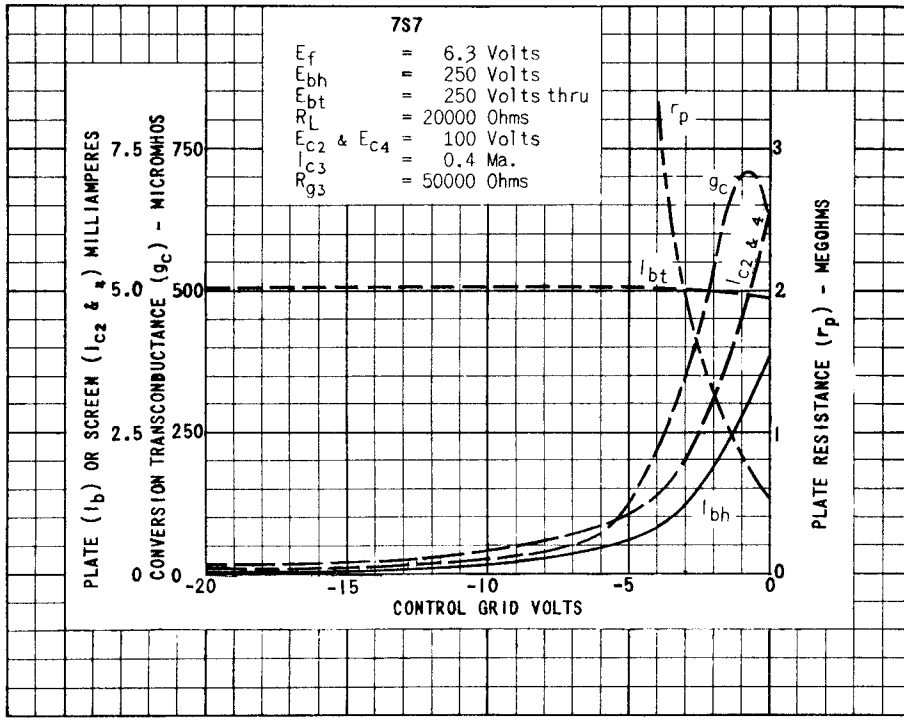

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2040
JULY 1,
1948

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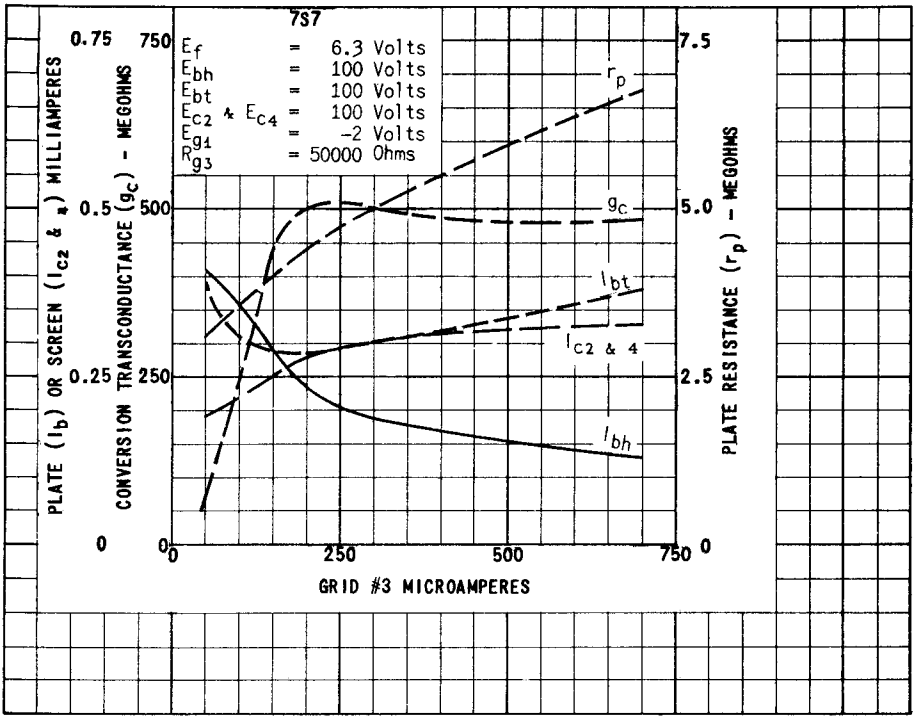
7S7



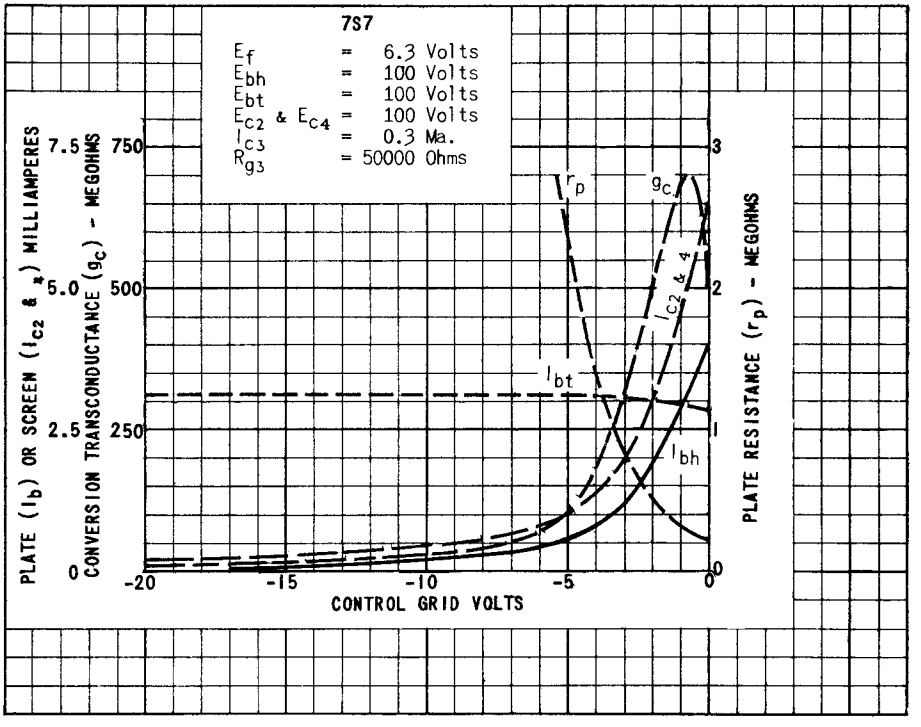


PLATE 2041
JULY 1, 1948

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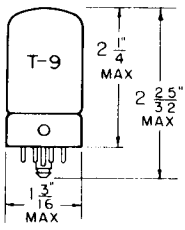
TUNG-SOL

PENTODE



GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7V7 IS A HEATER-CATHODE TYPE SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW INTERELECTRODE CAPACITANCES WHICH ADAPT IT TO USE IN WIDE-BAND HIGH FREQUENCY AMPLIFIERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.004	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	9.5	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM CATHODE BIAS RESISTOR	160	OHMS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.8	WATT

CONTINUED ON FOLLOWING PAGE

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PLATE 2103
NOV. 1, 1948

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	CONDITION 1[A]	CONDITION 2[B]	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	300	300	VOLTS
GRID #3 VOLTAGE	PINS #4 AND #5 CONNECTED TO PIN #7 AT SOCKET		
GRID #2 SUPPLY VOLTAGE[C]	150	300	VOLTS
GRID #2 SERIES RESISTOR	---	40 000	OHMS
CATHODE BIAS RESISTOR	160	160	OHMS
PLATE RESISTANCE (APPROX.)	0.3	0.3	MEG.
TRANSCONDUCTANCE	5 800	5 800	µMHOS
PLATE CURRENT	10	10	MA.
GRID #2 CURRENT	3.9	3.9	MA.
GRID #1 VOLTAGE FOR I_b = 10 µA	-8	-16	VOLTS

[A] CONDITION 1 WITH FIXED SCREEN SUPPLY.

[B] CONDITION 2 WITH SERIES SCREEN RESISTOR.

[C] SCREEN SUPPLY VOLTAGES IN EXCESS OF 150 VOLTS REQUIRE THE USE OF A SERIES-DROPPING RESISTOR TO LIMIT THE VOLTAGE AT THE SCREEN TO 150 VOLTS WHEN THE PLATE CURRENT IS AT ITS NORMAL VALUE OF 10 MA.

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NOV. 1, 1948

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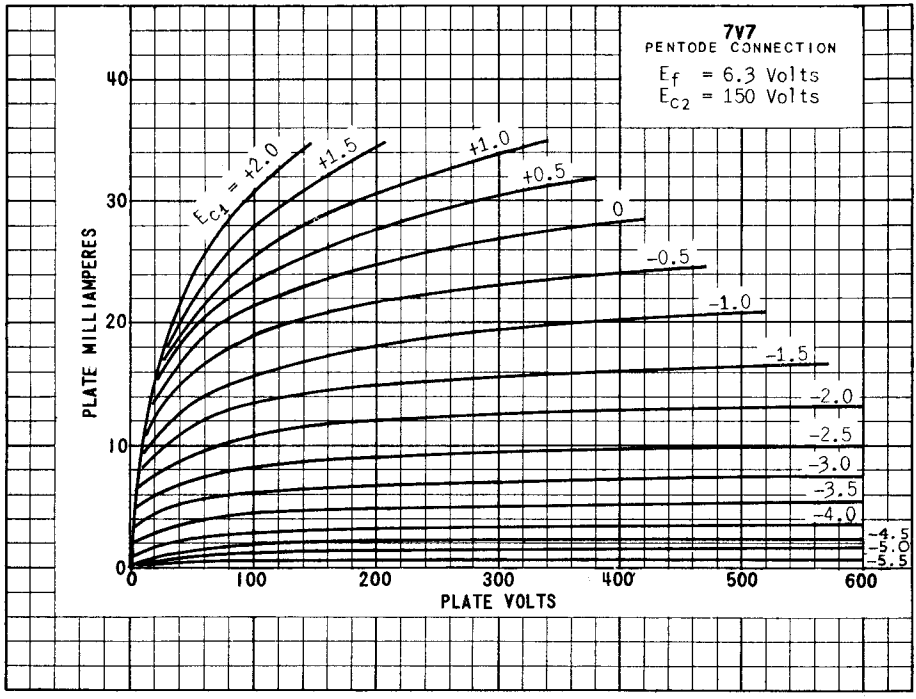

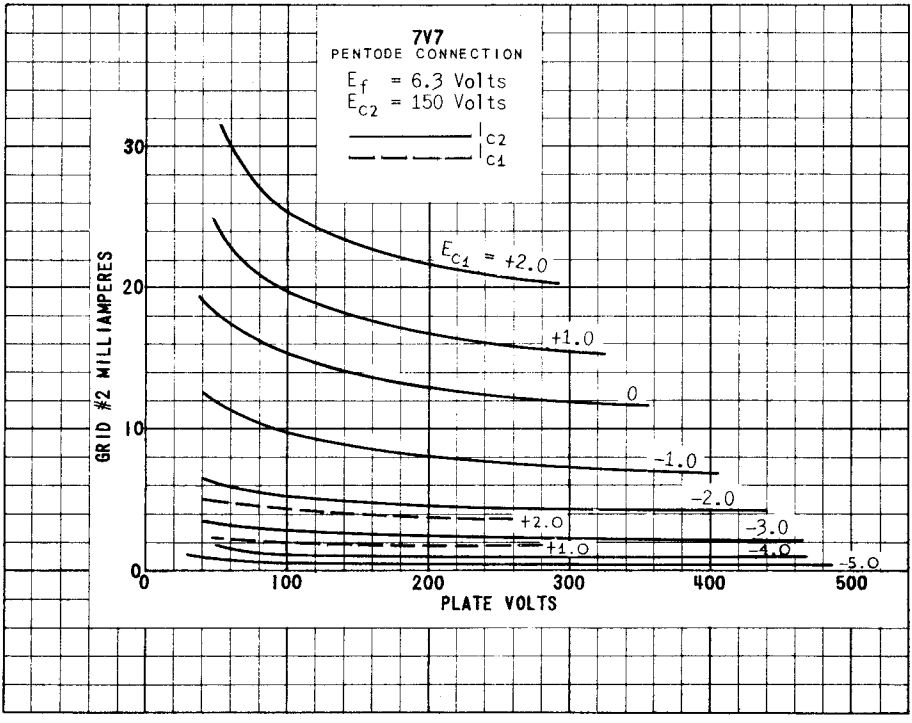

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2105
NOV. 1,
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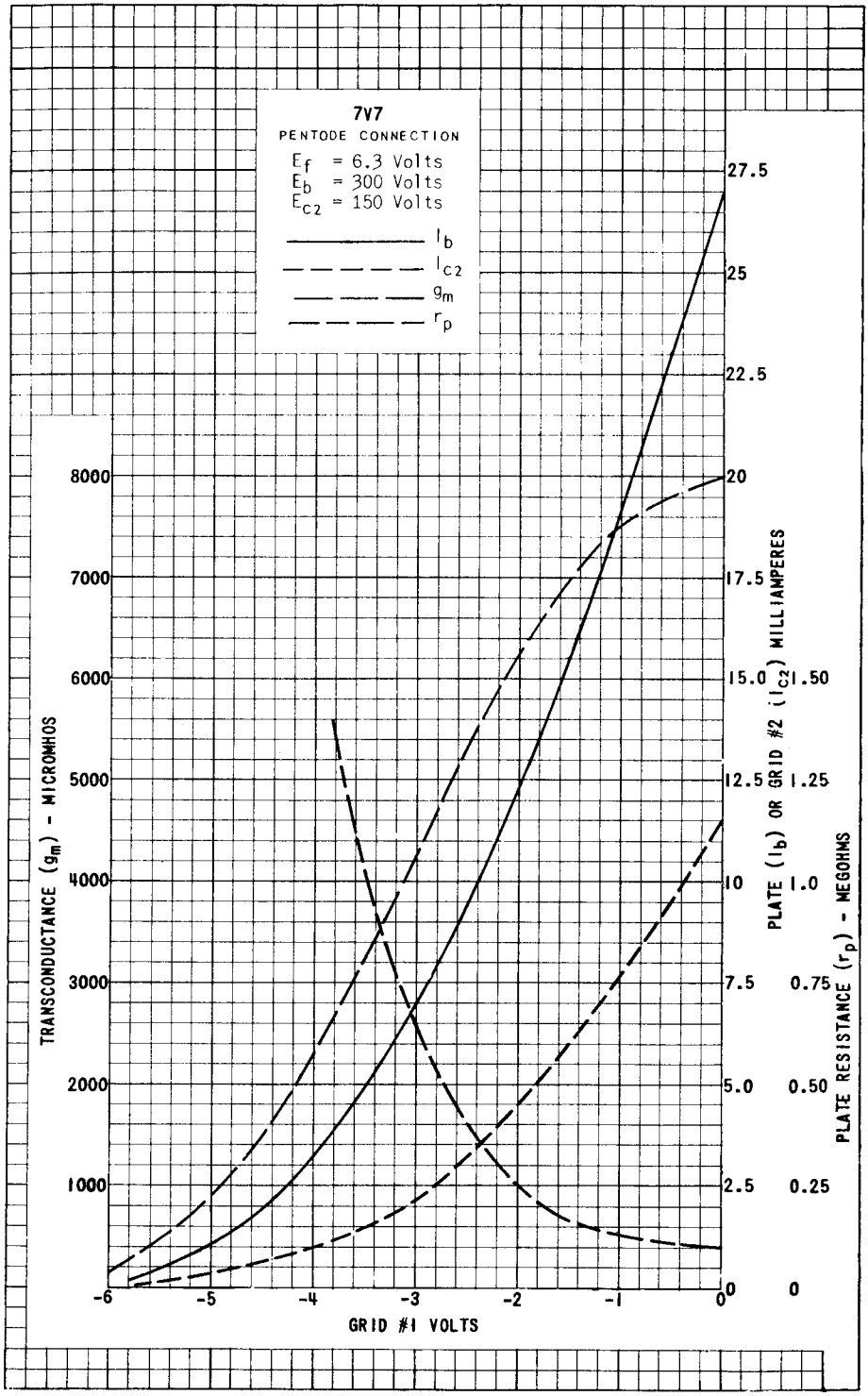
7V7



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NOV. 1, 1948

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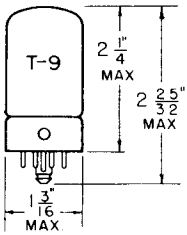
PENTODE

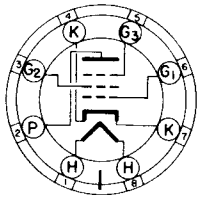


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7W7 IS A CATHODE TYPE SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER IN THE LOCK-IN CONSTRUCTION. IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW GRID-TO-PLATE CAPACITANCE WHICH MAKE IT USEFUL IN HIGH GAIN NARROW BAND AMPLIFIER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD CONNECTED TO CATHODE

GRID TO PLATE: (G TO P) MAX.	0.0025	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	9.5	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.0	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.8	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	WITH FIXED SCREEN SUPPLY	WITH SERIES SCREEN RESISTOR	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	450	450	MA.
PLATE VOLTAGE	300	300	VOLTS
GRID #3 VOLTAGE	PIN #5 CONNECTED TO PIN #4 AT SOCKET		
GRID #2 VOLTAGE	150	---	VOLTS
GRID #2 SUPPLY VOLTAGE[A]	---	300	VOLTS
GRID #2 SERIES RESISTOR	---	40 000	OHMS
CATHODE BIAS RESISTOR	160	160	OHMS
PLATE RESISTANCE (APPROX.)	0.3	0.3	MEGOHM
TRANSCONDUCTANCE	5 800	5 800	μMHOS
PLATE CURRENT	10	10	MA.
GRID #2 CURRENT	3.9	3.9	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-8	-16	VOLTS

[A] WHEN A SCREEN SUPPLY VOLTAGE IN EXCESS OF 150 VOLTS IS USED, A SERIES SCREEN DROPPING RESISTOR MUST BE EMPLOYED TO LIMIT SCREEN VOLTAGE TO 150 VOLTS WITH PLATE CURRENT AT RATED VALUE OF 10 MA.

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PLATE 2057
AUG. 2, 1948

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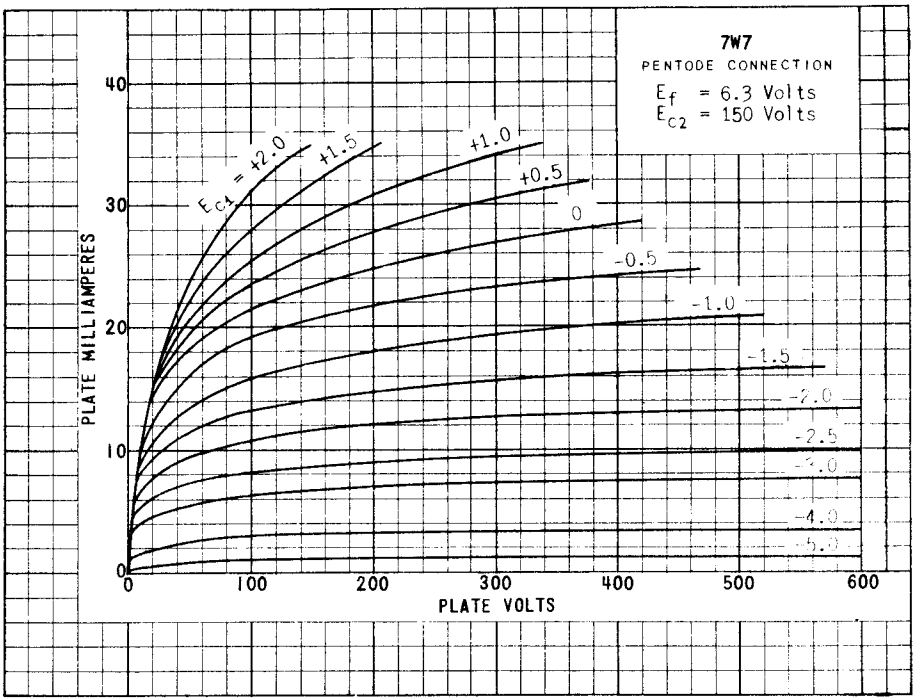
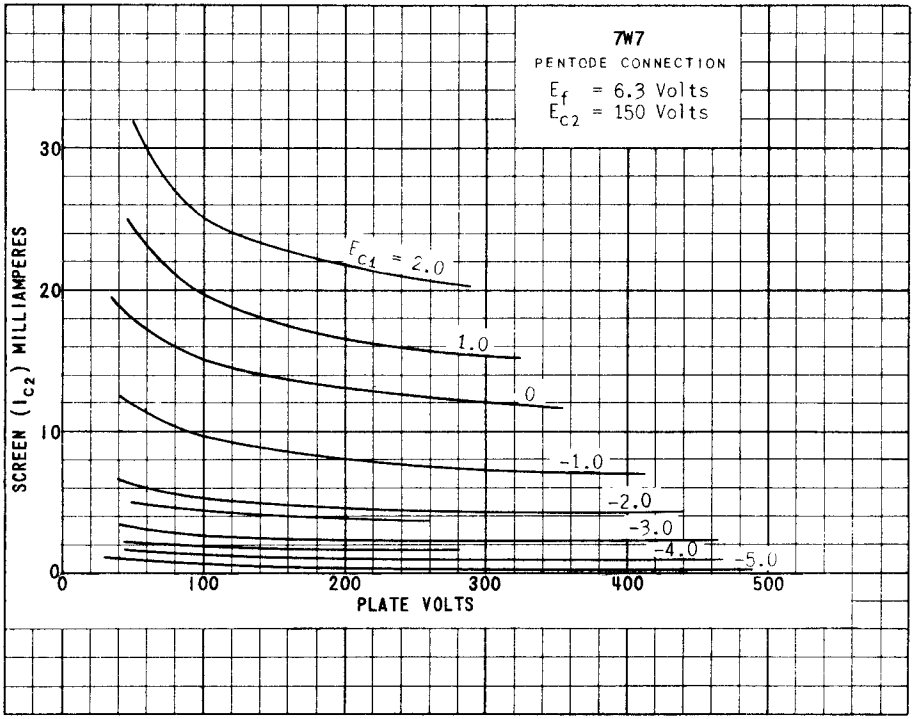
7W7





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AUG. 2, 1948

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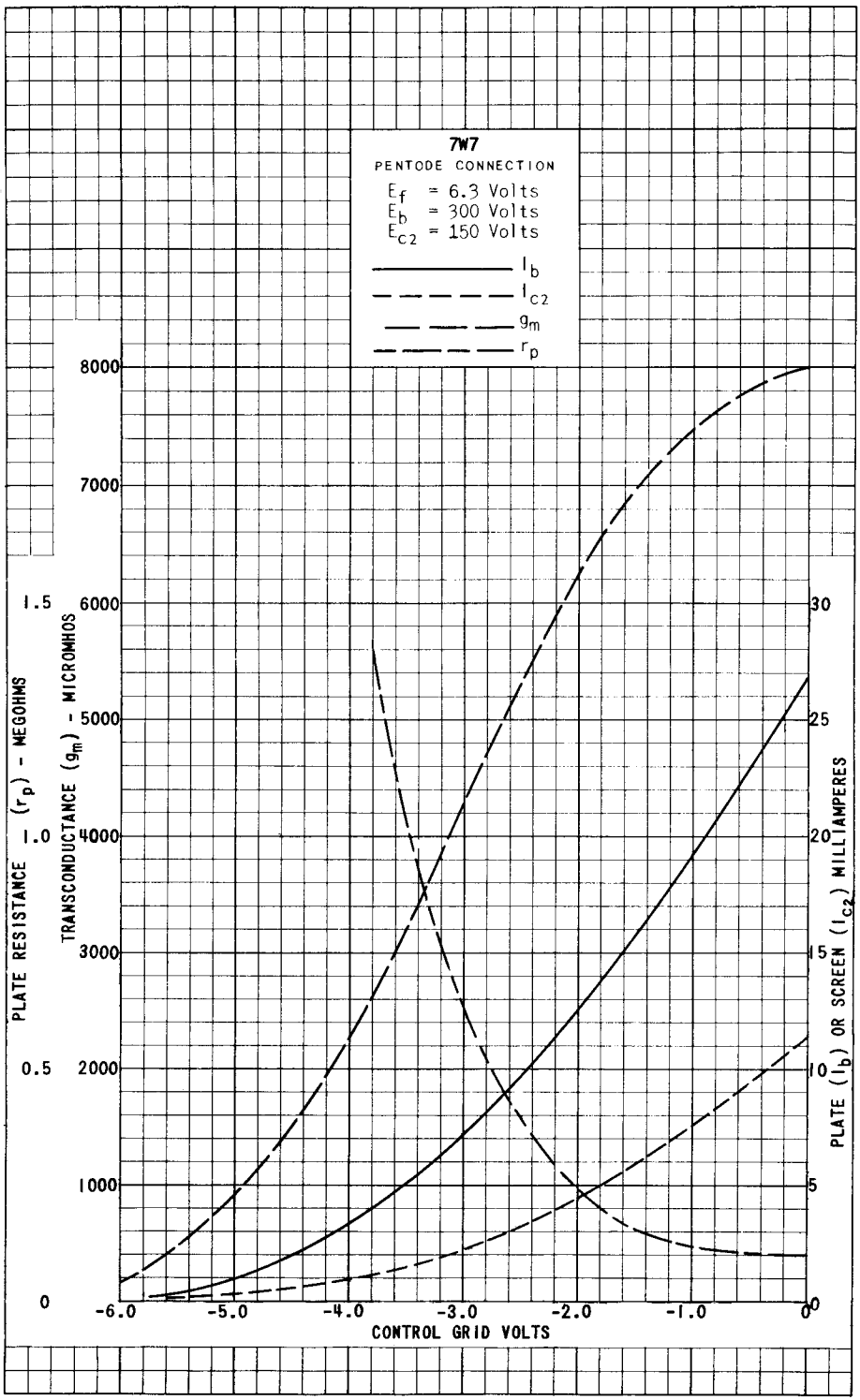

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PLATE
2026
JUNE 1,
1948

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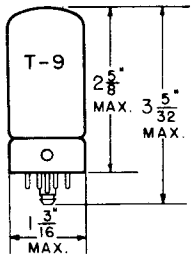
DOUBLE DIODE

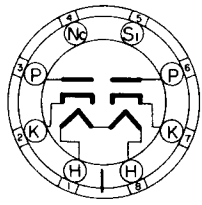


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
7AJ

THE 7X6 IS A HEATER-CATHODE TYPE HIGH-VACUUM TWIN DIODE USING THE LOCK-IN CONSTRUCTION. IT IS INTENDED FOR POWER RECTIFIER SERVICE IN TRANSFORMERLESS RADIO OR TELEVISION RECEIVER DESIGNS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	450	MA.
MAXIMUM OUTPUT CURRENT	75	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER - CONDENSER INPUT TO FILTER

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	1.2	AMP.
PLATE SUPPLY VOLTAGE (RMS)	117	150	235	VOLTS
FILTER INPUT CAPACITANCE	16	16	16	µf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	40	100	OHMS
DC OUTPUT CURRENT	75	75	75	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 150 MA. EACH PLATE)	22	22	22	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings, same ratings and characteristics as types 25Z5 and 25Z6GT.

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MAY 1 1950

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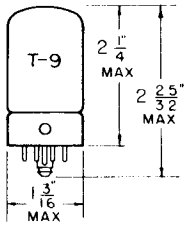
DOUBLE DIODE

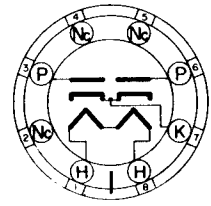


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 500 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7Y4 IS A HEATER TYPE HIGH VACUUM TWIN DIODE USING THE LOCK-IN CONSTRUCTION. IT IS INTENDED FOR USE AS A FULL-WAVE RECTIFIER IN EITHER AC OR STORAGE BATTERY OPERATED EQUIPMENT WHERE ECONOMY OF HEATER POWER IS DESIRED.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1 250	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS)CONDENSER INPUT	325	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS) CHOKE INPUT	450	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	210	MA.
MAXIMUM OUTPUT CURRENT	70	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 70 MA. EACH PLATE)	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER
CONDENSER INPUT TO FILTER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	500	MA.
AC PLATE VOLTAGE EACH PLATE (RMS)	325	VOLTS
DC OUTPUT CURRENT	70	MA.
MINIMUM PLATE SUPPLY IMPEDANCE EACH PLATE[A]	150	OHMS

[A] WHEN A FILTER CONDENSER LARGER THAN 40 MF IS USED, IT MAY BE NECESSARY TO INCREASE THE SPECIFIED PLATE SUPPLY IMPEDANCE.

CHOKE INPUT TO FILTER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	500	MA.
AC PLATE VOLTAGE EACH PLATE (RMS)	450	VOLTS
DC OUTPUT CURRENT	70	MA.
MINIMUM VALUE OF INPUT CHOKE	10	HENRYS

SIMILAR TYPE REFERENCE: Ratings and characteristics somewhat similar to types 6X5GT and 84.

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NOV. 1, 1948

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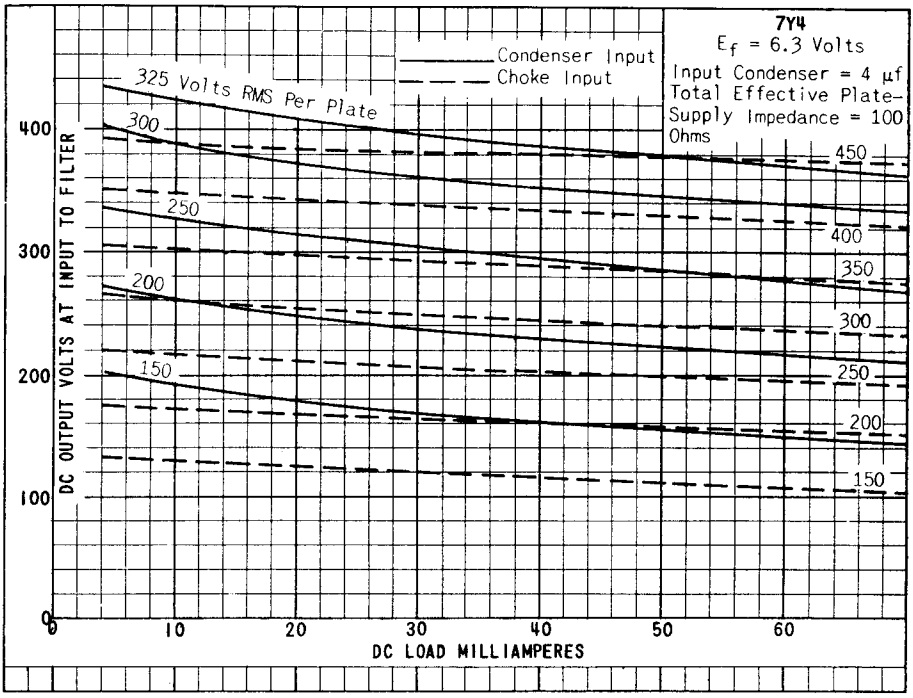

PLATE 2108
NOV. 1, 1948

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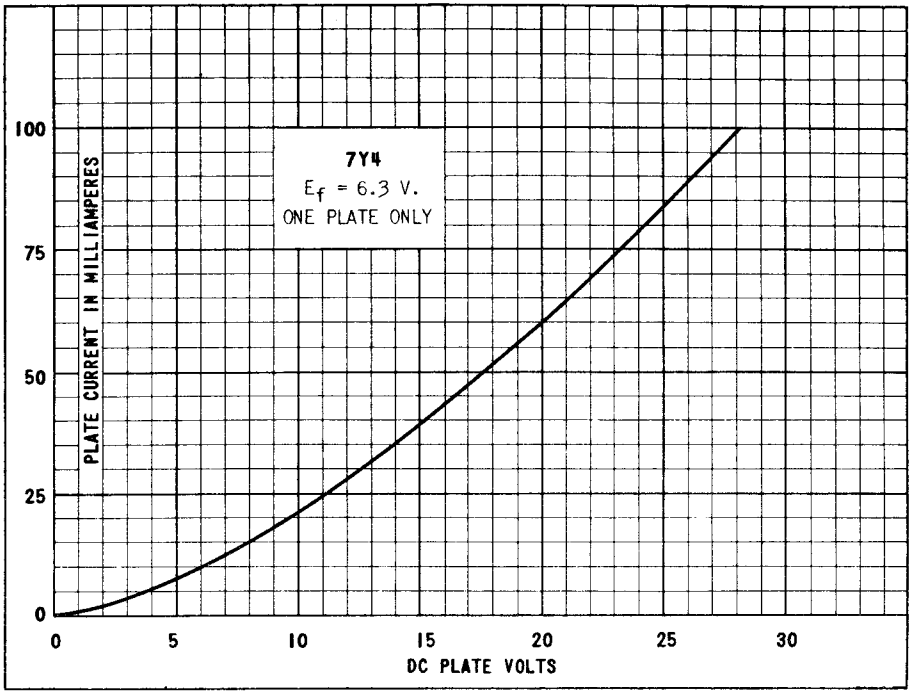
7Y4



FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

PLATE
825-1

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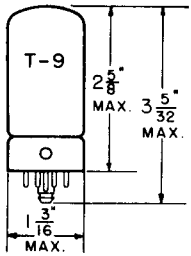
DOUBLE DIODE

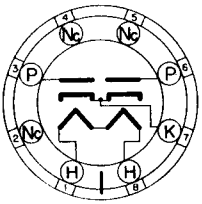


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.90 AMPERE
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN 8 PIN BASE

THE 7Z4 IS A HEATER-CATHODE TYPE HIGH VACUUM TWIN DIODE USING THE LOCK-IN CONSTRUCTION. IT IS INTENDED FOR POWER RECTIFIER SERVICE IN AC OPERATED EQUIPMENT OR FOR USE WITH STORAGE BATTERY AND VIBRATOR IN AUTOMOTIVE RECEIVERS OR AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS) CONDENSER INPUT	325	VOLTS
MAXIMUM PLATE VOLTAGE (RMS) CHOKE INPUT	450	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1 250	VOLTS
MAXIMUM DC OUTPUT CURRENT	100	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	300	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 100 MA. EACH PLATE)	40	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER

CONDENSER INPUT TO FILTER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.90	AMP.
AC PLATE VOLTAGE EACH PLATE (RMS)	325	VOLTS
DC OUTPUT CURRENT	100	MA.
PLATE SUPPLY IMPEDANCE EACH PLATE[A]	75	OHMS

[A] WHEN A FILTER CONDENSER LARGER THAN 40 μF IS USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

CHOKE INPUT TO FILTER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.90	AMP.
AC PLATE VOLTAGE EACH PLATE (RMS)	450	VOLTS
DC OUTPUT CURRENT	100	MA.
MINIMUM VALUE INPUT CHOKE	6	HENRYS

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PLATE 2120
DEC. 1, 1948

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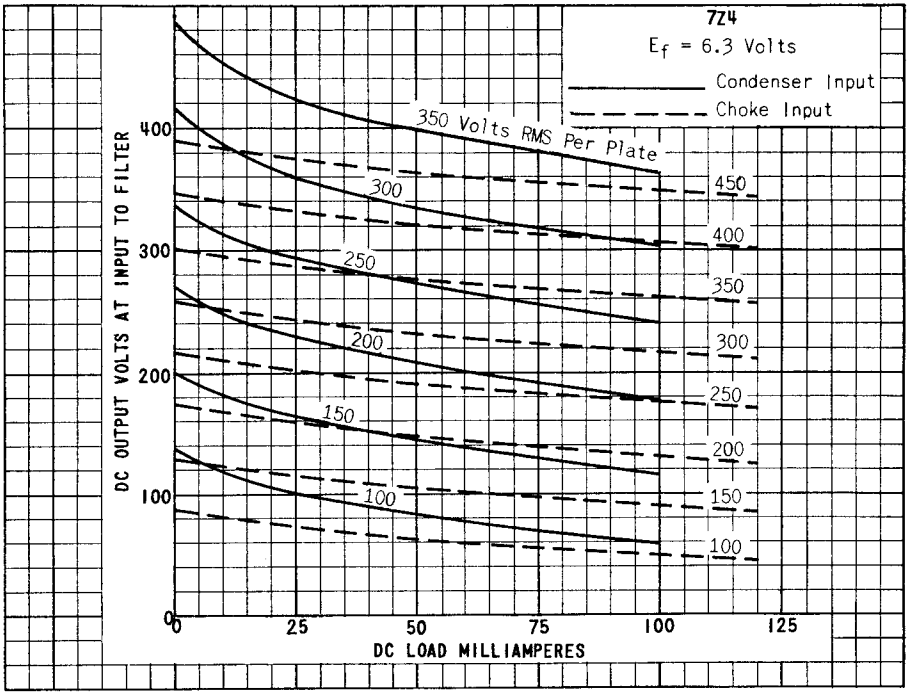
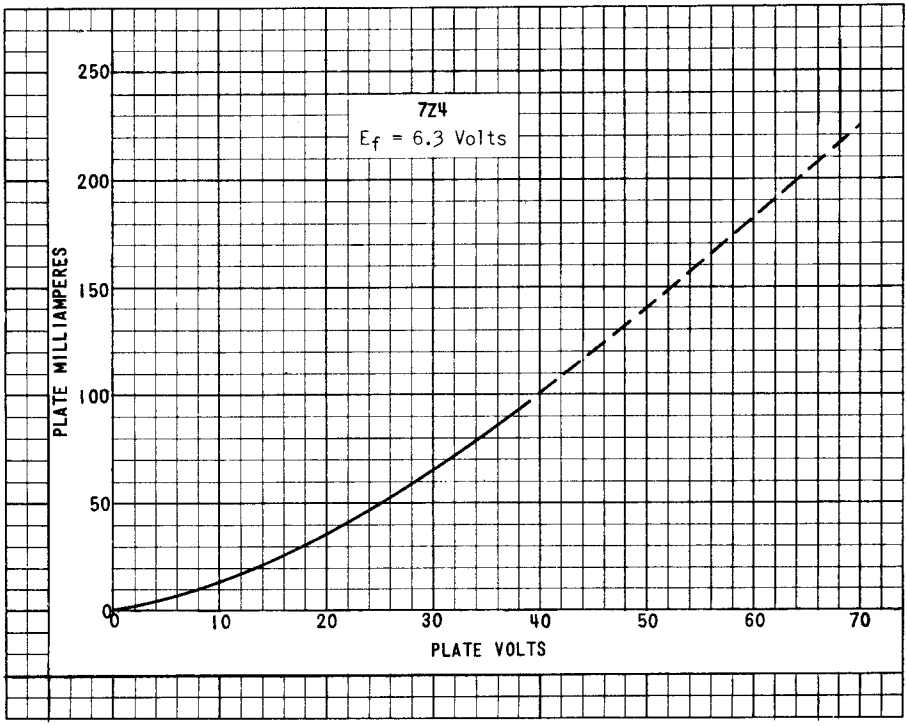
7Z4





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DEC. 1, 1948

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

METAL-CONE ENVELOPE

SMALL SHELL DUODECAL 7 PIN BASE

THE 8AP4 IS A DIRECTLY VIEWED PICTURE TUBE INTENDED FOR USE IN TELEVISION RECEIVERS. IT HAS A HIGH-EFFICIENCY, WHITE FLUORESCENT SCREEN ON A RELATIVELY FLAT FACE AND METAL-CONE ENVELOPE. THE TUBE UTILIZES MAGNETIC FOCUS AND MAGNETIC DEFLECTION TO PROVIDE 5 1/4" X 7" PICTURES WITH HIGH BRILLIANCE AND DEFINITION. ION SPOT BLEMISHES ARE ELIMINATED BY THE USE OF AN EXTERNAL ION-TRAP MAGNET.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
MAXIMUM DEFLECTING ANGLE	54 DEGREES
ION TRAP	MAGNETIC
ANODE TERMINAL	METAL-CONE LIP
RASTER SIZE (APPROX.)	5 1/4" X 7"

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELECTRODES	6	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	9 000	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VALUE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO MID TAP OF THE HEATER TRANSFORMER WINDING.

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PLATE
2247

SEPT. 1
1949

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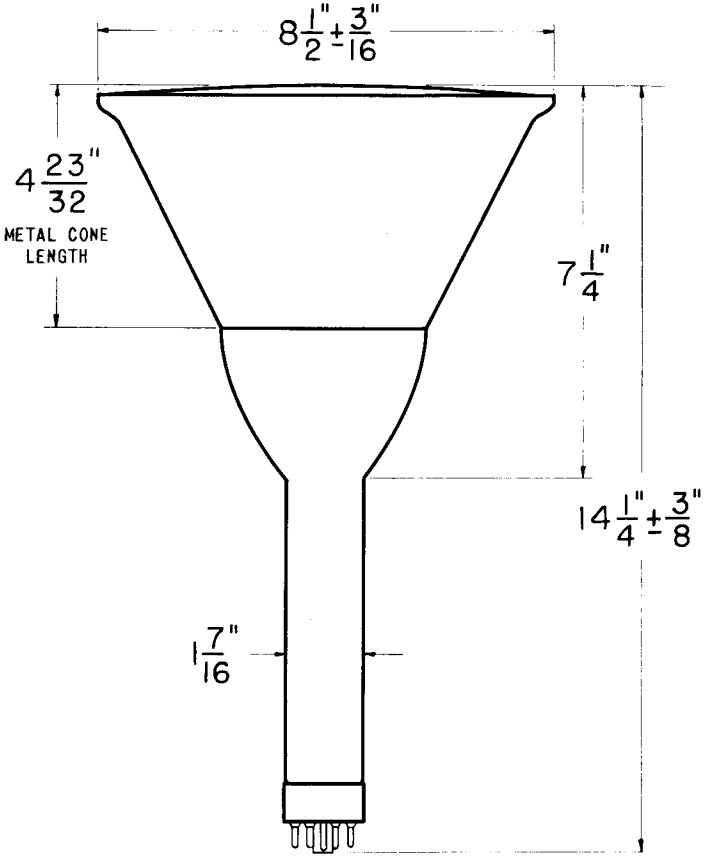
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

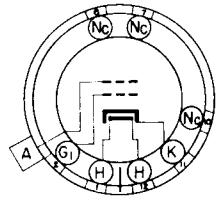
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	7 000	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT	115	MA.



1. HEATER
2. GRID #1
6. NO CONNECTION
7. NO CONNECTION
10. NO CONNECTION
11. CATHODE
12. HEATER

METAL CONE LIP: ANODE



12H

PLATE 2248
SEPT. 1 1949

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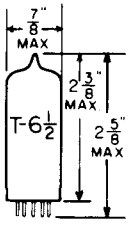
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

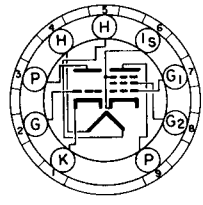


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
8.4 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 8AU8 AND 8AU8A ARE GENERAL PURPOSE MINIATURE TUBES CONTAINING A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE IN ONE ENVELOPE. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. THEY ARE DESIGNED FOR USE IN 450 MA. SERIES HEATER OPERATED MONOCHROME AND COLOR TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATERS ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED THEY ARE USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. THE PENTODE SECTIONS ARE PARTICULARLY SUITED FOR USE AS VIDEO AMPLIFIERS, VIDEO IF AMPLIFIERS, AND SOUND IF AMPLIFIERS. THE TRIODE SECTIONS ARE INTENDED FOR USE AS SYNC AMPLIFIERS, SEPARATORS OR CLIPPERS, OR AS SWEEP OSCILLATORS. THE 8AU8A DIFFERS FROM THE 8AU8 PRIMARILY BY INCORPORATING A CONTROLLED PLATE-KNEE CHARACTERISTIC.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID TO PLATE	0.06[A]	2.2	μμf
INPUT	7.5	2.6	μμf
OUTPUT	3.4[B]	0.34	μμf
PENTODE GRID #1 TO TRIODE PLATE	0.006		μμf
TRIODE GRID TO PENTODE PLATE	0.022		μμf
PENTODE PLATE TO TRIODE PLATE	0.12		μμf

[A] VALUE FOR 8AU8: 0.044

[B] VALUE FOR 8AU8: 2.4

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	8.4		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	---	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.25	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

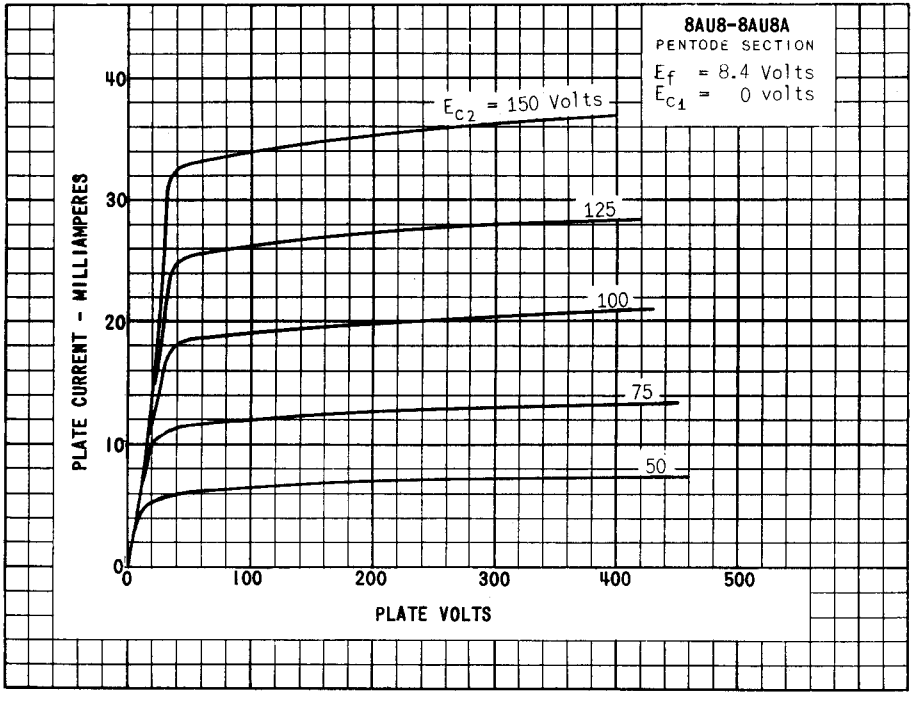
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

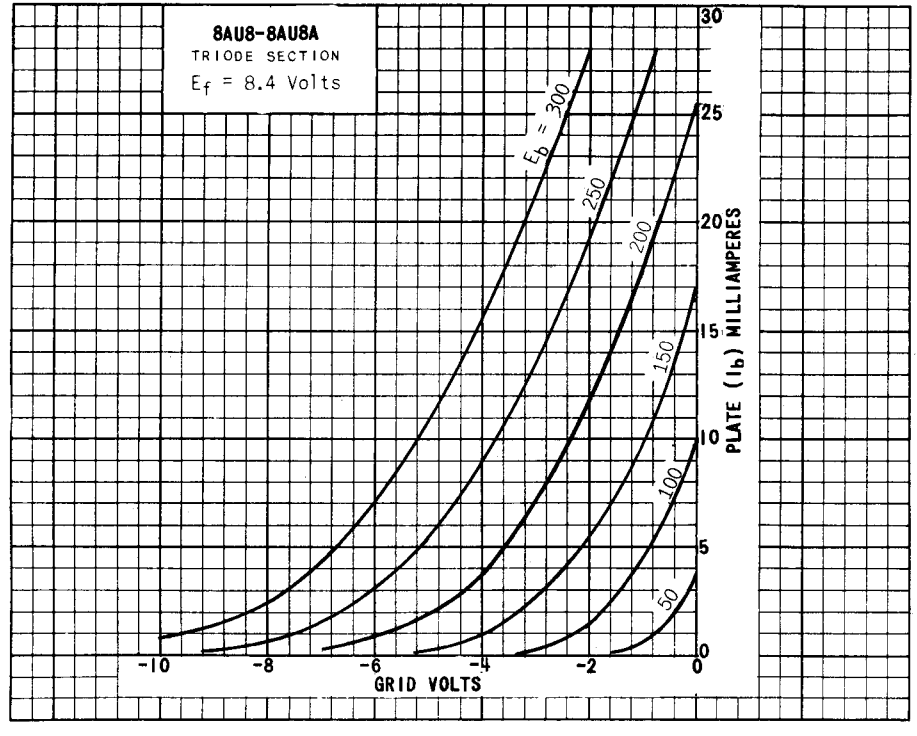
CLASS A_1 AMPLIFIER

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	8.4		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	150	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	150 000	8 200	OHMS
TRANSCONDUCTANCE	7 000	4 900	μMHOS
PLATE CURRENT	15	9.0	MA.
GRID #2 CURRENT	3.4	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMP.	-8	-6.5	VOLTS

NOTE:

THE TRIODE SECTION OF THE 8AU8A MAY BE DIODE-CONNECTED AND EMPLOYED AS A HIGH-PERVEANCE DIODE IN VIDEO-DETECTOR APPLICATIONS. THE DIODE OPERATION CAN BE OBTAINED EITHER WITH THE TRIODE GRID CONNECTED TO THE TRIODE PLATE AND THE COMBINATION OPERATED AS THE PLATE OF THE DIODE, OR WITH THE TRIODE PLATE GROUNDED AND THE TRIODE GRID OPERATED AS THE PLATE OF THE DIODE.





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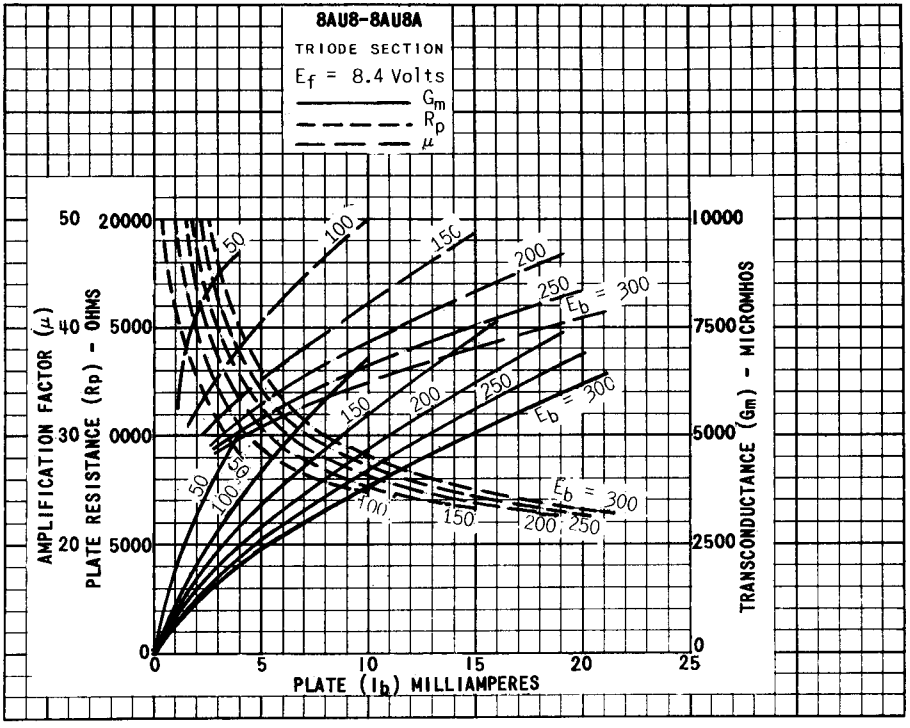
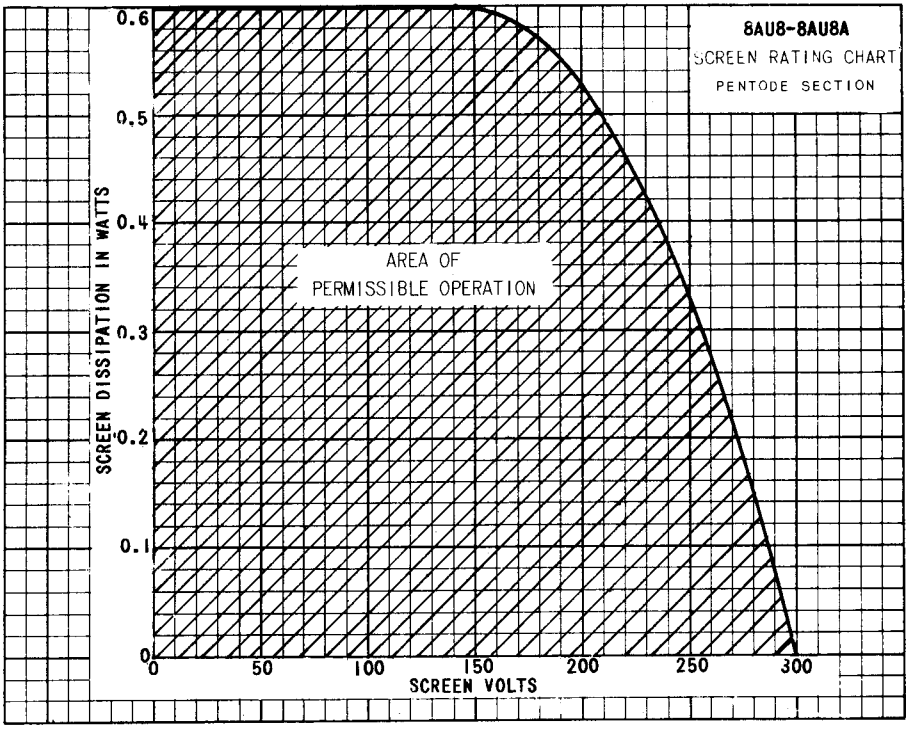
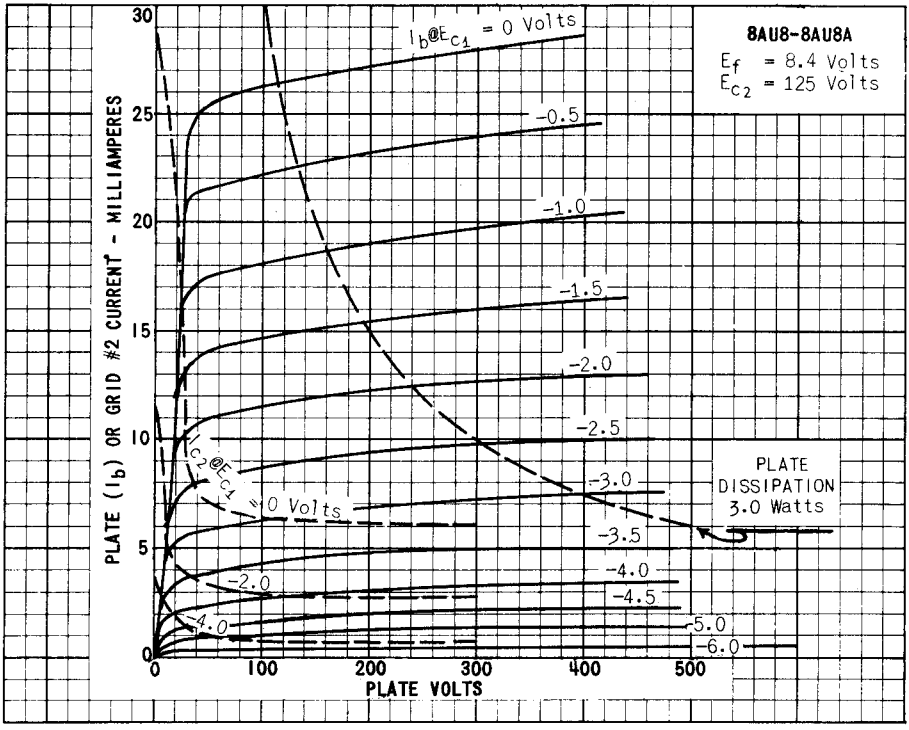
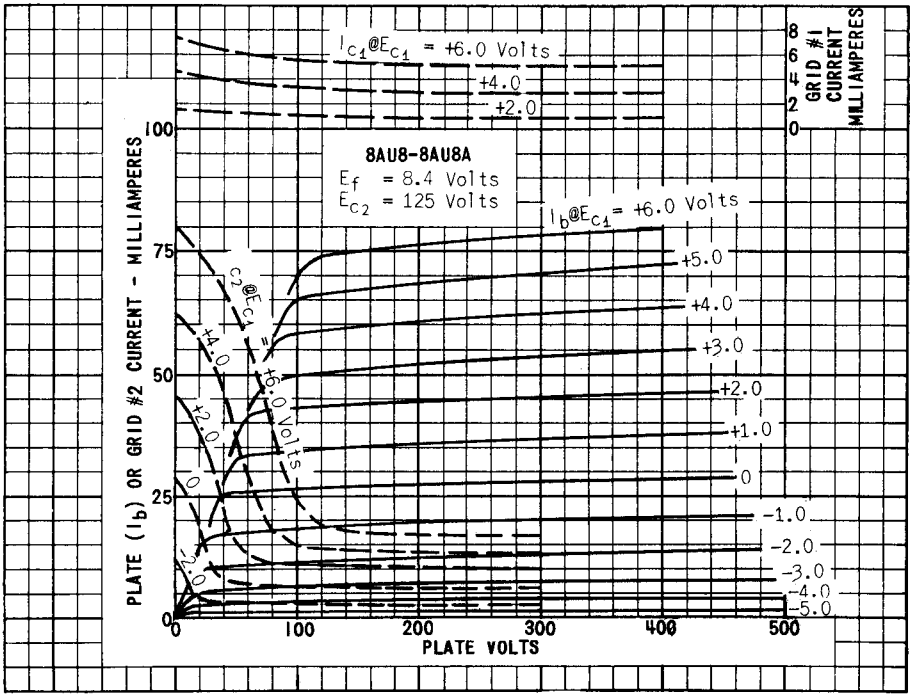

8AU8-8AU8A
TRIODE SECTION
E_f = 8.4 Volts
G_m
R_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) - OHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
E_b = 300
250
200
150
100
50
0
5
10
15
20
25
50
40
30
20
20000
15000
10000
5000
7500
2500


8AU8-8AU8A
SCREEN RATING CHART
PENTODE SECTION
AREA OF
PERMISSIBLE OPERATION
SCREEN DISSIPATION IN WATTS
SCREEN VOLTS
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150
200
250
300





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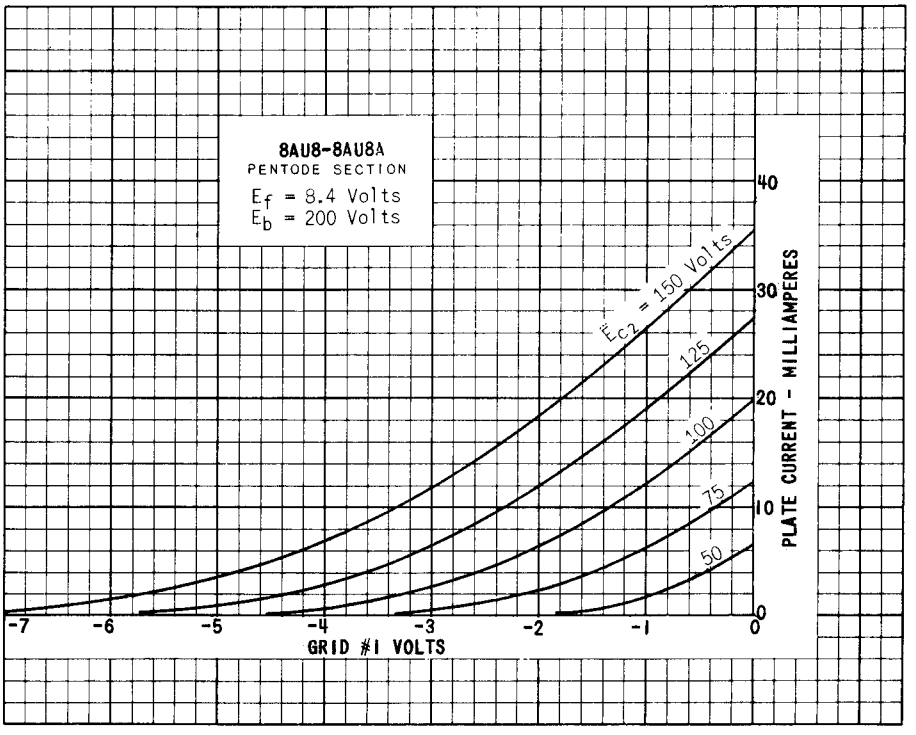
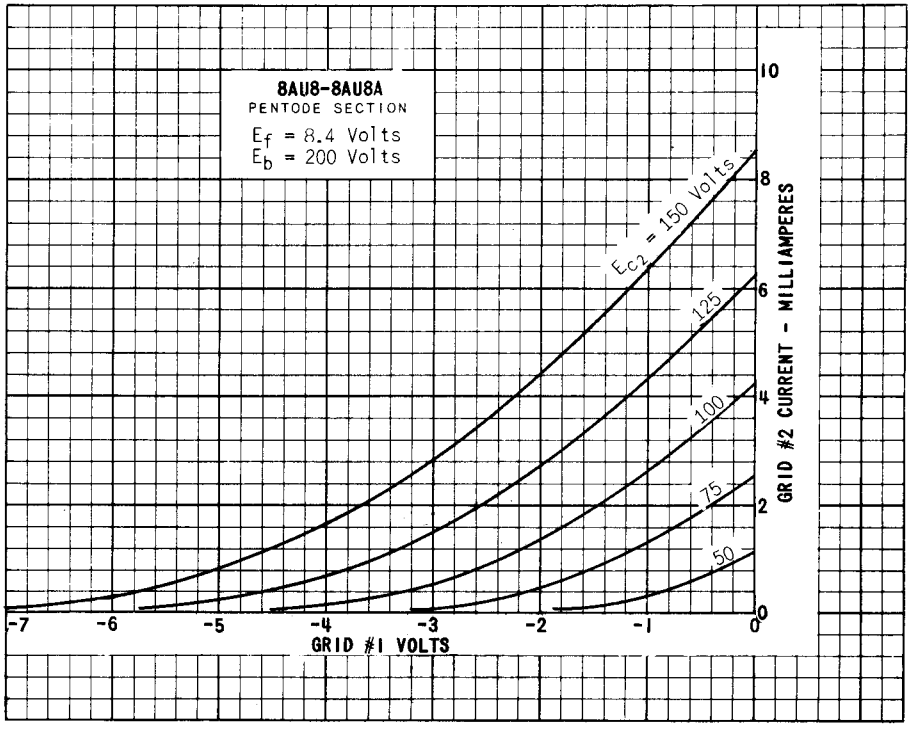
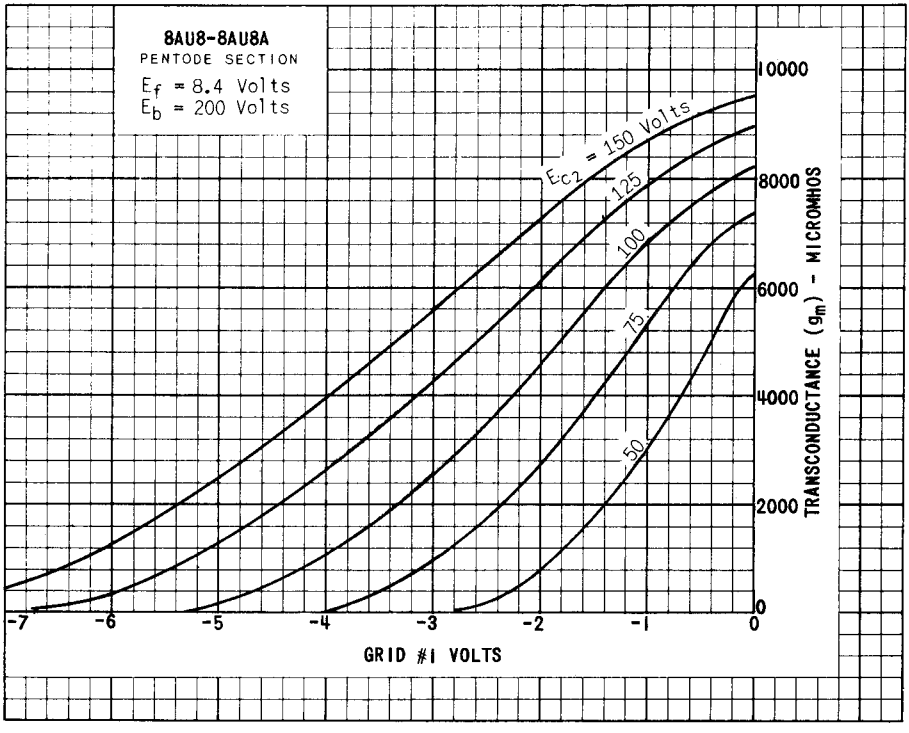
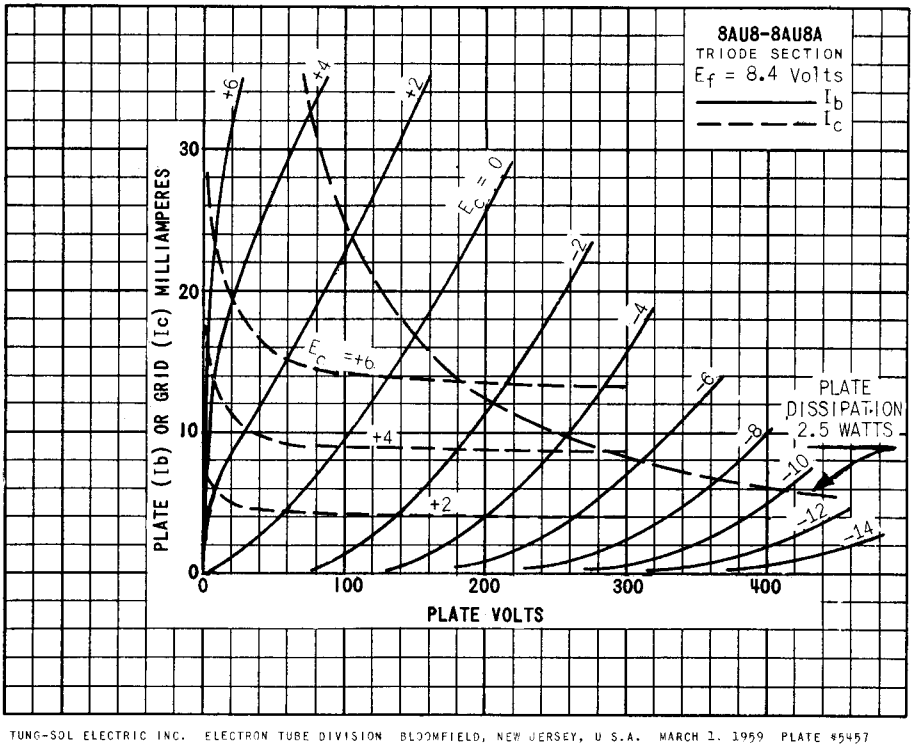

8AU8-8AU8A
PENTODE SECTION
E_f = 8.4 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
40
30
20
10
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
PLATE CURRENT - MILLIAMPERES


8AU8-8AU8A
PENTODE SECTION
E_f = 8.4 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
10
8
6
4
2
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
GRID #2 CURRENT - MILLIAMPERES





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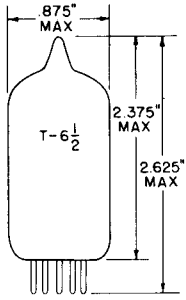
TRIODE PENTODE

MINIATURE TYPE



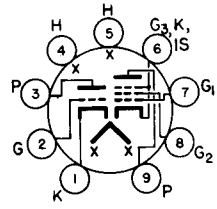
GLASS BULB
MINIATURE BUTTON 9 PIN BASE E9-1 OUTLINE DRAWING JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR USE AS A SYNC SEPARATOR

AND VIDEO AMPLIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM JEDEC 9DX

THE 8AW8A IS A SHARP CUT-OFF PENTODE AND A HIGH MU TRIODE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC FOR THE PENTODE SECTION. THE TRIODE SECTION MAY BE USED AS A SYNC SEPARATOR WHILE THE PENTODE SECTION IS DESIGNED TO SERVE AS A VIDEO AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE GRID 1 TO PENTODE PLATE (PG1 TO PP) MAX.	→ 0.05	→ 0.06	pf
PENTODE INPUT: PG TO (H+PG2+PK,G3,I.S.)	10	10	pf
PENTODE OUTPUT: PP TO (H+ PG2+PK,G3,I.S.)	4.5	3.6	pf
TRIODE GRID TO TRIODE PLATE: (TG TO TP)	2.2	2.2	pf
TRIODE INPUT: TG TO (H+TK÷PK, PG3, I.S.)	3.4	3.2	pf
TRIODE OUTPUT: TP TO (H+TK−PK, PG3, I.S,)	3.0	1.8	pf
PENTODE GRID 1 TO TRIODE PLATE: (PG1 TO TP) MAX.	.005	.008	pf
PENTODE PLATE TO TRIODE PLATE: (PP TO TP) MAX.	.025	.150	pf

[A] EXTERNAL SHIELD 315 CONNECTED TO PIN 4 AND PIN 5.

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	8.4 VOLTS	450	MA.
HEATER WARM-UP TIME [B]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION (SERIES HEATER OPERATION)		450±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE	----	SEE J5-C4-2	
GRID 2 SUPPLY VOLTAGE	----	330	VOLTS
PLATE DISSIPATION	1.1	3.75	WATTS
GRID 2 DISSIPATION		1.1	WATTS
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHM
FOR FIXED BIAS OPERATION	0.5	0.25	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

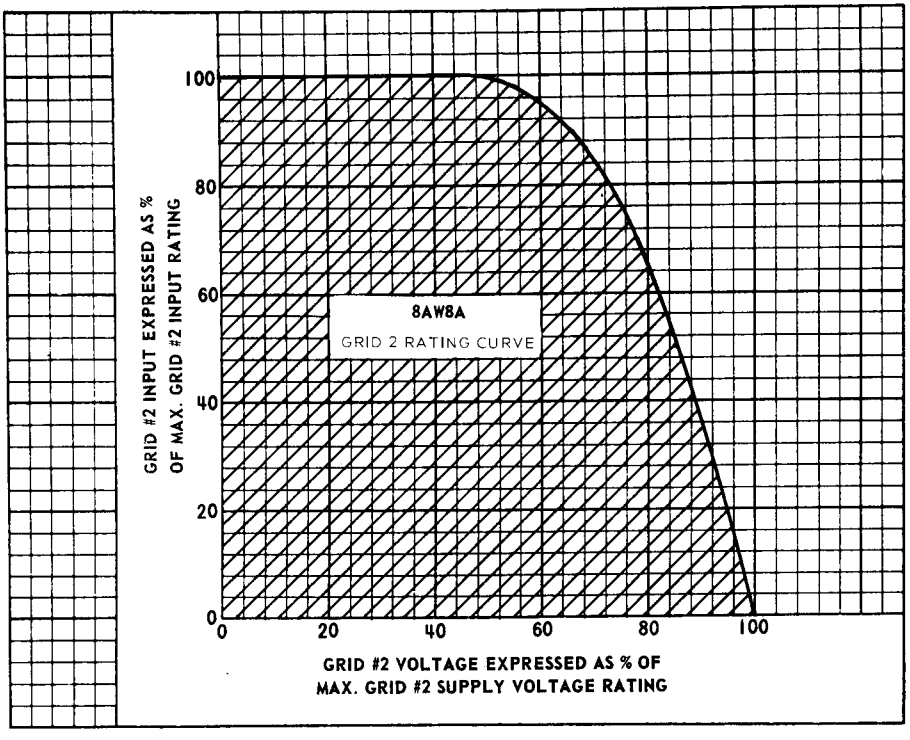
CLASS A1 AMPLIFIER

	TRIODE	PENTODE		
PLATE SUPPLY VOLTAGE	200	65	150	VOLTS
GRID 2 SUPPLY VOLTAGE		150	150	VOLTS
GRID 1 VOLTAGE	-2	0		VOLTS
CATHODE BIAS RESISTOR	----	----	150	OHMS
AMPLIFICATION FACTOR	70	----	----	
PLATE RESISTANCE (APPROX.)		----	200	KOHMS
TRANSCONDUCTANCE	4000	----	9500	μMHOS
PLATE CURRENT	4.0	46	15.0	MA.
GRID 2 CURRENT		15	3.5	MA.
GRID 1 VOLTAGE (APPROX.)				
FOR Ib = 20 μA	-5		-8	VOLTS

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[C] FOR PARALLEL HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER VOLTAGE IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT HEATER CURRENT IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.


8AW8A
GRID 2 RATING CURVE
GRID #2 INPUT EXPRESSED AS % OF MAX. GRID #2 INPUT RATING
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING
0
20
40
60
80
100

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

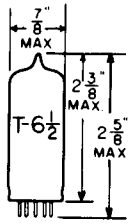
COATED UNIPOTENTIAL CATHODE

HEATER

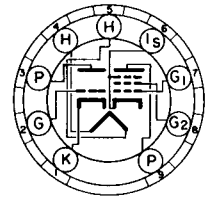
8.4 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

90X

THE 8BA8A IS A MINIATURE MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE WHICH HAS A CONTROLLED PLATE KNEE CHARACTERISTIC. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE			
GRID TO PLATE: (G TO P)	2.2	2.2	μμf
INPUT: G TO (H + K)	2.7	2.5	μμf
OUTPUT: P TO (H + K)	1.9	0.4	μμf
PENTODE			
GRID TO PLATE: (G_1 TO P)	0.03	0.04	μμf
INPUT: G TO (H+K+G_2+G_3+I.S.)	10.0	10.0	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	4.5	3.6	μμf
COUPLING			
PENTODE GRID #1 TO TRIODE PLATE	0.003	0.006	μμf
PENTODE PLATE TO TRIODE GRID	0.006	0.016	μμf
PENTODE PLATE TO TRIODE PLATE	0.050	0.200	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	8.4		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
DC	100		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.0	3.25	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.0	WATT
MAXIMUM NEGATIVE GRID #1 VOLTAGE	---	50	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	---	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
SELF BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[B]	11.0		SECONDS

[A] SHIELD #315 TIED TO CATHODE BASE PIN OF SECTION UNDER TEST.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

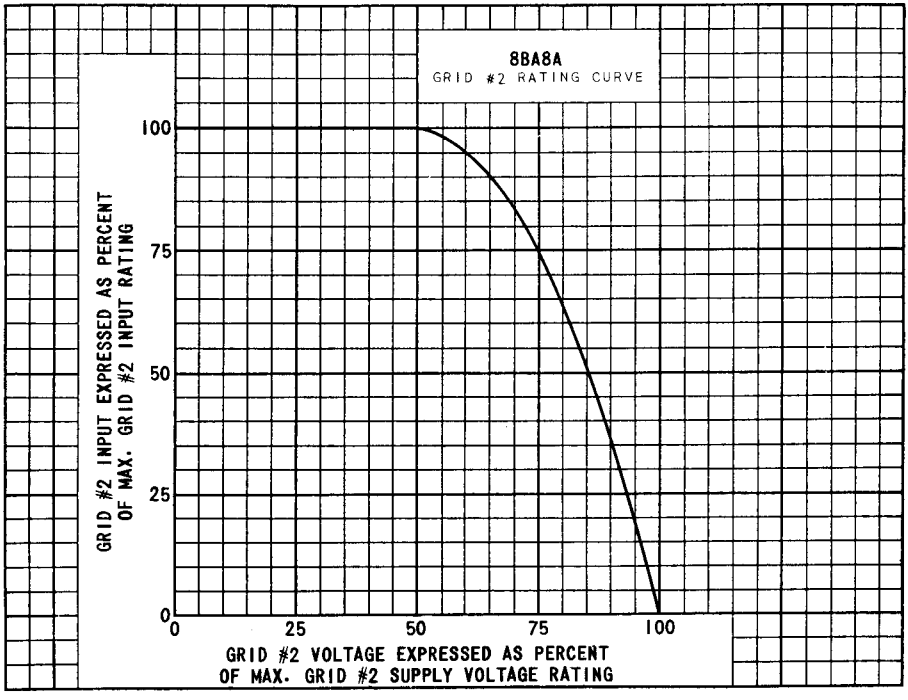
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE		8.4	VOLTS
HEATER CURRENT		0.45	AMP.
PLATE VOLTAGE	200	200	VOLTS
GRID #2 VOLTAGE	---	150	VOLTS
GRID #1 VOLTAGE	-8	0	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
AMPLIFICATION FACTOR	18	---	
PLATE RESISTANCE (APPROX.)	6 700	400 000	OHMS
TRANSCONDUCTANCE	2 700	9 000	μMHOS
PLATE CURRENT	8.0	13	MA.
GRID #2 CURRENT	---	3.5	MA.
GRID #1 VOLTAGE FOR I_b = 10 μA. (APPROX.)	-16	-10	VOLTS
ZERO BIAS: WITH E_b =65V., AND E_{c2} =150 V., (INSTANTANEOUS VALUES)			
PLATE CURRENT		42	MA.
GRID #2 CURRENT		12.5	MA.

SIMILAR TYPE REFERENCE: 6BA8A



TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

MEDIUM SHELL DIHEPTAL 12 PIN BASE

THE 8BP4 IS A DIRECTLY VIEWED PICTURE TUBE INTENDED FOR USE IN LOW COST TELEVISION RECEIVERS. IT HAS A HIGH-EFFICIENCY, WHITE FLUORESCENT SCREEN AND USES ELECTROSTATIC FOCUS AND ELECTROSTATIC DEFLECTION TO PROVIDE PICTURES 4 3/4" X 6 1/2".

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING METHOD	ELECTROSTATIC
FOCUSING METHOD	ELECTROSTATIC

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

CATHODE TO ALL OTHER ELECTRODES	10	μμf
GRID #1 TO ALL OTHER ELECTRODES	8	μμf
DJ_1 TO DJ_2	4	μμf
DJ_3 TO DJ_4	2	μμf
DJ_1 TO ALL OTHER ELECTRODES EXCEPT DJ_2	8	μμf
DJ_2 TO ALL OTHER ELECTRODES EXCEPT DJ_1	8	μμf
DJ_3 TO ALL OTHER ELECTRODES EXCEPT DJ_4	6	μμf
DJ_4 TO ALL OTHER ELECTRODES EXCEPT DJ_3	6	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	VOLTS
MAXIMUM ANODE #2 AND GRID #2 VOLTAGE	6 600	VOLTS
MAXIMUM ANODE #1 VOLTAGE	3 100	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	200	VOLTS
POSITIVE BIAS VOLTAGE[A]	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK VOLTAGE BETWEEN ANODE #2 AND ANY DEFLECTING ELECTRODE	750	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM RESISTANCE IN ANY DEFLECTING ELECTRODE CIRCUIT[B]	5	MEGOHMS

[A] FOR OPERATION WITH ZERO VOLTS ON GRID #1 AND WITH 4000 TO 6000 VOLTS ON ANODE #2 IT IS ESSENTIAL THAT THE RESISTANCE OF THE ANODE #2 SUPPLY BE ADEQUATE TO LIMIT THE ANODE #2 INPUT POWER TO 6 WATTS.

[B] IT IS RECOMMENDED THAT THE DEFLECTING-ELECTRODE-CIRCUIT RESISTANCES BE APPROXIMATELY EQUAL.

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PLATE 2275
NOV. 1, 1949

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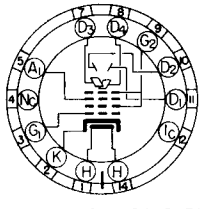
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FOR ANODE #2 AND GRID #2 VOLTAGE OF	6 000	VOLTS
ANODE #1 VOLTAGE	1620 TO 2400	VOLTS
GRID #1 VOLTAGE[C]	-72 TO -168	VOLTS
DEFLECTION FACTORS:		
DJ_1 AND DJ_2	146 TO 198	VOLTS DC/IN
DJ_3 AND DJ_4	124 TO 168	VOLTS DC/IN
FOR ANODE #2 AND GRID #2 (E_{b2}) VOLTAGE BETWEEN	3000 TO 6000	VOLTS
ANODE #1 VOLTAGE FOR FOCUS[D]	27% TO 40% OF E_{b2}	VOLTS
GRID #1 VOLTAGE FOR VISUAL CUT-OFF OF SPOT	1.2% TO 2.8% OF E_{b2}	VOLTS
ANODE #1 CURRENT FOR ANY OPERATING CONDITION	-15 TO +10	μAMP.
DEFLECTION FACTORS:		
DJ_1 AND DJ_2[E]	24 TO 33 V. DC/IN/KV OF E_{b2}	
DJ_3 AND DJ_4	21 TO 28 V. DC/IN/KV OF E_{b2}	
SPOT POSITION (UNDEFLECTED)	10 (MAX.) MILLIMETERS	

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

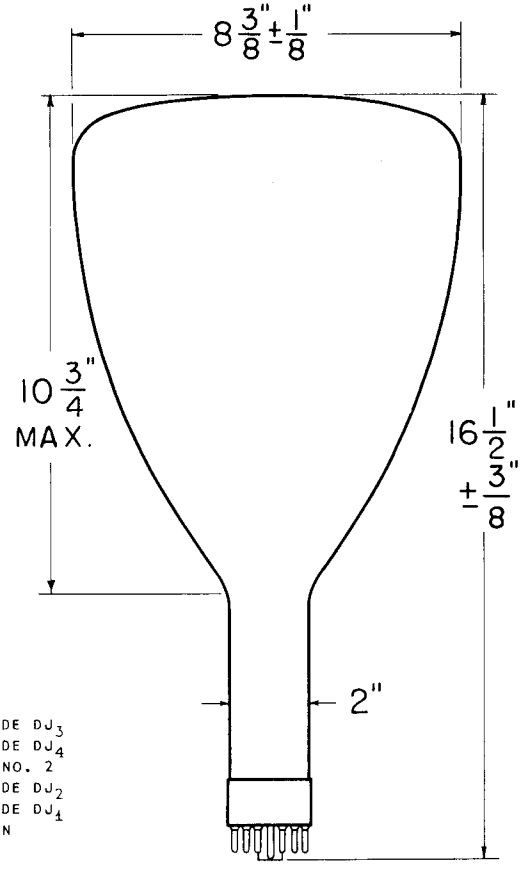
[D] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 15 FOOT-LAMBERTS ON A 4 3/4" X 6 1/2" PICTURE AREA.

[E] TO OBTAIN MAXIMUM DEFLECTION SENSITIVITY, DEFLECTING ELECTRODES DJ_1 AND DJ_2 ARE DESIGNED TO PRODUCE LESS THAN FULL SCREEN DEFLECTION. IT IS THEREFORE RECOMMENDED THAT FOR TELEVISION SERVICE THESE ELECTRODES BE USED FOR VERTICAL DEFLECTION.



MEDIUM SHELL DIHEPTAL
12 PIN BASE
14G

1. HEATER
2. CATHODE
3. GRID NO. 1
4. NO CONNECTION
5. ANODE NO. 1
7. DEFLECTING ELECTRODE DJ_3
8. DEFLECTING ELECTRODE DJ_4
9. GRID NO. 2, ANODE NO. 2
10. DEFLECTING ELECTRODE DJ_2
11. DEFLECTING ELECTRODE DJ_1
12. INTERNAL CONNECTION
14. HEATER



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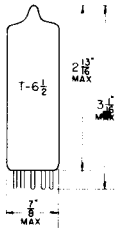
PENTODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE.

HEATER

8.0±0.7 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9CV

THE 8BQ5 IS AN OUTPUT PENTODE DESIGNED FOR USE IN MEDIUM POWER HI-FI AMPLIFIERS.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL ELEMENTS EXCEPT PLATE	10.8	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	6.5	μμf
PLATE TO GRID #1	0.5	μμf
GRID #1 TO HEATER	0.25	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	8.0±0.7	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MAXIMUM GRID #2 DISSIPATION (ZERO SIGNAL)	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION (MAX. SIGNAL)	4.0	WATTS
MAXIMUM CATHODE CURRENT	65	MA.
MAXIMUM GRID RESISTANCE (CATHODE BIAS)	1.0	MΩ
MAXIMUM GRID RESISTANCE (FIXED BIAS)	300	KΩ
MAXIMUM FILAMENT TO CATHODE VOLTAGE	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE CURRENT	48	MA.
GRID #2 CURRENT	5.5	MA.
GRID #1 VOLTAGE	-7.3	VOLTS
TRANSCONDUCTANCE	11 300	μMHOS
PLATE RESISTANCE	40	KΩ
AMPLIFICATION FACTOR (GRID #1 TO GRID #2)	19.5	

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

CLASS A – ONE TUBE

HEATER VOLTAGE	8.0	8.0	8.0	8.0	VOLTS
HEATER CURRENT	0.60	0.60	0.60	0.60	AMP.
PLATE VOLTAGE	250	250	250	250	VOLTS
SCREEN GRID VOLTAGE	250	250	250	210	VOLTS
PLATE LOAD RESISTANCE	5.2	4.5	7.0	7.0	kΩ
CATHODE RESISTANCE	135	135	210	160	Ω
GRID #1 VOLTAGE	-7.3	-7.3	-8.4	-6.4	VOLTS
PLATE CURRENT (ZERO SIGNAL)	48	48	36	36	MA.
PLATE CURRENT (MAX. SIGNAL)	49.5	50.6	36.8	36.6	MA.
GRID #2 CURRENT (ZERO SIGNAL)	5.5	5.5	4.1	3.9	MA.
GRID #2 CURRENT (MAX. SIGNAL)	10.8	10.0	8.5	7.3	MA.
INPUT (RMS) SIGNAL VOLTAGE	4.3	4.4	3.5	3.4	VOLTS
POWER OUTPUT	5.7	5.7	4.2	4.3	WATTS
TOTAL DISTORTION (MEASURED WITH FIXED GRID BIAS)	10	10	10	10	PERCENT

CLASS AB – TWO TUBES, PUSH-PULL

PLATE VOLTAGE	250	300	VOLTS
GRID #2 VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTANCE	130	130	Ω
PLATE TO PLATE LOAD RESISTANCE	8.0	8.0	kΩ
PLATE CURRENT (ZERO SIGNAL)	2x31	2x36	MA.
PLATE CURRENT (MAX. SIGNAL)	2x37.5	2x46	MA.
GRID #2 CURRENT (ZERO SIGNAL)	2x3.5	2x4.0	MA.
GRID #2 CURRENT (MAX.SIGNAL)	2x7.5	2x11	MA.
INPUT SIGNAL VOLTAGE (RMS)	8	10	VOLTS
POWER OUTPUT	11	17	WATTS
PERCENT DISTORTION	3.0	4.0	PERCENT

CLASS B – TWO TUBES, PUSH-PULL

PLATE VOLTAGE	250	300	VOLTS
GRID #2 VOLTAGE	250	300	VOLTS
GRID #1 VOLTAGE	-11.6	-14.7	VOLTS
PLATE TO PLATE LOAD RESISTANCE	8.0	8.0	kΩ
PLATE CURRENT (ZERO SIGNAL)	2x10	2x7.5	MA.
PLATE CURRENT (MAX. SIGNAL)	2x37.5	2x46	MA.
GRID #2 CURRENT (ZERO SIGNAL)	2x1.1	2x0.8	MA.
GRID #2 CURRENT (MAX.SIGNAL)	2x7.5	2x11	MA.
INPUT SIGNAL VOLTAGE (RMS)	8	10	VOLTS
POWER OUTPUT	11	17	WATTS
PERCENT DISTORTION	3.0	4.0	PERCENT

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TUNG-SOL

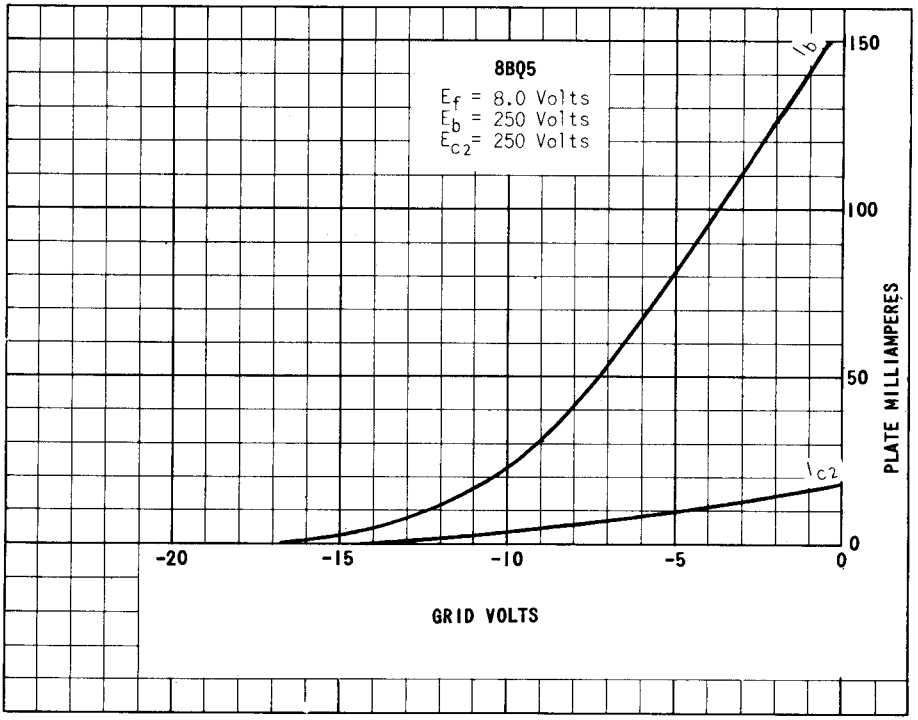
CONTINUED FROM PRECEDING PAGE

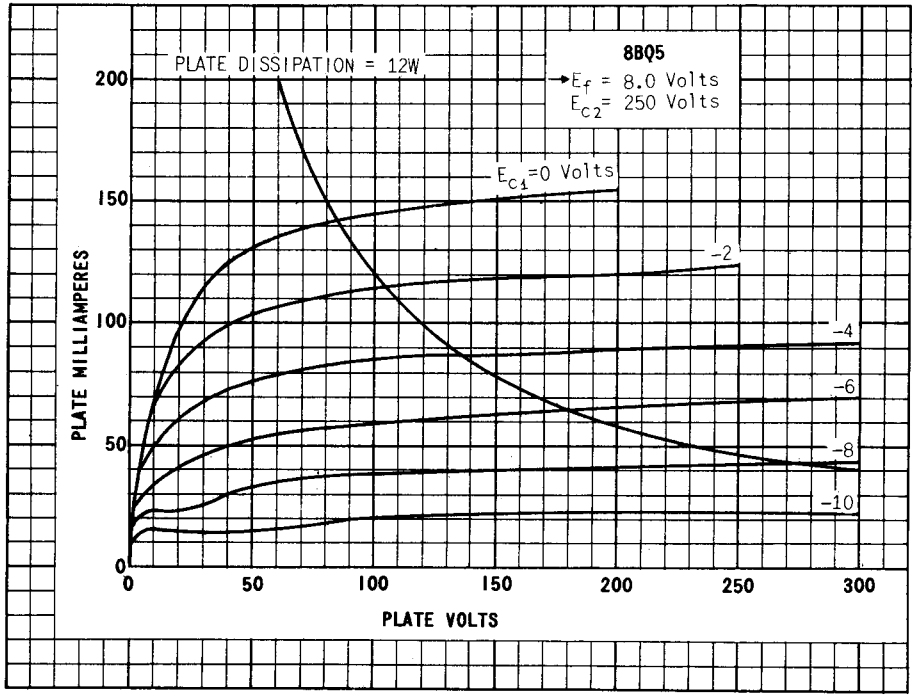
CLASS A – TRIODE OPERATION
SCREEN GRID CONNECTED TO PLATE

PLATE VOLTAGE	250	VOLTS
COMMON CATHODE RESISTANCE	270	Ω
PLATE LOAD RESISTANCE	3.5	KΩ
PLATE CURRENT (ZERO SIGNAL)	34	MA.
PLATE CURRENT (MAX. SIGNAL)	36	MA.
INPUT SIGNAL VOLTAGE (RMS)	6.7	VOLTS
POWER OUTPUT	1.95	WATTS
PERCENT DISTORTION	9.0	PERCENT

CLASS AB – TRIODE OPERATION
TWO TUBES, PUSH-PULL. SCREEN GRID CONNECTED TO PLATE

PLATE VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTANCE	270	270	Ω
PLATE TO PLATE LOAD RESISTANCE	10	10	KΩ
PLATE CURRENT (ZERO SIGNAL)	2x20	2x24	MA.
PLATE CURRENT (MAX. SIGNAL)	2x21.7	2x26.0	MA.
INPUT SIGNAL VOLTAGE (RMS)	8.3	10	VOLTS
POWER OUTPUT	3.4	5.2	WATTS
PERCENT DISTORTION	2.5	2.5	PERCENT





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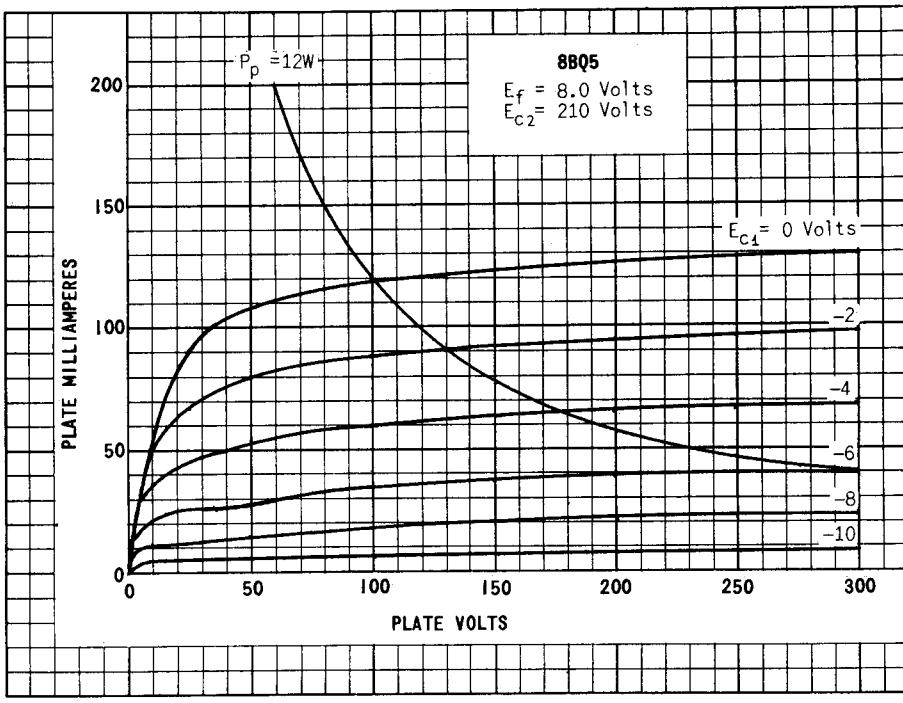
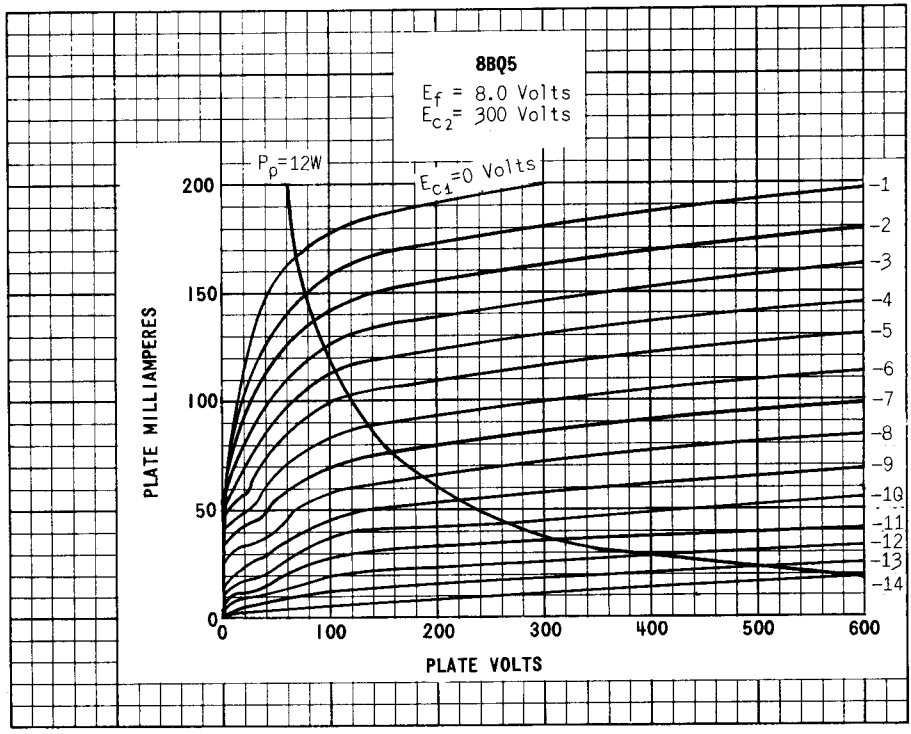
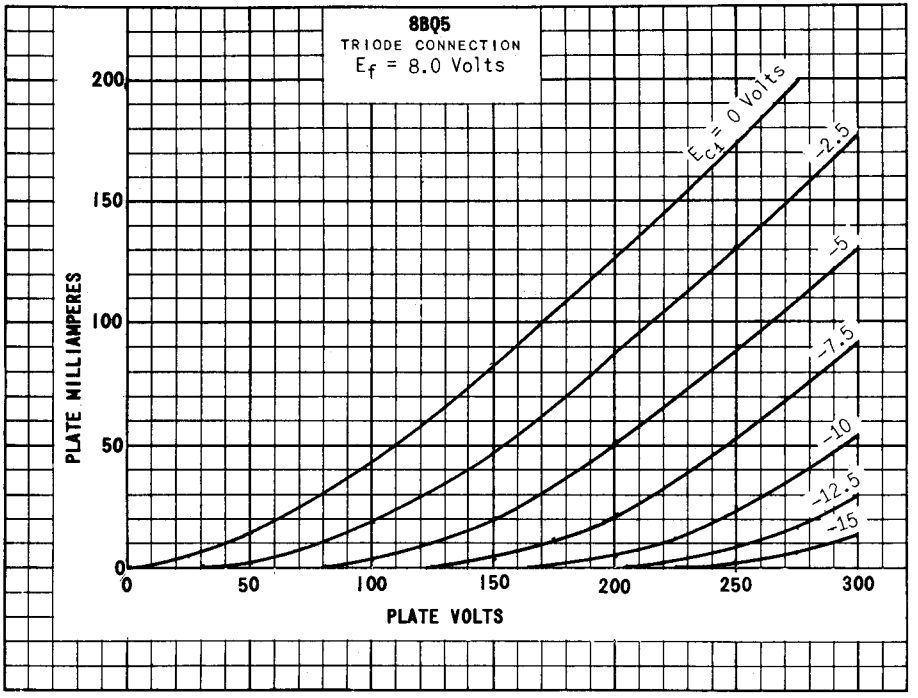
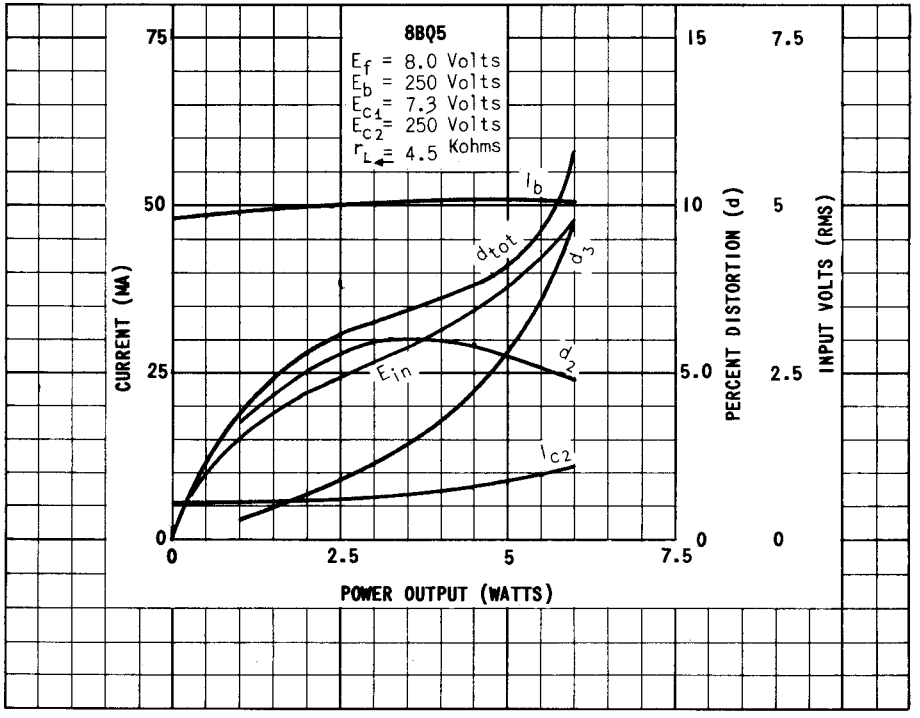

8BQ5
E_f = 8.0 Volts
E_{c_2} = 210 Volts
P_p =12W
E_{c_1} = 0 Volts
-2
-4
-6
-8
-10
PLATE MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
300


8BQ5
E_f = 8.0 Volts
E_{c_2} = 300 Volts
P_p=12W
E_{c_1}=0 Volts
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
PLATE MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
300
400
500
600





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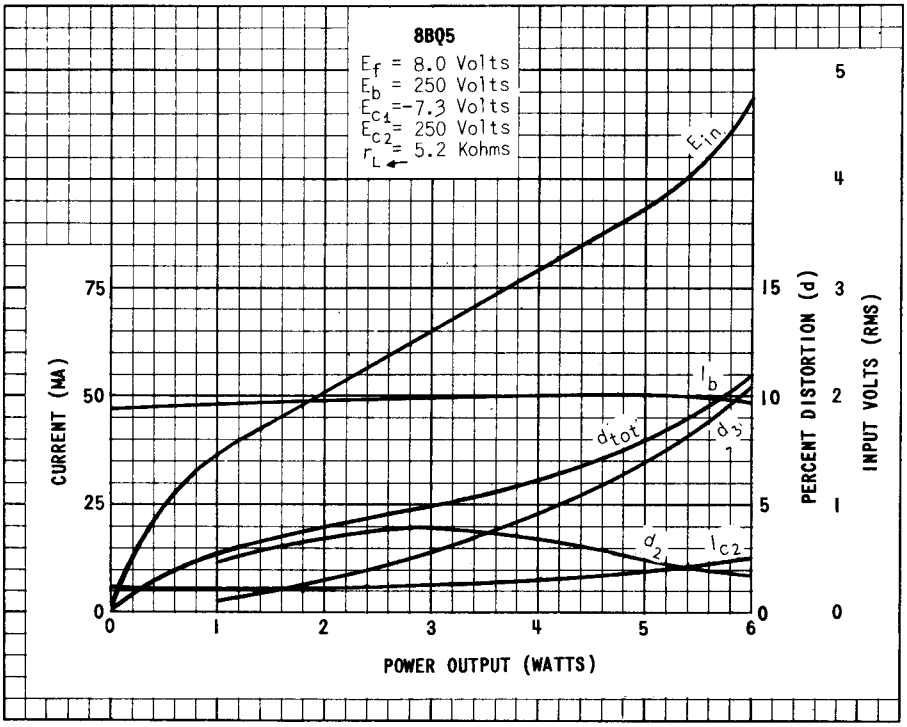

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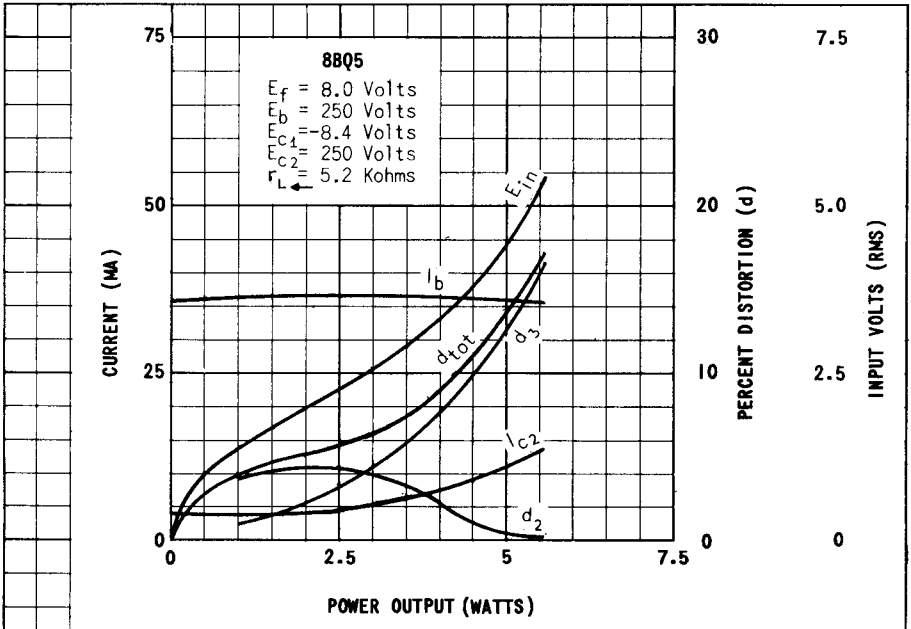

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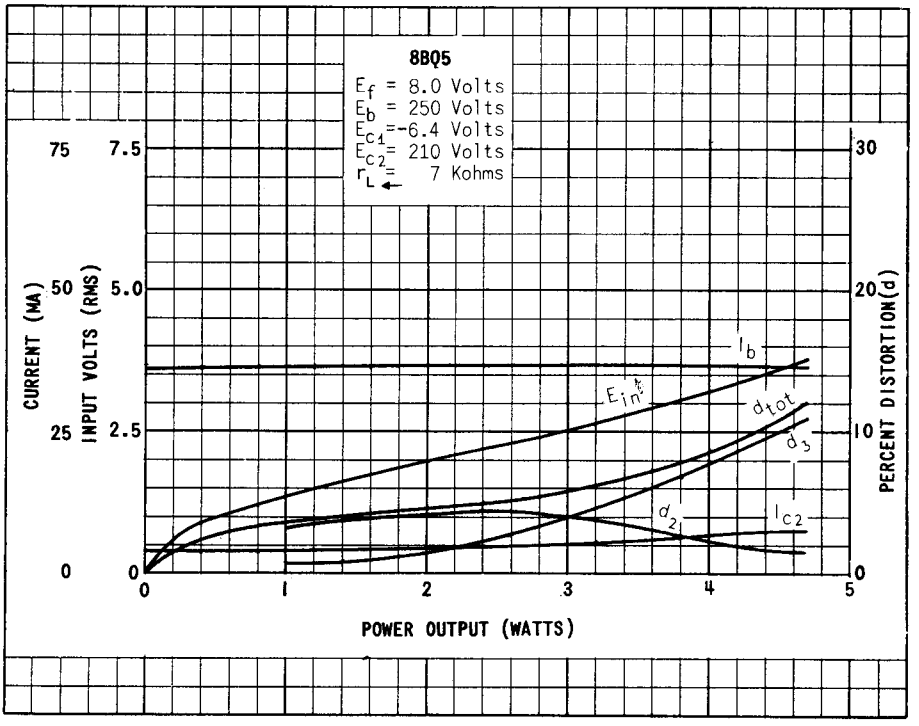

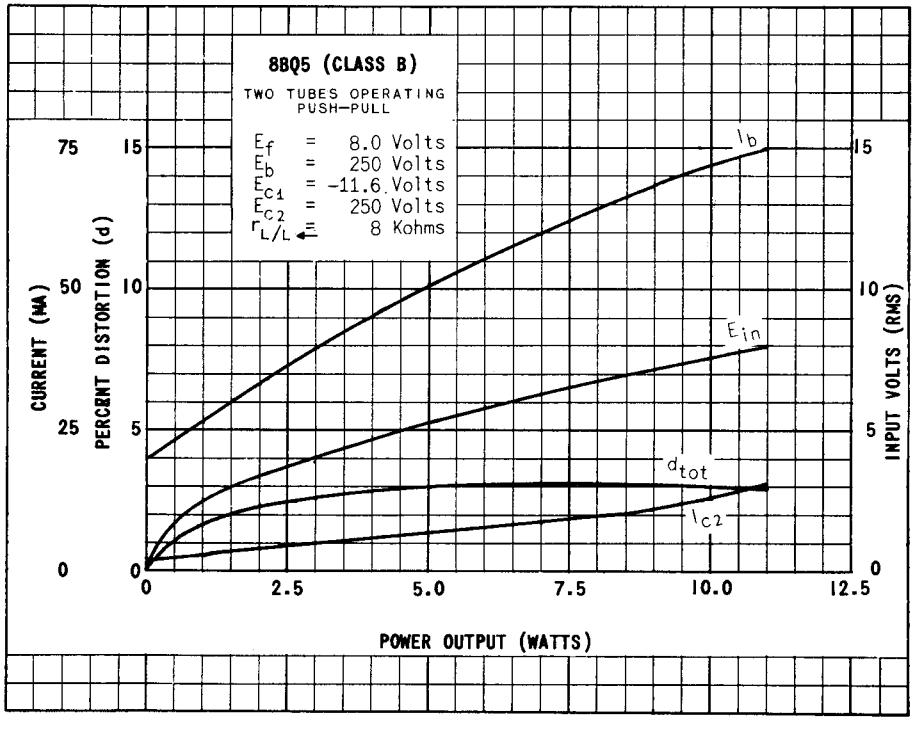

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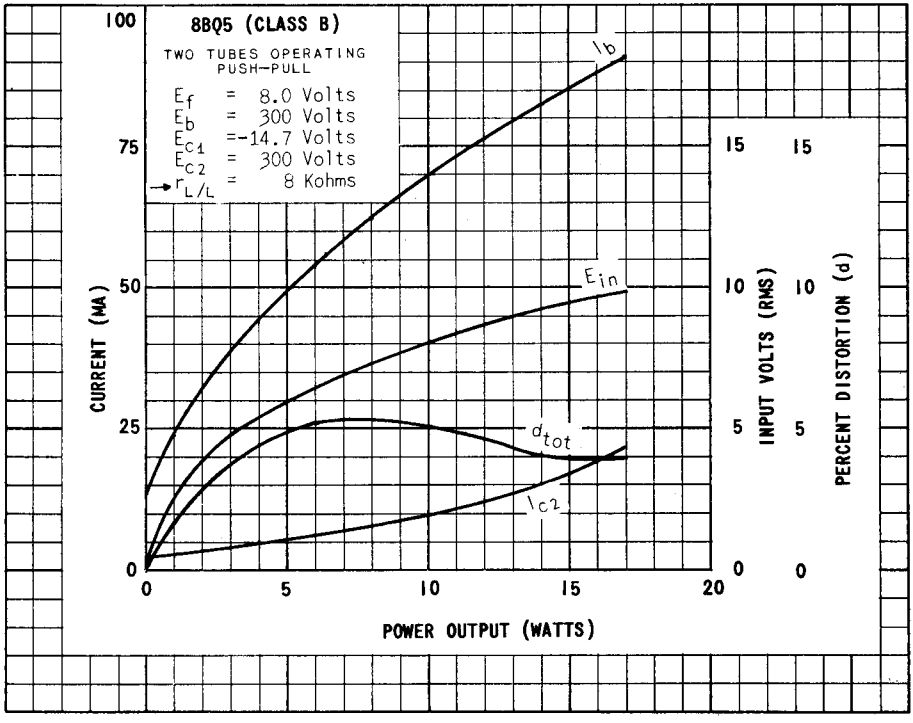

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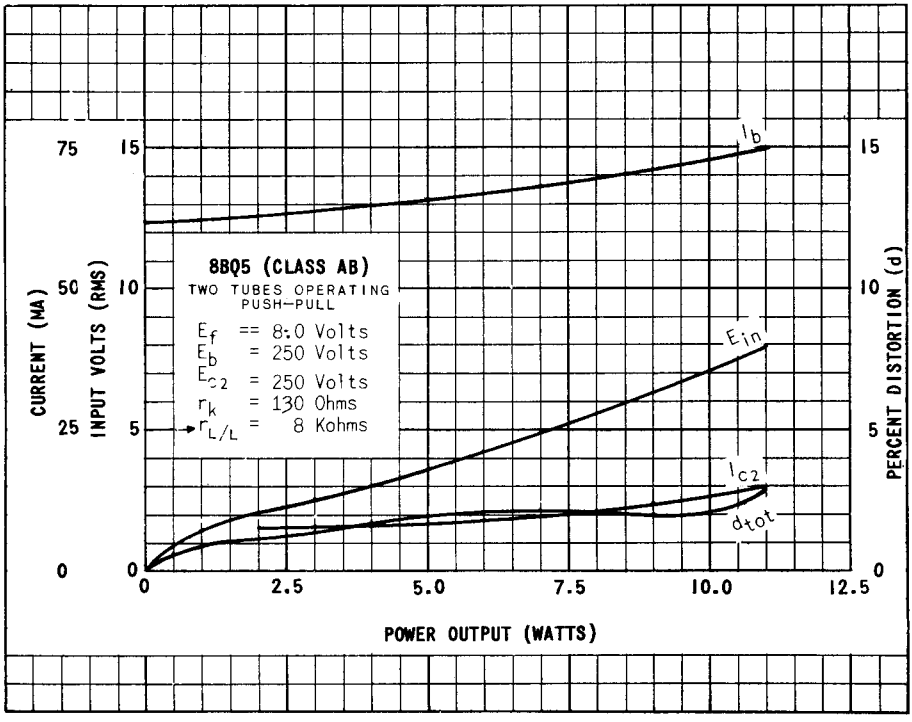

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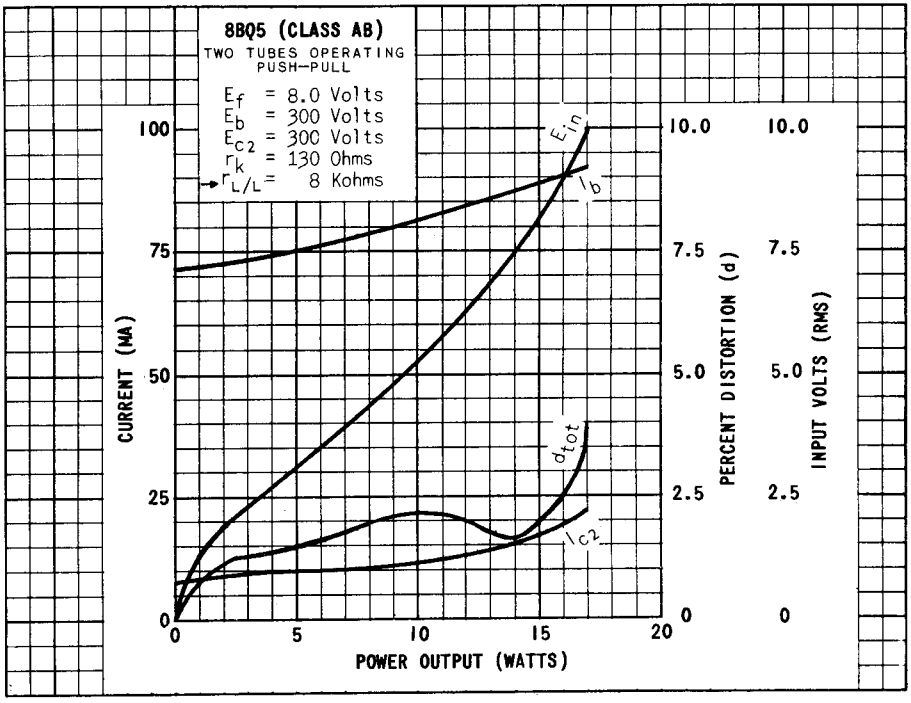

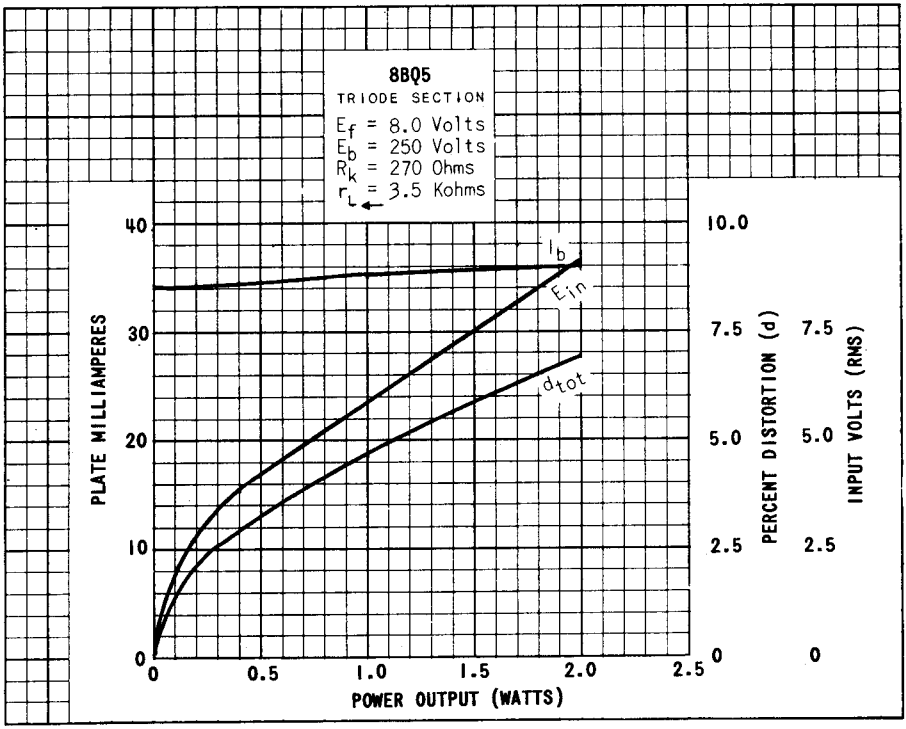

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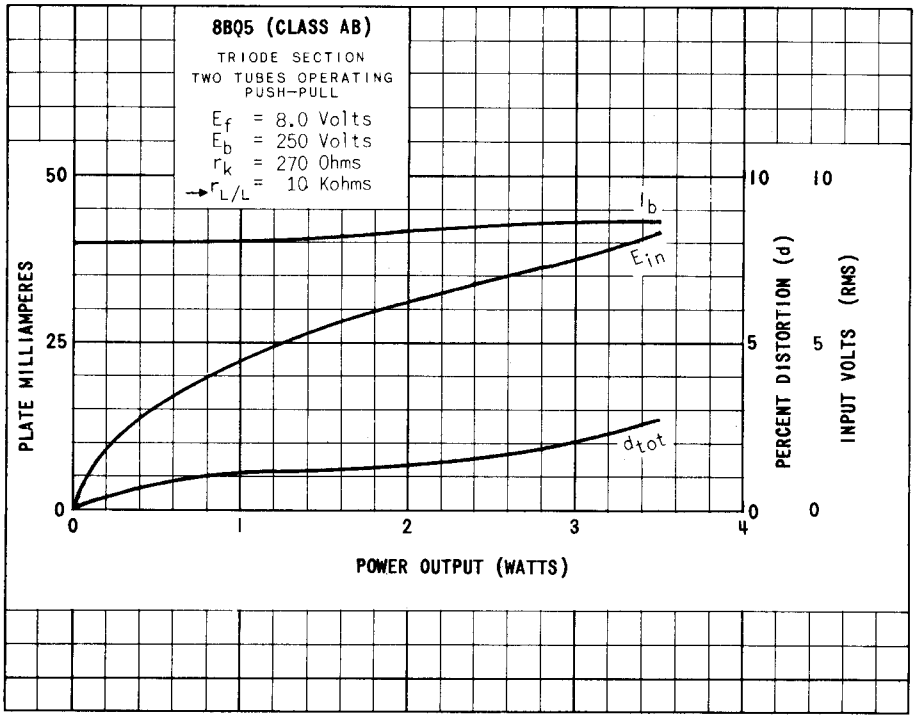

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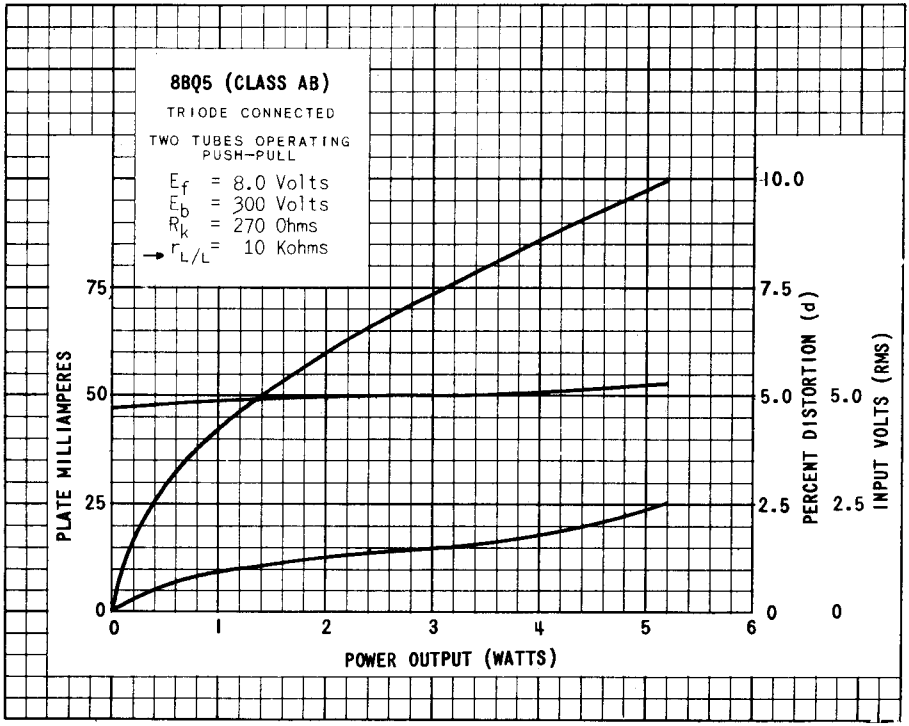

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TUNG-SOL

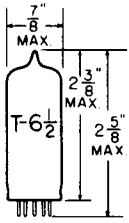
DOUBLE TRIODE

MINIATURE TYPE

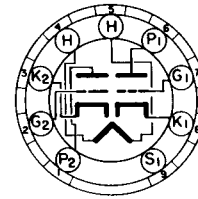
COATED UNIPOTENTIAL CATHODE

HEATER
8.4 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9AJ

THE 8CG7 IS A GENERAL PURPOSE, MEDIUM-MU TWIN TRIODE USING THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED PARTICULARLY FOR USE AS A VERTICAL DEFLECTION OSCILLATOR AND HORIZONTAL DEFLECTION OSCILLATOR IN TELEVISION RECEIVERS. IT MAY ALSO BE USED AS A PHASE INVERTER, MULTIVIBRATOR, SYNCHRONIZING SEPARATOR AND AMPLIFIER, AND RESISTANCE COUPLED AMPLIFIER IN ELECTRONIC EQUIPMENT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 6CG7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

	UNIT 1	UNIT 2	
GRID TO PLATE: G TO P	4.0	4.0	μμf
INPUT: G TO (K+H&IS)	2.3	2.3	μμf
OUTPUT: P TO (K+H&IS)	2.2	2.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH UNIT

	CLASS A_1 AMPLIFIER	
HEATER VOLTAGE	8.4	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION:		
EACH PLATE	3.5	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5	WATTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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RATINGS[C]— CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH UNIT

	VERTICAL DEFLECTION OSCILLATOR	HORIZONTAL DEFLECTION OSCILLATOR	
HEATER VOLTAGE	8.4		VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]		VOLTS
MAXIMUM DC PLATE VOLTAGE	300	300	VOLTS
MAXIMUM NEGATIVE PULSE GRID VOLTAGE	400[E]	600[F]	VOLTS
MAXIMUM CATHODE CURRENT:			
PEAK	70	300	MA.
DC	20	20	MA.
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	3.5	3.5	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5	5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS, GRID-RESISTOR BIAS OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[G]	11.0		SECONDS

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[D] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[E] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM; 15 PERCENT OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

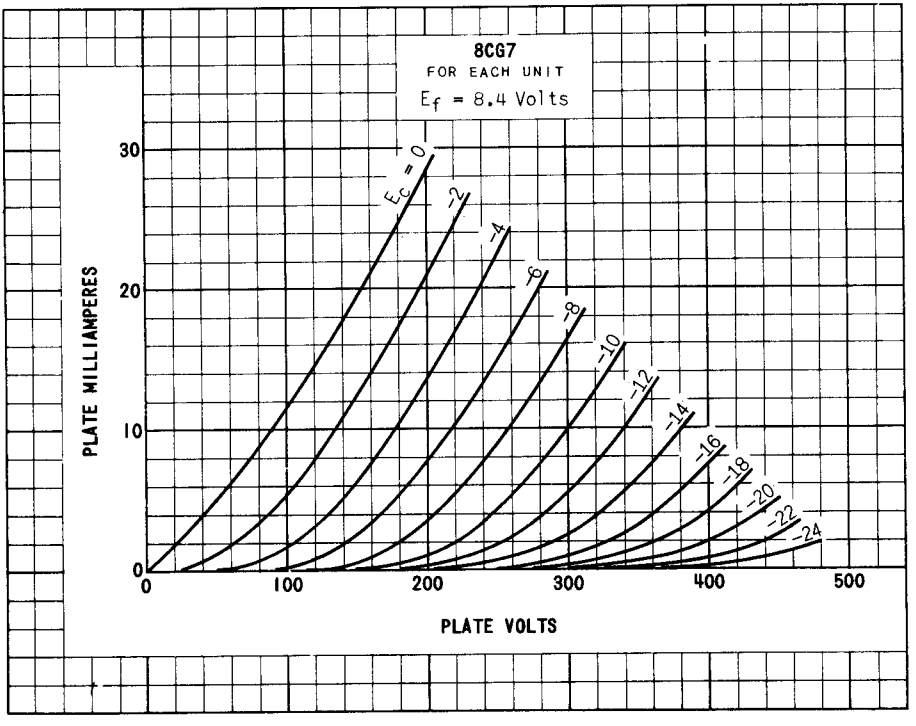
[F] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE IN A 525-LINE, 30-FRAME SYSTEM; 15 PERCENT OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

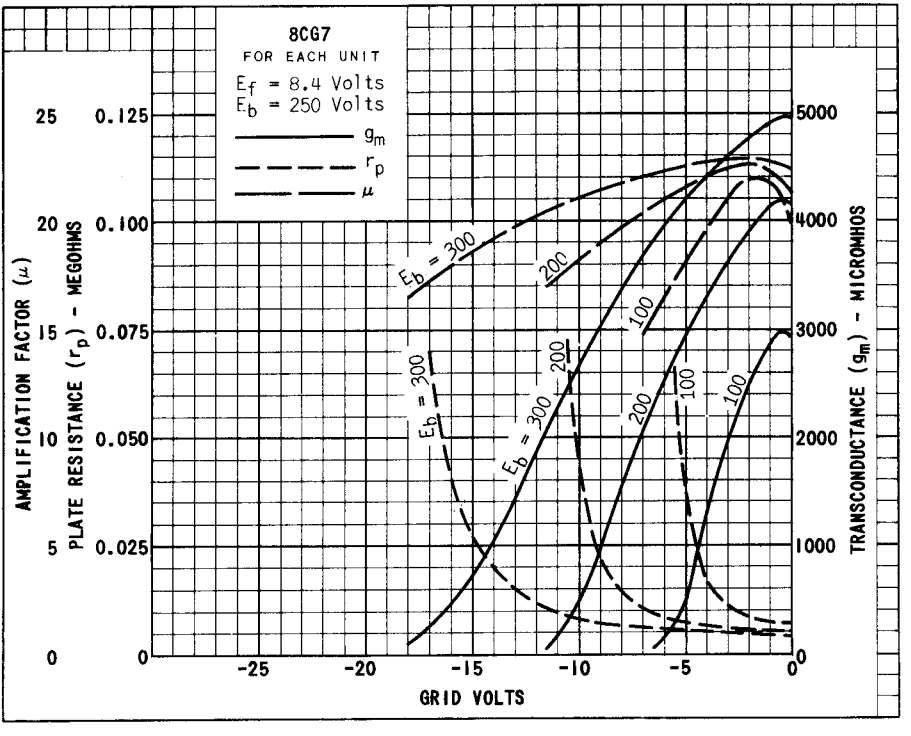
[G] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH UNIT

	CLASS A_1 AMPLIFIER		
HEATER VOLTAGE	8.4		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6700	7700	OHMS
TRANSCONDUCTANCE	3000	2600	μMHOS
GRID VOLTAGE (APPROX.)			
FOR I_b = 10 μAMP.	-7	-18	VOLTS
PLATE CURRENT OR GRID VOLTAGE OF -12.5 VOLTS	---	1.3	MA.
PLATE CURRENT	10	9	MA.

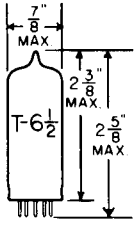

8CG7
FOR EACH UNIT
E_f = 8.4 Volts
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
PLATE MILLIAMPERES
0
10
20
30
0
100
200
300
400
500
PLATE VOLTS


8CG7
FOR EACH UNIT
E_f = 8.4 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
E_b = 300
200
100
0
5
10
15
20
25
0.025
0.050
0.075
0.100
0.125
1000
2000
3000
4000
5000
-25
-20
-15
-10
-5
0
GRID VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

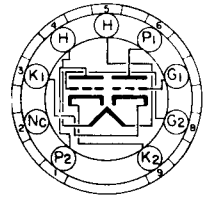


GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
8.4 VOLTS 0.45 AMP
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON NOVAL
9 PIN BASE
9ES

THE 8CM7 IS A MEDIUM-MU DOUBLE TRIODE OF THE 9 PIN MINIATURE TYPE CONTAINING TWO DISSIMILAR TRIODES IN ONE ENVELOPE. IT IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

	UNIT #1 OSCILLATOR	UNIT #2 AMPLIFIER	
GRID TO PLATE	3.8	3	μμf
GRID TO CATHODE AND HEATER	2	3.5	μμf
PLATE TO CATHODE AND HEATER	0.5	0.4	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[B]

	UNIT #1 VERTICAL DEFLECTION OSCILLATOR	UNIT #2 VERTICAL DEFLECTION AMPLIFIER	
HEATER VOLTAGE	8.4		VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]		VOLTS
MAXIMUM DC PLATE VOLTAGE	500	500	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)[D]	---	2 200[E]	VOLTS
MAXIMUM CATHODE CURRENT:			
PEAK	70	70	MA.
AVERAGE	15	20	MA.
MAXIMUM PLATE DISSIPATION	1.25	5.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
CATHODE BIAS	2.2	2.5	MEGOHMS
FIXED BIAS	2.2	1.0	MEGOHMS
GRID RESISTOR BIAS	2.2	---	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[F]	11.0		SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION.

[B] UNLESS OTHERWISE SPECIFIED.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[D] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM 15% OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

[E] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

[F] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

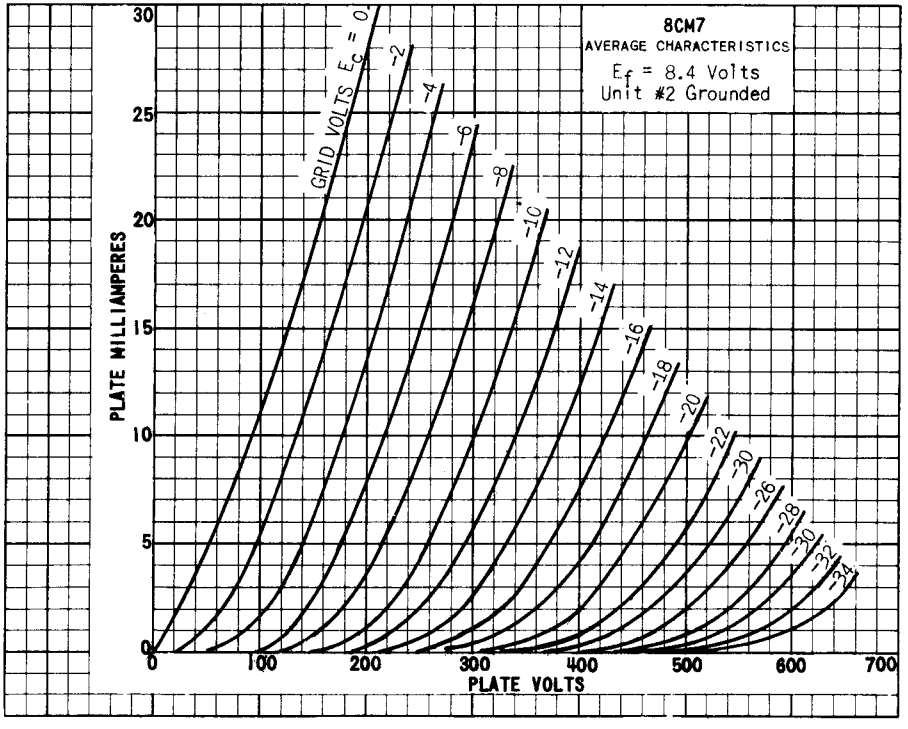
CONTINUED FROM PRECEDING PAGE

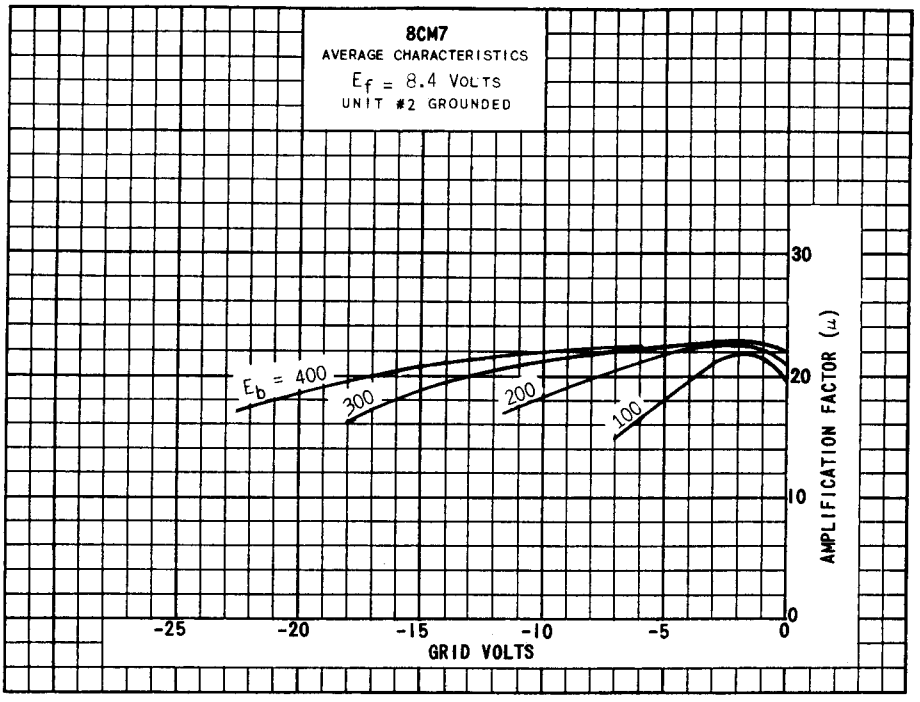
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

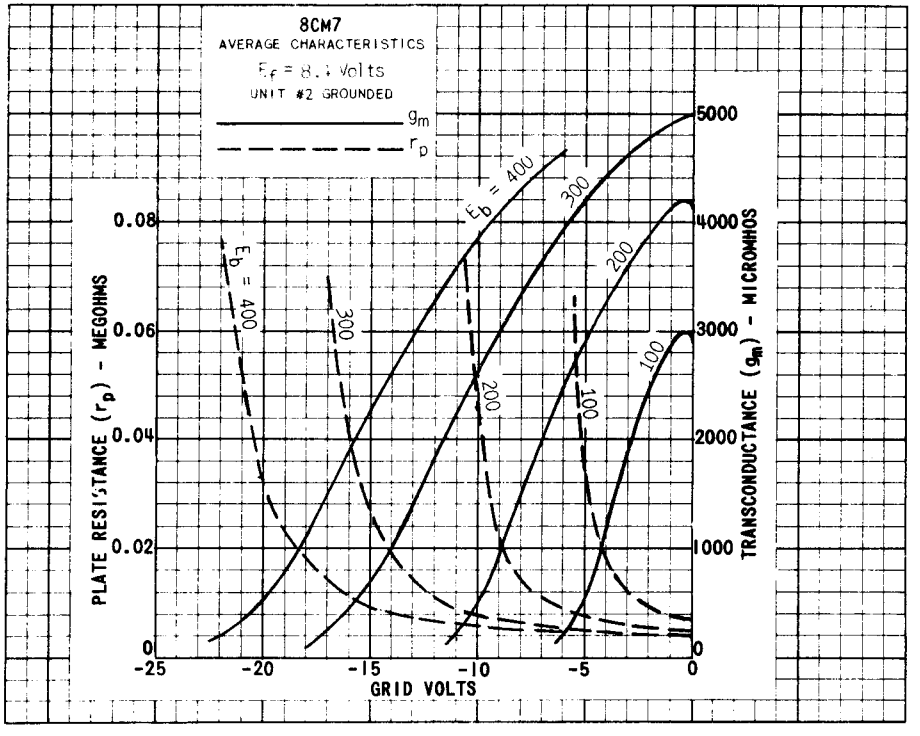
CLASS A_1 AMPLIFIER

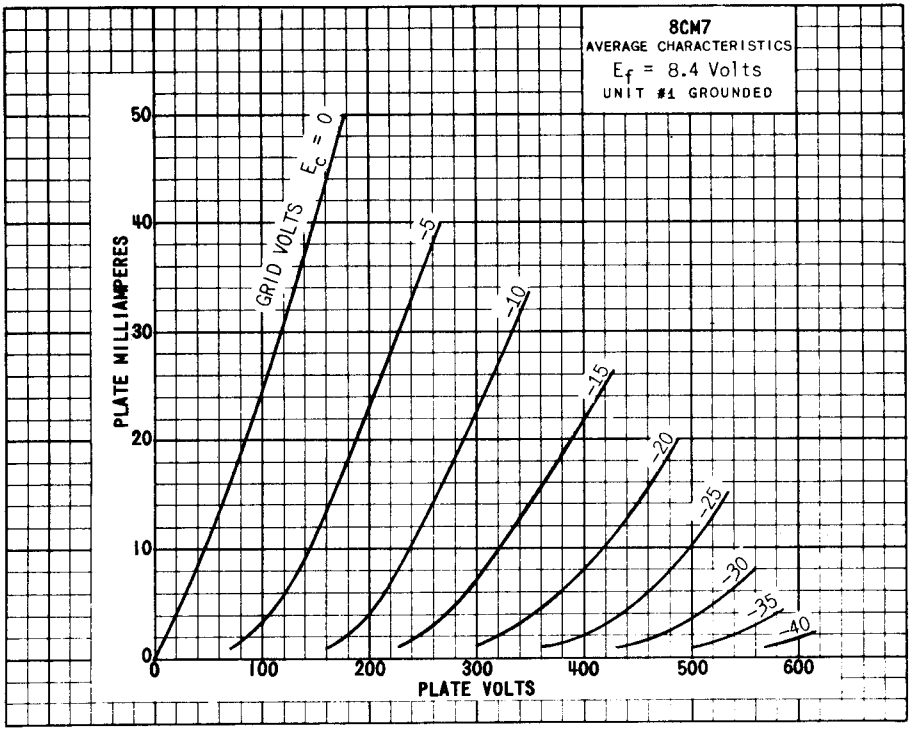
	UNIT #1 OSCILLATOR	UNIT #2 AMPLIFIER	
HEATER VOLTAGE	8.4		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE VOLTAGE	200	250	VOLTS
GRID VOLTAGE	−7	−18	VOLTS
AMPLIFICATION FACTOR	21	18	
PLATE RESISTANCE (APPROX.)	10 500	4 100	OHMS
TRANSCONDUCTANCE	2 000	4 400	μMHOS
PLATE CURRENT	5	20	MA.
PLATE CURRENT FOR GRID VOLTAGE OF −10 VOLTS	1	---	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	14	---	VOLTS

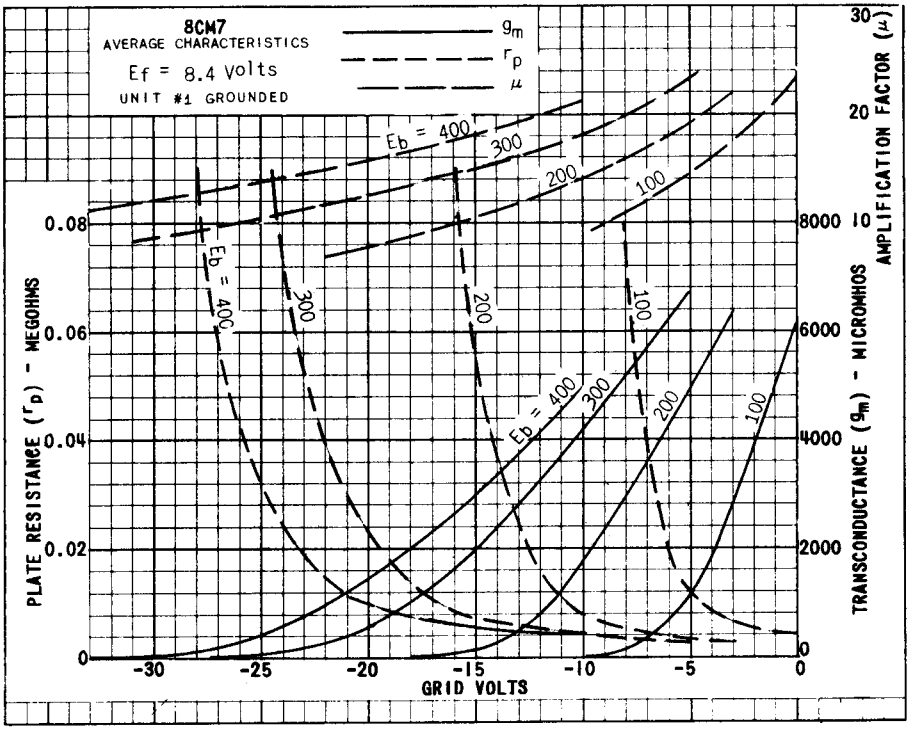
SIMILAR TYPE REFERENCE: Except for heater ratings, the 8CM7 is identical to the 6CM7.




8CM7
AVERAGE CHARACTERISTICS
E_f = 8.4 VOLTS
UNIT #2 GROUNDED
E_b = 400
300
200
100
30
20
10
0
AMPLIFICATION FACTOR (μ)
-25
-20
-15
-10
-5
0
GRID VOLTS


8CM7
AVERAGE CHARACTERISTICS
E_f = 8.4 Volts
UNIT #2 GROUNDED
g_m
r_p
E_b = 400
300
200
100
0.08
0.06
0.04
0.02
0
PLATE RESISTANCE (r_p) - MEGOHMS
5000
4000
3000
2000
1000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-25
-20
-15
-10
-5
0
GRID VOLTS

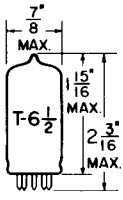

8CM7
AVERAGE CHARACTERISTICS
Ef = 8.4 Volts
UNIT #1 GROUNDED
PLATE MILLIAMPERES
PLATE VOLTS
GRID VOLTS Ec = 0
-5
-10
-15
-20
-25
-30
-35
-40
0
10
20
30
40
50
100
200
300
400
500
600


8CM7
AVERAGE CHARACTERISTICS
Ef = 8.4 Volts
UNIT #1 GROUNDED
gm
rp
μ
Eb = 400
300
200
100
PLATE RESISTANCE (rp) - MEGOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0
0.02
0.04
0.06
0.08
2000
4000
6000
8000
10
20
30
-5
-10
-15
-20
-25
-30

TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

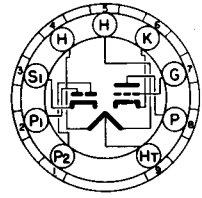
HEATER

SERIES	PARALLEL
8.4 VOLTS	4.2 VOLTS
0.225 AMP.	0.45 AMP.

AC OR DC

ANY MOUNTING POSITION

CONTROL OF HEATER WARM-UP TIME APPLIES ONLY TO PARALLEL CONNECTION.



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9EN

THE 8CN7 IS A DUPLEX DIODE HIGH-MU TRIODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE DIODE AND TRIODE SECTIONS. IT IS INTENDED PRIMARILY FOR SERVICE AS A COMBINED HORIZONTAL PHASE DETECTOR AND REACTANCE TUBE IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 8CN7 IS IDENTICAL TO THE 6CN7.

DIRECT INTERELELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	1.8	μμf
TRIODE INPUT	1.5	μμf
TRIODE OUTPUT	0.5	μμf
GRID TO EACH DIODE PLATE	0.006	μμf
DIODE #1 PLATE TO DIODE CATHODE AND HEATER	3.6	μμf
DIODE #2 PLATE TO DIODE CATHODE AND HEATER	3.6	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	8.4	4.2	VOLTS
MAXIMUM PLATE VOLTAGE	300		VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0		VOLTS
MAXIMUM PLATE DISSIPATION	1.0		WATTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION, (EACH DIODE)	5.0		MA.
HEATER WARM-UP TIME*	11.0		SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

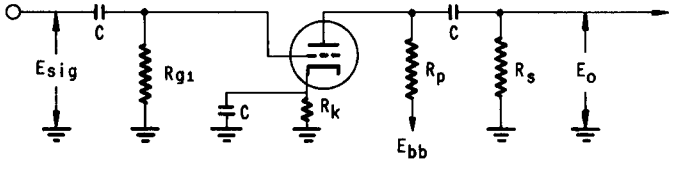
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	8.4	4.2	8.4	4.2	VOLTS
PLATE CURRENT	0.225	0.45	0.225	0.45	AMP.
PLATE VOLTAGE	100		250		VOLTS
GRID VOLTAGE	-1.0		-3.0		VOLTS
AMPLIFICATION FACTOR	70		70		
PLATE RESISTANCE (APPROX.)	54 000		58 000		OHMS
TRANSCONDUCTANCE	1 300		1 200		μMHOS
PLATE CURRENT	0.8		1.0		MA.
AVERAGE DIODE CURRENT (EACH DIODE) WITH 5.0 VOLTS DC APPLIED			20		MA.

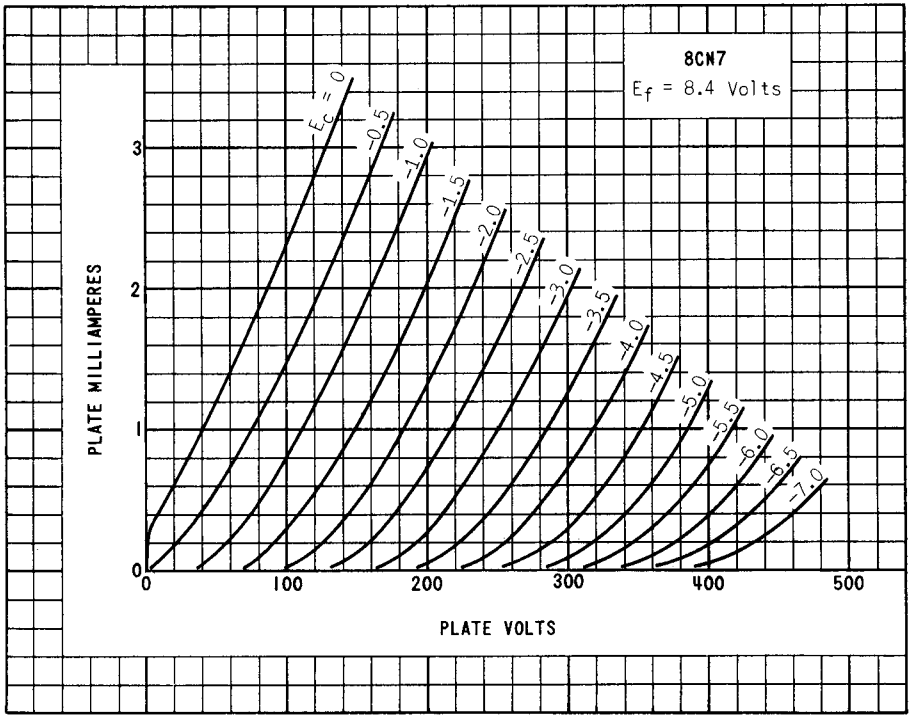
CLASS A RESISTANCE - COUPLED AMPLIFIER

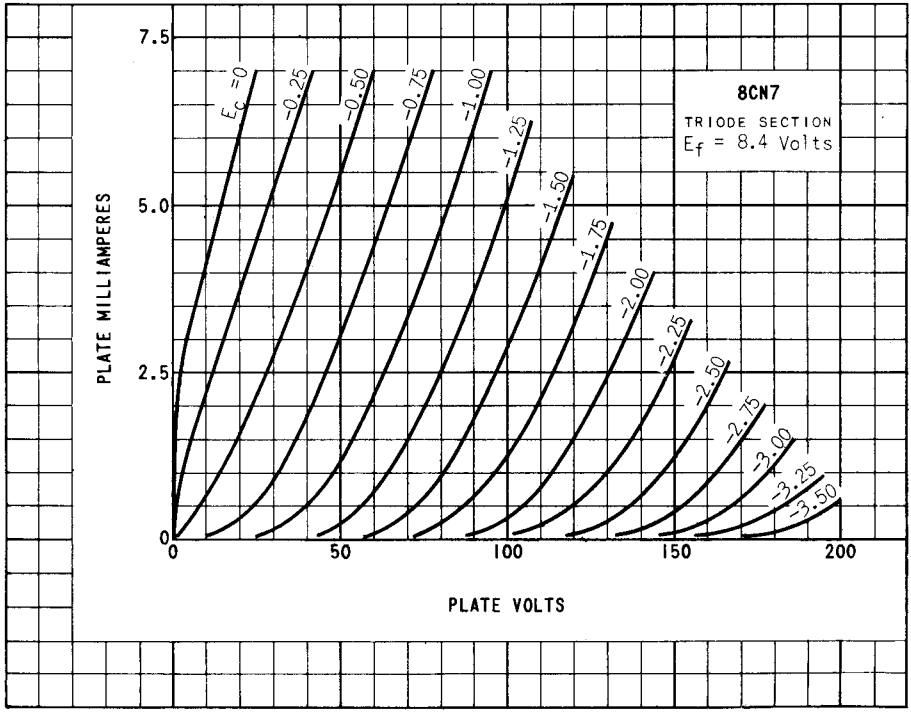
Rp Meg.	Rs Meg.	Rg_1 Meg.	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
			Rk	Gain	Eo	Rk	Gain	Eo	Rk	Gain	Eo
0.10	0.10	0.10	5700	21	7.0	2400	29	18	1800	33	35
0.10	0.24	0.10	6100	26	9.0	2700	34	23	2000	38	42
0.24	0.24	0.10	9100	30	10	4300	40	24	3000	44	43
0.24	0.51	0.10	10000	34	13	4700	45	31	3300	49	52
0.51	0.51	0.10	15000	37	14	7500	47	28	5600	51	50
0.51	1.0	0.10	16000	40	16	8200	50	35	6200	55	60
0.24	0.24	10	0	31	5.0	0	44	19	0	48	40
0.24	0.51	10	0	37	7.0	0	49	25	0	52	52
0.51	0.51	10	0	39	7.5	0	51	22	0	54	44
0.51	1.0	10	0	42	10	0	54	28	0	58	56

Eo IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.





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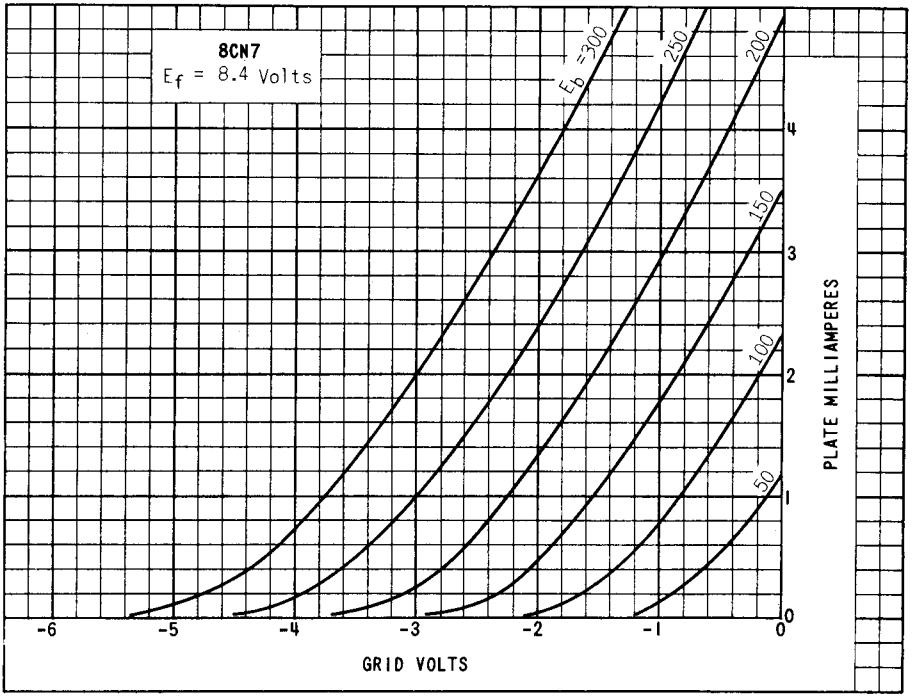
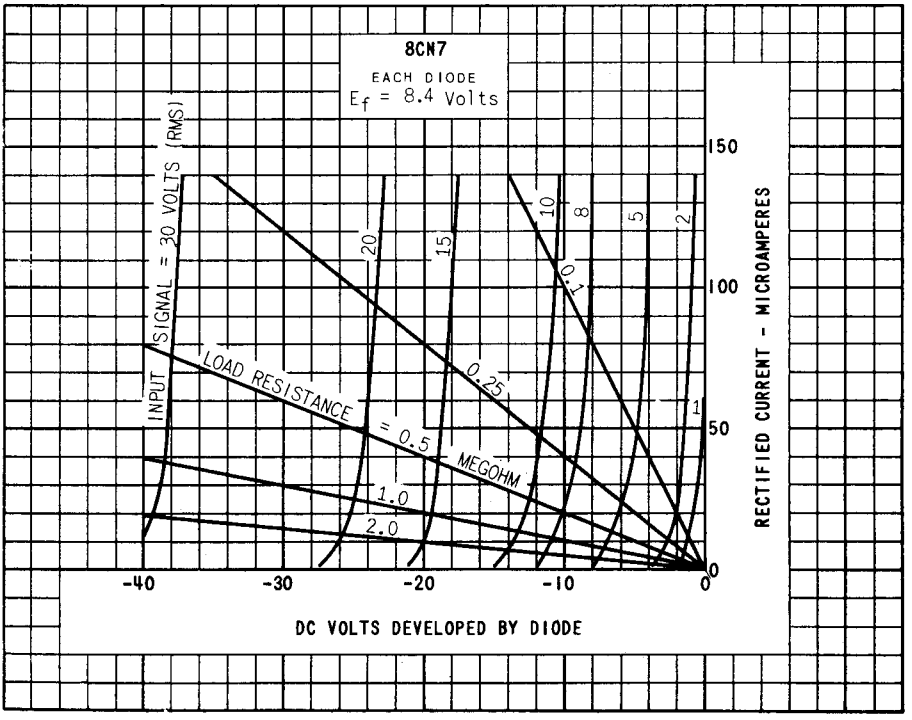
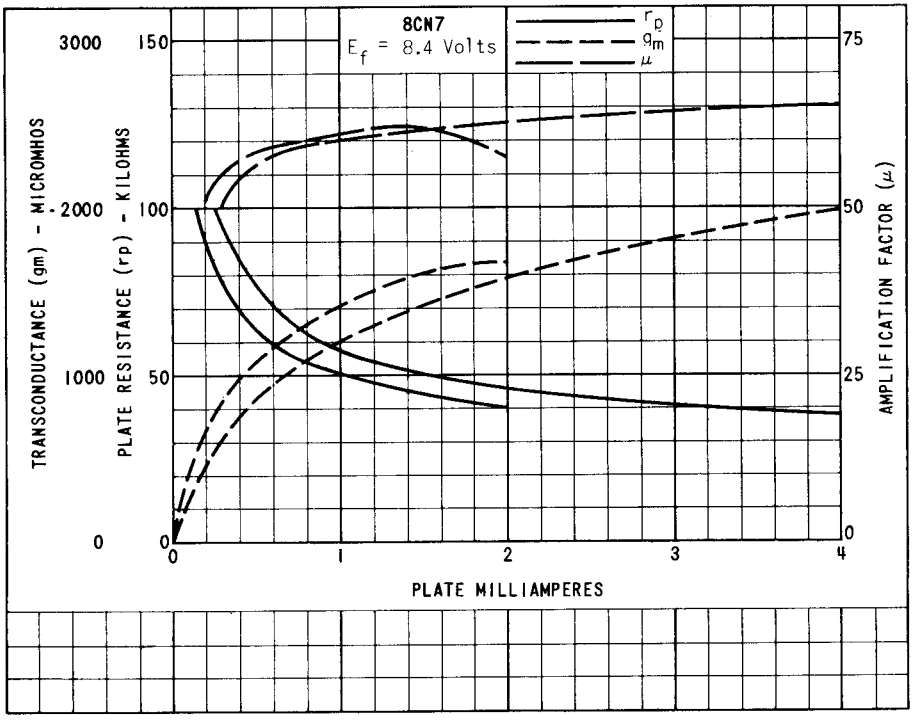
8CN7


8CN7
E_f = 8.4 Volts
E_b =300
250
200
150
100
50
PLATE MILLIAMPERES
0
1
2
3
4
-6
-5
-4
-3
-2
-1
0
GRID VOLTS


8CN7
EACH DIODE
E_f = 8.4 Volts
INPUT SIGNAL = 30 VOLTS (RMS)
LOAD RESISTANCE
= 0.5 MEGOHM
0.25
1.0
2.0
20
15
10
8
5
2
1.0
0.1
150
100
50
0
RECTIFIED CURRENT - MICROAMPERES
-40
-30
-20
-10
0
DC VOLTS DEVELOPED BY DIODE

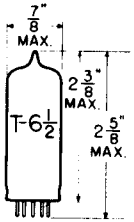


TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. OCTOBER 1, 1956 PLATE #4803

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

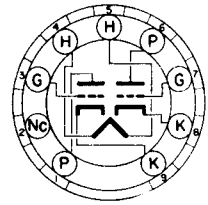


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
8.4 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9EF

THE 8CS7 IS A DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR OPERATION AS A VERTICAL DEFLECTION OSCILLATOR AND SECTION #2 AS A VERTICAL DEFLECTION AMPLIFIER. THERMAL CHARACTERISTICS ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

	TRIODE #1[A]	TRIODE #2	
GRID TO PLATE (G TO P)	2.6	2.6	μμf
INPUT: G TO (K+H)	1.8	3.0	μμf
OUTPUT: P TO (K+H)	0.5	0.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[B]

	TRIODE #1[A] OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	8.4		VOLTS
MAXIMUM HEATER—CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	500	500	VOLTS
MAXIMUM PEAK POSITIVE-PULSE PLATE VOLTAGE (ABSOLUTE MAX.)		2 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.25	6.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20	30	MA.
MAXIMUM PEAK CATHODE CURRENT	70	105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME[D]	11		SECONDS

[A] TRIODE #1 CONNECTS TO PINS #6, #7 AND #8. TRIODE #2 CONNECTS TO PINS #1, #3 AND #9.

[B] FOR OPERATION IN A 525 LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS: FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN ABSENCE OF EXCITATION.

[D] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1[A]	TRIODE #2	
HEATER VOLTAGE	8.4	8.4	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	250	250	VOLTS
GRID VOLTAGE	-8.5	-10.5	VOLTS
PLATE CURRENT	10.5	19.0	MA.
TRANSCONDUCTANCE	2 200	4 500	μMHOS
AMPLIFICATION FACTOR	17.0	15.5	
PLATE RESISTANCE	7 700	3 450	OHMS
PLATE CURRENT AT E_c=-16 VOLTS		3.0	MA.
GRID VOLTAGE FOR I_b=10μA	-24		VOLTS
GRID VOLTAGE FOR I_b=50μA		-22	VOLTS

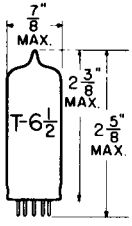
[A] TRIODE #1 CONNECTS TO PINS #6, #7 AND #8. TRIODE #2 CONNECTS TO PINS #1, #3 AND #9.

SIMILAR TYPE REFERENCE: Except for heater ratings the 8CS7 is identical to the 6CS7.

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

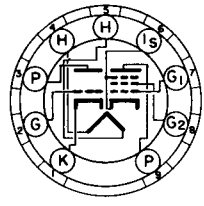


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
8.0 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
90X

THE 8CX8 IS A SHARP-CUTOFF PENTODE AND A MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED PRIMARILY FOR USE AS A VIDEO AMPLIFIER. THE TRIODE SECTION IS SUITABLE FOR A 4.5 MEGACYCLE SOUND IF AMPLIFIER, SWEEP OSCILLATOR, SYNC SEPARATOR, SYNC AMPLIFIER, OR SYNC CLIPPER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 8CX8 IS IDENTICAL TO THE 6CX8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION:		
GRID #1 TO PLATE	0.06	μμf
INPUT	9.0	μμf
OUTPUT	4.4	μμf
TRIODE SECTION:		
GRID TO PLATE	4.4	μμf
INPUT	2.2	μμf
OUTPUT	0.38	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	8.0	8.0	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	1.1	---	WATTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

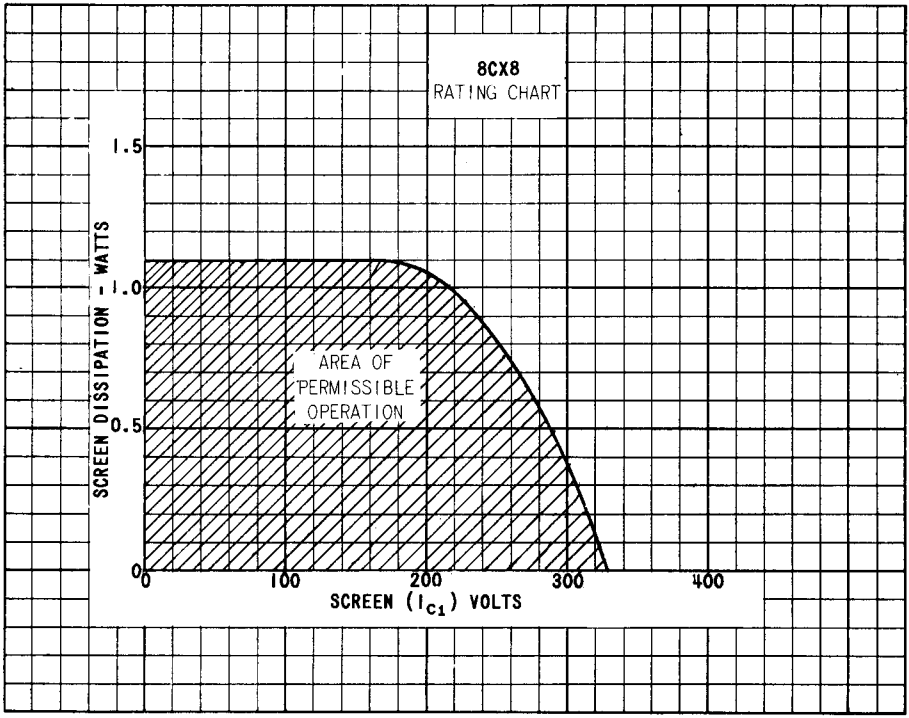
CLASS A_1 AMPLIFIER

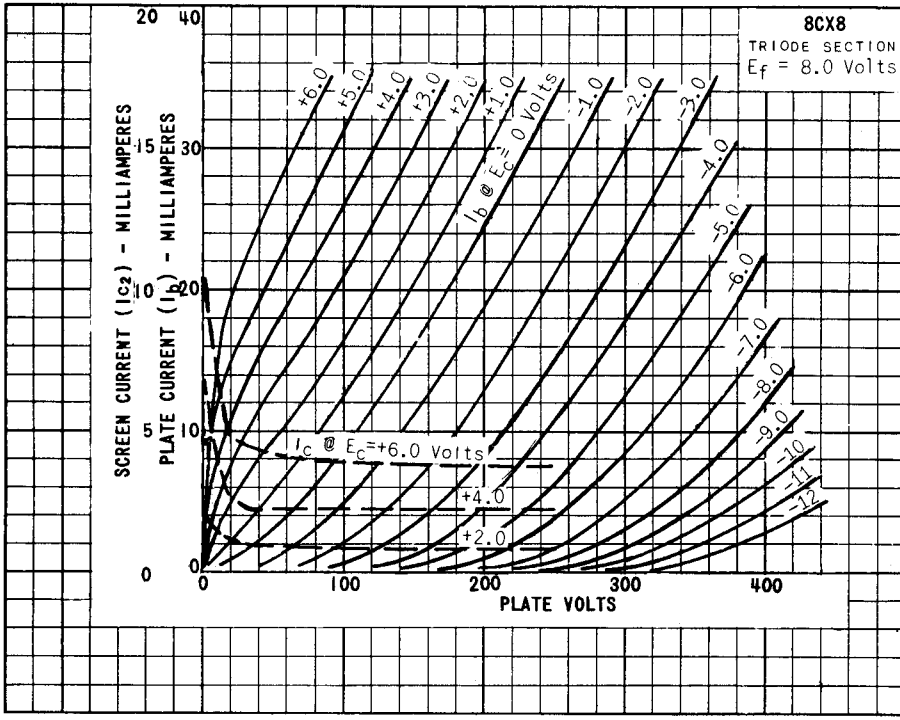
		PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	8.0	8.0	8.0	VOLTS
HEATER CURRENT	0.6±6%	0.6±6%	0.6±6%	AMP.
PLATE VOLTAGE	40	200	150	VOLTS
SCREEN VOLTAGE	125	125	---	VOLTS
GRID #1 VOLTAGE	0[A]	---	---	VOLTS
CATHODE-BIAS RESISTOR	---	68	150	OHMS
AMPLIFICATION FACTOR	---	---	40	
PLATE RESISTANCE (APPROX.)	---	70 000	8 700	OHMS
TRANSCONDUCTANCE	---	10 000	4 600	μMHOS
PLATE CURRENT	40	24	9.2	MA.
SCREEN CURRENT	15.5	5.2	---	MA.
GRID #1 VOLTAGE(APPROX.)				
I_b =100μA.	---	-8.5	-5.0	VOLTS

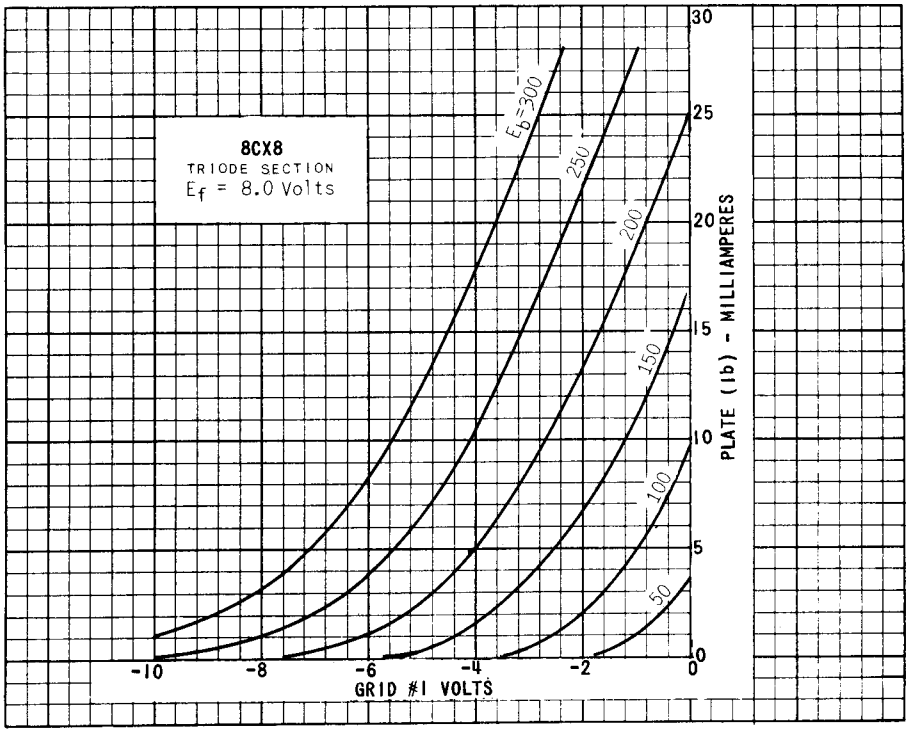
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

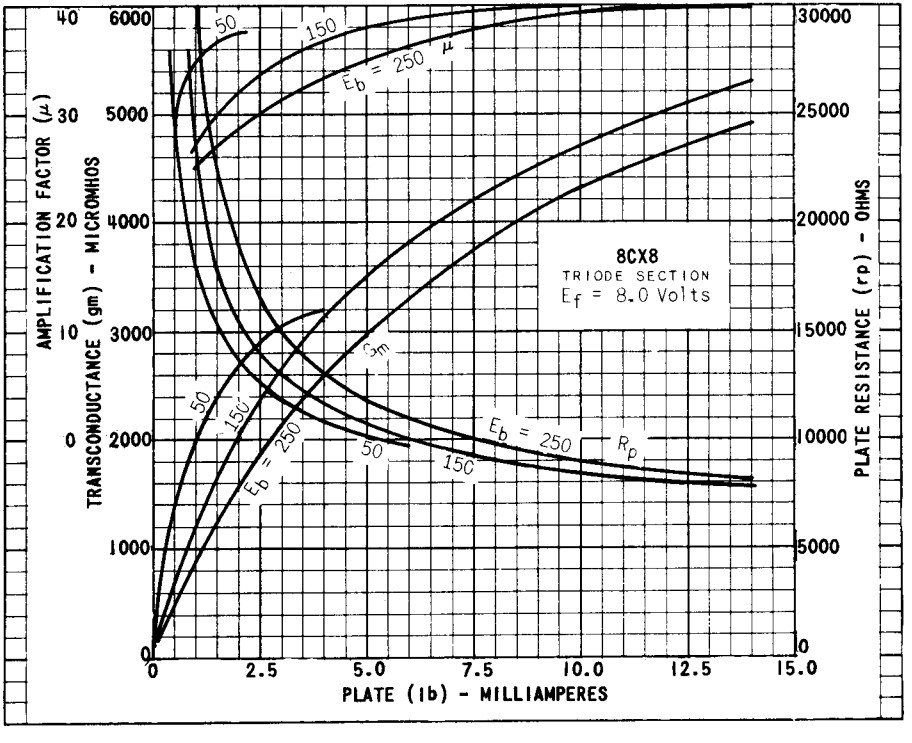
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

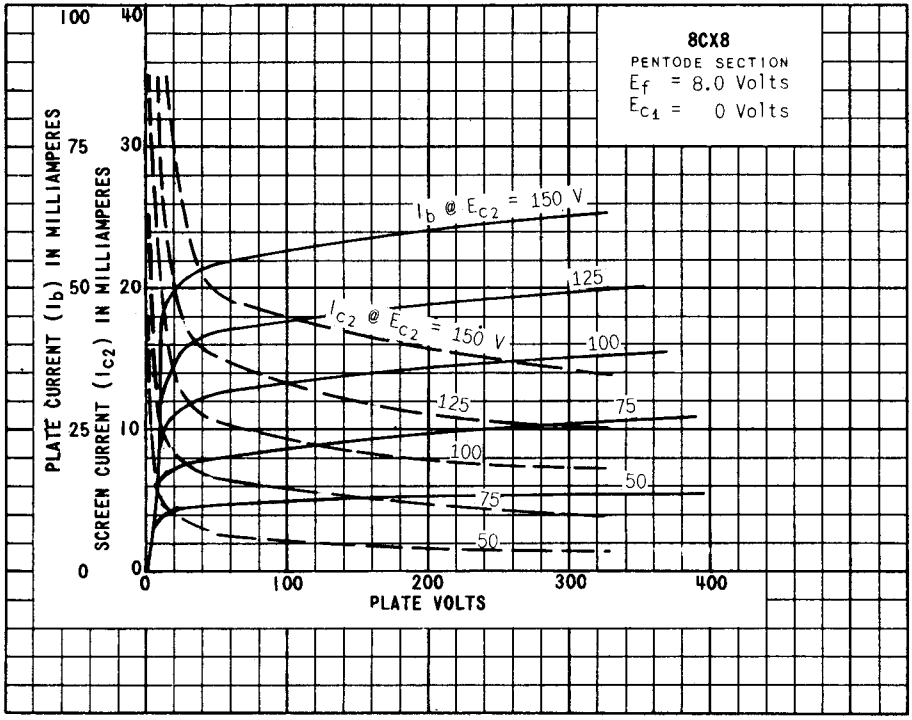
[A] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

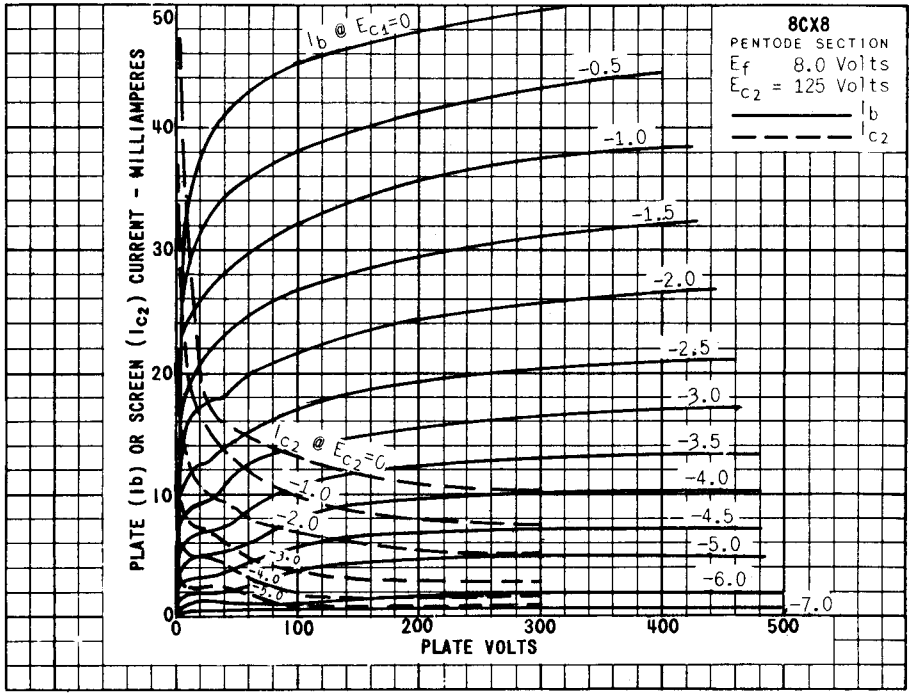

8CX8
RATING CHART
SCREEN DISSIPATION - WATTS
1.5
1.0
0.5
0
AREA OF
PERMISSIBLE
OPERATION
0
100
200
300
400
SCREEN (I_{c1}) VOLTS


8CX8
TRIODE SECTION
E_f = 8.0 Volts
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
PLATE CURRENT (I_b) - MILLIAMPERES
20
40
15
30
10
20
5
10
0
0
100
200
300
400
PLATE VOLTS
+6.0
+5.0
+4.0
+3.0
+2.0
+1.0
I_b @ E_c= 0 Volts
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10
-11
-12
I_c @ E_c=+6.0 Volts
+4.0
+2.0


8CX8
TRIODE SECTION
Ef = 8.0 Volts
Eb=300
250
200
150
100
50
PLATE (Ib) - MILLIAMPERES
GRID #1 VOLTS
-10
-8
-6
-4
-2
0
5
10
15
20
25
30


8CX8
TRIODE SECTION
Ef = 8.0 Volts
Eb = 250 μ
50
150
gm
Eb = 250
Rp
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - OHMS
PLATE (Ib) - MILLIAMPERES
0
2.5
5.0
7.5
10.0
12.5
15.0
1000
2000
3000
4000
5000
6000
10000
15000
20000
25000
30000
10
20
30
40





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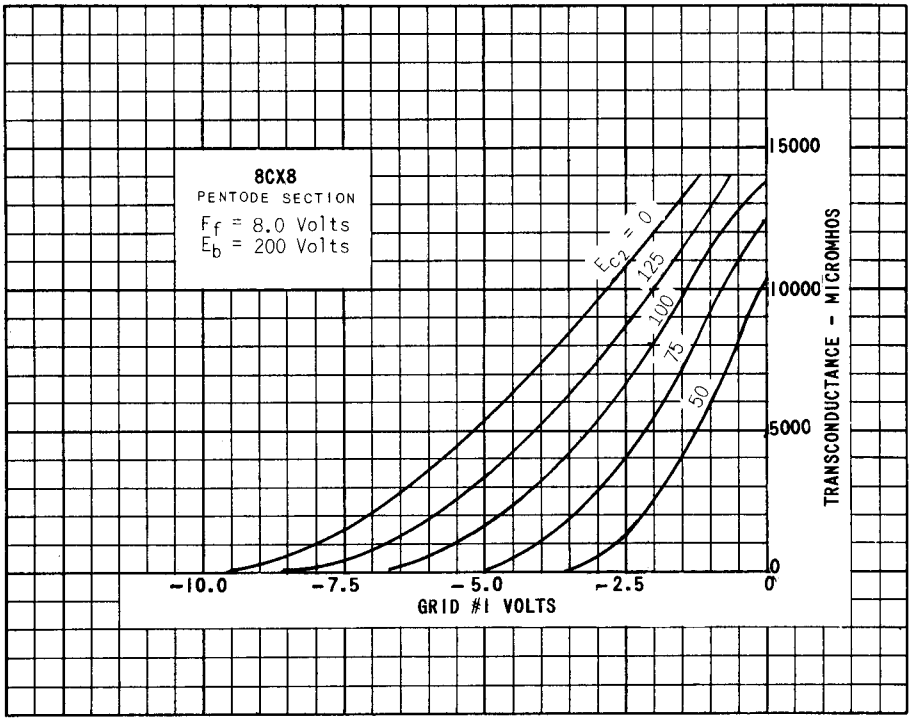
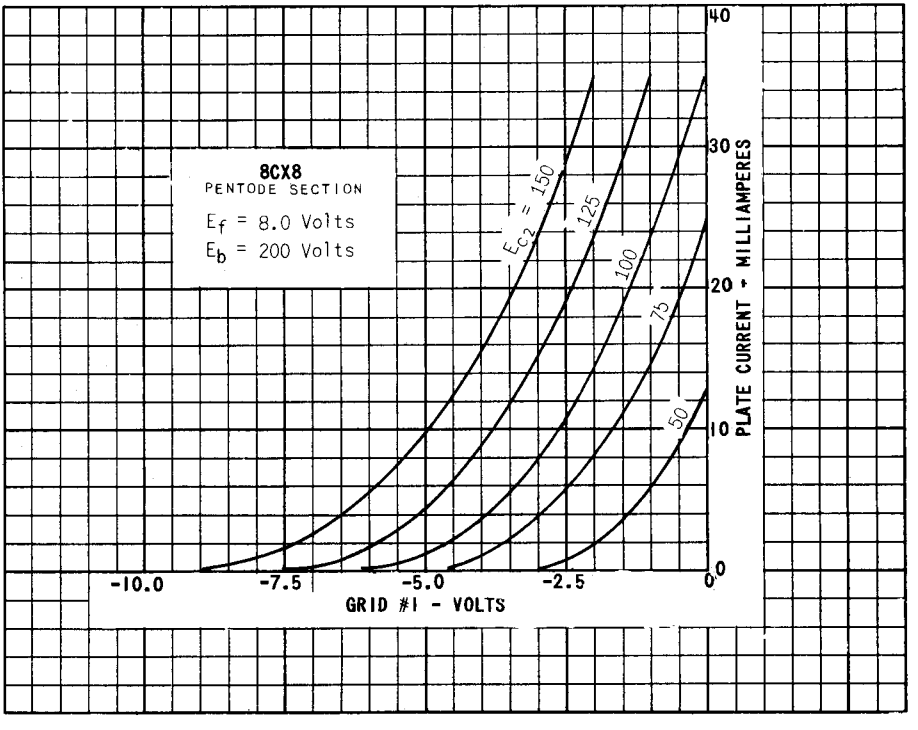
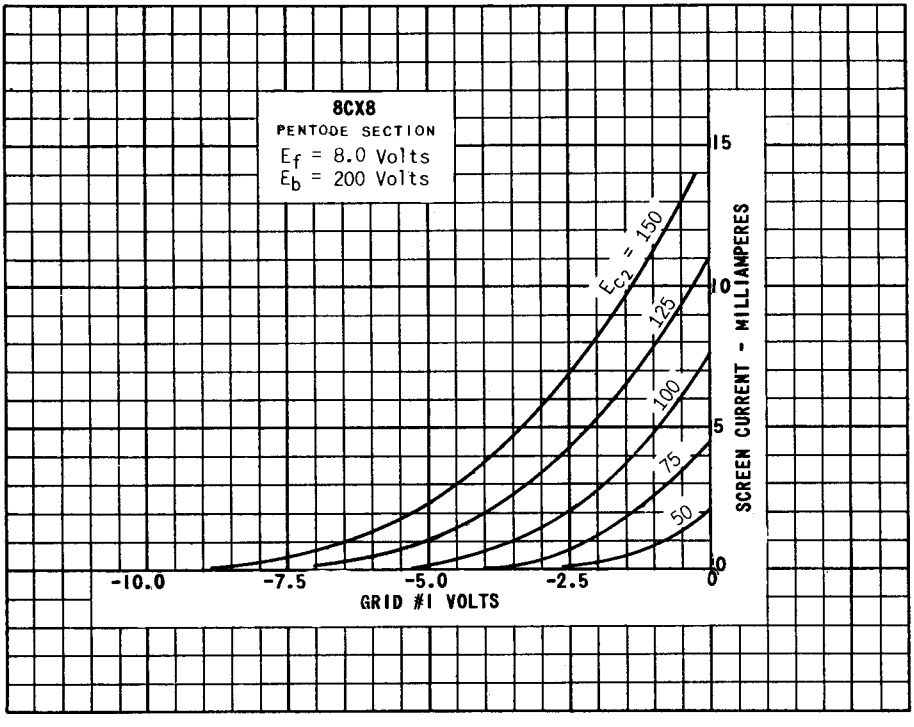

8CX8
PENTODE SECTION
E_f = 8.0 Volts
E_b = 200 Volts
E_{c2} = 0
125
100
75
50
15000
10000
5000
0
TRANSCONDUCTANCE - MICROMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

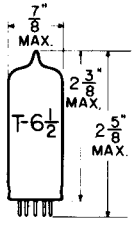

8CX8
PENTODE SECTION
E_f = 8.0 Volts
E_b = 200 Volts
E_{c2} = 150
125
100
75
50
40
30
20
10
0
PLATE CURRENT - MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 - VOLTS


8CX8
PENTODE SECTION
E_f = 8.0 Volts
E_b = 200 Volts
E_{c2} = 150
125
100
75
50
15
10
5
0
SCREEN CURRENT - MILLIAMPERES
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

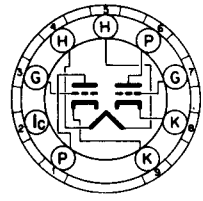


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
7.9 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

9LG ←

THE 8CY7 IS A DISSIMILAR DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS A COMBINED VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.⊕

	SEC. 1	SEC. 2	
GRID TO PLATE	1.8	4.4	μμf
INPUT	1.5	5.0	μμf
OUTPUT	0.30	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	VERTICAL-[B] OSCILLATOR SERVICE (SEC. 1)	VERTICAL-[B] DEFLECTION AMPLIFIER (SEC. 2)	
HEATER VOLTAGE	7.9	7.9	VOLTS
MAXIMUM DC PLATE VOLTAGE	350	350	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1 800	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.5[A]	WATTS
MAXIMUM DC CATHODE CURRENT	---	35	MA.
MAXIMUM DC PEAK CATHODE CURRENT	---	120	MA.
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE			
WITH FIXED BIAS	2.2	---	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
HEATER VOLTAGE	7.9	7.9	7.9	VOLTS
HEATER CURRENT	0.6±6%	0.6±6%	0.6±6%	AMP.
PLATE VOLTAGE	250	60	150	VOLTS
GRID VOLTAGE	-3.0	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	620	OHMS
AMPLIFICATION FACTOR	68	---	5.0	
PLATE RESISTANCE (APPROX.)	52 000	---	920	OHMS
TRANSCONDUCTANCE	1 300	---	5 400	μMHOS
PLATE CURRENT	1.2	80	30	MA.
PLATE CURRENT (APPROX.) E_c=-30V.	---	---	3.5	MA.
GRID VOLTAGE (APPROX.) I_b=200 μA.	---	---	-40	VOLTS
GRID VOLTAGE (APPROX.) I_b=10 μA.	-5.5	---	---	VOLTS

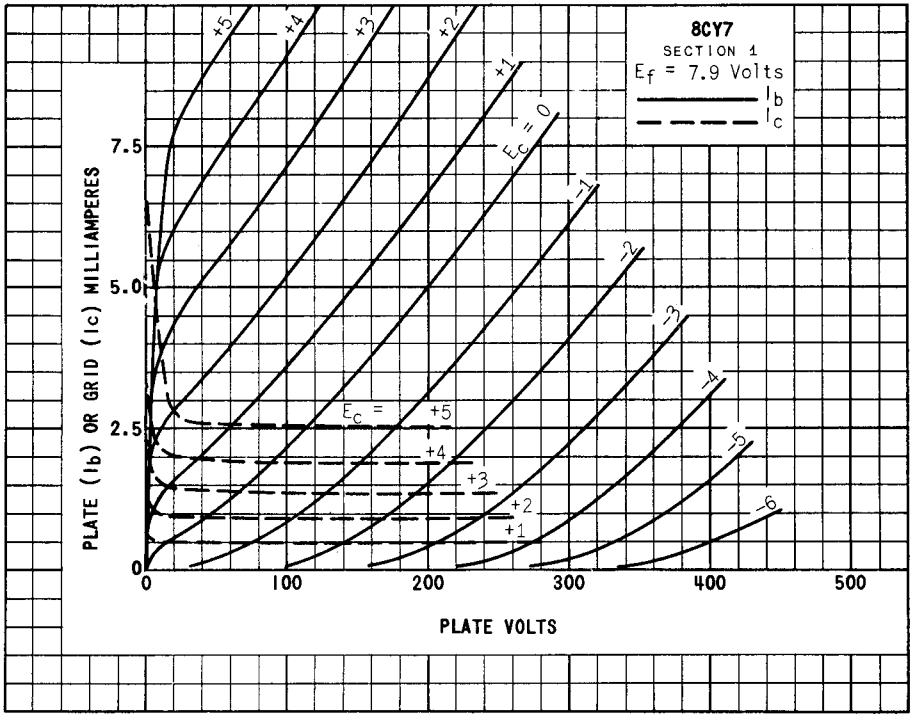
⊕ WITHOUT EXTERNAL SHIELD.

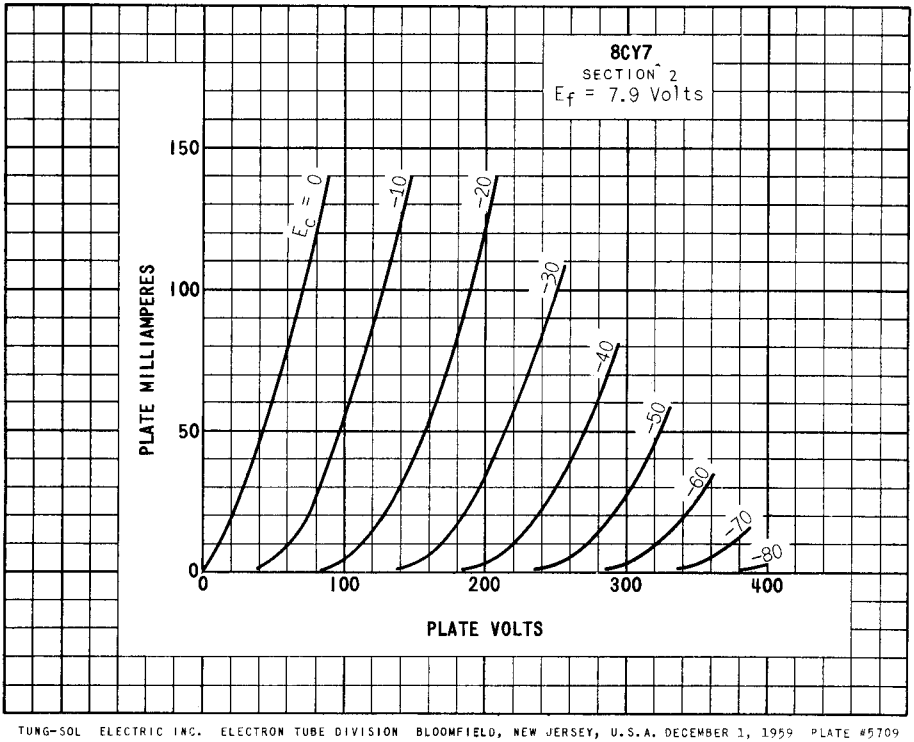
A IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

B FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.





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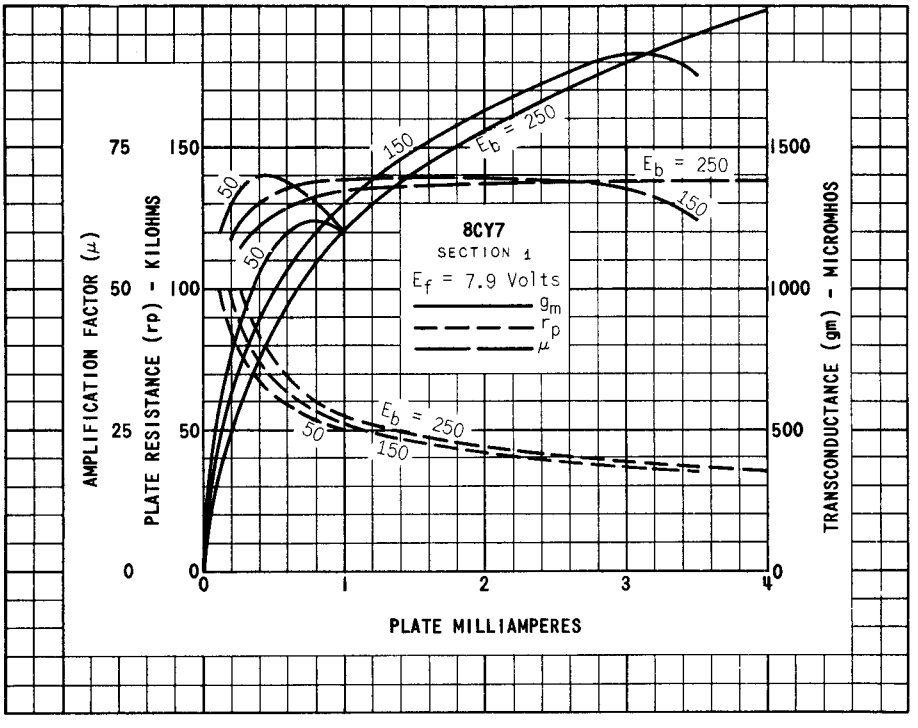
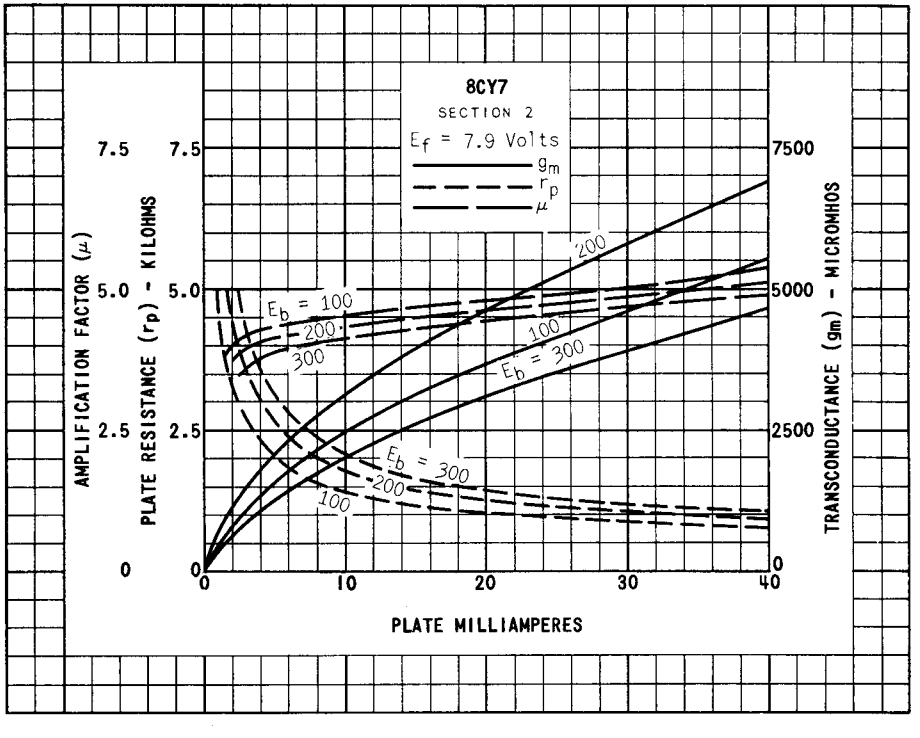
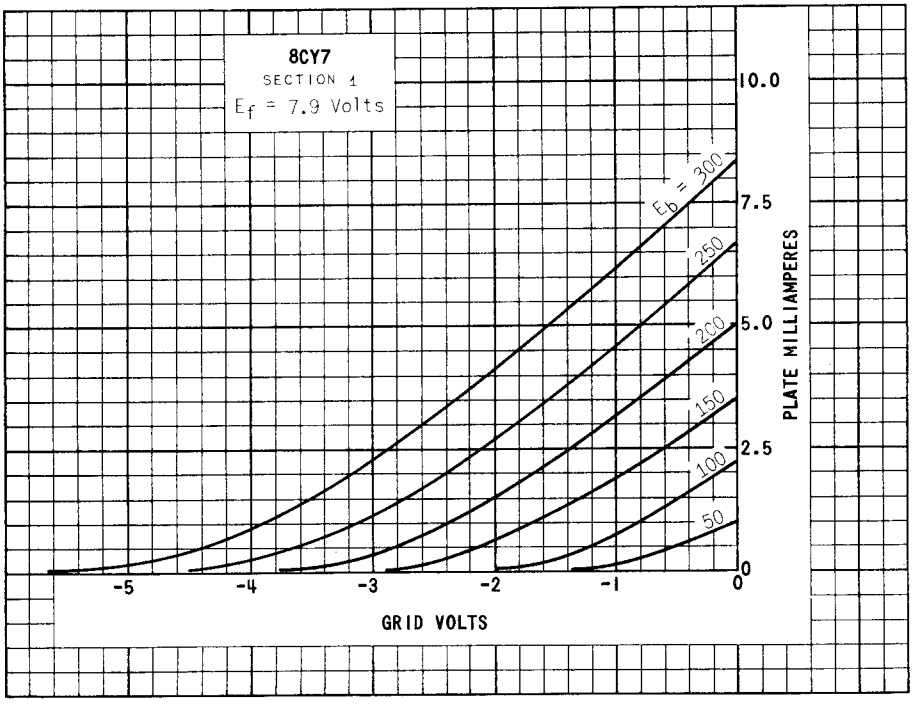
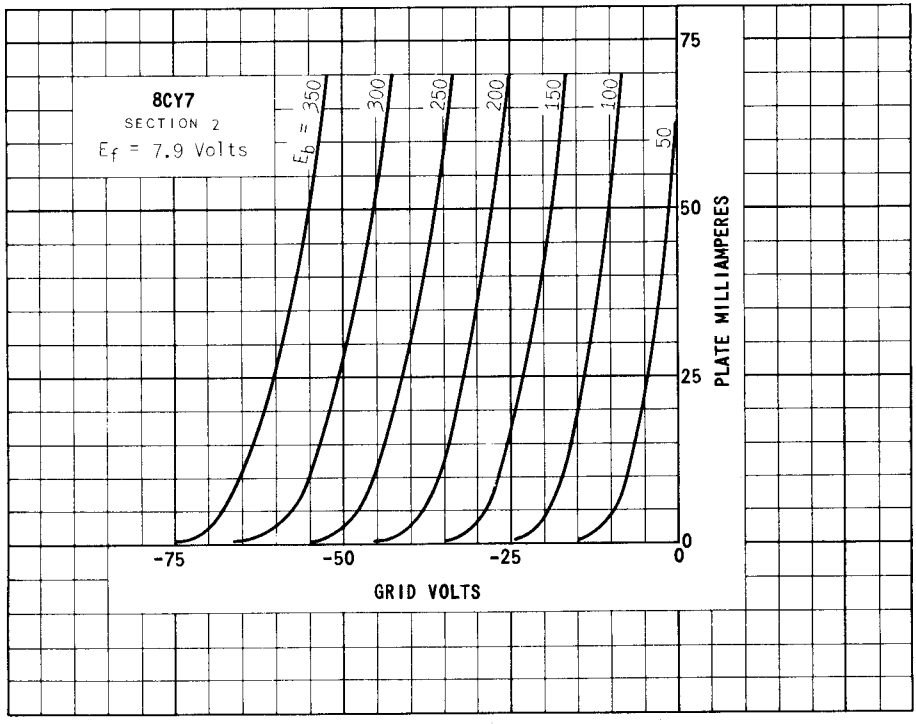

8CY7
SECTION 1
Ef = 7.9 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
Eb = 250
150
50
0
25
50
75
100
150
500
1000
1500
1
2
3
4


8CY7
SECTION 2
Ef = 7.9 Volts
gm
rp
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE MILLIAMPERES
Eb = 100
200
300
0
2.5
5.0
7.5
2500
5000
7500
10
20
30
40

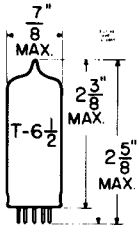

8CY7
SECTION 1
E_f = 7.9 Volts
E_b = 300
250
200
150
100
50
10.0
7.5
5.0
2.5
0
-5
-4
-3
-2
-1
0
GRID VOLTS
PLATE MILLIAMPERES


8CY7
SECTION 2
E_f = 7.9 Volts
E_b = 350
300
250
200
150
100
50
75
50
25
0
-75
-50
-25
0
GRID VOLTS
PLATE MILLIAMPERES

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

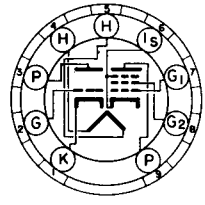
COATED UNIPOTENTIAL CATHODE

HEATER

8.0 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9DX

THE 8EB8 IS A HIGH-MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER WHILE THE PENTODE SECTION HAS A CONTROLLED PLATE KNEE CHARACTERISTIC AND IS DESIGNED FOR USE AS A VIDEO AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SO THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 8BE8 IS IDENTICAL TO THE 6EB8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION:		
GRID TO PLATE	4.4	μμf
INPUT: G TO (H + K)	2.4	μμf
OUTPUT: P TO(H + K)	0.36	μμf
PENTODE SECTION:		
GRID #1 TO PLATE (MAX.)	0.1	μμf
INPUT: G_1 TO (H+K+G_2+G_3+I.S.)	11	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	4.2	μμf
COUPLING:		
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	8.0	8.0	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE			
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION		1.1	WATTS

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TUNG-SOL

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME* (APPROX.)	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	8.0	8.0	VOLTS
HEATER CURRENT	0.60	0.60	AMP.
PLATE VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2		VOLTS
CATHODE BIAS RESISTOR		68	OHMS
PLATE CURRENT	2	25	MA.
GRID #2 CURRENT		7	MA.
TRANSCONDUCTANCE	2 700	12 500	μMHOS
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE (APPROX.)	37 000	75 000	OHMS
GRID #1 VOLTAGE FOR I_b= 100 μA (APPROX.)		-9	VOLTS
GRID #1 VOLTAGE FOR I_b= 20 A (APPROX.)	-5		

PLATE KNEE CHARACTERISTICS - INSTANTANEOUS VALUES

E_b = 45 VOLTS, E_{c2} = 125 VOLTS AND E_{c1} = 0 VOLTS

PLATE CURRENT	40	MA.
GRID #2 CURRENT	15	MA.

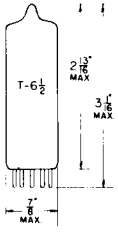
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

8.4 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9HN

THE 8EM5 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS THE VERTICAL DEFLECTION AMPLIFIER IN HIGH-EFFICIENCY DEFLECTION CIRCUITS OF TV RECEIVERS WHICH USE PICTURE TUBES WITH A 110° DIAGONAL DEFLECTION ANGLE. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS AND HEATER WARM-UP TIME, THE 8EM5 IS IDENTICAL TO THE 6EM5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.7	μμf
GRID #1 TO CATHODE & G3, G2, AND HEATER	10	μμf
PLATE TO CATHODE & G3, G2, AND HEATER	5.1	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	8.4	VOLTS
MAXIMUM PLATE VOLTAGE:		
DC	315	VOLTS
PEAK POSITIVE PULSE (ABS. MAX.)[B]	2 200[C]	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	-250	VOLTS
MAXIMUM CATHODE CURRENT:		
PEAK	210	MA.
AVERAGE	60	MA.
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 INPUT	1.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[D]	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	2.2	MEGOHMS
FOR CATHODE-BIAS OPERATION	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	8.4	8.4	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	60	250	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE	250	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	0	-18	VOLTS
MU-FACTOR, GRID #1 TO GRID #2	---	8.7	
TRANSCONDUCTANCE	---	5100	μMHOS
PLATE CURRENT	180[E]	40	MA.
GRID #2 CURRENT	30[E]	3	MA.
PLATE RESISTANCE (APPROX.)●		30 000	OHMS
GRID #1 VOLTAGE FOR PLATE CURRENT 0.2 MA.	---	-37	

●INDICATES AN ADDITION.

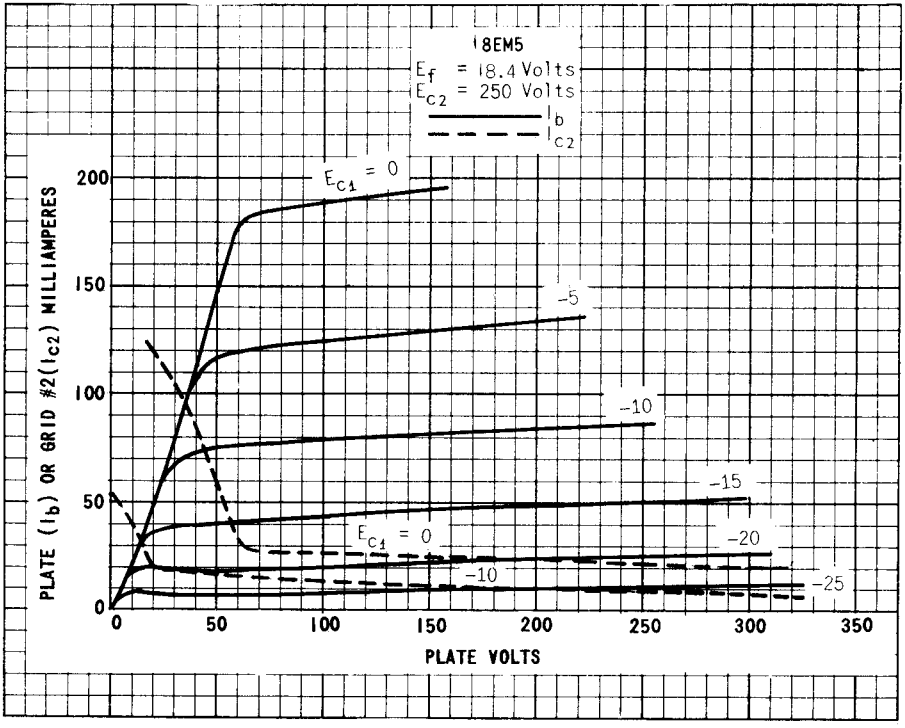
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C]UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

[D]THE DC COMPONENT MUST NOT EXCEED 100 VOLTS

[E]THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.



TUNG-SOL

DUO-DIODE PENTODE

MINIATURE TYPE

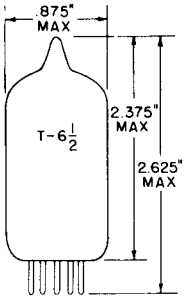
COATED UNIPOTENTIAL CATHODE

HEATER

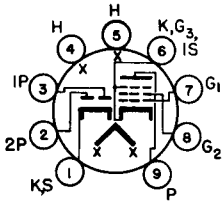
8.0 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9LT

THE 8ET7 IS A DUO-DIODE SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TUBE IS DESIGNED PRIMARILY FOR USE AS A COMBINED VIDEO AMPLIFIER AND HORIZONTAL PHASE DETECTOR IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION

GRID #1 TO PLATE, MAX.	0.1	pf
INPUT: G1 TO (H+Pk+G3, I.S.+G2 Dk,DSh)	10	pf
OUTPUT: P TO (H+Pk+G3, I.S.+G2 Dk,DSh)	4.2	pf

DIODE SECTION (EACH DIODE)

DIODE PLATE TO (h+Dk, Dsh+Pk, G3, I.S.)	1.5	pf
DIODE CATHODE; DIODE SHIELD TO (h+Dp+Pk, G3, I.S)	7.5	pf

COUPLING

PENTODE GRID #1 TO DIODE PLATE (EACH DIODE) (MAX)	.005	pf
PENTODE PLATE TO DIODE PLATE (EACH DIODE) (MAX.)	.02	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	8.0	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM #2 VOLTAGE	SEE RATING CHART	
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION	1.1	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS	0.25	MEGOHMS
FIXED BIAS	0.1	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX)*	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE – CLASS A_1 AMPLIFIER

HEATER VOLTAGE	8.0	VOLTS
HEATER CURRENT	0.60	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #2 VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	25	MA.
GRID #2 CURRENT	5.5	MA.
TRANSCONDUCTANCE	11 500	μMHOS
PLATE RESISTANCE (APPROX.)	60 000	OHMS
Ec1 FOR Ib = 100 μA (APPROX.)	-10	VOLTS
AVERAGE DIODE CURRENT WITH 10 VOLTS DC APPLIED (EACH DIODE)	1.5	MA.
INSTANTANEOUS PLATE KNEE VALUES Eb =60V, Ec2 =150, AND Ec1 =0 V; Ib =55 MA AND Ic2 =18 MA.		

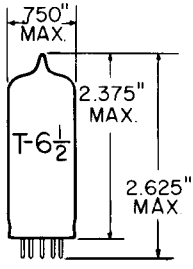
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

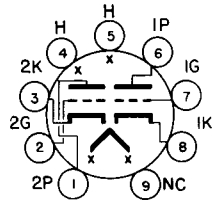


GLASS BULB
SMALL-BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR SERIES STRING OPERATION
IN TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9LP

THE 8FQ7 IS A GENERAL PURPOSE, MEDIUM-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED PRIMARILY FOR USE AS A VERTICAL-DEFLECTION OSCILLATOR AND HORIZONTAL-DEFLECTION OSCILLATOR IN TELEVISION RECEIVERS. THE 8FQ7 MAY ALSO BE USED IN PHASE-INVERTER, MULTIVIBRATOR, SYNC-SEPARATOR, SYNC-AMPLIFIER, AND IN RESISTANCE-COUPLED AF AMPLIFIER CIRCUITS OF ELECTRONIC EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID TO PLATE	3.6	3.8	pf
GRID TO CATHODE AND HEATER	2.4	2.4	pf
PLATE TO CATHODE AND HEATER	0.34	0.26	pf
PLATE OF UNIT #1 TO PLATE OF UNIT #2	1.0		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	8.4 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±27	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200●	VOLTS
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

● THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

VALUES ARE FOR EACH UNIT

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
CATHODE CURRENT	22	MA.
PLATE DISSIPATION:		
EITHER PLATE	4	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7	WATTS
MAX. CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE:		
FOR FIXED -BIAS OPERATION	1	MEGOHM

HORIZONTAL-DEFLECTION OSCILLATOR [B]

VALUES ARE FOR EACH UNIT

DC PLATE VOLTAGE	330	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE[C]	660	VOLTS
CATHODE CURRENT:		
PEAK	330	MA.
DC	22	MA.
PLATE DISSIPATION:		
EITHER PLATE	4	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7	WATTS
MAX. CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE	2.2	MEGOHM

VERTICAL-DEFLECTION OSCILLATOR [B]

VALUES ARE FOR EACH UNIT

DC PLATE VOLTAGE	330	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE[D]	440	VOLTS
CATHODE CURRENT:		
PEAK	77	MA.
DC	22	MA.
PLATE DISSIPATION:		
EITHER PLATE	4	WATTS
BOTH PLATES (BOTH UNITS OPERATING)	5.7	WATTS
MAX. CIRCUIT VALUES:		
GRID-CIRCUIT RESISTANCE	2.2	MEGOHMS

CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH UNIT

PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6700	7700	OHMS
TRANSCONDUCTANCE	3000	2600	μMHOS
PLATE CURRENT	10	9	MA.
PLATE CURRENT FOR GRID VOLTS =-12.5	---	1.3	MA.
GRID VOLTAGE (APPROX.)FOR PLATE μA=10	-7	-18	VOLTS

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NOTES

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS." FEDERAL COMMUNICATIONS COMMISSION.

[C] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

[D] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15 PER CENT OF ONE VERTICAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15 PER CENT OF ONE VERTICAL SCANNING CYCLE IS 2.5 MILLISECONDS.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 8FQ7 is identical to the 6FQ7.

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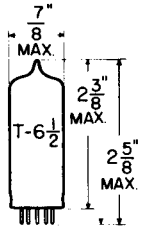
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



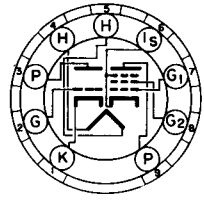
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

8.0 VOLTS 0.6 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON

9 PIN BASE

9DX

THE 8GN8 IS A HIGH MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER OR SYNC-SEPARATOR. THE PENTODE SECTION IS DESIGNED FOR VIDEO AMPLIFIER SERVICE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 8GN8 IS IDENTICAL TO THE 6GN8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE	4.4	μμf
INPUT: G TO (H+K)	2.4	μμf
OUTPUT: P TO (H+K)	0.36	μμf
PENTODE SECTION		
GRID #1 TO PLATE (MAX.)	0.1	μμf
INPUT: G1 TO (H+K+G2+G3+I.S.)	11	μμf
OUTPUT: P TO (H+K+G2+G3+I.S.)	4.2	μμf
COUPLING		
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION		PENTODE SECTION	
HEATER VOLTAGE		8.0		VOLTS
MAXIMUM PLATE VOLTAGE	330		330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE			330	VOLTS

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TUNG-SOL

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	8.0		VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION		1.1	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
HEATER WARM UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	8.0		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		150	VOLTS
GRID #1 VOLTAGE	-2		VOLTS
CATHODE BIAS RESISTOR		100	OHMS
PLATE CURRENT	2	25	MA.
GRID #2 CURRENT		5.5	MA.
TRANSCONDUCTANCE	2700	11500	μMHOS
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE	37000	60000	OHMS
Ec1 FOR Ib = 100 μA (APPROX.)		-10	VOLTS
Ec1 FOR Ib = 20 μA (APPROX.)	-5		VOLTS

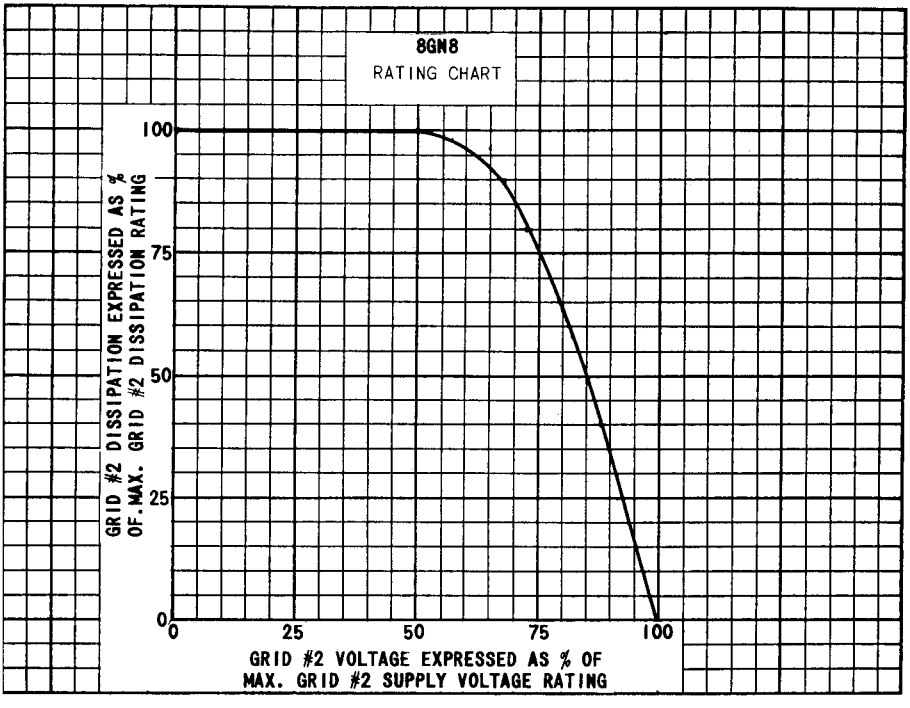
INSTANTANEOUS PLATE KNEE CHARACTERISTICS
PENTODE SECTION
Eb = 60 VOLTS, Ec2 = 150 VOLTS AND Ec1 = 0 VOLTS
Ib = 55 MA AND Ic2 = 18 MA.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR (4) TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE (3) TIMES RATED HEATER VOLTAGE DIVIDED BY RATED HEATER CURRENT.

A. DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS.

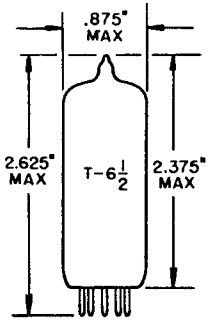
THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDD ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS.

THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.


8GN8
RATING CHART
GRID #2 DISSIPATION EXPRESSED AS % OF MAX. GRID #2 DISSIPATION RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF MAX. GRID #2 SUPPLY VOLTAGE RATING

TUNG-SOL

TRIODE PENTODE
MINIATURE TYPE

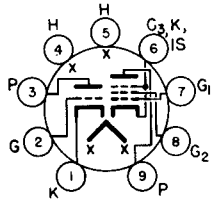


GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR COMBINED VIDEO AMPLIFIER AND GENERAL PURPOSE T.V. APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 8JV8 IS A TRIODE PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE IN SOUND IF, KEYED A.G.C., SYNC-SEPARATION, SYNC-AMPLIFICATION OR NOISE SUPPRESSION CURCUITS; THE PENTODE SECTION IS DESIGNED FOR USE AS A VIDEO AMPLIFIER. THE HEATER MAY BE OPERATED FROM A TRANSFORMER OR IN A SERIES STRING.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

TRIODE:		
GRID TO PLATE: Tg TO Tp	2.2	pf
INPUT: Tg TO (h+Tk+Pk, Pg3, i.s.)	3.0	pf
OUTPUT: Tp TO (h+Tk+Pk, Pg3, i.s.)	2.0	pf
PENTODE:		
GRID 1 TO PLATE: Pg1 to Pp (MAX)	0.08	pf
INPUT: Pg1 TO (h+Pg2+Pk, Pg3, i.s.)	8.0	pf
OUTPUT: Pp TO (h+Pg2+Pk, Pg3, i.s.)	3.2	pf
COUPLING:		
PENTODE GRID 1 TO TRIODE PLATE: Pg1 TO Tp (MAX.)	0.012	pf
PENTODE PLATE TO TRIODE PLATE: Pp TO Tp (MAX.)	0.24	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	8.5 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE - BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION	1.1	4.0	WATTS
GRID 2 VOLTAGE	----	330	VOLTS
GRID 2 DISSIPATION	----	1.7	WATTS
NEGATIVE GRID 1 VOLTAGE	50	50	VOLTS
POSITIVE GRID 1 VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION	1.0	1.0	MEGOHMS
FOR FIXED BIAS OPERATION	0.5	0.25	MEGOHM

AVERAGE CHARACTERISTICS

	TRIODE	PENTODE		
PLATE VOLTAGE	200	125	200	VOLTS
GRID 2 VOLTAGE	----	125	200	VOLTS
GRID 1 VOLTAGE	-2.0	-1.0	-2.9	VOLTS
PLATE CURRENT	4	22	22	MA.
GRID 2 CURRENT	----	4	4	MA.
TRANSCONDUCTANCE	4,000	11,500	10,700	μMHOS
PLATE RESISTANCE - APPROX.	17.5	100	150	KOHMS
AMPLIFICATION FACTOR	70	----	----	
GRID 1 VOLTAGE FOR Ib≅20μA (APPROX.)	-5	-5.5	-9	VOLTS

KNEE CHARACTERISTICS
Ec1 = 0 INSTANTANEOUSLY

PLATE VOLTAGE	----	40	60	VOLTS
GRID 2 VOLTAGE	----	125	200	VOLTS
PLATE CURRENT	----	28	51	MA.
GRID 2 CURRENT	----	9	14	MA.

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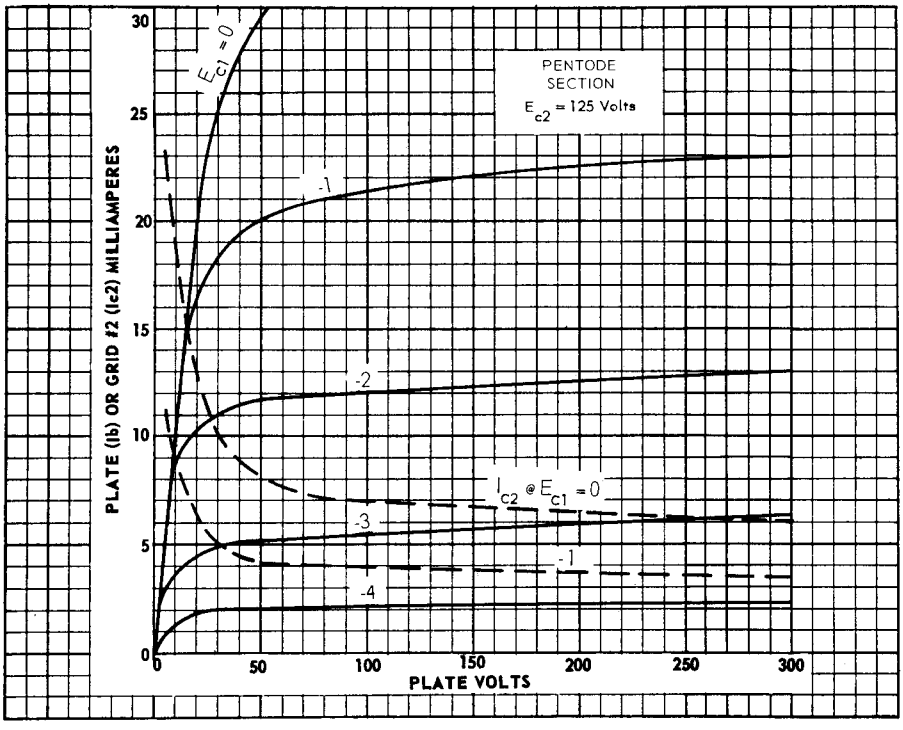
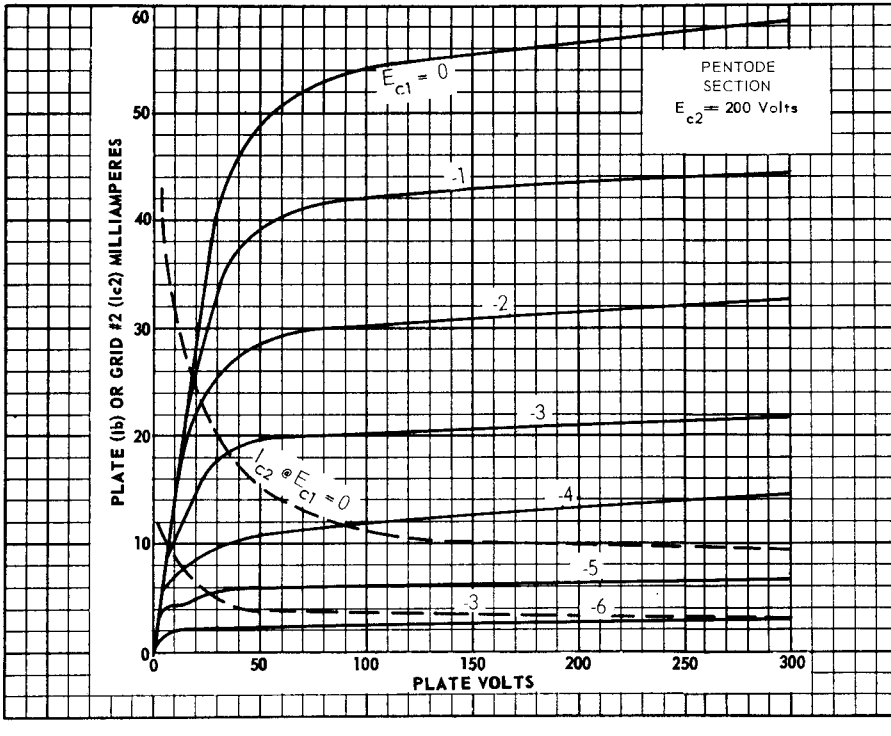
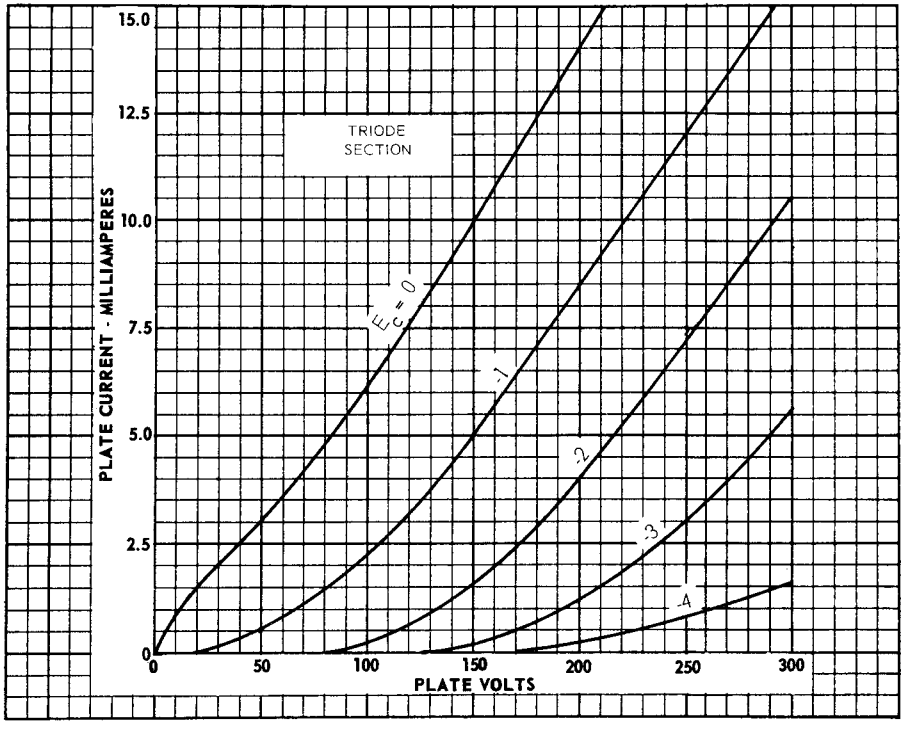

PENTODE
SECTION
E_{c2} = 125 Volts
E_{c1} = 0
-1
-2
-3
-4
I_{c2} @ E_{c1} = 0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
30
50
100
150
200
250
300


PENTODE
SECTION
E_{c2} = 200 Volts
E_{c1} = 0
-1
-2
-3
-4
-5
-6
I_{c2} @ E_{c1} = 0
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
60
50
100
150
200
250
300

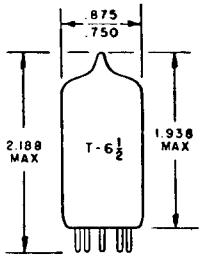
8JV8


TRIODE
SECTION
PLATE CURRENT - MILLIAMPERES
15.0
12.5
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
300
PLATE VOLTS
E_c = 0
-1
-2
-3
-4

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

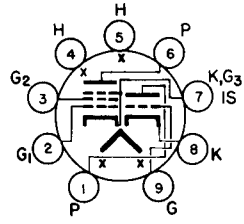
FOR

FREQUENCY CHANGER

APPLICATIONS IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9 AE

THE 9A8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A FREQUENCY CHANGER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	TRIODE SECTION	PENTODE SECTION	
PLATE TO GRID 1		MAX. 0.025	pf
PLATE TO GRID	1.5		pf
INPUT	2.5	5.5	pf
OUTPUT	1.8	3.8	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	9.0 VOLTS	300	MA
LIMITS OF SUPPLIED CURRENT		300 ± 20	MA
HEATER-CATHODE VOLTAGE		100	VOLTS

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MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTS	250	250	VOLTS
PLATE DISSIPATION	1.5	1.7	WATTS
GRID CIRCUIT RESISTANCE	0.5		MEGOHM
GRID 2 VOLTAGE AT I_k = 14 MA		175	VOLTS
GRID 2 VOLTAGE AT I_k < 10 MA		200	VOLTS
GRID 2 VOLTAGE WITHOUT CURRENT		550	VOLTS
GRID 2 DISSIPATION AT Pp > 1.2 WATTS		0.5	WATT
CATHODE CURRENT	14	14	MA.
GRID 1 CIRCUIT RESISTANCE-AUTOMATIC BIAS		1	MEGOHM
GRID 1 CIRCUIT RESISTANCE-FIXED BIAS		0.5	MEGOHM

TYPICAL CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	100	170	VOLTS
GRID 2 VOLTAGE		170	VOLTS
GRID 1 VOLTAGE	-2	-2	VOLTS
PLATE CURRENT	14	10	MA
GRID 2 CURRENT		2.8	MA
TRANSCONDUCTANCE	5,000	6,200	μMHOS
TRIODE AMPLIFICATION FACTOR	20	47	
PLATE RESISTANCE		0.4	MEGOHM
INPUT RESISTANCE AT 50 Mc/s		10,000	OHMS
EQUIVALENT NOISE RESISTANCE		1,500	OHMS

OPERATING CHARACTERISTICS

FOR USE AS A MIXER

PLATE VOLTAGE	170	170	VOLTS
GRID 2 VOLTAGE	170	170	VOLTS
GRID 1 CIRCUIT RESISTANCE	0.1	0.1	MEGOHM
CATHODE RESISTOR	330	820	OHMS
OSCILLATOR VOLTAGE	3.5	3.5	VOLTS RMS
PLATE CURRENT	6.5	5.2	MA
GRID 2 CURRENT	2.0	1.5	MA
GRID 1 CURRENT	25	0	μA
CONVERSION CONDUCTANCE	2,200	2,100	μMHOS
PLATE RESISTANCE	0.8	0.87	MEGOHM

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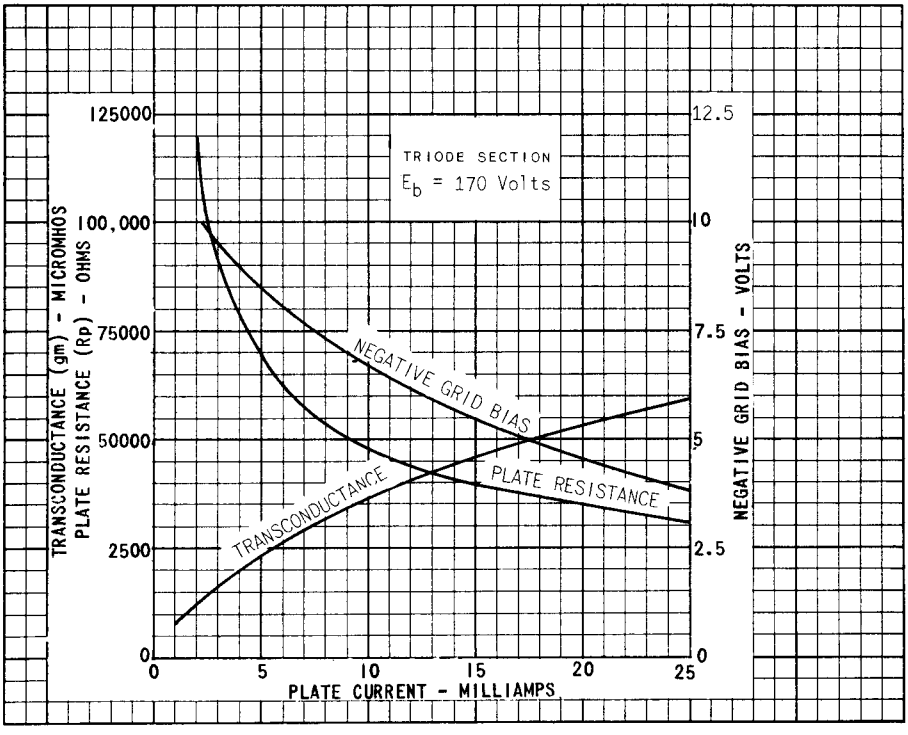

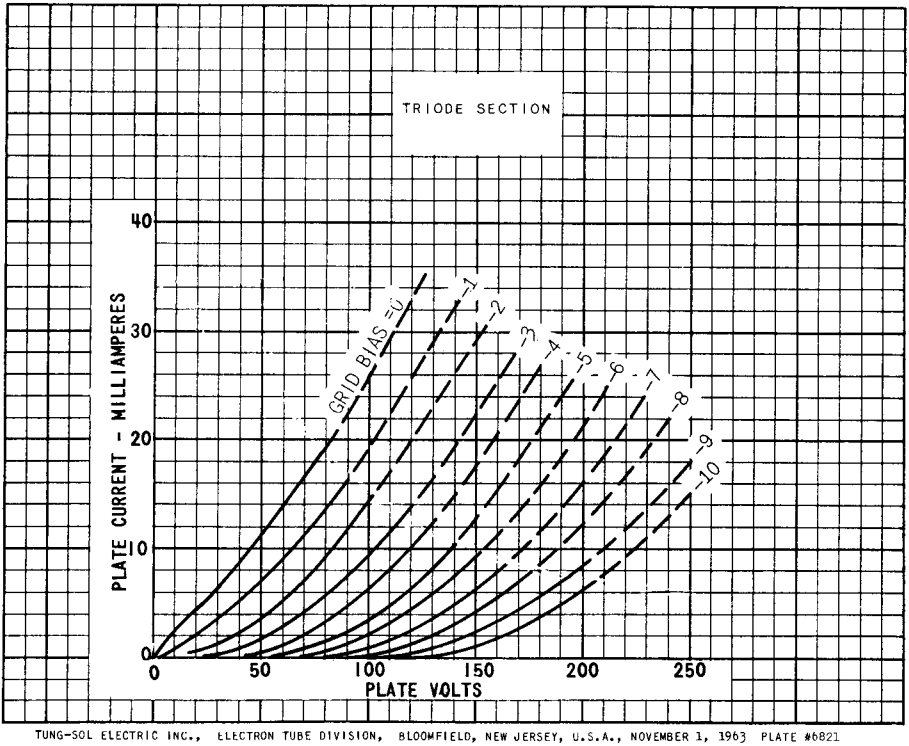

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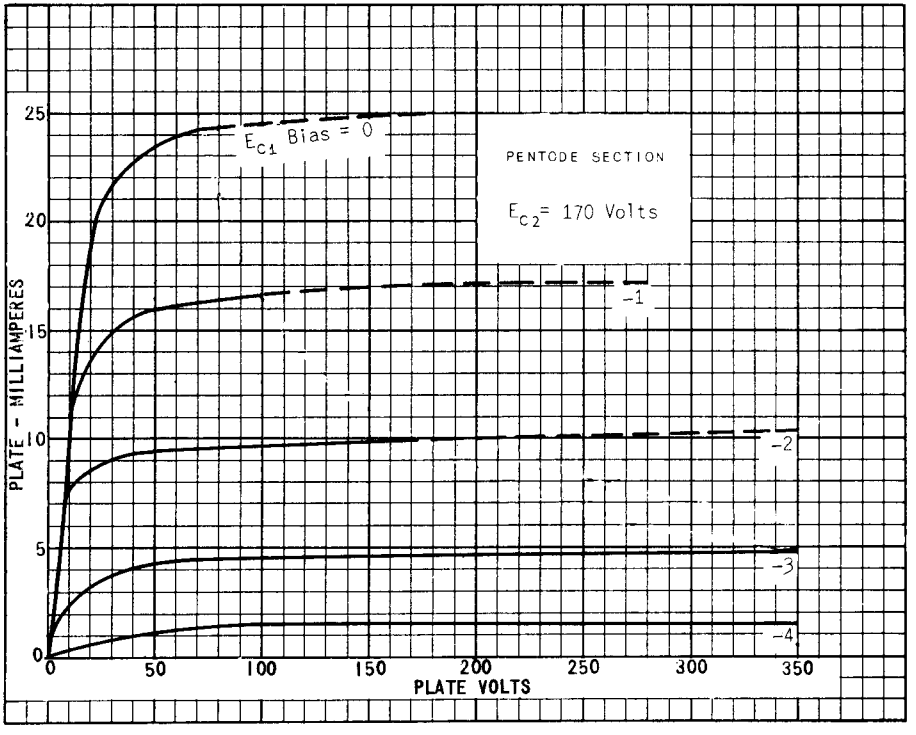
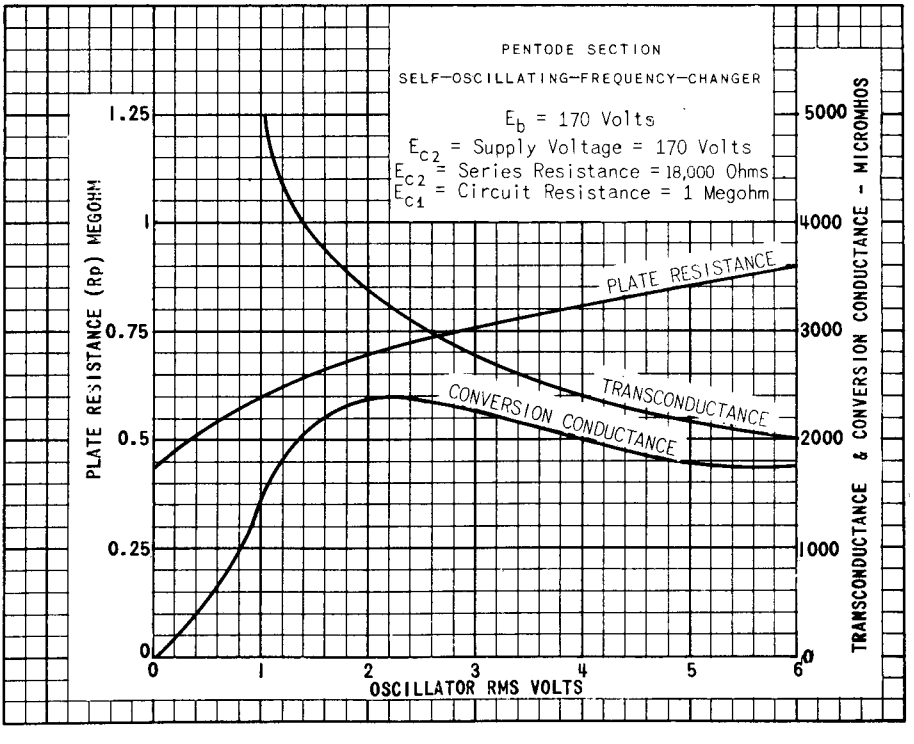
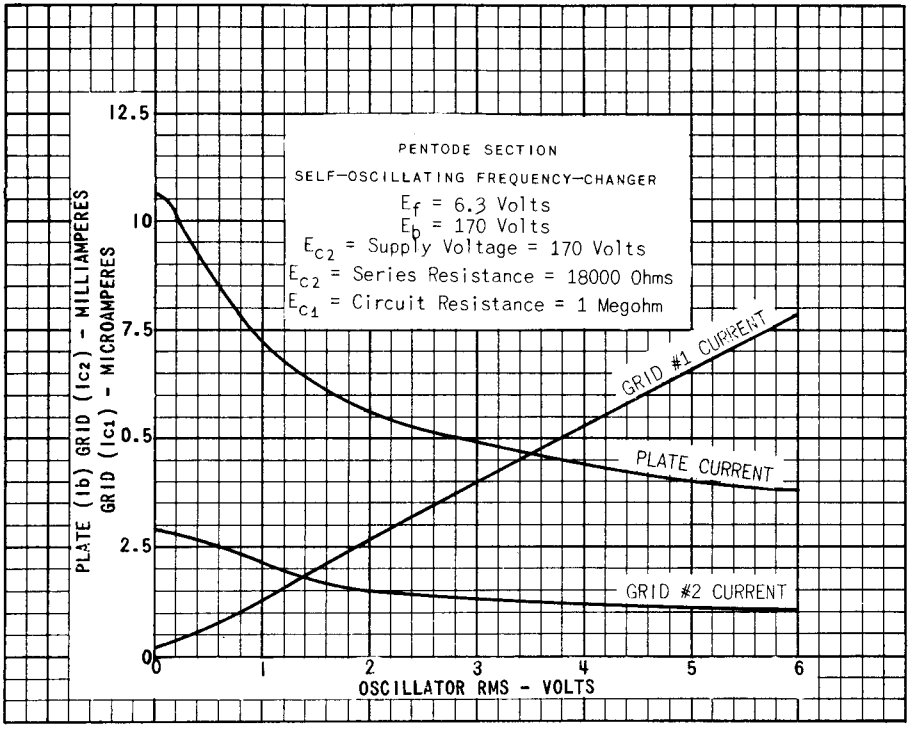

PENTODE SECTION
E_{c2} = 170 Volts
E_{c1} Bias = 0
-1
-2
-3
-4
PLATE - MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
50
100
150
200
250
300
350

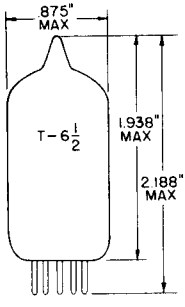

PENTODE SECTION
SELF-OSCILLATING-FREQUENCY-CHANGER
E_b = 170 Volts
E_{c2} = Supply Voltage = 170 Volts
E_{c2} = Series Resistance = 18,000 Ohms
E_{c1} = Circuit Resistance = 1 Megohm
PLATE RESISTANCE
TRANSCONDUCTANCE
CONVERSION CONDUCTANCE
PLATE RESISTANCE (Rp) MEGOHM
TRANSCONDUCTANCE & CONVERSION CONDUCTANCE - MICROMHOS
OSCILLATOR RMS VOLTS
0
0.25
0.5
0.75
1
1.25
1000
2000
3000
4000
5000
1
2
3
4
5
6


PENTODE SECTION
SELF-OSCILLATING FREQUENCY-CHANGER
E_f = 6.3 Volts
E_b = 170 Volts
E_{c2} = Supply Voltage = 170 Volts
E_{c2} = Series Resistance = 18000 Ohms
E_{c1} = Circuit Resistance = 1 Megohm
PLATE (Ib) GRID (Ic2) - MILLIAMPERES
GRID (Ic1) - MICROAMPERES
12.5
10
7.5
0.5
2.5
0
0
1
2
3
4
5
6
OSCILLATOR RMS - VOLTS
GRID #1 CURRENT
PLATE CURRENT
GRID #2 CURRENT

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

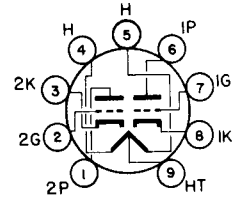


GLASS BULB
SMALL BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

FOR
AUDIO FREQUENCY AMPLIFIER
OR COMBINED OSCILLATOR AND
MIXER APPLICATIONS IN
T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 9A

THE 9AU7 COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATION EITHER AS AN AUDIO FREQUENCY AMPLIFIER OR AS A COMBINED OSCILLATOR AND MIXER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS AND HEATER WARM-UP TIME IT IS IDENTICAL TO THE 12AU7A.

→ DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT T_1	TRIODE UNIT T_2	
GRID TO PLATE	1.5	1.5	pf
GRID TO CATHODE	1.6	1.6	pf
PLATE TO CATHODE	0.50	0.35	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
HEATER IN SERIES	9.4 VOLTS	225	MA.
HEATER IN PARALLEL	4.7 VOLTS	450	MA.
HEATER WARM-UP TIME (AVG.) (IN PARALLEL)		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (IN SERIES)		9.4±0.9	VOLTS
CURRENT OPERATION (IN PARALLEL)		450±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT

	CLASS A1 AMPLIFIER	VERTICAL DEFLECTION OSCILLATOR	
PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION:			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
CATHODE CURRENT	22		MA.
PEAK NEGATIVE PULSE GRID VOLTAGE		440	VOLTS
AVERAGE CATHODE CURRENT		22	MA.
PEAK CATHODE CURRENT		66	MA.
MAXIMUM CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE:			
FOR FIXED BIAS, GRID-RESISTOR BIAS, OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

	HORIZONTAL DEFLECTION OSCILLATOR	VERTICAL DEFLECTION AMPLIFIER	
DC PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
PEAK POSITIVE-PULSE PLATE VOLTAGE		1200	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE	660	275	VOLTS
AVERAGE CATHODE CURRENT	22	22	MA.
PEAK CATHODE CURRENT	330	66	MEGOHMS
MAXIMUM CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE:			
FOR FIXED BIAS, GRID-RESISTOR BIAS, OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - EACH UNIT

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
AMPLIFICATION FACTOR	→ 19.5	17	
PLATE RESISTANCE	→ 6250	7700	OHMS
TRANSCONDUCTANCE	3100	2200	μMHOS
PLATE CURRENT	11.8	10.5	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP.		-24	VOLTS

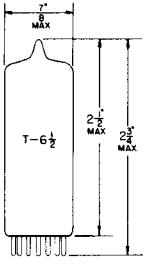
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SEREIS WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

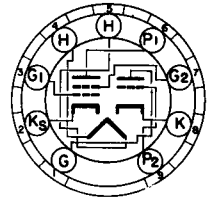
COATED UNIPOTNETIAL CATHODE

HEATER

9.0 VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 9DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	9.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	.75	6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---	135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---	1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110	110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0	0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0	60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE	9.0			VOLTS
HEATER CURRENT	0.60			AMP.
PLATE VOLTAGE	120	---	145	VOLTS
GRID #2 VOLTAGE	---		120	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	1500		180	OHMS
PLATE CURRENT	0.8		45	MA.
GRID #2 CURRENT	---		6	MA.
TRANSCONDUCTANCE	1400		7500	μMHOS
LOAD RESISTANCE	---		2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5		---	VOLTS
AMPLIFICATION FACTOR	100		---	
POWER OUTPUT	---		2.0	WATTS

SIMILAR TYPE REFERENCE: Except for heater ratings the 9DZ8 is identical to the 6DZ8, 12DZ8, 18DZ8, and the 35DZ8.

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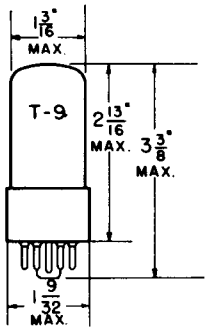
TUNG-SOL

BEAM PENTODE

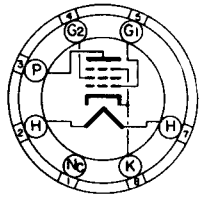


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
9.4 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN BASE
7S

THE 9EF6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN WIDE ANGLE TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.8	μμf
GRID #1 TO CATHODE GRID #3, GRID #2, HEATER	11.5	μμf
PLATE TO CATHODE GRID #3, GRID #2, HEATER	9.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
VERTICAL DEFLECTION AMPLIFIER – PENTODE CONNECTED

HEATER VOLTAGE	9.4	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)[A]	2 000	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	250	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	60	MA.
MAXIMUM PEAK CATHODE CURRENT	180	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE (Rk=100 OHMS MIN.)[B]	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	9.4	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	−18	VOLTS
PLATE CURRENT	50	MA.
GRID #2 CURRENT	2	MA.
TRANSCONDUCTANCE	5 000	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR I_b=1 MA.	−40	VOLTS
PLATE CURRENT FOR E_b= 75V, E_{c2}=250V, E_{c1} =0 [C]	170	MA.
SCREEN CURRENT E_b= 75V, E_{c2}=250V, E_{c1} =0 [C]	17	MA

[A] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING SYSTEM WHICH IS 2.5 MILLISECONDS IN A 525-LINE, 30-FRAME.

[B] IN THE CASE OF GRID RESISTOR BIAS SOME PROTECTION IS NECESSARY FOR THE TUBE IN THE NO DRIVE CONDITIONS.

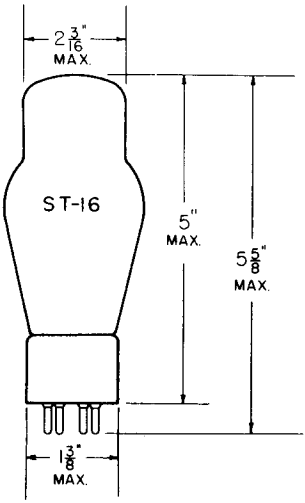
[C] INSTANTANEOUS VALUES.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater ratings, and heater warm-up time the 9EF6 is identical to the 6EF6.*

Except for heater ratings, it is identical to the 12EF6.

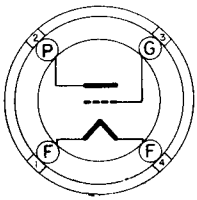
TRIODE POWER AMPLIFIER



GLASS BULB

THORIATED TUNGSTEN FILAMENT

FILAMENT
7.5 VOLTS 1.25 AMPERES
AC OR DC



BOTTOM VIEW

MEDIUM 4-PIN BAYONET BASE

VERTICAL
MOUNTING POSITION

TYPE 10 IS A HIGH-VACUUM, FILAMENT TYPE POWER AMPLIFIER TRIODE. IT MAY BE USED IN AUDIO STAGES AS A CLASS A AMPLIFIER OR, IN PUSH-PULL ARRANGEMENT, AS A CLASS B AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

CLASS A AMPLIFIER

FILAMENT VOLTAGE (AC OR DC)	7.5	VOLTS
FILAMENT CURRENT	1.25	AMP.
MAX. DC PLATE VOLTAGE	425	VOLTS
MAX. PLATE DISSIPATION	12	WATTS

CLASS B AMPLIFIER

FILAMENT VOLTAGE (AC OR DC)	7.5	VOLTS
FILAMENT CURRENT	1.25	AMP.
MAX. DC PLATE VOLTAGE	425	VOLTS
MAX. PLATE DISSIPATION (AVERAGED OVER ANY AF CYCLE)	12	WATTS
MAX.-SIGNAL, MAX. DC PLATE CURRENT (PER TUBE)	60	MA.
MAX.-SIGNAL, MAX. PLATE INPUT (PER TUBE)	25	WATTS

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

GRID TO PLATE	7	μμf
INPUT	4	μμf
OUTPUT	3	μμf

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

AC FILAMENT VOLTAGE	7.5	7.5	7.5	VOLTS
DC PLATE VOLTAGE	250	350	425	VOLTS
DC GRID VOLTAGE[A]	-23.5	-32	-40	VOLTS
PEAK GRID SWING	18.5	27	35	VOLTS
DC PLATE CURRENT	10	16	18	MA.
CATHODE RESISTOR	2350	2000	2220	OHMS
PLATE RESISTANCE	6000	5150	5000	OHMS
LOAD RESISTANCE	13 000	11 000	10 200	OHMS
TRANSCONDUCTANCE	1330	1550	1600	µMHOS
AMPLIFICATION FACTOR	8	8	8	
UNDISTORTED POWER OUTPUT	0.4	0.9	1.6	WATTS

CLASS B AMPLIFIER
TWO TUBES

AC FILAMENT VOLTAGE	7.5	7.5	7.5	VOLTS
DC PLATE VOLTAGE	250	350	425	VOLTS
DC GRID VOLTAGE [A] (APPROX.)	-28	-40	-50	VOLTS
PEAK AF GRID VOLTAGE (APPROX.)	110	120	130	VOLTS
ZERO-SIGNAL DC PLATE CURRENT (PER TUBE)	4	4	4	MA.
MAX.-SIGNAL DC PLATE CURRENT (PER TUBE)	55	55	55	MA.
LOAD RESISTANCE (PER TUBE)	1000	1500	2000	OHMS
EFFECTIVE PLATE-TO-PLATE LOAD RESISTANCE	4000	6000	8000	OHMS
MAX.-SIGNAL DRIVING POWER (APPROX.)	2.1	2.3	2.5	WATTS
MAX.-SIGNAL POWER OUTPUT (APPROX.)	13	20	25	WATTS

[A] GRID-VOLTAGE MEASURED FROM MID-POINT OF AC OPERATED FILAMENT.

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1629

NOV. 30
1945

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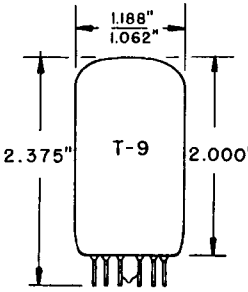
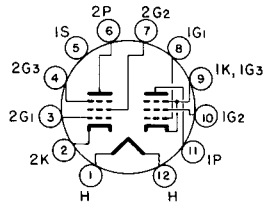
DOUBLE PENTODE

COMPACTRON



DISSIMILAR DOUBLE PENTODE
FOR
USE AS AN FM DETECTOR
AND AUDIO-FREQUENCY OUTPUT
AMPLIFIER IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BU

THE 10AL11 IS A SHARP-CUTOFF, DUAL-CONTROL PENTODE AND A POWER PENTODE IN A T-9 COMPACTRON CONSTRUCTION. THE DUAL-CONTROL PENTODE (SECTION 2) IS INTENDED FOR USE AS AN FM DETECTOR AND THE POWER PENTODE (SECTION 1) AS AN AUDIO-FREQUENCY OUTPUT AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

SECTION 1		
GRID 1 TO PLATE: (1_{G1} TO 1P)	0.26	pf
INPUT: 1G1 TO (H+ 1K + 1G2 + 1G3 + I.S.)	11	pf
OUTPUT: 1P TO (H + 1K + 1G2 + 1G3 + I.S.)	12	pf
SECTION 2		
GRID 1 TO PLATE: (2G1 TO 2P)	0.034	pf
GRID 3 TO PLATE: (2 G3 TO 2P)	3.2	pf
GRID 1 TO ALL EXCEPT PLATE: 2_{G1} TO (H + 2K + 2G2 + 2G3 + I.S.)	6.5	pf
GRID 3 TO ALL: 2_{G3} TO (H + 2K + 2G1 + 2G2 + 2P + I.S.)	7.5	pf
GRID 1 TO GRID 3: (2 G1 TO 2G3)	0.24	pf
PLATE TO PLATE: (1P TO 2P)	0.12	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	9.8 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
HEATER-CATHODE VOLTAGE	SECTION 1	SECTION 2	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	SECTION 1	SECTION 2	
PLATE VOLTAGE	275	330	VOLTS
GRID 2 VOLTAGE	275	SEE RATING CHART	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 3 (SUPPESSOR) VOLTAGE		28	VOLTS
POSITIVE DC GRID 1 VOLTAGE		0	VOLTS
PLATE DISSIPATION	10	1.7	WATTS
GRID 2 DISSIPATION	2.0	1.1	WATTS
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25		MEGOHMS
WITH CATHODE BIAS	0.5		MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

SECTION 1

PLATE VOLTAGE		250	VOLTS
GRID 2 VOLTAGE		250	VOLTS
GRID 1 VOLTAGE		-8.0	VOLTS
PEAK AF GRID 1 VOLTAGE		8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT		35	MA.
MAXIMUM-SIGNAL PLATE CURRENT		39	MA.
ZERO-SIGNAL GRID 2 CURRENT		2.5	MA.
MAXIMUM SIGNAL GRID 2 CURRENT		7.0	MA.
MAXIMUM-SIGNAL POWER OUTPUT		4.2	WATTS
TRANSCONDUCTANCE		6,500	MICROMHOS
PLATE RESISTANCE	Approx.	100,000	OHMS
LOAD RESISTANCE		5,000	OHMS
TOTAL HARMONIC DISTORTION	Approx.	10	PERCENT

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TUNG-SOL

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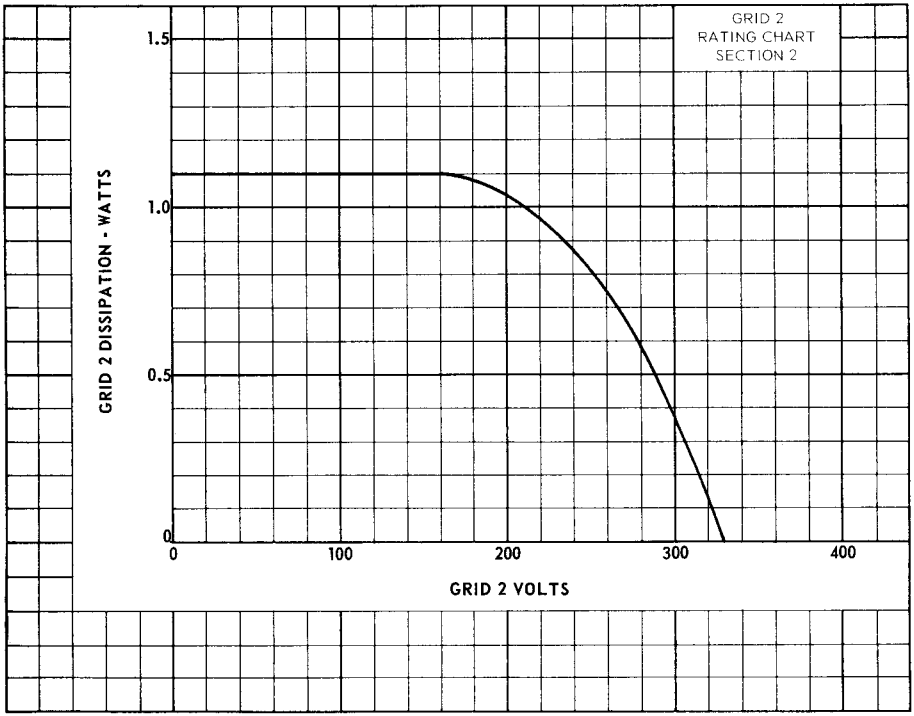
AVERAGE CHARACTERISTICS - SECTION 2

PLATE VOLTAGE		150	VOLTS
GRID 2 VOLTAGE		100	VOLTS
GRID 3 VOLTAGE		0	VOLTS
CATHODE-BIAS RESISTOR		560	OHMS
PLATE CURRENT		1.3	MA.
GRID 2 CURRENT		2.1	MA.
GRID 1 TRANSCONDUCTANCE		1,000	MICROMHOS
GRID 3 TRANSCONDUCTANCE		400	MICROMHOS
PLATE RESISTANCE	Approx.	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA	Approx.	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 50 μA	Approx.	-4.5	VOLTS



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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 7 PIN BASE

THE 10BP4 IS AN ELECTROMAGNETIC CATHODE RAY TUBE INTENDED FOR DIRECT VIEW TELEVISION USE. IT PROVIDES A BLACK AND WHITE 6" BY 8" PICTURE OF GOOD DEFINITION. THIS TUBE USES MAGNETIC FOCUS AND DEFLECTION. IT REQUIRES THE USE OF AN EXTERNAL ION-TRAP MAGNET TO ELIMINATE SCREEN BLEMISHES.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE OF PHOSPHORESCENCE	MEDIUM
DEFLECTION AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	50 DEGREES
ION TRAP	MAGNETIC
EXTERNAL COATING	CONDUCTIVE

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELECTRODES: G_1 TO ($H+K+G_2+A\&G_3$)	6.5	μμf
CATHODE TO ALL OTHER ELECTORDES: K TO ($H+K+G_2+A\&G_3$)	5.0	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE #2	2500 MAX., 500 MIN.	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE ($A\&G_3$)	10 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE: HEATER NEG. WITH RESPECT TO CATHODE DURING EQUIPMENT WARMING UP PERIOD NOT EXCEEDING 15 SEC.	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE		9 000	VOLTS
GRID #2 VOLTAGE		250	VOLTS
GRID #1 VOLTAGE	(VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.)	-27 TO -63	VOLTS

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MAR. 1, 1949

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TENTATIVE DATA

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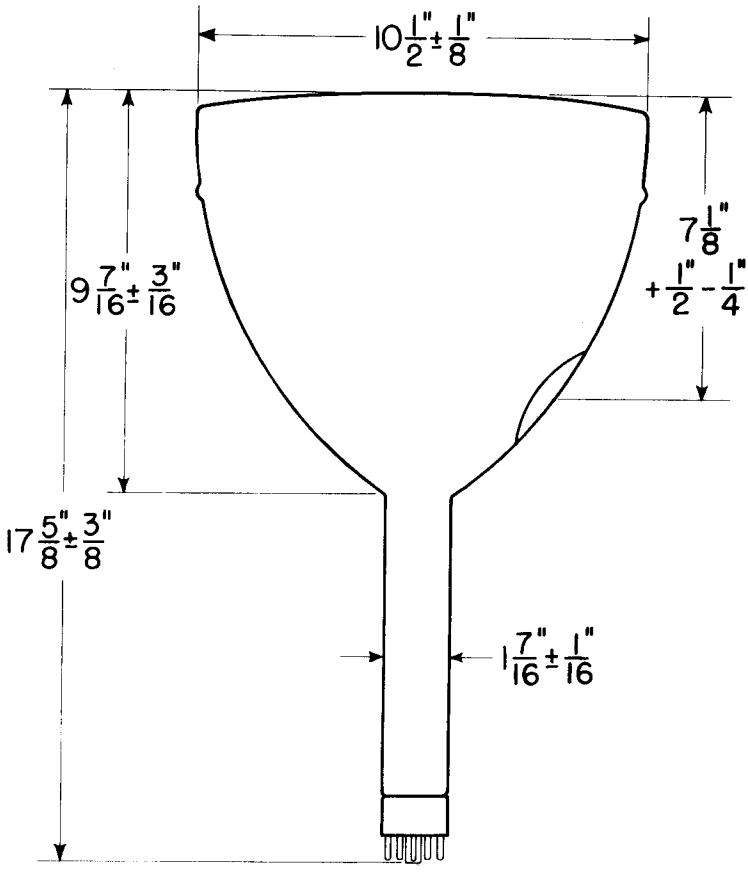

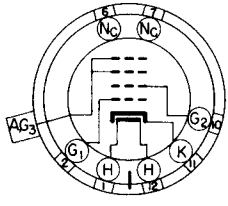

1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. GRID NO. 2
11. CATHODE
12. HEATER

CAP ANODE, GRID NO.3

PLATE 2160
MAR. 1, 1949

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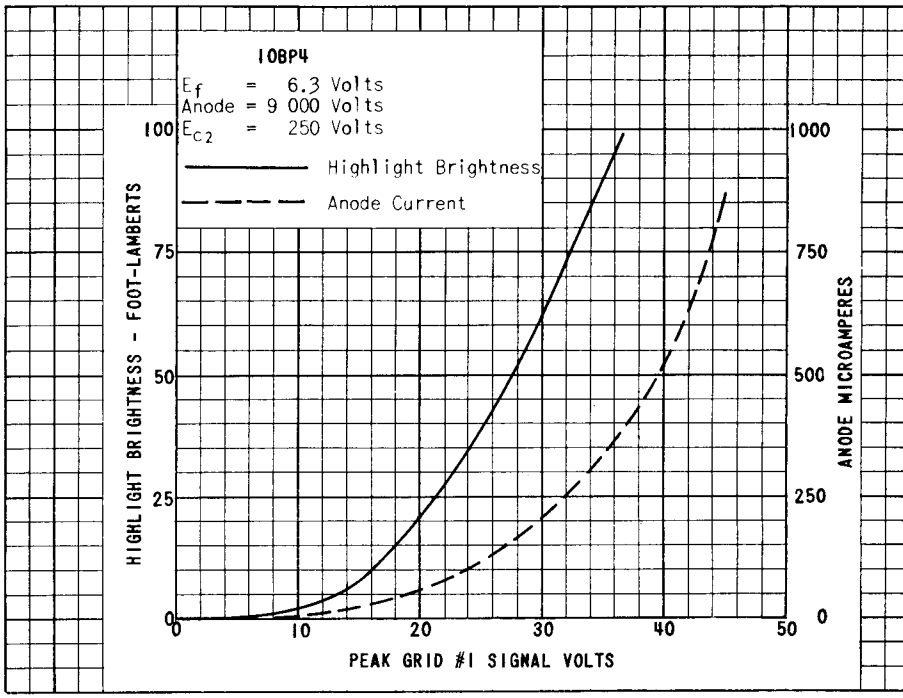

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2161
MAR. 1,
1949

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 7 PIN BASE

THE 10BP4A IS A MAGNETIC FOCUS AND MAGNETIC DEFLECTION DIRECT VIEW PICTURE TUBE FOR TELEVISION RECEIVERS. IT HAS A GREY NEUTRAL-DENSITY FACEPLATE FOR INCREASED PICTURE CONTRAST AND DETAIL UNDER HIGH AMBIENT LIGHT CONDITIONS. THE ELECTRON GUN IS DESIGNED TO BE USED WITH AN EXTERNAL ION-TRAP MAGNET.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTION AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	50 DEGREES
ION TRAP	MAGNETIC
EXTERNAL COATING	CONDUCTIVE

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELECTRODES: G_1 TO (H+K+G_2+A&G_3)	6.5	μμf
CATHODE TO ALL OTHER ELECTRODES: K TO (H+K+G_2+A&G_3)	5.0	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE #2	2500 MAX., 500 MIN.	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE (A&G_3)	10 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE: HEATER NEG. WITH RESPECT TO CATHODE DURING EQUIPMENT WARMING UP PERIOD NOT EXCEEDING 15 SEC.	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	9 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT	110	MA.
ION TRAP CURRENT	120	MA.

SIMILAR TYPE REFERENCE: The 10BP4A is identical to the 10BP4 except for the grey filter faceplate.

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PLATE 2402

MAY 1 1950

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TENTATIVE DATA

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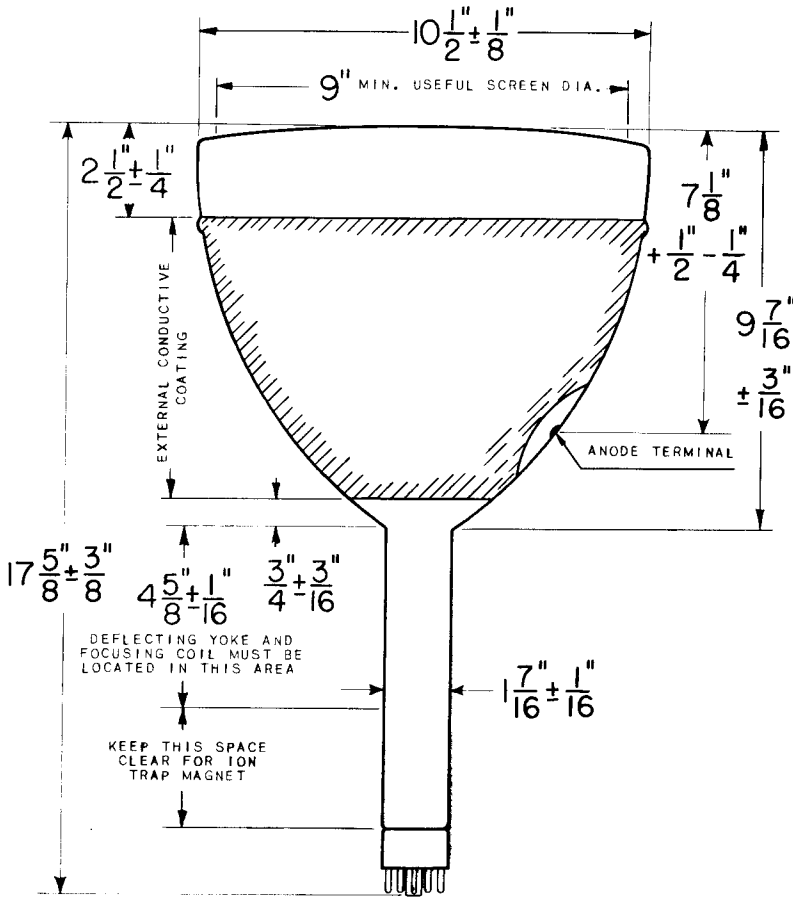

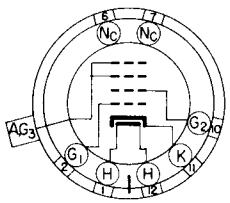

1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. GRID NO. 2
11 CATHODE
12. HEATER
CAP ANODE, GRID NO.3

PLATE 2403

MAY 1 1950

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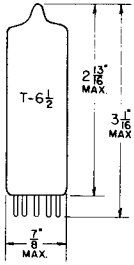
PENTODE



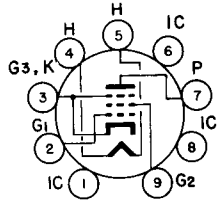
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-4

COATED UNIPOTENTIAL CATHODE

HEATER

10.6[D] VOLTS 0.45[E] AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CV

THE 10BQ5 IS AN OUTPUT PENTODE DESIGNED FOR APPLICATION IN MEDIUM POWER HI-FI AMPLIFIERS. A PAIR OF TUBES IN CLASS AB, PUSH-PULL CONVENTIONAL OPERATION YIELDS AN OUTPUT OF UP TO 17 WATTS AT 4% DISTORTION (WITHOUT FEEDBACK). IN SINGLE-ENDED OPERATION A POWER OUTPUT OF 5.7 WATTS CAN BE OBTAINED. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 10BQ5 IS IDENTICAL TO THE 6BQ5.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS	10.8	pf
PLATE TO ALL OTHER ELEMENTS	6.5	pf
PLATE TO GRID #1 (MAX.)	0.5	pf
GRID #1 TO HEATER (MAX.)	0.25	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER CURRENT[F]	450±30	MA.
MAXIMUM PLATE VOLTAGE[A]	300	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
MAXIMUM PLATE DISSIPATION[A]	12	WATTS
MAXIMUM GRID #2 VOLTAGE [A]	300	VOLTS
MAXIMUM GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #2 PEAK DISSIPATION	4	WATTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	100	VOLTS
MAXIMUM GRID CURRENT STARTING POINT		
MAXIMUM GRID #1 VOLTAGE WHEN GRID #1 CURRENT IS 0.3 μAMP.	-1.3	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE WITH FIXED BIAS	0.3	MEGOHM
MAXIMUM CATHODE CURRENT	65	MA.
MAXIMUM VOLTAGE BETWEEN HEATER AND CATHODE	100	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME*	11	SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A, ONE TUBE

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			−7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			5200			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3	3.4	4.3	4.7	VOLTS
PLATE CURRENT	48	---	---	49.5	49.2	MA.
GRID #2 CURRENT	5.5	---	---	10.8	11.6	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	μMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	6.8	10	---	PERCENT
SECOND HARMONIC[B]	---	---	3.0	2.0	---	PERCENT
THIRD HARMONIC[B]	---	---	5.8	9.5	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			−7.3			VOLTS
CATHODE RESISTOR			135			OHMS
PLATE LOAD RESISTANCE			4500			OHMS
INPUT A.F. VOLTAGE (RMS)	0	0.3	3.5	4.4	4.8	VOLTS
PLATE CURRENT	48	---	---	50.6	50.5	MA.
GRID #2 CURRENT	5.5	---	---	10	11	MA.
TRANSCONDUCTANCE	11300	---	---	---	---	μMHOS
PLATE RESISTANCE	38000	---	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05	4.5	5.7	6.0[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	7.5	10	---	PERCENT
SECOND HARMONIC[B]	---	---	5.7	5.0	---	PERCENT
THIRD HARMONIC[B]	---	---	4.5	8	---	PERCENT

PLATE VOLTAGE			250			VOLTS
GRID #2 VOLTAGE			250			VOLTS
GRID #1 BIAS			−8.4			VOLTS
CATHODE RESISTOR			210			OHMS
PLATE LOAD RESISTANCE			7000			OHMS
INPUT A.F. VOLTAGE(RMS)	0	0.3		3.5	5.5	VOLTS
PLATE CURRENT	36	---		36.8	36	MA.
GRID #2 CURRENT	4.1	---		8.5	14.6	MA.
TRANSCONDUCTANCE	10000	---		---	---	μMHOS
PLATE RESISTANCE	40000	---		---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---		---	---	
MAX. SIGNAL POWER OUTPUT[B]	0	0.05		4.2	5.6[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---		10	---	PERCENT
SECOND HARMONIC[B]	---	---		1.7	---	PERCENT
THIRD HARMONIC[B]	---	---		8.7	---	PERCENT

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A, ONE TUBE - CONT'D.

PLATE VOLTAGE			250		VOLTS
GRID #2 VOLTAGE			210		VOLTS
GRID #1 BIAS			-6.4		VOLTS
CATHODE RESISTOR			160		OHMS
PLATE LOAD RESISTANCE			7000		OHMS
INPUT A.F. VOLTAGE(RMS.)	0	0.3	3.4	3.8	VOLTS
PLATE CURRENT	36	---	36.6	36.5	MA.
GRID #2 CURRENT	3.9	---	7.3	8.0	MA.
TRANSCONDUCTANCE	10400	---	---	---	μMHOS
PLATE RESISTANCE	40000	---	---	---	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	19	---	---	---	OHMS
MAX. SIGNAL POWER OUTPUT [B]	0	0.05	4.3	4.7[C]	WATTS
TOTAL HARMONIC DISTORTION[B]	---	---	10	---	PERCENT
SECOND HARMONIC[B]	---	---	1.8	---	PERCENT
THIRD HARMONIC[B]	---	---	9.3	---	PERCENT

CLASS B, TWO TUBES

PLATE VOLTAGE		250		300	VOLTS
GRID #2 VOLTAGE		250		300	VOLTS
GRID #1 BIAS		-11.6		-14.7	VOLTS
LOAD RESISTANCE, PLATE TO PLATE		8000		8000	
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x10	2x37.5	2x7.5	2x46	MA.
GRID #2 CURRENT	2x1.1	2x7.5	2x0.8	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENT

CLASS AB, TWO TUBES

PLATE VOLTAGE		250		300	VOLTS
GRID #2 VOLTAGE		250		300	VOLTS
COMMON CATHODE RESISTOR		130		130	OHMS
LOAD RESISTANCE, PLATE TO PLATE		8000		8000	OHMS
INPUT A.F. VOLTAGE (RMS)	0	8	0	10	VOLTS
PLATE CURRENT	2x31	2x37.5	2x36	2x46	MA.
GRID #2 CURRENT	2x3.5	2x7.5	2x4	2x11	MA.
MAX. SIGNAL POWER OUTPUT	0	11	0	17	WATTS
TOTAL HARMONIC DISTORTION	---	3	---	4	PERCENTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - cont'd.

CLASS A IN TRIODE CONNECTION

(GRID #2 CONNECTED TO PLATE)

PLATE VOLTAGE	250	VOLTS
CATHODE RESISTOR	270	OHMS
PLATE LOAD RESISTANCE	3500	OHMS
ZERO-SIGNAL PLATE CURRENT	34	MA.
INPUT A.F. VOLTAGE (RMS)	6.7	VOLTS
MAX. SIGNAL PLATE CURRENT	36	MA.
MAX. SIGNAL POWER OUTPUT	1.95	WATTS
TOTAL HARMONIC DISTORTION	9	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS)	1.0	VOLT

CLASS AB, TWO TUBES IN TRIODE CONNECTION

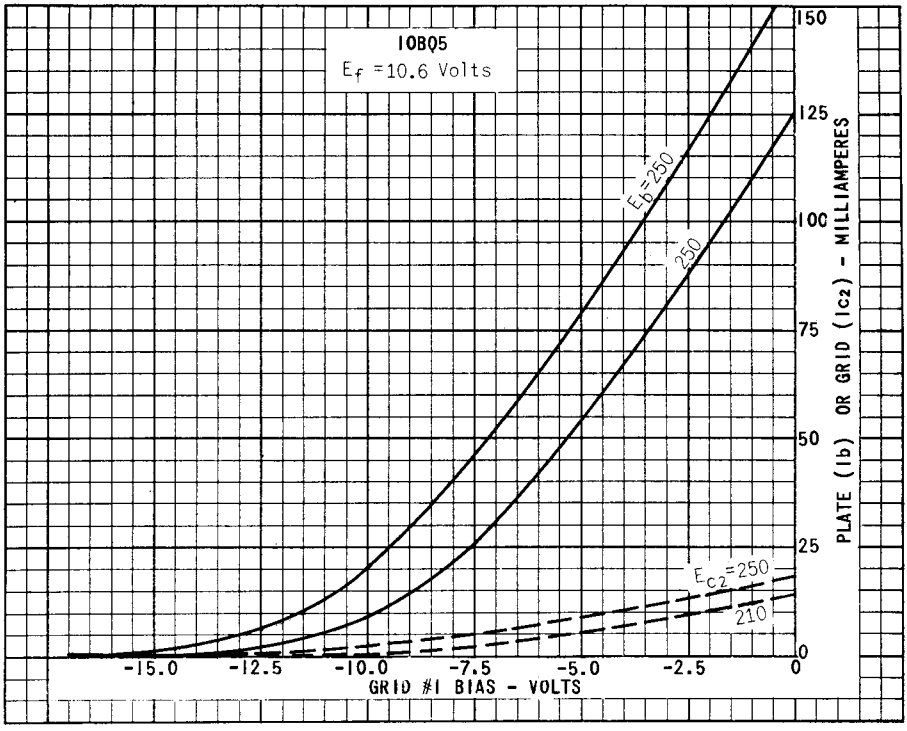
(GRID #2 CONNECTED TO PLATES)

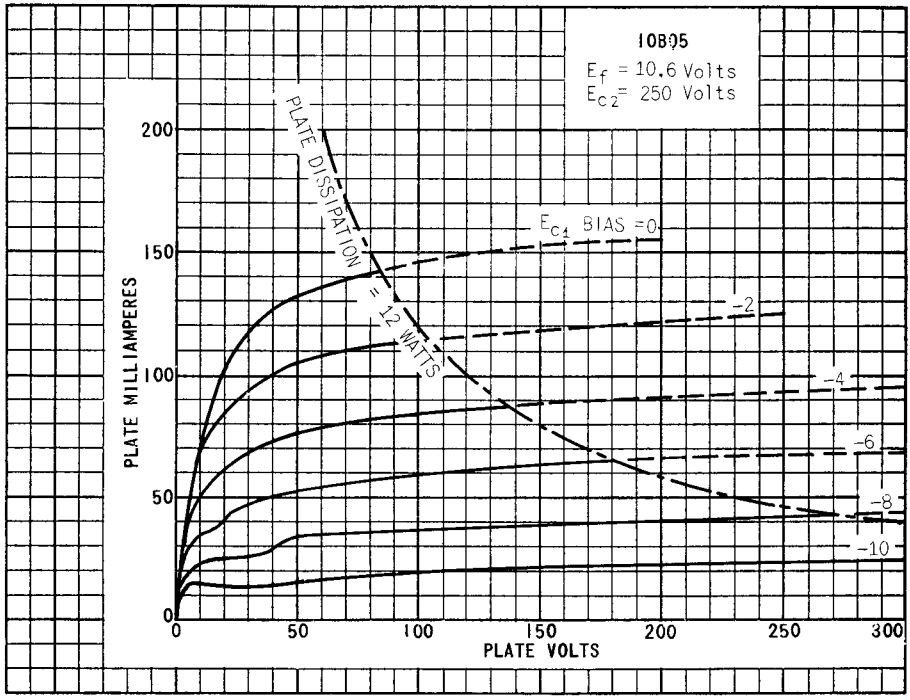
PLATE VOLTAGE	250	300	VOLTS
COMMON CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE (PLATE TO PLATE)	10 000	10 000	OHMS
ZERO-SIGNAL PLATE CURRENT	2x20	2x24	MA.
INPUT A.F. VOLTAGE (RMS)	8.3	10	VOLTS
MAX. SIGNAL PLATE CURRENT	2x21.7	2x26	MA.
MAX. SIGNAL POWER OUTPUT	3.4	5.2	WATTS
TOTAL HARMONIC DISTORTION	2.5	2.5	PERCENTS
INPUT A.F. VOLTAGE AT A POWER OUTPUT OF 50 MWATTS (RMS.)	0.95	0.9	VOLTS

[A] WHEN THE HEATER AND POSITIVE VOLTAGES ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR, THE MAX. VALUES OF THE PLATE AND GRID #2 VOLTAGES ARE 250 VOLTS AND THAT OF THE PLATE DISSIPATION 9 WATTS.

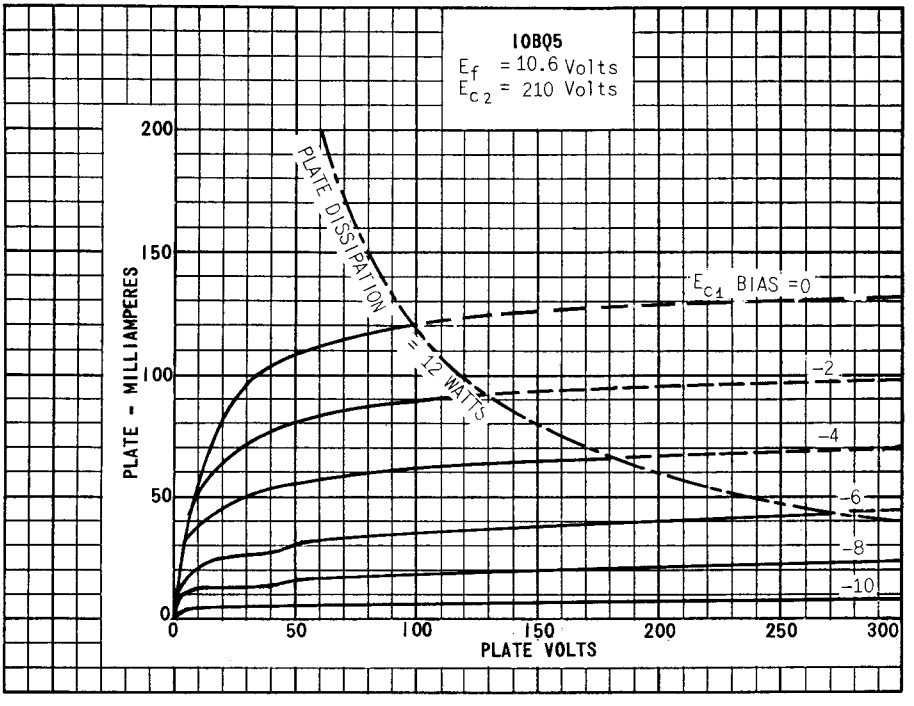
[B] MEASURED WITH FIXED BIAS.

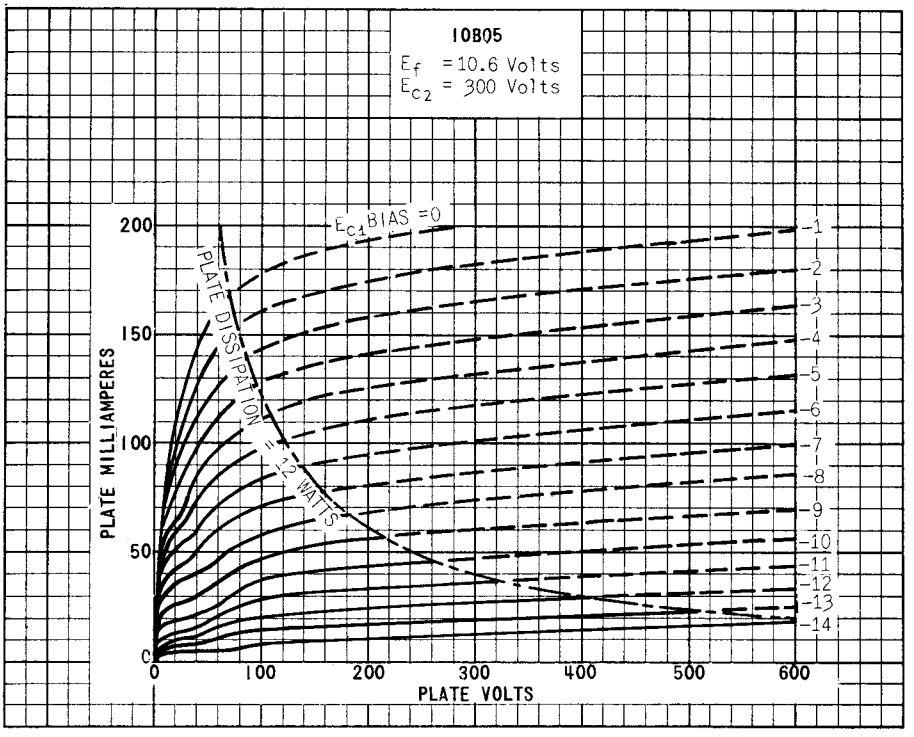
[C] POWER OUTPUT AT START OF POSITIVE GRID CURRENT.

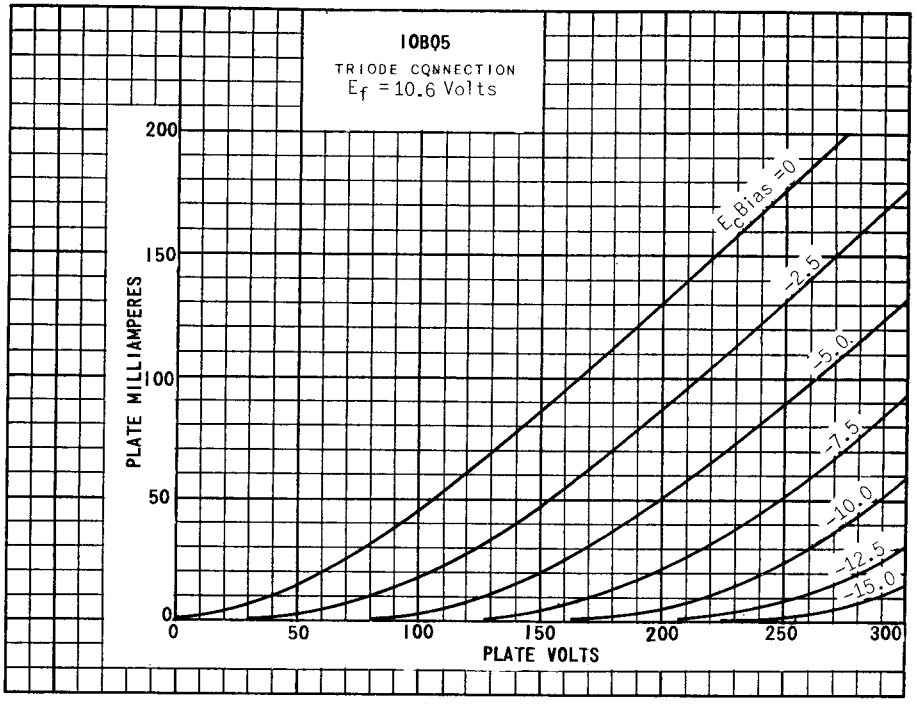

10BQ5
E_f =10.6 Volts
E_b=250
250
E_{c2}=250
210
150
125
100
75
50
25
0
PLATE (Ib) OR GRID (Ic2) - MILLIAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 BIAS - VOLTS

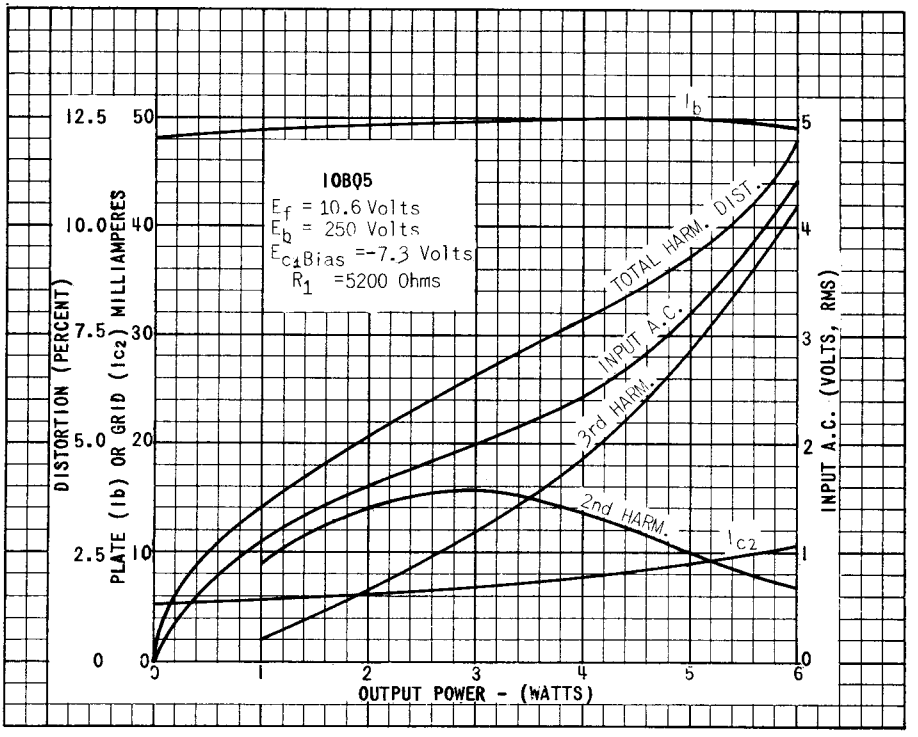

10BQ5
E_f = 10.6 Volts
E_{c2}= 250 Volts
PLATE DISSIPATION = 12 WATTS
E_{c1} BIAS =0
-2
-4
-6
-8
-10
200
150
100
50
0
PLATE MILLIAMPERES
0
50
100
150
200
250
300
PLATE VOLTS

10BQ5

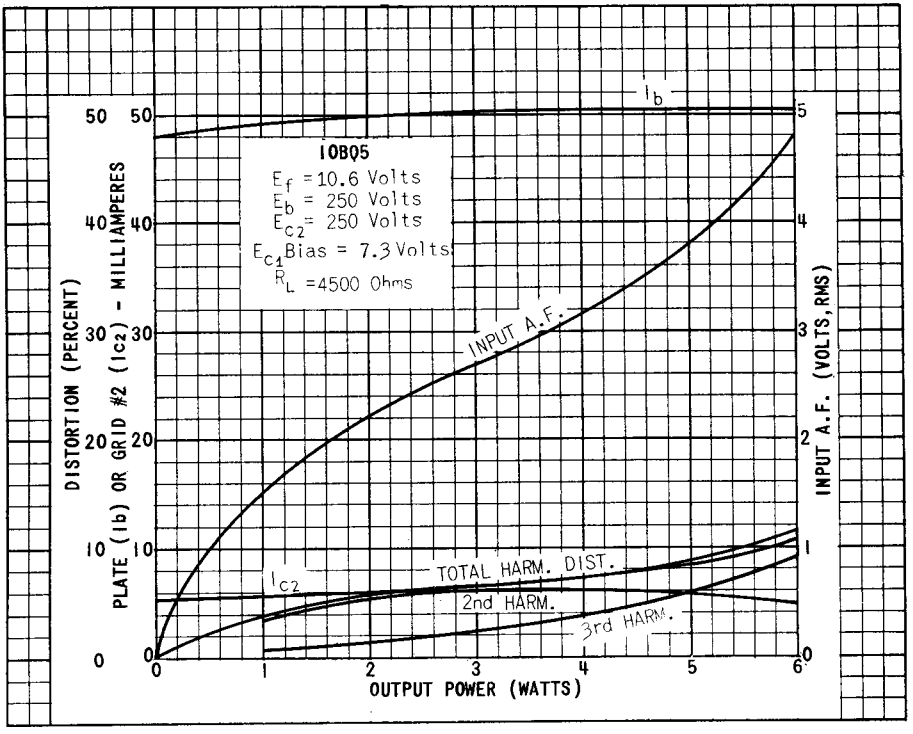

10BQ5
E_f = 10.6 Volts
E_{c2} = 210 Volts
PLATE - MILLIAMPERES
PLATE VOLTS
PLATE DISSIPATION = 12 WATTS
E_{c1} BIAS = 0
-2
-4
-6
-8
-10
0
50
100
150
200
250
300

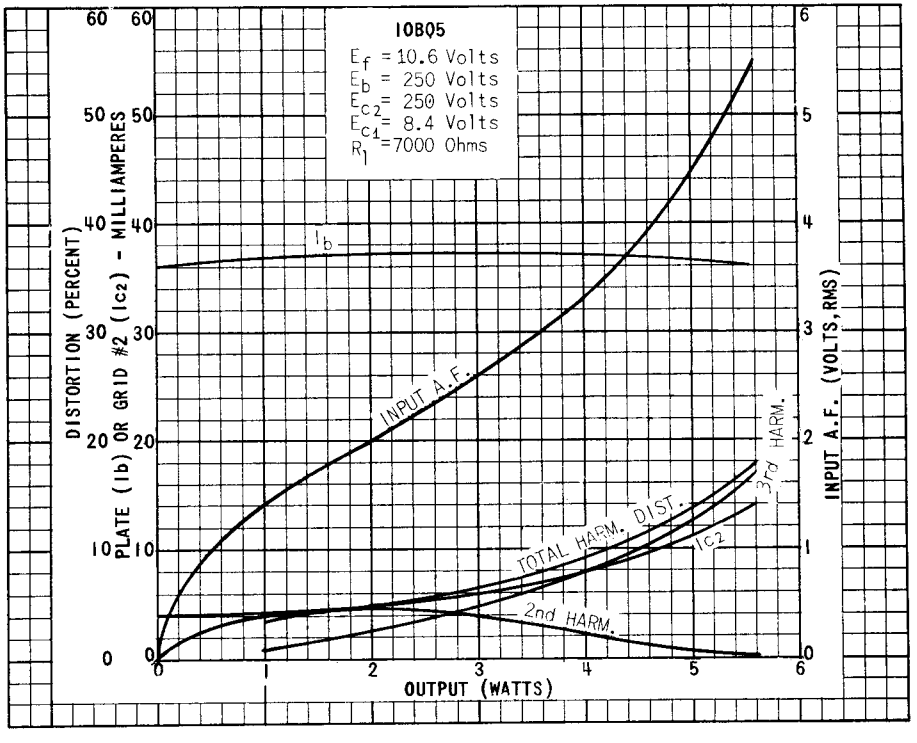

10B05
E_f = 10.6 Volts
E_{c2} = 300 Volts
PLATE MILLIAMPERES
PLATE VOLTS
PLATE DISSIPATION = 12 WATTS
E_{c1} BIAS = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
0
50
100
150
200
300
400
500
600

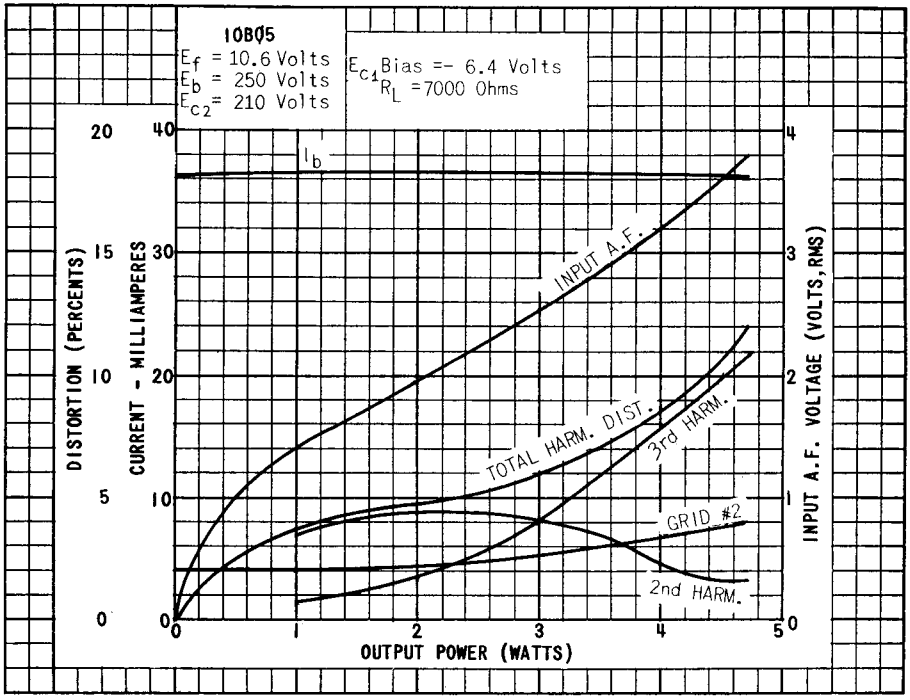

10BQ5
TRIODE CONNECTION
E_f = 10.6 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c Bias = 0
-2.5
-5.0
-7.5
-10.0
-12.5
-15.0
0
50
100
150
200
250
300

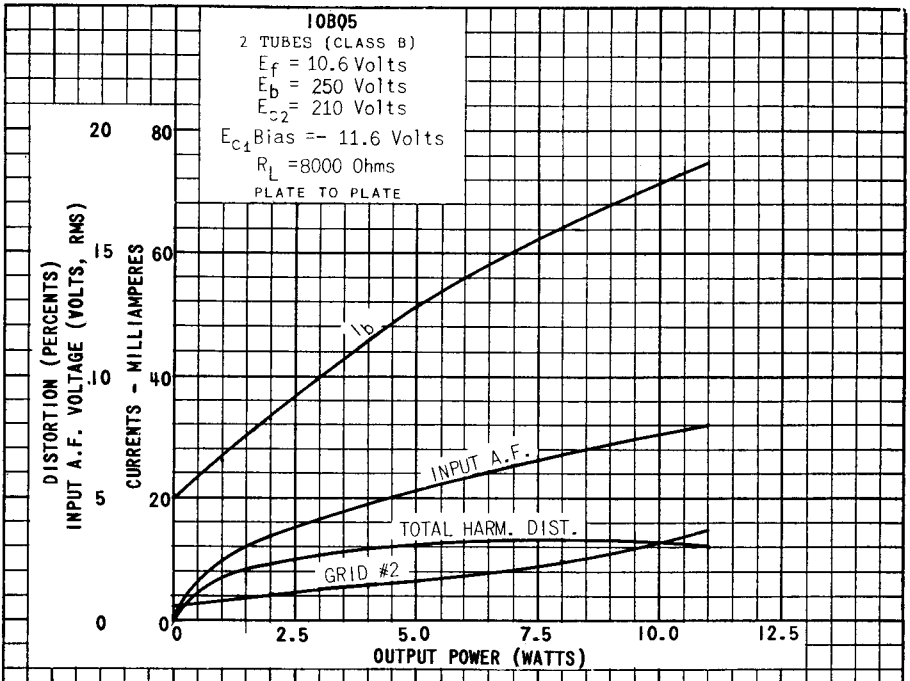

10BQ5
E_f = 10.6 Volts
E_b = 250 Volts
E_{c_1} Bias = -7.3 Volts
R_1 = 5200 Ohms
DISTORTION (PERCENT)
PLATE (Ib) OR GRID (I_{c_2}) MILLIAMPERES
INPUT A.C. (VOLTS, RMS)
OUTPUT POWER - (WATTS)
I_b
TOTAL HARM. DIST.
INPUT A.C.
3rd HARM.
2nd HARM.
I_{c_2}

10BQ5


10BQ5
E_f = 10.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} Bias = 7.3 Volts
R_L = 4500 Ohms
I_b
INPUT A.F.
I_{c2}
TOTAL HARM. DIST.
2nd HARM.
3rd HARM.
DISTORTION (PERCENT)
PLATE (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT POWER (WATTS)


10BQ5
E_f = 10.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = 8.4 Volts
R_1 = 7000 Ohms
I_b
INPUT A.F.
3rd HARM.
TOTAL HARM. DIST.
I_{c2}
2nd HARM.
DISTORTION (PERCENT)
PLATE (I_b) OR GRID #2 (I_{c2}) - MILLIAMPERES
INPUT A.F. (VOLTS, RMS)
OUTPUT (WATTS)





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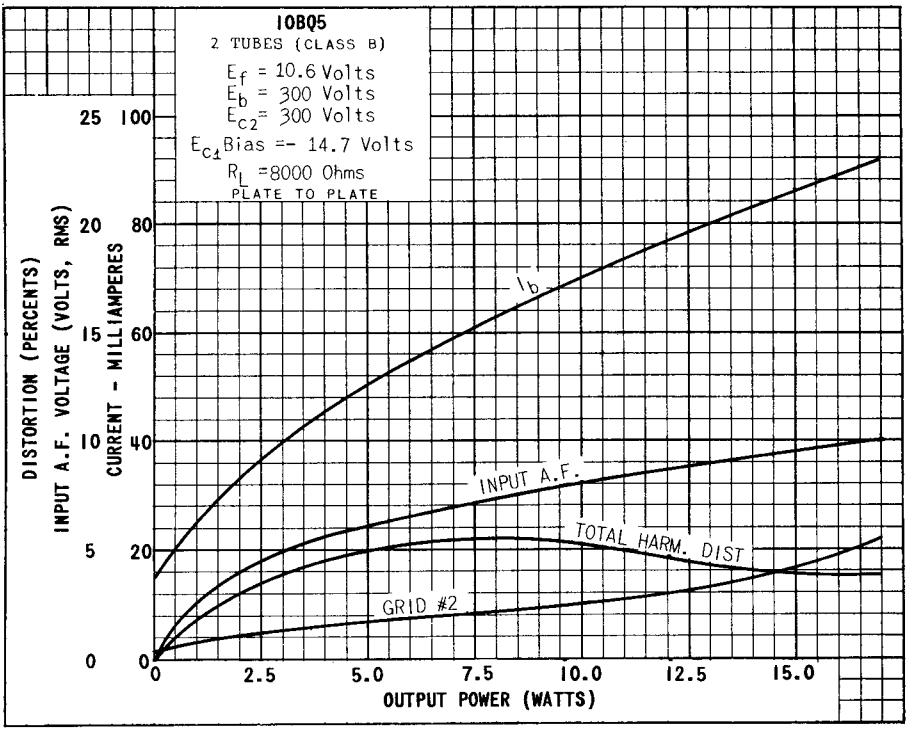
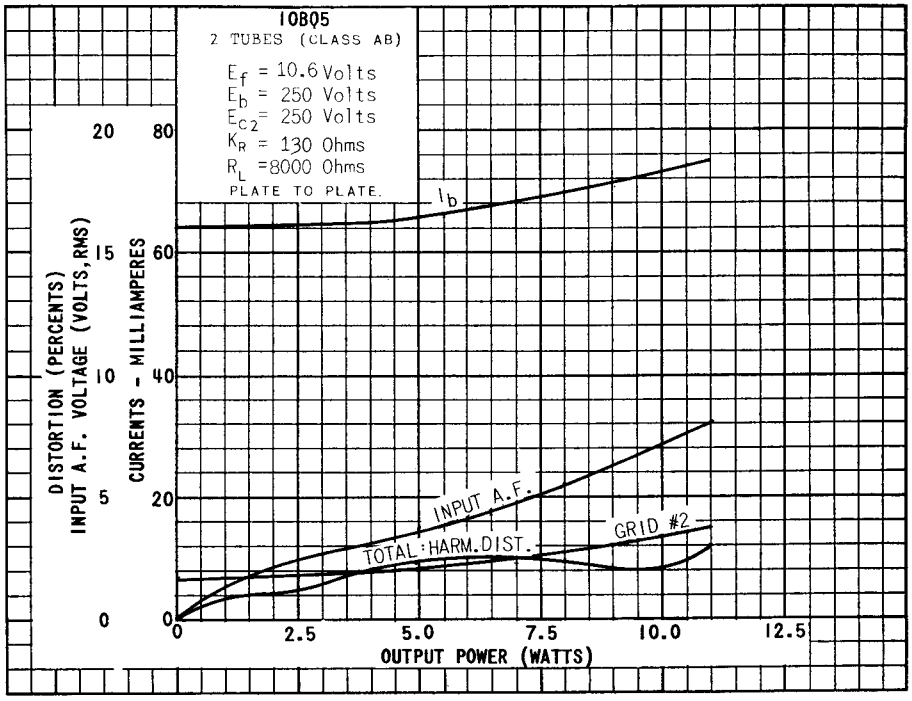
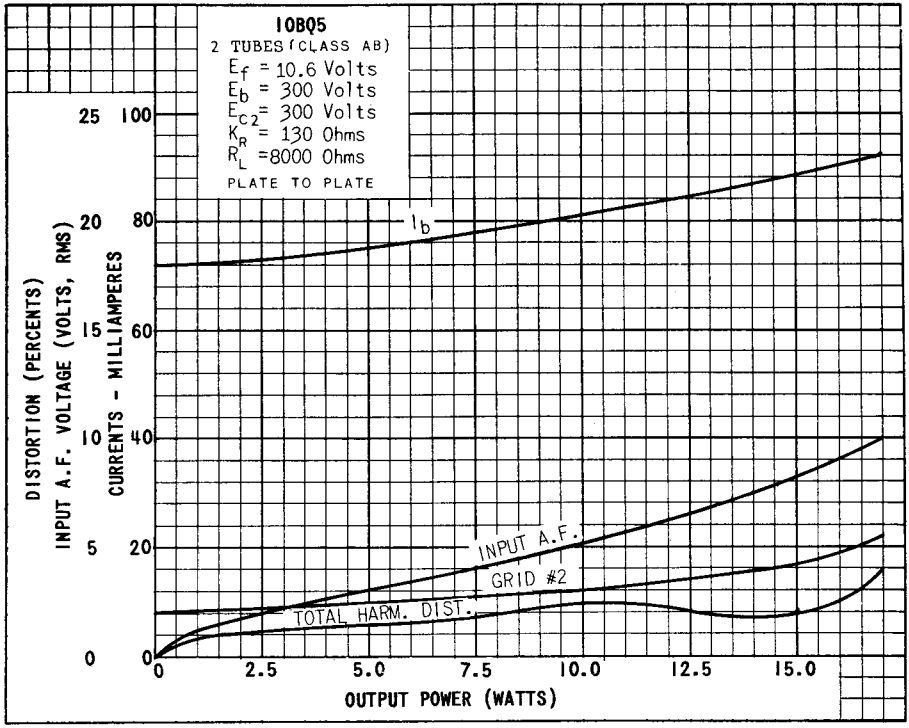
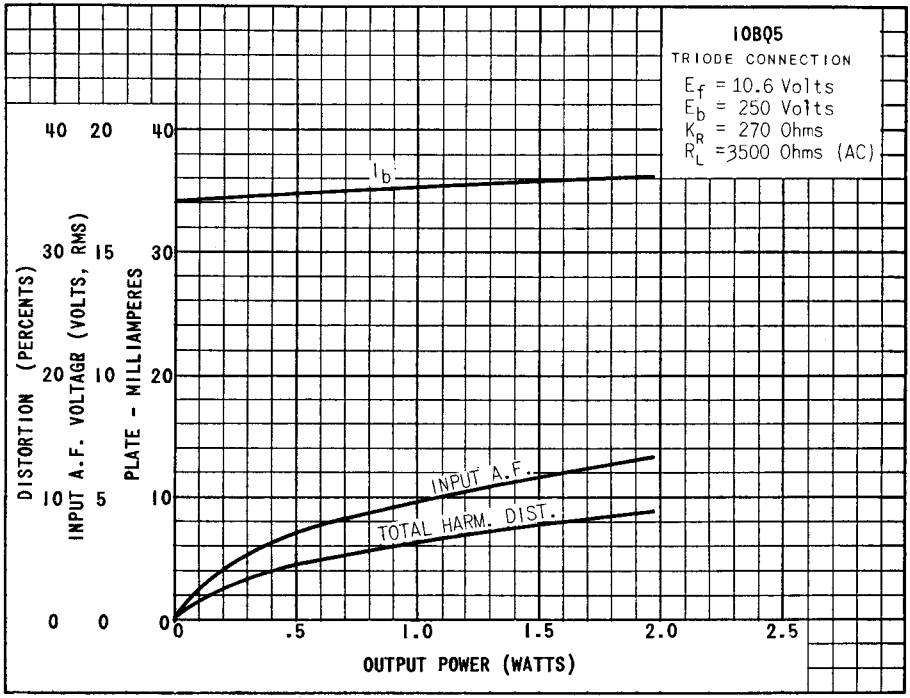
10BQ5


10BQ5
2 TUBES (CLASS B)
E_f = 10.6 Volts
E_b = 300 Volts
E_{c2} = 300 Volts
E_{c1} Bias = - 14.7 Volts
R_L = 8000 Ohms
PLATE TO PLATE
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENT - MILLIAMPERES
25
20
15
10
5
0
100
80
60
40
20
0
I_b
INPUT A.F.
TOTAL HARM. DIST
GRID #2
0
2.5
5.0
7.5
10.0
12.5
15.0
OUTPUT POWER (WATTS)


10BQ5
2 TUBES (CLASS AB)
E_f = 10.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
K_R = 130 Ohms
R_L = 8000 Ohms
PLATE TO PLATE.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
CURRENTS - MILLIAMPERES
20
15
10
5
0
80
60
40
20
0
I_b
INPUT A.F.
TOTAL HARM. DIST.
GRID #2
0
2.5
5.0
7.5
10.0
12.5
OUTPUT POWER (WATTS)





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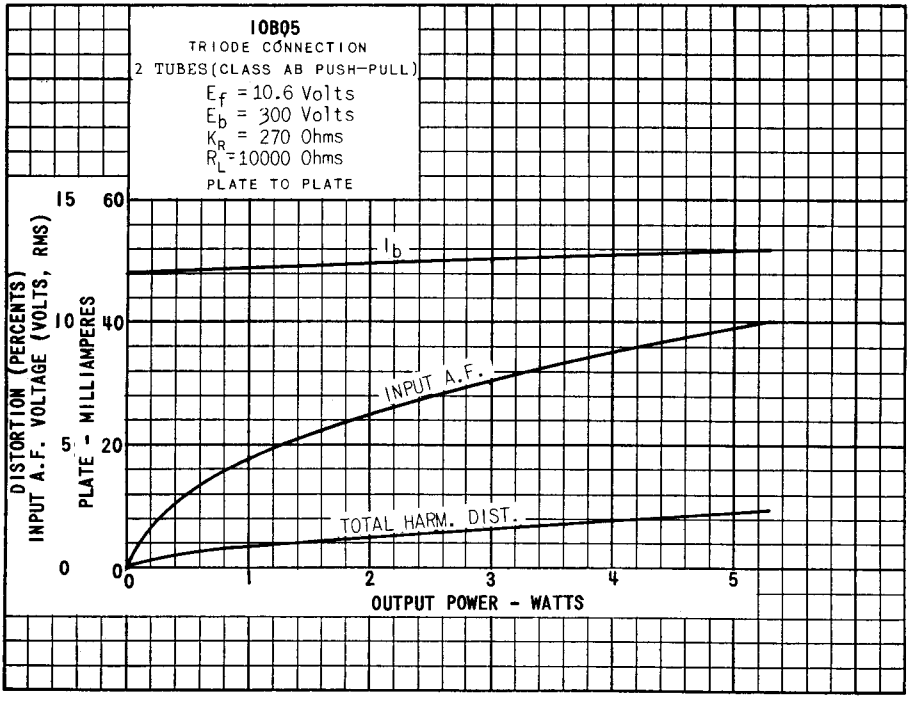
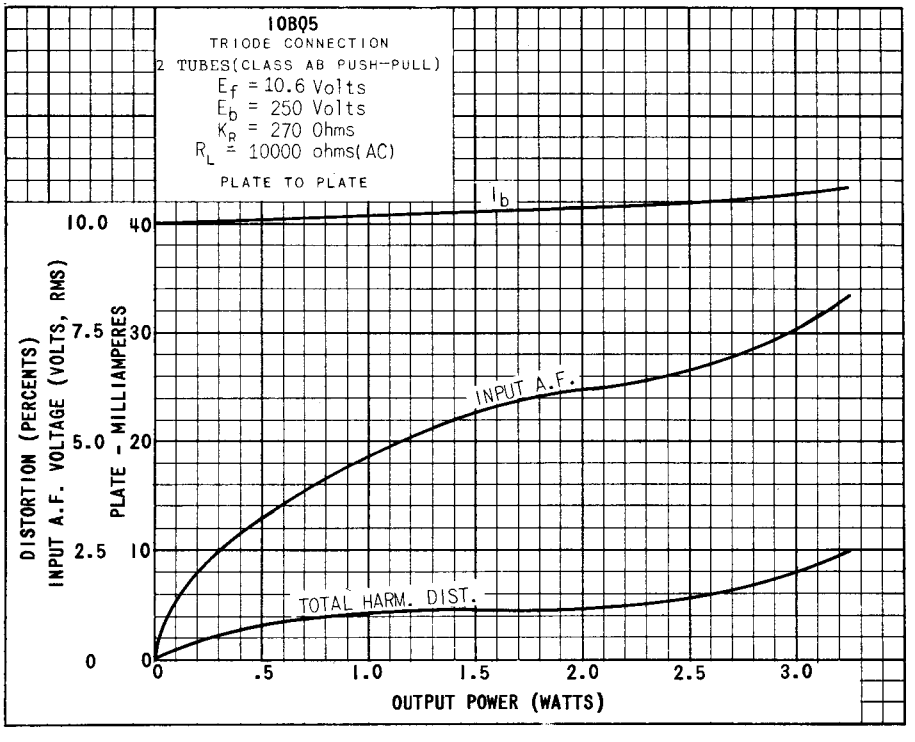
10BQ5

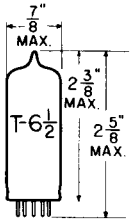

10BQ5
TRIODE CONNECTION
2 TUBES(CLASS AB PUSH-PULL)
E_f = 10.6 Volts
E_b = 300 Volts
K_R = 270 Ohms
R_L = 10000 Ohms
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER - WATTS
0
5
10
15
20
40
60
1
2
3
4


10BQ5
TRIODE CONNECTION
2 TUBES(CLASS AB PUSH-PULL)
E_f = 10.6 Volts
E_b = 250 Volts
K_R = 270 Ohms
R_L = 10000 ohms(AC)
PLATE TO PLATE
I_b
INPUT A.F.
TOTAL HARM. DIST.
DISTORTION (PERCENTS)
INPUT A.F. VOLTAGE (VOLTS, RMS)
PLATE - MILLIAMPERES
OUTPUT POWER (WATTS)
0
2.5
5.0
7.5
10.0
10
20
30
40
.5
1.0
1.5
2.0
2.5
3.0

TUNG-SOL

DOUBLE TRIODE

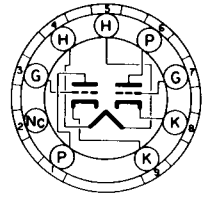
MINIATURE TYPE



COATED UNIPOTENTIAL CATHODE

HEATER
10.5 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9EF

THE 10DA7 IS A MINIATURE 9-PIN DOUBLE TRIODE WITH DISSIMILAR SECTIONS. ONE IS A MEDIUM-MU TRIODE INTENDED FOR VERTICAL OSCILLATOR SERVICE; THE OTHER IS A LOW-MU TRIODE WITH HIGH PLATE DISSIPATION FOR VERTICAL AMPLIFIER SERVICE. THE 10DA7, THEREFORE, COMBINES THE FUNCTION OF OSCILLATOR AND HIGH CURRENT OUTPUT AMPLIFIER FOR VERTICAL SWEEP OF LARGE 90° PICTURE TUBES.

DIRECT INTERELECTRODE CAPACITANCES

	SECTION #1	SECTION #2	
GRID TO PLATE: G_1 TO P	2.3	6.9	μμf
INPUT: G_1 TO K+H	2.0	5.5	μμf
OUTPUT: P TO K+H	0.415	0.82	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	10.5		VOLTS
MAXIMUM PLATE VOLTAGE	300	500	VOLTS
MAXIMUM PLATE VOLTAGE, PEAK POSITIVE PULSE*		1800	VOLTS
MAXIMUM CONTROL-GRID VOLTAGE, PEAK NEGATIVE PULSE*	-400	-400	VOLTS
MAXIMUM CONTROL-GRID VOLTAGE, NEG., DC	-50	-50	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	6.0	WATTS
MAXIMUM CATHODE CURRENT	20	40	MA.
MAXIMUM CONTROL-GRID CIRCUIT RESISTANCE SELF BIAS		2.2	MEGOHMS.
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[B]	200		VOLTS
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	SECTION #1	SECTION #2	
HEATER VOLTAGE		10.5	VOLTS
HEATER CURRENT		0.6	VOLTS
PLATE VOLTAGE	250	150	VOLTS
CONTROL-GRID VOLTAGE	-8	-17.5	VOLTS
PLATE RESISTANCE (APPROX.)	7700	1100	OHMS
TRANSCONDUCTANCE	2600	5700	μMHOS
AMPLIFICATION FACTOR	20	6.3	
PLATE CURRENT	9.0	40	MA.
CONTROL-GRID VOLTAGE (APPROX.) FOR Ib = 0.5 MA.		-42	VOLTS
CONTROL-GRID VOLTAGE (APPROX.) FOR gm = 30 μMHOS AND Ib = 50 μA	-16.5		VOLTS
ZERO BIAS PLATE CURRENT FOR Eb = 60 VOLTS		80	MA.

SIMILAR TYPE REFERENCE: *Except for heater ratings and heater warm-up time the 10AD7 is identical to the 6AD7.*

*FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

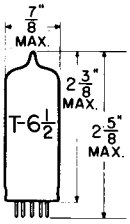
A HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B DC COMPONENT MUST NOT EXCEED 100 VOLTS MAX.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



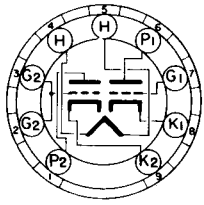
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

9.7 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9HF

THE 10DE7 IS A MINIATURE DOUBLE TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR HAVING MEDIUM MU AND SECTION #2 IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER WITH LOW MU. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 10DE7 IS IDENTICAL TO THE 13DE7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.0	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.52	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	9.7	9.7 ←	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500 ←	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
HEATER VOLTAGE		9.7 ←	VOLTS
HEATER CURRENT		0.6	AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	35	MA.
TRANSCONDUCTANCE	2000	6500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	925	
GRID VOLTAGE FOR Ib = 10 μA	-20	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec = -24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

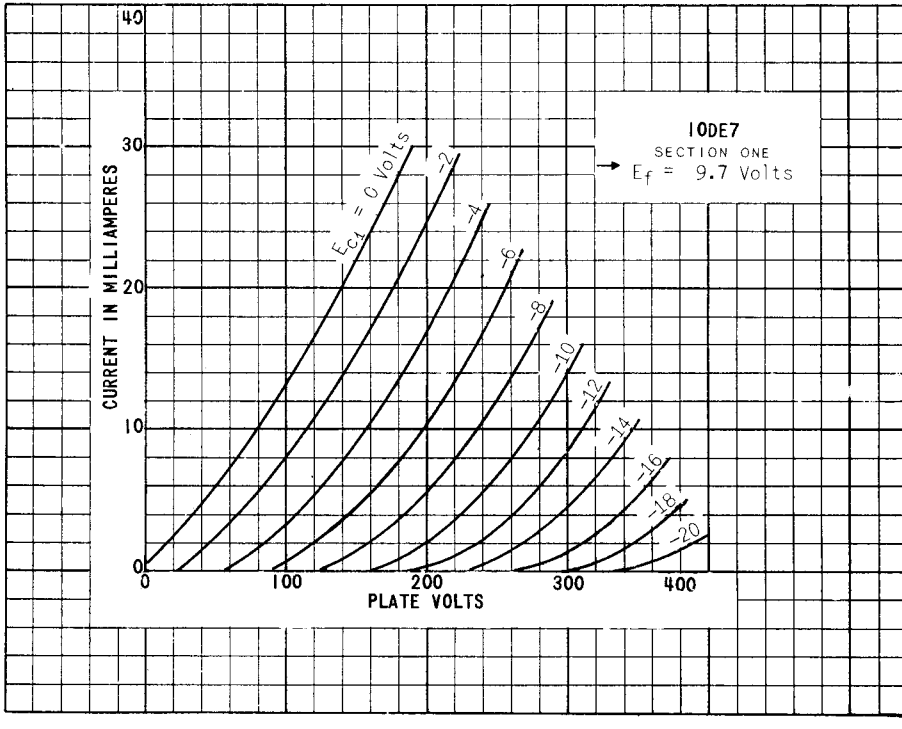
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

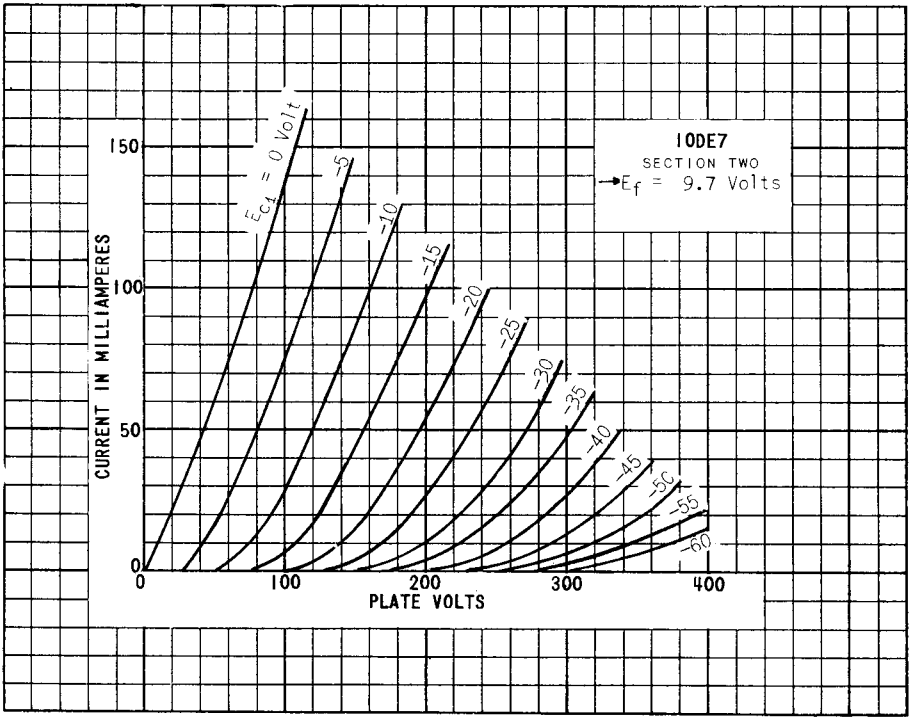
[B] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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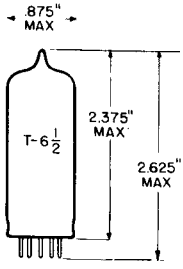
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



MINIATURE BUTTON 9 PIN BASE E9-1

OUTLINE DRAWING JEDEC 6-3

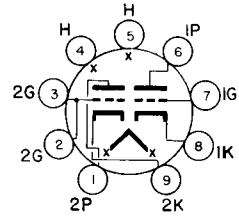
COATED UNIPOTENTIAL CATHODE

HEATER

9.7 VOLTS 600 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM JEDEC 9HF

THE 10DR7 IS A DOUBLE TRIODE WITH DISSIMILAR SECTION IN THE 9 PIN MINIATURE CONSTRUCTION. SECTION #1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION #2 HAS A LOW MU AND IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. SECTION #2 OF THE 10DR7 IS IDENTICAL TO SECTION #2 OF THE 6DE7. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.5	8.5	pf
INPUT: G TO (H+K)	2.2	5.5	pf
OUTPUT: P TO (H+K)	0.34	1.0	pf

RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
MAXIMUM HEATER–CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.0	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20	50	MA.
MAXIMUM PEAK CATHODE CURRENT	70	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)[D]	11.0		SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-17.5	VOLTS
PLATE CURRENT	1.4	35	MA.
TRANSCONDUCTANCE	1600	6500	μMHOS
AMPLIFICATION FACTOR	~~24~~ ←	6.0	
PLATE RESISTANCE (APPROX.)	40 000	925	
GRID VOLTAGE FOR Ib = 10 μA	5.5	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec = -24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

→ INDICATES A CHANGE.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

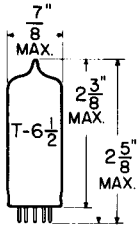
[D] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: Except for heater ratings, and heater warm-up time, the 10DR7 is identical to the 6DR7.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

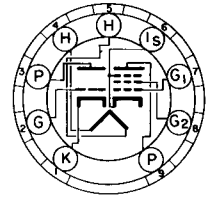


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
10.5 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DX

THE 10EB8 IS A HIGH-MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER WHILE THE PENTODE SECTION HAS A CONTROLLED PLATE KNEE CHARACTERISTIC AND IS DESIGNED FOR USE AS A VIDEO AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SO THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 10EB8 IS IDENTICAL TO THE 6EB8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION:		
GRID TO PLATE	4.4	μμf
INPUT: G TO (H + K)	2.4	μμf
OUTPUT: P TO(H + K)	0.36	μμf
PENTODE SECTION:		
GRID #1 TO PLATE (MAX.)	0.1	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$+I.S.)	11	μμf
OUTPUT: P TO ($H+K+G_2+G_3$+I.S.)	4.2	μμf
COUPLING:		
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	μμf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	μμf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	10.5	10.5	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		330	VOLTS
MAXIMUM GRID #2 VOLTAGE			
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION		1.1	WATTS

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME* (APPROX.)	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	10.5	10.5	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #1 VOLTAGE	-2		VOLTS
CATHODE BIAS RESISTOR		68	OHMS
PLATE CURRENT	2	25	MA.
GRID #2 CURRENT		7	MA.
TRANSCONDUCTANCE	2 700	12 500	μMHOS
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE (APPROX.)	37 000	75 000	OHMS
GRID #1 VOLTAGE FOR I_b= 100 μA (APPROX.)		-9	VOLTS
GRID #1 VOLTAGE FOR I_b= 20 A (APPROX.)	-5		

PLATE KNEE CHARACTERISTICS - INSTANTANEOUS VALUES

E_b = 45 VOLTS, E_{c2} = 125 VOLTS AND E_{c1} = 0 VOLTS

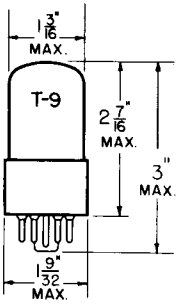
PLATE CURRENT	40	MA.
GRID #2 CURRENT	15	MA.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING RONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DOUBLE TRIODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

9.7 VOLTS 0.60 AMP.

ANY MOUNTING POSITION

BOTTOM VIEW

SHORT INTERMEDIATE SHELL

8 PIN BASE

8BD

THE 10EG7 IS A DISSIMILAR DOUBLE TRIODE INTENDED FOR USE IN TELEVISION RECEIVERS EMPLOYING SERIES STRING HEATERS. SECTION #1 IS DESIGNED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR; SECTION #2 IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SECT. #1	SECT. #2	
GRID TO PLATE	4.4	9.5	μμf
INPUT: G TO (H + K)	2.2	7.0	μμf
OUTPUT: P TO (H + K)	0.6	1.6	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[B]

	SECT. #1 OSCILLATOR		SECT. #2 AMPLIFIER	
HEATER VOLTAGE		9.7		VOLTS
MAXIMUM PLATE VOLTAGE	330		330	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---		1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400		250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5		10	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22		50	MA.
MAXIMUM PEAK CATHODE CURRENT	77		175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE;				
SELF BIAS	2.2		2.2	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC		100		VOLTS
TOTAL DC AND PEAK		200		VOLTS
HEATER WARM-UP TIME (APPROX.)*		11.0		SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	SECT. #1[D]	SECT. #2[D]	
HEATER VOLTAGE	9.7		VOLTS
HEATER CURRENT	0.60		AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	−11	−17.5	VOLTS
PLATE CURRENT	5.5	45	MA.
TRANSCONDUCTANCE	2000	7500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	800	OHMS
E_c FOR I_b = 10 μA (APPROX.)	−20	---	VOLTS
E_c FOR I_b = 100 μA (APPROX.)	---	−40	VOLTS
I_b AT E_c = −25 Vdc	---	8	MA.
I_b WITH E_b = 60 V AND E_c = 0V		95	MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

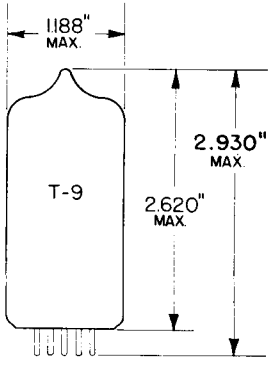
[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C]IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D]SECTION #1 CONNECTS TO PINS 4, 5, & 6. SECTION #2 CONNECTS TO PINS 1, 2, & 3.

TUNG-SOL

DOUBLE TRIODE



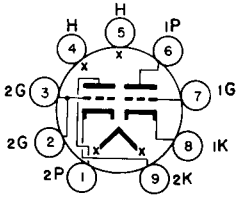
GLASS BULB
BASE E9-68
JEDEC OUTLINE 9-70

COATED UNIPOTENTIAL CATHODE

HEATER

9.7 VOLTS 0.60 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9HF

THE 10EW7 IS A DISSIMILAR DOUBLE TRIODE UTILIZING THE 9T9 BULB AND PIN CONFIGURATION. THE TUBE IS DESIGNED TO SERVE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 10EW7 IS IDENTICAL TO THE 6EW7.

THE 9T9 DESIGN UTILIZES A T-9 (1 1/8" DIA.)BULB BASED TO FIT MOST STANDARD 9 PIN MINIATURE SOCKETS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SECT #1	SECT. 2	
GRID TO PLATE	4.2	9.0	μμf
INPUT: G TO (H+K)	2.2	7.0	μμf
OUTPUT: P TO (H+K)	0.4	1.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER [C]

	SECT. #1 OSCILLATOR [D]	SECT. #2 AMPLIFIER [D]	
HEATER VOLTAGE	9.7		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION [E]	1.5	10	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
SELF BIAS	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

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RATINGS - CONT'D.
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[C]

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

AVERAGE CHARACTERISTICS

	SECT. #1[D]	SECT. #2[D]	
HEATER VOLTAGE		9.7	VOLTS
HEATER CURRENT[A]		0.60	AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	45	MA.
TRANSCONDUCTANCE	2000	7500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	800	OHMS
E_c FOR I_b = 10 μA (APPROX.)	-20	---	VOLTS
E_c FOR I_b = 100 μA (APPROX.)	---	-40	VOLTS
I_b AT E_c =-25 VDC	---	8	MA.
I_b WITH E_b =60 V AND E_c=0 V (INSTANTANEOUS VALUES)		95	MA.

[A] FOR SERIES HEATER OPERATION, EQUIPMENT SHOULD BE SO DESIGNED SO THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[D] SECTION #1 CONNECTS TO PINS 6, 7 AND 8. SECTION #2 CONNECTS TO PINS 1, 2, 3 AND 9.

[E] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 5 PIN BASE

THE 10FP4 IS A GLASS ENVELOPE MAGNETIC DEFLECTION AND MAGNETIC FOCUS DIRECT-VIEW PICTURE TUBE INTENDED FOR USE IN TELEVISION RECEIVERS. IT PROVIDES FOR A PICTURE 6" X 8". A REFLECTIVE METAL-BACKED SCREEN PREVENTS ION-SPOT BLEMISH AND GIVES IMPROVED PICTURE CONTRAST. AN EXTERNAL CONDUCTIVE COATING, WHEN GROUNDED, SERVES AS A HIGH VOLTAGE FILTER CAPACITOR.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	54 DEGREES
COATING	CONDUCTIVE
ANODE TERMINAL	RECESSED SMALL CAVITY CAP
RASTER SIZE	6" X 8"

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO ALL OTHER ELECTRODES	6	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE	500 – 2 500	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	11 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)	110	MA.
SPOT CENTERING	16	MM.

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PLATE 2555
JAN. 1 1951

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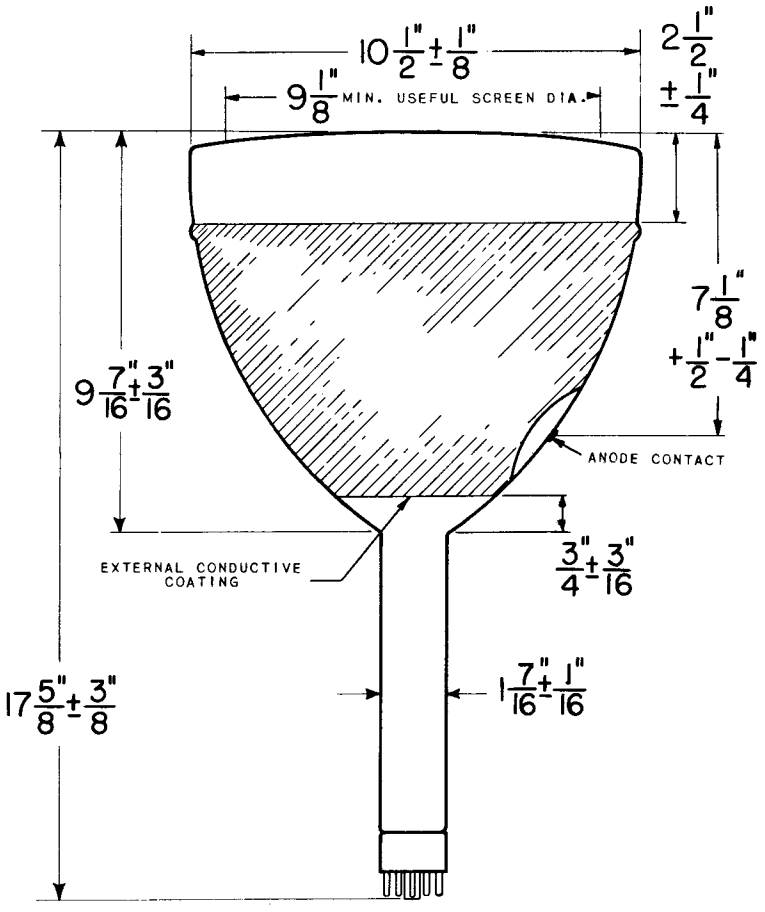
TENTATIVE DATA

TUNG-SOL



1. HEATER
2. GRID NO. 1
10. GRID NO. 2
11. CATHODE
12. HEATER
CAP ANODE

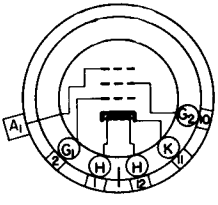


PLATE 2556
JAN. 1 1951

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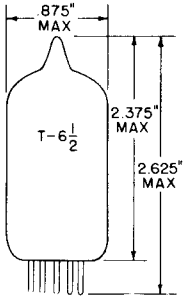
TRIODE PENTODE

MINIATURE TYPE



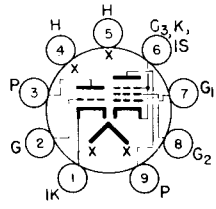
GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR

VIDEO AMPLIFIER SERVICE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 10GN8 IS A HIGH MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER OR SYNC-SEPARATOR. THE PENTODE SECTION IS DESIGNED FOR VIDEO AMPLIFIER SERVICE FEATURING A CONTROLLED PLATE KNEE CHARACTERISTIC. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 10GN8 IS IDENTICAL TO THE 6GN8 AND THE 8GN8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION		
GRID TO PLATE	4.4	pf
INPUT: G TO (H+K)	2.4	pf
OUTPUT: P TO (H+K)	0.36	pf
PENTODE SECTION		
GRID #1 TO PLATE (MAX)	0.1	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	11	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	4.2	pf
COUPLING		
TRIODE GRID TO PENTODE PLATE (MAX.)	.018	pf
PENTODE GRID #1 TO TRIODE PLATE (MAX.)	.005	pf
PENTODE PLATE TO TRIODE PLATE (MAX.)	0.17	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES -- SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	10.5	VOLTS	450	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION (AC OR DC)			450 ± 25	MA.
MAXIMUM HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID #2 SUPPLY VOLTAGE		330	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART		
POSITIVE GRID #1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	1.0	5.0	WATTS
GRID #2 DISSIPATION		1.1	WATTS
GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	250	200	VOLTS
GRID #2 VOLTAGE		150	VOLTS
GRID #1 VOLTAGE	−2		VOLTS
CATHODE BIAS RESISTOR		100	OHMS
PLATE CURRENT	2	25	MA.
GRID #2 CURRENT		5.5	MA.
TRANSCONDUCTANCE	2700	11500	μMHOS
AMPLIFICATION FACTOR	100		
PLATE RESISTANCE	37000	60000	OHMS
E_{c1} FOR I_b = 100 μA (APPROX.)		−10	VOLTS
E_{c1} FOR I_b = 20 μA (APPROX.)	−5		VOLTS

INSTANTANEOUS PLATE KNEE CHARACTERISTICS

PENTODE SECTION

E_b = 60 VOLTS, E_{c2} = 150 VOLTS AND E_{c1} = 0 VOLTS
I_b = 55 MA AND I_{c2} = 18 MA.

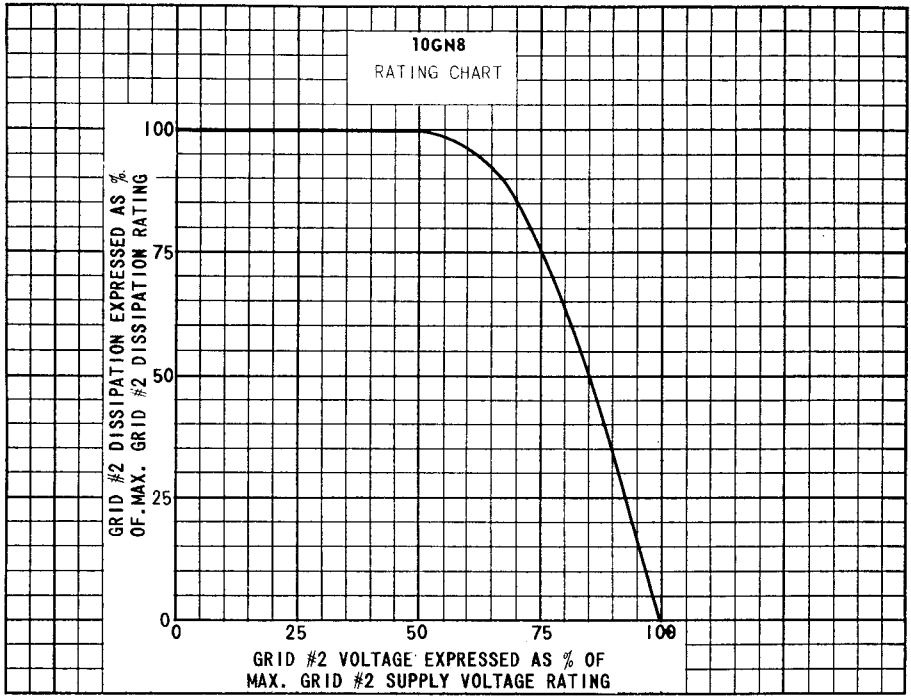
TUNG-SOL

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING FOUR (4) TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO THREE (3) TIMES RATED HEATER VOLTAGE DIVIDED BY RATED HEATER CURRENT.

A. DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS.

THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDD ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS.

THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.



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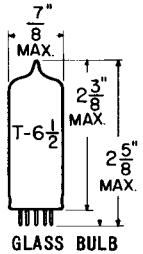
TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

SMALL-BUTTON NOVAL
9 PIN BASE E9-1

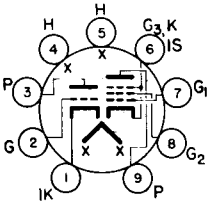
UNIPOTENTIAL CATHODE

HEATER

10.5 VOLTS 0.45±.03 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DX

THE 10HF8 IS A HIGH-MU TRIODE AND A SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN COLOR AND BLACK-AND-WHITE TELEVISION RECEIVERS.
THE PENTODE UNIT IS ESPECIALLY USEFUL AS A VIDEO OUTPUT AMPLIFIER AND THE TRIODE UNIT IS USEFUL IN VOLTAGE-AMPLIFIER APPLICATIONS SUCH AS SYNC-SEPARATOR, SYNC-CLIPPER AND PHASE-INVERTER CIRCUITS.
EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 10HF8 IS IDENTICAL TO THE 6HF8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE UNIT:		
GRID TO PLATE	3.5	pf
GRID TO TRIODE CATHODE, PK,G3,I.S. & H.	2.8	pf
PLATE TO TRIODE CATHODE, PK,G3,I.S. & H.	2.6	pf
PENTODE UNIT:		
GRID #1 TO PLATE (MAX.)	0.1	pf
GRID #1 TO K,I.S.,G3,G2 &H	10	pf
PLATE TO K, I.S., G3, G2 & H.	4.2	pf
TRIODE GRID TO PENTODE PLATE (MAX.)	0.015	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT	PENTODE UNIT	
HEATER VOLTAGE	10.5		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	---	SEE INPUT RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:			
POSITIVE-BIAS VALUE	0	0	VOLTS

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

	TRIODE UNIT		PENTODE UNIT	
MAXIMUM PLATE DISSIPATION	1		5	WATTS
MAXIMUM GRID #2 INPUT				
FOR GRID #2 VOLTAGES UP TO 165 V.	---		1.1	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS		SEE RATING	INPUT CHART	
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]		200[A]	VOLTS
HEATER WARM-UP TIME (AVERAGE)		11		SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

CHARACTERISTICS

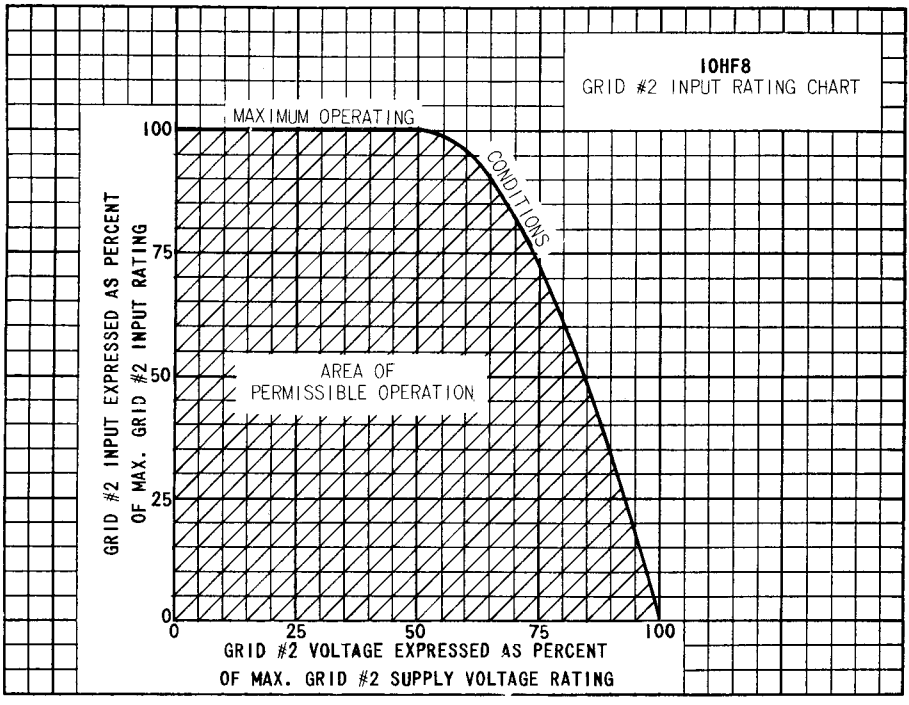
CLASS A_1 AMPLIFIER

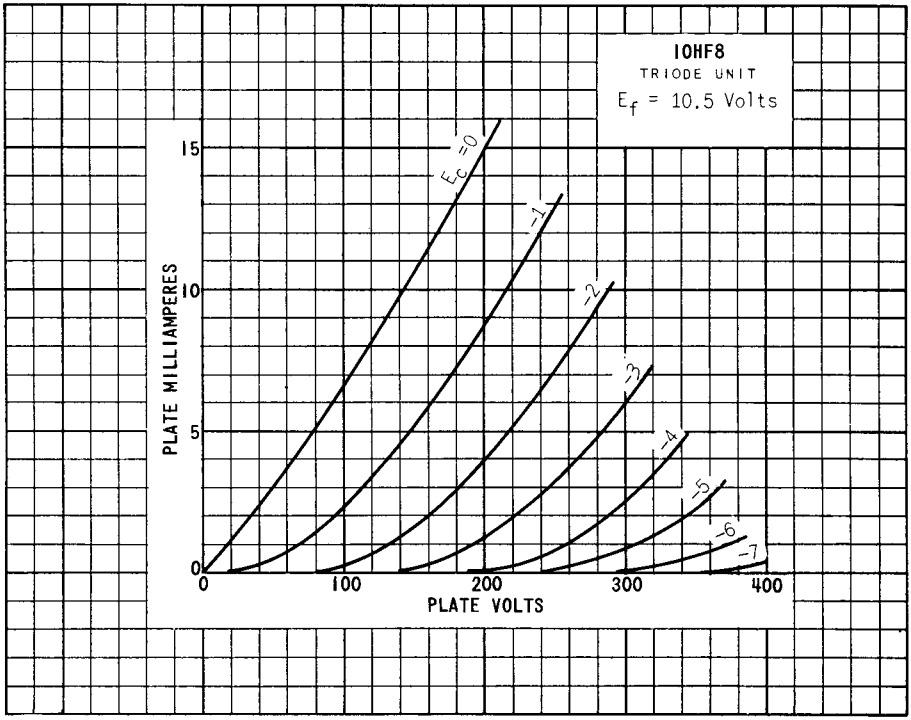
	TRIODE UNIT	PENTODE UNIT		
PLATE-SUPPLY VOLTAGE	200	45	200	VOLTS
GRID #2 SUPPLY VOLTAGE	---	125	125	VOLTS
GRID #1 VOLTAGE	-2	0	---	VOLTS
CATHODE RESISTOR	---	---	68	OHMS
AMPLIFICATION FACTOR	70	---	---	
PLATE RESISTANCE (APPROX.)	17500	---	75000	OHMS
TRANSCONDUCTANCE	4000	---	12500	μMHOS
PLATE CURRENT	4	40[B]	25	MA.
GRID #2 CURRENT	---	15[B]	7	MA.
GRID #1 VOLTAGE (APPROX.)				
FOR PLATE CURRENT OF 100 μA	---	---	-9	VOLTS
GRID #1 VOLTAGE (APPROX.)				
FOR PLATE CURRENT OF 20 μA	-6	---	---	VOLTS

MAXIMUM CIRCUIT VALUES

	TRIODE UNIT	PENTODE UNIT	
GRID #1 CIRCUIT RESISTANCE:			
FOR CATHODE-BIAS OPERATION (MAX.)	1.0	1.0	MEGOHM
FOR FIXED-BIAS OPERATION (MAX.)	0.5	0.25	MEGOHM

[B] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVEFORM SUCH THAT PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.





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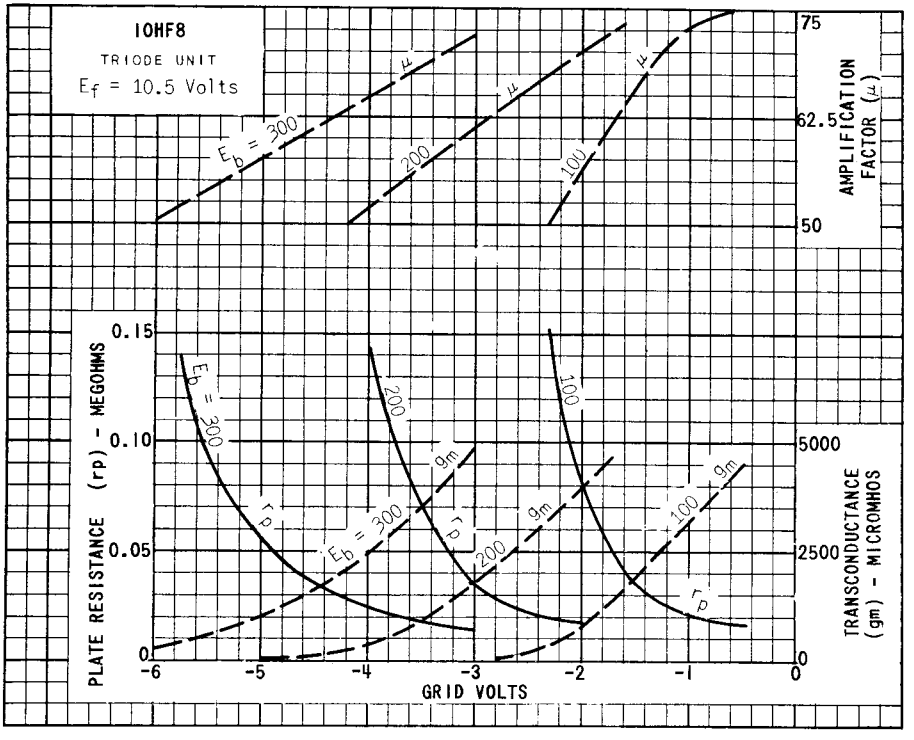
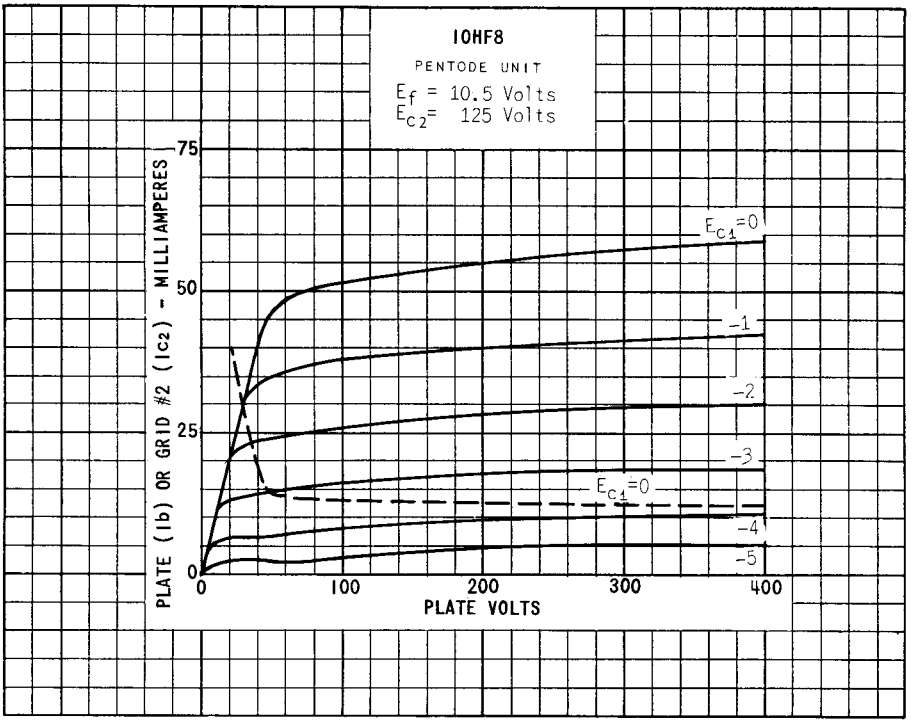
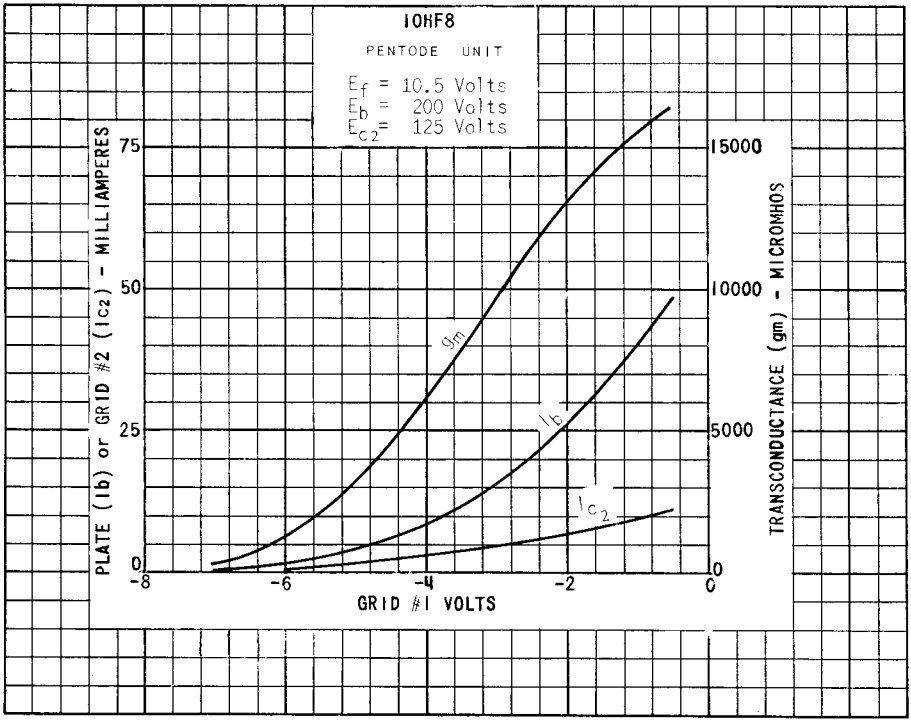

10HF8
TRIODE UNIT
E_f = 10.5 Volts
E_b = 300
200
100
μ
75
62.5
50
AMPLIFICATION FACTOR (μ)
0.15
0.10
0.05
0
PLATE RESISTANCE (rp) - MEGOHMS
r_p
gm
5000
2500
0
TRANSCONDUCTANCE (gm) - MICROMHOS
-6
-5
-4
-3
-2
-1
0
GRID VOLTS


10HF8
PENTODE UNIT
E_f = 10.5 Volts
E_{c2}= 125 Volts
75
50
25
0
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
E_{c1}=0
-1
-2
-3
-4
-5
0
100
200
300
400
PLATE VOLTS



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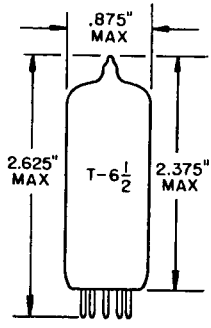
TRIODE - PENTODE

MINIATURE TYPE

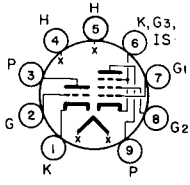


GLASS BULB
SMALL BUTTON 9 PIN
BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

FOR COLOR
AND BLACK-AND-WHITE
T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DX

THE 10JA8 IS A HIGH-MU TRIODE AND A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE UNIT IS DESIGNED FOR SERVICE AS A SYNC SEPARATOR, SYNC CLIPPER AND PHASE INVERTER WHILE THE PENTODE UNIT IS DESIGNED FOR OPERATION AS A VIDEO AMPLIFIER. EXCEPT FOR HEATER RATINGS AND CHARACTERISTICS THE 10JA8 IS IDENTICAL TO THE 6JA8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

		TRIODE UNIT	PENTODE UNIT	
GRID 1 TO PLATE		4.6	MAX. 0.1	pf
INPUT		2.6	11	pf
OUTPUT		2.6	4.4	pf
COUPLING:				
PENTODE GRID1 TO TRIODE PLATE	MAX.	0.005		pf
PENTODE PLATE TO TRIODE GRID	MAX.	0.018		pf
PENTODE PLATE TO TRIODE PLATE	MAX.	0.17		pf

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES -SEE EIA STANDARD RS-239

AVERAGE CHARACTERICTICS	10.5 VOLTS	450	MA.
HEATER WARM-UP TIME	APPROX.	11	SECONDS
LIMITS OF SUPPLIED CURRENT	450 ± 30		MA.

	TRIODE UNIT	PENTODE UNIT	
HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS

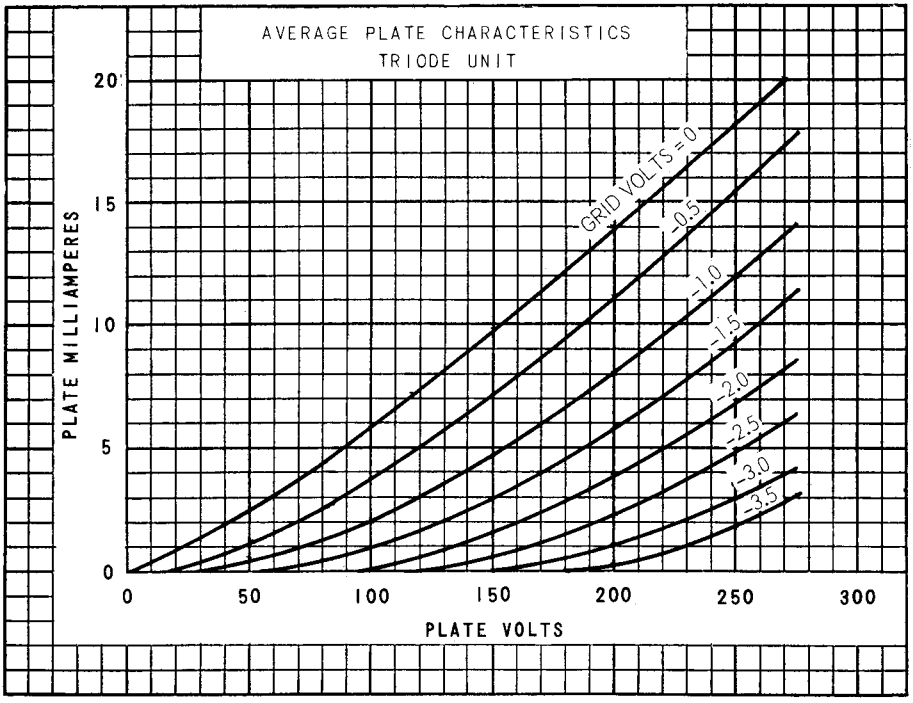
MAXIMUM RATINGS

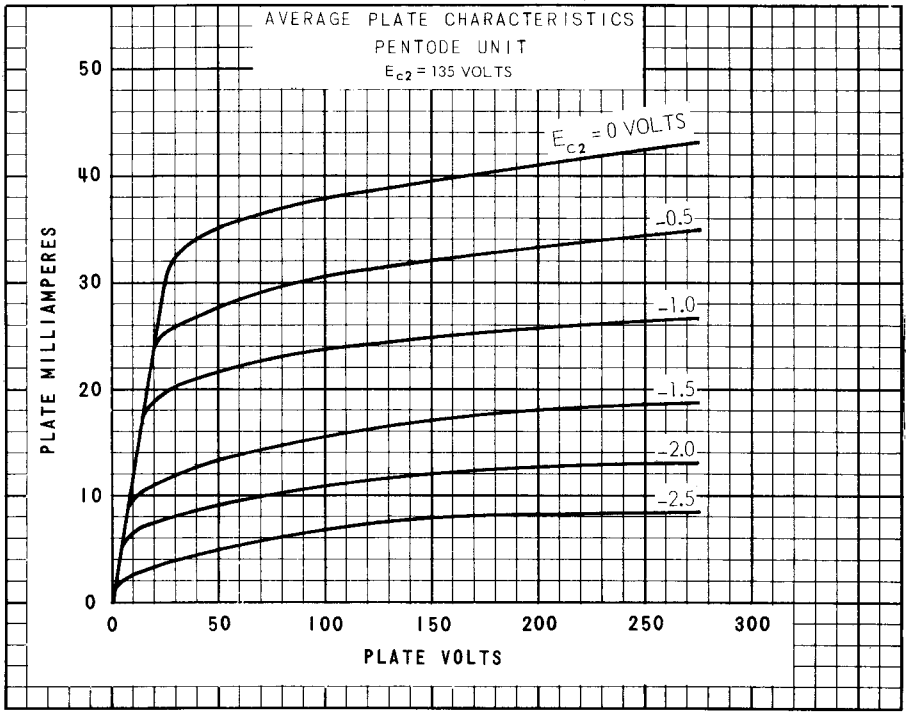
DESIGN MAXIMUM RATINGS-SEE EIA STANDARD RS-239

	TRIODE UNIT	PENTODE UNIT	
PLATE VOLTAGE	300	300	VOLTS
GRID2 SUPPLY VOLTAGE	-	330	VOLTS
GRID2 VOLTAGE		SEE RATING CHART	
PLATE DISSIPATION	1	5	WATTS
GRID 2 DISSIPATION	-	1.5	WATTS
POSITIVE GRID 1 BIAS VOLTAGE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE RESISTOR BIAS	1.0	1.0	MEGOHM

CHARACTERISTICS AND TYPICAL OPERATION

TRIODE UNIT:				
PLATE VOLTAGE		135	200	VOLTS
GRID VOLTAGE		-2	-2	VOLTS
PLATE CURRENT		1	3.5	MA.
TRANSCONDUCTANCE		1,550	3,700	μMHOS
AMPLIFICATION FACTOR		60	70	
PLATE RESISTANCE		39,000	19,000	OHMS
GRID 1 VOLTAGE FOR I_b = 10 μA		-4.8	-7	VOLTS
PENTODE UNIT:				
PLATE VOLTAGE	30	135	200	VOLTS
GRID 2 VOLTAGE	135	135	135	VOLTS
GRID1 VOLTAGE	0	-1.5	-1.5	VOLTS
PLATE CURRENT	32	17	18	MA.
GRID 2 CURRENT	14	4.2	4	MA.
TRANCONDUCTANCE	-	12,600	14,000	μMHOS
PLATE RESISTANCE	-	66,000	70,000	OHMS
GRID 1 VOLTAGE FOR I_b = 10 μA	-	-5	-5	VOLTS





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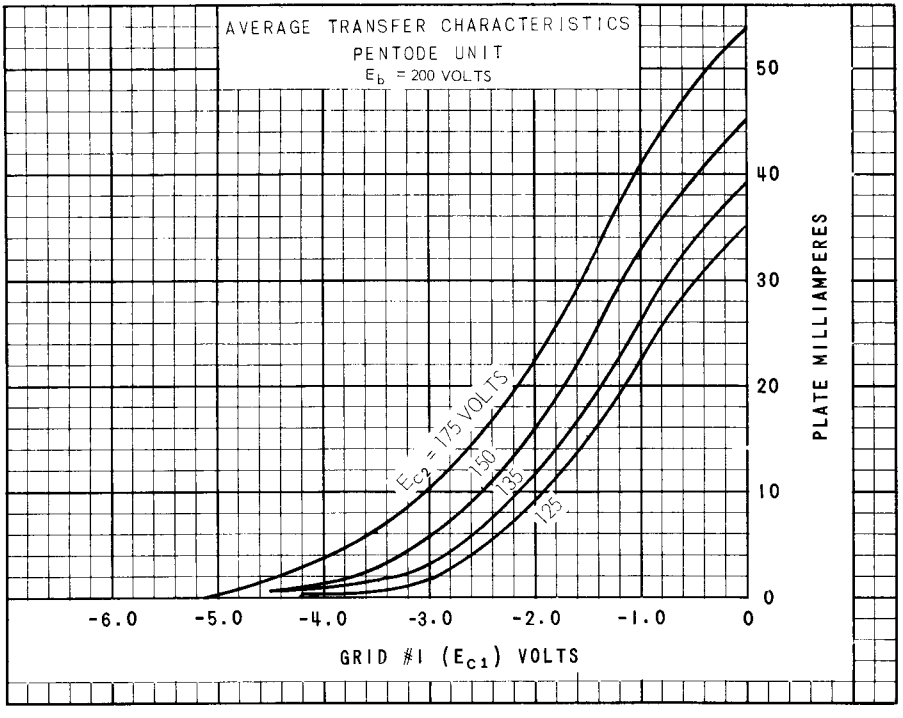
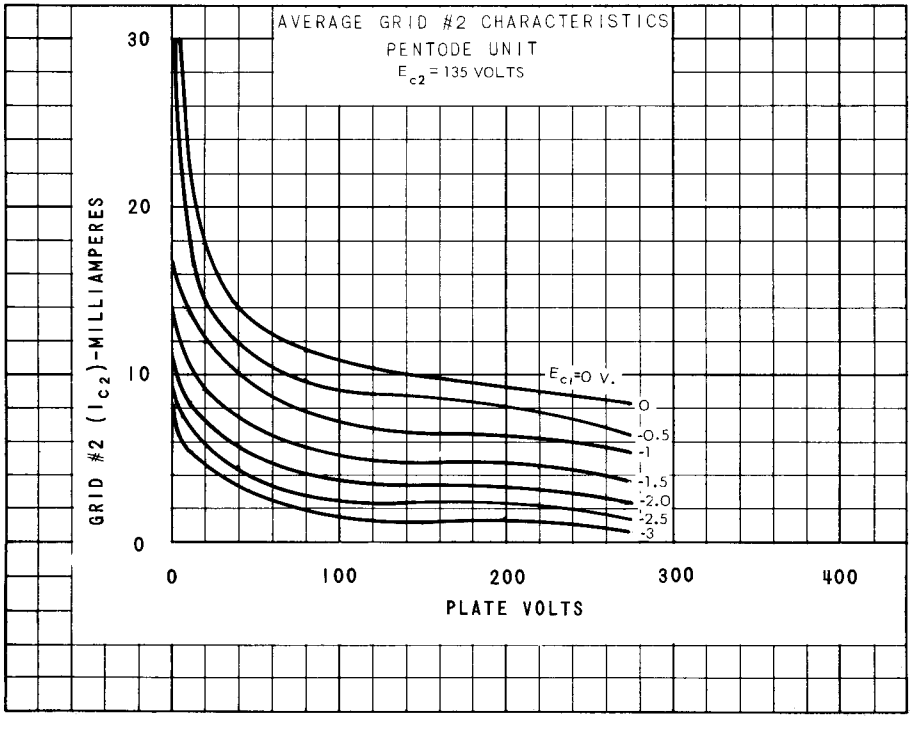
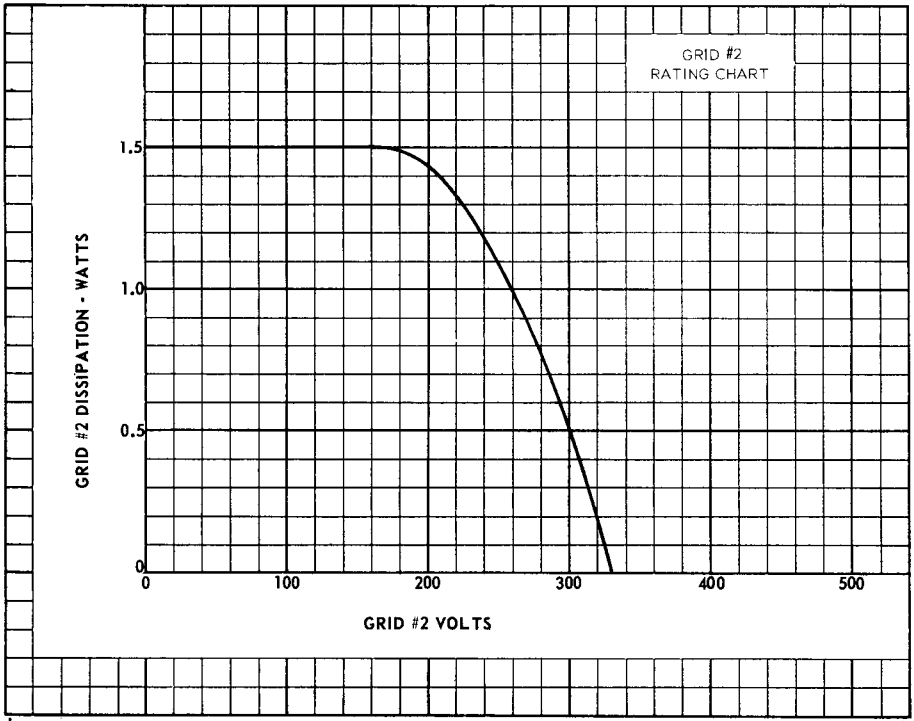

AVERAGE TRANSFER CHARACTERISTICS
PENTODE UNIT
E_b = 200 VOLTS
50
40
30
20
10
0
PLATE MILLIAMPERES
E_{c2} = 175 VOLTS
150
135
125
-6.0
-5.0
-4.0
-3.0
-2.0
-1.0
0
GRID #1 (E_{c1}) VOLTS


AVERAGE GRID #2 CHARACTERISTICS
PENTODE UNIT
E_{c2} = 135 VOLTS
30
20
10
0
GRID #2 (I_{c2})-MILLIAMPERES
E_{c1}=0 V.
0
-0.5
-1
-1.5
-2.0
-2.5
-3
0
100
200
300
400
PLATE VOLTS



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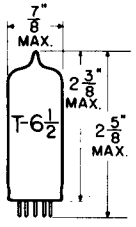
DOUBLE TRIODE

MINIATURE TYPE

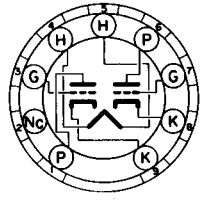


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
11.0 VOLTS 0.45±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

9EF

THE 11CY7 IS A DISSIMILAR DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS A COMBINED VERTICAL-DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.®

	SEC. 1	SEC. 2	
GRID TO PLATE	1.8	4.4	μμf
INPUT	1.5	5.0	μμf
OUTPUT	0.30	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	VERTICAL-[B] OSCILLATOR SERVICE (SEC. 1)	VERTICAL-[B] DEFLECTION AMPLIFIER (SEC. 2)	
HEATER VOLTAGE	11.0	11.0	VOLTS
MAXIMUM DC PLATE VOLTAGE	350	350	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1 800	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	5.5[A]	WATTS
MAXIMUM DC CATHODE CURRENT	---	35	MA.
MAXIMUM DC PEAK CATHODE CURRENT	---	120	MA.
MAXIMUM HEATER CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE			
WITH FIXED BIAS	2.2	---	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
HEATER VOLTAGE	11.0	11.0	11.0	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE VOLTAGE	250	60	150	VOLTS
GRID VOLTAGE	-3.0	0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	620	OHMS
AMPLIFICATION FACTOR	68	---	5.0	
PLATE RESISTANCE (APPROX.)	52 000	---	920	OHMS
TRANSCONDUCTANCE	1 300	---	5 400	μMHOS
PLATE CURRENT	1.2	80	30	MA.
PLATE CURRENT (APPROX.) E_c=-30V.	---	---	3.5	MA.
GRID VOLTAGE (APPROX.) I_b=200 μA.	---	---	-40	VOLTS
GRID VOLTAGE (APPROX.) I_b=10 μA.	-5.5	---	---	VOLTS

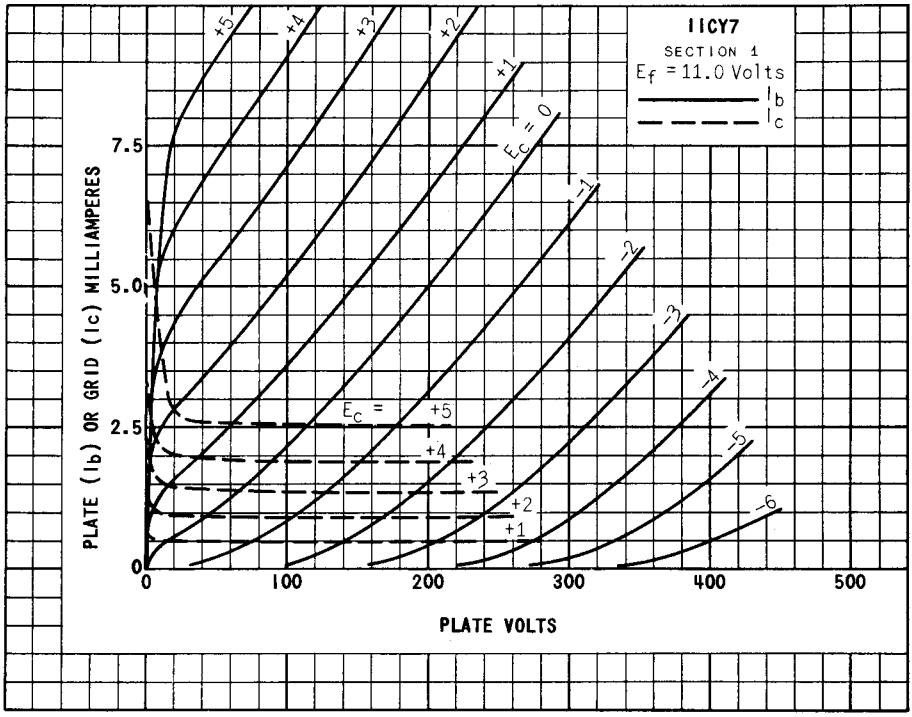
⊕ WITHOUT EXTERNAL SHIELD.

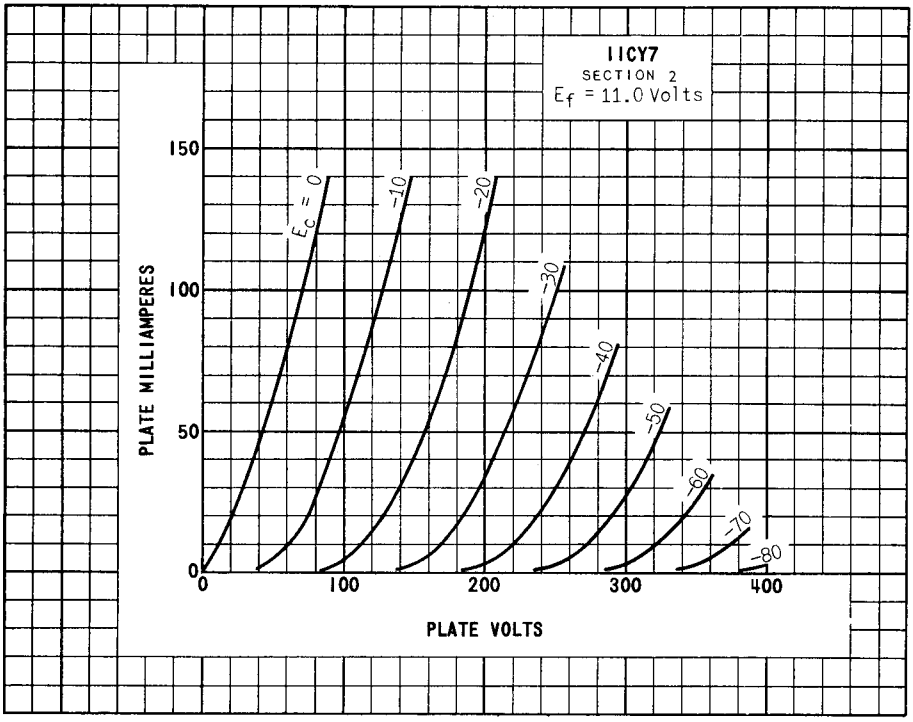
A IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

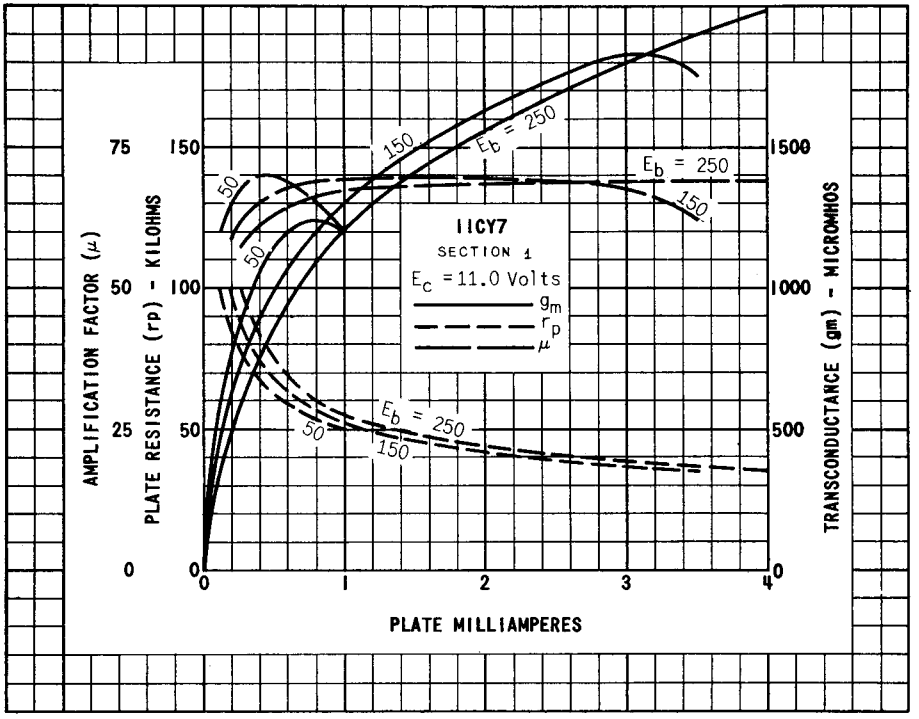
B FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

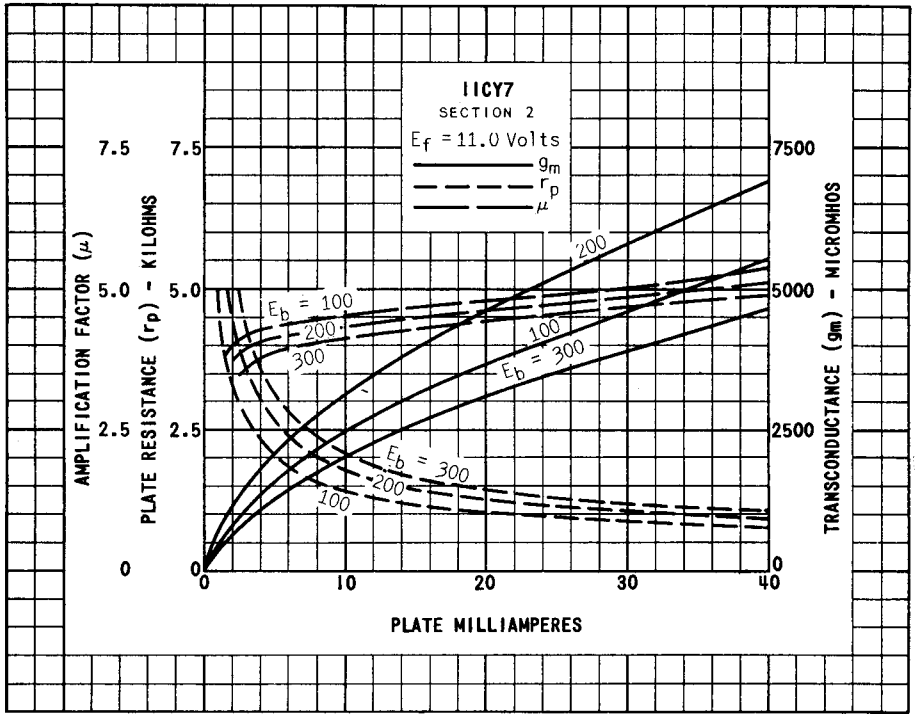
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

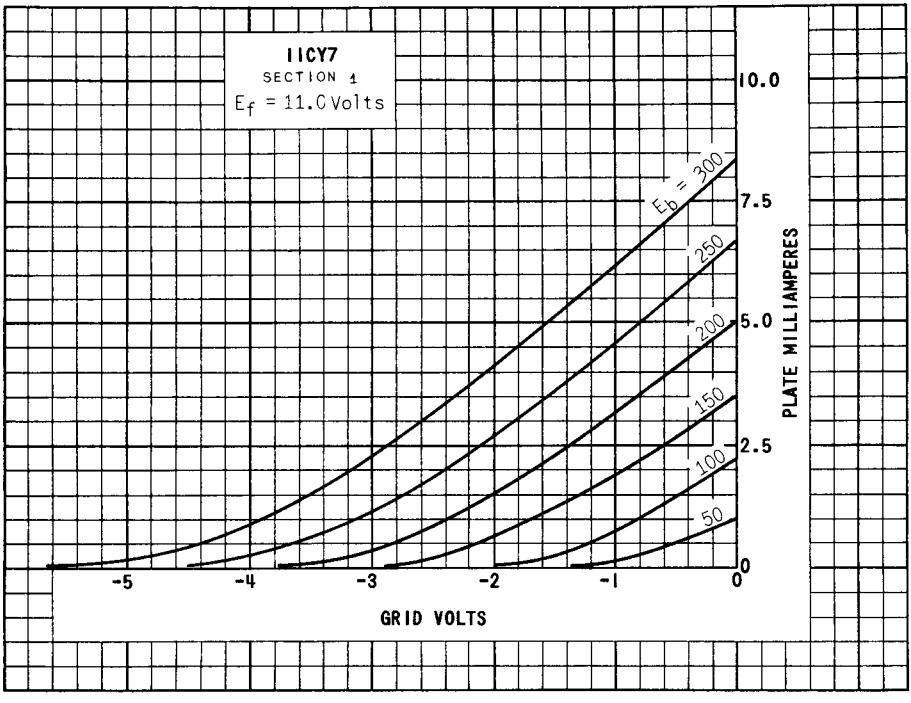
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

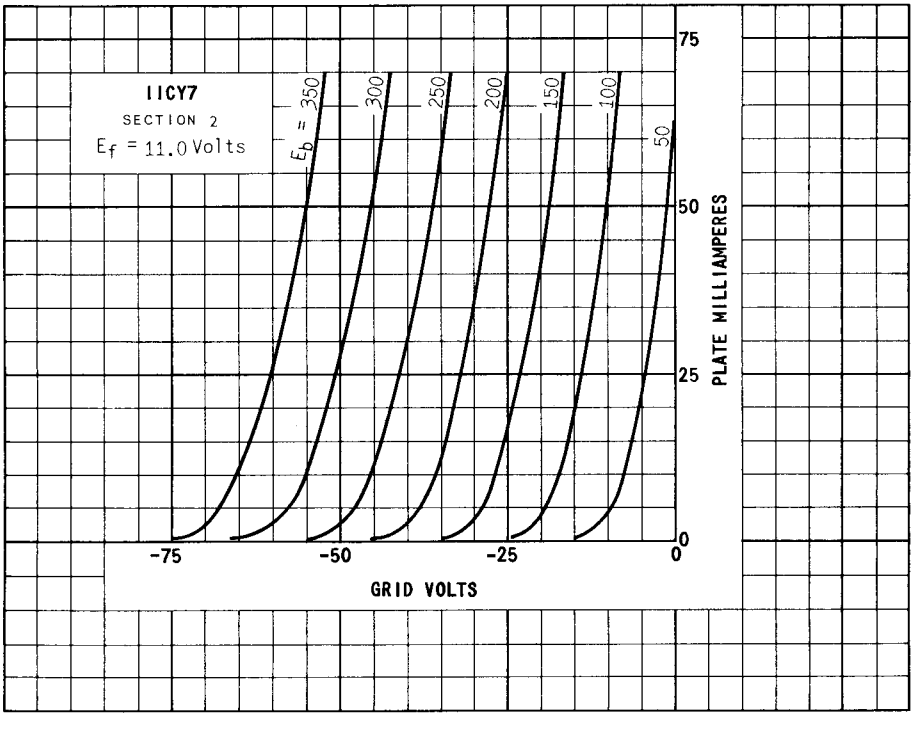

11CY7
SECTION 1
Ef = 11.0 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
0
2.5
5.0
7.5
0
100
200
300
400
500
+5
+4
+3
+2
+1
Ec = 0
-1
-2
-3
-4
-5
-6
Ec =
+5
+4
+3
+2
+1


11CY7
SECTION 2
Ef = 11.0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
50
100
150
0
100
200
300
400
Ec = 0
-10
-20
-30
-40
-50
-60
-70
-80


11CY7
SECTION 1
E_c = 11.0 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
E_b = 250
150
50
0
1
2
3
4
75
50
25
0
150
100
50
1500
1000
500


11CY7
SECTION 2
E_f = 11.0 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
E_b = 100
200
300
0
10
20
30
40
7.5
5.0
2.5
0
7500
5000
2500





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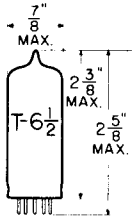
TRIODE

MINIATURE TYPE



GLASS BULB

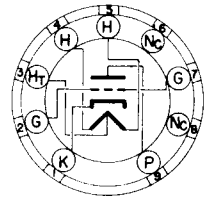
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 6.3 VOLTS
300 MA. 600 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9AG

THE 12A4 IS A HIGH PERVEANCE, MEDIUM-MU TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN TELEVISION RECEIVERS AND OTHER APPLICATIONS WHERE HIGH PEAK CURRENT MUST BE DEVELOPED WITH A LOW VOLTAGE POWER SUPPLY. THE HIGH PERVEANCE IS SUCH AS TO MAKE IT SUITABLE FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING LARGE DEFLECTION ANGLES AND HAVING LOW PLATE SUPPLY POTENTIALS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #315

GRID TO PLATE: (G TO P)	4.9	μμf
INPUT: G TO (H+K)	6.7	μμf
OUTPUT: P TO (H+K)	3.8	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	CLASS A AMPLIFIER	VERTICAL[A] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	12.6 6.3	12.6 6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	180	180	VOLTS
MAXIMUM DC PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE[BC]	----	1000	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	-50	-50	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE[A]	----	-100	VOLTS
MAXIMUM PLATE DISSIPATION[B]	6.5	6.5	WATTS
MAXIMUM CATHODE CURRENT	40	30	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)[B]	2.5	2.5	MEGOHMS
MAXIMUM GRID CIRCUIT RESISTANCE (FIXED BIAS)[B]	1.2	1.2	MEGOHMS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS" FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 16% OF ONE SCANNING CYCLE OR APPROXIMATELY 2.5 MILLISECONDS.

[B] THESE RATINGS ARE ON THE ABSOLUTE MAXIMUM SYSTEM! ABSOLUTE MAXIMUM RATINGS ARE THE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED FROM THE VIEWPOINT OF LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS, THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED UNDER ANY USUAL CONDITION OF LINE VOLTAGE VARIATION, MANUFACTURING VARIATIONS (INCLUDING COMPONENTS) IN THE EQUIPMENT ITSELF, OR ADJUSTMENTS OF CONTROLS.

[C] THE PEAKING RESISTOR INCORPORATED IN THE OSCILLATOR DISCHARGE CIRCUIT SHOULD BE CHOSEN SO THAT THIS RATING IS NOT EXCEEDED UNDER ANY CONDITION.

CONTINUED ON FOLLOWING PAGE

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PLATE 2529
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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	6.3	VOLTS
HEATER CURRENT	300	600	MA.
PLATE VOLTAGE	250		VOLTS
GRID VOLTAGE	−9		VOLTS
PLATE CURRENT	21		MA.
TRANSCONDUCTANCE	7800		µMHOS
AMPLIFICATION FACTOR	20		
GRID VOLTAGE (APPROX.) FOR I_b = 50 µA. AT E_b = 500	−33		VOLTS

VERTICAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	12.6	6.3	VOLTS
HEATER CURRENT	300	600	MA.
DC PLATE VOLTAGE	250		VOLTS
GRID INPUT VOLTAGE (APPROX.)			
PEAK-TO-PEAK SAWTOOTH COMPONENT	25		VOLTS
NEGATIVE PEAKING COMPONENT	30		VOLTS
DC PLATE CURRENT	15		MA.
PLATE OUTPUT VOLTAGE:			
PEAK POSITIVE PULSE COMPONENT	450		VOLTS
PEAK-TO-PEAK SAWTOOTH COMPONENT	220		VOLTS
PEAK-TO PEAK SAWTOOTH CURRENT IN YOKE (50 MILLIHENRY INDUCTANCE)	360		MA.
CATHODE BIAS RESISTOR (VARIABLE)	560		OHMS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS" FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE OR APPROXIMATELY 2.5 MILLISECONDS.

PLATE 2530
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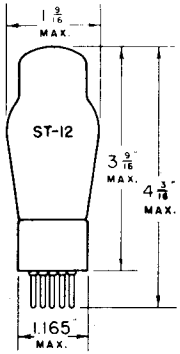
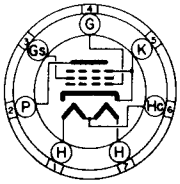


PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS[A] 0.6 AMPERE
12.6 VOLTS[B] 0.3 AMPERE
AC OR DC

GLASS BULB



BOTTOM VIEW

SMALL 7 PIN BASE

THE TUNG-SOL 12A5 IS AN OUTPUT PENTODE WITH A CENTER TAPPED HEATER, SO THAT THE HEATER MAY BE OPERATED ON EITHER 6.3 VOLTS OR 12.6 VOLTS.

RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	180	VOLTS
MAXIMUM PLATE DISSIPATION	8.25	WATTS
MAXIMUM SCREEN DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	180	VOLTS
SCREEN VOLTAGE	100	180	VOLTS
CONTROL GRID VOLTAGE	-15	-25	VOLTS
PEAK AF SIGNAL VOLTAGE	15	25	VOLTS
ZERO-SIGNAL PLATE CURRENT	17	45	MA.
ZERO SIGNAL SCREEN CURRENT	3	8	MA.
MAXIMUM-SIGNAL PLATE CURRENT	19	48	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	6.5	14	MA.
PLATE RESISTANCE APPROX.	50 000	35 000	OHMS
TRANSCONDUCTANCE	1700	2400	µMHOS
LOAD RESISTANCE	4500	3300	OHMS
TOTAL HARMONIC DISTORTION	12	11	PER CENT
SECOND HARMONIC DISTORTION	8.5	6.5	PER CENT
THIRD HARMONIC DISTORTION	8	8	PER CENT
POWER OUTPUT	0.8	3.4	WATTS

[A] HEATERS CONNECTED IN PARALLEL

[B] HEATERS CONNECTED IN SERIES

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 1323-2
SEPT. 23 1943

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TUNG-SOL

BEAM POWER AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS	
BASE INTER. SHELL OCTAL 7-PIN	PIN 1 NO CONN.	PIN 7 HEATER
CAP NONE	PIN 2 HEATER	PIN 8 CATH. & DEFL.
BULB T-9	PIN 3 PLATE	
MAXIMUM DIAMETER 1 5/16"	PIN 4 GRID 2	
MAXIMUM OVERALL LENGTH 3 1/4"	PIN 5 GRID 1	TOP CAP NONE
MAXIMUM SEATED HEIGHT 2 11/16"	PIN 6 NONE	

RATINGS

HEATER OR FILAMENT VOLTAGE	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.5	WATTS

RATINGS ARE TO BE INTERPRETED ACCORDING TO RMA STANDARD M8-210

CAPACITANCES

CONTROL GRID TO CATHODE	9.0	μμf
PLATE TO CATHODE	9.0	μμf
GRID TO PLATE	0.6 MAX.	μμf

WITH STANDARD RMA SHIELD M8-308

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE	-12.5	VOLTS
PEAK AF SIGNAL VOLTAGE	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL SCREEN CURRENT	3.5	MA.
MAXIMUM-SIGNAL PLATE CURRENT	32	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	5.5	MA.
PLATE RESISTANCE		MEGOHMS
TRANSCONDUCTANCE	3000	μMHOS
AMPLIFICATION FACTOR		
LOAD RESISTANCE	7500	OHMS
TOTAL HARMONIC DISTORTION	7	PER CENT
POWER OUTPUT	3.0	WATTS

THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER RATED MAXIMUM CONDITIONS FOR THE TYPE 12A6GT SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED BIAS OPERATION.

PLATE 1303-1
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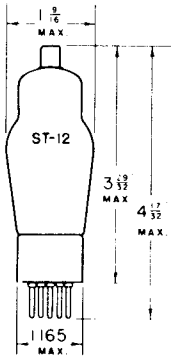
TUNG-SOL



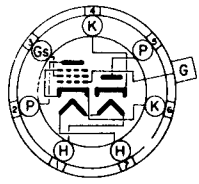
RECTIFIER

PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
12.6 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



BOTTOM VIEW

SMALL 7 PIN BASE

THE TUNG-SOL 12A7 COMBINES A HALF-WAVE RECTIFIER AND OUTPUT POWER AMPLIFIER IN A SINGLE BULB. IT IS DESIGNED FOR SERVICE IN AC – DC RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE UNIT – CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	VOLTS
SCREEN VOLTAGE	135	VOLTS
CONTROL GRID VOLTAGE	-13.5	VOLTS
PLATE CURRENT	9.0	MA.
SCREEN CURRENT	2.5	MA.
PLATE RESISTANCE	102 000	OHMS
TRANSCONDUCTANCE	975	μMHOS
AMPLIFICATION FACTOR	100	
LOAD RESISTANCE	13 500	OHMS
POWER OUTPUT	0.55	WATT

RECTIFIER UNIT

AC VOLTAGE PER PLATE (RMS)	125 MAX.	VOLTS
DC OUTPUT CURRENT	30 MAX.	MA.

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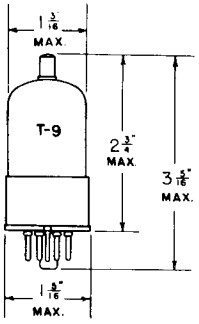

PENTAGRID CONVERTER

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

BOTTOM VIEW

SMALL WAFER 8 PIN OCTAL BASE WITH METAL SHELL

THE TUNG-SOL 12A8GT IS A PENTAGRID CONVERTER DESIGNED FOR SERVICE IN AC-DC OPERATED SUPERHETERODYNE RECEIVERS USING 150 MA. HEATER TUBES. WITH THE EXCEPTION OF HEATER RATINGS AND CAPACITANCES, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF TYPES 7B8, 6A8, 6A8G AND 6A8GT.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN (Gs) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN (Gs) VOLTAGE	100	VOLTS
MINIMUM EXTERNAL CONTROL GRID (G) BIAS VOLTAGE	0	VOLTS
MAXIMUM OSCILLATOR ANODE (GA) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM OSCILLATOR ANODE (GA) VOLTAGE	200	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM OSCILLATOR ANODE (GA) DISSIPATION	.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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SEPT. 23
1943

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID (G) TO MIXER PLATE (P)	0.26 MAX.	μμf
CONTROL GRID (G) TO OSCILLATOR ANODE (G_A)	0.19 MAX.	μμf
CONTROL GRID (G) TO OSCILLATOR GRID (G_0)	0.16 MAX.	μμf
OSCILLATOR GRID (G_0) TO OSCILLATOR ANODE (G_A)	1.1	μμf
RF INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES	9.5	μμf
OSCILLATOR INPUT: OSCILLATOR GRID (G_0) TO ALL OTHER ELECTRODES EXCEPT OSCILLATOR ANODE (G_A)	6.0	μμf
OSCILLATOR OUTPUT: OSCILLATOR ANODE (G_A) TO ALL OTHER ELECTRODES EXCEPT OSCILLATOR GRID (G_0)	4.6	μμf
MIXER OUTPUT: MIXER PLATE (P) TO ALL OTHER ELECTRODES	12	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMPERE
PLATE (P) VOLTAGE	100	250	VOLTS
SCREEN (G_S) VOLTAGE	50	100	VOLTS
CONTROL GRID (G) VOLTAGE	−1.5	−3	VOLTS
OSCILLATOR ANODE (G_A) SUPPLY VOLTAGE[A]	−	250	VOLTS
OSCILLATOR ANODE (G_A) VOLTAGE	100	−	VOLTS
OSCILLATOR GRID (G_0) RESISTOR	50 000	50 000	OHMS
PLATE CURRENT	1.1	3.5	MA.
SCREEN CURRENT	1.3	2.7	MA.
OSCILLATOR ANODE CURRENT	2.0	4.0	MA.
OSCILLATOR GRID CURRENT	25	0.4	MA.
TOTAL CATHODE CURRENT	4.6	10.6	MA.
PLATE RESISTANCE APPROX.	0.6	0.36	MEGOHM
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −1.5 V.	360	−	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −3 V.	180	550	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −6 V.	50	325	μMHOS
CONVERSION TRANSCONDUCTANCE FOR CONTROL GRID (G) VOLTAGE = −10 V.	−	100	μMHOS
CONVERSION TRANCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = −20 V.	3	−	μMHOS
CONVERSION TRANSCONDUCTANCE APPROX. FOR CONTROL GRID (G) VOLTAGE = −35 V.	−	6	μMHOS

[A] APPLIED THROUGH A PROPERLY BY-PASSED 20000 OHM DROPPING RESISTOR.

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

NOTE: THE TRANSCONDUCTANCE OF THE OSCILLATOR SECTION (NOT OSCILLATING IS APPROXIMATELY 1150 UMHOS, THE AMPLIFICATION FACTOR IS 75 AND THE OSCILLATOR ANODE CURRENT IS 4.0 MA. CONDITIONS: PLATE VOLTAGE = 250 V., OSCILLATOR ANODE VOLTAGE = 100 V., SCREEN VOLTAGE = 55 V., CONTROL GRID VOLTAGE = −2.0 V., AND THE OSCILLATOR GRID VOLTAGE = −1.0 V.

PLATE 1325-3
SEPT. 23 1943

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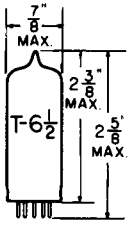
TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

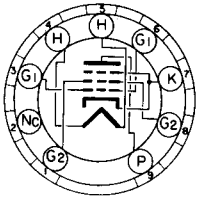


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS[A] 0.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9EU

THE 12AB5 IS A BEAM POWER TUBE USING THE 9 PIN MINIATURE CONSTRUCTION DESIGNED FOR USE AS AN AUDIO POWER AMPLIFIER IN AUTOMOBILE RADIO SERVICE WHERE THE POWER SOURCE IS A 12 VOLT BATTERY.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G TO P	0.7	μμf
INPUT: G_1 TO (H+K+G_2&G_3)	8.0	μμf
OUTPUT: P TO (H+K+G_2&G_3)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
NEGATIVE (DC)	200	VOLTS
POSITIVE (DC)	100	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE	250	°C.

OPERATING CONDITIONS AND CHARACTERISTICS[A]

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE[A]	12.6	12.6	VOLTS
HEATER CURRENT	0.2	0.2	AMP.
PLATE VOLTAGE	250	250	VOLTS
GRID #2 VOLTAGE	200	250	VOLTS
GRID #1 VOLTAGE	---	-12.5	VOLTS
CATHODE BIAS RESISTOR	270	---	OHMS
PEAK AF GRID #1 VOLTAGE	10.5	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	33.5	45	MA.
MAXIMUM SIGNAL PLATE CURRENT	36.0	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	1.6	4.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	3.2	7.0	MA.
PLATE RESISTANCE	---	50	KILOHMS
TRANSCONDUCTANCE	4 000	4 100	μMHOS
LOAD RESISTANCE	6 000	5 000	OHMS
POWER OUTPUT (MAXIMUM SIGNAL)	3.3	4.5	WATTS
TOTAL HARMONIC DISTORTION	12	8	PERCENT

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

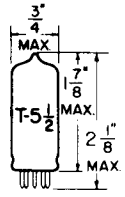
PENTODE

MINIATURE TYPE

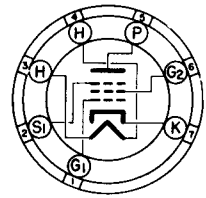
COATED UNIPOTENTIAL CATHODE

* HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 12AC6 IS A REMOTE CUT-OFF PENTODE WITH A UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN RF OR IF AMPLIFIER WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
GRID TO PLATE:	0.005	0.004	μμf
INPUT:	4.3	4.3	μμf
OUTPUT:	5.0	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS

* THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

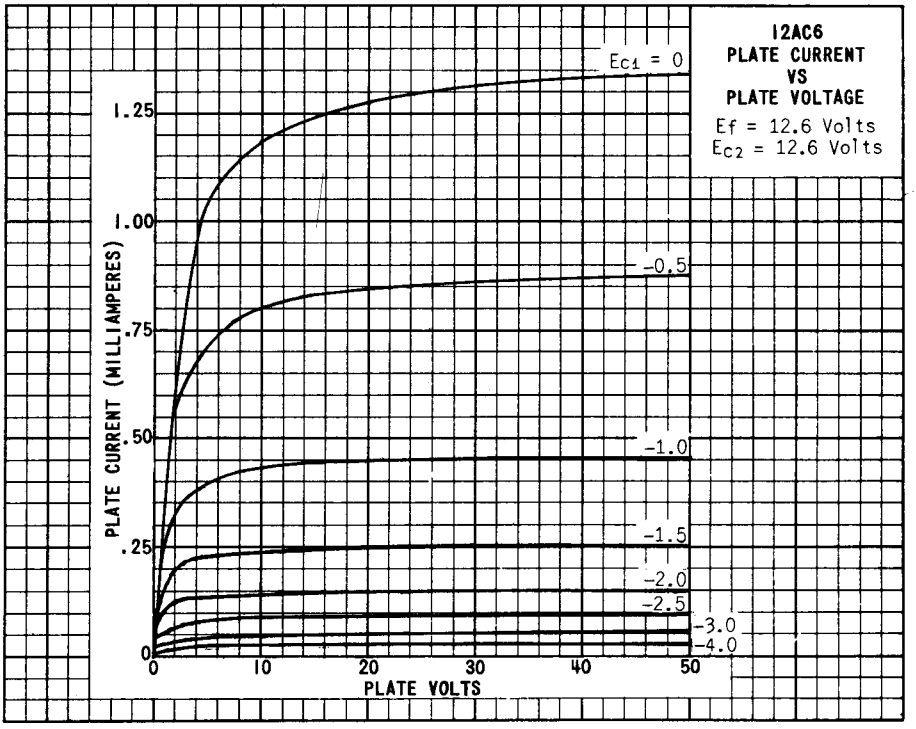
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

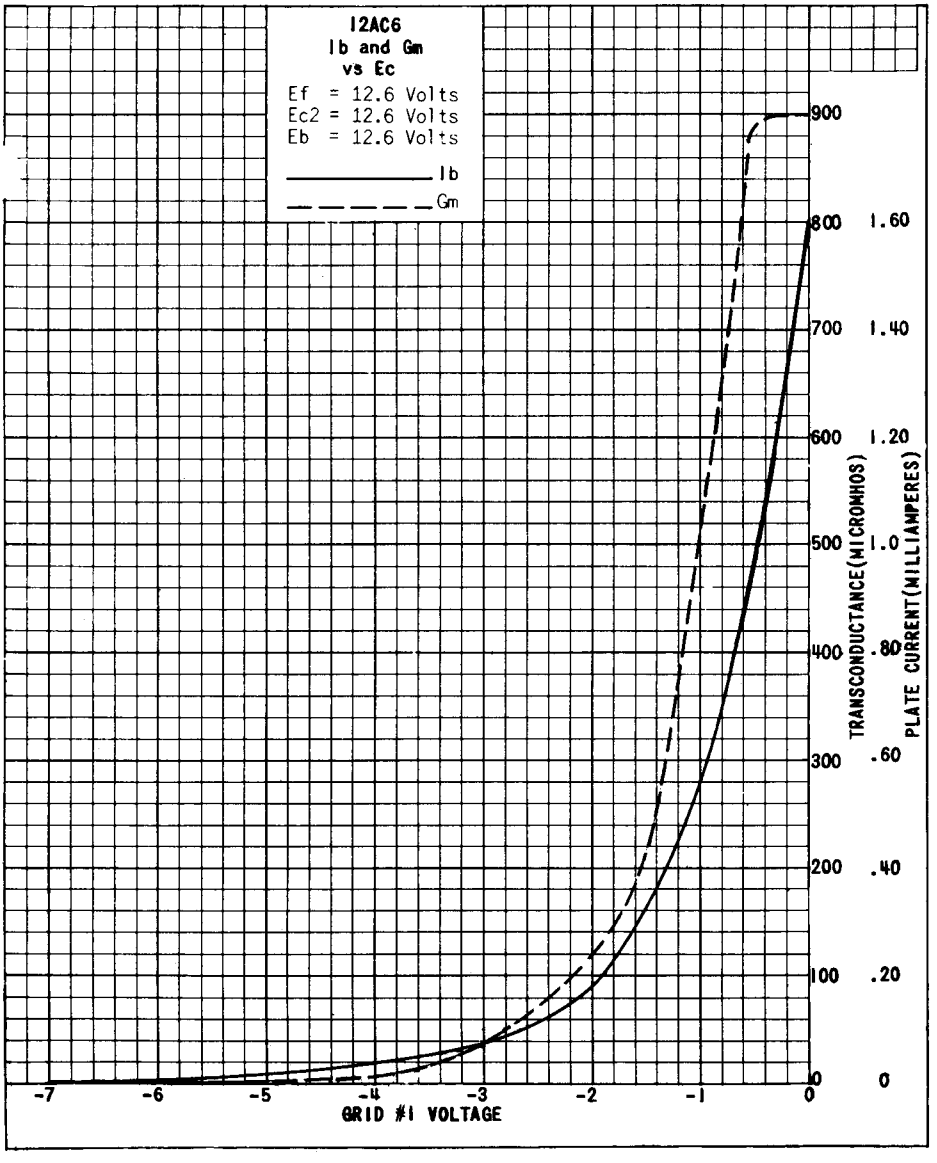
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID #3 VOLTAGE (CONNECTED TO CATHODE AT SOCKET)	0	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE*	0	VOLTS
PLATE CURRENT	550	μAMPS
GRID #2 CURRENT	200	μAMPS
PLATE RESISTANCE	.5	MEGOHM
TRANSCONDUCTANCE[A]	730	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR G_m[A] = 10 μMHOS E_{c3} =O	-5.2	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR G_m[A] =10 μMHOS E_{c1} =O*	-3.7	VOLTS

* GRID #1 RESISTANCE = 2.2 MEGOHMS.

[A] FROM GRID #1 TO PLATE.

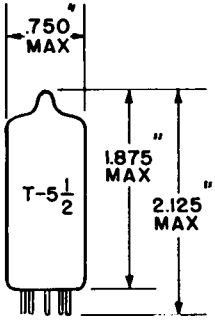



12AC6
Ib and Gm
vs Ec
Ef = 12.6 Volts
Ec2 = 12.6 Volts
Eb = 12.6 Volts
Ib
Gm
900
800
700
600
500
400
300
200
100
0
1.60
1.40
1.20
1.0
.80
.60
.40
.20
0
TRANSCONDUCTANCE(MICROMHOS)
PLATE CURRENT(MILLIAMPERES)
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTAGE

TUNG-SOL

HEPTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

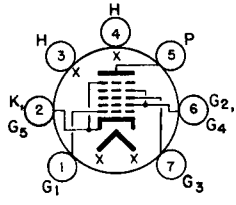
COATED UNIPOTENTIAL CATHODE

FOR

AUTOMATIVE RADIO

RECEIVER SERVICE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 12AD6 IS A PENTAGRID CONVERTER WITH A UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED AS A COMBINED OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

→ DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
MIXER GRID TO PLATE: G3 TO P MAXIMUM	0.26	0.30	pf
MIXER GRID TO OSCILLATOR GRID: G3 TO G1 MAX.	0.15	0.15	pf
RF INPUT: G3 TO (H+K+G1+G2 &4+G5+P)	7.0	7.0	pf
OSCILLATOR INPUT: G1 TO (H+K+P+G3+G5)	3.2	3.2	pf
MIXER OUTPUT: P TO(H+K+G1 + G2 & 4 + G3+G5)	12	7.0	pf
OSCILLATOR OUTPUT: G2 & 4 TO (H+K+G3+P+G5)	11	11	pf
OSCILLATOR GRID TO OSCILLATOR PLATE: G1 TO G2 AND 4	2.2	2.2	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	150	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION[B]		10.0 - 15.9	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK		16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK		16	VOLTS

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	→ 16	VOLTS
GRID #2 & #4 VOLTAGE	→ 16	VOLTS
GRID #2 & #4 SUPPLY VOLTAGE	→ 16	VOLTS
NEGATIVE DC GRID #3 VOLTAGE	→ 16	VOLTS
POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
CATHODE CURRENT	20	MA.
GRID #3 CIRCUIT RESISTANCE	10	MEGOHMS

→ TYPICAL OPERATING CHARACTERISTICS

CONVERTER - SEPARATE EXCITATION

PLATE VOLTAGE	10.6	12.6	14.6	VOLTS
GRID #3 VOLTAGE	0	0	0	VOLTS
GRID #2 & #4 VOLTAGE	10.6	12.6	14.6	VOLTS
GRID #1 VOLTAGE PEAK TO PEAK	4.5	4.5	4.5	VOLTS
GRID #1 RESISTANCE	33000	33000	33000	OHMS
GRID #3 RESISTANCE	2.2	2.2	2.2	MEGOHMS
PLATE RESISTANCE (APPROX.)	0.50	0.40	0.20	MEGOHMS
GRID #1 CURRENT (APPROX.)		60		μA.
CONVERSION TRANSCONDUCTANCE		320		μMHOS
PLATE CURRENT		350		μA
CATHODE CURRENT		1600		μA
GRID #3 VOLTAGE FOR Gc =5μMHOS (APPROX.)		-3.0		VOLTS
GRID #3 VOLTAGE FOR Gc =0.5 μMHOS (APPROX.)		-4.0		VOLTS

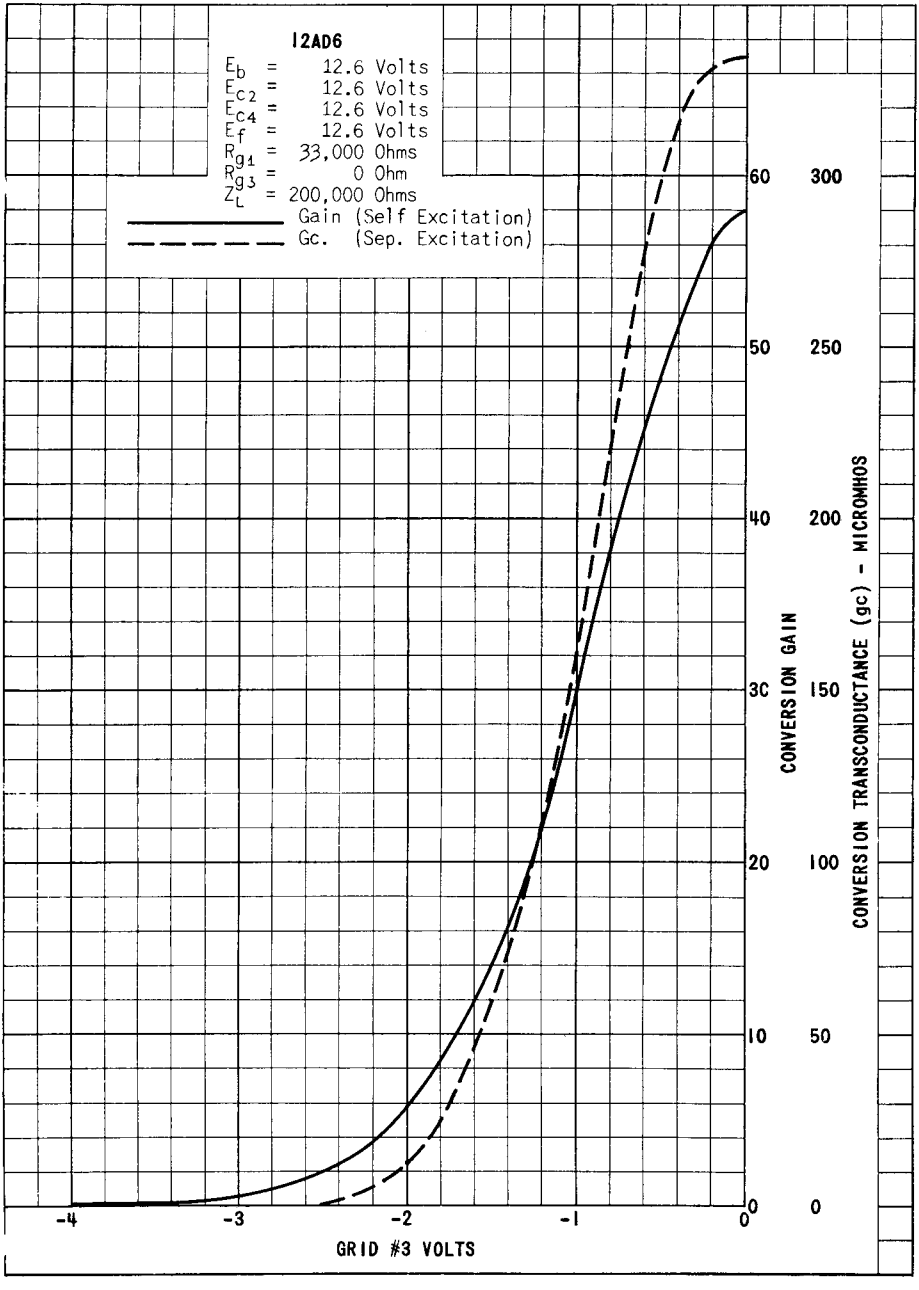
→ OSCILLATOR CHARACTERISTICS - NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRID #2 & #4 CONNECTED TO PLATE	12.6	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1, #2 & #4 CONNECTED TO PLATE	3600	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1, #2 AND 4 CONNECTED TO PLATE	9.4	
CATHODE CURRENT	4.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 10 μA.	-3.7	VOLTS

A
EXTERNAL SHIELD #316 CONNECTED TO CATHODE.

B
THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE. FILAMENT SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN FILAMENT VOLTAGE WITHIN THE SPECIFIED TOLERANCE. FOR LONGEST LIFE IT IS RECOMMENDED THAT THE HEATER BE OPERATED WITHIN THE RANGE OF 11 TO 14 VOLTS.

→ INDICATES A CHANGE.


12AD6
E_b = 12.6 Volts
E_{c2} = 12.6 Volts
E_{c4} = 12.6 Volts
E_f = 12.6 Volts
R_{g1} = 33,000 Ohms
R_{g3} = 0 Ohm
Z_L = 200,000 Ohms
Gain (Self Excitation)
Gc. (Sep. Excitation)
CONVERSION GAIN
CONVERSION TRANSCONDUCTANCE (gc) - MICROMHOS
GRID #3 VOLTS
-4
-3
-2
-1
0
60
50
40
30
20
10
300
250
200
150
100
50

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

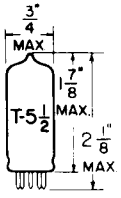
COATED UNIPOTENTIAL CATHODE

HEATER

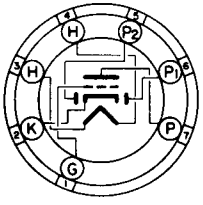
12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 12AE6 IS A COMBINED DOUBLE DETECTOR DIODE AND MEDIUM MU TRIODE WITH A COMMON UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS INTENDED FOR USE AS AN AF VOLTAGE AMPLIFIER WHERE THE HEATER AND PLATE POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2.0	μμf
INPUT: G TO (H+K)	1.8	μμf
OUTPUT: P TO (H+K)	1.1	μμf
DIODE TO DIODE	.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE*	12.6	VOLTS
MAXIMUM HEATER--CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM AVERAGE DIODE CURRENT	1	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	10	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – TRIODE UNIT

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	750	μAMPS
PLATE RESISTANCE	15 000	OHMS
TRANSCONDUCTANCE	1 000	μMHOS
AMPLIFICATION FACTOR	15	

* THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

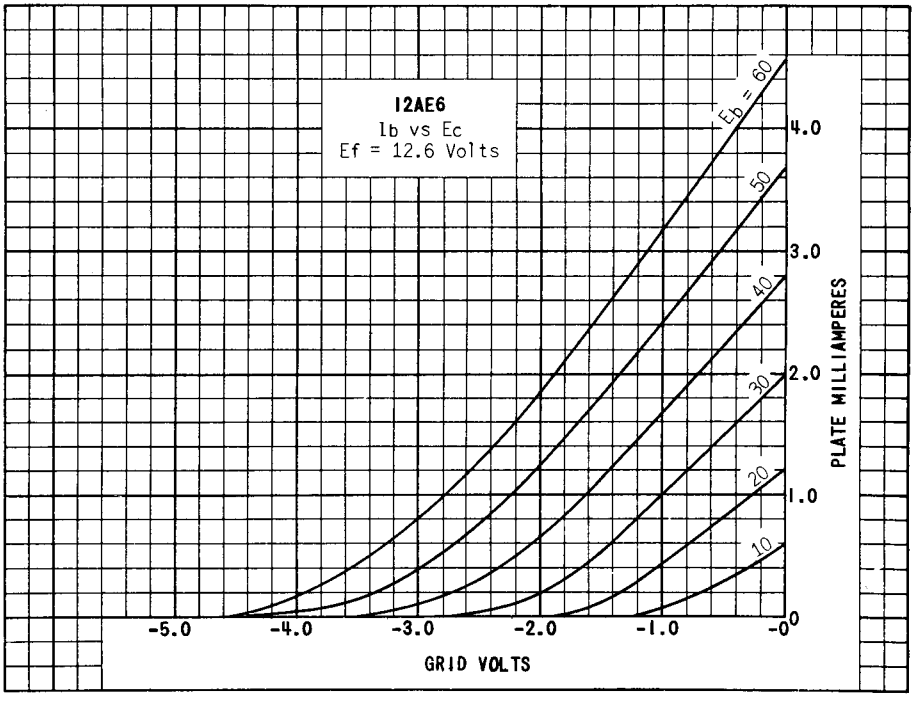
DIODE UNITS – TWO

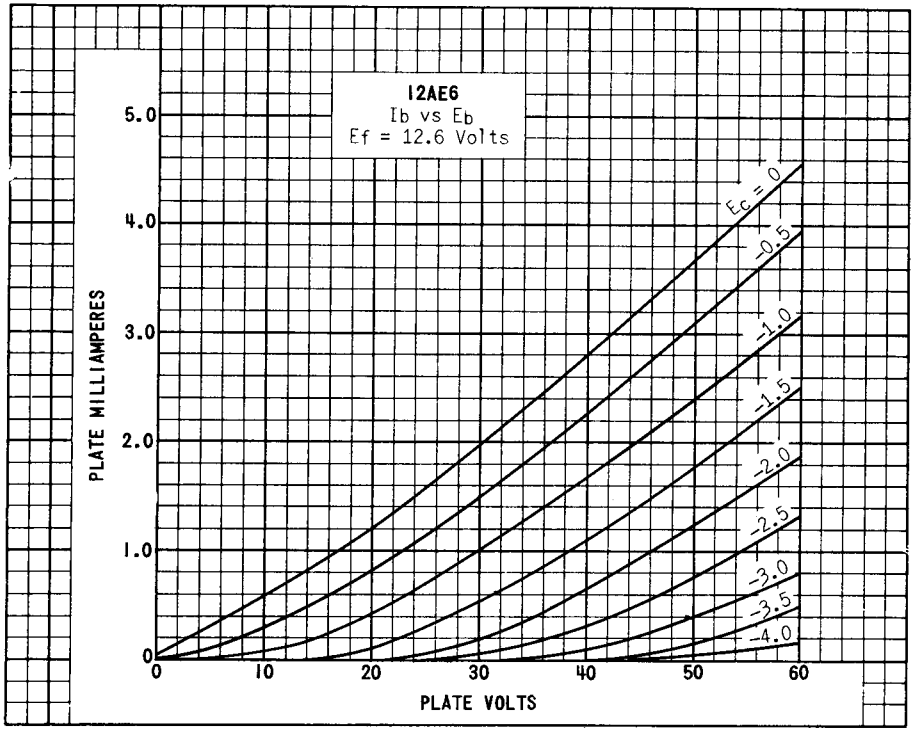
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED (EACH DIODE)	2.0	MA.

RESISTANCE COUPLED AMPLIFIER – TRIODE UNIT

PLATE SUPPLY VOLTAGE	14.4	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PLATE LOAD RESISTOR	470 000	OHMS
CONTROL GRID RESISTOR	2.2	MEGOHMS
INPUT CONDENSER	0.01	μf
OUTPUT CONDENSER	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	2.2	MEGOHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	OHMS
VOLTAGE GAIN AT 400 CPS**	10	

** MEASURED AT AN OUTPUT VOLTAGE OF 1 VOLT RMS.




12AE6
Ib vs Eb
Ef = 12.6 Volts
PLATE MILLIAMPERES
5.0
4.0
3.0
2.0
1.0
0
0
10
20
30
40
50
60
PLATE VOLTS
Ec = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

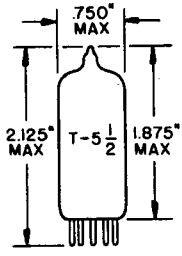
FOR

AF VOLTAGE AMPLIFIER

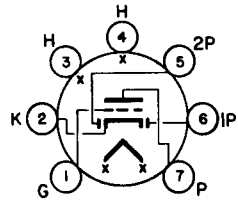
SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BT

THE 12AE6A IS A COMBINED DOUBLE DETECTOR DIODE AND MEDIUM MU TRIODE WITH A COMMON UNIPOTENTIAL CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS INTENDED FOR USE AS AN AF VOLTAGE AMPLIFIER INTO A LOW IMPEDANCE LOAD WHERE THE HEATER AND PLATE POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

HEATER CHARACTERISTICS AND RATI NGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	150	MA.
HEATER SUPPLY LIMITS:				
APPLIED VOLTAGE			10 TO 15.9	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			±30	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	30	VOLTS
CATHODE CURRENT	20	MA.
AVERAGE DIODE CURRENT	1	MA.
GRID CIRCUIT RESISTANCE	10	MEGOHMS

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TUNG-SOL

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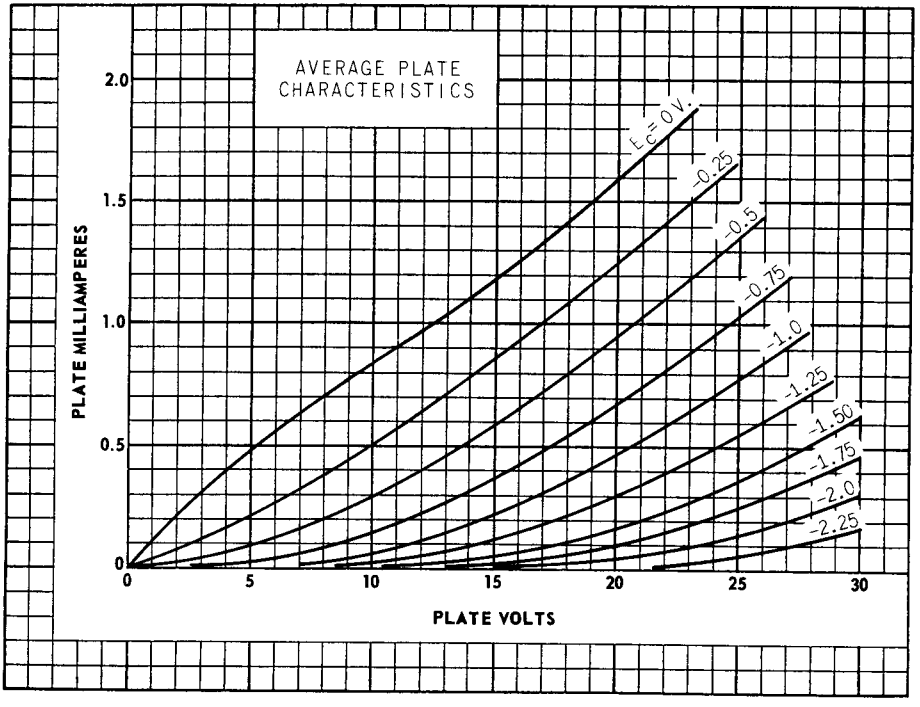
TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - TRIODE UNIT

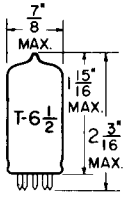
HEATER POTENTIAL	12.6	12.6	VOLTS
PLATE POTENTIAL	12.6	12.6	VOLTS
GRID POTENTIAL	0	------	VOLTS
GRID RESISTOR	0	10	MEGOHMS
PLATE CURRENT	1.0	0.32	MA.
TRANSCONDUCTANCE	1,300	715	μMHOS
PLATE RESISTANCE	13	20	KILOHMS
AMPLIFIER FACTOR	16.7	14.3	
DIODE UNITS - TWO			
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED (EACH DIODE)		2.0	MA.



TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

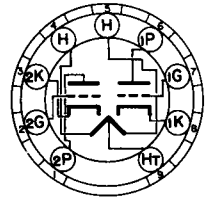
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.45±10% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTON VIEW

SMALL BUTTON
9 PIN BASE

9A

THE 12AE7 IS A MINIATURE LOW-MU DISSIMILAR DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR USE AS A DRIVER TUBE FOR THE AUDIO OUTPUT STAGE OF HYBRID AUTOMOBILE RADIOS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE #1	TRIODE #2	
GRID TO PLATE	3.9	3.4	μμf
INPUT	4.7	4.2	μμf
OUTPUT	0.75	0.85	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

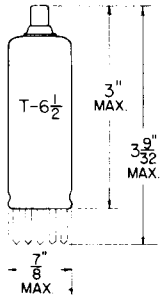
HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16.0	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID CIRCUIT RESISTANCE	1.5	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16.0	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16.0	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.45±10%		AMP.
PLATE VOLTAGE (EACH TRIODE)	12.6	12.6	VOLTS
GRID LEAK RESISTOR	1.5	1.0	MEGOHM
PLATE CURRENT	1.9	7.5	MA.
TRANSCONDUCTANCE	4000	6500	μMHOS
AMPLIFICATION FACTOR	13.0	6.4	
PLATE RESISTANCE	3150	985	OHMS

[A] RATINGS APPLY TO EACH SECTION UNLESS OTHERWISE STATED.

TUNG-SOL



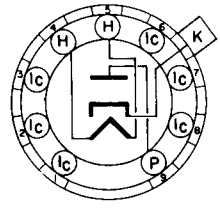
GLASS BULB
SKIRTED MINIATURE

DIODE
MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON
9 PIN NOVAL
9CB

THE 12AF3 IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

HEATER TO CATHODE H TO K	2.8	μμf
CATHODE TO PLATE AND HEATER K TO (P + H)	9.0	μμf
PLATE TO CATHODE AND HEATER P TO (K + H)	6.0	μμf

RATINGS[A]
INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM[BC]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	1000	VOLTS
TOTAL DC AND PEAK	4500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	4500	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PAEK PLATE CURRENT	750	MA.
MAXIMUM PLATE DISSIPATION	6.0	WATTS
MAXIMUM BULB TEMPERATURE	210	°C
HEATER WARM-UP TIME*	11.0	SECONDS

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TUNG-SOL

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AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT =340 MA.)	30	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE CUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B]UNLESS OTHERWISE STATED.

[C]DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST EXTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

PENTODE

MINIATURE TYPE

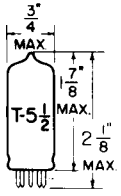
COATED UNIPOTENTIAL CATHODE

HEATER

12.6* VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

78K

THE 12AF6 IS A MINIATURE PENTODE INTENDED FOR USE AS A RADIO-FREQUENCY OR INTERMEDIATE-FREQUENCY AMPLIFIER IN AUTOMOBILE RADIO RECEIVERS. THE TUBE IS SPECIALLY DESIGNED TO OPERATE WITH PLATE AND SCREEN VOLTAGES SUPPLIED DIRECTLY FROM A 12-VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE, (MAX.)	0.006	μμf
INPUT	5.5	μμf
OUTPUT	4.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM SCREEN VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	2.2	MEGOHMS

*WHEN USED IN AUTOMOTIVE SERVICE FROM A 12-VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS; HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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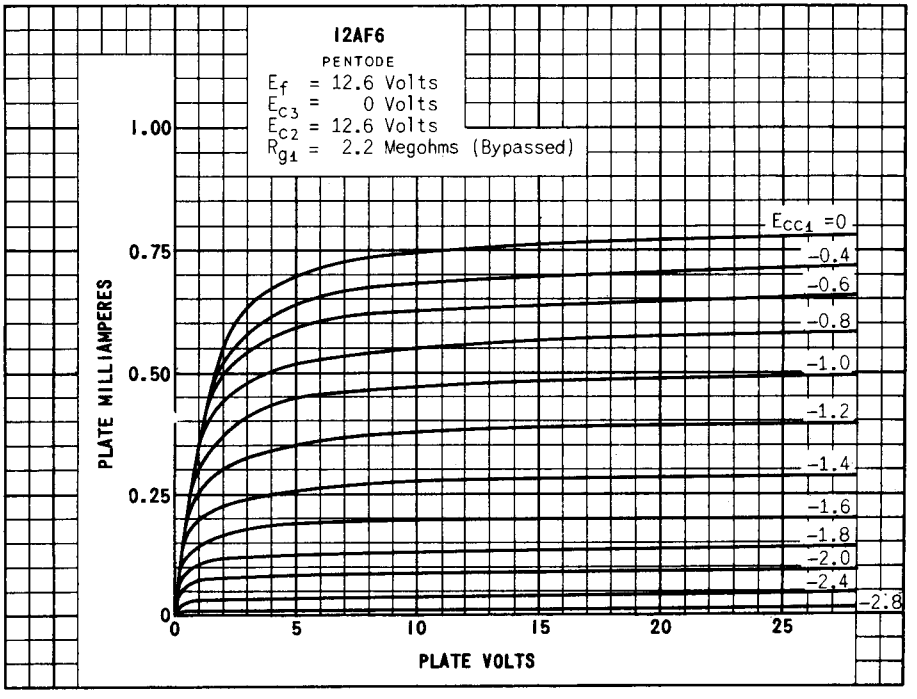
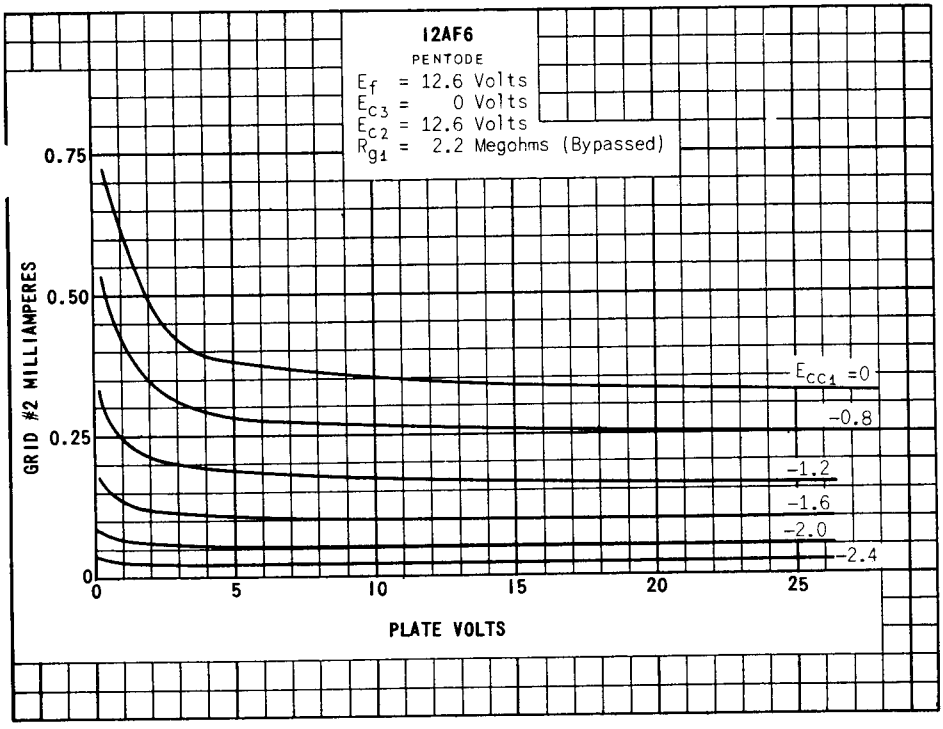
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

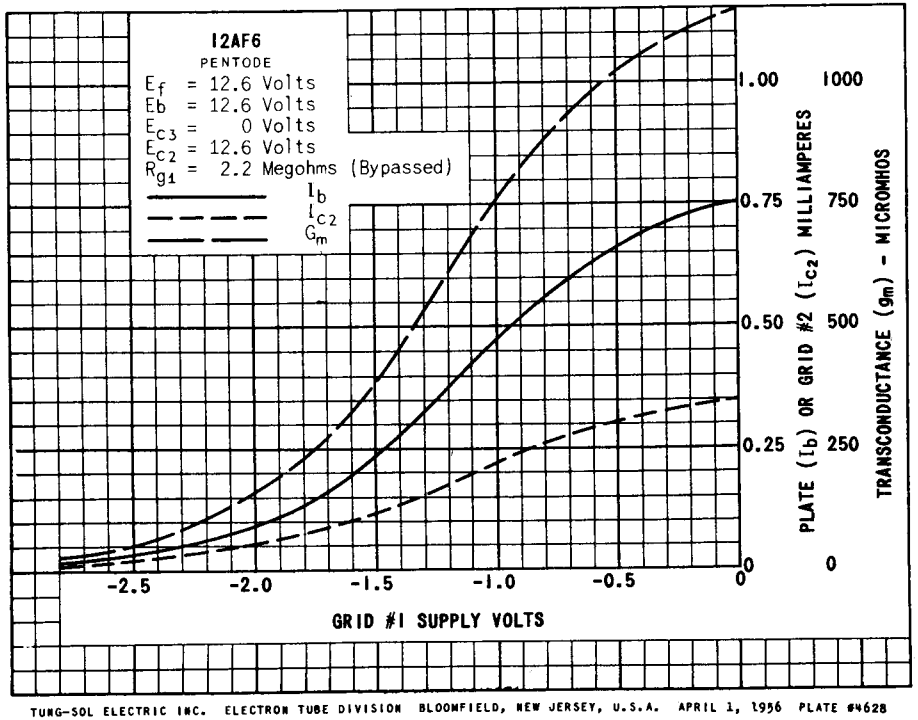
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
SUPPRESSOR VOLTAGE	0	VOLTS
SCREEN VOLTAGE	12.6	VOLTS
GRID #1 SUPPLY VOLTAGE	0	VOLTS
GRID #1 RESISTOR (BYPASSED)	2.2	MEGOHMS
PLATE RESISTANCE (APPROX.)	→ 0.35	MEGOHMS
TRANSCONDUCTANCE	→ 1500	μMHOS
PLATE CURRENT	→ 1.1	MA.
SCREEN CURRENT	→ 0.45	MA.
GRID #1 VOLTAGE (APPROX.) G_m =40 μMHOS	−2.7	VOLTS
GRID #1 VOLTAGE (APPROX.)MEASURED * WITH GRID #1 TIED TO GRID #3, R_{g1} = O, G_m =1O μMHOS	−3.5	VOLTS

* INDICATES AN ADDITION.

→ INDICATES A CHANGE.




12AF6
PENTODE
Ef = 12.6 Volts
Ec3 = 0 Volts
Ec2 = 12.6 Volts
Rg1 = 2.2 Megohms (Bypassed)
GRID #2 MILLIAMPERES
0.75
0.50
0.25
0
0
5
10
15
20
25
PLATE VOLTS
Ecc1 =0
-0.8
-1.2
-1.6
-2.0
-2.4


12AF6
PENTODE
Ef = 12.6 Volts
Eb = 12.6 Volts
Ec3 = 0 Volts
Ec2 = 12.6 Volts
Rg1 = 2.2 Megohms (Bypassed)
Ib
Ic2
Gm
1.00
0.75
0.50
0.25
0
1000
750
500
250
0
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID #1 SUPPLY VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS

TUNG-SOL

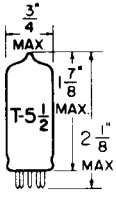
HEPTODE

MINIATURE TYPE

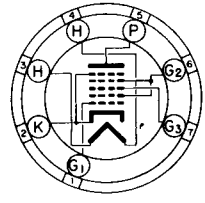
COATED UNIPOTENTIAL CATHODE

HEATER
12.6* VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 12AG6 IS A MINIATURE HEPTODE INTENDED PRIMARILY TO PERFORM THE COMBINED FUNCTIONS OF MIXER AND OSCILLATOR IN AUTOMOBILE RADIO RECEIVERS. THE TUBE IS SPECIFICALLY DESIGNED TO OPERATE WITH PLATE AND SCREEN VOLTAGES SUPPLIED DIRECTLY FROM A 12-VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #3 TO ALL	6.5	μμf
PLATE TO ALL	7.5	μμf
GRID #1 TO ALL	5.5	μμf
CATHODE TO ALL EXCEPT GRID #1	18	μμf
GRID #3 TO PLATE (MAX.)	0.28	μμf
GRID #1 TO GRID #3 (MAX.)	0.17	μμf
GRID #1 TO PLATE (MAX.)	0.065	μμf
GRID #1 TO CATHODE	2.8	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM SCREEN VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM DC GRID #1 CURRENT	0.2	MA.
MAXIMUM GRID #3 CIRCUIT RESISTANCE	2.2	MEGOHMS

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

*WHEN USED IN AUTOMOTIVE SERVICE FROM A 12-VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS; HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE[A]

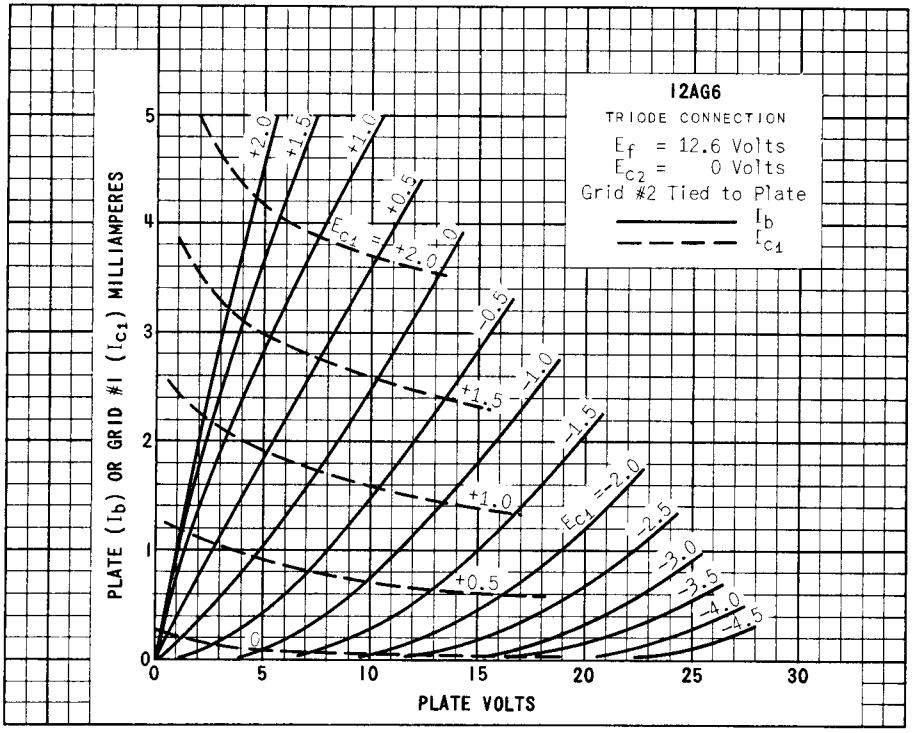
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
SCREEN VOLTAGE	12.6	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #3 RESISTOR (BYPASSED)	2.2	MEGOHMS
GRID #1 VOLTAGE, RMS, (APPROX.)	0.85	VOLTS
GRID #1 RESISTOR	20 000	OHMS
CONVERSION TRANSCONDUCTANCE	300	μMHOS
PLATE CURRENT	0.55	MA.
SCREEN CURRENT	1.4	MA.
GRID #1 CURRENT	0.050	MA.
GRID #3 VOLTAGE, (APPROX.) G_c=10 μMHOS	-2.0	VOLTS

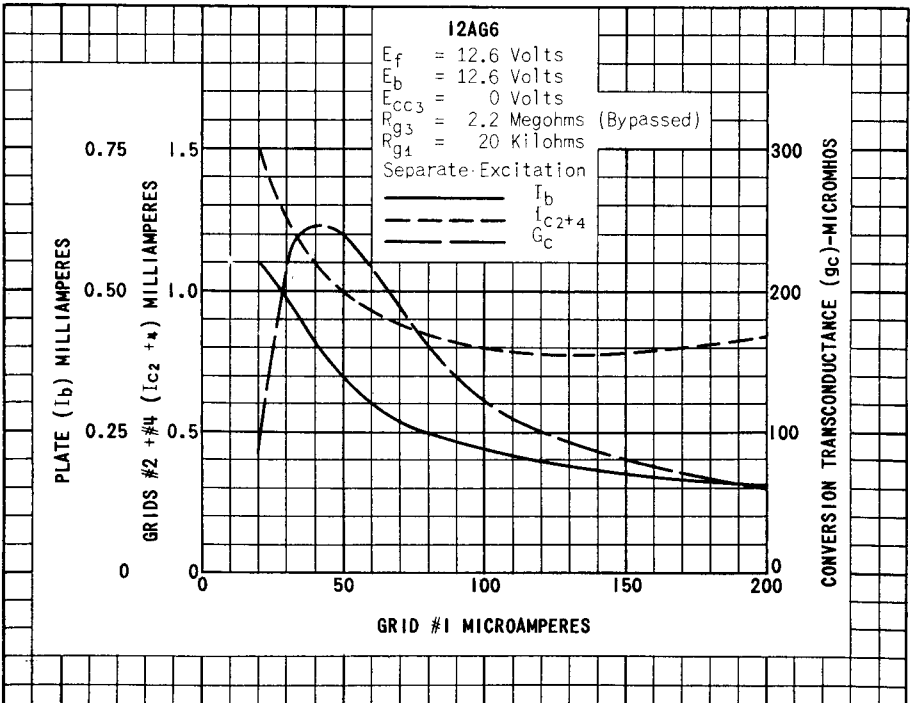
OSCILLATOR CHARACTERISTICS, NOT OSCILLATING

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
SCREEN—CONNECTED TO PLATE		
GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
AMPLIFICATION FACTOR[B]	9.0	
TRANSCONDUCTANCE[B]	3 400	μMHOS
CATHODE CURRENT	4.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b=10 μAMPS	-4	VOLTS

[A] CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RETMA 60-CYCLE CONVERSION TRANSCONDUCTANCE TEST SET EXCEPT THAT THE APPLIED GRID-NUMBER 3 SIGNAL VOLTAGE HAS BEEN REDUCED FROM 1.0 VOLT PEAK-TO-PEAK TO 0.1 VOLT PEAK-TO-PEAK.

[B] BETWEEN GRID-NUMBER 1 AND GRIDS NUMBER 2 AND 4 CONNECTED TO PLATE.





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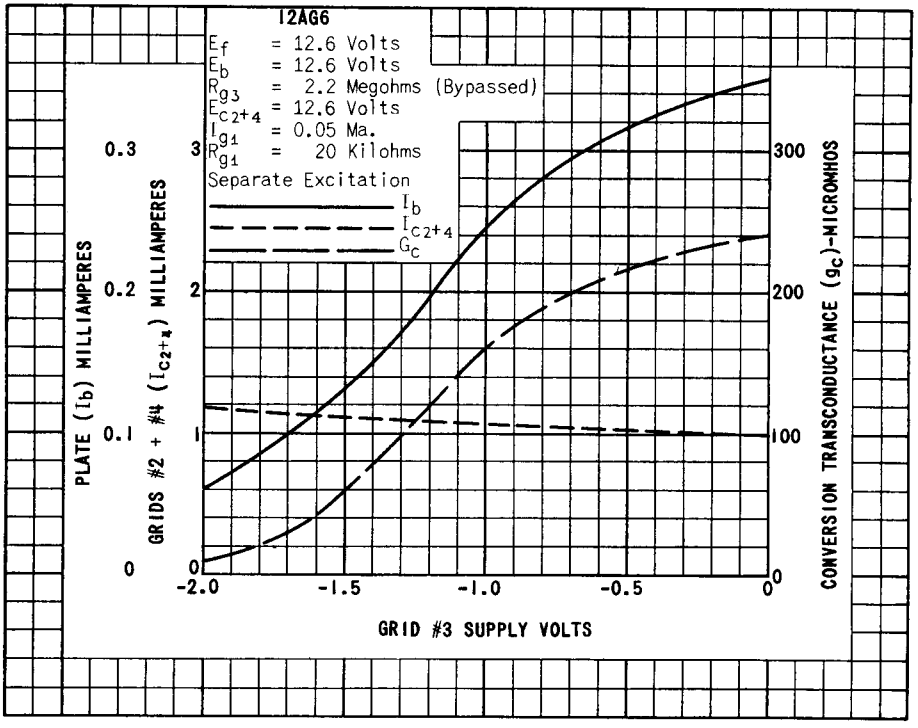
12AG6
E_f = 12.6 Volts
E_b = 12.6 Volts
R_{g3} = 2.2 Megohms (Bypassed)
E_{c2+4} = 12.6 Volts
I_{g1} = 0.05 Ma.
R_{g1} = 20 Kilohms
Separate Excitation
I_b
I_{c2+4}
G_c
PLATE (I_b) MILLIAMPERES
GRIDS #2 + #4 (I_{c2+4}) MILLIAMPERES
CONVERSION TRANSCONDUCTANCE (g_c)-MICROMHOS
GRID #3 SUPPLY VOLTS
0.3
0.2
0.1
0
3
2
1
0
300
200
100
0
-2.0
-1.5
-1.0
-0.5
0

TENTATIVE DATA

12AH7GT

TUNG-SOL

TWIN TRIODE

PHYSICAL SPECIFICATIONS

EMITTER	UNIPOTENTIAL CATHODE	PIN CONNECTIONS			
BASE	8-PIN OCTAL BAKELITE	PIN 1	GRID 1	PIN 7	HEATER
CAP	NONE	PIN 2	CATHODE 1	PIN 8	HEATER
BULB	T-9	PIN 3	PLATE 1		
MAXIMUM DIAMETER	1 5/16"	PIN 4	CATHODE 2		
MAXIMUM OVERALL LENGTH	3 1/16"	PIN 5	GRID 2	TOP CAP	NONE
MAXIMUM SEATED HEIGHT	2 1/2"	PIN 6	PLATE 2		

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	.150	AMPS.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE		VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM SCREEN DISSIPATION		WATTS

RATINGS ARE TO BE INTERPRETED ACCORDING TO RMA STANDARD M8-210

CAPACITANCES (WITH TIGHT FITTING SHIELD)

GRID TO CATHODE	3.2	2.9	MAX. μμf
PLATE TO CATHODE	3.0	2.6	MAX. μμf
GRID TO PLATE	2.2	3.0	MAX. μμf
PLATE TO PLATE	.4		MAX. μμf
GRID TO GRID	.06		MAX. μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
(EACH TRIODE SECTION)

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	.150	AMPS.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE		VOLTS
GRID VOLTAGE	-9	VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
PLATE CURRENT	12	MA.
ZERO-SIGNAL SCREEN CURRENT		MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE	6600	OHMS
TRANSCONDUCTANCE	2400	μMHOS
AMPLIFICATION FACTOR	16	
PLATE CURRENT WITH EG = -30 VOLTS	10	MMA

GENERAL DESCRIPTION

APPLICATION: THE 12AH7GT IS A CATHODE TYPE OF TUBE CONSISTING OF TWO TRIODES WITHIN A SINGLE ENVELOPE. IT WAS DESIGNED FOR USE IN CONVERTER AND AUDIO APPLICATIONS. THE 12AH7GT IS A GLASS TUBE EQUIPPED WITH AN OCTAL BASE.

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PLATE 1317-1
SEPT. 23 1943

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TUNG-SOL

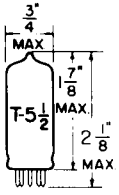
DOUBLE-DIODE TRIODE

MINIATURE TYPE

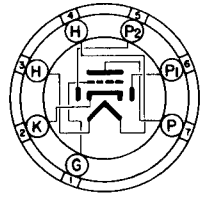
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 12AJ6 IS A COMBINED DOUBLE DIODE DETECTOR AND HIGH MU TRIODE WITH A COMMON UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS INTENDED FOR USE AS AN AF VOLTAGE AMPLIFIER WHERE THE HEATER AND PLATE POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE:(G TO P)	2.0	μμf
INPUT: G TO (H + K)	2.2	μμf
OUTPUT: P TO (H+K)	0.8	μμf
DIODE TO DIODE	.9	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM AVERAGE DIODE CURRENT	1	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	10	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - TRIODE UNIT

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	750	μAMPS
PLATE RESISTANCE	45 000	OHMS
TRANSCONDUCTANCE	1 200	μMHOS
AMPLIFICATION FACTOR	.55	

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D

DIODE UNITS – TWO

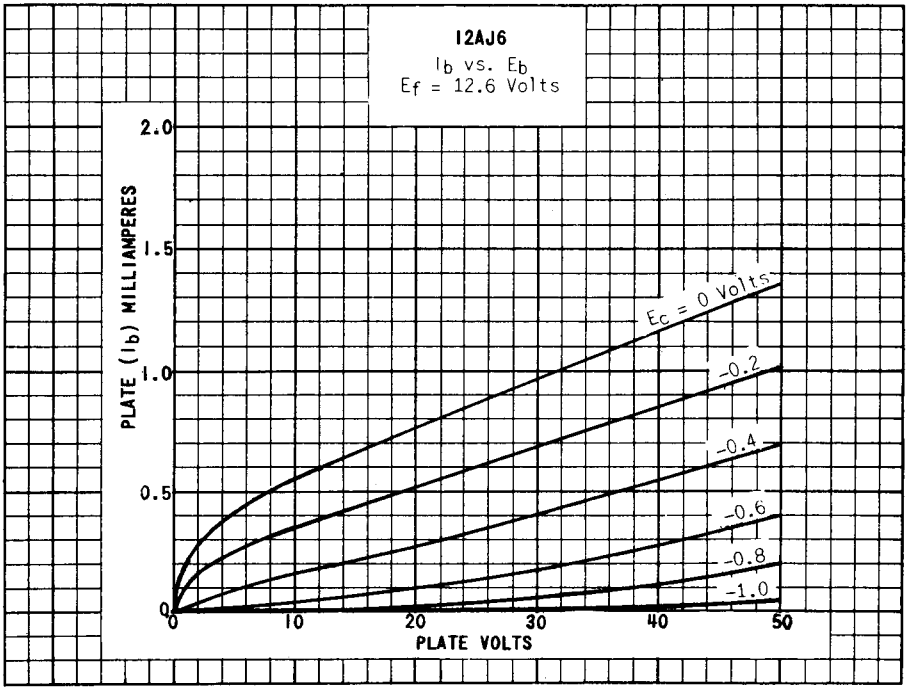
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED (EACH DIODE)	2.0	MA.

RESISTANCE COUPLED AMPLIFIER – TRIODE UNIT

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE SUPPLY VOLTAGE	12.6	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PLATE LOAD RESISTOR	1.0	MEGOHMS
CONTROL GRID RESISTOR	1.0	MEGOHMS
INPUT CONDENSER	0.02	μf
OUTPUT CONDENSER	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	2.0	MEGOHMS
VOLTAGE GAIN AT 400 CPS**	16	

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

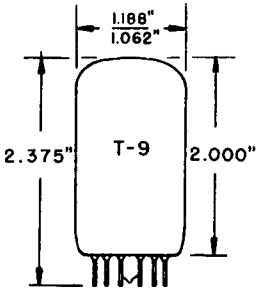
**MEASURED AT AN OUTPUT VOLTAGE OF 1 VOLT RMS.



TUNG-SOL

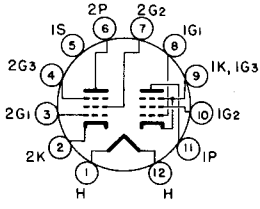
DOUBLE PENTODE

COMPACTRON



DISSIMILAR DOUBLE PENTODE
FOR
USE AS AN FM DETECTOR
AND AUDIO-FREQUENCY OUTPUT
AMPLIFIER IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BU

THE 12AL11 IS A SHARP-CUTOFF, DUAL-CONTROL PENTODE (SECTION 2) AND A POWER PENTODE (SECTION 1) IN THE 12 PIN COMPACTRON CONSTRUCTION. THE DUAL-CONTROL PENTODE IS INTENDED FOR USE AS AN FM DETECTOR AND THE POWER PENTODE AS AN AUDIO-FREQUENCY OUTPUT AMPLIFIER IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

SECTION 1		
GRID 1 TO PLATE: (1_{G1} TO IP)	0.26	pf
INPUT: IG1 TO (H+ IK + IG2 + IG3 + I.S.)	11	pf
OUTPUT: IP TO (H + IK + IG2 + IG3 + I.S.)	12	pf
SECTION 2		
GRID 1 TO PLATE: (2G1 TO 2P)	0.034	pf
GRID 3 TO PLATE: (2 G3 TO 2P)	3.2	pf
GRID 1 TO ALL EXCEPT PLATE: 2_{G1} TO (H + 2K + 2G2 + 2G3 + I.S.)	6.5	pf
GRID 3 TO ALL: 2_{G3} TO (H + 2K + 2G1 + 2G2 + 2P + I.S.)	7.5	pf
GRID 1 TO GRID 3: (2 G1 TO 2G3)	0.24	pf
PLATE TO PLATE: (1P TO 2P)	0.12	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER-CATHODE VOLTAGE	SECTION 1	SECTION 2	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	SECTION 1	SECTION 2	
PLATE VOLTAGE	275	330	VOLTS
GRID 2 VOLTAGE	275	SEE RATING CHART	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 3 (SUPPESSOR) VOLTAGE		28	VOLTS
POSITIVE DC GRID 1 VOLTAGE		0	VOLTS
PLATE DISSIPATION	10	1.7	WATTS
GRID 2 DISSIPATION	2.0	1.1	WATTS
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	0.25		MEGOHMS
WITH CATHODE BIAS	0.5		MEGOHMS

CHARACTERISTICS AND TYPICAL OPERATION

SECTION 1

PLATE VOLTAGE		250	VOLTS
GRID 2 VOLTAGE		250	VOLTS
GRID 1 VOLTAGE		-8.0	VOLTS
PEAK AF GRID 1 VOLTAGE		8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT		35	MA.
MAXIMUM-SIGNAL PLATE CURRENT		39	MA.
ZERO-SIGNAL GRID 2 CURRENT		2.5	MA.
MAXIMUM SIGNAL GRID 2 CURRENT		7.0	MA.
MAXIMUM-SIGNAL POWER OUTPUT		4.2	WATTS
TRANSCONDUCTANCE		6,500	MICROMHOS
PLATE RESISTANCE	Approx.	100,000	OHMS
LOAD RESISTANCE		5,000	OHMS
TOTAL HARMONIC DISTORTION	Approx.	10	PERCENT

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TUNG-SOL

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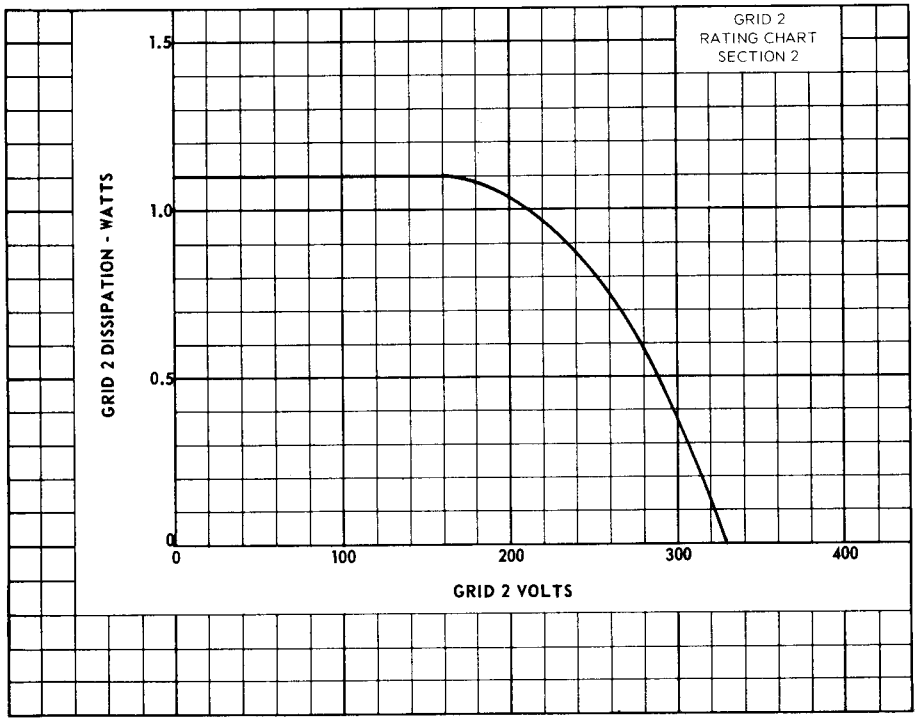
AVERAGE CHARACTERISTICS - SECTION 2

PLATE VOLTAGE		150	VOLTS
GRID 2 VOLTAGE		100	VOLTS
GRID 3 VOLTAGE		0	VOLTS
CATHODE-BIAS RESISTOR		560	OHMS
PLATE CURRENT		1.3	MA.
GRID 2 CURRENT		2.1	MA.
GRID 1 TRANSCONDUCTANCE		1,000	MICROMHOS
GRID 3 TRANSCONDUCTANCE		400	MICROMHOS
PLATE RESISTANCE	Approx.	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 30 μA	Approx.	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 50 μA	Approx.	-4.5	VOLTS



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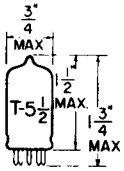
TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE

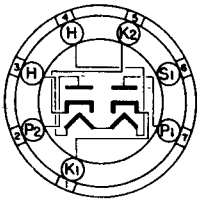


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 12AL5 COMBINES TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM DETECTOR SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
PLATE INPUT: P TO (H+K+IS) EACH UNIT	2.5	3.2	μμf
COUPLING: 1P TO 2P (MAX.)	0.068	0.026	μμf
CATHODE INPUT: K TO (P+H+IS) EACH UNIT	3.4	3.6	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #6.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	330	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM AC PLATE VOLTAGE (EACH PLATE) RMS	117	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE)	54	MA.
MAXIMUM DC OUTPUT CURRENT (EACH PLATE)	9	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	OHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
HALF-WAVE RECTIFIER

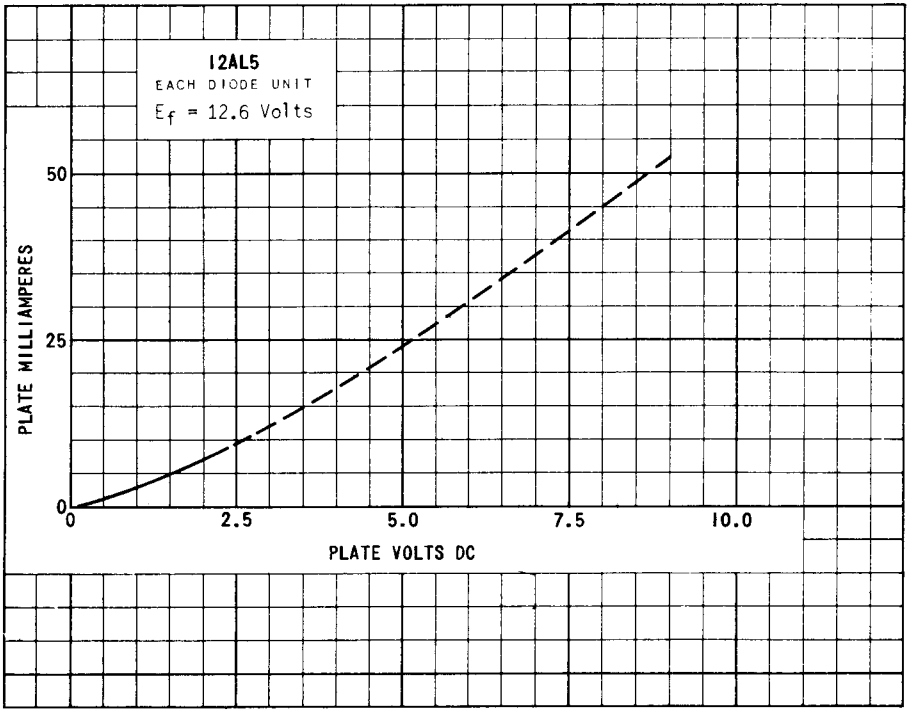
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	60	MA.

THE RESONANT FREQUENCY OF EACH UNIT OF THE 12AL5 IS 700 MC. (APPROX.)

PLATE
3166

→INDICATES A CHANGE OR ADDITION.

12AL5 (6AL5)



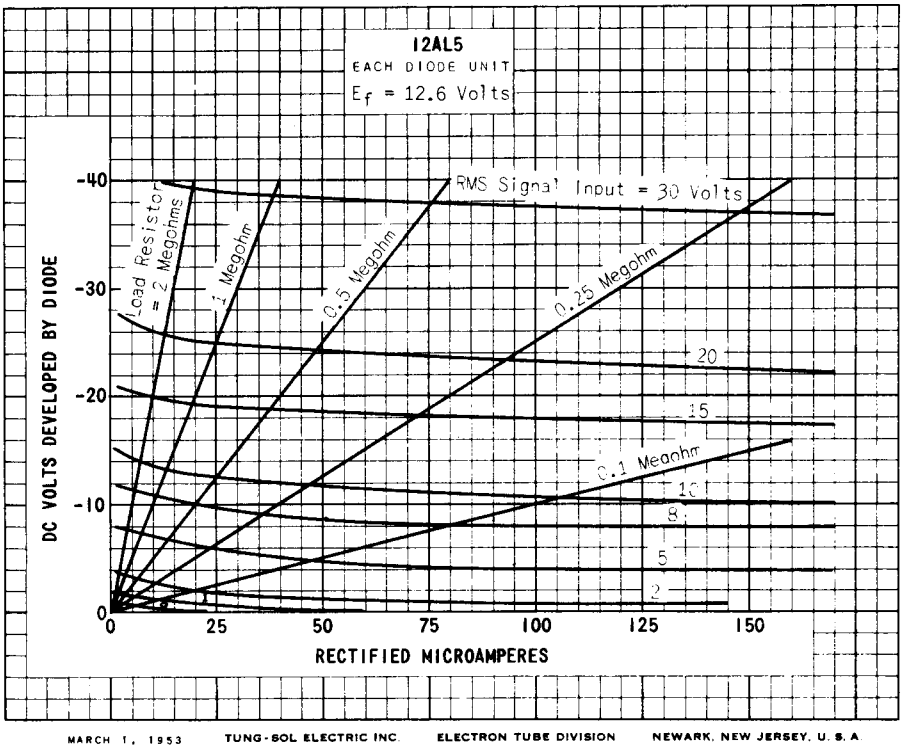
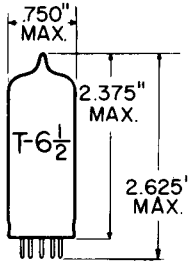


PLATE 3167

TUNG-SOL

TRIODE-TETRODE

MINIATURE TYPE



GLASS BULB

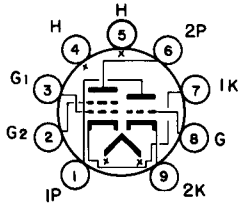
MINIATURE BUTTON
9 PIN BASE E9-1

OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.55 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9GS

THE 12AL8 IS A COMBINED MEDIUM-MU TRIODE AND SPACE-CHARGE GRID TETRODE WITH INDEPENDENT UNIPOTENTIAL CATHODES IN THE 9-PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION IS INTENDED FOR USE AS DETECTOR OR VOLTAGE AMPLIFIER AND THE TETRODE SECTION IS INTENDED FOR USE AS A POWER AMPLIFIER WHERE THE HEATER, PLATE AND SPACE-CHARGE GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE INPUT: (G TO K + H)	1.8	pf
TRIODE OUTPUT: (P TO K + H)	0.4	pf
TRIODE GRID TO PLATE	5.7	pf
TETRODE INPUT: (G_2 TO G_1 +K+H)	→ 12	pf
TETRODE OUTPUT: (P TO G_1 +K+H)	1.6	pf
TETRODE GRID TO PLATE	→ 12	pf
COUPLING: (TETRODE GRID #2 TO TRIODE GRID #1) (MAX.)	0.1	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM TETRODE PLATE VOLTAGE	30	VOLTS
MAXIMUM POSITIVE TETRODE GRID #1 VOLTAGE	16	VOLTS
MAXIMUM NEGATIVE TETRODE GRID #2 VOLTAGE	20	VOLTS
MAXIMUM TETRODE GRID #2 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM TRIODE PLATE VOLTAGE	30	VOLTS
MAXIMUM TRIODE CATHODE CURRENT	20	MA.
MAXIMUM TRIODE GRID CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS

*THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

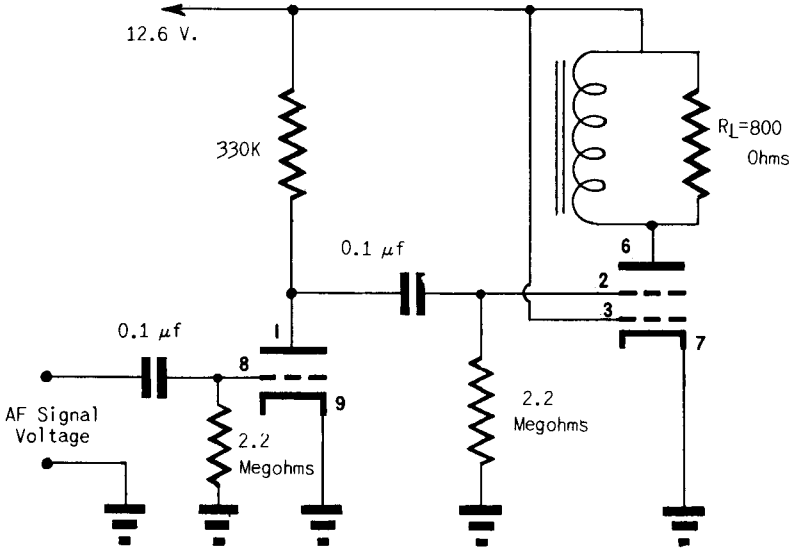
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER – SINGLE TUBE

	TRIODE		TETRODE	
HEATER VOLTAGE		12.6		VOLTS
HEATER CURRENT		0.55		AMP.
PLATE VOLTAGE	12.6		12.6	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	---		12.6	VOLTS
CONTROL GRID VOLTAGE	-0.9[A]		-0.5[A]	VOLTS
PLATE CURRENT	0.5		40	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	---		7.5	MA.
PLATE RESISTANCE	13 000		480	OHMS
AMPLIFICATION FACTOR	13		7.2[C]	
TRANSCONDUCTANCE	1 000		15 000[C]	μMHOS

RESISTANCE-COUPLED AMPLIFIER-SINGLE TUBE
(SEE CIRCUIT)

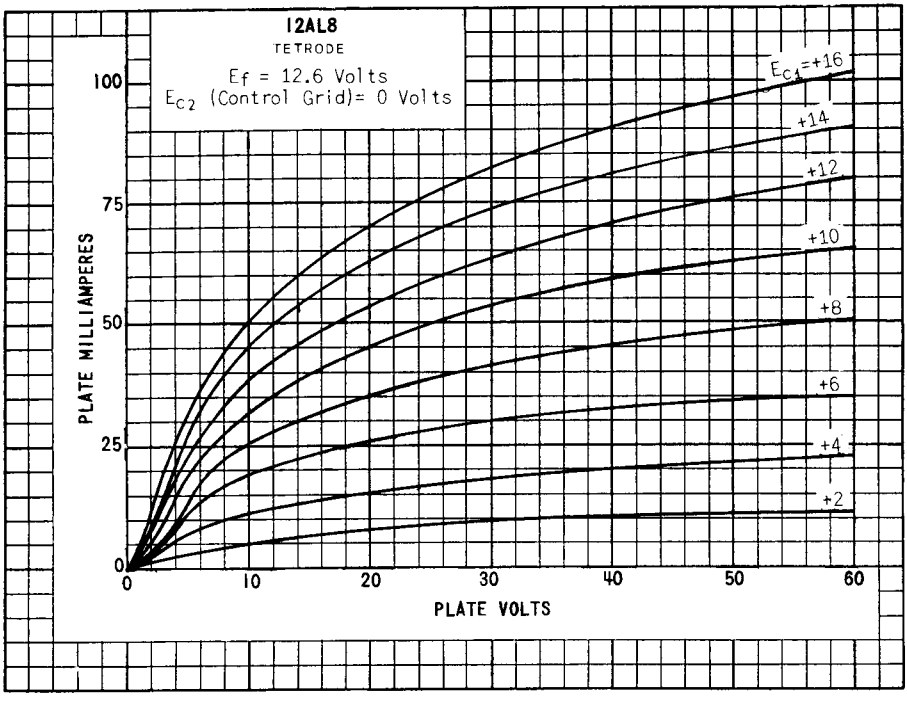
PLATE (SPACE-CHARGE GRID & HEATER) SUPPLY VOLTAGE	12.6	VOLTS
AF SIGNAL VOLTAGE	.18	VOLTS
PLATE CURRENT (TETRODE)	8.0[B]	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
LOAD RESISTANCE (TETRODE)	800	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
POWER OUTPUT	40	MW.

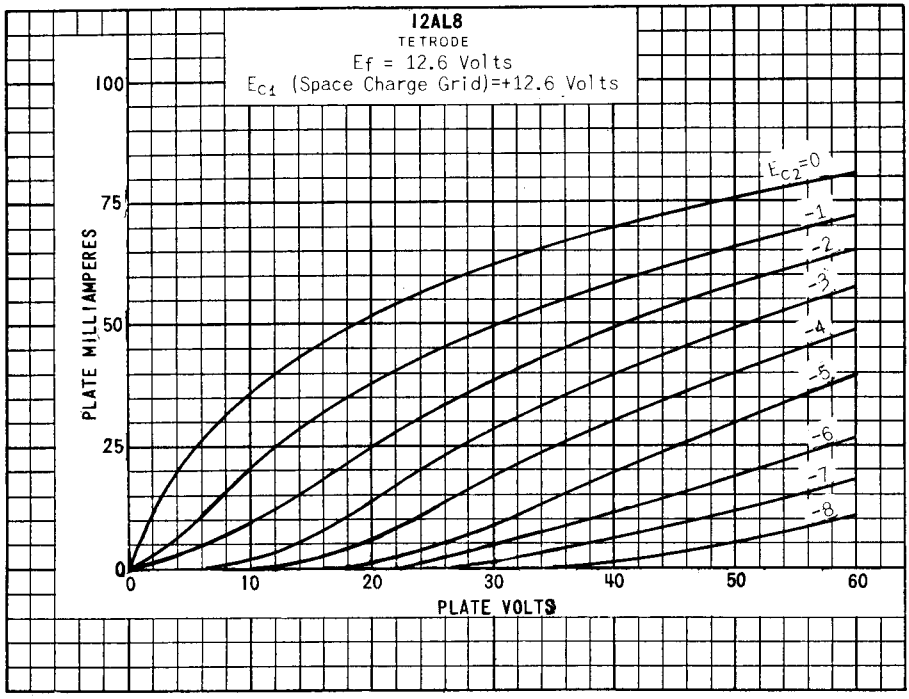


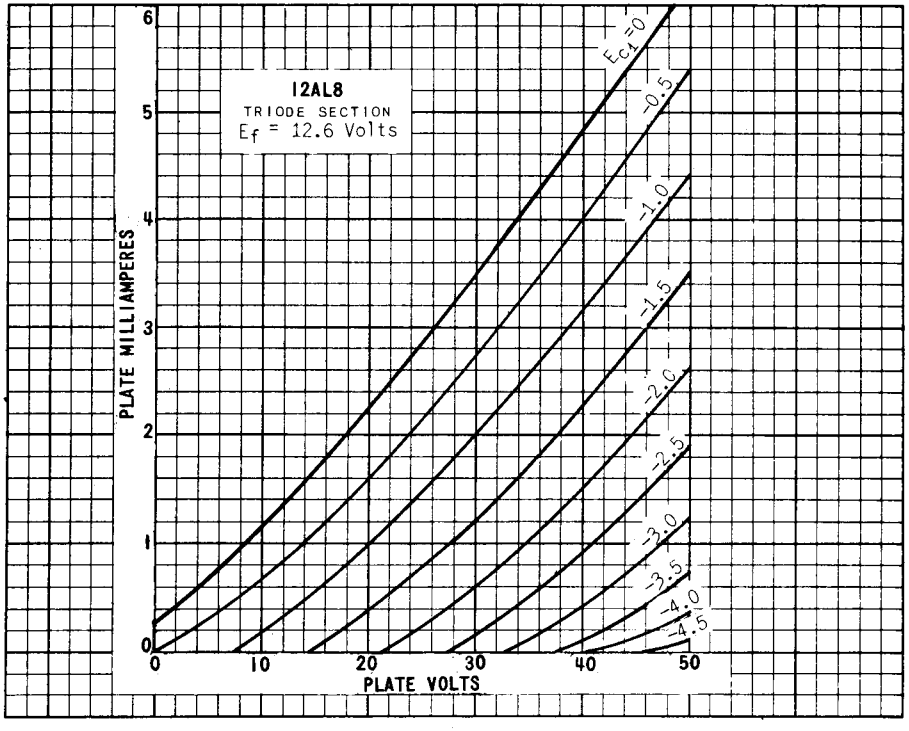
[A] AVERAGE BIAS DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.

[B] ZERO-SIGNAL PLATE CURRENT IS APPROXIMATELY 40 MA BECAUSE BIAS IS OBTAINED BY GRID #2 RECTIFICATION.

[C] FROM GRID #2 TO PLATE.


12AL8
TETRODE
Ef = 12.6 Volts
Ec2 (Control Grid)= 0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
10
20
30
40
50
60
Ec1=+16
+14
+12
+10
+8
+6
+4
+2


12AL8
TETRODE
Ef = 12.6 Volts
Ec1 (Space Charge Grid)=+12.6 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
10
20
30
40
50
60
Ec2=0
-1
-2
-3
-4
-5
-6
-7
-8


12AL8
TRIODE SECTION
E_f = 12.6 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
5
6
0
10
20
30
40
50
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

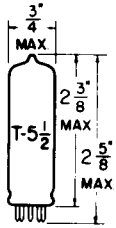
COATED UNIPOTENTIAL CATHODE

HEATER

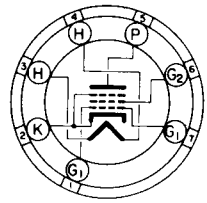
12.6 VOLTS 0.225 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
78Z

THE 12AQ5 IS A BEAM POWER AMPLIFIER USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN AC AND STORAGE BATTERY OPERATED RECEIVERS WHERE HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT IS DESIRED.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.35	μμf
INPUT	8.3	μμf
OUTPUT	8.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	CLASS A_1 AMPLIFIER	CLASS AB_1 AMPLIFIER	
HEATER VOLTAGE	12.6	12.6	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	100 ←		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	100 ←		VOLTS
MAXIMUM PLATE VOLTAGE	250	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	250	VOLTS
MAXIMUM PLATE DISSIPATION	12	12	WATTS
MAXIMUM GRID #2 INPUT	2	2	WATTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)[A]	250	250	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS OPERATION	0.1	0.1[BC]	MEGOHMS
CATHODE BIAS OPERATION	0.5	0.5[BC]	MEGOHMS

[A] HIGH AMBIENT TEMPERATURE AND SHIELDING MAY NECESSITATE A REDUCTION IN OPERATING DISSIPATION. WHEN TUBE SHIELDS ARE USED, IT IS ADVISABLE TO PAINT THE INSIDE AND OUTSIDE SURFACES OF THE TUBE SHIELD A DULL BLACK AND TO PROVIDE VENTILATION SLOTS TO REDUCE OPERATING TEMPERATURE.

[B] IF THE GRID #1 CIRCUIT RESISTANCE IS COMMON TO TWO TUBES, THE INDICATED MAXIMUM VALUES PER TUBE SHOULD BE HALVED.

[C] THE TYPE OF INPUT COUPLING USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT. TRANSFORMER OR IMPEDANCE-COUPLING DEVICES ARE RECOMMENDED.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

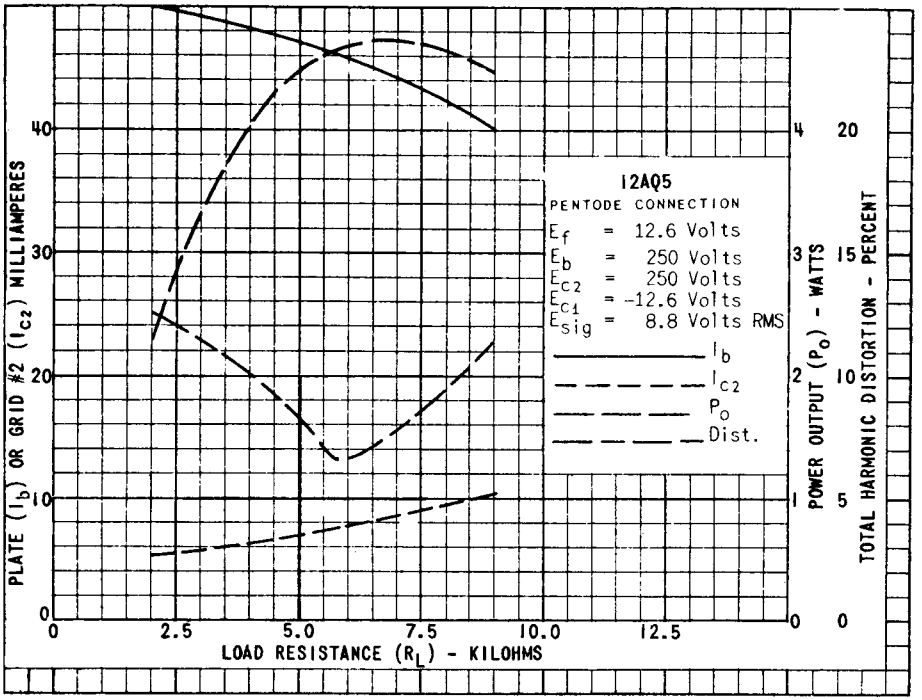
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.225	0.225	AMP.
PLATE VOLTAGE	180	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	MA.
MAXIMUM SIGNAL PLATE CURRENT	30	47	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	3	4.5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	4	7	MA.
PLATE RESISTANCE (APPROX.)	58 000	52 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	μMHOS
LOAD RESISTANCE	5 500	5 000	OHMS
TOTAL HARMONIC DISTORTION	8	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.0	4.5	WATTS

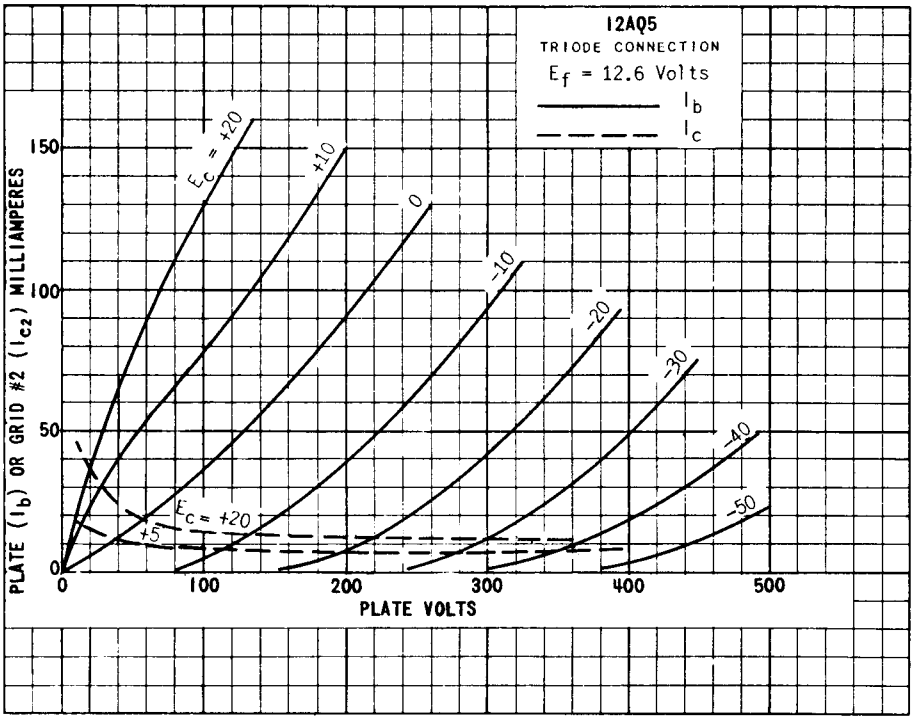
CLASS AB_1 AMPLIFIER

VALUES ARE FOR TWO TUBES UNLESS OTHERWISE SPECIFIED

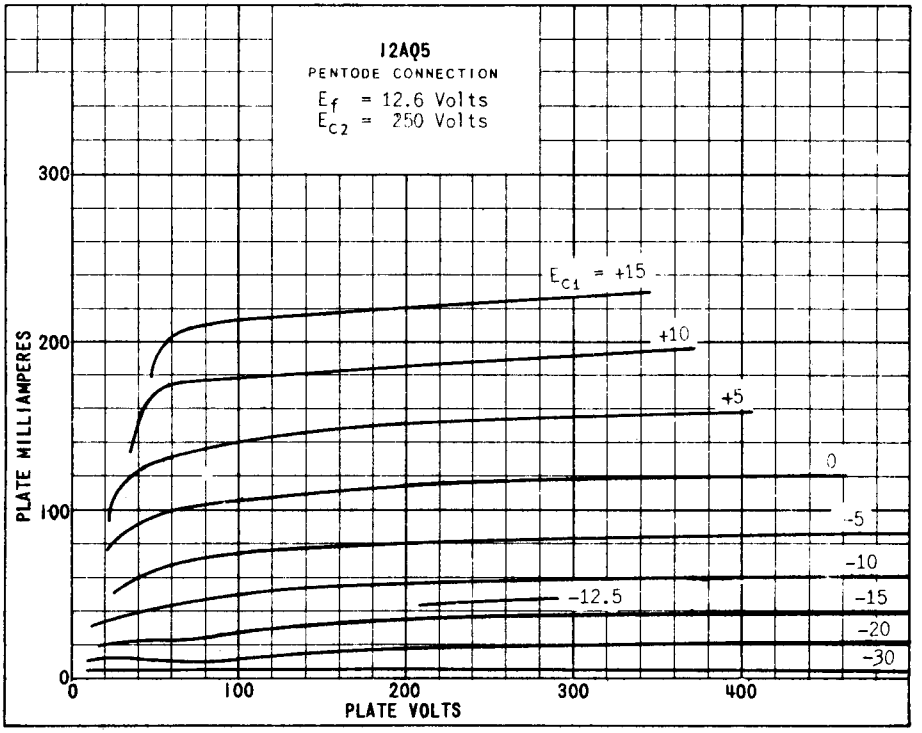
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE[C]	-15	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	30	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	MA.
MAXIMUM SIGNAL PLATE CURRENT	79	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	5	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	13	MA.
PLATE RESISTANCE (EACH TUBE) APPROX.	60 000	OHMS
TRANSCONDUCTANCE (EACH TUBE)	3 750	μMHOS
EFFECTIVE PLATE-TO-PLATE LOAD RESISTANCE	10 000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	10	WATTS

[C] THE TYPE OF INPUT COUPLING USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID #1 CIRCUIT, TRANSFORMER OR IMPEDANCE COUPLING DEVICES ARE RECOMMENDED.


12AQ5
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = -12.6 Volts
E_{sig} = 8.8 Volts RMS
I_b
I_{c2}
P_o
Dist.
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
POWER OUTPUT (P_o) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE (R_L) - KILOHMS
0
2.5
5.0
7.5
10.0
12.5
10
20
30
40
1
2
3
4
5
15
20


12AQ5
TRIODE CONNECTION
E_f = 12.6 Volts
I_b
I_c
E_c = +20
+10
0
-10
-20
-30
-40
-50
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
50
100
150

12AQ5 (6AQ5)



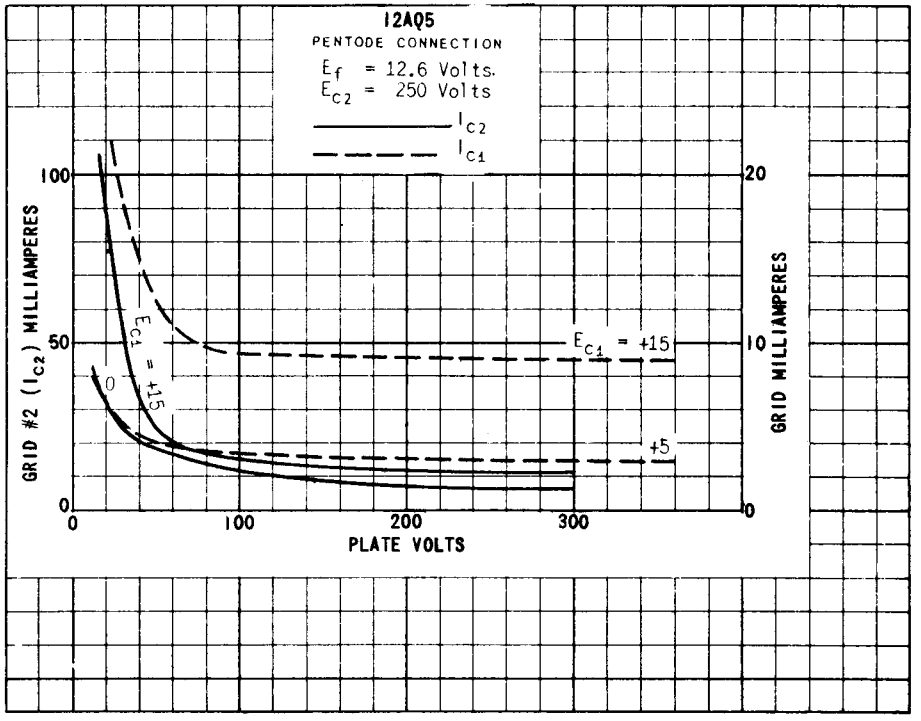
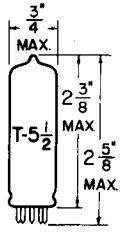


PLATE #3317 AUGUST 1, 1953 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION NEWARK, NEW JERSEY, U.S.A.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

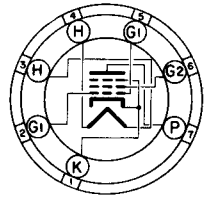
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0 0.4 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7CV

THE 12AS5 IS A HEATER-CATHODE, BEAM PENTODE POWER AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN OUTPUT TUBE IN AUTOMOBILE AND AC OPERATED RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS, THE 12AS5 IS IDENTICAL TO THE 6AS5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.6	μμf
INPUT: G1 TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	6.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER MAXIMUM SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE GRID #2 RATING CURVE	
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	90	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

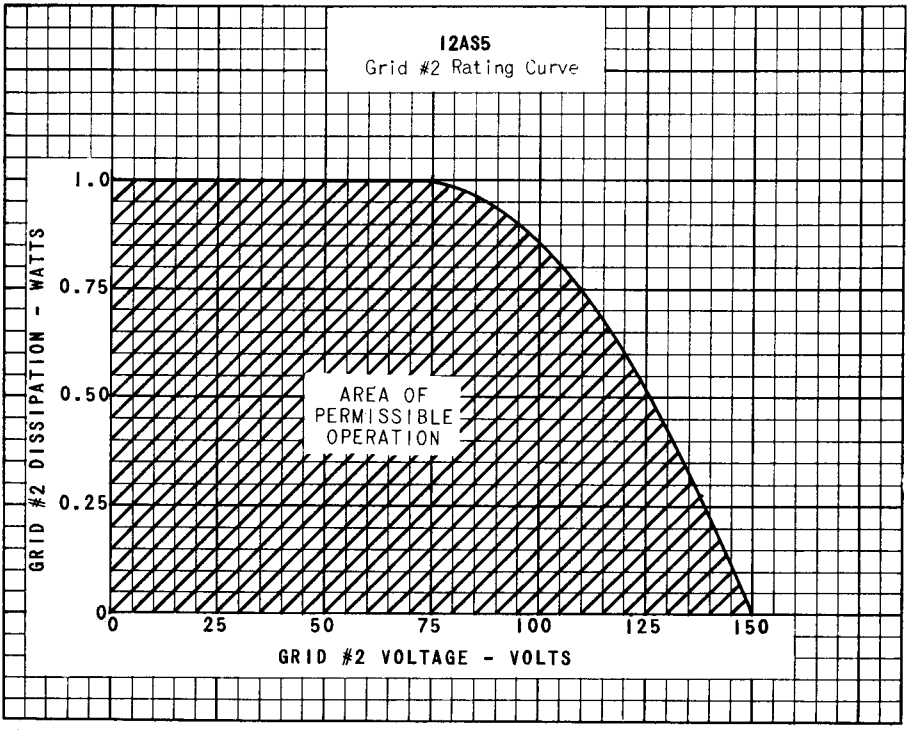
CONTINUED FROM PRECEDING PAGE

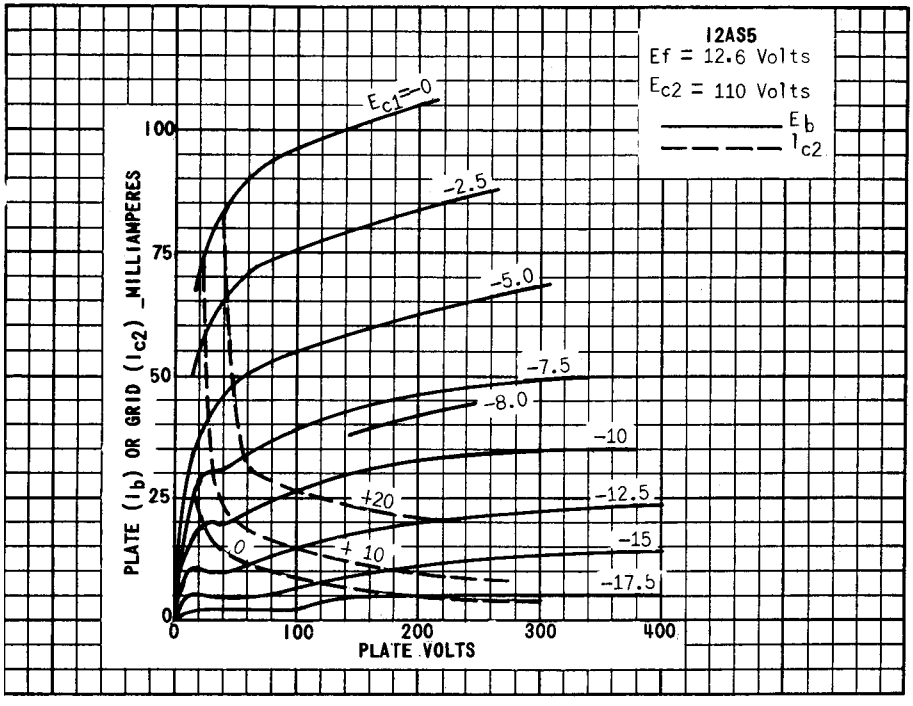
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

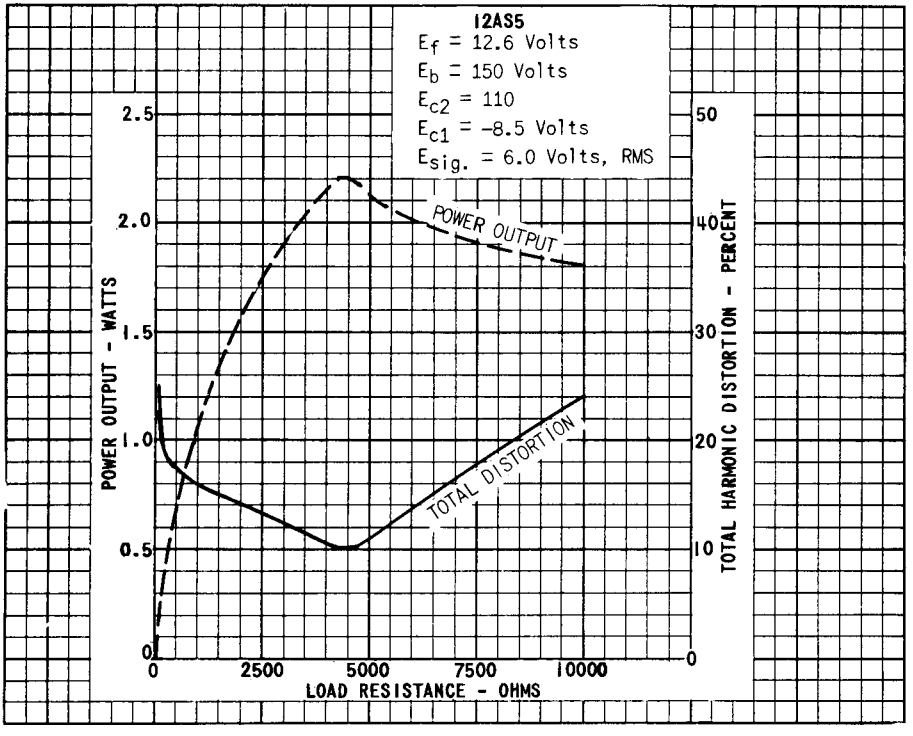
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.4	VOLTS
PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE[A]	-8.5	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAX. SIGNAL PLATE CURRENT	36	MA.
ZERO-SIGNAL GRID #2 CURRENT (APPROX.)	2	MA.
MAX.-SIGNAL GRID #2 CURRENT (APPROX.)	6.5	MA.
TRANSCONDUCTANCE	5600	μMHOS
LOAD RESISTANCE	4500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	2.2	WATTS

[A]UNDER MAX. RATED CONDITIONS THE DC RESISTANCE OF THE GRID #1 CIRCUIT SHOULD NOT EXCEED 0.1 MEG. FOR FIXED BIAS OPERATION OR 0.5 MEG. FOR CATHODE BIAS OPERATION.




12AS5
Ef = 12.6 Volts
Ec2 = 110 Volts
Eb
Ic2
Ec1=0
-2.5
-5.0
-7.5
-8.0
-10
-12.5
-15
-17.5
+20
0
+ 10
PLATE (Ib) OR GRID (Ic2) _MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
100
200
300
400


12AS5
Ef = 12.6 Volts
Eb = 150 Volts
Ec2 = 110
Ec1 = -8.5 Volts
Esig. = 6.0 Volts, RMS
POWER OUTPUT
TOTAL DISTORTION
POWER OUTPUT - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE - OHMS
0
0.5
1.0
1.5
2.0
2.5
10
20
30
40
50
0
2500
5000
7500
10000

TUNG-SOL

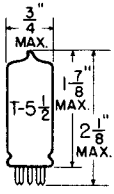
DOUBLE-DIODE TRIODE

MINIATURE TYPE

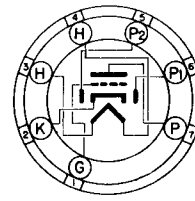
UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 12AT6 IS A COMBINED HIGH-MU VOLTAGE AMPLIFIER AND DOUBLE-DIODE DETECTOR USING THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE OUTPUT VOLTAGE ADEQUATE FOR FULL POWER OUTPUT OF MOST BEAM-POWER TUBES.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	2.1	μμf
INPUT: G TO (H + K)	2.3	μμf
OUTPUT: P TO (H + K)	1.1	μμf
DIODE PLATE #2 TO TRIODE GRID: (P_2 TO G) (MAX.)	0.025	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED	0.8	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT – CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1.0	MA.
PLATE RESISTANCE	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	

DIODE UNITS – TWO

THE DIODE UNITS ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE SLEEVE.

SIMILAR TYPE REFERENCE: *Except for heater ratings somewhat similar to 6Q7, 6Q7GT, 6SQ7, 6SQ7GT, 7B6, 7C6.*

→ INDICATES A CHANGE OR ADDITION.

PRINTED IN U.S.A.

PLATE
1847
JULY 1,
1947

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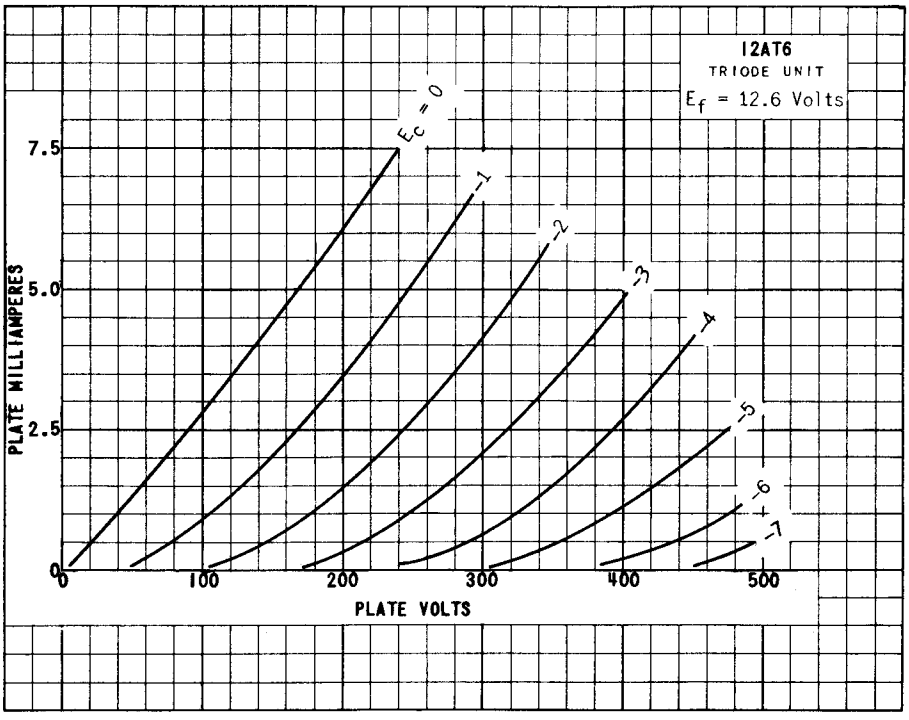
12AT6



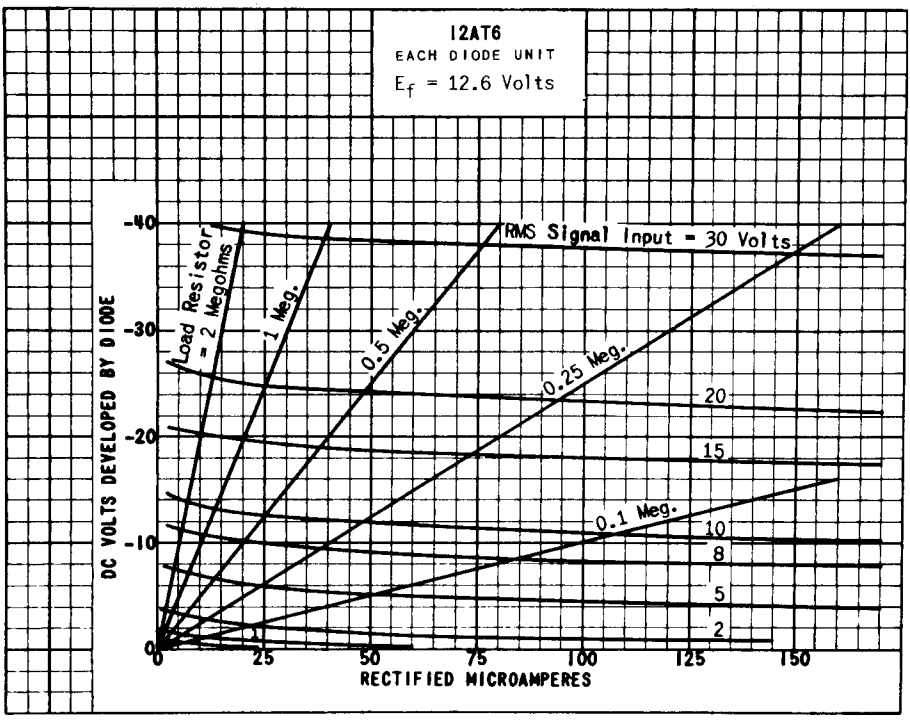


PLATE 1848
JULY 1, 1947

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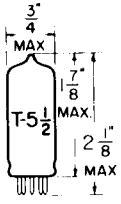
TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

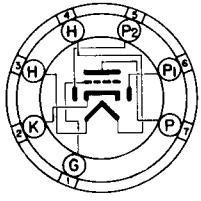


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 12AT6 IS A COMBINED HIGH-MU VOLTAGE AMPLIFIER AND DOUBLE-DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE OUTPUT VOLTAGE ADEQUATE FOR FULL POWER OUTPUT OF MOST BEAM POWER TUBES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO TRIODE PLATE)	2.0	2.0	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf
COUPLING: #1 DIODE PLATE TO GRID (MAX.)*		0.07	μμf
#2 DIODE PLATE TO HEATER AND CATHODE *		0.95	μμf
#1 DIODE PLATE TO HEATER AND CATHODE *		0.66	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT (EACH UNIT) FOR CONTINOUS OPERATION	1.0	MA.

*INDICATES AN ADDITION.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
PLATE RESISTANCE	54 000	58 000	OHMS
AMPLIFICATION FACTOR	70	70	
TRANSCONDUCTANCE	1 300	1 200	µMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

TRIODE UNIT

HEATER VOLTAGE	12.6	12.6	VOLTS
PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	8	34	VOLTS
VOLTAGE GAIN AT 400 CPS.	35	46	

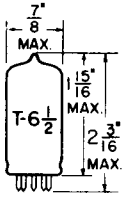
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODES

HEATER

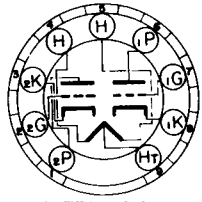


GLASS BULB

SERIES	PARALLEL
12.6 VOLTS 150 MA.	6.3 VOLTS 300 MA.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9A

ANY MOUNTING POSITION

THE 12AT7 COMBINES TWO HIGH TRANSCONDUCTANCE TRIODES IN A 9 PIN MINIATURE CONSTRUCTION. ITS LOW CAPACITANCE AND HIGH RATIO OF PLATE CURRENT TO TRANSCONDUCTANCE ADAPT IT TO USE AS A HIGH FREQUENCY COMBINED OSCILLATOR AND MIXER OR AS A GROUNDED GRID RADIO FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316[A]	
INPUT: G TO (H+K) (EACH SECTION)	2.2	2.2	μμf
OUTPUT: P TO (H+K) (SECTION #1)	0.5	1.2	μμf
(SECTION #2)	0.4	1.5	μμf
GRID TO PLATE: (G TO P) (EACH SECTION)	1.5	1.5	μμf
HEATER TO CATHODE: (H TO K) (EACH SECTION)	2.4	2.4	μμf

GROUNDED GRID	WITHOUT SHIELD	WITH SHIELD #316[B]	
INPUT: K TO (H+G) (EACH SECTION)	4.6	4.6	μμf
OUTPUT: P TO (H+G) (EACH SECTION)	1.8	2.6	μμf
PLATE TO CATHODE (P TO K) (EACH SECTION)	0.2	0.2	μμf

[A] CONNECTED TO CATHODE OF SECTION UNDER TEST.

[B] CONNECTED TO GRID OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE	90		VOLTS
MAXIMUM PLATE VOLTAGE	300		VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	−50		VOLTS
MAXIMUM PLATE DISSIPATION	2.5		WATTS

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→ INDICATES A CHANGE OR ADDITION.

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PLATE 2569
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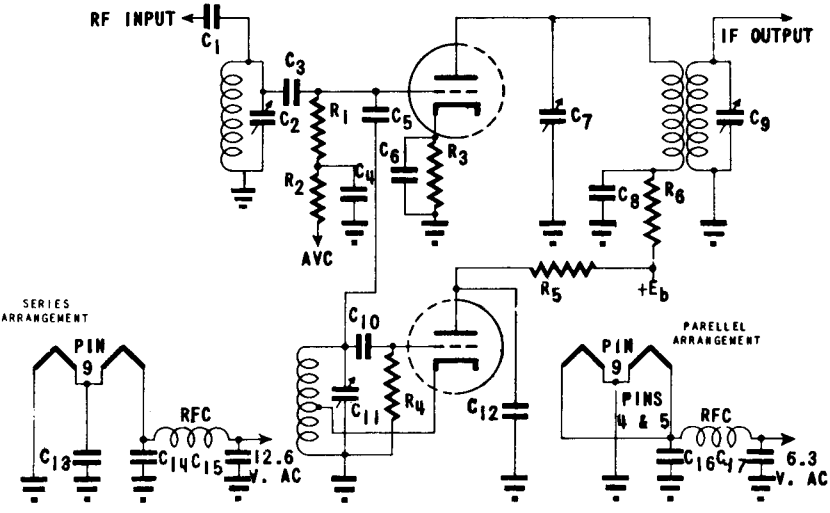
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	150	300	150	300	MA.
PLATE VOLTAGE	100		250		VOLTS
CATHODE BIAS RESISTOR	270		200		OHMS
PLATE CURRENT	3.7		10		MA.
PLATE RESISTANCE	15 000		10 900		OHMS
TRANSCONDUCTANCE	4 000		5 500		μMHOS
AMPLIFICATION FACTOR	60		60		
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	-5		-12		VOLTS

TYPICAL CIRCUIT FOR CONVERTER OPERATION AT 100 MEGACYCLES



C_1 = 100 μμF
C_2 = RF TUNING CAPACITOR
C_3 = 25 μμF
C_4 = 1000 μμF
C_5 = 1 μμF
C_6 = 1000 μμF

C_7 = 50 μμF (MAX.)
C_8 = 1000 μμF
C_9 = 50 μμF (MAX.)
C_{10} = 50 μμF
C_{11} = OSCILLATOR TUNING CAPACITOR
C_{12} = 1000 μμF

C_{13} = 1000 μμF
C_{14} = 1000 μμF
C_{15} = 1000 μμF
C_{16} = 1000 μμF
C_{17} = 1000 μμF
R_1 = 50000 OHMS

R_2 = 2000 OHMS
R_3 = 10000 OHMS
R_4 = 1000 OHMS
R_5 = 1000 OHMS
R_6 = 100 OR 250 VOLTS
E_b

OSCILLATOR VOLTAGE APPLIED TO MIXER SHOULD BE JUST SUFFICIENT TO CAUSE GRID CURRENT TO FLOW IN THE MIXER SECTION.

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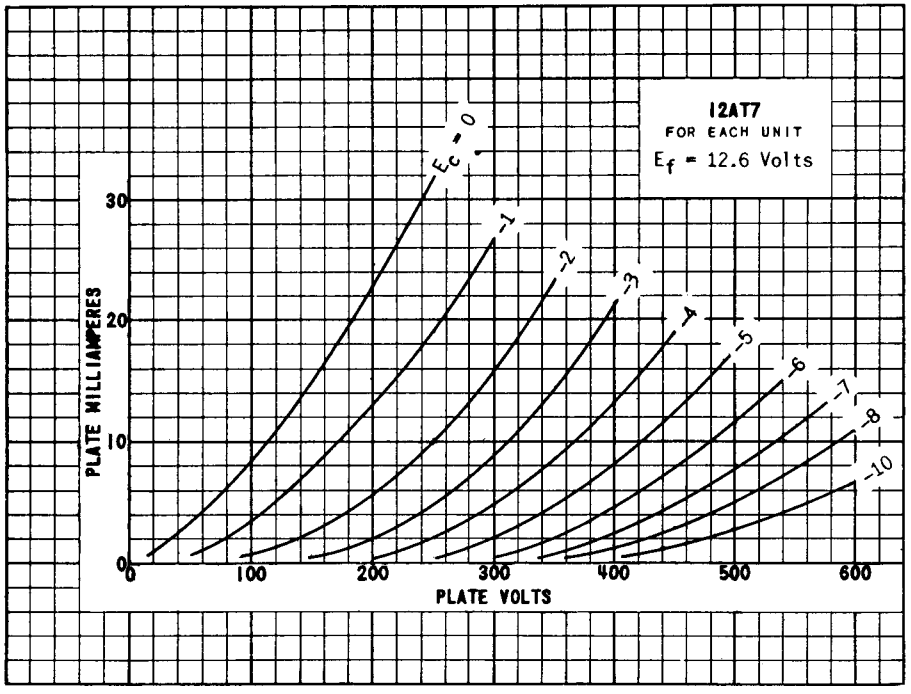

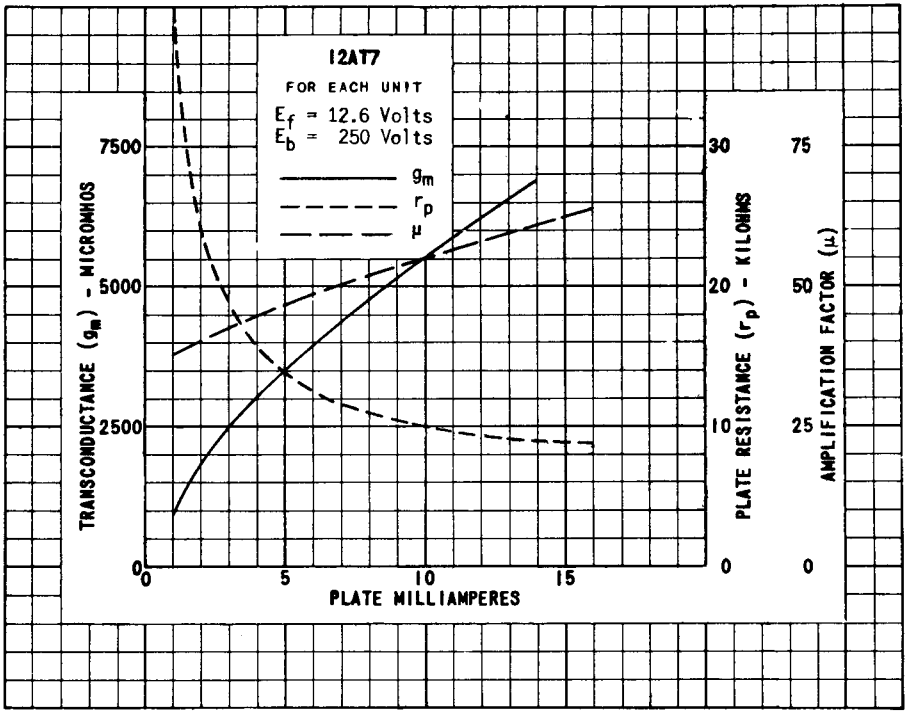

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1894
OCT. 1,
1947

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TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

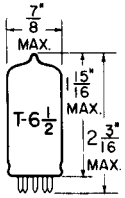
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMP.
12.6 VOLTS 0.150 AMP.

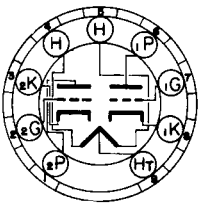
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9A

THE 12AT7WA IS A RUGGEDIZED TWIN TRIODE OF THE 9-PIN MINIATURE CONSTRUCTION. THE TWO HIGH TRANSCONDUCTANCE TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE HIGH RATIO OF PLATE CURRENT TO TRANSCONDUCTANCE MAKES IT ADAPTABLE FOR USE AS A COMBINED HIGH FREQUENCY OSCILLATOR AND MIXER, OR AS A GROUNDED GRID RF AMPLIFIER. THE HEATER CENTER TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 12AT7WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

EACH SECTION

	WITH SHIELD #316	WITHOUT SHIELD	
GRID TO PLATE #1 (RATED)	1.5	1.5	μμf
MAXIMUM	---	1.90	μμf
MINIMUM	---	1.30	μμf
INPUT SECTION #1 (RATED)	2.2	2.2	μμf
MAXIMUM	---	3.00	μμf
MINIMUM	---	2.00	μμf
OUTPUT (SECTION#1) (RATED)	1.2	0.5	μμf
MAXIMUM	---	0.70	μμf
MINIMUM	---	0.20	μμf
OUTPUT (SECTION#2) (RATED)	1.5	0.4	μμf
MAXIMUM	---	0.60	μμf
MINIMUM	---	0.16	μμf
PLATE TO PLATE			
MAXIMUM	---	0.33	μμf
MINIMUM	---	0.15	μμf
HEATER TO CATHODE #1 (RATED)	2.4	2.4	μμf
MAXIMUM	---	3.50	μμf
MINIMUM	---	2.10	μμf
HEATER TO CATHODE #2 (RATED)	2.4	2.4	μμf
MAXIMUM	---	3.50	μμf
MINIMUM	---	2.10	μμf
GRID TO PLATE #2 (RATED)	1.5	1.5	μμf
MAXIMUM	---	1.90	μμf
MINIMUM	---	1.30	μμf
INPUT SECTION #2 (RATED)	2.2	2.2	μμf
MAXIMUM	---	3.00	μμf
MINIMUM	---	2.00	μμf

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TUNG-SOL

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RATINGS

ABSOLUTE MAXIMUM VALUES

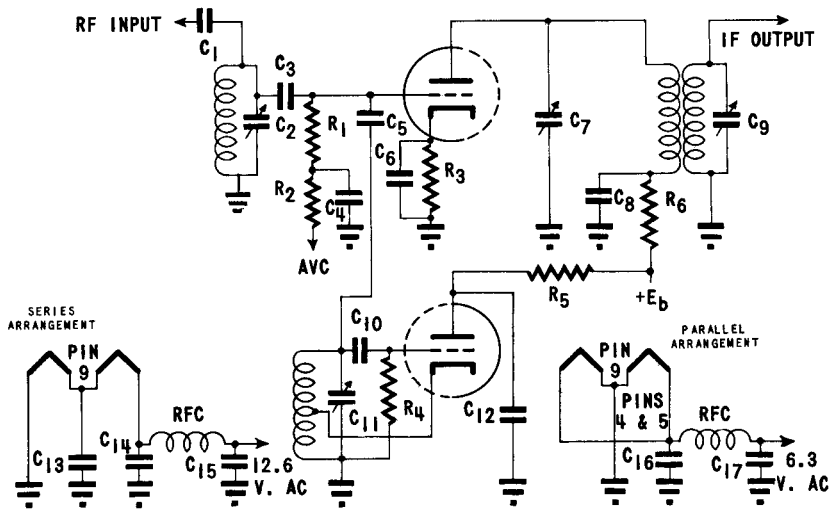
HEATER VOLTAGE	6.3±10%	12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	−55		VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	2.8		WATTS
MAXIMUM HEATER CATHODE VOLTAGE	±100		VOLTS
MAXIMUM BULB TEMPERATURE	200		°C
MAXIMUM ALTITUDE	10 000		FEET
MAXIMUM SHOCK	600		G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	150	300	150	300	mA
PLATE VOLTAGE	100		250		VOLTS
CATHODE BIAS RESISTOR	270		200		OHMS
PLATE CURRENT	3.7		10		mA
PLATE RESISTANCE	15 000		10 900		OHMS
TRANSCONDUCTANCE	4 000		5 500		μMHOS
AMPLIFICATION FACTOR	60		60		
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	−5		−12		VOLTS

TYPICAL CIRCUIT FOR CONVERTER OPERATION AT 100 MEGACYCLES



C_1 = 100 μμF
C_2 = RF TUNING CAPACITOR
C_3 = 25 μμF
C_4 = 1000 μμF
C_5 = 1 μμF
C_6 = 1000 μμF

C_7 = 50 μμF (MAX.)
C_8 = 1000 μμF
C_9 = 50 μμF (MAX.)
C_{10} = 50 μμF
C_{11} = OSCILLATOR TUNING CAPACITOR
C_{12} = 1000 μμF

C_{13} = 1000 μμF
C_{14} = 1000 μμF
C_{15} = 1000 μμF
C_{16} = 1000 μμF
C_{17} = 1000 μμF
R_1 = 50000 OHMS

R_2 = 50000 OHMS
R_3 = 2000 OHMS
R_4 = 10000 OHMS
R_5 = 1000 OHMS
R_6 = 1000 OHMS
E_b = 100 OR 250v.

OSCILLATOR VOLTAGE APPLIED TO MIXER SHOULD BE JUST SUFFICIENT TO CAUSE GRID CURRENT TO FLOW IN THE MIXER SECTION.

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TUNG-SOL

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

(E_f = 12.6V, E_b = 250Vdc, RK/K = 200 OHMS)
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	138	162	144	156	138	162	mA
HEATER–CATHODE LEAKAGE[A] (E_{hk} =±100Vdc)	---	±10	---	±2	---	±10	μAdc
GRID CURRENT[B] (R_g = 0.5 MEG.)	---	-0.7	---	-0.2	---	-0.7	μAdc
PLATE CURRENT (1)[B]	7.0	14.0	8.5	11.5	---	---	mAdc
TRANSCONDUCTANCE (1)	4500	6500	4880	6120	3800	6500	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	20	PERCENT
INSULATION OF ELECTRODES[CB] (E_f=12.6 V, E(g–all)= -100Vdc, E(p–all)=-300Vdc)							
R_g–all	100	---	---	---	50	---	MEGOHM
R_p–all	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (2)[DB] (E_c=-20Vdc, R_p=0.1MEG, R_k=0, C_k=0)	---	100	---	---	---	---	μAdc
PLATE CURRENT DIFFERENCE[B] BETWEEN SECTIONS	---	3.2	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[EB] (E_f = 11.0V)	4000	---	4400	---	---	---	μMHOS
AMPLIFICATION FACTOR[FB]	50	70	---	---	---	---	
GRID EMISSION[GB] (E_f=15.0V, E_c=20Vdc, R_g=0.5MEG, R_k=0, C_k=0)	---	-1.5	---	---	---	---	μAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[HA] (E_c=-3Vdc, R_p=2000, R_k=0, C_k=0)	---	100	mVac
VIBRATIONAL FATIGUE[J]	---	---	
MINIATURE TUBE BASE STRAIN[K] (NO VOLTAGES)	---	---	
STABILIZATION[L] (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
SHOCK[M] (HAMMER ANGLE =42°, E_{hk} =100Vdc, R_g =0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER CATHODE LEAKAGE	---	30	μAdc
TRANSCONDUCTANCE (1)	3800	---	μMHOS
GRID CURRENT	---	-1.5	μAdc
SHORT AND CONTINUITY	---	---	
RF NOISE[NA] (E_{sig}=15mVac, R_k=100, C_k=0.2 μf)	---	---	
NOISE AND MICROPHONICS[P] (E_f =12.6Vdc, Ebb=300Vdc, E_{cal}=100mVac, R_p=10,000)	---	100	mVac
LOW FREQUENCY VIBRATION[QA] (E_c =-3Vdc, R_p =2000, R_k =0, C_k=0)	---	100	mVac
INTERMITTENT LIFE TEST (E_{hk} =135Vdc, R_g =0.5 MEG., C_k= 0)	---	---	
HEATER CYCLING LIFE TEST (E_f = 7.5V HEATERS IN PARALLEL, E_{hk} = 135Vdc)	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINT HEATER CATHODE LEAKAGE	---	20	μAdc

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NOTES

[A] TEST WITH UNITS TIED TOGETHER.

[B] TEST EACH UNIT SEPARATELY WITH ELEMENTS OF OPPOSITE SECTION GROUNDED.

[C] SEE MIL-E-1C 4.8.2

[D] THE PLATE CURRENT DIFFERENCE BETWEEN SECTIONS SHALL BE WITHIN THE SPECIFIED LIMIT.

[E] PREHEAT ALL TUBES TO BE TESTED FOR TRANSCONDUCTANCE (2) UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. PREHEAT WITH TRIODE SECTIONS OPERATING SEPARATELY. E_f = 11.0V, E_b = 250Vdc, Rk = 200, R_g = 0.5MEG.

[F] SEE MIL-E-1C 4.10.11.1

[G] PREHEAT ALL TUBES TO BE TESTED FOR GRID EMISSION UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING: E_f=15.0V, E_b=250Vdc, R_g=0.5MEG, R_k=200. PREHEAT WITH TRIODE SECTIONS OPERATING SEPARATELY. TWO SECONDS SHALL BE THE MAXIMUM TIME BETWEEN PREHEAT AND TEST.

[H] SEE MIL-E-1C 4.9.20.3

[J] SEE MIL-E-1C 4.9.20.6

[K] SEE MIL-E-1C 4.9.6.1

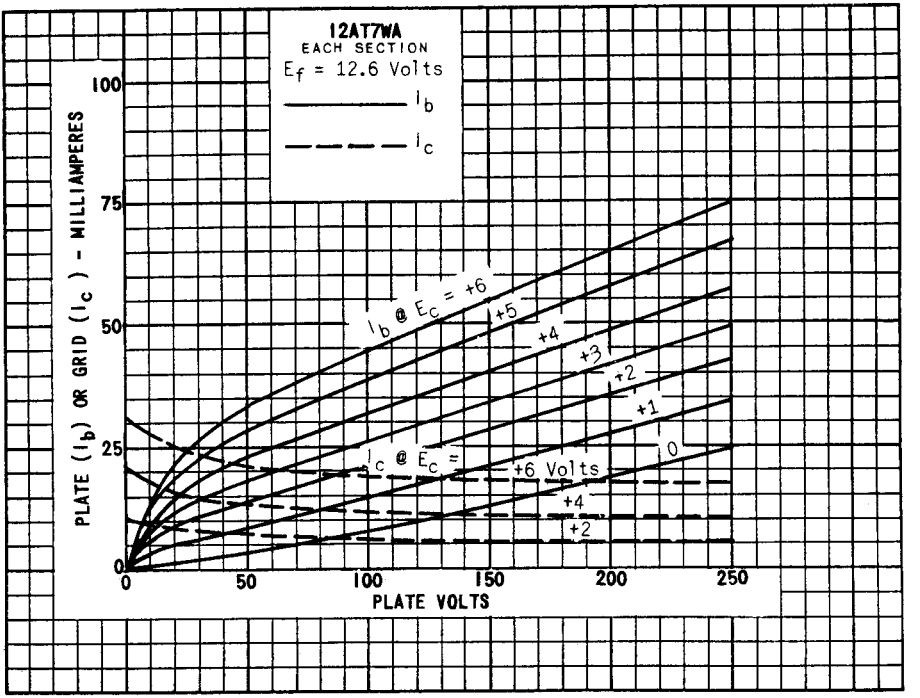
[L] SEE MIL-E-1C 4.6.2

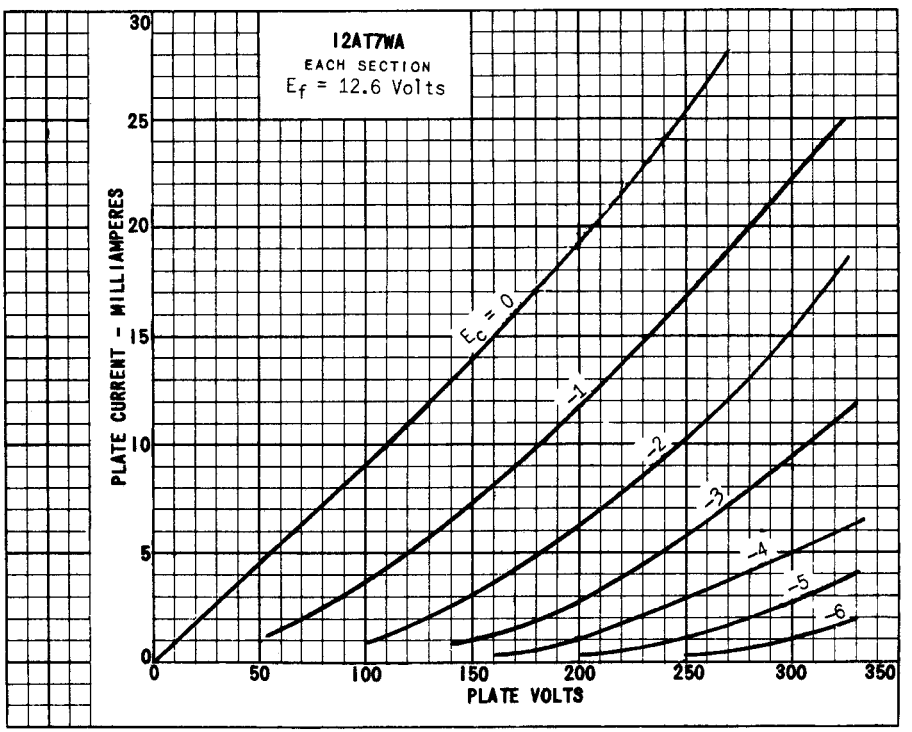
[M] SEE MIL-E-1C 4.9.20.5

[N] SEE MIL-E-1C 4.10.3.1

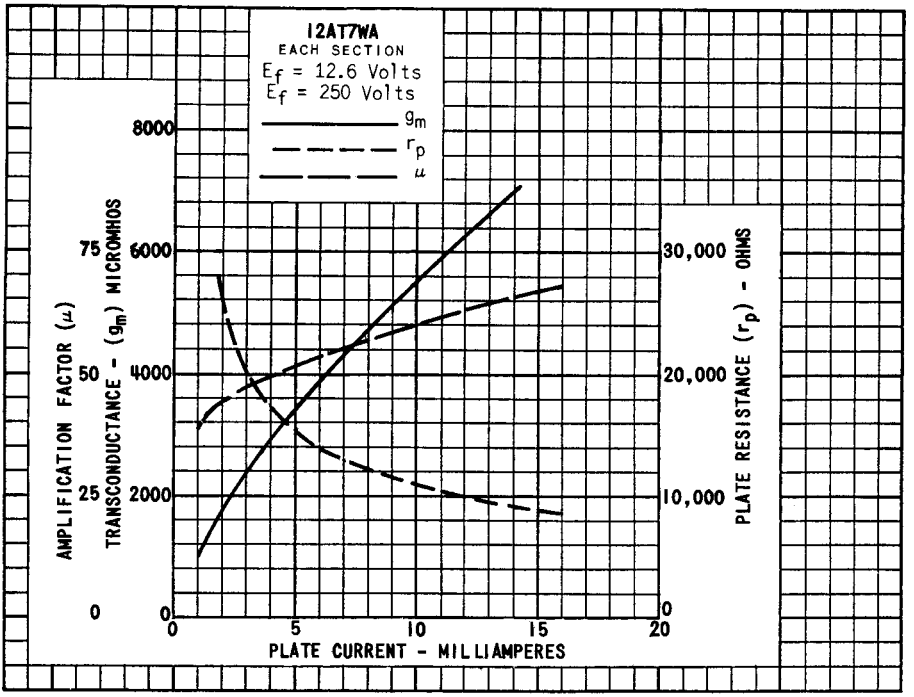
[P] TEST WITH TWO SECTIONS CONNECTED IN PARALLEL. TIE CATHODE TOGETHER AND GROUND THRU A 200 OHM RESISTOR. GRIDS ARE GROUNDED.

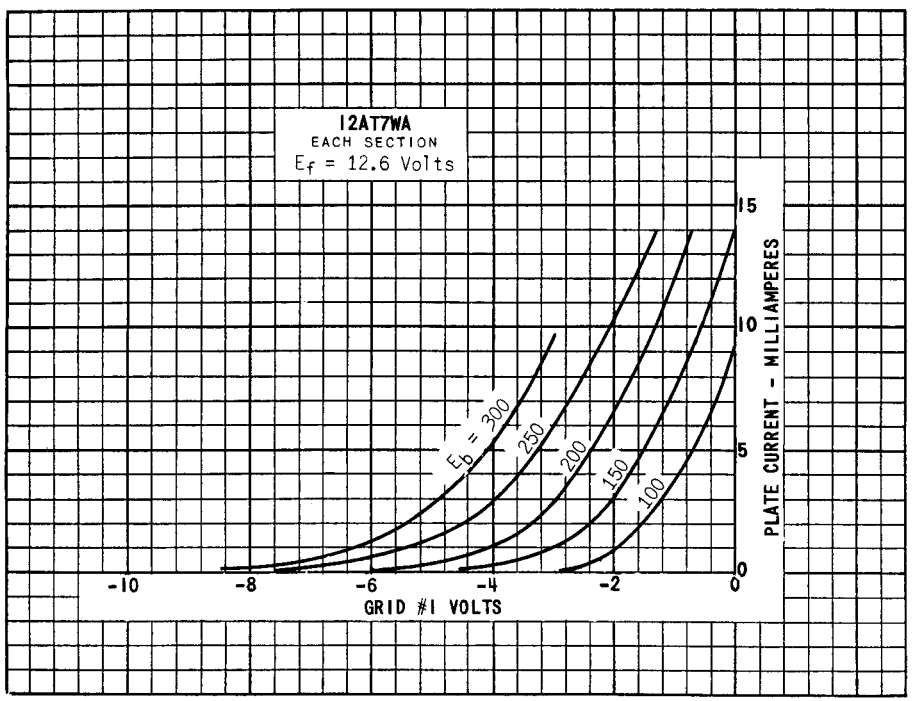
[Q] SEE MIL-E-1C 4.9.20.4


12AT7WA
EACH SECTION
E_f = 12.6 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) - MILLIAMPERES
100
75
50
25
0
I_b @ E_c = +6
+5
+4
+3
+2
+1
0
I_c @ E_c =
+6 Volts
+4
+2
0
50
100
150
200
250
PLATE VOLTS

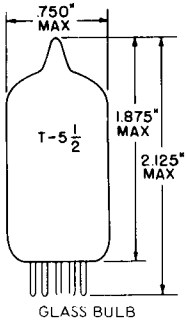

12AT7WA
EACH SECTION
E_f = 12.6 Volts
PLATE CURRENT - MILLIAMPERES
30
25
20
15
10
5
0
E_c = 0
-1
-2
-3
-4
-5
-6
50
100
150
200
250
300
350
PLATE VOLTS

12AT7WA
PREMIUM TUBE





TUNG-SOL



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

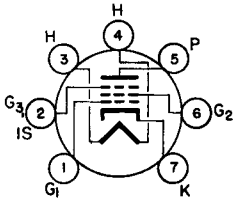
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
12.6±1.3 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 12AU6 IS A PENTODE AMPLIFIER HAVING A SHARP CUT-OFF CONTROL CHARACTERISTIC USING THE MINIATURE CONSTRUCTION. WITH HIGH TRANSCONDUCTANCE, LOW GRID-PLATE CAPACITANCE, IT IS INTENDED FOR SERVICE AS EITHER AN RF OR AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PENTODE CONNECTION:			
GRID TO PLATE: (G_1 TO P) MAX.	.0035	.0035	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5	5	pf
TRIODE CONNECTION:			
GRID TO PLATE: G_1 TO (P+G_2+G_3&IS)	2.6	2.6	pf
INPUT: G_1 TO (H+K)	3.2	3.2	pf
OUTPUT: (P+G_2+G_3&IS) TO (H+K)	9.5	1.7	pf

[A] SHIELD #316 CONNECTED TO PIN #7.

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[C]	PENTODE CONNECTION	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200●	200●	VOLTS
MAXIMUM PLATE VOLTAGE	275	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	---	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	SEE J5-C4-2	
MAXIMUM GRID #3 VOLTAGE PIN #2 CONNECTED TO:	PLATE	CATHODE	
MAXIMUM PLATE DISSIPATION	3.5	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	---	WATTS
MAXIMUM GRID #2 INPUT: *			VOLTS
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	---	0.75	WATT
FOR GRID #2 VOLTAGES BETWEEN 165 VOLTS AND 330 VOLTS *	---	SEE J5-C4-2	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

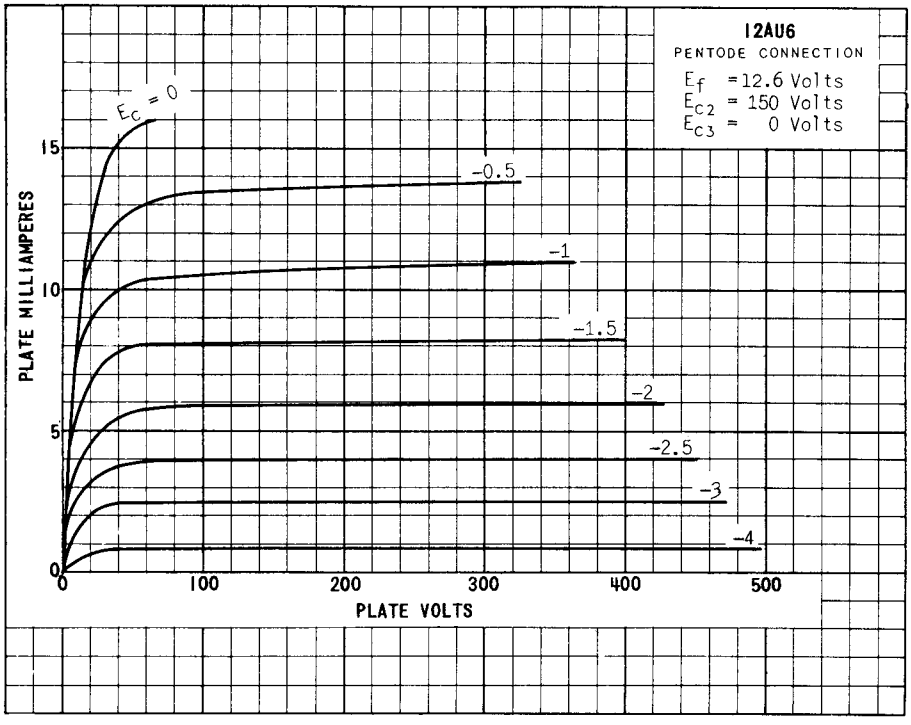
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	150	100	68	OHMS
GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET			
TRANSCONDUCTANCE	3 900	4 500	5 200	µMHOS
PLATE CURRENT	5	7.6	10.6	MA.
GRID #2 CURRENT	2.1	3	4.3	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.5	1	MEGOHMS
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA.	-4.2	-5.5	-6.5	VOLTS

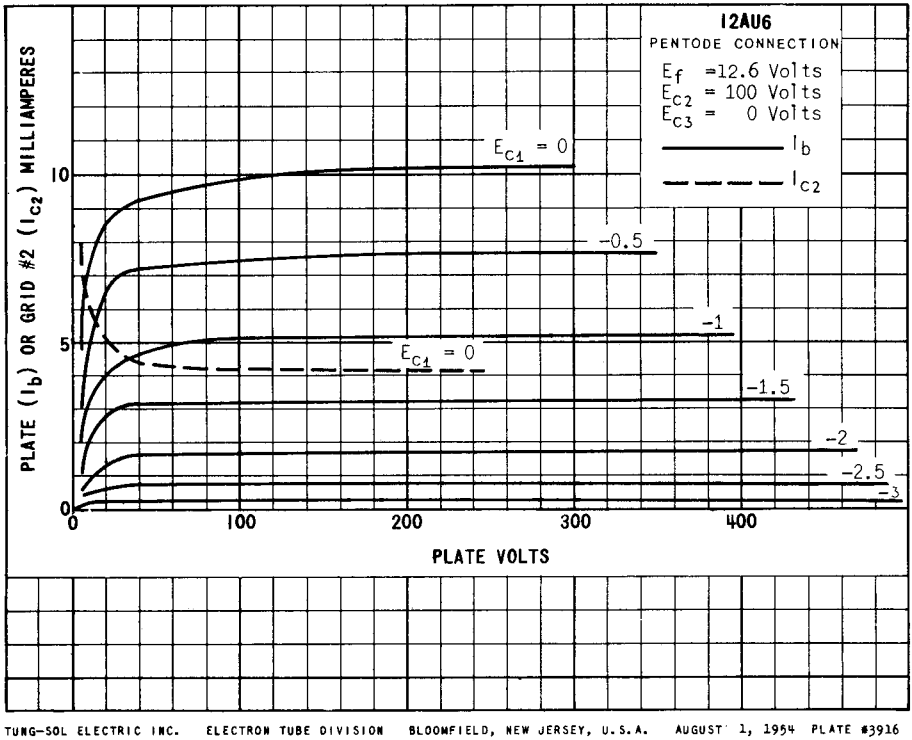
CLASS A_1 AMPLIFIER – TRIODE CONNECTION[C]

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	PLATE	
CATHODE RESISTOR	330	OHMS
GRID #3 VOLTAGE	PLATE	
TRANSCONDUCTANCE	4 800	µMHOS
PLATE CURRENT	12.2	MA.
AMPLIFICATION FACTOR	36	

[C] TRIODE CONNECTION: GRID #2 AND GRID #3 CONNECTED TO PLATE.

• THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.





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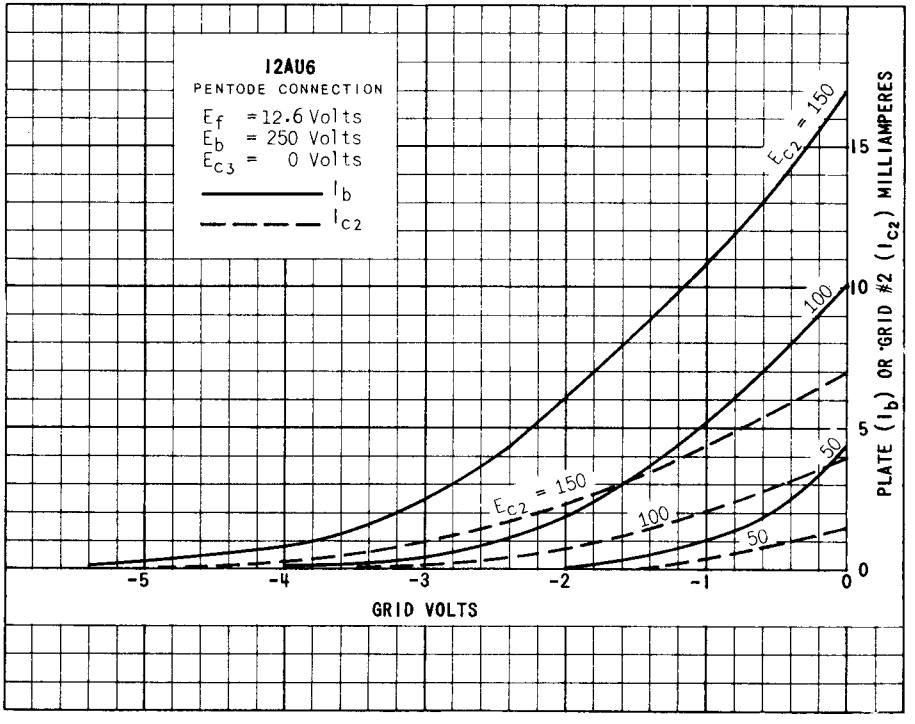
12AU6 (6AU6)



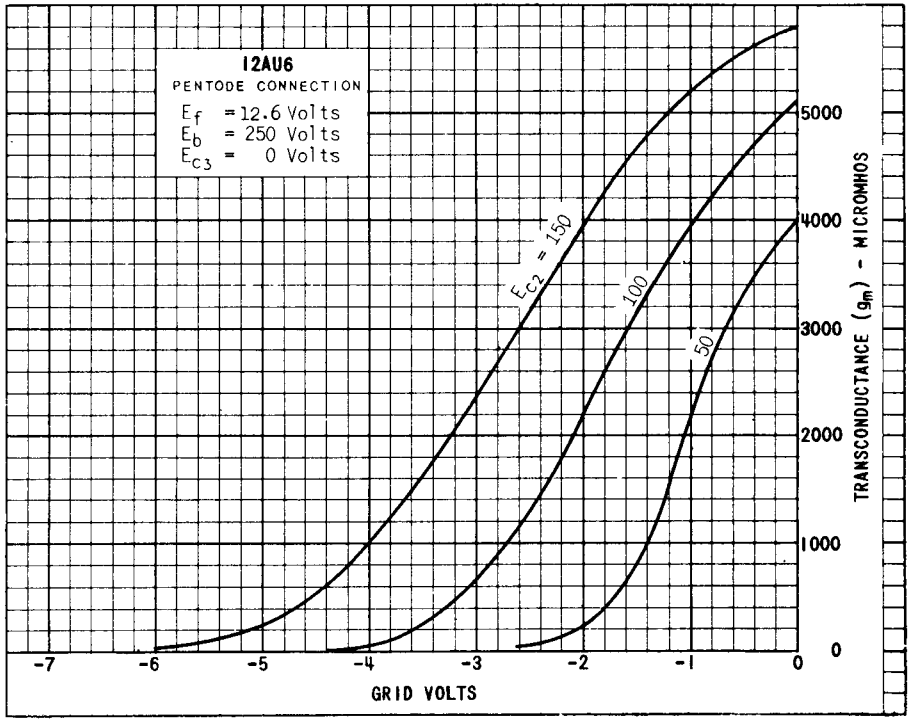


PLATE #3917 AUGUST 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

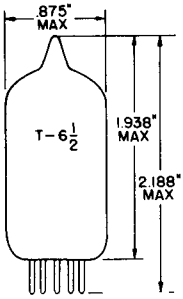
COATED UNIPOTENTIAL CATHODE

HEATER

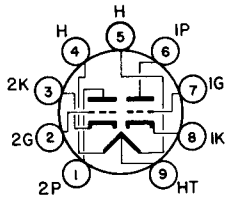
SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 12AU7 COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE SMALL 9 PIN BUTTON CONSTRUCTION. IT IS ADAPTABLE TO APPLICATION EITHER AS AN AUDIO FREQUENCY AMPLIFIER OR AS COMBINED OSCILLATOR AND MIXER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE UNIT 1			
GRID TO PLATE: (G TO P)	1.5	1.5	pf
INPUT: G TO (H+K)	1.8	1.6	pf
OUTPUT: P TO (H+K)	2.0	0.40	pf
TRIODE UNIT 2			
GRID TO PLATE: (G TO P)	1.5	1.5	pf
INPUT: G TO (H+K)	1.8	1.6	pf
OUTPUT: P TO (H+K)	2.0	0.32	pf

[A] EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

	CLASS A_1[B] AMPLIFIER	VERTICAL[B] DEFLECTION AMPLIFIER	
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE: TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE: DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1200	VOLTS
MAXIMUM PLATE DISSIPATION:[C]			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	60	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
FIXED BIAS OPERATION	0.25	---	MEGOHM
CATHODE BIAS OPERATION	1.0	2.2	MEGOHMS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

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RATINGS (CONT'D)

EACH TRIODE UNIT

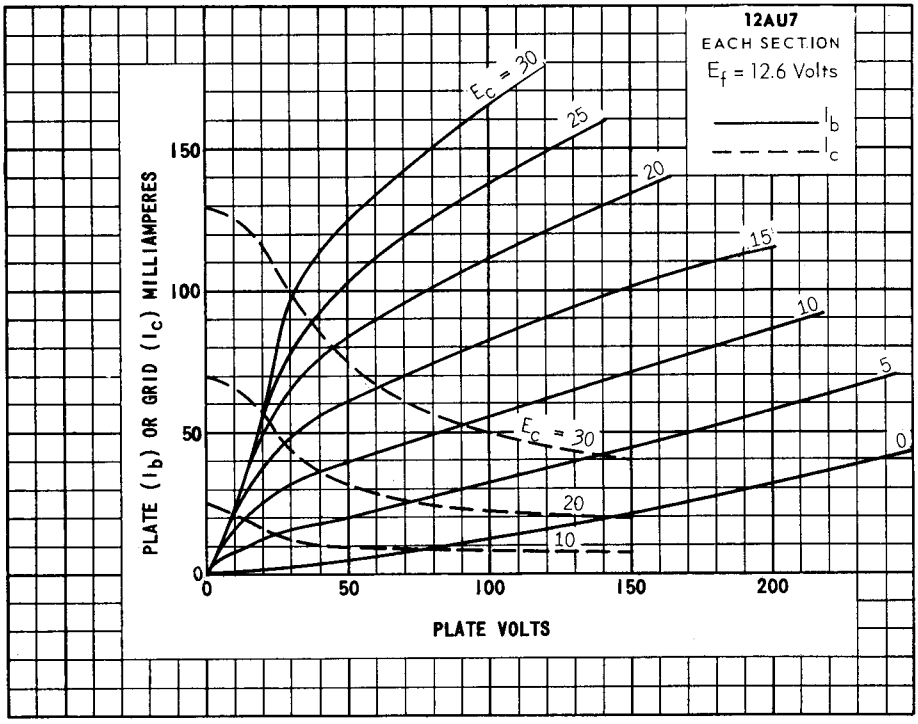
	VERTICAL[D] DEFLECTION OSCILLATOR	HORIZONTAL[D] DEFLECTION OSCILLATOR	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE:			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM DC PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	60	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

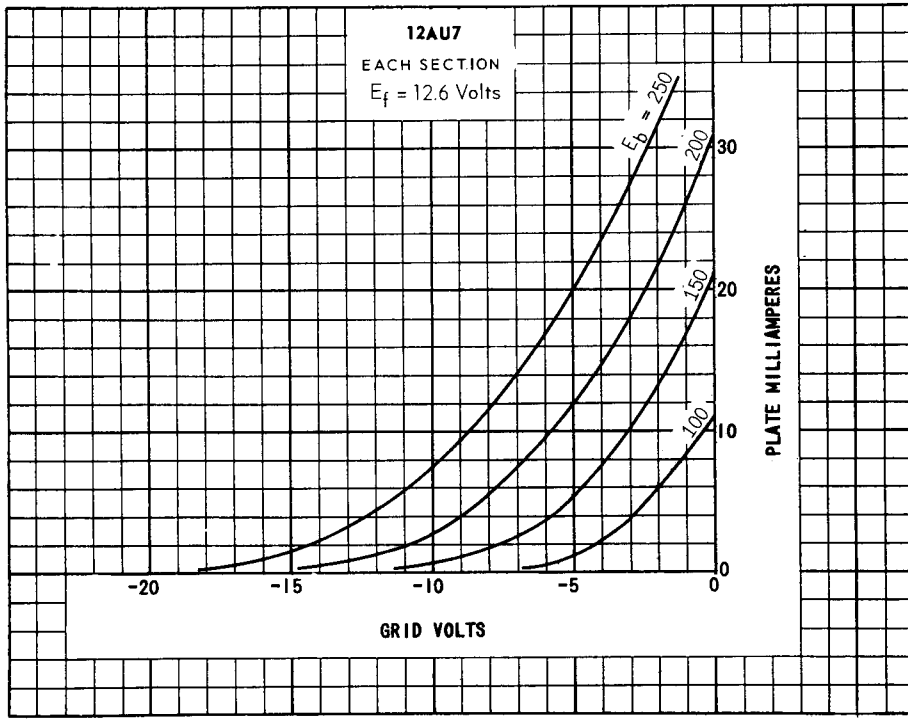
[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

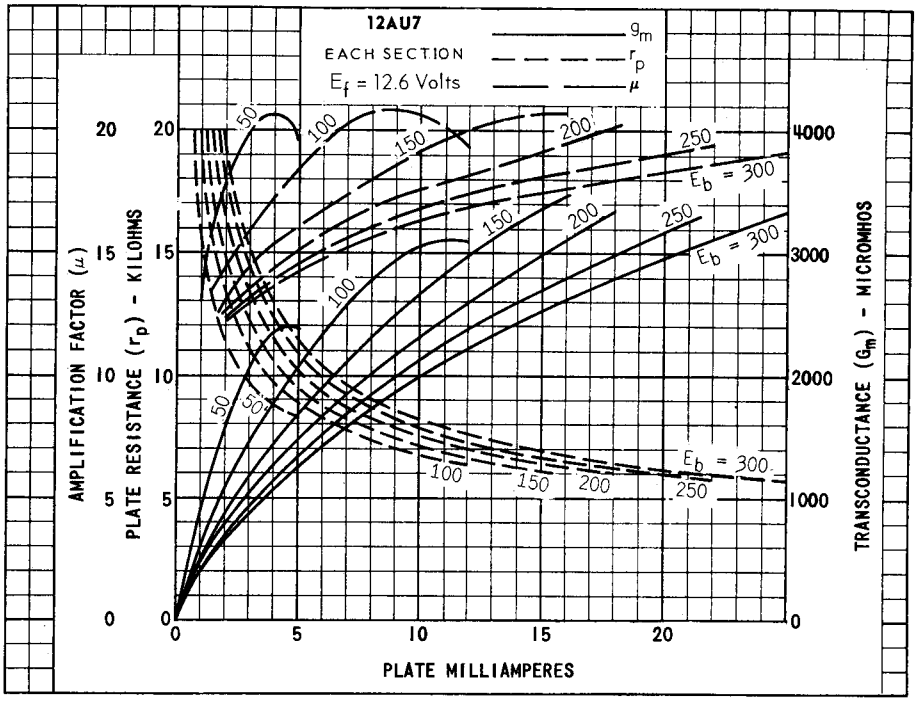
CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

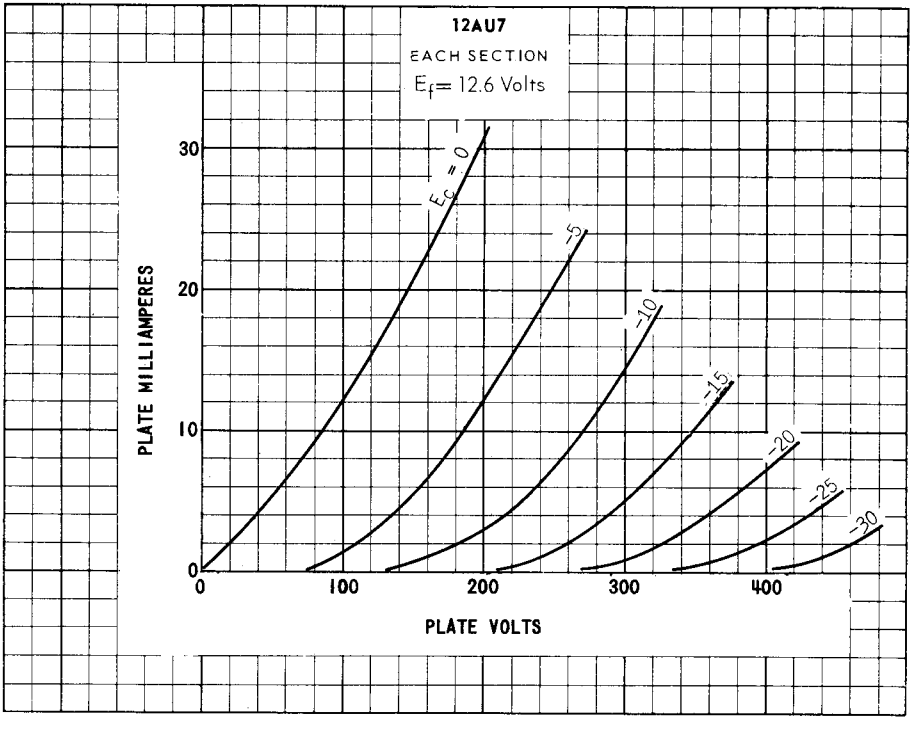
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	−8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
PLATE RESISTANCE (APPROX.)	6 500	7 700	OHMS
TRANSCONDUCTANCE	3 100	2 200	μMHOS
AMPLIFICATION FACTOR	20	17	
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	---	− 24	VOLTS


12AU7
EACH SECTION
E_f = 12.6 Volts
I_b
I_c
E_c = 30
25
20
15
10
5
0
E_c = 30
20
10
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
150
100
50
0
0
50
100
150
200
PLATE VOLTS


12AU7
EACH SECTION
E_f = 12.6 Volts
E_b = 250
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS

12AU7


12AU7
EACH SECTION
E_f = 12.6 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE MILLIAMPERES
50
100
150
200
250
E_b = 300
0
5
10
15
20
1000
2000
3000
4000


12AU7
EACH SECTION
E_f = 12.6 Volts
PLATE MILLIAMPERES
PLATE VOLTS
E_c = 0
-5
-10
-15
-20
-25
-30
0
100
200
300
400
10
20
30

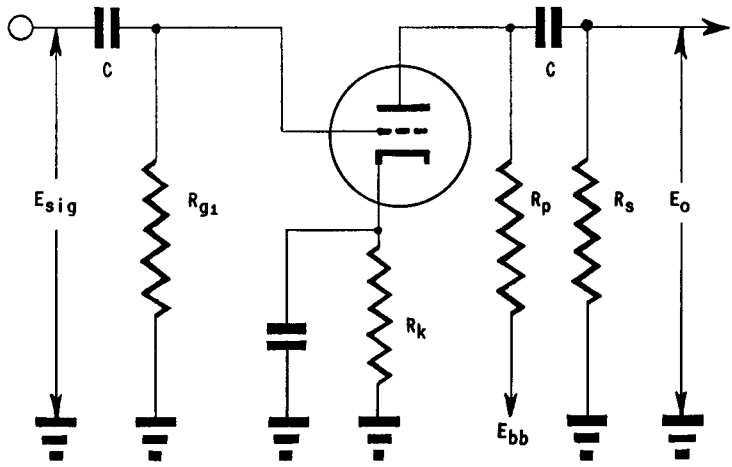
TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

EACH SECTION

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	0.24	0.10	3600	14	16	2700	15	33	2200	15	51
0.24	0.24	0.10	7500	14	16	5100	15	30	4300	15	44
0.24	0.51	0.10	9100	14	19	6800	15	39	5100	15	54
0.51	0.51	0.10	13000	14	16	9100	15	30	6800	16	40
0.51	1.0	0.10	15000	14	19	10000	16	32	7500	16	45
0.24	0.24	10	0	15	13	0	16	33	0	17	46
0.24	0.51	10	0	16	17	0	17	38	0	18	62
0.51	0.51	10	0	16	14	0	18	32	0	18	53
0.51	1.0	10	0	17	18	0	18	41	0	19	68

NOTES: 1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION.
2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE.
R_k SHOULD BE ADEQUATELY BY-PASSED

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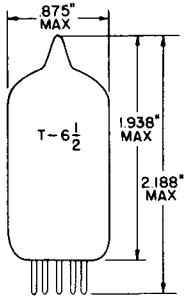
TUNG-SOL

TWIN TRIODE
MINIATURE TYPE

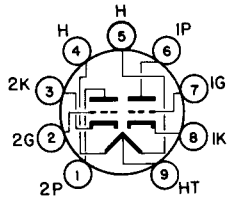


GLASS BULB
SMALL BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

UNIPOTENTIAL CATHODE

FOR
AUDIO FREQUENCY AMPLIFIER
OR COMBINED OSCILLATOR AND
MIXER APPLICATIONS IN
T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 12AU7A COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATION EITHER AS AN AUDIO FREQUENCY AMPLIFIER OR AS A COMBINED OSCILLATOR AND MIXER. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 7AU7 AND THE 9AU7.

→ DIRECT INTERELECTRODE CAPACITANCES

	TRIODE UNIT T_1	TRIODE UNIT T_2	
GRID TO PLATE	1.5	1.5	pf
GRID TO CATHODE	1.6	1.6	pf
PLATE TO CATHODE	0.50	0.35	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
HEATER IN SERIES	12.6 VOLTS	150	MA.
HEATER IN PARALLEL	6.3 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION			
HEATER IN SERIES		12.6±1.3	VOLTS
HEATER IN PARALLEL		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT

	CLASS A1 AMPLIFIER	VERTICAL DEFLECTION OSCILLATOR	
PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION:			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
CATHODE CURRENT	22		MA.
PEAK NEGATIVE PULSE GRID VOLTAGE		440	VOLTS
AVERAGE CATHODE CURRENT		22	MA.
PEAK CATHODE CURRENT		66	MA.
MAXIMUM CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE:			
FOR FIXED BIAS, GRID-RESISTOR BIAS, OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

	HORIZONTAL DEFLECTION OSCILLATOR	VERTICAL DEFLECTION AMPLIFIER	
DC PLATE VOLTAGE	330	330	VOLTS
PLATE DISSIPATION			
EACH PLATE	2.75	2.75	WATTS
BOTH PLATES	5.5	5.5	WATTS
PEAK POSITIVE-PULSE PLATE VOLTAGE		1200	VOLTS
PEAK NEGATIVE-PULSE GRID VOLTAGE	660	275	VOLTS
AVERAGE CATHODE CURRENT	22	22	MA.
PEAK CATHODE CURRENT	330	66	MEGOHMS
MAXIMUM CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE:			
FOR FIXED BIAS, GRID-RESISTOR BIAS, OR CATHODE-BIAS OPERATION	2.2	2.2	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - EACH UNIT

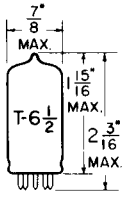
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
AMPLIFICATION FACTOR	→ 19.5	17	
PLATE RESISTANCE	→ 6250	7700	OHMS
TRANSCONDUCTANCE	3100	2200	μMHOS
PLATE CURRENT	11.8	10.5	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP.		-24	VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1

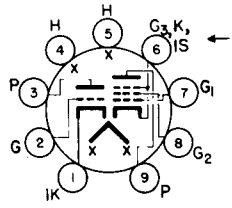
OUTLINE DRAWING
JEDEC 6-3

OCATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS* 0.300±0.030 AMPS.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DX

THE 12AU8 IS A SHARP-CUTOFF PENTODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. IT IS DESIGNED FOR USE IN MONOCHROME AND COLOR TELEVISION RECEIVERS. THE PENTODE SECTION IS PARTICULARLY SUITED FOR USE AS A VIDEO AMPLIFIER, VIDEO IF AMPLIFIER, AND SOUND IF AMPLIFIER. THE TRIODE SECTION IS INTENDED FOR USE AS A SYNC AMPLIFIER, SEPARATOR OR CLIPPER, OR AS A SWEEP OSCILLATOR.
EXCEPT FOR HEATER RATINGS, THE 12AU8 IS IDENTICAL TO THE 6AU8.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	PENTODE SECTION	TRIODE SECTION	
GRID TO PLATE	0.044	2.2	pf
INPUT	7.5	2.6	pf
OUTPUT	2.4	0.34	pf
PENTODE GRID #1 TO TRIODE PLATE	0.005		pf
TRIODE GRID TO PENTODE PLATE	0.002		pf
PENTODE PLATE TO TRIODE PLATE	0.12		pf

*AT 0.300 AMPERES.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	12.6		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	---	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	---	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.25	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0		SECONDS

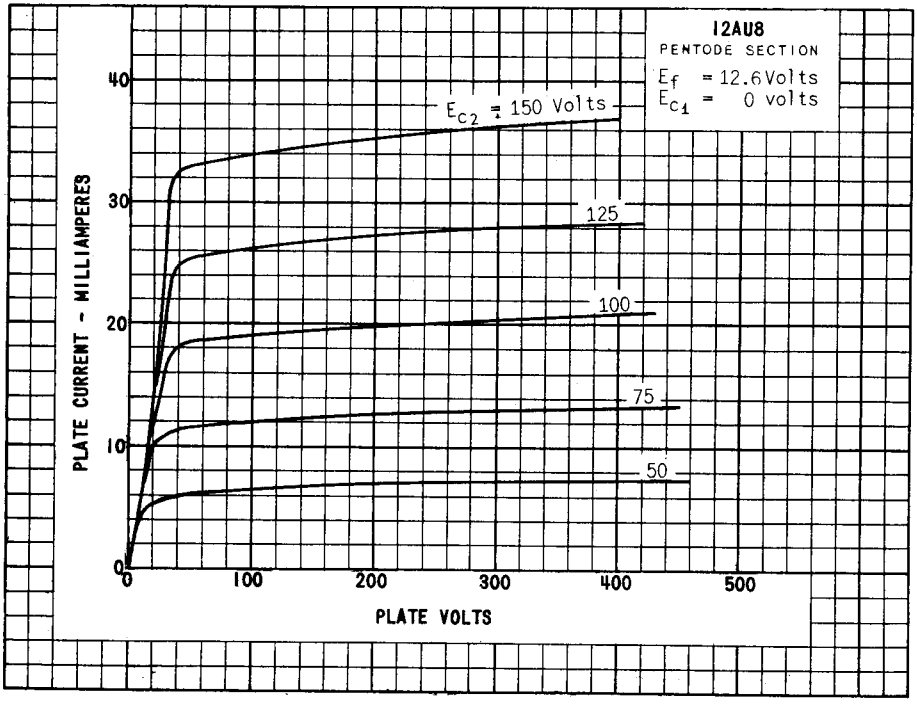
[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

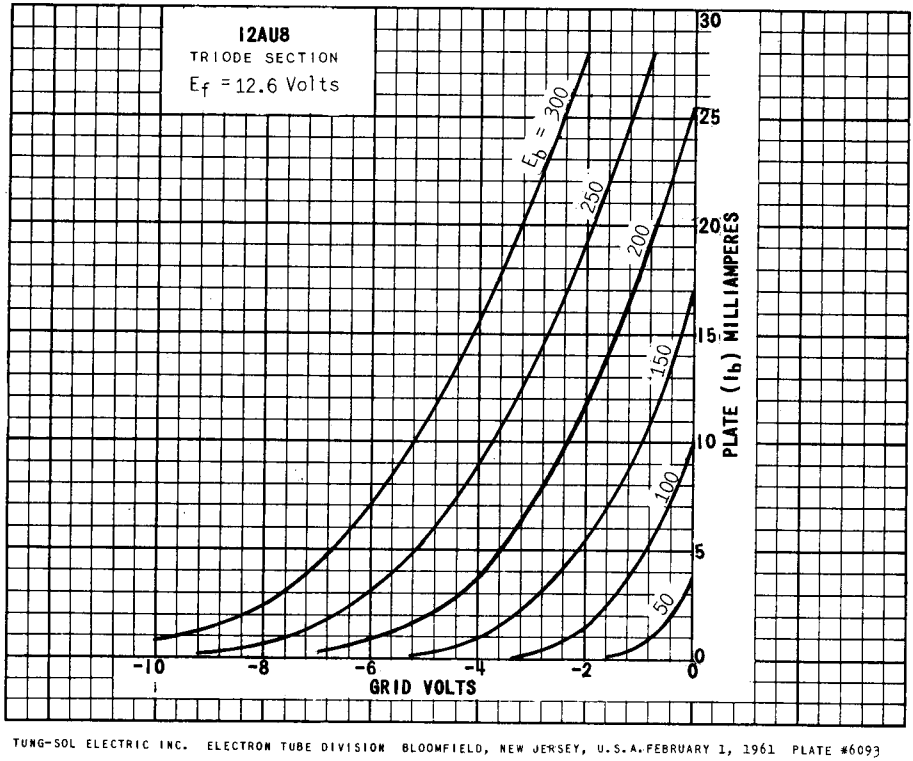
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	PENTODE SECTION	TRIODE SECTION	
PLATE VOLTAGE	200	150	VOLTS
GRID #2 VOLTAGE	125	---	VOLTS
CATHODE BIAS RESISTOR	82	150	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	150 000	8 200	OHMS
TRANSCONDUCTANCE	7 000	4 900	μMHOS
PLATE CURRENT	15	9.0	MA.
GRID #2 CURRENT	3.4	---	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 100 μAMP.	-8	-6.5	VOLTS

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISSACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.





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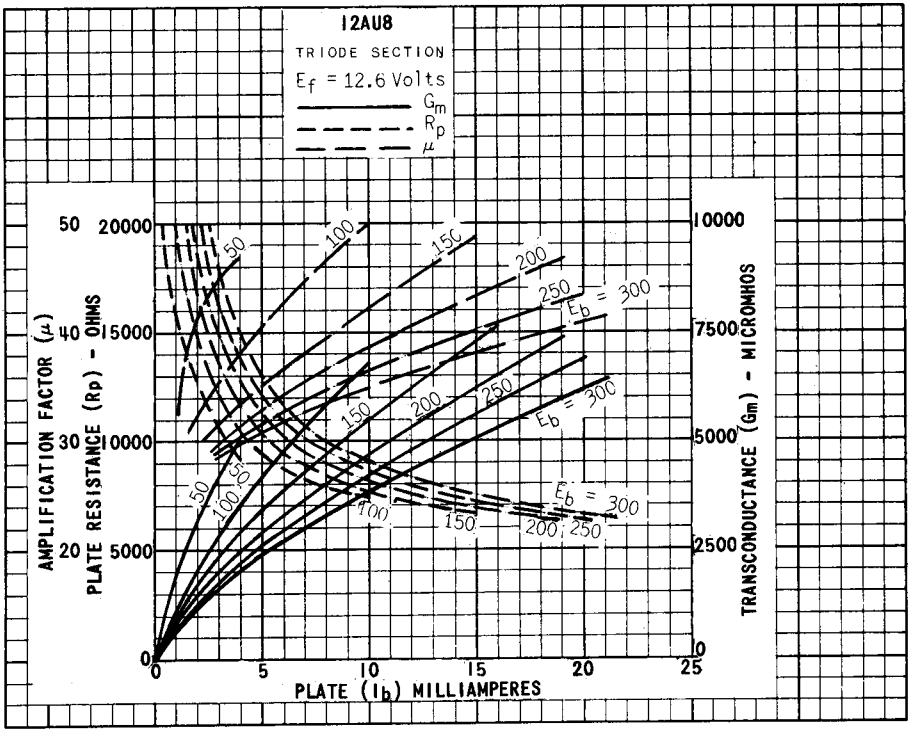
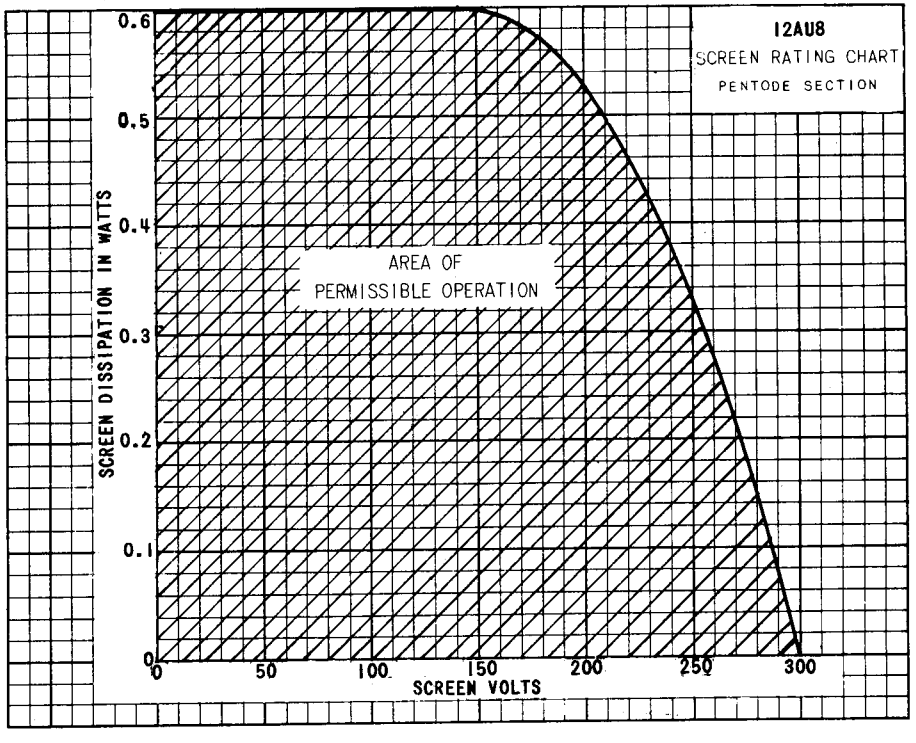
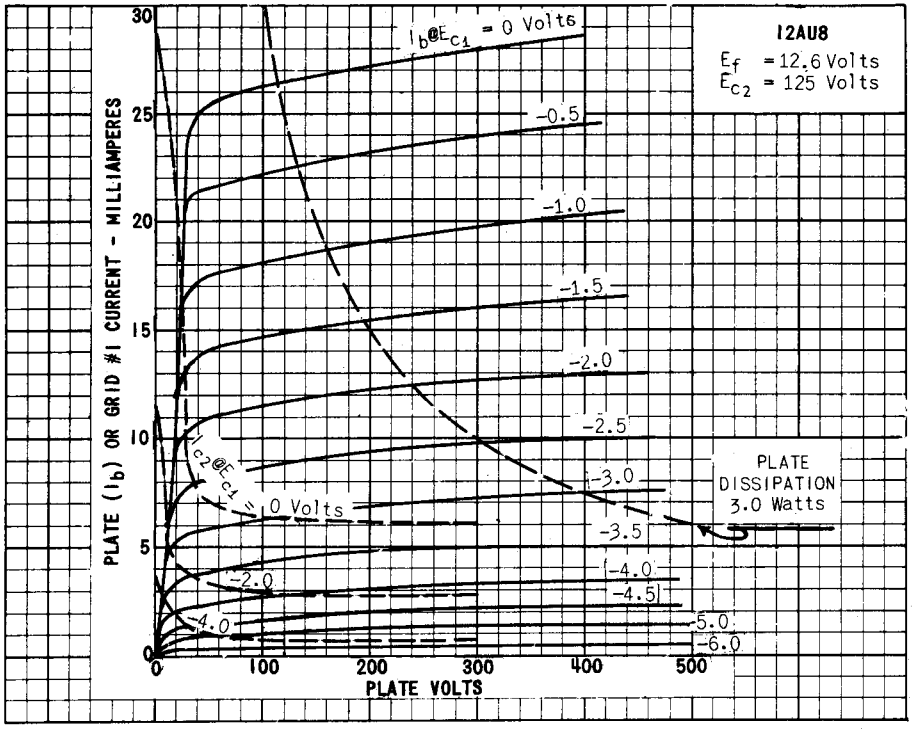
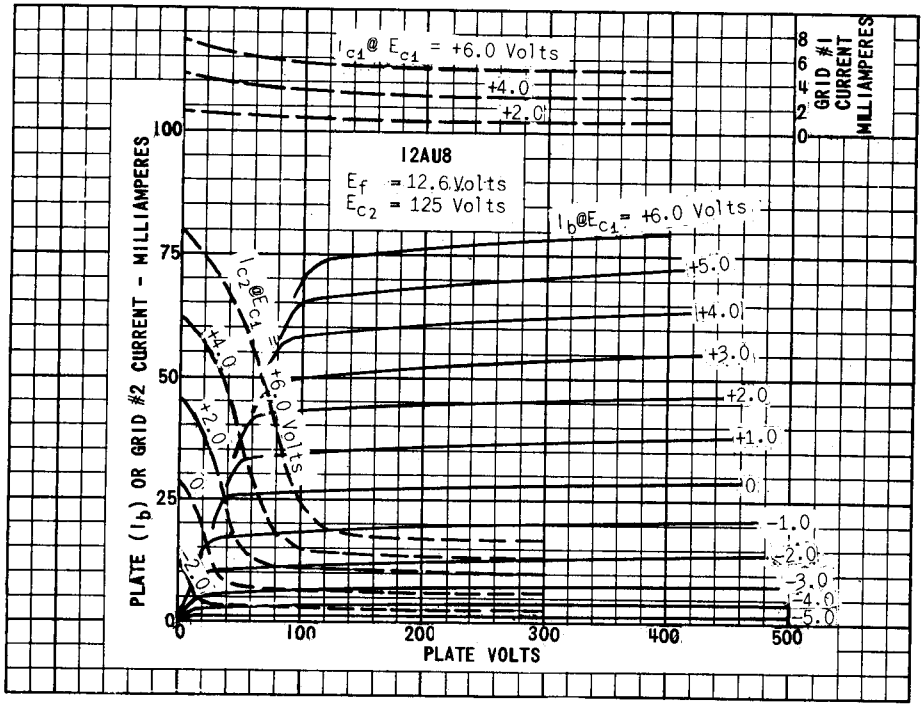

12AU8
TRIODE SECTION
E_f = 12.6 Volts
G_m
R_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) - OHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE (I_b) MILLIAMPERES
E_b = 300
50
100
150
200
250


12AU8
SCREEN RATING CHART
PENTODE SECTION
AREA OF
PERMISSIBLE OPERATION
SCREEN DISSIPATION IN WATTS
SCREEN VOLTS





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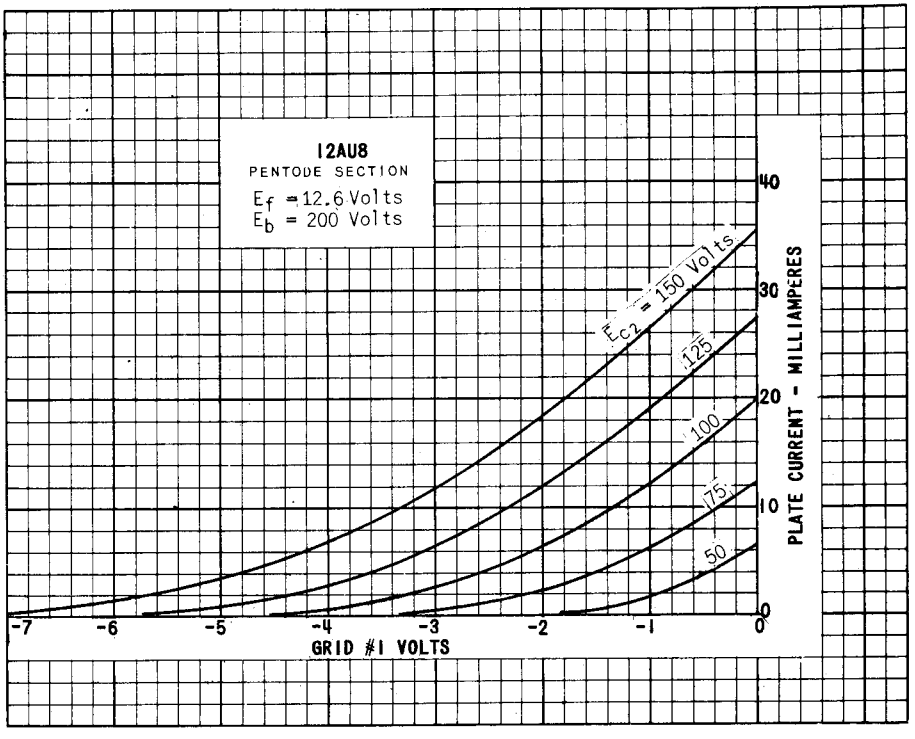
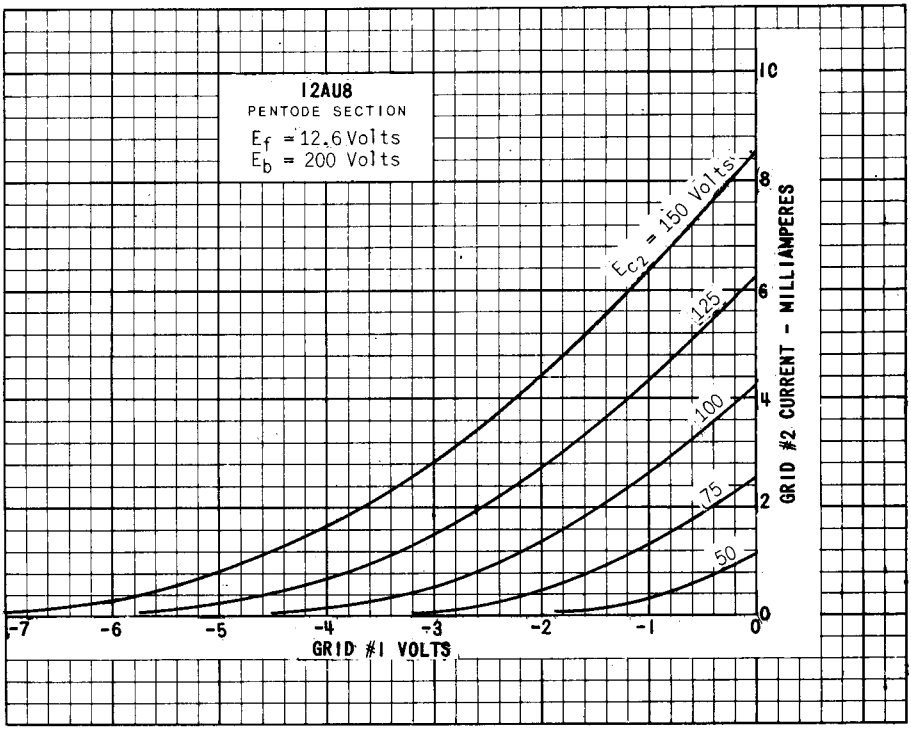
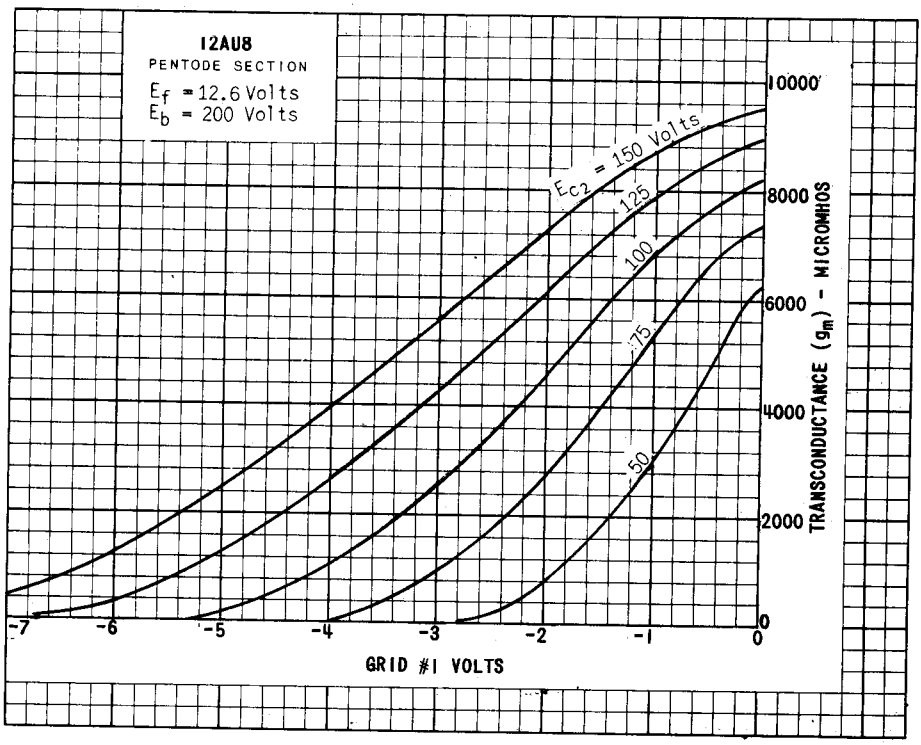
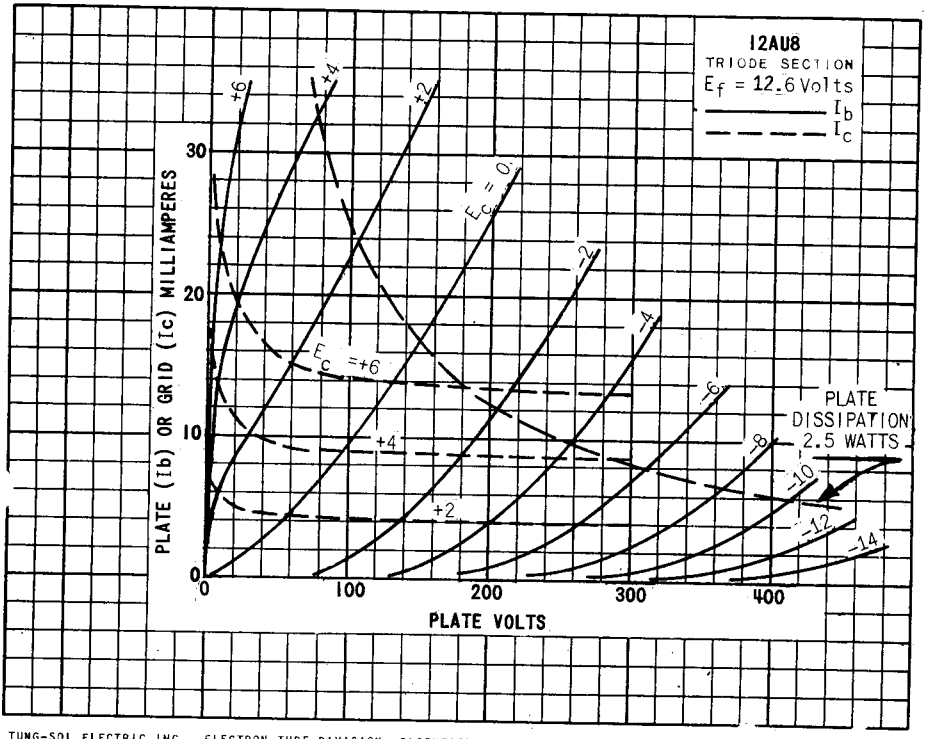
12AU8


12AU8
PENTODE SECTION
E_f = 12.6 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
40
30
20
10
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
PLATE CURRENT - MILLIAMPERES

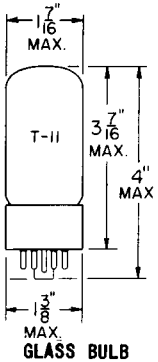

12AU8
PENTODE SECTION
E_f = 12.6 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
10
8
6
4
2
0
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
GRID #2 CURRENT - MILLIAMPERES


12AU8
PENTODE SECTION
E_f = 12.6 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
125
100
75
50
10000
8000
6000
4000
2000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


12AU8
TRIODE SECTION
E_f = 12.6 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
30
20
10
0
+6
+4
+2
E_c = 0
-2
-4
-6
-8
-10
-12
-14
E_c =+6
+4
+2
PLATE DISSIPATION 2.5 WATTS
0
100
200
300
400
PLATE VOLTS

TUNG-SOL

PENTODE



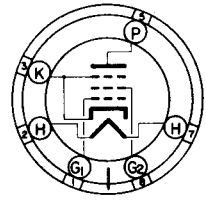
GLASS BULB

THE MAX. DIAMETER OF THE T-12 BULB IS 1.9/16"

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
6 PIN OCTAL
6CK

THE 12AV5GA IS A BEAM PENTODE USING EITHER A T-11 OR T-12 BULB. IT IS DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	14	μμf
OUTPUT	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAX.)	5 500[C]	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[D]	11	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

[C] THIS VALUE MUST NOT BE EXCEEDED.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATION RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

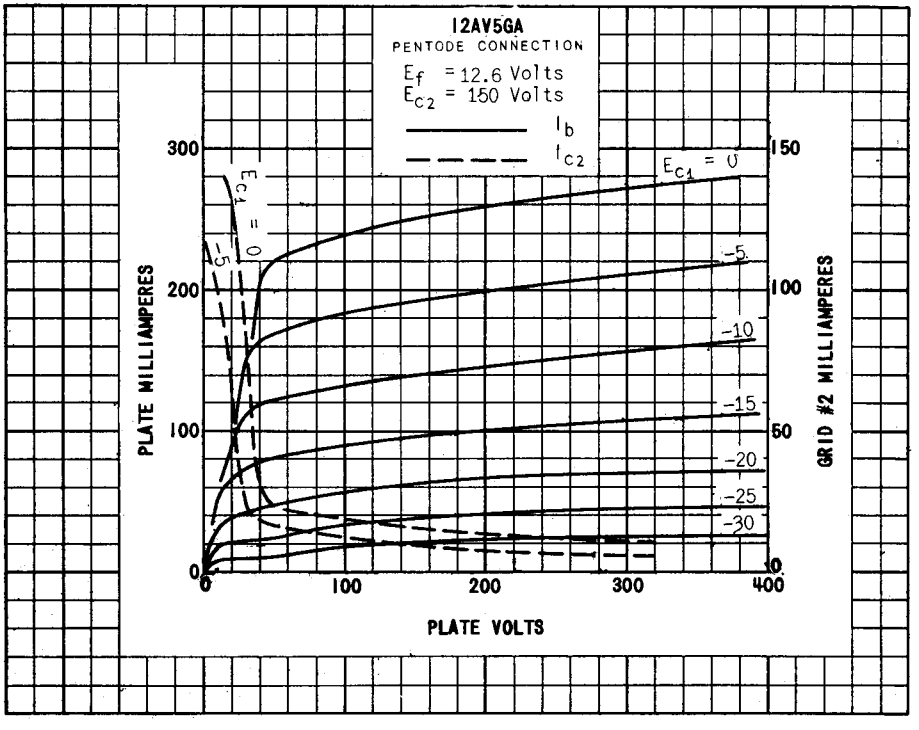
HEATER VOLTAGE	12.6			VOLTS
HEATER CURRENT	0.6			AMP.
PLATE VOLTAGE	60		250	VOLTS
GRID #2 VOLTAGE	150		150	VOLTS
GRID #1 VOLTAGE	0[E]		-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---		14 500 ←	OHMS
TRANSCONDUCTANCE	---		5 900 ←	μMHOS
PLATE CURRENT	260 ←		57 ←	MA.
GRID #2 CURRENT	26 ←		2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---		-43 ←	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	---		4.3	

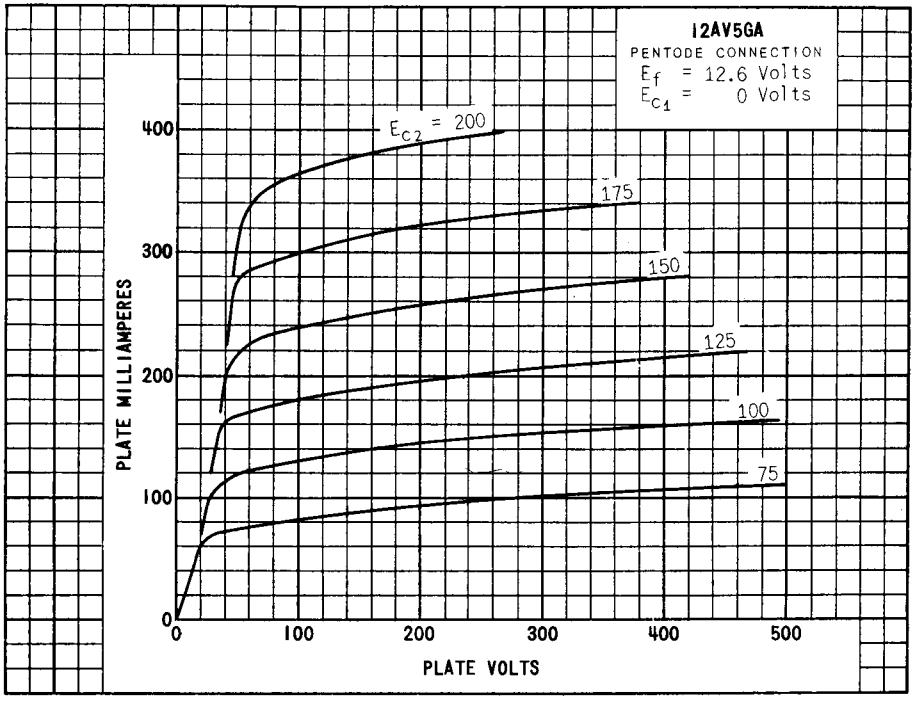
[E] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

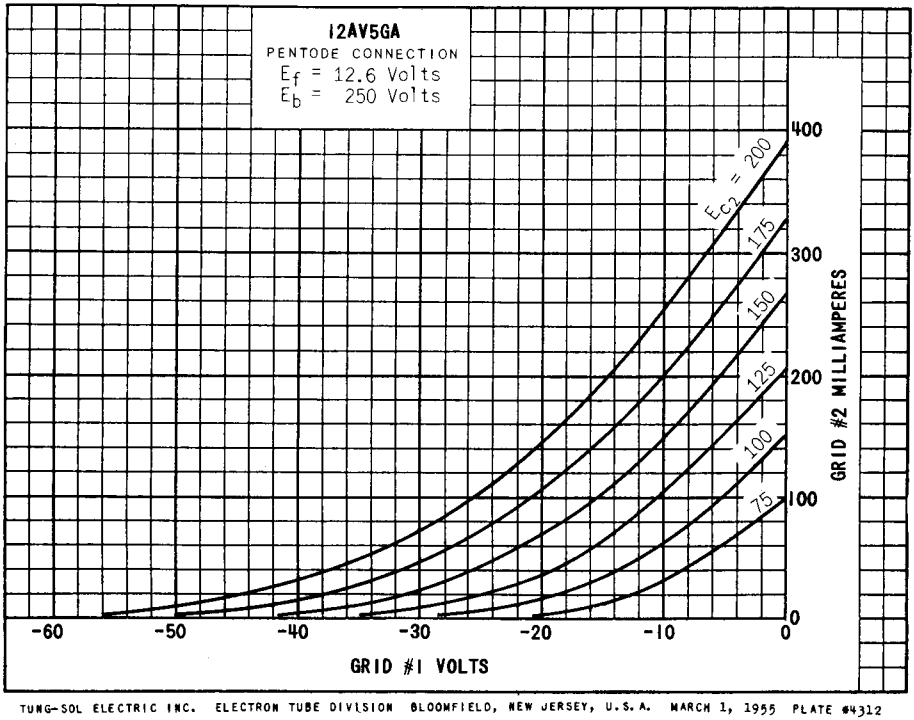
[F] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 12AV5GA is identical to the 6AV5GA, 17AV5GA & the 25AV5GA.

→ INDICATES A CHANGE.




12AV5GA
PENTODE CONNECTION
E_f = 12.6 Volts
E_{c_1} = 0 Volts
E_{c_2} = 200
175
150
125
100
75
PLATE MILLIAMPERES
0
100
200
300
400
0
100
200
300
400
500
PLATE VOLTS


12AV5GA
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts
E_{c_2} = 200
175
150
125
100
75
GRID #2 MILLIAMPERES
0
100
200
300
400
-60
-50
-40
-30
-20
-10
0
GRID #1 VOLTS

12AV5GA

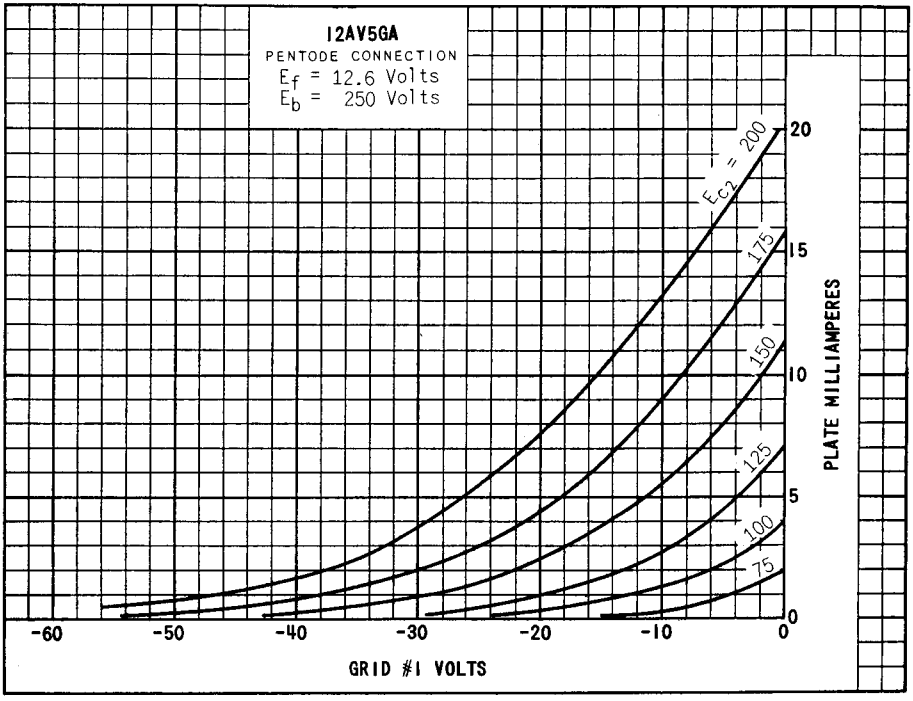


PLATE #4313 MARCH 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

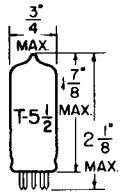
DOUBLE-DIODE TRIODE

MINIATURE TYPE

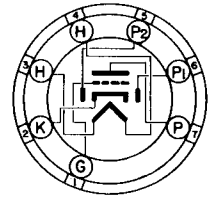
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 12AV6 COMBINES A HIGH MU-TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7-PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1.0	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE UNIT - CLASS A_1 AMPLIFIER

FILAMENT VOLTAGE	12.6	12.6	VOLTS
FILAMENT CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	µMHOS
AMPLIFICATION FACTOR	100	100	

DIODE UNITS - TWO

THE DIODE UNITS ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE SLEEVE.

DIODE BIASING OF THE TRIODE UNIT IS NOT SUITABLE.

SIMILIAR TYPE REFERENCE: Ratings and Characteristics somewhat similiar to 12AT6 except for the use of more thorough shielding of the diode units from the triode.

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PLATE 1969
FEB. 2, 1948

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RESISTANCE COUPLED AMPLIFIER

R_L MEG.	R_c MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
		R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.1	0.22	4700	35[A]	4	2000	47	18	1500	52	40
0.22	0.47	7400	45[B]	6	3500	59	24	2800	65	49
0.47	1.0	13000	52[C]	8	6700	66	28	5200	73	54

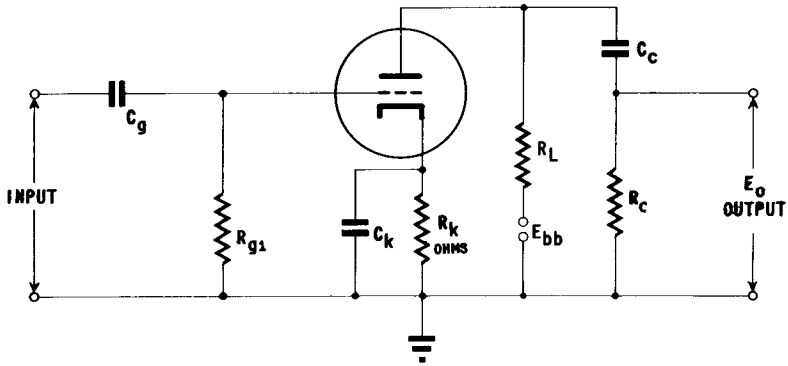
E_o IS RMS OUTPUT AT GRID CURRENT POINT.

GAIN MEASURED AT 5.0 VOLTS RMS OUTPUT EXCEPT AS INDICATED.

[A] OUTPUT VOLTAGE OF 2 VOLTS RMS.

[B] OUTPUT VOLTAGE OF 3 VOLTS RMS.

[C] OUTPUT VOLTAGE OF 4 VOLTS RMS.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PLATE 1970
FEB. 2, 1947

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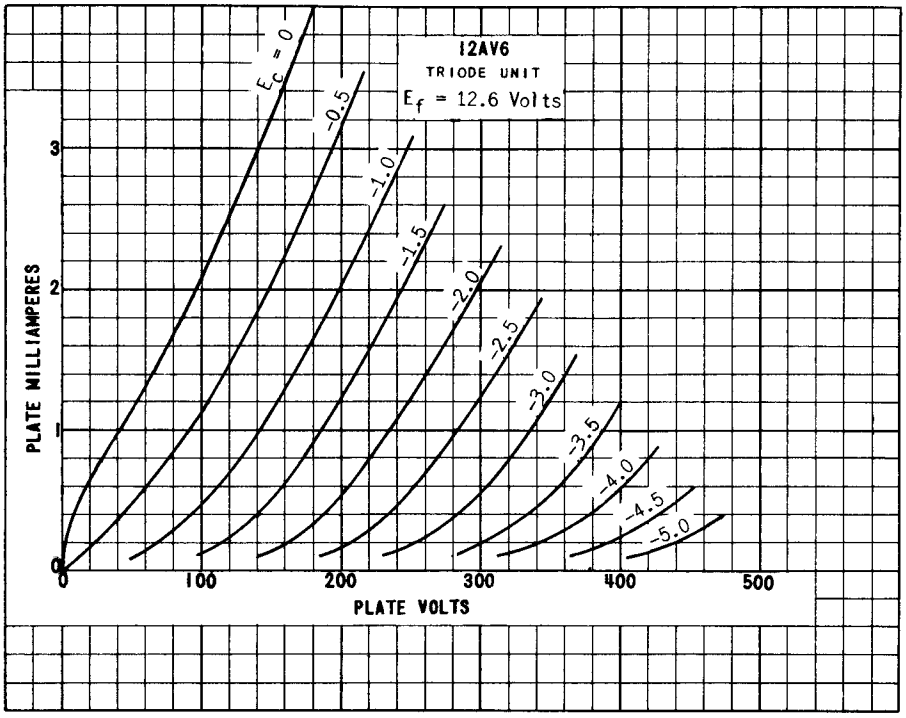

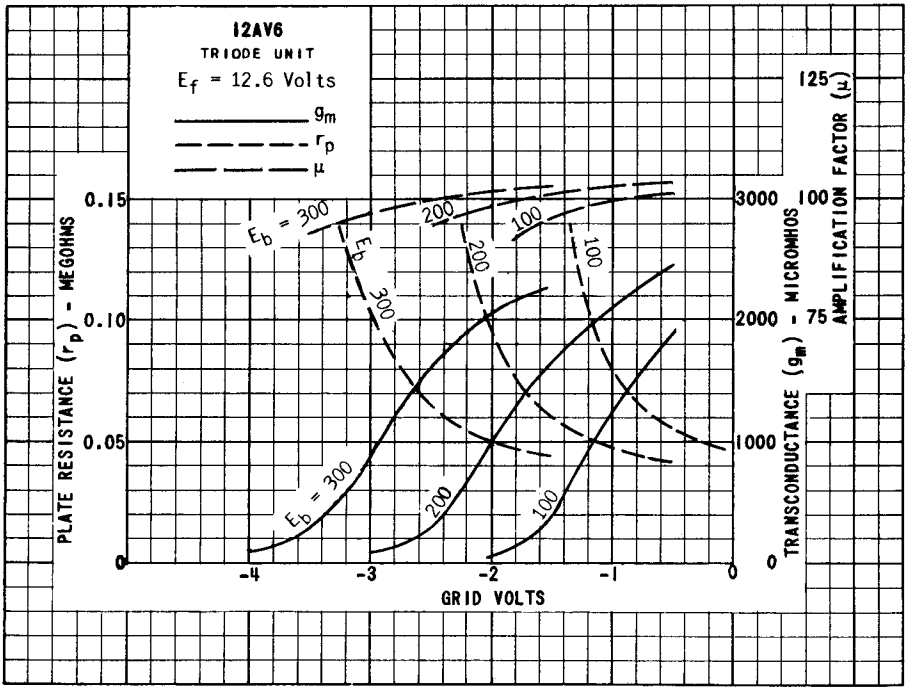

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PLATE
1971
FEB. 2,
1948

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12AV6

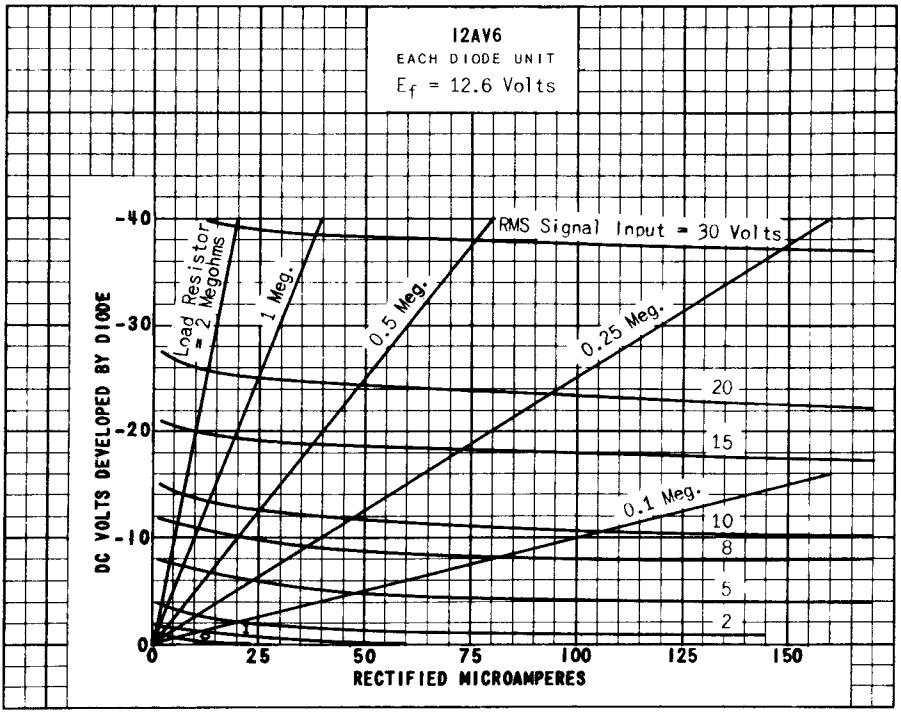

PLATE 1972
FEB. 2, 1948

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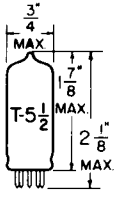
TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

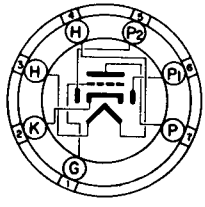


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6±10% VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 12AV6 COMBINES A HIGH-MU TRIODE AND TWO INDEPENDENT DIODE UNITS IN THE 7 PIN MINIATURE CONSTRUCTION. IT PERMITS A SINGLE TUBE TO FUNCTION AS DETECTOR, AVC RECTIFIER, AND AUDIO AMPLIFIER. COUPLING BETWEEN THE DIODE AND TRIODE SECTIONS IS MINIMIZED BY THE USE OF INTERNAL SHIELDING.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G TO P)	2	2	μμf
INPUT: G TO (H+K)	2.2	2.2	μμf
OUTPUT: P TO (H+K)	1.2	0.8	μμf
COUPLING: #2 DIODE PLATE TO GRID (MAX.)	0.04	0.04	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	12.6±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
DC COMPONENT	100	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1	MA.

→INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

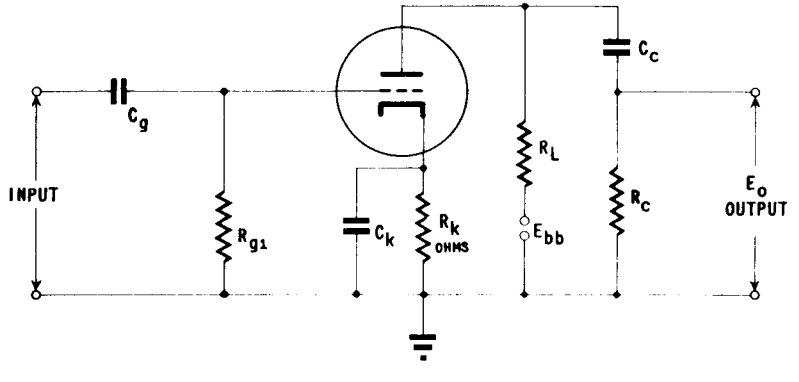
PLATE VOLTAGE	100	250	VOLTS
GRID #1 VOLTAGE	−1	−2	VOLTS
PLATE RESISTANCE	80 000	62 500	OHMS
AMPLIFICATION FACTOR	100	100	
TRANSCONDUCTANCE	1 250	1 600	µMHOS
PLATE CURRENT	0.5	1.2	MA.
AVERAGE DIODE CURRENT AT 10 VOLTS DC (EACH UNIT)	2.0	2.0	MA.

RESISTANCE COUPLED AMPLIFIER

TRIODE UNIT

PLATE SUPPLY VOLTAGE	90	250	VOLTS
CONTROL GRID VOLTAGE	0	0	VOLTS
PLATE LOAD RESISTOR	220 000	470 000	OHMS
CONTROL GRID RESISTOR	10.0	10.0	MEGOHMS
INPUT CONDENSER	0.01	0.01	µf
OUTPUT CONDENSER	0.01	0.01	µf
GRID RESISTOR OF FOLLOWING STAGE	470 000	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	1 000	OHMS
DISTORTION	5	5	PERCENT
OUTPUT VOLTAGE	5.5	30	VOLTS
VOLTAGE GAIN AT 400 CPS	42	63	

→INDICATES A CHANGE OR ADDITION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

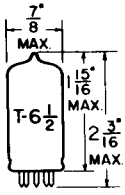
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
225 MA.	450 MA.

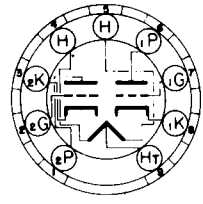
AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON 9 PIN BASE

9A

THE 12AV7 COMBINES TWO INDEPENDENT MEDIUM-MU TRIODES USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATION EITHER AS AN AF AMPLIFIER OR AS COMBINED OSCILLATOR AND MIXER.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
GRID TO PLATE: (G TO P) EACH SECTION	1.9	1.9	μμf
INPUT: G TO (H+K) EACH SECTION	3.1	3.2	μμf
OUTPUT: P TO (H+K) SECTION #1	0.5	1.3	μμf
SECTION #2	0.4	1.6	μμf
HEATER TO CATHODE: (H TO K) EACH SECTION	3.8	4	μμf
GROUNDED GRID			
PLATE TO CATHODE: (P TO K) EACH SECTION	0.24	0.23	μμf
INPUT: K TO (H+G) EACH SECTION	6.9	7	μμf
OUTPUT: P TO (H+G) SECTION #1	2	2.8	μμf
SECTION #2	2	3.2	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

EACH TRIODE UNIT

HEATER VOLTAGE	6.3	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		90	VOLTS
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE		-50	VOLTS
MAXIMUM PLATE DISSIPATION		2.7	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	12.6	6.3	12.6	VOLTS
HEATER CURRENT	450	225	450	225	MA.
PLATE VOLTAGE	100		150		VOLTS
CATHODE BIAS RESISTOR	120		56		OHMS
PLATE CURRENT	9		18		MA.
PLATE RESISTANCE	6 100		4 800		OHMS
TRANSCONDUCTANCE	6 100		8 500		μMHOS
AMPLIFICATION FACTOR	37		41		
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	-9		-12		VOLTS

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PLATE 2740

SEPT. 1 1951

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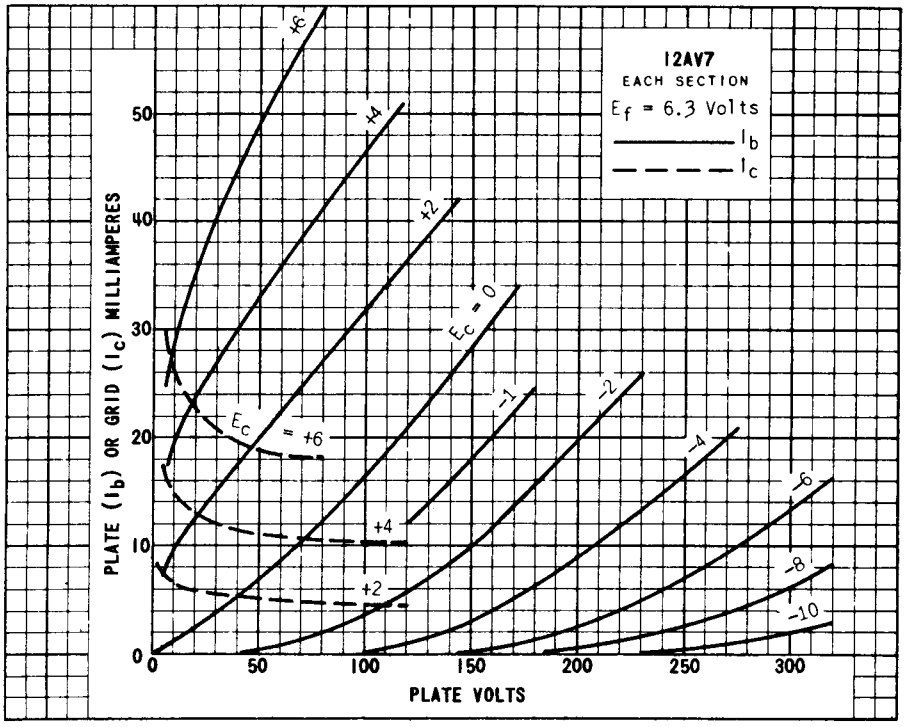
12AV7



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1951

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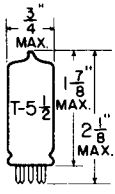
TUNG-SOL

PENTODE

MINIATURE TYPE

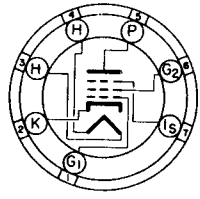


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 12AW6 IS A MINIATURE TYPE RF PENTODE HAVING A SHARP CUT-OFF CHARACTERISTIC AND A HIGH VALUE OF TRANSCONDUCTANCE. IN COMPACT, LIGHT-WEIGHT EQUIPMENT IT IS USEFUL AS AN RF AMPLIFIER UP TO ABOUT 400 MEGACYCLES, AND AS A HIGH-FREQUENCY, INTERMEDIATE AMPLIFIER. IT HAS LOW INPUT AND OUTPUT CAPACITANCES AND A SEPARATE SUPPRESSOR CONNECTION ALL OF WHICH CONTRIBUTE TO ITS HIGH FREQUENCY PERFORMANCE. THE 12AW6 IS ELECTRICALLY EQUIVALENT TO TYPE 6AG5.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P) MAX.	0.025	μμf
INPUT: G TO (H+K+G_2+G_3&IS)	6.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	1.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

	TRIODE CONNECTION[A]	PENTODE CONNECTION	
HEATER VOLTAGE	12.6	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	—	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	—	300	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	50	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	2	WATTS
MAXIMUM GRID #2 DISSIPATION	—	0.5	WATT

[A] GRID #2 TIED TO PLATE AND GRID #3 TIED TO CATHODE.

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PLATE 1912
NOV. 1, 1947

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PENTODE CONNECTION

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	150	150	150	MA.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #3 VOLTAGE		CONNECTED TO CATHODE AT SOCKET		
GRID #2 VOLTAGE	100	125	150	VOLTS
CATHODE BIAS RESISTOR	100	100	200	OHMS
PLATE RESISTANCE (APPROX.)	0.3	0.5	0.8	MEGOHM
TRANSCONDUCTANCE	4 750	5 100	5 000	µMHOS
PLATE CURRENT	5.5	7.2	7	MA.
GRID #2 CURRENT	1.6	2.1	2	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA.	-5	-6	-8	VOLTS

CLASS A_1 AMPLIFIER - TRIODE CONNECTION

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	180	250	VOLTS
CATHODE BIAS RESISTOR	350	825	OHMS
PLATE RESISTANCE	7 900	11 000	OHMS
TRANSCONDUCTANCE	5 700	3 800	µMHOS
AMPLIFICATION FACTOR	45	42	
PLATE CURRENT	7.0	5.5	MA.

SIMILIAR TYPE REFERENCE: Ratings and characteristics identical to 6AG5.

PLATE 1913
NOV. 1, 1947

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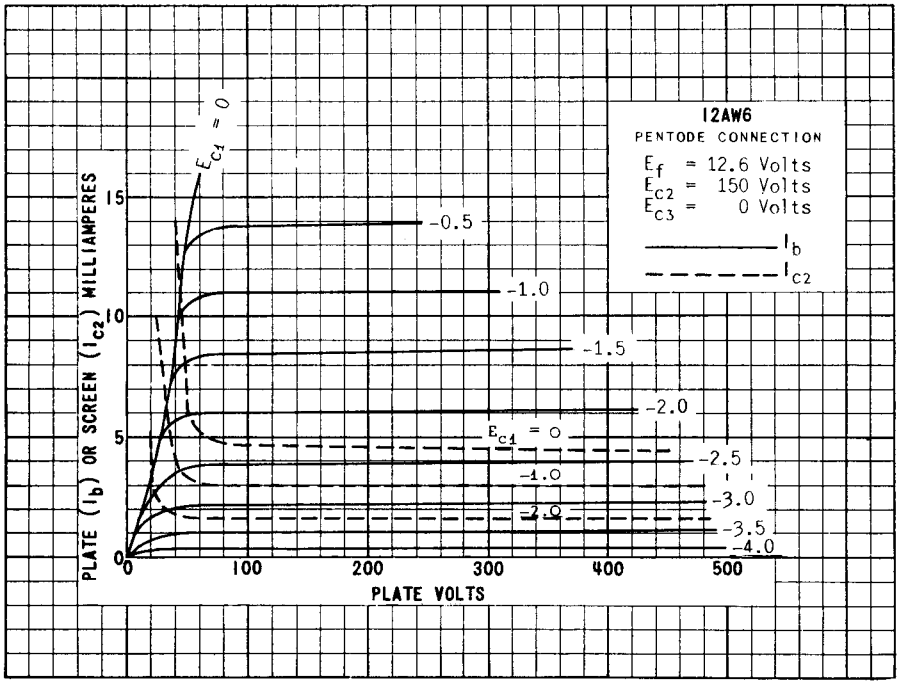

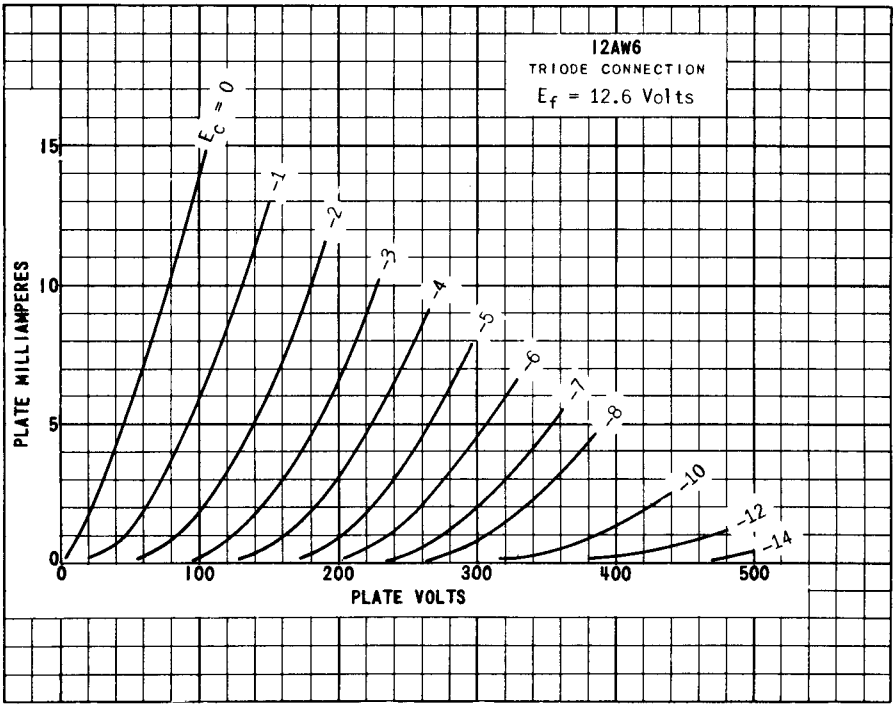

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1914
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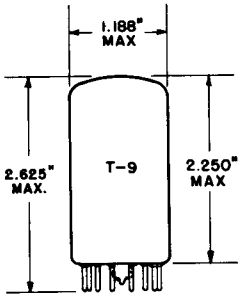
DIODE

COMPACTRON



GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-59

COATED UNIPOTENTIAL CATHODE

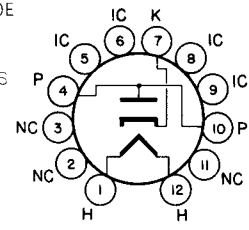
FOR

DAMPING DIODE APPLICATIONS

IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

THE 12AX3 IS A HEATER-CATHODE SINGLE DIODE IN THE COMPACT 12 PIN, T-9 CONSTRUCTION. IT IS SPECIFICALLY DESIGNED FOR USE AS A DAMPING DIODE IN T.V. RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 12AX3 IS IDENTICAL TO THE 6AX3.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+H)	7.5	pf
PLATE TO CATHODE AND HEATER: P TO (K+H	5.5	pf
HEATER TO CATHODE: (H TO K)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION[A]		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT		900	VOLTS
TOTAL DC AND PEAK		5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS
HEATER WARM-UP TIME •		11	SECONDS

[A] THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT SO THAT THE HEATER VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

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MAXIMUM RATINGS[B]

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

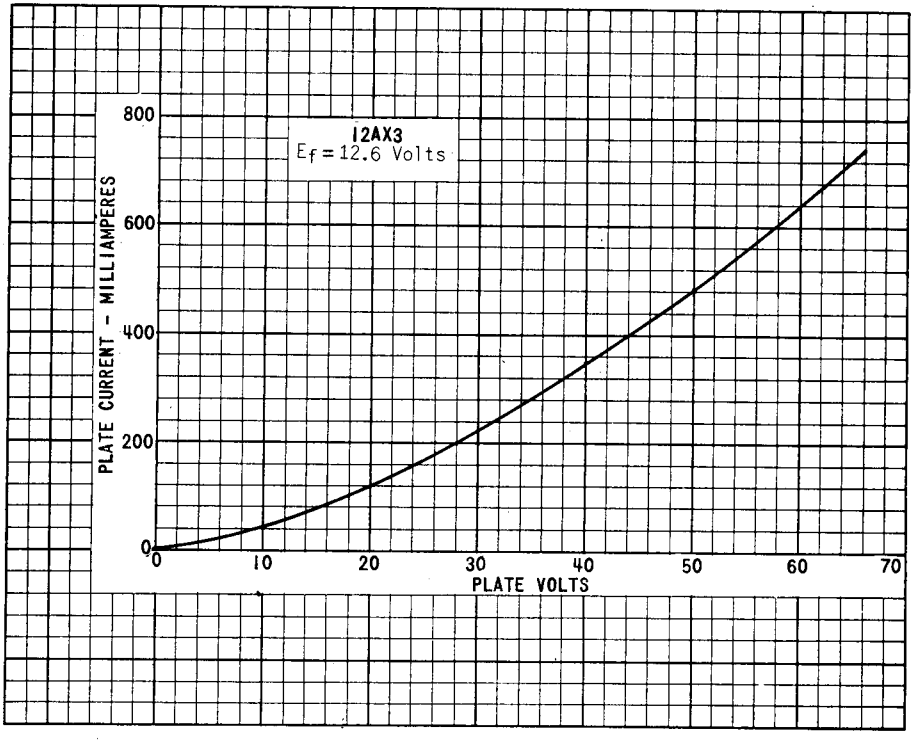
PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	5.3	WATTS
STEADY-STATE PEAK PLATE CURRENT	1000	MA.
DC OUTPUT	165	MA.

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP		
I_b = 250 MILLIAMPERES DC	32	VOLTS

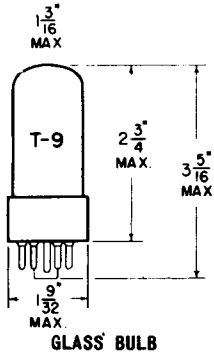
•HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.



TUNG-SOL

DIODE



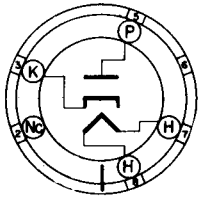
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE-SHELL
5 PIN OCTAL
4QG

THE 12AX4GTB IS A HEATER-CATHODE-TYPE SINGLE DIODE INTENDED FOR USE AS THE DAMPING DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. IT IS PARTICULARLY USEFUL IN AUTOTRANSFORMER DEFLECTION SYSTEMS IN WHICH HIGH PULSE VOLTAGES ARE APPLIED TO THE CATHODE OF THE DAMPER TUBE.

EXCEPT FOR HEATER RATINGS, THE 12AX4GTB IS IDENTICAL TO THE 6AX4GTB AND ← IS UNILATERALLY INTERCHANGEABLE WITH THE 12AX4GTA.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER	8.5	μμf
PLATE TO CATHODE AND HEATER	5.0	μμf
HEATER TO CATHODE	4.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

TV DAMPER SERVICE

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1000	MA.
MAXIMUM DC OUTPUT CURRENT	165	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→INDICATES A CHANGE

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

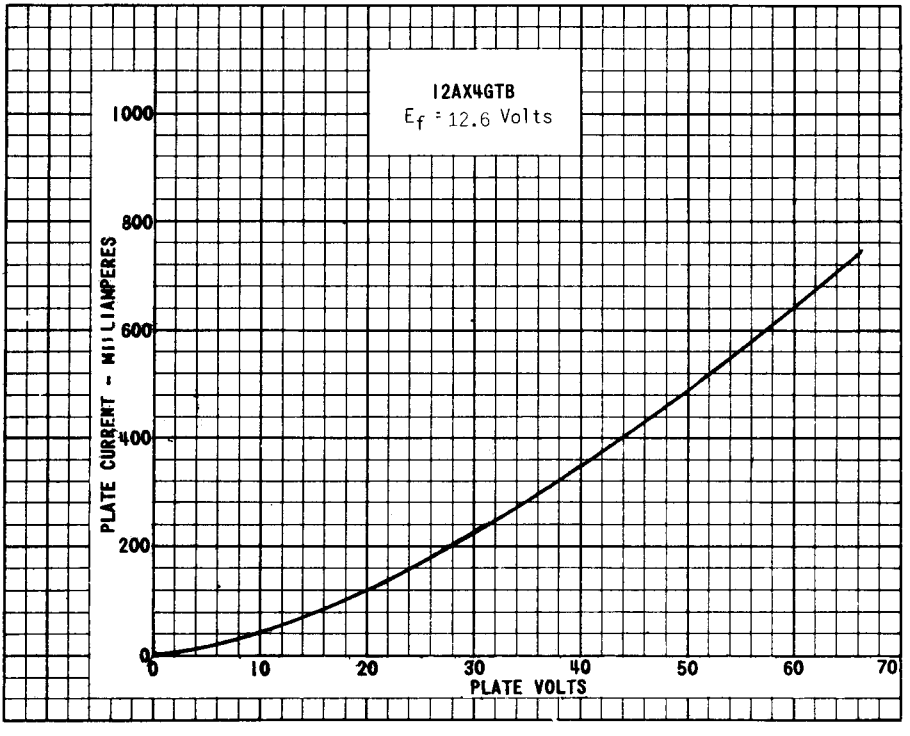
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.6±6%	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

NOTE:

OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

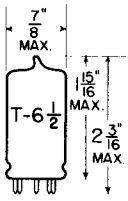


TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

UNIPOTENTIAL CATHODES



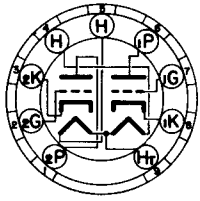
GLASS BULB

HEATER

SERIES	PARALLEL
12.6 VOLTS 150 MA.	6.3 VOLTS 300 MA.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

ANY MOUNTING POSITION

THE 12AX7 COMBINES TWO COMPLETELY INDEPENDENT HIGH-MU TRIODES IN THE SMALL 9 PIN BUTTON CONSTRUCTION. IT IS ADAPTABLE TO APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATION, SUCH AS VOLTAGE AMPLIFIERS, PHASE INVERTERS AND MULTIVIBRATORS. THE CENTER TAPPED HEATER CONNECTION PERMITS OPERATION FROM EITHER A 6.3 VOLT OR 12.6 VOLT SUPPLY AND IN 300 MA. OR 150 MA. SERIES HEATER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	TRIODE UNIT 1	TRIODE UNIT 2	
GRID TO PLATE: (G TO P)	1.7	1.7	μμf
INPUT: G TO (H + K)	1.6	1.6	μμf
OUTPUT: P TO (H + K)	0.46	0.34	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	180		VOLTS
MAXIMUM PLATE VOLTAGE	300		VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50		VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0		VOLTS
MAXIMUM PLATE DISSIPATION	1		WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	150	300	150	300	MA.
PLATE VOLTAGE	100		250		VOLTS
GRID VOLTAGE	-1		-2		VOLTS
PLATE CURRENT	0.5		1.2		MA.
PLATE RESISTANCE	80 000		62 500		OHMS
TRANSCONDUCTANCE	1 250		1 600		μMHOS
AMPLIFICATION FACTOR	100		100		

SIMILIAR TYPE REFERENCE: Characteristics somewhat similiar to types 6SL7GT and 12SL7GT.

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PLATE 1931
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RESISTANCE COUPLED AMPLIFIER

R_1 MEG.	R_C MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
		R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.1	0.22	4700	35[A]	4	2000	47	18	1500	52	40
0.22	0.47	7400	45[B]	6	3500	59	24	2800	65	49
0.47	1.0	13000	52[C]	8	6700	66	28	5200	73	54

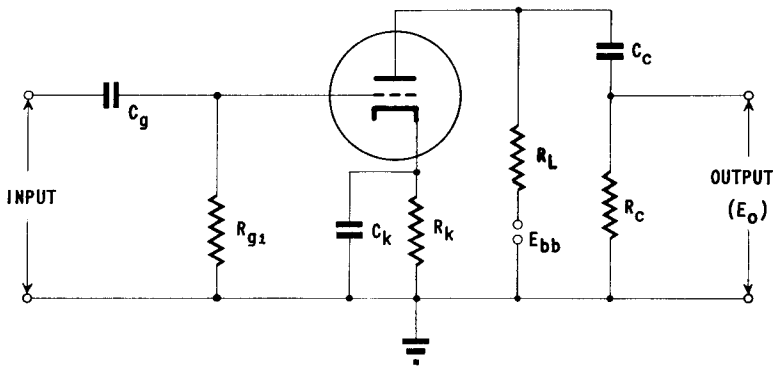
E_o IS RMS OUTPUT AT GRID CURRENT POINT.

GAIN MEASURED AT 5.0 VOLTS RMS OUTPUT EXCEPT AS INDICATED.

[A] OUTPUT VOLTAGE OF 2 VOLTS RMS.

[B] OUTPUT VOLTAGE OF 3 VOLTS RMS.

[C] OUTPUT VOLTAGE OF 4 VOLTS RMS.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PLATE 1932

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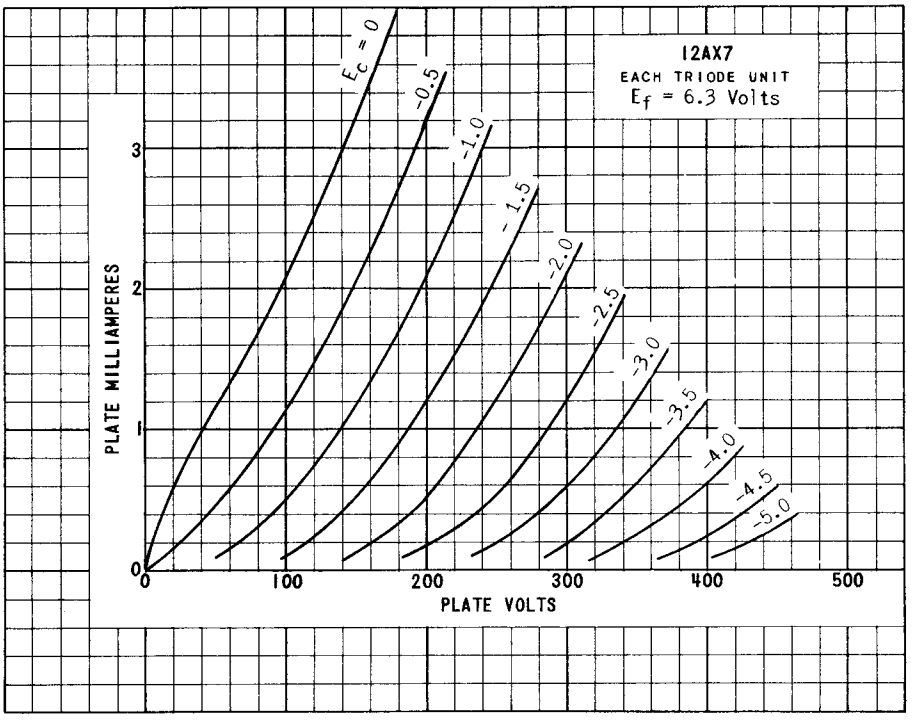

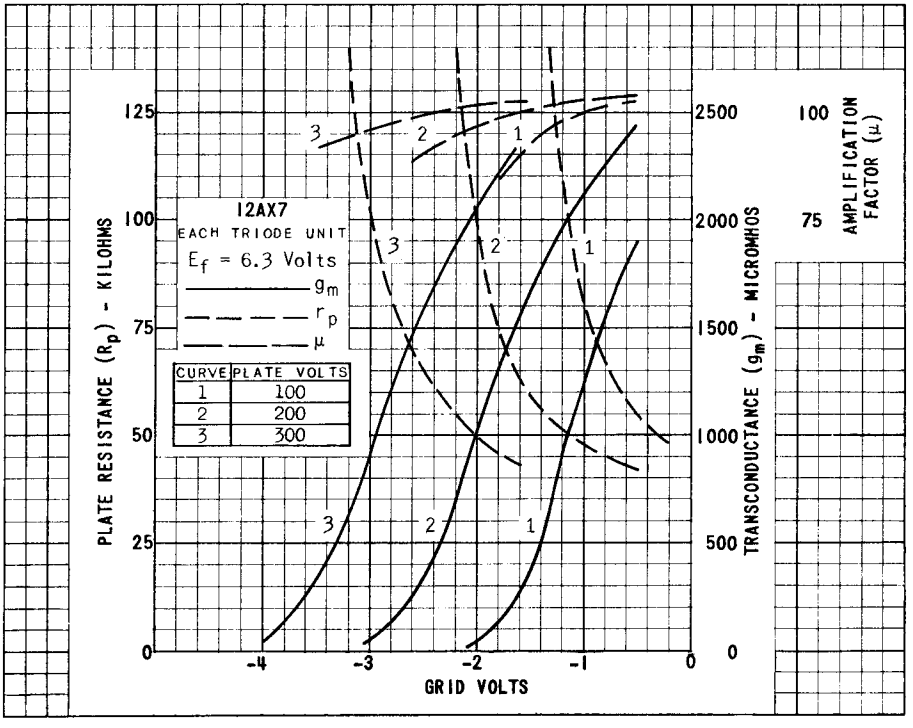

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PLATE
1933
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1947

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TUNG-SOL

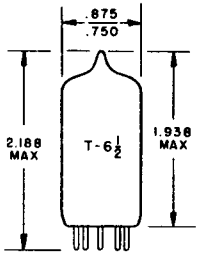
TWIN TRIODE

MINIATURE TYPE

FOR

HIGH VOLTAGE GAIN AND

LOW HEATER POWER APPLICATIONS

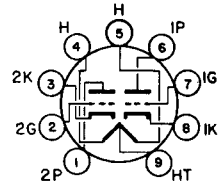


GLASS BULB

SMALL BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 12AX7A COMBINES TWO COMPLETELY INDEPENDENT HIGH-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATIONS, AND IS SUITABLE FOR USE IN MODERN HIGH GAIN AUDIO AMPLIFIERS AND MODERN TELEVISION CIRCUITS WHERE LOW HUM AND LOW MICROPHONIC NOISE IS REQUIRED. THE CENTER TAPPED HEATER CONNECTION PERMITS OPERATION FROM EITHER A 6.3 VOLT OR 12.6 VOLT SUPPLY AND IN 300 MA. OR 150 MA. SERIES HEATER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE UNIT 1	TRIODE UNIT 2	
GRID TO PLATE	1.7	1.7	pf
GRID TO CATHODE	1.6	1.6	pf
PLATE TO CATHODE	0.46	0.34	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4+5	
AVERAGE VALUES - VOLTAGE	12.6	6.3	VOLTS
CURRENT	150	300	MA.
HEATER WARM-UP TIME [A]	11		SECONDS
LIMITS OF APPLIED HEATER VOLTAGE	12.6 ±1.3	6.3 ±0.6	VOLTS
LIMITS OF SUPPLIED CURRENT	150 ± 10	300 ± 20	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200 [A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEET 100 VOLTS.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT

PLATE VOLTAGE	330	VOLTS
PLATE DISSIPATION	1.2	WATT
GRID VOLTAGE		
NEGATIVE BIAS VALUE	55	VOLTS
POSITIVE BIAS VALUE	0	VOLTS

CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
AMPLIFICATION FACTOR	100	100	VOLTS
TRANSCONDUCTANCE	1,250	1,600	μMHOS
PLATE RESISTANCE	80,000	62,500	OHMS
EQUIVALENT NOISE AND HUM VOLTAGE, AVERAGE, RMS		1.8	MV.

EACH TRIODE SECTION MEASURED IN "TRUE RMS" UNITS UNDER THE FOLLOWING CONDITIONS: HEATER (PARALLEL ARRANGEMENT) VOLTAGE OF 6.3 VOLTS AC; CENTER TAP OF HEATER TRANSFORMER GROUNDED; PLATE SUPPLY VOLTAGE, 250 VOLTS DC; PLATE LOAD RESISTOR, 100,000 OHMS; CATHODE RESISTOR, 2,700 OHMS BYPASSED BY 100 μF CAPACITOR; GRID RESISTOR, 0 OHMS; AND AMPLIFIER COVERING FREQUENCY RANGE BETWEEN 25 AND 10,000 CPS. EQUIVALENT VOLTAGE REFERENCED TO GRID.

RESISTANCE COUPLED AMPLIFIER

R_p MEG.	R_S MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.

FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

TUNG-SOL

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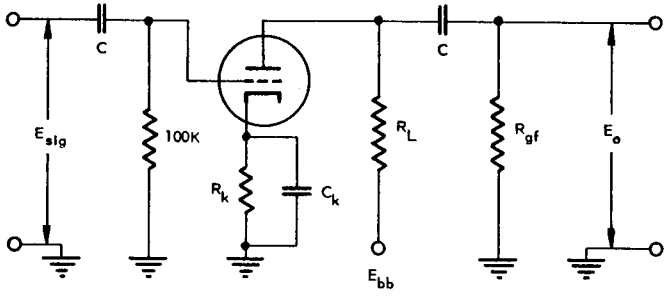
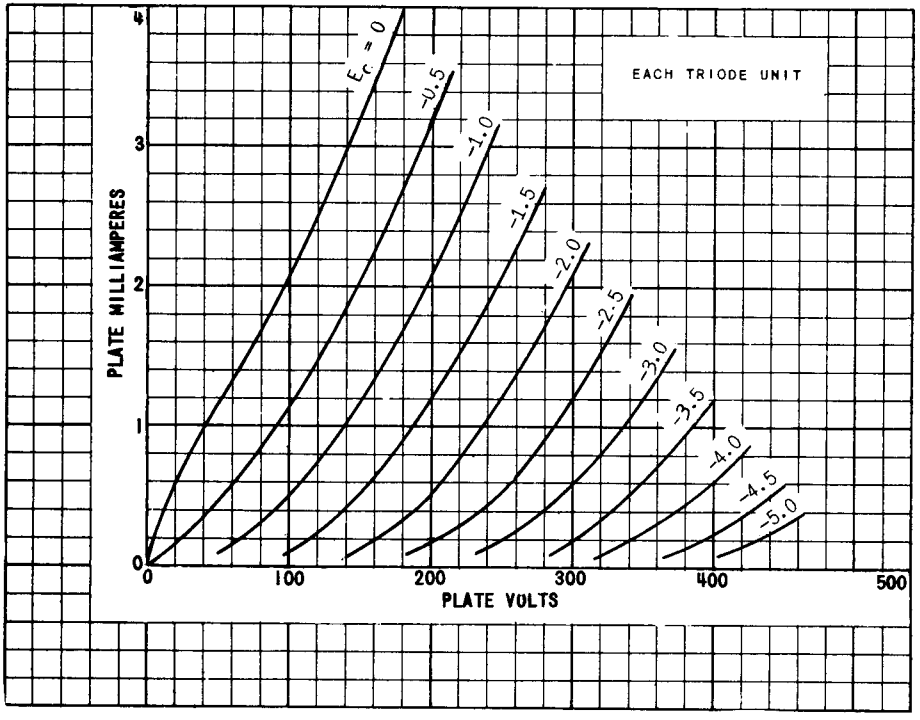


COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.



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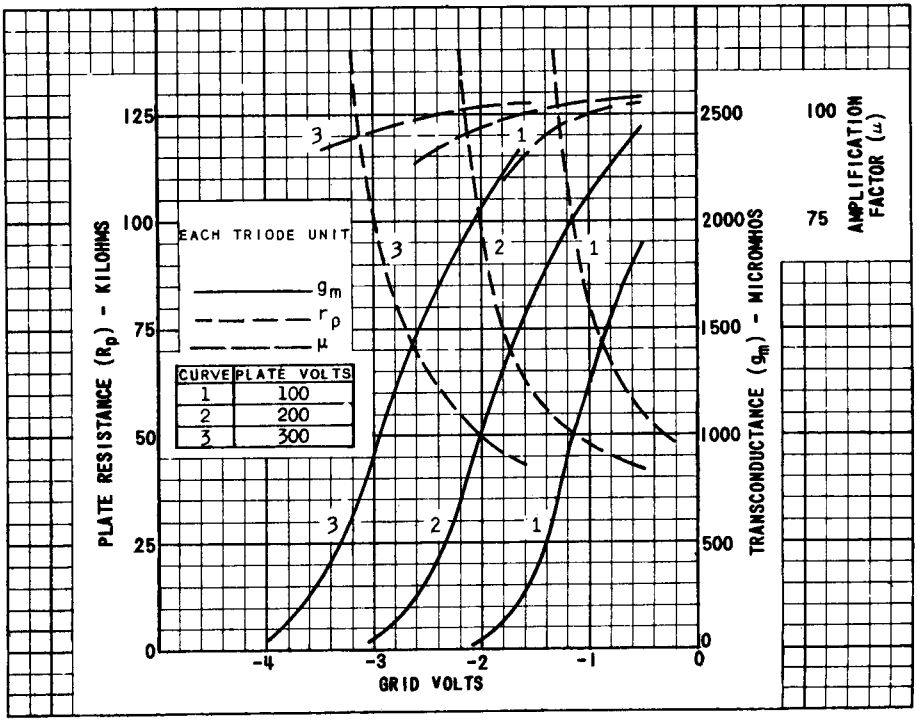
12AX7A


EACH TRIODE UNIT
g_m
r_p
μ
CURVE PLATE VOLTS
1 100
2 200
3 300
PLATE RESISTANCE (R_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
125
100
75
50
25
0
2500
2000
1500
1000
500
0
100
75
-4
-3
-2
-1
0

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

HIGH-MU TRIODES

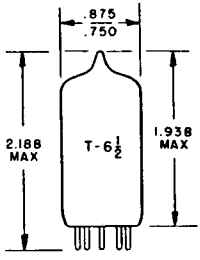
FOR

HIGH GAIN AUDIO AMPLIFIER SERVICE

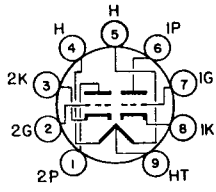
IN MILITARY APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 12AX7WA CONTAINS TWO INDEPENDENT HIGH-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATION, SUCH AS VOLTAGE AMPLIFIER, PHASE INVERTERS OR MULTIVIBRATORS. THE CENTER TAPPED HEATER CONNECTION PERMITS OPERATION FROM EITHER A 6.3 VOLT OR 12.6 VOLT SUPPLY AND IN 300 MA. OR 150 MA. SERIES HEATER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G TO P	1.7	pf
INPUT	1.8	pf
OUTPUT SECTION 1	0.46	pf
OUTPUT SECTION 2	0.34	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4+5	
AVERAGE VALUES– VOLTAGE	12.6	6.3	VOLTS
– CURRENT	150	300	MA.
LIMITS OF APPLIED VOLTAGE	12.6 ± 1.2	6.3 ± 0.6	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT

PLATE VOLTAGE	330	VOLTS
PLATE DISSIPATION	1.0	WATT
GRID VOLTAGE		
NEGATIVE BIAS VALUE	-50	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
BULB TEMPERATURE	+165	°C

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CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	1.2	MA.
AMPLIFICATION FACTOR	100	μ
TRANSCONDUCTANCE	1,650	μMHOS
PLATE RESISTANCE	62,500	OHMS

SPECIAL TESTS AND RATINGS

HEATER CYCLING RATING		
ALTITUDE	80,000	FEET
SHOCK		

RESISTANCE COUPLED AMPLIFIER

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

TUNG-SOL

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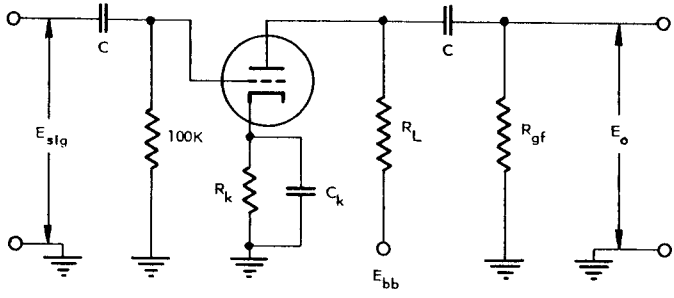
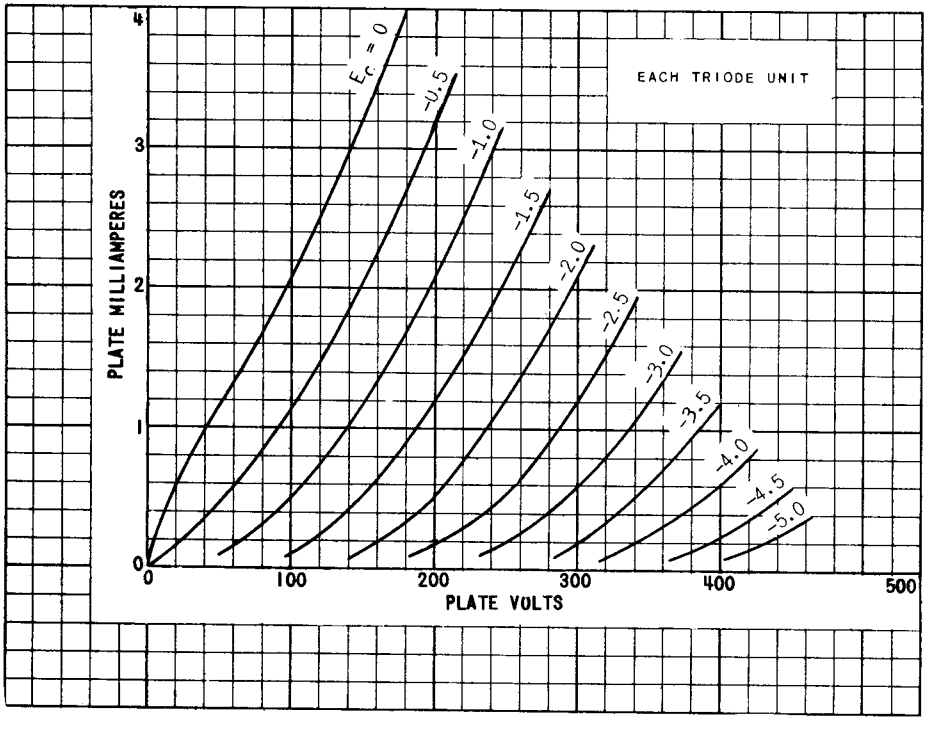


COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.



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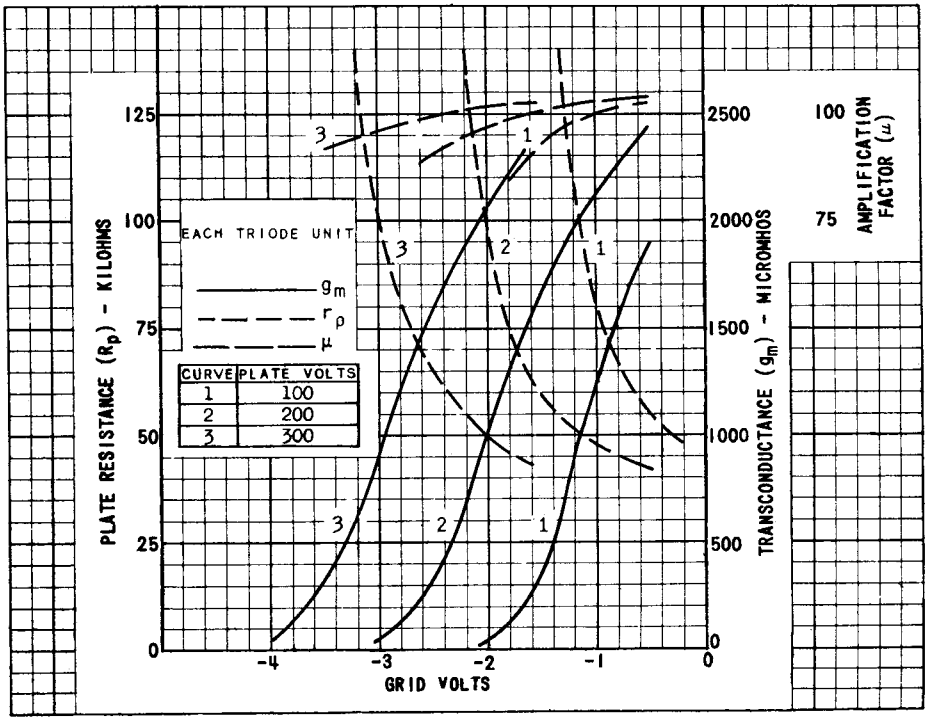
12AX7WA


EACH TRIODE UNIT
g_m
r_p
μ
CURVE | PLATE VOLTS
1 | 100
2 | 200
3 | 300
PLATE RESISTANCE (R_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
125
100
75
50
25
0
2500
2000
1500
1000
500
0
100
75
-4
-3
-2
-1
0

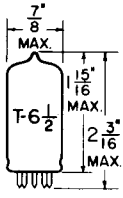
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER



GLASS BULB

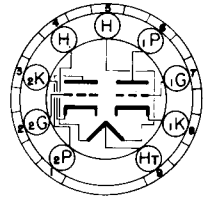
SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
150 MA.	300 MA.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

WHEN OPERATING FROM AN AC HEATER SUPPLY, DO NOT USE THE 12.6 VOLT CONNECTION IF LOW-HUM CAPABILITIES ARE TO BE REALIZED.

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9A

THE 12AY7 COMBINES TWO INDEPENDENT MEDIUM-MU INDIRECTLY HEATED CATHODE TYPE TRIODES IN THE SMALL 9 PIN BUTTON MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN HIGH GAIN AUDIO AMPLIFIER SERVICE WHERE PARTICULAR ATTENTION IS PAID TO MICROPHONICS, HUM, AND OTHER SOURCES OF INTERNAL NOISE.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

	EACH UNIT	
GRID TO PLATE: (G TO P)	1.3	μμf
INPUT: G TO (H+K)	1.3	μμf
OUTPUT: P TO (H+K)	0.6	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	90		VOLTS
MAXIMUM PLATE DISSIPATION	1.5		WATTS
MAXIMUM CATHODE CURRENT	10		MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

	EACH TRIODE UNIT		
HEATER VOLTAGE	12.6	6.3	VOLTS
HEATER CURRENT	150	300	MA.
PLATE VOLTAGE	250		VOLTS
GRID VOLTAGE	-4		VOLTS
PLATE CURRENT	3		MA.
TRANSCONDUCTANCE	1 750		μMHOS
AMPLIFICATION FACTOR	44		
PLATE RESISTANCE (APPROX.)	25 000		OHMS *

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

LOW LEVEL AMPLIFIER SERVICE

	EACH TRIODE SECTION	
HEATER VOLTAGE[A]	6.3	VOLTS
HEATER CURRENT	300	MA.
HEATER SUPPLY VOLTAGE	150	VOLTS
PLATE LOAD RESISTOR	20 000	OHMS
CATHODE RESISTOR	2 700	OHMS
CATHODE CAPACITOR	40	µf
GRID RESISTOR	0.1	MEGOHM
VOLTAGE GAIN	12.5	

[A] PIN NUMBER 9 CONNECTED TO NEGATIVE B SUPPLY.

→ INDICATES A CHANGE OR ADDITION

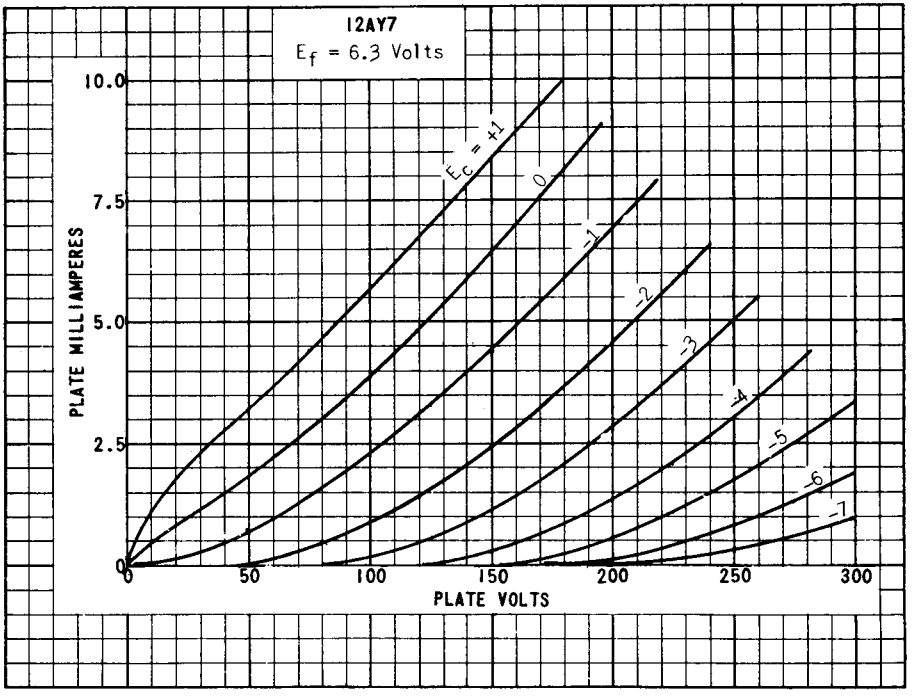

PLATE 2578
FEB. 1 1951

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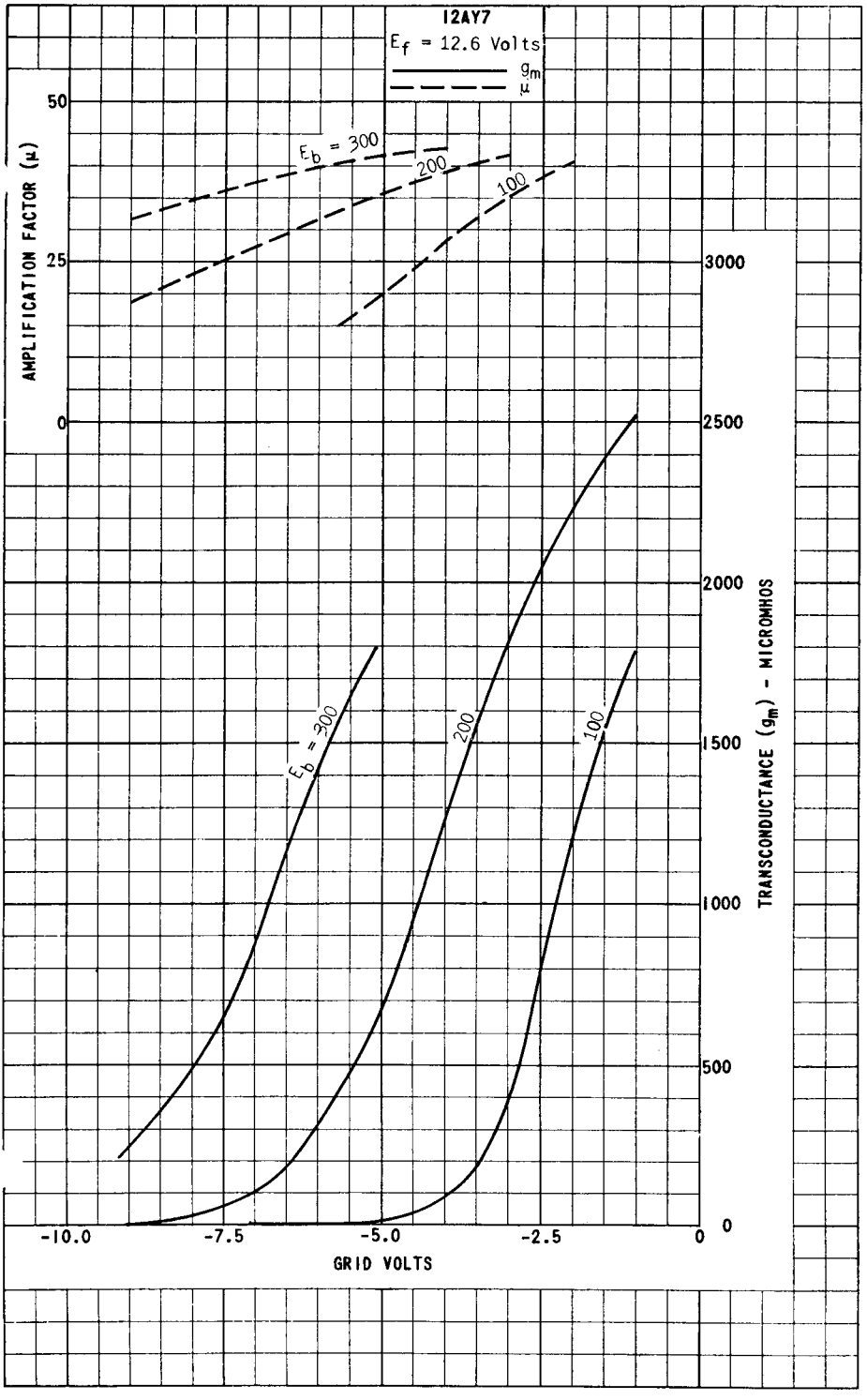

PLATE 2170
APR. 1, 1949

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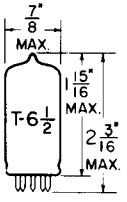
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

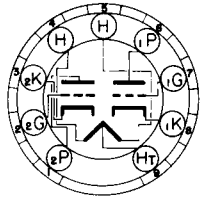
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
225 MA.	450 MA.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9A

THE 12AZ7 COMBINES TWO INDEPENDENT MEDIUM-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE TO APPLICATION EITHER AS AN AF AMPLIFIER OR AS COMBINED OSCILLATOR AND MIXER.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITHOUT SHIELD	WITH SHIELD #315 [A]	
GRID TO PLATE: (G TO P) EACH SECTION	2.0	1.9	μμf
INPUT: G TO (H+K) EACH SECTION	2.6 –	2.8 –	μμf
OUTPUT: P TO (H+K) SECTION #1	0.44 –	1.4 –	μμf
SECTION #2	0.36	1.6	μμf

[A] WITH INTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	300		VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	-50		VOLTS
MAXIMUM PLATE DISSIPATION	2.5		WATTS

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CONTINUED FROM PRECEDING PAGE

RATINGS -CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH TRIODE UNIT

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE:*		
FOR CATHODE-BIAS OPERATION	1.0	MEGOHMS
FOR FIXED BIAS OPERATION	0.25	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	6.3	12.6	6.3	12.6	VOLTS
HEATER CURRENT	450	225	450	225	MA.
PLATE VOLTAGE	100		250		VOLTS
CATHODE BIAS RESISTOR	270		200		OHMS
PLATE CURRENT	3.7		10		MA.
PLATE RESISTANCE	15 000		10 900		OHMS
TRANSCONDUCTANCE	4 000		5 500		µMHOS
AMPLIFICATION FACTOR	60		60		
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	-5		-12		VOLTS

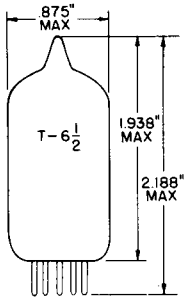
* INDICATES AN ADDITION.

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



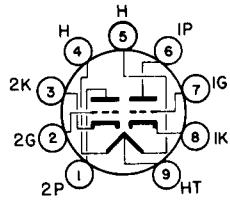
GLASS BULB

SMALL BUTTON MINIATURE
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR AUDIO AMPLIFIER OR
COMBINED OSCILLATOR-MIXER
APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 12AZ7A COMBINES TWO INDEPENDENT MEDIUM-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTABLE FOR APPLICATIONS AS AN AUDIO AMPLIFIER OR AS A COMBINED OSCILLATOR-MIXER IN VHF TELEVISION TUNERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID TO PLATE: (G TO P) EACH SECTION	1.9	2.0	pf
INPUT: G TO (H+K) EACH SECTION	2.8	2.6	pf
OUTPUT: P TO (H+K) TRIODE 1	1.4	0.44	pf
OUTPUT: P TO (H+K) TRIODE 2	1.6	0.36	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
HEATER IN SERIES	12.6 VOLTS	225	MA.
HEATER IN PARALLEL	6.3 VOLTS	450	MA.
HEATER WARM-UP TIME[B]		11	SECONDS
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (HEATER IN SERIES)		12.6±1.3	VOLTS
CURRENT OPERATION (HEATER IN PARALLEL)		450±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
NEGATIVE DC GRID VOLTAGE	55	VOLTS
PLATE DISSIPATION (EACH SECTION)	2.5	WATTS
TOTAL PLATE DISSIPATION	5.0	WATTS
GRID CIRCUIT RESISTANCE:		
FIXED BIAS	0.25	MEGOHM
SELF BIAS	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
CATHODE BIAS RESISTOR	270	200	OHMS
PLATE CURRENT	3.7	10	MA.
TRANSCONDUCTANCE	4,000	5,500	μMHOS
AMPLIFICATION FACTOR	60	60	
PLATE RESISTANCE (APPROX.)	15,000	10,900	OHMS
GRID VOLTAGE (APPROX.)			
FOR Ib=10μA. PLATE CURRENT	-5	-12	VOLTS

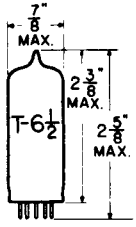
A
WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

B
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER HEATER OPERATING RESISTANCE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

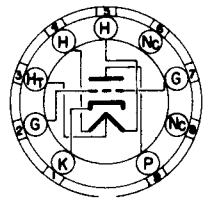
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.3 AMP.	0.6 AMP.

AC OR DC

ANY MOUNTING POSITION

CONTROL OF HEATER CHARACTERISTICS APPLIES ONLY TO 600 MA. HEATER CONNECTION.



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9AG

THE 12B4A IS A LOW-MU, HIGH PERVEANCE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS AND OTHER APPLICATION WHERE HIGH PEAK CURRENTS MUST BE DEVELOPED WITH LOW SUPPLY VOLTAGES. THERMAL CHARACTERISTICS OF THE HEATER HAVE BEEN CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF CONTROL OF THE HEATER THERMAL CHARACTERISTICS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 12B4.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: G TO P	4.8	μμf
INPUT: G TO (H+K)	5.0	μμf
OUTPUT: P TO (H+K)	1.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	CLASS A_1 AMPLIFIER	VERTICAL DEFLECTION AMPLIFIER[A]	
HEATER VOLTAGE (PARALLEL CONNECTION)	6.3	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	550	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1000	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	5.5[B]	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	---	30	MA.
MAXIMUM PEAK CATHODE CURRENT	---	105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS	0.47	---	MEGOHM
CATHODE BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE (PARALLEL CONNECTION)	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE	-17.5	VOLTS
PLATE CURRENT	34	MA.
AMPLIFICATION FACTOR	6.5	
PLATE RESISTANCE (APPROX.)	1 030	OHMS
TRANSCONDUCTANCE	6 300	µMHOS
PLATE CURRENT E_c = -23 VOLTS	9.6	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 200 µA.	-32	VOLTS

PLATE #3979 SEPTEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

TRIPLE GRID REMOTE CUT-OFF AMPLIFIER

PHYSICAL SPECIFICATIONS

		PIN CONNECTIONS			
EMITTER	UNIPOTENTIAL CATHODE	PIN 1	HEATER	PIN 7	CATHODE
BASE	LOCKING-IN 8 PIN	PIN 2	PLATE	PIN 8	HEATER
CAP	NONE	PIN 3	GRID 2		
BULB	T-9	PIN 4	GRID 3		
MAXIMUM DIAMETER	1 3/16"	PIN 5	INT. SHIELD	TOP CAP	NONE
MAXIMUM OVERALL LENGTH	2 25/32"	PIN 6	GRID 1		
MAXIMUM SEATED HEIGHT	2 1/4"				

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION		WATTS
MAXIMUM SCREEN DISSIPATION		WATTS

CAPACITANCES [4]

CONTROL GRID TO CATHODE	5.5		μμf
PLATE TO CATHODE	7.0		μμf
GRID TO PLATE	0.005	MAX.	μμf

[4] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE	12.6	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	0.15	AMPS.
PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE (GRID 2)	100	100	VOLTS
CONTROL GRID VOLTAGE (GRID 1)	-3	-3	VOLTS
PEAK AF SIGNAL VOLTAGE			VOLTS
ZERO-SIGNAL PLATE CURRENT	8.9	9.2	MA.
ZERO-SIGNAL SCREEN CURRENT	2.6	2.4	MA.
MAXIMUM-SIGNAL PLATE CURRENT			MA.
MAXIMUM-SIGNAL SCREEN CURRENT			MA.
PLATE RESISTANCE (APPROX.)	0.25	0.8	MEGOHMS
TRANSCONDUCTANCE	1900	2000	μMHOS
AMPLIFICATION FACTOR			
LOAD RESISTANCE			OHMS
TOTAL HARMONIC DISTORTION			PER CENT
POWER OUTPUT			WATTS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE 10 μMHOS (APPROX.)		-35	VOLTS
SUPRESSOR GRID VOLTAGE	0	0	VOLTS

PLATE 1329-2
SEPT. 23 1943

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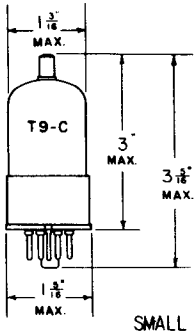
TUNG-SOL

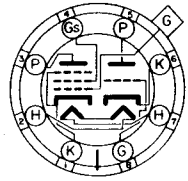


TRIODE - PENTODE AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
12.6 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



BOTTOM VIEW

SMALL WAFER 8 PIN OCTAL BASE WITH METAL SHELL

THE TUNG-SOL 12B8GT COMBINES A REMOTE CUT-OFF PENTODE AND AN INDEPENDENT HIGH-MU TRIODE IN A SINGLE BULB. IT IS DESIGNED FOR SERVICE IN AC - DC RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE SECTION - CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
SCREEN VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE	-3	VOLTS
PLATE CURRENT	7.0	MA.
SCREEN CURRENT	2.0	MA.
PLATE RESISTANCE	0.2	MEGOHM
TRANSCONDUCTANCE	1800	μMHOS
AMPLIFICATION FACTOR	360	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	-42.5	VOLTS

TRIODE SECTION

PLATE VOLTAGE	90	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	2.8	MA.
PLATE RESISTANCE	37 000	OHMS
TRANSCONDUCTANCE	2400	μMHOS
AMPLIFICATION FACTOR	90	
GRID VOLTAGE APPROX. FOR PLATE CURRENT CUT-OFF	-2.5	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

	PENTODE	TRIODE	
CONTROL GRID TO CATHODE	5.0	5.0	μμf
PLATE TO CATHODE	9.5	6.5	μμf
CONTROL GRID TO PLATE	.015	2.4	μμf
PENTODE CONTROL GRID TO TRIODE GRID	.002		μμf
PENTODE CONTROL GRID TO TRIODE PLATE	.003		μμf
PENTODE PLATE TO TRIODE PLATE	.08		μμf

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PLATE
1326-3
SEPT. 23
1943

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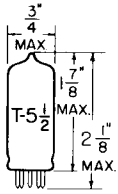
TUNG-SOL

PENTODE

MINIATURE TYPE

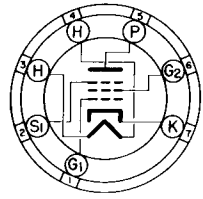


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CC

THE 12BA6 IS A PENTODE AMPLIFIER HAVING A REMOTE CONTROL GRID CHARACTERISTIC AND UTILIZING THE MINIATURE CONSTRUCTION. AS A RF AMPLIFIER IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW GRID-PLATE CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: (G_1 TO P) MAX.	0.0035	0.0035	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 7.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	50	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	μMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX. FOR G_m = 40 μMHOS)	-20	-20	VOLTS

PLATE
2249
SEPT. 1
1949

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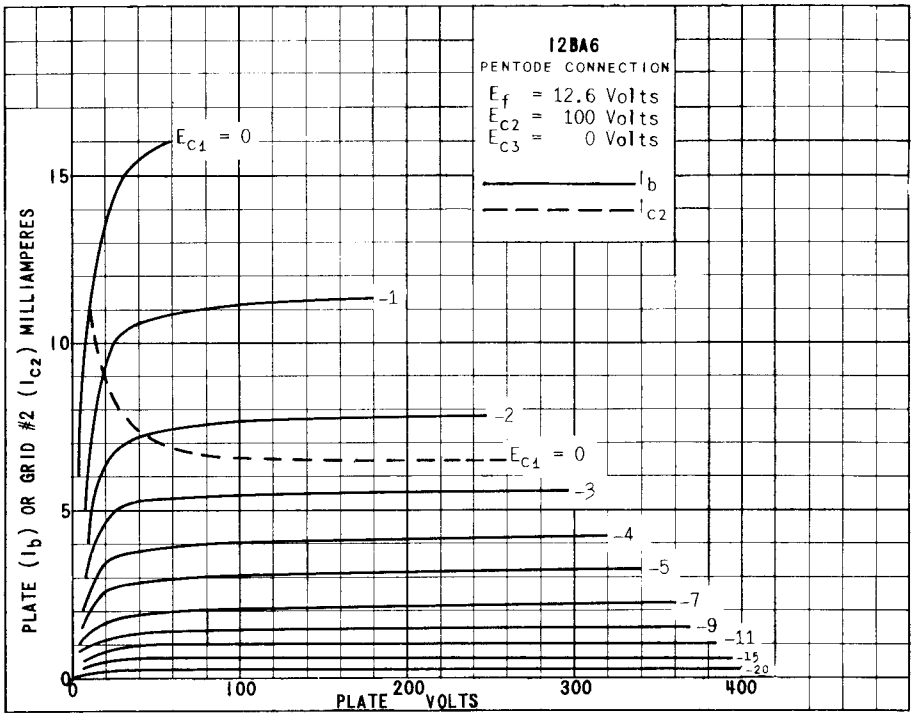
12BA6 (6BA6)



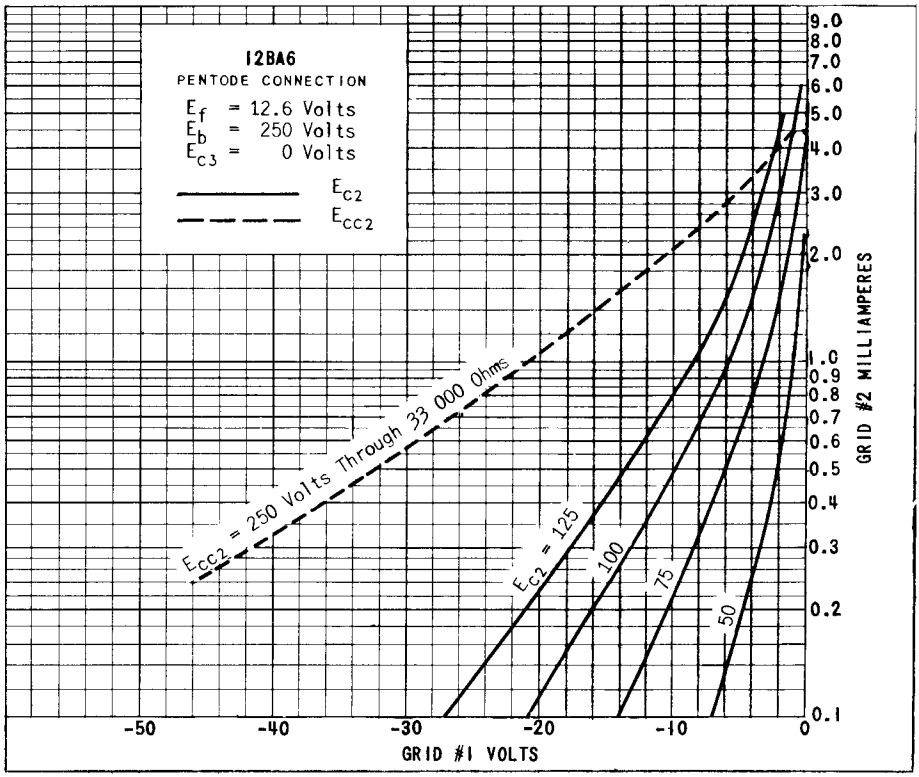


PLATE 1805
MAY 1 1947

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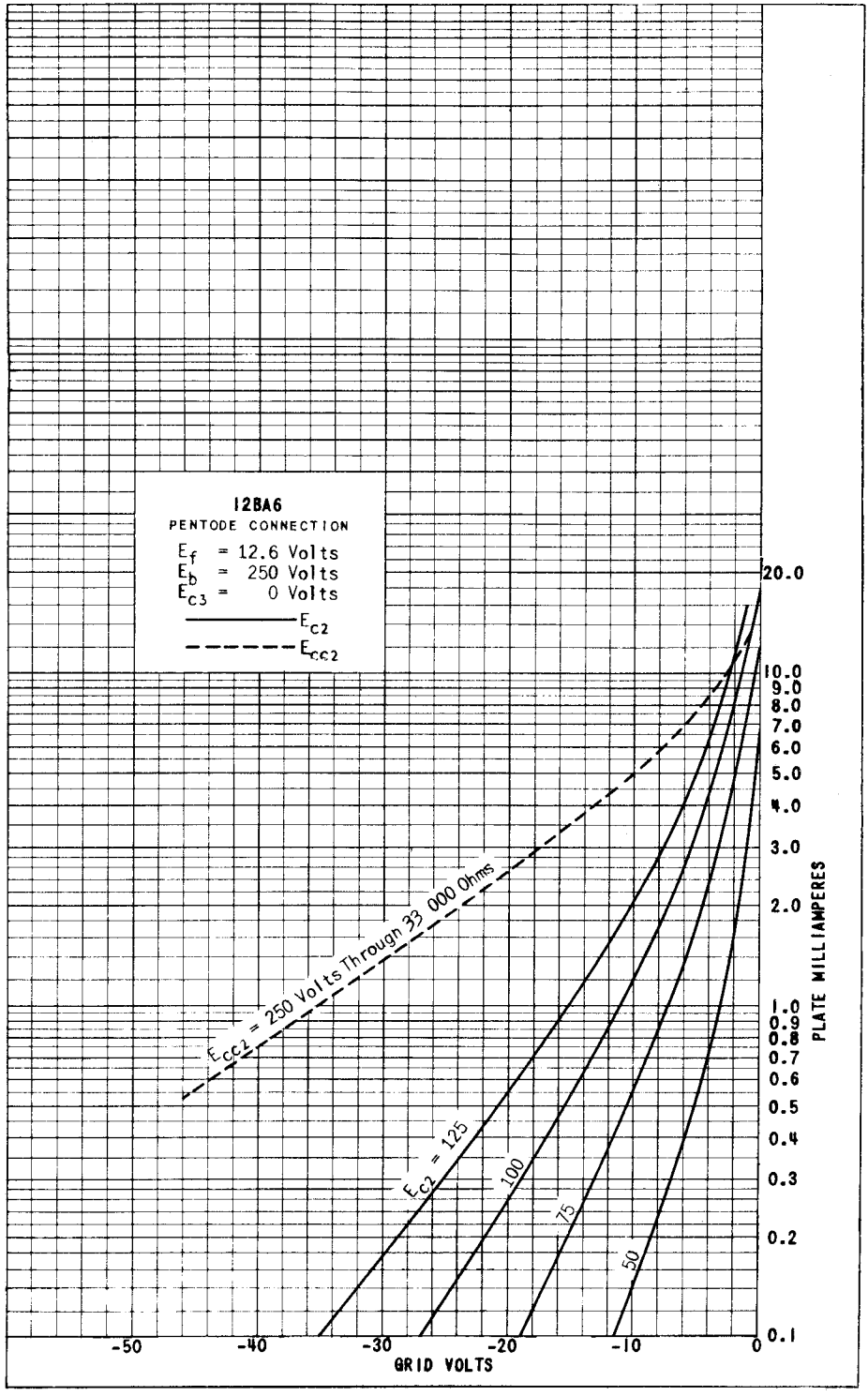

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PLATE
1806
MAY 1
1947

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12BA6

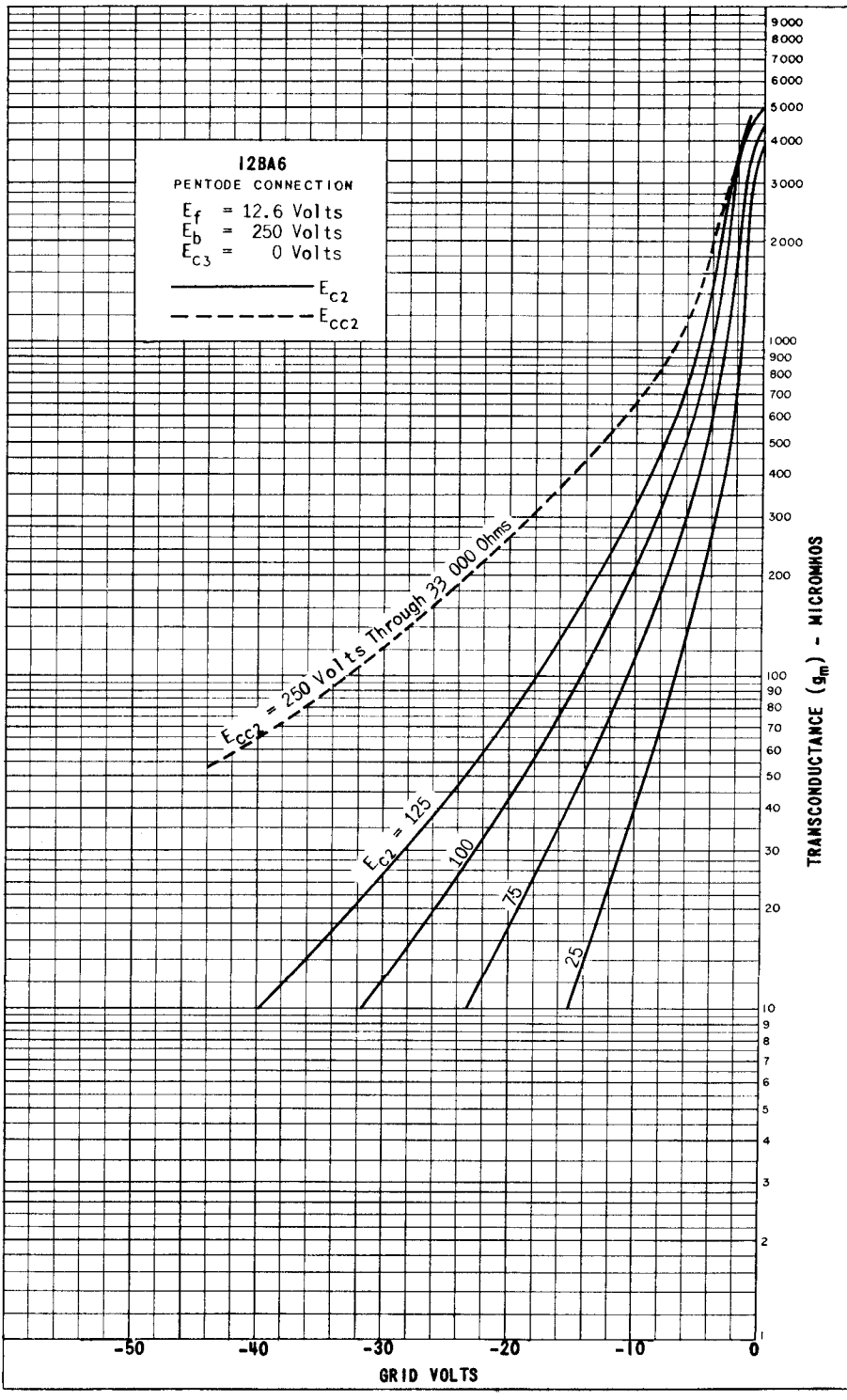

PLATE 1807
MAY 1 1947

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TUNG-SOL

PENTODE

MINIATURE TYPE

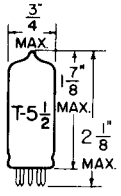
COATED UNIPOTENTIAL CATHODE

HEATER

12.6±1.3 VOLTS 0.15 AMP.

AC OR DC

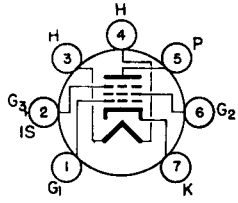
ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1

OUTLINE DRAWING JEDEC 6-7



BOTTOM VIEW

BASING DIAGRAM

JEDEC 7BK ←

THE 12BA6 IS A PENTODE AMPLIFIER HAVING REMOTE CONTROL GRID CHARACTERISTIC AND UTILIZING THE MINIATURE CONSTRUCTION. AS AN RF AMPLIFIER IT IS CHARACTERIZED BY HIGH TRANSCONDUCTANCE AND LOW GRID–PLATE CAPACITANCE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	0.0035	0.0035	μμf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G_2+G_3&IS)	5.5	5	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #7.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE J5-C4	
MAXIMUM GRID #3 VOLTAGE	PIN #2 CONNECTED TO PIN #7 AT SOCKET	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	−55	VOLTS
MAXIMUM PLATE DISSIPATION	3.4	WATTS
MAXIMUM GRID #2 DISSIPATION:		
FOR VOLTAGES UP TO 165 VOLTS	0.7	WATT
FOR VOLTAGES BETWEEN 165 & 330 VOLTS	SEE J5-C4	

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4 300	4 400	μMHOS
PLATE CURRENT	10.8	11	MA.
GRID #2 CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 40 μMHOS	−20	−20	VOLTS

→ INDICATES A CHANGE.

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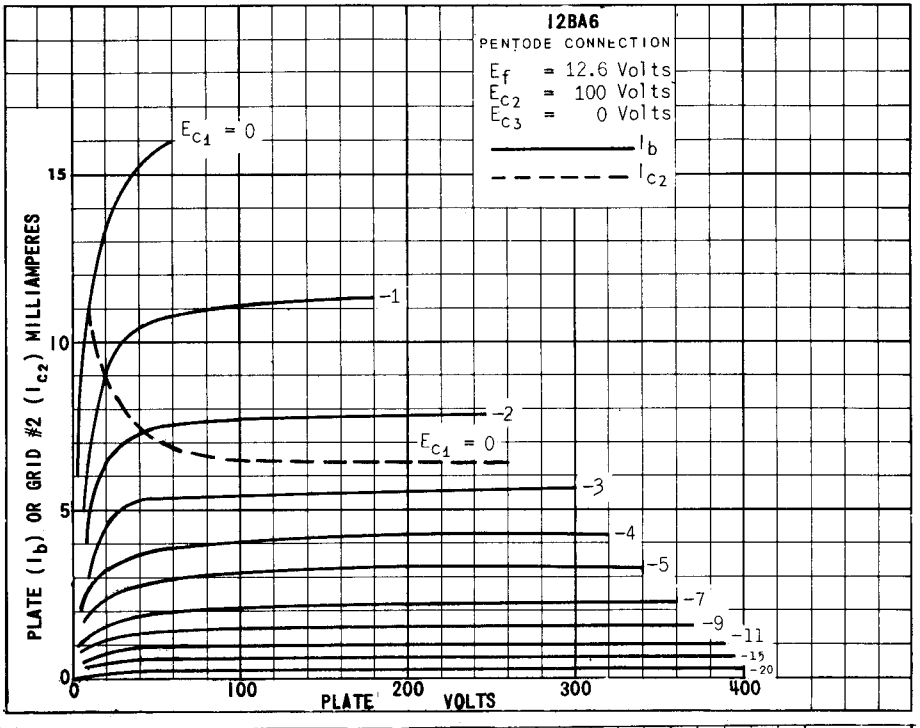
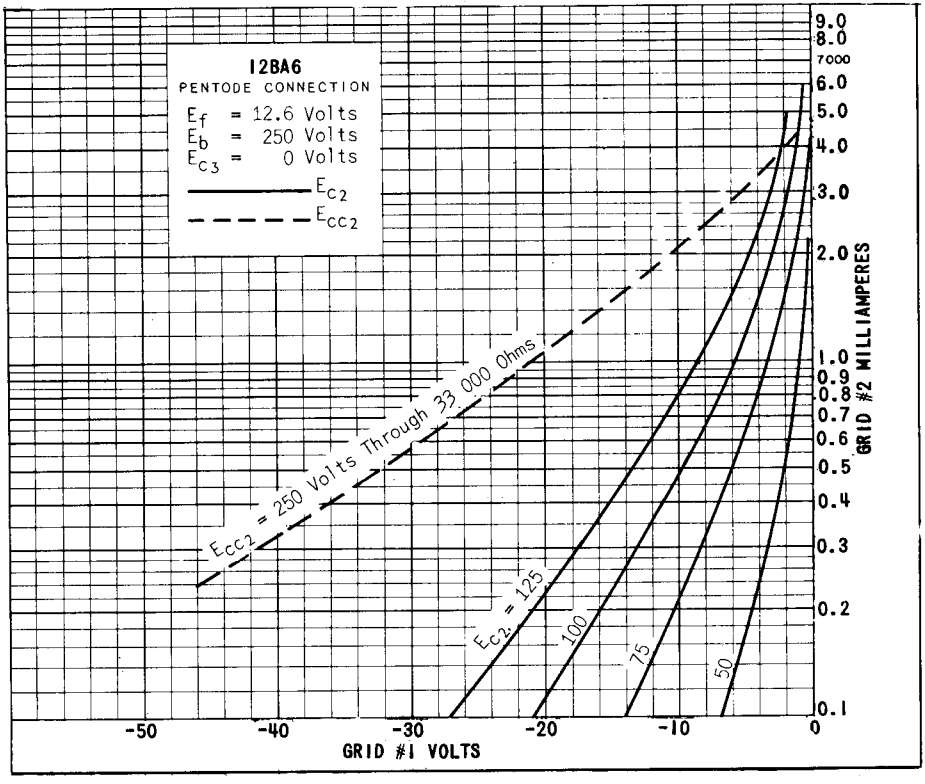

12BA6
PENTODE CONNECTION
Ef = 12.6 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
Ec1 = 0
-1
-2
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
0
5
10
15
100
200
300
400


12BA6
PENTODE CONNECTION
Ef = 12.6 Volts
Eb = 250 Volts
Ec3 = 0 Volts
Ec2
Ecc2
Ecc2 = 250 Volts Through 33,000 Ohms
Ec2 = 125
100
75
50
GRID #2 MILLIAMPERES
GRID #1 VOLTS
9.0
8.0
7000
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-50
-40
-30
-20
-10
0

TUNG-SOL

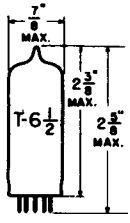
HEPTODE

MINIATURE TYPE

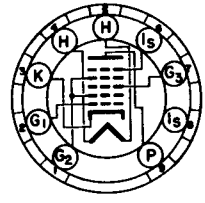
UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE

THE 12BA7 IS A CATHODE TYPE HIGH GAIN PENTAGRID CONVERTER IN THE SMALL 9-PIN BUTTON CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A COMBINED LOCAL OSCILLATOR AND MIXER AT HIGH FREQUENCIES, ESPECIALLY IN THE FM BROADCAST BAND.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #3 TO PLATE: (G_3 TO P) MAX.	0.19	μμf
GRID #1 TO GRID #3: (G_1 TO G_3) MAX.	0.1	μμf
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.05	μμf
GRID #1 TO CATHODE: (G_1 TO K)	3.3	μμf
GRID #1 TO ALL EXCEPT CATHODE: G_1 TO (H+G_2&G_4+G_3+G_5+P+IS)	3.4	μμf
CATHODE TO ALL EXCEPT GRID #1: K TO (H+G_2&G_4+G_3+G_5+P+IS)	4	μμf
RF INPUT: G_3 TO (H+K+G_1+G_2&G_4+G_5+P+IS)	9.5	μμf
OSCILLATOR INPUT: G_1 TO (H+K+G_2&G_4+G_3+G_5+P+IS)	6.7	μμf
MIXER OUTPUT: P TO (H+K+G_1+G_2&G_4+G_3+G_5+IS)	8.3	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM NEGATIVE GRID #3 VOLTAGE	100	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #5 & INTERNAL SHIELD VOLTAGE[A]	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM GRIDS #2 & #4 DISSIPATION	1.5	WATTS
MAXIMUM CATHODE CURRENT	22	MA.

[A] INTERNAL SHIELD (PINS #6 AND #8) CONNECTED DIRECTLY TO GROUND.

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PLATE 2086
OCT. 1, 1948

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE - SEPARATE EXCITATION

THE CHARACTERISTICS SHOWN WITH SEPARATE EXCITATION CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATOR CIRCUIT OPERATING WITH ZERO BIAS.

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRIDS #2 & #4 VOLTAGE	100	100	VOLTS
GRID #3 VOLTAGE	-1	-1	VOLTS
GRID #5 AND INTERNAL SHIELD[A]	CONNECTED DIRECTLY TO GROUND		
GRID #1 RESISTOR	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1	MEGOHM
CONVERSION TRANSCONDUCTANCE	900	950	µMHOS
PLATE CURRENT	3.6	3.8	MA.
GRIDS #2 & #4 CURRENT	10.2	10	MA.
GRID #1 CURRENT	0.35	0.35	MA.
TOTAL CATHODE CURRENT	14.2	14.2	MA.
CONVERSION TRANSCONDUCTANCE WITH E_{C3} = -20 VOLTS	3.5	3.5	µMHOS

[A] INTERNAL SHIELD (PINS #6 AND #8) CONNECTED DIRECTLY TO GROUND.

OSCILLATOR TRANSCONDUCTANCE

NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRIDS #2 & #4 CONNECTED TO PLATE	100	VOLTS
PLATE CURRENT	32	MA.
TRANSCONDUCTANCE BETWEEN GRID #1 & GRIDS #2 & #4 CONNECTED TO PLATE	8 000	µMHOS
AMPLIFICATION FACTOR	16.5	

SIMILAR TYPE REFERENCE: Except for heater ratings similar to 6SB7Y.

PLATE 2087
OCT. 1, 1948

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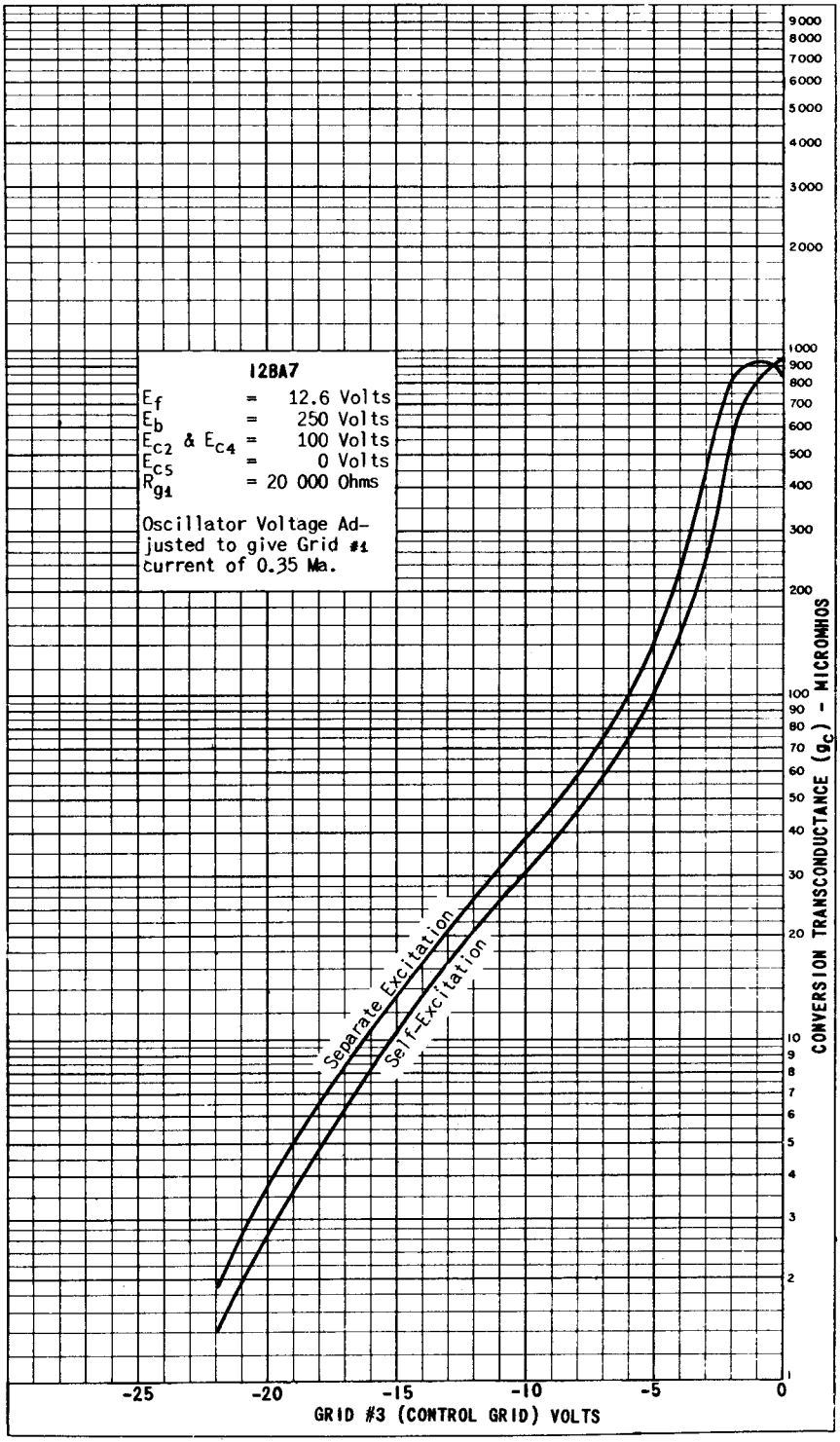

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OCT. 1, 1948

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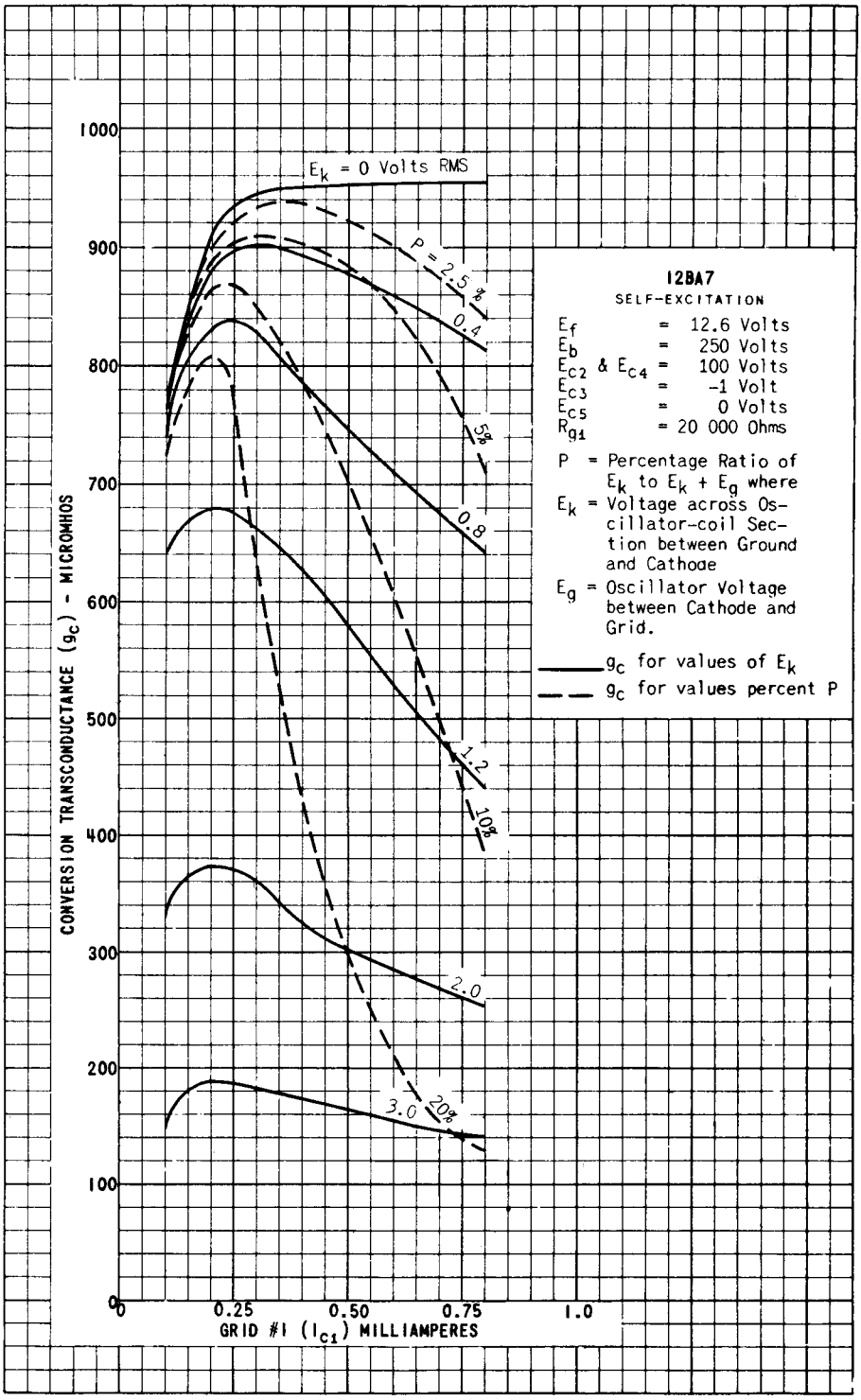
12BA7



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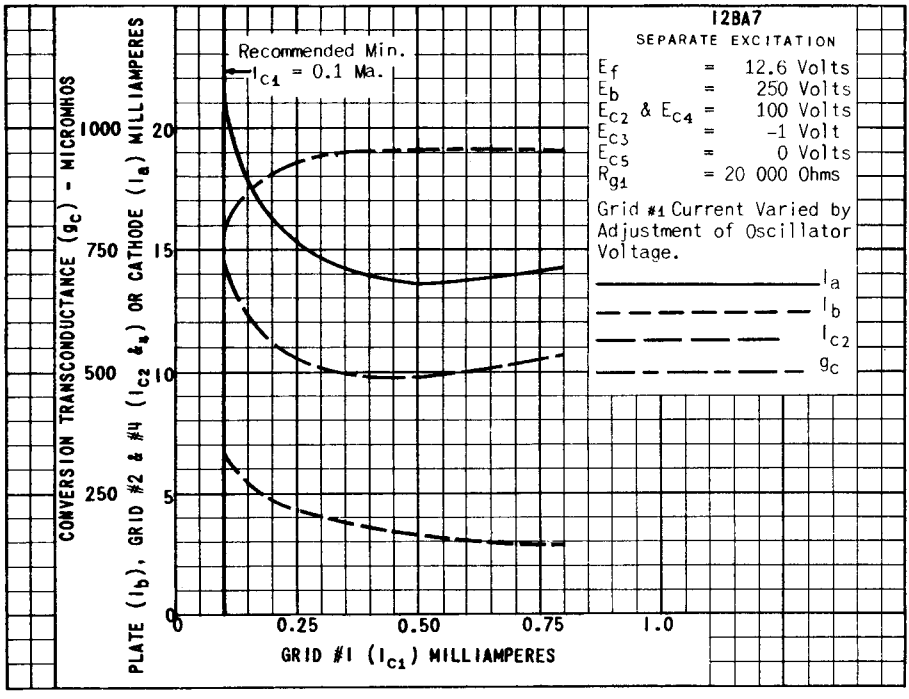

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PLATE
2090
OCT. 1,
1948

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TUNG-SOL

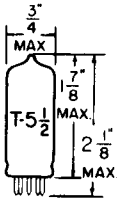
PENTODE

MINIATURE TYPE

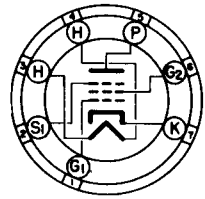
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 12BD6 IS A MINIATURE REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A RADIO-FREQUENCY OR INTERMEDIATE-FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE (MAX.)	0.005	0.004	μμf
INPUT	4.3	4.3	μμf
OUTPUT	5.0	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

DESIGN CENTER VALUES

HEATER VOLTAGE		12.6	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS *
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS *
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE		125	VOLTS
MAXIMUM PLATE DISSIPATION		3.0	WATTS ←
MAXIMUM GRID #2 DISSIPATION		0.4	WATT
MAXIMUM CATHODE CURRENT		14	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS *

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	0.15	AMP.
PLATE VOLTAGE	100	125	250	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET			
GRID #2 VOLTAGE	100	125	100	VOLTS
GRID #1 VOLTAGE	-1	-3	-3	VOLTS
PLATE CURRENT	13	13	9	MA.
GRID #2 CURRENT	5	5	3.0	MA.
PLATE RESISTANCE	0.15	0.18	0.8	MEGOHM
TRANSCONDUCTANCE	2 550	2 350	2 000	μMHOS
GRID VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	-35	-45	-35	VOLTS

→INDICATES A CHANGE.
*INDICATES AN ADDITION.

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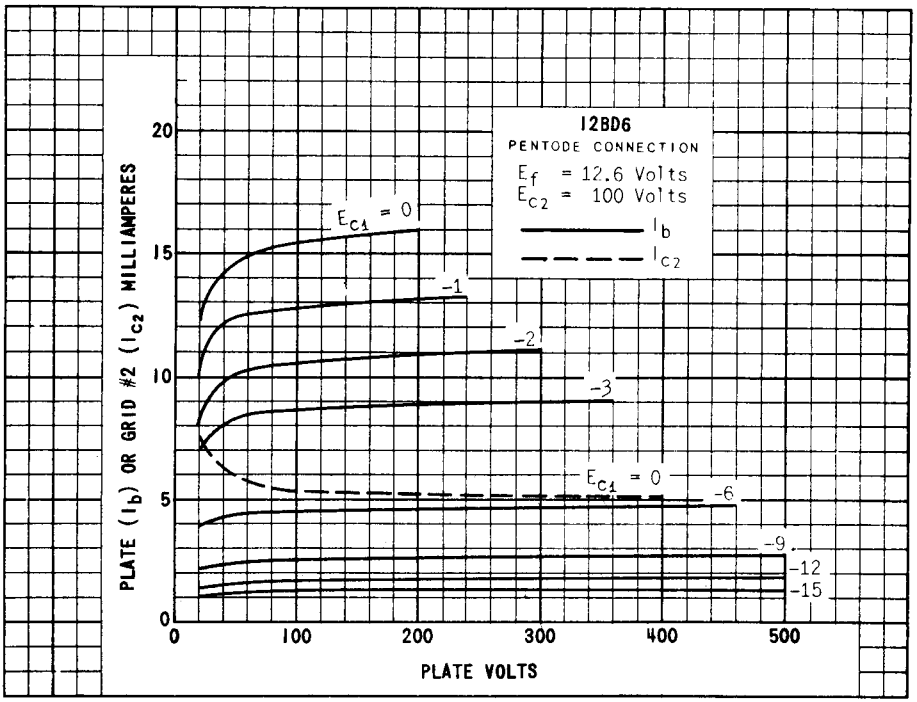
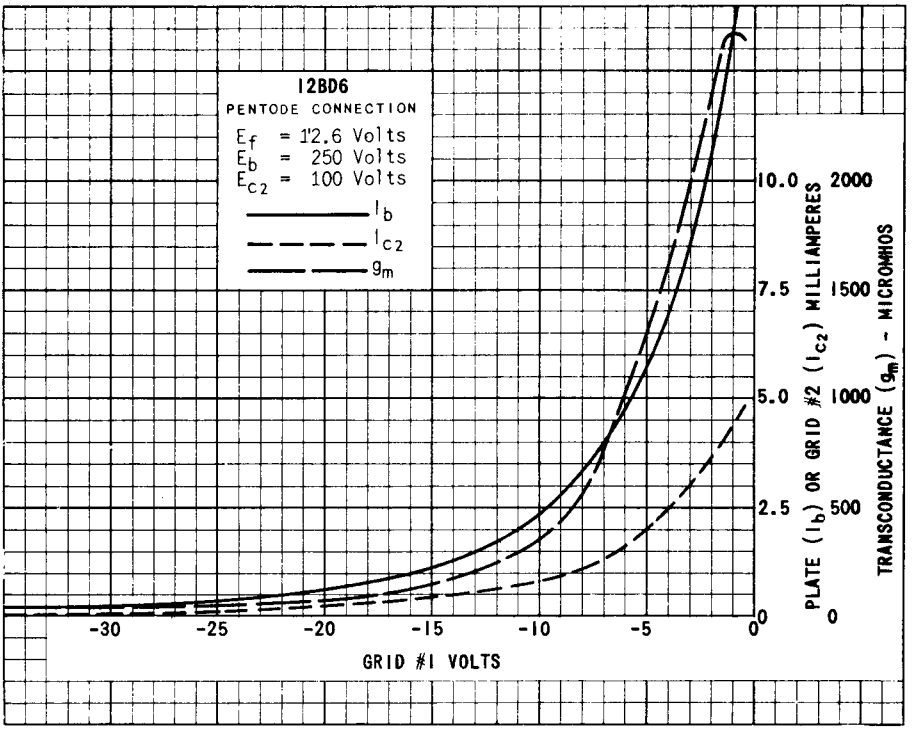
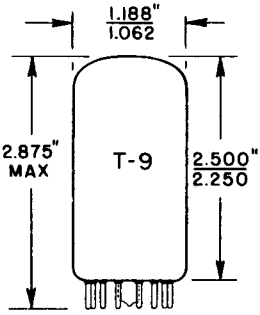

12BD6
PENTODE CONNECTION
E_f = 12.6 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
E_{c1} = 0
-6
-9
-12
-15
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
0
100
200
300
400
500


12BD6
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID #1 VOLTS
0
2.5
5.0
7.5
10.0
0
500
1000
1500
2000
-30
-25
-20
-15
-10
-5
0

TUNG-SOL

DIODE

COMPACTRON

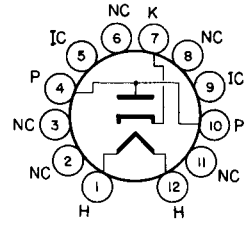


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-60

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA ←
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 12BE3 IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 12BE3 IS IDENTICAL TO THE 6BE3 AND THE 17BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	600	MA
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600 ± 40	MA
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES [B] - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	25	VOLTS

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TUNG-SOL

DIODE

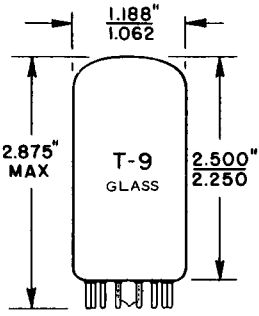
COMPACTRON

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

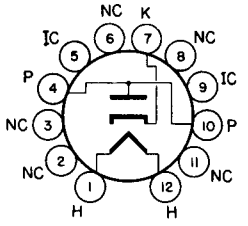
ANY MOUNTING POSITION

OUTLINE DRAWING
JEDEC 9-60



BASE 12 PIN BUTTON
JEDEC E12-70

BASING DIAGRAM
JEDEC 12GA



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 12BE3A IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 12BE3A IS IDENTICAL TO THE 6BE3A AND THE 17BE3A. THE VOLTAGE DROP OF THIS TYPE IS LOWER THAN THAT OF THE 12BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	600	MA
HEATER WARM-UP TIME SEE BELOW			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600 ± 40	MA
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE SEE BELOW

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

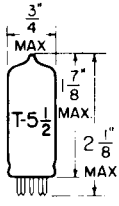
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	22.5	VOLTS

TUNG-SOL

HEPTODE

MINIATURE TYPE



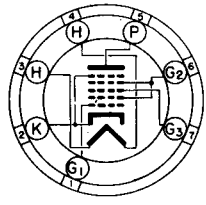
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

12.6±10% VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 12BE6 IS A PENTAGRID CONVERTER USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE AS A COMBINED OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	0.30	μμf
MIXER GRID TO OSCILLATOR GRID: (G_3 TO G_1) MAX.	0.15	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	7.0	7.0	μμf
OSCILLATOR INPUT: G_1 TO (H+K+$G_{2\&4}$+G_3+G_5+P)	5.5	5.5	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	13	8.0	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G_5)	3.0	3.0	μμf
OSCILLATOR OUTPUT: K TO (H+$G_{2\&4}$+G_3+P)	20	15	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.05	0.1	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

RATINGS ←

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	12.6±10%	VOLTS
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRIDS #2 AND #4 VOLTAGE	110	VOLTS
MAXIMUM GRIDS #2 AND #4 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	−55	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	WATT
MAXIMUM GRIDS #2 AND #4 DISSIPATION	1.1	WATT
MAXIMUM CATHODE CURRENT	15.5	MA.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SEPARATE EXCITATION[B]

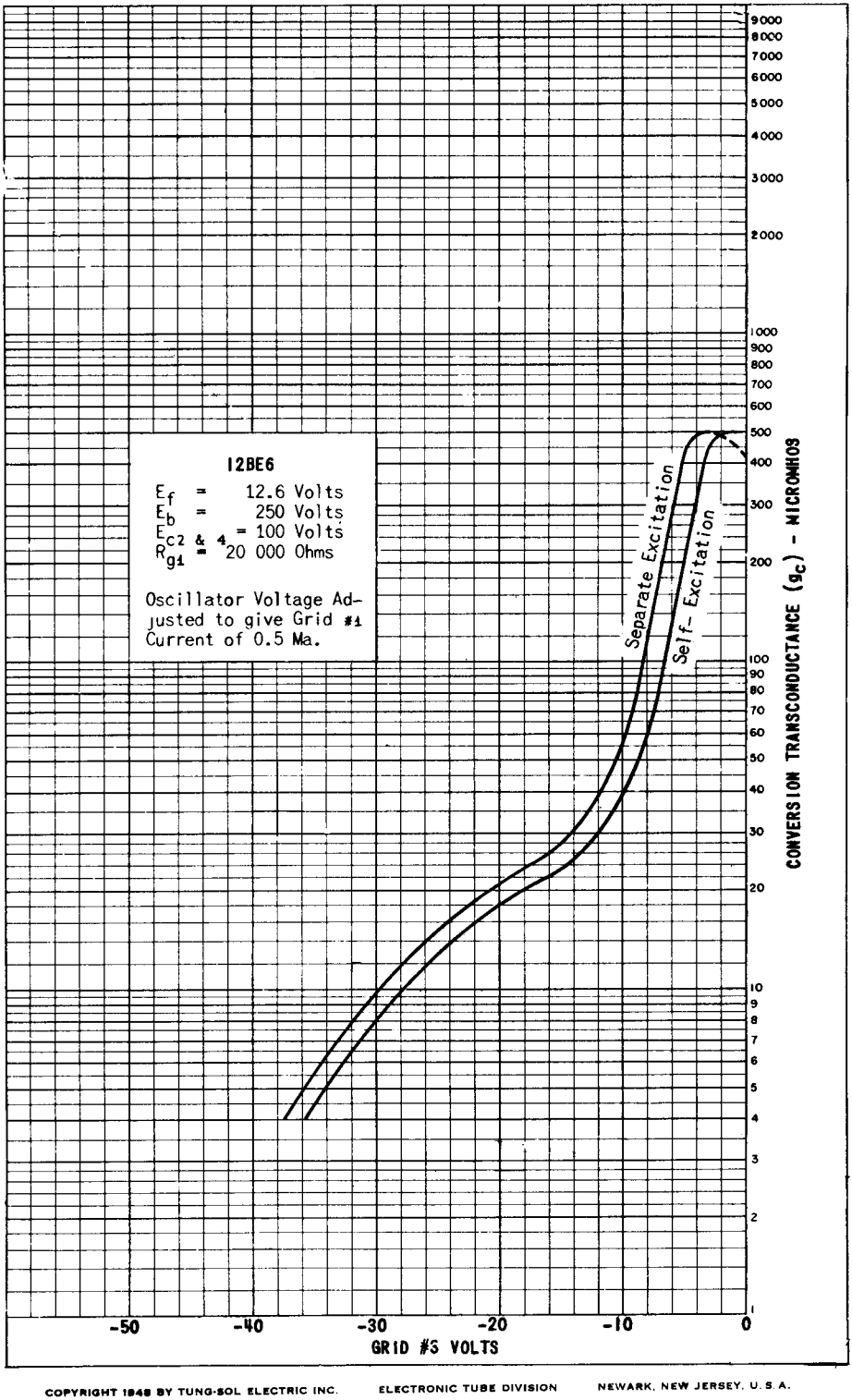
HEATER VOLTAGE	12.6±10%		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	-1.5	-1.5	VOLTS
GRIDS #2 AND #4 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	10	10	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	0.4	1.0	MEGOHMS
GRID #1 CURRENT (OSCILLATOR GRID)	0.5	0.5	MA.
CONVERSION TRANSCONDUCTANCE	455	475	µMHOS
PLATE CURRENT	2.6	2.9	MA.
GRIDS #2 AND #4 CURRENT	7.0	6.8	MA.
CATHODE CURRENT	10.1	10.2	MA.
GRID #3 VOLTAGE FOR G_c = 10 µMHOS (APPROX.)	-30	-30	VOLTS
GRID #3 VOLTAGE FOR G_c = 100 µMHOS (APPROX.)	-6	-6	VOLTS

[B] CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION CONDUCTANCE TEST SET WHICH USES SEPARATE EXCITATION. THE CHARACTERISTICS UNDER THESE CONDITIONS CORRESPOND VERY CLOSELY WITH THOSE OBTAINED IN A SELF-EXCITED OSCILLATORY CIRCUIT OPERATING WITH ZERO BIAS.

OSCILLATOR CHARACTERISTICS
NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRIDS #2 AND #4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	7 250	µMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 AND GRIDS #2 AND #4 CONNECTED TO PLATE	20	
CATHODE CURRENT	25	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µA	-11	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings, the 12BE6 is identical to the 6BE6.



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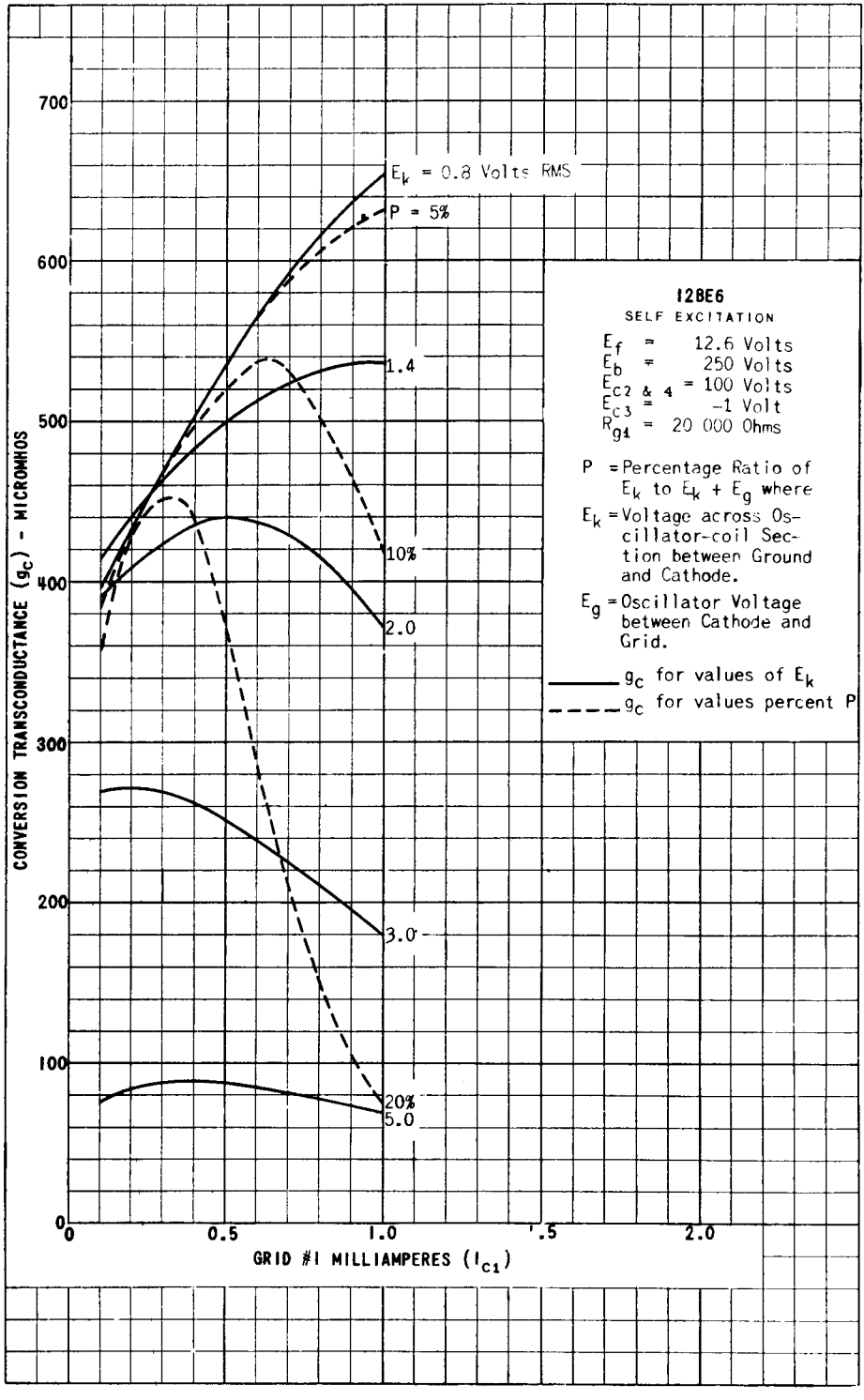
12BE6 (6BE6)



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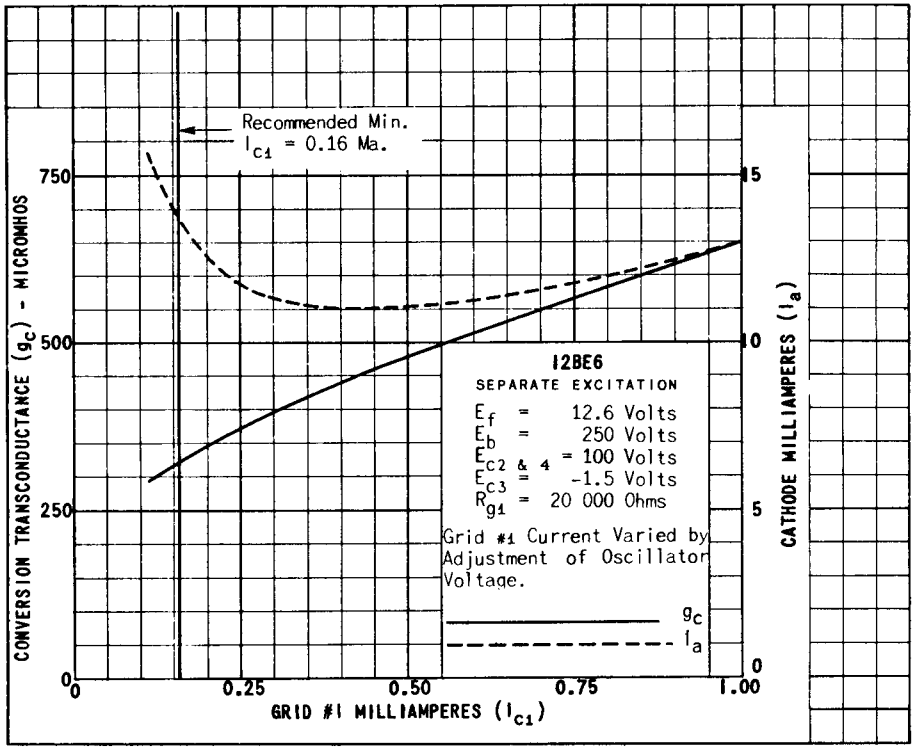

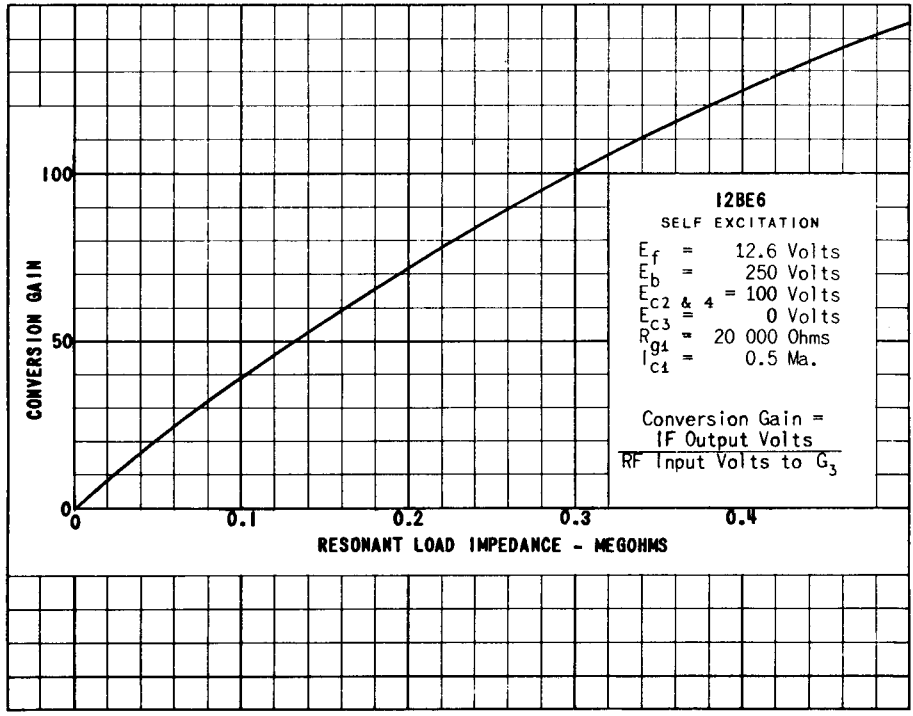

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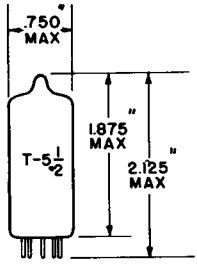
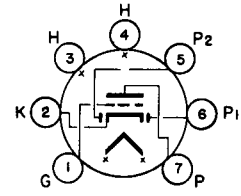


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

DOUBLE-DIODE TRIODE
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE
VOLTAGE AMPLIFIER
AND
DETECTOR

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BT

THE 12BF6 IS A COMBINED LOW-MU VOLTAGE AMPLIFIER AND DOUBLE-DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. THE LOW AMPLIFICATION FACTOR OF THE TRIODE PERMITS LARGE VALUES OF OUTPUT SIGNAL WITH LOW DISTORTION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE SECTION:			
GRID TO PLATE: (G TO TP)	1.9	1.9	pf
INPUT: G TO (H+K)	1.8	1.9	pf
OUTPUT: TP TO (H+K)	0.7	1.2	pf
DIODE SECTION:			
#1 DIODE PLATE TO GRID: (1DP TO G) MAX.	0.07	0.06	pf
#2 DIODE PLATE TO GRID: (2DP TO G) MAX.	0.06	0.05	pf
#2 DIODE PLATE TO HEATER AND CATHODE	0.95		pf
#1 DIODE PLATE TO HEATER AND CATHODE	0.66		pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		12.6±1.3	VOLTS
CURRENT OPERATION		150±15	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

[A] EXTERNAL SHIELD 316 CONNECTED TO PIN#2.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

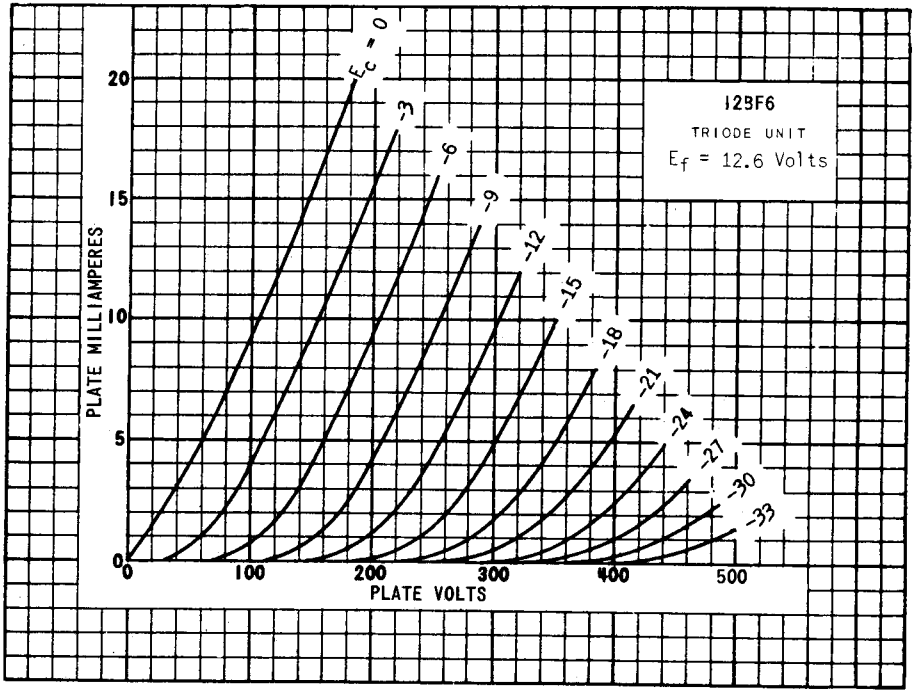
DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

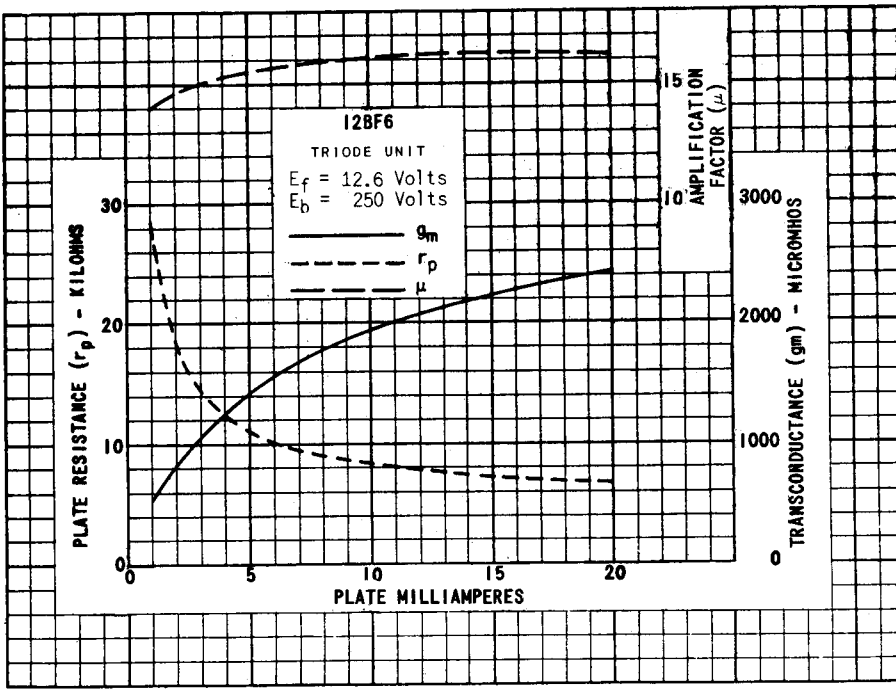
PLATE VOLTAGE	300	VOLTS
PLATE DISSIPATION	2.5	WATTS
AVERAGE DIODE CURRENT EACH UNIT FOR CONTINUOUS OPERATION	1.0	MA.

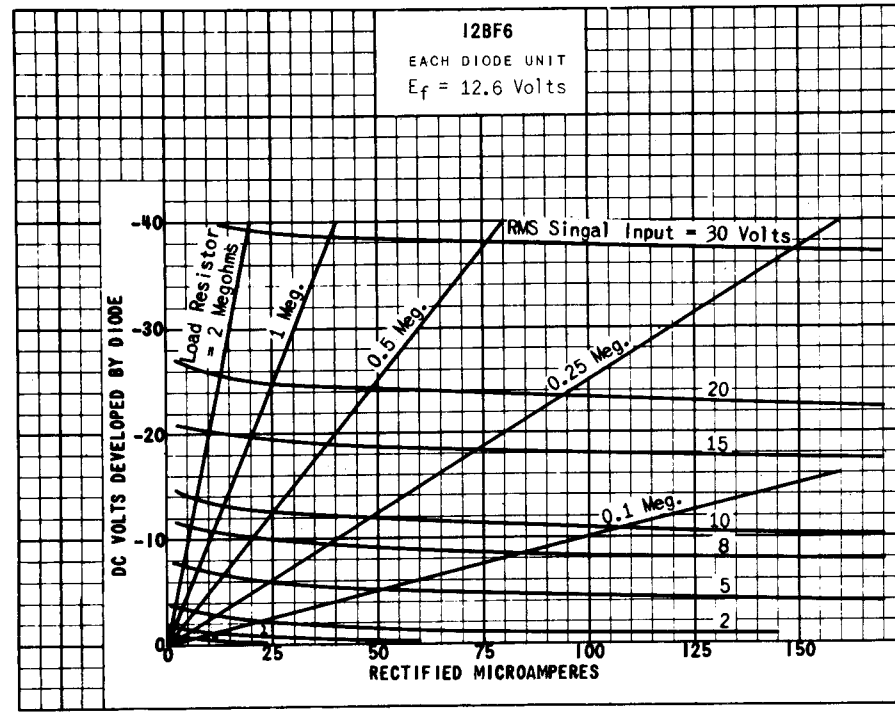
TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-9	VOLTS
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	
PLATE CURRENT	9.5	MA.
LOAD RESISTANCE	10000	OHMS
TOTAL HARMONIC DISTORTION	6.5	PERCENT
POWER OUTPUT	300	MW.
DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED (MIN.)	0.8	MA.







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DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

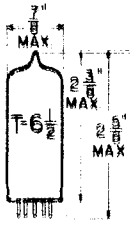
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
300 MA.	600 MA.

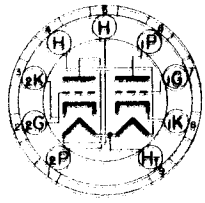
AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #7 AND PINS #4 AND #5 CONNECTED TOGETHER.

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 12BH7 COMBINES TWO INDEPENDENT SEMI-HIGH PERVEANCE, MEDIUM-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE AS A COMBINED VERTICAL DEFLECTION SWEEP GENERATOR AND DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING PICTURE TUBES WITH WIDE DEFLECTION ANGLES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
TRIODE UNIT #1			
GRID TO PLATE: (G TO P)	2.4	2.4	μμf
INPUT: G TO (H+K)	3	3	μμf
OUTPUT: P TO (H+K)	2	0.8	μμf
TRIODE UNIT #2			
GRID TO PLATE: (G TO P)	2.4	2.4	μμf
INPUT: G TO (H+K)	3	3	μμf
OUTPUT: P TO (H+K)	2.6	0.8	μμf
COUPLING: (1P TO 2P)	0.6	0.9	μμf

[A] WITH SHIELD #319 CONNECTED TO CATHODE OF UNIT UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

	CLASS A1 AMPLIFIER		VERTICAL DEFLECTION AMPLIFIER		
HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE	180		180		VOLTS
MAXIMUM DC PLATE VOLTAGE	300		500		VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	—		1 500[B]		VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	-50		-50		VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	—		-220[B]		VOLTS
MAXIMUM PLATE DISSIPATION (EACH UNIT)	3.5		5[B]		VOLTS
MAXIMUM DC CATHODE CURRENT (EACH UNIT)	20		20		MA.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	2.5		2.5		MEGOHMS
MAXIMUM GRID CIRCUIT RESISTANCE (FIXED BIAS)	1		1		MEGOHM

[B] THESE RATINGS ARE ON THE ABSOLUTE MAXIMUM SYSTEM! ABSOLUTE MAXIMUM RATINGS ARE THE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED FROM THE VIEWPOINT OF LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS, THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED UNDER ANY USUAL CONDITION OF LINE VOLTAGE VARIATION, MANUFACTURING VARIATIONS (INCLUDING COMPONENTS) IN THE EQUIPMENT ITSELF, OR ADJUSTMENTS OF CONTROLS.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	300	600	300	600	MA.
PLATE VOLTAGE	85		250		VOLTS
GRID VOLTAGE	0		10.5		VOLTS
PLATE CURRENT (EACH UNIT)	20		11.5		VOLTS
TRANSCONDUCTANCE (EACH UNIT)	6200		3100		VOLTS
AMPLIFICATION FACTOR	21		17		
GRID VOLTAGE (APPROX.) FOR I_b = μA. AT E_b = 500	-45				VOLTS

VERTICAL DEFLECTION CIRCUIT

HEATER VOLTAGE	12.6	6.3	VOLTS
HEATER CURRENT	300	600	MA.
DC PLATE VOLTAGE	350		VOLTS
CATHODE BIAS RESISTOR (VARIABLE)	560		OHMS
GRID INPUT VOLTAGE:			
PEAK TO PEAK SAWTOOTH COMPONENT (APPROX.)	25		VOLTS
NEGATIVE PEAKING COMPONENT (APPROX.)	32		VOLTS
DC PLATE CURRENT	16		MA.
PLATE OUTPUT VOLTAGE:			
PEAK POSITIVE COMPONENT	670		VOLTS
PEAK TO PEAK SAWTOOTH COMPONENT	230		VOLTS
SWEEP HEIGHT (16RP4 OR 16TP4 TUBE WITH 14KV ON ANODE)[C]	10½		INCHES

[C] SEE CIRCUIT ON FOLLOWING PAGE.

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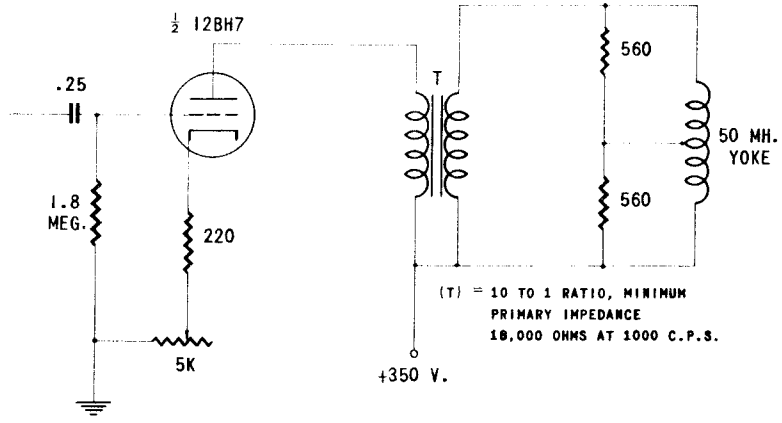

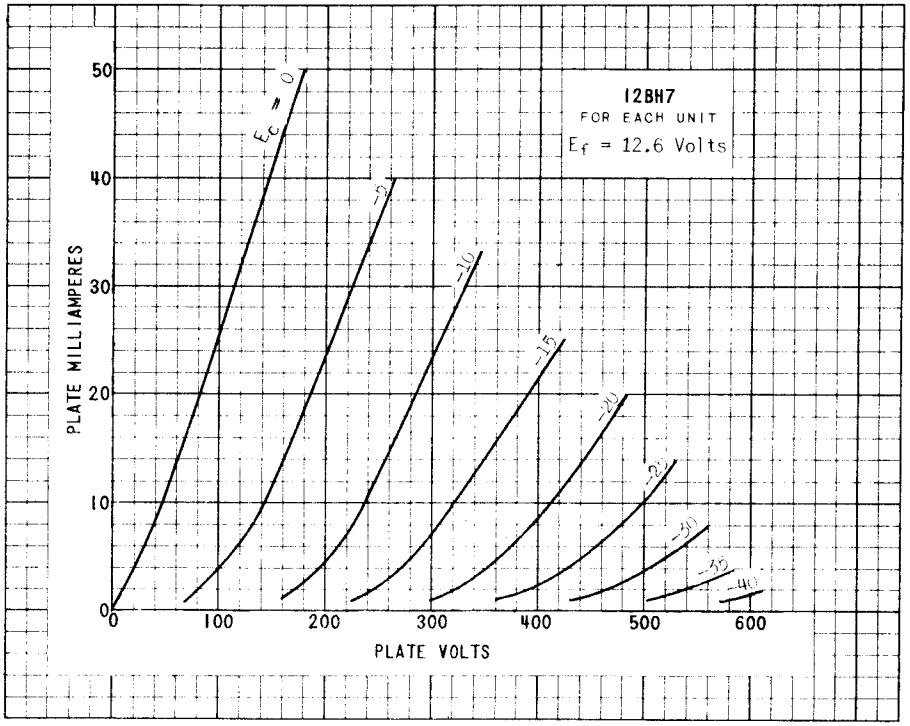

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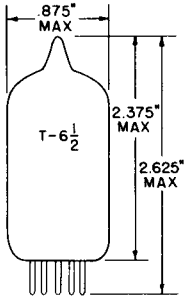
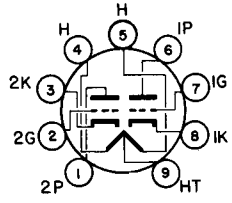
DOUBLE TRIODE



GLASS BULB
MINIATURE BUTTON
9PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

FOR USE AS A VERTICAL DEFLECTION SWEEP GENERATOR AND DEFLECTION AMPLIFIER IN T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 12BH7A COMBINES TWO INDEPENDENT SEMI-HIGH PERVEANCE, MEDIUM-MU TRIODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE AS A VERTICAL DEFLECTION SWEEP GENERATOR AND DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS WHICH USE PICTURE TUBES WITH WIDE DEFLECTION ANGLES. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
TRIODE UNIT 1			
GRID TO PLATE: G TO P	2.4	→ 2.6	pf
INPUT: G TO (H+K)	3.3	→ 3.2	pf
OUTPUT: P TO (H+K)	2.0	→ 0.5	pf
TRIODE UNIT 2			
GRID TO PLATE: G TO P	2.4	→ 2.6	pf
INPUT: G TO (H+K)	3.3	→ 3.2	pf
OUTPUT: P TO (H+K)	2.0	→ 0.4	pf
COUPLING: #1 PLATE TO #2 PLATE	----	→ 0.8	pf
	0.6		

[A] WITH SHIELD #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESING MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS			
WITH HEATER CONNECTION	PARALLEL	SERIES	
USING BASE PINS	9 & 4 + 5	4 & 5	
HEATER SECTIONS			
VOLTAGE	6.3	12.6	VOLTS
CURRENT	600	300	MA.
HEATER WARM-UP TIME	11	11	SECONDS
HEATER SUPPLY LIMTS:			
VOLTAGE OPERATION	6.3+0.6	12.6+1.3	VOLTS
CURRENT OPERATION	600+40	300+20	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
DC AND PEAK	200		VOLTS

→ MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

VALUES ARE FOR EACH UNIT	CLASS A1 AMPLIFIER	VER. DEF.[B] AMPLIFIER (VALUES ARE FOR EACH UNIT)	
DC PLATE VOLTAGE	300	450	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	----	1500 (ABS. MAX.)	VOLTS
PEAK NEGATIVE PULSE GRID VOLTAGE	----	250	VOLTS
NEGATIVE DC GRID VOLTAGE	-50		VOLTS
CATHODE CURRENT	20		MA.
AVERAGE CATHODE CURRENT		20	MA.
PEAK CATHODE CURRENT		70	MA.
PLATE DISSIPATION:			
EACH PLATE	3.5 (EA. UNIT)	3.5[C]	WATTS
BOTH PLATES	70 (EA. UNIT)	7.0[C]	WATTS
GRID CIRCUIT RESISTANCE:			
CATHODE BIAS	1.0	2.2	MEGOHMS
FIXED BIAS	0.25		MEGOHM

VALUES ARE FOR EACH UNIT

	VER. DEF.[B] OSCILLATOR *	HORIZONTAL[B] DEF. OSC. *	
DC PLATE VOLTAGE	450	450	VOLTS
PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
AVERAGE CATHODE CURRENT	20	20	MA.
PEAK CATHODE CURRENT	70	300	MA.
PLATE DISSIPATION			
EACH PLATE	3.5	3.5	WATTS
BOTH PLATES	7.0	7.0	WATTS
GRID CIRCUIT RESISTANCE:			
FIXED BIAS GRID-RESISTOR, OR CATHODE BIAS	2.2	2.2	MEGOHMS

*INDICATES AN ADDITION.
→ NDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH UNIT*

PLATE RESISTANCE (APPROX.)	5300	OHMS
PLATE CURRENT FOR GRID VOLTAGE OF -14 VOLTS	4	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 50 μA AT 250 VOLTS	-23	VOLTS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-10.5	VOLTS
AMPLIFICATION FACTOR	17	
TRANSCONDUCTANCE (EACH UNIT)	3100	μMHOS
PLATE CURRENT (EACH UNIT)	11.5	MA.
GRID VOLTAGE (APPROX.) FOR I_b = 50 μA AT E_b = 150 (EACH UNIT)	-17	VOLTS

[B] FOR OPERATION IN A 525-LINE 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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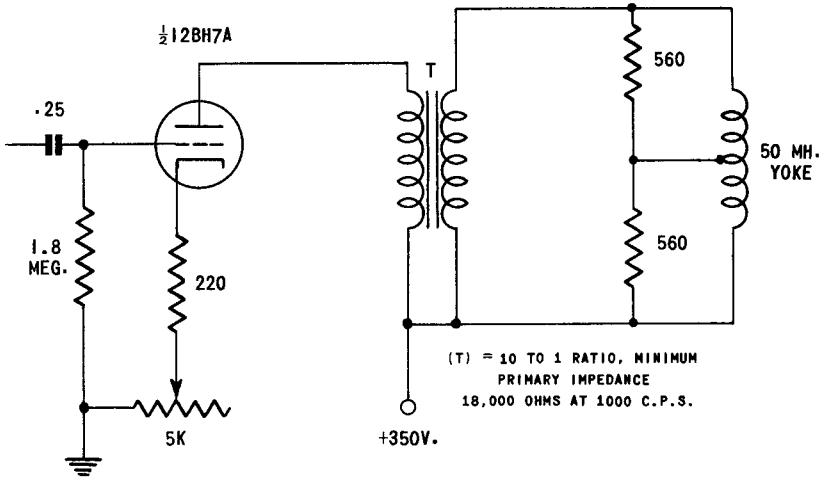
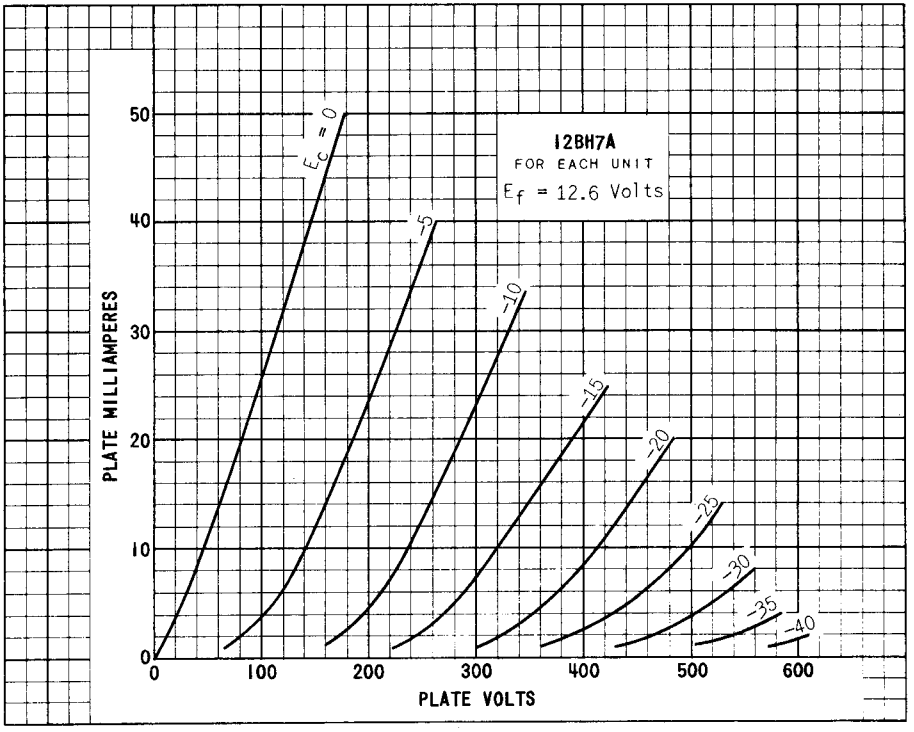

½12BH7A
.25
1.8 MEG.
220
5K
T
560
560
50 MH. YOKE
(T) = 10 TO 1 RATIO, MINIMUM PRIMARY IMPEDANCE 18,000 OHMS AT 1000 C.P.S.
+350V.


12BH7A
FOR EACH UNIT
Ef = 12.6 Volts
Ec = 0
-5
-10
-15
-20
-25
-30
-35
-40
PLATE MILLIAMPERES
0
10
20
30
40
50
0
100
200
300
400
500
600
PLATE VOLTS

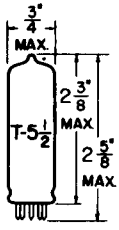
TENTATIVE DATA

(6BK6,26BK6)12BK6

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

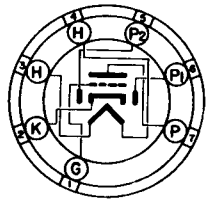
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 150 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BT

THE 12BK6 IS A HIGH-MU DOUBLE DIODE TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
DIODE #1 OR DIODE #2 TO CATHODE: (1P OR 2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.013	0.01	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
AMPLIFICATION FACTOR	100	100	

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PLATE 2338
FEB. 1 1950

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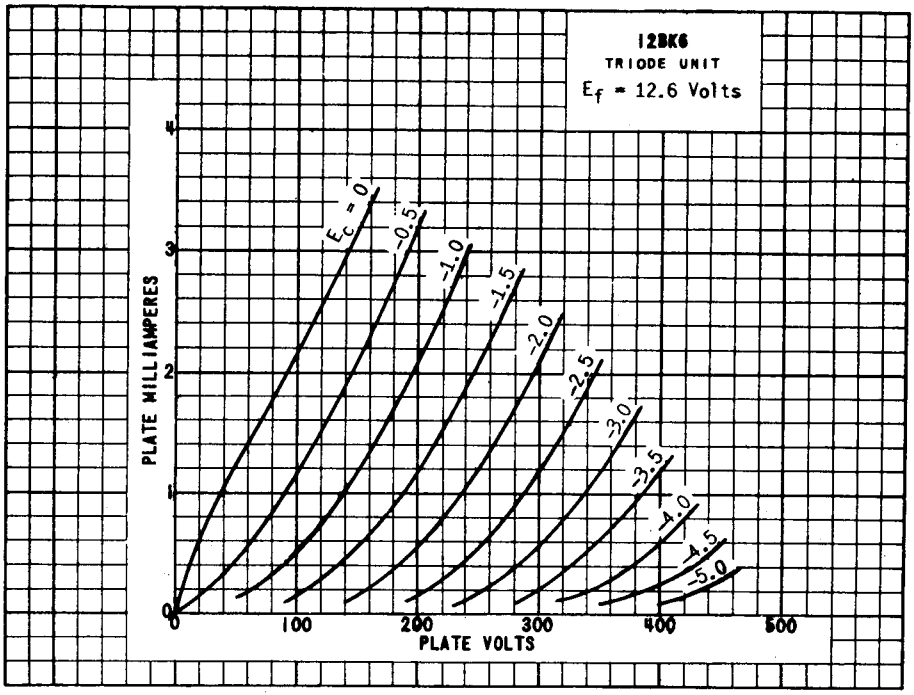
12BK6 (6BK6,26BK6)



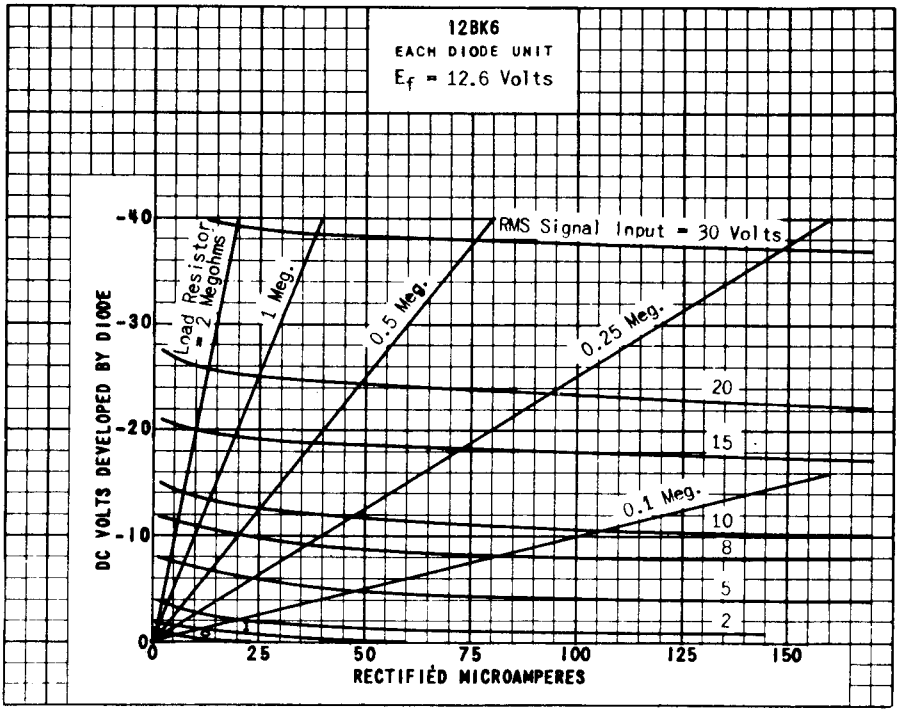


PLATE 2339
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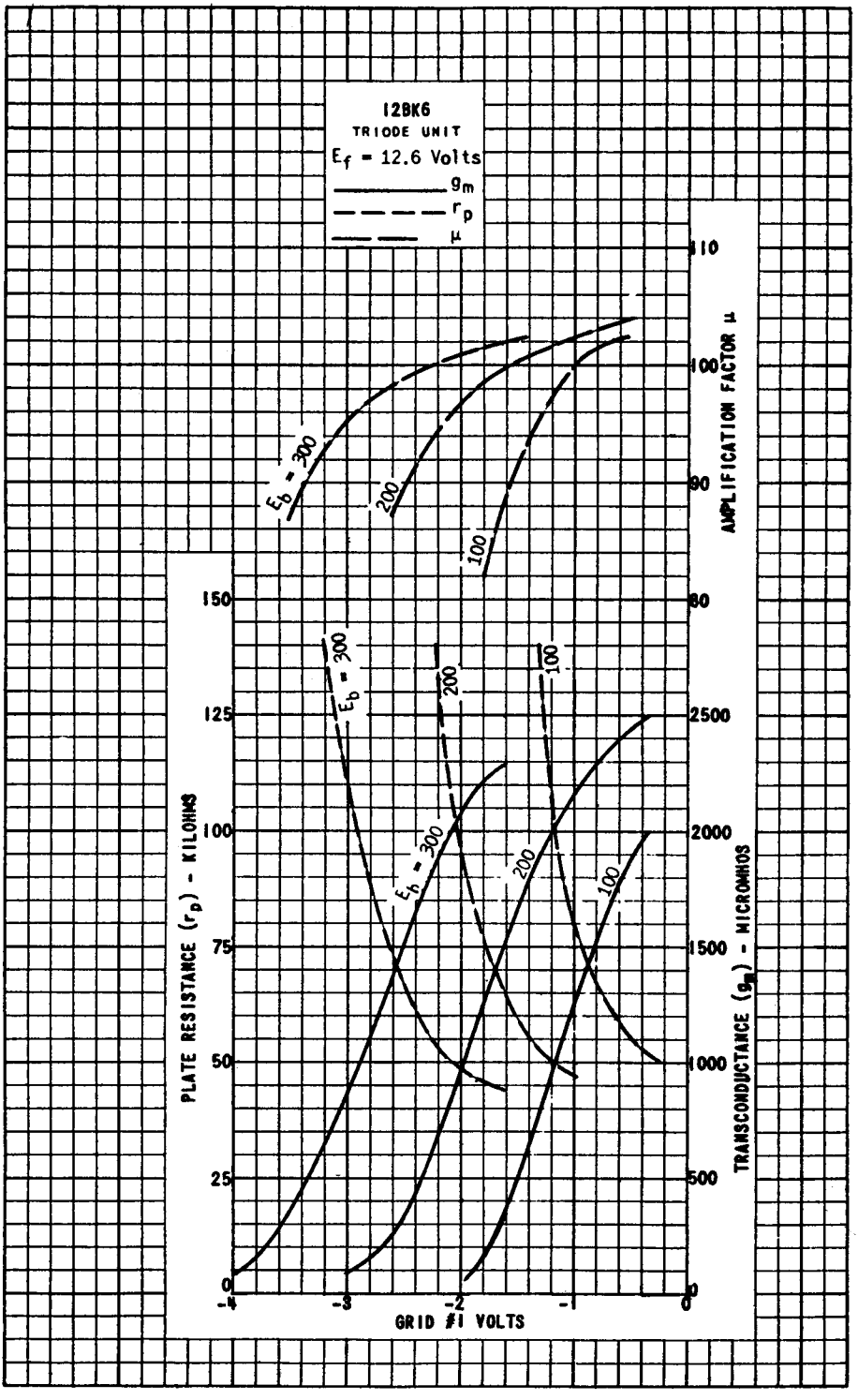

PLATE
2340
FEB. 1
1950

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TUNG-SOL

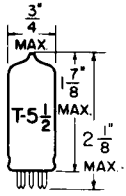
PENTODE

MINIATURE TYPE

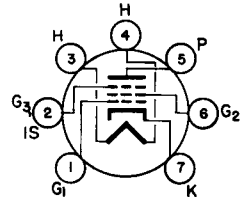
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
→JEDEC 7BK

→ THE 12BL6 IS A REMOTE CUT-OFF PENTODE WITH A UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN RF OR IF AMPLIFIER WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD⊕	
GRID TO PLATE: (MAX.)	0.006	pf
INPUT:	5.5	pf
OUTPUT:	4.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM HEATER–CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

⊕WITH SHIELD #316.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	12.6	VOLTS
GRID #3 VOLTAGE*	0	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE[A]	-0.65	VOLTS
PLATE CURRENT	1 350	μAMPS
GRID #2 CURRENT	500	μAMPS
PLATE RESISTANCE (APPROX.)	.5	MEGOHM
TRANSCONDUCTANCE[B]	1 350	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR G_m[B] = 10 μMHOS	-6.0	VOLTS
GRID #1 & #3 VOLTAGE (APPROX.) FOR G_m[B] = 10 μMHOS	-5.0	VOLTS

[A] AVERAGE CONTACT POTENTIAL DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.

[B] FROM GRID #1 TO PLATE.

* CONNECTED TO CATHODE AT SOCKET.

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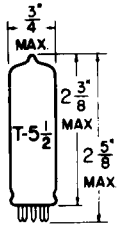
PENTODE

MINIATURE TYPE

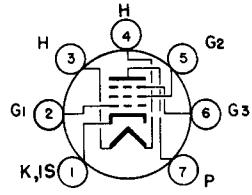


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

GATED-BEAM DISCRIMINATOR
FOR FM AND INTERCARRIER
TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7DF

THE 12BN6 IS A GATED BEAM DISCRIMINATOR TUBE USING THE MINIATURE CONSTRUCTION. IT IS DESIGNED TO PERFORM THE COMBINED OPERATION OF DETECTOR AND AUDIO-VOLTAGE AMPLIFIER IN FM RECEIVERS. A UNIQUE DESIGN, MAKING USE OF THE ELECTROSTATIC BEAM DEFLECTION PRINCIPLE, RESULTS IN VERY EFFICIENT LIMITING AS WELL AS PROVIDING FOR FM DETECTOR AND AMPLIFICATION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO ALL	4.2	pf
GRID #3 TO ALL	3.3	pf
GRID #1 TO GRID #3 (MAX.)	0.004	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		150±15	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME (APPROX.)*		11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS ←

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID VOLTAGE	110	VOLTS
PEAK POSITIVE LIMITER-GRID VOLTAGE	60	VOLTS
DC CATHODE CURRENT	13	MA.

TYPICAL OPERATING CHARACTERISTICS ←

LIMITER-DISCRIMINATOR SERVICE

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	MEGACYCLES
FREQUENCY DEVIATION	±75	±75	±25	KCYCLES
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	63	122	121	VOLTS
ACCELERATOR VOLTAGE	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) [A]	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85000	330000	330000	OHMS
PLATE LINEARITY RESISTOR	470	1500	1000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μf
COUPLING CAPACITOR	0.25	0.01	0.25	μf
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION, RMS [B]	1.25	1.25	1.25	VOLTS
DC PLATE CURRENT	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT [A]	1.25	2.0	2.0	VOLTS
AM REJECTION AT Esig=2.0V., RMS	31	20	25	DECIBELS
AM REJECTION AT Esig=3.0V., RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

[A] THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

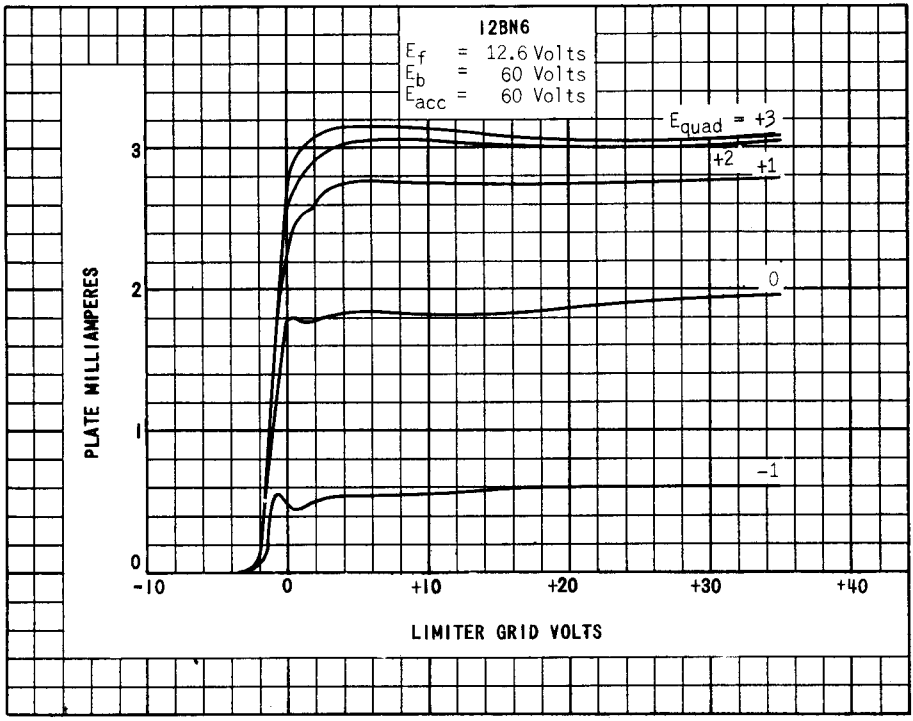
[B] AT SIGNAL LEVELS ABOVE SPECIFIED VALUE, LIMITING IS WITHIN ±2 DECIBELS.

ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

STANDARD DE-EMPHASEIS REQUIREMENTS FOR FM ARE INCLUDED.

THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS (RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10 μμf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

→ INDICATES A CHANGE.



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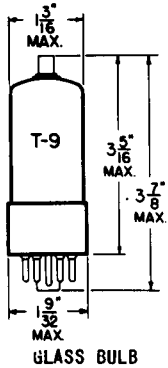
BEAM PENTODE

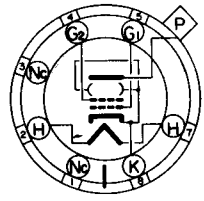


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 12BQ6GT IS A BEAM PENTODE DESIGNED FOR USE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT IS SPECIFICALLY INTENDED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING MAGNETIC DEFLECTION. THE PLATE IS BROUGHT OUT TO A TOP CAP FOR ISOLATION OF THE HIGH VOLTAGE AND CONVENIENCE IN A CIRCUIT LAYOUT. ITS ELECTRICAL CHARACTERISTICS ARE SUCH AS TO PROVIDE GOOD PERFORMANCE WHERE THE SUPPLY VOLTAGES ARE LIMITED. THERMAL CHARACTERISTICS OF THE HEATER HAVE BEEN CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, IT IS IDENTICAL TO THE 6BQ6GT.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.6	μμf
INPUT: G_1 TO (H+K+G_2+BP)	15	μμf
OUTPUT: P TO (H+K+G_2+BP)	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220°	CENTIGRADE
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.6	AMP.
PENTODE CONNECTION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	µMHOS
PLATE RESISTANCE	20 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

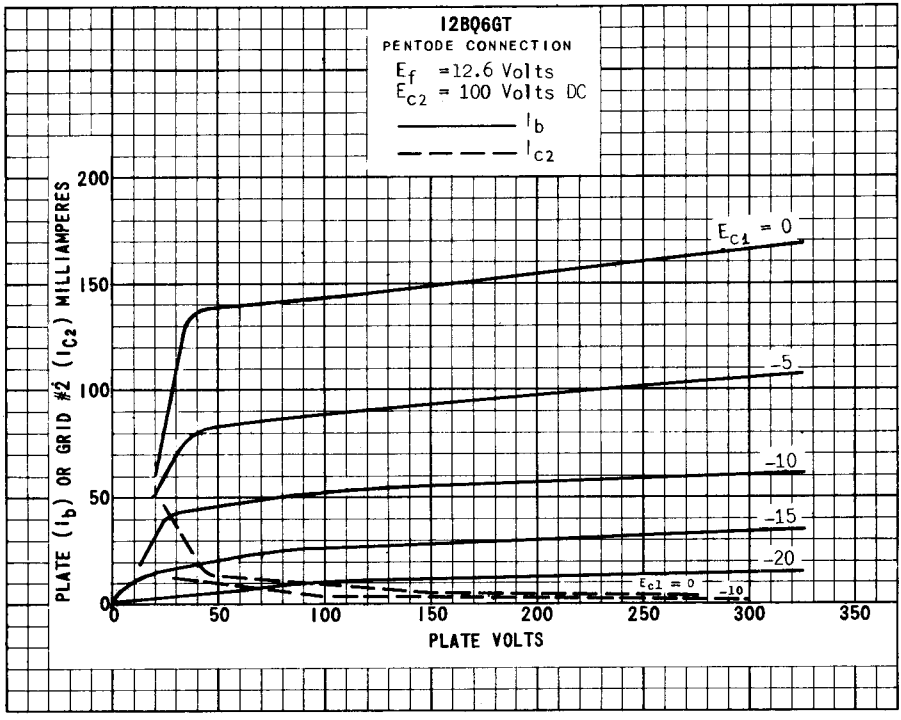
[C] WITH E_b = 250 VOLTS, E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

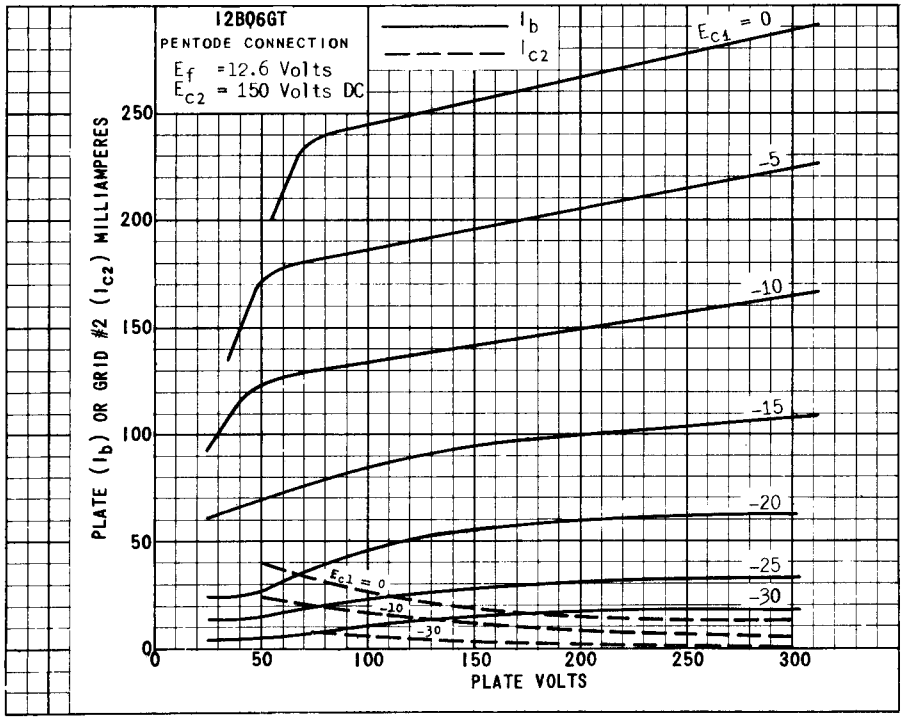
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS.

[E] FOR I_b = 1 MA. WITH E_b = 250 VOLTS AND E_{C2} = 150 VOLTS

[F] WITH E_b = E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

INDICATES A CHANGE OR ADDITION.





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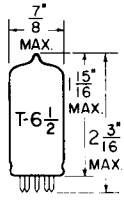
DOUBLE DIODE TRIODE

MINIATURE TYPE



GLASS BULB

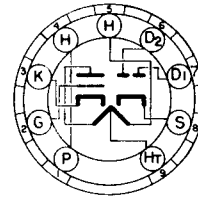
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.225 AMP.	0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

THE 12BR7 CONTAINS TWO HIGH PERVEANCE DIODES AND A MEDIUM-MU TRIODE IN ONE ENVELOPE USING THE 9 PIN MINIATURE CONSTRUCTION. THE DIODES HAVE A COMMON CATHODE WHICH IS INDEPENDENT OF THE TRIODE CATHODE.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #315

TRIODE INPUT: G TO (H+K)	2.8	μμf
TRIODE OUTPUT: P TO (H+K)	1.0	μμf
GRID TO PLATE: G TO P	1.9	μμf
DIODE INPUT: D TO (K+H) EACH DIODE	2.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	12.6	6.3	
HEATER VOLTAGE			VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
DC AND PEAK		200	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE		-50	VOLTS
MAXIMUM PLATE VOLTAGE		300	VOLTS
MAXIMUM PLATE DISSIPATION		2.5	WATTS
MAXIMUM PEAK INVERSE DIODE VOLTAGE		300	VOLTS
MAXIMUM PEAK DIODE CURRENT		60	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE SECTION

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	0.225	0.45	0.225	0.45	AMP.
PLATE VOLTAGE	100		250		VOLTS
CATHODE BIAS RESISTOR	270		200		OHMS
PLATE CURRENT	3.7		10		MA.
PLATE RESISTANCE	15 000		10 900		OHMS
TRANSCONDUCTANCE	4 000		5 500		μMHOS
AMPLIFICATION FACTOR	60		60		
GRID VOLTAGE (APPROX.) FOR I_b = 10 μA.	-5		-12		VOLTS

DIODE SECTION

AVERAGE DIODE CURRENT WITH 5 Vdc APPLIED (EACH SECTION)	17	MA.

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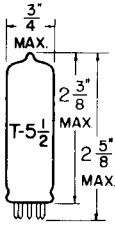
DOUBLE-DIODE TRIODE

MINIATURE TYPE

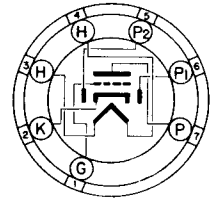


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 12BT6 IS A COMBINED HIGH-MU TRIODE VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED TO PROVIDE ADEQUATE OUTPUT VOLTAGE TO DRIVE MOST BEAM POWER TUBES TO FULL POWER OUTPUT. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNAL LEVELS AND THE LOW DIODE TO TRIODE GRID CAPACITANCE REDUCES TROUBLE FROM AUDIO COUPLING BETWEEN THE TWO SECTIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
DIODE #1 TO CATHODE: (1P TO K)	1	1	μμf
DIODE #2 TO CATHODE: (2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.01	0.013	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	0.8	1	MA.
PLATE RESISTANCE	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	

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PLATE 2315
JAN. 1 1950

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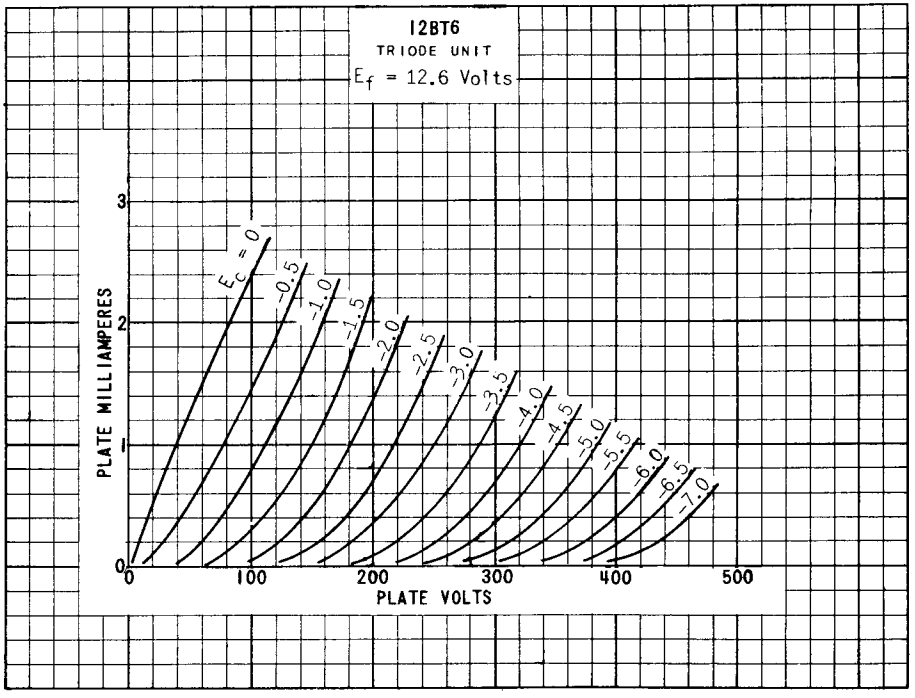
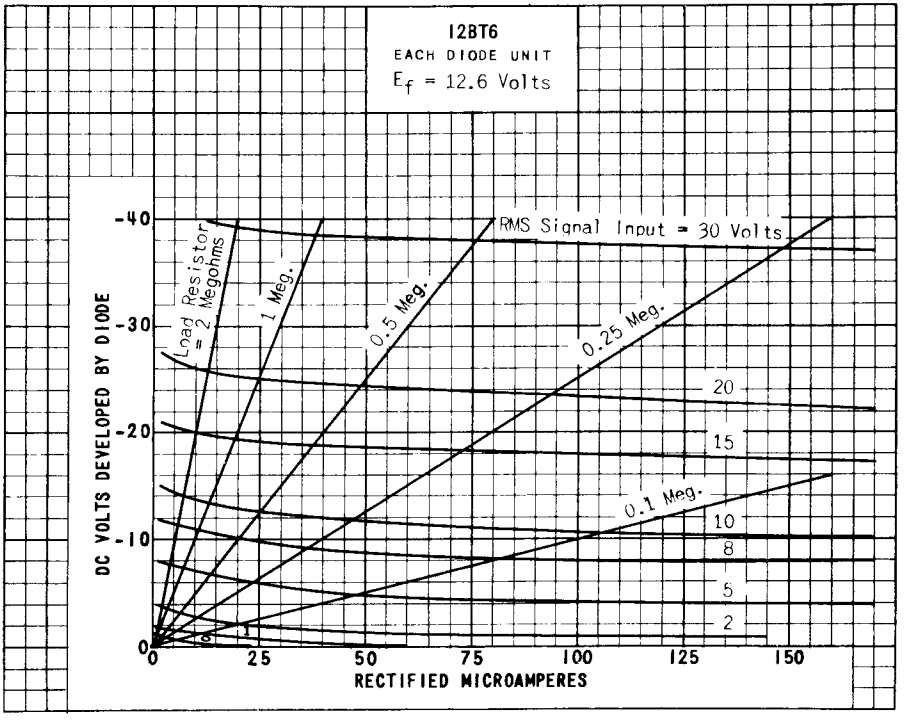
12BT6 (6BT6)





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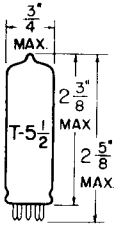
TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE

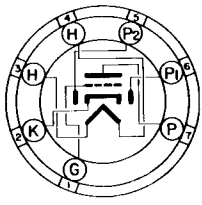


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BT

THE 12BU6 IS A COMBINED LOW-MU TRIODE VOLTAGE AMPLIFIER AND DOUBLE DIODE DETECTOR USING THE 7 PIN MINIATURE CONSTRUCTION. THE LOW AMPLIFICATION FACTOR OF THE TRIODE PERMITS LARGE VALUES OF OUTPUT SIGNAL WITH LOW DISTORTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
DIODE #1 OR DIODE #2 TO CATHODE	1	1	μμf
DIODE #1 TO GRID	0.01	0.013	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
AVERAGE DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-3	-9	VOLTS
SELF BIAS RESISTOR	770	950	OHMS
PLATE CURRENT	3.9	9.5	MA.
PLATE RESISTANCE	11 000	8 500	OHMS
TRANSCONDUCTANCE	1 500	1 900	μMHOS
AMPLIFICATION FACTOR	16.5	16	
LOAD RESISTANCE	---	10 000	OHMS
TOTAL HARMONIC DISTORTION	---	6.5	PERCENT
POWER OUTPUT	---	300	MW.

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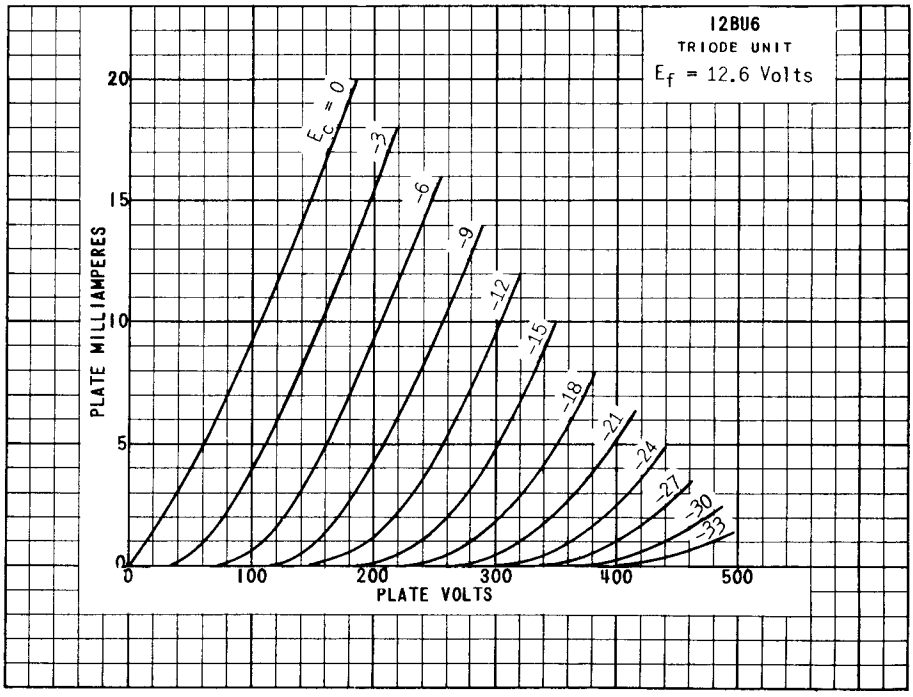
12BU6 (6BU6)



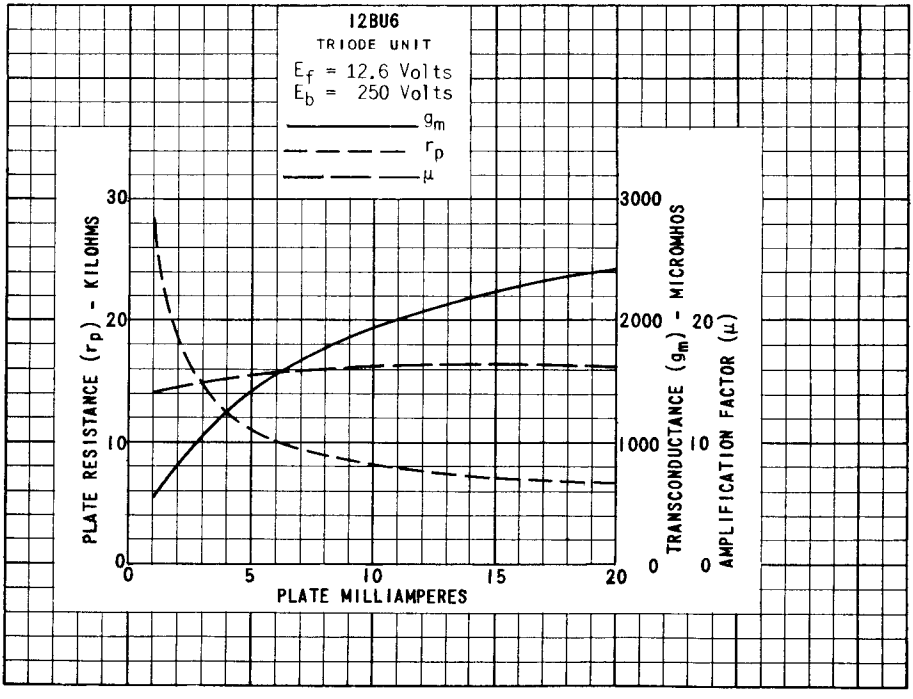


PLATE
2318
JAN. 1
1950

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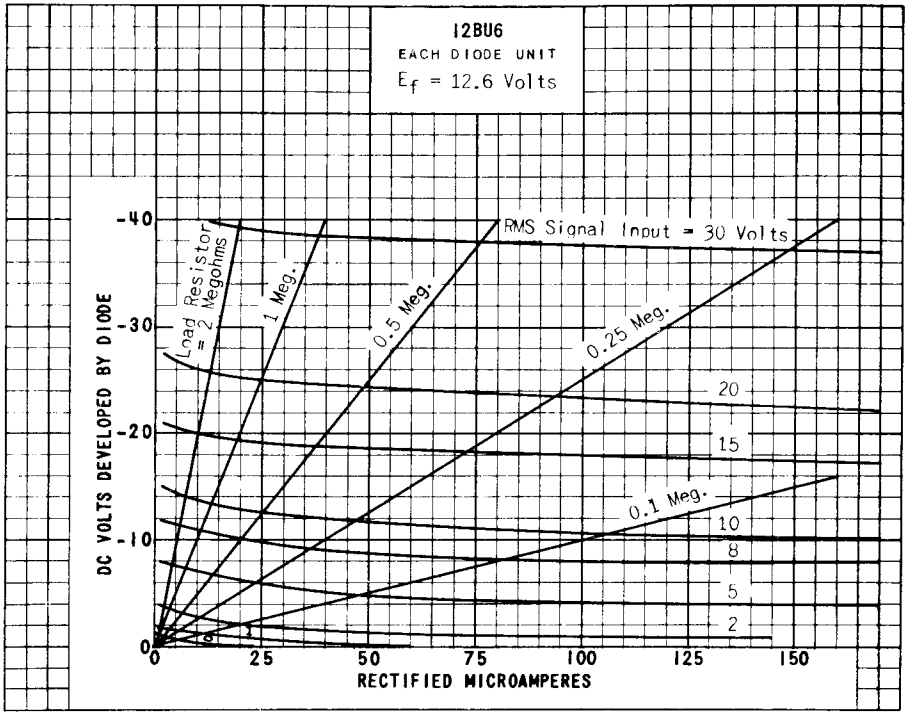

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TUNG-SOL

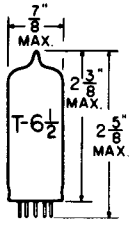
DOUBLE DIODE

MINIATURE TYPE

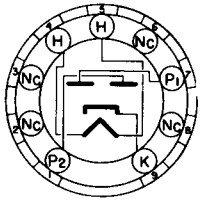
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 450 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9DJ

THE 12BW4 IS A MINIATURE CATHODE TYPE FULL WAVE RECTIFIER FEATURING RELATIVELY HIGH OUTPUT CURRENT CAPABILITIES. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 6BW4.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

RECTIFIER SERVICE

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1275	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS) (SEE RATING CHART #1)	450	VOLTS
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #2)	350	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE RATING CHART #3)	2.0	AMP.
MAXIMUM HEATER CATHODE VOLTAGE: HEATER NEGATIVE, DC	450	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER

	CAPACITOR INPUT FILTER	CHOKE INPUT FILTER	
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	450	450	MA.
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)[A]	325	450	VOLTS
FILTER INPUT CAPACITOR	40	---	μf
FILTER INPUT CHOKE	---	10	HENRYS
EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE	82	---	OHMS
DC OUTPUT CURRENT	100	100	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	330	360	VOLTS
TUBE VOLTAGE DROP TUBE CONDUCTING: 100 MA. EACH PLATE	40	40	VOLTS

[A] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

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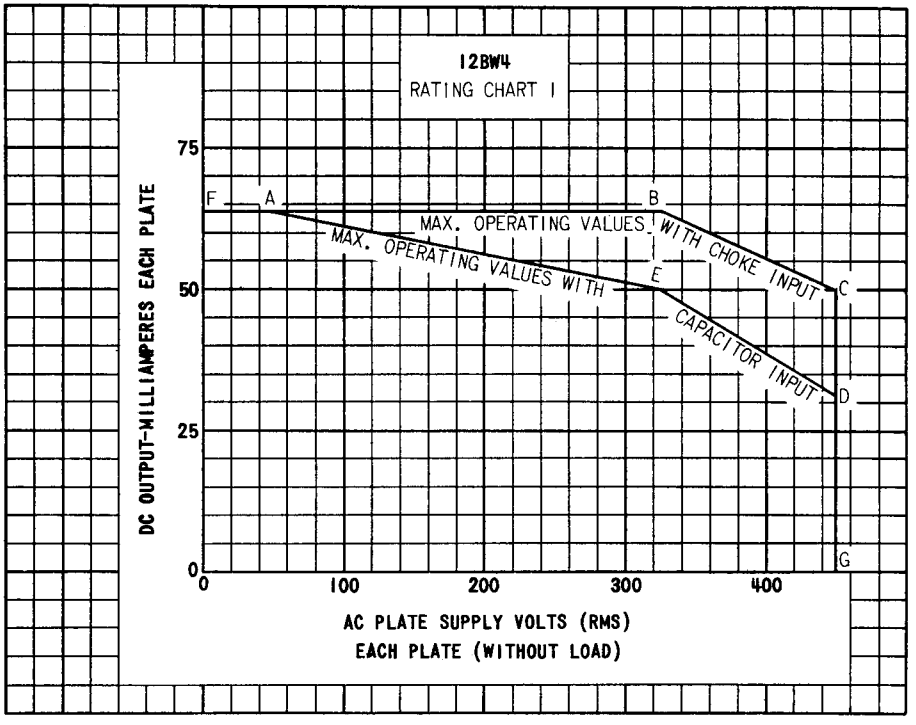
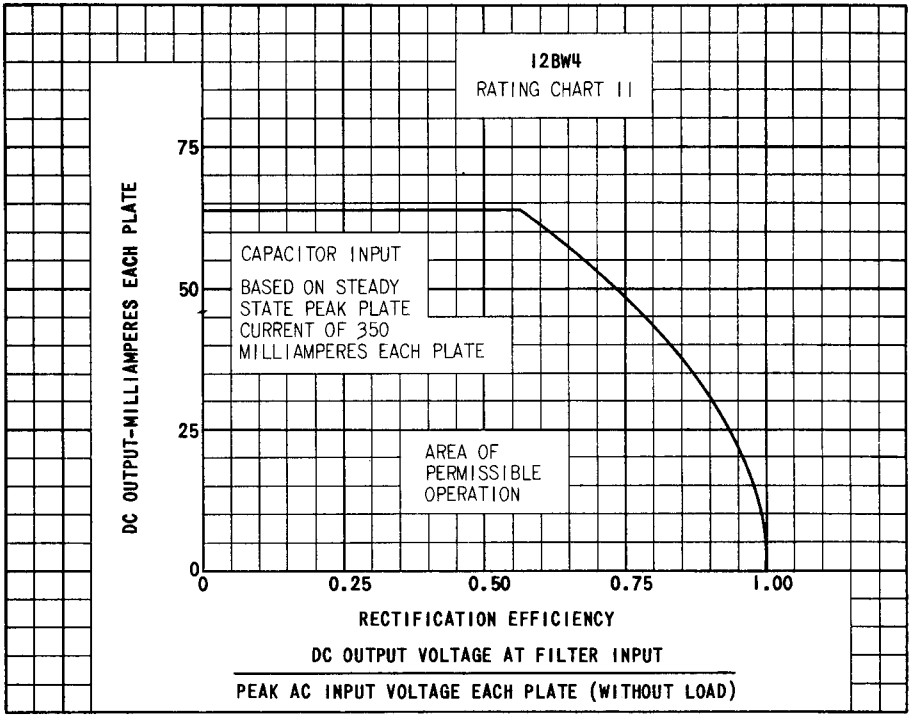
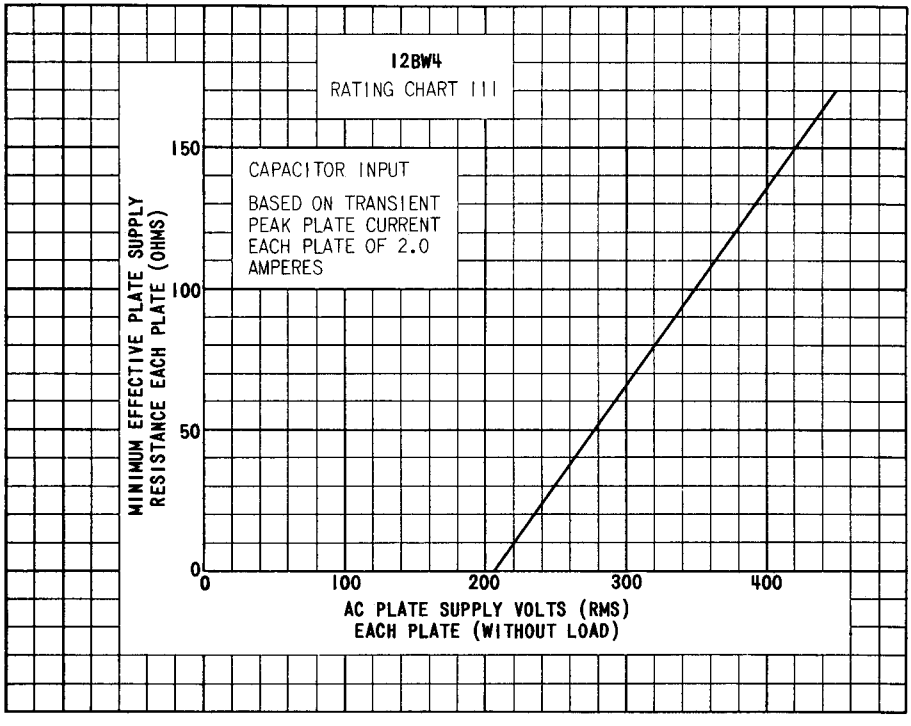
12BW4 (6BW4)


12BW4
RATING CHART I
DC OUTPUT-MILLIAMPERES EACH PLATE
75
50
25
0
F
A
B
C
D
E
G
MAX. OPERATING VALUES WITH CHOKE INPUT
MAX. OPERATING VALUES WITH
CAPACITOR INPUT
0
100
200
300
400
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)

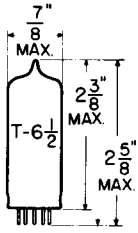

12BW4
RATING CHART II
DC OUTPUT-MILLIAMPERES EACH PLATE
75
50
25
0
CAPACITOR INPUT
BASED ON STEADY
STATE PEAK PLATE
CURRENT OF 350
MILLIAMPERES EACH PLATE
AREA OF
PERMISSIBLE
OPERATION
0
0.25
0.50
0.75
1.00
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)


12BW4
RATING CHART III
CAPACITOR INPUT
BASED ON TRANSIENT PEAK PLATE CURRENT EACH PLATE OF 2.0 AMPERES
MINIMUM EFFECTIVE PLATE SUPPLY RESISTANCE EACH PLATE (OHMS)
150
100
50
0
0
100
200
300
400
AC PLATE SUPPLY VOLTS (RMS) EACH PLATE (WITHOUT LOAD)

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

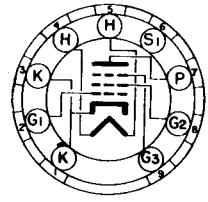
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9AQ

THE 12BX6 IS A PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN R.F., I.F. OR A VIDEO AMPLIFIER OR MIXER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS, THE 12BX6 IS IDENTICAL TO THE 3BX6.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT ANODE	7.5	μμf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	3.3	μμf
PLATE TO GRID #1 (MAX.)	0.007	μμf
PLATE TO CATHODE (MAX.)	0.012	μμf
GRID #2 TO ALL OTHER ELEMENTS	5.4	μμf
GRID #2 TO GRID #1	2.6	μμf
GRID #1 TO HEATER (MAX.)	0.15	μμf
CATHODE TO HEATER	5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE WITHOUT CURRENT	550	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 VOLTAGE WITH COLD CATHODE	550	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATTS
MAXIMUM GRID #2 DISSIPATION AT PLATE DISSIPATION < 1.8 WATTS	0.9	WATTS
MAXIMUM CATHODE CURRENT	15	MAMPS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM
MAXIMUM VOLTAGE BETWEEN CATHODE AND HEATER	150	VOLTS
MAXIMUM CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

R.F. AMPLIFIER

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	0.15	AMP.
PLATE VOLTAGE	170	200	250	VOLTS
GRID #3 VOLTAGE	0	0	0	VOLT
GRID #2 VOLTAGE	170	200	250	VOLTS
GRID #1 VOLTAGE	-2.0	-2.55	-3.5	VOLTS
PLATE CURRENT	10	10	10	MAMPS
GRID #2 CURRENT	2.5	2.6	2.8	MAMPS
TRANSCONDUCTANCE	7400	7100	6800	μMHOS
PLATE RESISTANCE	0.5	0.55	0.65	MEGOHM
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	50	50	50	
EQUIVALENT NOISE RESISTANCE	1000	1100	1200	OHMS
INPUT RESISTANCE AT FREQUENCY = 50 Mc (PIN 1 CONNECTED TO PIN 3)	10 000	12 000	15 000	OHMS

OBSERVATION

WHEN USING THE 12BX6 AS VIDEO AMPLIFIER THE AMPLIFICATION BETWEEN THE INPUT GRID OF THE 12BX6 AND THE INPUT OF THE CATHODE RAY TUBE SHOULD NOT EXCEED A VALUE OF 25, IN ORDER TO PREVENT MICROPHONIC EFFECT.

TUNG-SOL

PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

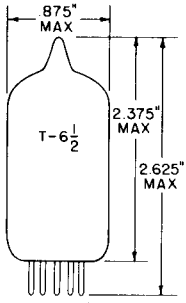
HEATER

SERIES	PARALLEL
12.6±1.3 VOLTS	6.3 VOLTS
300 MA	600±40 MA.

AC OR DC

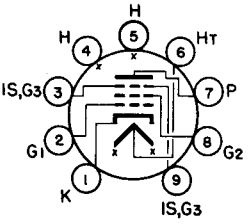
ANY MOUNTING POSITION

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #5 AND #4. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #6 AND PINS #4 AND #5 CONNECTED TOGETHER. CONTROL OF HEATER CHARACTERISTICS APPLIES ONLY TO 600 MA. HEATER CONNECTION.



GLASS BULB

MINIATURE BUTTON 9 PIN BASE E9-1 OUTLINE DRAWING JEDEC 6-3



BOTTOM VIEW

BASING DIAGRAM JEDEC 9BF

THE 12BY7A IS A HIGH TRANSCONDUCTANCE PENTODE USING THE 9-PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A VIDEO AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS LOW AND LARGE OUTPUT VOLTAGES ARE REQUIRED WITH LOW VALUE OF PLATE LOAD RESISTORS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: G_1 TO P	0.063	pf
INPUT: G_1 TO (H+K+G_2+G_3&IS)	10.2	pf
OUTPUT: P TO (H+K+G_2+G_3&IS)	3.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE	→ 330	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	→ 55	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 VOLTAGE	→ 190	VOLTS
MAXIMUM PLATE DISSIPATION	→ 6.5	WATTS
MAXIMUM GRID #2 DISSIPATION	→ 1.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:	0.25	MEGOHM
MAFIXED BIAS OPERATION	0.25	MEGOHM
CATHODE BIAS OPERATION	1	MEGOHM
HEATER WARM-UP TIME (APPROX.)[A]	11.0	SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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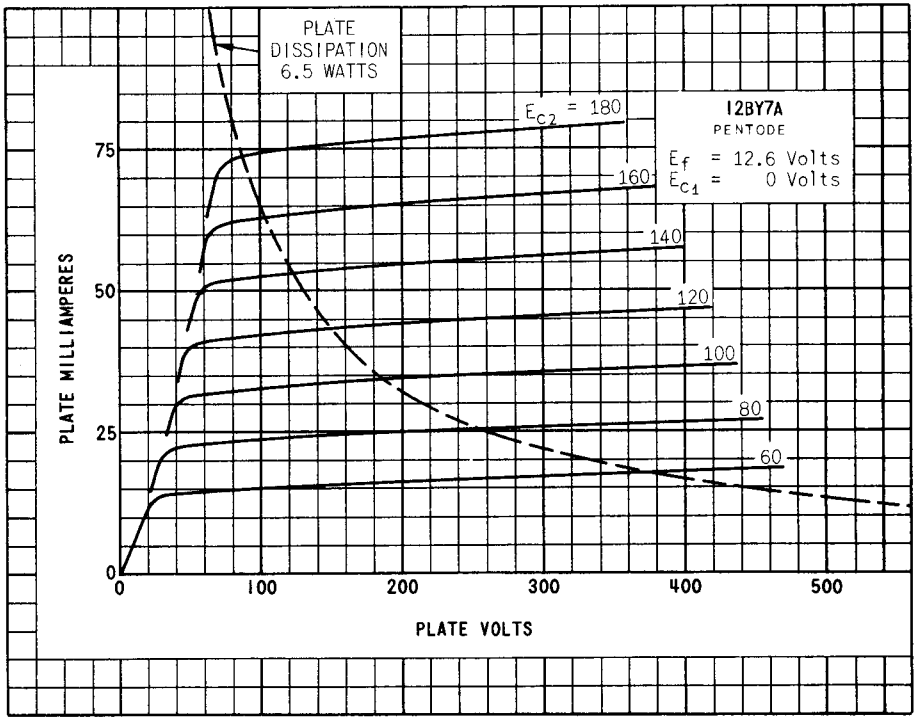
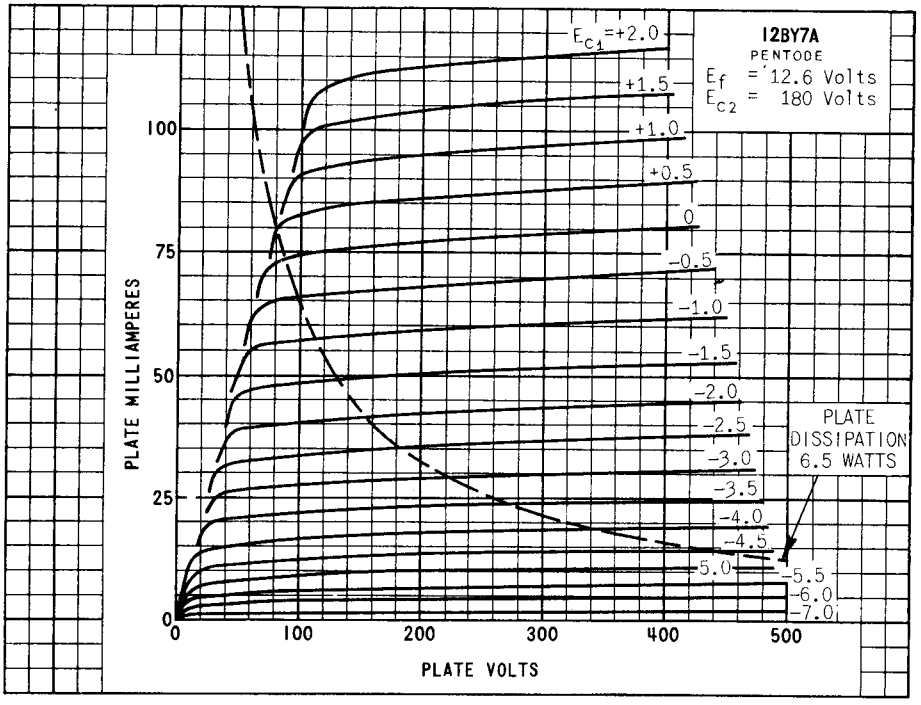
CONTINUED FROM PRECEDING PAGE

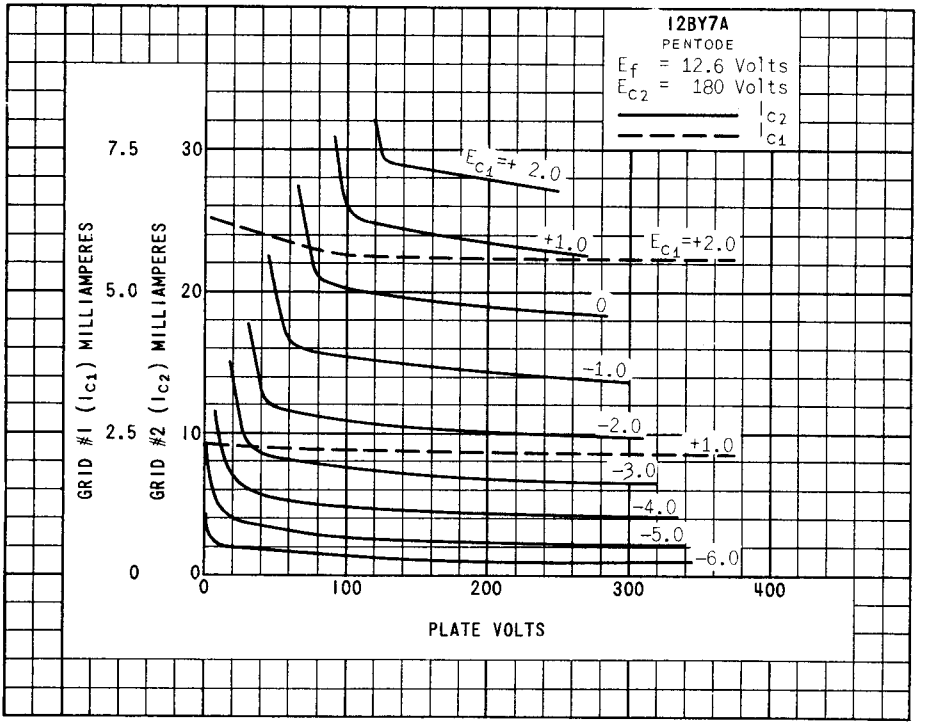
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	180	VOLTS
CATHODE RESISTOR	100	OHMS
PLATE CURRENT	26	MA.
GRID #2 CURRENT	5.7	MA.
PLATE RESISTANCE	93 000	OHMS
TRANSCONDUCTANCE	11 000	μMHOS
AMPLIFICATION FACTOR	1 035	
GRID #1 VOLTAGE FOR I_b = 20 μA.	11.6	VOLTS
TRIODE AMPLIFICATION FACTOR	28.5	







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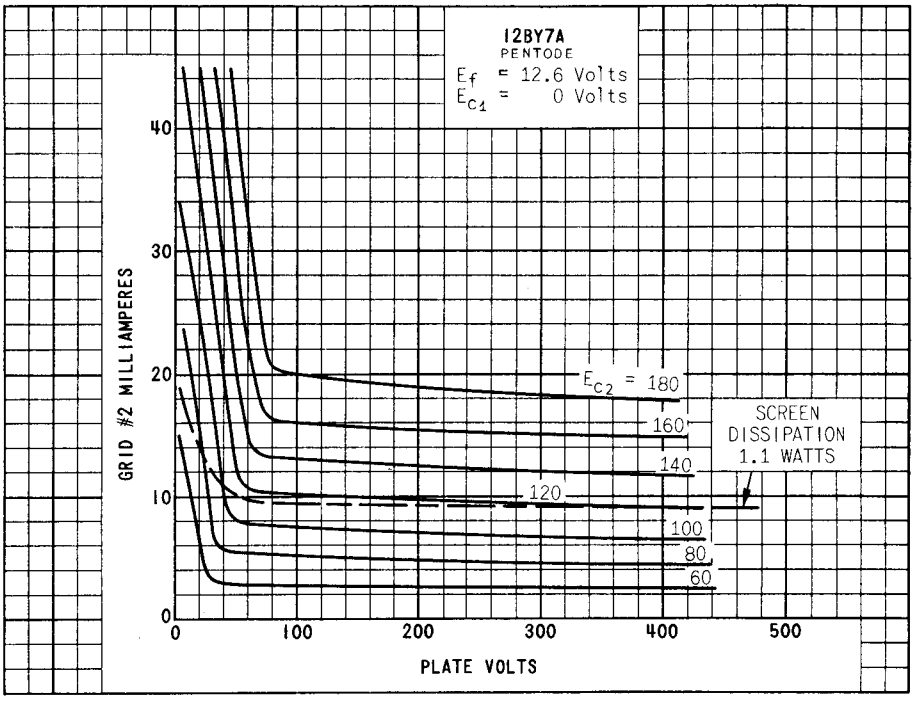
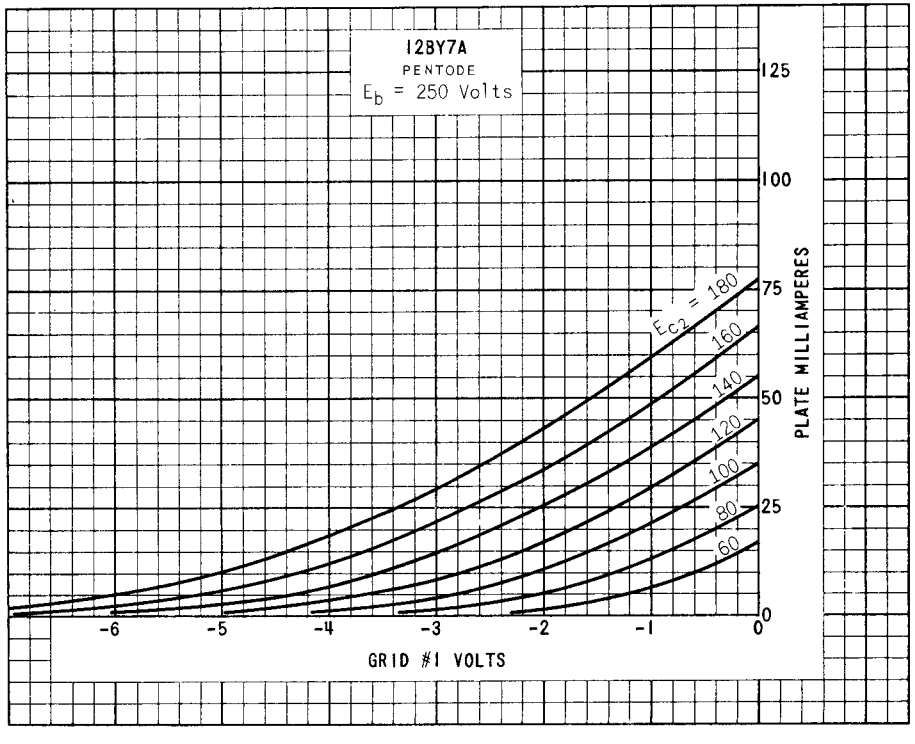
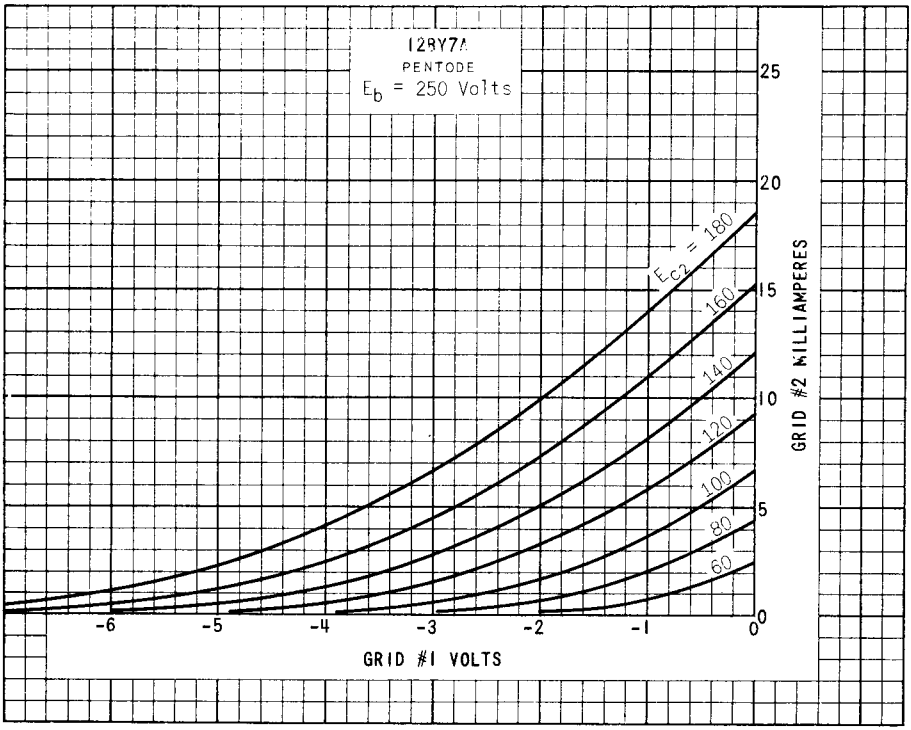
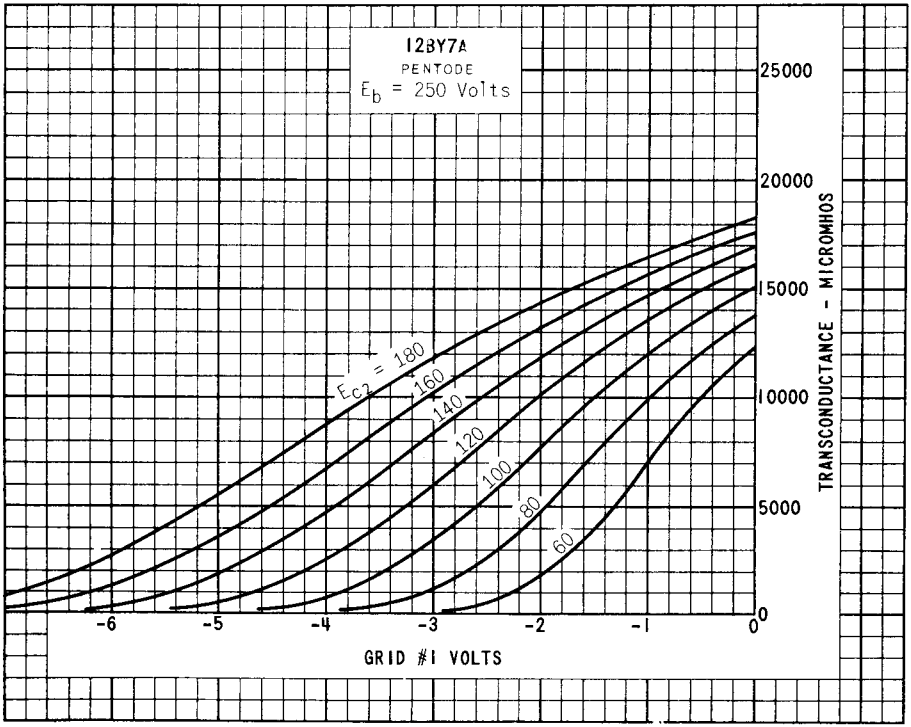
12BY7A


12BY7A
PENTODE
E_f = 12.6 Volts
E_{c_1} = 0 Volts
GRID #2 MILLIAMPERES
0
10
20
30
40
0
100
200
300
400
500
PLATE VOLTS
E_{c_2} = 180
160
140
120
100
80
60
SCREEN DISSIPATION 1.1 WATTS


12BY7A
PENTODE
E_b = 250 Volts
PLATE MILLIAMPERES
0
25
50
75
100
125
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
E_{c_2} = 180
160
140
120
100
80
60





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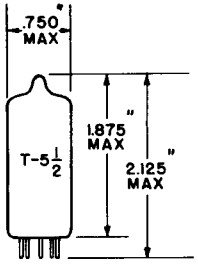
PENTODE

MINIATURE TYPE

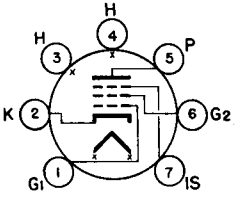


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 12BZ6 IS A HIGH TRANSCONDUCTANCE, SEMI-REMOTE CUT-OFF, PENTODE AMPLIFIER. IT IS DESIGNED FOR SERVICE AS AN AUTOMATIC GAIN CONTROLLED IF → AMPLIFIER IN 150 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6BZ6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE: G_1 TO P (MAX.)	.015	.025	pf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	7.0	7.0	pf
OUTPUT: P TO (H+K+G_2+G_3+IS)	3.0	2.0	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO CATHODE AT SOCKET.

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CURVE	
MAXIMUM PLATE DISSIPATION	2.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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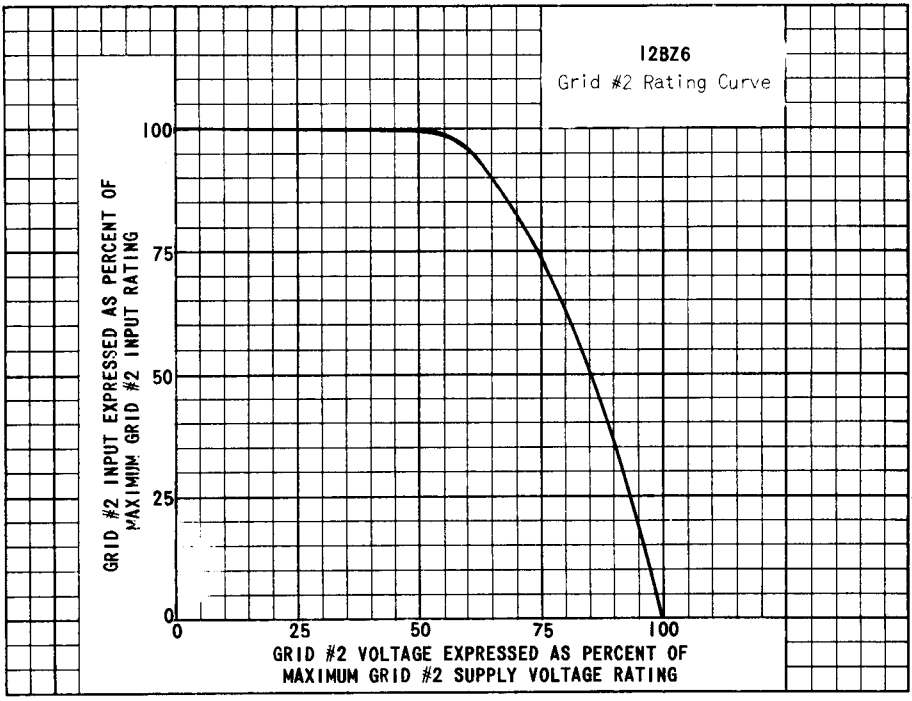
CONTINUED FROM PRECEDING PAGE

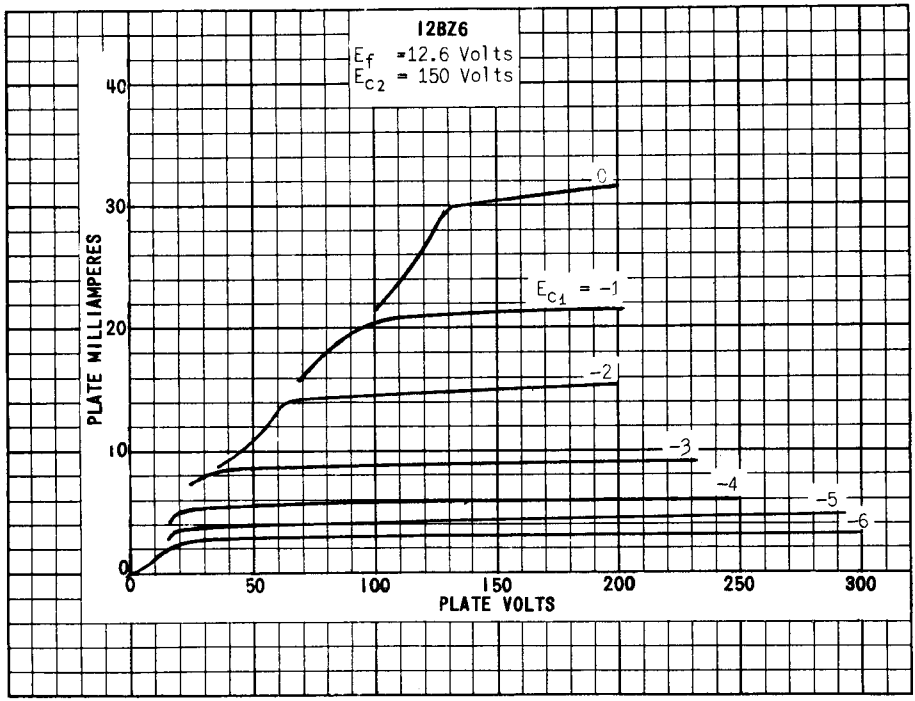
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

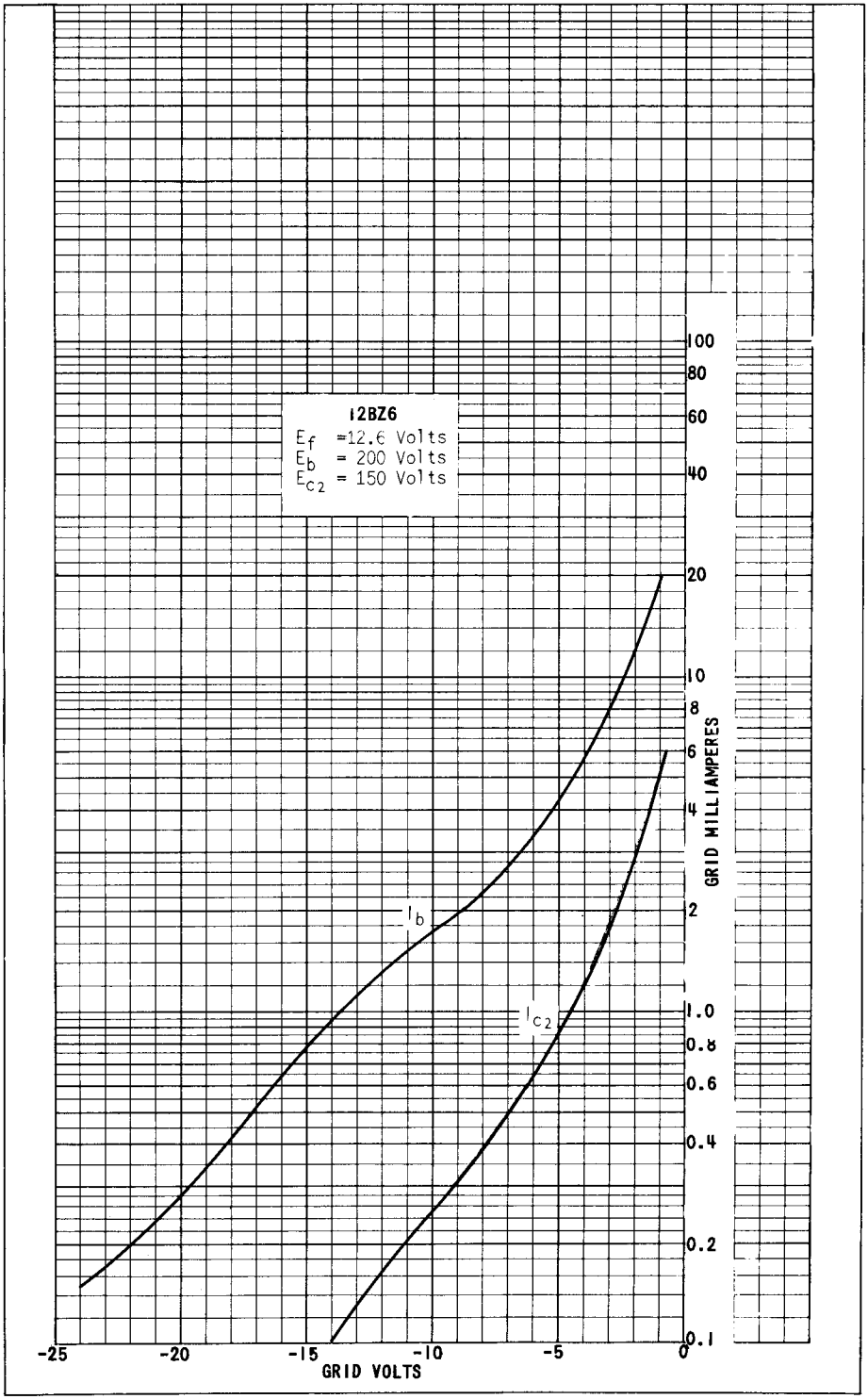
PLATE VOLTAGE		125	VOLTS
GRID #2 VOLTAGE		125	VOLTS
GRID #3 VOLTAGE	PIN #7 CONNECTED TO PIN #2 AT SOCKET		
CATHODE BIAS RESISTOR		56	OHMS
PLATE RESISTANCE (APPROX.)		0.26	MEGOHM
TRANSCONDUCTANCE		8 000	μMHOS
PLATE CURRENT		14	MA.
GRID #2 CURRENT		3.6	MA.
GRID #1 VOLTAGE (APPROX.) FOR G_m = 50 μMHOS		-19	VOLTS
TRANSCONDUCTANCE (E_{c1}=-4.5 V., Rk=0)		700	μMHOS

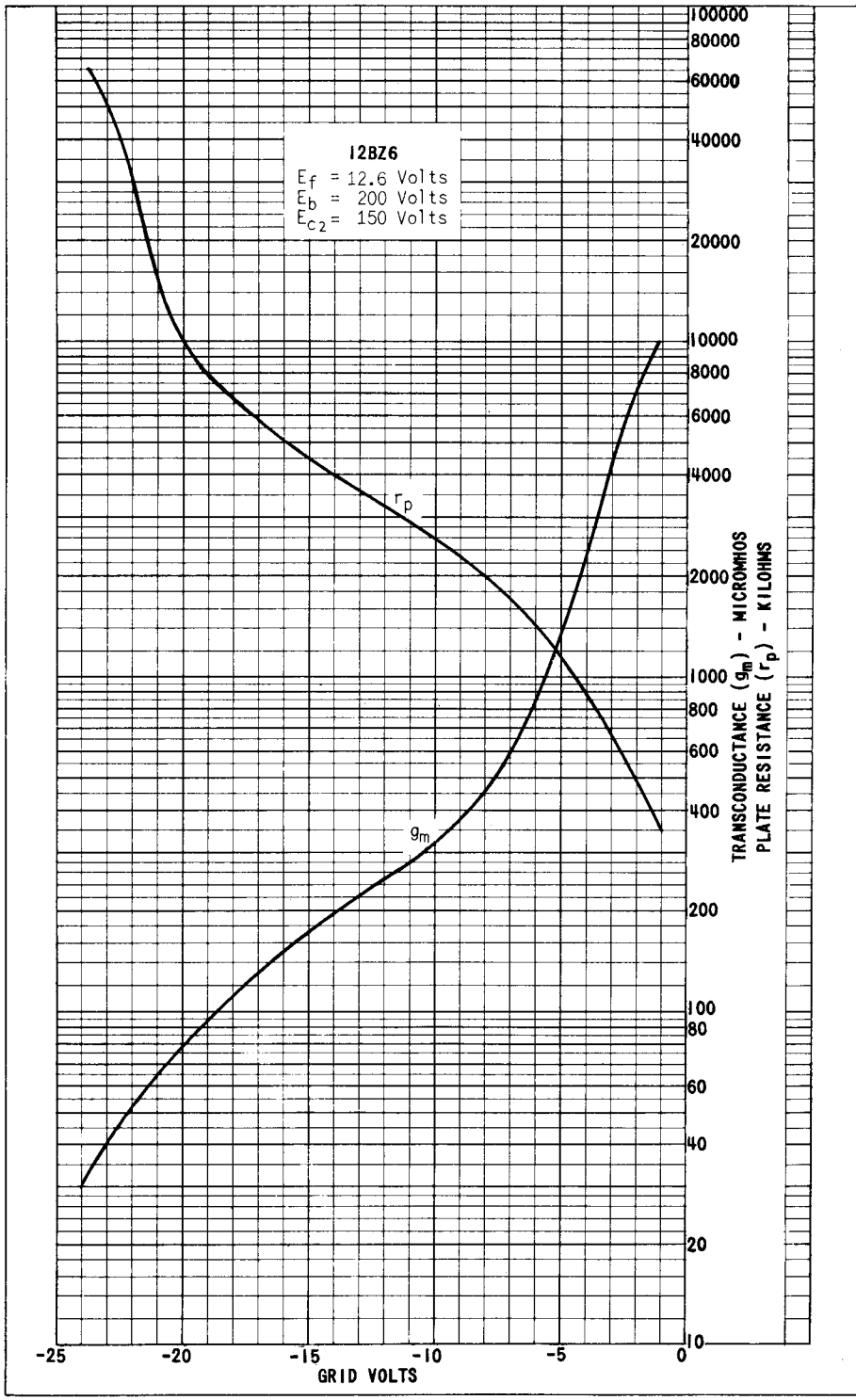
[B] DESIGN MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR IN THE TYPES OF SERVICE FOR WHICH THE TUBE IS RATED. THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT INITIALLY AND THROUGHOUT EQUIPMENT LIFE NO DESIGN MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.


12BZ6
Grid #2 Rating Curve
GRID #2 INPUT EXPRESSED AS PERCENT OF MAXIMUM GRID #2 INPUT RATING
100
75
50
25
0
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS PERCENT OF MAXIMUM GRID #2 SUPPLY VOLTAGE RATING


12BZ6
E_f =12.6 Volts
E_{c2} = 150 Volts
PLATE MILLIAMPERES
40
30
20
10
0
0
50
100
150
200
250
300
PLATE VOLTS
0
E_{c1} = -1
-2
-3
-4
-5
-6

12BZ6


12BZ6
E_f =12.6 Volts
E_b = 200 Volts
E_{c2} = 150 Volts
I_b
I_{c2}
GRID MILLIAMPERES
100
80
60
40
20
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.1
-25
-20
-15
-10
-5
0
GRID VOLTS


12BZ6
E_f = 12.6 Volts
E_b = 200 Volts
E_{c_2} = 150 Volts
r_p
g_m
100000
80000
60000
40000
20000
10000
8000
6000
4000
2000
1000
800
600
400
200
100
80
60
40
20
10
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE RESISTANCE (r_p) - KILOHMS
-25
-20
-15
-10
-5
0
GRID VOLTS

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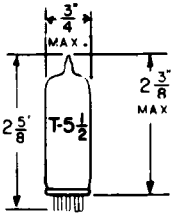
BEAM PENTODE

MINIATURE TYPE

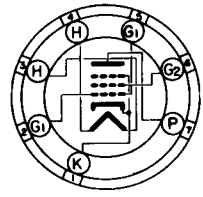


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CV

THE 12C5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME IT IS IDENTICAL TO THE 50C5.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.6←	μμf
INPUT	13.0←	μμf
OUTPUT	8.5←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200←	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	6←	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0*	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
CATHODE BIAS	0.5	MEGOHM
FIXED BIAS	0.1	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220←	°C
HEATER WARM-UP TIME (APPROX.)[B]	11.0	SECONDS

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

* INDICATES AN ADDITION

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

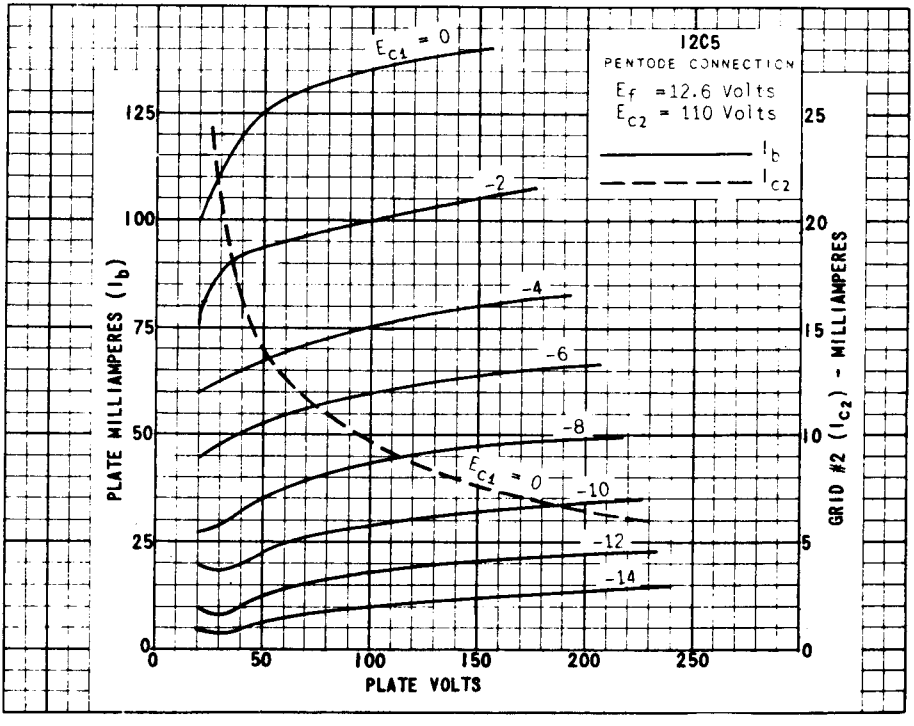
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – AF POWER AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	120 ←	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE (CONTROL GRID)	−8 ←	VOLTS
PEAK AF GRID #1 VOLTAGE	8 ←	VOLTS
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	8.5	MA.
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10 ←	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.3 ←	WATTS

ALL ELECTRICAL DATA FOR TYPE 12C5 ARE IDENTICAL WITH THOSE OF TYPE 12CU5.

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS ARE IDENTICAL WITH THOSE OF TYPES 12C5, 25C5, 50B5, AND 50C5.



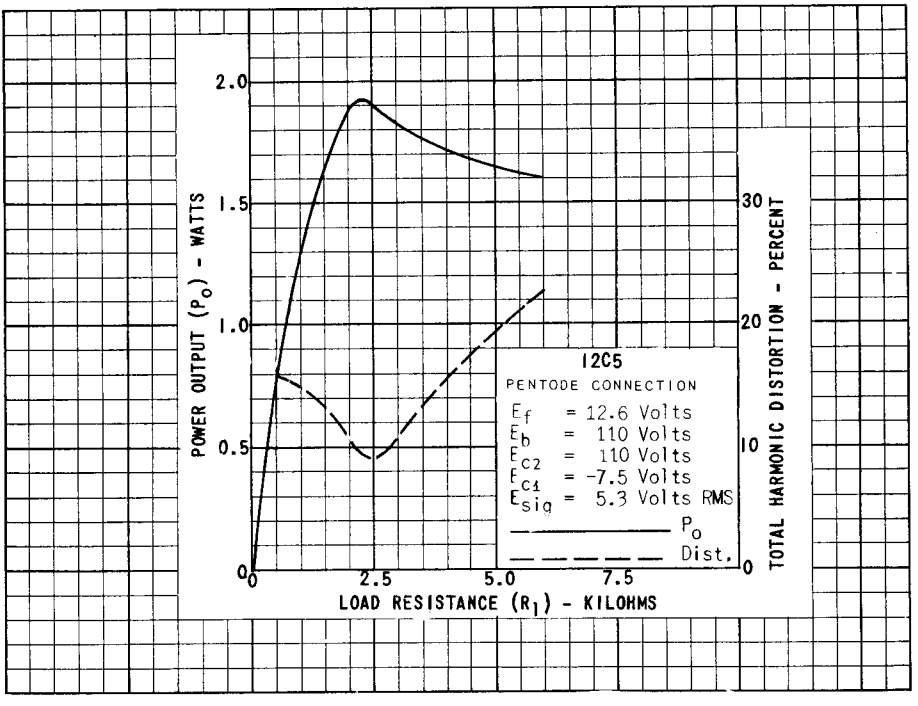

POWER OUTPUT (P_o) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE (R_l) - KILOHMS
2.0
1.5
1.0
0.5
0
2.5
5.0
7.5
30
20
10
0
12C5
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 110 Volts
E_{c2} = 110 Volts
E_{c1} = -7.5 Volts
E_{sig} = 5.3 Volts RMS
P_o
Dist.

PLATE 559-3

TUNG-SOL

DUPLEX DIODE PENTODE

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS		
BASE SMALL WAFER 8 PIN OCTAL	PIN 1 SHELL	PIN 7 HEATER	
CAP MINIATURE	PIN 2 HEATER	PIN 8 CATHODE AND GRID #3	
BULB METAL SHELL, MT-8	PIN 3 PLATE		
MAXIMUM DIAMETER 1 5/16"	PIN 4 DIODE PL. #2		
MAXIMUM OVERALL LENGTH 3 1/8"	PIN 5 DIODE PL. #1	TOP CAP GRID #1	
MAXIMUM SEATED HEIGHT 2 9/16"	PIN 6 GRID #2		

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.150	AMPS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATTS
MINIMUM EXTERNAL GRID (#1) BIAS VOLTAGE	0	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.

CAPACITANCES [A]

CONTROL GRID TO CATHODE	6	μμf
PLATE TO CATHODE	9	μμf
GRID TO PLATE	0.005 MAX.	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.150	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	125	VOLTS
CONTROL GRID VOLTAGE	-3	VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
ZERO-SIGNAL PLATE CURRENT	10	MA.
ZERO-SIGNAL SCREEN CURRENT	2.3	MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE (APPROX.)	0.6	MEGOHMS
TRANSCONDUCTANCE	1325	μMHOS
AMPLIFICATION FACTOR		
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS
CONTROL GRID VOLTAGE FOR CATHODE CURRENT CUT-OFF (APPROX.)	-21	VOLTS

PLATE 1330-2
SEPT. 23 1943

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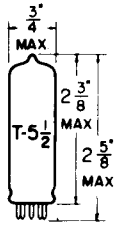
PENTODE

MINIATURE TYPE

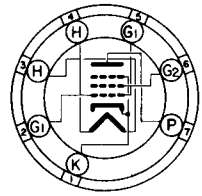
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CV

THE 12CA5 IS A BEAM PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN THE AUDIO-FREQUENCY POWER OUTPUT STAGE OF 600 MA. SERIES HEATER OPERATED TELEVISION AND RADIO RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. IT FEATURES HIGH SENSITIVITY AT RELATIVELY LOW PLATE AND SCREEN VOLTAGES. WITH EXCEPTION OF HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 6CA5.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	15	μμf
OUTPUT	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	300 ←	VOLTS
MAXIMUM PLATE VOLTAGE	130	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	180	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE .

→ INDICATES A CHANGE.

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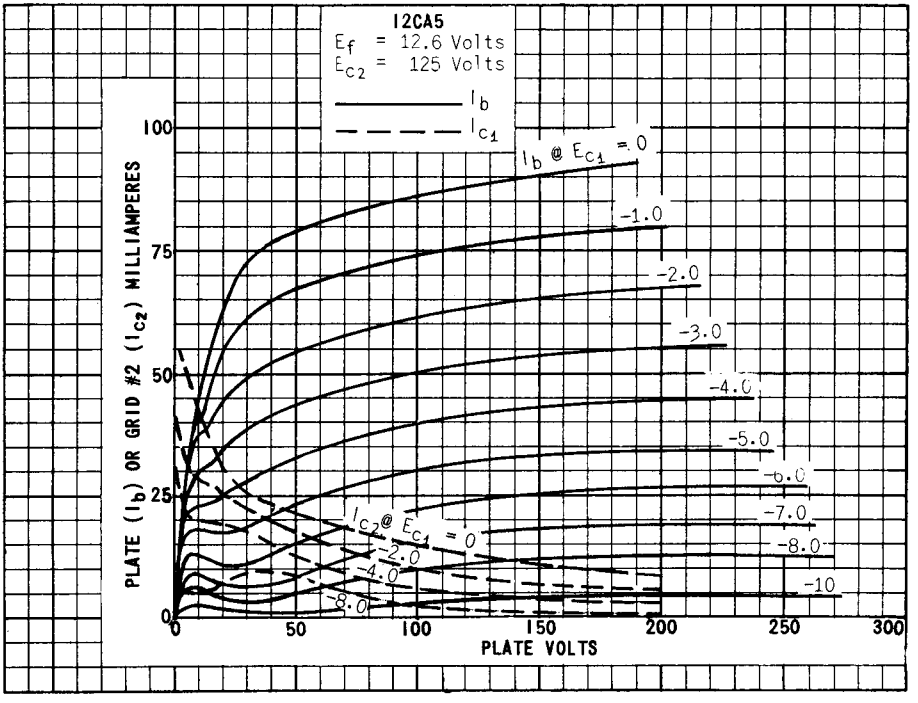
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	110	125	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-4.0	-4.5	VOLTS
PEAK AF GRID #1 VOLTAGE	4.0	4.5	VOLTS
PLATE RESISTANCE (APPROX.)	16 000	15 000	OHMS
TRANSCONDUCTANCE	8 100	9 200	μMHOS
ZERO-SIGNAL PLATE CURRENT	32	37	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	31	36	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	4.0	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	7.5	11	MA.
LOAD RESISTANCE	3 500	4 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	5	6	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.1	1.5	WATTS



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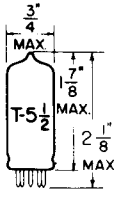
DIODE PENTODE

MINIATURE TYPE

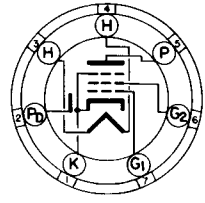


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 12CR6 IS A COMBINED SINGLE DETECTOR DIODE AND REMOTE CUT-OFF PENTODE WITH A COMMON CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN AUDIO AMPLIFIER IN WHICH AVC VOLTAGE IS APPLIED TO THE CONTROL GRID FOR IMPROVED OVERALL RECEIVER AVC.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.3	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED	2	MA.
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #1 VOLTAGE	-2	VOLTS
PLATE CURRENT	9.6	MA.
GRID #2 CURRENT	2.6	MA.
TRANSCONDUCTANCE	2 200	μMHOS
PLATE RESISTANCE (APPROX.)	0.8	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	-32	VOLTS

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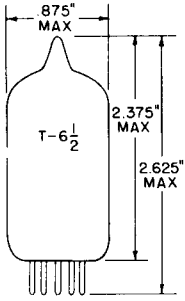


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 6-3

BEAM PENTODE

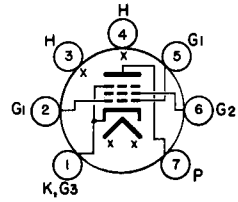
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER

12.6±1.3 VOLTS 600 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 12CU5 IS A MINIATURE BEAM POWER PENTODE INTENDED FOR USE IN THE AUDIO OUTPUT STAGE OF TELEVISION RECEIVERS. HIGH POWER SENSITIVITY AND HIGH EFFICIENCY AT LOW PLATE AND SCREEN VOLTAGES ENABLE THE 12CU5 TO PROVIDE RELATIVELY HIGH POWER OUTPUT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO CATHODE & GRID #3, HEATER, AND GRID #2	13.0	pf
PLATE TO CATHODE & GRID #3, HEATER, AND GRID #2	8.5	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	130	VOLTS
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	7	WATTS
MAXIMUM GRID #2 INPUT	1.4	WATTS
MAXIMUM BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	220	°C
HEATER WARM-UP TIME (AVERAGE)*	11	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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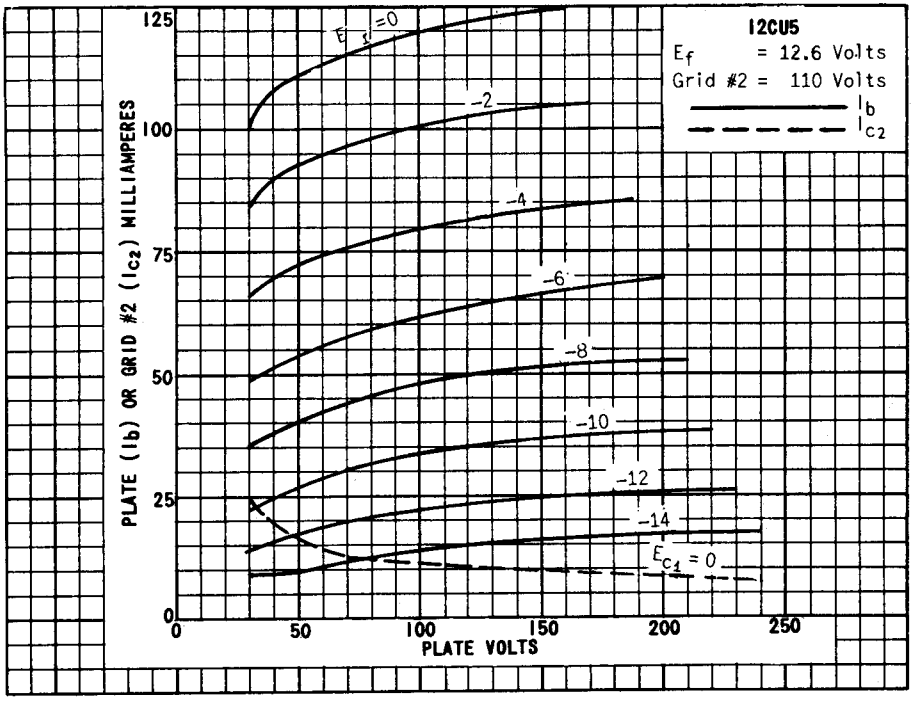
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

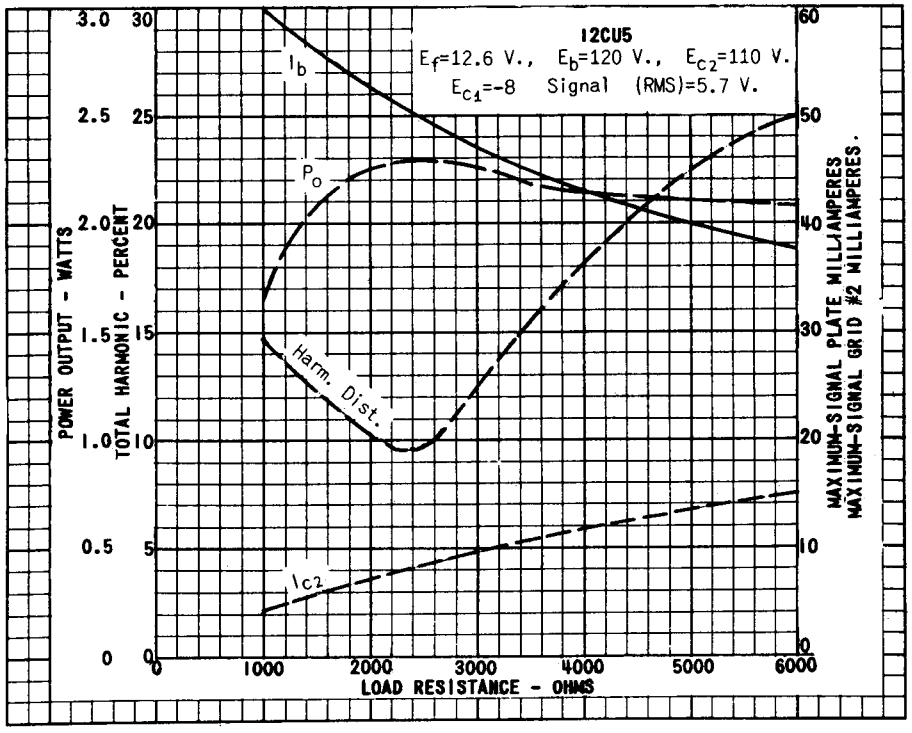
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−8	VOLTS
PEAK AF GRID #1 VOLTAGE	8	VOLTS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	8.5	MA.
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
SIGNAL POWER OUTPUT (MAX.)	2.3	WATTS

MAXIMUM CIRCUIT VALUES

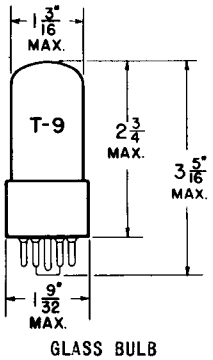
GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM


12CU5
Ef = 12.6 Volts
Grid #2 = 110 Volts
Ib
Ic2
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1=0
-2
-4
-6
-8
-10
-12
-14
0
25
50
75
100
125
0
50
100
150
200
250


12CU5
Ef=12.6 V., Eb=120 V., Ec2=110 V.
Ec1=-8 Signal (RMS)=5.7 V.
Ib
Po
Harm. Dist.
Ic2
POWER OUTPUT - WATTS
TOTAL HARMONIC - PERCENT
MAXIMUM-SIGNAL PLATE MILLIAMPERES
MAXIMUM-SIGNAL GRID #2 MILLIAMPERES.
LOAD RESISTANCE - OHMS
0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
25
30
0
10
20
30
40
50
60
0
1000
2000
3000
4000
5000
6000

TUNG-SOL

DIODE



GLASS BULB

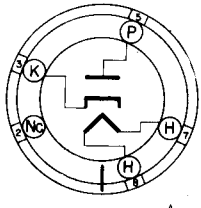
UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.60±0.040 AMP.

ANY MOUNTING POSITION

[A] SOCKET PINS 1, 2, 4 & 6 MUST NOT BE USED AS TIE POINTS.



BOTTOM VIEW[A]

INTERMEDIATE SHELL
5 PIN OCTAL

4CG

THE 12D4A IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

HEATER TO CATHODE: H TO K	3.0	μμf
CATHODE TO PLATE AND HEATER: K TO (P+ H)	9.0	μμf
PLATE TO CATHODE AND HEATER: P TO (K +H)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE[C]	12.6	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	8.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE[D]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	1000	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.60±0.040	AMP.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT --340 MA.)	30	VOLTS

B

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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[C] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER CURRENT IS AT THE SPECIFIED BOGIE VALUE. HEATER SUPPLY VARIATIONS SHOULD BE RESTRICTED SO THAT THE HEATER CURRENT WILL BE MAINTAINED WITHIN THE SPECIFIED TOLERANCE.

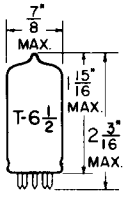
[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF G OD ENGINEERING PRACTICE FOR TELEVISION BROAD AST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DIODE-PENTODE

MINIATURE TYPE

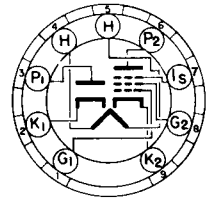


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.200 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

THE 12DE8 IS A COMBINED REMOTE CUT-OFF PENTODE AND DIODE WITH INDEPENDENT UNIPOTENTIAL CATHODES IN THE 9-PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN RF OR IF AMPLIFIER WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
PENTODE GRID #1 TO PLATE: (MAX.)	.006	μμf
PENTODE INPUT:	5.5	μμf
PENTODE OUTPUT:	5.7	μμf
DIODE INPUT:	3.7	μμf
DIODE OUTPUT:	5.7	μμf
COUPLING (DIODE PLATE TO PENTODE GRID (MAX.)	.018	μμf
COUPLING (DIODE PLATE TO PENTODE PLATE (MAX.)	.012	μμf
COUPLING (DIODE CATHODE TO PENTODE GRID (MAX.)	.13	μμf
COUPLING (DIODE CATHODE TO PENTODE PLATE (MAX.)	.0016	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT	5	MA.

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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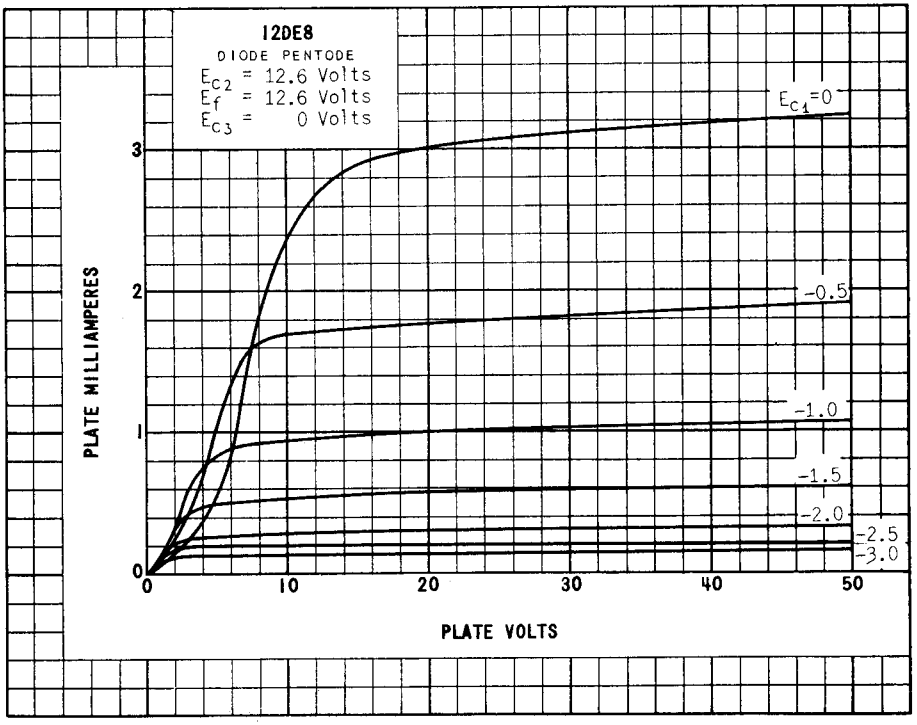
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.200	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID #3 VOLTAGE[B]	0	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE	-.80[C]	VOLTS
PLATE CURRENT	1 300	μAMPS
GRID #2 CURRENT	500	μAMPS
PLATE RESISTANCE (APPROX.)	.3	MEGOHM
TRANSCONDUCTANCE[D]	1 500	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR G_{mD} = 10 μMHOS	-6.0	VOLTS
DIODE CURRENT WITH 5 VOLTS APPLIED	20	MA.

[C] AVERAGE BIAS DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.

[D] FROM GRID #1 TO PLATE.

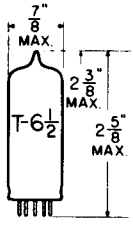
[B] CONNECTED TO CATHODE AT SOCKET.



TUNG-SOL

DOUBLE DIODE

MINIATURE TYPE



GLASS BULB

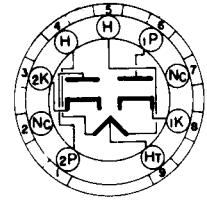
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.45 AMP.	0.9 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9BS

THE 12DF5 IS A DOUBLE DIODE FULL WAVE RECTIFIER IN THE 9-PIN MINIATURE CONSTRUCTION. IT HAS A CENTER-TAPPED HEATER, SEPARATE CATHODE CONNECTIONS, AND RELATIVELY HIGH OUTPUT CURRENT CAPABILITIES.

RATINGS

RECTIFIER SERVICE

HEATER VOLTAGE	12.6	6.3	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1275		VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE, (EACH PLATE RMS.)(SEE RATING CHART #1)	450		VOLTS
MAXIMUM DC OUTPUT CURRENT	SEE RATING CHART #1		
MAXIMUM STEADY STATE PEAK PLATE CURRENT (EACH PLATE) (SEE RATING CHART #2)	350		MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT (EACH PLATE) (SEE RATING CHART #3)	2.0		AMP.
MAXIMUM AC HEATER CATHODE VOLTAGE (RMS)	225		VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE HEATER NEGATIVE WITH RESPECT TO CATHODE	450		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	12.6	6.3	VOLTS
HEATER CURRENT	0.45	0.9	AMP.
TUBE VOLTAGE DROP TUBE CONDUCTING: 100 MA. EACH PLATE	40		VOLTS

TYPICAL OPERATION – FULL WAVE RECTIFIER

	INPUT TO FILTER CAPACITOR	INPUT TO FILTER CHOKE	
HEATER VOLTAGE	12.6	6.3	VOLTS
HEATER CURRENT	0.45	0.9	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE)(RMS)[A]	325	450	VOLTS
FILTER INPUT CONDENSER	40	---	μf
FILTER INPUT CHOKE	---	10	HENRYS
EFFECTIVE PLATE SUPPLY RESISTANCE (EA. PLATE)	82	---	OHMS
DC OUTPUT CURRENT AT FILTER	100	100	MA.
DC OUTPUT VOLTAGE AT FILTER	330	360	VOLTS

[A] AC PLATE VOLTAGE IS MEASURED WITHOUT LOAD.

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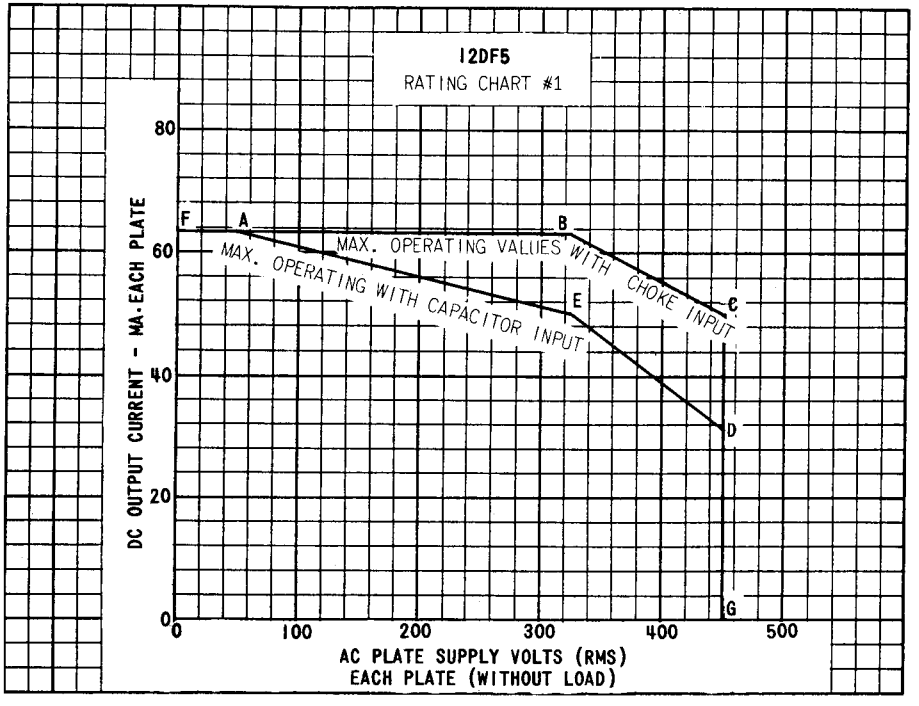
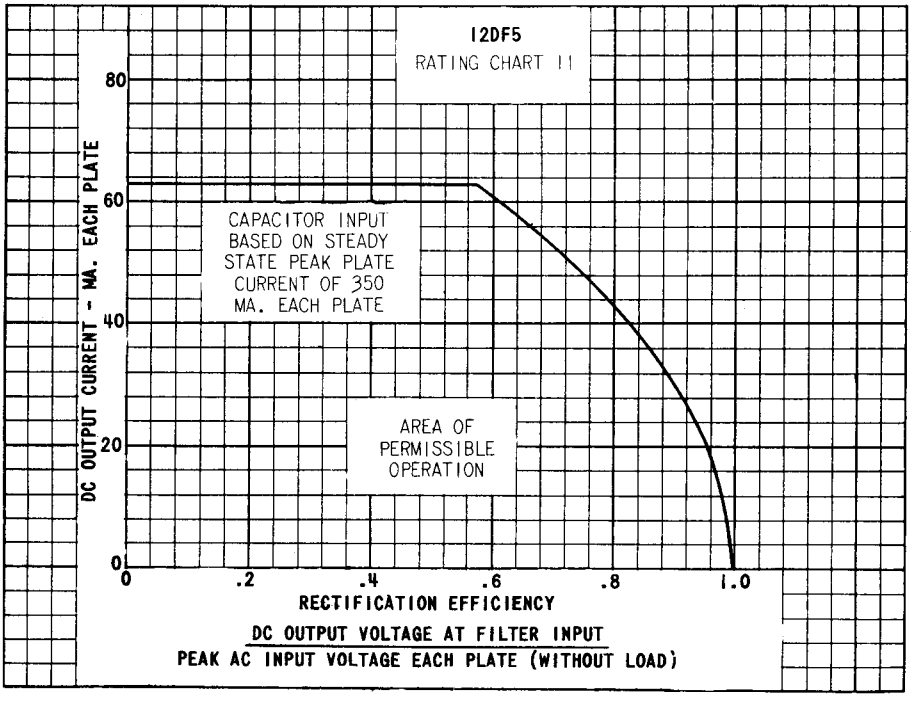
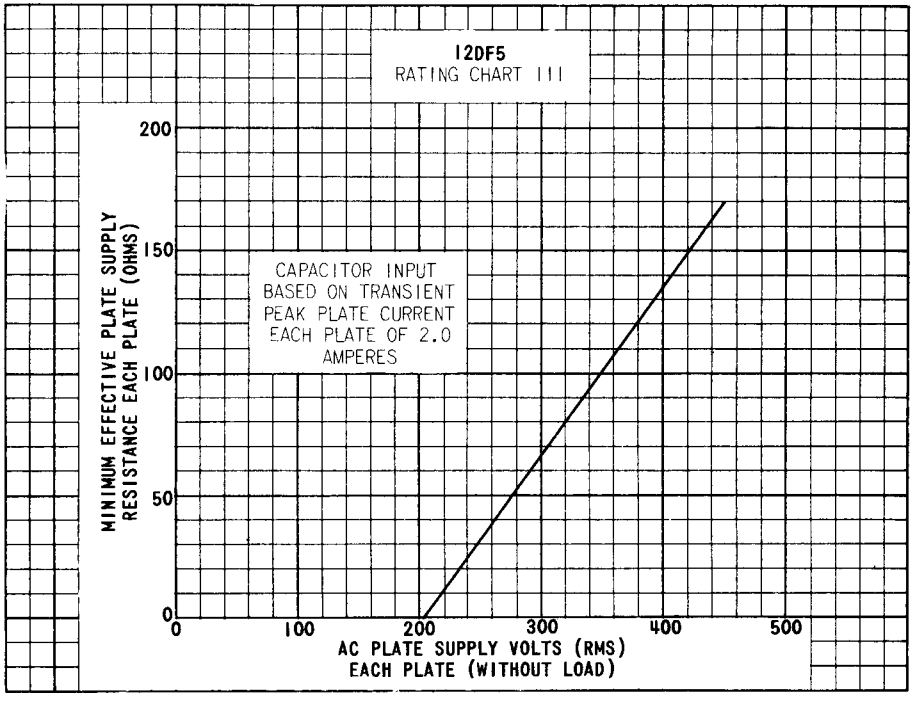

12DF5
RATING CHART #1
DC OUTPUT CURRENT - MA. EACH PLATE
80
60
40
20
0
F
A
B
C
D
E
G
MAX. OPERATING VALUES WITH CHOKE INPUT
MAX. OPERATING WITH CAPACITOR INPUT
0
100
200
300
400
500
AC PLATE SUPPLY VOLTS (RMS)
EACH PLATE (WITHOUT LOAD)


12DF5
RATING CHART II
DC OUTPUT CURRENT - MA. EACH PLATE
80
60
40
20
0
CAPACITOR INPUT
BASED ON STEADY
STATE PEAK PLATE
CURRENT OF 350
MA. EACH PLATE
AREA OF
PERMISSIBLE
OPERATION
0
.2
.4
.6
.8
1.0
RECTIFICATION EFFICIENCY
DC OUTPUT VOLTAGE AT FILTER INPUT
PEAK AC INPUT VOLTAGE EACH PLATE (WITHOUT LOAD)



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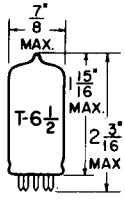
TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

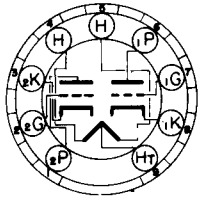
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON 9 PIN BASE

9A

THE 12DF7 IS A 9 PIN MINIATURE TWIN TRIODE DESIGNED FOR SERVICE AS A LOW LEVEL INPUT VOLTAGE AMPLIFIER FOR TAPE RECORDERS AND HIGH QUALITY AUDIO PREAMPLIFIERS. THE 12DF7 IS A LOW MICROPHONICS VERSION OF THE 12AX7 AND MAY BE USED AS A REPLACEMENT FOR THAT TYPE.

DIRECT INTERELECTRODE CAPACITANCES

	SEC. #1	SEC. #2	
GRID TO PLATE	1.4	1.4	μμf
INPUT	1.6	1.6	μμf
OUTPUT	0.4	0.3	μμf
			μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

EACH SECTION

HEATER VOLTAGE	12.6 6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	180	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	-50	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

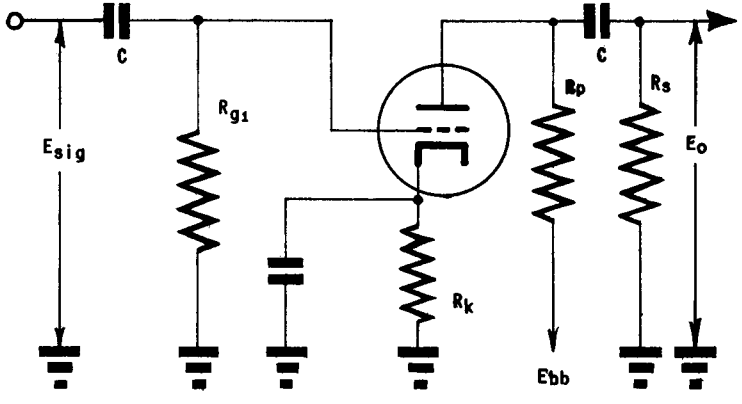
CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	12.6	6.3	12.6	6.3	VOLTS
HEATER CURRENT	0.15	0.3	0.15	0.3	AMP.
PLATE VOLTAGE	100		250		VOLTS
GRID VOLTAGE	-1		-2		VOLTS
AMPLIFICATION FACTOR	100		100		
PLATE RESISTANCE	70 000		55 000		OHMS
TRANSCONDUCTANCE	1 250		1 600		μMHOS
PLATE CURRENT	0.5		1.2		MA.

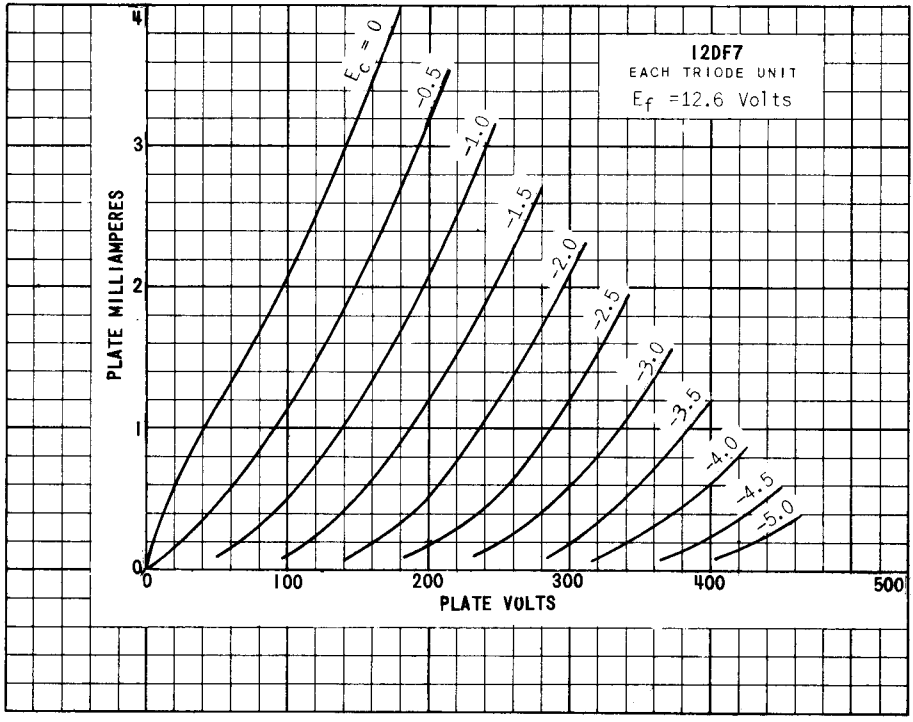
RESISTANCE COUPLED AMPLIFIER

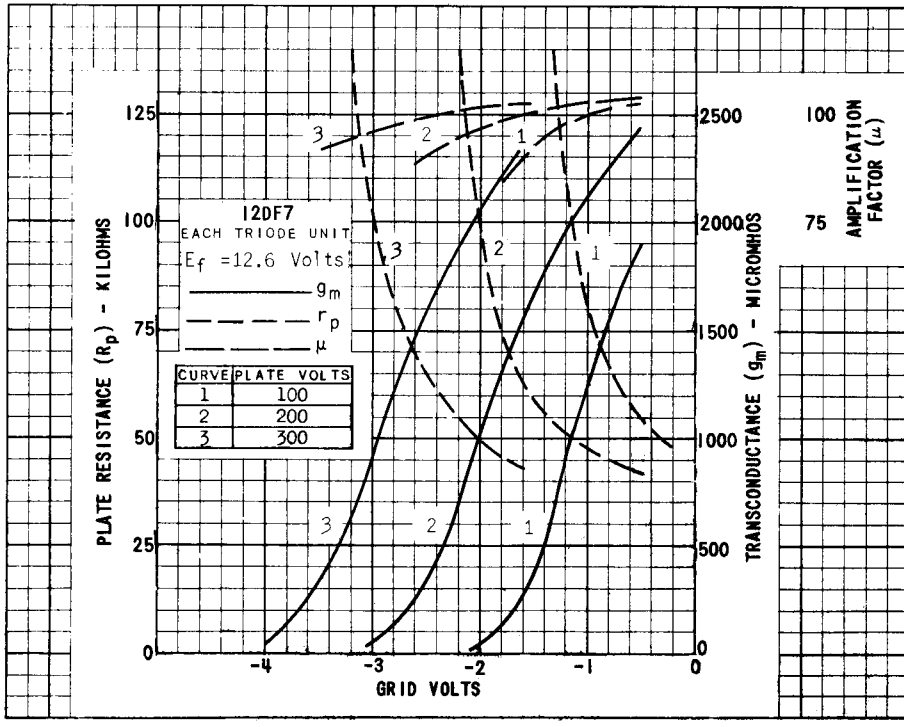
R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.





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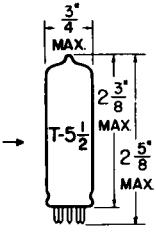
TUNG-SOL

DOUBLE DIODE-TETRODE

MINIATURE TYPE

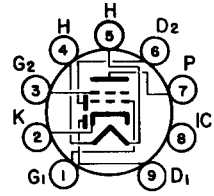


GLASS BULB
MINIATURE BUTTON
9 PIN BASE B9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.50 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9MZ

THE 12DK7 IS A COMBINED DETECTOR, AVC DIODE, AND A TETRODE WITH A COMMON UNIPOTENTIAL CATHODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE TETRODE SECTION IS INTENDED FOR USE AS A POWER AMPLIFIER WHERE THE HEATER, PLATE, AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE (TETRODE)	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	15	MEGOHMS
MAXIMUM HEATER CATHODE VOLTAGE	±30	VOLTS
MAXIMUM TETRODE PLATE CURRENT←	10	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CHARACTERISTICS – CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.50	AMP.
PLATE VOLTAGE (TETRODE)	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
HEATER VOLTAGE	12.6	VOLTS
GRID #1 RESISTOR (BYPASSED)	2.2	MEGOHMS
PLATE CURRENT	6.0	MA.
GRID #2 CURRENT	1.0	MA.
TRANSCONDUCTANCE	5 000	μMHOS
PLATE RESISTANCE	4 000	OHMS
DIODE CURRENT WITH 10 VOLTS APPLIED	1.0	MA.

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTER SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

TYPICAL OPERATION - CLASS A_1 AMPLIFIER

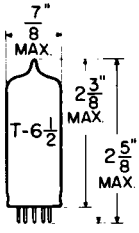
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.50	AMP.
PLATE VOLTAGE (TETRODE)	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE[A]	---	
GRID #1 SIGNAL VOLTAGE	1.0	VRMS
SIGNAL SOURCE RESISTANCE	200 000	OHMS
LOAD RESISTANCE	3 500	OHMS
SIGNAL PLATE CURRENT (MAX.)	2.5	MA.
SIGNAL GRID #2 CURRENT POWER OUTPUT (MAX.)	10	MW.
TOTAL HARMONIC DISTORTION	10	PERCENT

[A] OBTAINED BY GRID #1 RECTIFICATION WITH A 15 MEGOHM GRID RESISTOR. THE ZERO SIGNAL PLATE CURRENT IS APPROX. 6.0 MA.

TUNG-SOL

TWIN-DIODE TETRODE

MINIATURE TYPE

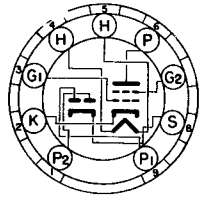


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.55 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

9HR

THE 12DL8 IS A COMBINED TWIN-DIODE AND SPACE-CHARGE GRID TETRODE WITH INDEPENDENT UNIPOTENTIAL CATHODES IN THE 9-PIN MINIATURE CONSTRUCTION. THE DIODE SECTION IS INTENDED FOR USE AS DETECTOR AND THE TETRODE SECTION IS INTENDED FOR USE AS A POWER AMPLIFIER WHERE THE HEATER PLATE, AND SPACE-CHARGE GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

#1 DIODE INPUT: (#1 Pd TO Kd+H)	1.6	μμf
#2 DIODE INPUT: (#2 Pd TO Kd+H)	1.6	μμf
#1 DIODE TO #2 DIODE (#1 Pd TO #2 Pd)	.03	μμf
TETRODE INPUT: (G2 TO G1+K+H)	12	μμf
TETRODE OUTPUT: (P TO G1+K+H)	1.3	μμf
TETRODE GRID #2 TO PLATE	14	μμf
COUPLING: (#1 DIODE PLATE TO TETRODE GRID #2)(MAX.)	.02	μμf
(#2 DIODE TO TETRODE GRID #2) (MAX.)	.006	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM TETRODE PLATE VOLTAGE	30	VOLTS
MAXIMUM POSITIVE TETRODE GRID #1 VOLTAGE (ABS. MAX.)	16	VOLTS
MAXIMUM NEGATIVE TETRODE GRID #2 VOLTAGE	20	VOLTS
MAXIMUM TETRODE GRID #2 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT	5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - SINGLE TUBE

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.55	AMPL
PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL GRID) VOLTAGE[B]	-0.5	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	12.6	VOLTS
PLATE CURRENT	40	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
PLATE RESISTANCE	480	OHMS
AMPLIFICATION FACTOR[C]	7.2	
TRANSCONDUCTANCE[C]	15 000	μMHOS

DIODE UNITS - TWO

DIODE CURRENT WITH 10.0 VOLTS APPLIED (EACH DIODE)	3	MA.

TYPICAL OPERATION

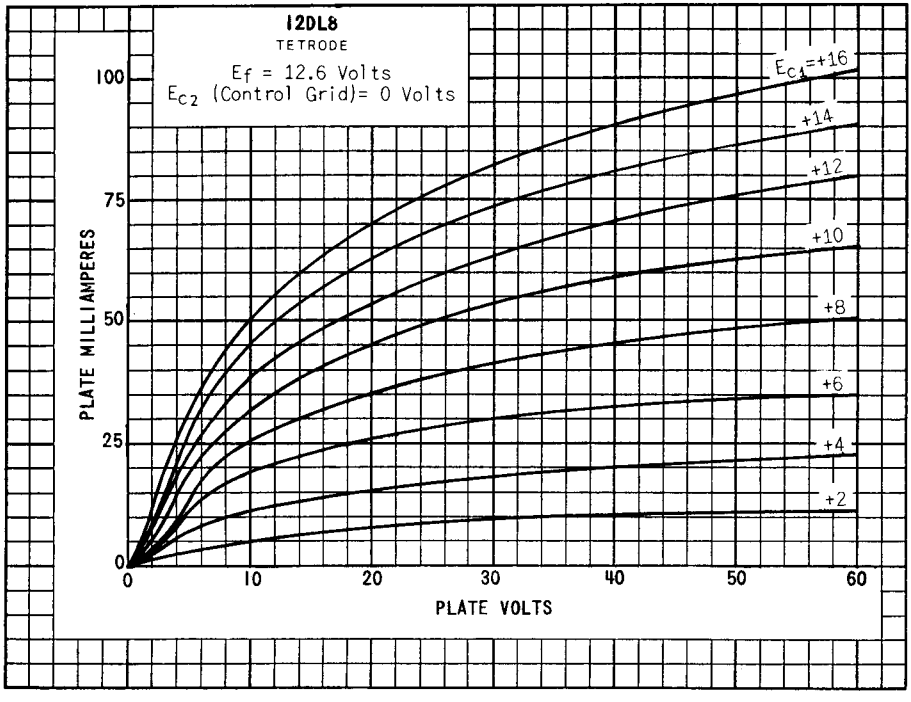
CLASS A_1 AMPLIFIER - SINGLE TUBE

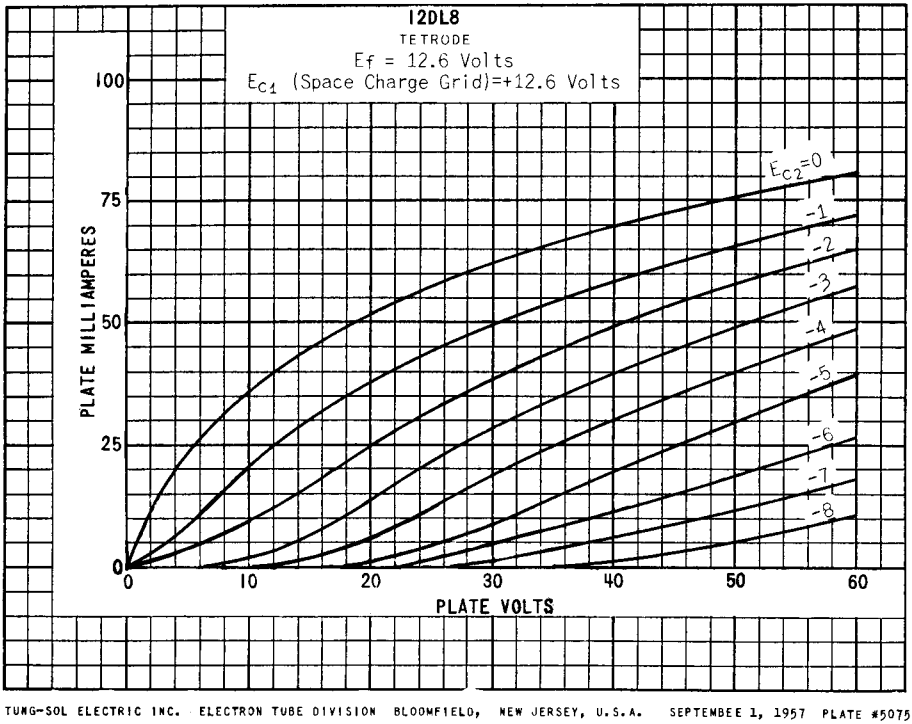
PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL GRID) VOLTAGE[D]	-2.0	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	12.6	VOLTS
PEAK AF GRID #2 VOLTAGE	2.5	VOLTS
AF SIGNAL SOURCE RESISTANCE	100 000	OHMS
LOAD RESISTANCE	800	OHMS
PLATE CURRENT	8.0	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
POWER OUTPUT	40	MW.
TOTAL HARMONIC DISTORTION (MAX.)	10	PERCENT

[B] AVERAGE BIAS DEVELOPED ACROSS A 2.2 MEGOHM RESISTOR.

[C] FROM GRID #2 TO PLATE.

[D] OBTAINED ACROSS A 2.2 MEGOHM RESISTOR BY GRID #2 RECTIFICATION IN WHICH CASE THE ZERO SIGNAL PLATE CURRENT IS APPROXIMATELY 40 MA.





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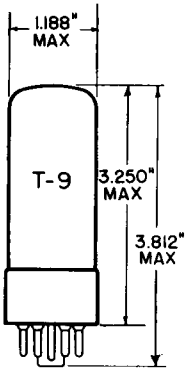
DIODE



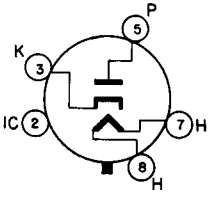
GLASS BULB
SHORT INTERMEDIATE SHELL
5 PIN OCTAL WITH
EXTERNAL BARRIERS
85-85
OUTLINE DRAWING
JEDEC 9-44

UNIPOTENTIAL CATHODE

FOR DAMPER SERVICE IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 4CG

THE 12DM4 IS A HALF-WAVE VACUUM RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 12DM4 IS IDENTICAL TO THE 6DM4 AND THE 17DM4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	pf
CATHODE TO HEATER AND PLATE	11.5	pf
HEATER TO CATHODE	4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		600±36	MA.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		5000[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		300[B]	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIUM VALUES - SEE EIA STANDARD RS-239

DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000[D]	VOLTS
PEAK PLATE CURRENT	1100	MA.
DC PLATE CURRENT	175	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

TUBE VOLTAGE DROP FOR PLATE CURRENT OF 400 MA. APPROXIMATE	35	VOLTS

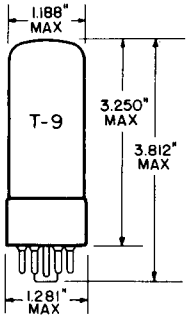
[A] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

[B] THF DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE. (15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.)

TUNG-SOL

DIODE



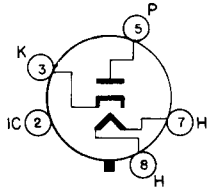
GLASS BULB

SHORT INTERMEDIATE SHELL
5 PIN OCTAL BASE B5-85
OUTLINE DRAWING
JEDEC 9-44

FOR DAMPER SERVICE IN
TELEVISION RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

SOCKET TERMINALS 1,2,4 & 6,
SHOULD NOT BE USED AS
TIE POINTS.

THE 12DM4A IS AN INDIRECTLY-HEATED HALF-WAVE RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF TELEVISION RECEIVERS.
EXCEPT FOR HEATER CHARACTERISICS AND RATINGS, THE 12DM4A I S IDENTICAL TO THE 6DM4A AND THE 17DM4A.
ALSO, THE 12DM4A IS IDENTICAL TO THE 12DM4 EXCEPT FOR HIGHER PLATE CURRENT RATINGS.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE	4	pf
PLATE TO CATHODE	8.5	pf
CATHODE TO PLATE AND HEATER	11.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	600	MA.
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600 ± 40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	
TOTAL DC AND PEAK			300	VOLTS

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

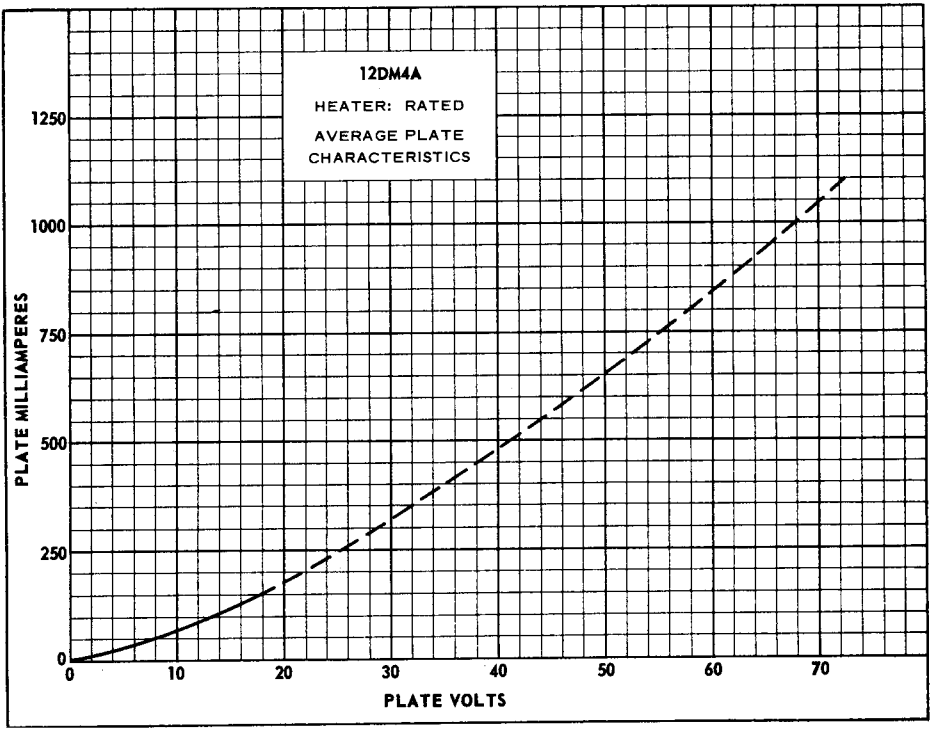
DAMPER SERVICE[B]

PEAK INVERSE VOLTAGE	5000	VOLTS
PEAK PLATE CURRENT	1200	MA.
DC PLATE CURRENT	200	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

VOLTAGE DROP AT Ib = 400 MA.	35	VOLTS

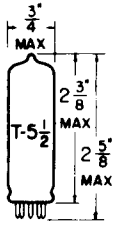
B
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.



TUNG-SOL

PENTODE

MINIATURE TYPE

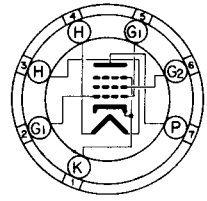


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CV

THE 12DM5 IS A BEAM POWER PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS INTENDED FOR APPLICATION AS AN AUDIO POWER OUTPUT TUBE IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.55	$\mu\mu f$
INPUT: G_1 TO K+H+G_1+B.P.	13	$\mu\mu f$
OUTPUT: P TO K+H+G_2+B.P.	9	$\mu\mu f$

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHMS
CATHODE BIAS	0.5	MEGOHMS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE[A]	200	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] DC COMPONENT MUST NOT EXCEED 100 VOLTS MAX.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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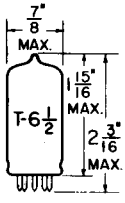
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 (SCREEN) VOLTAGE	110	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	7.5	VOLTS
PLATE RESISTANCE (APPROX.)	14 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
GRID #1 INPUT VOLTAGE, PEAK AF	7.5	VOLTS
PLATE CURRENT, ZERO SIGNAL	49	MA.
PLATE CURRENT, MAXIMUM SIGNAL	50	MA.
GRID #2 CURRENT, ZERO SIGNAL	4.0	MA.
GRID #2 CURRENT, MAXIMUM SIGNAL	8.5	MA.
LOAD RESISTANCE IMPEDANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	9	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	1.9	WATTS

TUNG-SOL

DUOTRIODE

MINIATURE TYPE



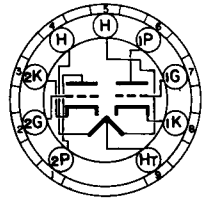
GLASS BULB

HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.13 AMP.	0.26 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE
9 PIN BASE
9A

THE 12DM7 IS A LOW-HUM HIGH-MU DUOTRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. ITS HIGH AMPLIFICATION AND LOW-HUM MAKES THE 12DM7 PARTICULARLY ADAPTED FOR APPLICATION IN LOW LEVEL STAGES OF HIGH-FIDELITY AMPLIFIERS AND OTHER AUDIO EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	SEC. #1	SEC. #2	
GRID TO PLATE: G1 TO P	1.7	1.7	μμf
INPUT: G1 TO K+H	1.6	1.6	μμf
OUTPUT: P TO K+H	0.46	0.34	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
EACH SECTION

HEATER VOLTAGE	12.6	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	330		VOLTS
MAXIMUM CONTROL GRID VOLTAGE, NEGATIVE -DC	50		VOLTS
MAXIMUM CONTROL GRID VOLTAGE, POSITIVE -DC	0		VOLTS
MAXIMUM PLATE DISSIPATION	1.1		WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE TO CATHODE	180	180	VOLTS
HEATER POSITIVE TO CATHODE	180	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

HEATER VOLTAGE		12.6	6.3	VOLTS
HEATER CURRENT		0.13	0.26	AMP.
PLATE VOLTAGE	100	250		VOLTS
CONTROL GRID VOLTAGE	-1	-2		VOLTS
PLATE RESISTANCE (APPROX.)	80	62.5		K OHMS
TRANSCONDUCTANCE	1250	1600		μMHOS
AMPLIFICATION FACTOR	100	100		
PLATE CURRENT	0.5	1.2		MA.
SIGNAL-TO-NOISE-RATION IN 630B R-C AMP.		57db		DOWN

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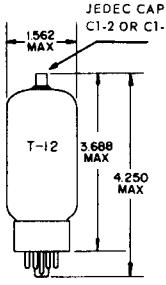
BEAM PENTODE



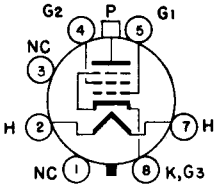
SKIRTED MINIATURE
SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B5-190 ←
OUTLINE DRAWING
JEDEC 12-51

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #1 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 12DQ6A IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER TUBE IN HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 12DQ6A IS IDENTICAL TO THE 6DQ6A.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA..
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME, APPROX.			SECONDS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6000	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION, [B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	155	MA.
CATHODE CURRENT, PEAK	540	MA.
GRID #1 CIRCUIT RESISTANCE, [B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

AVERAGE CHARACTERISTICS

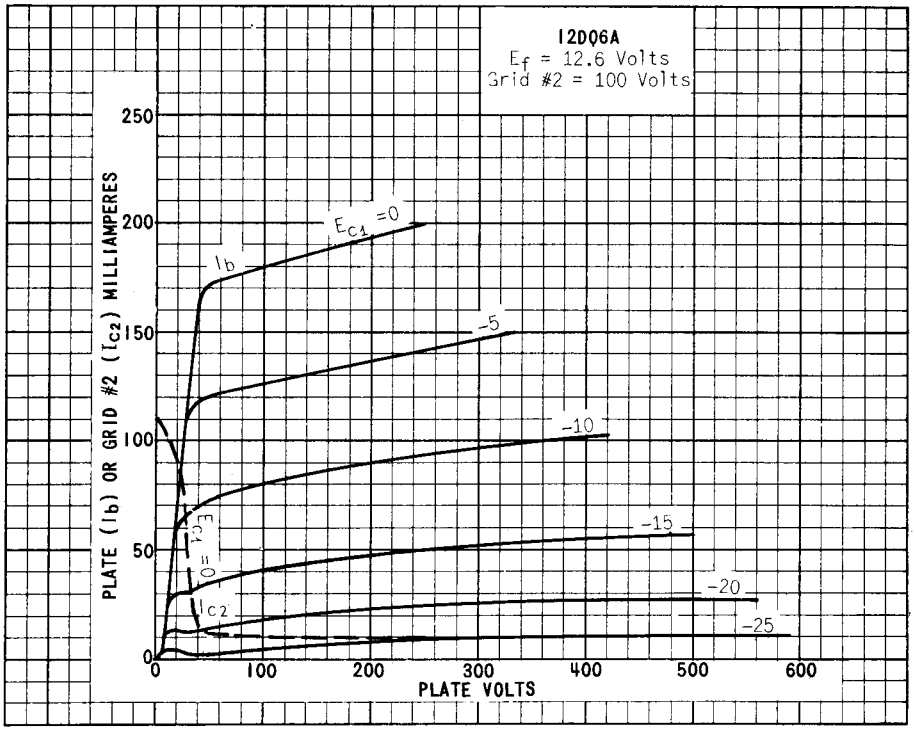
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	1.5	MA.
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE, APPROX.	20,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	315	MA.
GRID #2 CURRENT	25	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-40	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.5	

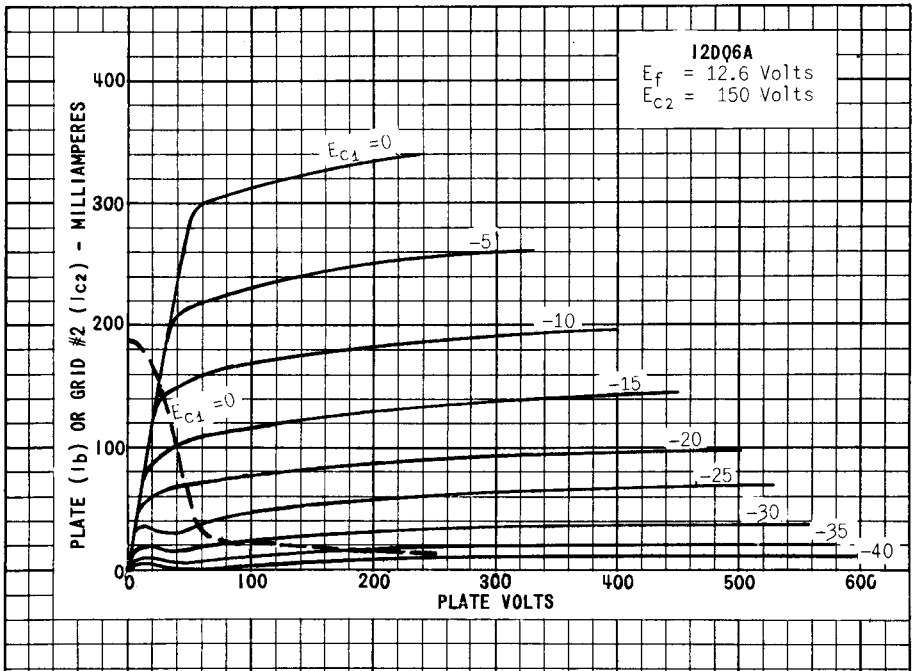
→ INDICATES A CHANGE.

A
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B
IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

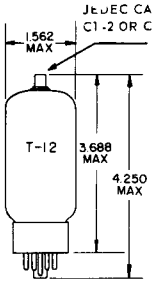
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


12DQ6A
Ef = 12.6 Volts
Grid #2 = 100 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
250
200
150
100
50
0
Ec1 =0
Ib
-5
-10
-15
-20
-25
Ec1 =0
Ic2
0
100
200
300
400
500
600
PLATE VOLTS


12DQ6A
Ef = 12.6 Volts
Ec2 = 150 Volts
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
400
300
200
100
0
Ec1 =0
-5
-10
-15
-20
-25
-30
-35
-40
Ec1 =0
0
100
200
300
400
500
600
PLATE VOLTS

TUNG-SOL

BEAM PENTODE



GLASS BULB

SKIRTED MINIATURE

SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B6-198 ←

OUTLINE DRAWING
JEDEC 10-82

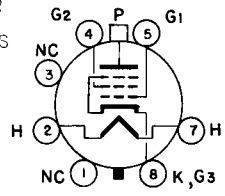
COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER

APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #1 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 12DQ6B IS A BEAM POWER PENTODE PRIMARILY DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ITS HIGH ZERO-BIAS PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES MAKES THE TUBE WELL SUITED FOR USE IN RECEIVERS THAT OPERATE AT LOW PLATE-SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 12DQ6B IS IDENTICAL TO THE 6DQ6B.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA..
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME, APPROX.*			SECONDS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6500	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	175	MA.
CATHODE CURRENT, PEAK	610	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

AVERAGE CHARACTERISTICS

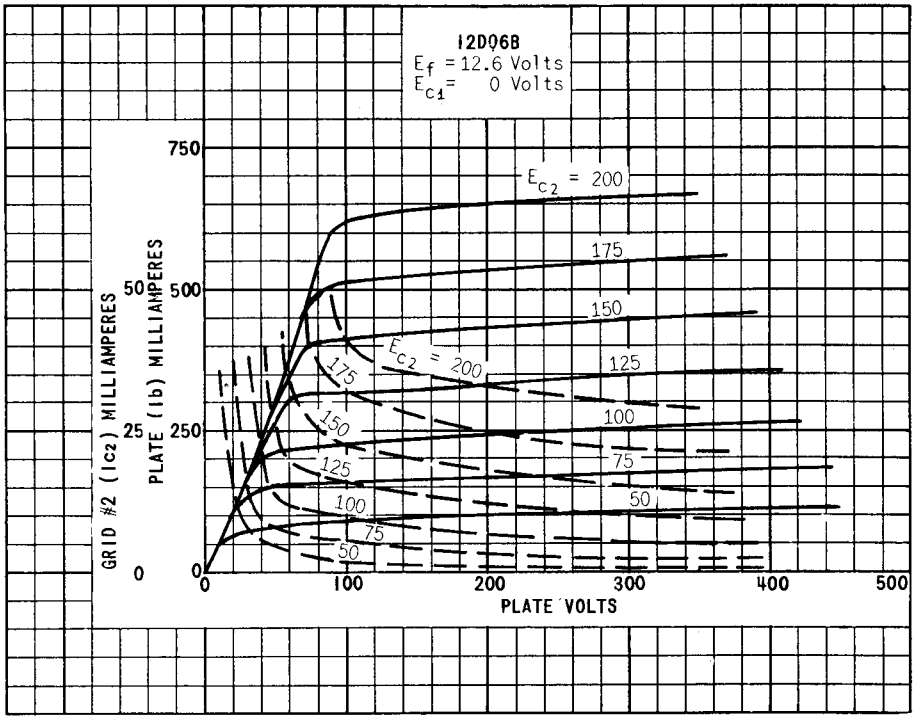
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	65	MA.
GRID #2 CURRENT	1.8	MA.
TRANSCONDUCTANCE	7300	μMHOS
PLATE RESISTANCE, APPROX.	18,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	27	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-42	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.4	

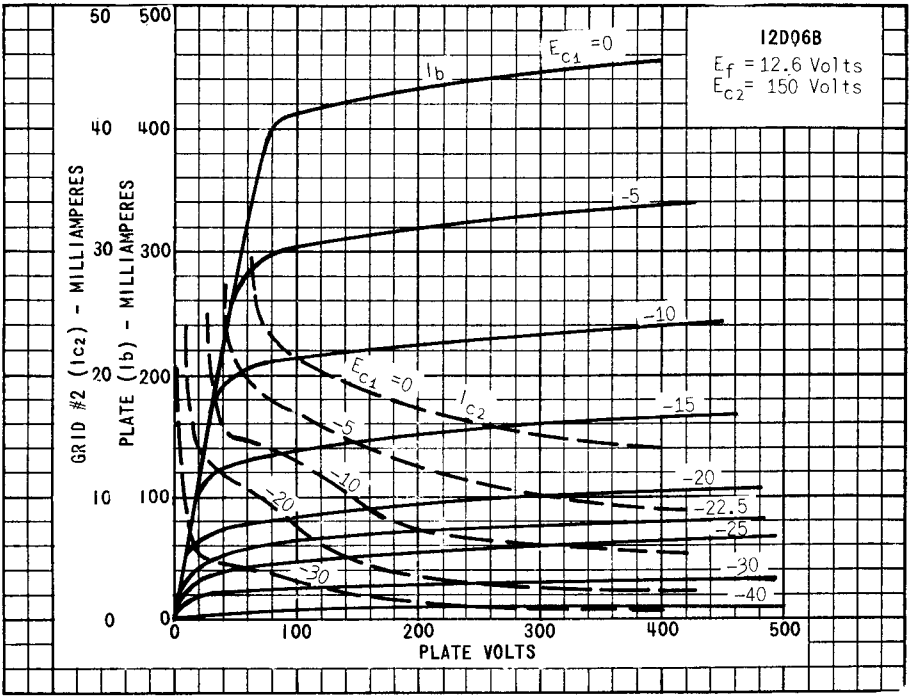
→ INDICATES A CHANGE.

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

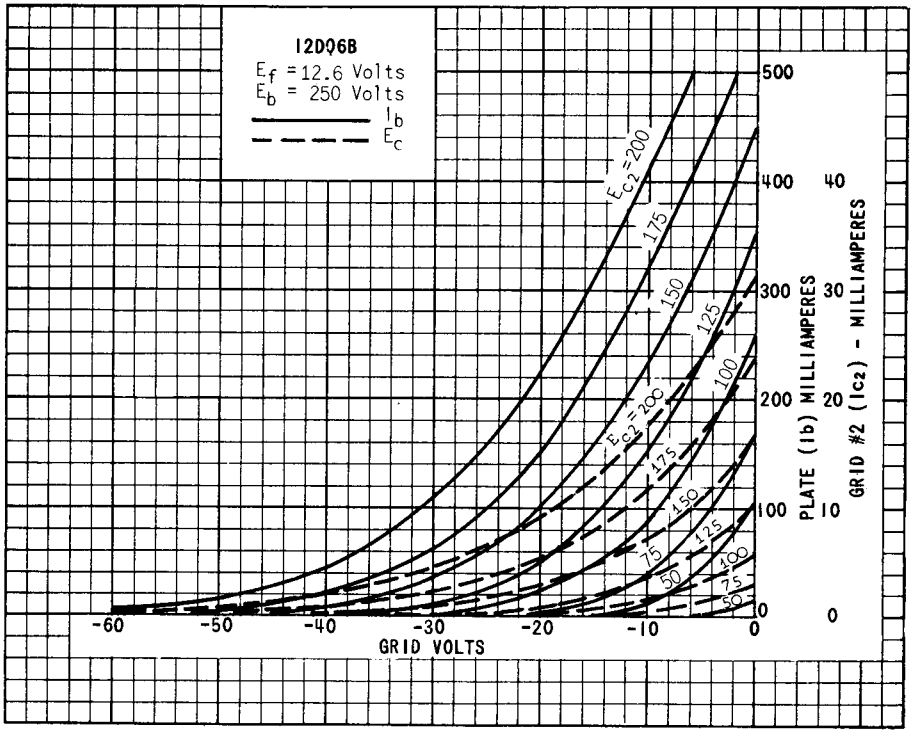
B IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


12DQ6B
E_f = 12.6 Volts
E_{c1} = 0 Volts
GRID #2 (I_{c2}) MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
E_{c2} = 200
175
150
125
100
75
50
0
100
200
300
400
500
250
750


12DQ6B
E_f = 12.6 Volts
E_{c2} = 150 Volts
GRID #2 (I_{c2}) - MILLIAMPERES
PLATE (I_b) - MILLIAMPERES
PLATE VOLTS
I_b
E_{c1} =0
-5
-10
-15
-20
-22.5
-25
-30
-40
I_{c2}
0
100
200
300
400
500
10
20
30
40
50

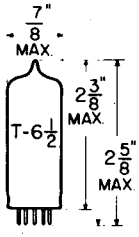
12DQ6B


12DQ6B
E_f = 12.6 Volts
E_b = 250 Volts
I_b
E_c
E_{c2} = 200
175
150
125
100
75
50
500
400
300
200
100
0
40
30
20
10
0
PLATE (Ib) MILLIAMPERES
GRID #2 (I_{c2}) - MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

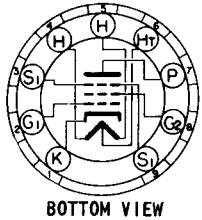
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
12.6±10% VOLTS	6.3 VOLTS
0.3 AMP.	0.6±6% AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE
98F

THE 12DQ7 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE AS THE VIDEO OUTPUT AMPLIFIER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.1	μμf
INPUT	10.0	μμf
OUTPUT	3.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	12.6±10%	6.3	VOLTS
MAXIMUM PLATE VOLTAGE		330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE		330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART		
MAXIMUM POSITIVE DC GRID #1 VOLTAGE		0	VOLTS
MAXIMUM PLATE DISSIPATION		6.5	WATTS
MAXIMUM SCREEN DISSIPATION		1.1	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS		0.25	MEGOHMS
WITH CATHODE BIAS		1.0	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*		11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

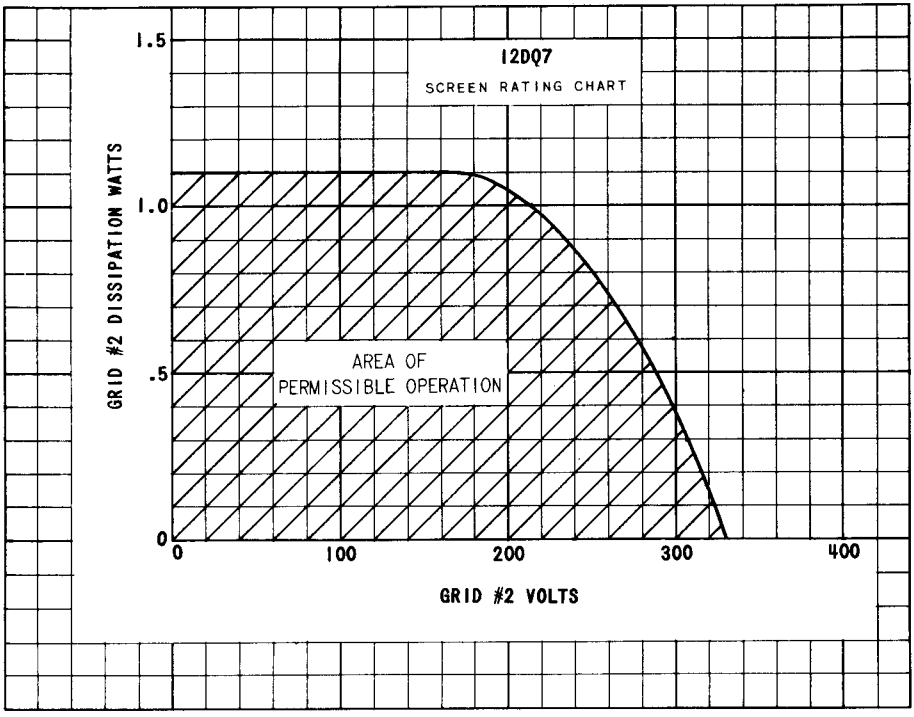
CLASS A_1 AMPLIFIER

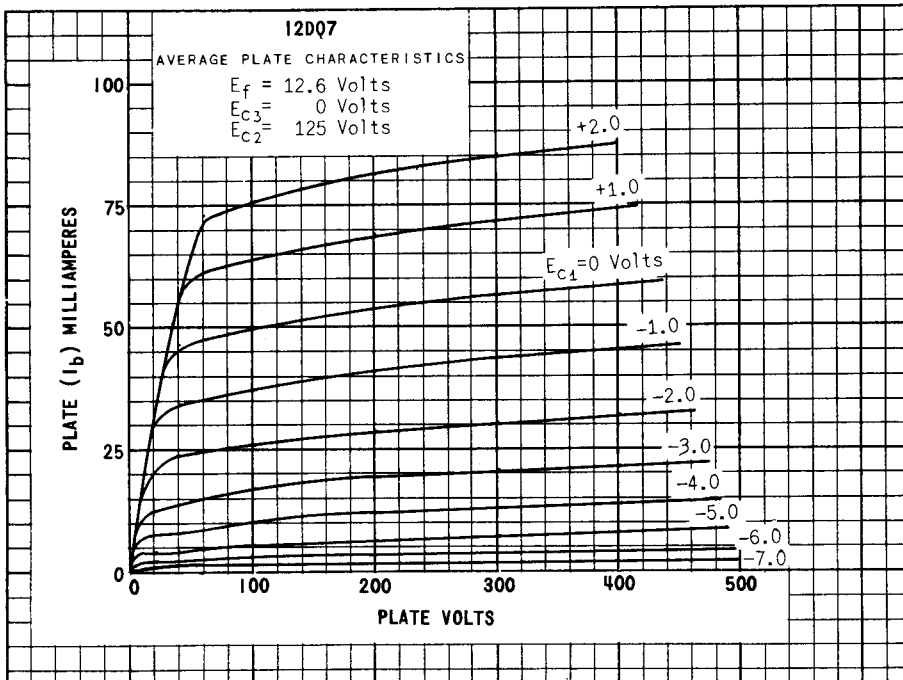
HEATER VOLTAGE		12.6±10%	6.3	VOLTS
HEATER CURRENT		0.3	0.6±6%	AMP.
PLATE VOLTAGE	40	200		VOLTS
SUPPRESSOR	CONNECTED TO CATHODE AT SOCKET			
SCREEN VOLTAGE	125	125		VOLTS
GRID #1 VOLTAGE	0[A]	---		VOLTS
CATHODE BIAS RESISTOR	---	68		OHMS
PLATE RESISTANCE, (APPROX.)	---	53 000		OHMS
TRANSCONDUCTANCE	---	10 500		μMHOS
PLATE CURRENT	45	26		MA.
SCREEN CURRENT	16	5.6		MA.
GRID #1 VOLTAGE (APPROX.) I_b = 100 μAMPS.	---	-9		VOLTS

[A] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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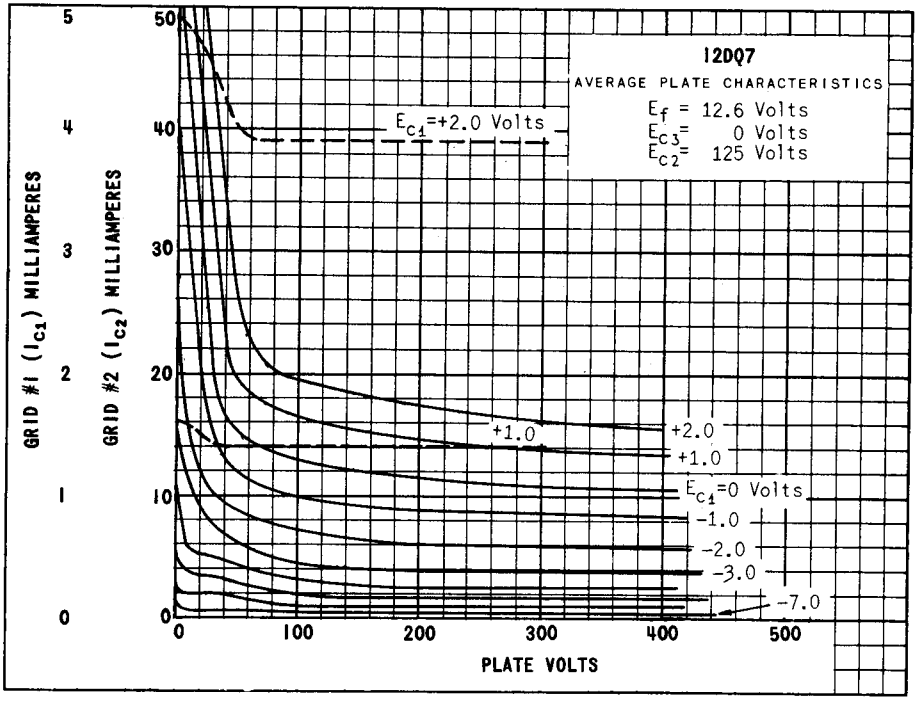
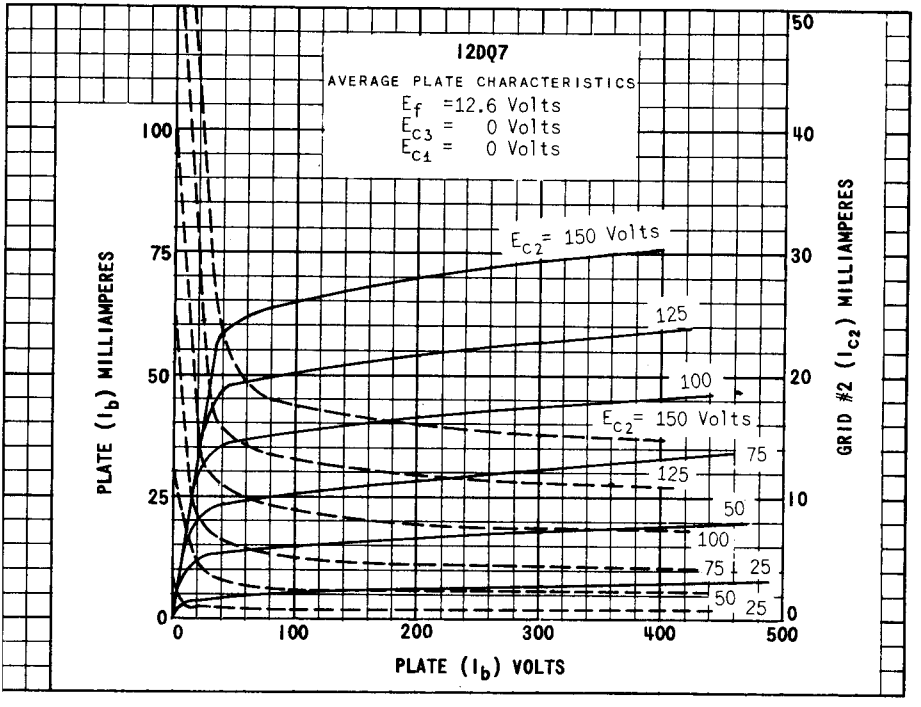
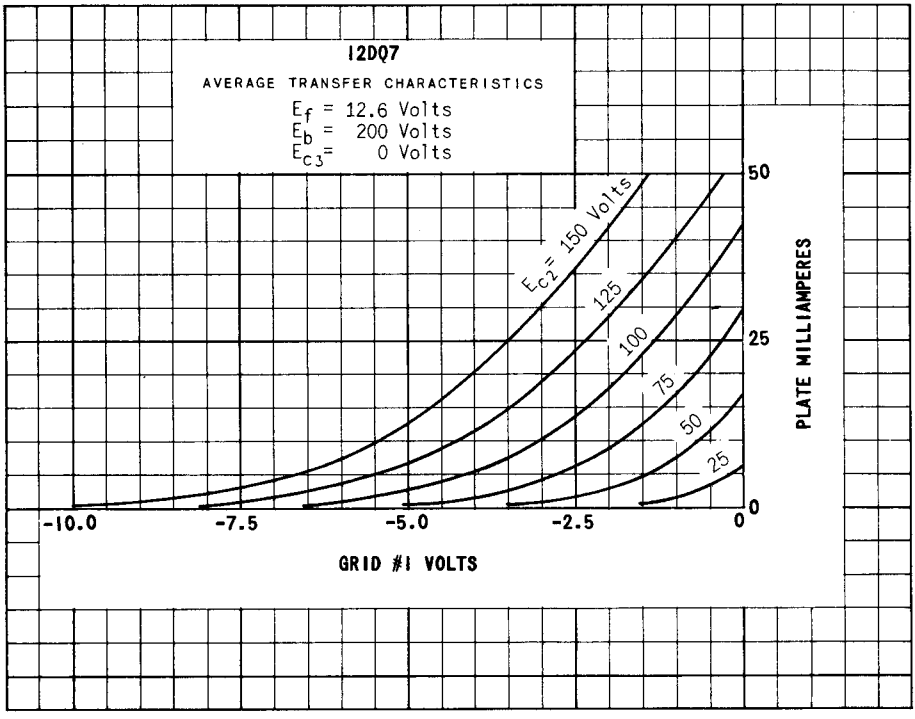
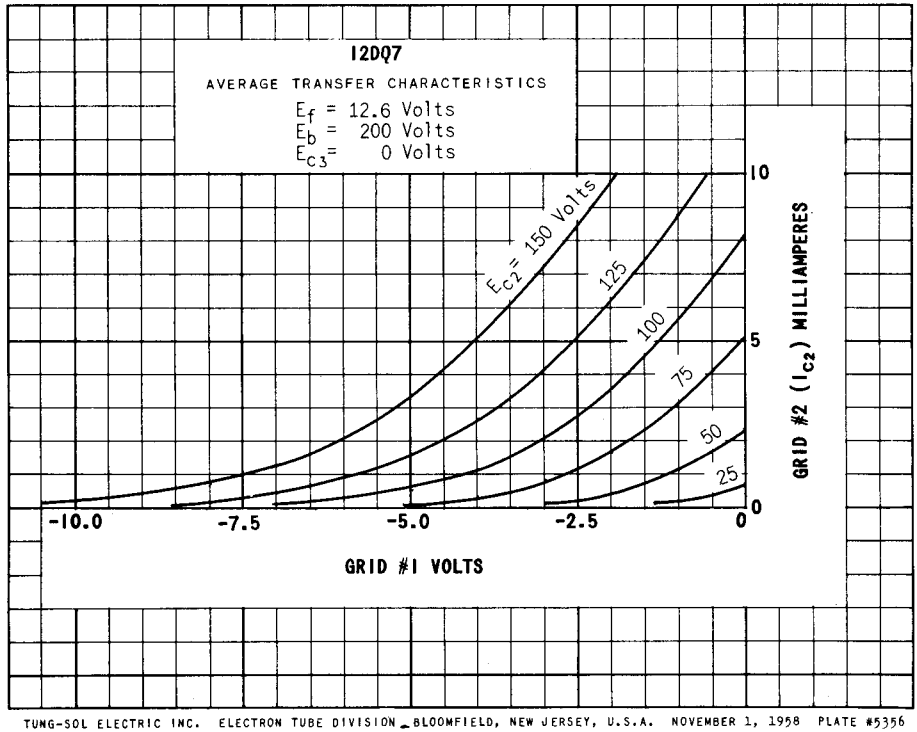

12DQ7
AVERAGE PLATE CHARACTERISTICS
E_f = 12.6 Volts
E_{c3} = 0 Volts
E_{c2} = 125 Volts
E_{c1}=+2.0 Volts
+1.0
+2.0
+1.0
E_{c1}=0 Volts
-1.0
-2.0
-3.0
-7.0
GRID #1 (I_{c1}) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
1
2
3
4
5
10
20
30
40
50


12DQ7
AVERAGE PLATE CHARACTERISTICS
E_f =12.6 Volts
E_{c3} = 0 Volts
E_{c1} = 0 Volts
E_{c2}= 150 Volts
125
100
E_{c2}= 150 Volts
75
125
50
100
75
25
50
25
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE (I_b) VOLTS
0
100
200
300
400
500
25
50
75
100
10
20
30
40
50





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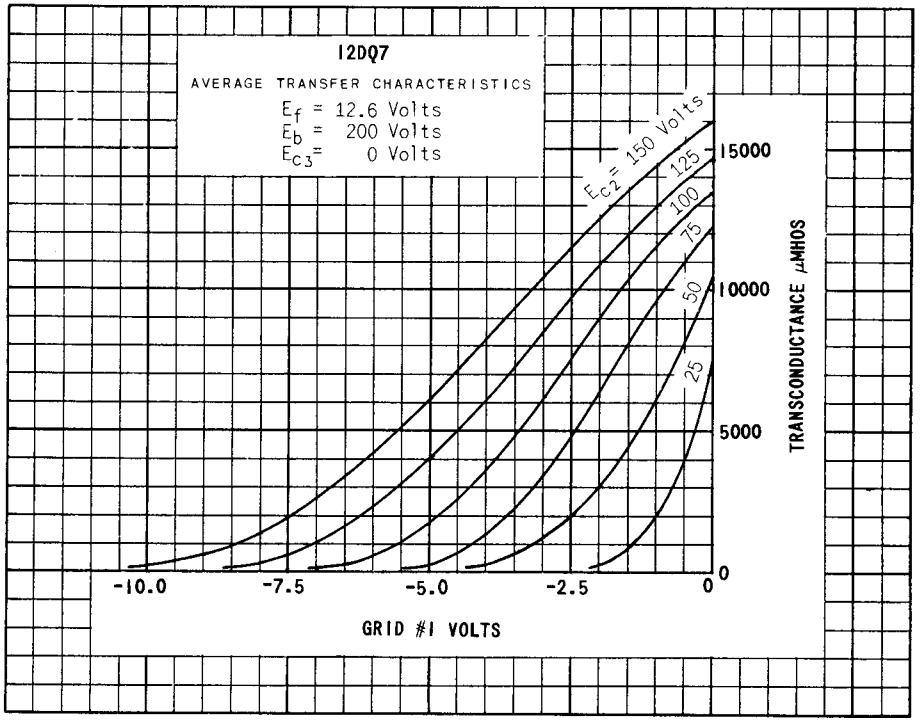
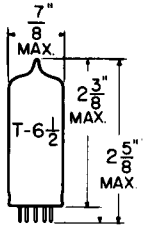

12DQ7
AVERAGE TRANSFER CHARACTERISTICS
E_f = 12.6 Volts
E_b = 200 Volts
E_{c3} = 0 Volts
E_{c2} = 150 Volts
125
100
75
50
25
15000
10000
5000
0
TRANSCONDUCTANCE μMHOS
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL

TWIN DIODE-TETRODE

MINIATURE TYPE



GLASS BULB

SMALL-BUTTON NOVAL 9 PIN BASE E9-1

OUTLINE DRAWING JEDEC 6-3

UNIPOTENTIAL CATHODE

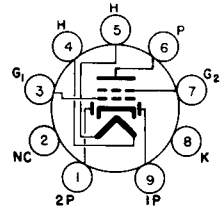
HEATER

12.6 VOLTS 0.4 AMP

AC OR DC

ANY MOUNTING POSITION

SPACE CHARGE GRID TETRODE



BOTTOM VIEW

BASING DIAGRAM JEDEC 9JU

THE 12DS7 IS A TWIN DIODE-POWER TETRODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN AUTOMOBILE RECEIVERS WHERE THE TUBE AND TRANSISTOR ELECTRODE VOLTAGES ARE OBTAINED DIRECTLY FROM A 12 VOLT BATTERY. IN THIS APPLICATION THE DIODE UNITS ARE USED FOR AM SIGNAL DETECTION AND AUTOMATIC VOLUME CONTROL. THE TETRODE UNIT IS USED AS THE DRIVER FOR THE TRANSISTORIZED AF POWER OUTPUT STAGE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TETRODE UNIT:

GRID #2 TO PLATE	→ 13	pf
GRID #2 TO GRID #1, HEATER & CATHODE	→ 13	pf
PLATE TO GRID #1, HEATER & CATHODE	→2.4	pf

DIODE UNITS:

DIODE PLATE #1 TO DIODE CATHODE & HEATER	0.5	pf
DIODE PLATE #2, TO DIODE CATHODE & HEATER	0.5	pf
DIODE PLATE #1, TO DIODE PLATE #2	0.1	pf
TETRODE GRID #2 TO DIODE PLATE #1 (MAX.)	→0.3	pf
TETRODE GRID #2 TO DIODE PLATE #2 (MAX.)	→0.3	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

TETRODE UNIT – AUDIO DRIVER SERVICE

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM GRID #2 (CONTROL-GRID) VOLTAGE		
NEGATIVE BIAS VALUE	16	VOLTS
MAXIMUM GRID #1 (SPACE-CHARGE-GRID) VOLTAGE	16	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DIODE UNITS - TWO
VALUES ARE FOR EACH UNIT

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM PLATE CURRENT	5	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS•
CLASS A_1 AMPLIFIER

HEATER VOLTAGE[A]	12.6	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL-GRID) VOLTAGE:		
DEVELOPED ACROSS A 2.2 MEGOHM RESISTOR	-0.5	VOLTS
GRID #1 (SPACE-CHARGE-GRID) VOLTAGE	12.6	VOLTS
PLATE RESISTANCE (APPROX.)	→ 500	OHMS
AMPLIFICATION FACTOR, GRID #2 TO PLATE	→ 8	
TRANSCONDUCTANCE, GRID #2 TO PLATE	→16 000	μMHOS
PLATE CURRENT	→ 35	MA.
GRID #1 CURRENT	75	MA.

TYPICAL OPERATION

TETRODE UNIT - AUDIO DRIVER SERVICE

PLATE SUPPLY VOLTAGE	→ 11.2	VOLTS
PLATE VOLTAGE[B]		
GRID #1 SUPPLY VOLTAGE	→ 11.2	VOLTS
GRID #2 SUPPLY VOLTAGE	0	VOLTS
GRID #2 RESISTOR	1.8	MEGOHMS
CATHODE RESISTOR	18	OHMS
PEAK AF GRID #2 SUPPLY VOLTAGE (APPROX.):		
FROM 3.3 MEGOHM SIGNAL SOURCE	→ 4.25	VOLTS
PLATE CURRENT:		
ZERO SIGNAL (APPROX.)	→ 20	MA.
INDICATED-SIGNAL	→ 7	MA.
GRID #1 CURRENT	→ 58	MA.
LOAD RESISTANCE	1250	OHMS
TOTAL HARMONIC DISTORTION (AT POWER OUTPUT OF 2.5 MW)	→ 5	PERCENT
INDICATED-SIGNAL POWER OUTPUT	→ 8	MW.

•WITH 12.6 VOLTS ON HEATER AND GRID #2 VOLTAGE OBTAINED BY A GRID #2 RESISTOR.

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

[B] OBTAINED FROM INDICATED PLATE SUPPLY THROUGH SERIES 100 HENRY CHOKE HAVING DC RESISTANCE OF 150 OHMS.

→ INDICATES A CHANGE

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

TYPICAL OPERATION

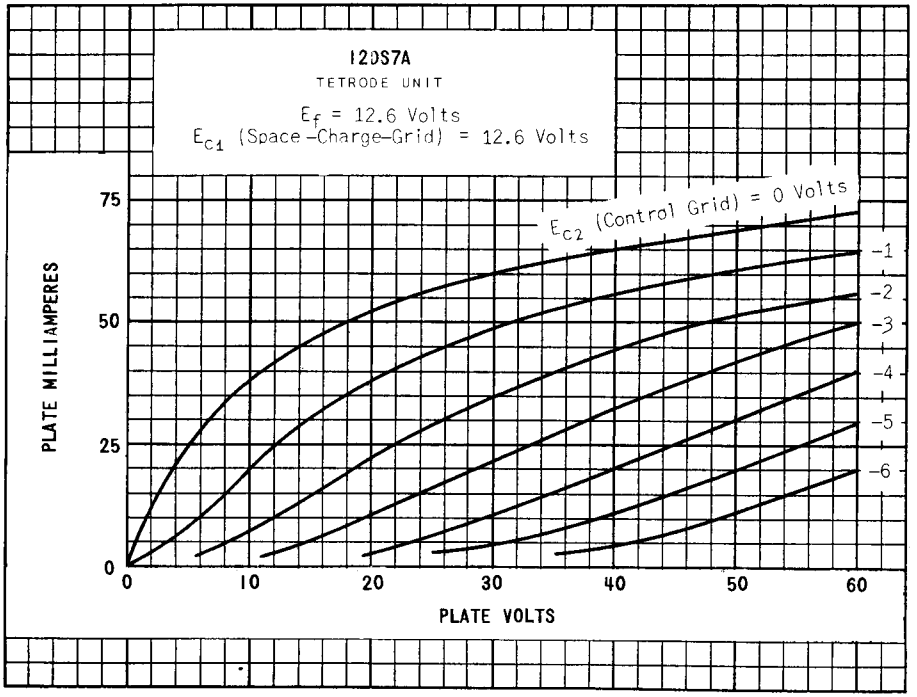
PLATE VOLTAGE		12.6	VOLTS
GRID #1 VOLTAGE		12.6	VOLTS
GRID #2 VOLTAGE:			
OBTAINED BY RECTIFICATION THROUGH A 2.2 MEGOHM RESISTOR	→	-1.6	VOLTS
PEAK AF GRID #2 SUPPLY VOLTAGE (APPROX.):			
FROM 0.22 MEGOHM SIGNAL SOURCE ←		2.5	VOLTS
PLATE CURRENT:			
ZERO SIGNAL (APPROX.)	→	35	MA.
MAXIMUM SIGNAL	→	15	MA.
GRID #1 CURRENT	→	80	MA.
LOAD RESISTANCE	→	700	OHMS
TOTAL HARMONIC DISTORTION		10	PERCENT
MAX. SIGNAL POWER OUTPUT	→	35	MW.
MAXIMUM CIRCUIT VALUES:			
GRID #2 CIRCUIT RESISTANCE		10	MEGOHMS

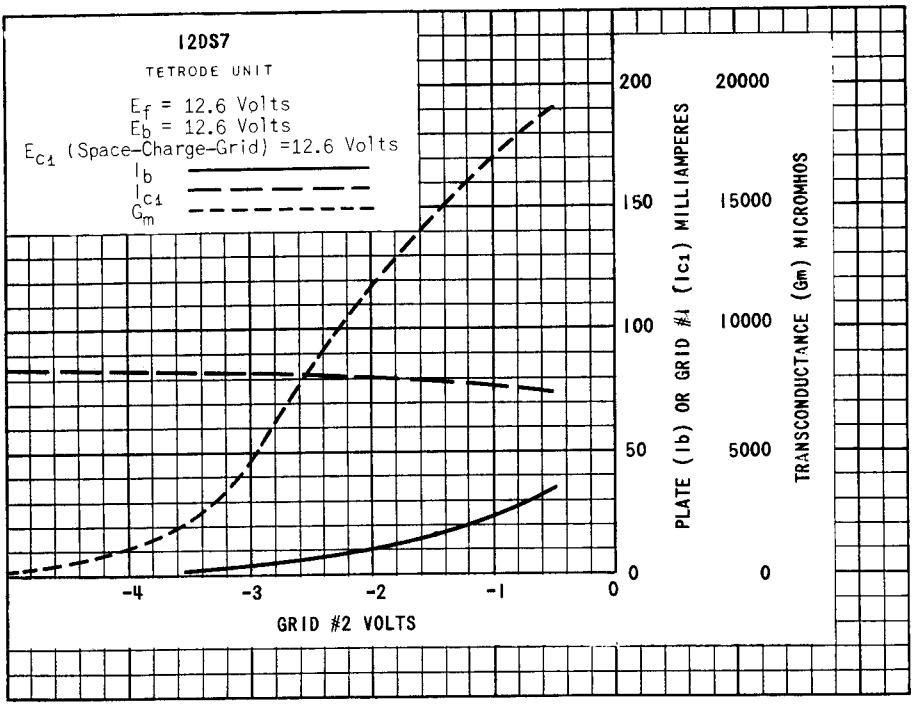
CHARACTERISTICS

DIODE UNITS - TWO
VALUES ARE FOR EACH UNIT

PLATE CURRENT FOR PLATE VOLTS = 10		3	MA.

→INDICATES A CHANGE.

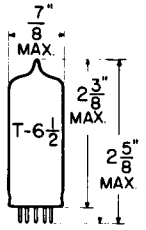



12DS7
TETRODE UNIT
E_f = 12.6 Volts
E_b = 12.6 Volts
E_{c_1} (Space-Charge-Grid) =12.6 Volts
I_b
I_{c_1}
G_m
200
150
100
50
0
20000
15000
10000
5000
0
PLATE (I_b) OR GRID #1 (I_{c_1}) MILLIAMPERES
TRANSCONDUCTANCE (Gm) MICROMHOS
-4
-3
-2
-1
0
GRID #2 VOLTS

TUNG-SOL

TWIN DIODE-TETRODE

MINIATURE TYPE



GLASS BULB

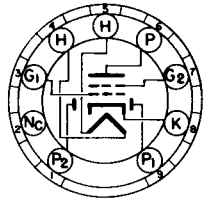
UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.4 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9JU

THE 12DS7A IS A TWIN DIODE AND A HIGH PERVEANCE POWER TETRODE OF THE SPACE-CHARGE-GRID TYPE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN "HYBRID" AUTOMOBILE RECEIVERS IN WHICH TUBE AND TRANSISTOR ELECTRODE VOLTAGES ARE OBTAINED DIRECTLY FROM A 6-ALL STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TETRODE UNIT:		
GRID #2 TO PLATE	13.8	μμf
GRID #2 TO GRID #1, HEATER & CATHODE	12.7	μμf
PLATE TO GRID #1, HEATER & CATHODE	2.2	μμf
DIODE UNITS:		
DIODE PLATE #1 TO DIODE CATHODE & HEATER	0.5	μμf
DIODE PLATE #2, TO DIODE CATHODE & HEATER	0.5	μμf
DIODE PLATE #1, TO DIODE PLATE #2	0.1	μμf
TETRODE GRID #2 TO DIODE PLATE #1	0.3	μμf
TETRODE GRID #2 TO DIODE PLATE #2	0.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

TETRODE UNIT – AUDIO DRIVER SERVICE

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM GRID #2 (CONTROL-GRID) VOLTAGE		
NEGATIVE BIAS VALUE	-16	VOLTS
MAXIMUM GRID #1 (SPACE-CHARGE-GRID) VOLTAGE	16	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS

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TUNG-SOL

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RATINGS - CONT'D
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DIODE UNITS - TWO
VALUES ARE FOR EACH UNIT

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM PLATE CURRENT	5	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[A]	12.6	VOLTS
HEATER CURRENT	0.4	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL-GRID) VOLTAGE:		
DEVELOPED ACROSS A 2.2 MEGOHM RESISTOR	-0.5	VOLTS
GRID #1 (SPACE-CHARGE-GRID) VOLTAGE	12.6	VOLTS
PLATE RESISTANCE (APPROX.)	500	OHMS
AMPLIFICATION FACTOR, GRID #2 TO PLATE	9.1	
TRANSCONDUCTANCE, GRID #2 TO PLATE	19 000	μMHOS
PLATE CURRENT	35	MA.
GRID #1 CURRENT	75	MA.

TYPICAL OPERATION
AS DRIVER FOR
TRANSISTORIZED AF POWER-OUTPUT STAGE

PLATE SUPPLY VOLTAGE	11.2	VOLTS
PLATE VOLTAGE[B]		
GRID #1 SUPPLY VOLTAGE	11.2	VOLTS
GRID #2 SUPPLY VOLTAGE	0	VOLTS
GRID #2 RESISTOR	1.8	MEGOHMS
CATHODE RESISTOR	18	OHMS
PEAK AF GRID #2 SUPPLY VOLTAGE (APPROX.):		
FROM 3.3 MEGOHM SIGNAL SOURCE	4.25	VOLTS
PLATE CURRENT:		
ZERO SIGNAL (APPROX.)	20	MA.
INDICATED SIGNAL	7	MA.
GRID #1 CURRENT	58	MA.
LOAD RESISTANCE	1250	OHMS
TOTAL HARMONIC DISTORTION (AT POWER OUTPUT OF 2.5 MW)	5	PERCENT
INDICATED SIGNAL POWER OUTPUT	10	MW.

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

[B] OBTAINED FROM INDICATED PLATE SUPPLY THROUGH SERIES 100 HENRY CHOKE HAVING DC RESISTANCE OF 150 OHMS.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

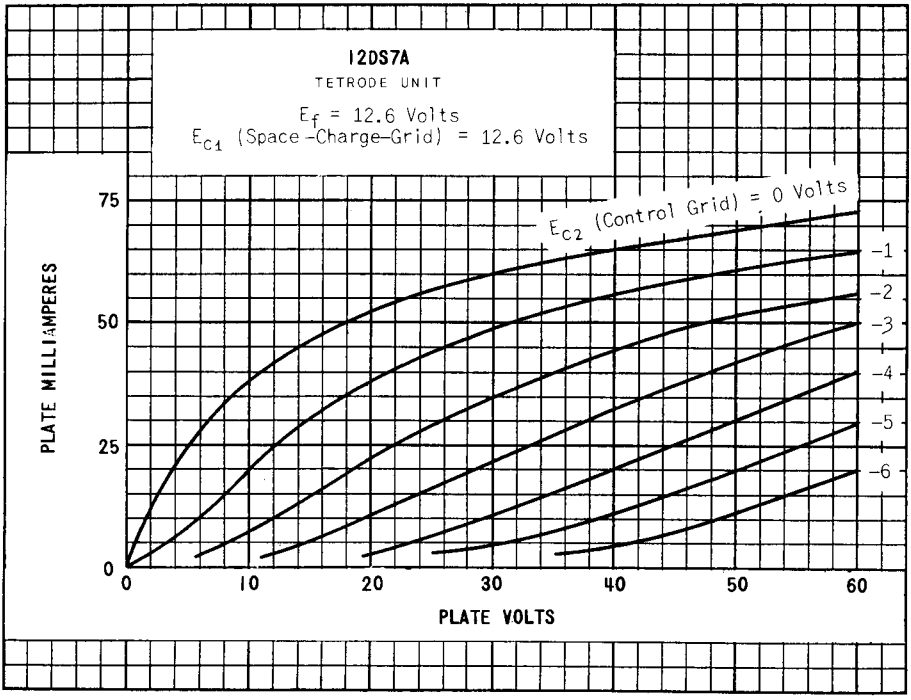
TYPICAL OPERATION

PLATE VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE	12.6	VOLTS
GRID #2 VOLTAGE:		
OBTAINED BY RECTIFICATION THROUGH A 2.2 MEGOHM RESISTOR	-2.5	VOLTS
PEAK AF GRID #2 VOLTAGE (APPROX.): FROM 0.22 MEGOHM SIGNAL SOURCE	2.5	VOLTS
PLATE CURRENT:		
ZERO SIGNAL (APPROX.)	35	MA.
MAXIMUM SIGNAL	11	MA.
GRID #1 CURRENT	80	MA.
LOAD RESISTANCE	700	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAX. SIGNAL POWER OUTPUT	45	MW.
MAXIMUM CIRCUIT VALUES:		
GRID #2 CIRCUIT RESISTANCE	10	MEGOHMS

CHARACTERISTICS

DIODE UNITS - TWO
VALUES ARE FOR EACH UNIT

PLATE CURRENT FOR PLATE VOLTS = 10	3	MA.



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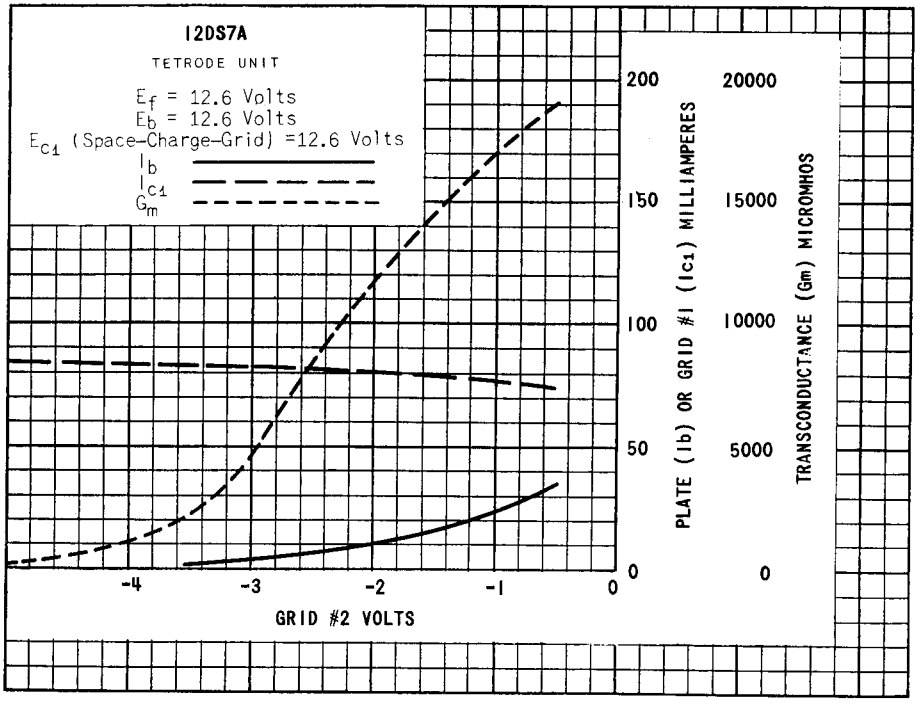
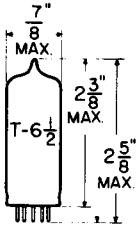
TENTATIVE DATA



TUNG-SOL

BEAM-POWER PENTODE

MINIATURE TYPE



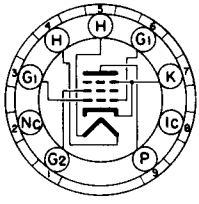
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.60±6% AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
SMALL-BUTTON
9 PIN BASE

9HN

THE 12DT5 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A VERTICAL DEFLECTION OUTPUT AMPLIFIER IN TELEVISION RECEIVERS UTILIZING A 110° DEFLECTION ANGLE PICTURE TUBE AND A B+ SUPPLY VOLTAGE OF 250 VOLTS. IT HAS HIGH ZERO BIAS PLATE CURRENT AND A HIGH PLATE CURRENT TO GRID #2 CURRENT RATIO. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 12DT5 IS IDENTICAL TO THE 6DT5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.57	μμf
INPUT	12.5	μμf
OUTPUT	4.9	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION SERVICE[B]

DEFLECTING 110° PICTURE TUBE

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 200	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	-250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9.0	WATTS
MAXIMUM GRID #2 DISSIPATION	2.0	WATTS
MAXIMUM CATHODE CURRENT:		
AVERAGE	55	MA.
PEAK	190	MA.
MAXIMUM HEATER POSITIVE OR NEGATIVE WITH RESPECT TO[⊕] CATHODE (TOTAL DC AND PEAK)	200	VOLTS
MAXIMUM GRID #1 CIRCUIT VALUES		
FIXED BIAS	0.5	MEGOHM
CATHODE BIAS	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[*]	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	0.60±6%	0.60±6%	0.60±6%	AMP.
PLATE VOLTAGE	60	80 ←	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	150	250	250	VOLTS
GRID #1 VOLTAGE	0[E]	0[E]	-16.5	VOLTS
TRANSCONDUCTANCE	---	---	6 200	μMHOS
PLATE CURRENT	→ 95	195[F]	44	MA.
GRID #2 CURRENT	→ 8.5	19[F]	1.5	MA.
GRID #1 CUTOFF VOLTAGE[G]	---	---	-35	VOLTS

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[E] APPLIED FOR SHORT INTERVAL (MAXIMUM OF 2 SECONDS) SO AS NOT TO DAMAGE TUBE.

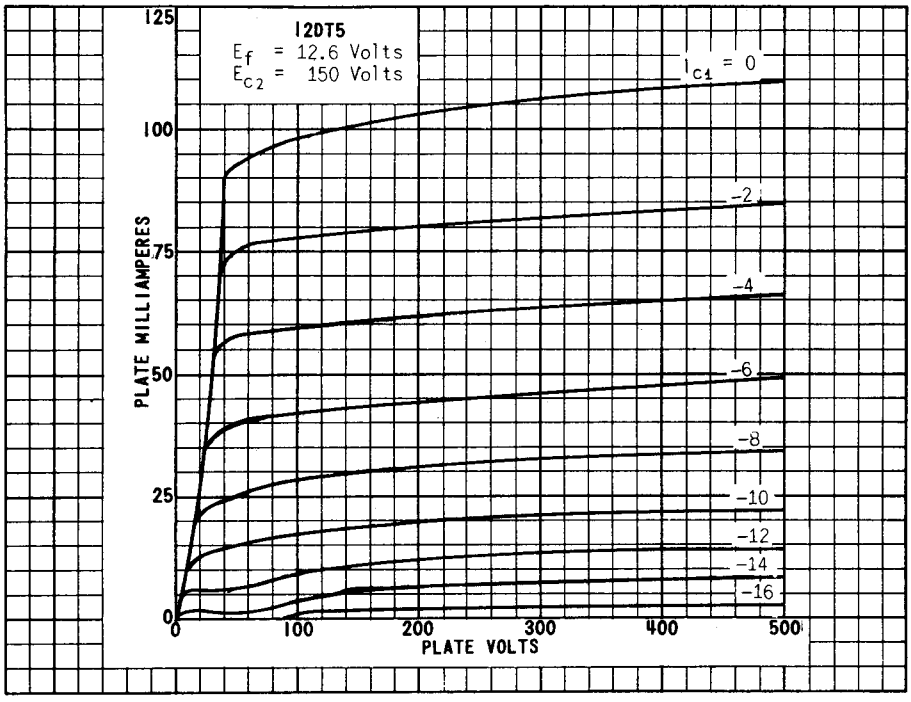
[F] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

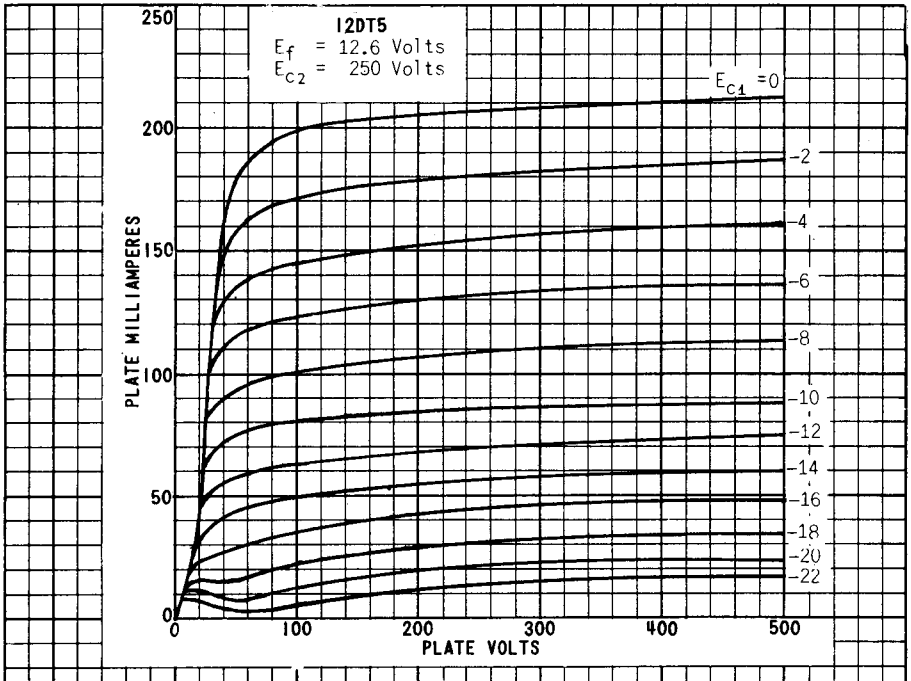
[G] FOR PLATE CURRENT OF 100 μAMPERES.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

⊕ DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.





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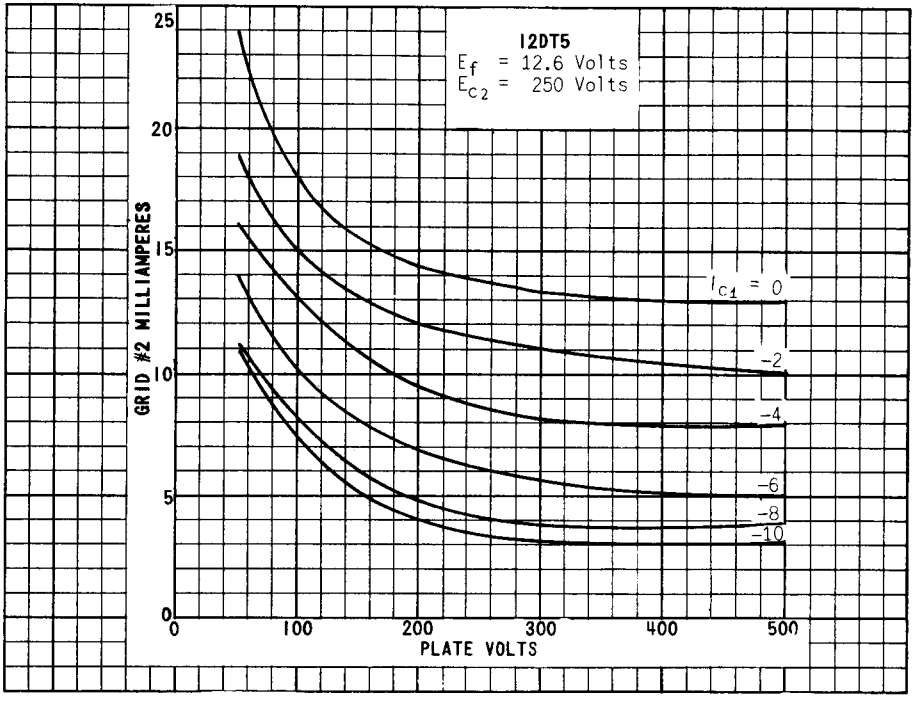
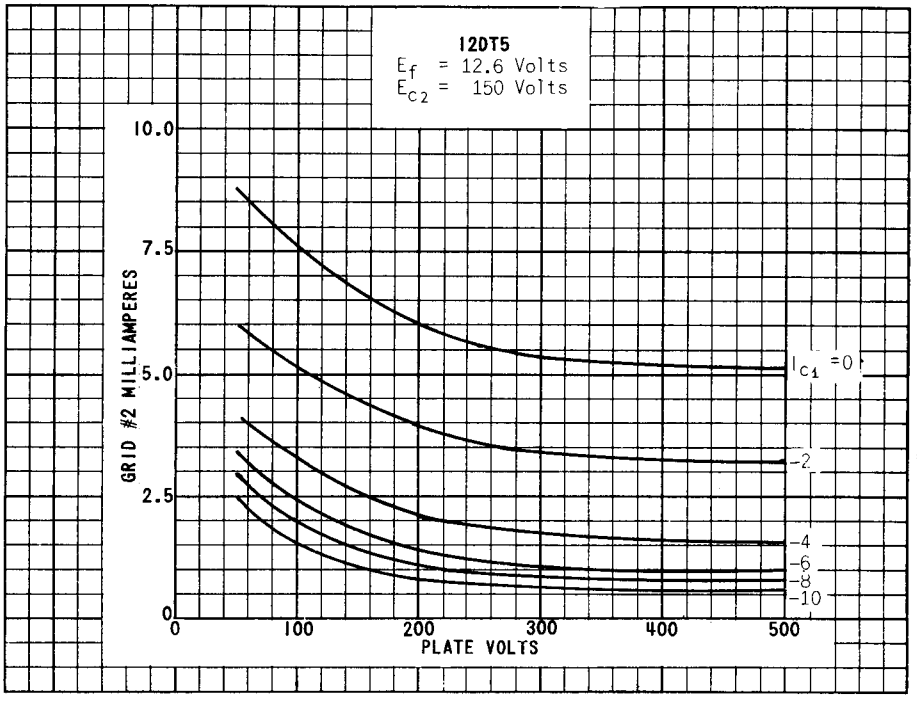
12DT5


12DT5
E_f = 12.6 Volts
E_{c_2} = 250 Volts
GRID #2 MILLIAMPERES
25
20
15
10
5
0
0
100
200
300
400
500
PLATE VOLTS
I_{c_1} = 0
-2
-4
-6
-8
-10


12DT5
E_f = 12.6 Volts
E_{c_2} = 150 Volts
GRID #2 MILLIAMPERES
10.0
7.5
5.0
2.5
0
0
100
200
300
400
500
PLATE VOLTS
I_{c_1} =0
-2
-4
-6
-8
-10

TUNG-SOL

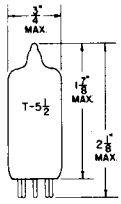
PENTODE

MINIATURE TYPE

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPS.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTON VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

7EM

THE 12DT6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN FM DETECTOR IN TELEVISION RECEIVERS. DESIGNED SO THAT GRID #1 AND GRID #3 CAN EACH BE USED AS INDEPENDENT SHARP CUTOFF CONTROL ELECTRODES, THE TUBE MAY ALSO BE USED IN DELAY CIRCUITS, GAIN-CONTROLLED AMPLIFIER CIRCUITS, AND MIXER CIRCUITS. WITH THE EXCEPTION OF HEATER WARM-UP TIME AND HEATER CHARACTERISTICS, IT IS IDENTICAL TO THE 6DT6.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH EXTERNAL SHIELD, #316, CONNECTED TO CATHODE

GRID #1 TO PLATE	0.02	μμf
GRID #1 TO GRID #3	0.1	μμf
GRID #3 TO ALL OTHER ELECTRODES	6.1	μμf
GRID #1 TO GRID #2, GRID #3, HEATER, AND INTERNAL SHIELD AND CATHODE	5.8	μμf
GRID #3 TO PLATE	1.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

FM DETECTOR SERVICE

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM GRID #3 (SUPPRESSOR) VOLTAGE	28	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	330	VOLTS
MAXIMUM GRID #2 (SCREEN) VOLTAGE	SEE RATING CHART	
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 165 VOLTS	1.1	WATTS
FOR GRID #2 VOLTAGES BETWEEN 165 AND 330 VOLTS	SEE RATING CHART	
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100[A]	VOLTS
HEATER WARM-UP TIME (APPROX.) *	11	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE SUPPLY VOLTAGE	150	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #2 SUPPLY VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	560	OHMS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHM
TRANSCONDUCTANCE:		
GRID #1 TO PLATE	800	μMHOS
GRID #3 TO PLATE	515	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-4.5	VOLTS
GRID #3 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μAMP	-3.5	VOLTS
PLATE CURRENT	1.1	MA.
GRID #2 CURRENT	2.1	MA.

TYPICAL OPERATION IN THE ACCOMPANYING LOCKED-OSCILLATOR, QUADRATURE-GRID FM DETECTOR CIRCUIT AT A CARRIER FREQUENCY OF 4.5 MC:

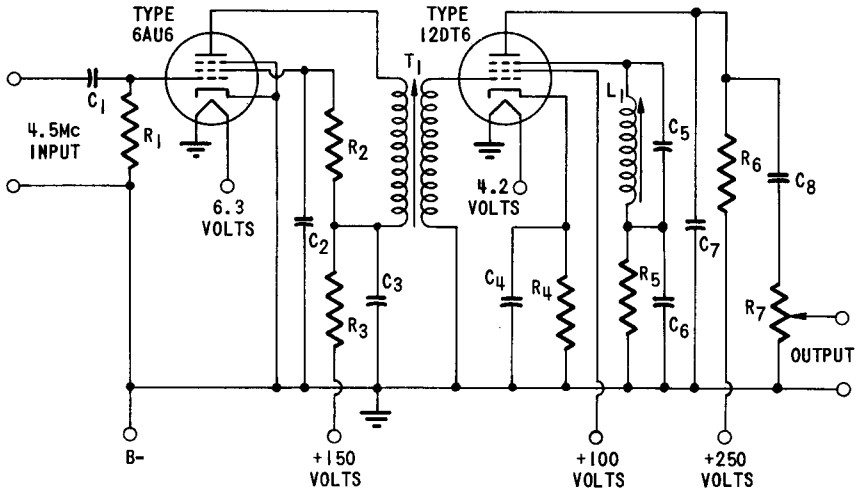
INPUT SIGNAL TO GRID OF DRIVER TUBE	15	200	500	MV RMS
PLATE SUPPLY VOLTAGE	250	250	250	VOLTS
GRID #3 VOLTAGE (OBTAINED FROM A 560000-OHM RESISTOR)	-5	-6	-6.4	VOLTS
GRID #2 SUPPLY VOLTAGE	100	100	100	VOLTS
CATHODE-BIAS RESISTOR	560	560	560	OHMS
PLATE LOAD RESISTOR	0.27	0.27	0.27	MEGOHM
PLATE CURRENT	0.23	0.22	0.21	MA.
GRID #2 CURRENT	3.4	5.5	6	MA.
GRID #1 CURRENT	0.013	0.6	0.8	MA.
BANDWIDTH:				
FOR A TOTAL HARMONIC DISTORTION OF 10 PERCENT	65	120	118	KC
AM REJECTION (APPROX.)[B]	33	29	28	DB
AUDIO OUTPUT VOLTAGE (RMS, APPROX.):				
WITH ± 7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	5.5	6.5	7.5	VOLTS
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	17	21	23	VOLTS
TOTAL HARMONIC DISTORTION:				
WITH ± 25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC	2	3	4	PERCENT
SENSITIVITY:				
WITH ±7.5-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			5[C]	MILLIVOLTS
WITH ±25-KC DEVIATION FROM MEAN VALUE OF 4.5 MC			15[C]	MILLIVOLTS
MAXIMUM CIRCUIT VALUES:				
GRID #1 CIRCUIT RESISTANCE:				
FOR FIXED-BIAS OPERATION			0.25	MEGOHM
FOR CATHODE-BIAS OPERATION			0.5	MEGOHM

[B] RATIO OF THE AUDIO OUTPUT VOLTAGE PRODUCED BY 30-PERCENT AMPLITUDE MODULATION OF THE 4.5-MC CARRIER FREQUENCY TO THE AUDIO OUTPUT PRODUCED BY ± 25-KC DEVIATION FROM THE 4.5-MC CARRIER FREQUENCY, WITH A MODULATING FREQUENCY OF 400 CPS IN BOTH CASES.

[C] SIGNAL LEVEL AT WHICH DETECTOR CIRCUIT WILL HANDLE THE INDICATED DEVIATION IN FREQUENCY FROM THE MEAN VALUE OF 4.5 MC, BEFORE DISTORTION OCCURS.

TUNG-SOL

LOCKED-OSCILLATOR, QUADRATURE-GRID DETECTOR CIRCUIT UTILIZING TYPE 12DT6



C_1: 47μμf, 400 VOLTS
C_2 C_3: 0.01μf, 400 VOLTS
C_4: 0.01μf, 200 VOLTS
C_5: 18μμf, 200 VOLTS
C_6: 0.05μf, 200 VOLTS
C_7: 100 TO 1000μμf, 400 VOLTS
C_8: 0.01μf, 400 VOLTS

L_1: SLUG-TUNED INDUCTOR WITH Q OF 50 AND TUNEABLE TO 4.5-MC.

R_1: 100000 OHMS, 0.5 WATT
R_2: 12000 OHMS, 0.5 WATT
R_3: 1000 OHMS, 0.5 WATT
R_4: 560 OHMS, 0.5 WATT
R_5: 560000 OHMS, 0.5 WATT
R_6: 270000 OHMS, 0.5 WATT
R_7: 0.5 MEGOHM POTENTIOMETER

T_1: SLUG-TUNED, BIFILAR WOUND IF TRANSFORMER WITH RATIO OF 1:1.5, Q>60, AND TUNEABLE TO 4.5-MC WITH TUBE AND WIRING CAPACITANCE.

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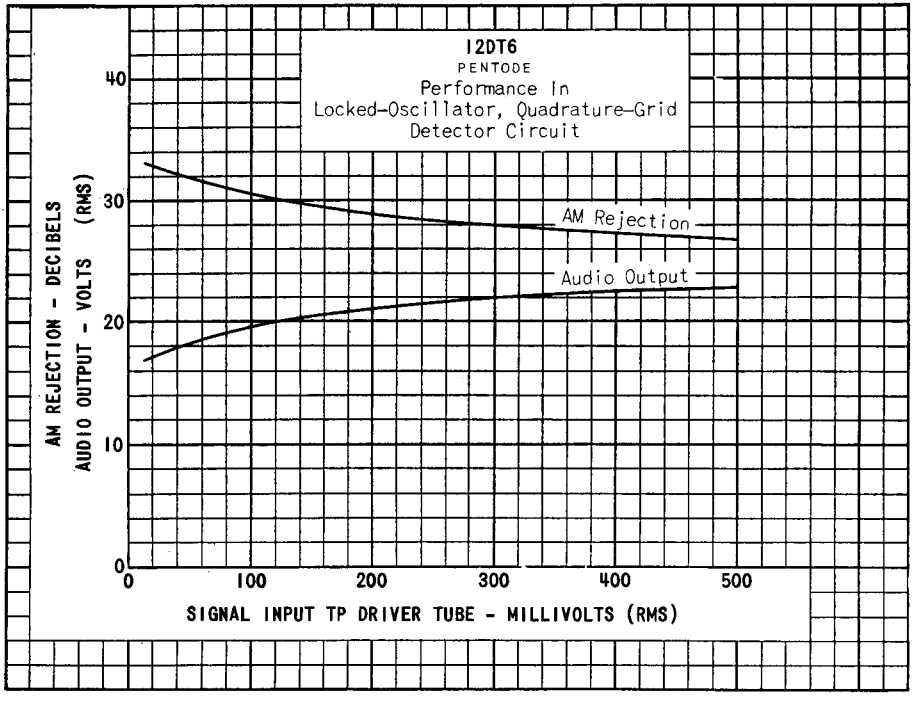
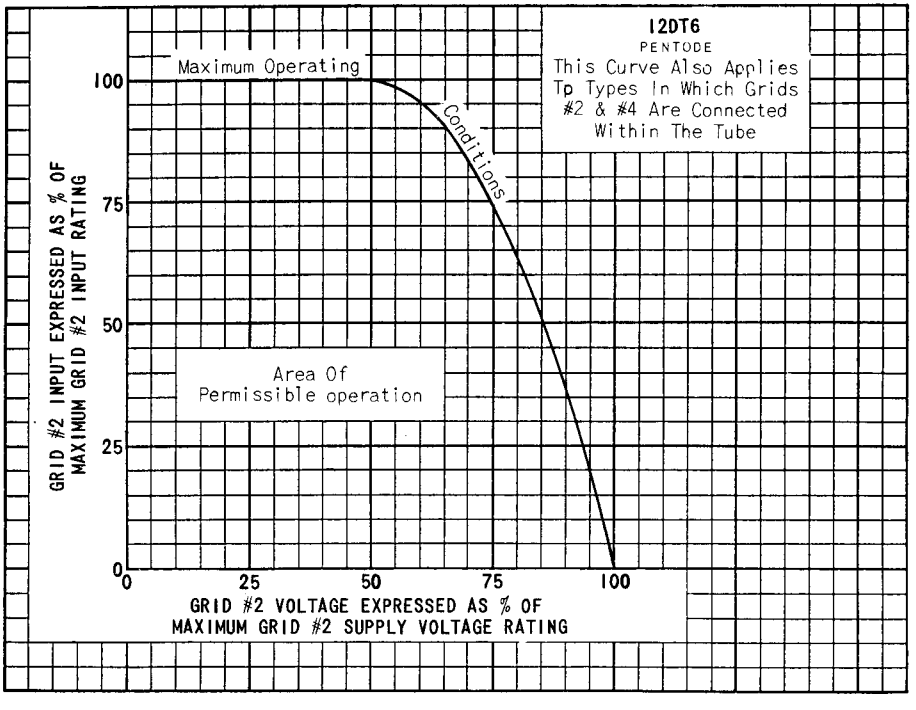
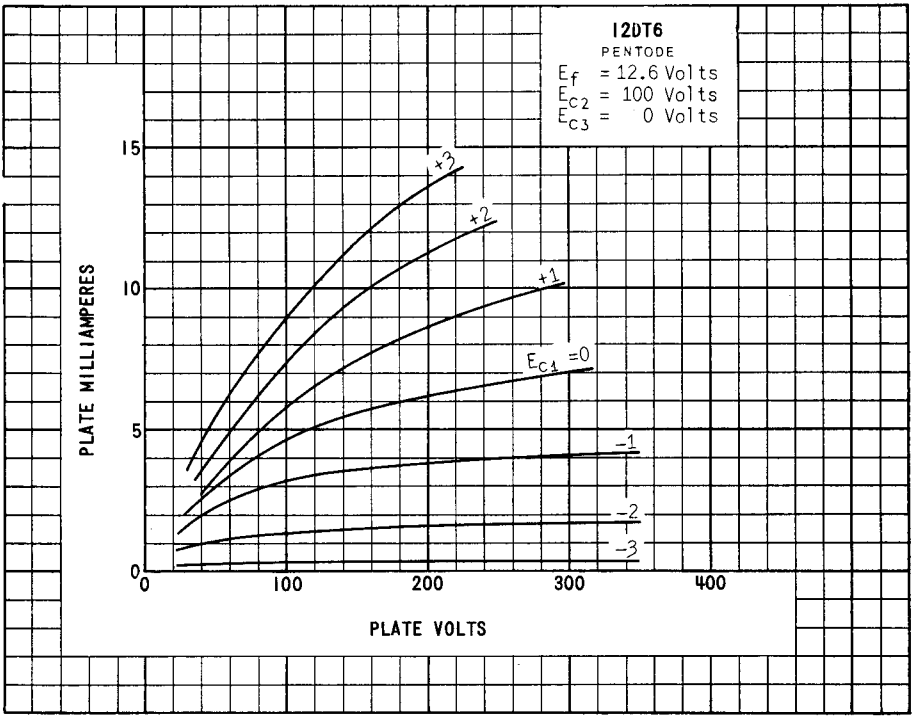
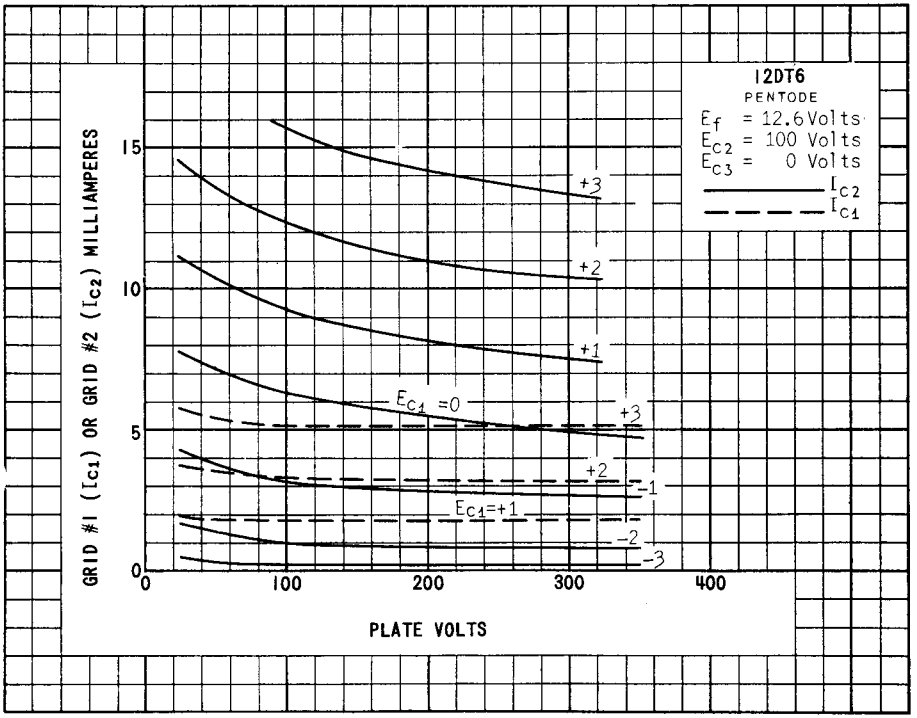

12DT6
PENTODE
Performance In
Locked-Oscillator, Quadrature-Grid
Detector Circuit
AM Rejection
Audio Output
AM REJECTION - DECIBELS
AUDIO OUTPUT - VOLTS (RMS)
0
10
20
30
40
0
100
200
300
400
500
SIGNAL INPUT TP DRIVER TUBE - MILLIVOLTS (RMS)


12DT6
PENTODE
This Curve Also Applies
Tp Types In Which Grids
#2 & #4 Are Connected
Within The Tube
Maximum Operating
Conditions
Area Of
Permissible operation
GRID #2 INPUT EXPRESSED AS % OF
MAXIMUM GRID #2 INPUT RATING
0
25
50
75
100
0
25
50
75
100
GRID #2 VOLTAGE EXPRESSED AS % OF
MAXIMUM GRID #2 SUPPLY VOLTAGE RATING





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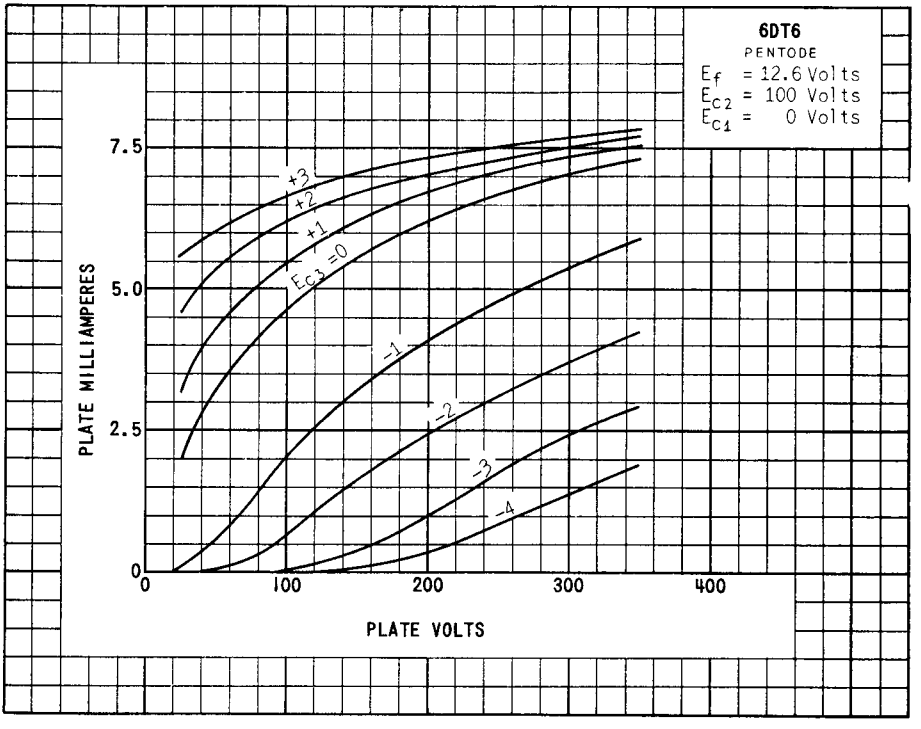
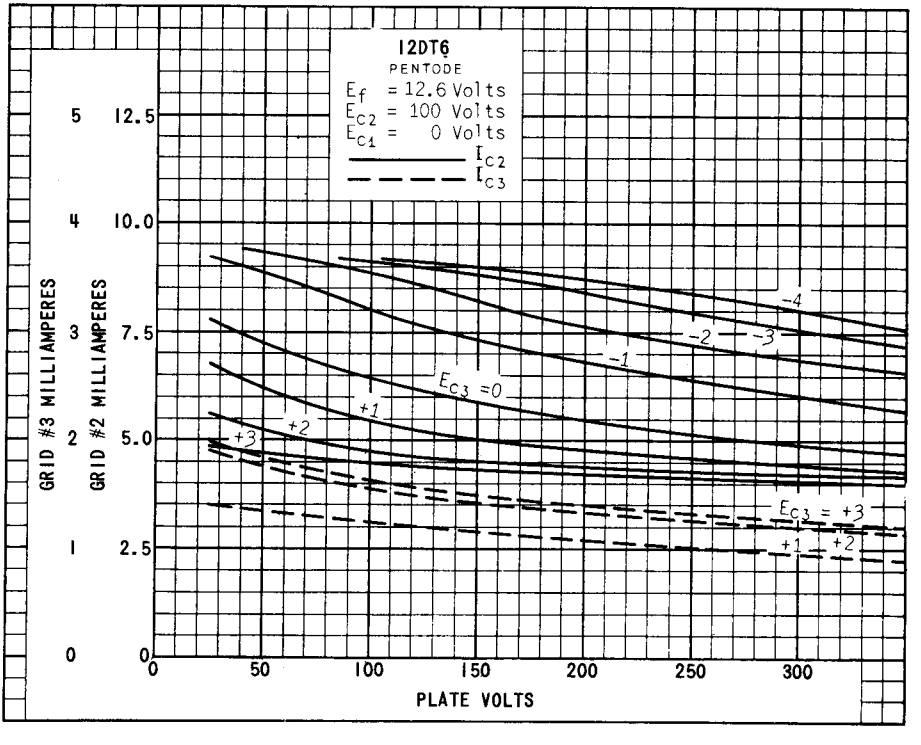
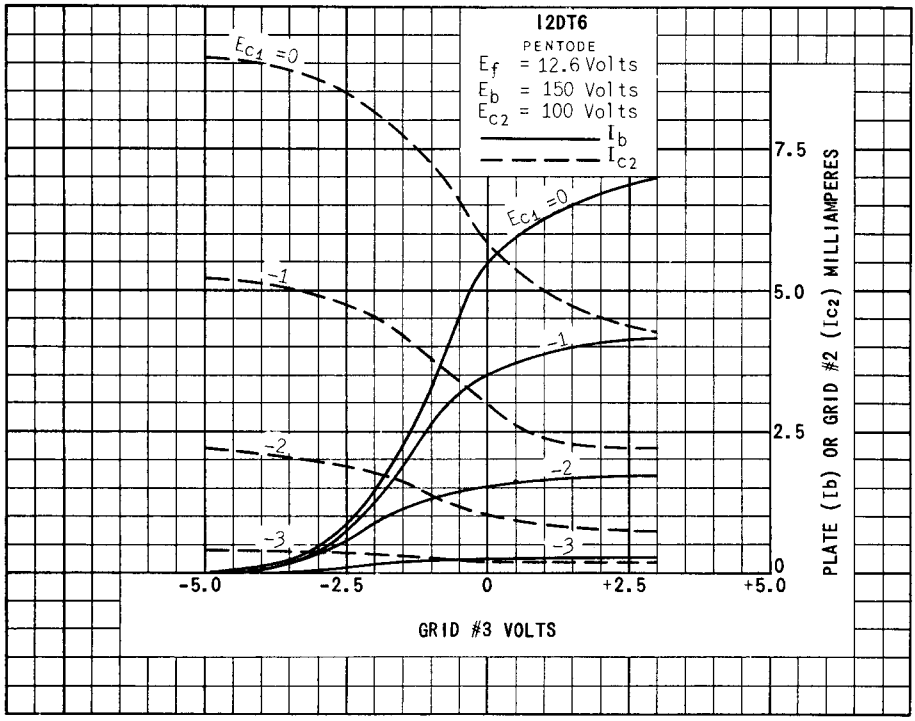
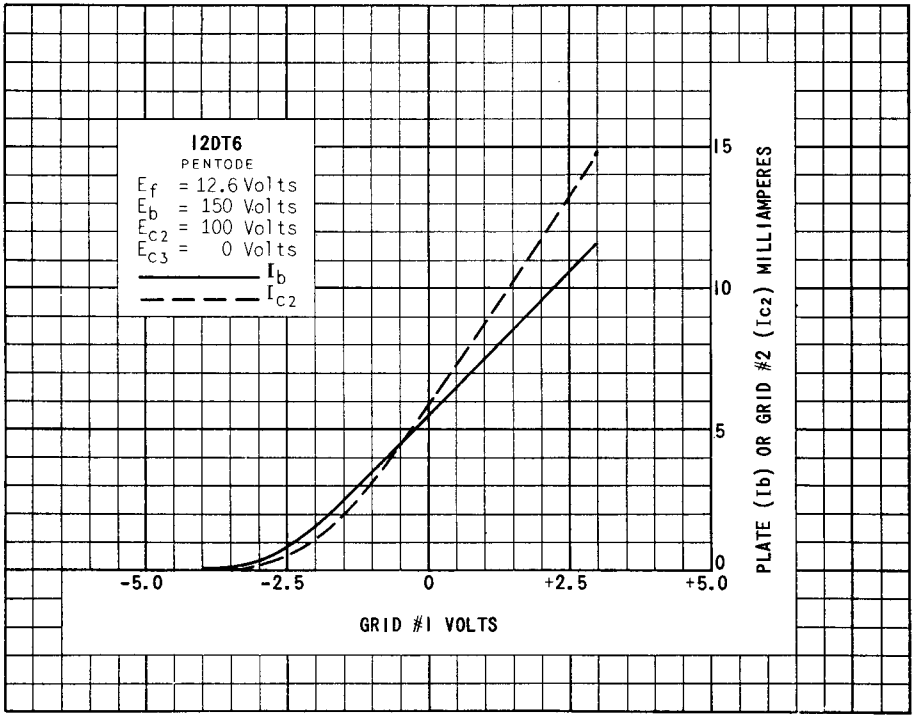

6DT6
PENTODE
E_f = 12.6 Volts
E_{C2} = 100 Volts
E_{C1} = 0 Volts
PLATE MILLIAMPERES
7.5
5.0
2.5
0
+3
+2
+1
E_{C3} =0
-1
-2
-3
-4
0
100
200
300
400
PLATE VOLTS


12DT6
PENTODE
E_f = 12.6 Volts
E_{C2} = 100 Volts
E_{C1} = 0 Volts
I_{C2}
I_{C3}
GRID #3 MILLIAMPERES
GRID #2 MILLIAMPERES
5
4
3
2
1
0
12.5
10.0
7.5
5.0
2.5
0
-4
-2
-3
-1
E_{C3} =0
+1
+2
+3
E_{C3} = +3
+1
+2
0
50
100
150
200
250
300
PLATE VOLTS

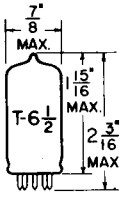

12DT6
PENTODE
Ef = 12.6 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ib
Ic2
Ec1 =0
-1
-2
-3
7.5
5.0
2.5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #3 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES


12DT6
PENTODE
Ef = 12.6 Volts
Eb = 150 Volts
Ec2 = 100 Volts
Ec3 = 0 Volts
Ib
Ic2
15
10
5
0
-5.0
-2.5
0
+2.5
+5.0
GRID #1 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

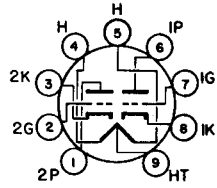
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.15 AMPS.	0.3 AMPS.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9A

THE 12DT7 IS A HEATER-CATHODE TYPE HIGH-MU DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR USE AS A RESISTANCE-COUPLED VOLTAGE AMPLIFIER IN CRITICAL AUDIO DESIGNS WHERE LOW NOISE AND HUM ARE OF PRIMARY CONSIDERATION. IN OTHER RESPECTS IT IS SIMILAR TO TYPE 12AX7.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID TO PLATE	1.7	1.7	μμf
INPUT	1.6	1.6	μμf
OUTPUT	0.46	0.34	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH UNIT

HEATER VOLTAGE	6.3/12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	180	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	180	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE - BIAS VALUE	50	VOLTS
POSITIVE - BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM PEAK HEATER-CATHODE VOLTAGE	180	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE		6.3/12.6		VOLTS
HEATER CURRENT		0.3/0.15		AMPS.
PLATE VOLTAGE	100		250	VOLTS
GRID VOLTAGE	−1		−2	VOLTS
AMPLIFICATION FACTOR	100		100	
PLATE RESISTANCE	80 000		62 500	OHMS
TRANSCONDUCTANCE	1 250		1 600	μMHOS
PLATE CURRENT	0.5		1.2	MA.

BALLISTIC NOISE LEVEL — EACH UNIT

AVERAGE VALUE	+5	DB
PLATE SUPPLY	250	VOLTS
PLATE LOAD RESISTOR	220	KILOHMS
CATHODE RESISTOR	3 000	OHMS
CATHODE BY-PASS CAPACITOR	100	μf
GRID RESISTOR	20	KILOHMS

AMPLIFIER COVERING FREQUENCY RANGE OF 30 TO 12,000 CPS. ±2db: FOR A SENSITIVITY OF 20mV IN, FOR 50mw OUT: EQUIVALENT TO 17 db: USING A HAND MALLET PER MIL-E-1C PAR. 4.10.3 AND PAR. 4.10.3.5. ←

EQUIVALENT NOISE AND HUM VOLTAGE
UNITS IN PARALLEL

AVERAGE VALUE	−46	DB
PLATE SUPPLY	100	VOLTS
PLATE LOAD RESISTOR	110	KILOHMS
CATHODE RESISTOR (UNBYPASSED)	2 400	OHMS
GRID RESISTOR	0	OHMS

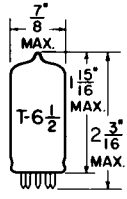
AMPLIFIER FREQUENCY RESPONSE ± 0.5 db 20 TO 30,000 CPS @ 1 WATT OUT GAIN 110 db.

⟶ INDICATES A CHANGE

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

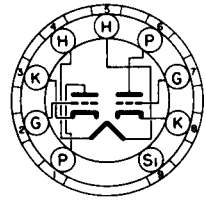


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON
9-PIN NOVAL
9DE

THE 12DT8 IS A GENERAL-PURPOSE HIGH-MU TWIN TRIODE OF THE 9-PIN MINIATURE TYPE INTENDED FOR USE AS AN RF AMPLIFIER AND AS A COMBINED OSCILLATOR-MIXER IN FM TUNERS. THIS TUBE IS ALSO USEFUL IN A WIDE VARIETY OF APPLICATIONS IN RADIO AND TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACTANCES - APPROX.

WITH EXTERNAL SHIELD

	UNIT #1	UNIT #2	
GRID-DRIVE OPERATION:[A]			
GRID TO PLATE	1.6	1.6	μμf
GRID TO CATHODE, HEATER & I.S.	2.7	2.7	μμf
PLATE TO CATHODE, HEATER & I.S.	1.6	1.6	μμf
HEATER TO CATHODE	3.0	3.0	μμf
CATHODE-DRIVE OPERATION:[B]			
CATHODE TO GRID, HEATER, & I.S.	---	5.3	μμf
PLATE TO GRID, HEATER, & I.S.	---	2.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS A1 AMPLIFIER

EACH UNIT

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE BIAS VALUE	50	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[C]	VOLTS
MAXIMUM GRID-CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.25	MEGOHM
FOR CATHODE-BIAS OPERATION	1	MEGOHM

[A] WITH EXTERNAL SHIELD, #315 CONNECTED TO CATHODE OF UNIT UNDER TEST.

[B] WITH EXTERNAL SHIELD, #315, CONNECTED TO GRID OF UNIT UNDER TEST.

[C] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

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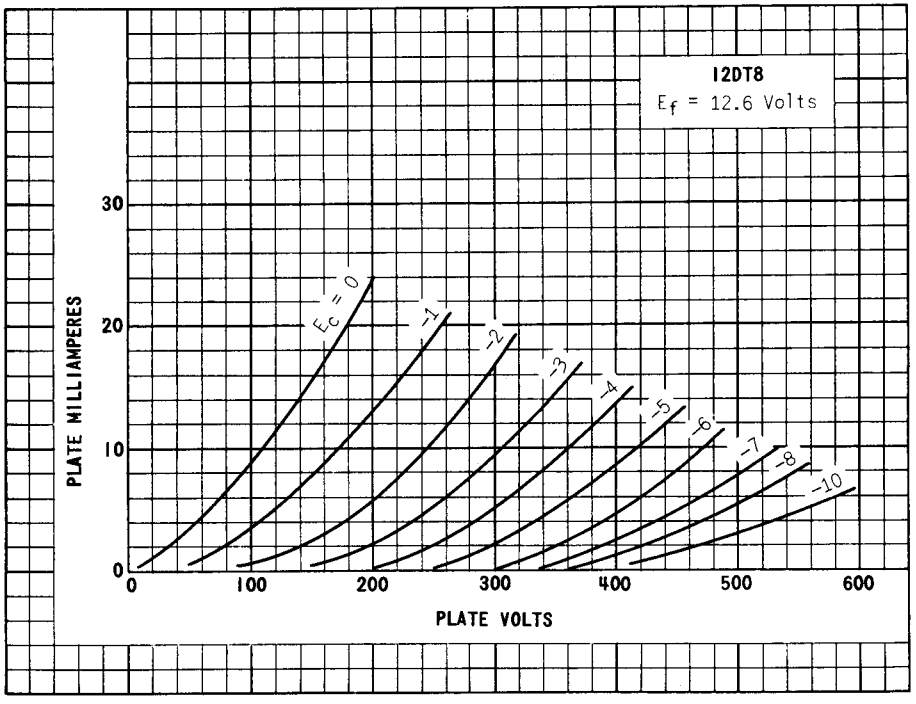
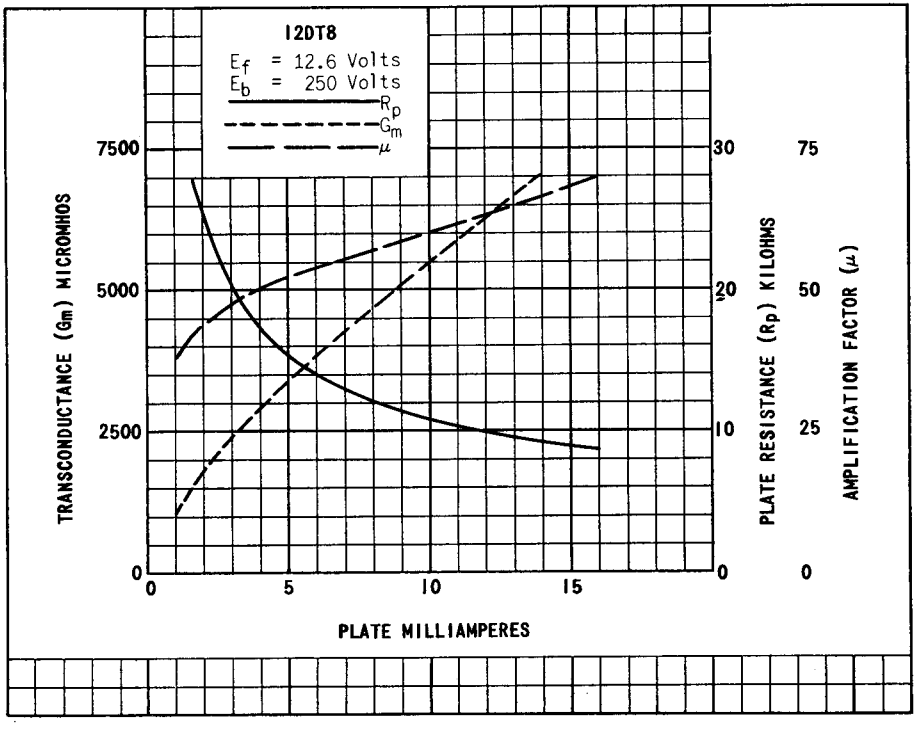
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH UNIT

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE-SUPPLY VOLTAGE	100	250	VOLTS
CATHODE-BIAS RESISTOR	270	200	OHMS
AMPLIFICATION FACTOR	60	60	
PLATE RESISTANCE (APPROX.)	15 000	10 900	OHMS
TRANSCONDUCTANCE	4 000	5 500	μMHOS
PLATE CURRENT	3.7	10	MA.
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT OF 10 μA.	-5	-12	VOLTS

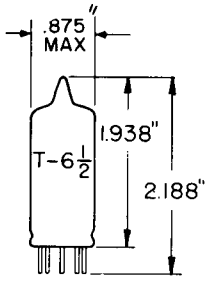



12DT8
E_f = 12.6 Volts
E_b = 250 Volts
R_p
G_m
μ
TRANSCONDUCTANCE (Gm) MICROMHOS
7500
5000
2500
0
PLATE RESISTANCE (Rp) KILOHMS
30
20
10
0
AMPLIFICATION FACTOR (μ)
75
50
25
0
0
5
10
15
PLATE MILLIAMPERES

TUNG-SOL

DUO-DIODE TETRODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

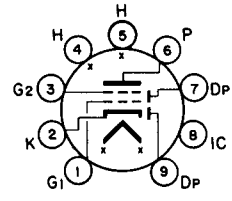
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.250 AMP. ←

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9JX

THE 12DU7 IS A DUO – DIODE, TETRODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED DETECTOR, AVC RECTIFIER AND AUDIO POWER AMPLIFIER DRIVER IN APPLICATIONS WHERE THE HEATER, PLATE, AND SCREEN VOLTAGES ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TETRODE SECTION:

GRID #1 TO PLATE	0.6	pf
INPUT: G1 TO (H+TK+G2)	11	pf
OUTPUT: P TO (H+TK+G2)	3.6	pf
GRID #1 TO DIODE PLATE #1 (MAX.)	0.22	pf
GRID #1 TO DIODE PLATE #2 (MAX.)	0.12	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM GRID #2 VOLTAGE	16	VOLTS
MAXIMUM GRID #1 RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT (EACH DIODE)	1.0	MA.

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

→ INDICATES A CHANGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 RESISTOR[C]	2.2	MEGOHMS
AF GRID VOLTAGE (RMS)	1.6	VOLTS
PLATE CURRENT	12	MA.
GRID #2 CURRENT	1.5	MA.
TRANSCONDUCTANCE	6 200	μMHOS
PLATE RESISTANCE (APPROX.)	6 000	OHMS
LOAD RESISTANCE	2 700	OHMS
MAXIMUM SIGNAL POWER OUTPUT	25	MW.
TOTAL HARMONIC DISTORTION	10	PERCENT
AVERAGE DIODE CURRENT WITH 10V. DC APPLIED, (EA. DIODE)	1.3	MA.

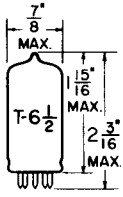
[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] AVERAGE CONTACT POTENTIAL BIAS DEVELOPED ACROSS SPECIFIED GRID RESISTOR.

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE



GLASS BULB

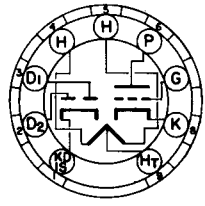
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9JY

THE 12DV7 IS A DOUBLE DIODE, MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A SECOND DETECTOR AUDIO AMPLIFIER IN APPLICATIONS WHERE THE HEATER AND PLATE VOLTAGES ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.6	μμf
INPUT: G TO (H TK)	1.3	μμf
OUTPUT: P TO (H TK)	0.38	μμf
DIODE PLATE #1 TO GRID (MAX.)	0.005	μμf
DIODE PLATE #2 TO GRID (MAX.)	0.005	μμf
DIODE PLATE #1 TO DIODE PLATE #2 (MAX.)	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM VALUES[A]

HEATER VOLTAGE[B]	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT (EACH DIODE)	1.0	MA.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
PLATE VOLTAGE	12.6	VOLTS
GRID VOLTAGE[C]		
GRID RESISTOR	2.2	MEGOHMS
PLATE CURRENT	400	μA
TRANSCONDUCTANCE	750	μMHOS
AMPLIFICATION FACTOR	14	
PLATE RESISTANCE	19 000	OHMS
EC FOR Ib = 10 μA. (APPROX.)	-2	VOLTS
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED (EACH DIODE)[D]	1.3	MA.

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

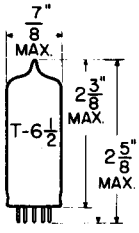
[C] AVERAGE CONTACT POTENTIAL BIAS DEVELOPED ACROSS SPECIFIED GRID RESISTOR.

[D] TEST CONDITION ONLY.

TUNG-SOL

DUPLEX-DIODE TETRODE

MINIATURE TYPE

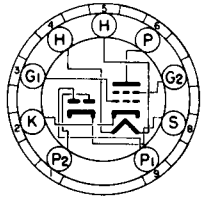


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.375 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9HR

THE 12DV8 IS A DUPLEX-DIODE, SPACE-CHARGE-GRID TETRODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A COMBINED DETECTOR, AVC RECTIFIER, AND TRANSISTOR DRIVER. THE TETRODE SECTION IS SPECIALLY DESIGNED TO OPERATE WITH ITS PLATE AND SPACE-CHARGE-GRID VOLTAGES SUPPLIED DIRECTLY FROM A 12 VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TETRODE GRID #2 TO PLATE	12	μμf
TETRODE INPUT	9.0	μμf
TETRODE OUTPUT	1.0	μμf
TETRODE GRID #2 TO ANY DIODE PLATE (MAX.)	0.015	μμf
DIODE #1 INPUT	1.7	μμf
DIODE #2 INPUT	1.6	μμf
DIODE #1 PLATE TO DIODE #2 PLATE (MAX.)	0.10	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6[A]	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM NEGATIVE CONTROL-GRID VOLTAGE	16	VOLTS
MAXIMUM SPACE-CHARGE-GRID VOLTAGE	16	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM CONTROL-GRID CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA.DIODE)	5.0	MA.

[A] WHEN USED IN AUTOMOTIVE SERVICE FROM A 12-VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS: HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.375	AMP.
PLATE VOLTAGE	12.6	VOLTS
CATHODE RESISTOR	18	OHMS
CONTROL GRID RESISTOR	4.7	MEGOHMS
SPACE-CHARGE-GRID VOLTAGE	12.6	VOLTS
AMPLIFICATION FACTOR[B]	7.6	
PLATE RESISTANCE (APPROX.)	900	OHMS
TRANSCONDUCTANCE[B]	8 500	μMHOS
PLATE CURRENT	9.0	MA.
SPACE-CHARGE-GRID CURRENT	53	MA.
AVERAGE DIODE CURRENT (EACH DIODE) WITH 10 VOLTS DC APPLIED	3.0	MA.

CLASS A AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.375	AMP.
PLATE VOLTAGE	12.6	VOLTS
CATHODE RESISTOR	18	OHMS
CONTROL-GRID RESISTOR	4.7	MEGOHMS
SPACE-CHARGE-GRID VOLTAGE	12.6	VOLTS
PEAK AF CONTROL-GRID VOLTAGE	1.2	VOLTS
AF SIGNAL SOURCE RESISTANCE	300 000	OHMS
MAXIMUM SIGNAL PLATE CURRENT	6.8	MA.
SPACE-CHARGE-GRID CURRENT	54	MA.
LOAD RESISTANCE	1 250	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	3	PERCENT
POWER OUTPUT	5	MW.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] CONTROL GRID TO PLATE.

TUNG-SOL

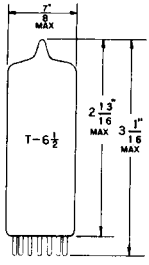
BEAM POWER PENTODE

MINIATURE TYPE

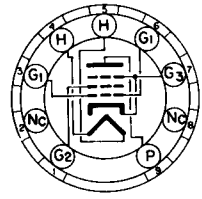
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9CK

THE 12DW5 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR VERTICAL DEFLECTION AMPLIFIER SERVICE IN TELEVISION RECEIVERS EMPLOYING 110° DEFLECTION SYSTEMS. IT HAS A HIGH ZERO BIAS PLATE CURRENT AND IS DESIGNED TO OPERATE AT RELATIVELY LOW B SUPPLY VOLTAGES. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 12DW5 IS IDENTICAL TO THE 6DW5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P)	0.5	μμf
INPUT: (G_1 TO H+K)	14	μμf
OUTPUT: (P TO H+K)	9	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

(PENTODE CONNECTED)

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	220	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	11	WATTS
MAXIMUM GRID #2 DISSIPATION[C]	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	65	MA.
MAXIMUM PEAK CATHODE CURRENT	225	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:		
SELF BIAS	2.2	MEGOHMS

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER[B]

(PENTODE CONNECTED)

MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM-UP TIME (APPROX.)[D]	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VERTICAL DEFLECTION AMPLIFIER[B]

(PENTODE CONNECTED)

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	200	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
GRID #2 VOLTAGE	150	VOLTS
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.0	MA.
TRANSCONDUCTANCE	5 500	μMHOS
PLATE RESISTANCE (APPROX.)	15 000	OHMS
GRID VOLTAGE FOR I_b = 0.1 MA.	-55	VOLTS
ZERO BIAS WITH E_b =60VDC; E_{c1} =0; E_{c2} =150VDC (INSTANTANEOUS VALUES)		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	20	MA.
TRIODE AMPLIFICATION FACTOR WITH E_b =E_{c2}=150 V; E_{c1}=-22.5	4.3	

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

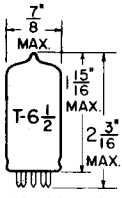
[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

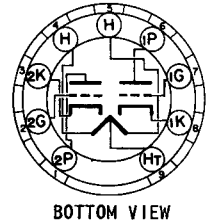
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.15 AMP.	0.30 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9A

THE 12DW7 IS A DISSIMILAR DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITABLE FOR APPLICATIONS REQUIRING A HIGH GAIN VOLTAGE AMPLIFIER AND A CATHODYNE TYPE PHASE-INVERTER.

DIRECT INTERELECTRODE CAPACITANCES

	SECTION #1 [A]		SECTION #2 [A]		
	WITH [B] SHIELD	WITHOUT SHIELD	WITH [B] SHIELD	WITHOUT SHIELD	
GRID TO PLATE	1.7	1.7	1.5	1.5	μμf
INPUT: G TO (H + K)	1.8	1.6	1.8	1.7	μμf
OUTPUT: P TO(H + K)	2.0	0.44	2.4	0.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [C]

	SECTION #1	SECTION #2	
HEATER VOLTAGE (SERIES)	12.6		VOLTS
HEATER VOLTAGE (PARALLEL)	6.3		VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM PLATE DISSIPATION	1.2	3.3	WATT
MAXIMUM CATHODE CURRENT	---	22	MA.
MAXIMUM POSITIVE DC GRID VOLTAGE	0	---	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	---	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS		0.25	MEGOHM
SELF BIAS		1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	SECTION #1		SECTION #2		
HEATER VOLTAGE (SERIES)		12.6			
HEATER VOLTAGE (PARALLEL)		6.3			
HEATER CURRENT (SERIES)		0.15			
HEATER CURRENT (PARALLEL)		0.30			
PLATE VOLTAGE	100	250	100	250	VOLTS
GRID VOLTAGE	−1	−2	0	−8.5	VOLTS
PLATE CURRENT	0.5	1.2	11.8	10.5	MA.
TRANSCONDUCTANCE	1250	1600	3100	2200	μMHOS
AMPLIFICATION FACTOR	100	100	20	17	
PLATE RESISTANCE	80000	62500	6500	7700	OHMS
E_{c1} FOR I_b=10 μAMPS.				−24	VOLTS

[A] SECTION #1 CONNECTS TO PINS 6, 7, AND 8.
SECTION #2 CONNECTS TO PINS 1, 2, AND 3.

[B] EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

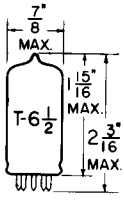
[C]

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DIODE-DISSIMILAR DUO-TRIODE

MINIATURE TYPE



GLASS BULB

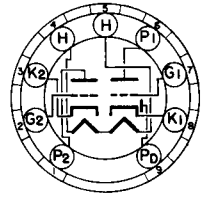
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON MINIATURE
9 PIN BASE
9AC

THE 12DW8 IS A DIODE-DISSIMILAR DUO-TRIODE DESIGNED TO FUNCTION AS A COMBINED SECOND DETECTOR, FIRST AUDIO STAGE, AND TRANSISTOR DRIVER STAGE IN 12 VOLT HYBRID AUTOMOBILE RADIOS. TRIODE #1 IS THE FIRST AUDIO STAGE, TRIODE #2 IS THE DRIVER.

DIRECT INTERELECTRODE CAPACITANCES

	WITH [A] SHIELD	WITHOUT SHIELD	
TRIODE #1:			
GRID TO PLATE (G TO P)	1.8	1.8	μμf
INPUT: G TO (H+K)	2.9	1.6	μμf
OUTPUT: P TO (H+K)	1.4	0.7	μμf
DIODE PLATE TO TRIODE #1 GRID (MAX.)	0.4	0.4	μμf
TRIODE #2:			
GRID TO PLATE (G TO P)	3.5	3.2	μμf
INPUT: G TO (H+K)	4.4	4.4	μμf
OUTPUT: P TO (H+K)	2.1	0.7	μμf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #8.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	DIODE	TRIODE #1	TRIODE #2	
HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE	16.0	16.0	16.0	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16.0	16.0	16.0	VOLTS
MAXIMUM PLATE VOLTAGE		16.0	16.0	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE		0	0	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	0.5	0.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE		1.5	1.5	MEGOHM

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

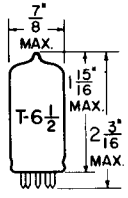
	TRIODE #1	TRIODE #2	DIODE	
HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	0.45	0.45	0.45	AMP.
PLATE SUPPLY VOLTAGE	12.6	12.6		VOLTS
TRANSCONDUCTANCE	2700	6500		μMHO
AMPLIFICATION FACTOR	9.5	6.4		
PLATE CURRENT	1.9	7.5		MA.
AVERAGE DIODE CURRENT @ 10 V.			20	MA.
GRID VOLTAGE	0	0		VOLTS
GRID RESISTOR	1.5	1.0		MEGOHMS
PLATE VOLTAGE DROPPING RESISTOR	100	100		OHMS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

TRIODE TETRODE

MINIATURE TYPE



GLASS BULB

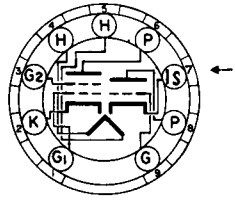
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.35 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9JD

THE 12DY8 IS A SHARP CUTOFF TRIODE TETRODE IN THE 9-PIN MINIATURE CONSTRUCTION. THE TETRODE SECTION IS DESIGNED FOR RELAY SERVICE IN "SIGNAL-SEEKER" APPLICATIONS WHILE THE TRIODE SECTION IS DESIGNED FOR GENERAL PURPOSE USE. THE 12DY8 IS DESIGNED FOR OPERATION WHERE THE PLATE AND SCREEN VOLTAGES ARE OBTAINED DIRECTLY FROM A 12 VOLT AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE	TETRODE	
GRID TO PLATE:	1.5	0.74	μμf
INPUT;	2.0	11	μμf
OUTPUT:	2.0 ←	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

	TRIODE	TETRODE	
HEATER VOLTAGE[B]	12.6	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	16	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	16	VOLTS
MAXIMUM GRID #1 RESISTANCE	10	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE	16		VOLTS

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE	TETRODE	
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.35	0.35	AMP.
PLATE VOLTAGE	12.6	12.6	VOLTS
GRID #1 VOLTAGE	0	(NOTE C)	VOLTS
GRID #2 VOLTAGE	---	12.6	VOLTS
GRID #1 RESISTOR	---	2.2	MEGOHMS
TRANSCONDUCTANCE	2000	6000	μMHOS
AMPLIFICATION FACTOR	20	---	
PLATE RESISTANCE (APPROX.)	10000	5000	OHMS
PLATE CURRENT	1.2	14	MA.
SCREEN CURRENT	---	2	MA.
GRID VOLTAGE FOR I_b = 10 μADC	-2.0	----	VOLTS
GRID VOLTAGE FOR I_b = 20 μADC	---	-9.0	VOLTS

TYPICAL OPERATION
TETRODE SECTION – RELAY SERVICE

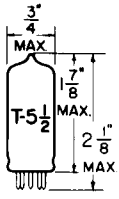
HEATER VOLTAGE	10.0	15.0	VOLTS
PLATE SUPPLY VOLTAGE	10.0	15.0	VOLTS
GRID #2 VOLTAGE	10.0	15.0	VOLTS
GRID #1 VOLTAGE	(NOTE C)	-6.0	VOLTS
GRID #1 RESISTOR	10	0	MEGOHMS
PLATE LOAD RESISTOR	700	700	OHMS
PLATE CURRENT	(MIN.) 5.0	(MAX.) 3.0	MA.

[B] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

[C] CONTACT POTENTIAL BIAS DEVELOPED ACROSS SPECIFIED GRID RESISTOR..

TUNG-SOL

PENTODE
MINIATURE TYPE

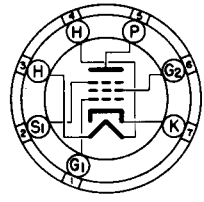


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.190 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 12DZ6 IS A PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN RF AMPLIFIER IN AUTOMOBILE RADIO RECEIVERS AND IS DESIGNED TO OPERATE WITH ITS PLATE AND SCREEN VOLTAGES SUPPLIED DIRECTLY FROM A 12 VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.05 ←	μμf
INPUT	9.5	μμf
OUTPUT	4.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6[A]	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM SCREEN VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE *	10	MEGOHMS

[A] WHEN USED IN AUTOMOTIVE SERVICE FROM A 12-VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS: HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

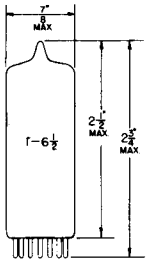
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.190 ←	AMP.
PLATE VOLTAGE	12.6	VOLTS
SUPPRESSOR VOLTAGE	0	VOLTS
SCREEN VOLTAGE	12.6	VOLTS
GRID #1 SUPPLY VOLTAGE	0	VOLTS
GRID #1 RESISTOR (BYPASSED)	10	MEGOHMS
PLATE RESISTANCE (APPROX.)	25 000	OHMS
TRANSCONDUCTANCE	3 800	μMHOS
PLATE CURRENT	4.5	MA.
SCREEN CURRENT	2.2	MA.
GRIDS #1 & #3 SUPPLY VOLTAGE (APPROX.)(GRID #1 TO PLATE) G_m = 10 μMHOS*	−10	VOLTS
GRID #3 RESISTOR (BYPASSED)*	10	MEGOHMS

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

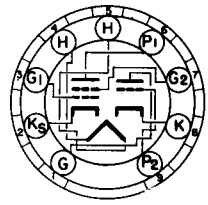
COATED UNIPOTNETIAL CATHODE

HEATER

12.0 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 12DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	12.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	.75	6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---	135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---	1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110	110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0	0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0	60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE	12.0			VOLTS
HEATER CURRENT	0.45			AMP.
PLATE VOLTAGE	120	---	145	VOLTS
GRID #2 VOLTAGE	---		120	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	1500		180	OHMS
PLATE CURRENT	0.8		45	MA.
GRID #2 CURRENT	---		6	MA.
TRANSCONDUCTANCE	1400		7500	μMHOS
LOAD RESISTANCE	---		2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5		---	VOLTS
AMPLIFICATION FACTOR	100		---	
POWER OUTPUT	---		2.0	WATTS

SIMILAR TYPE REFERENCE: Except for heater ratings the 12DZ8 is identical to the 6DZ8, 9DZ8, 18DZ8, and the 35DZ8.

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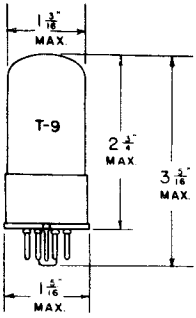
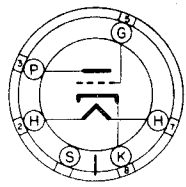


TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



6Q
BOTTOM VIEW

SMALL WAFER 6 PIN OCTAL BASE WITH METAL SHELL

THE TUNG-SOL 12E5GT IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER. WITH THE EXCEPTION OF HEATER RATINGS, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 76 AND THE 6P5GT.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250 MAX.	VOLTS
GRID VOLTAGE	-5	-13.5	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	MEGOHM
PLATE CURRENT	2.5	5.0	MA.
PLATE RESISTANCE	12000	9500	OHMS
TRANSCONDUCTANCE	1150	1450	μMHOS
AMPLIFICATION FACTOR	13.8	13.8	

DETECTOR

	BIASED		GRID LEAK	
PLATE VOLTAGE	100	250	45	VOLTS
GRID VOLTAGE	-8	-20	RETURN TO CATHODE	VOLTS
PLATE CURRENT	ADJUST TO 0.2 MA. WITH NO INPUT SIGNAL		—	
GRID LEAK	—	—	1 TO 5	MEGOHMS
GRID CONDENSER	—	—	250	μμf

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.05	0.25	0.05	0.25	MEGOHM
CATHODE RESISTOR	3800	15000	3800	15000	OHMS
VOLTAGE GAIN	8.5	10	9	10	

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	3.6	μμf
PLATE TO CATHODE	2.6	μμf
GRID TO PLATE	2.8	μμf

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PLATE 651-1

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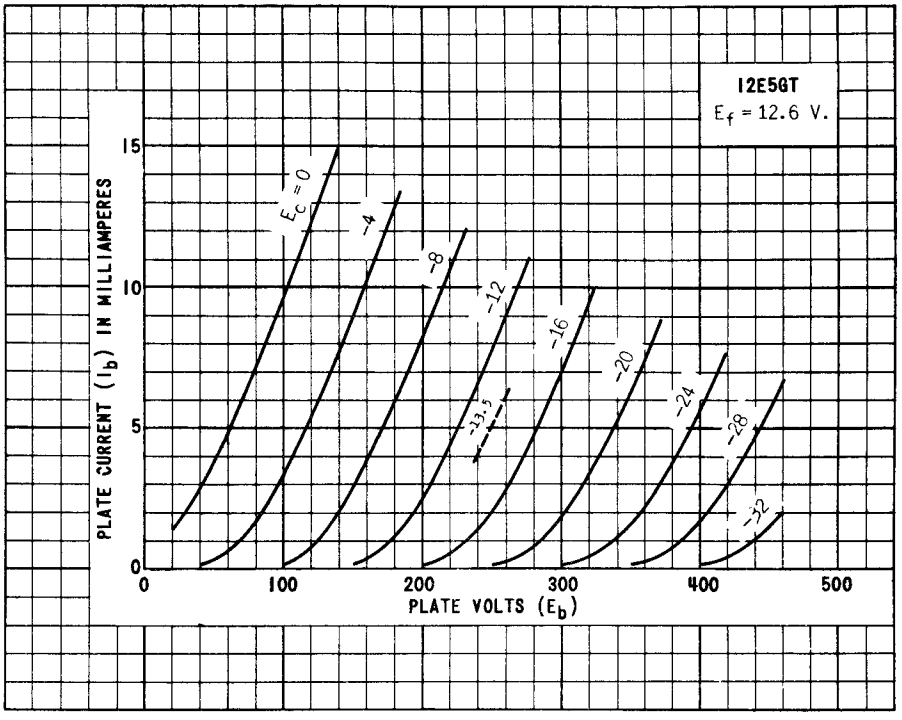
12E5GT



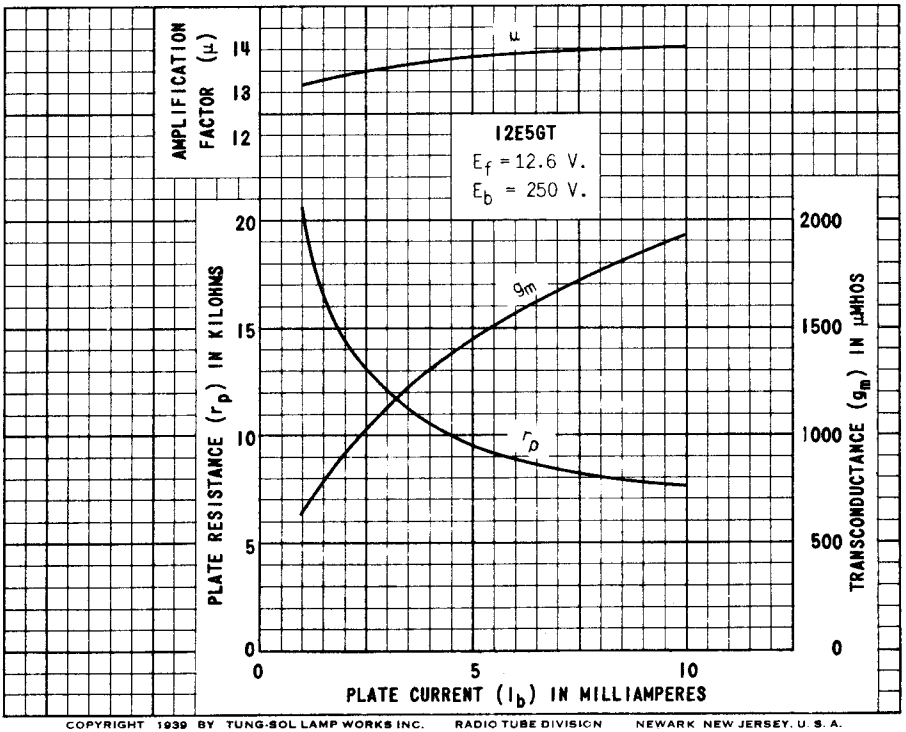


PLATE 652-1

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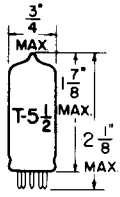
TUNG-SOL

PENTODE
MINIATURE TYPE

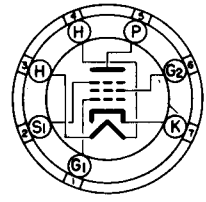


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.190 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 12EA6 IS A PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN RF AMPLIFIER IN AUTOMOBILE RADIO RECEIVERS AND IS DESIGNED TO OPERATE WITH ITS PLATE AND SCREEN VOLTAGES SUPPLIED DIRECTLY FROM A 12 VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.04	μμf
INPUT	11	μμf
OUTPUT	4.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6[A]	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM SCREEN VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM GRID #3 CIRCUIT RESISTANCE *	10	MEGOHMS

[A] WHEN USED IN AUTOMOTIVE SERVICE FROM A 12-VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS: HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

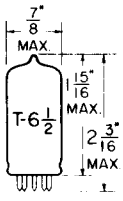
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.190 ←	AMP.
PLATE VOLTAGE	12.6	VOLTS
SUPPRESSOR VOLTAGE	0	VOLTS
SCREEN VOLTAGE	12.6	VOLTS
GRID #1 RESISTOR (BYPASSED)	10	MEGOHMS
PLATE RESISTANCE (APPROX.)	32 000	OHMS
TRANSCONDUCTANCE	3 800	μMHOS
PLATE CURRENT	3.2	MA.
SCREEN CURRENT	1.4	MA.
GRID #1 VOLTAGE (APPROX.)		
I_b = 10 μAMP.	-3.4	VOLTS
		MEGOHMS

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE PENTODE

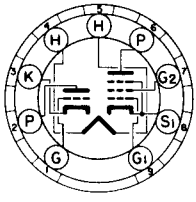
MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS .225 AMP.
AC OR DC



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE

9FA

THE 12EC8 IS A MEDIUM-MU TRIODE AND SHARP CUTOFF PENTODE IN THE 9-PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS A COMBINED VHF OSCILLATOR AND MIXER IN APPLICATIONS WHERE THE HEATER, GRID #2 AND PLATE POTENTIALS ARE SUPPLIED DIRECTLY FROM A 12 VOLT AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE SECTION:		
GRID TO PLATE	1.7	μμf
INPUT: TG TO (H + K)	2.6	μμf
OUTPUT: P TO (H + K)	0.4	μμf
HEATER TO CATHODE	2.6	μμf
PENTODE SECTION:		
GRID #1 TO PLATE (MAX.)	0.02	μμf
INPUT: G_1 TO (H+K+G_2+G_3+I.S.)	4.6	μμf
OUTPUT: P TO (H+K+G_2+G_3+I.S.)	2.6	μμf
HEATER TO CATHODE	2.6	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE [A]	12.6	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	16	VOLTS
MAXIMUM GRID #2 VOLTAGE		16	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.0	1.0	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	16		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16		VOLTS

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

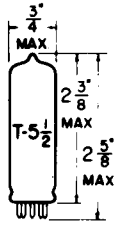
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	.225	.225	AMP.
PLATE SUPPLY VOLTAGE	12.6	12.6	VOLTS
GRID #2 VOLTAGE		12.6	VOLTS
GRID #1 VOLTAGE	0	0	
GRID #1 RESISTOR	4 700	33 000	OHMS
PLATE CURRENT	2.4	0.66	MA.
GRID #2 CURRENT		0.28	MA.
TRANSCONDUCTANCE	4 700	2 000	μMHOS
AMPLIFICATION FACTOR	25		
PLATE RESISTANCE (APPROX.)	6 000	750 000	OHMS
GRID #1 VOLTAGE FOR I_b = 10 μA (APPROX.)	-2.2	-1.6	VOLTS

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

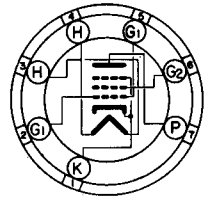
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

THE 12ED5 IS A BEAM POWER PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION AND IS DESIGNED FOR SERVICE AS AN AUDIO OUTPUT AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.26	μμf
INPUT: G_1 TO $(H+K+G_2+G_3)$	14	μμf
OUTPUT: P TO $(H+K+G_2+G_3)$	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	6.25	WATTS
MAXIMUM GRID #2 DISSIPATION	1.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	200	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.45	0.45	AMP.
PLATE VOLTAGE	110	125	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-4.0	-4.5	VOLTS
PEAK AF GRID #1 VOLTAGE	4.0	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	32	37	MA.
MAXIMUM-SIGNAL PLATE CURRENT	31	36	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.0	7.0	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	8.0	11	MA.
TRANSCONDUCTANCE	8 100	8 500	μMHOS
PLATE RESISTANCE (APPROX.)	14 000	14 000	OHMS
LOAD RESISTANCE	4 500	4 500	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	1.1	1.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	5	5	PERCENT

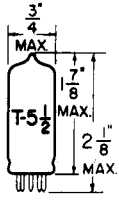
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

A DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WI H RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

HEPTODE

MINIATURE TYPE

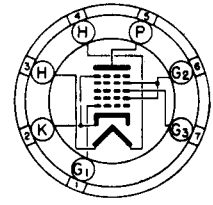


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 12EG6 IS A DUAL CONTROL HEPTODE WITH A UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION. IT IS INTENDED AS AN RF AMPLIFIER IN SUPERHETERODYNE RECEIVERS WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY. THE DESIGN OF THIS TYPE PERMITS THE APPLICATION OF AVC CONTROL VOLTAGE TO TWO CONTROL GRIDS THEREBY REDUCING BACK BIASING OF THE AVC LINE WITH LARGE RF SIGNALS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	
MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	μμf
MIXER GRID TO OSCILLATOR GRID: (G_3 TO G_1) MAX.	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	6.5	μμf
OSCILLATOR INPUT: G_1 TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	5.7	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	12	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G_5)	3.2	μμf
OSCILLATOR OUTPUT: K TO (H+$G_{2\&4}$+G_3+P)	23	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	0.04	μμf

RATINGS[B]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	30	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	30	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	30	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #3 CIRCUIT RESISTANCE	10	MEGOHMS

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN #2.

[B] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEPTODE CONNECTED

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRIDS #2 & #4 VOLTAGE	12.6	VOLTS
GRID #3 VOLTAGE	-0.8[C]	VOLTS
GRID #1 VOLTAGE	-0.8[D]	VOLTS
PLATE CURRENT	400	μAMPS
SCREEN CURRENT	2 400	μAMPS
TRANSCONDUCTANCE[E]	800	μMHOS
PLATE RESISTANCE (APPROX.)	0.15	MEGOHMS
GRID #3 VOLTAGE [C] AND GRID #1 VOLTAGE (APPROX.) FOR G_m[E] = 10 μMHOS	-3.0	VOLTS

[C] PROVIDED BY GRID #1 VOLTAGE THROUGH A SUITABLE GRID #3 RESISTOR.

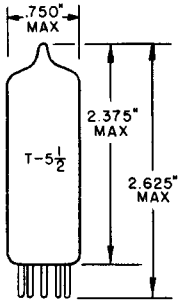
[D] AVERAGE BIAS DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.

[E] FROM GRID #3 TO PLATE.

TUNG-SOL

PENTODE

MINIATURE TYPE

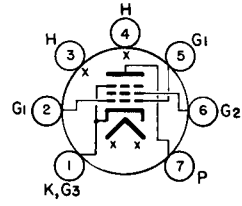


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

FOR USE IN
AUDIO OUTPUT STAGES OF
RADIO AND TV RECEIVERS
AND PHONOGRAPHS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 12EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS BEEN SPECIFICALLY DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS AND PHONOGRAPHS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, HEATER WARM-UP TIME AND HIGHER HEATER-CATHODE VOLTAGE RATINGS, IT IS IDENTICAL TO THE 6EH5, 25EH5 AND 50EH5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.65	pf
GRID 1 TO CATHODE & GRID 3, HEATER & GRID 2	17	pf
PLATE TO CATHODE & GRID 3, HEATER & GRID 2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	600	MA.
HEATER WARM-UP TIME [A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600 ± 40	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200 [B]	VOLTS

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AMPLIFIER

PLATE VOLTAGE	→ 150	VOLTS
GRID 2 (SCREEN-GRID) VOLTAGE	→ 130	VOLTS
PLATE DISSIPATION	→ 5.5	WATTS
GRID 2 INPUT	→ 2	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	110	VOLTS
GRID 2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID 1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	42	MA.
SIGNAL PLATE CURRENT (MAX.)	42	MA.
ZERO-SIGNAL GRID 2 CURRENT	11.5	MA.
SIGNAL GRID 2 CURRENT (MAX.)	14.5	MA.
TRANSCONDUCTANCE	14,600	μMHOS
PLATE RESISTANCE (APPROX.)	11,000	OHMS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
SIGNAL POWER OUTPUT (MAX.)	1.4	WATTS

PUSH-PULL AF POWER AMPLIFIER - CLASS AB1

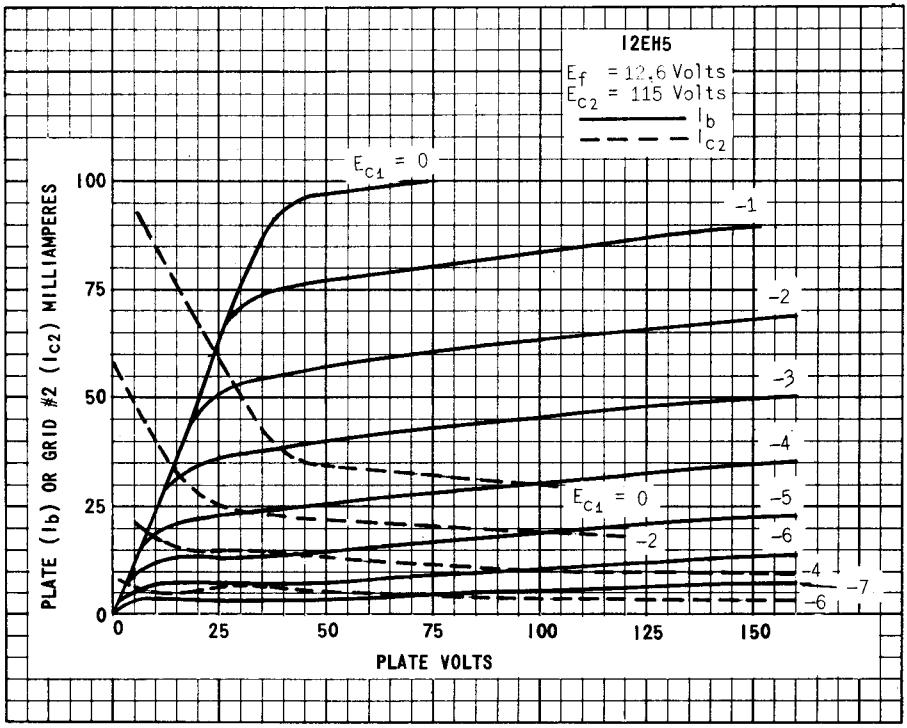
VALUES ARE FOR TWO TUBES

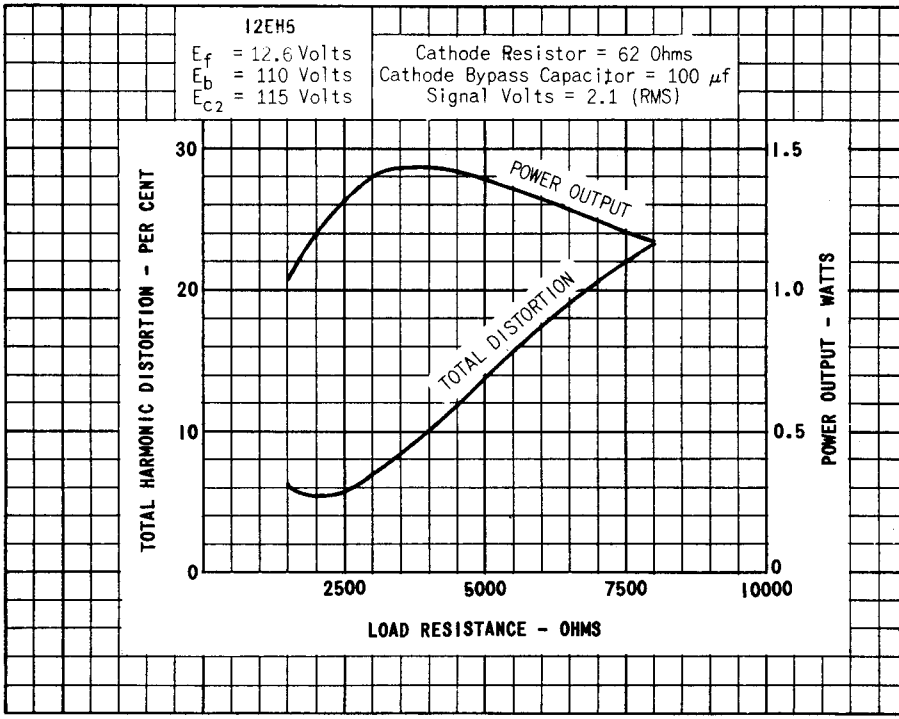
PLATE SUPPLY VOLTAGE	140	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR	68	OHMS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	9.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL GRID 2 CURRENT	11	MA.
MAX.-SIGNAL GRID 2 CURRENT	17.7	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAX.-SIGNAL POWER OUTPUT	3.8	WATTS.

→ INDICATES A CHANGE.

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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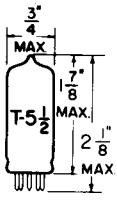
PENTODE
MINIATURE TYPE

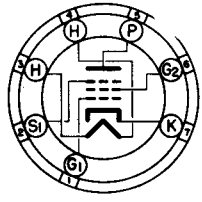


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.190 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 12EK6 IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A VHF, RF OR IF AMPLIFIER IN APPLICATIONS WHERE THE HEATER, PLATE AND GRID #2 POTENTIALS ARE SUPPLIED DIRECTLY FROM A 12 VOLT AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE (MAX.)	0.036 ←	μμf
INPUT: G_1 TO ($H+K+G_2+G_3$)	10	μμf
OUTPUT: P TO ($H+K+G_2+G_3$)	5.0 ←	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE[B]	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM GRID #2 VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.2	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE [C]		
GRID #1 RESISTOR	2.2	MEGOHMS
PLATE CURRENT	4.0 ←	MA.
GRID #2 CURRENT	1.7 ←	MA.
TRANSCONDUCTANCE	4 200	μMHOS
PLATE RESISTANCE (APPROX.)	50 000 ←	OHMS
GRID #1 VOLTAGE FOR I_b= 10 μA	− 3.8 ←	VOLTS

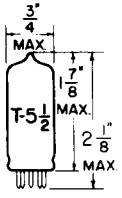
[C] AVERAGE CONTACT POTENTIAL BIAS DEVELOPED ACROSS SPECIFIED GRID RESISTOR.

→ INDICATES A CHANGE.

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE

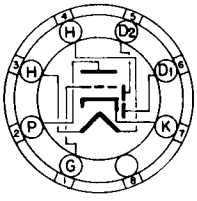


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7F8

THE 12EL6 IS A DOUBLE DIODE, HIGH-MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE PRIMARILY AS A SECOND DETECTOR AUDIO AMPLIFIER IN OPERATION WHERE THE HEATER AND PLATE VOLTAGE ARE SUPPLIED DIRECTLY FROM A 12 VOLT AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.8	μμf
INPUT: G TO (H+K)	2.2	μμf
OUTPUT: P TO (H+K)	1.0	μμf
DIODE PLATE TO DIODE PLATE	1.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE	30	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	30	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	750	μA.
TRANSCONDUCTANCE	1 200	μMHOS
AMPLIFICATION FACTOR	55	
PLATE RESISTANCE	45 000	OHMS
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED (EACH DIODE)[B]	2.0	MA.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

RESISTANCE COUPLED AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMPL
PLATE SUPPLY VOLTAGE	12.6	VOLTS
GRID VOLTAGE[C]		
GRID RESISTOR	1.0	MEGOHM
PLATE LOAD RESISTOR	1.0	MEGOHM
INPUT CAPACITOR	0.02	μf
OUTPUT CAPACITOR	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	2.0	MEGOHMS
VOLTAGE GAIN AT 400 CPS[D]	16	

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

[B] TEST CONDITION ONLY.

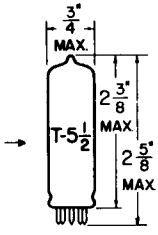
[C] CONTACT POTENTIAL DEVELOPED ACROSS SPECIFIED GRID RESISTOR.

[D] MEASURED AT AN OUTPUT VOLTAGE OF 1.0 VOLT RMS.

TUNG-SOL

DIODE TETRODE

MINIATURE TYPE

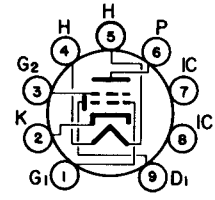


GLASS BULB
MINIATURE BUTTON
9 PIN BASE B9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.50 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9HV

THE 12EM6 IS A COMBINED DETECTOR DIODE AND A TETRODE WITH A COMMON UNIPOTENTIAL CATHODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TETRODE SECTION IS INTENDED FOR USE AS A POWER AMPLIFIER WHERE THE HEATER, PLATE, AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE (TETRODE)	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	15	MEGOHMS
MAXIMUM HEATER CATHODE VOLTAGE	±30	VOLTS
MAXIMUM TETRODE PLATE CURRENT→	10	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CHARACTERISTICS – CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.50	AMP.
PLATE VOLTAGE (TETRODE)	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
HEATER VOLTAGE	12.6	VOLTS
GRID #1 RESISTOR (BYPASSED)	2.2	MEGOHMS
PLATE CURRENT	6.0	MA.
GRID #2 CURRENT	1.0	MA.
TRANSCONDUCTANCE	5 000	μMHOS
PLATE RESISTANCE	4 000	OHMS
DIODE CURRENT WITH 10 VOLTS APPLIED	1.0	MA.

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTER SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

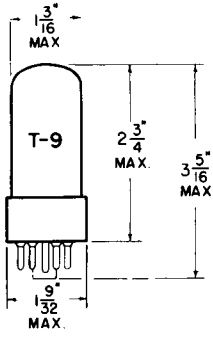
TYPICAL OPERATION – CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.50	AMP.
PLATE VOLTAGE (TETRODE)	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE[A]	---	
AF GRID #1 VOLTAGE	1.0	VRMS
AF SIGNAL SOURCE RESISTANCE	200 000	OHMS
LOAD RESISTANCE	3 500	OHMS
PLATE CURRENT	2.5	MA.
POWER OUTPUT	10	MW.
TOTAL HARMONIC DISTORTION	10	PERCENT

[A] OBTAINED BY GRID #1 RECTIFICATION WITH A 15 MEGOHM GRID RESISTOR. THE ZERO SIGNAL PLATE CURRENT IS APPROX. 6.0 MA.

TUNG-SOL

BEAM POWER PENTODE

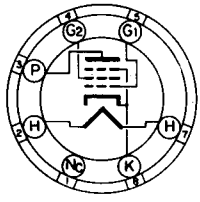


GLASS VIEW

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL
8 PIN OCTAL
7S

THE 12EN6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS SWEEP CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	0.65	μμf
INPUT	14	μμf
OUTPUT	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION AMPLIFIER SERVICE[A]

	TRIODE CONNECTION[B]	PENTODE CONNECTION	
HEATER VOLTAGE	12.6	12.6	VOLTS
MAXIMUM DC PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	1200	1200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	7.5	7.0	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	250	250	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	---	150	VOLTS
MAXIMUM GRID #2 DISSIPATION	---	1.25	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	50	50	MA.
MAXIMUM PEAK CATHODE CURRENT	175	175	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100		VOLTS
TOTAL DC & PEAK	200		VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT	200		VOLTS
TOTAL DC & PEAK	300		VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VERTICAL DEFLECTION AMPLIFIER SERVICE[A]

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.6±6%		AMP.
PLATE VOLTAGE	50	200	VOLTS
GRID #2 VOLTAGE	110	110	VOLTS
GRID #1 VOLTAGE	0[D]	-9.5	VOLTS
PLATE CURRENT	135	50	MA.
GRID #2 CURRENT	18	2.2	MA.
PLATE RESISTANCE		28 000	OHMS
TRANSCONDUCTANCE		8 000	μMHOS
GRID #1 CUTOFF VOLTAGE (APPROX.)		-35	VOLTS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] WITH GRID #2 TIED TO PLATE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

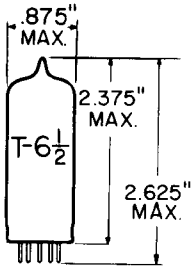
[D] APPLIED FOR SHORT INTERVAL (2 SECONDS MAXIMUM) SO AS NOT TO DAMAGE THE TUBE.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DIODE-REMOTE-CUTOFF PENTODE

MINIATURE TYPE

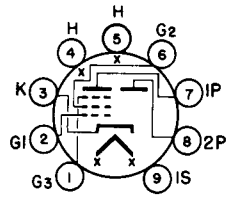


GLASS BULB
SMALL BUTTON
9 PIN NOVAL E9-1
OUTLINE DRAWING
JEDEC 6-3

UNIPOTENTIAL CATHODE

FOR AM AND AM/FM
BROADCAST RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9LQ

THE 12EQ7 IS A DIODE AND A REMOTE-CUTOFF PENTODE WITH A COMMON CATHODE OF THE 9 PIN MINIATURE TYPE ESPECIALLY DESIGNED FOR USE AS COMBINED IF-AMPLIFIER AND AM-DETECTOR TUBES IN AM AND AM/FM BROADCAST RECEIVERS. THE PENTODE UNIT MAY ALSO BE USED AS AN RF-OR IF-AMPLIFIER TUBE; THE DIODE UNIT MAY BE USED FOR AUTOMATIC VOLUME CONTROL OR DETECTION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	.002	pf
GRID #1 TO K, H, G2, G3, & I.S.	5.5	pf
PLATE TO K, H, G2, G3, & I.S.	5.0	pf
GRID #1 TO DIODE PLATE (MAX.)	0.0015	pf
PENTODE PLATE TO DIODE PLATE	.095	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		12.6±1.3	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER—PENTODE UNIT

PLATE VOLTAGE	300	VOLTS
GRID #3 VOLTAGE:		
POSITIVE VALUE	300	VOLTS
NEGATIVE VALUE	300	VOLTS
GRID #2 SUPPLY VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	SEE RATING CHART	
GRID #1 VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
NEGATIVE BIAS VALUE	50	VOLTS
PLATE DISSIPATION	3	WATTS
GRID #3 INPUT	0.2	WATT
GRID #2 INPUT:		
FOR GRID #2 VOLTAGES UP TO 150 VOLTS	0.6	WATT
FOR GRID #2 VOLTAGES BETWEEN 150 & 300 VOLTS	SEE RATING CHART	
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	150	°C

DIODE UNIT

PLATE CURRENT	1.0	MA.

TYPICAL OPERATING CHARACTERISTICS

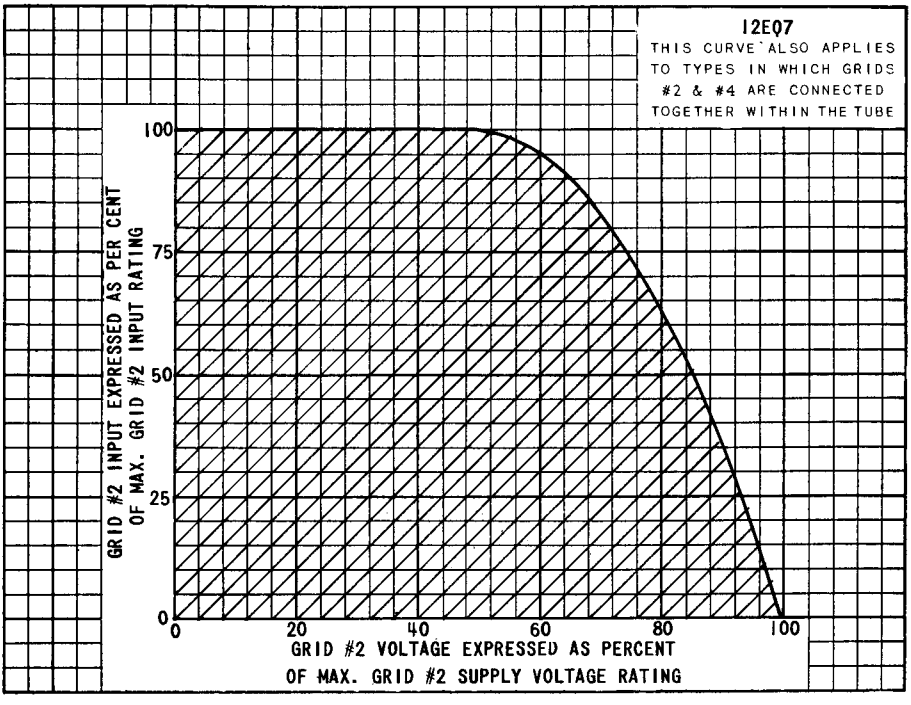
CLASS A_1 AMPLIFIER

PENTODE UNIT

PLATE VOLTAGE	100	VOLTS
GRID #3	CONNECT TO CATHODE AT SOCKET	
INTERNAL SHIELD	CONNECT TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
GRID #1 SUPPLY VOLTAGE	0	VOLT
GRID #1 RESISTOR (BYPASSED)	2.2	MEGOHMS
TRANSCONDUCTANCE	3800	μMHOS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
PLATE CURRENT	9	MA.
GRID #2 CURRENT	3.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE OF 40 μMHOS	-20	VOLTS

DIODE UNIT - AVERAGE CHARACTERISTICS

PLATE VOLTAGE	10	VOLTS
PLATE CURRENT	2	MA.



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TUNG-SOL

PENTODE

MINIATURE TYPE

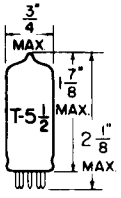
COATED UNIPOTENTIAL CATHODE

HEATER

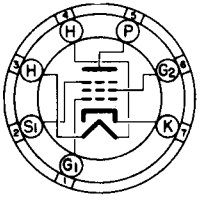
12.6 VOLTS .175 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

THE 12EZ6 IS A SHARP CUTOFF PENTODE WITH A UNIPOTENTIAL CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN RF OR IF AMPLIFIER WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (MAX.)	.008	μμf
INPUT:	7.8	μμf
OUTPUT:	5.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	10	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

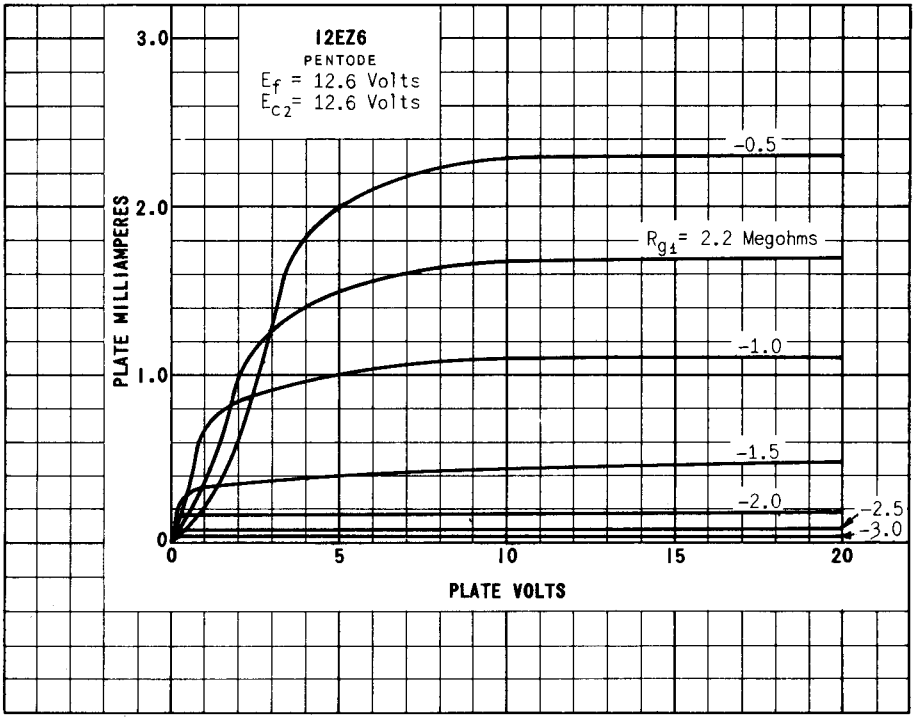
CLASS A_1 AMPLIFIER

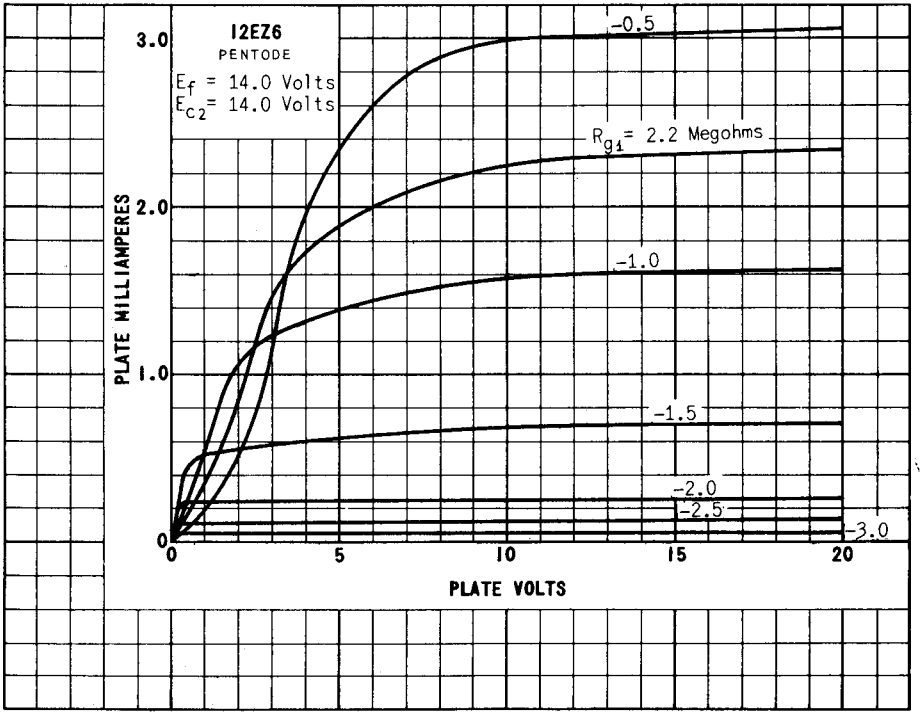
HEATER VOLTAGE	12.6	14.0	VOLTS
HEATER CURRENT	.175	.175	AMP.
PLATE VOLTAGE	12.6	14.0	VOLTS
GRID #3 VOLTAGE[B]	0	0	VOLTS
GRID #2 VOLTAGE	12.6	14.0	VOLTS
GRID #1 VOLTAGE	-0.7	-0.8[D]	
PLATE CURRENT	1.9	2.3	MA.
GRID #2 CURRENT	0.7	0.85	MA.
PLATE RESISTANCE	0.40	0.30	MEGOHMS
TRANSCONDUCTANCE[C]	2700	3000	μMHOS
GRID #1 VOLTAGE FOR I_b=50 μMHOS	-2.6	-2.8	VOLTS
GRID #1 & GRID #3 VOLTAGE FOR G_m=30 μMHOS	-2.8	-3.0	VOLTS

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

[B] CONNECTED TO CATHODE AT SOCKET. [C] FROM GRID #1 TO PLATE.

[D] AVERAGE BIAS DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.


12EZ6
PENTODE
E_f = 12.6 Volts
E_{c2} = 12.6 Volts
PLATE MILLIAMPERES
PLATE VOLTS
3.0
2.0
1.0
0
0
5
10
15
20
-0.5
R_{g1} = 2.2 Megohms
-1.0
-1.5
-2.0
-2.5
-3.0


12EZ6
PENTODE
E_f = 14.0 Volts
E_{c2} = 14.0 Volts
PLATE MILLIAMPERES
PLATE VOLTS
3.0
2.0
1.0
0
0
5
10
15
20
-0.5
R_{g1} = 2.2 Megohms
-1.0
-1.5
-2.0
-2.5
-3.0

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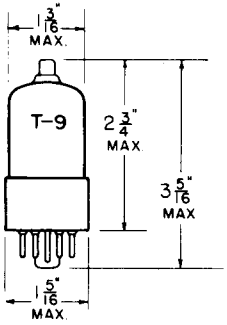
HIGH-MU TRIODE AMPLIFIER

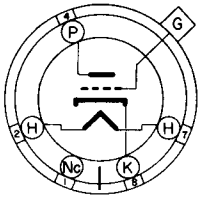


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
5-PIN OCTAL

THE 12F5GT IS A GENERAL PURPOSE HIGH AMPLIFICATION FACTOR TRIODE. EXCEPT FOR THE HEATER RATING, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 6F5GT.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
MAX. PLATE VOLTAGE	300	VOLTS
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE	

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE	2.8	μμf
GRID TO CATHODE	2.2	μμf
PLATE TO CATHODE	3.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	85 000	66 000	OHMS
TRANSCONDUCTANCE	1150	1500	μMHOS
AMPLIFICATION FACTOR	100	100	

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PLATE
1613
OCT. 15,
1945

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ZERO-BIAS RESISTANCE-COUPLED AMPLIFIER CLASS A_1

HEATER VOLTAGE	6.3			6.3		VOLTS
PLATE SUPPLY VOLTAGE	100			300		VOLTS
GRID LEAK	10			10		MEGOHM
LOAD RESISTANCE	0.25			0.25		MEGOHM
COUPLING CAPACITOR	0.01	TO	0.005	0.01	TO 0.005	µf
GRID RESISTOR FOR FOLLOWING TUBE	0.5		1.0	0.5	1.0	MEGOHM
VOLTAGE GAIN	48		52	66	71	
VOLTAGE OUTPUT (RMS) AT 5 PER CENT HARMONIC DISTORTION	7.0		8.5	44	50	VOLTS

SIMILAR TYPE REFERENCE: *Except for heater ratings, same characteristics and application as types 6F5, 6F5G, 6F5GT, 6SF5, 6SF5GT; same characteristics as types 12SF5, 12SF5GT, 7B4.*

PLATE 1614
OCT. 15, 1945

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TUNG-SOL

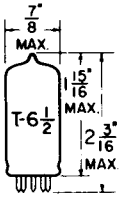
DOUBLE-DIODE-PENTODE

MINIATURE TYPE

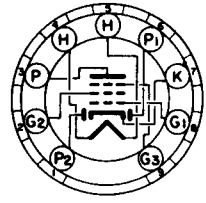
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9FH

THE 12F8 IS A COMBINED DOUBLE DETECTOR DIODE AND REMOTE CUT-OFF PENTODE WITH A COMMON UNIPOTENTIAL CATHODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR USE AS AN AF VOLTAGE AMPLIFIER WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY. THE DESIGN OF THIS TYPE PERMITS THE APPLICATION AF AVC VOLTAGE TO THE CONTROL GRID THEREBY IMPROVING OVERALL RECEIVER AVC.

DIRECT INTERELECTRODE CAPACITANCES

INPUT: (G_1 TO G_2+G_3+H+K)	4.5	μμf
OUTPUT: (P TO G_2+G_3+H+K)	3.0	μμf
GRID TO PLATE: (G_1 TO P)	.06	μμf
DIODE TO DIODE	0.3	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10.0	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT	1	MA.

*THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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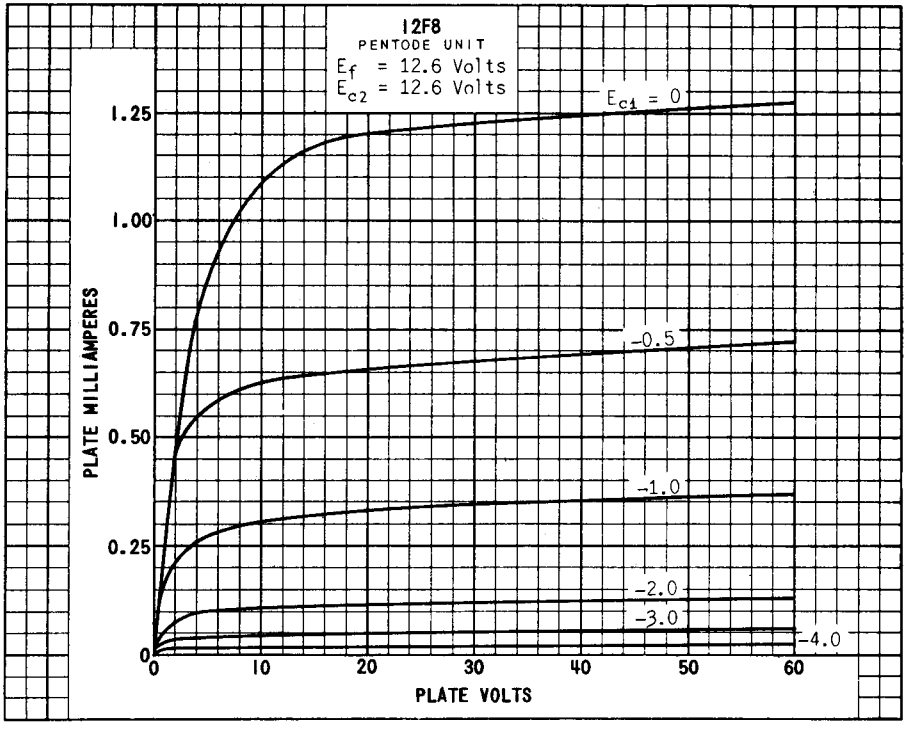
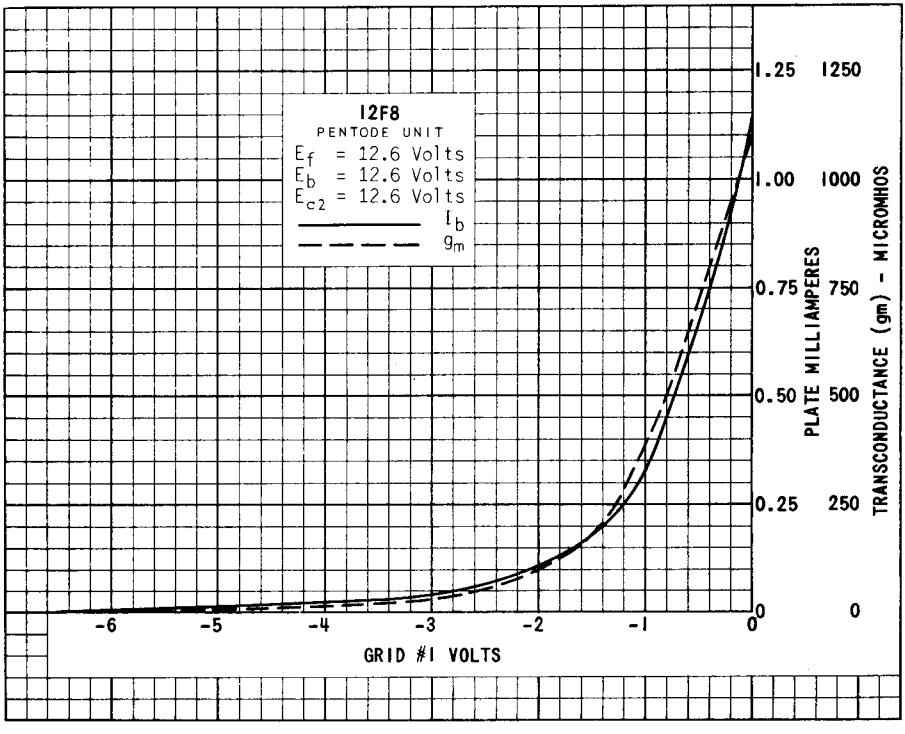
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

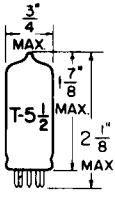
HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE	0	VOLTS
PLATE CURRENT	1.0	MA.
GRID #2 CURRENT	0.38	MA.
TRANSCONDUCTANCE	1000	μMHOS
PLATE RESISTANCE (APPROX.)	.33	MEGOHM
GRID #1 VOLTAGE (APPROX.) FOR G_m =10 μMHOS	-5	VOLTS
AVERAGE DIODE CURRENT WITH 10 VOLTS DC APPLIED	2	MA.




12F8
PENTODE UNIT
E_f = 12.6 Volts
E_b = 12.6 Volts
E_{c2} = 12.6 Volts
I_b
g_m
1.25
1.00
0.75
0.50
0.25
0
1250
1000
750
500
250
0
PLATE MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

HEPTODE
MINIATURE TYPE

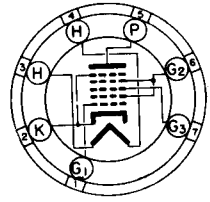


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 12AF6 IS A PENTAGRID CONVERTER WITH A UNIPOTENTIAL CATHODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED AS A COMBINED OSCILLATOR AND MIXER IN SUPERHETERODYNE RECEIVERS WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES
WITH EXTERNAL SHIELD #316 CONNECTED TO PIN #2

MIXER GRID TO PLATE: (G_3 TO P) MAX.	0.25	μμf
MIXER GRID TO OSCILLATOR GRID: (G_3 TO G_1) MAX.	0.15	μμf
RF INPUT: G_3 TO (H+K+G_1+G_2&4+G5+P)	7.2	μμf
OSCILLATOR INPUT: G_1 TO (H+K+G_1+G_2&4+G_3+G5)	7.2	μμf
MIXER OUTPUT: P TO (H+K+G_1+G_2&4+G_3+G5)	12.0	μμf
OSCILLATOR GRID TO CATHODE: (G_1 TO K+G5)	5.0	μμf
OSCILLATOR OUTPUT: K TO (H+G_2&4+G_3+P)	20	μμf
OSCILLATOR GRID TO PLATE: (G_1 TO P) MAX.	.05	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM HEATER–CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	30	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	30	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	30	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM GRID #3 CIRCUIT RESISTANCE	10	MEGOHMS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE – SELF EXCITATION [A]

HEATER VOLTAGE	12.6	VOLTS
PLATE VOLTAGE	12.6	VOLTS
GRID #3 VOLTAGE	0.50[B]	VOLTS
GRIDS #2 & #4 VOLTAGE	12.6	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	2.5	VOLTS
GRID #1 RESISTANCE (OSCILLATOR GRID)	33 000	OHMS
PLATE RESISTANCE (APPROX.)	0.8	MEGOHMS
GRID #1 CURRENT (OSCILLATOR GRID)	60	μA
CONVERSION TRANSCONDUCTANCE	320	μMHOS
PLATE CURRENT	450	μA
GRIDS #2 & #4 CURRENT	1 000	μA
CATHODE CURRENT	1 500	μA
GRID #3 VOLTAGE FOR G_c=5μMHOS (APPROX.)	-3.5	VOLTS
GRID #3 VOLTAGE FOR G_c=20 μMHOS (APPROX.)	-3.0	VOLTS

CONVERTER SERVICE – EXTERNAL EXCITATION

HEATER VOLTAGE	12.6	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID) RMS	0.85	VOLTS
GRIDS #2 & #4 CONNECTED TO PLATE	12.6	VOLTS
CONVERSION TRANSCONDUCTANCE	300	μMHOS
CATHODE CURRENT	1 900	μA
GRIDS #2 & #4 CURRENT	1 200	μA
PLATE CURRENT	670	μA
GRID #1 CURRENT	45	μA
GRID #3 VOLTAGE FOR G_c = 10 μMHOS	-3.2	

OSCILLATOR CHARACTERISTICS – NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRID #2 & #4 CONNECTED TO PLATE	12.6	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 & GRID #2 & #4 CONNECTED TO PLATE	4 000	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 & GRID #2 & #4 CONNECTED TO PLATE	9	
CATHODE CURRENT	4.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA.	-3.5	VOLTS

*THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

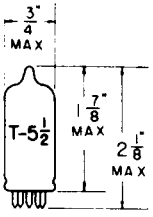
[A] SCREEN FEEDBACK. $G_{2,4}$ TO CATHODE VOLTAGE APPROXIMATELY 13% OF G_1 TO CATHODE VOLTAGE.

[B] AVERAGE CONTACT POTENTIAL DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.

TUNG-SOL

TWIN DIODE-TRIODE

MINIATURE TYPE



GLASS BULB

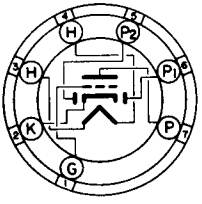
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE
7BT

THE 12FK6 IS A TWIN DIODE, LOW-MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE DIODE SECTION PERFORMS THE FUNCTIONS OF DETECTION AND AVC WHILE THE TRIODE SECTION IS INTENDED FOR USE AS THE FIRST AF AMPLIFIER. THE TUBE IS DESIGNED FOR USE WHERE THE PLATE AND GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO TRIODE PLATE	1.6	μμf
TRIODE GRID TO CATHODE AND HEATER	1.8	μμf
TRIODE PLATE TO CATHODE AND HEATER	0.7	μμf
PLATE OF DIODE UNIT #1 TO PLATE OF DIODE UNIT #2	0.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-CENTER SYSTEM

	DIODE UNIT	TRIODE UNIT	
HEATER VOLTAGE[A]		12.6	VOLTS
MAXIMUM PLATE VOLTAGE		16	VOLTS
MAXIMUM GRID VOLTAGE:			
POSITIVE VALUE		0	VOLTS
NEGATIVE VALUE		16	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		16	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		16	VOLTS
MAXIMUM PLATE CURRENT (EACH UNIT)	1		MA.
MAXIMUM CIRCUIT VALUES:			
GRID-CIRCUIT RESISTANCE		10	MEGOHMS

A
THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	DIODE UNIT	TRIODE UNIT	
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	10[B]	12.6	VOLTS
GRID-SUPPLY VOLTAGE		0	VOLTS
GRID RESISTOR (BYPASSED)		2.2	MEGOHMS
AMPLIFICATION FACTOR		7.4	
PLATE RESISTANCE (APPROX.)		6 200	OHMS
TRANSCONDUCTANCE		1 200	μMHOS
PLATE CURRENT	2[B]	1.3	MA.
PLATE CURRENT (APPROX.) FOR GRID BIAS OF -3 VOLTS		0.08	MA.

[B] EACH UNIT.

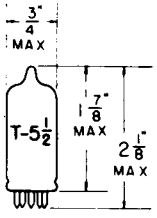
OPERATION OF HEATERS IN SERIES WITH OTHER HEATERS IS NOT RECOMMENDED.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

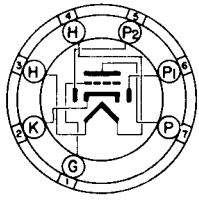
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BT

THE 12FM6 IS A DOUBLE DETECTOR DIODE AND MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. THE TWO SECTIONS HAVE A COMMON UNIPOTENTIAL CATHODE. THE TRIODE SECTION IS INTENDED FOR USE AS AN AF VOLTAGE AMPLIFIER INTO A LOW IMPEDANCE LOAD WHERE THE PLATE AND HEATER POTENTIALS ARE OBTAINED DIRECTELY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	1.7	μμf
INPUT: G TO (H + K)	2.7	μμf
OUTPUT: P TO (H + K)	1.7	μμf
DIODE TO DIODE	1.1	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM AVERAGE DIODE CURRENT	1	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	10	MEGOHMS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

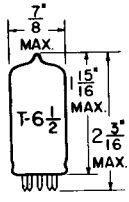
CLASS A, AMPLIFIER – TRIODE UNIT

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
HEATER POTENTIAL	12.6	12.6	VOLTS
PLATE POTENTIAL	12.6	12.6	VOLTS
GRID POTENTIAL	0	----	VOLTS
GRID RESISTOR	0	2.2	MEGOHMS
PLATE CURRENT	1.8	1.0	MA.
TRANSCONDUCTANCE	2400	1300	μMHOS
PLATE RESISTANCE	5600	7700	OHMS
AMPLIFICATION FACTOR	13.5	10	
DIODE UNITS – TWO			
AVERAGE DIODE CURRENT WITH			
10 VOLTS APPLIED (EACH DIODE)		2.0	MA.

TUNG-SOL

TWIN DOUBLE-PLATE TRIODE

MINIATURE TYPE



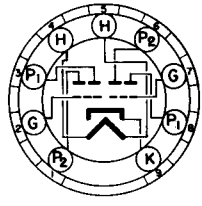
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9KT

GLASS BULB

THE 12FQ8 IS A TWIN DOUBLE-PLATE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. EACH SECTION HAS A GRID AND TWO PLATES BROUGHT OUT TO A SEPARATE PIN.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

INPUT , EACH SECTION	1.7	μμf
OUTPUT:		
PLATE #1 (SECTION 1)	0.34	μμf
PLATE #2 (SECTION 1)	0.24	μμf
PLATE #1 (SECTION 2)	0.30	μμf
PLATE #2 (SECTION 2)	0.18	μμf
GRID TO PLATE:		
SECTION 1— GRID TO PLATE #1	0.9	μμf
GRID TO PLATE #2	0.9	μμf
SECTION 2— GRID TO PLATE #1	0.9	μμf
GRID TO PLATE #2	0.9	μμf
PLATE TO PLATE, EACH SECTION	→0.7	μμf
PLATE #1 (SECTION 1) TO PLATE #1 (SECTION 2)	0.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE	0.5	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-1.5	VOLTS
AMPLIFICATION FACTOR, GRID TO EACH PLATE[A]	95	
PLATE RESISTANCE, (APPROX.) EACH PLATE[A]	76000	OHMS
TRANSCONDUCTANCE, GRID TO EACH PLATE [A]	1250	μMHOS
PLATE CURRENT, EACH PLATE [A]	1.5	MA.

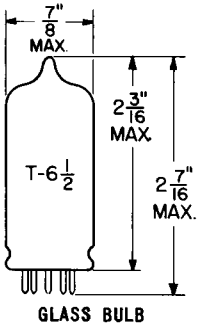
[A] OTHER PLATE OF SAME SECTION GROUNDED.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE TUBE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN TUBE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

PENTODE-TRIODE-DIODE

MINIATURE TYPE



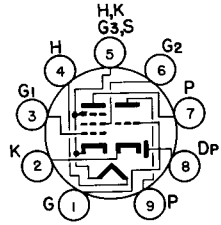
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.32 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON 9 PIN BASE

9KU

THE 12FR8 IS A PENTODE, TRIODE, DIODE, IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE AS AN IF AMPLIFIER, AF AMPLIFIER AND SECOND DETECTOR IN RECEIVERS WHERE THE HEATER, PLATE AND SCREEN GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE GRID #1 TO PLATE (MAX.)	.015	μμf
PENTODE INPUT	8.5	μμf
PENTODE OUTPUT	5.5	μμf
TRIODE GRID TO PLATE	1.7	μμf
TRIODE INPUT	2.6	μμf
TRIODE OUTPUT	2.0	μμf
COUPLING, PENTODE GRID #1 TO TRIODE GRID (MAX.)	.012	μμf
COUPLING, PENTODE GRID #1 TO DIODE PLATE (MAX.)	.004	μμf
COUPLING, TRIODE GRID TO DIODE PLATE (MAX.)	.17	μμf
COUPLING, TRIODE PLATE TO DIODE PLATE	.8	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	PENTODE	TRIODE	DIODE	
HEATER VOLTAGE[A]	12.6	12.6		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	---	±16	---	VOLTS
MAXIMUM PLATE VOLTAGE	16	16	---	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	16	---	---	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	16	---	---	VOLTS
MAXIMUM PENTODE GRID CIRCUIT RESISTANCE	10	---	---	MEGOHMS
MAXIMUM TRIODE GRID CIRCUIT RESISTANCE	---	10	---	MEGOHMS
MAXIMUM PLATE CURRENT	---	---	5	MA.

A

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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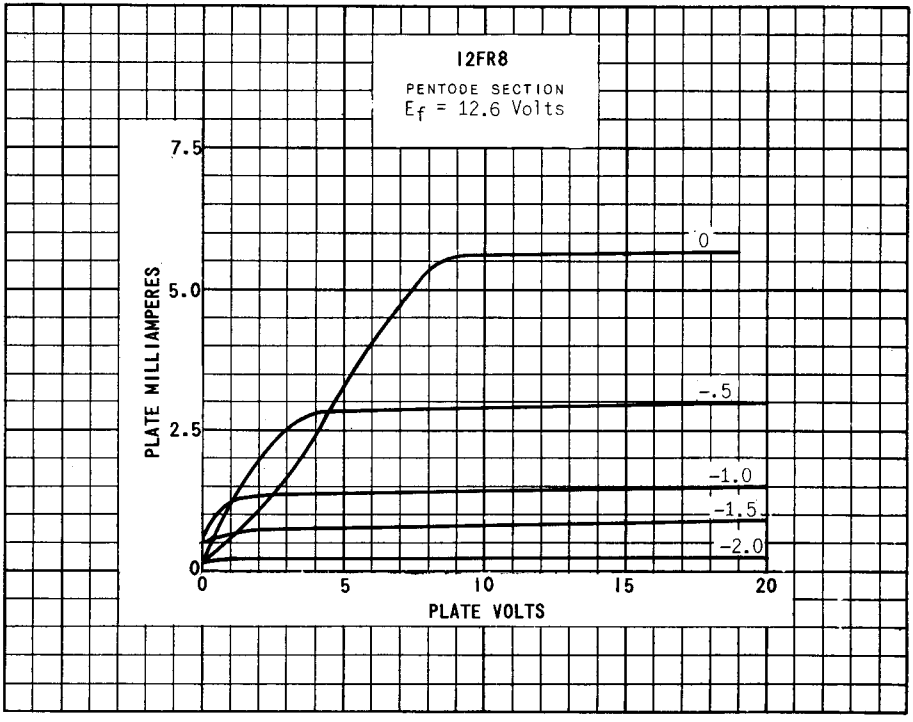
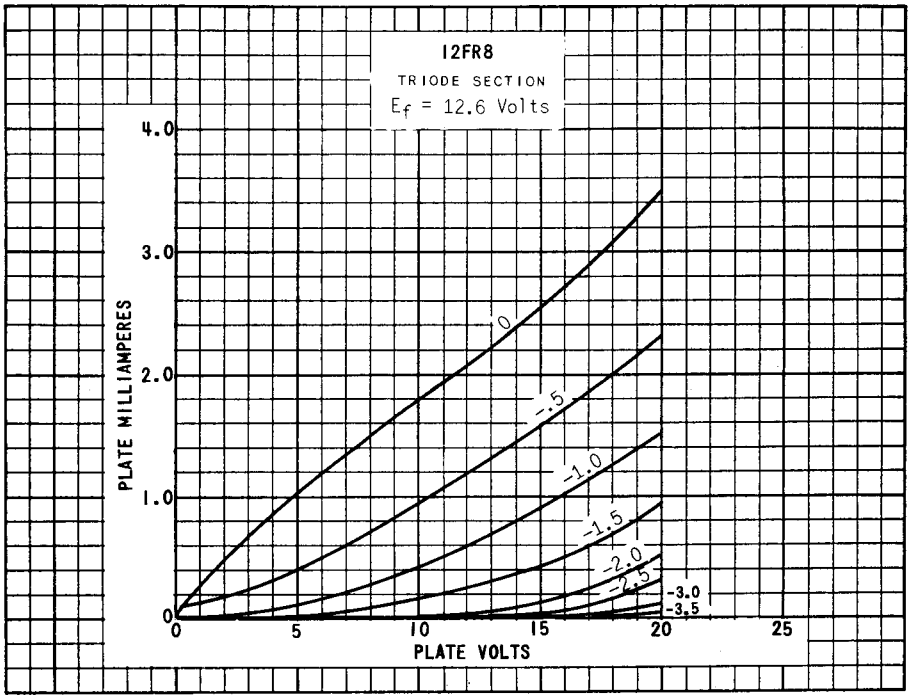
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	PENTODE	TRIODE	DIODE[B]	
HEATER VOLTAGE	12.6	12.6		VOLTS
HEATER CURRENT	0.32	0.32		AMP.
PLATE VOLTAGE	12.6	12.6	10	VOLTS
GRID #2 VOLTAGE	12.6	---	---	VOLTS
GRID #1 VOLTAGE	-0.8[C]	-0.6[C]	---	VOLTS
PLATE CURRENT	1.9	1.0	2	MA.
SCREEN CURRENT	.7	---	---	MA.
TRANSCONDUCTANCE	2700	1200	---	μMHOS
PLATE RESISTANCE (APPROX.)	.40	---	---	MEGOHMS
AMPLIFICATION FACTOR	---	10	---	
GRID #1 VOLTAGE FOR TRANSCONDUCTANCE = 30 μMHOS	-2.8	---	---	VOLTS
GRID VOLTAGE FOR PLATE CURRENT OF 10μA	---	-3.5	---	VOLTS

[B] AVERAGE CHARACTERISTICS.

[C] AVERAGE BIAS DEVELOPED ACROSS A 2.2 MEGOHM GRID RESISTOR.





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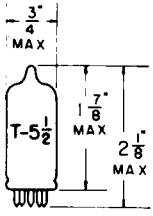
TUNG-SOL

DUO-DIODE-TRIODE

MINIATURE TYPE



GLASS BULB

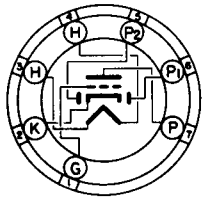
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
7 PIN BASE

7BT

THE 12FT6 IS A DUO-DIODE-TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS THE SECOND DETECTOR AND AUDIO DRIVER AMPLIFIER IN HYBRID (TUBE AND TRANSISTOR) AUTOMOBILE RADIO RECEIVERS THAT OPERATE WITH "A" AND "B" SUPPLY DIRECTLY FROM A 12-VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	2.0	μμf
INPUT	1.8	μμf
OUTPUT	1.1	μμf
DIODE 1 TO DIODE 2	0.9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM AVERAGE DIODE CURRENT	1	MA.
MAXIMUM GRID #1 RESISTANCE	10	MEGOHMS
MAXIMUM PEAK HEATER TO CATHODE VOLTAGE	±30	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

TRIODE UNIT			
HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	12.6	12.6	VOLTS
GRID #1 VOLTAGE	0	---	VOLTS
GRID #1 CIRCUIT RESISTANCE	0	2.2	MEGOHM
PLATE RESISTANCE (APPROX.)	7600	13 000	OHMS
TRANSCONDUCTANCE	1900	1 000	μMHOS
AMPLIFICATION FACTOR	15.0	14.0	
PLATE CURRENT	2.0	0.6	MA.
DIODE UNITS			
AVERAGE DIODE CURRENT WITH 10 VOLTS APPLIED (EA. DIODE)	3.0		MA.

THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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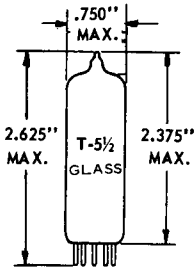
TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 5-3



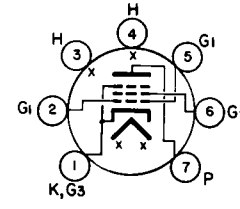
BASE 7 PIN BUTTON
JEDEC E7-1

AUDIO OUTPUT PENTODE

HIGH POWER SENSITIVITY

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7CV



BOTTOM VIEW

THE 12FX5 IS A BEAM POWER PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO RECORD PLAYER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6	pf
INPUT: G_1 TO ($G_2 + G_3 + K + H$)	17	pf
OUTPUT: P TO ($G_2 + G_3 + K + H$)	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT - AC OR DC		450 ± 30	MA
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	5.5	WATTS
GRID #2 DISSIPATION	2	WATTS
GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	225	° C

CHARACTERISTICS

PLATE VOLTAGE	110	VOLTS
GRID 2 VOLTAGE	115	VOLTS
CATHODE BIAS RESISTOR	62	OHMS
PLATE CURRENT	36	MA
GRID 2 CURRENT	10	MA
TRANSCONDUCTANCE	13,500	μMHOS
PLATE RESISTANCE - APPROX.	17,500	OHMS

TYPICAL OPERATING CONDITIONS

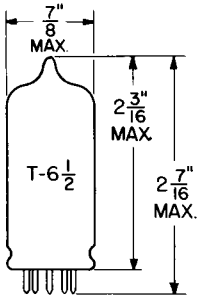
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	115	VOLTS
CATHODE BIAS RESISTOR - BY PASSED	62	OHMS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
MAXIMUM SIGNAL PLATE CURRENT	35	MA
MAXIMUM SIGNAL GRID #2 CURRENT	12	MA
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	8	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.3	WATTS

TUNG-SOL

TRIODE-HEPTODE

MINIATURE TYPE

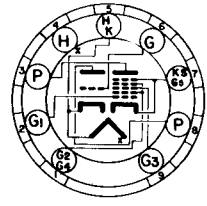


GLASS BULB

COATED UNIPOTENTIAL CATHODES-(2)

HEATER

12.6 VOLTS 0.27 AMP.



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9KV

THE 12FX8 IS A TRIODE AND HEPTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE IN SUPERHETERODYNE RECEIVERS AS A TRIODE RF AMPLIFIER AND FREQUENCY CONVERTER WHERE THE PLATE, HEATER AND SCREEN POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
HEPTODE:		
MIXER GRID TO PLATE (G3 TO P) (MAX.)	0.28	μμf
MIXER GRID TO OSCILLATOR GRID (G3 TO G1)(MAX.)	0.12	μμf
RF INPUT (G3 TO H+K+G1+G2,4+G5+P)	6.0	μμf
MIXER OUTPUT (P TO H+K+G1+G2,4+G5)	5.0	μμf
OSCILLATOR INPUT (G1 TO H+K+G2,4+G3+G5)	5.0	μμf
OSCILLATOR GRID TO CATHODE (G1 TO K)	3.0	μμf
OSCILLATOR OUTPUT (K TO H+G2,4+G3+P)	17	μμf
OSCILLATOR GRID TO PLATE (G1 TO P) (MAX.)	0.16	μμf
TRIODE:		
GRID TO PLATE	1.3	μμf
INPUT	2.2	μμf
OUTPUT	0.25	μμf
COUPLING:		
TRIODE GRID TO MIXER GRID (MAX.)	.01	μμf
TRIODE PLATE TO MIXER GRID (MAX.)	0.18	μμf
TRIODE PLATE TO HEPTODE PLATE (MAX.)	0.20	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±16	VOLTS
MAXIMUM HEPTODE PLATE VOLTAGE	16	VOLTS
MAXIMUM TRIODE PLATE VOLTAGE	16	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	16	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	16	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	16	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	0	VOLTS
MAXIMUM GRID #3 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM TRIODE GRID CIRCUIT RESISTANCE	10	MEGOHMS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	HEPTODE[C]		TRIODE	
HEATER VOLTAGE		12.6		VOLTS
PLATE VOLTAGE	12.6		12.6	VOLTS
GRID VOLTAGE	----		-.8[B]	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	1.6		----	VOLTS
GRID #2 & #4 VOLTAGE (SCREEN GRID)	12.6		----	VOLTS
GRID #3 VOLTAGE (SIGNAL GRID)	.5[B]		----	VOLTS
PLATE RESISTANCE	.5		----	MEGOHM
TRANSCONDUCTANCE	----		1400	μMHOS
PLATE CURRENT	290		1300	μA
GRID #2 CURRENT	1250		----	μA
CONVERSION TRANSCONDUCTANCE	300		----	μMHOS
AMPLIFICATION FACTOR	----		10	
GRID VOLTAGE FOR I_b OF 10μA (APPROX.)	----		-3.2	VOLTS
GRID #3 VOLTAGE FOR CONVERSION TRANS-CONDUCTANCE OF 10 μMHOS (APPROX.)	-3.0		----	VOLTS

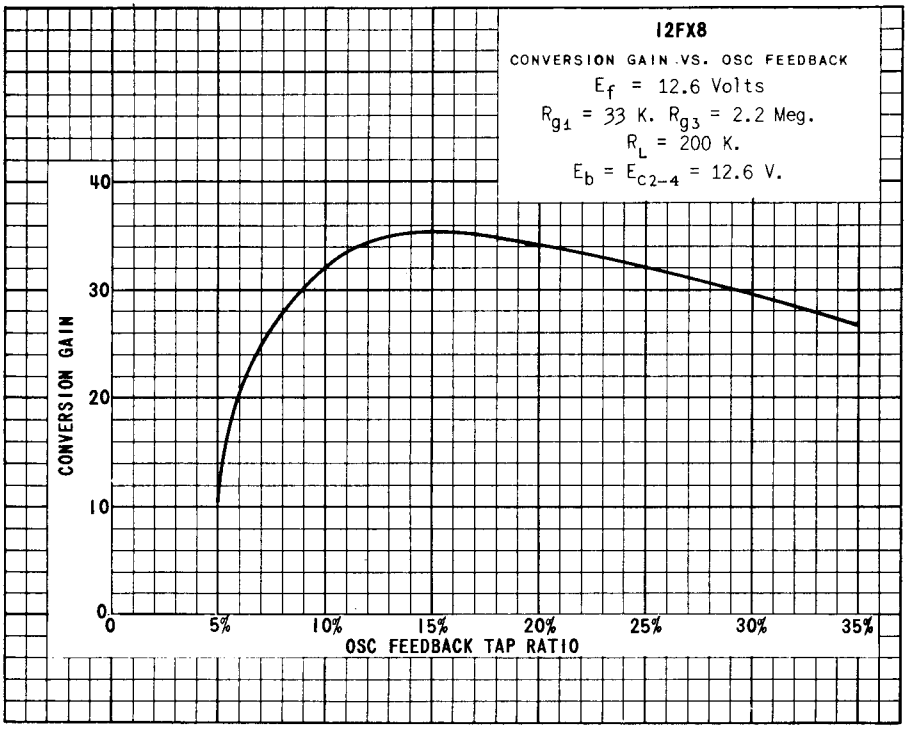
HEPTODE OSCILLATOR CHARACTERISTICS - NOT OSCILLATING

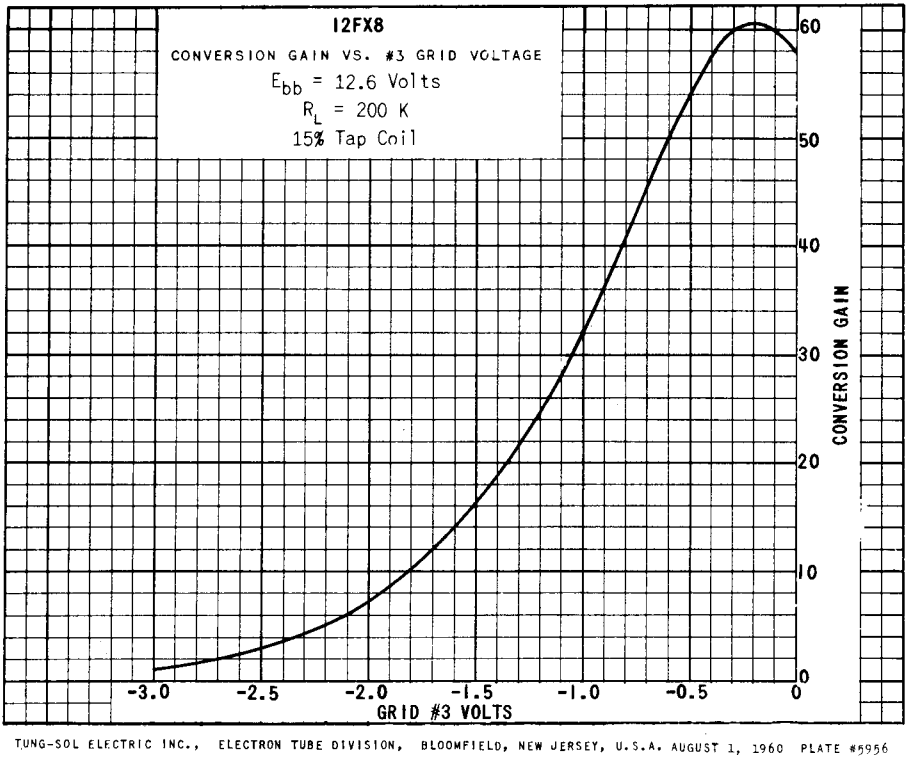
GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE (OSCILLATOR GRID)	0	VOLTS
GRIDS #2 & #4 CONNECTED TO PLATE	12.6	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 & GRIDS #2 & #4 CONNECTED TO PLATE	3600	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1 & GRIDS #2 & #4 CONNECTED TO PLATE	9.0	
CATHODE CURRENT	4.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 μA	-4.5	VOLTS

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

[B] AVERAGE BIAS DEVELOPED ACROSS 2.2 MEGOHM GRID RESISTOR.

[C] CONVERTER SERVICE-SELF EXCITATION, SCREEN FEED BACK. OSCILLATOR GRID RESISTOR 33,000 OHMS.





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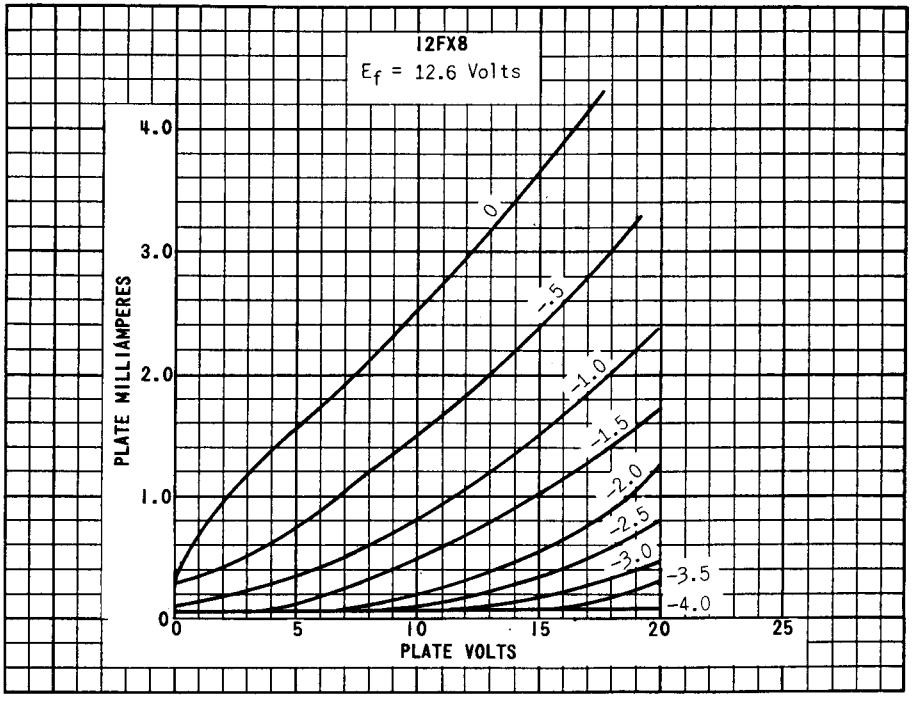
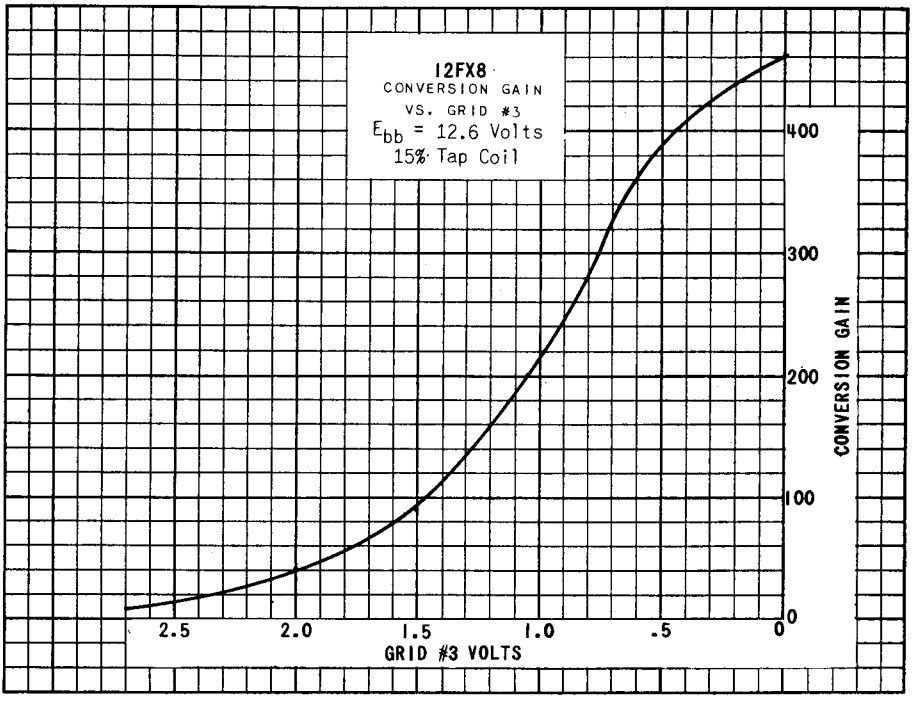
TENTATIVE DATA

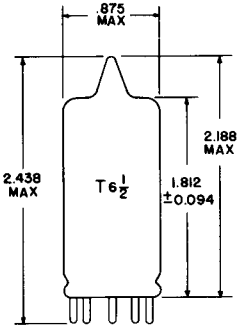




TUNG-SOL

TRIODE - HEPTODE

MINIATURE TYPE



GLASS BULB

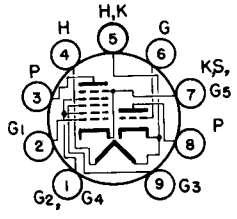
SMALL BUTTON
9 PIN BASE E9-1

OUTLINE DRAWING
JEDEC 6-10

COATED UNIPOTENTIAL CATHODES (2)

FOR

AUTOMOBILE RADIO
RECEIVER SERVICE
RF AMPLIFIER AND
FREQUENCY-CONVERTER



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9KV

THE 12FX8A IS A MINIATURE TRIODE-HEPTODE DESIGNED FOR USE IN AUTOMOBILE RADIO RECEIVER SERVICE WHERE PLATE AND SCREEN VOLTAGES ARE SUPPLIED DIRECTLY FROM A 12-VOLT STORAGE BATTERY. THE TRIODE SECTION IS INTENDED FOR RF AMPLIFIER USE AND THE HEPTODE SECTION FOR FREQUENCY-CONVERTER USE. THE 12FX8A IS UNILATERALLY INTERCHANGEABLE WITH THE 12FX8 AND DIFFERS ONLY IN HAVING AN ADDITIONAL CONTROL ON THE CONVERSION-CONDUCTANCE CUT-OFF CHARACTERISTIC OF THE HEPTODE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

HEPTODE		
GRID #3 TO PLATE: (HG3 TO HP) MAX.	0.28	pf
GRID #3 TO GRID #1! (HG3 TO HG1), MAX.	0.12	pf
RF INPUT: HG3 TO (H+TK+HK+HG1+HG2,4+HG5+HP+I.S.)	6.0	pf
OSCILLATOR INPUT: HG1 TO (H+TK+HK+HG2,4+HG3+HG5+ HP+I.S.)	5.0	pf
MIXER OUTPUT: HP TO (H+TK+HK+HG1+HG2,4+HG3+HG5+I.S.)	5.0	pf
GRID #1 TO CATHODE: HG1 TO (HK+HG5+I.S.)	3.0	pf
OSCILLATOR OUTPUT: HK TO (H+TK+HG2,4+HG3+HP)	17	pf
GRID #1 TO PLATE: (HG1 TO HP) MAX.	0.16	pf
TRIODE		
GRID TO PLATE: (TG TO TP)	1.3	pf
INPUT: TG TO (TK+H)	2.2	pf
OUTPUT: TP TO (TK+H)	0.25	pf
TRIODE GRID TO HEPTODE GRID #3: (TG TO HG3), MAX.	0.01	pf
TRIODE PLATE TO HEPTODE GRID #3: (TP TO HG3), MAX.	0.18	pf
TRIODE PLATE TO HEPTODE PLATE: (TP TO HP), MAX.	0.20	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	270 MA.

HEATER SUPPLY LIMITS:

WHEN USED IN AUTOMOBILE SERVICE FROM A 12-VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS; HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER VOLTAGE AND IN LIFE EXPECTANCE AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

HEPTODE PLATE VOLTAGE	16	VOLTS
HEPTODE SCREEN-SUPPLY VOLTAGE	16	VOLTS
HEPTODE SCREEN VOLTAGE	16	VOLTS
HEPTODE POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
HEPTODE NEGATIVE DC GRID #3 VOLTAGE	16	VOLTS
TRIODE PLATE VOLTAGE	16	VOLTS
HEPTODE GRID #3 CIRCUIT RESISTANCE	10	MEGOHMS
TRIODE GRID-CIRCUIT RESISTANCE	10	MEGOHMS

DESIGN-CENTER RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER NORMAL CONDITIONS. THESE VALUES ARE CHOSEN BY THE TUBE MANUFACTURER TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE IN AVERAGE APPLICATIONS, TAKING RESPONSIBILITY FOR EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, ENVIRONMENTAL CONDITIONS, AND VARIATIONS IN THE CHARACTERISTICS OF ALL TUBES. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY NO DESIGN-CENTER VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY TUBE IN EQUIPMENT OPERATING AT THE STATED NORMAL SUPPLY-VOLTAGE.

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

	HEPTODE[A]	TRIODE	
PLATE VOLTAGE	12.6	12.6	VOLTS
SCREEN VOLTAGE	12.6	---	VOLTS
GRID #3 VOLTAGE	0.5[B]	---	VOLTS
GRID #3 RESISTANCE	2.2	---	MEGOHMS
GRID #1 VOLTAGE, RMS	1.6	---	VOLTS
GRID #1 RESISTANCE	0.033	2.2	MEGOHMS
GRID VOLTAGE	---	0.8[C]	VOLTS
PLATE RESISTANCE, APPROX.	0.5	---	MEGOHMS
CONVERSION TRANSCONDUCTANCE	300	---	MICROMHOS
TRANSCONDUCTANCE	---	1400	MICROMHOS
AMPLIFICATION FACTOR	---	10	
PLATE CURRENT	0.29	1.3	MA.
SCREEN CURRENT	1.25	---	MA.
GRID #3 VOLTAGE, APPROX.			
Gc = 10 μMHOS	-3.0	---	VOLTS
Gc = 1.0 μMHOS	-8.0	---	VOLTS
GRID VOLTAGE, APPROX.			
Ib = 10 μAMPS.	---	-3.2	VOLTS

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TUNG-SOL

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TYPICAL OPERATING CHARACTERISTICS - CONT'D.

HEPTODE OSCILLATOR CHARACTERISTICS (NOT OSCILLATING)

PLATE VOLTAGE	12.6	VOLTS
SCREEN, CONNECTED TO PLATE		
GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
AMPLIFICATION FACTOR[D]	9	
TRANSCONDUCTANCE[D]	3600	μMHOS
CATHODE CURRENT	4.4	MA.
GRID #1 VOLTAGE, APPROX. Ib = 10 μAMPS.	-4.5	VOLTS

[A] SELF-EXCITED CONVERTER SERVICE.

[B] VOLTAGE DEVELOPED ACROSS 2.2 MEGOHM GRID #3 RESISTOR.

[C] VOLTAGE DEVELOPED ACROSS 2.2 MEGOHM GRID RESISTOR.

[D] BETWEEN GRID #1 AND GRIDS #2 & 4 CONNECTED TO PLATE.

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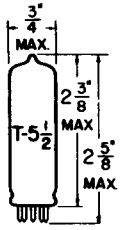
TUNG-SOL

TRIODE

MINIATURE TYPE

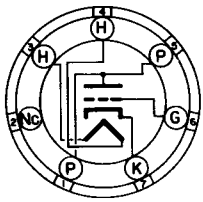


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BG

THE 12G4 IS A MEDIUM MU TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF TYPE 12J5GT.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
GRID TO PLATE	3.4	3.4	μμf
INPUT	2.4	2.6	μμf
OUTPUT	0.9	3.2	μμf

[A] WITH SHIELD #308 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10	9	MA.
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	
GRID VOLTAGE FOR 10 μA. PLATE CURRENT	-7	-18	VOLTS

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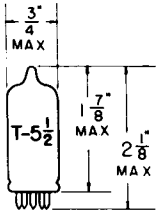
TUNG-SOL

HEPTODE

MINIATURE TYPE



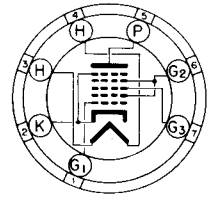
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 12GA6 IS A MINIATURE HEPTODE PRIMARILY INTENDED TO PERFORM THE COMBINED FUNCTIONS OF MIXER AND OSCILLATOR IN AUTOMOBILE RADIO RECEIVERS. THE TUBE IS SPECIALLY DESIGNED TO OPERATE WITH PLATE AND SCREEN VOLTAGES SUPPLIED DIRECTLY FROM A 12-VOLT STORAGE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID #3 TO ALL	8.0	8.0	μμf
PLATE TO ALL	13	8.0	μμf
GRID #1 TO ALL	5.0	5.0	μμf
CATHODE TO ALL EXCEPT GRID #1	20	15	μμf
GRID #3 TO PLATE, MAX.	0.25	0.3	μμf
GRID #1 TO GRID #3 , MAX.	0.15	0.15	μμf
GRID #1 TO PLATE, MAX.	0.05	0.1	μμf
GRID #1 TO CATHODE	2.5	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE[B]	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	16	VOLTS
MAXIMUM SCREEN VOLTAGE	16	VOLTS
MAXIMUM POSITIVE DC GRID #3 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #3 VOLTAGE	16	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	16	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16	VOLTS
MAXIMUM GRID #3 CIRCUIT RESISTANCE	10	MEG.

[A] WITH EXTERNAL SHIELD 316 CONNECTED TO PIN 2.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
SCREEN VOLTAGE	12.6	VOLTS
GRID #3 SUPPLY VOLTAGE	0	VOLTS
GRID #3 RESISTOR (BYPASSED)	2.2	MEG.
GRID #1 VOLTAGE, RMS, APPROX.	1.6	VOLTS
GRID #1 RESISTOR	33000	OHMS
PLATE RESISTANCE, APPROX.	1.0	MEG.
CONVERSION TRANSCONDUCTANCE	140	μMHOS
PLATE CURRENT	0.30	MA.
SCREEN CURRENT	0.80	MA.
GRID #1 CURRENT	0.060	MA.
GRID #3 VOLTAGE, APPROX. Gc =5 μMHOS	-3	VOLTS
GRID #3 VOLTAGE, APPROX. Gc = 20 μMHOS	-2.5	VOLTS

OSCILLATOR CHARACTERISTICS - NOT OSCILLATING

PLATE VOLTAGE	12.6	VOLTS
SCREEN, CONNECTED TO PLATE		
SCREEN VOLTAGE	0	VOLTS
GRID #3 VOLTAGE	0	VOLTS
AMPLIFICATION FACTOR[C]	9.0	
TRANSCONDUCTANCE[C]	2400	μMHOS
CATHODE CURRENT	3.6	MA.
GRID #1 VOLTAGE, APPROX. Ib =10 μAMPS.	-3.3	VOLTS

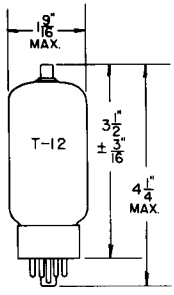
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY TUBE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THESE VALUES ARE CHOSEN BY THE TUBE MANUFACTURER TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE TUBE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN THE CHARACTERISTICS OF THE TUBE UNDER CONSIDERATION. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, VARIATION IN CHARACTERISTICS OF ALL OTHER TUBES IN THE EQUIPMENT, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B]WHEN USED IN AUTOMOBILE SERVICE FROM A 12 VOLT SOURCE, UNDER NO CIRCUMSTANCES SHOULD THE HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 VOLTS. THESE EXTREME VARIATIONS IN HEATER VOLTAGE MAY BE TOLERATED FOR SHORT PERIODS; HOWEVER, OPERATION AT OR NEAR THESE ABSOLUTE LIMITS IN HEATER VOLTAGE NECESSARILY INVOLVES SACRIFICE IN PERFORMANCE AT LOW HEATER-VOLTAGE AND IN LIFE EXPECTANCY AT HIGH HEATER VOLTAGE. EQUIPMENT RELIABILITY CAN BE SIGNIFICANTLY INCREASED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

[C]BETWEEN GRID #1 AND GRID NUMBERS 2 & 4 CONNECTED TO PLATE.

TUNG-SOL

PENTODE

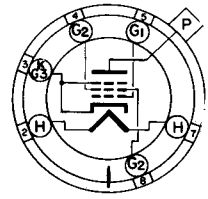


GLASS BULB

HEATER

12.6 VOLTS 0.6 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM OCTAL
WITH EXTERNAL BARRIERS

8JX

THE 12GC6 IS A HEATER-CATHODE TYPE BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT HAS EXTREMELY HIGH PERVEANCE, SUCH THAT THE DESIGN OF WIDE-ANGLE DEFLECTION SYSTEMS IS MADE POSSIBLE WITHOUT THE NECESSITY OF USING AN EXPENSIVE DEFLECTION AMPLIFIER TUBE. EXCEPT FOR HEATER CHARACTERISTICS, THE 12GC6 IS IDENTICAL TO THE6GC6.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G1 TO P)	0.55	μμf
INPUT: G1 TO (H+K+G2+B.P)	15	μμf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE (BOOST+DC POWER SUPPLY)	770	VOLTS
MAXIMUM GRID #2 VOLTAGE	220	VOLTS
MAXIMUM PLATE DISSIPATION[B]	17.5	WATTS
MAXIMUM GRID #2 DISSIPATION	4.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	175	MA.
MAXIMUM PEAK CATHODE CURRENT	550	MA.
MAXIMUM PEAK POSITIVE PLATE VOLTAGE	6500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1500	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	330	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.0	MEG.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME*	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.6	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
PLATE CURRENT	75	MA.
GRID #2 CURRENT	2.4	MA.
TRIODE AMPLIFICATION FACTOR[C]	4.1	
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE	20000	OHMS
GRID #1 VOLTAGE (APPROX.) FOR Ib= 1 MA. (APPROX.)	-46	VOLTS
ZERO-BIAS: WITH Eb=60 V., AND Ec2 = 150 V.(INSTANTANEOUS VALUE)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	30	MA.
CUTOFF: FOR Ib= 1MA. WITH E_b =5000 V., AND Ec2 = 150 V (APPROX. VALUE)	-100	VOLTS

A. FOR OPERATION IN A 525 LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARD OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

B. IN STAGES OPERATING GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

C. Eb=Ec2=150 VOLTS.

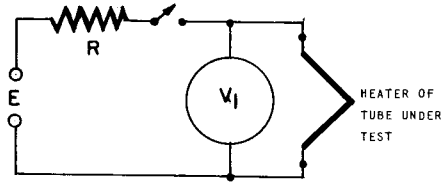
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE FROM ZERO TO THE HEATER TEST VOLTAGE (V_1).

E = 50 Volts (RMS or DC)

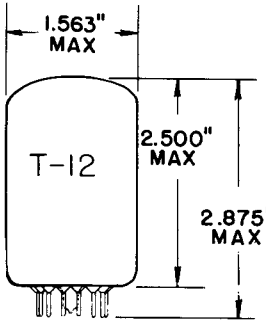
V_1 = 10.0 Volts (RMS or DC)

R = 63 Ohms



TUNG-SOL

BEAM PENTODE
COMPACTRON



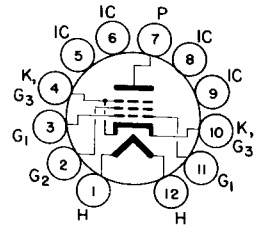
GLASS BULB

BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL-DEFLECTION AMPLIFIER APPLICATIONS IN T.V. RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BJ

THE 12GE5 IS A BEAM-POWER PENTODE IN THE COMPACT 12 PIN, T-12 CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.
EXCEPT FOF HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 12GE5 IS IDENTICAL TO THE 6GE5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.34	pf
INPUT: G1 TO ($H+K+G2+B.P.$)	16	pf
OUTPUT: P TO ($H+K+G2+B.P.$)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME[□]		11	SECONDS

[□] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 50% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE•

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY))	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
GRID #2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID #1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[A]	17.5	WATTS
GRID #2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID #1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0[B]	-22.5	VOLTS
PLATE RESISTANCE, APPROX.	---	20,000	OHMS
TRANSCONDUCTANCE	---	6600	μMHOS
PLATE CURRENT	345	75	MA.
GRID #2 CURRENT	33	2.4	MA.
GRID #1 VOLTAGE, APPROX. I_b = 1.0 MA.	---	-46	VOLTS
TRIODE AMPLIFICATION FACTOR G2 TIED TO PLATE, $E_b = E_{c2}$ = 150 V., E_{c1} = -22.5 V.	---	4.1	

•FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

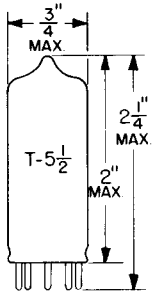
A IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

B APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

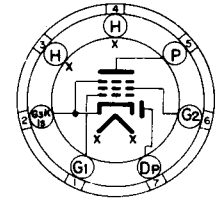
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7FW

THE 12GN6 IS A REMOTE-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS A HIGH GAIN R.F. OR I.F. AMPLIFIER AND A DEMODULATOR DIODE BOTH ON A COMMON CATHODE. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 12GN6 IS IDENTICAL TO THE 6GN6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	.0035	.0035	μμf
INPUT	5.5	5.5	μμf
OUTPUT	5.5	5.0	μμf
COUPLING DIODE PLATE TO GRID (MAX.)	.05	.05	μμf

[A] WITH EXTERNAL SHIELD #316 CONNECTED TO PIN 2.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.6	WATTS
MAXIMUM DIODE CURRENT (CONTINUOUS OPERATION)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	---	VOLTS
TOTAL DC PLUS PEAK	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC PLUS PEAK	100	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

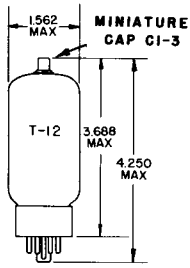
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	100	250	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET			
SCREEN VOLTAGE	100	100	VOLTS
CATHODE-BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHMS
TRANSCONDUCTANCE	4300	4400	μMHOS
PLATE CURRENT	10.8	11	MA.
SCREEN CURRENT	4.4	4.2	MA.
GRID #1 VOLTAGE (APPROX.) G_m = 40 μMHOS	−20	−20	VOLTS
AVERAGE DIODE CURRENT AT 10V D.C.	1.5	1.5	MA.

TUNG-SOL

BEAM PENTODE



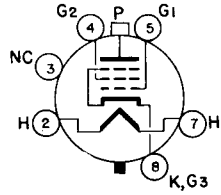
GLASS BULB

SHORT MEDIUM SHELL
5 OR 6 PIN OCTAL WITH
EXTERNAL BARRIERS
STYLE B: B6-122 OR B5-190

FOR
HORIZONTAL-DEFLECTION-AMPLIFIER
CIRCUITS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #3 IS OMITTED WHEN B5-190 BASE IS USED



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AM

THE 12GW6 IS A BEAM POWER PENTODE EMPLOYING A T-12 ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE IN HORIZONTAL-DEFLECTION-AMPLIFIER CIRCUITS OF TELEVISION RECEIVERS WHICH OPERATE WITH LOW PLATE SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	pf
GRID #1 TO CATHODE, GRID #3, GRID #2 & HEATER	17	pf
PLATE TO CATHODE, GRID #3, GRID #2 & HEATER	7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6	VOLTS	600	MA.
HEATER WARM-UP TIME*			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			600±40	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200[A]	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE-PULSE PLATE VOLTAGE[B]	6500	VOLTS
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1500	VOLTS
DC GRID #2 VOLTAGE	220	VOLTS
DC GRID #1 VOLTAGE	-55	VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS-CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	330	VOLTS
CATHODE CURRENT:		
PEAK	550	MA.
AVERAGE	175	MA.
PLATE DISSIPATION[C]	17.5	WATTS
GRID #2 INPUT	3.5	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	240	°C

MAXIMUM CIRCUIT VALUES:

GRID #1 CIRCUIT RESISTANCE[C]	1.0	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	VOLTS
MU-FACTOR, GRID #2 TO GRID #1 WITH PLATE CONNECTED TO GRID #2, PLATE VOLTS = GRID #2 VOLTS =150, AND GRID #1 VOLTS =-22.5	---	4.4	
PLATE RESISTANCE (APPROX.)	---	15000	OHMS
TRANSCONDUCTANCE	---	7100	μMHOS
PLATE CURRENT	→390[D]	70	MA.
GRID #2 CURRENT	32[D]	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 1 MA.		42	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

A
THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

B
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE POLSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

C
IN STAGES OPERATING WITH GRID-RESISTOR BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

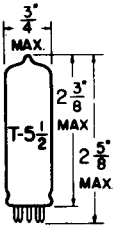
D
THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVE FORM SUCH THAT THE CATHODE CURRENT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

→ INDICATES A CHANGE.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

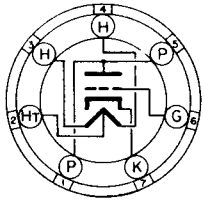
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS	6.3 VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7DW

THE 12H4 IS A MINIATURE GENERAL PURPOSE TRIODE VOLTAGE AMPLIFIER. FEATURING A HEATER CONSTRUCTION WHICH PERMITS OPERATION AT EITHER 6 OR 12 VOLTS SUPPLY. THIS TUBE IS NOT PARTICULARLY SUITED TO HIGH FREQUENCY SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	3.4	3.4	μμf
INPUT	2.6	2.4	μμf
OUTPUT	3.2	0.9	μμf

[A] SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER—CATHODE VOLTAGE	±90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
DC PLATE VOLTAGE	90	250	VOLTS
DC GRID VOLTAGE	0	−8	VOLTS
PLATE CURRENT	10	9	MA.
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	
GRID VOLTAGE FOR 10 μA. PLATE CURRENT	−7	−18	VOLTS

SIMILAR TYPE REFERENCE: Electrically similar to 1/2 of type 6SN7GT.

→ INDICATES A CHANGE.

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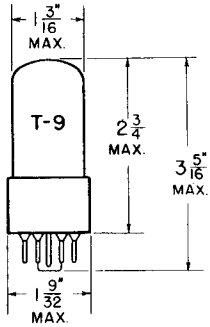
TUNG-SOL

TRIODE

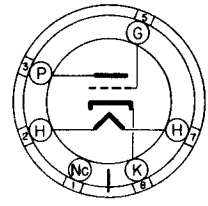


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL BASE

THE 12J5GT IS A GENERAL PURPOSE MEDIUM-MU TRIODE. IT IS USEFUL FOR SERVICE AS AN OSCILLATOR OR AUDIO-FREQUENCY AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH CLOSE FITTING SHIELD CONNECTED TO CATHODE

GRID TO PLATE: (G TO P)	3.8	μμf
INPUT: G TO (H+K)	4.2	μμf
OUTPUT: P TO (H+K)	5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM NEGATIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	MEG.
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM CATHODE CURRENT	20	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	CLASS A_1 AMPLIFIER		
HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10	9	MA.
PLATE RESISTANCE	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	

SIMILIAR TYPE REFERENCE: Ratings and characteristics are identical to 1U4U, except for heater ratings.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE
1948

JAN. 2,
1948

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CONTINUED FROM PRECEDING PAGE

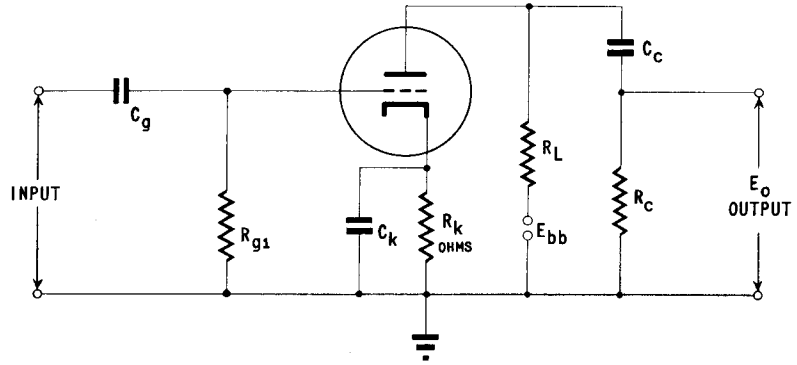
RESISTANCE COUPLED AMPLIFIER

R_1 MEG.	R_{g1} MEG.	R_s MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	A	0.24	3600	14	16	2700	15	33	2200	15	51
0.24	A	0.24	7500	14	16	5100	15	30	4300	15	44
0.24	A	0.51	9100	14	19	6800	15	39	5100	15	54
0.51	A	0.51	13000	14	16	9100	15	30	6800	16	40
0.51	A	1.0	15000	14	19	10000	16	32	7500	16	45
0.24	10	0.24	---	15	13	---	16	33	---	17	46
0.24	10	0.51	---	16	17	---	17	38	---	18	62
0.51	10	0.51	---	16	14	---	18	32	---	18	53
0.51	10	1.0	---	17	18	---	18	41	---	19	68

[A] VALUE OF R_{g1} IS NOT CRITICAL.

GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.

E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PLATE 1949
JAN. 2, 1948

→ INDICATES A CHANGE OR ADDITION.

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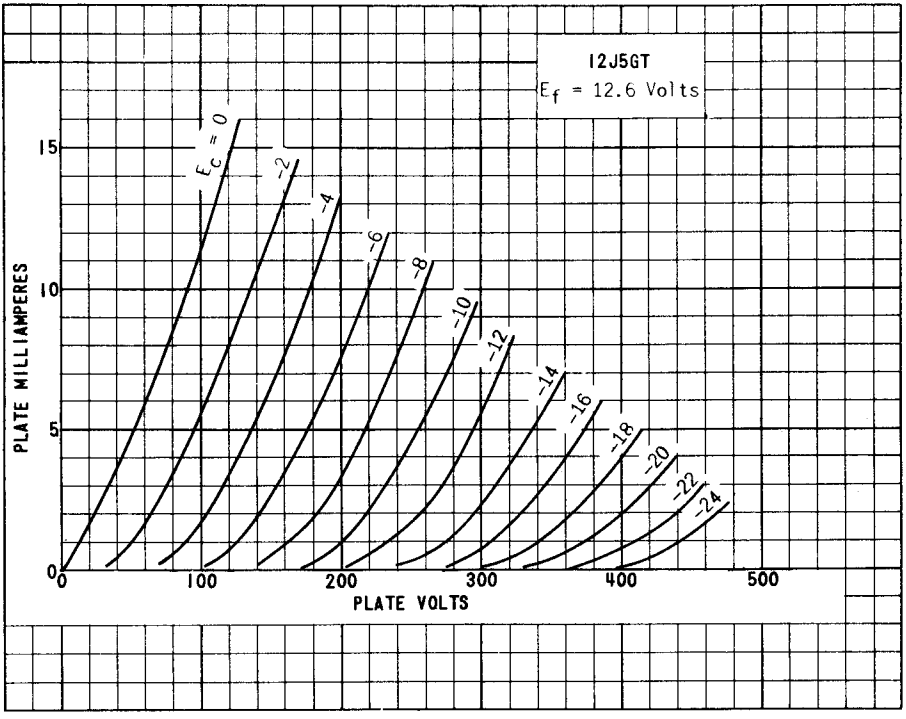

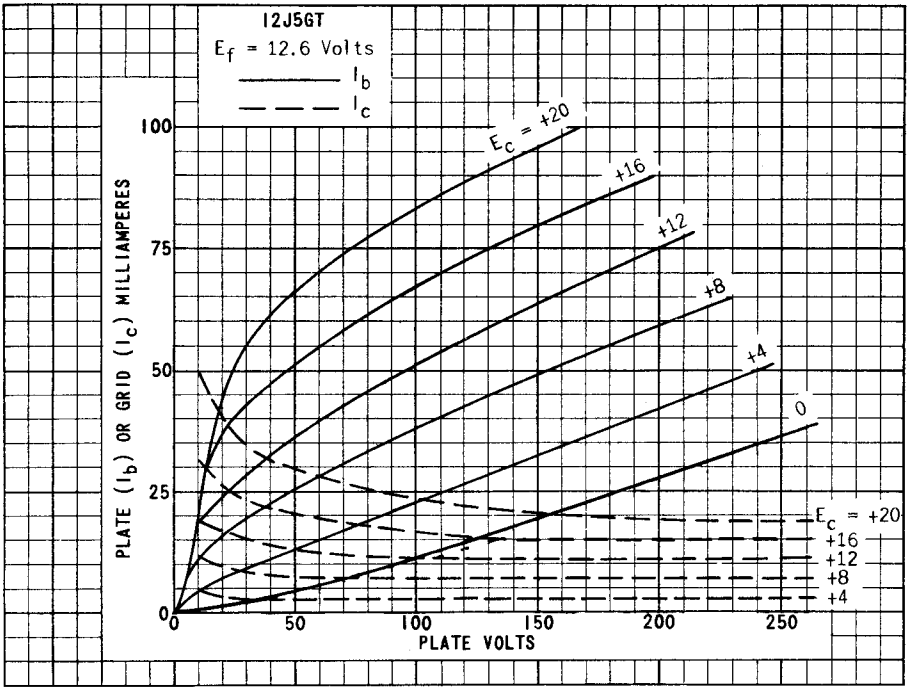

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PLATE
1950
JAN. 2,
1948

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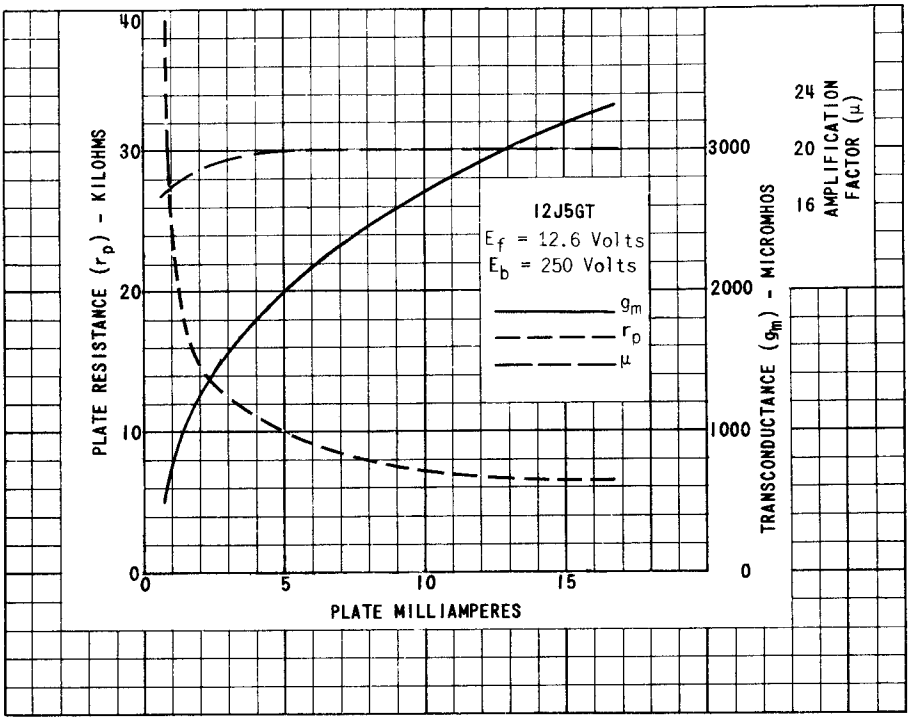
12J5GT



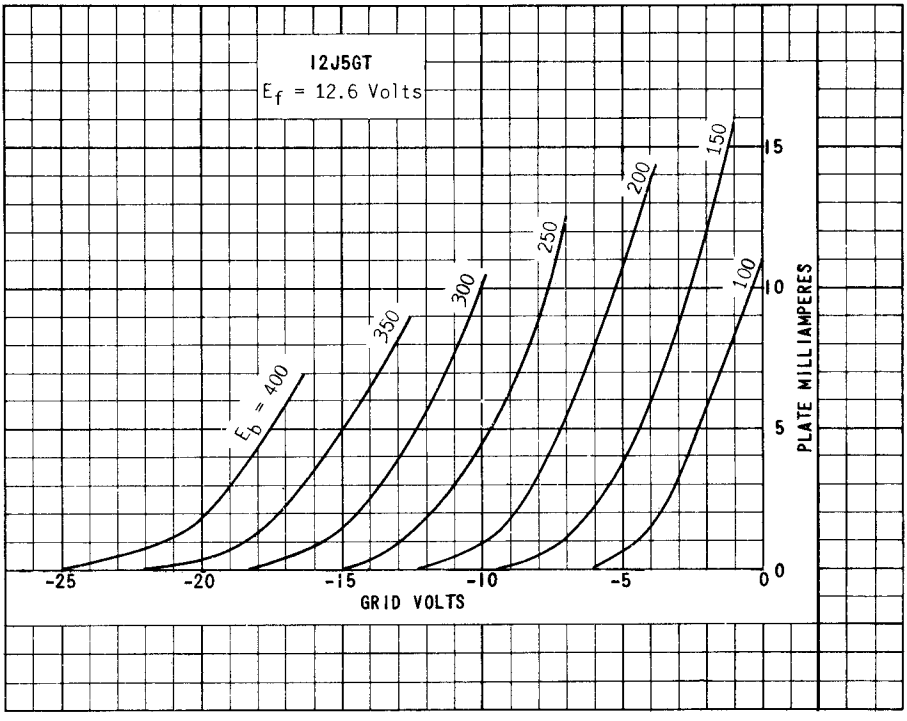


PLATE 1951
JAN. 2, 1948

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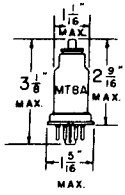
TUNG-SOL

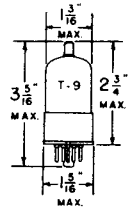


TRIPLE GRID
DETECTOR AMPLIFIER

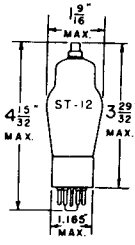
UNIPOTENTIAL CATHODE

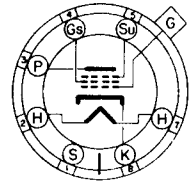
HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

SMALL 7 PIN OCTAL BASES



G-7Ra
BOTTOM VIEW





7R
BOTTOM VIEW

THE TUNG-SOL 6J7, 6J7G, 6J7GT AND THE 12J7GT ARE SHARP CUT-OFF GENERAL PURPOSE AMPLIFIERS. WITH THE EXCEPTION OF HEATER AND CAPACITANCE RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 6C6.

RATINGS

	TRIODE[A] CONNECTION	PENTODE CONNECTION	
MAXIMUM PLATE VOLTAGE	250	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	–	300	VOLTS
MAXIMUM SCREEN VOLTAGE	–	125	VOLTS
MINIMUM EXTERNAL CONTROL GRID BIAS VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.75	0.75	WATT
MAXIMUM SCREEN DISSIPATION	–	0.10	WATT

[A] SUPPRESSOR GRID AND SCREEN TIED TO PLATE

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1022-2

APR. 21
1941

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

TRIODE CONNECTION

	6J7	6J7G	6J7GT 12J7GT
CONTROL GRID TO CATHODE	5[B]	2.6[C]	2.6[C]
PLATE TO CATHODE	14	17	17
CONTROL GRID TO PLATE	2.0	1.8	1.8

PENTODE CONNECTION

CONTROL GRID TO CATHODE	7[B]	4.6[D]	4.6[D]
PLATE TO CATHODE	12	12	12
CONTROL GRID TO PLATE MAX.	0.005	0.007	0.005

[B] WITH SHELL CONNECTED TO CATHODE
[C] WITHOUT EXTERNAL SHIELD
[D] WITH EXTERNAL SHIELD CONNECTED TO CATHODE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

	TRIODE CONNECTION		PENTODE CONNECTION		
PLATE VOLTAGE	180	250	100	250	VOLTS
SCREEN VOLTAGE	PLATE	PLATE	100	100	VOLTS
CONTROL GRID VOLTAGE [E]	-5.3	-8	-3	-3	VOLTS
SUPPRESSOR GRID	PLATE	PLATE	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	5.3	6.5	2.0	2.0	MA.
SCREEN CURRENT	—	—	0.5	0.5	MA.
PLATE RESISTANCE APPROX.	0.0110	0.0105	1.0	— [F]	MEGOHM
TRANSCONDUCTANCE	1800	1900	1185	1225	μMHOS
CONTROL GRID VOLTAGE FOR CATHODE CURRENT CUT-OFF	—	—	-7	-7	VOLTS

[E] THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM

[F] GREATER THAN 1 MEGOHM

PLATE 1023-1

APR. 21 1941

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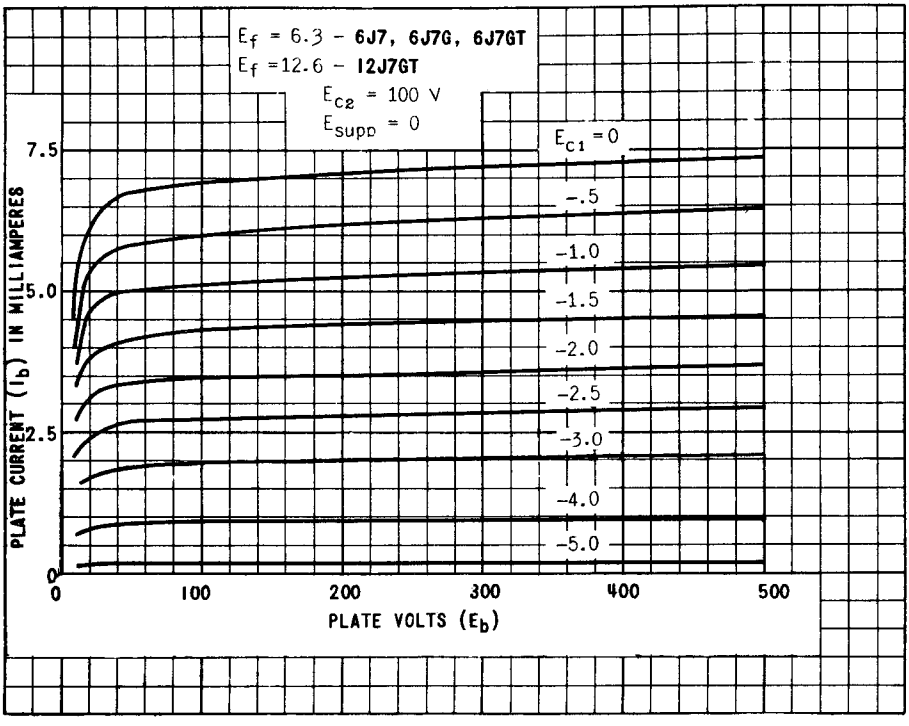

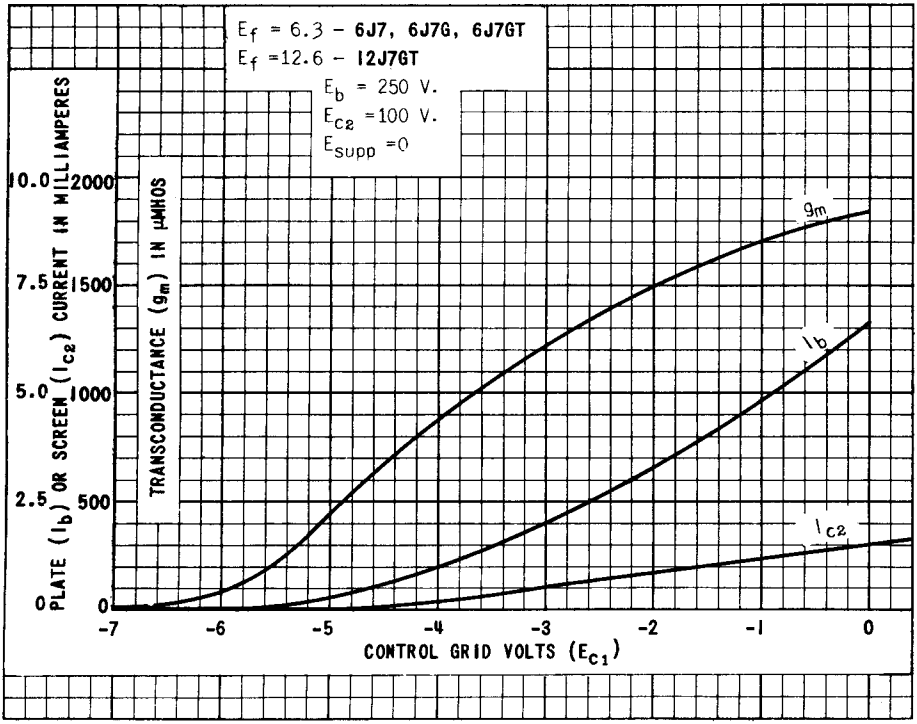

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PLATE
1024-1

APR. 21
1941

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(6J7, 6J7G, 6J7GT) 12J7GT

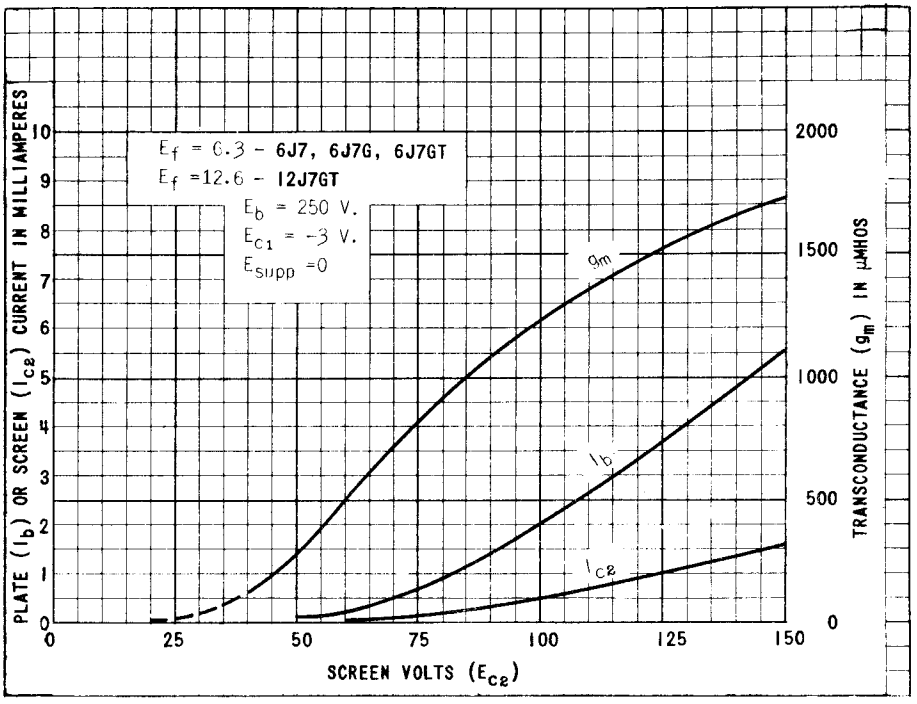

PLATE
1025-1

APR. 21
1941

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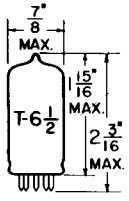
TUNG-SOL

DOUBLE-DIODE-TETRODE

MINIATURE TYPE

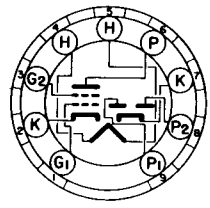


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.325 AMP. ←
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9GC

THE 12J8 IS A MINIATURE DOUBLE-DIODE TETRODE DESIGNED FOR USE IN AUTOMOBILE RECEIVERS. IT IS RATED FOR OPERATION FROM A 12.0 VOLT BATTERY SOURCE.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

TETRODE

GRID TO PLATE	0.70 ←	μμf
INPUT: G_1 TO (H+TK+G_2)	10.5 ←	μμf
OUTPUT: P TO (H+TK+G_2)	4.4 ←	μμf
		μμf
#2 DIODE PLATE TO TETRODE GRID #1 (MAX.)	0.015	μμf
#1 DIODE PLATE TO TETRODE GRID #1 (MAX.)	0.04	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE[A]	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER POSITIVE WITH RESPECT TO CATHODE	30	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM GRID #1 RESISTANCE	10	MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT (EACH DIODE)	5.0	MA.

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

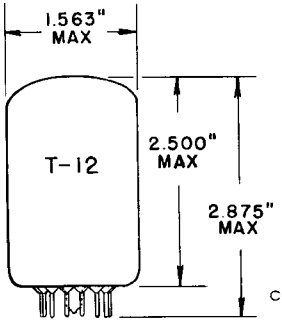
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.325 ←	AMP.
GRID #1 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	12.6	VOLTS
GRID #1 RESISTOR	2.2	MEGOHMS
GRID #1 RESISTOR BYPASS CONDENSER	1.0	μf
TRANSCONDUCTANCE	5 500 ←	μMHOS
PLATE RESISTANCE (APPROX.)	6 000 ←	OHMS
ZERO SIGNAL PLATE CURRENT	12 ←	MA.
ZERO SIGNAL GRID #2 CURRENT	1.5 ←	MA.
AF GRID #1 VOLTAGE (RMS)	1.6	VOLTS
LOAD RESISTANCE	2 700 ←	OHMS
MAXIMUM SIGNAL POWER OUTPUT	20	MW.
TOTAL HARMONIC DISTORTION	5	PERCENT
AVERAGE #1 DIODE CURRENT AT 5 VOLTS DC	8.5	MA.
AVERAGE #2 DIODE CURRENT AT 5 VOLTS DC	12.0	MA.

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BEAM PENTODE

FOR

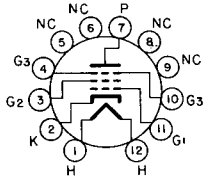
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FK

THE 12JN6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMZE "SNIVETS".
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 12JN6 IS IDENTICAL TO THE 6JN6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.34	pf
INPUT: G1 TO (H + K + G2 + G3)	16	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		600 ± 40	MA.
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEG. W/ RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POS. W/ RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE - SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY).	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

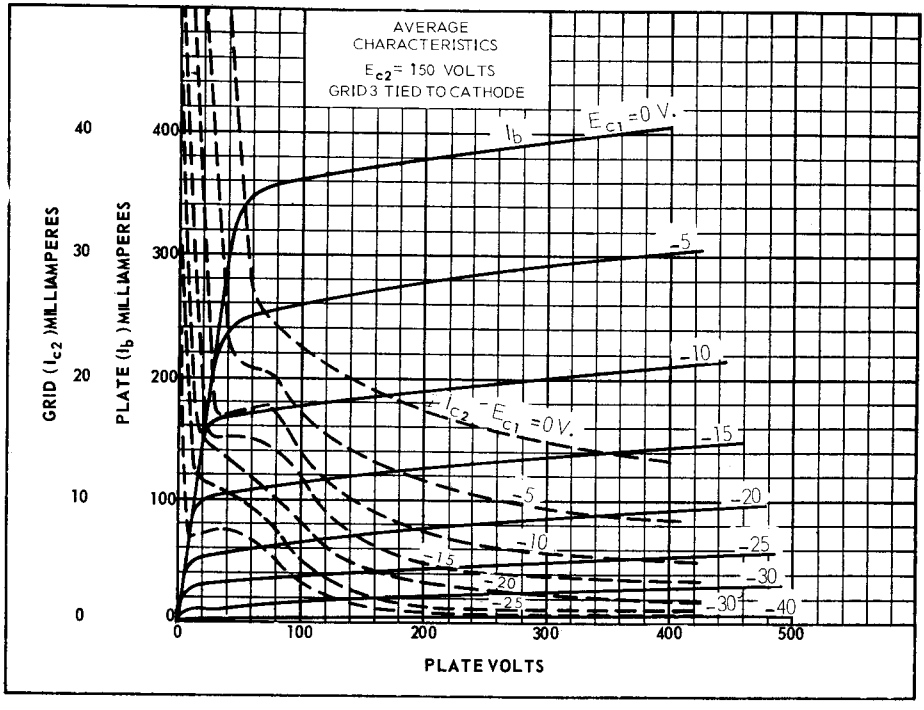
A - IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

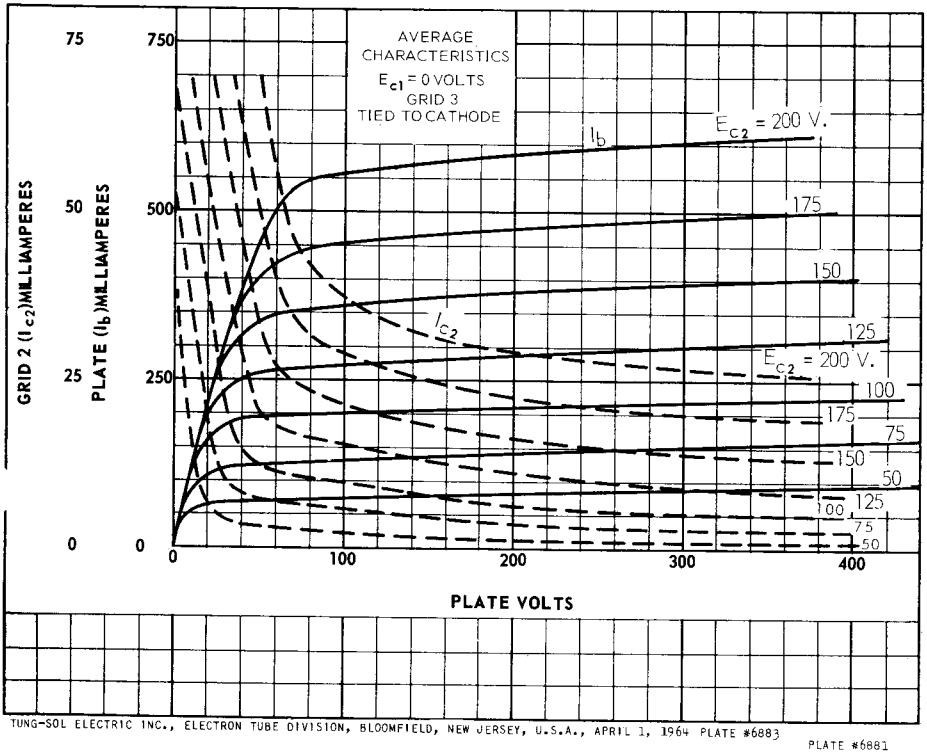
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	250	VOLTS
GRID 3 - CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	–	0 [B]	-22.5	VOLTS
PLATE CURRENT	–	345	65	MA.
GRID 2 CURRENT	–	27	1.8	MA.
TRANSCONDUCTANCE	–	–	7,300	μMHOS
PLATE RESISTANCE - APPROX.	–	–	18,000	OHMS
GRID 1 VOLTAGE AT I_b = 1.0 MA. - APPROX.	-100	–	-42	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	–	–	4.4	

B - APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

C - TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} =$ 150 VOLTS AND $E_{c1} =$ -22.5 VOLTS





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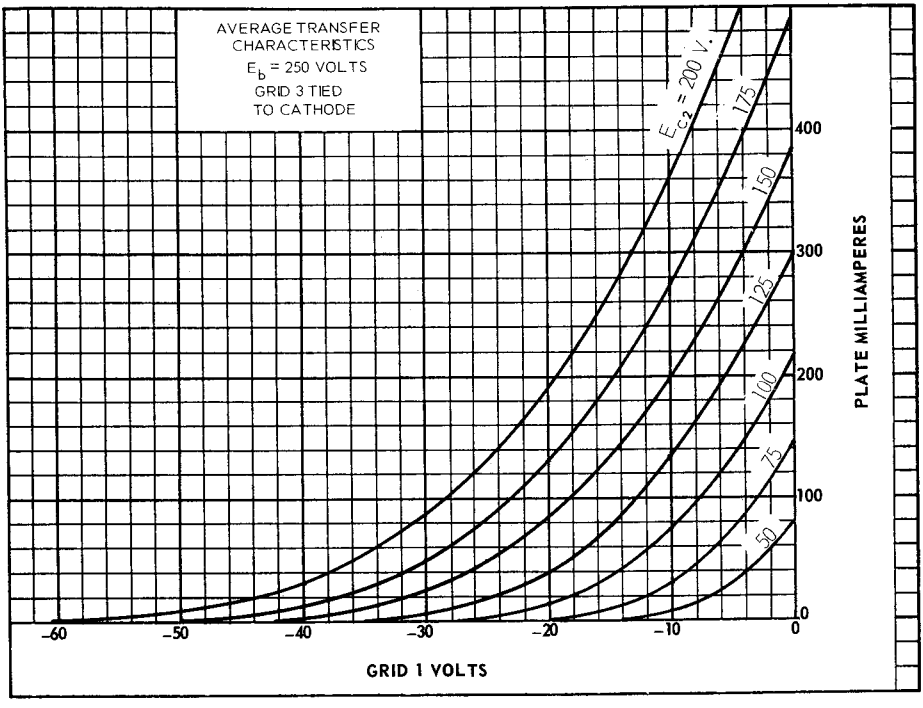
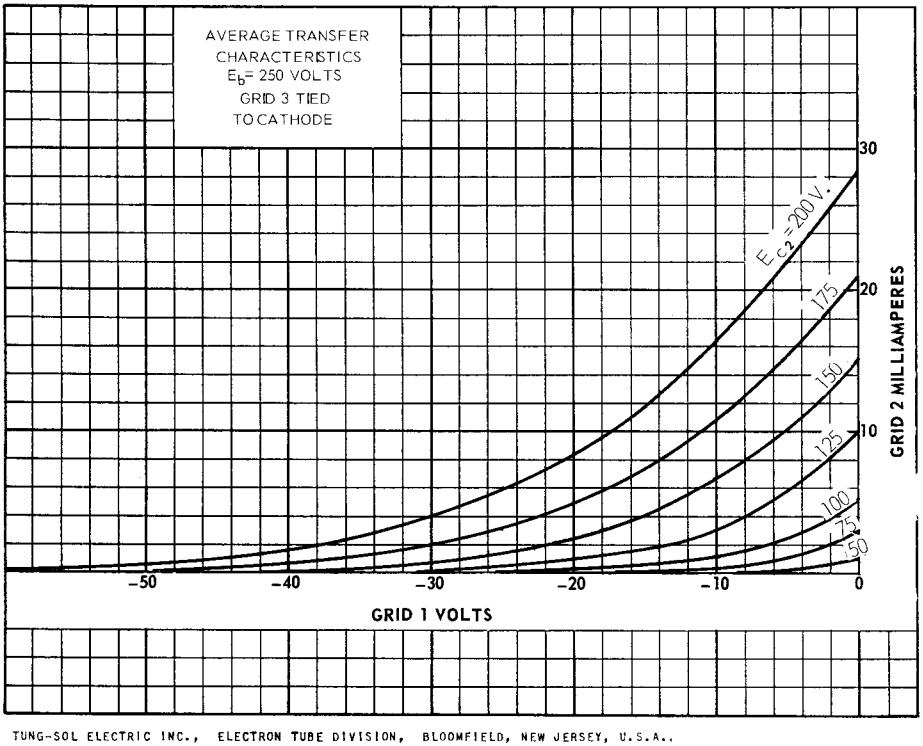

AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
400
300
200
100
0
PLATE MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID 1 VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b= 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c2} = 200 V.
175
150
125
100
75
50
30
20
10
GRID 2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

ANY MOUNTING POSITION

THE 12JP4 IS A DIRECTLY VIEWED PICTURE TUBE DESIGNED FOR USE IN TELEVISION RECEIVERS. THE TUBE UTILIZES MAGNETIC DEFLECTION AND MAGNETIC FOCUS TO PROVIDE 7 3/4" X 10 1/4" PICTURES WITH HIGH BRILLANCE AND DEFINITION.

DESCRIPTION

FLUORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTION AND FOCUSING METHOD	MAGNETIC
MAXIMUM DEFLECTION ANGLE (APPROX.)	50 DEGREES
BULB CONTACT	RECESSED SMALL BALL CAP

DIRECT INTERELECTRODE CAPACITANCES

CATHODE TO ALL OTHER ELECTRODES: K TO (H+G_1+G_2+A)	6	μμf
GRID #1 TO ALL OTHER ELECTRODES: G_1 TO (H+K+G_2+A)	7.9	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
ANODE VOLTAGE[B]	10 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE[C]	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)[D]	146	MA.
SPOT POSITION (UNDEFLECTED)[E]	WITHIN 25 MILLIMETER RADIUS CIRCLE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEG.

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

[B] ANODE CONTACT ALIGNS WITH VACANT PIN POSITION #3 ± 10 DEGREES.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] FOR STANDARD FOCUS COIL WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 25 FOOT LAMBERTS ON 7 3/4" X 10 1/4" PICTURE AREA.

[E] WHEN THE TUBE IS OPERATED AT NORMAL HEATER VOLTAGE; WITH E_b = 10,000 VOLTS, AND E_{c2} = 250 VOLTS, AND E_{c1} SET AT SUCH A VALUE AS WILL AVOID DAMAGE TO THE SCREEN AND THE TUBE SHIELDED AGAINST EXTERNAL INFLUENCES: THE UNDEFLECTED AND UNFOCUSED SPOT WILL FALL WITHIN A CIRCLE OF 25 MM. RADIUS, THE CENTER OF WHICH COINCIDES WITH THE GEOMETRIC CENTER OF THE TUBE FACE.

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PLATE 2196
MAY 2 1949

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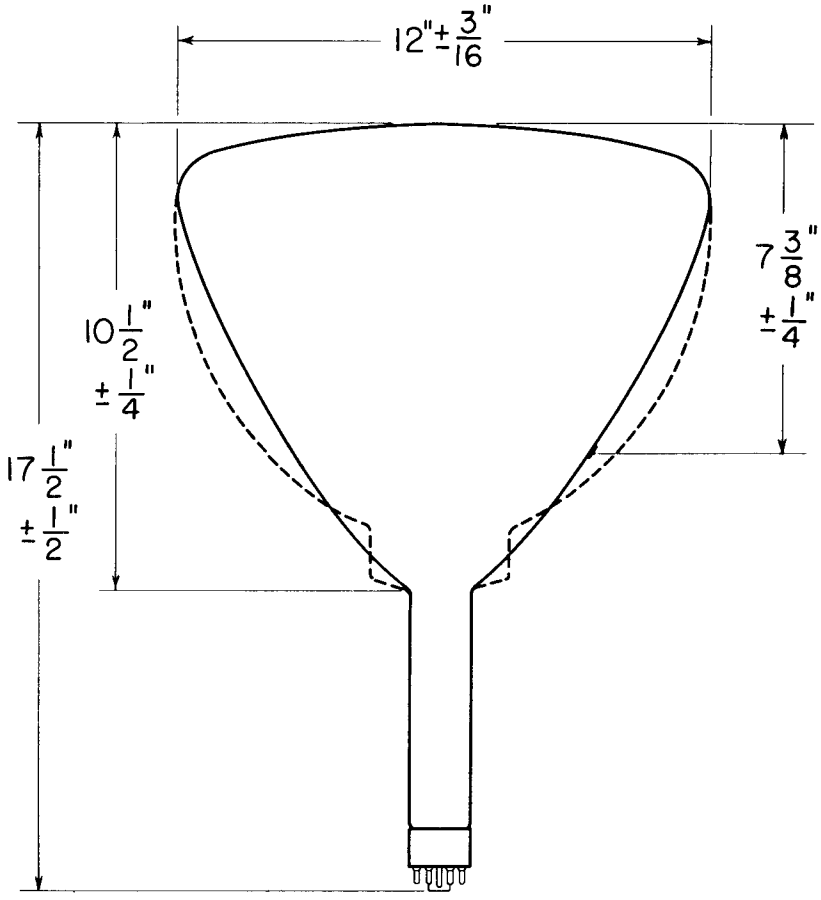
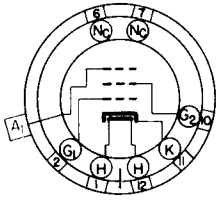
TUNG-SOL





SMALL SHELL DUODECAL
7 PIN BASE
12D

1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. GRID NO. 2
11. CATHODE
12. HEATER
CAP. ANODE NO. 1

PLATE
2197
MAY 2
1949

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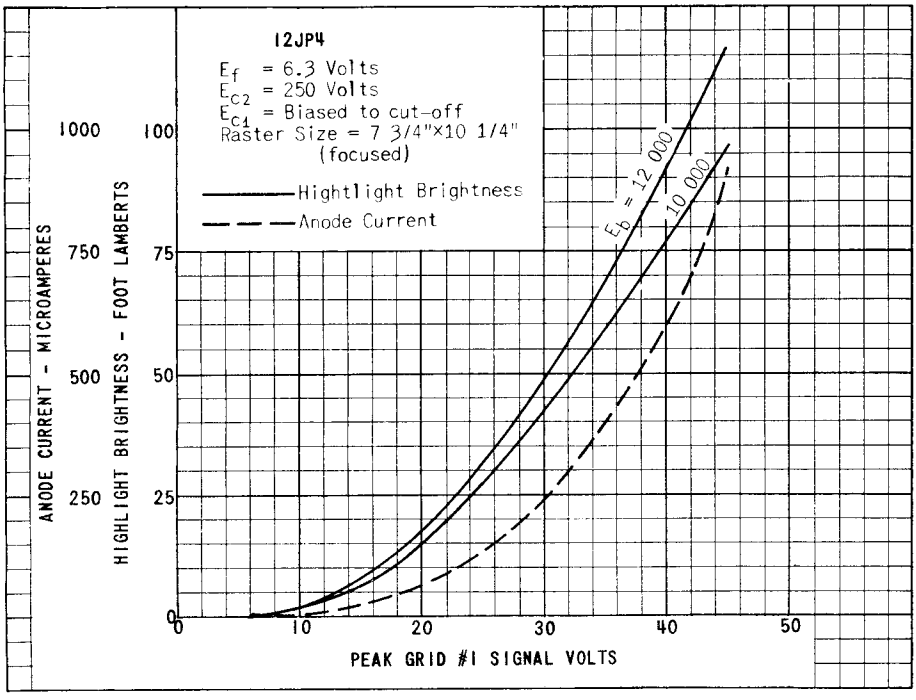

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PLATE
2198
MAY 2
1949

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TUNG-SOL

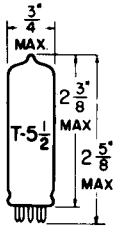
TETRODE

MINIATURE TYPE

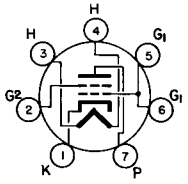
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.40 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7FD

THE 12K5 IS A TETRODE WITH A UNIPOTENTIAL CATHODE IN THE 7-PIN MINIATURE CONSTRUCTION DESIGNED FOR SPACE-CHARGE GRID OPERATION. IT IS INTENDED FOR USE AS A POWER AMPLIFIER DRIVER WHERE THE HEATER, PLATE AND SPACE-CHARGE GRID POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES*
WITHOUT EXTERNAL SHIELD

INPUT: G2 TO (K+H+G1)	13.0	pf
OUTPUT: P TO (K+H+G1)	1.8	pf
GRID TO PLATE: G2 TO P	11.0	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE (ABS. MAX.)	16	VOLTS
MAXIMUM NEGATIVE GRID #2 VOLTAGE	20	VOLTS
MAXIMUM GRID #2 CIRCUIT RESISTANCE	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER – SINGLE TUBE

PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL GRID) VOLTAGE[B]	-0.5	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	12.6	VOLTS
PLATE CURRENT	40	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
PLATE RESISTANCE	480	OHMS
AMPLIFICATION FACTOR[C]	7.2	
TRANSCONDUCTANCE[C]	15 000	μMHOS

*INDICATES AN ADDITION.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

TYPICAL OPERATION

CLASS A_1 AMPLIFIER - SINGLE TUBE

HEATER VOLTAGE	12.6	VOLTS
PLATE VOLTAGE	12.6	VOLTS
GRID #2 (CONTROL GRID) VOLTAGE[D]	-2.0	VOLTS
GRID #1 (SPACE-CHARGE GRID) VOLTAGE	12.6	VOLTS
PEAK AF GRID #2 VOLTAGE	2.5	VOLTS
AF SIGNAL SOURCE RESISTANCE	100 000	OHMS
LOAD RESISTANCE	800	OHMS
PLATE CURRENT	8.0	MA.
GRID #1 (SPACE-CHARGE GRID) CURRENT	75	MA.
TOTAL HARMONIC DISTORTION (MAX.)	10	PERCENT
POWER OUTPUT	40	MW.

[A] THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

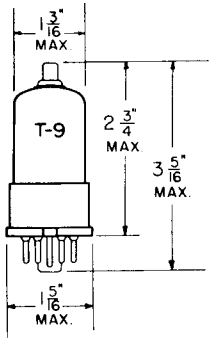
[B] AVERAGE CONTACT POTENTIAL DEVELOPED ACROSS A 2.2 MEGOHM RESISTOR.

[C] FROM GRID #2 TO PLATE

[D] OBTAINED ACROSS A 2.2 MEG. RESISTOR BY GRID #2 RECTIFICATION IN WHICH CASE THE ZERO SIGNAL PLATE CURRENT IS APPROXIMATELY 40 MA.

TUNG-SOL

PENTODE

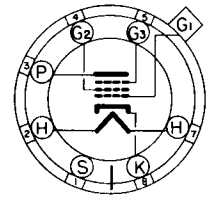


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
METAL SLEEVE
7R

THE 12K7GT IS A VARIABLE MU PENTODE AMPLIFIER IN THE OCTAL GLASS CONSTRUCTION. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS AND MINIMIZES CROSS MODULATION.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G TO P) MAX.	0.005	μμf
INPUT: G_1 TO (H+K+G_2+G_3+S+IS)	4.6	μμf
OUTPUT: P TO (H+K+G_2+G_3+S+IS)	12	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM GRID #2 DISSIPATION	0.35	WATT

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PLATE 2223
JULY 1, 1949

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	150	150	150	MA.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #3 VOLTAGE	PIN #5 CONNECTED TO PIN #8 AT SOCKET			
GRID #2 VOLTAGE	100	100	125	VOLTS
GRID #1 VOLTAGE	-1	-3	-3	VOLTS
PLATE RESISTANCE (APPROX.)	0.15	0.8	0.6	MEGOHM
TRANSCONDUCTANCE	1 650	1 450	1 650	µMHOS
PLATE CURRENT	9.5	7	10.5	MA.
GRID #2 CURRENT	2.7	1.7	2.6	MA.
GRID #1 VOLTAGE FOR G_m = 2 µMHOS (APPROX.)	-38.5	-42.5	-52.5	VOLTS

PLATE 2224

JULY 1, 1949

→ INDICATES A CHANGE OR ADDITION.

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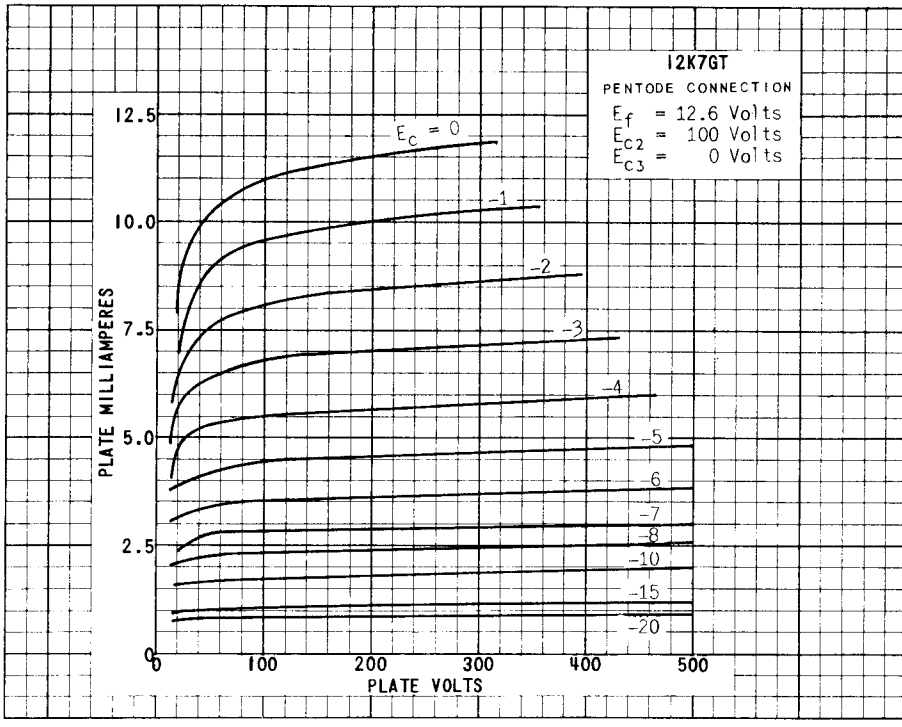

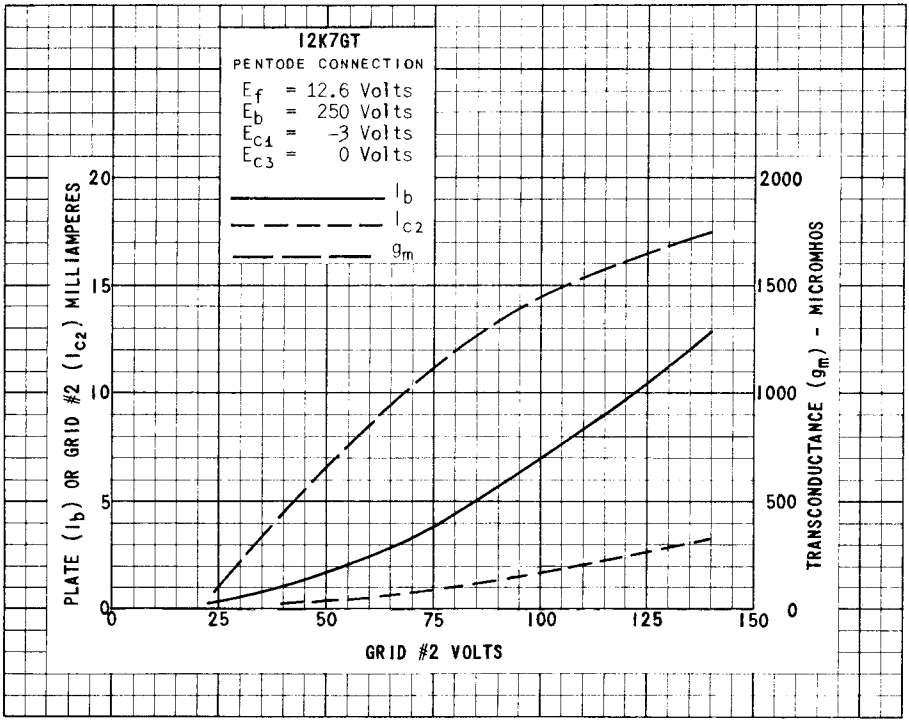

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PLATE
2225
JULY 1,
1949

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12K7GT(6K7,6K7GT)

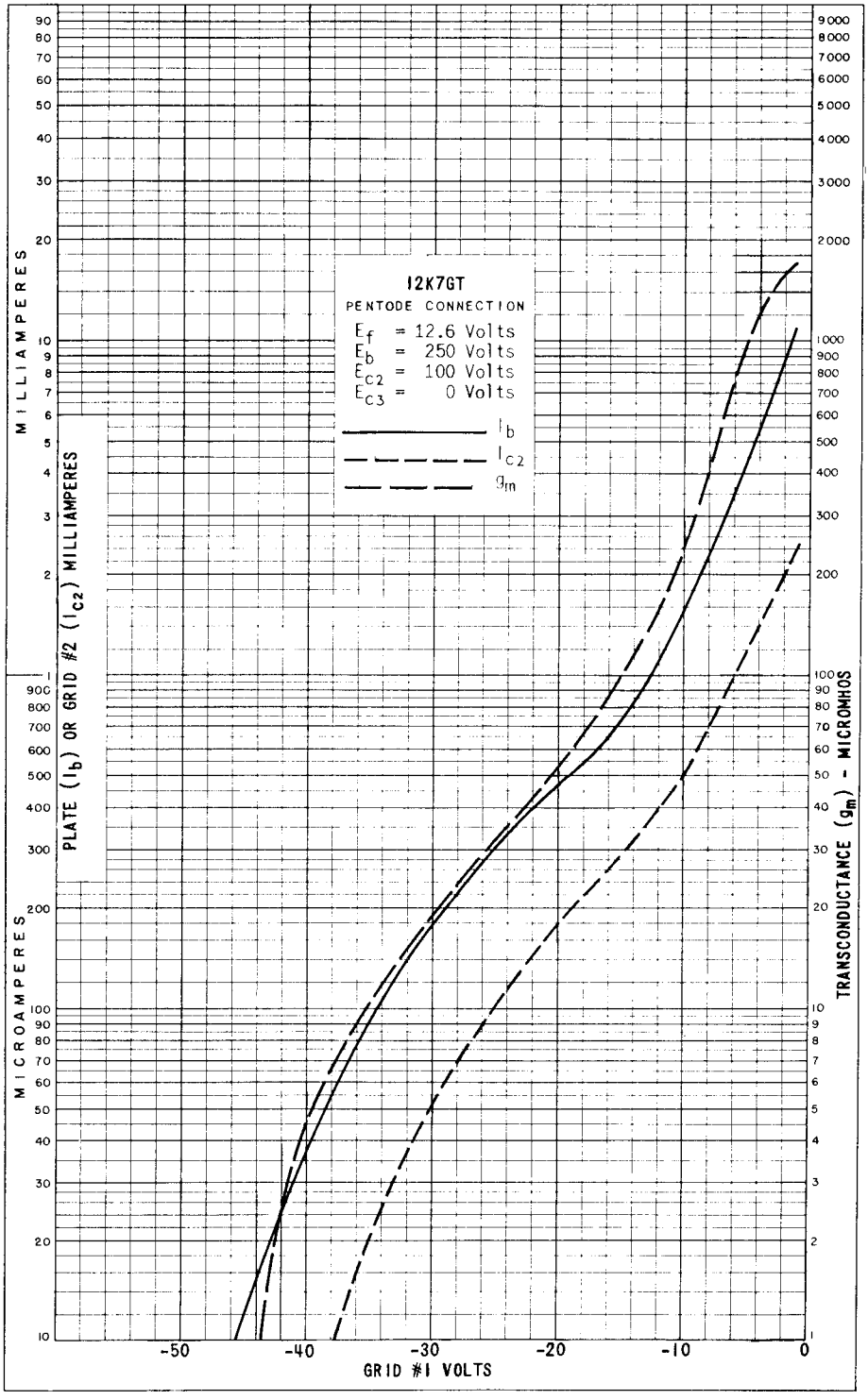

PLATE 2226
JULY 1, 1949

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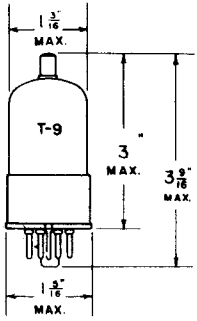


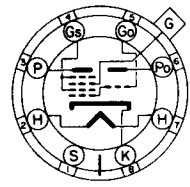
TRIODE HEXODE CONVERTER

UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



8K

BOTTOM VIEW

SMALL WAFER 8 PIN OCTAL BASE WITH METAL SHELL

THE TUNG-SOL 12K8GT CONSISTS OF A TRIODE OSCILLATOR AND A HEXODE MIXER IN A COMMON ENVELOPE. THE PHYSICAL DESIGN OF THIS TUBE REDUCES INTERACTION BETWEEN THE OSCILLATOR AND MIXER SECTIONS AND MAKES FOR STABLE OPERATION ON THE HIGH FREQUENCIES AS WELL AS THE BROADCAST BAND. IT IS USED IN AC-DC SUPERHETERODYNES USING 150 MA. HEATER TUBES.

RATINGS

MAXIMUM HEXODE PLATE (P) VOLTAGE	300	VOLTS
MAXIMUM HEXODE SCREEN (Gs) SUPPLY VOLTAGE	300	VOLTS
MAXIMUM HEXODE SCREEN (Gs) VOLTAGE	150	VOLTS
MAXIMUM HEXODE PLATE DISSIPATION	0.75	WATT
MAXIMUM HEXODE SCREEN DISSIPATION	0.7	WATT
MAXIMUM TOTAL CATHODE CURRENT	16	MA.
MINIMUM EXTERNAL SIGNAL GRID (G) BIAS VOLTAGE	0	VOLT
MAXIMUM OSCILLATOR ANODE (Po) VOLTAGE	125	VOLTS
MAXIMUM OSCILLATOR ANODE DISSIPATION	0.75	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1252-1
NOV. 17
1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEXODE PLATE (P) VOLTAGE	100	250	VOLTS
HEXODE SCREEN (G_5) VOLTAGE	100	100	VOLTS
HEXODE CONTROL GRID (G) VOLTAGE	−3	−3	VOLTS
OSCILLATOR ANODE (P_o) VOLTAGE	100	100	VOLTS
HEXODE PLATE CURRENT	2.3	2.5	MA.
HEXODE SCREEN CURRENT	6.2	6.0	MA.
OSCILLATOR ANODE CURRENT	3.8	3.8	MA.
OSCILLATOR GRID (G_o) CURRENT	0.15	0.15	MA.
TOTAL CATHODE CURRENT	12.5	12.5	MA.
OSCILLATOR GRID RESISTOR	50 000	50 000	OHMS
CONVERSION TRANSCONDUCTANCE	325	350	μMHOS
HEXODE PLATE RESISTANCE APPROX.	0.4	0.6	MEGOHM
HEXODE CONTROL GRID VOLTAGE APPROX.	−30	−30	VOLTS

FOR CONVERSION TRANSCONDUCTANCE = 2 μMHOS

DIRECT INTERELECTRODE CAPACITANCES[5]

SIGNAL GRID TO MIXER PLATE (G TO P)	0.08 MAX.	μμf
SIGNAL GRID TO OSCILLATOR PLATE (G TO P_o)	0.05 MAX.	μμf
SIGNAL GRID TO OSCILLATOR GRID (G TO G_o)	0.2 MAX.	μμf
OSCILLATOR GRID TO OSCILLATOR PLATE (G_o TO P_o)	1.8	μμf
SIGNAL INPUT: G TO ALL OTHER ELECTRODES	4.6	μμf
OSCILLATOR INPUT: G_o TO ALL OTHER ELECTRODES EXCEPT P_o	6.5	μμf
OSCILLATOR OUTPUT: P_o TO ALL OTHER ELECTRODES EXCEPT G_o	3.4	μμf
MIXER OUTPUT: P TO ALL OTHER ELECTRODES	4.8	μμf
OSCILLATOR GRID TO MIXER PLATE (G_o TO P)	0.15 MAX.	μμf

[A] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

NOTE: THE TRANSCONDUCTANCE OF THE OSCILLATOR SECTION (NOT OSCILLATING) IS APPROXIMATELY 3000 UMHOS WHEN THE TRIODE PLATE VOLTAGE IS 100 VOLTS, AND THE TRIODE GRID VOLTAGE IS ZERO VOLTS.

PLATE 1152-1

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 7 PIN BASE

THE 12KP4A IS A GLASS ENVELOPE, MAGNETIC DEFLECTION AND MAGNETIC FOCUS DIRECT-VIEW PICTURE TUBE INTENDED FOR USE IN TELEVISION RECEIVERS. IT PROVIDES FOR A PICTURE 7 3/4" X 10 1/2". A REFLECTIVE METAL-BACKED SCREEN PREVENTS ION-SPOT BLEMISH AND GIVES IMPROVED PICTURE CONTRAST AND DETAIL. AN EXTERNAL CONDUCTIVE COATING WHEN GROUNDED SERVES AS A HIGH VOLTAGE FILTER CAPACITOR.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	54 DEGREES
COATING	CONDUCTIVE
BULB CONTACT	RECESSED SMALL CAVITY CAP
RASTER SIZE	7 3/4" X 10 1/2"

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	11 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)	135	MA.

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PLATE 2493
NOV. 1 1950

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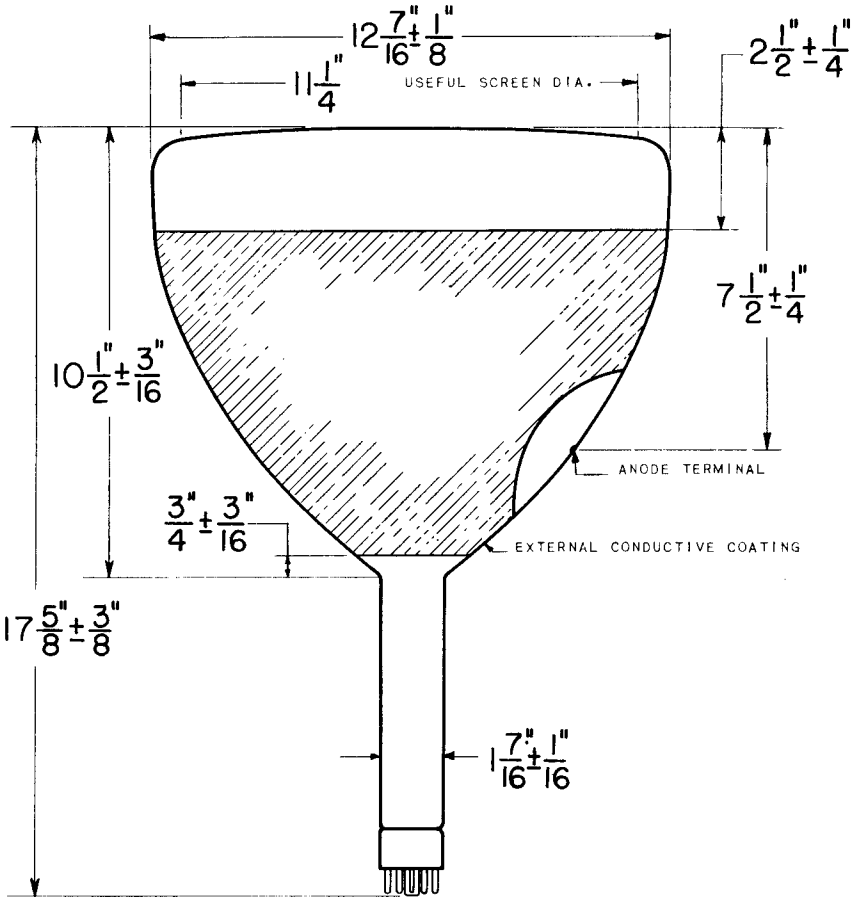
12KP4A

TUNG-SOL



1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. GRID NO. 2
11. CATHODE
12. HEATER

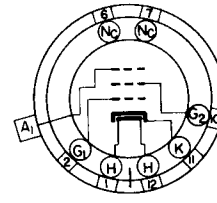


PLATE 2494
NOV. 1 1950

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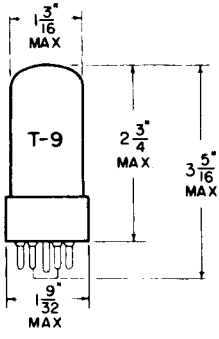
BEAM PENTODE

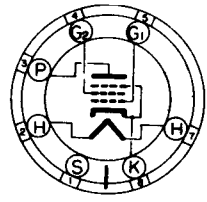


GLASS BULB

COATED UNIPOTENTIAL CATHODE.

HEATER
12.6 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
7 PIN OCTAL
7S

THE 12L6GT IS A BEAM PENTODE DESIGNED FOR SERVICE IN 600 MA. SERIES HEATER OPERATED RECEIVERS. IT DELIVERS A HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES. THERMAL CHARACTERISTICS OF THE HEATER HAVE BEEN CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO THE 25L6GT.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	12.6	VOLTS
→ MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHMS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.6	0.6	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

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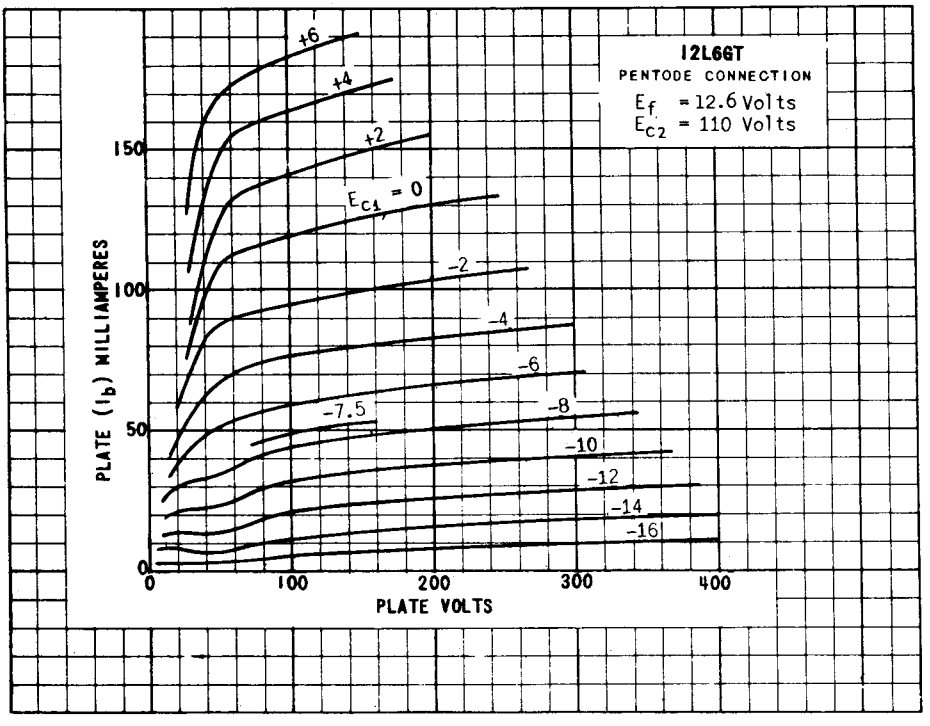
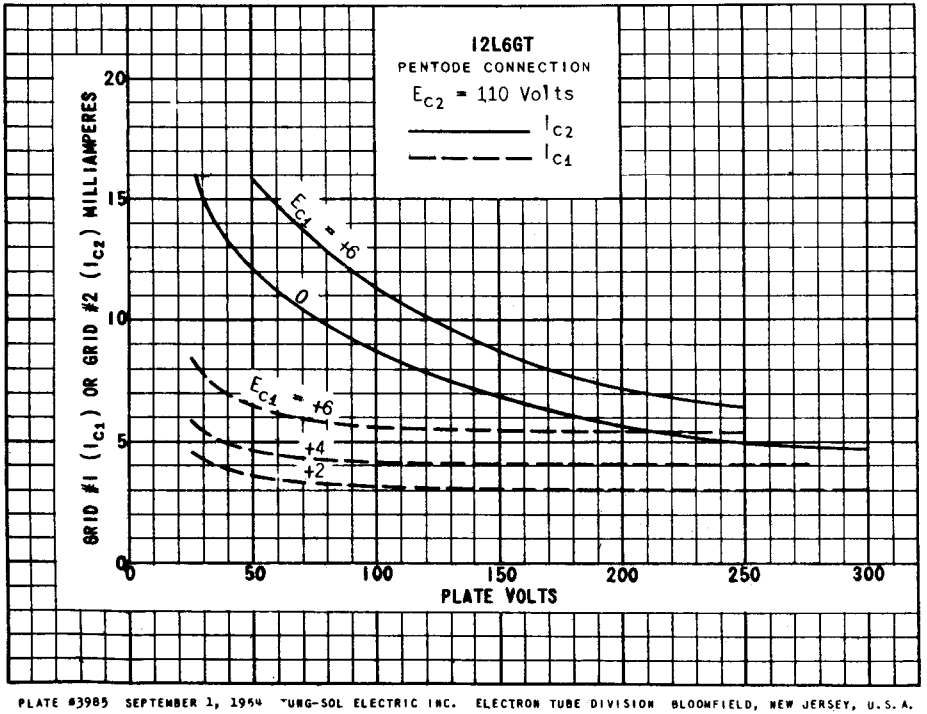
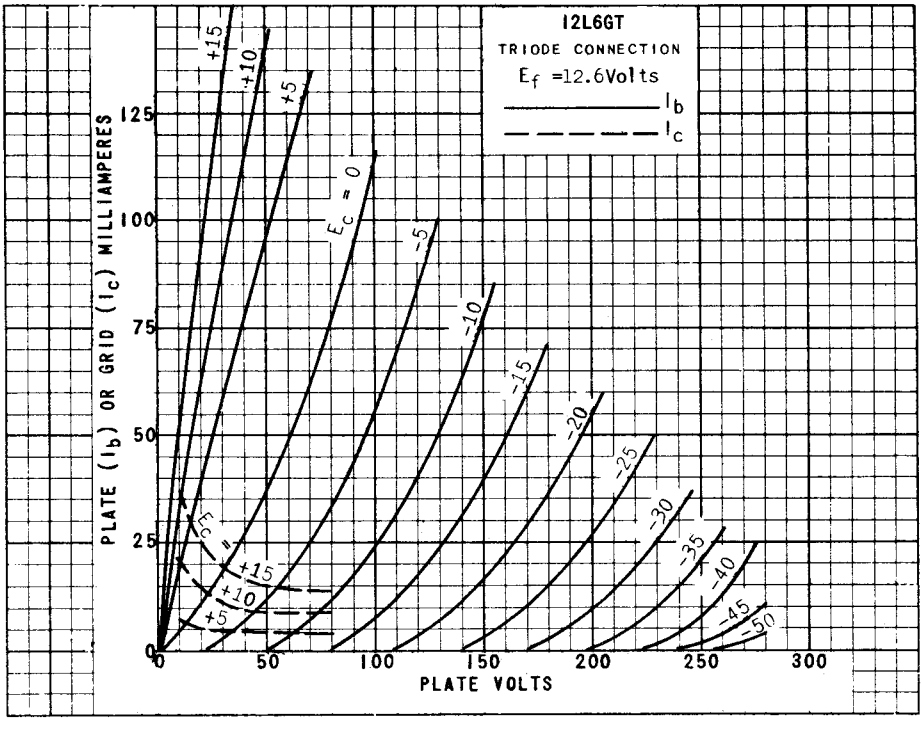
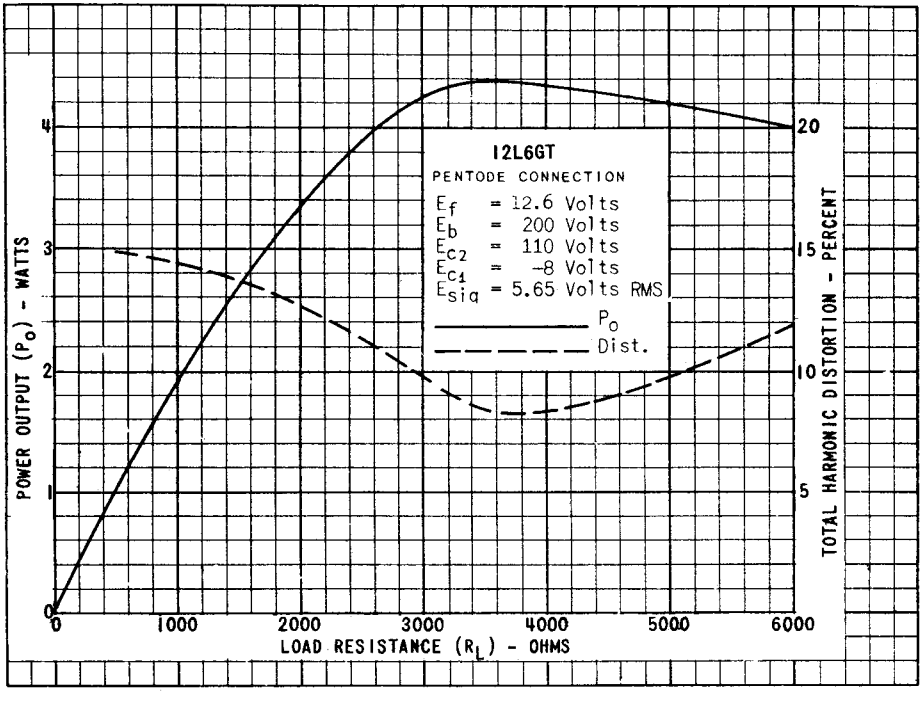
12L6GT


12L6GT
PENTODE CONNECTION
E_f = 12.6 Volts
E_{c2} = 110 Volts
+6
+4
+2
E_{c1} = 0
-2
-4
-6
-7.5
-8
-10
-12
-14
-16
PLATE (I_b) MILLIAMPERES
150
100
50
0
0
100
200
300
400
PLATE VOLTS


12L6GT
PENTODE CONNECTION
E_{c2} = 110 Volts
I_{c2}
I_{c1}
E_{c1} = +6
0
E_{c1} = +6
+4
+2
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
20
15
10
5
0
0
50
100
150
200
250
300
PLATE VOLTS





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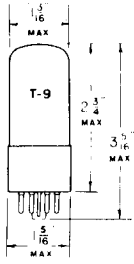
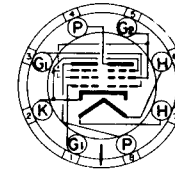


TWIN-PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMPERES



THE 12L8-GT IS A HEATER-CATHODE TYPE OF TWIN-UNIT TUBE WHICH CONTAINS TWO POWER-AMPLIFIER PENTODES WHICH HAVE A COMMON CATHODE. USING SINGLE-ENDED GT-CONSTRUCTION, THE 12L8-GT IS USEFUL IN THE OUTPUT STAGE OF COMPACT, LIGHTWEIGHT EQUIPMENT WHERE MODERATE POWER OUTPUT IS DESIRED. IN SUCH SERVICE, THE UNITS MAY BE CONNECTED IN PUSH-PULL OR IN PARALLEL DEPENDING ON THE REQUIREMENTS.

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)		12.6	VOLTS
HEATER OR FILAMENT CURRENT		0.15	AMP.
MAXIMUM PLATE VOLTAGE	EACH UNIT	180	VOLTS
MAXIMUM SCREEN VOLTAGE	" "	180	VOLTS
MAXIMUM PLATE DISSIPATION	" "	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	" "	1.0	WATT
MAXIMUM D-C HEATER-CATHODE POTENTIAL		100	VOLTS

DIRECT INTERELECTRODE CAPACITANCES (WITH NO EXTERNAL SHIELD)

	PENTODE UNIT P1		PENTODE UNIT P2	
CONTROL GRID TO CATHODE	5.0		5.0	μμf
PLATE TO CATHODE	6.0		6.0	μμf
GRID TO PLATE	0.7		0.7	μμf
GRID TO GRID		0.08		μμf
PLATE TO PLATE		1.5		μμf
GRID OF P1-PLATE OF P2		0.2		μμf
GRID OF P2-PLATE OF P1		0.1		μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER (EACH SECTION)

HEATER OR FILAMENT VOLTAGE	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
PLATE VOLTAGE	180	VOLTS
SCREEN VOLTAGE	180	VOLTS
CONTROL GRID VOLTAGE	-9	VOLTS
PEAK AF SIGNAL VOLTAGE	9	VOLTS
ZERO-SIGNAL PLATE CURRENT	13	MA.
ZERO-SIGNAL SCREEN CURRENT	2.8	MA.
MAXIMUM-SIGNAL PLATE CURRENT	13.5	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	4.6	MA.
PLATE RESISTANCE	0.16	MEGOHM
TRANSCONDUCTANCE	2150	μMHOS
LOAD RESISTANCE	10000	OHMS
TOTAL HARMONIC DISTORTION	10	PER CENT
POWER OUTPUT	1	WATT

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PLATE 1378-1 DEC. 15 1943

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

ANY MOUNTING POSITION

THE 12LP4 IS A DIRECTLY VIEWED PICTURE TUBE DESIGNED FOR USE IN TELEVISION RECEIVERS. THE TUBE UTILIZES MAGNETIC DEFLECTION AND MAGNETIC FOCUS TO PROVIDE 7 1/2" X 10" PICTURES.

DESCRIPTION

FLUORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTION AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	54 DEGREES
EXTERNAL COATING WHEN GROUNDED ACTS AS A FILTER CAPACITOR	
ELECTRON GUN TO BE USED WITH ION-TRAP MAGNET	
BULB CONTACT	RECESSED SMALL CAVITY CAP

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

CATHODE TO ALL OTHER ELECTRODES: K TO ($H+G_1+G_2+A$)	5	μμf
GRID #1 TO ALL OTHER ELECTRODES: G_1 TO ($H+K+G_2+A$)	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	3 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
ANODE VOLTAGE[A]	11 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE[B]	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)[C]	110	MA.
ION-TRAP CURRENT (APPROX.)[D]	120	MA.
GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] ANODE CONTACT ALIGNS WITH VACANT PIN POSITION #3 ± 10 DEGREES.

[B] VUSUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR JETEC STANDARD FOCUS COIL WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO — SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 7½x10 INCH PICTURE AREA. DISTANCE FROM REFERENCE LINE OF BULB TO CENTER OF FOCUS COIL AIR GAP SHALL BE 3.25 IN.

[D] WITH JETEC STANDARD ION-TRAP MAGNET.

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PLATE 2199
MAY 2 1949

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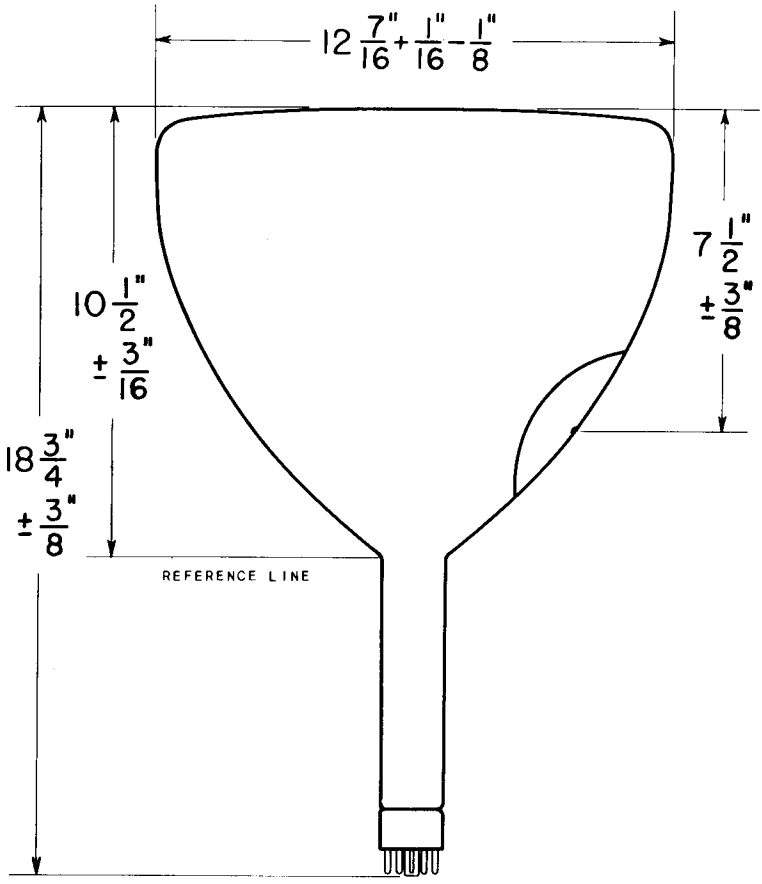
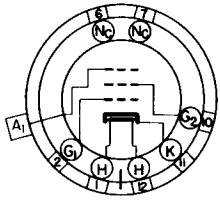
TUNG-SOL





SMALL SHELL DUODECAL
7 PIN BASE
12D

1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. GRID NO. 2
11. CATHODE
12. HEATER
CAP. ANODE NO. 1

PLATE 2200
MAY 2 1949

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TENTATIVE DATA

12LP4A

TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.6 AMPERE

AC OR DC

ANY MOUNTING POSITION

THE 12LP4A IS A MAGNETIC FOCUS AND MAGNETIC DEFLECTION DIRECT VIEW PICTURE TUBE FOR TELEVISION RECEIVERS. IT HAS A GREY NEUTRAL-DENSITY FACEPLATE FOR INCREASED PICTURE CONTRAST AND DETAIL UNDER HIGH AMBIENT LIGHT CONDITIONS.

DESCRIPTION

FLUORESCENCE	WHITE
PERISTENCE	MEDIUM
DEFLECTION AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	54 DEGREES
EXTERNAL COATING WHEN GROUNDED ACTS AS A FILTER CAPACITOR	
ELECTRON GUN TO BE USED WITH ION-TRAP MAGNET	
BULB CONTACT	RECESSED SMALL CAVITY CAP

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

CATHODE TO ALL OTHER ELECTRODES: K TO ($H+G_1+G_2+A$)	5	μμf
GRID #1 TO ALL OTHER ELECTRODES: G_1 TO ($H+K+G_2+A$)	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	3 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
ANODE VOLTAGE[A]	11 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE[B]	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)[C]	110	MA.
ION-TRAP CURRENT (APPROX.)[D]	120	MA.
GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] ANODE CONTACT ALIGNS WITH VACANT PIN POSITION #3 ± 10 DEGREES.

[B] VUSUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR JETEC STANDARD FOCUS COIL WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO — SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 7½x10 INCH PICTURE AREA. DISTANCE FROM REFERENCE LINE OF BULB TO CENTER OF FOCUS COIL AIR GAP SHALL BE 3.25 IN.

[D] WITH JETEC STANDARD ION-TRAP MAGNET.

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PLATE 2404

MAY 1 1950

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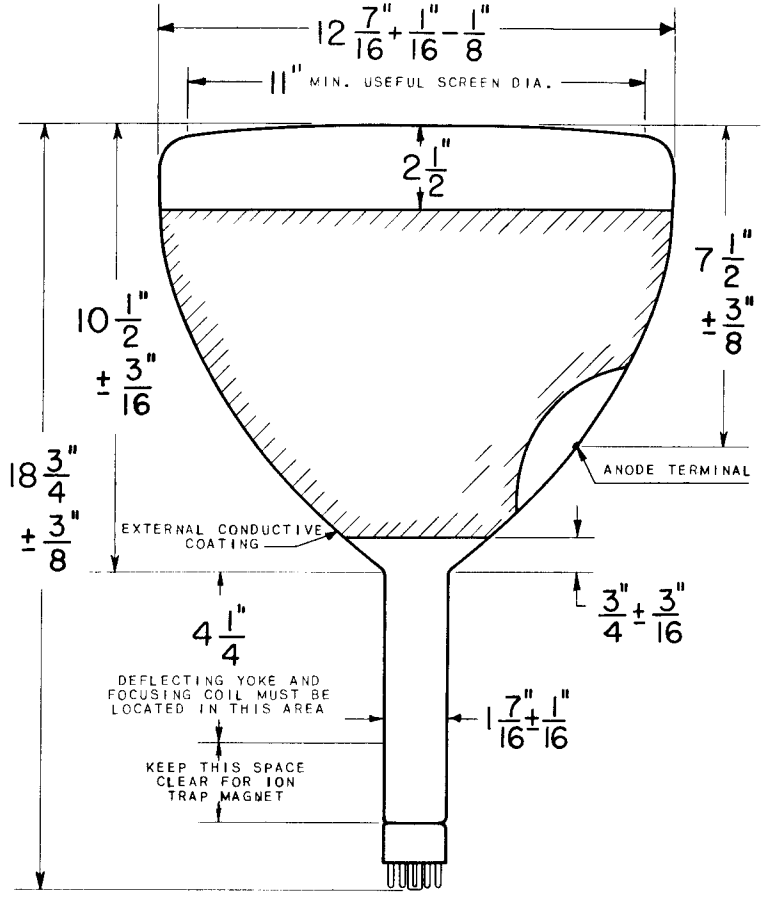
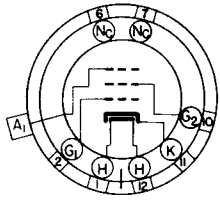
TUNG-SOL





SMALL SHELL DUODECAL
7 PIN BASE
12D

1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. GRID NO. 2
11. CATHODE
12. HEATER
CAP. ANODE NO. 1

PLATE 2405
MAY 1 1950

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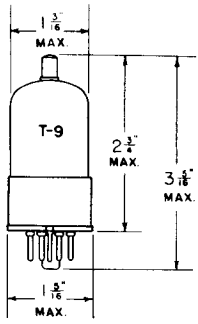
TUNG-SOL



DUO-DIODE

HIGH MU TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

7V
BOTTOM VIEW

GLASS BULB

SMALL WAFER 7 PIN OCTAL BASE WITH METAL SHELL

THE TUNG-SOL 12Q7GT COMBINES TWO DIODES AND A HIGH MU TRIODE IN A SINGLE BULB, USING A COMMON CATHODE. IT IS DESIGNED FOR SERVICE AS A DIODE DETECTOR, AVC RECTIFIER, AND A HIGH GAIN RESISTANCE COUPLED AMPLIFIER IN AC – DC OPERATED RECEIVERS USING 150 MA. HEATER TUBES.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM DIODE CURRENT WITH 10 VOLTS DC APPLIED PER PLATE	0.8	MA.

AVERAGE CHARACTERISTICS OF TRIODE UNIT

PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE	−1	−3	VOLTS
PLATE CURRENT	0.8	1.0	MA.
PLATE RESISTANCE	58000	58000	OHMS
TRANSCONDUCTANCE	1200	1200	μMHOS
AMPLIFICATION FACTOR	70	70	

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1118-2

SEPT. 17
1941

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12Q7GT

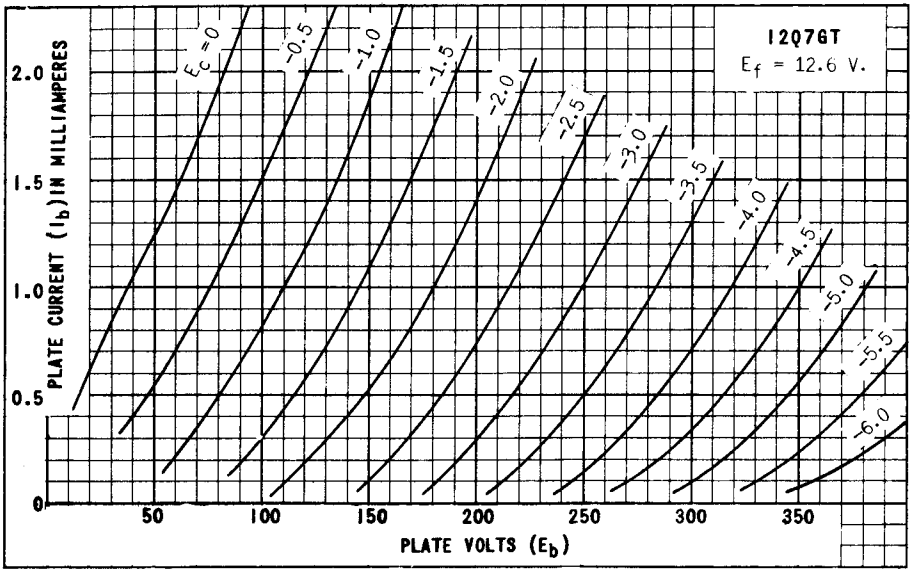
TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ZERO BIAS, RESISTANCE COUPLED, CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	100		300		VOLTS
PLATE LOAD RESISTOR	0.25		0.25		MEGOHM
GRID RESISTOR	10		10		MEGOHM
COUPLING CONDENSER	.01 TO .005		.01 TO .005		μf
GRID RESISTOR FOR FOLLOWING TUBE	.5 TO 1.0		.5 TO 1.0		MEGOHM
EXTERNAL GRID CIRCUIT IMPEDANCE	0	0	0	0	MEGOHM
VOLTAGE GAIN	40	42	50	56	
VOLTAGE OUTPUT (RMS)[A]	11	13	51	58	VOLTS

[A] AT 5% TOTAL HARMONIC DISTORTION.



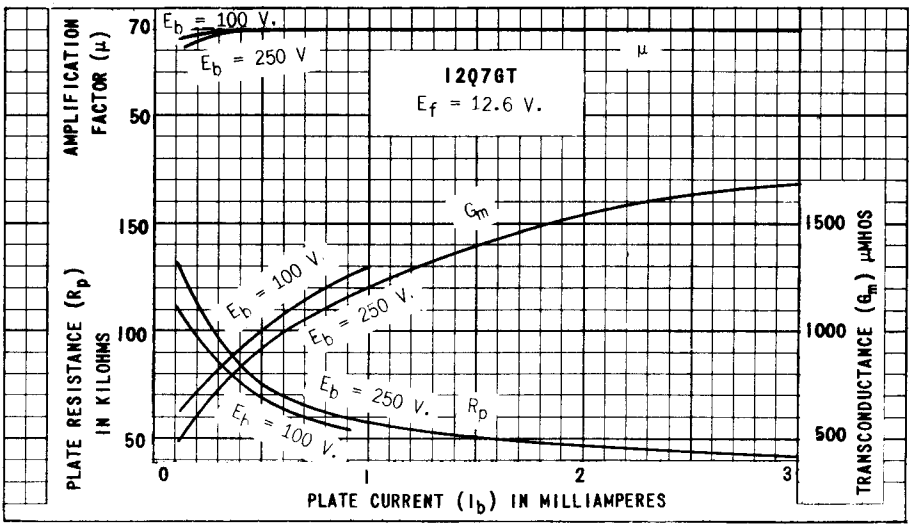


PLATE 1119-1

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 7 PIN BASE

THE 12QP4 IS A GLASS ENVELOPE, MAGNETIC DEFLECTION AND MAGNETIC FOCUS DIRECT-VIEW PICTURE TUBE INTENDED FOR USE IN TELEVISION RECEIVERS. IT PROVIDES FOR A PICTURE 7 1/2" X 10". THE ELECTRON GUN IS DESIGNED TO BE USED WITH AN EXTERNAL SINGLE MAGNET ION-TRAP FOR THE PREVENTION OF ION-SPOT BLEMISH.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	55 DEGREES
ION-TRAP	MAGNETIC
BULB CONTACT	RECESSED SMALL CAVITY CAP
RASTER SIZE	7 1/2" X 10"

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

GRID #1 TO ALL OTHER ELECTRODES	7	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

CONTINUED ON FOLLOWING PAGE

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PLATE 2495
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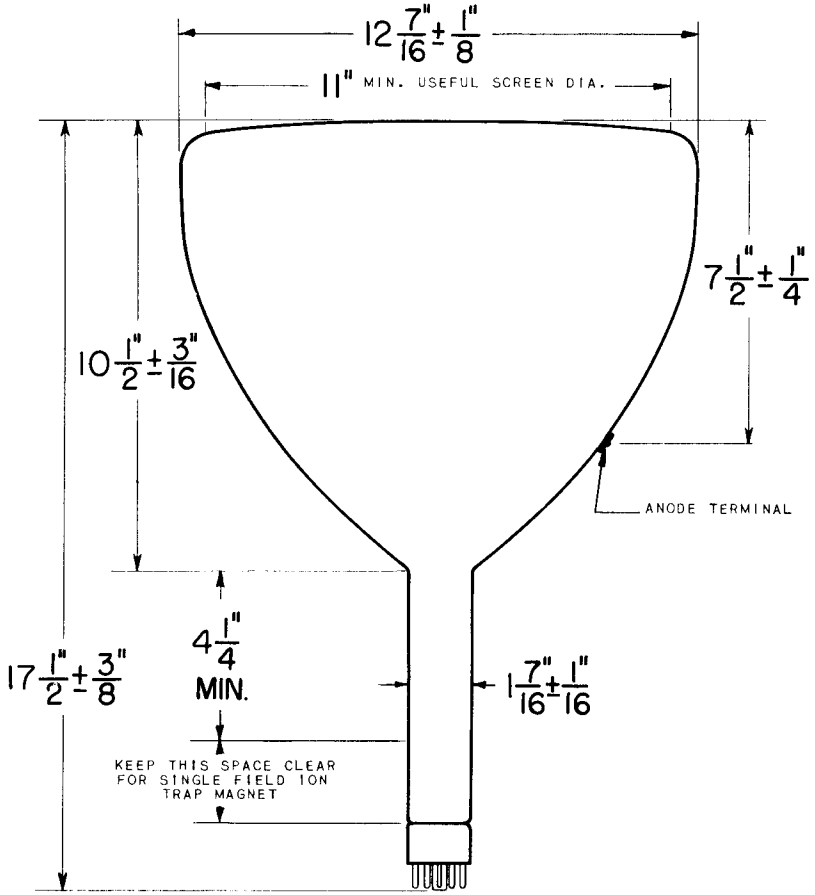
TUNG-SOL

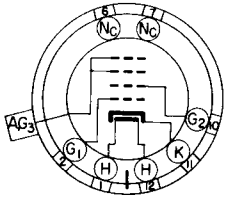
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	10 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)	135	MA.
ION-TRAP CURRENT (APPROX.)[A]	80	MA.

[A] SINGLE FIELD ION-TRAP MAGNET.





1. HEATER
2. GRID NO. 1
6. NO CONNECTION
7. NO CONNECTION
10. NO CONNECTION
11. CATHODE
12. HEATER
CAP ANODE

PLATE 2496
NOV. 1 1950

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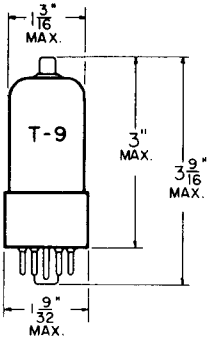
TUNG-SOL

TRIPLE-DIODE TRIODE

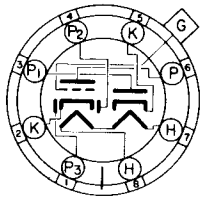


GLASS BULB
SKIRTED
MINIATURE CAP

COATED UNIPOTENTIAL CATHODES

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL BASE
8C3

THE 12S8GT COMBINES IN ONE ENVELOPE A HIGH-MU TRIODE AND THREE SEPARATE DIODES. ONE OF THE THREE DIODES HAS A SEPARATE CATHODE PERMITTING USE AS A BALANCED DISCRIMINATOR OR DETECTOR. IN COMBINATION FM/AM RECEIVERS THIS TUBE PROVIDES THE NECESSARY ELEMENTS FOR DETECTION OF BOTH TYPES OF SIGNAL WITHOUT NEED FOR ADDITIONAL SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #308 CONNECTED TO PIN 2

TRIODE GRID TO ANY DIODE PLATE (MAX.)	0.005	μμf
DIODE INPUT (EACH DIODE) (APPROX.)	1	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM TRIODE PLATE VOLTAGE	300	VOLTS
MAXIMUM TRIODE PLATE DISSIPATION	0.5	WATT
MAXIMUM CONTINOUS DIODE CURRENT (EACH DIODE)	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
TRIODE PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
GRID CIRCUIT RESISTOR	0	0	MEGOHM
TRIODE PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE (APPROX.)	110 000	91 000	OHMS
TRANSCONDUCTANCE	900	1 100	μMHOS
AMPLIFICATION FACTOR	100	100	
AVERAGE DIODE CURRENT WITH 10 VOLTS DC APPLIED (EACH DIODE)	2.5	2.5	MA.

ONE DIODE HAS A SEPARATE CATHODE, THE OTHER CATHODE IS COMMON TO TWO DIODES AND THE TRIODE UNIT.

IT IS RECOMMENDED THAT DIODE #1 (PIN 3) AND DIODE #3 (PIN 1) BE USED IN BALANCED DETECTOR CIRCUITS.

→ INDICATES A CHANGE OR ADDITION.

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PLATE
2130
JAN. 2,
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CONTINUED FROM PRECEDING PAGE

RESISTANCE COUPLED AMPLIFIER

R1 MEG.	Rg1 MEG.	Rc MEG.	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
			Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.1	A	0.1	6800	25	6	4700	27	10	2200	36	29
0.1	A	0.27	8200	29	7	4700	35	15	2700	45	35
0.27	A	0.27	10000	35	9	6800	44	19	4700	53	42
0.27	A	0.47	12000	39	10	6800	48	21	5600	56	48
0.47	A	0.47	18000	39	10	10000	45	24	8200	58	51
0.47	A	1	18000	46	15	12000	54	29	9100	63	59
0.27	10	0.27	---	34	5	---	54	20	---	58	40
0.27	10	0.47	---	38	6	---	57	25	---	60	49
0.47	10	0.47	---	39	7	---	60	23	---	62	47
0.47	10	1	---	42	9.5	---	65	33	---	70	63

[A] VALUE OF Rg1 IS NOT CRITICAL.

Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.

Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.

GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.

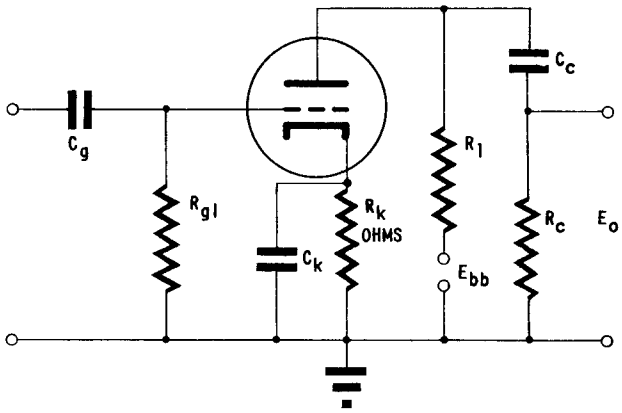

PLATE 2131

JAN. 2, 1949

→ INDICATES A CHANGE OR ADDITION.

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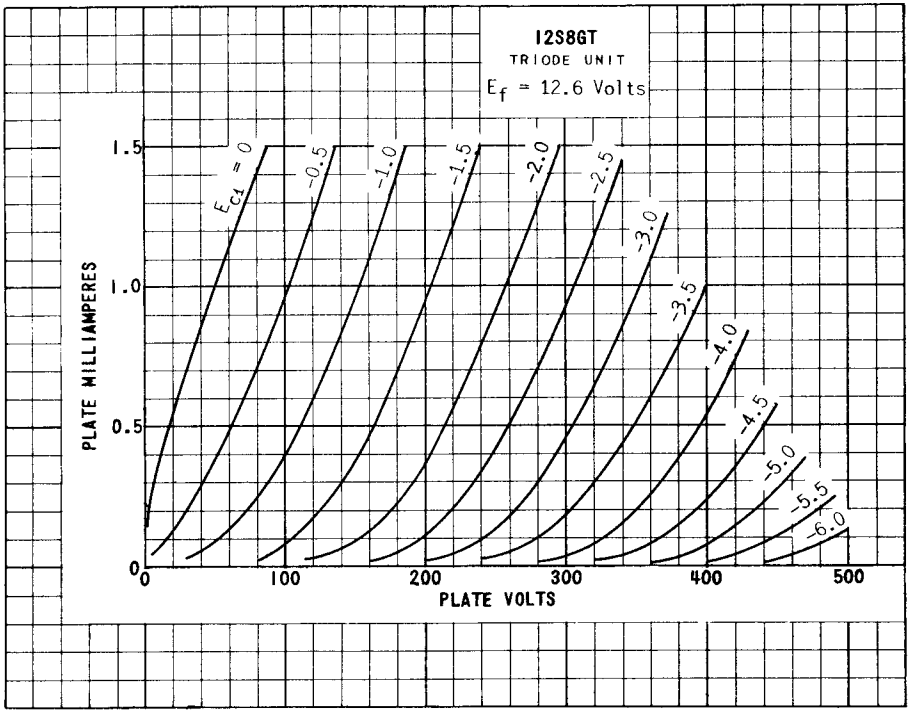

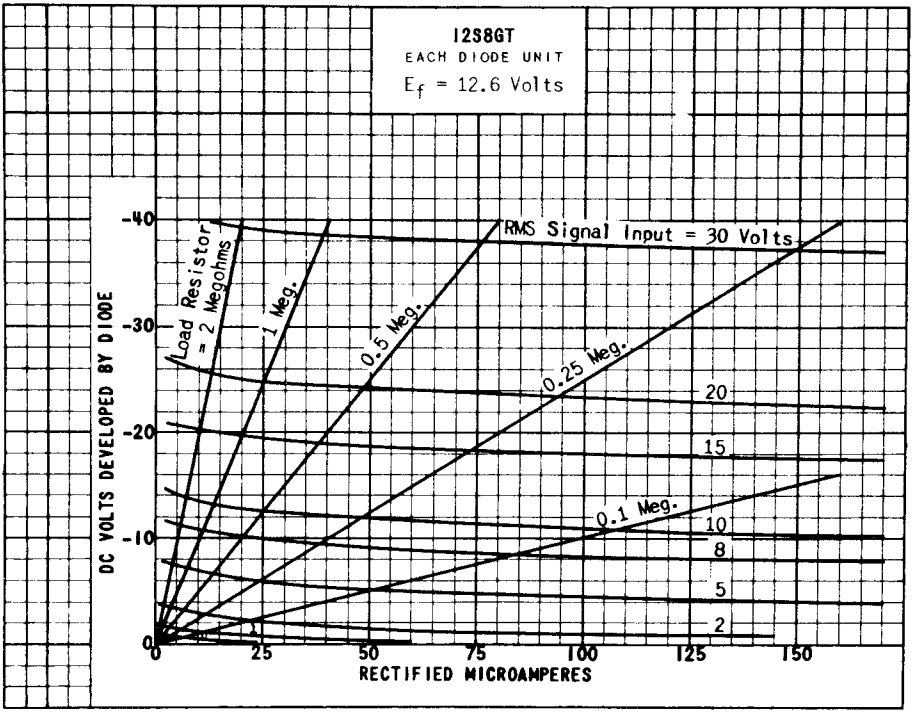

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PLATE
1897
OCT. 1,
1947

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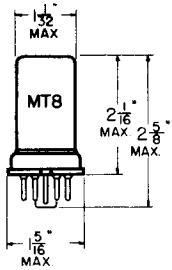
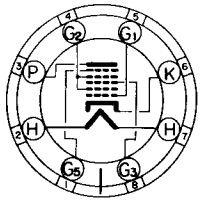
TUNG-SOL

HEPTODE

12SA7



METAL SHELL



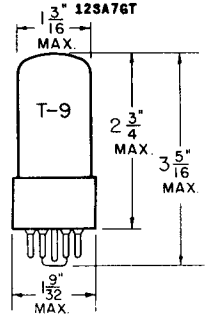
BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL BASE

COATED UNIPOTENTIAL CATHODE

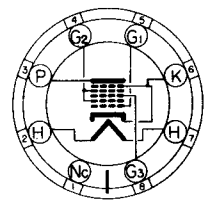
HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION

1 3/16" 12SA7GT



GLASS BULB



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL BASE

THE 12SA7 AND 12SA7GT ARE PENTAGRID CONVERTERS DESIGNED TO MINIMIZE FREQUENCY DRIFT. THEY ARE INTENDED FOR SERVICE AS COMBINED OSCILLATORS AND MIXERS IN AC, STORAGE BATTERY, AND AC/DC OPERATED SUPERHETERODYNES.

DIRECT INTERELECTRODE CAPACITANCES

	12SA7	12SA7GT	
RF INPUT: G_3 TO (H+K+G_1+$G_{2\&4}$+G_5+P)	9.5[A]	11[B]	μμf
OSC. INPUT: G_1 TO (H+K+$G_{2\&4}$+G_3+G_5+P)	7[A]	8[B]	μμf
MIXER OUTPUT: P TO (H+K+G_1+$G_{2\&4}$+G_3+G_5)	12[A]	11[B]	μμf
GRID #3 TO PLATE: (G_3 TO P) MAX.	0.13[A]	0.5[B]	μμf
GRID #3 TO GRID #1: (G_3 TO G_1) MAX.	0.15[A]	0.4[B]	μμf
GRID #1 TO PLATE: (G_1 TO P) MAX.	0.06[A]	0.2[B]	μμf
GRID #1 TO ALL EXCEPT CATHODE: G_1 TO (H+$G_{2\&4}$+G_3+S&G_5+P)	4.4	—	μμf
GRID #1 TO ALL EXCEPT CATHODE & GRID #5: G_1 TO (H+$G_{2\&4}$+G_3+P)	—	5	μμf
GRID #1 TO CATHODE: (G_1 TO K)	2.6	—	μμf
GRID #1 TO CATHODE AND GRID #5: (G_1 TO K & G_5)	—	3	μμf
CATHODE TO ALL EXCEPT GRID #1: K TO (H+$G_{2\&4}$+G_3+S&G_5+P)	5	—	μμf
CATHODE AND GRID #5 TO ALL EXCEPT GRID #1: K & G_5 TO (H+$G_{2\&4}$+G_3+P)	—	14	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

[B] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 1879
SEPT. 2 1947

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM HEATER VOLTAGE	12.6	VOLTS
→ MAXIMUM HEATER–CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRIDS #2 & #4 VOLTAGE	100	VOLTS
MAXIMUM GRIDS #2 & #4 SUPPLY VOLTAGE	300	VOLTS
MINIMUM GRID #3 VOLTAGE[C]	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRIDS #2 & #4 DISSIPATION	1.0	WATT
MAXIMUM CATHODE CURRENT	14	MA.

[C] FOR SELF-EXCITED OSCILLATOR.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

	SELF EXCITATION[D]		SEPARATE EXCITATION		
→ HEATER VOLTAGE	12.6	12.6	12.6	12.6	VOLTS
HEATER CURRENT	150	150	150	150	MA.
PLATE VOLTAGE	100	250	100	250	VOLTS
GRIDS #2 &4 VOLTAGE	100	100	100	100	VOLTS
GRID #3 VOLTAGE	0	0	−2	−2	VOLTS
GRID #1 RESISTOR	20 000	20 000	20 000	20 000	OHMS
PLATE CURRENT	3.3	3.5	3.3	3.5	MA.
GRIDS #2 &#4 CURRENT	8.5	8.5	8.5	8.5	MA.
GRID #1 CURRENT	0.5	0.5	0.5	0.5	MA.
TOTAL CATHODE CURRENT	12.3	12.5	12.3	12.5	MA.
PLATE RESISTANCE (APPROX.)	0.5	1.0	0.5	1.0	MEGOHM
CONVERSION TRANSCONDUCTANCE:					
WITH E_{g3}=−2 VOLTS	425	450	425	450	µMHOS
WITH E_{g3}=−6 VOLTS	---	---	310	325	µMHOS
WITH E_{g3}=−10 VOLTS	---	---	75	80	µMHOS
WITH E_{g3}=−35 VOLTS (APPROX.)	2	2	2	2	µMHOS

[D] HARTLEY OSCILLATOR CIRCUIT WITH A FEEDBACK OF APPROXIMATELY 2 VOLTS PEAK IN THE CATHODE CIRCUIT. VALUES ARE APPROXIMATE.

→ OSCILLATOR TRANSCONDUCTANCE

NOT OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRIDS #2 & 4 CONNECTED TO PLATE	100	VOLTS
TRANSCONDUCTANCE BETWEEN GRID #1 AND GRIDS #2 & 4 CONNECTED TO PLATE	4 500	µMHOS

SIMILIAR TYPE REFERENCE: Ratings and Characteristics somewhat similiar to 14Q7.

PLATE 1880
SEPT. 2 1947

→ INDICATES A CHANGE OR ADDITION.

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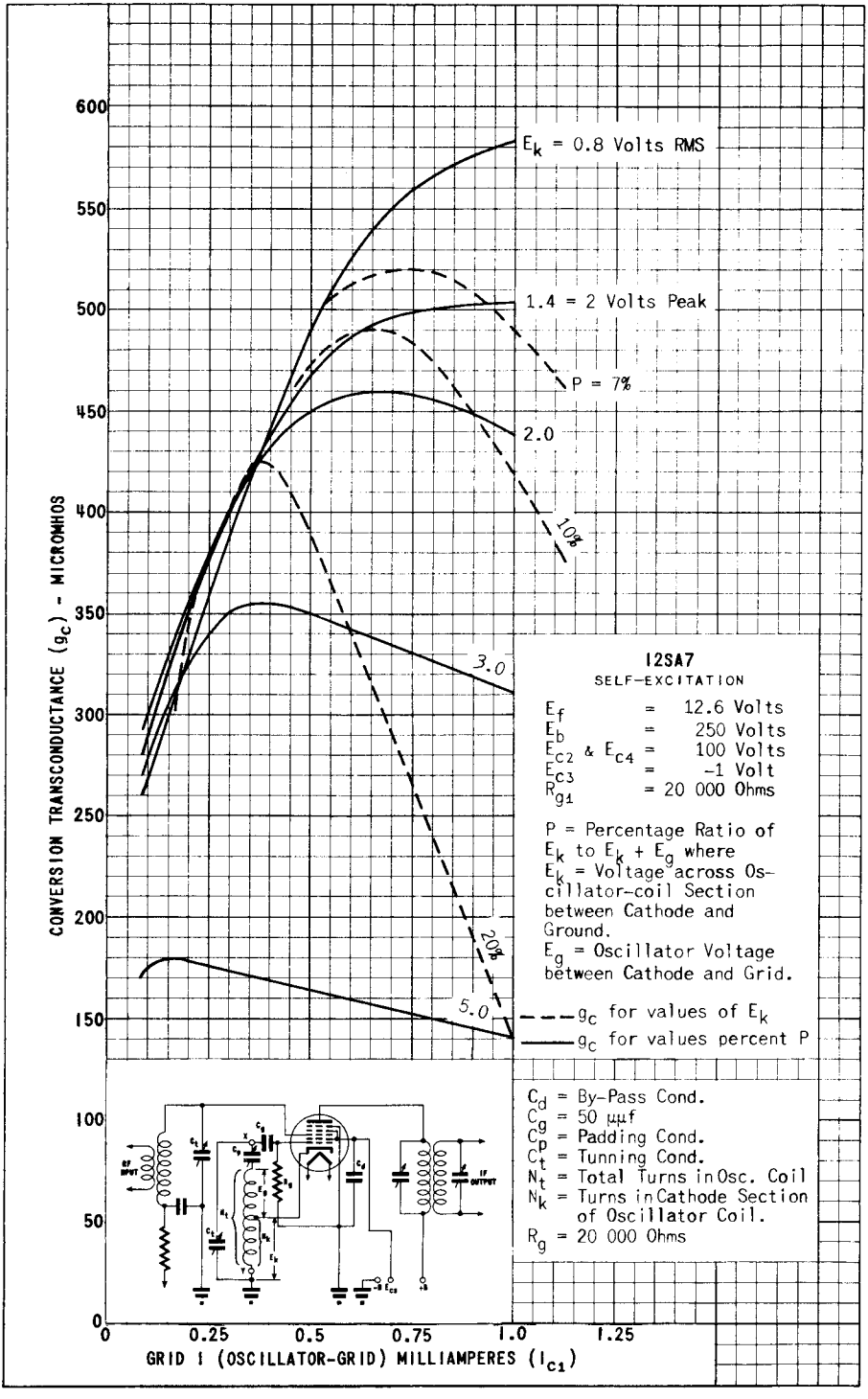

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PLATE 1881
SEPT. 2 1947

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12SA7, 12SA7GT

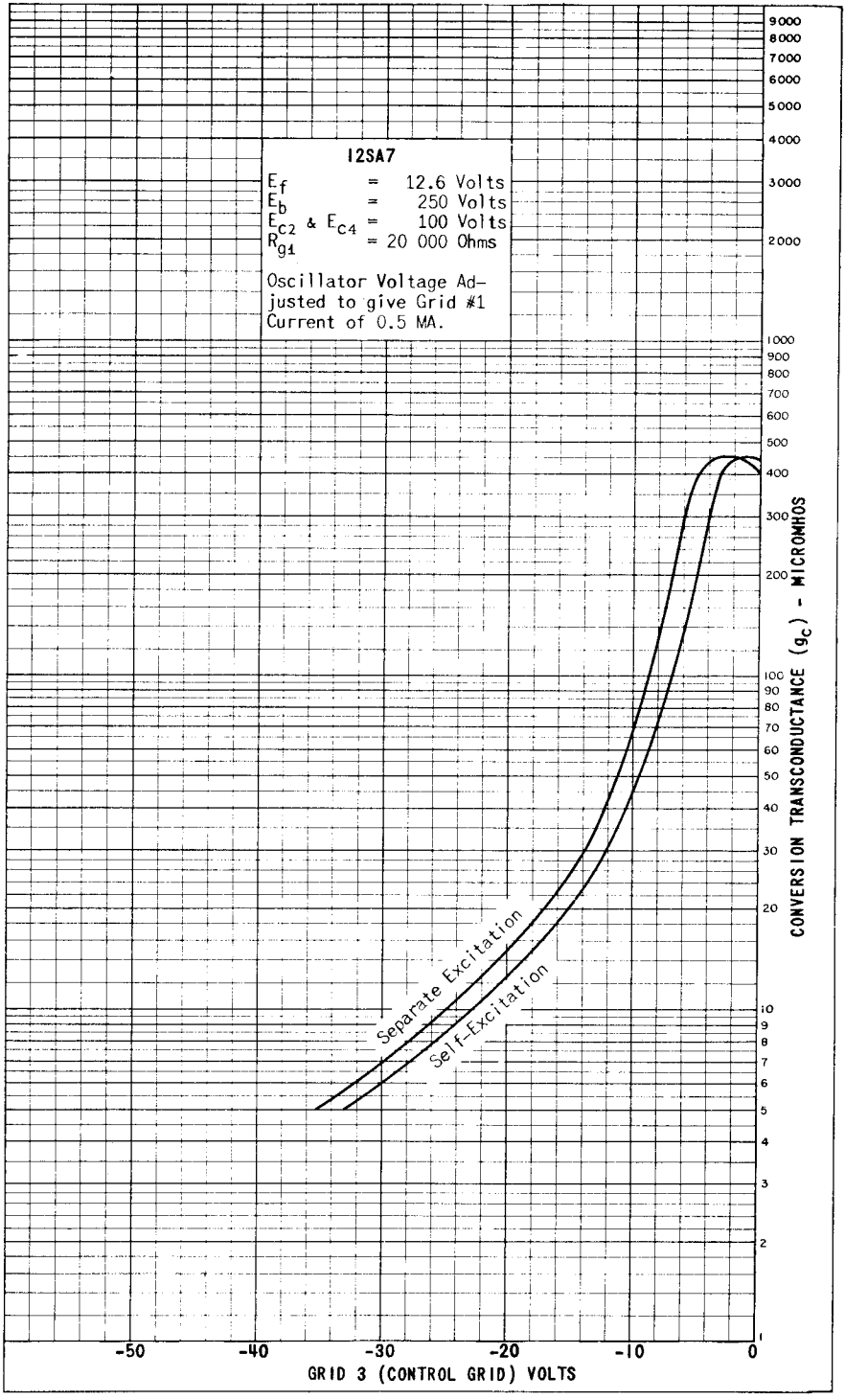

PLATE
1882
SEPT. 2
1947

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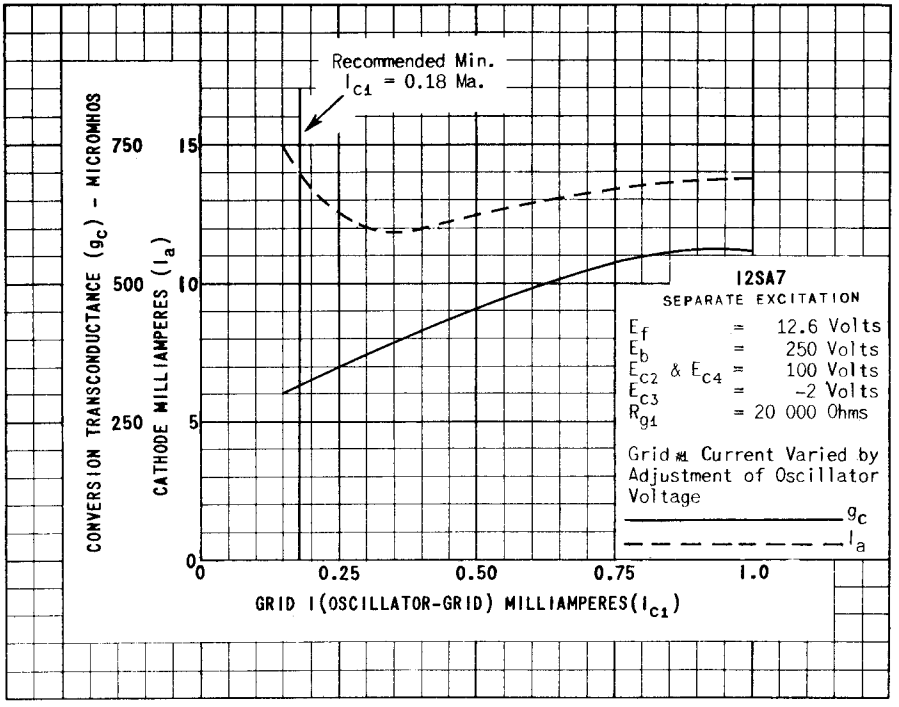

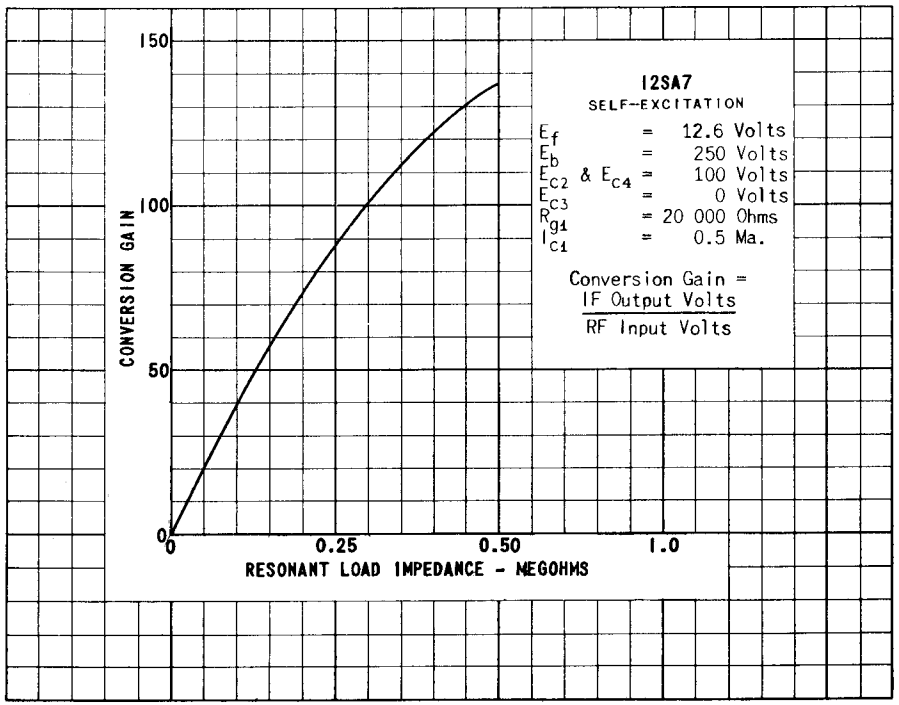

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PLATE
1883
SEPT. 2
1947

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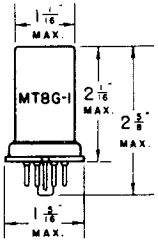
TUNG-SOL

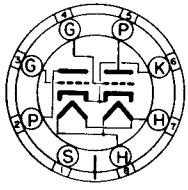
TWIN TRIODE AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

METAL SHELL



8S
BOTTOM VIEW

SMALL WAFER 8 PIN OCTAL BASE

THE TUNG-SOL 12SC7 IS A SINGLE-ENDED TWIN TRIODE AMPLIFIER IN A METAL SHELL. EACH SECTION IS DESIGNED WITH A HIGH AMPLIFICATION FACTOR. ITS PRIMARY APPLICATION IS AS A PHASE INVERTER AND AUDIO AMPLIFIER.

RATINGS

MAXIMUM PLATE VOLTAGE	250	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

VALUES ARE FOR EACH TRIODE SECTION

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−2	VOLTS
PLATE CURRENT	2	MA.
PLATE RESISTANCE	53000	OHMS
TRANSCONDUCTANCE	1325	μMHOS
AMPLIFICATION FACTOR	70	

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE
968-1

JAN. 6
1941

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12SC7

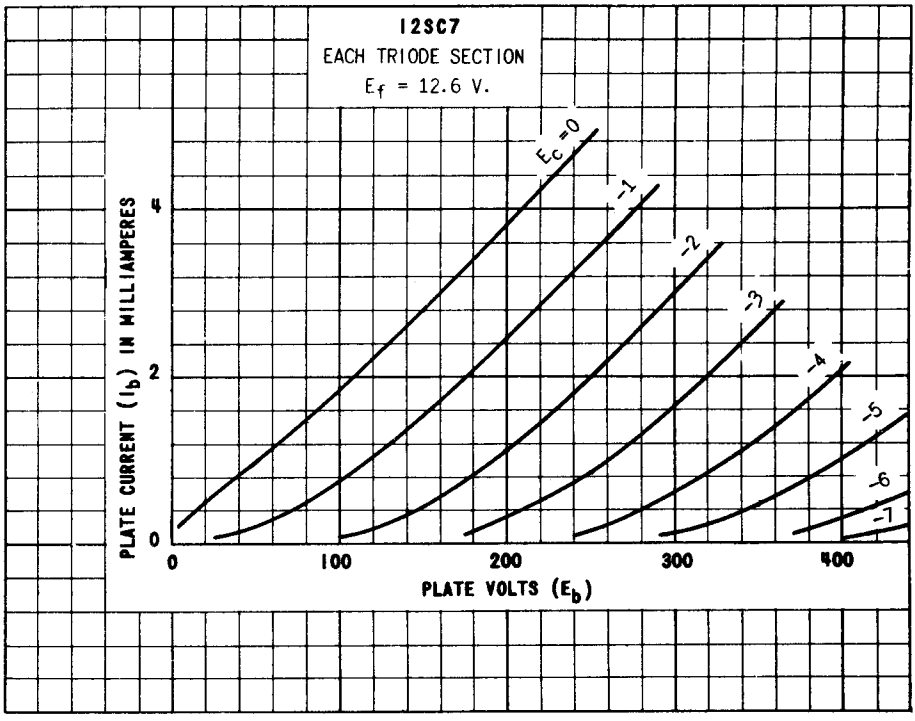

PLATE
969-1

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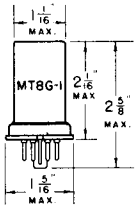
TUNG-SOL



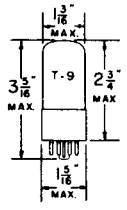
METAL SHELL
SMALL WAFER
6 PIN OCTAL BASE
12SF5

HIGH MU TRIODE AMPLIFIER

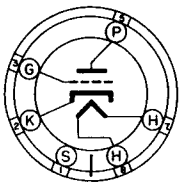
UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMPERE
AC OR DC

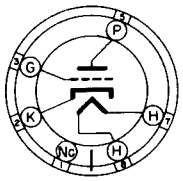


GLASS BULB
INTERMEDIATE
6 PIN OCTAL BASE
12SF5GT



6AB

BOTTOM VIEWS



G-6AB

THE TUNG-SOL 12SF5 AND 12SF5GT ARE GENERAL PURPOSE HIGH MU TRIODES. THEY ARE DESIGNED FOR SERVICE AS HIGH GAIN RESISTANCE COUPLED AMPLIFIERS IN AC – DC OPERATED RECEIVERS USING 150 MA. HEATER TUBES.

RATINGS

HEATER VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER CURRENT	0.15	AMPERE
MAXIMUM PLATE VOLTAGE	300	VOLTS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	85000	66000	OHMS
TRANSCONDUCTANCE	1150	1500	μMHOS
AMPLIFICATION FACTOR	100	100	

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CONTINUED NEXT PAGE

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PLATE
1092-2

JULY 28
1941

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12SF5, 12SF5GT

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ZERO BIAS, RESISTANCE COUPLED, CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	100		300		VOLTS
PLATE LOAD RESISTOR	0.25		0.25		MEGOHM
GRID RESISTOR	10		10		MEGOHMS
COUPLING CONDENSER	.01 TO .005		.01 TO .005		μμf
GRID RESISTOR FOR FOLLOWING TUBE	.5	TO 1.0	.5	TO 1.0	MEGOHM
EXTERNAL GRID CIRCUIT IMPEDANCE	0	0	0	0	MEGOHM
VOLTAGE GAIN	48	52	66	71	
VOLTAGE OUTPUT (RMS)[A]	7.0	8.5	44	50	VOLTS

[A] AT FIVE PER CENT TOTAL HARMONIC DISTORTION.

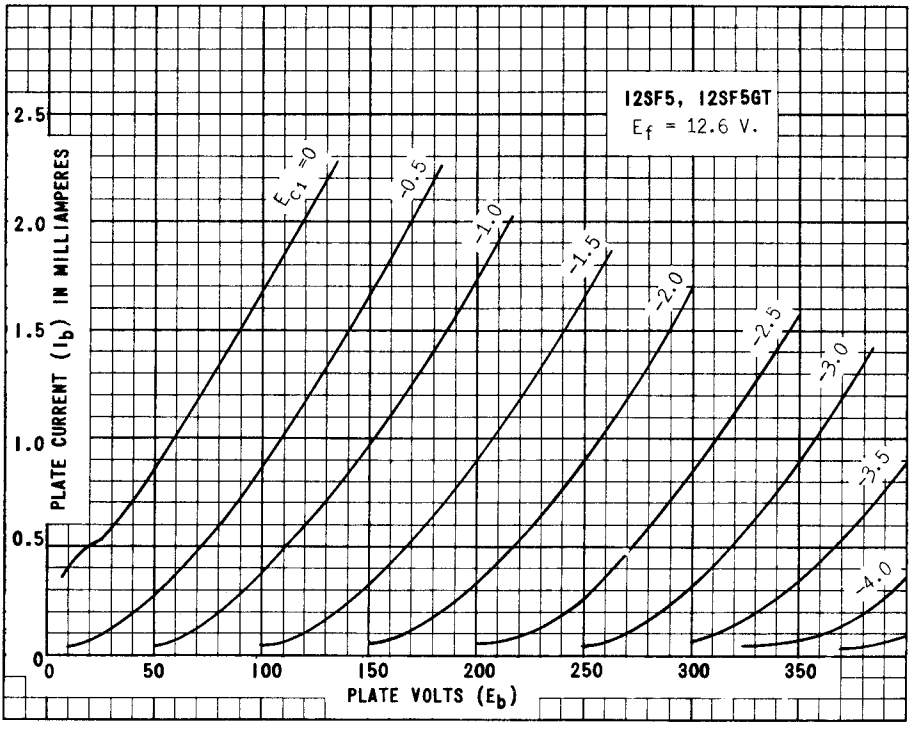

PLATE 1093-1

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TENTATIVE DATA 12SF7GT

TUNG-SOL

DIODE AMPLIFIER PENTODE

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE 8 PIN OCTAL WAFER WITH METAL SHELL	PIN 1 BASE SHELL, INTER-PIN SHIELD	
	PIN 2 GRID 1	PIN 7 HEATER
BULB T-9	PIN 3 G3, S1, K	PIN 8 HEATER
MAXIMUM DIAMETER 1 5/16"	PIN 4 GRID 2	
MAXIMUM OVERALL LENGTH 3 5/16"	PIN 5 DI. PLATE	MOUNTING POS. ANY
MAXIMUM SEATED HEIGHT 2 3/4"	PIN 6 PENT. PLATE	

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
MAXIMUM PENTODE PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM PENTODE PLATE DISSIPATION	3.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.5	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MINIMUM DIODE PLATE CURRENT WITH 10 VOLTS DC APPLIED	0.8	MA.

CAPACITANCES
WITH EXTERNAL SHIELD CONNECTED TO CATHODE

CONTROL GRID TO CATHODE	5.5	μμf
PENTODE PLATE TO CATHODE	6.0	μμf
GRID TO PENTODE PLATE	0.004	μμf (MAX.)
DIODE PLATE TO PENTODE GRID 1	0.002	μμf (MAX.)
DIODE PLATE TO PENTODE PLATE	1.3	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE	12.6	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	-1	-1	VOLT
PEAK AF SIGNAL VOLTAGE			VOLTS
PLATE CURRENT	12	12.4	MA.
SCREEN CURRENT	3.4	3.3	MA.
MAXIMUM-SIGNAL PLATE CURRENT			MA.
MAXIMUM-SIGNAL SCREEN CURRENT			MA.
PLATE RESISTANCE (APPROX.)	0.2	0.7	MEGOHM
TRANSCONDUCTANCE	1975	2050	μMHOS
AMPLIFICATION FACTOR			
LOAD RESISTANCE			OHMS
TOTAL HARMONIC DISTORTION			PER CENT
POWER OUTPUT			WATTS
CONTROL GRID VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE=10 μMHOS	-35	-35	VOLTS

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PLATE 1709
APRIL 15 1946

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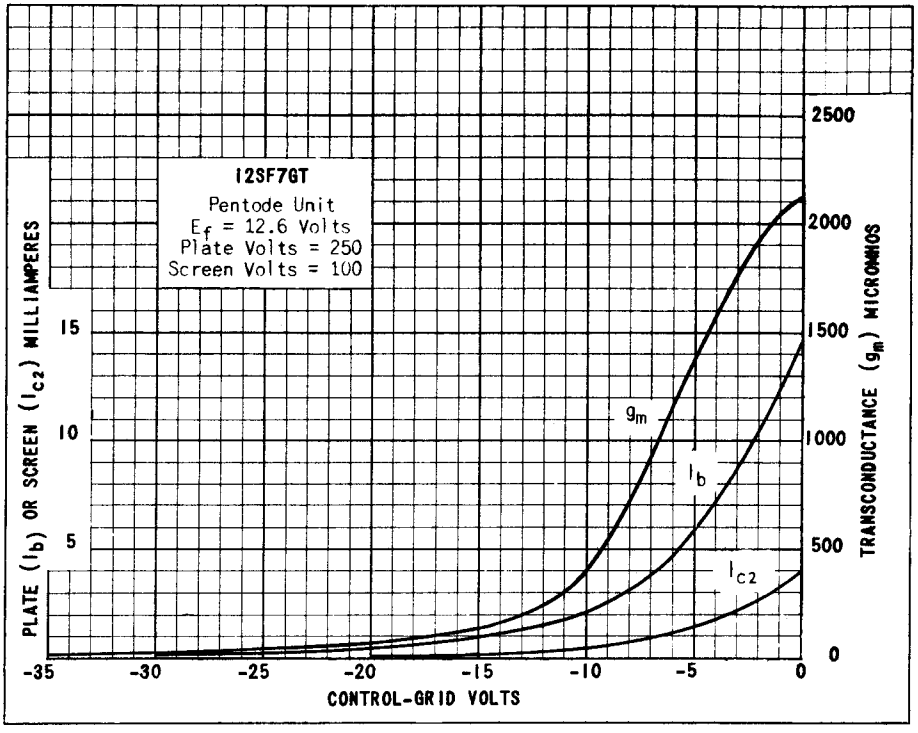
12SF7GT



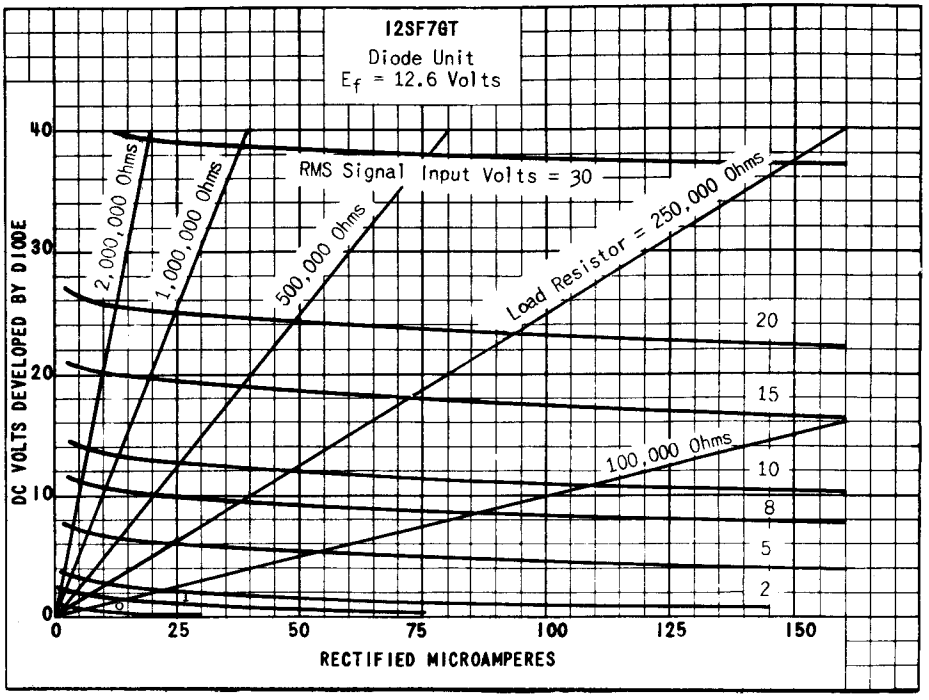


PLATE 1710
APRIL 1946

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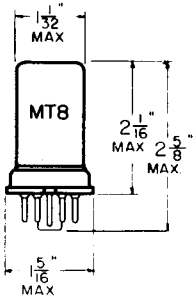
TUNG-SOL

PENTODE

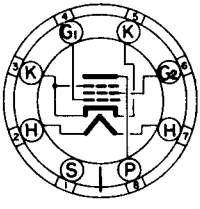


METAL SHELL

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL

THE 12SG7 IS A SEMI-REMOTE CUT OFF PENTODE VOLTAGE AMPLIFIER IN THE OCTAL METAL CONSTRUCTION. IT FEATURES HIGH TRANSCONDUCTANCE WITH LOW GRID-PLATE CAPACITANCE AND A DUAL CATHODE CONNECTION TO MINIMIZE EFFECTS OF COMMON CATHODE CIRCUIT COUPLING.

DIRECT INTERELECTRODE CAPACITANCES

	12SG7[A]	
GRID TO PLATE: (G TO P) MAX.	0.003	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	8.5	μμf
OUTPUT: P TO (H+K&G_3+G_2)	7	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATT

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PLATE 2064
AUG. 2, 1948

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	150	150	150	MA.
PLATE VOLTAGE	100	250	250	VOLTS
GRID #2 VOLTAGE	100	125	150	VOLTS
GRID #1 VOLTAGE	-1	-1	-2.5	VOLTS
SELF BIAS RESISTOR	90	60	190	OHMS
PLATE RESISTANCE (APPROX.)	0.25	0.9	[C]	MEGOHM
TRANSCONDUCTANCE	4100	4700	4000	μMHOS
PLATE CURRENT	8.2	11.8	9.2	MA.
GRID #2 CURRENT	3.2	4.4	3.4	MA.
GRID #1 VOLTAGE (APPROX.) FOR g_m = 40 μMHOS	-11.5	-14	-17.5	VOLTS

[C] GREATER THAN 1.0 MEGOHM.

PLATE 2065
AUG. 2, 1948

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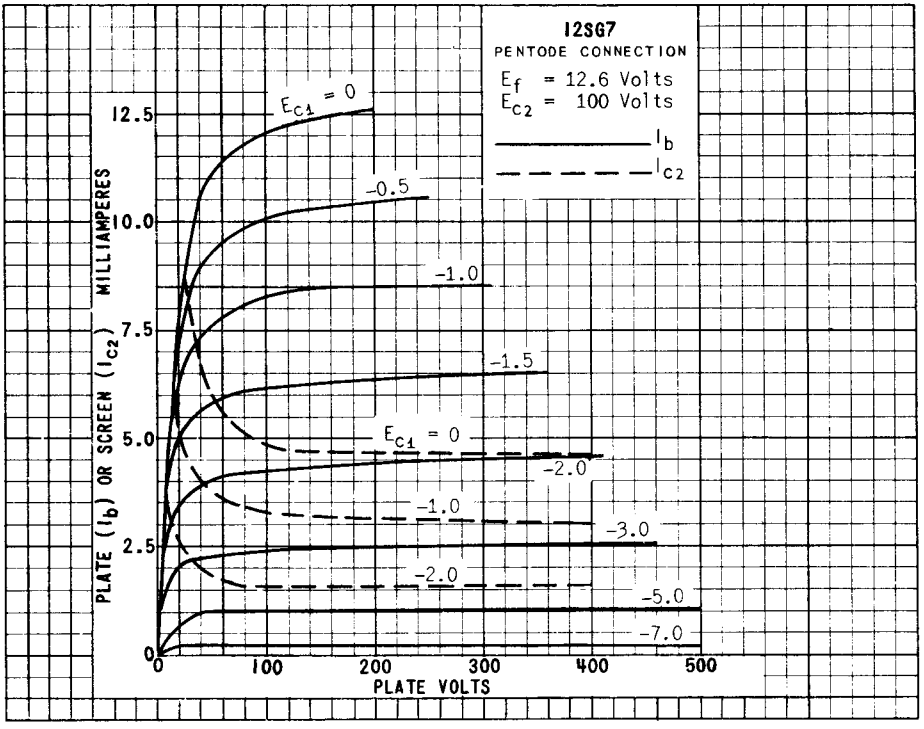

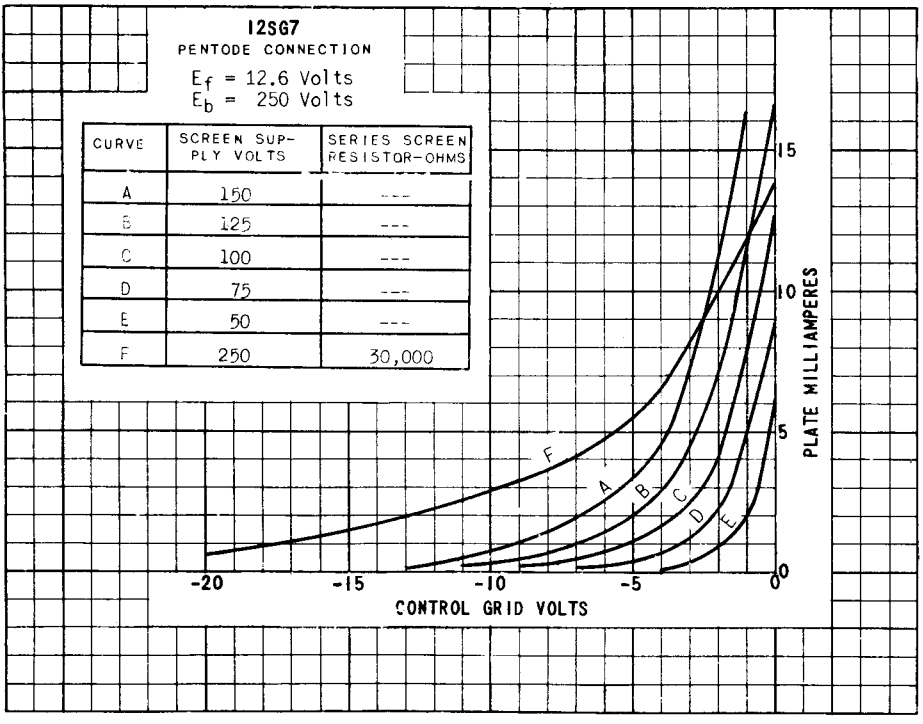

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000

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PLATE 2066
AUG. 2, 1948

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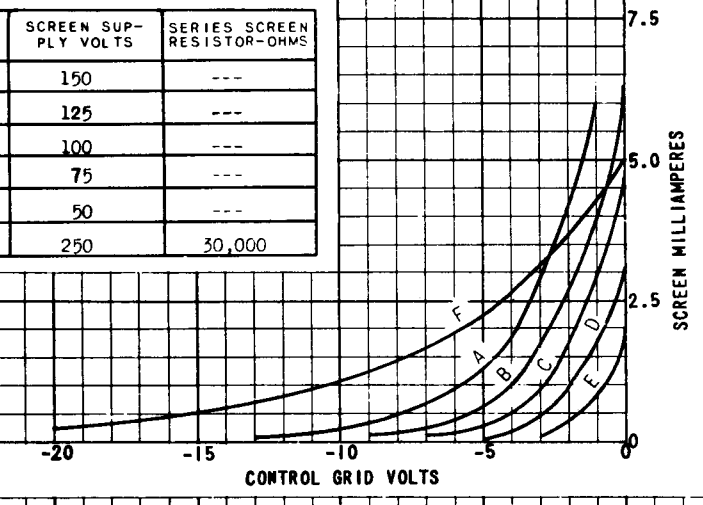
12SG7 (6SG7, 6SG7GT)

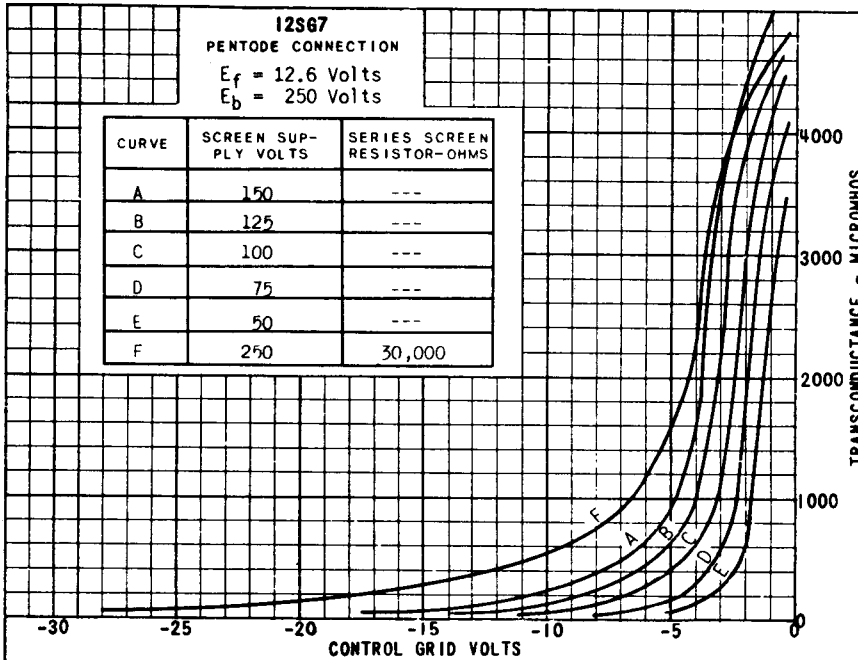
12SG7
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000



12SG7
PENTODE CONNECTION
E_f = 12.6 Volts
E_b = 250 Volts

CURVE	SCREEN SUPPLY VOLTS	SERIES SCREEN RESISTOR-OHMS
A	150	---
B	125	---
C	100	---
D	75	---
E	50	---
F	250	30,000



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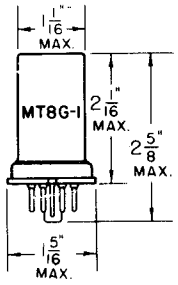
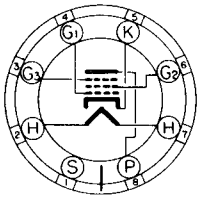
TUNG-SOL

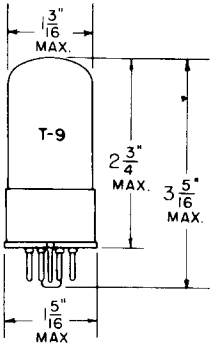
TRIPLE-GRID DETECTOR AMPLIFIER



METAL SHELL
SMALL WAFER OCTAL
8 PIN BASE
6SJ7, 12SJ7



BOTTOM VIEW
6SJ7, 6SJ7GT
12SJ7, 12SJ7GT



GLASS BULB
SMALL WAFER OCTAL 8 PIN
BASE WITH METAL SLEEVE
6SJ7GT, 12SJ7GT

UNIPOTENTIAL CATHODE

HEATER

6SJ7, 6SJ7GT - 6.3 V. 0.3 A.
12SJ7, 12SJ7GT - 12.6 V. 0.15 A.

AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN THE HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. UNDER NO CONDITIONS SHOULD IT EXCEED 100 VOLTS.

THESE TUBES ARE SINGLE ENDED PENTODES HAVING SHARP CUT-OFF CHARACTERISTICS. THEY MAY BE USED AS BIASED DETECTORS, RADIO FREQUENCY OSCILLATORS OR AS MIXER TUBES IN PROPERLY DESIGNED CIRCUITS. WITH THE EXCEPTION OF HEATER AND CAPACITANCE RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MINIMUM GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATTS

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PLATE 1441
JUNE 15 1944

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12SJ7, 12SJ7GT (6SJ7, 6SJ7GT)

TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES

SHELL CONNECTED TO CATHODE

	6SJ7-12SJ7	6SJ7GT-12SJ7GT	
GRID TO PLATE	0.005 MAX.	0.005 MAX.	μμf
INPUT	6.0	6.3	μμf
OUTPUT	7.0	10.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
GRID VOLTAGE	−3	−3	VOLTS
SUPPRESSOR	TIE TO CATHODE		
PLATE CURRENT	2.9	3.0	MA.
SCREEN CURRENT	0.9	0.8	MA.
PLATE RESISTANCE (APPROX.)	0.7	1.5	MEGOHMS
TRANSCONDUCTANCE	1575	1650	μMHOS
GRID VOLTAGE (FOR CATHODE CURRENT CUT-OFF)	−9	−9	VOLTS

PLATE 1442
JUNE 15 1944

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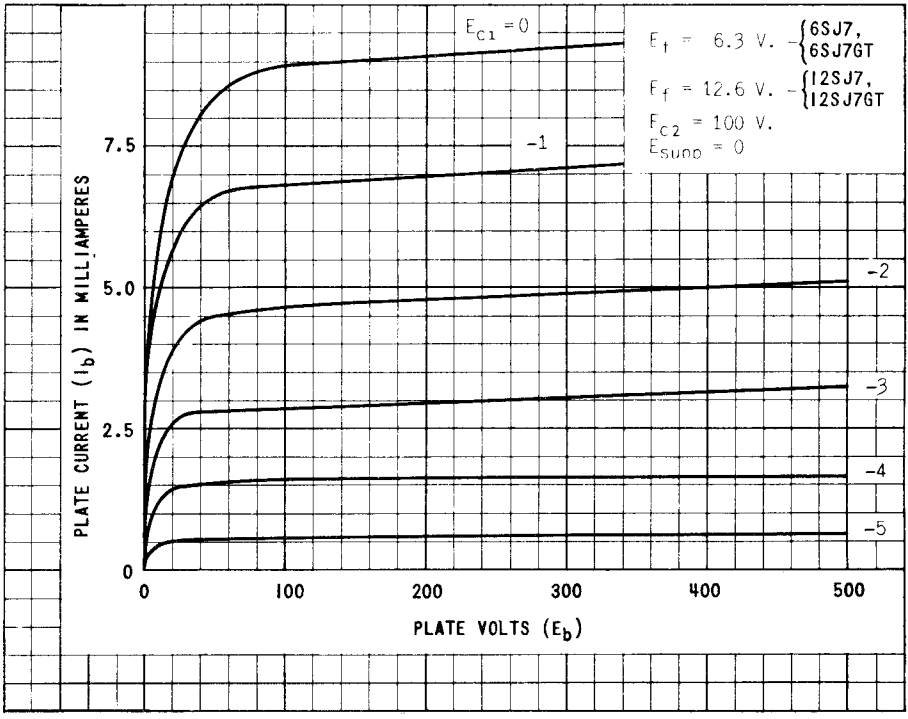

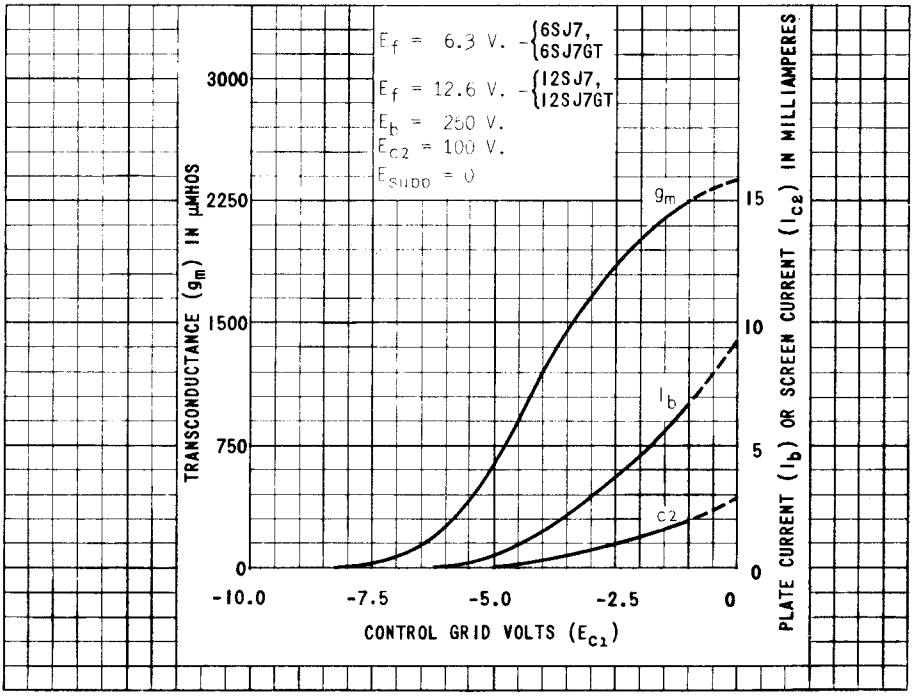

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TUNG-SOL

TRIPLE GRID

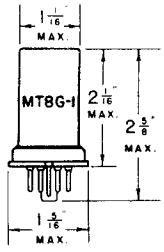
REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMPERE

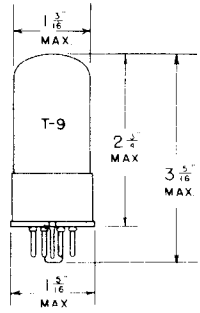
AC OR DC



METAL SHELL
12SK7

8N

BOTTOM VIEW



GLASS BULB
12SK7GT/G

SMALL WAFER 8 PIN OCTAL BASE

THE TUNG-SOL 12SK7 AND 12SK7GT/G ARE TRIPLE GRID VARIABLE MU AMPLIFIERS. THEY ARE DESIGNED FOR USE WITH AVC IN RF AND IF AMPLIFIERS, AND THEY MINIMIZE CROSS MODULATION. WITH THE EXCEPTION OF HEATER RATINGS, THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6SK7 AND 6SK7GT/G.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MINIMUM EXTERNAL CONTROL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.4	WATT

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FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

PLATE
1122-1

SEPT. 17
1941

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TUNG-SOL

DIRECT INTERELECTRODE CAPACITANCES[S]

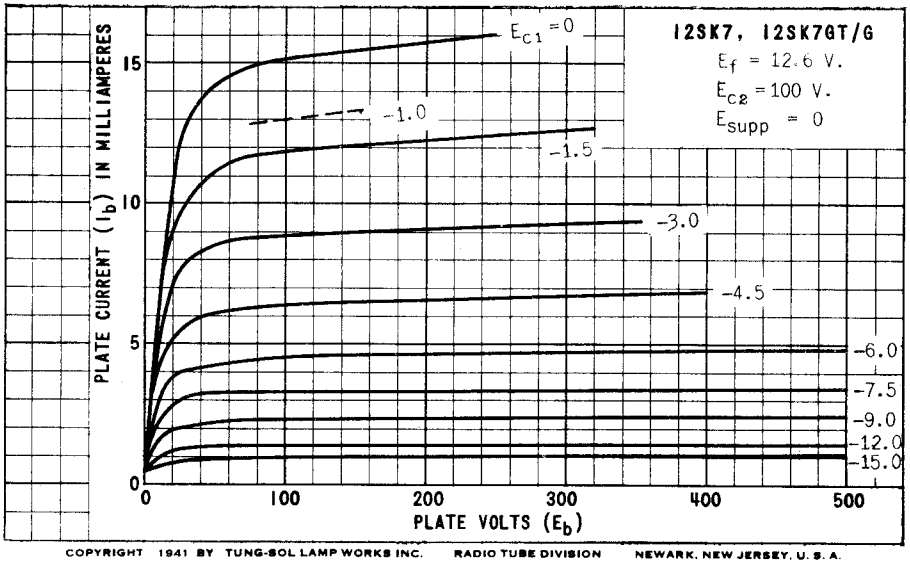
	12SK7	12SK7GT/G	
CONTROL GRID TO CATHODE	6.0	6.5	μμf
PLATE TO CATHODE	7.0	7.5	μμf
CONTROL GRID TO PLATE	0.003 MAX.	0.005 MAX.	μμf

[S] WITH SHELL CONNECTED TO CATHODE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	−1	−3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	13	9.2	MA.
SCREEN CURRENT	4.0	2.6	MA.
PLATE RESISTANCE APPROX.	0.12	0.8	MEGOHM
TRANSCONDUCTANCE	2350	2000	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 10 μMHOS	−35	−35	VOLTS



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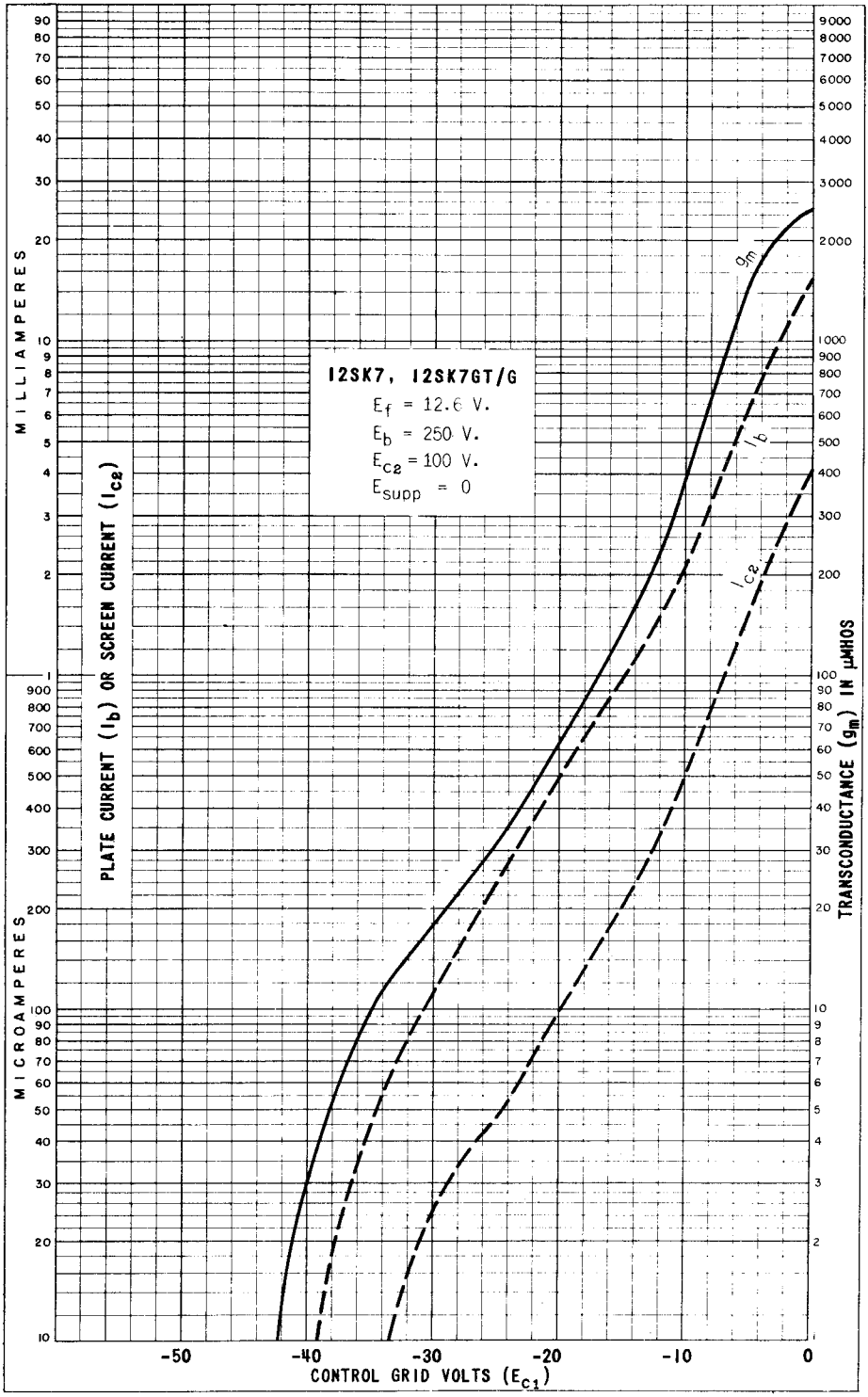

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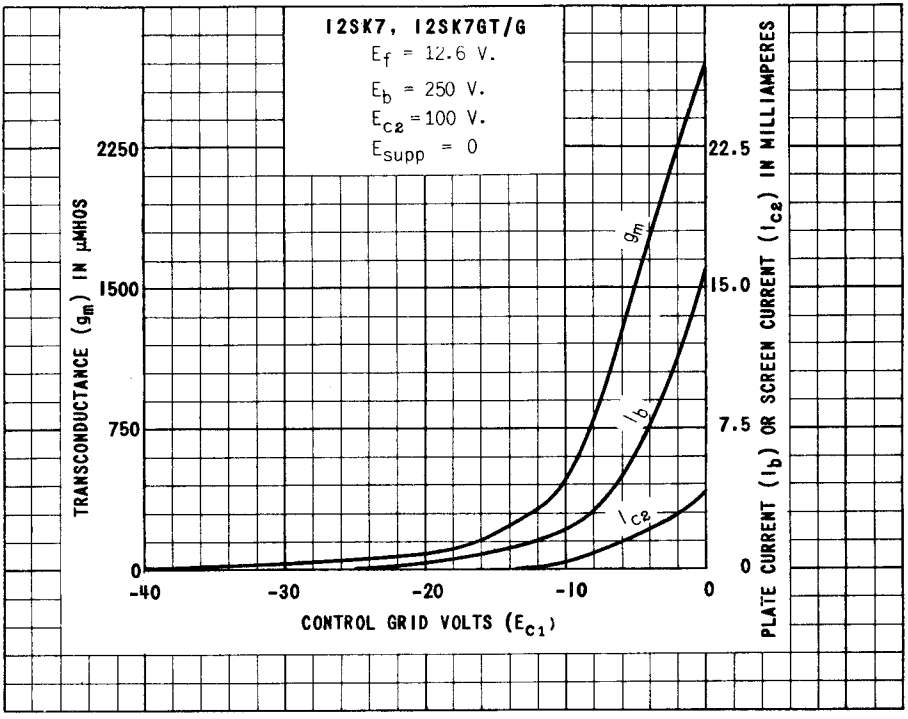
12SK7, 12SK7GT/G



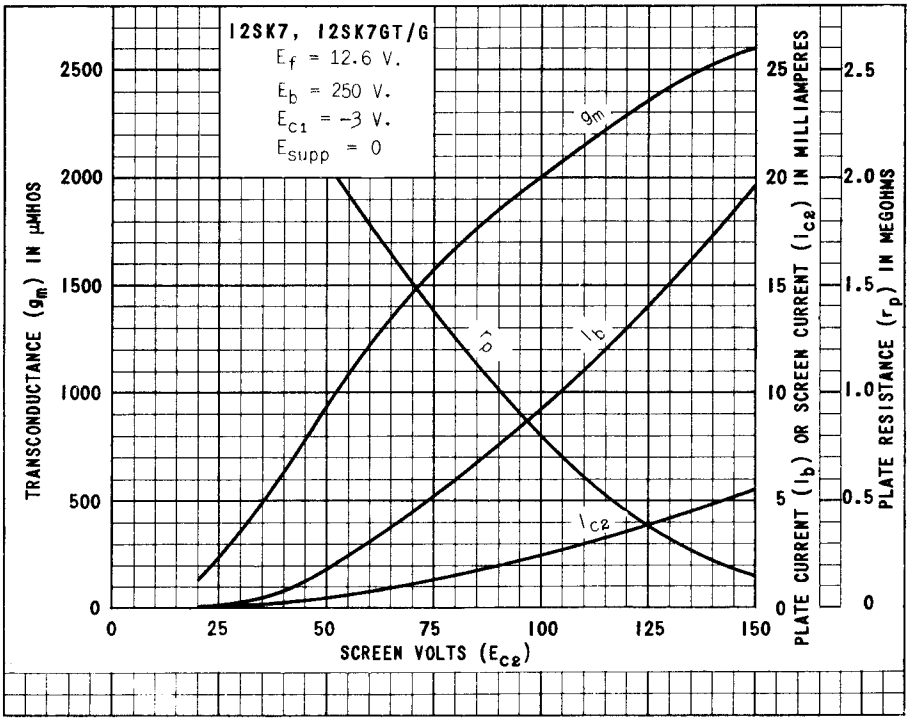


PLATE
1125-1

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TENTATIVE DATA

12SL7GT

TUNG-SOL

TWIN-TRIODE AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS		
BASE INTERMEDIATE SHELL OCTAL 8-PIN	PIN 1 GRID (T2)	PIN 7	HEATER
CAP NONE	PIN 2 PLATE (T2)	PIN 8	HEATER
BULB T-9	PIN 3 CATHODE (T2)		
MAXIMUM DIAMETER 1 5/16"	PIN 4 GRID (T1)		
MAXIMUM OVERALL LENGTH 3 5/16"	PIN 5 PLATE (T1)	TOP CAP	NONE
MAXIMUM SEATED HEIGHT 2 3/4"	PIN 6 CATHODE (T1)		

RATINGS

AMPLIFIER – EACH UNIT

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	.1	WATTS
MAXIMUM SCREEN DISSIPATION		WATTS

RATINGS ARE TO BE INTERPRETED ACCORDING TO RMA STANDARD M8-210

CAPACITANCES

	TRIODE UNIT T1	TRIODE UNIT T2	
GRID TO CATHODE	3.0	3.4	μμf
PLATE TO CATHODE	3.6	3.2	μμf
GRID TO PLATE	2.8	2.8	μμf
PLATE TO PLATE	0.4		μμf
GRID TO GRID	0.65		μμf
GRID T2 TO PLATE T1	0.13		μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
CONTROL GRID VOLTAGE		VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
ZERO-SIGNAL PLATE CURRENT	2.3	MA.
ZERO-SIGNAL SCREEN CURRENT		MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE (APPROX.)	44000	OHMS
TRANSCONDUCTANCE	1600	μMHOS
AMPLIFICATION FACTOR	70	
LOAD RESISTANCE		OHMS
TOTAL HARMONIC DISTORTION		PER CENT
POWER OUTPUT		WATTS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE μMHOS		VOLTS

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PLATE 1318-1

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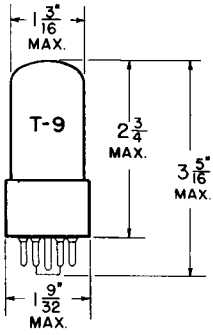
TUNG-SOL

DOUBLE TRIODE

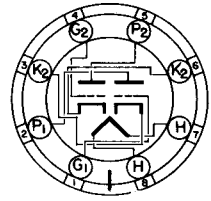


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8BD

THE 12SN7GT COMBINES TWO MEDIUM-MU TRIODES IN ONE ENVELOPE. IT IS DESIGNED FOR USE AS A RESISTANCE COUPLED AMPLIFIER, OR COMBINED VERTICAL OSCILLATOR AND VERTICAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	SECTION 1[A]	SECTION 2[B]	
GRID TO PLATE	3.8	4.0	μμf
INPUT	2.8	3.0	μμf
OUTPUT	0.8	1.2	μμf

[A] CONNECTED TO PINS 4, 5 AND 6.

[B] CONNECTED TO PINS 1, 2 AND 3.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[C]

EACH SECTION[C]

	CLASS A_1 AMPLIFIER	VERTICAL[D] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	12.6		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PLATE DISSIPATION			
EACH PLATE	3.5	3.5	WATTS
BOTH PLATES	5.0	5.0	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	70	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	1.0	---	MEGOHMS
CATHODE BIAS	---	2.2	MEGOHMS

[C] UNLESS OTHER WISE SPECIFIED.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

RATINGS — CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

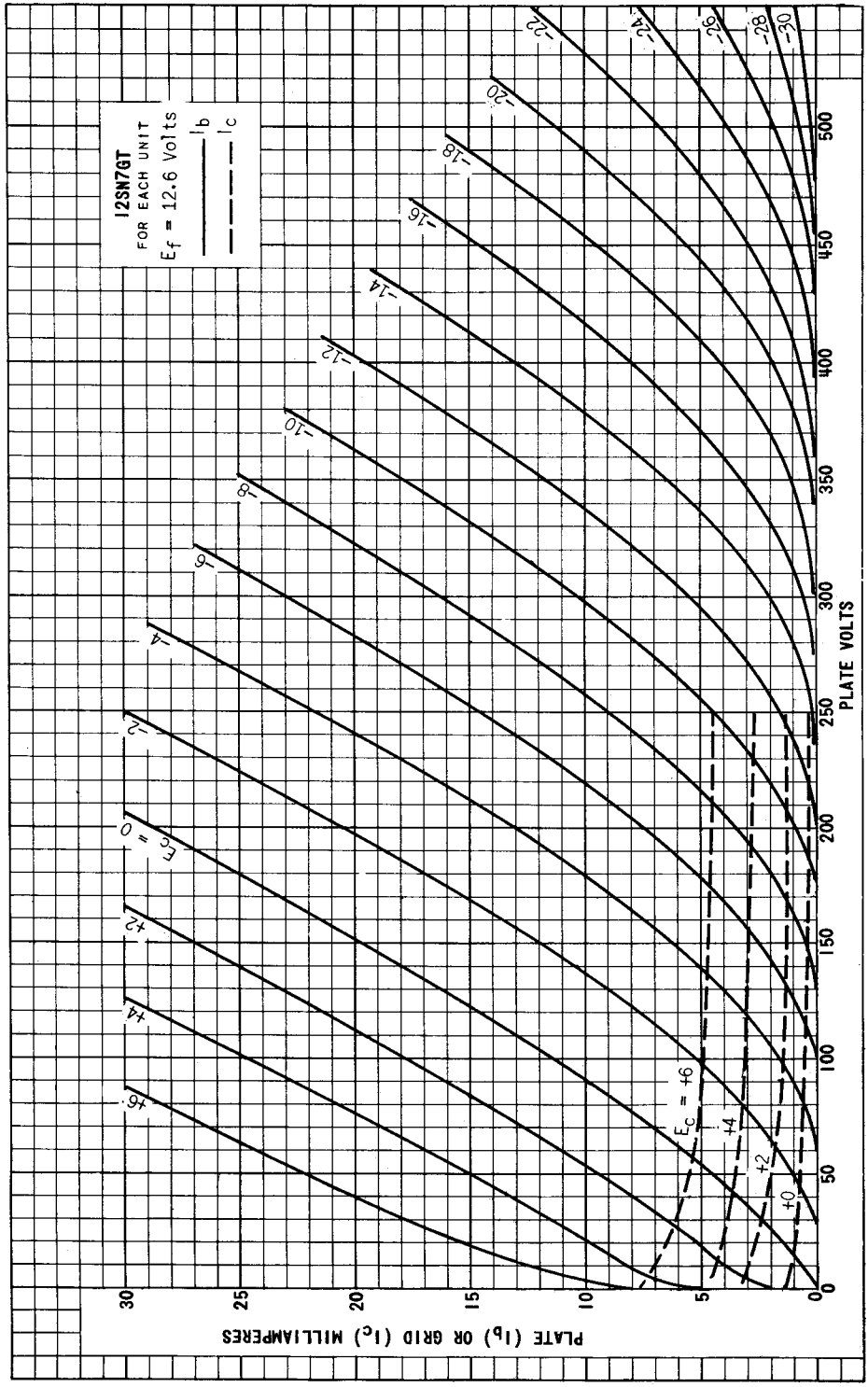
	VERTICAL[E] DEFLECTION OSCILLATOR	HORIZONTAL[E] DEFLECTION OSCILLATOR	
HEATER VOLTAGE	12.6		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PLATE DISSIPATION			
EACH PLATE	3.5	3.5	WATTS
BOTH PLATES	5.0	5.0	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	70	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

[E] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF 'GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	-8.0	VOLTS
PLATE CURRENT	10	9.0	MA.
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	20	20	
PLATE CURRENT AT E_c = -12.5 VOLTS	---	1.3	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	-7.0	-18	MA.



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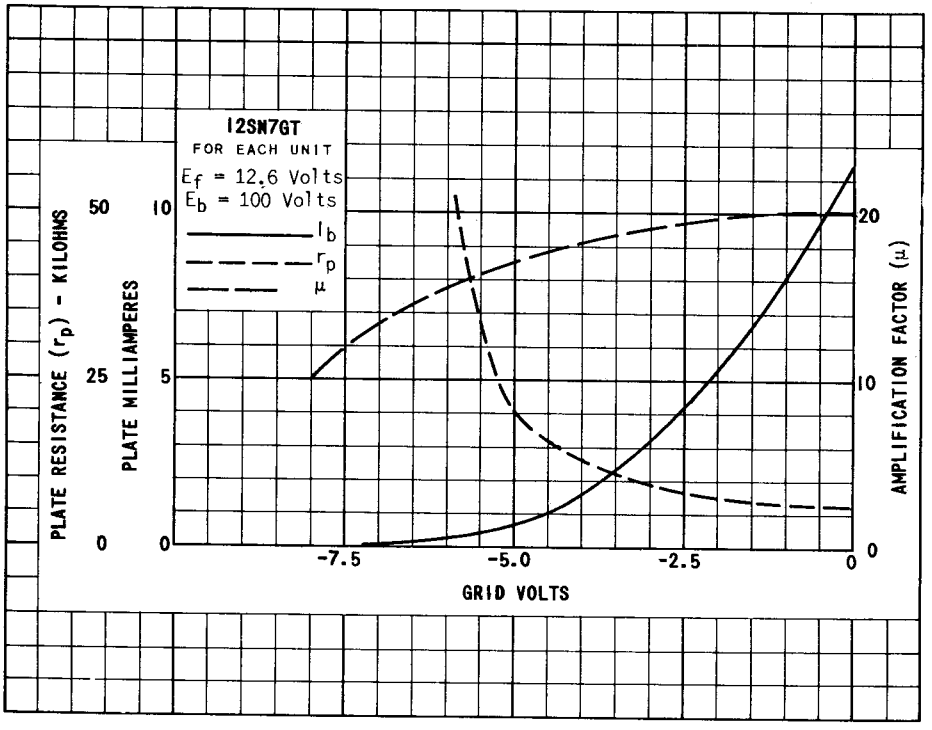
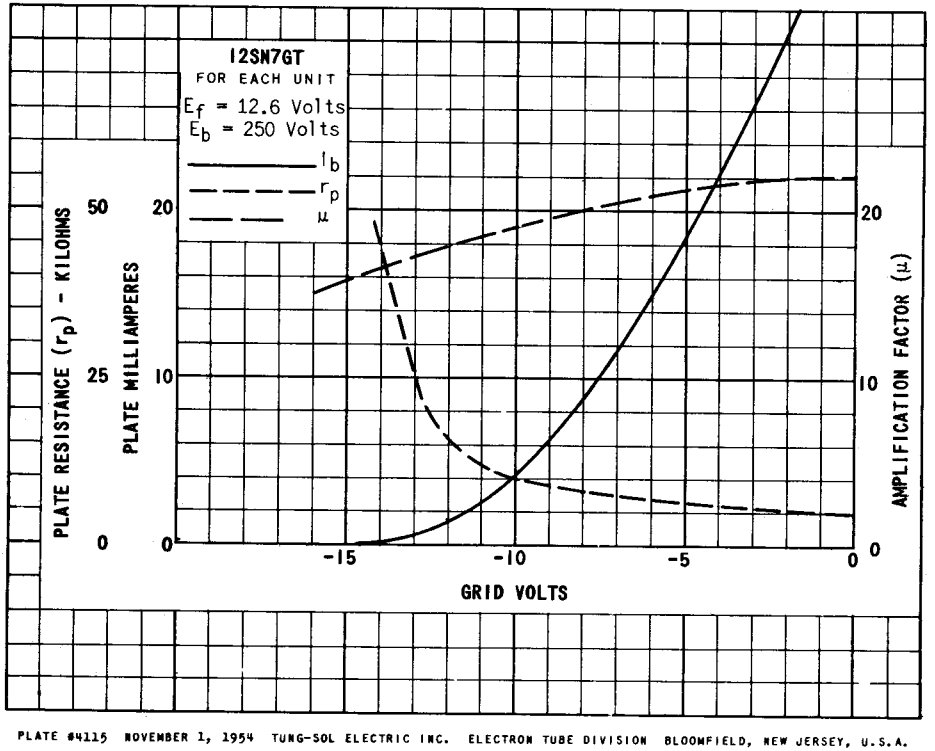
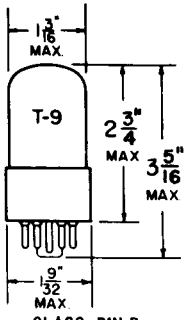
12SN7GT (6SN7GT)





TUNG-SOL

DOUBLE TRIODE

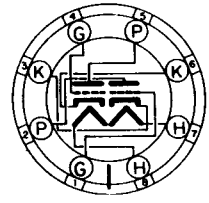


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
8BD

THE 12SN7GTA IS A MEDIUM-MU DOUBLE TRIODE SUITABLE FOR USE IN A WIDE VARIETY OF GENERAL-PURPOSE AMPLIFIER AND PHASE-INVERTER APPLICATIONS. IT IS ALSO USEFUL AS A BLOCKING OSCILLATOR, MULTIVIBRATOR, OR VERTICAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. EXCEPT FOR HEATER AND HEATER WARM-UP TIME RATINGS, THE 12SN7GTA IS IDENTICAL TO THE 6SN7GTB.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

	TRIODE 1	TRIODE 2	
GRID TO PLATE: G TO P	4.0	3.8	μμf
INPUT: G TO (H+K)	2.2	2.6	μμf
OUTPUT: P TO (H+K)	0.7	0.7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

EACH UNIT

	CLASS A_1 AMPLIFIER	VERTICAL[A] DEFLECTION AMPLIFIER	
HEATER VOLTAGE	12.6		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 500	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	5.0	5.0[B]	WATTS
BOTH PLATES	7.5	7.5[B]	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	---	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	---	70	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
CATHODE BIAS	1.0	2.2	MEGOHMS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS – CONT'D

	VERTICAL[C] DEFLECTION OSCILLATOR	HORIZONTAL[C] DEFLECTION OSCILLATOR	
HEATER VOLTAGE	12.6		VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	450	450	VOLTS
MAXIMUM PLATE DISSIPATION:			
EACH PLATE	5.0	5.0	WATTS
BOTH PLATES	7.5	7.5	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	600	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	20	20	MA.
MAXIMUM PEAK CATHODE CURRENT	70	300	MA.
MAXIMUM GRID CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

[C] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

HEATER VOLTAGE	12.6		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	90	250	VOLTS
GRID VOLTAGE	0	−8	VOLTS
PLATE CURRENT	10	9	MA.
AMPLIFICATION FACTOR	20	20	
PLATE RESISTANCE (APPROX.)	6 700	7 700	OHMS
TRANSCONDUCTANCE	3 000	2 600	μMHOS
PLATE CURRENT	10	9.0	MA.
GRID VOLTAGE FOR I_b = 10 μA. (APPROX.)	−7.0	−18	VOLTS

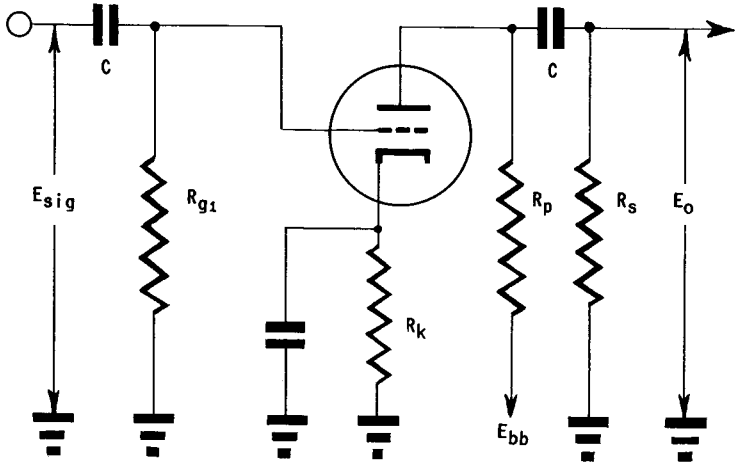
TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

EACH SECTION

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.10	3900	10	10	3600	11	20	3500	11	30
0.10	0.24	0.10	5000	11	14	4700	12	27	4400	12	41
0.24	0.24	0.10	9400	11	13	8700	11	25	8700	12	38
0.24	0.51	0.10	11000	11	17	11000	12	32	11000	12	48
0.51	0.51	0.10	19000	11	15	18000	12	29	18000	12	43
0.51	1.0	0.10	24000	11	19	23000	12	37	23000	12	54
0.24	0.24	10	0	14	12	0	16	20	0	17	28
0.24	0.51	10	0	14	16	0	16	28	0	17	40
0.51	0.51	10	0	14	15	0	15	26	0	16	38
0.51	1.0	10	0	14	19	0	16	35	0	16	52

NOTES: 1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION.
2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED

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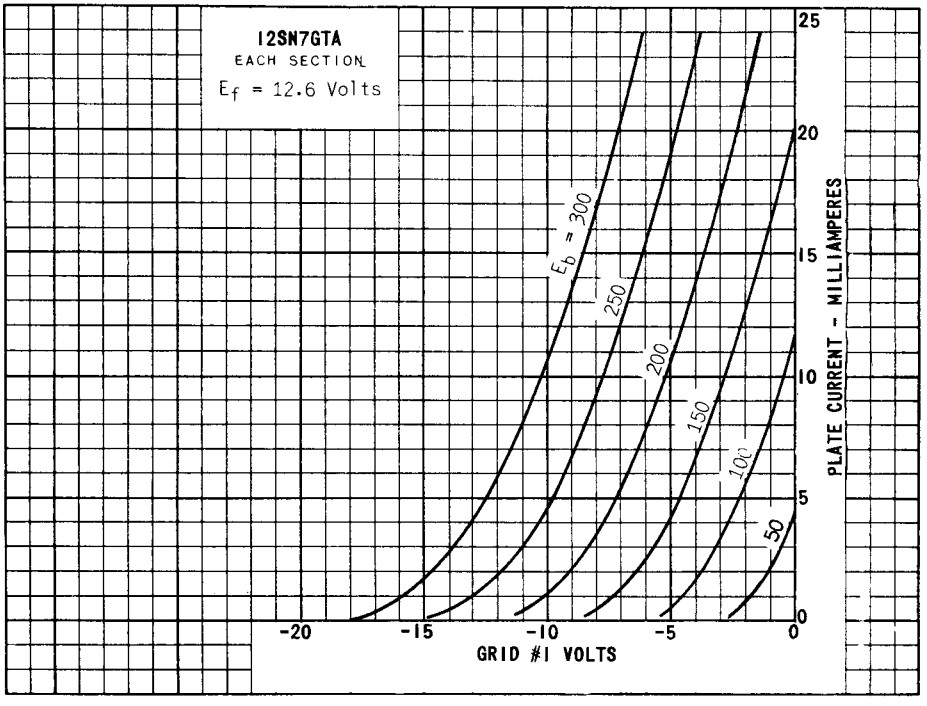
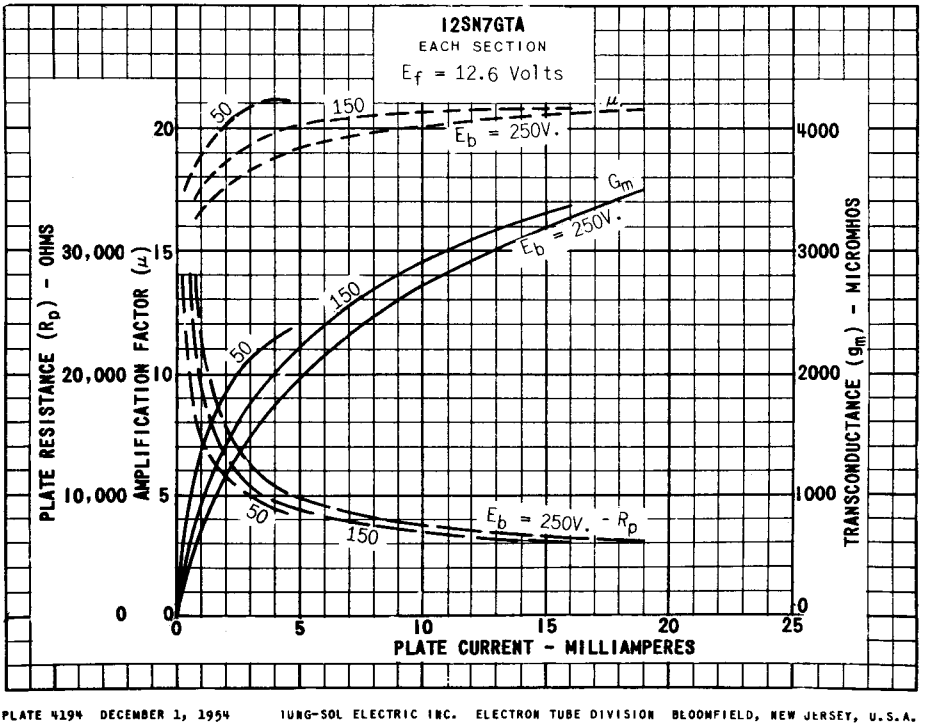
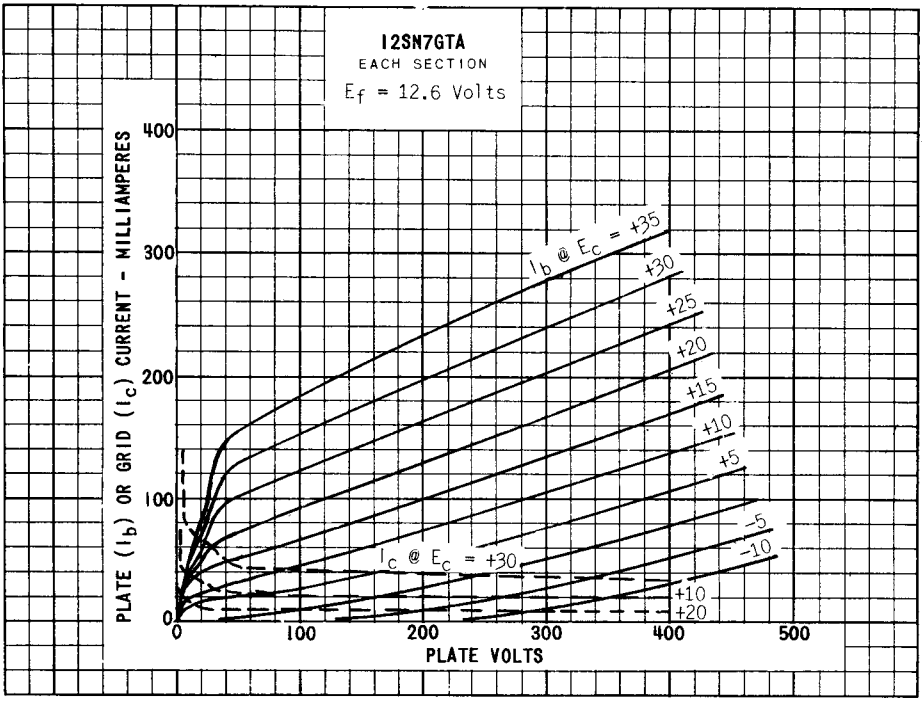
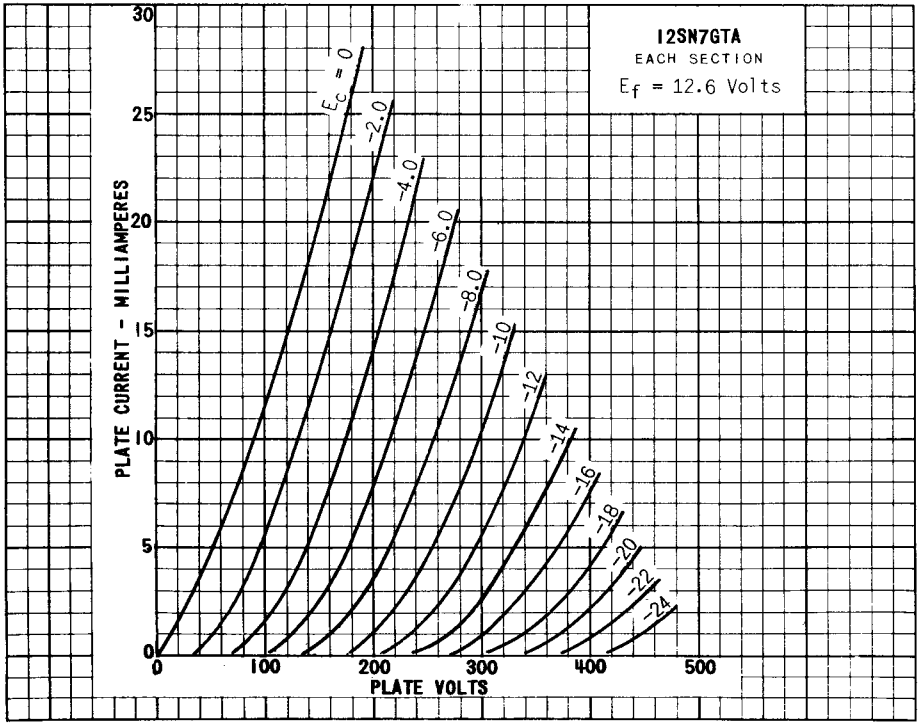
12SN7GTA


12SN7GTA
EACH SECTION
E_f = 12.6 Volts
E_b = 300
250
200
150
100
50
-20
-15
-10
-5
0
25
20
15
10
5
0
GRID #1 VOLTS
PLATE CURRENT - MILLIAMPERES


12SN7GTA
EACH SECTION
E_f = 12.6 Volts
50
150
μ
E_b = 250V.
G_m
E_b = 250V.
150
50
50
150
E_b = 250V. - R_p
PLATE RESISTANCE (R_p) - OHMS
30,000
20,000
10,000
0
AMPLIFICATION FACTOR (μ)
20
15
10
5
0
4000
3000
2000
1000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
0
5
10
15
20
25
PLATE CURRENT - MILLIAMPERES





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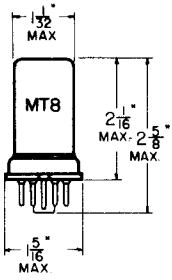
TUNG-SOL

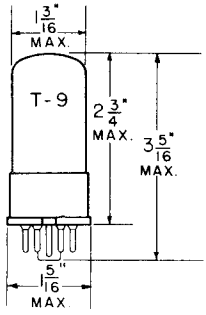
DOUBLE-DIODE TRIODE

12SQ7



METAL SHELL

12SQ7GT

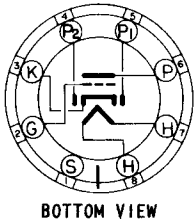


GLASS BULB

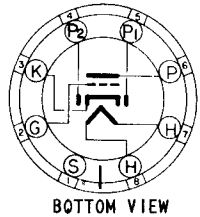
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL WAFER
8-PIN OCTAL



BOTTOM VIEW
SMALL WAFER
8-PIN OCTAL
METAL SLEEVE

THE 12SQ7 AND 12SQ7GT COMBINE TWO DIODE UNITS AND A HIGH-MU TRIODE IN A SINGLE ENVELOPE. EACH SECTION USES A COMMON CATHODE. IT IS INTENDED FOR SERVICE AS A COMBINED DETECTOR, AVC SOURCE, AND HIGH GAIN AUDIO AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

	12SQ7[A]	12SQ7GT[B]	
GRID TO PLATE: (G TO P)	1.6	1.8	μμf
INPUT: G TO (H + K)	3.2	4.2	μμf
OUTPUT: P TO (H + K)	3.0	3.4	μμf

[A] WITH SHELL CONNECTED TO CATHODE.

[B] WITH NO EXTERNAL SHIELD.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM DIODE CURRENT EACH PLATE WITH 10 VOLTS APPLIED	0.8	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1.0	MA.

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PLATE 1934
DEC. 1, 1947

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - TRIODE UNIT

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.4	0.9	MA.
PLATE RESISTANCE	110 000	91 000	OHMS
TRANSCONDUCTANCE	900	1 100	µMHOS
AMPLIFICATION FACTOR	100	100	

DIODE UNITS - TWO

THE TWO DIODE PLATES ARE PLACED AROUND THE CATHODE AND ARE INDEPENDENT OF THE TRIODE UNIT EXCEPT FOR THE COMMON CATHODE.

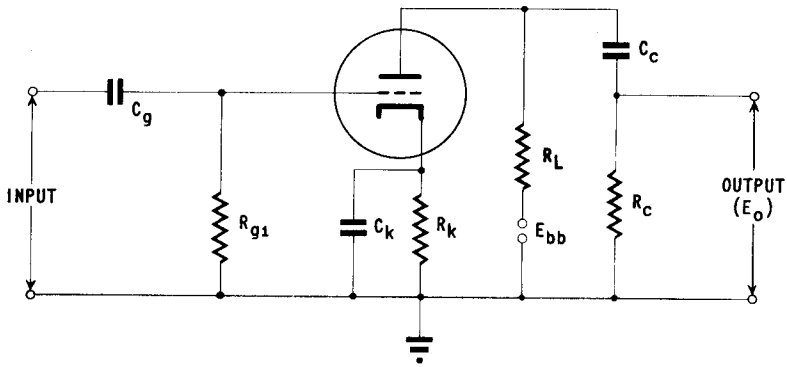
SIMILIAR TYPE REFERENCE: Ratings and characteristics identical to 1486.

R_1 MEG.	R_{g1} MEG.	R_c MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	A	0.10	4300	22	5.0	2400	29	15	2000	31	28
0.10	A	0.24	4700	27	7.0	2700	35	20	2200	38	37
0.24	A	0.24	7500	31	7.5	4300	42	20	3300	46	36
0.24	A	0.51	8200	40	10	4700	50	26	3900	52	50
0.51	A	0.51	13000	39	9.5	7500	53	24	5600	58	47
0.51	A	1.0	15000	43	11	8200	58	31	6200	62	56
0.24	10	0.24	---	39	4.5	---	45	19	---	49	38
0.24	10	0.51	---	45	6.5	---	52	24	---	57	48
0.51	10	0.51	---	48	7.0	---	59	22	---	62	42
0.51	10	1.0	---	52	8.5	---	62	25	---	66	55

[A] VALUE OF R_{g1} IS NOT CRITICAL.

GAIN MEASURED AT E_o = 2.0 VOLTS RMS OUTPUT.

E_o IS RMS OUTPUT FOR 5% TOTAL HARMONIC DISTORTION.



NOTE: COUPLING CAPACITORS C_g AND C_c SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED BY CAPACITOR C_k.

PLATE 1935

DEC. 1, 1947

→ INDICATES A CHANGE OR ADDITION

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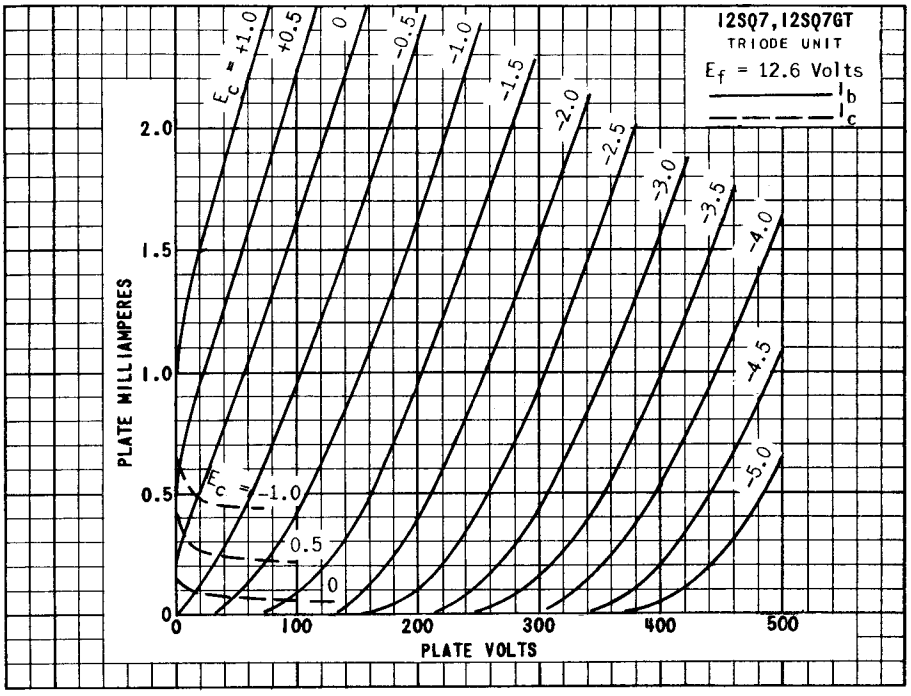

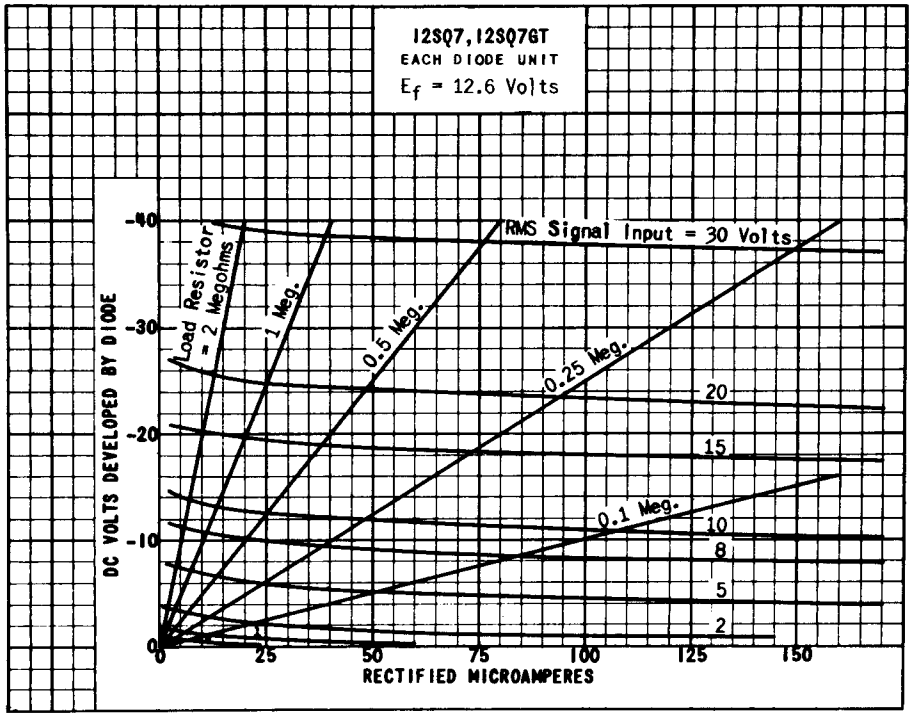

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1973
FEB. 2,
1948

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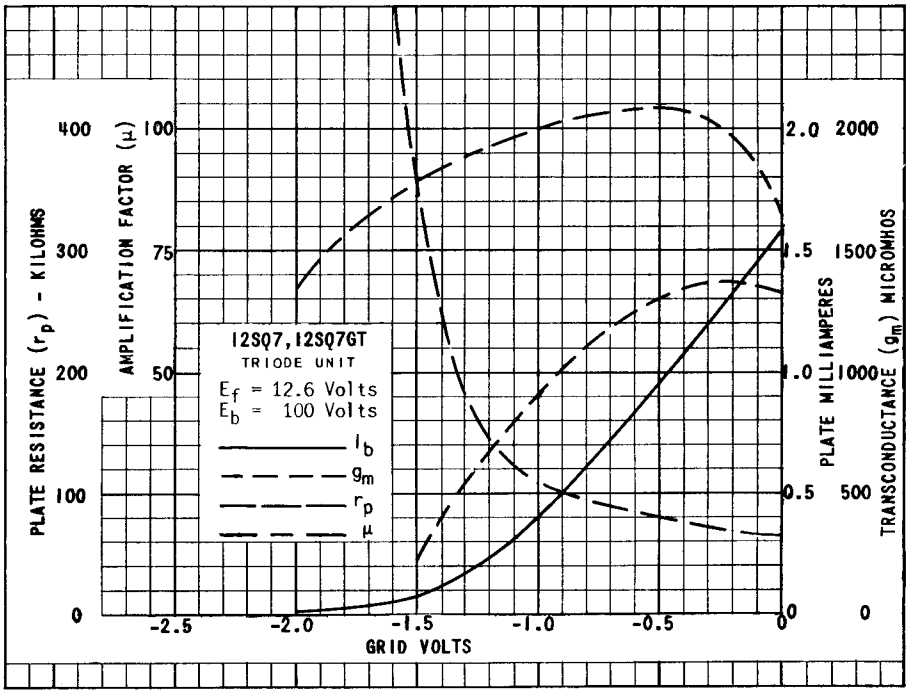
12SQ7, 12SQ7GT



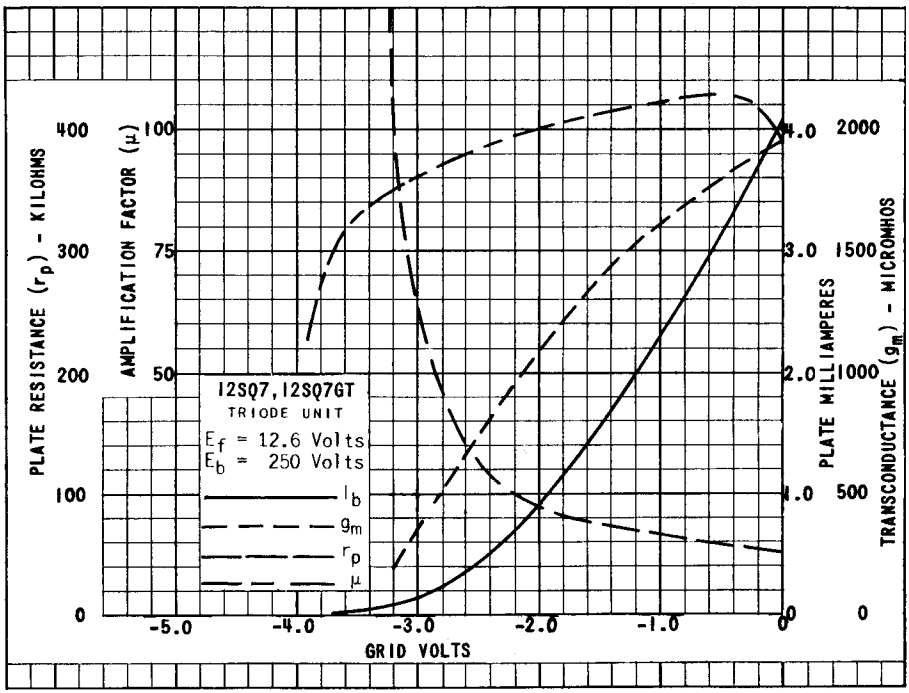


PLATE 1974
FEB. 2, 1948

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TENTATIVE DATA

12SR7GT

TUNG-SOL

DUO-DIODE TRIODE

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS	
BASE INTERMEDIATE SHELL OCTAL 8-PIN	PIN 1 NO CONN.	PIN 7 HEATER
CAP NONE	PIN 2 TRIODE GRID	PIN 8 HEATER
BULB T-9 GLASS	PIN 3 CATHODE AND DIODE SHIELD	
MAXIMUM DIAMETER 1 5/16"	PIN 4 DIODE PLATE-RIGHT	
MAXIMUM OVERALL LENGTH 3 5/16"	PIN 5 DIODE PLATE-LEFT	
MAXIMUM SEATED HEIGHT 2 3/4"	PIN 6 TRIODE PLATE	

RATINGS

HEATER OR FILAMENT VOLTAGE	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE		VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM SCREEN DISSIPATION		WATTS

FOR INTERPRETATION OF RATINGS, SEE "RECEIVING TUBE RATINGS" (CS-1800)

CAPACITANCES (WITH STANDARD RMA SHIELD M8-308)

CONTROL GRID TO CATHODE	3.5	μμf
PLATE TO CATHODE	3.8	μμf
GRID TO PLATE	2.3	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER TRIODE SECTION

HEATER OR FILAMENT VOLTAGE	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMPS.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE		VOLTS
GRID BIAS [A]	-9	VOLTS
PEAK AF SIGNAL VOLTAGE		VOLTS
PLATE CURRENT	9.5	MA.
ZERO-SIGNAL SCREEN CURRENT		MA.
MAXIMUM-SIGNAL PLATE CURRENT		MA.
MAXIMUM-SIGNAL SCREEN CURRENT		MA.
PLATE RESISTANCE	8500	OHMS
TRANSCONDUCTANCE	1900	μMHOS
AMPLIFICATION FACTOR	16	

[A] THE D-C RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM UNDER RATED MAXIMUM CONDITIONS.

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1320-1
SEPT. 23
1943

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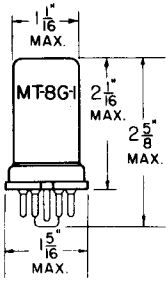
DUO-DIODE TRIODE



METAL SHELL

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
SMALL WAFER
8 PIN OCTAL

THE 12SW7 HAS TWO DIODES AND A MEDIUM-MU TRIODE IN ONE ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE IN EQUIPMENT WHERE THE OPERATING VOLTAGES ARE OBTAINED FROM A 12 CELL STORAGE BATTERY AND FOR OPERATION AT A PLATE-SUPPLY VOLTAGE HAVING A DESIGN CENTER OF 26.6 VOLTS. IT MAY BE USED FOR SERVICE AS A DIODE DETECTOR, AVC RECTIFIER AND AS AN AUDIO AMPLIFIER IN AC, STORAGE BATTERY AND AC-DC OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	250	VOLTS
PLATE DISSIPATION	2.5	WATTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEG. WITH RESPECT TO CATHODE	90	VOLTS
HEATER POS. WITH RESPECT TO CATHODE	90	VOLTS

DIRECT INTERELECTRODE CAPACITANCES - TRIODE UNIT

WITH SHELL CONNECTED TO CATHODE

GRID TO PLATE (APPROX.)	2.4	μμf
INPUT (APPROX.)	3.0	μμf
OUTPUT (APPROX.)	2.8	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	26.5	250	VOLTS
GRID VOLTAGE:			
USING FIXED SUPPLY	---	-9	VOLTS
USING GRID RESISTOR	2	---	MEGOHMS
PLATE CURRENT	1.1	9.5	MA.
PLATE RESISTANCE	15 500	8 500	OHMS
TRANSCONDUCTANCE	1 100	1 900	μMHOS
AMPLIFICATION FACTOR	17	16	

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NOV. 1, 1946

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

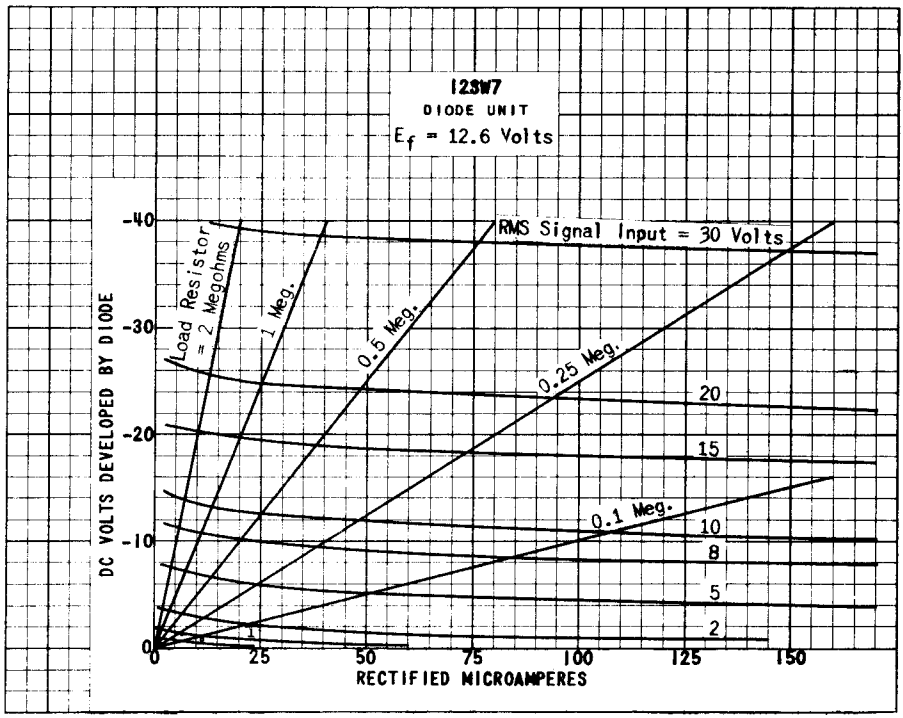
RESISTANCE-COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE[A]	90	180	300	VOLTS
LOAD RESISTANCE	0.1	0.1	0.1	MEGOHM
GRID RESISTOR	0.25	0.25	0.25	MEGOHMS
CATHODE RESISTOR	4 400	4 100	3 800	OHMS
CATHODE BY-PASS CONDENSER	0.9	0.9	1.1	µf
BLOCKING CONDENSER	0.01	0.01	0.015	µf
PEAK VOLTAGE OUTPUT[B]	19	43	68	VOLTS
VOLTAGE GAIN (AT 5.0 VOLTS RMS)	10	10	10	

[A] VOLTAGE AT PLATE EQUALS PLATE SUPPLY VOLTAGE MINUS VOLTAGE DROP IN LOAD RESISTANCE AND CATHODE RESISTOR.

[B] VOLTAGE ACROSS GRID RESISTOR AT GRID-CURRENT POINT.

SIMILIAR TYPE REFERENCE: *Except for heater ratings, same ratings and characteristics as 6R7, 6R7G, 6R7GT, 6SR7, 6SR7GT, 2606. Same ratings and characteristics as 12SR7GT.*



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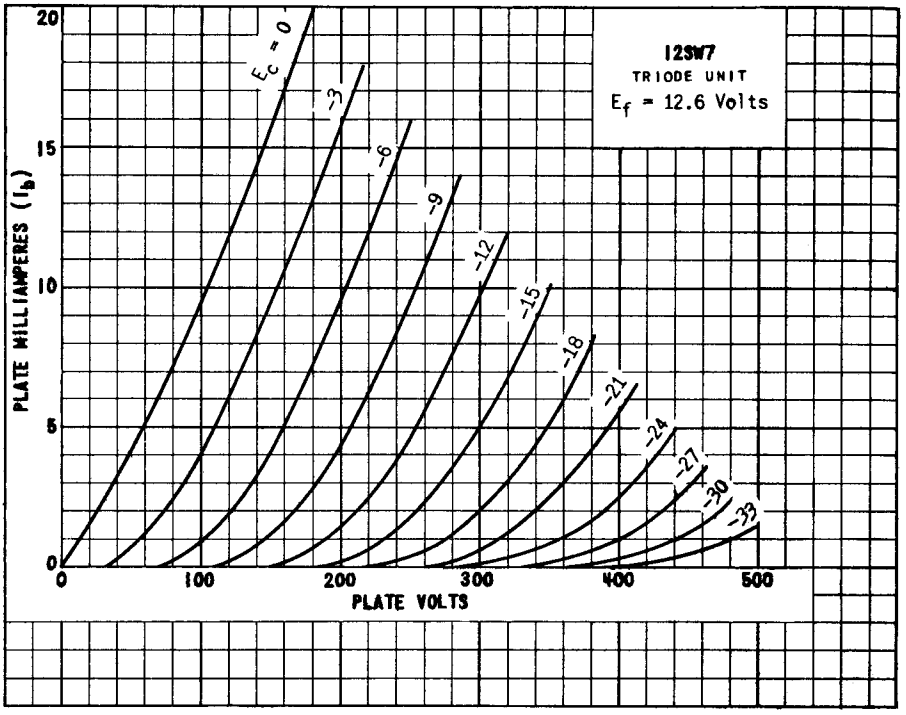

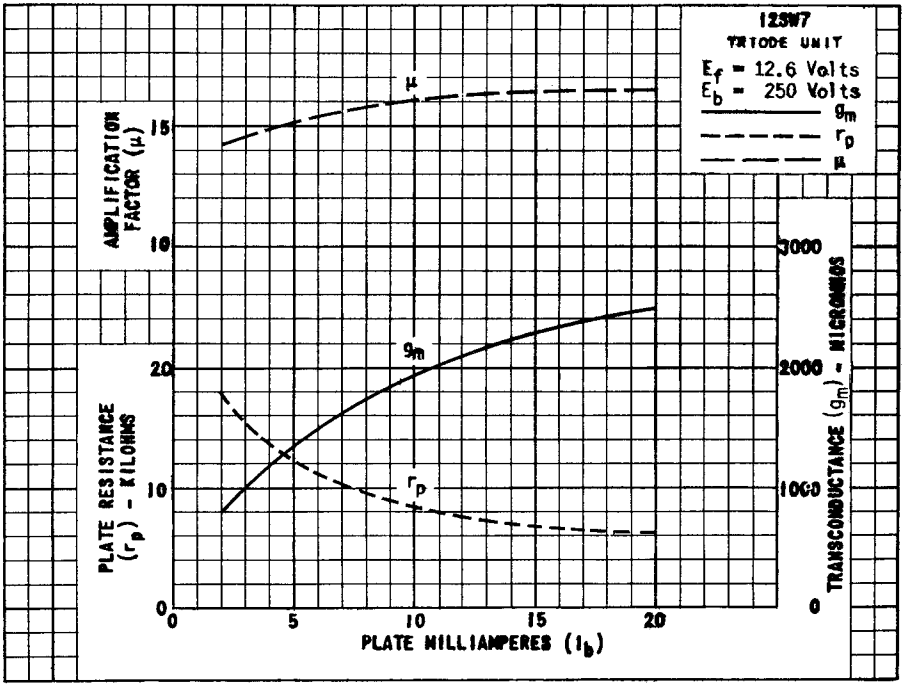

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1753
NOV. 1,
1946

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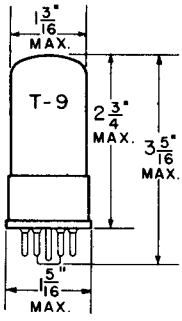
TWIN TRIODE AMPLIFIER



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.3 AMPERE
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL BASE

THE 12SX7GT IS A TWIN MEDIUM MU TRIODE WHOSE SECTIONS ARE ELECTRICALLY INDEPENDENT EXCEPT FOR THE COMMON HEATER. IT IS DESIGNED ESPECIALLY FOR USE IN EQUIPMENT WHERE THE OPERATING VOLTAGES ARE OBTAINED FROM A 12 CELL STORAGE BATTERY AND FOR OPERATION AT A PLATE-SUPPLY VOLTAGE HAVING A DESIGN-CENTER OF 26.5 VOLTS. IT IS USEFUL AS AN AUDIO AMPLIFIER, OSCILLATOR, CONVERTER AND MULTI-VIBRATOR.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

PER AMPLIFIER UNIT

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.3	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID VOLTAGE:		
NEG. BIAS VOLTAGE	50	VOLTS
POS. BIAS VOLTAGE	0	VOLTS
MAXIMUM CATHODE CURRENT	20	MA.
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEG. WITH RESPECT TO CATHODE	90	VOLTS
HEATER POS. WITH RESPECT TO CATHODE	90	VOLTS

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

	TRIODE UNIT 1	TRIODE UNIT 2	
GRID TO PLATE	3.6	3.6	μμf
INPUT	3.0	2.8	μμf
OUTPUT	0.8	1.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - PER UNIT

PLATE VOLTAGE	26.5	90	250	VOLTS
GRID VOLTAGE:				
USING FIXED SUPPLY	---	0	-8	VOLTS
USING GRID RESISTOR	0.05	---	---	MEGOHM
PLATE CURRENT	1.8	10	9.0	MA.
GRID CIRCUIT RESISTANCE (MAX.)	1.0	1.0	1.0	MEGOHM
PLATE RESISTANCE	11 500	6 700	7 700	OHMS
TRANSCONDUCTANCE	1 800	3 000	2 600	μMHOS
AMPLIFICATION FACTOR	21	20	20	

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NOV. 1, 1946

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

RESISTANCE COUPLED AMPLIFIER - PER UNIT

PLATE SUPPLY-VOLTAGE[A]	90	180	300	VOLTS
LOAD RESISTANCE	0.1	0.1	0.1	MEGOHM
GRID RESISTOR	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	3 940	2 830	2 440	OHMS
CATHODE BY-PASS CONDENSER	1.29	1.35	1.42	µf
BLOCKING CONDENSER	0.012	0.012	0.0125	µf
PEAK VOLTAGE OUTPUT[B]	17	34	56	VOLTS
VOLTAGE GAIN (AT 5.0 VOLTS RMS)	13	14	14	

[A] VOLTAGE AT PLATE EQUALS PLATE-SUPPLY VOLTAGE MINUS VOLTAGE DROP IN LOAD RESISTANCE AND CATHODE RESISTOR.

[B] VOLTAGE ACROSS GRID RESISTOR AT GRID CURRENT POINT.

SIMILIAR TYPE REFERENCE: *Except for heater ratings, same ratings and characteristics per unit as 6F8G, 6J5, 6J5G, 6J5GT. Except for heater ratings, same ratings and characteristics as 6SN7GT. Same ratings and characteristics per unit as 12J5GT. Same ratings and characteristics as 12SN7GT and 1633.*

PLATE 1755
NOV. 1, 1946

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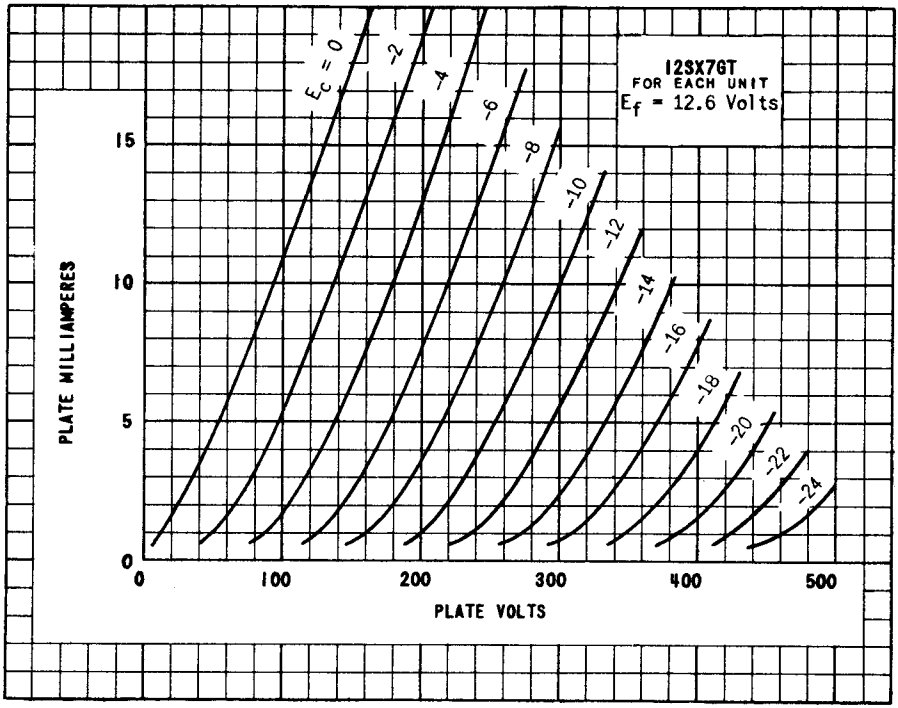

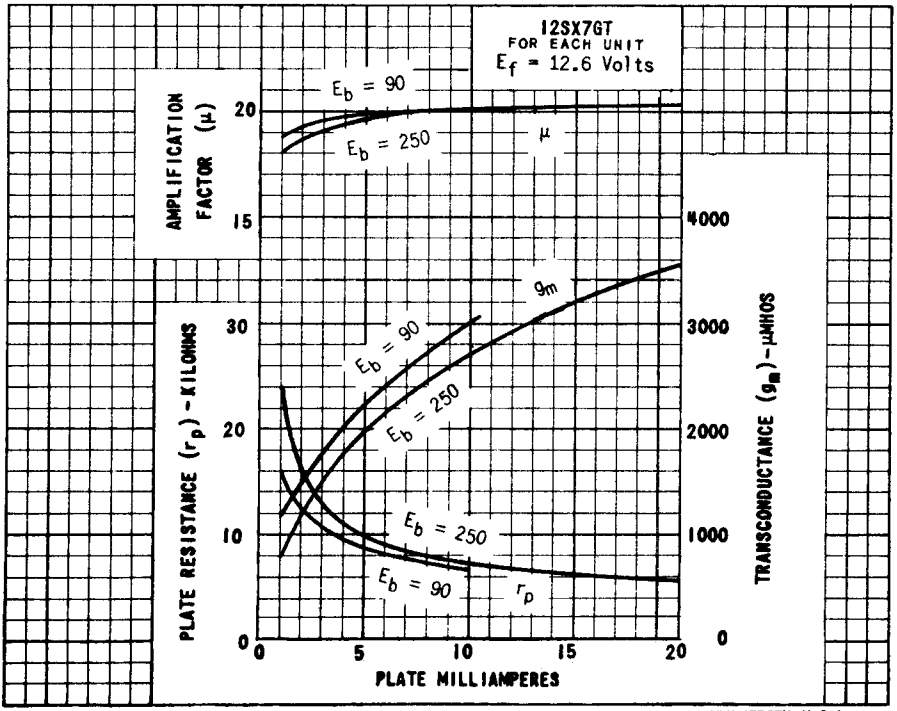

PLATE 1756
NOV. 1, 1946

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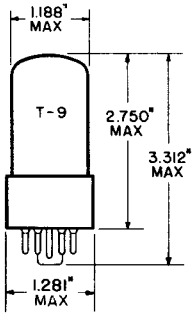
TUNG-SOL

TWIN TRIODE



GLASS BULB

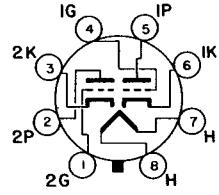
SHORT INTERMEDIATE SHELL
8 PIN OCTAL B8-58
OUTLINE DRAWING
JEDEC 9-41

COATED UNIPOTENTIAL CATHODE

FOR USE AS AN
AUDIO AMPLIFIER, OSCILLATOR,
CONVERTER OR MULTI-VIBRATOR

LOW B VOLTAGE RATING

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 12SX7GT COMBINES TWO MEDIUM-MU TRIODES IN ONE ENVELOPE WHOSE SECTIONS ARE ELECTRICALLY INDEPENDENT EXCEPT FOR THE COMMON HEATER. IT IS DESIGNED FOR USE IN EQUIPMENT WHERE OPERATING VOLTAGES ARE OBTAINED FROM A 12 CELL STORAGE BATTERY. THE 12SX7GT IS RATED IN COMPLIANCE WITH MILITARY STANDARDS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	TRIODE #1	TRIODE #2	
GRID TO PLATE:G TO P	3.6	3.6	pf
INPUT: G TO (H+K)	3.0	2.8	pf
OUTPUT: P TO (H+K)	0.8	1.2	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		12.6±1.3	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		100	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
NEGATIVE BIAS VOLTAGE	50	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
CATHODE CURRENT	20	MA.
PLATE DISSIPATION	2.75	WATTS
GRID CIRCUIT RESISTANCE	1.0	MEGOHM
ALTITUDE	10,000	FT.

TYPICAL OPERATING CHARACTERISTICS

RESISTANCE COUPLED AMPLIFIER - EACH TRIODE

PLATE SUPPLY-VOLTAGE[A]	90	180	300	VOLTS
LOAD RESISTANCE	0.1	0.1	0.1	MEGOHM
GRID RESISTOR	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	3,940	2,830	2,440	OHMS
CATHODE BY-PASS CONDENSER	1.29	1.35	1.42	μf
BLOCKING CONDENSER	0.012	0.012	0.0125	μf
PEAK VOLTAGE OUTPUT[B]	17	34	56	VOLTS
VOLTAGE GAIN (AT 5.0 VOLTS VOLTS RMS)	13	14	14	

A
VOLTAGE AT PLATE EQUALS PLATE-SUPPLY VOLTAGE MINUS VOLTAGE DROP IN LOAD RESISTANCE AND CATHODE RESISTOR.

B
VOLTAGE ACROSS GRID RESISTOR AT GRID CURRENT POINT.

TUNG-SOL

HEPTODE PENTAGRID CONVERTER

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE SMALL WAFER OCTAL 8-PIN	PIN 1 SHELL, GRID 5	PIN 7 HEATER
PHENOLIC	PIN 2 HEATER	PIN 8 SIGNAL GRID (G3)
BULB MT-8 METAL	PIN 3 PLATE	
MAXIMUM DIAMETER 1 5/16"	PIN 4 SCR. (G2 & G4)	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH 2 5/8"	PIN 5 OSC. GRID (G1)	
MAXIMUM SEATED HEIGHT 2 1/16"	PIN 6 CATHODE	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD NB-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	1.0	WATT
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION		WATTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MINIMUM EXTERNAL SIGNAL GRID BIAS VOLTAGE [A]	0	VOLTS
MAXIMUM ANODE-GRID VOLTAGE		VOLTS
MAXIMUM ANODE-GRID SUPPLY VOLTAGE		VOLTS
MAXIMUM ANODE-GRID DISSIPATION		WATT

[A] WITH SELF-EXCITED OSCILLATOR

CAPACITANCES

SIGNAL GRID TO MIXER PLATE (G3 TO P) [B]	0.13	μμf (MAX.)
K TO ALL OTHER ELECTRODES EXCEPT G1	5.0	μμf
SIGNAL GRID TO OSC. GRID (G3 TO G1) [B]	0.15	μμf (MAX.)
OSC. GRID TO MIXER PLATE (G1 TO P) [B]	0.06	μμf (MAX.)
SIGNAL INPUT (G3 TO ALL OTHER ELECTRODES) [B]	9.5	μμf
OSC. INPUT (G1 TO ALL OTHER ELECTRODES) [B]	7.0	μμf
G1 TO ALL OTHER ELECTRODES EXCEPT K	4.4	μμf
MIXER OUTPUT (P TO ALL OTHER ELECTRODES) [B]	12	μμf
G1 TO K	2.6	μμf

[B] WITH SHIELD NO. 308 CONNECTED TO CATHODE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE - SEPARATE EXCITATION

CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION TRANSCONDUCTANCE TEST SET AND CORRESPOND VERY CLOSELY TO THOSE OBTAINED WITH ZERO BIAS IN A SELF-EXCITED OSCILLATOR CIRCUIT.

HEATER OR FILAMENT VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	0.15	0.15	AMP.
PLATE VOLTAGE	28	100	250	VOLTS
SCREEN VOLTAGE	28	100	100	VOLTS
SIGNAL GRID BIAS	-1	-2	-2	VOLTS
ANODE-GRID VOLTAGE	0	0	0	VOLTS
PLATE CURRENT	0.5	3.3	3.5	MA.
SCREEN CURRENT	1.8	8.5	8.5	MA.
ANODE-GRID CURRENT				MA.
OSCILLATOR-GRID CURRENT	0.1	0.5	0.5	MA.
TOTAL CATHODE CURRENT	2.4	12.3	12.5	MA.
OSCILLATOR-GRID RESISTOR	20 000	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	---	0.5	1.0	MEGOHM
CONVERSION TRANSCONDUCTANCE				
SIGNAL GRID BIAS = -1	250	---	---	μMHOS
SIGNAL GRID BIAS = -2	---	425	450	μMHOS
SIGNAL GRID BIAS = -6	8	310	325	μMHOS
SIGNAL GRID BIAS = -10	---	75	80	μMHOS
SIGNAL GRID BIAS = -35	---	2	2	μMHOS APPROX.

NOTE: WITH G2 & G4 CONNECTED TO PLATE (100 VOLTS), AND SIGNAL APPLIED TO G1 (0 VOLTS BIAS): THE TRANSCONDUCTANCE IS 4500 μMHOS, THE PLATE CURRENT IS 27 MA., AND THE AMPLIFICATION IS 13. G3 IS CONNECTED TO GROUND DURING THIS TEST.

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PLATE 1711

APRIL 15 1946

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TUNG-SOL

HEPTODE PENTAGRID CONVERTER

PHYSICAL SPECIFICATIONS

EMITTER COATED UNIPOT. CATHODE	PIN CONNECTIONS	
BASE SMALL WAFER OCTAL 8-PIN	PIN 1 BASE SHELL	PIN 7 HEATER
WITH METAL SHELL	PIN 2 HEATER	PIN 8 SIGNAL GRID (G3)
BULB T-9 GLASS	PIN 3 PLATE	
MAXIMUM DIAMETER 1 5/16"	PIN 4 SCR. (G2 & G4)	MOUNTING POS. ANY
MAXIMUM OVERALL LENGTH 3 5/16"	PIN 5 OSC. GRID (G1)	
MAXIMUM SEATED HEIGHT 2 3/4"	PIN 6 K, G5, SI	

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	1.0	WATT
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION		WATTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MINIMUM EXTERNAL SIGNAL GRID BIAS VOLTAGE[A]	0	VOLTS
MAXIMUM ANODE-GRID VOLTAGE		VOLTS
MAXIMUM ANODE-GRID SUPPLY VOLTAGE		VOLTS
MAXIMUM ANODE-GRID DISSIPATION		WATT

[A] WITH SELF-EXCITED OSCILLATOR

CAPACITANCES

SIGNAL GRID TO MIXER PLATE (G3 TO P)[B]	0.2	μμf (MAX.)
K TO ALL OTHER ELECTRODES EXCEPT G1	30	μμf
SIGNAL GRID TO OSC. GRID (G3 TO G1)[B]	0.2	μμf (MAX.)
OSC. GRID TO MIXER PLATE (G1 TO P)[B]	0.2	μμf (MAX.)
SIGNAL INPUT (G3 TO ALL OTHER ELECTRODES)[B]	11	μμf
OSC. INPUT (G1 TO ALL OTHER ELECTRODES)[B]	8.0	μμf
G1 TO ALL OTHER ELECTRODES EXCEPT K	5	μμf
MIXER OUTPUT (P TO ALL OTHER ELECTRODES)[B]	12	μμf
G1 TO K	3.0	μμf

[B] WITH BASE SHELL AND STANDARD TUBE SHIELD CONNECTED TO CATHODE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE - SEPARATE EXCITATION

CHARACTERISTICS SHOWN ARE OBTAINED IN THE STANDARD RMA CONVERSION TRANSCONDUCTANCE TEST SET AND CORRESPOND VERY CLOSELY TO THOSE OBTAINED WITH ZERO BIAS IN A SELF-EXCITED OSCILLATOR CIRCUIT.

HEATER OR FILAMENT VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	0.15	0.15	AMP.
PLATE VOLTAGE	28	100	250	VOLTS
SCREEN VOLTAGE	28	100	100	VOLTS
SIGNAL GRID BIAS	-1	-2	-2	VOLTS
ANODE-GRID VOLTAGE (G5)	0	0	0	VOLTS
PLATE CURRENT	0.5	3.3	3.5	MA.
SCREEN CURRENT	1.8	8.5	8.5	MA.
ANODE-GRID CURRENT				MA.
OSCILLATOR-GRID CURRENT	0.1	0.5	0.5	MA.
TOTAL CATHODE CURRENT	2.4	12.3	12.5	MA.
OSCILLATOR-GRID RESISTOR	20 000	20 000	20 000	OHMS
PLATE RESISTANCE (APPROX.)	---	0.5	1.0	MEGOHM
CONVERSION TRANSCONDUCTANCE:				
SIGNAL GRID BIAS = -1	250	---	---	μMHOS
SIGNAL GRID BIAS = -2	---	425	450	μMHOS
SIGNAL GRID BIAS = -6	8	310	325	μMHOS
SIGNAL GRID BIAS = -10	---	75	80	μMHOS
SIGNAL GRID BIAS = -35	---	2	2	μMHOS APPROX.

NOTE: WITH G2 & G4, CONNECTED TO PLATE (100 VOLTS), AND SIGNAL APPLIED TO G1 (0 VOLTS BIAS): THE TRANSCONDUCTANCE IS 4500 μMHOS, THE PLATE CURRENT IS 27 MA., AND THE AMPLIFICATION IS 13. G3 IS CONNECTED TO GROUND DURING THIS TEST.

PLATE 1712

APRIL 15 1946

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TUNG-SOL

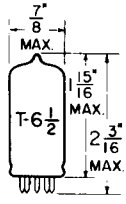
DOUBLE TRIODE

MINIATURE TYPE

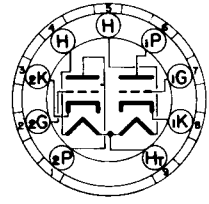
COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 12U7 CONTAINS TWO INDEPENDENT MEDIUM MU TRIODES WITH UNIPOTENTIAL CATHODES IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION IS INTENDED FOR USE AS A GENERAL PURPOSE TRIODE WHERE THE HEATER AND PLATE POTENTIALS ARE OBTAINED DIRECTLY FROM AN AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
TRIODE UNIT #1			
GRID TO PLATE: (G TO P)	1.5	1.5	μμf
INPUT: G TO (H+K)	1.8	1.6	μμf
OUTPUT: P TO (H+K)	2.0	0.40	μμf
TRIODE UNIT #2			
GRID TO PLATE:(G TO P)	1.5	1.5	μμf
INPUT: G TO (H+K)	1.8	1.6	μμf
OUTPUT: P TO (H+K)	2.0	0.32	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER

HEATER VOLTAGE* (APPLIED TO PINS #4 & #5)	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±30	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	15	MA.
MAXIMUM GRID CIRCUIT RESISTANCE		
FIXED BIAS OPERATION	0.25	MEGOHM
CATHODE BIAS OPERATION	1.0	MEGOHM

*THIS TUBE IS INTENDED TO BE USED IN AUTOMOTIVE SERVICE FROM A NOMINAL 12 VOLT BATTERY SOURCE. THE HEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN THIS SERVICE. THE MAXIMUM RATINGS OF THE TUBE PROVIDE FOR AN ADEQUATE SAFETY FACTOR SUCH THAT THE TUBE WILL WITHSTAND THE WIDE VARIATION IN SUPPLY VOLTAGES.

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TUNG-SOL

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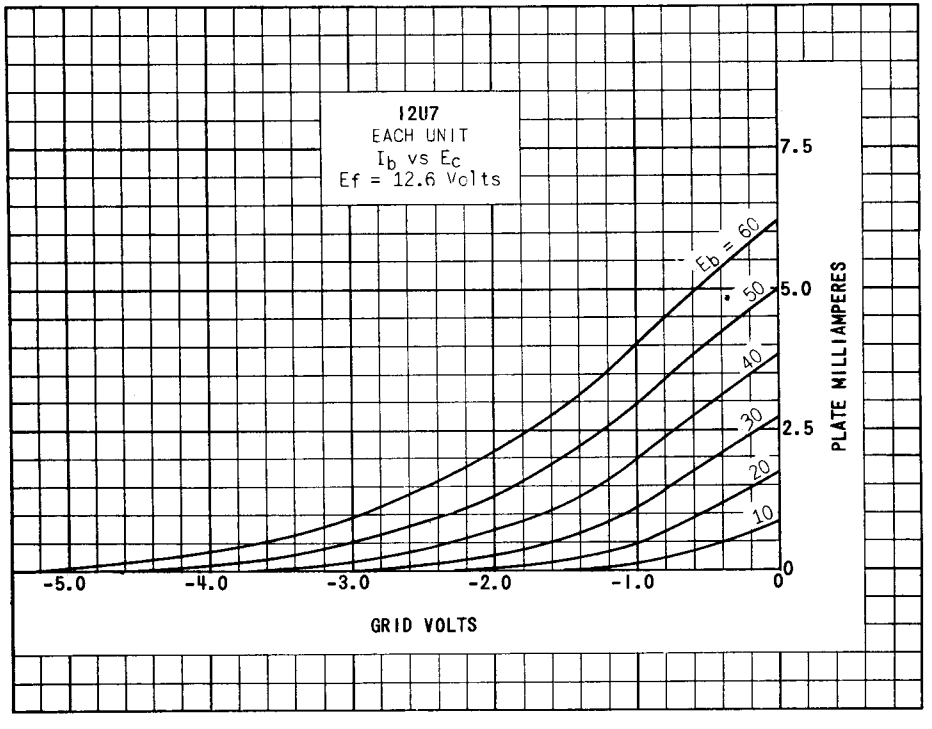
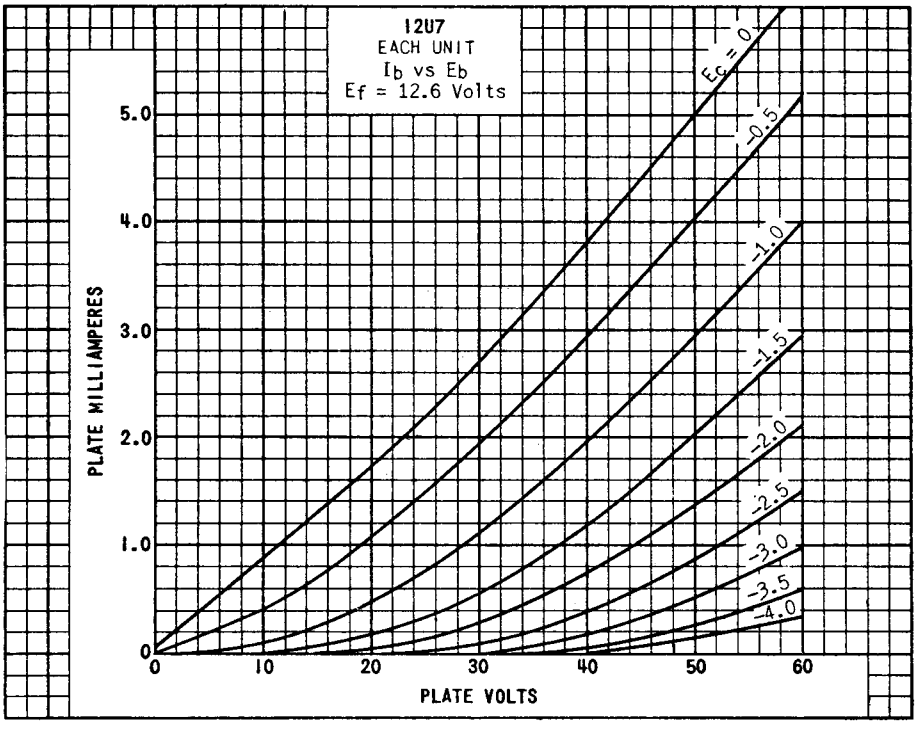
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	12.6	VOLTS
GRID VOLTAGE	0	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE (APPROX.)	12 500	OHMS
TRANSCONDUCTANCE	1 600	μMHOS
AMPLIFICATION FACTOR	20	
GRID VOLTAGE FOR I_b= 10 μA (APPROX.)	−1.5	VOLTS





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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

METAL-CONE ENVELOPE

SMALL SHELL DUODECAL 5 PIN BASE

THE 12UP4A IS A METAL-CONE DIRECTLY VIEWED PICTURE TUBE DESIGNED FOR USE IN TELEVISION RECEIVERS. THE TUBE UTILIZES MAGNETIC FOCUS AND DEFLECTION TO PROVIDE 7 3/4" X 10 1/2" PICTURES. IT HAS A GREY NEUTRAL-DENSITY FACEPLATE FOR INCREASED PICTURE CONTRAST AND HIGH AMBIENT LIGHT CONDITIONS AND AN ELECTRON GUN TO BE USED WITH AN EXTERNAL ION-TRAP MAGNET FOR THE PREVENTION OF ION-SPOT BLEMISH.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	54 DEGREES
ION TRAP	MAGNETIC
ANODE TERMINAL	METAL-CONE LIP

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO ALL OTHER ELECTRODES	6	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARDS M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	11 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)	110	MA.

SIMILAR TYPE REFERENCE: The 12UP4A is identical to the 12UP4 except for the grey filter faceplate.

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PLATE 2406

MAY 1 1950

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12UP4A

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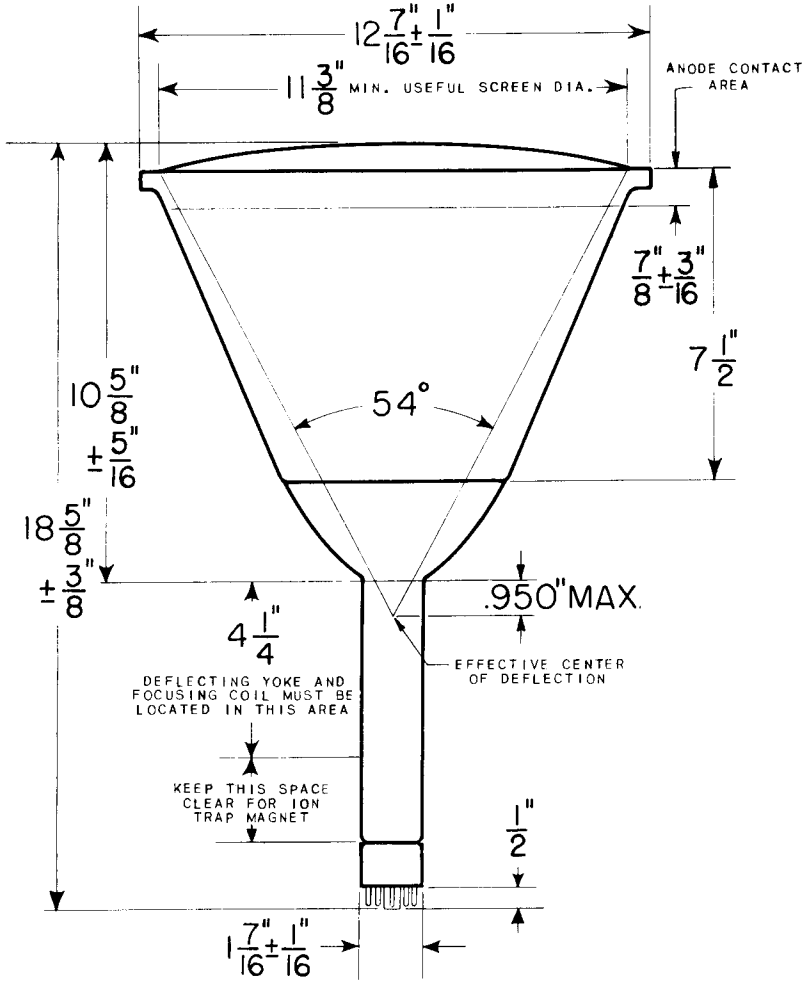

1. HEATER
2. GRID NO. 1
10. GRID NO. 2
11. CATHODE
12. HEATER

METAL-CONE LIP: ANODE, GRID NO.3

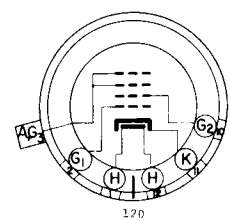

PLATE 2407
MAY 1 1950

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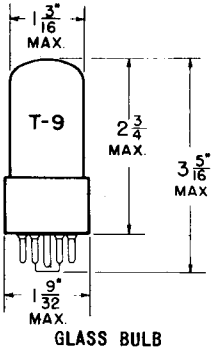
TUNG-SOL

BEAM PENTODE



GLASS BULB

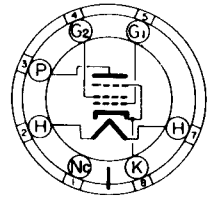
COATED UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.225 AMP

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
7 PIN OCTAL

7AC

THE 12V6GT IS A BEAM POWER AMPLIFIER, DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC AND STORAGE BATTERY OPERATED RECEIVERS. IT HAS HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT WITH COMPARATIVELY LOW SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	9.0	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	100 ←	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	100 ←	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 DISSIPATION	2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS OPERATION	0.1	MEGOHM
CATHODE BIAS OPERATION	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER - TRIODE CONNECTION[AB]

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM DC PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE VOLTAGE (ABSOLUTE MAXIMUM)	1200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9	WATTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250	VOLTS
MAXIMUM AVERAGE CATHODE CURRENT	35	MA.
MAXIMUM PEAK CATHODE CURRENT	105	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	2.2	MEGOHMS

[A] ALL VALUES ARE EVALUATED ON DESIGN CENTER SYSTEM EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE

HEATER VOLTAGE	12.6	12.6	12.6	VOLTS
HEATER CURRENT	0.225	0.225	0.225	AMP.
PLATE VOLTAGE	180	250	315	VOLTS
GRID #2 VOLTAGE	180	250	225	VOLTS
GRID #1 VOLTAGE	-8.5	-12.5	-13.0	VOLTS
PEAK AF GRID #1 VOLTAGE	8.5	12.5	13.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	29	45	34	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	47	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	4.5	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	4	7	6	MA.
PLATE RESISTANCE (APPROX.)	50 000	50 000	80 000	OHMS
TRANSCONDUCTANCE	3 700	4 100	3 750	µMHOS
LOAD RESISTANCE	5 500	5 000	8 500	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	2	4.5	5.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	8	8	12	PERCENT

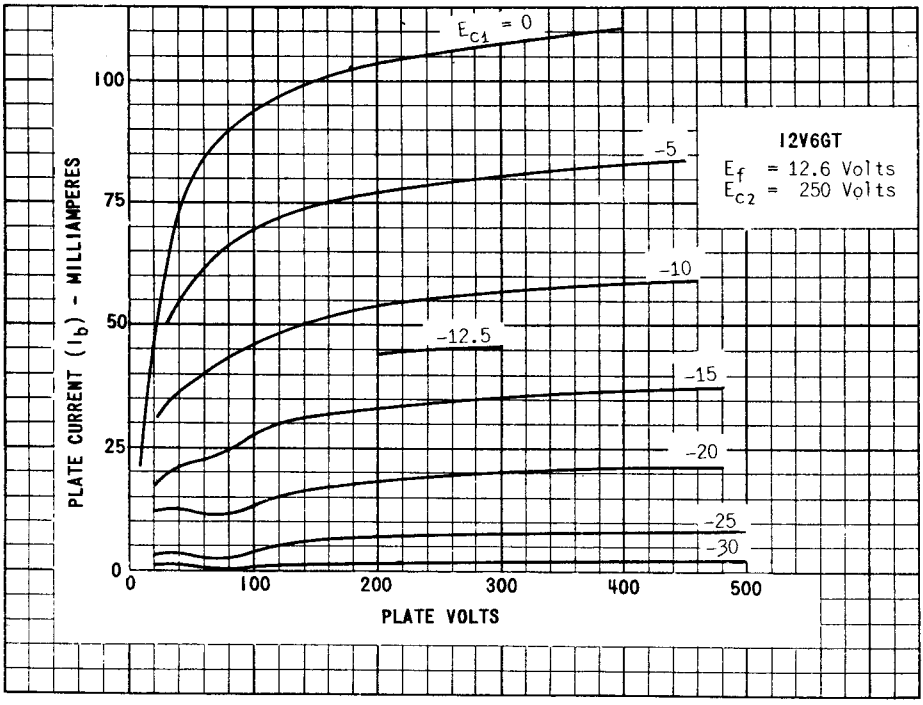
CLASS A_1 AMPLIFIER – PUSH-PULL

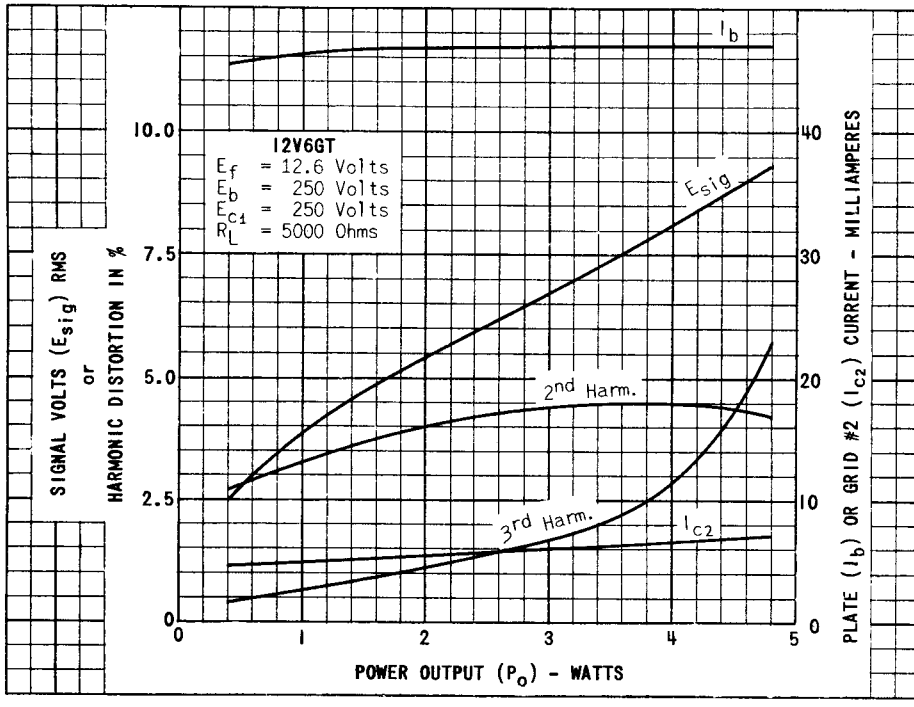
UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR TWO TUBES.

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.225	0.225	AMP.
PLATE VOLTAGE	250	285	VOLTS
GRID #2 VOLTAGE	250	285	VOLTS
GRID #1 VOLTAGE	-15	-19	VOLTS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	30	38	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	70	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	92	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	13	13.5	MA.
PLATE-TO-PLATE LOAD RESISTANCE	10 000	8 000	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	10	14	WATTS
TOTAL HARMONIC DISTORTION	5	3.5	PERCENT

CLASS A_1 AMPLIFIER – TRIODE CONNECTION

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.225	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-12.5	VOLTS
PLATE CURRENT	49.5	MA.
TRANSCONDUCTANCE	5 000	µMHOS
AMPLIFICATION FACTOR	9.8	
PLATE RESISTANCE (APPROX.)	1 960	OHMS
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-36	VOLTS





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2995
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1952

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12V6GT (6V6GT)

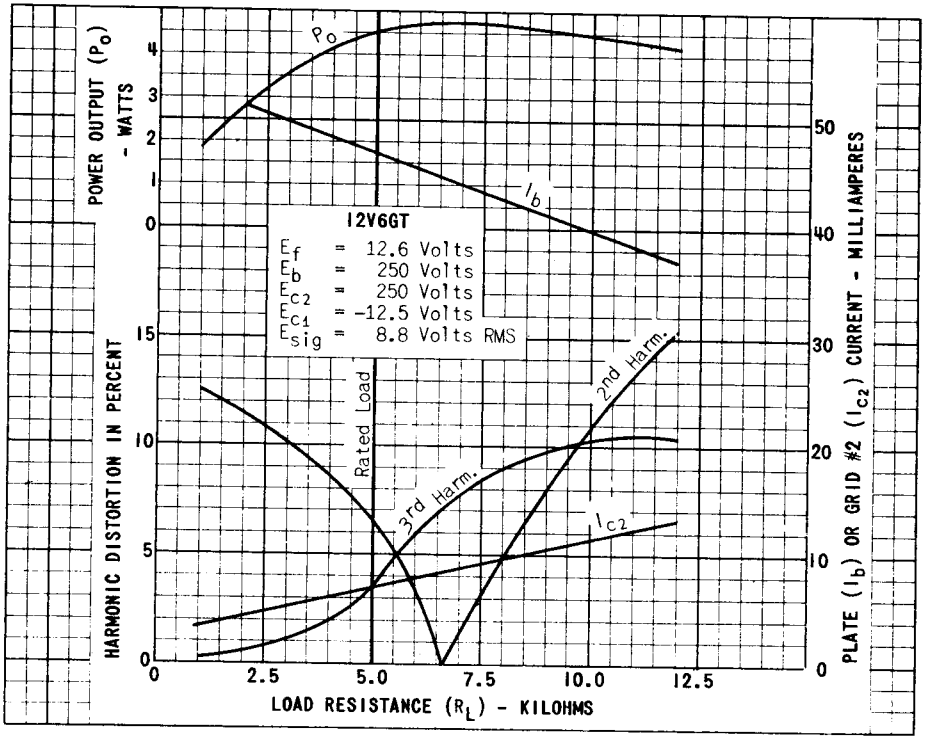

PLATE
2996
JULY 1
1952

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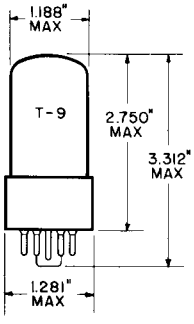
BEAM PENTODE



GLASS BULB
INTERMEDIATE SHELL OCTAL
B6-81 OR B7-7
OR
SHORT INTERMEDIATE
SHELL OCTAL
B6-84 OR B7-59
OUTLINE DRAWING
JEDEC 9-11 OR 9-41

COATED UNIOPTENTIAL CATHODE

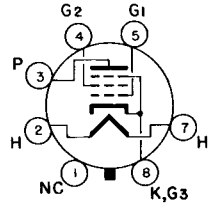
FOR USE AS A VERTICAL

DEFLECTION AMPLIFIER

IN TV RECEIVERS

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 12W6GT IS A BEAM PENTODE POWER AMPLIFIER. IT IS INTENDED FOR SERVICE AS A VERTICAL SCANNING OUTPUT TUBE IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. WITH THE EXCEPTION OF HEATER TATINGS, ITS CHARACTERISTICS ARE IDENTICAL TO TYPE 6W6GT.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE: (G1 TO P)	0.5	pf
INPUT: G1 TO (H+K+G2+G3)	15	pf
OUTPUT: P TO (H+K+G2+G3)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	600	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		600±40	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		200	VOLTS
TOTAL DC AND PEAK		300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A1 AMPLIFIER

PLATE VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	165	VOLTS
PLATE DISSIPATION	12	WATTS
GRID 2 DISSIPATION	1.35	WATTS
GRID 1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

VERTICAL DEFLECTION AMPLIFIER[A,B]

	TRIODE CONNECTED	PENTODE CONNECTED	
DC PLATE VOLTAGE	330	330	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	1200	1500	VOLTS
DC GRID 2 VOLTAGE		165	VOLTS
PLATE DISSIPATION	8.5	8	WATTS
GRID 2 DISSIPATION		1.2	WATT
PEAK NEGATIVE PULSE GRID 1 VOLTAGE	275	275	VOLTS
AVERAGE CATHODE CURRENT	65	65	MA.
PEAK CATHODE CURRENT	195	195	MA.
GRID 1 CIRCUIT RESISTANCE			
CATHODE BIAS	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE	110	200	VOLTS
GRID 2 VOLTAGE	110	125	VOLTS
GRID 1 VOLTAGE	-7.5	----	VOLTS
CATHODE BIAS RESISTOR	----	180	OHMS
PEAK AF GRID 1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTOR (APPROX.)	13,000	28,000	OHMS
TRANSCONDUCTANCE	8,000	8,000	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT (APPROX.)	50	47	MA.
ZERO-SIGNAL GRID 2 CURRENT	4.0	2.2	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (APPROX.)	10	8.5	MA.
LOAD RESISTANCE	2,000	4,000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

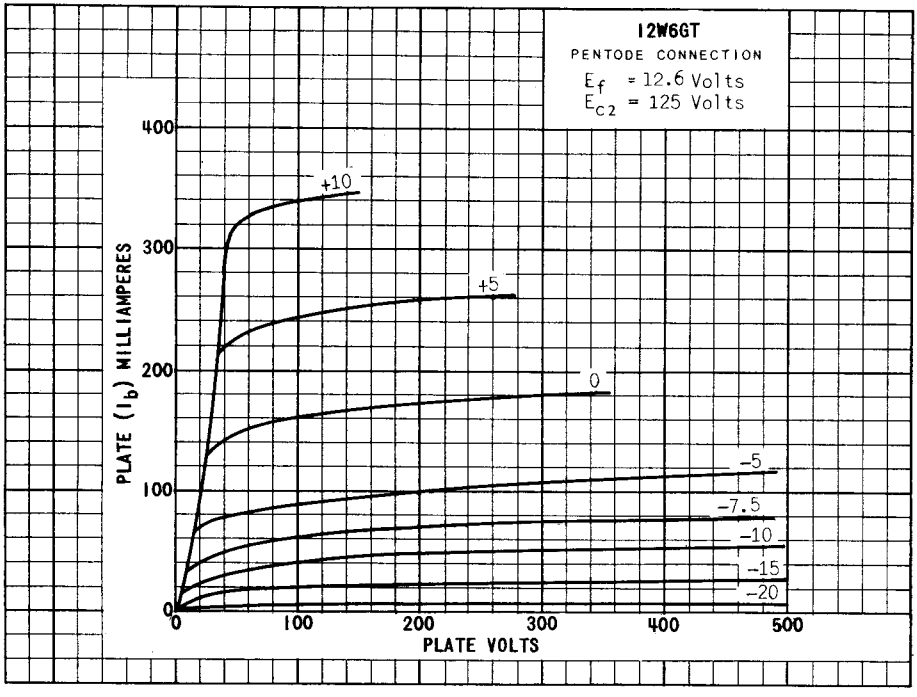
TRIODE CONNECTION

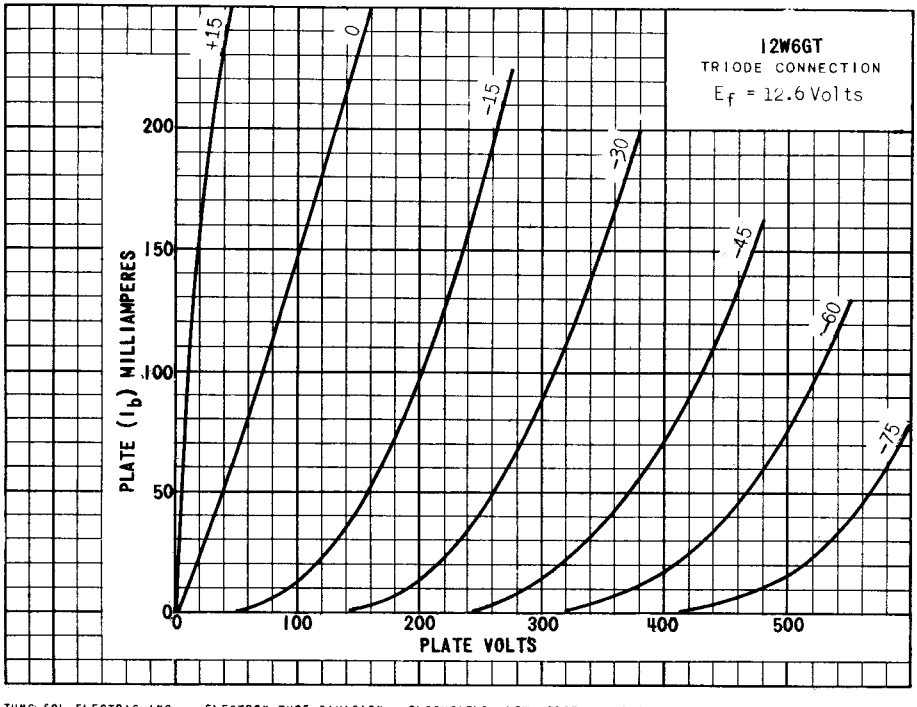
PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	-30	VOLTS
AMPLIFICATION FACTOR	6.2	
PLATE RESISTANCE (APPROX.)	1,600	OHMS
TRANSCONDUCTANCE	3,800	μMHOS
PLATE CURRENT	22	MA.
GRID VOLTAGE FOR Ib=0.5 MA. (APPROX.)	-42	VOLTS

[A] TRIODE CONNECTION - GRID #2 TIED TO PLATE.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER HEATER OPERATING RESISTANCE.





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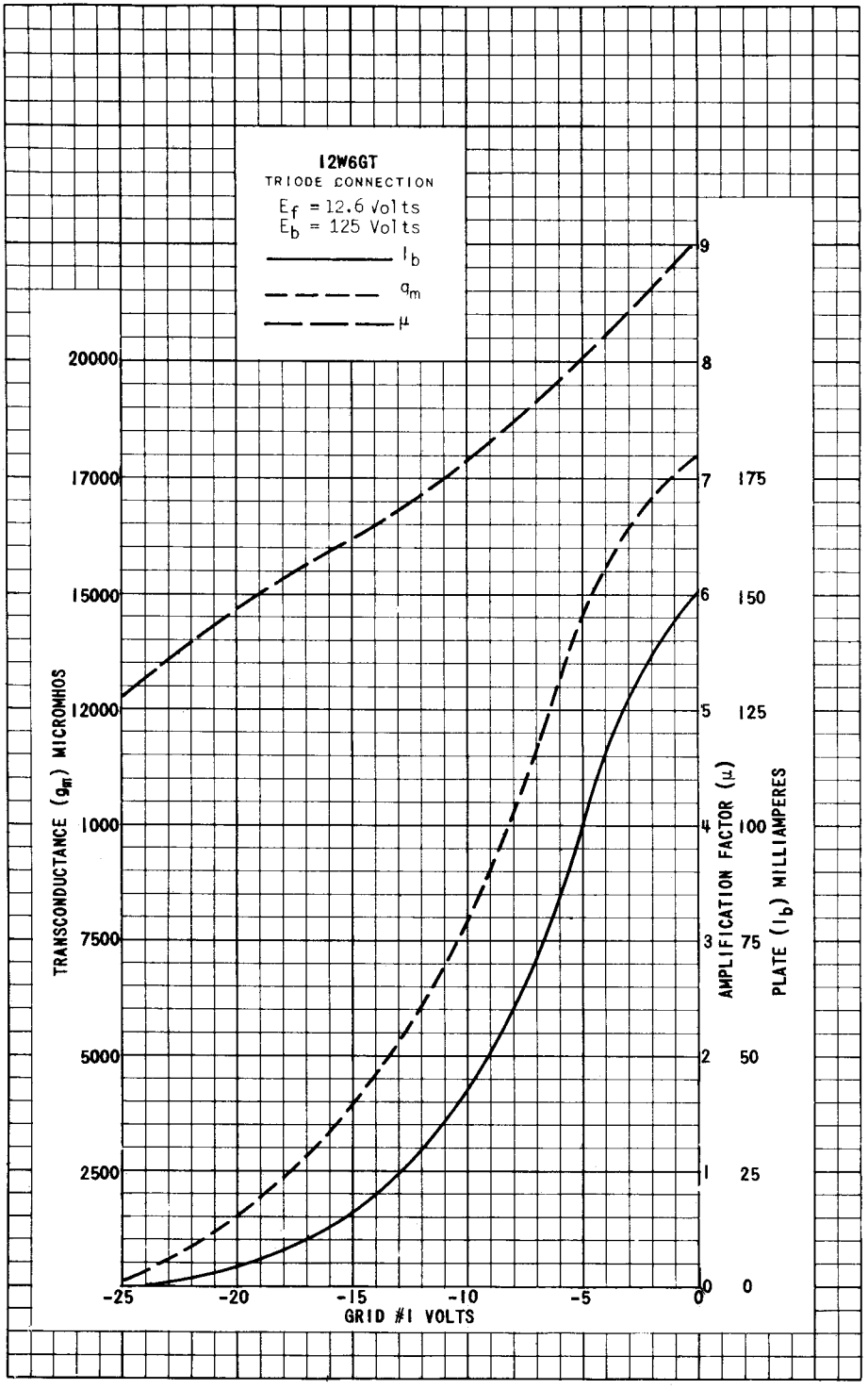
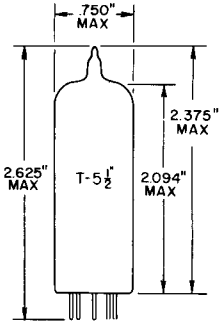
12W6GT


12W6GT
TRIODE CONNECTION
E_f = 12.6 Volts
E_b = 125 Volts
I_b
g_m
μ
TRANSCONDUCTANCE (g_m) MICROMHOS
20000
17000
15000
12000
1000
7500
5000
2500
AMPLIFICATION FACTOR (μ)
9
8
7
6
5
4
3
2
1
0
PLATE (I_b) MILLIAMPERES
175
150
125
100
75
50
25
0
-25
-20
-15
-10
-5
0
GRID #1 VOLTS

TUNG-SOL

MINIATURE TYPE

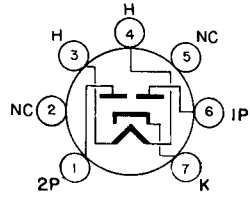


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

FULL WAVE RECTIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BS

THE 12X4 IS A HEATER-CATHODE TYPE POWER RECTIFIER IN THE MINIATURE CONSTRUCTION. ITS LOW VOLTAGE DROP AND SMALL SIZE ADAPT IT TO USE WITH VIBRATOR-TYPE INVERTERS IN AUTOMOBILE RECEIVERS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	12.6 VOLTS	300	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 70 MA EACH PLATE)		22	VOLTS
HEATER SUPPLY LIMITS: VOLTAGE OPERATION [A]		12.6±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		450	VOLTS
TOTAL DC AND PEAK		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

→MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE PLATE VOLTAGE		1250	VOLTS
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)		SEE CHART I	
DC OUTPUT CURRENT EACH PLATE		SEE CHART I	
STEADY STATE PEAK PLATE CURRENT EACH PLATE (SEE CHART II)		245	MA.
TRANSIENT PEAK PLATE CURRENT EACH PLATE (SEE CHART III)		1.1	AMP.
VIBRATOR OPERATION (MINIMUM DUTY CYCLE OF 75%)			
DC OUTPUT VOLTAGE (AT FILTER INPUT)		350	VOLTS
DC OUTPUT CURRENT EACH PLATE		45	MA.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

→ TYPICAL OPERATING CHARACTERISTICS

FULL-WAVE RECTIFIER

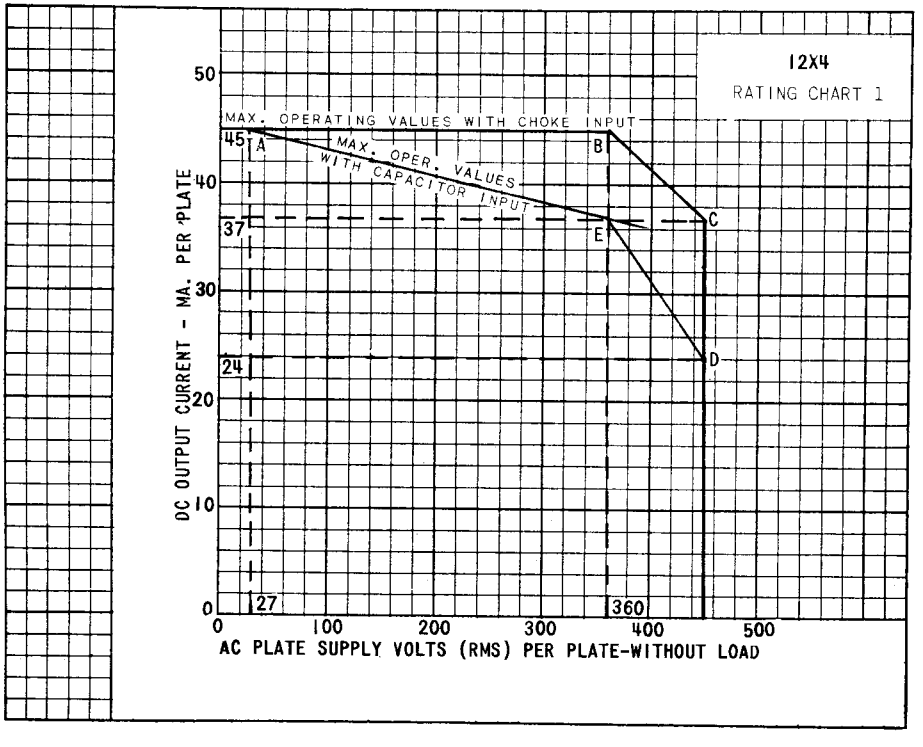
	SINE WAVE OPERATION INPUT TO FILTER		VIBRATOR OPERATION INPUT TO FILTER	
	CAPACITOR	CHOKE	CAPACITOR	
AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)[B]	325	400	---	VOLTS
INPUT CAPACITOR	10	---	10	μf
INPUT CHOKE	---	10	---	HENRYS
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	525	---		OHMS
DC OUTPUT CURRENT	70	70	70	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)	310	340	240	VOLTS

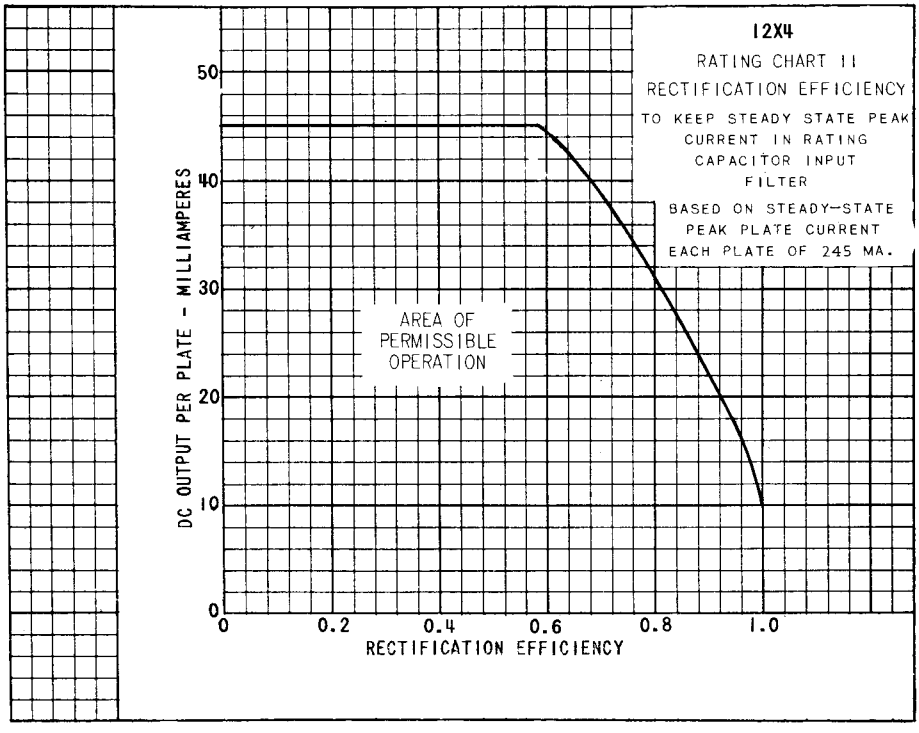
A
WHEN USED IN AUTOMOTIVE SERVICE FROM A 12 VOLT BATTERY SOURCE, THE PERMISSIBLE RANGE IN HEATER VOLTAGE IS FROM 10.0 TO 15.9 VOLTS.

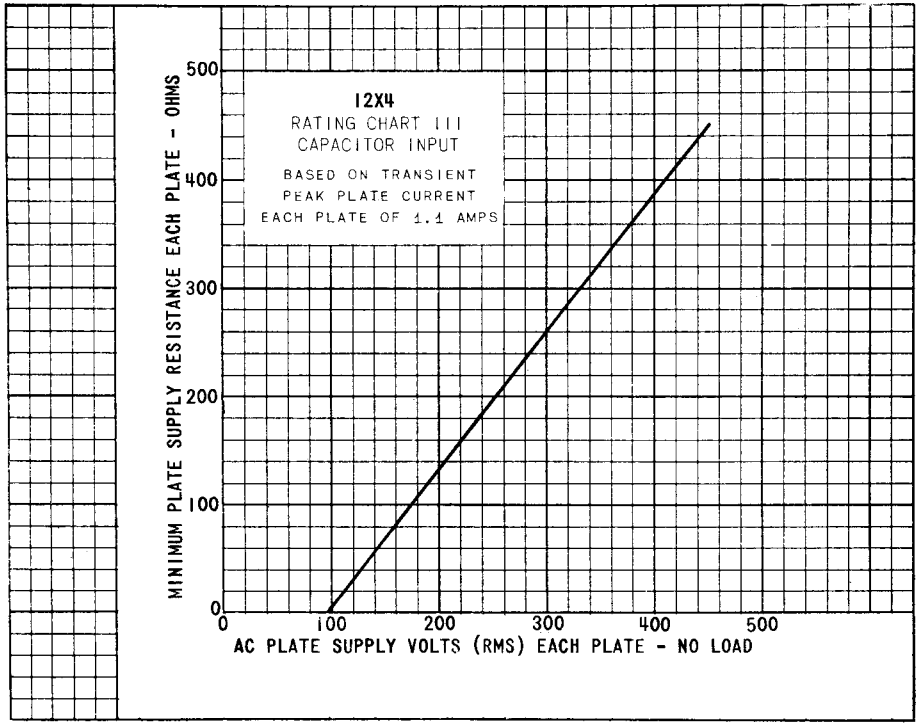
B
AC PLATE SUPPLY VOLTAGE IS MEASURED WITHOUT LOAD.

→INDICATES A CHANGE.

SIMILAR TYPE REFERENCE: Except for heater ratings, the 12X4 is identical to the 6X4.







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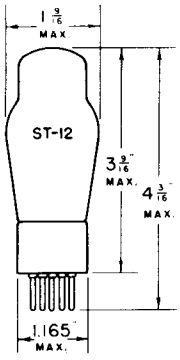


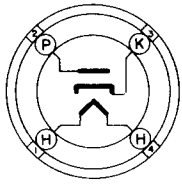
HALF WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



4G

BOTTOM VIEW

SMALL 4 PIN BASE

THE TUNG-SOL 12Z3 IS DESIGNED FOR SERVICE AS A POWER RECTIFIER IN AC–DC RECEIVERS.

RATINGS

MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	330	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

HALF WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE (RMS)	117	150	235 MAX.	VOLTS
DC OUTPUT CURRENT MAX.	55	55	55	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE MIN. [A]	0	30	75	OHMS
TUBE VOLTAGE DROP AT 110 MA. PLATE CURRENT	17			VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 711-2

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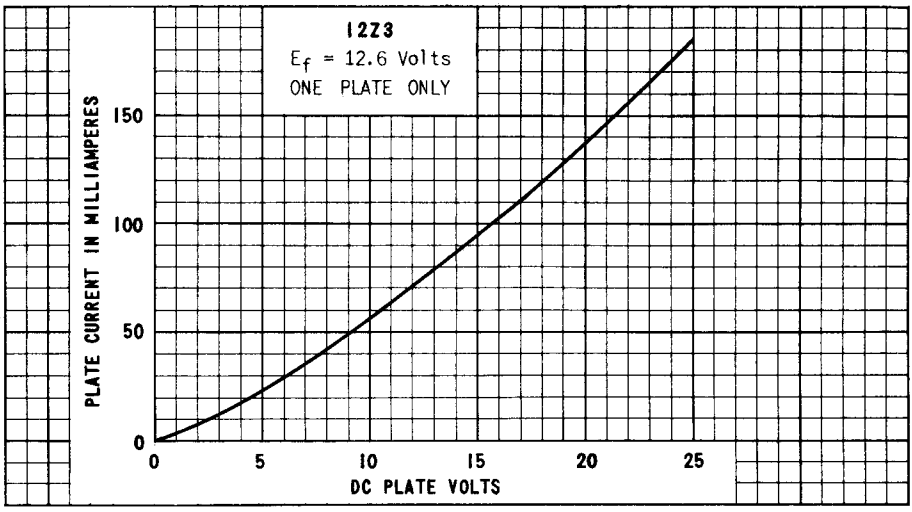
12Z3



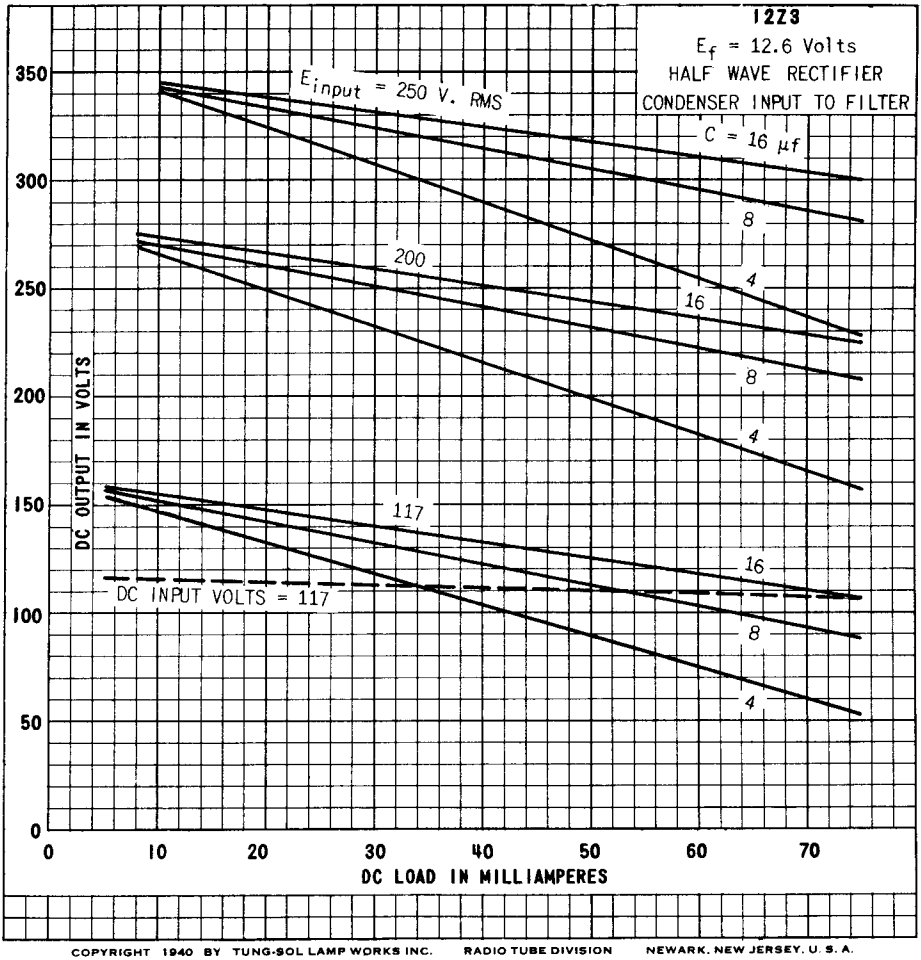


PLATE
712-1

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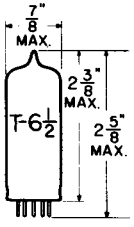
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

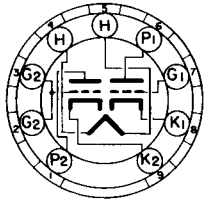


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
13.0 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9HF

THE 13DE7 IS A MINIATURE DOUBLE TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR HAVING MEDIUM MU AND SECTION #2 IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER WITH LOW MU. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 13DE7 IS IDENTICAL TO THE 10DE7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.0	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.52	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	13.0	13.0 ←	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500 ←	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
HEATER VOLTAGE		13.0 ←	VOLTS
HEATER CURRENT		0.45	AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	35	MA.
TRANSCONDUCTANCE	2000	6500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	925	
GRID VOLTAGE FOR Ib = 10 μA	-20	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT			
Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

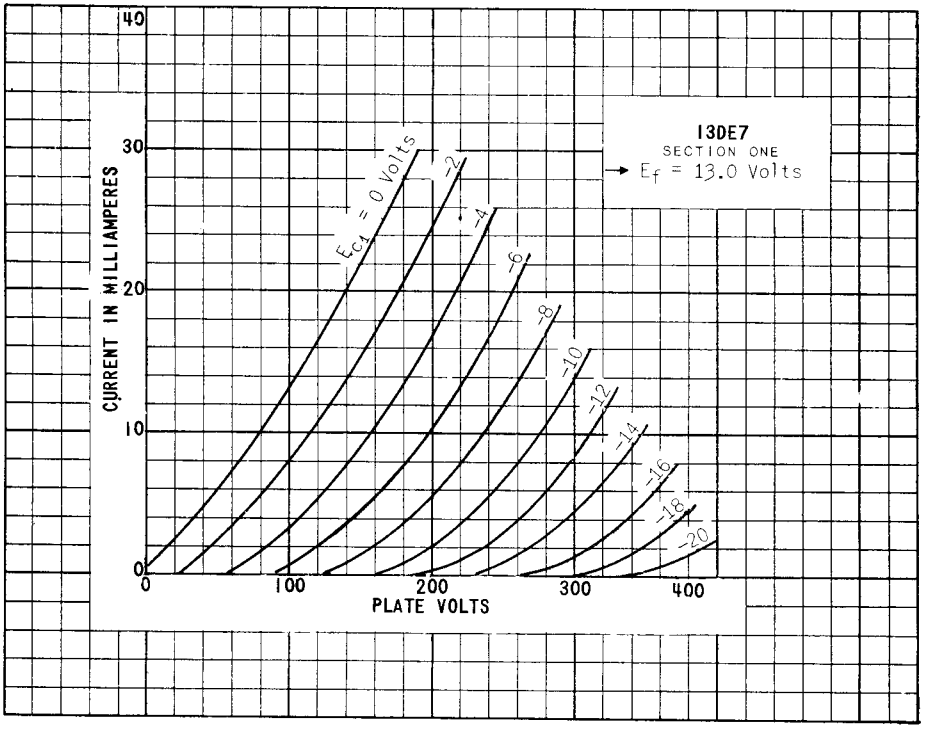
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

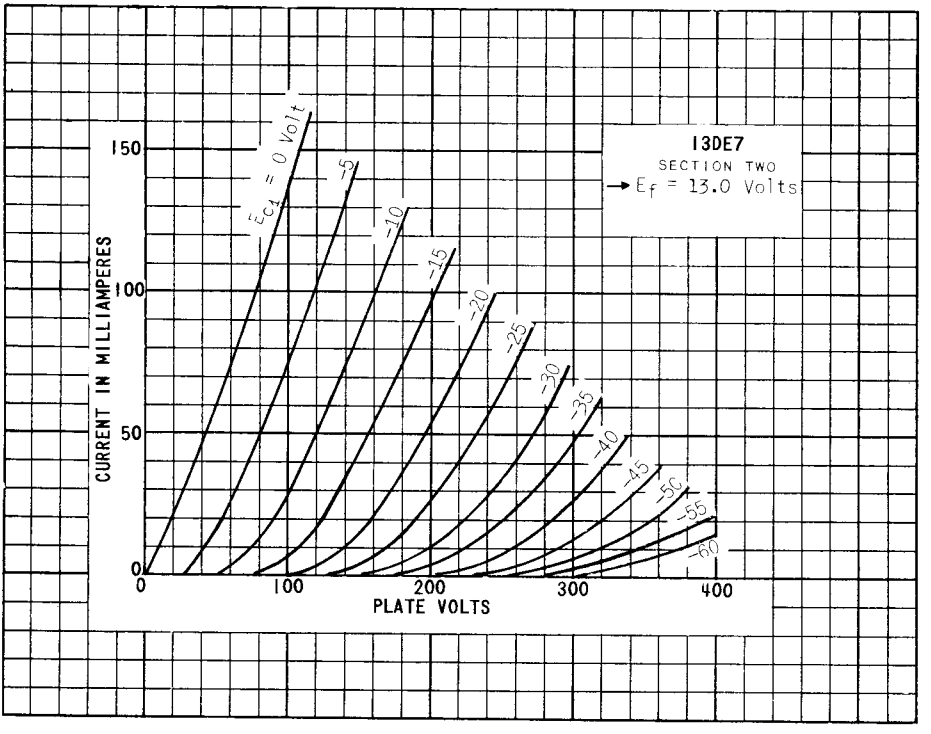
[B] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.





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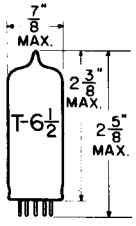
TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

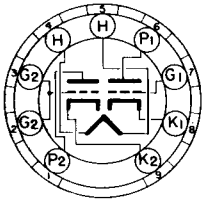


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
13.0 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9HF

THE 13DR7 IS A DOUBLE TRIODE WITH DISSIMILAR SECTIONS IN THE 9-PIN MINIATURE CONSTRUCTION. SECTION #1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION #2 HAS A LOW MU AND IS DESIGNED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. EXCEPT FOR HEATER RATINGS, THE 13DR7 IS IDENTICAL TO THE 6DR7.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE: (G TO P)	4.5	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.34	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR		TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	13.0		13.0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE[B]				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK		200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC		100		VOLTS
TOTAL DC AND PEAK		200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330		275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---		1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400		250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.0		7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20		50	MA.
MAXIMUM PEAK CATHODE CURRENT	70		175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE				
SELF BIAS	2.2		2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*		11.0		SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE #1	TRIODE #2	
HEATER VOLTAGE		13.0	VOLTS
HEATER CURRENT		0.45	AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-17.5	VOLTS
PLATE CURRENT	1.4	35	MA.
TRANSCONDUCTANCE	1600	6500	μMHOS
AMPLIFICATION FACTOR	68	6.0	
PLATE RESISTANCE (APPROX.)	40 000	925	
GRID VOLTAGE FOR Ib = 10 μA	5.5	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec = -24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT			
Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES)	---	80	MA.

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

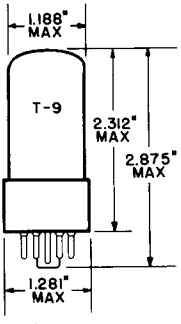
B DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

C IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DOUBLE TRIODE



GLASS BULB
SHORT INTERMEDIATE SHELL
8 PIN OCTAL B8-58
OUTLINE DRAWING
JEDEC 9-37

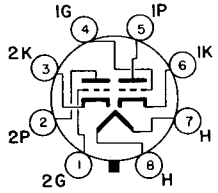
COATED UNIPOTENTIAL CATHODE

HEATER

13.0 VOLTS 450 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BD

THE 13EM7 CONTAINS TWO DISSIMILAR TRIODES IN ONE ENVELOPE. SECTION 1 HAS A HIGH MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR. SECTION 2 HAS A LOW MU AND IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER. EXCEPT FOR HEATER CHARACTERISTICS, THE 13EM7 IS IDENTICAL TO THE 6EM7.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SEC.#1 [D]	SEC.#2 [D]	
GRID TO PLATE	4.8	10	pf
INPUT: G TO (H + K)	2.2	7.0	pf
OUTPUT: P TO (H + K)	0.6	1.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
(EXCEPT AS NOTED)

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	SEC.#1 [D] OSCILLATOR	SEC.#2 [D] AMPLIFIER	
MAXIMUM DC PLATE VOLTAGE	330	330	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE(ABS.MAX)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	10	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	2.2	2.2	MEGOHMS

→ INDICATES A CHANGE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESING MAXIMUM SYSTEM
(EXCEPT AS NOTED)

VERTICAL DEFLRCTION OSCILLATOR AND AMPLIFIER[A]

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME* (APPROX.)	11.0	VOLTS

AVERAGE CHARACTERISTICS

	SEC. #1[D]	SEC. #2[D]	
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-3	-20	VOLTS
PLATE CURRENT	1.4	50	MA.
TRANSCONDUCTANCE	1 600	7 200	μMHOS
AMPLIFICATION FACTOR	64 ←	5.4	
PLATE RESISTANCE (APPROX.)	40 000	750	OHMS
Ec FOR Ib =10 μA (APPROX.)	-5.5	---	VOLTS
Ec FOR Ib =100μA (APPROX.)	---	-45	VOLTS
Ib AT Ec =-28 Vdc APPROX.	---	10	MA.

INSTANTANEOUS PLATE KNEE VALUES (SECTION #2)
Eb = 60 V; Ec =0
Ib = 95 MA.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

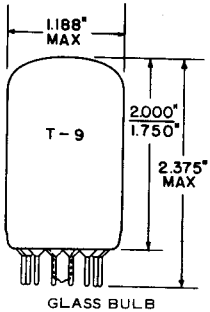
[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DE ICE MA UFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D] SECTION #1 CONNECTS TO PINS 4, 5 AND 6.

TUNG-SOL

DUAL PENTODE



GLASS BULB
BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-58

COMPACTRON

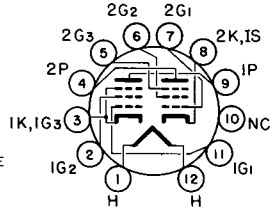
FOR

DISCRIMINATOR AND

AUDIO POWER OUTPUT SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12BT

THE 13J10 IS A GATED-BEAM DISCRIMINATOR PENTODE AND A BEAM PENTODE IN THE T-9 COMPACTRON CONSTRUCTION. SECTION 2 THE GATED-BEAM DISCRIMINATOR PENTODE IS SUITABLE FOR FM AND TV LIMITER AND DISCRIMINATOR APPLICATIONS AND SECTION 1 THE BEAM PENTODE FOR AUDIO POWER OUTPUT SERVICE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DISCRIMINATOR SECTION: (SECTION 2)		
GRID 1 TO GRID 3	0.01	pf
GRID 1 TO ALL	4.0	pf
GRID 3 TO ALL	3.2	pf
OUTPUT SECTION: (SECTION 1)		
GRID 1 TO PLATE	0.2	pf
INPUT:	11	pf
OUTPUT:	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	13.2 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.

	DISCRIMINATOR SECTION	OUTPUT SECTION	
HEATER CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

OUTPUT SECTION 1

PLATE VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	275	VOLTS
PLATE DISSIPATION	10	WATTS
GRID 2 DISSIPATION	2.0	WATTS
GRID 1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.25	MEGOHM
WITH CATHODE BIAS	0.5	MEGOHM

DISCRIMINATOR SECTION 2

PLATE SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	110	VOLTS
PEAK POSITIVE GRID 1 VOLTAGE	60	VOLTS
CATHODE CURRENT - DC	13	MA.

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER

OUTPUT SECTION 1

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID - NUMBER 1 VOLTAGE	-8.0	VOLTS
PEAK AF GRID - NUMBER 1 VOLTAGE	8.0	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
MAXIMUM - SIGNAL PLATE CURRENT	39	MA.
ZERO-SIGNAL GRID 2 CURRENT	2.5	MA.
MAXIMUM - SIGNAL GRID 2 CURRENT	7.0	MA.
TRANSCONDUCTANCE	6,500	μMHOS
PLATE RESISTANCE, APPROXIMATE	100,000	OHMS
LOAD RESISTANCE	5,000	OHMS
TOTAL HARMONIC DISTORTION, APPROXIMATE	10	PERCENT
MAXIMUM - SIGNAL POWER OUTPUT	4.2	WATTS

DISCRIMINATOR SECTION 2

INPUT-SIGNAL CENTER FREQUENCY	10.7	10.7	4.5	Mc/s
FREQUENCY DEVIATION	±75	±75	±25	Kc/s
PLATE-SUPPLY VOLTAGE	85	285	270	VOLTS
PLATE VOLTAGE	62	122	121	VOLTS
GRID 2 VOLTS	55	100	100	VOLTS
CATHODE-BIAS RESISTOR (VARIABLE) SEE BELOW	200-400	200-400	200-400	OHMS
PLATE LOAD RESISTOR	85,000	330,000	330,000	OHMS
PLATE LINEARITY RESISTOR	470	1,500	1,000	OHMS
INTEGRATING CAPACITOR	0.002	0.001	0.001	μF
COUPLING CAPACITOR	0.25	0.01	0.25	μF
MINIMUM SIGNAL VOLTAGE FOR LIMITING ACTION-RMS	1.25	1.25	1.25	VOLTS
AT SIGNAL LEVELS ABOVE THIS VALUE, LIMITING IS WITHIN ± 3 dbs				
PLATE CURRENT-DC	0.25	0.49	0.44	MA.
ACCELERATOR CURRENT	4.1	9.8	10	MA.
INPUT SIGNAL LEVEL FOR AM REJECTION ADJUSTMENT	1.25	2.0	2.0	VOLTS
AM REJECTION AT ESIG = 2.0 VOLTS, RMS	31	20	25	DECIBELS
AM REJECTION AT ESIG = 3.0 VOLTS, RMS	30	29	30	DECIBELS
TOTAL HARMONIC DISTORTION	2.0	1.6	1.8	PERCENT
PEAK AUDIO OUTPUT VOLTAGE	6.0	16.6	16.8	VOLTS

THE CATHODE RESISTOR SHOULD BE ADJUSTED FOR MAXIMUM AM REJECTION IN THE OUTPUT OF THE LIMITER-DISCRIMINATOR STAGE AT THE SPECIFIED SIGNAL LEVEL. AM REJECTION IS MEASURED WITH AN APPLIED SIGNAL CONTAINING 30-PERCENT AMPLITUDE MODULATION AND 30-PERCENT FREQUENCY MODULATION.

ADEQUATE SHIELDING BETWEEN COMPONENTS OF THE LIMITER GRID AND THE QUADRATURE GRID MUST BE USED TO INSURE PROPER PHASING OF THE VOLTAGE DEVELOPED ON THE QUADRATURE GRID.

STANDARD DE-EMPHASIS REQUIREMENTS FOR FM ARE INCLUDED.

THE Q OF THE QUADRATURE GRID CIRCUIT SHOULD BE HIGH ENOUGH TO DEVELOP A MINIMUM OF 4 VOLTS (RMS) SIGNAL WITH 2 VOLTS(RMS) OF THE CENTER-FREQUENCY SIGNAL APPLIED TO THE LIMITER GRID. IT IS RECOMMENDED THAT THE COIL BE SHUNTED BY A MINIMUM OF 10pf. THE CAPACITANCE MAY BE COMPOSED OF TUBE INPUT CAPACITANCE, STRAY CAPACITANCE, AND DISTRIBUTED CAPACITANCE, AS WELL AS PHYSICAL CAPACITANCE.

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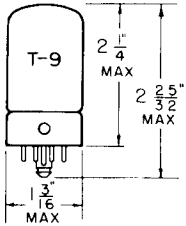
BEAM PENTODE

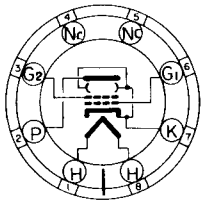


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
6AA

THE 14A5 IS A BEAM POWER AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT SHOULD BE POINTED OUT THAT THIS TYPE IS AN EXCEPTION TO THE RULE THAT THE CORRESPONDING 7 AND 14 VOLT TYPES HAVE THE SAME CHARACTERISTICS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.5	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-12.5	VOLTS
PEAK A-F SIGNAL VOLTAGE	12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	32	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	5.5	MA.
PLATE RESISTANCE	70 000	OHMS
TRANSCONDUCTANCE	3 000	μMHOS
LOAD RESISTANCE	7 500	OHMS
POWER OUTPUT	2.8	WATTS
TOTAL HARMONIC DISTORTION	7	PERCENT

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PLATE
2408

MAY 1
1950

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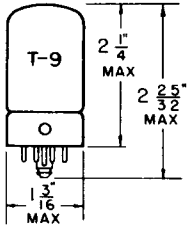
TENTATIVE DATA

(7A7) 14A7/12B7

TUNG-SOL

PENTODE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW
LOCK-IN
8 PIN BASE
8V

THE 14A7/12B7 IS A PENTODE VOLTAGE AMPLIFIER USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR RF OR IF SERVICE IN AC/DC RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P)	0.003	μμf
INPUT: G_1 TO (H+K+G_2+G_3+IS)	6	μμf
OUTPUT: P TO (H+K+G_2+G_3+IS)	7	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	4	WATTS
MAXIMUM GRID #2 DISSIPATION	0.4	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	PIN #4 AND PIN #5 CONNECTED TO PIN #8		
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
SELF BIAS RESISTOR	60	260	OHMS
PLATE RESISTANCE (APPROX.)	0.12	0.8	MEGOHM
TRANSCONDUCTANCE	2350	2000	μMHOS
PLATE CURRENT	13	9.2	MA.
GRID #2 CURRENT	4	2.6	MA.
GRID #1 VOLTAGE FOR G_m = 10 μMHOS (APPROX.)	-35	-35	VOLTS

→ INDICATES A CHANGE OR ADDITION

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PLATE
2409
MAY 1
1950

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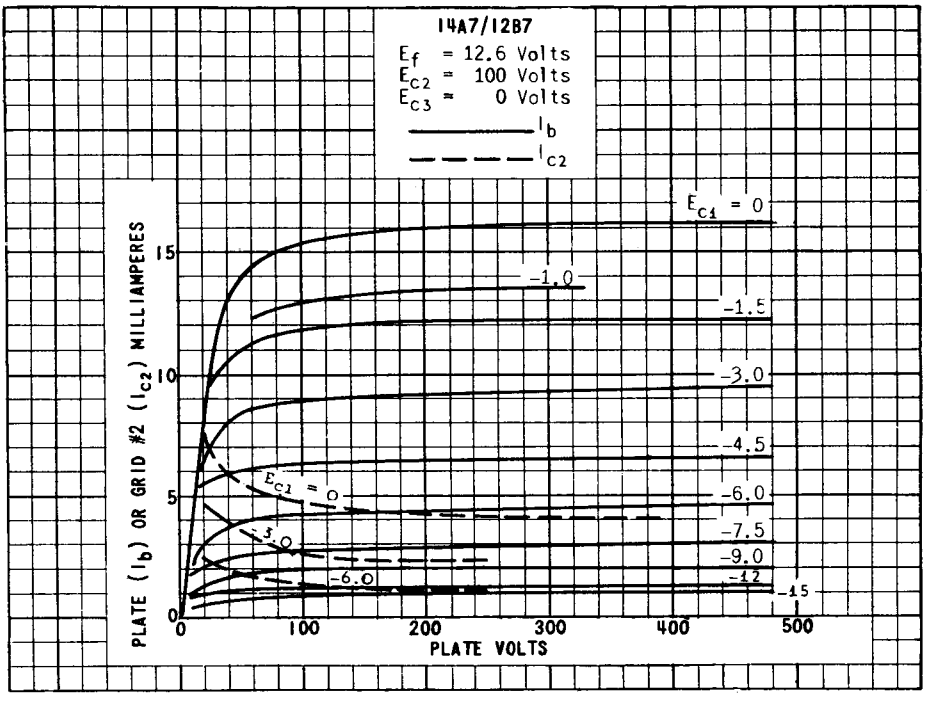
14A7/12A7 (7A7)



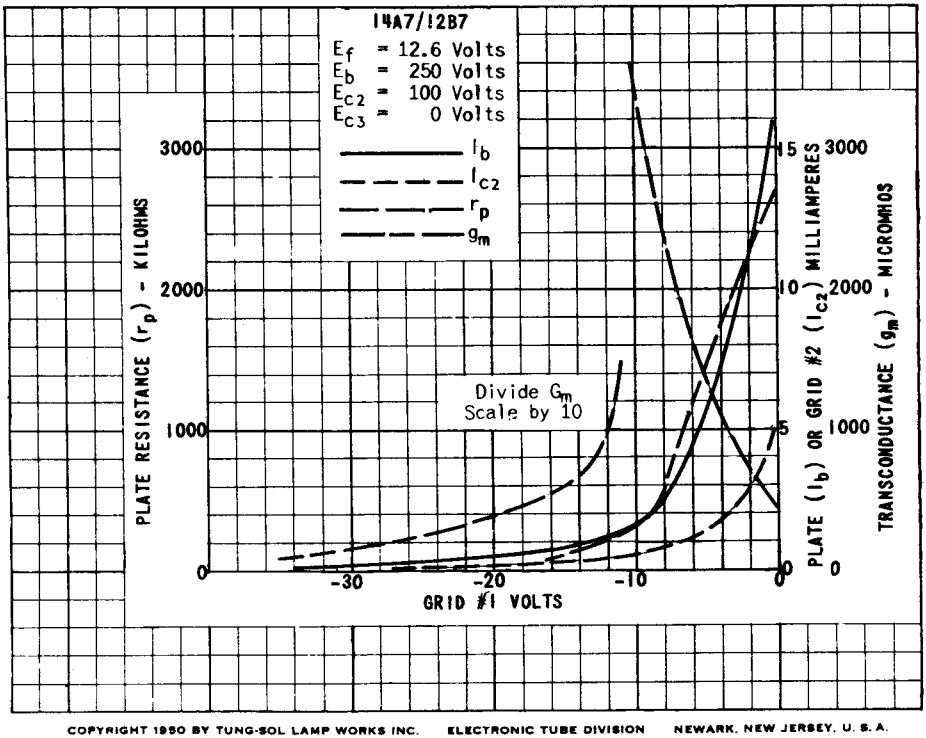


PLATE 2410
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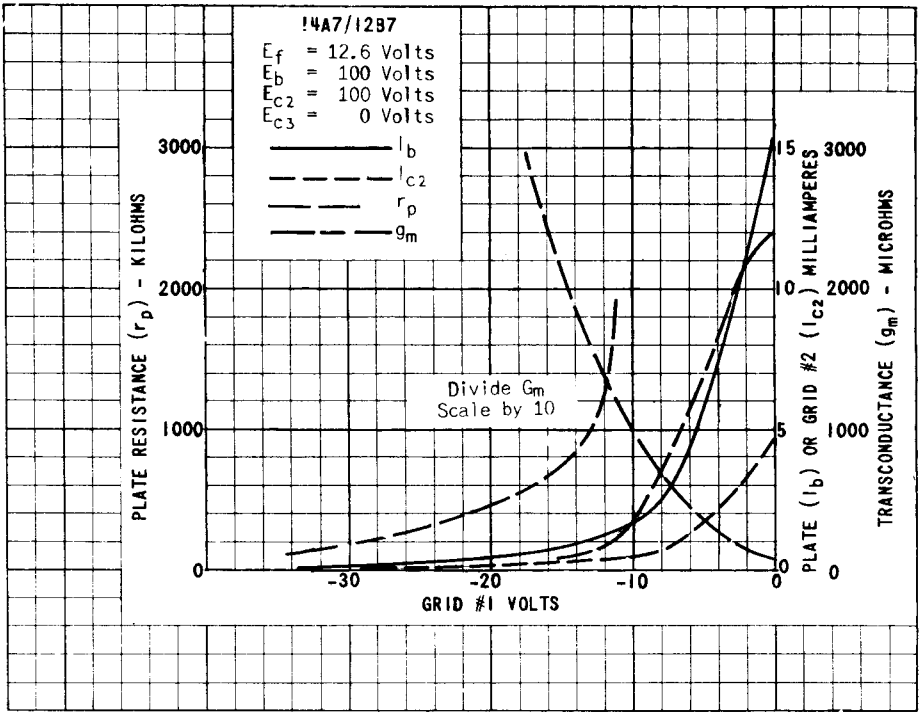

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PLATE
2411

MAY 1
1950

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

RECTANGULAR GLASS BULB

SMALL SHELL DUODECAL 5 PIN BASE

THE 14BP4 IS AN ALL GLASS MAGNETIC FOCUS AND DEFLECTION DIRECT-VIEW PICTURE TUBE FOR TELEVISION APPLICATION. ITS RECTANGULAR FACE PROVIDES FOR A PICTURE 8 5/8" X 11 5/8". FEATURES OF THIS TUBE ARE AN ELECTRON GUN DESIGNED TO BE USED WITH AN EXTERNAL ION-TRAP MAGNET FOR THE PREVENTION OF ION-SPOT BLEMISH, A GREY NEUTRAL-DENSITY FACEPLATE FOR INCREASED PICTURE CONTRAST AND DETAIL UNDER HIGH AMBIENT LIGHT CONDITIONS AND A SPACE-SAVING RECTANGULAR BULB SHAPE. AN EXTERNAL CONDUCTIVE COATING SERVES AS A FILTER CAPACITOR WHEN GROUNDED.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTING ANGLE (APPROX.):	
HORIZONTAL	70 DEGREES
DIAGONAL	65 DEGREES
FACEPLATE LIGHT TRANSMISSION (NEUTRAL DENSITY FILTER)	70 PERCENT
BULB CONTACT	RECESSED SMALL CAVITY CAP
COATING	CONDUCTIVE

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

EXTERNAL CONDUCTIVE COATING	500 - 2000	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	12 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	11 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
FOCUSING COIL CURRENT (APPROX.)	110	MA.
ION TRAP CURRENT (APPROX.)	120	MA.

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PLATE 2391
APR. 1 1950

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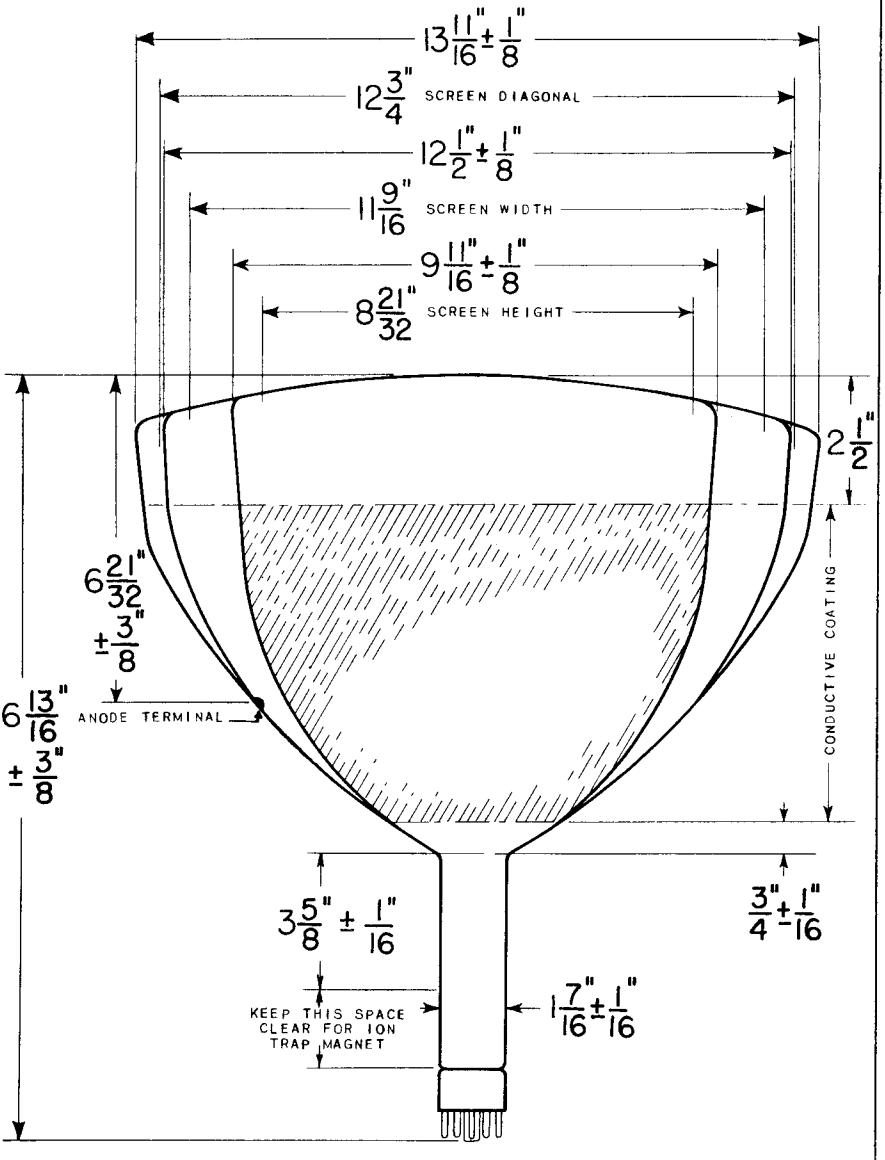
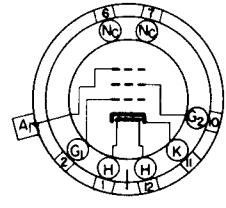
14BP4

TUNG-SOL



1. HEATER
2. GRID NO. 1
10. GRID NO. 2
11. CATHODE
12. HEATER
CAP ANODE



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APR. 1 1950

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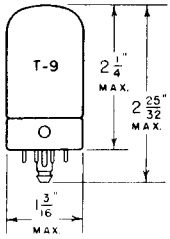
TUNG-SOL

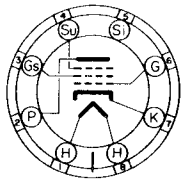
TRIPLE GRID
DETECTOR AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



8V

BOTTOM VIEW

LOCKING-IN 8 PIN BASE

THE TUNG-SOL 14C7 IS A TRIPLE GRID GENERAL PURPOSE DETECTOR, DESIGNED FOR SERVICE IN AC-DC RECEIVERS USING 150 MA. HEATER TUBES. WITH THE EXCEPTION OF HEATER RATINGS ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 7C7.

RATINGS

NOMINAL HEATER VOLTAGE	14.0	VOLTS
NOMINAL HEATER CURRENT	0.16	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLT
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM SCREEN DISSIPATION	0.1	WATT

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	6.0	μμf
PLATE TO CATHODE	6.5	μμf
CONTROL GRID TO PLATE	0.007 MAX.	μμf

[S] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 1153-1

NOV. 17 1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	-1	-3	VOLTS
SUPPRESSOR GRID AND PIN #5	0	0	VOLT
PLATE CURRENT	5.7	2.2	MA.
SCREEN CURRENT	1.8	0.7	MA.
PLATE RESISTANCE APPROX.	.325	1.0	MEGOHM
TRANSCONDUCTANCE	2275	1575	μMHOS

PLATE
1154-1

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

RECTANGULAR GLASS BULB

SMALL SHELL DUODECAL 5 PIN BASE

THE 14CP4 IS AN ALL GLASS MAGNETIC FOCUS AND DEFLECTION DIRECT VIEW PICTURE TUBE FOR TELEVISION APPLICATIONS. ITS RECTANGULAR FACE PROVIDES FOR A PICTURE 8 5/8" X 11 1/2". FEATURES OF THIS TUBE ARE A SPACE-SAVING RECTANGULAR BULB, A GREY NEUTRAL-DENSITY FACEPLATE FOR INCREASED PICTURE CONTRAST AND DETAIL UNDER HIGH AMBIENT LIGHT CONDITIONS, AND AN ELECTRON GUN DESIGNED TO BE USED WITH AN EXTERNAL ION-TRAP MAGNET FOR THE PREVENTION OF ION-SPOT BLEMISH.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.):	
HORIZONTAL	65 DEGREES
VERTICAL	70 DEGREES
ION-TRAP	MAGNETIC
BULB CONTACT	RECESSED SMALL CAVITY CAP
COATING	CONDUCTIVE

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO ALL OTHER ELECTRODES	6	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE (APPROX.)	1500	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD MB-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	14 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	12 000	VOLTS
GRID #2 VOLTAGE	300	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-33 TO -77	VOLTS
FOCUSING COIL CURRENT (APPROX.)	115	MA.
ION-TRAP FIELD INTENSITY (APPROX.)[A]	23	GAUSS

[A] SINGLE FIELD ION-TRAP MAGNET

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SEPT. 1 1950

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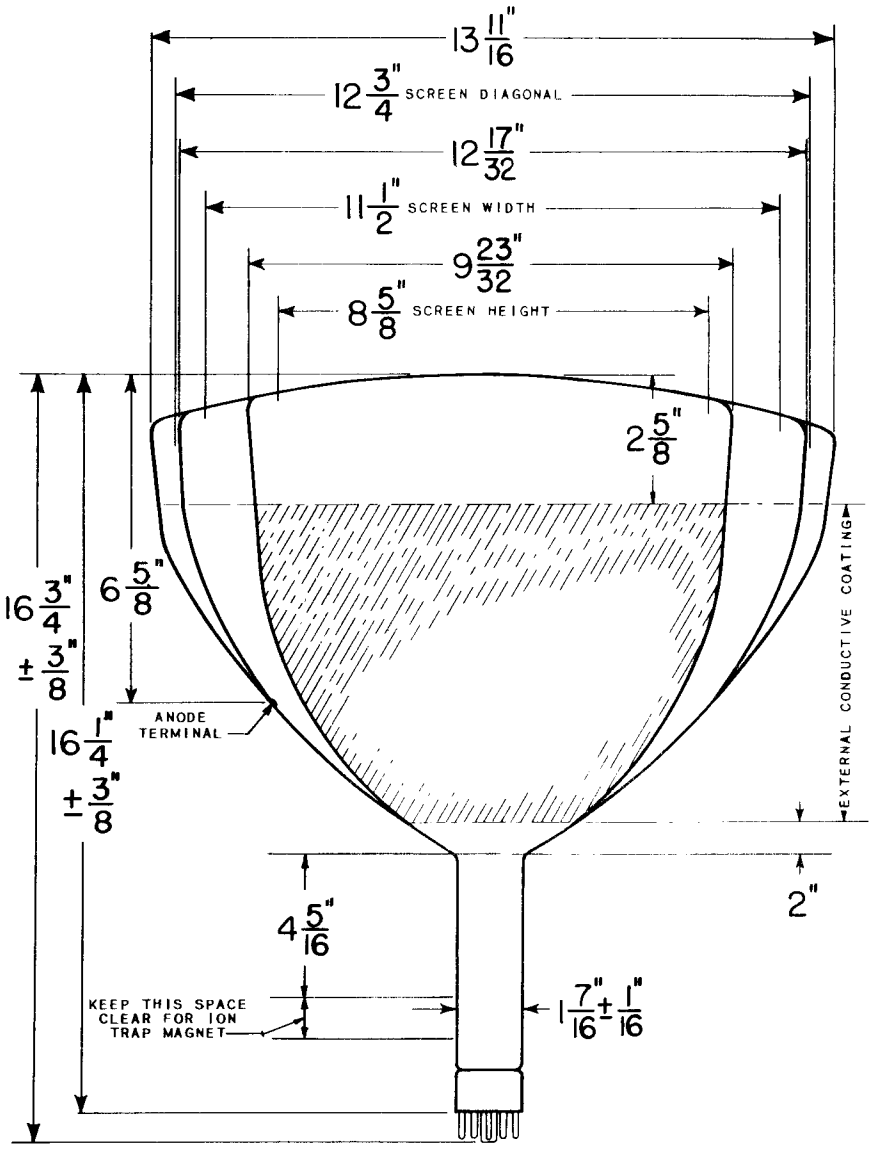
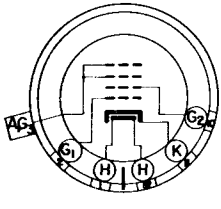
14CP4

TUNG-SOL





1. HEATER
2. GRID #1
10. GRID #2
11. CATHODE
12. HEATER

CAP ANODE, GRID #3

PLATE 2469

SEPT. 1 1950

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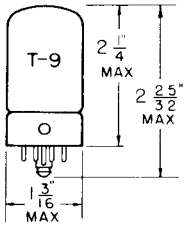
TENTATIVE DATA

(7E7)14E7

TUNG-SOL

DOUBLE-DIODE PENTODE

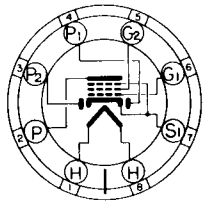


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8AE

THE 14E7 IS A COMBINED REMOTE CUT OFF PENTODE AND DOUBLE DIODE DETECTOR USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE AS A COMBINED DETECTOR, AVC RECTIFIER AND RF, IF OR AF AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA SHIELD #308 CONNECTED TO CATHODE

GRID TO PLATE: (G_1 TO P) MAX.	0.005	μμf
INPUT: G_1 TO (H+K+G_2+IS)	4.6	μμf
OUTPUT: P TO (H+K+G_2+IS)	5.5	μμf
DIODE #1 TO GRID (1P TO G_1) MAX.	0.013	μμf
DIODE #2 TO GRID (2P TO G_1) MAX.	0.003	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	100	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATT
MAXIMUM VOLTAGE DROP MEASURED WITH TUBE CONDUCTING 0.8 MA. EACH PLATE	10	VOLTS
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

RF OR IF AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID #2 VOLTAGE	100	100	VOLTS
GRID #1 VOLTAGE	-1	-3	VOLTS
PLATE CURRENT	10	7.5	MA.
GRID #2 CURRENT	2.7	1.6	MA.
PLATE RESISTANCE (APPROX.)	0.15	0.7	MEGOHM
TRANSCONDUCTANCE	1 600	1 300	μMHOS
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 2 μMHOS	-36	-42.5	VOLTS

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2277
NOV. 1,
1949

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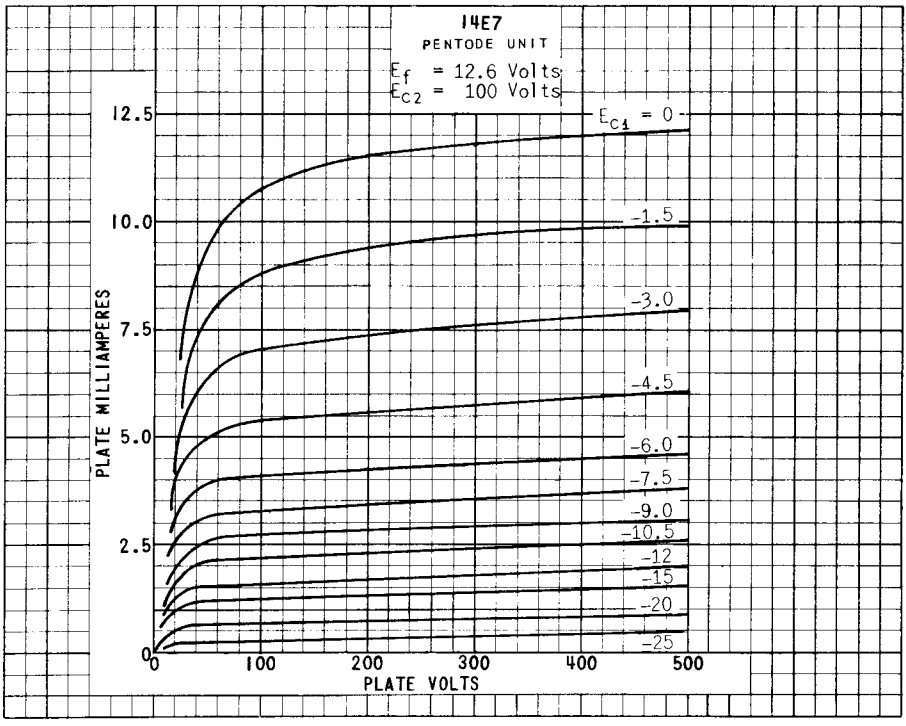

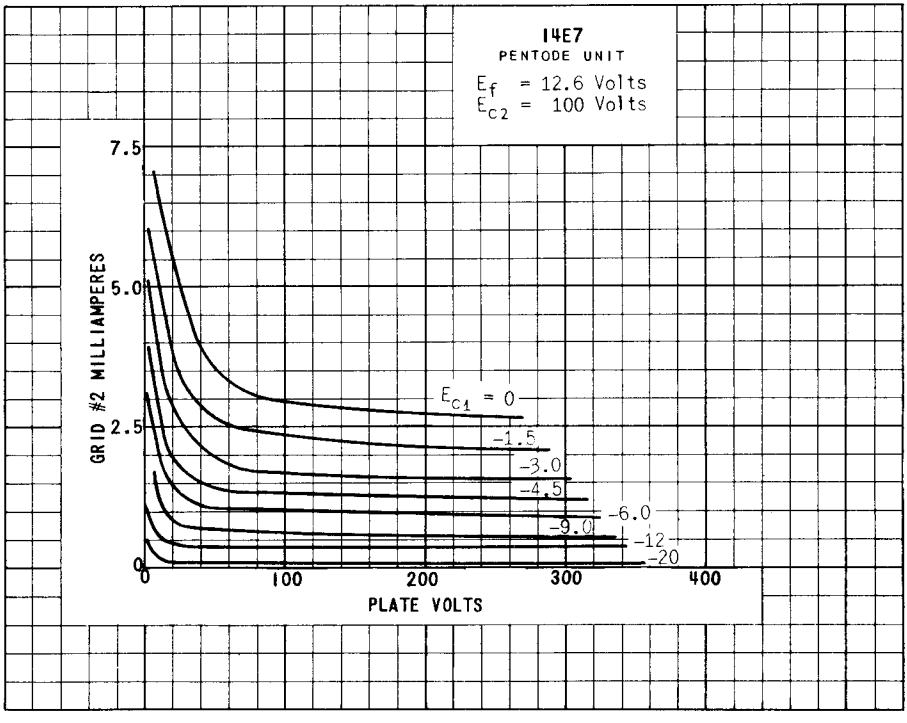

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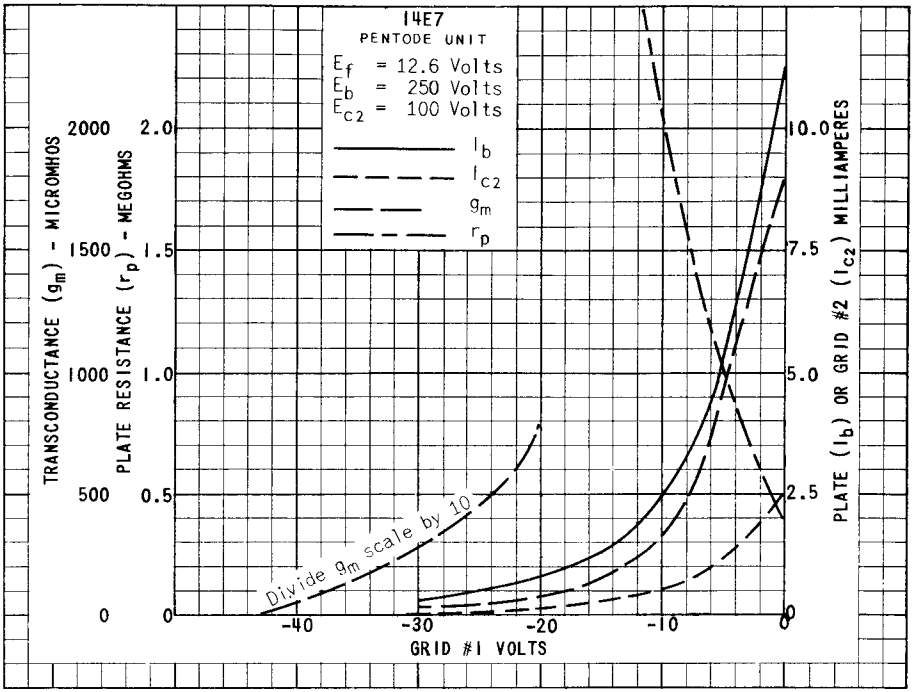

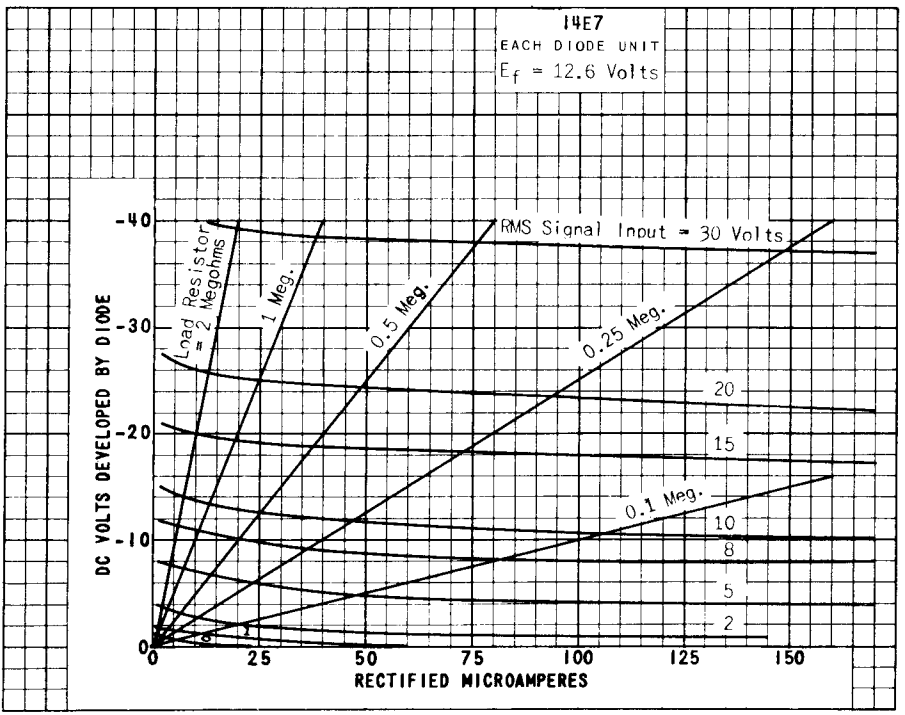

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NOV. 1, 1949

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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

RECTANGULAR GLASS BULB

SMALL SHELL DUODECAL 5 PIN BASE

THE 14EP4 IS A GLASS ENVELOPE, MAGNETIC DEFLECTION AND MAGNETIC FOCUS DIRECT-VIEW PICTURE TUBE INTENDED FOR USE IN TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE THE GREY NEUTRAL-DENSITY FACEPLATE FOR INCREASED PICTURE CONTRAST AND DETAIL UNDER HIGH AMBIENT LIGHT CONDITIONS AND AN ELECTRON GUN DESIGNED TO BE USED WITH AN EXTERNAL ION-TRAP MAGNET FOR THE PREVENTION OF ION-SPOT BLEMISH. AN EXTERNAL CONDUCTIVE COATING WHEN GROUNDED SERVES AS A HIGH VOLTAGE FILTER CAPACITOR.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.):	
HORIZONTAL	65 DEGREES
DIAGONAL	70 DEGREES
FACEPLATE LIGHT TRANSMISSION (NEUTRAL DENSITY FILTER)	66 PERCENT
COATING	CONDUCTIVE
BULB CONTACT	RECESSED SMALL CAVITY CAP
RASTER SIZE	11 1/2" X 8 5/8"

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO ALL OTHER ELECTRODES	6	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE	1 250	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	14 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM-UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

CONTINUED ON FOLLOWING PAGE

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NOV. 1 1950

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	12 000	VOLTS
GRID #2 VOLTAGE	300	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	−33 TO −77	VOLTS
FOCUSING COIL CURRENT (APPROX.)	110 ± 20%	MA.
ION-TRAP CURRENT (APPROX.)[A]	110 ± 50%	MA.
HORIZONTAL DEFLECTING COIL CURRENT (APPROX.)	750	MA.

[A] SINGLE FIELD ION-TRAP MAGNET.

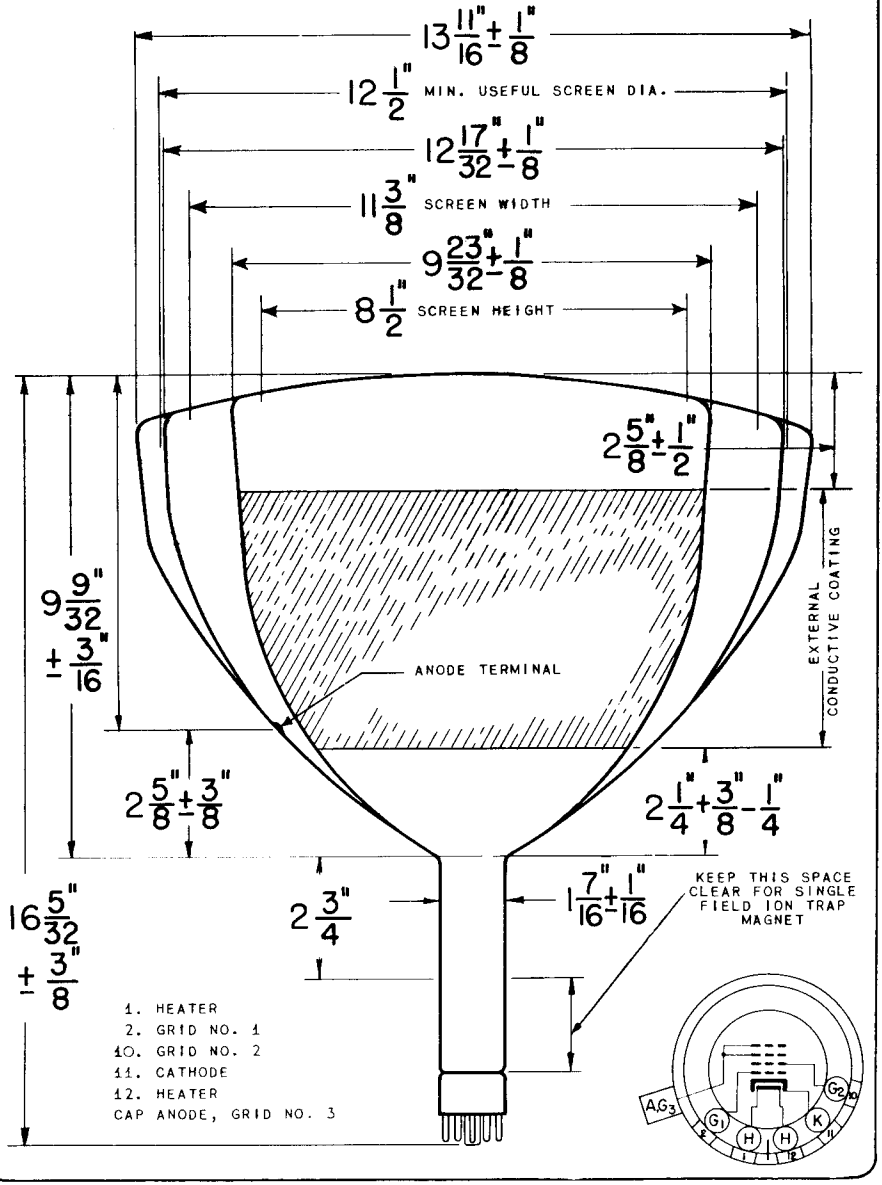

PLATE 2498
NOV. 1 1950

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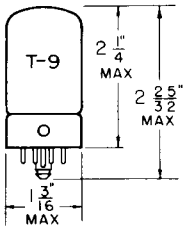
TUNG-SOL

DOUBLE TRIODE

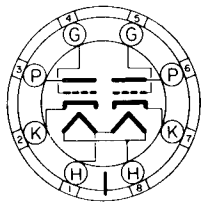


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
12.6 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE
8AC

THE 14F7 IS A TWIN HIGH-MU TRIODE USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR USE AS A VOLTAGE AMPLIFIER IN RESISTANCE COUPLED CASCADE OR PHASE INVERTER SERVICE.

DIRECT INTERELECTRODE CAPACITANCES
WITH RMA #308 SHIELD CONNECTED TO CATHODE

	TRIODE UNIT 1		TRIODE UNIT 2	
GRID TO PLATE: (G TO P)	1.6		1.6	μμf
INPUT: G TO (H+K)	2.4		2.4	μμf
OUTPUT: P TO (H+K)	2.0		2.0	μμf
GRID TO GRID: (G TO G) MAX.		0.2		μμf
PLATE TO PLATE: (P TO P) MAX.		1.0		μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	12.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION PER UNIT	1	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER - EACH TRIODE UNIT

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.65	2.3	MA.
PLATE RESISTANCE	62 000	44 000	OHMS
TRANSCONDUCTANCE	1 125	1 600	μMHOS
AMPLIFICATION FACTOR	70	70	

SIMILAR TYPE REFERENCES: Characteristics are identical to type 6SL7GT.

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PLATE 2296
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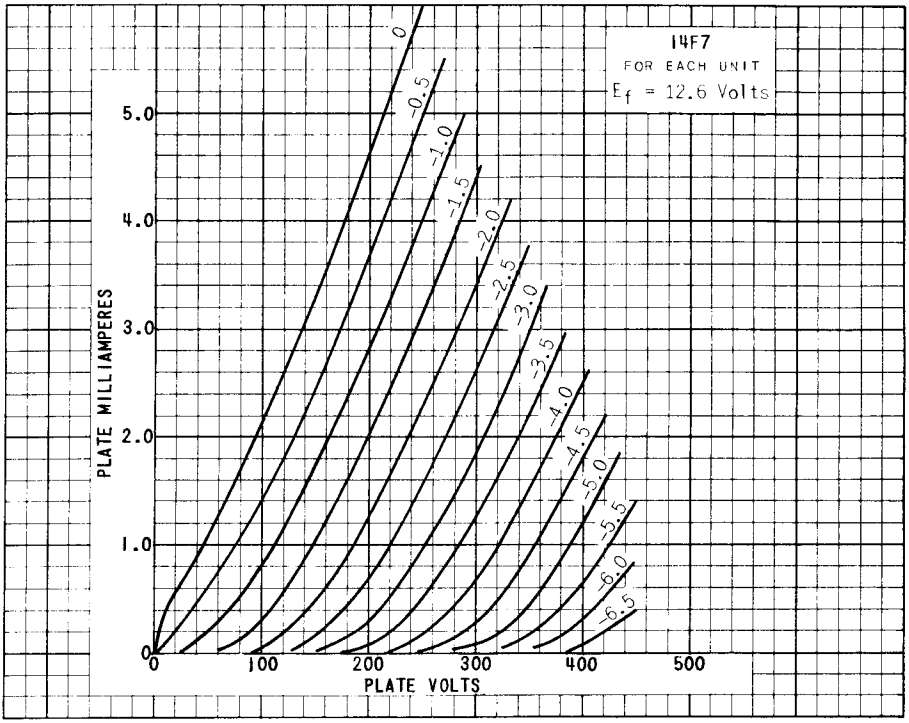
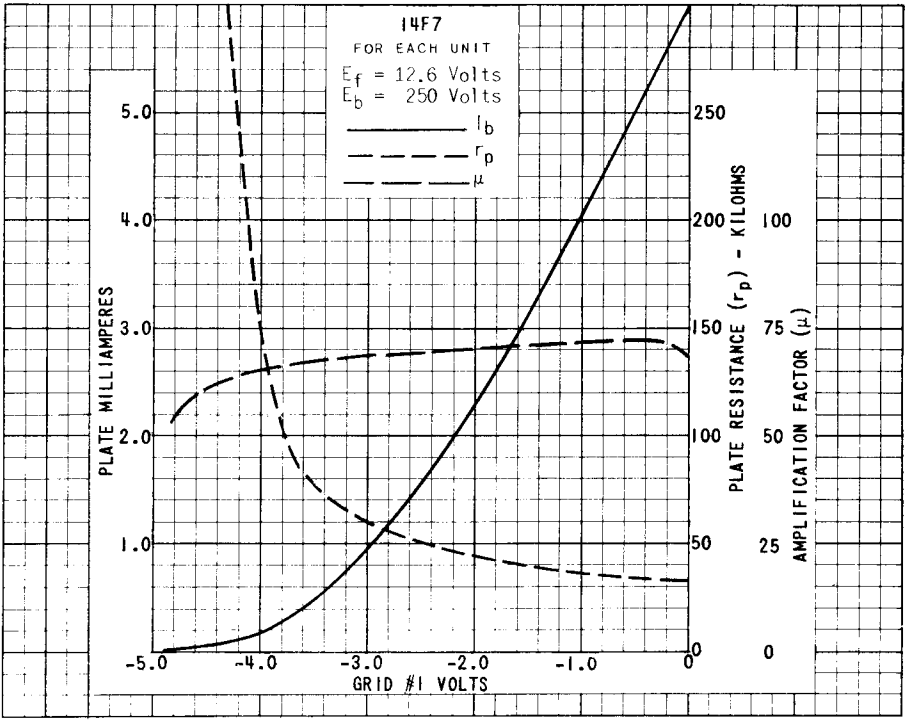
14F7 (7F7)





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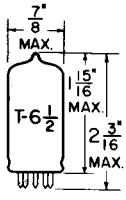
TUNG-SOL

DUPLEX-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

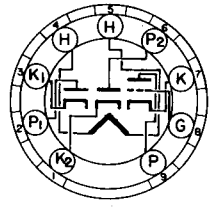
COATED UNIPOTENTIAL CATHODE

HEATER

14±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN, BASE

9KR

THE 14GT8 IS A DUPLEX-DIODE, HIGH-MU TRIODE DESIGNED FOR USE AS AN FM DETECTOR AND AF VOLTAGE AMPLIFIER. IT HAS SEPARATE CATHODES FOR EACH OF THE DIODE SECTIONS AND THE TRIODE SECTION.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

TRIODE GRID TO PLATE	1.8	μμf
TRIODE INPUT	1.6	μμf
TRIODE OUTPUT	0.24	μμf
GRID TO DIODE #1 PLATE, MAX.	0.09	μμf
GRID TO DIODE #2 PLATE, MAX.	0.07	μμf
DIODE #1 INPUT	2.4	μμf
DIODE #2 INPUT	2.4	μμf
DIODE #1 CATHODE TO ALL	6.5	μμf
DIODE #2 CATHODE TO ALL	6.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	14±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION, EACH DIODE	5.0	MA.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

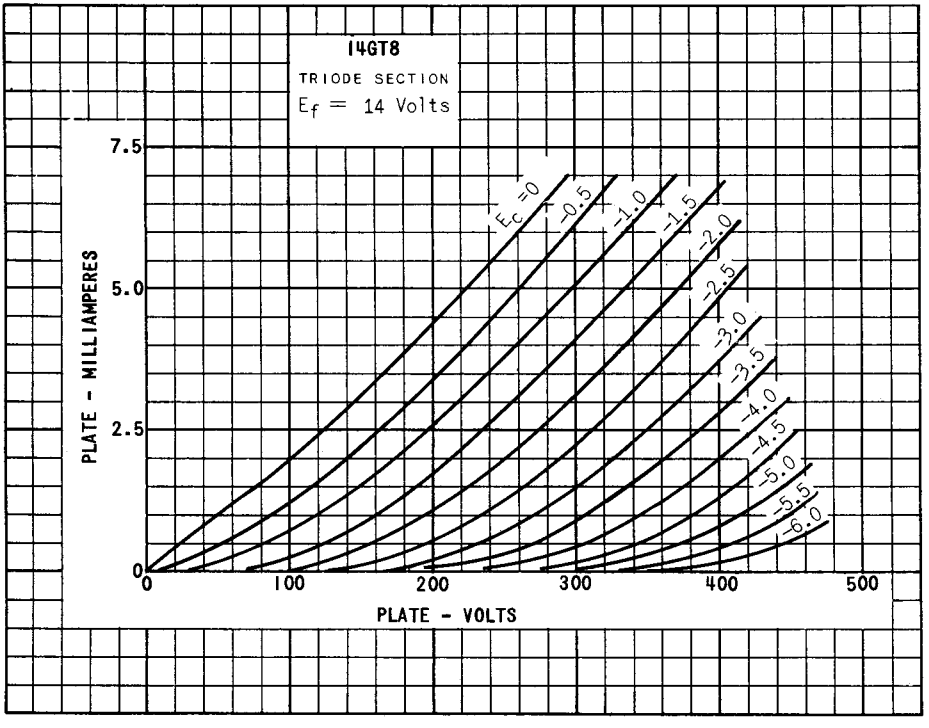
CONTINUED FROM PRECEDING PAGE

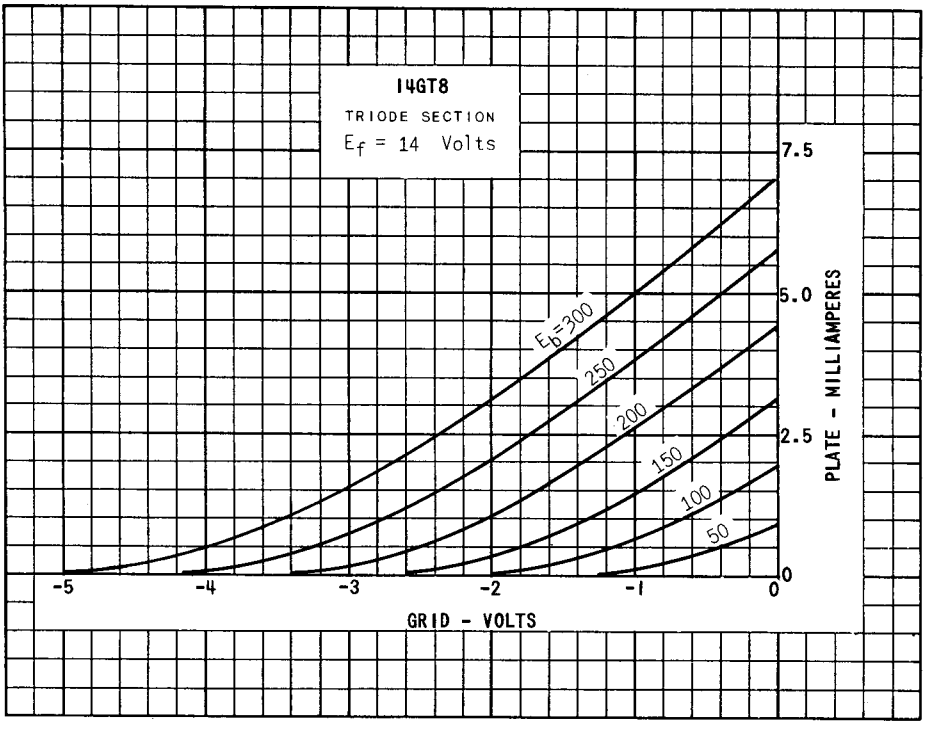
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

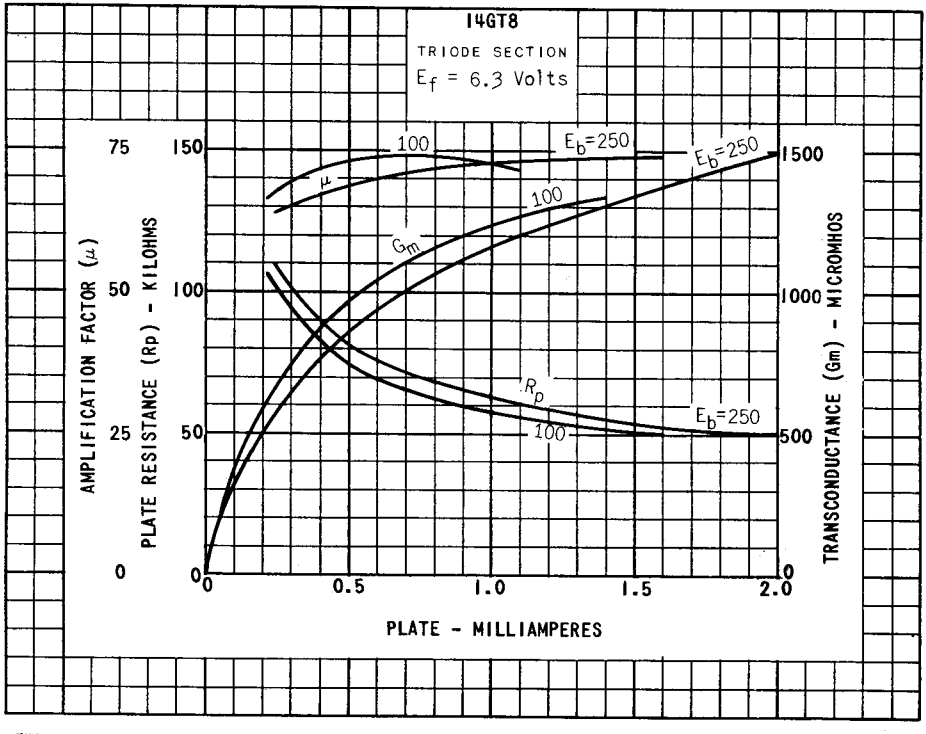
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	14±10%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−3.0	VOLTS
AMPLIFICATION FACTOR	72	
PLATE RESISTANCE, APPROX.	72 000	OHMS
TRANSCONDUCTANCE	1 000	μMHOS
PLATE CURRENT	0.7	MA.
AVERAGE DIODE CURRENT, EACH DIODE WITH 5.0 VOLTS DC APPLIED	18	MA.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.







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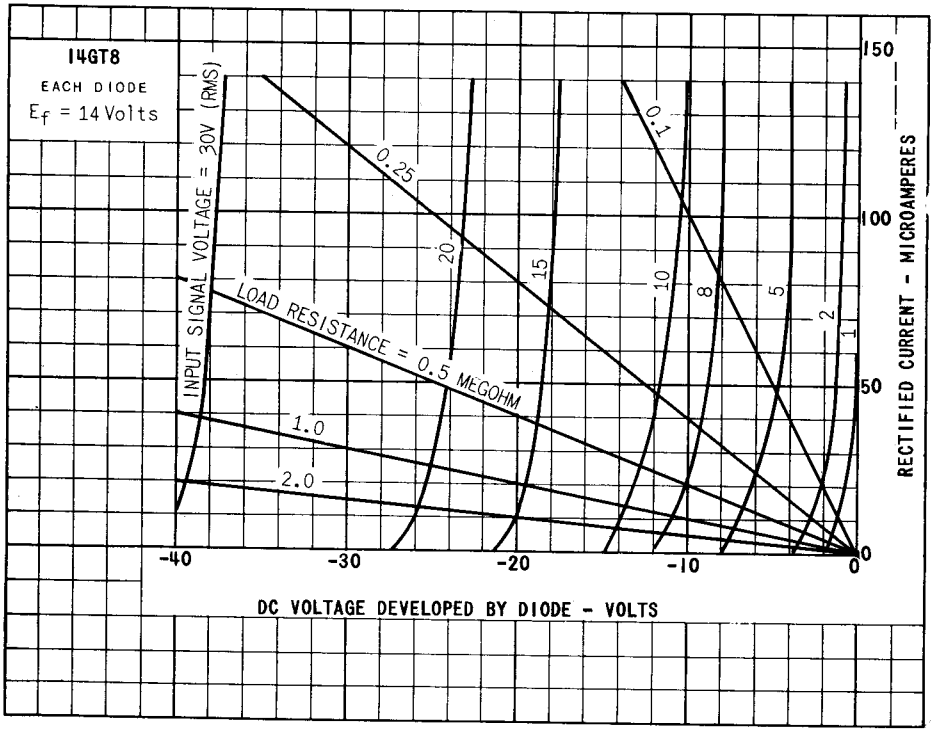
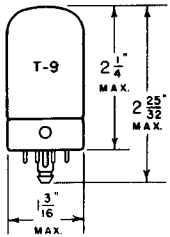
TENTATIVE DATA



TUNG-SOL

TRIPLE GRID

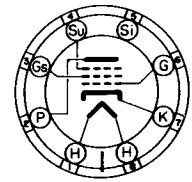
SEMI-REMOTE CUT-OFF AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.16 AMPERE
AC OR DC



8V

BOTTOM VIEW

GLASS BULB

LOCKING IN 8 PIN BASE

THE TUNG-SOL 14H7 IS A SEMI-REMOTE CUT-OFF AMPLIFIER. IT IS SUITABLE FOR USE WITH AVC AS RF AND IF AMPLIFIERS IN AC-DC OPERATED RECEIVERS USING 150 MA. HEATER TUBES.

RATINGS

NOMINAL HEATER VOLTAGE	14.0	VOLTS
NOMINAL HEATER CURRENT	0.16	AMPERE
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	150	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM SCREEN DISSIPATION	.5	WATT

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMPERE
PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	150	VOLTS
CONTROL GRID VOLTAGE	-1	-2.5	VOLTS
SUPPRESSOR AND INTERNAL SHIELD	0	0	VOLT
PLATE CURRENT	8.2	9.5	MA.
SCREEN CURRENT	3.3	3.5	MA.
PLATE RESISTANCE APPROX.	0.25	0.8	MEGOHM
TRANSCONDUCTANCE	3800	3800	μMHOS
CONTROL GRID VOLTAGE APPROX. FOR TRANSCONDUCTANCE = 35 μMHOS	-12	-19	VOLTS

DIRECT INTERELECTRODE CAPACITANCES[5]

INPUT: CONTROL GRID TO ALL OTHER ELECTRODES EXCEPT PLATE	8.0	μμf
OUTPUT: PLATE TO ALL OTHER ELECTRODES EXCEPT CONTROL GRID	7.0	μμf
CONTROL GRID TO PLATE	0.007 MAX.	μμf

[5] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

PLATE 1156-1

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TUNG-SOL

CATHODE RAY

THE 14HP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION RECEIVERS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	MAGNETIC DEFLECTION
EXTERNAL CONDUCTIVE COATING	GREY FILTER FACEPLATE
RECTANGULAR GLASS CONSTRUCTION	11 3/8" X 8 1/2" RASTER SIZE
LOW VOLTAGE ELECTROSTATIC FOCUS	EXTERNAL SINGLE FIELD ION TRAP MAGNET

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO + 500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	450	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #4 VOLTAGE [A]	-48 TO + 264	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE [B]	-28 TO -72	VOLTS
DC ION TRAP MAGNET STANDARD COIL #111 (APPROX.)	70	MA.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE #2 CURRENT OF 100 MICROAMPERES ON A 11 1/4" BY 8 3/8" PICTURE SIZE.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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PLATE 994-3

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TUNG-SOL

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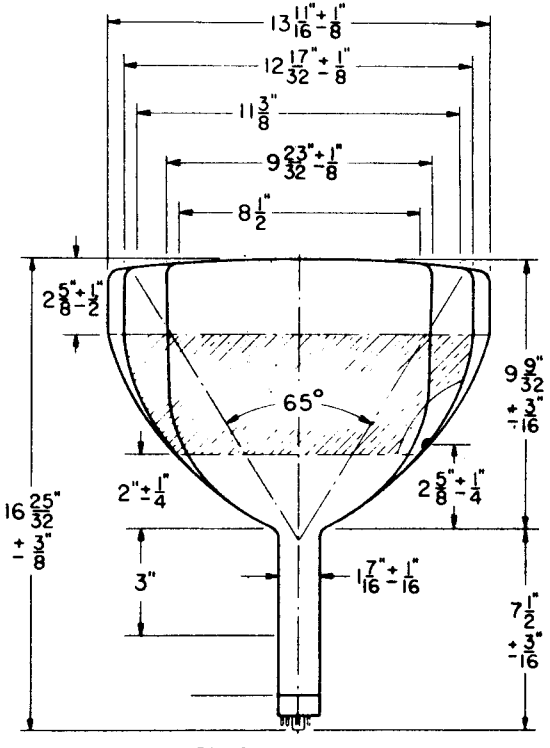
MECHANICAL DATA

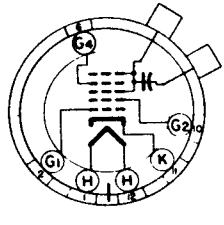
OVERALL LENGTH	16 25/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	13 11/16	INCHES
WIDTH	12 17/32 ± 1/8	INCHES
HEIGHT	9 23/32 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	11 3/8	INCHES
HEIGHT	8 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP

TUNG-SOL

PENTAGRID

PHYSICAL SPECIFICATIONS

EMITTER	UNIPOTENTIAL CATHODE	PIN CONNECTIONS			
BASE	LOCKING-IN - 8 PIN	PIN 1	HEATER	PIN 7	CATHODE
CAP	NONE	PIN 2	PLATE	PIN 8	HEATER
BULB	T-9	PIN 3	GRIDS #2 & #4		
MAXIMUM DIAMETER	1 3/16"	PIN 4	GRID #1		
MAXIMUM OVERALL LENGTH	2 25/32"	PIN 5	GRID #5	TOP CAP	NONE
MAXIMUM SEATED HEIGHT	2 1/4"	PIN 6	GRID #3		

RATINGS

HEATER OR FILAMENT VOLTAGE - NOMINAL (AC OR DC)	14.0	VOLTS
HEATER OR FILAMENT CURRENT - NOMINAL	0.16	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE (GRIDS #2 & #4)	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION		WATTS
MAXIMUM SCREEN DISSIPATION	1.0	WATT
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION	2.0	WATTS
MAXIMUM TOTAL CATHODE CURRENT	14	MA.
MINIMUM EXTERNAL SIGNAL GRID BIAS VOLTAGE* (GRID #3)	0	VOLTS
MAXIMUM ANODE-GRID VOLTAGE		VOLTS
MAXIMUM ANODE-GRID SUPPLY VOLTAGE		VOLTS
MAXIMUM ANODE-GRID DISSIPATION		WATT

* WITH SELF-EXCITATED OSCILLATOR

CAPACITANCES[$]

SIGNAL GRID TO MIXER PLATE (GRID #3 TO PLATE)	0.20 MAX.	μμf
SIGNAL GRID TO OSC. GRID (GRID #3 TO GRID #1)	0.20 MAX.	μμf
SIGNAL INPUT (GRID #3 TO ALL OTHER ELECTRODES)	9.0	μμf
OSC. GRID TO CATHODE (GRID #1 TO CATHODE)	2.2	μμf
OSC. GRID TO PLATE (GRID #1 TO PLATE)	0.15 MAX.	μμf
OSC. INPUT (GRID #1 TO ALL OTHER ELECTRODES)	7.0	μμf
OSC. GRID TO ALL OTHER ELECTRODES EXCEPT CATHODE	5.0	μμf
MIXER OUTPUT (PLATE TO ALL OTHER ELECTRODES)	9.0	μμf
CATHODE TO ALL OTHER ELECTRODES EXCEPT GRID #1	6.0	μμf

[$] WITH EXTERNAL SHIELD CONNECTED TO BASE SHELL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CONVERTER SERVICE

HEATER OR FILAMENT VOLTAGE	12.6	12.6	VOLTS
HEATER OR FILAMENT CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	-2	-2	VOLTS
ANODE-GRID VOLTAGE			VOLTS
PLATE CURRENT	3.3	3.5	MA.
SCREEN CURRENT	8.5	8.5	MA.
ANODE-GRID CURRENT			MA.
OSCILLATOR-GRID CURRENT	0.5	0.5	MA.
TOTAL CATHODE CURRENT	12.3	12.5	MA.
OSCILLATOR-GRID RESISTOR	20000	20000	OHMS
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
CONVERSION TRANSCONDUCTANCE	525	550	μMHOS
FOR CONTROL GRID VOLTAGE = -2 VOLTS			
CONVERSION TRANSCONDUCTANCE	275	300	μMHOS
FOR CONTROL GRID VOLTAGE = -6 VOLTS			
CONVERSION TRANSCONDUCTANCE (APPROX.)	2	2	μMHOS
FOR CONTROL GRID VOLTAGE = -35 VOLTS			
SUPPRESSOR GRID (GRID #5)	0	0	VOLTS

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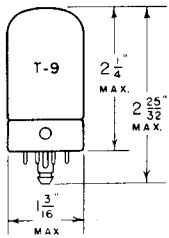
TUNG-SOL

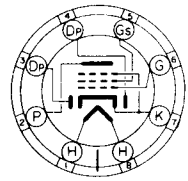
DUO-DIODE PENTODE AMPLIFIER



UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.15 AMPERE
AC OR DC



8AE-L-7

GLASS BULB

LOCKING-IN 8 PIN BASE

THE TUNG-SOL 14R7 COMBINES TWO DIODES AND A PENTODE IN A SINGLE BULB, USING A COMMON CATHODE. IT IS DESIGNED FOR SERVICE AS A DIODE DETECTOR, AVC RECTIFIER AND PENTODE AMPLIFIER IN AC-DC RECEIVERS USING 150 MA. HEATER TUBES.

RATINGS

NOMINAL HEATER VOLTAGE	14.0	VOLTS
NOMINAL HEATER CURRENT	0.16	AMPERE
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	250	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLT
MAXIMUM PLATE DISSIPATION	2.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.25	WATT
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.
MAXIMUM DIODE CURRENT PER PLATE FOR CONTINUOUS OPERATION	1.0	MA.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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DIRECT INTERELECTRODE CAPACITANCES[5]

INPUT: CONTROL GRID (G) TO ALL OTHER ELECTRODES EXCEPT PLATE (P)	5.6	μμf
OUTPUT: PLATE (P) TO ALL OTHER ELECTRODES EXCEPT CONTROL GRID (G)	5.3	μμf
CONTROL GRID (G) TO PLATE (P)	0.004 MAX.	μμf
DIODE #1 TO CONTROL GRID (G)	0.005 MAX.	μμf
DIODE #2 TO CONTROL GRID (G)	0.002 MAX.	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE UNIT – CLASS A1 AMPLIFIER

HEATER VOLTAGE	12.6	12.6	VOLTS
HEATER CURRENT	0.15	0.15	AMPERE
PLATE (P) VOLTAGE	100	250	VOLTS
SCREEN (G_5) VOLTAGE	100	100	VOLTS
CONTROL GRID (G) VOLTAGE	-1	-1	VOLTS
PLATE CURRENT	5.5	5.7	MA.
SCREEN CURRENT	2.2	2.1	MA.
PLATE RESISTANCE APPROX.	0.35	1.0	MEGOHM
TRANSCONDUCTANCE	3000	3200	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	-16	-20	VOLTS

[5] WITH EXTERNAL SHIELD CONNECTED TO CATHODE.

PLATE
1183-1

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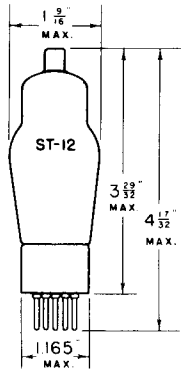


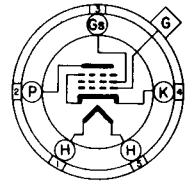
PENTODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.0 VOLTS 0.220 AMPERE
DC

GLASS BULB

SMALL 5 PIN BASE



5F

BOTTOM VIEW

THE TUNG-SOL 15 IS A SHARP CUT-OFF PENTODE WITH A HEATER OF LOW POWER DRAIN.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	67.5	135 MAX.	VOLTS
SCREEN VOLTAGE MAX.	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE	-1.5	-1.5	VOLTS
PLATE CURRENT	1.85	1.85	MA.
SCREEN CURRENT	0.30	0.30	MA.
PLATE RESISTANCE	0.63	0.8	MEGOHM
TRANSCONDUCTANCE	710	750	μMHOS
AMPLIFICATION FACTOR	450	600	

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	2.35	μμf
PLATE TO CATHODE	7.8	μμf
GRID TO PLATE S	0.01 MAX.	μμf

S WITH SHIELD

PLATE
662-2

NOV. 20
1939

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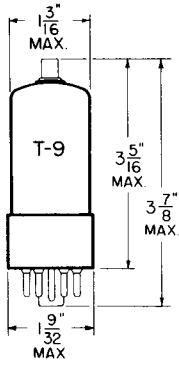
TUNG-SOL

TRIODE PENTODE

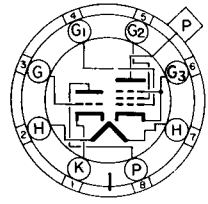


GLASS BULB
SKIRTED MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
15.0 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 8 PIN OCTAL
8GS

THE 15A8 IS A MEDIUM MU TRIODE AND BEAM PENTODE DESIGNED FOR USE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

	TRIODE	PENTODE	
GRID #1 TO PLATE	3.4	0.7	μμf
INPUT	2.6	11	μμf
OUTPUT	0.9	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
CLASS A_1 AMPLIFIER

	TRIODE	PENTODE	
HEATER VOLTAGE	15.0		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE		150	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	10	WATTS
MAXIMUM GRID #2 DISSIPATION		1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
FIXED BIAS	1.0	0.1	MEGOHM
SELF BIAS		0.5	MEGOHM
HEATER WARM-UP TIME[A]		11	SECONDS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

RATINGS -- CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[B]

	TRIODE AS OSCILLATOR	PENTODE AS TRIODE CONNECTED AMPLIFIER[C]	
HEATER VOLTAGE	15.0		VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)		1 200	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[D]	2.5	7.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	20	40	MA.
MAXIMUM PEAK CATHODE CURRENT	70	140	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	PENTODE TRIODE CONNECTED[C]	
HEATER VOLTAGE	15.0	15.0	15.0	15.0	VOLTS
HEATER CURRENT	0.6	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	90	250	110	225	VOLTS
GRID #1 VOLTAGE	0	-8	-7.5	-30	VOLTS
GRID #2 VOLTAGE			110		VOLTS
PLATE CURRENT	9	9	45	25	MA.
TRANSCONDUCTANCE	2 600	2 600	7 300	3 800	μMHOS
AMPLIFICATION FACTOR	20	20		6.0	
PLATE RESISTANCE (APPROX.)	7 700	7 700	13 000	1 600	OHMS
PLATE CURRENT AT E_c=-12.5V.		2.3			MA.
PLATE CURRENT AT E_c=-38V.				7.4	MA.
GRID #1 VOLTAGE FOR I_b=50μA	-6.3	-17			VOLTS
GRID #1 VOLTAGE FOR I_b=0.5 MA.				-46	VOLTS

[B] FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS: FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] GRID #2 CONNECTED TO PLATE.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN ABSENCE OF EXCITATION.

TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 5 PIN BASE

THE 15CP4 IS AN ELECTROMAGNETIC CATHODE RAY TUBE INTENDED FOR DIRECT VIEW TELEVISION USE. IT PROVIDES A BLACK AND WHITE PICTURE OF GOOD DEFINITION APPROXIMATELY 9" X 12". THIS TUBE USES MAGNETIC FOCUS AND DEFLECTION. IT REQUIRES THE USE OF AN EXTERNAL ION-TRAP MAGNET TO ELIMINATE ION-SPOT BLEMISH.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	50 DEGREES
ION-TRAP	MAGNETIC
BULB CONTACT	RECESSED SMALL CAVITY

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE	15 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHM

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→INDICATES A CHANGE OR ADDITION.

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TUNG-SOL

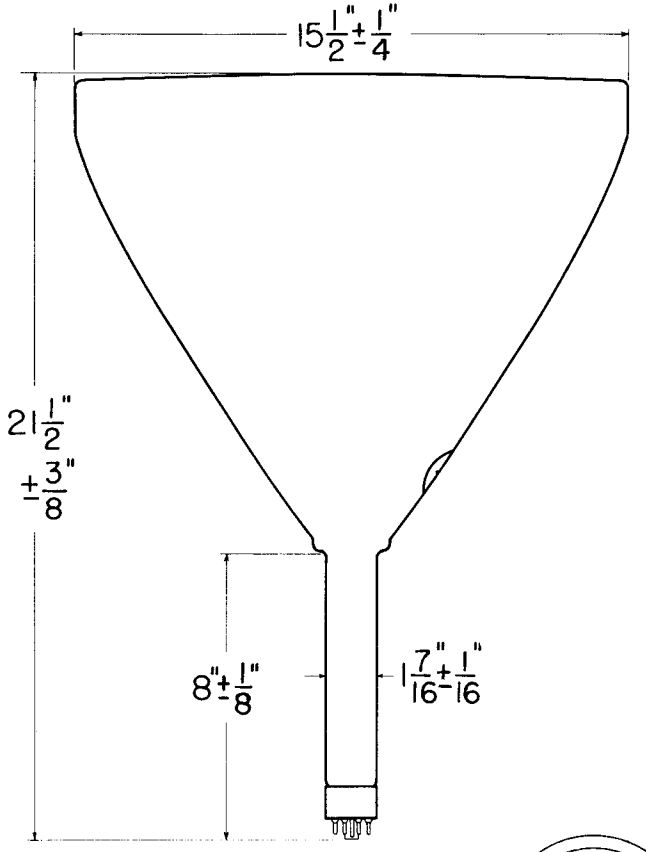
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE[A]	9 000 TO 15 000	VOLTS
GRID #2 VOLTAGE	250+	VOLTS
GRID #1 VOLTAGE	-45	VOLTS
DC FOCUSING COIL CURRENT (±15%)	115	MA.
DC ION-TRAP MAGNET CURRENT (APPROX.)	109	MA.

[A] BRILLIANCE AND DEFINTION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 9000 VOLTS.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING GRID #2 VOLTAGE. IN GENERAL, GRID #2 VOLTAGE SHOULD NOT BE LESS THAN 125 VOLTS.



1. HEATER
2. GRID #1
10. GRID #2
11. CATHODE
12. HEATER
CAP ANODE

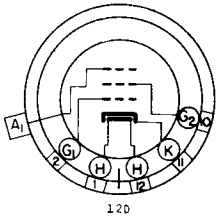


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PLATE 2532
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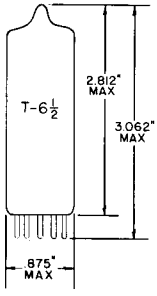
TUNG-SOL

PENTODE

MINIATURE TYPE



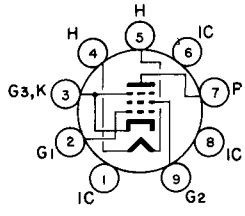
GLASS BULB

BASE E9-1
OUTLINE DRAWING
JEDEC 6-4

COATED UNIPOTENTIAL CATHODE

AUDIO OUTPUT TUBE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CV

THE 15CW5 IS AN A.F. OUTPUT PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN COMBINED PHASE INVERTER AND PUSH-PULL APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO ALL OTHER ELEMENTS EXCEPT PLATE	11.8	pf
PLATE TO ALL OTHER ELEMENTS EXCEPT GRID #1	6.0	pf
PLATE TO GRID #1 (MAX.)	0.6	pf
GRID #1 TO HEATER (MAX.)	0.25	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	15 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		300±20	MA.

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	250	VOLTS
PLATE VOLTAGE WITHOUT PLATE CURRENT	550	VOLTS
PLATE DISSIPATION	12	WATTS
GRID #2 VOLTAGE	200	VOLTS
GRID #2 VOLTAGE WITHOUT CURRENT	550	VOLTS
GRID #2 DISSIPATION	1.75	WATTS
GRID #2 PEAK DISSIPATION	6	WATTS
CATHODE CURRENT	100	MAMPS
GRID #1 CIRCUIT RESISTANCE WITH AUTOMATIC BIAS	1	MEGOHM
VOLTAGE BETWEEN HEATER AND CATHODE	200	VOLTS
PEAK VOLTAGE BETWEEN HEATER AND CATHODE (CATHODE POSITIVE WITH RESPECT TO HEATER)[A]	300	VOLTS
CIRCUIT RESISTANCE BETWEEN CATHODE AND HEATER	20 000	OHMS

[A] FOR SINGLE-ENDED PUSH-PULL APPLICATIONS: DC COMPONENT MAX. 150 VOLTS.

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TYPICAL CHARACTERISTICS

PLATE VOLTAGE	100	170	200	VOLTS
GRID #2 VOLTAGE	100	170	---	VOLTS
GRID #2 SUPPLY VOLTAGE	---	---	200	VOLTS
GRID #2 SERIES RESISTOR (NOT BYPASSED)	---	---	470	OHMS
GRID #1 BIAS	-6.7	-12.5	-17.3	VOLTS
PLATE CURRENT	43	70	60	MAMPS
GRID #2 CURRENT	3.0	5.0	4.1	MAMPS
TRANSCONDUCTANCE	9 000	10 000	8 800	μMHOS
PLATE RESISTANCE	23 000	23 000	28 000	OHMS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1	8	8	8	

OPERATING CHARACTERISTICS

CLASS A

ONE TUBE

PLATE VOLTAGE	100	170	200	VOLTS
GRID #2 VOLTAGE	100	170	---	VOLTS
GRID #2 SUPPLY VOLTAGE	---	---	200	VOLTS
GRID #2 SERIES RESISTOR (NOT BYPASSED)	---	---	470	OHMS
GRID #1 BIAS	-6.7	-12.5	-17.3	VOLTS
PLATE LOAD RESISTANCE	2400	2400	2400	OHMS
INPUT AF GRID #1 VOLTAGE, RMS	4.3	7.0	7.8	VOLTS
ZERO-SIGNAL PLATE CURRENT	43	70	60	MAMPS
MAX.-SIGNAL PLATE CURRENT	43	70	62.5	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	3.0	5.0	4.1	MAMPS
MAX.-SIGNAL GRID #2 CURRENT	11	22	12.5	MAMPS
TOTAL HARMONIC DISTORTION	10	10	10	PERCENT
POWER OUTPUT	1.9	5.6	5.2	WATTS

OPERATING CHARACTERISTICS

TWO TUBES

	CLASS B PUSH PULL		CLASS AB PUSH PULL		
PLATE VOLTAGE	100	170	100	170	VOLTS
GRID #2 VOLTAGE	100	170	100	170	VOLTS
GRID #1 BIAS	-11.4	-20.5			OHMS
COMMON CATHODE RESISTOR			135	120	OHMS
LOAD RESISTANCE PLATE TO PLATE	3500	3500	3500	3500	OHMS
INPUT AF GRID #1 VOLTAGE, RMS	7.9	14.6	7.0	13.1	VOLTS
ZERO-SIGNAL PLATE CURRENT	2x10	2x15	2x29	2x56.5	MAMPS
MAX.-SIGNAL PLATE CURRENT	2x30.5	2x57.5	2x31	2x57.5	MAMPS
ZERO-SIGNAL GRID #2 CURRENT	2x0.55	2x0.7	2x1.6	2x3.0	MAMPS
MAX.-SIGNAL GRID #2 CURRENT	2x7.1	2x20.5	2x7,0	2x20.5	MAMPS
TOTAL HARMONIC DISTORTION	2.8	4.8	3.0	4.5	PERCENT
POWER OUTPUT	3.7	13.5	3.6	13.0	WATTS

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TUNG-SOL

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OPERATING CHARACTERISTICS IN TRIODE CONNECTION

CLASS A

ONE TUBE

(GRID #2 CONNECTED TO PLATE)

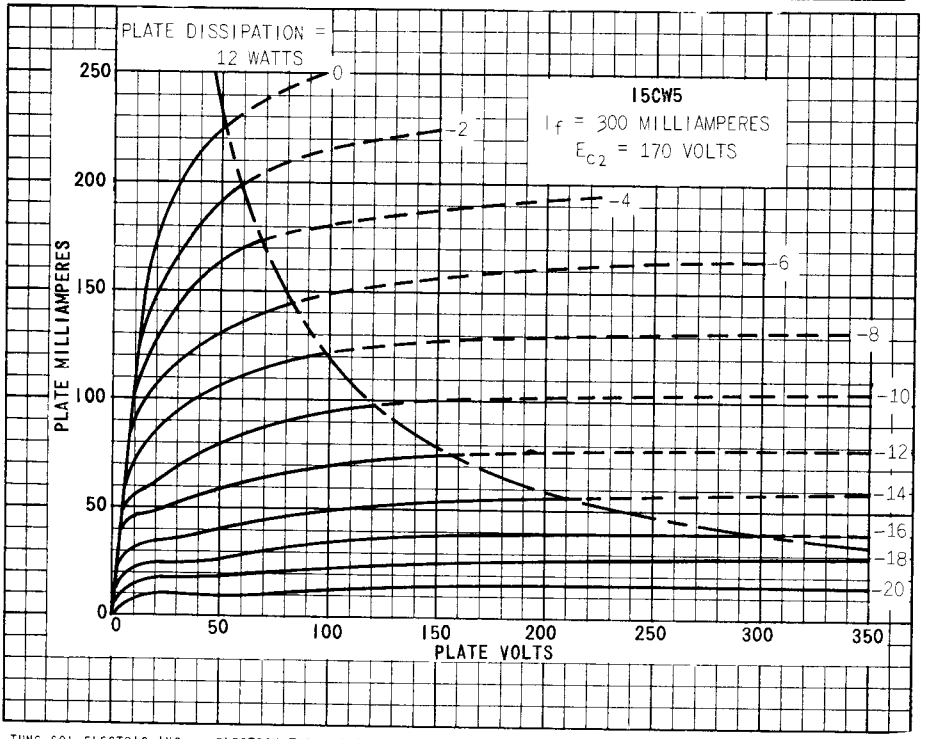
PLATE VOLTAGE	100	170	VOLTS
GRID BIAS	-8.0	-15.1	VOLTS
PLATE LOAD RESISTANCE	1200	1200	OHMS
INPUT AF GRID VOLTAGE, RMS	5.7	10.8	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	50	MAMPS
MAX.-SIGNAL PLATE CURRENT	36.1	62	MAMPS
TOTAL HARMONIC DISTORTION	10	10	PERCENTS
POWER OUTPUT	0.52	2.1	WATTS

CLASS AB PUSH PULL

TWO TUBES

(GRID #2 CONNECTED TO PLATE)

PLATE VOLTAGE	100	170	VOLTS
CATHODE RESISTOR	270	270	OHMS
LOAD RESISTANCE, PLATE TO PLATE	3500	3500	OHMS
INPUT AF GRID VOLTAGE, RMS	7.3	13.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	2x18	2x32.5	MAMPS
MAX.-SIGNAL PLATE CURRENT	2x20	2x36	MAMPS
TOTAL HARMONIC DISTORTION	3.2	3.8	PERCENTS
OUTPUT POWER	1.0	3.9	WATTS



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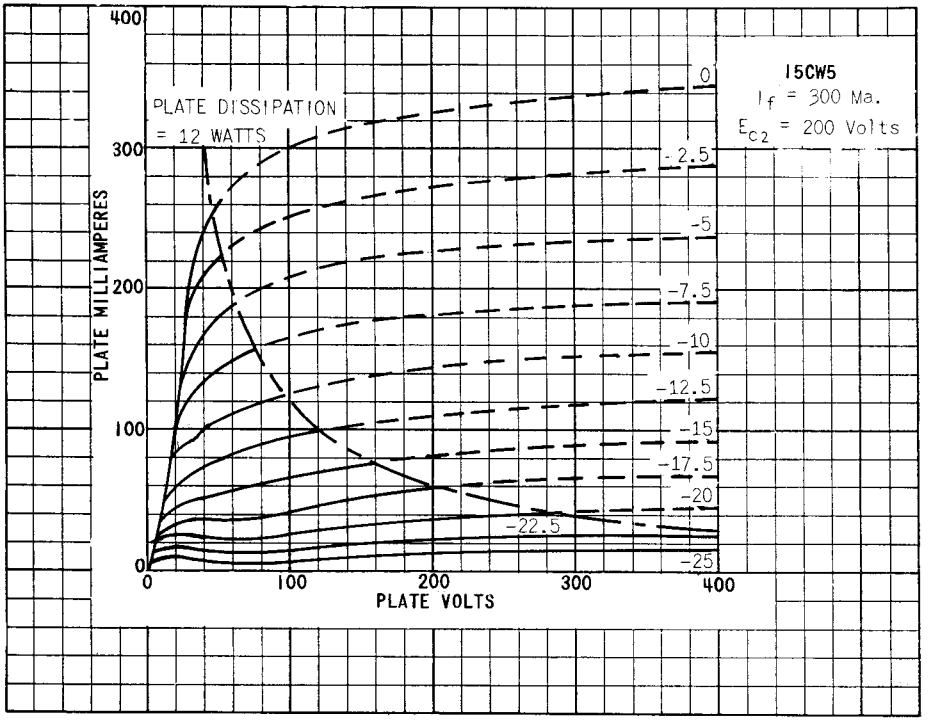
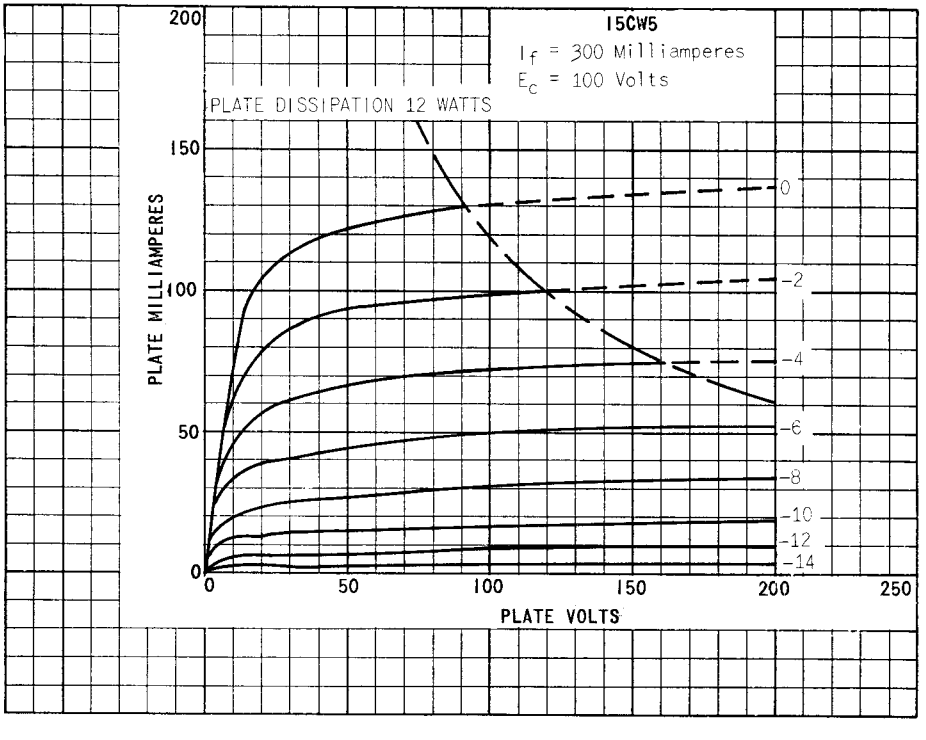
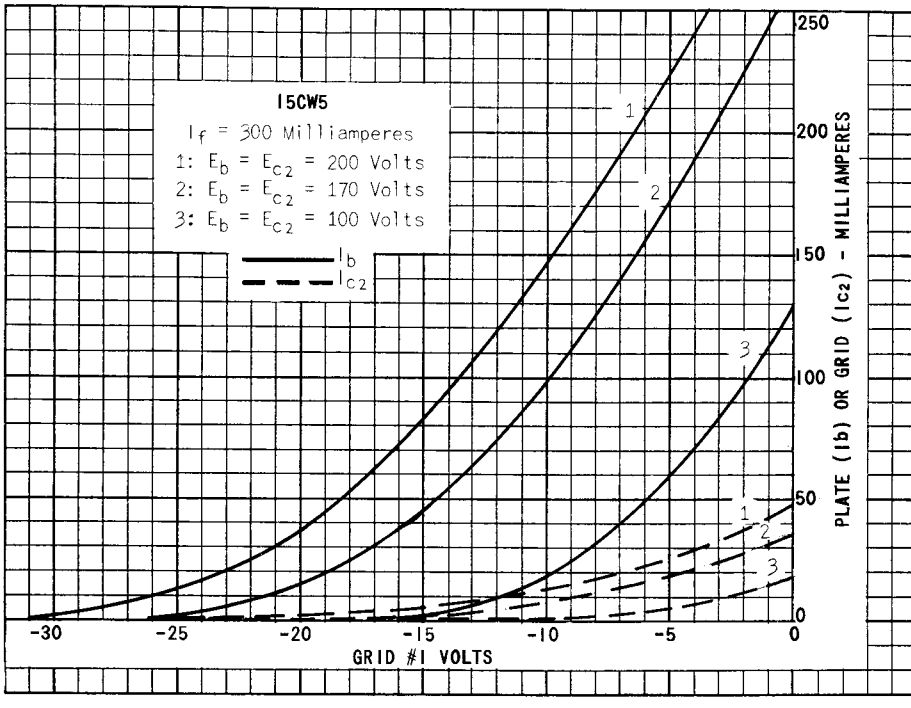

15CW5
I_f = 300 Ma.
E_{c2} = 200 Volts
PLATE DISSIPATION
= 12 WATTS
PLATE MILLIAMPERES
PLATE VOLTS
0
-2.5
-5
-7.5
-10
-12.5
-15
-17.5
-20
-22.5
-25
400
300
200
100
0
0
100
200
300
400


15CW5
I_f = 300 Milliamperes
E_c = 100 Volts
PLATE DISSIPATION 12 WATTS
PLATE MILLIAMPERES
PLATE VOLTS
0
-2
-4
-6
-8
-10
-12
-14
200
150
100
50
0
0
50
100
150
200
250



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TUNG-SOL

CATHODE RAY

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

SMALL SHELL DUODECAL 5 PIN BASE

THE 15DP4 IS A DIRECTLY VIEWED PICTURE TUBE INTENDED FOR USE IN TELEVISION RECEIVERS. THE TUBE UTILIZES MAGNETIC FOCUS AND DEFLECTION TO PROVIDE 9 1/2" X 12 3/4" PICTURES WITH HIGH BRILLIANCE AND DEFINITION. THE ELECTRON GUN DESIGN UTILIZES A BENT ELECTRODE STRUCTURE TO BE USED WITH A SINGLE EXTERNAL MAGNETIC FIELD FOR THE ELIMINATION OF ION SPOT BLEMISHES.

DESCRIPTION

FLUORESCENCE AND PHOSPHORESCENCE	WHITE
PERSISTENCE	MEDIUM
DEFLECTING AND FOCUSING METHOD	MAGNETIC
DEFLECTION ANGLE (APPROX.)	57 DEGREES
BULB CONTACT	RECESSED SMALL BALL CAP

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO ALL OTHER ELECTRODES	7	μμf
CATHODE TO ALL OTHER ELECTRODES	5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM ANODE VOLTAGE (A+G3)	15 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	125	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
POSITIVE PEAK VOLTAGE	2	VOLTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING EQUIPMENT WARM UP PERIOD NOT EXCEEDING 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

ANODE VOLTAGE	13 000	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE (VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT)	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	146	MA.
DC ION-TRAP MAGNET CURRENT (APPROX.)	105	MA.

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DEC. 1 1949

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15DP4

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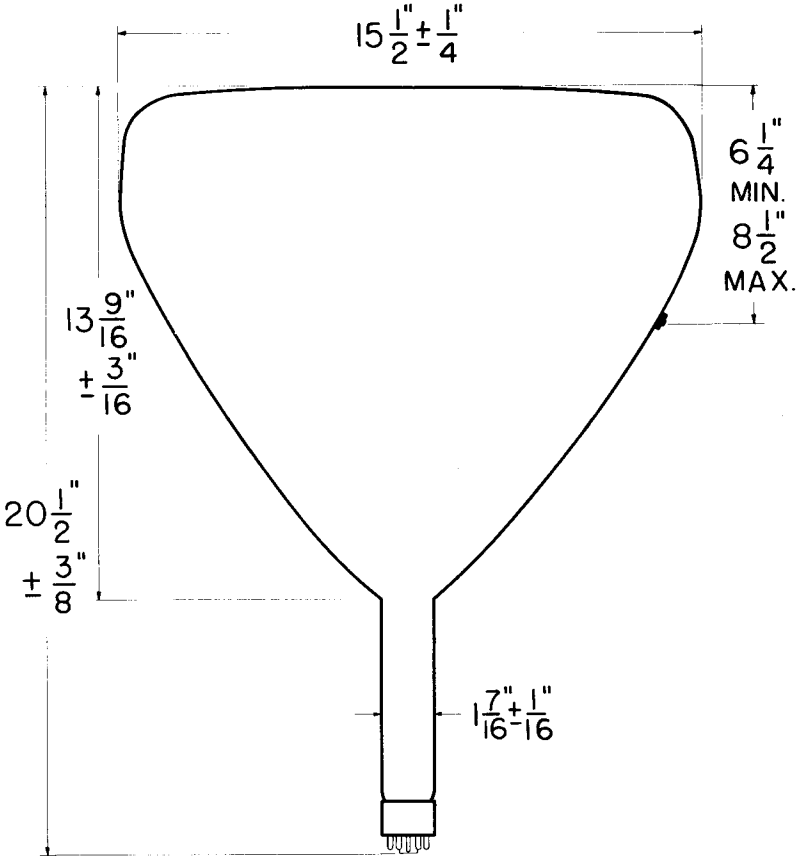
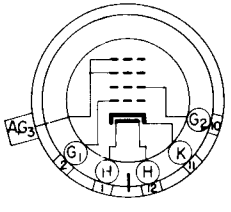


1. HEATER
2. GRID #1
10. GRID #2
11. CATHODE
12. HEATER
CAP ANODE, GRID #3



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DEC. 1 1949

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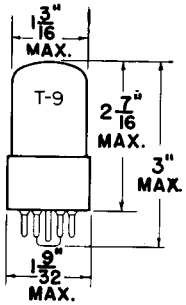
TUNG-SOL

DOUBLE-TRIODE

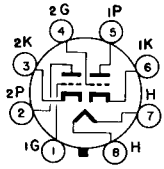


GLASS BULB
INTERMEDIATE SHELL
8 PIN OCTAL 88-6
OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

HEATER
14.8 VOLTS[D] 0.45±0.03 AMP.[E]
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 15EA7 IS A DISSIMILAR DOUBLE-TRIODE DESIGNED FOR USE AS A COMBINED VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER IN TELEVISION RECEIVERS. SECTION ONE, A HIGH-MU TRIODE, IS INTENDED FOR SERVICE AS AN OSCILLATOR; SECTION TWO, A LOW-MU, HIGH PERVEANCE TRIODE, IS INTENDED FOR SERVICE AS AN AMPLIFIER. EXCEPT FOR HEATER RATINGS, AND HEATER WARM-UP TIME, THE 15EA7 IS IDENTICAL TO THE 6EA7.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

	SECTION 1	SECTION 2	
GRID TO PLATE	4.0	8.0	μμf
INPUT	2.2	6.0	μμf
OUTPUT	0.6	1.3	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	VERTICAL[A] OSCILLATOR SERVICE (SECTION 1)	VERTICAL[A] DEFLECTION AMPLIFIER (SECTION 2)	
HEATER VOLTAGE	14.8		VOLTS
MAXIMUM ALLOWABLE HEATER VOLTAGE	5.7 to 6.9		VOLTS
MAXIMUM DC PLATE VOLTAGE	350	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	10[B]	WATTS
MAXIMUM DC CATHODE CURRENT	---	50	MA.
MAXIMUM PEAK CATHODE CURRENT	---	175	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
WITH FIXED BIAS	1.0	1.0	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME*	11		SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

	SECTION 1 (OSCILLATOR)	SECTION 2 (AMPLIFIER)		
PLATE VOLTAGE	250	60	175	VOLTS
GRID VOLTAGE	-3.0	0[C]	-25	VOLTS
AMPLIFICATION FACTOR	66	---	5.5	
PLATE RESISTANCE (APPROX.)	30 000	---	920	OHMS
TRANSCONDUCTANCE	2 200	---	6 000	μMHOS
PLATE CURRENT	2.0	100	40	MA.
GRID VOLTAGE (APPROX.) I_b = 20 μAMPS.	5.3	---	---	VOLTS
GRID VOLTAGE (APPROX.) I_b = 200 μAMPS.	---	---	-45	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B]IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[C]APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

*THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VALUE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE EQUAL TO 3 TIMES THE RATED HEATER VOLTAGE DIVIDED BY THE RATED HEATER CURRENT.

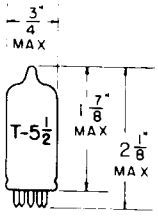
[D]HEATER VOLTAGE AT BOGEY HEATER CURRENT.

[E]FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL DESIGN THE EQUIPMENT SO THAT HEATER CURRENT IS CENTERED AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

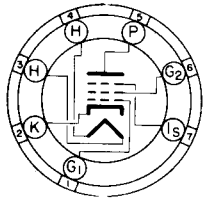
COATED UNIPOTENTIAL CATHODE

HEATER

15.0 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CM

THE 15EW6 IS A SHARP CUTOFF PENTODE IN THE 7-PIN MINIATURE CONSTRUCTION AND HAS BEEN DESIGNED FOR INTERMEDIATE AMPLIFIER SERVICE IN TELEVISION RECEIVERS. EXCEPT FOR HEATER RATINGS, THE 15EW6 IS IDENTICAL TO THE 6EW6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.03	0.04	μμf
INPUT	10.0	10.0	μμf
OUTPUT	3.4	2.4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM VALUES

HEATER CURRENT[B]	0.150±0.009	AMP.
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM SCREEN-SUPPLY VOLTAGE	330	VOLTS
MAXIMUM SCREEN VOLTAGE	SEE SCREEN RATING CHART	
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	WATTS
MAXIMUM SCREEN DISSIPATION	0.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH EXTERNAL SHIELD (EIA 316) CONNECTED TO CATHODE.

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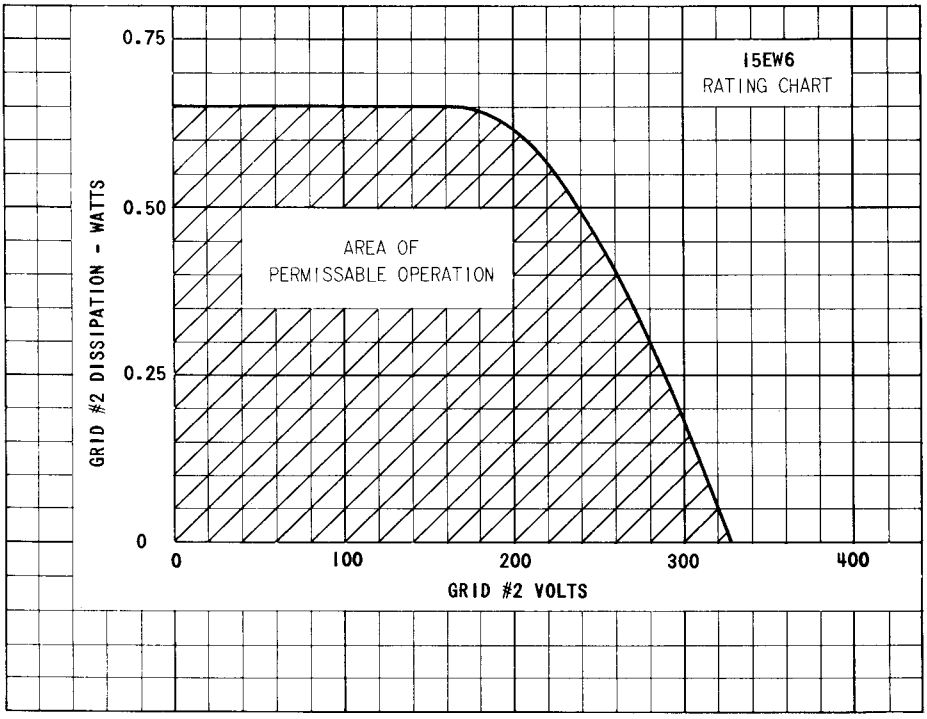
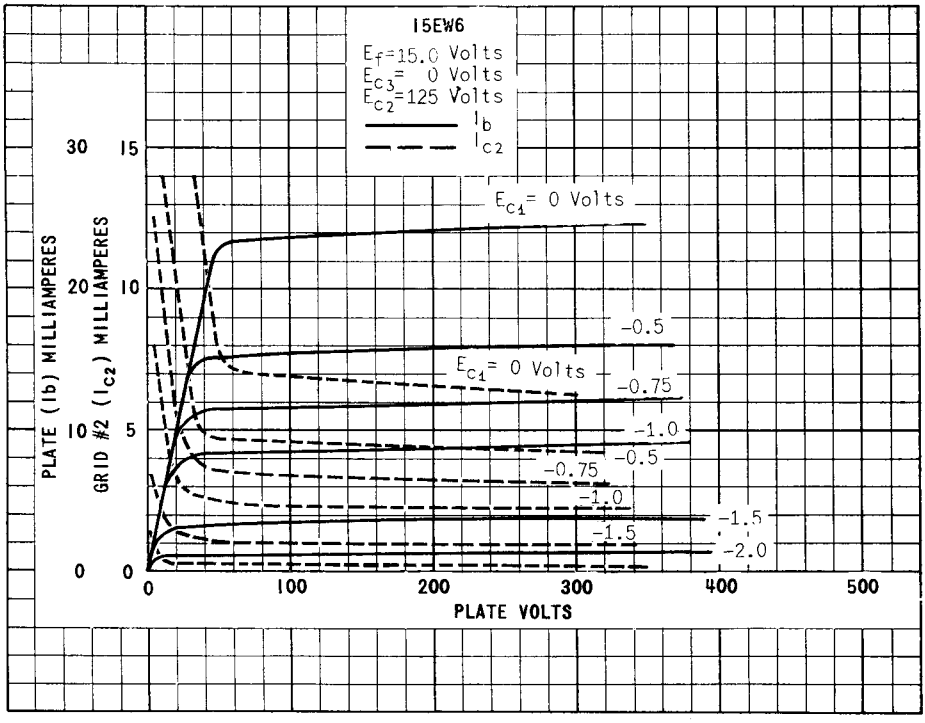
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	125	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	125	VOLTS
CATHODE-BIAS RESISTOR	56	OHMS
PLATE RESISTANCE (APPROX.)	0.2	MEGOHMS
TRANSCONDUCTANCE	14 000	μMHOS
PLATE CURRENT	11	MA.
SCREEN CURRENT	3.2	MA.
GRID #1 VOLTAGE (APPROX.) I_b= 20 μAMPS.	-3.5	VOLTS

[B]THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE.





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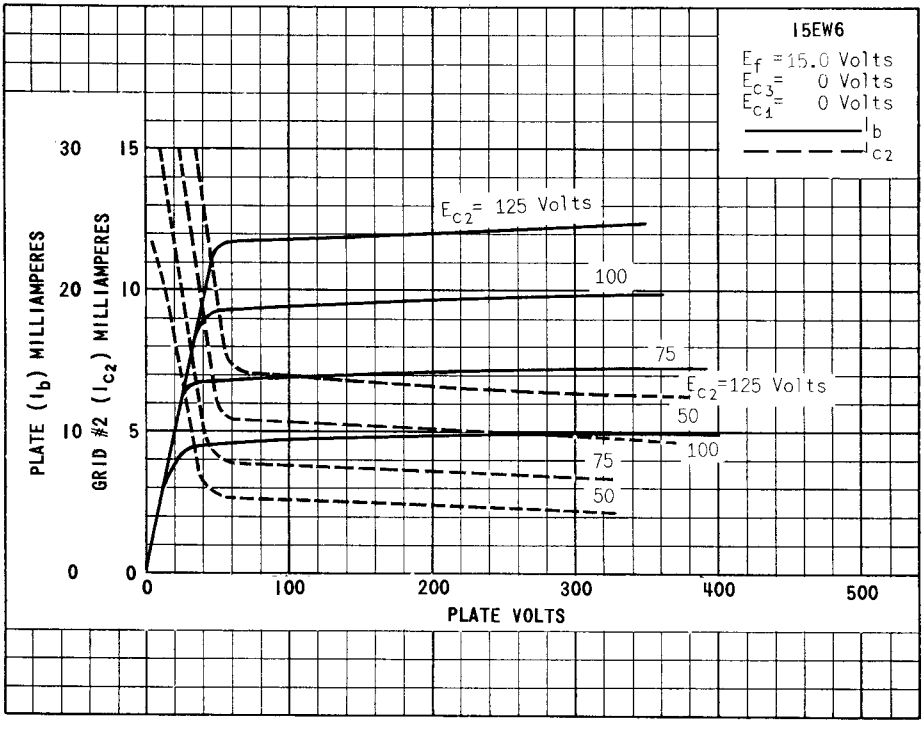
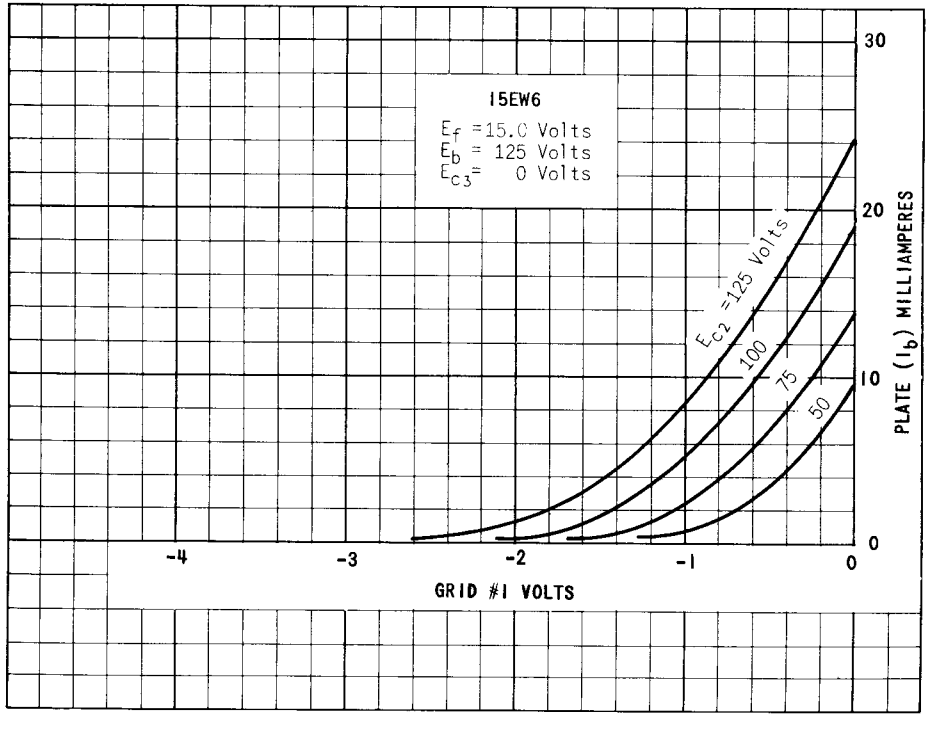
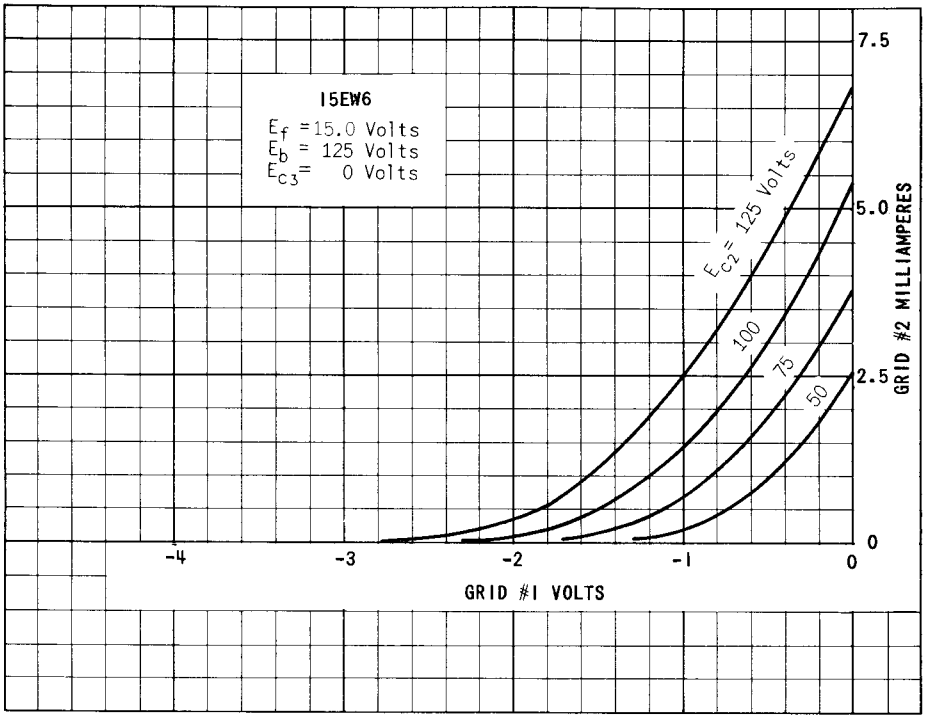
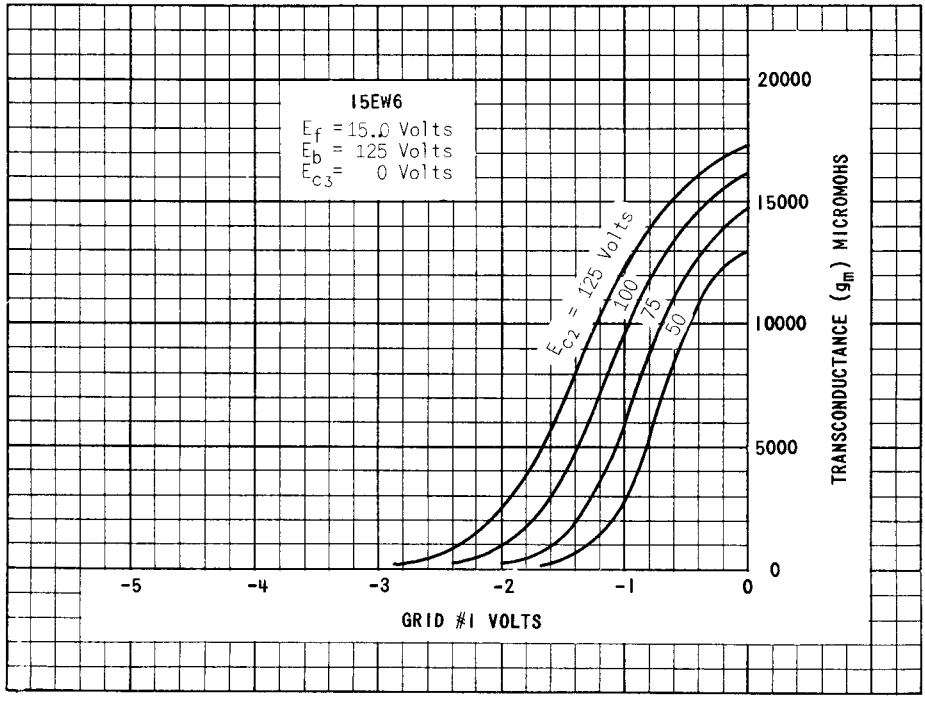
15EW6


15EW6
E_f =15.0 Volts
E_{c3}= 0 Volts
E_{c1}= 0 Volts
I_b
I_{c2}
E_{c2}= 125 Volts
100
75
50
E_{c2}=125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
0
5
10
15
20
30


15EW6
E_f =15.0 Volts
E_b = 125 Volts
E_{c3}= 0 Volts
E_{c2} =125 Volts
100
75
50
PLATE (I_b) MILLIAMPERES
GRID #1 VOLTS
-4
-3
-2
-1
0
0
10
20
30





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TUNG-SOL

CATHODE RAY

THE 16ABP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**13 1/2" X 10 1/2" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.) DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

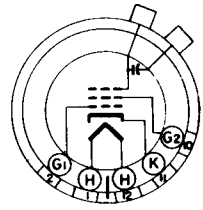
MECHANICAL DATA

OVERALL LENGTH	18 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8 ± 1/8	INCHES
WIDTH	14 3/4 ± 1/8	INCHES
HEIGHT	11 1/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	14 7/8	INCHES
WIDTH	13 1/2	INCHES
HEIGHT	10 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

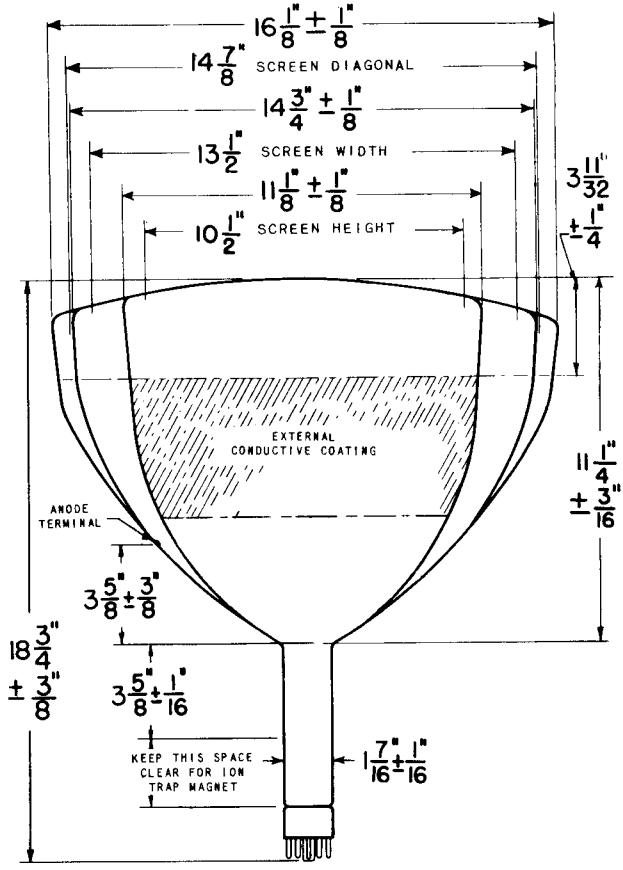
DC ANODE, GRID #3, GRID #5 VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

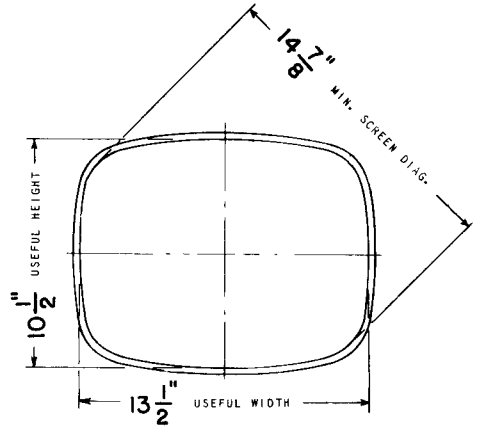
[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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CATHODE RAY

THE 16ACP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS **MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE **ROUND GLASS CONSTRUCTION**
EXTERNAL CONDUCTIVE COATING

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	60	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

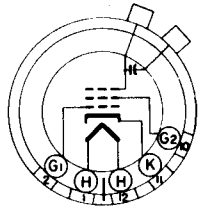
MECHANICAL DATA

OVERALL LENGTH	20 7/8 ± 1/4	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	15 1/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

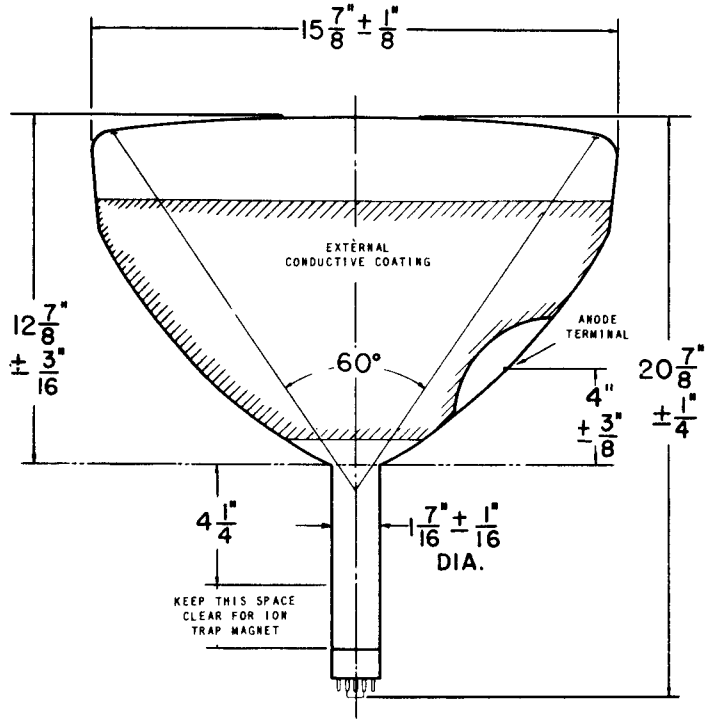
ANODE VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -68	VOLTS
DC ION TRAP CURRENT (APPROX.)	120	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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CATHODE RAY

THE 16AEP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**10 1/8" X 13 1/2" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

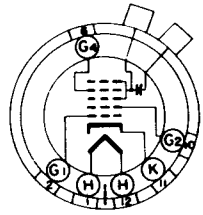
MECHANICAL DATA

OVERALL LENGTH	18 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8 ± 1/8	INCHES
WIDTH	14 3/4 ± 1/8	INCHES
HEIGHT	11 1/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	13 1/2	INCHES
HEIGHT	10 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M
BULB CONTACT ALIGNMENT		

*J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.
DC GRID #4 VOLTAGE	-64 TO +350	VOLTS

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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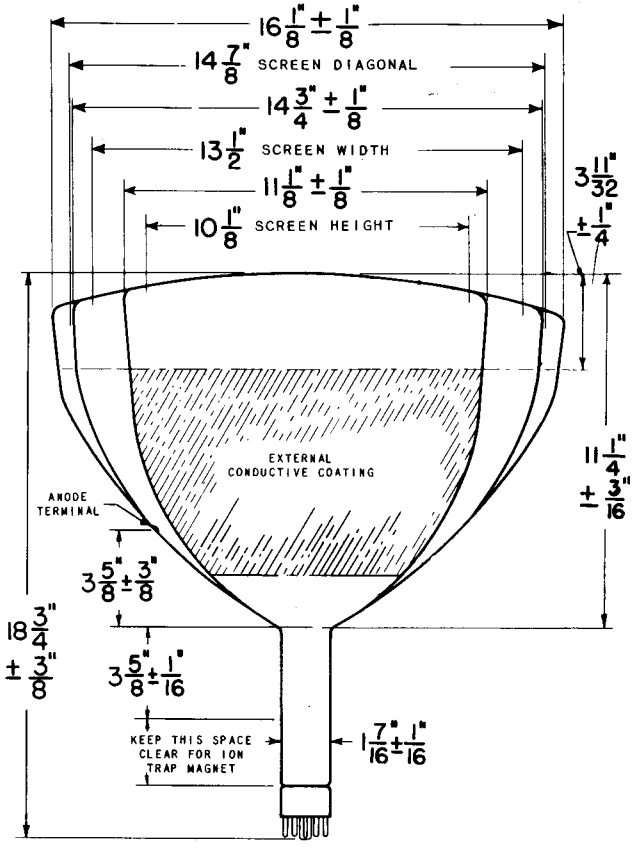

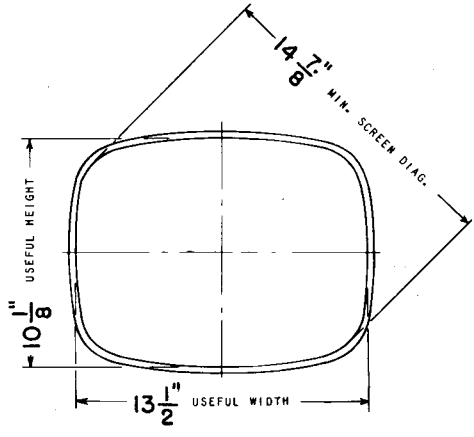

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CATHODE RAY

THE 16AP4 AND 16AP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE FROSTED GREY FILTER FACEPLATE USED ON THE 16AP4A. THEIR COMMON FEATURES INCLUDE: ←

UNIPOTENTIAL CATHODE — ROUND METAL CONSTRUCTION
MAGNETIC FOCUS & DEFLECTION — EXTERNAL DOUBLE FIELD ION TRAP
10" X 13 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	53	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.0	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.) **16AP4A**	66	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE[A]	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[B]	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[D] (APPROX.)	85 ± 20%	MA.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 9000 VOLTS.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 10" BY 13 1/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

→ INDICATES A CHANGE.

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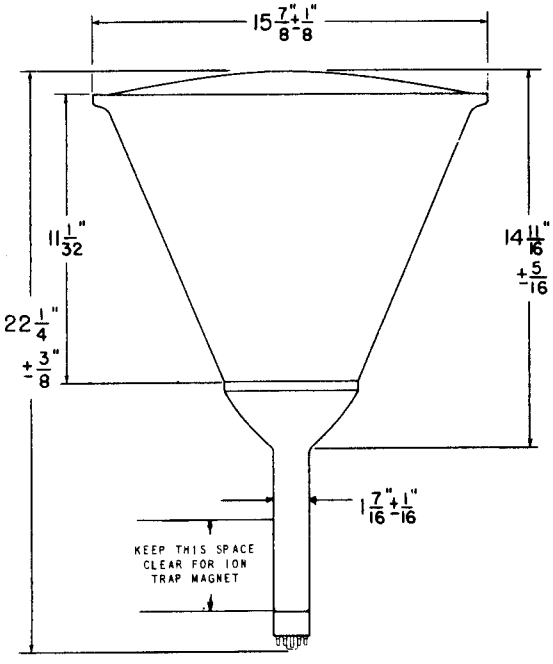
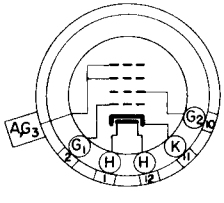
MECHANICAL DATA

OVERALL LENGTH	22 1/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 3/8	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
ANODE
GRID NO. 3

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CATHODE RAY

THE 16CP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ROUND GLASS CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION — **DOUBLE FIELD ION TRAP MAGNET**
10 1/4" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	52	DEGREES

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM

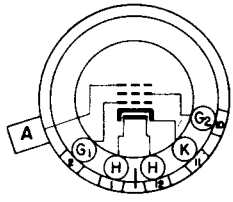
MECHANICAL DATA

OVERALL LENGTH	21 1/2 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ±1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	15 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	110	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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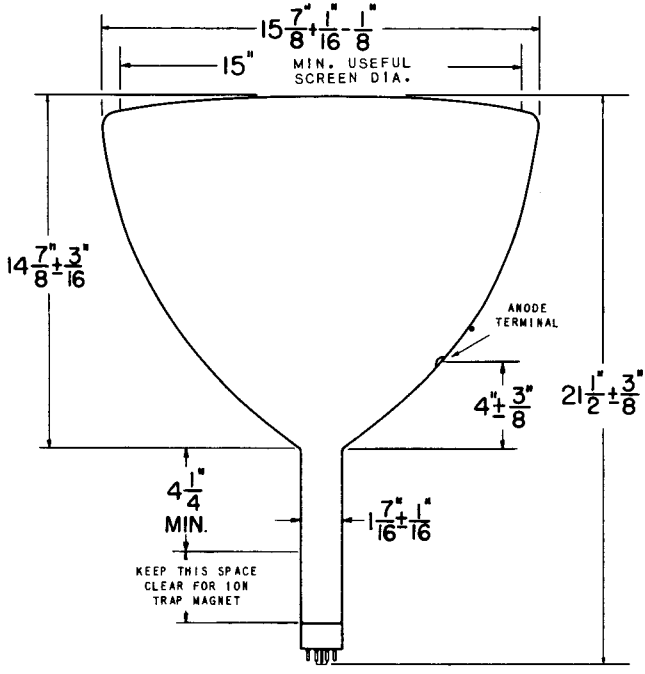

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CATHODE RAY

THE 16DP4 AND 16DP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTION:*

16DP4 - CLEAR GLASS FACEPLATE *16DP4A - GREY FILTER FACEPLATE*

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE **ROUND GLASS CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION **EXTERNAL DOUBLE FIELD ION TRAP**
10 1/4" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	60	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.) **16DP4A**	70	PERCENT

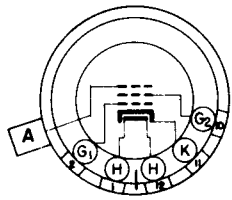
MECHANICAL DATA

OVERALL LENGTH	20 3/4 ± 1/4	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2



BOTTOM VIEW

PIN 11 - CATHODE
PIN 12 - HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	15 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[A]	12 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[B]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[C]	115 ± 15%	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	109	MA.

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 9,000 VOLTS.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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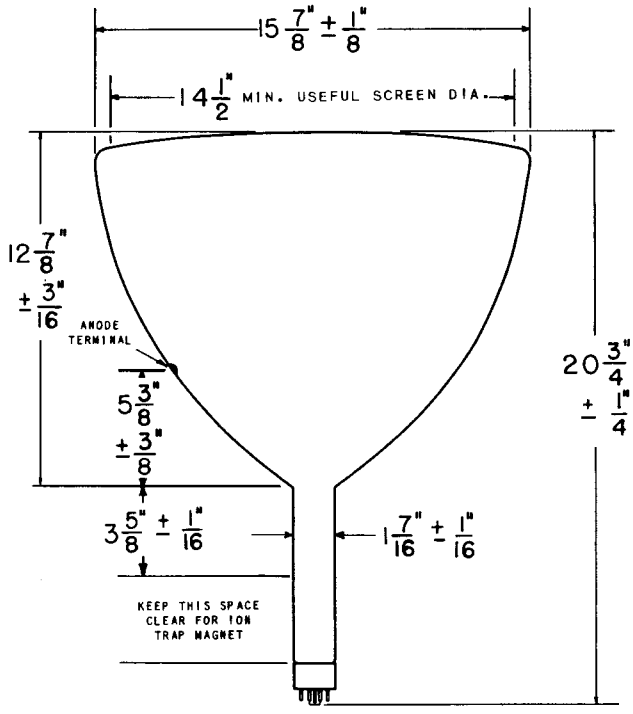

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CATHODE RAY

THE 16EP4, 16EP4A AND 16EP4B ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 16EP4A AND 16EP4B HAVE GREY FILTER FACEPLATES. THE FACEPLATE OF THE 16EP4B HAS ALSO BEEN TREATED TO REDUCE SPECULAR REFLECTION. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ROUND METAL CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION — **EXTERNAL SINGLE FIELD ION TRAP**
10" X 13 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	60	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

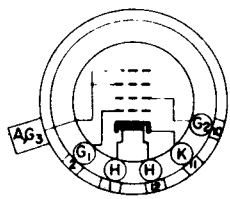
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.) **16EP4A-B**	66	PERCENT
SPECULAR REFLECTION OF AMBIENT LIGHT **16EP4B**	2.5	PERCENT

MECHANICAL DATA

OVERALL LENGTH	19 5/16 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 3/8	INCHES
BULB CONTACT	METAL CONE LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
ANODE
GRID NO. 3

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	−33 TO −77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	105 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	80 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 10" BY 13 1/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 2.75 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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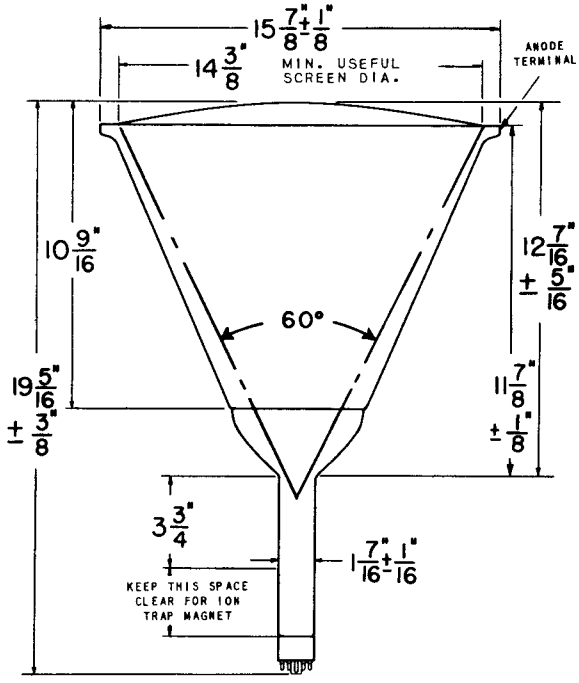

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CATHODE RAY

THE 16FP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE **ROUND GLASS CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION **EXTERNAL SINGLE FIELD ION TRAP**
10 1/4" X 13 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	62	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	7	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

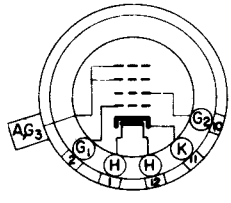
MECHANICAL DATA

OVERALL LENGTH	20 1/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	16 1/8 ± 1/4	INCHES
MINIMUM USEFUL SCREEN DIAMETER	15	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
WIDTH	13 1/2	INCHES
HEIGHT	10 1/4	INCHES
BULB CONTACT	RECESSED SMALL BALL CAP	J1-22
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-22 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	146	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	105	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #106, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 35 FOOT LAMBERTS ON A 10 1/4" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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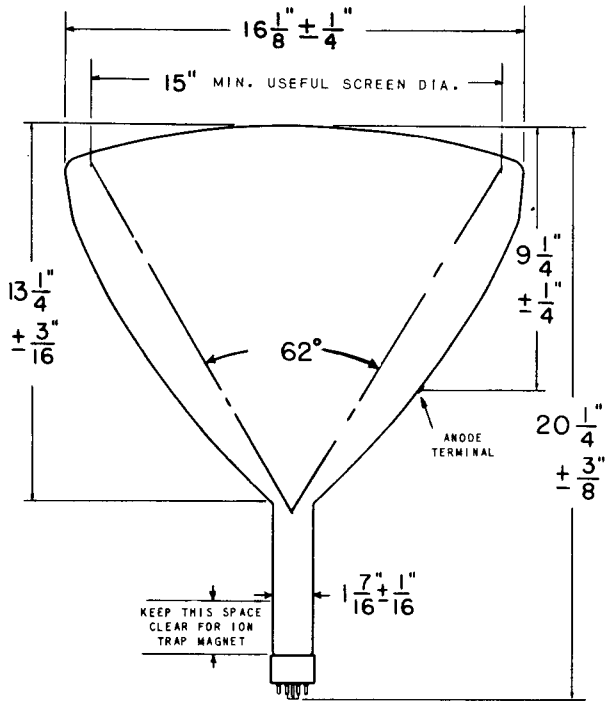

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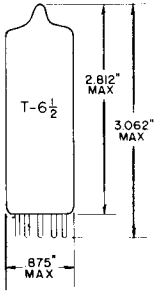
PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-4

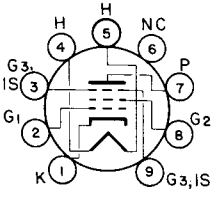
COATED UNIPOTENTIAL CATHODE

AUDIO AMPLIFIER

FOR

HEATER SERIES STRING OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9GK

THE 16GK6 IS A POWER PENTODE AUDIO AMPLIFIER IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF HIGH QUALITY AUDIO AMPLIFIERS. EXCEPT FOR HEATER RATINGS, THE 16GK6 IS IDENTICAL TO THE 6GK6.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE: G1 TO P (MAX.)	.14	pf
INPUT: G1 TO ALL	10.0	pf
OUTPUT: P TO ALL	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.0 VOLTS	300	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		300±20	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		100	VOLTS
HEATER WARM-UP TIME[A]		11	SECONDS

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330[B]	VOLTS
PLATE SUPPLY VOLTAGE	605	VOLTS
GRID #2 VOLTAGE	330	VOLTS
GRID #2 SUPPLY VOLTAGE	605	VOLTS
NEGATIVE GRID #1 VOLTAGE	100	VOLTS
PLATE DISSIPATION	13.2[B]	WATTS
GRID #2 DISSIPATION (AVERAGE)	2	WATTS
GRID #2 DISSIPATION, PEAK	4	WATTS
CATHODE CURRENT (AVERAGE)	65	MA.
GRID #1 VOLTAGE FOR GRID CURRENT STARTING POINT WITH I_{c1} = 0.3 μA.	-1.3	VOLTS
GRID CIRCUIT RESISTANCE:		
FIXED BIAS	0.3	MEGOHM
SELF BIAS	1.0	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	250	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	-7.3	VOLTS
CATHODE BIAS RESISTOR	135	OHMS
PLATE RESISTANCE (APPROX.)	38000	OHMS
TRANSCONDUCTANCE	11300	μMHOS
PLATE CURRENT ZERO SIGNAL	48	MA.
GRID #2 CURRENT, ZERO SIGNAL	5.5	MA.
LOAD RESISTANCE	5200	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	5.7	WATTS
AMPLIFICATION FACTOR OF GRID #2 WITH RESPECT TO GRID #1 ZERO SIGNAL	19	

PUSH PULL AMPLIFIER - VALUES FOR TWO TUBES

	CLASS AB		CLASS B		
PLATE VOLTAGE	250	300	250	300	VOLTS
GRID #2 (SCREEN) VOLTAGE	250	300	250	300	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE	---	---	-11.6	-14.7	VOLTS
CATHODE BIAS RESISTOR	130	130	---	---	OHMS
GRID TO GRID INPUT VOLTAGE PEAK A-F	22.4	28	22.4	28	VOLTS
PLATE CURRENT, ZERO SIGNAL	62	72	20	15	MA.
PLATE CURRENT, MAXIMUM SIGNAL	75	92	75	92	MA.
GRID #2 CURRENT, ZERO SIGNAL	7	8	2.2	1.6	MA.
GRID #2 CURRENT, MAXIMUM SIGNAL	15	22	15	22	MA.
LOAD RESISTANCE, PLATE-TO-PLATE	8000	8000	8000	8000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	3	4	3	4	PERCENT
POWER OUTPUT, MAXIMUM SIGNAL	11	17	11	17	WATTS

[B] WHEN THE HEATER AND POSITIVE VOLTAGE ARE OBTAINED FROM A STORAGE BATTERY BY MEANS OF A VIBRATOR THE MAXIMUM VALUES OF THE PLATE AND GRID 2 VOLTAGES ARE 275 VOLTS AND THE PLATE DISSIPATION IS 9.9 WATTS.

TUNG-SOL

CATHODE RAY

THE 16GP4, 16GP4A, 16GP4B, AND 16GP4C ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THEIR FACEPLATES WHICH ARE AS FOLLOWS:

16GP4 - GREY FILTER FACEPLATE
16GP4A - CLEAR GLASS FACEPLATE
16GP4B - GREY FILTER - FROSTED
16GP4C - CLEAR GLASS - FROSTED

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE **ROUND METAL CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION **EXTERNAL SINGLE FIELD ION TRAP**
10" X 13 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHODE		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

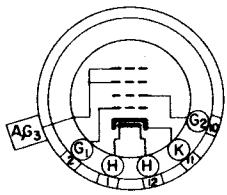
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	65	PERCENT
SPECULAR REFLECTION OF AMBIENT LIGHT **16GP4B**	2.5	PERCENT

MECHANICAL DATA

OVERALL LENGTH	17 11/16	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 3/8	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2
PIN 11 - CATHODE



BOTTOM VIEW

PIN 12 - HEATER
METAL SHELL LIP:
ANODE
GRID NO. 3

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TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID 3 VOLTAGE[A]	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

[A] THE PRODUCT OF ANODE VOLTAGE AND AVERAGE ANODE CURRENT SHOULD BE LIMITED TO 6 WATTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[B]		12 000	VOLTS
DC GRID #2 VOLTAGE		300	VOLTS
DC GRID #1 VOLTAGE[C]		-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[D]		100	MA.
ION TRAP MAGNET (RATED STRENGTH)		23	GAUSSES
	16GP4A AND 16GP4B ONLY	35	GAUSSES

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

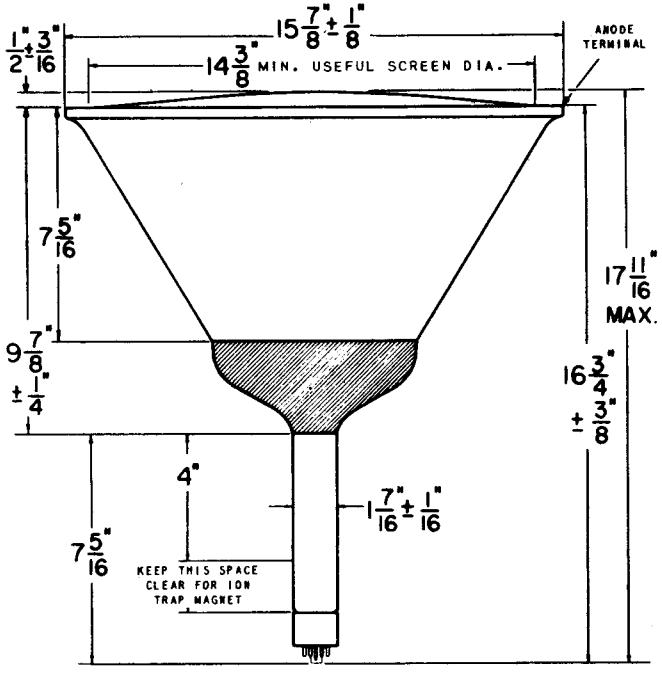
[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 10" BY 13 1/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


1" ± 3/16"
15 7/8" ± 1/8"
14 3/8" MIN. USEFUL SCREEN DIA.
ANODE TERMINAL
7 5/16"
17 11/16" MAX.
9 7/8" ± 1/4"
16 3/4" ± 3/8"
4"
1 7/16" ± 1/16"
7 5/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET

TUNG-SOL

CATHODE RAY

THE 16HP4 AND 16HP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE GREY FILTER FACEPLATE USED ON THE 16HP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL DOUBLE FIELD ION TRAP
ROUND GLASS CONSTRUCTION
EXTERNAL CONDUCTIVE COATING
10 1/4" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	60	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	3 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

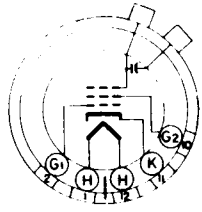
MECHANICAL DATA

OVERALL LENGTH	21 1/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2



BOTTOM VIEW

PIN 11 - CATHODE
PIN 12 - HEATER
ANODE CAP

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

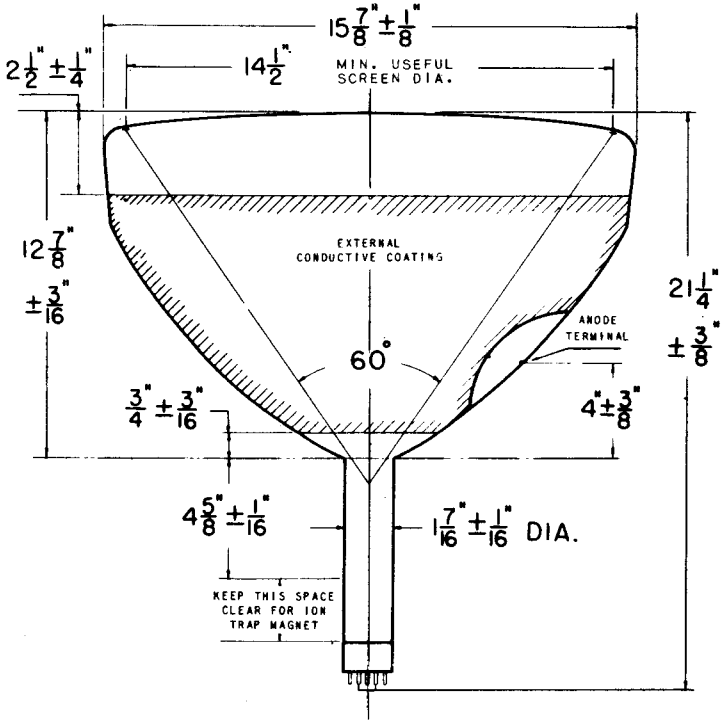
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VEDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


15 7/8" ± 1/8"
2 1/2" ± 1/4"
14 1/2"
MIN. USEFUL SCREEN DIA.
12 7/8" ± 3/16"
EXTERNAL CONDUCTIVE COATING
21 1/4" ± 3/8"
ANODE TERMINAL
60°
3/4" ± 3/16"
4" ± 3/8"
4 5/8" ± 1/16"
1 7/16" ± 1/16" DIA.
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET

TUNG-SOL

CATHODE RAY

THE 16JP4 AND 16JP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL EXCEPT FOR THE GREY FILTER FACEPLATE USED ON THE 16JP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ROUND GLASS CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
EXTERNAL DOUBLE FIELD ION TRAP

MECHANICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	60	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

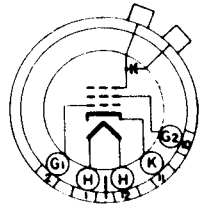
MECHANICAL DATA

OVERALL LENGTH	20 3/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	16 1/8 ± 1/4	INCHES
MINIMUM USEFUL SCREEN DIAMETER	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

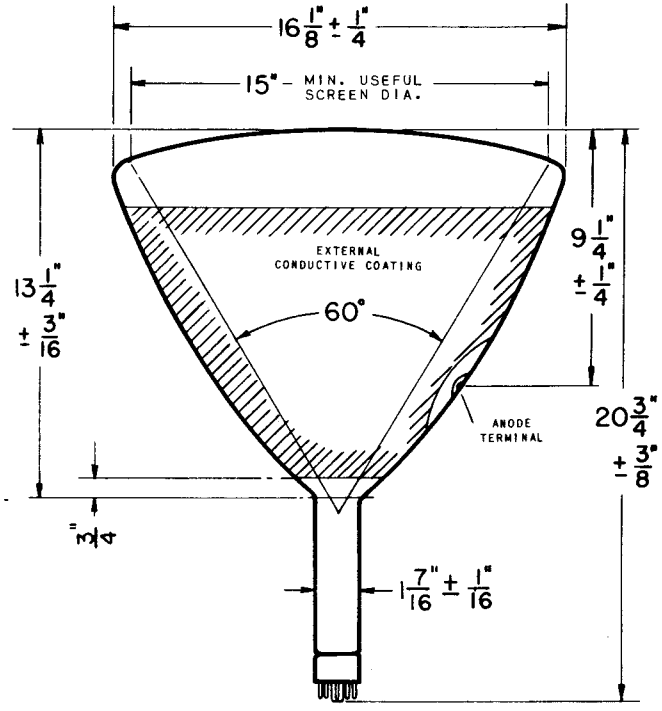
DC ANODE VOLTAGE	11 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	115	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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TUNG-SOL

CATHODE RAY

THE 16KP4 AND 16KP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 16KP4A.

UNIPOTENTIAL CATHODE — **GREY FILTER FACEPLATE**
MAGNETIC FOCUS & DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
EXTERNAL SINGLE FIELD ION TRAP — **RECTANGULAR GLASS CONSTRUCTION**
13 1/2" X 10 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	72	PERCENT

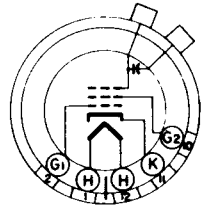
MECHANICAL DATA

OVERALL LENGTH	18 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8 ± 1/8	INCHES
WIDTH	14 3/4 ± 1/8	INCHES
HEIGHT	11 1/2 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	14 7/8	INCHES
WIDTH	13 1/2	INCHES
HEIGHT	10 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER.
ANODE CAP:
GRID NO. 3

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE[A]	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[B]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

[A] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER OF INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE.

[B] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[D] (APPROX.)	90 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

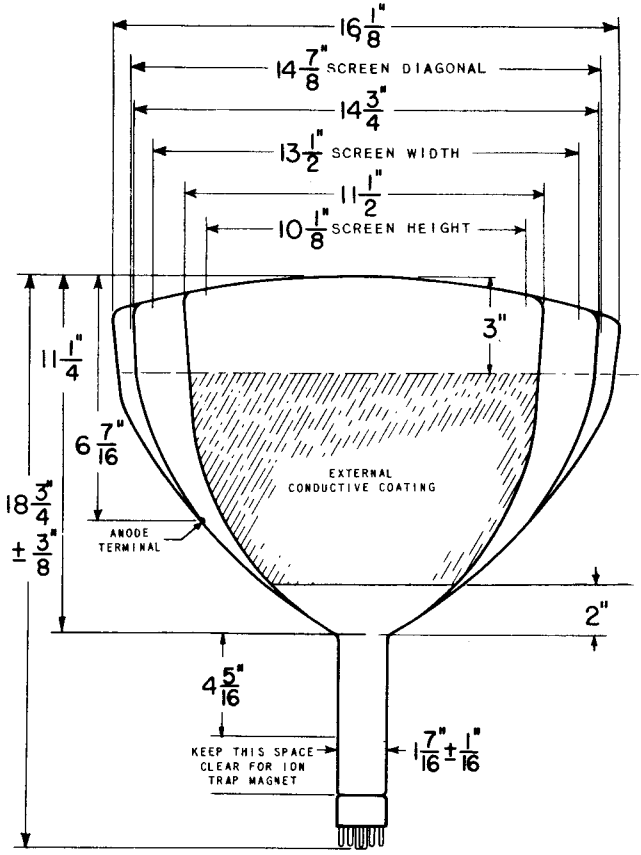
[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

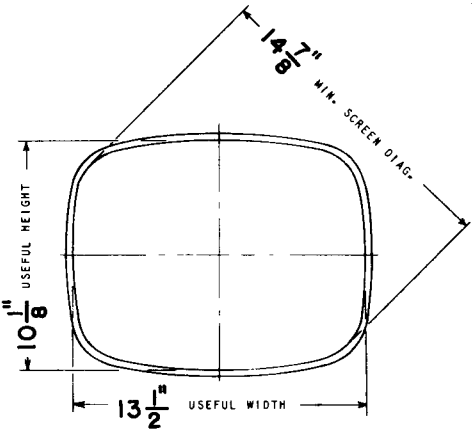
[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 35 FOOT LAMBERTS ON A 10 1/8" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL

CATHODE RAY

THE 16LP4 AND 16LP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE GREY FILTER FACEPLATE USED ON THE 16LP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ROUND GLASS CONSTRUCTION**
MAGNETIC FOCUS & DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
EXTERNAL DOUBLE FIELD ION TRAP — **10 1/4" X 14 1/2" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	52	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

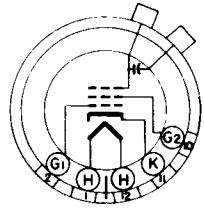
MECHANICAL DATA

OVERALL LENGTH	22 1/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

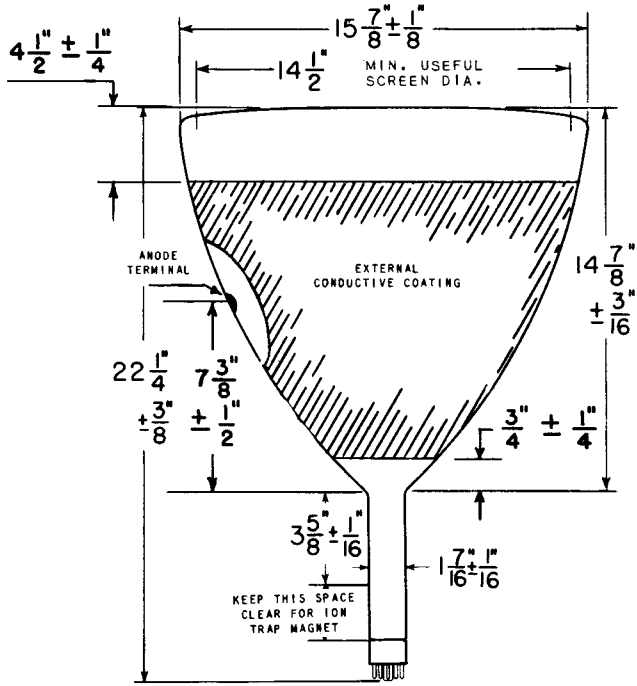
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #106, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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TUNG-SOL

CATHODE RAY

THE 16MP4 AND 16MP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE GREY FILTER FACEPLATE USED ON THE 16MP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL DOUBLE FIELD ION TRAP
ROUND GLASS CONSTRUCTION
EXTERNAL CONDUCTIVE COATING
10 1/2" X 14 3/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	60	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	3 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

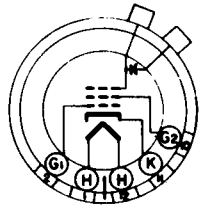
MECHANICAL DATA

OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	16 1/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	110	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

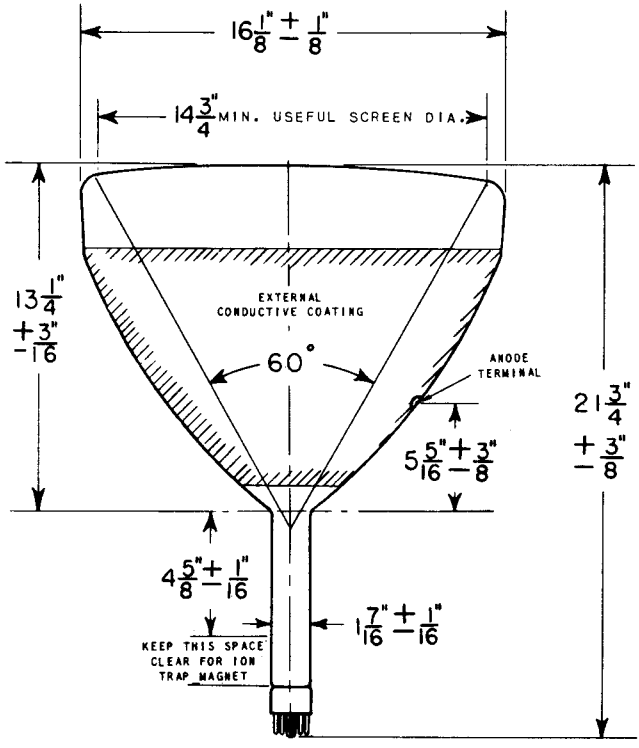
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/2" BY 14 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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TUNG-SOL

CATHODE RAY

THE 16QP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
RECTANGULAR GLASS CONSTRUCTION
GREY FILTER FACEPLATE
10 1/8" X 13 1/2" RASTER SIZE
EXTERNAL DOUBLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	54.5	DEGREES
VERTICAL	50.8	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	7	μμf

OPTICAL DATA

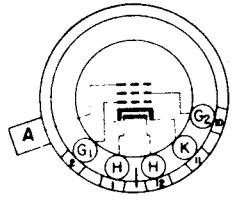
PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

MECHANICAL DATA

OVERALL LENGTH	19 1/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8	INCHES
WIDTH	14 3/4	INCHES
HEIGHT	11 1/2	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15	INCHES
WIDTH	13 19/32	INCHES
HEIGHT	10 3/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

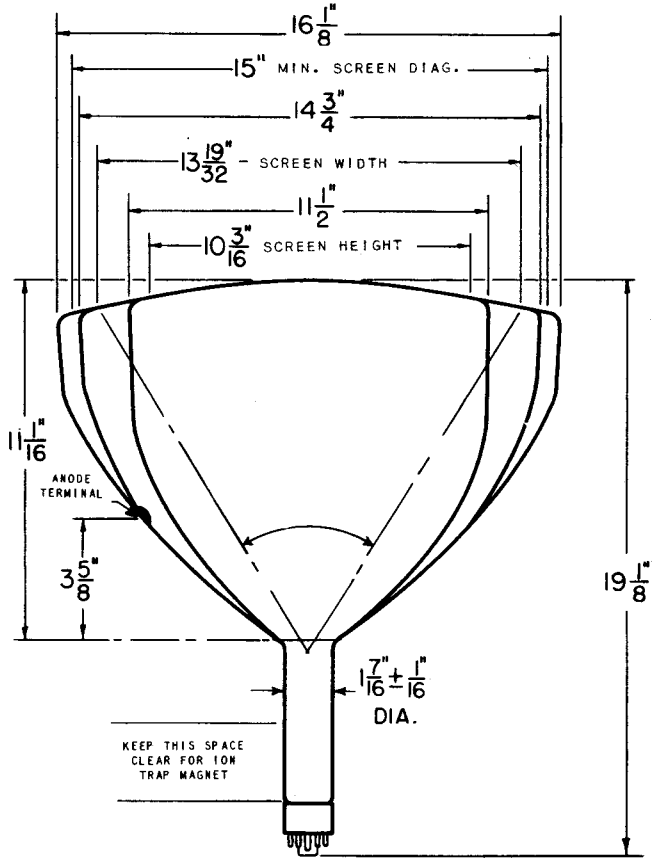
DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	150	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

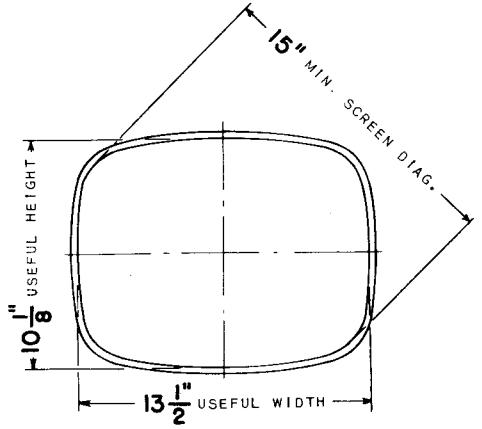
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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CATHODE RAY

THE 16RP4 AND 16RP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTION:*

16RP4A - ALUMINIZED SCREEN

THEIR COMMON FEATURES INCLUDE:

GREY FILTER FACEPLATE

UNIPOTENTIAL CATHODE	**EXTERNAL CONDUCTIVE COATING**
MAGNETIC FOCUS & DEFLECTION	**10 1/8" X 13 1/2" RASTER SIZE**
EXTERNAL SINGLE FIELD ION TRAP	**RECTANGULAR GLASS CONSTRUCTION**

ELECTRICAL DATA

FOCUSING METHODE		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	100 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 10 1/8" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.50 INCHES.

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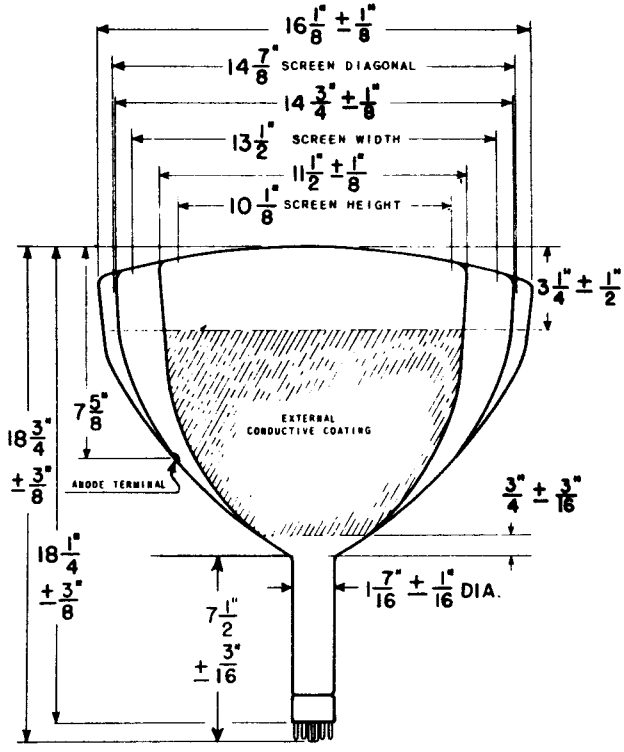
MECHANICAL DATA

OVERALL LENGTH	18 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8 ± 1/8	INCHES
WIDTH	14 3/4 ± 1/8	INCHES
HEIGHT	11 1/2 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	14 7/8	INCHES
WIDTH	13 1/2	INCHES
HEIGHT	10 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

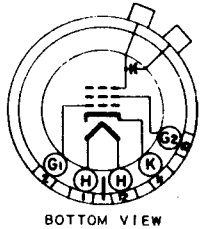
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

TUNG-SOL

CATHODE RAY

THE 16SP4 AND 16SP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE GREY FILTER FACEPLATE USED ON THE 16SP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**EXTERNAL CONDUCTIVE COATING**
ROUND GLASS CONSTRUCTION	**MAGNETIC FOCUS & DEFLECTION**
EXTERNAL SINGLE FIELD ION TRAP	**10 1/8" X 14 1/2" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	3 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

MECHANICAL DATA

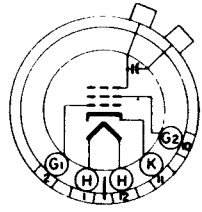
OVERALL LENGTH	17 5/16 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

BOTTOM VIEW

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110	MA.
DC ION TRAP CURRENT (APPROX.)	120	MA.

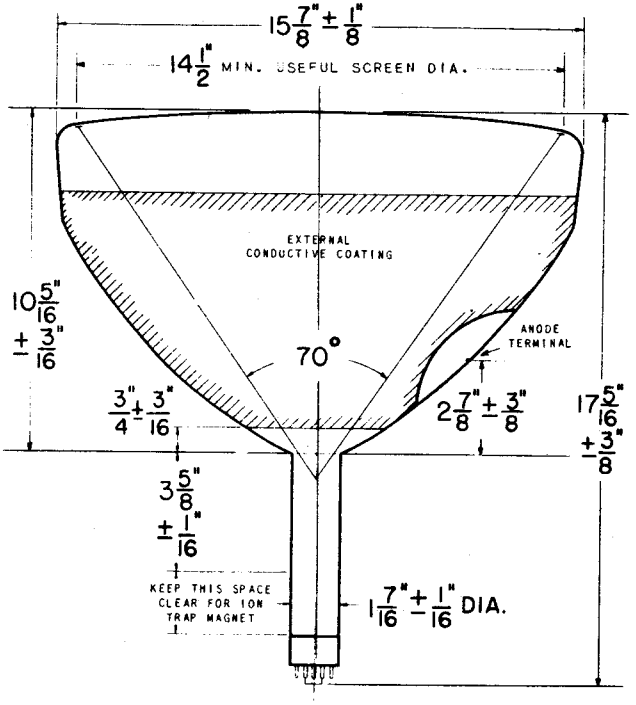
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" X 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


15 7/8" ± 1/8"
14 1/2" MIN. USEFUL SCREEN DIA.
EXTERNAL CONDUCTIVE COATING
10 5/16" ± 3/16"
70°
ANODE TERMINAL
3/4" ± 3/16"
2 7/8" ± 3/8"
17 5/16" ± 3/8"
3 5/8" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
1 7/16" ± 1/16" DIA.

TUNG-SOL

CATHODE RAY

THE 16TP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **GREY FILTER FACEPLATE**
MAGNETIC FOCUS & DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
EXTERNAL SINGLE FIELD ION TRAP — **RECTANGULAR GLASS CONSTRUCTION**
13 1/2" X 10 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	72	PERCENT

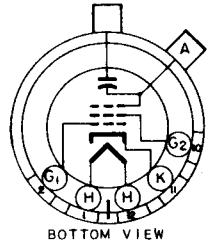
MECHANICAL DATA

OVERALL LENGTH	18 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8 ± 1/8	INCHES
WIDTH	14 3/4 ± 1/8	INCHES
HEIGHT	11 1/2 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	14 7/8	INCHES
WIDTH	13 1/2	INCHES
HEIGHT	10 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	99 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 35 FOOT LAMBERTS ON A 10 1/8" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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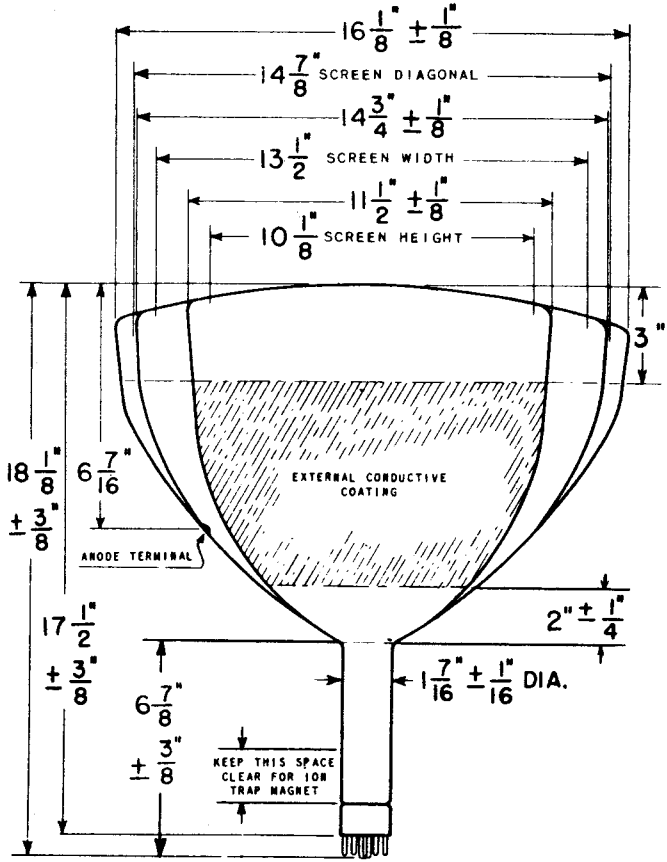

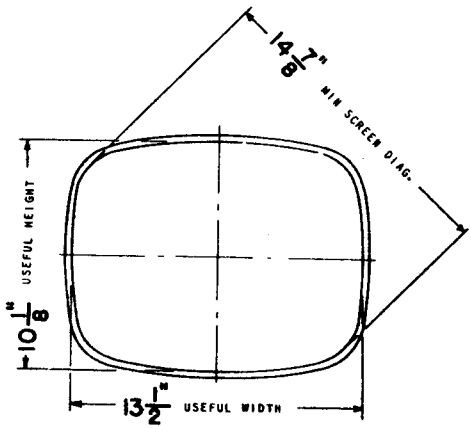

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CATHODE RAY

THE 16UP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL SINGLE FIELD ION TRAP
GREY FILTER FACEPLATE
10 1/8" X 13 1/2" RASTER SIZE
RECTANGULAR GLASS CONSTRUCTION

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

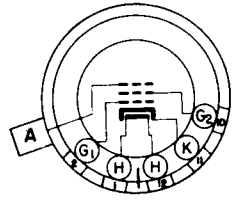
MECHANICAL DATA

OVERALL LENGTH	18 1/8 ± 1/2	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8	INCHES
WIDTH	14 3/4	INCHES
HEIGHT	11 1/2	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15	INCHES
WIDTH	13 19/32	INCHES
HEIGHT	10 3/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	15 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	100	MA.
ION TRAP MAGNET (RATED STRENGTH)	23	GAUSSES

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/8" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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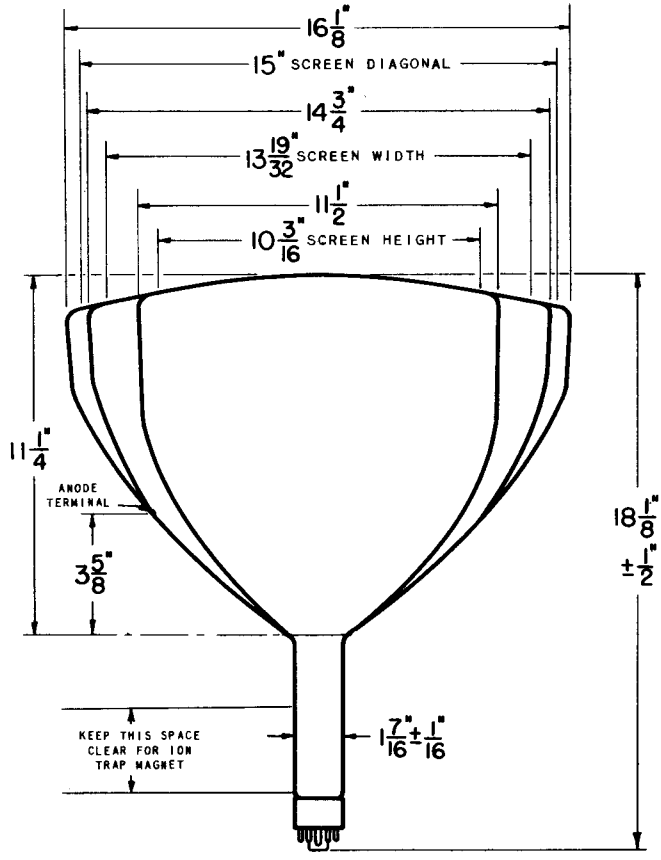

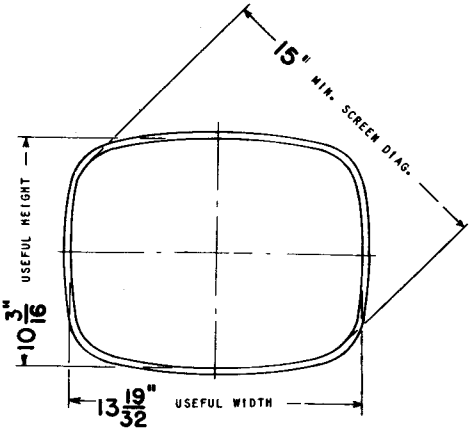

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CATHODE RAY

THE 16VP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
MAGNETIC FOCUS & DEFLECTION	**ROUND GLASS CONSTRUCTION**
EXTERNAL SINGLE FIELD ION TRAP	**10 1/8" X 14 1/2" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

MECHANICAL DATA

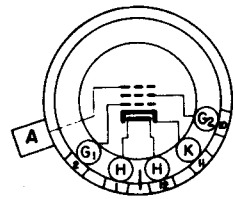
OVERALL LENGTH	17 3/16 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	15 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	120	MA.

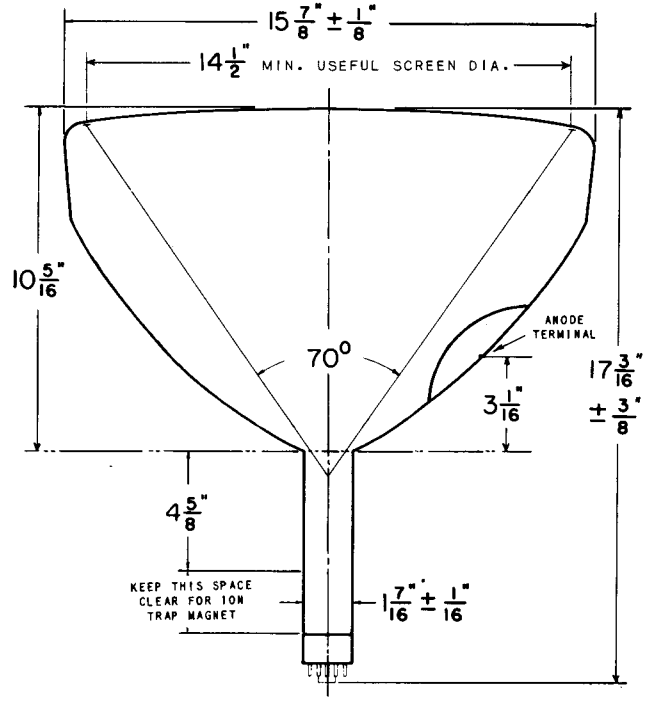
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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CATHODE RAY

THE 16WP4 AND 16WP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE EXTERNAL CONDUCTIVE COATING USED ON THE 16WP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL DOUBLE FIELD ION TRAP
GREY FILTER FACEPLATE
ROUND GLASS CONSTRUCTION
10 1/4" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE **16WP4A**	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE **16WP4A**	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

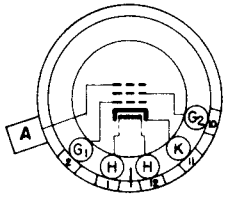
MECHANICAL DATA

OVERALL LENGTH	17 3/4 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING	**16WP4** – 12D **16WP4A**	12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

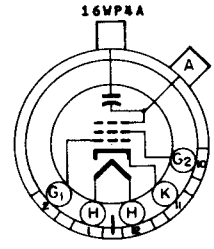
16WP4



PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

BOTTOM VIEW

16WP4A



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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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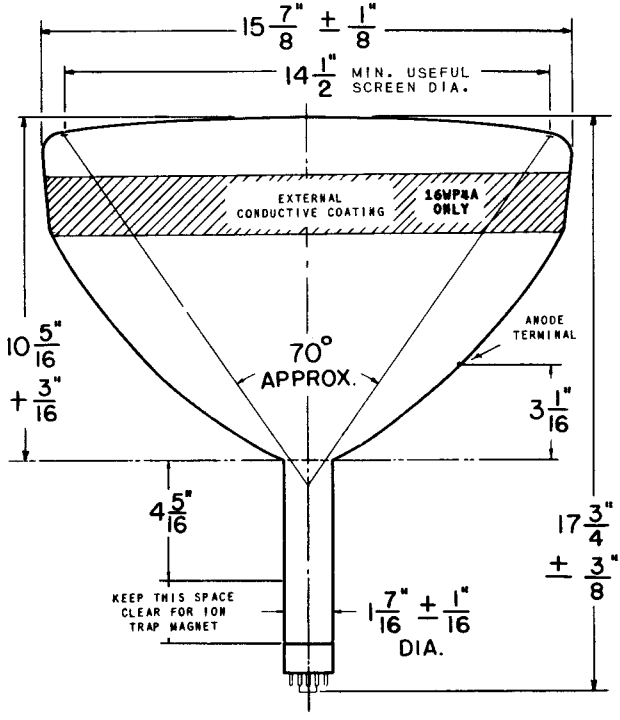

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TUNG-SOL

CATHODE RAY

THE 16XP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
MAGNETIC FOCUS & DEFLECTION	**10 1/8" X 13 1/2" RASTER SIZE**
EXTERNAL DOUBLE FIELD ION TRAP	**RECTANGULAR GLASS CONSTRUCTION**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

MECHANICAL DATA

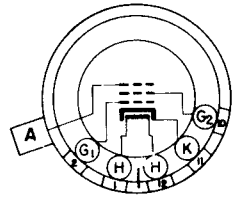
OVERALL LENGTH	18 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 1/8	INCHES
WIDTH	14 3/4	INCHES
HEIGHT	11 1/2	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15	INCHES
WIDTH	13 19/32	INCHES
HEIGHT	10 3/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS BETWEEN PIN POSITIONS #6 & 7 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

BOTTOM VIEW

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	15 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	100	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

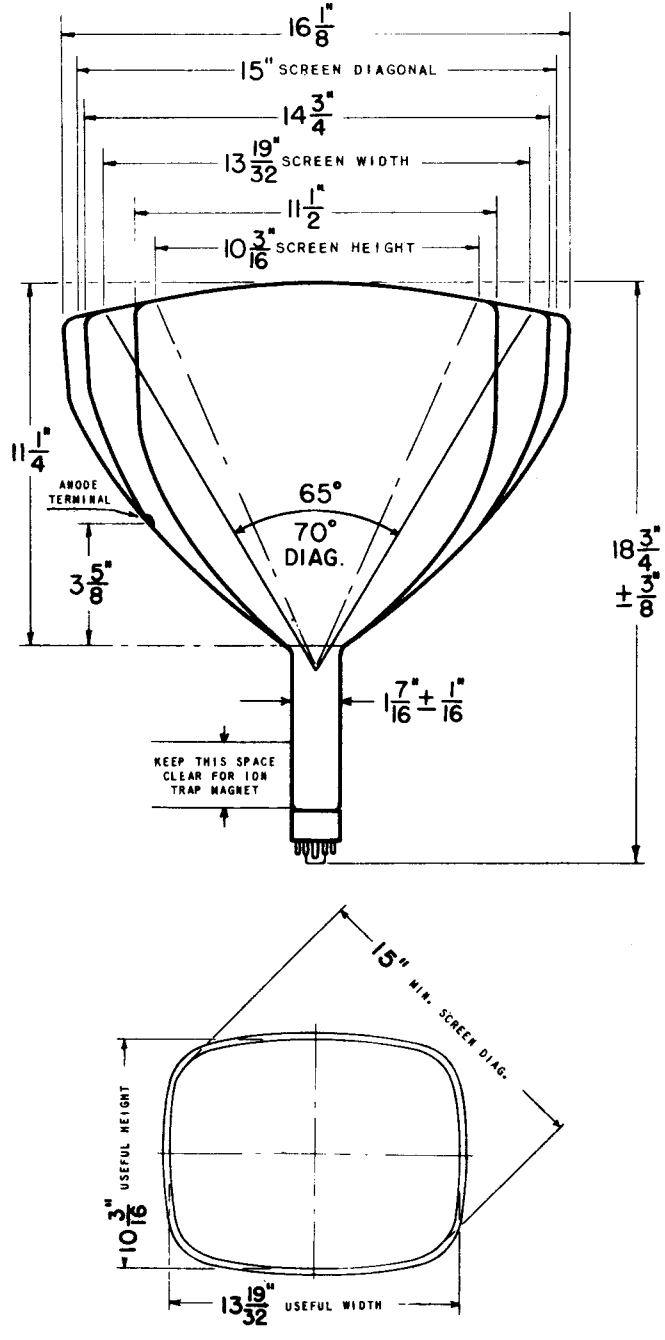
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/8" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


16 1/8"
15" SCREEN DIAGONAL
14 3/4"
13 19/32" SCREEN WIDTH
11 1/2"
10 3/16" SCREEN HEIGHT
11 1/4"
ANODE TERMINAL
65°
70° DIAG.
3 5/8"
18 3/4" ± 3/8"
1 7/16" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
15" MIN. SCREEN DIAG.
10 3/16" USEFUL HEIGHT
13 19/32" USEFUL WIDTH

TUNG-SOL

CATHODE RAY

THE 16YP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **GREY FILTER FACEPLATE**
MAGNETIC FOCUS & DEFLECTION — **ROUND GLASS CONSTRUCTION**
EXTERNAL SINGLE FIELD ION TRAP — **EXTERNAL CONDUCTIVE COATING**
10 1/4" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.0	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

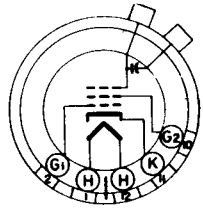
MECHANICAL DATA

OVERALL LENGTH	17 5/16 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	100	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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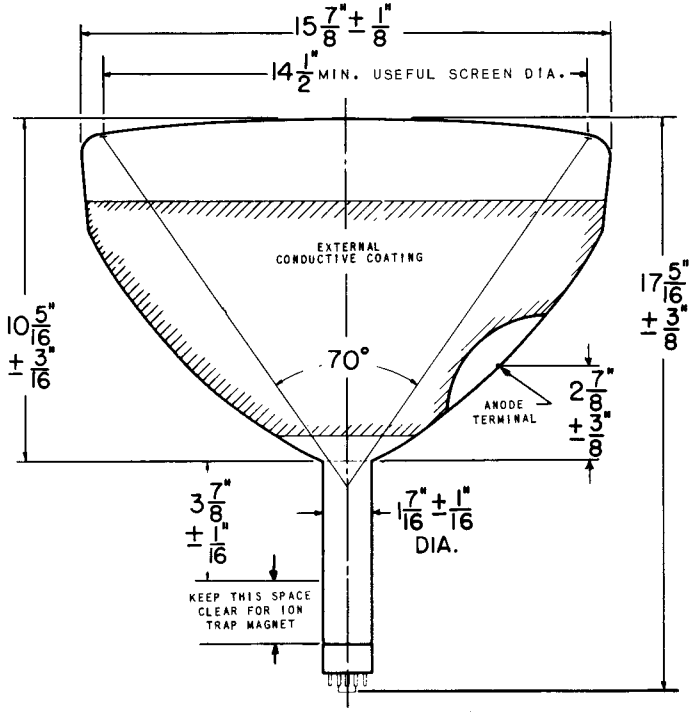

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CATHODE RAY

THE 16ZP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **GREY FILTER FACEPLATE**
MAGNETIC FOCUS & DEFLECTION — **ROUND GLASS CONSTRUCTION**
EXTERNAL DOUBLE FIELD ION TRAP — **EXTERNAL CONDUCTIVE COATING**
10 1/4" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	52	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	65	PERCENT

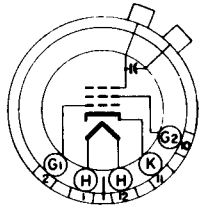
MECHANICAL DATA

OVERALL LENGTH	22 1/4 ± 3/8	INCHES
GREATEST DIAMETER	15 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	14 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	120	MA.

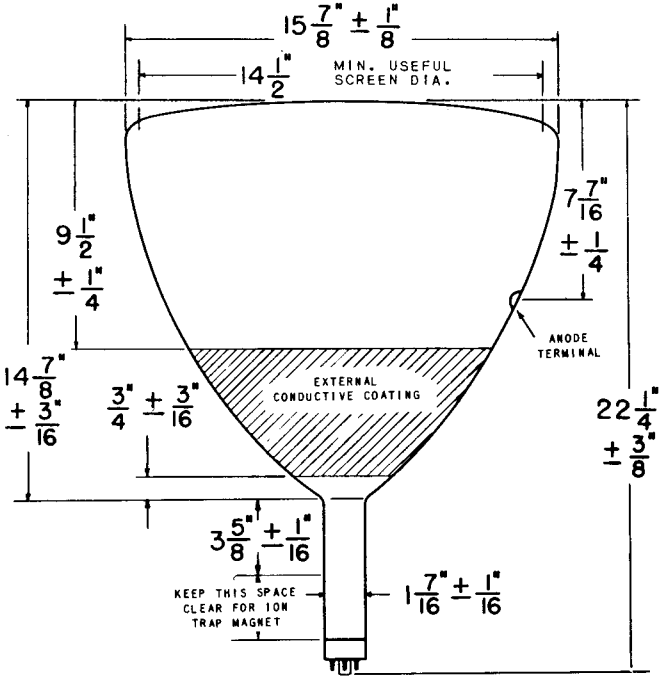
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 10 1/4" BY 14 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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TUNG-SOL

CATHODE RAY

THE 17AP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE
EXTERNAL CONDUCTIVE COATING
RECTANGULAR GLASS CONSTRUCTION
UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL SINGLE FIELD ION TRAP
10 3/4" X 14 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	7	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2 000	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

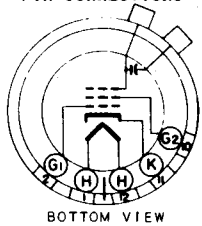
MECHANICAL DATA

OVERALL LENGTH	18 5/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH VACANT PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	100 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111	75 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 25 FOOT LAMBERTS ON A 14 1/4" BY 10 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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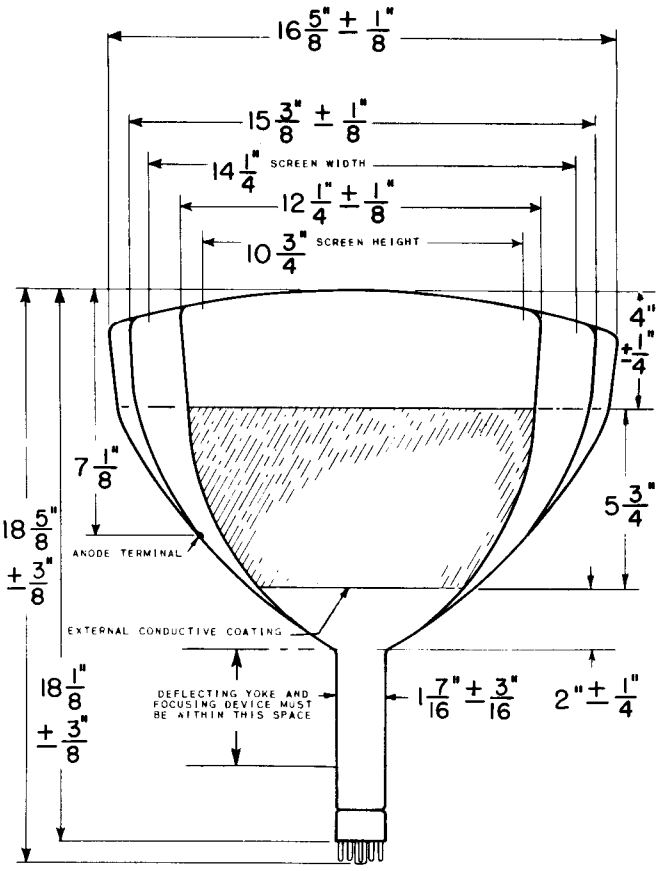

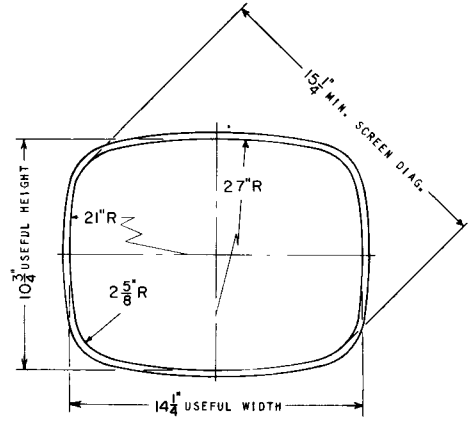

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CATHODE RAY

THE 17ATP4 AND 17ATP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE METAL-BACKED SCREEN ON THE 17ATP4A. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION	SPHERICAL FACEPLATE
UNIPOTENTIAL CATHODE	GREY FILTER FACEPLATE
RECTANGULAR GLASS CONSTRUCTION	EXTERNAL CONDUCTIVE COATING
LOW VOLTAGE ELECTROSTATIC FOCUS	EXTERNAL SINGLE FIELD ION TRAP

10 3/4" X 14 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	80	DEGREES
VERTICAL	65	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	1 500	$\mu\mu$f
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	750	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE[B]	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE:		
POSITIVE	1 000	VOLTS
NEGATIVE[C]	500[C]	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE (WITH ANODE CURRENT OF 100 μAMP.)	-55 TO +300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[D]	-33 TO -77	VOLTS
DC ION TRAP MAGNET	37	GAUSSES

[A] EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

[C] THIS VALUE APPLIES WHERE AN AC VOLTAGE IS PROVIDED FOR DYNAMIC FOCUSING.

[D] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

INASMUCH AS THE TUBE RATING PERMITS OPERATION AT VOLTAGES AS HIGH AS 17.6 KILOVOLTS (ABSOLUTE VALUE), SHIELDING OF THE TUBE FOR X-RAY RADIATION MAY BE NEEDED WHEREVER THE OPERATING CONDITIONS INVOLVE VOLTAGES IN EXCESS OF 16 KILOVOLTS.

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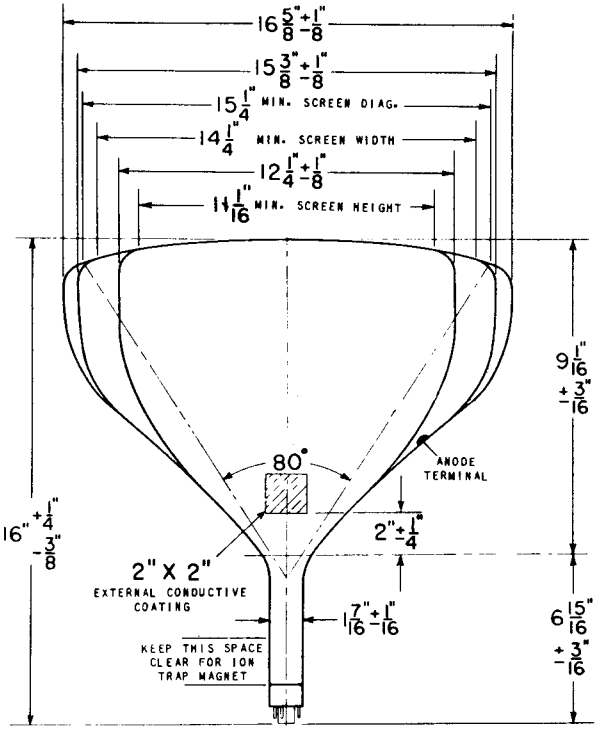
MECHANICAL DATA

OVERALL LENGTH	16 +1/4 -3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 1/4	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	11 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

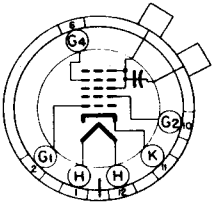
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID #3
GRID #5
COLLECTOR

SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY.

TUNG-SOL

CATHODE RAY

THE 17AVP4 AND 17AVP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 17AVP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
EXTERNAL CONDUCTIVE COATING — MAGNETIC DEFLECTION
RECTANGULAR GLASS CONSTRUCTION — FILTERGLASS FACEPLATE
LOW VOLTAGE ELECTROSTATIC FOCUS — EXTERNAL SINGLE FIELD ION TRAP
10 3/4" X 14 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	P-4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	SHORT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC COLLECTOR, GRID #3, GRID #5 VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[A]	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC COLLECTOR, GRID #3, GRID #5 VOLTAGE	12 000	VOLTS
DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)[B]	-48 TO +264	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC GRID #2 CURRENT	-15 TO +15	μAMP.
DC FOCUSING COIL CURRENT (APPROX.)	-25 TO +25	μAMP.
ION TRAP CURRENT STANDARD COIL #117 (APPROX.)	30	MA.

[A] THE FOCUS ELECTRODE MAY BE MODULATED TO IMPROVE OVERALL FOCUS.

[B] WITH THE COMBINED GRID #1 VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE A COLLECTOR CURRENT OF 100 MICROAMPERES ON A 10 3/4" X 14 1/4" PICTURE AREA.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

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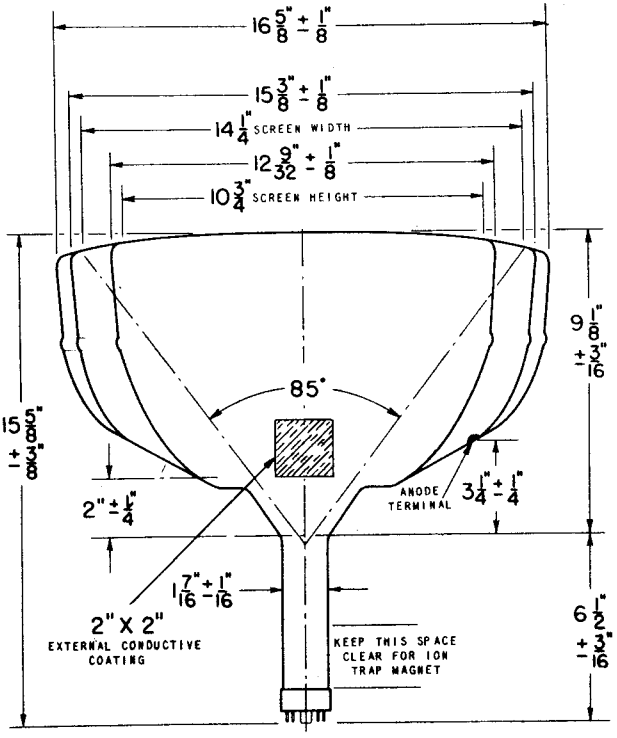
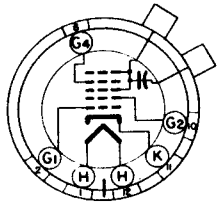
MECHANICAL DATA

OVERALL LENGTH	15 5/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

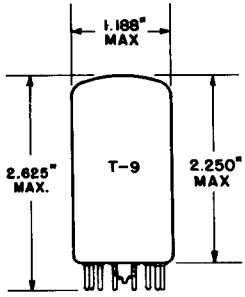
PIN 12 – HEATER
ANODE CAP:
GRID #3
GRID #5
COLLECTOR

SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED: IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY.

TUNG-SOL

DIODE

COMPACTRON

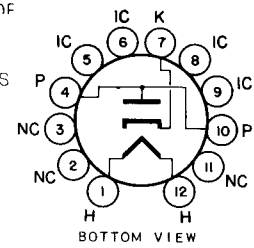


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-59

COATED UNIPOTENTIAL CATHODE

DAMPING DIODE APPLICATIONS IN TV RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

THE 17AX3 IS A HEATER-CATHODE SINGLE DIODE IN THE COMPACT 12 PIN T-9 CONSTRUCTION. ITS HIGH HEATER AND CATHODE INSULATION IS DESIGNED FOR USE AS A DAMPING DIODE IN T.V. RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+H)	7.5	pf
PLATE TO CATHODE AND HEATER: P TO (K+H	5.5	pf
HEATER TO CATHODE: (H TO K)	2.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION[A]		450±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT		900	VOLTS
TOTAL DC AND PEAK		5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

[A] FOR SERIES HEATER OPERATION, THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER CURRENT IS AT THE SPECIFIED BOGEY VALUE, WITH HEATER SUPPLY VARIATIONS RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED TOLERANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS[B]

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	5.3	WATTS
STEADY-STATE PEAK PLATE CURRENT	1000	MA.
DC OUTPUT	165	MA.

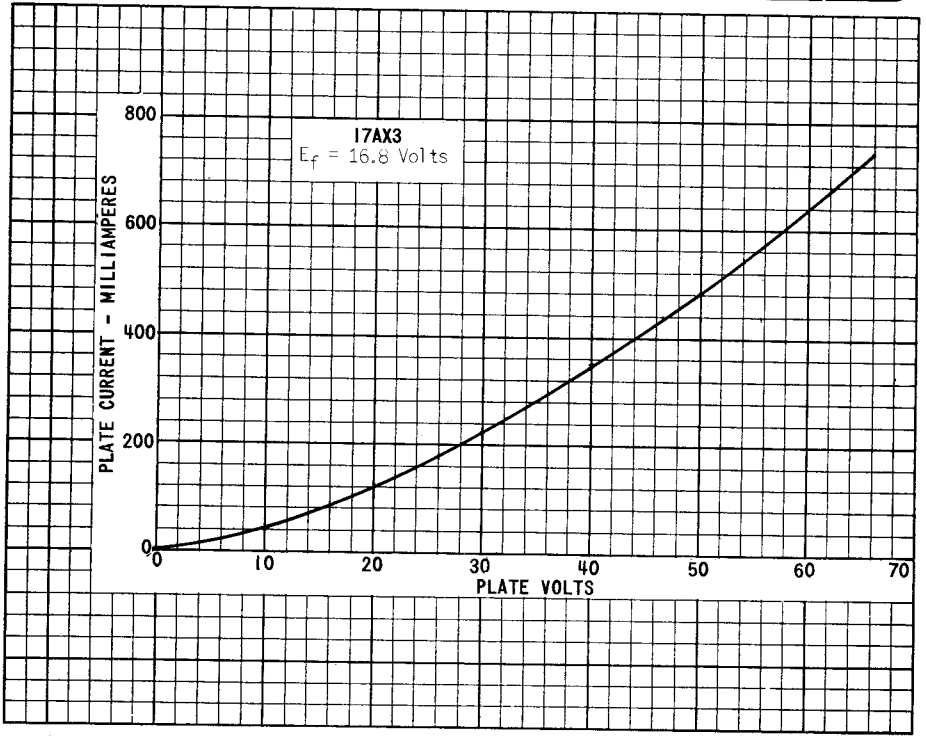
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP I_b = 250 MILLIAMPERES DC	32	VOLTS

SIMILAR TYPE REFERENCE: Except for heater ratings, the 17AX3 is identical to the 6AX3 and the 12AX3.

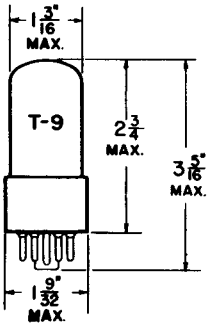
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.



TUNG-SOL

DIODE

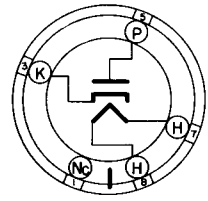


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
4CG

THE 17AX4GT IS A HEATER-CATHODE TYPE DIODE DESIGNED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE IN TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS, SUCH AS NORMALLY ENCOUNTERED IN "DIRECT-DRIVE" CIRCUITS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 17AX4GT IS IDENTICAL TO THE 6AX4GT.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

HEATER TO CATHODE	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DESIGN CENTER VALUES

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.45	AMP.
MAXIMUM HEATER CATHODE VOLTAGE;		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900[B]	VOLTS
TOTAL DC AND PEAK	4400[B]	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[A]	4000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT[C]	3.0	AMP.
MAXIMUM DC OUTPUT CURRENT	125	MA.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 250 MA.)	32	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] APPLICABLE WHERE THE DUTY CYCLE OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE SCANNING CYCLE, AND ITS DURATION IS LIMITED TO 10 MICROSECONDS.

[C] THIS RATING APPLIES TO HOT SWITCHING WHERE TRANSIENT DURATION DOES NOT EXCEED 0.2 SECONDS.

[B] VALUE GIVEN IS TO BE CONSIDERED AS AN ABSOLUTE MAXIMUM RATING. IN THIS CASE, THE COMBINED EFFECT OF SUPPLY-VOLTAGE VARIATION, MANUFACTURING VARIATION INCLUDING COMPONENTS IN THE EQUIPMENT, AND ADJUSTMENT OF EQUIPMENT CONTROLS SHOULD NOT CAUSE THE RATED VALUE TO BE EXCEEDED.

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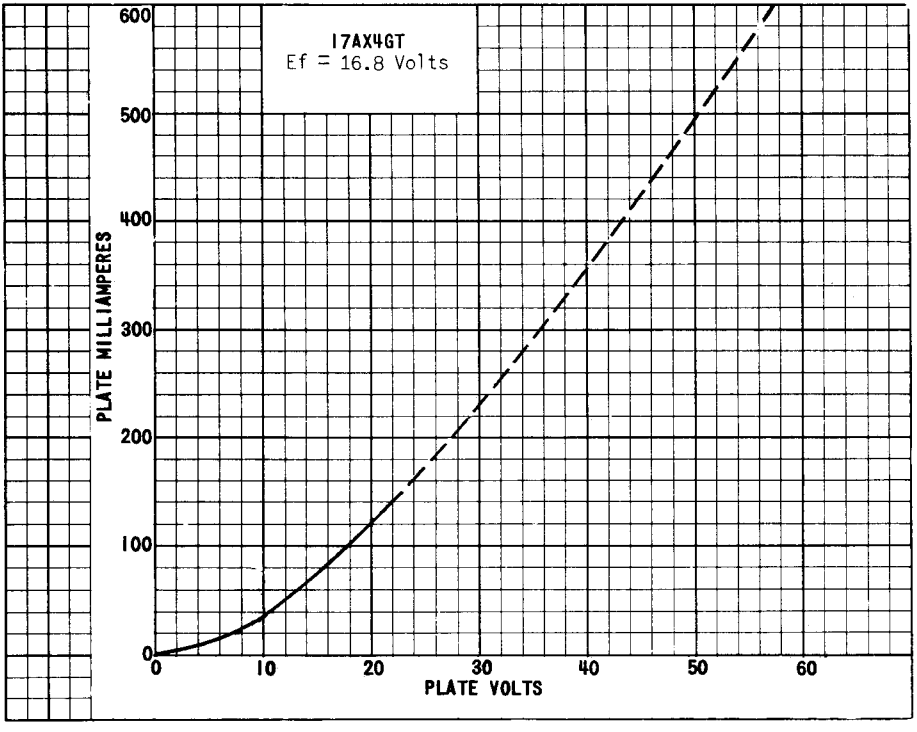
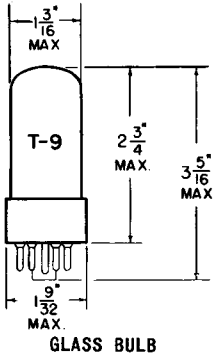


*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DIODE



GLASS BULB

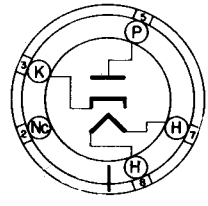
COATED UNIPOTENTIAL CATHODE

HEATER

16.8 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE-SHELL
5 PIN OCTAL

4CG

THE 17AX4GTA IS A SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL-DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. IT WAS DESIGNED TO WITHSTAND HIGH PULSE VOLTAGES BETWEEN THE PLATE AND CATHODE WHICH MAKES THE TUBE PARTICULARLY USEFUL IN AUTOTRANSFORMER DEFLECTION SYSTEMS IN WHICH HIGH PULSE VOLTAGES ARE APPLIED TO THE CATHODE OF THE DAMPER TUBE. EXCEPT FOR HEATER CHARACTERISTICS, TYPE 17AX4GTA IS IDENTICAL TO THE 6AX4GTB AND THE 12AX4GTB.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER	8.5	μμf
PLATE TO CATHODE AND HEATER	5.0	μμf
HEATER TO CATHODE	4.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

TV DAMPER SERVICE

HEATER VOLTAGE	16.8	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	4400	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	1000	MA.
MAXIMUM DC OUTPUT CURRENT	165	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	900	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER WARM-UP TIME* (APPROX.)	11.0	SECONDS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT[B]	0.45	AMP.
TUBE VOLTAGE DROP I_b=250 MA. DC	32	VOLTS

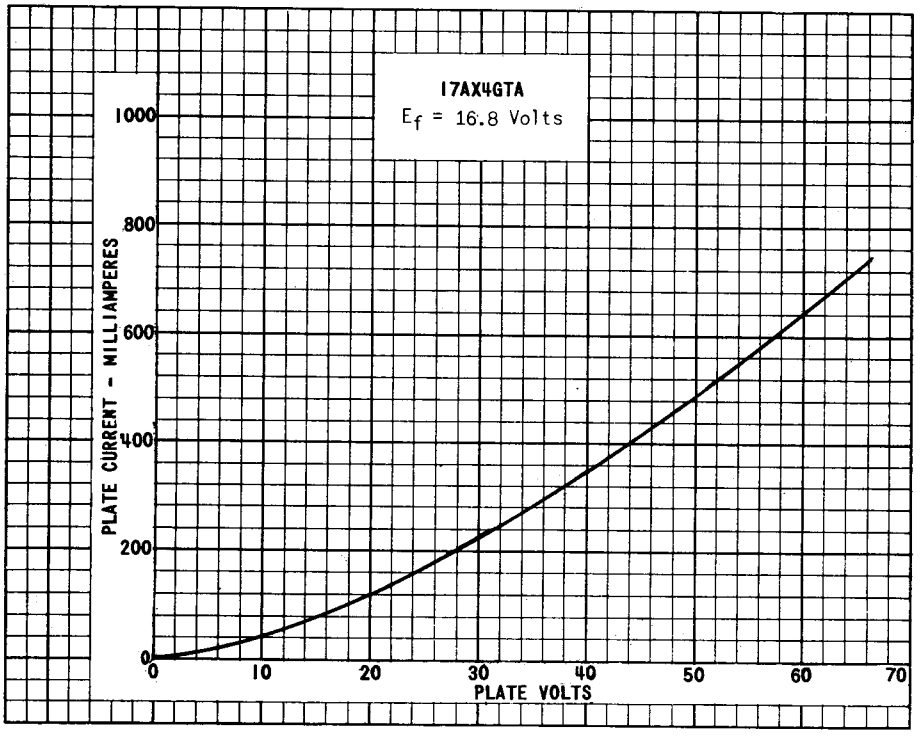
NOTE:

OPERATION OF THIS TUBE AS A POWER RECTIFIER IS NOT RECOMMENDED.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

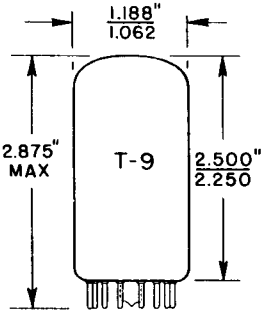
[B] FOR SERIES HEATER OPERATION, EQUIPMENT SHOULD BE SO DESIGNED SO THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.



TUNG-SOL

DIODE

COMPACTRON

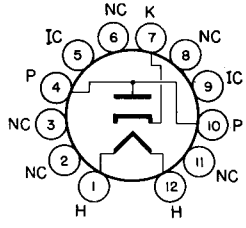


GLASS BULB
BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-60

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA ←
SOCKET TERMINALS 5,6,8 AND 9
SHOULD NOT BE USED AS TIE POINTS.
IT IS FURTHER RECOMMENDED THAT
THE SOCKET CLIPS FOR
THESE PINS BE REMOVED.

THE 17BE3 IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17BE3 IS IDENTICAL TO THE 6BE3 AND THE 12BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	VOLTS	450	MA
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			450 ± 30	MA
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES [B] - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP, Ib = 350 MA. DC	25	VOLTS

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B

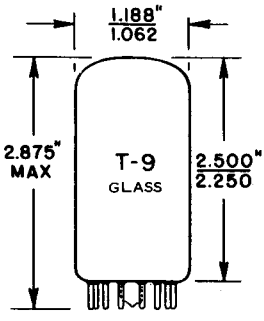
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

TUNG-SOL

DIODE

COMPACTRON

OUTLINE DRAWING
JEDEC 9-60



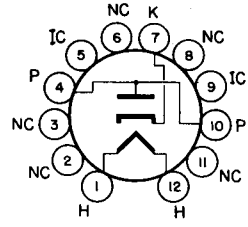
BASE 12 PIN BUTTON
JEDEC E12-70

FOR TV DAMPING
DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12GA



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12GA
SOCKET TERMINALS 5,6,8 AND 9 SHOULD NOT BE USED AS TIE POINTS. IT IS FURTHER RECOMMENDED THAT THE SOCKET CLIPS FOR THESE PINS BE REMOVED.

THE 17BE3A IS A COMPACTRON, SINGLE HEATER-CATHODE TYPE DIODE INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17BE3A IS IDENTICAL TO THE 6BE3A AND THE 12BE3A. THE VOLTAGE DROP OF THIS TYPE IS LOWER THAN THAT OF THE 17BE3.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	10	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	8.0	pf
HEATER TO CATHODE: (H TO K)	3.4	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	VOLTS	450	MA
HEATER WARM-UP TIME SEE BELOW			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			450 ± 30	MA
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE SEE BELOW

PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY STATE PEAK PLATE CURRENT	1200	MA
DC OUTPUT CURRENT	200	MA

FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

AVERAGE CHARACTERISTICS

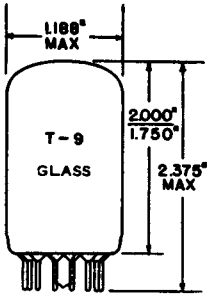
TUBE VOLTAGE DROP, Ib = 350 MA. DC	22.5	VOLTS

TUNG-SOL

DUAL PENTODE

COMPACTRON

OUTLINE
JEDEC 9-58



BASE 12 PIN BUTTON
JEDEC E12-70

FOR

FM DETECTOR

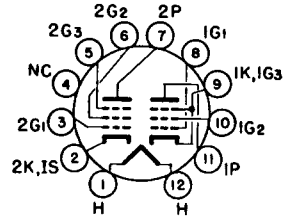
AND AUDIO OUTPUT

IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12EZ



BOTTOM VIEW

THE TUNG-SOL 17BF11 IS A 12-PIN T-9 COMPACTRON CONTAINING TWO DISSIMILAR PENTODES. SECTION 1 IS A POWER PENTODE FOR AUDIO APPLICATION. SECTION 2 IS A DUAL CONTROL PENTODE INTENDED FOR USE AS FM DETECTOR IN TV CIRCUITS. ELECTRICALLY, SECTION 2 IS SIMILAR TO TYPE 6DT6. EXCEPT FOR HEATER CHARACTERISTICS, THE 17BF11 IS IDENTICAL TO THE 6BF11.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

PENTODE 1 - GRID 1 TO PLATE	0.24	pf
INPUT: (G1 TO H + K + I.S. + G_2)	13	pf
OUTPUT: (P TO H + K + I.S. + G_2)	10	pf
PENTODE 2 - GRID 1 TO PLATE	0.036	pf
GRID 1 TO ALL (G1 TO H + K + I.S. + G_2 + G_3 + P)	6.5	pf
GRID 3 TO PLATE	3.2	pf
GRID 3 TO ALL (G_3 TO H + K + I.S. + G_1 + G_2 + P)	8.0	pf
GRID 1 TO GRID 3	0.11	pf
COUPLING - PLATE TO PLATE	0.13	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	0.45	AMPS.
HEATER WARM-UP TIME		11	SEC.
LIMITS OF SUPPLIED CURRENT		0.45 ± 0.03	AMPS.
MAXIMUM HEATER-CATHODE VOLTAGE-BOTH SECTIONS			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

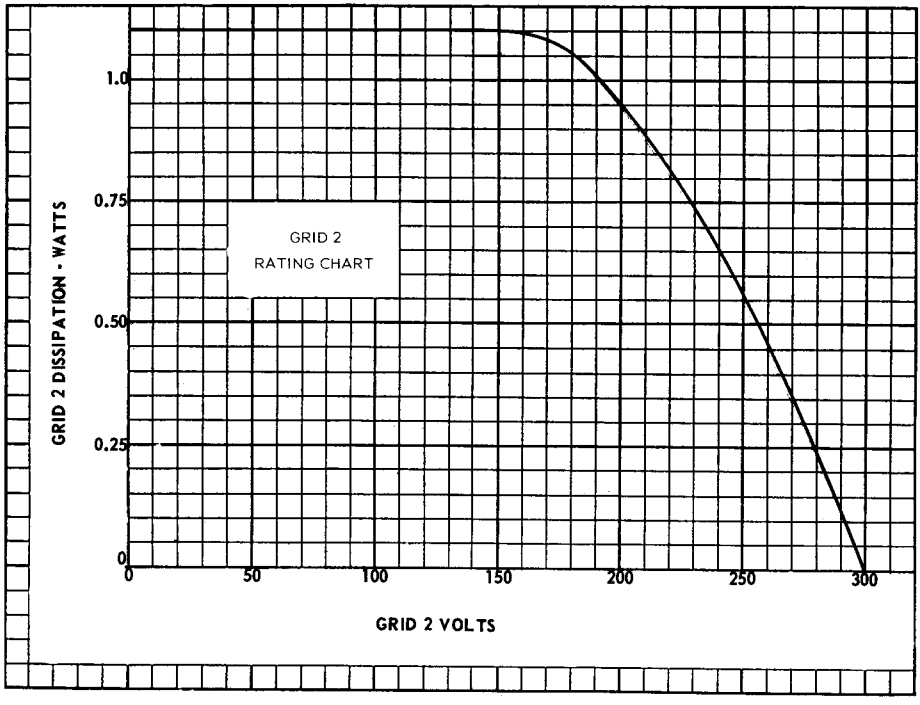
	SECTION 1	SECTION 2	
PLATE VOLTAGE	165	330	VOLTS
GRID 2 VOLTAGE	150	-	VOLTS
GRID 2 SUPPLY VOLTAGE	-	330	VOLTS
POSITIVE DC GRID 3 VOLTAGE	-	28	VOLTS
PLATE DISSIPATION	6.5	1.7	WATTS
GRID 2 DISSIPATION	1.8	SEE CHART	WATTS
UP TO 150 VOLTS	-	1.1	WATTS
CATHODE CURRENT	65	-	MA
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.25	-	MEGOHMS
SELF BIAS	0.5	-	MEGOHMS

AVERAGE CHARACTERISTICS

	SECTION 1	SECTION 2	
PLATE VOLTAGE	145	150	VOLTS
GRID 2 VOLTAGE	110	100	VOLTS
GRID 3 VOLTAGE	-	0	VOLTS
GRID 1 VOLTAGE	-6.0	0	VOLTS
CATHODE RESISTOR	-	560	OHMS
PLATE CURRENT	36	1.3	MA
GRID 2 CURRENT	3.0	2.0	MA
TRANSCONDUCTANCE GRID 1 TO PLATE	8,600	1,000	μMHOS
GRID 3 TO PLATE	-	400	μMHOS
PLATE RESISTANCE - APPROX.	0.03	0.15	MEGOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS
GRID 3 VOLTAGE FOR I_b = 10 μA	-	-4.5	VOLTS

TYPICAL OPERATION - CLASS A1 POWER AMPLIFIER

	SECTION 1	
PLATE VOLTAGE	145	VOLTS
GRID 2 VOLTAGE	110	VOLTS
GRID 1 VOLTAGE	-6.0	VOLTS
PEAK AUDIO GRID 1 VOLTAGE	6.0	VOLTS
LOAD RESISTANCE	3,000	OHMS
MAXIMUM SIGNAL PLATE CURRENT	40	MA
MAXIMUM SIGNAL GRID 2 CURRENT	9.0	MA
TOTAL HARMONIC DISTORTION	10	%
POWER OUTPUT	2.4	WATTS



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TUNG-SOL

CATHODE RAY

THE 17BJP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN — **ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE — **EXTERNAL CONDUCTIVE COATING**
REQUIRES NO ION TRAP MAGNET — **RECTANGULAR GLASS CONSTRUCTION**
14 1/4" X 10 3/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1200	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-55 TO 300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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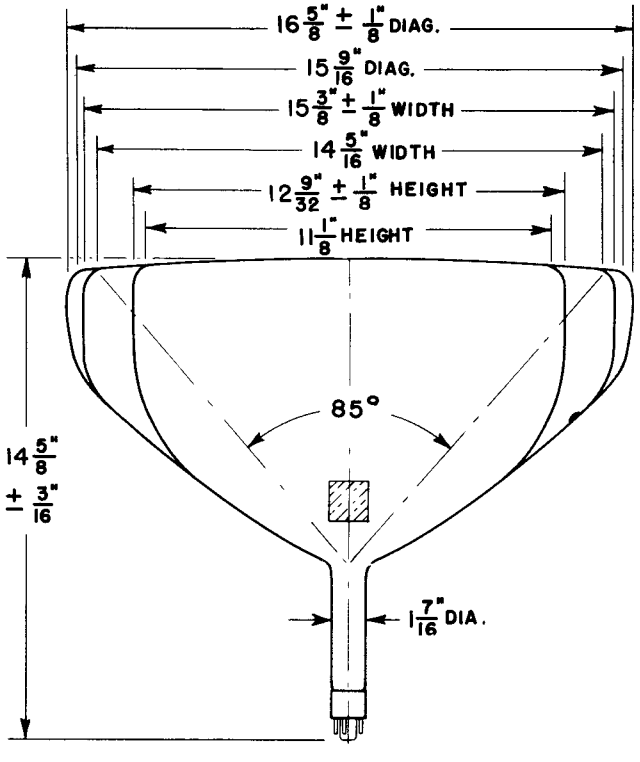
MECHANICAL DATA

OVERALL LENGTH	14 5/8 ± 3/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 9/16	INCHES
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

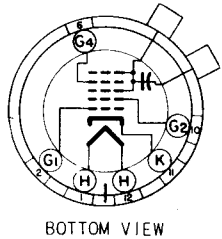
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ±30 DEGREES



PIN CONNECTIONS

PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE



BOTTOM VIEW

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17BKP4 AND 17BKP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THE TUBES ARE IDENTICAL EXCEPT FOR THE ALUMINIZED SCREEN ON THE 17BKP4A.
THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION	**ELECTROSTATIC FOCUS**
UNIPOTENTIAL CATHODE	**GRAY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**14 5/16" X 11 1/8" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1200	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.450 ±5%	AMP.
MAXIMUM DC ANODE VOLTAGE	17 600	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-550 TO +1100	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-56 TO++310	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC ION TRAP MAGNET STANDARD COIL #117 (APPROX.)	28	MA.
DC ION TRAP MAGNET RATED STRENGTH	31	GAUSES

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

* HEATER WARM-UP TIME IS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE TO 5.0 VOLTS IN THE JETEC TEST CIRCUIT, WITH E=25 VOLTS AND SERIES R=42 OHMS.

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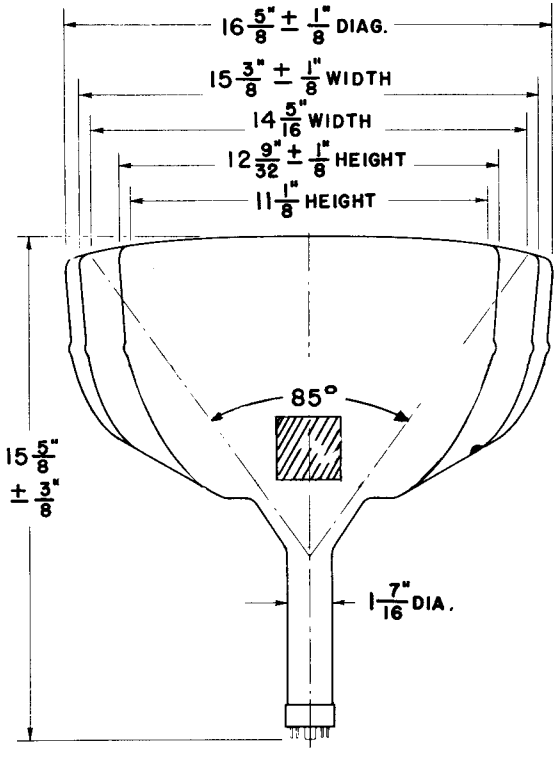
MECHANICAL DATA

OVERALL LENGTH	15 5/8 ± 3/8	INCHES
GREATEST DIMENTSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

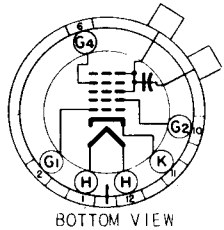
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO.3
GRID NO.5

TUNG-SOL

CATHODE RAY

THE 17BMP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**ALUMINIZED SCREEN**
MAGNETIC DEFLECTION	**GRAY FILTER FACEPLATE**
UNIPOTENTIAL CATHODE	**19 1/8" X 15" RASTER SIZE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
	14 5/16" X 11 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	80	DEGREES
VERTICAL	65	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE*	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS[A]

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-55 TO +300	VOLTS
DC GRID #2 VOLTAGE	110	VOLTS
DC GRID #1 VOLTAGE	-32 TO -50	VOLTS
DC ION TRAP MAGNET RATED STRENGTH	37	GAUSSES

*BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

[A]THIS TUBE MAY BE OPERATED IN GRID DRIVE IF DESIRED, WITH SOME LOSS IN EFFICIENCY. AVERAGE RASTER CUTOFF, USING GRID DRIVE, MAY BE CALCULATED: $E_{g1co} = -.502\ E_{g2} + 5.8$

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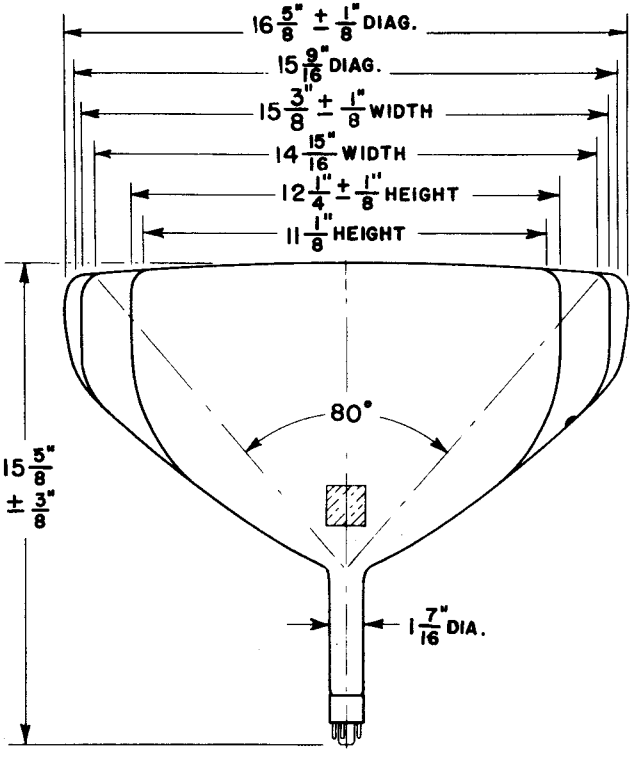
MECHANICAL DATA

OVERALL LENGTH	15 5/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 9/16	INCHES
WIDTH	14 15/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

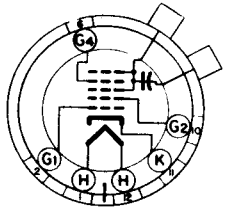
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE

PIN CONNECTIONS



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17BNP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **ALUMINIZED SCREEN**
UNIPOTENTIAL CATHODE — **MAGNETIC DEFLECTION**
GRAY FILTER FACEPLATE — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **14 5/16" X 11 1/8" RASTER SIZE**

DOES NOT REQUIRE ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CATHODE DRIVE SERVICE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE*	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CATHODE DRIVE[A]

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-50 TO +350	VOLTS
DC GRID #2 VOLTAGE	110	VOLTS
DC GRID #1 VOLTAGE[B]	-37 TO -50	VOLTS

[A] THIS TUBE MAY BE OPERATED IN GRID DRIVE IF DESIRED, WITH SOME LOSS IN EFFICIENCY. AVERAGE RASTER CUTOFF, USING DRIVE, MAY BE CALCULATED: $E_{g1c} = .502\ E_{g2} + 5.8$

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

* BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

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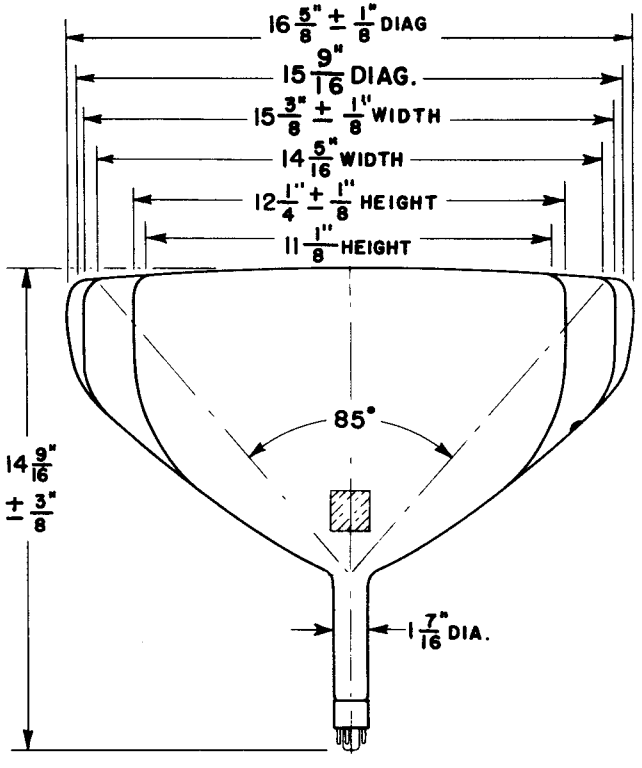
MECHANICAL DATA

OVERALL LENGTH	14 9/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 9/16	INCHES
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

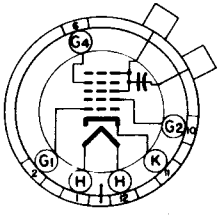
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ±30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17BP4, 17BP4A, 17BP4B, AND 17BP4C ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTIONS:*

17BP4 - NO EXTERNAL CONDUCTIVE COATING *17BP4B - ALUMINIZED SCREEN*
17BP4C - FROSTED FACEPLATE

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE **GREY FILTER FACEPLATE**
MAGNETIC FOCUS AND DEFLECTION **14 1/4" X 10 3/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION **EXTERNAL SINGLE FIELD ION TRAP**
EXTERNAL CONDUCTIVE COATING

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
17BP4A, 17BP4B AND 17BP4C		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

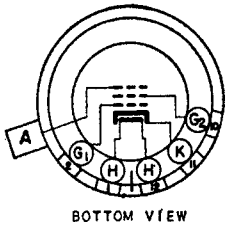
MECHANICAL DATA

OVERALL LENGTH	19 1/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 3/8	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING	17BP4 - 12D ALL OTHERS	12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

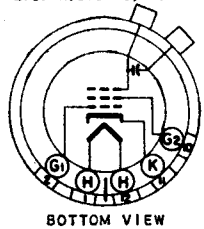
17BP4



BOTTOM VIEW

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2
PIN 11 - CATHODE
PIN 12 - HEATER
ANODE CAP:
GRID NO. 3

17BP4A, 17BP4B, 17BP4C



BOTTOM VIEW

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[A]	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[C]	92 ± 10%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	70	MA.

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

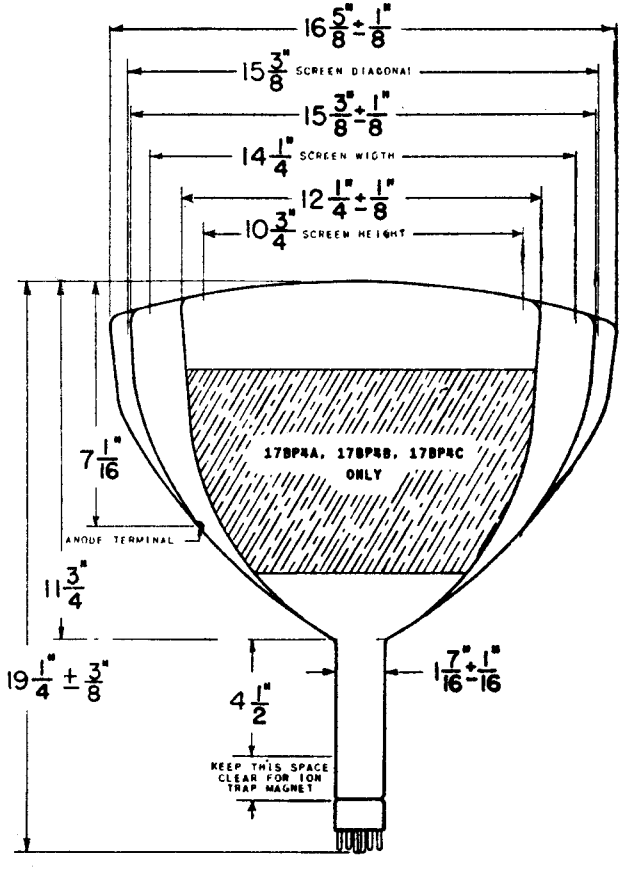
[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

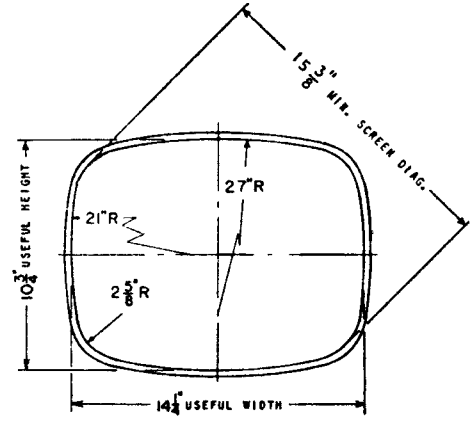
[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 14 1/4" X 10 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

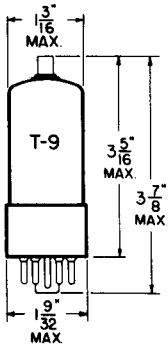
TUNG-SOL


16 5/8" ± 1/8"
15 3/8" SCREEN DIAGONAL
15 3/8" ± 1/8"
14 1/4" SCREEN WIDTH
12 1/4" ± 1/8"
10 3/4" SCREEN HEIGHT
17BP4A, 17BP4B, 17BP4C ONLY
7 1/16"
ANODE TERMINAL
11 3/4"
19 1/4" ± 3/8"
4 1/2"
1 7/16" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET


15 3/8" MIN. SCREEN DIAG.
10 3/4" USEFUL HEIGHT
21"R
27"R
2 5/8"R
14 1/4" USEFUL WIDTH

TUNG-SOL

PENTODE

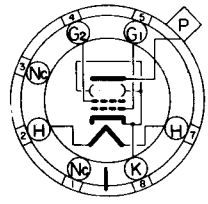


GLASS BULB
SKIRTED
MINIATURE CAP

COATED UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 17BQ6GTB IS A BEAM POWER AMPLIFIER DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID TO PLATE	0.6	μμf
INPUT	15	μμf
OUTPUT	7	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES
(UNLESS OTHERWISE SPECIFIED)

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	16.8	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	600	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAX.)	6 000	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTADE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.45	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	57	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 900	µMHOS
PLATE RESISTANCE	14 500	OHMS
ZERO BIAS:[D]		
PLATE CURRENT	260	MA.
GRID #2 CURRENT	26	MA.
CUTOFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-43	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

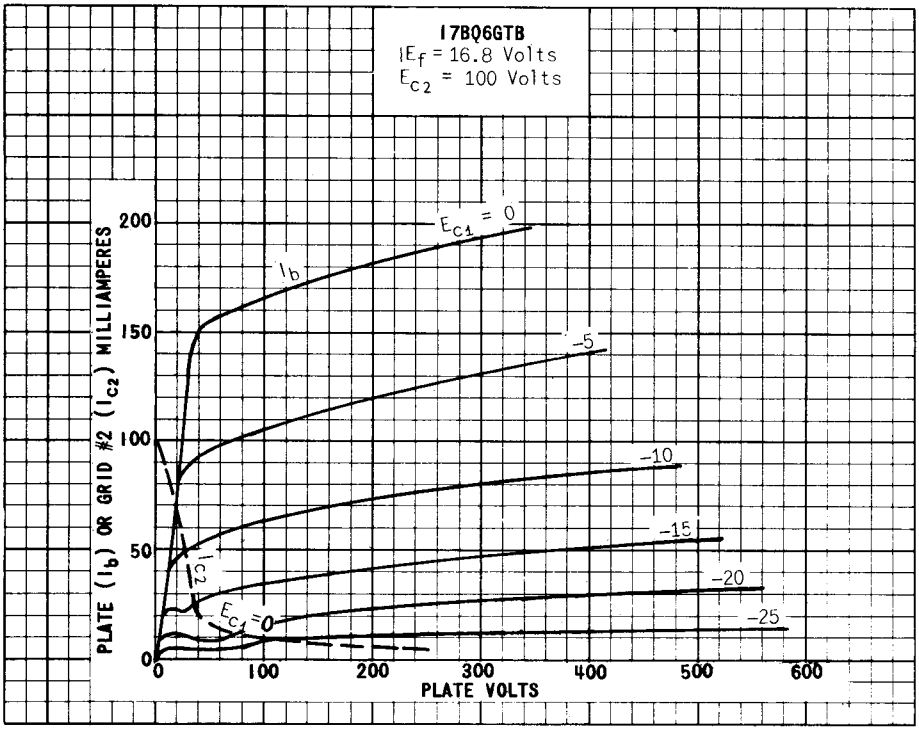
SIMILAR TYPE REFERENCE: Except for heater characteristics, the 17BQ6GTB is identical to the 6BQ6GTB.

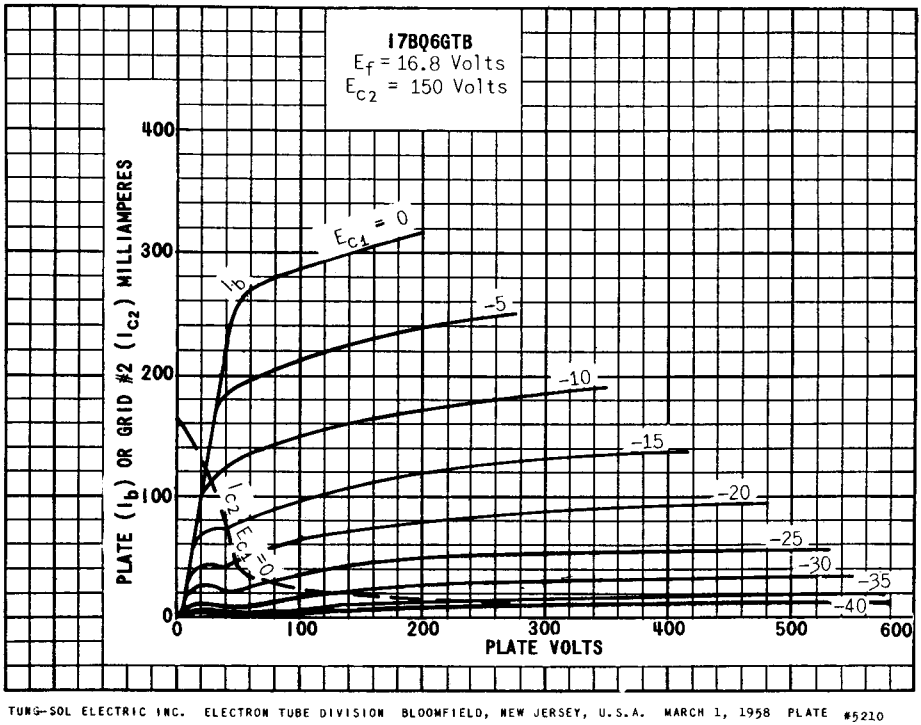
[C] WITH E_b = 250V, E_{c2} = 150V, AND E_{c1} = -22.5V.

[D] WITH E_B = 60V. AND E_{C2} = 150V. (INSTANTANEOUS VALUES)

[E] FOR I_b = 1 MA. WITH E_b = 250V. AND E_{c2} = 150V.

[F] WITH E_b = E_{c2} = 150V. AND E_{c1} = -22.5V.


17BQ6GTB
Ef = 16.8 Volts
Ec2 = 100 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 = 0
-5
-10
-15
-20
-25
Ib
Ic2
0
50
100
150
200
0
100
200
300
400
500
600


17BQ6GTB
Ef = 16.8 Volts
Ec2 = 150 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 = 0
-5
-10
-15
-20
-25
-30
-35
-40
Ib
Ic2
0
100
200
300
400
0
100
200
300
400
500
600

TUNG-SOL

CATHODE RAY

THE 17BSP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN	**ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE	**14 5/16" X 11 1/8" RASTER SIZE**
DOES NOT REQUIRE ION TRAP	**RECTANGULAR GLASS CONSTRUCTION**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1200	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45 ±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-50 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-28 TO -72	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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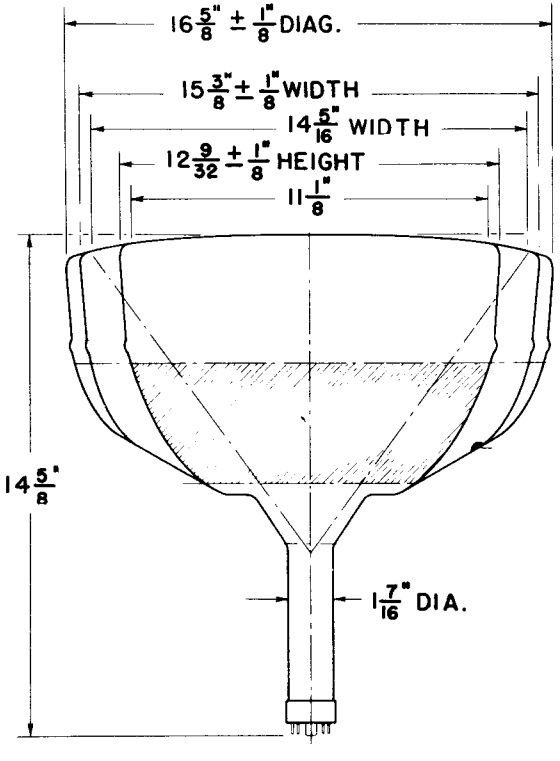
MECHANICAL DATA

OVERALL LENGTH	14 5/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

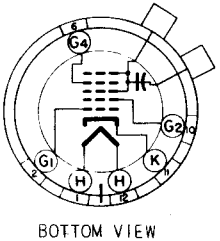
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE



BOTTOM VIEW

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17BUP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. *EXCEPT* FOR HAVING AN ALUMINIZED SCREEN, THE 17BUP4 IS IDENTICAL TO THE 17CBP4. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE	**GRAY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**14 5/16" X 11 1/8" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1200	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[A]	12 000	VOLTS
DC GRID #4 VOLTAGE	−50 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−28 TO −72	VOLTS
DC ION TRAP MAGNET RATED STRENGTH	32	GAUSSES

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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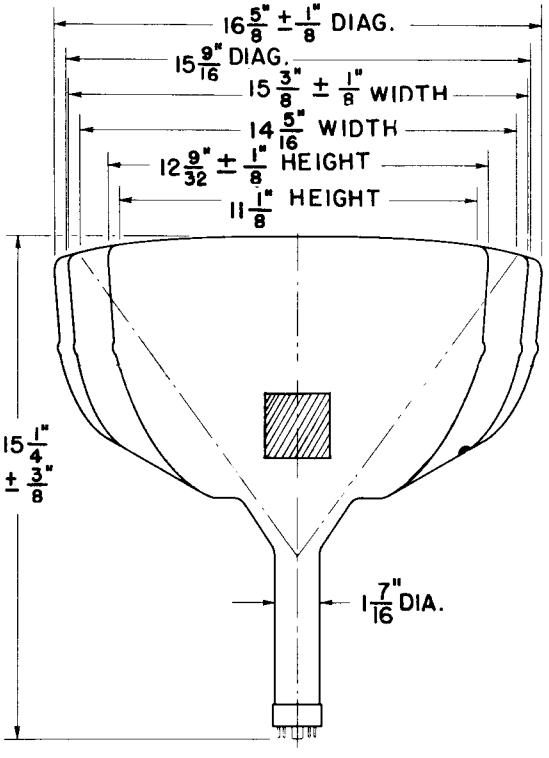
MECHANICAL DATA

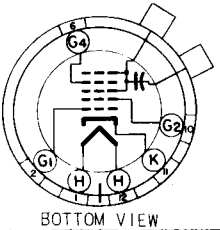
OVERALL LENGTH	15 1/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 9/16	INCHES
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6± 30 DEGREES



PIN CONNECTIONS



PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17BVP4 IS A VERY SHORT, DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN	**ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
14 3/4 X 11 3/4 RASTER SIZE	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**CONTROLLED HEATER WARM-UP TIME**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	105	DEGREES
VERTICAL	87	DEGREES
DIAGONAL	110	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE	SHORT TO MEDIUM	
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	79	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±5%	AMP.
MAXIMUM DC ANODE VOLTAGE	17 600	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-550 TO +1100	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	154	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-50 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-35 TO -72	VOLTS
DC ION TRAP MAGNET RATED STRENGTH	33	GAUSSES

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

*HEATER WARM-UP TIME IS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE TO 5.0 VOLTS IN THE JETEC TEST CIRCUIT, WITH E =25 VOLTS AND SERIES R =31.5 OHMS.

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TUNG-SOL

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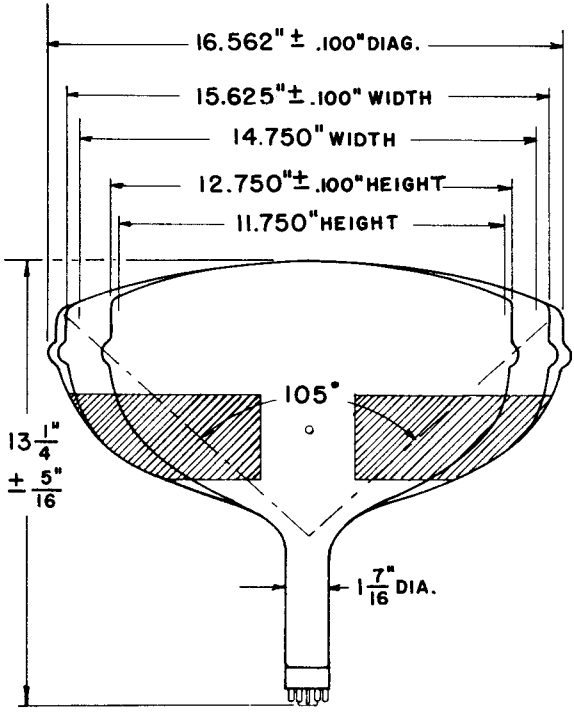
MECHANICAL DATA

OVERALL LENGTH	13 1/4 ± 5/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16.562 ± .100	INCHES
WIDTH	15.625 ± .100	INCHES
HEIGHT	12.750 ± .100	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15.750	INCHES
WIDTH	14.750	INCHES
HEIGHT	11.750	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE		B6-185
BASING		7FA

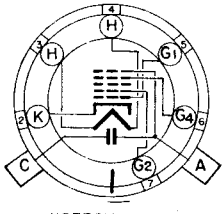
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #7 ± 30 DEGREES



PIN CONNECTIONS

PIN 2 — CATHODE
PIN 3 — HEATER
PIN 4 — HEATER
PIN 5 — GRID #1
PIN 6 — GRID #4
PIN 7 — GRID #2



BOTTOM VIEW

ANODE CAP:
GRID NO. 3

TUNG-SOL

CATHODE RAY

THE 17BZP4 IS A VERY SHORT DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN — **ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE — **DOES NOT REQUIRE ION TRAP**
EXTERNAL CONDUCTIVE COATING — **RECTANGULAR GLASS CONSTRUCTION**
14 3/8" X 11 11/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	105	DEGREES
VERTICAL	87	DEGREES
DIAGONAL	110	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	800	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	78	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

GRID DRIVE SERVICE[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] GRID DRIVE IS THE OPERATING CONDITION IN WHICH THE VIDEO SIGNAL VARIES THE GRID #1 POTENTIAL WITH RESPECT TO CATHODE.

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TUNG-SOL

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CATHODE DRIVE SERVICE[B]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	−500 TO +1000	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #2 TO GRID #1 VOLTAGE	640	VOLTS
MAXIMUM GRID #2 TO CATHODE VOLTAGE	500	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

GRID DRIVE SERVICE

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	0 TO 400	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	−28 TO −72	VOLTS

CATHODE DRIVE SERVICE

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	0 TO 400	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	28 TO 60	VOLTS

[B] CATHODE DRIVE IS THE OPERATING CONDITION IN WHICH THE VIDEO SIGNAL VARIES THE CATHODE POTENTIAL WITH RESPECT TO GRID #1 AND THE OTHER ELECTRODES.

[C] VISUAL EXTINCTION ON FOCUSED RASTER.

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TUNG-SOL

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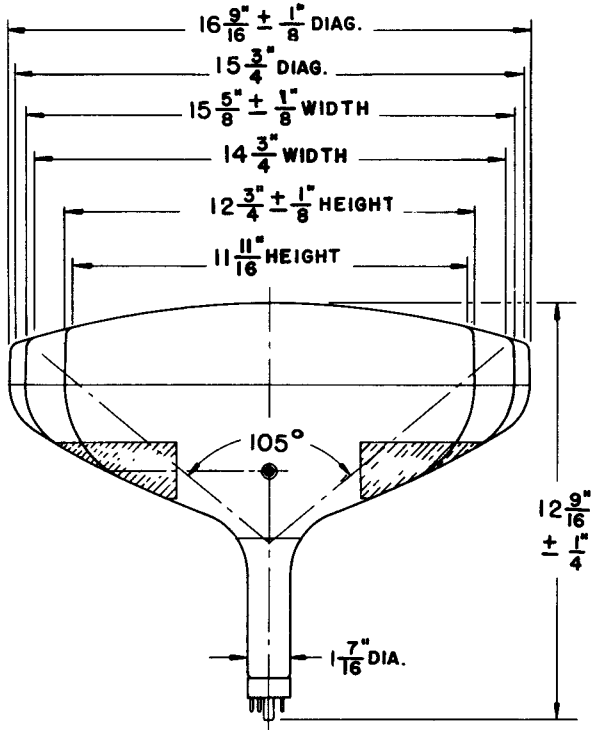
MECHANICAL DATA

OVERALL LENGTH	12 9/16 ± 1/4	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 9/16 ± 1/8	INCHES
WIDTH	15 5/8 ± 1/8	INCHES
HEIGHT	12 3/4 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 3/4	INCHES
WIDTH	14 3/4	INCHES
HEIGHT	11 11/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL BUTTON EIGHTAR 7 PIN-STYLE B	B7-183
BASING		8HR

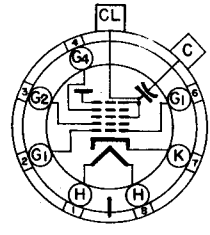
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #4 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 — HEATER
PIN 2 — GRID #1
PIN 3 — GRID #2
PIN 4 — GRID #4
PIN 6 — GRID #1
PIN 7 — CATHODE



BOTTOM VIEW

PIN 8 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

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TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

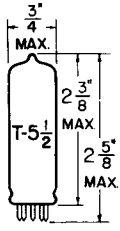
COATED UNIPOTENTIAL CATHODE

HEATER

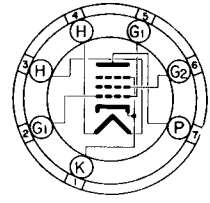
16.8 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CV

THE 17C5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME THE 17C5 IS IDENTICAL TO THE 50C5.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6 ←	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	13.0 ←	μμf
OUTPUT: P TO (H+K&G_3+G_2)	8.5 ←	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	16.8	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC COMPONENT	200	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	6.0 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0*	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220 ←	°C
HEATER WARM-UP TIME*	11.0	SECONDS

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 17C5 ARE IDENTICAL WITH THOSE OF TYPES 12C5, 12CU5, 50C5, 25C5, AND 50B5.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

*INDICATES AN ADDITION.

→INDICATES A CHANGE.

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TUNG-SOL

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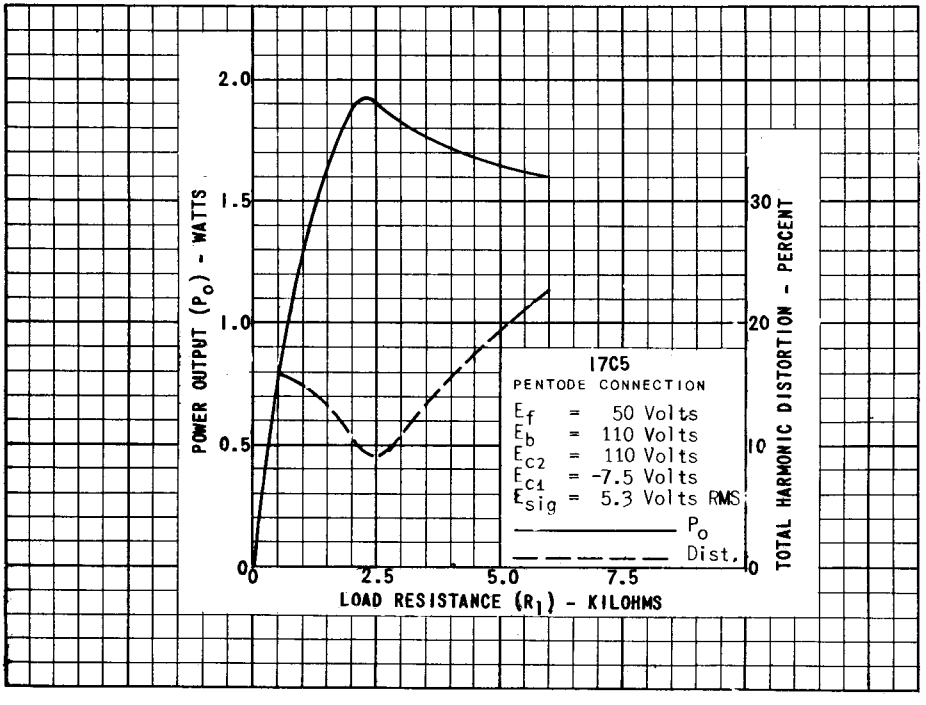
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	120 ←	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-8 ←	VOLTS
PEAK AF GRID #1 VOLTAGE	8 ←	VOLTS
ZERO-SIGNAL PLATE CURRENT	49	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	8.5	MA.
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10 ←	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.3 ←	WATTS



TUNG-SOL

CATHODE RAY

THE 17CBP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLI-CATIONS. *EXCEPT* FOR THE NON ALUMINIZED SCREEN, THE 17CBP4 IS IDENTICAL TO THE 17BUP4. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS
UNIPOTENTIAL CATHODE
EXTERNAL CONDUCTIVE COATING
RECTANGULAR GLASS CONSTRUCTION
MAGNETIC DEFLECTION
GRAY FILTER FACEPLATE
EXTERNAL SINGLE FIELD ION TRAP
14 5/16" X 11 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1200	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[A]	12 000	VOLTS
DC GRID #4 VOLTAGE	-50 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC ION TRAP MAGNET RATED STRENGTH	32	GAUSSES

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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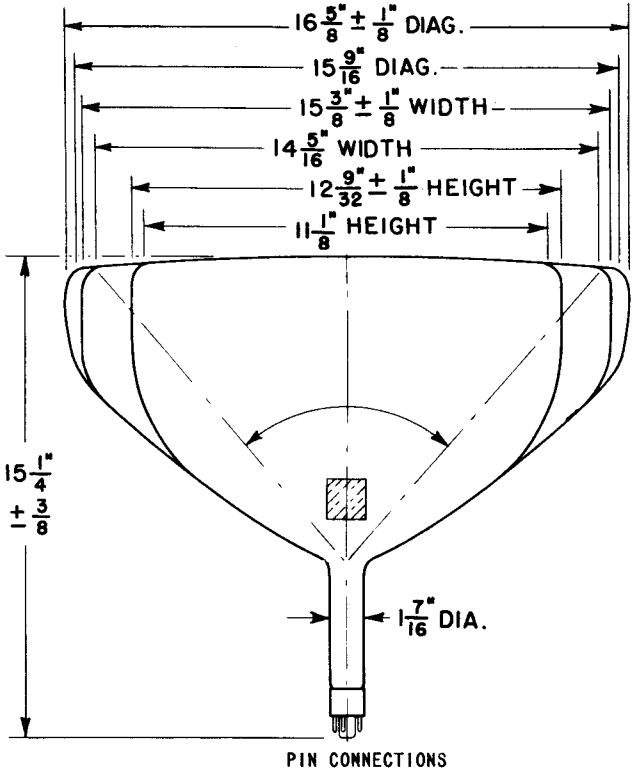
MECHANICAL DATA

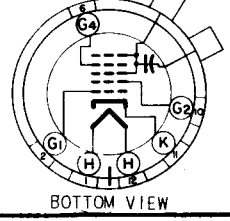
OVERALL LENGTH	15 1/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 9/16	INCHES
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6± 30 DEGREES



PIN CONNECTIONS



BOTTOM VIEW

PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17CDP4 IS A VERY SHORT DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN	**ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE	**DOES NOT REQUIRE ION TRAP**
EXTERNAL CONDUCTIVE COATING	**RECTANGULAR GLASS CONSTRUCTION**
CONTROLLED HEATER WARM-UP TIME	**14 3/4" X 11 11/16" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	105	DEGREES
VERTICAL	87	DEGREES
DIAGONAL	110	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	$\mu\mu$f
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	800	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	78	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

GRID DRIVE SERVICE[A]

HEATER VOLTAGE	8.4	VOLTS
HEATER CURRENT	0.45	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER WARM-UP TIME (APPROX.)	11.0	SECONDS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[A] GRID DRIVE IS THE OPERATING CONDITION IN WHICH THE VIDEO SIGNAL VARIES THE GRID #1 POTENTIAL WITH RESPECT TO CATHODE.

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CATHODE DRIVE SERVICE[B]

HEATER VOLTAGE	8.4	VOLTS
HEATER CURRENT	0.45	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #2 TO GRID #1 VOLTAGE	640	VOLTS
MAXIMUM GRID #2 TO CATHODE VOLTAGE	500	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

GRID DRIVE SERVICE

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	0 TO 400	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-28 TO -72	VOLTS

CATHODE DRIVE SERVICE

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	0 TO 400	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	28 TO 60	VOLTS

[B] CATHODE DRIVE IS THE OPERATING CONDITION IN WHICH THE VIDEO SIGNAL VARIES THE CATHODE POTENTIAL WITH RESPECT TO GRID #1 AND THE OTHER ELECTRODES.

[C] VISUAL EXTINCTION ON FOCUSED RASTER.

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TUNG-SOL

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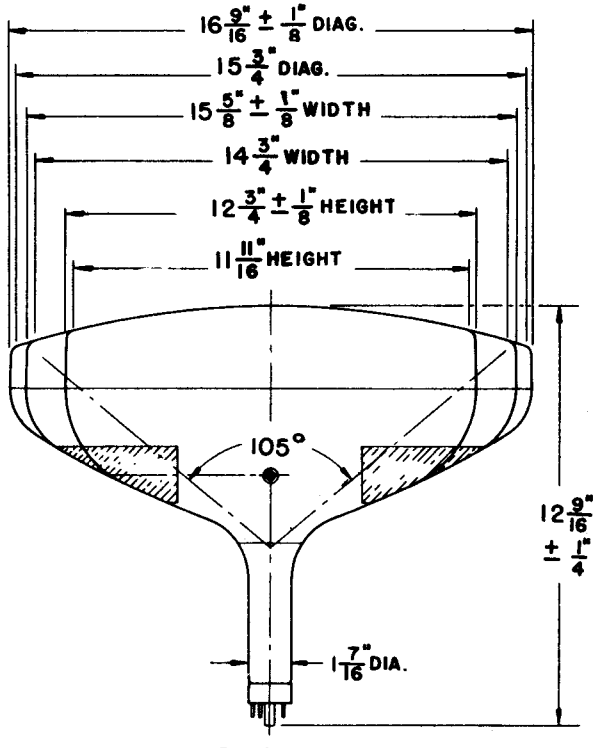
MECHANICAL DATA

OVERALL LENGTH	12 9/16 ± 1/4	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 9/16 ± 1/8	INCHES
WIDTH	15 5/8 ± 1/8	INCHES
HEIGHT	12 3/4 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 3/4	INCHES
WIDTH	14 3/4	INCHES
HEIGHT	11 11/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL BUTTON EIGHTAR 7 PIN-STYLE 8	B7-183
BASING		8HR

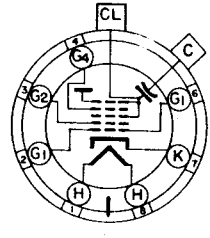
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #4 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 3 – GRID #2
PIN 4 – GRID #4
PIN 6 – GRID #1
PIN 7 – CATHODE



BOTTOM VIEW

PIN 8 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 17CGP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN — **MAGNETIC DEFLECTION**
ELECTROSTATIC FOCUS — **UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **14 5/16" X 18 1/8" RASTER SIZE**
DOES NOT REQUIRE ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	11 000	VOLTS
DC GRID #4 VOLTAGE	-56 TO +310	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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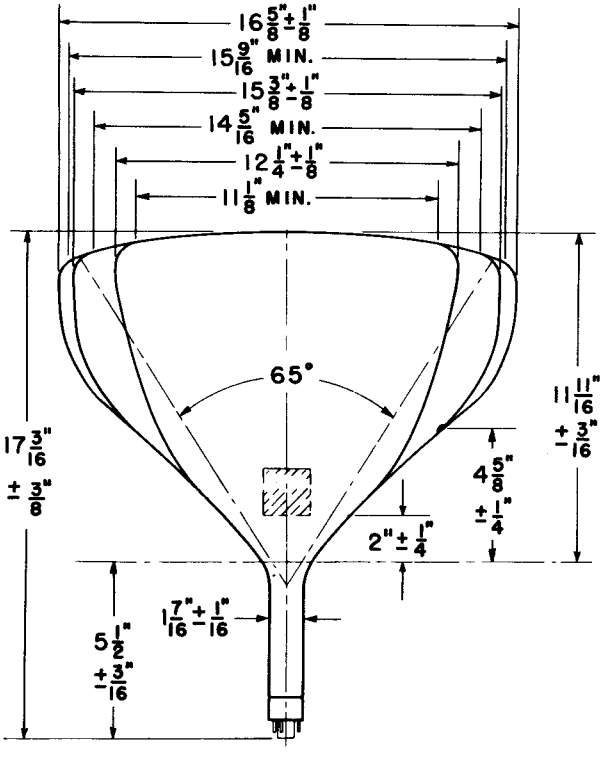
MECHANICAL DATA

OVERALL LENGTH	17 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	15 9/16	INCHES
WIDTH	14 5/16	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

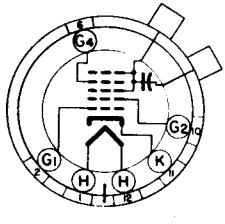
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO.3
GRID NO.5

TUNG-SOL

CATHODE RAY

THE 17CP4 AND 17CP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTION:*

17CP4 — FROSTED FACEPLATE *17CP4A - UNFROSTED FACEPLATE*

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
14 5/8" X 11" RASTER SIZE
RECTANGULAR METAL CONSTRUCTION
FILTER GLASS FACEPLATE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL SINGLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	65	PERCENT

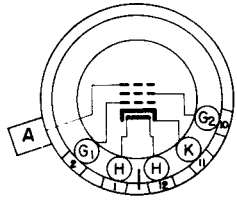
MECHANICAL DATA

OVERALL LENGTH	19	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 13/16 ± 3/16	INCHES
WIDTH	15 15/16 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
WIDTH	14 5/8	INCHES
HEIGHT	11	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D
BASE ALIGNMENT		

PIN #6 ALIGNS WITH HORIZONTAL PICTURE AXIS ± 10 DEGREES

PIN CONNECTIONS

PIN 1 — HEATER
PIN 2 — GRID NO. 1
PIN 10 — GRID NO. 2
PIN 11 — CATHODE



BOTTOM VIEW

PIN 12 — HEATER
METAL SHELL LIP: ANODE

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] THE PRODUCT OF ANODE VOLTAGE AND AVERAGE ANODE CURRENT SHOULD BE LIMITED TO 6 WATTS.

TYPICAL OPERATING CONDITIONS ANDECHARACTERISTICS

DC ANODE VOLTAGE[B]	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[D] (APPROX.)	96 ± 6%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	70	MA.
FIELD STRENGTH OF ION TRAP MAGNET	45	GAUSSES

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 12,000 VOLTS.

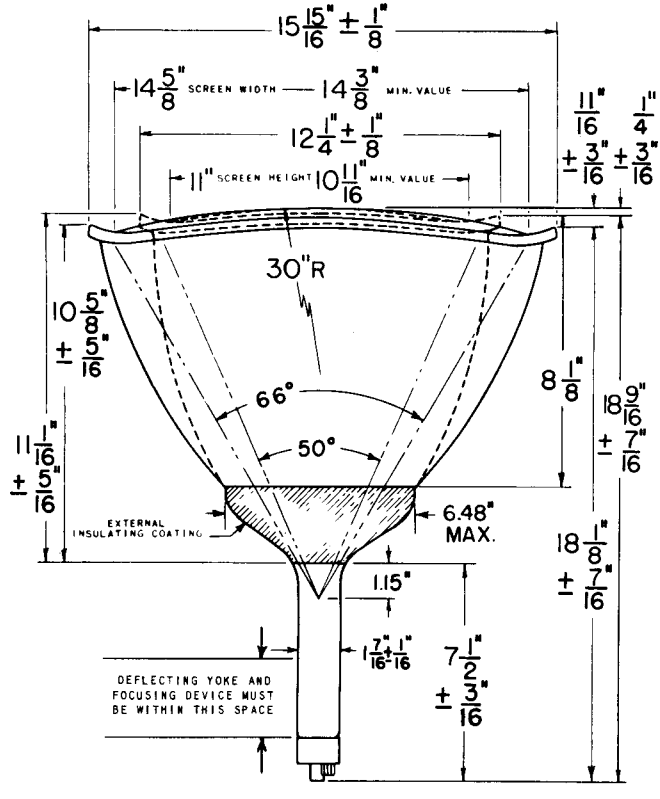
[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

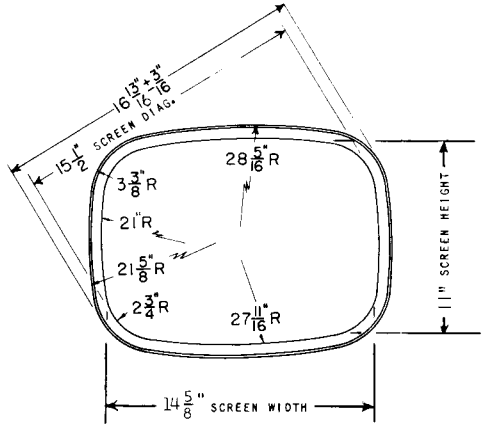
[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 10 11/16" BY 14 3/8" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

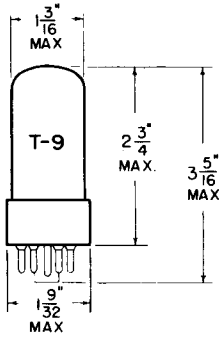
TUNG-SOL


15 15/16" ± 1/8"
14 5/8" SCREEN WIDTH
14 3/8" MIN. VALUE
12 1/4" ± 1/8"
11" SCREEN HEIGHT
10 11/16" MIN. VALUE
11/16" ± 3/16"
1/4" ± 3/16"
30"R
66°
50°
10 5/8" ± 5/16"
11 1/16" ± 5/16"
8 1/8"
18 9/16" ± 7/16"
18 1/8" ± 7/16"
6.48" MAX.
EXTERNAL INSULATING COATING
1.15"
1 7/16" ± 1/16"
7 1/2" ± 3/16"
DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE


16 13/16" ± 3/16" SCREEN DIAG.
15 1/2"
28 5/16"R
3 3/8"R
21"R
21 5/8"R
2 3/4"R
27 11/16"R
11" SCREEN HEIGHT
14 5/8" SCREEN WIDTH

TUNG-SOL

DIODE

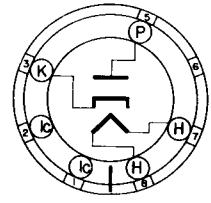


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
8 PIN OCTAL
4CG

THE 17D4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

HEATER TO CATHODE	3.0	μμf
PLATE TO CATHODE & HEATER[A]	6.0	μμf
CATHODE TO PLATE & HEATER[A]	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM - UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK	4 400	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A] TIE UNUSED PINS AND METAL PART TO HEATER.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

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TUNG-SOL

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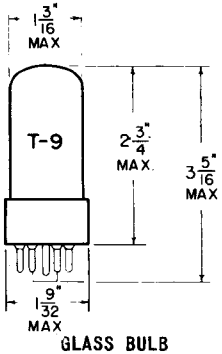
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DIODE



GLASS BULB

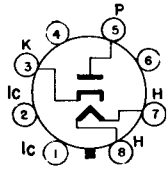
INTERMEDIATE SHELL B5-85 OR
SHORT INTERMEDIATE SHELL B6-60
8 PIN OCTAL

OUTLINE DRAWING
JEDEC 9-41

UNIPOTENTIAL CATHODE

HEATER
16.8 VOLTS 0.45 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •

BASING DIAGRAM

JEDEC 4CG

THE 17D4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

HEATER TO CATHODE	3.0	pf
PLATE TO CATHODE & HEATER[A]	6.0	pf
CATHODE TO PLATE & HEATER[A]	8.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM - UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	16.8	VOLTS
HEATER CURRENT	→0.45	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK	4 400	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A]TIE UNUSED PINS AND METAL PART TO HEATER.

[B]FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

→INDICATES A CHANGE.

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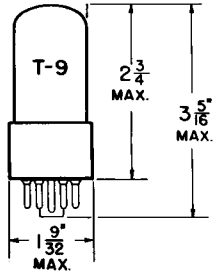
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TUNG-SOL

DIODE



GLASS BULB

INTERMEDIATE SHELL
5 PIN OCTAL B5-85
OUTLINE DRAWING
JEDEC 9-41

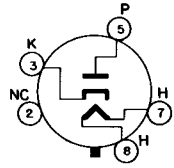
UNIPOTENTIAL CATHODE

HEATER

16.8 VOLTS .450±.030 AMPS.

ANY MOUNTING POSITION

[A] SOCKET PINS 1, 2, 4 & 6 MUST NOT BE USED AS TIE POINTS.



BOTTOM VIEW[A]

BASING DIAGRAM
JEDEC 4CG

THE 17D4A IS A SINGLE INDIRECTLY-HEATED DIODE INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

HEATER TO CATHODE: H TO K	3.0	pf
CATHODE TO PLATE AND HEATER: K TO (P+ H)	9.0	pf
PLATE TO CATHODE AND HEATER: P TO (K +H)	7.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER CURRENT[C]	.450±.030	AMPS.
MAXIMUM PEAK INVERSE PLATE VOLTAGE	5000	VOLTS
MAXIMUM DC PLATE CURRENT	185	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	8.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE[D]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	1000	VOLTS
TOTAL DC AND PEAK	5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE (AT 0.45 AMP.)	16.8	VOLTS
HEATER CURRENT	.450±.030	AMP.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING PLATE CURRENT --340 MA.)	30	VOLTS

B

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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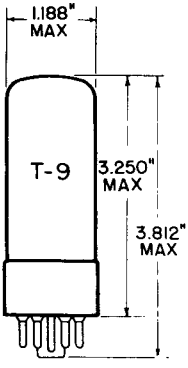
[C] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER CURRENT IS AT THE SPECIFIED BOGIE VALUE. HEATER SUPPLY VARIATIONS SHOULD BE RESTRICTED SO THAT THE HEATER CURRENT WILL BE MAINTAINED WITHIN THE SPECIFIED TOLERANCE.

[D] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

[*] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

HALF-WAVE VACUUM RECTIFIER



GLASS BULB
JEDEC GROUP 1 B5-85
SHORT
INTERMEDIATE-SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS

PINS 1, 4, & 6 ARE OMITTED

OUTLINE DRAWING
JEDEC 9-44

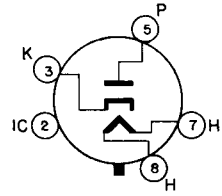
UNIPOTENTIAL CATHODE

HEATER

17.0 VOLTS 600±40 MA. ←

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 17DE4 IS A HALF-WAVE VACUUM RECTIFIER OF THE GLASS-OCTAL TYPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS.

EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 17DE4 IS IDENTICAL TO THE 6DE4 AND 22DE4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	pf
CATHODE TO HEATER AND PLATE	11.5	pf
HEATER TO CATHODE	4	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	5500[A]	VOLTS
MAXIMUM PEAK PLATE CURRENT	1100	MA.
MAXIMUM DC PLATE CURRENT	180	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	5500[B]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	300[C]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TUNG-SOL

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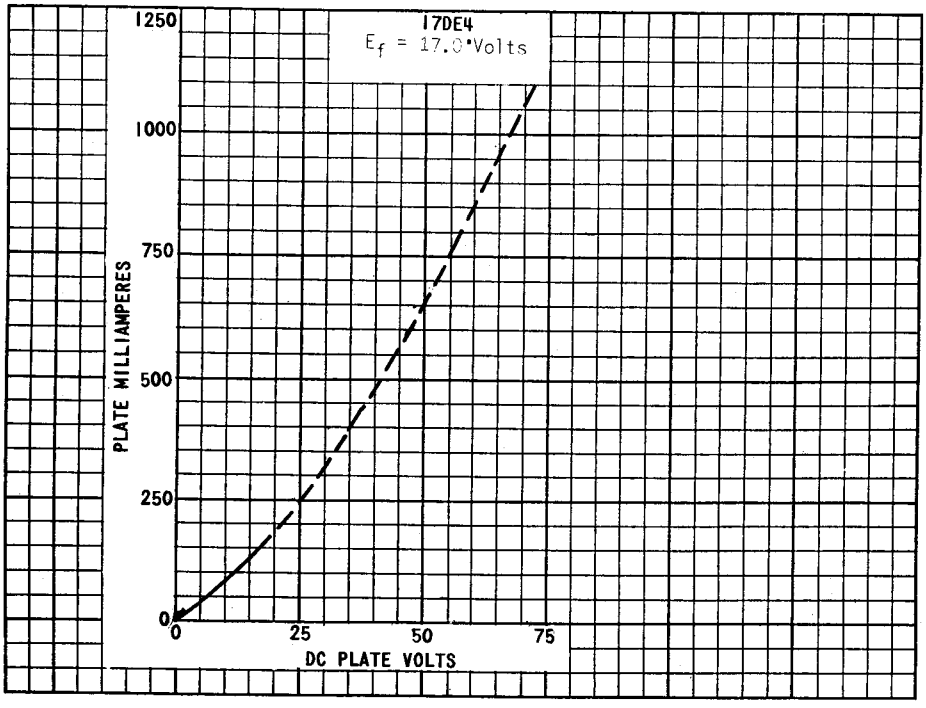
NOTES

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

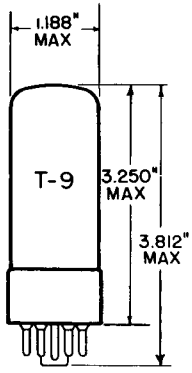
C THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



TUNG-SOL

DIODE



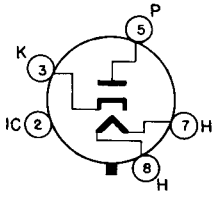
GLASS BULB
SHORT INTERMEDIATE SHELL
5 PIN OCTAL WITH
EXTERNAL BARRIERS
B5 - 85
OUTLINE DRAWING
JEDEC 9-44

UNIPOTENTIAL CATHODE

FOR DAMPER SERVICE IN

TELEVISION RECEIVERS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 4CG

THE 17DM4 IS A HALF-WAVE VACUUM RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND HEATER WARM-UP TIME, THE 17DM4 IS IDENTICAL TO THE 6DM4 AND THE 12DM4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	pf
CATHODE TO HEATER AND PLATE	11.5	pf
HEATER TO CATHODE	4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±27	MA.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		5000[A]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		300[B]	VOLTS
HEATER WARM-UP TIME (AVERAGE)[C]		11	SECONDS

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MAXIMUM RATINGS

DESIGN MAXIUM VALUES - SEE EIA STANDARD RS-239

DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5000[D]	VOLTS
PEAK PLATE CURRENT	1100	MA.
DC PLATE CURRENT	175	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

TUBE VOLTAGE DROP FOR PLATE CURRENT OF 400 MA. APPROXIMATE	35	VOLTS

[A] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

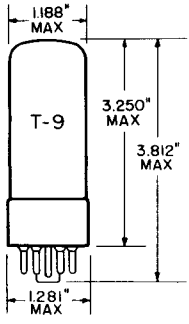
[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[C] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[D] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE. (15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.)

TUNG-SOL

DIODE



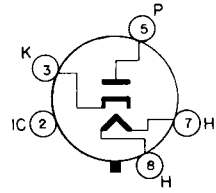
GLASS BUBL

SHORT INTERMEDIATE SHELL
5 PIN OCTAL BASE B5-85
OUTLINE DRAWING
JEDEC 9-44

FOR DAMPER SERVICE IN
TELEVISION RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

SOCKET TERMINALS 1,2,4 & 6,
SHOULD NOT BE USED AS
TIE POINTS.

THE 17DM4A IS AN INDIRECTLY-HEATED HALF-WAVE RECTIFIER EMPLOYING A T-9 ENVELOPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF TELEVISION RECEIVERS.

EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17DM4A IS IDENTICAL TO THE 6DM4A AND THE 12DM4A.

ALSO, THE 17DM4A IS IDENTICAL TO THE 17DM4 EXCEPT FOR HIGHER PLATE CURRENT RATINGS.

DIRECT INTERELECTRODE CAPACITANCES

HEATER TO CATHODE	4	pf
PLATE TO CATHODE	8.5	pf
CATHODE TO PLATE AND HEATER	11.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	VOLTS	450	MA.
HEATER WARM-UP TIME[A]			11	SECONDS
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			450 ± 30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	
TOTAL DC AND PEAK			300	VOLTS

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

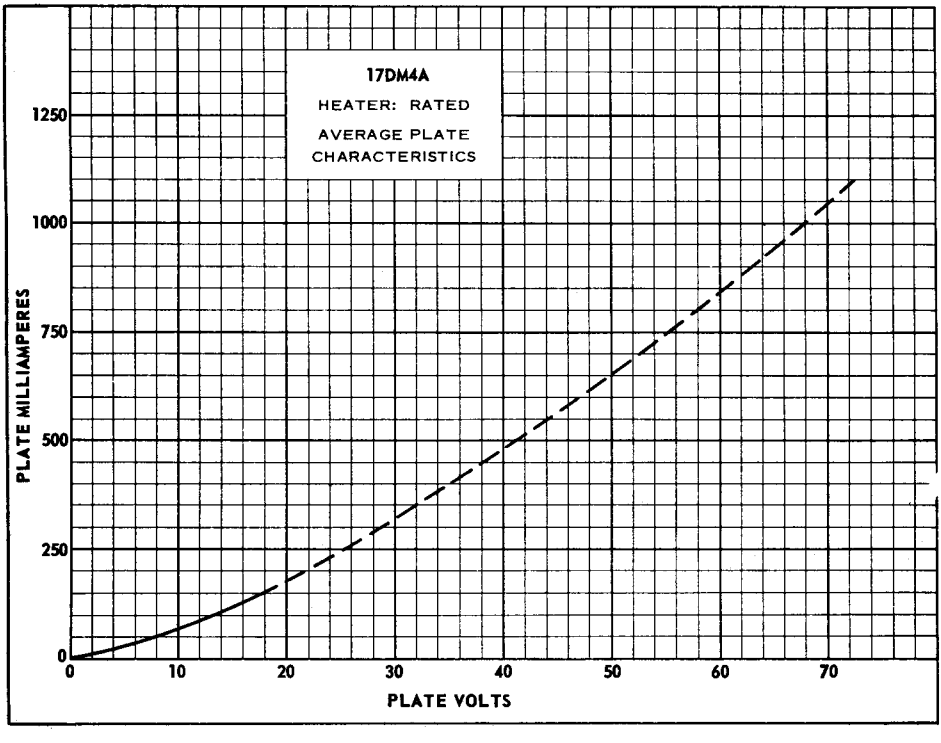
DAMPER SERVICE[B]

PEAK INVERSE VOLTAGE	5000	VOLTS
PEAK PLATE CURRENT	1200	MA.
DC PLATE CURRENT	200	MA.
PLATE DISSIPATION	6.5	WATTS

CHARACTERISTICS

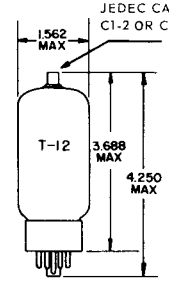
VOLTAGE DROP AT Ib = 400 MA.	35	VOLTS

B
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN 'STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION'. THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.



TUNG-SOL

BEAM PENTODE



GLASS BULB

SKIRTED MINIATURE
SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B5-190 ←
OUTLINE DRAWING
JEDEC 12-51

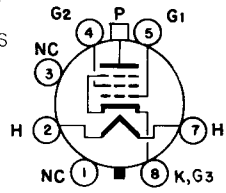
COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER

APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #2 IS OMITTED WHEN EITHER A
B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 17DQ6A IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER TUBE IN HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 17DQ6A IS IDENTICAL TO THE 6DQ6A.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME, APPROX.*		11	SECONDS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6000	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	155	MA.
CATHODE CURRENT, PEAK	540	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

AVERAGE CHARACTERISTICS

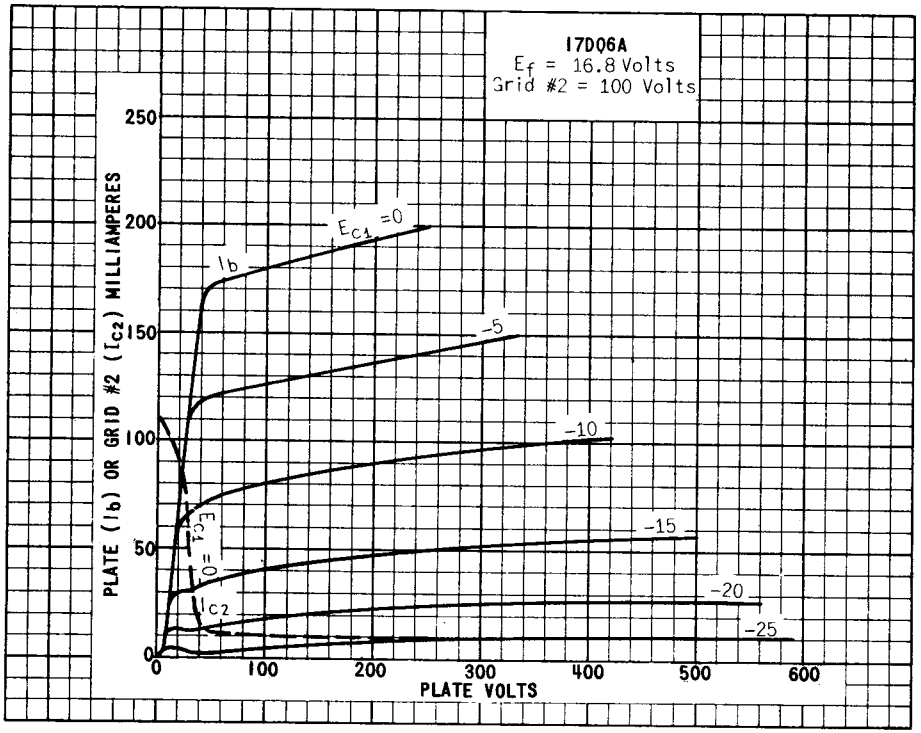
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	1.5	MA.
TRANSCONDUCTANCE	6600	μMHOS
PLATE RESISTANCE, APPROX.	20,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	315	MA.
GRID #2 CURRENT	25	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-40	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.5	

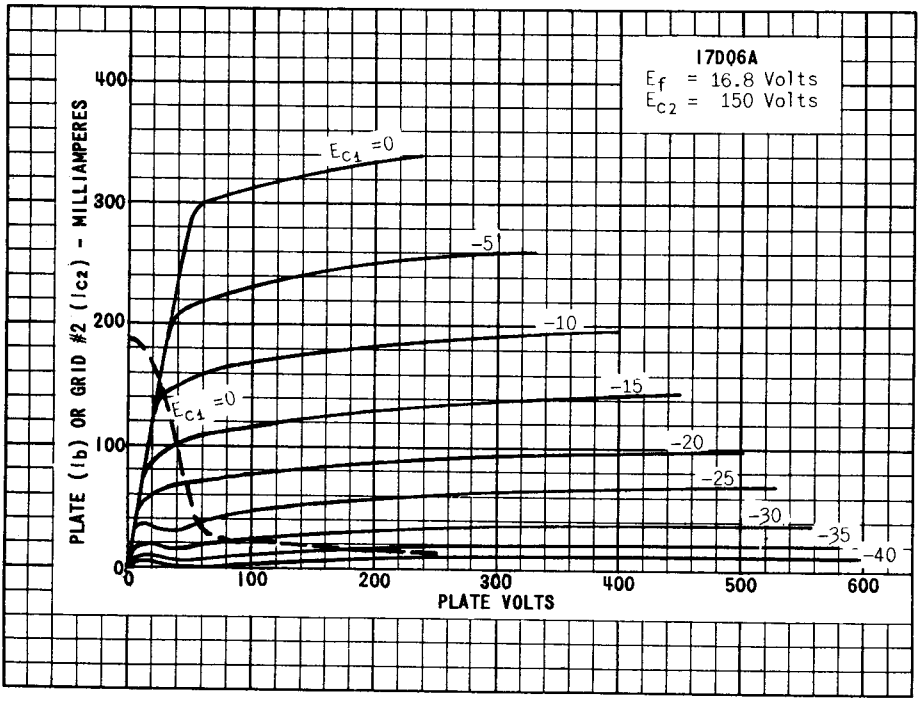
→ INDICATES A CHANGE.

A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

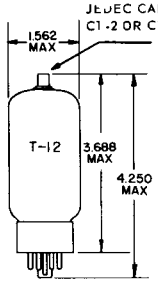
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


17D06A
E_f = 16.8 Volts
Grid #2 = 100 Volts
PLATE (Ib) OR GRID #2 (I_{c2}) MILLIAMPERES
250
200
150
100
50
0
E_{c1} =0
Ib
-5
-10
-15
-20
-25
E_{c1} =0
I_{c2}
0
100
200
300
400
500
600
PLATE VOLTS


17D06A
E_f = 16.8 Volts
E_{c2} = 150 Volts
PLATE (Ib) OR GRID #2 (I_{c2}) - MILLIAMPERES
400
300
200
100
0
E_{c1} =0
-5
-10
-15
-20
-25
-30
-35
-40
E_{c1} =0
0
100
200
300
400
500
600
PLATE VOLTS

TUNG-SOL

BEAM PENTODE



GLASS BULB

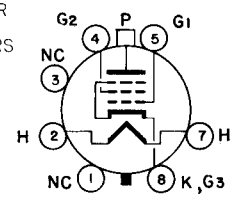
SKIRTED MINIATURE
SHORT MEDIUM-SHELL
6 PIN OCTAL B6-122,
B6-148 OR
7 PIN OCTAL
B7-111, B7-119 OR B5-190 ←
OUTLINE DRAWING
JEDEC 12-51

COATED UNIPOTENTIAL CATHODE

FOR HORIZONTAL DEFLECTION AMPLIFIER APPLICATIONS IN TELEVISION RECEIVERS

ANY MOUNTING POSITION

PIN #1 IS OMITTED WHEN EITHER A B6-122 OR B6-148 BASE IS USED



BASING DIAGRAM
JEDEC 6AM

THE 17DQ6B IS A BEAM POWER PENTODE PRIMARILY DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. ITS HIGH ZERO-BIAS PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES MAKES THE TUBE WELL SUITED FOR USE IN RECEIVERS THAT OPERATE AT LOW PLATE-SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 17DQ6B IS IDENTICAL TO THE 6DQ6B.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (G TO P)	0.5	pf
INPUT: (G1 TO H+K, BP + G2)	15.0	pf
OUTPUT: (P TO H+K, BP + B2)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME, APPROX.*		11	SECONDS

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL DEFLECTION AMPLIFIER[A]

PLATE SUPPLY VOLTAGE, DC (BOOST+DC POWER SUPPLY)	770	VOLTS
PLATE VOLTAGE, PEAK PULSE, POSITIVE	6500	VOLTS
PLATE VOLTAGE, PEAK PULSE, NEGATIVE	1500	VOLTS
PLATE DISSIPATION,[B]	18	WATTS
GRID #1 VOLTAGE, PEAK PULSE, NEGATIVE	330	VOLTS
GRID #2 VOLTAGE, DC	220	VOLTS
GRID #2 DISSIPATION	3.6	WATTS
CATHODE CURRENT, AVERAGE	175	MA.
CATHODE CURRENT, PEAK	610	MA.
GRID #1 CIRCUIT RESISTANCE,[B]	1.0	MEGOHM
BULB TEMPERATURE, (AT HOTTEST POINT)	220	°C

AVERAGE CHARACTERISTICS

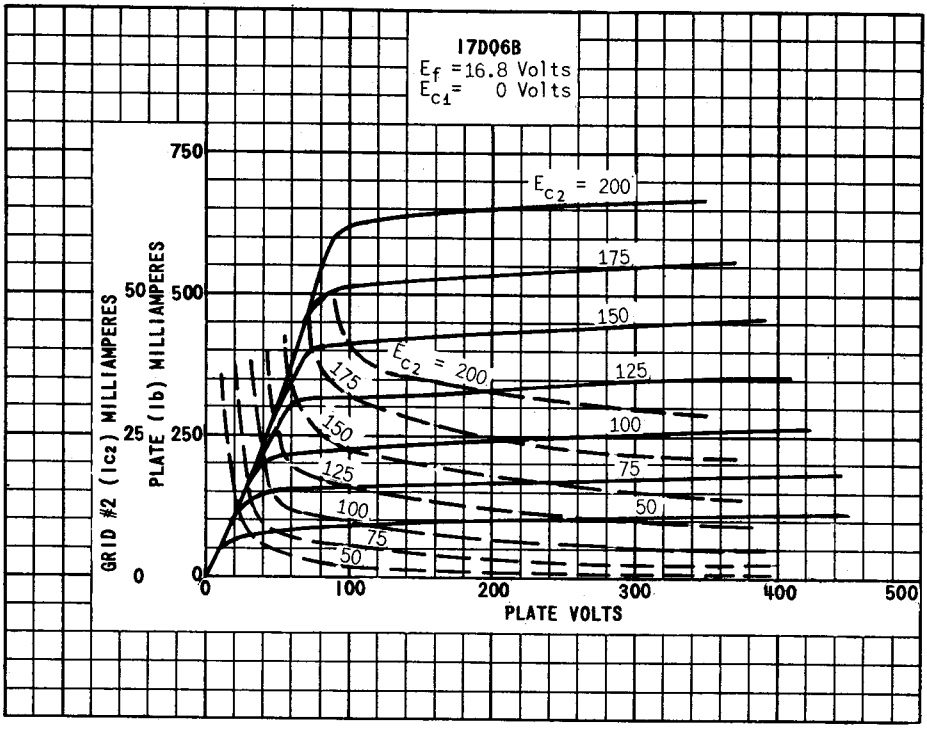
PENTODE OPERATION: Eb = 250V, Ec2 = 150V, Ec1 = -22.5V.		
PLATE CURRENT	65	MA.
GRID #2 CURRENT	1.8	MA.
TRANSCONDUCTANCE	7300	μMHOS
PLATE RESISTANCE, APPROX.	18,000	OHMS
ZERO BIAS: Eb = 60V, Ec2 = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	345	MA.
GRID #2 CURRENT	27	MA.
CUTOFF: Ib = 1 MA, Eb = 250 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-42	VOLTS
CUTOFF: Ib = 1 Ma, Eb = 5000 V, Ec2 = 150 V.		
GRID #1 VOLTAGE, APPROX.	-100	VOLTS
TRIODE MU: Eb = Ec2 = 150 V, Ec1 = -22.5 V.	4.4	

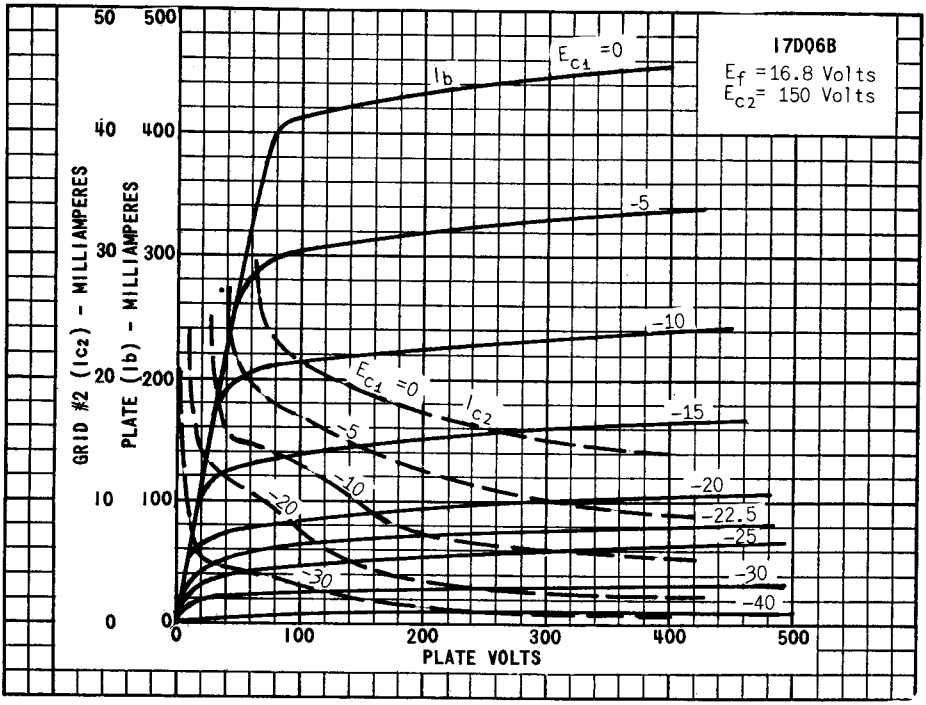
→ INDICATES A CHANGE.

A
FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B
IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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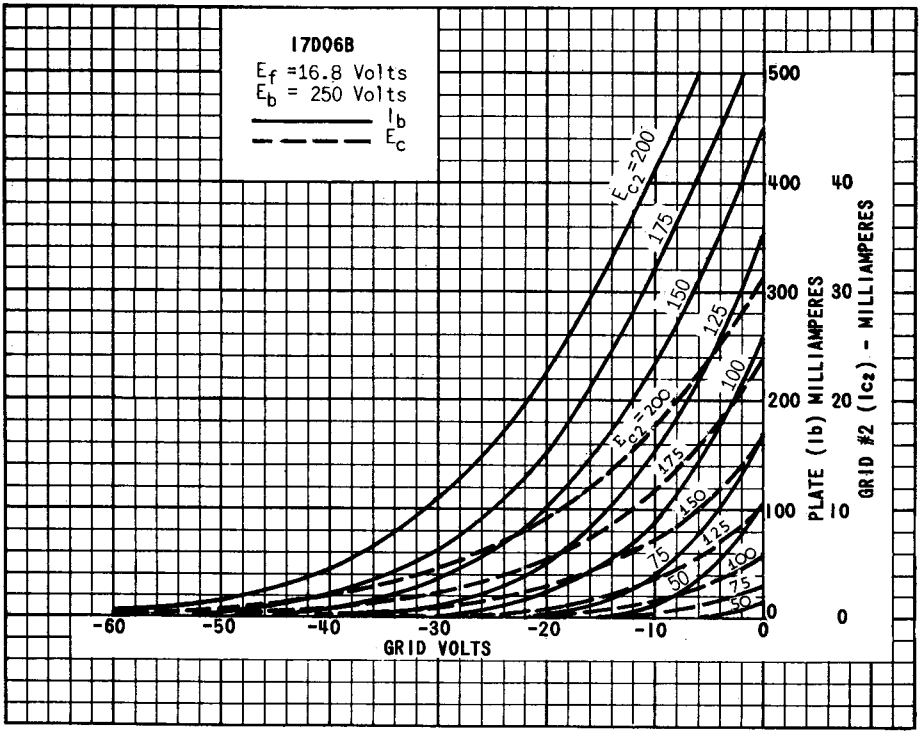
17DQ6B


17D06B
E_f =16.8 Volts
E_b = 250 Volts
I_b
E_c
E_{c2} =200
175
150
125
100
75
50
-60
-50
-40
-30
-20
-10
0
GRID VOLTS
500
400
300
200
100
0
40
30
20
10
0
PLATE (Ib) MILLIAMPERES
GRID #2 (Ic2) - MILLIAMPERES

TUNG-SOL

CATHODE RAY

THE 17FP4 AND 17FP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTION:*

17FP4 - PARTIAL EXTERNAL COATING *17FP4A - COMPLETE EXTERNAL COATING*

THEIR COMMON FEATURES INCLUDE:

ELECTROSTATIC FOCUS **MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE **GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION **EXTERNAL SINGLE FIELD ION TRAP**
14 1/4" X 11 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD			ELECTROSTATIC
DEFLECTING METHOD			MAGNETIC
DEFLECTION ANGLE (APPROX.)			
HORIZONTAL		65	DEGREES
DIAGONAL		70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)			
CATHODE TO ALL OTHER ELECTRODES		5	μμf
GRID #1 TO ALL OTHER ELECTRODES		6	μμf
	17FP4A	17FP4	
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

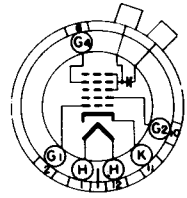
MECHANICAL DATA

OVERALL LENGTH	19 1/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 1/2	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	11 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID #3,
GRID #5,
COLLECTOR

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC ANODE #1 VOLTAGE	5 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[B]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

[A] IF THIS TUBE IS OPERATED AT VOLTAGE IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE.

[B] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	12 000	VOLTS
DC ANODE #1 VOLTAGE (FOCUSING ELECTRODE)[C]	2300 TO 3550	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[D]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.
ION TRAP FIELD INTENSITY (APPROX.)	35	GAUSSES

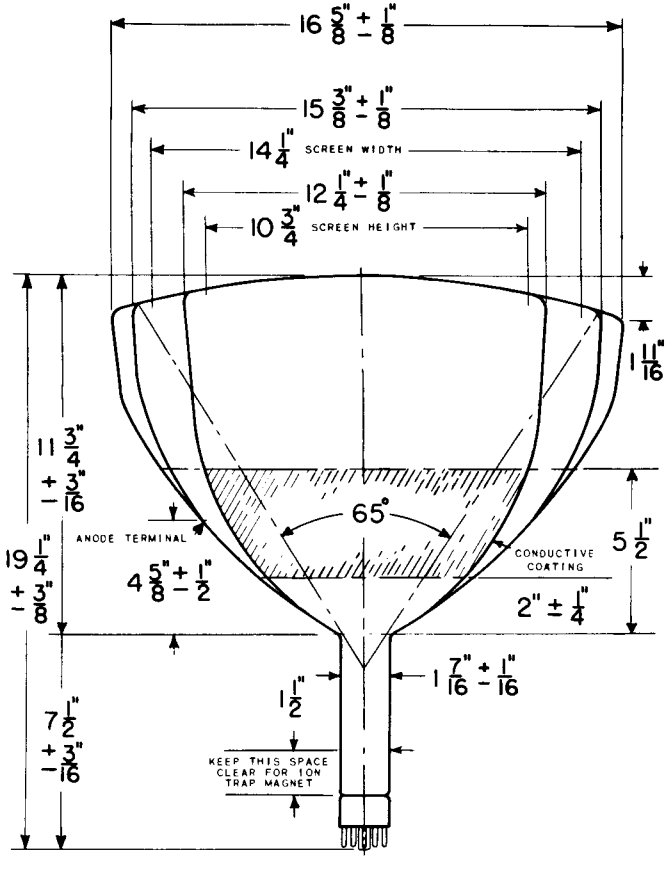
[C] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON A 10 3/4" X 14 1/4" PICTURE SIZE.

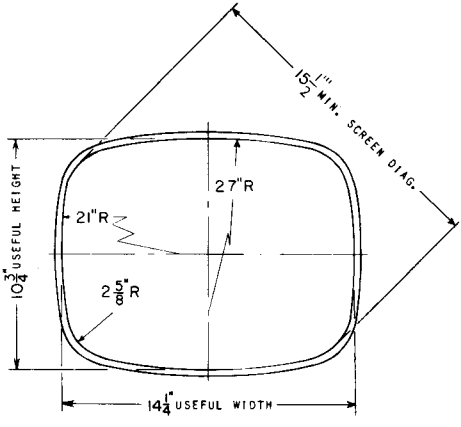
[D] VISUAL EXTINCTION OF UNDEFLECTED FOCUSING SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL

CATHODE RAY

THE 17GP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
ELECTROSTATIC FOCUS — **FROSTED FILTERGLASS FACEPLATE**
RECTANGULAR METAL CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
14 5/8" X 11" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

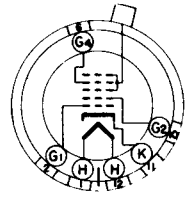
PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

MAXIMUM OVERALL LENGTH	19 5/16	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 13/16 ± 3/16	INCHES
WIDTH	15 15/16 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 1/2	INCHES
WIDTH	14 5/8	INCHES
HEIGHT	11	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M
BASE ALIGNMENT		
PIN #6 ALIGNS WITH HORIZONTAL PICTURE AXIS ± 10 DEGREES		

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

BOTTOM VIEW

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	5 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
GRID #4 CURRENT	-15 TO +25	μAMP.
GRID #2 CURRENT	-15 TO +15	μAMP.
GRID #4 VOLTAGE FOR ANODE CURRENT OF 100 μAMP.	2670 TO 3620	VOLTS
FIELD STRENGTH OF ION TRAP MAGNET	40	GAUSSES
FIELD STRENGTH OF ADJUSTABLE CENTERING MAGNET	0 TO 8	GAUSSES

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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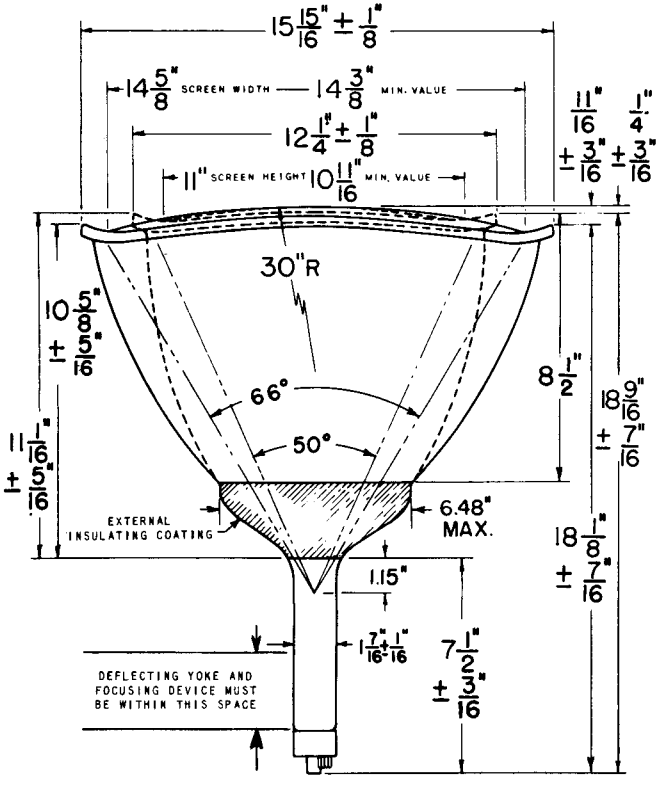

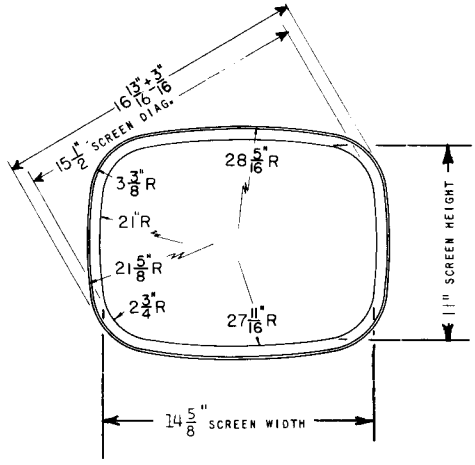

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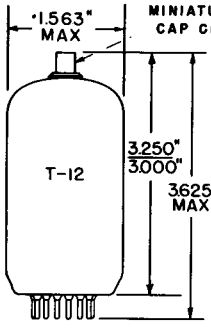
BEAM PENTODE



GLASS BULB
BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-79

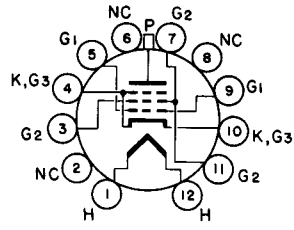
FOR

TV HORIZONTAL DEFLECTION

AMPLIFIER APPLICATIONS

ANY MOUNTING POSITION

COATED UNIPOTENTIAL CATHODE



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12DR

THE 17GV5 IS A COMPACTRON BEAM-POWER PENTODE EMPLOYING A 12 PIN T-12 ENVELOPE. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.6	pf
INPUT: G1 TO (H+K+G2+B.P)	16	pf
OUTPUT: P TO (H+K+G2+B.P.)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER WARM-UP TIME [A]		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION[B]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	C

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	5000	60	250	VOLTS
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	----	0[C]	-22.5	VOLTS
PLATE RESISTANCE, APPROX.	----	----	18000	OHMS
TRANSCONDUCTANCE	----	----	7300	μMHOS
PLATE CURRENT	----	345	65	MA.
GRID 2 CURRENT	----	27 ←	1.8	MA.
GRID 1 VOLTAGE, APPROX. Ib=1.0 MA.	-100	----	-42	VOLTS
TRIODE AMPLIFICATION FACTOR[D]	----	----	4.4	

A

HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE THREE TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

B

IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

C

APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

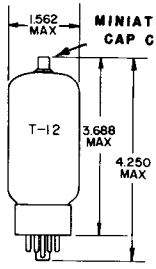
D

TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb=Ec2=150 VOLTS AND Ec1=-22.5 VOLTS

→ INDICATES A CHANGE.

TUNG-SOL

BEAM PENTODE



GLASS BULB

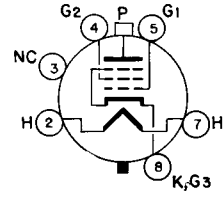
SHORT MEDIUM SHELL
5 OR 6 PIN OCTAL WITH
EXTERNAL BARRIERS
B6-122 OR B5-190

FOR
HORIZONTAL-DEFLECTION-AMPLIFIER
CIRCUITS IN TELEVISION RECEIVERS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

PIN #3 IS OMITTED WHEN B5-190 BASE IS USED



BOTTOM VIEW
BASING DIAGRAM
JEDEC 6AM

THE 17GW6 IS A BEAM POWER PENTODE EMPLOYING A T-12 ENVELOPE. IT IS DESIGNED ESPECIALLY FOR USE IN HORIZONTAL-DEFLECTION-AMPLIFIER CIRCUITS OF TELEVISION RECEIVERS WHICH OPERATE WITH LOW PLATE SUPPLY VOLTAGES.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	pf
GRID #1 TO CATHODE, GRID #3, GRID #2 & HEATER	17	pf
PLATE TO CATHODE, GRID #3, GRID #2 & HEATER	7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA.
HEATER WARM-UP TIME*		11	SECONDS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		450±30	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE-PULSE PLATE VOLTAGE[B]	6500	VOLTS
PEAK NEGATIVE-PULSE PLATE VOLTAGE	1500	VOLTS
DC GRID #2 VOLTAGE	220	VOLTS
DC GRID #1 VOLTAGE	-55	VOLTS

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MAXIMUM RATINGS-CONT'D.

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK NEGATIVE-PULSE GRID #1 VOLTAGE	330	VOLTS
CATHODE CURRENT:		
PEAK	550	MA.
AVERAGE	175	MA.
PLATE DISSIPATION[C]	17.5	WATTS
GRID #2 INPUT	3.5	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	240	°C
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE[C]	1.0	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	VOLTS
MU-FACTOR, GRID #2 TO GRID #1 WITH PLATE CONNECTED TO GRID #2, PLATE VOLTS = GRID #2 VOLTS =150, AND GRID #1 VOLTS =-22.5	---	4.4	
PLATE RESISTANCE (APPROX.)	---	15000	OHMS
TRANSCONDUCTANCE	---	7100	μMHOS
PLATE CURRENT	→390[D]	70	MA.
GRID #2 CURRENT	32[D]	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR PLATE CURRENT OF 1 MA.		42	VOLTS

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

A THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

B FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

15% OF ONE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

C IN STAGES OPERATING WITH GRID-RESISTOR BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

D THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVE FORM SUCH THAT THE CATHODE CURRENT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

SIMILAR TYPE REFERENCE:

Except for heater characteristics, the 17GW6 is identical to the 6GW6 and the 12GW6.

→ INDICATES A CHANGE.

TUNG-SOL

CATHODE RAY

THE 17HP4, 17HP4A AND 17HP4B ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTIONS:*

17HP4 - GREY FILTER FACEPLATE 17HP4A - GREY FROSTED FILTER FACEPLATE
17HP4B - ALUMINIZED SCREEN

THEIR COMMON FEATURES INCLUDE:

ELECTROSTATIC FOCUS MAGNETIC DEFLECTION
UNIPOTENTIAL CATHODE EXTERNAL CONDUCTIVE COATING
RECTANGULAR GLASS CONSTRUCTION EXTERNAL SINGLE FIELD ION TRAP
10 3/4" X 14 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	−56 TO 310	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	−33 TO −77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	85	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

→ INDICATES A CHANGE.

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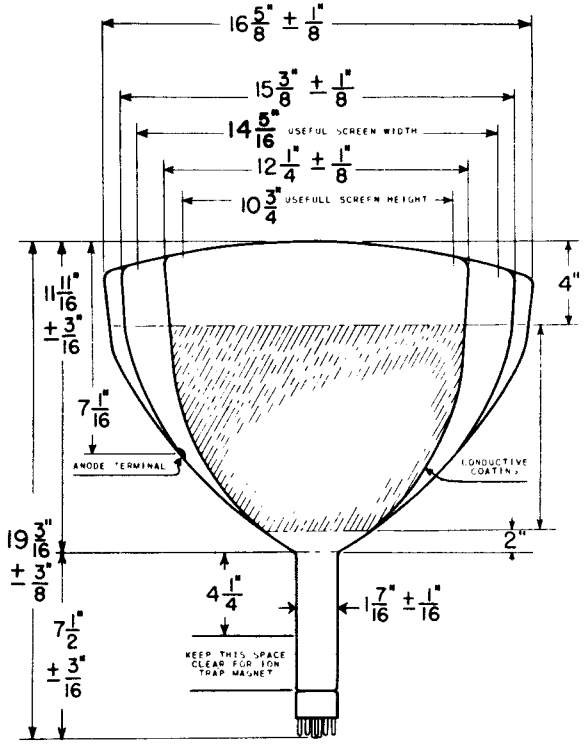
MECHANICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
WIDTH	14 5/16 ←	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

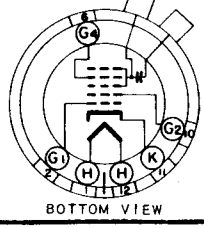
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE

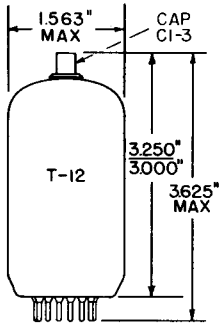


PIN 12 – HEATER
ANODE CAP:
GRID #3,
GRID #5,
COLLECTOR

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BEAM PENTODE

FOR

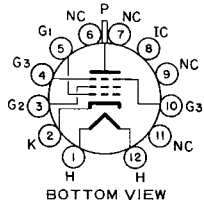
HORIZONTAL-DEFLECTION

AMPLIFIER APPLICATIONS

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12FK

THE 17JM6 IS A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. A SEPARATE CONNECTION IS PROVIDED FOR THE BEAM PLATES (GRID 3) TO MINIMZE "SNIVETS".
EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 17JM6 IS IDENTICAL TO THE 6JM6.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.34	pf
INPUT: G1 TO (H + K + G2 + G3)	16	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
MAXIMUM HEATER - CATHODE VOLTAGE:			
HEATER NEG. W/ RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POS. W/ RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE - SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY).	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
POSITIVE DC GRID 3 VOLTAGE	70	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	17.5	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	175	MA.
PEAK CATHODE CURRENT	550	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

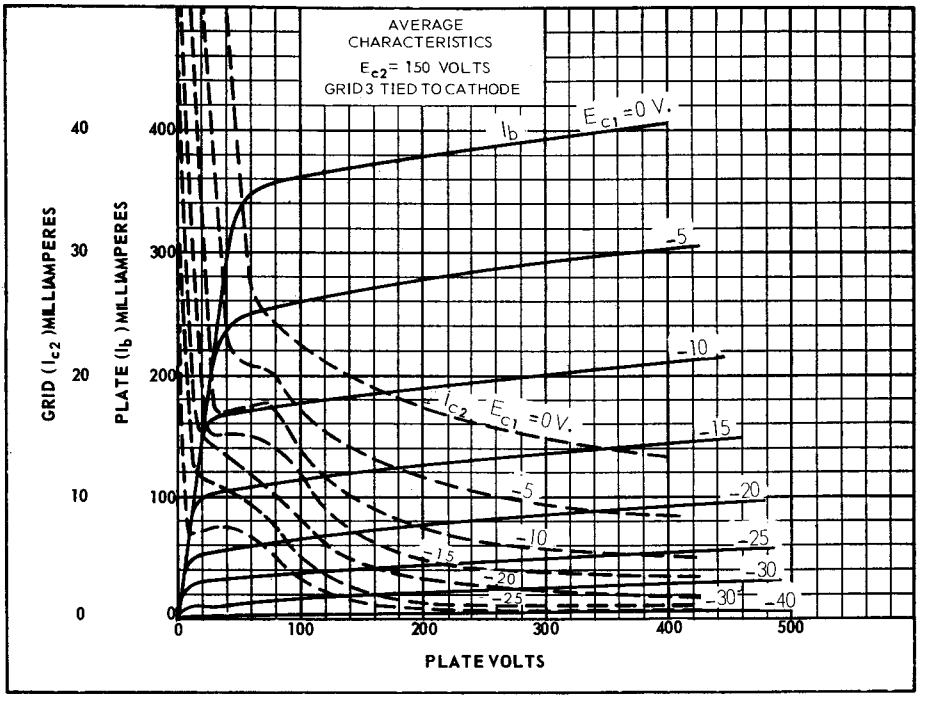
A - IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

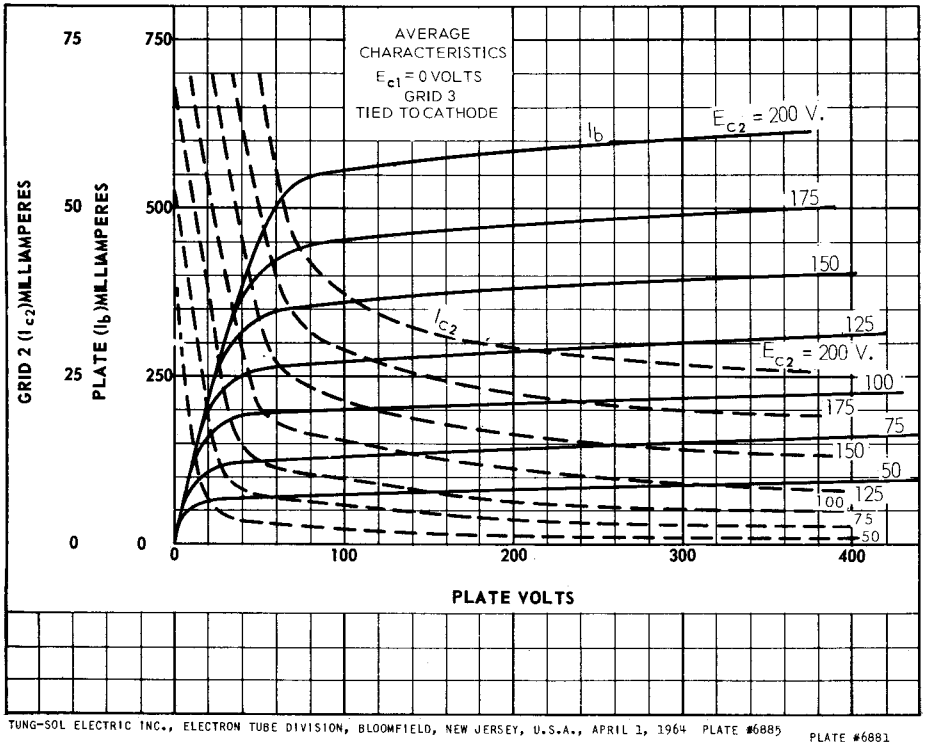
CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	250	VOLTS
GRID 3 - CONNECTED TO CATHODE AT SOCKET				
GRID 2 VOLTAGE	150	150	150	VOLTS
GRID 1 VOLTAGE	–	0 [B]	–22.5	VOLTS
PLATE CURRENT	–	345	65	MA.
GRID 2 CURRENT	–	27	1.8	MA.
TRANSCONDUCTANCE	–	–	7,300	μMHOS
PLATE RESISTANCE - APPROX.	–	–	18,000	OHMS
GRID 1 VOLTAGE AT I_b = 1.0 MA. - APPROX.	–100	–	–42	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	–	–	4.4	

B - APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

C - TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} =$ 150 VOLTS AND $E_{c1} =$ -22.5 VOLTS





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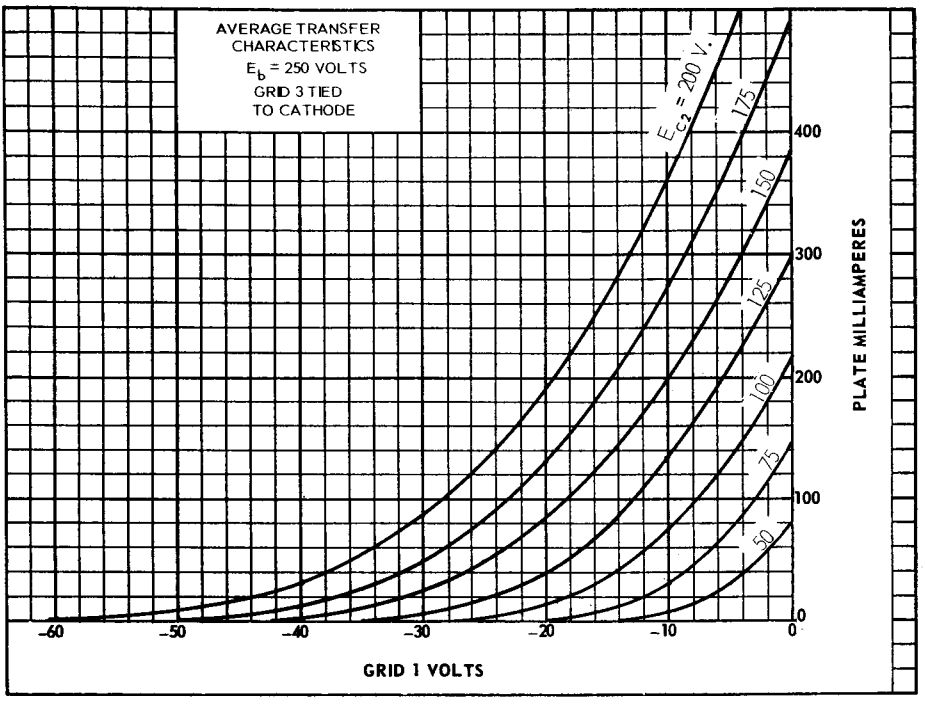
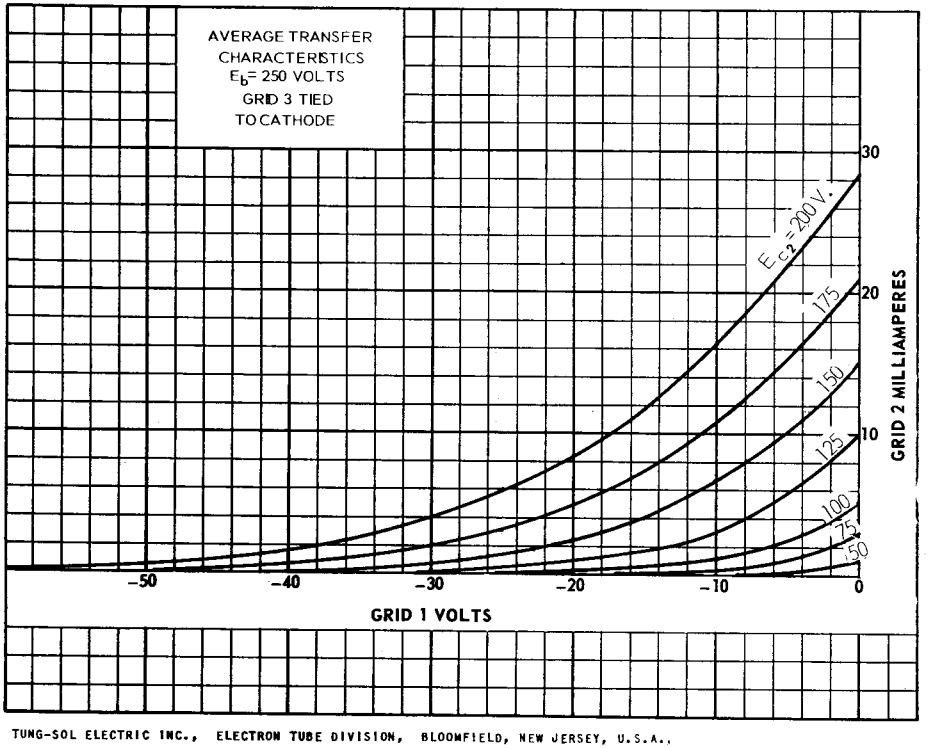

AVERAGE TRANSFER
CHARACTERISTICS
E_b = 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c_2} = 200 V.
175
150
125
100
75
50
400
300
200
100
0
PLATE MILLIAMPERES
-60
-50
-40
-30
-20
-10
0
GRID 1 VOLTS


AVERAGE TRANSFER
CHARACTERISTICS
E_b= 250 VOLTS
GRID 3 TIED
TO CATHODE
E_{c_2} = 200 V.
175
150
125
100
75
50
30
20
10
GRID 2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID 1 VOLTS

TUNG-SOL

CATHODE RAY

THE 17JP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

NEUTRAL DENSITY FACEPLATE — **UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING — **MAGNETIC FOCUS & DEFLECTION**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
10 3/4" X 14 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO COLLECTOR	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO COLLECTOR	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

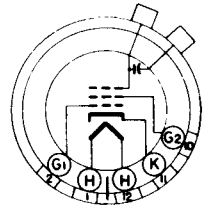
MECHANICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 +1/8 −7/32	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 1/2	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
COLLECTOR

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3 & COLLECTOR VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3 & COLLECTOR VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	110 ± 10%	MA.
ION TRAP RATED STRENGTH STANDARD COIL #111	50	GAUSSES

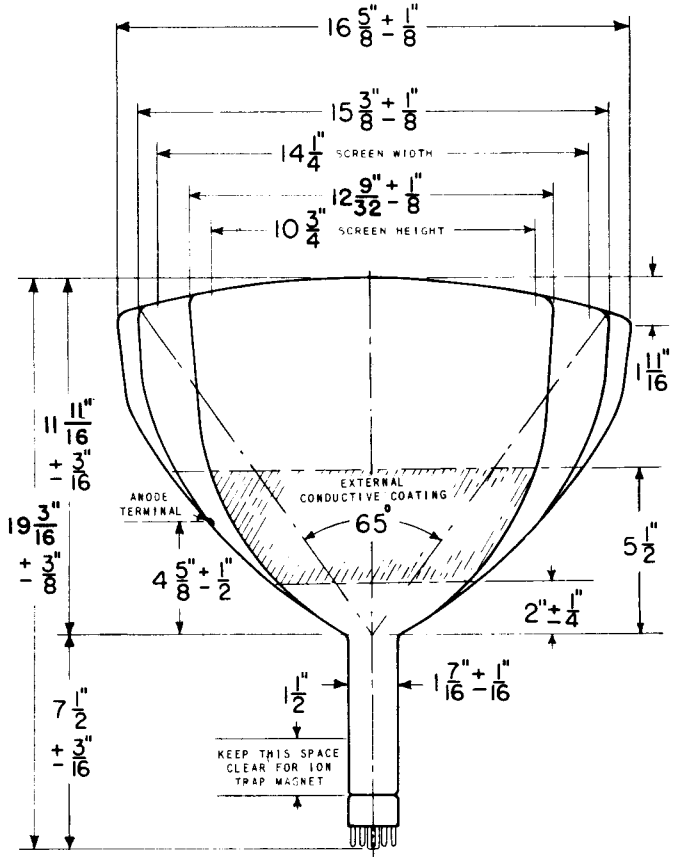
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

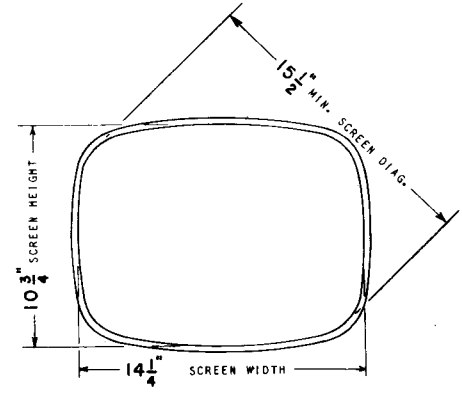
[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 14 1/4" BY 10 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL

TRIODE-PENTODE

COMPACTRON

MEDIUM-MU TRIODE AND BEAM PENTODE

FOR

VERTICAL-DEFLECTION OSCILLATOR

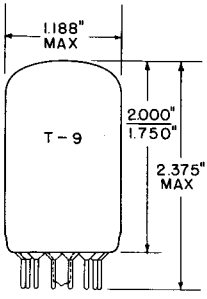
AND VERTICAL-DEFLECTION AMPLIFIER

SERVICE

IN T.V. APPLICATIONS

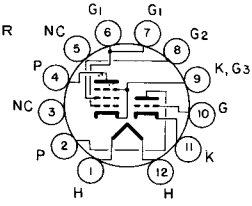
COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB

BUTTON
12 PIN BASE E12-70
OUTLINE DRAWING
JEDEC 9-58



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12 DZ

THE 17JZ8 IS A MEDIUM - MU TRIODE AND A BEAM PENTODE IN THE 12 PIN COMPACTRON CONSTRUCTION. THE TRIODE IS DESIGNED FOR SERVICE AS A VERTICAL-DEFLECTION OSCILLATOR AND THE PENTODE AS A VERTICAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE SECTION	
GRID 1 TO PLATE (g TO p)	0.34 pf
INPUT: G1 TO (H + K + G_2 + G_3)	11 pf
OUTPUT: P TO (H + K + G_2 + G_3)	7.0 pf
TRIODE SECTION	
GRID TO PLATE (G TO P)	3.6 pf
INPUT: G TO (H + K)	2.2 pf
OUTPUT: P TO (H + K)	0.7 pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUE - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	16.8 VOLTS	450	MA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450, ± 30	MA
HEATER-CATHODE VOLTAGE:			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
	VERTICAL OSCILLATOR [A] SERVICE	VERTICAL DEFLECTION [A] AMPLIFIER SERVICE	
PLATE VOLTAGE - DC	250	250	VOLTS
PEAK PULSE PLATE VOLTAGE		2,000	VOLTS
GRID 2 VOLTAGE		200	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	400	150	VOLTS
PLATE DISSIPATION	1.0	7.0 [B]	WATTS
GRID 2 DISSIPATION		1.8	WATTS
CATHODE CURRENT - DC	20	70	MA
PEAK CATHODE CURRENT	70	245	MA
GRID 1 CIRCUIT RESISTANCE			
WITH FIXED BIAS	1.0	1.0	MEGOHMS
WITH CATHODE BIAS	2.0	2.0	MEGOHMS

A FOR OPERATION IN A 525 - LINE, 30 - FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING BROADCAST STATIONS", FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE.

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CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION		
PLATE VOLTAGE	150	45	120	VOLTS
GRID 2 VOLTAGE		110	110	VOLTS
GRID 1 VOLTAGE	-5.0	0 [C]	-8.0	VOLTS
PLATE CURRENT	5.5	122	46	MA
GRID 2 CURRENT		16.5	3.5	MA
AMPLIFICATION FACTOR	20			
TRANSCONDUCTANCE	2,350		7,100	μMHOS
PLATE RESISTANCE - APPROX.	8.5		11.7	KOHMS
GRID 1 VOLTAGE FOR I_b = 10 μA APPROX.	-11		-25	VOLTS

C APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

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TUNG-SOL

CATHODE RAY

THE 17KP4 IS A DIRECT VIEW PICTURE TUBE INTENDED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION	**ELECTROSTATIC FOCUS**
UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**14 1/4" X 10 3/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	6.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 000	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

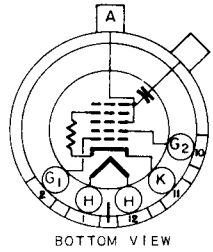
OVERALL LENGTH	19 1/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12P

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN NO. 1 – HEATER
PIN NO. 2 – GRID NO. 1
PIN NO. 10 – GRID NO. 2



BOTTOM VIEW

PIN NO. 11 – CATHODE
PIN NO. 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	−33 TO −77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	50 ± 50%	MA.
FIELD STRENGTH OF CENTERING MAGNET	0 TO 8	GAUSSES

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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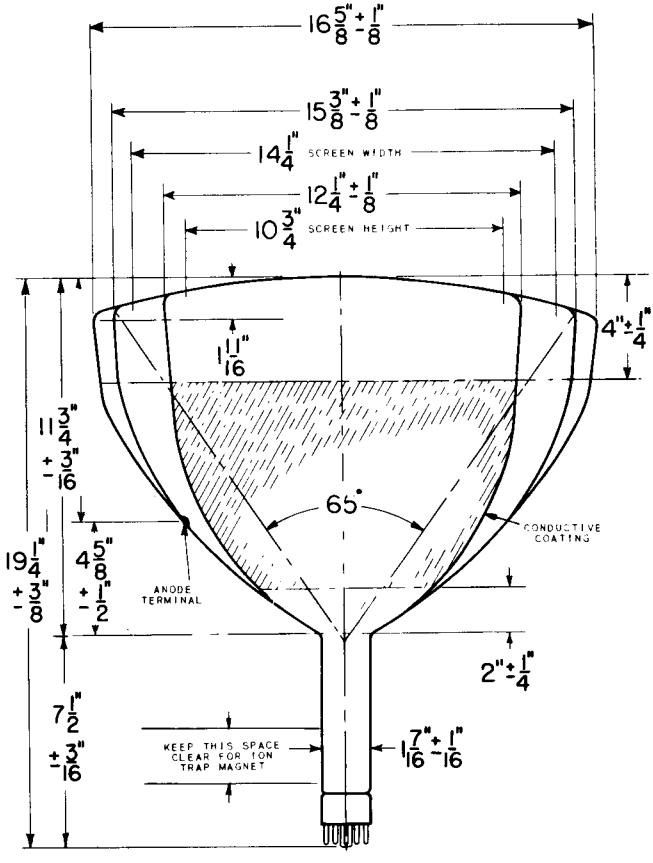

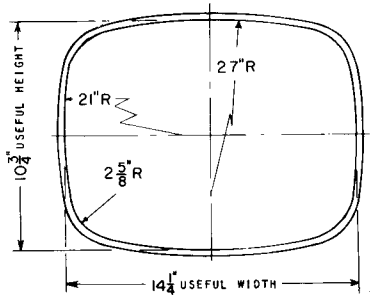

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CATHODE RAY

THE 17LP4 AND 17LP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING *EXCEPTION:*

17LP4 - ALUMINIZED SCREEN

THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION	**GREY FILTER FACEPLATE**
CYLINDRICAL FACEPLATE	**14 1/4" X 10 3/8" RASTER SIZE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**LOW VOLTAGE ELECTROSTATIC FOCUS**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO COLLECTOR	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO COLLECTOR	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
PEAK POSITIVE VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC GRID #4 VOLTAGE (APPROX.)[C]	-48 TO +260	VOLTS
GRID #4 CURRENT	-15 TO +25	μAMP.
GRID #2 CURRENT	-15 TO +15	μAMP.
ION TRAP FIELD STRENGTH (APPROX.)[D]	35	GAUSSES

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] OVER THE USEFUL RANGE OF COLLECTOR VOLTAGE, GRID #4 REQUIRED FOR FOCUS OF FROM -0.4 TO +2.2% OF THE COLLECTOR VOLTAGE.

[D] FOR SINGLE FIELD ION TRAP MAGNET, RETMA #111 OR EQUIVALENT.

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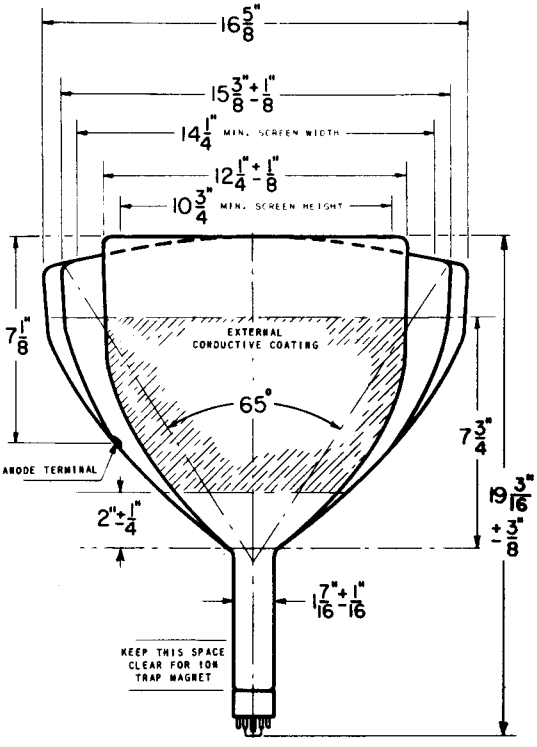
MECHANICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 5/16	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

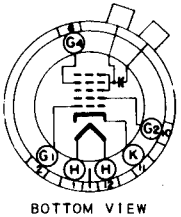
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5
COLLECTOR

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CATHODE RAY

THE 17QP4 AND 17QP4A ARE DIRECT VIEW PICTURE TUBES INTENDED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 17QP4A.

GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING	**CYLINDRICAL FACEPLATE**
MAGNETIC FOCUS AND DEFLECTION	**10 3/4" X 14 1/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR	SULFIDE TYPE	NO. 4.
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	18 000 ←	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500 ←	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	14 000 ←	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72 ←	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	95 ←	MA.
ION TRAP FIELD INTENSITY STANDARD COIL #111 (APPROX.)	30 ←	GAUSSES

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 14 1/4" BY 10 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

→ INDICATES A CHANGE.

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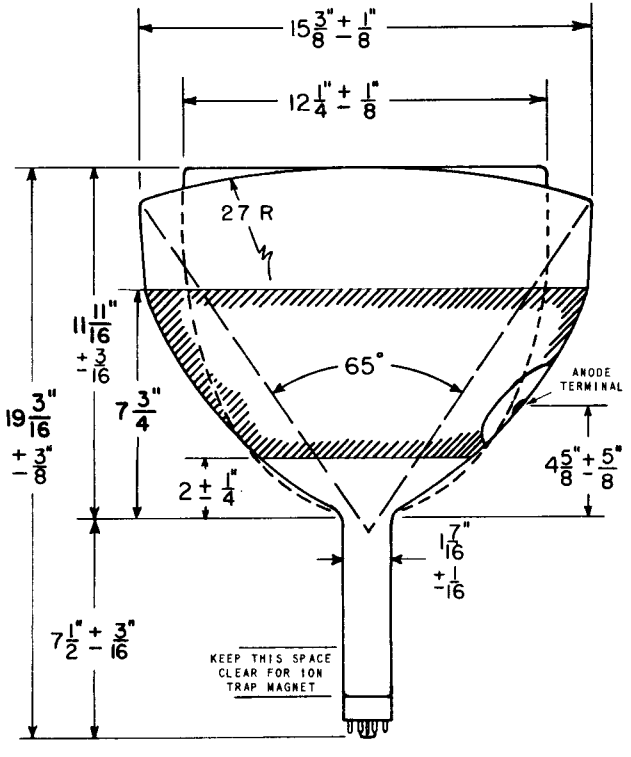
MECHANICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 5/16	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

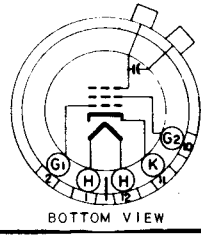
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH VACANT PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

TUNG-SOL

CATHODE RAY

THE 17RP4 AND 17RP4C ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 17RP4C. THEIR COMMON FEATURES INCLUDE.

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**14 1/4" X 10 3/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	16 000	VOLTS
MAXIMUM DC ANODE #1 VOLTAGE	−500 TO +1000 ←	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	12 000	VOLTS
DC ANODE #1 VOLTAGE (FOCUSING ELECTRODE)[A]	0	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−33 TO −77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

[A] THE FOCUS ELECTRODE MAY BE MODULATED FOR IMPROVED OVERALL FOCUS.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

→ INDICATES A CHANGE.

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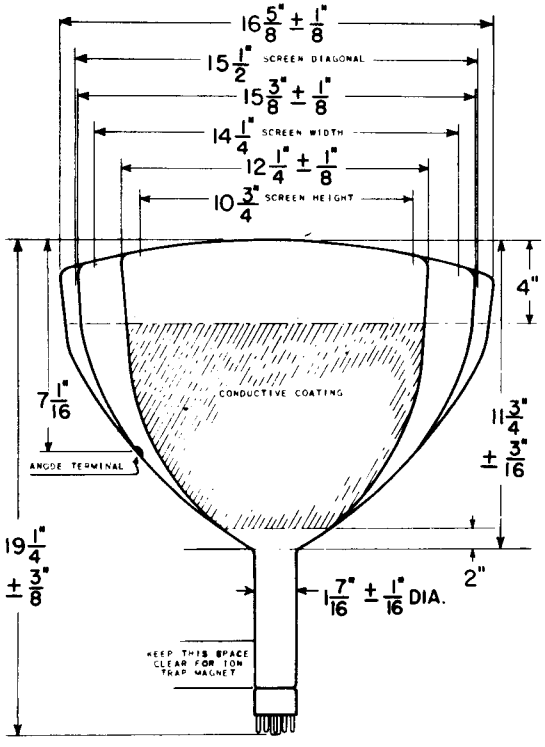
MECHANICAL DATA

OVERALL LENGTH	19 1/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 1/2	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

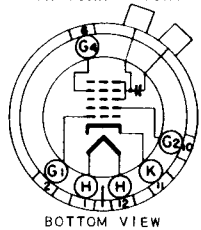
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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CATHODE RAY

THE 17SP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**
CYLINDRICAL FACEPLATE — **UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING — **GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
14 1/2" X 10 7/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

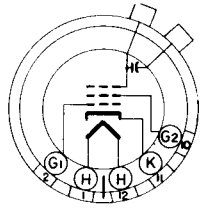
MECHNICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 13/16	INCHES
WIDTH	14 1/2	INCHES
HEIGHT	10 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11-CATHODE
PIN 12-HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	120	MA.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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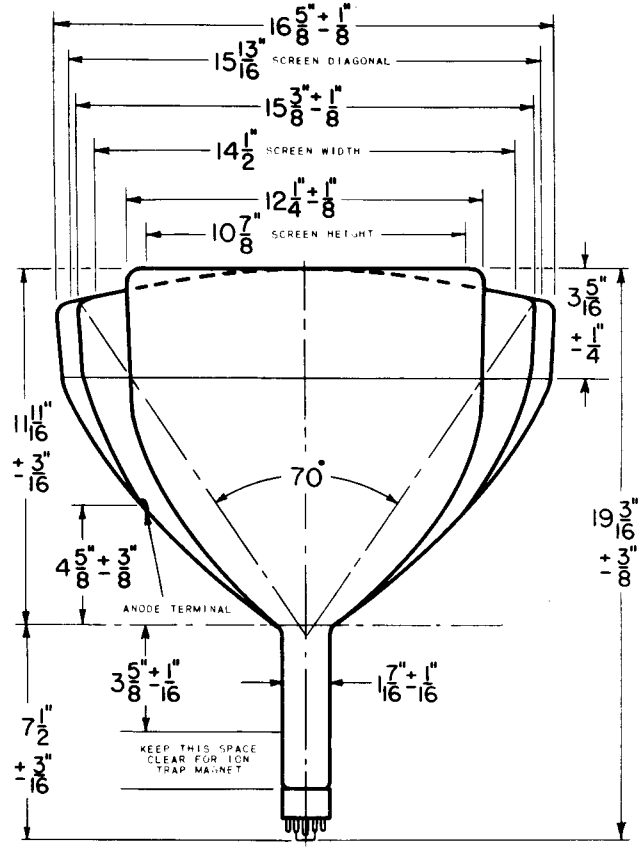

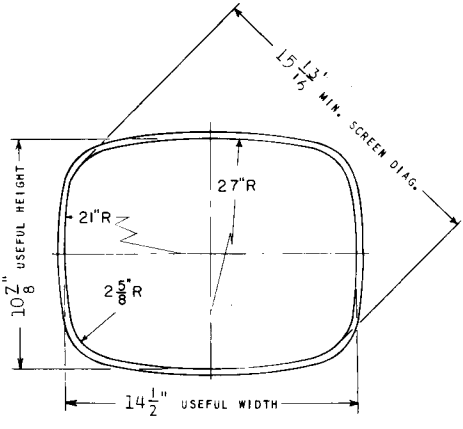

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CATHODE RAY

THE 17TP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
FROSTED FILTERGLASS FACEPLATE — **EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR METAL CONSTRUCTION — **LOW VOLTAGE ELECTROSTATIC FOCUS**
14 5/8" X 11" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

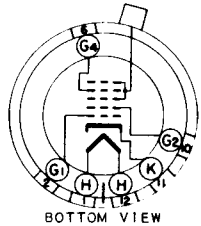
MECHANICAL DATA

OVERALL LENGTH	19 5/16	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 13/16 ± 3/16	INCHES
WIDTH	15 15/16 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 1/2	INCHES
WIDTH	14 5/8	INCHES
HEIGHT	11	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

BASE ALIGNMENT
PIN #6 ALIGNS WITH HORIZONTAL PICTURE AXIS ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

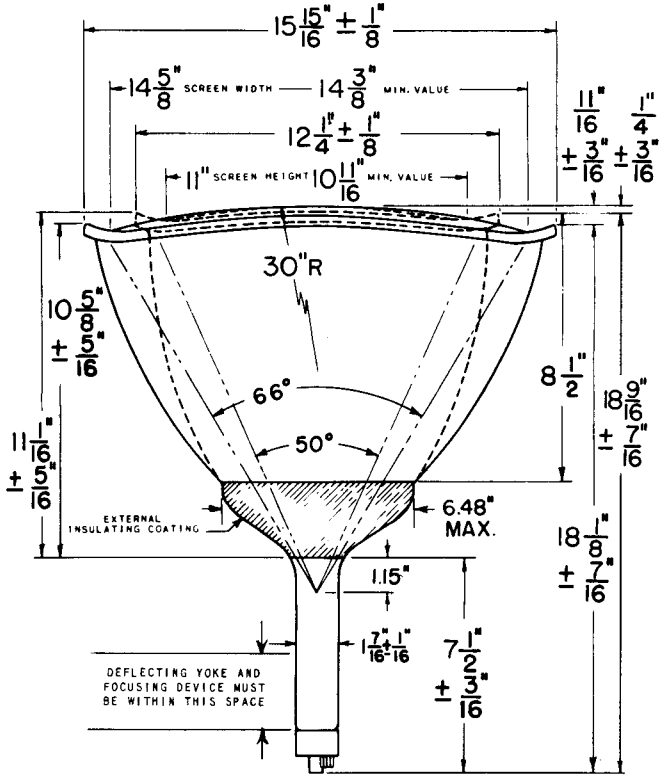
DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
ION TRAP MAGNET (RATED STRENGTH)	35	GAUSSES
DC GRID #4 VOLTAGE	0 TO 350	VOLTS

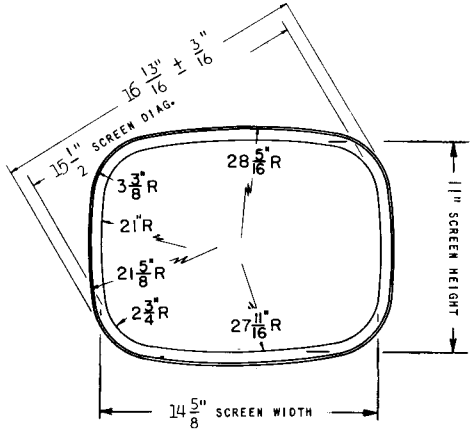
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


15 15/16" ± 1/8"
14 5/8" SCREEN WIDTH
14 3/8" MIN. VALUE
12 1/4" ± 1/8"
11" SCREEN HEIGHT
10 11/16" MIN. VALUE
11/16" ± 3/16"
1/4" ± 3/16"
30"R
10 5/8" ± 5/16"
66°
50°
8 1/2"
18 9/16" ± 7/16"
11 1/16" ± 5/16"
EXTERNAL INSULATING COATING
6.48" MAX.
18 1/8" ± 7/16"
1.15"
1 7/16" ± 1/16"
7 1/2" ± 3/16"
DEFLECTING YOKE AND FOCUSING DEVICE MUST BE WITHIN THIS SPACE


16 13/16" ± 3/16"
15 1/2" SCREEN DIAG.
28 5/16"R
3 3/8"R
21"R
21 5/8"R
2 3/4"R
27 11/16"R
11" SCREEN HEIGHT
14 5/8" SCREEN WIDTH

TUNG-SOL

CATHODE RAY

THE 17UP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING	**CYLINDRICAL FACEPLATE**
MAGNETIC FOCUS AND DEFLECTION	**14 1/2" X 10 7/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	70	PERCENT

MECHANICAL DATA

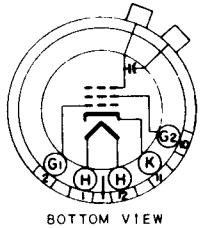
OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 13/16	INCHES
WIDTH	14 1/2	INCHES
HEIGHT	10 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

[A] THE CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	110	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	120	MA.

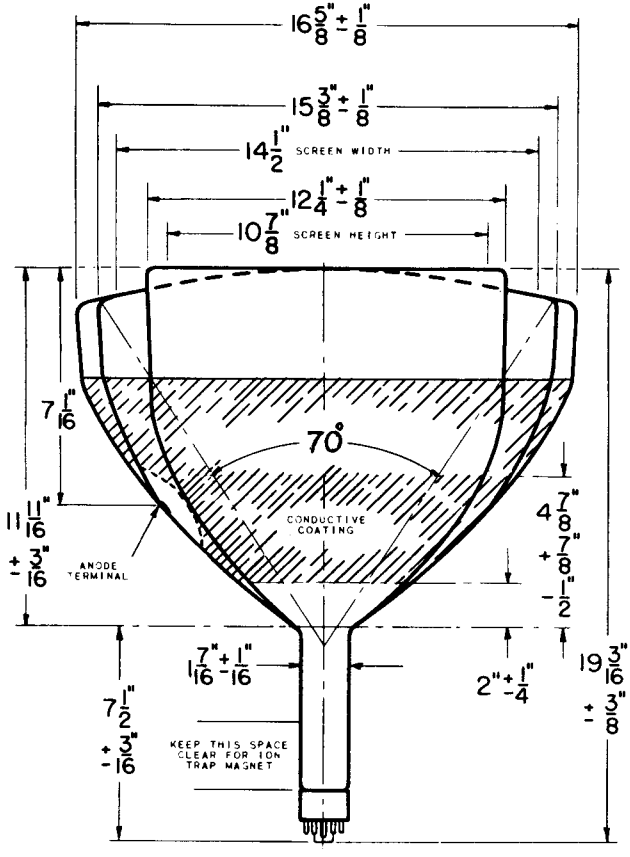
[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

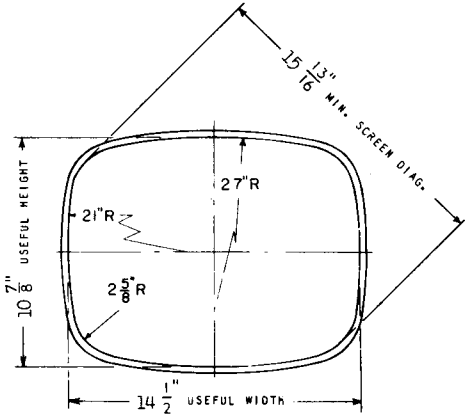
[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 7 1/2" BY 10" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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CATHODE RAY

THE 17VP4 AND 17VP4B ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 17VP4B. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING — **CYLINDRICAL FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION — **NEUTRAL DENSITY FACEPLATE**
LOW VOLTAGE ELECTROSTATIC FOCUS — **EXTERNAL SINGLE FIELD ION TRAP**
10 7/8" X 14 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	58 - 72	PERCENT

RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE #2, GRID #3 VOLTAGE (WITH PROTECTIVE FACE VIEWING WINDOW)[A]	16 000	VOLTS
MAXIMUM ANODE #1 VOLTAGE RANGE FOR FOCUS[B]	-64 TO +350	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC ANODE #1 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC ANODE #1 CURRENT RANGE	-15 TO +25	μAMP.
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

[B] WITH THE COMBINED GRID #1 VOLTAGE AND VIDEO-DRIVE VOLTAGE ADJUSTED, USING AN INDIAN HEAD TEST PATTERN WITH THE BLACKS JUST BLACK, TO GIVE AN AVERAGE BEAM CURRENT OF 100 MICROAMPERES ON A 10 3/4" BY 14 1/4" PICTURE AREA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE #2,, GRID #3 VOLTAGE	12 000	VOLTS
DC ANODE #1 VOLTAGE (FOCUSING ELECTRODE)	-48 TO +260	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111	75 ± 50%	MA.
ION TRAP FIELD INTENSITY (APPROX.)[D]	35	GAUSSES

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] SINGLE FIELD ION-TRAP ADJUSTED TO OPTIMUM POSITION.

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TUNG-SOL

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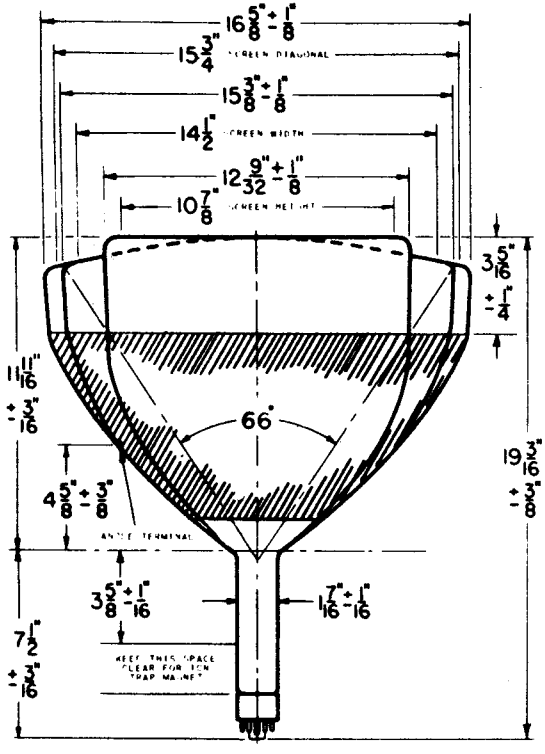
MECHANICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 9/32 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 3/4	INCHES
WIDTH	14 1/2	INCHES
HEIGHT	10 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

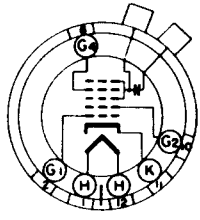
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

TUNG-SOL

CATHODE RAY

THE 17YP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING	**CYLINDRICAL FACEPLATE**
MAGNETIC FOCUS AND DEFLECTION	**10 3/4" X 14 1/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	55	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO COLLECTOR	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO COLLECTOR	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

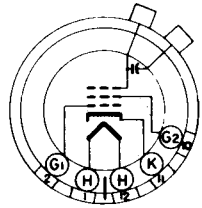
MECHANICAL DATA

OVERALL LENGTH	19 3/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	16 5/8 ± 1/8	INCHES
WIDTH	15 3/8 ± 1/8	INCHES
HEIGHT	12 1/4 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	15 3/4	INCHES
WIDTH	14 1/4	INCHES
HEIGHT	10 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
COLLECTOR

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC COLLECTOR VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE BIASE VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

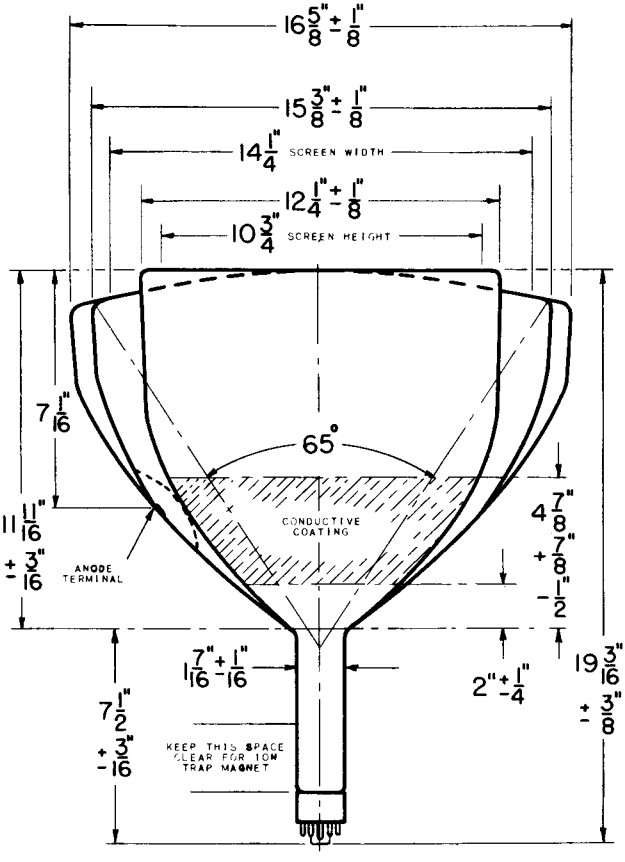
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

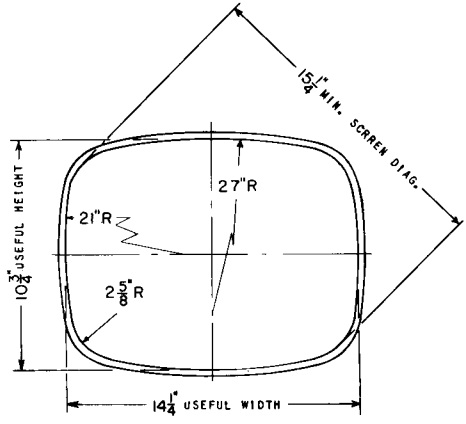
DC COLLECTOR VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	100	MA.
ION TRAP FIELD INTENSITY (APPROX.)	45	GAUSSES

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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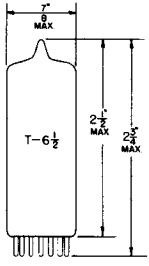
TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

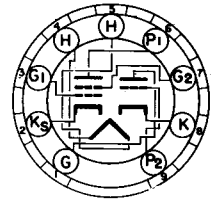
COATED UNIPOTNETIAL CATHODE

HEATER

18.0 VOLTS 0.30 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 18DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE	18.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	.75	6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---	135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---	1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110	110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0	0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0	60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE	18.0			VOLTS
HEATER CURRENT	0.30			AMP.
PLATE VOLTAGE	120	---	145	VOLTS
GRID #2 VOLTAGE	---		120	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	1500		180	OHMS
PLATE CURRENT	0.8		45	MA.
GRID #2 CURRENT	---		6	MA.
TRANSCONDUCTANCE	1400		7500	μMHOS
LOAD RESISTANCE	---		2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5		---	VOLTS
AMPLIFICATION FACTOR	100		---	
POWER OUTPUT	---		2.0	WATTS

SIMILAR TYPE REFERENCE: Except for heater ratings the 18DZ8 is identical to the 6DZ8, 9DZ8, 12DZ8, and the 35DZ8.

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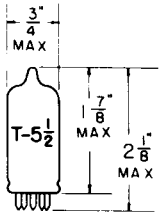
PENTODE

MINIATURE TYPE



GLASS BULB

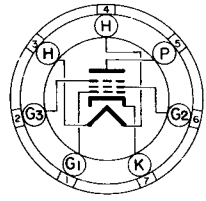
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7CC

THE 18FW6 IS A SEMI REMOTE CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA HEATER AND IS DESIGNED FOR RF AND IF APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES [A]

GRID #1 TO PLATE (MAX.)	.0035	μμf
INPUT	5.5	μμf
OUTPUT	5.0	μμf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 7 (CATHODE).

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	68	OHMS
PLATE CURRENT	11	MA.
GRID #2 CURRENT	4.4	MA.
TRANSCONDUCTANCE	4400	μMHOS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
GRID #1 VOLTAGE FOR gm = 25 μMHOS	-20	VOLTS

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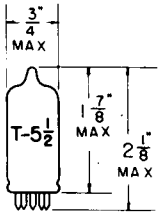
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

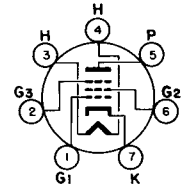
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CC

THE 18FW6A IS A SEMI REMOTE CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS EXPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MA. SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 18FW6A IS IDENTICAL TO THE 18FW6.

DIRECT INTERELECTRODE CAPACITANCES [A]

GRID #1 TO PLATE (MAX.)	.0035	pf
INPUT	5.5	pf
OUTPUT	5.0	pf

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 7 (CATHODE).

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER CURRENT [C]	0.100±0.006	AMP.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER–CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME*	20	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE (SERIES OPERATION)	18	VOLTS
HEATER CURRENT [B] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET	
GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	68	OHMS
PLATE CURRENT	11	MA.
GRID #2 CURRENT	4.4	MA.
TRANSCONDUCTANCE	4400	μMHOS
PLATE RESISTANCE (APPROX.)	0.25	MEGOHM
GRID #1 VOLTAGE FOR gm = 25 μMHOS	−20	VOLTS

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[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

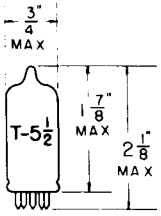
[C] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

PENTAGRID AMPLIFIER

MINIATURE TYPE

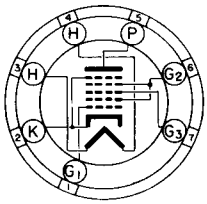


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
18 VOLTS 0.10 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CH

THE 18FX6 IS A DUAL CONTROL PENTAGRID AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA HEATER AND IS DESIGNED FOR CONVERTER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #3 TO PLATE (MAX.)	0.25	0.30	μμf
GRID #3 TO GRID #1 (MAX.)	0.15	0.15	μμf
GRID #3 INPUT: G3 TO (H+K+G1+G2+4+G5+P)	7.0	7.0	μμf
GRID #1 INPUT: G1 TO (H+K+G2+4+G3+G5+P)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G1+G2+4+G3+G5)	13.0	8.0	μμf
GRID #1 TO CATHODE	3.0	3.0	μμf
CATHODE TO ALL ELECTRODES EXCEPT GRID #1	20.0	15.0	μμf
GRID #1 TO PLATE	0.05	0.1	μμf

[A] SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM #2 & GRID #4 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 & GRID #4 VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & GRID #4 DISSIPATION	1.2	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS

B

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SEPARATE EXCITATION

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-1.5	VOLTS
GRID #1 RESISTANCE	20 000	OHMS
GRID #1 CURRENT	0.5	MA.
PLATE CURRENT	2.3	MA.
GRID #2 CURRENT	6.2	MA.
CONVERSION TRANSCONDUCTANCE	480	μMHOS
PLATE RESISTANCE (APPROX.)	0.4	MEGOHM
CATHODE CURRENT	9	MA.
GRID #3 VOLTAGE (APPROX.) FOR G_c = 10 μMHOS	-21	VOLTS

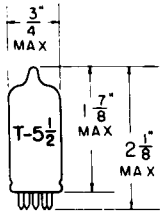
OSCILLATOR SECTION – NON OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRID #2 CONNECTED TO PLATE	100	VOLTS
CATHODE CURRENT	24	MA.
TRANSCONDUCTANCE BETWEEN GRID #1, GRID #2 & GRID #4 CONNECTED TO PLATE	7000	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1, GRID #2 & #4 CONNECTED TO PLATE	22	
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA	-9.2	VOLTS

TUNG-SOL

PENTAGRID AMPLIFIER

MINIATURE TYPE



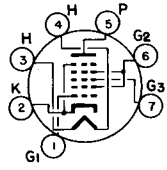
GLASS BULB

MINIATURE BUTTON
9 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

HEATER
18 VOLTS 0.10 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CH

THE 18FX6A IS A DUAL CONTROL PENTAGRID AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MA. SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 18FX6A IS IDENTICAL TO THE 18FX6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #3 TO PLATE (MAX.)	0.25	0.30	μμf
GRID #3 TO GRID #1 (MAX.)	0.15	0.15	μμf
GRID #3 INPUT: G3 TO (H+K+G1+G2+4+G5+P)	7.0	7.0	μμf
GRID #1 INPUT: G1 TO (H+K+G2+4+G3+G5+P)	5.5	5.5	μμf
OUTPUT: P TO (H+K+G1+G2+4+G3+G5)	13.0	8.0	μμf
GRID #1 TO CATHODE	3.0	3.0	μμf
CATHODE TO ALL ELECTRODES EXCEPT GRID #1	20.0	15.0	μμf
GRID #1 TO PLATE	0.05	0.1	μμf

[A] SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER CURRENT [C]	0.100±0.006	AMP.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM #2 & GRID #4 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 & GRID #4 VOLTAGE	110	VOLTS
MAXIMUM PLATE DISSIPATION	1.0	WATT
MAXIMUM GRID #2 & GRID #4 DISSIPATION	1.2	WATT
MAXIMUM HEATER–CATHODE VOLTAGE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME*	20	SECONDS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

SEPARATE EXCITATION

HEATER VOLTAGE (SERIES OPERATION)	18	VOLTS
HEATER CURRENT[D] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE	-1.5	VOLTS
GRID #1 RESISTANCE	20 000	OHMS
GRID #1 CURRENT	0.5	MA.
PLATE CURRENT	2.3	MA.
GRID #2 CURRENT	6.2	MA.
CONVERSION TRANSCONDUCTANCE	480	μMHOS
PLATE RESISTANCE (APPROX.)	0.4	MEGOHM
CATHODE CURRENT	9	MA.
GRID #3 VOLTAGE (APPROX.) FOR G_c = 10 μMHOS	-21	VOLTS

OSCILLATOR SECTION – NON OSCILLATING

GRID #3 VOLTAGE	0	VOLTS
GRID #1 VOLTAGE	0	VOLTS
GRID #2 CONNECTED TO PLATE	100	VOLTS
CATHODE CURRENT	24	MA.
TRANSCONDUCTANCE BETWEEN GRID #1, GRID #2 & GRID #4 CONNECTED TO PLATE	7000	μMHOS
AMPLIFICATION FACTOR BETWEEN GRID #1, GRID #2 & #4 CONNECTED TO PLATE	22	
GRID #1 VOLTAGE (APPROX.) FOR I_b = 20 μA	-9.2	VOLTS

[B]DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C]HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

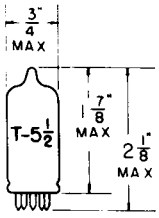
[D]FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE



GLASS BULB

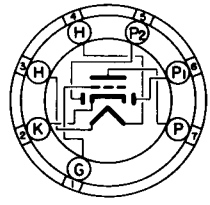
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 18FY6 IS A MINIATURE HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA. HEATER AND IS DESIGNED FOR DETECTOR AMPLIFIER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE	1.8	1.8	μμf
INPUT	2.4	2.4	μμf
OUTPUT	2	0.22	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.2	0.2	μμf

[A] SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM DIODE PLATE CURRENT (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	0.6	MA.
PLATE RESISTANCE	77 000	OHMS
TRANSCONDUCTANCE	1 300	μMHOS
AMPLIFICATION FACTOR	100	
AVERAGE DIODE CURRENT (EA.DIODE) WITH 10V. APPLIED[C]	2.0	MA.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] TEST CONDITION ONLY.

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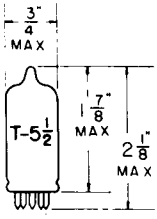
TUNG-SOL

DOUBLE DIODE TRIODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

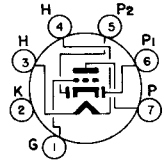
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

BASING DIAGRAM
JEDEC 7ET

THE 18FY6A IS A HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MA. SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 18FY6A IS IDENTICAL TO THE 18FY6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
GRID TO PLATE	1.8	1.8	μμf
INPUT	2.4	2.4	μμf
OUTPUT	2	0.22	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.2	0.2	μμf

[A] SHIELD #316 CONNECTED TO PIN #2.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER CURRENT[C]	0.100±0.006	AMPS.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM POSITIVE GRID VOLTAGE	0	VOLTS
MAXIMUM DIODE PLATE CURRENT (EACH DIODE)	1.0	MA.
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM–UP TIME *	20	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE (SERIES OPERATION)	18	VOLTS
HEATER CURRENT [D] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−1	VOLTS
PLATE CURRENT	0.6	MA.
PLATE RESISTANCE	77 000	OHMS
TRANSCONDUCTANCE	1 300	μMHOS
AMPLIFICATION FACTOR	100	
AVERAGE DIODE CURRENT (EA.DIODE) WITH 10V. APPLIED [E]	2.0	MA.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

[D] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

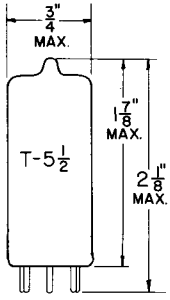
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[E] TEST CONDITION ONLY.

TUNG-SOL

PENTODE

MINIATURE TYPE

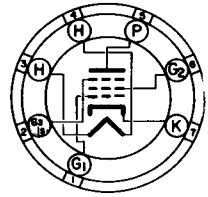


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
18 VOLTS 0.10 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BK

THE 18GD6 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES A 100 MILLIAMPERE HEATER AND IS DESIGNED FOR RF AND IF APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACTTANCES[A]

GRID #1 TO PLATE (MAX.)	.0035	μμf
INPUT: G1 TO (H+K+G2+G3+I.S.)	6.0	μμf
OUTPUT: P TO (H+K+G2+G3+I.S.)	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM [B]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE [B]	100	VOLTS

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 7 (CATHODE)

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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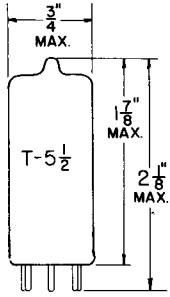
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE		18	VOLTS
HEATER CURRENT		0.10	AMP.
PLATE VOLTAGE		100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET		
GRID #2 VOLTAGE		100	VOLTS
CATHODE BIAS RESISTOR		150	OHMS
PLATE CURRENT		5	MA.
GRID #2 CURRENT		2.0	MA.
TRANSCONDUCTANCE		4300	μMHOS
PLATE RESISTANCE (APPROX.)		0.5	MEGOHM
E_{c1} FOR I_b = 10 μA (APPROX.)		−4.7	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

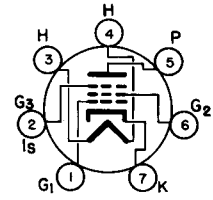
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC

COATED UNIPOTENTIAL CATHODE

HEATER NOMINAL

18 VOLTS[B] 0.10 AMP.

SERIES OPERATION
AC OR DC
ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BK

THE 18GD6A IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES A 100 MILLIAMPERE HEATER AND IS DESIGNED FOR RF AND IF APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS OR OTHER ELECTRONIC EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES[A]

GRID #1 TO PLATE (MAX.)	.0035	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	6.0	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	5.0	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM
SEE EIA STANDARD RS-239

HEATER CURRENT[C]	0.100±0.006	AMPS.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID #2 DISSIPATION	0.6	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME*	20	SECONDS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE		100	VOLTS
GRID #3 VOLTAGE	CONNECTED TO CATHODE AT SOCKET		
GRID #2 VOLTAGE		100	VOLTS
CATHODE BIAS RESISTOR		150	OHMS
PLATE CURRENT		5	MA.
GRID #2 CURRENT		2.0	MA.
TRANSCONDUCTANCE		4300	μMHOS
PLATE RESISTANCE (APPROX.)		0.5	MEGOHM
E_{c1} FOR I_b = 10 μA (APPROX.)		-4.7	VOLTS

[A] EXTERNAL SHIELD #316 CONNECTED TO PIN 7 (CATHODE).

[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[C] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

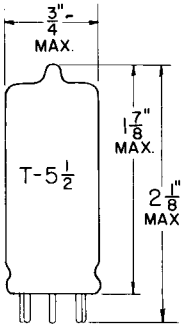
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater warm-up time, the 18GD6A is identical to the 18GD6.*

TUNG-SOL

TRIODE DOUBLE DIODE

MINIATURE TYPE



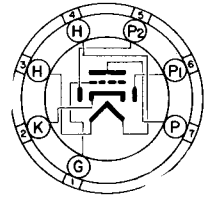
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS 0.10 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 18GE6 IS A HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES 100 MILLIAMPERE HEATER AND IS DESIGNED FOR DETECTOR-AMPLIFIER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.8	μμf
INPUT: G TO (H + K)	2.4	μμf
OUTPUT: P TO (H + K)	0.2	μμf
GRID TO DIODE #2 PLATE (MAX.)	0.2	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE	18	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM DIODE PLATE CURRENT, (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE[A]	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE	40 000	OHMS
TRANSCONDUCTANCE	1 700	μMHOS
AMPLIFICATION FACTOR	70	
AVERAGE DIODE CURRENT, EACH DIODE[B] WITH 10 VOLTS DC APPLIED	2.0	MA.

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] TEST CONDITION ONLY.

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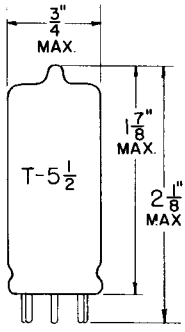
TUNG-SOL

TRIODE DOUBLE DIODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-2

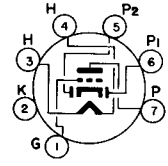
COATED UNIPOTENTIAL CATHODE

HEATER

18 VOLTS[B] 0.10 AMP.

SERIES OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BT

THE 18GE6A IS A HIGH MU TRIODE DOUBLE DIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT FEATURES 100 MILLIAMPERE HEATER AND IS DESIGNED FOR DETECTOR-AMPLIFIER APPLICATIONS IN AC/DC TYPE RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.8	pf
INPUT: G TO (H + K)	2.4	pf
OUTPUT: P TO (H + K)	0.2	pf
GRID TO DIODE #2 PLATE (MAX.)	0.2	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER CURRENT[C]	0.100±0.006	AMPS.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM DIODE PLATE CURRENT, (EACH DIODE)	1.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE[A]	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	100	VOLTS
HEATER WARM-UP TIME*	20	SECONDS

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	−1	VOLTS
PLATE CURRENT	1.0	MA.
PLATE RESISTANCE	40 000	OHMS
TRANSCONDUCTANCE	1 700	μMHOS
AMPLIFICATION FACTOR	70	
AVERAGE DIODE CURRENT, EACH DIODE[D] WITH 10 VOLTS DC APPLIED	2.0	MA.

[C]HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

[D]TEST CONDITION ONLY.

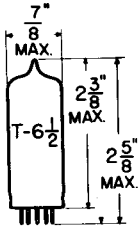
*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE REATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: *Except for heater-warm-up time, the 18GE6A is identical to the 18GE6.*

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



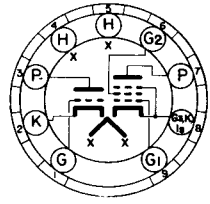
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

18.0 VOLTS 0.30 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9ME

THE 18HB8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR AUDIO APPLICATIONS IN STEREO AND MONAURAL SOUND EQUIPMENT. EXCEPT FOR HEATER RATINGS, THE 18HB8 IS IDENTICAL TO THE 35HB8.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE[A]	18.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	135	VOLTS
MAXIMUM CATHODE CURRENT	5	50	MA.
MAXIMUM PLATE DISSIPATION	0.75	6.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS	0.1		MEGOHM
CATHODE BIAS	0.47		MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	18.0		VOLTS
HEATER CURRENT	0.30		AMP.
PLATE VOLTAGE	115	115	VOLTS
GRID #2 VOLTAGE	---	115	VOLTS
PEAK AF GRID #1 VOLTAGE	---	6.0	VOLTS
CATHODE RESISTOR	410	150	OHMS

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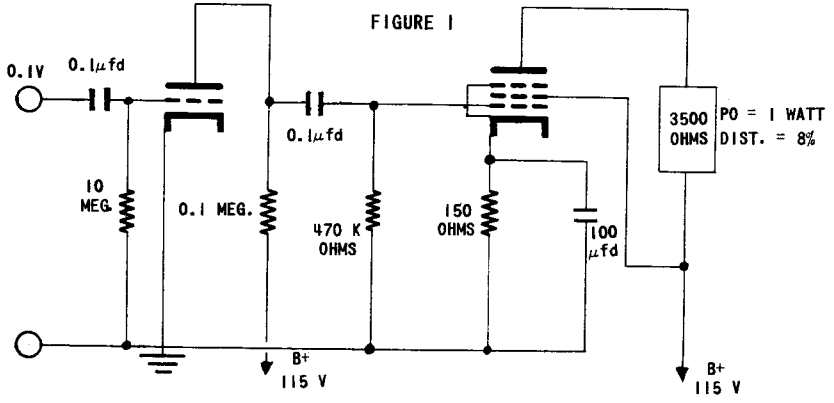
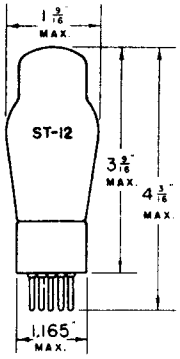
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS (cont'd.)

	TRIODE SECTION		PENTODE SECTION	
HEATER VOLTAGE		18.0		VOLTS
HEATER CURRENT		0.30		AMP.
ZERO-SIGNAL PLATE CURRENT	2.5		33	MA.
MAX.-SIGNAL PLATE CURRENT	---		32	MA.
ZERO-SIGNAL GRID #2 CURRENT	---		7.5	MA.
MAX.-SIGNAL GRID #2 CURRENT	---		10	MA.
TRANSCONDUCTANCE	3900		6250	μMHOS
AMPLIFICATION FACTOR	74		---	
LOAD RESISTANCE	---		3500	OHMS
MAX.-SIGNAL POWER OUTPUT	---		1.0	WATT
TOTAL HARMONIC DISTORTION (APPROX.)	---		8	PERCENT

[A] THE HEATER SHOULD BE CONNECTED WITH PIN #4 CLOSEST TO THE GROUND END OF THE HEATER STRING.

FIGURE 1



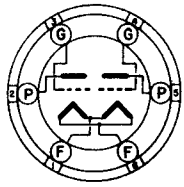


TWIN TRIODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.26 AMPERE
DC

GLASS BULB



SMALL 6 PIN BASE

THE TUNG-SOL 19 IS DESIGNED FOR SERVICE AS A CLASS B POWER AMPLIFIER IN THE OUTPUT STAGE OF BATTERY OPERATED RECEIVERS. EXCEPT FOR FILAMENT CURRENT ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 1J6G.

OPERATING CONDITIONS AND CHARACTERISTICS

MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	50	MA.

CLASS B_2 AMPLIFIER

PLATE VOLTAGE MAX.	135	135	135	VOLTS
GRID VOLTAGE [A]	-6	-3	0	VOLTS
ZERO-SIG. PLATE CURRENT PER PLATE	0.5	2	5	MA.
LOAD RESISTANCE PER PLATE	2500	2500	2500	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	10 000	10 000	10 000	OHMS
AVERAGE POWER INPUT GRID TO GRID APPROX.	0.095	0.13	0.17	WATT
POWER OUTPUT APPROX.	1.6	1.9	2.1	WATTS

[A] RETURN TO NEGATIVE FILAMENT (PIN #6)

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PLATE
542-2

AUG. 14
1939

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TUNG-SOL

CATHODE RAY

THE 19AP4, 19AP4A, 19AP4B, 19AP4C, AND 19AP4D ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL EXCEPT FOR THE FOLLOWING DIFFERENCES IN THEIR FACEPLATES.

19AP4 - CLEAR GLASS FACEPLATE
19AP4A - GREY FILTER FACEPLATE
19AP4B - FROSTED FILTER FACEPLATE
19AP4C - GREY FILTER FACEPLATE ALUMINIZED SCREEN
19AP4D - CLEAR FROSTED FACEPLATE

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
ROUND METAL CONSTRUCTION
MAGNETIC FOCUS AND DEFLECTION
EXTERNAL SINGLE FIELD ION TRAP
11 3/4" X 15 3/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	66	DEGREES
DIRECT INTERELECTRODE CAPACITANCES, (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	7	μμf

OPTICAL DATA

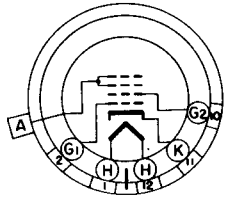
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

OVERALL LENGTH	21 1/2 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	18 5/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	17 3/8	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



PIN 12 – HEATER
METAL SHELL LIP: GRID NO. 3
ANODE

BOTTOM VIEW

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	19 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

[A] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12.000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	140 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #106, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 18 FOOT LAMBERTS ON A 11 3/4" X 15 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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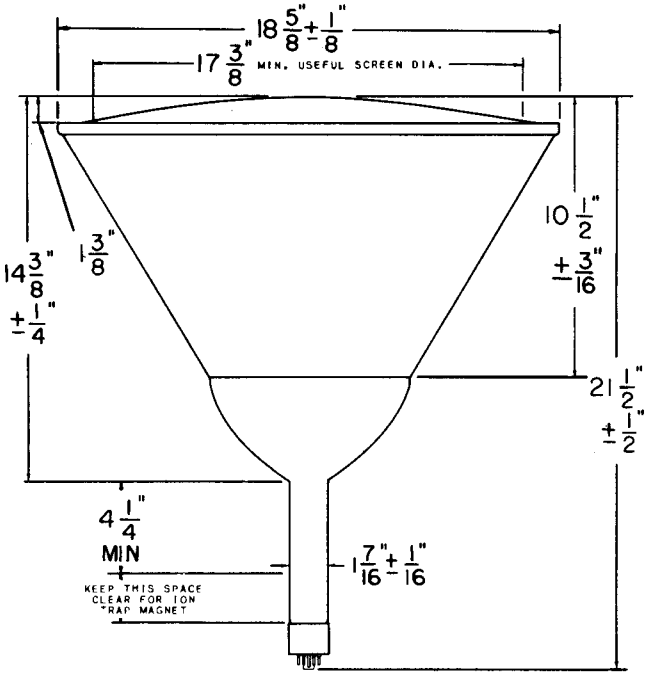

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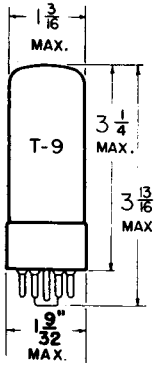
DIODE



GLASS BULB

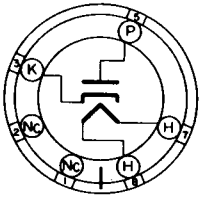
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 0.6 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT INTERMEDIATE SHELL 5 OR 6 PIN OCTAL

SOCKET TERMINALS #1, #2, #4 AND #6 SHOULD NOT BE USED AS TIE POINTS. PIN #1 OMITTED ON 5-PIN BASE.

4CG

THE 19AU4 AND 19AU4GTA ARE SINGLE INDIRECTLY-HEATED DIODES INTENDED FOR USE IN TELEVISION HORIZONTAL FREQUENCY DAMPER SERVICE. THEY ARE DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS ARE NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS. EXCEPT FOR THE HIGHER MAXIMUM DC OUTPUT CURRENT AND PEAK PLATE CURRENT OF THE 19AU4GTA, THE TWO TUBES ARE IDENTICAL.

DIRECT INTERELECTRODE CAPACITANCES ●

HEATER TO CATHODE: (H TO K)	4.0	μμf
PLATE TO CATHODE AND HEATER: P TO (H+K)	8.5	μμf
CATHODE TO PLATE AND HEATER: K TO (P+H)	11.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

DAMPER DIODE[B]

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK (ABSOLUTE MAXIMUM)	4 500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	4 500	VOLTS
MAXIMUM DC PLATE CURRENT 190 [A]	175	MA.
MAXIMUM STEADY STATE PEAK PLATE CURRENT 1 150	1 050	MA.
MAXIMUM PLATE DISSIPATION	6.0	WATTS
AVERAGE TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 350 MA.)	25	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE, NOT TO EXCEED 15% OF SCANNING CYCLE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[A] VALUES FOR 19AU4GTA.

● WITHOUT EXTERNAL SHIELD.

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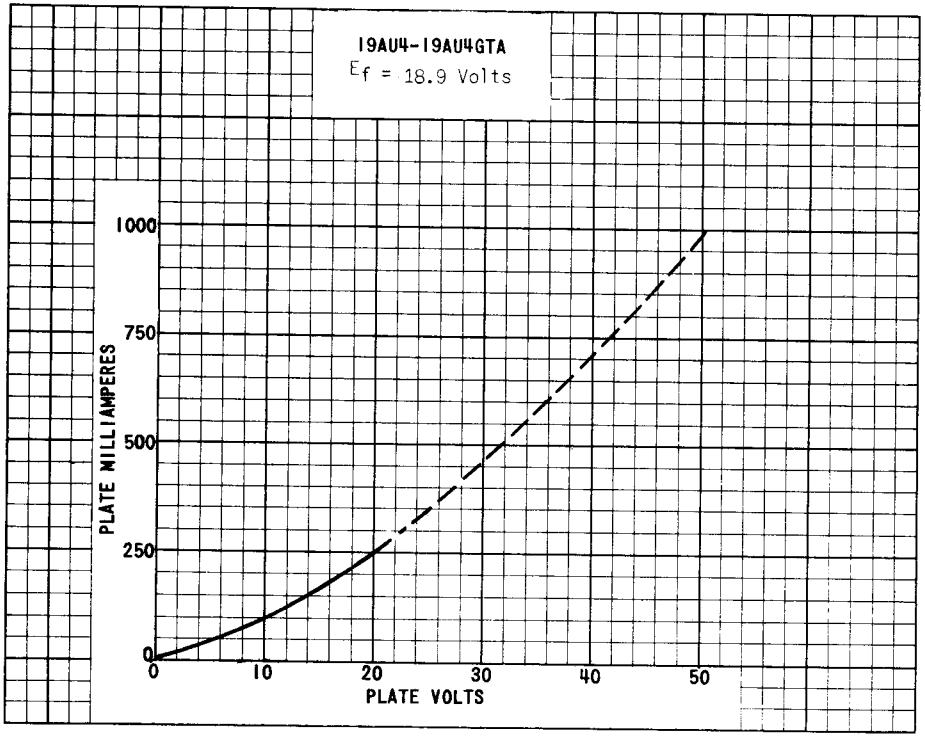
TENTATIVE DATA



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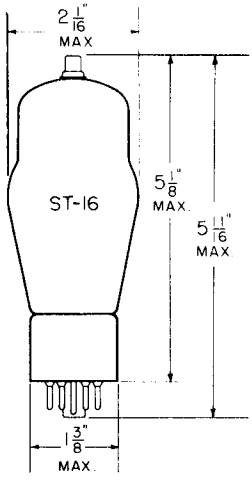
BEAM PENTODE

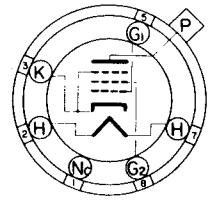


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
18.9 VOLTS .300 AMPERE
AC OR DC

MOUNTING POSITION
VERTICAL - BASE UP OR DOWN.
HORIZONTAL - PLANE OF PINS 2&7 VERTICAL.



BOTTOM VIEW
MEDIUM SHELL
6 PIN OCTAL
58T

THE 19BG6G IS ESSENTIALLY A MECHANICAL REDESIGN OF TYPE 6L6G TO PERMIT OPERATION AS A HORIZONTAL DEFLECTION AMPLIFIER FOR TELEVISION SERVICE. IT USES A TOP CAP CONNECTION AND ADDITIONAL INSULATION FOR THE PLATE STRUCTURE TO WITHSTAND THE HIGH PEAK PLATE VOLTAGE ENCOUNTERED IN SUCH CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P) MAX.	0.65	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	11	μμf
OUTPUT: P TO (H+K&G_3+G_2)	6.5	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	250	VOLTS
MAXIMUM DC PLATE VOLTAGE	500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE[A]	350	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-50	VOLTS
MAXIMUM PLATE DISSIPATION	20	WATTS
MAXIMUM DC PLATE CURRENT	100	MA.
MAXIMUM PEAK POSITIVE SURGE PLATE VOLTAGE[B]	6 000	VOLTS
MAXIMUM PEAK NEGATIVE SURGE GRID #1 VOLTAGE	-400	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1	MEGOHM

[A] PREFERABLY OBTAINED FROM PLATE-VOLTAGE SUPPLY THROUGH A SERIES DROPPING RESISTOR OF SUFFICIENT MAGNITUDE TO LIMIT THE GRID #2 INPUT TO THE RATED MAXIMUM VALUE FOR WIDE VARIATION IN GRID #2 CURRENT.

[B] THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND ITS DURATION MUST BE LIMITED TO TEN MICROSECONDS.

CONTINUED ON FOLLOWING PAGE

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APR. 1, 1949

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HORIZONTAL DEFLECTION CIRCUIT

HEATER VOLTAGE	18.9	VOLTS
HEATER CURRENT	300	AMP.
PLATE & GRID #2 SUPPLY VOLTAGE	400	VOLTS
PEAK POSITIVE SURGE PLATE VOLTAGE (APPROX.)	4 000	VOLTS
PEAK NEGATIVE SURGE GRID #1 VOLTAGE (APPROX.)	-100	VOLTS
PLATE CURRENT	70	MA.
GRID #2 CURRENT	6	MA.
GRID #1 CURRENT	25	μAMP

PLATE 2172
APR. 1, 1949

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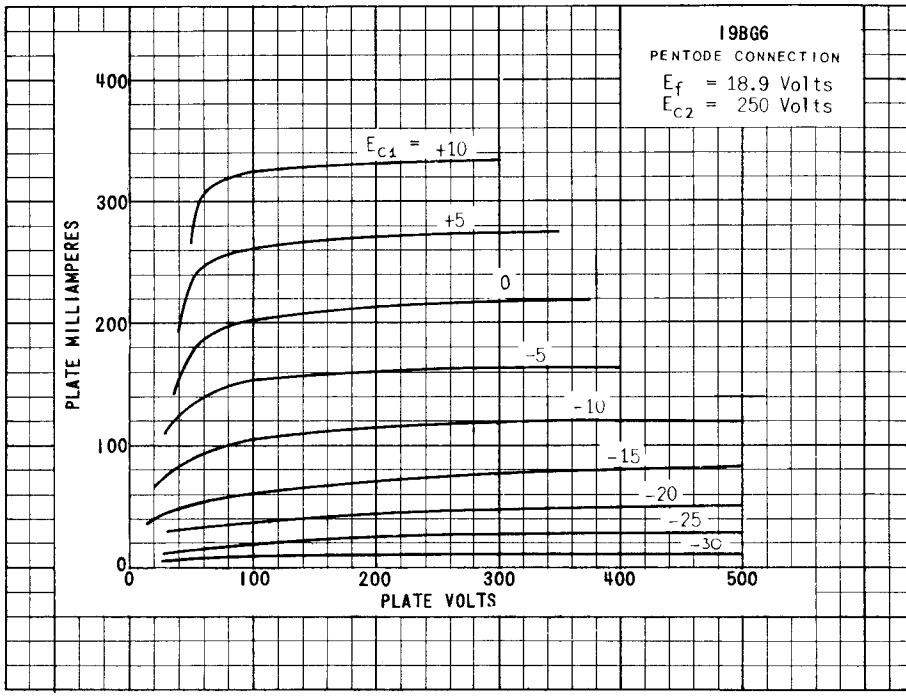

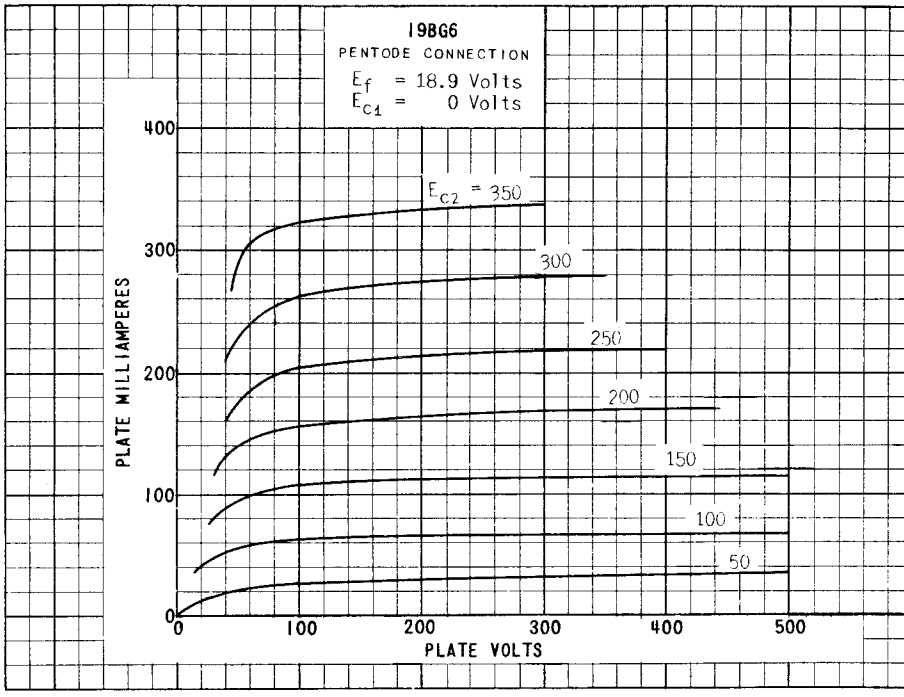

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PLATE
2173
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1949

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19BG6G

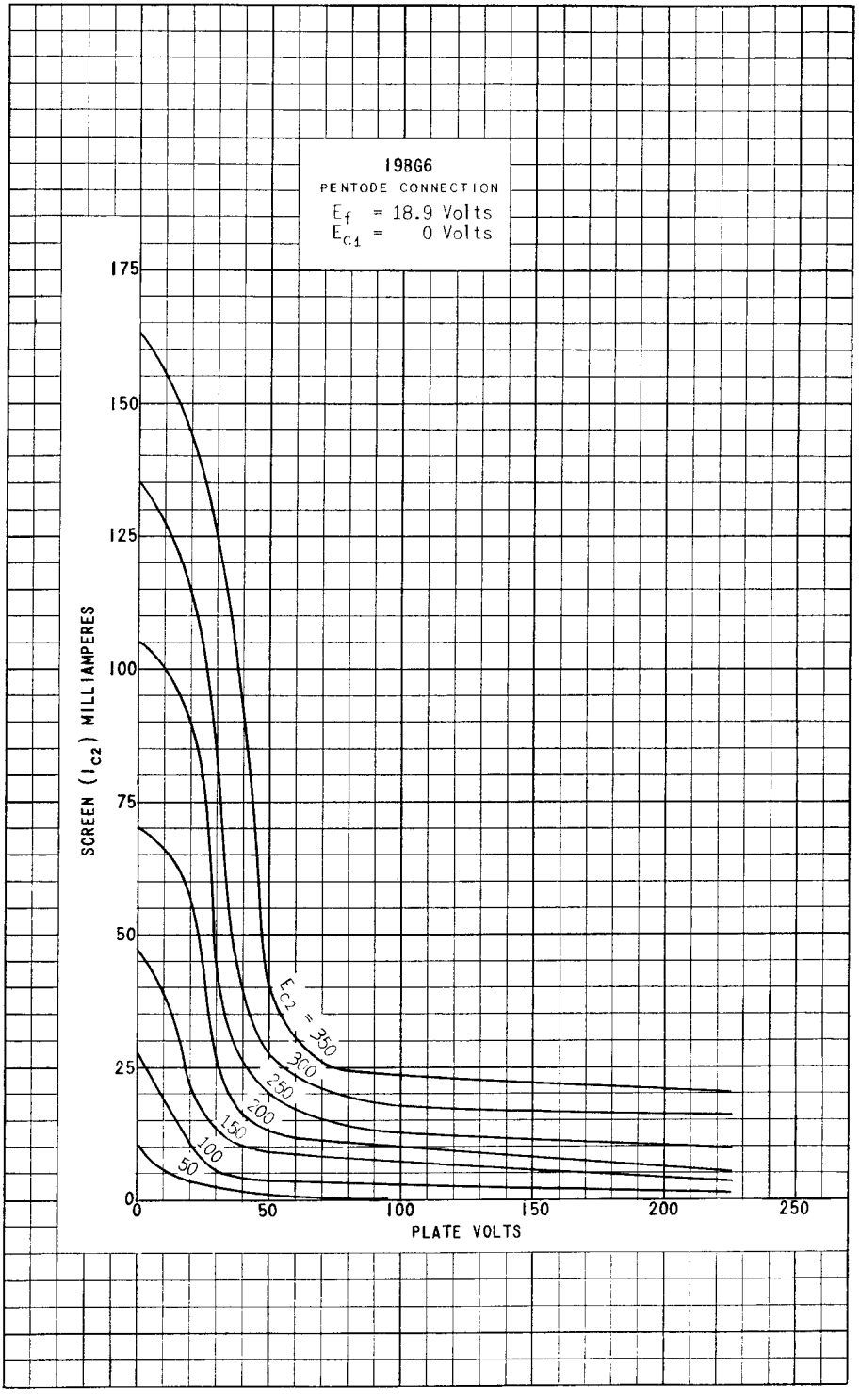

PLATE 2174
APR. 1, 1949

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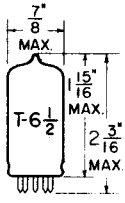
TUNG-SOL

TRIPLE-DIODE TRIODE

MINIATURE TYPE

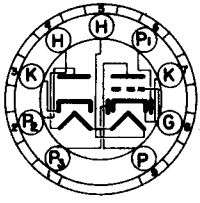


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
18.9 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9E

THE 19C8 COMPRISES THREE HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE CONSTRUCTION. ONE OF THE THREE DIODE PLATES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

DIODE #1 TO ALL: 1P TO (H+1K+2K+2P+3P+G+P)	5.2	µµf
DIODE #2 TO ALL: 2P TO (H+1K+2K+1P+3P+G+P)	4	µµf
DIODE #3 TO ALL: 3P TO (H+1K+2K+1P+2P+G+P)	5.2	µµf
DIODE #1 TO GRID: (1P TO G) MAX.	0.030	µµf
DIODE #2 TO GRID: (2P TO G) MAX.	0.006	µµf
DIODE #3 TO GRID: (3P TO G) MAX.	0.030	µµf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	6	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – TRIODE UNIT

HEATER VOLTAGE	18.9	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLT
PLATE CURRENT	0.5	MA.
PLATE RESISTANCE	80 000	OHMS
TRANSCONDUCTANCE	1 250	µMHOS
AMPLIFICATION FACTOR	100	

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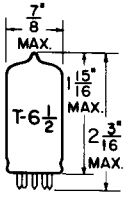
TRIODE TETRODE

MINIATURE TYPE



GLASS BULB

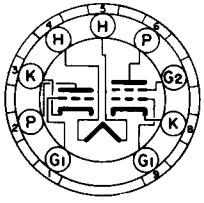
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9FX

THE 19CL8A IS A SHARP CUTOFF TETRODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE, PRIMARILY AS A COMBINED TRIODE OSCILLATOR AND TETRODE MIXER IN VHF TELEVISION TUNERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 19CL8A IS IDENTICAL TO THE 6CL8A.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[B] SHIELD #315	WITHOUT SHIELD	
TRIODE:			
GRID TO PLATE (G TO P)	1.8.	1.8	μμf
INPUT: G TO (H+K)	2.7	2.7	μμf
OUTPUT: P TO (H+K)	1.2	0.4	μμf
TETRODE:			
GRID TO PLATE (G_1 TO P) (MAX.)	0.010	0.028	μμf
INPUT: G_1 TO (H+K+G_2)	5.0	5.0	μμf
OUTPUT: P TO (H+K+G_2)	3.4	2.4	μμf
CATHODE TO HEATER (EITHER SECTION APPROX.)	2.5[C]	2.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	TETRODE	
HEATER VOLTAGE	18.9	18.9	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE		300	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART		
MAXIMUM PLATE DISSIPATION	2.7	2.8	WATTS
MAXIMUM GRID #2 DISSIPATION	---	0.5	WATT
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS

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RATINGS—CONT'D.

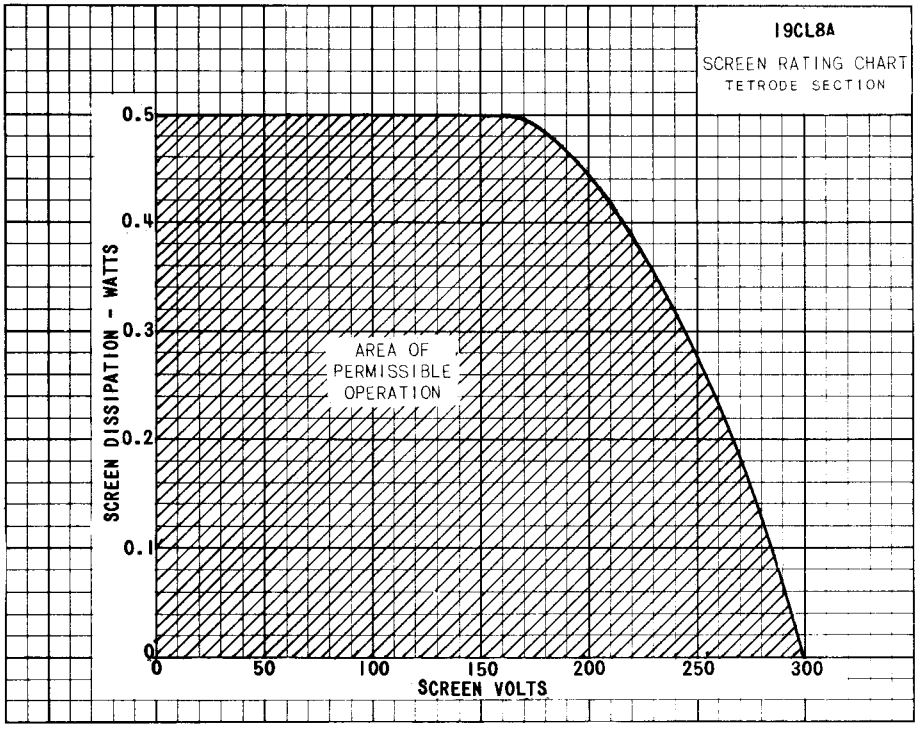
	TRIODE	TETRODE	
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM
HEATER WARM-UP TIME[A]	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TETRODE SECTION		TRIODE SECTION	
HEATER VOLTAGE	18.9	18.9	18.9	VOLTS
HEATER CURRENT	0.15	0.15	0.15	AMP.
PLATE VOLTAGE	100	125	125	VOLTS
SCREEN VOLTAGE	100	125	---	VOLTS
GRID #1 VOLTAGE	0	-1.0	---	VOLTS
CATHODE-BIAS RESISTOR	---	---	56	OHMS
AMPLIFICATION FACTOR	---	---	40	
PLATE RESISTANCE (APPROX.)	---	100000	5000	OHMS
TRANSCONDUCTANCE	8200	6400	8000	μMHOS
PLATE CURRENT	---	12	15	MA.
SCREEN CURRENT	---	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)				
I_b = 10 μAMPERES	---	-10	-9	VOLTS

[A] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



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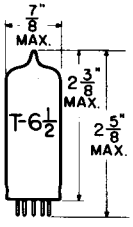
DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB

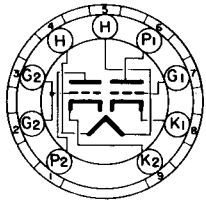
COATED UNIPOTENTIAL CATHODE

HEATER

19.4 VOLTS 0.30 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9HF

THE 19DE7 IS A MINIATURE DOUBLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. SECTION #1 IS INTENDED FOR USE AS A VERTICAL DEFLECTION OSCILLATOR HAVING MEDIUM MU AND SECTION #2 IS INTENDED FOR USE AS A VERTICAL DEFLECTION AMPLIFIER WITH LOW MU. EXCEPT FOR HEATER RATINGS THE 19DE7 IS IDENTICAL TO THE 6DE7.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

GRID TO PLATE: (G TO P)	4.0	8.5	μμf
INPUT: G TO (H+K)	2.2	5.5	μμf
OUTPUT: P TO (H+K)	0.52	1.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION OSCILLATOR AND AMPLIFIER[A]

	TRIODE #1 OSCILLATOR	TRIODE #2 AMPLIFIER	
HEATER VOLTAGE	19.4	19.4	VOLTS
MAXIMUM HEATER—CATHODE VOLTAGE[B]			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS
MAXIMUM DC PLATE VOLTAGE	330	275	
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	---	1500	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID VOLTAGE	400	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	1.5	7.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	22	50	MA.
MAXIMUM PEAK CATHODE CURRENT	77	175	MA.
MAXIMUM GRID CIRCUIT RESISTANCE			
SELF BIAS	2.2	2.2	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0		SECONDS

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TA TENTATIVE DATA

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

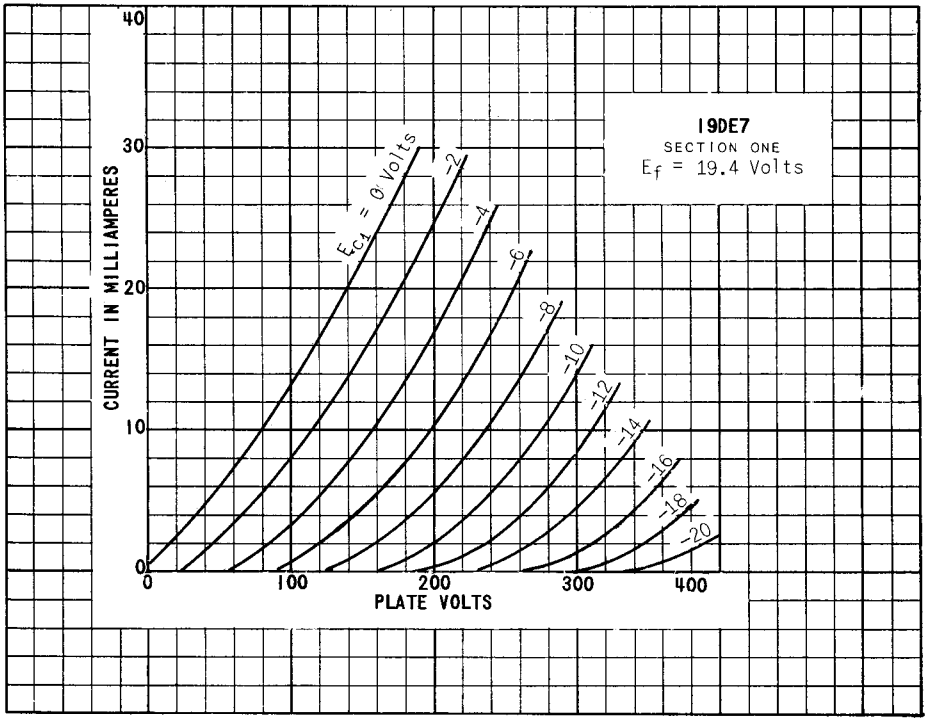
	TRIODE #1	TRIODE #2	
HEATER VOLTAGE	19.4		VOLTS
HEATER CURRENT	0.30		AMP.
PLATE VOLTAGE	250	150	VOLTS
GRID #1 VOLTAGE	-11	-17.5	VOLTS
PLATE CURRENT	5.5	35	MA.
TRANSCONDUCTANCE	2000	6500	μMHOS
AMPLIFICATION FACTOR	17.5	6.0	
PLATE RESISTANCE (APPROX.)	8750	925	
GRID VOLTAGE FOR Ib = 10 μA	-20	---	VOLTS
GRID VOLTAGE FOR Ib = 50 μA	---	-44	VOLTS
PLATE CURRENT AT Ec =-24 Vdc	---	10	MA.
ZERO BIAS PLATE CURRENT Eb = 60V; Ec = 0 (INSTANTANEOUS VALUES))	---	80	MA.

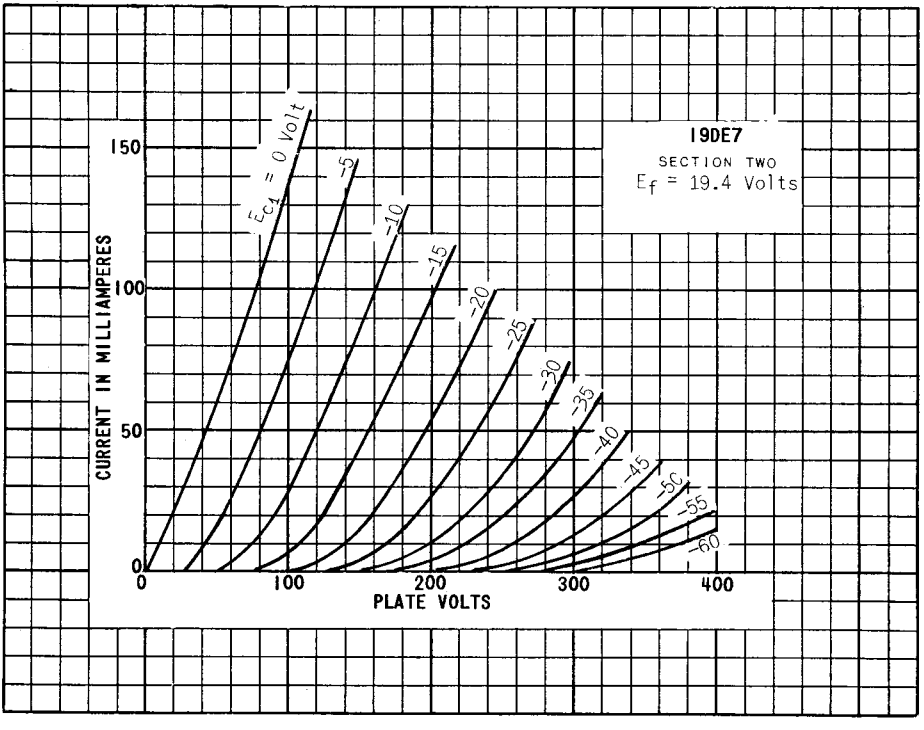
A FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

B DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

C IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER-WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.





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CATHODE RAY

THE 19DP4 AND 19DP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL EXCEPT FOR THE FOLLOWING DIFFERENCE IN THEIR FACEPLATES:

19DP4 - CLEAR GLASS FACEPLATE *19DP4A - GREY FILTER FACEPLATE*

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
11 3/4" X 15 3/4" RASTER SIZE
ROUND GLASS CONSTRUCTION
EXTERNAL CONDUCTIVE COATING
EXTERNAL SINGLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	66	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.) **19DP4A**	70	PERCENT

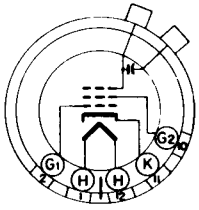
MECHANICAL DATA

OVERALL LENGTH	21 1/2 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	18 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	17 3/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2



BOTTOM VIEW

PIN 11 - CATHODE
PIN 12 - HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	17 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-26 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	146	MA.
DC ION TRAP CURRENT STANDARD COIL (APPROX.)	75 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 25 FOOT LAMBERTS ON A 11 3/4" BY 15 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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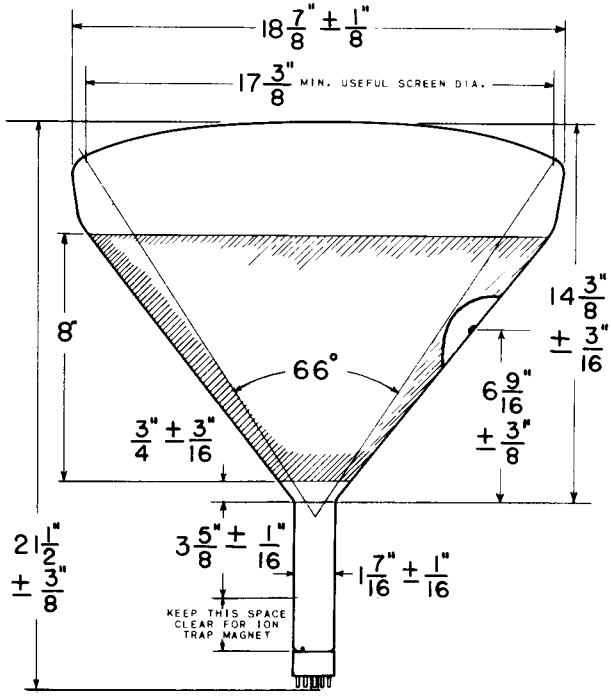

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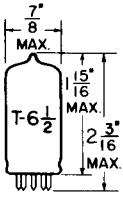
TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

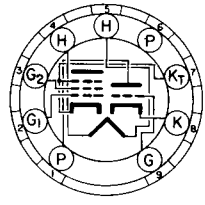
COATED UNIPOTENTIAL CATHODE

HEATER

18.9 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL BUTTON
9 PIN BASE

9AE

THE 19EA8 IS A SHARP CUTOFF PENTODE AND A TRIODE IN THE 9-PIN MINIATURE CONSTRUCTION. EACH SECTION HAS ITS OWN CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE IS INTENDED PRIMARILY FOR USE AS A COMBINED TRIODE OSCILLATOR AND PENTODE MIXER IN TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS, THE 19EA8 IS IDENTICAL TO THE 6EA8.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
PENTODE SECTION:			
GRID #1 TO PLATE (MAX.)	0.01	0.02	μμf
INPUT	5.0	5.0	μμf
OUTPUT	3.4	2.6	μμf
TRIODE SECTION:			
GRID TO PLATE	1.7	1.7	μμf
INPUT	3.2	3.0	μμf
OUTPUT	1.1	0.3	μμf
HEATER TO CATHODE (EACH SECTION) [B]	3.0	3.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	18.9	18.9	VOLTS
MAXIMUM PLATE VOLTAGE	330	330	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	330	---	VOLTS
MAXIMUM SCREEN VOLTAGE			
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	0	VOLTS
MAXIMUM PLATE DISSIPATION	3.1	3.0	WATTS
MAXIMUM SCREEN DISSIPATION	0.55	---	WATTS

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RATINGS – CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	PENTODE SECTION	TRIODE SECTION	
MAXIMUM HEATER–CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER WARM–UP TIME*	11.0		SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

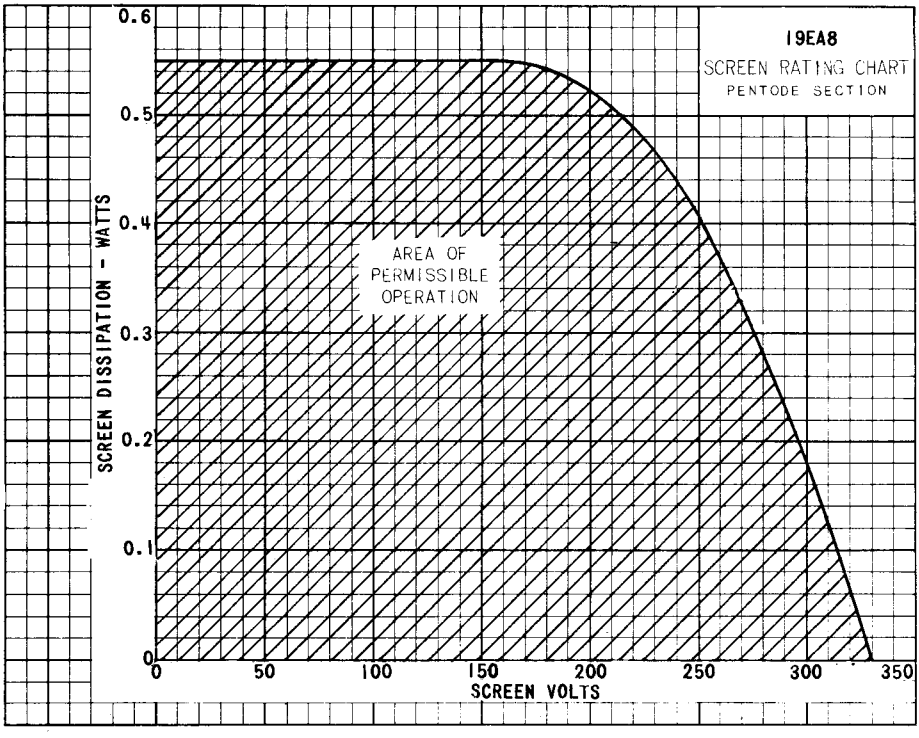
AVERAGE CHARACTERISTICS

	PENTODE SECTION	TRIODE SECTION	
HEATER VOLTAGE	18.9	18.9	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	125	150	VOLTS
SCREEN VOLTAGE	125	---	VOLTS
GRID #1 VOLTAGE	-1.0	---	
CATHODE–BIAS RESISTOR	---	56	OHMS
AMPLIFICATION FACTOR	---	40	
PLATE RESISTANCE (APPROX.)	80 000	5 000	OHMS
TRANSCONDUCTANCE	6 400	8 500	μAMPS
PLATE CURRENT	12	18	MA.
SCREEN CURRENT	4.0	---	MA.
GRID #1 VOLTAGE (APPROX.)			
I_b = 10 μAMPS.	-9	-12	VOLTS

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO CATHODE OF SECTION UNDER TEST UNLESS OTHERWISE INDICATED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

*HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.


19EA8
SCREEN RATING CHART
PENTODE SECTION
SCREEN DISSIPATION - WATTS
0.6
0.5
0.4
0.3
0.2
0.1
0
AREA OF
PERMISSIBLE
OPERATION
0
50
100
150
200
250
300
350
SCREEN VOLTS

TUNG-SOL

CATHODE RAY

THE 19EP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE
MAGNETIC FOCUS AND DEFLECTION
RECTANGULAR GLASS CONSTRUCTION
UNIPOTENTIAL CATHODE
12" X 16" RASTER SIZE
EXTERNAL DOUBLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

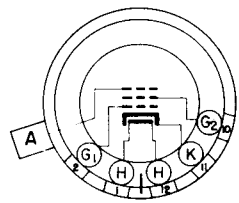
MECHANICAL DATA

OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIAMETER OF BULB	18 5/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	17 21/32	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	19 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-26 TO -63	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	95 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	75 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 25 FOOT LAMBERTS ON A 12" X 16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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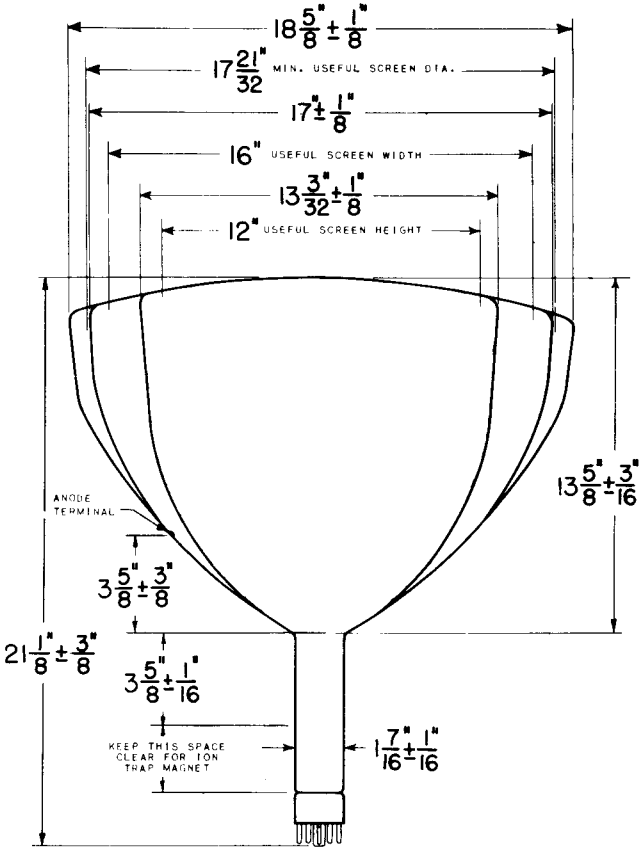

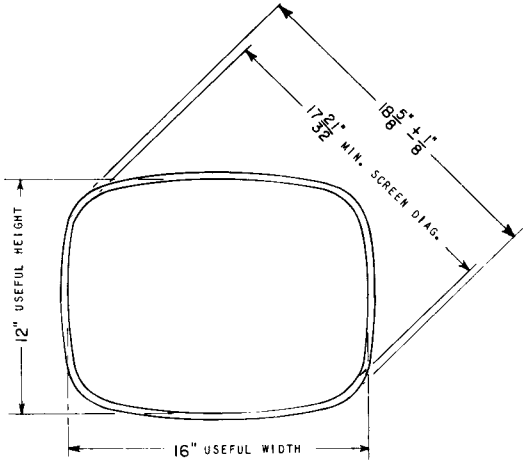

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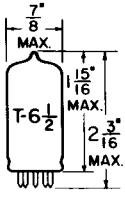
TRIPLE TRIODE

MINIATURE TYPE



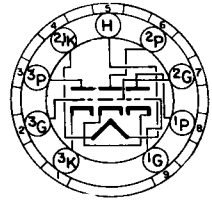
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

18.9±10% VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON
9 PIN BASE
9KA

THE 19EZ8 IS A HIGH MU, TRIPLE TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE CATHODES OF SECTIONS 1 AND 2 HAVE A COMMON CONNECTION WITH ONE SIDE OF THE HEATER. THE CATHODE OF SECTION 3 IS BROUGHT OUT TO A SEPARATE BASE PIN.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (EACH SECTION)	1.5	1.5	μμf
INPUT (EACH SECTION)	2.6	2.4	μμf
OUTPUT, SECTION #1	1.4	0.21	μμf
OUTPUT, SECTION #2	1.2	0.4	μμf
OUTPUT, SECTION #3	1.2	0.36	μμf
HEATER TO CATHODE, SECTION #3	0.15	0.17	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH SECTION

HEATER VOLTAGE	18.9±10%	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	50	VOLTS
MAXIMUM PLATE DISSIPATION (EACH PLATE)	2.0	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (ALL PLATES)	5.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE (SECTION 3):		
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

EACH SECTION

PLATE VOLTAGE	125	VOLTS
GRID VOLTAGE	-1.0	VOLTS
AMPLIFICATION FACTOR	57	
PLATE RESISTANCE (APPROX.)	13 600	OHMS
TRANSCONDUCTANCE	4 200	μMHOS
PLATE CURRENT	4.2	MA.
GRID VOLTAGE (APPROX.) I_b= 20 μAMPS.	-4	VOLTS

TUNG-SOL

CATHODE RAY

THE 19FP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE
ROUND GLASS CONSTRUCTION
11 3/8" X 15 3/4" RASTER SIZE
UNIPOTENTIAL CATHODE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL DOUBLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	66	DEGREES

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

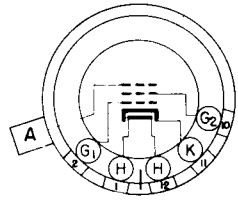
MECHANICAL DATA

OVERALL LENGTH	22 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	18 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	17 3/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	19 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	130	MA.
DC ION TRAP CURRENT STANDARD COIL #108 (APPROX.)	110	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 11 3/4" X 15 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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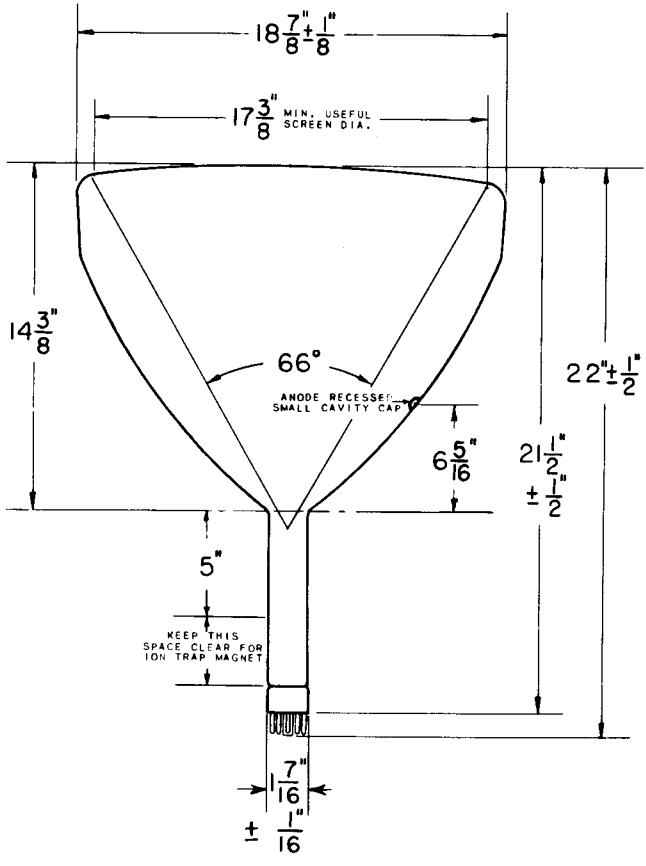

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CATHODE RAY

THE 19GP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
ROUND GLASS CONSTRUCTION	**11 3/4" X 15 3/4" RASTER SIZE**
MAGNETIC FOCUS AND DEFLECTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	66	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

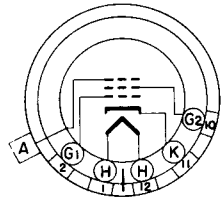
OVERALL LENGTH	21 1/4 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	18 7/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	17 3/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	19 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	125	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	125	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	13 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	130	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	105	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 11 3/4" X 15 3/4" PCITURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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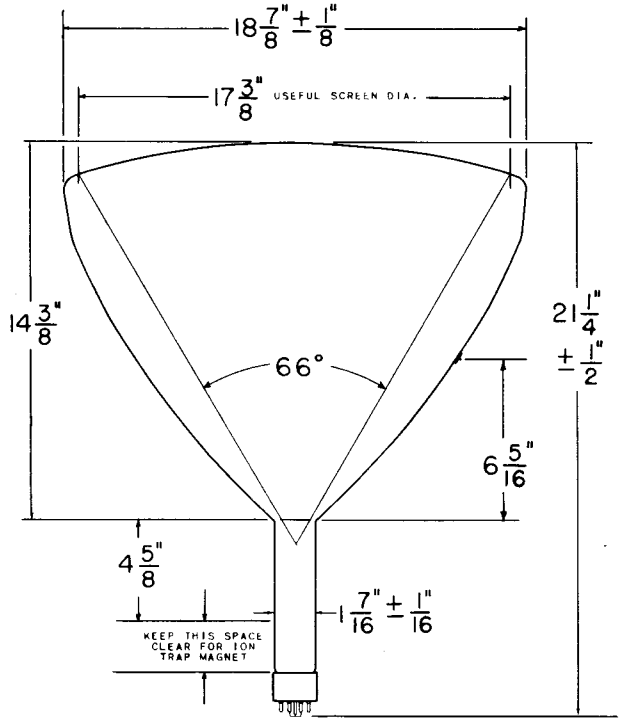

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TRIPLE DIODE

MINIATURE TYPE

FOR

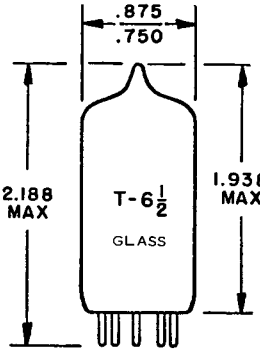
AM AND FM

DETECTION

COATED UNIPOTENTIAL CATHODE

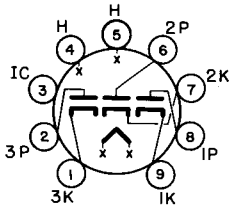
ANY MOUNTING POSITION

OUTLINE DRAWING
JEDEC 6-2



BUTTON 9 PIN BASE
JEDEC E9-1

BASING DIAGRAM
JEDEC 9QM



BOTTOM VIEW

THE 19GQ7 IS A TRIPLE HIGH PERVEANCE DIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN AM DETECTOR AND FM RADIO-DETECTOR OR DISCRIMINATOR.

DIRECT INTERELECTRODE CAPACITANCES

PLATE INPUT EACH UNIT: P TO (K+H)	2.05	pf
CATHODE INPUT EACH UNIT: K TO (P+H)	3.10	pf
PLATE, UNIT #1 TO PLATE, UNIT #2	0.47	pf
PLATE, UNIT #1 TO PLATE, UNIT #3	0.47	pf
PLATE, UNIT #2 TO PLATE, UNIT #3	0.05	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	18.9 VOLTS	150	mA
LIMITS OF SUPPLIED CURRENT		150 ± 9	mA
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		330	VOLTS
DC COMPONENT		330	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
DC COMPONENT		100	VOLTS

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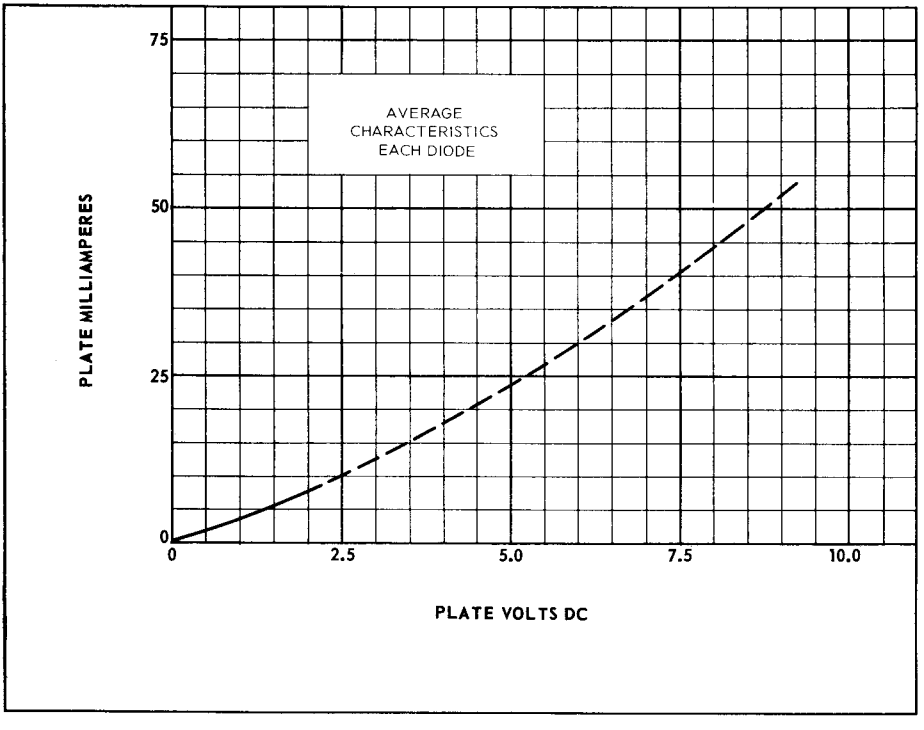
MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PEAK INVERSE VOLTAGE	330	VOLTS
AC PLATE VOLTAGE RMS - EACH PLATE	117	VOLTS
STEADY STATE PEAK PLATE CURRENT - EACH PLATE	54	mA
DC OUTPUT CURRENT - EACH PLATE	9	mA
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDENCE - EACH PLATE	300	OHMS

CHARACTERISTICS

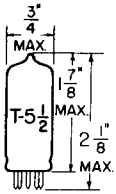
TUBE VOLTAGE DROP AT 60 mA	10	VOLTS
RESONANT FREQUENCY - EACH UNIT	APPROX. 700	Mc/s



TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

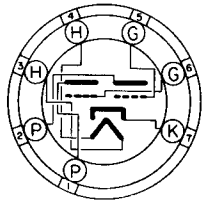


GLASS BULB

UNIPOTENTIAL CATHODE

HEATER
18.9 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
7BF

THE 19J6 IS A TWIN TRIODE HAVING TWO PLATES AND TWO GRIDS WITH A COMMON CATHODE, USING THE MINIATURE CONSTRUCTION. IT MAY BE OPERATED IN PARALLEL OR PUSH-PULL. WITH THE GRIDS IN A PUSH-PULL ARRANGEMENT AND THE PLATES IN PARALLEL, THE 19J6 IS PARTICULARLY APPLICABLE AS A MIXER AT FREQUENCIES AS HIGH AS 600 MEGACYCLES. IT IS ALSO USEFUL AS AN OSCILLATOR.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

	EACH UNIT	
GRID TO PLATE: (G TO P)	1.5	μμf
GRID TO CATHODE: (G TO K)	2	μμf
PLATE TO CATHODE: (P TO K)	0.4	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH UNIT

HEATER VOLTAGE	18.9	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR[A]	50[B]	OHMS
PLATE CURRENT	8.5	MA.
PLATE RESISTANCE	7 100	OHMS
TRANSCONDUCTANCE	5 300	μMHOS
AMPLIFICATION FACTOR	38	

[A] FIXED BIAS OPERATION NOT RECOMMENDED.

[B] VALUE IS FOR BOTH UNITS OPERATING AT THE SPECIFIED CONDITIONS.

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JAN. 2, 1949

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CONTINUED FROM PRECEDING PAGE

MIXER SERVICE - EACH UNIT

HEATER VOLTAGE	18.9	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR[A]	810[B]	OHMS
OSCILLATOR PEAK VOLTAGE	3	VOLTS
PLATE RESISTANCE	10 200	OHMS
CONVERSION TRANSCONDUCTANCE	1 900	μMHOS
SHORT-CIRCUIT INPUT CONDUCTANCE AT 100 MC	96	μMHOS
PLATE CURRENT	4.8	MA.

[A] FIXED BIAS OPERATION NOT RECOMMENDED.

[B] VALUE IS FOR BOTH UNITS OPERATING AT THE SPECIFIED CONDITIONS.

PLATE 2139
JAN. 2, 1949

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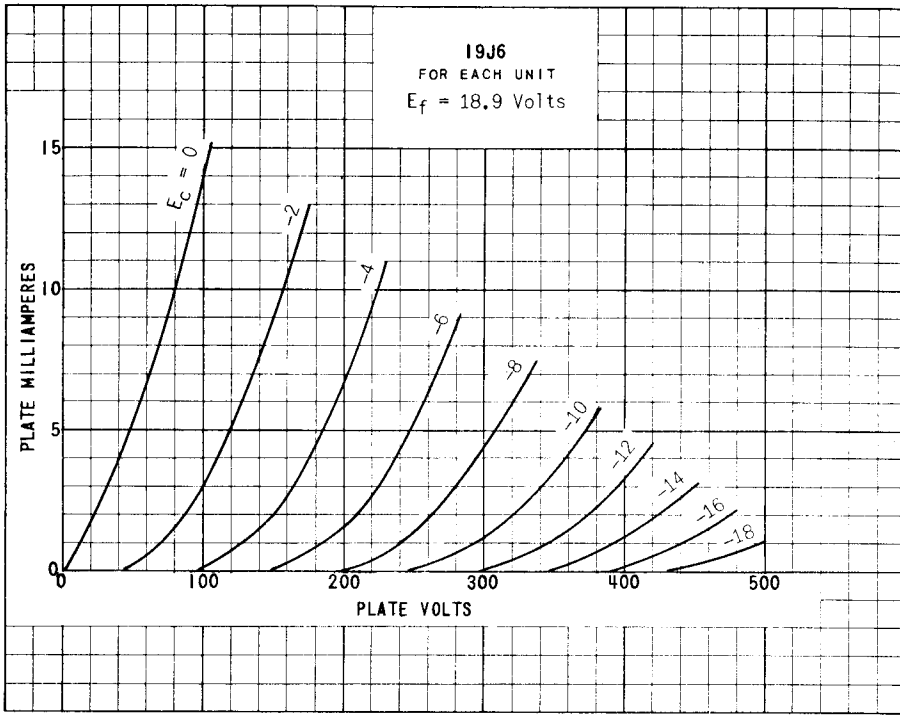

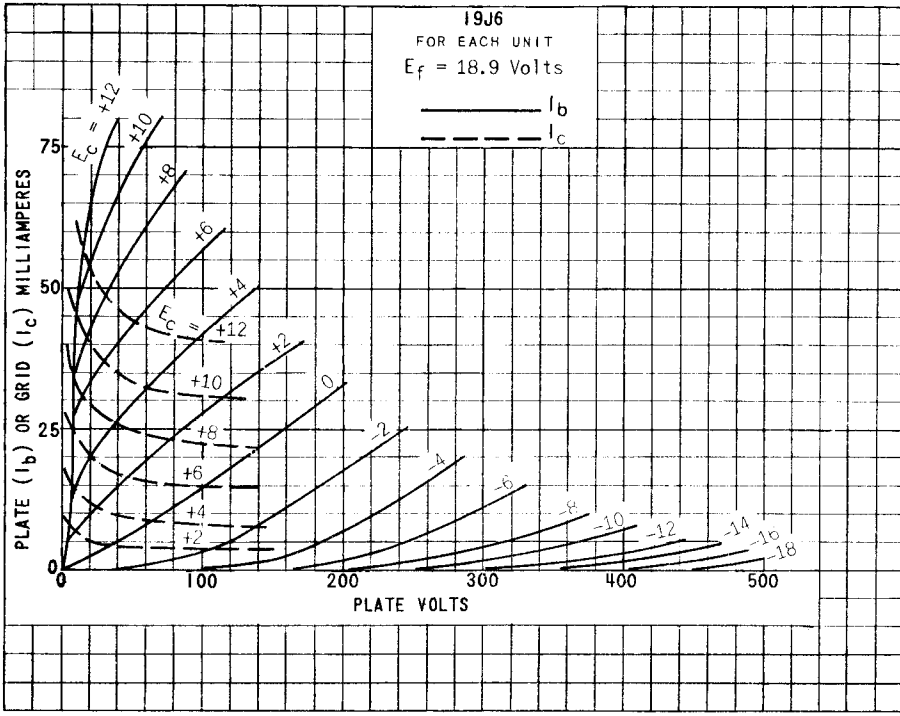

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PLATE
2134
JAN. 2,
1949

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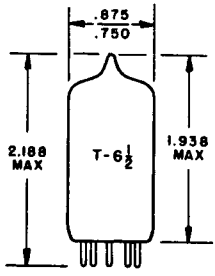
TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-2

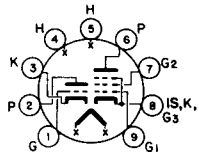


SMALL BUTTON BASE
9 PIN JEDEC E9-1

FOR
APPLICATIONS IN
FM OR TV RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9FA



BOTTOM VIEW

THE 19JN8 IS A SHARP-CUTOFF PENTODE AND MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE PENTODE SECTION IS INTENDED FOR OSCILLATOR SERVICE IN THE HORIZONTAL DEFLECTION SYSTEM OF TELEVISION RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 19JN8 IS IDENTICAL TO THE 6JN8.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE

PENTODE SECTION:			
GRID 1 TO PLATE: (G1 TO P)	MAX.	0.01	pf
INPUT: G_1 TO (H + K + G_2 + G_3 + I.S.)		5.5	pf
OUTPUT: P TO (H + K + G_2 + G_3 + I.S.)		3.4	pf
TRIODE SECTION:			
GRID TO PLATE: (G TO P)		1.7	pf
INPUT: G TO (H + TK + PK + PG3 + I.S.)		3.2	pf
OUTPUT: P TO (H + TK + PK + PG3 + I.S.)		2.2	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	18.9 VOLTS	150	mA
LIMITS OF SUPPLIED CURRENT		150 ± 10	mA
HEATER-CATHODE VOLTAGE: EACH SECTION:			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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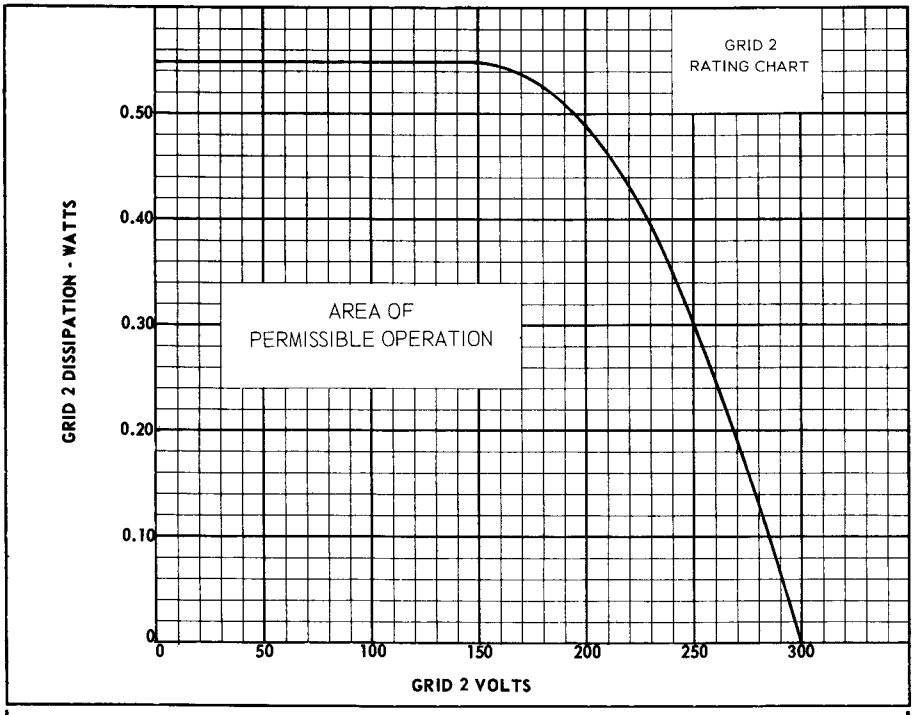
MAXIMUM RATINGS

DESIGN - MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	300	300	VOLTS
GRID 2 SUPPLY VOLTAGE	–	300	VOLTS
GRID 2 VOLTAGE	–	SEE RATING CHART	
POSITIVE DC GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.5	2.5	WATTS
GRID 2 DISSIPATION	–	0.55	WATTS
GRID 1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	2.2	2.2	MEGOHMS
WITH CATHODE BIAS	2.2	2.2	MEGOHMS

AVERAGE CHARACTERISTICS AND TYPICAL OPERATION

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	125	125	VOLTS
GRID 2 VOLTAGE	–	125	VOLTS
GRID 1 VOLTAGE	–1.0	–1.0	VOLTS
PLATE CURRENT	13.5	12	mA
GRID 2 CURRENT	–	4.0	mA
TRANSCONDUCTANCE	8,500	7,500	μMHOS
AMPLIFICATION FACTOR	46	–	
PLATE RESISTANCE	5,400	200,000	OHMS
GRID 1 VOLTAGE (APPROX.) FOR I_b = 10 μA	–8	–8	VOLTS



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CATHODE RAY

THE 19JP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE
MAGNETIC FOCUS AND DEFLECTION
RECTANGULAR GLASS CONSTRUCTION
UNIPOTENTIAL CATHODE
12" X 16" RASTER SIZE
EXTERNAL SINGLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

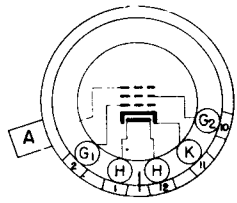
MECHANICAL DATA

OVERALL LENGTH	20 13/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	18 5/8 ± 1/8	INCHES
WIDTH	17 1/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	17 21/32	INCHES
WIDTH	16	INCHES
HEIGHT	12	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		120

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

BOTTOM VIEW

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TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	95 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111	75 ± 50%	MA.

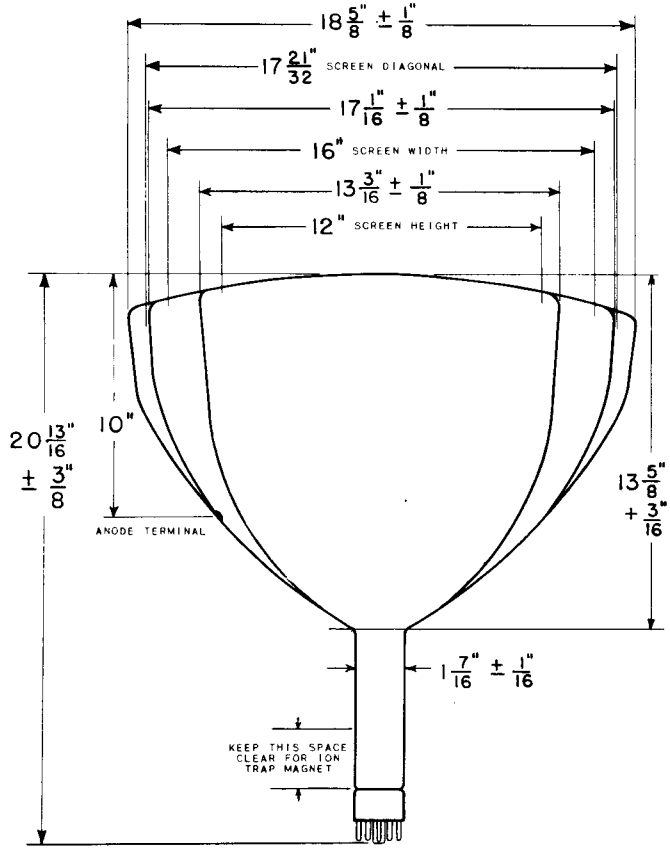
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

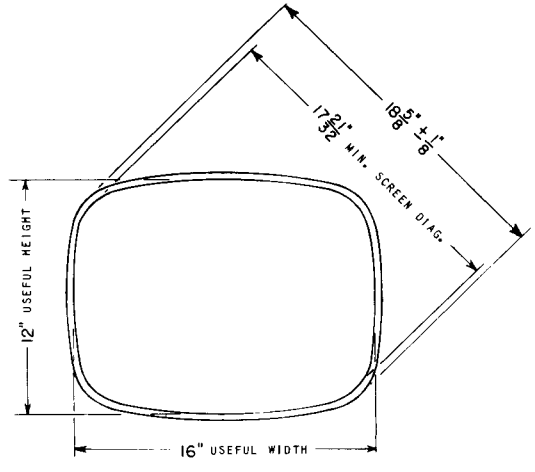
[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 12" X 16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL

CATHODE RAY

THE 19QP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE	**12" X 16" RASTER SIZE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**LOW VOLTAGE ELECTROSTATIC FOCUS**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

MECHANICAL DATA

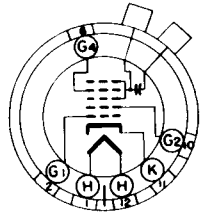
OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB		
DIAGONAL	18 5/8 ± 1/8	INCHES
WIDTH	17 1/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS		
DIAGONAL	17 21/32	INCHES
WIDTH	16	INCHES
HEIGHT	12	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #4 VOLTAGE[A]	−50 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−33 TO −77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

[A] I_b SET FOR 100 UAMP.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL

TRIPLE-DIODE TRIODE

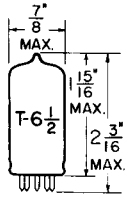
MINIATURE TYPE

COATED UNIPOTENTIAL CATHODES

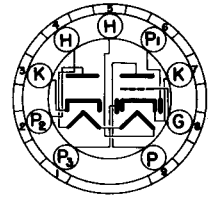
HEATER

18.9 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE GLASS BUTTON
9 PIN BASE
9E

THE 19T8 COMPRISES THREE HIGH PERVEANCE DIODES AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE CONSTRUCTION. ONE OF THE THREE DIODE PLATES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES ←

	WITHOUT SHIELD	WITH[A] SHIELD	
TRIODE GRID TO PLATE	1.7	1.7	μμf
TRIODE INPUT	1.6	1.7	μμf
TRIODE OUTPUT	1.2	2.4	μμf
GRID TO ANY DIODE PLATE (MAX.)	.034	.034	μμf
INPUT DIODE 1	3.8	3.8	μμf
INPUT DIODE 2	3.8	3.8[B]	μμf
INPUT DIODE 3	3.4	3.6	μμf
DIODE 2 CATHODE TO ALL	7.5	8.5[C]	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM PLATE VOLTAGE	330 ←	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1.1 ←	WATTS
MAXIMUM DIODE CURRENT FOR CONTINUOUS OPERATION (EA. PLATE)	5.5 ←	MA.
MAXIMUM HEATER-CATHODE VOLTAGE		
HEATER NEGATIVE WITH RESPECT TO CATHODE	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18.9	18.9	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−3	VOLTS
AMPLIFICATION FACTOR	70	70	
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
PLATE CURRENT	0.8	1.0	MA.
AVERAGE DIODE CURRENT: (EACH SECTION) MEASURED WITH 5 VOLTS DC APPLIED		20	MA.

TRIODE UNIT AS RESISTANCE COUPLED AMPLIFIER *

PLATE SUPPLY VOLTAGE	90	VOLTS
CONTROL GRID VOLTAGE	0	VOLTS
PLATE LOAD RESISTOR	220 000	OHMS
CONTROL GRID RESISTOR	10.0	MEGOHMS
INPUT CONDENSER	0.01	μf
OUTPUT CONDENSER	0.01	μf
GRID RESISTOR OF FOLLOWING STAGE	470 000	OHMS
SIGNAL SOURCE IMPEDANCE (MAX.)	1 000	OHMS
DISTORTION	5	PERCENT
OUTPUT VOLTAGE	8.5	VOLTS
VOLTAGE GAIN AT 400 CPS	35	

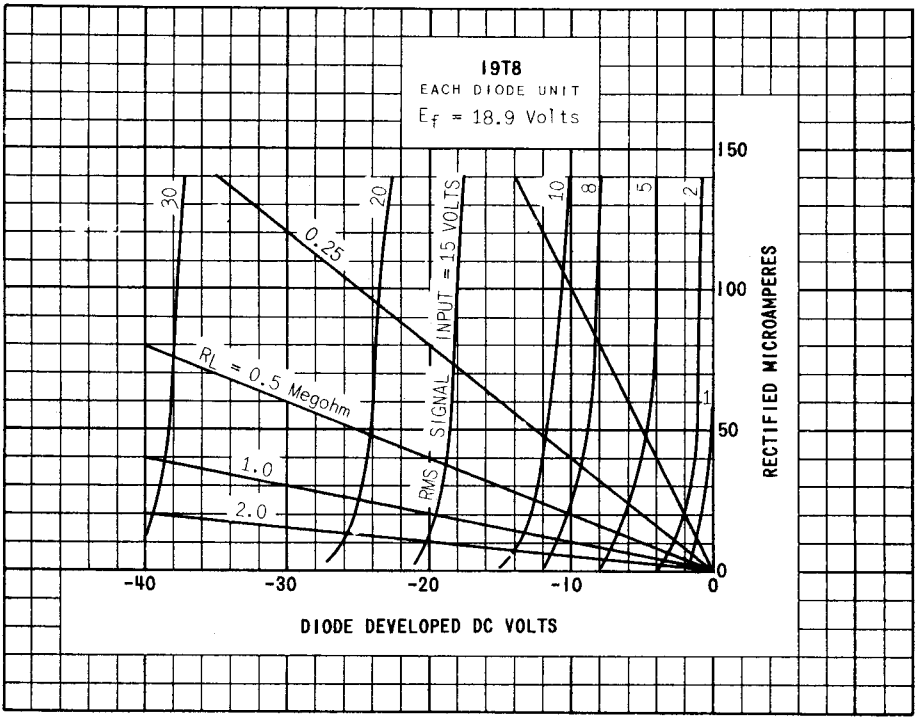
[A] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #7, EXCEPT AS NOTED.

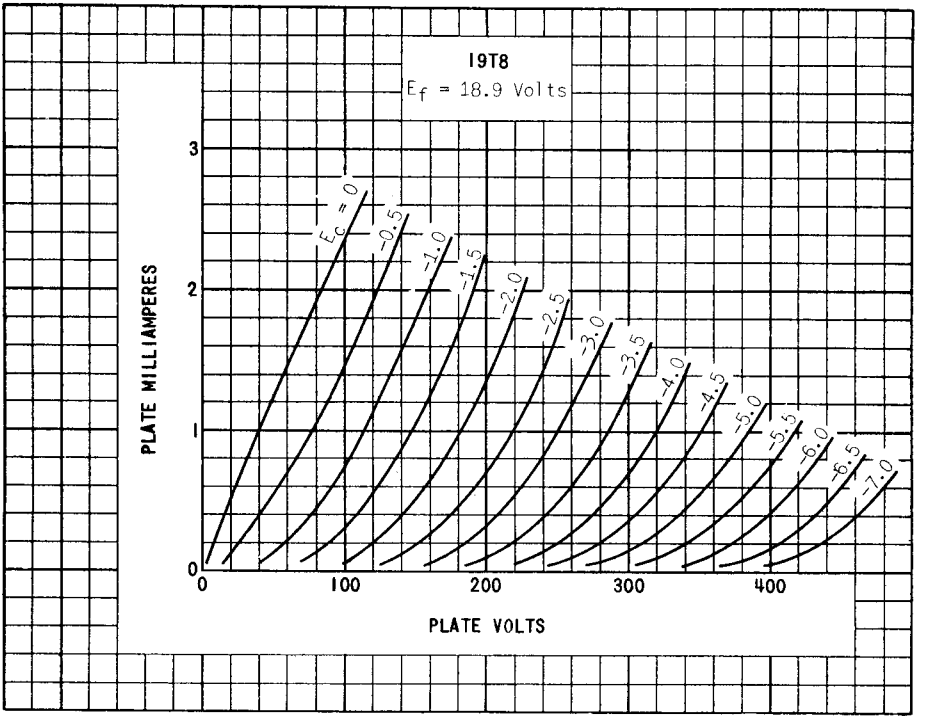
[B] WITH EXTERNAL SHIELD #315 CONNECTED TO PIN #3.

[C] WITH EXTERNAL SHIELD #315 CONNECTED TO PINS #4 AND #5.

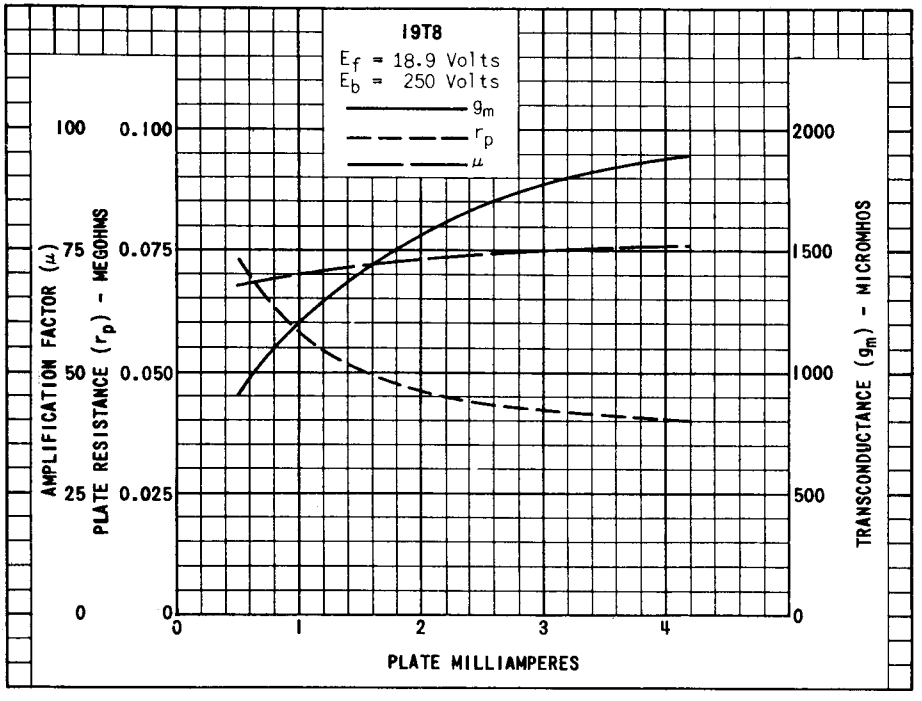
→ INDICATES A CHANGE..

* INDICATES AN ADDITION.


19T8
EACH DIODE UNIT
E_f = 18.9 Volts
30
20
10
8
5
2
1
0.25
R_L = 0.5 Megohm
1.0
2.0
RMS SIGNAL INPUT = 15 VOLTS
150
100
50
0
RECTIFIED MICROAMPERES
-40
-30
-20
-10
0
DIODE DEVELOPED DC VOLTS


19T8
E_f = 18.9 Volts
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
3
2
1
0
PLATE MILLIAMPERES
0
100
200
300
400
PLATE VOLTS

19T8



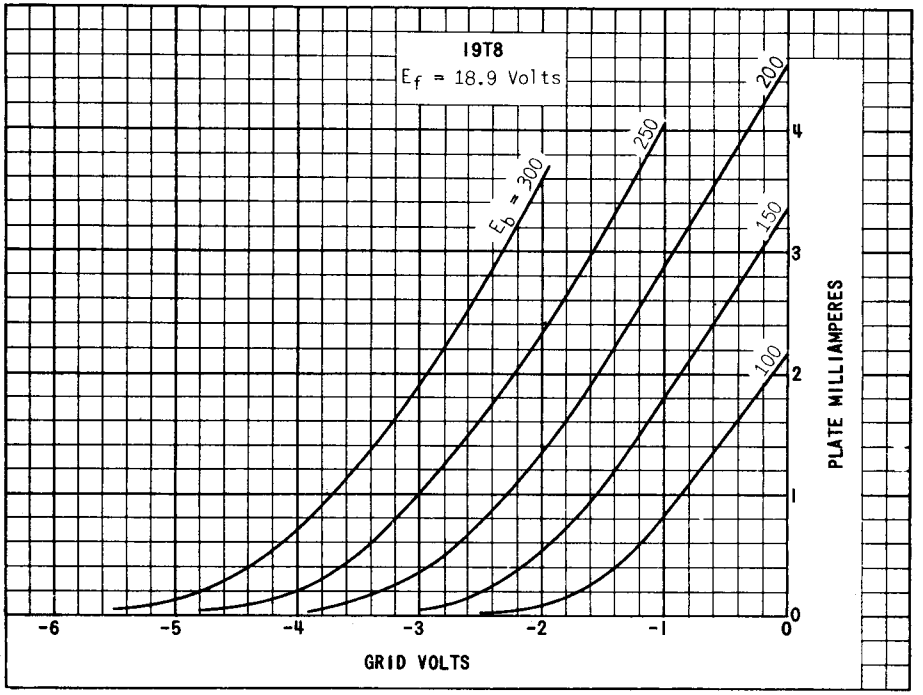


PLATE #3991 SEPTEMBER 1, 1954 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

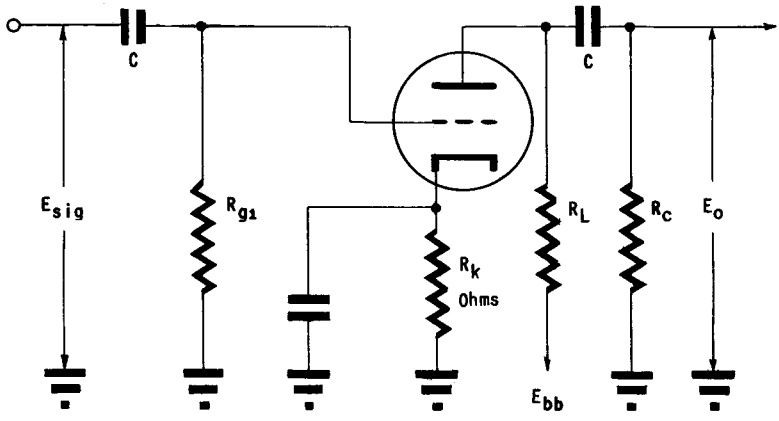
TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

R1	Rg1	Rc	Ebb = 90 VOLTS			Ebb = 180 VOLTS			Ebb = 300 VOLTS		
MEG.	MEG.	MEG.	Rk	GAIN	Eo	Rk	GAIN	Eo	Rk	GAIN	Eo
0.10	A	0.10	5700	21	7	2400	29	18	1800	33	35
0.10	A	0.24	6100	26	9	2700	34	23	2000	38	42
0.24	A	0.24	9100	30	10	4300	40	24	3000	44	43
0.24	A	0.51	10000	34	13	4700	45	31	3300	49	52
0.51	A	0.51	15000	37	14	7500	47	28	5600	51	50
0.51	A	1	16000	40	16	8200	50	35	6200	55	60
0.24	10	0.24	---	31	5.0	---	44	19	---	48	40
0.24	10	0.51	---	37	7.0	---	49	25	---	52	52
0.51	10	0.51	---	39	7.5	---	51	22	---	54	44
0.51	10	1	---	42	10	---	54	28	---	58	56

[A] VALUE OF Rg1 IS NOT CRITICAL.

*Rk TAKEN TO NEAREST RMA VALUE FOR EACH CASE INSTEAD OF ABSOLUTE OPTIMUM VALUE.
Eo IS RMS OUTPUT AT 5% TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT Eo = 2.0 VOLTS RMS OUTPUT.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

TUNG-SOL

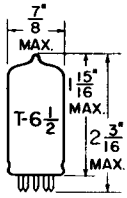
TRIPLE-DIODE TRIODE

MINIATURE TYPE

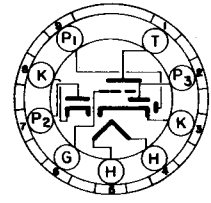
COATED UNIPOTENTIAL CATHODE

HEATER
18.9 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9AH

THE 19V8 COMPRISES TWO HIGH PERVEANCE DIODES, A MEDIUM PERVEANCE DIODE, AND A HIGH-MU TRIODE IN ONE ENVELOPE WITH THE 9 PIN MINIATURE BASE. ONE OF THE HIGH PERVEANCE DIODES HAS AN INDEPENDENT CATHODE PROVIDING SATISFACTORY OPERATION IN BALANCED LOW IMPEDANCE DETECTOR CIRCUITS. THIS TUBE STRUCTURE PERMITS THE CONSTRUCTION OF AM/FM RECEIVERS WITH A MINIMUM OF SWITCHING.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

DIODE #1 TO GRID:	(1P TO G) MAX.	0.1	μμf
DIODE #2 TO GRID:	(2P TO G) MAX.	0.2	μμf
DIODE #3 TO GRID:	(3P TO G) MAX.	0.02	μμf
DIODE #1 TO ALL:	1P TO (H+K+G+P+2P+3P)	1.3	μμf
DIODE #2 TO ALL:	2P TO (H+K+G+P+1P+3P)	5.3	μμf
DIODE #3 TO ALL:	3P TO (H+K+G+P+1P+2P)	5.3	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	18.9	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT
MAXIMUM DIODE #2, DIODE #3, CURRENT FOR CONTINUOUS OPERATION	10	MA.
MAXIMUM DIODE #1 CURRENT FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	18.9	18.9	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−3	VOLTS
PLATE RESISTANCE (APPROX.)	54 000	58 000	OHMS
TRANSCONDUCTANCE	1 300	1 200	μMHOS
AMPLIFICATION FACTOR	70	70	
PLATE CURRENT	0.8	1	MA.
AVERAGE DIODE #2 OR DIODE #3 WITH 5 VOLTS DC APPLIED	40		MA.
RATIO OF $\frac{ID3}{ID2}$ OR $\frac{ID2}{ID3}$ WITH 5 VOLTS APPLIED (MAX.)	1.5		
DIODE #2 OR DIODE #3 CURRENT THROUGH 40,000 OHMS WITH NO VOLTAGE APPLIED (MAX.)	24		μA.
AVERAGE DIODE #1 CURRENT WITH 10 VOLTS DC APPLIED	2		MA.
HEATER TO ALL CATHODES WITH ± 100 VOLTS APPLIED (MAX.)	5		μA.

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CATHODE RAY

THE 20BP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ROUND GLASS CONSTRUCTION **UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS AND DEFLECTION **EXTERNAL SINGLE FIELD ION TRAP**
17" X 12 3/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	54	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	7	μμf
GRID #1 TO ALL OTHER ELECTRODES	8	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM

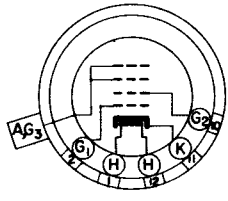
MECHANICAL DATA

OVERALL LENGTH	28 ± 3/4	INCHES
GREATEST DIAMETER OF BULB	20 ± 3/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	18 3/4	INCHES
BULB CONTACT	MEDIUM METAL CAP	C1-5
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
C1-5 CONTACT ALIGNS WITH PIN POSITION #3 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2
PIN 11 - CATHODE



BOTTOM VIEW

PIN 12 - HEATER
ANODE CAP:
GRID NO. 3

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RATINGS

DESIGN-CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:	140	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	15 000	VOLTS
DC GRID #2 VOLTAGE	250	VOLTS
DC GRID #1 VOLTAGE[A]	-27 TO -63	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	135	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #106, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 25 FOOT LAMBERTS ON A 12 3/4" x 17" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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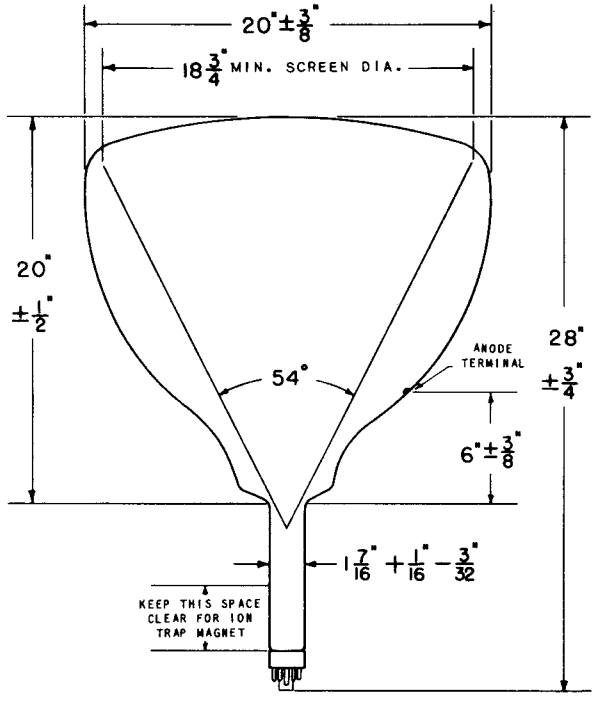

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CATHODE RAY

THE 20CP4, 20CP4A, 20CP4B, 20CP4C AND 20CP4D ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING EXCEPTIONS.

20CP4A & 20CP4D - *External conductive coating*

20CP4B & 20CP4D - *Aluminized*

20CP4C - *Faceplate has been treated with a specular reflection reducing surface.*

THEIR COMMON FEATURES INCLUDE:

GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS & DEFLECTION	**17" X 12 3/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD			MAGNETIC
DEFLECTING METHOD			MAGNETIC
DEFLECTION ANGLE (APPROX.):			
HORIZONTAL		66	DEGREES
DIAGONAL		70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):			
CATHODE TO ALL OTHER ELECTRODES		5	μμf
GRID #1 TO ALL OTHER ELECTRODES		6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	**20CP4A**	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	**20CP4D**	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	95 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 12 3/4" BY 17" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

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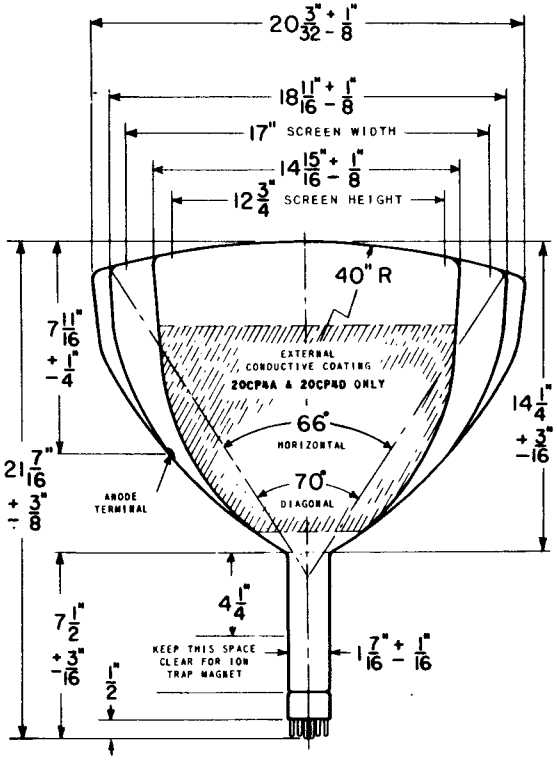
MECHANICAL DATA

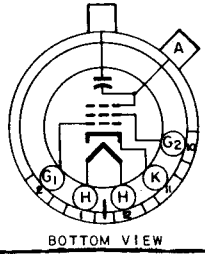
OVERALL LENGTH	21 7/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 1/8	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	18 3/4	INCHES
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING	20CP4A, 20CP4D - 12N; OTHERS	12D

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



20CP4A & 20CP4D

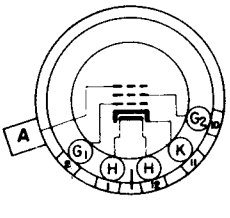


BOTTOM VIEW

PIN CONNECTIONS

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2
PIN 11 - CATHODE
PIN 12 - HEATER
ANODE CAP

20CP4, 20CP4B & 20CP4C



BOTTOM VIEW

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CATHODE RAY

THE 20DP4, 20DP4A, 20DP4B, AND 20DP4C ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING EXCEPTIONS:

20DP4A & 20DP4C - *EXTERNAL CONDUCTIVE COATINGS*
20DP4B & 20DP4C - *ALUMINIZED SCREENS*

THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **SPHERICAL FACEPLATE**
MAGNETIC FOCUS AND DEFLECTION — **GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
12 3/4" X 17" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE: (APPROX.)		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES: (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$
20DP4A AND 20DP4C		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	$\mu\mu f$
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	$\mu\mu f$

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	73	PERCENT

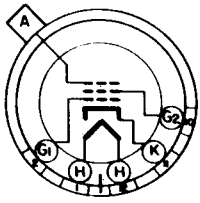
MECHANICAL DATA

OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 3/16	INCHES
WIDTH	18 11/16 ± 3/16	INCHES
HEIGHT	14 15/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING	**20DP4 AND 20DP4B**	12D
	20DP4A AND 20DP4C	12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

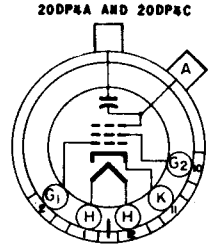
20DP4 AND 20DP4B



BOTTOM VIEW

PIN 1 - HEATER
PIN 2 - GRID NO. 1
PIN 10 - GRID NO. 2
PIN 11 - CATHODE
PIN 12 - HEATER
ANODE CAP:
GRID NO. 3

20DP4A AND 20DP4C



BOTTOM VIEW

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[A]	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	95	MA.
ION TRAP FIELD STRENGTH (APPROX.)	35	GAUSSES

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 12 3/4" BY 17" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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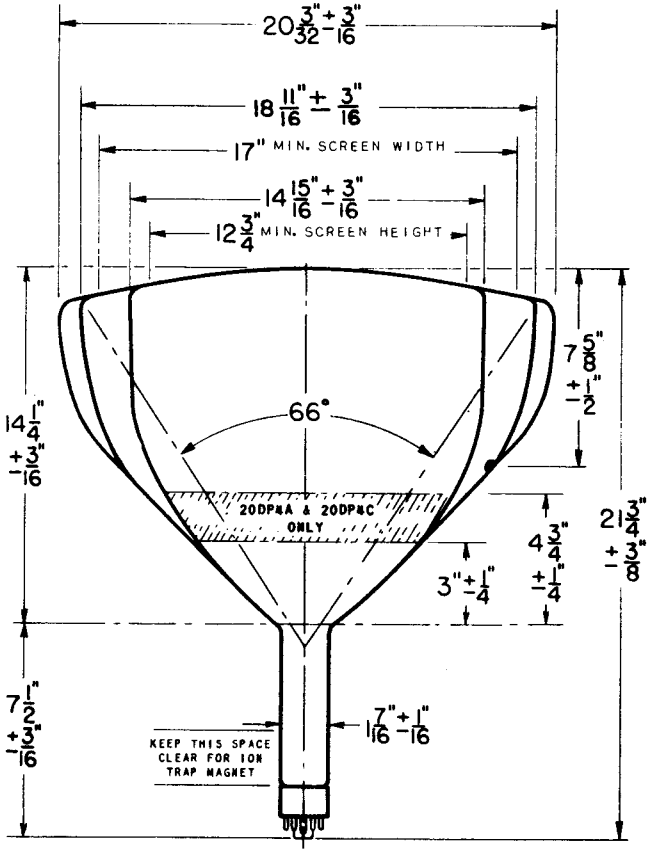

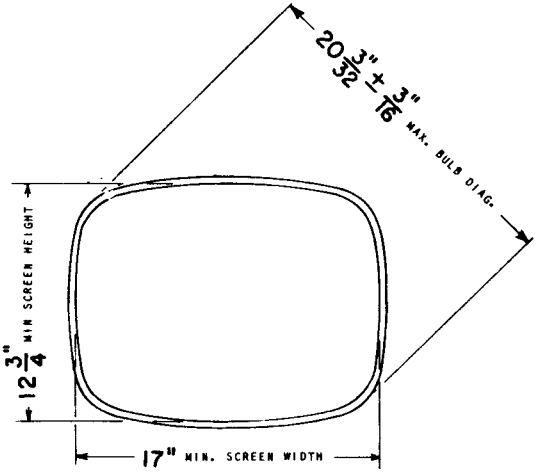

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CATHODE RAY

THE 20FP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**
GREY FILTER FACEPLATE — **UNIPOTENTIAL CATHODE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
17 1/4" X 13 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

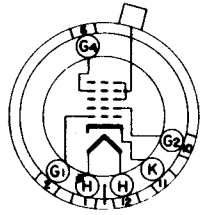
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66.	PERCENT

MECHANICAL DATA

OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 1/8	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	18 3/8	INCHES
WIDTH	17 1/4	INCHES
HEIGHT	13 1/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5
COLLECTOR

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC COLLECTOR, GRID #3, GRID #5 VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	5 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC COLLECTOR, GRID #3, GRID #5 VOLTAGE	12 000	VOLTS
DC GRID #4 VOLTAGE	2300 TO 3200	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.
DC GRID #4 CURRENT	-15 TO +25	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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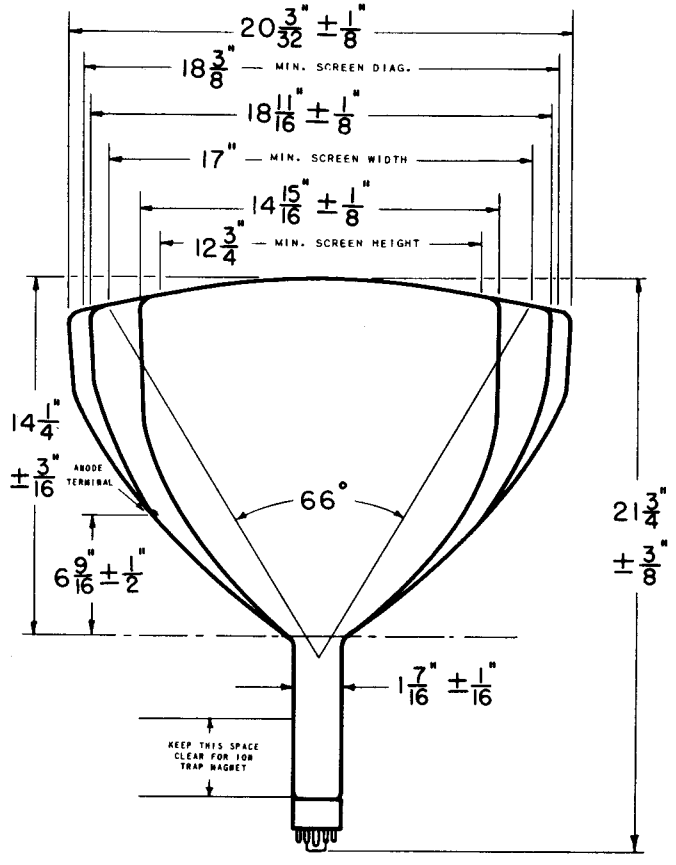

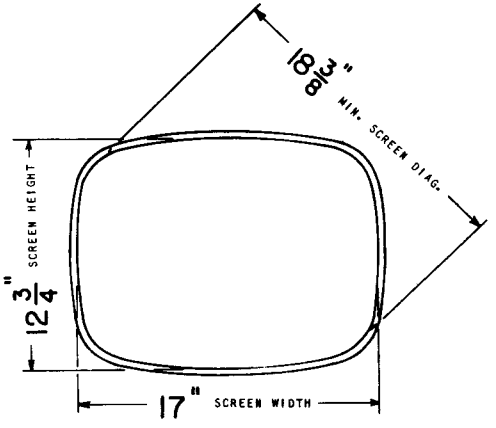

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CATHODE RAY

THE 20GP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING	**17 1/8" X 13 1/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE (MAX.)	750	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE (MIN.)	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

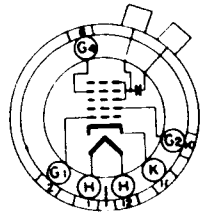
OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 3/16	INCHES
WIDTH	18 11/16 ± 3/16	INCHES
HEIGHT	14 15/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	18 5/8	INCHES
WIDTH	17 1/4	INCHES
HEIGHT	13 1/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5
COLLECTOR

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC COLLECTOR, GRID #3, GRID #5 VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	5 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

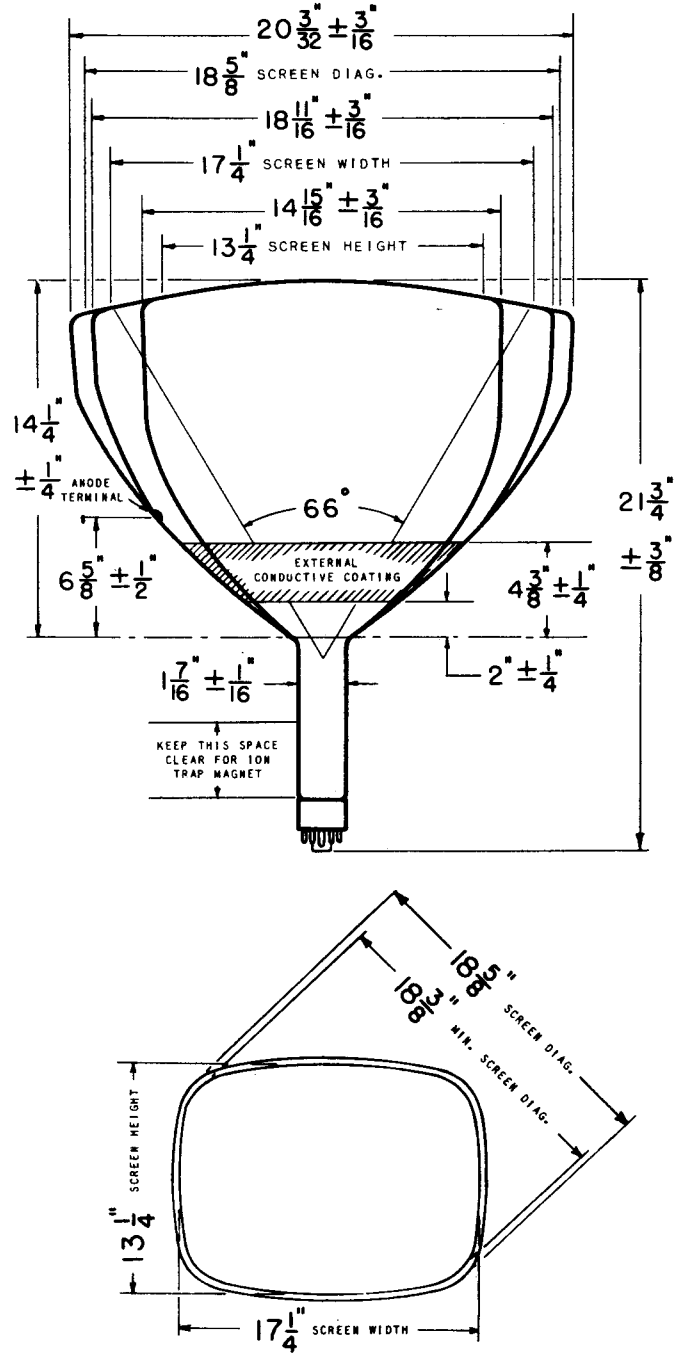
DC COLLECTOR, GRID #3, GRID #5 VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	2750 TO 3740	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75	MA.
GRID #4 CURRENT	-15 TO +25	μAMP.
GRID #2 CURRENT	-15 TO +15	μAMP.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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CATHODE RAY

THE 20HP4, 20HP4A, 20HP4B, 20HP4C, AND 20HP4D ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL WITH THE FOLLOWING EXCEPTIONS:

20HP4A & 20HP4D – *EXTERNAL CONDUCTIVE COATINGS*
20HP4C & 20HP4D – *ALUMINIZED SCREENS*
20HP4B – *FROSTED FACEPLATE*

THEIR COMMON FEATURES INCLUDE:

SPHERICAL FACEPLATE
GREY FILTER FACEPLATE
EXTERNAL SINGLE FIELD ION TRAP
LOW VOLTAGE ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION
UNIPOTENTIAL CATHODE
12 3/4" X 17" RASTER SIZE
RECTANGULAR GLASS CONSTRUCTION

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
20HP4A AND 20HP4D ONLY		
MAXIMUM EXTERNAL CONDUCTIVE COATING[A]	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING[A]	750	μμf

[A]EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

OPTICAL DATA

PHOSPHOR NUMBER		P4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	73	PERCENT

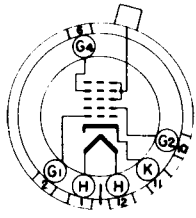
MECHANICAL DATA

OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 3/16	INCHES
WIDTH	18 11/16 ± 3/16	INCHES
HEIGHT	14 15/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING	**20HP4, 20HP4B AND 20HP4C**	12M
	20HP4A AND 20HP4D	12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

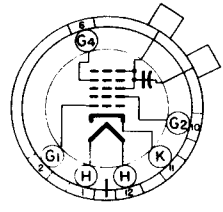
20HP4, 20HP4B & 20HP4C



BOTTOM VIEW

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

20HP4A & 20HP4D



BOTTOM VIEW

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)	−500 TO +1000	VOLTS
MAXIMUM GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE-BIAS VALUE (DC)	125	VOLTS
POSITIVE-BIAS VALUE (DC)	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[B]	14 000	VOLTS
DC GRID #4 VOLTAGE[C]	−56 TO +310	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[D]	−28 TO −72	VOLTS
ION TRAP MAGNET FIELD STRENGTH (APPROX.)	30	GAUSSES

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[C] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON A 10 3/4" X 14 1/4" PICTURE SIZE.

[D] VISUAL EXTINCTION OF FOCUSED RASTER.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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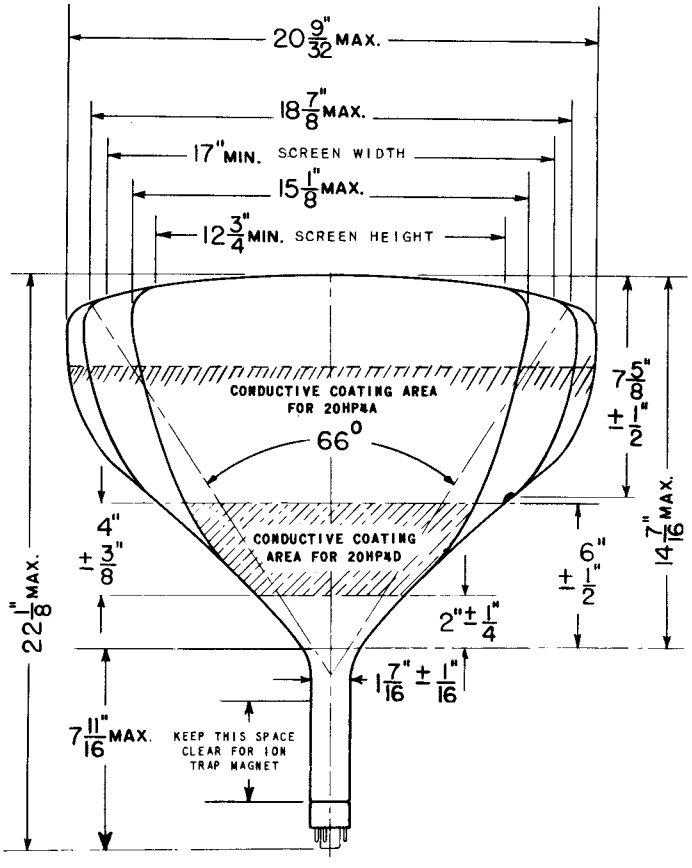

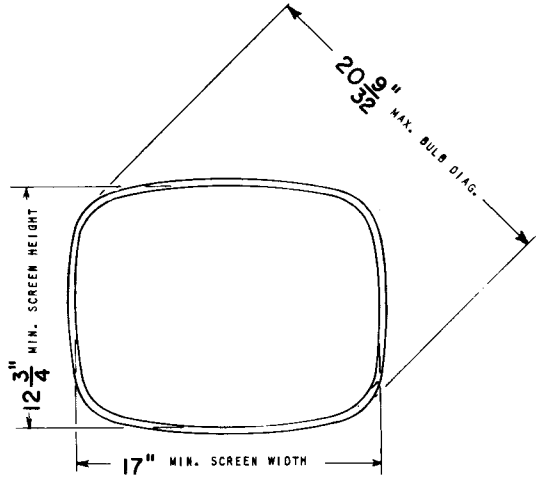

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CATHODE RAY

THE 20JP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
EXTERNAL CONDUCTIVE COATING	**17" X 12 3/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	6.0	μμf
GRID #1 TO ALL OTHER ELECTRODES	6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

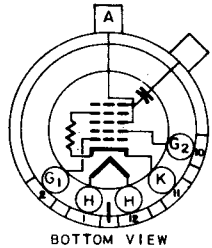
OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 1/8	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12P

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

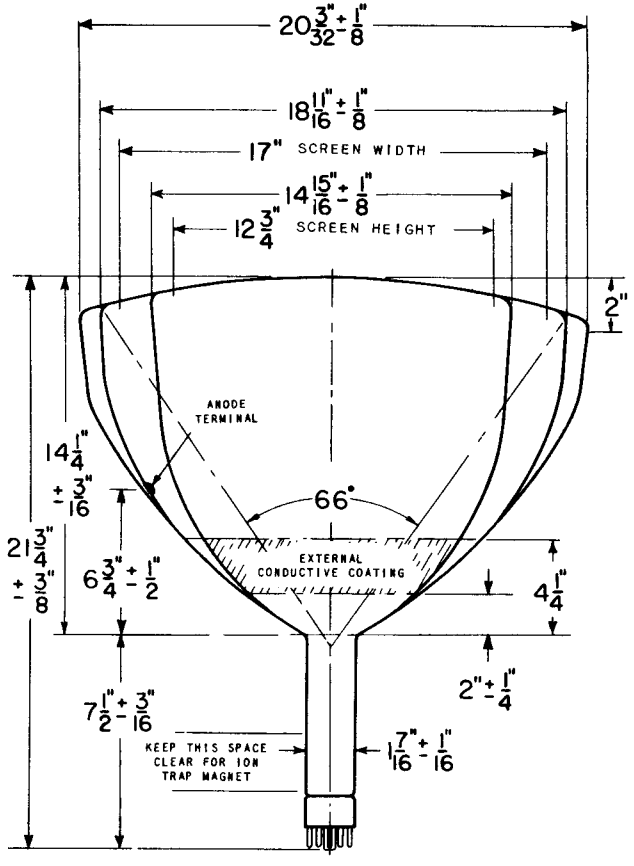
DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	50 ± 50%	MA.

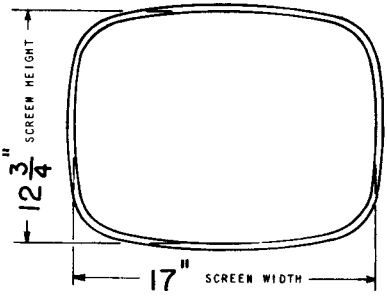
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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CATHODE RAY

THE 20LP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE	**17" X 13 1/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL CONDUCTIVE COATING**
LOW VOLTAGE ELECTROSTATIC FOCUS.	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	64 TO 72.5	PERCENT

MECHANICAL DATA

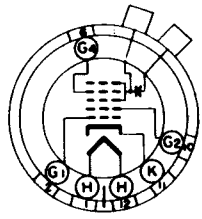
OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 1/8	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	13 1/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #2 VOLTAGE		
(WITH PROTECTIVE FACE VIEWING WINDOW)[A]	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[B]	-1000 TO +2000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	

[A] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE.

[B] THE FOCUSING ELECTRODE MAY BE MODULATED WITHIN THE MAXIMUM RANGE GIVEN WITHOUT DAMAGING THE TUBE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

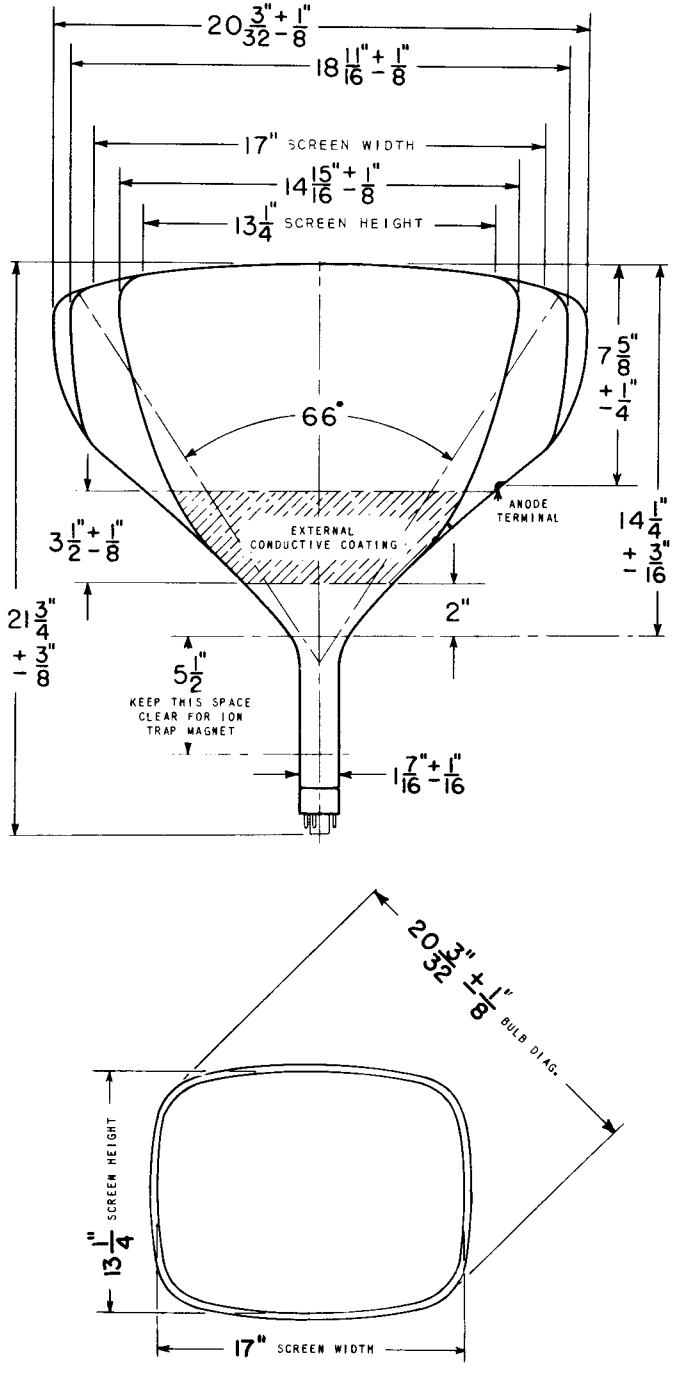
DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	0	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
ION TRAP FIELD INTENSITY (APPROX.)	35	GAUSSES

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


20 3/32" + 1/8"
18 11/16" + 1/8"
17" SCREEN WIDTH
14 15/16" + 1/8"
13 1/4" SCREEN HEIGHT
66°
7 5/8" + 1/4"
ANODE TERMINAL
EXTERNAL CONDUCTIVE COATING
3 1/2" + 1/8"
14 1/4" + 3/16"
21 3/4" + 3/8"
2"
5 1/2"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
1 7/16" + 1/16"
20 3/32" + 1/8" BULB DIAG.
13 1/4" SCREEN HEIGHT
17" SCREEN WIDTH

TUNG-SOL

CATHODE RAY

THE 20MP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION	**17 1/8" X 13 1/8" RASTER SIZE**
LOW VOLTAGE ELECTROSTATIC FOCUS	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

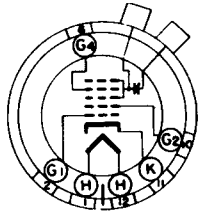
OVERALL LENGTH	21 3/4 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/32 ± 3/16	INCHES
WIDTH	18 11/16 ± 3/16	INCHES
HEIGHT	14 15/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	18 5/8	INCHES
WIDTH	17 1/4	INCHES
HEIGHT	13 1/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5
COLLECTOR

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)[A]	-55 TO +300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
ION TRAP MAGNET (RATED STRENGTH)	45	GAUSSES

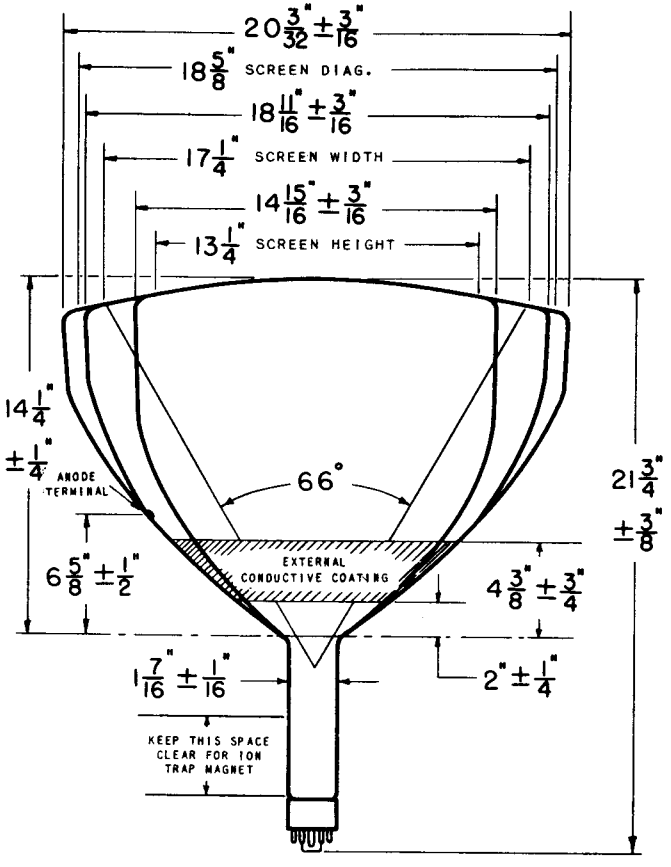
[A] FOR ANODE CURRENT OF 100 UAMP.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



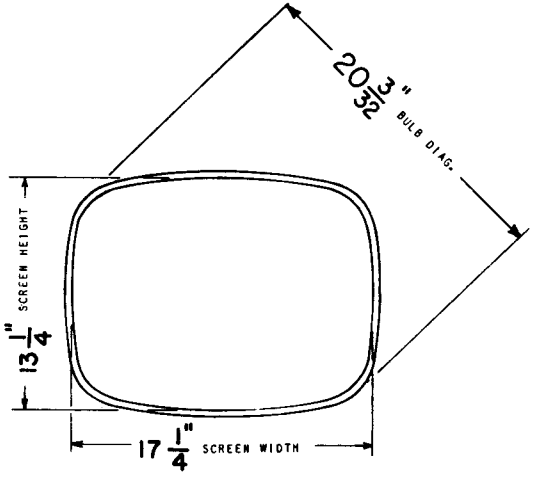


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PLATE 554-3

TUNG-SOL

CATHODE RAY

THE 21ACP4 AND 21ACP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 21ACP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	SPHERICAL FACEPLATE
EXTERNAL CONDUCTIVE COATING	GREY FILTER FACEPLATE
MAGNETIC FOCUS AND DEFLECTION	EXTERNAL SINGLE FIELD ION TRAP
RECTANGULAR GLASS CONSTRUCTION	14 7/8" X 18 15/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.)	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS[B]

DC ANODE, GRID #3 VOLTAGE[C]	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[D]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[E]	117	MA.
ION TRAP FIELD INTENSITY (APPROX.)	40	GAUSSES

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

[B] IF THIS TUBE IS OPERATED IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER FROM PROLONGED EXPOSURE.

[C] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE, IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[D] VISUAL EXTINCTION OF FOCUSED RASTER.

[E] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 14 7/8" BY 18 15/16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.75 INCHES.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

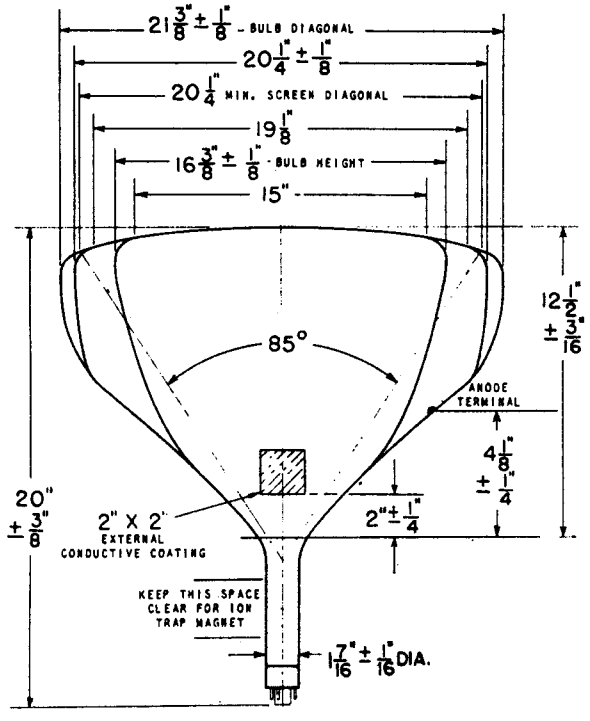
CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

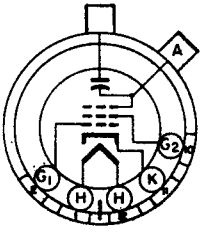
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

→INDICATES A CHANGE.

TUNG-SOL

CATHODE RAY

THE 21ALP4, 21ALP4A, AND 21ALP4B ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 21ALP4A AND 21ALP4B HAVE METAL-BACKED SCREENS. THE 21ALP4B ALSO HAS AN INCREASED ANODE VOLTAGE. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**MAGNETIC DEFLECTION**
15" X 19 1/8" RASTER SIZE	**EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**
SPHERICAL GREY FILTER FACEPLATE	**LOW VOLTAGE ELECTROSTATIC FOCUS**

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	750	$\mu\mu$f
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	500	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	75	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

		21ALP4B ONLY	
HEATER VOLTAGE		6.3	VOLTS
HEATER CURRENT		0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5, VOLTAGE[B]	20 000	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[C]	-500 TO +1000		VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500		VOLTS
MAXIMUM GRID #1 VOLTAGE:			
DC NEGATIVE-BIAS VALUE	125		VOLTS
DC POSITIVE-BIAS VALUE	0		VOLTS
POSITIVE-PEAK VALUE	2		VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410		VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180		VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5		MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE[B]	14 000	VOLTS
DC GRID #4 VOLTAGE[D]	-55 TO +300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[E]	-28 TO -72	VOLTS
DC ION TRAP MAGNET (RATED STRENGTH)	40	GAUSSES

[A] EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS

[C] THIS VALUE APPLIES WHERE AN AC VOLTAGE IS PROVIDED FOR DYNAMIC FOCUSING.

[D] WITH ANODE CURRENT OF 100 μAMP.

[E] VISUAL EXTINCTION OF FOCUSED RASTER.

INASMUCH AS THE TUBE RATING PERMITS OPERATION AT VOLTAGES AS HIGH AS 19.8 KILOVOLTS (ABSOLUTE VALUE), SHIELDING OF THE TUBE FOR X-RAY RADIATION MAY BE NEEDED WHEREVER THE OPERATING CONDITIONS INVOLVE VOLTAGE IN EXCESS OF 16 KILOVOLTS.

CONTINUED ON FOLLOWING PAGE

*INDICATES AN ADDITION.

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PLATE 994-3

TUNG-SOL

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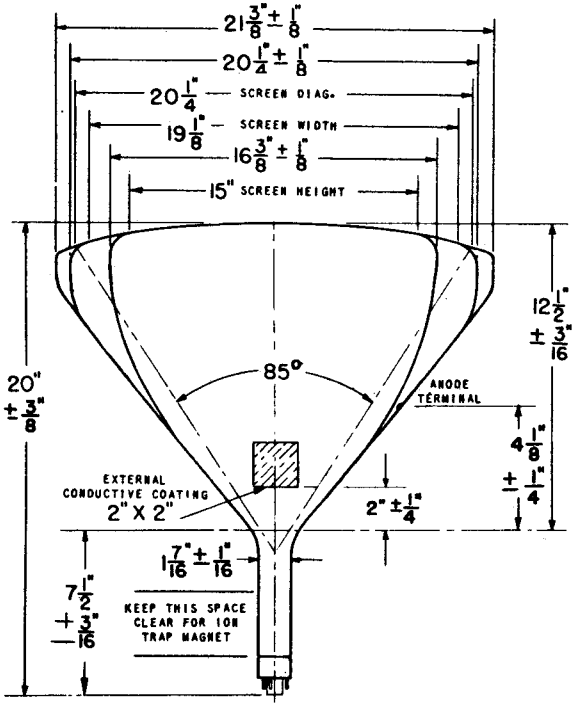
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES.
HEIGHT	16 3/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

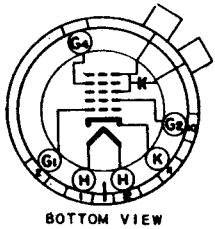
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5
COLLECTOR

THE SOCKET SHOULD NOT BE MOUNTED RIGIDLY BUT IT SHOULD BE ALLOWED TO MOVE FREELY AND IT SHOULD HAVE FLEXIBLE LEADS.

→ INDICATES A CHANGE.

TUNG-SOL

CATHODE RAY

THE 21AMP4 AND 21AMP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE METAL-BACKED SCREEN ON THE 21AMP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **MAGNETIC FOCUS AND DEFLECTION**
SPHERICAL GREY FILTER FACEPLATE — **EXTERNAL SINGLE FIELD ION TRAP**
15" X 19 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX..):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	75	PERCENT

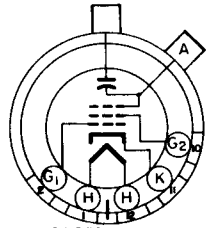
MECHANICAL DATA

OVERALL LENGTH	20 7/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 3/16	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	16 3/8 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH VACANT PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
COLLECTOR

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, COLLECTOR VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, COLLECTOR VOLTAGE[A]	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[C]	102 ± 20%	MA.
DC ION TRAP MAGNET FIELD INTENSITY (APPROX.) STANDARD COIL #111	95 ± 50%	MA.
ION TRAP MAGNET (RATED STRENGTH)	45	GAUSSES

CIRCUIT VALUES

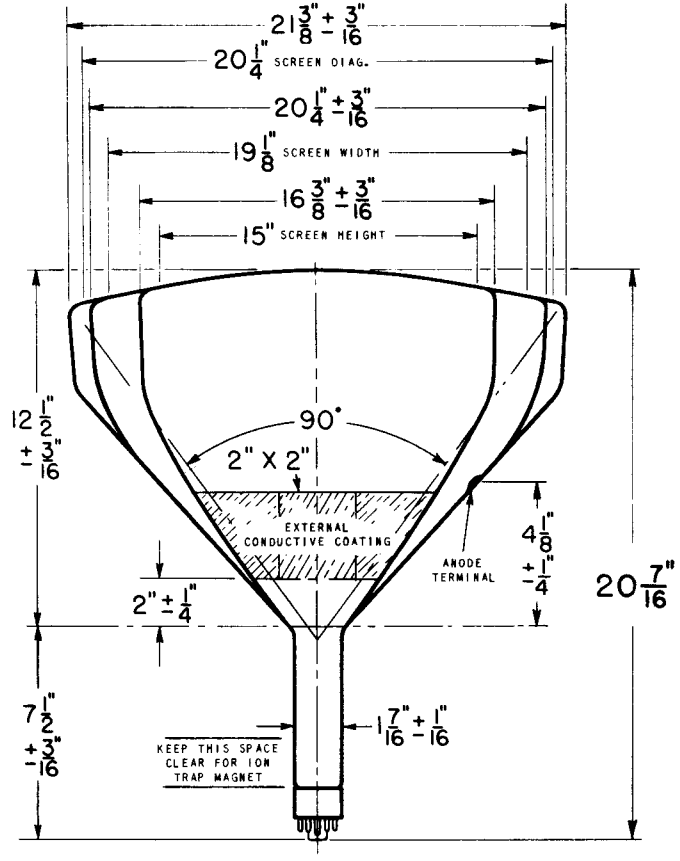
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	VOLTS

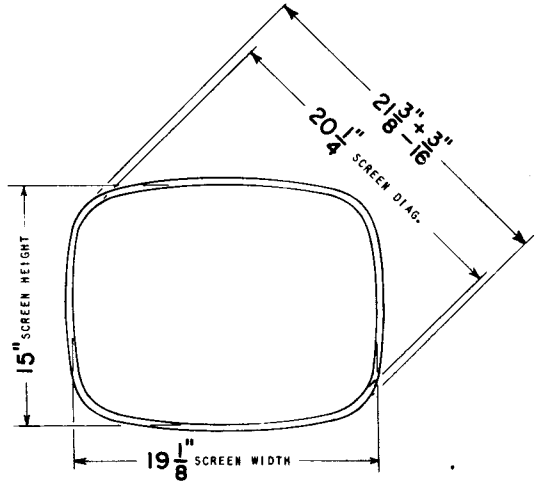
[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 15" BY 19 1/8" PICTURE. SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

TUNG-SOL


21 3/8" + 3/16 - 3/16
20 1/4" SCREEN DIAG.
20 1/4" + 3/16 - 3/16
19 1/8" SCREEN WIDTH
16 3/8" + 3/16 - 3/16
15" SCREEN HEIGHT
12 1/2" + 3/16 - 3/16
90°
2" X 2"
EXTERNAL CONDUCTIVE COATING
ANODE TERMINAL
4 1/8" + 1/4 - 1/4
20 7/16"
2" ± 1/4
7 1/2" + 3/16 - 3/16
1 7/16" + 1/16 - 1/16
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET


21 3/8" + 3/16 - 3/16
20 1/4" SCREEN DIAG.
15" SCREEN HEIGHT
19 1/8" SCREEN WIDTH

TUNG-SOL

CATHODE RAY

THE 21ANP4 AND 21ANP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 21ANP4A HAS A METAL BACKED SCREEN. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **MAGNETIC DEFLECTION**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
SPHERICAL GREY FILTER FACEPLATE — **LOW VOLTAGE ELECTROSTATIC FOCUS**
15" X 19 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$

OPTICAL DATA

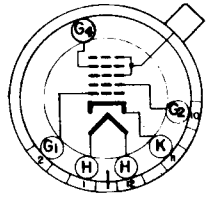
PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	75	PERCENT

MECHANICAL DATA

OVERALL LENGTH	20 7/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 3/16	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	16 3/8 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

PIN CONNECTIONS

PIN #1 – HEATER
PIN #2 – GRID NO. 1
PIN #6 – GRID NO. 4
PIN #10 – GRID NO. 2



BOTTOM VIEW

PIN #11 – CATHODE
PIN #12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

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TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RRSPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE[B]	-55 TO +300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-28 TO -72	VOLTS
ION TRAP MAGNET (RATED STRENGTH)	40	GAUSSES

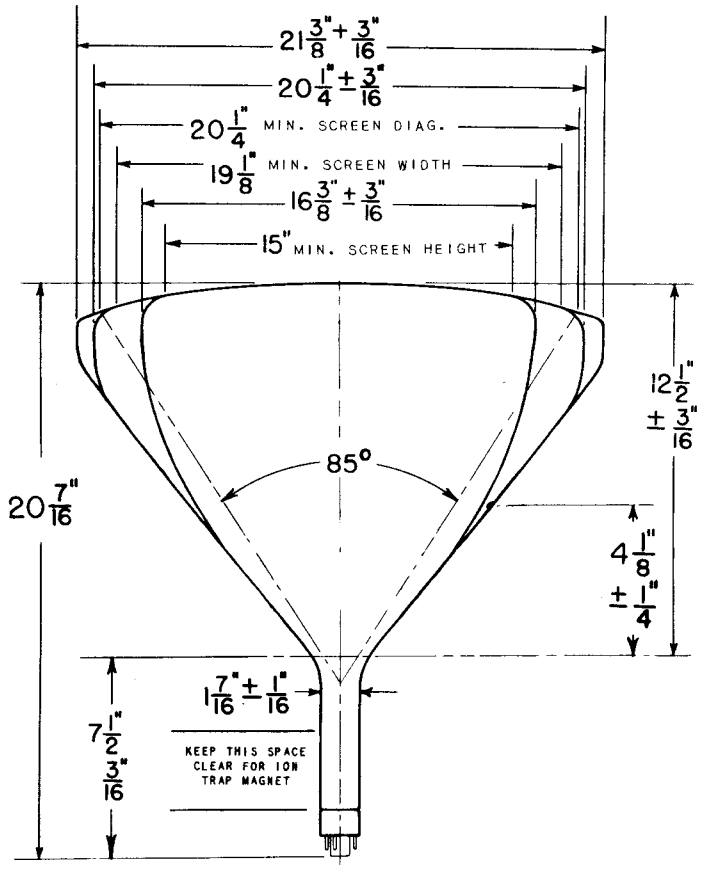
[B] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON A 15" X 19 1/8" PICTURE SIZE.

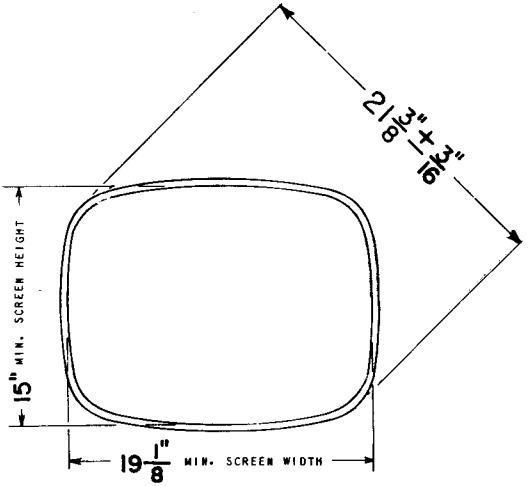
[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL

CATHODE RAY

THE 21AP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
RECTANGULAR METAL CONSTRUCTION
EXTERNAL SINGLE FIELD ION TRAP
MAGNETIC FOCUS & DEFLECTION
FROSTED FILTERGLASS FACEPLATE
18 3/8" X 13 15/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

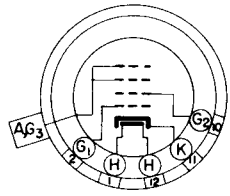
MECHANICAL DATA

OVERALL LENGTH	22 5/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/4 ± 1/4	INCHES
WIDTH	19 23/32 ± 1/8	INCHES
HEIGHT	15 5/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	18 3/8	INCHES
HEIGHT	13 15/16	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
METAL SHELL LIP CONTACT ALIGNS WITH PIN POSITION #6 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	104 ± 6%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	90	MA.

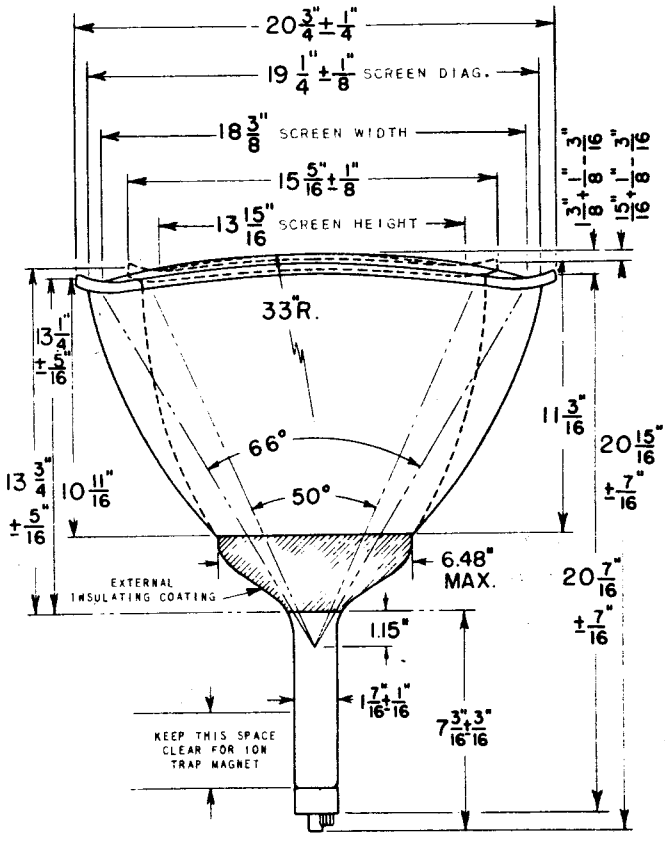
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

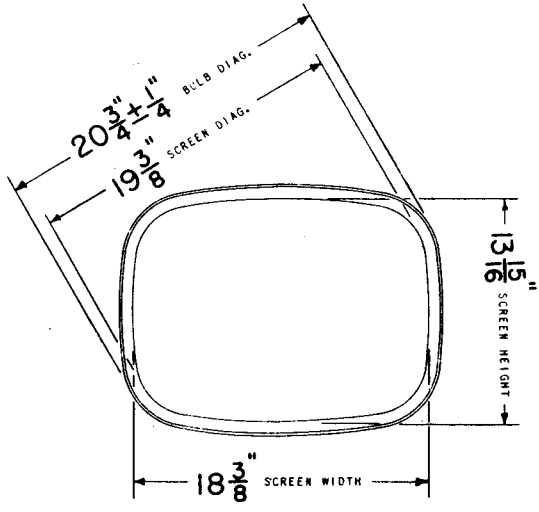
[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 18 3/8" BY 13 15/16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


20 3/4" ± 1/4"
19 1/4" ± 1/8" SCREEN DIAG.
18 3/8" SCREEN WIDTH
15 5/16" ± 1/8"
13 15/16" SCREEN HEIGHT
3/16" - 1/8" = 3/16"
3/16" + 1/8" = 5/16"
33"R.
13 1/4" ± 5/16"
66°
50°
11 3/16"
20 15/16" ± 7/16"
13 3/4" ± 5/16"
10 11/16"
6.48" MAX.
EXTERNAL INSULATING COATING
20 7/16" ± 7/16"
1.15"
1 7/16" ± 1/16"
7 3/16" ± 3/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET


20 3/4" ± 1/4" BULB DIAG.
19 3/8" SCREEN DIAG.
13 5/16" SCREEN HEIGHT
18 3/8" SCREEN WIDTH

TUNG-SOL

CATHODE RAY

THE 21AQP4 AND 21AQP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE METAL-BACKED SCREEN ON THE 21AQP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
RECTANGULAR GLASS CONSTRUCTION
SPHERICAL GREY FILTER FACEPLATE
15" X 19 1/8" RASTER SIZE
MAGNETIC FOCUS AND DEFLECTION
EXTERNAL SINGLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$

OPTICAL DATA

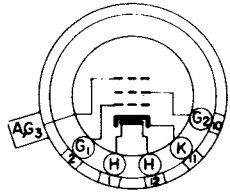
PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	75	PERCENT

MECHANICAL DATA

OVERALL LENGTH	20 7/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 3/16	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	16 3/8 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D
BULB CONTACT ALIGNMENT		
J1-21 CONTACT ALIGNS WITH VACANT PIN POSITION #6 ± 30 DEGREES		

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE[AB]	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[AB]	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	−28 TO −72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[D]	102 ± 20%	MA.
DC ION TRAP MAGNET FIELD INTENSITY (APPROX.) STANDARD COIL #111	95 ± 50%	MA.
ION TRAP MAGNET (RATED STRENGTH)	45	GAUSSES

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

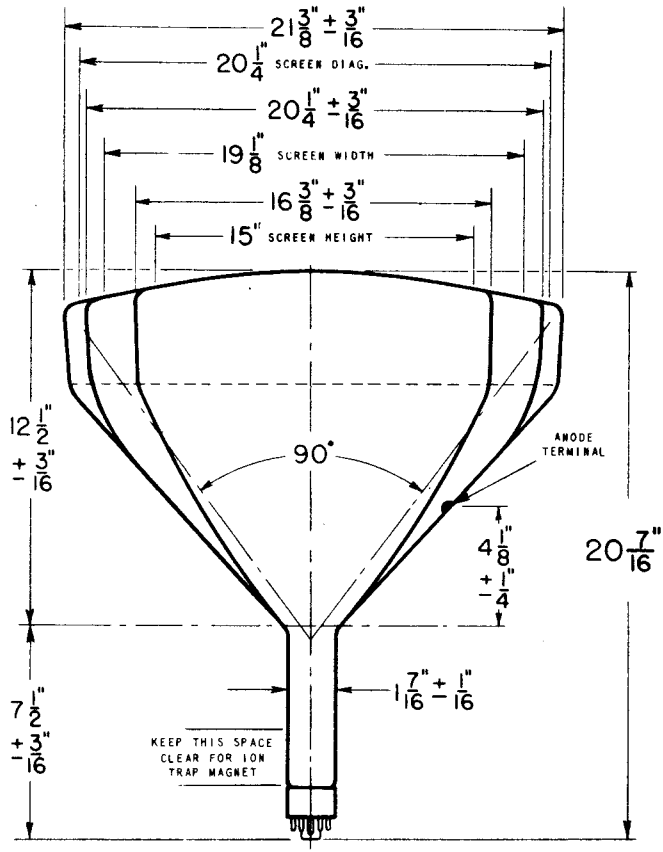
[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS

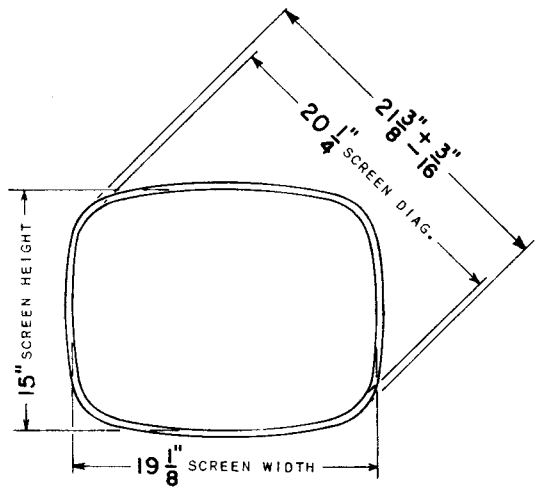
[B] INASMUCH AS THE TUBE RATING PERMITS OPERATION AT VOLTAGES AS HIGH AS 19.8 KILOVOLTS (ABSOLUTE VALUE), SHIELDING OF THE TUBE FOR X-RAY RADIATION MAY BE NEEDED WHEREVER THE OPERATING CONDITIONS INVOLVE VOLTAGES IN EXCESS OF 16 KILOVOLTS.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 15" BY 19 1/8" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

TUNG-SOL


21 3/8" ± 3/16"
20 1/4" SCREEN DIAG.
20 1/4" ± 3/16"
19 1/8" SCREEN WIDTH
16 3/8" ± 3/16"
15" SCREEN HEIGHT
12 1/2" ± 3/16"
90°
ANODE TERMINAL
4 1/8" + 1" − 1/4"
20 7/16"
7 1/2" ± 3/16"
1 7/16" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET


21 3/8" + 3/16" − 1/16"
20 1/4" SCREEN DIAG.
15" SCREEN HEIGHT
19 1/8" SCREEN WIDTH

TUNG-SOL

CATHODE RAY

THE 21ASP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. IT IS IDENTICAL TO THE 21XP4 IN ALL RESPECTS *EXCEPT* THAT THE EXTERNAL CONDUCTIVE COATING IS NOT APPLIED. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION	**SPHERICAL FACEPLATE**
ELECTROSTATIC FOCUS	**GREY FILTER FACEPLATE**
UNIPOTENTIAL CATHODE	**12 3/4" X 17" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	72	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE[A]	-64 TO +352	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC ION TRAP MAGNET STANDARD COIL #117 (APPROX.)	30 ±40%	MA.
DC ION TRAP MAGNET RATED STRENGTH	35	GAUSSES

[A] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON 17" BY 12 3/4" PICTURE SIZE.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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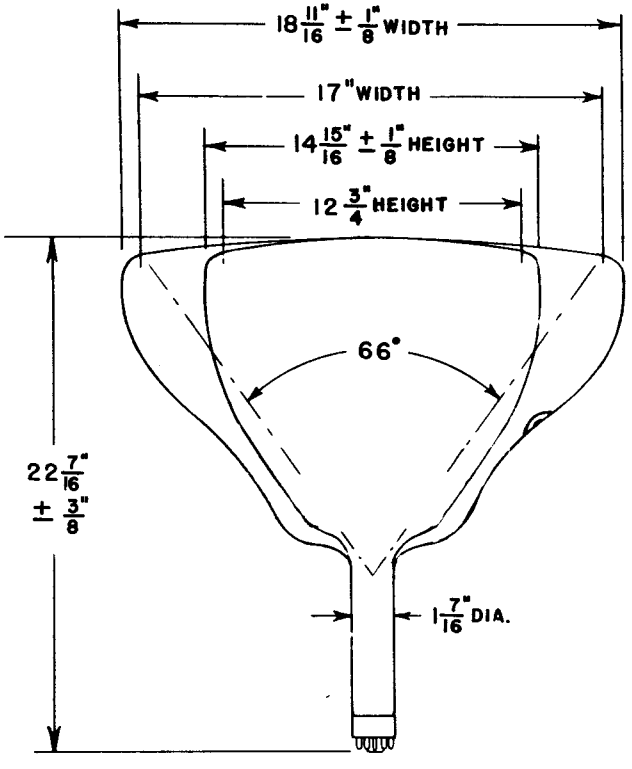
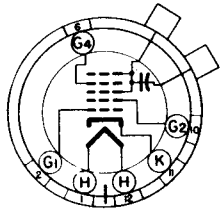
MECHANICAL DATA

OVERALL LENGTH	22 7/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 5/8 ± 3/16	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BULB CONTACT ALIGNMENT		
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES		
BASING		12L



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO.3
GRID NO.5

TUNG-SOL

CATHODE RAY

THE 21ATP4, 21ATP4A AND 21ATP4B ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL EXCEPT FOR THE NON ALUMINIZED SCREEN ON THE 21ATP4B. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION	**ALUMINIZED SCREEN**
UNIPOTENTIAL CATHODE	**SPHERICAL FACEPLATE**
GREY FILTER FACEPLATE	**19 1/8" X 15" RASTER SIZE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**LOW VOLTAGE ELECTROSTATIC FOCUS**

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	1 500	$\mu\mu f$
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	1 200	$\mu\mu f$

[A] EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

OPTICAL DATA

PHOSPHOR NUMBER	ALUMINIZED	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	71	PERCENT

RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE *	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

* VALUE FOR 21ATP4A 20,000 VOLTS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE[B]	16 000	VOLTS
DC GRID #4 VOLTAGE[C]	-64 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[D]	-28 TO -72	VOLTS
ION TRAP MAGNET FIELD STRENGTH (APPROX.)	35	GAUSSES

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[C] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON A 19 1/8" X 15" PICTURE SIZE.

[D] VISUAL EXTINCTION OF FOCUSED RASTER.

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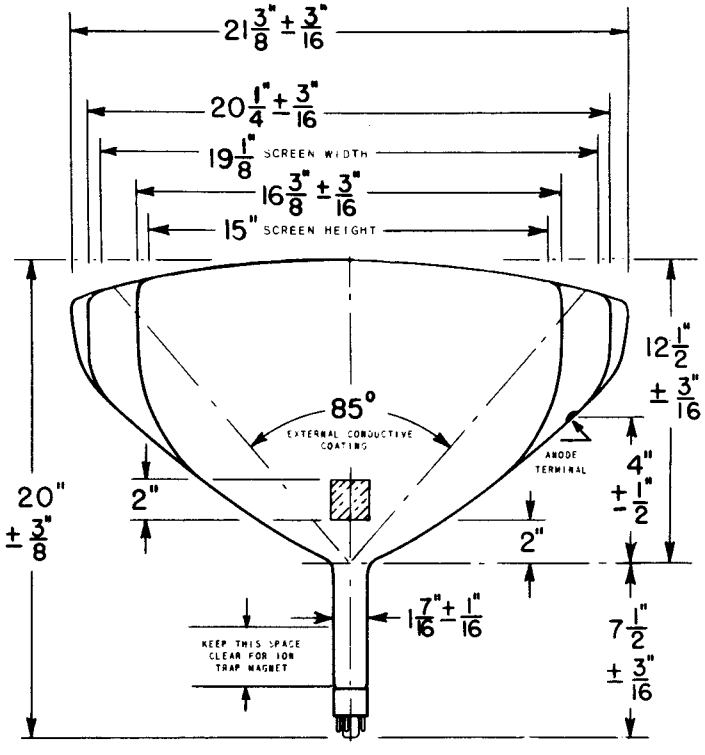
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 3/16	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	16 3/8 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

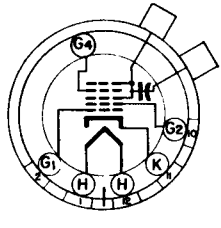
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21AUP4, 21AUP4A, AND 21AUP4B ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE METAL BACKED SCREENS ON THE 21AUP4A AND 21AUP4B. THE 21AUP4B ALSO HAS AN INCREASED ANODE VOLTAGE. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION	SPHERICAL FACEPLATE
UNIPOTENTIAL CATHODE	GREY FILTER FACEPLATE
RECTANGULAR GLASS CONSTRUCTION	EXTERNAL CONDUCTIVE COATING
LOW VOLTAGE ELECTROSTATIC FOCUS	EXTERNAL SINGLE FIELD ION TRAP

15" X 19 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	67	DEGREES
VERTICAL	53	DEGREES
DIAGONAL	72	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	$\mu\mu f$
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	$\mu\mu f$

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.)	71	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE		6.3	VOLTS
HEATER CURRENT		0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE[A]	21AUP4B ONLY 20 000	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE:			
POSITIVE		1 000	VOLTS
NEGATIVE		500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE		500	VOLTS
MAXIMUM GRID #1 VOLTAGE:			
DC NEGATIVE-BIAS VALUE		125	VOLTS
DC POSITIVE-BIAS VALUE		0	VOLTS
POSITIVE-PEAK VALUE		2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS		410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD		180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE[A]		18 000	VOLTS
DC GRID #4 VOLTAGE[B]	−72	TO 396	VOLTS
DC GRID #2 VOLTAGE		300	VOLTS
DC GRID #1 VOLTAGE[C]	−28	TO −72	VOLTS
DC ION TRAP MAGNET (RATED STRENGTH)[D]		46	GAUSSES

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NO BE LESS THAN 14,000 VOLTS.

[B] FOR FOCUS WITH ANODE CURRENT OF 100 μAMPS.

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

[D] THE NON-UNIFORM MAGNETIC FIELD INHERENT IN THE DESIGN OF SOME EXTERNAL ION-TRAP MAGNETS USUALLY REQUIRES FOR OPTIMUM ADJUSTMENT THAT THE MAGNET SLUG BE LOCATED ON THE SAME SIDE OF THE TUBE NECK AS PIN 6.

INASMUCH AS THE TUBE RATING PERMITS OPERATION AT VOLTAGES AS HIGH AS 19.8 KILOVOLTS (ABSOLUTE VALUE), SHIELDING OF THE TUBE FOR X-RAY RADIATION MAY BE NEEDED WHEREVER THE OPERATING CONDITIONS INVOLVE VOLTAGE IN EXCESS OF 16 KILOVOLTS.

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TUNG-SOL

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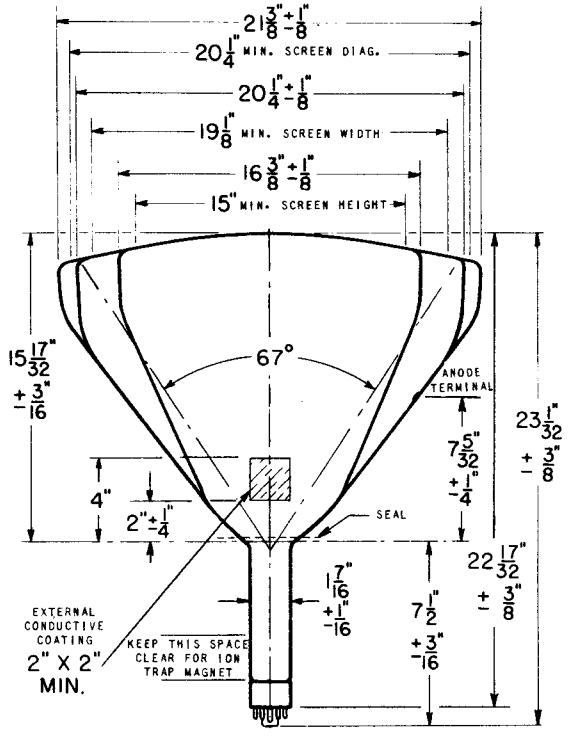
MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 1/2	INCHES
WIDTH	20 3/8	INCHES
HEIGHT	16 1/2	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

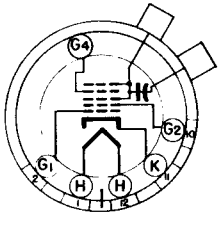
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID #3
GRID #5
COLLECTOR

SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY.

TUNG-SOL

CATHODE RAY

THE 21AVP4, 21AVP4A, AND 21AVP4B ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE METAL BACKED SCREENS ON THE 21AVP4A AND 21AVP4B. THE 21AVP4B ALSO HAS AN INCREASED ANODE VOLTAGE. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION — **SPHERICAL FACEPLATE**
UNIPOTENTIAL CATHODE — **GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL CONDUCTIVE COATING**
LOW VOLTAGE ELECTROSTATIC FOCUS — **EXTERNAL SINGLE FIELD ION TRAP**
15" X 19 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	67	DEGREES
VERTICAL	53	DEGREES
DIAGONAL	72	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	$\mu\mu$f
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.)	71	PERCENT

RATINGS

DESIGN CENTER VALUES

		21AVP4B ONLY	
HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.6		AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE[A]	20 000	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE:			
POSITIVE	1 000		VOLTS
NEGATIVE	500		VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500		VOLTS
MAXIMUM GRID #1 VOLTAGE:			
DC NEGATIVE-BIAS VALUE	125		VOLTS
DC POSITIVE-BIAS VALUE	0		VOLTS
POSITIVE-PEAK VALUE	2		VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410		VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180		VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5		MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE[A]	18 000	VOLTS
DC GRID #4 VOLTAGE[B]	-72 TO 396	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-28 TO -72	VOLTS
DC ION TRAP MAGNET (RATED STRENGTH)[D]	46	GAUSSES

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NO BE LESS THAN 14,000 VOLTS.

[B] FOR FOCUS WITH ANODE CURRENT OF 100 μAMPS.

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

[D] THE NON-UNIFORM MAGNETIC FIELD INHERENT IN THE DESIGN OF SOME EXTERNAL ION-TRAP MAGNETS USUALLY REQUIRES FOR OPTIMUM ADJUSTMENT THAT THE MAGNET SLUG BE LOCATED ON THE SAME SIDE OF THE TUBE NECK AS PIN 6.

INASMUCH AS THE TUBE RATING PERMITS OPERATION AT VOLTAGES AS HIGH AS 19.8 KILOVOLTS (ABSOLUTE VALUE), SHIELDING OF THE TUBE FOR X-RAY RADIATION MAY BE NEEDED WHEREVER THE OPERATING CONDITIONS INVOLVE VOLTAGE IN EXCESS OF 16 KILOVOLTS.

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TUNG-SOL

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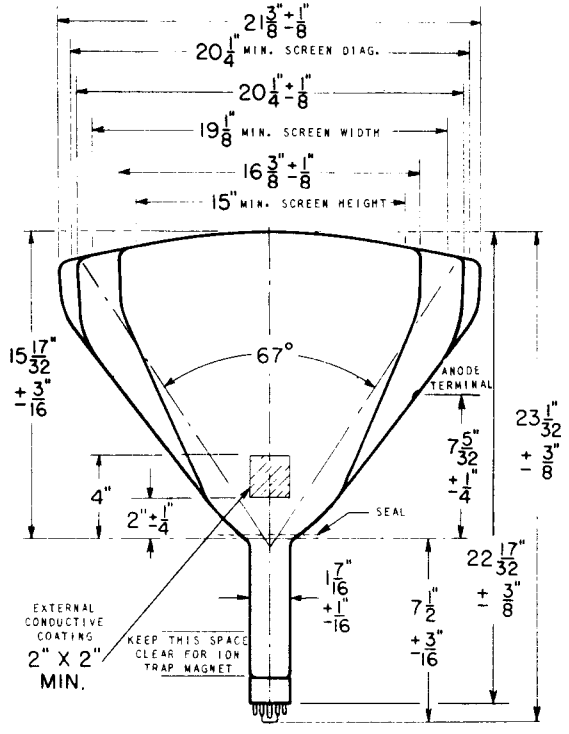
MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 1/2	INCHES
WIDTH	20 3/8	INCHES
HEIGHT	16 1/2	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

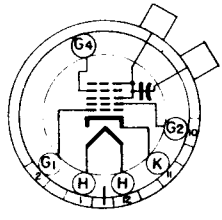
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



PIN 12 – HEATER
ANODE CAP:
GRID #3
GRID #5
COLLECTOR

BOTTOM VIEW

SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY.

TUNG-SOL

CATHODE RAY

THE 21AWP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ALUMINIZED SCREEN**
GREY FILTER FACEPLATE — **SPHERICAL FACEPLATE**
MAGNETIC FOCUS AND DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
19 1/8" X 15" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	67	DEGREES
VERTICAL	53	DEGREES
DIAGONAL	72	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE (MAX.)[A]	1 500	μμf
EXTERNAL CONDUCTIVE COATING TO ANODE (MIN.)[A]	1 200	μμf

OPTICAL DATA

PHOSPHOR NUMBER	ALUMINIZED	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	71	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[C]	108 ± 20%	MA.
ION TRAP MAGNET STRENGTH (APPROX.)	35	GAUSSES

[A] EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 19 1/8" BY 15". PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3 INCHES.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

TUNG-SOL

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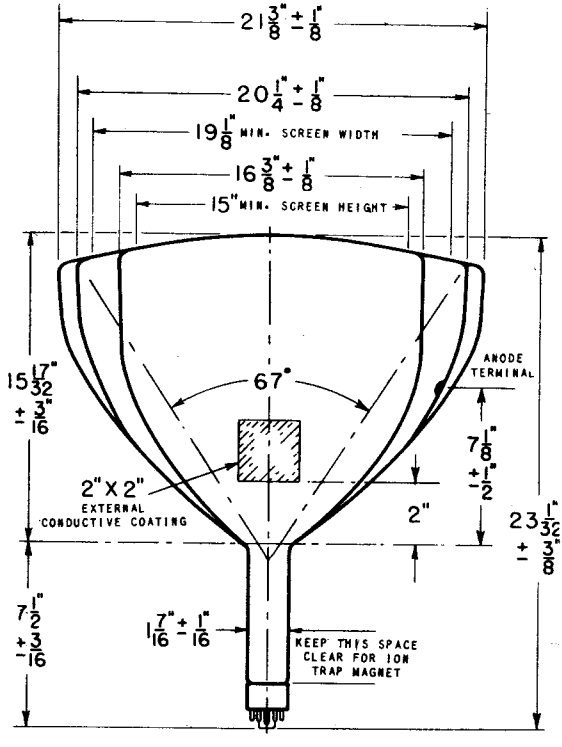
MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP.	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

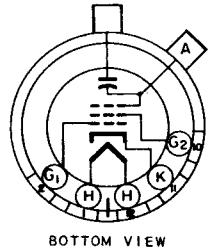
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID #3

→ INDICATES A CHANGE.

TUNG-SOL

CATHODE RAY

THE 21AYP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. *EXCEPT* FOR INCREASED EXTERNAL CONDUCTIVE COATING TO ANODE CAPACITANCE VALUES, IT IS IDENTICAL TO THE 21XP4. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION — **SPHERICAL FACEPLATE**
ELECTROSTATIC FOCUS — **GREY FILTER FACEPLATE**
UNIPOTENTIAL CATHODE — **12 3/4" X 17" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
EXTERNAL CONDUCTIVE COATING

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	77	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	72	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE[A]	−64 TO +352	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−28 TO −72	VOLTS
DC ION TRAP MAGNET STANDARD COIL #117 (APPROX.)	30 ±40%	MA.
DC ION TRAP MAGNET RATED STRENGTH	35	GAUSSES

[A] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON 17" BY 12 3/4" PICTURE SIZE.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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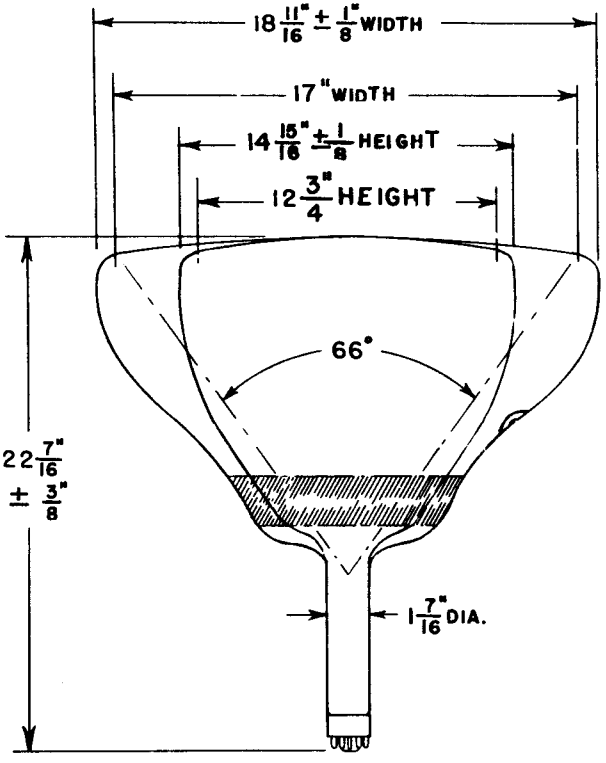
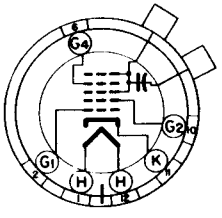
MECHANICAL DATA

OVERALL LENGTH	22 7/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 5/8 ± 3/16	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BULB CONTACT ALIGNMENT		
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES		
BASING		12L



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO.3
GRID NO.5

TUNG-SOL

CATHODE RAY

THE 21BAP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **ALUMINIZED SCREEN**
MAGNETIC DEFLECTION — **GRAY FILTER FACEPLATE**
UNIPOTENTIAL CATHODE — **19 1/8" X 15" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL CONDUCTIVE COATING**
DOES NOT REQUIRE ION TRAP MAGNET

ELECTRICAL DATA

FOCUSING METHOD	ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ± 10%	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE*	16 000	VOLTS
DC GRID #4 VOLTAGE	0 TO 500	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC GRID #4 CURRENT	-15 TO +25	μAMP

*BRIGHTNESS AND FOCUS QUALITY DDCREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[A]VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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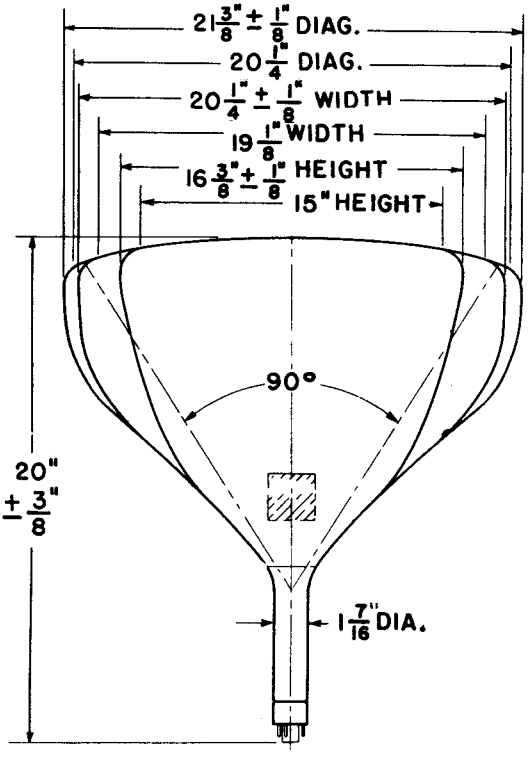
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

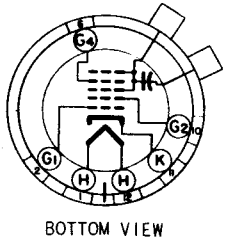
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE

PIN CONNECTIONS



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21BCP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	ALUMINIZED SCREEN
MAGNETIC DEFLECTION	GRAY FILTER FACEPLATE
UNIPOTENTIAL CATHODE	EXTERNAL CONDUCTIVE COATING
RECTANGULAR GLASS CONSTRUCTION	19 1/8" X 14 3/16" RASTER SIZE

DOES NOT REQUIRE ION TRAP MAGNET

ELECTRICAL DATA

FOCUSING METHOD	ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ± 10%	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[B]	16 000	VOLTS
DC GRID #4 VOLTAGE	+50 TO +550	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC GRID #4 CURRENT	-15 TO +25	μAMP

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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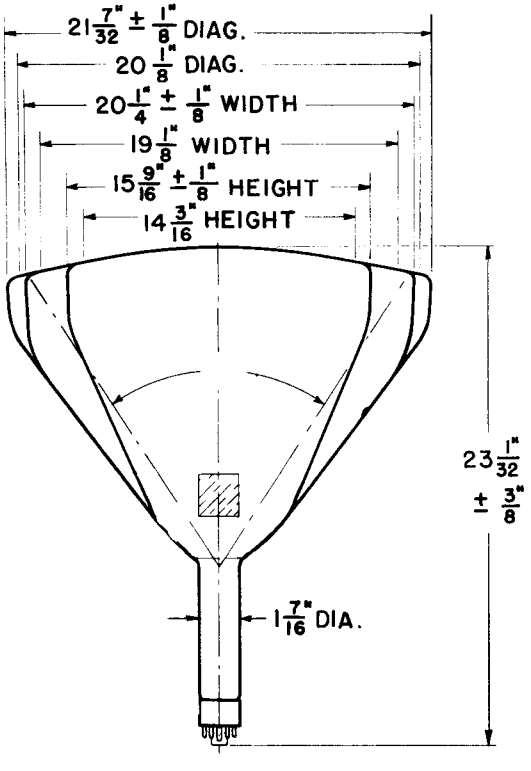
MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 7/32 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	15 9/16 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/8	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	14 3/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

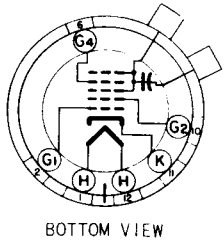
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE

PIN CONNECTIONS



BOTTOM VIEW

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21BDP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN — **ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE — **19 1/8" X 15" RASTER SIZE**
EXTERNAL CONDUCTIVE COATING — **RECTANGULAR GLASS CONSTRUCTION**
DOES NOT REQUIRE ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	67	DEGREES
VERTICAL	53	DEGREES
DIAGONAL	72	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	$\mu\mu$f
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[B]	16 000	VOLTS
DC GRID #4 VOLTAGE	+50 TO +550	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-28 TO -72	VOLTS
DC GRID #4 CURRENT	-15 TO +25	μAMP.

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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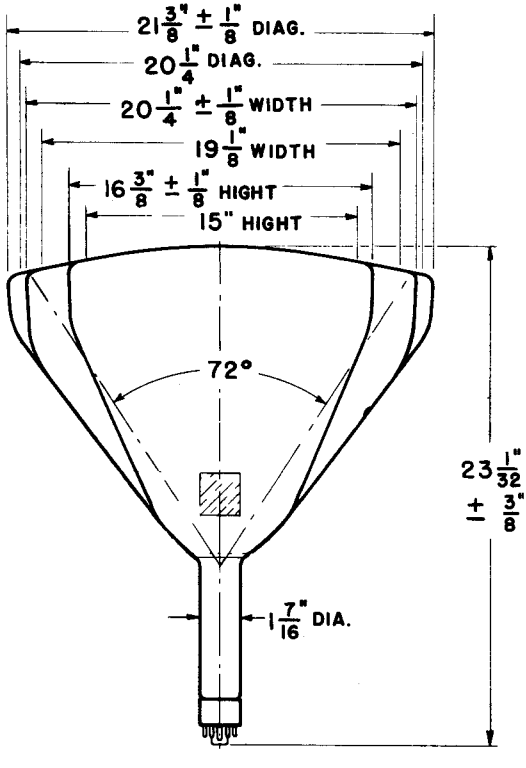
MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

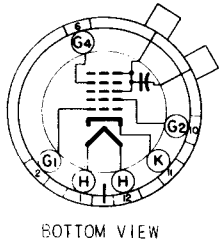
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE



BOTTOM VIEW

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21BNP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**UNIPOTENTIAL CATHODE**
MAGNETIC DEFLECTION	**ALUMINIZED SCREEN**
19 1/8" X 15" RASTER SIZE	**EXTERNAL CONDUCTIVE COATING**
GREY FILTERGLASS FACEPLATE	**REQUIRES NO ION TRAP MAGNET**

ELECTRICAL DATA

FOCUSING METHOD	ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1500	$\mu\mu f$
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1200	$\mu\mu f$

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE	+50 TO +550	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC GRID #4 CURRENT	-15 TO +25	μAMP

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

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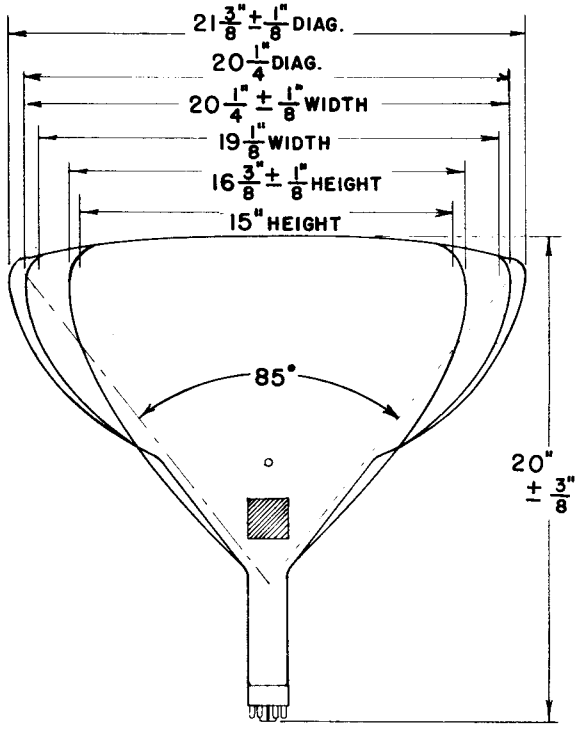
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	15	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

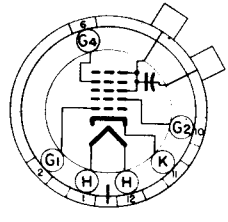
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ±30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21BSP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GRAY FILTER FACEPLATE — **ALUMINIZED SCREEN**
MAGNETIC FOCUS AND DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
19 1/16" X 15 1/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE	SHORT TO MEDIUM	
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±5%	AMP.
MAXIMUM DC ANODE VOLTAGE	22 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	116 ±15%	MA.
DC ION TRAP MAGNET STANDARD COIL #117 (APPROX.)	30	MA.
DC ION TRAP MAGNET RATED STRENGTH	33	GAUSSES

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 15 1/16" BY 19 1/16" PICTURE SIZE.

*HEATER WARM-UP TIME IS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE TO 5.0 VOLTS IN THE JETEC TEST CIRCUIT, WITH E=25 VOLTS AND SERIES R=31.5 OHMS.

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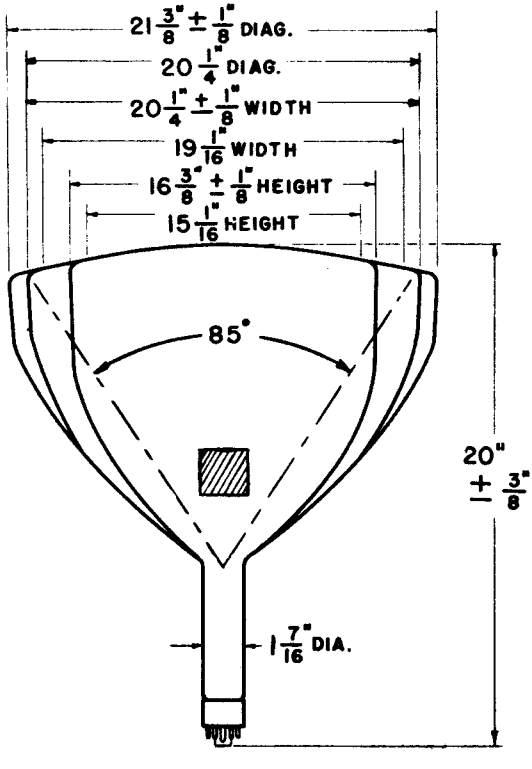
MECHANICAL DATA

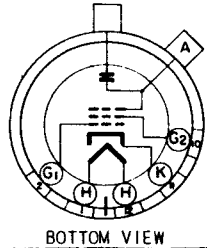
OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS



BOTTOM VIEW

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 10 – GRID #2
PIN 11 – CATHODE

PIN 12 – HEATER
ANODE CAP:
GRID NO.3

TUNG-SOL

CATHODE RAY

THE 21CBP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**UNIPOTENTIAL CATHODE**
MAGNETIC DEFLECTION	**ALUMINIZED SCREEN**
GREY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
19 1/16" X 15 1/16" RASTER SIZE	**REQUIRES NO ION TRAP MAGNET**

ELECTRICAL DATA

FOCUSING METHOD	ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6±10%	AMP.
MAXIMUM DC ANODE VOLTAGE *	18,000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	140	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	-55 TO 300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

*BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

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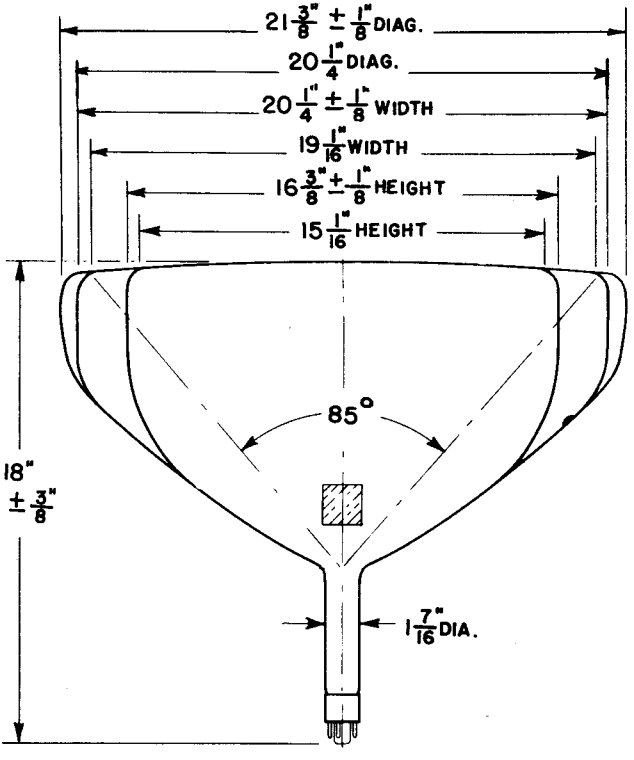
MECHANICAL DATA

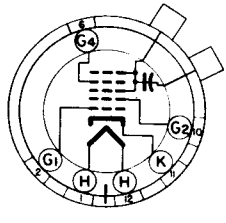
OVERALL LENGTH	18 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L
BULB CONTACT ALIGNMENT		

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ±30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21CDP4 AND 21CDP4A ARE DIRECT VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THE TUBES ARE IDENTICAL EXCEPT FOR THE ALUMINIZED SCREEN ON THE 21CDP4A.
THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION	**ELECTROSTATIC FOCUS**
UNIPOTENTIAL CATHODE	**GRAY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**19" 1/16" X 15 1/16" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE	SHORT TO MEDIUM	
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.45 ±5%	AMP.
MAXIMUM DC ANODE VOLTAGE	22 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-550 TO +1100	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.) *	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE	-64 TO +352	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC ION TRAP MAGNET STANDARD COIL #117 (APPROX.)	30	MA.
DC ION TRAP MAGNET RATED STRENGTH	33	GAUSES

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

* HEATER WARM-UP TIME IS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE TO 5.0 VOLTS IN THE JETEC TEST CIRCUIT, WITH E=25 VOLTS AND SERIES R=42 OHMS.

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TUNG-SOL

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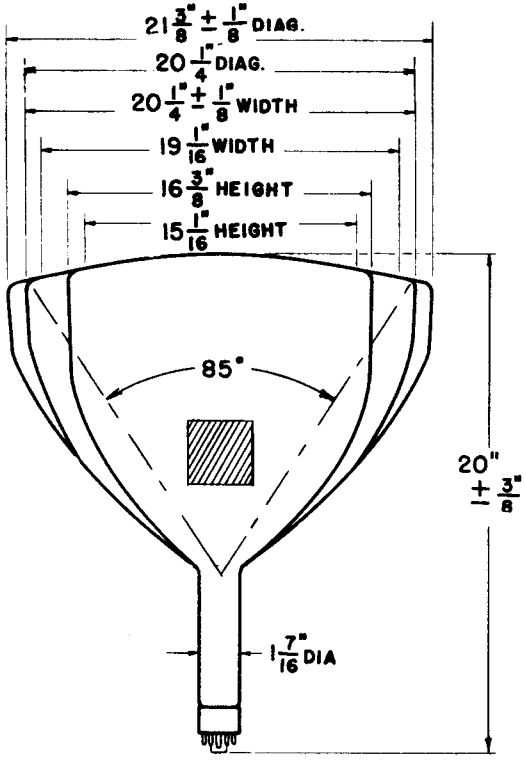
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENTSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL CUODECAL 6 PIN	B6-63
BASING		12L

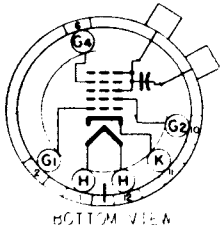
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO.3
GRID NO.5

TUNG-SOL

CATHODE RAY

THE 21CGP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN	ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION	UNIPOTENTIAL CATHODE
GRAY FILTER FACEPLATE	EXTERNAL CONDUCTIVE COATING
EXTERNAL SINGLE FIELD ION TRAP	RECTANGULAR GLASS CONSTRUCTION

19 1/16 X 15 1/16 RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	75	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE*	18 000	VOLTS
DC GRID #4 VOLTAGE	−72 TO +396	VOLTS
DC GRID #2 VOLTAGE	110	VOLTS
DC GRID #1 VOLTAGE[B]	−32 TO −50	VOLTS
DC ION TRAP MAGNET RATED STRENGTH	46	GAUSSES

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

* THIS TUBE MAY BE OPERATED IN GRID DRIVE IF DESIRED, WITH SOME LOSS IN EFFICIENCY. AVERAGE RASTER CUTOFF, WITH GRID DRIVE, MAY BE CALCULATED: $E_{g1co} = .502\ E_{g2} + 5.8$

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TUNG-SOL

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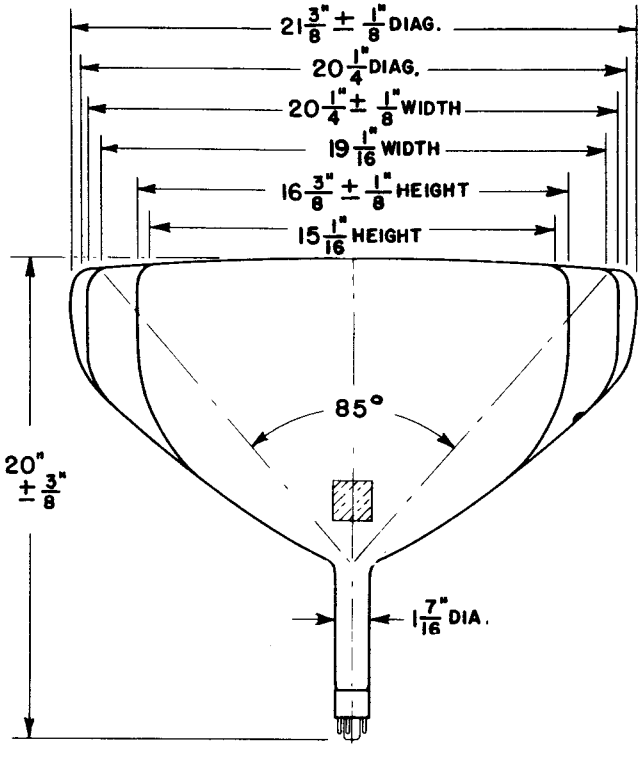
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

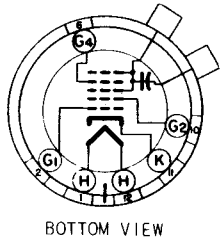
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ±30 DEGREES



PIN CONNECTIONS

PIN 1 — HEATER
PIN 2 — GRID #1
PIN 6 — GRID #4
PIN 10 — GRID #2
PIN 11 — CATHODE



BOTTOM VIEW

PIN 12 — HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21CHP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**ALUMINIZED SCREEN**
UNIPOTENTIAL CATHODE	**MAGNETIC DEFLECTION**
GRAY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION	**19 1/16" X 15 1/16 RASTER SIZE**

DOES NOT REQUIRE ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CATHODE DRIVE SERVICE

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE*	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	0	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CATHODE DRIVE[A]

DC ANODE VOLTAGE	18 000	VOLTS
DC GRID #4 VOLTAGE	-50 TO +350	VOLTS
DC GRID #2 VOLTAGE	110	VOLTS
DC GRID #1 VOLTAGE[B]	-37 TO -50	VOLTS

[A] THIS TUBE MAY BE OPERATED IN GRID DRIVE IF DESIRED, WITH SOME LOSS IN EFFICIENCY. AVERAGE RASTER CUTOFF, USING DRIVE, MAY BE CALCULATED: $E_{g1c} = .502\ E_{g2} + 5.8$

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

* BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

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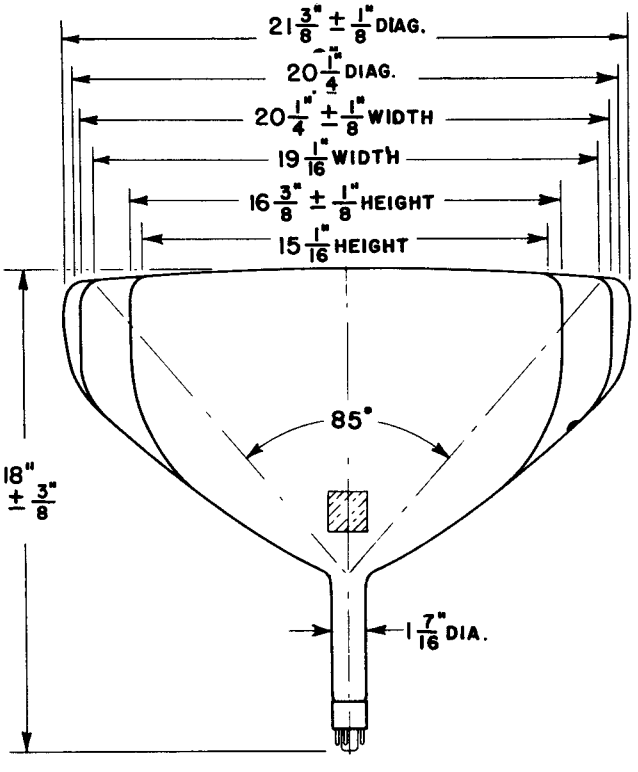
MECHANICAL DATA

OVERALL LENGTH	18 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

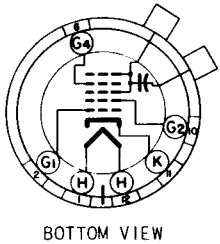
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ±30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21CUP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — **ALUMINIZED SCREEN**
GRAY FILTER FACEPLATE — **EXTERNAL CONDUCTIVE COATING**
MAGNETIC FOCUS AND DEFLECTION — **EXTERNAL SINGLE FIELD ION TRAP**
19 1/16" X 15 1/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	22 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	117	MA.
DC ION TRAP MAGNET RATED STRENGTH	40	GAUSSES

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

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TUNG-SOL

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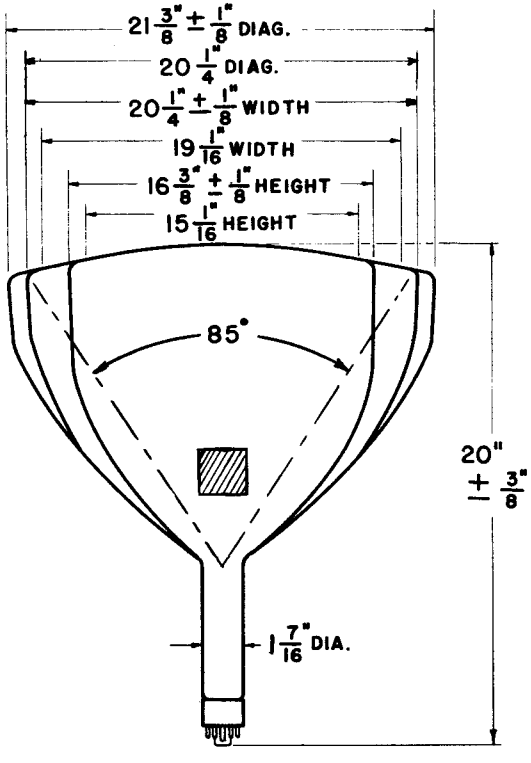
MECHANICAL DATA

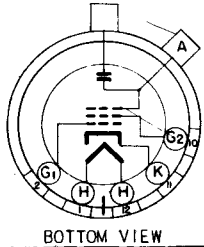
OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS



BOTTOM VIEW

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 10 – GRID #2
PIN 11 – CATHODE

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

TUNG-SOL

CATHODE RAY

THE 21CVP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	ALUMINIZED SCREEN
MAGNETIC DEFLECTION	GRAY FILTER FACEPLATE
UNIPOTENTIAL CATHODE	RECTANGULAR GLASS CONSTRUCTION
EXTERNAL CONDUCTIVE COATING	19 1/16" X 15 1/16" RASTER SIZE

REQUIRES NO ION TRAP

ELECTRICAL DATA

FOCUSING METHOD	ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	22 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[A]	-550 TO +1100	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE	-64 TO +352	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS

[A] THE FOCUS ELECTRODE MAY BE MODULATED TO IMPROVE OVERALL FOCUS.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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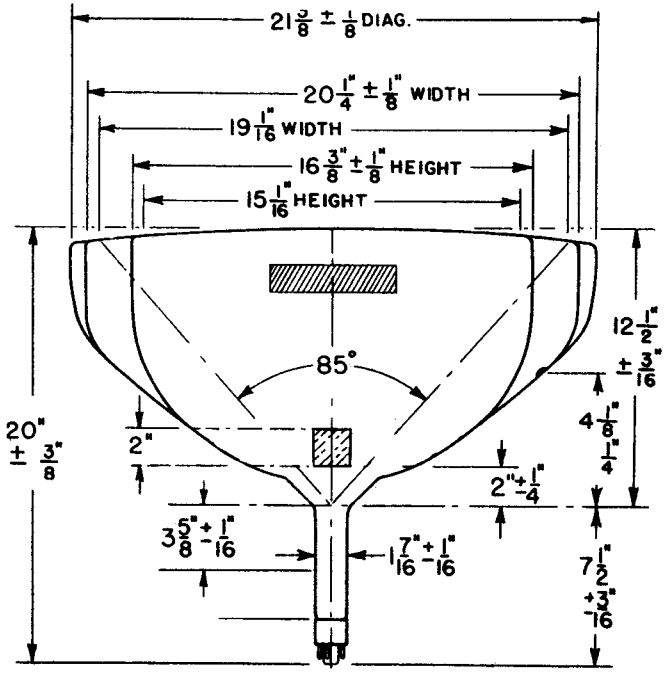
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6-PIN	B6-63
BASING		12L

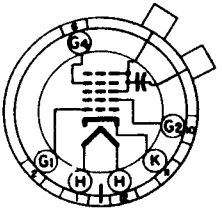
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

BOTTOM VIEW

TUNG-SOL

CATHODE RAY

THE 21CWP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**ALUMINIZED SCREEN**
MAGNETIC DEFLECTION	**GRAY FILTER FACEPLATE**
UNIPOTENTIAL CATHODE	**RECTANGULAR GLASS CONSTRUCTION**
EXTERNAL CONDUCTIVE COATING	**19 1/16" X 15 1/16" RASTER SIZE**

EXTERNAL SINGLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	74	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±5%	AMP.
MAXIMUM DC ANODE VOLTAGE	22 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[A]	-550 TO +1100	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	550	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE	-64 TO +352	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC ION TRAP MAGNET RATED STRENGTH	40	GAUSSES

[A] THE FOCUS ELECTRODE MAY BE MODULATED TO IMPROVE OVERALL FOCUS.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

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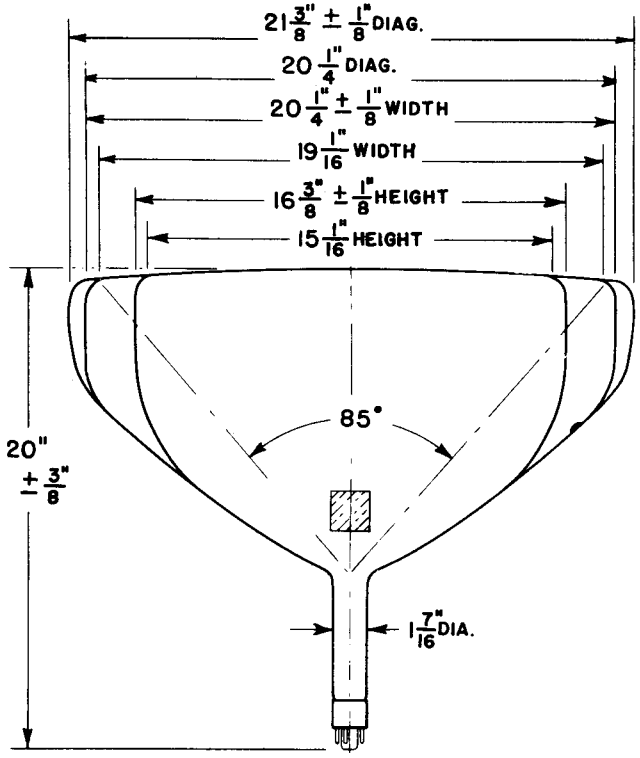
MECHANICAL DATA

OVERALL LENGTH	20 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	16 3/8 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/4	INCHES
WIDTH	19 1/16	INCHES
HEIGHT	15 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

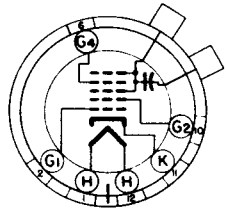
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

TUNG-SOL

CATHODE RAY

THE 21DP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE — **FROSTED FILTERGLASS FACEPLATE**
RECTANGULAR METAL CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
18 3/8" X 13 15/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

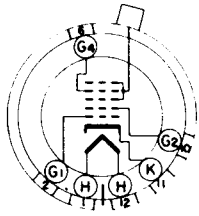
MECHANICAL DATA

OVERALL LENGTH	22 5/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/4 ± 1/4	INCHES
WIDTH	19 23/32 ± 1/8	INCHES
HEIGHT	15 5/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	19 3/8	INCHES
WIDTH	18 3/8	INCHES
HEIGHT	13 15/16	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

BULB CONTACT ALIGNMENT
METAL SHELL LIP CONTACT ALIGNS WITH PIN POSITION #6 ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	5 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT-WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT-TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC GRID #4 VOLTAGE[B]	2750 TO 3740	VOLTS
ION TRAP MAGNET (RATED STRENGTH)	40	GAUSSES

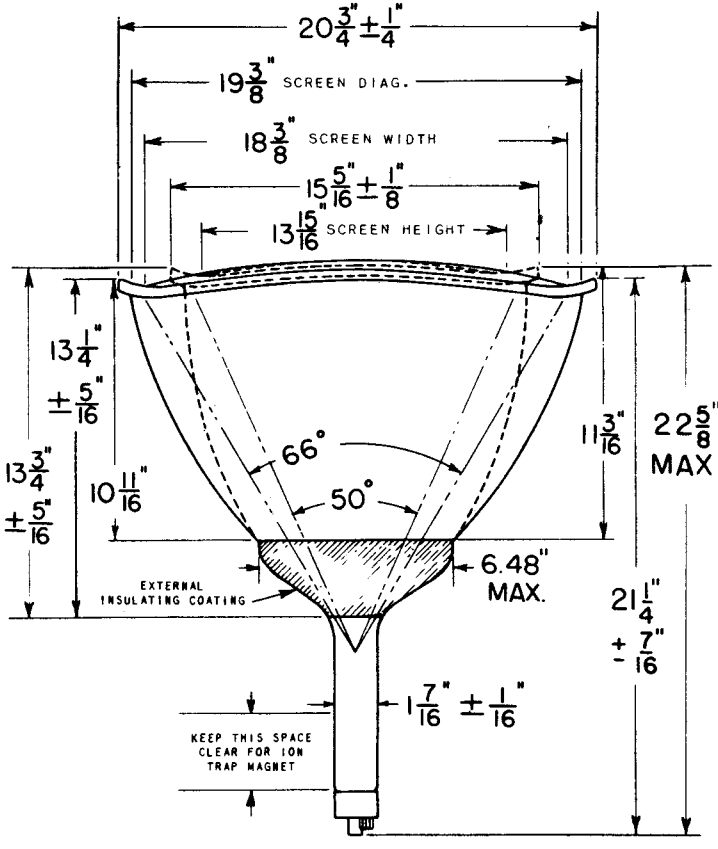
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

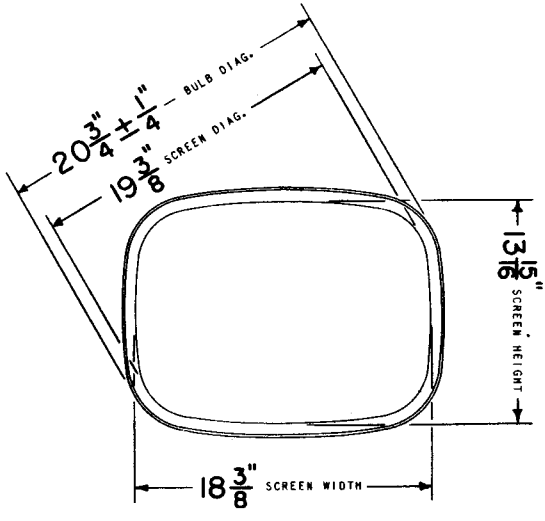
[B] WITH GRID #3, GRID #5, COLLECTOR CURRENT OF 100 UAMP.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL ELECTRIC INC.

X2110A

TENTATIVE DATA

21DUP4

CATHODE RAY TUBE

Tung-Sol X2110A is a 21 inch 110° deflection, aluminized all glass picture tube. It features electrostatic focus in a short-necked construction requiring no ion trap and 1 7/16" neck diameter.

ELECTRICAL DATA

Focusing Method		Electrostatic
Deflecting Method		Magnetic
Deflection Angle (Approx.)		
Diagonal	110	Degrees
Horizontal	105	Degrees
Vertical	87	Degrees
Direct Interlectrode Capacitances (Approx.)		
Cathode to all other Electrodes	5	uuf
Grid #1 to all other Electrodes	6	uuf
External Conductive Coating to Anode		
Maximum	2000	uuf
Minimum	2500	uuf

OPTICAL DATA

Phosphor Number	Sulfide Type	P-4
Fluorescent Color		White
Phosphorescent Color		White
Persistence		Short
Faceplate - Gray		
Light Transmission at Center (Approx.)	74	Percent

MECHANICAL DATA

Maximum Overall Lenght	15	Inches
Greatest Dimensions of Bulb		
Diagonal	21 3/8±1/8	Inches
Width	20 1/4±1/8	Inches
Height	16 3/8±1/8	Inches
Minimum Useful Screen Dimensions		
Diagonal	20 1/4	Inches
Width	19 1/16	Inches
Height	15 1/16	Inches
Neck Length	5 7/16	Inches
Bulb Contact	Recessed Small Cavity Cap	JETEC J1-21
Base	Small Shell Duodecal 6 Pin	JETEC B6-63
Basing		JETEC 12L

Bulb Contact Alignment

Anode Contact Aligns with Pin #6 ± 30 Degrees

from JEDEC release #1941C, Oct. 3, 1978

BASE PIN CONNECTIONS

Pin 1 - Heater	Pin 12 - Heater
Pin 2 - Grid #1	Anode Cap: Grid #3
Pin 6 - Grid #4	Grid #5
Pin 10 - Grid #2	Conductive Coating
Pin 11 - Cathode	

RATINGS - Design - Center Values[A]

Heater Voltage	6.3	Volts
Heater Current	0.6±10%	Amp.
Maximum Anode Voltage[B]	18000	Volts DC
	Min. 12000	Volts DC
Maximum Focusing - Electrode Voltage	-500 to + 1000	Volts DC
Maximum Grid #2 Voltage	500	Volts DC
Maximum Grid #1 Voltage		
Negative - Bias Value	140	Volts DC
Negative - Peak Value	200	Volts DC
Positive - Bias Value	0	Volts DC
Positive - Peak Value	2	Volts
Maximum Peak Heater - Cathode Voltage[C]		
Heater Negative with Respect to Cathode	180	Volts
During Warm - Up Period not to Exceed 15 Seconds	440	Volts
After Equipment Warm - Up Period	180	Volts
Heater Positive with Respect to Cathode	180	Volts

TYPICAL OPERATING CONDITIONS

Anode Voltage[D]	16000	Volts DC
Focusing - Electrode Voltage for Focus[E]	0 to +450	Volts DC
Focusing - Electrode Current	-15 to +25	uAmps DC
Grid #2 Voltage	300	Volts DC
Grid #11 Voltage[F]	-28 to -72	Volts DC

CIRCUIT VALUES

Maximum Grid #1 Circuit Resistance	1.5	Megohms

A-The maximum ratings provide a ten-percent safety factor in accordance with the standard design-center system of rating cathode-ray tubes. The tube will withstand the combined effects of variations in line voltage and components provided the maximum design-center values are not exceeded by more than ten-percent.

B-Anode, Grid #3 and Grid #5 which are connected together within the tube are referred to herin as anode. If this tube is operated at voltages in excess of 16,000 volts, X-Ray radiation shielding may be necessary to avert possible danger of personal injury from prolonged exposure at close range. The protective face-viewing window of apparatus using tubes of this type may provide such a safeguard. If the radiation measured in contact with this window does not exceed 0.25 millirontegens per hour, the window will normally provide adequate protection.

C-Cathode should be returned to one side or to the midtap of the heater transformer winding.

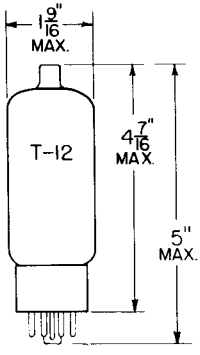
D-Brightness and focus quality decrease with decreasing anode voltage. In general, the anode voltage should not be less than 14,000 volts.

E-The focusing electrode may be modulated within the stipulated maximum range to improve over-all focus.

F-For visual extinction of focused raster.

TUNG-SOL

BEAM PENTODE



GLASS BULB

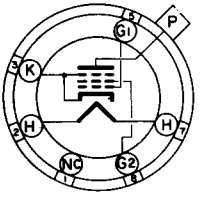
HEATER

21.5 VOLTS 0.6 AMP.

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE



BOTTOM VIEW

SHORT MEDIUM-SHELL 5 PIN OCTAL WITH EXTERNAL BARRIERS

5BT

THE 21EX6 IS A BEAM-POWER PENTODE DESIGNED PRIMARILY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS WHICH INCORPORATE LARGE-DEFLECTION-ANGLE PICTURE TUBES. FEATURES OF THE TUBE INCLUDE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES, AND A HIGH RATIO OF PLATE TO SCREEN CURRENT. EXCEPT FOR HEATER RATINGS, THE 21EX6 IS IDENTICAL TO THE 6EX6.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

HEATER VOLTAGE	21.5	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	7000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE (ABS. MAX.)	1500	VOLTS
MAXIMUM SCREEN VOLTAGE	195	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	220	VOLTS
MAXIMUM PLATE DISSIPATION[B]	22	WATTS
MAXIMUM SCREEN DISSIPATION	3.5	WATTS
MAXIMUM DC CATHODE CURRENT	220	MA.
MAXIMUM PEAK CATHODE CURRENT	770	MA.
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	225	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	21.5	21.5	21.5	VOLTS
HEATER CURRENT	0.6	0.6	0.6	AMP.
PLATE VOLTAGE	60	60	175	VOLTS
SCREEN VOLTAGE	125	150	175	VOLTS
GRID #1 VOLTAGE	0[C]	0[C]	-30	VOLTS
PLATE RESISTANCE (APPROX.)			8500	OHMS
TRANSCONDUCTANCE			7700	μMHOS
PLATE CURRENT	360	460	67	MA.
SCREEN CURRENT	30	45	3.3	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.			-50	VOLTS
TRIODE AMPLIFICATION FACTOR WITH $E_b = E_{c2}$ = 175V.			4.2	
GRID #1 VOLTAGE WITH E_b=5000V. FOR I_b=1.0 MA.	-88	-94	-101	VOLTS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[C] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

CATHODE RAY

THE 21FP4, 21FP4A AND 21FP4C ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THE 21FP4A AND 21FP4C HAVE EXTERNAL CONDUCTIVE COATINGS WITH THE 21FP4C ALSO HAVING AN ALUMINIZED SCREEN. IN ALL OTHER RESPECTS THESE TUBES ARE IDENTICAL. THEIR COMMON FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
CYLINDRICAL FACEPLATE	**19 1/8" X 13 7/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD			ELECTROSTATIC
DEFLECTING METHOD			MAGNETIC
DEFLECTION ANGLE (APPROX.):			
HORIZONTAL		65	DEGREES
DIAGONAL		70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):			
CATHODE TO ALL OTHER ELECTRODES		5	μμf
GRID #1 TO ALL OTHER ELECTRODES		6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	21FP4A &	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	21FP4C	500	μμf

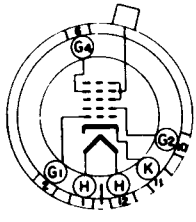
OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

OVERALL LENGTH	23 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 1/4 ± 3/16	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	15 9/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	19 1/8	INCHES
HEIGHT	13 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING	21FP4A & 21FP4C-12L 21FP4	12M
BULB CONTACT ALIGNMENT		
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES		

21FP4

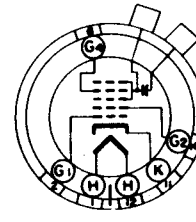


BOTTOM VIEW

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

21FP4A & 21FP4C



BOTTOM VIEW

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM GRID #4 CURRENT	−15 TO +25	μAMP.
MAXIMUM GRID #2 CURRENT	−15 TO +25	μAMP.
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] BECAUSE THE RATING OF THIS TUBE PERMITS ANODE VOLTAGES AS HIGH AS 19.8KV, SHIELDING OF X-RAY RADIATION FROM THE TUBE MAY BE NECESSARY. THIS PRECAUTION SHOULD BE OBSERVED WHEN THE ANODE IS OPERATED IN EXCESS OF 16KV.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

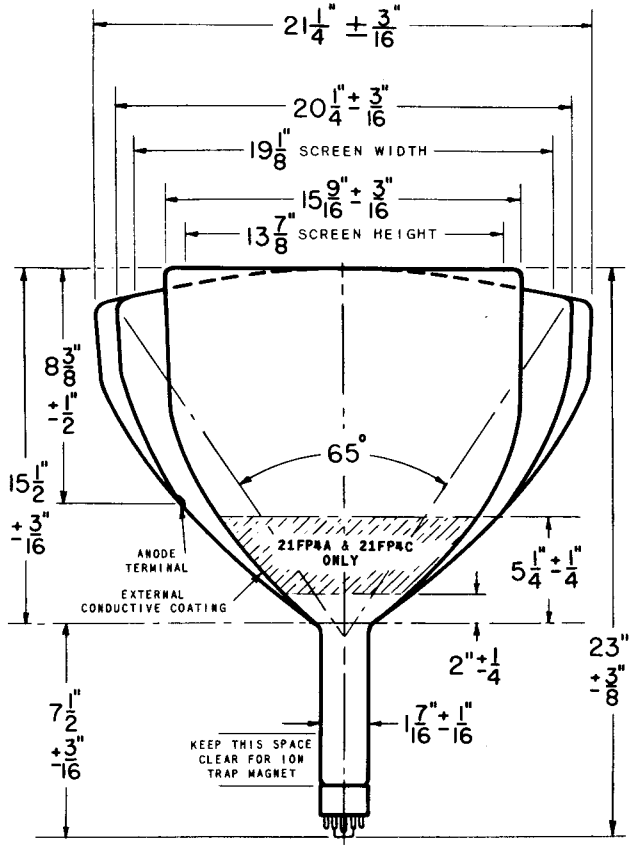
DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE	−56 TO +310	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−33 TO −77	VOLTS
ION TRAP MAGNET (RATED STRENGTH) STANDARD COIL #111	35	GAUSSES

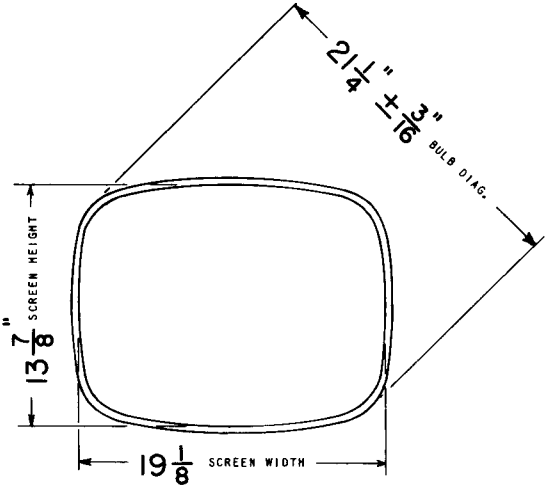
[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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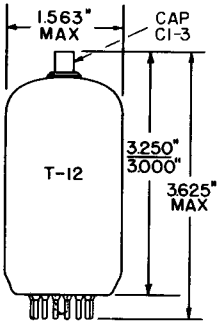
TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB
BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-79

BEAM PENTODE

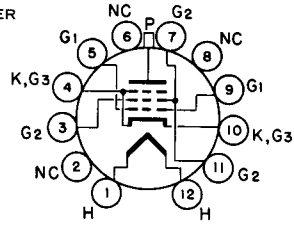
FOR

HORIZONTAL-DEFLECTION AMPLIFIER

APPLICATIONS IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 DR

THE 21GY5 IS A BEAM-POWER PENTODE IN THE 12 PIN COMPACTRON CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.7	pf
INPUT: G1 TO (H + K + G2 + G3)	22	pf
OUTPUT: P TO (H + K + G2 + BP)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	21 VOLTS	450	MA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF APPLIED CURRENT		450 ± 30	MA
HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,500	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	18	WATTS
GRID2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	230	MA
PEAK CATHODE CURRENT	800	MA
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	^{o}C

A- IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CHARACTERISTICS

PLATE VOLTAGE	5,000	60	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 [B]	-20	VOLTS
PLATE CURRENT	-	410	50	MA
GRID 2 CURRENT		24	1.75	MA
PLATE RESISTANCE	-	-(APPROX.)	11,000	OHMS
TRANSCONDUCTANCE			9,100	MICROMHOS
GRID 1 VOLTAGE FOR I_b = 1.0 MA (APPROX.)	-66	-	-33	VOLTS
TRIODE AMPLICATION FACTOR [C]			4.7	

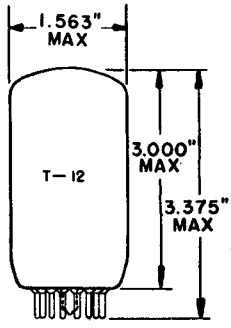
B- APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

C- TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH E_b = E_{c2} = 130 VOLTS AND E_{c1} = -20 VOLTS

TUNG-SOL

PENTODE

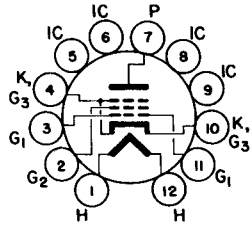
COMPACTRON



GLASS BULB
BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-58

BEAM PENTODE
FOR
HORIZONTAL-DEFLECTION
AMPLIFIER
APPLICATIONS
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 BJ

THE 21HB5 IS A BEAM PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN T.V. RECEIVERS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, THE 21HB5 IS IDENTICAL TO THE 6HB5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: (G1 TO P)	0.4	pf
INPUT: G1 TO (H + K + G2 + G3)	22	pf
OUTPUT: P TO (H + K + G3 + G3)	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	21.0 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER - CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	770	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	6,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	1,500	VOLTS
GRID 2 VOLTAGE	220	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION [A]	18	WATTS
GRID 2 DISSIPATION	3.5	WATTS
DC CATHODE CURRENT	230	MA.
PEAK CATHODE CURRENT	800	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

A- IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	5,000	60	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 [B]	-20	VOLTS
PLATE CURRENT	-	410	50	MA.
GRID 2 CURRENT	-	24	1.75	MA.
TRANSCONDUCTANCE	-	-	9,100	μMHOS
PLATE RESISTANCE	-	-	Approx. 11,000	OHMS
GRID 1 VOLTAGE FOR I_b = 1.0 MA. -APPROX.	-66	-	-33	VOLTS
TRIODE AMPLIFICATION FACTOR [C]	-	-	4.7	

B- APPLIED FOR SHORT INTERVAL (2 SECONDS) SO AS NOT TO DAMAGE TUBE.

C- TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH $E_b = E_{c2} = 130$ VOLTS AND $E_{c1} = -20$ VOLTS.

TUNG-SOL

CATHODE RAY

THE 21JP4 AND 21JP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 21JP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
CYLINDRICAL FACEPLATE
RECTANGULAR GLASS CONSTRUCTION
BUILT-IN ION TRAP & FOCUSING UNIT
GREY FILTER FACEPLATE
EXTERNAL CONDUCTIVE COATING
MAGNETIC FOCUS AND DEFLECTION
19 1/8" X 13 7/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	71	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	20 000	VOLTS
MAXIMUM ANODE INPUT[B]	6	WATTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE BIAS VALUE	125	VOLTS
DC POSITIVE BIAS VALUE	0	VOLTS
POSITIVE PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[C]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[D]	16 000 ± 3 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[E]	-28 TO -72	VOLTS

[A] THE MAXIMUM RATINGS PROVIDE A 10% SAFETY FACTOR IN ACCORDANCE WITH THE STANDARD DESIGN-CENTER SYSTEM OF RATING CATHODE-RAY TUBES. THE TUBE WILL WITHSTAND THE COMBINED EFFECTS OF VARIATIONS IN LINE VOLTAGE AND COMPONENTS PROVIDED THE MAXIMUM DESIGN-CENTER VALUES ARE NOT EXCEEDED BY MORE THAN 10%.

[B] ANODE INPUT EQUALS THE PRODUCT OF ANODE VOLTAGE AND AVERAGE CURRENT MEASURED AT THE TERMINAL.

[C] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

[D] OPTIMUM FOCUSING CONDITIONS REQUIRE THAT THE TUBE BE OPERATED WITHIN THE SPECIFIED VOLTAGE RANGE.

[E] VISUAL EXTINCTION OF FOCUSED RASTER.

IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER OF PERSONAL INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE. THE PROTECTIVE FACE-VIEWING WINDOW OF APPRATUS USING TUBES OF THIS TYPE MAY PROVIDE SUCH A SAFEGUARD. IF THE RADIATION MEASURED IN CONTACT WITH THIS WINDOW DOES NOT EXCEED 6.25 MILLIROENTGENS PER HOUR, THE WINDOW WILL NORMALLY PROVIDE ADEQUATE PROTECTION.

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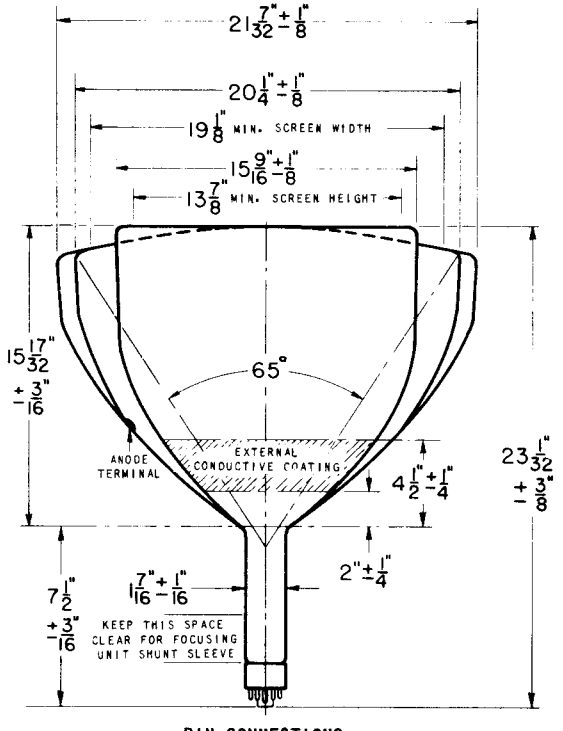
MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 7/32 ± 1/8	INCHES
WIDTH	20 1/4 ± 1/8	INCHES
HEIGHT	15 9/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/8	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	13 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

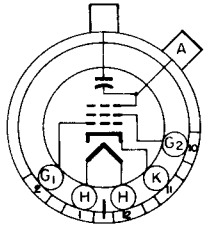
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID #3

TUNG-SOL

CATHODE RAY

THE 21KP4 AND 21KP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE EXTERNAL CONDUCTIVE COATING ON THE 21KP4A. THEIR COMMON FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
UNIPOTENTIAL CATHODE	**CYLINDRICAL FACEPLATE**
GREY FILTER FACEPLATE	**13 7/8" X 19 1/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD			ELECTROSTATIC
DEFLECTING METHOD			MAGNETIC
DEFLECTION ANGLE (APPROX.):			
HORIZONTAL		65	DEGREES
DIAGONAL		70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.)			
CATHODE TO ALL OTHER ELECTRODES		6	μμf
GRID #1 TO ALL OTHER ELECTRODES		6.5	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	**21KP4A**	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	**ONLY**	500	μμf

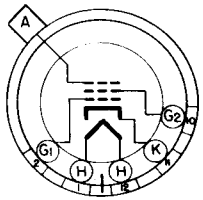
OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

OVERALL LENGTH		23 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:			
DIAGONAL		21 7/32 ± 1/8	INCHES
WIDTH		20 1/4 ± 1/8	INCHES
HEIGHT		15 9/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:			
WIDTH		19 1/8	INCHES
HEIGHT		13 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP		J1-21
BASE	SMALL SHELL DUODECAL 5 PIN		B5-57
BASING	**21KP4A** — 12N	21KP4	12D
BULB CONTACT ALIGNMENT			
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES			

21KP4

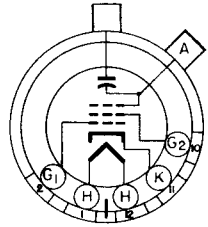


BOTTOM VIEW

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

21KP4A



BOTTOM VIEW

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

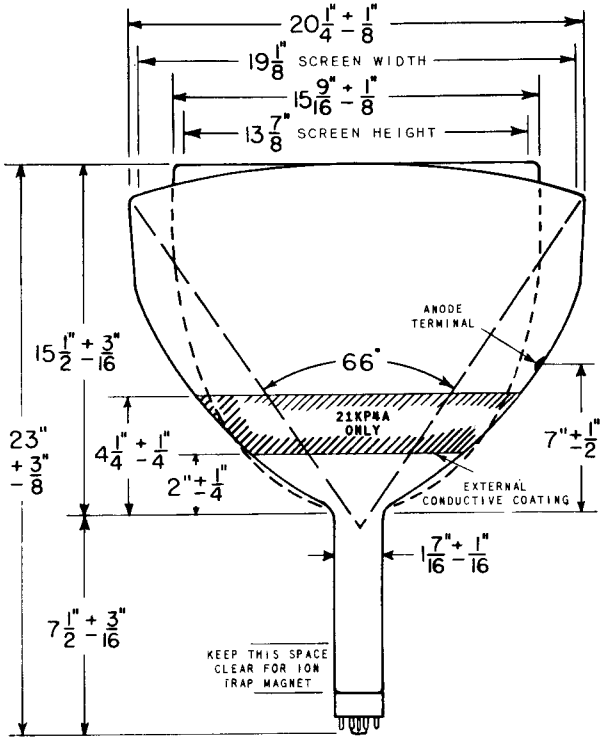
DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	50 ± 50%	MA.
CENTERING MAGNET FIELD STRENGTH	0 TO 8	GAUSSES

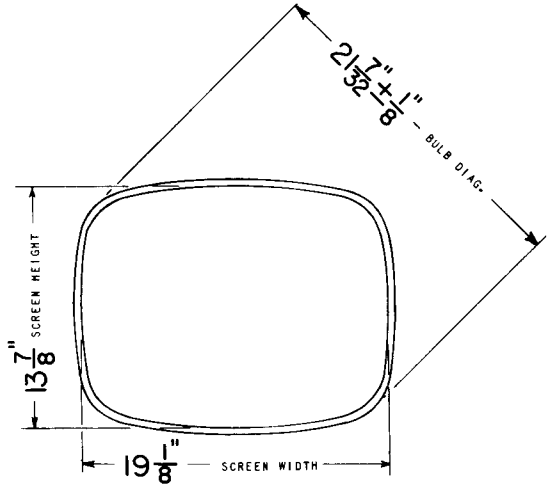
[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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CATHODE RAY

THE 21MP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
RECTANGULAR METAL CONSTRUCTION — **FROSTED FILTERGLASS FACEPLATE**
LOW VOLTAGE ELECTROSTATIC FOCUS — **EXTERNAL SINGLE FIELD ION TRAP**
18 3/8" X 14" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

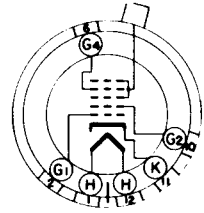
MECHANICAL DATA

OVERALL LENGTH	22 5/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 3/4 ± 1/4	INCHES
WIDTH	19 23/32 ± 1/8	INCHES
HEIGHT	15 5/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	19 3/8	INCHES
WIDTH	18 3/8	INCHES
HEIGHT	14	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

BASE ALIGNMENT
PIN #6 ALIGNS WITH HORIZONTAL PICTURE AXIS ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

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TUNG-SOL

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	−500[A] TO +1000	VOLTS
MAXIMUM DC PEAK HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] THIS VALUE HAS BEEN SPECIFIED TO TAKE CARE OF THE CONDITION WHERE AN AC VOLTAGE IS PROVIDED FOR DYNAMIC FOCUSING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	14 000	VOLTS
DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)[B]	−55 TO +300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	−33 TO −77	VOLTS
ION TRAP MAGNET (RATED STRENGTH)	45	GAUSSES

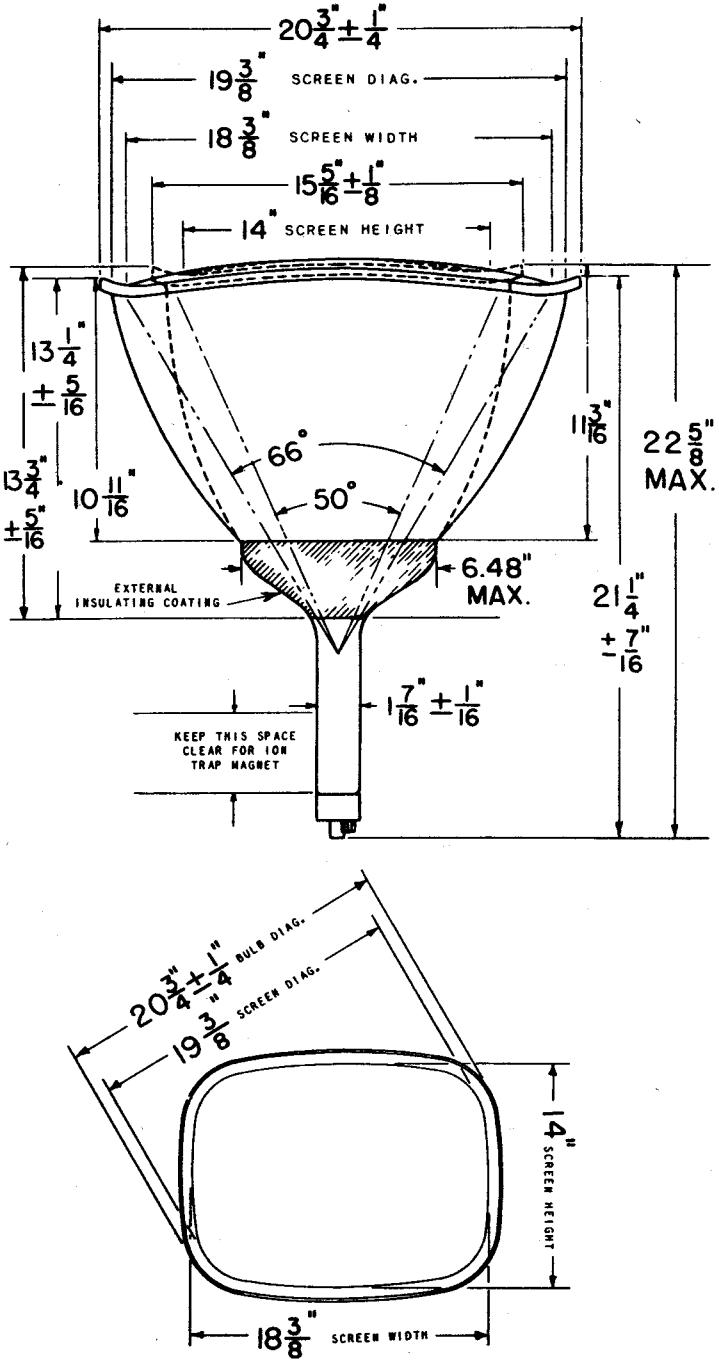
[B] WITH GRID #3, GRID #5, COLLECTOR CURRENT OF 100 UAMP.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


20 3/4" ± 1/4"
19 3/8" SCREEN DIAG.
18 3/8" SCREEN WIDTH
15 5/16" ± 1/8"
14" SCREEN HEIGHT
13 1/4" ± 5/16
13 3/4" ± 5/16"
10 11/16"
66°
50°
11 3/16"
22 5/8" MAX.
6.48" MAX.
EXTERNAL INSULATING COATING
21 1/4" ± 7/16"
1 7/16" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
20 3/4" ± 1/4" BULB DIAG.
19 3/8" SCREEN DIAG.
14" SCREEN HEIGHT
18 3/8" SCREEN WIDTH

TUNG-SOL

CATHODE RAY

THE 21WP4 AND 21WP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 21WP4A. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**SPHERICAL FACEPLATE**
GREY FILTER FACEPLATE	**12 3/4" X 17" RASTER SIZE**
MAGNETIC FOCUS & DEFLECTION	**EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		P4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	72	PERCENT

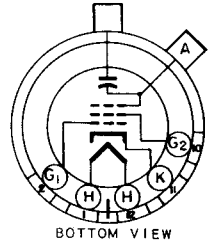
MECHANICAL DATA

OVERALL LENGTH	22 7/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 5/8 ± 3/16	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	100 ± 20%	MA.
ION TRAP CURRENT STANDARD COIL #117 (APPROX.)	30 ± 40%	MA.
ION TRAP MAGNET FIELD STRENGTH (APPROX.)	35	GAUSSES

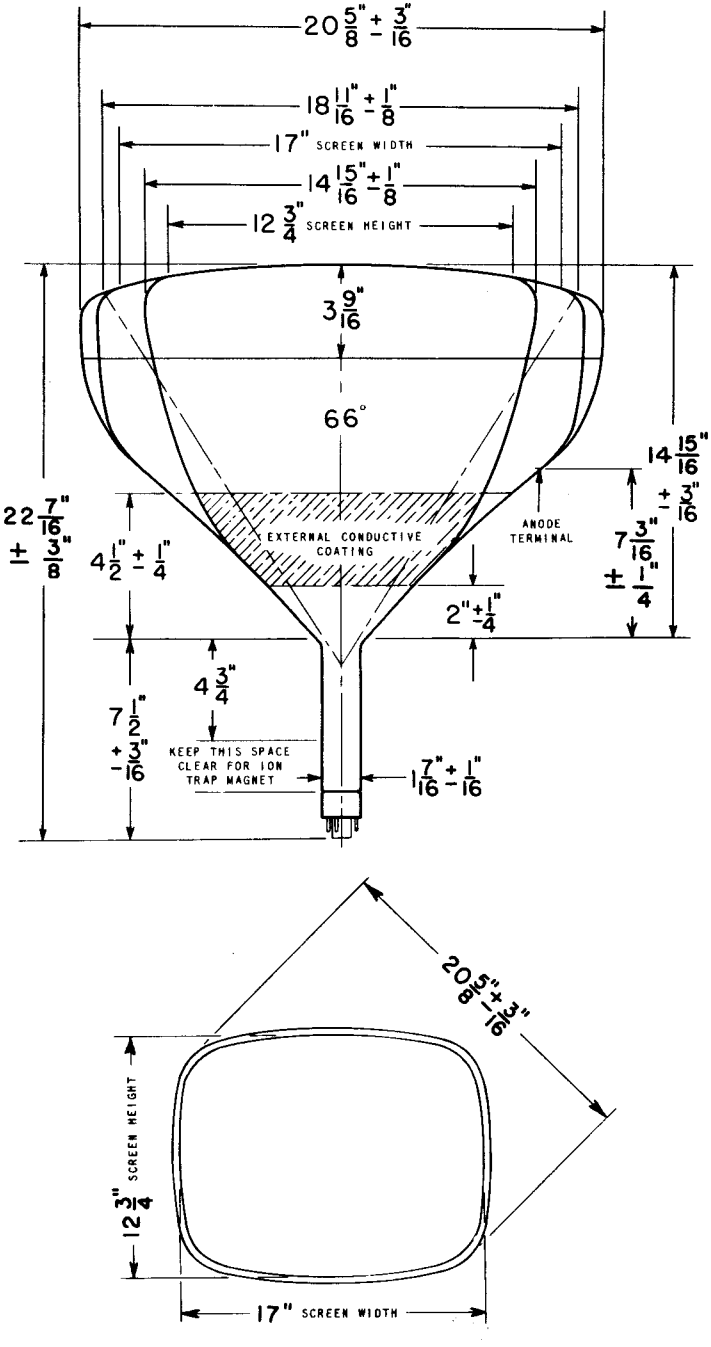
[A] VISUAL EXTINCTION OF FOCUSED RASTER.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 12 3/4" BY 17" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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TUNG-SOL

CATHODE RAY

THE 21XP4 AND 21XP4A ARE DIRECT-VIEW PICTURE TUBES INTENDED FOR TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 21XP4A. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION — **SPHERICAL FACEPLATE**
UNIPOTENTIAL CATHODE — **GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL CONDUCTIVE COATING**
LOW VOLTAGE ELECTROSTATIC FOCUS — **EXTERNAL SINGLE FIELD ION TRAP**
12 3/4" X 17" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	66	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	72	PERCENT

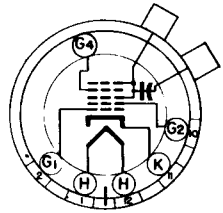
MECHANICAL DATA

OVERALL LENGTH	22 7/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	20 5/8 ± 3/16	INCHES
WIDTH	18 11/16 ± 1/8	INCHES
HEIGHT	14 15/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	17	INCHES
HEIGHT	12 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

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TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 GRID #5 VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE	16 000	VOLTS
DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)[A]	−64 TO +352	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−28 TO −72	VOLTS
DC ION TRAP CURRENT STANDARD COIL #117 (APPROX.)	30 ± 40%	MA.
ION TRAP MAGNET FIELD STRENGTH (APPROX.)	35	GAUSSES

[A] WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO GIVE AN ANODE CURRENT OF 100 MICROAMPERES ON A 12 3/4" X 17" PICTURE SIZE.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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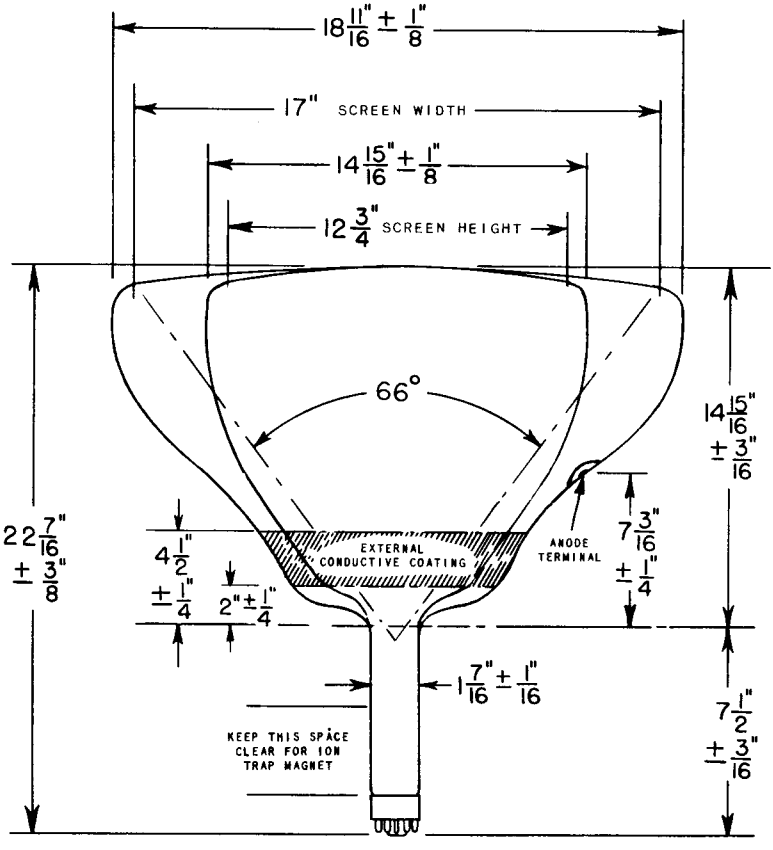

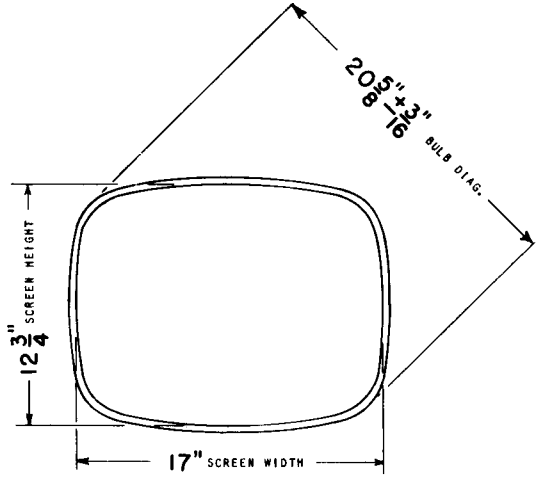

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CATHODE RAY

THE 21YP4 AND 21YP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN USED ON THE 21YP4A. THEIR COMMON FEATURES INCLUDE:

MAGNETIC DEFLECTION — **UNIPOTENTIAL CATHODE**
SPHERICAL FACEPLATE — **GREY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING — **EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION — **LOW VOLTAGE ELECTROSTATIC FOCUS**
19 1/8" X 14 3/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	75	PERCENT

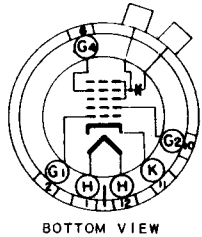
MECHANICAL DATA

OVERALL LENGTH	23 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 3/8	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	15 9/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	19 1/8	INCHES
HEIGHT	14 3/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[B]	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[B] THIS VALUE APPLIES WHERE AN AC VOLTAGE IS PROVIDED FOR DYNAMIC FOCUSING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE[C]	16 000	VOLTS
DC GRID #4 VOLTAGE[D]	−64 TO +350	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[E]	−33 TO −77	VOLTS
ION TRAP MAGNET (RATED STRENGTH)	45	GAUSSES

[C] BECAUSE THE RATING OF THIS TUBE PERMITS ANODE VOLTAGES AS HIGH AS 19.8 KV, SHIELDING OF X-RAY RADIATION FROM THE TUBE MAY BE NECESSARY. THIS PRECAUTION SHOULD BE OBSERVED WHEN THE ANODE IS OPERATED IN EXCESS OF 16 KV.

[D] WITH ANODE CURRENT OF 100 UAMP.

[E] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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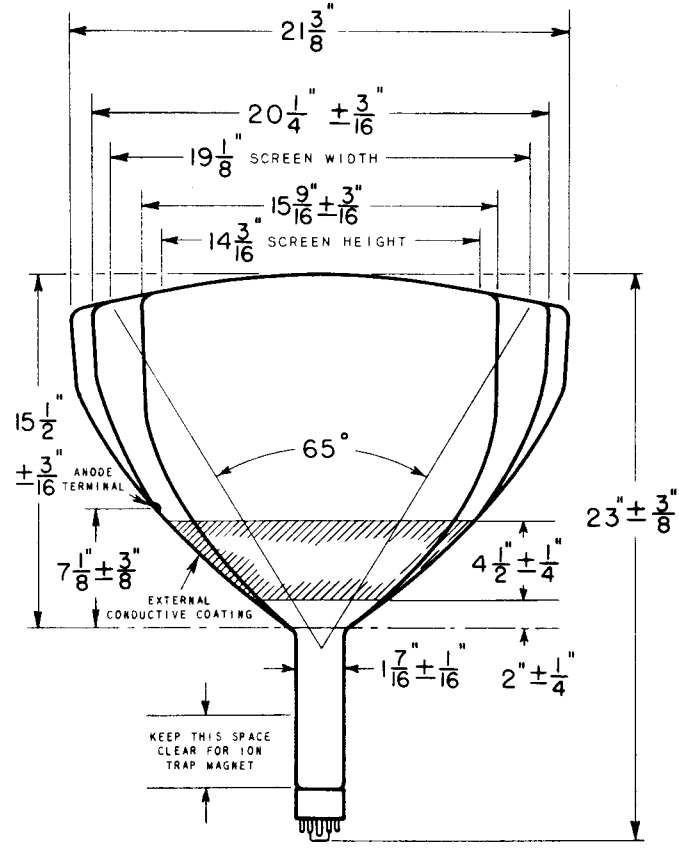

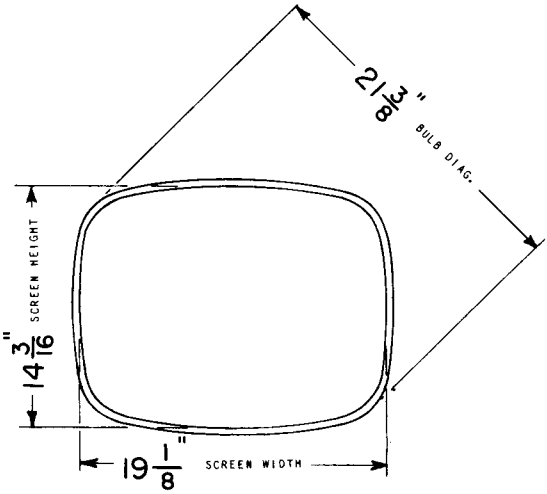

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CATHODE RAY

THE 21ZP4, 21ZP4A AND 21ZP4B ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 21ZP4A AND 21ZP4B HAVE EXTERNAL CONDUCTIVE COATINGS AND THE 21ZP4B ALSO HAS AN ALUMINIZED SCREEN. THEIR COMMON FEATURES INCLUDE:

SPHERICAL FACEPLATE — **UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE — **MAGNETIC FOCUS & DEFLECTION**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
19 1/8" X 14 3/16" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	65	DEGREES
VERTICAL	50	DEGREES
DIAGONAL	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
21ZP4A AND 21ZP4B ONLY		
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

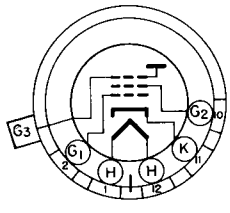
PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE **21ZP4B** — SHORT	21ZP4 & 21ZP4A	MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	75	PERCENT

MECHANICAL DATA

OVERALL LENGTH	23 1/32 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	21 7/32 ± 1/8	INCHES
WIDTH	20 1/4 ± 3/16	INCHES
HEIGHT	15 9/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	20 1/8	INCHES
WIDTH	19 1/8	INCHES
HEIGHT	14 3/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING **21ZP4** — 12D	21ZP4A & 21ZP4B	12N
BULB CONTACT ALIGNMENT		
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES		

PIN CONNECTIONS

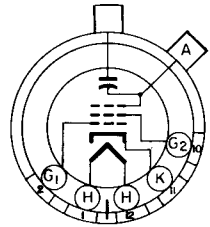
21ZP4



BOTTOM VIEW

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

21ZP4A & 21ZP4B



BOTTOM VIEW

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[A]:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[BC]	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[E]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[D] (APPROX.)	100 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	95 ± 50%	MA.
ION TRAP MAGNET (RATED STRENGTH) APPROX.	45	GAUSSES

[B] BRIGHTNESS AND FOCUS QUALITY DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[C] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER FROM PROLONGED EXPOSURE AT CLOSE RANGE.

[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 19 3/16" BY 14 5/16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

[E] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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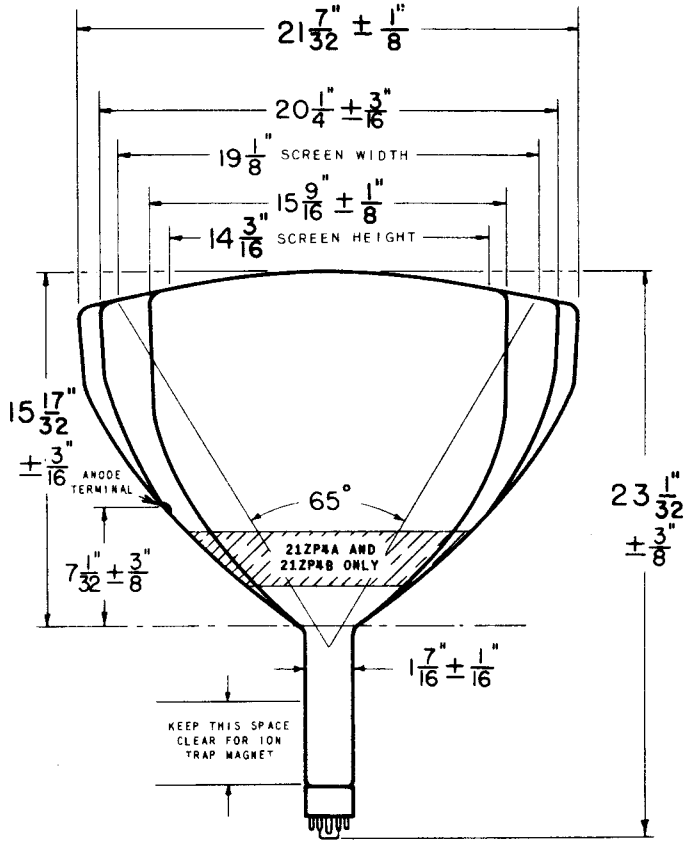

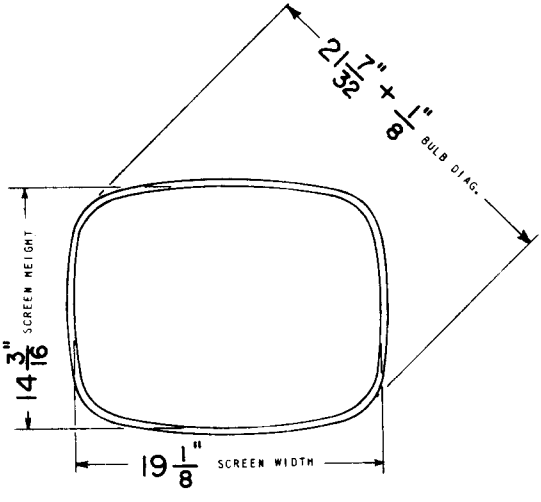

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CATHODE RAY

THE 22AP4 AND 22AP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 22AP4A HAS A GREY FILTER FACEPLATE. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE — ROUND METAL CONSTRUCTION
MAGNETIC FOCUS AND DEFLECTION — EXTERNAL SINGLE FIELD ION TRAP
13 1/2" X 18" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

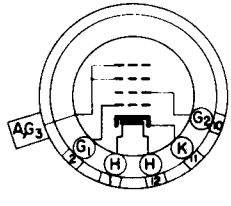
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.) **22AP4A**	66	PERCENT

MECHANICAL DATA

OVERALL LENGTH	22 7/8 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	21 11/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIAMETER	20 1/4	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
ANODE
GRID NO. 3

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[A]:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	140	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	140	VOLTS

[A] THE CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	117	MA.
ION TRAP MAGNET (RATED STRENGTH) APPROX.	35	GAUSSES

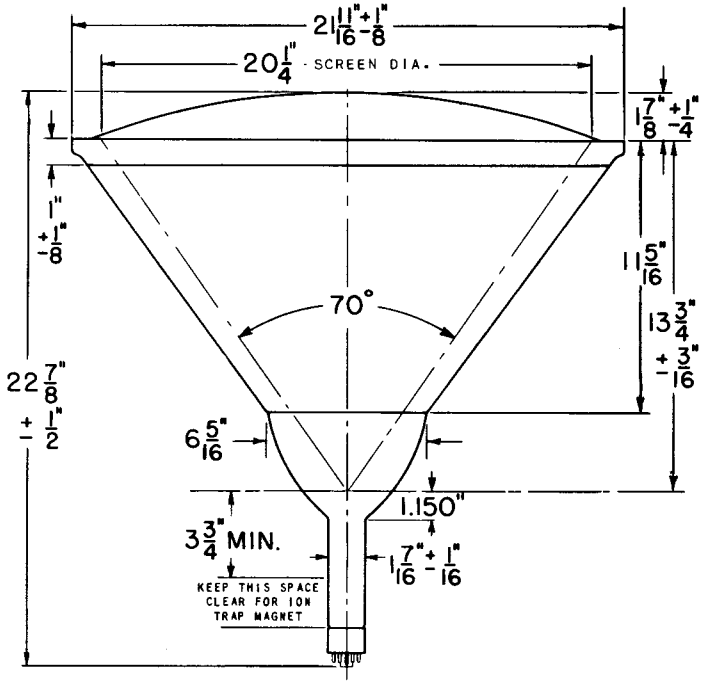
[B] FOR VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 25 FOOT LAMBERTS ON A 18" BY 13 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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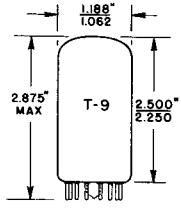
DIODE
COMPACTRON



GLASS BULB

BUTTON 12 PIN
BASE E12-70
OUTLINE DRAWING
JEDEC 9-60

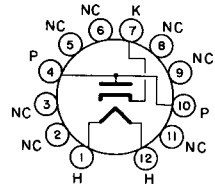
FOR

TV DAMPING

DIODE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12BL

SOCKET TERMINALS 3, 6, 7, AND 10 SHOULD NOT BE USED AS THE POINTS

THE 22BW3 IS A HEATER-CATHODE TYPE DIODE IN THE T-9 COMPACTRON CONSTRUCTION. IT IS INTENDED FOR SERVICE AS THE DAMPING DIODE IN THE HORIZONTAL DEFLECTION CIRCUIT OF TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P + H)	8.5	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	6.0	pf
HEATER TO CATHODE: H TO K	3.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	22.4	VOLTS	450	MA.
HEATER WARM-UP TIME		Approx.	11	SECONDS
LIMITS OF SUPPLIED CURRENT	450 ± 30			MA.
HEATER-CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT			100	VOLTS
TOTAL DC AND PEAK			300	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT			900	VOLTS
TOTAL DC AND PEAK			5000	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

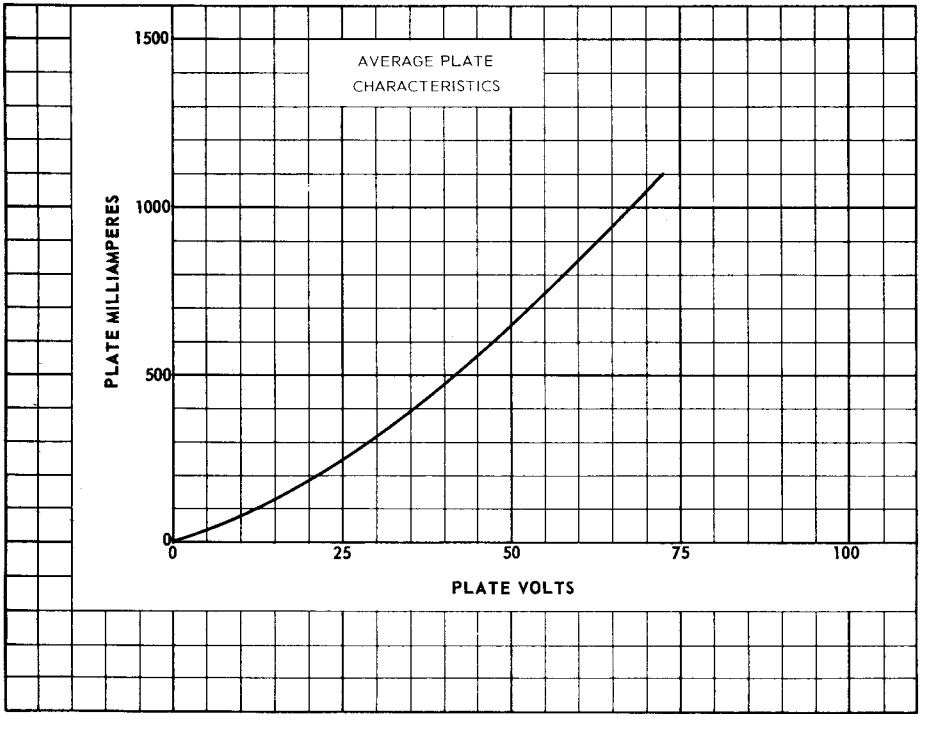
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	5,000	VOLTS
PLATE DISSIPATION	6.5	WATTS
STEADY - STATE PEAK PLATE CURRENT	1,100	MA.
DC OUTPUT CURRENT	175	MA.

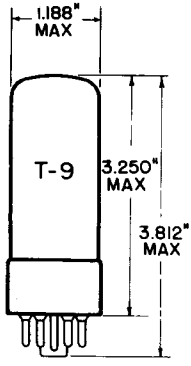
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP FOR I_b = 350 MADC	32	VOLTS



TUNG-SOL

HALF-WAVE VACUUM RECTIFIER



GLASS BULB
JEDEC GROUP 1 B5-85
SHORT
INTERMEDIATE-SHELL
5 PIN OCTAL
WITH EXTERNAL BARRIERS

PINS 1, 4, & 6 ARE OMITTED

OUTLINE DRAWING
JEDEC 9-44

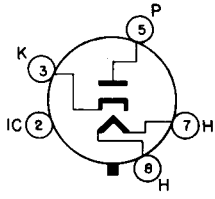
UNIPOTENTIAL CATHODE

HEATER

22.4 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 4CG

THE 22DE4 IS A HALF-WAVE VACUUM RECTIFIER OF THE GLASS-OCTAL TYPE. IT IS DESIGNED SPECIFICALLY FOR USE AS A DAMPER DIODE IN HORIZONTAL-DEFLECTION CIRCUITS OF BLACK-AND-WHITE TELEVISION RECEIVERS.

EXCEPT FOR HEATER RATINGS AND HEATER WARM-UP TIME, THE 22DE4 IS IDENTICAL TO THE 6DE4 AND 17DE4.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

PLATE TO HEATER AND CATHODE	8.5	μμf
CATHODE TO HEATER AND PLATE	11.5	μμf
HEATER TO CATHODE	4	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

DAMPER SERVICE

MAXIMUM PEAK INVERSE PLATE VOLTAGE	→ 5500[A]	VOLTS
MAXIMUM PEAK PLATE CURRENT	1100	MA.
MAXIMUM DC PLATE CURRENT	→ 180	MA.
MAXIMUM PLATE DISSIPATION	6.5	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	→ 5500[B]	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	300[C]	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

→ INDICATES A CHANGE.

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TUNG-SOL

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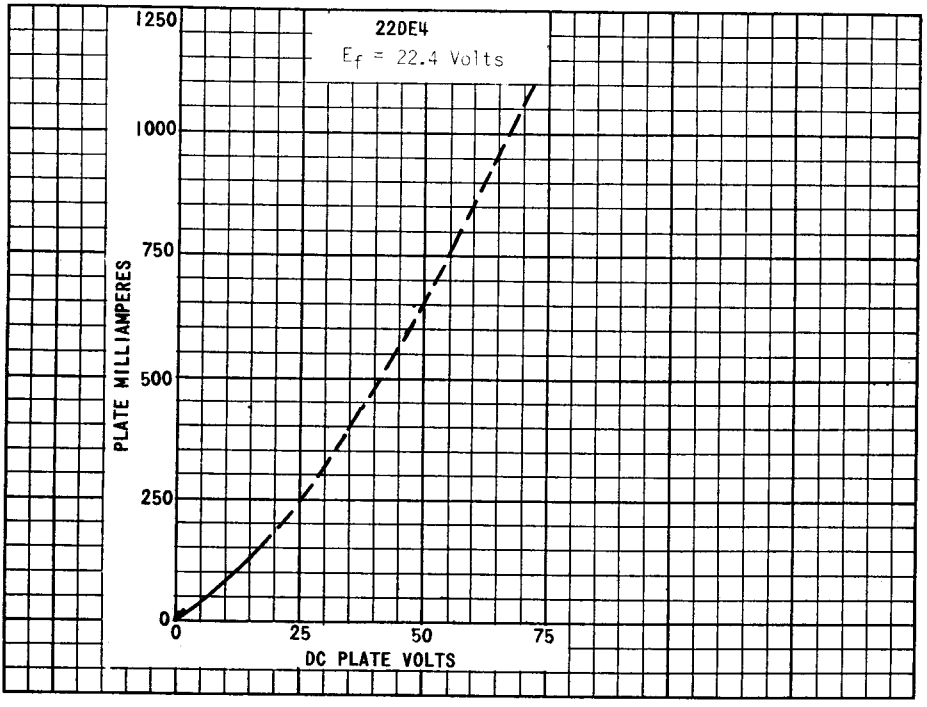
NOTES

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] THE DC COMPONENT MUST NOT EXCEED 900 VOLTS.

[C] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.



TUNG-SOL

CATHODE RAY

THE 24ADP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GRAY FILTER FACEPLATE	**ALUMINIZED SCREEN**
MAGNETIC FOCUS AND DEFLECTION	**UNIPOTENTIAL CATHODE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL CONDUCTIVE COATING**
21 7/16" X 16 7/8" RASTER SIZE	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	2000	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE	SHORT TO MEDIUM	
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	75	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±5%	AMP.
MAXIMUM DC ANODE VOLTAGE	24 200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	660	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	155	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	450	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	18 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	125 ±15%	MA.
DC ION TRAP MAGNET STANDARD COIL #117 (APPROX.)	32	MA.
DC ION TRAP MAGNET RATED STRENGTH	36	GAUSSES

[A] VISUAL EXTINCTION OF FOCUSED RASTER.

*HEATER WARM-UP TIME IS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TERMINALS TO INCREASE TO 5.0 VOLTS IN THE JETEC TEST CIRCUIT, WITH E=25 VOLTS AND SERIES R=31.5 OHMS.

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TUNG-SOL

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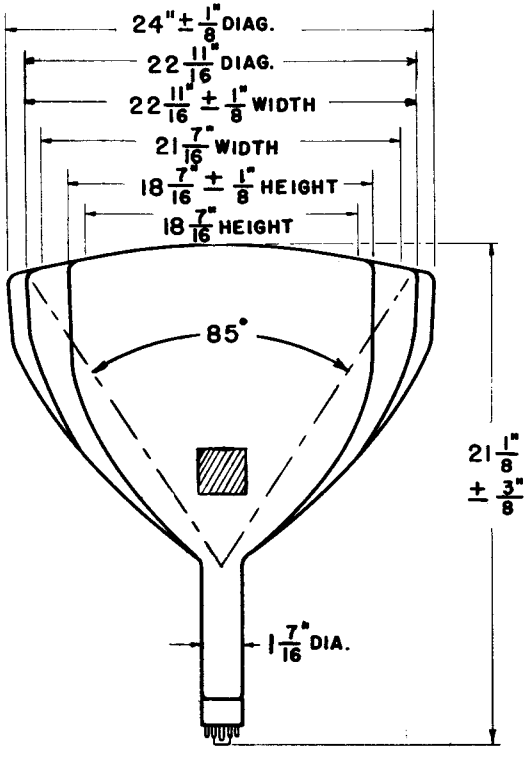
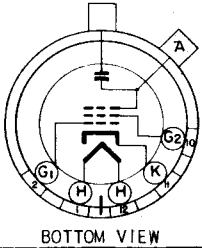
MECHANICAL DATA

OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24 ± 1/8	INCHES
WIDTH	22 11/16 ± 1/8	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	22 11/16	INCHES
WIDTH	21 7/16	INCHES
HEIGHT	18 7/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N
BULB CONTACT ALIGNMENT		
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES		



PIN CONNECTIONS



BOTTOM VIEW

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 10 – GRID #2
PIN 11 – CATHODE

PIN 12 – HEATER
ANODE CAP:
GRID NO.3

TUNG-SOL

CATHODE RAY

THE 24AP4, 24AP4A AND 24AP4B ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* FOR THE ALUMINIZED SCREEN ON THE 24AP4A AND THE FACEPLATE TREATED TO ELIMINATE SPECULAR REFLECTION ON THE 24AP4B. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
ROUND METAL CONSTRUCTION
MAGNETIC FOCUS & DEFLECTION
GREY FILTER FACEPLATE
EXTERNAL SINGLE FIELD ION TRAP
16 9/16" X 22 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

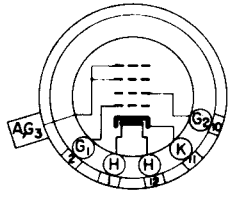
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	62	PERCENT

MECHANICAL DATA

OVERALL LENGTH	23 15/16 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	24 ± 1/4	INCHES
MINIMUM USEFUL SCREEN DIAMETER	22 1/8	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
ANODE
GRID NO. 3

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TUNG-SOL

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE[A]	16 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[B]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

[A] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO AVERT POSSIBLE DANGER FROM PROLONGED EXPOSURE AT CLOSE RANGE.

[B] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

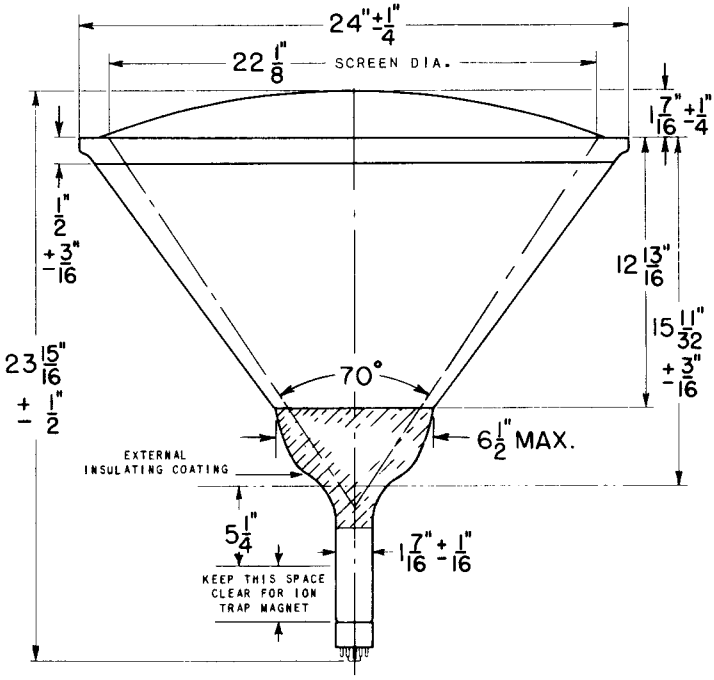
DC ANODE, GRID #3 VOLTAGE	15 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)	114	MA.
ION TRAP (RATED STRENGTH) APPROX.	36	GAUSSES

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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CATHODE RAY

THE 24BP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS	**MAGNETIC DEFLECTION**
GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
ROUND METAL CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	70	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

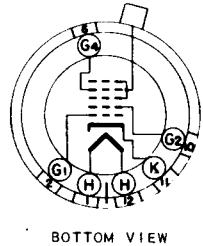
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	62	PERCENT

MECHANICAL DATA

OVERALL LENGTH	24 1/4 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	24	INCHES
MINIMUM USEFUL SCREEN DIAMETER	22 1/4	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3,
GRID NO. 5,
COLLECTOR

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	16 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE RANGE (FOCUSING ELECTRODE)	−64 TO 350	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[A]	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] FOCUS ELECTRODE MAY BE MODULATED TO IMPROVE OVERALL FOCUS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	12 000	VOLTS
DC GRID #4 VOLTAGE RANGE[B]	−48 TO 260	VOLTS
DC GRID #4 CURRENT	−15 TO +25	μA.
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	−33 TO −77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75	MA.

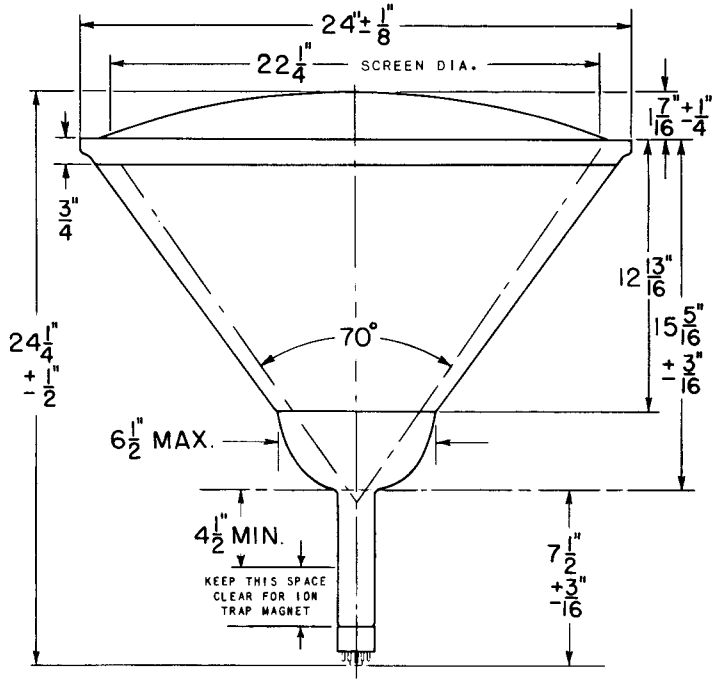
[B] MEASURED AT 100 uA. ANODE CURRENT AND EQUAL VERTICAL AND HORIZONTAL RESOLUTION.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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CATHODE RAY

THE 24CP4 AND 24CP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 24CP4A HAS AN ALUMINIZED SCREEN. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**SPHERICAL FACEPLATE**
GREY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
MAGNETIC FOCUS AND DEFLECTION	**16 1/4" X 21 1/4" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
DIAGONAL	90	DEGREES
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	73	PERCENT

MECHANICAL DATA

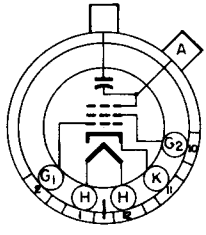
OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24 ± 1/8	INCHES
WIDTH	22 11/16	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	21 1/4	INCHES
HEIGHT	16 1/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[A]:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	18 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[C]	115 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	100 ± 50%	MA.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 21 1/4" BY 16 3/4" PICTURE SIZE, DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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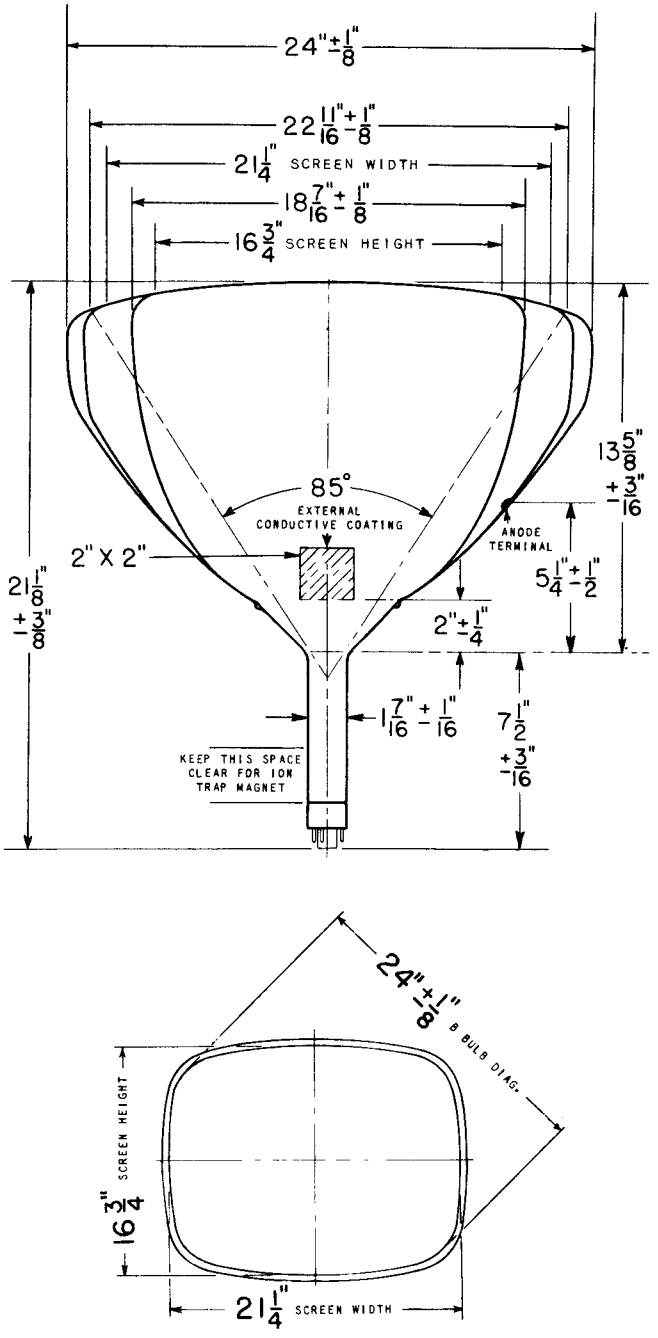

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CATHODE RAY

THE 24DP4 AND 24DP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 24DP4A HAS AN ALUMINIZED SCREEN. THEIR COMMON FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**
SPHERICAL FACEPLATE — **UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
21 7/8" X 16 7/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	73	PERCENT

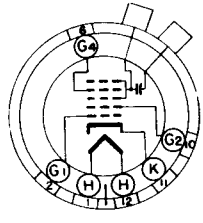
MECHANICAL DATA

OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24	INCHES
WIDTH	22 11/16	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	21 7/8	INCHES
HEIGHT	16 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE:	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	18 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC GRID #4 VOLTAGE	-72 TO +400	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	100 ± 50%	MA.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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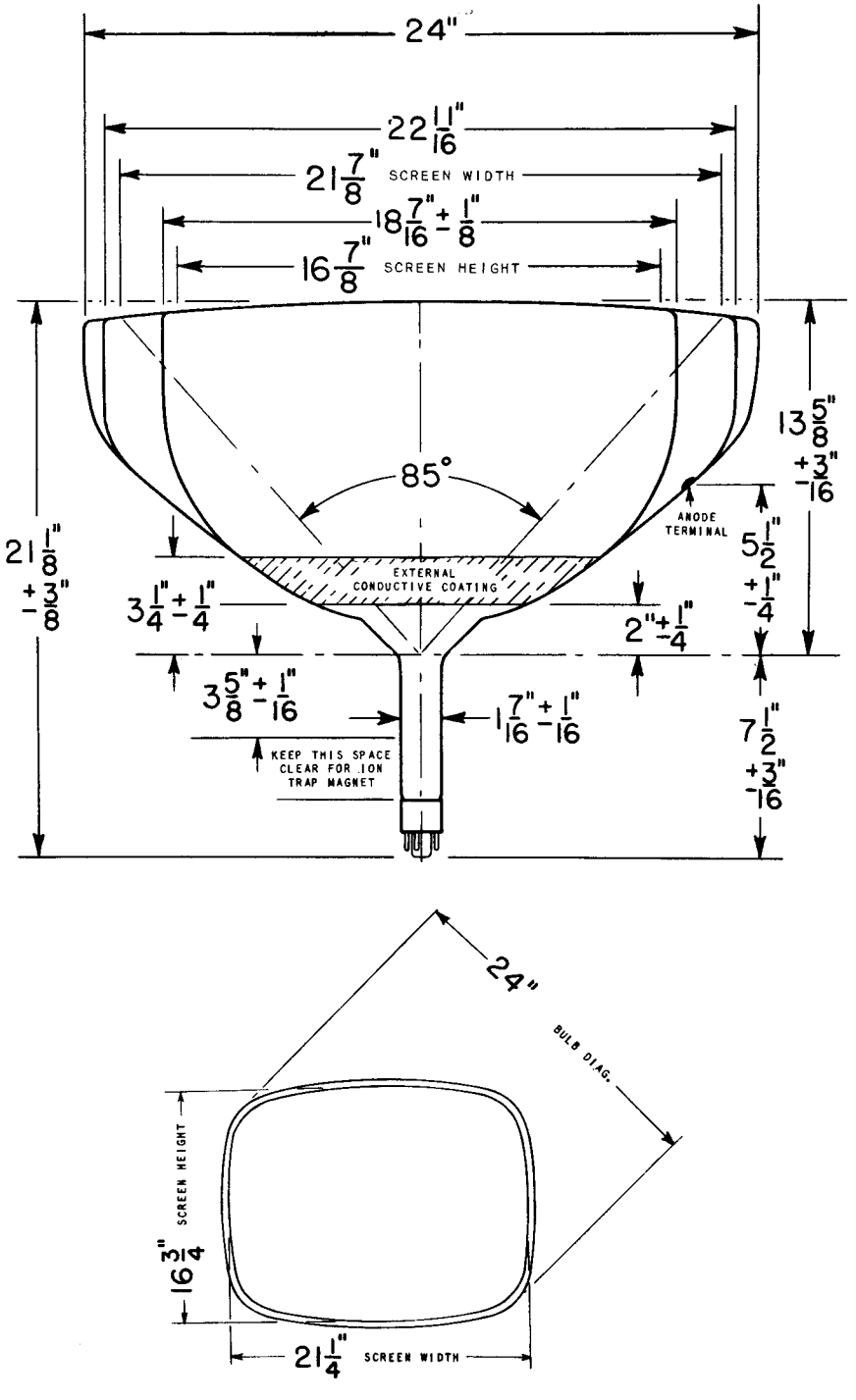

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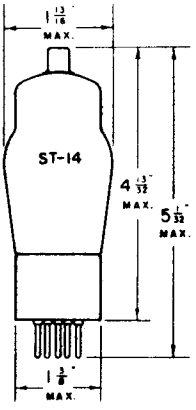


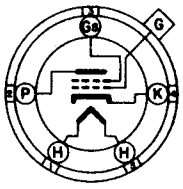
TETRODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 1.75 AMPERES
AC OR DC

GLASS BULB

MEDIUM 5 PIN BASE



5E

BOTTOM VIEW

THE TUNG-SOL 24 IS A SCREEN-GRID AMPLIFIER EMPLOYED PRIMARILY IN RF APPLICATIONS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE [A]	180	250	VOLTS
SCREEN VOLTAGE MAX.	90	90	VOLTS
CONTROL GRID VOLTAGE	-3	-3	VOLTS
PLATE CURRENT	4	4	MA.
SCREEN CURRENT	1.7	1.7	MA.
PLATE RESISTANCE	0.4	0.6	MEGOHM
TRANSCONDUCTANCE	1000	1050	μMHOS
AMPLIFICATION FACTOR	400	630	

[A] MAXIMUM PLATE V. = 275 V.

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	5.3	μμf
PLATE TO CATHODE	10.5	μμf
CONTROL GRID TO PLATE [S]	.007 MAX.	μμf

[S] WITH SHIELD

PLATE 543-2

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CATHODE RAY

THE 24QP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

SPHERICAL FACEPLATE	**UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
MAGNETIC FOCUS & DEFLECTION	**21 7/8" X 16 7/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	72	PERCENT

MECHANICAL DATA

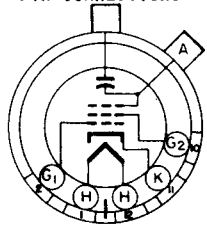
OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24 ± 3/16	INCHES
WIDTH	22 11/16 ± 1/8	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	21 7/8	INCHES
HEIGHT	16 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] BECAUSE THE RATING OF THIS TUBE PERMITS ANODE VOLTAGES AS HIGH AS 19.8KV, SHIELDING OF X-RAY RADIATION FROM THE TUBE MAY BE NECESSARY. THIS PRECAUTION SHOULD BE OBSERVED WHEN THE ANODE IS OPERATED IN EXCESS OF 16KV.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	100 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	100 ± 50%	MA.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 21 7/8" BY 16 7/8" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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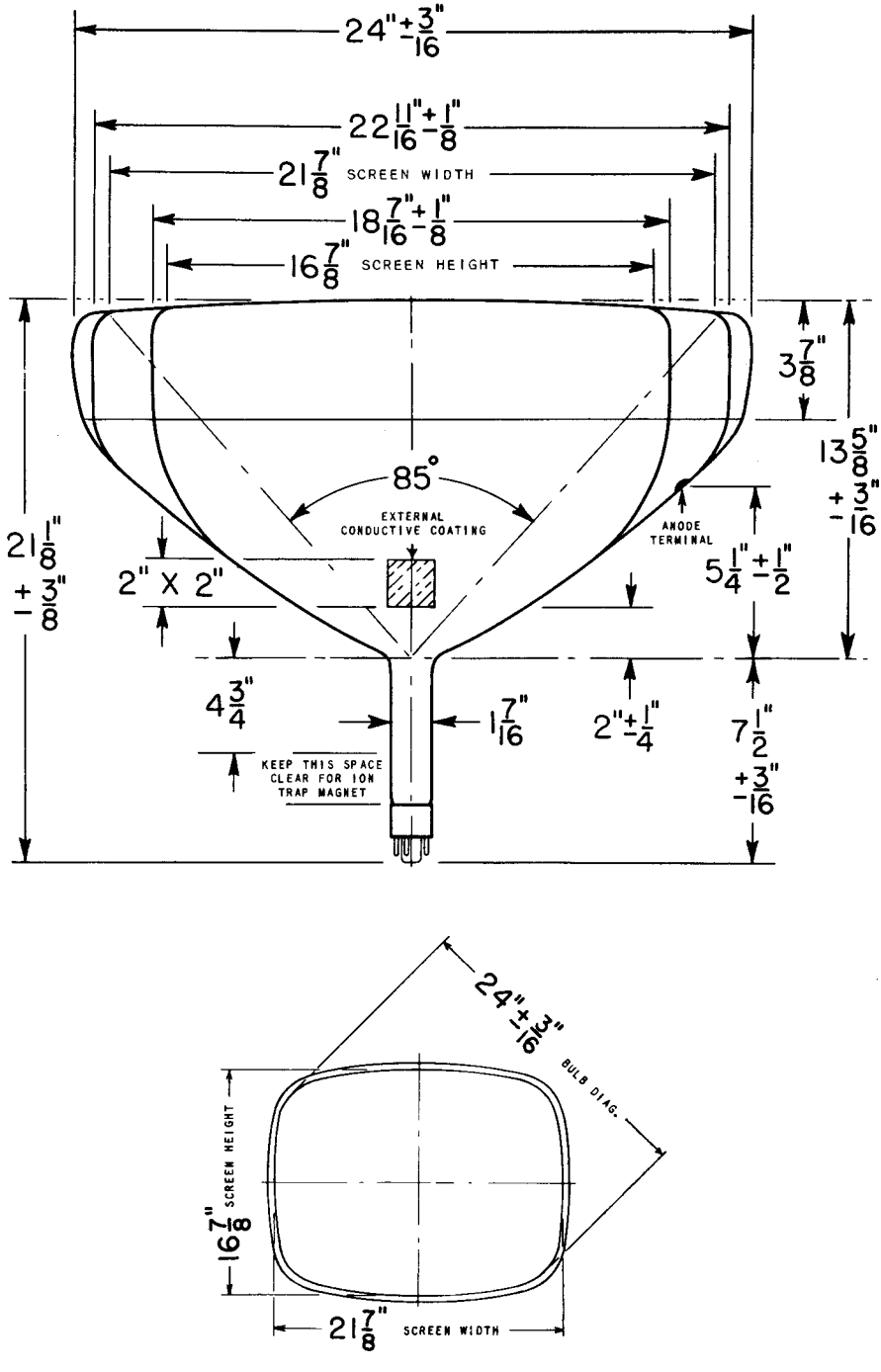

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CATHODE RAY

THE 24TP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

SPHERICAL FACEPLATE
ALUMINIZED FACEPLATE
MAGNETIC FOCUS & DEFLECTION
RECTANGULAR GLASS CONSTRUCTION
UNIPOTENTIAL CATHODE
GREY FILTER FACEPLATE
EXTERNAL CONDUCTIVE COATING
EXTERNAL SINGLE FIELD ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTING ANGLE (APPROX.) DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	250	μμf

OPTICAL DATA

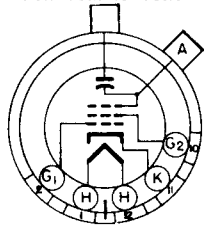
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	72	PERCENT

MECHANICAL DATA

OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24	INCHES
WIDTH	22 11/16	INCHES
HEIGHT	18 7/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	21 7/16	INCHES
HEIGHT	17 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	14 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[B] (APPROX.)	110 ± 10	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	85 ± 50%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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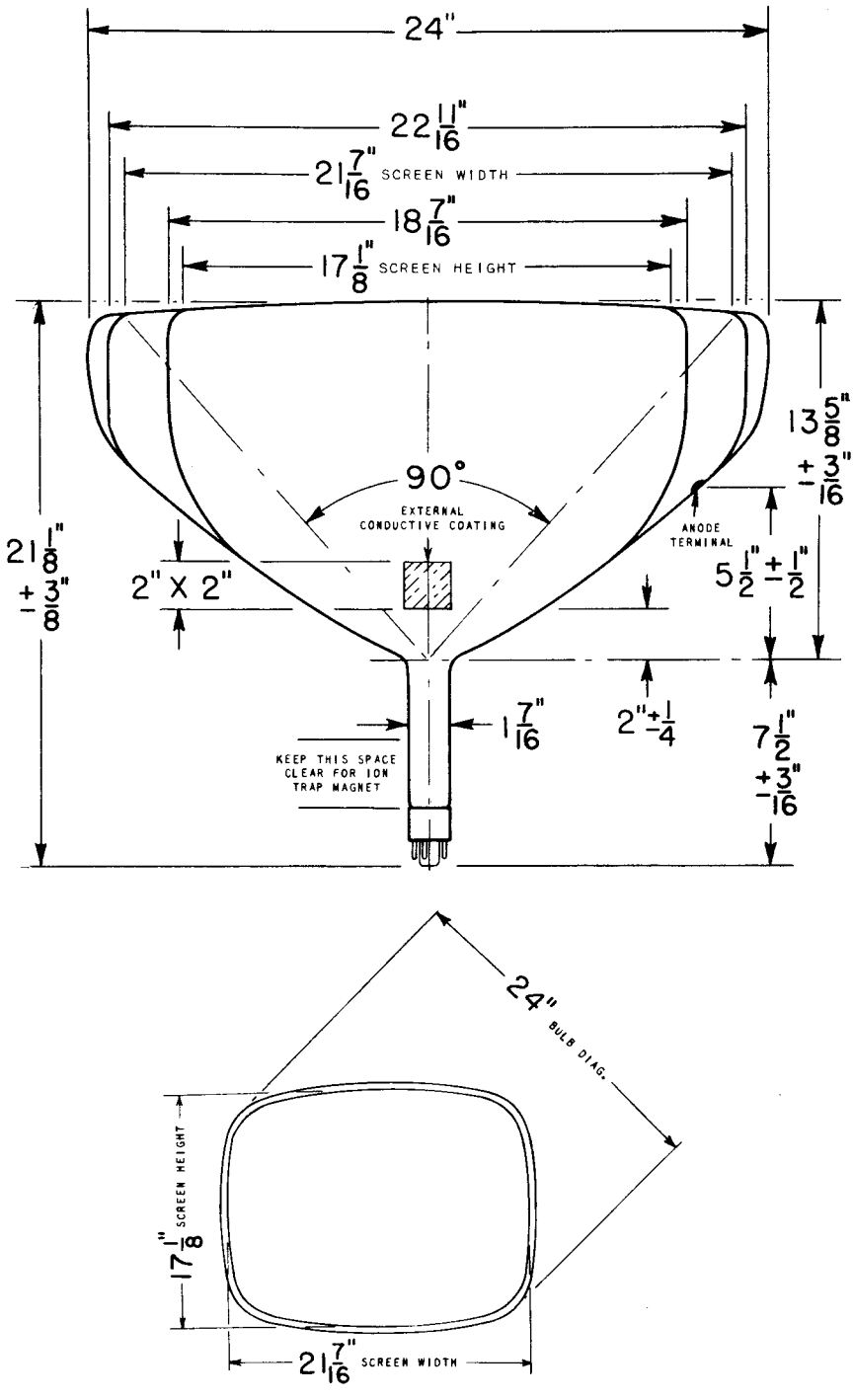

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CATHODE RAY

THE 24VP4 AND 24VP4A ARE DIRECT-VIEW PICTURE TUBES DESIGNED FOR USE IN TELEVISION APPLICATIONS. THEY ARE IDENTICAL *EXCEPT* THAT THE 24VP4A HAS AN ALUMINIZED SCREEN. THEIR COMMON FEATURES INCLUDE:

UNIPOTENTIAL CATHODE	**GREY FILTER FACEPLATE**
EXTERNAL CONDUCTIVE COATING	**21 3/8" X 16 1/6" RASTER SIZE**
MAGNETIC FOCUS AND DEFLECTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	87	DEGREES
VERTICAL	73	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	68	PERCENT

MECHANICAL DATA

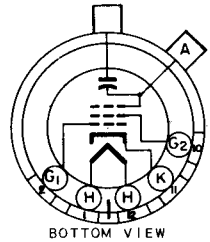
OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24 ± 1/8	INCHES
WIDTH	22 43/64 ± 1/8	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	22 13/16	INCHES
WIDTH	21 3/8	INCHES
HEIGHT	16 1/16	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE	22 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	600	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[A]	20 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	125	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	135	MA.

[A] WHEN THE TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 20,000 VOLTS PEAK, THE STORED ENERGY IN THE HIGH VOLTAGE CIRCUIT WILL BE OVER THE MAXIMUM PERMITTED BY THE UNDERWRITERS LABORATORY. THIS CONDITION WILL REQUIRE THAT PROVISION BE MADE FOR GROUNDING THE HIGH VOLTAGE SUPPLY WHEN THE BACK OF THE SET IS REMOVED FOR MAINTENANCE PURPOSES.

[B] FOR VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 21 3/8" BY 16 1/16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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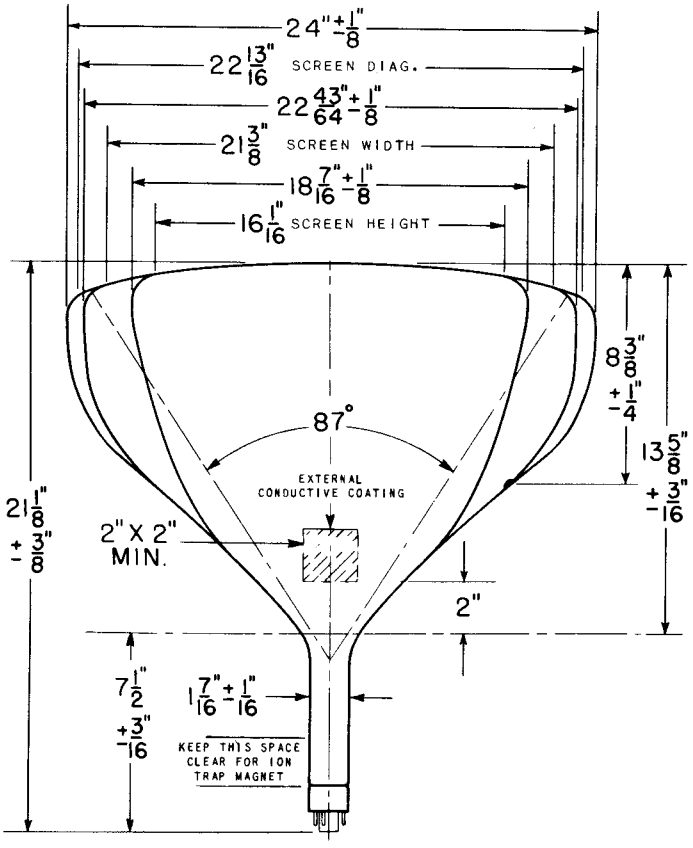

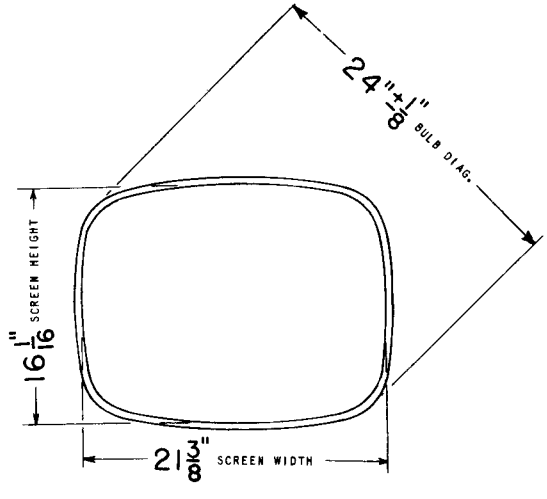

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CATHODE RAY

THE 24XP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

UNIPOTENTIAL CATHODE
RECTANGULAR GLASS
16 3/4" X 21 1/4" RASTER SIZE
GREY FILTER FACEPLATE
EXTERNAL SINGLE FIELD ION TRAP
MAGNETIC FOCUS & DEFLECTION

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

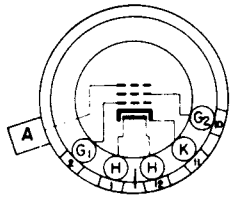
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	68	PERCENT

MECHANICAL DATA

OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24 ± 3/16	INCHES
WIDTH	22 11/16 ± 3/16	INCHES
HEIGHT	18 7/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	21 1/4	INCHES
HEIGHT	16 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	18 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[A]	-28 TO -72	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[B]	125 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #117 (APPROX.)	35 ± 40%	MA.

[A] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[B] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 21 1/4" BY 16 3/4" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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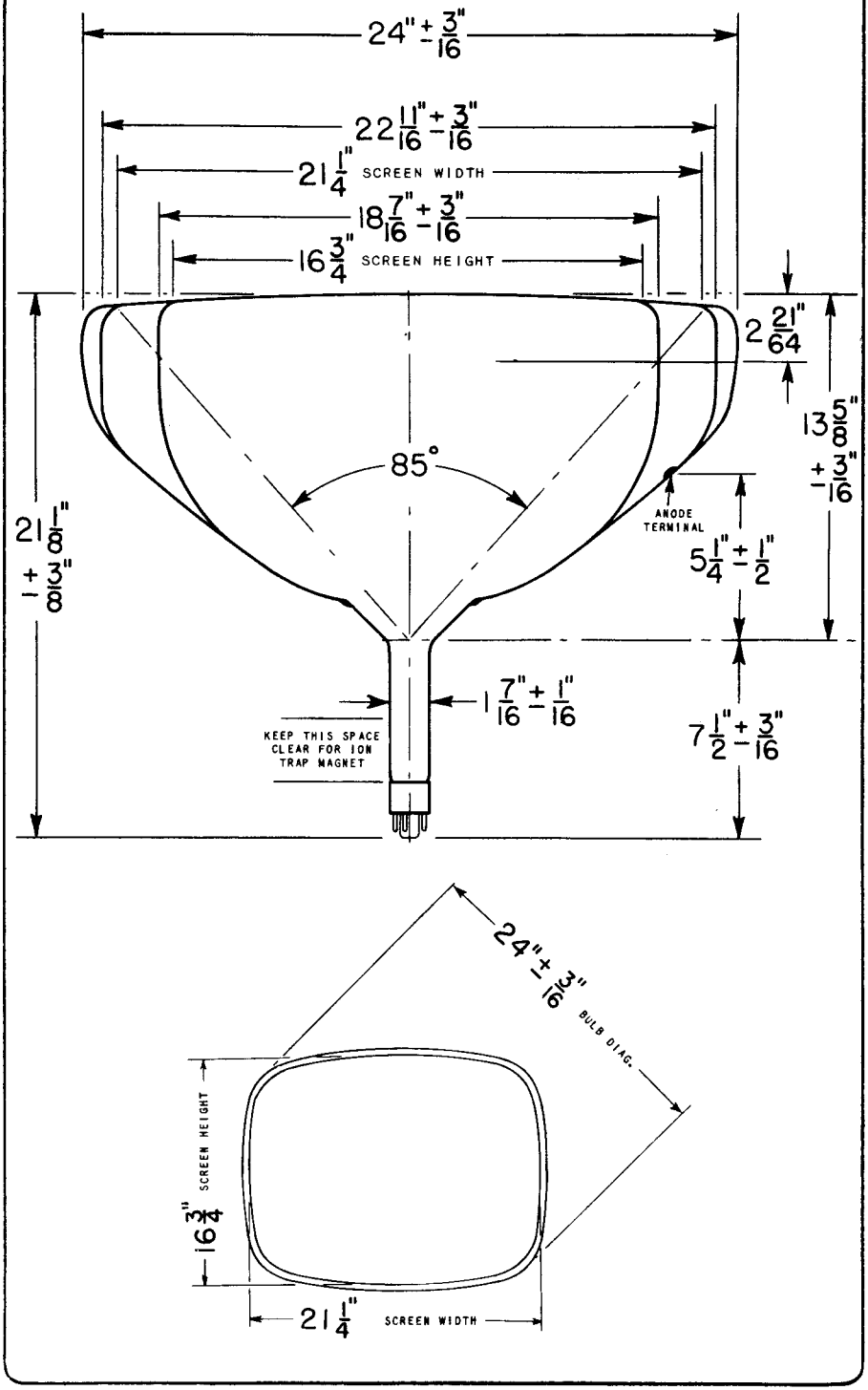

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CATHODE RAY

THE 24YP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

SPHERICAL FACEPLATE	**ALUMINIZED SCREEN**
UNIPOTENTIAL CATHODE	**MAGNETIC DEFLECTION**
EXTERNAL CONDUCTIVE COATING	**GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION	**16 7/8" X 21 7/8" RASTER SIZE**
LOW VOLTAGE ELECTROSTATIC FOCUS	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	68	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 500	$\mu\mu f$
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	1 200	$\mu\mu f$

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE TRANSMISSION AT CENTER (APPROX.)	73	PERCENT

RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	18 000	VOLTS
DC GRID #4 VOLTAGE	-72 TO +400	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC ION TRAP MAGNET STANDARD COIL #111 (APPROX.)	100 ± 50%	MA.

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

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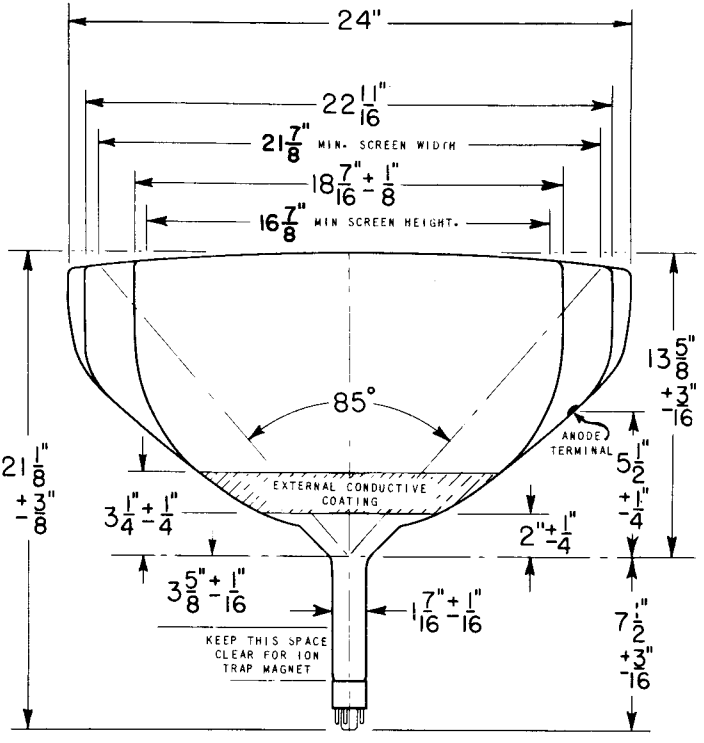
CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

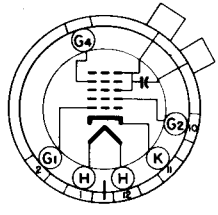
OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24	INCHES
WIDTH	22 11/16	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	21 7/8	INCHES
HEIGHT	16 7/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP:
GRID #3

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CATHODE RAY

THE 24ZP4 IS A DIRECT VIEW PICTURE TUBE DESIGNED FOR TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN	**ELECTROSTATIC FOCUS**
MAGNETIC DEFLECTION	**UNIPOTENTIAL CATHODE**
GRAY FILTER FACEPLATE	**21 1/4" X 16 3/4" RASTER SIZE**
EXTERNAL CONDUCTIVE COATING	**RECTANGULAR GLASS CONSTRUCTION**

DOES NOT REQUIRE ION TRAP

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	70	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu$f
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu$f
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	$\mu\mu$f
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	$\mu\mu$f

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE TRANSMISSION AT CENTER (APPROX.):	68	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6 ±10%	AMP.
MAXIMUM DC ANODE VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE	-500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE[B]	16 000	VOLTS
DC GRID #4 VOLTAGE	0 TO 500	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-28 TO -72	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MIDTAP OF THE HEATER TRANSFORMER WINDING.

[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, THE ANODE VOLTAGE SHOULD NOT BE LESS THAN 14,000 VOLTS.

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

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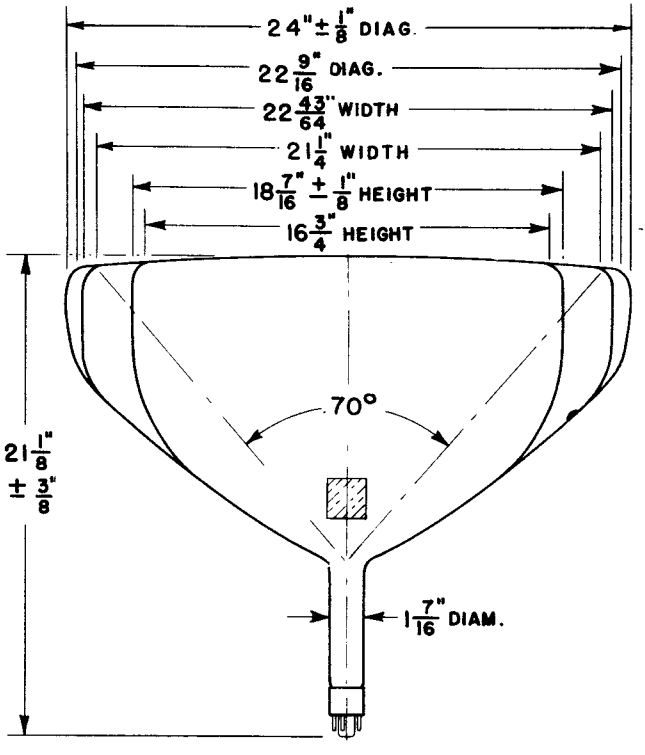
CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

OVERALL LENGTH	21 1/8 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	24 ± 1/8	INCHES
WIDTH	22 43/64 ± 1/8	INCHES
HEIGHT	18 7/16 ± 1/8	INCHES
MIN. USEFUL SCREEN DIMENSIONS:		
DIAGONAL	22 9/16	INCHES
WIDTH	21 1/4	INCHES
HEIGHT	16 3/4	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

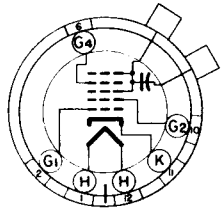
BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES



PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID #1
PIN 6 – GRID #4
PIN 10 – GRID #2
PIN 11 – CATHODE



BOTTOM VIEW

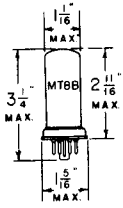
PIN 12 – HEATER-ANODE CAP:
GRID NO. 3
GRID NO. 5

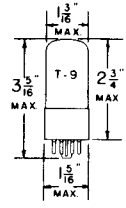
TUNG-SOL

PENTODE POWER AMPLIFIER

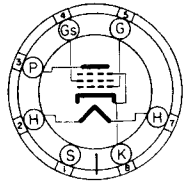
UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC



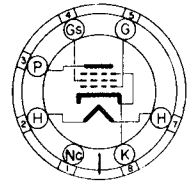


METAL SHELL
SMALL WAFER
7-PIN OCTAL BASE



7S

25A6 BOTTOM VIEW



G-7S

25A6GT/G BOTTOM VIEW

GLASS BULB
INTERMEDIATE
7-PIN OCTAL BASE

THE TUNG-SOL 25A6 AND 25A6GT/G ARE DESIGNED FOR SERVICE IN THE POWER OUTPUT STAGES OF AC – DC RECEIVERS. THE R RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE TYPE 43

RATINGS

MAXIMUM PLATE VOLTAGE	160	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM SCREEN DISSIPATION	1.9	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	95	135	160	VOLTS
SCREEN VOLTAGE	95	135	120	VOLTS
CONTROL GRID VOLTAGE[A]	-15	-20	-18	VOLTS
PEAK AF SIGNAL VOLTAGE	15	20	18	VOLTS
ZERO-SIGNAL PLATE CURRENT	20	37	33	MA.
ZERO-SIGNAL SCREEN CURRENT	4	8	6.5	MA.
MAXIMUM-SIGNAL PLATE CURRENT	22	39	36	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	8	14	12	MA.
PLATE RESISTANCE APPROX.	45000	35000	42000	OHMS
TRANSCONDUCTANCE	2000	2450	2375	μMHOS
LOAD RESISTANCE	4500	4000	5000	OHMS
TOTAL HARMONIC DISTORTION	11	9	10	PER CENT
POWER OUTPUT	0.9	2	2.2	WATTS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF BIAS OPERATION AND 0.1 MEGOHM FOR FIXED BIAS OPERATION.

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PLATE
1056-2

JUNE 6
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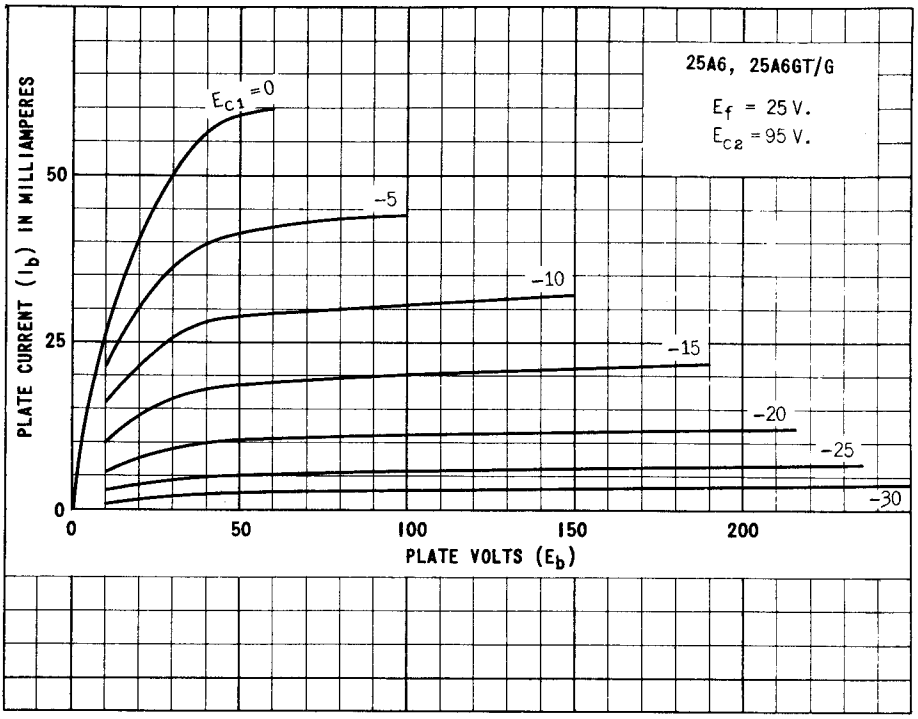
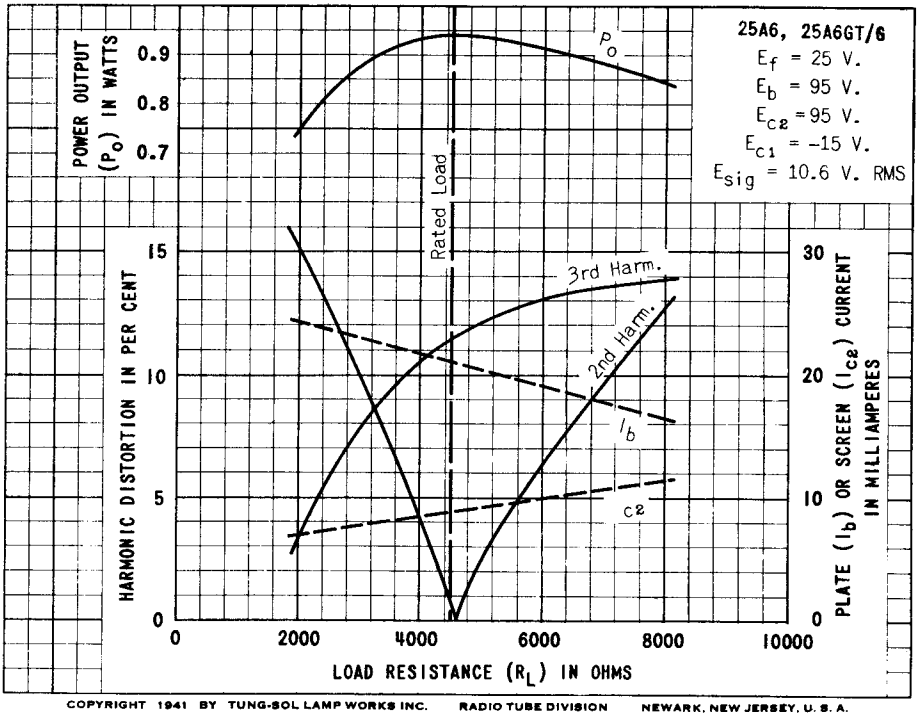
25A6, 25A6GT/G





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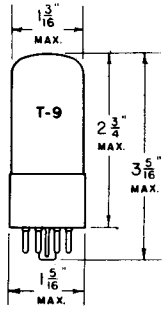

RECTIFIER

PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER

25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

G-8F

BOTTOM VIEW

INTERMEDIATE 8 PIN OCTAL BASE

THE TUNG-SOL 25A7GT/G COMBINES A HALF WAVE RECTIFIER AND A PENTODE POWER AMPLIFIER IN A SINGLE BULB. IT IS DESIGNED FOR SERVICE IN AC–DC OPERATED RECEIVERS.

RATINGS

PENTODE POWER AMPLIFIER UNIT

MAXIMUM PLATE VOLTAGE	117	VOLTS
MAXIMUM SCREEN VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	2.25	WATTS
MAXIMUM SCREEN DISSIPATION	0.8	WATT

RATINGS

RECTIFIER UNIT

MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	175	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	350	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	450	MA.
TUBE VOLTAGE DROP: MEASURED WITH APPLIED DC AT 150 MA. PLATE CURRENT	23	VOLTS
MAXIMUM DC OUTPUT CURRENT	75	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS

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25A7GT/G

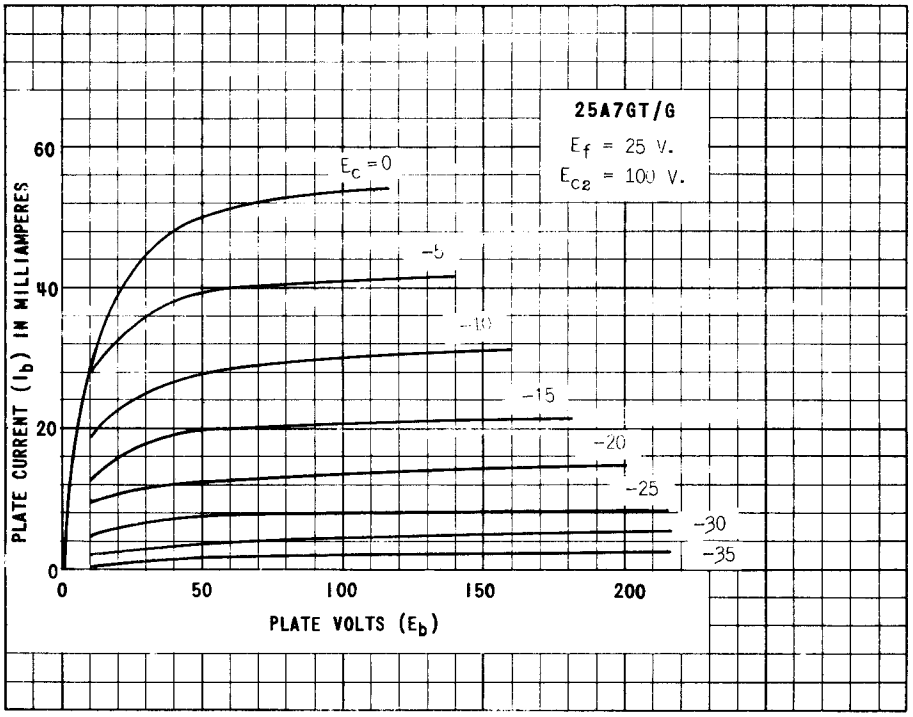
TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE	100	VOLTS
CONTROL GRID VOLTAGE[A]	−15	VOLTS
ZERO-SIGNAL PLATE CURRENT	20.5	MA.
ZERO-SIGNAL SCREEN CURRENT	4	MA.
PLATE RESISTANCE	50 000	OHMS
TRANSCONDUCTANCE	1800	μMHOS
LOAD RESISTANCE	4500	OHMS
TOTAL HARMONIC DISTORTION	9	PER CENT
POWER OUTPUT	0.77	WATT

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF BIAS OPERATION AND 0.1 MEGOHM FOR FIXED BIAS OPERATION.



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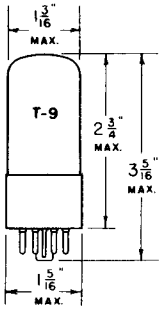
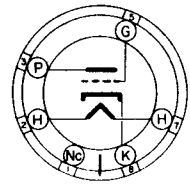


TRIODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



G-6Qa

BOTTOM VIEW

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 25AC5GT/G IS A HIGH-MU POWER OUTPUT TRIODE DESIGNED FOR SERVICE WITH POSITIVE GRID BIAS IN DYNAMIC COUPLED CIRCUITS EMPLOYING A TYPE 6AE5GT/G, TYPE 6P5GT/G, TYPE 76, OR A TYPE 37 AS A DRIVER.

RATINGS

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	110	VOLTS
CONTROL GRID VOLTAGE	+15	VOLTS
PLATE CURRENT	45	MA.
GRID CURRENT	7	MA.
PLATE RESISTANCE	15 200	OHMS
TRANSCONDUCTANCE	3800	μMHOS
AMPLIFICATION FACTOR	58	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DYNAMIC-COUPLED CLASS A1 AMPLIFIER

DRIVER TUBE TYPE	6AE5GT/G	6P5GT/G	37	
PLATE SUPPLY VOLTAGE	110	180	180	VOLTS
CONTROL GRID VOLTAGE	[A]	[A]	[A]	VOLTS
DRIVER GRID RESISTOR MAX.	1.0	1.0	1.0	MEGOHM
POWER TUBE PLATE CURRENT	45	27	37	MA.
DRIVER TUBE PLATE CURRENT	7	4	5.3	MA.
INPUT SIGNAL TO DRIVER VOLTAGE (RMS)[B]	22	12	17	VOLTS
LOAD RESISTANCE	2000	8000	5000	OHMS
TOTAL HARMONIC DISTORTION	10	10	10	PER CENT
POWER OUTPUT	2.0	2.0	2.7	WATTS

[A] BIAS VOLTAGE FOR BOTH THE 25AC5GT/G AND THE DRIVER ARE AUTOMATICALLY DEVELOPED BY THE "DYNAMIC COUPLED" CIRCUIT.

[B] DRIVER GRID CURRENT DOES NOT FLOW DURING ANY PART OF THE INPUT CYCLE.

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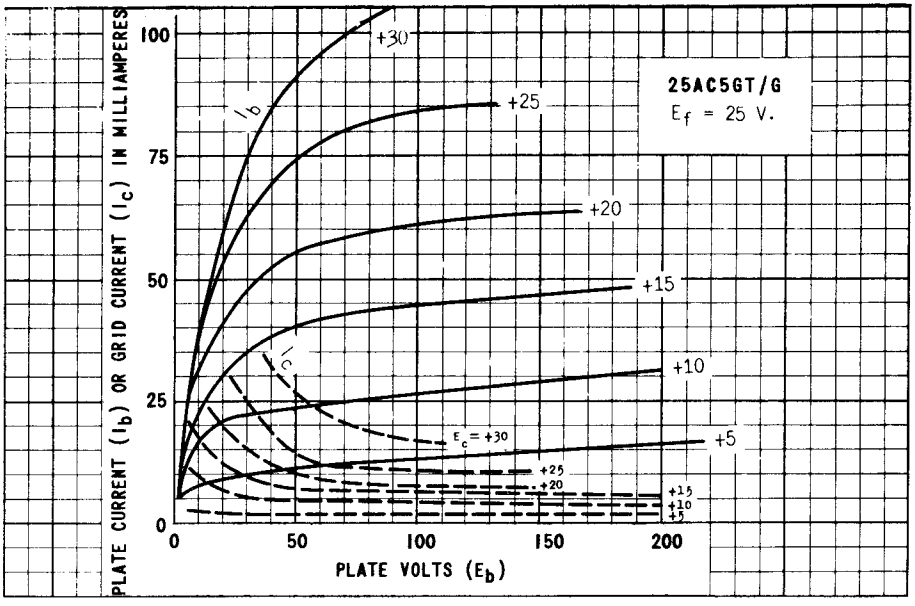
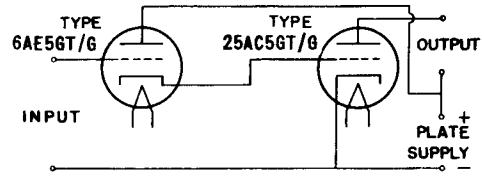
25AC5GT/G





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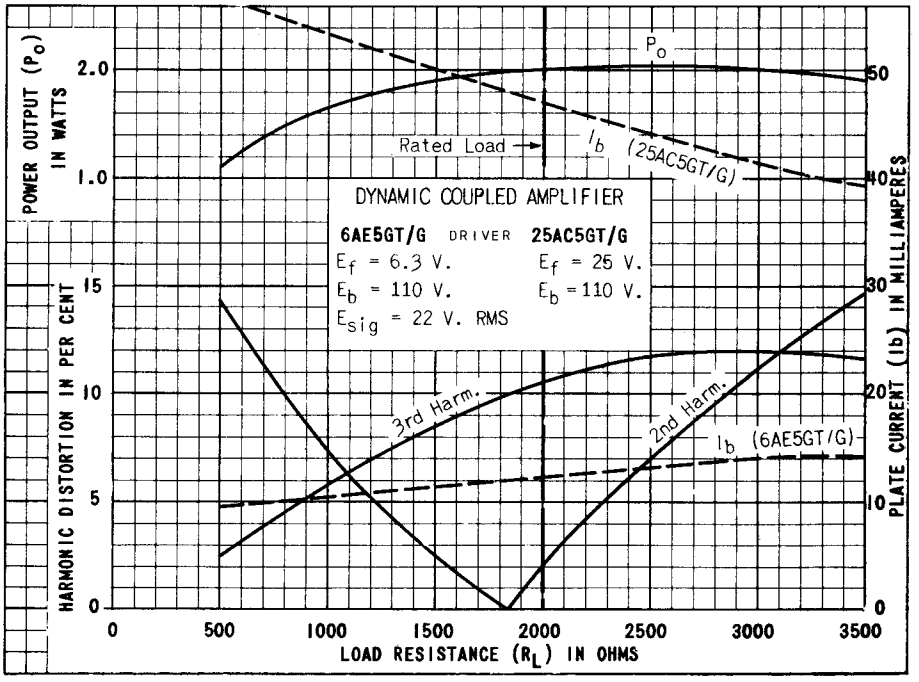

PLATE
1160-1

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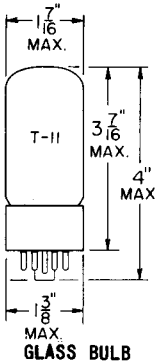
TUNG-SOL

PENTODE



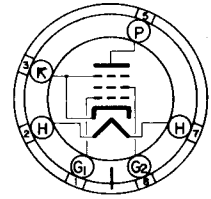
GLASS BULB

THE MAX. DIAMETER OF THE T-12 BULB IS 1 9/16"

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
6 PIN OCTAL
6CK

THE 25AV5GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT USES EITHER A T-11 OR T-12 BULB.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	14	μμf
OUTPUT	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABSOLUTE MAX.)	5 500[C]	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[D]	11	WATTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM DC CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

[C] THIS VALUE MUST NOT BE EXCEEDED.

[D] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATION RESISTANCE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

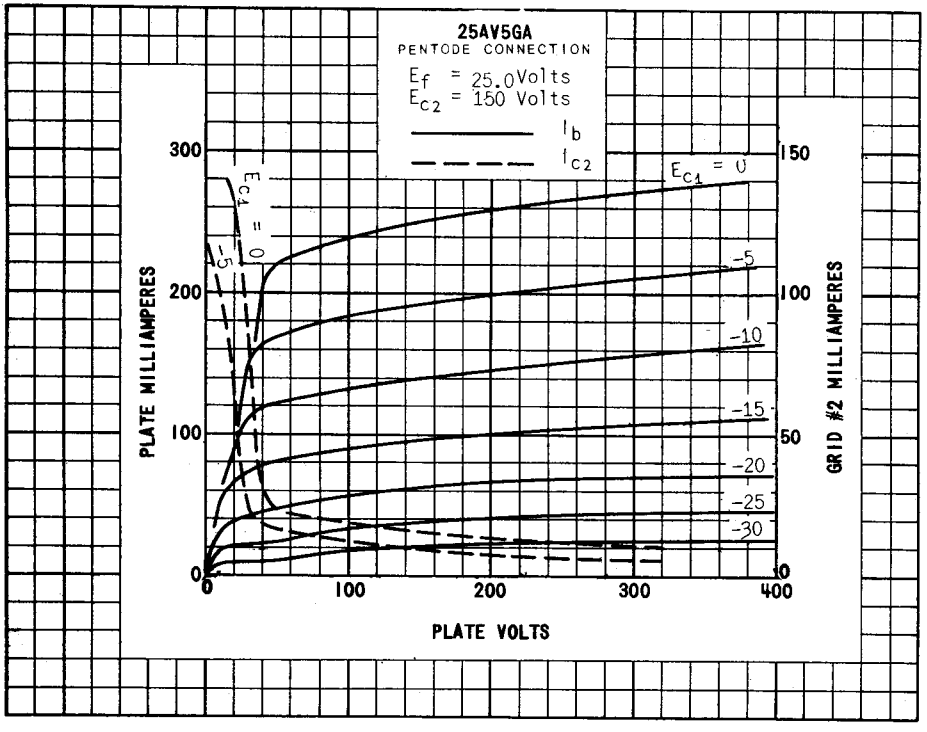
HEATER VOLTAGE	25.0		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	60	250	VOLTS
GRID #2 VOLTAGE	150	150	VOLTS
GRID #1 VOLTAGE	0[E]	-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---	14 500 ←	OHMS
TRANSCONDUCTANCE	---	5 900 ←	μMHOS
PLATE CURRENT	260 ←	57 ←	MA.
GRID #2 CURRENT	26 ←	2.1	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	-43 ←	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	---	4.3	

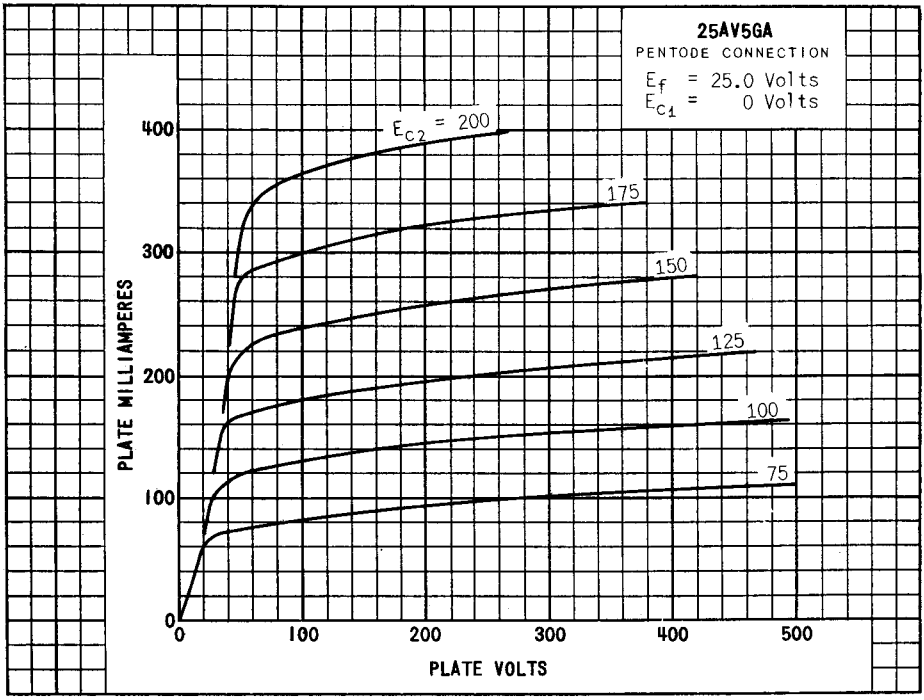
[E] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

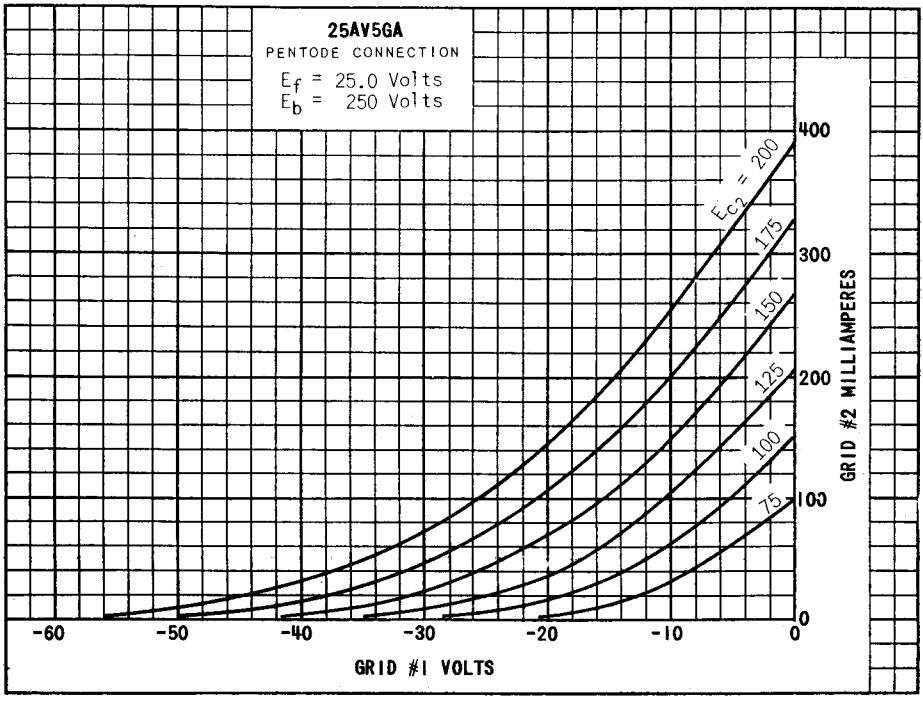
[F] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2}$ = 150 VOLTS AND E_{c1} = -22.5 VOLTS

SIMILAR TYPE REFERENCE: Except for heater characteristics, the 25AV5GA is identical to the 6AV5GA, 12AV5GA & the 17AV5GA.

→ INDICATES A CHANGE.







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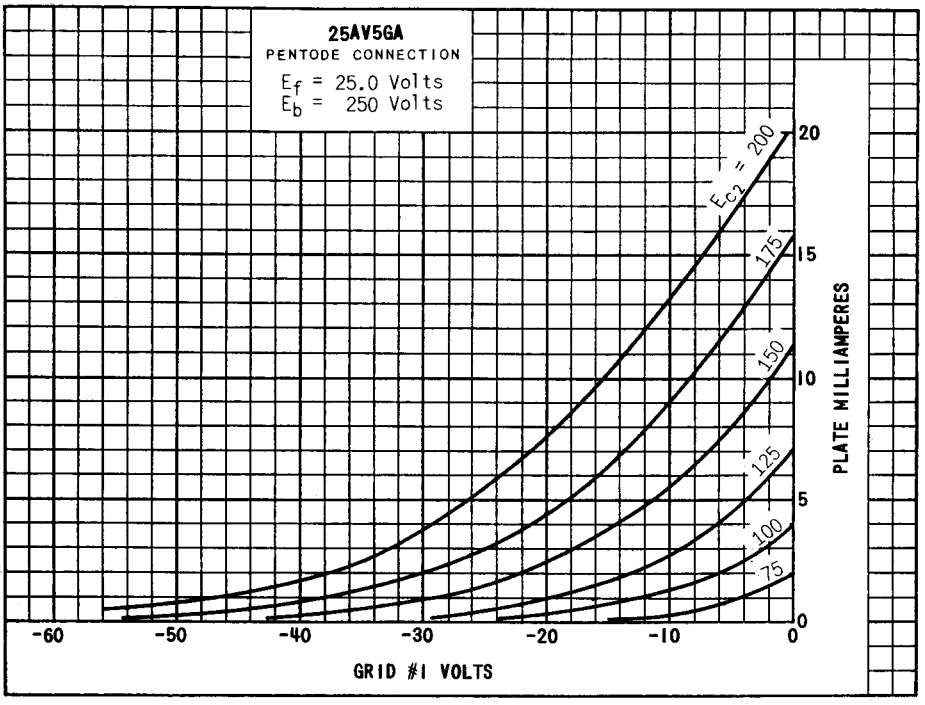
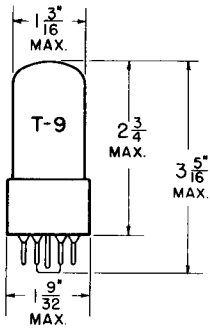
25AV5GA (6AV5GA)



TUNG-SOL

BEAM PENTODE

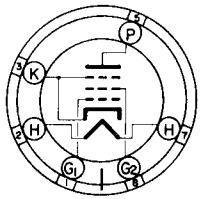


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 300 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL
6CK

THE 25AV5GT IS A BEAM POWER AMPLIFIER INTENDED PRIMARILY FOR OPERATION WITH RELATIVELY LOW SUPPLY VOLTAGE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH-SURGE PLATE VOLTAGES FOR RELATIVELY SHORT PERIODS OF TIME. IT CAN BE USED WITH DIRECT OR WITH TRANSFORMER HORIZONTAL-YOKE DRIVE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	25	VOLTS	
MAXIMUM HEATER-CATHODE VOLTAGE	180	VOLTS	→
MAXIMUM PLATE SUPPLY VOLTAGE	550	VOLTS	→
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE[AB]	5 500	VOLTS	→
MAXIMUM GRID #2 VOLTAGE	200	VOLTS	
MAXIMUM GRID #1 VOLTAGE	-100	VOLTS	→
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE[A]	-400	VOLTS	→
MAXIMUM PLATE DISSIPATION	11	WATTS	
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS	
MAXIMUM PLATE CURRENT	100	MA.	
MAXIMUM GRID #1 CIRCUIT RESISTANCE[C]	1	MEGOHM	

[A] THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND THE DURATION OF THE PULSE MUST BE LIMITED TO 10 MICROSECONDS.

[B] VALUE GIVEN IS TO BE CONSIDERED AS THE ABSOLUTE VOLTAGE BEYOND WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED.

[C] THE USE OF A CATHODE RESISTOR OR OTHER SUITABLE PROTECTIVE DEVICE IS NECESSARY TO PROTECT THE TUBE IN EVENT OF LOSS OF EXCITATION AND CONSEQUENT LOSS OF DEVELOPED BIAS.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE
2542
DEC. 1
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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	300	MA.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
TRANSCONDUCTANCE	5 800	µMHOS
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
GRID #2 TO GRID #1 AMPLIFICATION FACTOR[D]	4.5	

[D] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2} = 150$ VOLTS AND $E_{c1} = -22.5$ VOLTS.

HORIZONTAL DEFLECTION AMPLIFIER

	8AP4A	12KP4A	16KP4	
HEATER VOLTAGE	25	25	25	VOLTS
HEATER CURRENT	300	300	300	MA.
TOTAL PLATE VOLTAGE	240	370	410	VOLTS
PLATE SUPPLY VOLTAGE	150	250	250	VOLTS
BOOST VOLTAGE	90	120	160	VOLTS
GRID #2 SUPPLY VOLTAGE	150	250	—	VOLTS
GRID #2 RESISTOR	1000	10 000	—	OHMS
GRID #2 VOLTAGE	135	165	122	VOLTS
CATHODE BIAS RESISTOR	0	0	0	OHMS
GRID #1 RESISTOR	0.22	0.47	1	MEGOHM
PEAK-TO-PEAK GRID SIGNAL VOLTAGE (APPROX.)	90	90	220	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE (APPROX.)	2.9	3.6	4.3	KV.
PLATE CURRENT	84	89	87	MA.
GRID #2 CURRENT	15	8.5	15	MA.
GRID #1 CURRENT	66	40	64	µA.
PICTURE TUBE ANODE VOLTAGE	8.7[E]	10.8[F]	12.8[F]	KV.
DEFLECTION ANGLE	54	54	65	DEGREES
SWEEP WIDTH	7 3/4	11 1/2	13 1/2	INCHES

[E] MEASURED WITH 75 MICROAMPERES TOTAL PICTURE TUBE DRAIN.

[F] MEASURED WITH 100 MICROAMPERES TOTAL PICTURE TUBE DRAIN.

PLATE 2543
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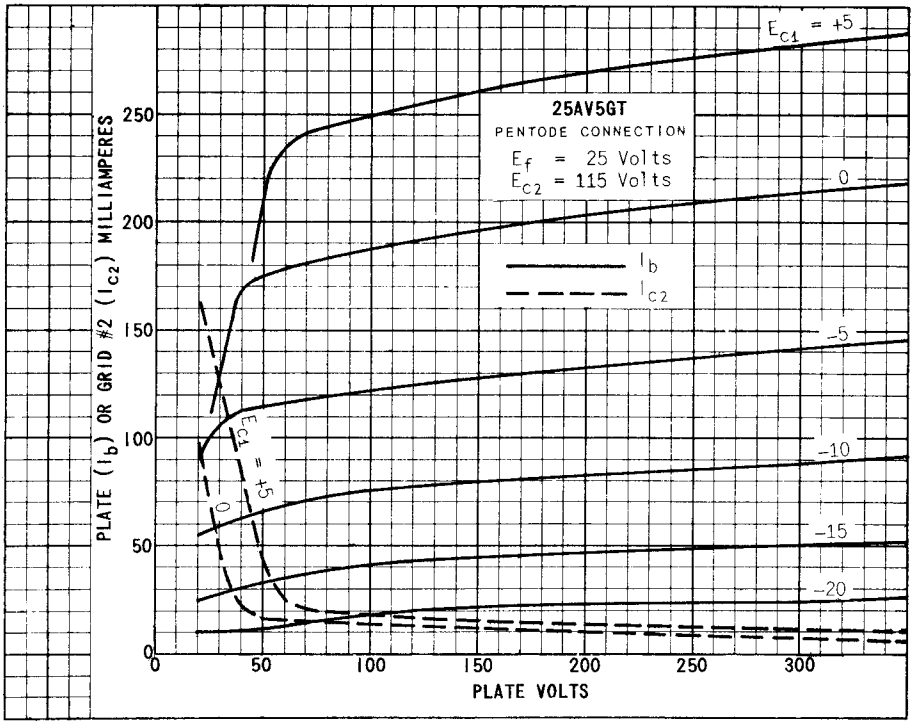

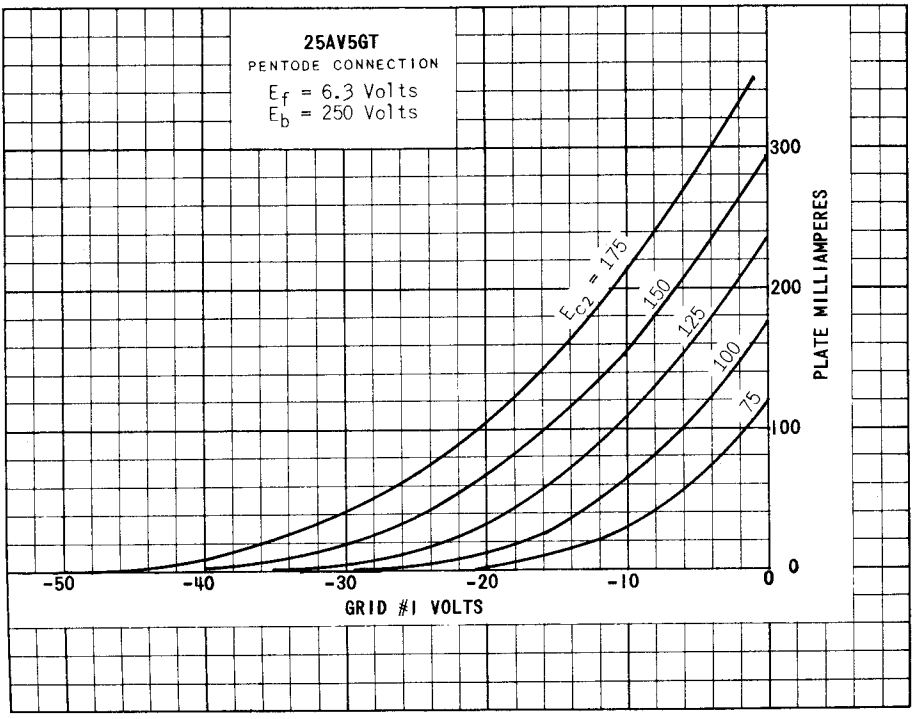

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2544
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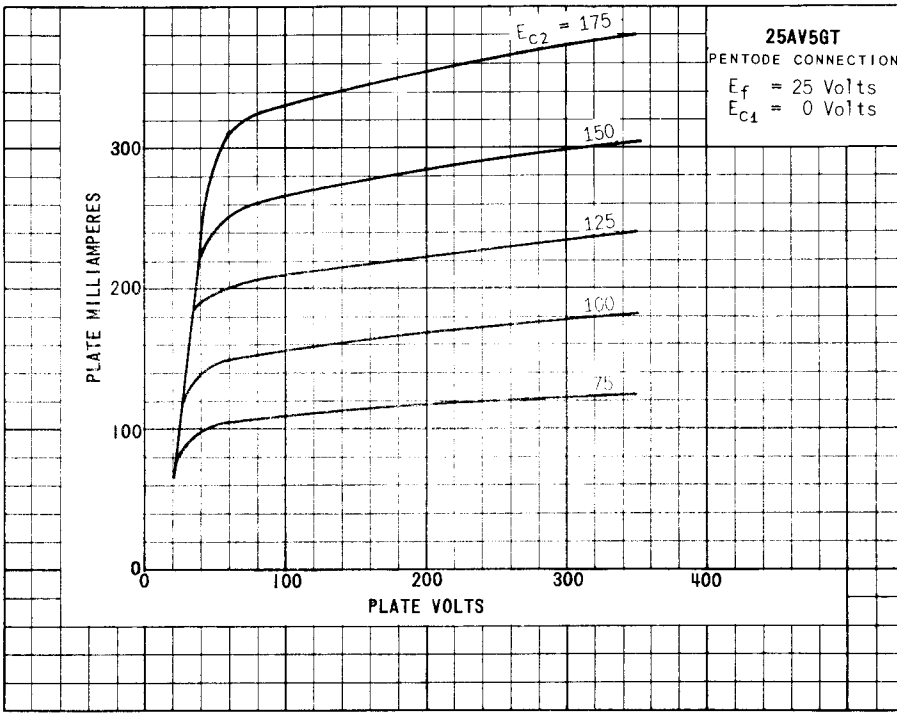
25AV5GT (6AV5GT)



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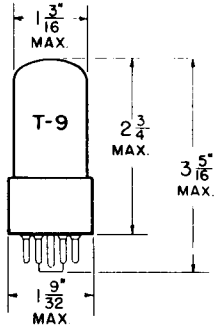
TUNG-SOL

BEAM PENTODE

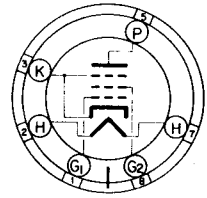


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
6 PIN OCTAL
6CK

THE 25AV5GT IS A BEAM POWER AMPLIFIER INTENDED PRIMARILY FOR OPERATION WITH RELATIVELY LOW SUPPLY VOLTAGE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH-SURGE PLATE VOLTAGES FOR RELATIVELY SHORT PERIODS OF TIME. IT CAN BE USED WITH DIRECT OR WITH TRANSFORMER HORIZONTAL-YOKE DRIVE.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.7	μμf
INPUT: G_1 TO (H+K+G_2+G_3)	14	μμf
OUTPUT: P TO (H+K+G_2+G_3)	7.0	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	210°	CENTIGRADE

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE
3138
JAN. 1
1953

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	1.2	AMP.
PENTODE OPERATION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	µMHOS
PLATE RESISTANCE	20 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

[C] WITH E_b = 250 VOLTS, E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

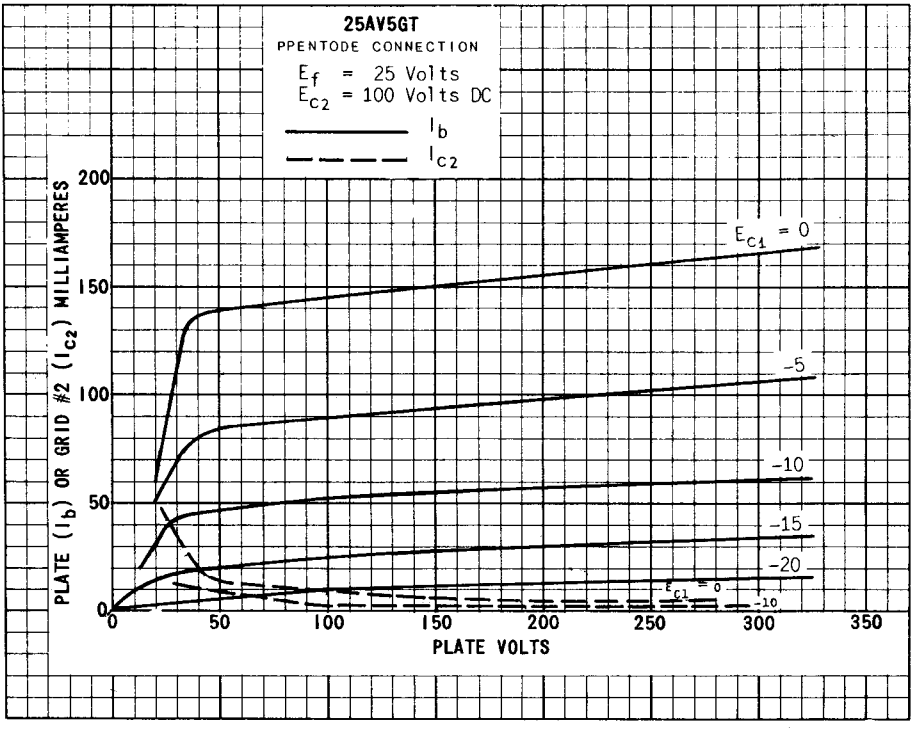
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS (INSTANEOUS VALUES).

[E] FOR I_b = 1 MA. WITH E_b = 250 VOLTS AND E_{C2} = 150 VOLTS.

[F] WITH E_b = E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

→INDICATES A CHANGE OR ADDITION.

PLATE 3139
JAN. 1 1953



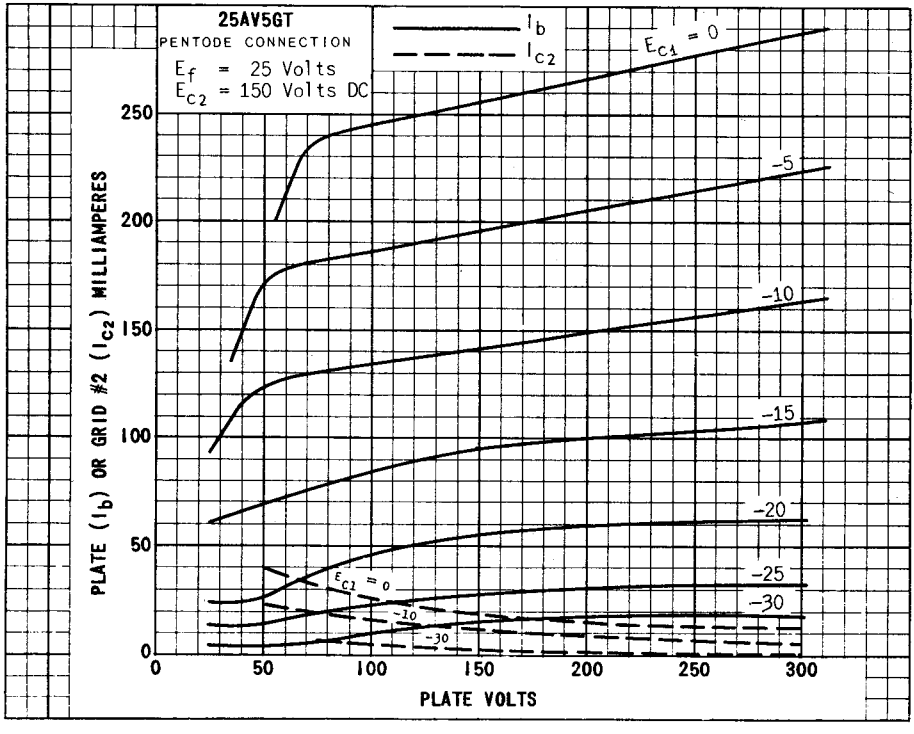


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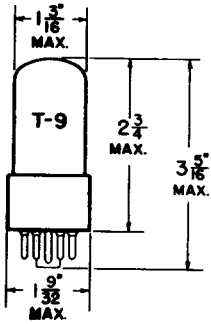
PLATE
3140
JAN. 1
1953

TUNG-SOL

DIODE

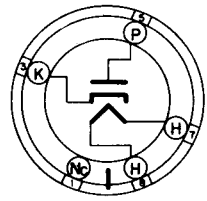


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT INTERMEDIATE SHELL 6 PIN OCTAL
4CG

THE 25AX4GT IS A HEATER-CATHODE TYPE DIODE DESIGNED FOR USE IN HORIZONTAL FREQUENCY DAMPER SERVICE IN TELEVISION RECEIVERS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES OF LINE FREQUENCY BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS, SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

HEATER TO CATHODE	7.5	μμf

RATINGS
INTERPRETED ACCORDING TO RETMA STANDARD MB-210

DESIGN CENTER VALUES

HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	0.3	AMP.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE	4 000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE[A]	4 000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT[B]	3.0	AMP.
MAXIMUM DC OUTPUT CURRENT	125	MA.
TUBE VOLTAGE DROP (WITH TUBE CONDUCTING 250 MA.)	32	VOLTS

[A] APPLICABLE WHERE THE DUTY CYCLE OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE SCANNING CYCLE, AND ITS DURATION IS LIMITED TO 10 MICROSECONDS.

[B] THIS RATING APPLIES TO HOT SWITCHING WHERE TRANSIENT DURATION DOES NOT EXCEED 0.2 SECONDS.

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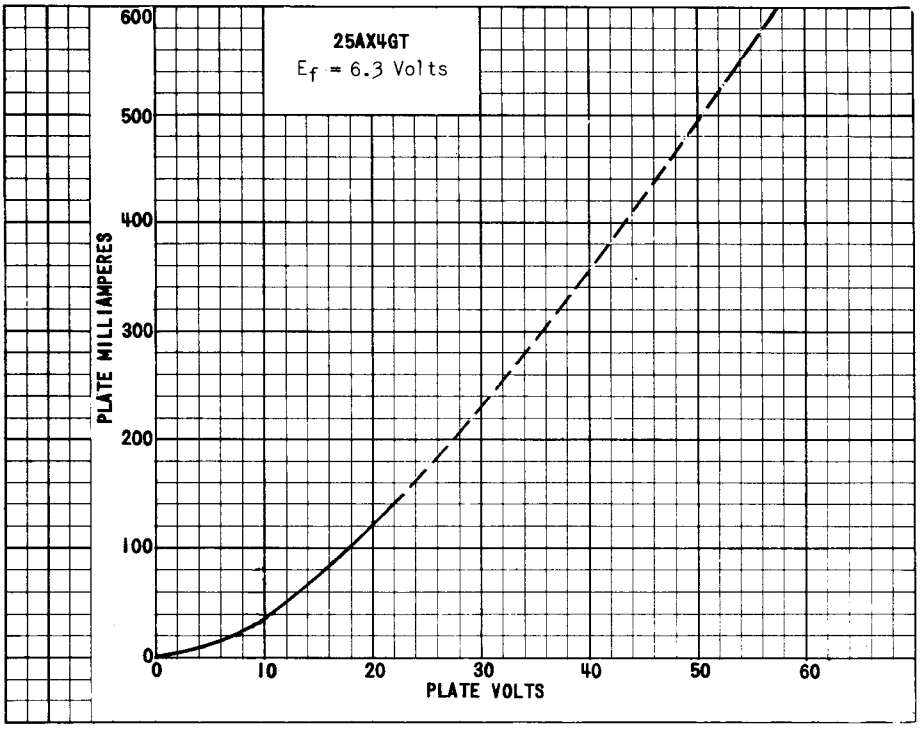
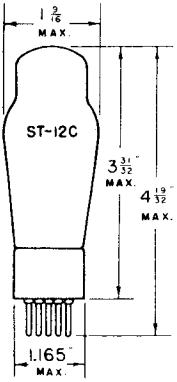
25AX4GT


25AX4GT
E_f = 6.3 Volts
PLATE MILLIAMPERES
600
500
400
300
200
100
0
0
10
20
30
40
50
60
PLATE VOLTS

TUNG-SOL



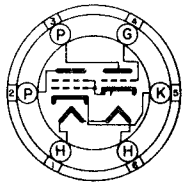
DYNAMIC COUPLED POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN BASE



6Da
BOTTOM VIEW

THE TUNG-SOL 25B5 CONSISTS OF TWO DYNAMICALLY COUPLED TRIODES AND IS DESIGNED FOR SERVICE IN THE POWER OUTPUT STAGE OF AC-DC RECEIVERS. ALL NECESSARY BIASES ARE SUPPLIED INTERNALLY. IT RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 25N6G.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

OUTPUT PLATE (2) VOLTAGE	110	180 MAX.	VOLTS
INPUT PLATE (3) VOLTAGE	110	100 P	VOLTS
INPUT GRID (4) VOLTAGE	0	0	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	MEGOHM
OUTPUT PLATE CURRENT	45	46	MA.
INPUT PLATE CURRENT	7	5.8	MA.
TRANSCONDUCTANCE	2200	2300	µMHOS
AMPLIFICATION FACTOR	25	35	
LOAD RESISTANCE	2000	4000	OHMS
SIGNAL VOLTAGE (RMS) S	21	21	VOLTS
TOTAL HARMONIC DISTORTION	9	9	PER CENT
POWER OUTPUT	2.0	3.8	WATTS

(2) BASE PIN #2 (3) BASE PIN #3 (4) BASE PIN #4

S FOR RATED POWER OUTPUT

P BOTH PLATES MAY BE OPERATED AT 180 VOLTS IF THE GRID IS BIASED TO -20 VOLTS. FIXED OR SELF BIAS MAY BE USED. FOR SELF BIAS THE CATHODE RESISTOR SHOULD BE 400 OHMS.

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PLATE 461-2

JUNE 1 1939

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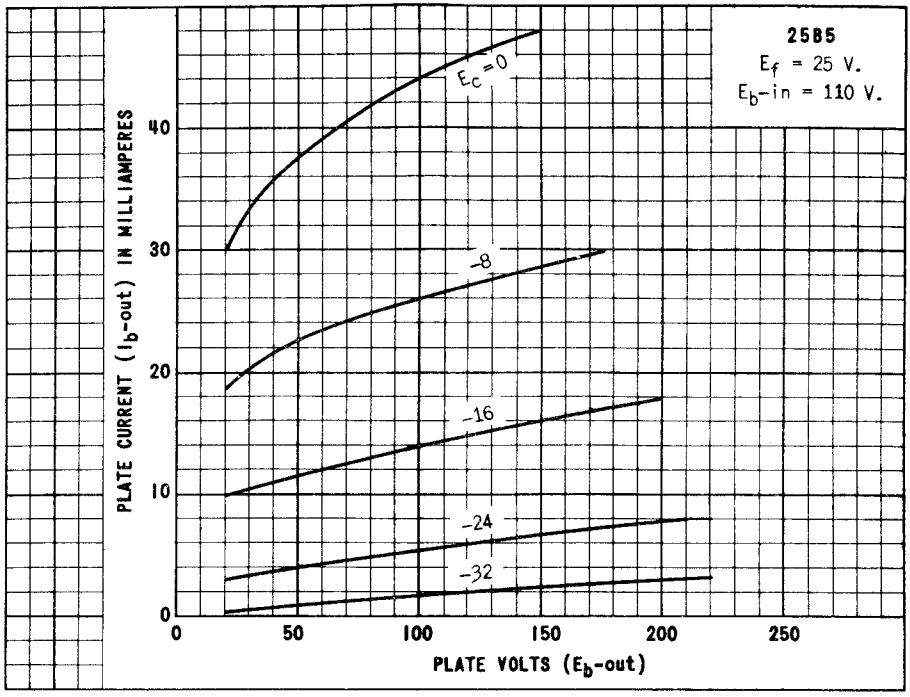
25B5



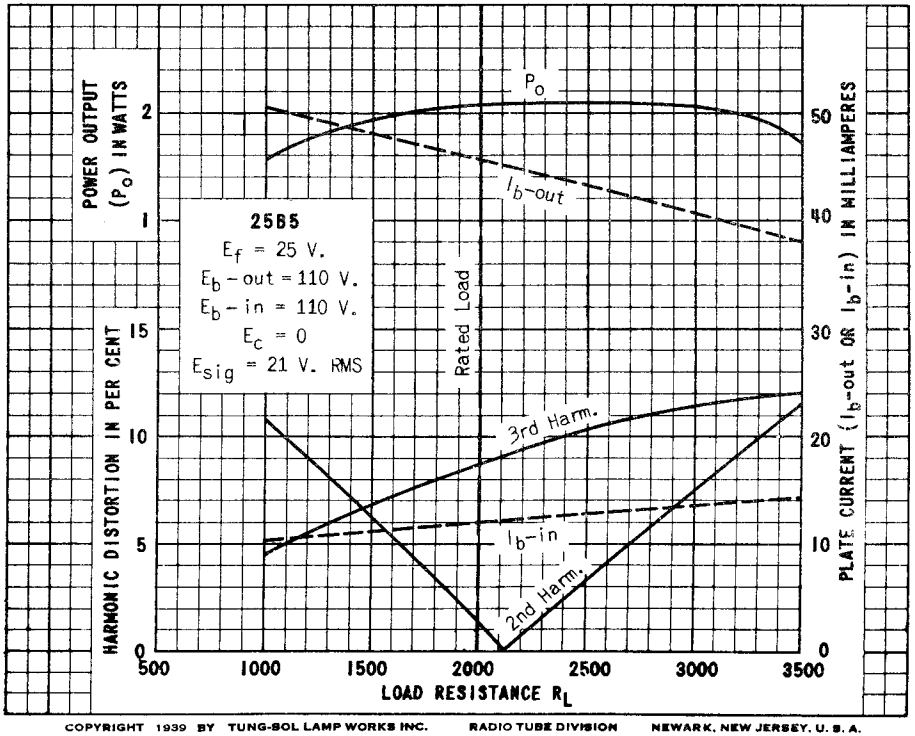


PLATE 462-1

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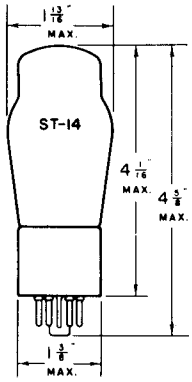
TUNG-SOL



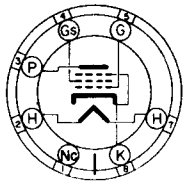
PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE



G-7S
BOTTOM VIEW

THE TUNG-SOL 25B6G IS A POWER OUTPUT PENTODE, WHICH IS DESIGNED FOR SERVICE IN SERIES OPERATED HEATER CIRCUITS THAT REQUIRE A HIGH POWER OUTPUT.

RATINGS

MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM SCREEN DISSIPATION	2.0	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	105	135	200	VOLTS
SCREEN VOLTAGE	105	135	135	VOLTS
CONTROL GRID VOLTAGE	−16	−22	−23	VOLTS
PEAK AF SIGNAL VOLTAGE	16	22	23	VOLTS
ZERO-SIGNAL PLATE CURRENT	48	61	62	MA.
ZERO-SIGNAL SCREEN CURRENT	2.0	2.5	1.8	MA.
MAXIMUM-SIGNAL PLATE CURRENT	55	69	71	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	10	14.5	13	MA.
PLATE RESISTANCE	15500	15000	18000	OHMS
TRANSCONDUCTANCE	4800	5000	5000	μMHOS
LOAD RESISTANCE	1700	1700	2500	OHMS
TOTAL HARMONIC DISTORTION	12.5	14	15	PER CENT
SECOND HARMONIC DISTORTION	7	8	8.5	PER CENT
THIRD HARMONIC DISTORTION	10	11	11	PER CENT
POWER OUTPUT	2.4	4.3	7.1	WATTS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
926-2

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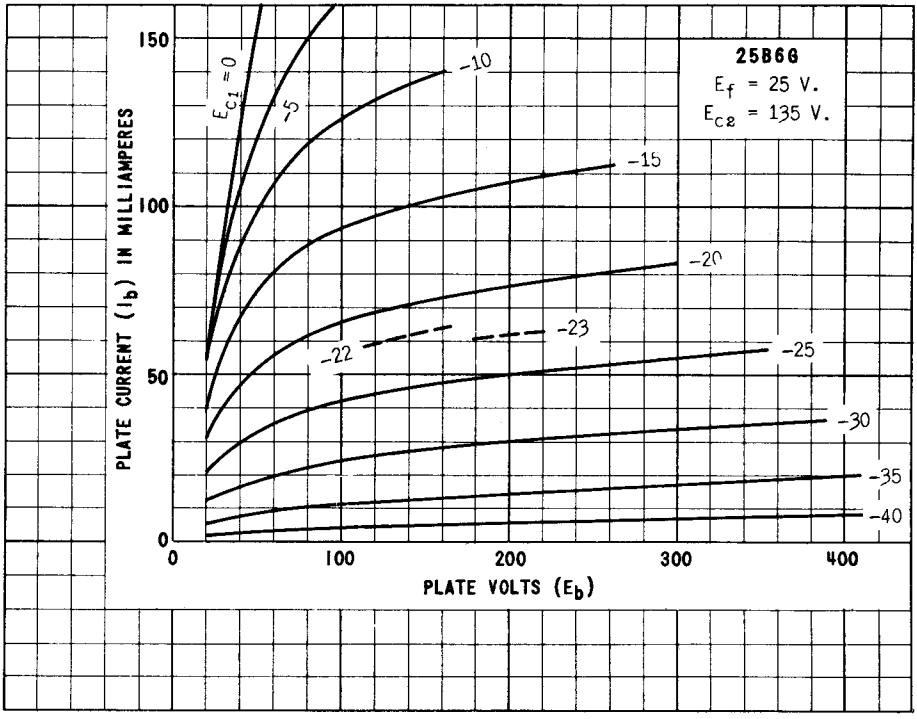
25B6 G



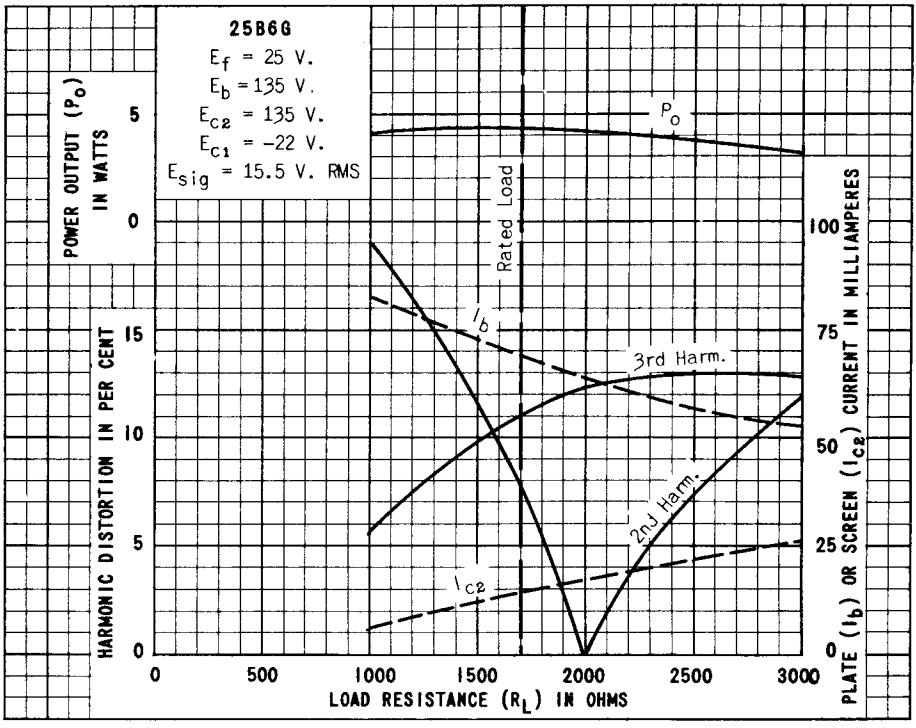


PLATE 927-2

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TUNG-SOL

TRIODE-PENTODE AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS	
BASE INTERMEDIATE-8 PIN OCTAL	PIN 1 PENT.CATH.*	PIN 7 PENT.HEATER
CAP SKIRTED MINIATURE-STYLE C	PIN 2 TRIODE HTR.	PIN 8 TRIODE GRID
BULB T-9	PIN 3 PENT.PLATE	
MAXIMUM DIAMETER 1 5/16"	PIN 4 PENT.GRID #2	
MAXIMUM OVERALL LENGTH 3 5/16"	PIN 5 TRIODE PLATE	TOP CAP PENT.GRID #1
MAXIMUM SEATED HEIGHT 2 3/4"	PIN 6 TRIODE CATH.	

*AND GRID #3

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)	25	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.

DIRECT INTERELECTRODE CAPACITANCES

	PENTODE	TRIODE	
CONTROL GRID TO CATHODE	5.5	5.0	μμf
PLATE TO CATHODE	10.0	4.6	μμf
CONTROL GRID TO PLATE	0.02	2.2	μμf
PENTODE CONTROL GRID TO TRIODE GRID	0.02		μμf
PENTODE CONTROL GRID TO TRIODE PLATE	0.009		μμf
PENTODE PLATE TO TRIODE GRID	0.075		μμf

OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE SECTION-CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE (GRID #2)	100	VOLTS
CONTROL GRID VOLTAGE (GRID #1)	-3	VOLTS
PLATE CURRENT	7.6	MA.
SCREEN CURRENT	2.0	MA.
PLATE RESISTANCE	0.185	MEGOHM
TRANSCONDUCTANCE	2000	μMHOS
AMPLIFICATION FACTOR	370	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	-41	VOLTS

TRIODE SECTION-CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLT
PLATE CURRENT	0.6	MA.
PLATE RESISTANCE	0.075	MEGOHM
TRANSCONDUCTANCE	1500	μMHOS
AMPLIFICATION FACTOR	112.5	
GRID VOLTAGE (APPROX.) FOR PLATE CURRENT CUT-OFF	-2.5	VOLTS

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PLATE T857-1

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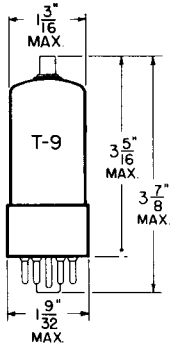
TUNG-SOL

BEAM PENTODE

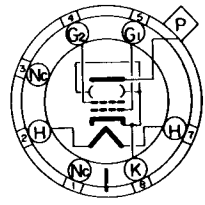


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 25BQ6GT IS A BEAM PENTODE DESIGNED SPECIFICALLY FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING MAGNETIC DEFLECTION. THE PLATE IS BROUGHT OUT TO A TOP CAP FOR ISOLATION OF THE HIGH VOLTAGE AND CONVENIENCE IN CIRCUIT LAYOUT. IT'S ELECTRICAL CHARACTERISTICS ARE SUCH AS TO PROVIDE GOOD PERFORMANCE WHERE THE SUPPLY VOLTAGES ARE LIMITED.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G_1 TO P)	0.95	μμf
INPUT: G_1 TO (H+K&BP+G_2)	14	μμf
OUTPUT: P TO (H+K&BP+G_2)	9.5	μμf

RATINGS – ABSOLUTE VALUES[A]

HORIZONTAL DEFLECTION AMPLIFIER
FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM[B]

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE SUPPLY VOLTAGE[C]	600	VOLTS
MAXIMUM GRID #2 VOLTAGE	220	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	-55	VOLTS
MAXIMUM PLATE INPUT	35	WATTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 INPUT	2.8	WATTS
MAXIMUM PLATE CURRENT	110	MA.
MAXIMUM PEAK POSITIVE PLATE SURGE VOLTAGE[D]	5500	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 SURGE VOLTAGE[D]	-150	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.6	MEGOHM

[A] ABSOLUTE MAXIMUM RATINGS ARE THE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE TUBE MAY BE IMPAIRED FROM THE VIEWPOINT OF LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS, THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED UNDER ANY USUAL CONDITION OF LINE VOLTAGE VARIATION, MANUFACTURING VARIATIONS (INCLUDING COMPONENTS) IN THE EQUIPMENT ITSELF, OR ADJUSTMENTS OF CONTROLS.

[B] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION.

[C] LIMITATION ON MAXIMUM DC PLATE SUPPLY POTENTIAL ESTABLISHED BY NO-SIGNAL PLATE DISSIPATION WHICH IN TURN IS DEPENDENT UPON CIRCUITRY.

[D] THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE AND ITS DURATION MUST BE LIMITED TO 10 MICROSECONDS.

CONTINUED ON FOLLOWING PAGE

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PLATE 2345
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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	150	VOLTS
GRID #1 VOLTAGE	-22.5	VOLTS
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5500	µMHOS
G_1 TO G_2 AMPLIFICATION FACTOR	4.5	

HORIZONTAL DEFLECTION AMPLIFIER
FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM[B]

	NOTE E	NOTE F	NOTE G	NOTE H	
HEATER VOLTAGE	25.0	25.0	25.0	25.0	VOLTS
HEATER CURRENT	0.3	0.3	0.3	0.3	AMP.
POWER SUPPLY VOLTAGE:					
FROM DC SUPPLY	250	270	360	250	VOLTS
FROM DC BOOST	0	100	80	100	VOLTS
TOTAL SUPPLY VOLTAGE	250	370	440	350	VOLTS
OPERATING GRID #2 VOLTAGE	130	130	105	140	VOLTS
GRID #2 DROPPING RESISTOR	10 000	24 000	67 000	18 000	OHMS
CATHODE BIAS RESISTOR	47	100	100	43	OHMS
CATHODE BY-PASS CAPACITOR	10	10	10	10	µf
PEAK TO PEAK GRID SIGNAL VOLTAGE (APPROX.)[J]	75	75	75	75	VOLTS
PEAK FORWARD PLATE VOLTAGE (APPROX.)[K]	2 500	3 600	4 500	3 000	VOLTS
PICTURE TUBE ANODE VOLTAGE (APPROX.)[K]	10 000	10 000	10 000	10 000	VOLTS
PLATE CURRENT	90	60	60	99	MA.
GRID #2 CURRENT	12	10	5	11.5	MA.
GRID #1 CURRENT	30	30	40	30	µA.
GRID #1 RESISTANCE	0.47	0.47	0.47	0.47	MEGOHM
PLATE DISSIPATION (APPROX.)	6	8	8	8	WATTS
SWEEP WIDTH (12LP4 PICTURE TUBE)	11.5	11.5	11.5	11.5	INCHES

[B] AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION.

[E] DIRECT-COUPLED CIRCUIT USING HIGH-IMPEDANCE YOKE, (APPROX. 30 MH), HAZELTINE BULLETIN 7060 MODIFIED TO INCORPORATE CHARGING CHOKE WITH AUTO WINDING FOR HIGH VOLTAGE.

[F] TRANSFORMER-COUPLED CIRCUIT USING 8.3 MH. YOKE AND RAM R33 TRANSFORMER OMITTING DAMPER LOAD RESISTOR.

[G] TRANSFORMER-COUPLED CIRCUIT USING 8.3 MH. YOKE AND ELECTROMETRIC S-10-80 TRANSFORMER.

[H] TRANSFORMER-COUPLED CIRCUIT USING G.E. 77J1 TRANSFORMER.

[J] NEGATIVE PEAKING USED. ADJUST SHAPE OF GRID VOLTAGE FOR MINIMUM PLATE INPUT.

[K] MEASURED WITH 100 UA TOTAL PICTURE TUBE DRAIN.

PLATE 2346
FEB. 1 1950

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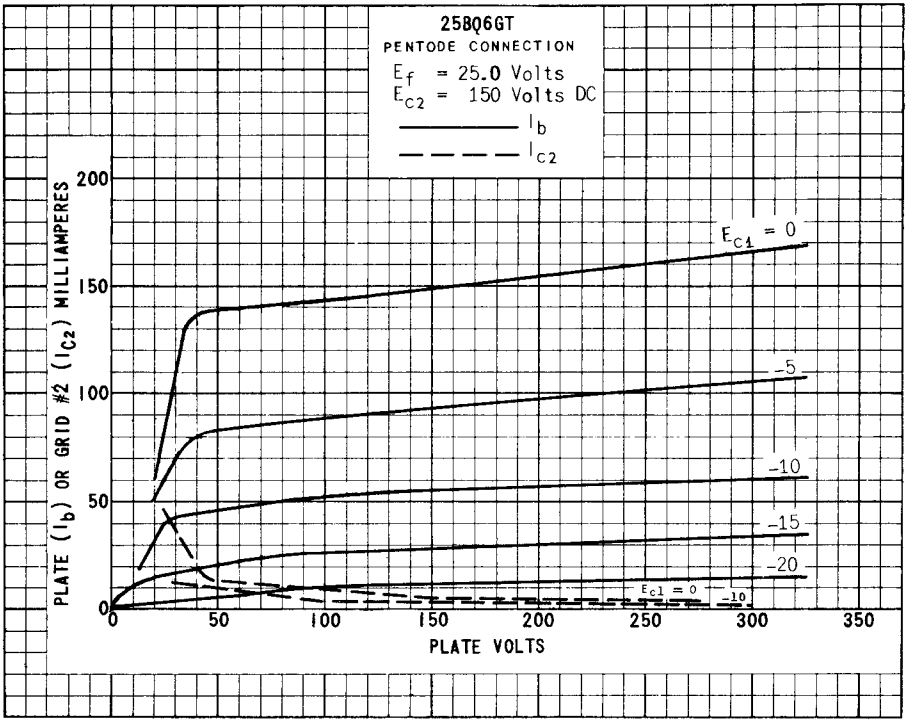

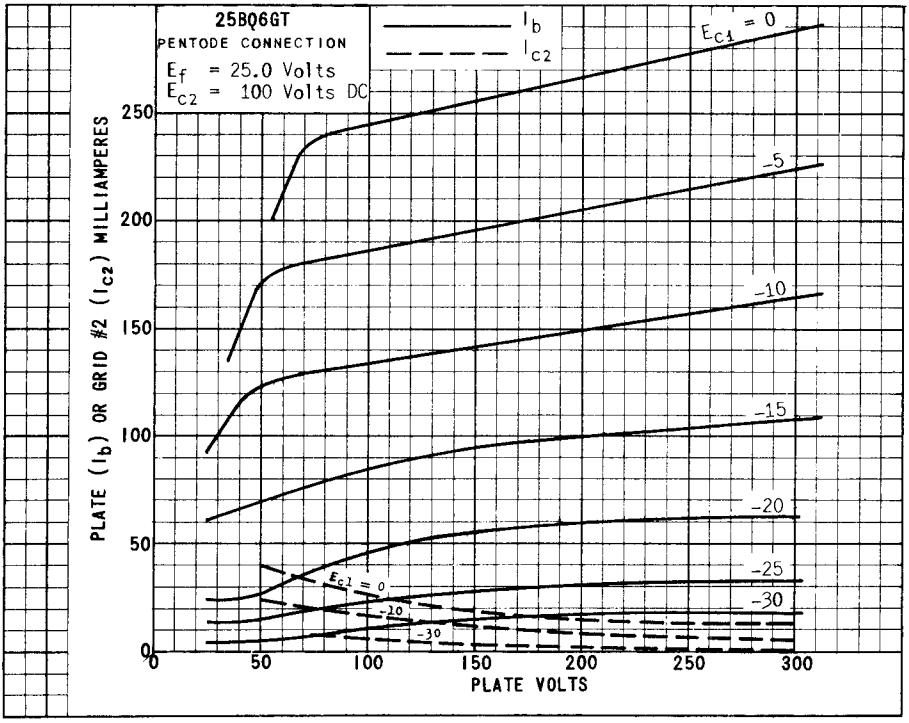

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PLATE
2347
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1950

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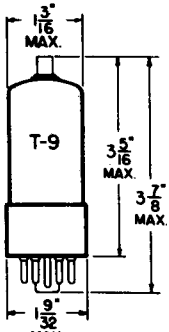
TUNG-SOL

BEAM PENTODE

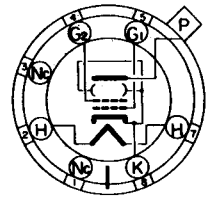


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 25BQ6GT IS A BEAM PENTODE DESIGNED SPECIFICALLY FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS USING MAGNETIC DEFLECTION. THE PLATE IS BROUGHT OUT TO A TOP CAP FOR ISOLATION OF THE HIGH VOLTAGE AND CONVENIENCE IN CIRCUIT LAYOUT. ITS ELECTRICAL CHARACTERISTICS ARE SUCH AS TO PROVIDE GOOD PERFORMANCE WHERE THE SUPPLY VOLTAGES ARE LIMITED.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE: (G_1 TO P)	0.6	μμf
INPUT: G_1 TO (H+K+G_2+BP)	15	μμf
OUTPUT: P TO (H+K+G_2+BP)	7.5	μμf

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[A]

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE:		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	5 500	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[B]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220°	CENTIGRADE

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION.

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PLATE 3150
FEB. 1 1953

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.3	AMP.
PENTODE CONNECTION:[C]		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	µMHOS
PLATE RESISTANCE	20 000	OHMS
ZERO-BIAS:[D]		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF:[E]		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE AMPLIFICATION FACTOR[F]	4.3	

[C] WITH E_b = 250 VOLTS, E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

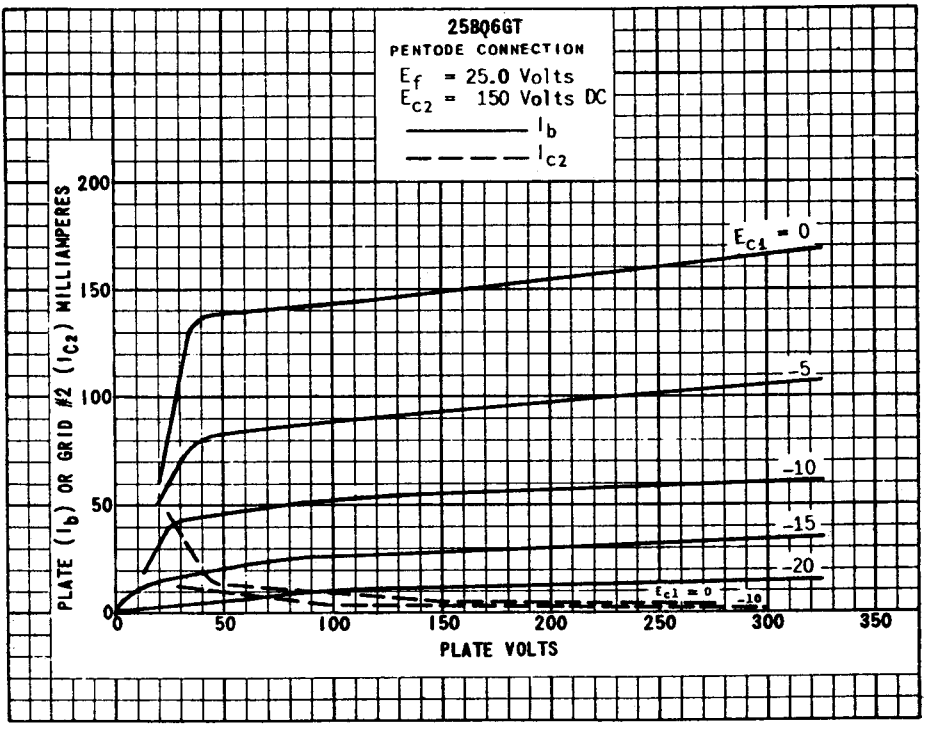
[D] WITH E_b = 60 VOLTS AND E_{C2} = 150 VOLTS.

[E] FOR I_b = 1 MA. WITH E_b = 250 VOLTS AND E_{C2} = 150 VOLTS

[F] WITH E_b = E_{C2} = 150 VOLTS AND E_{C1} = -22.5 VOLTS.

→ INDICATES A CHANGE OR ADDITION.

PLATE 3151
FEB. 1 1953



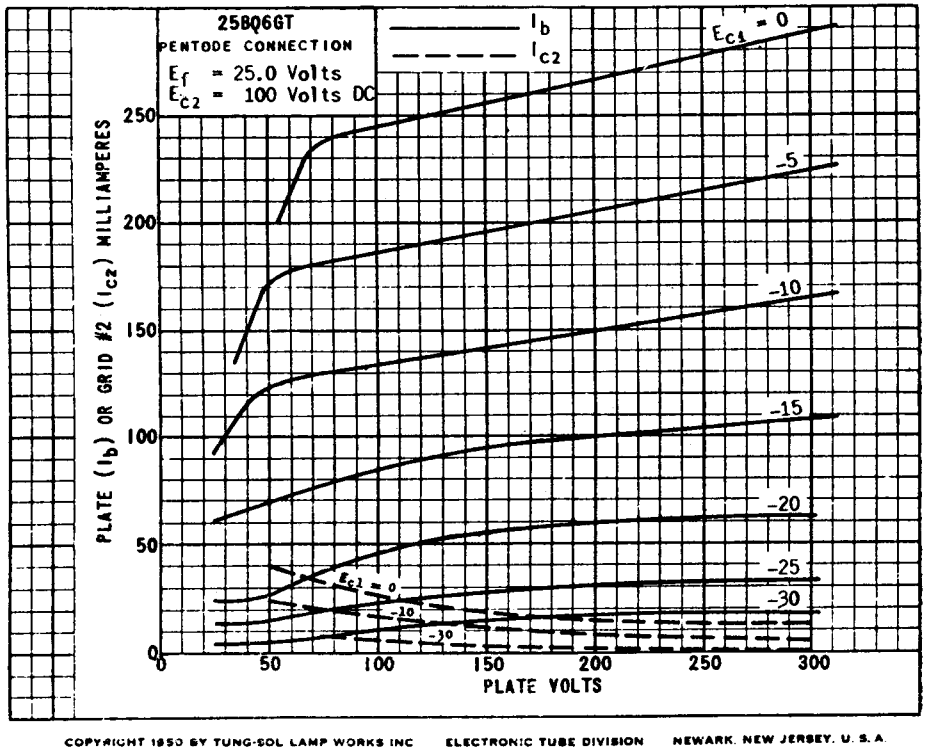


PLATE 2397 FEB. 1 1950

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TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

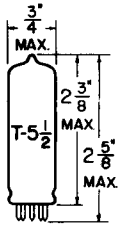
HEATER

25±10% VOLTS 0.30 AMP.

AC OR DC

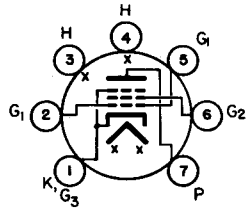
ANY MOUNTING POSITION

FOR SERIES STRING



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 25C5 IS A HEATER-CATHODE TYPE, BEAM PENTODE OF MINIATURE CONSTRUCTION DESIGNED FOR USE AS A POWER AMPLIFIER IN THE OUTPUT STAGE OF AC-DC RECEIVERS. EXCEPT FOR HEATER RATINGS THE 25C5 IS IDENTICAL TO THE 50C5.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	13.0	μμf
OUTPUT: P TO (H+K&G_3+G_2)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER CURRENT	300±20	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	7	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	220	°C

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 25C5 ARE IDENTICAL WITH THOSE OF TYPES 12C5. 12CU5. 17C5, 50C5 AND 50B5.

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

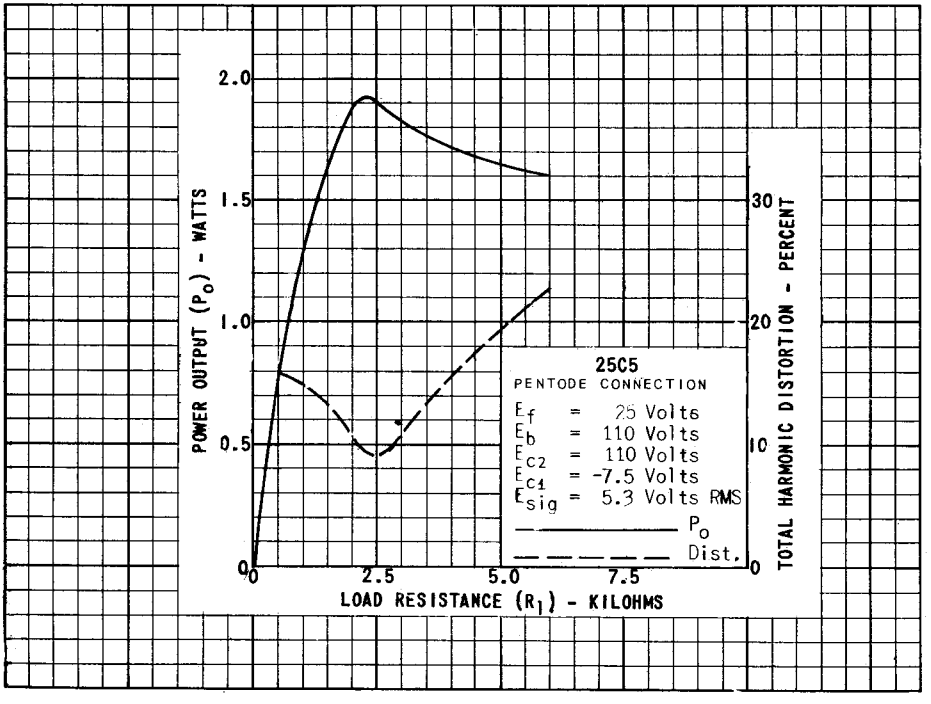
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

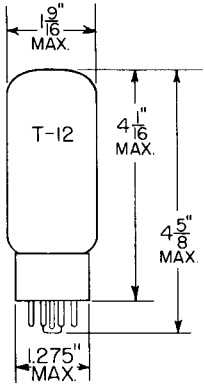
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−8	VOLTS
PEAK AF GRID #1 VOLTAGE	8	VOLTS
ZERO-SIGNAL PLATE CURRENT	49	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	8.5	MA.
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.3	WATTS



TUNG-SOL

BEAM PENTODE

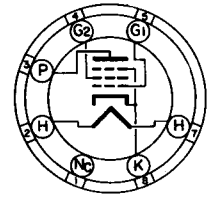


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
7S

THE 25C6GA IS A BEAM POWER AMPLIFIER HAVING HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW DC SUPPLY VOLTAGES. EXCEPT FOR HEATER RATINGS, THE 25C6GA IS IDENTICAL TO THE 50C6GA.

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	25	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM

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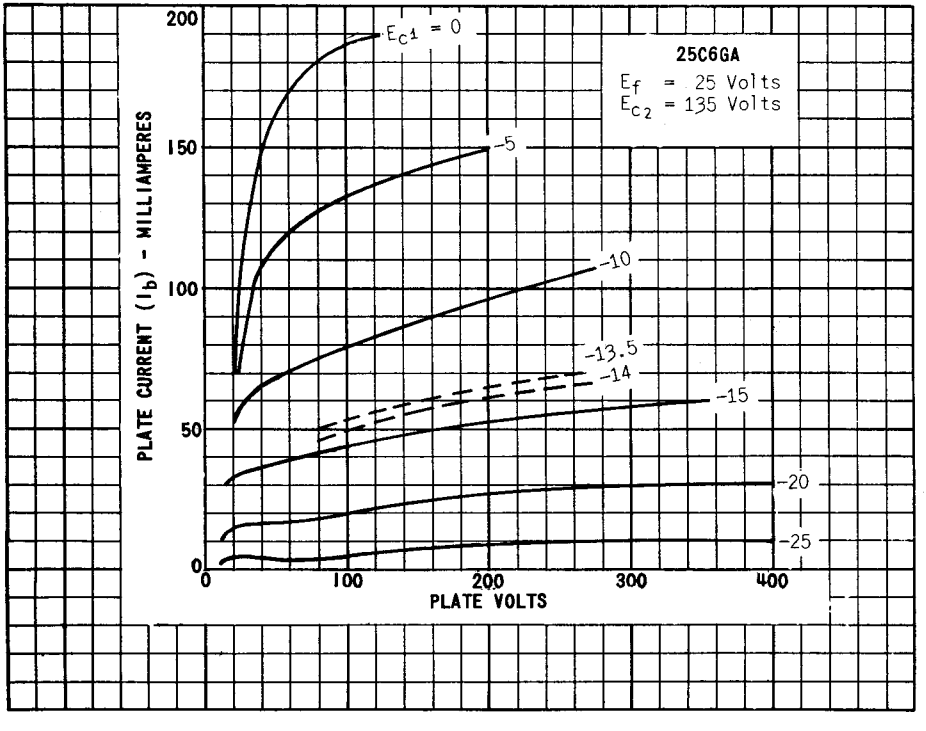
TUNG-SOL

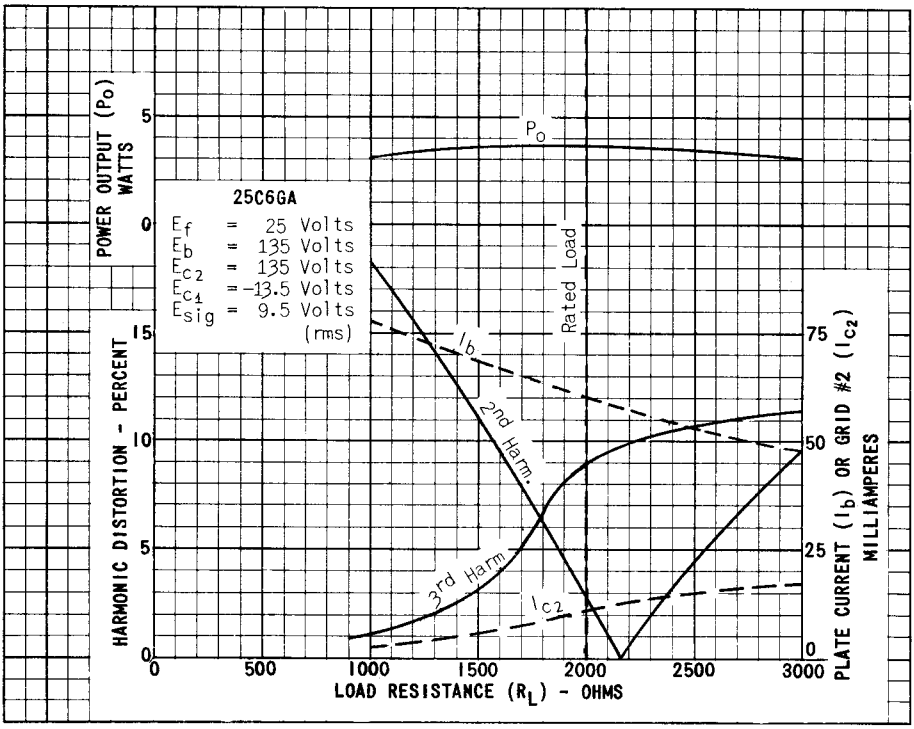
CONTINUED FROM PRECEDING PAGE

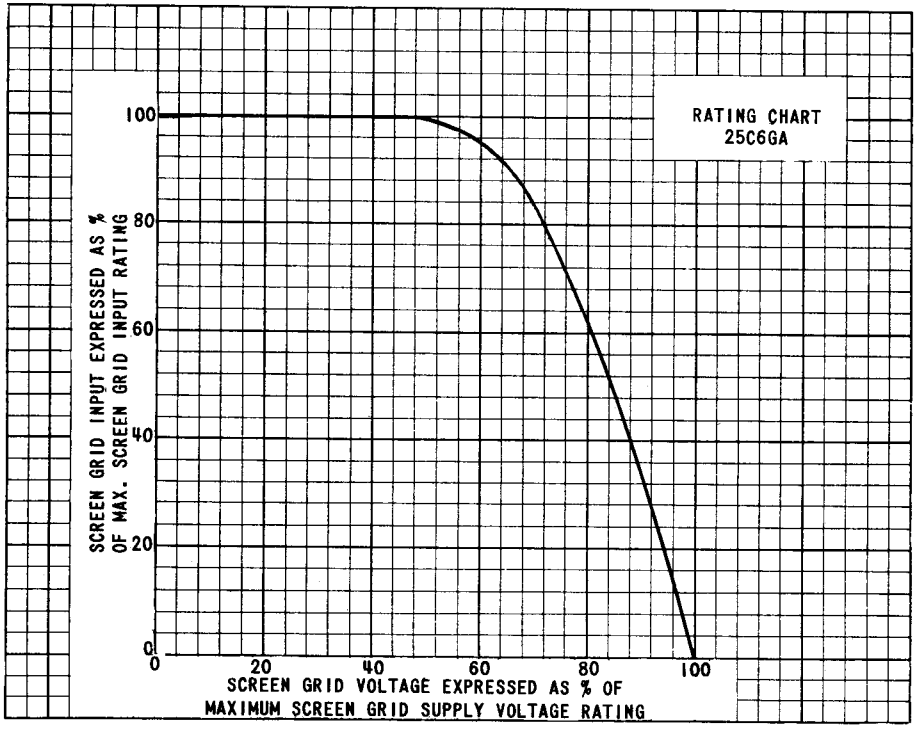
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

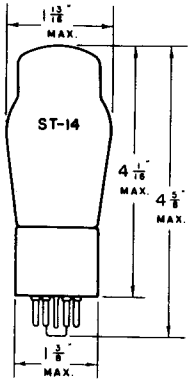
HEATER VOLTAGE	25		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	135	200	VOLTS
GRID #2 VOLTAGE	135	135	VOLTS
GRID #1 VOLTAGE	−13.5	−14	VOLTS
PEAK AF GRID #1 VOLTAGE	13.5	14	VOLTS
ZERO SIGNAL PLATE CURRENT	58	61	MA.
MAXIMUM SIGNAL PLATE CURRENT	60	66	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11.5	9	MA.
TRANSCONDUCTANCE	7 000	7 100	μMHOS
PLATE RESISTANCE (APPROX.)	9 300	18 300	OHMS
LOAD RESISTANCE	2 000	2 600	OHMS
MAXIMUM SIGNAL POWER OUTPUT	3.6	6	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT




25C6GA
Ef = 25 Volts
Eb = 135 Volts
Ec2 = 135 Volts
Ec1 = -13.5 Volts
Esig = 9.5 Volts (rms)
POWER OUTPUT (Po) WATTS
HARMONIC DISTORTION - PERCENT
PLATE CURRENT (Ib) OR GRID #2 (Ic2) MILLIAMPERES
LOAD RESISTANCE (RL) - OHMS
Po
Rated Load
Ib
2nd Harm.
3rd Harm.
Ic2
0
500
1000
1500
2000
2500
3000
5
0
15
10
5
0
75
50
25
0


RATING CHART
25C6GA
SCREEN GRID INPUT EXPRESSED AS % OF MAX. SCREEN GRID INPUT RATING
SCREEN GRID VOLTAGE EXPRESSED AS % OF MAXIMUM SCREEN GRID SUPPLY VOLTAGE RATING
100
80
60
40
20
0
0
20
40
60
80
100

TUNG-SOL



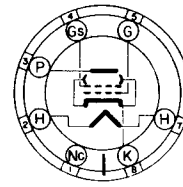
BEAM POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE



G-7AC

BOTTOM VIEW

THE TUNG-SOL 25C6G IS A BEAM POWER AMPLIFIER, DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC-DC RECEIVERS. IT FEATURES HIGH POWER OUTPUT WITH LOW SUPPLY VOLTAGES.

RATINGS

MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.75	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	200	VOLTS
SCREEN VOLTAGE	135	135	VOLTS
CONTROL GRID VOLTAGE[A]	-13.5	-14	VOLTS
PEAK AF SIGNAL VOLTAGE	13.5	14	VOLTS
ZERO-SIGNAL PLATE CURRENT	58	61	MA.
ZERO-SIGNAL SCREEN CURRENT (NOMINAL)	3.5	2.2	MA.
MAXIMUM-SIGNAL PLATE CURRENT	60	66	MA.
MAXIMUM-SIGNAL SCREEN CURRENT (NOMINAL)	11.5	9	MA.
PLATE RESISTANCE APPROX.	9300	18300	OHMS
TRANSCONDUCTANCE	7000	7100	μMHOS
LOAD RESISTANCE	2000	2600	OHMS
TOTAL HARMONIC DISTORTION	10	10	PER CENT
POWER OUTPUT	3.6	6.0	WATTS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED BIAS OPERATION.

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PLATE
1094-2

JULY 28
1941

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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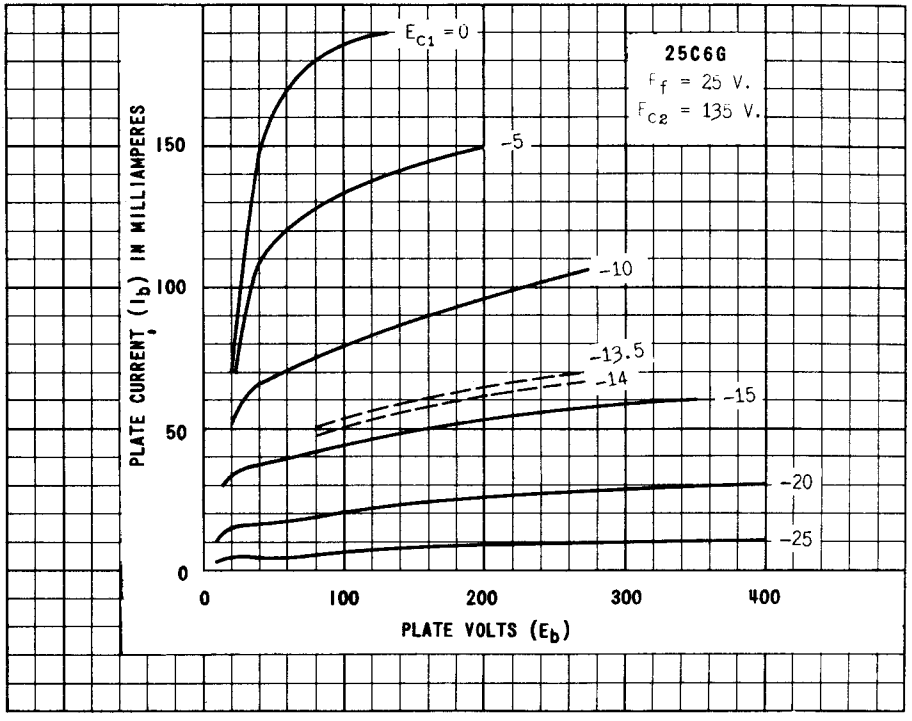
25C6G



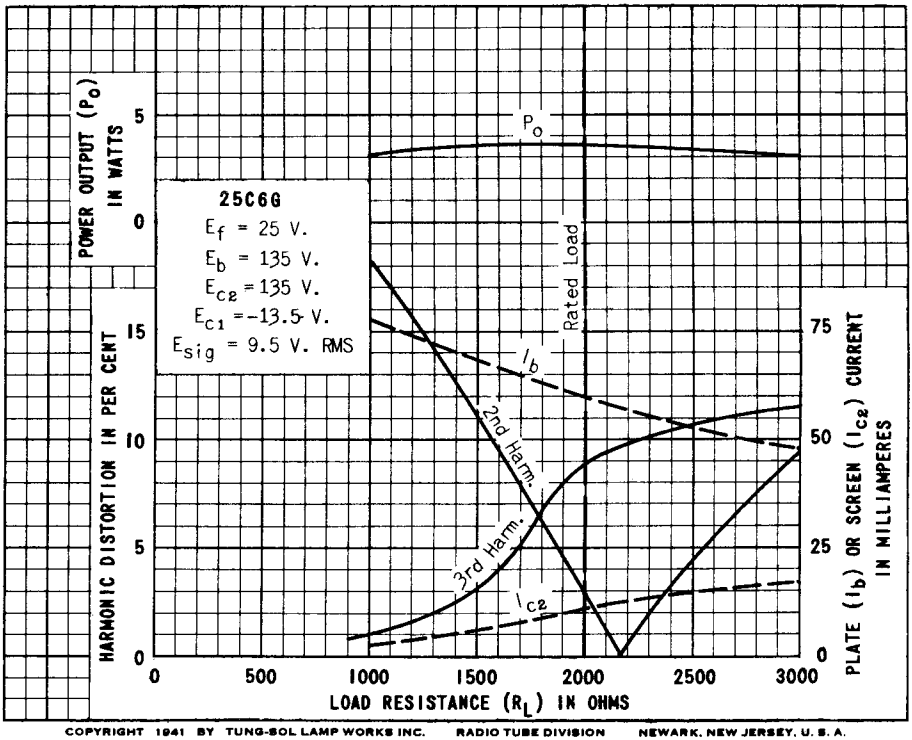


PLATE 1095-1

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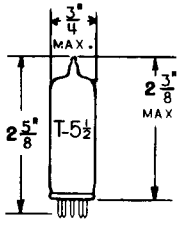
TUNG-SOL

PENTODE

MINIATURE TYPE



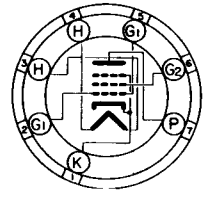
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CV

THE 25CA5 IS A BEAM PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO FREQUENCY POWER OUTPUT STAGE OF TELEVISION AND RADIO RECEIVERS. IT FEATURES HIGH POWER SENSITIVITY AT RELATIVELY LOW PLATE AND SCREEN VOLTAGES. EXCEPT FOR HEATER RATINGS IT IS IDENTICAL TO THE 6CA5.

DIRECT INTERELECTRODE CAPACITANCES

*WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	15	μμf
OUTPUT	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	25	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	130	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	180	°C

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TUNG-SOL

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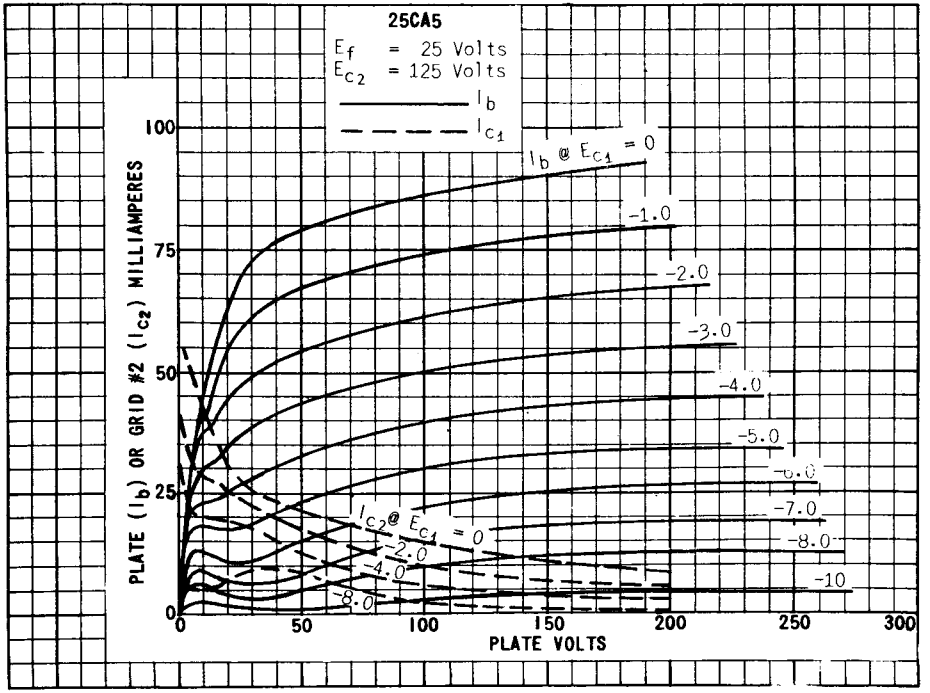
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

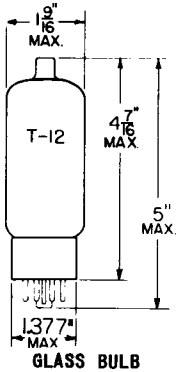
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	110	125	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-4.0	-4.5	VOLTS
PEAK AF GRID #1 VOLTAGE	4.0	4.5	VOLTS
PLATE RESISTANCE (APPROX.)	16 000	15 000	OHMS
TRANSCONDUCTANCE	8 100	9 200	µMHOS
ZERO-SIGNAL PLATE CURRENT	32	37	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	31	36	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	4.0	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	7.5	11	MA.
LOAD RESISTANCE	3 500	4 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	5	6	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.1	1.5	WATTS



TUNG-SOL

BEAM PENTODE

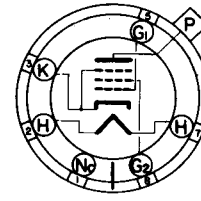


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.6 AMP.
AC OR DC

VERTICAL MOUNTING POSITION
HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM-SHELL
8 PIN OCTAL
5BT

THE 25CD6GB IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES AND A HIGH RATIO OF PLATE TO SCREEN CURRENT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

HEATER VOLTAGE	25	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	7 000	VOLTS
MAXIMUM NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION[C]	20	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM DC CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	25		VOLTS
HEATER CURRENT	0.6		AMP.
PLATE VOLTAGE	60	175	VOLTS
GRID #2 VOLTAGE	100	175	VOLTS
GRID #1 VOLTAGE	0[D]	-30	VOLTS
PLATE RESISTANCE (APPROX.)	---	7 200	OHMS
TRANSCONDUCTANCE	---	7 700	μMHOS
PLATE CURRENT	230	75	MA.
GRID #2 CURRENT	21	5.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	-55	VOLTS
TRIODE AMPLIFICATION FACTOR[E]	---	3.9	

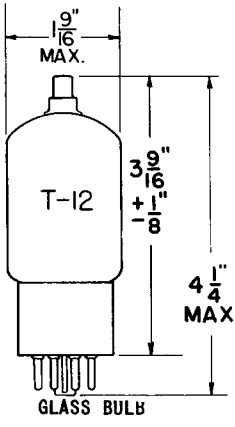
[D] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

[E] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2}$ = 175 VOLTS AND E_{c1} = -30 VOLTS.

SIMILAR TYPE REFERENCE: The 25CD6GB is identical to the 6CD6GA except for heater ratings and heater warm-up time.

TUNG-SOL

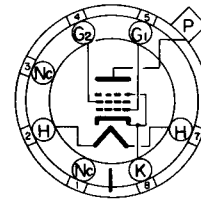
PENTODE



COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
6AM

THE 25CU6 IS A BEAM POWER AMPLIFIER DESIGNED FOR USE AS THE HORIZONTAL DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS EMPLOYING SERIES-STRING HEATER ARRANGEMENTS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: G_1 TO P	0.55	μμf
INPUT: G_1 TO (H+K+G_2+BP)	15.0	μμf
OUTPUT: P TO (H+K+G_2+BP)	7.0	μμf

RATINGS[A]
INTERPRETED ACCORDING TO RETMA STANDARD M8-210

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	25	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST+POWER SUPPLY)	550	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	6 000	VOLTS
MAXIMUM PEAK NEGATIVE PLATE VOLTAGE	1 250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	11	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	2.5	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	110	MA.
MAXIMUM PEAK CATHODE CURRENT	400	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220	°C

[A] DESIGN CENTER VALUES EXCEPT WHERE ABSOLUTE MAXIMUM IS STATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% (10 MICROSECONDS) OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PENTODE OPERATION: WITH E_b = 250V., E_{c2} = 150V. AND E_{c1} = -22.5V.		
PLATE CURRENT	55	MA.
GRID #2 CURRENT	2.1	MA.
TRANSCONDUCTANCE	5 500	μMHOS
PLATE RESISTANCE (APPROX.)	20 000	OHMS
ZERO BIAS: WITH E_b = 60V. AND E_{c2} = 150V. (INSTANTANEOUS VALUES)		
PLATE CURRENT	225	MA.
GRID #2 CURRENT	25	MA.
CUT-OFF: FOR I_b = 1 MA., WITH E_b = 250V. AND E_{c2} = 150V.		
GRID #1 VOLTAGE (APPROX.)	-46	VOLTS
TRIODE μ: WITH E_b = E_{c2} = 150V. AND E_{c1} = 22.5V.	4.3	

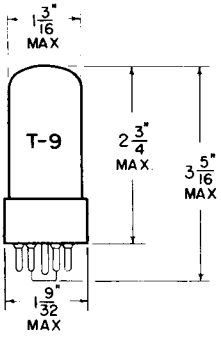
HORIZONTAL DEFLECTION AMPLIFIER - SCANNING 70° CRT

HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE SUPPLY VOLTAGE	310	VOLTS
AVERAGE PLATE VOLTAGE (BOOST + SUPPLY)	540	VOLTS
PEAK POSITIVE PLATE VOLTAGE (DC COMPONENT + PULSE)	4.6	KV.
AVERAGE PLATE CURRENT	79	MA.
PEAK PLATE CURRENT	270	MA.
PLATE DISSIPATION	7	WATTS
GRID #2 VOLTAGE	140	VOLTS
GRID #2 CURRENT	11±2	MA.
GRID #2 DISSIPATION	1.57	WATTS
GRID INPUT VOLTAGE:		
PEAK TO PEAK	130	VOLTS
SAWTOOTH COMPONENT	65	VOLTS
ANODE VOLTAGE CRT	15.7	KV.
ANODE CURRENT CRT	100	μA.

SIMILAR TYPE REFERENCE: Except for heater operation the 25CU6 is identical to the 6CU6 and 12CU6.

TUNG-SOL

DIODE



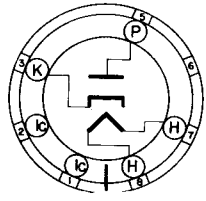
GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

25.0 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW •
INTERMEDIATE SHELL
OR
SHORT INTERMEDIATE SHELL
8 PIN OCTAL
4CG

THE 25D4 IS AN INDIRECTLY-HEATED HALF WAVE RECTIFIER DESIGNED FOR SERVICE AS A DAMPING DIODE IN HORIZONTAL DEFLECTION CIRCUITS OF 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

HEATER TO CATHODE	3.0	μμf
PLATE TO CATHODE & HEATER[A]	6.0	μμf
CATHODE TO PLATE & HEATER[A]	8.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM — UNLESS OTHERWISE INDICATED

DAMPER SERVICE[B]

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.30	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	900	VOLTS
TOTAL DC AND PEAK	4 400	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	300	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	4 400	VOLTS
MAXIMUM DC PLATE CURRENT	155	MA.
MAXIMUM DC PLATE CURRENT (DESIGN CENTER SYSTEM)	145	MA.
MAXIMUM PEAK PLATE CURRENT	900	MA.
MAXIMUM PLATE DISSIPATION	5.5	WATTS
TUBE VOLTAGE DROP WITH Ib= 250 MA.	22	VOLTS
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

•PINS 1, 2, 4, & 6 MUST NOT BE USED AS TIE POINTS.

[A] TIE UNUSED PINS AND METAL PART TO HEATER.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF ONE SCANNING CYCLE.

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TUNG-SOL

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*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

TENTATIVE DATA

25D8 GT

TUNG-SOL

DIODE TRIODE
REMOTE CUT-OFF PENTODE

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE	PIN CONNECTIONS	
BASE INTERMEDIATE-8 PIN OCTAL	PIN 1 CATHODES*	PIN 7 TRIODE HEATER
CAP SKIRTED MINIATURE-STYLE C	PIN 2 PENT. HEATER	PIN 8 DIODE PLATE
BULB T-9	PIN 3 PENT. PLATE	
MAXIMUM DIAMETER 1 5/16"	PIN 4 PENT. GRID #2	
MAXIMUM OVERALL LENGTH 3 9/16"	PIN 5 TRIODE GRID	TOP CAP PENT. GRID #1
MAXIMUM SEATED HEIGHT 3"	PIN 6 TRIODE PLATE	

*DIODE-TRIODE CATHODE TIED TO PENTODE CATHODE

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)	25.0	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE		VOLTS

DIRECT INTERELECTRODE CAPACITANCES

	PENTODE	TRIODE	
CONTROL GRID TO CATHODE	5.2	3.7	μμf
PLATE TO CATHODE	10.0	4.5	μμf
CONTROL GRID TO PLATE	0.015 MAX.	2.5	μμf
PENTODE CONTROL GRID TO TRIODE GRID	0.01 MAX.		μμf
PENTODE CONTROL GRID TO TRIODE PLATE	0.02 MAX.		μμf
PENTODE PLATE TO TRIODE GRID	0.10 MAX.		μμf

OPERATING CONDITIONS AND CHARACTERISTICS

TRIODE SECTION - CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
GRID VOLTAGE	-1	VOLT
PLATE CURRENT	0.5	MA.
PLATE RESISTANCE	91000	OHMS
TRANSCONDUCTANCE	1100	μMHOS
AMPLIFICATION FACTOR	100	

PENTODE SECTION - CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE (GRID #2)	100	VOLTS
CONTROL GRID VOLTAGE (GRID #1)	-3	VOLTS
PLATE CURRENT	8.5	MA.
SCREEN CURRENT	2.7	MA.
PLATE RESISTANCE APPROX.	200 000	OHMS
TRANSCONDUCTANCE	1900	μMHOS
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS APPROX.	-35	VOLTS

PLATE T842-1

SEPT. 9 1940

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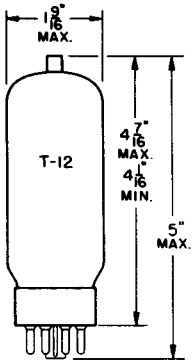
TUNG-SOL

PENTODE

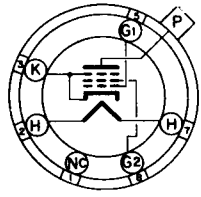


GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.6 AMP.
AC OR DC

VERTICAL MOUNTING POSITION
HORIZONTAL OPERATION PERMITTED IF PLANE OF PINS 1 AND 3 IS VERTICAL



BOTTOM VIEW
SHORT-MEDIUM SHELL
8 PIN OCTAL
5BT

THE 25DN6 IS A BEAM POWER AMPLIFIER INTENDED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN 600 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS HAVING LOW B SUPPLY VOLTAGE. THERMAL CHARACTERISTICS OF THE HEATER HAVE BEEN CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

GRID #1 TO PLATE	0.8	μμf
INPUT	22	μμf
OUTPUT	11.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES[A]

HORIZONTAL DEFLECTION AMPLIFIER[B]

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	6 600	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM PLATE DISSIPATION[C]	15	WATTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	175	VOLTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C
HEATER WARM-UP TIME (APPROX.)[D]	11.0	SECONDS

[A] UNLESS OTHERWISE INDICATED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[D] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

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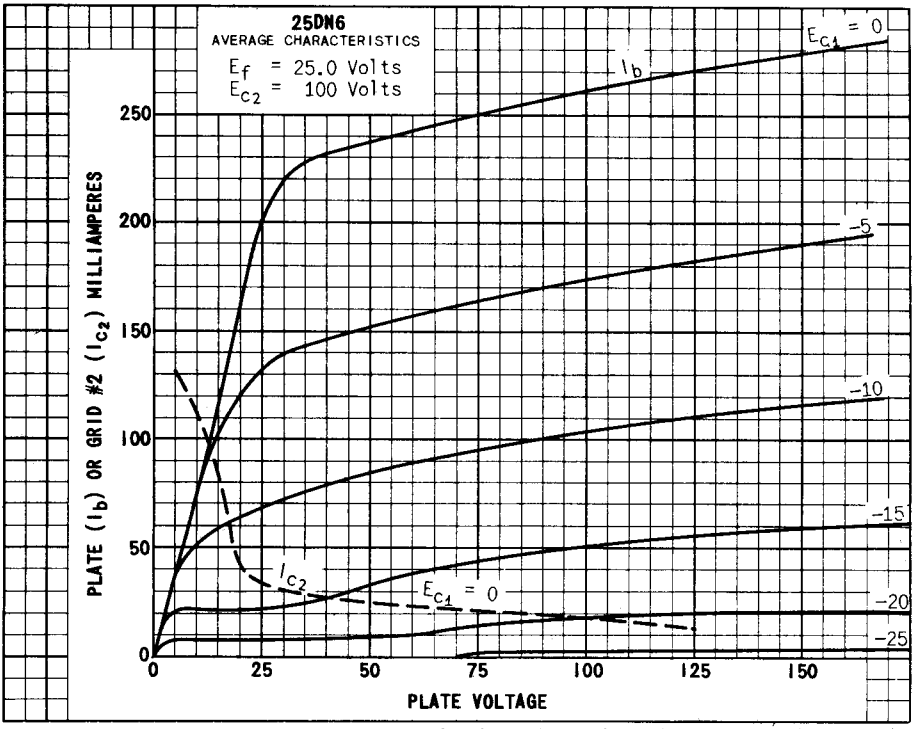
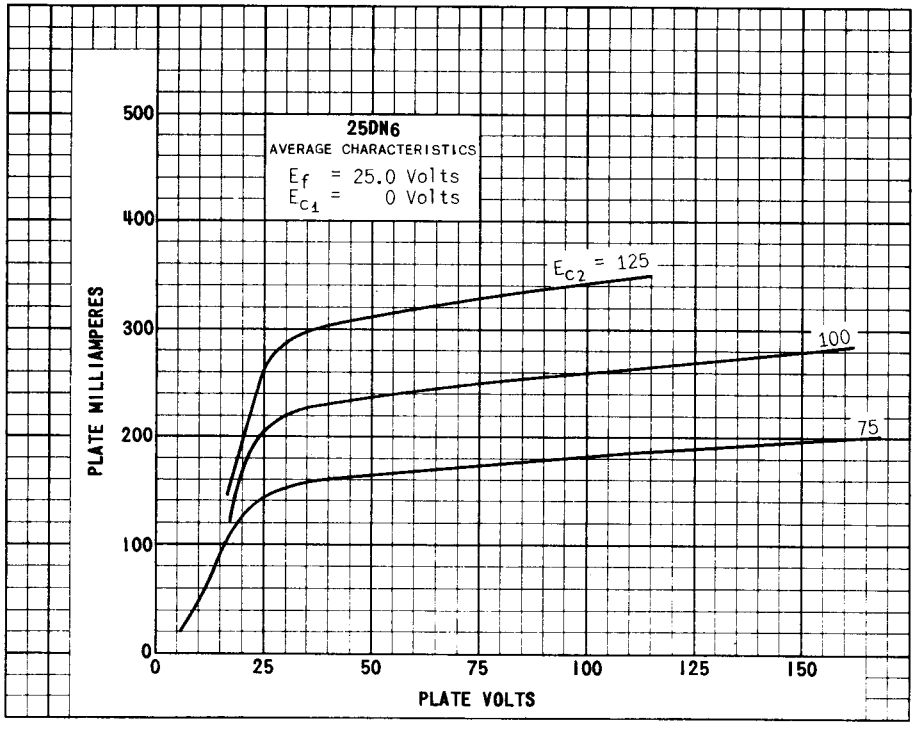
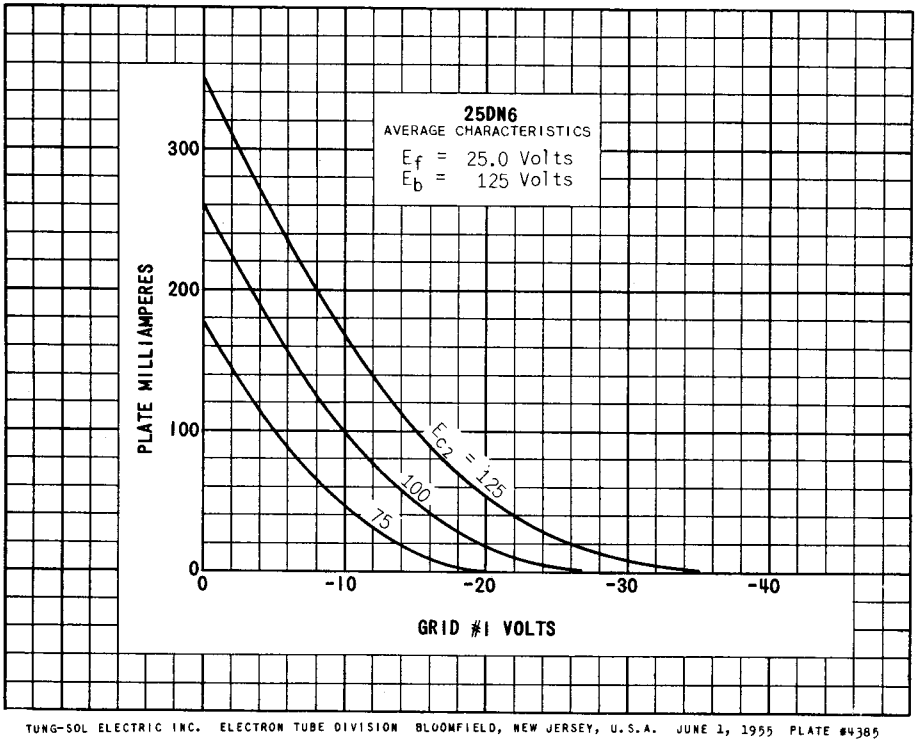
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	25.0	VOLTS
HEATER CURRENT	0.6	AMP.
PENTODE OPERATION: WITH E_b = 125 VOLTS, E_{c2} = 125 VOLTS AND E_{c1} = -18 VOLTS.		
PLATE CURRENT	70	MA.
GRID #2 CURRENT	6.3	MA.
TRANSCONDUCTANCE	9 000	μMHOS
PLATE RESISTANCE (APPROX.)	4 000	OHMS
ZERO-BIAS: WITH E_b = 50 VOLTS, E_{c2} = 100 VOLTS & E_{c1} = 0 VOLTS (INSTANTANEOUS VALUES)		
PLATE CURRENT	240	MA.
GRID #2 CURRENT	30	MA.
CUT-OFF: FOR I_b = 0.5 MA. WITH E_b = 125 VOLTS AND E_{c2} = 125 VOLTS		
GRID #1 VOLTAGE (APPROX.)	-36	VOLTS
TRIODE AMPLIFICATION FACTOR; WITH E_b = E_{c2} = 125 V. & E_{c1} = -18 V.	4.35	







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25DN6

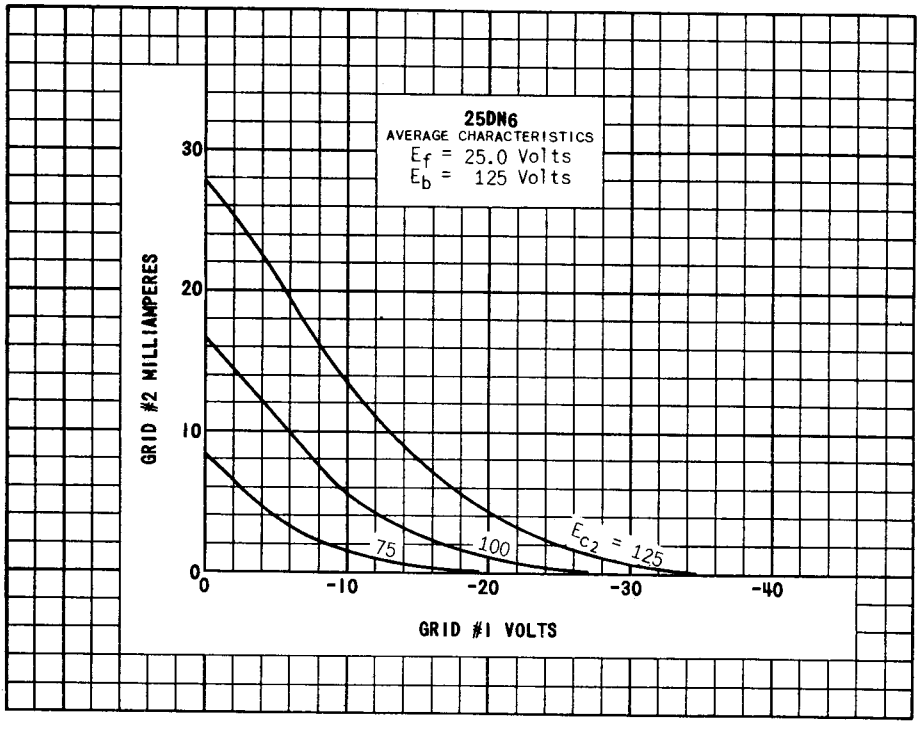
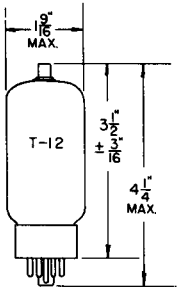


PLATE #4386 JUNE 1, 1955 TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A.

TUNG-SOL

BEAM POWER PENTODE

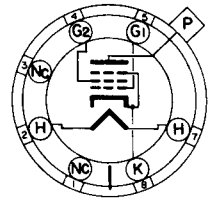


GLASS BULB
SKIRTED MINIATURE CAP

UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM-SHELL 7 PIN OCTAL
WITH EXTERNAL BARRIERS
6AM

THE 25DQ6A IS A HIGH-PERVEANCE BEAM POWER PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER TUBE IN HIGH EFFICIENCY DEFLECTION CIRCUITS OF TELEVISION RECEIVERS. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TUBES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR THE CONTROLLED HEATER WARM-UP TIME AND HEATER RATINGS THE 25DQ6A IS IDENTICAL TO THE 6DQ6A.

DIRECT INTERELECTRODE CAPACITANCES—APPROX.
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.55	μμf
GRID #1 TO CATHODE & GRID #3, HEATER AND GRID #2	15	μμf
PLATE TO CATHODE & GRID #3, HEATER AND GRID #2	7	μμf

RATINGS [A]
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM
HORIZONTAL DEFLECTION AMPLIFIER

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM PLATE VOLTAGE:		
DC (INCLUDING BOOST)	700	VOLTS
PEAK POSITIVE-PULSE (ABSOLUTE MAX.) [B]	6 000 [C]	VOLTS
PEAK NEGATIVE-PULSE [B]	1 375	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	200	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC	−50	VOLTS
PEAK NEGATIVE-PULSE	300	VOLTS
MAXIMUM CATHODE CURRENT:		
DC	140	MA.
PEAK	440	MA.
MAXIMUM GRID #2 INPUT	3	WATTS

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION".

[B] THIS RATING IS APPLICABLE WHERE THE DURATION OF THE VOLTAGE PULSE DOES NOT EXCEED 15% OF ONE HORIZONTAL SCANNING CYCLE. IN A 525-LINE, 30-FRAME SYSTEM, 15% OF THE HORIZONTAL SCANNING CYCLE IS 10 MICROSECONDS.

[C] UNDER NO CIRCUMSTANCES SHOULD THIS ABSOLUTE VALUE BE EXCEEDED.

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RATINGS[A]– CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL DEFLECTION AMPLIFIER

MAXIMUM PLATE DISSIPATION[D]	15	WATTS
MAXIMUM PEAK HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
MAXIMUM CIRCUIT VALUES:		
GRID #1 CIRCUIT RESISTANCE:		
FOR GRID RESISTOR–BIAS OPERATION[D]	1.0	MEGOHM
HEATER WARM–UP TIME (AVERAGE)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

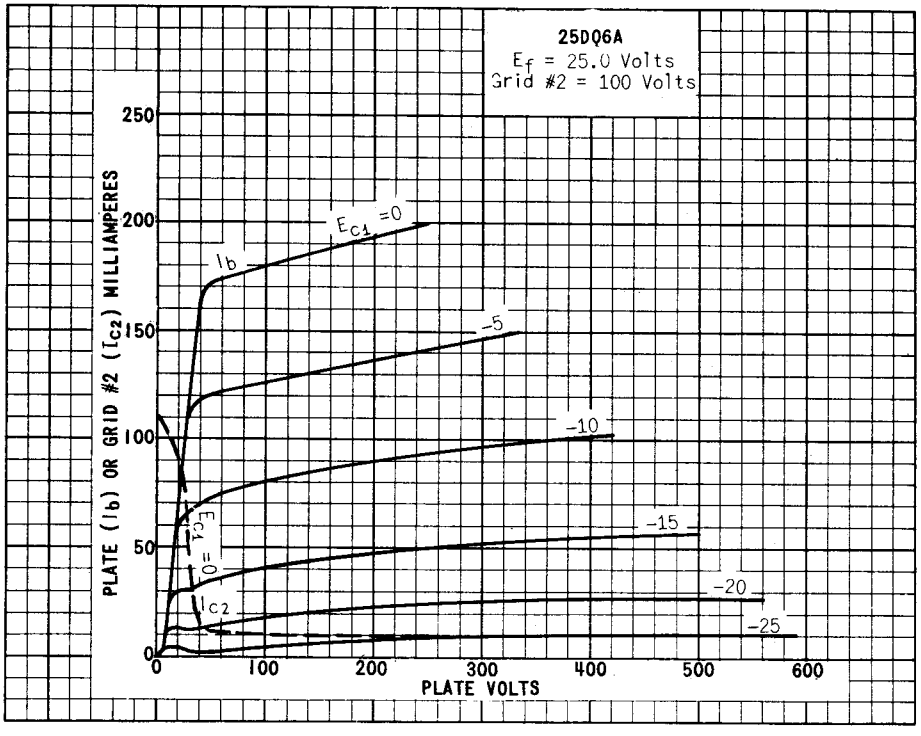
HEATER VOLTAGE	25.0	25.0	25.0	VOLTS
HEATER CURRENT	0.30	0.30	0.30	AMP.
PLATE VOLTAGE	60	150	250	VOLTS
GRID #2 VOLTAGE	150	150	150	VOLTS
GRID #1 VOLTAGE	0	-22.5	-22.5	VOLTS
MU–FACTOR, GRID #2 TO GRID #1	---	4.1	---	
PLATE RESISTANCE (APPROX.)	---	---	20 000	OHMS
TRANSCONDUCTANCE	---	---	6 600	μMHOS
PLATE CURRENT	300[E]	---	75	MA.
GRID #2 CURRENT	27[E]	---	2.4	MA.
GRID #1 VOLTAGE (APPROX.)				
FOR PLATE CURRENT OF 1 MA.	---	---	-46	VOLTS

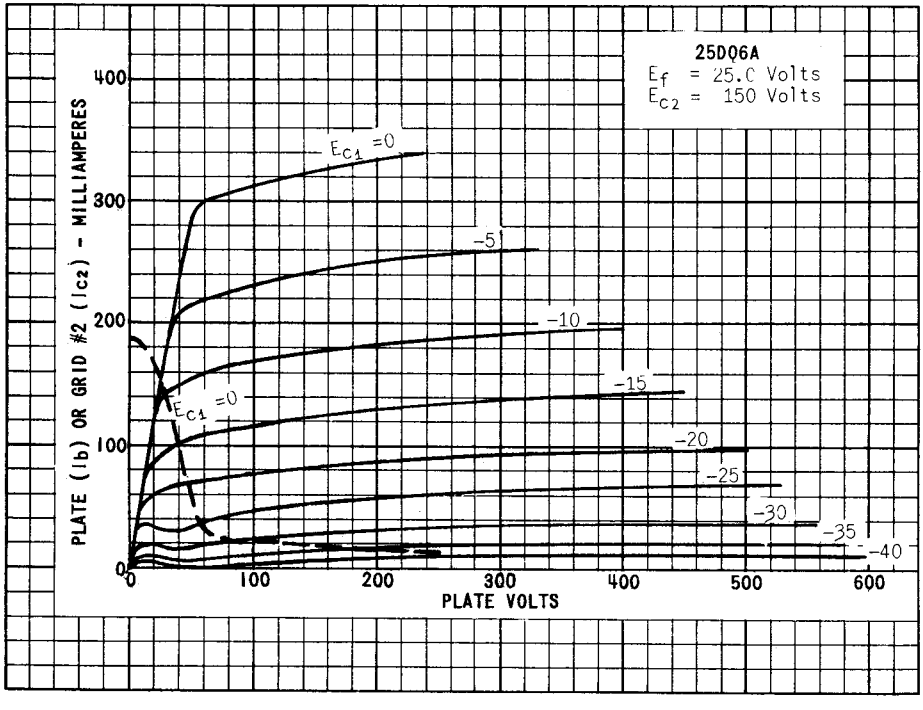
[A] FOR OPERATION IN A 525–LINE, 30–FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS; FEDERAL COMMUNICATIONS COMMISSION".

[D] IT IS ESSENTIAL THAT THE PLATE DISSIPATION BE LIMITED IN THE EVENT OF LOSS OF GRID SIGNAL. FOR THIS PURPOSE, SOME PROTECTIVE MEANS SUCH AS A CATHODE RESISTOR OF SUITABLE VALUE SHOULD BE EMPLOYED.

[E] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RECURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

* HEATER WARM–UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

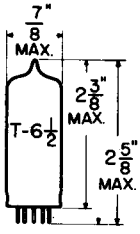

25DQ6A
Ef = 25.0 Volts
Grid #2 = 100 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE VOLTS
Ec1 =0
-5
-10
-15
-20
-25
Ib
Ec2
Ec1 =0
0
50
100
150
200
250
0
100
200
300
400
500
600


25DQ6A
Ef = 25.0 Volts
Ec2 = 150 Volts
PLATE (Ib) OR GRID #2 (Ic2) - MILLIAMPERES
PLATE VOLTS
Ec1 =0
-5
-10
-15
-20
-25
-30
-35
-40
Ec1 =0
0
100
200
300
400
0
100
200
300
400
500
600

TUNG-SOL

BEAM-POWER PENTODE

MINIATURE TYPE

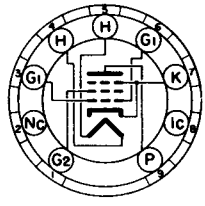


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25.0 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE
SMALL-BUTTON
9 PIN BASE
9HN

THE 25DT5 IS A BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS A VERTICAL DEFLECTION OUTPUT AMPLIFIER IN TELEVISION RECEIVERS UTILIZING A 110° DEFLECTION ANGLE PICTURE TUBE AND A B+ SUPPLY VOLTAGE OF 250 VOLTS. IT HAS HIGH ZERO BIAS PLATE CURRENT AND A HIGH PLATE CURRENT TO GRID #2 CURRENT RATIO. IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED. EXCEPT FOR HEATER RATINGS AND WARM-UP TIME, THE 25DT5 IS IDENTICAL TO THE 6DT5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.57	μμf
INPUT	12.5	μμf
OUTPUT	4.9	μμf

RATINGS[A]

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

VERTICAL DEFLECTION SERVICE[B]

DEFLECTING 110° PICTURE TUBE

HEATER VOLTAGE	25.0	VOLTS
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE (ABS. MAX.)	2 200	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM PEAK NEGATIVE PULSE GRID #1 VOLTAGE	-250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	9.0	WATTS
MAXIMUM GRID #2 DISSIPATION	2.0	WATTS
MAXIMUM CATHODE CURRENT:		
AVERAGE	55	MA.
PEAK	190	MA.
MAXIMUM HEATER POSITIVE OR NEGATIVE WITH RESPECT TO CATHODE (TOTAL DC AND PEAK)	200	VOLTS
MAXIMUM GRID #1 CIRCUIT VALUES		
FIXED BIAS	0.5	MEGOHM
CATHODE BIAS	1.0	MEGOHM
HEATER WARM-UP TIME (APPROX.)[D]	11.0	SECONDS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	25.0	25.0	25.0	VOLTS
HEATER CURRENT	0.30	0.30	0.30	AMP.
PLATE VOLTAGE	60	80 ←	250	VOLTS
GRID #2 (SCREEN) VOLTAGE	150	250	250	VOLTS
GRID #1 VOLTAGE	0[E]	0[E]	-16.5	VOLTS
TRANSCONDUCTANCE	---	---	6 200	μMHOS
PLATE CURRENT	→ 95	195[F]	44	MA.
GRID #2 CURRENT	→ 8.5	19[F]	1.5	MA.
GRID #1 CUTOFF VOLTAGE[G]	---	---	-35	VOLTS

[A] DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

[E] APPLIED FOR SHORT INTERVAL (MAXIMUM OF 2 SECONDS) SO AS NOT TO DAMAGE TUBE.

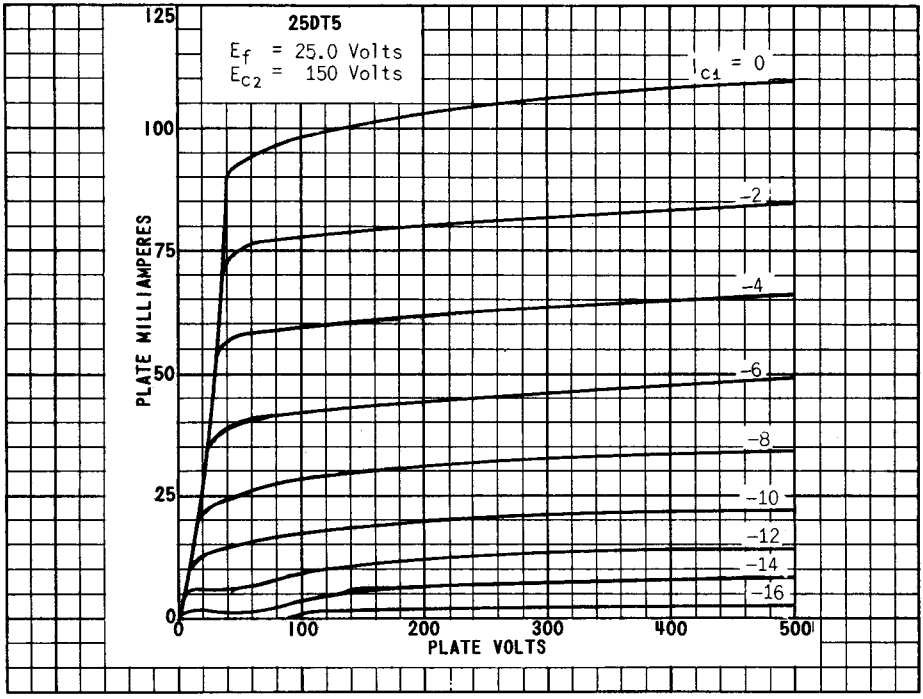
[F] THESE VALUES CAN BE MEASURED BY A METHOD INVOLVING A RE-CURRENT WAVEFORM SUCH THAT THE PLATE DISSIPATION AND GRID #2 INPUT WILL BE KEPT WITHIN RATINGS IN ORDER TO PREVENT DAMAGE TO THE TUBE.

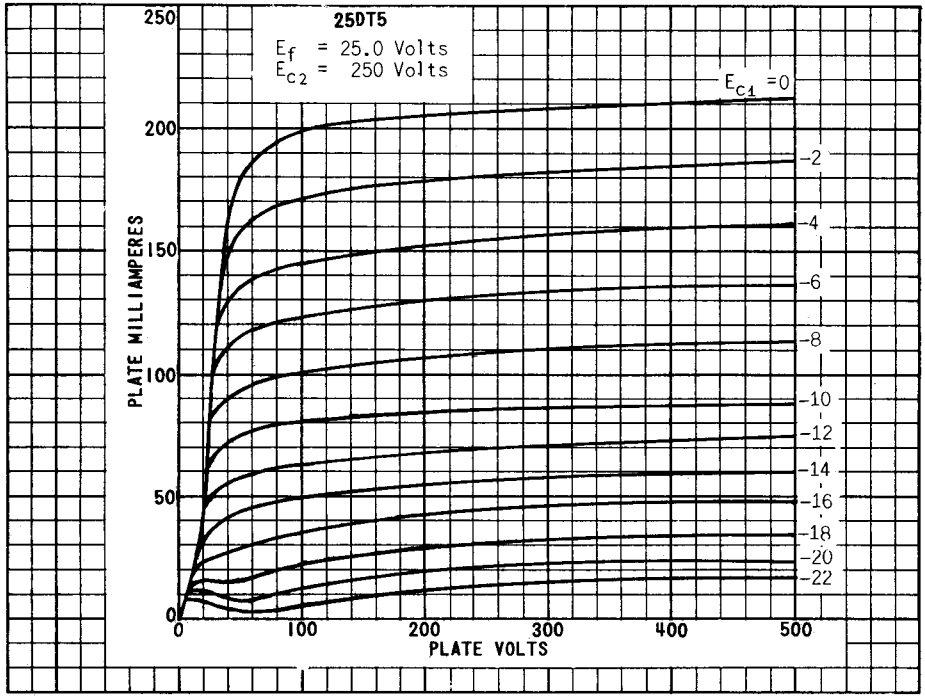
[G] FOR PLATE CURRENT OF 100 μAMPERES.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

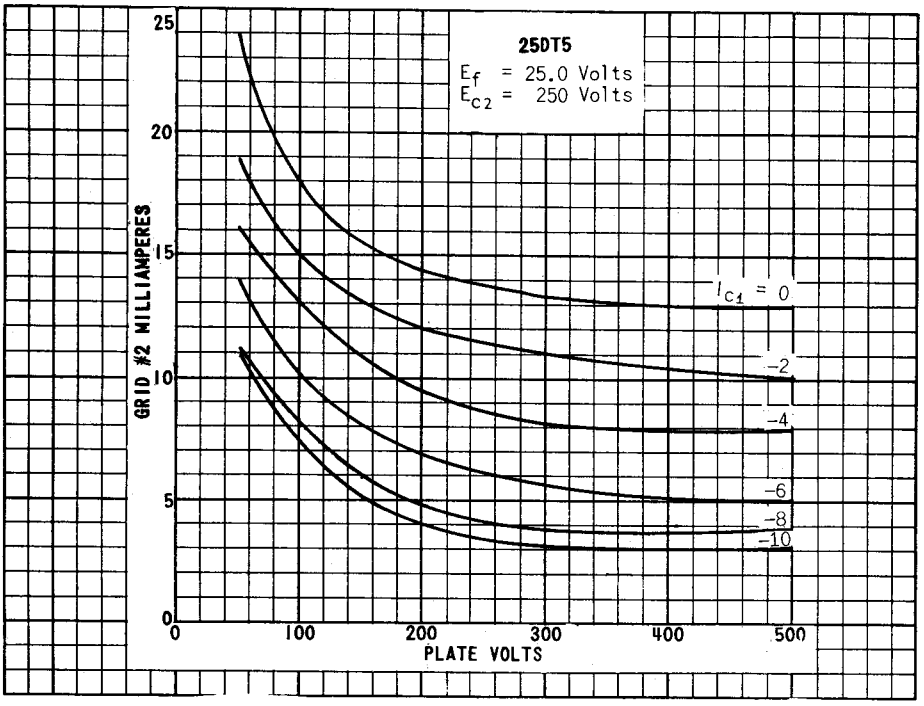
⊕ DC COMPONENT MUST NOT EXCEED 100 VOLTS.

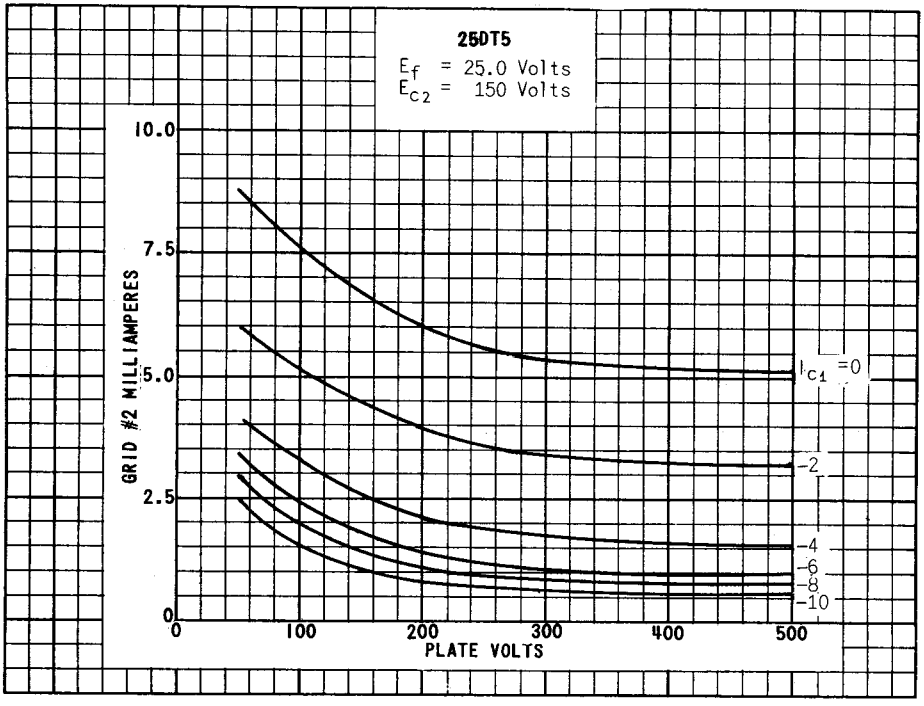
→ INDICATES A CHANGE.


25DT5
E_f = 25.0 Volts
E_{c2} = 150 Volts
I_{c1} = 0
-2
-4
-6
-8
-10
-12
-14
-16
PLATE MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
125
0
100
200
300
400
500


25DT5
E_f = 25.0 Volts
E_{c2} = 250 Volts
E_{c1} =0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
PLATE MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
0
100
200
300
400
500

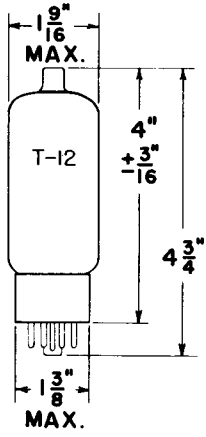
25DT5


25DT5
E_f = 25.0 Volts
E_{c2} = 250 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
0
5
10
15
20
25
100
200
300
400
500
I_{c1} = 0
-2
-4
-6
-8
-10


25DT5
E_f = 25.0 Volts
E_{c2} = 150 Volts
GRID #2 MILLIAMPERES
PLATE VOLTS
0
2.5
5.0
7.5
10.0
100
200
300
400
500
I_{c1} =0
-2
-4
-6
-8
-10

TUNG-SOL

BEAM PENTODE

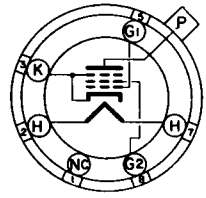


GLASS BULB
SMALL TOP CAP

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.6 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM-SHELL
8 PIN OCTAL
5BT

THE 25EC6 IS A BEAM POWER PENTODE DESIGNED FOR USE AS THE HORIZONTAL-DEFLECTION AMPLIFIER TUBE IN TELEVISION RECEIVERS THAT EMPLOY 110 DEGREE-DEFLECTION PICTURE TUBES. IT HAS ELECTRICAL CHARACTERISTICS SIMILAR TO THOSE OF THE 25CD6GB AND IN ADDITION, THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT	24	μμf
OUTPUT	10	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

HEATER VOLTAGE	25	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE(BOOST+DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	7 000	VOLTS
MAXIMUM PEAK NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM SCREEN VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION[B]	10	WATTS
MAXIMUM SCREEN DISSIPATION	4.0	WATTS
MAXIMUM DC CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.

[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

[B] IN STAGES OPERATING WITH GRID LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

RATINGS--CONT'D.

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[A]

MAXIMU

MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC COMPONENT	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
WITH GRID-LEAK BIAS	1.5	MEGOHMS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C
HEATER WARM-UP TIME (APPROX.)*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE		25		VOLTS
HEATER CURRENT		0.6±6%		AMP.
PLATE VOLTAGE	60		135	VOLTS
SCREEN VOLTAGE	135		135	VOLTS
GRID #1 VOLTAGE	0[C]		-22.5	VOLTS
PLATE RESISTANCE (APPROX.)	---		4 700	OHMS
TRANSCONDUCTANCE	---		7 500	μMHOS
PLATE CURRENT	350		70	MA.
SCREEN CURRENT	40		4.5	MA.
GRID #1 VOLTAGE (APPROX.)				
I_b =1.0 MA.	---		-42	VOLTS
TRIODE AMPLIFICATION FACTOR[D]	---		3.8	

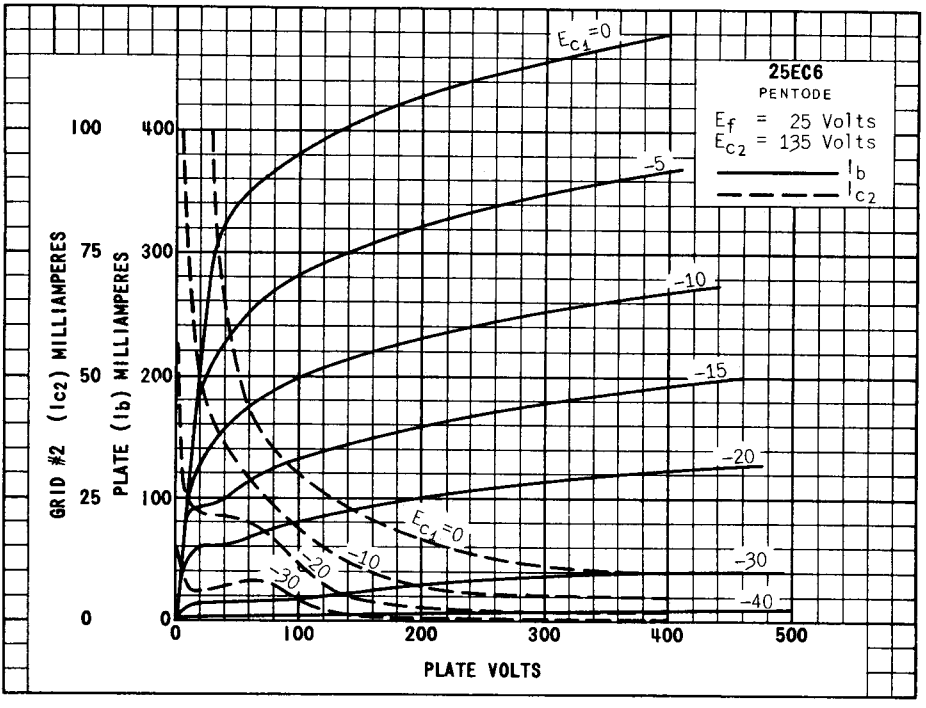
[A] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCAST STATIONS: FEDERAL COMMUNICATIONS COMMISSION", THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

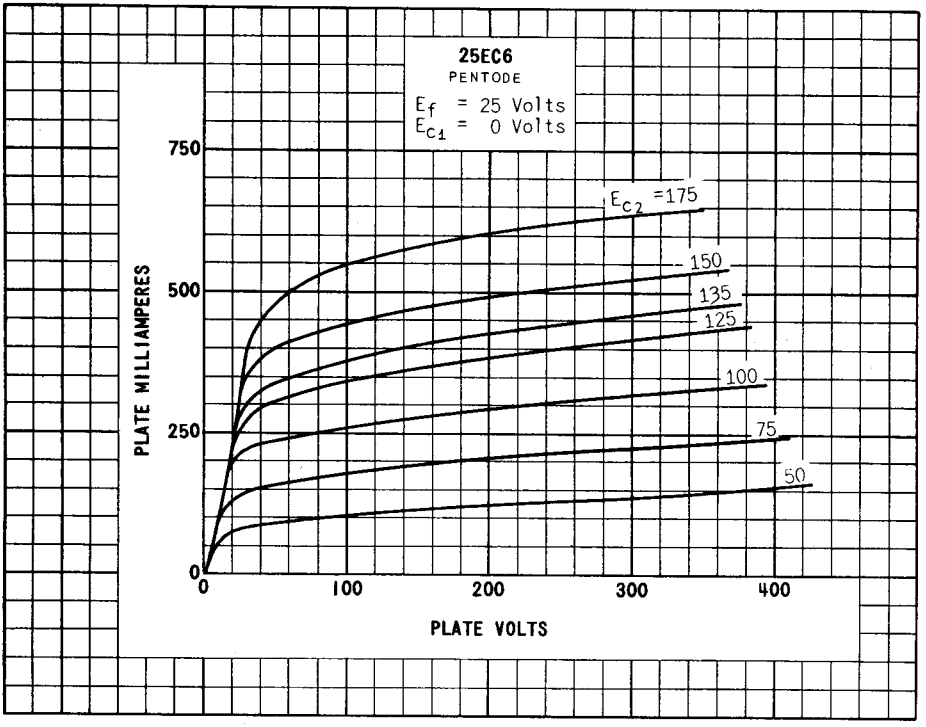
[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

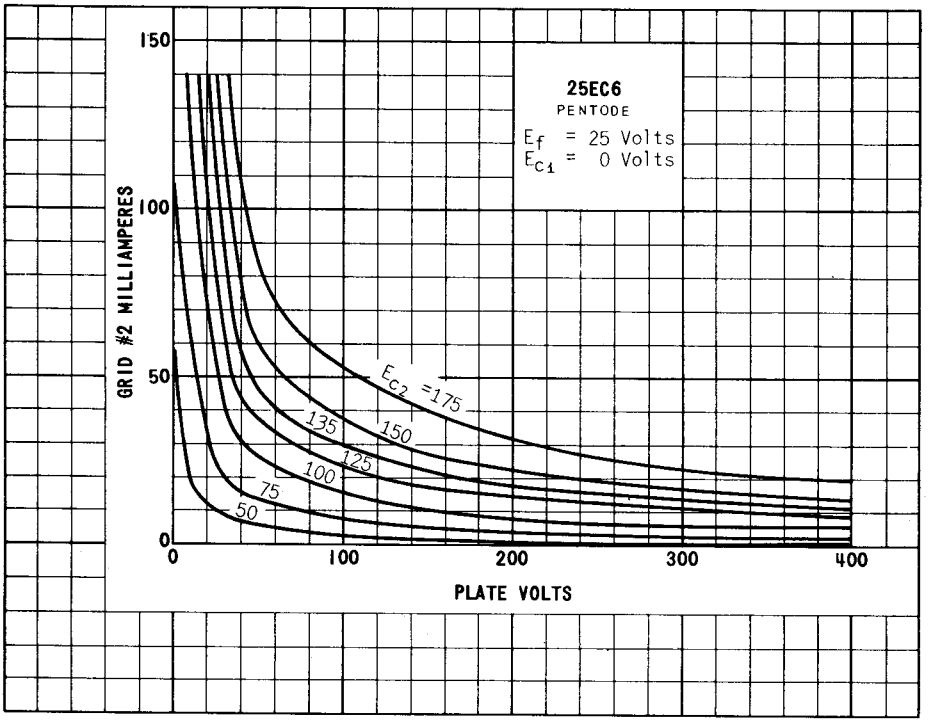
[D] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH Eb=Ec2=135 VOLTS AND Ec1=-22.5 VOLTS.

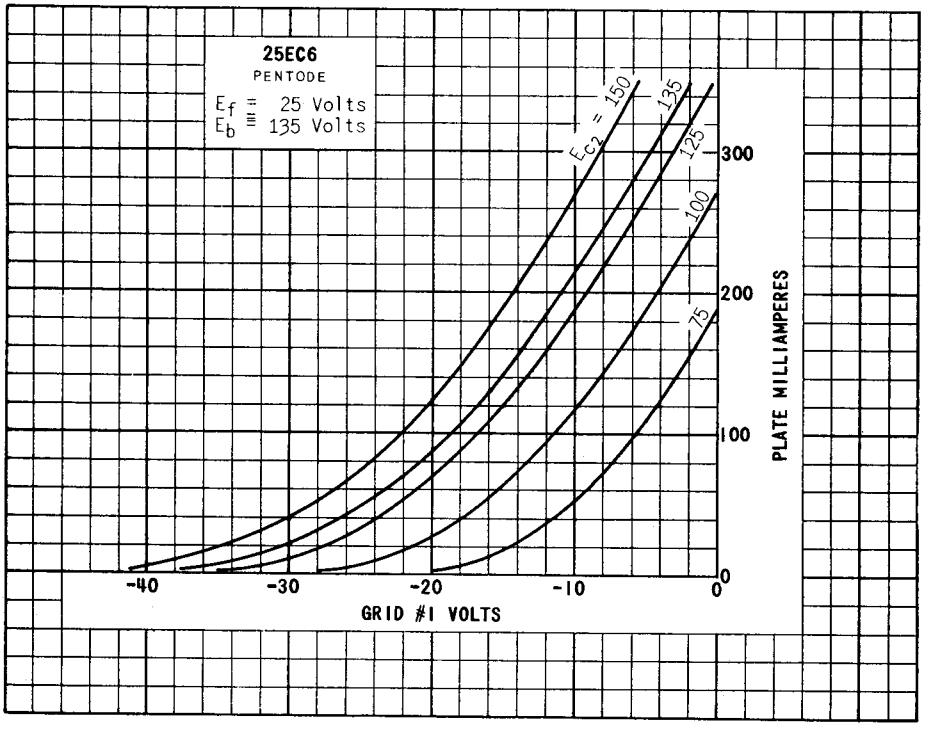
* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

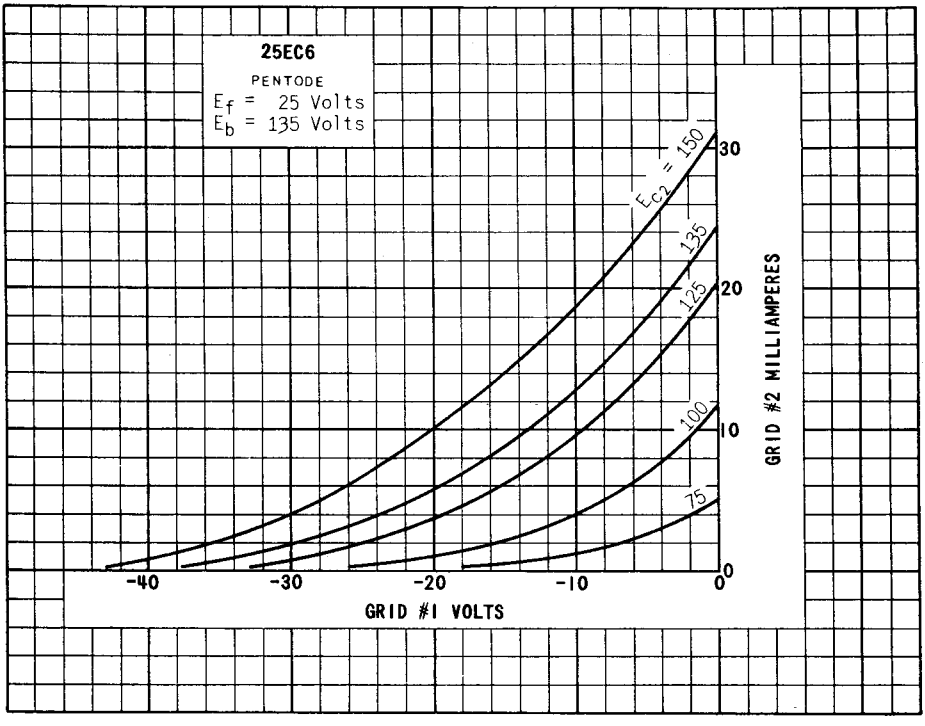
DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.


25EC6
PENTODE
E_f = 25 Volts
E_{c_2} = 135 Volts
I_b
I_{c_2}
E_{c_1}=0
-5
-10
-15
-20
-30
-40
GRID #2 (I_{c_2}) MILLIAMPERES
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
100
200
300
400
500


25EC6
PENTODE
E_f = 25 Volts
E_{c_1} = 0 Volts
E_{c_2} =175
150
135
125
100
75
50
PLATE MILLIAMPERES
PLATE VOLTS
0
250
500
750
100
200
300
400


25EC6
PENTODE
E_f = 25 Volts
E_{c1} = 0 Volts
GRID #2 MILLIAMPERES
150
100
50
0
E_{c2} =175
150
135
125
100
75
50
0
100
200
300
400
PLATE VOLTS

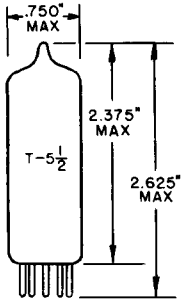

25EC6
PENTODE
E_f = 25 Volts
E_b = 135 Volts
E_{c2} = 150
135
125
100
75
300
200
100
0
PLATE MILLIAMPERES
-40
-30
-20
-10
0
GRID #1 VOLTS


25EC6
PENTODE
E_f = 25 Volts
E_b = 135 Volts
E_{c2} = 150
135
125
100
75
30
20
10
0
GRID #2 MILLIAMPERES
-40
-30
-20
-10
0
GRID #1 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

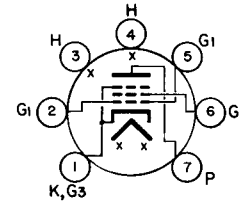


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

FOR USE IN
AUDIO OUTPUT STAGES OF
RADIO AND TV RECEIVERS
AND PHONOGRAPHS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 25EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS BEEN SPECIFICALLY DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS AND PHONOGRAPHS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, IT IS IDENTICAL TO THE 6EH5, 12EH5 AND THE 50EH5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.65	pf
GRID 1 TO CATHODE & GRID 3, HEATER & GRID 2	17	pf
PLATE TO CATHODE & GRID 3, HEATER & GRID 2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	25	VOLTS	300	MA.
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			300 ± 20	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200 [B]	VOLTS

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AMPLIFIER

PLATE VOLTAGE	→ 150	VOLTS
GRID 2 (SCREEN-GRID) VOLTAGE	→ 130	VOLTS
PLATE DISSIPATION	→ 5.5	WATTS
GRID 2 INPUT	→ 2	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

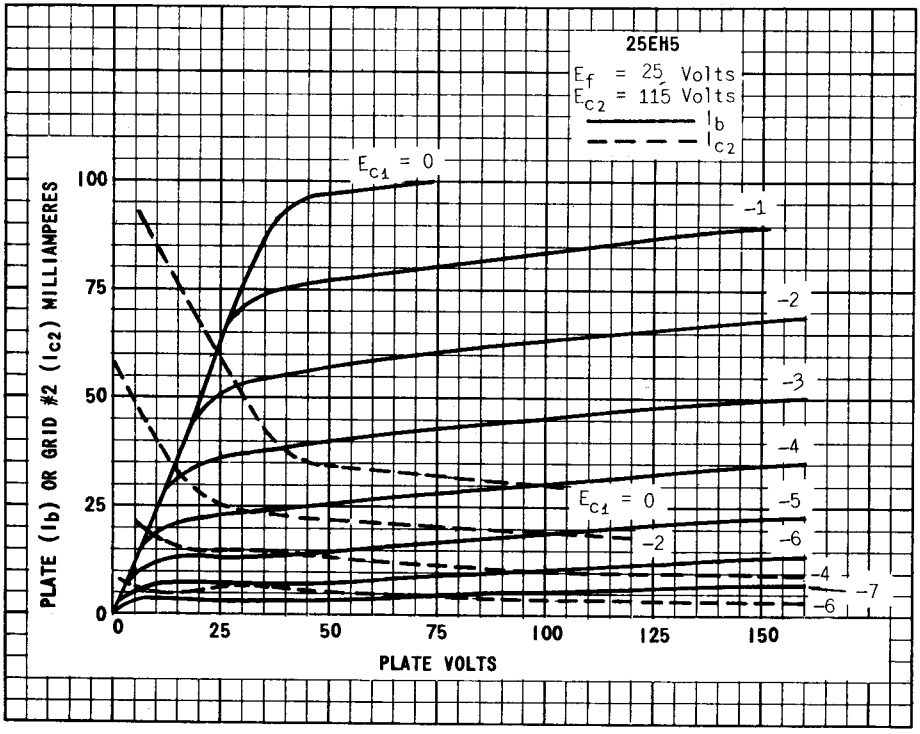
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID 2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID 1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	42	MA.
SIGNAL PLATE CURRENT (MAX.)	42	MA.
ZERO-SIGNAL GRID 2 CURRENT	11.5	MA.
SIGNAL GRID 2 CURRENT (MAX.)	14.5	MA.
TRANSCONDUCTANCE	14,600	μMHOS
PLATE RESISTANCE (APPROX.)	11,000	OHMS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
SIGNAL POWER OUTPUT (MAX.)	1.4	WATTS

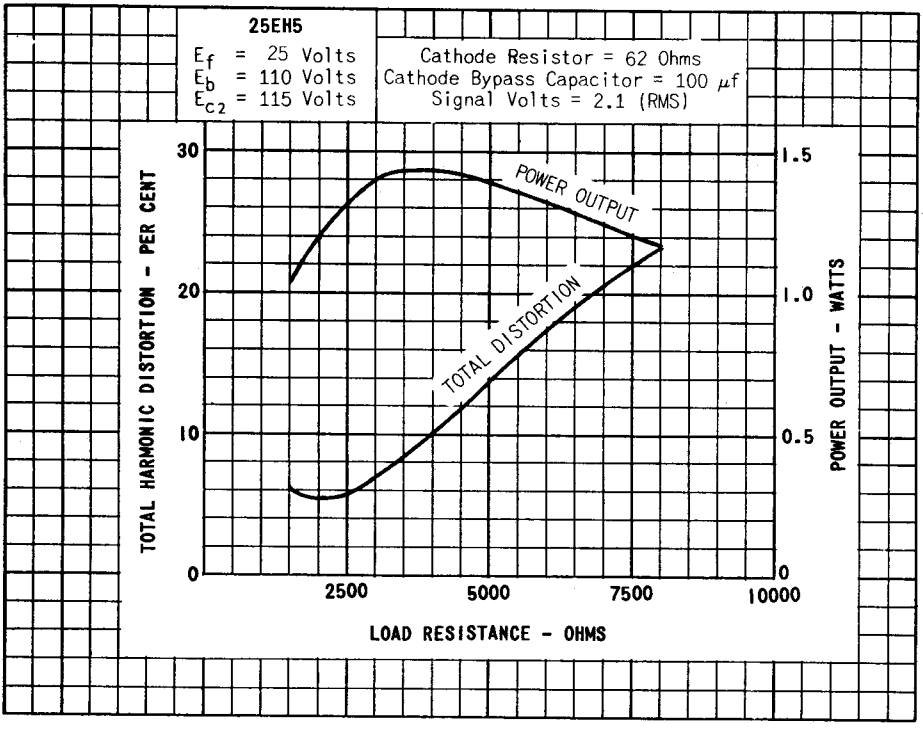
PUSH-PULL AF POWER AMPLIFIER - CLASS AB1

VALUES ARE FOR TWO TUBES

PLATE SUPPLY VOLTAGE	140	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR	68	OHMS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	9.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL GRID 2 CURRENT	11	MA.
MAX.-SIGNAL GRID 2 CURRENT	17.7	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAX.-SIGNAL POWER OUTPUT	3.8	WATTS.

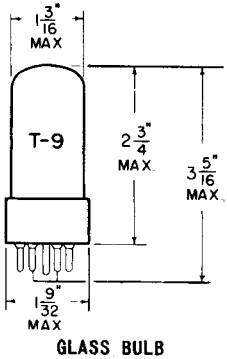
→ INDICATES A CHANGE.


25EH5
E_f = 25 Volts
E_{c2} = 115 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
-4
E_{c1} = 0
-5
-2
-6
-4
-7
-6
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
100
75
50
25
0
0
25
50
75
100
125
150
PLATE VOLTS


25EH5
E_f = 25 Volts
E_b = 110 Volts
E_{c2} = 115 Volts
Cathode Resistor = 62 Ohms
Cathode Bypass Capacitor = 100 μf
Signal Volts = 2.1 (RMS)
POWER OUTPUT
TOTAL DISTORTION
TOTAL HARMONIC DISTORTION - PER CENT
30
20
10
0
1.5
1.0
0.5
0
POWER OUTPUT - WATTS
2500
5000
7500
10000
LOAD RESISTANCE - OHMS

TUNG-SOL

BEAM PENTODE

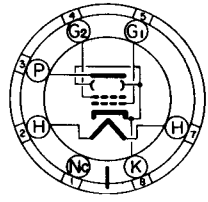


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
7 PIN OCTAL

7AC

THE 25L6GT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC/DC RECEIVERS. IT DELIVERS A HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	25	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	25	25	VOLTS
HEATER CURRENT	0.3	0.3 ←	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

→ INDICATES A CHANGE.

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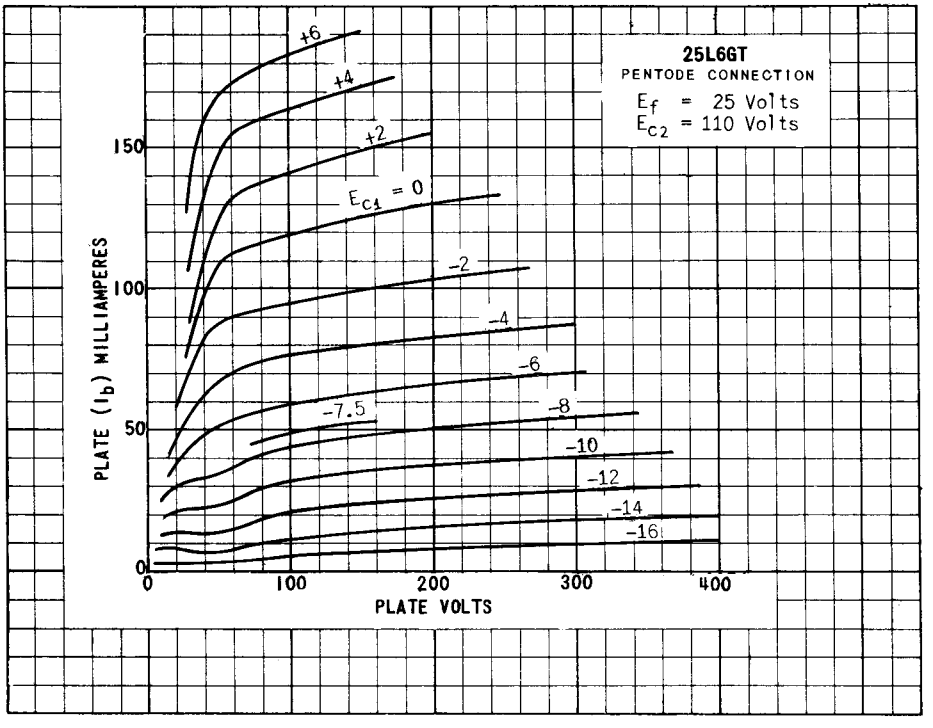
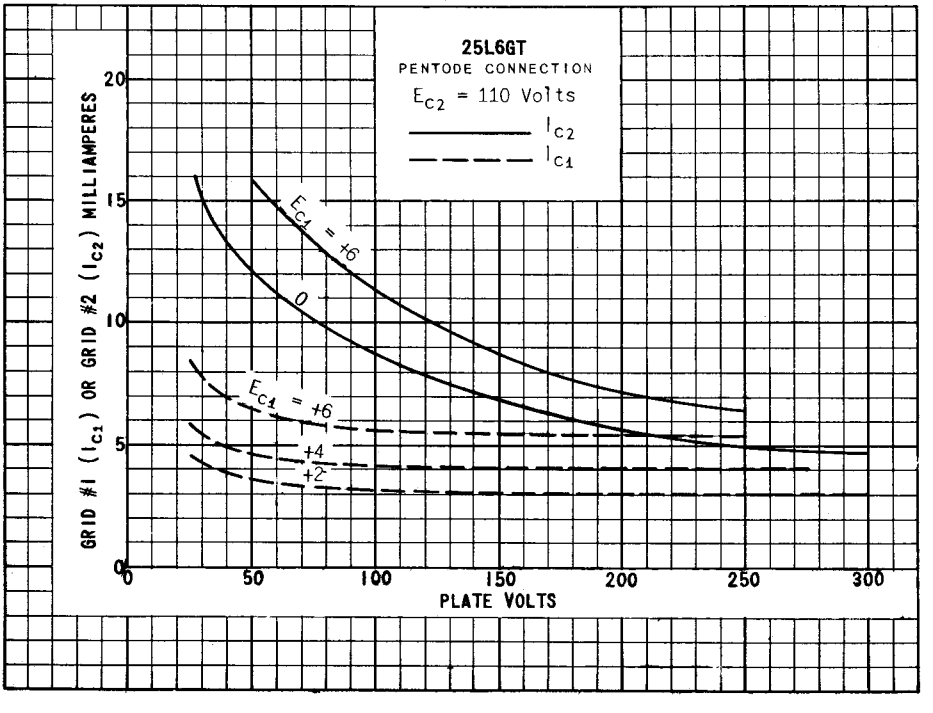
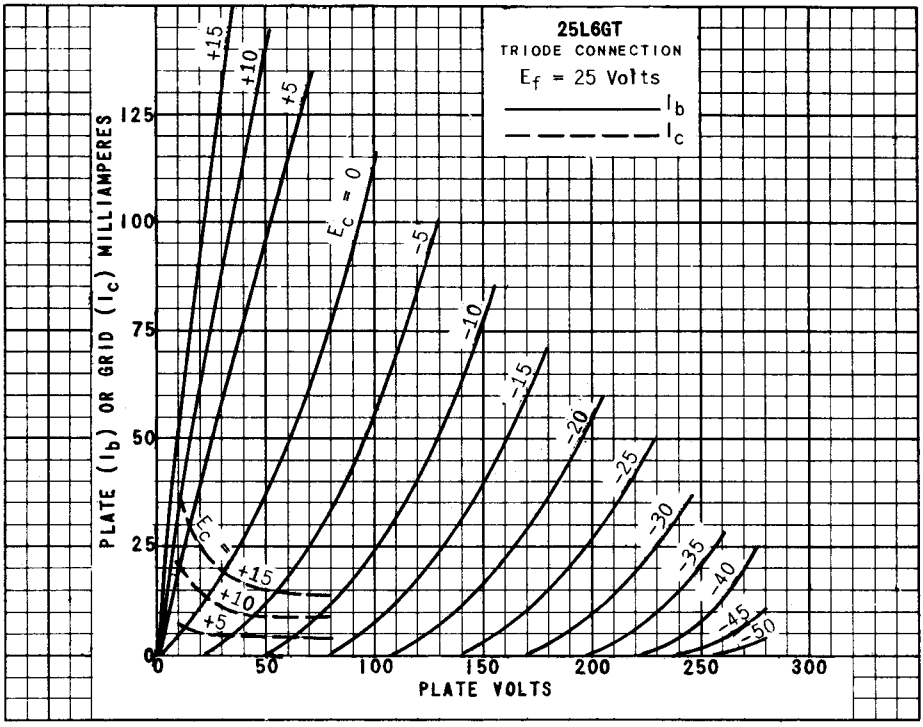
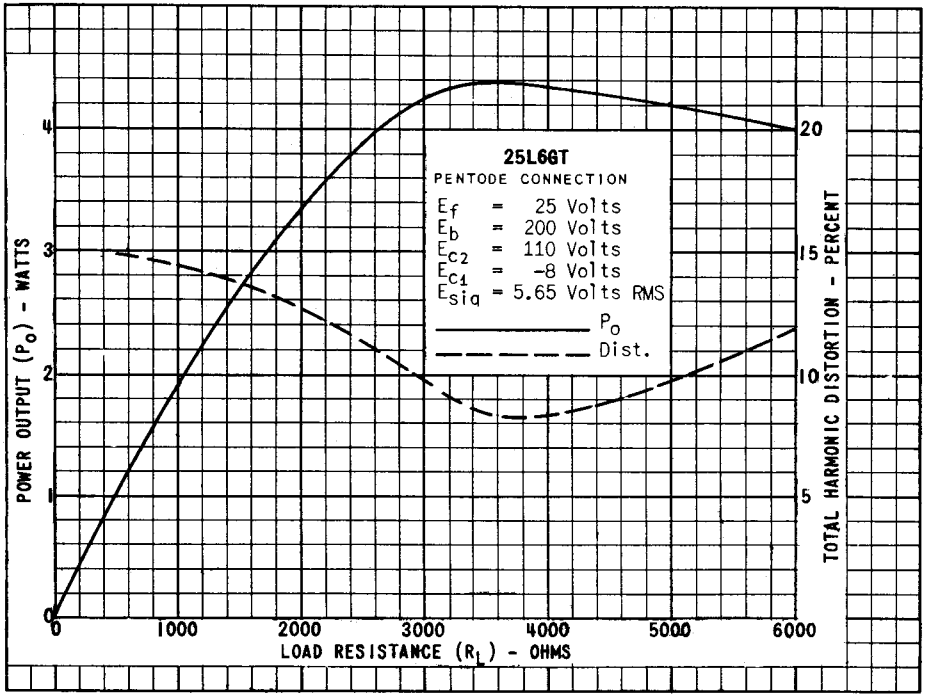
25L6GT


25L6GT
PENTODE CONNECTION
E_f = 25 Volts
E_{c2} = 110 Volts
+6
+4
+2
E_{c1} = 0
-2
-4
-6
-7.5
-8
-10
-12
-14
-16
PLATE (I_b) MILLIAMPERES
0
50
100
150
0
100
200
300
400
PLATE VOLTS


25L6GT
PENTODE CONNECTION
E_{c2} = 110 Volts
I_{c2}
I_{c1}
E_{c1} = +6
0
E_{c1} = +6
+4
+2
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
0
5
10
15
20
0
50
100
150
200
250
300
PLATE VOLTS





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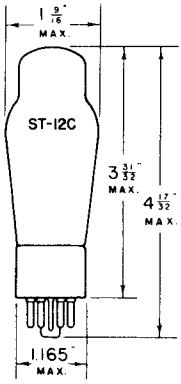
TUNG-SOL



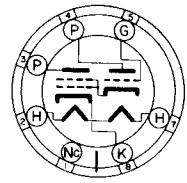
DYNAMIC COUPLED POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 7 PIN OCTAL BASE



G-7Wa

THE TUNG-SOL 25N6G CONSISTS OF TWO DYNAMICALLY COUPLED TRIODES AND IS DESIGNED FOR SERVICE IN THE POWER OUTPUT STAGE OF AC-DC RECEIVERS. ALL NECESSARY BIASES ARE SUPPLIED INTERNALLY. ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 25B5.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

OUTPUT PLATE (3) VOLTAGE	110	180 MAX.	VOLTS
INPUT PLATE (4) VOLTAGE	110	100 P	VOLTS
INPUT GRID (5) VOLTAGE	0	0	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	MEGOHM
OUTPUT PLATE CURRENT	42	46	MA.
INPUT PLATE CURRENT	7	5.8	MA.
TRANSCONDUCTANCE	2200	2300	μMHOS
AMPLIFICATION FACTOR	25	35	
LOAD RESISTANCE	2000	4000	OHMS
SIGNAL VOLTAGE (RMS) S	21	21	VOLTS
TOTAL HARMONIC DISTORTION	9	9	PER CENT
POWER OUTPUT	2.0	3.8	WATTS

(3) BASE PIN #3, (4) BASE PIN #4 (5) BASE PIN #5

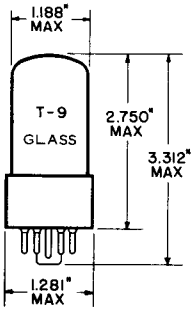
S FOR RATED POWER OUTPUT

P BOTH PLATES MAY BE OPERATED AT 180 VOLTS IF THE GRID IS BIASED TO -20 VOLTS. FIXED OR SELF BIAS MAY BE USED. FOR SELF BIAS THE CATHODE RESISTOR SHOULD BE 400 OHMS.

PLATE 215-1

TUNG-SOL

OUTLINE DRAWING
JEDEC 9-11 OR 9-41



INTERMEDIATE SHELL OCTAL
BASE 5 PIN JEDEC B5-82
OR 6 PIN JEDEC B6-8
OR SHORT INTERMEDIATE OCTAL
BASE 5 PIN JEDEC B5-85 OR
6 PIN JEDEC B6-60

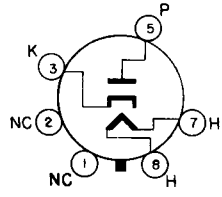
DIODE

FOR
DAMPING SERVICE
IN T.V. RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 4CG



BOTTOM VIEW

THE 25W4GT IS AN INDIRECTLY HEATED HALF-WAVE RECTIFIER IN THE T-9 OCTAL CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS THE DAMPING DIODE IN DIRECT-DRIVE SWEEP CIRCUITS IN TELEVISION RECEIVERS. IT MAY ALSO BE USED IN CONVENTIONAL RECTIFIER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

HEATER TO CATHODE	11	pf
PLATE TO CATHODE AND HEATER	6.0	pf
CATHODE TO PLATE AND HEATER	17	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN CENTER VALUES (EXCEPT AS NOTED) - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	25 VOLTS	300	mA
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC - ABSOLUTE MAXIMUM		500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN CENTER VALUES (EXCEPT AS NOTED) - SEE EIA STANDARD RS-239

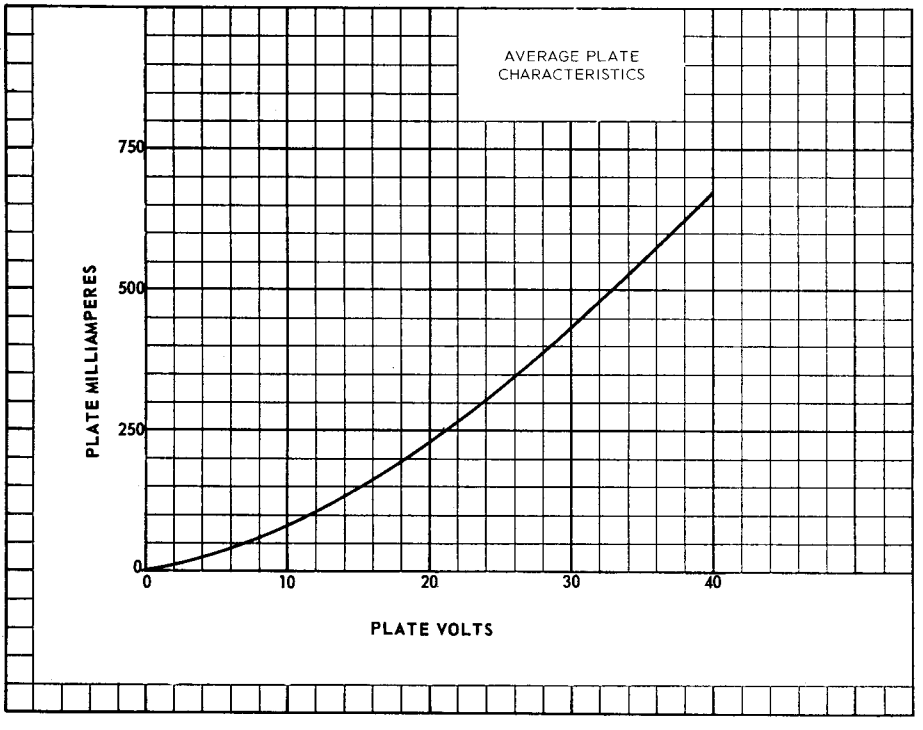
DAMPER SERVICE SEE NOTE

PEAK INVERSE PLATE VOLTAGE - ABSOLUTE MAXIMUM	3,850	VOLTS
PLATE DISSIPATION	3.5	WATTS
STEADY STATE PEAK CURRENT	750	mA
DC PLATE CURRENT	125	mA

NOTE - FOR OPERATION IN A 525 LINE, 30 FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION." THE DUTY CYCLE OF THE HORIZONTAL VOLTAGE PULSE NOT TO EXCEED 15% OF A SCANNING CYCLE.

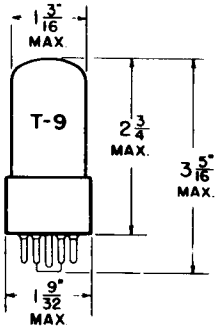
CHARACTERISTICS

TUBE VOLTAGE DROP FOR I_b = 250 mA	21	VOLTS



TUNG-SOL

BEAM PENTODE

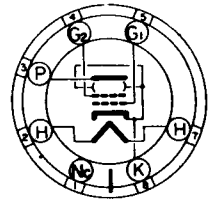


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 25W6GT IS A BEAM PENTODE POWER AMPLIFIER DESIGNED SPECIFICALLY FOR USE AS A VERTICAL SCANNING OUTPUT TUBE IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE: (G_1 TO P) MAX.	0.5	μμf
INPUT: G_1 TO (H+K+BP+G_2)	15	μμf
OUTPUT: P TO (H+K+BP+G_2)	9.0	μμf

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

	CLASS A_1 AMPLIFIER	VERTICAL DEFLECTION AMPLIFIER [AB]	
HEATER VOLTAGE	25	25	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE:			
TOTAL DC AND PEAK	200	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE:			
DC	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
MAXIMUM PLATE VOLTAGE	300	300	VOLTS
MAXIMUM GRID #2 VOLTAGE	150	---	VOLTS
MAXIMUM PEAK POSITIVE PLATE VOLTAGE (ABSOLUTE MAXIMUM)	---	1 200	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	---	250	VOLTS
MAXIMUM PLATE DISSIPATION[C]	10	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	---	WATTS
MAXIMUM AVERAGE CATHODE CURRENT	---	40	MA.
MAXIMUM PEAK CATHODE CURRENT	---	140	MA.
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS OPERATION	0.1	---	MEGOHMS
CATHODE BIAS OPERATION	0.5	2.2	MEGOHMS

[A] TRIODE CONNECTION - GRID #2 TIED TO PLATE.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

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PLATE 3152
FEB. 1 1953

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

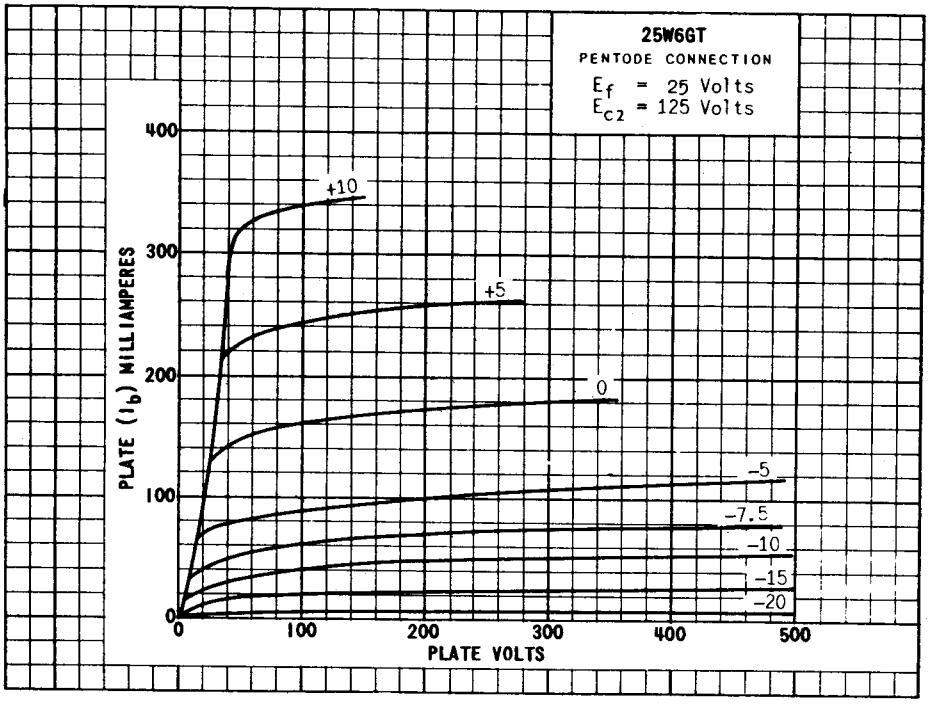
HEATER VOLTAGE	25	25	VOLTS
HEATER CURRENT	0.3	0.3	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	---	VOLTS
CATHODE BIAS RESISTOR	---	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTOR (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT (APPROX.)	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.0	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT (APPROX.)	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

TRIODE CONNECTION[C]

HEATER VOLTAGE	25	VOLTS
HEATER CURRENT	0.3	AMP.
PLATE VOLTAGE	225	VOLTS
GRID VOLTAGE	-30	VOLTS
AMPLIFICATION FACTOR	6.2	
PLATE RESISTANCE[1] (APPROX.)	1 600	OHMS
TRANSCONDUCTANCE	3 800	µMHOS
PLATE CURRENT	22	MA.
GRID VOLTAGE FOR I_b = 0.5 MA. (APPROX.)	-42	VOLTS

[C] GRID #2 TIED TO PLATE.

PLATE 3153
FEB. 1 1953



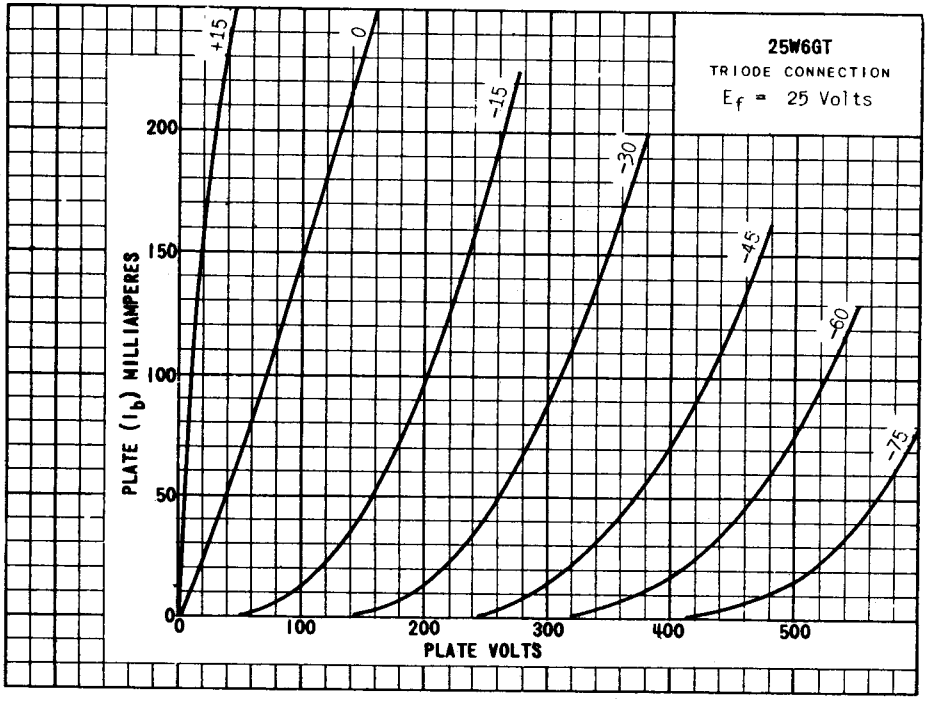


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PLATE
3154
FEB. 1
1953

25W6GT (25W6GT)

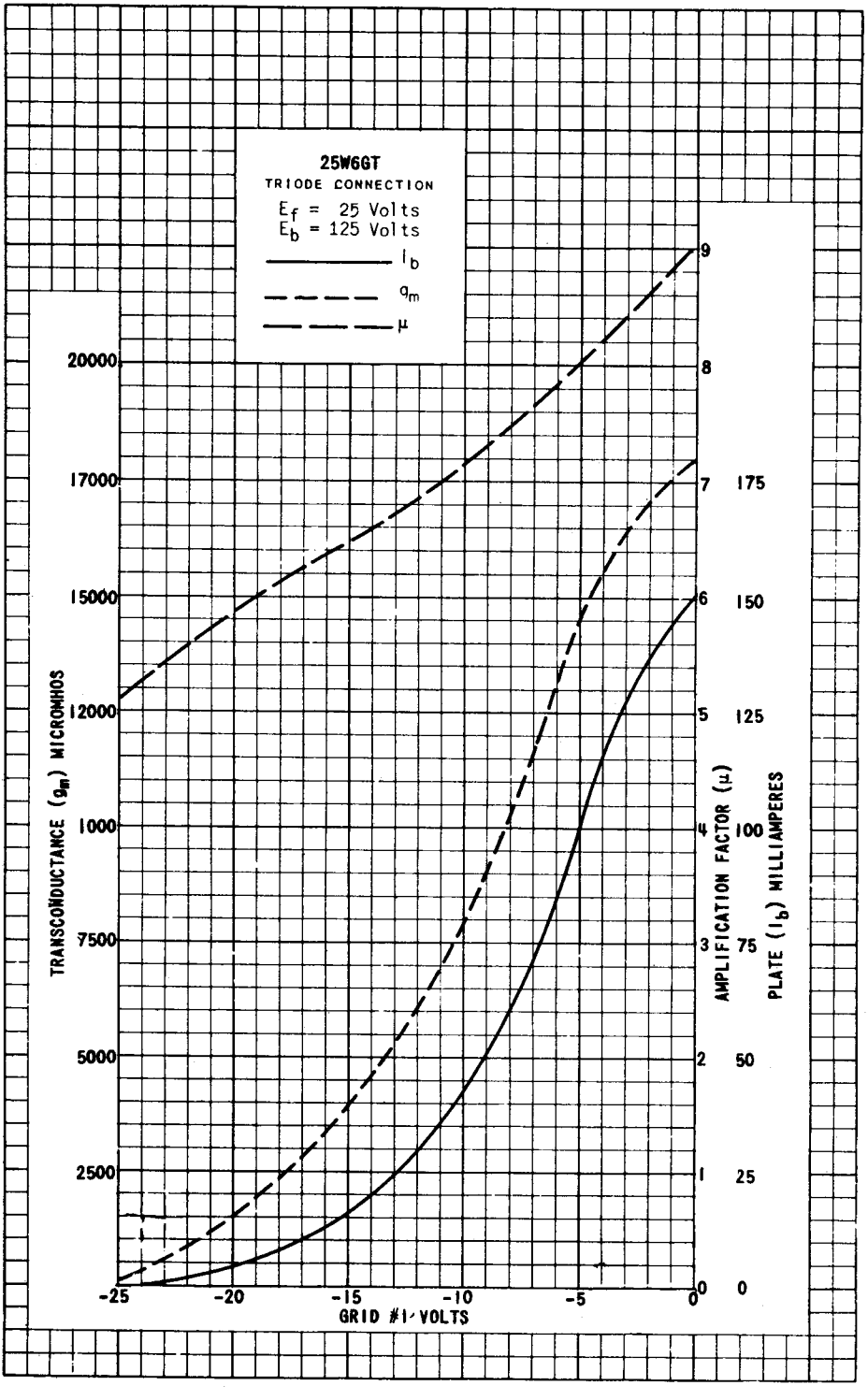
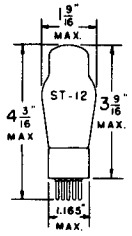


PLATE 3155
FEB. 1 1953

TUNG-SOL



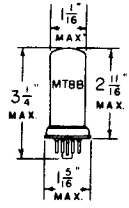
GLASS BULB
SMALL 6 PIN BASE
25Z5

TWIN DIODE HIGH VACUUM RECTIFIER

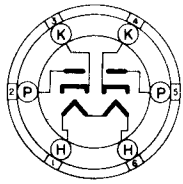
VOLTAGE DOUBLER

UNIPOTENTIAL CATHODES

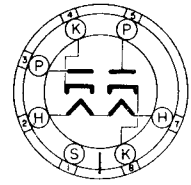
HEATER
25 VOLTS 0.3 AMPERE
AC OR D



METAL SHELL
7 PIN OCTAL BASE
25Z6



6E
BOTTOM VIEW
25Z5



7Q
BOTTOM VIEW
25Z6

THE TUNG-SOL 25Z5 AND 25Z6 ARE DESIGNED PRIMARILY FOR SERVICE AS POWER RECTIFIERS IN AC-DC RECEIVERS. TWO SEPARATE RECTIFIER SECTIONS PERMIT USING THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. FOR HALF WAVE OPERATION THE TWO SECTIONS MAY BE OPERATED SEPARATELY, OR IN PARALLEL TO REDUCE TUBE DROP. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 25Z6GT/G.

RATINGS

MAXIMUM AC PLATE VOLTAGE PER PLATE (RMS)	235	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	450	MA.
TUBE VOLTAGE DROP AT 150 MA. PER PLATE	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
AC VOLTAGE PER PLATE (RMS) MAX.	117	117	VOLTS
DC OUTPUT CURRENT MAX.	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	30	15	OHMS

A WHEN FILTER CONDENSER LARGER THAN 40 MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 928-3

DEC.-30 1940

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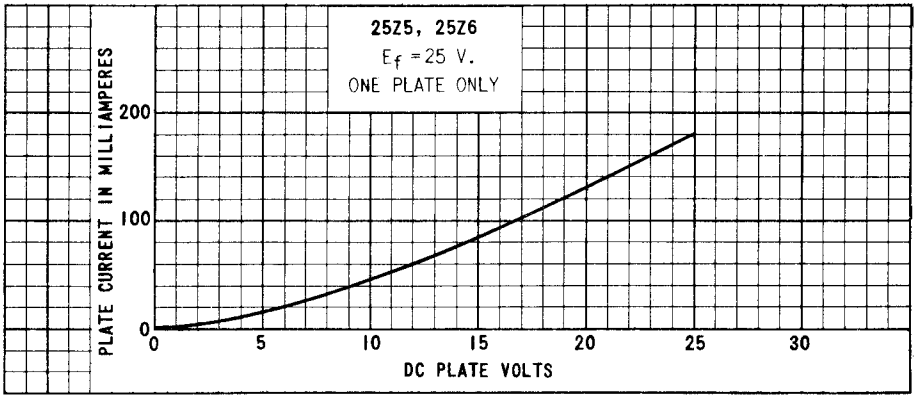
25Z5, 25Z6

TUNG-SOL

HALF-WAVE RECTIFIER

AC VOLTAGE PER PLATE (RMS)$^{MAX.}$	117	150	235$^{MAX.}$	VOLTS
DC OUTPUT CURRENT PER PLATE$^{MAX.}$	75	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE$^{MIN.A}$	15	40	100	OHMS



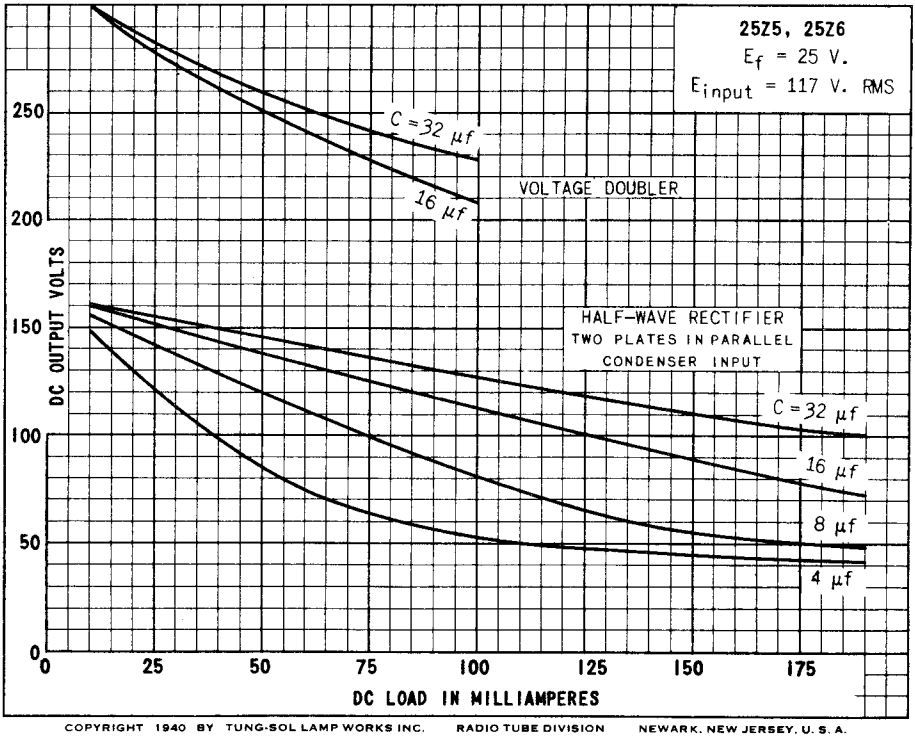


PLATE
929-3

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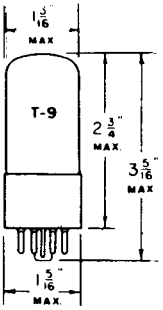
TUNG-SOL

TWIN DIODE HIGH VACUUM RECTIFIER

VOLTAGE DOUBLER



UNIPOTENTIAL CATHODES

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

G-7Qa
BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 25Z6GT/G IS DESIGNED PRIMARILY FOR SERVICE AS A POWER RECTIFIER IN AC - DC RECEIVERS. TWO SEPARATE RECTIFIER SECTIONS PERMIT USING THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. FOR HALF-WAVE OPERATION THE TWO SECTIONS MAY BE OPERATED SEPARATELY, OR IN PARALLEL TO REDUCE TUBE DROP. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 25Z5 AND 25Z6.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	450	MA.
TUBE VOLTAGE DROP AT 150 MA. PER PLATE	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
AC VOLTAGE PER PLATE (RMS) MAX.	117	117	VOLTS
DC OUTPUT CURRENT MAX.	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[A]	30	15	OHMS

NOTE: THIS DOUBLE-BRANDED TUBE, 25Z6GT/G, REPLACES EITHER THE 25Z6G OR THE 25Z6GT.

[A] WHEN FILTER CONDENSERS LARGER THAN 40 MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

PLATE 930-K

DEC. 30 1940

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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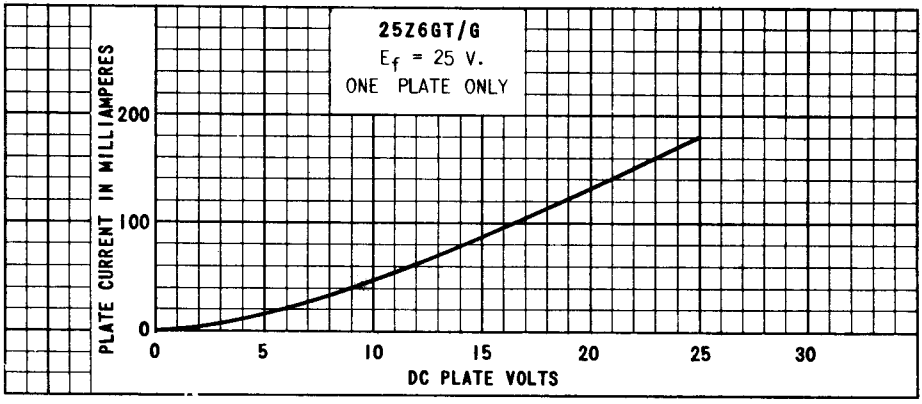
25Z6GT/G

TUNG-SOL

HALF-WAVE RECTIFIER

AC VOLTAGE PER PLATE (RMS)	117	150	235 MAX.	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	75	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.A	15	40	100	OHMS



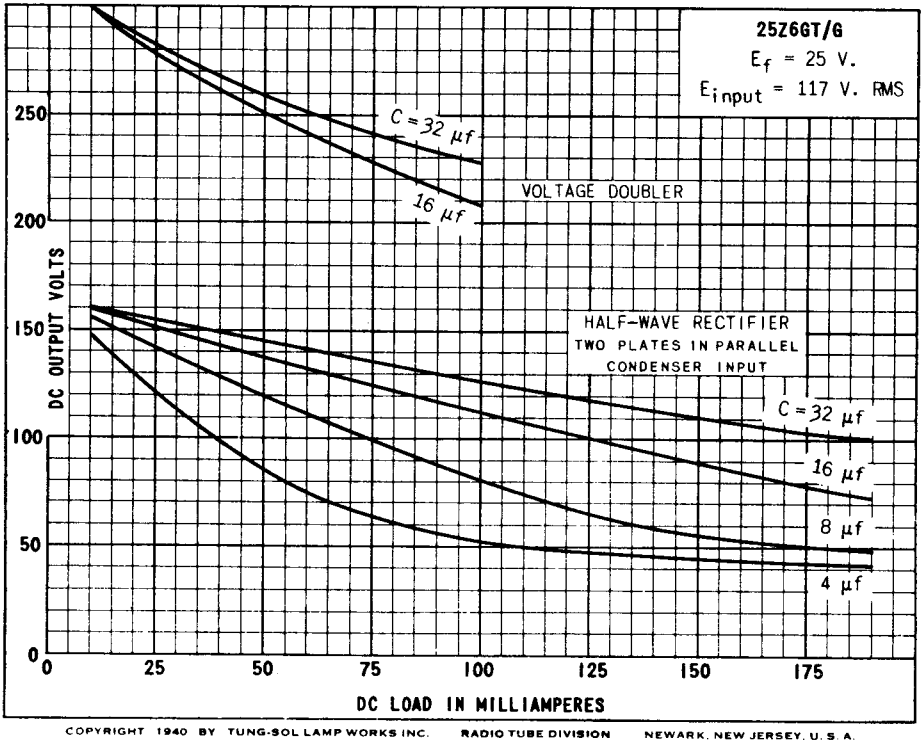


PLATE 931-4

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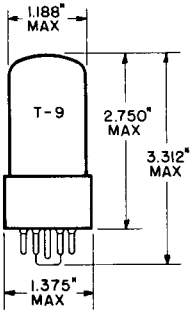
TUNG-SOL

OUTLINE DRAWING



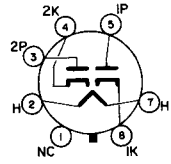
GLASS BULB
LOW LOSS MEDIUM SHELL 7 PIN OCTAL WITH RUBBER INSERT BASE B7-12

TWIN DIODE
FOR
USE IN THE
POWER SUPPLY OF AC
OR AC/DC RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM JEDEC 7Q



BOTTOM VIEW

THE 25Z6WGT IS A RUGGEDIZED HEATER-CATHODE TYPE FULL-WAVE HIGH-VACUUM RECTIFIER-DOUBLER IN THE OCTAL BASE T-9 CONSTRUCTION. IT IS DESIGNED FOR USE IN THE POWER SUPPLY OF AC OR AC/DC RECEIVERS.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	25.0	VOLTS	300	mA
LIMITS OF APPLIED VOLTAGE			25.0±2.5	VOLTS
HEATER-CATHODE VOLTAGE			350	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

PEAK INVERSE PLATE VOLTAGE	730	VOLTS
PEAK PLATE CURRENT PER PLATE	500	mA
DC OUTPUT CURRENT PER PLATE	85	mA
ALTITUDE	10,000	FT.

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP AT I_b = 150mA	22	VOLTS

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

HALF-WAVE RECTIFIER (CAPACITOR INPUT FILTER)*

PLATE SUPPLY VOLTAGE, RMS, PER PLATE	117	235	VOLTS
PLATE SUPPLY RESISTANCE PER PLATE	15	100	OHMS
FILTER INPUT CAPACITOR	16	16	μF
DC OUTPUT CURRENT PER PLATE	75	75	mA
DC OUTPUT VOLTAGE AT FILTER INPUT	115	255	VOLTS

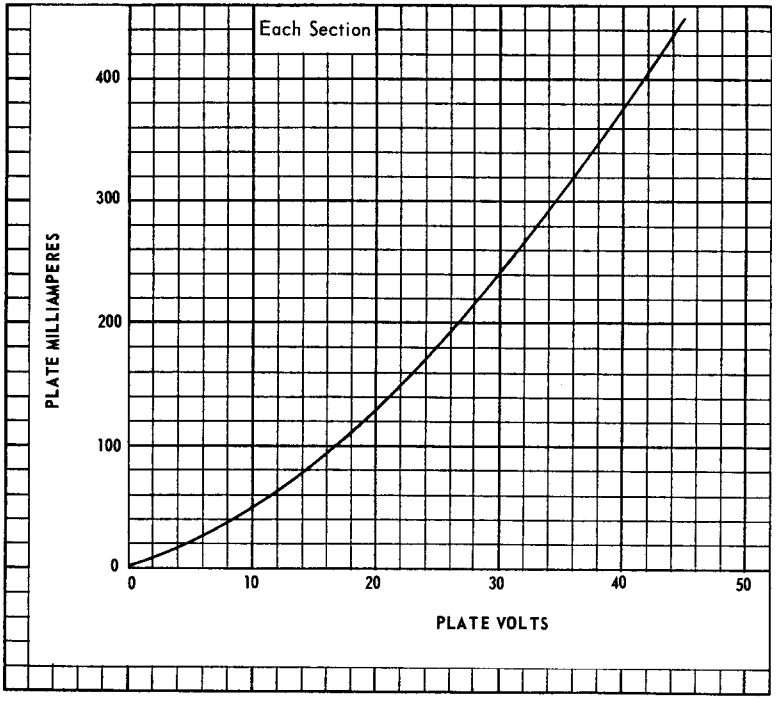
*AS A HALF-WAVE RECTIFIER, THE TWO SECTIONS MAY BE USED SEPARATELY OR IN PARALLEL.

TYPICAL OPERATION

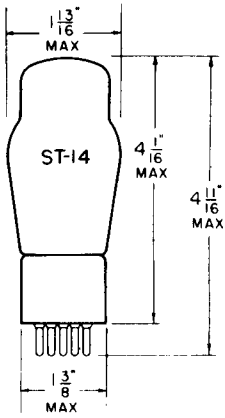
VOLTAGE DOUBLER

	HALF-WAVE	FULL-WAVE	
PLATE SUPPLY VOLTAGE, RMS, PER PLATE	117	117	VOLTS
FILTER INPUT CAPACITOR	16	16	μF
PLATE SUPPLY IMPEDANCE PER PLATE	30	15	OHMS
DC OUTPUT CURRENT	75	75	mA
DC OUTPUT VOLTAGE AT FILTER INPUT:			
AT HALF-LOAD CURRENT OF 37.5 mA	–	250	VOLTS
AT FULL-LOAD CURRENT OF 75 mA	–	205	VOLTS

NOTE: WHEN FILTER CAPACITORS LARGER THAN 40 μF ARE USED, IT MAY BE NECESSARY TO INCREASE PLATE SUPPLY RESISTANCE ABOVE VALUE GIVEN.



TRIODE AMPLIFIER

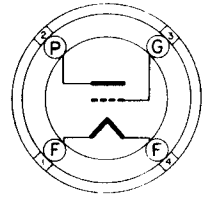


GLASS BULB

COATED FILAMENT

FILAMENT
1.5 VOLTS 1.05 AMPERES
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM
4 PIN BASE

THE 26 IS A TRIODE AMPLIFIER INTENDED PRIMARILY FOR USE IN RF AND AF STAGES OF AC OPERATED RECEIVERS.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	1.5	VOLTS
FILAMENT CURRENT	1.05	AMP.
MAXIMUM PLATE VOLTAGE	180	VOLTS

DIRECT INTERELECTRODE CAPACITANCES
WITH NO EXTERNAL SHIELD

GRID TO PLATE	8.1	μμf
INPUT	2.8	μμf
OUTPUT	2.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	90	135	180	VOLTS
GRID VOLTAGE[A]	-7	-10	-14.5	VOLTS
PLATE CURRENT	2.9	5.5	6.2	MA.
PLATE RESISTANCE	8900	7600	7300	OHMS
TRANSCONDUCTANCE	935	1100	1150	μMHOS
AMPLIFICATION FACTOR	8.3	8.3	8.3	

[A] MEASURED FROM MIDPOINT OF AC OPERATED FILAMENT.

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→ INDICATES A CHANGE OR ADDITION.

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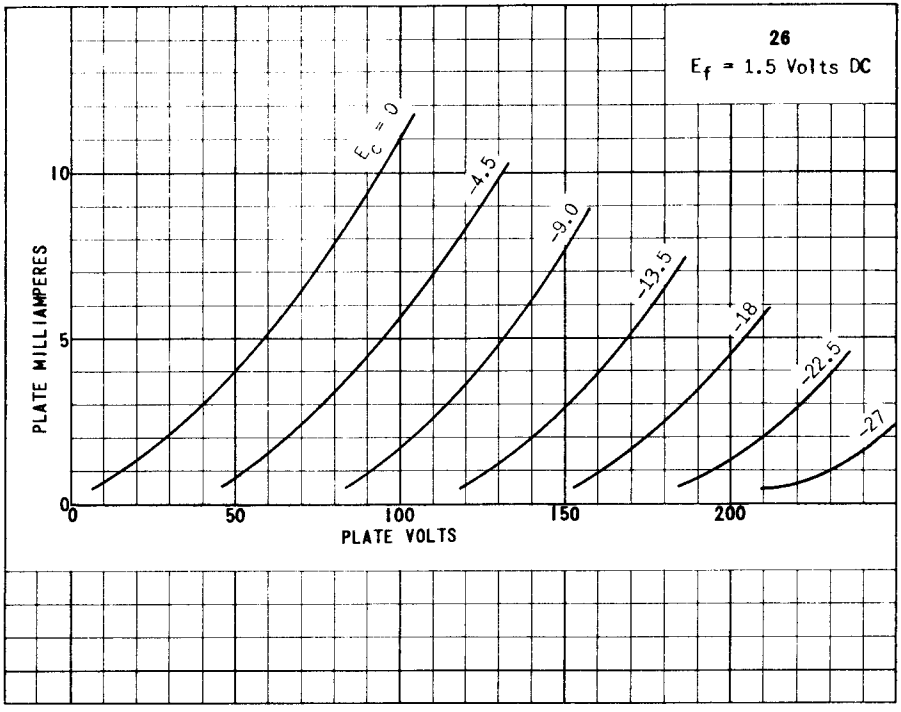

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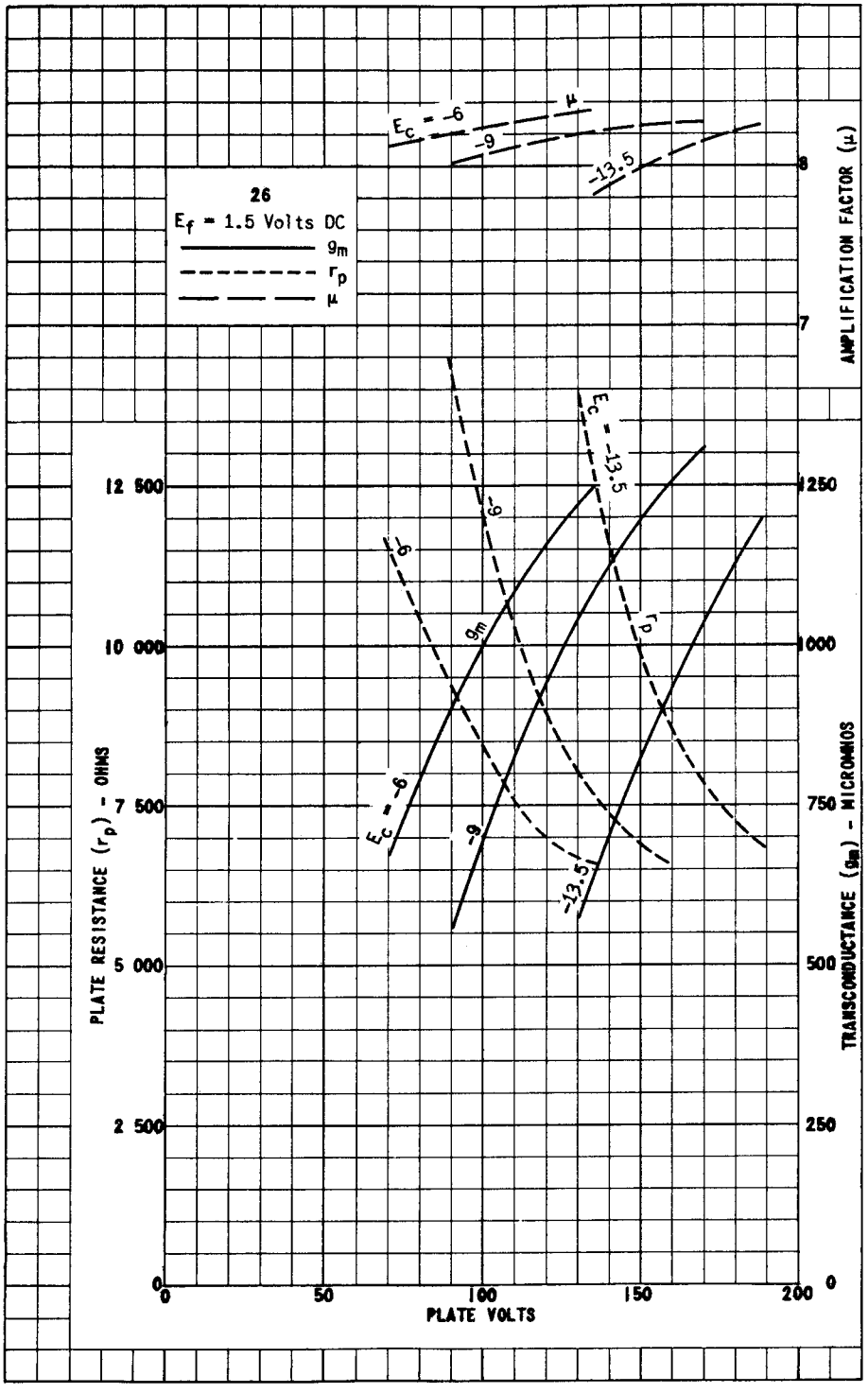

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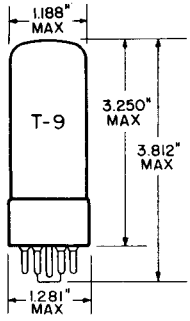
DOUBLE BEAM PENTODE



GLASS BULB
INTERMEDIATE SHELL B8-6
OR
SHORT INTERMEDIATE
SHELL B8-58
8 PIN OCTAL
OUTLINE DRAWING
JEDEC 9-33 OR 9-44

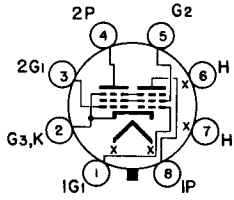
COATED UNIPOTENTIAL CATHODE

FOR

POWER OUTPUT TUBE IN

AIRCRAFT OR MOBILE SERVICE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BU

THE 26A7GT IS A CATHODE TYPE TWIN BEAM POWER AMPLIFIER USING THE OCTAL BASE CONSTRUCTION. IT IS INTENDED FOR USE AS A PUSH-PULL OR PARALLEL CONNECTED POWER OUTPUT TUBE IN AIRCRAFT OR MOBILE SERVICE WHERE BOTH THE PLATE AND HEATER SUPPLY IS LIMITED TO 28 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

EACH UNIT

GRID TO PLATE: (G1 TO P)	1.2	pf
INPUT: G1 TO (H+K+G2+G3)	16	pf
OUTPUT: P TO (H+K+G2+G3)	13	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	26.5 VOLTS	600	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

EACH UNIT

PLATE VOLTAGE	50	VOLTS
GRID 2 VOLTAGE	50	VOLTS
PLATE DISSIPATION	2	WATTS
GRID 2 DISSIPATION	0.5	WATTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

EACH UNIT

PLATE VOLTAGE	26.5	VOLTS
GRID 2 VOLTAGE	26.5	VOLTS
GRID 1 VOLTAGE [A]	-4.5	VOLTS
PEAK AF GRID 1 VOLTAGE	4.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	20	MA.
MAXIMUM-SIGNAL PLATE CURRENT	20.5	MA.
ZERO-SIGNAL GRID 2 CURRENT	1.9	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT	5.5	MA.
TRANSCONDUCTANCE	5700	μMHOS
LOAD RESISTANCE	1500	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	165	MW.

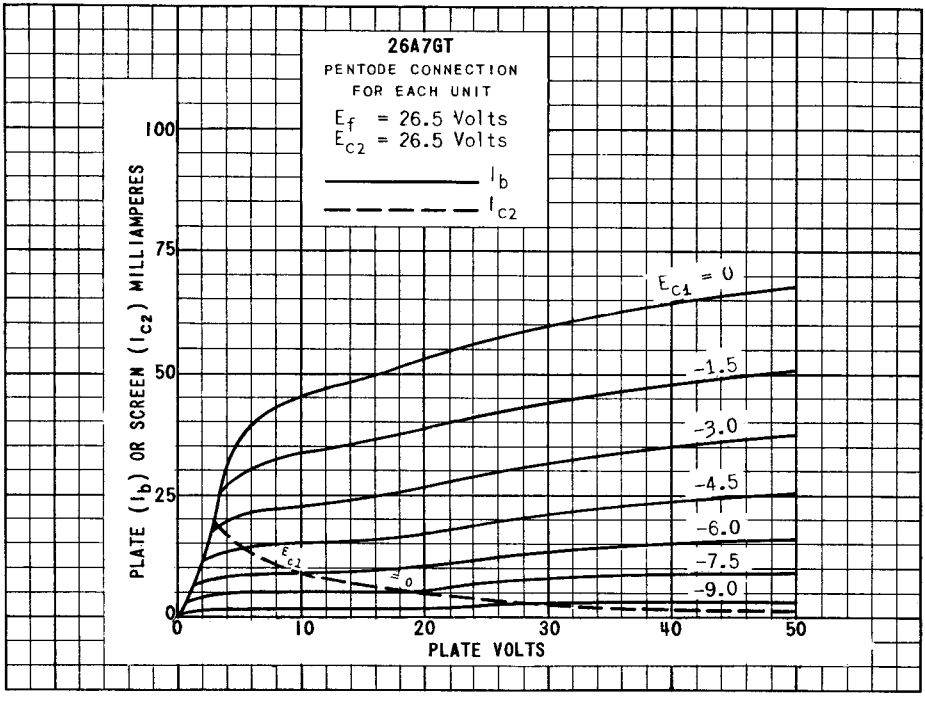
PUSH-PULL CLASS AB1 AMPLIFIER

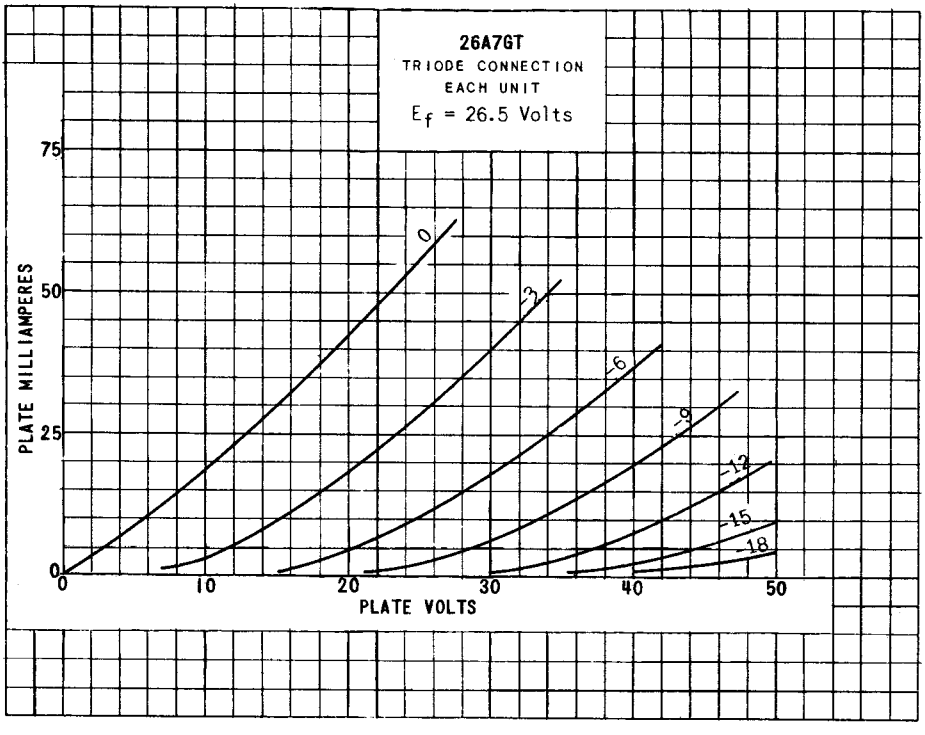
BOTH UNITS

PLATE VOLTAGE	26.5	VOLTS
GRID 2 VOLTAGE	26.5	VOLTS
GRID 1 VOLTAGE [A]	-7	VOLTS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	14	VOLTS
ZERO-SIGNAL PLATE CURRENT	19	MA.
MAXIMUM-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID 2 CURRENT (APPROX.)	2	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (APPROX.)	8.5	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	2500	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	500	MW.

A

UNDER MAXIMUM RATED CONDITIONS, THE DC RESISTANCE IN EACH GRID CIRCUIT MAY BE AS HIGH AS 0.5 MEGOHM WITH CATHODE BIAS AND 0.1 MEGOHM WITH FIXED BIAS. WHEN THE PLATE VOLTAGE AND THE SCREEN VOLTAGE DO NOT EXCEED A MAXIMUM DESIGN VALUE OF 26.5 VOLTS, THE DC RESISTANCE IN THE GRID CIRCUIT MAY BE AS HIGH AS 0.5 MEGOHM WITH GRID-RESISTOR BIAS.





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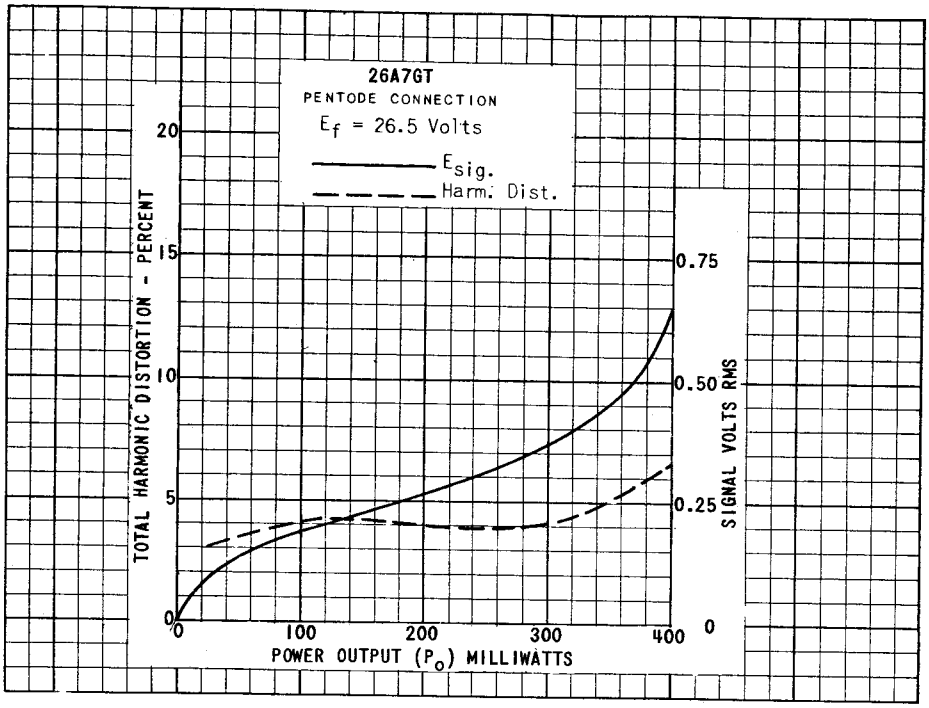
26A7GT


26A7GT
PENTODE CONNECTION
E_f = 26.5 Volts
$E_{sig.}$
Harm. Dist.
TOTAL HARMONIC DISTORTION - PERCENT
SIGNAL VOLTS RMS
POWER OUTPUT (P_o) MILLIWATTS
0
5
10
15
20
0.25
0.50
0.75
100
200
300
400

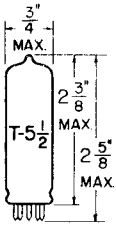
TENTATIVE DATA

(6BK6,12BK6)26BK6

TUNG-SOL

DOUBLE-DIODE TRIODE

MINIATURE TYPE



GLASS BULB

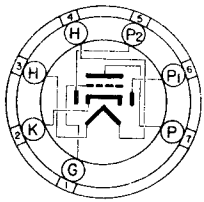
COATED UNIPOTENTIAL CATHODE

HEATER

26.5 VOLTS 70 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7BT

THE 26BK6 IS A HIGH-MU DOUBLE DIODE TRIODE USING THE 7 PIN MINIATURE CONSTRUCTION. THE HIGH PERVEANCE DIODES GIVE GOOD RECTIFICATION EFFICIENCY AT LOW SIGNALS AND THE DIODE SHIELDING REDUCES UNDESIRABLE AUDIO COUPLING BETWEEN DIODES AND TRIODE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
DIODE #1 OR DIODE #2 TO CATHODE: (1P OR 2P TO K)	1	1	μμf
DIODE #1 TO GRID: (1P TO G)	0.013	0.01	μμf

[A] WITH RMA SHIELD #316 CONNECTED TO CATHODE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	26.5	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
AVERAGE DIODE CURRENT EACH PLATE WITH 10 VOLTS DC APPLIED	4	MA.
MAXIMUM DIODE CURRENT EACH PLATE FOR CONTINUOUS OPERATION	1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	26.5	26.5	VOLTS
HEATER CURRENT	70	70	MA.
PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	-1	-2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS
AMPLIFICATION FACTOR	100	100	

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PLATE 2348

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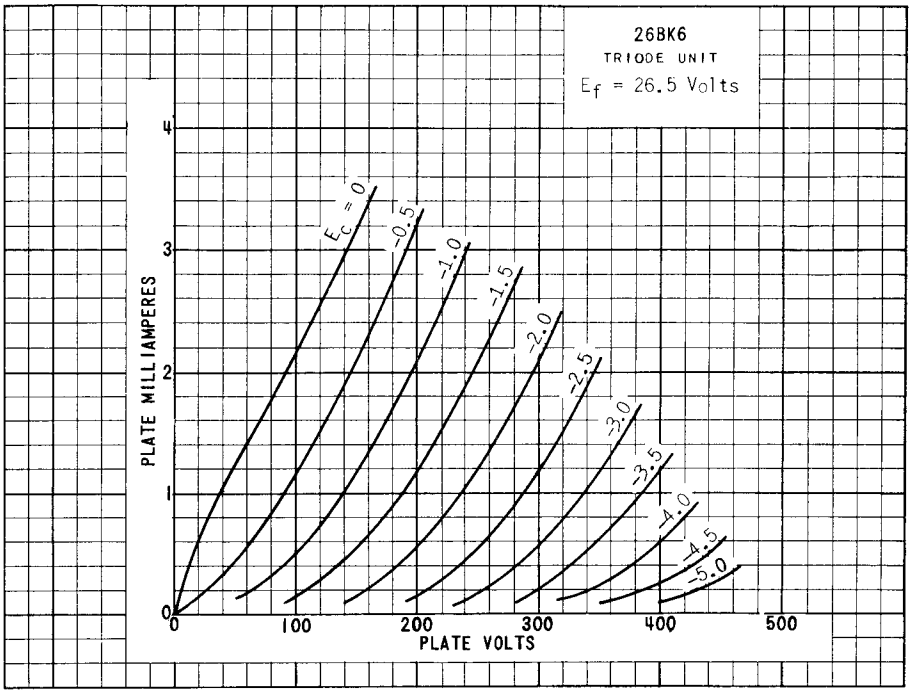
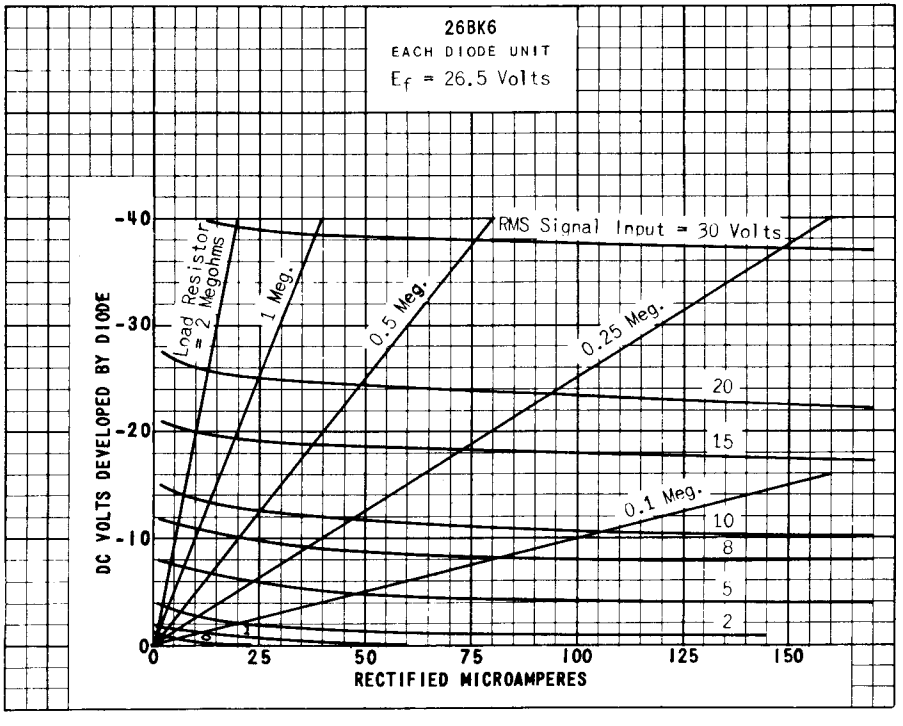
26BK6 (6BK6, 12BK6)





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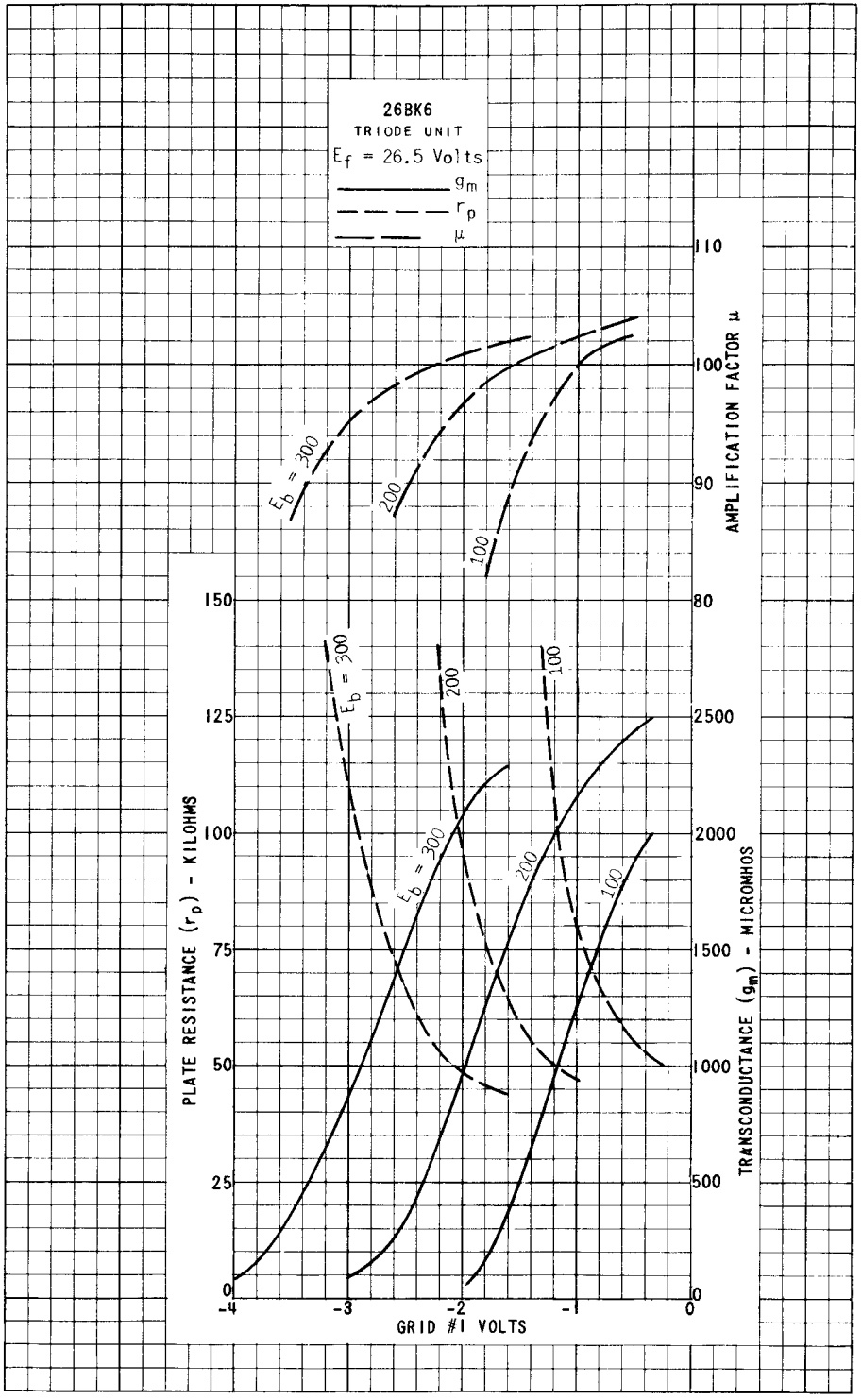

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from JETEC release #1525, Oct. 3, 1955

SEPTEMBER 1, 1955

JETEC REGISTRATION DATA

TUNG-SOL ELECTRIC INC.

26E6G

THIS TUBE IS SPECIFICALLY INTENDED FOR MILITARY APPLICATIONS. ALL PRODUCTION OF THIS TYPE WILL BE UNDER THE DESIGNATION 26E6WG.

TENTATIVE DATA

BEAM PENTODE

THE 26E6G IS A BEAM PENTODE POWER AMPLIFIER INTENDED FOR SERVICE WHERE RELATIVE IMMUNITY FROM SHOCK AND VIBRATION IS REQUIRED. IT IS DESIGNED TO WITHSTAND IMPACT SHOCKS AS HIGH A 600 G. APPLIED IN ANY DIRECTION.

MECHANICAL DATA

COATED UNIPOTENTIAL CATHODE		
OUTLINE DRAWING	BULB	T-11
BASE RETMA B8-46	INTERMEDIATE SHORT SHELL OCTAL	8-PIN
MAXIMUM DIAMETER		1-7/16 IN.
MAXIMUM OVERALL LENGTH		3-1/8 IN.
MAXUMUM SEATED HEIGHT		2-9/16 IN.
PIN CONNECTIONS:	RETMA BASING	7S
PIN 1 – NO CONNECTION	PIN 5 – GRID #1	
PIN 2– HEATER	PIN 6 – NO CONNECTION	
PIN 3 – PLATE	PIN 7 – HEATER	
PIN 4 – GRID #2	PIN 8 – GRID #3, CATHODE	
MOUNTING POSITION		ANY

ELECTRICAL DATA

HEATER CHARACTERISTICS

HEATER VOLTAGE (AC OR DC)	26.5 ± 15%	VOLTS
HEATER CURRENT	300	MA.

RATINGS – INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

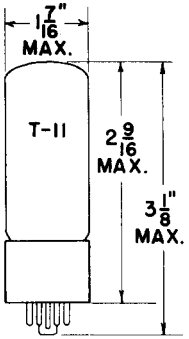
CLASS A AMPLIFIER		
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.5	WATTS
MAXIMUM GRID #2 VOLTAGE	135	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	-100	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE (POSITIVE OR NEGATIVE)	300	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS	CLASS A. AMPLIFIER	
HEATER VOLTAGE (AC OR DC)	26.5	VOLTS
HEATER CURRENT	300	MA.
DC PLATE VOLTAGE	200	VOLTS
DC GRID #2 VOLTAGE	135	VOLTS
DC GRID #1 VOLTAGE	-14	VOLTS
PEAK AF SIGNAL VOLTAGE	14	VOLTS
ZERO SIGNAL PLATE CURRENT	61	MA.
ZERO SIGNAL GRID #2 CURRENT	3.0	MA.
MAXIMUM SIGNAL PLATE CURRENT	66	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	9	MA.
PLATE RESISTANCE	18,000	OHMS
TRANSCONDUCTANCE	7,100	μOHMS
EXTERNAL PLATE LOAD RESISTANCE	2,600	OHMS
TOTAL HARMONIC DISTORTION	10%	
POWER OUTPUT	6	WATTS

TUNG-SOL

PENTODE

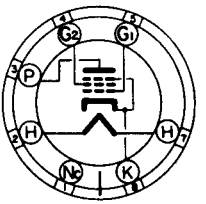
COATED UNIPOTENTIAL CATHODE



GLASS BULB

HEATER
26.5 VOLTS 0.30AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SHORT INTERMEDIATE SHELL 8 PIN OCTAL LOW LOSS PHENOLIC

7S

THE 26E6WG IS A RUGGEDIZED, SINGLE-ENDED BEAM PENTODE USED IN AF POWER OUTPUT APPLICATIONS REQUIRING APPROXIMATELY FIVE WATTS. THE HEATER DESIGN MAKES THIS TYPE IDEAL FOR OPERATION IN AIRBORNE EQUIPMENT WHERE A 26 VOLT POWER SUPPLY IS NORMALLY AVAILABLE. ALSO THE RUGGEDIZED STRUCTURE IS CAPABLE OF WITHSTANDING SEVER SHOCK AND VIBRATION SUCH AS THAT ENCOUNTERED IN AIRCRAFT.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	26.5±15%	VOLTS
MAXIMUM DC PLATE VOLTAGE	220	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATT
MAXIMUM HEATER CATHODE VOLTAGE	±300	VOLTS
MAXIMUM ALTITUDE	10 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	26.5	VOLTS
HEATER CURRENT	0.3	AMP.
DC PLATE VOLTAGE	200	VOLTS
DC GRID #1 VOLTAGE	-14	VOLTS
DC GRID #2 VOLTAGE	135	VOLTS
PEAK AF SIGNAL VOLTAGE	14	VOLTS
ZERO SIGNAL PLATE CURRENT	61	Ma
ZERO SIGNAL GRID #2 CURRENT	3.0	Ma
MAXIMUM SIGNAL PLATE CURRENT	56	MA
MAXIMUM SIGNAL GRID #2 CURRENT	9	mA

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

CLASS A_1 AMPLIFIER

PLATE RESISTANCE	18 000	OHMS
TRANSCONDUCTANCE	7 100	μMHOS
EXTERNAL PLATE LOAD RESISTANCE	2 600	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
POWER OUTPUT	6	WATTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 26.5V, E_b = 200Vdc, E_{c2} = 135Vdc, E_{c1} =-14Vdc

EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	---	---	---	---	mA
HEATER-CATHODE LEAKAGE	0	75	---	---	---	---	μAdc
TOTAL GRID CURRENT	0	-3	---	---	---	---	μAdc
PLATE CURRENT (1)	43	79	---	---	---[A]	---	mAdc
POWER OUTPUT[B]	4.8	---	---	---	2.9	---	WATTS
PLATE CURRENT (2) (E_{c1} = 45 Vdc)	0	1	---	---	---	---	mAdc
SCREEN GRID CURRENT	0	6	---	---	---	---	mAdc
TRANSCONDUCTANCE	5800	8400	---	---	---	---	μMHOS
GRID EMISSION (E_b=E_{c1}=E_{c2}=30Vdc)	180	---	---	---	---	---	mAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[C] (R_p=2000, E_{c1}=-22Vdc)	---	750	mVac
LOW FREQUENCY VIBRATION[D] (R_p=2000, E_{c1}=-22 dc)	---	350	mVac
SHOCK[E] (HAMMER ANGLE =48°)	---	---	
VIBRATIONAL FATIGUE[F]			
POST SHOCK AND FATIGUE END POINTS			
LOW FREQUENCY VIBRATION	---	500	mVac
HEATER-CATHODE LEAKAGE	0	100	μAdc
PLATE CURRENT (2)	0	2	mAdc
POWER OUTPUT	4.15	---	WATTS
MECHANICAL RESONANCE[G]	---	---	
AF NOISE[H] (E_{sig}=200 mVac, R_p=2000)	---	17	VU
HEATER CYCLING LIFE TEST (E_f=32Vac, E_b=E_{c2}=E_{c1}=0)	---	---	

NOTES

[A] DURING THE FIRST 100 HOURS OF LIFE, PLATE CURRENT (1) SHALL NOT CHANGE BY MORE THAN 15% FROM ITS INITIAL VALUE.

[B] E_{sig}=9.9 Vac, R_p=2600

[C] SEE MIL-E-1C 4.9.20.3

[D] SEE MIL-E-1C 4.9.20.4

[E] SEE MIL-E-1C 4.9.20.5

[F] SEE MIL-E-1C 4.9.20.6

[G] THE MOUNT SHALL EXHIBIT NO PRONOUNCED MECHANICAL RESONANCE BELOW 100 CPS.

[H] SEE MIL-E-1C 4.10.3.2

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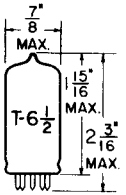
DOUBLE DIODE

MINIATURE TYPE

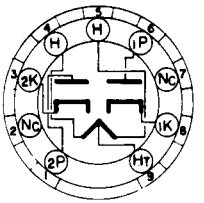


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
26.5 VOLTS 0.20 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9BS

THE 26Z5W IS A RUGGEDIZED HEATER-CATHODE TYPE DOUBLE DIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE IN HALF OR FULL WAVE RECTIFIER APPLICATIONS OR AS A VOLTAGE DOUBLER. THE HEATER DESIGN MAKES THIS TYPE IDEAL FOR OPERATION IN AIRBORNE EQUIPMENT WHERE A 26 VOLT POWER SUPPLY IS NORMALLY AVAILABLE. ALSO THE RUGGEDIZED STRUCTURE IS CAPABLE OF WITHSTANDING SEVERE SHOCK AND VIBRATION SUCH AS THAT ENCOUNTERED IN AIRCRAFT.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	26.5±15%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	1375	VOLTS
MAXIMUM DC PLATE CURRENT (EACH PLATE)	300	mA.
MAXIMUM DC OUTPUT CURRENT (PER PLATE)	55	mA.
MAXIMUM SURGE CURRENT	1	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE	450	VOLTS
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	700	G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	INPUT TO FILTER CAPACITOR	INPUT TO FILTER CHOKE	
HEATER VOLTAGE	26.5	26.5	VOLTS
HEATER CURRENT	0.20	0.20	AMP.
AC PLATE SUPPLY VOLTAGE (EACH PLATE) RMS	325	450	VOLTS
INPUT CONDENSER	10	---	μf
OUTPUT CHOKE	---	10	HENRYS
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE (EACH PLATE)	300	---	OHMS
DC OUTPUT CURRENT	100	100	mA.
DC OUTPUT VOLTAGE AT INPUT TO FILTER	325	380	VOLTS

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef = 26.5V, Epp/p = 400Vac, RL = 3650 Ohms, CL = 8μf
EXCEPT AS MODIFIED BELOW

	INITIAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	180	220	mAdc
OPERATION [AB]	100	---	mAdc
HEATER CATHODE LEAKAGE (EHK = Eo)	0	±150	μAdc
GRID EMISSION (1) (E_{2B}=O; E_{1b}=40Vdc)	160	---	mAdc
GRID EMISSION (2) (E_{1B}=O; E_{2b}=40Vdc)	160	---	mAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[C] (NO VOLTAGES)	---	---	
LOW FREQUENCY VIBRATION[D] (NO VOLTAGES)	---	---	
SHOCK[EF] (HAMMER ANGLE = 48°C)	---	---	
VIBRATIONAL FATIGUE[G]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
HEATER-CATHODE LEAKAGE	---	250	Vdc
OPERATION	94	---	mAdc
LIFE TEST[H]	1500	---	HOURS
LIFE TEST END POINT[J]			
OPERATION	88	---	mAdc
HEATER CYCLING LIFE TEST[KL]	2000	---	CYCLES

NOTES

[A] SEE MIL-E-1C 4.10.13

[B] IN A FULL-WAVE CIRCUIT ADJUST Zp/p SUCH THAT A TUBE HAVING Etd=22 Vdc AT 100 mAdc PER PLATE GIVES I_o =110 mAdc.

[C] SEE MIL-E-1C 4.9.20.3

[D] SEE MIL-E-1C 4.9.20.4

[E] SEE MIL-E-1C 4.9.20.5

[F] AFTER SHOCK TESTS, THE TUBES SHALL MEET POST-SHOCK AND FATIGUE TEST END POINT REQUIREMENTS. IN ADDITION, THE TUBES SHALL NOT SHOW PERMANENT SHORTS OR OPEN CIRCUITS WHEN TESTED PER 4.7 (F-1e) AFTER SHOCK TESTS.

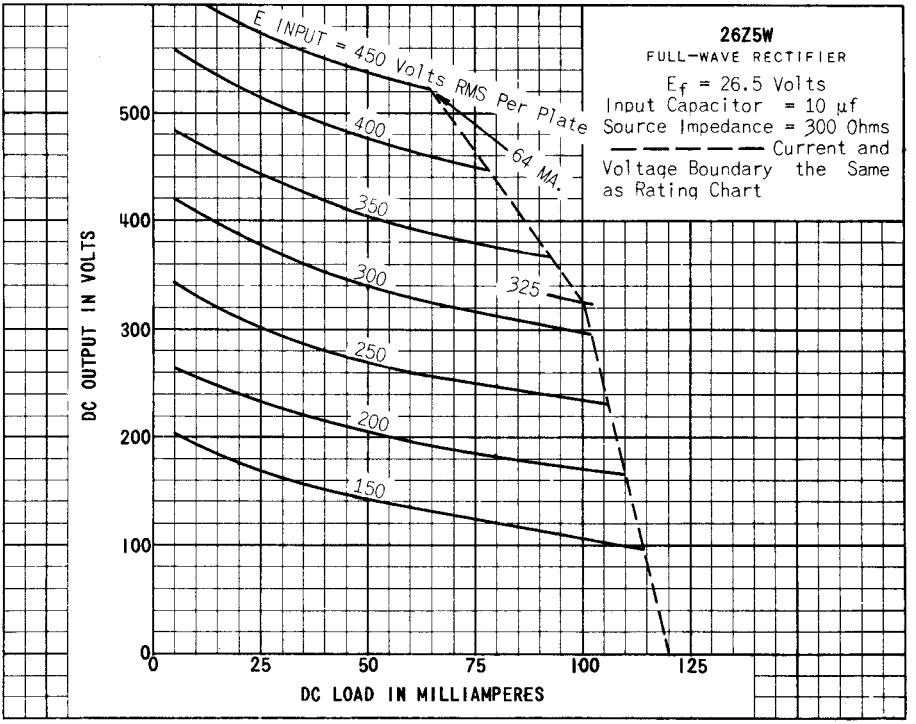
[G] SEE MIL-E-1C 4.9.20.6

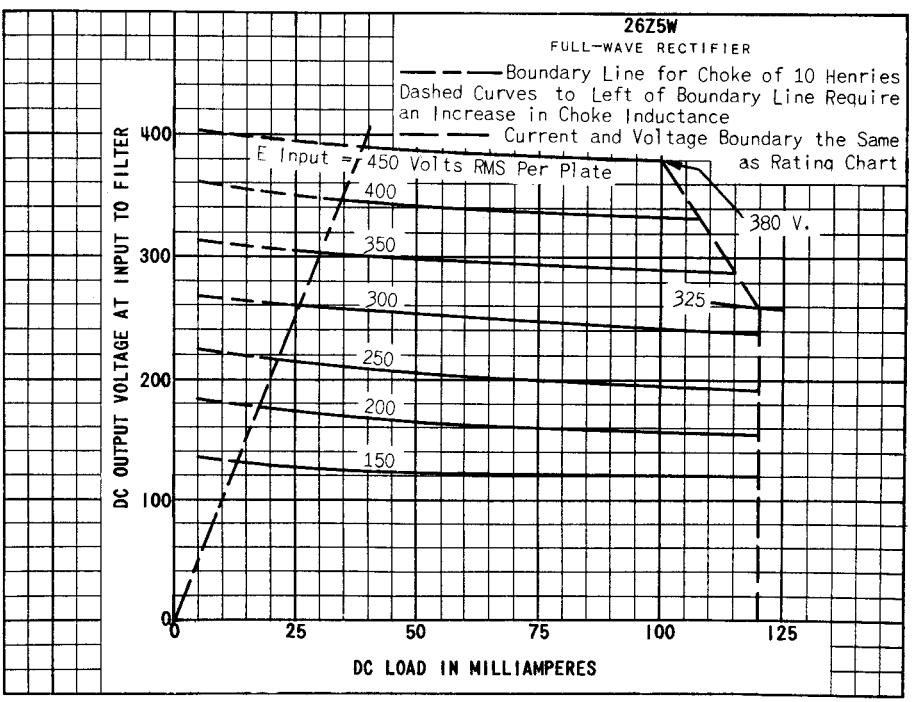
[H] IN LIFE TEST CONDITIONS THE VALUES OF RL AND CL GIVEN IN TEST CONDITIONS MAY BE CONSIDERED APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE I_o EQUAL TO OR GREATER THAN 110mAdc WITH Ib EQUAL TO OR GREATER THAN 300 mA. Ehk = Eo.

[J] SEE MIL-E-1C 4.11.4

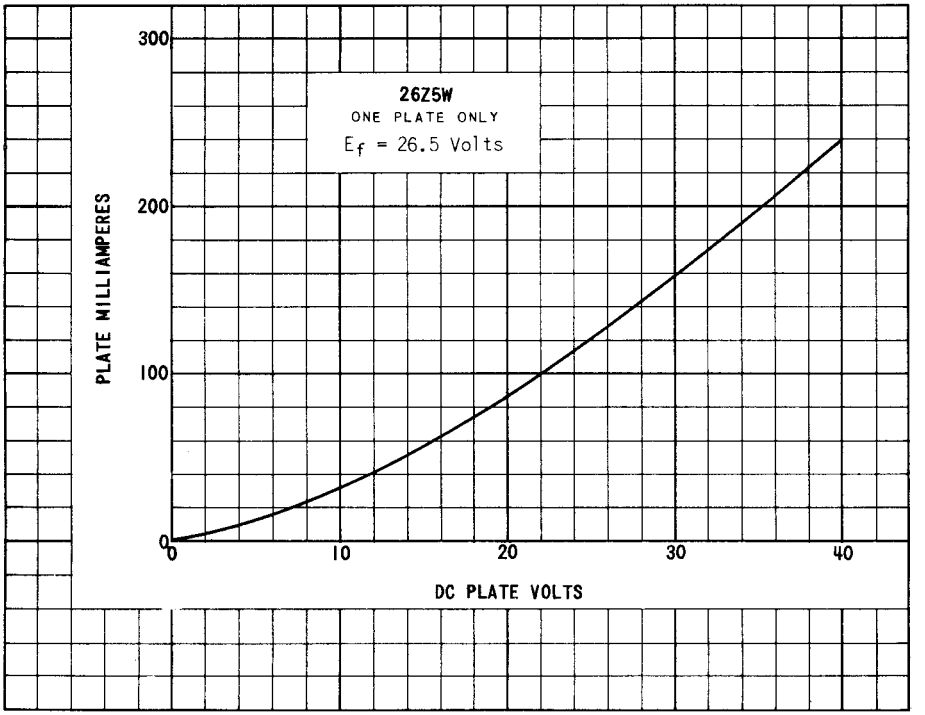
[K] SEE MIL-E-1C 4.11.7

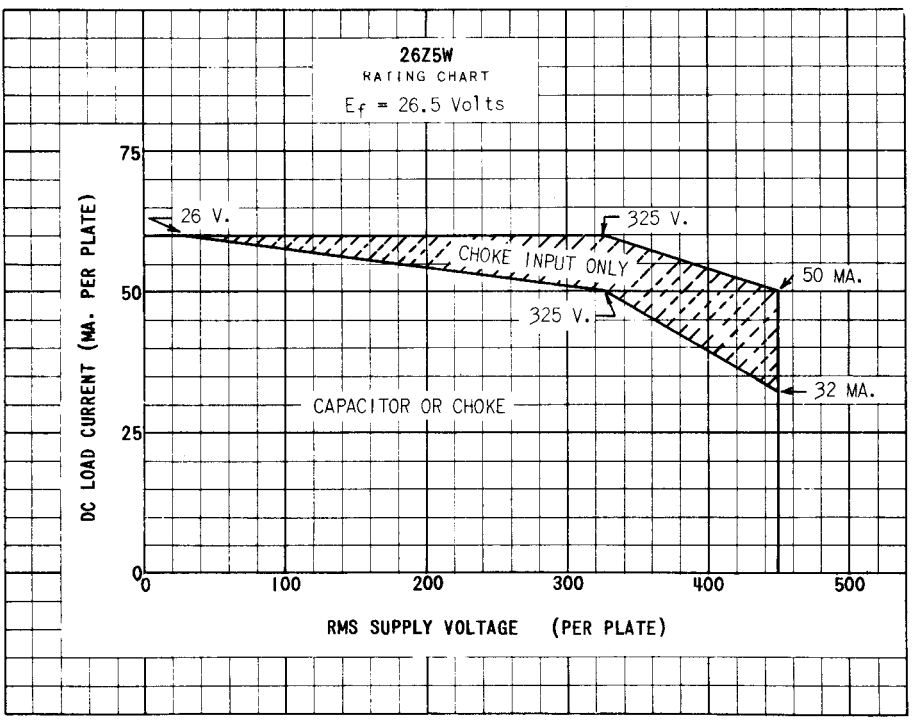
[L] Ef=32vac, Ehk=-450V; Ep=Ec=0. TUBES TO PASS If, Ihk AND LIFE TEST END POINTS.


26Z5W
FULL-WAVE RECTIFIER
E_f = 26.5 Volts
Input Capacitor = 10 µf
Source Impedance = 300 Ohms
— — — — — Current and Voltage Boundary the Same as Rating Chart
E INPUT = 450 Volts RMS Per Plate
400
350
300
250
200
150
64 MA.
325
DC OUTPUT IN VOLTS
0
100
200
300
400
500
0
25
50
75
100
125
DC LOAD IN MILLIAMPERES


26Z5W
FULL-WAVE RECTIFIER
— — — Boundary Line for Choke of 10 Henries
Dashed Curves to Left of Boundary Line Require an Increase in Choke Inductance
— — — Current and Voltage Boundary the Same as Rating Chart
E Input = 450 Volts RMS Per Plate
400
350
300
250
200
150
380 V.
325
DC OUTPUT VOLTAGE AT INPUT TO FILTER
0
100
200
300
400
0
25
50
75
100
125
DC LOAD IN MILLIAMPERES

26Z5W
PREMIUM TUBE





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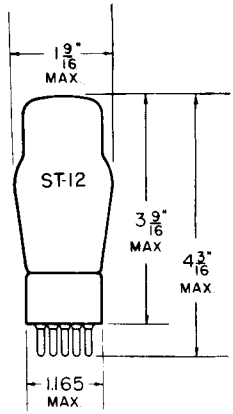
TRIODE DETECTOR AMPLIFIER



GLASS BULB

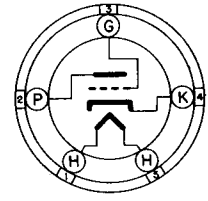
COATED UNIPOTENTIAL CATHODE

HEATER

2.5 VOLTS 1.75 AMPERES

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL
5 PIN BASE

THE 27 IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	2.5	VOLTS
HEATER CURRENT	1.75	AMP.
MAXIMUM PLATE VOLTAGE	275	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE	3.3	μμf
INPUT	3.1	μμf
OUTPUT	2.3	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	90	135	180	250	VOLTS
GRID VOLTAGE	-6	-9	-13.5	-21	VOLTS
PLATE CURRENT	2.7	4.5	5.0	5.2	MA.
PLATE RESISTANCE	11 000	9 000	9 000	9 250	OHMS
TRANSCONDUCTANCE	820	1 000	1 000	975	μMHOS
AMPLIFICATION FACTOR	9	9	9	9	

DETECTOR

	BIASED		GRID LEAK	
PLATE VOLTAGE	250	275	45	VOLTS
GRID VOLTAGE (APPROX.)	-30	-35	RETURN TO CATHODE	VOLTS
PLATE CURRENT[A]	ADJUSTED TO 0.2 MA. WITH NO INPUT SIGNAL		---	
GRID RESISTOR:				
MINIMUM	---	---	1/5	MEGOHM
MAXIMUM	---	---	5	MEGOHMS
GRID CONDENSER	---	---	250	μμf

[A] MAXIMUM DC PLATE CURRENT SHOULD BE LIMITED TO 5.0 MA.

→ INDICATES A CHANGE OR ADDITION.

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PLATE 1760
NOV. 1, 1946

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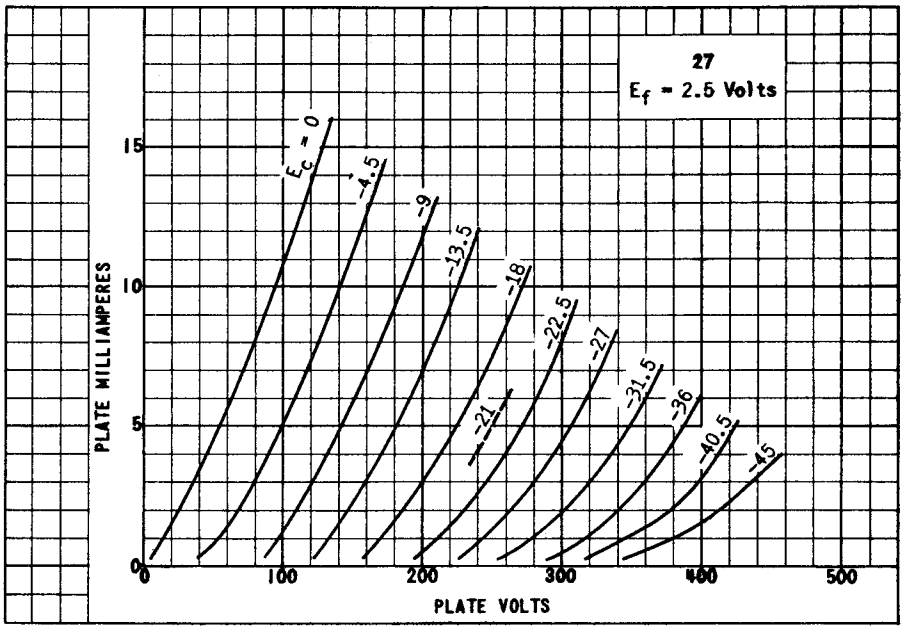

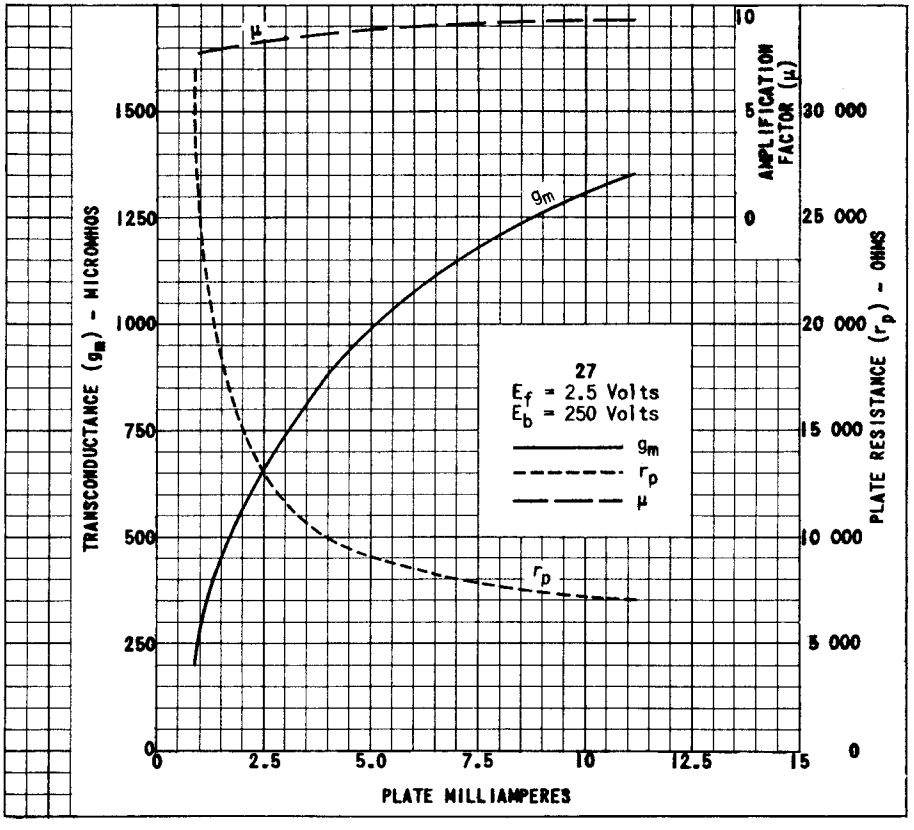

PLATE 1761
NOV. 1, 1946

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TUNG-SOL

CATHODE RAY

THE 27AP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**
GREY FILTER FACEPLATE — **UNIPOTENTIAL CATHODE**
RECTANGULAR METAL CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
23 7/16" X 18 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		ELECTROSTATIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
DIAGONAL	90	DEGREES
HORIZONTAL	85	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

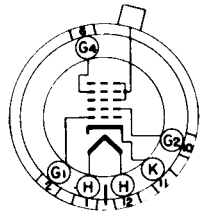
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT
SPECULAR REFLECTION OF AMBIENT LIGHT	2.5	PERCENT

MECHANICAL DATA

OVERALL LENGTH	21 5/8 ± 9/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 7/8 ± 3/16	INCHES
WIDTH	25 1/4 ± 1/8	INCHES
HEIGHT	19 15/16 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	23 7/16	INCHES
HEIGHT	18 1/8	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12M

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
METAL SHELL LIP:
GRID NO. 3
GRID NO. 5
COLLECTOR

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, GRID #5, COLLECTOR VOLTAGE	18 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE[A]	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] THE FOCUS ELECTRODE MAY BE MODULATED TO IMPROVE OVERALL FOCUS.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC GRID #3, GRID #5, COLLECTOR VOLTAGE	15 000	VOLTS
DC GRID #4 VOLTAGE[B]	−60 TO +300	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	−33 TO −77	VOLTS
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	85	MA.
DC GRID #4 CURRENT	−15 TO +25	µAMP.

[B] MEASURED AT 100 UAMP. ANODE CURRENT AND EQUAL VERTICAL AND HORIZONTAL RESOLUTION.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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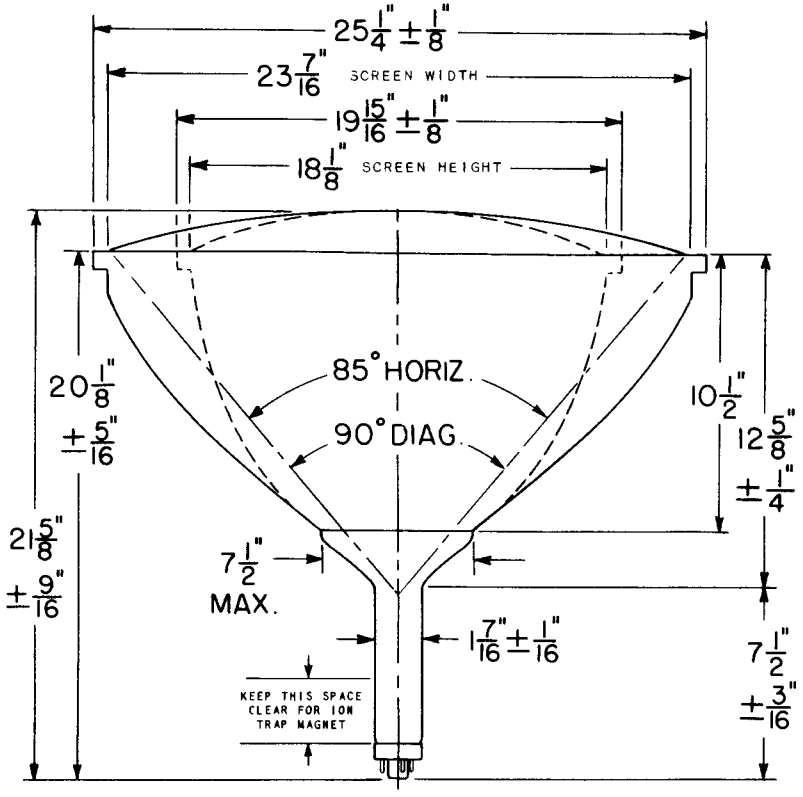

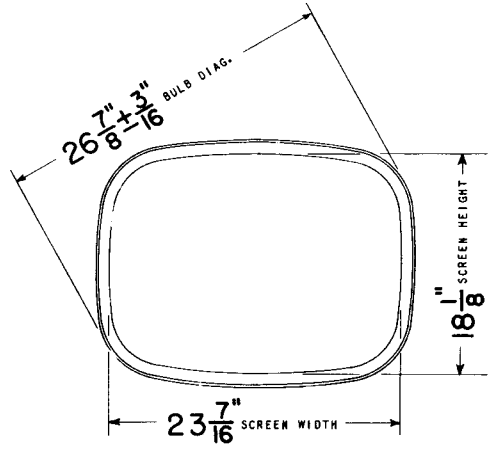

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CATHODE RAY

THE 27EP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

SPHERICAL FACEPLATE	**ALUMINIZED SCREEN**
GREY FILTER FACEPLATE	**UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS & DEFLECTION	**24" X 18 1/2" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.):	70	PERCENT

MECHANICAL DATA

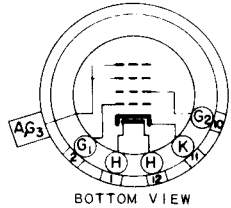
OVERALL LENGTH	23 1/16 ± 1/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16 ± 3/16	INCHES
WIDTH	25 9/32 ± 3/16	INCHES
HEIGHT	20 7/32 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	25 3/4	INCHES
WIDTH	24	INCHES
HEIGHT	18 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 –HEATER
ANODE CAP:
GRID NO. 3

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RATINGS[A]
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE[B]	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE[C]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] THESE MAXIMUM RATINGS CONTAIN A 10% SAFETY FACTOR IN ACCORDANCE WITH THE STANDARD DESIGN CENTER SYSTEM IN RATING CATHODE-RAY TUBES. CONSEQUENTLY, THE TUBE WILL WITHSTAND VARIATIONS IN SUPPLY LINE VOLTAGE WHICH DO NOT CAUSE THE MAXIMUM RATINGS TO BE EXCEEDED BY MORE THAN 10%.

[B] IF THE TUBE IS OPERATED AT VOLTAGE IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO PREVENT DANGER FROM PROLONGED EXPOSURE AT CLOSE RANGE.

[C] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[D]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[E]	87 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.
ION TRAP MAGNET (RATED STRENGTH) APPROX.	38	GAUSSES

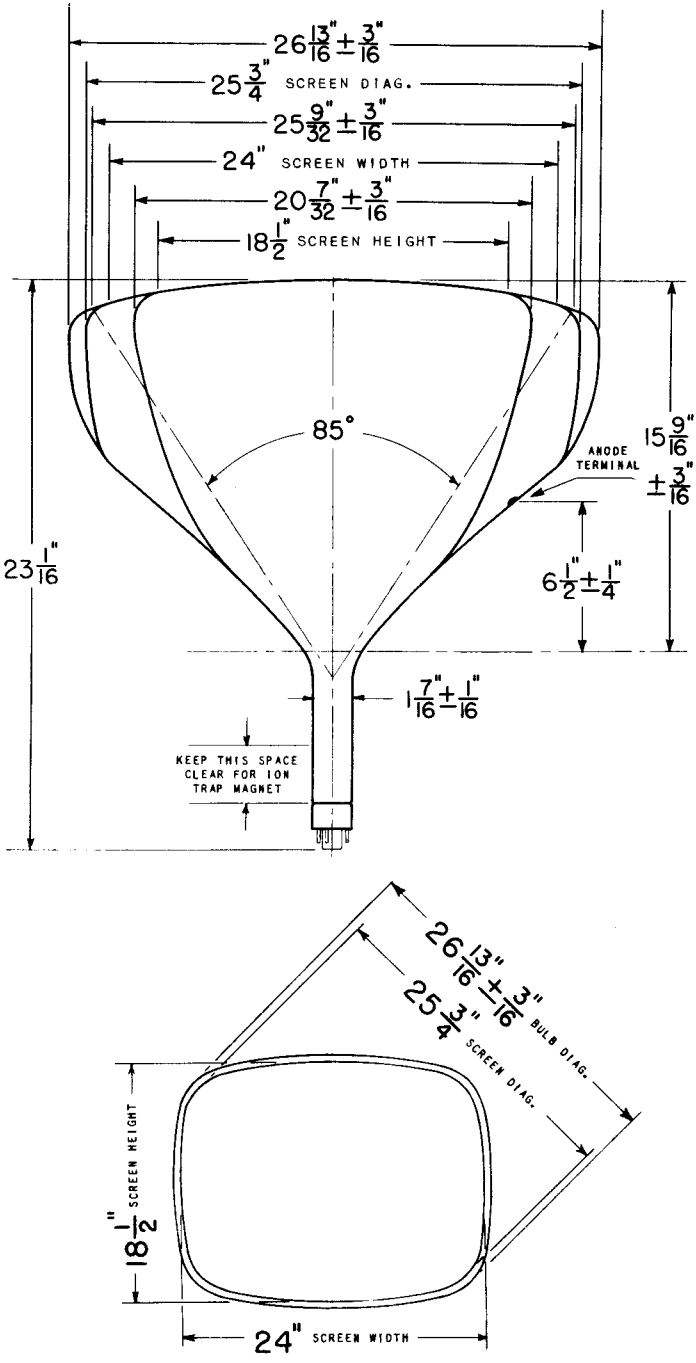
[D] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[E] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 24" BY 18 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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TUNG-SOL

CATHODE RAY

THE 27GP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE — **SPHERICAL FACEPLATE**
MAGNETIC FOCUS & DEFLECTION — **UNIPOTENTIAL CATHODE**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
18 1/8" X 24 1/4" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.) DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

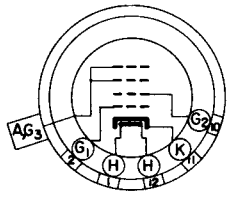
MECHANICAL DATA

OVERALL LENGTH	23 1/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16	INCHES
WIDTH	25 9/32	INCHES
HEIGHT	20 7/32	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	24 1/4	INCHES
HEIGHT	18 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3 VOLTAGE	22 500	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:[A]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] CATHODE SHOULD BE RETURNED TO ONE SIDE OR TO THE MID-TAP OF THE HEATER TRANSFORMER WINDING.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3 VOLTAGE[B]	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[D]	95 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	100	MA.

[B] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO PROTECT AGAINST POSSIBLE INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE. SUCH PROTECTION MAY BE PROVIDED BY THE PROTECTIVE FACE VIEWING WINDOW OF APPARATUS USING TUBES OF THIS TYPE.

[C] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 24 1/4" BY 18 1/8" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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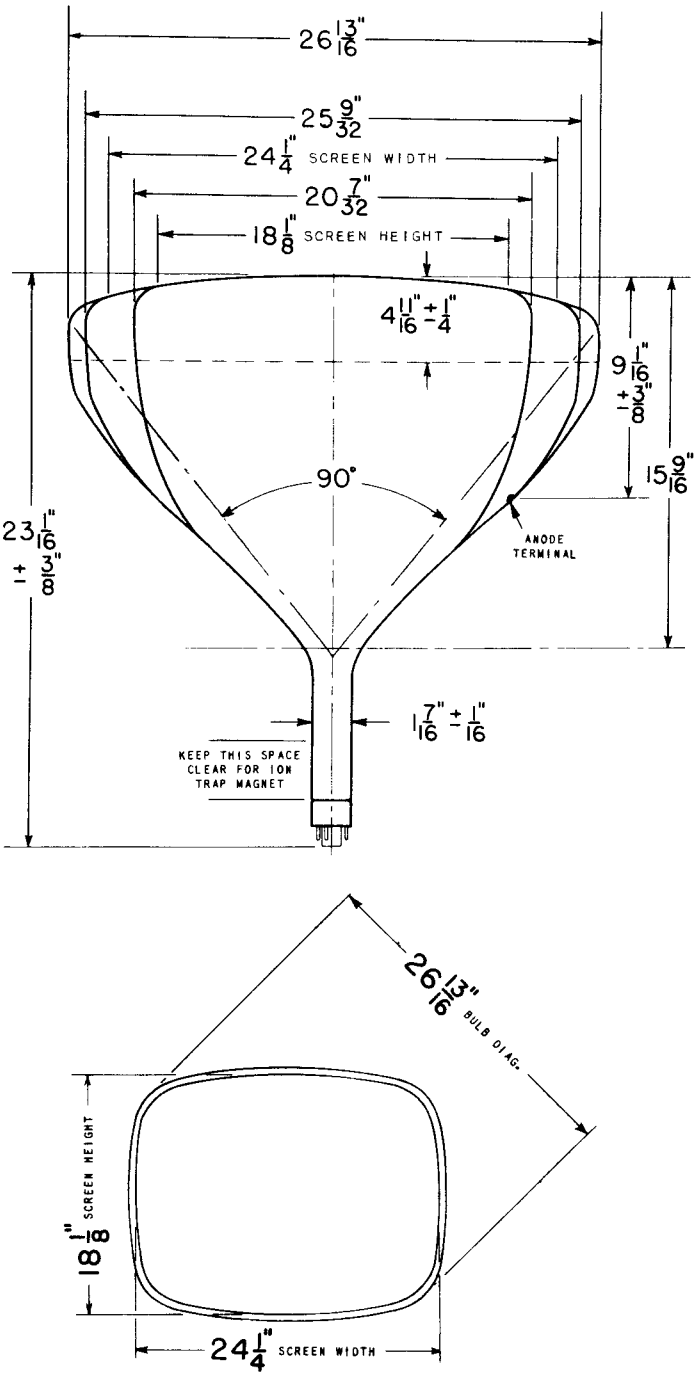

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CATHODE RAY

THE 27LP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE	**ALUMINIZED SCREEN**
EXTERNAL CONDUCTIVE COATING	**UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS AND DEFLECTION	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**18 15/32" X 23 17/32" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	400	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	250	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

MECHANICAL DATA

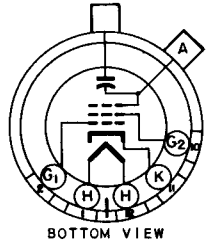
OVERALL LENGTH	24 23/64 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16 ± 1/4	INCHES
WIDTH	25 9/32 ± 1/4	INCHES
HEIGHT	20 7/32 ± 1/4	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	23 17/32	INCHES
HEIGHT	18 15/32	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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CATHODE RAY

THE 27LP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE	**ALUMINIZED SCREEN**
EXTERNAL CONDUCTIVE COATING	**UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS AND DEFLECTION	**EXTERNAL SINGLE FIELD ION TRAP**
RECTANGULAR GLASS CONSTRUCTION	**18 15/32" X 23 17/32" RASTER SIZE**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	400	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	250	μμf

OPTICAL DATA

PHOSPHOR NUMBER	NO. 4
FLUORESCENT COLOR	WHITE
PHOSPHORESCENT COLOR	WHITE
PERSISTENCE	MEDIUM

MECHANICAL DATA

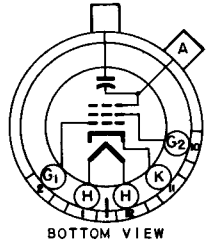
OVERALL LENGTH	24 23/64 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16 ± 1/4	INCHES
WIDTH	25 9/32 ± 1/4	INCHES
HEIGHT	20 7/32 ± 1/4	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	23 17/32	INCHES
HEIGHT	18 15/32	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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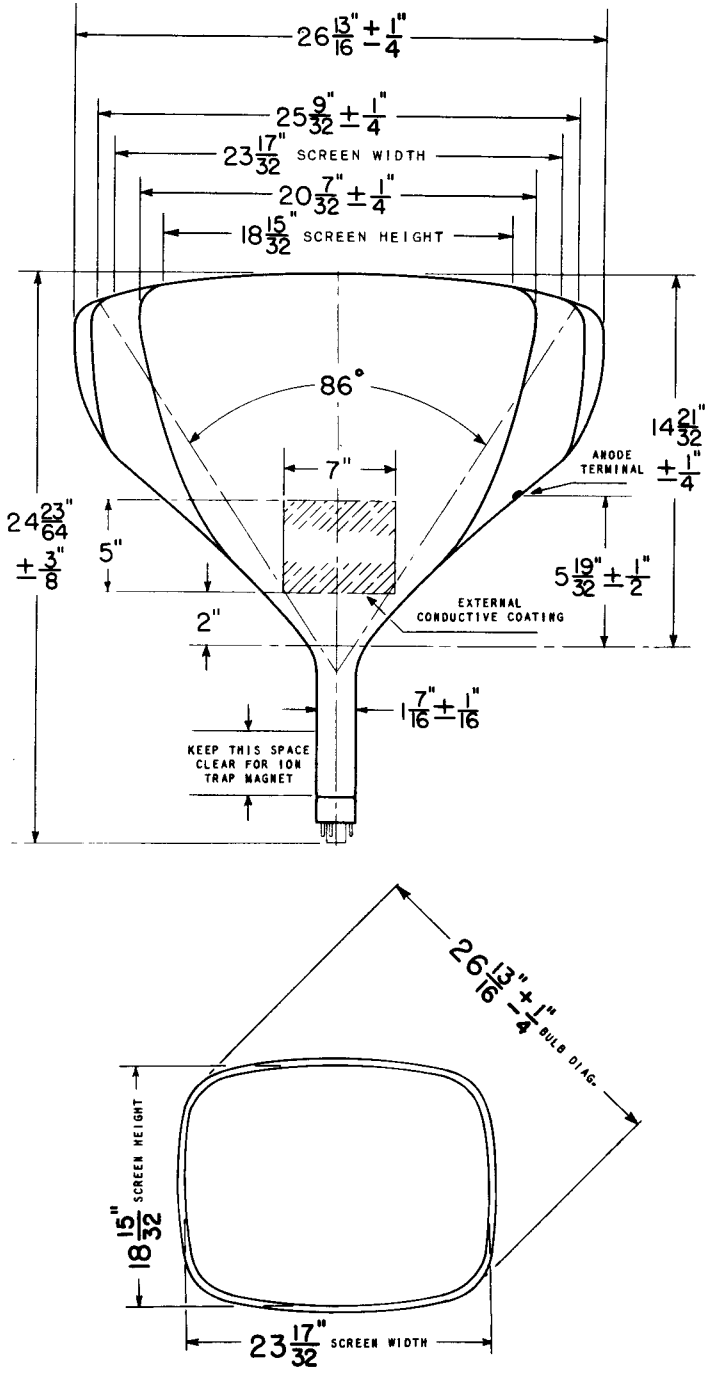
26 13/16" ± 1/4"
25 9/32" ± 1/4"
23 17/32" SCREEN WIDTH
20 7/32" ± 1/4"
18 15/32" SCREEN HEIGHT
86°
7"
14 21/32" ± 1/4"
ANODE TERMINAL
24 23/64" ± 3/8"
5"
5 19/32" ± 1/2"
EXTERNAL CONDUCTIVE COATING
2"
1 7/16" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
26 13/16" ± 1/4" BULB DIAG.
18 15/32" SCREEN HEIGHT
23 17/32" SCREEN WIDTH

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CATHODE RAY

THE 27MP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN — **UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS & DEFLECTION — **FROSTED FILTERGLASS FACEPLATE**
RECTANGULAR METAL CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
23 7/16" X 18 1/8" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
VERTICAL	69	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf

OPTICAL DATA

PHOSPHOR NUMBER	SULFIDE TYPE	NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		SHORT
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

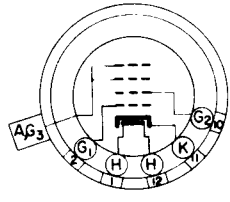
MECHANICAL DATA

OVERALL LENGTH	22 3/16	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 7/8 ± 1/4	INCHES
WIDTH	25 1/4 ± 3/16	INCHES
HEIGHT	19 15/16 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
DIAGONAL	25 1/16	INCHES
WIDTH	23 7/16	INCHES
HEIGHT	18 1/8	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

BASE ALIGNMENT
PIN #6 ALIGNS WITH HORIZONTAL PICTURE AXIS ± 10 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC GRID #3, COLLECTOR VOLTAGE[AB]	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING COLLECTOR VOLTAGE. IN GENERAL, THE COLLECTOR VOLTAGE SHOULD NOT BE LESS THAN 16,000 VOLTS.

[B] BECAUSE THE RATING OF THIS TUBE PERMITS ANODE VOLTAGES AS HIGH AS 19.8 KV, SHIELDING OF X-RAY RADIATION FROM THE TUBE MAY BE NECESSARY. THIS PRECAUTION SHOULD BE OBSERVED WHEN THE ANODE IS OPERATED IN EXCESS OF 16 KV.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC COLLECTOR, GRID #3 VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[C]	-37 TO -73	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[D]	110 ± 10%	MA.
ION TRAP MAGNET (RATED STRENGTH)	50	GAUSSES

[C] VISUAL EXTINCTION OF FOCUSED RASTER.

[D] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 30 FOOT LAMBERTS ON A 23 7/16" BY 18 1/8" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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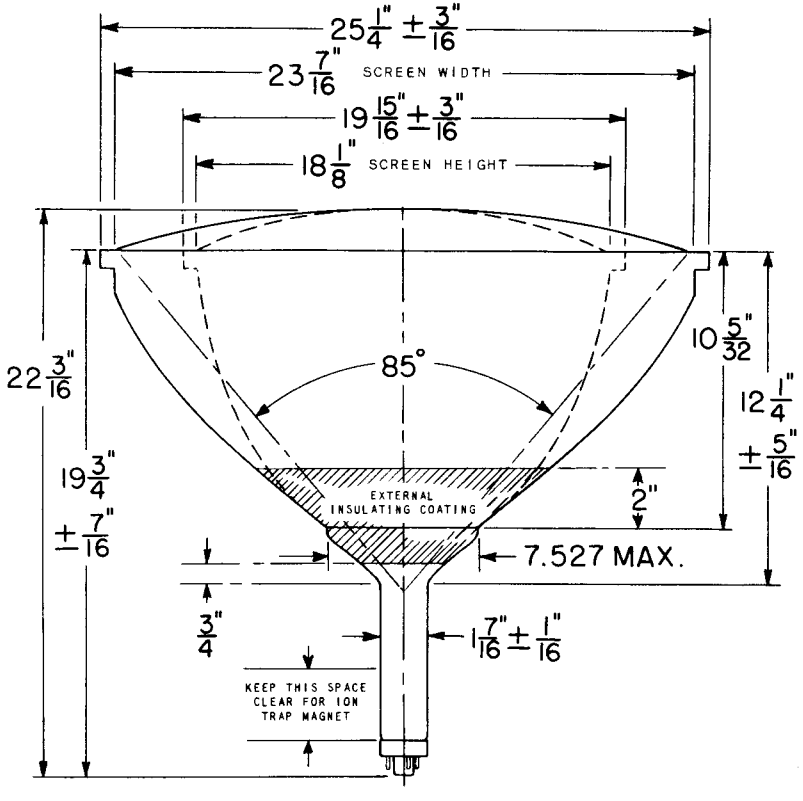

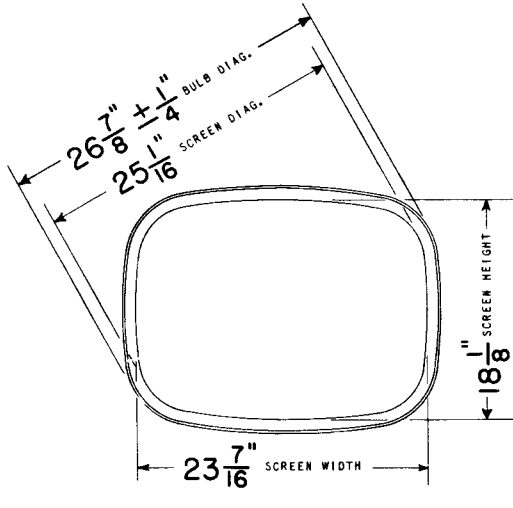

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CATHODE RAY

THE 27NP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

SPHERICAL FACEPLATE	**UNIPOTENTIAL CATHODE**
GREY FILTER FACEPLATE	**EXTERNAL CONDUCTIVE COATING**
MAGNETIC FOCUS & DEFLECTION	**24 1/4" X 18 1/8" RASTER SIZE**
RECTANGULAR GLASS CONSTRUCTION	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	68	PERCENT

MECHANICAL DATA

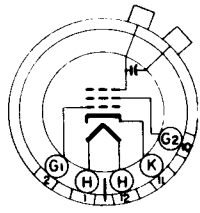
OVERALL LENGTH	23 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16 ± 3/16	INCHES
WIDTH	25 9/32 ± 1/8	INCHES
HEIGHT	20 7/32 ± 1/8	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	24 1/4	INCHES
HEIGHT	18 1/8	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS

DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	18 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
NEGATIVE-BIAS VALUE (DC)	125	VOLTS
POSITIVE-BIAS VALUE (DC)	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VODTS

[A] BECAUSE THE RATING OF THIS TUBE PERMITS ANODE VOLTAGES AS HIGH AS 19.8 KV, SHIELDING OF X-RAY RADIATION FROM THE TUBE MAY BE NECESSARY. THIS PRECAUTION SHOULD BE OBSERVED WHEN THE ANODE IS OPERATED IN EXCESS OF 16 KV.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	−28 TO −72	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	95 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	100 ± 50%	MA.

[B] VISUAL EXTINCTION OF FOCUSED RASTER.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 24 1/4" BY 18 1/8" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.25 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

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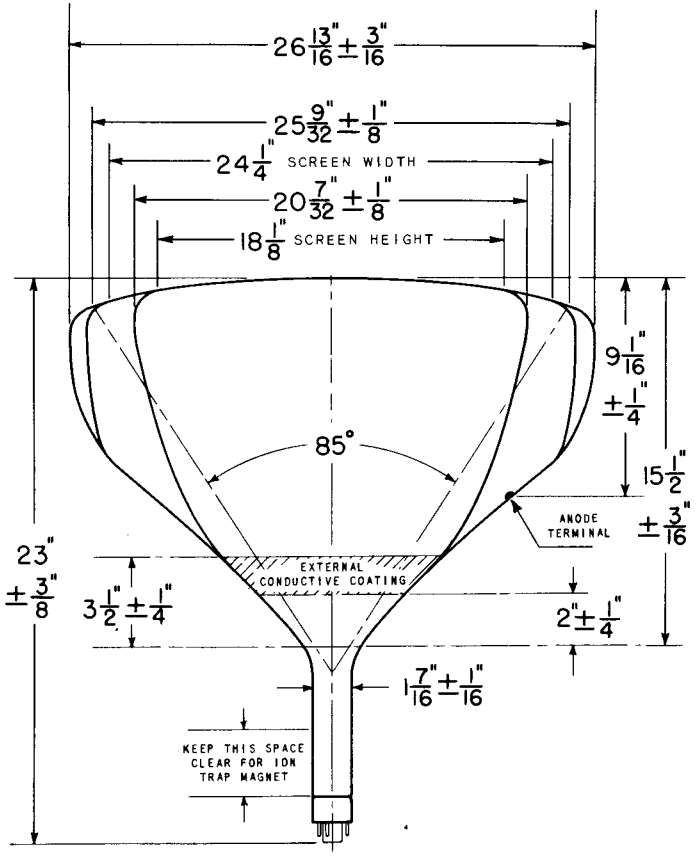

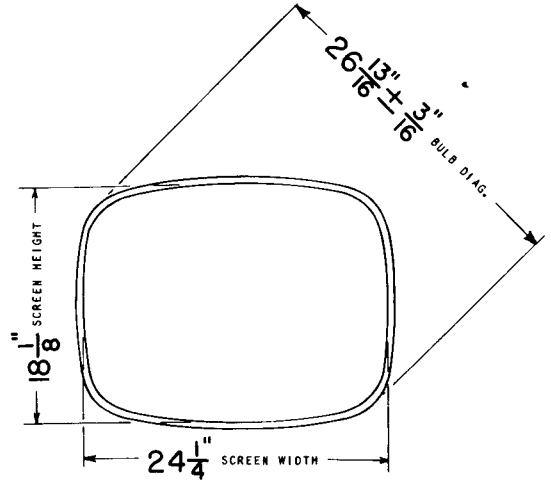

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CATHODE RAY

THE 27RP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

SPHERICAL FACEPLATE — **ALUMINIZED SCREEN**
GREY FILTER FACEPLATE — **UNIPOTENTIAL CATHODE**
MAGNETIC FOCUS & DEFLECTION — **EXTERNAL CONDUCTIVE COATING**
RECTANGULAR GLASS CONSTRUCTION — **EXTERNAL SINGLE FIELD ION TRAP**
24" X 18 1/2" RASTER SIZE

ELECTRICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.):		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	6	μμf
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	750	μμf
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE	500	μμf

OPTICAL DATA

PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

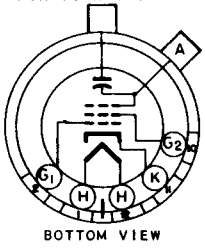
MECHANICAL DATA

OVERALL LENGTH	23 1/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16 ± 3/16	INCHES
WIDTH	25 9/32 ± 3/16	INCHES
HEIGHT	20 7/32 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	24	INCHES
HEIGHT	18 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12N

BULB CONTACT ALIGNMENT
J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ACCELERATOR CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ACCELERATOR VOLTAGE[A]	20 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
*DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

[A] BECAUSE THE RATING OF THIS TUBE PERMITS ANODE VOLTAGES AS HIGH AS 19.8 KV, SHIELDING OF X-RAY RADIATION FROM THE TUBE MAY BE NECESSARY. THIS PRECAUTION SHOULD BE OBSERVED WHEN THE ANODE IS OPERATED IN EXCESS OF 16 KV.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ACCELERATOR VOLTAGE	16 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT (APPROX.)[C]	105 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	85 ± 50%	MA.

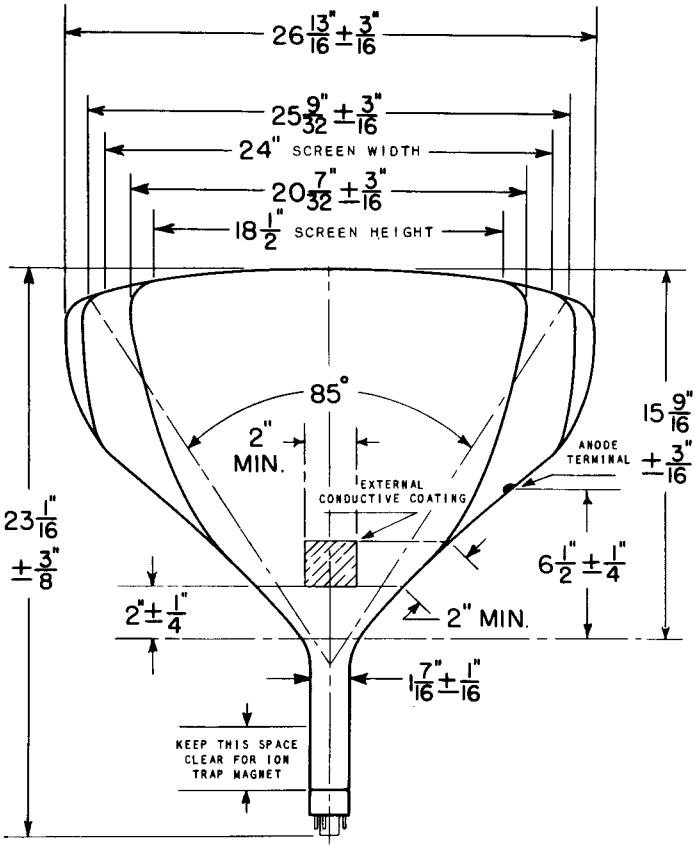
[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

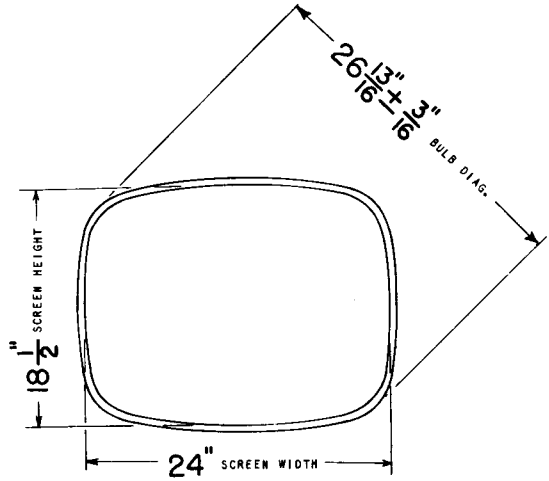
[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 20 FOOT LAMBERTS ON A 24" BY 18 1/2" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL





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TUNG-SOL

CATHODE RAY

THE 27SP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

ALUMINIZED SCREEN	**SPHERICAL FACEPLATE**
UNIPOTENTIAL CATHODE	**MAGNETIC DEFLECTION**
EXTERNAL CONDUCTIVE COATING	**GREY FILTER FACEPLATE**
RECTANGULAR GLASS CONSTRUCTION	**24" X 18 1/2" RASTER SIZE**
LOW VOLTAGE ELECTROSTATIC FOCUS	**EXTERNAL SINGLE FIELD ION TRAP**

ELECTRICAL DATA

FOCUSING METHOD	LOW VOLTAGE ELECTROSTATIC	
DEFLECTING METHOD	MAGNETIC	
DEFLECTION ANGLE: (APPROX.)		
HORIZONTAL	85	DEGREES
DIAGONAL	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES: (APPROX.)		
CATHODE TO ALL OTHER ELECTRODES	5	$\mu\mu f$
GRID #1 TO ALL OTHER ELECTRODES	6	$\mu\mu f$
MAXIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	750	$\mu\mu f$
MINIMUM EXTERNAL CONDUCTIVE COATING TO ANODE[A]	500	$\mu\mu f$

[A] EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

OPTICAL DATA

PHOSPHOR NUMBER		P-4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	68	PERCENT

MECHANICAL DATA

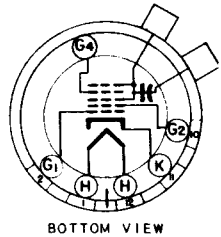
OVERALL LENGTH	23 1/16 ± 3/8	INCHES
GREATEST DIMENSIONS OF BULB:		
DIAGONAL	26 13/16	INCHES
WIDTH	25 9/32 ± 3/16	INCHES
HEIGHT	20 7/32 ± 3/16	INCHES
MINIMUM USEFUL SCREEN DIMENSIONS:		
WIDTH	24	INCHES
HEIGHT	18 1/2	INCHES
BULB CONTACT	RECESSED SMALL CAVITY CAP	J1-21
BASE	SMALL SHELL DUODECAL 6 PIN	B6-63
BASING		12L

BULB CONTACT ALIGNMENT

J1-21 CONTACT ALIGNS WITH PIN POSITION #6 ± 30 DEGREES

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 6 – GRID NO. 4
PIN 10 – GRID NO. 2
PIN 11 – CATHODE



BOTTOM VIEW

PIN 12 – HEATER
ANODE CAP:
GRID NO. 3
GRID NO. 5

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE, GRID #3, GRID #5 VOLTAGE	20 000	VOLTS
MAXIMUM DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)	−500 TO +1000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	500	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE, GRID #3, GRID #5 VOLTAGE[B]	18 000	VOLTS
DC GRID #4 VOLTAGE (FOCUSING ELECTRODE)	−72 TO +396	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE REQUIRED FOR CUTOFF[C]	−28 TO −72	VOLTS
ION TRAP MAGNET STRENGTH (APPROX.)	40	GAUSSES

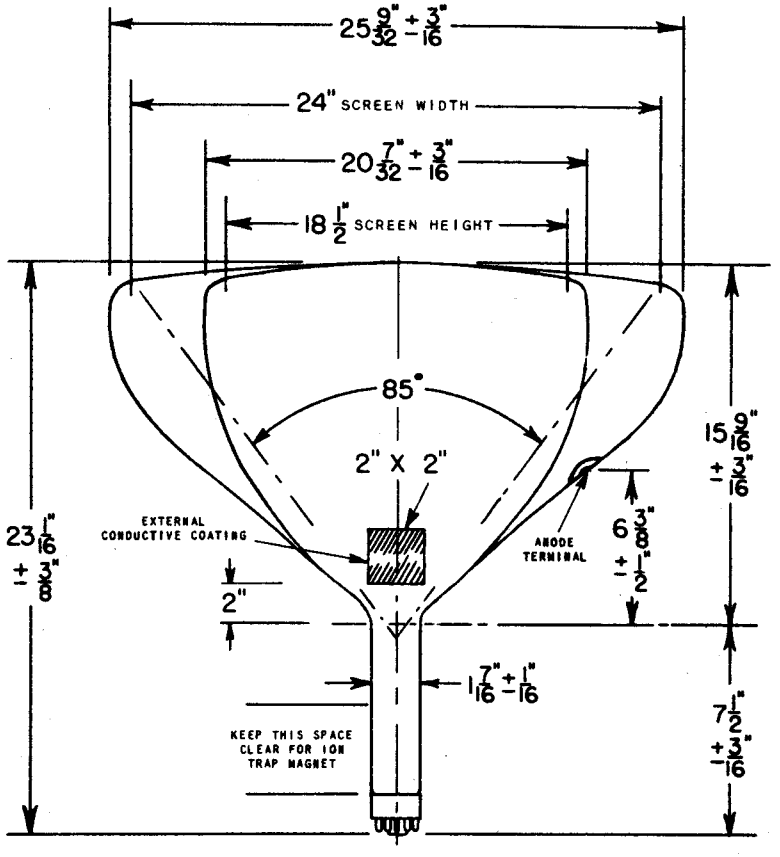
[B] BRILLIANCE AND DEFINITION DECREASE WITH DECREASING ANODE VOLTAGE. IN GENERAL, ANODE VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

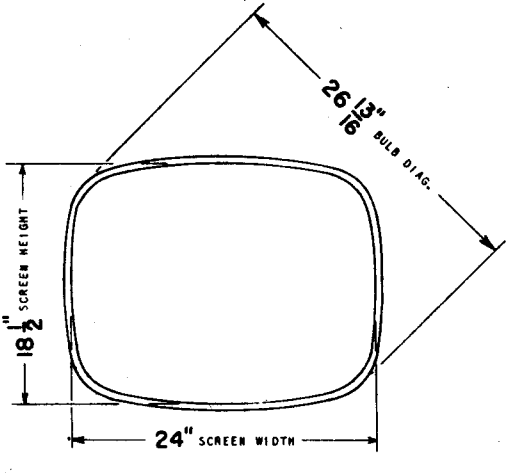
[C] VISUAL EXTINCTION OF FOCUSED RASTER. EXTINCTION OF THE STATIONARY FOCUSED SPOT WILL REQUIRE THAT THESE VALUES BE ABOUT 5 VOLTS MORE NEGATIVE.

CIRCUIT VALUES

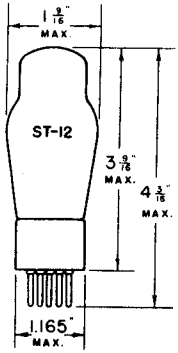
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL


25 9/32" ± 3/16"
24" SCREEN WIDTH
20 7/32" ± 3/16"
18 1/2" SCREEN HEIGHT
85°
2" X 2"
EXTERNAL CONDUCTIVE COATING
ANODE TERMINAL
2"
1 7/16" ± 1/16"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
23 1/16" +3/8" -3/16"
15 9/16" ± 3/16"
6 3/8" ± 1/2"
7 1/2" +3/8" -3/16"


26 13/16" BULB DIAG.
18 1/2" SCREEN HEIGHT
24" SCREEN WIDTH

TRIODE AMPLIFIER

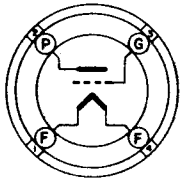


COATED FILAMENT

2.0 VOLTS 0.06 AMPERE
DC

GLASS BULB

SMALL 4 PIN BASE



4D

THE TUNG-SOL 30 IS A GENERAL PURPOSE FILAMENT TYPE TRIODE DESIGNED FOR SERVICE IN BATTERY OPERATED RECEIVERS. WITH THE EXCEPTION OF CAPACITANCES ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 1H4G.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	135	180 MAX.	VOLTS
GRID VOLTAGE	-4.5	-9.0	-13.5	VOLTS
GRID CIRCUIT RESISTANCE MAX.	2	2	2	MEGOHMS
PLATE CURRENT	2.5	3.0	3.1	MA.
PLATE RESISTANCE	11 000	10 300	10 300	OHMS
TRANSCONDUCTANCE	850	900	900	μMHOS
AMPLIFICATION FACTOR	9.3	9.3	9.3	

DETECTOR

	BIASED			GRID LEAK	
PLATE VOLTAGE	90	135	180 MAX.	45 MAX.	VOLTS
GRID VOLTAGE	-9 A	-13.5 A	-18 A	RETURN TO (+) FILAMENT	VOLTS
PLATE CURRENT P	ADJUST TO 0.2 MA. WITH NO INPUT SIGNAL			–	
GRID LEAK	–	–	–	1 TO 5	MEGOHMS
GRID CONDENSER	–	–	–	250	μμf

A APPROXIMATE, GRID RETURN TO NEGATIVE END OF FILAMENT.

P WITH MAXIMUM SIGNAL THE AVERAGE DC PLATE CURRENT SHOULD NOT EXCEED 2.0 MA.

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CLASS B_2 AMPLIFIER

PLATE VOLTAGE	180 MAX.	VOLTS
PEAK PLATE CURRENT PER TUBE	50 MAX.	MA.
ZERO-SIGNAL PLATE CURRENT PER TUBE	1.5 MAX.	MA.

TYPICAL OPERATING CONDITIONS

VALUES ARE FOR TWO TUBES

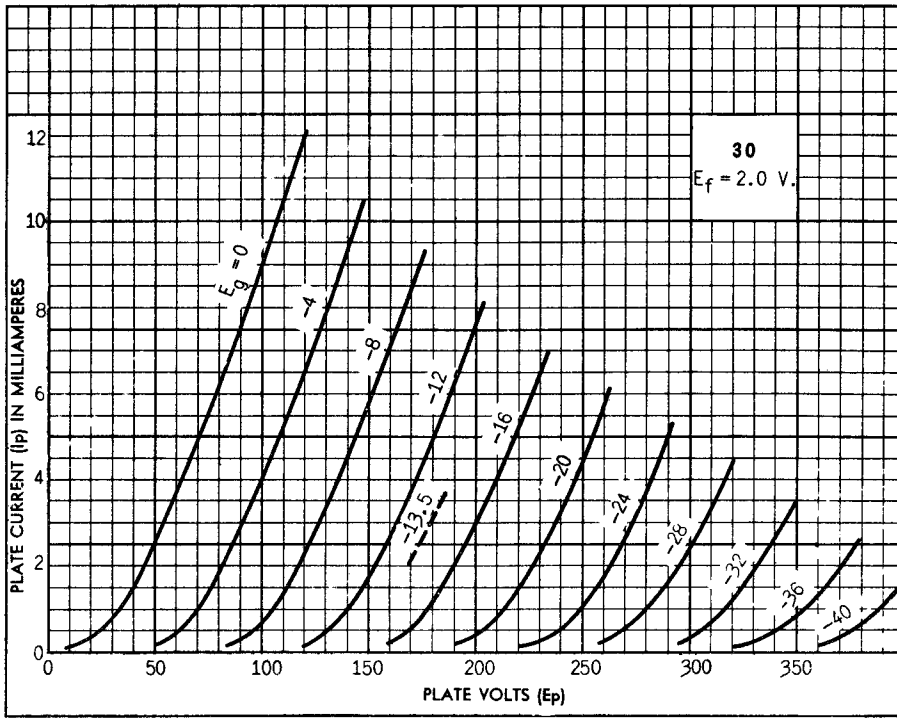
PLATE VOLTAGE	157.5	VOLTS
GRID VOLTAGE	-15	VOLTS
ZERO-SIGNAL PLATE CURRENT	1	MA.
LOAD RESISTANCE PER TUBE	2000	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	8000	OHMS
PEAK POWER INPUT GRID TO GRID	260 MAX.	MILLIWATTS
POWER OUTPUT[D] (6% TO 7% DISTORTION)	2.1	WATTS

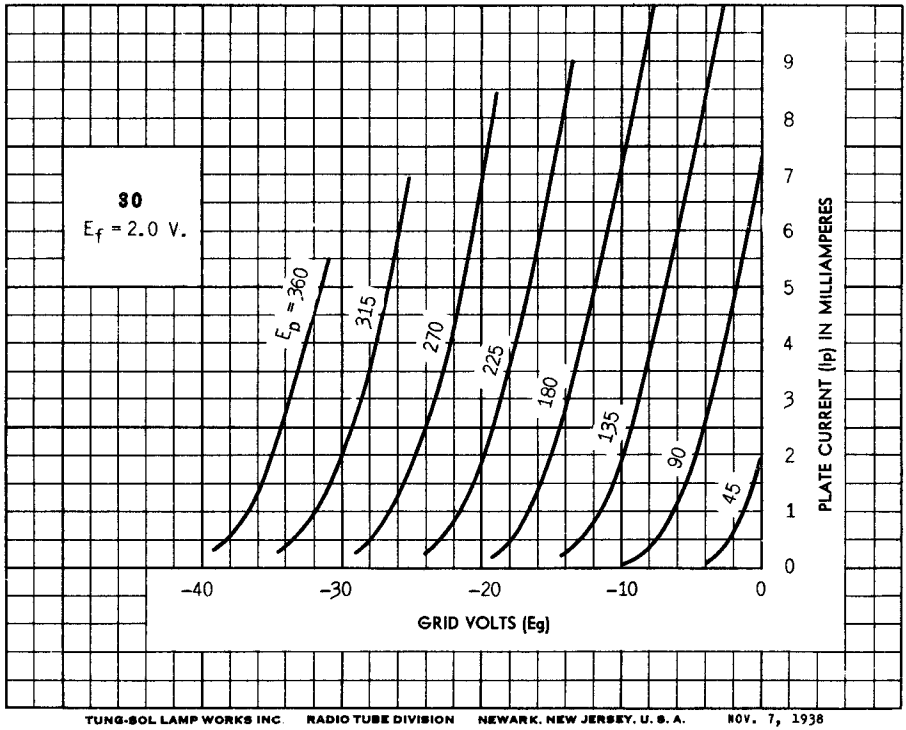
[D] WITH ONE TYPE 30 AS DRIVER, OPERATED WITH PLATE VOLTAGE = 157.5 VOLTS, GRID VOLTAGE = -11.3 VOLTS, PLATE LOAD OF APPROXIMATELY 18,000 OHMS, AND INPUT TRANSFORMER RATIO, PRIMARY TO ONE HALF SECONDARY = 1.165.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO FILAMENT	3.0	μμf
PLATE TO FILAMENT	2.2	μμf
GRID TO PLATE	6.0	μμf

PLATE
187-1





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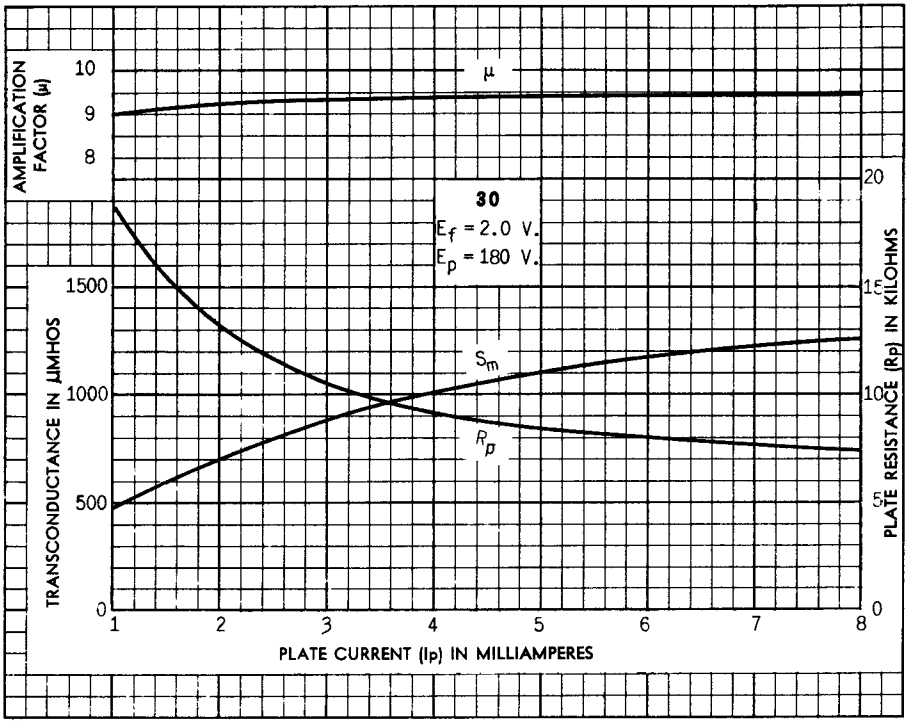

AMPLIFICATION FACTOR (μ)
10
9
8
μ
30
E_f = 2.0 V.
E_p = 180 V.
1500
1000
500
0
TRANSCONDUCTANCE IN μMHOS
S_m
R_p
20
15
10
5
0
PLATE RESISTANCE (Rp) IN KILOHMS
1
2
3
4
5
6
7
8
PLATE CURRENT (Ip) IN MILLIAMPERES

PLATE
159-1

TUNG-SOL

CATHODE RAY

THE 30BP4 IS A DIRECT-VIEW PICTURE TUBE DESIGNED FOR USE IN TELEVISION APPLICATIONS. ITS FEATURES INCLUDE:

GREY FILTER FACEPLATE
MAGNETIC FOCUS & DEFLECTION
EXTERNAL SINGLE FIELD ION TRAP
UNIPOTENTIAL CATHODE
ROUND METAL CONSTRUCTION
25 9/16" X 19 1/4" RASTER SIZE

MECHANICAL DATA

FOCUSING METHOD		MAGNETIC
DEFLECTING METHOD		MAGNETIC
DEFLECTION ANGLE (APPROX.)	90	DEGREES
DIRECT INTERELECTRODE CAPACITANCES (APPROX.):		
CATHODE TO ALL OTHER ELECTRODES	5	μμf
GRID #1 TO ALL OTHER ELECTRODES	7	μμf

OPTICAL DATA

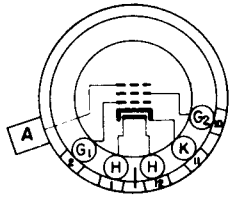
PHOSPHOR NUMBER		NO. 4
FLUORESCENT COLOR		WHITE
PHOSPHORESCENT COLOR		WHITE
PERSISTENCE		MEDIUM
FACEPLATE LIGHT TRANSMISSION AT CENTER (APPROX.)	66	PERCENT

MECHANICAL DATA

OVERALL LENGTH	23 9/16 ± 1/2	INCHES
GREATEST DIAMETER OF BULB	30 1/8 ± 1/4	INCHES
MINIMUM USEFUL SCREEN DIAMETER	28 1/4	INCHES
BULB CONTACT	METAL SHELL LIP	
BASE	SMALL SHELL DUODECAL 5 PIN	B5-57
BASING		12D

PIN CONNECTIONS

PIN 1 – HEATER
PIN 2 – GRID NO. 1
PIN 10 – GRID NO. 2



BOTTOM VIEW

PIN 11 – CATHODE
PIN 12 – HEATER
ANODE CAP

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RATINGS
DESIGN CENTER VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.6	AMP.
MAXIMUM DC ANODE VOLTAGE[A]	30 000	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	410	VOLTS
MAXIMUM GRID #1 VOLTAGE:		
DC NEGATIVE-BIAS VALUE	125	VOLTS
DC POSITIVE-BIAS VALUE	0	VOLTS
POSITIVE-PEAK VALUE	2	VOLTS
MAXIMUM DC PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DURING WARM-UP PERIOD NOT TO EXCEED 15 SECONDS	410	VOLTS
AFTER EQUIPMENT WARM-UP PERIOD	150	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	150	VOLTS

[A] IF THIS TUBE IS OPERATED AT VOLTAGES IN EXCESS OF 16,000 VOLTS, X-RAY RADIATION SHIELDING MAY BE NECESSARY TO PROTECT AGAINST POSSIBLE INJURY FROM PROLONGED EXPOSURE AT CLOSE RANGE. SUCH PROTECTION MAY BE PROVIDED BY THE PROTECTIVE FACE VIEWING WINDOW OF APPARATUS USING TUBES OF THIS TYPE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC ANODE VOLTAGE	12 000	VOLTS
DC GRID #2 VOLTAGE	300	VOLTS
DC GRID #1 VOLTAGE[B]	-33 TO -77	VOLTS
DC FOCUSING COIL CURRENT[C] (APPROX.)	95 ± 20%	MA.
DC ION TRAP CURRENT STANDARD COIL #111 (APPROX.)	75 ± 50%	MA.

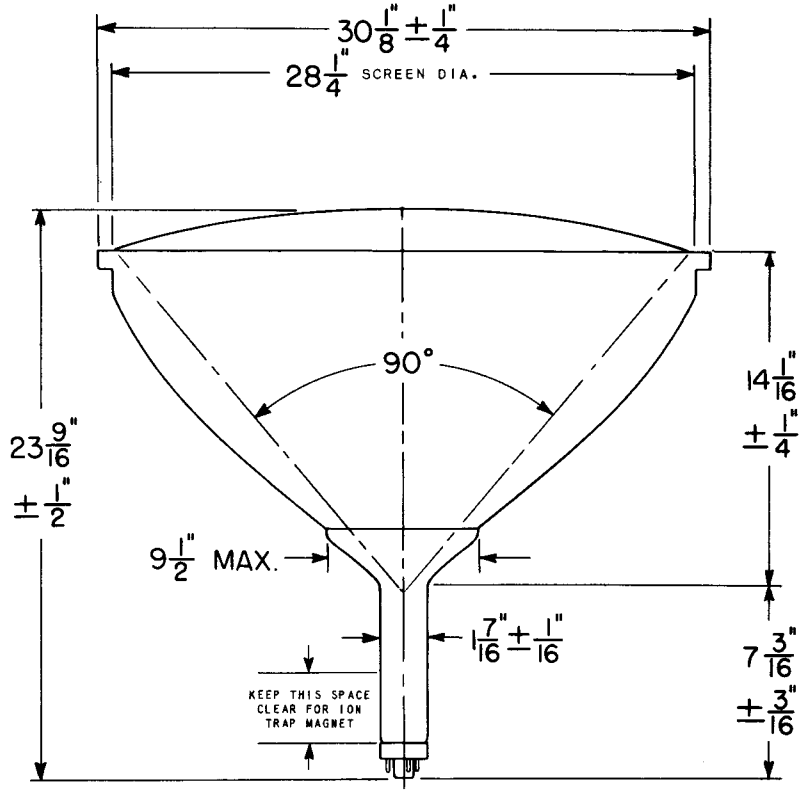
[B] VISUAL EXTINCTION OF UNDEFLECTED FOCUSED SPOT.

[C] FOR STANDARD FOCUS COIL #109, OR EQUIVALENT, WITH THE COMBINED GRID #1 BIAS VOLTAGE AND VIDEO-SIGNAL VOLTAGE ADJUSTED TO PRODUCE A HIGHLIGHT BRIGHTNESS OF 7 FOOT LAMBERTS ON A 19 1/4" BY 25 9/16" PICTURE SIZE. DISTANCE FROM REFERENCE LINE TO CENTER OF AIR GAP ON FOCUS COIL SHALL BE 3.0 INCHES.

CIRCUIT VALUES

MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.5	MEGOHMS

TUNG-SOL



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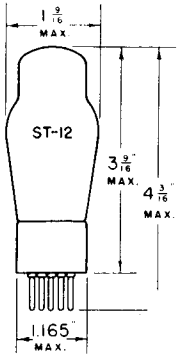


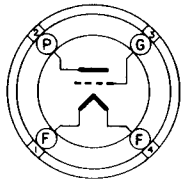
TRIODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.13 AMPERE
DC

GLASS BULB

SMALL 4 PIN BASE



4D

BOTTOM VIEW

THE TUNG-SOL 31 IS A TRIODE POWER AMPLIFIER DESIGNED FOR BATTERY OPERATION.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	180	VOLTS
GRID VOLTAGE [A]	-22.5	-30	VOLTS
GRID CIRCUIT RESISTANCE [G]	0.5 MAX.	0.5 MAX.	MEGOHM
PLATE CURRENT	8	12.3	MA.
PLATE RESISTANCE	4100	3600	OHMS
TRANSCONDUCTANCE	925	1050	μMHOS
AMPLIFICATION FACTOR	3.8	3.8	
LOAD RESISTANCE	7000	5700	OHMS
POWER OUTPUT	0.185	0.375	WATT

[A] RETURN TO NEGATIVE FILAMENT (PIN #4) [G] WITH FIXED BIAS

DIRECT INTERELECTRODE CAPACITANCES

GRID TO FILAMENT	3.6	μμf
PLATE TO FILAMENT	2.8	μμf
GRID TO PLATE	5.5	μμf

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PLATE
544-2

AUG. 14
1939

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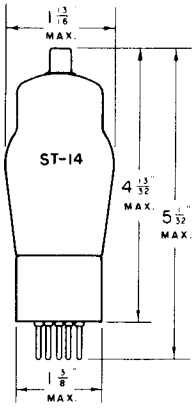
TUNG-SOL



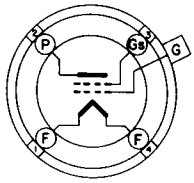
TETRODE AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.06 AMPERE
DC

GLASS BULB

MEDIUM 4 PIN BASE



4K

BOTTOM VIEW

THE TUNG-SOL 32 IS DESIGNED FOR SERVICE AS A GENERAL PURPOSE SHARP CUT-OFF TETRODE VOLTAGE AMPLIFIER IN BATTERY OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	180 MAX.	VOLTS
SCREEN VOLTAGE MAX.	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE [A]	-3	-3	VOLTS
GRID CIRCUIT RESISTANCE MAX.	2	2	MEGOHMS
PLATE CURRENT	1.7	1.7	MA.
SCREEN CURRENT MAX.	0.4	0.4	MA.
PLATE RESISTANCE APPROX.	0.95	1.2	MEGOHMS
TRANSCONDUCTANCE APPROX.	640	650	μMHOS
AMPLIFICATION FACTOR APPROX.	610	780	

DETECTOR

	BIASED		GRID LEAK	
PLATE SUPPLY VOLTAGE	135	180	135	VOLTS
SCREEN VOLTAGE	45	67.5 MAX.	45 MAX.	VOLTS
PLATE RESISTOR [P]	0.1	0.1	0.1	MEGOHM
GRID VOLTAGE	-4.5 [A]	-6 [A]	RETURN TO + FIL. (PIN #1)	VOLTS
PLATE CURRENT	ADJUST TO 0.2 MA. WITH NO INPUT SIGNAL		—	
GRID LEAK	—	—	1 TO 5	MEGOHMS
GRID CONDENSER	—	—	250	μμf

[P] OR EQUIVALENT IMPEDANCE

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO FILAMENT	5.5	μμf
PLATE TO FILAMENT	11	μμf
CONTROL GRID TO PLATE [S]	0.015 MAX.	μμf

[S] WITH SHIELD

[A] RETURN TO NEGATIVE FILAMENT (PIN #4)

PLATE 545-2

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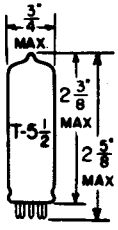
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

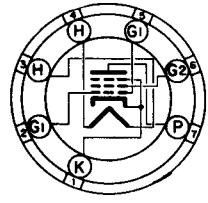
COATED UNIPOTENTIAL CATHODE

HEATER

32 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CV

THE 32ET5 IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA HEATER AND IS DESIGNED FOR USE IN AC/DC RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT: G TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	6.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE	32	VOLTS
MAXIMUM HEATER—CATHODE VOLTAGE:	0.10	AMP.
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.4	WATTS
MAXIMUM GRID #2 DISSIPATION	1.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

A

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

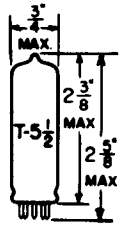
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	32	VOLTS
HEATER CURRENT	0.10	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID #2 CURRENT	2.8	MA.
TRANSCONDUCTANCE	5500	μMHOS
PLATE RESISTANCE (APPROX.)	21 500	OHMS
LOAD RESISTANCE	2800	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	1.2	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

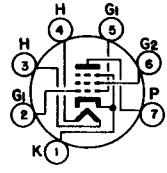
COATED UNIPOTENTIAL CATHODE

HEATER

32 VOLTS 0.10 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 32ET5A IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN AC/DC RADIOS THAT EMPLOY 100 MILLI-AMPERE SERIES CONNECTED HEATERS. EXCEPT FOR HEATER RATINGS, THE 32ET5A IS IDENTICAL TO THE 32ET5.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	μμf
INPUT: G TO (H+K+G2+G3)	12	μμf
OUTPUT: P TO (H+K+G2+G3)	6.0	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER CURRENT[B]	0.100±0.006	AMPS.
MAXIMUM HEATER-CATHODE VOLTAGE:	0.10	AMP.
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.4	WATTS
MAXIMUM GRID #2 DISSIPATION	1.2	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
HEATER WARM-UP TIME*	20	SECONDS

A
DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

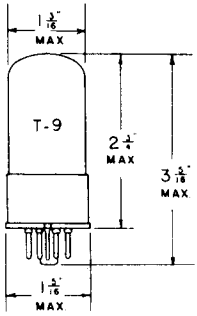
HEATER VOLTAGE[B] (SERIES OPERATION)	32	VOLTS
HEATER CURRENT[C] (SERIES OPERATION)	0.10	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	30	MA.
ZERO-SIGNAL GRID #2 CURRENT	2.8	MA.
TRANSCONDUCTANCE	5500	μMHOS
PLATE RESISTANCE (APPROX.)	21 500	OHMS
LOAD RESISTANCE	2800	OHMS
MAXIMUM-SIGNAL POWER OUTPUT	1.2	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT

[C] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[B] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIFIED VALUES.

* HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL



RECTIFIER
BEAM POWER AMPLIFIER

UNIPOTENTIAL CATHODES

HEATER
32.5 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

8F

BOTTOM VIEW

8 PIN OCTAL BASE

THE TUNG-SOL 32L7GT COMBINES A HALF WAVE POWER RECTIFIER AND OUTPUT POWER AMPLIFIER IN A SINGLE BULB. IT IS DESIGNED FOR SERVICE IN AC-DC RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

AMPLIFIER SECTION - CLASS A1

PLATE VOLTAGE	90	90	VOLTS
SCREEN VOLTAGE	90	90	VOLTS
CONTROL GRID VOLTAGE	-5	-7	VOLTS
PLATE CURRENT	38	27	MA.
SCREEN CURRENT	3.0	2.0	MA.
PLATE RESISTANCE	15 000	17 000	OHMS
TRANSCONDUCTANCE	6800	4800	μMHOS
AMPLIFICATION FACTOR	90	81	
LOAD RESISTANCE	2600	2600	OHMS
TOTAL HARMONIC DISTORTION	5.3	9.0	PER CENT
SECOND HARMONIC DISTORTION	2.2	6.5	PER CENT
THIRD HARMONIC DISTORTION	4.6	5.5	PER CENT
POWER OUTPUT	0.8	1.0	WATT

NOTE: THE GRID CIRCUIT RESISTANCE SHOULD NOT EXCEED 0.5 MEGOHM.

RECTIFIER SECTION

AC PLATE VOLTAGE	125 MAX.	VOLTS
DC OUTPUT CURRENT	60 MAX.	MA.

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PLATE
340-1

FEB. 27
1939

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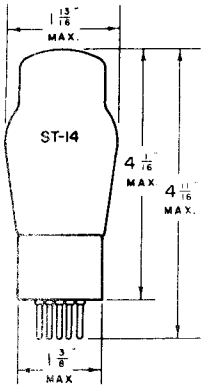
TUNG-SOL



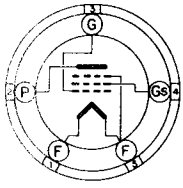
PENTODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.26 AMPERE
DC

GLASS BULB

MEDIUM 5 PIN BASE



5K

BOTTOM VIEW

THE TUNG-SOL 33 IS A FILAMENT TYPE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF BATTERY AND DC OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	180 MAX.	VOLTS
SCREEN VOLTAGE	135	180 MAX.	VOLTS
CONTROL GRID VOLTAGE [A]	-13.5	-18	VOLTS
GRID CIRCUIT RESISTANCE [G]	0.5 MAX.	0.5 MAX.	MEGOHM
PLATE CURRENT	14.5	22	MA.
SCREEN CURRENT	3	5	MA.
TRANSCONDUCTANCE	1450	1700	µMHOS
AMPLIFICATION FACTOR	70	90	
LOAD RESISTANCE	7000	6000	OHMS
TOTAL HARMONIC DISTORTION	7	7	PER CENT
POWER OUTPUT	0.7	1.4	WATTS

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO FILAMENT	8	µµf
PLATE TO FILAMENT	12	µµf
CONTROL GRID TO PLATE	1	µµf

[A] RETURN TO NEGATIVE FILAMENT (PIN #5)

[G] WITH FIXED BIAS

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PLATE
507-2

AUG. 14
1939

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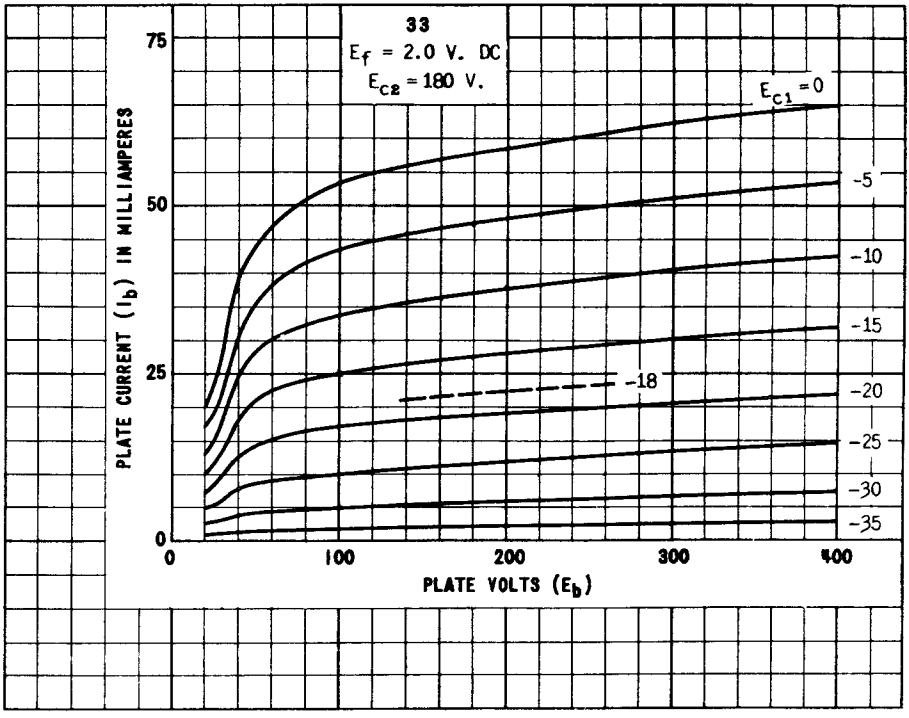

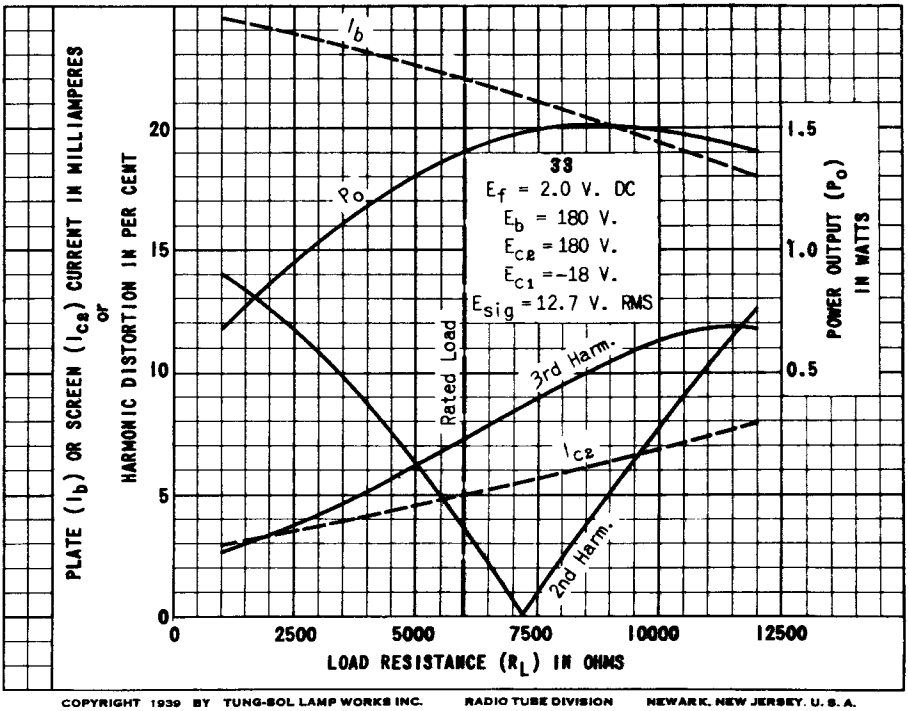

PLATE 506-1

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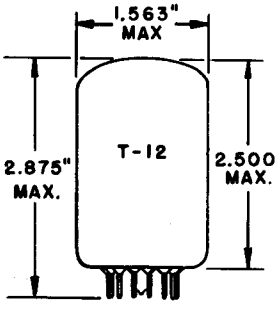
TUNG-SOL

DIODE-PENTODE



COMPACTRON

HIGH-PERVEANCE

DIODE

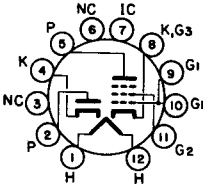
AND BEAM POWER PENTODE

FOR

TELEVISION APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
BUTTON 12 PIN
BASE E12-74
OUTLINE DRAWING
JEDEC 12-56

BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 FN
SOCKET TERMINALS
3,6,7 SHOULD NOT
BE USED AS TIE POINTS

THE 33GY7 IS A HIGH-PERVEANCE DIODE AND A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS THE DAMPING DIODE AND THE PENTODE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

DIODE SECTION		
CATHODE TO PLATE AND HEATER: K TO (P + H)	8.5	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	5.5	pf
HEATER TO CATHODE: (H TO K)	3.2	pf
PENTODE SECTION		
GRID 1 TO PLATE: (G1 TO P)	0.2	pf
INPUT: G1 TO (H + K + G2 + G3)	17	pf
OUTPUT: P TO (H + K + G2 + G3)	7.0	pf

CONTINUED ON FOLLOWING PAGE

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	33.6 VOLTS	450	MA.
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	MA.
HEATER-CATHODE VOLTAGE	DIODE SECTION	PENTODE SECTION	
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC COMPONENT	100	100	VOLTS
TOTAL DC AND PEAK	200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC COMPONENT	400		VOLTS
TOTAL DC AND PEAK	4,200	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

BULB TEMPERATURE AT HOTTEST POINT	200	^{0} C
DIODE SECTION		
PEAK INVERSE PLATE VOLTAGE	4,200	VOLTS
PLATE DISSIPATION [B]	3.8	WATTS
STEADY-STATE PEAK PLATE CURRENT	810	MA.
DC OUTPUT CURRENT	135	MA.
PENTODE SECTION		
DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	400	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	5,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	0	VOLTS
GRID 2 VOLTS	150	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION	9.0	WATTS
GRID 2 DISSIPATION	3.0	WATTS
DC CATHODE CURRENT	155	MA.
PEAK CATHODE CURRENT	540	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS

A- FOR OPERATION IN A 525-LINE, 30-FRAME TELEVISION SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE CONCERNING TELEVISION BROADCAST STATIONS," FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE MUST NOT EXCEED 15 PERCENT OF ONE SCANNING CYCLE.

B- IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE-BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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AVERAGE CHARACTERISTICS

PENTODE SECTION

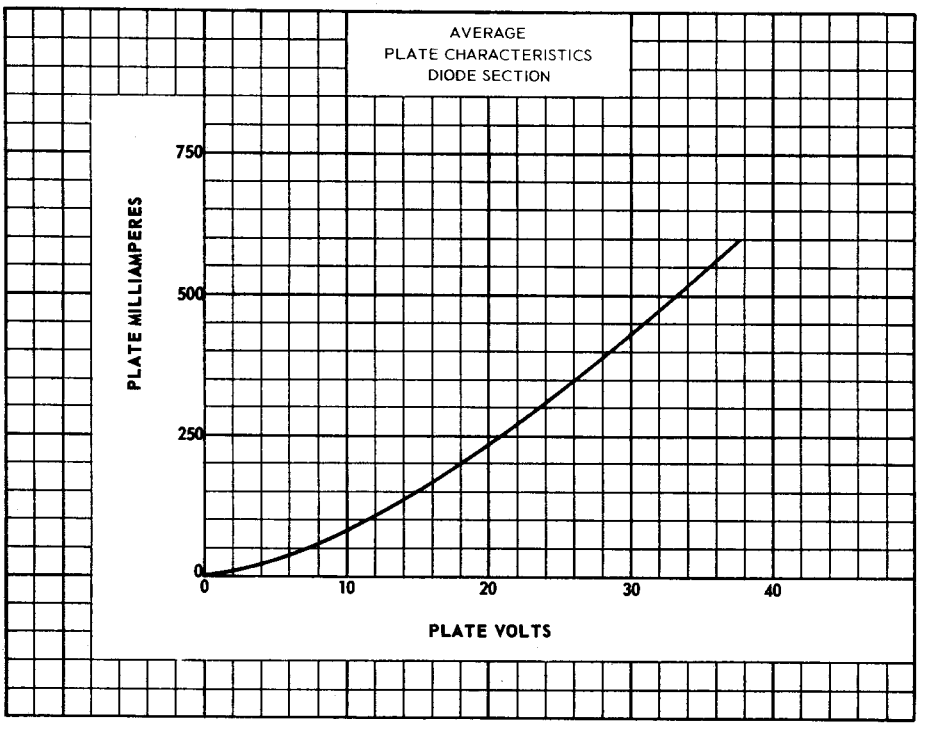
PLATE VOLTAGE		5,000	60	130	VOLTS
GRID 2 VOLTAGE		130	130	130	VOLTS
GRID 1 VOLTAGE		-	0 [C]	-22.5	VOLTS
PLATE CURRENT		-	320	48	MA.
GRID 2 CURRENT		-	22	2.9	MA.
TRANSCONDUCTANCE		-	-	6,500	μMHOS
PLATE RESISTANCE	(Approx.)	-	-	10,000	OHMS
GRID 1 VOLTAGE FOR I_b = 1.0 MA.	(Approx.)	-80	-	-40	VOLTS
TRIODE AMPLIFICATION FACTOR [D]		-	-	4.0	

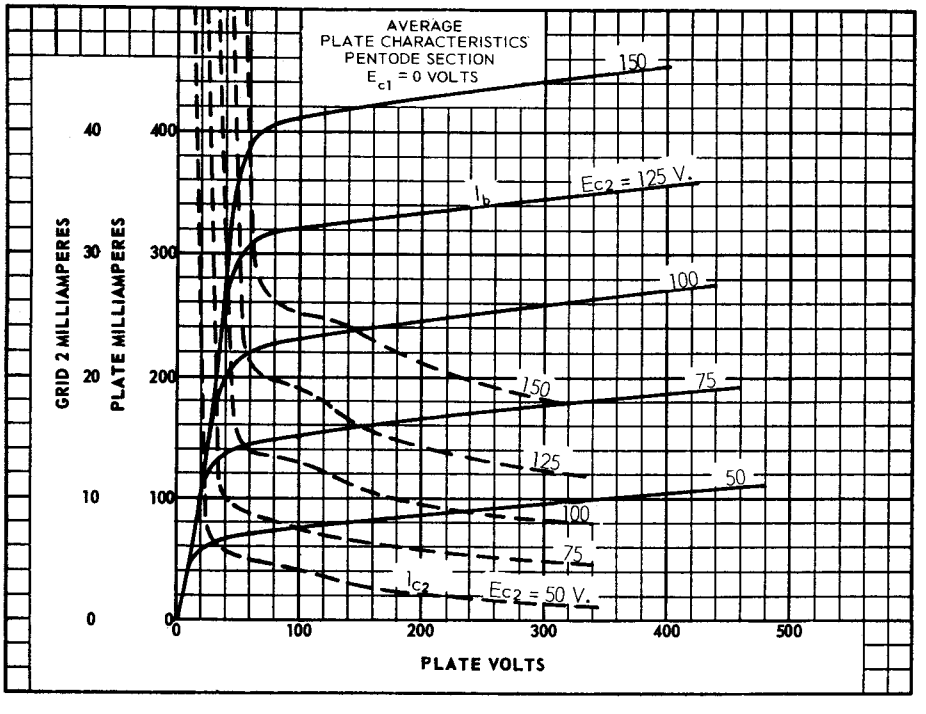
DIODE SECTION

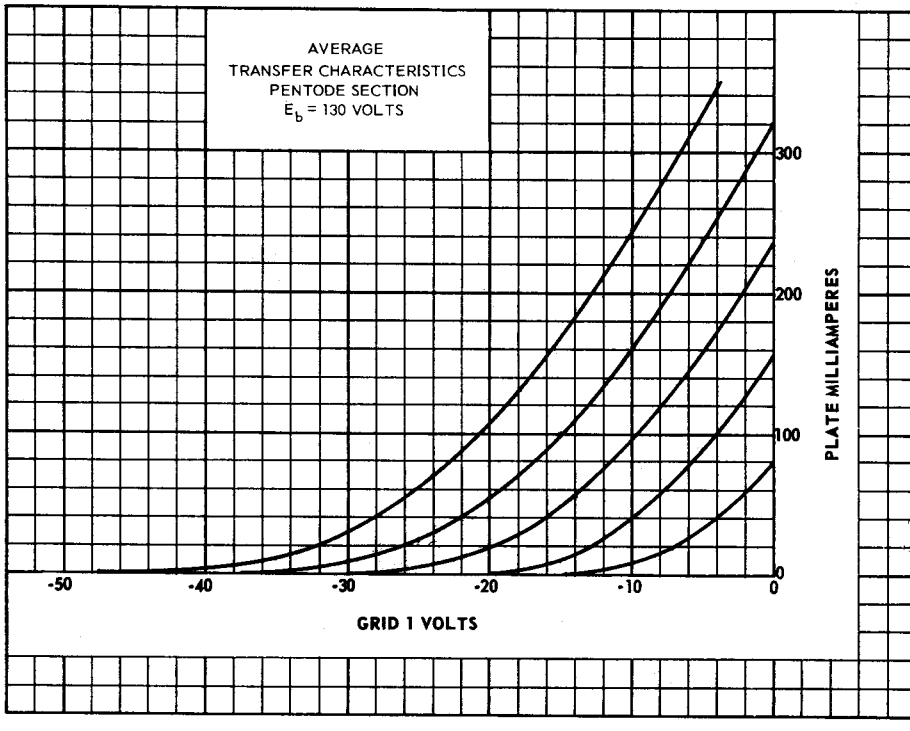
TUBE VOLTAGE DROP FOR I_b = 250 MA.				21	VOLTS

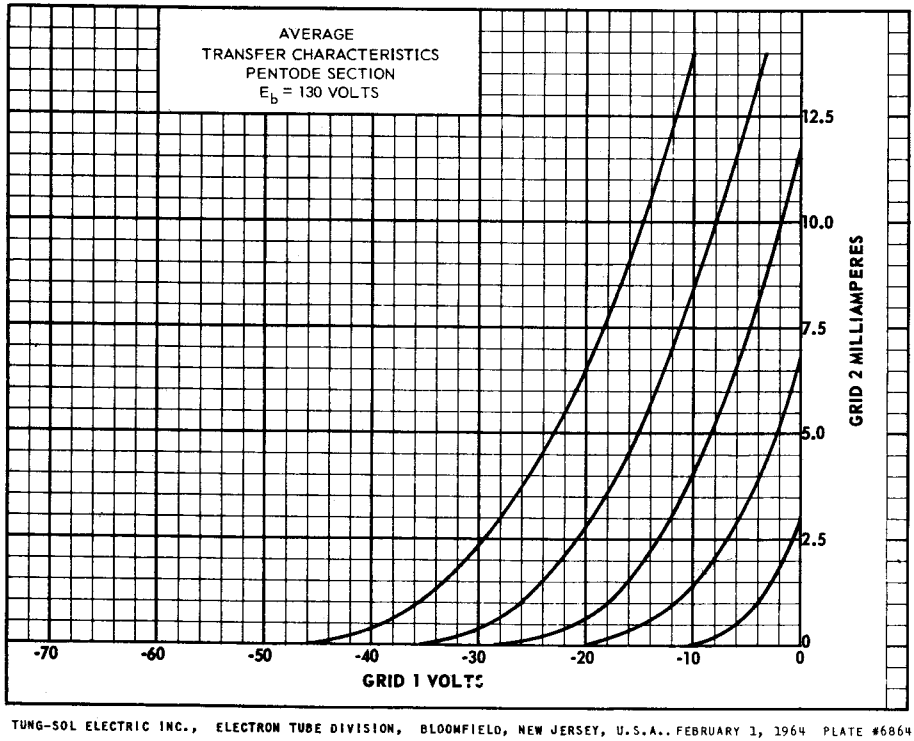
C- APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.
D- TRIODE CONNECTION (GRID 2 TIED TO PLATE) WITH Eb = Ec2 = 130 VOLTS AND Ec1 = - 22.5 VOLTS.

33GY7


AVERAGE
PLATE CHARACTERISTICS
DIODE SECTION
PLATE MILLIAMPERES
750
500
250
0
0
10
20
30
40
PLATE VOLTS


AVERAGE
PLATE CHARACTERISTICS
PENTODE SECTION
E_{c1} = 0 VOLTS
GRID 2 MILLIAMPERES
PLATE MILLIAMPERES
40
30
20
10
0
400
300
200
100
0
0
100
200
300
400
500
PLATE VOLTS
150
I_b
E_{c2} = 125 V.
100
150
75
125
50
100
75
I_{c2}
E_{c2} = 50 V.





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TUNG-SOL

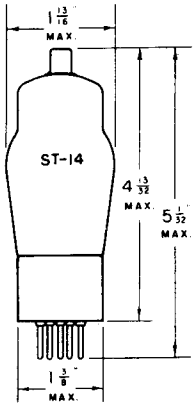


FIG. 7

REMOTE CUT - OFF

PENTODE AMPLIFIER

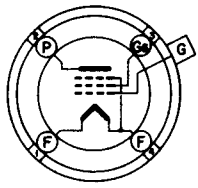
COATED FILAMENT

2.0 VOLTS 0.06 AMPERE

DC

GLASS BULB

MEDIUM 4 PIN BASE



4M

THE TUNG-SOL 34 IS A REMOTE CUT-OFF PENTODE AMPLIFIER DESIGNED FOR USE IN BATTERY OPERATED RECEIVERS. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS AND MINIMIZES CROSS MODULATION.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	67.5	135	180 MAX.	VOLTS
SCREEN VOLTAGE MAX.	67.5	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE MIN.	-3	-3	-3	VOLTS
PLATE CURRENT	2.7	2.8	2.8	MA.
SCREEN CURRENT	1.1	1.0	1.0	MA.
PLATE RESISTANCE APPROX.	0.4	0.6	1.0	MEGOHM
TRANSCONDUCTANCE	560	600	620	μMHOS
AMPLIFICATION FACTOR APPROX.	224	360	620	
CONTROL GRID VOLTAGE	-22.5	-22.5	-22.5	VOLTS

FOR TRANSCONDUCTANCE = 15 μMHOS

AS MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	67.5	135	180 MAX.	VOLTS
SCREEN VOLTAGE MAX.	67.5	67.5	67.5	VOLTS
CONTROL GRID VOLTAGE APPROX. [G]	-5	-5	-5	VOLTS

[G] THIS GRID BIAS IS MINIMUM FOR AN OSCILLATOR PEAK VOLTAGE OF 4.0 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO FILAMENT	6.0	μμf
PLATE TO FILAMENT	11.5	μμf
CONTROL GRID TO PLATE[S]	0.015 MAX.	μμf

[S] WITH SHIELD

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PLATE 258-2

DEC. 12 1938

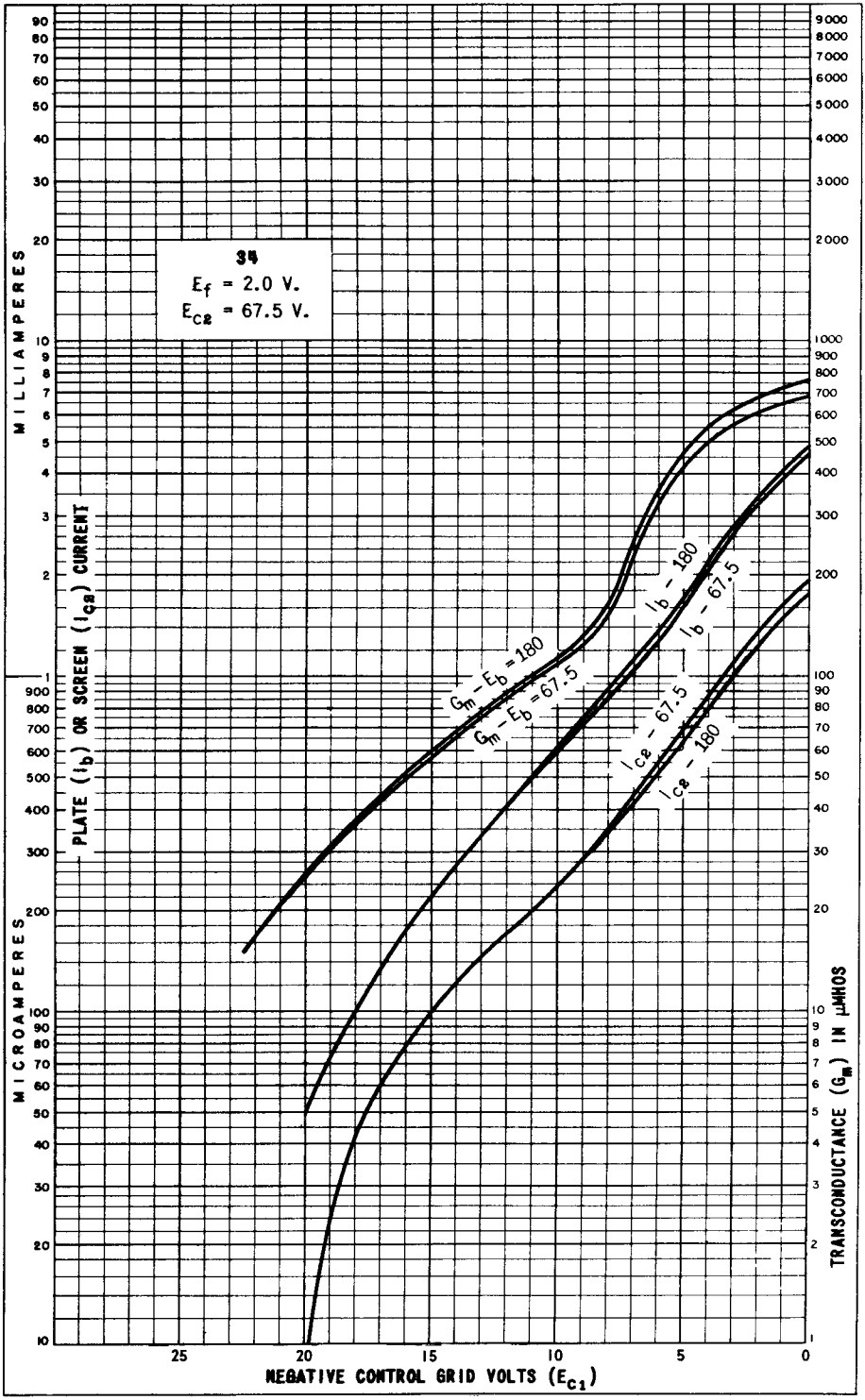

PLATE 259-1

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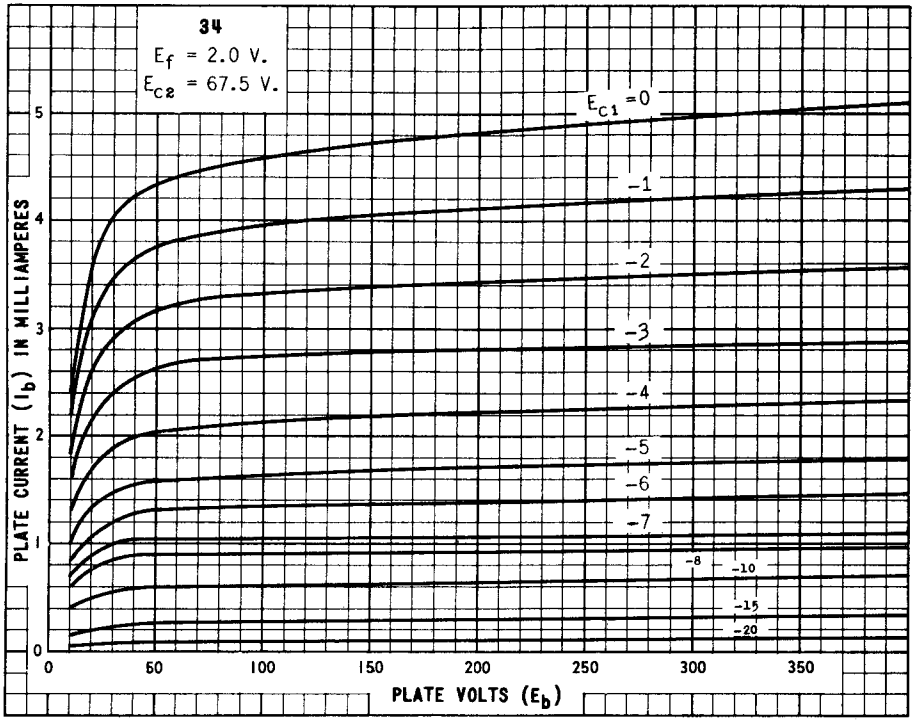

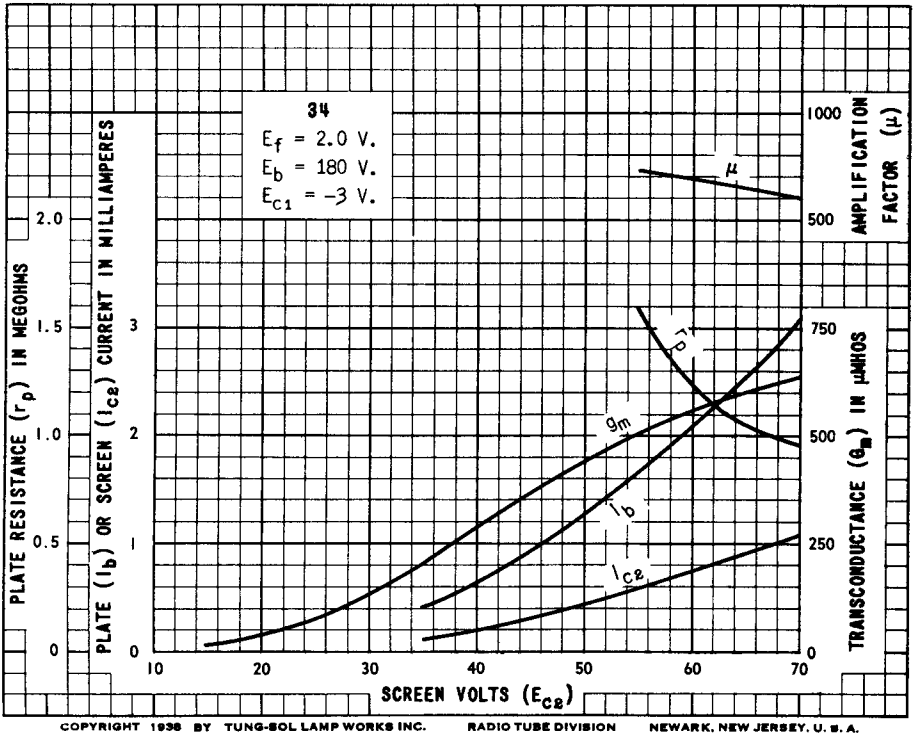

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PLATE 224-1

DEC. 12 1938

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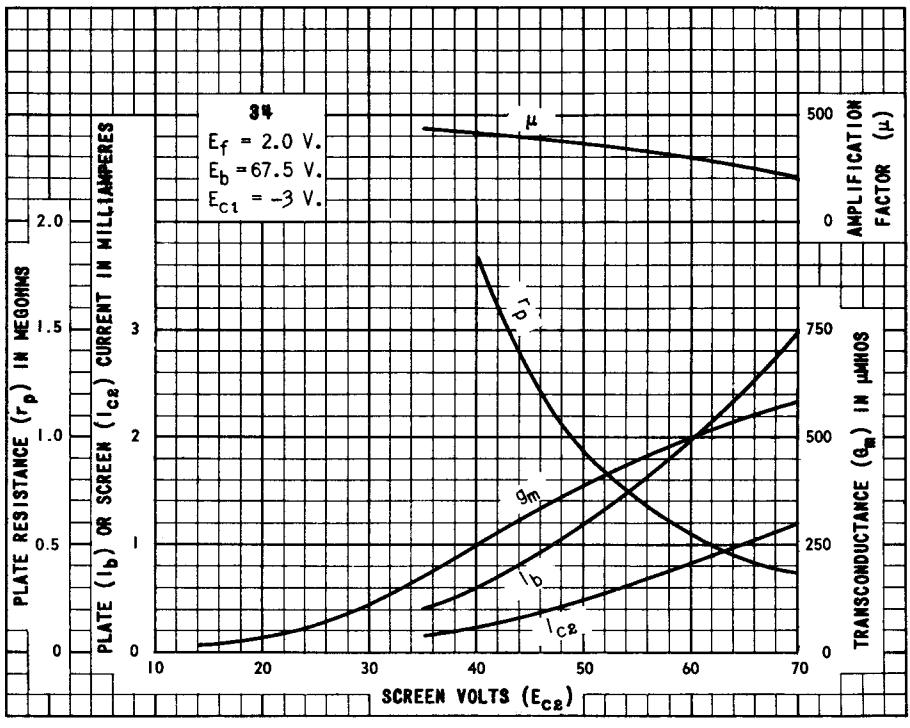

PLATE
225-1

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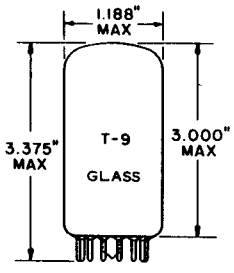
TUNG-SOL

DIODE
COMPACTRON

OUTLINE



BASE 12 PIN BUTTON
JEDEC E12-70

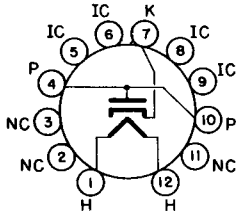
FOR

T.V. DAMPER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 12FX



BOTTOM VIEW

THE TUNG-SOL 34CD3 IS AN INDIRECTLY-HEATED DIODE IN COMPACTRON CONSTRUCTION. IT IS INTENDED FOR USE IN DAMPER SERVICE OF TELEVISION HORIZONTAL DEFLECTION CIRCUITS. IT IS DESIGNED TO WITHSTAND HIGH VOLTAGE PULSES BETWEEN CATHODE AND BOTH HEATER AND PLATE ELEMENTS SUCH AS NORMALLY ENCOUNTERED IN "DIRECT DRIVE" CIRCUITS. ITS HIGH CURRENT CAPABILITY MAKES IT PARTICULARLY SUITABLE FOR COLOR TELEVISION APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

CATHODE TO PLATE AND HEATER: K TO (P+H)	16	pf
PLATE TO CATHODE AND HEATER: P TO (K+H)	13	pf
HEATER TO CATHODE: H TO K	4.6	pf

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM SYSTEM-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	34.5 VOLTS	450	mA
HEATER WARM-UP TIME		11	SECONDS
LIMITS OF SUPPLIED CURRENT		450 ± 30	mA
MAXIMUM HEATER CATHODE VOLTAGE *			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
DC		1,000	VOLTS
TOTAL DC AND PEAK		6,000	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		300	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

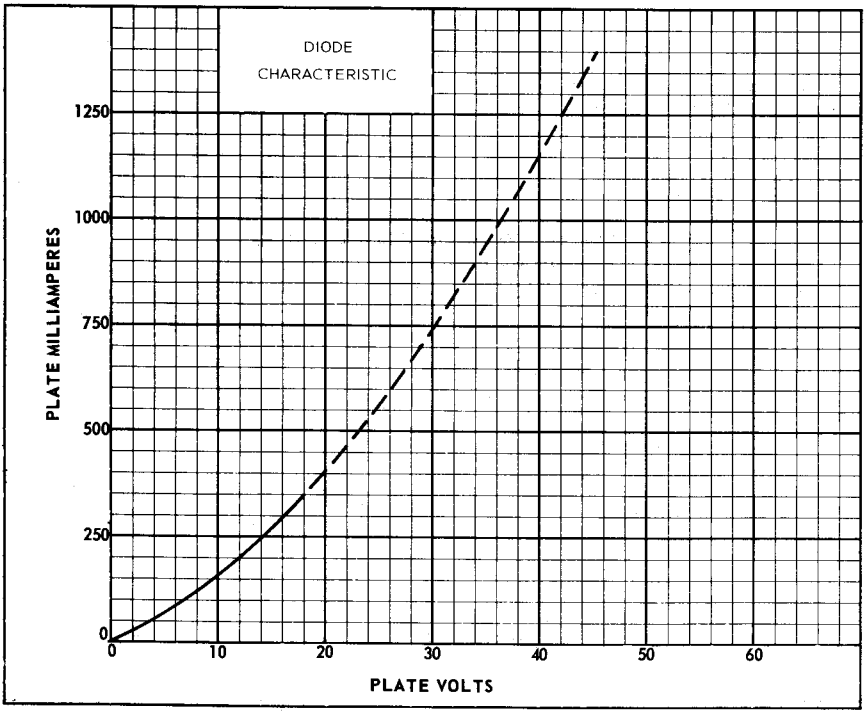
DESIGN MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

DAMPER DIODE SERVICE *		
PEAK INVERSE PLATE VOLTAGE	6,000	VOLTS
DC OUTPUT CURRENT	350	MA.
STEADY STATE PEAK PLATE CURRENT	1,500	MA.
PLATE DISSIPATION	12	WATTS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP	SEE GRAPH BELOW

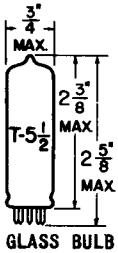
* FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION. THE DUTY CYCLE OF THE VOLTAGE PULSE IS NOT EXCEED 15 PER CENT OF A SCANNING CYCLE.



TUNG-SOL

BEAM POWER TUBE

MINIATURE TYPE

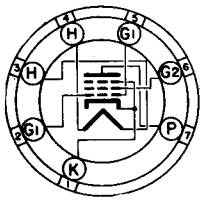


GLASS BULB
5-3

COATED UNIPOTENTIAL CATHODE

HEATER
34 VOLTS 0.10 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE

7CV

THE 34GD5 IS A BEAM POWER TUBE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN AUDIO AMPLIFIER TUBE IN AC/DC RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO K,G3,H &G2	12	pf
PLATE TO K,G3,H & G2	9	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

CLASS A_1 AMPLIFIER

HEATER CURRENT[B]	0.100±.006	AMP.
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5	WATTS
MAXIMUM GRID #2 INPUT	1.1	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	250	°C

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION (MAX.)	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION (MAX.)	0.5	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS

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CHARACTERISTICS
(CONT'D.)

CLASS A_1 AMPLIFIER

ZERO-SIGNAL PLATE CURRENT	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
PLATE RESISTANCE (APPROX.)	13000	OHMS
TRANSCONDUCTANCE	5700	μMHOS
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.4	WATTS

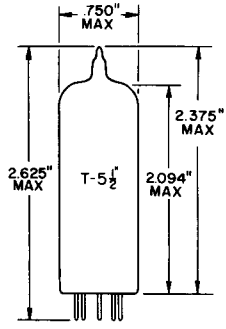
[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE FILAMENT VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

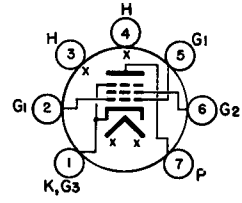


GLASS BULB
SMALL BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

UNIPOTENTIAL CATHODE

AUDIO OUTPUT AMPLIFIER
FOR SERIES STRING OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 34GD5A IS A BEAM POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN AUDIO OUTPUT AMPLIFIER IN AC/DC RADIO RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
GRID #1 TO CATHODE & GRID #3, #2 & HEATER	12	pf
PLATE TO CATHODE & GRID #3, #2, & HEATER	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	34 VOLTS	100	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6	MA.
MAXIMUM PEAK HEATER–CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	VOLTS
HEATER WARM–UP TIME, (APPROX.)[B]		20	SECONDS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5	WATTS
GRID #2 INPUT	1.1	WATTS
GRID #1 (CONTROL GRID) VOLTAGE:		
NEGATIVE BIAS VALUE	50	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

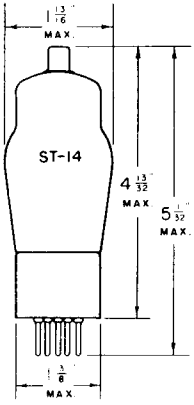
MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
PLATE RESISTANCE (APPROX.)	13,000	OHMS
TRANSCONDUCTANCE	5700	μMHOS
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.4	WATTS



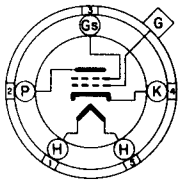
REMOTE CUT-OFF TETRODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 1.75 AMPERES
AC OR DC

GLASS BULB

MEDIUM 5 PIN BASE



5E

BOTTOM VIEW

THE TUNG-SOL 35 IS DESIGNED FOR USE AS AN AMPLIFIER OR MIXER IN SUPERHETERODYNE RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	180	250	VOLTS
SCREEN VOLTAGE MAX.	90	90	VOLTS
CONTROL GRID VOLTAGE	-3	-3	VOLTS
PLATE CURRENT	6.3	6.5	MA.
SCREEN CURRENT	2.5	2.5	MA.
PLATE RESISTANCE	0.3	0.4	MEGOHM
TRANSCONDUCTANCE	1020	1050	μMHOS
AMPLIFICATION FACTOR	305	420	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 15 μMHOS	-40	-40	VOLTS

AS MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE MAX.	90	VOLTS
CONTROL GRID VOLTAGE APPROX. G	-7	VOLTS

G THIS GRID BIAS IS MINIMUM FOR AN OSCILLATOR PEAK VOLTAGE OF 6.0 VOLTS

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	5.3	μμf
PLATE TO CATHODE	10.5	μμf
CONTROL GRID TO PLATE S	.007 MAX.	μμf

S WITH SHIELD

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PLATE 486-1

JUNE 26 1939

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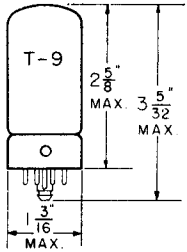
TUNG-SOL

BEAM POWER AMPLIFIER

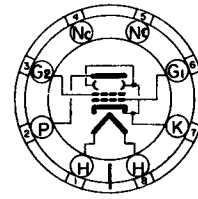


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCKING-IN
8 PIN BASE

THE 35A5 IS A BEAM POWER AMPLIFIER OF THE HEATER-CATHODE TYPE USING THE LOCK-IN CONSTRUCTION. IT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF DC AND AC-DC RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	35	VOLTS
HEATER CURRENT	0.15	AMP.
MAX. PLATE VOLTAGE	200	VOLTS
MAX. SCREEN VOLTAGE	117	VOLTS
MAX. PLATE DISSIPATION	8.5	WATTS
MAX. SCREEN DISSIPATION	1	WATT
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	200	VOLTS
SCREEN VOLTAGE	110	110	VOLTS
GRID VOLTAGE	7.5	-8	VOLTS
PEAK AF GRID VOLTAGE	7.5	8	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	41	MA.
ZERO-SIGNAL SCREEN CURRENT (APPROX.)	3	2	MA.
MAX.-SIGNAL PLATE CURRENT	41	44	MA.
MAX.-SIGNAL SCREEN CURRENT (APPROX.)	7	7	MA.
PLATE RESISTANCE (APPROX.)	14 000	40 000	OHMS
GRID RESISTOR (MAX.)			
FIXED BIAS	0.1	0.1	MEGOHM
CATHODE BIAS	0.5	0.5	MEGOHM
LOAD RESISTANCE	2500	4500	OHMS
TRANSCONDUCTANCE	5800	5900	µMHOS
MAX.-SIGNAL POWER OUTPUT	1.5	3.3	WATTS
TOTAL HARMONIC DISTORTION	10	10	PER CENT

SIMILAR TYPE REFERENCE: *Same characteristics as type 35L6G; somewhat similar to type 25L6G, amplifier unit of type 70L7GT.*

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PLATE
1632
NOV. 30
1945

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TUNG-SOL

BEAM POWER AMPLIFIER

MINIATURE TYPE

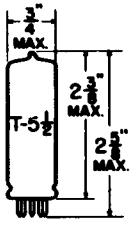
UNIPOTENTIAL CATHODE

HEATER

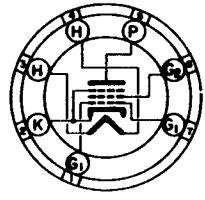
35 VOLTS 0.015 AMPERE

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 35B5 IS A BEAM POWER AMPLIFIER IN THE MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	35	VOLTS
HEATER CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE	117	VOLTS
MAXIMUM SCREEN VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	4.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.0	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	150	VOLTS

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE	0.4	μμf
INPUT	11	μμf
OUTPUT	6.5	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
CONTROL GRID VOLTAGE	-7.5	VOLTS
PEAK AF GRID VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
ZERO-SIGNAL SCREEN CURRENT (APPROX.)	3	MA.
MAXIMUM SIGNAL PLATE CURRENT	41	MA.
MAXIMUM SIGNAL SCREEN CURRENT (APPROX.)	7	MA.
GRID CIRCUIT RESISTANCE (MAX.):		
FOR FIXED BIAS	0.1	MEGOHM
FOR CATHODE-BIAS	0.5	MEGOHM
LOAD RESISTANCE	2 500	OHMS
PLATE RESISTANCE	14 000	OHMS
TRANSCONDUCTANCE	5 800	μMHOS
MAXIMUM SIGNAL POWER OUTPUT	1.5	WATTS
TOTAL HARMONIC DISTORTION	10	PERCENT

SIMILIAR TYPE REFERENCE: *Within its ratings identical to 35L6GT. Except for heater ratings, somewhat similiar to types 745, 50B5.*

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PLATE 1035 JUNE 2, 1947

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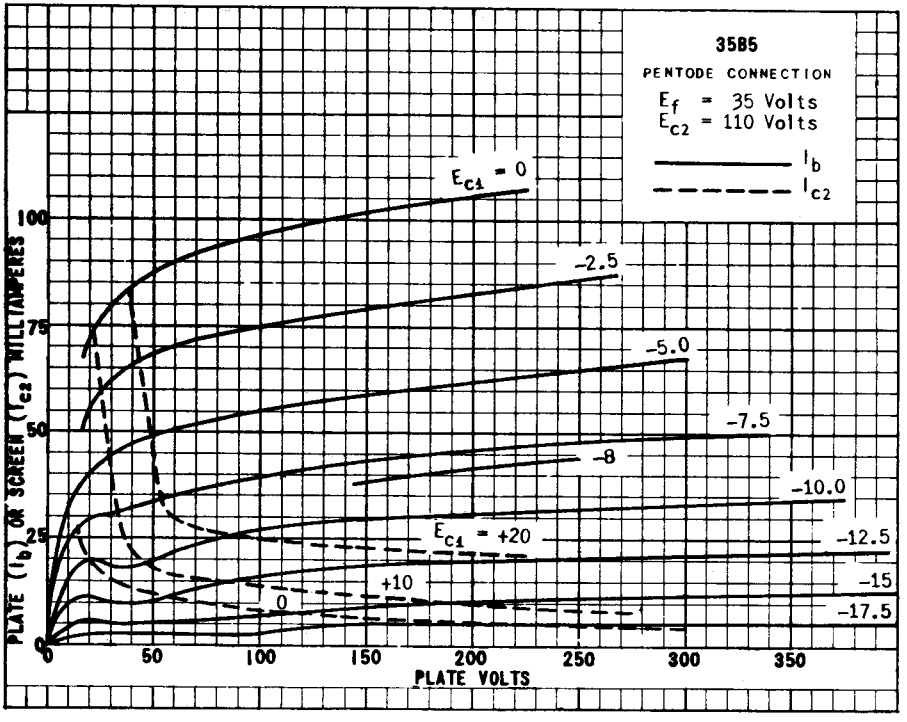
35B5



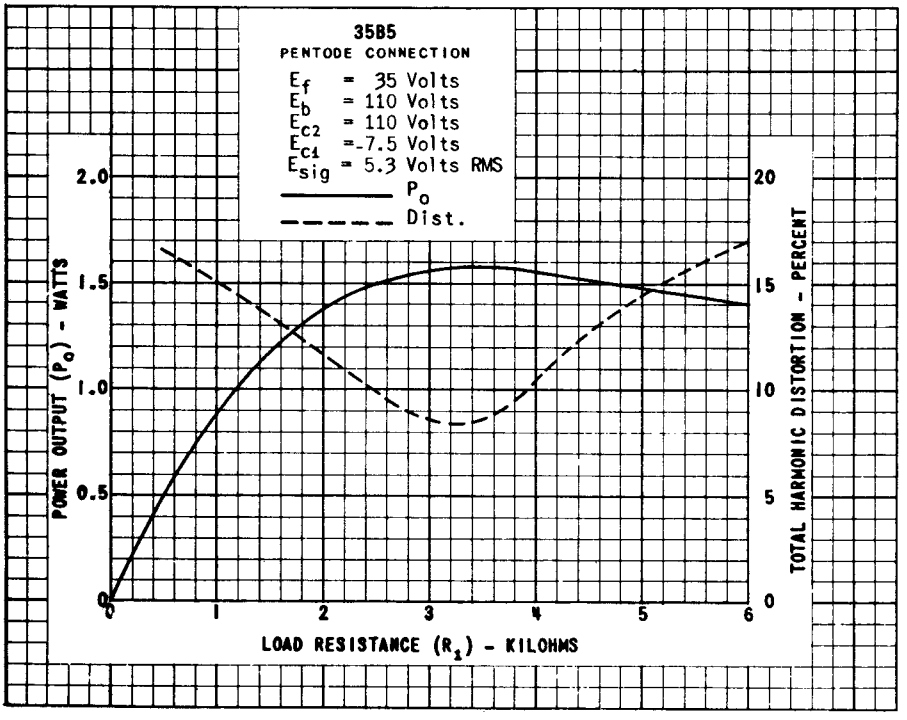


PLATE 1836
JUNE 2, 1947

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TUNG-SOL

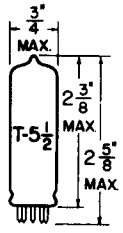
BEAM PENTODE

MINIATURE TYPE

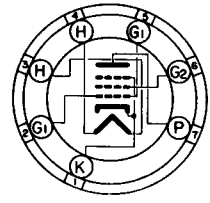
UNIPOTENTIAL CATHODE

HEATER
35±10% VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BUB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 35C5 IS A BEAM POWER AMPLIFIER IN THE MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH NO EXTERNAL SHIELD

GRID TO PLATE: (G TO P)	0.60	μμf
GRID #1 TO CATHODE & GRID #3, GRID #2 & HEATER	12 *	μμf
PLATE TO CATHODE & GRID #3, GRID #2 & HEATER	9 *	μμf

RATINGS ←
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	35±10%	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.2	WATTS
MAXIMUM GRID #2 DISSIPATION	1.1	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.1	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	35±10%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
ZERO-SIGNAL GRID #2 CURRENT (NOMINAL)	3	MA.
MAXIMUM SIGNAL PLATE CURRENT	41	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	7	MA.
TRANSCONDUCTANCE	5 800	MICROMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.5	WATTS

[A] DC COMPONENT MUST NOT EXCEED 100 VOLTS.

→ INDICATES A CHANGE.

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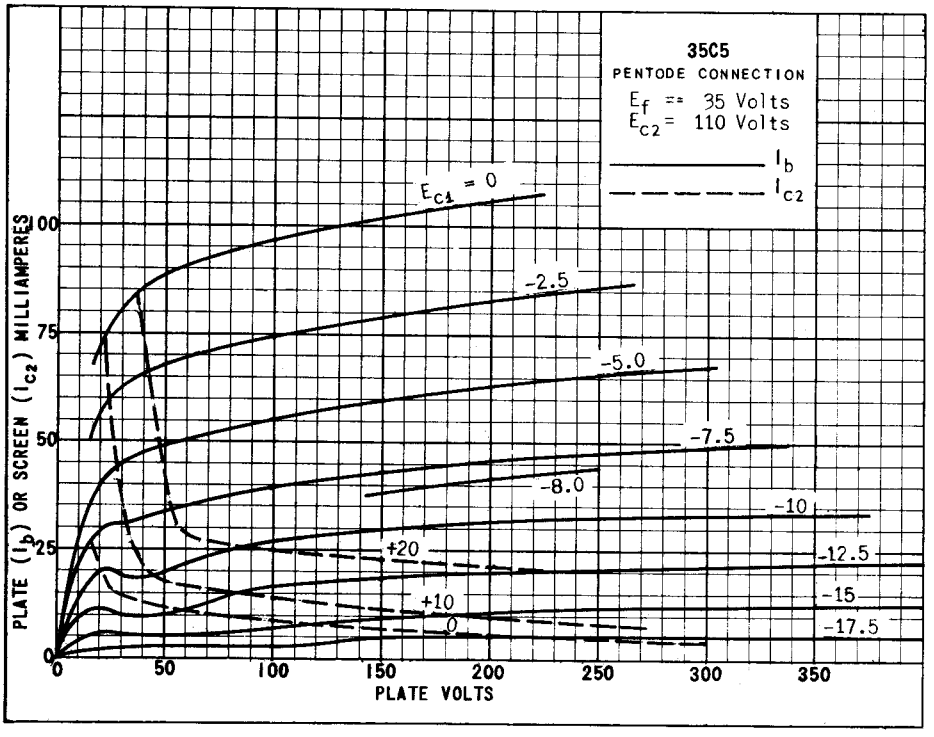
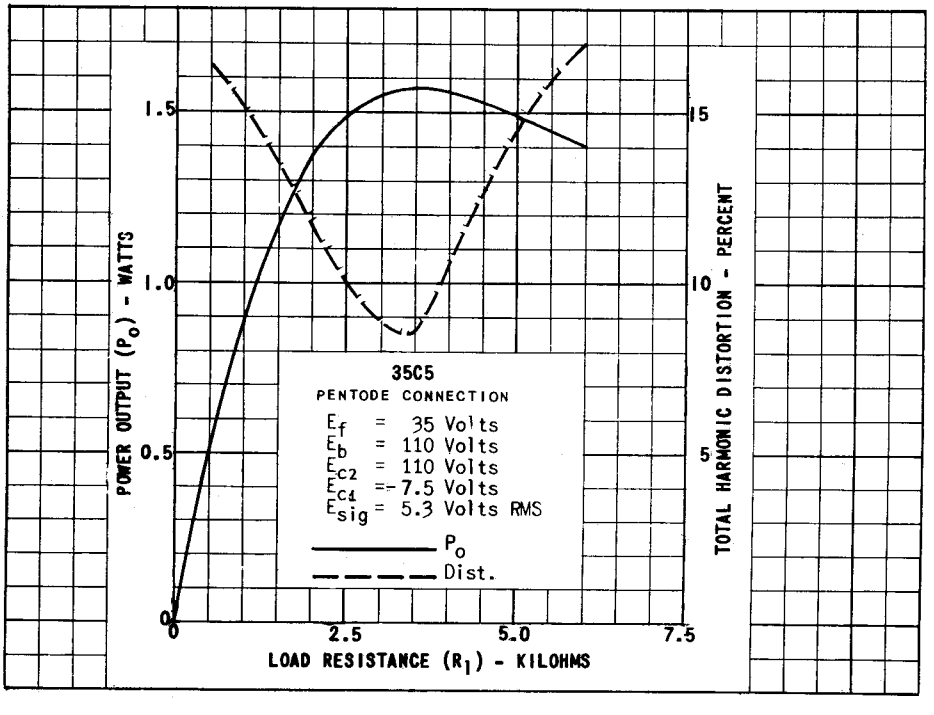
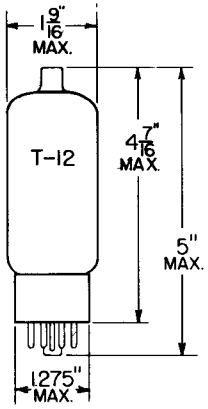

35C5
PENTODE CONNECTION
E_f = 35 Volts
E_{c2} = 110 Volts
I_b
I_{c2}
E_{c1} = 0
-2.5
-5.0
-7.5
-8.0
-10
-12.5
-15
-17.5
+20
+10
0
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
300
350
25
50
75
100


35C5
PENTODE CONNECTION
E_f = 35 Volts
E_b = 110 Volts
E_{c2} = 110 Volts
E_{c1} = -7.5 Volts
E_{sig} = 5.3 Volts RMS
P_o
Dist.
POWER OUTPUT (P_o) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE (R_l) - KILOHMS
0
0.5
1.0
1.5
5
10
15
2.5
5.0
7.5

TUNG-SOL

BEAM PENTODE



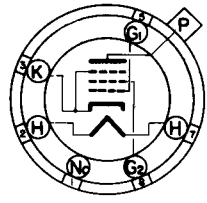
GLASS BULB
SMALL CAP

COATED UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 0.45 AMP.
AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION IS PERMITTED IF PINS 2 AND 7 ARE IN A VERTICAL PLANE.



BOTTOM VIEW
SHORT MEDIUM-SHELL
8 PIN OCTAL
5BT

THE 35CD6GA IS A BEAM PENTODE DESIGNED FOR USE AS A HORIZONTAL DEFLECTION AMPLIFIER IN 450 MA. SERIES HEATER OPERATED TELEVISION RECEIVERS. FEATURES OF THIS TUBE ARE AN EXTREMELY HIGH PERVEANCE, HIGH PLATE CURRENT AT LOW PLATE AND SCREEN VOLTAGES AND A HIGH RATIO OF PLATE TO SCREEN CURRENT. THERMAL CHARACTERISTICS OF THE HEATER ARE CONTROLLED SUCH THAT HEATER VOLTAGE SURGES DURING THE WARM-UP CYCLE ARE MINIMIZED PROVIDED IT IS USED WITH OTHER TYPES WHICH ARE SIMILARLY CONTROLLED.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.
WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	1.1	μμf
INPUT	22	μμf
OUTPUT	8.5	μμf

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

HEATER VOLTAGE	35	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	700	VOLTS
MAXIMUM PEAK POSITIVE PULSE PLATE VOLTAGE	7 000	VOLTS
MAXIMUM NEGATIVE PULSE PLATE VOLTAGE	1 500	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PEAK NEGATIVE GRID #1 VOLTAGE	200	VOLTS

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS - CONT'D

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE[B]

MAXIMUM PLATE DISSIPATION[C]	20	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM DC CATHODE CURRENT	200	MA.
MAXIMUM PEAK CATHODE CURRENT	700	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.47	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	225	°C
HEATER WARM-UP TIME*	11.0	SECONDS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	35		VOLTS
HEATER CURRENT	0.45		AMP.
PLATE VOLTAGE	60	175	VOLTS
GRID #2 VOLTAGE	100	175	VOLTS
GRID #1 VOLTAGE	0[D]	-30	VOLTS
PLATE RESISTANCE (APPROX.)	---	7 200	OHMS
TRANSCONDUCTANCE	---	7 700	μMHOS
PLATE CURRENT	230	75	MA.
GRID #2 CURRENT	21	5.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 1.0 MA.	---	-55	VOLTS
TRIODE AMPLIFICATION FACTOR[E]	---	3.9	

[A] UNLESS OTHERWISE SPECIFIED.

[B] FOR OPERATION IN A 525-LINE, 30-FRAME SYSTEM AS DESCRIBED IN "STANDARDS OF GOOD ENGINEERING PRACTICE FOR TELEVISION BROADCASTING STATIONS; FEDERAL COMMUNICATIONS COMMISSION". THE DUTY CYCLE OF THE VOLTAGE PULSE NOT TO EXCEED 15 PERCENT OF A SCANNING CYCLE.

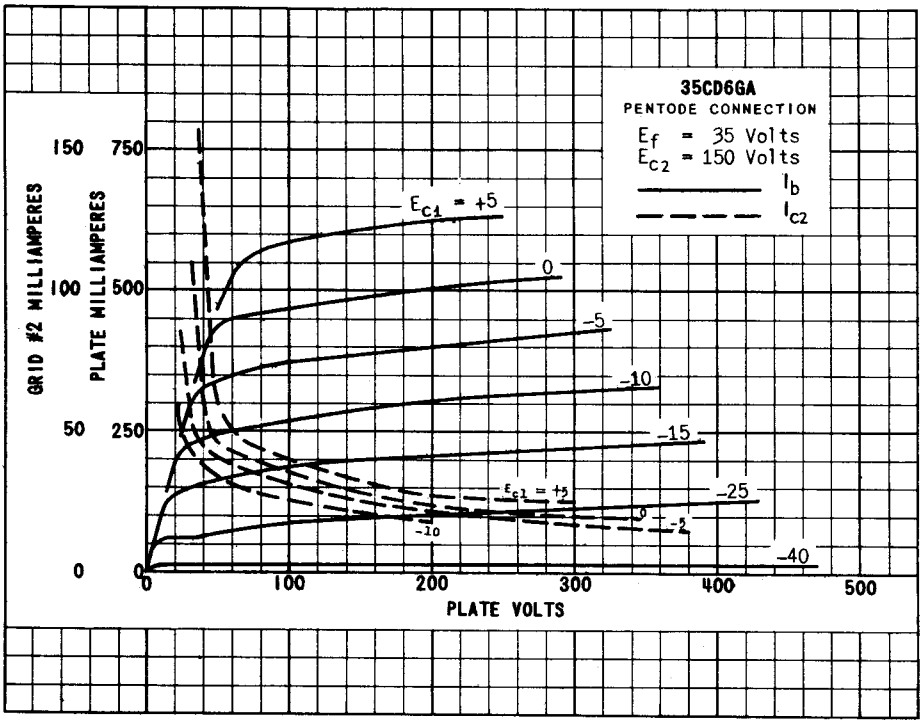
[C] IN STAGES OPERATING WITH GRID-LEAK BIAS, AN ADEQUATE CATHODE BIAS RESISTOR OR OTHER SUITABLE MEANS IS REQUIRED TO PROTECT THE TUBE IN THE ABSENCE OF EXCITATION.

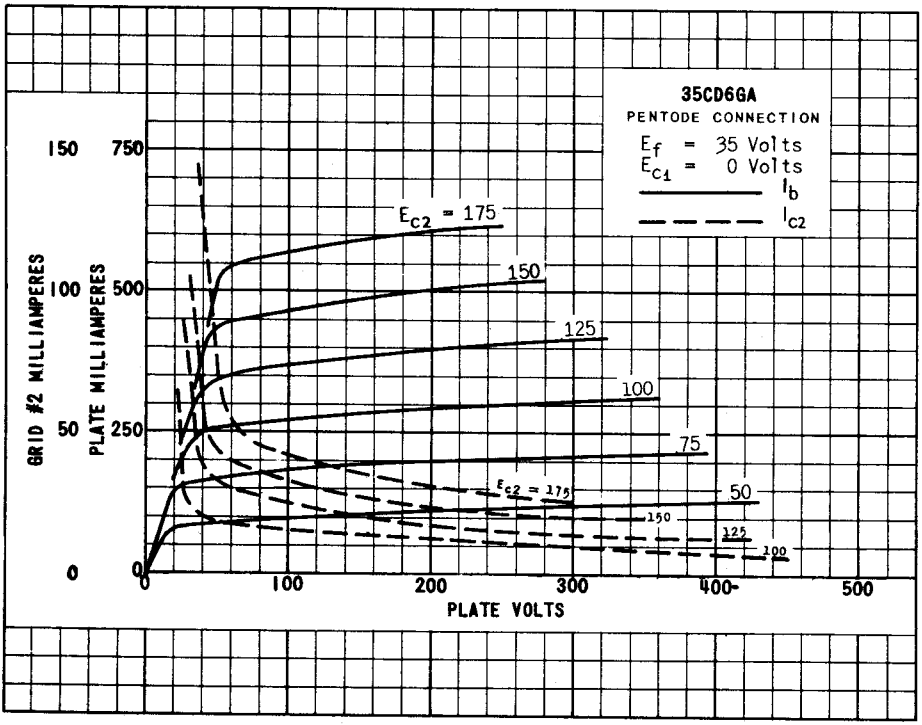
[D] APPLIED FOR VERY SHORT INTERVAL SO AS NOT TO DAMAGE TUBE.

[E] TRIODE CONNECTION (SCREEN TIED TO PLATE) WITH $E_b = E_{c2}$ = 175 VOLTS AND E_{c1} = -30 VOLTS.

*HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

SIMILAR TYPE REFERENCE: Except for heater ratings and heater warm-up time, the 35CD6GA is identical to the 6CD6GA.





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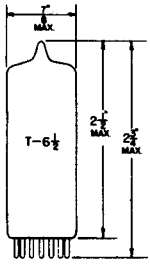
TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE



GLASS BULB

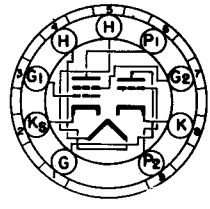
COATED UNIPOTNETIAL CATHODE

HEATER

35 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE
9 PIN BASE

THE 35DZ8 IS A HIGH-MU TRIODE, POWER PENTODE IN THE MINIATURE 9 PIN CONSTRUCTION. IT IS DESIGNED AS A TWO STAGE AUDIO FREQUENCY AMPLIFIER WHERE THE PLATE SUPPLY VOLTAGE IS OBTAINED FROM A SINGLE HALF-WAVE RECTIFIER DIRECTLY FROM THE 120 VOLT AC LINE.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

	TRIODE	PENTODE	
HEATER VOLTAGE			VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM PLATE DISSIPATION	.75	6.5	WATTS
MAXIMUM GRID (2) VOLTAGE	---	135	VOLTS
MAXIMUM GRID (2) DISSIPATION	---	1.5	WATTS
MAXIMUM DC HEATER-CATHODE POTENTIAL	110	110	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	5.0	0.5	MEGOHMS
MAXIMUM CATHODE CURRENT	5.0	60.0	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE		PENTODE	
HEATER VOLTAGE		35		VOLTS
HEATER CURRENT		0.15		AMP.
PLATE VOLTAGE	120	---	145	VOLTS
GRID #2 VOLTAGE	---		120	VOLTS
GRID #1 VOLTAGE	0		0	VOLTS
CATHODE RESISTOR	1500		180	OHMS
PLATE CURRENT	0.8		45	MA.
GRID #2 CURRENT	---		6	MA.
TRANSCONDUCTANCE	1400		7500	μMHOS
LOAD RESISTANCE	---		2500	OHMS
GRID CUTOFF VOLTAGE FOR 20μA	-2.5		---	VOLTS
AMPLIFICATION FACTOR	100		---	
POWER OUTPUT	---		2.0	WATTS

SIMILAR TYPE REFERENCE: Except for heater ratings the 35DZ8 is identical to the 6DZ8, 9DZ8, 12DZ8 and the 18DZ8.

TUNG-SOL

PENTODE

MINIATURE TYPE

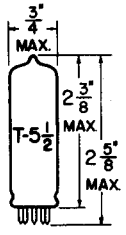
COATED UNIPOTENTIAL CATHODE

HEATER

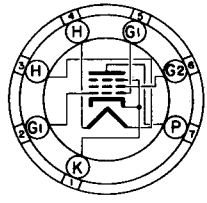
35 VOLTS 0.15 AMP.

AC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

7CV

THE 35EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE AS AN AUDIO OUTPUT TUBE. THE 35EH5 IS SIMILAR TO THE 50EH5.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	.65	μμf
INPUT: G1 TO (H+K+G2+G3)	17.0	μμf
OUTPUT: P TO (H+K+G2+G3)	9.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	35	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 INPUT	1.75	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE (FIXED BIAS)	.1	MEGOHM
MAXIMUM GRID CIRCUIT RESISTANCE (CATHODE BIAS)	.5	MEGOHM
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	35	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK H.F. GRID #1 VOLTAGE	3	VOLTS
PLATE RESISTANCE (APPROX.)	14 000	OHMS
TRANSCONDUCTANCE	12 000	μMHOS
ZERO-SIGNAL PLATE CURRENT	32.0	MA.
MAX. SIGNAL PLATE CURRENT	32.0	MA.
ZERO-SIGNAL GRID #2 CURRENT	7.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	12.0	MA.
LOAD RESISTANCE	3 000	OHMS
TOTAL DISTORTION	8.0	PERCENT
POWER OUTPUT	1.2	WATTS

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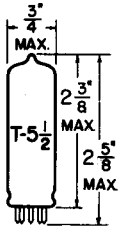
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

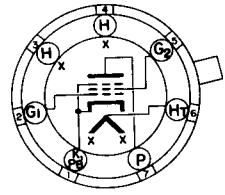
COATED UNIPOTENTIAL CATHODE

HEATER

35±10% VOLTS 0.15 AMP.

AC OR DC[A]

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON

7 PIN BASE

7FZ

THE 35GL6 IS A BEAM PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO-FREQUENCY POWER OUTPUT STAGE OF RADIO RECEIVERS. THE 35GL6 IS TAPPED TO PERMIT OPERATION OF A PANEL LAMP.

DIRECT INTERELECTRODE CAPACITANCES -APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	14	μμf
OUTPUT	9.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	35±10%	VOLTS
HEATER-TAP VOLTAGE WHEN PANEL LAMP FAILS, RMS	14	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM SCREEN VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.1	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
WITH FIXED BIAS	0.1	MEGOHM
WITH CATHODE BIAS	0.5	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	225	°C

DESIGN-MAXIMUM RATINGS ARE THE LIMITING VALUES EXPRESSED WITH RESPECT TO BOGIE TUBES AT WHICH SATISFACTORY TUBE LIFE CAN BE EXPECTED TO OCCUR. TO OBTAIN SATISFACTORY CIRCUIT PERFORMANCE, THEREFORE, THE EQUIPMENT DESIGNER MUST ESTABLISH THE CIRCUIT DESIGN SO THAT NO DESIGN-MAXIMUM VALUE IS EXCEEDED WITH A BOGIE TUBE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] OPERATION WITHOUT PANEL LAMP.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE[A]	35±10%	VOLTS
HEATER-TAP VOLTAGE[A]	7.0	VOLTS
HEATER CURRENT[A]	0.15	AMP.
PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
PLATE RESISTANCE, APPROX.	12 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
ZERO-SIGNAL PLATE CURRENT	45	MA.
MAXIMUM-SIGNAL PLATE CURRENT	47	MA.
ZERO-SIGNAL SCREEN CURRENT	3.0	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	9.0	MA.
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	8	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	1.8	WATTS

THE 35GL6 HAS A HEATER TAP, WHICH MAY BE USED FOR OPERATING A 6.3 VOLT, 150 MILLIAMPERE PANEL LAMP IN EQUIPMENT EMPLOYING SEMICONDUCTOR RECTIFIERS. THE TABLE BELOW GIVES THE REQUIRED VALUES OF PANEL-LAMP SHUNTING RESISTOR FOR VARIOUS RECTIFIER LOAD CURRENTS.

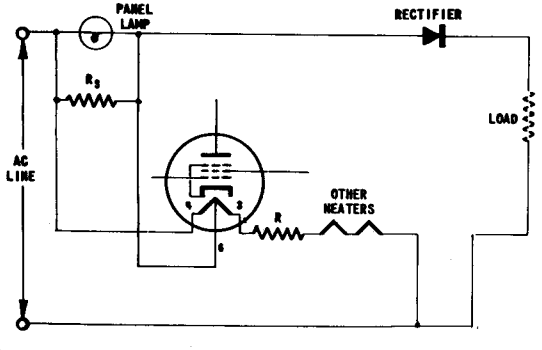
SHUNTING RESISTOR REQUIRED WITH PANEL LAMP #40 OR #47

(SEE TYPICAL CIRCUIT)

HEATER VOLTAGE (PIN 3 TO PIN 4)	32	32	32	32	32	32	32	VOLTS
HEATER-TAP VOLTAGE (PIN 4 TO PIN 6)	5.0	5.4	5.5	5.5	5.5	5.5	5.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 6)	150	150	150	150	150	150	150	MA.
PANEL-LAMP SHUNTING RESISTOR	---	---	370	175	120	88	73	OHMS
RECTIFIER LOAD CURRENT[B]	60	70	80	90	100	110	120	MA.

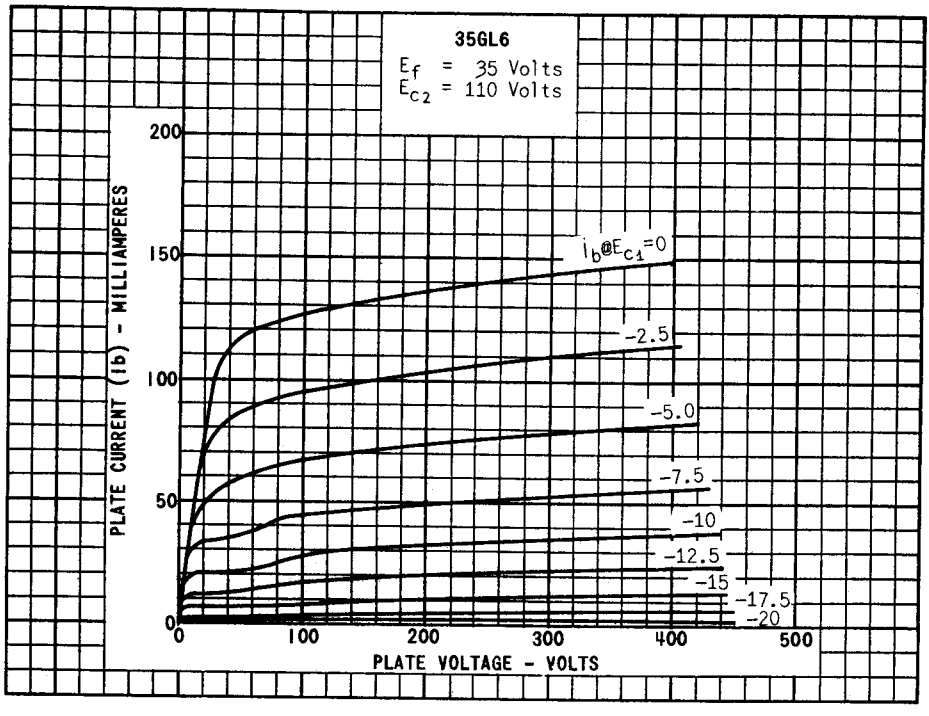
[B] HIGHER LOAD CURRENTS WILL REQUIRE SMALLER VALUES OF PANEL-LAMP SHUNTING RESISTOR. FOR MAXIMUM PANEL-LAMP LIFE, THE SHUNTING RESISTOR SHOULD BE SELECTED TO ALLOW A PANEL-LAMP VOLTAGE OF 5.5 VOLTS WITH FULL RECTIFIER LOAD CURRENT.

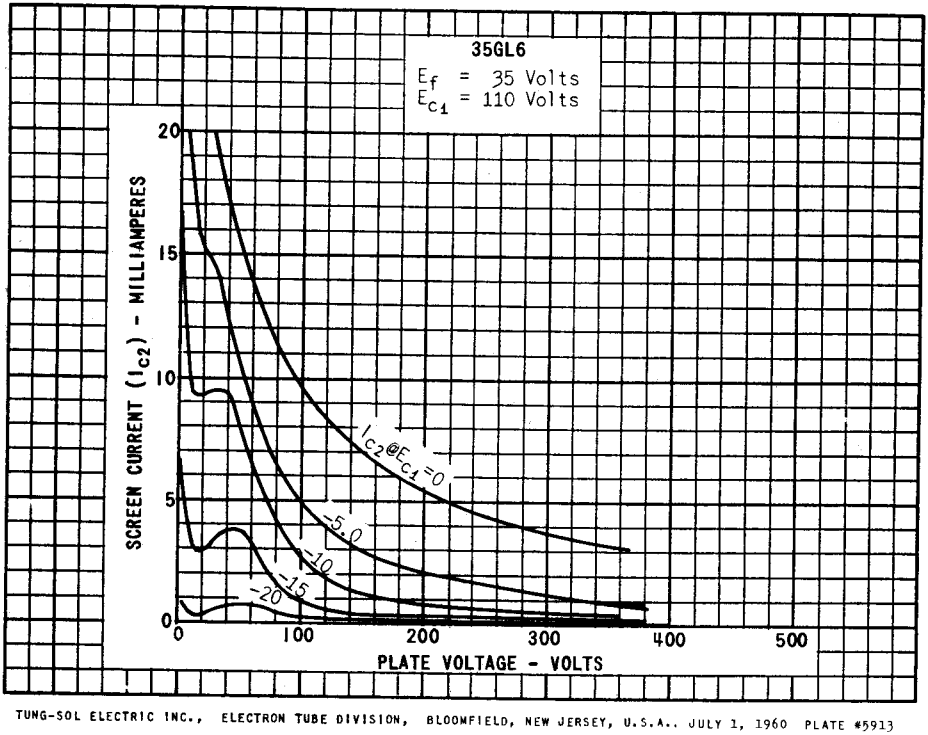
TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



R_S = PANEL-LAMP SHUNTING RESISTOR.

DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DEFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES.





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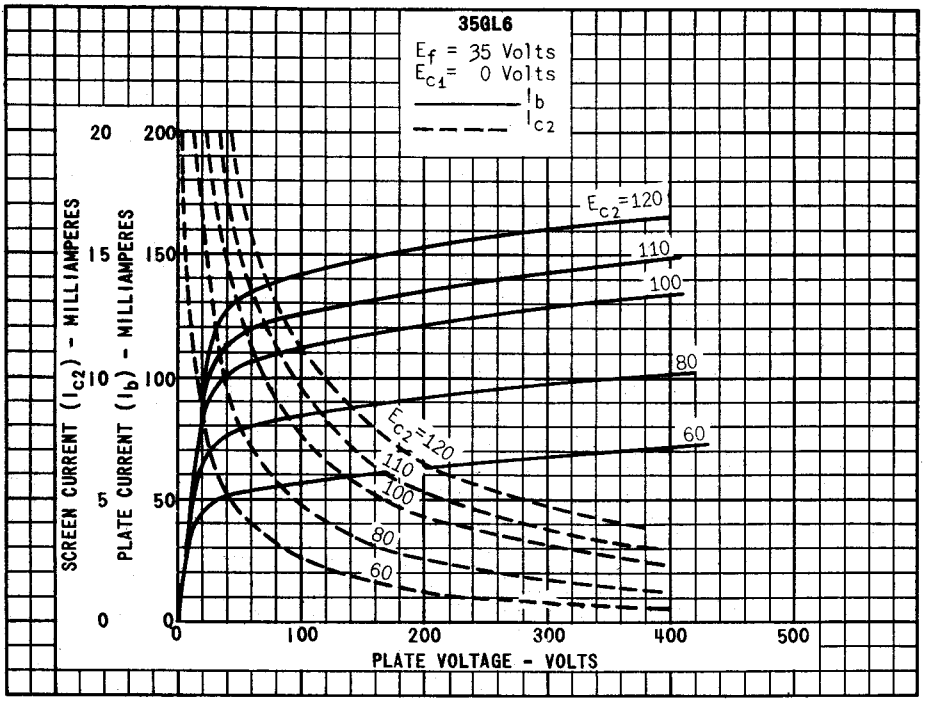
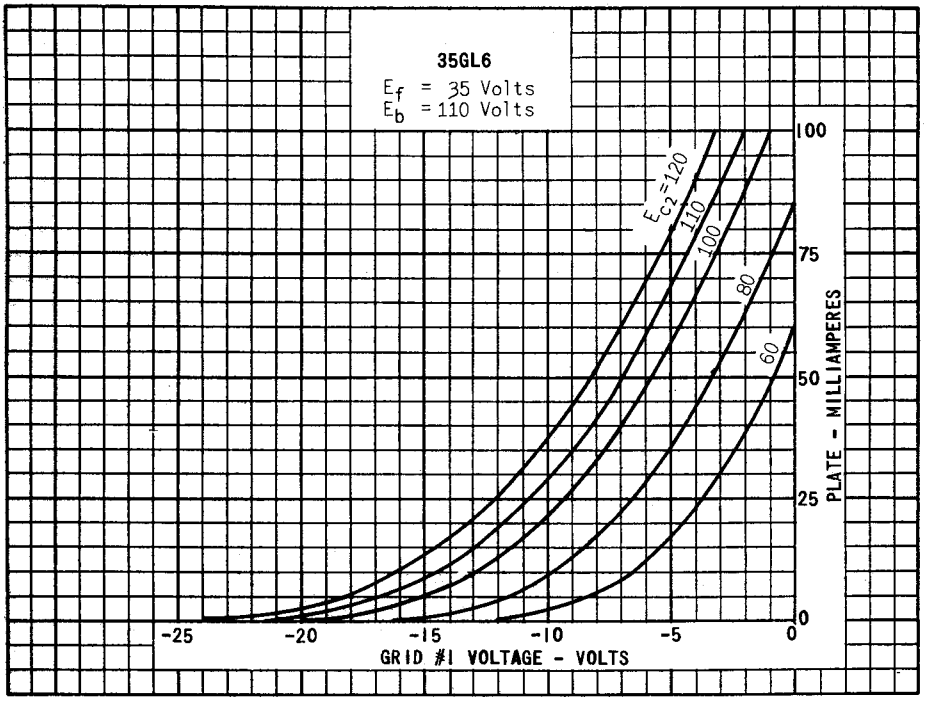
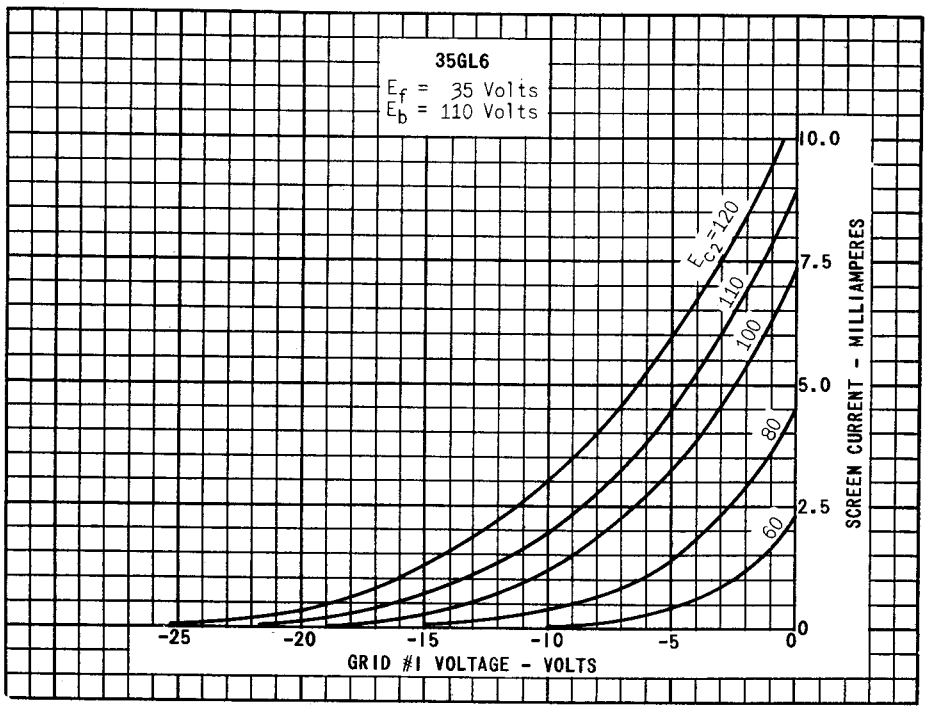
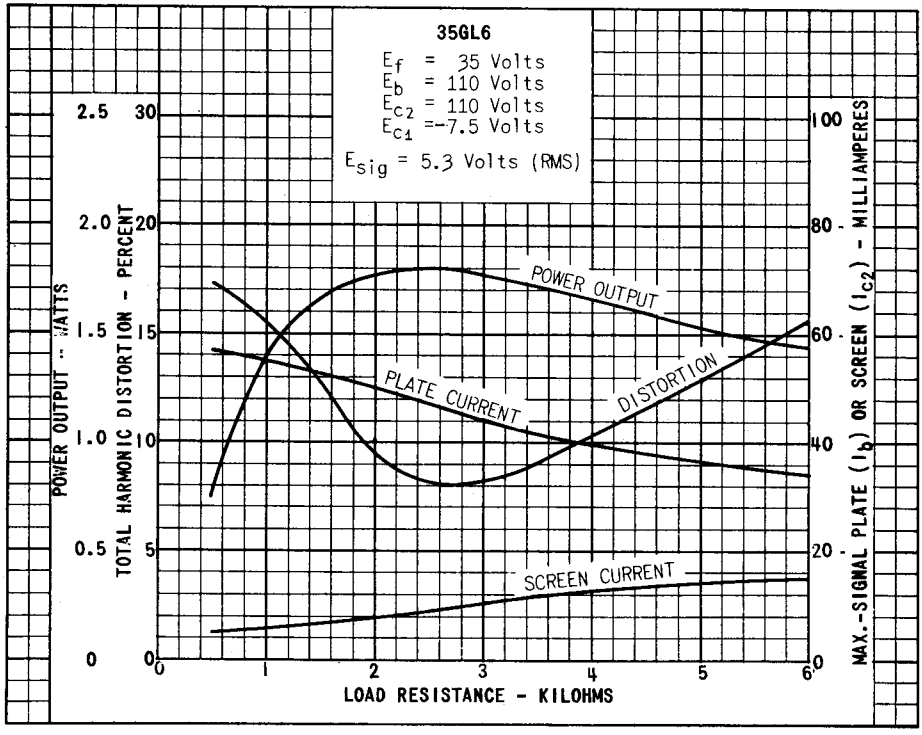

35GL6
E_f = 35 Volts
E_{c_1} = 0 Volts
I_b
I_{c_2}
E_{c_2}=120
110
100
80
60
SCREEN CURRENT (I_{c_2}) - MILLIAMPERES
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE - VOLTS
0
5
10
15
20
50
100
150
200
300
400
500


35GL6
E_f = 35 Volts
E_b = 110 Volts
E_{c_2}=120
110
100
80
60
PLATE - MILLIAMPERES
GRID #1 VOLTAGE - VOLTS
0
25
50
75
100
-25
-20
-15
-10
-5
0





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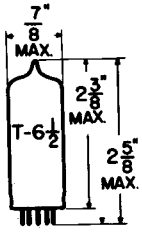
TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



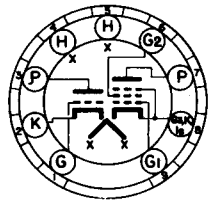
GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

35.0 VOLTS 0.15 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE
9ME

THE 35HB8 IS A TRIODE-PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR AUDIO APPLICATIONS IN STEREO AND MONAURAL SOUND EQUIPMENT. EXCEPT FOR HEATER RATINGS, THE 35HB8 IS IDENTICAL TO THE 18HB8.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE[A]	35.0		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	135	VOLTS
MAXIMUM CATHODE CURRENT	5	50	MA.
MAXIMUM PLATE DISSIPATION	0.75	6.5	WATTS
MAXIMUM GRID #2 DISSIPATION	---	1.5	WATTS
MAXIMUM GRID CIRCUIT RESISTANCE:			
FIXED BIAS	0.1		MEGOHM
CATHODE BIAS	0.47		MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	35.0		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	115	115	VOLTS
GRID #2 VOLTAGE	---	115	VOLTS
PEAK AF GRID #1 VOLTAGE	---	6.0	VOLTS
CATHODE RESISTOR	410	150	OHMS

CONTINUED ON FOLLOWING PAGE

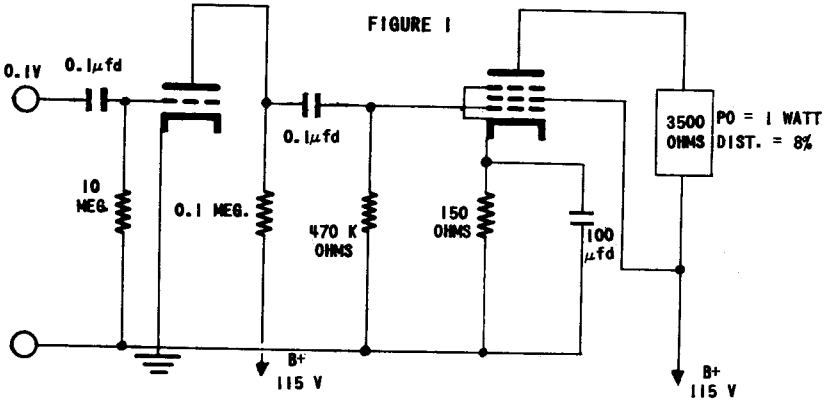
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS (cont'd.)

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	35.0		VOLTS
HEATER CURRENT	0.15		AMP.
ZERO-SIGNAL PLATE CURRENT	2.5	33	MA.
MAX.-SIGNAL PLATE CURRENT	---	32	MA.
ZERO-SIGNAL GRID #2 CURRENT	---	7.5	MA.
MAX.-SIGNAL GRID #2 CURRENT	---	10	MA.
TRANSCONDUCTANCE	3900	6250	μMHOS
AMPLIFICATION FACTOR	74	---	
LOAD RESISTANCE	---	3500	OHMS
MAX.-SIGNAL POWER OUTPUT	---	1.0	WATT
TOTAL HARMONIC DISTORTION (APPROX.)	---	8	PERCENT

[A] THE HEATER SHOULD BE CONNECTED WITH PIN #4 CLOSEST TO THE GROUND END OF THE HEATER STRING.

FIGURE 1



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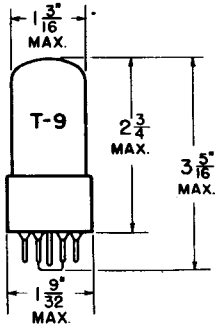
BEAM PENTODE

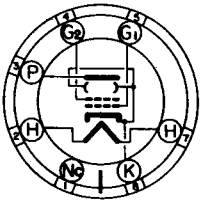


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 35L6GT IS A BEAM POWER AMPLIFIER DESIGNED PRIMARILY FOR SERVICE IN THE OUTPUT STAGE OF AC DC RECEIVERS EMPLOYING 150 MA. HEATER TUBES. IT DELIVERS HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	35	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1	WATT
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	35	35		VOLTS
HEATER CURRENT	150	150		MA.
PLATE VOLTAGE	110	200		VOLTS
GRID #2 VOLTAGE	110	125		VOLTS
GRID #1 VOLTAGE	-7.5	0		VOLTS
CATHODE BIAS RESISTOR	0	180	←	OHMS
PEAK AF SIGNAL VOLTAGE	7.5	8		VOLTS
PLATE RESISTANCE (APPROX.)	14 000	34 000		OHMS
TRANSCONDUCTANCE	5 800	6 100		µMHOS
ZERO-SIGNAL PLATE CURRENT	40	43		MA.
ZERO-SIGNAL GRID #2 CURRENT	3	2		MA.
MAXIMUM-SIGNAL PLATE CURRENT	41	43		MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	7	5.5		MA.
LOAD RESISTANCE	2 500	5 000		OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10		PERCENT
POWER OUTPUT	1.5	3		WATTS

→ INDICATES A CHANGE.

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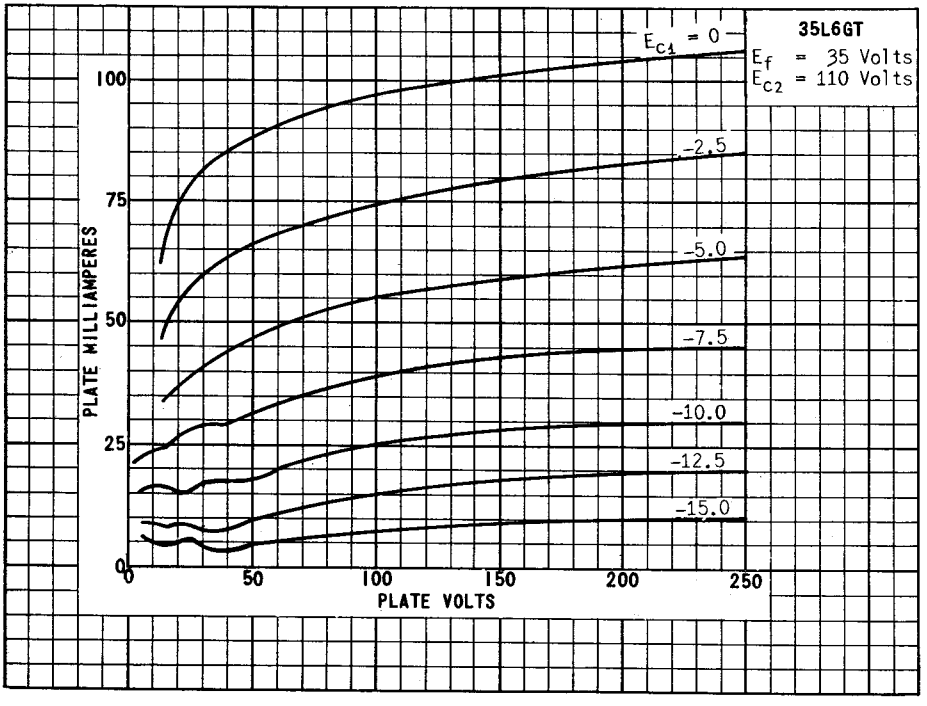
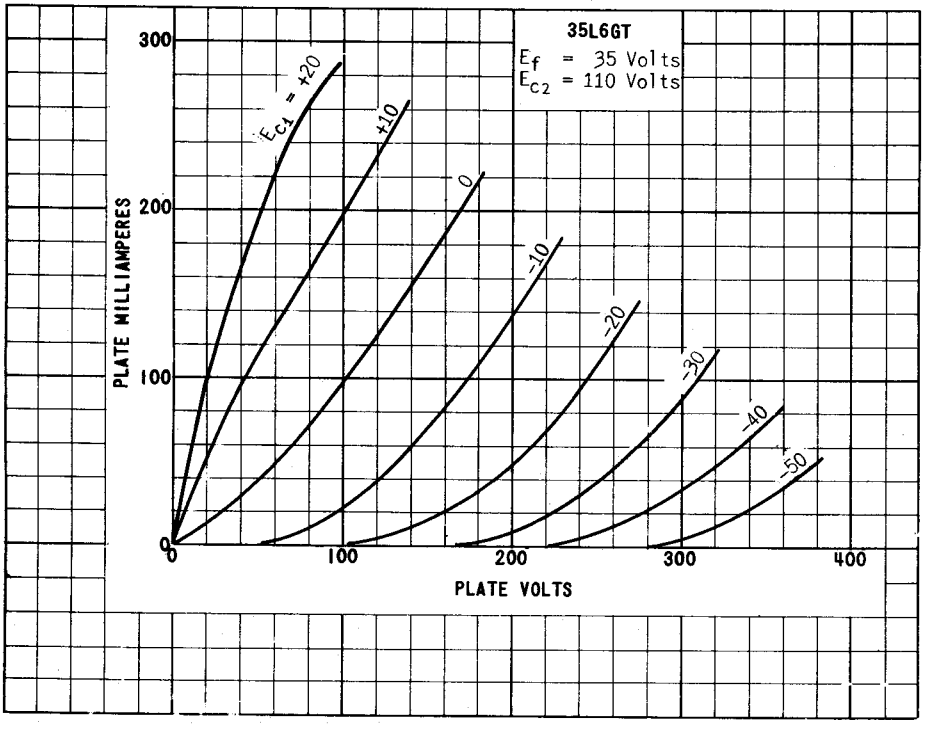
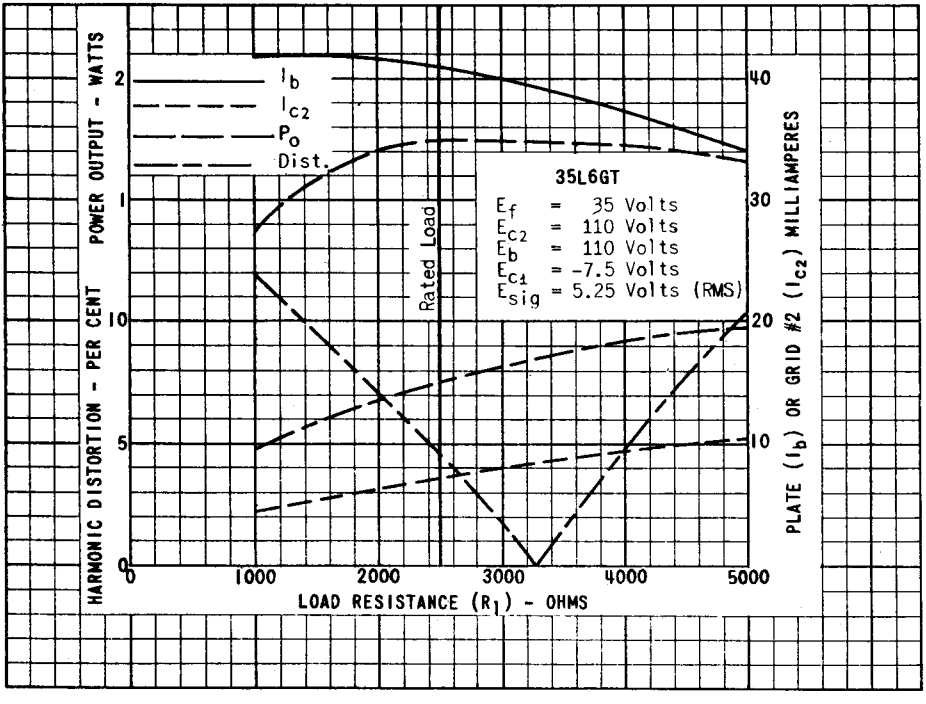
35L6GT


35L6GT
E_f = 35 Volts
E_{c2} = 110 Volts
E_{c1} = 0
-2.5
-5.0
-7.5
-10.0
-12.5
-15.0
PLATE MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
50
100
150
200
250


35L6GT
E_f = 35 Volts
E_{c2} = 110 Volts
E_{c1} = +20
+10
0
-10
-20
-30
-40
-50
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
0
100
200
300
400



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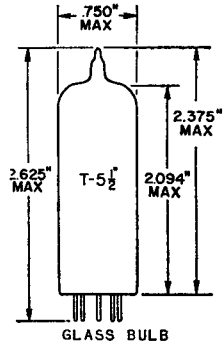
DIODE
MINIATURE TYPE



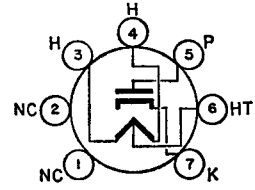
GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1 OUTLINE DRAWING JEDEC 5-3

COATED UNIPTOENTIAL CATHODE

HALF-WAVE RECTIFIER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BQ

THE 35W4 IS A MINIATURE CATHODE TYPE, HALF-WAVE RECTIFIER DESIGNED FOR SERVICE IN AC/DC RECEIVERS. THE TAPPED HEATER PERMITS OPERATION OF A PANEL LAMP. IT IS RECOMMENDED THAT THE PLATE CURRENT PASS THROUGH THE PANEL LAMP AND THE TAPPED SECTION OF THE HEATER. THIS IS ACCOMPLISHED BY CONNECTING PLATE TO THE HEATER TAP.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	35 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION (WITHOUT PANEL LAMP)		35±3.5	VOLTS
(WITH #40 OR#47 PANEL LAMP)		32±3.2	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		360	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		360	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	WITHOUT PANEL LAMP	WITH #40 OR #47 PANEL LAMP	
HEATER VOLTAGE:			
ENTIRE HEATER (PINS #3 & #4)	35	32	VOLTS
PANEL LAMP SECTION (PINS #4 & #6)	7.5	5.5	VOLTS
HEATER CURRENT:			
BETWEEN PINS #3 & #4	150	---	MA.
BETWEEN PINS #3 & #6	---	150	MA.
PEAK INVERSE VOLTAGE	→360		VOLTS
STEADY-STATE PEAK PLATE CURRENT	→660		MA.
PANEL LAMP SECTION VOLTAGE WHEN LAMP FAILS	→ 17		VOLTS
STEADY STATE DC OUTPUT CURRENT:			
WITH PANEL LAMP AND NO SHUNTING RESISTOR	→ 66		MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	→100		MA.
WITHOUT PANEL LAMP	→110		MA.
VALUE OF PANEL LAMP SHUNTING RESISTOR:			
FOR DC OUTPUT CURRENT OF 70 MA.	800		OHMS
FOR DC OUTPUT CURRENT OF 80 MA.	400		OHMS
FOR DC OUTPUT CURRENT OF 90 MA.	250		OHMS
TUBE VOLTAGE DROP MEASURED WITH TUBE CONDUCTING 200 MA. DC PLATE CURRENT	18		VOLTS

→ INDICATES A CHANGE.

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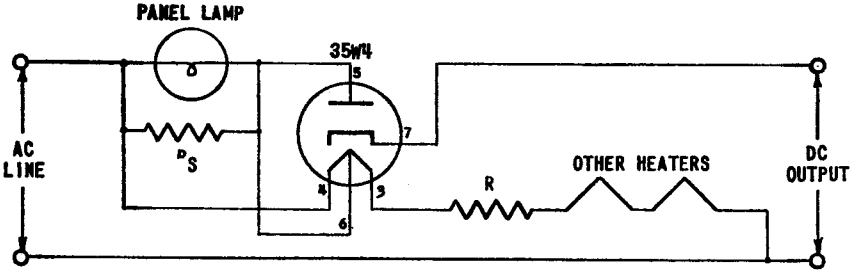
CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

WITH #40 OR #47 PANEL LAMP IN CIRCUIT WITH CAPACITOR INPUT TO FILTER

HEATER VOLTAGE	32	32	32	32	VOLTS
HEATER CURRENT	150	150	150	150	MA.
AC PLATE SUPPLY VOLTAGE	117	117	117	117	VOLTS
FILTER INPUT CAPACITOR	40	40	40	40	µF
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	15	15	15	OHMS
PANEL-LAMP SHUNTING RESISTOR	---	300	150	100	OHMS
DC OUTPUT CURRENT	60	70	80	90	MA.

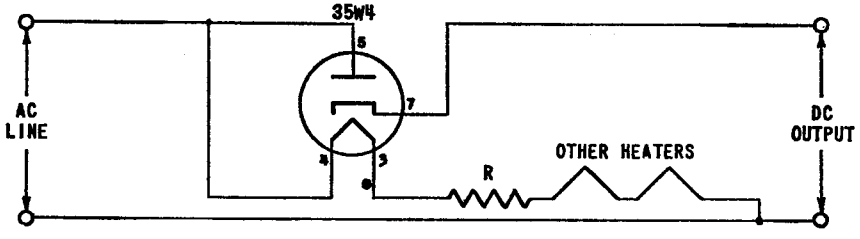


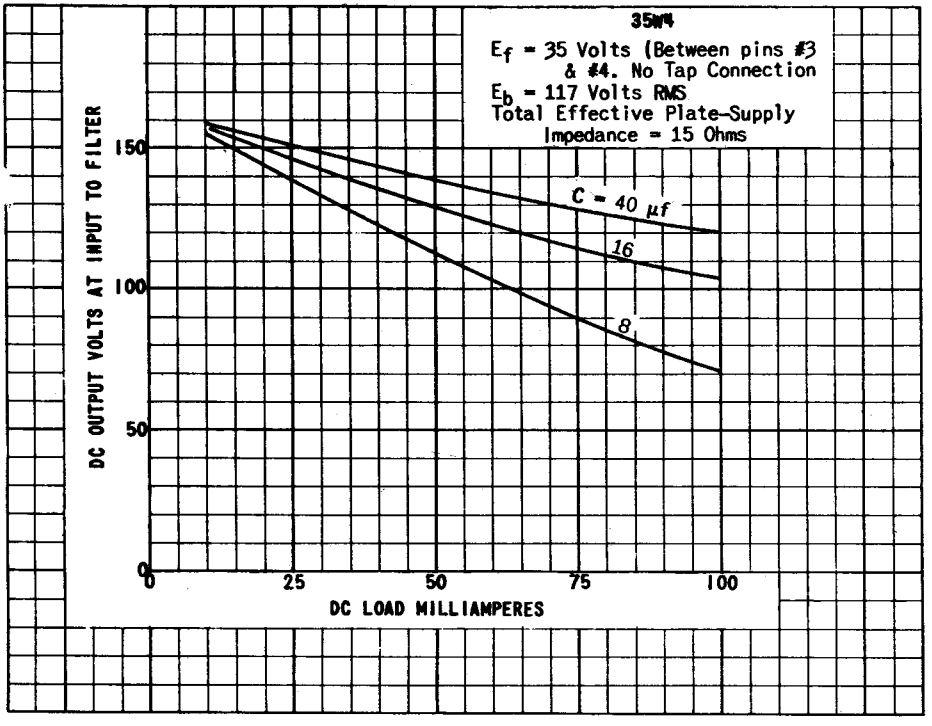
DROP ACROSS R AND ALL HEATERS (WITH PANEL LAMP) SHOULD EQUAL 117 VOLTS AT 0.15 AMPERE. R_s = SHUNTING RESISTOR REQUIRED WHEN DC OUTPUT CURRENT EXCEEDS 60 MILLIAMPERES.

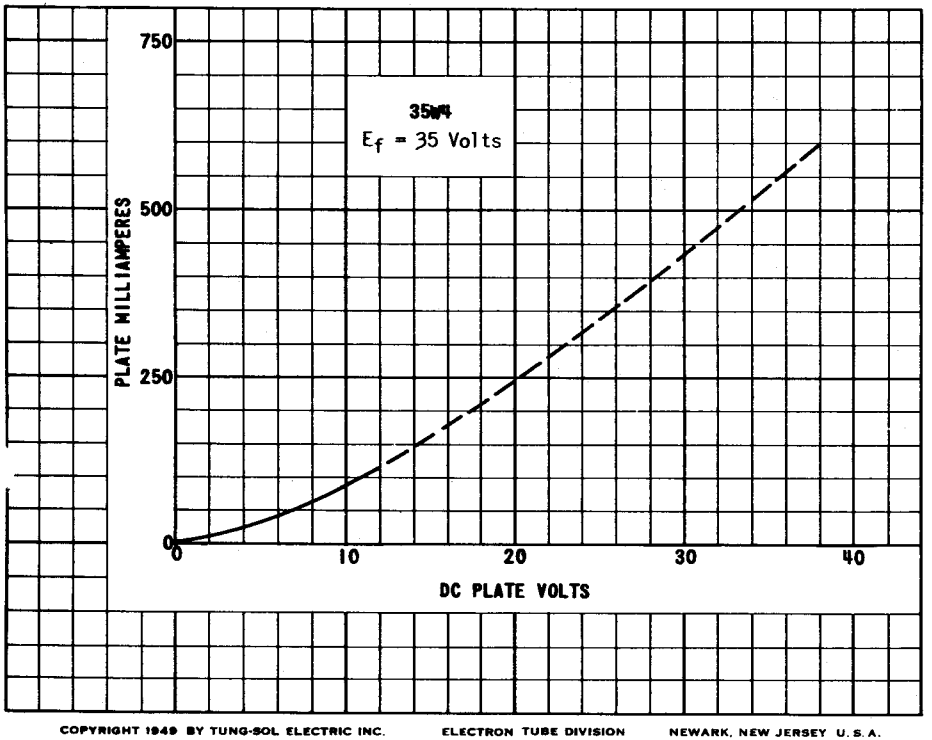
HALF-WAVE RECTIFIER-CAPACITOR INPUT TO FILTER

WITHOUT PANEL LAMP

HEATER VOLTAGE	35	VOLTS
HEATER CURRENT	150	MA.
AC PLATE SUPPLY VOLTAGE RMS	117	VOLTS
FILTER INPUT CAPACITOR	15	µf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.)		
AT 50 MA. (HALF LOAD)	135	VOLTS
AT 100 MA. (FULL LOAD)	120	VOLTS
DC OUTPUT CURRENT	100	MA.
VOLTAGE REGULATION (APPROX.) FROM HALF-LOAD TO FULL LOAD	20	VOLTS







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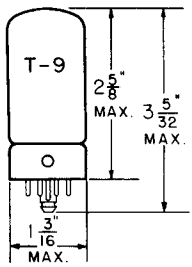
DIODE

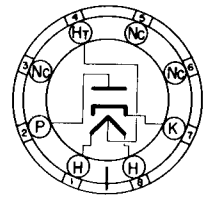


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
8 PIN LOCK-IN

THE 35Y4 IS A SINGLE DIODE IN THE LOCK-IN CONSTRUCTION INTENDED FOR HALF-WAVE POWER RECTIFIER SERVICE. IT FEATURES A TAPPED HEATER SECTION PROVIDING A BALLAST ACTION AND SOURCE OF VOLTAGE FOR A PANEL LAMP.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	35	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	300	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM DC OUTPUT CURRENT:		
WITHOUT PANEL LAMP	100	MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	90	MA.
WITH PANEL LAMP AND NO SHUNTING RESISTOR	60	MA.
MAXIMUM VALUE OF PANEL LAMP SHUNTING RESISTOR:		
FOR 70 MA. DC OUTPUT CURRENT	800	OHMS
FOR 80 MA. DC OUTPUT CURRENT	400	OHMS
FOR 90 MA. DC OUTPUT CURRENT	250	OHMS
TAPPED SECTION VOLTAGE (BETWEEN PINS #1 & #4) WITH 150 MA. FLOWING BETWEEN PINS #1 & #8	7.5	VOLTS
MAXIMUM VOLTAGE ACROSS TAPPED SECTION WHEN PANEL LAMP FAILS (RMS)	15	VOLTS
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 200 MA.)	20	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

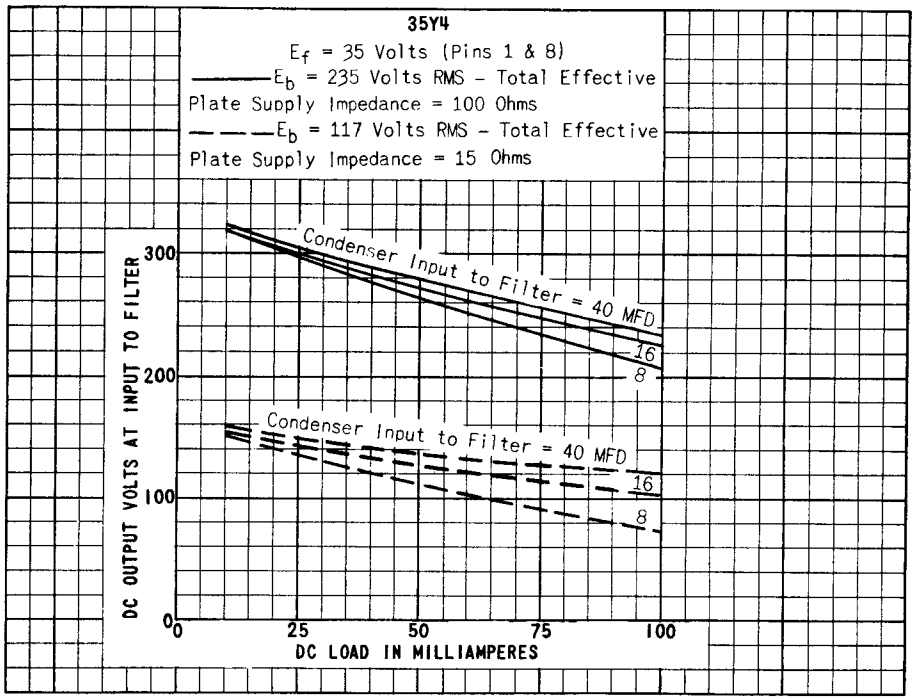
WITH 40 MFD. INPUT CONDENSER AND #40 OR #47 PANEL LAMP

HEATER VOLTAGE (PINS #1 & #8)	32	32	32	32	32	VOLTS
HEATER CURRENT (PINS #4 & #8)	150	150	150	150	150	MA.
VOLTAGE ACROSS TAPPED SECTION OF HEATER (PINS #1 & #4)	5.5	5.5	5.5	5.5	5.5	VOLTS
AC PLATE VOLTAGE (RMS)	117	117	117	117	235	VOLTS
DC OUTPUT CURRENT	60	70	80	90	60	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE	15	15	15	15	100	OHMS
PANEL LAMP SHUNT RESISTOR	---	300	150	100	---	OHMS

WITH 40 MFD. INPUT CONDENSER AND NO PANEL LAMP

HEATER VOLTAGE (PINS #1 & #8)	35	35	VOLTS
HEATER CURRENT (PINS #4 & #8)	150	150	MA.
VOLTAGE ACROSS TAPPED SECTION OF HEATER (PINS #1 & #4)	7.5	7.5	VOLTS
AC PLATE VOLTAGE (RMS)	117	235	VOLTS
DC OUTPUT CURRENT	100	100	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE	15	100	OHMS

SIMILAR TYPE REFERENCE: *Ratings and characteristics somewhat similar to types 35W4 and 35Z5GT.*



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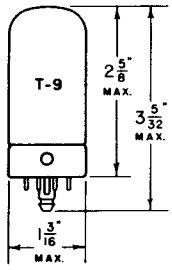
TUNG-SOL

HALF WAVE

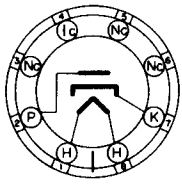
HIGH VACUUM RECTIFIER



UNIPOTENTIAL CATHODE

HEATER
32.0 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



4Z
BOTTOM VIEW

NOTE: 1c DENOTES INTERNAL CONNECTION

8 PIN LOCKING-IN BASE

THE TUNG-SOL 35Z3 IS DESIGNED PRIMARILY FOR SERVICE AS A POWER RECTIFIER IN AC-DC RECEIVERS WHICH EMPLOY 150 MA. HEATER TUBES.

RATINGS

NOMINAL HEATER VOLTAGE	35.0	VOLTS
NOMINAL HEATER CURRENT	0.16	AMP.
MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	600	MA.
TUBE VOLTAGE DROP - AT 200 MA.	20	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE (RMS)	117	150	235 MAX.	VOLTS
DC OUTPUT CURRENT MAX.	100	100	100	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE MIN.A	15	40	100	OHMS

A WHEN FILTER CONDENSERS LARGER THAN 40 μFDS. ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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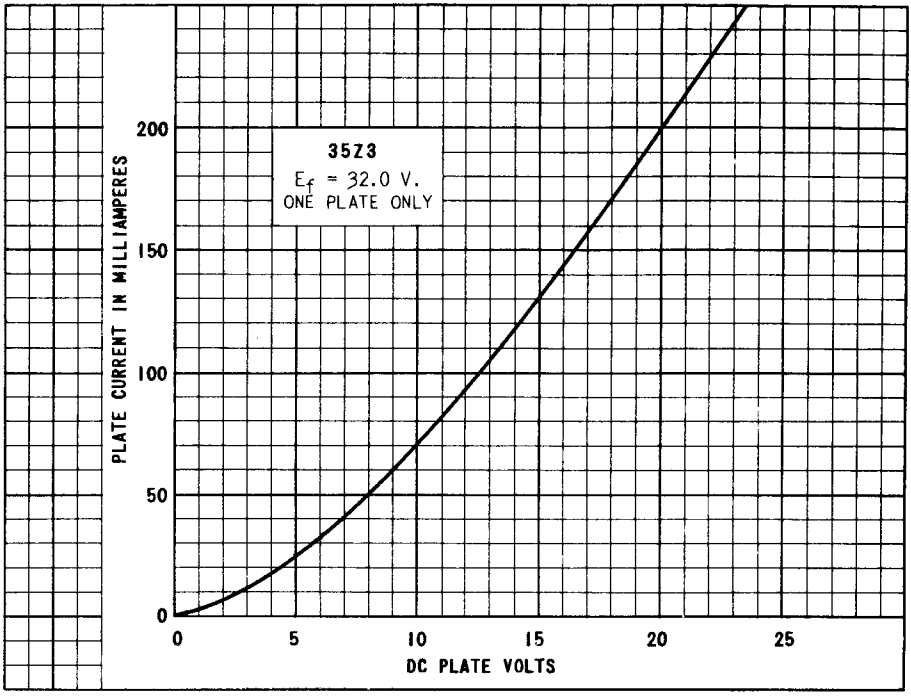
35Z3



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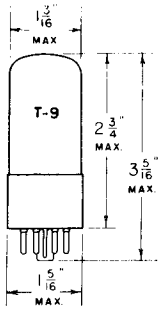
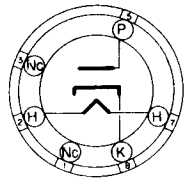


HALF WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
35 VOLTS 0.15 AMPERE
AC OR DC



5AA
BOTTOM VIEW

GLASS BULB

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 35Z4GT IS DESIGNED PRIMARILY FOR SERVICE AS A POWER RECTIFIER IN AC-DC RECEIVERS EMPLOYING 150 MA. HEATER TUBES.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	600	MA.
TUBE VOLTAGE DROP - AT 200 MA.	18	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE (RMS)	117	235 MAX.	VOLTS
DC OUTPUT CURRENT MAX.	100	100	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE MIN.A	15	100	OHMS

A WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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DEC.-30 1940

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35Z4 GT

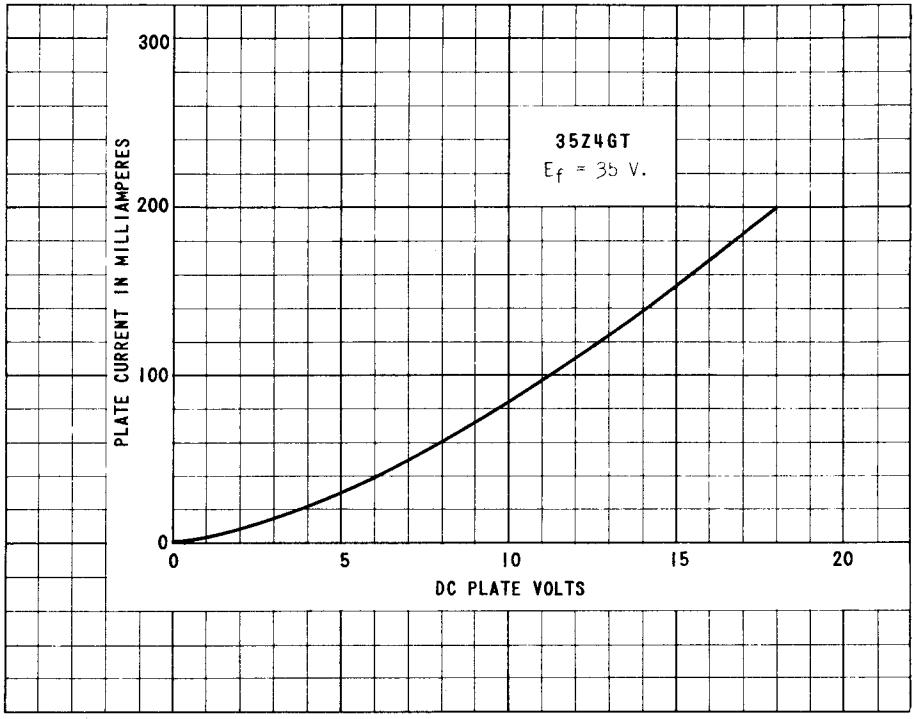

PLATE
933-3

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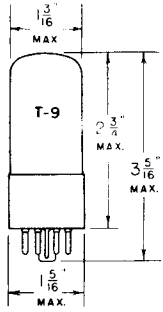
TUNG-SOL



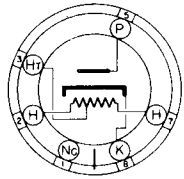
HALF WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
35.0 VOLTS 0.150 AMPERE
AC OR DC
WITHOUT PANEL LAMP

GLASS BULB



6AD-0-0

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 35Z5GT/G IS DESIGNED FOR USE AS A RECTIFIER IN AC-DC RECEIVERS. IT FEATURES A 35 V. 150 MA. HEATER HAVING A TAP BROUGHT OUT SO THAT, WITH PROPER EXTERNAL CONNECTIONS, THE TAPPED SECTION OF THE HEATER SERVES AS A BALLAST RESISTOR FOR A PANEL LAMP. IT IS RECOMMENDED THAT THE PLATE CURRENT OF THE RECTIFIER BE PASSED THROUGH THE PANEL LAMP AND THE TAPPED SECTION OF THE HEATER, WHICH IS ACCOMPLISHED BY CONNECTING THE PLATE OF THE RECTIFIER TO THE TAP ON THE HEATER.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM DC OUTPUT CURRENT:		
NO PANEL LAMP	100	MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	90	MA.
WITH PANEL LAMP AND NO SHUNTING RESISTOR	60	MA
MAXIMUM VALUE OF PANEL LAMP SHUNTING RESISTOR:		
FOR 70 MA. DC OUTPUT CURRENT	800	OHMS
FOR 80 MA. DC OUTPUT CURRENT	400	OHMS
FOR 90 MA. DC OUTPUT CURRENT	250	OHMS
TAPPED HEATER SECTION VOLTAGE (BETWEEN #2 AND #3) WITH 150 MA. FLOWING BETWEEN PINS #2 AND #7	7.5	VOLTS
MAXIMUM VOLTAGE ACROSS TAPPED HEATER SECTION WHEN PANEL LAMP FAILS (RMS)	15.0	VOLTS
TUBE VOLTAGE DROP AT 200 MA. DC	18	VOLTS

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PLATE 1184-1

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

WITH #40 OR #47 PANEL LAMP

HEATER VOLTAGE (BETWEEN PINS #2 AND #7)	32	32	32	32	32	VOLTS
HEATER CURRENT (BETWEEN PINS #3 AND #7)	.150	.150	.150	.150	.150	AMPERE
VOLTAGE ACROSS TAPPED SECTION OF HEATER (PINS #2 AND #3)	5.5	5.5	5.5	5.5	5.5	VOLTS
AC PLATE VOLTAGE (RMS)	117	117	117	117	235	VOLTS
DC OUTPUT CURRENT	60	70	80	90	60	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE	15	15	15	15	100	OHMS
PANEL LAMP SHUNT RESISTANCE	-	300	150	100	-	OHMS

WITHOUT PANEL LAMP

HEATER VOLTAGE (BETWEEN PINS #2 AND #7)	35.0	35.0	VOLTS
HEATER CURRENT (BETWEEN PINS #3 AND #7)	.150	.150	AMPERE
VOLTAGE ACROSS TAPPED SECTION OF HEATER (PINS #2 AND #3)	7.5	7.5	VOLTS
AC PLATE VOLTAGE (RMS)	235	117	VOLTS
DC OUTPUT CURRENT	100	100	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE	100	15	OHMS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 UFDS. ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

THE DROP ACROSS THE SERIES RESISTANCE, IF ANY, AND ALL HEATERS SHOULD TOTAL 117 V. AT 0.15 AMPERE.

VOLTAGES SHOULD NOT BE APPLIED TO THE SOCKET WHEN TUBES ARE INSTALLED OR REMOVED.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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PLATE 1185-1

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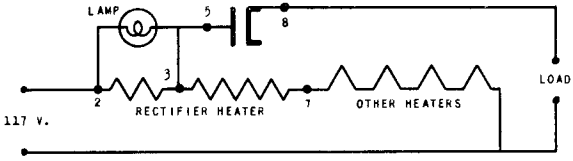
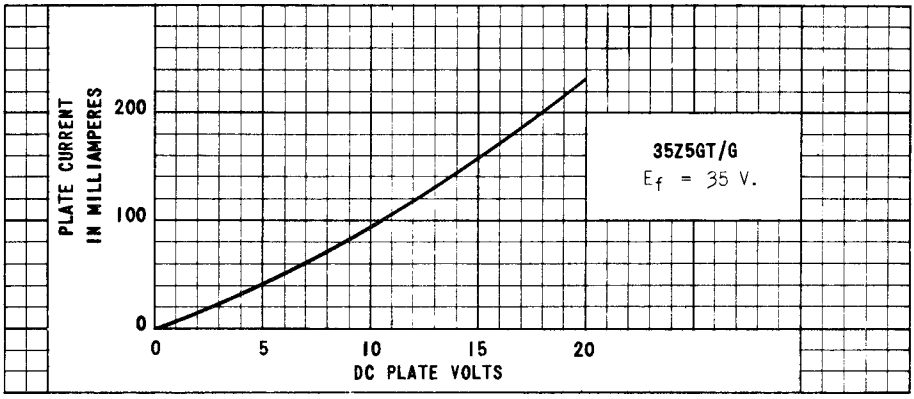
TUNG-SOL





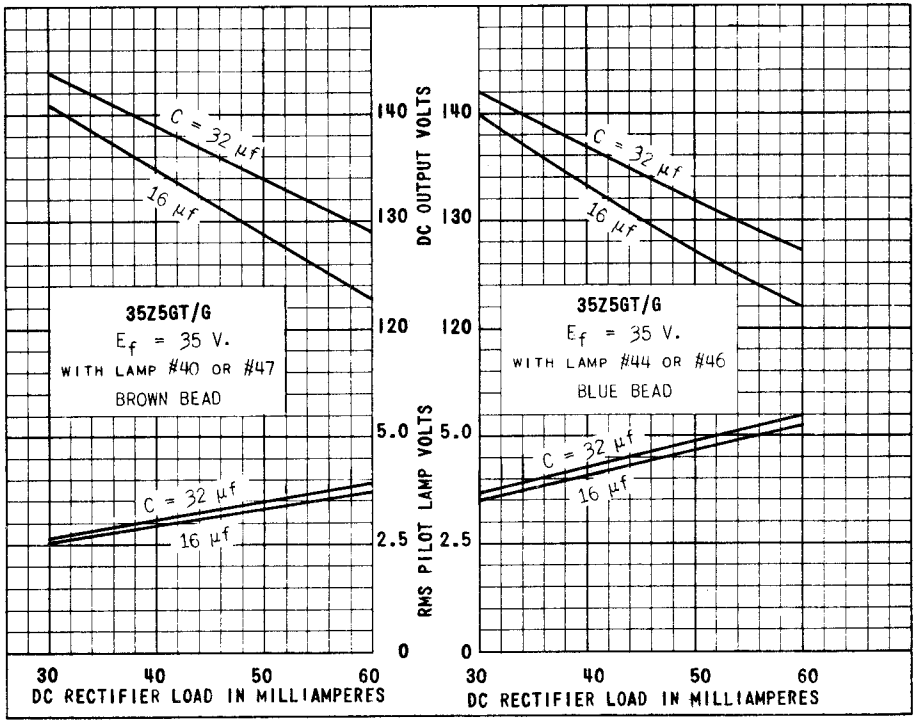


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PLATE
1186-1

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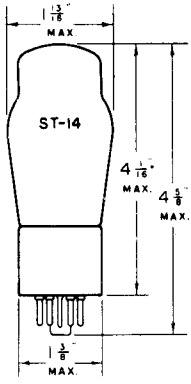
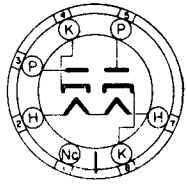
35Z6G

TUNG-SOL



TWIN-DIODE HIGH VACUUM RECTIFIER

VOLTAGE DOUBLER



7Q-0-0

UNIPOTENTIAL CATHODES

HEATER
35 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE

THE TUNG-SOL 35Z6G IS DESIGNED PRIMARILY FOR HEAVY DUTY SERVICE AS A POWER RECTIFIER IN AC-DC CIRCUITS. TWO SEPARATE RECTIFIER SECTIONS PERMIT USING THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. FOR HALF WAVE OPERATION THE TWO SECTIONS MAY BE USED SEPARATELY, OR IN PARALLEL TO INCREASE THE OUTPUT CURRENT AND REDUCE TUBE DROP.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	660	MA.
TUBE VOLTAGE DROP AT 220 MA. DC PER PLATE	20	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERSTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
AC PLATE VOLTAGE PER PLATE (RMS)	117	117	VOLTS
DC OUTPUT CURRENT MAX.	110	110	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	30	15	OHMS

HALF WAVE RECTIFIER

CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS)	117	150	235	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	110	110	110	MA.
MINIMUM EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	15	40	100	OHMS

PLATE 1187-2

FEB. 28 1942

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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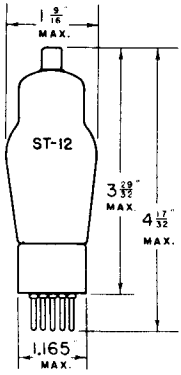
TUNG-SOL



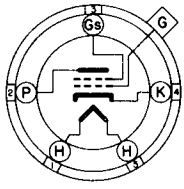
TETRODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 5 PIN BASE



5E
BOTTOM VIEW

THE TUNG-SOL 36 IS DESIGNED FOR USE AS AN RF AMPLIFIER OR DETECTOR.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	100	135	180	250 MAX.	VOLTS
SCREEN VOLTAGE	55	67.5	90 MAX.	90 MAX.	VOLTS
CONTROL GRID VOLTAGE	-1.5	-1.5	-3	-3	VOLTS
PLATE CURRENT	1.8	2.8	3.1	3.2	MA.
SCREEN CURRENT	–	–	–	1.7 MAX.	MA.
PLATE RESISTANCE	0.55	0.475	0.50	0.55	MEGOHM
TRANSCONDUCTANCE	850	1000	1050	1080	μMHOS
AMPLIFICATION FACTOR	470	475	525	595	

DETECTOR

	BIASED			GRID LEAK	
PLATE SUPPLY VOLTAGE	100	180	250 MAX.	135	VOLTS
SCREEN VOLTAGE	55	67.5	90 MAX.	45 MAX.	VOLTS
CONTROL GRID VOLTAGE	-5 A	-6 A	-8 A	RETURN TO CATHODE	VOLTS
PLATE RESISTOR	0.25 B	0.25 B	0.25 B	0.25 B	MEGOHM
PLATE CURRENT	ADJUSTED TO 0.1 MA. WITH NO INPUT SIGNAL				
GRID LEAK	–	–	–	2 TO 5	MEGOHMS
GRID CONDENSER	–	–	–	250	μμf

A APPROXIMATE

B OR EQUIVALENT IMPEDANCE

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	3.7	μμf
PLATE TO CATHODE	9.2	μμf
CONTROL GRID TO PLATE S	.007 MAX.	μμf

S WITH SHIELD

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PLATE 472-1

JUNE 26 1939

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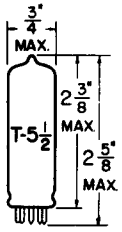
TUNG-SOL

HALF-WAVE RECTIFIER

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER

36 VOLTS[A] 32 VOLTS[B]

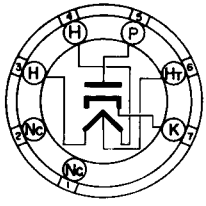
0.10 AMP.

AC OR DC

ANY MOUNTING POSITION

[A] BETWEEN PINS 3 AND 4.

[B] BETWEEN PINS 3 AND 6.



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE

5BQ

THE 36AM3 IS A HALF-WAVE RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS A 100 MA. HEATER AND A HEATER TAP-SECTION THAT IS DESIGNED FOR OPERATION IN SERIES WITH THE PLATE SUPPLY INPUT, SERVING AS A CURRENT LIMITING DEVICE.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[D]

HEATER VOLTAGE[C] (BETWEEN PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (BETWEEN PINS 3 & 6)	32	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	365	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	530	MA.
MAXIMUM STEADY-STATE DC OUTPUT CURRENT	82	MA.
EFFECTIVE PLATE SUPPLY RESISTANCE	SEE NOTE E	
MAXIMUM HEATER-CATHODE VOLTAGE[C]		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC	350	VOLTS
TOTAL DC AND PEAK	350	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK (ABS. VALUE)	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

(SEE DIAGRAM)

HALF WAVE RECTIFIER – CAPACITOR INPUT

HEATER VOLTAGE[C] (BETWEEN PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (BETWEEN PINS 3 & 6)	32	VOLTS
HEATER CURRENT	0.10	AMP.
AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
DC OUTPUT CURRENT	75	MA.
DC OUTPUT VOLTAGE	105	VOLTS
EFFECTIVE PLATE SUPPLY RESISTANCE	SEE NOTE E	
INPUT CAPACITOR	40	μf
TUBE VOLTAGE DROP FOR I_b = 150 MA.	20	VOLTS

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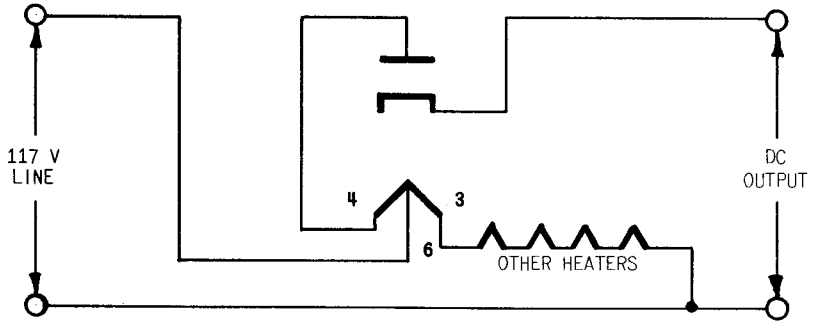
TUNG-SOL

36AM3



TYPICAL APPLICATION

NOTES

[C] THE HEATER IS DESIGNED TO BE USED IN THE CONNECTION SHOWN IN THE DIAGRAM. THE SECTION BETWEEN PINS 4 AND 6 IS INTENDED FOR USE AS A LIMITING RESISTANCE IN THE RECTIFIER PLATE CIRCUIT. THE TUBE IS NOT DESIGNED FOR USE WITH A PILOT LAMP WHERE THE HEATER SECTION BETWEEN PINS 4 AND 6 IS USED AS A PILOT LAMP SHUNT.

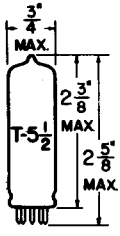
[D] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[E] THE TUBE SHOULD BE OPERATED WITH THE HEATER SECTION BETWEEN PIN 4 AND 6 IN SERIES WITH THE PLATE CIRCUIT. WITH 82 MADC OUTPUT CURRENT THE RESISTANCE OF THIS SECTION IS APPROXIMATELY 45 OHMS.

TUNG-SOL

HALF-WAVE VACUUM RECTIFIER

MINIATURE TYPE



GLASS BULB

SMALL-BUTTON MINIATURE
7 PIN BASE E7-1

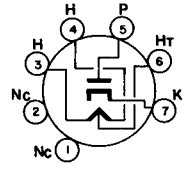
OUTLINE DRAWING
JEDEC 5-3

UNIPOTENTIAL CATHODE

HEATER NOMINAL

36 VOLTS 32 VOLTS
0.10±.006 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5BQ

THE 36AM3A IS A HALF-WAVE VACUUM RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN AC/DC RECEIVERS. FEATURES OF THE TUBE ARE A LOW TUBE-VOLTAGE DROP AND A 100-MILLIAMPERE HEATER.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HALF-WAVE RECTIFIER

HEATER CURRENT[A]	0.10±.006	AMP.
HEATER VOLTAGE (ENTIRE HEATER - PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (TAP-SECTION PINS 3 & 6)	32	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	365	VOLTS
MAXIMUM PEAK PLATE CURRENT	530	MA.
MAXIMUM DC OUTPUT CURRENT	82	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	350	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[B]	VOLTS

TYPICAL OPERATION IN ACCOMPANYING HALF-WAVE CIRCUIT

CAPACITOR-INPUT FILTER

AC PLATE-SUPPLY VOLTAGE, RMS	120	VOLTS
FILTER-INPUT CAPACITOR	40	μf
TOTAL EFFECTIVE PLATE-SUPPLY RESISTANCE	A	OHMS
DC OUTPUT CURRENT	75	MA.
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.)	118	VOLTS
TUBE VOLTAGE DROP FOR PLATE MA. = 150	16	VOLTS

[A] THE HEATER OF THE 36AM3A IS DESIGNED SO THAT THE HEATER SECTION BETWEEN PIN 4 & 6 IS USED AS A LIMITING RESISTANCE IN THE RECTIFIER PLATE CIRCUIT. (SEE TYPICAL HALF-WAVE CIRCUIT).

THIS TYPE IS NOT DESIGNED FOR USE WITH A PANEL LAMP WHERE THE HEATER SECTION BETWEEN PINS 4 & 6 IS USED AS A PANEL-LAMP SHUNT.

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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TUNG-SOL

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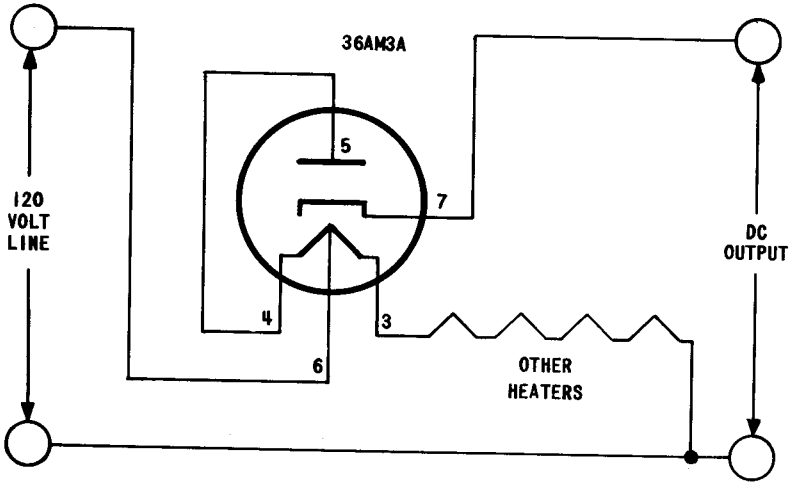
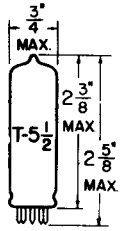
TYPICAL HALF-WAVE CIRCUIT



TUNG-SOL

RECTIFIER

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1

OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

HEATER

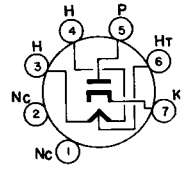
36 VOLTS[A] 32 VOLTS[B,C]

0.10 AMP.

ANY MOUNTING POSITION

[A] PINS 3 AND 4

[B] PINS 3 AND 6



BOTTOM VIEW

BASING DIAGRAM
JEDEC 5BQ

THE 36AM3B IS A HALF-WAVE RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. FEATURES OF THE TUBE ARE A 100 MA. HEATER WITH 20 SECOND WARM-UP TIME. IT HAS A HEATER TAP SECTION (PINS 4 & 6) THAT MAY BE USED AS A LIMITING RESISTANCE IN THE RECTIFIER PLATE CIRCUIT OR AS A PANEL LAMP SHUNT.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE (PINS 3 & 4)	36	VOLTS
HEATER VOLTAGE (PINS 3 & 6)	32	VOLTS
HEATER CURRENT (PINS 3 & 6)[D]	.100±.006	AMP.
MAXIMUM INVERSE VOLTAGE	365	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	580	MA.
MAXIMUM VOLTAGE (RMS) OF PANEL LAMP SECTION WHEN PANEL LAMP FAILS	10	VOLTS
MAXIMUM DC OUTPUT CURRENT		
WITHOUT PANEL LAMP PER CIRCUIT 1	82	MA.
WITH PANLE LAMP PER CIRCUIT 2 AND NO SHUNTING RESISTOR	68	MA.
WITH PANEL LAMP PER CIRCUIT 2 AND SHUNTING RESISTOR	82	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK	350	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
HEATER WARM-UP TIME (PINS 3 & 4)[E]	20	SECONDS

AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP WITH PLATE CURRENT = 150 MA.	16	VOLTS

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TYPICAL OPERATION

HALF-WAVE RECTIFIER – CAPACITOR INPUT TO FILTER[F]

WITH PANEL LAMP CM8-54 - CIRCUIT 2

HEATER TAP VOLTAGE (PINS 4 & 6)	3.7	4.0	4.0	4.0	4.0	VOLTS
AC PLATE SUPPLY VOLTAGE, RMS	120	120	120	120	120	VOLTS
EFFECTIVE PLATE SUPPLY RESISTANCE (APPROX.)	20	20	20	20	20	OHMS
PANEL LAMP SHUNTING RESISTOR	0	470	200	130	100	OHMS
DC OUTPUT CURRENT	50	60	65	70	75	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	129	125	124	122	120	VOLTS

TAP SECTION AS LIMITING RESISTANCE[F]

WITHOUT PANEL LAMP - CIRCUIT 1

AC PLATE SUPPLY VOLTAGE	120	120	VOLTS
EFFECTIVE PLATE SUPPLY RESISTANCE	(NOTE G)	(NOTE G)	
FILTER INPUT CAPACITOR	40	40	μf
DC OUTPUT CURRENT	60	75	MA
DC OUTPUT VOLTAGE AT FILTER INPUT	122	113	VOLTS

[C] FOR SERIES OPERATION OF HEATERS, EQUIPMENT SHOULD BE DESIGNED THAT AT NORMAL SUPPLY VOLTAGE BOGEY TUBES WILL OPERATE AT THIS VALUE OF HEATER CURRENT.

[D] HEATER VOLTAGE SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER CURRENT WITHIN THE SPECIED VALUES.

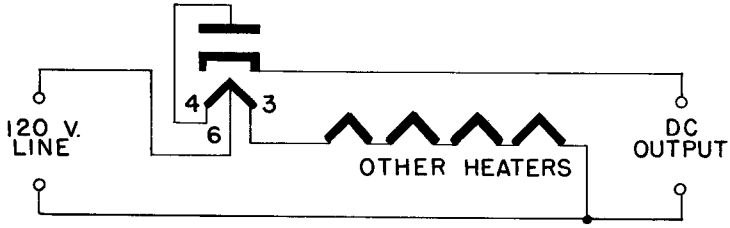
[E] HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATFR TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

[F] IN A SERIES STRING ENTERTAINMENT EQUIPMENT COMPLEMENT WITH 100 MILLIAMPERE HEATER CURRENT TUBES DESIGNED FOR A NOMINAL 120 VOLT AC LINE.

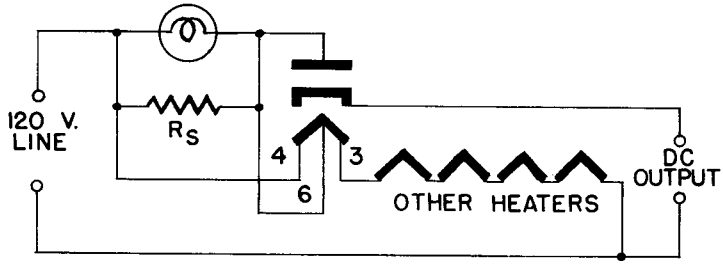
[G] IN THIS MODE OF OPERATION, WITH THE HEATER TAP SECTION BETWEEN PINS 4 AND 6 IN SERIES WITH THE RECTIFIER PLATE CIRCUIT, THE RESISTANCE OF THE TAP SECTION IS APPROXIMATELY 45 OHMS.

TUNG-SOL

CIRCUIT 1



CIRCUIT 2



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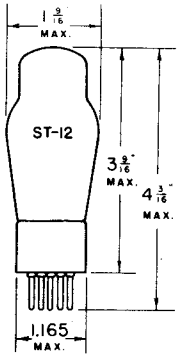
TUNG-SOL



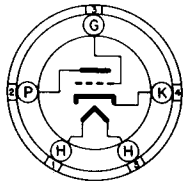
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 5 PIN BASE



5A

BOTTOM VIEW

THE TUNG-SOL 37 IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	90	135	180	250 MAX.	VOLTS
GRID VOLTAGE	-6	-9	-13.5	-18	VOLTS
PLATE CURRENT	2.5	4.1	4.3	7.5	MA.
PLATE RESISTANCE	11 500	10 000	10 200	8400	OHMS
TRANSCONDUCTANCE	800	925	900	1100	μMHOS
AMPLIFICATION FACTOR	9.2	9.2	9.2	9.2	

DETECTOR

	BIASED				GRID LEAK	
PLATE VOLTAGE	90	135	180	250 MAX.	45	VOLTS
GRID VOLTAGE	-10	-15	-20	-28	RETURN TO CATHODE	VOLTS
PLATE CURRENT	ADJUST TO 0.2 MA. WITH NO INPUT SIGNAL					
GRID LEAK	-	-	-	-	1 TO 5	MEGOHMS
GRID CONDENSER	-	-	-	-	250	μμf

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	250	VOLTS
PLATE RESISTOR	0.1	MEGOHM
CATHODE RESISTOR	11 000	OHMS
VOLTAGE GAIN	7	

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	3.5	μμf
PLATE TO CATHODE	2.9	μμf
GRID TO PLATE	2.0	μμf

PLATE 473-1

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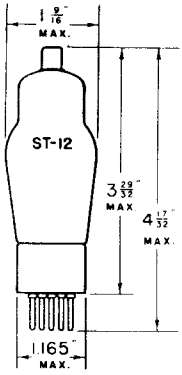
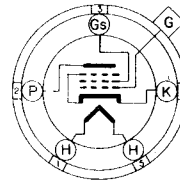


PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



5F
BOTTOM VIEW

SMALL 5 PIN BASE

THE TUNG-SOL 38 IS A PENTODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC OR STORAGE BATTERY OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	100	135	180	250 MAX.	VOLTS
SCREEN VOLTAGE	100	135	180	250 MAX.	VOLTS
CONTROL GRID VOLTAGE	-9	-13.5	-18	-25	VOLTS
PLATE CURRENT	7	9	14	22	MA.
SCREEN CURRENT	1.2	1.5	2.4	3.8	MA.
PLATE RESISTANCE	0.14	0.13	0.11	0.10	MEGOHM
TRANSCONDUCTANCE	875	925	1050	1200	μMHOS
AMPLIFICATION FACTOR	120	120	120	120	
LOAD RESISTANCE	15 000	13 500	11 600	10 000	OHMS
TOTAL HARMONIC DISTORTION	8	10	8	8	PER CENT
POWER OUTPUT	0.27	0.55	1.0	2.5	WATTS

NOTE: THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	3.5	μμf
PLATE TO CATHODE	7.5	μμf
CONTROL GRID TO PLATE	0.3	μμf

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PLATE 470-1

JUNE 26 1939

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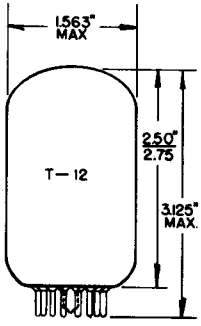
TUNG-SOL

DIODE - PENTODE

COMPACTRON



GLASS BULB
BUTTON 12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12 - 57

FOR

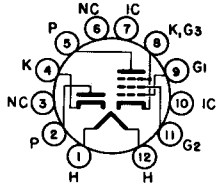
COMBINED DAMPING

AND AMPLIFIER SERVICE

IN TV RECEIVERS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 12 FS

THE 38HE7 IS A HIGH-PERVEANCE DIODE AND A BEAM-POWER PENTODE IN THE T-12 COMPACTRON CONSTRUCTION. THE DIODE IS DESIGNED FOR SERVICE AS THE DAMPING DIODE AND THE PENTODE AS THE HORIZONTAL-DEFLECTION AMPLIFIER IN TELEVISION RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

DIODE SECTION

CATHODE TO PLATE AND HEATER: K TO (P + H)	8.0	pf
PLATE TO CATHODE AND HEATER: P TO (K + H)	7.0	pf
HEATER TO CATHODE: (H TO K)	1.6	pf

PENTODE SECTION

GRID 1 TO PLATE: (G_1 TO P)	0.38	pf
INPUT: G 1 TO (H + K + G_2 + G_3)	19	pf
OUTPUT: P TO (H + K + G_2 + G_3)	8.0	pf

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	37.8	VOLTS	450	MA.
HEATER WARM-UP TIME		APPROX.	11	SECONDS
LIMITS OF SUPPLIED CURRENT			450 ± 30	MA.
HEATER-CATHODE VOLTAGE		DIODE SECTION	PENTODE SECTION	
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC COMPONENT		100	100	VOLTS
TOTAL DC AND PEAK		200	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE				
DC COMPONENT		500		
TOTAL DC AND PEAK		4,200	200	VOLTS

RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HORIZONTAL-DEFLECTION AMPLIFIER SERVICE

DC PLATE-SUPPLY VOLTAGE (BOOST + DC POWER SUPPLY)	500	VOLTS
PEAK POSITIVE PULSE PLATE VOLTAGE	5,000	VOLTS
PEAK NEGATIVE PULSE PLATE VOLTAGE	0	VOLTS
GRID 2 VOLTAGE	150	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PEAK NEGATIVE GRID 1 VOLTAGE	330	VOLTS
PLATE DISSIPATION	10	WATTS
GRID 2 DISSIPATION	3.5	WATTS
GRID 2 DISSIPATION FOR $P_p \leq 9$ WATTS	4.0	WATTS
DC CATHODE CURRENT	230	MA.
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHMS

TV DAMPER SERVICE

PEAK INVERSE PLATE VOLTAGE	4,200	VOLTS
STEADY-STATE PEAK PLATE CURRENT	1,200	MA.
DC OUTPUT CURRENT	200	MA.
BULB TEMPERATURE AT HOTTEST POINT	200	°C

CHARACTERISTICS AND TYPICAL OPERATION

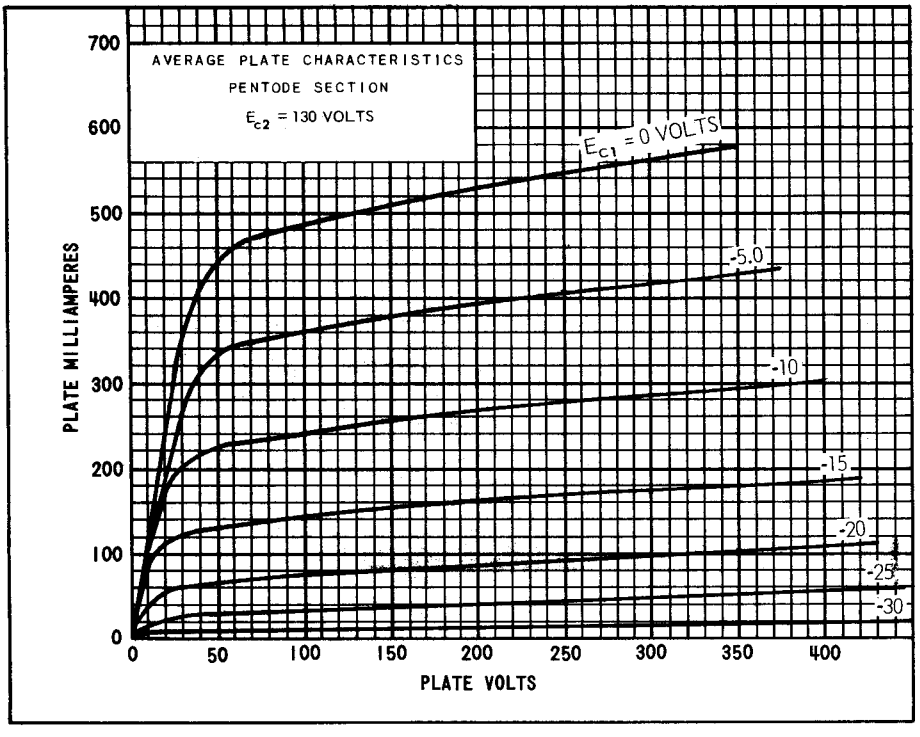
PENTODE SECTION

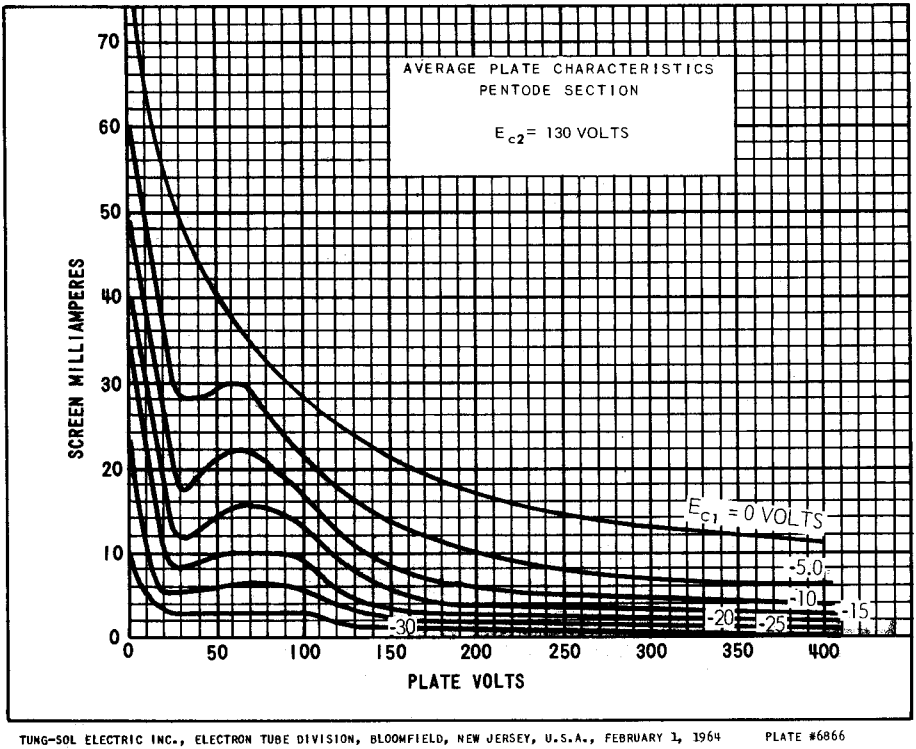
PLATE VOLTAGE	5,000	50	130	VOLTS
GRID 2 VOLTAGE	130	130	130	VOLTS
GRID 1 VOLTAGE	-	0 [A]	-22	VOLTS
PLATE CURRENT	-	450	60	MA.
GRID 2 CURRENT	-	40	2.8	MA.
TRANSCONDUCTANCE	-	-	8,800	MICROMHOS
TRIODE AMPLIFICATION FACTOR - GRID 2 TIED TO PLATE	-	-	4.2	
GRID 1 VOLTAGE FOR I_b = 1.0 MA. APPROX.	-80	-	-39	VOLTS

DIODE SECTION

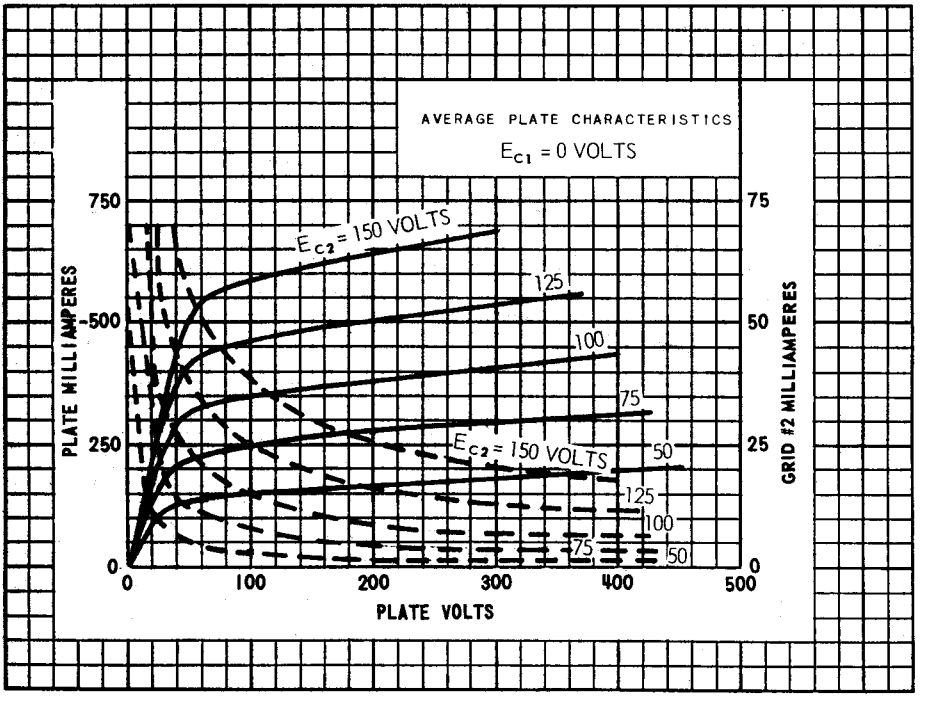
TUBE VOLTAGE DROP FOR I_b = 350 MADC	21	VOLTS

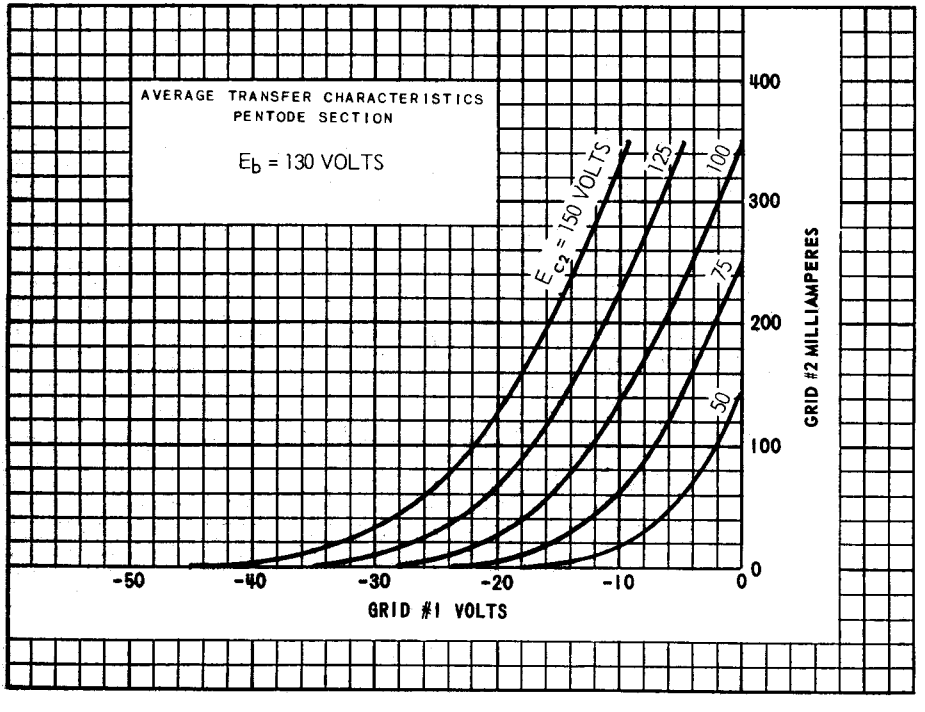
A - APPLIED FOR SHORT INTERVAL (2 SECONDS MAX.) SO AS NOT TO DAMAGE TUBE.

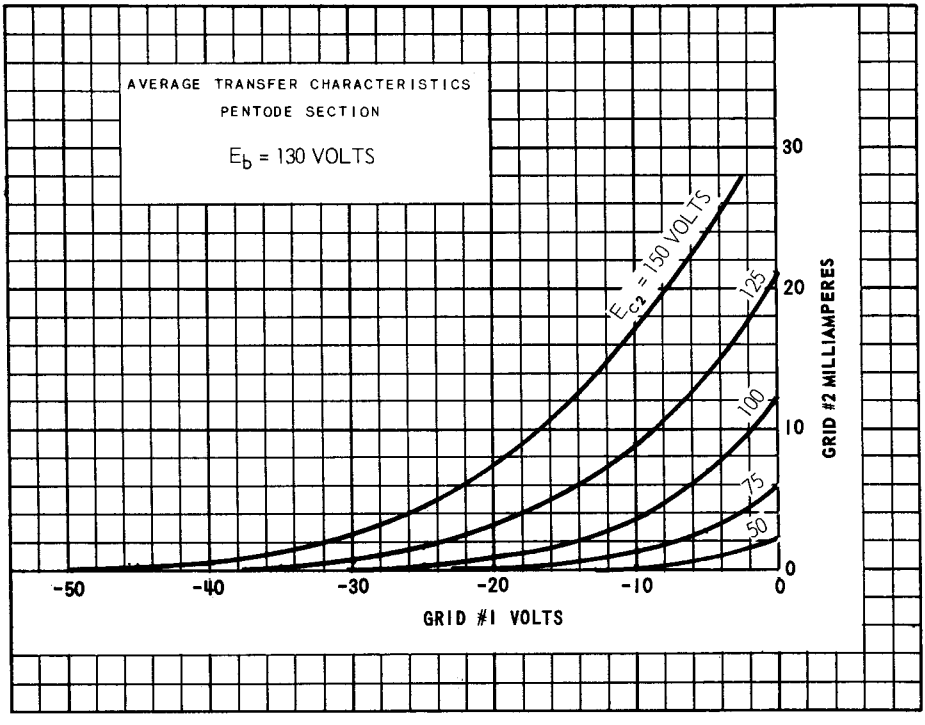


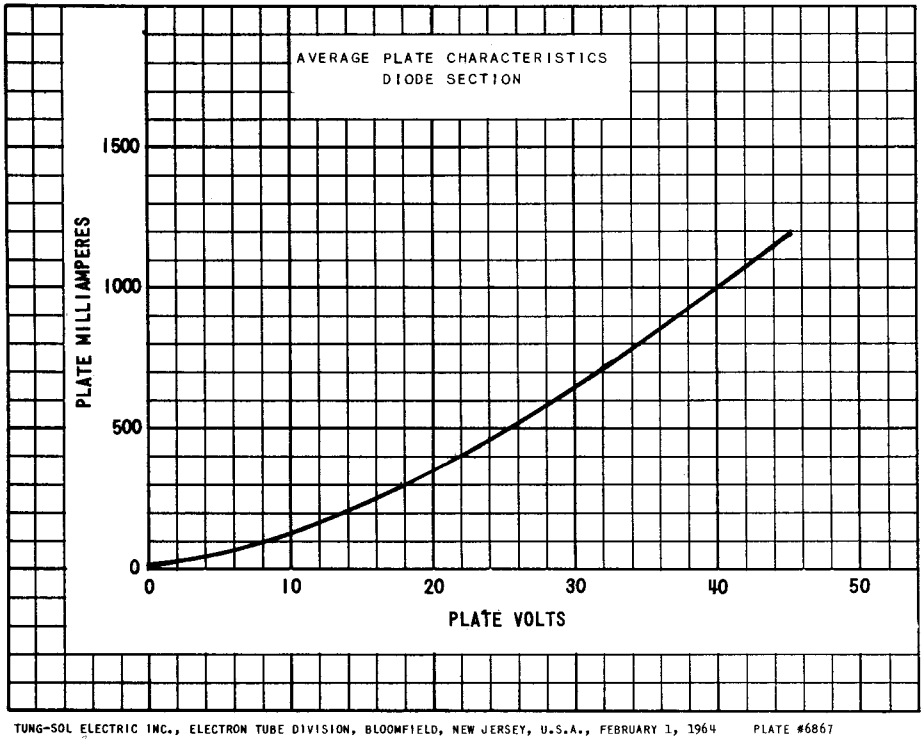


TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., FEBRUARY 1, 1964 PLATE #6866

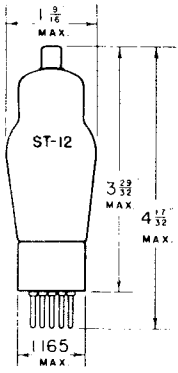

AVERAGE PLATE CHARACTERISTICS
E_{c1} = 0 VOLTS
PLATE MILLIAMPERES
750
500
250
0
E_{c2} = 150 VOLTS
125
100
75
50
E_{c2} = 150 VOLTS
125
100
75
50
0
100
200
300
400
500
PLATE VOLTS
75
50
25
0
GRID #2 MILLIAMPERES


AVERAGE TRANSFER CHARACTERISTICS
PENTODE SECTION
E_b = 130 VOLTS
E_{c2} = 150 VOLTS
125
100
75
50
400
300
200
100
0
GRID #2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID #1 VOLTS


AVERAGE TRANSFER CHARACTERISTICS
PENTODE SECTION
E_b = 130 VOLTS
E_{c_2} = 150 VOLTS
125
100
75
50
30
20
10
0
GRID #2 MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID #1 VOLTS


AVERAGE PLATE CHARACTERISTICS
DIODE SECTION
1500
1000
500
0
PLATE MILLIAMPERES
0
10
20
30
40
50
PLATE VOLTS

TUNG-SOL



REMOTE CUT - OFF

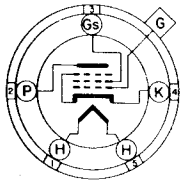
PENTODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 5 PIN BASE



5F

BOTTOM VIEW

THE TUNG-SOL 39/44 IS DESIGNED FOR USE AS AN RF AMPLIFIER OR MIXER IN AC AND STORAGE BATTERY OPERATED SUPERHETERODYNE RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	90	180	250 MAX.	VOLTS
SCREEN VOLTAGE MAX.	90	90	90	VOLTS
CONTROL GRID VOLTAGE MIN. [A]	-3	-3	-3	VOLTS
PLATE CURRENT	5.6	5.8	5.8	MA.
SCREEN CURRENT	1.6	1.4	1.4	MA.
PLATE RESISTANCE	0.375	0.75	1.0	MEGOHM
TRANSCONDUCTANCE	960	1000	1050	μMHOS
AMPLIFICATION FACTOR	360	750	1050	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	-42.5	-42.5	-42.5	VOLTS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 3 MEGOHMS.

AS MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	90	180	250 MAX.	VOLTS
SCREEN VOLTAGE MAX.	90	90	90	VOLTS
CONTROL GRID VOLTAGE	-7	-7	-7	VOLTS

THIS GRID BIAS IS MINIMUM FOR AN OSCILLATOR PEAK VOLTAGE OF 6 VOLTS.

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	3.5	μμf
PLATE TO CATHODE	10	μμf
CONTROL GRID TO PLATE [S]	.007 MAX.	μμf

[S] WITH SHIELD

PLATE 471-1

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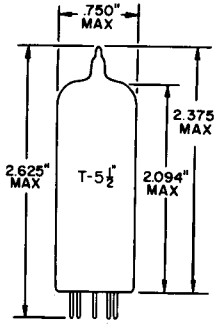
TUNG-SOL

PENTODE

MINIATURE TYPE

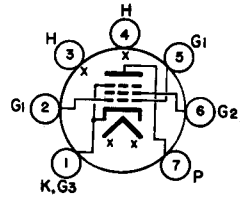


GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

AUDIO POWER AMPLIFIER
FOR SERIES STRING OPERATION

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 40FR5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR SERVICE AS AN AUDIO POWER AMPLIFIER.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.3	pf
INPUT: G_1 TO $(K+G_3+G_2+H)$	12	pf
OUTPUT: P TO $(K+G_3+G_2+H)$	9.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	40 VOLTS	100	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSTIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME [A]		20	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5.2	WATTS
GRID #2 DISSIPATION	1.2	WATTS
GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

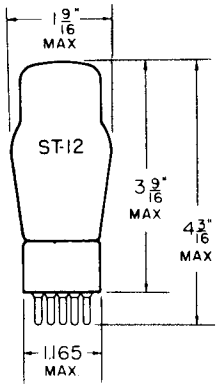
TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	115	110	VOLTS
GRID #2 VOLTAGE	115	110	VOLTS
GRID #1 VOLTAGE	---	-7.5	VOLTS
CATHODE RESISTOR	180	---	OHMS
PEAK AF GRID #1 VOLTAGE	7.0	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	34	32	MA.
MAX.-SIGNAL PLATE CURRENT	31	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.2	3	MA.
MAX.-SIGNAL GRID #2 CURRENT	7.	7.5	MA.
TRANSCONDUCTANCE	---	6000	μMHOS
PLATE RESISTANCE, APPROX.	---	20,000	OHMS
LOAD RESISTANCE	3200	2800	OHMS
MAX.-SIGNAL POWER OUTPUT	1.3	1.5	WATTS
TOTAL HARMONIC DISTORTION	10	10	PERCENT

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

PENTODE

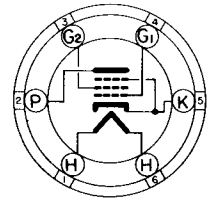


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 400 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL 6 PIN BASE
68

THE 41 IS AN INDIRECTLY HEATED CATHODE TYPE POWER AMPLIFIER PENTODE DESIGNED FOR SERVICE IN THE OUTPUT STAGES OF AC, AC/DC AND STORAGE BATTERY OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS ←
MAXIMUM PLATE VOLTAGE	315	VOLTS
MAXIMUM GRID #2 VOLTAGE	285	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS ←
MAXIMUM PLATE DISSIPATION	8.5	WATTS
MAXIMUM GRID #2 DISSIPATION	2.8	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - SINGLE TUBE

HEATER VOLTAGE	6.3	6.3	6.3	VOLTS
HEATER CURRENT	400	400	400	MA.
PLATE VOLTAGE	100	250	315	VOLTS
GRID #2 VOLTAGE	100	250	250	VOLTS
GRID #1 VOLTAGE[A]	-7	-18	-21	VOLTS
PEAK AF GRID #1 VOLTAGE	7	18	21	VOLTS
ZERO SIGNAL PLATE CURRENT	9	32	25.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	9.5	33	28	MA.
ZERO SIGNAL GRID #2 CURRENT	1.6	5.5	4	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	3	10	9	MA.
PLATE RESISTANCE (APPROX.)	104 000	90 000	110 000	OHMS
TRANSCONDUCTANCE	1 500	2 300	2 100	µMHOS
LOAD RESISTANCE	12 000	7 600	9 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	0.35	3.4	4.5	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	11	11	15	PERCENT

[A] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR FIXED BIAS = 0.1 MEGOHM.

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE OR ADDITION

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PUSH-PULL - TWO TUBES[B]

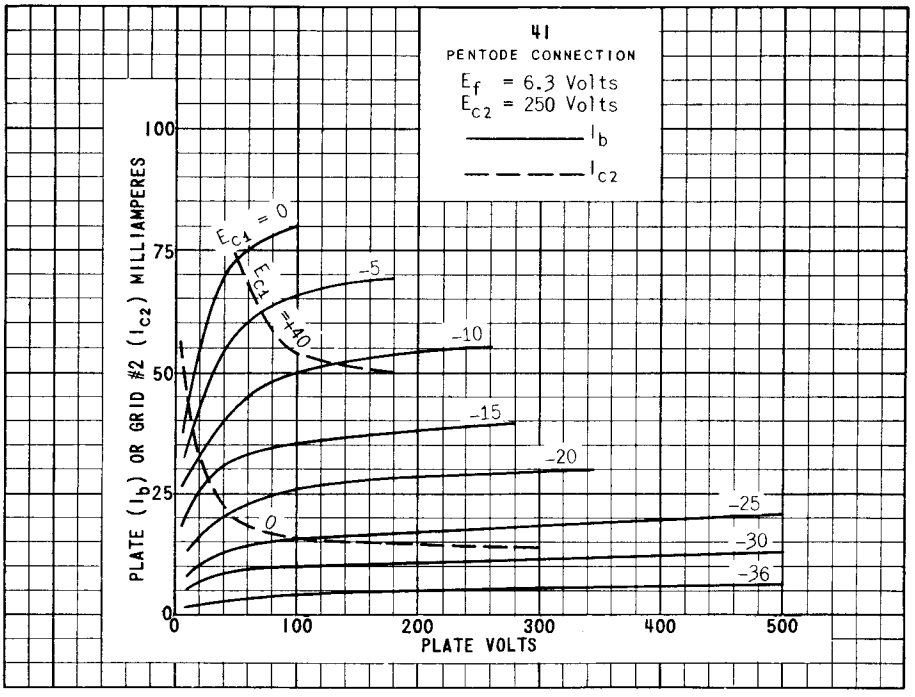
	FIXED BIAS	CATHODE BIAS	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	400	400	MA.
PLATE VOLTAGE	285	285	VOLTS
GRID #2 VOLTAGE	285	285	VOLTS
GRID #1 VOLTAGE	-25.5[A]	---	VOLTS
CATHODE RESISTOR	---	400[C]	OHMS
PEAK AF GRID #1 TO GRID #1 VOLTAGE	51	51	VOLTS
ZERO SIGNAL PLATE CURRENT	55	55	MA.
MAXIMUM SIGNAL PLATE CURRENT	72	61	MA.
ZERO SIGNAL GRID #2 CURRENT	9	9	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	17	13	MA.
PLATE TO PLATE LOAD RESISTANCE	12 000	12 000	OHMS
MAXIMUM SIGNAL POWER OUTPUT	10.5	9.8	WATTS
TOTAL HARMONIC DISTORTION	6	4	PERCENT

[A] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR FIXED BIAS = 0.1 MEGOHM.

[B] UNLESS OTHERWISE SPECIFIED.

[C] MAXIMUM GRID #1 CIRCUIT RESISTANCE FOR CATHODE BIAS = 0.5 MEGOHM.

SIMILAR TYPE REFERENCE: Ratings and characteristics are identical to types 7B5 and 6K6GT.



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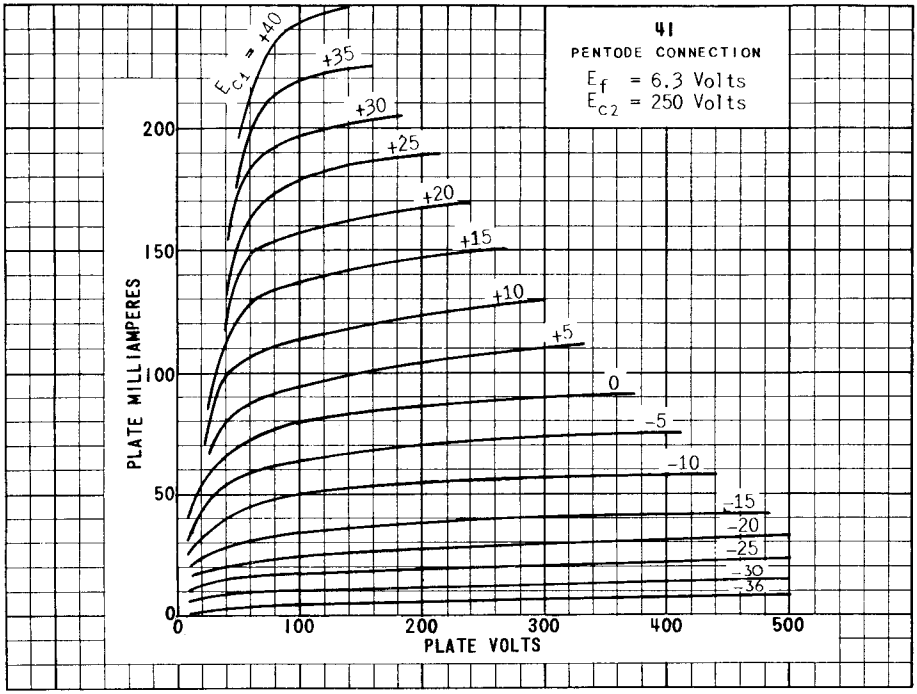

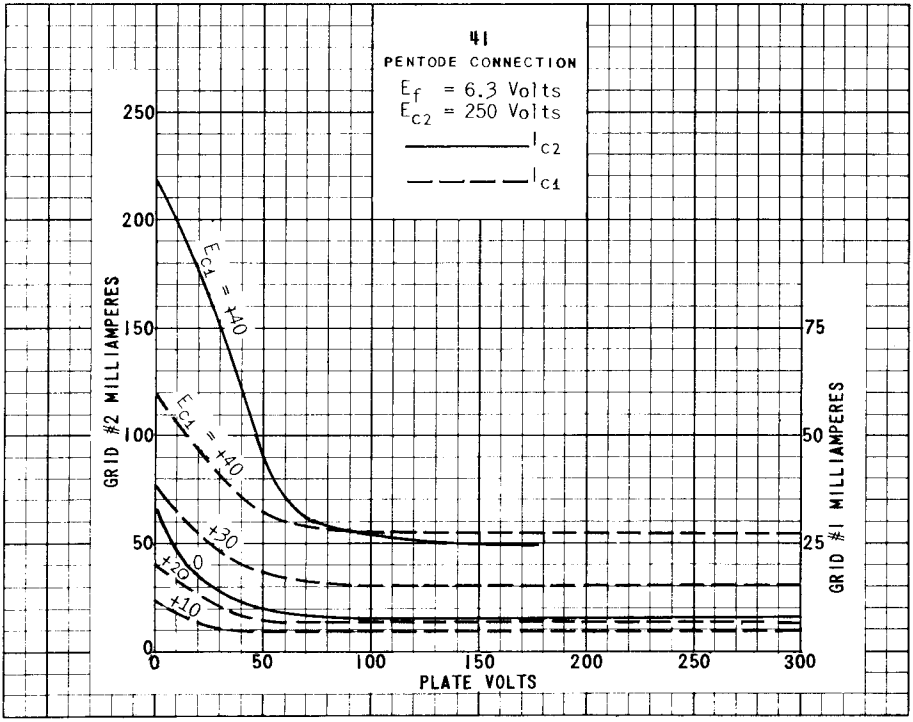

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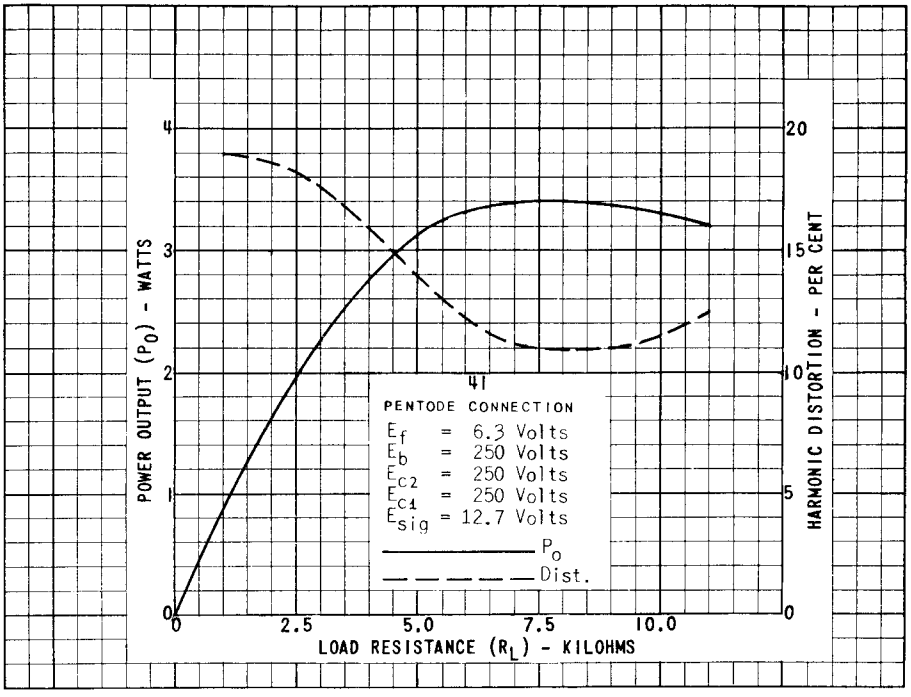
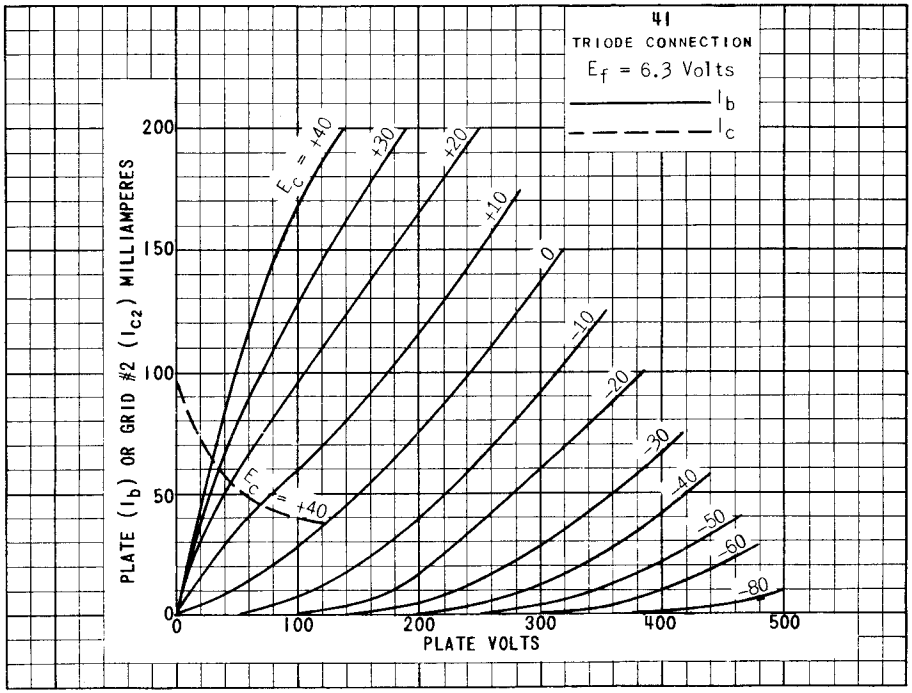
41 (6K6GT, 7B5)





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TUNG-SOL

PENTODE POWER AMPLIFIER

COATED UNIPOTENTIAL CATHODE

HEATERS

6F6, 6F6GT/G, 42 – 6.3 V., 0.7 AMPERE
2A5 – 2.5 V., 1.75 AMPERES

TYPES 6F6, 6F6GT/G, 2A5 AND 42 ARE PENTODE AMPLIFIERS DESIGNED FOR APPLICATION IN POWER OUTPUT STAGES OF RECEIVERS. WITH THE EXCEPTION OF HEATER RATINGS, THEIR ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

MAXIMUM RATINGS

	PENTODE CONNECTION	TRIODE CONNECTION	
MAXIMUM PLATE VOLTAGE	375	350	VOLTS
MAXIMUM SCREEN VOLTAGE	285	–	VOLTS
MAXIMUM PLATE DISSIPATION	11	–	WATTS
MAXIMUM SCREEN DISSIPATION	3.75	–	WATTS
MAXIMUM TOTAL PLATE AND SCREEN DISSIPATION	–	10	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – SINGLE TUBE [C]

	PENTODE CONNECTION		TRIODE CONNECTION	
PLATE VOLTAGE	250	285	250	VOLTS
SCREEN VOLTAGE	250	285	–	VOLTS
CONTROL GRID VOLTAGE [A]	-16.5	-20	-20	VOLTS
PEAK AF SIGNAL VOLTAGE	16.5	20	20	VOLTS
ZERO-SIGNAL PLATE CURRENT	34	38	31	MA.
ZERO-SIGNAL SCREEN CURRENT	6.5	7	–	MA.
MAXIMUM-SIGNAL PLATE CURRENT	36	40	34	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	10.5	13	–	MA.
PLATE RESISTANCE (APPROX.)	80000	78000	2600	OHMS
TRANSCONDUCTANCE	2500	2550	2600	μMHO.
AMPLIFICATION FACTOR	–	–	6.8	
LOAD RESISTANCE	7000	7000	4000	OHMS
TOTAL HARMONIC DISTORTION	8	9	6.5	PER CENT
POWER OUTPUT	3.2	4.8	0.85	WATTS

PUSH-PULL AMPLIFIER - TWO TUBES [F]

	CLASS A_1 AMPLIFIER [C]	CLASS AB_2 AMPLIFIER [D]		
	PENTODE CONNECTION	PENTODE CONNECTION	TRIODE CONNECTION	
PLATE VOLTAGE	315	375	350	VOLTS
SCREEN VOLTAGE	285	250	–	VOLTS
CONTROL GRID VOLTAGE	-24 [A]	-26	-38	VOLTS
PEAK AF SIGNAL VOLTAGE (GRID TO GRID)	48	82	123	VOLTS
ZERO-SIGNAL PLATE CURRENT	62	34	48	MA.
ZERO-SIGNAL SCREEN CURRENT	12	5	–	MA.
MAXIMUM-SIGNAL PLATE CURRENT	80	82	92	MA.
MAXIMUM-SIGNAL SCREEN CURRENT	19.5	19.5	–	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	10000	10000	6000	OHMS
TOTAL HARMONIC DISTORTION	4	3.5	2	PER CENT
POWER OUTPUT	11	18.5	13	WATTS

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TYPICAL OPERATING CONDITIONS FOR CATHODE BIAS

	CLASS A_1 AMPLIFIER [C]				CLASS AB_2 AMPLIFIER [D]		
	SINGLE TUBE AMPLIFIER			PUSH-PULL AMPLI.	PUSH-PULL AMPLI.		
	Pentode Conn.		Triode Conn.	Pentode Conn. [F]	Pentode Conn. [F]	Triode Conn. [F]	
Plate	250	285	250	315	375	350	Volts
Screen	250	285	-	285	250	-	Volts
Cathode Resistor	410	-	650	320	340 [B]	730 [E]	Ohms
Peak A-F Grid Voltage	16.5	20	20	-	-	-	Volts
Peak A-F Grid-to-Grid Voltage	-	-	-	58	94	132	Volts
Zero-Sig. Plate Cur.	34	38	31	62	54	50	Ma.
Max.-Sig. Plate Cur.	35	38	32	73	77	60	Ma.
Zero-Sig. Screen Cur.	6.5	7	-	12	8	-	Ma.
Max.-Sig. Screen Cur.	9.7	12	-	18	18	-	Ma.
Load Resistance	7000	7000	4000	-	-	-	Ohms
Effective Load Resis. (plate to plate)	-	-	-	10000	10000	10000	Ohms
Total Harmonic Dist.	8.5	9	6.5	3	5	3	%
Max.-Sig. Power Output	3.1	4.5	0.8	10.5	19	9	Watts

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER RATED MAXIMUM CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED-BIAS OPERATION.

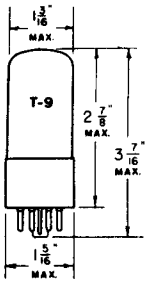
[B] THE VALUE GIVEN FOR THE CATHODE RESISTOR IS DETERMINED FOR A GRID BIAS OF -21 VOLTS.

[C] SUBSCRIPT 1 INDICATES THAT GRID CURRENT DOES NOT FLOW DURING ANY PART OF INPUT CYCLE.

[D] SUBSCRIPT 2 INDICATES THAT GRID CURRENT FLOWS DURING SOME PART OF INPUT CYCLE.

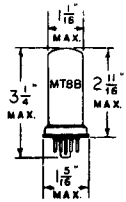
[E] THE VALUE GIVEN FOR THE CATHODE RESISTOR IS DETERMINED FOR A GRID BIAS OF -36.5 VOLTS.

[F] UNLESS OTHERWISE SPECIFIED, VALUES ARE FOR 2 TUBES.



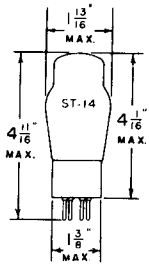
GLASS BULB

6F6GT/G



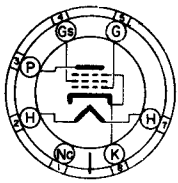
METAL SHELL

6F6

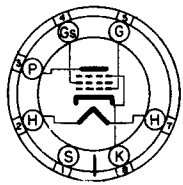


GLASS BULB

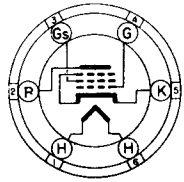
2A5 - 42



MEDIUM 7 PIN OCTAL BASE



7 PIN OCTAL BASE



MEDIUM 6 PIN BASE

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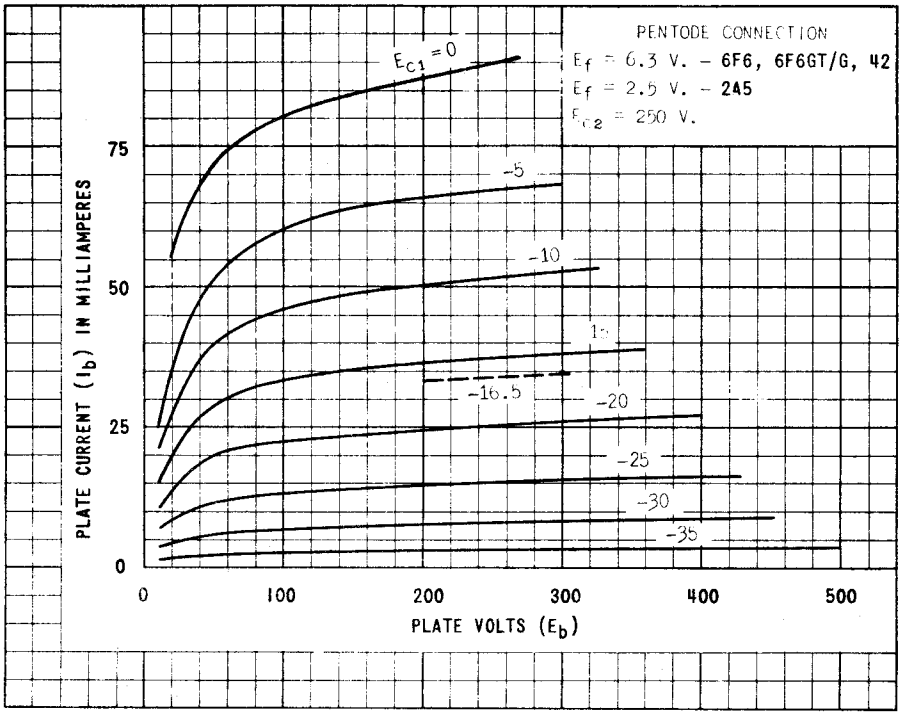

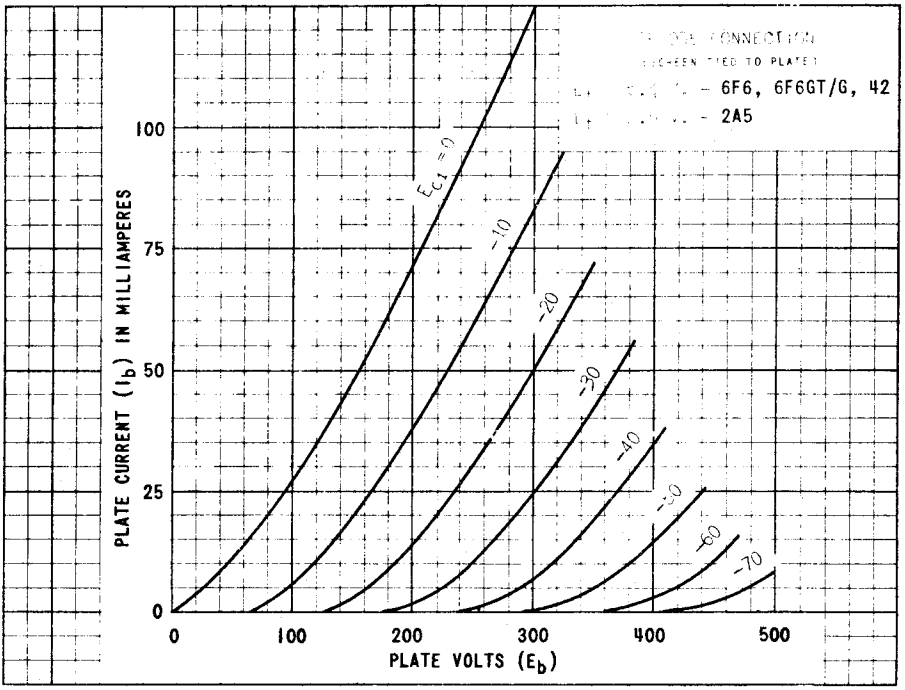

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OCT. 25
1943

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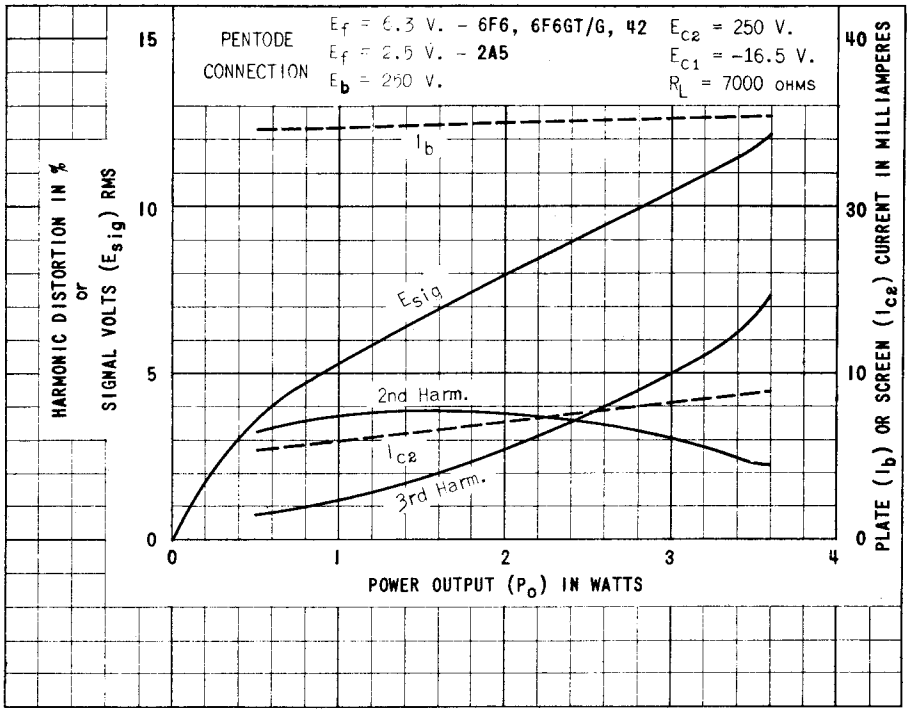

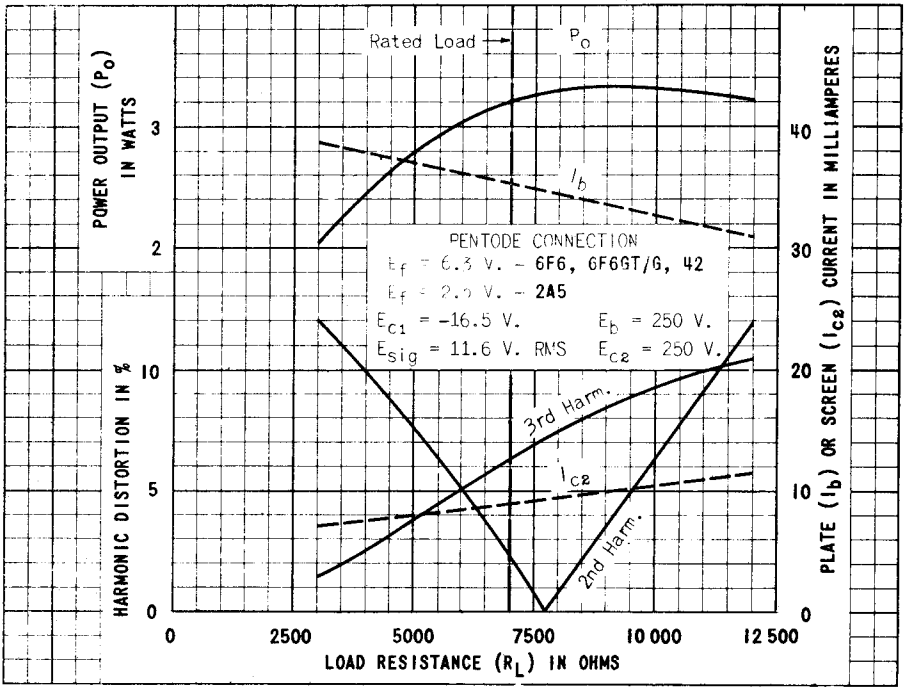

PLATE
1373-1
OCT. 25
1943

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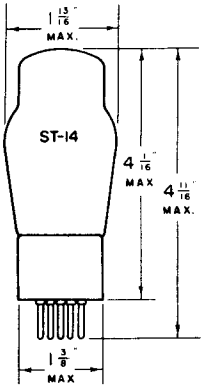
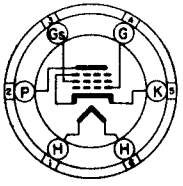


PENTODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
25 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



6B

BOTTOM VIEW

MEDIUM 6 PIN BASE

THE TUNG-SOL 43 IS DESIGNED FOR SERVICE IN THE POWER OUTPUT STAGE OF AC-DC RECEIVERS. ITS CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 25A6G.

MAXIMUM RATINGS

MAXIMUM PLATE VOLTAGE	160	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	5.3	WATTS
MAXIMUM SCREEN DISSIPATION	1.9	WATTS

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	95	135	160	VOLTS
SCREEN VOLTAGE	95	135	120	VOLTS
CONTROL GRID VOLTAGE	-15	-20	-18	VOLTS
PEAK AF SIGNAL VOLTAGE	15	20	18	VOLTS
ZERO-SIG. PLATE CURRENT	20	37	33	MA.
ZERO-SIG. SCREEN CURRENT	4	8	6.5	MA.
MAX.-SIG. PLATE CURRENT	22	39	36	MA.
MAX.-SIG. SCREEN CURRENT	8	14	12	MA.
PLATE RESISTANCE	45 000	35 000	42 000	OHMS
TRANSCONDUCTANCE	2000	2450	2375	μMHOS
LOAD RESISTANCE	4500	4000	5000	OHMS
TOTAL HARMONIC DISTORTION	11	9	10	PER CENT
POWER OUTPUT	0.9	2	2.2	WATTS

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PLATE 480-2

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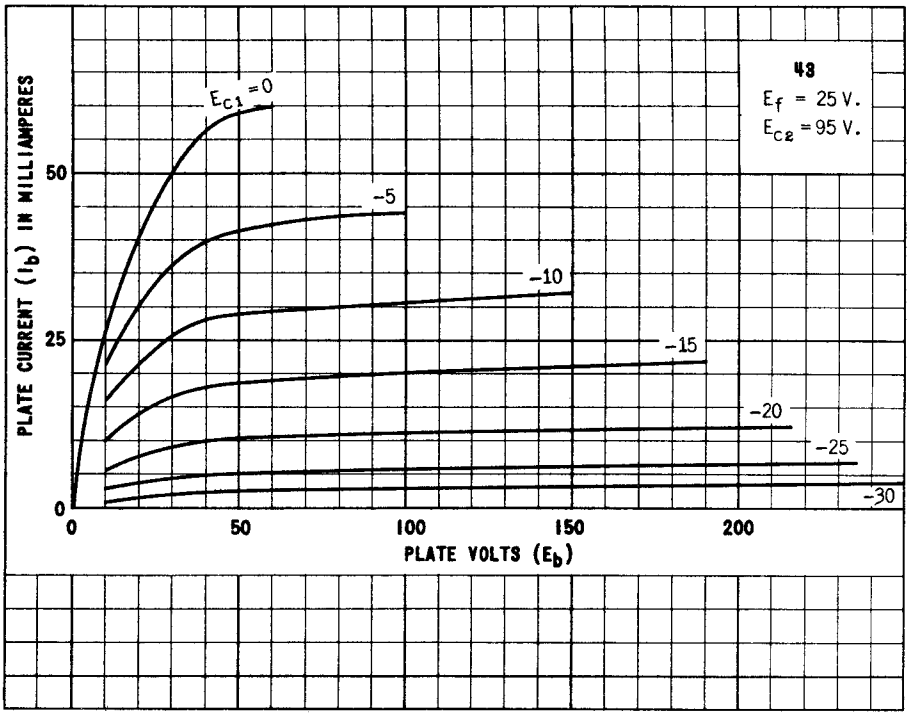

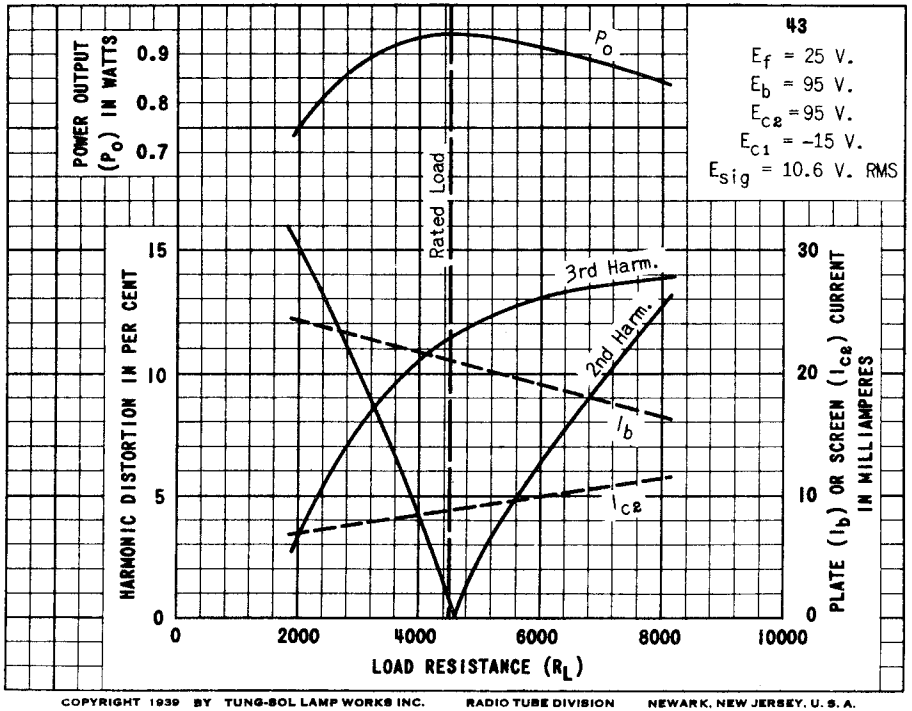

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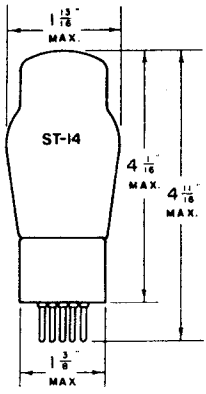


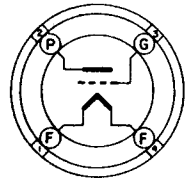
TRIODE POWER AMPLIFIER

COATED FILAMENT

2.5 VOLTS 1.5 AMPERES
AC OR DC

GLASS BULB

MEDIUM 4 PIN BASE



4D

BOTTOM VIEW

THE TUNG-SOL 45 IS A FILAMENT TYPE TRIODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AUDIO AMPLIFIERS WHERE HIGH OUTPUT AND LOW HARMONIC DISTORTION ARE DESIRED.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	180	250	275 MAX.	VOLTS
GRID VOLTAGE G	−31.5	−50	−56	VOLTS
GRID CIRCUIT RESISTANCE MAX.				
SELF BIAS	1	1	1	MEGOHM
FIXED BIAS	0.1	0.1	0.1	MEGOHM
PLATE CURRENT	31	34	36	MA.
PLATE RESISTANCE	1650	1610	1700	OHMS
TRANSCONDUCTANCE	2125	2175	2050	µMHOS
AMPLIFICATION FACTOR	3.5	3.5	3.5	
LOAD RESISTANCE	2700	3900	4600	OHMS
POWER OUTPUT	0.825	1.6	2.0	WATTS

PUSH-PULL CLASS AB_2 AMPLIFIER[T]

	FIXED BIAS	SELF BIAS	
PLATE VOLTAGE	275 MAX.	275 MAX.	VOLTS
GRID VOLTAGE G	−68		VOLTS
SELF BIAS RESISTOR		775	OHMS
ZERO-SIG. PLATE CURRENT	28	36	MA.
MAX.-SIG. PLATE CURRENT	138	90	MA.
LOAD RESISTANCE PLATE TO PLATE	3200	5060	OHMS
TOTAL HARMONIC DISTORTION	5	5	PER CENT
AVERAGE POWER INPUT GRID TO GRID	656	460	MILLIWATTS
POWER OUTPUT	18	12	WATTS

(CONTINUED NEXT PAGE)

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[G] GRID VOLTAGE MEASURED FROM MID-POINT OF AC OPERATED FILAMENT.

[T] VALUES SPECIFIED FOR TWO TUBES.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO FILAMENT	4	μμf
PLATE TO FILAMENT	3	μμf
GRID TO PLATE	7	μμf

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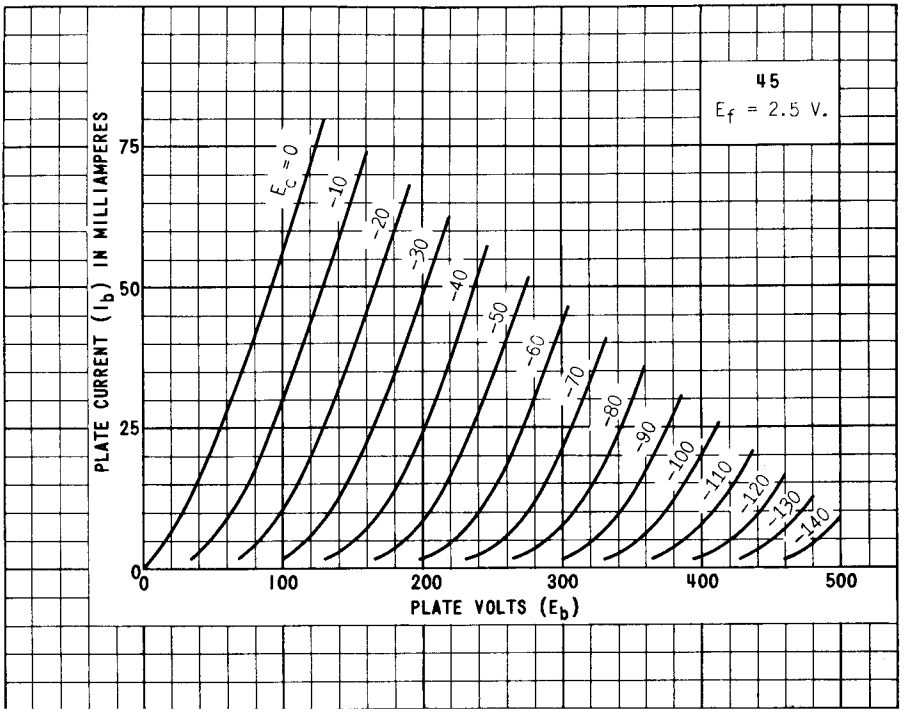

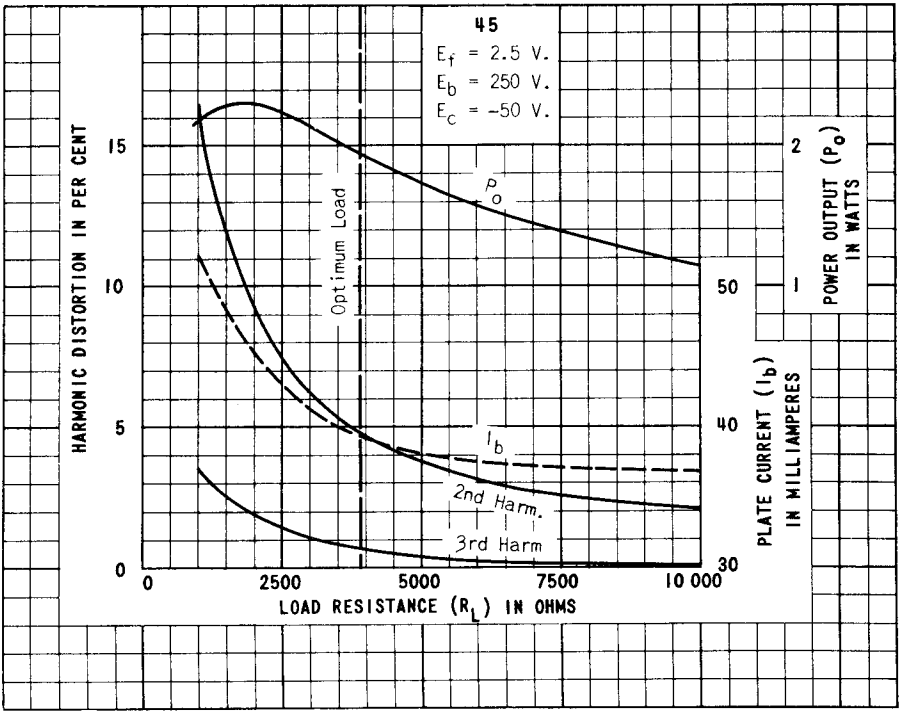

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PLATE
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1939

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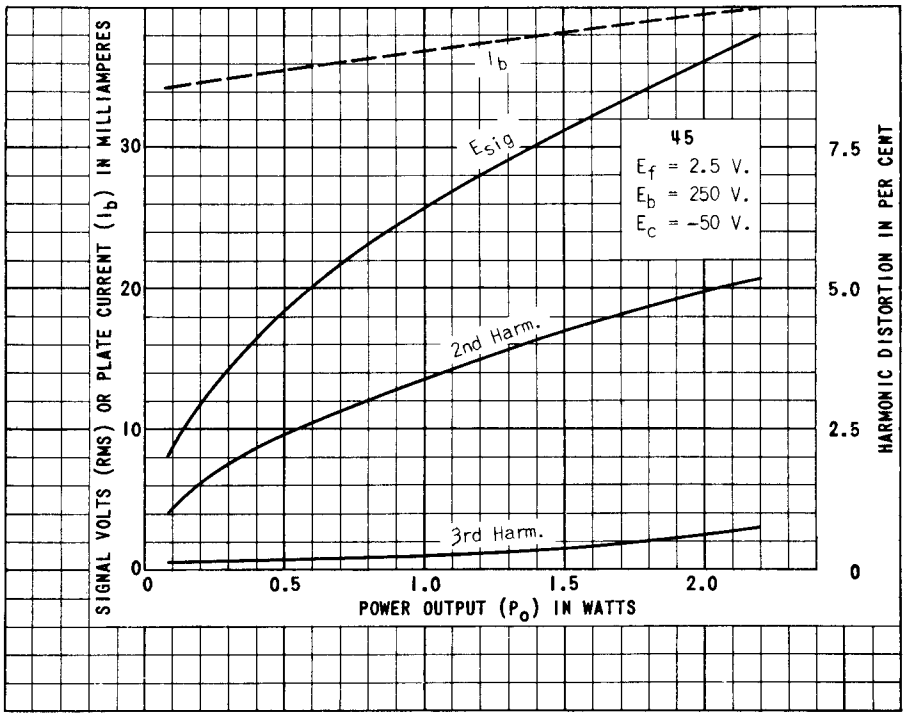

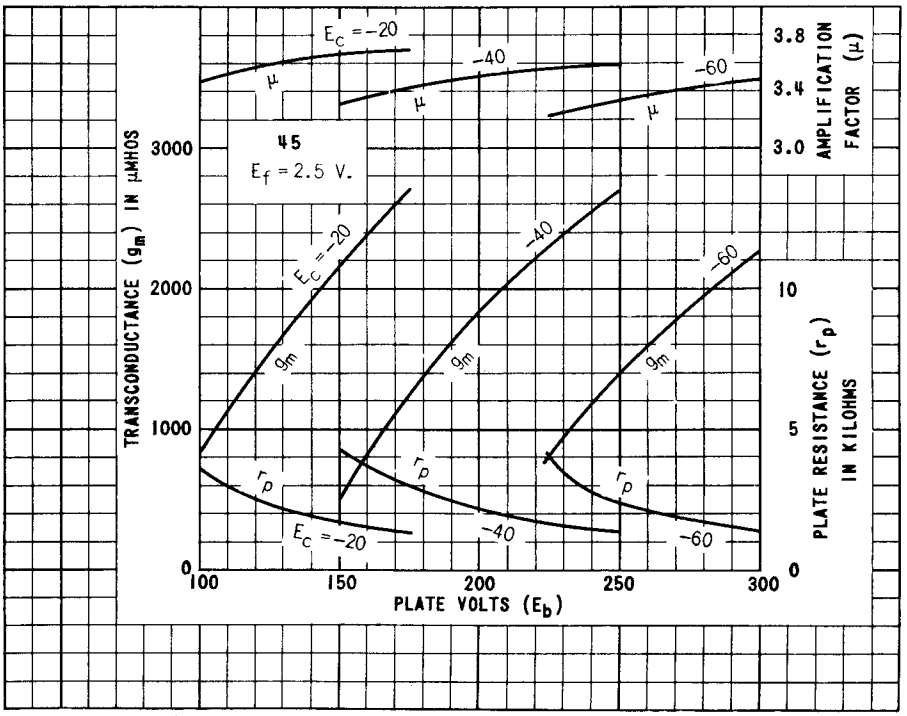

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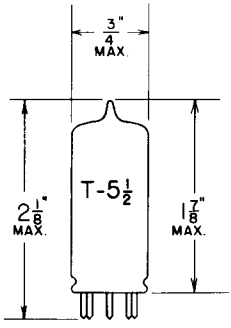
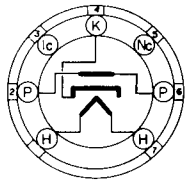


HALF-WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
45 VOLTS 0.075 AMPERE
AC OR DC



5AM-0-0

GLASS BULB

BUTTON 7 PIN BASE

THE TUNG-SOL 45Z3 IS A MINIATURE TYPE HALF WAVE POWER RECTIFIER DESIGNED FOR SERVICE IN COMPACT THREE WAY PORTABLE RECEIVERS USING MINIATURE TYPE TUBES. IT IS MADE WITHOUT A SEPARATE BASE, USING THE ELECTRODE LEADS THROUGH THE "BUTTON" STEM FOR BASE PINS.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	350	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	175	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	390	MA.
TUBE VOLTAGE DROP — AT 130 MA. DC	23	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF WAVE RECTIFIER

AC PLATE VOLTAGE (RMS)	117	VOLTS
DC OUTPUT CURRENT MAX.	65	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1188-1
FEB. 28
1942

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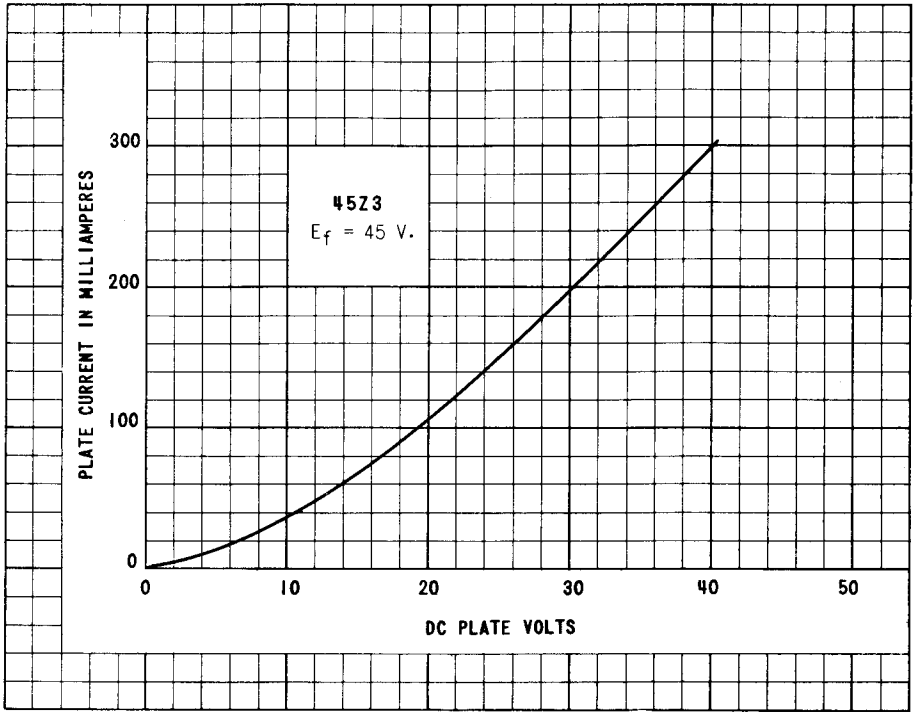
45Z3



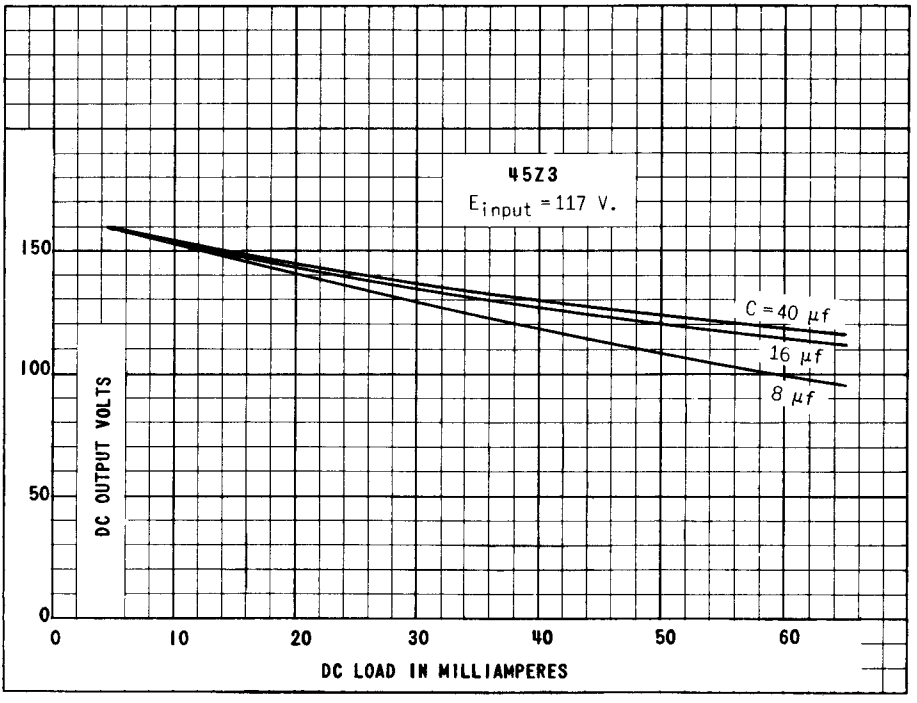


PLATE 1189-1

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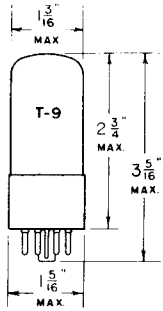
TUNG-SOL



HALF WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

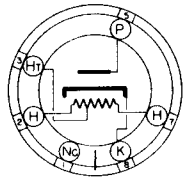
HEATER

45 VOLTS 0.15 AMPERE

AC OR DC

WITHOUT PANEL LAMP

GLASS BULB



6AD

BOTTOM VIEW

INTERMEDIATE 6 PIN OCTAL BASE

THE TUNG-SOL 45Z5GT IS DESIGNED PRIMARILY AS A POWER RECTIFIER FOR AC-DC RECEIVERS. IT FEATURES A 45 V. 150 MA. HEATER HAVING A TAP BROUGHT OUT SO THAT, WITH PROPER EXTERNAL CONNECTIONS, THE TAPPED SECTION OF THE HEATER SERVES AS A BALLAST RESISTOR FOR A PANEL LAMP. IT IS RECOMMENDED THAT THE PLATE CURRENT OF THE RECTIFIER BE PASSED THROUGH THE PANEL LAMP AND THE TAPPED SECTION OF THE HEATER, WHICH IS ACCOMPLISHED BY CONNECTING THE PLATE OF THE RECTIFIER TO THE TAP ON THE HEATER.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	600	MA.
MAXIMUM DC OUTPUT CURRENT:		
NO PANEL LAMP	100	MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	90	MA
WITH PANEL LAMP AND NO SHUNTING RESISTOR	60	MA.
MAXIMUM VALUE OF PANEL LAMP SHUNTING RESISTOR:		
FOR 70 MA. DC OUTPUT CURRENT	800	OHMS
FOR 80 MA. DC OUTPUT CURRENT	400	OHMS
FOR 90 MA. DC OUTPUT CURRENT	250	OHMS
TAPPED HEATER SECTION VOLTAGE (BETWEEN PINS #2 AND #3) WITH 0.150 AMPERES FLOWING BETWEEN PINS #2 AND #7	7.5	VOLTS
MAXIMUM VOLTAGE ACROSS TAPPED HEATER SECTION WHEN PANEL LAMP FAILS (RMS)	15.0	VOLTS
TUBE VOLTAGE DROP AT 200 MA. DC	16	VOLTS

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PLATE 860-2

SEPT. 23 1940

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45Z5 GT

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

WITH #40 OR #47 PANEL LAMP

HEATER VOLTAGE (BETWEEN PINS #2 & #7)	42.0	42.0	42.0	42.0	42.0	VOLTS
HEATER CURRENT (BETWEEN PINS #3 & #7)	0.15	0.15	0.15	0.15	0.15	AMP.
VOLTAGE ACROSS TAPPED SECTION OF HEATER (PINS #2 & #3)	5.5	5.5	5.5	5.5	5.5	VOLTS
AC PLATE VOLTAGE (RMS)	117	117	117	117	235	VOLTS
DC OUTPUT CURRENT	60	70	80	90	60	MA.
EFFECTIVE PLATE SUPPLY IMPEDANCE[MIN.A.]	15	15	15	15	100	OHMS
PANEL LAMP SHUNT RESISTANCE	–	300	150	100	–	OHMS

WITHOUT PANEL LAMP

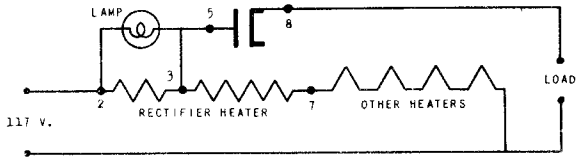
HEATER VOLTAGE (BETWEEN PINS #2 & #7)	45.0	45.0	VOLTS
HEATER CURRENT (BETWEEN PINS #3 & #7)	0.15	0.15	AMP.
VOLTAGE ACROSS TAPPED SECTION OF HEATER (PINS #2 & #3)	7.5	7.5	VOLTS
AC PLATE VOLTAGE (RMS)	235	117	VOLTS
DC OUTPUT CURRENT	100	100	MA.
EFFECTIVE PLATE SUPPLY IMPEDANCE[MIN.A]	100	15	OHMS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

THE DROP ACROSS THE SERIES RESISTANCE, IF ANY, AND ALL HEATERS SHOULD TOTAL 117 V. AT 0.15 AMPERE.

VOLTAGES SHOULD NOT BE APPLIED TO THE SOCKET WHEN TUBES ARE INSTALLED OR REMOVED.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.



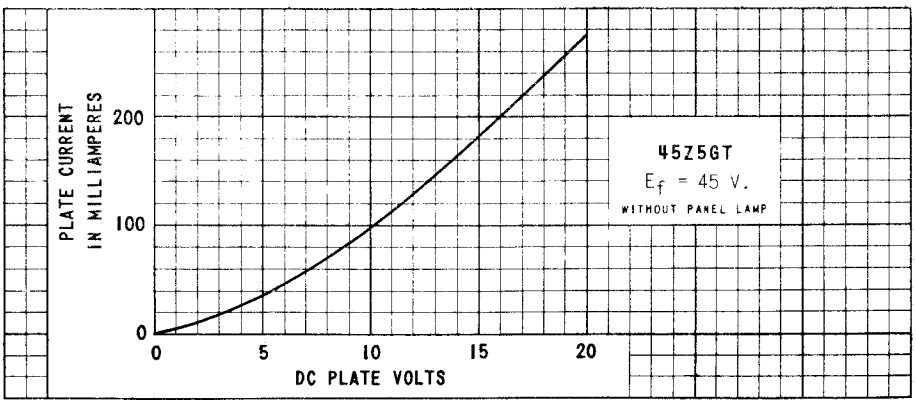


PLATE 861-2

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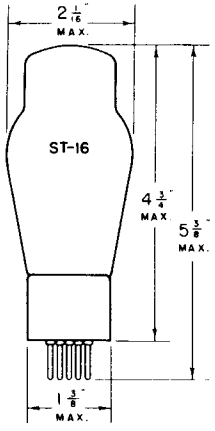
TUNG-SOL



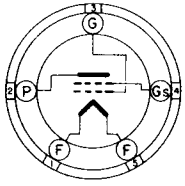
DUAL GRID POWER AMPLIFIER

COATED FILAMENT

2.5 VOLTS 1.75 AMPERES
AC OR DC

GLASS BULB

MEDIUM 5 PIN BASE



5C
BOTTOM VIEW

THE TUNG-SOL 46 IS A DUAL GRID POWER TUBE DESIGNED FOR USE IN A CLASS A OR CLASS B OUTPUT STAGE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

GRID G_5 CONNECTED TO PLATE AT SOCKET

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE [A]	-33	VOLTS
PLATE CURRENT	22	MA.
PLATE RESISTANCE	2380	OHMS
TRANSCONDUCTANCE	2350	µMHOS
AMPLIFICATION FACTOR	5.6	
LOAD RESISTANCE	6400	OHMS
POWER OUTPUT [B]	1.25	WATTS

[A] MEASURED FROM MIDPOINT OF AC OPERATED FILAMENT.

[B] APPROXIMATELY TWICE THIS VALUE IS RECOMMENDED FOR LOAD WHEN THIS TUBE IS USED AS DRIVER FOR CLASS B STAGE.

CLASS B AMPLIFIER – TWO TUBES

GRIDS CONNECTED TOGETHER AT SOCKET

PLATE VOLTAGE	300	400 MAX.	VOLTS
GRID VOLTAGE	0	0	VOLTS
ZERO-SIGNAL PLATE CURRENT	8	12	MA.
PEAK PLATE CURRENT PER TUBE	200 MAX.	200 MAX.	MA.
MAXIMUM PLATE DISSIPATION	10	10	WATTS
LOAD RESISTANCE PLATE TO PLATE	5200	5800	OHMS
AVERAGE POWER INPUT GRID #0 GRID	0.95	0.65	WATT
POWER OUTPUT	16	20	WATTS

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PLATE 474-1

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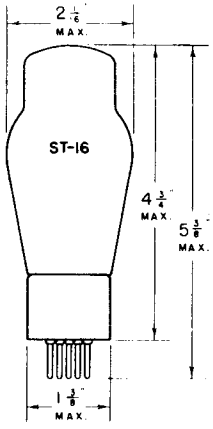
TUNG-SOL



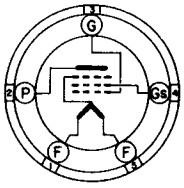
PENTODE POWER AMPLIFIER

COATED FILAMENT

2.5 VOLTS 1.75 AMPERES
AC OR DC

GLASS BULB

MEDIUM 5 PIN BASE



5B

BOTTOM VIEW

THE TUNG-SOL 47 IS A FILAMENT TYPE OUTPUT POWER PENTODE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	250 MAX.	VOLTS
SCREEN VOLTAGE	250 MAX.	VOLTS
CONTROL GRID VOLTAGE [A]	-16.5	VOLTS
PLATE CURRENT	31	MA.
SCREEN CURRENT	6	MA.
PLATE RESISTANCE	60 000	OHMS
TRANSCONDUCTANCE	2500	µMHOS
AMPLIFICATION FACTOR	150	
LOAD RESISTANCE	7000	OHMS
POWER OUTPUT [B]	2.7	WATTS

[A] MEASURED FROM MIDPOINT OF AC OPERATED FILAMENT.

[B] 6% TOTAL HARMONIC DISTORTION.

PLATE 475-1

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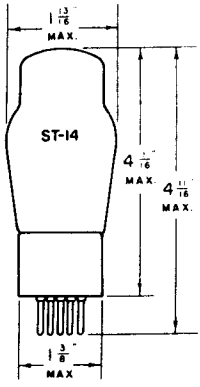


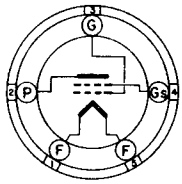
DUAL GRID POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.12 AMPERE
DC

GLASS BULB

MEDIUM 5 PIN BASE



5C

BOTTOM VIEW

THE TUNG-SOL 49 IS A DUAL GRID POWER TUBE DESIGNED FOR USE IN A CLASS A OR CLASS B OUTPUT STAGE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

GRID G_5 CONNECTED TO PLATE AT SOCKET

PLATE VOLTAGE	135 MAX.	VOLTS
GRID VOLTAGE [A]	-20	VOLTS
PLATE CURRENT	6.0	MA.
PLATE RESISTANCE	4175	OHMS
TRANSCONDUCTANCE	1125	µMHOS
AMPLIFICATION FACTOR	4.7	
LOAD RESISTANCE	11000 [B]	OHMS
POWER OUTPUT	0.170	WATT

[A] RETURN TO NEGATIVE FILAMENT (PIN #5)

[B] APPROXIMATELY TWICE THIS VALUE IS RECOMMENDED FOR LOAD AS DRIVER FOR CLASS B STAGE

CLASS B_2 AMPLIFIER – TWO TUBES – PUSH-PULL

GRIDS CONNECTED TOGETHER AT SOCKET

PLATE VOLTAGE	135	180 MAX.	VOLTS
GRID VOLTAGE [E]	0	0	VOLTS
PEAK AF SIGNAL VOLTAGE PER TUBE [C]	35	35	VOLTS
ZERO-SIGNAL PLATE CURRENT PER TUBE [D]	1.3	2	MA.
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	8000	12000	OHMS
POWER OUTPUT APPROX.	2.3	3.5	WATTS

[C] FOR POWER OUTPUT SHOWN

[D] MAXIMUM PEAK PLATE CURRENT IS 50 MA.

[E] RETURN TO NEGATIVE FILAMENT (PIN #5)

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PLATE 907-2

NOV. 8 1940

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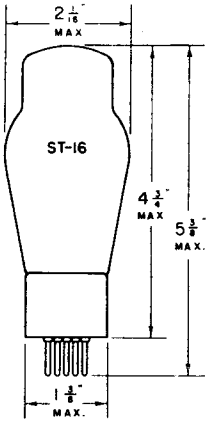
TUNG-SOL

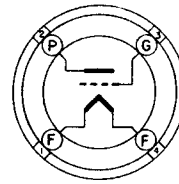


TRIODE POWER AMPLIFIER

COATED FILAMENT

7.5 VOLTS 1.25 AMPERES
AC OR DC

GLASS BULB



4D

BOTTOM VIEW

MEDIUM 4 PIN BASE

THE TUNG-SOL 50 IS A FILAMENT TYPE POWER OUTPUT TUBE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	300	350	400	450	VOLTS
GRID VOLTAGE[A]	-54	-63	-70	-84	VOLTS
PLATE CURRENT	35	45	55	55	MA.
PLATE RESISTANCE	2000	1900	1800	1800	OHMS
TRANSCONDUCTANCE	1900	2000	2100	2100	μMHOS
AMPLIFICATION FACTOR	3.8	3.8	3.8	3.8	
LOAD RESISTANCE	4600	4100	3670	4350	OHMS
POWER OUTPUT	1.6	2.4	3.4	4.6	WATTS

[A] GRID VOLTAGE MEASURED FROM MID-POINT OF AC OPERATED FILAMENT.

SELF BIAS IS RECOMMENDED IN ALL CASES. THE GRID CIRCUIT RESISTANCE SHOULD NOT EXCEED 10 000 OHMS.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO FILAMENT	4.2	μμf
PLATE TO FILAMENT	3.4	μμf
GRID TO PLATE	7.1	μμf

PLATE
908-2

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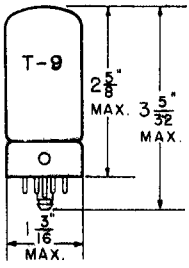
TUNG-SOL

BEAM PENTODE

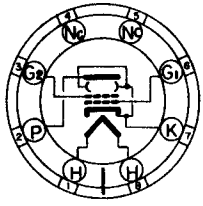


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCKING-IN
8 PIN BASE

THE 50A5 IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC/DC RECEIVERS. IT DELIVERS HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	50	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	50	50	VOLTS
HEATER CURRENT	150	150	MA.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	110	VOLTS
GRID #1 VOLTAGE	-7.5	-8	VOLTS
PEAK AF SIGNAL VOLTAGE	7.5	8	VOLTS
GRID CIRCUIT RESISTANCE (MAX.):			
FOR FIXED BIAS	0.1	0.1	MEGOHM
FOR CATHODE BIAS	0.5	0.5	MEGOHM
ZERO SIGNAL PLATE CURRENT	49	50	MA.
ZERO SIGNAL GRID #2 CURRENT (NOMINAL)	4	1.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	55	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (NOMINAL)	11	6	MA.
PLATE RESISTANCE (APPROX.)	10 000	35 000	OHMS
TRANSCONDUCTANCE	8 200	8 250	μMHOS
LOAD RESISTANCE	2 000	3 000	OHMS
TOTAL HARMONIC DISTORTION	10	10	PERCENT
POWER OUTPUT	2.2	4.7	WATTS

SIMILAR TYPE REFERENCE: *Ratings and characteristics identical to 50L6GT. Except for heater ratings identical to 25L6GT, somewhat similar to 35L6GT.*

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PLATE 1864
AUG. 1, 1947

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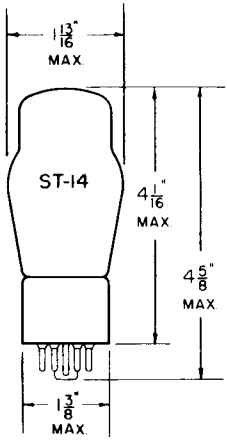
TUNG-SOL

DOUBLE DIODE

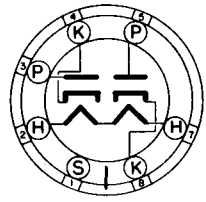


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM SHELL
7 PIN OCTAL
7Q

THE 50AX6G IS A FULL-WAVE HIGH VACUUM RECTIFIER DESIGNED FOR DAMPER SERVICE IN TELEVISION DEFLECTION CIRCUITS. IT CAN ALSO BE USED IN CONVENTIONAL RECTIFIER APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	50	VOLTS
HEATER CURRENT	0.3	AMP.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE (PER PLATE):		
RECTIFIER SERVICE	1250	VOLTS
DAMPER SERVICE[A]	2000	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	600	MA.
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE	125	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 250 MA. EACH PLATE)	21	VOLTS

[A] THE DURATION OF THE VOLTAGE PULSE MUST NOT EXCEED 15% OF ONE SCANNING CYCLE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER - CONDENSER INPUT

AC VOLTAGE EACH PLATE (RMS)	350	VOLTS
DC OUTPUT CURRENT	250	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE[B]	145	OHMS
DC OUTPUT VOLTAGE AT INPUT TO FILTER (APPROX.):		
AT HALF-LOAD CURRENT OF 125 MA.	395	VOLTS
AT FULL-LOAD CURRENT OF 250 MA.	350	VOLTS

[B] WHEN FILTER CAPACITORS LARGER THAN 40 μf ARE USED IT MAY BE NECESSARY TO INCREASE PLATE SUPPLY IMPEDANCE ABOVE THE VALUE SHOWN.

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PLATE
2440
JULY 1
1950

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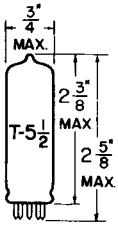
TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

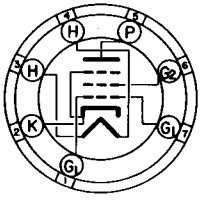


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BZ

THE 50B5 IS A BEAM POWER AMPLIFIER IN THE MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES *

GRID TO PLATE: (G_1 TO P)	0.6	$\mu\mu f$
INPUT: G_1 TO ($H+K+G_2+G_3$)	13.0	$\mu\mu f$
OUTPUT: P TO ($H+K+G_2+G_3$)	8.5	$\mu\mu f$

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM GRID #2 VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	6.0 ←	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM POSITIVE GRID #1 VOLTAGE*	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE: ←		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE		
CATHODE BIAS	0.5	MEGOHM
FIXED BIAS	0.1	MEGOHM
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT)	220 ←	°C

* INDICATES AN ADDITION.
→ INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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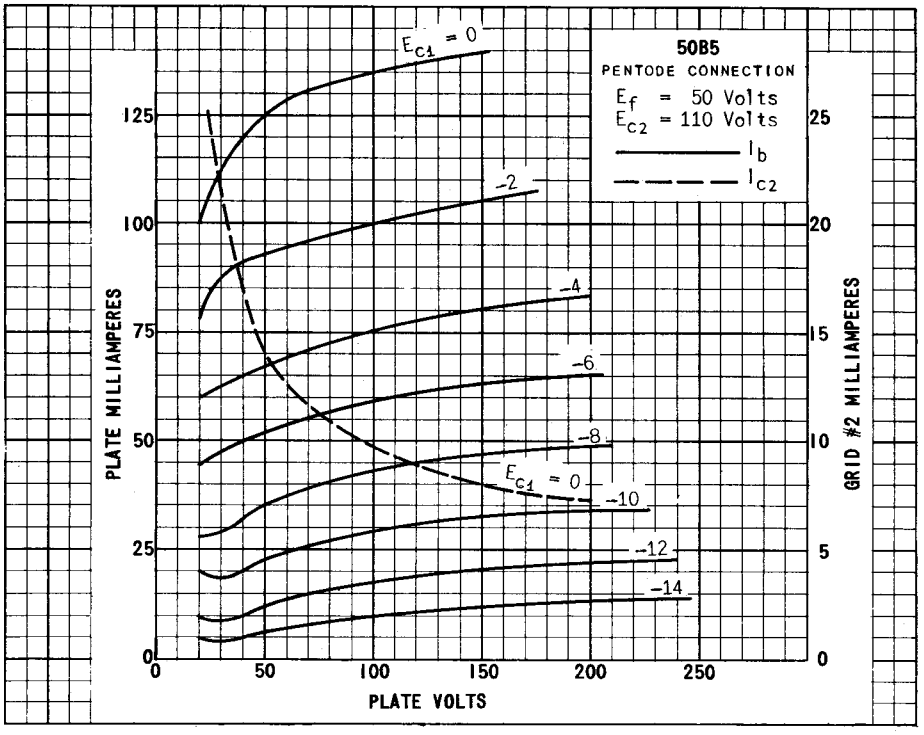
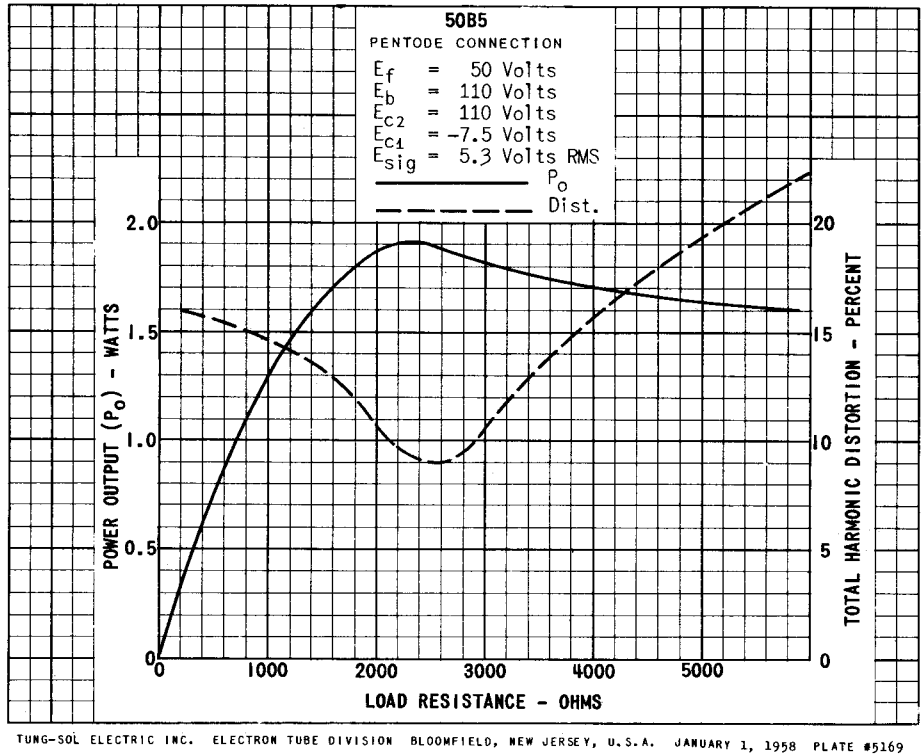
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	50	VOLTS
HEATER CURRENT	150	MA.
PLATE VOLTAGE	120 ←	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−8 ←	VOLTS
PEAK AF GRID #1 VOLTAGE	8 ←	VOLTS
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	8.5	MA.
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.3	WATTS

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 5085 ARE IDENTICAL WITH THOSE OF TYPES 12C5, 12CU5, 17C5, 25C5, AND 50C5.


50B5
PENTODE CONNECTION
E_f = 50 Volts
E_{c2} = 110 Volts
I_b
I_{c2}
E_{c1} = 0
-2
-4
-6
-8
-10
-12
-14
PLATE MILLIAMPERES
GRID #2 MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
125
150
200
250
5
10
15
20


50B5
PENTODE CONNECTION
E_f = 50 Volts
E_b = 110 Volts
E_{c2} = 110 Volts
E_{c1} = -7.5 Volts
E_{sig} = 5.3 Volts RMS
P_o
Dist.
POWER OUTPUT (P_o) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE - OHMS
0
0.5
1.0
1.5
2.0
1000
2000
3000
4000
5000
5
10
15
20

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

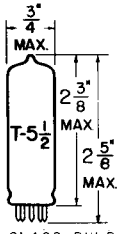
HEATER

50±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION

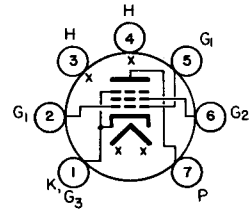
FOR SERIES STRING



GLASS BULB

MINIATURE BUTTON 7 PIN BASE E7-1 OUTLINE DRAWING

JEDEC 5-3



BOTTOM VIEW

BASING DIAGRAM

JEDEC 7CV

THE 50C5 IS A BEAM POWER AMPLIFIER USING THE 7 PIN MINIATURE CONSTRUCTION. BECAUSE OF ITS HIGH POWER SENSITIVITY AT LOW PLATE-SCREEN VOLTAGE, IT IS PARTICULARLY ADAPTABLE TO AC/DC RECEIVER APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITH NO EXTERNAL SHIELD

GRID TO PLATE: G_1 TO P	0.6	μμf
INPUT: G_1 TO (H+K&G_3+G_2)	13.0	μμf
OUTPUT: P TO (H+K&G_3+G_2)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50±10%	VOLTS
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM PLATE DISSIPATION	7	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE		
(AT HOTTEST POINT ON BULB SURFACE)	220	°C

ALL ELECTRICAL DATA EXCEPT HEATER CHARACTERISTICS FOR TYPE 50C5 ARE IDENTICAL WITH THOSE OF TYPES 12C5, 12CU5, 17C5, 25C5, AND 50B5.

→INDICATES A CHANGE.

CONTINUED ON FOLLOWING PAGE

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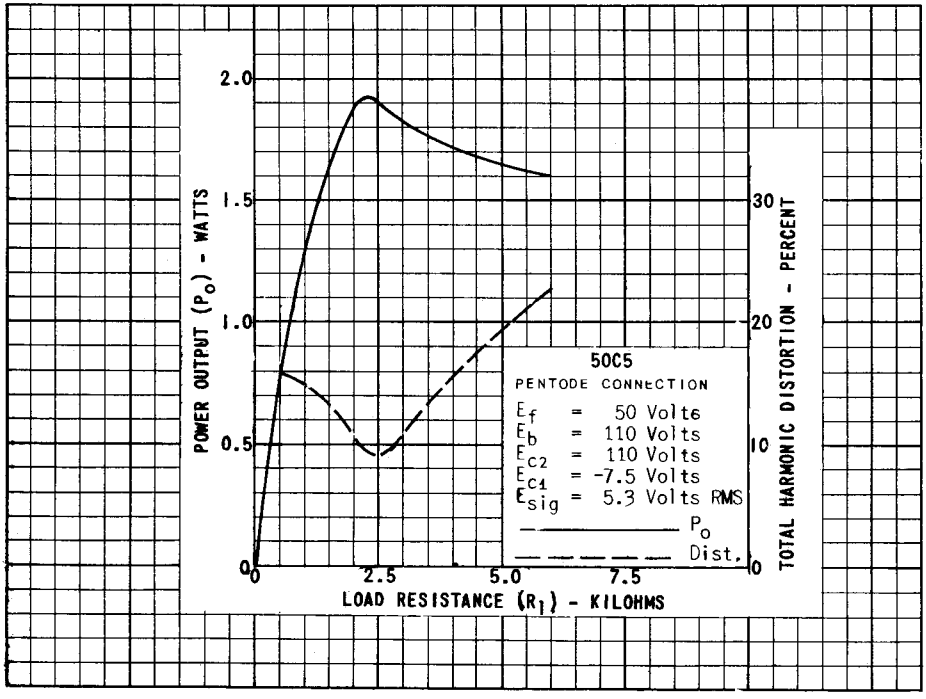
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

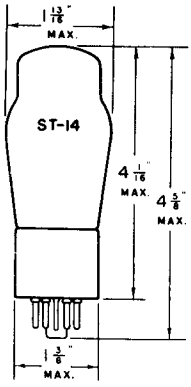
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	−8	VOLTS
PEAK AF GRID #1 VOLTAGE	8	VOLTS
ZERO-SIGNAL PLATE CURRENT	49	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	MA.
MAXIMUM SIGNAL PLATE CURRENT	50	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	8.5	MA.
PLATE RESISTANCE (APPROX.)	10 000	OHMS
TRANSCONDUCTANCE	7 500	μMHOS
LOAD RESISTANCE	2 500	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	2.3	WATTS



TUNG-SOL



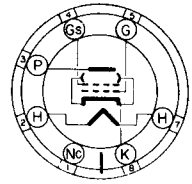
BEAM POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
50.0 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

MEDIUM 7 PIN OCTAL BASE



G-7AC

BOTTOM VIEW

THE TUNG-SOL 50C6G IS A BEAM POWER AMPLIFIER, DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC-DC RECEIVERS. IT FEATURES HIGH POWER OUTPUT WITH LOW SUPPLY VOLTAGES.

RATINGS

MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM SCREEN VOLTAGE	135	VOLTS
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM SCREEN DISSIPATION	1.75	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	200	VOLTS
SCREEN VOLTAGE	135	135	VOLTS
CONTROL GRID VOLTAGE [A]	-13.5	-14	VOLTS
PEAK AF SIGNAL VOLTAGE	13.5	14	VOLTS
ZERO-SIGNAL PLATE CURRENT	58	61	MA.
ZERO-SIGNAL SCREEN CURRENT (NOMINAL)	3.5	2.2	MA.
MAXIMUM-SIGNAL PLATE CURRENT	60	66	MA.
MAXIMUM-SIGNAL SCREEN CURRENT (NOMINAL)	11.5	9	MA.
PLATE RESISTANCE APPROX.	9300	18300	OHMS
TRANSCONDUCTANCE	7000	7100	μMHOS
LOAD RESISTANCE	2000	2600	OHMS
TOTAL HARMONIC DISTORTION	10	10	PER CENT
POWER OUTPUT	3.6	6.0	WATTS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT, UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 0.5 MEGOHM FOR SELF-BIAS OPERATION AND 0.1 MEGOHM FOR FIXED BIAS OPERATION.

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JUNE 6 1941

PLATE 1061-1

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

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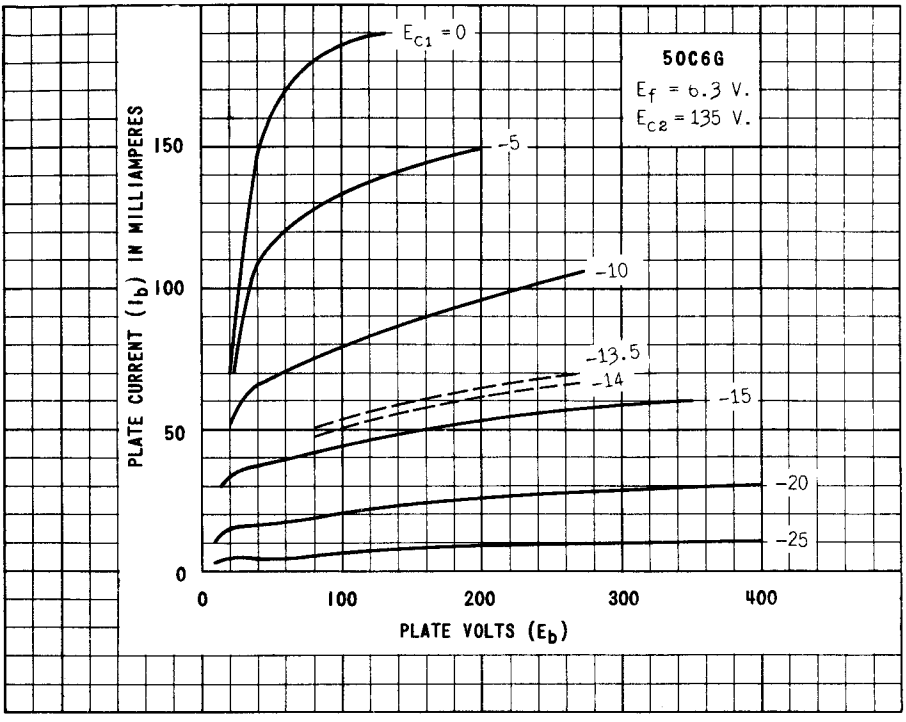
50C6G



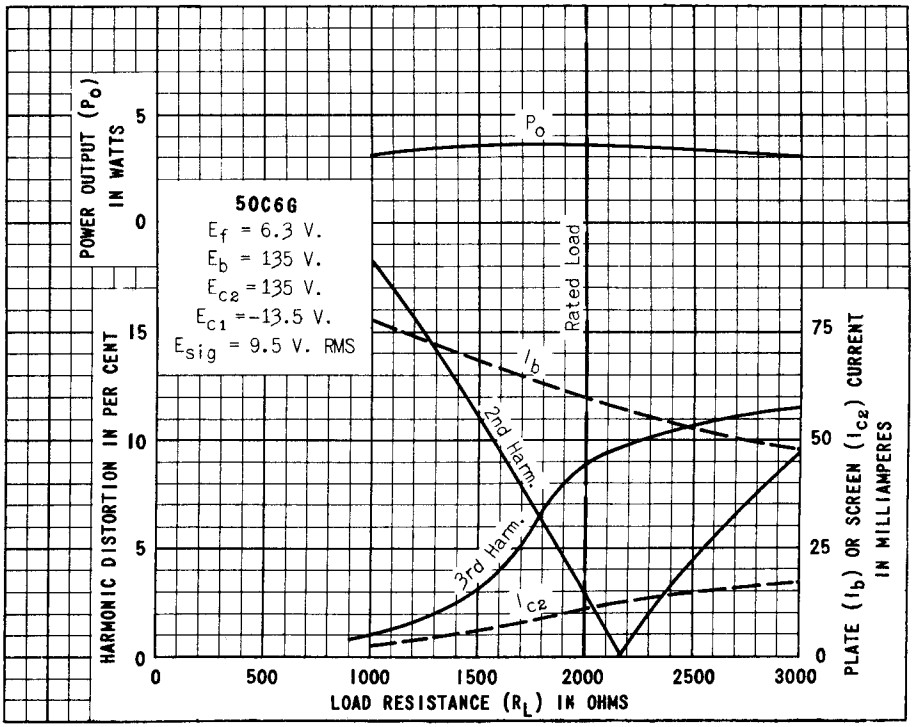


PLATE
1062-1

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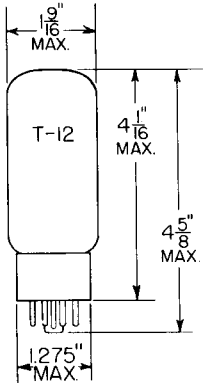
TUNG-SOL

BEAM PENTODE

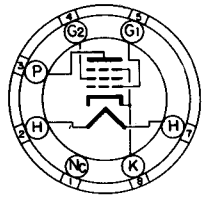


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SHORT MEDIUM SHELL
7 PIN OCTAL
7S

THE 50C6GA IS A BEAM POWER AMPLIFIER HAVING HIGH POWER SENSITIVITY AND HIGH POWER OUTPUT AT COMPARATIVELY LOW DC SUPPLY VOLTAGES. EXCEPT FOR ITS T-12 ENVELOPE THE 50C6GA IS IDENTICAL TO THE 50C6G.

RATINGS
INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	180	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	180	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 SUPPLY VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	SEE RATING CHART	
MAXIMUM PLATE DISSIPATION	12.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.75	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
SELF BIAS	0.5	MEGOHM

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TUNG-SOL

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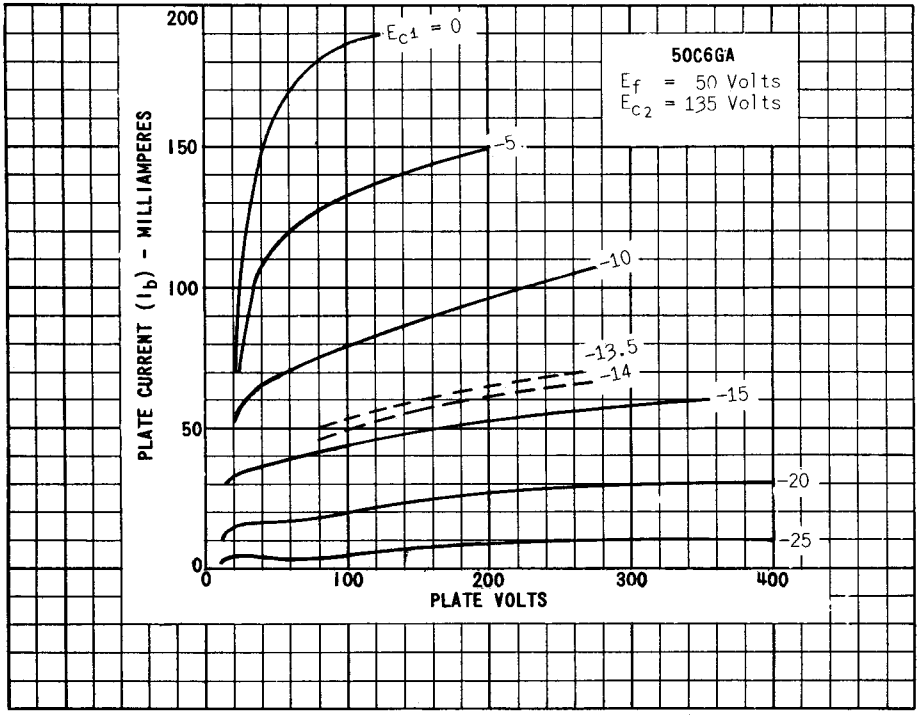
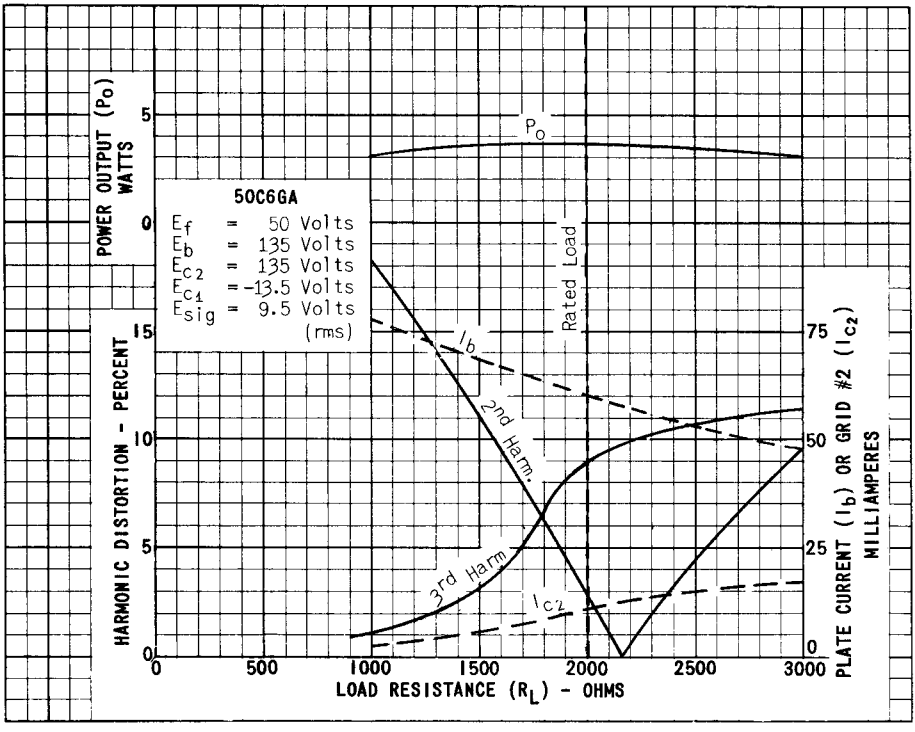
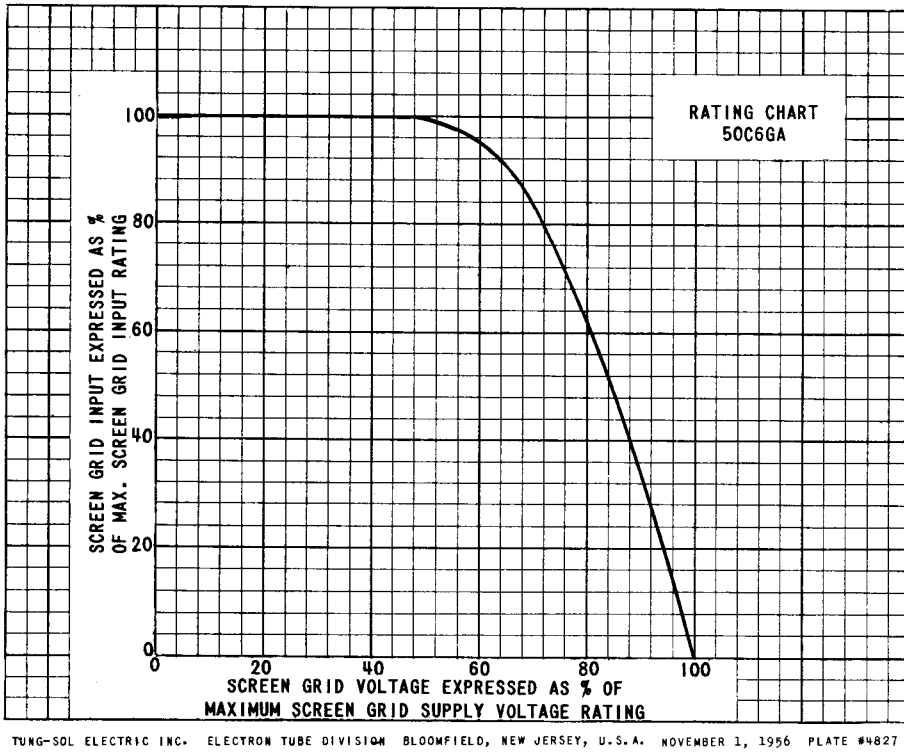
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	135	200	VOLTS
GRID #2 VOLTAGE	135	135	VOLTS
GRID #1 VOLTAGE	-13.5	-14	VOLTS
PEAK AF GRID #1 VOLTAGE	13.5	14	VOLTS
ZERO SIGNAL PLATE CURRENT	58	61	MA.
MAXIMUM SIGNAL PLATE CURRENT	60	66	MA.
ZERO SIGNAL GRID #2 CURRENT	3.5	2.2	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11.5	9	MA.
TRANSCONDUCTANCE	7 000	7 100	μMHOS
PLATE RESISTANCE (APPROX.)	9 300	18 300	OHMS
LOAD RESISTANCE	2 000	2 600	OHMS
MAXIMUM SIGNAL POWER OUTPUT	3.6	6	WATTS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT




POWER OUTPUT (P_o) WATTS
HARMONIC DISTORTION - PERCENT
PLATE CURRENT (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
LOAD RESISTANCE (R_L) - OHMS
50C6GA
E_f = 50 Volts
E_b = 135 Volts
E_{c2} = 135 Volts
E_{c1} = -13.5 Volts
E_{sig} = 9.5 Volts (rms)
P_o
Rated Load
I_b
2nd Harm.
3rd Harm
I_{c2}
0
500
1000
1500
2000
2500
3000
0
5
0
15
10
5
0
75
50
25
0


RATING CHART
50C6GA
SCREEN GRID INPUT EXPRESSED AS % OF MAX. SCREEN GRID INPUT RATING
SCREEN GRID VOLTAGE EXPRESSED AS % OF MAXIMUM SCREEN GRID SUPPLY VOLTAGE RATING
0
20
40
60
80
100

TUNG-SOL

PENTODE

MINIATURE TYPE

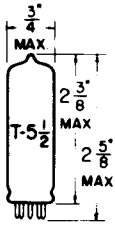
COATED UNIPOTENTIAL CATHODE

HEATER

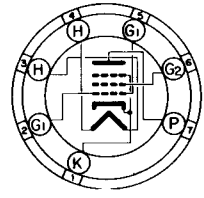
50 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE

7CV

THE 50CA5 IS A BEAM PENTODE USING THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO FREQUENCY POWER OUTPUT STAGE OF TELEVISION AND RADIO RECEIVERS. IT FEATURES HIGH POWER SENSITIVITY AT RELATIVELY LOW PLATE AND SCREEN VOLTAGES. EXCEPT FOR HEATER RATINGS, IT IS IDENTICAL TO THE 6AC5.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID #1 TO PLATE	0.5	μμf
INPUT	15	μμf
OUTPUT	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
DC	100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM PLATE VOLTAGE	130	VOLTS
MAXIMUM GRID #2 VOLTAGE	130	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.0	WATTS
MAXIMUM GRID #2 DISSIPATION	1.4	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	180	°C

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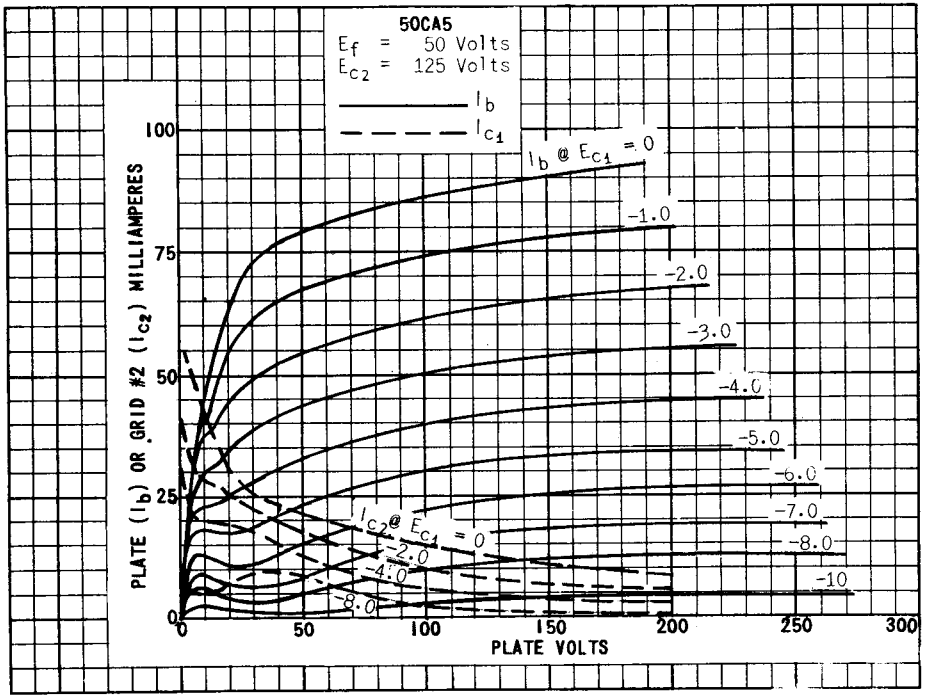
TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

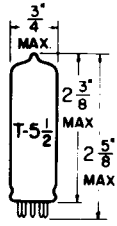
HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	110	125	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-4.0	-4.5	VOLTS
PEAK AF GRID #1 VOLTAGE	4.0	4.5	VOLTS
PLATE RESISTANCE (APPROX.)	16 000	15 000	OHMS
TRANSCONDUCTANCE	8 100	9 200	μMHOS
ZERO-SIGNAL PLATE CURRENT	32	37	MA.
MAXIMUM SIGNAL PLATE CURRENT (APPROX.)	31	36	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	4.0	MA.
MAXIMUM SIGNAL GRID #2 CURRENT (APPROX.)	7.5	11	MA.
LOAD RESISTANCE	3 500	4 500	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	5	6	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.1	1.5	WATTS



TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB

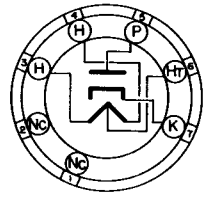
COATED UNIPOTENTIAL CATHODE

HEATER

50±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
7 PIN BASE
5BQ

THE 50DC4 IS A HALF-WAVE RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN LINE-OPERATED EQUIPMENT HAVING SERIES-CONNECTED HEATERS AND THE HEATER IS TAPPED TO PERMIT OPERATION OF A PANEL LAMP.

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

RECTIFIER SERVICE

HEATER VOLTAGE	50±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	330	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	720	MA.
MAXIMUM DC OUTPUT CURRENT		
WITHOUT PANEL LAMP	120	MA.
WITH PANEL LAMP AND SHUNTING RESISTOR	110	MA.
WITH PANEL LAMP AND NO SHUNTING RESISTOR	70	MA.
MAXIMUM HEATER-TAP VOLTAGE WHEN PANEL LAMP FAILS, RMS	16.5	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	330	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	330	VOLTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

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TUNG-SOL

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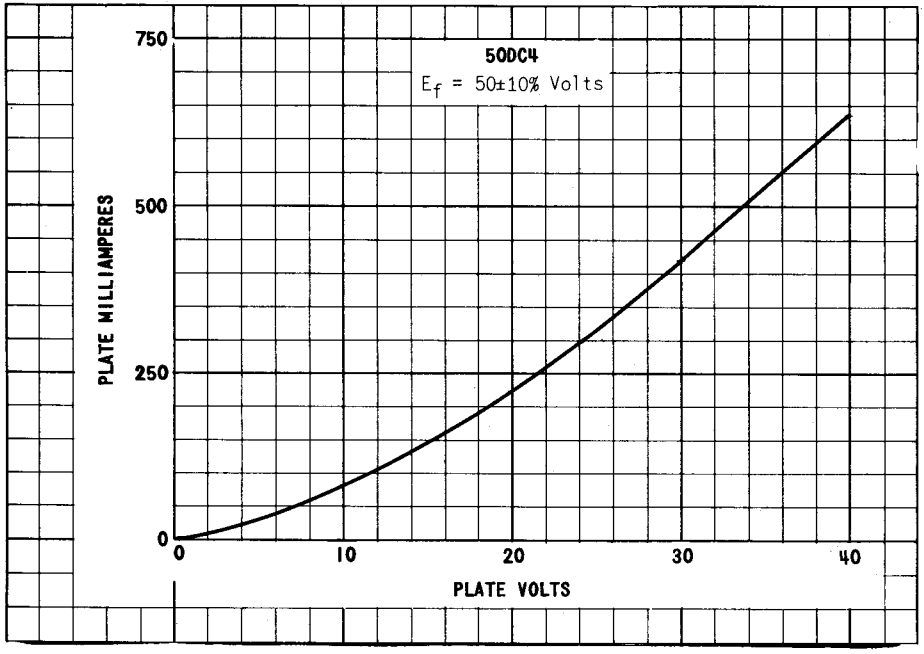
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER
WITH PANEL LAMP #40 OR #47

HEATER VOLTAGE (PIN 3 TO PIN 4)	45	45	45	45	VOLTS
HEATER-TAP VOLTAGE (PIN 4 TO PIN 6)	5.5	5.5	5.5	5.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 6)	150	150	150	150	MA.
AC PLATE-SUPPLY VOLTAGE, RMS	117	117	117	117	VOLTS
FILTER INPUT CAPACITOR	40	40	40	40	μf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	15	15	15	15	OHMS
PANEL-LAMP SHUNTING RESISTOR	450	200	100	75	OHMS
DC OUTPUT CURRENT	70	80	90	100	MA.

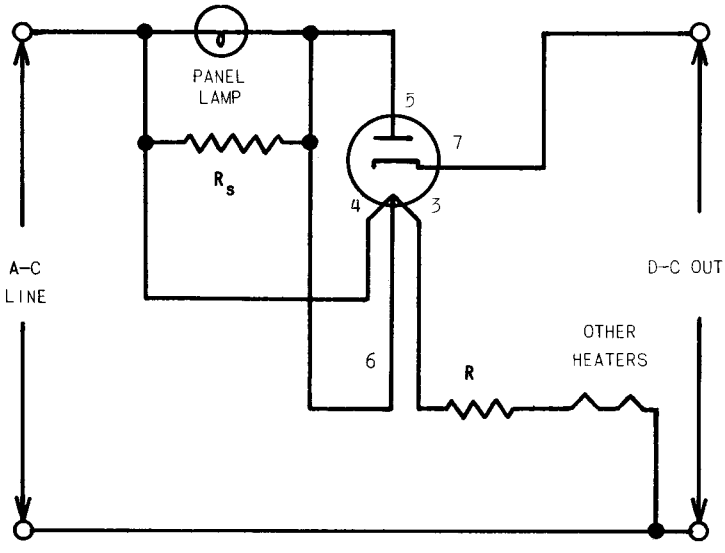
HALF-WAVE RECTIFIER
WITHOUT PANEL LAMP

HEATER VOLTAGE	50±10%	VOLTS
HEATER CURRENT	0.15	AMP.
HEATER VOLTAGE(PIN 3 TO PIN 4)	50	VOLTS
HEATER-TAP VOLTAGE (PIN 4 TO PIN 6)	7.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 4)	150	MA.
AC PLATE-SUPPLY VOLTAGE, RMS	117	VOLTS
FILTER INPUT CAPACITOR	40	μf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	15	OHMS
DC OUTPUT CURRENT	110	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT (APPROX.)		
FOR DC OUTPUT CURRENT OF 55 MA.	130	VOLTS
FOR DC OUTPUT CURRENT OF 110 MA.	110	VOLTS
TUBE VOLTAGE DROP I_b= 240 MA. DC	21	VOLTS

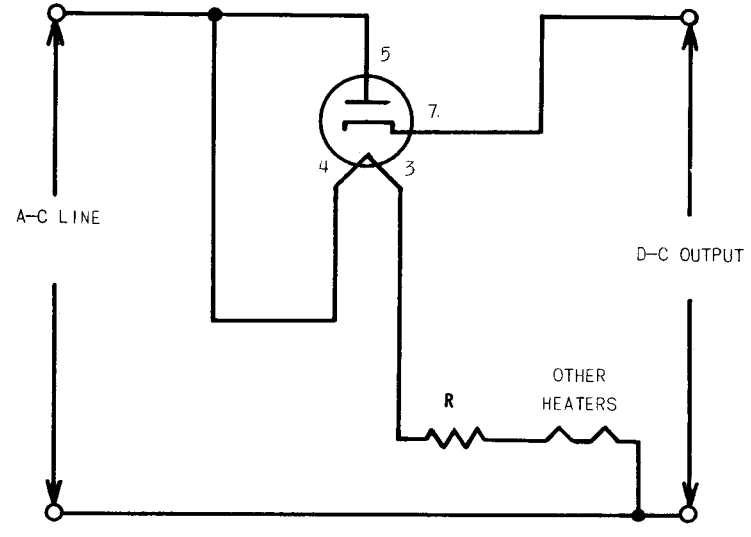


TUNG-SOL

TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



R_s = PANEL-LAMP SHUNTING RESISTOR
DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL OF ALL RATED HEATER VOLTAGES



TYPICAL CIRCUIT FOR OPERATION WITHOUT PANEL LAMP

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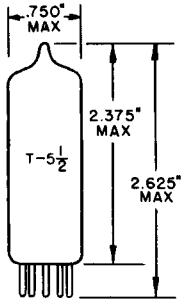
TUNG-SOL

PENTODE

MINIATURE TYPE

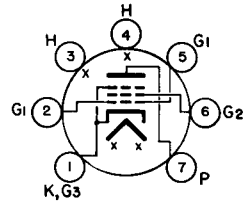


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

FOR USE IN
AUDIO OUTPUT STAGES OF
RADIO AND TV RECEIVERS
AND PHONOGRAPHS

UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CV

THE 50EH5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT HAS BEEN SPECIFICALLY DESIGNED FOR USE IN THE AUDIO OUTPUT STAGE OF RADIO AND TELEVISION RECEIVERS AND PHONOGRAPHS. EXCEPT FOR HEATER CHARACTERISTICS AND RATINGS, IT IS IDENTICAL TO THE 6EH5, 12EH5 AND THE 25EH5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.65	pf
GRID 1 TO CATHODE & GRID 3, HEATER & GRID 2	17	pf
PLATE TO CATHODE & GRID 3, HEATER & GRID 2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50	VOLTS	150	MA.
HEATER SUPPLY LIMITS:				
CURRENT OPERATION			150 ± 10	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			200 [B]	VOLTS

[B] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AMPLIFIER

PLATE VOLTAGE	→ 150	VOLTS
GRID 2 (SCREEN-GRID) VOLTAGE	→ 130	VOLTS
PLATE DISSIPATION	→ 5.5	WATTS
GRID 2 INPUT	→ 2	WATTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	220	°C
GRID 1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

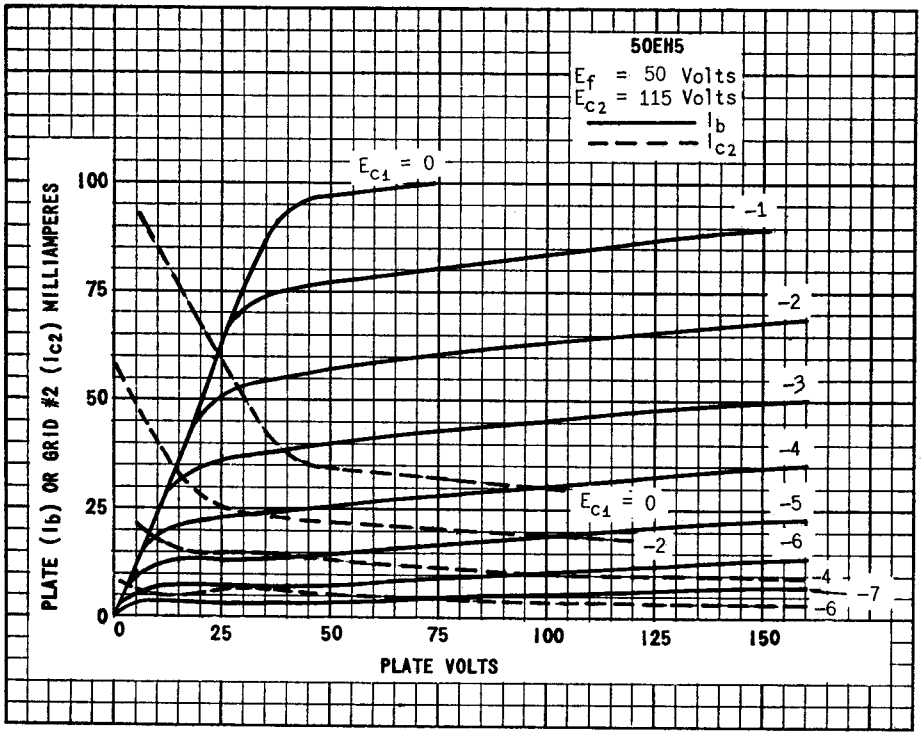
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID 2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID 1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	42	MA.
SIGNAL PLATE CURRENT (MAX.)	42	MA.
ZERO-SIGNAL GRID 2 CURRENT	11.5	MA.
SIGNAL GRID 2 CURRENT (MAX.)	14.5	MA.
TRANSCONDUCTANCE	14,600	μMHOS
PLATE RESISTANCE (APPROX.)	11,000	OHMS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	7	PERCENT
SIGNAL POWER OUTPUT (MAX.)	1.4	WATTS

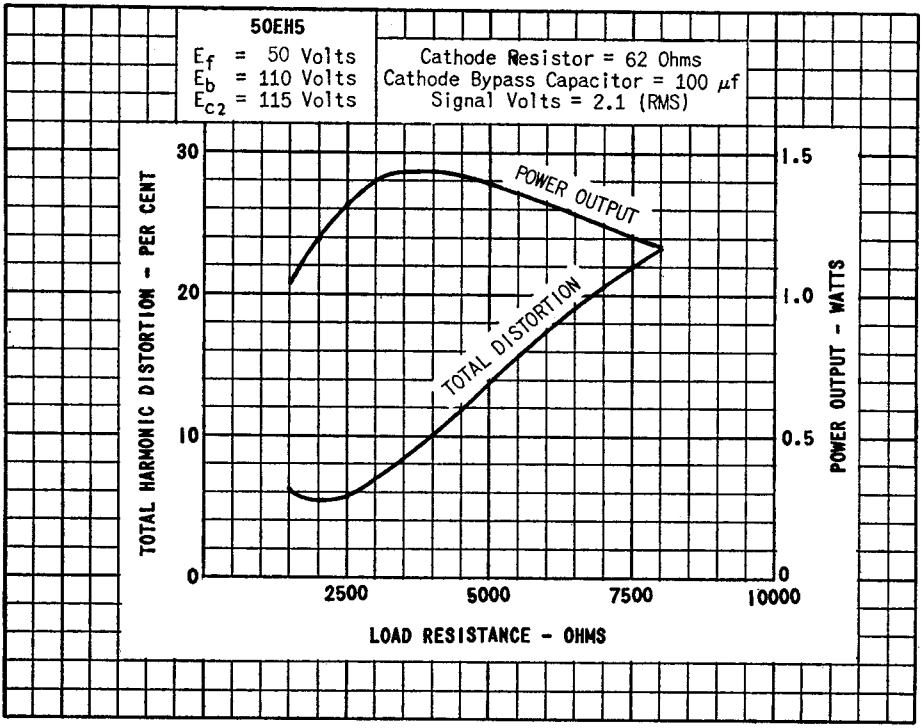
PUSH-PULL AF POWER AMPLIFIER - CLASS AB1

VALUES ARE FOR TWO TUBES

PLATE SUPPLY VOLTAGE	140	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR	68	OHMS
PEAK AF GRID 1 TO GRID 1 VOLTAGE	9.4	VOLTS
ZERO-SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL GRID 2 CURRENT	11	MA.
MAX.-SIGNAL GRID 2 CURRENT	17.7	MA.
EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE)	6000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAX.-SIGNAL POWER OUTPUT	3.8	WATTS.

→ INDICATES A CHANGE.

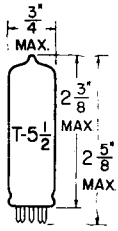

50EH5
E_f = 50 Volts
E_{c2} = 115 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} = 0
-1
-2
-3
-4
-5
-6
-7
0
25
50
75
100
125
150


50EH5
E_f = 50 Volts
E_b = 110 Volts
E_{c2} = 115 Volts
Cathode Resistor = 62 Ohms
Cathode Bypass Capacitor = 100 μf
Signal Volts = 2.1 (RMS)
TOTAL HARMONIC DISTORTION - PER CENT
POWER OUTPUT - WATTS
LOAD RESISTANCE - OHMS
POWER OUTPUT
TOTAL DISTORTION
0
10
20
30
0.5
1.0
1.5
2500
5000
7500
10000

TUNG-SOL

POWER PENTODE

MINIATURE TYPE



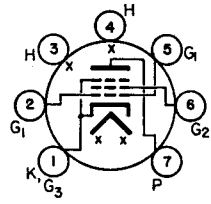
GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

HIGH POWER SENSITIVITY

FOR SERIES STRING RECEIVERS



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CV

THE 50FA5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR LOW HEAT DISSIPATION THROUGH USE OF A LOW CURRENT HEATER. HEATER WARM-UP TIME (IN SERIES STRING APPLICATIONS) IS CONTROLLED FOR IMPROVED RELIABILITY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.28	pf
INPUT: G1 TO (K+G3+G2+H)	11	pf
OUTPUT: P TO (K+G3+G2+H)	8.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50 VOLTS	100 [A]	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6 [B]	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS
HEATER WARM-UP TIME [A]		20	SECONDS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5.2	WATTS
GRID #2 DISSIPATION	1.1	WATTS
GRID #1 CIRCUIT RESISTANCE:		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM

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TYPICAL OPERATING CHARACTERISTICS

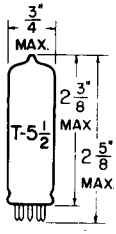
PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAX.-SIGNAL PLATE CURRENT	41	MA.
ZERO-SIGNAL GRID #2 CURRENT	3	MA.
MAX.-SIGNAL GRID #2 CURRENT	7	MA.
TRANSCONDUCTANCE	5800	μMHOS
PLATE RESISTANCE (APPROX.)	13,000	OHMS
LOAD RESISTANCE	2500	OHMS
MAX.-SIGNAL POWER OUTPUT	1.5	WATTS
TOTAL HARMONIC DISTORTION	10	PERCENT

A
HEATER WARM-UP TIME IS DEFINED AS THE TIME REQUIRED FOR THE VOLTAGE ACROSS THE HEATER TO REACH 80% OF ITS RATED VOLTAGE AFTER APPLYING 4 TIMES RATED HEATER VOLTAGE TO A CIRCUIT CONSISTING OF THE TUBE HEATER IN SERIES WITH A RESISTANCE OF VALUE 3 TIMES THE NOMINAL HEATER OPERATING RESISTANCE.

TUNG-SOL

POWER PENTODE

MINIATURE TYPE



SMALL-BUTTON MINIATURE

7 PIN BASE E7-1

OUTLINE DRAWING JEDEC 5-3

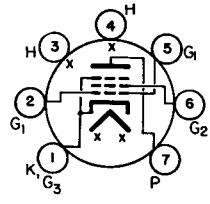
GLASS BULB

COATED UNIPOTENTIAL CATHODE

AUDIO OUTPUT AMPLIFIER

IN AC/DC RECEIVERS

ANY MOUNTING POSITION



BASING DIAGRAM

JEDEC 7CV

BOTTOM VIEW

THE 50FK5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN AC/DC RECEIVERS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.65	pf
GRID #1 TO CATHODE & GRID #3, HEATER & GRID #2	17	pf
PLATE TO CATHODE # GRID #3, HEATER & GRID #2	9	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50 VOLTS	100	MA.
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		100±6	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		200[A]	

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
GRID #2 (SCREEN-GRID) VOLTAGE:	130	VOLTS
GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE BIAS VALUE	0	VOLTS
PLATE DISSIPATION	5	WATTS
GRID #2 INPUT	1.75	WATTS
BULB TEMPERATURE (AT HOTTEST POINT)	225	°C

MAXIMUM CIRCUIT VALUES

GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

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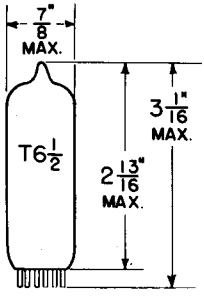
TYPICAL OPERATING CHARACTERISTICS

PLATE-SUPPLY VOLTAGE	110	VOLTS
GRID #2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	32	MA.
MAX.-SIGNAL PLATE CURRENT	32	MA.
ZERO-SIGNAL GRID #2 CURRENT	8.5	MA.
MAX.-SIGNAL GRID #2 CURRENT	12	MA.
PLATE RESISTANCE (APPROX.)	14000	OHMS
TRANSCONDUCTANCE	12800	μMHOS
LOAD RESISTANCE	3000	OHMS
TOTAL HARMONIC DISTORTION	8	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.2	WATTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB

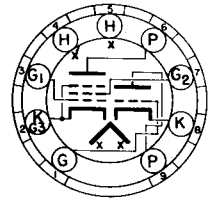
COATED UNIPOTENTIAL CATHODE

HEATER

50 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

9EX

THE 50FY8 IS A COMBINED TRIODE AND BEAM POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN LOW-COST STEREO SYSTEMS.

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	TRIODE SECTION	PENTODE SECTION	
HEATER VOLTAGE	50		VOLTS
MAXIMUM PLATE VOLTAGE	150	150	VOLTS
MAXIMUM GRID #2 VOLTAGE	---	150	VOLTS
MAXIMUM PLATE DISSIPATION	1	10	WATTS
MAXIMUM GRID #2 DISSIPATION	---	3	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE:			
FIXED BIAS	1.0	0.5	MEGOHM
CATHODE BIAS	3.0	1.0	MEGOHM
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE TO CATHODE	200		VOLTS
HEATER POSITIVE TO CATHODE[A]	200		VOLTS

[A] DC COMPONENT NOT TO EXCEED 100 VOLTS MAXIMUM.

TYPICAL OPERATION

FOR ONE CHANNEL STEREO AMPLIFIER

	EACH TRIODE	PUSH-PULL PENTODES	
HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE SUPPLY VOLTAGE	125	125	VOLTS
GRID #2 SUPPLY	---	125	VOLTS
GRID #2 RESISTOR, EACH PENTODE	---	1000	OHMS
CATHODE BIAS RESISTOR	1800	62	OHMS
LOAD RESISTANCE	220,000	4000 (P TO P)	OHMS
REQUIRED EACH TRIODE INPUT AF VOLTAGE FOR 6.0 WATTS OUTPUT	0.3	---	VRMS
STEREO POWER OUTPUT	---	6.0	WATTS

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TUNG-SOL

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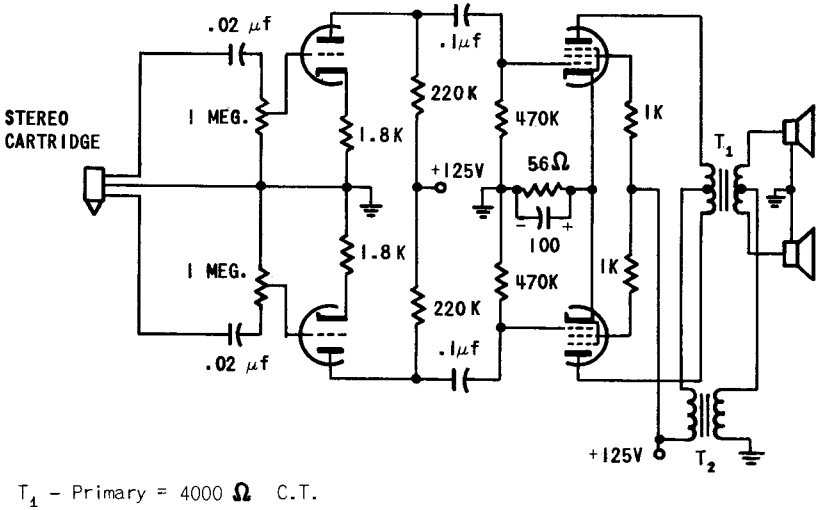
AVERAGE CHARACTERISTICS

CLASS A AMPLIFIER – EACH SECTION

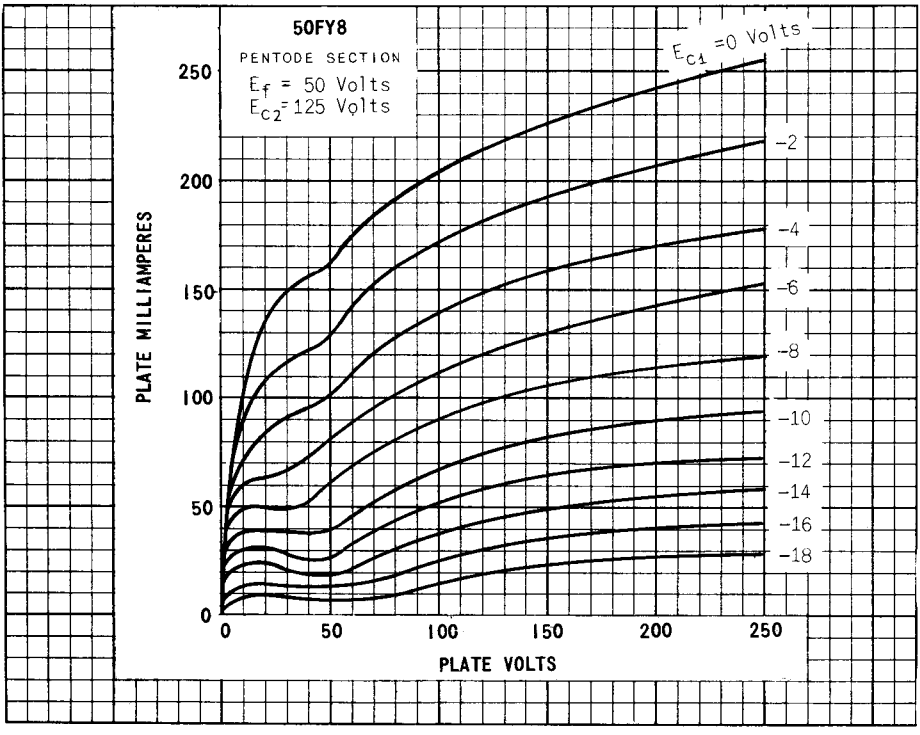
HEATER VOLTAGE	50		VOLTS
HEATER CURRENT	0.15		AMP.
PLATE VOLTAGE	125	125	VOLTS
GRID #2 VOLTAGE	---	125	VOLTS
GRID #1 VOLTAGE	-1.5	---	VOLTS
CATHODE BIAS RESISTOR	---	120	OHMS
PLATE RESISTANCE (APPROX.)	17000	5000	OHMS
TRANSCONDUCTANCE	2700	7500	μMHOS
PLATE CURRENT, ZERO SIGNAL	2.5	70	MA.
PLATE CURRENT, MAXIMUM SIGNAL	---	66	MA.
GRID #2 CURRENT, ZERO SIGNAL	---	10	MA.
GRID #2 CURRENT, MAXIMUM SIGNAL	---	19	MA.
LOAD RESISTANCE	---	2000	OHMS
POWER OUTPUT AT 10% DISTORTION	---	3	WATTS
AMPLIFICATION FACTOR	46	---	

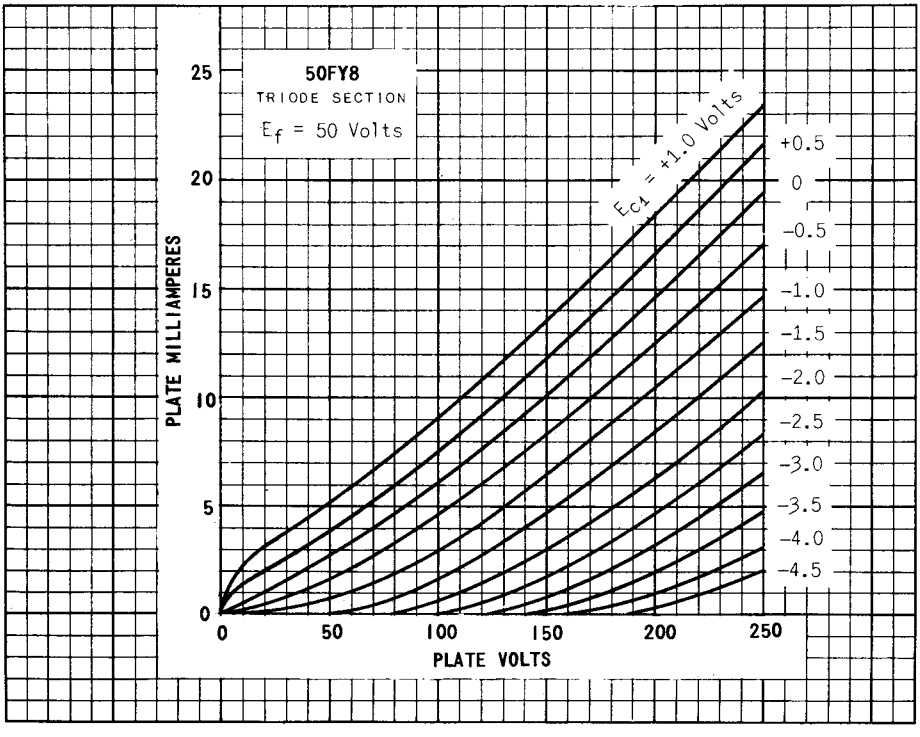
TWO TUBE 6 WATT STEREO AMPLIFIER



T_1 – Primary = 4000 Ω C.T.
– Secondary (One side to C.T.) = Voice Coil Impedance of One Speaker

T_2 – Primary = 1000 Ω
– Secondary = 1/2 Voice Coil Impedance of One Speaker





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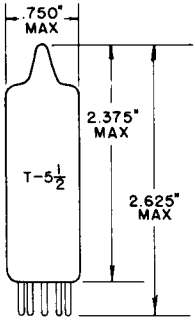
TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



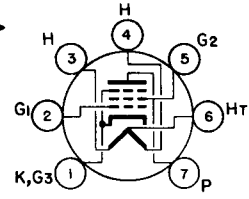
GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

COATED UNIPOTENTIAL CATHODE

FOR AF POWER

AMPLIFIER APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7FZ

THE 50HK6 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR USE IN THE AUDIO-FREQUENCY POWER OUTPUT STAGE OF RADIO RECEIVERS AND FOR PEAK CURRENT LIMITATION. FEATURES OF THE TUBE INCLUDE HIGH POWER SENSITIVITY AT LOW PLATE AND SCREEN VOLTAGES AND A HEATER TAP TO PERMIT OPERATION OF PANEL LAMP.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE: (G1 TO P)	0.5	pf
INPUT: G1 TO (H+K+G2+G3)	14	pf
OUTPUT: P TO (H+K+G2+G3)	9.0	pf

HEATER RATINGS AND CHARACTERISTICS

DESIGN MAXIMUM VALUES- SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	50 VOLTS	150	MA.
HEATER TAP VOLTAGE[A]		7.0	VOLTS
HEATER SUPPLY LIMITS:			
CURRENT OPERATION		150±10	MA.
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK		200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC		100	VOLTS
TOTAL DC AND PEAK		200	VOLTS

[A] WITHOUT PANEL LAMP.

CONTINUED ON FOLLOWING PAGE

→INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

HEATER TAP VOLTAGE WHEN PANEL LAMP FAILS, RMS	14	VOLTS
PLATE VOLTAGE	150	VOLTS
GRID #2 VOLTAGE	130	VOLTS
PLATE DISSIPATION	5.5	WATTS
GRID #2 DISSIPATION	1.1	WATTS
GRID #1 CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
GRID #2 VOLTAGE	110	VOLTS
GRID #1 VOLTAGE	-7.5	VOLTS
PEAK AF GRID #1 VOLTAGE	7.5	VOLTS
PLATE RESISTANCE, APPROX.	10 000	OHMS
TRANSCONDUCTANCE	7500	μMHOS
ZERO-SIGNAL PLATE CURRENT	49	MA.
MAX.-SIGNAL PLATE CURRENT	50	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.0	MA.
MAX.-SIGNAL GRID #2 CURRENT	8.5	MA.
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION, (APPROX.)	9	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.9	WATTS

THE 50HK6 HAS A HEATER TAP, WHICH MAY BE USED FOR OPERATING A 6.3-VOLT, 150-MILLIAMPERE PANEL LAMP IN EQUIPMENT EMPLOYING SEMICONDUCTOR RECTIFIERS. THE TABLE BELOW GIVES THE REQUIRED VALUES OF PANEL-LAMP SHUNTING RESISTOR FOR VARIOUS RECTIFIER LOAD CURRENTS.

SHUNTING RESISTOR REQUIRED WITH PANEL LAMP NUMBER 40 OR NUMBER 47

SEE TYPICAL CIRCUIT

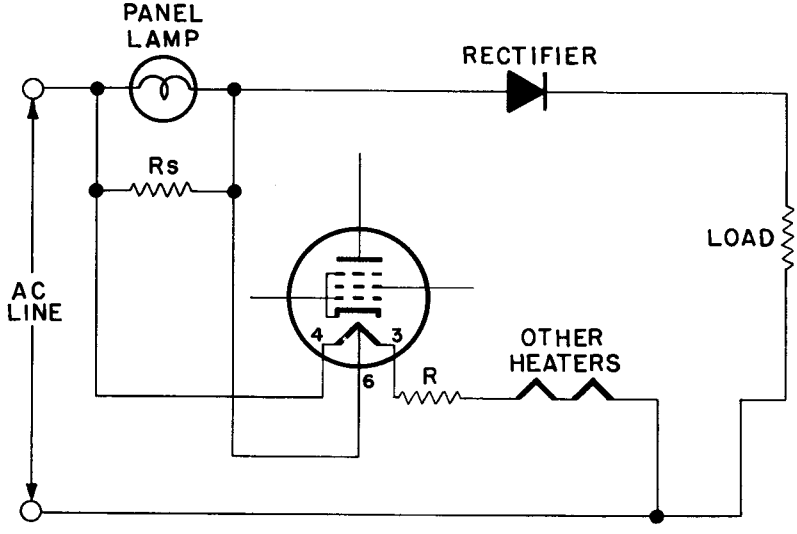
HEATER VOLTAGE (PIN 3 TO PIN 4)	45	45	45	45	45	45	45	VOLTS
HEATER-TAP VOLTAGE PIN 4 TO PIN 6)	5.0	5.4	5.5	5.5	5.5	5.5	5.5	VOLTS
HEATER CURRENT (BETWEEN PINS 3 & 6)	150	150	150	150	150	150	150	MA.
PANEL-LAMP SHUNTING RESISTOR	---	---	370	175	120	88	73	OHMS
RECTIFIER LOAD CURRENT[B]	60	70	80	90	100	110	120	MA.

[B] HIGHER LOAD CURRENTS WILL REQUIRE SMALLER VALUES OF PANEL-LAMP SHUNTING RESISTOR. FOR MAXIMUM PANEL-LAMP LIFE, THE SHUNTING RESISTOR SHOULD BE SELECTED TO ALLOW A PANEL-LAMP VOLTAGE OF 5.5 VOLTS WITH FULL RECTIFIER LOAD CURRENT.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

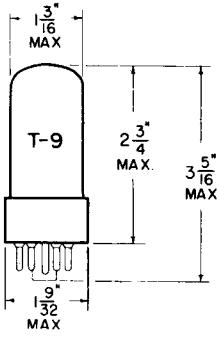
TYPICAL CIRCUIT FOR OPERATION WITH PANEL LAMP



R_S = PANEL-LAMP SHUNTING RESISTOR
DROP ACROSS R AT 0.15 AMPERE SHOULD EQUAL
DIFFERENCE BETWEEN LINE VOLTAGE AND TOTAL
OF ALL RATED HEATER VOLTAGES

TUNG-SOL

BEAM PENTODE

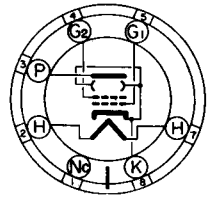


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

INTERMEDIATE SHELL
7 PIN OCTAL
7AC

THE 50L6GT IS DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF AC/DC RECEIVERS. IT DELIVERS A HIGH POWER OUTPUT WITH HIGH POWER SENSITIVITY FROM LOW SUPPLY VOLTAGES.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

HEATER VOLTAGE	50	VOLTS
MAXIMUM PLATE VOLTAGE	200	VOLTS
MAXIMUM GRID #2 VOLTAGE	125	VOLTS
MAXIMUM PLATE DISSIPATION	10	WATTS
MAXIMUM GRID #2 DISSIPATION	1.25	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM
MAXIMUM HEATER-CATHODE VOLTAGE: ←		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
DC AND PEAK	200	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	50	50	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
PLATE VOLTAGE	110	200	VOLTS
GRID #2 VOLTAGE	110	125	VOLTS
GRID #1 VOLTAGE	-7.5	0	VOLTS
CATHODE BIAS RESISTOR	0	180	OHMS
PEAK AF GRID #1 VOLTAGE	7.5	8.5	VOLTS
PLATE RESISTANCE (APPROX.)	13 000	28 000	OHMS
TRANSCONDUCTANCE	8 000	8 000	µMHOS
ZERO-SIGNAL PLATE CURRENT	49	46	MA.
MAXIMUM-SIGNAL PLATE CURRENT	50	47	MA.
ZERO-SIGNAL GRID #2 CURRENT	4	2.2	MA.
MAXIMUM-SIGNAL GRID #2 CURRENT	10	8.5	MA.
LOAD RESISTANCE	2 000	4 000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	10	10	PERCENT
POWER OUTPUT	2.1	3.8	WATTS

→ INDICATES A CHANGE.

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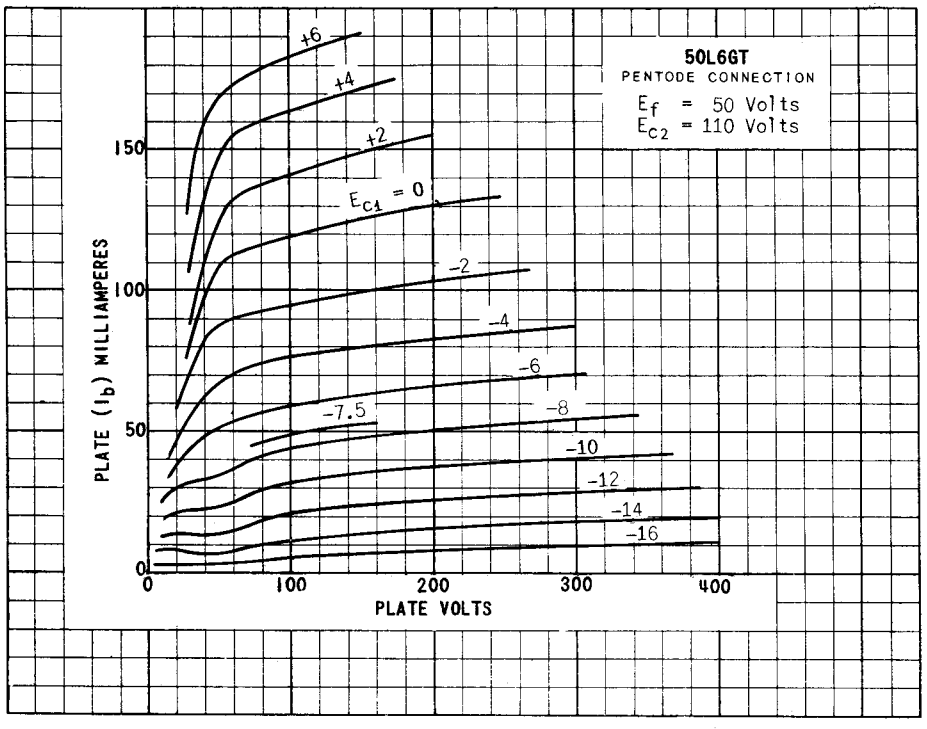
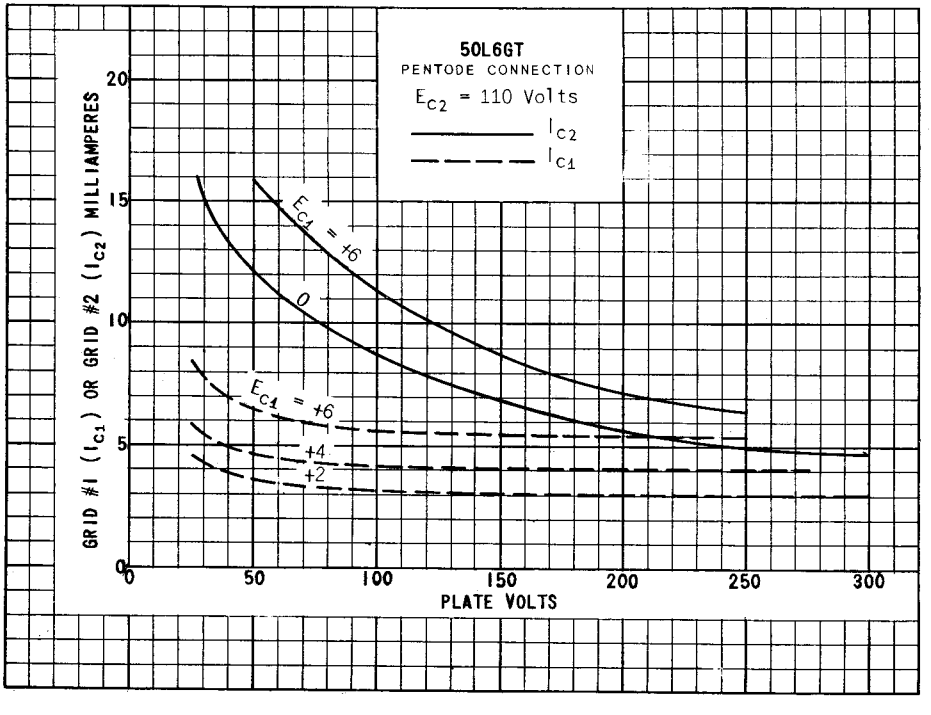
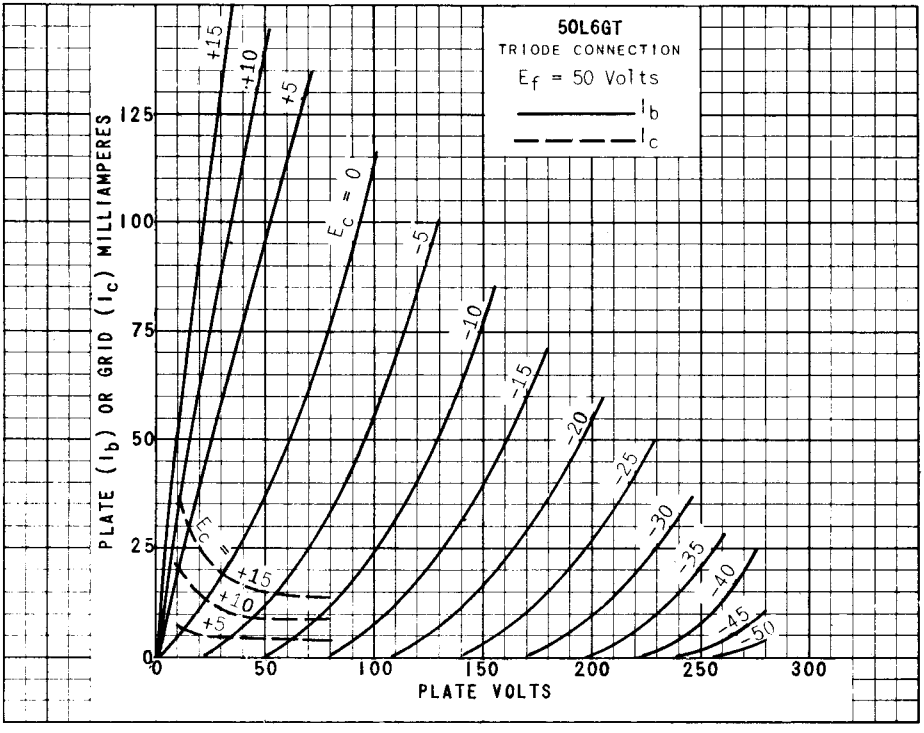
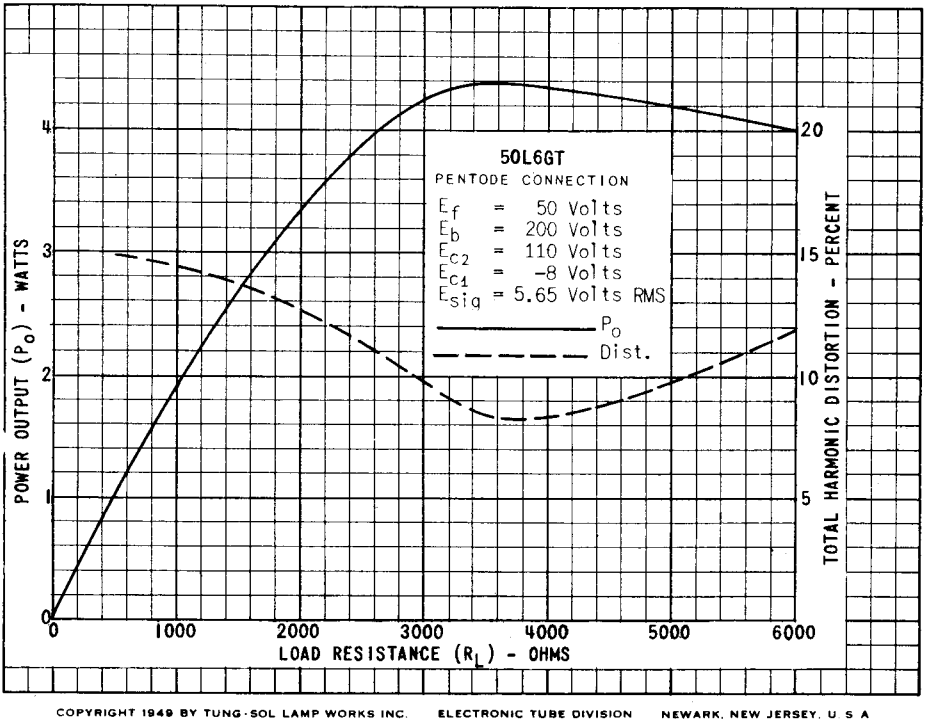
50L6GT


50L6GT
PENTODE CONNECTION
E_f = 50 Volts
E_{c2} = 110 Volts
+6
+4
+2
E_{c1} = 0
-2
-4
-6
-7.5
-8
-10
-12
-14
-16
PLATE (I_b) MILLIAMPERES
150
100
50
0
0
100
200
300
400
PLATE VOLTS


50L6GT
PENTODE CONNECTION
E_{c2} = 110 Volts
I_{c2}
I_{c1}
E_{c1} = +6
0
E_{c1} = +6
+4
+2
GRID #1 (I_{c1}) OR GRID #2 (I_{c2}) MILLIAMPERES
20
15
10
5
0
0
50
100
150
200
250
300
PLATE VOLTS





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2690
JUNE 1
1951

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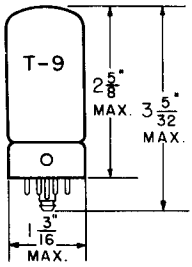
TUNG-SOL

DOUBLE DIODE

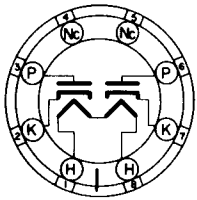


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
LOCK-IN
8 PIN BASE

THE 50X6 COMBINES TWO INDEPENDENT DIODES IN THE LOCK-IN CONSTRUCTION PERMITTING THE TUBE TO BE USED AS A POWER RECTIFIER IN EITHER HALF-WAVE, FULL-WAVE, OR VOLTAGE DOUBLER APPLICATIONS.

RATINGS
INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	50	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	350	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE	700	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT PER PLATE	450	MA.
MAXIMUM DC OUTPUT CURRENT PER PLATE	75	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 150 MA. AT PLATE)	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
HEATER VOLTAGE	50	50	VOLTS
HEATER CURRENT	150	150	MA.
AC PLATE VOLTAGE EACH PLATE RMS	117	117	VOLTS
FILTER INPUT CONDENSER	16	16	µf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	30	15	OHMS
DC OUTPUT CURRENT	75	75	MA.

HALF-WAVE RECTIFIER

	SINGLE SECTION	CONDENSER INPUT FILTER		
HEATER VOLTAGE	50	50	50	VOLTS
HEATER CURRENT	150	150	150	MA.
AC PLATE SUPPLY VOLTAGE RMS	117	150	235	VOLTS
FILTER INPUT CONDENSER	16	16	16	µf
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	40	100	OHMS
DC OUTPUT CURRENT	75	75	75	MA.

SIMILAR TYPE REFERENCE: *Electrically equivalent to 50Y7GT without pilot lamp.*

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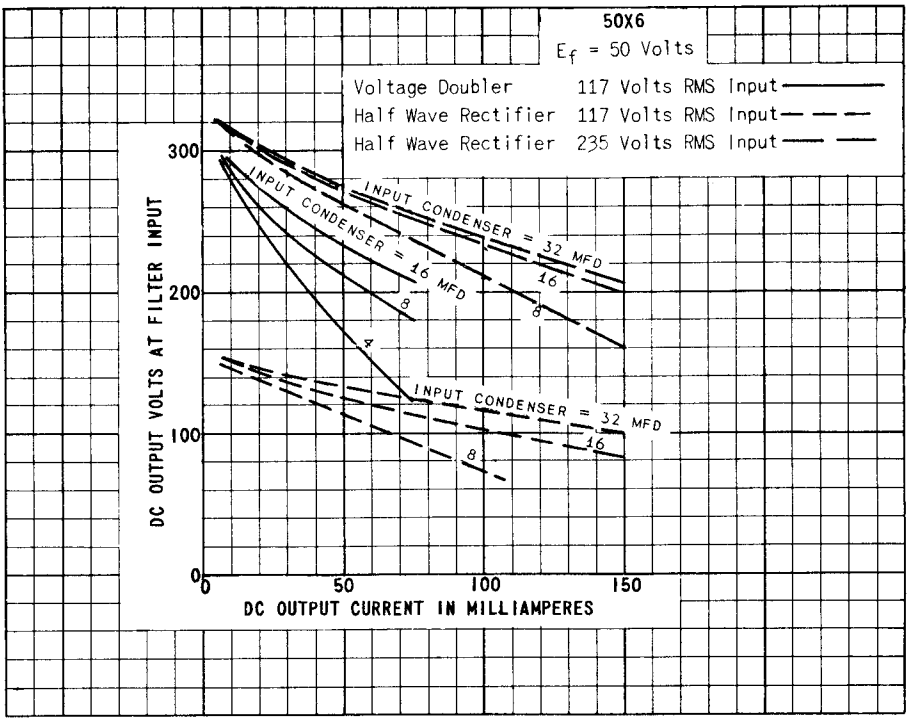
50X6



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1948

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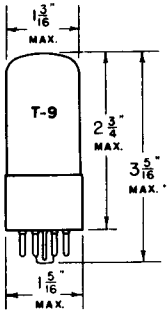
TUNG-SOL

TWIN DIODE HIGH VACUUM RECTIFIER

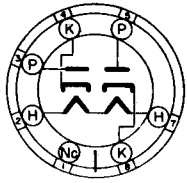
VOLTAGE DOUBLER



UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



G-7Qa

BOTTOM VIEW

INTERMEDIATE 7 PIN OCTAL BASE

THE TUNG-SOL 50Y6GT/G IS DESIGNED PRIMARILY FOR SERVICE AS A POWER RECTIFIER IN AC - DC RECEIVERS. TWO SEPARATE RECTIFIER SECTIONS PERMIT USING THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. FOR HALF WAVE OPERATION THE TWO SECTIONS MAY BE OPERATED SEPARATELY, OR IN PARALLEL TO REDUCE TUBE DROP. ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 25Z5 AND THE 25Z6GT/G.

RATINGS

MAXIMUM AC PLATE VOLTAGE (RMS)	235	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	450	MA.
TUBE VOLTAGE DROP AT 150 MA. PER PLATE	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

	HALF WAVE	FULL WAVE	
AC VOLTAGE PER PLATE (RMS) MAX.	117	117	VOLTS
DC OUTPUT CURRENT MAX.	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN-A	30	15	OHMS

A WHEN FILTER CONDENSERS LARGER THAN 40 UFDS ARE USED IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE 1063-2

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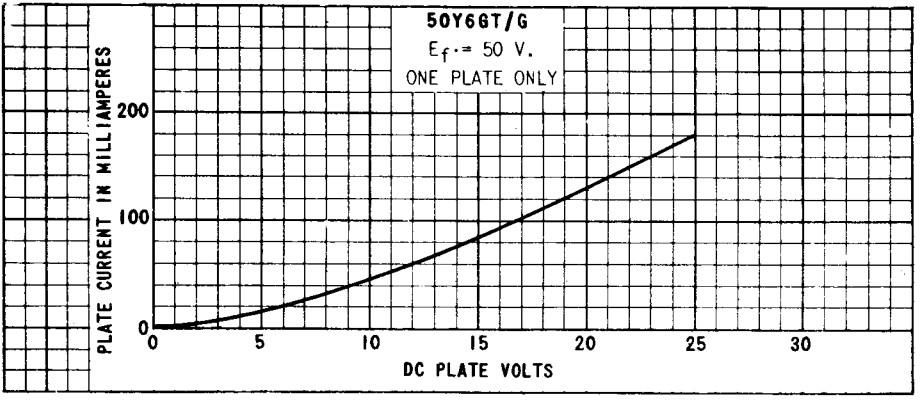
50Y6GT/G

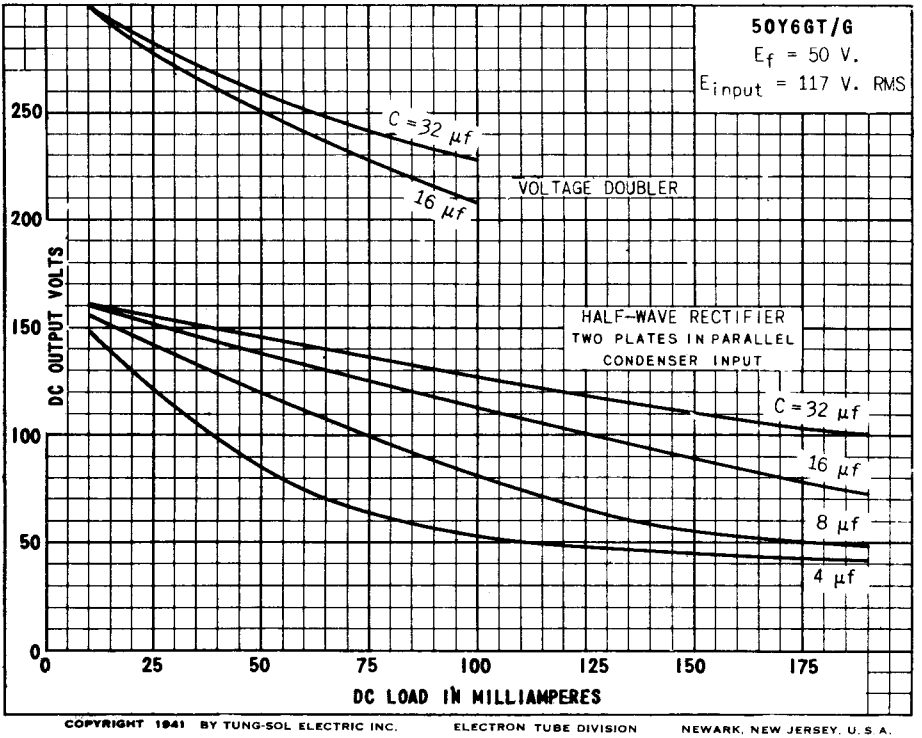
TUNG-SOL

HALF WAVE RECTIFIER

AC PLATE VOLTAGE PER PLATE (RMS)	117	150	235 MAX.	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	75	75	75	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[A]	15	40	100	OHMS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 UFDS ARE USED IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.





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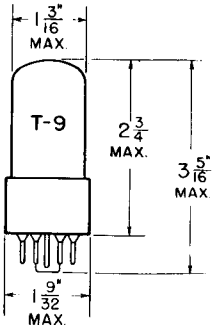
TUNG-SOL

DOUBLE DIODE

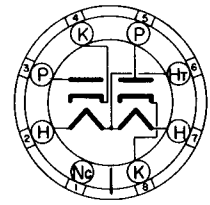


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
50 VOLTS 150 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL

THE 5OY7GT IS A TWIN DIODE POWER RECTIFIER TUBE USING THE LOCK-IN CONSTRUCTION. EACH DIODE UNIT IS INDEPENDENT WHICH PERMITS OPERATION AS EITHER HALF-WAVE, FULL-WAVE, OR VOLTAGE DOUBLER. THE HEATER IS COMMON TO THE TWO UNITS AND PROVIDES A TAP CONNECTION FOR PILOT LIGHT OPERATION.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	50	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	350	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	700	VOLTS
MAXIMUM AC PLATE VOLTAGE EACH PLATE (RMS) VOLTAGE DOUBLER HALF-WAVE RECTIFIER	 117 235	 VOLTS VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	450	MA.
TAPPED SECTION VOLTAGE (PINS #6 & #7)	7.5	VOLTS
MAXIMUM DC OUTPUT CURRENT EACH PLATE	75	MA.
MAXIMUM DC OUTPUT CURRENT EACH PLATE WITH PANEL LAMP	65	MA.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 150 MA. EACH PLATE)	22	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

VOLTAGE DOUBLER

HEATER VOLTAGE	46	VOLTS
HEATER CURRENT	150	MA.
AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
DC PLATE CURRENT TOTAL	65	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	15	OHMS
PANEL LAMP SHUNTING RESISTOR	250	OHMS

HALF-WAVE RECTIFIER

SINGLE SECTION WITH #40 OR #47 PANEL LAMP	CONDENSER INPUT FILTER			
HEATER VOLTAGE (PINS #2 & #7)	46	46	46	VOLTS
HEATER CURRENT	150	150	150	MA.
AC PLATE SUPPLY VOLTAGE (RMS)	117	150	235	VOLTS
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	15	40	100	OHMS
DC OUTPUT CURRENT PER PLATE	65	65	65	MA.

SIMILAR TYPE REFERENCE: Without pilot lamp electrically equivalent to type 50X6.

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PLATE 2076
SEPT. 1 1948

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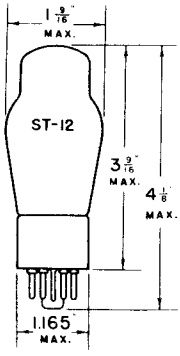
TUNG-SOL



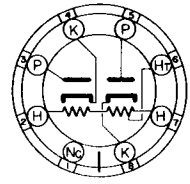
TWIN DIODE HIGH VACUUM RECTIFIER

VOLTAGE DOUBLER

UNIPOTENTIAL CATHODES

HEATER
50 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB



G-8AN
BOTTOM VIEW

SMALL 8 PIN OCTAL BASE

THE TUNG-SOL 50Z7G IS DESIGNED FOR SERVICE AS A POWER RECTIFIER IN AC-DC RECEIVERS. TWO SEPARATE RECTIFIER UNITS ALSO PERMIT THE USE OF THE TUBE AS A VOLTAGE DOUBLER, FULL WAVE RECTIFIER OR HALF WAVE RECTIFIER. WITH THE PROPER EXTERNAL CONNECTIONS, THE TAPPED SECTION OF THE HEATER SERVES AS A BALLAST RESISTOR FOR THE PANEL LAMP.

RATINGS

HEATER VOLTAGE (BETWEEN PINS #2 AND #7)	50.0	VOLTS
HEATER CURRENT (BETWEEN PINS #2 AND #7)	0.15	AMP.
MAXIMUM AC PLATE VOLTAGE PER PLATE (RMS)	235	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	700	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	350	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	400	MA.
MAXIMUM DC OUTPUT CURRENT PER PLATE WITH PANEL LAMP	65	MA.
TAPPED SECTION OF HEATER VOLTAGE (BETWEEN PINS #6 & #7) WITH 0.15 AMP. FLOWING BETWEEN PINS #2 & #7	2.0	VOLTS
TUBE VOLTAGE DROP — AT 130 MA. DC PER PLATE	21	VOLTS

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PLATE 862-1

SEPT. 23 1940

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CONTINUED NEXT PAGE

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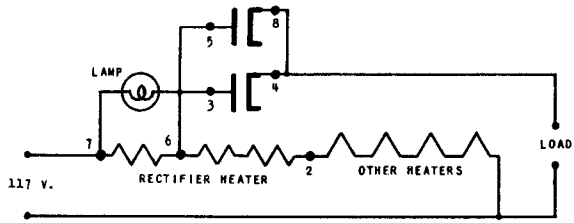
50Z7G

TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF WAVE RECTIFIER
WITH #292 OR #292A PANEL LAMP[A]

HEATER VOLTAGE (BETWEEN PINS #2 AND #7) APPROX.	50.0	50.0	VOLTS
HEATER CURRENT (BETWEEN PINS #2 AND #6)	0.15	0.15	AMP.
MAXIMUM VOLTAGE ACROSS TAPPED SECTION OF HEATER (BETWEEN PINS #6 AND #7)	2.5	2.5	VOLTS
AC PLATE VOLTAGE PER PLATE (RMS)	117	235 MAX	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	65	65	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[B]	15	100	OHMS



VOLTAGE DOUBLER
WITH #292 OR #292A PANEL LAMP[A]

HEATER VOLTAGE (BETWEEN PINS #2 AND #7)	50.0	VOLTS
AC PLATE VOLTAGE PER PLATE (RMS) MAX.	117	VOLTS
DC OUTPUT CURRENT PER PLATE MAX.	65	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[B]	15	OHMS

[A] IT IS RECOMMENDED THAT THE PLATE CURRENT OF THE RECTIFIER BE PASSED THROUGH THE PANEL LAMP AND THE TAPPED SECTION OF THE HEATER.

[B] WHEN FILTER CONDENSERS LARGER THAN 40 MFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

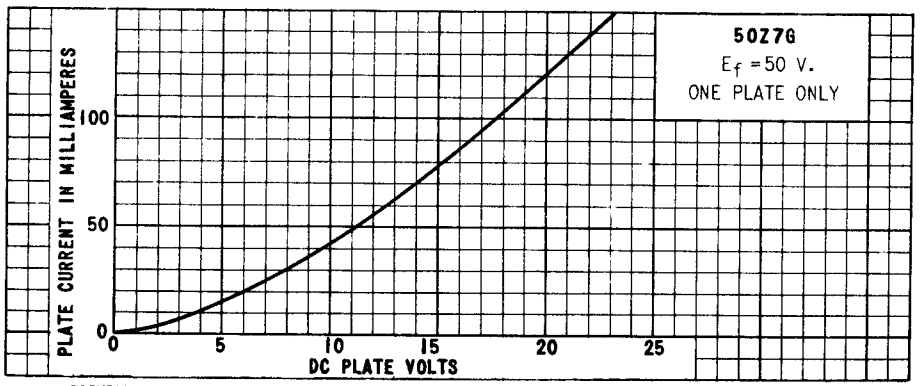


PLATE 863-1

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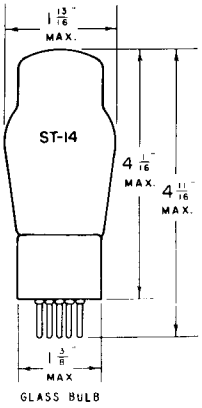
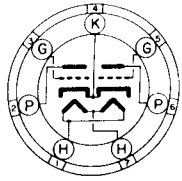
TUNG-SOL



TWIN TRIODE POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 2.0 AMPERES
AC OR DC



7B
BOTTOM VIEW
MEDIUM 7 PIN BASE

THE TUNG-SOL 53 IS A TWIN TRIODE DESIGNED PRIMARILY FOR SERVICE AS A CLASS B POWER AMPLIFIER. EXCEPT FOR CAPACITANCES AND HEATER RATINGS, ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL TO THOSE OF THE 6N7, 6N7G AND THE 6A6.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PEAK PLATE CURRENT PER PLATE	125	MA.
MAXIMUM AVERAGE DISSIPATION PER PLATE	5.5	WATTS

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODES CONNECTED IN PARALLEL

PLATE VOLTAGE	250	294	VOLTS
GRID VOLTAGE	−5	−6	VOLTS
PLATE CURRENT	6	7	MA.
PLATE RESISTANCE	11300	11000	OHMS
TRANSCONDUCTANCE	3100	3200	μMHOS
AMPLIFICATION FACTOR	35	35	

CLASS B_2 AMPLIFIER – PUSH-PULL

UNLESS STATED OTHERWISE, VALUES ARE FOR TWO TUBES

	IDEAL	TYPICAL	
ZERO-SIGNAL PLATE VOLTAGE	300	300	VOLTS
DC GRID VOLTAGE	0	0	VOLT
AF-PEAK SIGNAL VOLTAGE PER GRID [A]	29	41	VOLTS
MAXIMUM PEAK-SIGNAL GRID CURRENT PER GRID	20	22	MA.
ZERO-SIGNAL PLATE CURRENT PER PLATE	17.5	17.5	MA.
MAXIMUM-SIGNAL DC PLATE CURRENT PER PLATE	35	35	MA.
GRID IMPEDANCE AT 400 CYCLES	0	516 [B]	OHMS
PLATE SUPPLY IMPEDANCE	0	1000	OHMS
EFFECTIVE LOAD RESISTANCE PLATE-TO-PLATE	8000	8000	OHMS
TOTAL HARMONIC DISTORTION	4	8	PER CENT
THIRD HARMONIC	3.5	7.5	PER CENT
FIFTH HARMONIC	1.5	2.5	PER CENT
POWER OUTPUT	10	10	WATTS

[A] FOR POWER OUTPUT SHOWN

[B] 500 OHMS AND 50 MH.

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PLATE
902-2

NOV. 8
1940

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK

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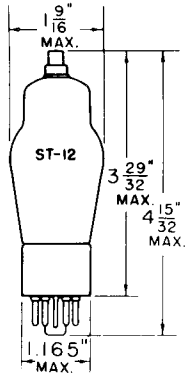


6V7G
SMALL 7 PIN OCTAL BASE

DUPLEX-DIODE TRIODE

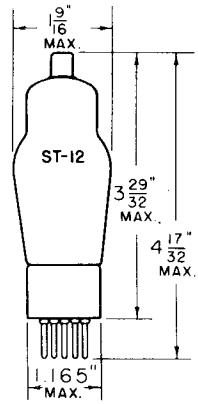
UNIPOTENTIAL CATHODE

HEATER

6V7G, 85	55
6.3 V.	2.5 V.
0.3 A.	1.0 A.

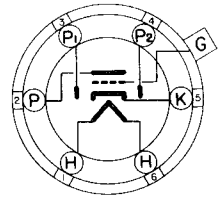
AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. UNDER NO CONDITIONS SHOULD IT EXCEED 100 VOLTS.



55, 85
SMALL 6 PIN BASE

6V7G



55, 85

BOTTOM VIEWS

THE 6V7G, 55 AND 85 ARE HEATER CATHODE TYPE TUBES CONSISTING OF TWO DIODES AND A TRIODE IN A SINGLE BULB. THEY ARE DESIGNED FOR USE AS COMBINED DETECTORS, AMPLIFIERS AND AUTOMATIC VOLUME CONTROL TUBES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	1.5	μμf
INPUT	1.5	μμf
OUTPUT	4.3	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	135	180	250	VOLTS
GRID VOLTAGE	-10.5	-13.5	-20	VOLTS
PLATE CURRENT	3.7	6.0	8.0	MA.
PLATE RESISTANCE	11000	8500	7500	OHMS
TRANSCONDUCTANCE	750	975	1100	μMHOS
AMPLIFICATION FACTOR	8.3	8.3	8.3	
LOAD RESISTANCE	25000	20000	20000	OHMS
POWER OUTPUT	75	160	350	MW.

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PLATE 1444
JUNE 15 1944

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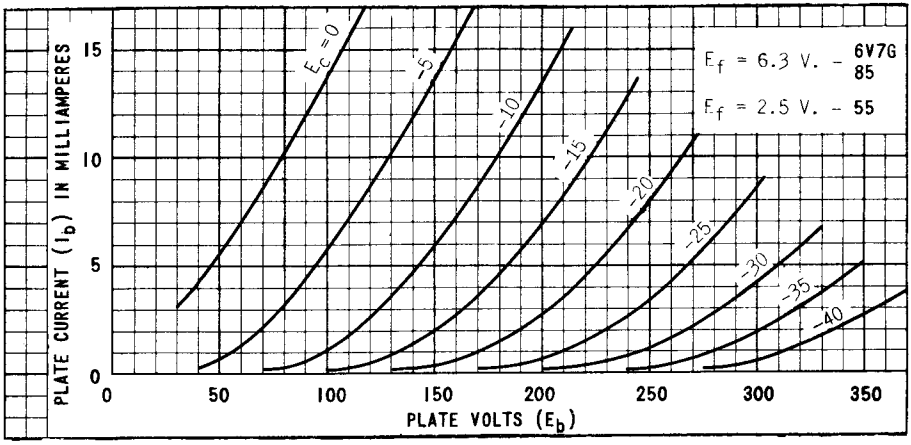
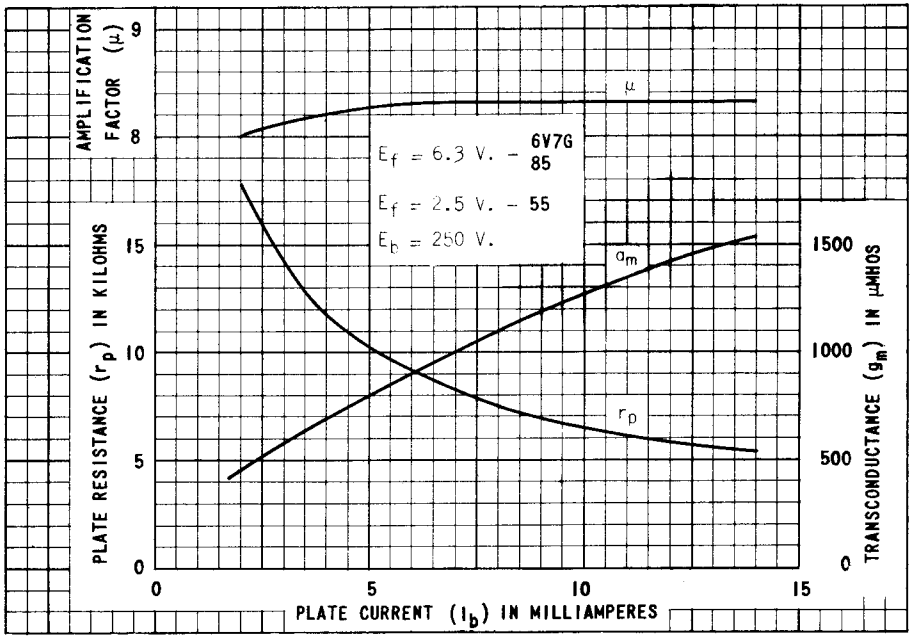
55 (6V7G, 85)





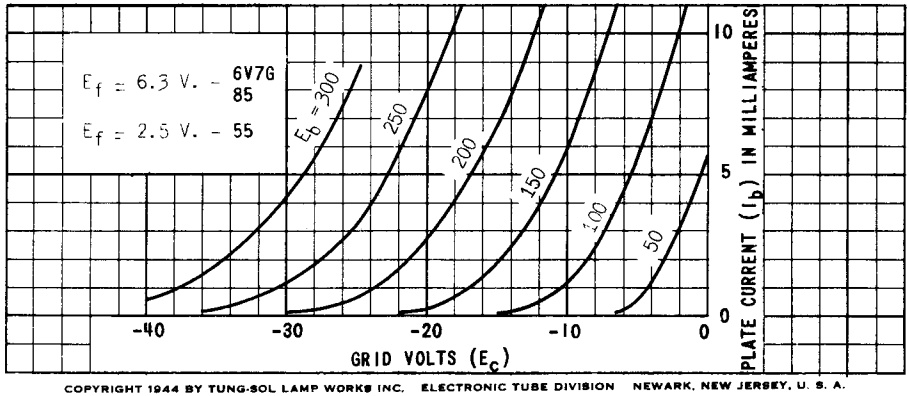


PLATE 1445
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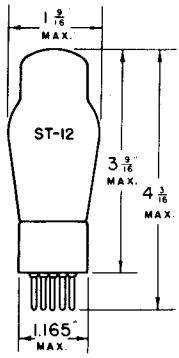


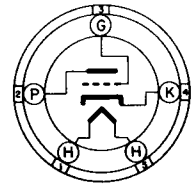
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 1.0 AMPERE
AC OR DC

GLASS BULB

SMALL 5 PIN BASE



BOTTOM VIEW

THE TUNG-SOL 56 IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER. EXCEPT FOR HEATER RATINGS AND CAPACITANCES, ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 76.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250 MAX.	VOLTS
GRID VOLTAGE	-5	-13.5	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	MEGOHM
PLATE CURRENT	2.5	5	MA.
PLATE RESISTANCE	12 000	9500	OHMS
TRANSCONDUCTANCE	1150	1450	μMHOS
AMPLIFICATION FACTOR	13.8	13.8	

DETECTOR

	BIASED		GRID LEAK	
PLATE VOLTAGE	100	250	45	VOLTS
GRID VOLTAGE	-8	-20	RETURN TO CATHODE	VOLTS
PLATE CURRENT	ADJUST TO 0.2 MA. WITH NO INPUT SIGNAL			
GRID LEAK			1 TO 5	MEGOHMS
GRID CONDENSER			250	μμf

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.05	0.25	0.05	0.25	MEGOHM
CATHODE RESISTOR	3800	15 000	3800	15 000	OHMS
VOLTAGE GAIN	8.5	10	9	10	

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	3.2	μμf
PLATE TO CATHODE	2.2	μμf
GRID TO PLATE	3.2	μμf

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PLATE
1446
JUNE 15
1944

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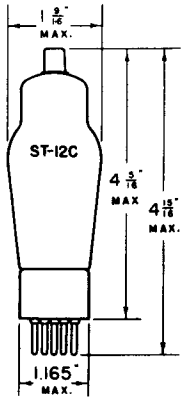


TRIPLE GRID

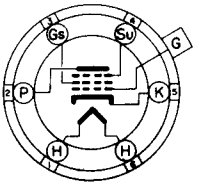
DETECTOR AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 1.0 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN BASE



6F

BOTTOM VIEW

THE TUNG-SOL 57 IS A TRIPLE GRID GENERAL PURPOSE DETECTOR AMPLIFIER. EXCEPT FOR HEATER RATINGS, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6C6.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	250	335	VOLTS
SCREEN VOLTAGE	100	100	125	110	VOLTS
CONTROL GRID VOLTAGE	-3	-3	-3	-3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET				
PLATE CURRENT	2	2	3.7	2.7	MA.
SCREEN CURRENT	0.5	0.5	1	0.7	MA.
PLATE RESISTANCE APPROX.	1.0	1.5	1.7	2.6	MEGOHMS
TRANSCONDUCTANCE	1185	1225	1510	1325	µMHOS
AMPLIFICATION FACTOR APPROX.	1185	1850	2500	3500	
CONTROL GRID VOLTAGE FOR CATHODE CURRENT CUT-OFF	-7	-7	-9	-7.5	VOLTS

BIASED DETECTOR

PLATE SUPPLY VOLTAGE	100	100	250	VOLTS
SCREEN SUPPLY VOLTAGE	16	100	100	VOLTS
PLATE RESISTOR	1	1	0.5	MEGOHM
SCREEN RESISTOR	0	2	0	MEGOHMS
CATHODE RESISTOR	30 000	25 000	10 000	OHMS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET			

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	5	µµf
PLATE TO CATHODE	6.5	µµf
CONTROL GRID TO PLATE[S]	.007 MAX.	µµf

[S] WITH SHIELD

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PLATE 319-1

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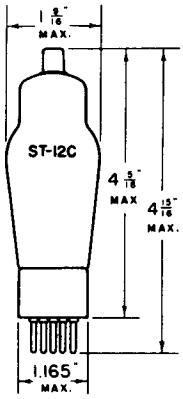
TUNG-SOL



TRIPLE GRID

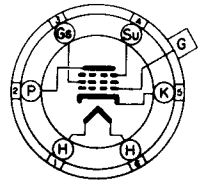
REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 1.0 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN BASE



6F

BOTTOM VIEW

THE TUNG-SOL 58 IS A TRIPLE GRID VARIABLE MU AMPLIFIER. EXCEPT FOR HEATER RATINGS, ITS ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6D6.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	100	100	VOLTS
CONTROL GRID VOLTAGE	-3	-3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	8	8.2	MA.
SCREEN CURRENT	2.2	2	MA.
PLATE RESISTANCE	0.25	0.8	MEGOHM
TRANSCONDUCTANCE	1500	1600	μMHOS
AMPLIFICATION FACTOR	375	1280	
CONTROL GRID VOLTAGE FOR TRANSCONDUCTANCE = 2 μMHOS	-50	-50	VOLTS

AS MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	100	250 MAX.	VOLTS
SCREEN VOLTAGE MAX.	100	100	VOLTS
CONTROL GRID VOLTAGE	-10	-10	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	4.7	μμf
PLATE TO CATHODE	6.3	μμf
CONTROL GRID TO PLATE[S]	.007 MAX.	μμf

[S] WITH SHIELD

PLATE 320-1

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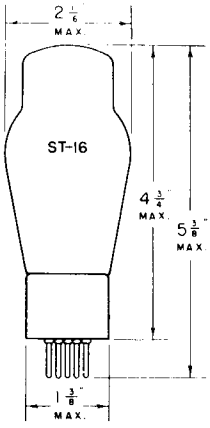


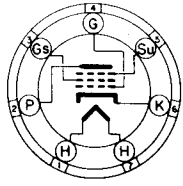
TRIPLE GRID POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
2.5 VOLTS 2.0 AMPERES
AC OR DC

GLASS BULB

MEDIUM 7 PIN BASE



7A
BOTTOM VIEW

THE TUNG-SOL 59 IS A TRIPLE GRID OUTPUT POWER TUBE WHICH MAY BE USED AS A CLASS A TRIODE, CLASS B TRIODE OR CLASS A PENTODE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE[A]	PENTODE[B]	
PLATE VOLTAGE MAX.	250	250	VOLTS
SCREEN (G_S) VOLTAGE	–	250 MAX.	VOLTS
CONTROL GRID (G) VOLTAGE	-28	-18	VOLTS
PLATE CURRENT	26	35	MA.
SCREEN CURRENT	–	9	MA.
PLATE RESISTANCE	2300	40 000	OHMS
TRANSCONDUCTANCE	2600	2500	μMHOS
AMPLIFICATION FACTOR	6	100	
LOAD RESISTANCE	5000[C]	6000	OHMS
POWER OUTPUT	1.25	3.0	WATTS

[A] GRIDS G_S AND Su TIED TO PLATE
[B] GRID Su TIED TO CATHODE
[C] APPROXIMATELY TWICE THIS VALUE IS RECOMMENDED FOR THE LOAD OF THIS TUBE WHEN USED AS A DRIVER FOR A CLASS B_2 STAGE.

CLASS B_2 AMPLIFIER – TWO TUBES

GRID Su TIED TO PLATE, GRIDS G AND G_S TIED TOGETHER

PLATE VOLTAGE	300	400 MAX.	VOLTS
GRID (G & G_S) VOLTAGE	0	0	VOLTS
ZERO-SIGNAL PLATE CURRENT	20	26	MA.
LOAD RESISTANCE PLATE TO PLATE	4600	6000	OHMS
POWER OUTPUT	15	20	WATTS

NOTE: MAXIMUM PLATE DISSIPATION IS 10 WATTS. MAXIMUM PEAK PLATE CURRENT IS 200 MA.

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PLATE 529-1

AUG. 14 1939

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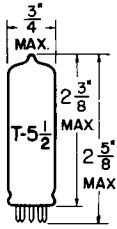
TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

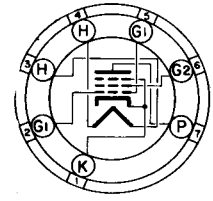
UNIPOTENTIAL CATHODE

HEATER

60±10% VOLTS 0.1 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE
7CV

THE 6OFX5 IS A POWER PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE OUTPUT STAGES OF AUDIO AMPLIFIERS DESIGNED TO OPERATE FROM TRANSFORMERLESS AC OR AC/DC POWER SUPPLIES. THE 6OFX5 IS PARTICULARLY SUITABLE FOR USE IN TWO-TUBE SERIES-STRING STEREO-AMPLIFIER SYSTEMS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.65	μμf
GRID #1 TO CATHODE & GRID #3, GRID #2 & HEATER	17	μμf
PLATE TO CATHODE & GRID #3, GRID #2 & HEATER	9	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	60±10%	VOLTS
MAXIMUM PLATE VOLTAGE	150	VOLTS
MAXIMUM GRID #2 (SCREEN-GRID) VOLTAGE	130	VOLTS
MAXIMUM GRID #1 (CONTROL-GRID) VOLTAGE:		
POSITIVE-BIAS VALUE	0	VOLTS
MAXIMUM PLATE DISSIPATION	5.5	WATTS
MAXIMUM GRID #2 INPUT	2	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	200[A]	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	225	°C
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
FOR FIXED-BIAS OPERATION	0.1	MEGOHM
FOR CATHODE-BIAS OPERATION	0.5	MEGOHM

CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	60±10%	VOLTS
HEATER CURRENT	0.1	AMP.
PLATE-SUPPLY VOLTAGE	110	VOLTS
GRID #2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PLATE RESISTANCE (APPROX.)	17 500	OHMS
TRANSCONDUCTANCE	13 500	μMHOS
PLATE CURRENT	36	MA.
GRID #2 CURRENT	10	MA.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

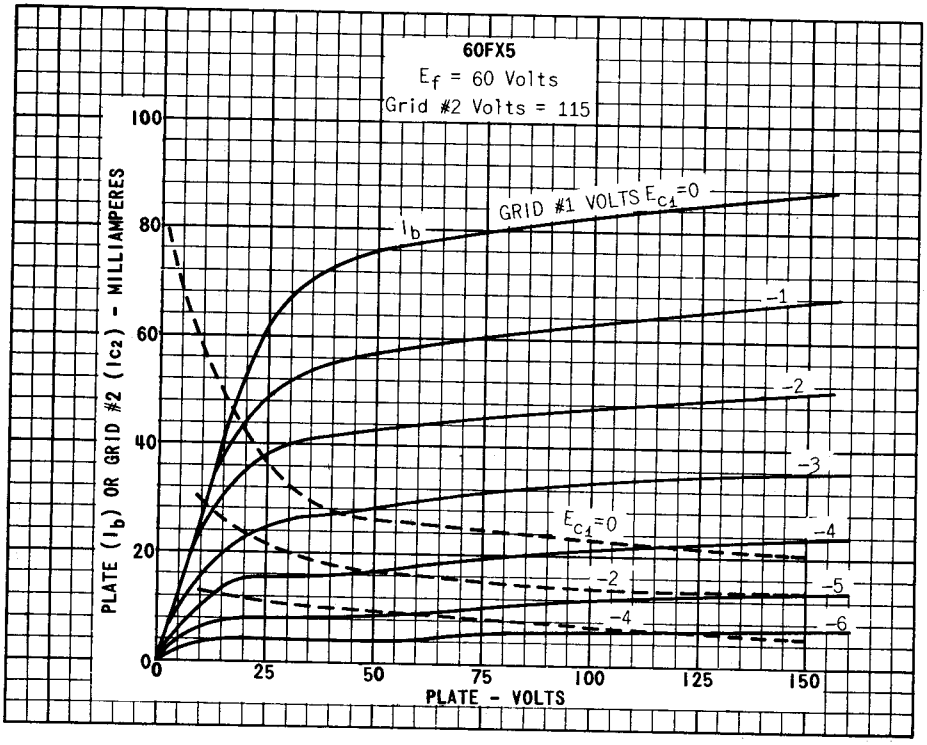
CONTINUED FROM PRECEDING PAGE

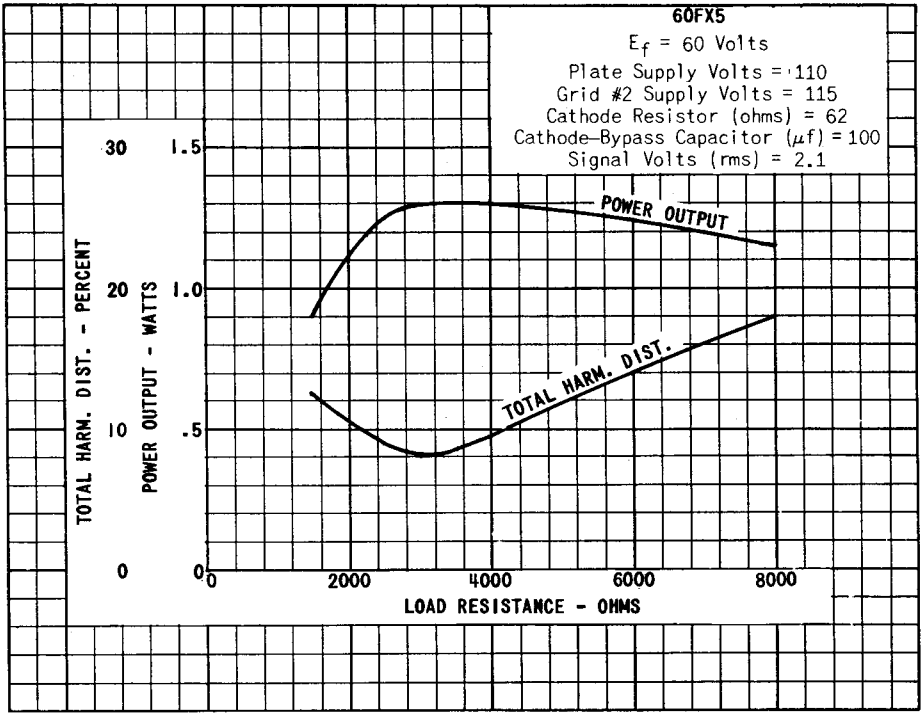
TYPICAL OPERATION

HEATER VOLTAGE	60±10%	VOLTS
HEATER CURRENT	0.1	AMP.
PLATE SUPPLY VOLTAGE	110	VOLTS
GRID #2 SUPPLY VOLTAGE	115	VOLTS
CATHODE RESISTOR	62	OHMS
PEAK AF GRID #1 VOLTAGE	3	VOLTS
ZERO-SIGNAL PLATE CURRENT	36	MA.
MAX.-SIGNAL PLATE CURRENT	35	MA.
ZERO-SIGNAL GRID #2 CURRENT	10	MA.
MAX.-SIGNAL GRID #2 CURRENT	12	MA.
LOAD RESISTANCE	3 000	OHMS
TOTAL HARMONIC DISTORTION	8	PERCENT
MAX.-SIGNAL POWER OUTPUT	1.3	WATTS

[A] THE DC COMPONENT MUST NOT EXCEED 100 VOLTS.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.





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TUNG-SOL

BEAM POWER AMPLIFIER

HALF-WAVE RECTIFIER WITH TAPPED HEATER

PHYSICAL SPECIFICATIONS

EMITTER UNIPOTENTIAL CATHODE		PIN CONNECTIONS	
BASE INTERMEDIATE 8 PIN OCTAL		PIN 1 RECT. CATHODE	PIN 7 RECT. HEATER*
CAP NONE		PIN 2 AMP. HEATER	PIN 8 AMP. CATHODE**
BULB T-9		PIN 3 AMP. PLATE	
MAXIMUM DIAMETER	1 5/16"	PIN 4 GRID #2	
MAXIMUM OVERALL LENGTH	3 5/16"	PIN 5 GRID #1	TOP CAP NONE
MAXIMUM SEATED HEIGHT	2 3/4"	PIN 6 RECT. PLATE*	

* PILOT LAMP CONNECTION

** AND BEAM PLATES

RATINGS

HEATER OR FILAMENT VOLTAGE (AC OR DC)	70.0	VOLTS
HEATER OR FILAMENT CURRENT	0.15	AMP.
MAXIMUM PLATE VOLTAGE (AMPLIFIER SECTION)	110	VOLTS
MAXIMUM SCREEN VOLTAGE (AMPLIFIER SECTION)	110	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS) (RECTIFIER SECTION)	125	VOLTS
TUBE VOLTAGE DROP AT 120 MA. DC (RECTIFIER SECTION)	14	VOLTS

OPERATING CONDITIONS AND CHARACTERISTICS

AMPLIFIER SECTION — CLASS A1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
CONTROL GRID VOLTAGE	-7.5	VOLTS
PLATE CURRENT	40	MA.
SCREEN CURRENT	3.0	MA.
TRANSCONDUCTANCE	5800	μMHOS
AMPLIFICATION FACTOR (APPROX.)	80	
LOAD RESISTANCE	2500	OHMS
TOTAL HARMONIC DISTORTION	6.5	PER CENT
POWER OUTPUT	1.5	WATTS

RECTIFIER SECTION — HALF WAVE RECTIFIER

WITH CONDENSER INPUT TO FILTER

MAXIMUM AC PLATE VOLTAGE (RMS)	125	VOLTS
MAXIMUM DC OUTPUT CURRENT	60	MA.

NOTE: THIS TUBE IS USED WITH A 0.15 AMPERE PILOT LAMP, WHICH IS CONNECTED BETWEEN PINS #6 AND #7. SINCE THE DC OUTPUT CURRENT OF THE RECTIFIER SECTION FLOWS THROUGH THE PILOT LAMP SECTION OF THE HEATER, THIS TUBE SHOULD NEVER BE USED IN CIRCUITS WITHOUT A PILOT LAMP.

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PLATE T751-1

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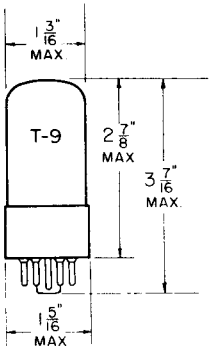
TUNG-SOL

COMBINED HALF WAVE RECTIFIER AND BEAM POWER AMPLIFIER



GLASS BULB

COATED UNIPOTENTIAL CATHODES

HEATER
70 VOLTS 0.15 AMPERE
AC OR DC

ANY MOUNTING POSITION

BOTTOM VIEW

INTERMEDIATE SHELL
8-PIN OCTAL

THE 7OL7GT IS A COMBINED RECTIFIER AND POWER OUTPUT BEAM TETRODE DESIGNED FOR SERVICE IN AC-DC RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	70	VOLTS
HEATER CURRENT	0.15	AMP.
RECTIFIER UNIT		
MAX. PEAK INVERSE PLATE VOLTAGE	350	VOLTS
MAX. PEAK PLATE CURRENT	420	MA.
MAX. DC HEATER-CATHODE POTENTIAL	175	VOLTS
WITH CONDENSER-INPUT FILTER:		
MAX. AC PLATE VOLTAGE (RMS)	117	VOLTS
MAX. DC OUTPUT CURRENT	70	MA.
MIN. TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE[A]	15	OHMS
AMPLIFIER UNIT		
MAX. PLATE VOLTAGE	117	VOLTS
MAX. SCREEN VOLTAGE	117	VOLTS
MAX. PLATE DISSIPATION	5.0	WATTS
MAX. SCREEN DISSIPATION	1.0	WATT
HEATER-CATHODE VOLTAGE	AS LOW AS POSSIBLE[B]	

[A] WHEN A FILTER-INPUT CONDENSER EXCEEDING 40 μf IS USED, MORE PLATE SUPPLY IMPEDANCE MAY BE NECESSARY TO LIMIT THE PEAK PLATE CURRENT TO THE RATED VALUE.

[B] OBTAINED BY CONNECTING PIN #2 TO THE SIDE OF THE LINE OPPOSITE THAT TO WHICH PINS #7 AND #8 ARE CONNECTED.

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1945

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	110	VOLTS
SCREEN VOLTAGE	110	VOLTS
GRID VOLTAGE	7.5	VOLTS
PEAK AF GRID VOLTAGE	7.5	VOLTS
ZERO-SIGNAL PLATE CURRENT	40	MA.
ZERO-SIGNAL SCREEN CURRENT (APPROX.)	3	MA.
MAX.- SIGNAL PLATE CURRENT	43	MA.
MAX.- SIGNAL SCREEN CURRENT (APPROX.)	6	MA.
GRID RESISTOR (MAX.)		
FIXED BIAS	0.1	MEGOHM
CATHODE BIAS	0.5	MEGOHM
PLATE RESISTANCE	15 000	OHMS
LOAD RESISTANCE	2000	OHMS
TRANSCONDUCTANCE	7500	µMHOS
MAX.-SIGNAL POWER OUTPUT	1.8	WATTS
TOTAL HARMONIC DISTORTION	10	PER CENT

SIMILAR TYPE REFERENCE: *Rectifier unit similar to types 117Z3 and 117Z4GT; amplifier unit somewhat similar to types 25L6G, 35A5, 35L6G.*

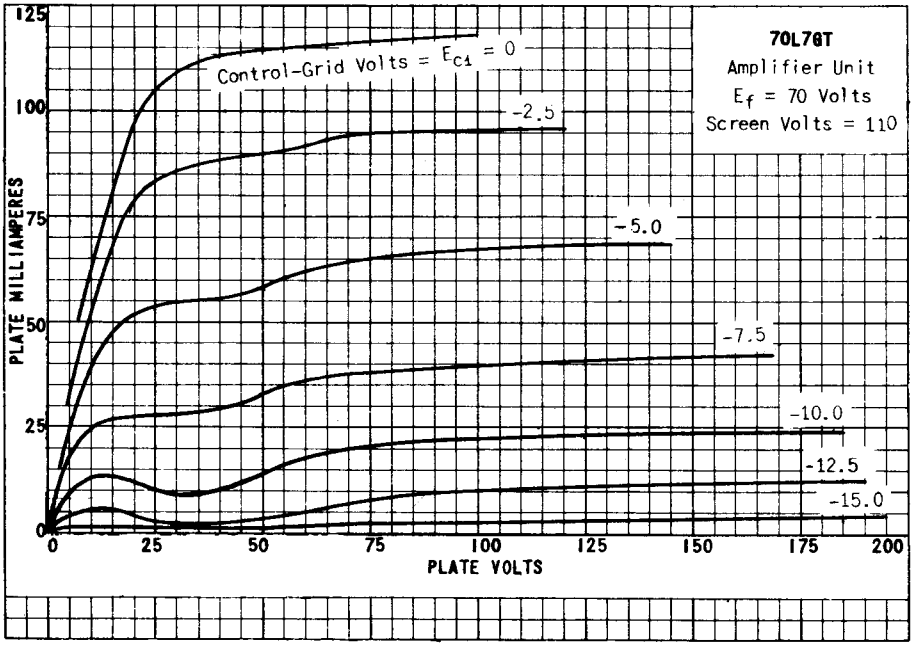

PLATE 1634
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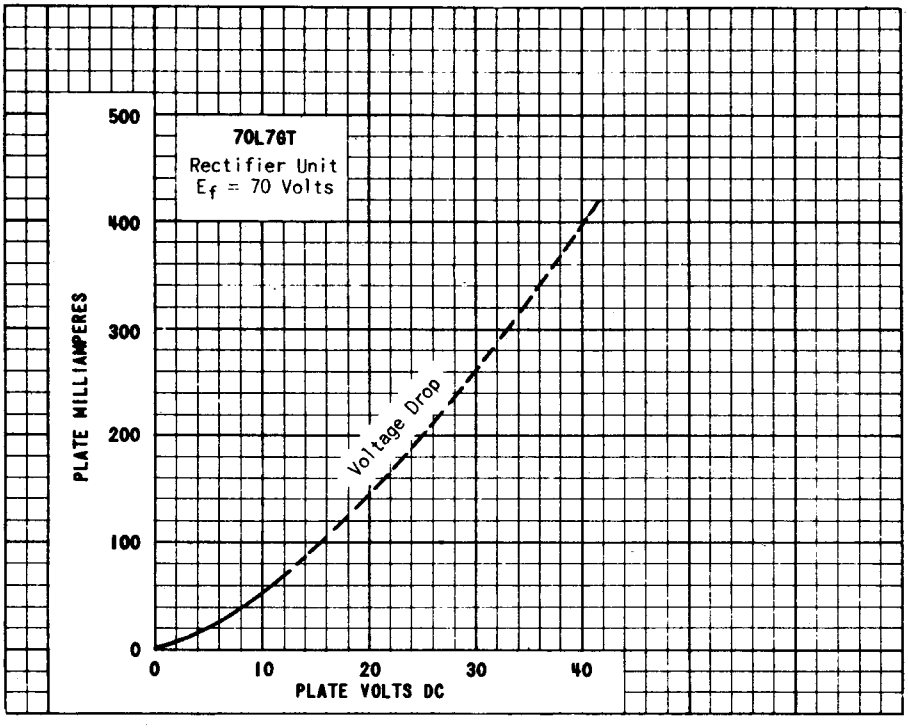

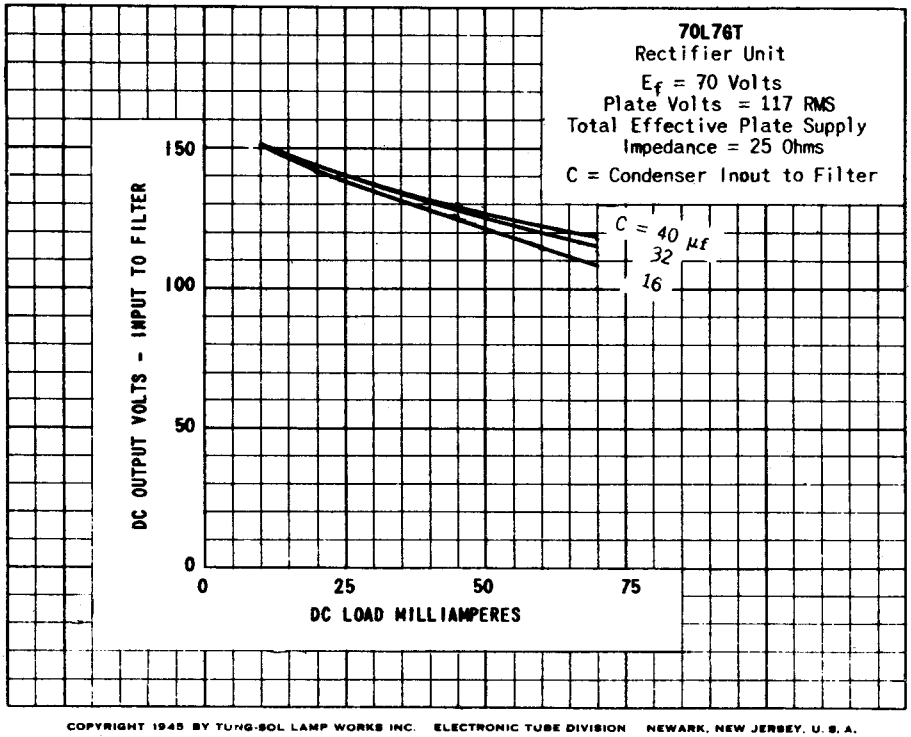

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1945

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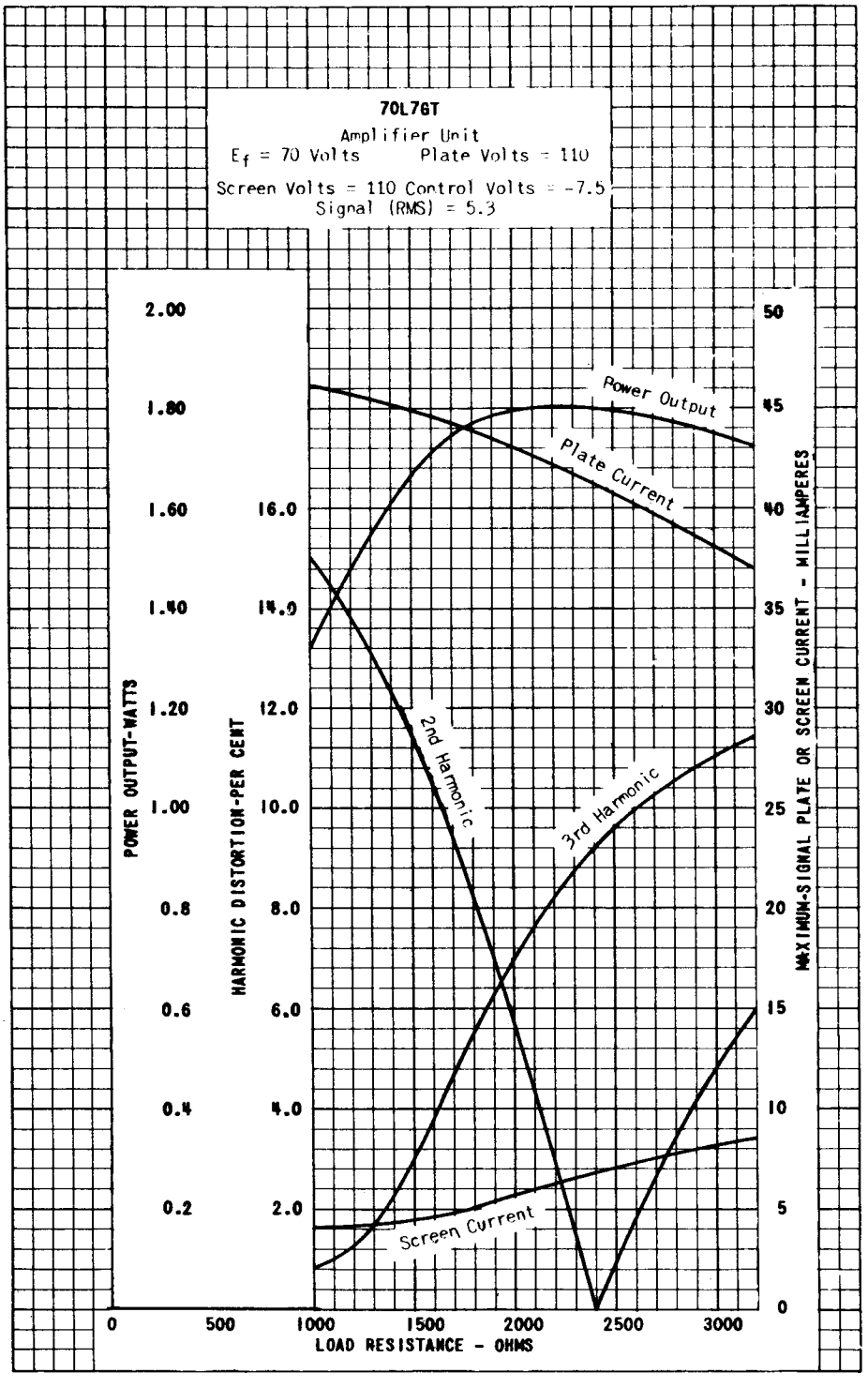
70L7GT



FLAT 1636
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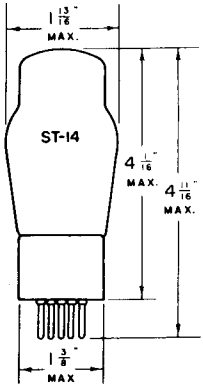
TUNG-SOL



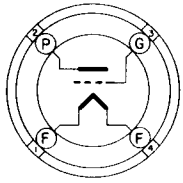
TRIODE POWER AMPLIFIER

COATED FILAMENT

5.0 VOLTS 0.25 AMPERE
AC OR DC

GLASS BULB

MEDIUM 4 PIN BASE



4D

BOTTOM VIEW

THE TUNG-SOL 71A IS A FILAMENT TYPE POWER AMPLIFIER HAVING LOW PLATE RESISTANCE.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	135	180 MAX.	VOLTS
GRID VOLTAGE [A]	-16.5	-27	-40.5	VOLTS
PLATE CURRENT	10	17.3	20	MA.
PLATE RESISTANCE	2170	1820	1750	OHMS
TRANSCONDUCTANCE	1400	1650	1700	μMHOS
AMPLIFICATION FACTOR	3	3	3	
LOAD RESISTANCE	3000	3000	4800	OHMS
TOTAL HARMONIC DISTORTION	5	5	5	PER CENT
POWER OUTPUT	0.125	0.4	0.79	WATT

[A] RETURN TO NEGATIVE FILAMENT (PIN #4)

DIRECT INTERELECTRODE CAPACITANCES

GRID TO FILAMENT	3.2	μμf
PLATE TO FILAMENT	2.9	μμf
GRID TO PLATE	7.5	μμf

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PLATE 575-1

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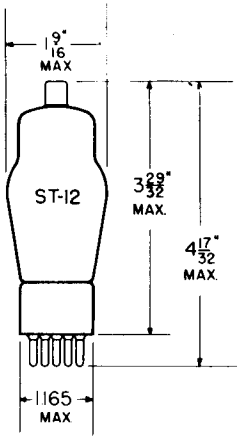


2A6, 75

SMALL METAL CAP

DUO-DIODE HIGH-MU TRIODE AMPLIFIER

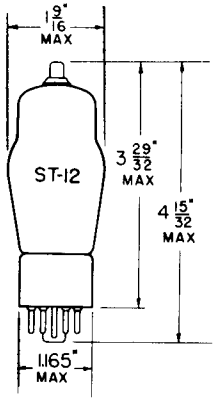
COATED UNIPOTENTIAL CATHODE

2A6	2.5 VOLTS	0.8 AMPERE
75	6.3 VOLTS	0.3 AMPERE
6B6G	6.3 VOLTS	0.3 AMPERE

AC OR DC

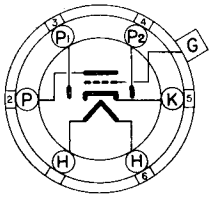
GLASS BULB

ANY MOUNTING POSITION



6B6G

SKIRTED MINIATURE CAP



BOTTOM VIEW

SMALL 6-PIN BASE

BOTTOM VIEW

SMALL 7-PIN OCTAL BASE

THE 2A6, 6B6G AND 75 COMBINE TWO DIODES AND A HIGH-MU TRIODE IN A SINGLE BULB, USING A COMMON CATHODE. THEY ARE DESIGNED FOR USE AS DIODE DETECTORS, AVC RECTIFIERS AND RESISTANCE COUPLED AMPLIFIERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MINIMUM DIODE CURRENT PER PLATE WITH 10 VOLTS DC APPLIED	0.8	MA.
MAXIMUM CATHODE VOLTAGE	100	VOLTS

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PLATE 1555
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CONTINUED FROM PRECEDING PAGE.

DIRECT INTERELECTRODE CAPACITANCES (APPROX.)

TRIODE UNIT

GRID TO PLATE	1.7	μμf
INPUT	1.7	μμf
OUTPUT	3.8	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

TRIODE UNIT

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2.0	VOLTS
PLATE CURRENT	0.9	MA.
PLATE RESISTANCE	91 000	OHMS
TRANSCONDUCTANCE	1 100	μMHOS
AMPLIFICATION FACTOR	100	

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	100	100	250	VOLTS
PLATE LOAD RESISTOR	0.25	0.25	0.25	MEGOHM
CATHODE RESISTOR	0.0	10 000	4 000	OHMS
GRID CIRCUIT RESISTOR	6.0	1.0	1.0	MEGOHMS
GRID COUPLING CONDENSER	0.01	0.05	0.05	μf
VOLTAGE GAIN	35	35	52	

PLATE
1556
JAN. 15
1945

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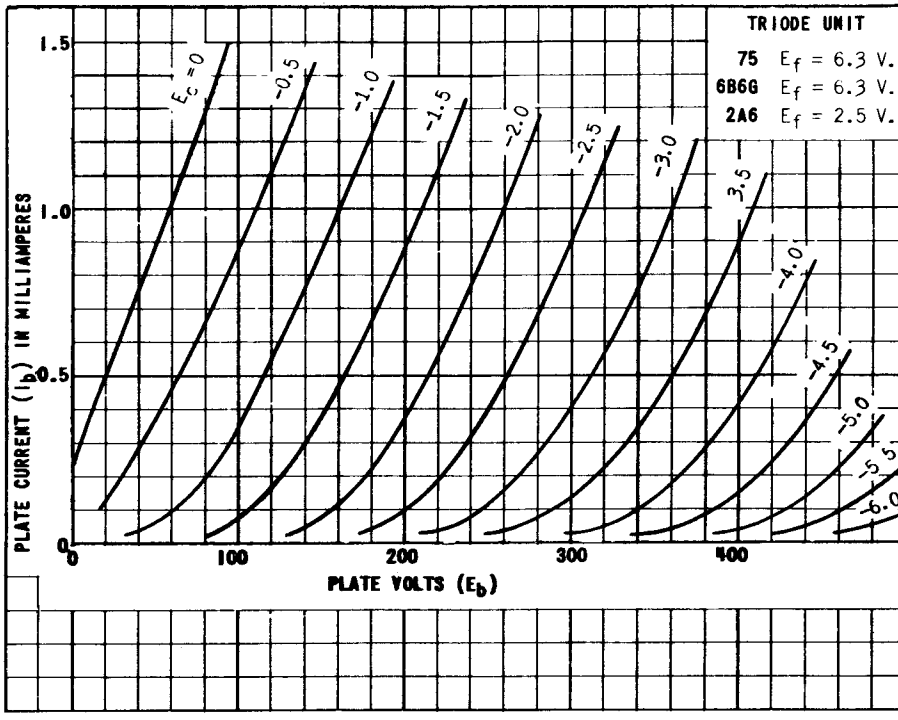

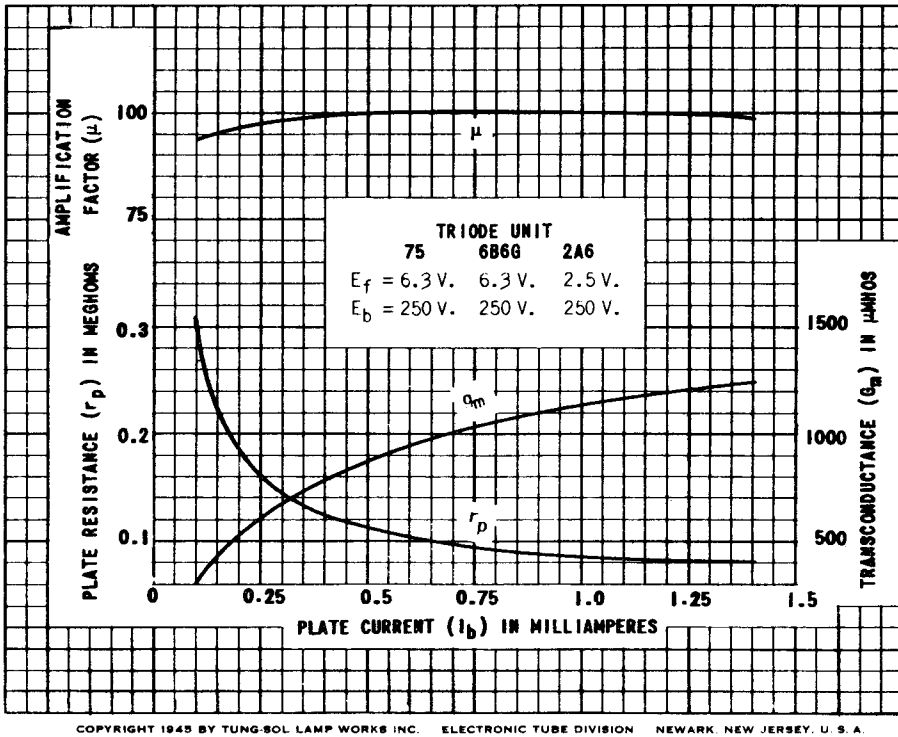

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1557
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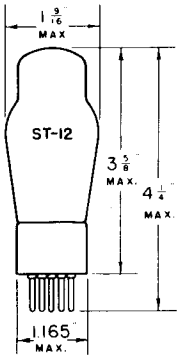


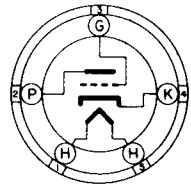
TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB

SMALL 5 PIN BASE



5A

THE TUNG-SOL 76 IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER. EXCEPT FOR HEATER VOLTAGE AND CURRENT ITS CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 56.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250 MAX.	VOLTS
GRID VOLTAGE	-5	-13.5	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	MEGOHM
PLATE CURRENT	2.5	5	MA.
PLATE RESISTANCE	12000	9500	OHMS
TRANSCONDUCTANCE	1150	1450	μMHOS
AMPLIFICATION FACTOR	13.8	13.8	

DETECTOR

	BIASED		GRID LEAK	
PLATE VOLTAGE	100	250	45	VOLTS
GRID VOLTAGE	-8	-20	RETURN TO CATHODE	VOLTS
PLATE CURRENT	ADJUST TO 0.2 MA. WITH NO INPUT SIGNAL			
GRID LEAK			1 TO 5	MEGOHMS
GRID CONDENSER			250	μμf

RESISTANCE COUPLED AMPLIFIER

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.05	0.25	0.05	0.25	MEGOHM
CATHODE RESISTOR	3800	15000	3800	15000	OHMS
VOLTAGE GAIN	8.5	10	9	10	

DIRECT INTERELECTRODE CAPACITANCES

GRID TO CATHODE	3.6	μμf
PLATE TO CATHODE	2.6	μμf
GRID TO PLATE	2.8	μμf

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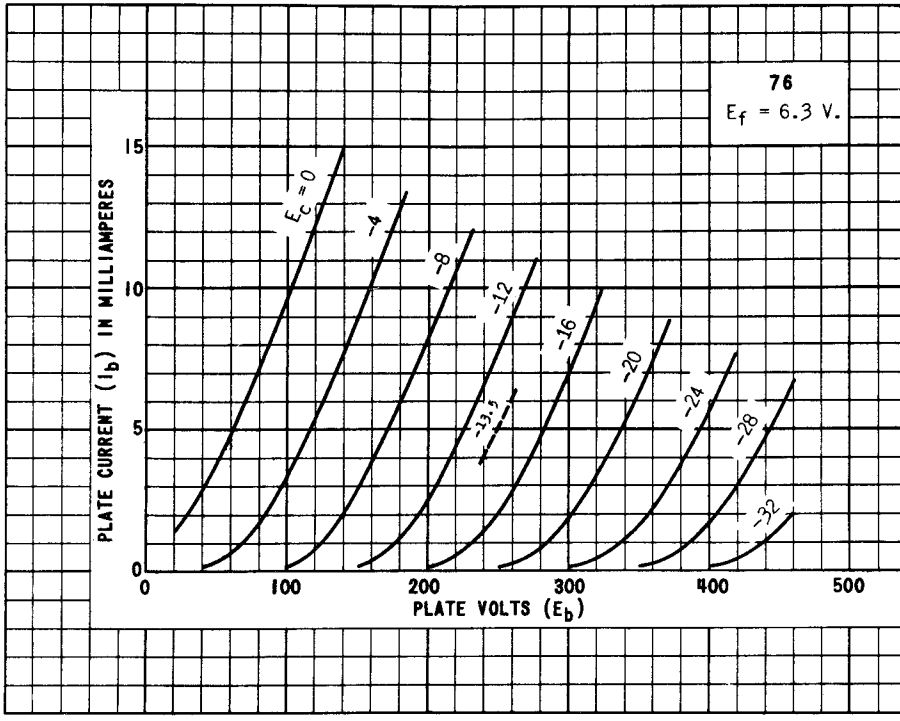

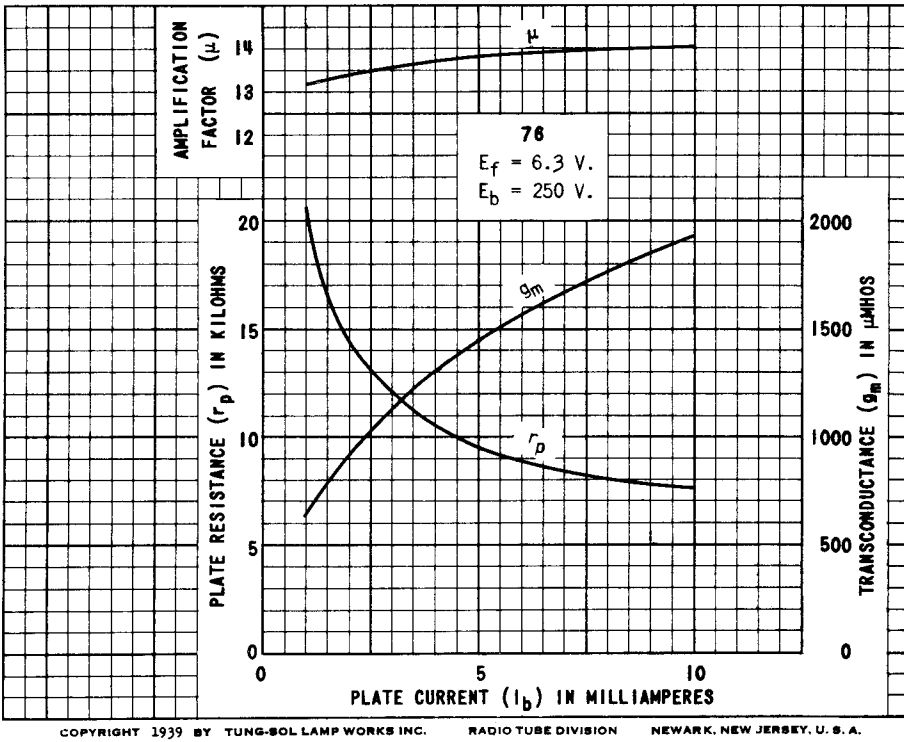

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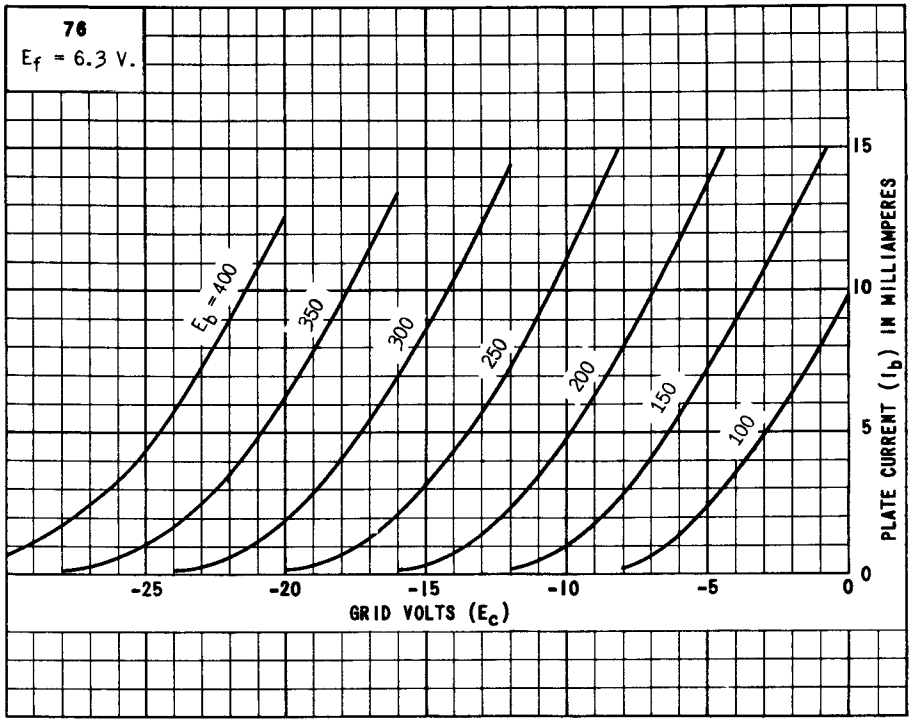

PLATE
333-1

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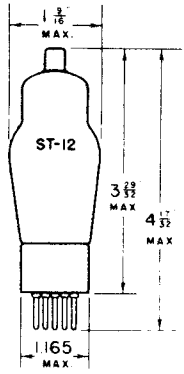


TRIPLE GRID

DETECTOR AMPLIFIER

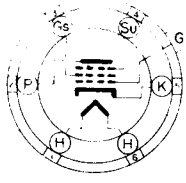
UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.3 AMPERE

AC OR DC

GLASS BULB



6F

BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 77 IS A TRIPLE GRID GENERAL PURPOSE DETECTOR AMPLIFIER.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	
MAXIMUM PLATE DISSIPATION	.75	WATT
MAXIMUM SCREEN DISSIPATION	.10	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
SCREEN VOLTAGE	60	100	VOLTS
CONTROL GRID VOLTAGE	-1.5	-3	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	MEGOHM
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET		
PLATE CURRENT	1.7	2.3	MA.
SCREEN CURRENT	0.4	0.5	MA.
PLATE RESISTANCE APPROX.	.6	1.0 MIN.	MEGOHM
TRANSCONDUCTANCE	1100	1250	μMHOS
CONTROL GRID VOLTAGE FOR CATHODE CURRENT CUT-OFF	-5.5	-7.5	VOLTS

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TUNG-SOL

BIASED DETECTOR

PLATE SUPPLY VOLTAGE	100	100	250	VOLTS
SCREEN SUPPLY VOLTAGE	16	100	100	VOLTS
PLATE RESISTOR	1	1	0.5	MEGOHM
SCREEN RESISTOR	0	2	0	MEGOHMS
CATHODE SELF BIASING RESISTOR	30 000	25 000	10 000	OHMS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET			

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	4.7	μμf
PLATE TO CATHODE	11	μμf
CONTROL GRID TO PLATE[S]	0.007 MAX.	μμf

[S] MEASURED WITH AN EXTERNAL SHIELD. THE INTERNAL SHIELD WITHIN THE DOME IS CONNECTED INTERNALLY TO THE SCREEN GRID (PIN #3).

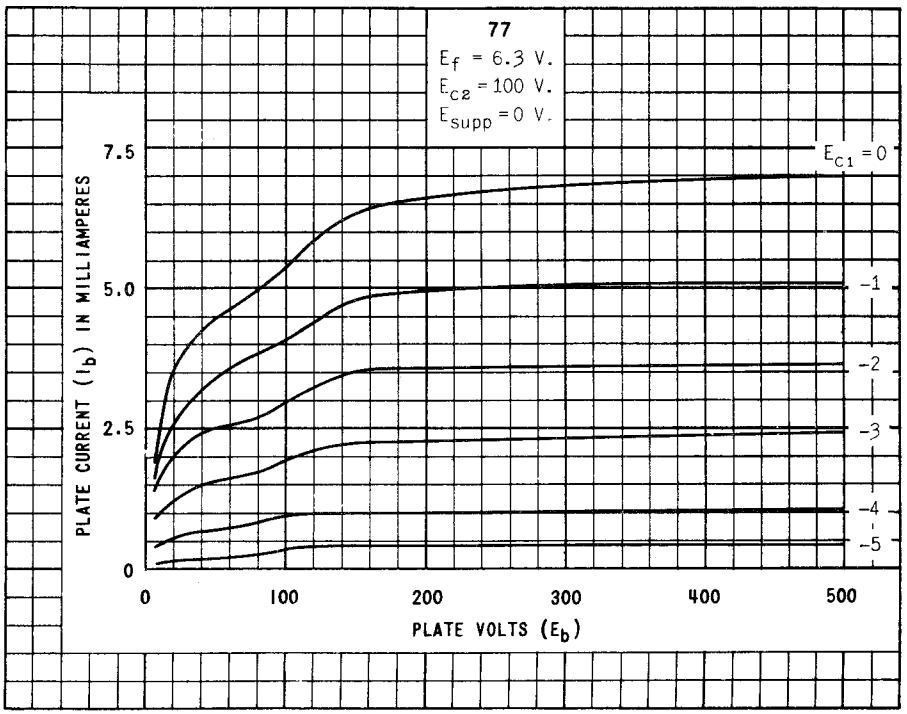

PLATE 656-1

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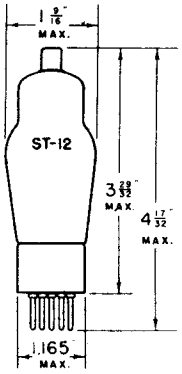
TUNG-SOL



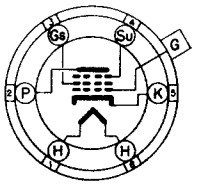
TRIPLE GRID

REMOTE CUT-OFF AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMPERE
AC OR DC

GLASS BULB



6F

BOTTOM VIEW

SMALL 6 PIN BASE

THE TUNG-SOL 78 IS A TRIPLE GRID REMOTE CUT-OFF AMPLIFIER. IT IS SUITABLE FOR USE WITH AVC IN RF AND IF AMPLIFIERS AND MINIMIZES CROSS MODULATION. WITH THE EXCEPTION OF CAPACITANCES, ITS RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6K7, THE 6K7G AND THE 6K7GT.

RATINGS

MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM SCREEN SUPPLY VOLTAGE	300	VOLTS
MAXIMUM SCREEN VOLTAGE	125	VOLTS
MINIMUM EXTERNAL GRID BIAS VOLTAGE	0	VOLTS
MAXIMUM PLATE DISSIPATION	2.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.35	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	90	180	250	250	VOLTS
SCREEN VOLTAGE	90	75	100	125	VOLTS
CONTROL GRID VOLTAGE	-3	-3	-3	-3	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET				
PLATE CURRENT	5.4	4.0	7.0	10.5	MA.
SCREEN CURRENT	1.3	1.0	1.7	2.6	MA.
PLATE RESISTANCE APPROX.	0.3	1.0	0.8	0.6	MEGOHM
TRANSCONDUCTANCE	1275	1100	1450	1650	μMHOS
CONTROL GRID BIAS FOR TRANSCONDUCTANCE = 2 μMHOS	-38.5	-38.5	-42.5	-52.5	VOLTS

CONTINUED NEXT PAGE

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PLATE 515-2

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TYPICAL OPERATING CONDITIONS WITH VARIABLE BIAS

MIXER IN SUPERHETERODYNE CIRCUITS

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	100	VOLTS
CONTROL GRID VOLTAGE APPROX. [A]	-10	VOLTS
SUPPRESSOR GRID	CONNECTED TO CATHODE AT SOCKET	

[A] THE GRID BIAS SHOWN IS MINIMUM FOR AN OSCILLATOR PEAK VOLTAGE OF 7 VOLTS. THESE VALUES ARE OPTIMUM.

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	4.5	μμf
PLATE TO CATHODE	11	μμf
CONTROL GRID TO PLATE	.007 MAX.	μμf

[S] MEASURED WITH AN EXTERNAL SHIELD. THE INTERNAL SHIELD IN THE DOME IS CONNECTED TO THE CATHODE WITHIN THE TUBE.

PLATE
516-2

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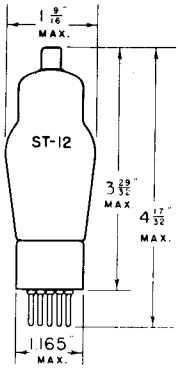


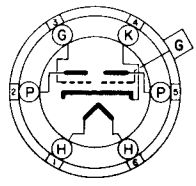
CLASS B TWIN TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.6 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN BASE



6H
BOTTOM VIEW

THE TUNG-SOL 79 COMBINES TWO TRIODES WITH A COMMON CATHODE IN A SINGLE BULB. IT IS DESIGNED FOR SERVICE AS A CLASS B POWER AMPLIFIER, VOLTAGE AMPLIFIER OR PHASE INVERTER. WITH THE EXCEPTION OF CAPACITANCES ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 6Y7G.

OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE MAX.	250	VOLTS
PEAK PLATE CURRENT PER PLATE MAX.	90	MA.
AVERAGE PLATE DISSIPATION MAX.	11.5	WATTS

CLASS B_2 AMPLIFIER

PLATE VOLTAGE	180	250 MAX.	VOLTS
GRID BIAS	0	0	VOLTS
ZERO-SIGNAL PLATE CURRENT PER PLATE	3.8	5.3	MA.
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	7000	14 000	OHMS
AVERAGE POWER INPUT GRID TO GRID	380	380	MILLIWATTS
POWER OUTPUT	5.5	8.0	WATTS

RESISTANCE COUPLED AMPLIFIER AND PHASE INVERTER

PLATE SUPPLY VOLTAGE	100	100	250	250	VOLTS
PLATE LOAD RESISTOR	0.1	0.5	0.1	0.5	MEGOHM
CATHODE RESISTOR	2000	6000	1200	3000	OHMS
VOLTAGE GAIN	30	35	35	43	

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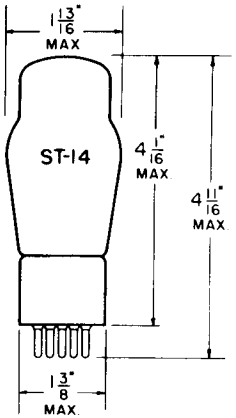
TUNG-SOL

DOUBLE DIODE



GLASS BULB

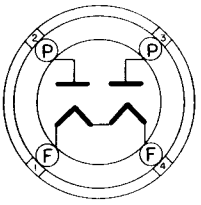
COATED FILAMENT

5.0 VOLTS 2.0 AMPERES

AC OR DC

VERTICAL MOUNTING POSITION

HORIZONTAL OPERATION PERMITTED IF PINS #1 AND #4 ARE IN A VERTICAL PLANE.



BOTTOM VIEW

MEDIUM SHELL
4 PIN OCTAL BASE
4C

THE 80 IS DESIGNED FOR USE AS A POWER RECTIFIER IN AC OPERATED RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

FILAMENT VOLTAGE	5.0	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	1 400	VOLTS
MAXIMUM AC PLATE SUPPLY VOLTAGE EACH PLATE (RMS)	SEE CHART	
MAXIMUM STEADY STATE PEAK PLATE CURRENT EACH PLATE	400	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT EACH PLATE	2.2	AMP.
TUBE VOLTAGE DROP (MEASURED WITH TUBE CONDUCTING 125 MA. EACH PLATE)	60	VOLTS
MAXIMUM STEADY STATE DC OUTPUT CURRENT EACH PLATE	SEE CHART	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER

	INPUT TO FILTER		
	CAPACITOR	CHOKE	
FILAMENT VOLTAGE	5.0	2.0	VOLTS
FILAMENT CURRENT	5.0	2.0	AMP.
AC PLATE SUPPLY VOLTAGE EACH PLATE	350	500	VOLTS
INPUT CONDENSER	10	---	µf
INPUT CHOKE	---	10	HENRYS
EFFECTIVE PLATE SUPPLY IMPEDANCE EACH PLATE	50	---	OHMS
DC OUTPUT CURRENT	125	125	MA.
DC OUTPUT VOLTAGE	350	390	MA.

SIMILAR TYPE REFERENCES: Ratings and Characteristics identical to types 5Y3GT and 5Y4G.

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80 (5Y3GT, 5Y4G)

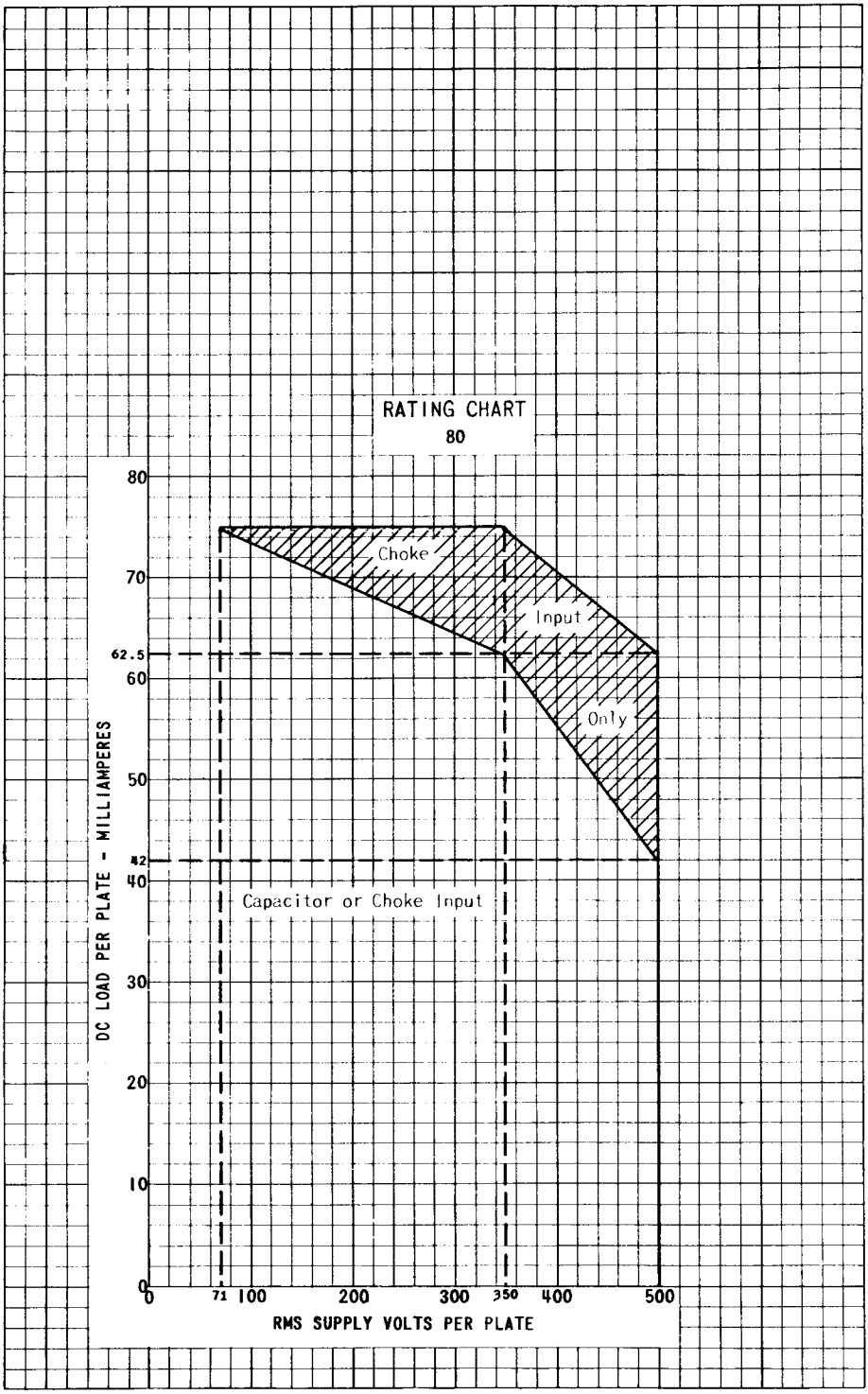

PLATE 2145
FEB. 1, 1949

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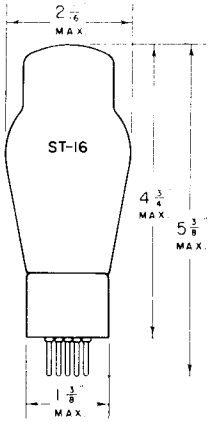
TUNG-SOL



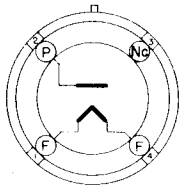
HALF-WAVE

HIGH VACUUM RECTIFIER

COATED FILAMENT

7.5 VOLTS 1.25 AMPERES
AC

GLASS BULB



4B

BOTTOM VIEW

MEDIUM 4 PIN BAYONET BASE

THE TUNG-SOL 81 IS A HALF-WAVE RECTIFIER WHICH MAY BE USED WITH EITHER CHOKE OR CONDENSER INPUT TO THE FILTER.

OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER - SINGLE TUBE

CONDENSER OR CHOKE INPUT TO FILTER

AC PLATE VOLTAGE (RMS)	700 MAX.	VOLTS
DC OUTPUT CURRENT	85 MAX.	MA.

FULL-WAVE RECTIFIER - TWO TUBES

CONDENSER OR CHOKE INPUT TO FILTER

AC PLATE VOLTAGE (RMS)	700 MAX.	VOLTS
DC OUTPUT CURRENT	170 MAX.	MA.
AVERAGE TUBE VOLTAGE DROP AT 170 MA. DC	91	VOLTS

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PLATE
576-1

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1939

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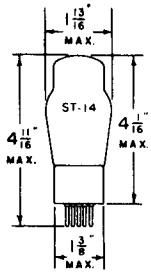


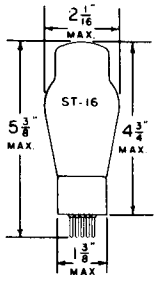
82

FULL WAVE
MERCURY VAPOR RECTIFIER

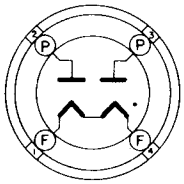
COATED FILAMENT

82 – 2.5 VOLTS 3.0 AMPERES
83 – 5.0 VOLTS 3.0 AMPERES
AC

GLASS BULB



83



4C

MEDIUM 4 PIN BASE BOTTOM VIEW
82 83

THE TUNG-SOL 82 AND 83 ARE DESIGNED FOR SERVICE AS POWER RECTIFIERS IN AC OPERATED RECEIVERS THAT REQUIRE A POWER SUPPLY WITH GOOD VOLTAGE REGULATION.

RATINGS

	82	83	
MAXIMUM PEAK INVERSE VOLTAGE	1550	1550	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	345	675	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

	82	83	
AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	450	VOLTS
DC OUTPUT CURRENT MAX.	115	225	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. [A]	50	50	OHMS
CONDENSED MERCURY TEMPERATURE OPERATING RANGE	24°–60°	20°–60°	CENTIGRADE

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

	82	83	
AC PLATE VOLTAGE PER PLATE (RMS) MAX.	550	550	VOLTS
DC OUTPUT CURRENT MAX.	115	225	MA.
VALUE OF INPUT CHOKE MIN.	6	3	HENRYS
CONDENSED MERCURY TEMPERATURE OPERATING RANGE	24°–60°	20°–60°	CENTIGRADE
APPROXIMATE TUBE VOLTAGE DROP	15	15	VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE. THE 82 AND 83 MAY BE OPERATED WITH PLATES CONNECTED IN PARALLEL. TO EQUALIZE THE CURRENT DISTRIBUTION BETWEEN PLATES, WHEN SO CONNECTED, IT IS NECESSARY TO ADD RESISTANCE IN SERIES WITH EACH PLATE LEAD (TYPE 82: 100 OHMS, TYPE 83: 50 OHMS). FOR PARALLEL OPERATION IN A FULL-WAVE CIRCUIT, IT IS DESIRABLE THAT BOTH PLATES WITHIN THE SAME TUBE BE CONNECTED TO THE SAME TERMINAL OF THE PLATE TRANSFORMER.

FULL PLATE LOAD SHOULD NOT BE APPLIED TO THIS TUBE UNTIL THE FILAMENTS HAVE REACHED THEIR NORMAL OPERATING TEMPERATURE. UNDER NORMAL OPERATING CONDITIONS, THE FILAMENTS HEAT QUICKLY WHEN THE SET IS "TURNED ON" AND ARE READY TO SUPPLY FULL-LOAD CURRENT BEFORE THE TUBES IN THE RECEIVER REQUIRE IT.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

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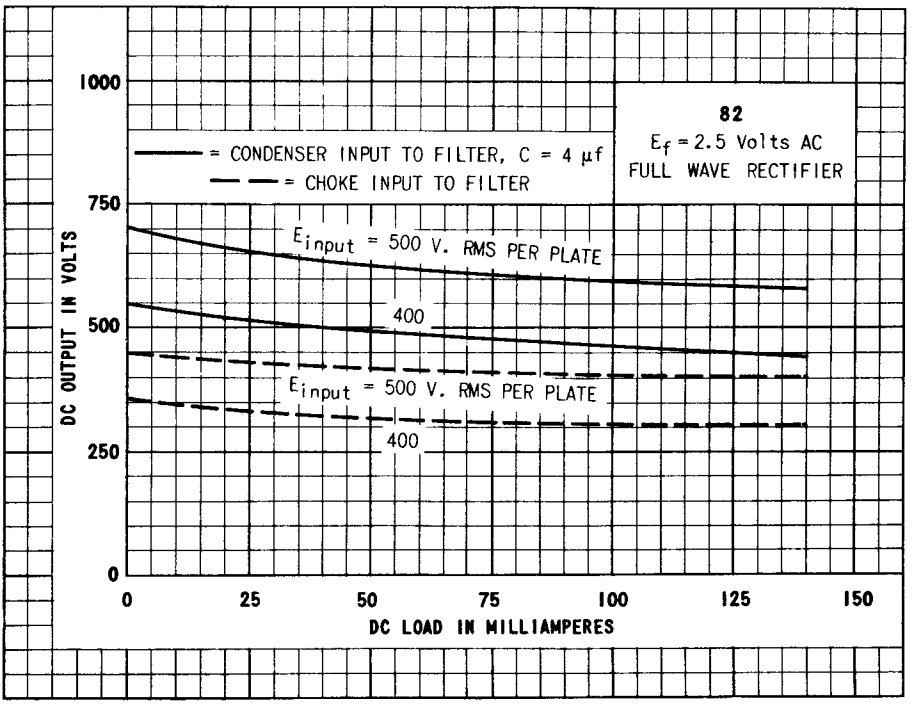
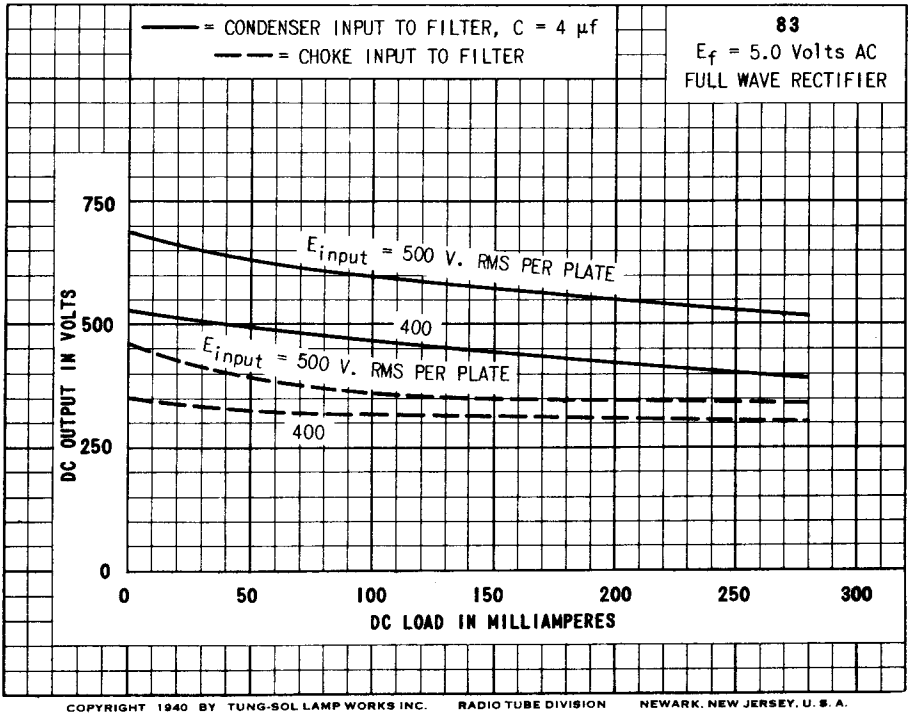
82, 83





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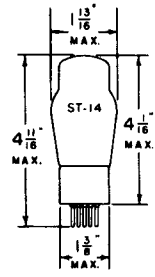
TUNG-SOL



MEDIUM 4 PIN BASE
83V

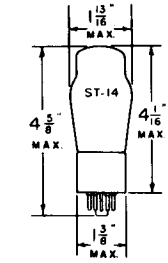
FULL WAVE

HIGH VACUUM RECTIFIER

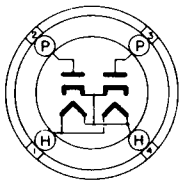
UNIPOTENTIAL CATHODE

HEATER
5.0 VOLTS 2.0 AMPERES
AC

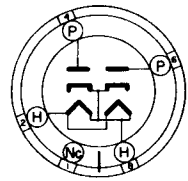
GLASS BULB



MEDIUM 5 PIN OCTAL BASE
5V4G



4L
BOTTOM VIEW



G-5L
BOTTOM VIEW

THE TUNG-SOL 5V4G AND 83V ARE POWER RECTIFIERS WITH LOW INTERNAL VOLTAGE DROPS. THEY ARE DESIGNED FOR SERVICE IN AC OPERATED RECEIVERS THAT REQUIRE HIGH CURRENTS. THEIR RATINGS AND ELECTRICAL CHARACTERISTICS ARE IDENTICAL.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1400	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	525	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	375	VOLTS
DC OUTPUT CURRENT MAX.	175	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN. A	65	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	500	VOLTS
DC OUTPUT CURRENT MAX.	175	MA.
VALUE OF INPUT CHOKE MIN.	4.0	HENRYS
TUBE VOLTAGE DROP AT 175 MA. PER PLATE	23	VOLTS

A WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

FOR "INTERPRETATION OF RATINGS", REFER TO FRONT OF BOOK.

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PLATE 701-2

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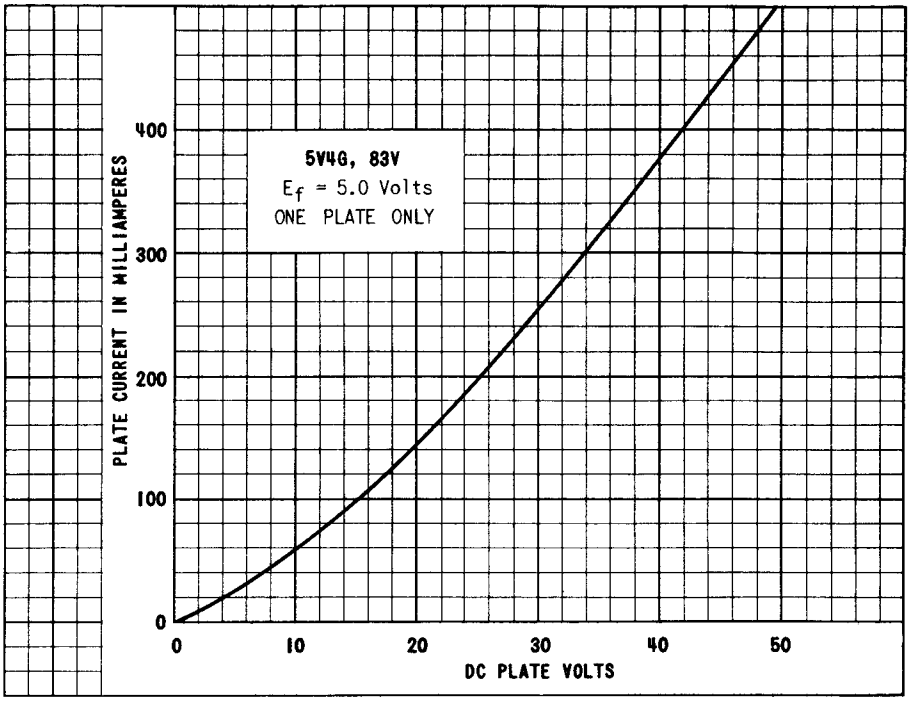
83V (5V4G)



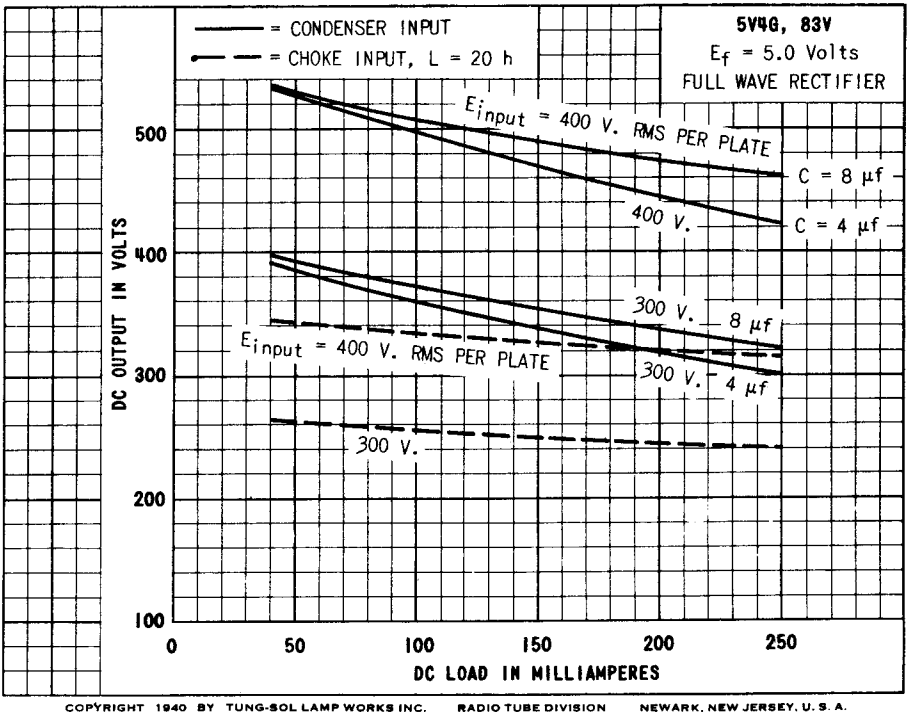


PLATE
702-1

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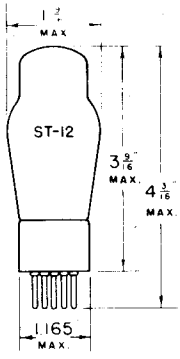
TUNG-SOL



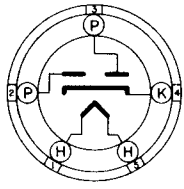
FULL WAVE

HIGH VACUUM RECTIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.5 AMPERE
AC OR DC

GLASS BULB



5D

BOTTOM VIEW

SMALL 5 PIN BASE

THE TUNG-SOL 84/6Z4 IS DESIGNED FOR USE AS A POWER RECTIFIER IN STORAGE BATTERY AND AC OPERATED RECEIVERS.

RATINGS

MAXIMUM PEAK INVERSE VOLTAGE	1250	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	450	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	180	MA.

OPERATING CONDITIONS AND CHARACTERISTICS

FULL WAVE RECTIFIER WITH CONDENSER INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	325	VOLTS
DC OUTPUT CURRENT MAX.	60	MA.
TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE MIN.[A]	65	OHMS

FULL WAVE RECTIFIER WITH CHOKE INPUT TO FILTER

AC PLATE VOLTAGE PER PLATE (RMS) MAX.	450	VOLTS
DC OUTPUT CURRENT MAX.	60	MA.
VALUE OF INPUT CHOKE MIN.	10	HENRYS
TUBE VOLTAGE DROP AT 60 MA. PER PLATE	20	VOLTS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μFDS ARE USED, IT MAY BE NECESSARY TO ADD ADDITIONAL PLATE SUPPLY IMPEDANCE.

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PLATE 715-2

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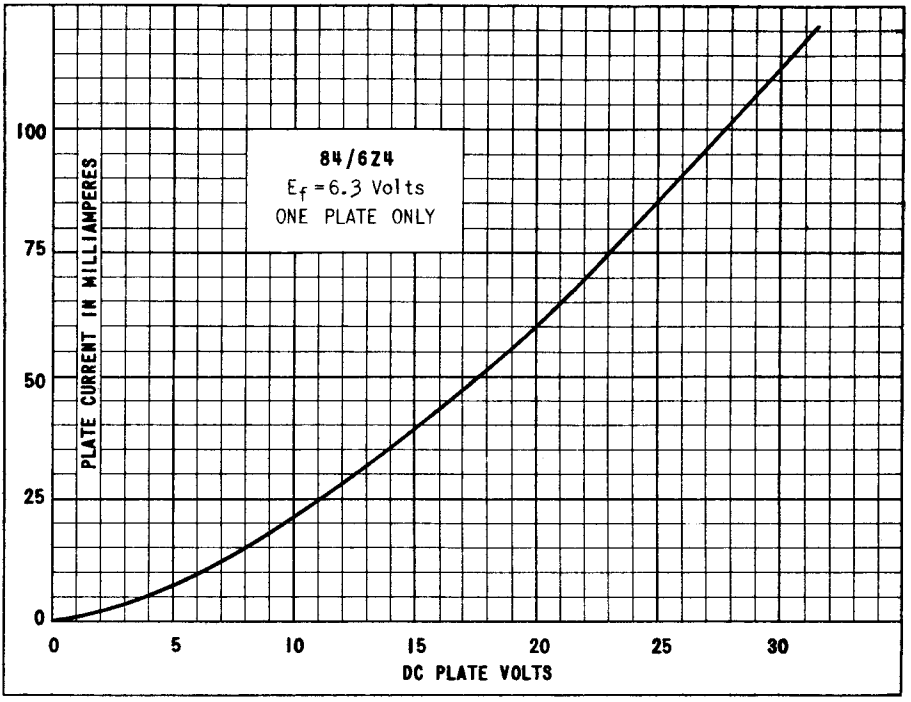
84/6Z4



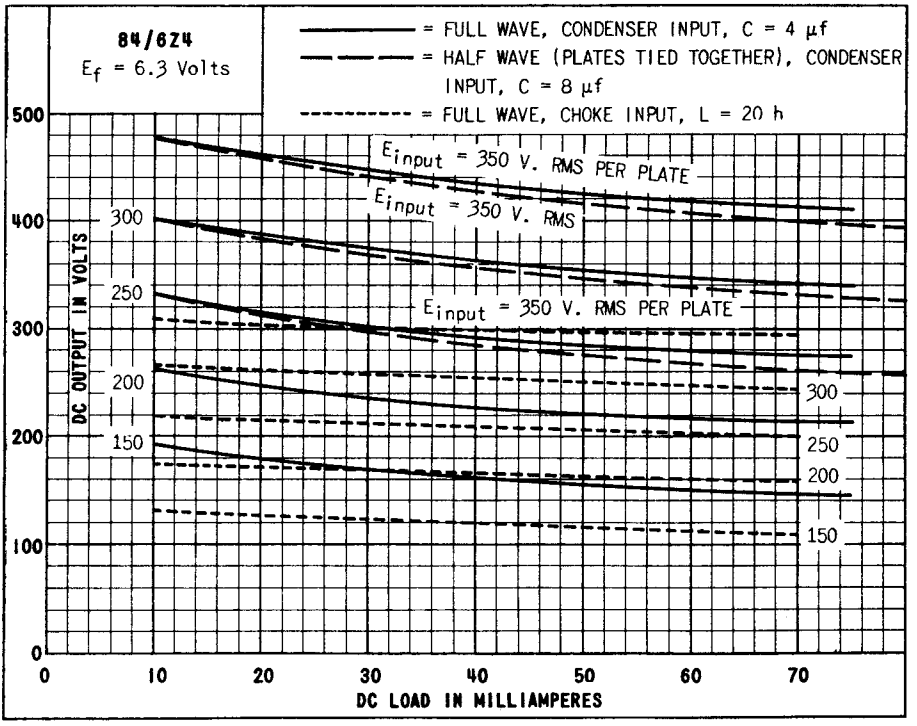


PLATE 716-1

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TUNG-SOL

DUPLEX-DIODE TRIODE

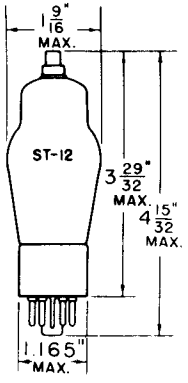
UNIPOTENTIAL CATHODE

HEATER

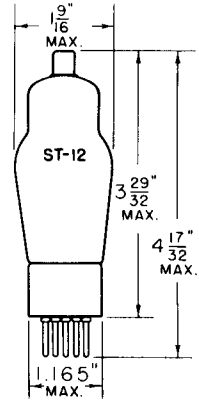
6V7G, 85	55
6.3 V.	2.5 V.
0.3 A.	1.0 A.

AC OR DC

IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. UNDER NO CONDITIONS SHOULD IT EXCEED 100 VOLTS.

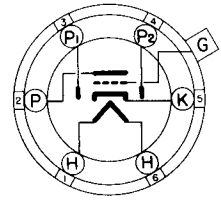


6V7G
SMALL 7 PIN OCTAL BASE



55, 85
SMALL 6 PIN BASE

6V7G



55, 85

BOTTOM VIEWS

THE 6V7G, 55 AND 85 ARE HEATER CATHODE TYPE TUBES CONSISTING OF TWO DIODES AND A TRIODE IN A SINGLE BULB. THEY ARE DESIGNED FOR USE AS COMBINED DETECTORS, AMPLIFIERS AND AUTOMATIC VOLUME CONTROL TUBES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	2.0	WATTS

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	1.5	μμf
INPUT	1.5	μμf
OUTPUT	4.3	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER

PLATE VOLTAGE	135	180	250	VOLTS
GRID VOLTAGE	-10.5	-13.5	-20	VOLTS
PLATE CURRENT	3.7	6.0	8.0	MA.
PLATE RESISTANCE	11000	8500	7500	OHMS
TRANSCONDUCTANCE	750	975	1100	μMHOS
AMPLIFICATION FACTOR	8.3	8.3	8.3	
LOAD RESISTANCE	25000	20000	20000	OHMS
POWER OUTPUT	75	160	350	MW.

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PLATE 1447
JUNE 15 1944

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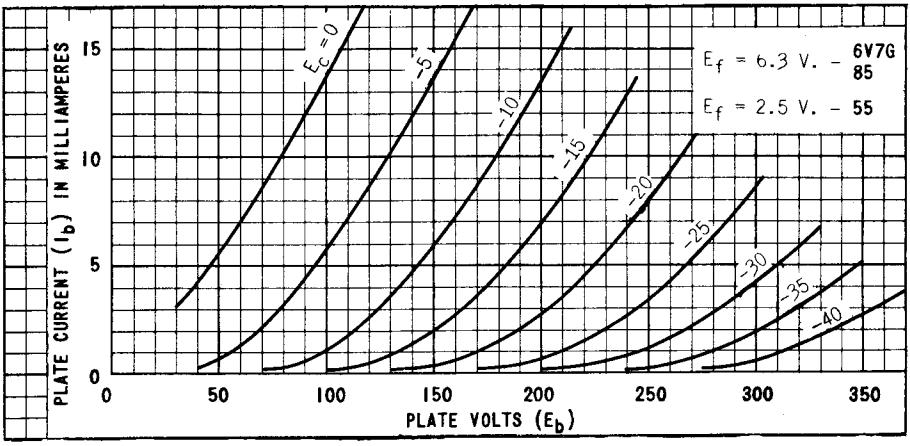
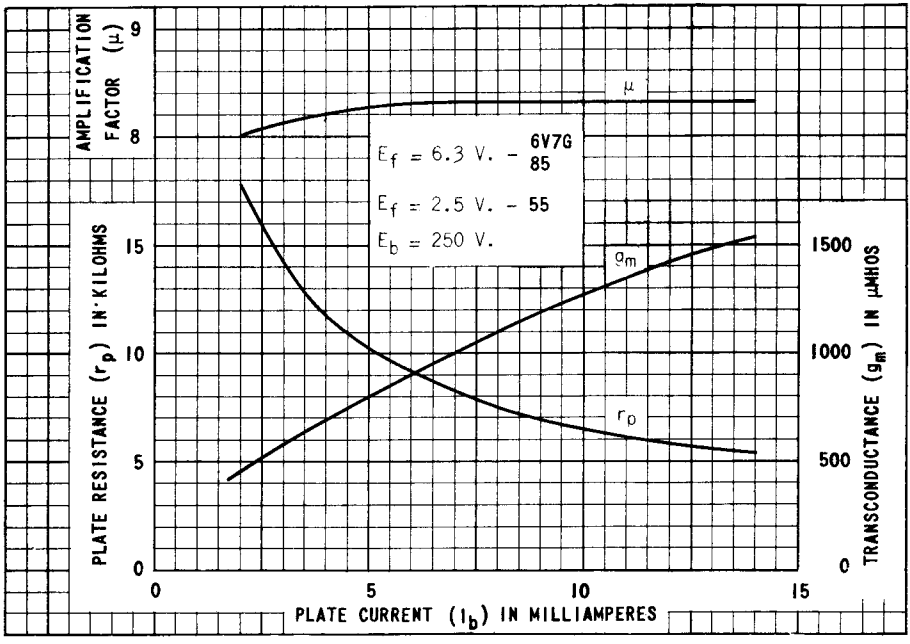
85 (6V7G, 55)





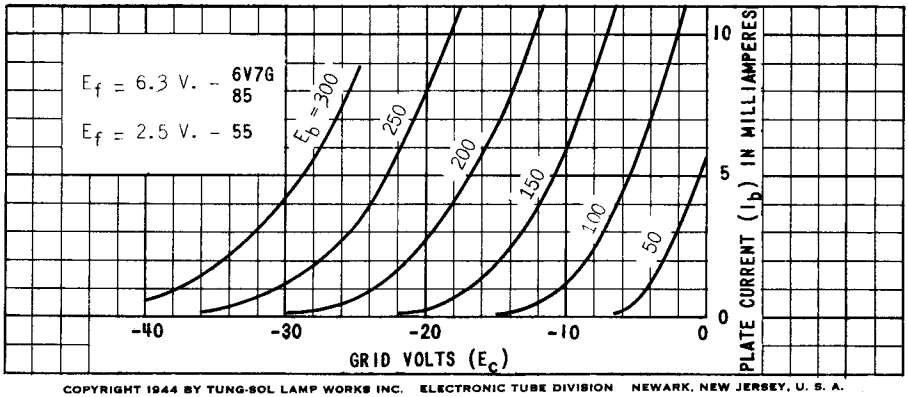


PLATE 1448
JUNE 15 1944

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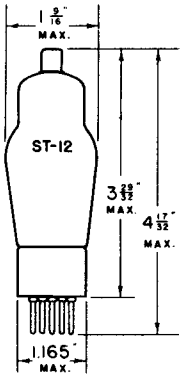


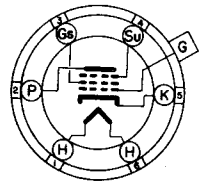
TRIPLE GRID POWER AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.4 AMPERE
AC OR DC

GLASS BULB

SMALL 6 PIN BASE



6F

THE TUNG-SOL 89 IS DESIGNED FOR SERVICE AS A PENTODE, CLASS A TRIODE, OR CLASS B TRIODE, IN THE OUTPUT STAGE OF AC OPERATED AND STORAGE BATTERY OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER – TRIODE CONNECTED

GRIDS G_S AND Su CONNECTED TO PLATE

PLATE VOLTAGE	160	180	250 MAX.	VOLTS
CONTROL GRID VOLTAGE	−20	−22.5	−31	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	1	MEGOHM
PLATE CURRENT	17	20	32	MA.
PLATE RESISTANCE	3300	3000	2600	OHMS
TRANSCONDUCTANCE	1425	1550	1800	μMHOS
AMPLIFICATION FACTOR	4.7	4.7	4.7	
LOAD RESISTANCE P	7000	6500	5500	OHMS
TOTAL HARMONIC DISTORTION MAX.	5	5	5	PER CENT
POWER OUTPUT	300	400	900	MW.

P WHEN USED AS A DRIVER FOR A CLASS B STAGE, APPROXIMATELY TWICE THIS VALUE OF LOAD RESISTANCE IS RECOMMENDED.

CLASS A1 AMPLIFIER – PENTODE CONNECTED

PLATE VOLTAGE	100	135	180	250 MAX.	VOLTS
SCREEN GRID VOLTAGE	100	135	180	250 MAX.	VOLTS
CONTROL GRID VOLTAGE	−10	−13.5	−18	−25	VOLTS
GRID CIRCUIT RESISTANCE MAX.	1	1	1	1	MEGOHM
SUPPRESSOR	CONNECTED TO CATHODE AT SOCKET				
PLATE CURRENT	9.5	14	20	32	MA.
SCREEN CURRENT	1.6	2.2	3.0	5.5	MA.
TRANSCONDUCTANCE	1200	1350	1550	1800	μMHOS
AMPLIFICATION FACTOR	125	125	125	125	
LOAD RESISTANCE	10 700	9200	8000	6750	OHMS
TOTAL HARMONIC DISTORTION	9	9	9	9	PER CENT
POWER OUTPUT	0.33	0.75	1.5	3.4	WATTS

PLATE 212-1

CONTINUED NEXT PAGE

CLASS B_2 AMPLIFIER – TRIODE CONNECTION

(GRID S_U TIED TO PLATE; GRIDS G AND G_S CONNECTED TOGETHER)

PLATE VOLTAGE MAX.	250	VOLTS
PEAK PLATE CURRENT MAX.	90	MA.
AVERAGE GRID DISSIPATION (GRIDS G AND G_S) MAX.	0.35	WATTS

TWO TUBES PUSH–PULL

PLATE VOLTAGE	180	180	VOLTS
GRID VOLTAGE	0	0	VOLTS
ZERO–SIGNAL PLATE CURRENT PER TUBE	3	3	MA.
LOAD RESISTANCE PER TUBE	3400	2350	OHMS
EFFECTIVE LOAD RESISTANCE PLATE TO PLATE	13 600	9400	OHMS
POWER OUTPUT (TWO TUBES) APPROX.	2.5	3.5	WATTS

DIRECT INTERELECTRODE CAPACITANCES[S]

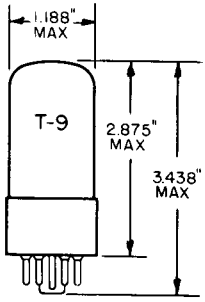
CONTROL GRID TO CATHODE	3.4	μμf
PLATE TO CATHODE	7.5	μμf
CONTROL GRID TO PLATE	0.5	μμf

[S] WITH SHIELD

PLATE
213-1

TUNG-SOL

DIODE-BEAM PENTODE



GLASS BULB
INTERMEDIATE SHELL
8 PIN OCTAL B8-6
OUTLINE DRAWING
JEDEC 9-15

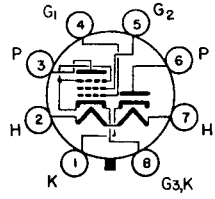
FOR

POWER RECTIFIER AND

AUDIO OUTPUT APPLICATIONS

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8A0

THE 117L7/M7GT COMBINES A HALF-WAVE RECTIFIER AND A BEAM POWER AMPLIFIER IN THE SAME ENVELOPE. IT IS DESIGNED FOR AC DC SERVICE FROM A 117 VOLT LINE IN THREE WAY PORTABLE RECEIVERS. IT HAS FOUND USE IN A NUMBER OF OTHER APPLICATIONS.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	117	VOLTS	90	MA.
LIMITS OF SUPPLIED VOLTAGE			117±12	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE			175	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

DIODE UNIT

AC PLATE VOLTAGE, RMS	117	VOLTS
PEAK INVERSE VOLTAGE	350	VOLTS
STEADY-STATE PEAK PLATE CURRENT	450	MA.

PENTODE UNIT

PLATE VOLTAGE	117	VOLTS
GRID 2 VOLTAGE	117	VOLTS
PLATE DISSIPATION	6.0	WATTS
GRID 2 DISSIPATION	1.0	WATTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND OPERATING CONDITIONS

DIODE UNIT

TUBE VOLTAGE DROP:		
MEASURED WITH APPLIED DC AT 150 MA PLATE CURRENT	16	VOLTS

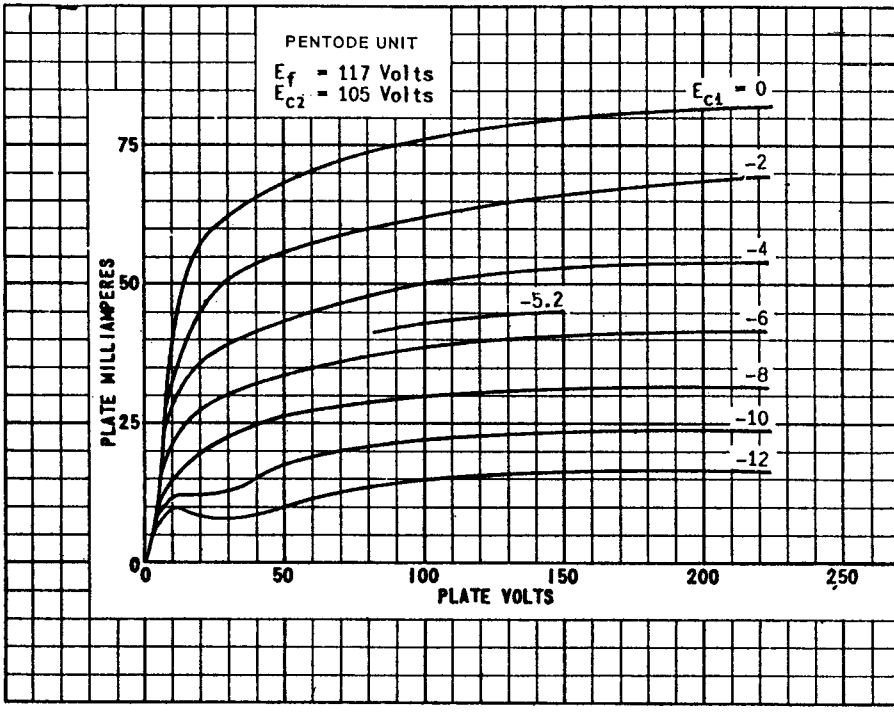
HALF-WAVE POWER RECTIFIER

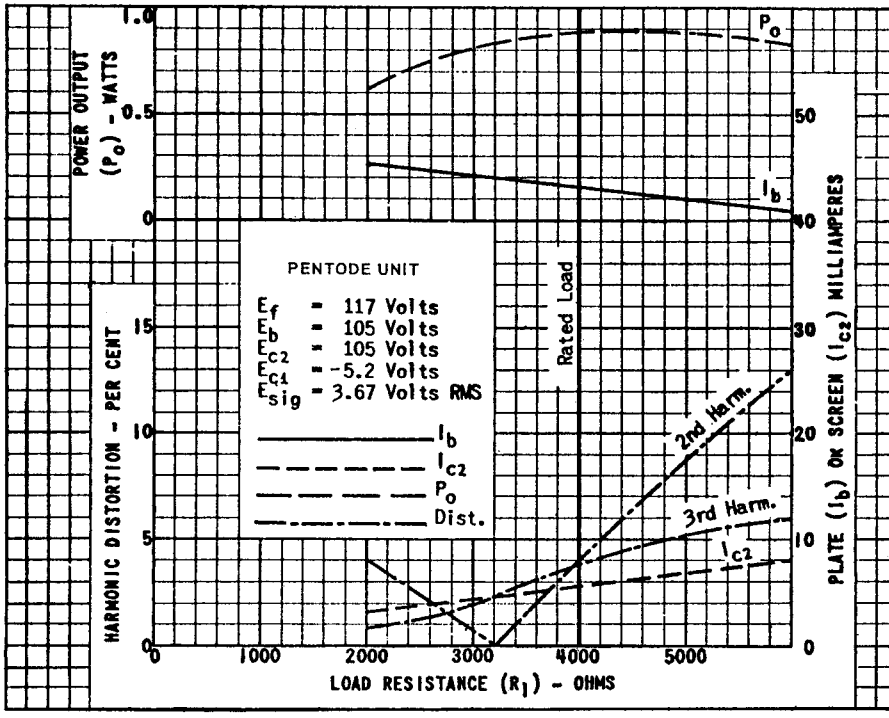
AC PLATE VOLTAGE, RMS	117	VOLTS
DC OUTPUT CURRENT	75	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS

PENTODE UNIT

CLASS A1 AUDIO POWER AMPLIFIER

PLATE VOLTAGE	105	VOLTS
GRID 2 VOLTAGE	105	VOLTS
GRID VOLTAGE	-5.2	VOLTS
PEAK AF GRID VOLTAGE	5.2	VOLTS
ZERO-SIGNAL PLATE CURRENT	43	MA.
MAXIMUM-SIGNAL PLATE CURRENT	43	MA.
ZERO-SIGNAL GRID 2 CURRENT (NOMINAL)	4	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT (NOMINAL)	5.5	MA.
PLATE RESISTANCE (APPROX.)	17,000	OHMS
TRANSCONDUCTANCE	5,300	μMHOS
LOAD RESISTANCE	4,000	OHMS
TOTAL HARMONIC DISTORTION	5.0	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	0.85	WATT





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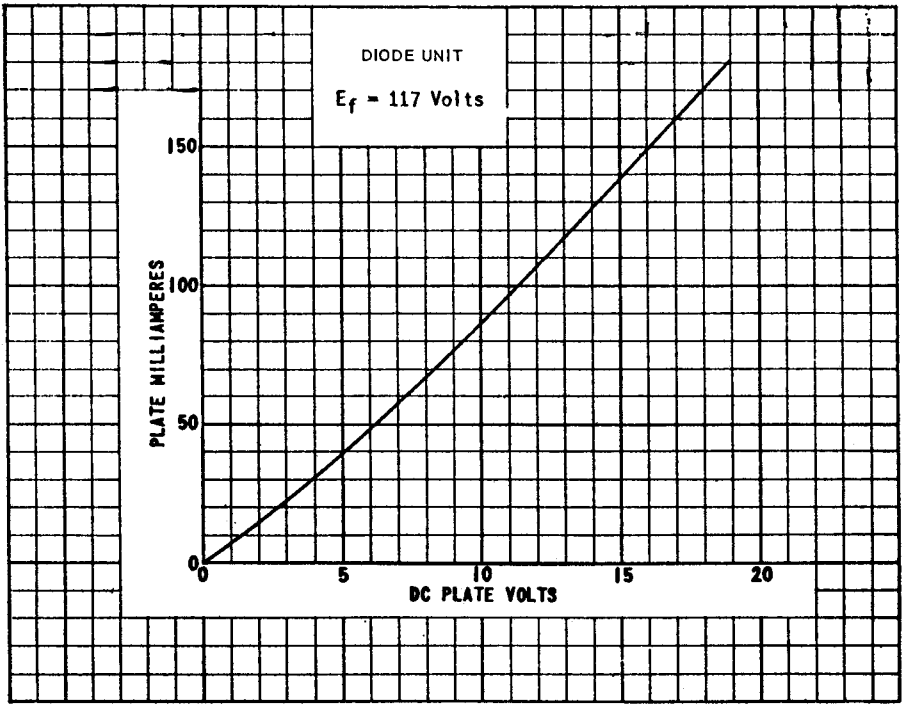
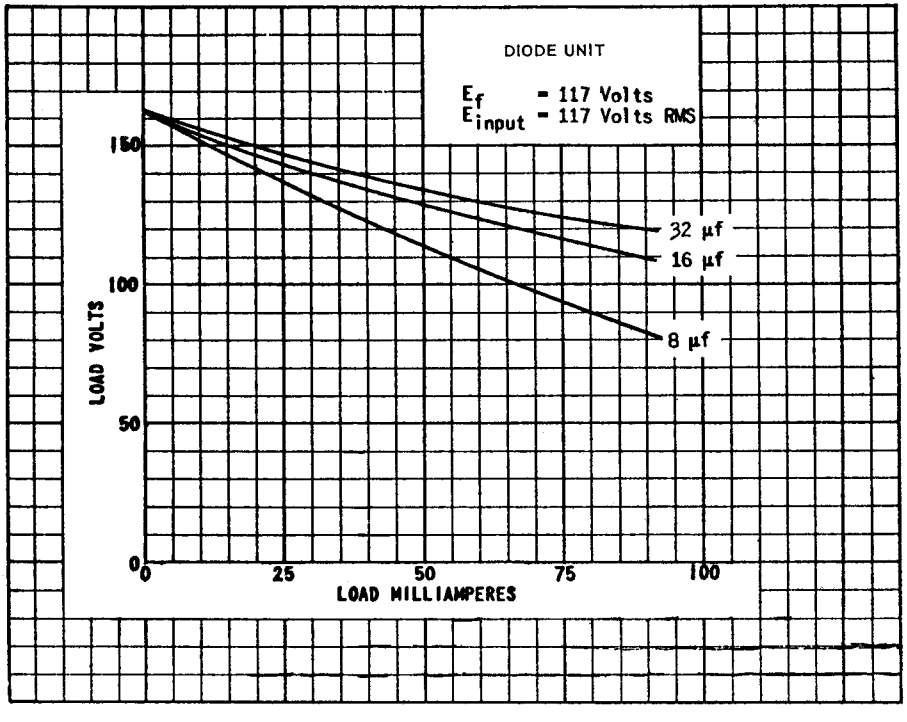
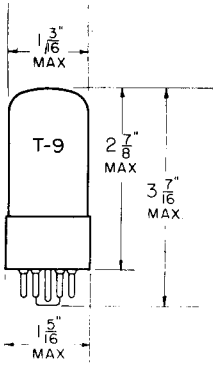

DIODE UNIT
E_f = 117 Volts
PLATE MILLIAMPERES
150
100
50
0
0
5
10
15
20
DC PLATE VOLTS


DIODE UNIT
E_f = 117 Volts
E_{input} = 117 Volts RMS
LOAD VOLTS
150
100
50
0
32 µf
16 µf
8 µf
0
25
50
75
100
LOAD MILLIAMPERES

TUNG-SOL

COMBINED HALF WAVE RECTIFIER AND BEAM POWER AMPLIFIER



COATED UNIPOTENTIAL CATHODES

HEATER
117 VOLTS 0.09 AMPERE
AC OR DC

ANY MOUNTING POSITION

GLASS BULB

BOTTOM VIEW

INTERMEDIATE SHELL
8-PIN OCTAL

THE 117N7GT IS A MULTI-UNIT TUBE CONTAINING A HALF-WAVE RECTIFIER AND A BEAM POWER AMPLIFIER IN THE SAME ENVELOPE. IT IS DESIGNED WITH A HEATER FOR CONNECTION DIRECTLY ACROSS A 117-VOLT SUPPLY LINE.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	117	VOLTS
HEATER CURRENT	0.09	AMP.

RECTIFIER UNIT

MAX. PEAK INVERSE PLATE VOLTAGE	350	VOLTS
MAX. PEAK PLATE CURRENT	450	MA.
MAX. DC HEATER-CATHODE POTENTIAL	175	VOLTS
WITH CONDENSER-INPUT FILTER:		
MAX. AC PLATE VOLTAGE (RMS)	117	VOLTS
MAX. DC OUTPUT CURRENT	75	MA.
MIN. TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE[A]	15	OHMS

[A] WHEN A FILTER-INPUT CONDENSER LARGER THAN 40 μf IS USED, IT MAY BE NECESSARY TO USE ADDITIONAL PLATE-SUPPLY IMPEDANCE TO LIMIT THE PEAK PLATE CURRENT TO RATED VALUE.

CONTINUED ON FOLLOWING PAGE

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PLATE 1615
OCT. 15, 1945

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CONTINUED FROM PRECEDING PAGE

AMPLIFIER UNIT

MAX. PLATE VOLTAGE	117	VOLTS
MAX. SCREEN VOLTAGE	117	VOLTS
MAX. PLATE DISSIPATION	5.5	WATTS
MAX. SCREEN DISSIPATION	1	WATT

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE	100	VOLTS
GRID VOLTAGE[B]	-6	VOLTS
PEAK AF GRID VOLTAGE	6	VOLTS
ZERO-SIGNAL PLATE CURRENT	51	MA.
ZERO-SIGNAL SCREEN CURRENT	5	MA.
PLATE RESISTANCE (APPROX.)	16 000	OHMS
LOAD RESISTANCE	3000	OHMS
TRANSCONDUCTANCE	7000	μMHOS
TOTAL HARMONIC DISTORTION	6	PER CENT
MAX. SIGNAL POWER OUTPUT	1.2	WATTS

[B] TYPE OF INPUT COUPLING USED SHOULD NOT INTRODUCE TOO MUCH RESISTANCE IN THE GRID CIRCUIT. RESISTANCE SHOULD NOT EXCEED 0.25 MEGOHM WITH FIXED BIAS, NOR 1.0 MEGOHM WITH CATHODE BIAS.

PLATE 1616
OCT. 15, 1945

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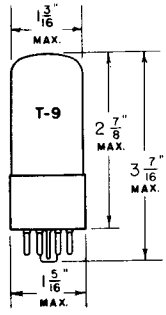
TUNG-SOL



BEAM POWER AMPLIFIER

HALF WAVE RECTIFIER

UNIPOTENTIAL CATHODES

HEATERS
117 VOLTS 0.090 AMPERE
AC OR DC

GLASS BULB

8AV
BOTTOM VIEW

INTERMEDIATE 8 PIN OCTAL BASE

THE TUNG-SOL 117P7GT COMBINES A HALF WAVE RECTIFIER AND A BEAM POWER AMPLIFIER IN THE SAME BULB. IT IS DESIGNED FOR AC – DC SERVICE FROM A 117 VOLT LINE IN THREE WAY PORTABLE RECEIVERS.

RATINGS

BEAM POWER AMPLIFIER UNIT

MAXIMUM PLATE VOLTAGE	117	VOLTS
MAXIMUM SCREEN VOLTAGE	117	VOLTS
MAXIMUM PLATE DISSIPATION	6.0	WATTS
MAXIMUM SCREEN DISSIPATION	1.0	WATT

RATINGS

RECTIFIER UNIT

MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM DC HEATER TO CATHODE POTENTIAL	175	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	350	VOLTS
MAXIMUM STEADY STATE PEAK PLATE CURRENT	450	MA.
TUBE VOLTAGE DROP AT 150 MA. PLATE CURRENT	16	VOLTS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK.

CONTINUED NEXT PAGE

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PLATE
1161-1

NOV.17
1941

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TUNG-SOL

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

BEAM POWER AMPLIFIER UNIT

CLASS A1 AMPLIFIER

PLATE VOLTAGE	105	VOLTS
SCREEN VOLTAGE	105	VOLTS
CONTROL GRID VOLTAGE [A]	-5.2	VOLTS
PEAK AF SIGNAL VOLTAGE	5.2	VOLTS
ZERO SIGNAL PLATE CURRENT	43	MA.
MAXIMUM SIGNAL PLATE CURRENT	43	MA.
ZERO SIGNAL SCREEN CURRENT	4	MA.
MAXIMUM SIGNAL SCREEN CURRENT	5.5	MA.
PLATE RESISTANCE APPROX.	17 000	OHMS
TRANSCONDUCTANCE	5300	μMHOS
LOAD RESISTANCE	4000	OHMS
TOTAL HARMONIC DISTORTION	5.0	PER CENT
MAXIMUM SIGNAL POWER OUTPUT	0.85	WATT

TYPICAL OPERATING CONDITIONS

HALF WAVE RECTIFIER

AC PLATE VOLTAGE (RMS)	117	VOLTS
DC OUTPUT CURRENT	75 MAX.	MA.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	15	OHMS

[A] THE DC RESISTANCE IN THE GRID CIRCUIT UNDER MAXIMUM RATED CONDITIONS, SHOULD NOT EXCEED 1.0 MEGOHM FOR FULL SELF BIAS AND SERIES SCREEN RESISTOR OPERATION AND 0.25 MEGOHM FOR FIXED BIAS OPERATION.

PLATE 1162-2

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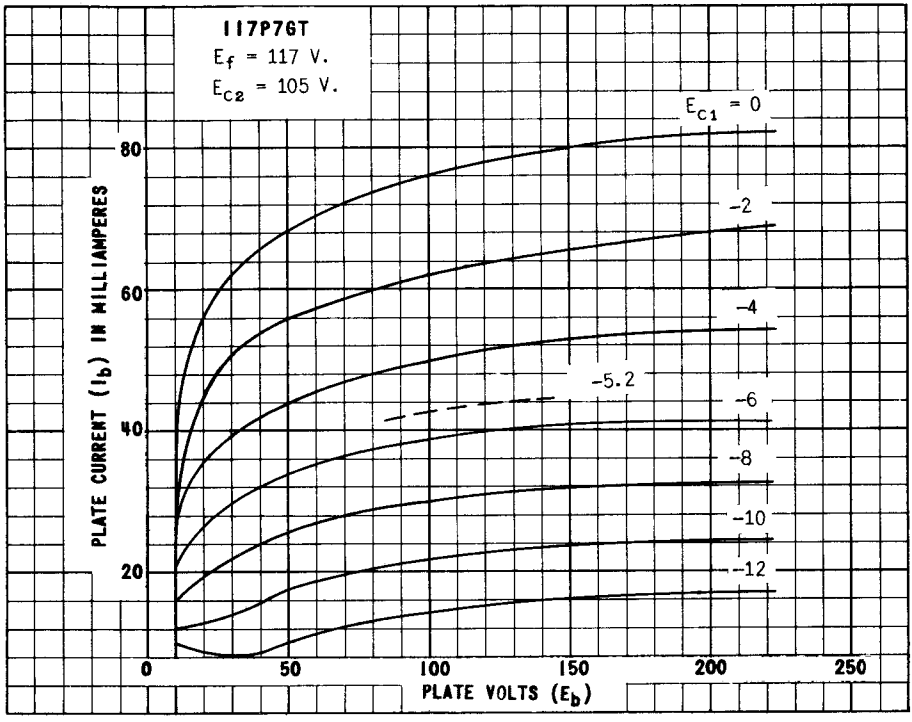

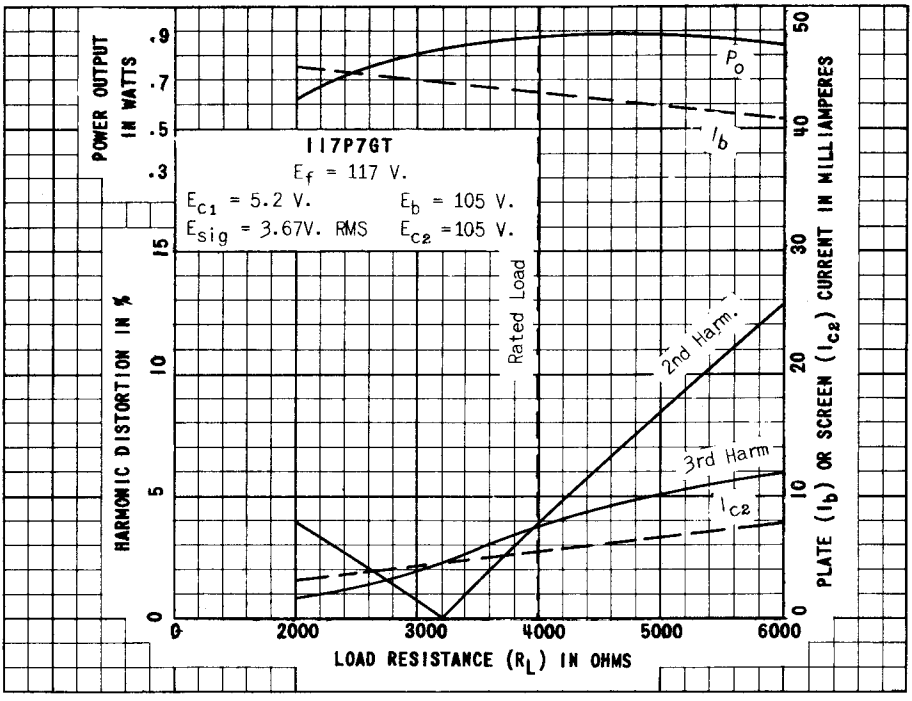

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PLATE
1163-1

NOV. 17
1941

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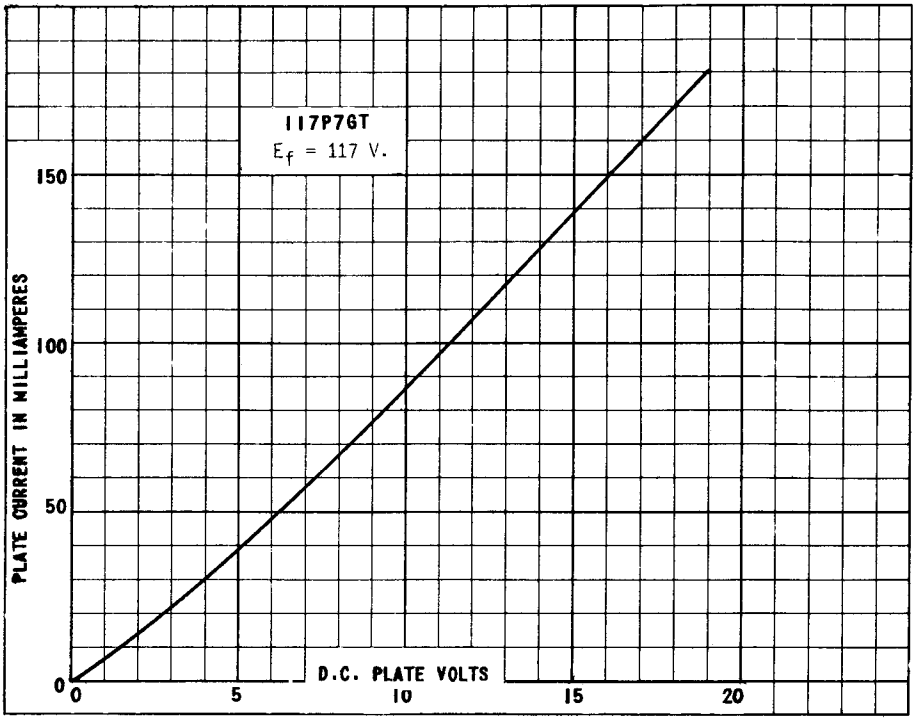
117P7GT



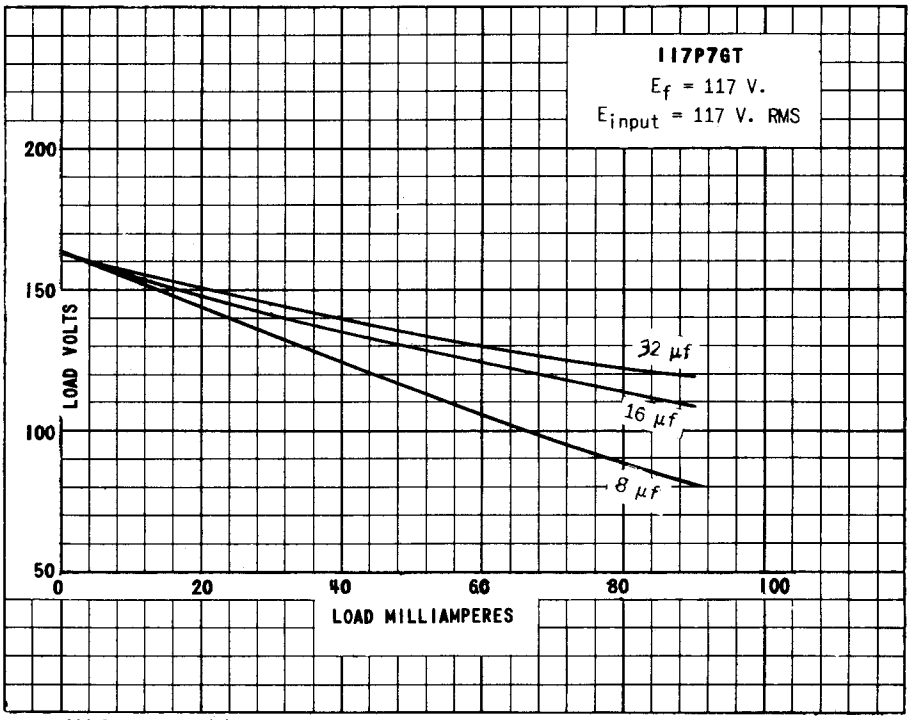


PLATE 1164-1

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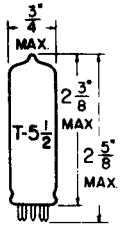
TUNG-SOL

DIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
117 VOLTS 40 MA.
AC OR DC

ANY MOUNTING POSITION

NOTE: DO NOT USE PIN #1 ON SOCKET AS TIE POST.

BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 117Z3 IS A MINIATURE CATHODE-TYPE, CLOSE-SPACED HALF-WAVE RECTIFIER DESIGNED FOR SERVICE IN THREE-WAY PORTABLE RECEIVERS. THE 117 VOLT HEATER PERMITS DIRECT, ACROSS THE LINE, HEATER OPERATION WITHOUT NEED FOR A DROPPING RESISTOR.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE	117	VOLTS
MAXIMUM DC HEATER-CATHODE VOLTAGE		
CATHODE POSITIVE	175	VOLTS
CATHODE NEGATIVE	100	VOLTS
MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM PEAK INVERSE VOLTAGE	330	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT	540	MA.
MAXIMUM STEADY-STATE DC OUTPUT CURRENT	90	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT	2.5	AMP.
TUBE VOLTAGE DROP: MEASURED WITH TUBE CONDUCTING 180 MA. PLATE CURRENT	22.5	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER

HEATER VOLTAGE	117	VOLTS
HEATER CURRENT	40	MA.
AC PLATE SUPPLY VOLTAGE (RMS)	117	VOLTS
DC OUTPUT VOLTAGE	110	VOLTS
DC OUTPUT CURRENT	90	MA.
EFFECTIVE PLATE SUPPLY IMPEDANCE	20	OHMS
INPUT CONDENSER	30	µf

SIMILAR TYPE REFERENCE: *Same general characteristics as type 117Z4GT; somewhat similar to the rectifier unit of type 70L7GT.*

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→ INDICATES A CHANGE OR ADDITION.

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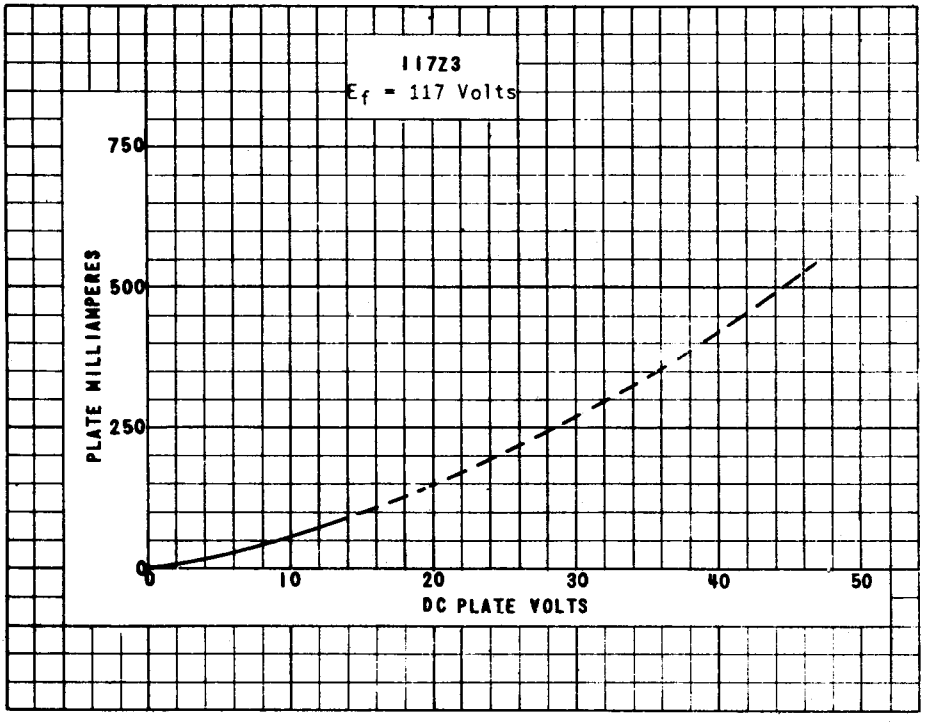
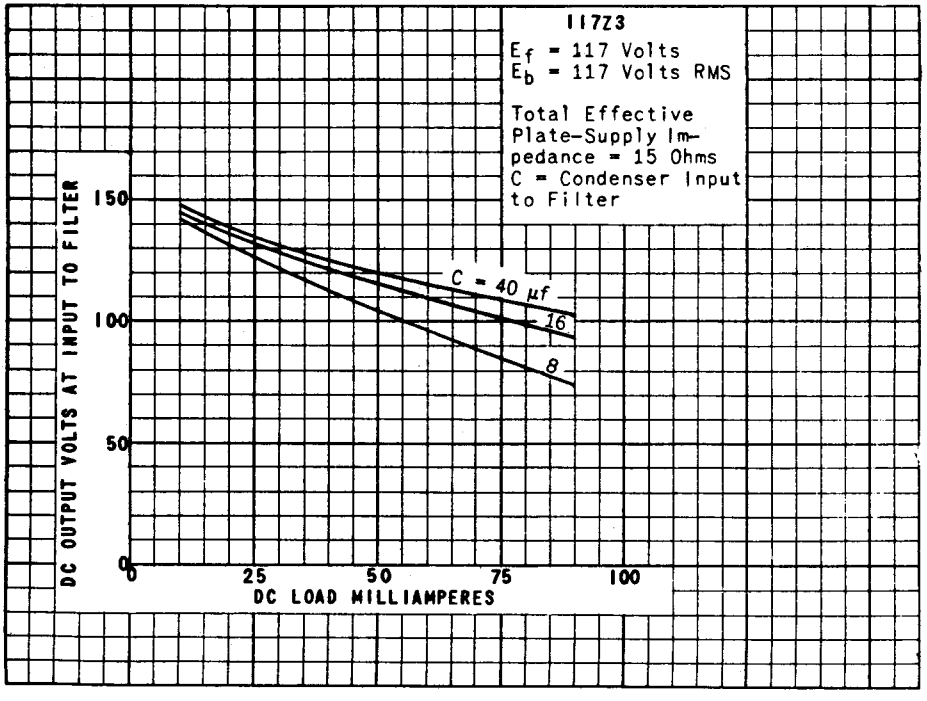
117Z3





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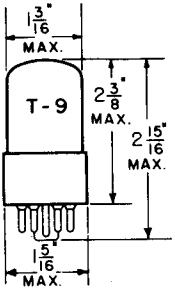
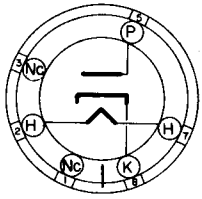
HALF-WAVE RECTIFIER



COATED UNIPOTENTIAL CATHODE

117 VOLTS .040 AMPERE
AC OR DC

ANY MOUNTING POSITION



GLASS BULB

BOTTOM VIEW
INTERMEDIATE SHELL
6-PIN OCTAL

THE 117Z4GT IS A HALF-WAVE RECTIFIER DESIGNED FOR SERVICE IN THREE-WAY PORTABLE RECEIVERS.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER VOLTAGE (AC OR DC)	117	VOLTS
HEATER CURRENT	.040	AMP.
MAX. AC PLATE VOLTAGE	117	VOLTS
MAX. DC HEATER CATHODE POTENTIAL	175	VOLTS
MAX. PEAK INVERSE PLATE VOLTAGE	350	VOLTS
MAX. STEADY STATE PEAK PLATE CURRENT	540	MA.
TUBE VOLTAGE DROP FOR 180 MA. DC	22.5	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

WITH CONDENSER-INPUT FILTER

HALF-WAVE RECTIFIER

AC PLATE VOLTAGE (RMS)	117	VOLTS
DC OUTPUT CURRENT	90	MA.
MIN. TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE[A]	30	OHMS

[A] WHEN FILTER CONDENSERS LARGER THAN 40 μf ARE USED, IT MAY BE NECESSARY TO USE ADDITIONAL PLATE SUPPLY IMPEDANCE.

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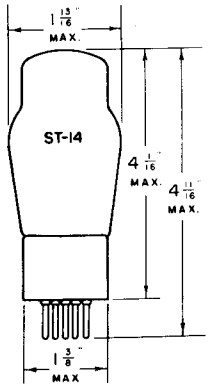


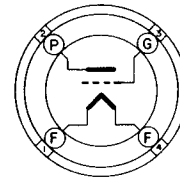
TRIODE POWER AMPLIFIER

COATED FILAMENT

5.0 VOLTS 1.25 AMPERES
AC OR DC

GLASS BULB

MEDIUM 4 PIN BASE



4D

BOTTOM VIEW

THE TUNG-SOL 183 IS A FILAMENT TYPE POWER TRIODE SUITABLE FOR SERVICE IN THE OUTPUT STAGE OF AC OPERATED RECEIVERS.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-60	VOLTS
PLATE CURRENT	25	MA.
PLATE RESISTANCE	1800	OHMS
TRANSCONDUCTANCE	1800	µMHOS
AMPLIFICATION FACTOR	3.2	
LOAD RESISTANCE	4500	OHMS
POWER OUTPUT	2.0	WATTS

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TUNG-SOL

ULTRA-HIGH FREQUENCY TRANSMITTING TRIODE

THORIATED TUNGSTEN FILAMENT

2.0 VOLTS 3.65 AMPERES

RATINGS

FILAMENT VOLTAGE[A]	2.0 ± 5%	VOLTS
MAXIMUM PLATE VOLTAGE	450	VOLTS
MAXIMUM GRID VOLTAGE	-250	VOLTS
MAXIMUM PLATE DISSIPATION	30	WATTS
MAXIMUM PLATE INPUT POWER	26	WATTS
MAXIMUM PLATE CURRENT	90	MA.
MAXIMUM GRID CURRENT	15	MA.
MAXIMUM FREQUENCY FOR ABOVE RATING	500	MC.
TRANSCONDUCTANCE (I_B = 67 MA)	2400	μMHOS

DIRECT INTERELECTRODE CAPACITANCES

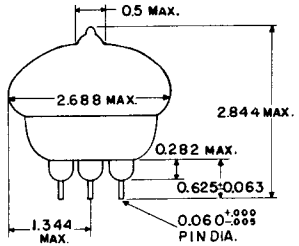
GRID TO PLATE	1.6	μμf
GRID TO FILAMENT	1.2	μμf
PLATE TO FILAMENT	0.8	μμf

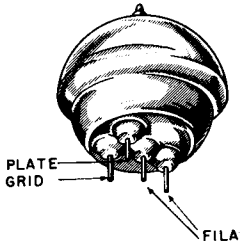
TYPICAL OPERATION CLASS C AMPLIFIER OR OSCILLATOR[B]

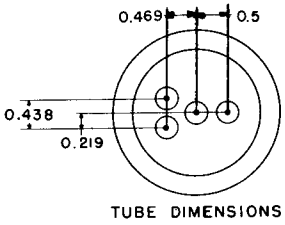
PLATE VOLTAGE	450	VOLTS
PLATE CURRENT	80	MA.
MAXIMUM GRID CURRENT	12	MA.
POWER OUTPUT	7.5	WATTS

[A] FILAMENT VOLTAGE SHOULD BE ADJUSTED FOR OVER-ALL OPTIMUM OPERATION WITHIN THE 5% FILAMENT VOLTAGE TOLERANCE.

[B] THE ABOVE TYPICAL OPERATING CONDITIONS APPLY AT 500 MC. FOR OPERATION AT HIGHER FREQUENCIES THE MAXIMUM PLATE INPUT POWER SHOULD BE REDUCED. FURTHERMORE, THE PLATE EFFICIENCY WILL DECREASE.

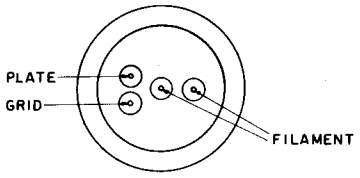






TUBE DIMENSIONS

BOTTOM VIEW



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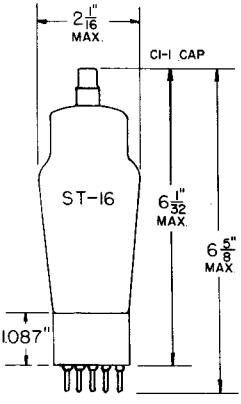


GLASS BULB

THYRATRON

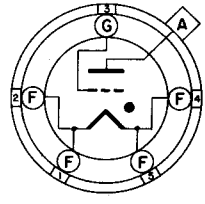
ARGON AND MERCURY-VAPOR

FILAMENT

2.5±0.125 VOLTS 7 AMP.

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

THE 323B IS A THREE ELECTRODE, ARGON AND MERCURY-VAPOR FILLED THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC DESIGNED FOR GRID CONTROLLED RECTIFIER, MOTOR CONTROL, OR RELAY SERVICE. THE ADDITION OF ARGON GAS TO THE MERCURY-VAPOR ATMOSPHERE PERMITS THE TUBE TO START CONDUCTION AT LOW TEMPERATURES.

THE 323B EMPLOYS A MEDIUM, 5 PIN BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±0.125	VOLTS
FILAMENT CURRENT @ Ef = 2.5 VOLTS	7	AMP.
CATHODE HEATING TIME - MINIMUM	15	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	1.8	μμf
DE-IONIZATION TIME—APPROXIMATE		
ANODE VOLTS = 120, ANODE CURRENT = 1.5 AMPERES		
GRID VOLTS =-20, GRID RESISTOR = 10,000 OHMS	360	μSECONDS
ANODE VOLTS =120, ANODE CURRENT = 1.5 AMPERES		
GRID VOLTS =- 500, GRID RESISTOR = 100,000 OHMS	60	μSECONDS
ANODE VOLTAGE DROP- APPROXIMATE		
INITIAL	10	VOLTS
END OF LIFE	20	VOLTS

MECHANICAL DATA

MOUNTING POSITION	VERTICAL, BASE DOWN
TYPE OF COOLING	CONVECTION
BULB	ST16
BASE	A5-11 MEDIUM
CAP	C1-I SMALL
NET WEIGHT	3 OUNCES MAXIMUM
SOCKET	MEDIUM, 5-PIN

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

		MIN.	MAX.	
PEAK ANODE VOLTAGE				
FORWARD		---	1250	VOLTS
REVERSE		---	1250	VOLTS
GRID VOLTAGE				
PEAKOR DC BEFORE TUBE CONDUCTION		---	-500	VOLTS
AVERAGE DURING TUBE CONDUCTION—NOTE 1		---	-10	VOLTS
ANODE CURRENT				
PEAK		---	6	AMP.
AVERAGE — NOTE 2		---	1.5	AMP.
FAULT— FOR DURATION OF 0.1 SECOND MAX. —NOTE 3		---	120	AMP.
GRID CURRENT				
AVERAGE — NOTE 4		---	+0.01	AMP.
OPERATING FREQUENCY	(PER SECOND)	---	420	CYCLES
ALTITUDE		---	10,000	FEET
TEMPERATURE RANGE — NOTE 5		40	80	°C
FILAMENT VOLTAGE		2.37	2.63	VOLTS

NOTES

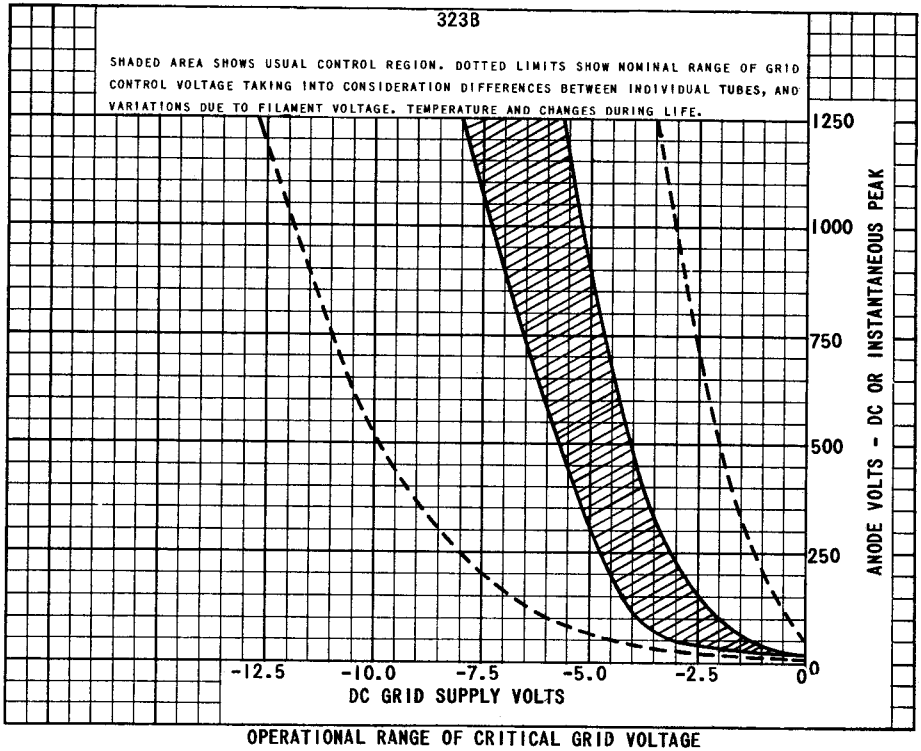
1. AVERAGED OVER ONE CONDUCTING PERIOD.

2. AVERAGED OVER ANY INTERVAL OF FIVE SECONDS MAXIMUM.

3. THE EQUIPMENT DESIGNER SHOULD LIMIT THE SHORT CIRCUIT CURRENT TO 120 AMPERES CIRCUITWISE. IT SHOULD BE UNDERSTOOD THAT WHILE THE TUBE MAY STAND SEVERAL FAULTS AT THIS MAGNITUDE OF CURRENT, EACH FAULT WILL ADVERSELY AFFECT TUBE LIFE.

4. AVERAGED OVER THE PERIOD OF GRID CONDUCTION.

5. THE RECOMMENDED OPERATING RANGE FOR THIS TUBE IS FROM 40° TO 80° CENTIGRADE. OPERATION BETWEEN -55° AND +40° CENTIGRADE AT REDUCED RATINGS, OR "STARTS" IN THIS TEMPERATURE RANGE ARE PERMISSIBLE, BUT WILL RESULT IN CONSIDERABLY SHORTENED LIFE.



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

APPLICATION NOTES

THYRATRON TUBES, IF CORRECTLY USED, WILL GIVE MANY THOUSANDS OF HOURS OF RELIABLE SERVICE. THE CORRECT USE OF A TUBE INVOLVES AMONG OTHER THINGS ADHERENCE TO THE FOLLOWING RULES:

1. AVOID COLD STARTS. THE HEAT SHIELDED, OXIDE COATED FILAMENT SHOULD BE ENERGIZED BEFORE THE ANODE VOLTAGE IS APPLIED IN ORDER TO OBTAIN MAXIMUM LIFE.

2. AVOID OPERATING THE TUBE OUTSIDE OF THE SPECIFIED FILAMENT VOLTAGE RANGE.

3. AVOID EXCEEDING THE RATED PEAK INVERSE VOLTAGE. EXCESS INVERSE VOLTAGE CAN CAUSE EITHER AN IMMEDIATE FAILURE OR A RAPID DECLINE IN USEFUL LIFE.

NO CLEAR CUT METHOD OF FORETELLING TUBE FAILURE HAS BEEN DEVISED. PERIODIC REPLACEMENT OF A TUBE AS A ROUTINE PREVENTIVE MAINTENANCE DEVICE IS NOT RECOMMENDED AS A TUBE THAT HAS OPERATED FOR SEVERAL THOUSAND HOURS MAY BE GOOD FOR SEVERAL MORE THOUSAND HOURS OF USEFUL OPERATION. QUITE OFTEN MAINTENANCE PERSONNEL CAN, AFTER SOME EXPERIENCE WITH A PIECE OF EQUIPMENT, ANTICIPATE TUBE FAILURE BY OBSERVATION. VISUAL CHECKS OF TUBE (ARC) DROP WILL INDICATE TUBES APPROACHING END OF LIFE. TUBE DROP VOLTAGES CONSIDERABLY HIGHER THAN THAT OF THE LAST READINGS, OR READINGS ABOVE 20 VOLTS INDICATE TUBES THAT MAY SOON FAIL. WHILE SUCH A READING CAN BE TAKEN DIRECTLY AT THE TUBE IN THE OPERATING EQUIPMENT, IT IS A DANGEROUS PRACTICE. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL.

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TUNG-SOL

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APPLICATION NOTES - CONT'D.

A MORE PRACTICAL AND EXACT MEASUREMENT IS OBSERVING THE TUBE VOLTAGE DROP IN A TEST JIG WHILE IT PASSES ONE OR TWO HIGH CURRENT PULSES. SUCH A JIG IS ILLUSTRATED IN FIGURE 1. THE OSCILLOSCOPE IS CALIBRATED BY FIRST SETTING SWITCH S2 TO CURRENT CHECK. MOMENTARY CONTACT SWITCH S1 IS THEN TAPPED WHILE CURRENT SET RESISTOR R2 IS ADJUSTED UNTIL A PATTERN 8 VOLTS HIGH APPEARS ON THE OSCILLOSCOPE SCREEN. THIS INDICATES THAT A PEAK CURRENT OF EIGHT AMPERES IS FLOWING THROUGH THE TUBE UNDER TEST AND THROUGH CALIBRATING RESISTOR R3. THE TUBE VOLTAGE DROP CAN THEN BE READ DIRECTLY IN VOLTS ON THE OSCILLOSCOPE SCALE BY SETTING SWITCH S2 TO THE TEST POSITION AND TAPPING SWITCH S1. A NEW TUBE WILL HAVE A VOLTAGE DROP OF APPROXIMATELY 10 VOLTS. A TUBE APPROACHING THE END OF LIFE MAY HAVE A VOLTAGE DROP OF 20 VOLTS.

GRID-CONTROLLED THYRATRONS CAN BE INCORPORATED INTO CIRCUITS TO PROVIDE NUMEROUS SERVICES INCLUDING THE SPEED CONTROL OF DC MOTORS, DC TO AC INVERSION, AC TO DC RECTIFICATION, AND SUPPLYING VARIABLE AC POWER FROM AN AC SOURCE.

FIGURE 2 ILLUSTRATES ONE METHOD OF CONVERTING AC TO DC. THE MAGNITUDE OF THE DC OUTPUT VOLTAGE IS CONTROLLED BY THE VARIABLE RESISTOR WHICH CONTROLS THE FIRING ANGLE, OR GRID VOLTAGE PHASE, OF THE THYRATRONS. THE USE OF THYRATRONS TO SUPPLY A VARIABLE AC OUTPUT FROM A FIXED AC SOURCE IS SHOWN IN FIGURE 3. AGAIN, THE VARIABLE RESISTOR SERVES TO CONTROL THE PHASE ANGLE OF THE APPLIED GRID VOLTAGE AND THUS THE OUTPUT VOLTAGE.

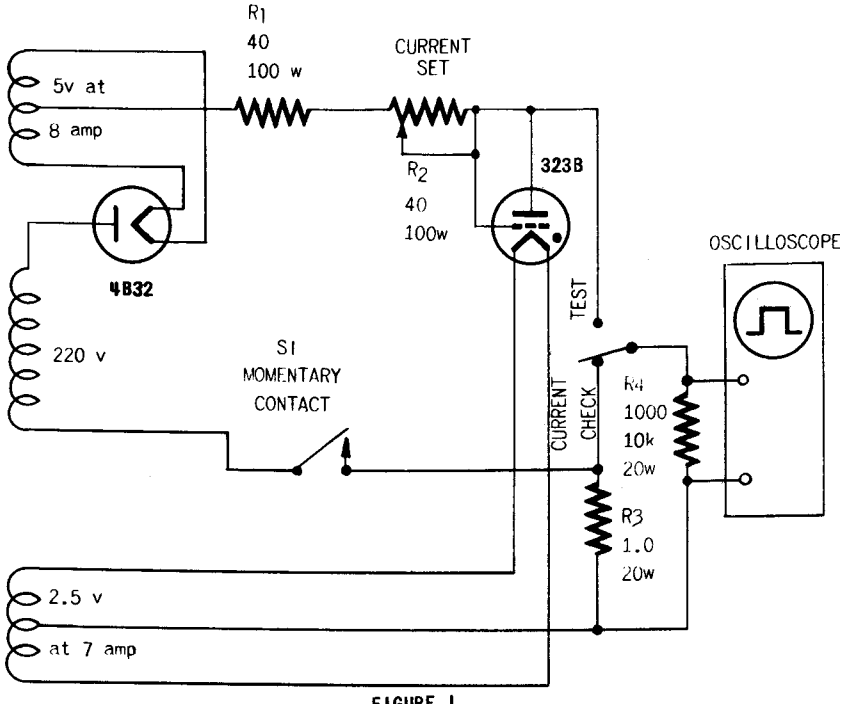

FIGURE 1

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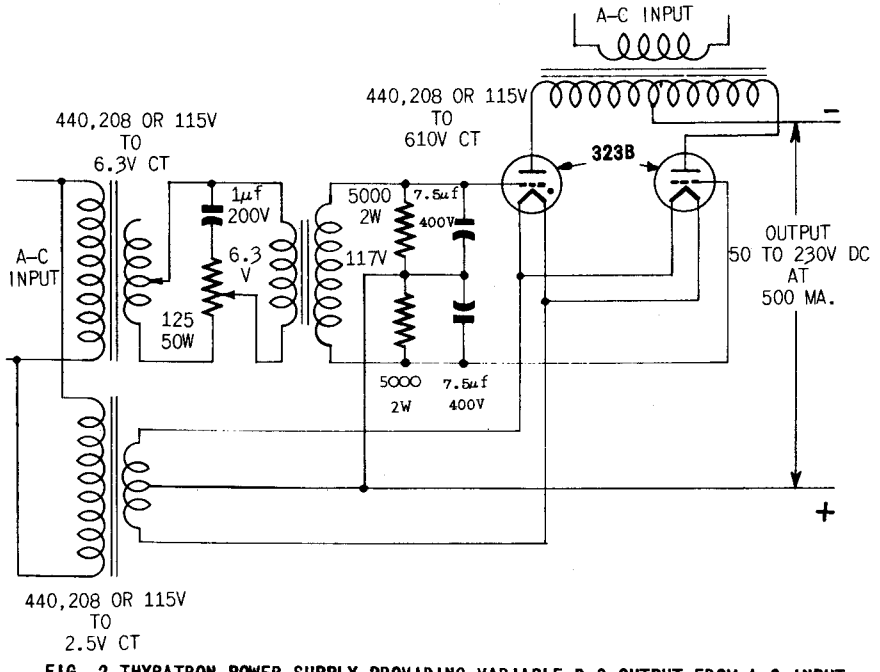


FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

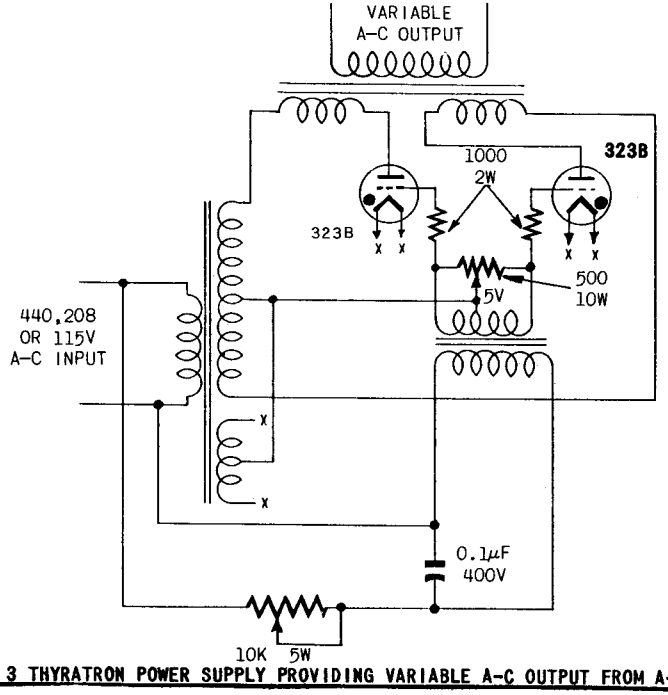
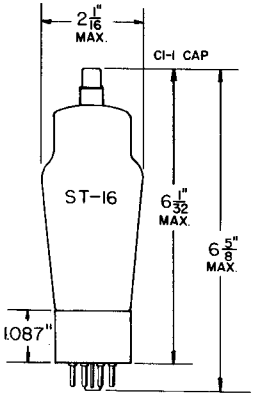


FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

TUNG-SOL

THYRATRON

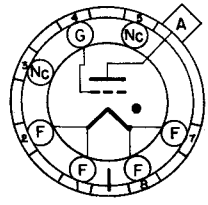
ARGON AND MERCURY VAPOR



FILAMENT

2.5±0.125 VOLTS 7 AMP.

MOUNTING POSITION
VERTICAL, BASE DOWN



BOTTOM VIEW
MEDIUM SHELL OCTAL
7 PIN BASE

GLASS BULB

THE 393A IS A THREE ELECTRODE, ARGON AND MERCURY-VAPOR FILLED THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC DESIGNED FOR GRID CONTROLLED RECTIFIER, MOTOR CONTROL, OR RELAY SERVICE. THE ADDITION OF ARGON GAS TO THE MERCURY-VAPOR ATMOSPHERE PERMITS THE TUBE TO START CONDUCTION AT LOW TEMPERATURES.

THE 393A EMPLOYS A 7 PIN OCTAL BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE	2.5±0.125	VOLTS
FILAMENT CURRENT @ Ef =2.5 VOLTS	7	AMP.
CATHODE HEATING TIME - MINIMUM	15	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	1.8	μμf
DE-IONIZATION TIME -APPROXIMATE		
ANODE VOLTS = 120 ANODE CURRENT = 1.5 AMP.		
GRID VOLTS =- 20, GRID RESISTOR = 10,000 OHMS	360	μSEC.
ANODE VOLTS = 120, ANODE CURRENT =1.5 AMP.		
GRID VOLTS =-500, GRID RESISTOR = 100,000 OHMS	60	μSEC.
ANODE VOLTAGE DROP – APPROXIMATE		
INITIAL	10	VOLTS
END OF LIFE	20	VOLTS

MECHANICAL DATA

MOUNTING POSITION	VERTICAL, BASE DOWN
TYPE OF COOLING	CONVECTION
BULB	ST16
BASE	B7-12 MEDIUM SHELL OCTAL
CAP	C1-1 SMALL
NET WEIGHT	3 OUNCES MAXIMUM
SOCKET	OCTAL

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS

ABSOLUTE VALUES

		MIN.	MAX.	
PEAK ANODE VOLTAGE				
FORWARD		---	1250	VOLTS
REVERSE		---	1250	VOLTS
GRID VOLTAGE				
PEAK OR DC BEFORE TUBE CONDUCTION		---	-500	VOLTS
AVERAGE DURING TUBE CONDUCTION --NOTE 1		---	-10	VOLTS
ANODE CURRENT				
PEAK		---	6	AMP.
AVERAGE – NOTE 2		---	1.5	AMP.
FAULT–FOR DURATION OF 0.1 SEC. MAX. –NOTE 3		---	120	AMP.
GRID CURRENT				
AVERAGE – NOTE 4		---	+0.01	AMP.
OPERATING FREQUENCY	(PER SEC)	---	420	CYCLES
ALTITUDE		---	10,000	FEET
TEMPERATURE RANGE – NOTE 5		40	80	°C
FILAMENT VOLTAGE		2.37	2.63	VOLTS

NOTES

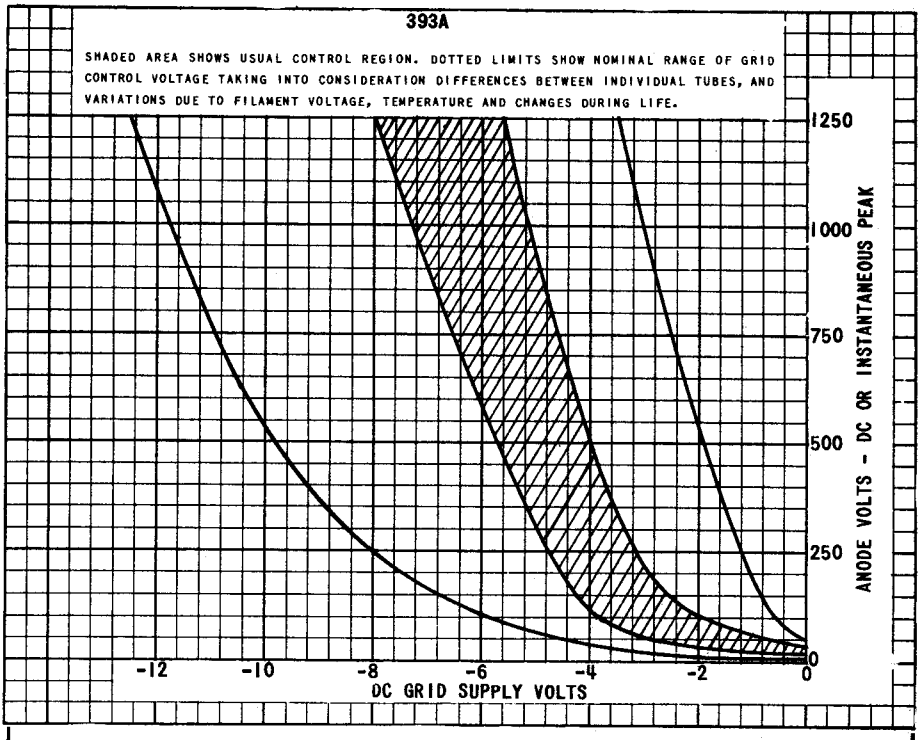
1. AVERAGED OVER ONE CONDUCTING PERIOD.

2. AVERAGED OVER ANY INTERVAL OF FIVE SECONDS.

3. THE EQUIPMENT DESIGNER SHOULD LIMIT THE SHORT CIRCUIT CURRENT TO 120 AMPERES CIRCUITWISE. IT SHOULD BE UNDERSTOOD THAT WHILE THE TUBE MAY STAND SEVERAL FAULTS AT THIS MAGNITUDE OF CURRENT, EACH FAULT WILL ADVERSELY AFFECT TUBE LIFE.

4. AVERAGED OVER THE PERIOD OF GRID CONDUCTION.

5. THE RECOMMENDED OPERATING RANGE FOR THIS TUBE IS FROM 40° TO 80° CENTIGRADE. OPERATION BETWEEN -55° AND +40° CENTIGRADE AT REDUCED RATINGS OR "STARTS" IN THIS TEMPERATURE RANGE ARE PERMISSIBLE, BUT WILL RESULT IN CONSIDERABLY SHORTENED LIFE.



APPLICATION NOTES

THYRATRON TUBES, IF CORRECTLY USED, WILL GIVE MANY THOUSANDS OF HOURS OF RELIABLE SERVICE. THE CORRECT USE OF A TUBE INVOLVES AMONG OTHER THINGS ADHERENCE TO THE FOLLOWING RULES:

1. AVOID COLD STARTS. THE HEAT SHIELDED, OXIDE COATED FILAMENT SHOULD BE ENERGIZED BEFORE THE ANODE VOLTAGE IS APPLIED IN ORDER TO OBTAIN MAXIMUM LIFE.

2. AVOID OPERATING THE TUBE OUTSIDE OF THE SPECIFIED FILAMENT VOLTAGE RANGE.

3. AVOID EXCEEDING THE RATED PEAK INVERSE VOLTAGE. EXCESS INVERSE VOLTAGE CAN CAUSE EITHER AN IMMEDIATE FAILURE OR A RAPID DECLINE IN USEFUL LIFE.

NO CLEAR CUT METHOD OF FORETELLING TUBE FAILURE HAS BEEN DEVISED. PERIODIC REPLACEMENT OF A TUBE AS A ROUTINE PREVENTIVE MAINTENANCE DEVICE IS NOT RECOMMENDED AS A TUBE THAT HAS OPERATED FOR SEVERAL THOUSAND HOURS MAY BE GOOD FOR SEVERAL MORE THOUSAND HOURS OF USEFUL OPERATION. QUITE OFTEN MAINTENANCE PERSONNEL CAN, AFTER SOME EXPERIENCE WITH A PIECE OF EQUIPMENT, ANTICIPATE TUBE FAILURE BY OBSERVATION. VISUAL CHECKS OF TUBE (ARC) DROP WILL INDICATE TUBES APPROACHING END OF LIFE. TUBE DROP VOLTAGES CONSIDERABLY HIGHER THAN THAT OF THE LAST READINGS, OR READINGS ABOVE 20 VOLTS INDICATE TUBES THAT MAY SOON FAIL. WHILE SUCH A READING CAN BE TAKEN DIRECTLY AT THE TUBE IN THE OPERATING EQUIPMENT, IT IS A DANGEROUS PRACTICE. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL.

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APPLICATION NOTES - CONT'D.

A MORE PRACTICAL AND EXACT MEASUREMENT IS OBSERVING THE TUBE VOLTAGE DROP IN A TEST JIG WHILE IT PASSES ONE OR TWO HIGH CURRENT PULSES. SUCH A JIG IS ILLUSTRATED IN FIGURE 1. THE OSCILLOSCOPE IS CALIBRATED BY FIRST SETTING SWITCH S2 TO CURRENT CHECK. MOMENTARY CONTACT SWITCH S1 IS THEN TAPPED WHILE CURRENT SET RESISTOR R2 IS ADJUSTED UNTIL A PATTERN 8 VOLTS HIGH APPEARS ON THE OSCILLOSCOPE SCREEN. THIS INDICATES THAT A PEAK CURRENT OF EIGHT AMPERES IS FLOWING THROUGH THE TUBE UNDER TEST AND THROUGH CALIBRATING RESISTOR R3. THE TUBE VOLTAGE DROP CAN THEN BE READ DIRECTLY IN VOLTS ON THE OSCILLOSCOPE SCALE BY SETTING SWITCH S2 TO THE TEST POSITION AND TAPPING SWITCH S1. A NEW TUBE WILL HAVE A VOLTAGE DROP OF APPROXIMATELY 10 VOLTS. A TUBE APPROACHING THE END OF LIFE MAY HAVE A VOLTAGE DROP OF 20 VOLTS.

GRID-CONTROLLED THYRATRONS CAN BE INCORPORATED INTO CIRCUITS TO PROVIDE NUMEROUS SERVICES INCLUDING THE SPEED CONTROL OF DC MOTORS, DC TO AC INVERSION, AC TO DC RECTIFICATION, AND SUPPLYING VARIABLE AC POWER FROM AN AC SOURCE.

FIGURE 2 ILLUSTRATES ONE METHOD OF CONVERTING AC TO DC. THE MAGNITUDE OF THE DC OUTPUT VOLTAGE IS CONTROLLED BY THE VARIABLE RESISTOR WHICH CONTROLS THE FIRING ANGLE, OR GRID VOLTAGE PHASE, OF THE THYRATRONS. THE USE OF THYRATRONS TO SUPPLY A VARIABLE AC OUTPUT FROM A FIXED AC SOURCE IS SHOWN IN FIGURE 3. AGAIN, THE VARIABLE RESISTOR SERVES TO CONTROL THE PHASE ANGLE OF THE APPLIED GRID VOLTAGE AND THUS THE OUTPUT VOLTAGE.

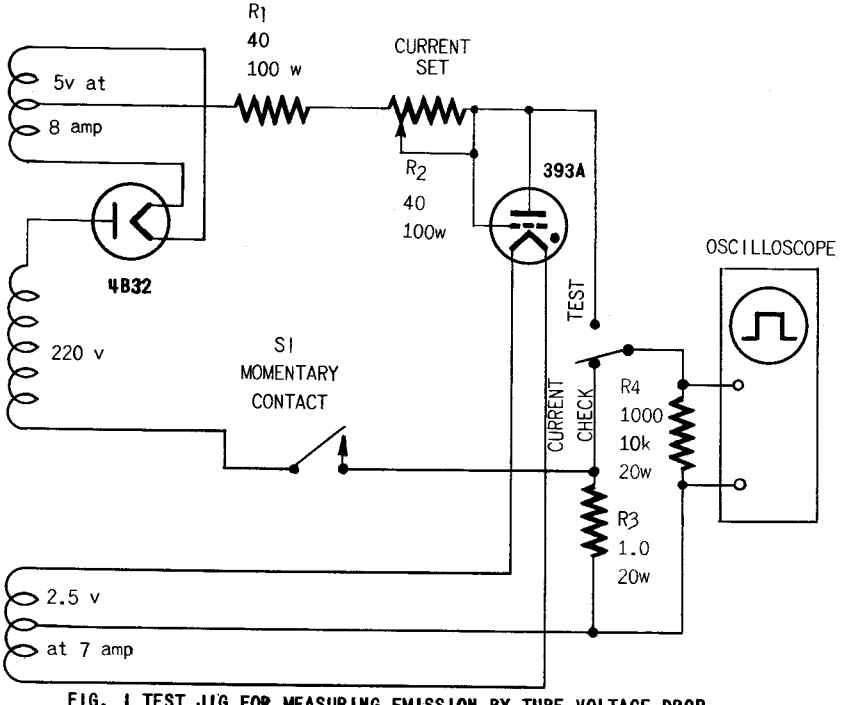

FIG. 1 TEST JIG FOR MEASURING EMISSION BY TUBE VOLTAGE DROP

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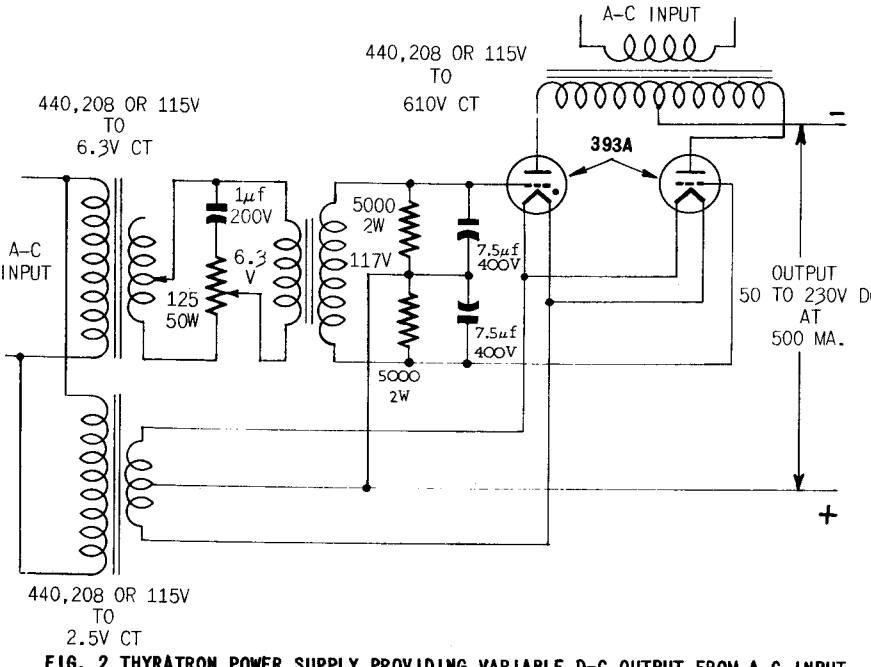

FIG. 2 THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

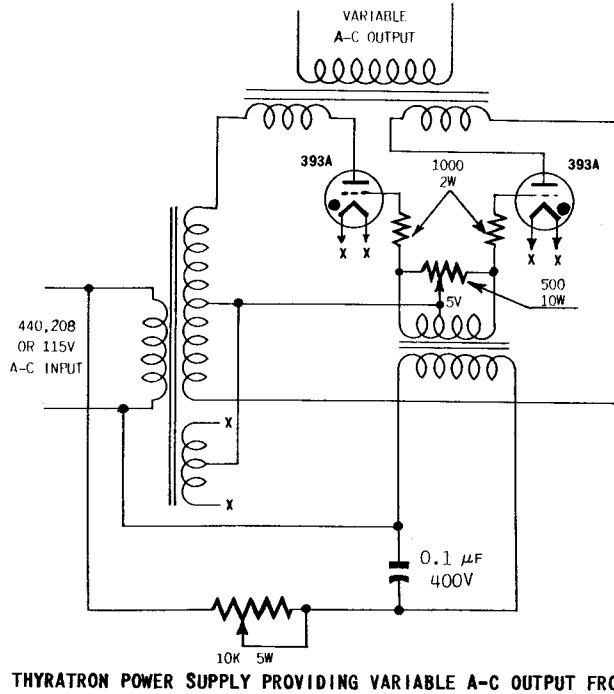

FIG. 3 THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

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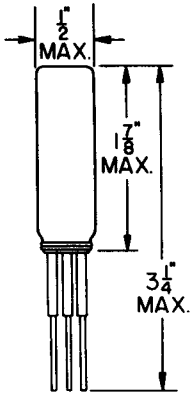
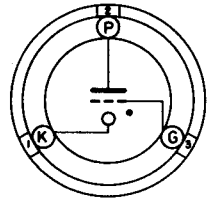
THYRATRON

COLD CATHODE



GLASS BULB



BOTTOM VIEW

THE 395A IS A SMALL SIZE, LIGHT WEIGHT, COLD CATHODE THYRATRON USED PRIMARILY IN RELAY SERVICE. THE CHARACTERISTIC NEON GLOW DISPLAYED ON THE SURFACE OF THE CATHODE WHILE THE TUBE IS CONDUCTING, MAKES THE USE OF AUXILIARY VISUAL INDICATING DEVICES UNNECESSARY. THE MINUTE TRIGGERING CURRENT REQUIREMENTS AND THE LACK OF NECESSITY FOR FILAMENT POWER MAKE THIS TUBE EXTREMELY SUITABLE FOR USE IN TRANSISTORIZED EQUIPMENT OR IN BATTERY OPERATED EQUIPMENT. THE 395A WILL FIRE DIRECTLY FROM A SIGNAL SUPPLIED BY EITHER A VACUUM PHOTO TUBE OR A CADMIUM SULFHIDE PHOTO CELL.

THE 395A HAS ALSO FOUND USE AS A TRIGGER TUBE, AS A RELAXATION OSCILLATOR, AND AS A VOLTAGE REGULATOR.

MAXIMUM RATINGS FOR RELAY SERVICE

ABSOLUTE VALUES

POSITIVE ANODE VOLTAGE	140	VDC
NEGATIVE ANODE VOLTAGE (WITHOUT (WITHOUT DISCHARGE TO A POSITIVE GRID)	-60	VDC
POSITIVE GRID BIAS VOLTAGE (WITHOUT GRID IONIZATION)	70	VDC
TOTAL POSITIVE GRID VOLTAGE TO INSURE BREAKDOWN (WITH Rg = 0.1 MEGOHM MAX.) (MIN.)	87	VDC
NEGATIVE GRID VOLTAGE (WITHOUT DISCHARGE TO A POSITIVE ANODE)	-10	VDC
GRID TRANSFER CURRENT	5	μADC
CATHODE CURRENT		
PEAK, RECURRING (AVERAGED OVER 1 SECOND)	35	MA.
AVERAGE (SEE LIFE EXPECTANCY CURVE)		
PEAK INVERSE ANODE CURRENT	1	MA.

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ELECTRICAL DATA
TYPICAL VALUES

	COLD	
CATHODE		
IONIZATION TIME (AT E_b=130V, Ec = 75V, e_c = 20V. PULSE, R_g=0.1 MEGOHMS)	23	μSEC
ANODE VOLTAGE DROP (AT I_b =10. MA.)	75	VDC
GRID VOLTAGE DROP (AT I_c =10. MA.)	65	VDC
ANODE IONIZATION VOLTAGE (AT E_g = 0)	170	VDC
GRID IONIZATION VOLTAGE	75	VDC
REQUIRED TRANSFER CURRENT FOR TRANSITION OF DISCHARGE TO ANODE AT 130 VOLTS DC	2.5	μAMP.

MECHANICAL DATA

TEMPERATURE	-40 TO +60	°C
ALTITUDE FOR FULL RATINGS	10 000	FEET
NORMAL ILLUMINATION (SEE APPLICATION NOTES)	5 TO 150	lm/SQ.FT.

TYPICAL OPERATING CONDITIONS

ANODE SUPPLY VOLTAGE	130	VDC
POSITIVE GRID BIAS	70	VDC
GRID TRIGGER VOLTAGE	20	VOLTS
ANODE CIRCUIT RESISTANCE	6800	OHMS
GRID CIRCUIT RESISTANCE	1	MEGOHM

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TUNG-SOL

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APPLICATION NOTES

THE 395A THYRATRON CONTAINS A CATHODE, A TRIGGER GRID AND AN ANODE WITHIN A GASEOUS ATMOSPHERE. IF AN INCREASING POSITIVE VOLTAGE IS APPLIED TO THE GRID, A MINUTE PRE-IONIZATION CURRENT WILL FLOW UNTIL THE CRITICAL GRID CURRENT OF ABOUT TWO MICROAMPERES IS REACHED. AT THIS POINT THE REGION BETWEEN THE GRID AND CATHODE "BREAKS DOWN" OR IONIZES. IF THE APPLIED ANODE VOLTAGE IS EQUAL TO OR GREATER THAN THE GRID VOLTAGE, THE GLOW WILL THEN TRANSFER TO THE CATHODE-ANODE REGION. THUS, A VERY LOW ENERGY SIGNAL IN THE GRID CIRCUIT CAN CONTROL MUCH HIGHER ENERGY IN THE ANODE CIRCUIT. IF, IN THIS ILLUSTRATION AN ANODE CURRENT OF 10 MILLIAMPERES WERE TO FLOW, THE TUBE HAS PROVIDED CURRENT AMPLIFICATION OF 5,000.

AS WITH ANY GAS TUBE, ONCE THE TUBE CONDUCTS, THE TUBE VOLTAGE DROP REMAINS VIRTUALLY CONSTANT AND THE CURRENT THROUGH THE TUBE IS LIMITED BY THE CIRCUIT RESISTANCE. IN THE ANODE CIRCUIT THIS MAY BE THE RESISTANCE OF THE LOAD ITSELF, OR, THE LOAD PLUS ADDITIONAL LIMITING RESISTANCE. THE GRID CIRCUIT SHOULD CONTAIN A 5,000 OHM SERIES RESISTANCE IF THE SOURCE RESISTANCE IS LOWER THAN THIS FIGURE. IF THE GRID CIRCUIT RESISTANCE IS ABOVE 10 MEGOHMS, HOWEVER, IT MAY BE NECESSARY TO CONNECT A SMALL CAPACITANCES BETWEEN THE GRID AND CATHODE. THIS IS TO STORE ENOUGH ENERGY TO INSURE GRID IONIZATION.

IF THE 395A IS USED IN TOTALLY ENCLOSED EQUIPMENT THERE MAY BE A DELAY OF SEVERAL MILLISECONDS BEFORE FIRING. THIS CAN BE ALLEVIATED BY PROVIDING OVER-VOLTAGE ON THE GRID SIGNAL OR LOCATING THE TUBE WHERE IT WILL RECEIVE SOME ILLUMINATION FROM PILOT LIGHTS OR THE HEATERS OF VACUUM TUBES. THE 395A IS RADIOACTIVELY DOSED TO MINIMIZE THIS DELAY. THE MAGNITUDE OF ACTIVITY IS NOT GREAT ENOUGH TO INSTITUTE A PERSONAL HAZARD. HOWEVER, PERSONS ARE CAUTIONED NOT TO HANDLE BROKEN TUBES TO AVOID GETTING THE ACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF A PERSON CUTS HIMSELF ON A BROKEN TUBE, THE CUT SHOULD BE CLEANSED IMMEDIATELY. AN OPEN CUT CAN BE CLEANSED BY HOLDING IT IN RUNNING WATER.

FOR "END ON" VISUAL INDICATION THE 395A CAN BE MOUNTED IN A RECESS IN A PANEL. FOR CURRENT LEVELS BELOW TWO MILLIAMPERES, THE ILLUMINATION CAN BE INCREASED BY USING FOR THE RECESS, TUBING WITH SHINY INNER WALLS. IF THE TUBE IS NOT USED IN A RECESS, THE BULB SIDES SHOULD BE SHIELDED (eg; NICKEL MESH) TO PREVENT HAND CAPACITY OR STRONG ELECTRIC FIELDS FROM ALTERING FIRING POTENTIALS.

TYPICAL CIRCUIT CONFIGURATIONS ARE ILLUSTRATED ABOVE. AS WITH ANY THYRATRON CIRCUIT, ONCE THE TUBE CONDUCTS, THE GRID WILL NOT REGAIN CONTROL UNTIL THE ANODE VOLTAGE FALLS LOW ENOUGH TO EXTINGUISH THE CATHODE-ANODE GLOW. THIS IS USUALLY ACCOMPLISHED BY BREAKING THE ANODE CIRCUIT. HOWEVER, IT CAN ALSO BE DONE UNDER D.C. OPERATION, BY CAUSING THE ANODE CURRENT TO FLOW IN SAW TOOTH STEPS. THE SAW TOOTH IS GENERATED BY RUNNING THE TUBE AS A RELAXATION OSCILLATOR BY INSERTING SUFFICIENT CAPACITY BETWEEN THE CATHODE AND ANODE. FIGURE 3 ILLUSTRATES AN APPLICATION OF THIS IDEA. THE 395A WILL ALSO REGAIN GRID CONTROL ON EACH CYCLE IF IT IS RUN FROM HALF WAVE RECTIFIER A.C. FIGURE 4 ILLUSTRATES AN APPLICATION OF THE TUBE ON A.C. OPERATION OF THE TUBE ON A.C. WITHOUT THE SERIES DIODE IS NOT RECOMMENDED.

THE FLAT ANODE VOLTAGE-CURRENT CHARACTERISTIC OF THE 395A HAS LED TO THE USE OF THE TUBE AS A VOLTAGE REGULATOR OR AS AN OVER VOLTAGE PROTECTIVE DEVICE. THE TUBE HAS ALSO FOUND USE AS A TRIGGER DEVICE CARRYING AMPERES OF CURRENT FOR SEVERAL SECONDS IN "ONE SHOT" APPLICATIONS.

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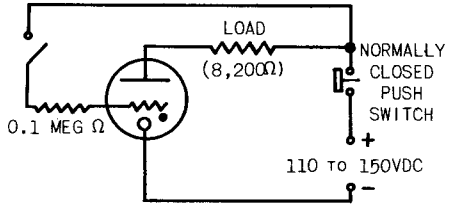
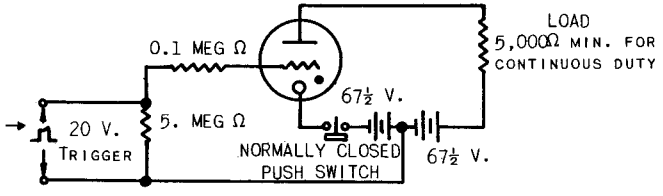


7400 USED AS A MECHANICALLY OPERATED RELAY

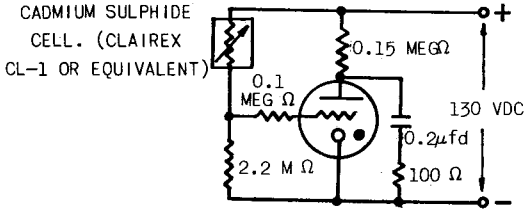
FIG. 1



395A OPERATED FROM DRY BATTERIES

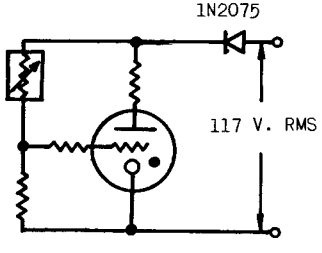
FIG. 2

→ INDICATES A CHANGE.



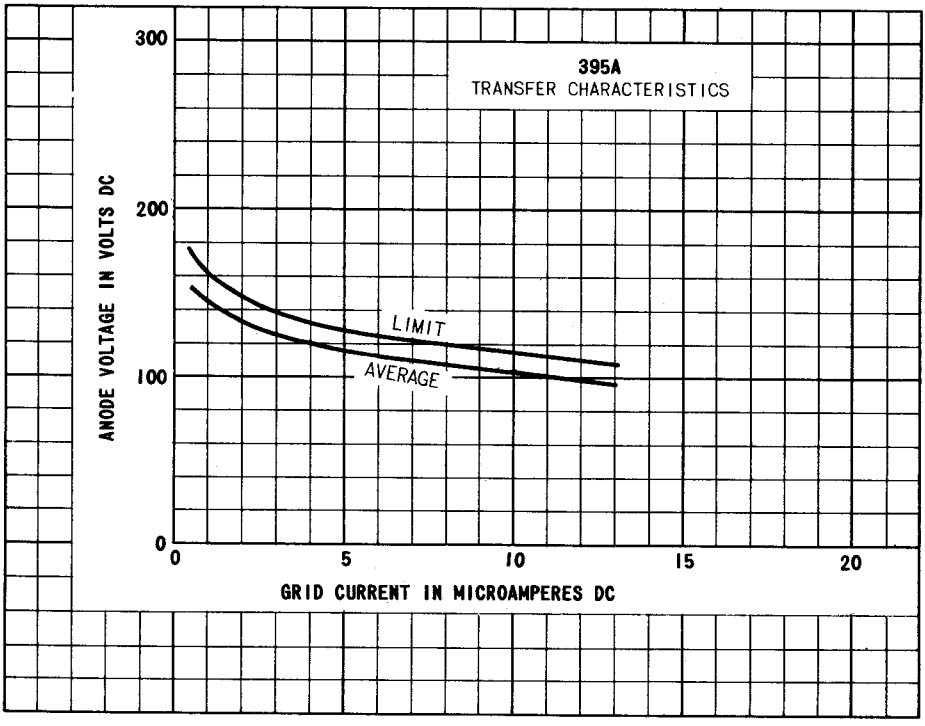
7400 ACTING AS A RELAY FOR A CADMIUM SULPHIDE PHOTO CELL

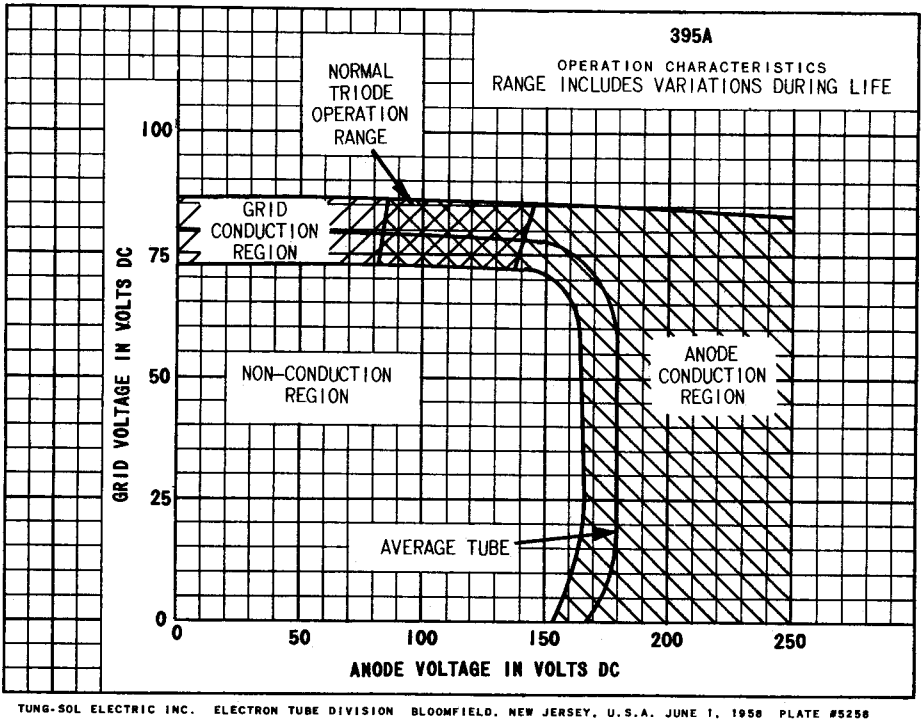
FIG. 3



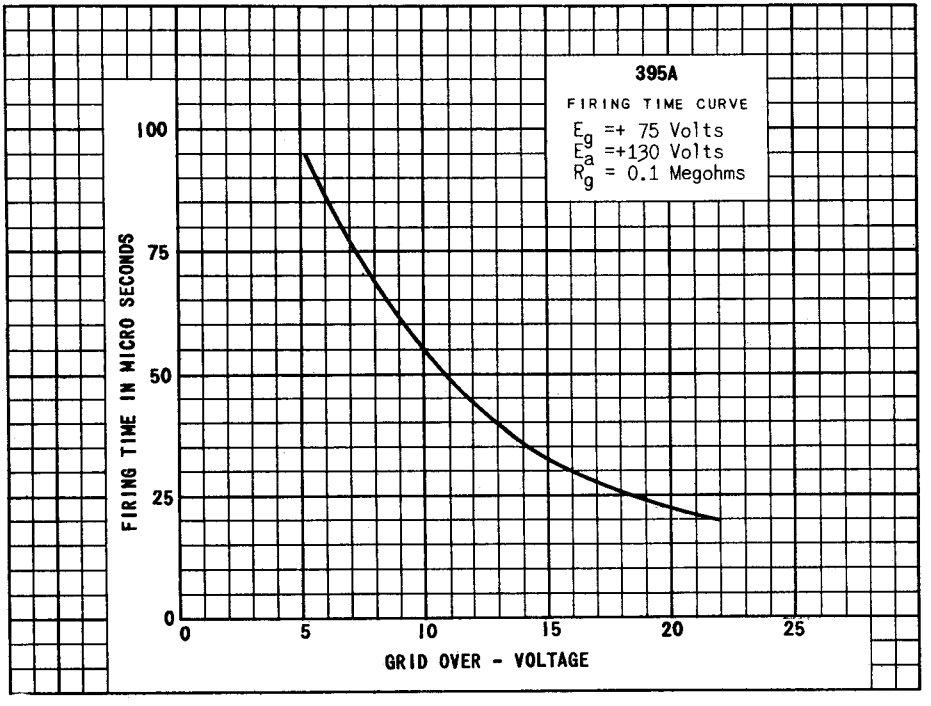
SAME AS FIGURE 3 BUT OPERATED FROM A.C. LINE

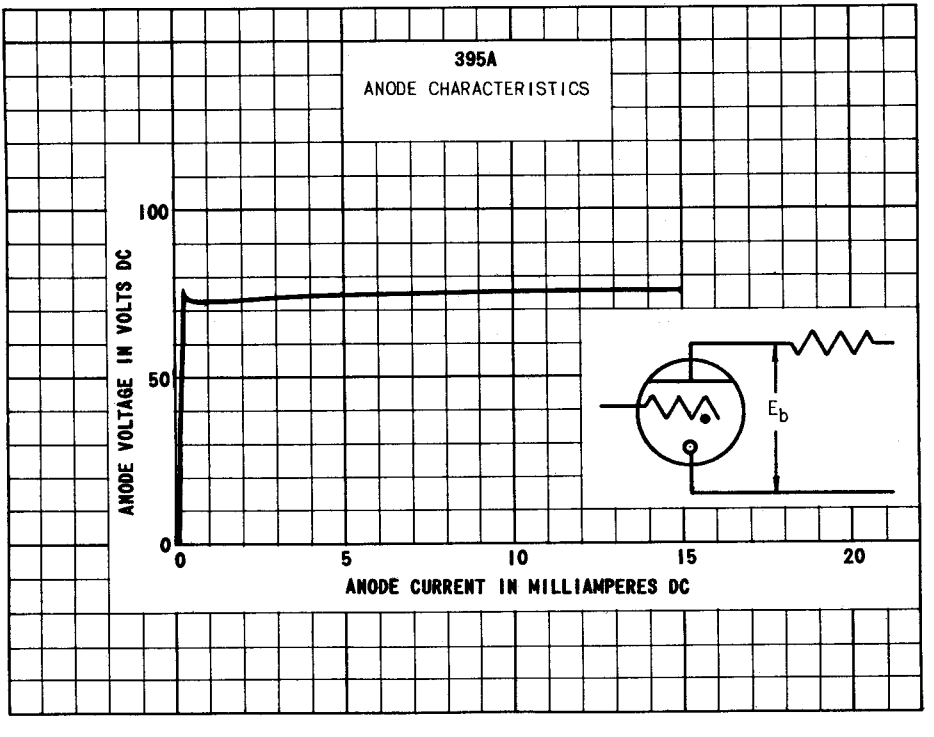
FIG. 4

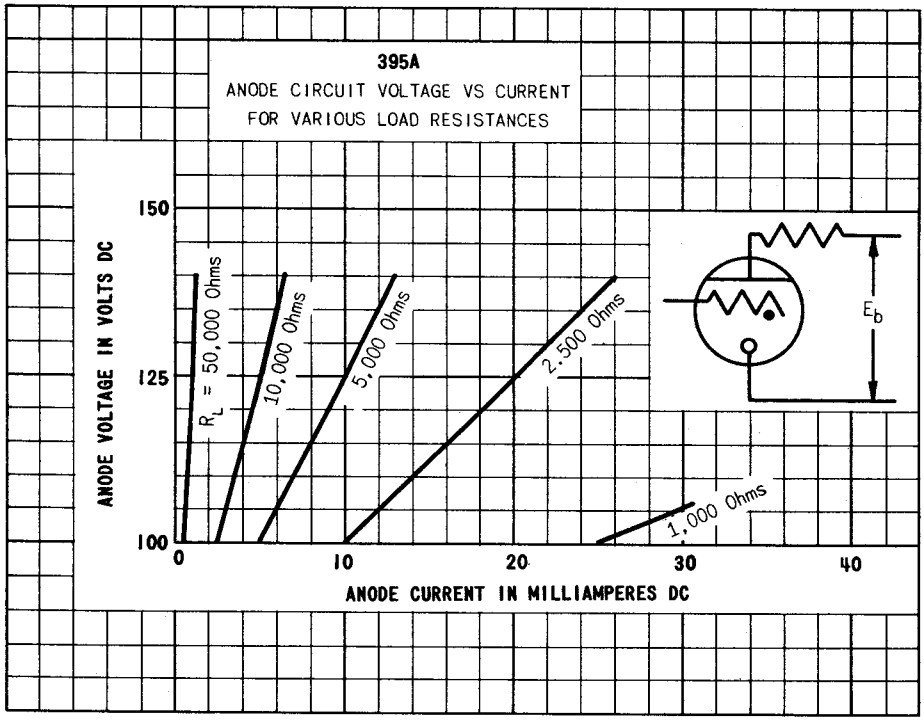

395A
TRANSFER CHARACTERISTICS
ANODE VOLTAGE IN VOLTS DC
300
200
100
0
LIMIT
AVERAGE
0
5
10
15
20
GRID CURRENT IN MICROAMPERES DC

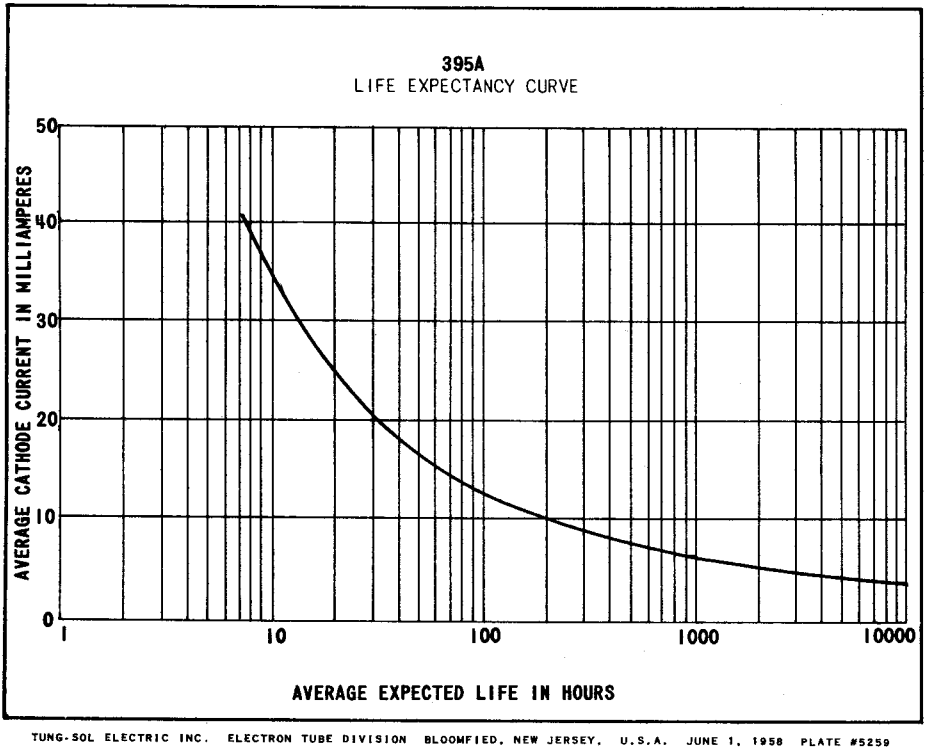

395A
OPERATION CHARACTERISTICS
RANGE INCLUDES VARIATIONS DURING LIFE
NORMAL TRIODE OPERATION RANGE
GRID CONDUCTION REGION
NON-CONDUCTION REGION
ANODE CONDUCTION REGION
AVERAGE TUBE
GRID VOLTAGE IN VOLTS DC
100
75
50
25
0
0
50
100
150
200
250
ANODE VOLTAGE IN VOLTS DC

TENTATIVE DATA






395A
ANODE CIRCUIT VOLTAGE VS CURRENT
FOR VARIOUS LOAD RESISTANCES
ANODE VOLTAGE IN VOLTS DC
150
125
100
0
10
20
30
40
ANODE CURRENT IN MILLIAMPERES DC
R_L = 50,000 Ohms
10,000 Ohms
5,000 Ohms
2,500 Ohms
1,000 Ohms
E_b


395A
LIFE EXPECTANCY CURVE
AVERAGE CATHODE CURRENT IN MILLIAMPERES
50
40
30
20
10
0
1
10
100
1000
10000
AVERAGE EXPECTED LIFE IN HOURS

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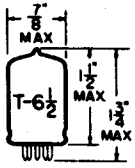
TWIN TRIODE

MINIATURE TYPE

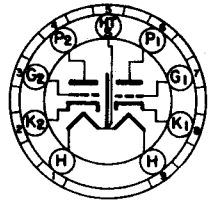


GLASS BULB

HEATER

SERIES	PARALLEL
40±5% VOLTS	20±5% VOLTS
.05 AMP.	0.1 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

THE TYPE 407A IS A NINE PIN MINIATURE, MEDIUM MU, TWIN TRIODE, FEATURING SEPARATE CATHODES. THE HEATER IS DESIGNED FOR PARALLEL OPERATION AT 20 VOLTS OR FOR SERIES OPERATION AT 40 VOLTS. OTHER CHARACTERISTICS ARE SIMILAR TO THOSE OF THE 2C51 AND THE 5670. A SHIELD IS ATTACHED TO THE CENTER OF THE HEATER TO DECREASE POSSIBLE INTERACTION BETWEEN TRIODE SECTIONS. THE USEFUL FREQUENCY RANGE AS AN AMPLIFIER, MIXER, OSCILLATOR, OR MULTIVIBRATOR EXTENDS FROM LOW FREQUENCY TO VHF.

BECAUSE OF THE INHERENT LOW NOISE AND CHOICE OF EITHER 20 VOLT OR 40 VOLT HEATER OPERATION, THE 407A HAS FOUND WIDE USE IN CARRIER TELEPHONY CIRCUITS.

ELECTRICAL DATA

HEATER VOLTAGE SERIES CONNECTION (USE PINS 1 & 9)	40±5%	VOLTS
PARALLEL CONNECTION (TIE PIN 1 TO PIN 9: USE PIN 5, 1 & 9)	20±5%	VOLTS
HEATER CURRENT SERIES CONNECTION (USE PINS 1 & 9)	.05	AMP.
PARALLEL CONNECTION (TIE PIN 1 TO PIN 9: USE PIN 5, 1, & 9)	0.1	AMP.
CHARACTERISTICS PER SECTION UNDER CONDITIONS E_b = 150 Vdc, E_c = 0, Rk/k = 240 OHMS		
PLATE CURRENT	8.2	MADC
TRANSCONDUCTANCE	5 500	μMHOS
AMPLIFICATION FACTOR	35	
PLATE RESISTANCE (APPROX.)	6 400	OHMS
INTERELECTRODE CAPACITANCES (MEASURED WITH NO SHIELD AND WITH HEATER TIED TO CATHODE OF UNIT UNDER TEST. EACH SECTION TESTED SEPARATELY.)		
GRID TO PLATE	1.3	μμfd
GRID TO CATHODE	2.25	μμfd
PLATE TO CATHODE	1.0	μμfd
HEATER TO CATHODE	2.4	μμfd
INTERELECTRODE CAPACITIES BETWEEN TRIODE SECTIONS PLATE TO PLATE	0.1	μμfd
NOISE AND MICROPHONICS (USING WESTERN ELECTRIC 2B NOISE MEASURING TEST SET WITH WEIGHTING FILTER (#F1A)	8	db

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MECHANICAL DATA

MOUNTING POSITION	ANY	
BULB	T-6 1/2	
BASE	MINIATURE BUTTON PIN	
NET WEIGHT, AVERAGE	0.3	OUNCES
MAXIMUM VIBRATION RATING (D=.08"@ 25 CPS)	2.5	G

RATINGS

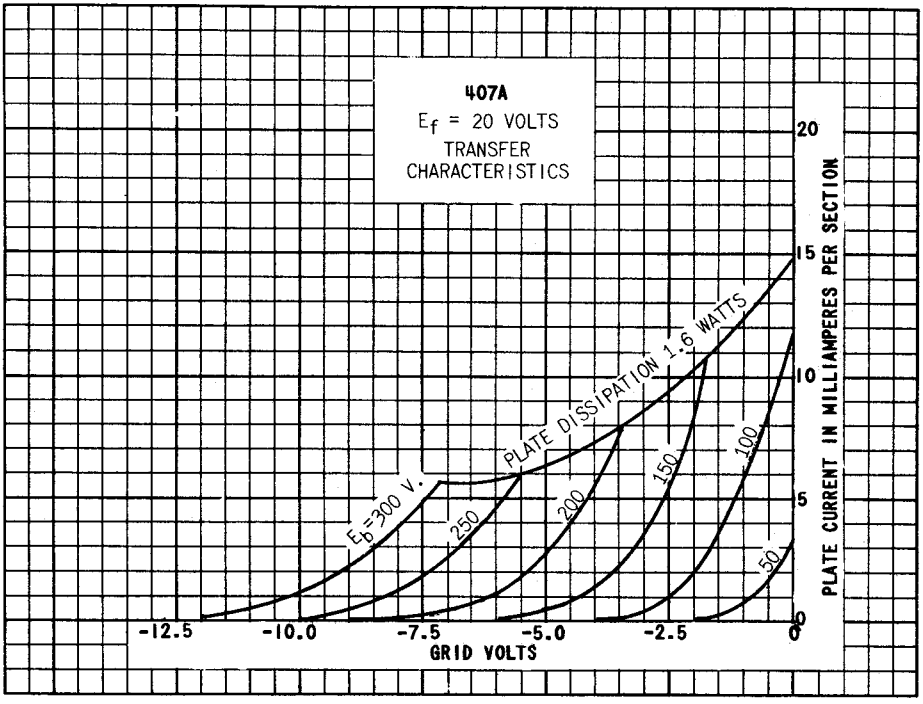
ABSOLUTE VALUES

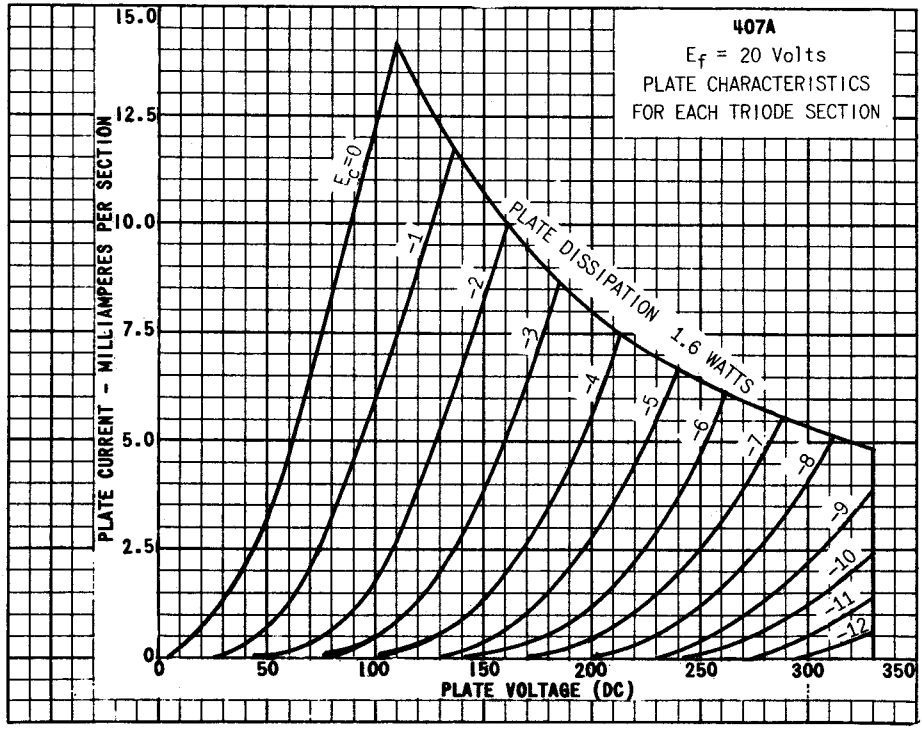
	MINIMUM	MAXIMUM	
HEATER VOLTAGE (20VOLTS NOMINAL)	19	21	VOLTS
(40VOLTS NOMINAL)	38	42	VOLTS
PLATE VOLTAGE DC	---	330	VOLTS
GRID VOLTAGE DC	-55	0	VOLTS
HEATER-CATHODE VOLTAGE	-130	+130	VOLTS
GRID CURRENT PER GRID	---	3.0	MA.
PLATE CURRENT PER PLATE DC	---	18	MA.
POWER DISSIPATION PER PLATE	---	1.6	WATTS
ENVELOPE TEMPERATURE	---	165°	C
ALTITUDE FOR FULL RATINGS	---	60 000	FEET
CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE PER GRID	---	0.5	MEGOHM

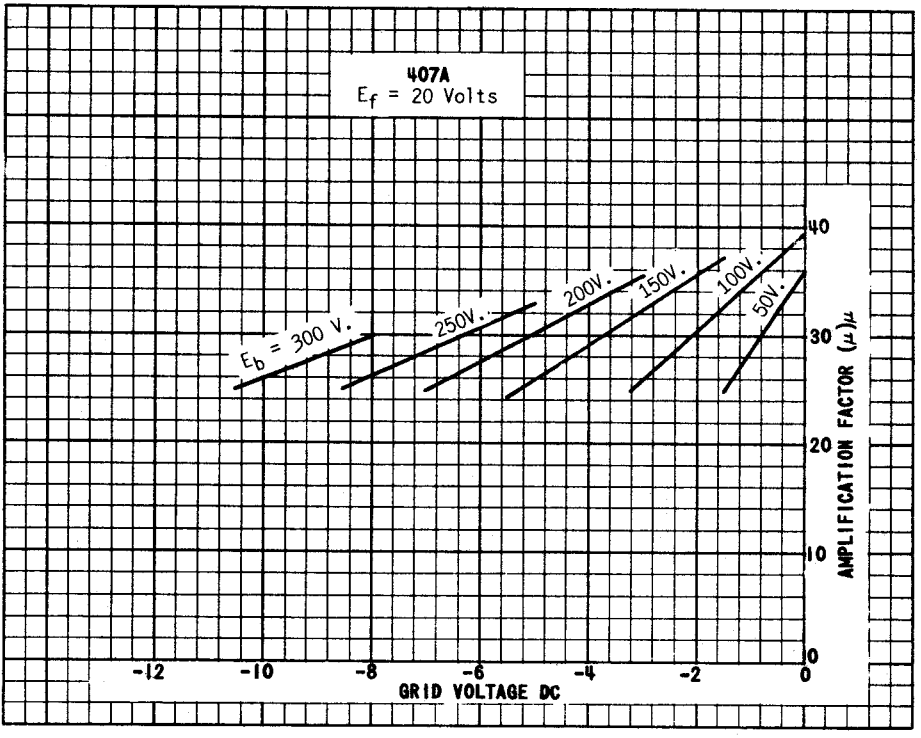
TYPICAL OPERATION

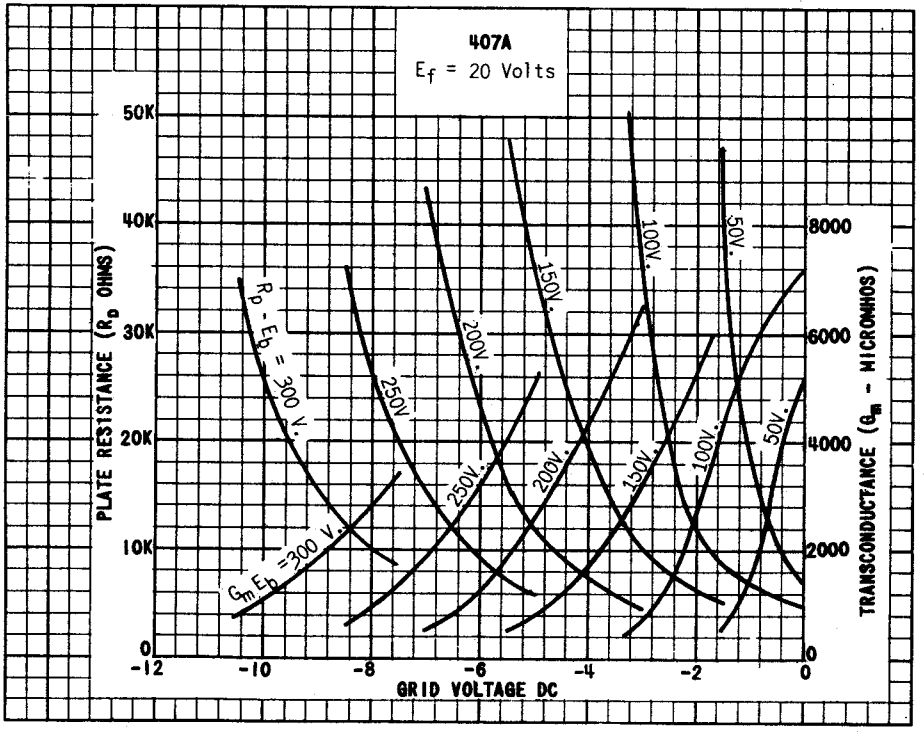
CLASS AB_1 AMPLIFIER

PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT PER SECTION	4.9	MA.
MAXIMUM SIGNAL PLATE CURRENT PER SECTION	6.3	MA.
LOAD IMPEDANCE (PLATE TO PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT

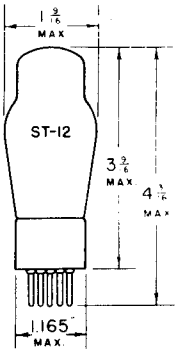

407A
E_f = 20 VOLTS
TRANSFER
CHARACTERISTICS
PLATE DISSIPATION 1.6 WATTS
E_b=300 V.
250
200
150
100
50
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS
20
15
10
5
0
PLATE CURRENT IN MILLIAMPERES PER SECTION


407A
E_f = 20 Volts
PLATE CHARACTERISTICS
FOR EACH TRIODE SECTION
E_c=0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
PLATE DISSIPATION 1.6 WATTS
15.0
12.5
10.0
7.5
5.0
2.5
0
PLATE CURRENT - MILLIAMPERES PER SECTION
0
50
100
150
200
250
300
350
PLATE VOLTAGE (DC)


407A
E_f = 20 Volts
E_b = 300 V.
250V.
200V.
150V.
100V.
50V.
AMPLIFICATION FACTOR (μ)μ
40
30
20
10
0
-12
-10
-8
-6
-4
-2
0
GRID VOLTAGE DC


407A
E_f = 20 Volts
PLATE RESISTANCE (R_p OHMS)
50K
40K
30K
20K
10K
0
R_p - E_b = 300 V.
G_m E_b =300 V.
250V.
200V.
150V.
100V.
50V.
TRANSCONDUCTANCE (G_m - MICROMHOS)
8000
6000
4000
2000
0
-12
-10
-8
-6
-4
-2
0
GRID VOLTAGE DC

TUNG-SOL

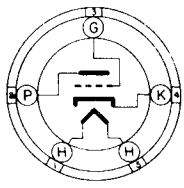


TRIODE AMPLIFIER

UNIPOTENTIAL CATHODE

HEATER
3.0 VOLTS 1.3 AMPERES
AC OR DC

GLASS BULB



5A

BOTTOM VIEW

SMALL 5 PIN BASE

THE TUNG-SOL 485 IS A GENERAL PURPOSE TRIODE DESIGNED FOR SERVICE AS AN OSCILLATOR, DETECTOR OR AMPLIFIER.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	180	VOLTS
GRID VOLTAGE	-9	VOLTS
PLATE CURRENT	6.0	MA.
PLATE RESISTANCE	9300	OHMS
TRANSCONDUCTANCE	1350	μMHOS
AMPLIFICATION FACTOR	12.5	

PLATE
658-1

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TUNG-SOL

ULTRA-HIGH FREQUENCY TRIODE

THORIATED TUNGSTEN FILAMENT

1.15 VOLTS 4.5 AMPERES

THE TYPE 703A IS ULTRA-HIGH FREQUENCY TRIODE IN A GLASS ENVELOPE WITH SHORT AND DIRECT LEADS TO THE ELEMENTS. CLOSE ELECTRODE SPACING AND LOW CAPACITANCES MAKE THE TUBE SUITABLE FOR OSCILLATOR, AMPLIFIER, OR MIXER SERVICE AT FREQUENCIES AS HIGH AS 1500 MEGACYCLES.

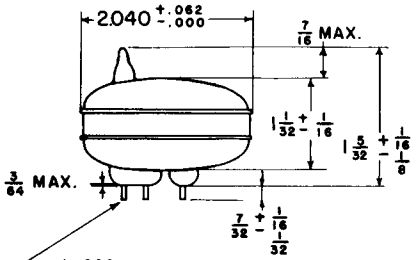
RATINGS

FILAMENT VOLTAGE[1]	1.15 ± 5%	VOLTS
MAXIMUM PLATE VOLTAGE	350	VOLTS
MAXIMUM PLATE DISSIPATION	20	WATTS
TRANSCONDUCTANCE (I_P = 45 MA)	2075	μMHOS

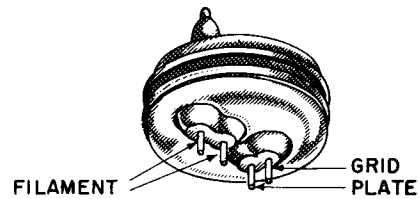
DIRECT ELECTRODE CAPACITANCES

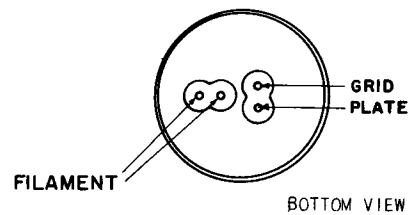
GRID TO PLATE	0.90	μμf
GRID TO FILAMENT	0.85	μμf
PLATE TO FILAMENT	0.60	μμf

[1] FILAMENT VOLTAGE SHOULD BE ADJUSTED FOR OVER-ALL OPTIMUM OPERATION WITHIN THE 5% FILAMENT VOLTAGE TOLERANCE.



TUBE DIMENSIONS





BOTTOM VIEW

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PLATE 1380-1 DEC. 15 1943

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705A

TUNG-SOL

HALF-WAVE HIGH VACUUM RECTIFIER

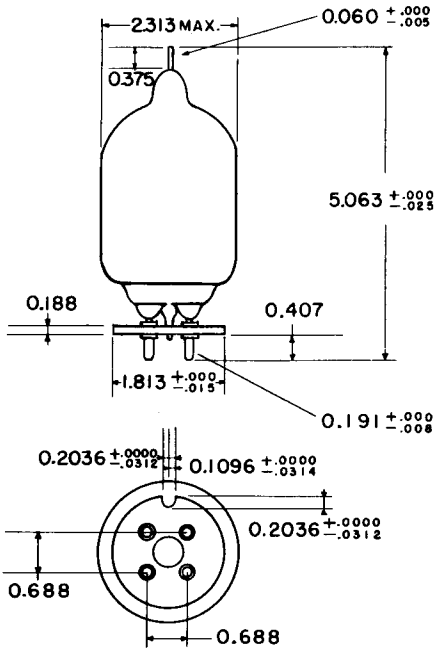
THORIATED TUNGSTEN FILAMENT

5.0 VOLTS 5 AMPERES

RATINGS

FILAMENT VOLTAGE[1]	5.0 ± 5%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	35	KV.
MAXIMUM AVERAGE RECTIFIED PLATE CURRENT	100	MA.
MAXIMUM PEAK PLATE CURRENT	500	MA.
VOLTAGE DROP (I_B = 365 MA)	300	VOLTS

[1] FILAMENT VOLTAGE SHOULD BE ADJUSTED FOR OVER-ALL OPTIMUM OPERATION WITHIN THE 5% FILAMENT VOLTAGE TOLERANCE.



TUBE DIMENSIONS

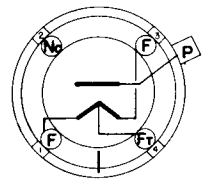


PLATE 1381-1

DEC. 15 1943

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TUNG-SOL

HIGH FREQUENCY PENTODE

UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 175 MA.

RATINGS

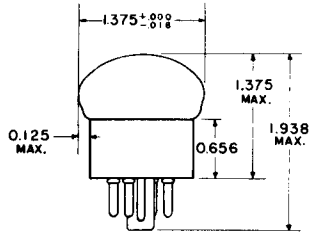
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM SCREEN VOLTAGE	120	VOLTS
MAXIMUM CATHODE CURRENT	10.1	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	175	MA.
PLATE VOLTAGE	120	VOLTS
SCREEN VOLTAGE	120	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	7.5	MA.
SCREEN CURRENT	2.5	MA.
MUTUAL CONDUCTANCE	4000	μMHOS
PLATE RESISTANCE	.25	MEGOHMS
GRID VOLTAGE (I_P = 10 μA, APPROX.)	-9	VOLTS

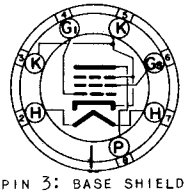
THE 713A AND 717A ARE IDENTICAL WITH THE EXCEPTION OF THE BASES AS SHOWN BELOW.

THE 713A HAS A SEVEN PIN OCTAL BAKELITE BASE AND THE 717A HAS A MICANOL WAFER WITH METAL SHELL AS SHOWN BELOW.

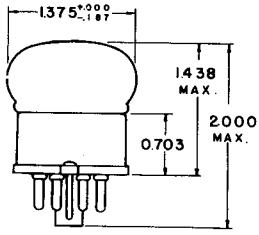


TUBE DIMENSIONS

713A



PIN 3: BASE SHIELD



TUBE DIMENSIONS

717A

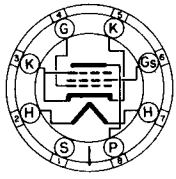


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PLATE 1382-1 DEC. 15 1943

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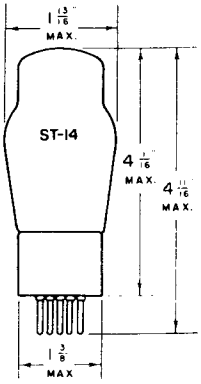
TUNG-SOL



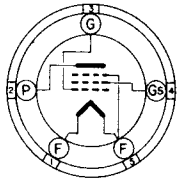
PENTODE POWER AMPLIFIER

COATED FILAMENT

2.0 VOLTS 0.12 AMPERE
DC

GLASS BULB

MEDIUM 5 PIN BASE



5K

BOTTOM VIEW

THE TUNG-SOL 950 IS A FILAMENT TYPE PENTODE POWER AMPLIFIER DESIGNED FOR SERVICE IN THE OUTPUT STAGE OF BATTERY OPERATED RECEIVERS. ITS RATINGS AND CHARACTERISTICS ARE IDENTICAL WITH THOSE OF THE 1U5G.

OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE	135	VOLTS
SCREEN VOLTAGE	135	VOLTS
CONTROL GRID VOLTAGE [A]	-16.5	VOLTS
GRID CIRCUIT RESISTANCE WITH FIXED BIAS MAX.	0.5	MEGOHM
PLATE CURRENT	7	MA.
SCREEN CURRENT	2	MA.
TRANSCONDUCTANCE	950	μMHOS
AMPLIFICATION FACTOR	100	
LOAD RESISTANCE	13500	OHMS
POWER OUTPUT	0.45	WATT

[A] RETURN TO NEGATIVE FILAMENT (PIN #5)

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PLATE 578-1

OCT. 20 1939

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TUNG-SOL

DETECTOR AMPLIFIER-PENTODE

ACORN TYPE

COATED UNIPOTENTIAL CATHODE [B]

HEATER
6.3 VOLTS [D] 0.15 AMPERE
AC OR DC

RATINGS

RF OR AF AMPLIFIER CLASS A

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN (GRID 2) VOLTAGE	100	VOLTS
MAXIMUM SUPPRESSOR (GRID 3) VOLTAGE	100	VOLTS
MINIMUM CONTROL GRID VOLTAGE (GRID 1)	-3	VOLTS
MAXIMUM PLATE DISSIPATION	0.5	WATT
MAXIMUM SCREEN DISSIPATION	0.1	WATT

DIRECT INTERELECTRODE CAPACITANCES

CONTROL GRID TO CATHODE	3	μμf
PLATE TO CATHODE	3.4	μμf
GRID TO PLATE (WITH SHIELD BAFFLE)	0.007 (MAX.)	μμf

TYPICAL OPERATION AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
PLATE VOLTAGE	90	250	VOLTS
SCREEN VOLTAGE (GRID 2)	90	100	VOLTS
CONTROL GRID VOLTAGE (GRID 1)	-3	-3	VOLTS
AMPLIFICATION FACTOR	1100	> 2000	
PLATE RESISTANCE	1.0	> 1.5	MEGOHMS
MUTUAL CONDUCTANCE	1100	1400	μMHOS
PLATE CURRENT	1.2	2.0	MA.
SCREEN CURRENT	0.5	0.7	MA.

SUPPRESSOR CONNECTED TO CATHODE AT SOCKET (GRID 3)

RESISTANCE COUPLED A-F VOLTAGE AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
PLATE-SUPPLY VOLTAGE [A]	250	VOLTS
SCREEN VOLTAGE (GRID 2)	50	VOLTS
CONTROL GRID VOLTAGE (GRID 1) [C]	-2.1	VOLTS
LOAD RESISTANCE	0.25	MEGOHM
PLATE CURRENT	0.5	MA.
VOLTAGE OUTPUT (5% SECOND HAR.)	40 TO 50	VOLTS (RMS)
VOLTAGE AMPLIFICATION (APPROX.)	100	

SUPPRESSOR CONNECTED TO CATHODE AT SOCKET (GRID 3)

(CONTINUED NEXT PAGE)

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PLATE
1351-1
OCT. 25
1943

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TUNG-SOL

BIASED DETECTOR

HEATER VOLTAGE	6.3	VOLTS
PLATE-SUPPLY VOLTAGE	250	VOLTS
SCREEN VOLTAGE (GRID 2)	100	VOLTS
CONTROL GRID VOLTAGE (GRID 1) (APPROX.)	-6	VOLTS
LOAD RESISTANCE	0.25	MEGOHM
PLATE CURRENT	ADJUSTED TO 0.1 MA. WITH NO INPUT SIGNAL	
SELF-BIAS RESISTOR	20000 TO 50000	OHMS

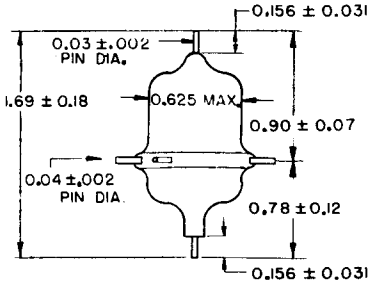
SUPPRESSOR CONNECTED TO CATHODE AT SOCKET (GRID 3)

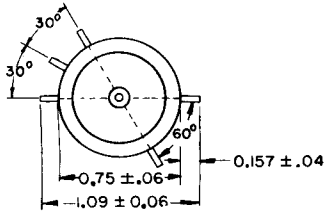
A THIS IS A PLATE-SUPPLY VOLTAGE VALUE. THE VOLTAGE EFFECTIVE AT THE PLATE WILL BE THE PLATE-SUPPLY VOLTAGE MINUS THE VOLTAGE DROP (IN THE LOAD RESISTOR) CAUSED BY THE PLATE CURRENT.

B IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. IF THE USE OF A LARGE RESISTOR BETWEEN HEATER AND CATHODE IS NECESSARY BECAUSE OF CIRCUIT CONSIDERATIONS, IT IS ESSENTIAL THAT THIS RESISTOR BE BY-PASSED BY A SUITABLE FILTER NETWORK OR OBJECTIONABLE HUM MAY DEVELOP.

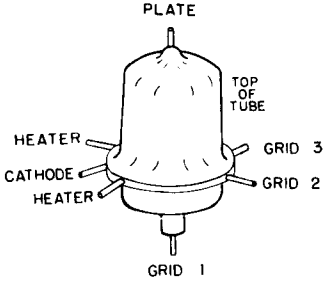
C THE D-C RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM.

D SHOULD NOT DEVIATE MORE THAN ± 10% FROM RATED VALUE.





ALL LINEAR DIMENSIONS ARE SPECIFIED IN INCHES



954-956

PIN CONNECTIONS

PLATE 1352-1
OCT. 25 1943

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TUNG-SOL

DETECTOR, AMPLIFIER, OSCILLATOR

ACORN TYPE

COATED UNIPOTENTIAL CATHODE [B]

HEATER

6.3 VOLTS [E] 0.15 AMPERE

AC OR DC

RATINGS

RF OR AF AMPLIFIER CLASS A

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.6	WATTS

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	1.4	μμf
GRID TO CATHODE	1.0	μμf
PLATE TO CATHODE	0.6	μμf

TYPICAL OPERATION AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	6.3	6.3	VOLTS
PLATE VOLTAGE	90	135	180	250	VOLTS
GRID VOLTAGE [A]	-2.5	-3.75	-5	-7	VOLTS
AMPLIFICATION FACTOR	25	25	25	25	
PLATE RESISTANCE	14700	13200	12500	11400	OHMS
TRANSCONDUCTANCE	1700	1900	2000	2200	μMHOS
PLATE CURRENT	2.5	3.5	4.5	6.3	MA.
LOAD RESISTANCE	-	-	20000	-	OHMS
U.P.O. (5% SECOND HAR.)	-	-	135	-	MW

TYPICAL CONDITIONS FOR RESISTANCE COUPLED A-F VOLTAGE AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
PLATE-SUPPLY VOLTAGE [C]	180	VOLTS
GRID VOLTAGE [A]	-3.5	VOLTS
LOAD RESISTANCE	250000	OHMS
PLATE CURRENT	0.42	MA.
VOLTAGE OUTPUT (5% SECOND HAR.)	45 (RMS)	VOLTS
VOLTAGE AMPLIFICATION (APPROX.)	20	

R-F POWER AMPLIFIER & OSCILLATOR - CLASS C

PLATE MODULATED OR C.W.

MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM PLATE CURRENT	8	MA.
MAXIMUM GRID CURRENT	2	MA.

TYPICAL OPERATION

HEATER VOLTAGE	6.3	VOLTS
PLATE VOLTAGE	180	VOLTS
GRID VOLTAGE (APPROX.)	-35	VOLTS
PLATE CURRENT	7	MA.
GRID CURRENT (APPROX.)	1.5	MA.
POWER OUTPUT [D] (APPROX.)	0.5	WATT

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PLATE 1353-1 OCT. 25 1943

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TUNG-SOL

DETECTOR

TYPICAL OPERATION

	BIASED	GRID LEAK	
HEATER VOLTAGE	6.3	6.3	VOLTS
PLATE-SUPPLY VOLT [C]	180	45	VOLTS
GRID VOLTAGE (APPROX.)	−7	GRID RETURN TO CATHODE	VOLTS
LOAD RESISTANCE	0.25	−	MEGOHM
PLATE CURRENT	ADJUSTED TO 0.2 MA. APPROX. WITH NO INPUT SIGNAL	−	MA.
SELF-BIAS RESISTOR (APPROX.)	20000		OHMS
GRID LEAK	−	1 TO 5	MEGOHMS
GRID CONDENSER	−	0.00025	µf

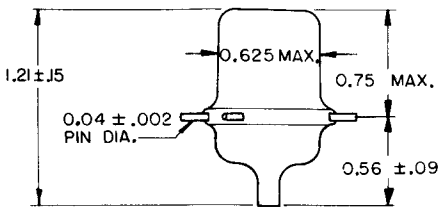
[A] THE D-C RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM.

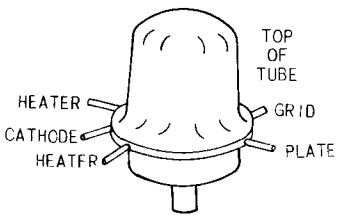
[B] IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. IF THE USE OF A LARGE RESISTOR BETWEEN HEATER AND CATHODE IS NECESSARY BECAUSE OF CIRCUIT CONSIDERATIONS, IT IS ESSENTIAL THAT THIS RESISTOR BE BY-PASSED BY A SUITABLE FILTER NETWORK OR OBJECTIONABLE HUM MAY DEVELOP.

[C] THIS IS A PLATE-SUPPLY VOLTAGE VALUE. THE VOLTAGE EFFECTIVE AT THE PLATE WILL BE THE PLATE-SUPPLY VOLTAGE MINUS THE VOLTAGE DROP (IN THE LOAD RESISTOR) CAUSED BY THE PLATE CURRENT.

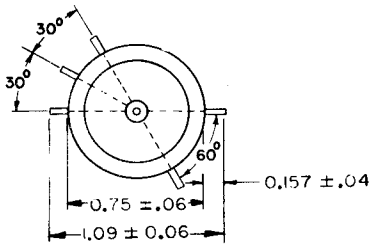
[D] AT 5 METERS. ONLY MODERATE REDUCTION IN THIS VALUE WILL BE FOUND FOR WAVELENGTHS AS LOW AS 1 METER. BELOW 1 METER, THE POWER OUTPUT DECREASES AS THE WAVELENGTH IS DECREASED.

[E] SHOULD NOT DEVIATE MORE THAN ± 10% FROM RATED VALUE.





PIN CONNECTIONS



ALL LINEAR DIMENSIONS ARE SPECIFIED IN INCHES

PLATE 1354-1
OCT. 25 1943

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TUNG-SOL

REMOTE CUT-OFF RF AMPLIFIER PENTODE

ACORN TYPE

COATED UNIPOTENTIAL CATHODE [A]

HEATER

6.3 VOLTS [C] 0.15 AMPERE

AC OR DC

RATINGS

RF OR AF AMPLIFIER CLASS A_1

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN (GRID 2) VOLTAGE	100	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM SCREEN DISSIPATION	.3	WATT

TYPICAL OPERATION AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	.15	AMP.
PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE (GRID 2)	100	VOLTS
CONTROL GRID VOLTAGE (GRID 1) [B]	-3	VOLTS
PLATE RESISTANCE (APPROX.)	.70	MEGOHM
TRANSCONDUCTANCE	1800	μMHOS
GRID VOLTAGE FOR GM = 10 μMHOS	-35	VOLTS
PLATE CURRENT	5.7	MA.
SCREEN CURRENT	2.7	MA.

SUPPRESSOR CONNECTED TO CATHODE AT SOCKET (GRID 3)

[A] IN CIRCUITS WHERE THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. IF THE USE OF A LARGE RESISTOR BETWEEN HEATER AND CATHODE IS NECESSARY BECAUSE OF CIRCUIT CONSIDERATIONS, IT IS ESSENTIAL THAT THIS RESISTOR BE BY-PASSED BY A SUITABLE FILTER NETWORK OR OBJECTIONABLE HUM MAY DEVELOP.

[B] THE D-C RESISTANCE IN THE GRID CIRCUIT SHOULD NOT EXCEED 1.0 MEGOHM.

[C] SHOULD NOT DEVIATE MORE THAN ± 10% FROM RATED VALUE.

SEE OTHER SIDE OF PAGE FOR PIN CONNECTIONS AND BULB DIMENSIONS

PRINTED IN U.S.A.

PLATE 1355-1
OCT. 25 1943

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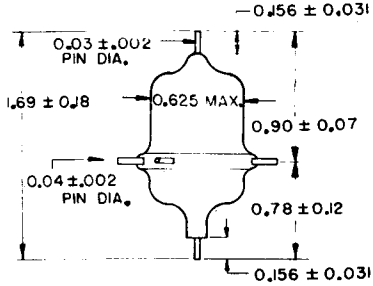
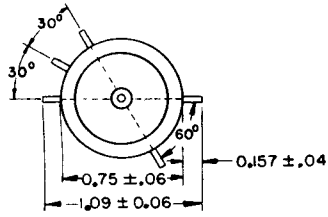
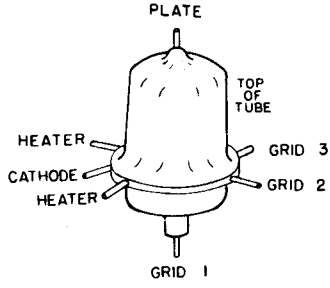
TUNG-SOL





ALL LINEAR DIMENSIONS ARE SPECIFIED IN INCHES



954-956

PIN CONNECTIONS

PLATE 1356-1
OCT. 25 1943

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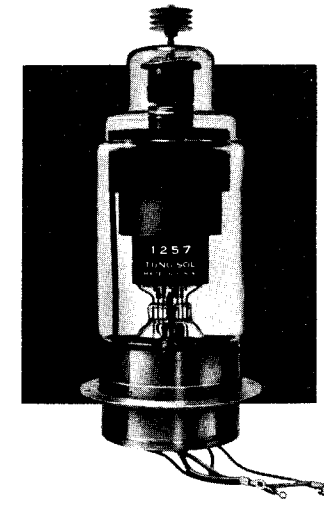
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 1257

JANUARY 1963

HIGH POWER HYDROGEN THYRATRON



DESCRIPTION — The 1257 is a three electrode, hydrogen filled, zero bias thyratron designed for the generation of high power pulses. The primary application of the tube is in high power, high voltage radar modulators. The 1257 is capable of supplying 33 megawatt pulses in this service. An internal hydrogen reservoir promotes long life and permits optimum pressure adjustment for various conditions of operation. The cathode is unipotential and is connected to the electrical center of the cathode heater circuit in order to minimize time jitter.

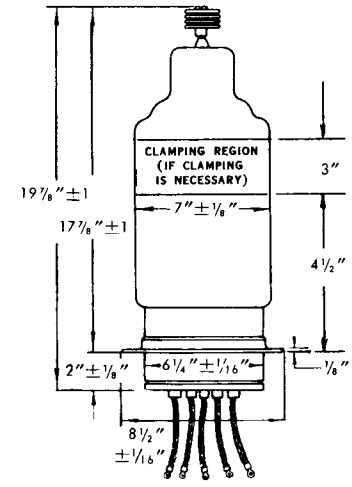
Firm electrical connections are made to the cathode heaters, grid and reservoir by means of flexible cables fitted with lugs. The tube is rigidly supported by a base with a flange containing bolt holes. The cathode connection is made through the base flange.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current — E_f = 6.3 volts	20	23	40	Amperes
Cathode Heating Time	15	—		Minutes
Reservoir Voltage (See application notes)	3.5	Marked on base	6.0	Volts
Reservoir Current	—	—	12	Amperes
Reservoir Heating Time	15	—		Minutes
Anode Voltage Drop	100	200	400	Volts

MECHANICAL DATA

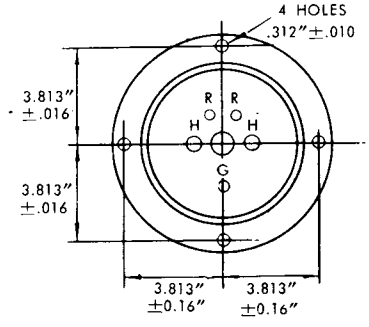
Type of Cooling	Convection
(Forced air cooling across the radiator is recommended for maximum tube life)	
Mounting Position	Vertical, base down
Maximum Net Weight	10 pounds
Dimensions	See outline drawing.



LEAD AND LUG DIMENSIONS ARE GIVEN WITH BASE CONNECTION INFORMATION ON PAGE 4

RATINGS, ABSOLUTE VALUES

	Min	Max	
Peak Anode Voltage			
Inverse — Note 1	0.5	33	Kilovolts
Forward (See Application Notes for starting procedure)	7	33	Kilovolts
Cathode Current			
Peak	—	2000	Amperes
Average	—	2.6	Amperes
RMS (For square pulse applications $I_p = \sqrt{lb \times ib}$)	—	60	Amperes
D-C Anode Voltage	3.5	—	Kilovolts
Operating Frequency	—	1500	Pulses-per-second
(This is not necessarily the upper operating frequency limit of the tube but represents the highest repetition rate extensively tested to date.)			
Peak Grid Voltage — Note 2	1300	2500	Volts
Peak Inverse Grid Voltage	—	650	Volts
Time of Rise of Grid Pulse — Note 5	—	0.35	Microseconds
Grid Pulse Width at 70.7% Point	2.0	—	Microseconds
Heating Factor (epy x ib x prr. — See page 4)	—	20×10^9	
Current Rate of Rise — Note 5	—	10,000	Amperes per microsecond
Anode Delay Time — Note 3	—	0.5	Microsecond
Time Jitter — Note 4	—	0.01	Microsecond
Ambient Temperature	−55	+75	Degrees Centigrade



Note 1: In pulsed operation, the peak inverse voltage, exclusive of a spike of 0.05 microseconds maximum duration, shall not exceed 5.0 kilovolts during the first 25 microseconds following the anode pulse.

Note 2: The grid drive requirements of a 1257 change considerably during the first few minutes of tube operation. In order to reliably trigger a cold tube, the grid pulse voltage and duration and the grid circuit impedance should be chosen according to the limiting curves on page 3.

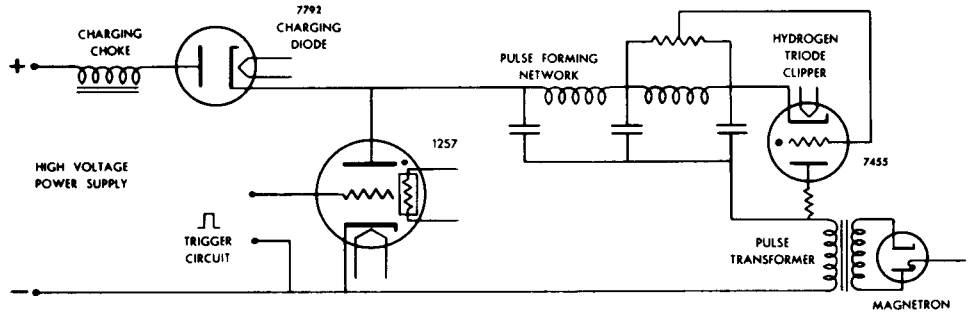
Note 3: Anode delay time is defined as the time interval between the point on the rising portion of the grid voltage pulse which is 26 percent of the maximum unloaded pulse amplitude and the point where anode conduction takes place.

Note 4: Time jitter is measured at 50 percent of the pulse amplitude after the tube has been operating for at least 60 seconds. The limit of 0.01 microseconds shown is the maximum allowable under specified unfavorable operating conditions. With sufficient grid drive and with anode voltages of 20 kilovolts and above, jitter not exceeding 0.005 microseconds can be easily achieved.

Note 5: Measurement made between 26 percent and 70.7 percent points.

APPLICATION NOTES

The 1257 hydrogen thyratron is designed primarily for use in high power radar modulator service. A basic circuit for such service is illustrated below. In such a circuit, the hydrogen thyratron serves as a switch to release into the magnatron or other radio frequency generator, the energy stored in the pulse-forming network. The 1257 is admirably suited for such service by its ability to hold off high voltage, and to pass high peak currents with relatively low tube voltage drop. The tube will operate over a wide range of pulse repetition rates, pulse widths and peak currents, thus providing a very flexible circuit element. Triggering requirements are simplified since the tube operates with zero bias.



The 1257 contains a hydrogen reservoir that maintains the gas pressure within the tube in accordance with the voltage impressed across it. Since the reservoir can hold many tube volumes of gas, long tube life is insured. In addition it is possible to set the gas pressure at the optimum value for any particular set of operating conditions. The reservoir heater voltage stamped on the tube base has been determined for a particular set of conditions somewhat beyond the maximum tube ratings and will be satisfactory for most applications. In general, it is desirable to operate at as high a reservoir voltage as possible without obtaining spurious discharges in the grid-anode region. When the 1257 is operated at or near maximum ratings, the reservoir voltage regulation should not exceed ±2.5 percent. If the 1257 is operated at reduced duty a wider reservoir operating range can be expected. However, care should be taken, when determining the reservoir voltage, to insure satisfactory operation with the anticipated reservoir voltage regulation. Under no circumstances should the reservoir voltage be reduced to such an extent that the anode shows color.

The instantaneous application of anode voltage (instantaneous starting or "slap on") is not recommended. When it is absolutely necessary, the maximum permissible forward peak anode voltage is 22 kilovolts and this value shall not be attained in less than 0.04 second. For initial application of maximum rated anode voltage, it is recommended that one of the following starting methods be used:

a) *Step starting.* Apply no more than 22 kilovolts epy initially. Do not increase in steps greater than 5 kilovolts per minute.

b) *Reduced Reservoir Voltage.* This method is suitable for automatic control. During warm-up and standby periods, the reservoir voltage is held at 92.5 percent of the nominal value. After initial anode voltage application of not greater than 22 kilovolts, the anode voltage may be increased at a maximum rate of one kilovolt per second. After 7.5 minutes of anode operation at maximum voltage, the reservoir voltage is increased to its nominal value. Other starting methods can be supplied to meet various particular applications.

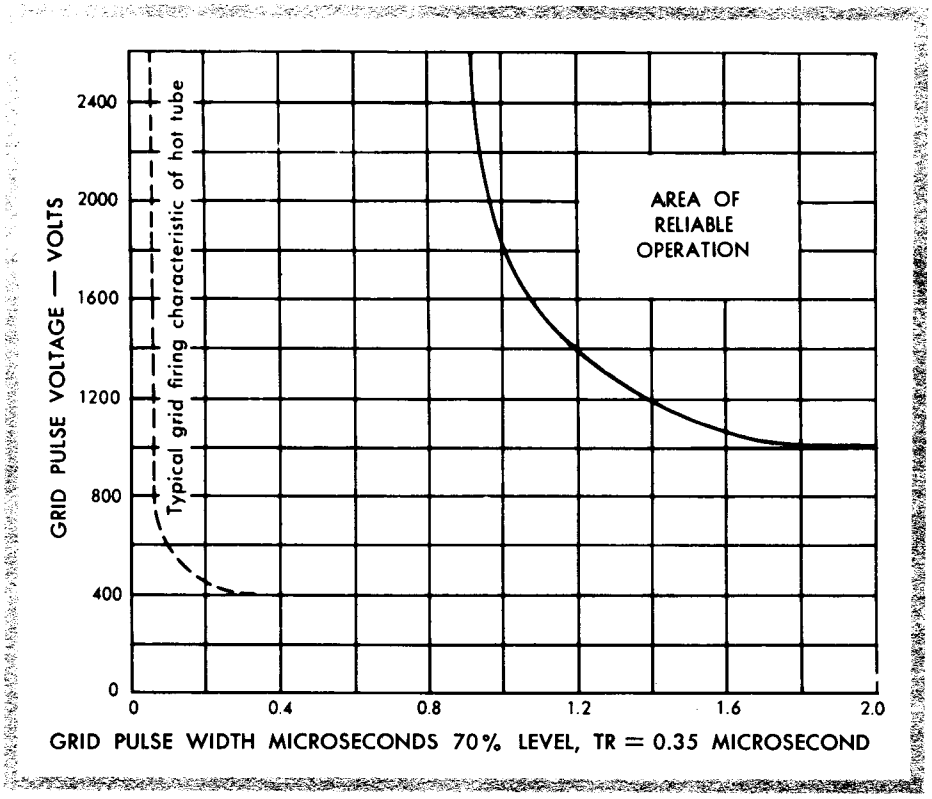
TYPICAL OPERATION

Variations in the operating parameters affect the life expectancy of hydrogen thyratrons; therefore, a simple method of rating for all conditions is difficult. Until such time as sufficient information is available to prepare complete operation rating charts, we list the following typical conditions of operation under which considerable tube life has been obtained. If the 1257 is to be employed in an operation differing widely from these conditions (unless the requirements are obviously less severe) it is suggested that the customer request a recommendation for the specific application.

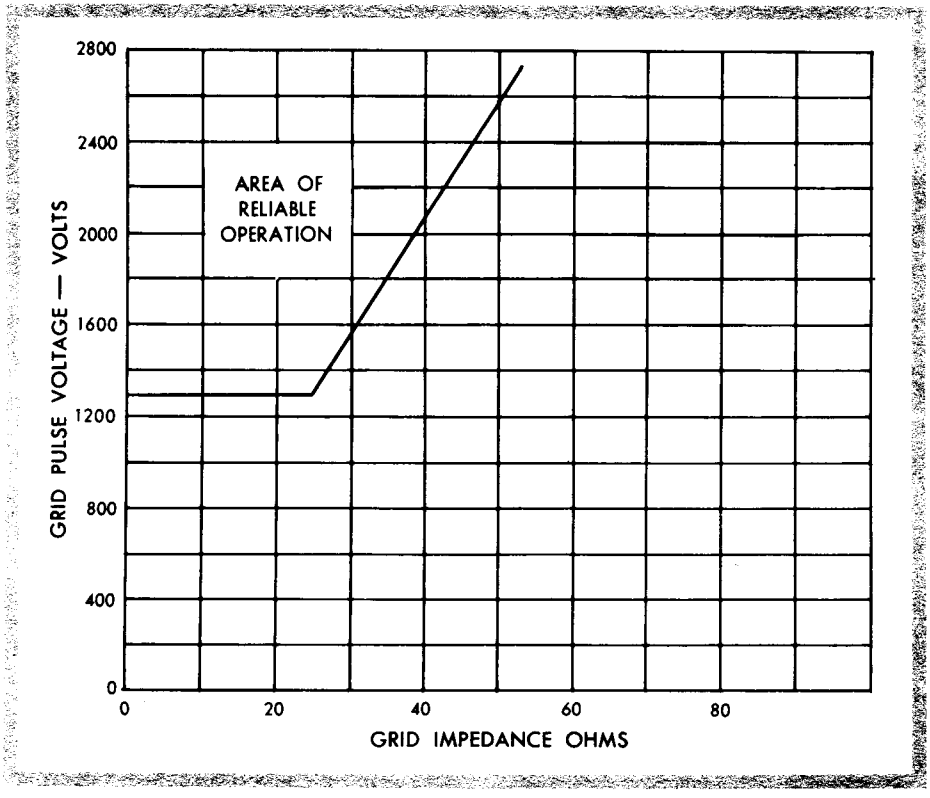
	Peak Anode Voltage		Peak	Pulse Width	
Prr	Forward	Inverse	Current	70% Point	di/dt
pps	kv	kv	amp	μs	amps/μs
310	33	5	2000	2.5	10000
500	30	1.7	1250	3.6	3400
*900	30	1.6	1250	1.0	4200
1500	20	5	667	1.3	6670

*Operation made possible by use of hydrogen triode clipper.

GRID PULSE REQUIREMENTS

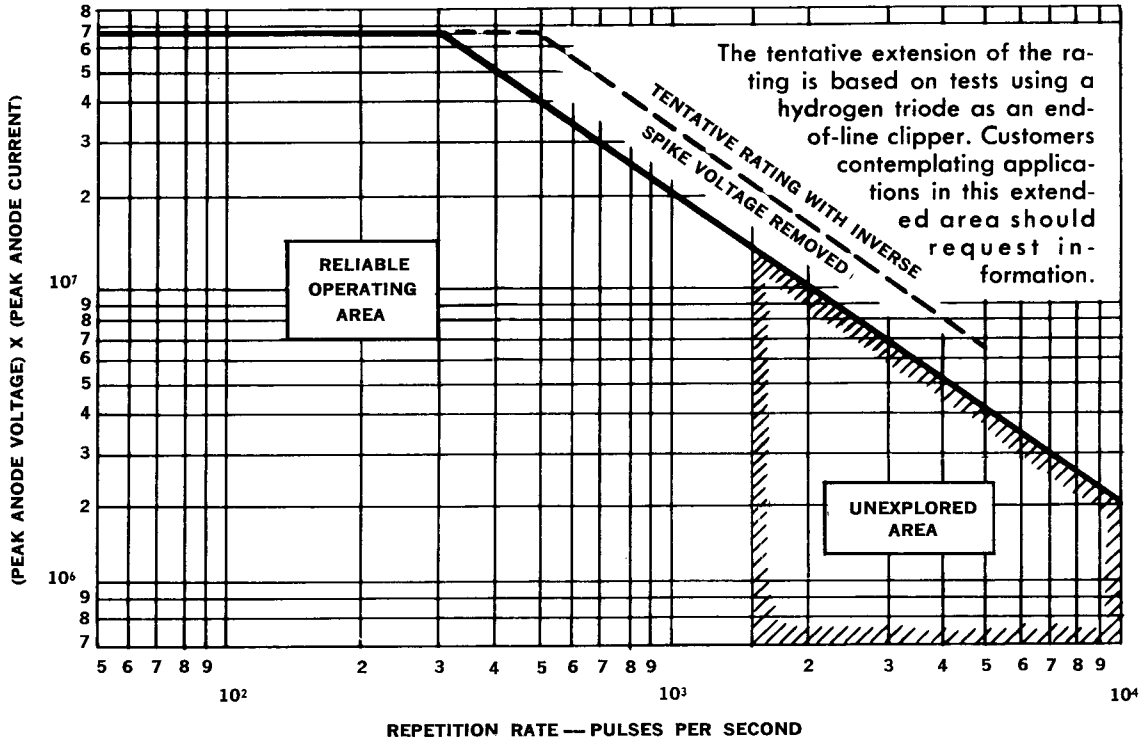


GRID IMPEDANCE REQUIREMENTS

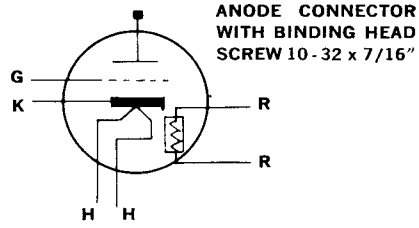


TYPE 1257

GRAPHICAL REPRESENTATION OF HEAT FACTOR



BASING CONNECTIONS

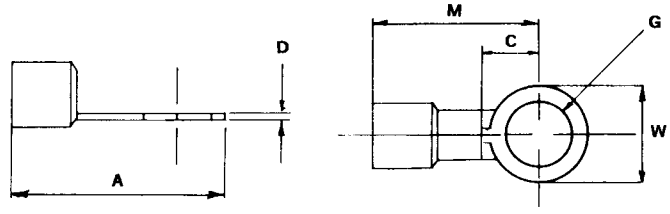


LEAD CONNECTIONS

Lead	Function	Lead Color	Lug Color	Lug
G	Grid	Green	Green	S
H	Heater	Yellow	Yellow	L
H	Heater	Yellow	Yellow	L
R	Reservoir	Red	Red	S
R	Reservoir	Red	Red	S
K	Cathode	Tube Base Flange		

Leads are flexible 8" ±¾" long from bottom of base to center of lug hole. Color coding as well as base marking identifies the leads.

LUG DIMENSIONS



LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	¼"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

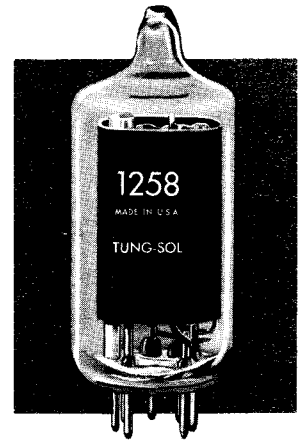
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 1258

JANUARY 1963

MINIATURE HYDROGEN THYRATRON



DESCRIPTION The 1258 is a zero bias miniature hydrogen thyratron designed primarily for use as a pulse modulator tube for low power radar transmitters. This tube can supply peak pulse power of 10 kilowatts and therefore will replace physically larger types in many applications. Because of its close electrode spacing and small size, made possible by hard glass construction, the 1258 is capable of relatively high pulse repetition rates.

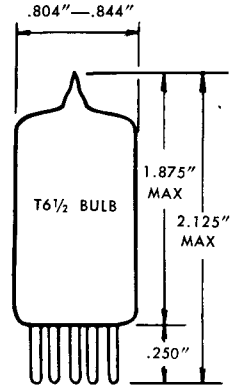
The 1258 has become the industry standard for a small size pulse modulator tube because of its long history of satisfactory service.

ELECTRICAL DATA

	Symbol	Min.	Bogey	Max.
Heater Voltage	Ef	5.7	6.3	6.6 Volts
(When Ip is less than 0.75 Aac, refer to Recommended Heater Voltage Curve on page 3)				
Heater Current	If	1.6	1.8	2.0 Amperes
(With bogie heater voltage)				
Cathode Heating Time	tk	60		Seconds
Anode Voltage Drop (At recommended E_f)	etd			175 Volts

MECHANICAL DATA

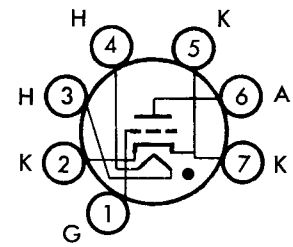
Type of Cooling	Convection
(Heat dissipating shields may be used. Forced air cooling is not recommended.)	
Altitude	See Application Notes
Mounting Position	Any
Maximum Net Weight	0.5 ounce
Dimensions: See outline drawings	
Vibration Test Conditions	10-50 cps @ 10 G
Maximum Shock Conditions	720 G/1 millisec.
(48° Hammer blow in Navy Fly Weight, High Impact Shock Machine)	



OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Symbol	Min.	Max.
Peak Anode Voltage			
Inverse (Note 1)	epx	—	1000 Volts
Forward	epy	200	1000 Volts
Cathode Current			
Peak	ib		20.0 Amp.
Average	Ib		50 ma.
RMS (For square pulse applications $I_p = \sqrt{Ib \times ib}$)	I_p		1.0 Amp.
D.C. Anode Voltage	Ebb	300	Volts
Heater-Cathode Voltage	Ehk	−100	+25 Volts
Operating Frequency	prr		5000 Cps.
(This is not necessarily the upper operating frequency limit but represents the highest repetition rate extensively life tested to date.)			
Peak Grid Voltage . . . See Recommended Grid Pulse Conditions on page 2	egy	175	500 Volts
Peak Inverse Grid Voltage	egx		150 Volts
Heating Factor (epy x ib x prr. See page 4)	Pb		1 x 10^8
Current Rate of Rise (Note 2)			400 Amp/μ sec.
Anode Delay Time (Note 3)	tad		0.6 μ sec.
Time Jitter (Note 4)	tj		0.01 μ sec.
Ambient Temperature	TA	−60°C	+125° C



BOTTOM VIEW

Small Button 7-Pin Miniature Base (See Application Notes)

Note 1. In pulsed operation, the peak inverse voltage, exclusive of a spike of 0.05 μ sec. maximum duration, shall not exceed 500 volts during the first 25 μ sec. following the anode pulse.

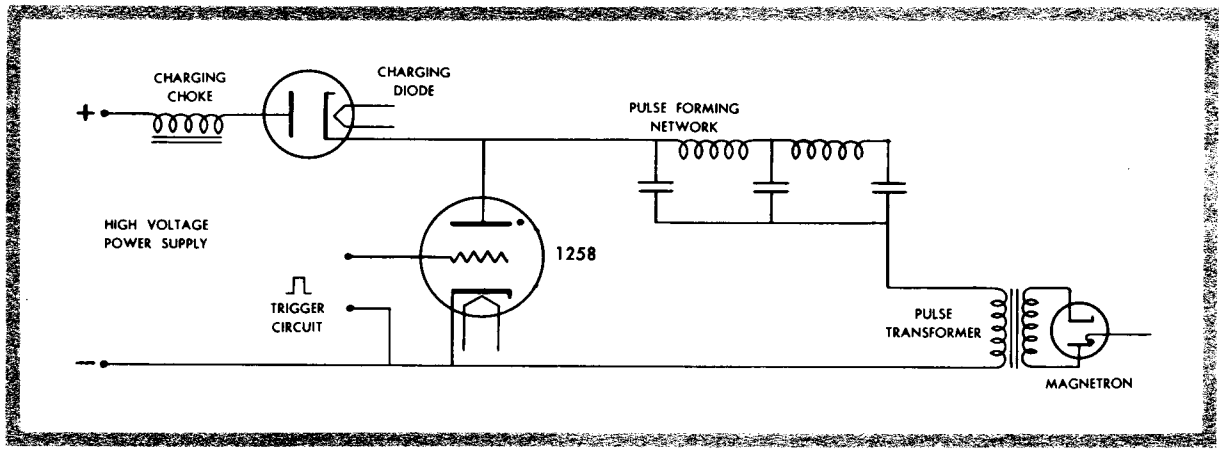
Note 2: Measurement made between 26% and 70.7% points.

Note 3: Anode delay time is defined as the time interval between the point on the rising portion of the grid voltage pulse which is 26 percent of the maximum unloaded pulse amplitude and the point where anode conduction takes place.

Note 4: Time jitter is measured at 50 percent of the pulse amplitude after the tube has been operating for at least 60 seconds. The limit of 0.01 μ sec. shown is the maximum allowable under specified unfavorable operating conditions. With sufficient grid drive and with anode voltages of 600 volts and above, jitter not exceeding 0.005 μ sec. can be easily achieved.

APPLICATION NOTES

The 1258 miniature hydrogen thyratron is designed primarily for use in line type radar modulators. A basic circuit for such service is illustrated below. In such a circuit, the hydrogen thyratron serves as a switch to release into the magnetron or other radio frequency generator, the energy stored in the pulse forming network. This tube is admirably suited for such service by its ability to hold off relatively high voltage, and to pass high peak current with relatively low tube voltage drop. The tube will operate over a wide range of pulse repetition rates, pulse widths and peak currents, thus providing a very flexible circuit element. Triggering requirements are simplified since the tube operates with zero bias.



The 1258 fits a standard 7 pin miniature socket. The tube pins, however, are stiff, and care should be taken to have the socket clips in perfect alignment before attempting to insert a tube. As the tube operates at high temperatures, a ceramic type socket should be employed. Connections to the socket should be made with flexible leads to provide floating action for the socket clips. Pin straighteners should never be used on these tube types, as any attempt to bend the pins will result in cracked button bases!

The nominal altitude rating for the 1258 is 10,000 feet. However, if provision is made to prevent arc-over between pins, these types also will operate at 80,000 feet. One method of preventing arc-over between pins is to pot the base end of the tube. If the entire envelope is to be potted, however, precaution must be taken to keep bulb temperature below 225°C.

Cathode temperature is determined by RMS cathode current as well as by heater power. The bogey heater voltage of 6.3 volts therefore is applicable only near full operating conditions. At light loading it is recommended to operate the heater voltage higher. Recommended figures for various operating conditions are shown on the curves on page 3.

TYPICAL OPERATION

Pulse Repetition Rate	Anode Current			Peak Anode Voltage	Pulse Width	Grid Drive	
	Peak	RMS	Average				
pps	Amps	Amps AC	mAd.c.	Volts	μ sec	μ sec	volts
5,000	20.0	1.0	50.	1,000	0.5	1.0	175
10,000	6.6	0.5	37.	316	0.56	2.0	175
*33,000	3.5	0.46	60.	350	0.5	Blocking Oscillator	200

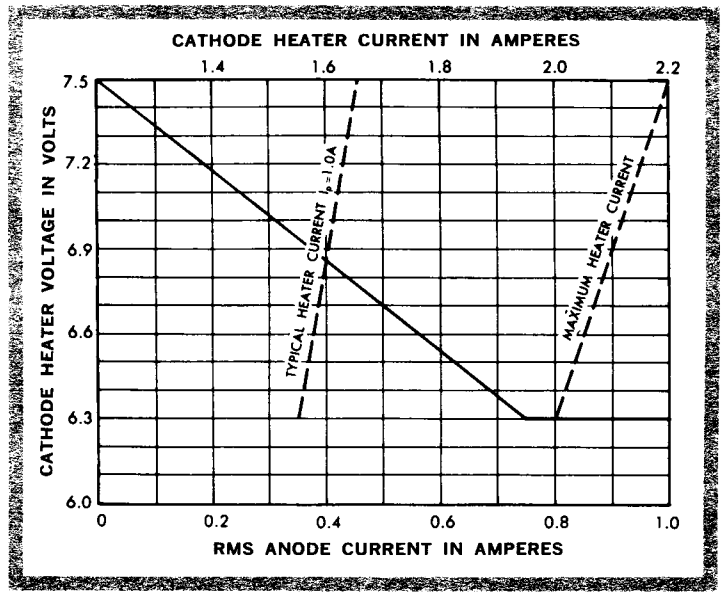
*Limited test information

RECOMMENDED GRID PULSE VALUES

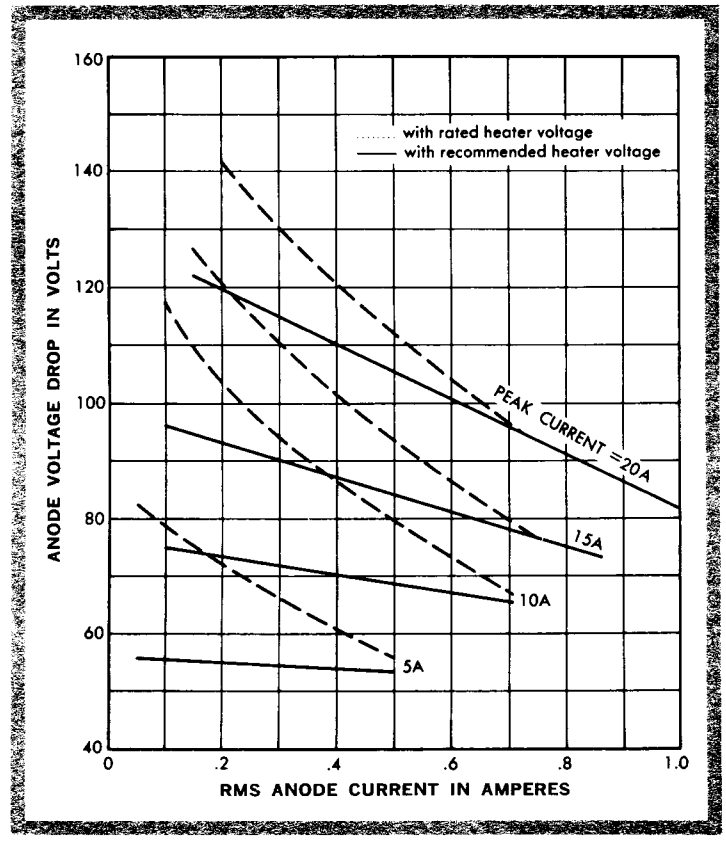
	Min.	Max.	
Peak Voltage	200	500	Volts
Driver Circuit Impedance	200	1000	Ohms
Voltage Rate of Rise	350		Volts/μ sec.

These values are as measured at the tube socket with the thyratron removed. The grid pulse width should not be longer than the anode pulse except in cases where the driver circuit impedance is high. The minimum peak trigger voltage recommended will increase with decreasing trigger pulse width. However, this effect is important only at pulse widths less than 0.5 microseconds.

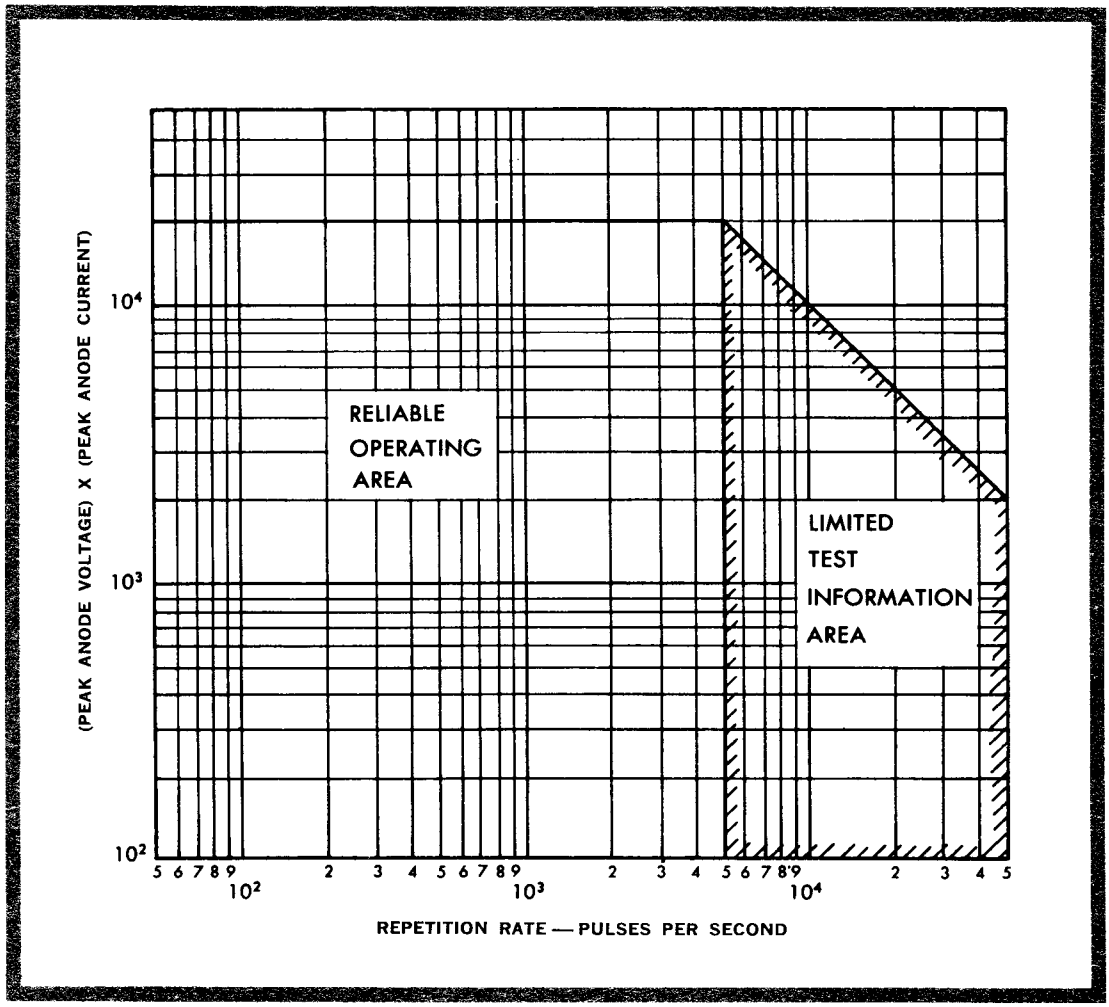
RECOMMENDED HEATER VOLTAGE CURVE



TYPICAL ANODE VOLTAGE DROP CURVE



GRAPHICAL REPRESENTATION OF HEAT FACTOR



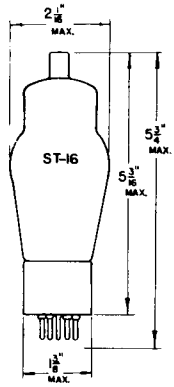
TUNG-SOL

TRANSMITTING BEAM POWER AMPLIFIER 1625

UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.45 AMPERES



RATINGS

HEATER VOLTAGE (AC/DC)	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	750	VOLTS
MAXIMUM SCREEN VOLTAGE	350	VOLTS
MAXIMUM PLATE DISSIPATION	30	WATTS
MAXIMUM SCREEN DISSIPATION	3.5	WATTS

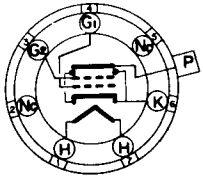
DIRECT INTERELECTRODE CAPACITANCES (WITH EXTERNAL SHIELD)

CONTROL GRID TO CATHODE	11	μμf
PLATE TO CATHODE	7	μμf
MAXIMUM GRID TO PLATE	.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

RF CLASS C AMPLIFIER OR OSCILLATOR

HEATER VOLTAGE (AC/DC)	12.6	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	600	VOLTS
SCREEN VOLTAGE	200	VOLTS
GRID CURRENT	6.0	MA.
SCREEN CURRENT	10	MA.
PLATE CURRENT	100	MA.
POWER OUTPUT	35	WATTS
GRID RESISTOR	10000	OHMS

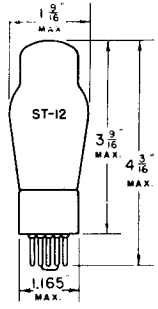


TRANSMITTING TRIODE 1626

UNIPOTENTIAL CATHODE

HEATER

12.6 VOLTS 0.25 AMPERES



RATINGS

HEATER VOLTAGE (AC OR DC)	12.6	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID VOLTAGE	−150	VOLTS
MAXIMUM PLATE DISSIPATION	5	WATTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE (AC OR DC)	12.6	VOLTS
HEATER CURRENT	0.25	AMP.
PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	−32	VOLTS
PLATE CURRENT	25	MA.
PLATE RESISTANCE	2500	OHMS
MUTUAL CONDUCTANCE	2500	μMHOS

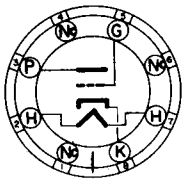


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PLATE 1383-1 DEC. 15 1943

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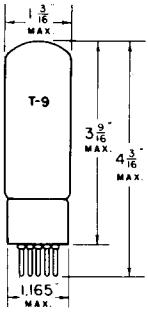
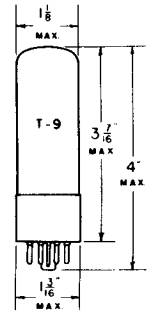
1629 (6E5)

TUNG-SOL



CATHODE RAY TUNING INDICATOR

UNIPOTENTIAL CATHODE

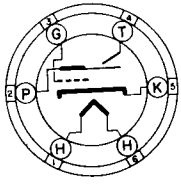


HEATERS

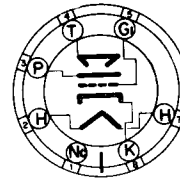
6E5 - 6.3 V., 0.3 AMPERE

1629 - 12.6 V., .15 AMPERE

6E5



1629



THE 1629 AND 6E5 ARE IDENTICAL WITH THE EXCEPTION OF THE HEATER RATINGS. THIS TUBE IS A CATHODE RAY TUNING INDICATOR WITH A CIRCULAR FLOURESCENT TARGET. THE DEGREE OF SHADOW ANGLE IS VARIED BY THE AVC OR OTHER CONTROLLING GRID VOLTAGE.

RATINGS

MAXIMUM PLATE SUPPLY VOLTAGE	250	VOLTS
MAXIMUM TARGET VOLTAGE	250	VOLTS
MINIMUM TARGET VOLTAGE	100	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE AND TARGET SUPPLY VOLTAGE	100	200	250	VOLTS
TRIODE GRID VOLTAGE (0° SHADOW ANGLE)	-3.3	-6.5	-8.0	VOLTS
TRIODE GRID VOLTAGE (90° SHADOW ANGLE)	0	0	0	VOLTS
SERIES TRIODE PLATE RESISTOR	0.5	1	1	MEGOHM
TRIODE PLATE CURRENT (TRIODE GRID V.=0)	0.19	0.19	0.24	MA.
TARGET CURRENT (TRIODE GRID V.=0) [1]	1	3	4	MA.

[1] SUBJECT TO WIDE VARIATIONS

FOR "INTERPRETATION OF RATINGS" REFER TO FRONT OF BOOK

PLATE 1384-1
DEC. 15 1943

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TUNG-SOL

HALF-WAVE HIGH-VACUUM RECTIFIER

MINIATURE TYPE

PHYSICAL SPECIFICATIONS

EMITTER COATED FILAMENT	PIN CONNECTIONS	
BASE MINIATURE BUTTON 7-PIN	PIN 1 FILAMENT-	PIN 7 FILAMENT +
CAP ———	PIN 2 IC-DO NOT USE	PIN 8 NONE
BULB T- 5½	PIN 3 IC-DO NOT USE	BULB TERMINAL PLATE
MAX. DIAMETER 3/4"	PIN 4 NO CONNECTION	
MAX. SEATED HEIGHT 2 3/16"	PIN 5 NO CONNECTION	MOUNTING POS. ANY
MAX. OVERALL LENGTH 2 7/16"	PIN 6 IC-DO NOT USE	

RATINGS[A]

INTERPRETED ACCORDING TO RMA STANDARD M8-210

HEATER OR FILAMENT VOLTAGE (AC OR DC)	1.4	VOLTS
HEATER OR FILAMENT CURRENT	0.05	AMP
MAXIMUM PEAK INVERSE PLATE VOLTAGE	7000	VOLTS
MAXIMUM PEAK PLATE CURRENT[B]	6	MA.
MAXIMUM AVERAGE PLATE CURRENT	1	MA.

[A] THESE RATINGS APPLY TO THE 1654 WHEN IT IS OPERATED FROM A POWER SUPPLY HAVING A FREQUENCY UP TO 500 CYCLES PER SECOND.

[B] A PEAK VALUE OF 20 MA. FOR 0.1 SECOND IS PERMITTED UNDER CONDITIONS OF "HOT-SWITCHING", I.E., SWITCHING THE PLATE CIRCUIT "ON" WHILE THE FILAMENT IS HOT.

DIRECT INTERELECTRODE CAPACITANCE (APPROX.)

WITH NO EXTERNAL SHIELD

PLATE TO FILAMENT	1.4	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HALF-WAVE RECTIFIER		
AC PLATE-SUPPLY VOLTAGE	2500	VOLTS
FILTER INPUT CONDENSER	0.025	μf
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE	175 000	OHMS
DC OUTPUT VOLTAGE (APPROX.) - AT INPUT TO FILTER	2350	VOLTS
DC OUTPUT CURRENT	1	MA.

CIRCUIT VALUES

A PLATE-SUPPLY IMPEDANCE OF 175000 OHMS IS REQUIRED SO THAT THE "HOT-SWITCHING" CURRENT WILL NOT EXCEED THE 20 MA. ALLOWABLE UNDER CONDITIONS OF NORMAL LINE-VOLTAGE FLUCTUATIONS.

THE PLATE-SUPPLY IMPEDANCE MAY BE DECREASED FOR PLATE-SUPPLY VOLTAGES LESS THAN 2500 VOLTS IF THE RESULTANT PEAK-CURRENT RATING OF 6 MA. AND THE "HOT-SWITCHING" CURRENT OF 20 MA. ARE NOT EXCEEDED.

NOTE: THE 1654 IS A MINIATURE, HALF-WAVE, HIGH VACUUM TUBE DESIGNED FOR HIGH VOLTAGE, LOW-CURRENT OPERATION WHERE THE POWER-SUPPLY FREQUENCY DOES NOT EXCEED 500 CYCLES PER SECOND. IT IS ESPECIALLY USEFUL IN EQUIPMENT DESIGN WHERE SPACE AND LOW FILAMENT DRAIN ARE HIGHLY SIGNIFICANT FACTORS.

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PLATE 1688
FEB. 15 1946

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1654

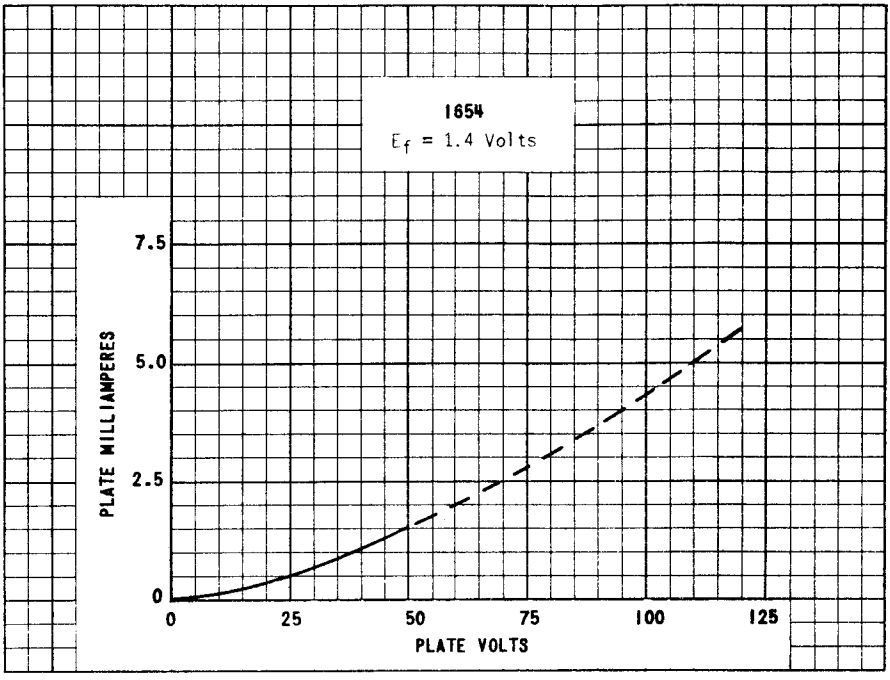

PLATE
1689
FEB. 15
1946

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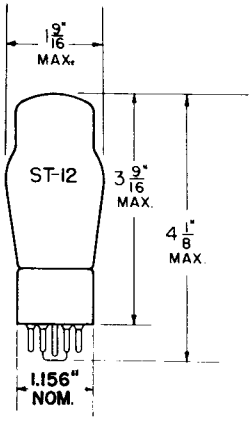
TUNG-SOL

THYRATRON ←



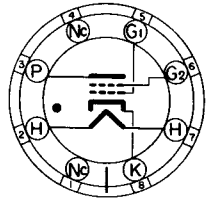
GLASS BULB

HEATER

6.3±10% VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL LOW-LOSS
OCTAL 8 PIN BASE

6BS

THE 2050 IS A XENON FILLED FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC. THIS TUBE IS DESIGNED FOR RELAY APPLICATIONS FOR GRID CONTROLLED RECTIFIER SERVICE. WITH SHIELD GRID TYPE OF CONSTRUCTION A VERY LOW PRECONDUCTION GRID CURRENT FLOWS WHICH ALLOWS THE USE OF A HIGH RESISTANCE IN THE GRID CIRCUIT. THE GRID CONTROL CHARACTERISTIC, BECAUSE OF THE INERT GAS FILLING, IS INDEPENDENT OF AMBIENT TEMPERATURE OVER A WIDE RANGE.

THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PIN #4 TO #8 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	0.60	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.26	μμf
CONTROL GRID TO CATHODE (AND SHIELD GRID)CAPACITANCE	4.2	μμf
ANODE TO CATHODE (AND SHIELD GRID)CAPACITANCE	3.6	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE) WITH GRID VOLTS =-250, GRID RES.=1000Ω ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	50	μSECONDS
WITH GRID VOLTS =-10, GRID RES.=1000 Ω, ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	100	μSECONDS
IONIZATION TIME, APPROX.	0.5	μSECONDS
ANODE VOLTAGE DROP, APPROX.	8	VOLTS
MAXIMUM CRITICAL GRID CURRENT (AT E_{bb}=460V. RMS)	0.5	μAMPS.

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

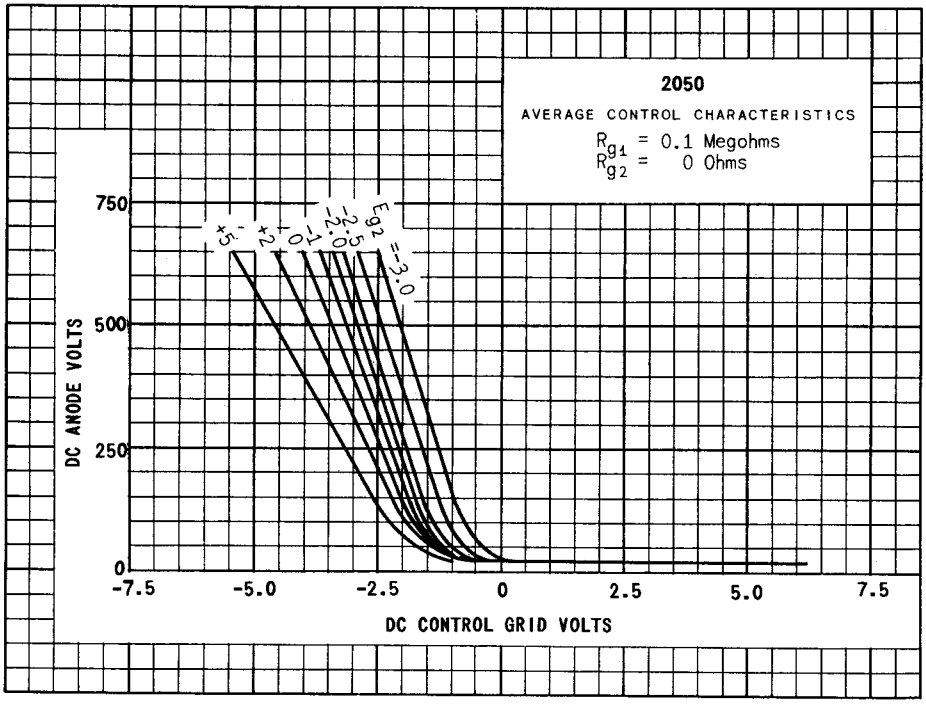
MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED LENGTH	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
BULB	ST-12	
BASE	SMALL SHELL OCTAL 8 PIN	
MAXIMUM NET WEIGHT	1.5	OUNCES

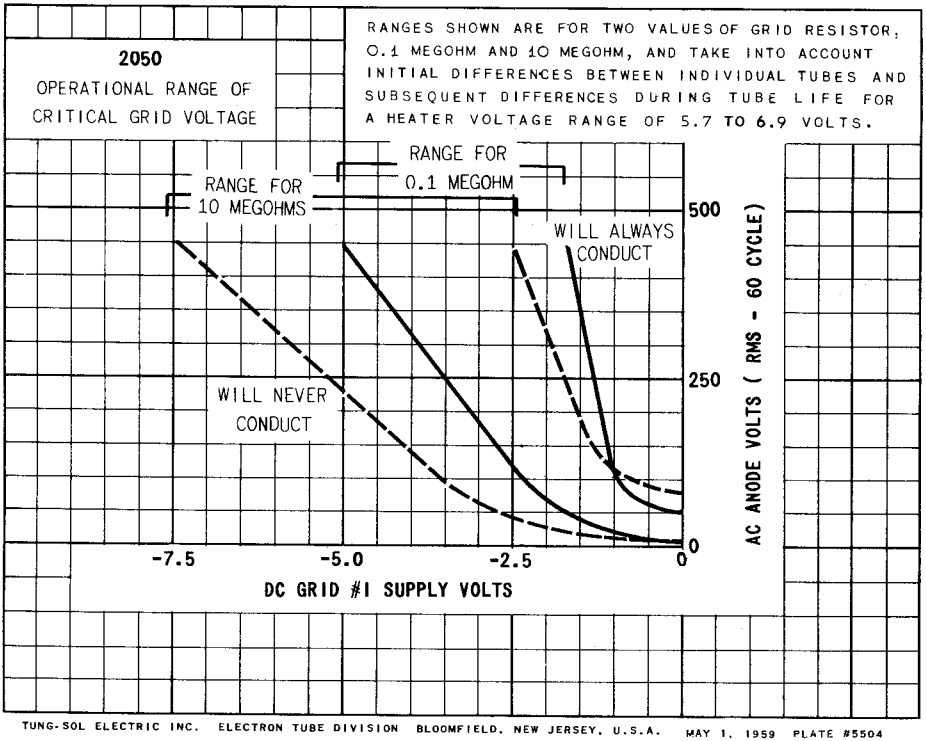
RATINGS

ABSOLUTE VALUES

MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	350	1300	VOLTS
FORWARD	180	650	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	1.0	1.0	AMPS.
AVERAGE	0.2	0.1	AMPS.
SURGE (MAX. DURATION 0.1 SECONDS)	10	10	AMPS.
MAXIMUM AVERAGING TIME	30	30	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE			
BEFORE CONDUCTION	−250	−250	VOLTS
DURING CONDUCTION	−10	−10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE			
BEFORE CONDUCTION	−100	−100	VOLTS
DURING CONDUCTION	−10	−10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM CONTROL GRID CIRCUIT RESISTANCE	1.0	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE	−100	−100	VOLTS
HEATER POSITIVE	25	25	VOLTS
AMBIENT TEMPERATURE LIMITS	−75 TO +90		°C

→ INDICATES A CHANGE.





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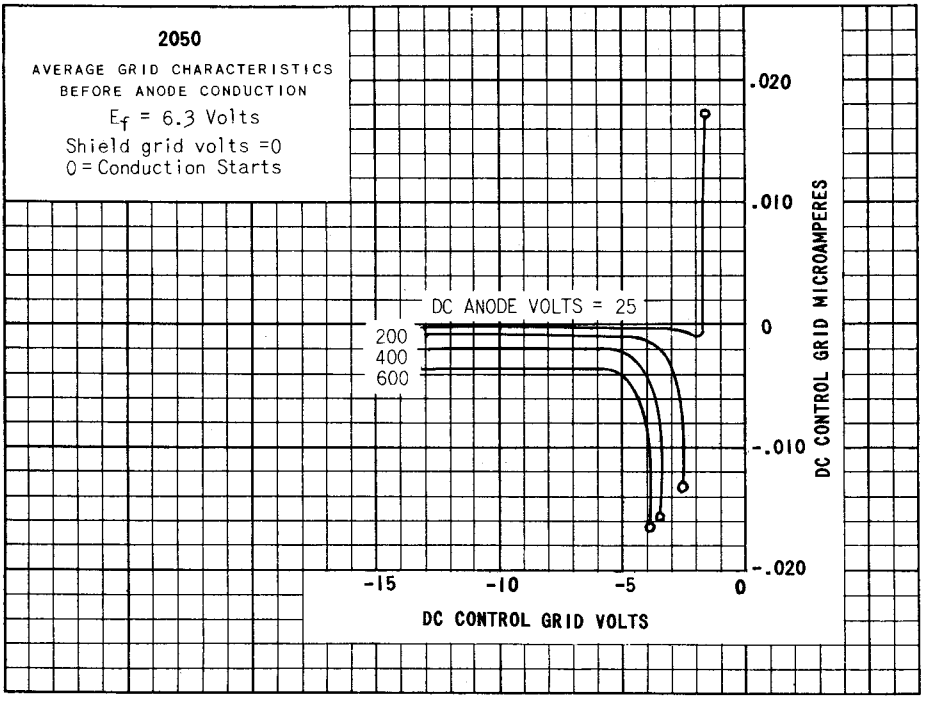
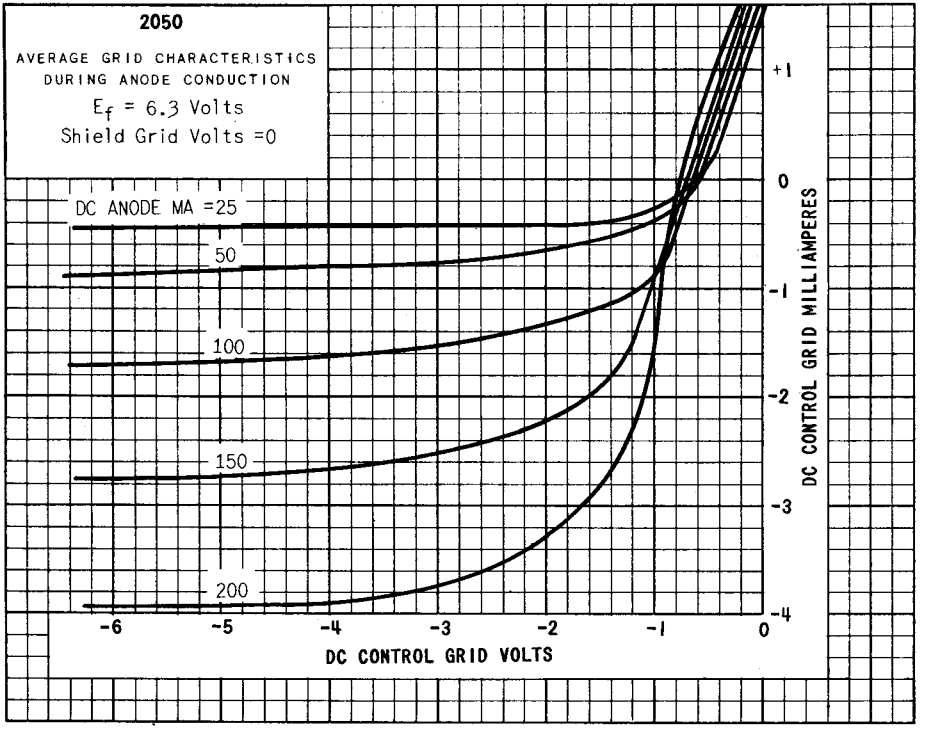
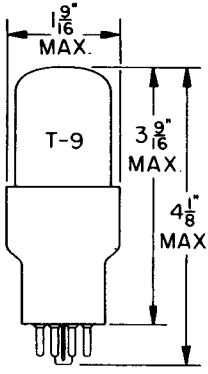

2050
AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION
E_f = 6.3 Volts
Shield grid volts =0
0 = Conduction Starts
DC ANODE VOLTS = 25
200
400
600
.020
.010
0
-.010
-.020
-15
-10
-5
0
DC CONTROL GRID VOLTS
DC CONTROL GRID MICROAMPERES


2050
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts =0
DC ANODE MA =25
50
100
150
200
+1
0
-1
-2
-3
-4
-6
-5
-4
-3
-2
-1
0
DC CONTROL GRID VOLTS
DC CONTROL GRID MILLIAMPERES

TUNG-SOL

THYRATRON ←



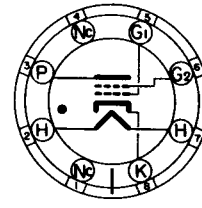
GLASS BULB

HEATER

6.3±10% VOLTS 0.60 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SPECIAL SKIRTED
SMALL SHELL LOW-LOSS
OCTAL 8 PIN BASE

6BS

THE 2050W IS A RUGGEDIZED, XENON FILLED, FOUR ELECTRODE THYRATRON WITH WITH NEGATIVE CONTROL CHARACTERISTICS. THIS TUBE IS ELECTRICALLY EQUIVALENT TO THE POPULAR TYPE 2050, BUT HAS BEEN RUGGEDIZED TO PERMIT THE TUBE TO STAND HIGH IMPACT SHOCKS AND VIBRATION. THE DESIGN FEATURES STRONGER ELEMENTS AND A CUSHIONING SILASTIC RUBBER FILLING BETWEEN THE GLASS ENVELOPE AND THE SPECIAL SKIRTED LOW LOSS BASE. THIS TUBE IS DESIGNED FOR RELAY APPLICATIONS AND FOR GRID CONTROLLED RECTIFIER SERVICE. WITH THE SHIELD GRID TYPE OF CONSTRUCTION, A VERY LOW PRE-CONDUCTION GRID CURRENT FLOWS WHICH ALLOWS THE USE OF A HIGH RESISTANCE IN THE GRID CIRCUIT. THE GRID CONTROL CHARACTERISTIC, BECAUSE OF THE INERT GAS FILLING, IS INDEPENDENT OF AMBIENT TEMPERATURE OVER A WIDE RANGE.

THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PIN #4 TO #8 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	0.60	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.26	μμf
CONTROL GRID TO CATHODE (AND SHIELD GRID)CAPACITANCE	4.2	μμf
ANODE TO CATHODE (AND SHIELD GRID)CAPACITANCE	3.6	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE) WITH GRID VOLTS =-250, GRID RES.=1000Ω ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	50	μSECONDS
WITH GRID VOLTS =-10, GRID RES.=1000 Ω, ANODE VOLTS =125, ANODE CURRENT =0.1 AMPS.	100	μSECONDS
IONIZATION TIME, APPROX.	0.5	μSECONDS
ANODE VOLTAGE DROP, APPROX.	8	VOLTS
MAXIMUMCCRITICAL GRID CURRENT (AT E_{bb}=460V. RMS)	0.5	μAMPS.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

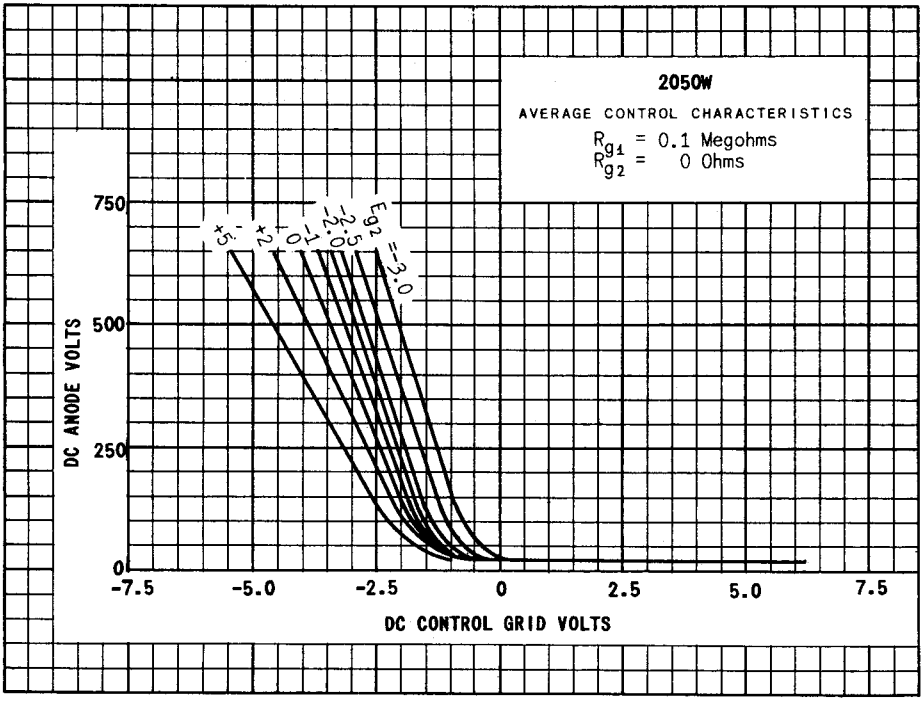
MAXIMUM SHOCK RATING	700	G
MOUNTING POSITION	ANY	
MAXIMUM OVERALL HEIGHT	4 1/8	INCHES
MAXIMUM SEATED LENGTH	3 9/16	INCHES
MAXIMUM DIAMETER	1 9/16	INCHES
BULB	T-9	
BASE	SMALL SHELL OCTAL 8 PIN	
MAXIMUM NET WEIGHT	2.5	OUNCES

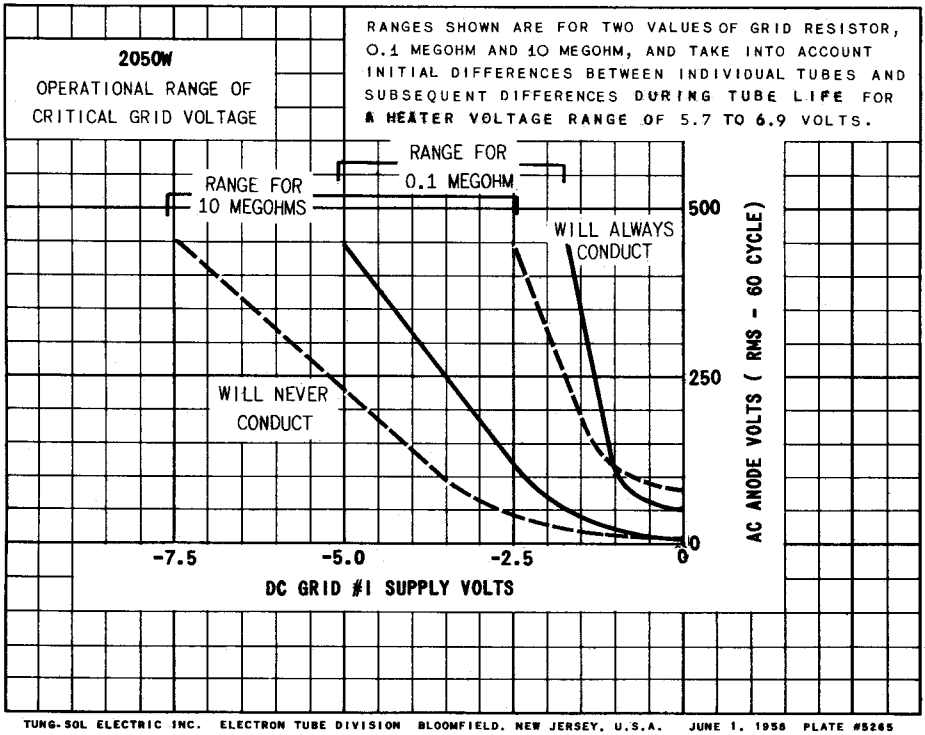
RATINGS

ABSOLUTE VALUES

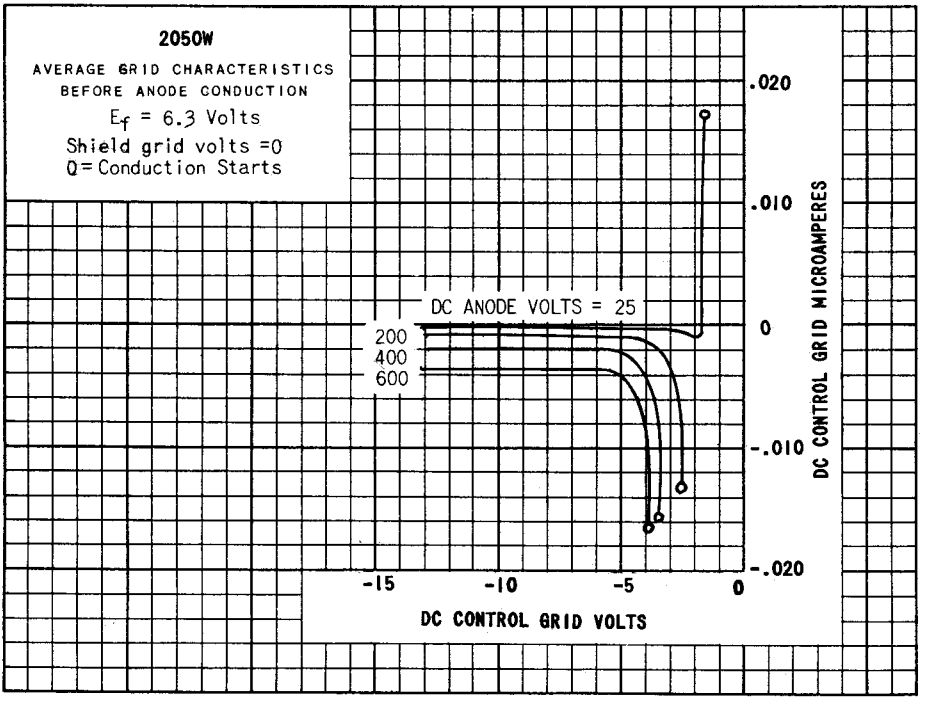
MAXIMUM PEAK ANODE VOLTAGE			
INVERSE	350	1300	VOLTS
FORWARD	180	650	VOLTS
MAXIMUM CATHODE CURRENT			
PEAK	1.0	1.0	AMPS.
AVERAGE	0.2	0.1	AMPS.
SURGE (MAX. DURATION 0.1 SECONDS)	10	10	AMPS.
MAXIMUM AVERAGING TIME	30	30	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE			
BEFORE CONDUCTION	-250	-250	VOLTS
DURING CONDUCTION	-10	-10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE			
BEFORE CONDUCTION	-100	-100	VOLTS
DURING CONDUCTION	-10	-10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT, AVG. (AVERAGING TIME, 1 CYCLE)	0.01	0.01	AMPS.
MAXIMUM CONTROL GRID CIRCUIT RESISTANCE	1.0	10	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE			
HEATER NEGATIVE	-100	-100	VOLTS
HEATER POSITIVE	25	25	VOLTS
AMBIENT TEMPERATURE LIMITS	-75 TO +90		°C

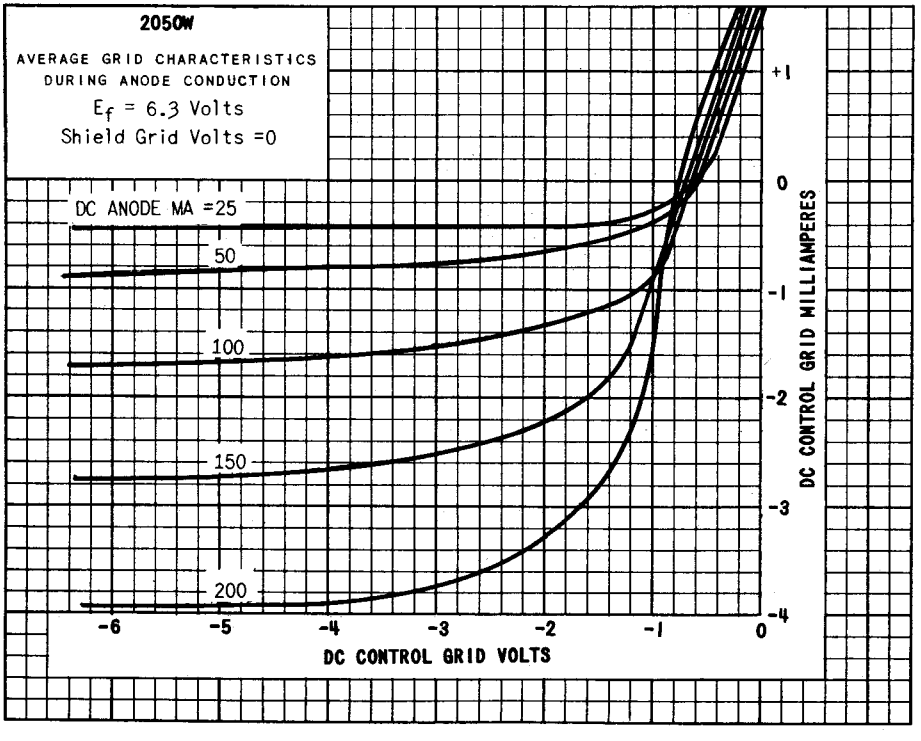
→ INDICATES A CHANGE.


2050W
AVERAGE CONTROL CHARACTERISTICS
R_{g1} = 0.1 Megohms
R_{g2} = 0 Ohms
E_{g2} = +5.0
+2.0
+1.0
-1.0
-2.5
-3.0
DC ANODE VOLTS
750
500
250
0
-7.5
-5.0
-2.5
0
2.5
5.0
7.5
DC CONTROL GRID VOLTS


2050W
OPERATIONAL RANGE OF
CRITICAL GRID VOLTAGE
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR, 0.1 MEGOHM AND 10 MEGOHM, AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE FOR A HEATER VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS.
RANGE FOR 0.1 MEGOHM
RANGE FOR 10 MEGOHMS
WILL ALWAYS CONDUCT
WILL NEVER CONDUCT
500
250
0
AC ANODE VOLTS (RMS - 60 CYCLE)
-7.5
-5.0
-2.5
0
DC GRID #1 SUPPLY VOLTS

TENTATIVE DATA

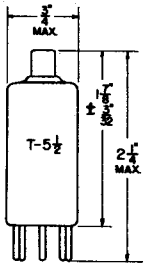




TUNG-SOL

HALF WAVE RECTIFIER

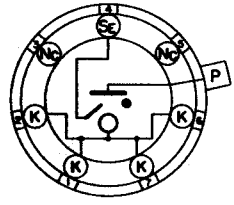
MINIATURE TYPE



GLASS BULB
SKIRTED MINIATURE
C1-3

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 5517 IS A GAS FILLED, COLD CATHODE, HALF WAVE RECTIFIER. THIS TUBE FEATURES SMALL SIZE, LIGHT WEIGHT AND INSTANT OPERATION. A STARTING ELECTRODE IS USED TO IGNITE THE TUBE AT RELATIVELY LOW VOLTAGE, PERMITTING IT TO OPERATE OVER A LARGE PORTION OF THE AC CYCLE. ONE TUBE IN A HALF WAVE CIRCUIT WILL SUPPLY 10 MADC AT MORE THAN 1,000 VDC. THIS TUBE IS USED EXTENSIVELY FOR PHOTOFLASH WORK AND FOR OTHER APPLICATIONS WHERE THE NECESSITY OF FILAMENT POWER DURING STANDBY WOULD BE A DISADVANTAGE.

MAXIMUM RATINGS

MAXIMUM PEAK INVERSE ANODE VOLTAGE	2800	VOLTS
MAXIMUM STARTING VOLTAGE (WITH STARTER ELECTRODE CONNECTED TO ANODE THROUGH 10 MEG.OHMS)RMS	400	VOLTS
MAXIMUM AVERAGE ANODE CURRENT	12	MA.
MAXIMUM PEAK ANODE CURRENT	100	MA.
MAXIMUM TUBE DROP (AT I_b =100 MA.)	125	VOLTS
MAXIMUM SURGE ANODE CURRENT	300	MA.
MINIMUM SOURCE IMPEDANCE[A]	5000	OHMS

[A] SOURCE IMPEDANCE MAY BE LESS THAN THAT SPECIFIED IF CIRCUIT CONSTANTS ARE SUCH THAT MAXIMUM PEAK ANODE CURRENT DOES NOT EXCEED 100MA AND THAT A SHORT CIRCUIT CURRENT IS LIMITED TO 300 MA.

ELECTRICAL DATA

AVERAGE TUBE DROP	100	VOLTS

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/4	INCHES
SEATED LENGTH	1 7/8 ± 3/32	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
CAP	SKIRTED MINIATURE, C1-3	
BASE	MINIATURE BUTTON 7 PIN	
AVERAGE WEIGHT	0.32	OUNCES

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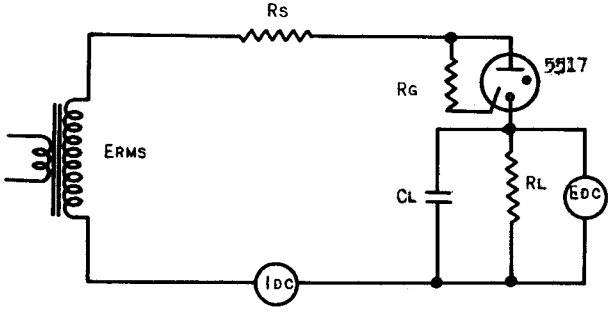
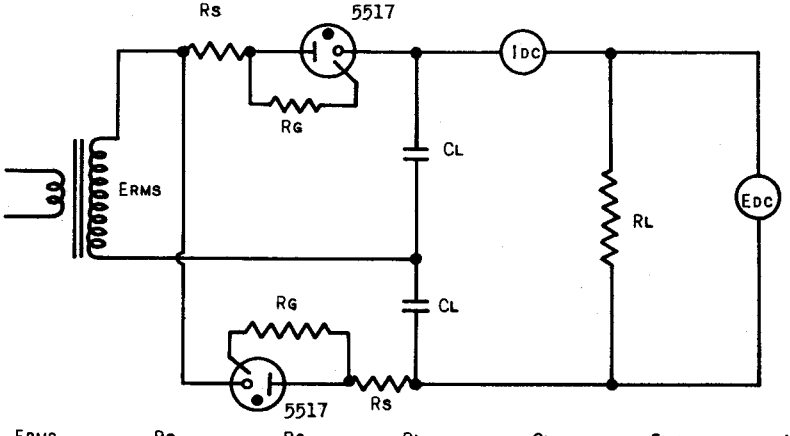
TUNG-SOL

Figure 1 - HALF WAVE RECTIFIER



ERMS VOLTS	Rs OHMS	RG MEGOHMS	RL OHMS	CL MFD	EDC VOLTS	IDC MILLIAMPS
1,000	6,000●	12●	100,000	2	1000	10

Figure 2 - VOLTAGE DOUBLER, FULL WAVE

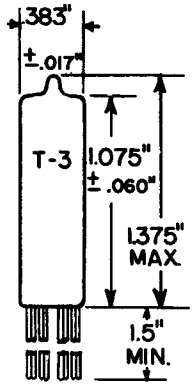


ERMS VOLTS	Rs OHMS	RG MEGOHMS	RL OHMS	CL MFD	EDC VOLTS	IDC MILLIAMPS
1,200	6,000●	12●	255,000	4	2550	10

●INCLUDING TRANSFORMER IMPEDANCE.

●USE THREE 3.9 MEGOHM, 350V, 1/2 WATT RESISTORS IN SERIES.

TUNG-SOL



GLASS BULB

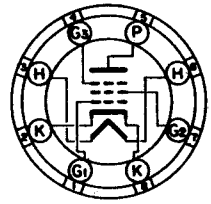
PENTODE

SUBMINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
8DC

THE 5636 IS A SUBMINIATURE DUAL-CONTROL PENTODE CAPABLE OF OPERATION OVER A RANGE OF FREQUENCIES FROM AF TO UHF. THE DUAL-CONTROL CHARACTERISTIC MAKES POSSIBLE ITS USE IN SUCH APPLICATIONS AS CONVERTER, MODULATOR, PHANTASTRON, AND GATING SERVICE, AS WELL AS SINGLE CONTROL USAGE SUCH AS AF, IF, AND RF AMPLIFIERS, MIXERS, ETC. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE OFFER GREATER ASSURANCE TO THE EQUIPMENT DESIGNER THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL-CENTERED. AS THE TUBE MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET THE TEST SPECIFICATIONS, THE 5636 IS ESPECIALLY SUITABLE FOR USE IN MILITARY AND INDUSTRIAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION, SUCH AS AIRBORNE COMMUNICATIONS EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE	0.020	0.030	µµf
MAXIMUM GRID #3 TO PLATE	1.10	1.10	µµf
MAXIMUM GRID #1 TO GRID #3	0.15	0.17	µµf
GRID #1 TO ALL OTHER ELECTRODES (RATED)	4.0	4.0	µµf
MINIMUM	3.5	---	µµf
MAXIMUM	4.5	---	µµf
GRID #3 TO ALL OTHER ELECTRODES (RATED)	4.0	3.8	µµf
MINIMUM	3.5	---	µµf
MAXIMUM	4.5	---	µµf
PLATE TO ALL OTHER ELECTRODES (RATED)	3.4	1.9	µµf
MINIMUM	2.9	---	µµf
MAXIMUM	3.9	---	µµf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±200	VOLTS
MAXIMUM DC PLATE VOLTAGE	165	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM POSITIVE GRID #3 VOLTAGE	30	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.55	WATT
MAXIMUM GRID #2 DISSIPATION	0.45	WATT
MAXIMUM PLATE CURRENT	11	mA
MAXIMUM GRID #2 CURRENT	7.0	mA
MAXIMUM BULB TEMPERATURE	220	°C
LIFE EXPECTANCY		
30°C AMBIENT TEMPERATURE	5 000	HOURS
175°C AMBIENT TEMPERATURE	1 000	HOURS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS [B]

DUAL CONTROL AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.15	0.15	AMP.
DC PLATE VOLTAGE	100	100	VOLTS
DC GRID #1 VOLTAGE	0	0	VOLTS
DC GRID #2 VOLTAGE	100	100	VOLTS
DC GRID #3 VOLTAGE	−1	CATHODE POTENTIAL	
CATHODE RESISTOR	150	150	OHMS
PLATE CURRENT	4.0	5.3	mA
GRID #2 CURRENT	5.8	3.6	mA
GRID #1 TRANSCONDUCTANCE	1 950	3 200	μMHOS
GRID #3 TRANSCONDUCTANCE	950	500	μMHOS
PLATE RESISTANCE	0.05	0.11	MEGOHM
GRID #1 VOLTAGE FOR I_b = 10 μA.	---	−7.5	VOLTS
GRID #3 VOLTAGE FOR I_b = 10 μA.	−8.0	---	VOLTS
NOISE OUTPUT VOLTAGE (MAX.) [C]	---	60	mV

MIXER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
DC PLATE VOLTAGE	100	VOLTS
DC GRID #2 VOLTAGE	100	VOLTS
GRID #3 VOLTAGE:		
DC	0	VOLTS
AC	15	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	3.5	mA
GRID #2 CURRENT	5.7	mA
PLATE RESISTANCE	320 000	OHMS
CONVERSION TRANSCONDUCTANCE	1 280	μMHOS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V; E_b = 100Vdc; E_{c1} = 0Vdc; E_{c2} = 100Vdc; E_{c3} = 0Vdc; E_{hk} = 0V; R_k = 150 Ohms
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVERAGE MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	140	160	144	156	138	164	mA.
HEATER CATHODE LEAKAGE (E_{hk}=±100V.)	---	±5.0	---	---	---	±10	μAdc
GRID #1 CURRENT (R_{g1} =1.0 MEGOHM)	0	−0.3	---	---	0	−0.9	μAdc
PLATE CURRENT	3.7	6.9	4.6	6.0	---	---	mA
GRID #1 TRANSCONDUCTANCE	2700	4000	2900	3500	---	20 [D]	PERCENT
					---	15 [E]	PERCENT
CUT-OFF PLATE CURRENT (E_{c1} = −7.5; R_K = 0	0	100	---	---	---	---	μAdc
INSULATION OF ELECTRODES [F]							
GRID #1 TO ALL	100	---	---	---	50	---	MEGOHMS
PLATE TO ALL	100	---	---	---	50	---	MEGOHMS
GRID #2 CURRENT	2.8	5.4	---	---	---	---	mA
GRID #1 EMISSION [G] (E_f = 7.5V; E_{c1} =−7.5V; [G] R_K = 0; R_{g1} = 1.0 MEG.)	0	−0.5	---	---	---	---	μAdc
Δ GRID #1 TRANSCONDUCTANCE (E_f = 5.7V.)	---	15	---	---	---	15	PERCENT
GRID #3 TRANSCONDUCTANCE (E_{c3} = −1.0V.)	500	1800	---	---	---	---	μMHOS

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TUNG-SOL

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SPECIAL REQUIREMENTS

	MINIMUM	MAXIMUM	
AF NOISE[H] (E_{sig} = 70mVac E_{c2} = 19V, R_p = 0.2 MEG.; R_{g1}= 9.1 MEG; R_{g2} = 1000 , C_k = 1000μf.	---	17	VU
LOW PRESSURE VOLTAGE BREAKDOWN[J] (PRESSURE = 55 +5mm Hg; VOLTAGE = 300VAC	---	---	
VARIABLE FREQUENCY VIBRATION[K] (F = 10CPS-4G TO F = 50CPS - 10G)	---	---	
LOW FREQUENCY VIBRATION[L] (F = 40 CPS; G = 15; R_p = 10K; C_K = 1,000μf)	---	60	mVac
SUBMINIATURE LEAD FATIGUE[M]	4	---	ARCS
SHOCK[N] (HAMMER ANGLE =30°; E_{hk} = +100V; R_{g1} =0.1MEG)	---	---	
VIBRATIONAL FATIGUE[P] (G = 2.5; FIXED FREQUENCY; F = 25 MIN-60 MAX.)	---	---	
POST SHOCK & VIBRATION FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	200	mVac
HEATER CATHODE LEAKAGE	---	±20	μA.
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
1 HOUR STABILITY LIFE TEST (E_{hk} = + 200V; R_{g1} = 1.0 MEG.)	---	---	
STABILITY LIFE TEST END POINTS Δ GRID #1 TRANSCONDUCTANCE OF INDIVIDUAL TUBES	---	15	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (STABILITY LIFE TEST CONDITION OR EQUIVALENT)	---	---	
SURVIVAL RATE LIFE TEST END POINTS (GRID #1 TRANSCONDUCTANCE	2350	---	μMHOS
HEATER CYCLING LIFE TEST (E_f = 7.0V; 1 MIN. ON - 4 MIN. OFF; E_{hk} = 140Vac; E_{c1} = E_{c2} = E_{c3} = E_b = 0)	2500		CYCLES

NOTES

[A] WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE.

[B] ALL VOLTAGES ARE REFERENCED TO THE NEGATIVE END OF THE CATHODE RESISTOR.

[C] ACROSS PLATE RESISTOR OF 10,000 OHMS, WITH APPLIED VIBRATIONAL ACCELERATION OF 15 G. AT NO CYCLES PER SECOND.

[D] SINGLE TUBE CHANGE IN TRANSCONDUCTANCE FROM INITIAL READING.

[E] AVERAGE CHANGE IN TRANSCONDUCTANCE.

[F] SEE MIL-E-1C 4.8.2

[G] PRIOR TO THIS TEST TUBES SHALL BE PREHEATED FOR A PERIOD OF 5 MINUTES UNDER CONDITIONS LISTED BELOW. TEST IMMEDIATELY AFTER PREHEATING. THREE MINUTE TEST IS NOT ALLOWED. GRID EMISSION SHALL BE THE LAST TEST ON THE SAMPLE SELECTED FOR THE GRID EMISSION TEST. E_f = 7.5 V, E_{c1} = 0 Vdc, E_{c2} = 100 Vdc, E_{c3} = 0 Vdc, E_b = 100 Vdc, R_k = 150 OHMS, R_{g1} = 1.0 MEG.

[H] SEE MIL-E-1C 4.10.3.2

[J] THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGES APPLIED.

[K] SEE MIL-E-1C 4.9.20.3 NO VOLTAGES -POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY.

[L] SEE MIL-E-1C 4.9.19.1

[M] SEE MIL-E-1C 4.9.5.3

[N] SEE MIL-E-1C 4.9.20.5

[P] SEE MIL-E-1C 4.9.20.6

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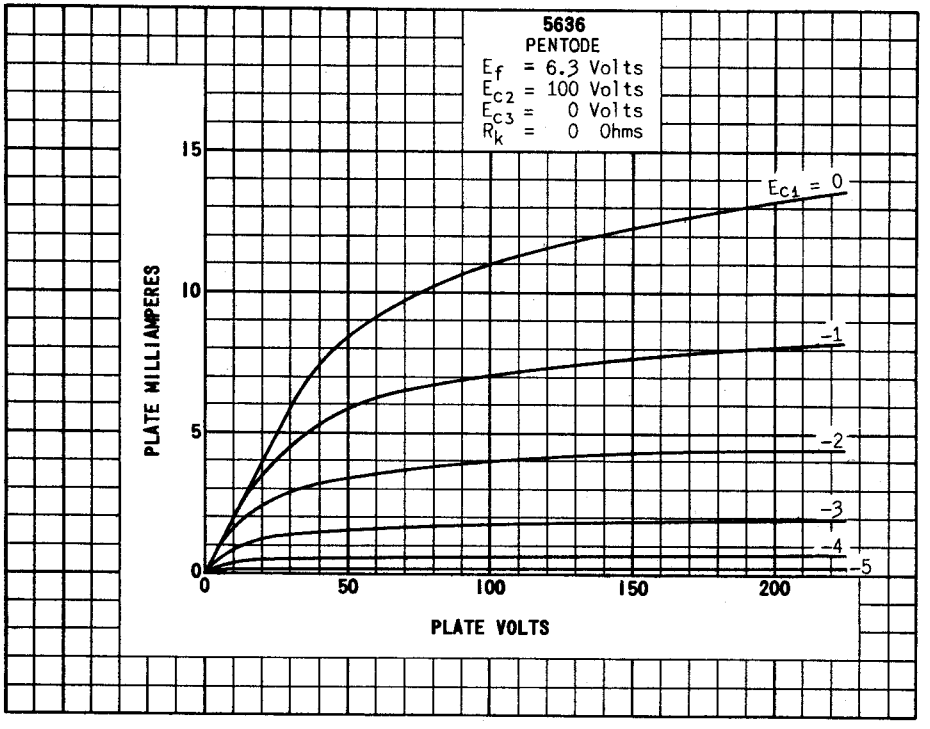
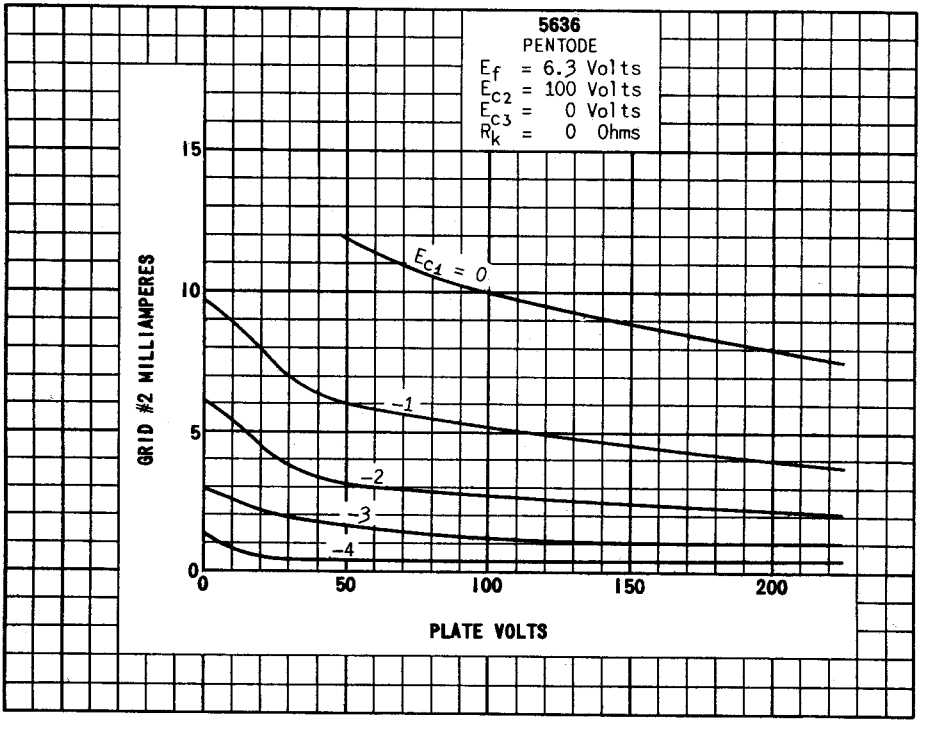
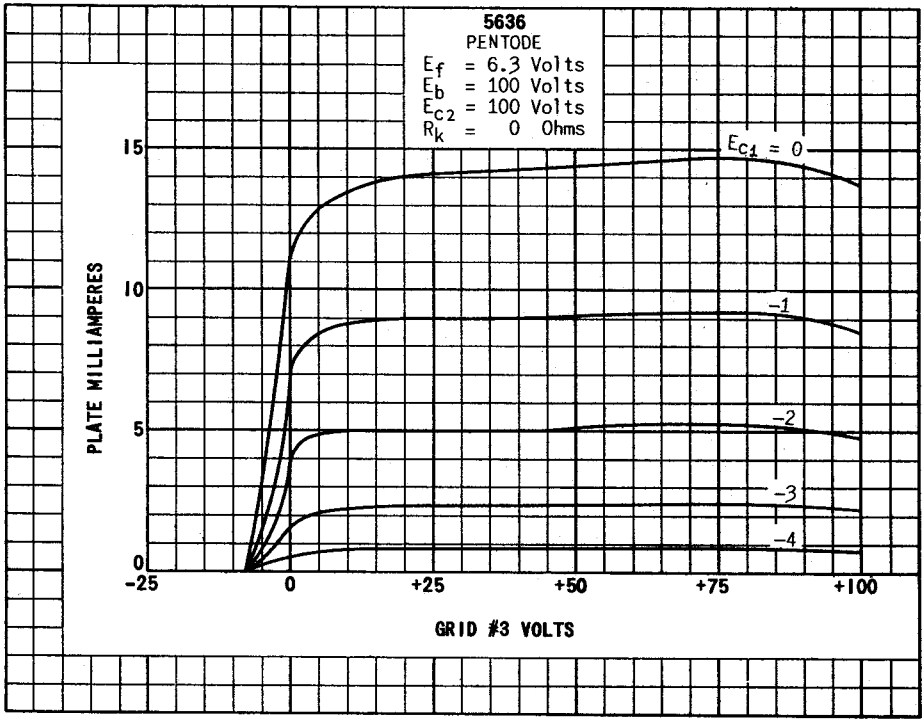
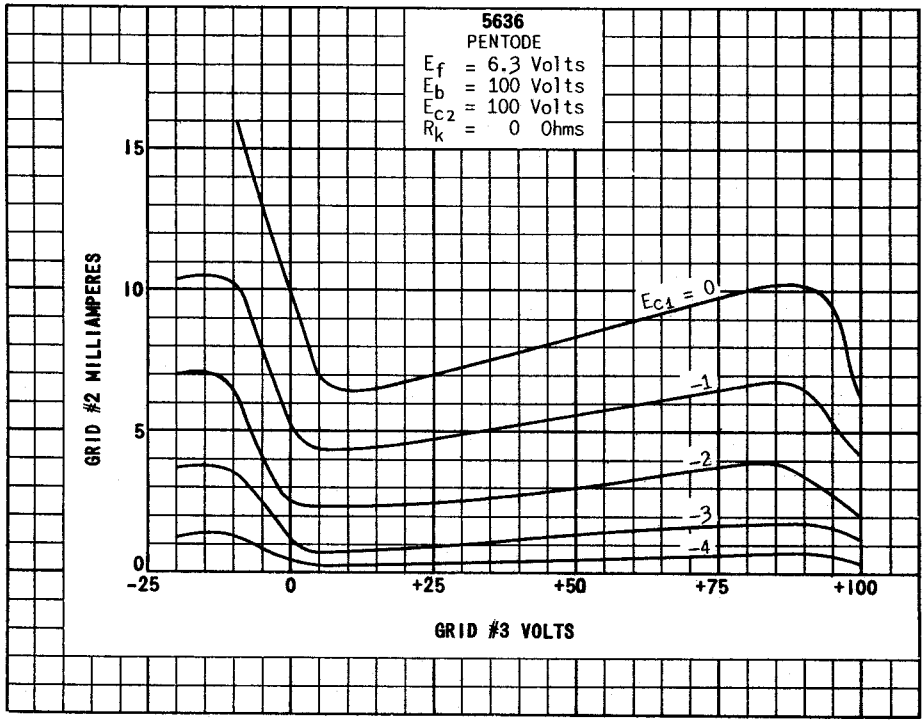
5636
PREMIUM TUBE









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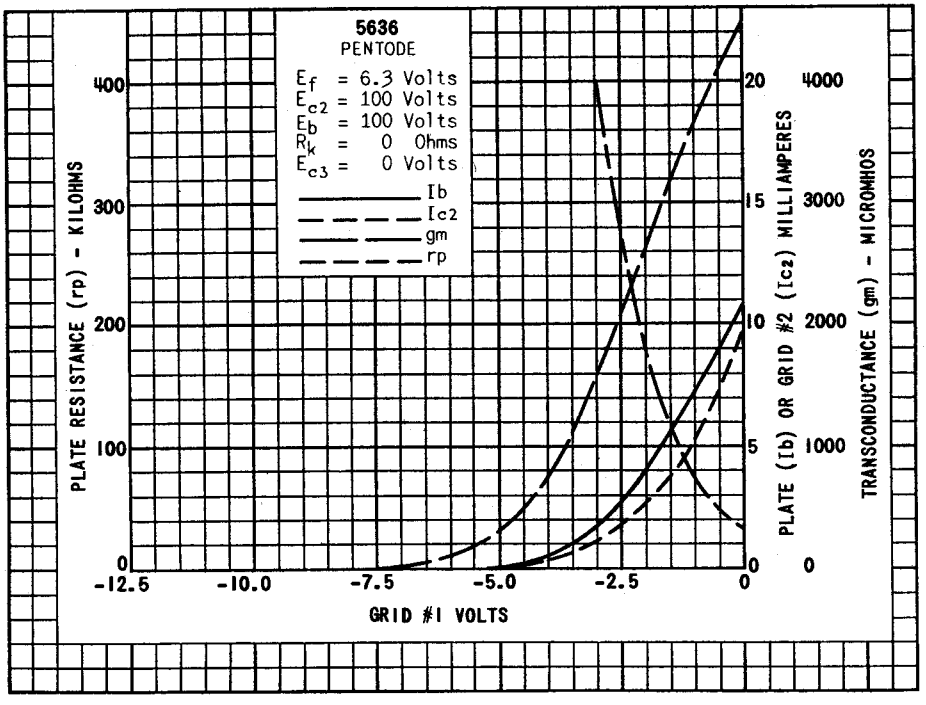
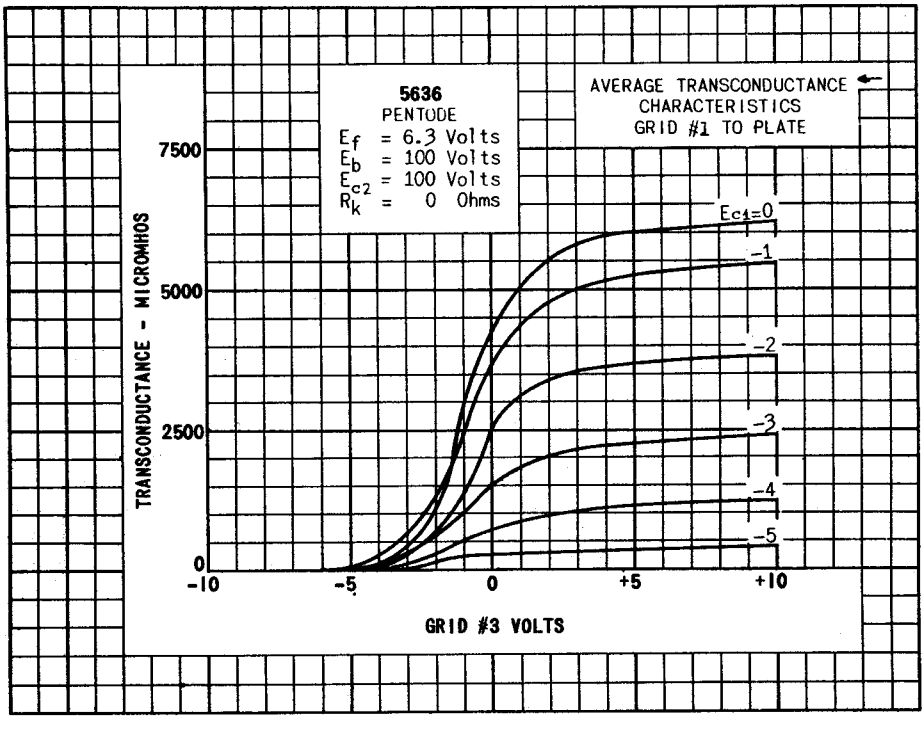
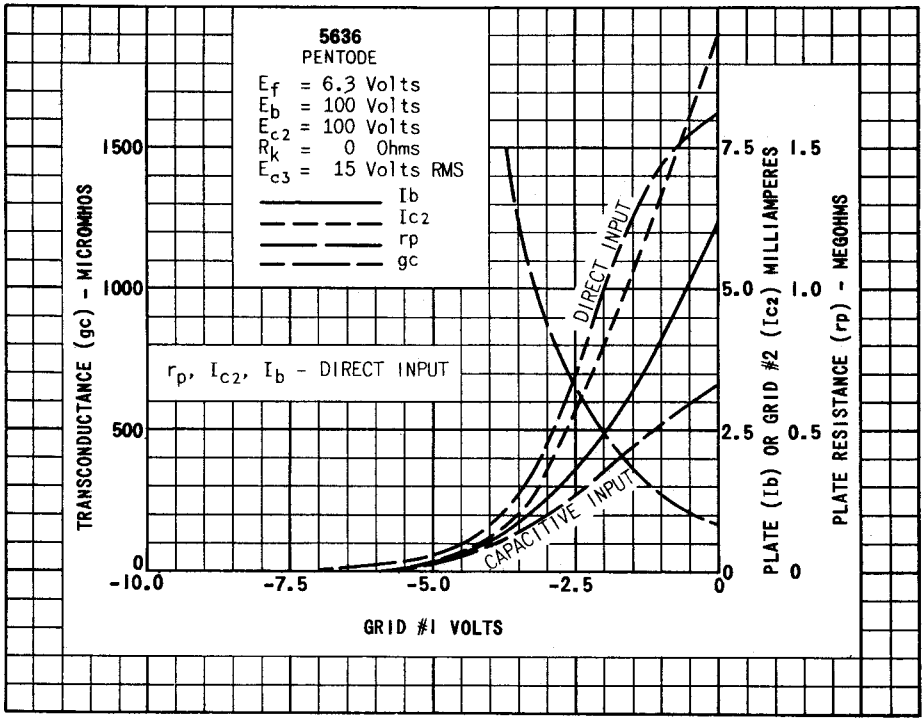
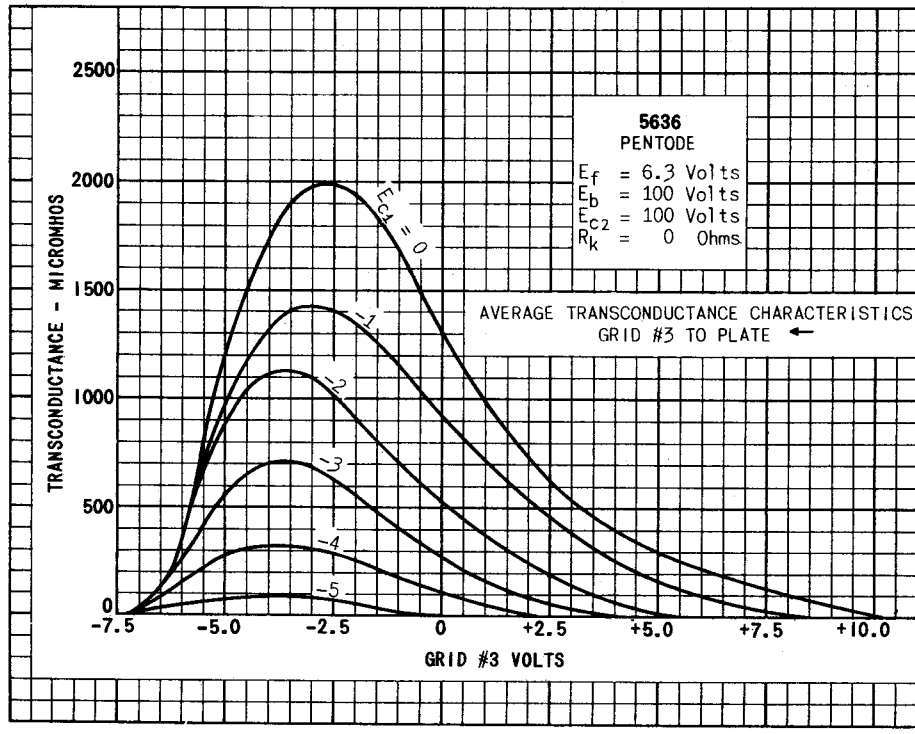
PREMIUM TUBE









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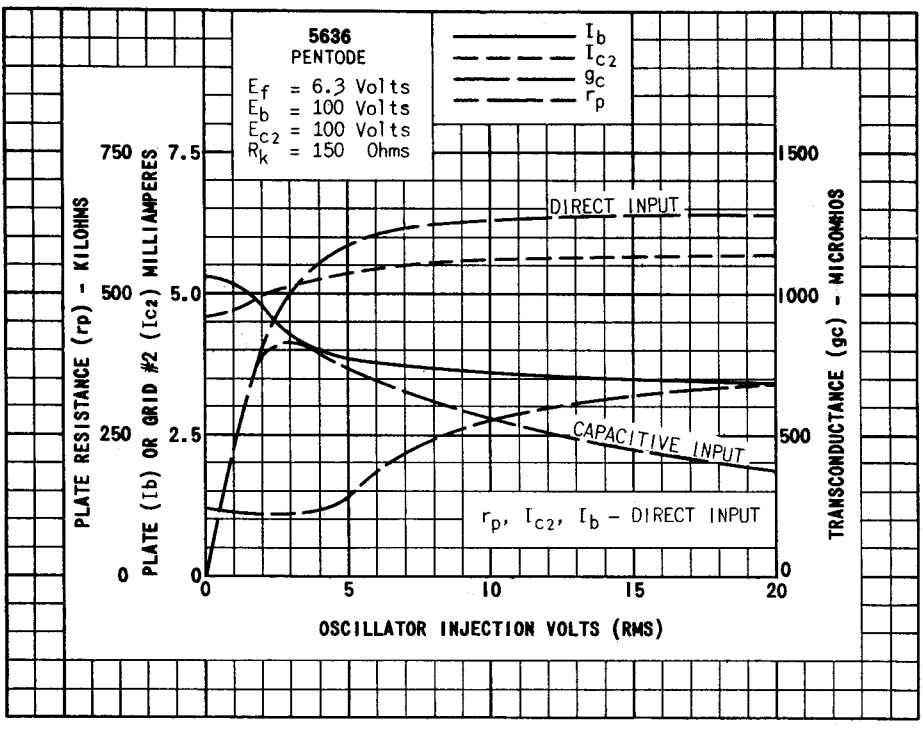
PREMIUM TUBE



→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

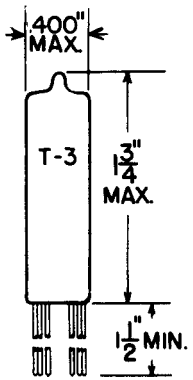
SUBMINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

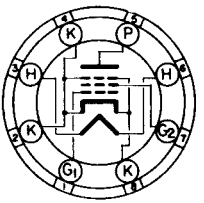
HEATER
6.3 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
8DL

THE 5639 IS A RUGGEDIZED PENTODE IN THE 8 LEAD BUTTON SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN BROAD BAND AMPLIFIER APPLICATIONS SUCH AS IN RADAR AND VIDEO AMPLIFIER SERVICE. CONTROLS ON THE PRODUCT AVERAGE FOR HEATER CURRENT ASSURE THAT THIS CHARACTERISTIC WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5639 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD[A]	
MAXIMUM GRID #1 TO PLATE (RATED)	0.18	0.13	μμf
INPUT: (RATED)	9.0	9.0	μμf
MAXIMUM	---	10.0	μμf
MINIMUM	---	8.0	μμf
OUTPUT: (RATED)	4.6	8.0	μμf
MAXIMUM	---	9.0	μμf
MINIMUM	---	7.0	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	165	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±200	VOLTS
MAXIMUM GRID #1 RESISTANCE	0.5	MEG
MAXIMUM DC CATHODE CURRENT	40	mA
MAXIMUM PLATE DISSIPATION	3.5	WATTS
MAXIMUM GRID #2 DISSIPATION	1.0	WATT
MAXIMUM BULB TEMPERATURE	+220	°C
MAXIMUM ALTITUDE	60 000	FEET
LIFE EXPECTANCY (30°C AMBIENT TEMPERATURE)	5 000	HOURS

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
DC PLATE VOLTAGE	150	VOLTS
DC GRID #2 VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	21	mA
GRID #2 CURRENT	4.0	mA
TRANSCONDUCTANCE	9 000	μMHOS
PLATE RESISTANCE	50 000	OHMS
GRID #1 VOLTAGE FOR 10μa PLATE CURRENT	-14	VOLTS
NOISE OUTPUT VOLTAGE (MAXIMUM) [B]	200	mV

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

R_k = 100 OHMS, E_f = 6.3V, E_b = 150Vdc, E_{c1} = 0Vdc, E_{c2} = 100Vdc, E_{hk} = 0V
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	420	480	432	468	414	492	mA
HEATER-CATHODE LEAKAGE (E_{hk} = ± 100Vdc)	---	15	---	---	---	60	μAdc
GRID #1 CURRENT (R_{g1}=1.0 MEG.)	0	-1.0	---	---	0	-2.0	μAdc
PLATE CURRENT (1)	14.0	28.0	---	---	---	---	mAdc
PLATE CURRENT (2) (E_{c1}=-14.0Vdc, R_k=0)	---	75	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	7500	10 500	---	---	μMHOS---	20[C]	PERCENT
ΔAVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES [E] R(g1-all)	100	---	---	---	50	---	MEGOHMS
R(p-all)	100	---	---	---	50	---	MEGOHMS
POWER OUTPUT [F] (E_{sig}=2.0Vac, R_p=9000)	0.75	---	---	---	---	---	WATT
SCREEN GRID CURRENT	2.0	6.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2) (E_f =5.7V)	---	10	---	---	---	15	PERCENT
GRID EMISSION [H] (E_f =7.5V, E_{c1}=14Vdc, R_{g1}=1.0 meg., R_k=0)	0	-2.0	---	---	---	---	μAdc
PLATE RESISTANCE	0.040	---	---	---	---	---	MEGOHM

SPECIAL REQUIREMENTS

	MIN.	MAX.	
CONTINUITY AND SHORTS [J]	---	---	
AF NOISE [K] (E_{sig} = 200mVac, E_{c2}=-100Vdc, E_{c1}=-2.5Vdc, R_{g1}=0.5 meg., R_{g2}=0.01 meg., R_p=2000, R_k=0, C_{g2}=4μf)	---	17	VU
LOW PRESSURE VOLTAGE BREAKDOWN (PRESSURE =55±5mm mercury, VOLTAGE =300Vac)	---	---	
VARIABLE FREQUENCY VIBRATION [M] (NO VOLTAGES: POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY)	---	---	
LOW FREQUENCY VIBRATION [NP] (R_p=2000, C_k=1000μf, G=15, F=40 cps)	---	100	mVac
SUBMINIATURE LEAD FATIGUE [Q]	4	---	ARCS
SHOCK [R] (HAMMER ANGLE=30°, E_{hk}= 100Vdc, R_{g1}=0.1 meg.)	---	---	
VIBRATIONAL FATIGUE [S] (G=2.5; FIXED FREQUENCY; F=25 min., 60 max.)	---	---	

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SPECIAL REQUIREMENTS — CONT'D.

	MIN.	MAX.	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	350	mVac
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	±40	μAdc
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
1 HOUR STABILITY LIFE TEST			
(E_{hk}= 200Vdc, R_{g1}=0.5 meg., TA=Room)	---	---	
STABILITY LIFE TEST END POINTS			
ΔTRANSCONDUCTANCE (1) INDIVIDUAL TUBES	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST			
STABILITY LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
SURVIVAL RATE LIFE TEST END POINTS			
CONTINUITY AND SHORTS	---	---	
TRANSCONDUCTANCE (1)	6750	---	μMHOS
HEATER CYCLING LIFE TEST			
(E_f=7.0V, 1 min. on, 4 min. off, E_{hk}=140Vac, E_{c1}=E_{c2}=E_b=0)	---	---	
INTERMITTENT LIFE TEST			
STABILITY LIFE TEST CONDITIONS			
(T-BULB=+220°C min.)	---	---	

NOTES

A WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE.

B ACROSS A PLATE RESISTOR OF 2,000 OHMS WITH APPLIED VIBRATIONAL ACCELERATION OF 15g AT 40 CYCLES PER SECOND.

C CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES.

E SEE MIL-E-1C 4.8.2

F SEE MIL-E-1C 4.10.16.1

G TRANSCONDUCTANCE (2) IS THE PERCENT CHANGE IN TRANSCONDUCTANCE (1) OF AN INDIVIDUAL TUBE TYPE RESULTING FROM THE CHANGE IN Ef.

H PRIOR TO THIS TEST TUBES SHALL BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED. TEST WITHIN 3 SECONDS AFTER PREHEATING. THREE MINUTE TEST IS NOT PERMITTED. GRID EMISSION SHALL BE THE LAST TEST PERFORMED ON THE SAMPLE SELECTED FOR THE GRID EMISSION TEST. CONDITIONS FOR TEST ARE AS FOLLOWS: Ef=7.5V, Ec1=0Vdc, Ec2=100Vdc, Ec3=0Vdc, Eb=150Vdc, Rk=100 OHMS, Rg1=0.5 MEG.

J SEE MIL-E-1C 4.7.5

K SEE MIL-E-1C 4.10.3.2

L THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGE APPLIED.

M SEE MIL-E-1C 4.9.20.3

N SEE MIL-E-1C 4.9.19.1

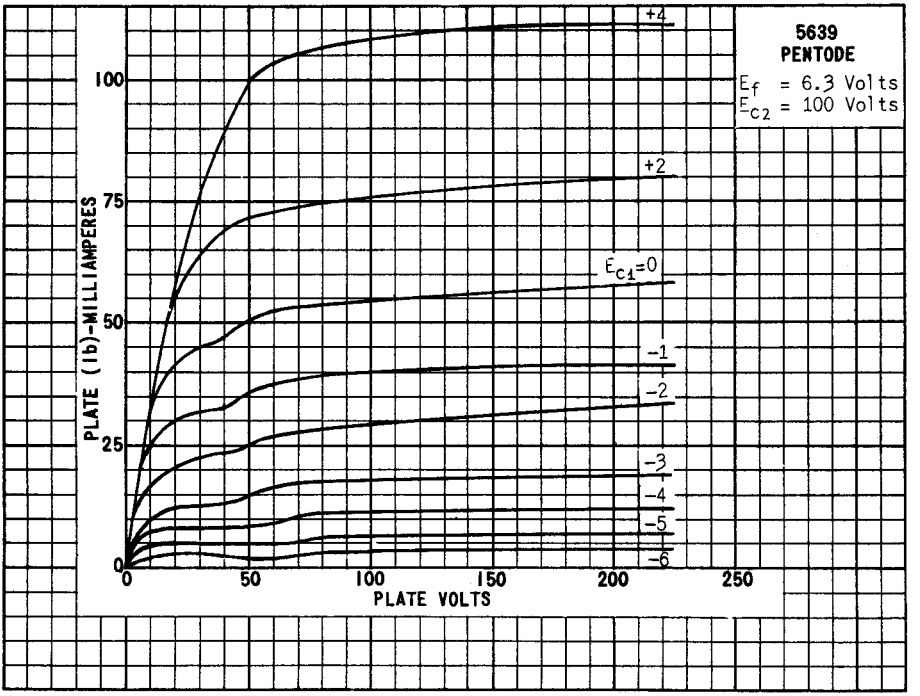
P FOR VIBRATION TESTS, THE IMPEDANCE OF THE PLATE VOLTAGE SUPPLY (AND SCREEN VOLTAGE SUPPLY IF ONE IS INDICATED) SHALL NOT EXCEED THAT OF A 40μf CAPACITOR AT 10 CPS.

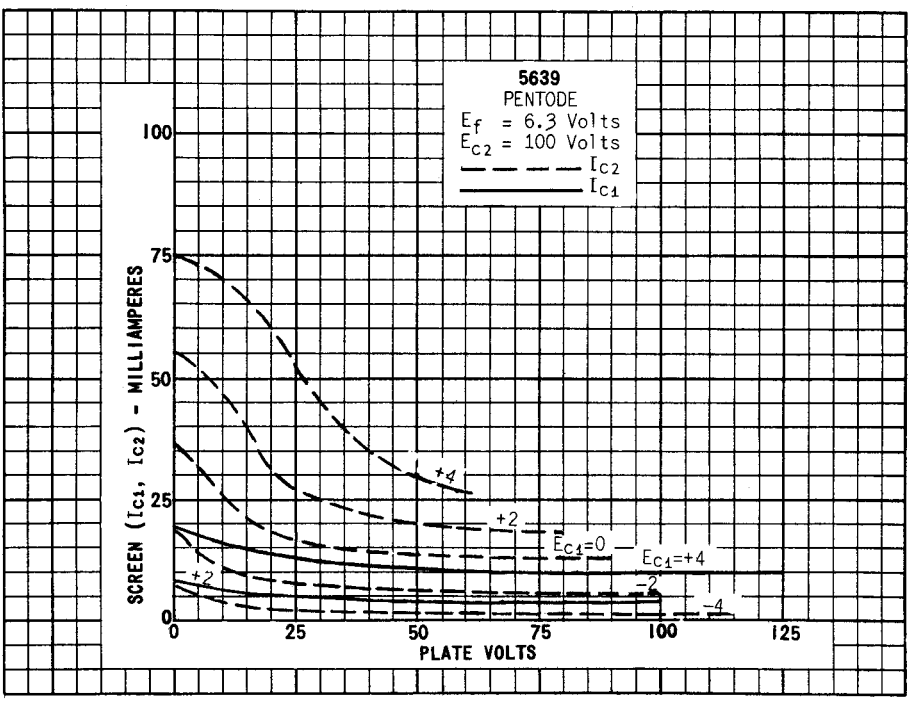
Q SEE MIL-E-1C 4.9.5.3

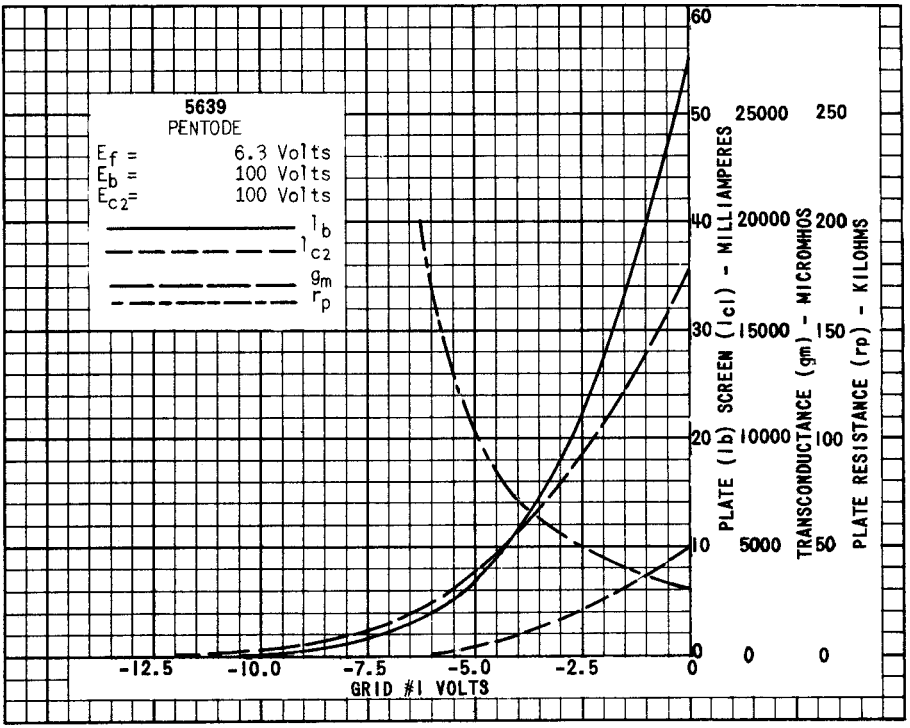
R SEE MIL-E-1C 4.9.20.5

S SEE MIL-E-1C 4.9.20.6

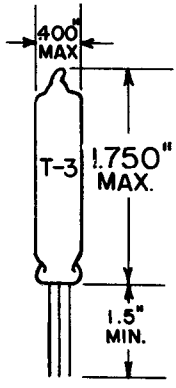
5639
PREMIUM TUBE






5639
PENTODE
Ef = 6.3 Volts
Eb = 100 Volts
Ec2= 100 Volts
Ib
Ic2
gm
rp
60
50
40
30
20
10
0
25000
20000
15000
10000
5000
0
250
200
150
100
50
0
PLATE (Ib) SCREEN (Ic1) - MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS
PLATE RESISTANCE (rp) - KILOHMS
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL

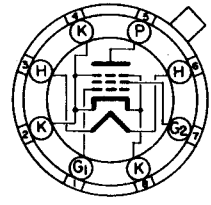


GLASS BULB

PENTODE
SUBMINIATURE TYPE

HEATER

AC OR DC



BOTTOM VIEW
SUBMINIATURE BUTTON
8 PIN BASE
0.017" TINNED FLEXIBLE LEADS
8DL

THE 5639WA IS A HEATER-CATHODE TYPE VIDEO AMPLIFIER PENTODE OF SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR WIDE BAND, RF OR VIDEO POWER AMPLIFIER SERVICE IN EQUIPMENT WITH LOW PLATE SUPPLY VOLTAGES. IT IS SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS
MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST - NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HOUR FATIGE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS
AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS (NOTE 7)	NORM. OPERATION (NOTE 6)	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	V
PLATE VOLTAGE	Eb:	---	150	150	250	Vdc
PEAK PLATE VOLTAGE	eb:	---	---	---	360	v
GRID #1 VOLTAGE	Ec1:	-55	0	0	0	Vdc
GRID #2 VOLTAGE	Ec2:	---	100	100	155	Vdc
PLATE DISSIPATION	Pp:	---	---	3.15	3.5	W
GRID #2 DISSIPATION	Pg2:	---	---	0.4	1.0	W
GRID #1 CIRCUIT RESISTANCE	Rg1:	---	---	---	0.5	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	---	+200	Vdc
CATHODE CURRENT	Ik:	---	---	---	40	mAdc
CATHODE RESISTANCE	Rk:	---	100	100	---	OHMS
PLATE CURRENT (1)	Ib(1):	---	---	21.0	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	4.0	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	9000	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.05	---	MEG.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1			COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES						
HEATER CURRENT:	0.4	If:	427	---	---	---	473	---	mA
HEATER-CATHODE LEAKAGE:									
Ehk=+100 Vdc	0.4	Ihk:	---	---	---	---	10	---	μAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	10	---	μAdc
GRID CURRENT:									
Rg=1.0 MEG.	0.4	Ic(1):	---	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.4	Ib(1):	14.0	---	21.0	---	28.0	---	mAdc
PLATE CURRENT (2):									
Ec1 =-14.0 Vdc	0.4	Ib(2):	---	---	---	---	50	---	μAdc
TRANSCONDUCTANCE (1):	0.4	Sm(1):	7500	---	9000	---	10500	---	μMHOS
CONTINUITY AND SHORTS (NOTE 11)									
INOPERATIVES:	0.4	---	---	---	---	---	---	---	---
MECHANICAL:									
ENVELOPE (8-4)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V									
Eg1-all=-100 Vdc	2.5	Rg1-all:	250	---	---	---	---	---	MEG.
Ep-all =-300 Vdc		Rp-all:	250	---	---	---	---	---	MEG.
POWER OUTPUT:									
Esig=2.0 Vac; Rp= 9000 OHMS	2.5	Po:	0.75	---	---	---	---	---	W
SCREEN CURRENT	2.5	Ic2:	2.0	---	4.0	---	6.0	---	mAdc
TRANSCONDUCTANCE (2):									
Ef=5.7 V (NOTE 9)	2.5	Δ_{Ef}Sm(2):	---	---	---	---	10	---	PERCENT
GRID EMISSION:									
Eb=250 Vdc; Rg=1.0 MEG: Rk=390 OHMS: Ec2=150 Vdc; Ef=7.5 V; PREHEAT 5MIN. AT Ec1= =0; TEST AT Ec1=-20 Vdc	6.5	Ic(2):	---	---	---	---	-2.0	---	μAdc
AF NOISE:									
Esig= 200mVac; Ecc2= 100 Vdc; Ec1=-2.5 Vdc; Rg1=0.5 MEG.; Rg2=0.01 MEG.; Rp=2000 OHMS; Rk= 0; Cg2=4μf	2.5	EB:	---	---	---	---	17	---	VU
PLATE RESISTANCE:	6.5	rp:	0.040	---	---	---	---	---	MEG.
CAPACITANCE:		Cgp:	---	---	---	---	0.13	---	μμf
CAPACITANCE (NOTE 2)	6.5	Cin:	8.0	---	9.0	---	10.0	---	μμf
CAPACITANCE:		Cout:	7.0	---	8.0	---	9.0	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE=21±3mmHg: VOLTAGE =300 Vac	6.5	---	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 (CONT'D.)			COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES						
VIBRATION (2): F=40 Cps; G=15; Rp= 2000 OHMS	2.5	Ep:	---	---	---	---	40	---	mVac
VIBRATION (3): F=70-2000 cps; G=15; T= 3 MIN. Rp=2000 OHMS POSITIONS X1 AND X2 ONLY	6.5	ep:	---	---	---	---	250 PEAK TO PEAK	---	mv
OPERATION TIME: (NOTE 11)	4.0	t:	---	---	---	---	20	---	sec.
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1); Ehk=+ 100 Vdc; Rg= 0.1 MEG: HAMMER ANGLE = 30° (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE (1): 96 HOURS; G=2.5: FIXED FREQUENCY: F =25 MIN., 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
SHOCK (2): Ehk=+100 Vdc; Rg= 0.1 MEG.; HAMMER ANGLE= 120°+ RUBBER PAD:G = 75: t=10 MILLISECONDS (NOTE 13)	20	---	---	---	---	---	---	---	---
FATIGUE (2): 6 HOURS: G=10: F=130 - 2000-130 cps; (NOTE 12)	6.5	---	---	---	---	---	---	---	---
POST SHOCK (1) & (2) AND FATIGUE (1) & (2) TEST END POINTS: F=40 Cps; G=15; Rp= 2000 OHMS VIBRATION (2):	---	Ep:	---	---	---	---	80	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=+100 Vdc	---	ihk:	---	---	---	---	20		μAdc
Ehk=-100 Vdc	---	ihk:	---	---	---	---	20	---	μAdc
CHANGE IN TRANSC. (1) OF INDIVIDUAL TUBES Ef=6.3 V	---	Δ_tSm(1):	---	---	---	---	15	---	PERCENT
GRID CURRENT (1):	---	Ic1	---	---	---	---	-3.0	---	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.4	---	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST ACCEPTANCE LIFE TESTS	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	ALLOWABLE DEF. PER CHARACTER. COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
HEATER CYCLING LIFE TEST: Ef=7.0 V; Eb=Ec1=Ec2= 0 V; 1 MIN. ON 4 MIN. OFF: Ehk=140 Vac	---	---	1.0	-----	2000	---	CYCLE
HEATER CYCLING LIFE TEST END POINTS: HEATER CATHODE LEAKAGE:							
Ehk=+100 Vdc	---	---	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc	---	---	---	Ihk:	---	20	μAdc
2 & 20 HOUR STABILITY LIFE TEST: Eb=250 Vdc ; Ec2= 150 Vdc; Rk = 390 OHMS: TA = ROOM: Rg= 0.47 MEG. Ehk=+200 Vdc	---	---	---	-----	---	---	---
2 & 20 HOUR STABILITY LIFE TEST END POINTS	---	---	---	-----	---	---	---
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLE SIZE = 50 TUBES)	---	---	1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE Eb =250 Vdc: Ec2 =150 Vdc: Rk =390 OHMS: TA = ROOM: Ehk =+200 Vdc; Rg = 0.47 MEG.	---	---	---	-----	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST: (TYPICAL SAMPLE SIZE = 200 TUBES)	---	---	---	-----	---	---	---
INOPERATIVES:	---	---	0.65	-----	---	---	---
TRANSCONDUCTANCE (1):	---	---	1.0	Sm(1):	6750	---	μMHOS
200 HOUR INTERMITTENT LIFE TEST (1): Eb =250 Vdc; Ec2 =150 Vdc: Rk =390 OHMS: TA = ROOM: Ehk =+200 Vdc: Rg=0.47 MEG.	---	---	---	-----	---	---	---
200 HOUR INTERMITTENT LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE = 10 TUBES 1st SAMPLES, 40 TUBES 2nd SAMPLE)	---	---	---	-----	---	---	---
INOPERATIVES:							
GRID CURRENT (1):	1	3	---	Ic(1):	0	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	414	492	mA
CHANGE IN TRANSC. (1) OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2) (NOTE 9)	1	3	---	Δ_{Ef}Sm (2):	---	20	PERCENT

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	ALLOWABLE DEF. PER CHARACTER. COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc
ELECTRODE INSULATION:							
g1-all	1	3	---	Rg1-all:	50	---	MEG.
p-all			---	Rp-all:	50	---	MEG.
TOTAL DEFECTIVES:	3	6	---	----	---	---	---
INTERMITTENT HIGH TEMPERATURE LIFE TEST (2): T BULB = 220° C; Ehk=+200 Vdc; Rg= 0.5 MEG.	---	---	---	----	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)	---	---	---	----	---	---	---
INOPERATIVES:	1	3	---	----	---	---	---
GRID CURRENT:	1	3	---	Ic1:	---	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	414	492	mA
CHANGE IN TRANSC. (1) OF INDIVIDUAL TUBES	1	3	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef} Sm(2)$:	---	15	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc
INSULATION OF ELECTRODES:							
g1-all	1	3	---	Rg1-all:	50	---	MEG.
p-all			---	Rp-all:	50	---	MEG.
TRANSC. (1) AVG. CHANGE:	---	---	---	Avg. Δ_t	---	15	PERCENT
TOTAL DEFECTIVES:	3	6	---	----	---	---	---
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	----	---	---	---
INOPERATIVES:	1	3	---	----	---	---	---
GRID CURRENT (1):	1	3	---	Ic1:	---	-2.0	μAdc
HEATER CURRENT:	1	3	---	If:	414	496	mA
TRANSC. (1) CHANGE OF INDIVIDUAL TUBES	1	3	---	$\Delta_t Sm$:	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef} Sm(2)$:	---	20	PERCENT
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	1	3	---	Ihk:	---	20	μAdc
Ehk=-100 Vdc			---	Ihk:	---	20	μAdc

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	ALLOWABLE DEF. PER CHARACTER. COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
ELECTRODE INSULATION:							
g1-all:	2	5	---	Rg1-all:	25	---	MEG.
p-all	4		---	Rp-all:	25	---	MEG.
TOTAL DEFECTIVES:	4	8	---	---	---	---	---

NOTES

NOTES:

1. CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES," AND MIL-STD-105A.

2. WITH A CYLINDRICAL SHIELD (0.405" I.D. 17/8" LONG) CONNECTED TO CATHODE LEAD.

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4. CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

5. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

6. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

7. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

8. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

9. CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef= 6.3V TO THAT VALUE MEASURED AT Ef=5.7V.

10. OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN ±15% OF THE THREE (3) MINUTE PLATE CURRENT (1) VALUE MEASURED AT PLATE CURRENT (1) TEST CONDITIONS. NO PREHEATING BEFORE THIS TEST IS ALLOWED. A COLD TUBE MUST BE USED.

11. DURING BOTH CONTINUITY AND SHORT TESTING, THE TUBE UNDER TEST SHALL BE TAPPED AT LEAST THREE TIMES IN EACH OF TWO PLANES 90° APART WITH A TAPPER WHICH SHALL BE ADJUSTED TO GIVE AN IMPULSE OF APPROXIMATELY ONE HALF SINE WAVE OF 300±50 MICRO SECONDS DURATION AND HAVING A MINIMUM AVERAGE AMPLITUDE OF 80 G's PEAK ACCELERATION AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DEVICE CAPABLE OF DETECTING AS SHORTS, THE FOLLOWING INTERELEMENT RESISTANCES OF THE GIVEN TIME DURATION.

DURATION	SENSITIVITY
PERMANENT SHORT	600,000 OHMS
500 μSEC.	500,000 OHMS
100 μSEC.	100,000 OHMS
60 μSEC.	1,000 OHMS

TUBES WHICH GIVE AN INDICATION OF ONE OR MORE OF THE FOLLOWING SHALL BE REJECTED AS INOPERABLE:

A. EITHER A PERMANENT OR TAP SHORT AT ANY TIME DURING THE TAPPING PROCEDURE.
B. ANY OPEN CIRCUIT.
C. ANY LEAKS.

12. THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2, AND Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

A. TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3.
B. TUBES WHICH DO NOT COMPLY WITH PAST FATIGUE LIMITS, THIS IS A DESTRUCTIVE TEST.

13. THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).

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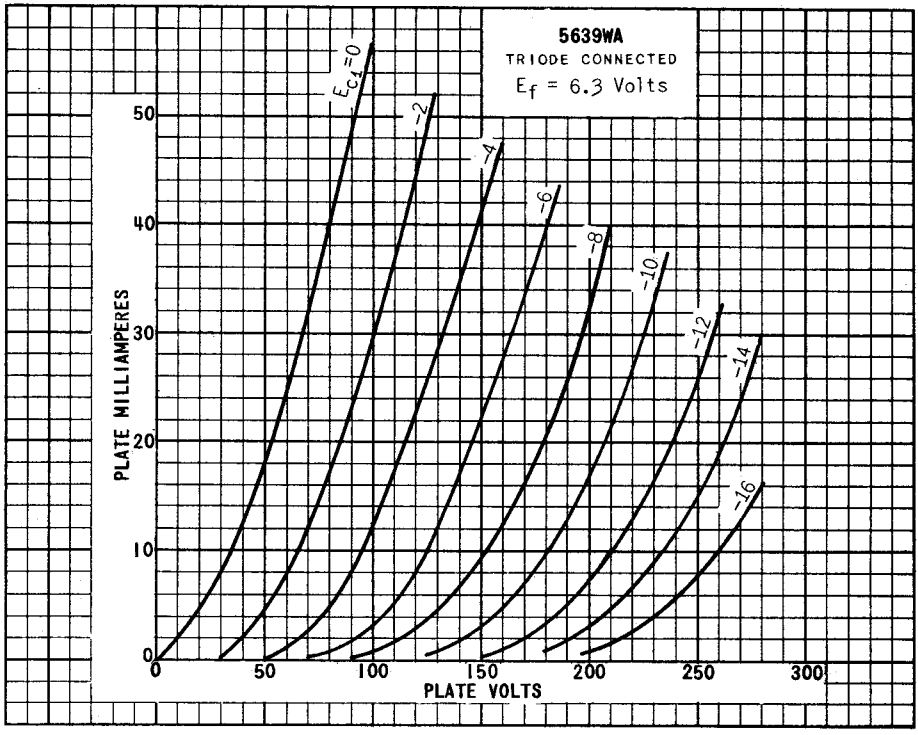

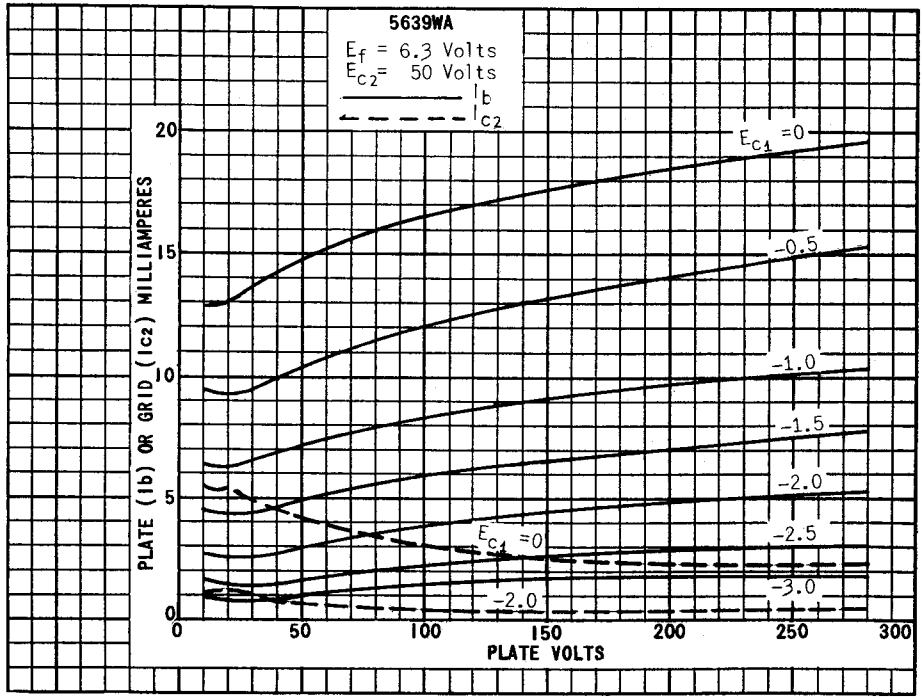

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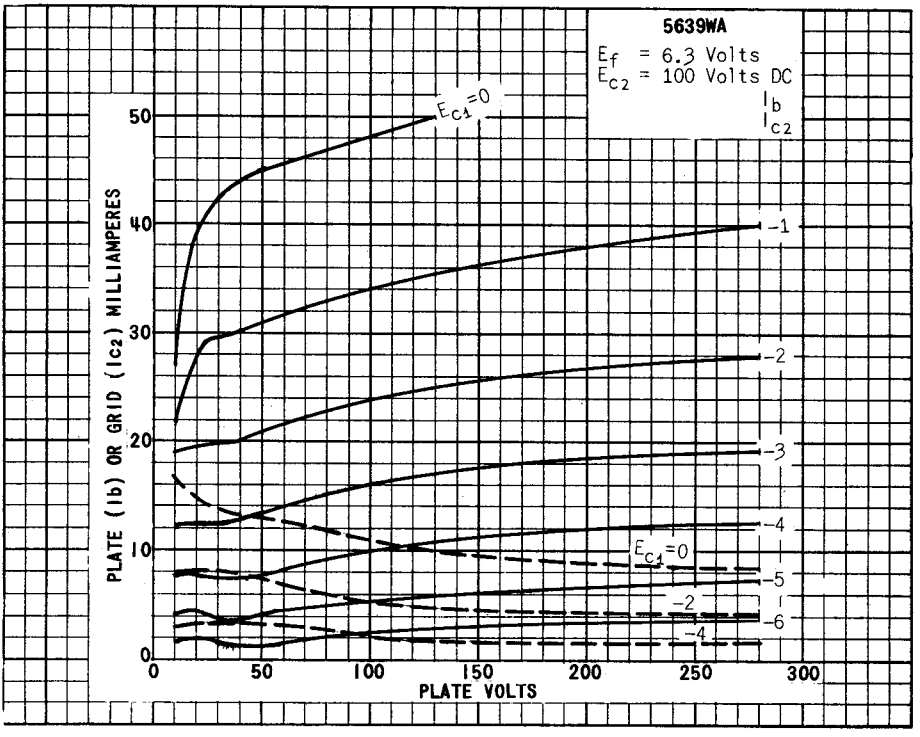
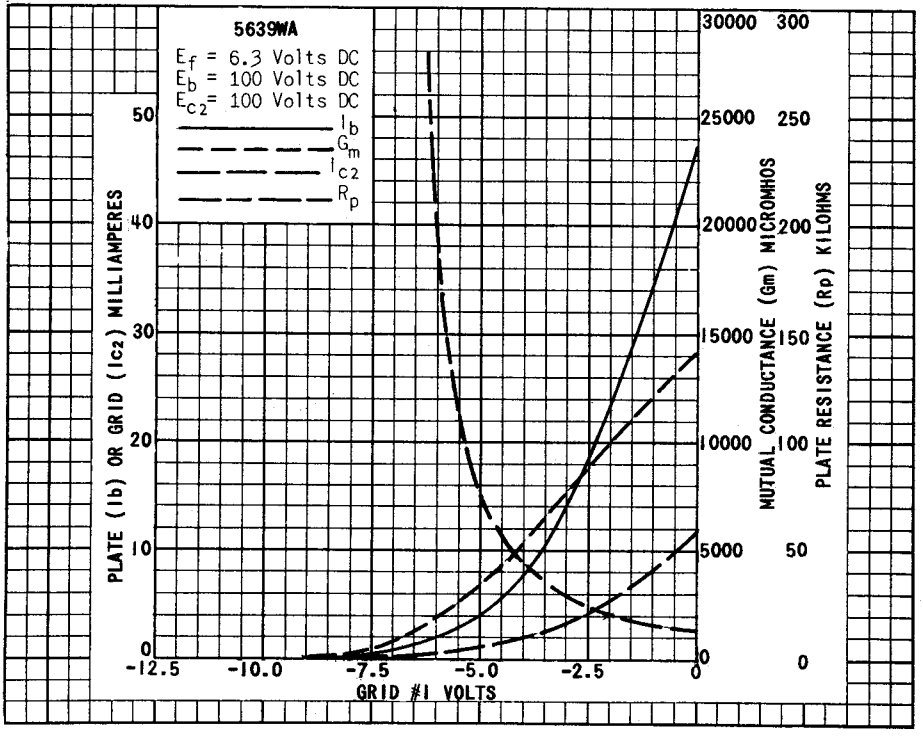
TENTATIVE DATA

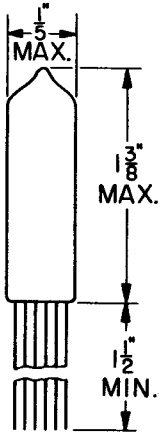




TUNG-SOL

SHIELD GRID THYRATRON

SUBMINIATURE TYPE



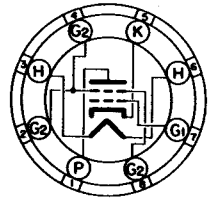
GLASS BULB

HEATER

6.3±5% VOLTS 0.150 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
.017" TINNED

SUBMINIATURE TYPE 5643 IS A XENON FILLED, FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTICS. IT IS SIMILAR IN CHARACTERISTICS TO THE MINIATURE TYPE 5696. THE 5643 IS SUITABLE FOR USE AS A SWITCHING TUBE, COUNTER, OR GRID CONTROLLED RECTIFIER. BECAUSE OF ITS SHIELD GRID CONSTRUCTION, THE INPUT WILL WORK DIRECTLY FROM A HIGH IMPEDANCE SOURCE SUCH AS A VACUUM PHOTOTUBE OR A CADMIUM SULPHIDE PHOTO CELL. THE EFFECTIVE DIODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING LEADS 2, 4 AND 8 TO LEAD 5, AND CONNECTING THE GRID RESISTOR DIRECTLY TO THE SOCKET TERMINALS.

THIS TUBE IS PARTICULARLY SUITED FOR USE IN COMPACT AND PORTABLE EQUIPMENT, BECAUSE OF ITS SMALL SIZE AND LIGHT WEIGHT.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	0.150	AMP.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.084	μμf
CONTROL GRID TO CATHODE (& SHIELD GRID) CAPACITANCE	1.33	μμf
ANODE TO CATHODE (& SHIELD GRID) CAPACITANCE	1.27	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE)		
WITH GRID VOLTS =-100, GRID RES.=1000 Ω ANODE VOLTS=500, ANODE CUR. =.016 AMPS	15	μSECONDS
WITH GRID VOLTS=- 10, GRID RES. =1000Ω, ANODE VOLTS =500, ANODE CUR.=.016 AMPS.	25	μSECONDS
ANODE VOLTAGE DROP, APPROX.	12.5	VOLTS
CRITICAL GRID CURRENT (AT E_{bb}=350V. RMS)	0.5	μAMPS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

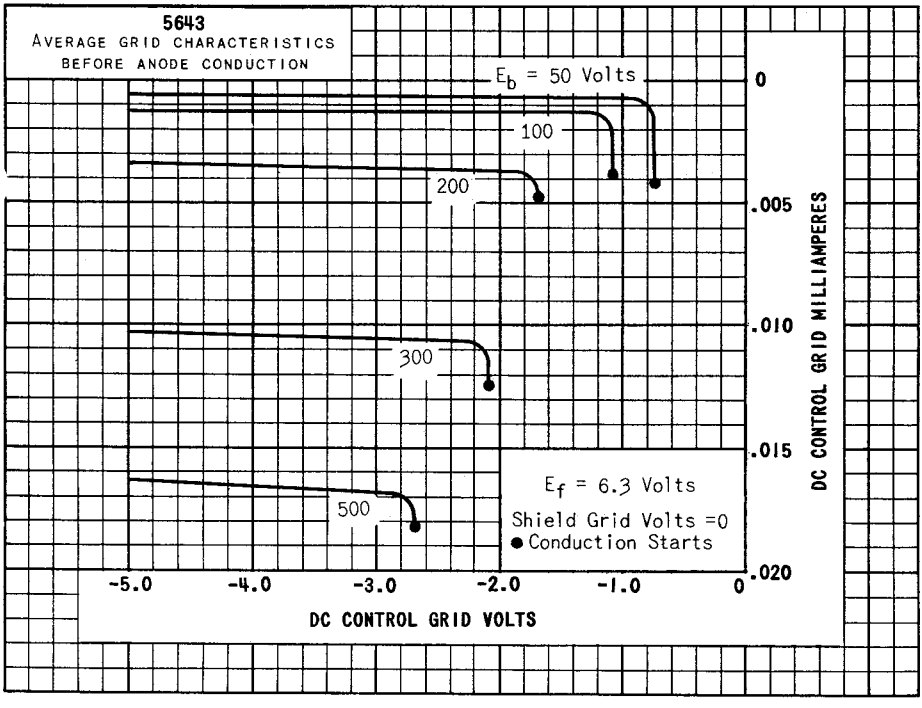
MECHANICAL DATA

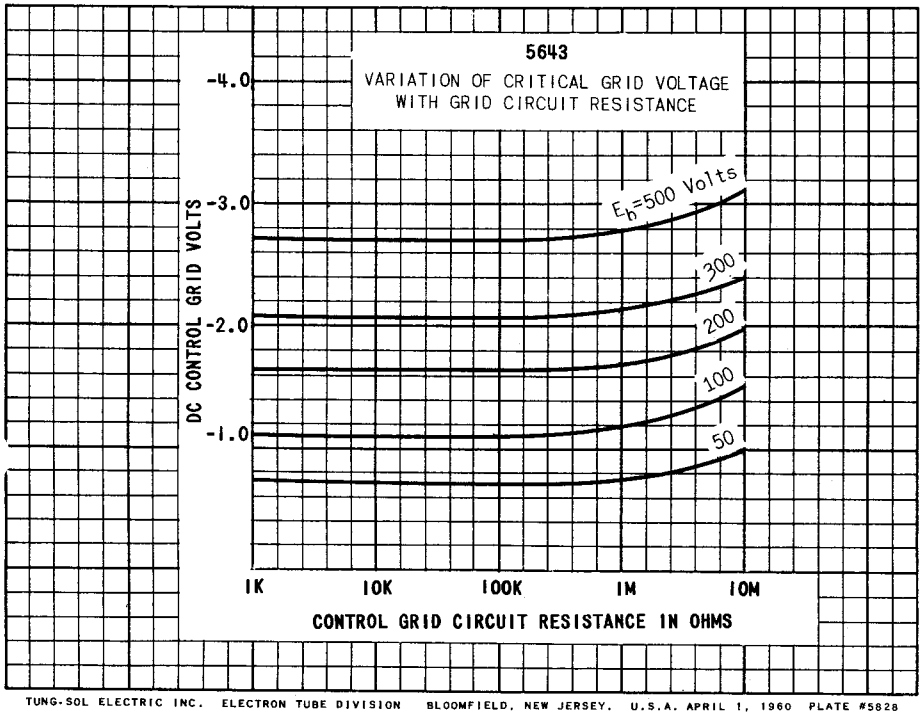
MAXIMUM SHOCK RATING	450	G
MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	SEE OUTLINE	
MAXIMUM SEATED LENGTH	1 3/8	INCHES
MAXIMUM DIAMETER	.40	INCHES
BULB	T-3	
BASE	SUBMINIATURE BUTTON 8 PIN LONG LEADS	
WEIGHT (APPROX.)	0.12	OUNCES

RATINGS

ABSOLUTE VALUES

MAXIMUM PEAK ANODE VOLTAGE		
INVERSE	500	VOLTS
FORWARD	500	VOLTS
MAXIMUM CATHODE CURRENT		
PEAK	100	MA.
AVERAGE	16	MA.
SURGE (MAX. DURATION 0.1 SECOND)	1.0	AMP.
MAXIMUM AVERAGE TIME	15	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE		
BEFORE CONDUCTION	-200	VOLTS
DURING CONDUCTION	-10	VOLTS
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE		
BEFORE CONDUCTION	-100	VOLTS
DURING CONDUCTION	-10	VOLTS
(THIS SHIELD GRID SHOULD NOT BE USED FOR CONTROL PURPOSES).		
MAXIMUM HEATER CATHODE VOLTAGE		
HEATER NEGATIVE	-100	VOLTS
HEATER POSITIVE	25	VOLTS
AMBIENT TEMPERATURE LIMITS	-55 TO +90	°C
MAXIMUM CONTROL GRID (G1) CIRCUIT RESISTANCE	10	MEGOHMS
ALTITUDE FOR FULL RATINGS	60 000	FEET

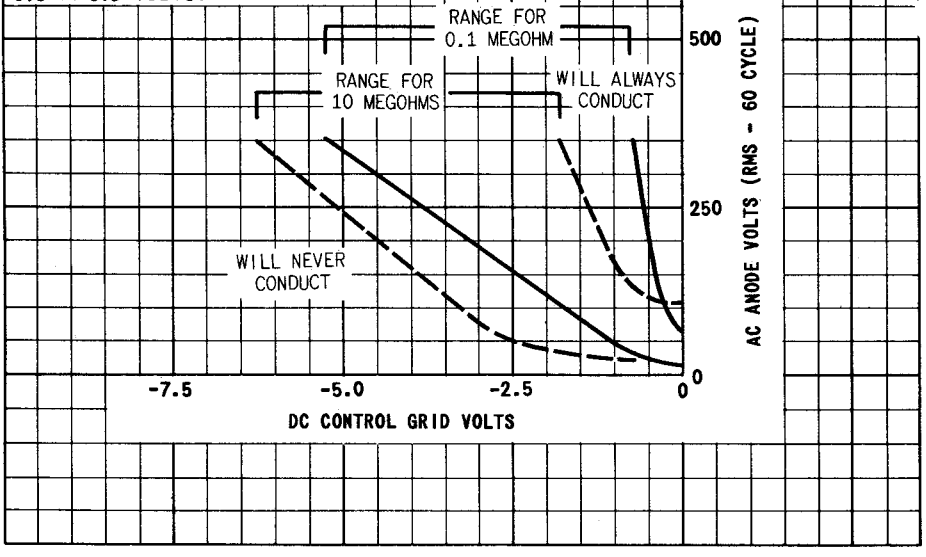




TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY. U.S.A. APRIL 1, 1960 PLATE #5828

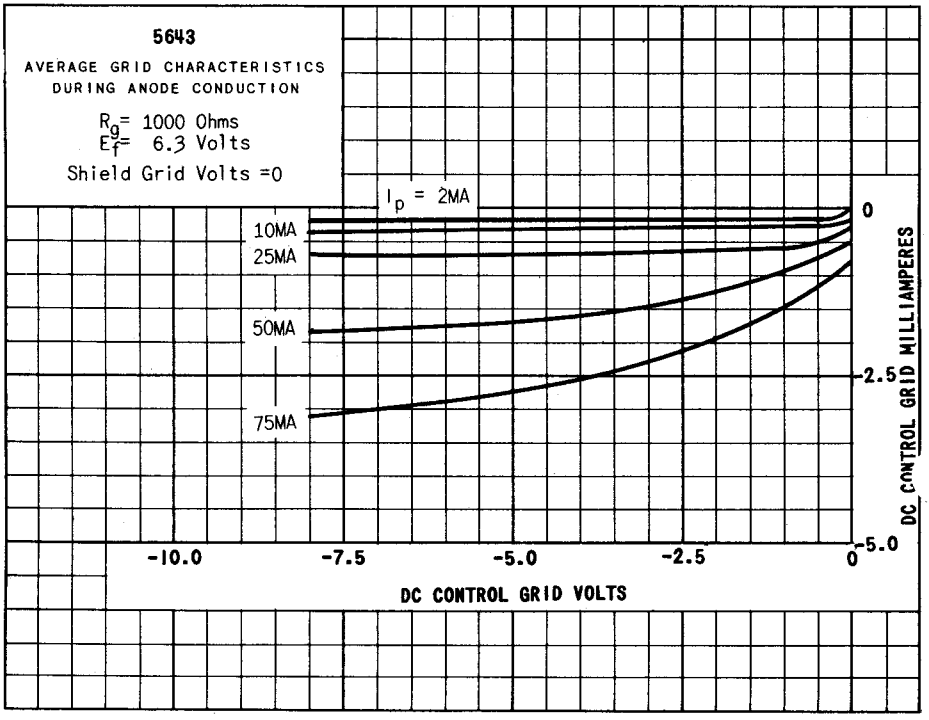
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR, 0.1 MEGOHM AND 10 MEGOHM, AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE FOR A HEATER VOLTAGE RANGE OF 6.0 TO 6.6 VOLTS.

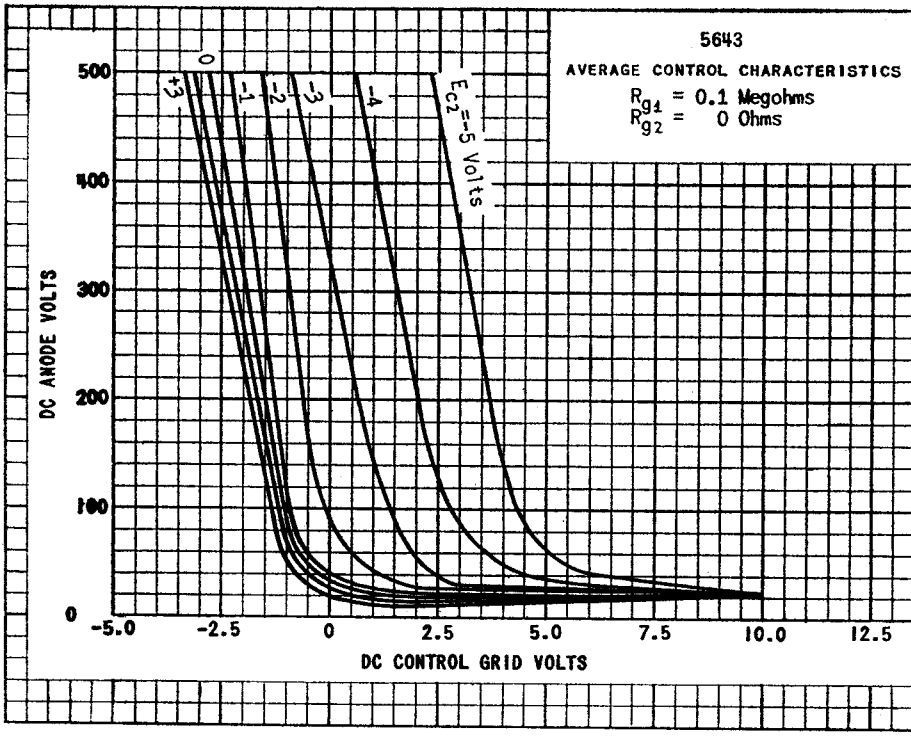
5643
OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



5643
AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION

R_g = 1000 Ohms
E_f = 6.3 Volts
Shield Grid Volts = 0




5643
AVERAGE CONTROL CHARACTERISTICS
R_{g1} = 0.1 Megohms
R_{g2} = 0 Ohms
DC ANODE VOLTS
500
400
300
200
100
0
-5.0
-2.5
0
2.5
5.0
7.5
10.0
12.5
DC CONTROL GRID VOLTS
+3
0
-1
-2
-3
-4
E_{c2}=-5 Volts

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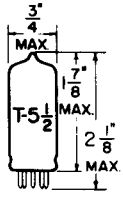
DIODE

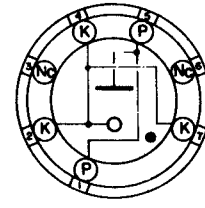
MINIATURE TYPE



GLASS BULB

COLD CATHODE – GLOW DISCHARGE

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL MINIATURE BUTTON
7 PIN BASE

THE 5651 IS A MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE, GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 0.1 VOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE.

ELECTRICAL DATA

CATHODE	COLD	

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/8	INCHES
MAXIMUM SEATED LENGTH	1 7/8	INCHES
MAXIMUM DIAMETER	3/4	INCHES
BULB	T-5 1/2	
BASE	SMALL BUTTON MINIATURE 7 PIN E7-1	

RATINGS

ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
AMBIENT TEMPERATURE RANGE	-55 TO +90	°C

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TUNG-SOL

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CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR	.02	μf
SERIES RESISTOR	SEE NOTE BELOW	

NOTE:

A SERIES RESISTOR MUST ALWAYS BE USED WITH THE 5651 IN ORDER TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

OPERATING NOTES

THE 5651 VOLTAGE REFERENCE TUBE HAS BEEN DESIGNED TO GIVE EXTREMELY STABLE TUBE VOLTAGE DROPS AT SPECIFIC CURRENTS WITHIN THE CURRENT RANGE VALUES. IT ALSO HAS BEEN DESIGNED TO ELIMINATE SUDDEN VOLTAGE JUMPS OR FLUCTUATIONS OVER ITS OPERATING CURRENT RANGE. THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THE CHANGE IN TUBE CURRENT THROUGH THE REFERENCE TUBE SHOULD BE LIMITED TO A PERCENTAGE LESS THAN THE ALLOWABLE PERCENTAGE VOLTAGE CHANGE. UNDER THESE CONDITIONS, CHANGES OF THE VOLTAGE DROP ACROSS THE TUBE WILL BE IN MANY CASES LESS THAN 0.2 PERCENT THROUGHOUT THE LIFE OF THE TUBE.

EQUIPMENT DESIGN AND RANGE VALUES

	MINIMUM VOLTS	AVERAGE VOLTS	MAXIMUM VOLTS
DC ANODE SUPPLY VOLTAGE IN DARKNESS	160[A]	---	---
DC ANODE SUPPLY VOLTAGE IN LIGHT	115[A]	---	---
ANODE BREAKDOWN VOLTAGE	---	106	115
TUBE VOLTAGE DROP (1) AT 1.5 MA.	82	84.5	---
TUBE VOLTAGE DROP (2) AT 3.5 MA.	---	86.0	92
REGULATION (1) (1.5 MA TO 3.5 MA.)	---	1.5	3
VOLTAGE JUMP[B]	---	0	0.1

[A] TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[B] DEFINED AS THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE OPERATING CURRENT RANGE.

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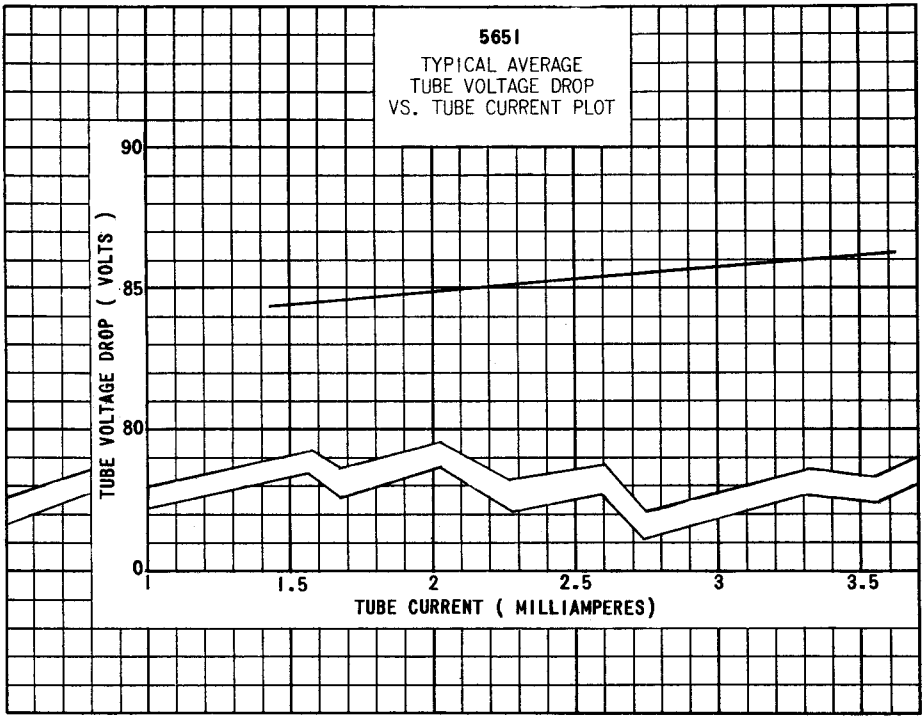

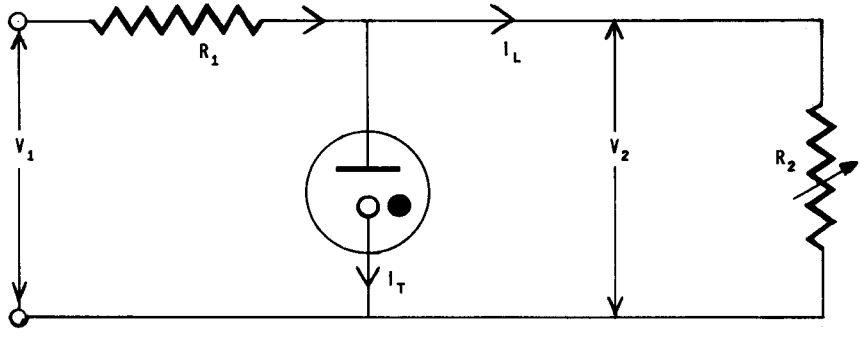

FIGURE 1

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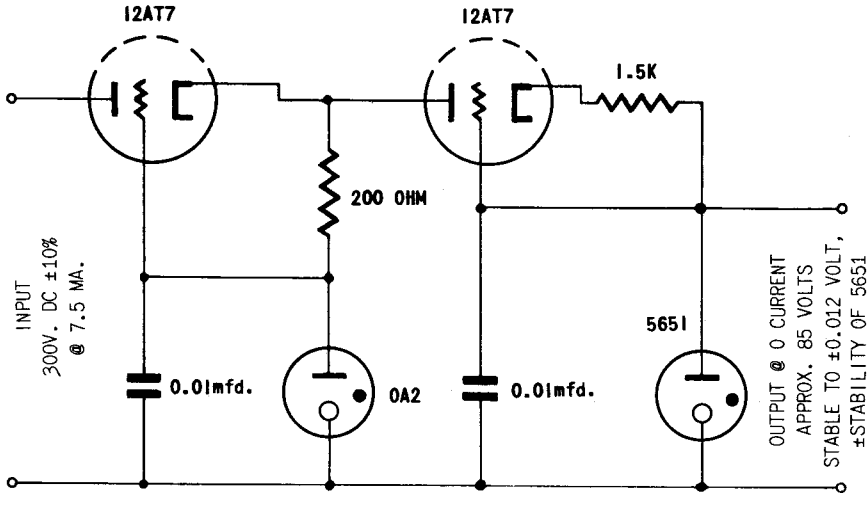
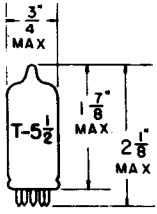
TYPICAL APPLICATION CIRCUIT



TUNG-SOL

DIODE

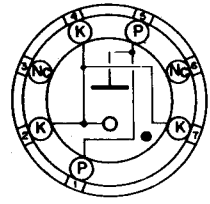
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL-BUTTON MINIATURE
7 PIN BASE
5B0

THE 5651WA IS A MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE, GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 5 MVOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE. THE 5651WA FEATURES HIGH SHOCK AND VIBRATION RATINGS AND WILL "STRIKE" AT LOW VOLTAGES IN THE ABSENCE OF LIGHT.

ELECTRICAL DATA

CATHODE	COLD	

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 1/8	INCHES
MAXIMUM SEATED LENGTH	1 7/8	INCHES
MAXIMUM DIAMETER	3/4	INCH
BULB	T-5 1/2	
BASE	7 PIN E7-1 SMALL-BUTTON MINIATURE	
NET WEIGHT (APPROX.)	0.3	OUNCES
MAXIMUM SHOCK RATING	450	G/1 MS
MAXIMUM VIBRATION RATING (D=.08" @ 50 CPS)	10	G

RATINGS
ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
AMBIENT TEMPERATURE RANGE	-55 TO +150	°C
ALTITUDE	60 000	FEET

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TUNG-SOL

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

FATIGUE: 25 CPS, 0.08" TOTAL DISPLACEMENT FOR 32 HOURS IN EACH OF 3 MUTUALLY PERPENDICULAR PLANES (2.5 G)

POST SHOCK AND FATIGUE LIMITS:		
IONIZATION VOLTAGE (MAX.)	115	VDC
REGULATION (1.5 TO 3.5 MA)	82 TO 90	VDC
TUBE VOLTAGE DROP (1.5 AND 3.5 MA.) (MAX.)	3.0	VDC
STABILITY LIFE TEST (1 HOUR):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b=2.5 mAdc (MAX.)	200	mVDC
SURVIVAL RATE LIFE TEST (100 HOURS):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b=2.5 mAdc (MAX.)	500	mVDC
INTERMITTENT LIFE TEST: END POINTS (500 HOURS)		
CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE @ I_b = 2.5 mVdc (MAX.)	1.5	VDC
TUBE VOLTAGE DROP	82 - 90	VDC
REGULATION (MAX.)	3.0	VDC
IONIZATION VOLTAGE (MAX.)	115	VDC
END POINTS: (1000 HOURS):		
TUBE VOLTAGE DROP	82 - 90	VDC
REGULATION (MAX.)	3.2	VDC
IONIZATION VOLTAGE (MAX.)	115	VDC

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
DC ANODE SUPPLY VOLTAGE IN DARKNESS	115[A]	---	---	VOLTS
DC ANODE SUPPLY VOLTAGE IN LIGHT	115[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	106	115	VOLTS
TUBE VOLTAGE DROP (1) AT 1.5 MA.	82	84.5	---	VOLTS
TUBE VOLTAGE DROP (2) AT 3.5 MA.	---	86.0.	88	VOLTS
REGULATION	---	0.8	1.0	VOLTS/MA.
VOLTAGE JUMP[B]	---	0	5.0	MVOLTS
VOLTAGE REPEATABILITY[C]	---	0.01	0.1	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	5.0	MVOLTS
LEAKAGE CURRENT (E_b =50V, R_p=3000Ω)	---	0	5.0	μAMPS.
GENERATED PLATE VOLTAGE (WHEN VIBRATED AT 40 CPS, 15G, R_p=10000Ω, I_b=2.5mAdc)	---	---	5.0	MVOLTS
MAXIMUM SHUNT CAPACITOR	---	---	0.02	μf
SERIES RESISTOR	D	---	---	
MAXIMUM CURRENT THROUGH INTERCONNECTED LEADS	---	---	1.0	AMP.

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NOTES

A TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

B THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE OPERATING CURRENT RANGE.

C TUBE IS CYCLED ONE MINUTE ON AND ONE MINUTE OFF FOR FIVE CYCLES. @ I_b = 2.5 mADC. READINGS ARE TAKEN INITIALLY AND AT THE END OF EACH "ON" PERIOD.

D SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA. AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

APPLICATION NOTES

VOLTAGE REFERENCE TUBES ARE OFTEN CONFUSED WITH VOLTAGE REGULATOR TUBES WHILE A REFERENCE TUBE IS A REGULATOR TUBE, IT IS A SPECIAL FORM OF REGULATOR TUBE, IN WHICH CURRENT RANGE AND REGULATION IS SACRIFICED TO PROVIDE VOLTAGE REPEATABILITY AND TEMPERATURE STABILITY AND TO MINIMIZE VOLTAGE JUMP AND LONG TERM DRIFT.

THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THEREFORE THE 5651WA **SHOULD BE RUN FROM A** CONSTANT SOURCE SUCH AS A VR TUBE, A PENTODE, OR A SIMPLE SERIES REGULATOR. PRACTICAL CIRCUITS ARE GIVEN IN FIGURES 1, 2, AND 3.

IF SO DESIRED, "INPUT AND OUTPUT" CONNECTIONS TO EITHER THE ANODE OR CATHODE CAN BE MADE TO DIFFERENT INTERNALLY CONNECTED PINS, SO THAT THE CIRCUIT WILL BE BROKEN UPON THE REMOVAL OF THE TUBE FROM ITS SOCKET. UNUSED PINS SHOULD NOT BE USED FOR CIRCUIT TIE POINTS AS VOLTAGE ON THESE PINS MAY CAUSE ERRATIC BEHAVIOR OF THE 5651WA OR EVEN FORM UNWANTED CIRCUIT CONNECTIONS THROUGH GAS BREAKDOWN. THE TUBE SHOULD BE SHIELDED IF IT IS TO BE USED IN STRONG RF OR MAGNETIC FIELDS.

MANY CIRCUITS UTILIZING THE 5651WA OR ITS PROTOTYPE, THE 5651, ARE TO BE FOUND IN THE HANDBOOK, PREFERRED CIRCUITS, Navy Aeronautical Electronic Equipment (NAVAER 16-1-519). THIS IS AVAILABLE FROM THE SUPERINTENDENT OF DOCUMENTS, US GOVT. PRINTING OFFICE, WASHINGTON 25, D.C. AT $1.75.

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TUNG-SOL

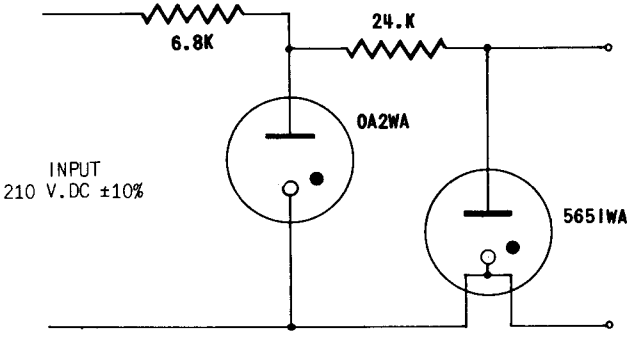

FIGURE 1

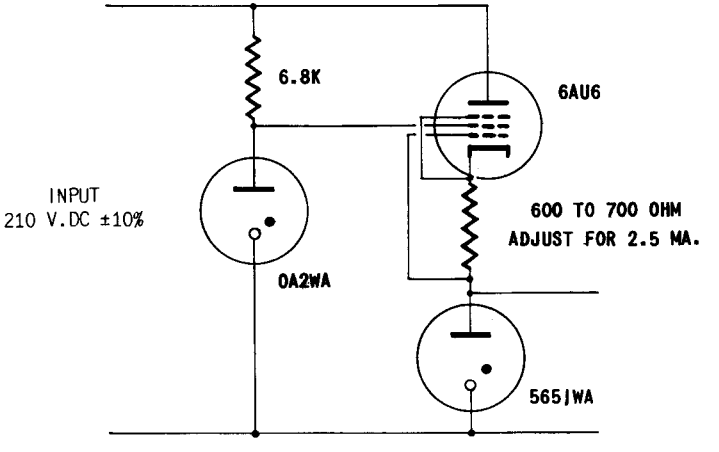

FIGURE 2

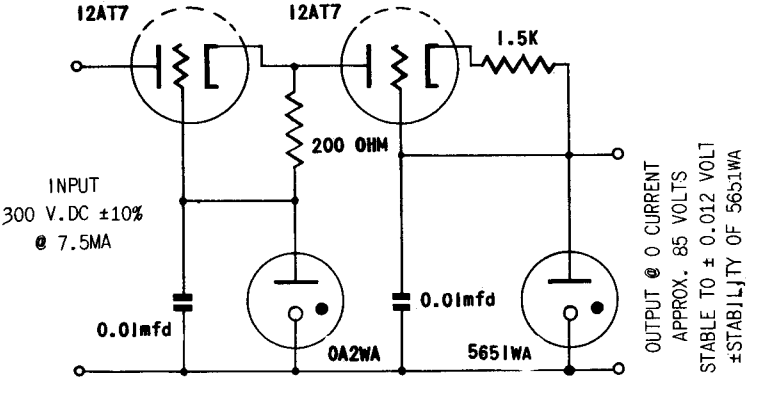

FIGURE 3

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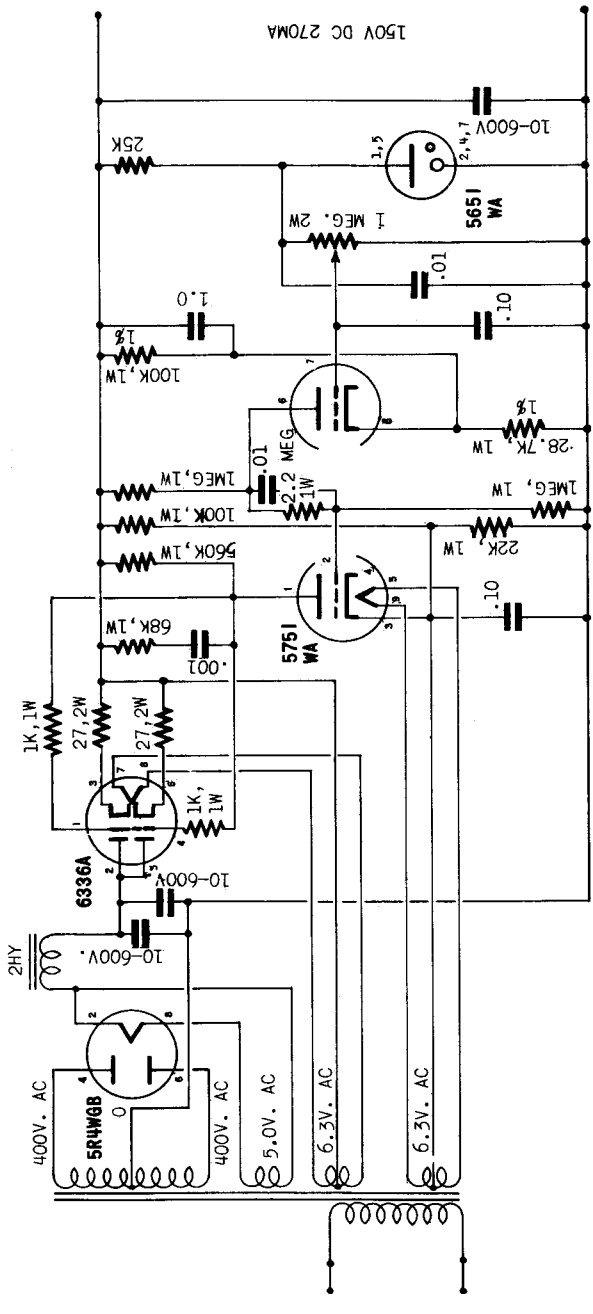
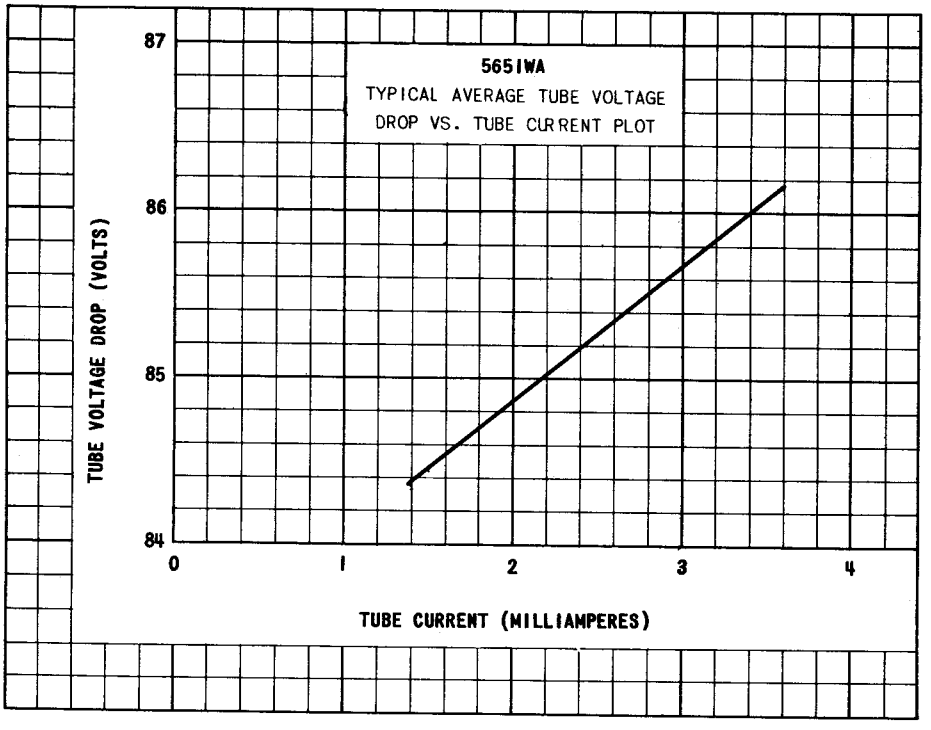
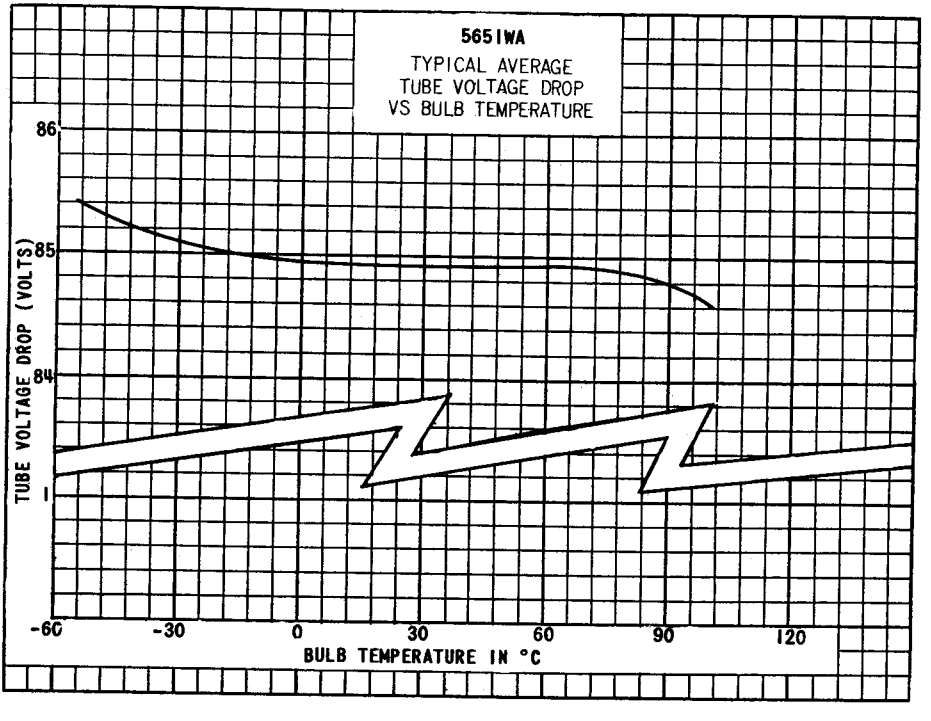


FIGURE 4

TENTATIVE DATA

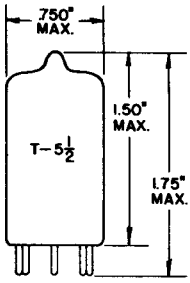




TUNG-SOL

PENTODE

MINIATURE TYPE

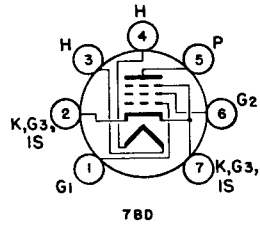


GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 175 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BD

THE 5654 IS A MINIATURE, SHARP-CUTOFF, RF PENTODE. IT IS DESIGNED FOR DEPENDABLE OPERATION UNDER CONDITIONS OF SHOCK AND VIBRATION USUALLY FOUND IN MOBILE AND AIRCRAFT APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #316 CONNECTED TO PIN #7.

GRID #1 TO PLATE (MAX.)	0.02	pf
GRID #1 TO ALL OTHER ELECTRODES EXCEPT PLATE	4.0	pf
PLATE TO ALL OTHER ELECTRODES EXCEPT GRID #1	2.9	pf

RATINGS

DESIGN CENTER VALUES

MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	180	VOLTS
MAXIMUM GRID #2 VOLTAGE	140	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM GRID #2 DISSIPATION	0.5	WATTS
MAXIMUM DC CATHODE CURRENT	18	MA.

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TUNG-SOL

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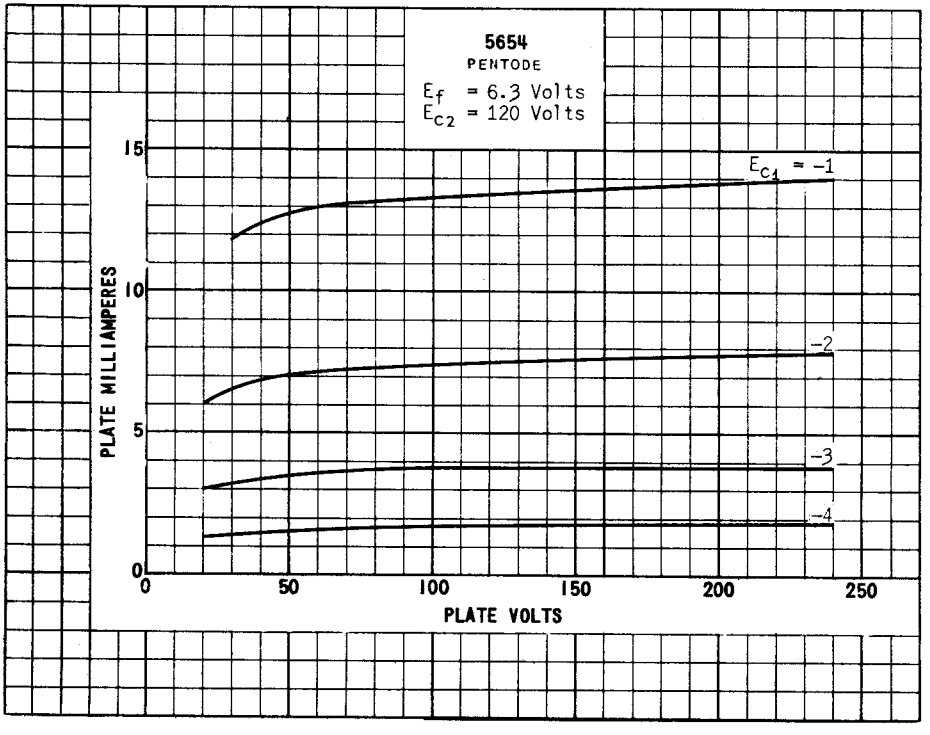
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

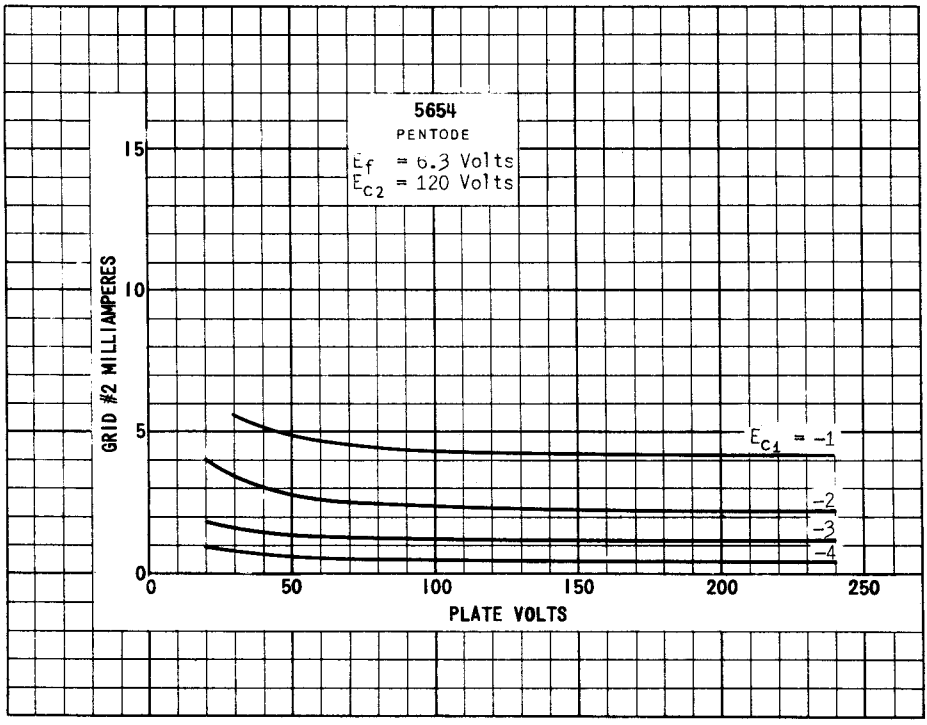
CLASS A_1 AMPLIFIER

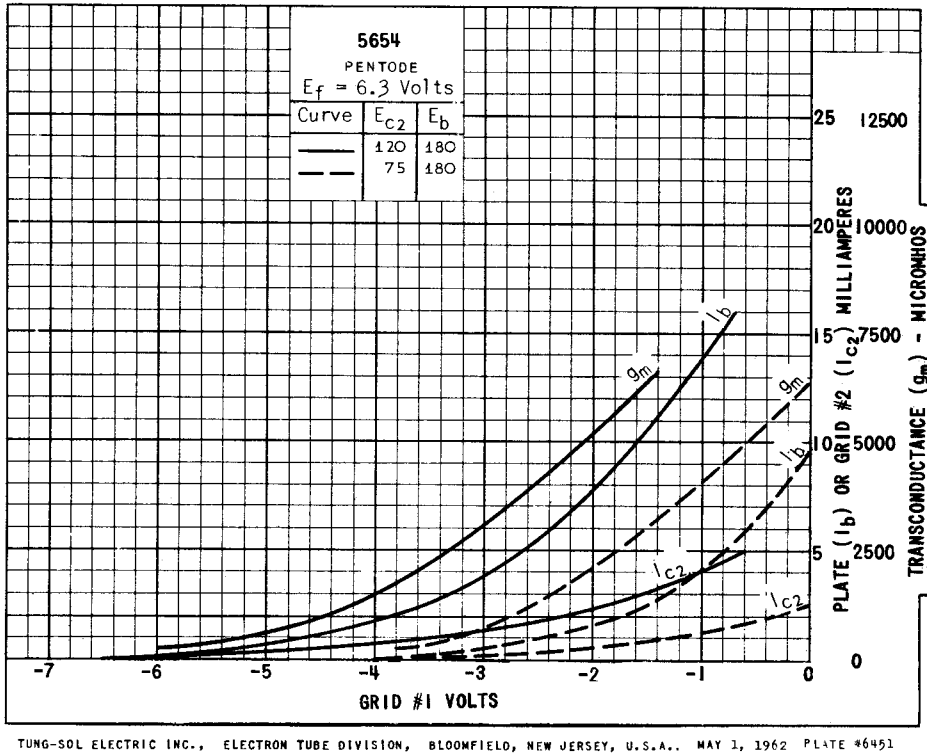
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE RESISTOR	200	OHMS
PLATE RESISTANCE	0.34	MEGOHM
TRANSCONDUCTANCE	5 000	µMHOS
PLATE CURRENT	7.5	MA.
GRID #2 CURRENT	2.5	MA.
GRID #1 VOLTAGE (APPROX.) FOR I_b = 10 µAMP.	−12	VOLTS
HEATER CYCLES OF INTERMITTENT OPERATION[A] (MIN.)	5 000	CYCLES

[A]THE TYPE 5654 HAS A HEATER WHICH IS DESIGNED TO WITHSTAND AT LEAST 3000 CYCLES OF INTERMITTENT OPERATION AT 7.5 VOLTS.

SIMILAR TYPE REFERENCE: Similar to the 6AK5.







TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.. MAY 1, 1962 PLATE #6451

TUNG-SOL

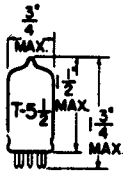
PENTODE

MINIATURE TYPE

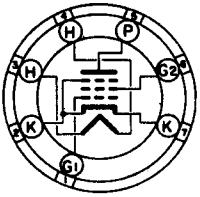
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.175 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7B0

THE 5654/6AK5W/6096 IS A RUGGEDIZED, SHARP CUT-OFF PENTODE OF THE SEVEN PIN MINIATURE CONSTRUCTION. IT IS CHARACTERIZED BY LOW HEATER POWER REQUIREMENTS, HIGH TRANSCONDUCTANCE AND INPUT IMPEDENCE AND LOW INTER-ELECTRODE CAPACITANCES AND LEAD INDUCTANCES. THESE FACTORS CONTRIBUTE GREATLY TO EXCELLENT PERFORMANCE IN HIGH FREQUENCY WIDE-BAND APPLICATIONS SUCH AS RADAR EQUIPMENT IF STAGES. THE 5654/6AK5W/6096 IS ELECTRICALLY EQUIVALENT TO THE 6AK5, BUT CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, SCREEN GRID CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5654/6AK5W/6096 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE NAVIGATIONAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
MAXIMUM GRID #1 TO PLATE (RATED)	0.03	0.02	μμf
INPUT: (RATED)	4.0	4.0	μμf
MAXIMUM	---	4.6	μμf
MINIMUM	---	3.4	μμf
OUTPUT: (RATED)	2.1*	2.85	μμf
MAXIMUM	---	3.25	μμf
MINIMUM	---	2.45	μμf

*NOMINAL VALUE.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM PLATE DISSIPATION	1.65	WATTS
MAXIMUM HEATER CATHODE VOLTAGE	130	VOLTS
MAXIMUM DC CATHODE CURRENT [A]	20	mA
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM BULB TEMPERATURE	+165	°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.175	AMP.
PLATE VOLTAGE	120	VOLTS
GRID #2 VOLTAGE	120	VOLTS
CATHODE BIAS RESISTOR [B]	200	OHMS
PLATE RESISTANCE (APPROX.)	0.34	MEGOHM
TRANSCONDUCTANCE	5000	µMHOS
PLATE CURRENT	7.5	mA
GRID #2 CURRENT	2.5	mA
GRID #1 VOLTAGE (APPROX.) I_p=10 µa	-12	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN
E_f = 6.3v, E_b = 120Vdc, E_{c1} =-2Vdc, E_{c2} = 120Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER-CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	10	---	---	---	10	µAdc
GRID #1 CURRENT (R_g=0.1 MEG.)	0	-0.1	---	---	0	-0.1	µAdc
PLATE CURRENT (1)	5.0	11.0	6.5	8.5	4.5	11.0	mAdc
TRANSCONDUCTANCE (1)	4000	6250	4525	5475	3750	6250	µMHOS
INSULATION OF ELECTRODES [C] (E_f=6.3V, E(g1-ALL)= -100Vdc, E(p-all)= -300Vdc, E(g2-all)= -300Vdc,							
R(g1-all)	100	---	---	---	50	---	MEGOHMS
R(p-all)	100	---	---	---	50	---	MEGOHMS
R(g2-all)	100	---	---	---	50	---	MEGOHMS
SCREEN CURRENT	0.8	4.0	1.8	3.2	---	---	mAdc
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
PLATE CURRENT (2) (E_{c1}=-10Vdc)	---	200	---	---	---	---	µAdc
PLATE CURRENT (3) (E_{c1}=-5.5Vdc)	5.0	---	---	---	---	---	µAdc
Δ TRANSCONDUCTANCE (2) [D] (E_f=5.7V.)	---	---	---	---	---	15	PERCENT
GRID CURRENT (2) [E] (E_f=7.0 V, R_{g1}=0.1MEG)	0	-0.5	---	---	---	---	µAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [F] (R_p = 10,000)	---	150	mVac
VIBRATIONAL FATIGUE [G]	---	---	
SHOCK [H] (HAMMER ANGLE=30°, E_{hk}=100Vdc, HEATER POS., R_{g1} = 0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER-CATHODE LEAKAGE	---	±30	µAdc
TRANSCONDUCTANCE (1)	3500	---	µMHOS
GRID #1 CURRENT	0	-0.2	µAdc

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TUNG-SOL

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SPECIAL REQUIREMENTS -CONT'D.

	MIN.	MAX.	
GLASS STRAIN [J]	---	---	
CONTINUITY AND SHORT [K]	---	---	
RF NOISE [L] (E_{c1}=0, E_{ca1}=15.0mVac, R_k=200, C_k=0.2 μf)	---	3.0	mW
NOISE AND MICROPHONICS [MN] (E_f=6.3Vac, E_{hk}=0, E_{bb}=E_{cc2}=200Vdc, E_{c1}=0, R_k=1000, R_p=0.1MEG, R_{g2}=0.5MEG., C_{g2}=2μf)	---	100	mVac
LOW FREQUENCY VIBRATION [P] (R_p=10,000)	---	150	mVac
LOW PRESSURE VOLTAGE BREAKDOWN [Q] (PRESSURE =±5mm mercury, TEMP=25±5°C, HUMIDITY=0, VOLTAGE =500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POS., E_b=E_{c1}=E_{c2}=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST [R] (E_b=150Vdc, E_{c1}=0, E_{c2}=125Vdc, E_{hk}=135Vdc, HEATER POSITIVE, R_{g1}=0.1MEG., R_k=130, MIN. BULB TEMPERATURE =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAYBE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] FIXED-BIAS OPERATION NOT RECOMMENDED.

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY FOLLOWING PREHEATING. E_f=7.0Vac, E_{c1}=0Vdc, R_k=130OHMS, R_g=0.1MEG., E_v=150Vdc, E_{c2}=125 Vdc.

[F] SEE MIL-E-1C 4.9.20.3

[G] SEE MIL-E-1C 4.9.20.6

[H] SEE MIL-E-1C 4.9.20.5

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.1

[M] SEE MIL-E-1C 4.10.3.5

[N] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

[P] SEE MIL-E-1C 4.9.20.4

[Q] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

[R] SEE MIL-E-1C 4.11.5

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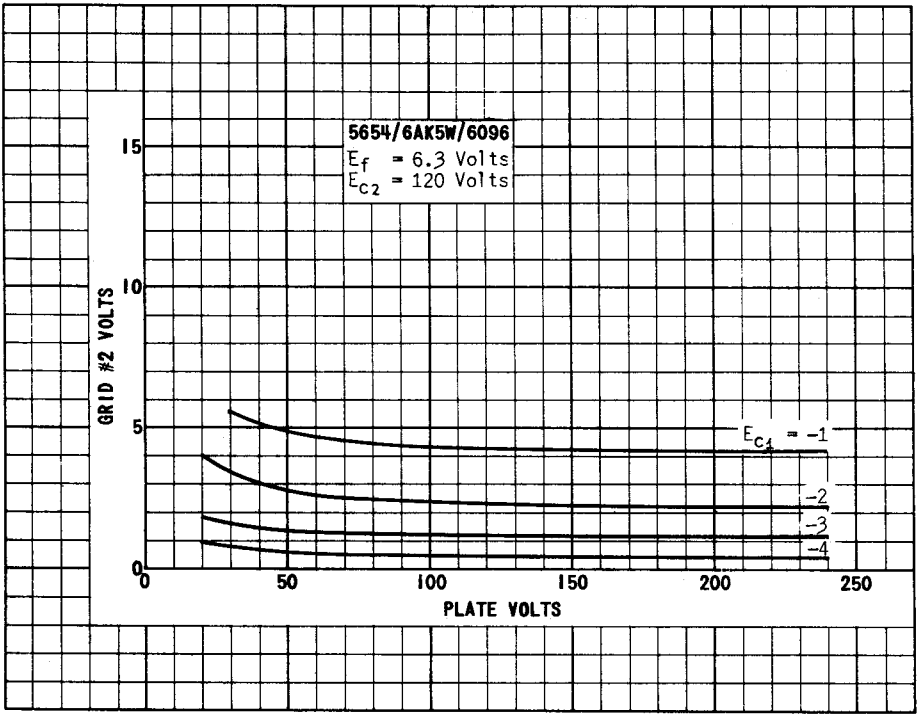
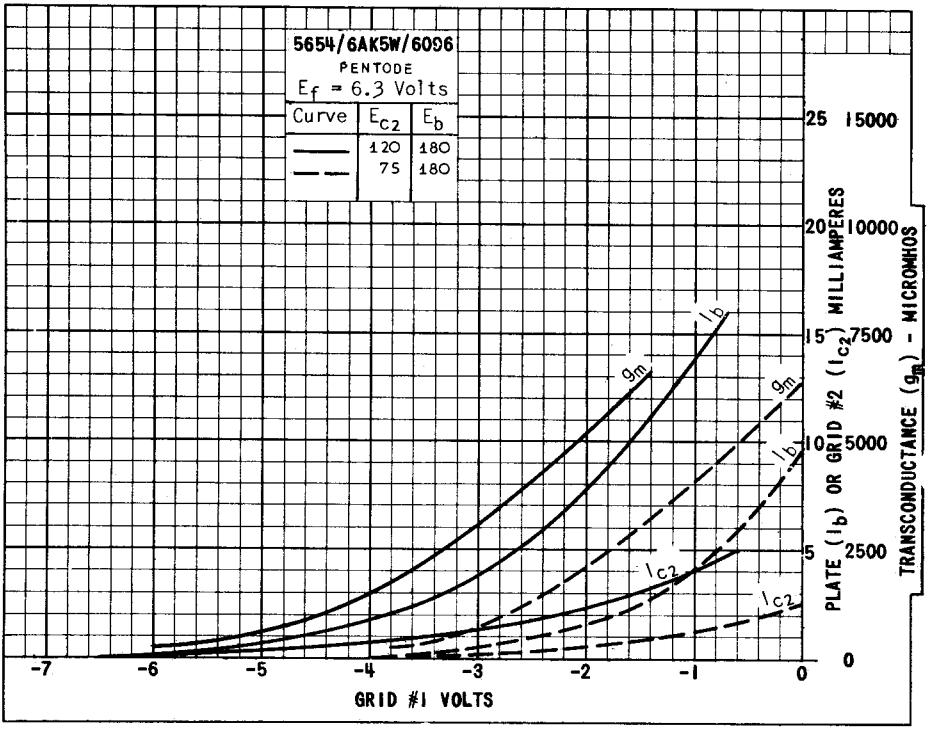
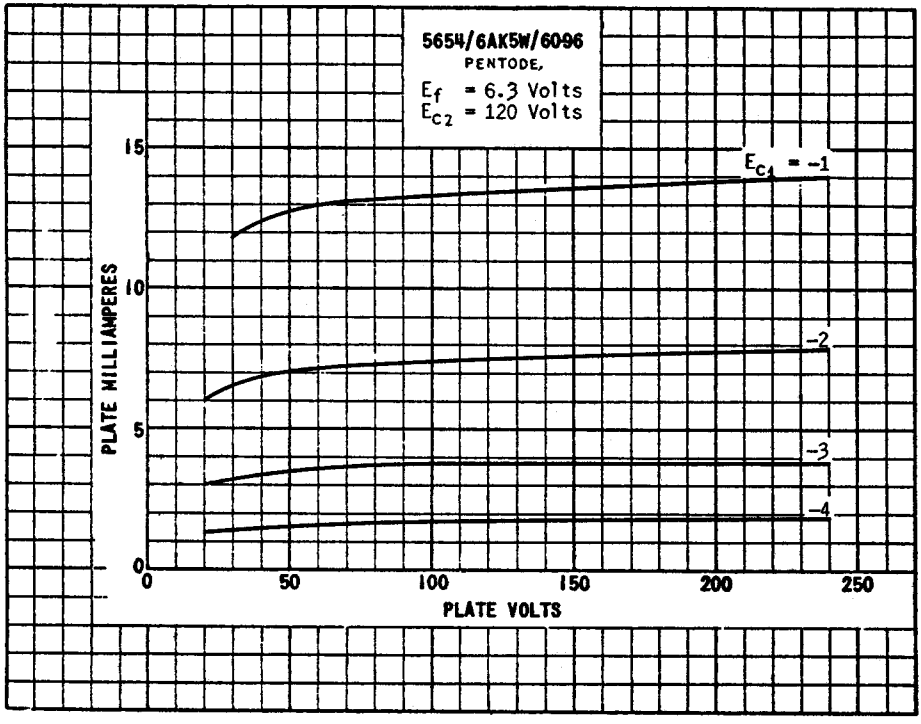
5654/6AK5W/6096
PREMIUM TUBE



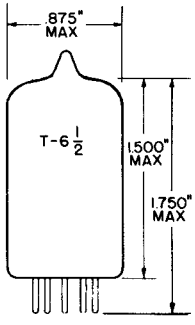



5654/6AK5W/6096
PENTODE,
E_f = 6.3 Volts
E_{c2} = 120 Volts
E_{c1} = -1
-2
-3
-4
PLATE MILLIAMPERES
0
5
10
15
0
50
100
150
200
250
PLATE VOLTS

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE

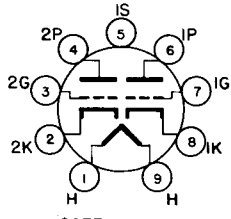


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 350 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8CJ

THE 5670 IS A HIGH-FREQUENCY DOUBLE TRIODE USING THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR RELIABLE LIFE UNDER CONDITIONS OF INTERMITTENT OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

PLATE TO GRID (EACH SECTION)[A]	→	1.1	pf
PLATE TO CATHODE (EACH SECTION)[A]		1.0	pf
GRID TO CATHODE (EACH SECTION)[A]		2.2	pf
PLATE TO PLATE (NOMINAL)		0.05	pf
PLATE TO PLATE (MAXIMUM)		0.10	pf

[A] INTERNAL SHIELD AND HEATER CONNECTED TO CATHODE.

RATINGS

EACH TRIODE SECTION – DESIGN CENTER VALUES

MAXIMUM HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM DC CATHODE CURRENT	16.5 *	MA.
BULB TEMPERATURE AT HOTTEST POINT (ABSOLUTE MAXIMUM)	165 *	°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR (EACH SECTION)	240	OHMS
PLATE CURRENT (EACH SECTION)	8.2	MA.
TRANSCONDUCTANCE (EACH SECTION)	5 500	µMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE (APPROX.) FOR I_b = 10 µA.	→ −8	VOLTS

CLASS AB_1 AMPLIFIER

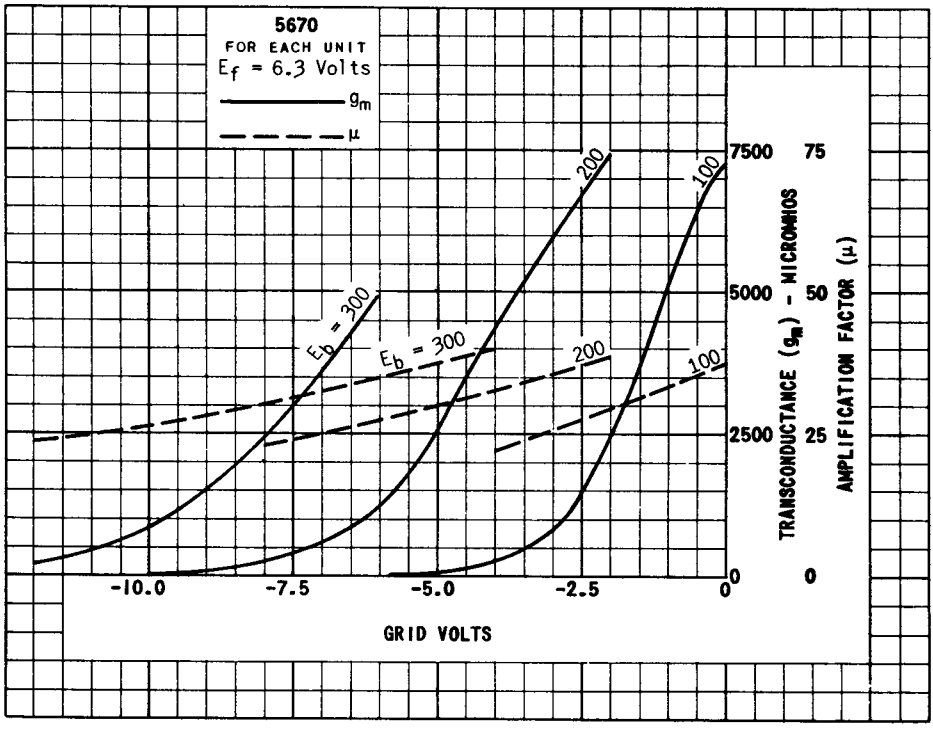
PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT (EACH SECTION)	4.9	MA.
MAXIMUM SIGNAL PLATE CURRENT (EACH SECTION)	6.3	MA.
LOAD IMPEDANCE (PLATE-TO-PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT

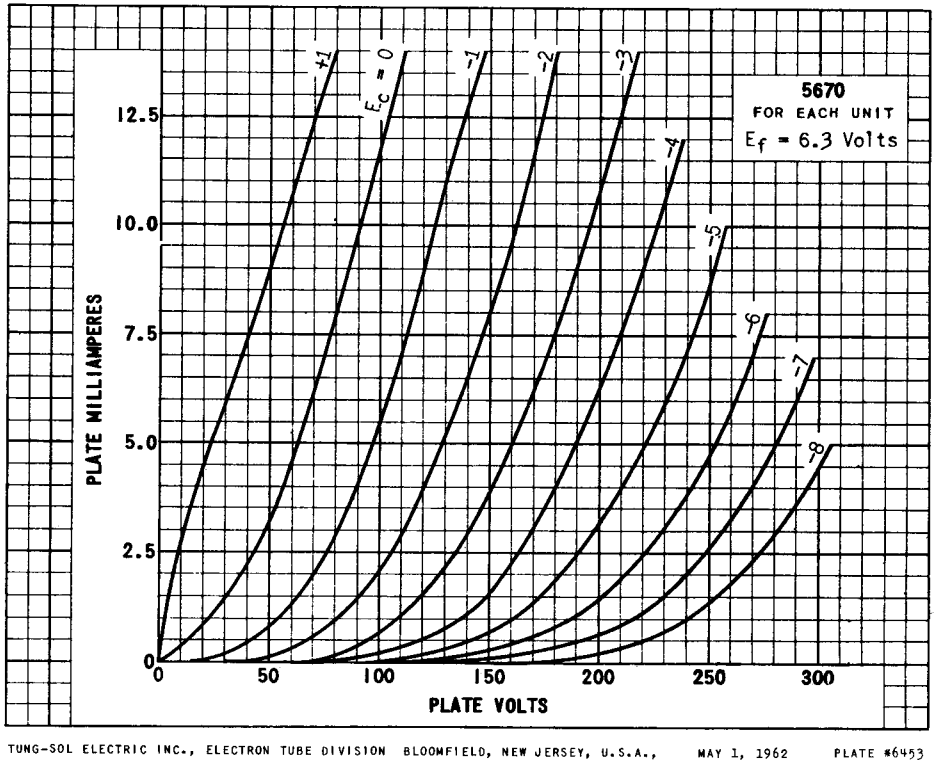
SPECIAL TESTS AND RATINGS *

HEATER-CYCLING RATINGS CYCLES OF INTERMITTENT OPERATION, MINIMUM Ef =7.5 VOLTS CYCLED FOR ONE MINUTE ON AND ONE MINUTE OFF. Eb=Ec=O VOLTS. Ehk =135 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE.	2 000	CYCLES
SHOCK RATING IMPACT ACCELERATION IN ANY DIRECTION FORCES AS APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MECHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.	600	G
FATIGUE RATINGS VIBRATIONAL ACCELERATION IN ANY DIRECTION VIBRATIONAL FORCES FOR A PERIOD OF AT LEAST 100 HOURS AT A FREQUENCY OF 25 CYCLES PER SECOND	2.5	G

→ INDICATES A CHANGE.

*INDICATES AN ADDITION.





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TUNG-SOL

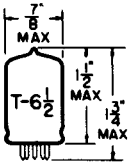
TWIN TRIODE

MINIATURE TYPE

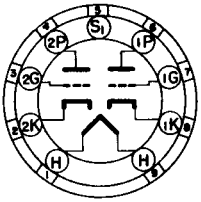
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.35 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
8CJ

THE 5670WA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE OF THE NINE-PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT WITH A SHIELD BETWEEN SECTIONS BROUGHT OUT TO A SEPERATE BASE PIN. THE 5670WA MAY BE USED IN SUCH GENERAL PURPOSE APPLICATIONS AS AMPLIFIER, MIXER, OSCILLATOR AND MULTIVIBRATOR CIRCUITS OVER A FREQUENCY RANGE OF AF. THROUGH VHF. IT MAY ALSO BE OPERATED AS AN OSCILLATOR AT FREQUENCIES AS HIGH AS 800 MC IN AN OPEN-CIRCUITED RESONANT LINE OSCILLATOR WHEN THE TWO TRIODE SECTIONS ARE CONNECTED IN PARALLEL. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5670WA IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
PLATE TO GRID (EACH SECTION)[A] (RATED)	1.1	μμf
MAXIMUM	1.4	μμf
MINIMUM	0.8	μμf
OUTPUT (RATED)	1.0	μμf
MAXIMUM	1.3	μμf
MINIMUM	0.7	μμf
INPUT (RATED)	2.2	μμf
MAXIMUM	2.7	μμf
MINIMUM	1.7	μμf
MAXIMUM PLATE TO PLATE (RATED)	0.10	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION, EACH SECTION	1.65	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	±100	VOLTS
MAXIMUM DC CATHODE CURRENT, EACH SECTION[AA]	18	mAdc

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.35	AMP.
PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR (EACH SECTION)	240	OHMS
PLATE CURRENT (EACH SECTION)	8.2	mA
TRANSCONDUCTANCE (EACH SECTION)	5 500	μMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE (APPROX.) FOR Ib = 10 μa	-8	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – CONT'D.

CLASS AB_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.35	AMP.
PLATE VOLTAGE	300	VOLTS
CATHODE RESISTOR	800	OHMS
AF GRID TO GRID VOLTAGE (RMS)	14	VOLTS
ZERO-SIGNAL PLATE CURRENT (EACH SECTION)	4.9	mA
MAXIMUM SIGNAL PLATE CURRENT (EACH SECTION)	6.3	mA
LOAD IMPEDANCE (PLATE-TO-PLATE)	27 000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	1.0	WATT

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 150Vdc, E_c = 0Vdc, Rk/k = 240 OHMS
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	330	370	---	---	330	370	mA
HEATER-CATHODE LEAKAGE[B] (E_{hk} =±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g =0.5 meg.)	0	-0.3	---	---	0	-0.3	μAdc
PLATE CURRENT (1)	5.9	10.5	7.3	9.1	---	---	mAdc
PLATE CURRENT (2) (E_c = 10Vdc, R_p=0.25 meg., R_k =0)	---	45	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	4500	6500	5125	5875	3850	6500	μMHOS
Δ AVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[C] (E_f=6.3V, E(g-all)= 100Vdc, g negative; E(p-all)= 300Vdc, p negative)							
R(g-all)	100	---	---	---	50	---	MEGOHM
R(p-all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	2.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[D] (E_f = 5.7V)	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (E_f = 7.0V)	0	-0.5	---	---	---	---	μAdc
AMPLIFICATION FACTOR	26	44	30	40	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[H] (R_p=2000, R_k=0, E_{c1}=-3Vdc)	---	100	mVac
VIBRATIONAL FATIGUE[F]	---	---	
SHOCK[G] (HAMMER ANGLE =42°, E_{hk}=100Vdc, HEATER POSITIVE, R_g=0.1 meg.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	300	mVac
HEATER-CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (1)	3850	---	μMHOS
GRID CURRENT (1)	0	-0.6	μAdc
GLASS STRAIN[J]	---	---	
CONTINUITY AND SHORT[K]	---	---	
RF NOISE[L,B,M] (E_p=250Vdc, E_{ca1}=1.1 mVac, C_k=0.2 μf)	---	3.0	mW

CONTINUED ON FOLLOWING PAGE

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SPECIAL REQUIREMENTS — CONT'D.

	MIN.	MAX.	
NOISE AND MICROPHONICS[NBMP] (E_f=6.3Vac, E_{hk}=0, E_{bb}=250Vdc, E_{c1}=0, R_p=10,000)	---	200	mVac
LOW FREQUENCY VIBRATION[QB] (E_c =−3Vdc, R_k=0, R_p=2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[R] (PRESSURE =55±5mm mercury, temp=25±5°C, HUMIDITY=0, VOLTAGE=500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_c=E_b=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER–CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_{hk}=135Vdc, HEATER POSITIVE, R_g=0.5 meg, min. BULB TEMPERATURE =+165°C)	---	---	

NOTES

[A] INTERNAL SHIELD AND HEATER CONNECTED TO CATHODE.

[AA] DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] TIE 1p TO 2p, 1g TO 2g, 1k TO 2k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.)

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] PRIOR TO TEST TUBES TO BE PREHEATED FIVE (5) MINUTES AT FOLLOWING CONDITIONS. TEST IMMEDIATELY AFTER PREHEATING. E_f = 7.0V, E_{c1} =0 Vdc, R_k = 240 OHMS, E_b = 150Vdc, R_g = 0.5 MEG.

[F] SEE MIL-E-1C 4.9.20.6

[G] SEE MIL-E-1C 4.9.20.5

[H] SEE MIL-E-1C 4.9.20.3

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST TWO (2) LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.1

[M] TIE CATHODES TOGETHER AND GROUND THRU A 240 OHM RESISTOR. GRIDS ARE GROUNDED.

[N] SEE MIL-E-1C 4.10.3.5

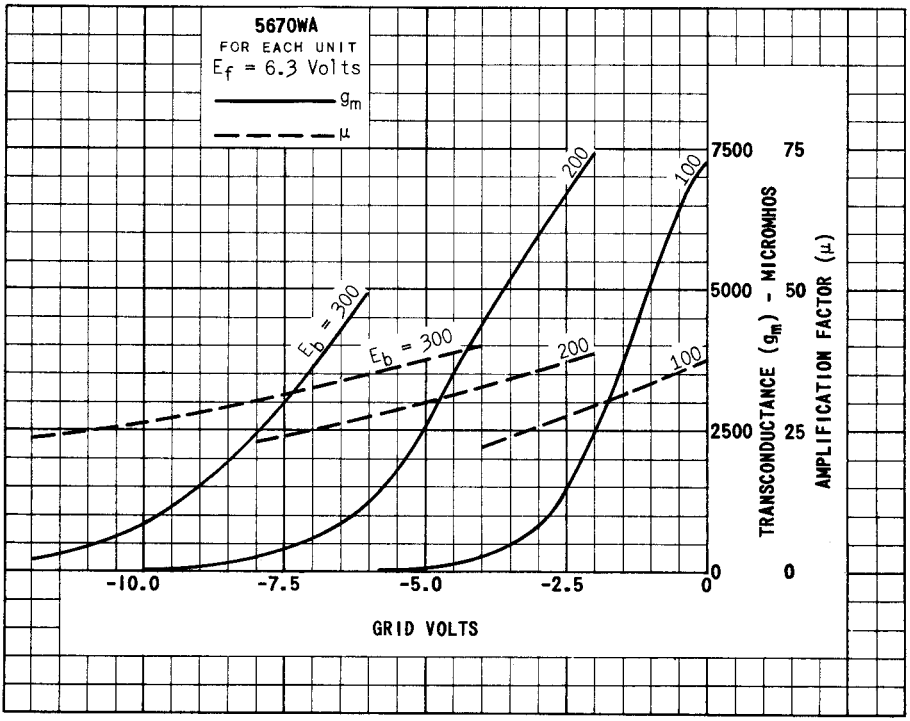
[P] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

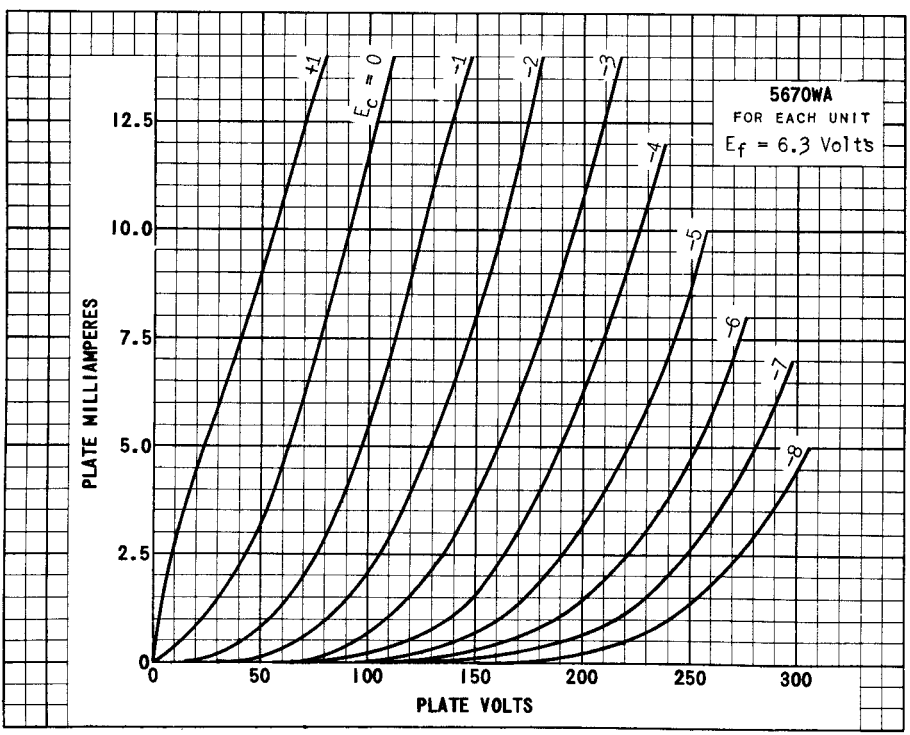
[Q] SEE MIL-E-1C 4.9.20.4

[R] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

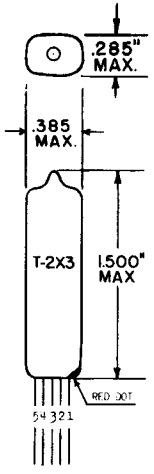
5670WA

PREMIUM TUBE





TUNG-SOL



GLASS BULB

RED DOT IS ADJACENT TO LEAD 1

PENTODE

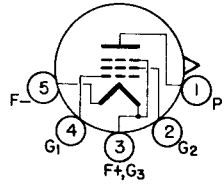
SUBMINIATURE TYPE

COATED FILAMENT

1.25 VOLTS 50 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" SPACING CENTER-TO-CENTER

THE 5672 IS A FILAMENT TYPE PENTODE POWER AMPLIFIER OF SUBMINIATURE CONSTRUCTION DESIGNED FOR SERVICE IN WEARABLE AND PORTABLE EQUIPMENT. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

RATINGS

DESIGN CENTER VALUES

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	90	VOLTS
MAXIMUM TOTAL CATHODE CURRENT	5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	67.5	VOLTS
GRID #2 VOLTAGE	67.5	VOLTS
GRID #1 VOLTAGE	-6.5	VOLTS
PLATE CURRENT	3.25	MA.
GRID #2 CURRENT	1.1	MA.
TRANSCONDUCTANCE	650	µMHOS
LOAD RESISTANCE	20	KILOHMS
DISTORTION	10	PERCENT
POWER OUTPUT	65	MW.

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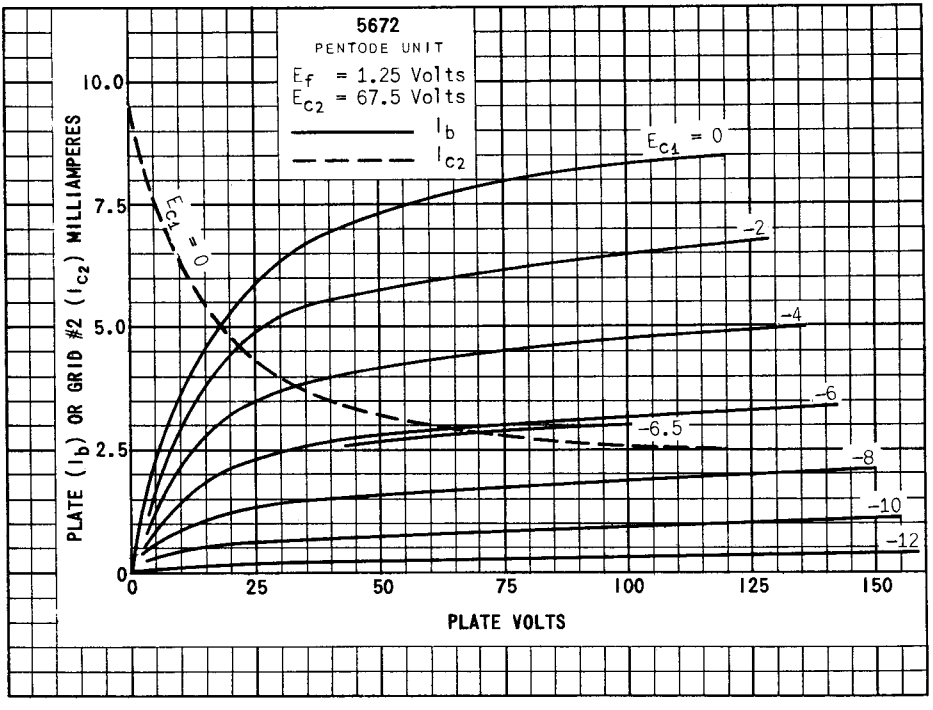
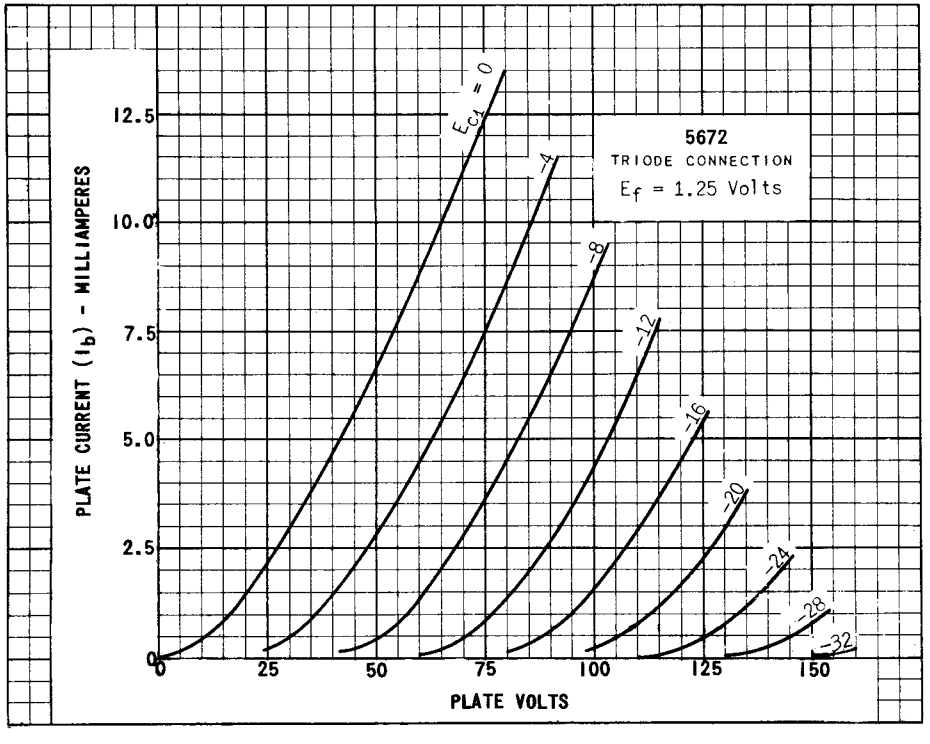
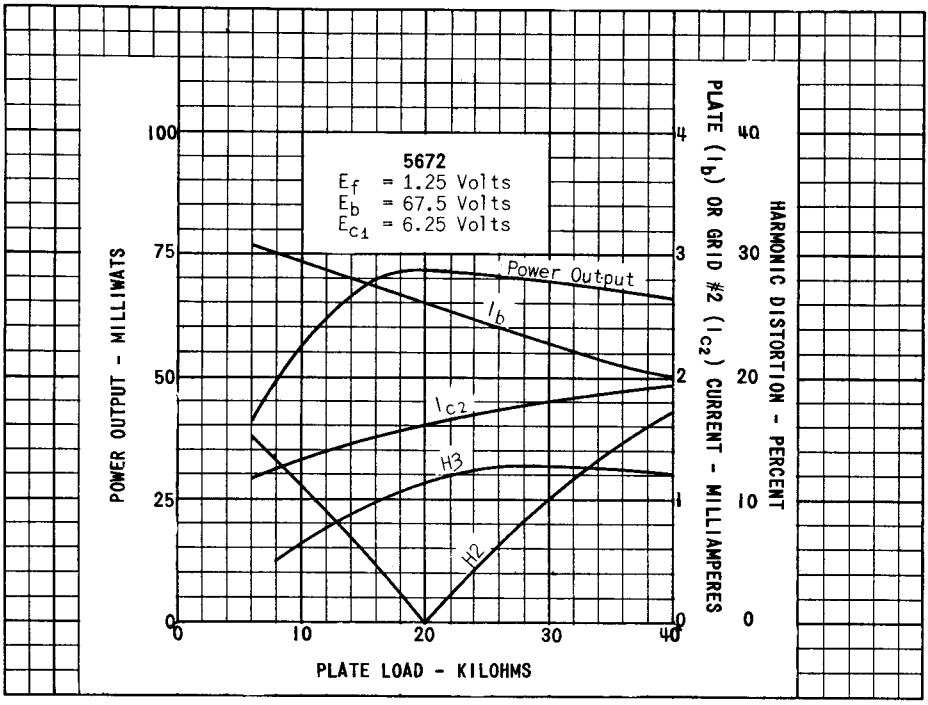
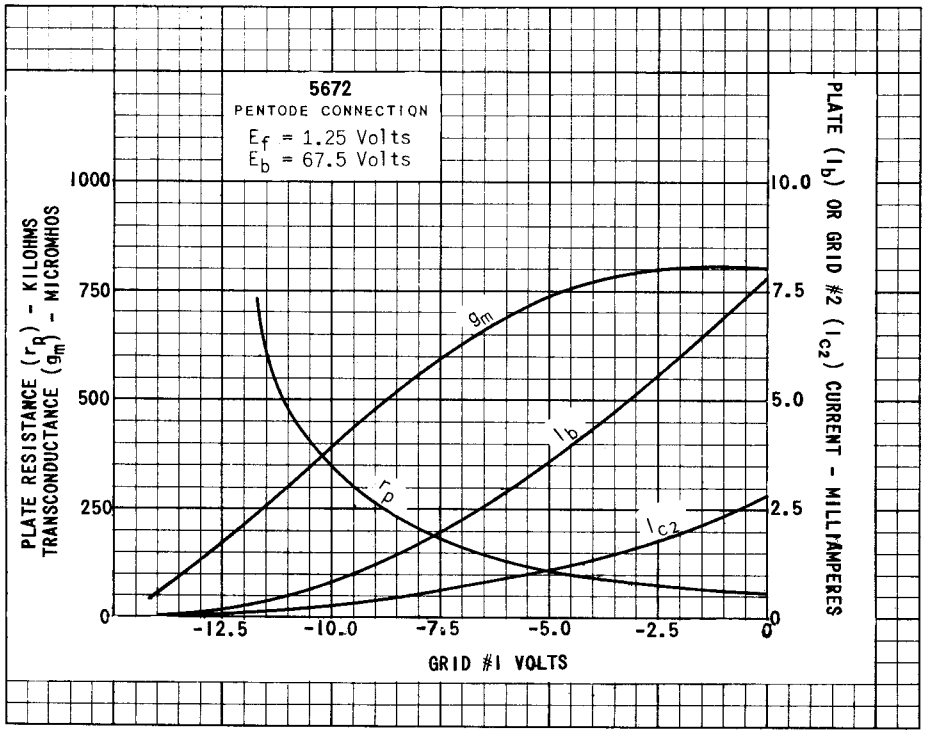

5672
PENTODE UNIT
E_f = 1.25 Volts
E_{c_2} = 67.5 Volts
I_b
I_{c_2}
PLATE (I_b) OR GRID #2 (I_{c_2}) MILLIAMPERES
PLATE VOLTS
E_{c_1} = 0
-2
-4
-6
-6.5
-8
-10
-12
0
2.5
5.0
7.5
10.0
0
25
50
75
100
125
150


5672
TRIODE CONNECTION
E_f = 1.25 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTS
E_{c_1} = 0
-4
-8
-12
-16
-20
-24
-28
-32
0
2.5
5.0
7.5
10.0
12.5
0
25
50
75
100
125
150





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TUNG-SOL

UHF POWER TRIODE

PENCIL TYPE

FOR

RF POWER AMPLIFIER, OSCILLATOR

AND FREQUENCY MULTIPLIER APPLICATIONS

IN MOBILE AND AIRCRAFT EQUIPMENT

PHYSICAL DIMENSIONS SEE OUTLINE DRAWING

ELECTRODE TERMINATIONS SEE OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

THE 5675 IS A COAXIAL METAL-GLASS PENCIL-TYPE MEDIUM MU TRIODE. ITS MAXIMUM PLATE DISSIPATION IS 5 WATTS CCS. THE TUBE MAY BE OPERATED WITH FULL RATINGS UP TO A FREQUENCY OF 1,700 MC/S, AND WITH REDUCED RATINGS UP TO 3,000 MC/S.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		1.4	pf
GRID TO CATHODE		2.4	pf
PLATE TO CATHODE	MAX.	0.09	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	135	mA
LIMITS OF APPLIED VOLTAGE – AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS
MINIMUM PREHEAT TIME		60	SEC.

AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	135	VOLTS
CATHODE RESISTOR	68	OHMS
PLATE CURRENT	24	mA
TRANSCONDUCTANCE	6,200	μMHOS
AMPLIFICATION FACTOR	20	

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CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

CONTINUOUS COMMERCIAL SERVICE		
DC PLATE VOLTAGE	300	VOLTS
DC GRID VOLTAGE	-90	VOLTS
DC PLATE CURRENT	31	mA
DC GRID CURRENT	8	mA
PLATE INPUT	5	WATTS
PLATE DISSIPATION – SEE NOTE	5	WATTS
PLATE SEAL TEMPERATURE	175	° C
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

NOTE: IF THE PLATE DISSIPATION EXCEEDS 2.5 WATTS, ADEQUATE COOLING MUST BE PROVIDED IN ORDER TO STAY WITHIN THE TEMPERATURE RATING.

TYPICAL OPERATION-OSCILLATOR IN CATHODE-DRIVE CIRCUIT

RF AMPLIFIER WITH CATHODE DRIVE

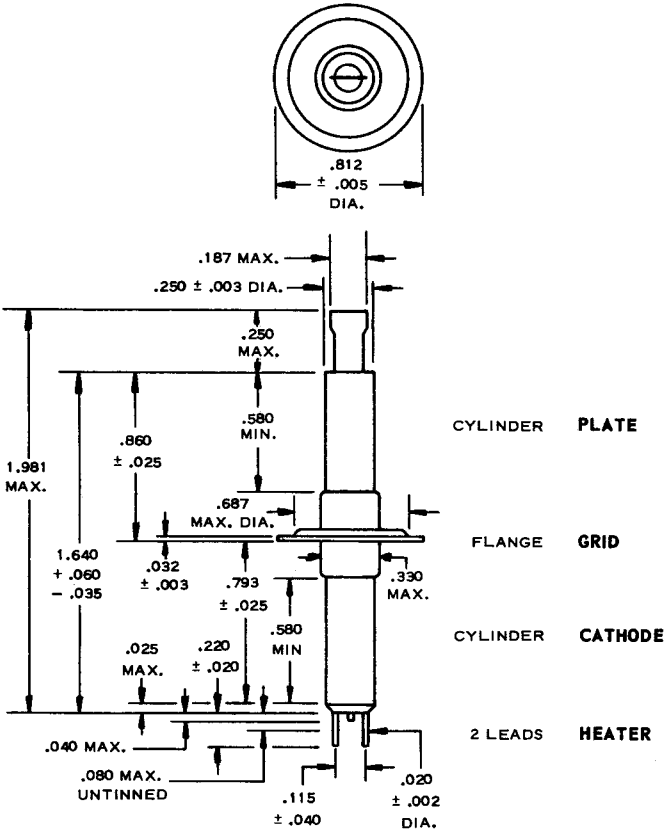
CONTINUOUS COMMERCIAL SERVICE			
FREQUENCY	1,700	3,000	MC/S
DC PLATE-TO-GRID VOLTAGE	128	151.5	VOLTS
DC CATHODE-TO-GRID VOLTAGE	8	1.5	VOLTS
FROM A GRID RESISTOR	2,000	5,000	OHMS
DC PLATE CURRENT	25	29	mA
DC GRID CURRENT - APPROX.	4	0.3	mA
USEFUL POWER OUTPUT - APPROX.	475	50	mW

SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

VIBRATION TEST
GLASS SEAL FRACTURE TESTS
500 HOUR LIFE TEST IN OSCILLATOR

OUTLINE DRAWING



ALL DIMENSIONS IN INCHES

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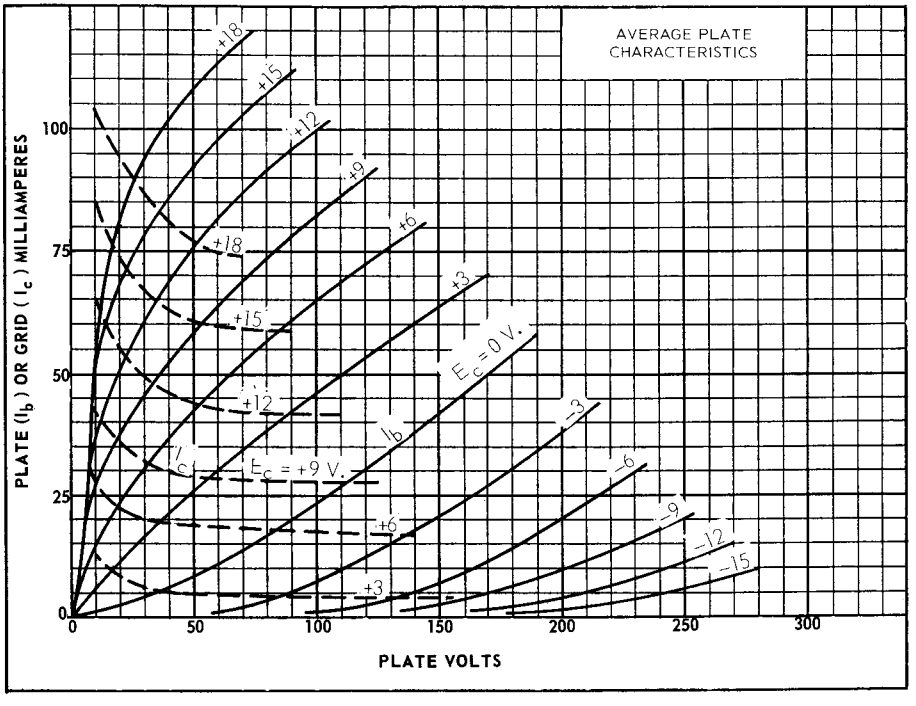
AVERAGE PLATE CHARACTERISTICS
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
0
50
100
150
200
250
300
+18
+15
+12
+9
+6
+3
E_c = 0 V.
I_b
I_c
E_c = +9 V.
-3
-6
-9
-12
-15

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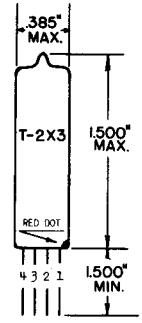
TRIODE

SUBMINIATURE TYPE



GLASS BULB

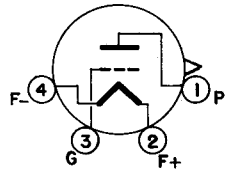
RED DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 120 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" SPACING CENTER-TO-CENTER

THE 5676 IS A SUBMINIATURE, FILAMENT TYPE, TRIODE. IT IS DESIGNED FOR SERVICE AS A HIGH FREQUENCY OSCILLATOR UP TO SEVERAL HUNDRED MEGACYCLES IN APPLICATIONS WHERE EXTREME COMPACTNESS MUST BE MAINTAINED. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITH CLOSE FITTING SHIELD CONNECTED TO LEAD #4

GRID TO PLATE	2.0	pf
GRID TO FILAMENT	1.3	pf
PLATE TO FILAMENT	4.0	pf

RATINGS

DESIGN CENTER VALUES

MAXIMUM PLATE VOLTAGE	135	VOLTS
MAXIMUM PLATE CURRENT	10	MA.

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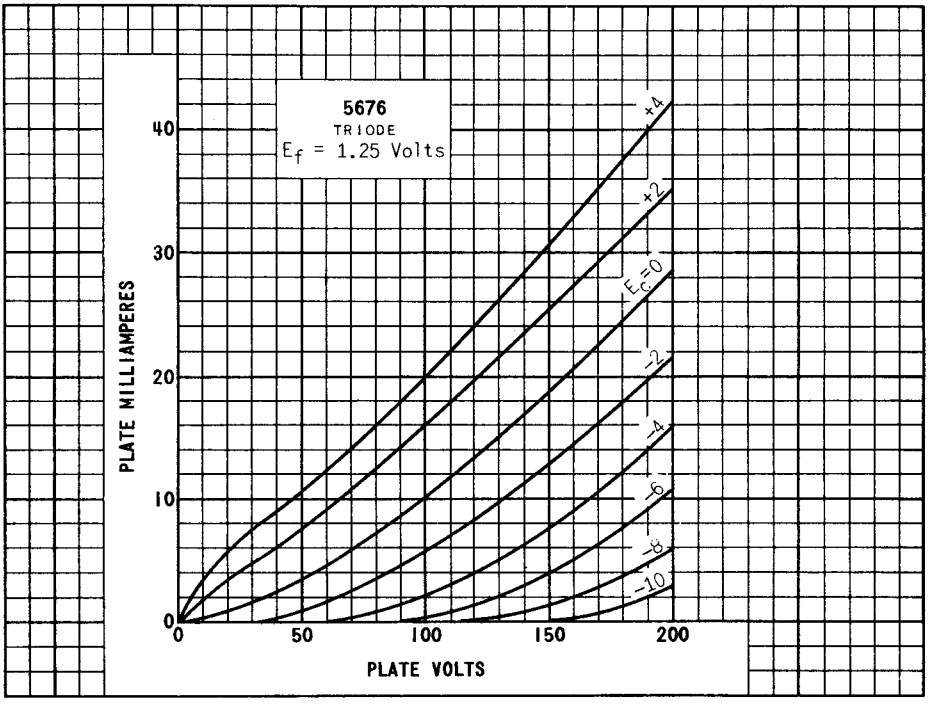
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	135	VOLTS
GRID VOLTAGE	−5	VOLTS
TRANSCONDUCTANCE	1 600	µMHOS
AMPLIFICATION FACTOR	15	
PLATE CURRENT	4.0	MA.

VHF OSCILLATOR

PLATE VOLTAGE	135	VOLTS
GRID LEAK	10 000	OHMS
GRID CURRENT	150 TO 500	µA.
PLATE CURRENT	9	MA.
FREQUENCY	100 TO 350	MC.



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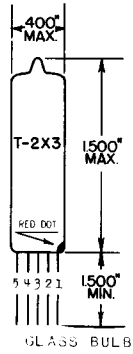
TUNG-SOL

PENTODE

SUBMINIATURE TYPE



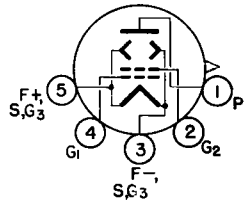
COLOR DOT IS ADJACENT TO LEAD 1

COATED FILAMENT

1.25 VOLTS 50 MA.

DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" SPACING CENTER-TO-CENTER

GRID #3 IS COMPRISED OF TWO SEPARATE BEAM PLATES, ONE OF WHICH IS CONNECTED TO LEAD #3 THE OTHER TO LEAD #5

THE 5678 IS A FILAMENT TYPE, SUBMINIATURE PENTODE DESIGNED FOR SERVICE IN RF APPLICATIONS REQUIRING ECONOMY OF SPACE, WEIGHT AND BATTERY DRAIN. A COATED METALLIC SHIELD IS USED AND CONNECTED TO LEAD #3. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE (MAX.)	0.01	pf
INPUT	3.3	pf
OUTPUT	3.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN-MAXIMUM SYSTEM

MAXIMUM PLATE VOLTAGE	90	VOLTS
MAXIMUM GRID #2 VOLTAGE	67.5	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	45	67.5	VOLTS
GRID #2 VOLTAGE	45	67.5	VOLTS
GRID #1 VOLTAGE[A]	0	0	VOLTS
PLATE RESISTANCE	1.2	1.0	MEGOHMS
TRANSCONDUCTANCE	820	1 100	μMHOS
PLATE CURRENT	0.8	1.8	MA.
GRID #2 CURRENT	0.22	0.48	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 μMHOS	-3	-4	VOLTS

[A] GRID RESISTOR = 5 MEGOHMS.

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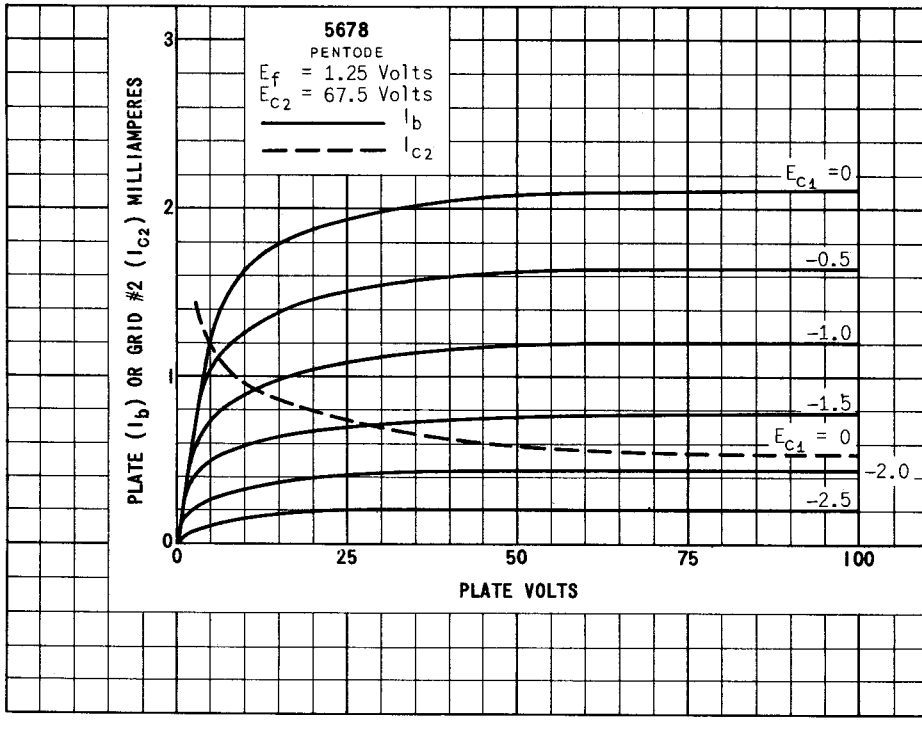

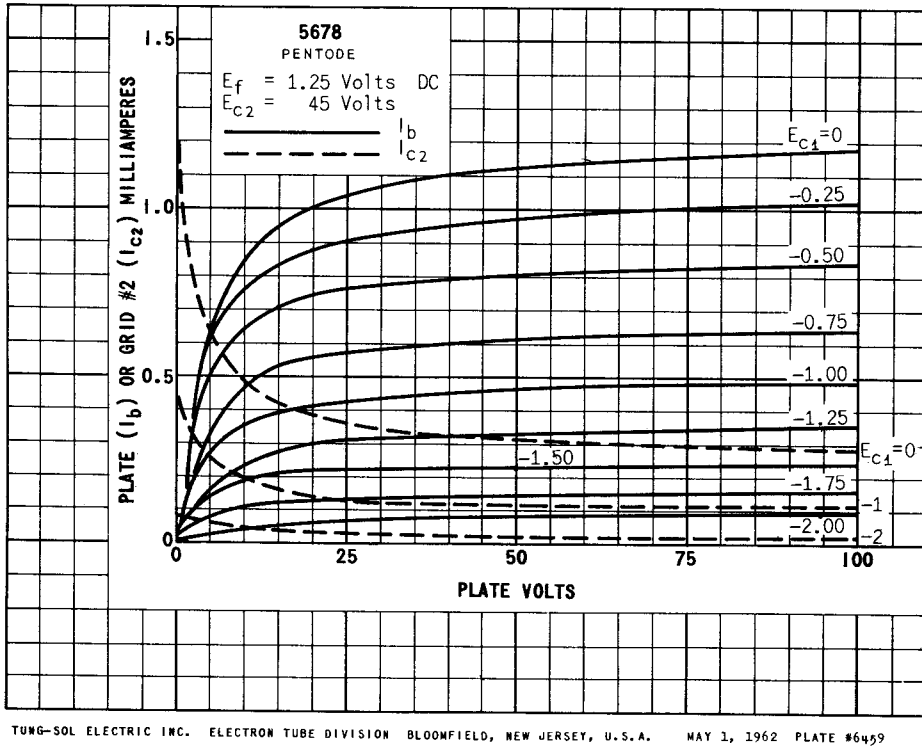

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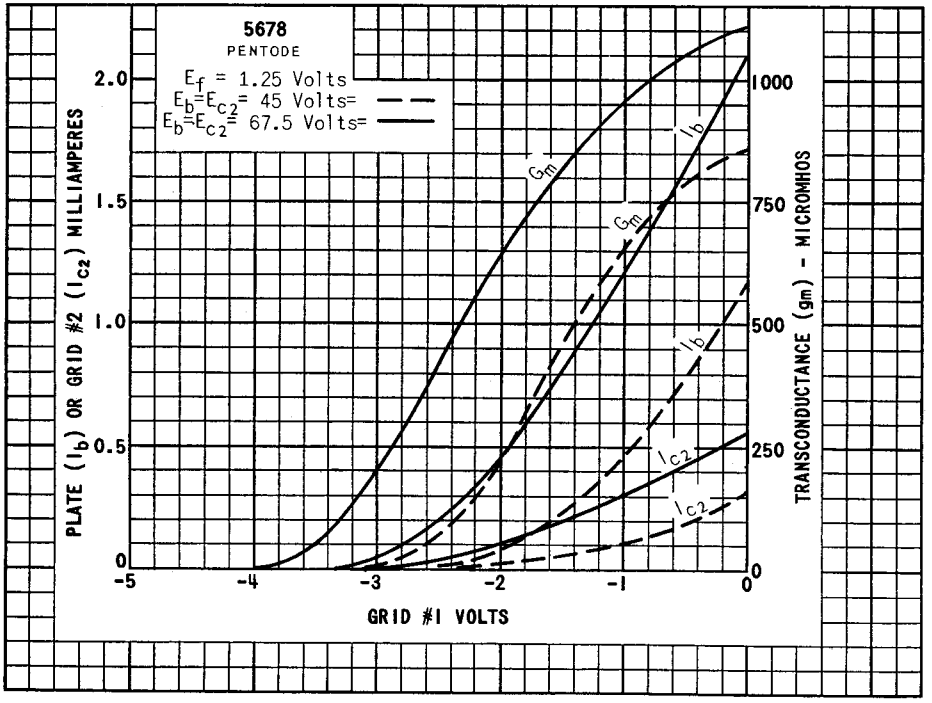
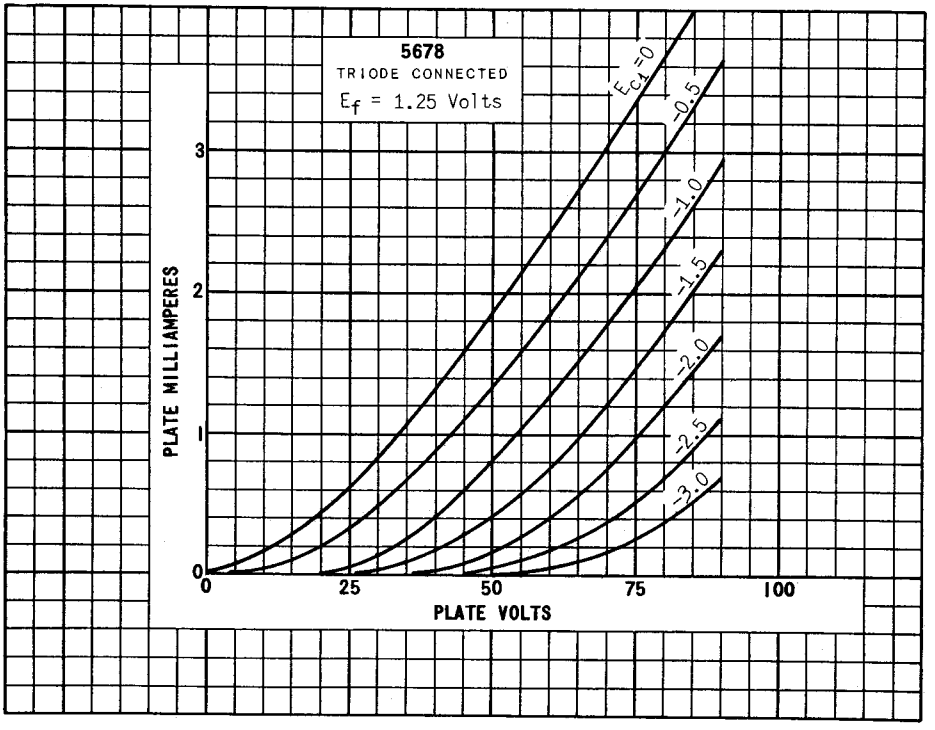
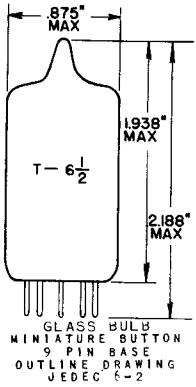

5678
PENTODE
E_f = 1.25 Volts
E_b=E_{c2}= 45 Volts=
E_b=E_{c2}= 67.5 Volts=
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS
GRID #1 VOLTS
Gm
I_b
I_{c2}
2.0
1.5
1.0
0.5
0
1000
750
500
250
-5
-4
-3
-2
-1


5678
TRIODE CONNECTED
E_f = 1.25 Volts
E_{c1}=0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
PLATE MILLIAMPERES
PLATE VOLTS
3
2
1
0
25
50
75
100

TUNG-SOL



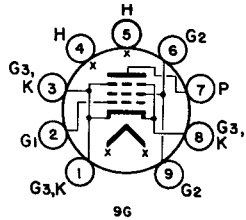
PENTODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 350 MA.
AC OR DC

ANY MOUNTING POSITION



9G

BOTTOM VIEW

BASING DIAGRAM
JEDEC 9G

THE 5686 IS A HEATER-CATHODE TYPE PENTODE POWER AMPLIFIER PARTICULARLY DESIGNED FOR DEPENDABLE OPERATION UNDER CONDITIONS USUALLY FOUND IN MOBILE AND AIRCRAFT APPLICATIONS. IT IS SUITABLE FOR CLASS A AUDIO POWER AMPLIFIER SERVICE OR FOR CLASS C RF POWER AMPLIFIER SERVICE UP TO 160 MC. MULTIPLE LEADS ON THE CATHODE AND SCREEN GRID, FACILITATE RF BYPASSING AT HIGH FREQUENCIES.

DIRECT INTERELECTRODE CAPACITANCES — APPROX.

	WITH SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.08	0.11	pf
INPUT	6.5	6.4	pf
OUTPUT	8.5	4.0	pf

RATINGS

CLASS A_1 AMPLIFIER — DESIGN CENTER VALUES

MAXIMUM PEAK HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

CLASS C RF AMPLIFIER — DESIGN CENTER VALUES

MAXIMUM PEAK HEATER CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID #2 VOLTAGE	250	VOLTS
MAXIMUM GRID #1 VOLTAGE	-150	VOLTS
MAXIMUM PLATE DISSIPATION	7.5	WATTS
MAXIMUM GRID #2 DISSIPATION	3.0	WATTS
MAXIMUM PLATE INPUT POWER	10	WATTS
MAXIMUM PLATE CURRENT	40	MA.
MAXIMUM GRID #2 CURRENT	15	MA.
MAXIMUM GRID #1 CURRENT	3	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	50 000	OHMS

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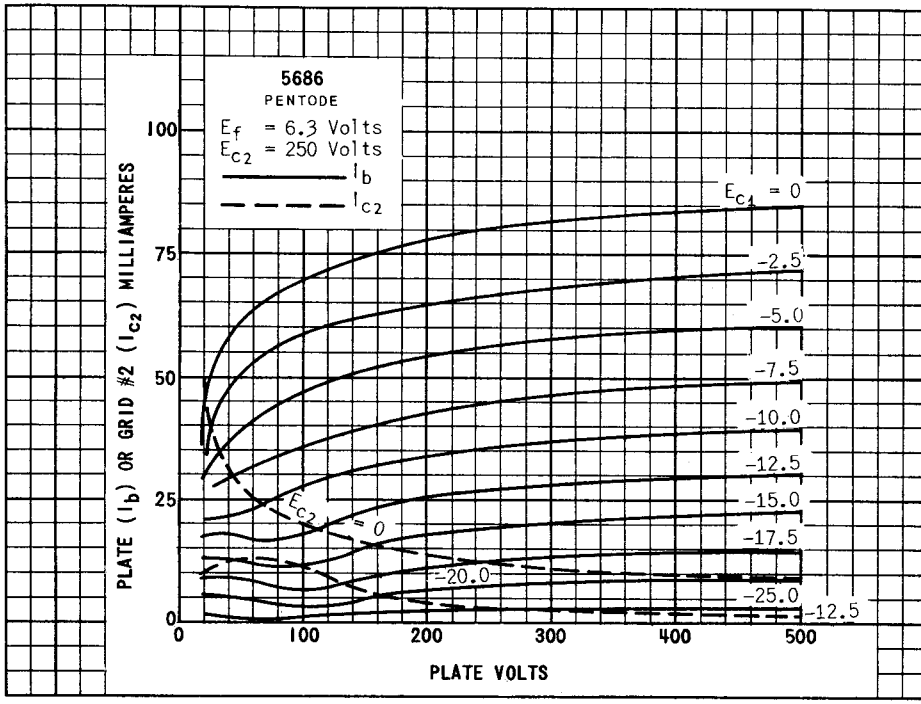
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

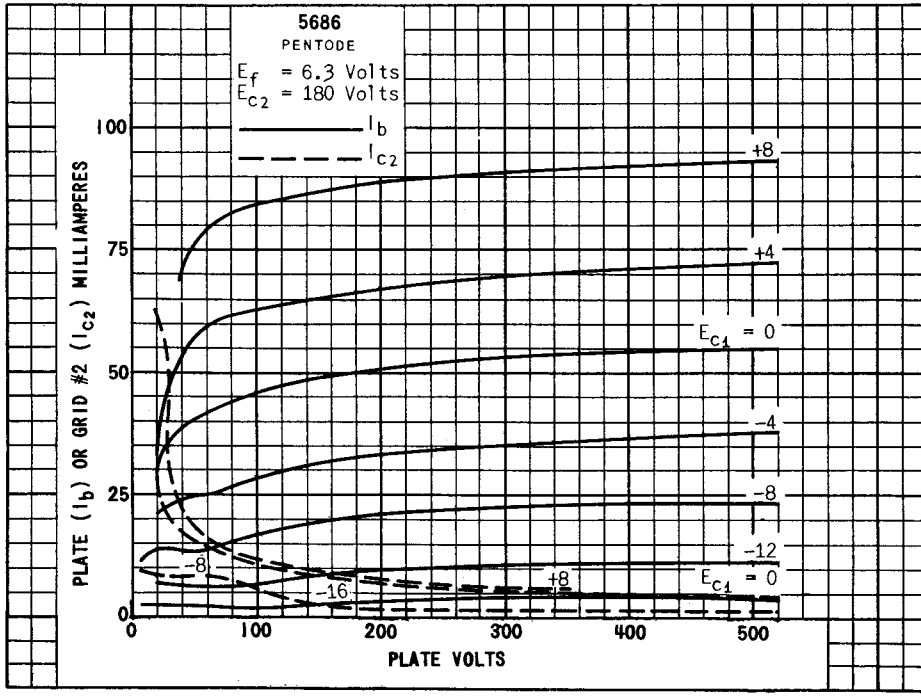
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-12.5	VOLTS
TRANSCONDUCTANCE	3 100	μMHOS
ZERO-SIGNAL PLATE CURRENT	27	MA.
ZERO-SIGNAL GRID #2 CURRENT	5.0	MA.
LOAD RESISTANCE	9 000	OHMS
POWER OUTPUT	2.7	WATTS

CLASS C RF AMPLIFIER UP TO 160 MC.

PLATE VOLTAGE	250	250	VOLTS
GRID #2 VOLTAGE	180	250	VOLTS
GRID #1 VOLTAGE	-30	-50	VOLTS
OR GRID #1 RESISTOR	15 000	25 000	OHMS
PEAK RF GRID #1 VOLTAGE	50	75	VOLTS
PLATE CURRENT	30	40	MA.
GRID #2 CURRENT (APPROX.)	6.5	10.5	MA.
GRID #1 CURRENT (APPROX.)	2.0	2.0	MA.
RF GRID DRIVING POWER (APPROX.)	5.0	6.5	MW.
USEFUL POWER OUTPUT AT 125 MC.	---	5.25	WATTS





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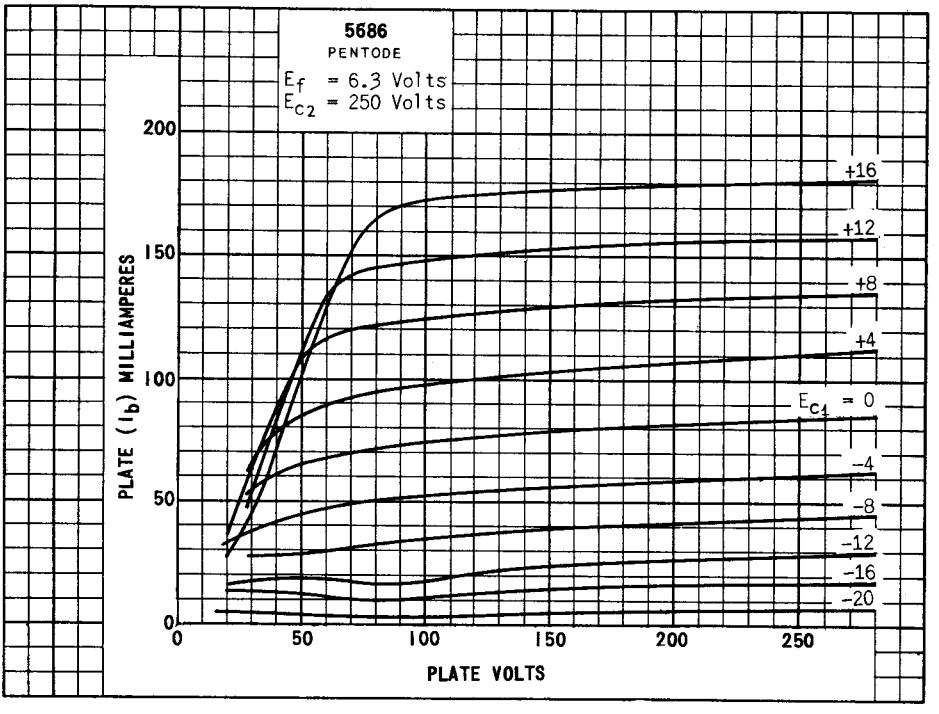
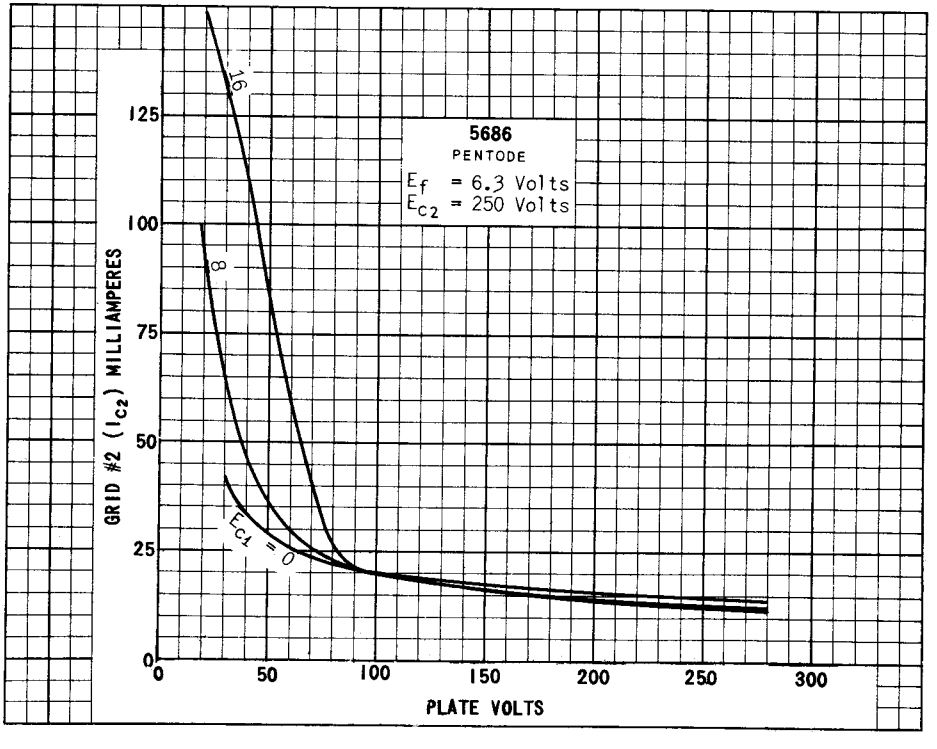
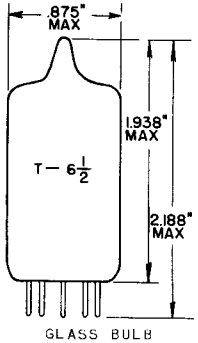

5686
PENTODE
E_f = 6.3 Volts
E_{c2} = 250 Volts
PLATE (I_b) MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
250
+16
+12
+8
+4
E_{c1} = 0
-4
-8
-12
-16
-20


5686
PENTODE
E_f = 6.3 Volts
E_{c2} = 250 Volts
GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
25
50
75
100
125
0
50
100
150
200
250
300
-16
-8
E_{c1} = 0

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

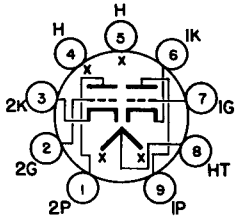
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
450 MA.	900 MA.

AC OR DC

ANY MOUNTING POSITION

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #8 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9H

THE 5687 IS A GENERAL PURPOSE MEDIUM-MU DOUBLE TRIODE USING THE 9 PIN BUTTON ALL-GLASS CONSTRUCTION. EACH TRIODE IS ELECTRICALLY INDEPENDENT ALTHOUGH THE TWO HEATERS HAVE A COMMON CONNECTION. THE TUBE IS CHARACTERIZED BY HIGH PERVEANCE AND HIGH EMISSION CAPABILITIES.

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

EACH TRIODE UNIT

GRID TO PLATE: (G TO P)	4.0	pf
GRID TO CATHODE: (G TO K+H)	4.0	pf
PLATE TO CATHODE: (P TO K+H)		
SECTION #1	0.6	pf
SECTION #2	0.5	pf
HEATER TO CATHODE: (H TO K)	7.0	pf
PLATE TO PLATE: (1P TO 2P) APPROX.	0.75	pf
GRID TO GRID: (1G TO 2G) APPROX.	0.025	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM HEATER-CATHODE VOLTAGE	90	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM INVERSE PLATE VOLTAGE	1000	VOLTS
MAXIMUM PLATE DISSIPATION (EACH UNIT)	4.2	WATTS
MAXIMUM TOTAL PLATE DISSIPATION (BOTH UNITS)	7.5	WATTS
MAXIMUM BULB TEMPERATURE (AT ANY PART OF ENVELOPE)	220	°C
MAXIMUM DC GRID CURRENT (EACH UNIT)	6	MA.
MAXIMUM EXTERNAL GRID CIRCUIT RESISTANCE (EACH UNIT)	1	MEGOHM

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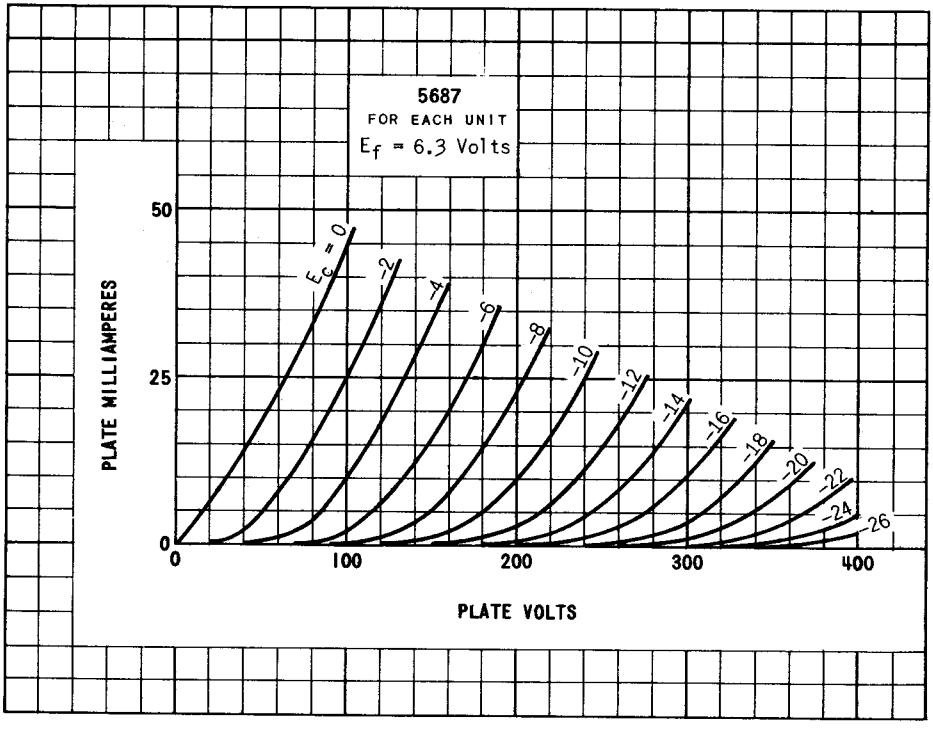
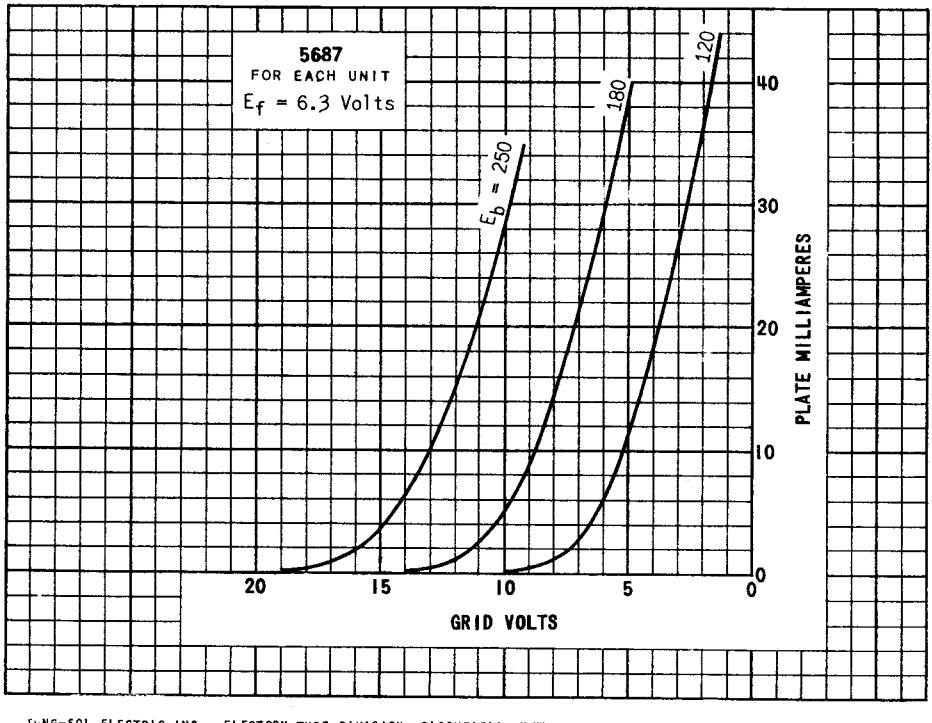
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

				VOLTS
				AMP.
PLATE VOLTAGE	120	180	250	VOLTS
GRID VOLTAGE	−2	−7	−12.5	VOLTS
PLATE CURRENT	36.0	23.0	12.0	MA.
PLATE RESISTANCE (APPROX.)	1 560	2 000	3 000	OHMS
TRANSCONDUCTANCE	11 500	8 500	5 400	µMHOS
AMPLIFICATION FACTOR	18.0	17.0	16.0	
GRID VOLTAGE FOR I_b = 100 µA. (APPROX.)	−9.0	−14.0	−19.0	VOLTS





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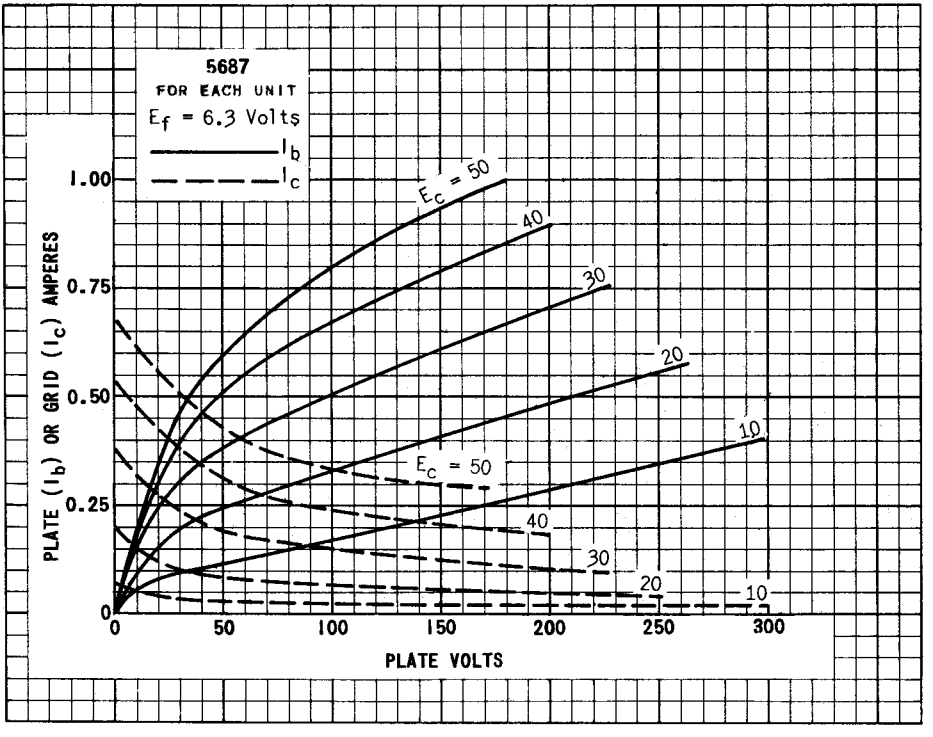
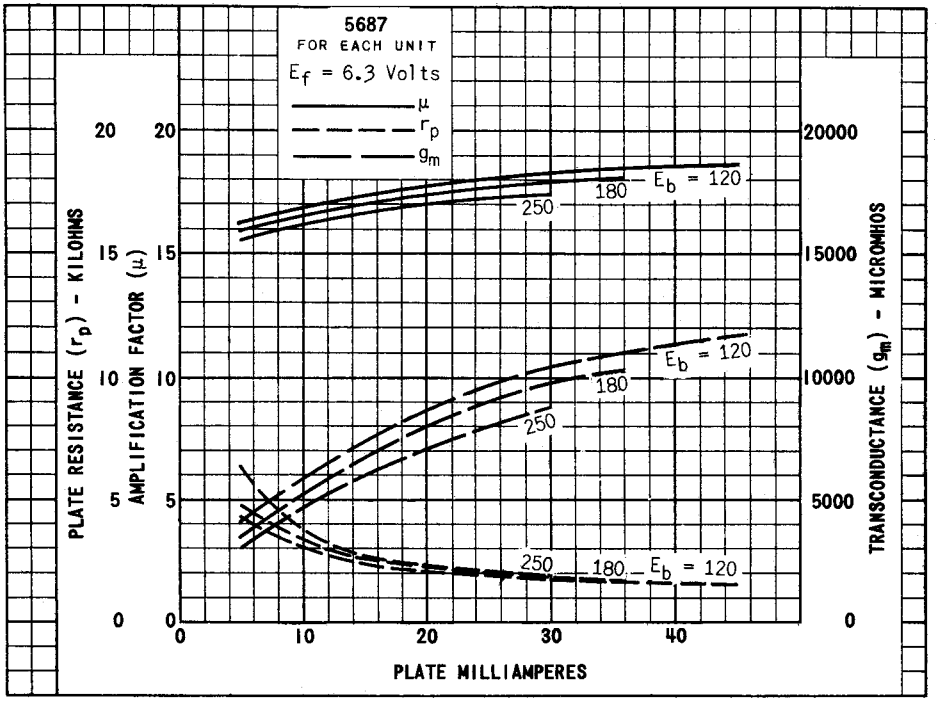
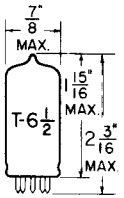

5687
FOR EACH UNIT
E_f = 6.3 Volts
I_b
I_c
PLATE (I_b) OR GRID (I_c) AMPERES
1.00
0.75
0.50
0.25
0
E_c = 50
40
30
20
10
0
50
100
150
200
250
300
PLATE VOLTS


5687
FOR EACH UNIT
E_f = 6.3 Volts
μ
r_p
g_m
PLATE RESISTANCE (r_p) - KILOHMS
AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (g_m) - MICROMHOS
20
15
10
5
0
20000
15000
10000
5000
0
E_b = 120
180
250
0
10
20
30
40
PLATE MILLIAMPERES

TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

COATED UNIPOTENTIAL CATHODE

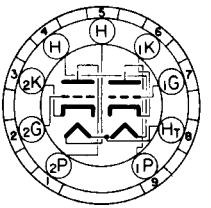
HEATER

6.3 VOLTS 0.9 AMP.
12.6 VOLTS 0.45 AMP.

AC OR DC

ANY MOUNTING POSITION

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #8 AND PINS #4 AND #5 TIED TOGETHER.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9H

THE 5687WA IS A RUGGEDIZED, GENERAL PURPOSE MEDIUM-MU TWIN TRIODE OF THE MINIATURE BUTTON 9-PIN ALL GLASS CONSTRUCTION. EACH TRIODE SECTION IS ELECTRICALLY INDEPENDENT, ALTHOUGH THE TWO HEATERS HAVE A COMMON CONNECTION PERMITTING EITHER A 6.3 OR 12.6 VOLT OPERATION. THIS TYPE HAS HIGH PERVEANCE AND HIGH EMISSION CAPABILITIES WHICH ALLOW VERY HIGH PLATE CURRENT PULSES IF A SUITABLE SHORT DUTY CYCLE IS EMPLOYED. THE CATHODE MATERIAL IS CHOSEN TO MINIMIZE INTERFACE FORMATION, THUS MAKING THE 5687WA IDEAL FOR TRIGGERED APPLICATIONS INVOLVING LONG PERIODS OF STAND-BY CUT-OFF SERVICE. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5687WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

EACH TRIODE UNIT

	WITHOUT SHIELD	
GRID TO PLATE (RATED)	4.0	μμf
GRID TO CATHODE (RATED)	4.0	μμf
PLATE TO CATHODE (RATED)		
SECTION #1	0.6	μμf
SECTION #2	0.5	μμf
HEATER TO CATHODE (RATED)	8.0	μμf
PLATE TO PLATE (APPROX.)	0.75	μμf
GRID TO GRID (APPROX.)	0.025	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	12.6±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM PLATE DISSIPATION, EACH PLATE[A]	4.2		WATTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	±100		VOLTS
MAXIMUM DC CATHODE CURRENT, EACH SECTION[B]	65		mAdc
MAXIMUM BULB TEMPERATURE	+225		°C

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 12.6V, E_b = 120Vdc, E_c = −2Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT (E_f = 6.3V)	0.82	0.94	---	---	0.80	0.96	AMP.
HEATER CATHODE LEAKAGE[C] (E_{hk}=±100Vdc)	---	±30	---	---	---	±50	μAdc
GRID CURRENT (1)[C] (R_g = 0.5MEG)	---	−1.5	---	---	---	−2.0	μAdc
PLATE CURRENT (1)	27	45	33	39	---	---	mAdc
INSULATION OF ELECTRODES (E_f=12.6V, E(g-all)= 300Vdc, E(g-neg., E(p-all)= 500 Vdc, P neg.)							
R(g-all)	100	---	---	---	50	---	MEGOHM
R(p-all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (2) (E_b=300Vdc, E_c=−20Vdc)	---	6.0	---	---	---	---	mAdc
PLATE CURRENT (3) (E_b=300Vdc, E_c=−25Vdc)	---	1.0	---	---	---	---	mAdc
TRANSCONDUCTANCE (2)[D]	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (E_f = 14.0V)	---	−5.0	---	---	---	---	μAdc
PLATE EMISSION[F] (E_b=195Vac, R_k/I_b= 10.5 mVdc, E_c = 0	---	25	---	---	---	---	μAdc
AMPLIFICATION FACTOR	16	21	---	---	---	---	
TRANSCONDUCTANCE (1)	---	---	10000	12000	6000	14000	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	15	PERCENT

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[G] (R_p=2,000)	---	100	mVac
VIBRATIONAL FATIGUE[H]	---	---	
SHOCK[J] (HAMMER ANGLE =24°, SHORT INDICATOR EMPLOYED)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER-CATHODE LEAKAGE	---	±50	μAdc
TRANSCONDUCTANCE (1)	6 000	---	μMHOS
GRID CURRENT (1)	−3.0	---	μAdc
GLASS STRAIN[K]	---	---	
CONTINUITY AND SHORT[L]	---	---	
AF NOISE[MNPQ] (E_f=12.6Vdc, E_{bb}=300Vdc, E_c=0, E_{cal}=70mVac)	---	17	VU
LOW FREQUENCY VIBRATION[RC] (R_p=2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[S] (PRESSURE = 55±5 mm mercury, TEMP.=25±5°C) HUMIDITY=0, VOLTAGE = 500Vac, 60 CYCLES, SINUSOIDAL WAVE FORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
SURVIVAL RATE LIFE TEST END POINTS PLATE CURRENT (1)	---	45	mAdc

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SPECIAL REQUIREMENTS -CONT'D.

	MIN.	MAX.	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_b=E_c=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS [T] HEATER-CATHODE LEAKAGE	---	±30	μAdc
INTERMITTENT LIFE TEST [P] (E_{hk}=135Vdc, HEATER POSITIVE, R_g=1.0 MEG., E_c=0, MIN. BULB TEMP. =+225°C, R_k=68 OHMS)	---	---	

NOTES

[A] MAXIMUM TOTAL DISSIPATION FOR BOTH SECTIONS SHALL BE 7.5 WATTS.

[B] R_g MAX. 1.0 MEG WITH CATHODE BIAS; 0.1 MEGOHM WITH FIXED BIAS.

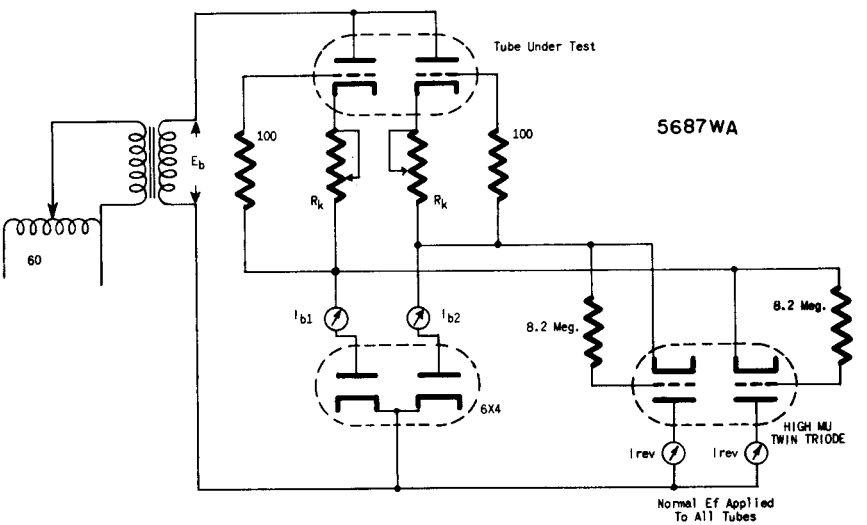
[C] TIE 1_p TO 2_p, 1_g TO 2_g, 1_k TO 2_k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.)

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 12.6)-(\text{SM AT } 11.4)}{(\text{SM AT } 12.6)} \times 100$$

[E] PRIOR TO THIS TEST TUBES SHALL BE PREHEATED AT FOLLOWING CONDITIONS AND TESTED IMMEDIATELY AFTER PREHEATING. E_f=14.0V, E_{c1}=-2Vdc, R_k=0 OHM, E_b=120Vdc, R_g=1.0 MEG.

[F] TIE GRIDS TO NEGATIVE END OF INDIVIDUAL Rk THRU INDIVIDUAL 100 OHM RESISTORS. ADJUST INDIVIDUAL Rk FOR SPECIFIED FORWARD PLATE CURRENT ±5% AS MEASURED ON THE FORWARD HALF CYCLE OF PLATE VOLTAGE. AFTER A MINIMUM OF 5 MINUTES OPERATION AS ABOVE, IMMEDIATELY MEASURE REVERSE PLATE CURRENT ON THE REVERSE HALF CYCLE OF PLATE VOLTAGE.



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NOTES -CONT'D.

G SEE MIL-E-1C 4.9.20.3

H SEE MIL-E-1C 4.9.20.6

J SEE MIL-E-1C 4.9.20.5

K GLASS STRAIN TEST SHALL CONSIST OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0° ±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER 15 TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. TUBES SHALL BE REJECTED FOR EVIDENCE OF AIR LEAK.

L SEE MIL-E-1C 4.7.5

M SEE MIL-E-1C 4.10.3.2

N THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

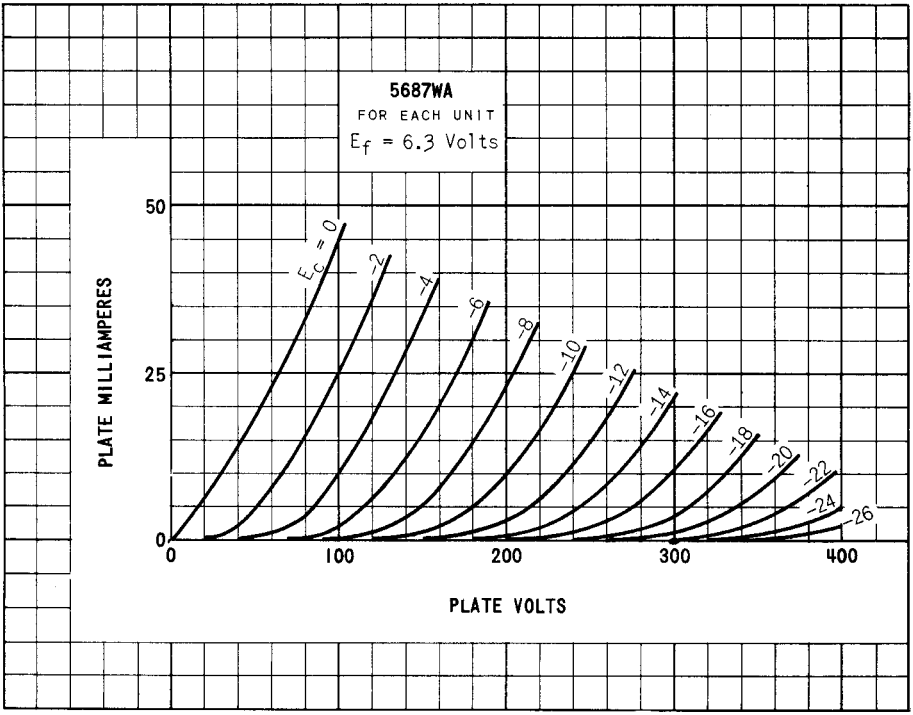
P R_p=2000 OHMS. $E_{c.a.}$=70mV FOR 17VU METER DEFLECTION INITIALLY. PARAGRAPH 4.10.3.2 OF MIL-E-1C IS AMMENDED AS FOLLOWS: THE FIFTH SENTENCE SHALL READ: THE GAIN OF THE POWER AMPLIFIER (SEE FIGURE 30) SHALL BE ADJUSTED BY REMOVING THE TUBE FROM THE SOCKET AND INTRODUCING THE SPECIFIED CALIBRATING VOLTAGE (SINE WAVE) THRU A CAPACITOR AND NOT MORE THAN 100 OHMS AT THE CALIBRATING FREQUENCY. THE POWER AMPLIFIER GAIN SHALL BE ADJUSTED FOR POWER OUTPUT LEVEL OF 17VU, (50MW).

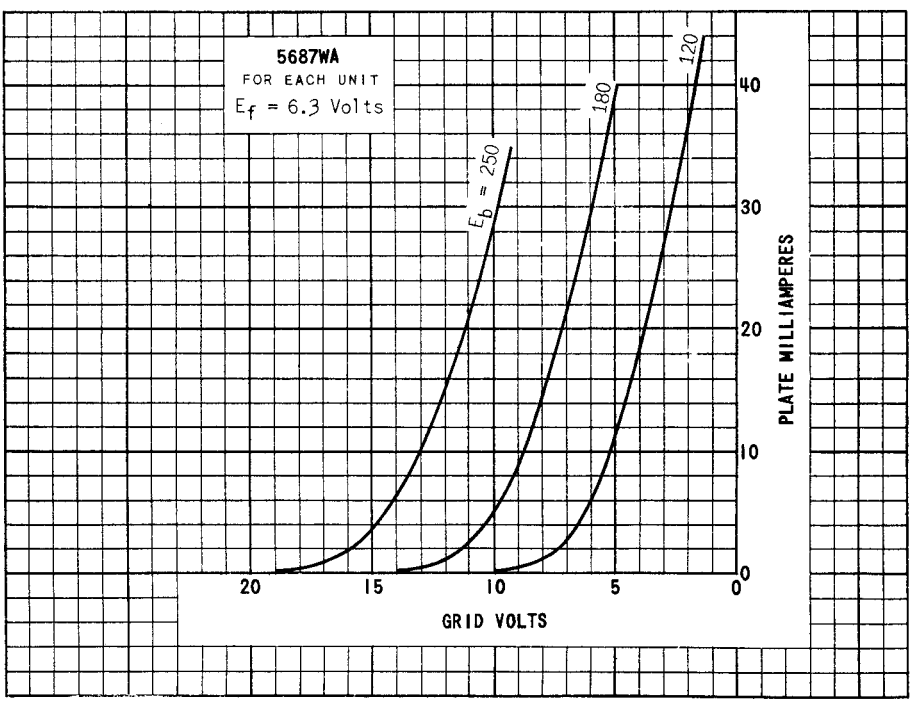
Q TIE PLATES TOGETHER. TIE GRIDS TOGETHER AND TO GROUND THRU A 1.0 MEG. RESISTOR. TIE CATHODES TOGETHER AND TO GROUND THRU A 680 OHM RESISTOR.

R SEE MIL-E-1C 4.9.20.4

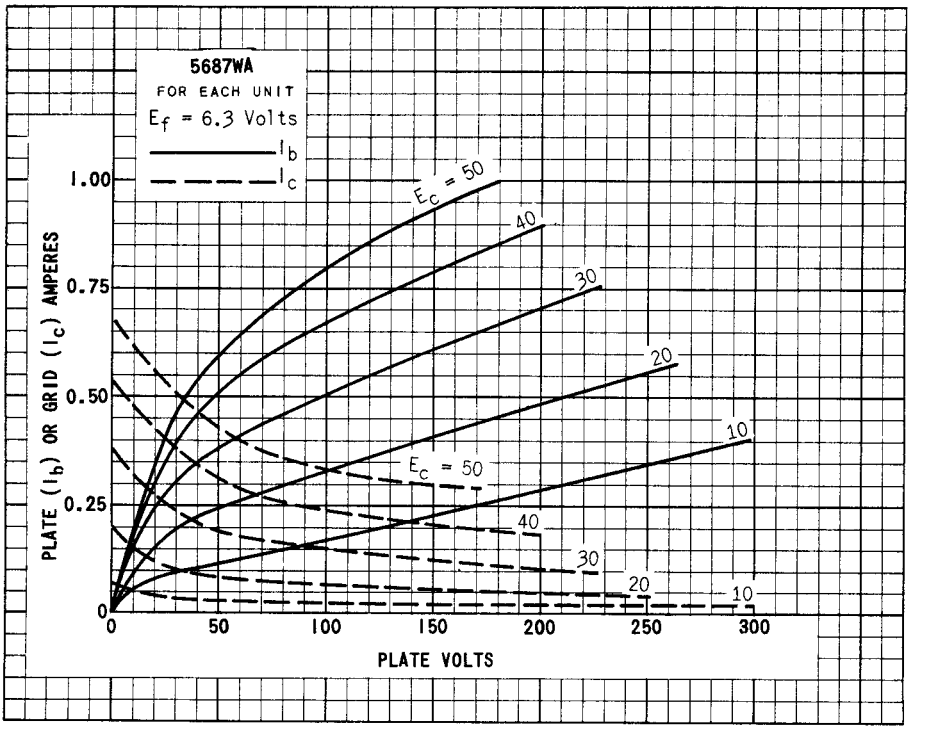
S BREAKDWON SHALL BE DEFINED AS THAT VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

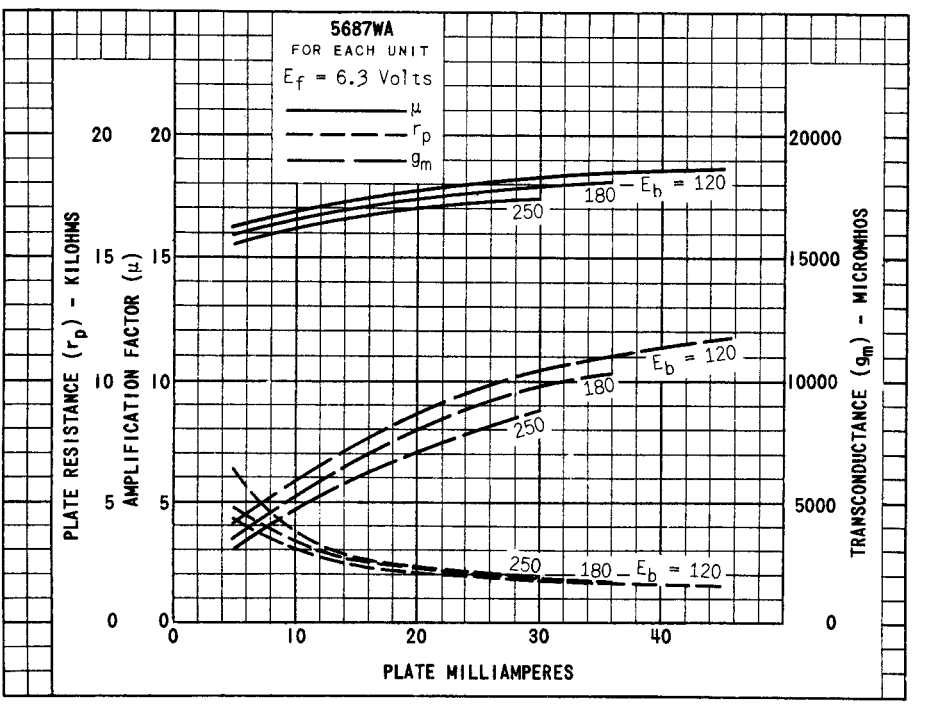
T AT THE CONCLUSION OF THE HEATER CYCLING LIFE TEST, A TEST SHALL BE MADE TO DETERMINE CATHODE CONTINUITY. A TUBE WHICH FAILS THE CATHODE CONTINUITY TEST SHALL BE CONSIDERED A DEFECTIVE TUBE FOR THE HEATER CYCLING LIFE TEST.


5687WA
FOR EACH UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
50
25
0
E_c = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
0
100
200
300
400
PLATE VOLTS


5687WA
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250
180
120
40
30
20
10
0
PLATE MILLIAMPERES
20
15
10
5
0
GRID VOLTS

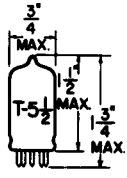
5687WA
PREMIUM TUBE





TUNG-SOL

THYRATRON
MINIATURE TYPE



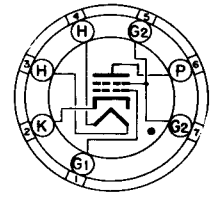
GLASS BULB

HEATER

6.3±10% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BN

THE 5696 IS A XENON FILLED, FOUR ELECTRODE THYRATRON WITH NEGATIVE CONTROL CHARACTERISTICS. IT HAS FOUND WIDE USAGE AS A SWITCHING TUBE, AND IN GRID CONTROLLED RECTIFIER SERVICE. BECAUSE OF ITS SHIELD GRID CONSTRUCTION, THE INPUT OF THE 5696 WILL WORK DIRECTELY FROM A HIGH IMPEDANCE SOURCE SUCH AS A PHOTOTUBE. THE EFFECTIVE ANODE TO CONTROL GRID CAPACITY MAY BE REDUCED BY CONNECTING PINS #5 & 7 TO #2 AND CONNECTING THE GRID RESISTOR DIRECTLY AT THE SOCKET TERMINAL. THE SMALL SIZE AND LIGHT WEIGHT OF THE 5696 AND ITS RELATIVE FREEDOM FROM TEMPERATURE RESTRICTIONS MAKE THIS TUBE PARTICULARLY SUITED FOR USE IN COMPACT EQUIPMENT.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 VOLTS)	0.15	AMPS.
MINIMUM CATHODE HEATING TIME	10.	SECONDS
ANODE TO CONTROL GRID CAPACITANCE	0.03	μμf
CONTROL GRID TO CATHODE (& SHIELD GRID) CAPACITANCE	1.8	μμf
DE-IONIZATION TIME, APPROX. (SHIELD TIED TO CATHODE)		
WITH GRID VOLTS =-100, GRID RES. =1000 Ω		
ANODE VOLTS =500 ANODE CUR. .025 AMPS	25	μSEC.
WITH GRID VOLTS =-15 GRID RES. = 1000 Ω		
ANODE VOLTS =500 ANODE CUR. .025 AMPS	40	μSEC.
IONIZATION TIME (APPROX.)	0.5	μSEC.
ANODE VOLTAGE DROP (APPROX.)	10	VOLTS
MAXIMUM CRITICAL GRID CURRENT (AT E_{bb} = 350 V.RMS)	0.5	μAMPS.

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	1.75	INCHES
MAXIMUM SEATED LENGTH	1.50	INCHES
MAXIMUM DIAMETER	0.75	INCHES
BULB	T-5 1/2	
BASE	MINIATURE BUTTON 7 PIN	
WEIGHT (NET)	0.3	OUNCES

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

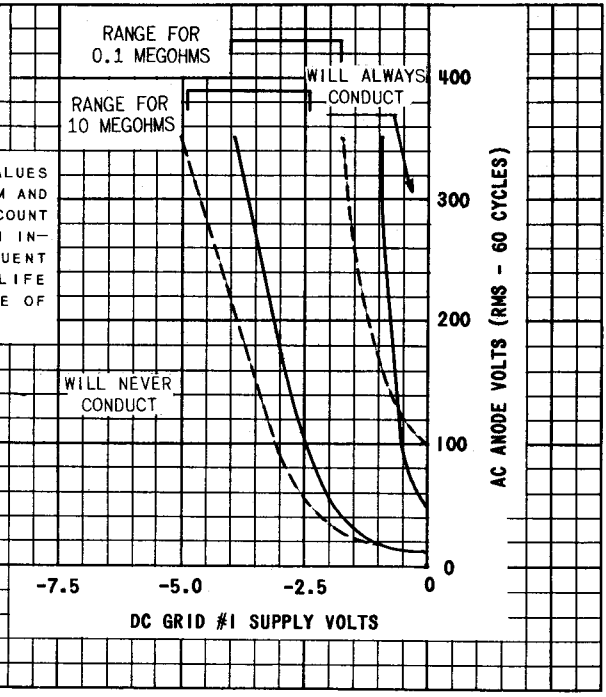
RATINGS
ABSOLUTE VALUES

MAXIMUM PEAK ANODE VOLTAGE		
INVERSE	500	VOLTS
FORWARD	500	VOLTS
MAXIMUM CATHODE CURRENT		
PEAK	100	MA.
AVERAGE	25	MA.
SURGE (MAX. DURATION 0.1 SECONDS)	2.0	AMP.
MAXIMUM AVERAGE TIME	30	SECONDS
MAXIMUM NEGATIVE CONTROL GRID VOLTAGE		
BEFORE CONDUCTION	−100	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	−10	VOLTS
MAXIMUM POSITIVE CONTROL GRID CURRENT		
AVERAGE	5	MA.
MAXIMUM NEGATIVE SHIELD GRID VOLTAGE		
BEFORE CONDUCTION	−50	VOLTS
DURING CONDUCTION (AVERAGED OVER 30 SEC. MAX.)	−10	VOLTS
MAXIMUM POSITIVE SHIELD GRID CURRENT		
AVERAGE	5	MA.
MAXIMUM HEATER CATHODE VOLTAGE		
HEATER NEGATIVE	−100	VOLTS
HEATER POSITIVE	25	VOLTS
AMBIENT TEMPERATURE LIMITS	−75 TO 90	°C
MAXIMUM CONTROL GRID (G1) CIRCUIT RESISTANCE	10	MEGOHMS

5696

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

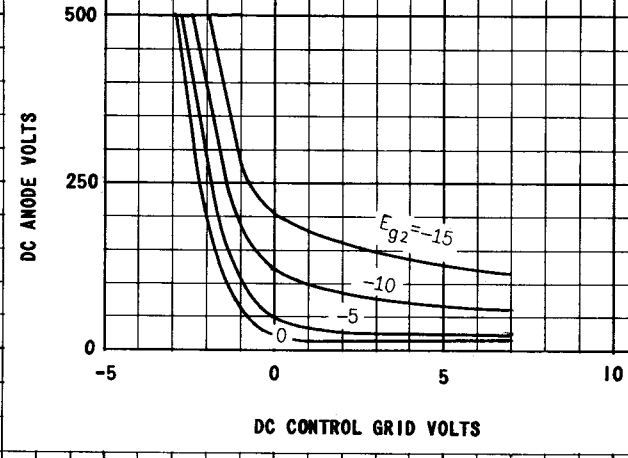
RANGES SHOWN ARE FOR TWO VALUES OF GRID RESISTOR, 0.1 MEGOHM AND 10 MEGOHM, AND TAKE INTO ACCOUNT INITIAL DIFFERENCES BETWEEN INDIVIDUAL TUBES AND SUBSEQUENT DIFFERENCES DURING TUBE LIFE FOR A HEATER VOLTAGE RANGE OF 5.7 TO 6.9 VOLTS.



5696

AVERAGE CONTROL CHARACTERISTICS

R_{g1} = 0.1 Megohms
R_{g2} = 0 Ohms



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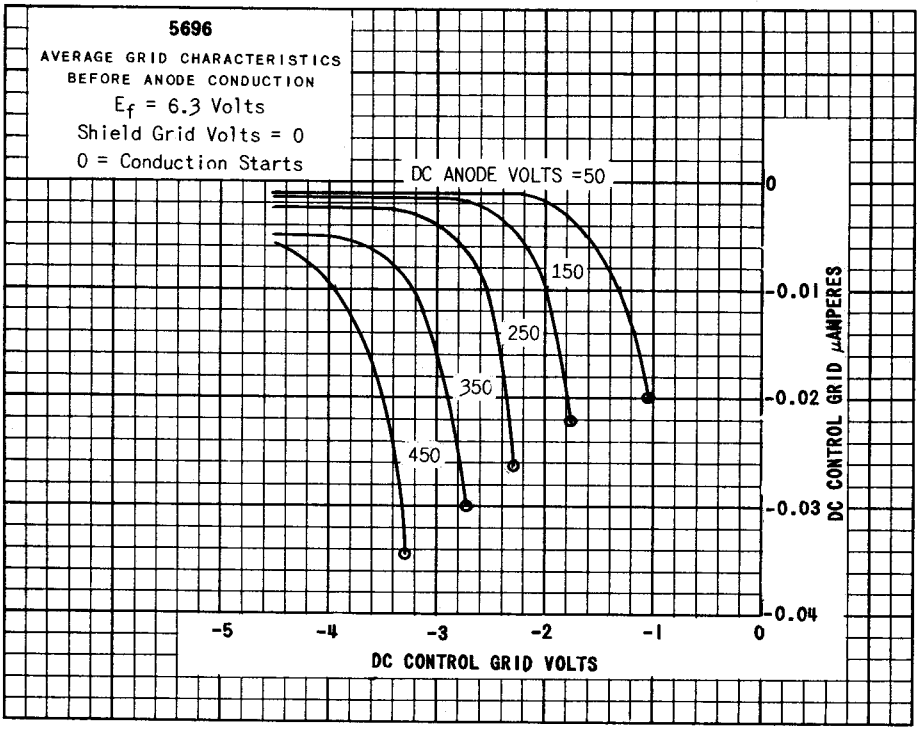
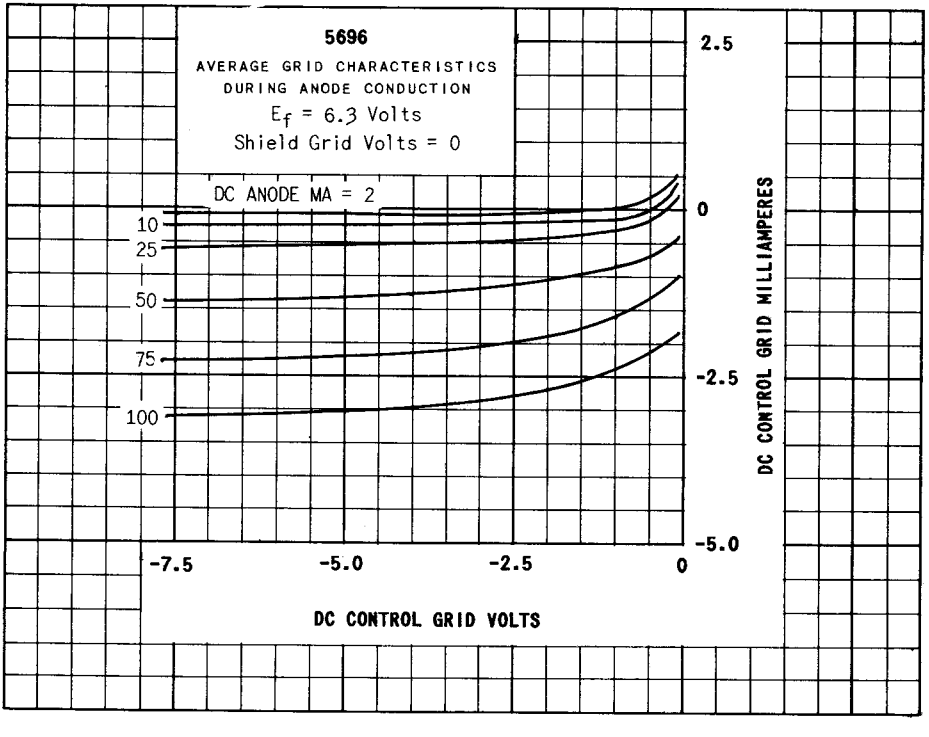
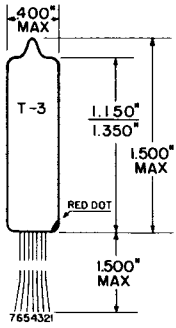

5696
AVERAGE GRID CHARACTERISTICS
BEFORE ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts = 0
0 = Conduction Starts
DC ANODE VOLTS =50
150
250
350
450
0
-0.01
-0.02
-0.03
-0.04
DC CONTROL GRID μAMPERES
-5
-4
-3
-2
-1
0
DC CONTROL GRID VOLTS


5696
AVERAGE GRID CHARACTERISTICS
DURING ANODE CONDUCTION
E_f = 6.3 Volts
Shield Grid Volts = 0
DC ANODE MA = 2
10
25
50
75
100
2.5
0
-2.5
-5.0
DC CONTROL GRID MILLIAMPERES
-7.5
-5.0
-2.5
0
DC CONTROL GRID VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

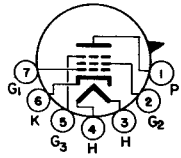


GLASS BULB

OUTLINE DRAWING
→ JEDEC 3-6

HEATER
6.3 VOLTS 0.20 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS
LENGTH: 1.5" MIN.
SPACING: 0.048"
CENTER-TO-CENTER
IN LINE

THE 5702 WA IS A HEATER-CATHODE TYPE SHARP-CUTOFF PENTODE DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED, CAPABLE OF OPERATION IN THE VHF REGION. A SEPARATE TERMINAL CONNECTION IS PROVIDED FOR GRID #3, WHICH UNDER SELF-BIAS CONDITIONS CAN BE CONNECTED DIRECTLY TO GROUND, PERMITTING THE CATHODE BY-PASS CAPACITOR TO BE OMITTED FOR LOWER GRID LOADING. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD INLINE SUBMINATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST #3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST #4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST #5)	2.5	G
MAXIMUM BULB TEMPERATURE	265	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	ABS. MIN.	NORMAL TEST COND. (NOTE 7)	NORMAL OPER. (NOTE 6)	ABS. MAX.	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE[8]	Ef:	5.7	6.3	6.3	6.9	---	V
PLATE VOLTAGE	Eb:	---	120	120	165	---	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	---	Vdc
GRID #2 VOLTAGE	Ec2:	---	120	120	155	---	Vdc
GRID #3 VOLTAGE	Ec3:	---	0	0	0	---	Vdc
PLATE DISSIPATION	Pp:	---	---	0.9	---	1.10	W
GRID #2 DISSIPATION	Pg2:	---	---	0.3	---	0.40	W
GRID #1 CIRCUIT RES.	Rg1	---	---	1.0	1.2	---	Meg
HEATER-CATHODE VOLT.	Ehk:	-200	---	100	+200	---	V
CATHODE CURRENT	Ik:	---	---	---	16.5	---	mAdc
CATHODE RESISTANCE	Rk:	---	200	200	---	---	OHMS
PLATE CURRENT (1)	Ib:	---	---	7.5	---	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.6	---	---	mAdc
TRANSCONDUCTANCE (1):	Sm(1):	---	---	5000	---	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.34	---	---	Meg.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOGIE	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0% EXCLUDING MECH. & INOPERATIVES					
HEATER CURRENT:	0.65	If:	183	192	200	mA
HEATER-CATHODE LEAKAGE: Ehk=+100 VDC, Ehk=-100VDC	0.65	Ihk:	---	---	---	μAdc
GRID CURRENT (1): Rg1=1.0 MEG.	0.65	Ic1(1):	---	---	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	5.5	6.7	7.5	mAdc
PLATE CURRENT (2): Ec1=-9.0 VDC , Rk=0	0.65	Ib(2):	---	---	---	μAdc
SCREEN CURRENT:	0.65	Ic2:	1.7	---	2.6	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	4200	4700	5000	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---

(CONT'D FROM ABOVE)	AQL %	MIL-E-1 SYMBOL	UAL	MAX.	ALD	MIL-E-1 UNITS
HEATER CURRENT:	0.65	If:	208	217	16	mA
HEATER-CATHODE LEAKAGE: Ehk=+100 VDC, Ehk=-100VDC	0.65	Ihk:	---	5	---	μAdc
GRID CURRENT (1): Rg1=1.0 MEG.	0.65	Ic1(1):	---	-0.1	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	8.3	9.5	2.3	mAdc
PLATE CURRENT (2): Ec1=-9.0 VDC, Rk=0	0.65	Ib(2):	---	50	---	μAdc
SCREEN CURRENT:	0.65	Ic2:	---	3.5	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	5300	5800	900	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---
MECHANICAL: ENVELOPE (8-7)						

	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOGIE	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TEST PART 2	COMBINED AQL=1.0% EXCLUDING MECH. & INOPERATIVES					
INSULATION OF ELECTRODES: (Ef=6.3V, Eg-all=-100 Vdc	2.5	Rg1-all	100	---	---	MEG.
(Ep-all=-300 Vdc		Rp-all	100	---	---	MEG.
TRANSCONDUCTANCE (2): Ef=5.5 V (NOTE 9)	2.5	ΔEfSm(2):	---	---	---	PERCENT
GRID EMISSION: Ef=7.5 V; Rg1=1.0 MEG.; PREHEAT 5 MIN. AT Ec1=0; TEST AT Ec1=-10Vdc	6.5	Ic(2):	---	---	---	μAdc
AF NOISE: Esig= 70mVac; Ec2=25 Vdc; Rg1=0.1 MEG. ;Rg2=1000 OHMS; Rp=0.2 MEG. ; Ck=1000 μf; Rk=4000 OHMS	2.5	EB:	---	---	---	VU

→INDICATES A CHANGE.

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CHARACTERISTICS AND QUALITY CONTROL TESTS -cont'd.[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOGIE	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TEST PART 2 (CONT'D)	COMBINED AQL= 1.0% EXCLUDING MECH. & INOPERATIVES					
PLATE RESISTANCE:	6.5	rp:	0.15	---	---	MEG.
CAPACITANCE:	6.5	Cgp:	---	---	---	μμf
CAPACITANCE: (NOTE 2)		Cin:	4.1	4.4	4.8	μμf
CAPACITANCE:		Cout:	2.9	3.1	3.5	μμf
LOW PRESSURE VOLT. BREAKDOWN PRESSURE =55±5mmHg; VOLTAGE = 300 Vac	6.5	----	---	---	---	----
VIBRATION (2): F=40cps; G=15; Rp=10,000 OHMS	2.5	Ep:	--	---	---	mVac

(CONT'D FROM ABOVE)	AQL %	MIL-E-1 SYMBOL	UAL	MAX.	ALD	MIL-E-1 UNITS
INSULATION OF ELECTRODES: Ef=6.3V; Eg-all=-100 Vdc; Ep-all=-300 Vdc	2.5	Rg1-all:	---	---	---	MEG.
		Rp-all	---	---	---	MEG.
TRANSCONDUCTANCE (2): Ef=5.5 V (NOTE 9)	2.5	ΔEfSm(2):	---	10	---	PERCENT
GRID EMISSION: Ef=7.5V; Rg1=1.0 MEG.; PREHEAT 5 MIN. AT Ec1=0; TEST AT Ec1=-10Vdc	6.5	ic(2):	---	-0.5	---	μAdc
AF NOISE: Esig=70mVac: Ec2=25Vdc; Rg1=0.1 MEG;Rg2=1000 OHMS; Rp=0.2 MEG; Ck=1000 μf; Rk=4000 OHMS	2.5	EB:	---	17	---	VU
PLATE RESISTANCE:	6.5	rp:	---	---	---	MEG.
CAPACITANCE:	6.5	Cgp:	---	0.03	---	μμf
CAPACITANCE: (NOTE 2)		Cin:	5.2	5.5	0.83	μμf
CAPACITANCE:		Cout:	3.9	4.1	0.71	μμf
LOW PRESSURE VOLT. BREAKDOWN: PRESSURE=55±5mmHg: VOLTAGE=300 Vac	6.5	---	---	---	---	----
VIBRATION (2): F=40 cps; G=15; Rp=10,000 OHMS	2.5	Ep:	---	50	---	mVac

	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG.	UAL	MAX	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS								
SUBMINIATURE LEAD FATIGUE: SHOCK (1): Ehk=+100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE =30° (NOTE 3)	2.5	---	4.0	---	---	---	---	arcs
	20	---	---	---	---	---	---	----
FATIGUE (1): 96 HOURS; G=2.5; FIXED FREQUENCY; F=25 MIN. 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	----

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CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd. [1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.)					
POST SHOCK (1) AND FATIGUE TESTES (1)					
END POINTS:					
VIBRATION (2):					
F=40cps; G=15; Rp=10,000 OHMS	----	Ep:	---	100	mVac
HEATER-CATHODE LEAKAGE:					
Ehk=+100 Vdc , Ehk=-100 Vdc	---	Ihk:	---	20	μAdc
CHANGE IN TRANSCONDUCTANCE (1)					
OF INDIVIDUAL TUBES: Ef=6.3 V.	---	Δ_tSm(1):	---	20	PERCENT
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	----
ACCEPTANCE LIFE TESTS					
HEATER CYCLE:					
Ef=7.0 V; Eb=Ec1=Ec2=Ec3=0V;					
Ehk=140 Vac; 1MIN. ON, 1MIN. OFF	1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS:					
HEATER-CATHODE LEAKAGE:					
Ehk=±100 Vdc Ehk=-100 Vdc	---	Ihk:	---	20	μAdc
1HOUR STABILITY LIFE TEST:					
TA=ROOM; Ehk=+200;Vdc; Rg1=1.0 MEG.	---	---	---	---	----
1 HOUR STABILITY LIFE TEST END POINTS:					
CHANGE IN TRANSCONDUCTANCE					
(1) OF INDIVIDUAL TUBES:					
(TYPICAL SAMPLE SIZE=50 TUBES)	1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST:					
TA=ROOM; Ehk=+200 Vdc; Rg1=1.0 MEG.	---	---	---	---	----
100 HOUR SURVIVAL RATE LIFE TEST					
END POINTS:					
(TYPICAL SAMPLE SIZE 200 TUBES)	---	---	---	---	----
INOPERATIVES:	0.65	---	---	---	----
TRANSCONDUCTANCE (1):	1.0	Sm(1):	3800	---	μMHOS
INTERMITTENT HIGH TEMPERATURE					
LIFE TESTS:					
T BULB =265°C MIN; Ehk=+ 200 Vdc;					
Rg1=1.0 MEG.	---	---	---	---	----
500 HOUR INTERMITTENT HIGH					
TEMPERATURE LIFE TEST END POINTS:					
(TYPICAL SAMPLE SIZE=20 TUBES 1st SAMPLE;					
40 TUBES 2nd SAMPLE)	---	---	---	---	----
INOPERATIVES: [A]	---	---	---	---	----
GRID CURRENT (1): [B]	---	Ic(1):	---	-0.5	μAdc
HEATER CURRENT: [C]	---	If:	180	220	mA
CHANGE IN TRANSCONDUCTANCE [D]					
(1) OF INDIVIDUAL TUBES:	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9) [F]	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE: [E]					
Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	10	μAdc
INSULATION OF ELECTRODES: G					
g1-all	---	Rg1-all:	50	---	MEG.
p-all		Rp-all:	50	---	MEG.

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd. [1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (cont'd.)					
TRANSCONDUCTANCE (1) AVG. CHANGE [H]	---	$Avg\Delta_t Sm(1)$:	---	15	PERCENT
TOTAL DEFECTIVES: [J]	---	---	---	---	----
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: [K] (TYPICAL SAMPLE SIZE=20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	----
INOPERATIVES: [L]	---	---	---	---	----
GRID CURRENT (1): [M]	---	Ic(1):	0	-1.0	μAdc
HEATER CURRENT: [N]	---	If:	177	223	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: [P]	---	$\Delta_t Sm(1)$:	---	30	PERCENT
HEATER - CATHODE LEAKAGE: [Q] Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	15	μAdc
TOTAL DEFECTIVES [R]	---	---	---	---	----

ALLOWABLE DEFECTS PER CHARACTERISTIC

NOTE:	1st SAMPLE	COMBINED SAMPLES
A	1	3
B	1	3
C	1	3
D	1	3
E	2	5
F	2	5
G	2	5
H	---	---
J	4	8
K	---	---
L	2	5
M	2	5
N	2	5
P	2	5
Q	2	5
R	5	10

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NOTES

NOTE 1 CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1 "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES" AND MIL-STD-105A.

NOTE 2 WITH A CYLINDRICAL SHIELD (0.405" I.D.–17/8" LONG) CONNECTED TO LEAD 6.

NOTE 3 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATION.

NOTE 4 CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

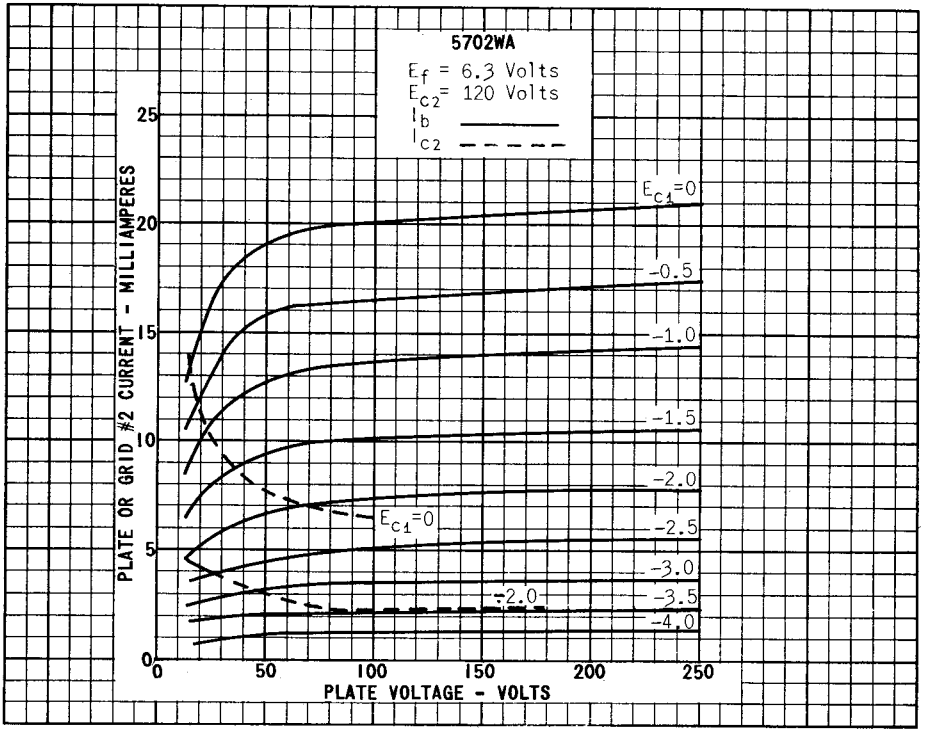
NOTE 5 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

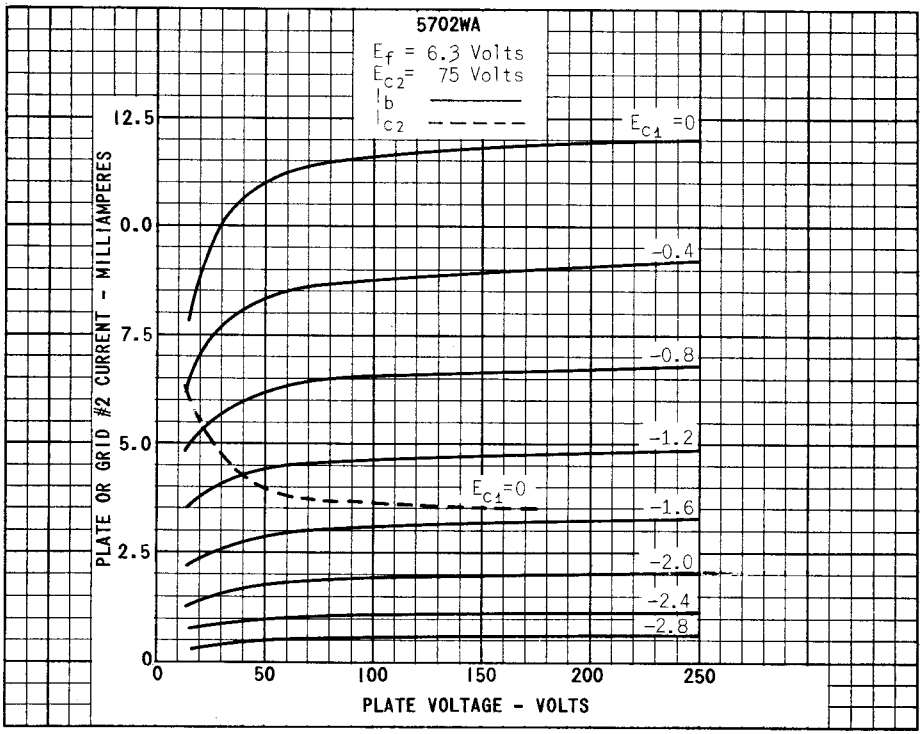
NOTE 6 THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

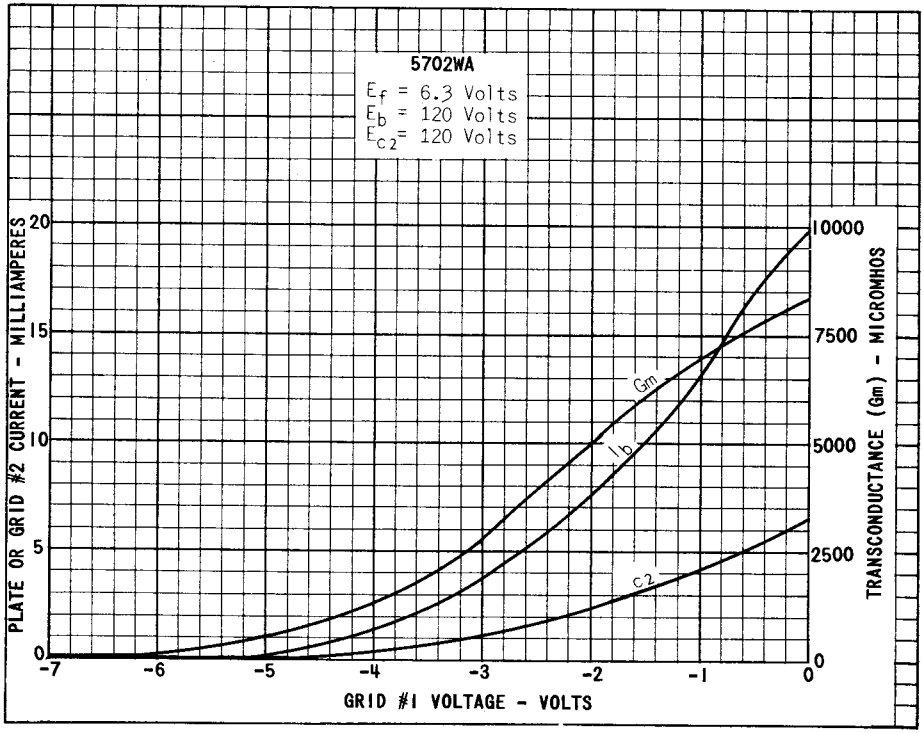
NOTE 7 THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8 FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

NOTE 9 CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef= 6.3V TO THAT VALUE MEASURED AT Ef=5.5V.







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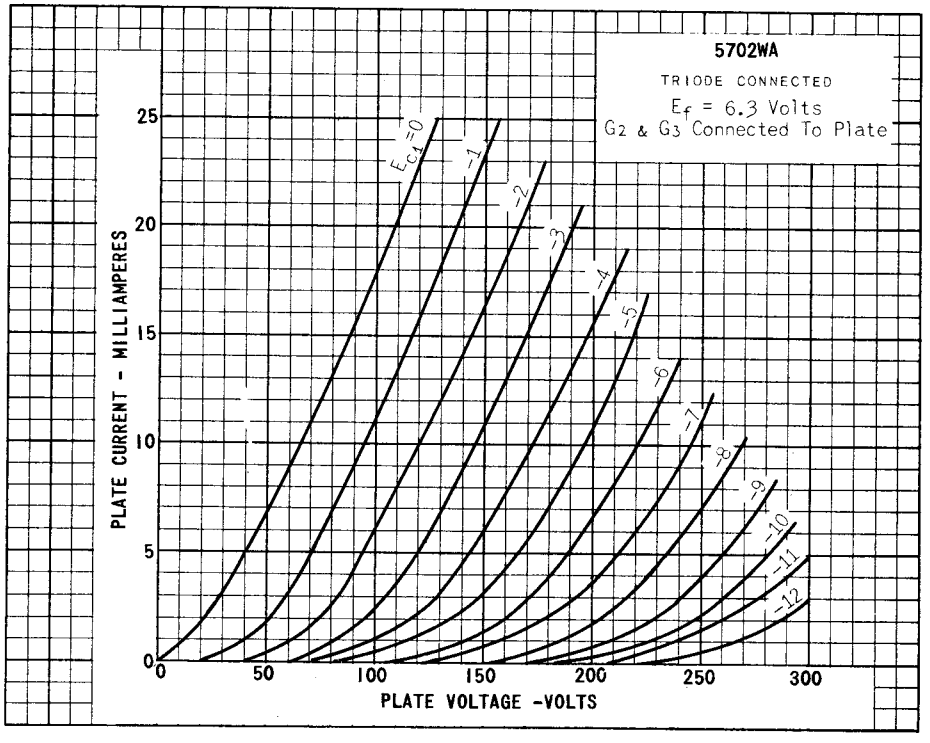
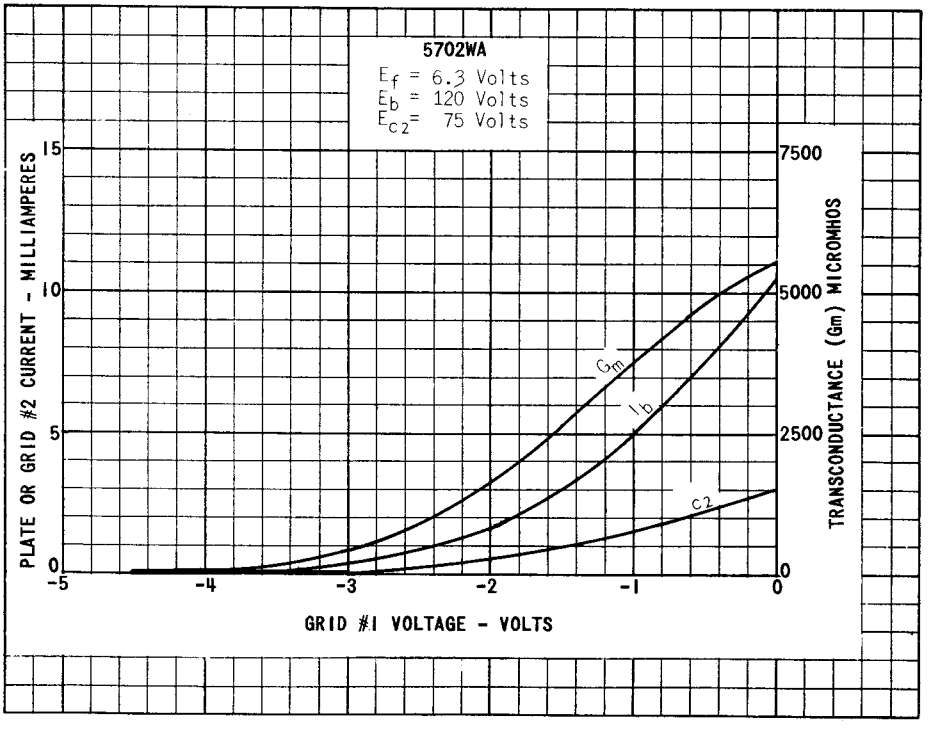
TENTATIVE DATA

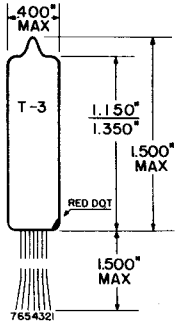




TUNG-SOL

PENTODE

SUBMINIATURE TYPE



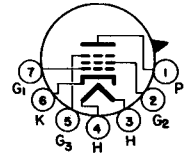
GLASS BULB

OUTLINE DRAWING
→ JEDEC 3-6

HEATER

6.3 VOLTS 0.20 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.048" CENTER-TO-CENTER
IN LINE

THE 5702 WB IS A HEATER-CATHODE TYPE SHARP-CUTOFF PENTODE OF SUBMINIATURE CONSTRUCTION CAPABLE OF OPERATION IN THE VHF REGION. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. A SEPARATE TERMINAL CONNECTION IS PROVIDED FOR GRID #3 WHICH UNDER SELF-BIAS CONDITIONS CAN BE CONNECTED DIRECTLY TO GROUND, PERMITTING THE CATHODE BY-PASS CAPACITOR TO BE OMITTED FOR LOWER GRID LOADING. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MAX	NORM. TEST CONDITIONS (NOTE 7)	NORM. OPERATION (NOTE 6)	DES. MAX	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	5.7	6.3	6.3	6.9	V
PLATE VOLTAGE	Eb:	---	120	120	165	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	Vdc
GRID #2 VOLTAGE	Ec2:	---	120	120	155	Vdc
GRID #3 VOLTAGE	Ec3:	---	0	0	0	Vdc
PLATE DISSIPATION	Pp:	---	---	0.9	1.10	W
GRID #2 DISSIPATION	Pg2:	---	---	0.3	0.40	W
GRID #1 CIRCUIT RES.	Rg1:	---	---	1.0	1.2	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	v
CATHODE CURRENT	Ik:	---	---	---	16.5	mAdc
CATHODE RESISTANCE	Rk:	---	200	200	---	OHMS
PLATE CURRENT (1)	Ib(1):	---	---	7.5	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.6	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	5000	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.34	---	MEG.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1		COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES							
HEATER CURRENT:	0.65	If:	190	---	200	---	210	---	mA
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc									
Ehk=+100 Vdc	0.65	Ihk:	---	---	---	---	5	---	μAdc
GRID CURRENT (1):	0.65	Ic1(1):	---	---	---	---	-0.1	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	5.5	6.9	7.5	8.1	9.5	2.3	mAdc
PLATE CURRENT (2):									
Ec1=-9.0 Vdc	0.65	Ib(2):	---	---	---	---	50	---	μAdc
SCREEN CURRENT:	0.65	Ic2:	1.7	---	2.6	---	3.5	---	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	4200	4775	5000	5225	5800	860	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-7)									
MEASUREMENTS ACCEPTANCE TEST PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V									
Eg-all=-100 Vdc	2.5	Rg1-all:	250	---	---	---	---	---	MEG.
Ep-all =-300 Vdc	2.5	Rp-all:	250	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2):									
Ef=5.7 V. (NOTE 9)	2.5	Δ_{Ef}Sm(2)	---	---	---	---	5	---	PERCENT
GRID EMISSION:									
Ef=7.5 V; PREHEAT 5 MINUTES AT Ec1=0; TEST AT Ec1=-10 Vdc	6.5	Ic(2):	---	---	---	---	-0.5	---	μAdc
AF NOISE:									
Esig=70 mVac; Ec2=25 Vdc; Rg1=0.1 MEG.; Rg2 =1000 OHMS; Rp=0.2 MEG; Ck =1000 μf; Rk=4000 OHMS.	2.5	EB:	---	---	---	---	17	---	VU.
PLATE RESISTANCE:	6.5	rp:	0.15	---	---	---	---	---	MEG.
CAPACITANCE:		Cgp:	---	---	---	---	0.03	---	μμf
CAPACITANCE: (NOT 2)	6.5	Cin:	4.1	---	---	---	5.5	---	μμf
CAPACITANCE:		Cout:	2.9	---	---	---	4.1	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE=55±5mm Hg:									
VOLTAGE = 300 Vac	6.5	---	---	---	---	---	---	---	---
OPERATION TIME: (NOTE 10)	4.0	t:	---	---	---	---	20	---	sec.

→INDICATES A CHANGE.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG.	UAL	MAX.	ALD.	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TEST PART 2 - cont'd.									
VIBRATION (2): F=40 cps;G=15; Rp= 10,000 OHMS	2.5	Ep:	---	---	---	---	50	---	mVac
VIBRATION (3): F=30-1000 cps;G=15; Rp =10,000 OHMS; t=3 MIN.; POSITIONS X_1 AND X_2 ONLY	4.0	Ep:	---	---	---	---	240 PEAK TO PEAK	---	mv
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1): Ehk=+100 Vdc;Rg=0.1 MEG HAMMER ANGLE =30° (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE (1): 96 HRS; G=2.5; FIXED FREQUENCY; F=25 MIN. 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
FATIGUE (2): 6 HOURS; G=10; FIXED FREQUENCY; F=25 MIN, 60 MAX. (NOTE 11)	---	---	---	---	---	---	---	---	---
POST SHOCK (1) AND FATIGUE TESTS (1) AND (2) END POINTS: VIBRATION (2): F=40 cps; G=15; Rp = 10,000 OHMS	---	Ep:	---	---	---	---	75	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	---	---	---	10	---	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: Ef = 6.3 V	---	Δ_tSm(1):	---	---	---	---	10	---	PERCENT
GRID CURRENT (1):	---	Ic(1):	---	---	---	---	-1.0	---	μAdc
SHOCK (2): Ehk=+100 Vdc; Rg=0.1 MEG.; G=75; (HAMMER ANGLE =120°+ RUBBER PAD); t =10 MILLISECONDS DURATION (NOTE 12)	---	---	---	---	---	---	---	---	---
POST SHOCK TEST (2) END POINTS: VIBRATION (2): F=40cps; G=15; Rp= 10,000 OHMS	---	Ep:	---	---	---	---	75	---	mVac

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST

DEGRADATION RATE ACCEPTANCE TESTS -CONT'D.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
HEATER-CATHODE LEAKAGE:					
Ehk =+100 Vdc Ehk=-100 Vdc	---	Ihk:	---	10	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:					
Ef = 6.3 V	---	Δ_tSm(1):	---	10	PERCENT
GRID CURRENT (1):	---	Ic(1):	---	-1.0	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	---
ACCEPTANCE LIFE TESTS					
HEATER CYCLE: Ef =7.5 V; Eb=Ec1=Ec2=Ec3=0V; Ehk=140 Vac; 1 MIN. ON, 1 MIN. OFF.	1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS: HEATER-CATHODE LEAKAGE:					
Ehk=+ 100 Vdc Ehk=-100 Vdc	---	Ihk:	---	20	μAdc
1 HOUR STABILITY LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg1 = 1.0 MEG.	---	---	---	---	---
1 HOUR STABILITY LIFE TEST END POINTS: CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLE SIZE = 50 TUBES)	1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg1 =1.0 MEG.	---	---	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)	---	---	---	---	---
INOPERATIVES:	0.65	---	---	---	---
TRANSCONDUCTANCE (1):	1.0	Sm(1):	3800	---	μMHOS
INTERMITTENT HIGH TEMPERATURE LIFE TESTS: T BULB = 220° C; Ehk =+200 Vdc; Rg1 = 1.0 MEG.	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMPLE	COMB. SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TEST - cont'd.							
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE 40 TUBES 2nd SAMPLE)			---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.5	μAdc
HEATER CURRENT:	1	3	---	If:	180	220	mA
CHANGE IN TRANSCONDUCTANCE (1) INDIVIDUAL TUBES:	1	3	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	2	5	---	$\Delta_{Ef} Sm(2)$:	---	15	PERCENT
HEATER-CATHODE LEAKAGE: Ehk=+ 100 Vdc Ehk=-100 Vdc	2	5	---	Ihk:	---	10	μAdc
INSULATION OF ELECTRODES: g1-all	2	5	---	Rg1-all:	50	---	MEG.
p-all	2	5	---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1): AVERAGE CHANGE:	---	---	---	Avg.$\Delta_t Sm(1)$:	---	15	PERCENT
TOTAL DEFECTIVES:	4	8	---	---	---	---	---
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	2	5	---	---	---	---	---
GRID CURRENT (1):	2	5	---	Ic(1):	---	-1.0	μAdc
HEATER CURRENT:	2	5	---	If:	177	223	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	2	5	---	$\Delta_t Sm(1)$:	---	30	PERCENT
HEATER-CATHODE LEAKAGE: Ehk=±100 Vdc	2	5	---	Ihk:	---	15	μAdc
TOTAL DEFECTIVES	5	10	---	---	---	---	---

NOTES

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1 INSPECTION INSTRUCTIONS FOR ELECTRON TUBES' AND MIL-STD-105A.

NOTE 2: WITH A CYLINDRICAL SHIELD (0.405" I.D.- 1 7/8" LONG) CONNECTED TO LEAD 6.

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NOTES - cont'd.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATION.

NOTE 4: CENTRIFUGE TEST WITH FORCES IN ANY DIRECTION.

NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATION.

NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

NOTE 7: THESE NORMAL TEST CONDITIONS ARE MADE FOR ALL CHARACTERISTIC TESTS UNLESS OTHER WISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8: FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY± 10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

NOTE 9: CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef=6.3 V TO THAT VALUE MEASURED AT Ef=5.7V.

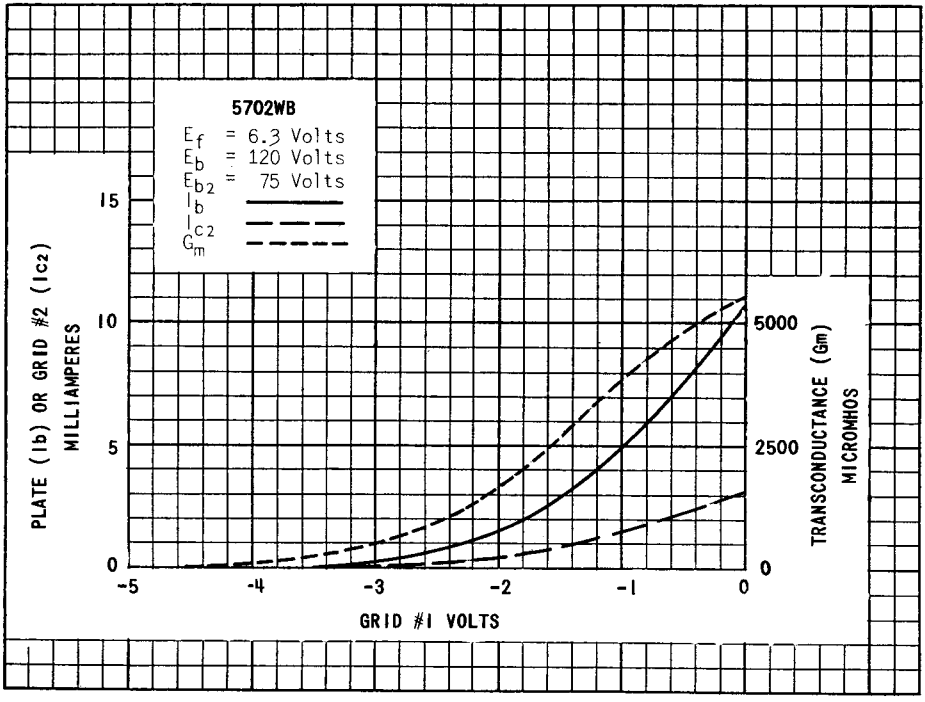
NOTE 10: OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN PLUS OR MINUS 10 PERCENT OF THE THREE MINUTE PLATE CURRENT (1) VALUE USING A COLD TUBE. NO PREHEATING BEFORE THIS TEST WILL BE ALLOWED.

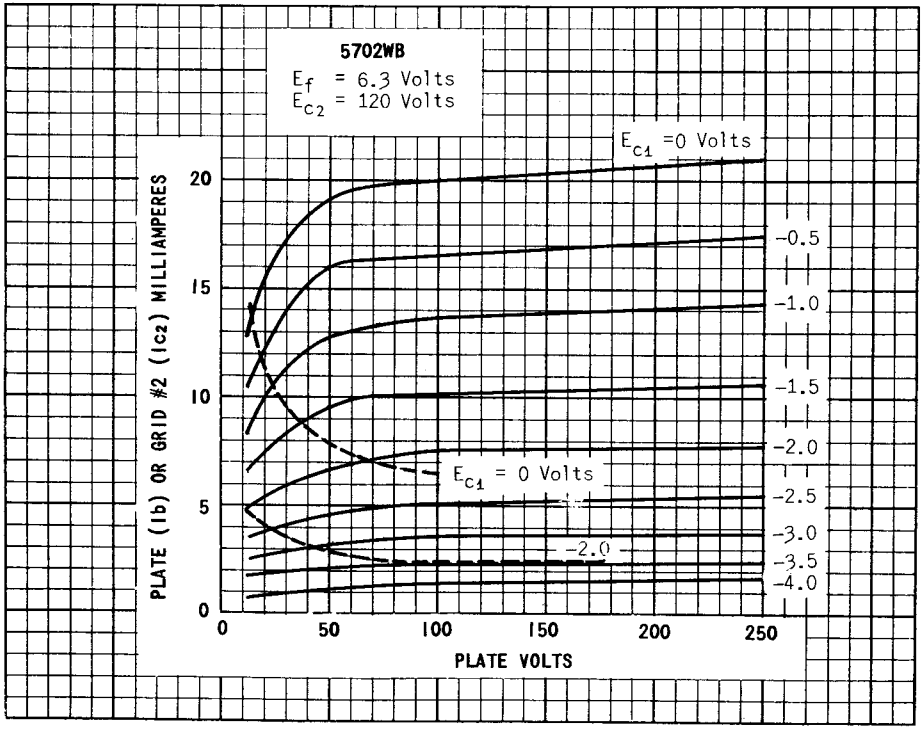
NOTE 11: THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2, AND Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

(A) TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3.

(B) TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS. THIS IS A DESTRUCTIVE TEST.

NOTE 12: THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).





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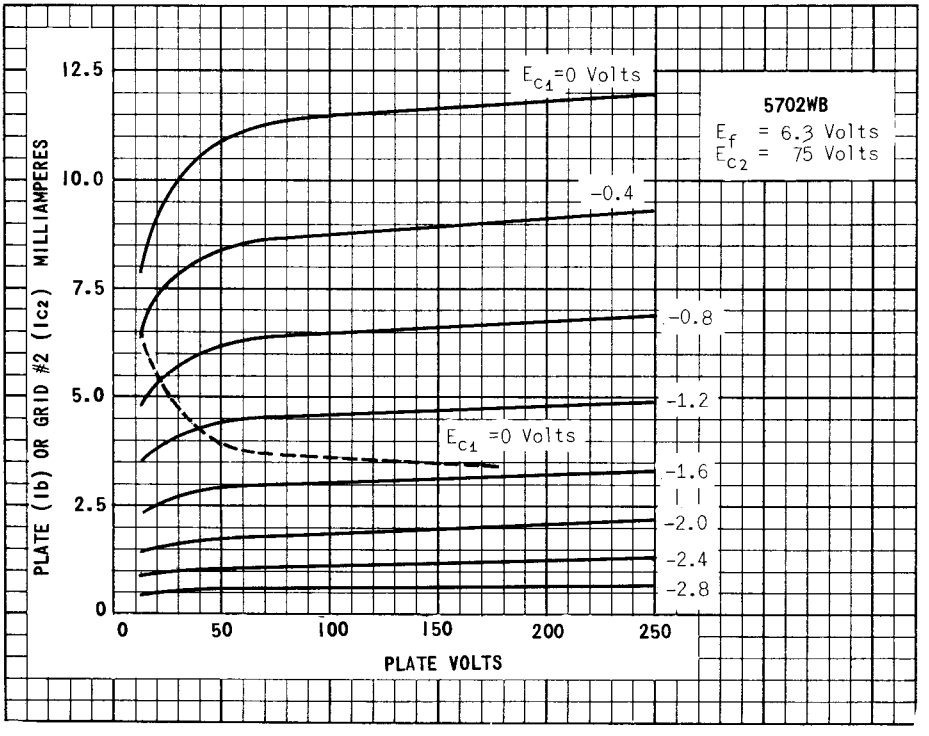
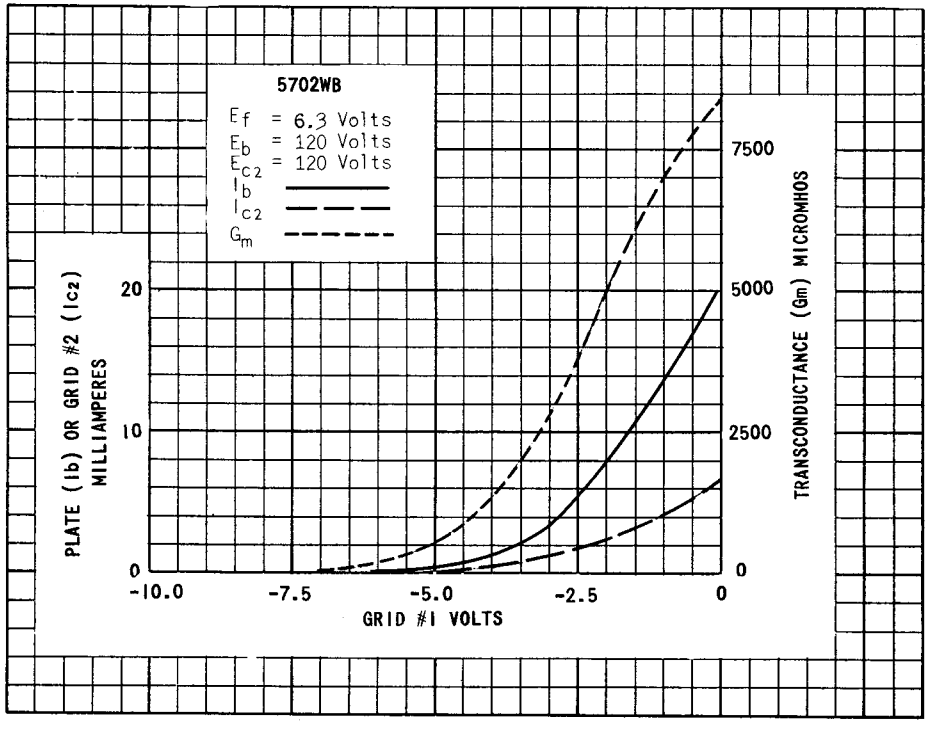
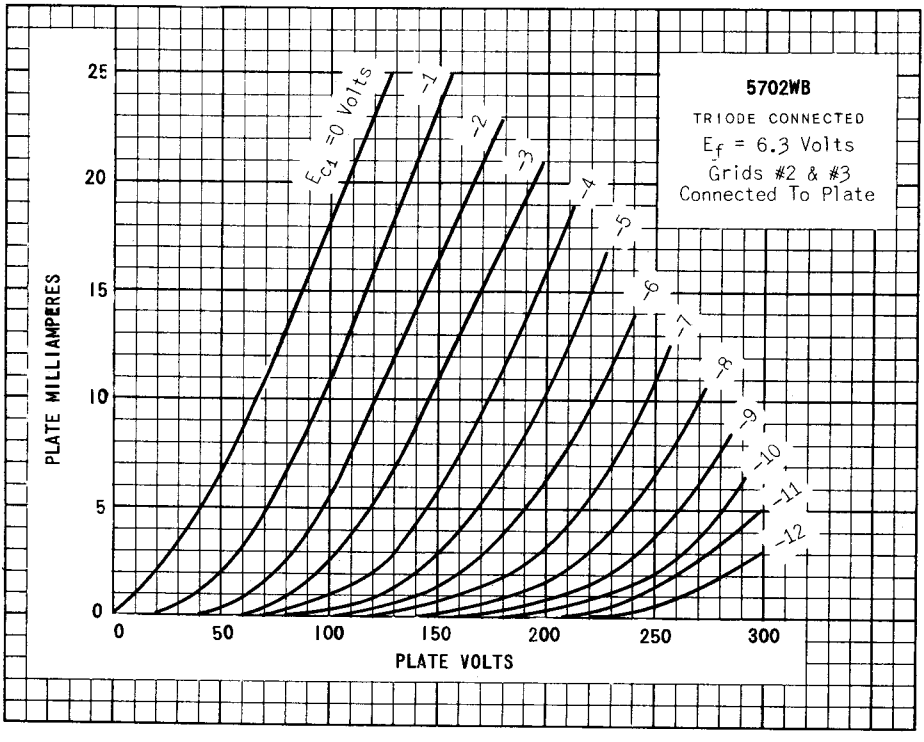

5702WB
E_f = 6.3 Volts
E_{c2} = 75 Volts
E_{c1}=0 Volts
-0.4
-0.8
-1.2
E_{c1} =0 Volts
-1.6
-2.0
-2.4
-2.8
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
PLATE VOLTS


5702WB
E_f = 6.3 Volts
E_b = 120 Volts
E_{c2} = 120 Volts
I_b
I_{c2}
G_m
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
20
10
0
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
7500
5000
2500
0
TRANSCONDUCTANCE (Gm) MICROMHOS



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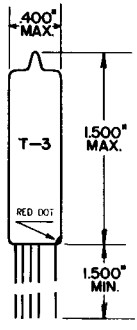
THIS DATA SHEET ALSO APPLIES TO TWO OTHER MILITARY VERSIONS, DESIGNATED 5703WA AND 5703WB

TRIODE
SUBMINIATURE TYPE

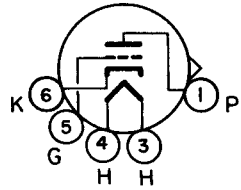
FOR UHF OSCILLATOR APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB

DOT IS ADJACENT TO LEAD 1..



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS
0.048" CENTER-TO-CENTER EXCEPT LEADS 1 - 3 = 0.096" CENTER-TO-CENTER
IN-LINE

THE 5703 IS A HEATER-CATHODE TYPE MEDIUM-MU SUBMINIATURE TRIODE CAPABLE OF OPERATION AS AN OSCILLATOR, CLASS C AMPLIFIER, OR FREQUENCY MULTIPLIER IN THE UHF REGION. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

GRID TO PLATE	1.2	pf
INPUT	2.6	pf
OUTPUT	0.7	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	200	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE			±100	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	275	VOLTS
PLATE DISSIPATION	3.3	WATTS
PLATE CURRENT	22	MA.
GRID CURRENT	5.5	MA.
ALTITUDE	10,000	FEET
ENVELOPE TEMPERATURE	220	°C

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TUNG-SOL

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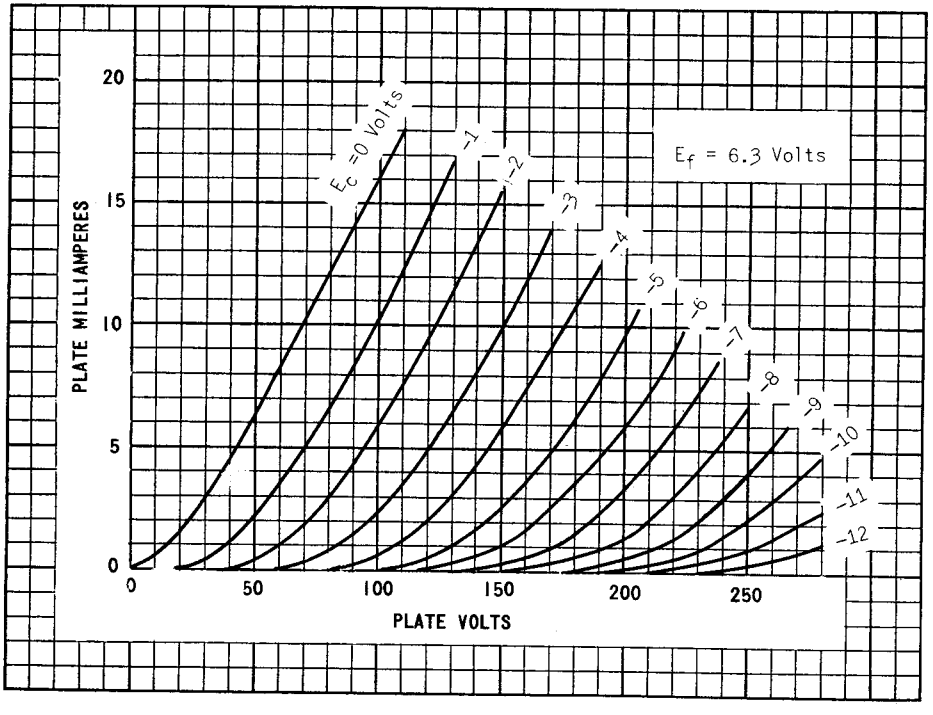
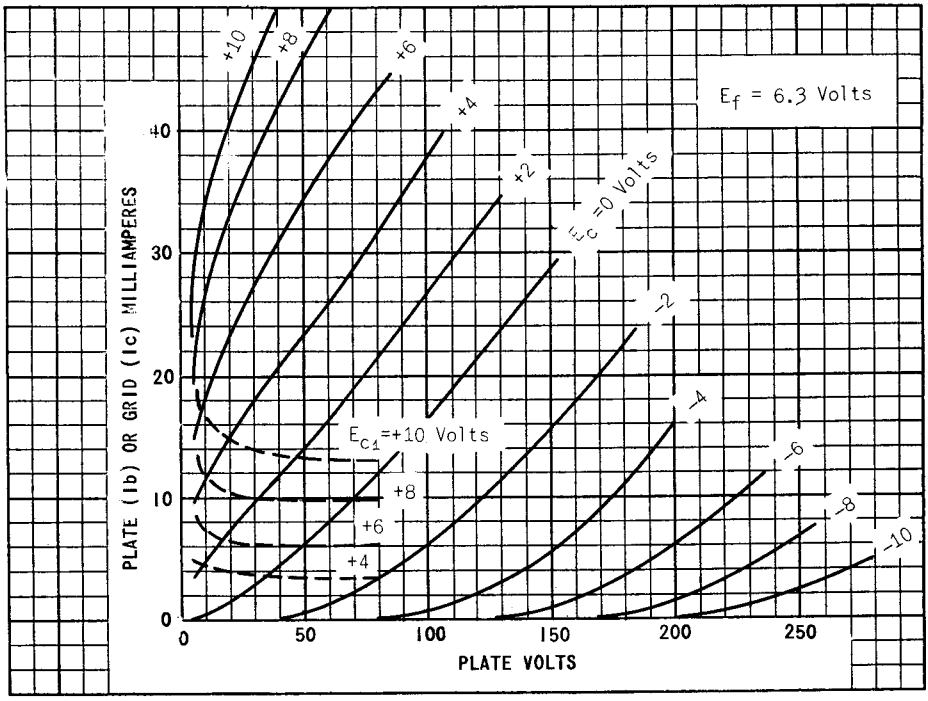
TYPICAL OPERATING CHARACTERISTICS

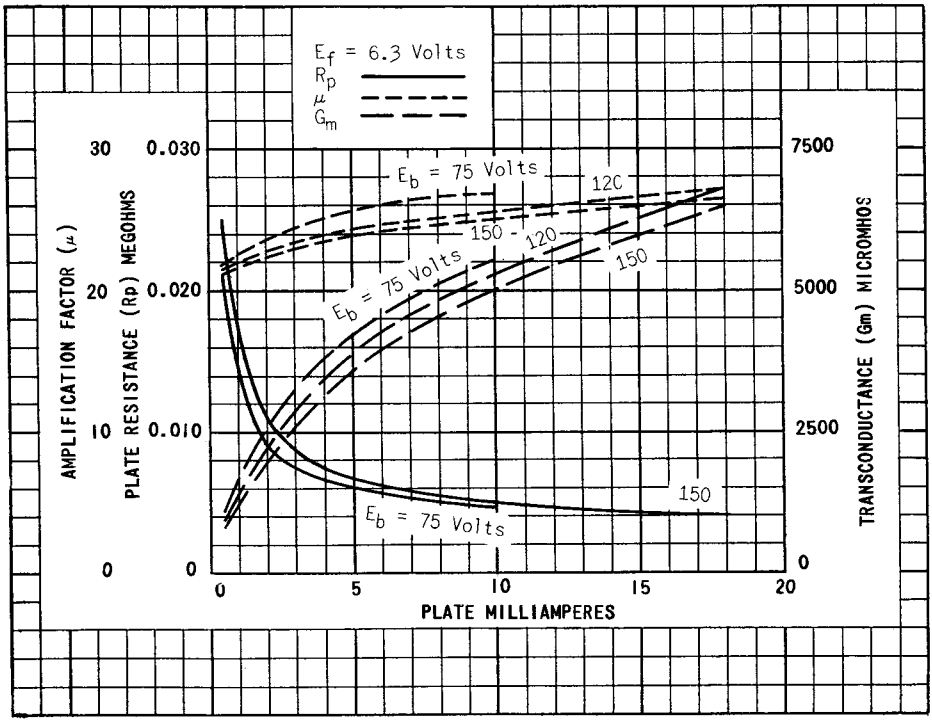
DC PLATE VOLTAGE	120	VOLTS
DC GRID VOLTAGE	0	VOLTS
CATHODE BIAS RESISTANCE	220	OHMS
PLATE CURRENT	9.6	MA.
TRANSCONDUCTANCE	5000	μMHOS
AMPLIFICATION FACTOR	25.5	

SPECIAL TESTS AND RATINGS

OPERATION PEAK OUTPUT (AC MIN.) Ebb = 105 Vdc; Ef = 5.2 Vac; Eg = 19.5 Vac; RL = 750; Rg = 2700; CIRCUIT DRAWING - SEE FIGURE 1	45	VOLTS
POWER OSCILLATION (MIN.) Ebb = 91 Vdc; Ef = 5.6 Vac; Tg = 2400; F = 400 Mc TEST PER 185 JAN DRAWING OR EQUIVALENT	180	MW







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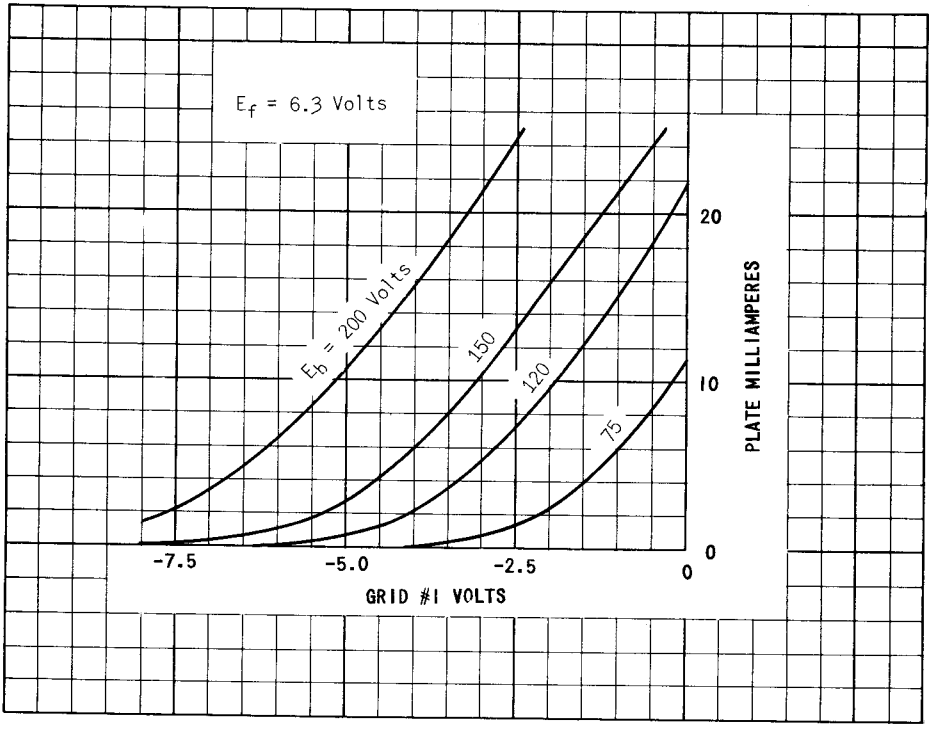

E_f = 6.3 Volts
E_b = 200 Volts
150
120
75
20
10
0
PLATE MILLIAMPERES
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

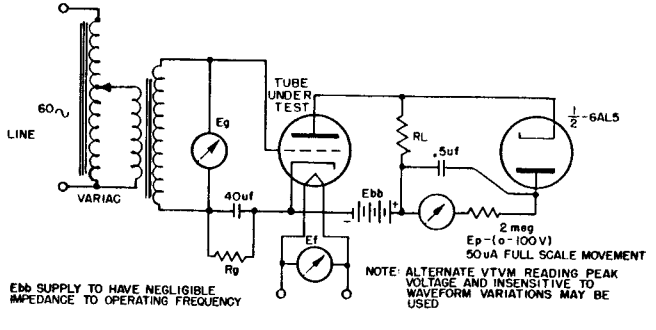
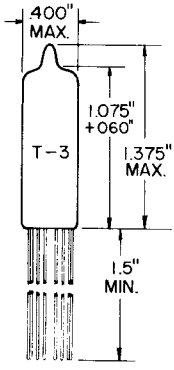

60~
LINE
VARIAC
Eg
TUBE UNDER TEST
RL
.5uf
1/2-6AL5
40uf
Ebb
Ef
Rg
2 meg
Ep-(o-100V)
50uA FULL SCALE MOVEMENT
Ebb SUPPLY TO HAVE NEGLIGIBLE IMPEDANCE TO OPERATING FREQUENCY
NOTE: ALTERNATE VTVM READING PEAK VOLTAGE AND INSENSITIVE TO WAVEFORM VARIATIONS MAY BE USED

FIG. 1

TUNG-SOL

TRIODE

SUBMINIATURE TYPE



GLASS BULB

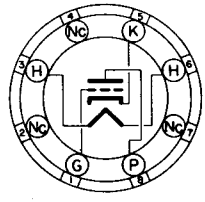
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 LEAD BASE

8DK

THE 5718 IS A SUBMINIATURE MEDIUM-MU TRIODE DESIGNED FOR USE AS A HIGH FREQUENCY OSCILLATOR OR AS A GENERAL-PURPOSE AMPLIFIER. A POWER OUTPUT OF APPROXIMATELY 0.9 WATT CAN BE OBTAINED AT A FREQUENCY OF 500 MEGACYCLES

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD [A]	WITHOUT SHIELD	
GRID TO PLATE	1.3	1.4	$\mu\mu f$
INPUT	2.4	2.2	$\mu\mu f$
OUTPUT	2.4	0.7	$\mu\mu f$

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO CATHODE

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.9	WATTS
MAXIMUM DC PLATE CURRENT	22	MA.
MAXIMUM DC GRID CURRENT	5.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	150	OHMS
AMPLIFICATION FACTOR	27	
PLATE RESISTANCE (APPROX.)	4650	OHMS
TRANSCONDUCTANCE	5800	μMHOS
PLATE CURRENT	8.5	MA.
GRID VOLTAGE (APPROX.) Ib = 10 μAMPS.	-7	VOLTS

UHF OSCILLATOR

PLATE VOLTAGE	150	VOLTS
PLATE CURRENT	20	MA.
FREQUENCY	500	MEGACYC.
POWER OUTPUT (APPROX.)	0.9	WATTS

CLASS A RESISTANCE - COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS			Ebb = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_o	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2100	8.0	14	1800	13	16	1600	25	17
0.10	0.24	2700	11	15	2300	21	16	2100	33	17
0.24	0.24	5600	9.7	14	4700	19	16	4600	29	17
0.24	0.51	6800	12	15	6400	24	16	5800	37	17
0.51	0.51	12000	11	15	11000	20	16	10000	31	16
0.51	1.0	15000	14	15	13000	25	16	14000	40	16

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS

R_L	R_{gf}	Ebb = 90 VOLTS			Ebb = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_o	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2700	10	14	2100	19	16	1800	30	17
0.10	0.24	3400	13	15	2700	25	16	2300	38	17
0.24	0.24	6900	12	14	5800	22	16	5000	34	17
0.24	0.51	8400	14	15	7000	27	16	6300	41	17
0.51	0.51	13000	13	15	12000	24	16	11000	37	16
0.51	1.0	17000	16	15	16000	29	16	15000	45	16

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.

4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

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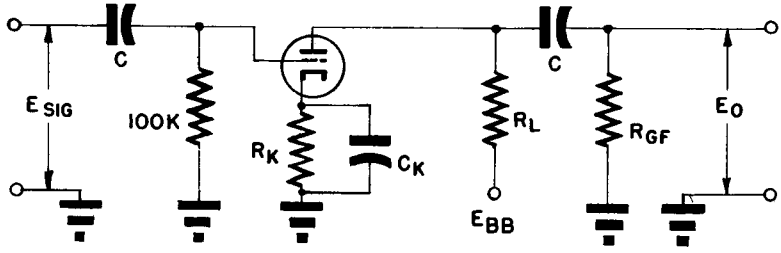

CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT:				
Ef = 6.3 VOLTS	INITIAL	140	160	MA.
	500 HR.	138	164	MA.
PLATE CURRENT				
Ef =6.3 V., Eb =100 V., Rk =150 OHMS (BY-PASSED)	INITIAL	6.0	11	MA.
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef = 5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500 HR.	15	---	PERCENT
TRANSCONDUCTANCE (1)				
Ef = 6.3 V., Eb =100 V., Rk =150 OHMS (BY-PASSED)	INITIAL	4800	6800	μMHOS
TRANSCONDUCTANCE CHANGE WITH OPERATION				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION:				
AVERAGE OF VALUES FOR 'TRANSCONDUCTANCE CHANGE WITH OPERATION'	500-HR	---	15	PERCENT
AMPLIFICATION FACTOR:				
Ef =6.3 V., Eb =100 V., Rk =150 OHMS (BY-PASSED)	INITIAL	23	31	
PLATE CURRENT CUTOFF (1):				
Ef = 6.3 V., Eb =100 V., Ec =-7.0 VOLTS	INITIAL	---	100	μAMPS
PLATE CURRENT CUTOFF (2)				
Ef =6.3 V., Eb= 100 V., Ec=-4.0 VOLTS	INITIAL	20	---	μAMPS.
RF POWER OUTPUT:				
Ef =6.3 V., Eb =150 V., F =500 mc, Rg ADJUSTED FOR Ib =20 ma d-c	INITIAL	600	---	MW.

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CHARACTERISTICS LIMITS - cont'd.

INTERELECTRODE CAPACITANCES:				
GRID TO PLATE (G TO P)	INITIAL	1.1	1.8	μμf
INPUT(G TO K+H)	INITIAL	1.6	2.8	μμf
OUTPUT (P TO K+H)	INITIAL	0.5	0.9	μμf
(MEASURED WITHOUT EXTERNAL SHIELD)				
NEGATIVE GRID CURRENT:				
Ef =6.3 V., Eb =150 V., Rk =380 OHMS				
(BY-PASSED), Rg = 1.0 MEG.	INITIAL	---	0.4	μAMPS.
	500 HR.	---	0.6	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef =6.3 V., Ehk =100 V.,				
HEATER POSITIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5	μAMPS.
	500 HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5	μAMPS.
	500 HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef =6.3 V POLARITY OF APPLIED DC				
INTERELECTRODE VOLTAGE IS SUCH				
THAT NO CATHODE EMISSION RESULTS:				
GRID TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	50	---	MEGOHMS
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	50	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS				
Ef =6.3 V., Ebb =100 V., Rk =150 OHMS				
(BY-PASSED), R_L = 10,000 OHMS,				
VIBRATIONAL ACCELERATION =15 G AT 40cps	INITIAL	---	25	MILLIV
GRID EMISSION CURRENT:				
Ef =7.5 V., Eb=100 V., Ecc=-7.0 V., Rg=1.0 MEG.	INITIAL	---	0.4	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Rk=150 OHMS, Rg=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE= 220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec=0 VOLTS, AND Ehk=140 VOLTS RMS.

SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

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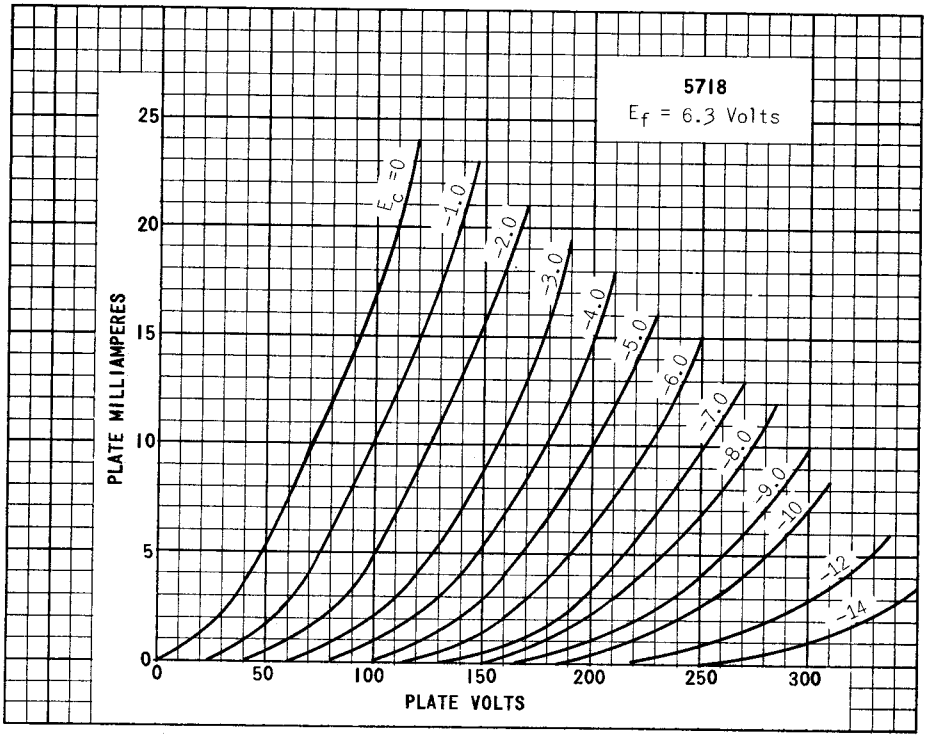
SECIAL TESTS AND RATINGS - cont'd.

FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

NOTE:
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



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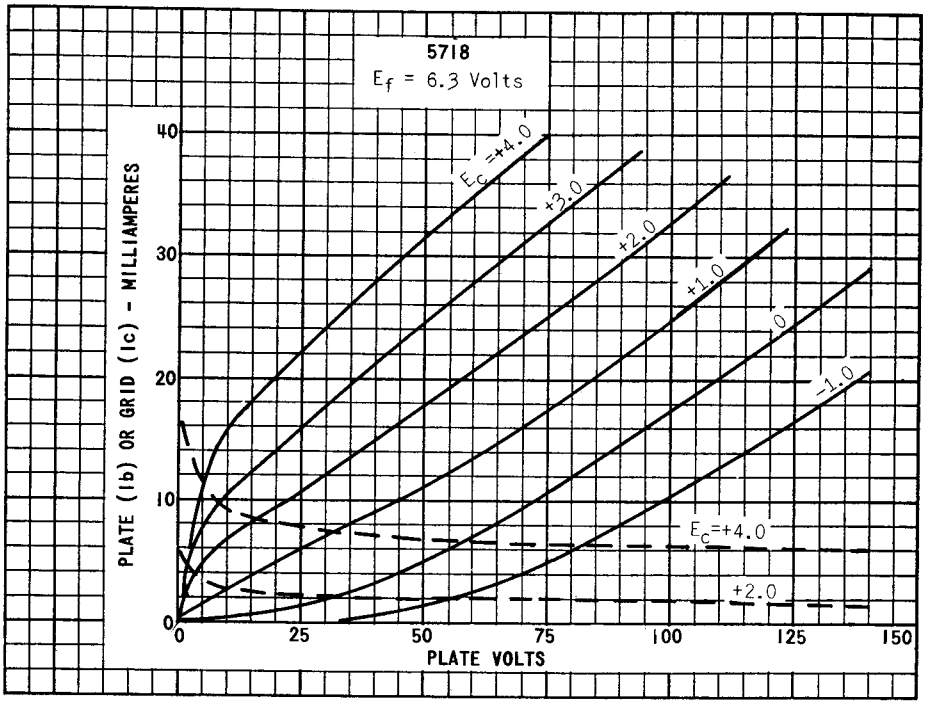
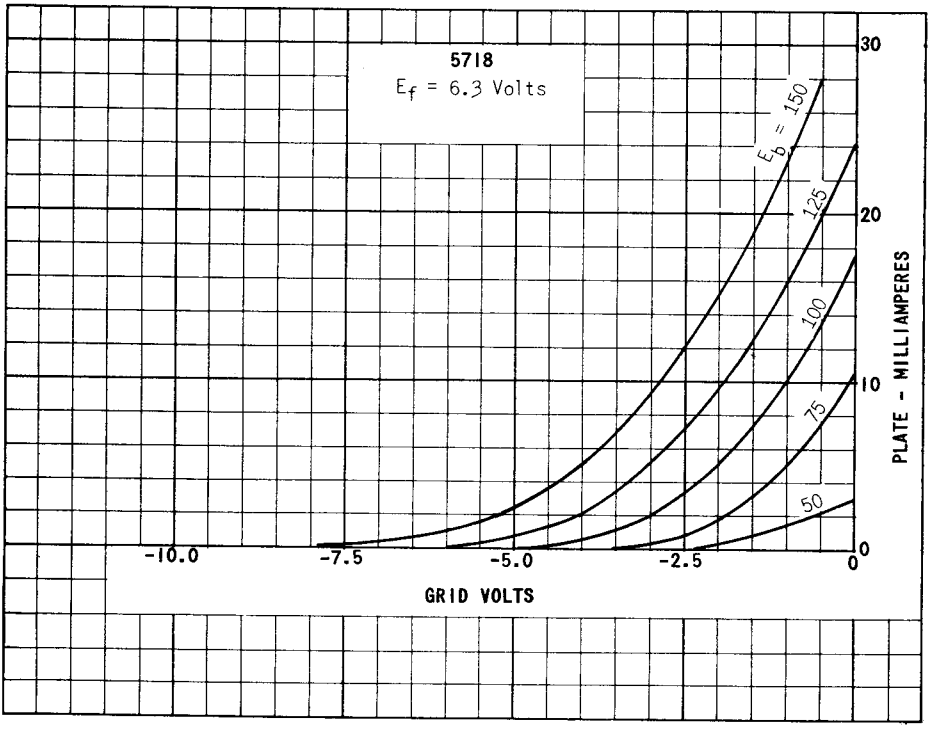
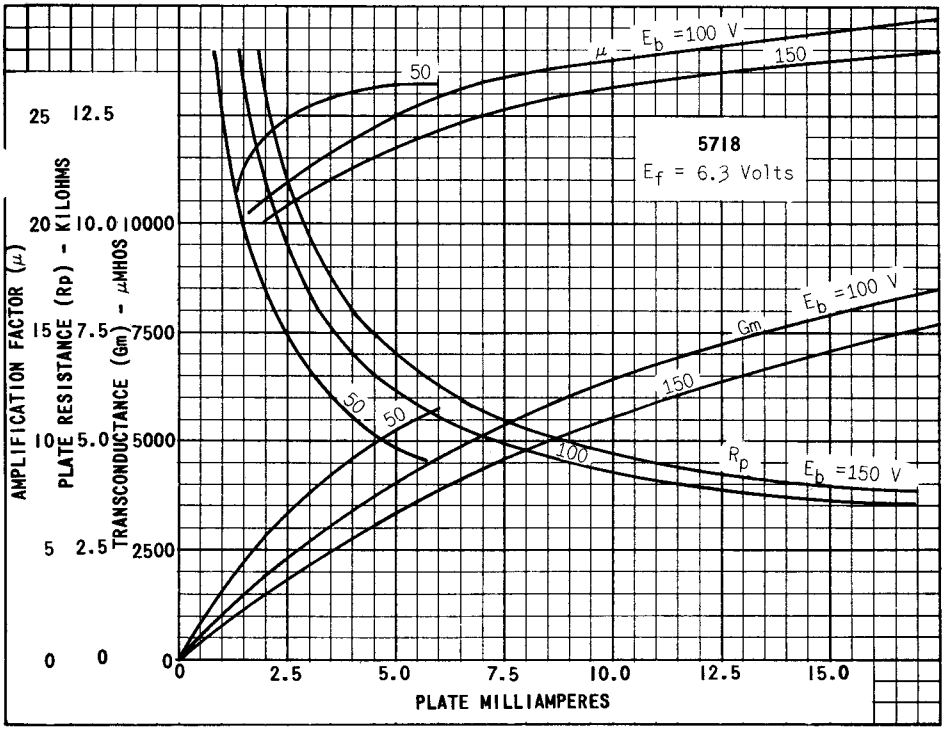

5718
E_f = 6.3 Volts
PLATE (Ib) OR GRID (Ic) - MILLIAMPERES
PLATE VOLTS
E_c=+4.0
+3.0
+2.0
+1.0
0
-1.0
E_c=+4.0
+2.0
0
10
20
30
40
0
25
50
75
100
125
150


5718
E_f = 6.3 Volts
PLATE - MILLIAMPERES
GRID VOLTS
E_b = 150
125
100
75
50
0
10
20
30
-10.0
-7.5
-5.0
-2.5
0


5718
E_f = 6.3 Volts
μ — E_b =100 V
150
50
Gm
E_b =100 V
150
50
50
100
R_p
E_b =150 V
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (Rp) - KILOHMS
TRANSCONDUCTANCE (Gm) - μMHOS
25 12.5
20 10.0 10000
15 7.5 7500
10 5.0 5000
5 2.5 2500
0 0 0
0 2.5 5.0 7.5 10.0 12.5 15.0
PLATE MILLIAMPERES

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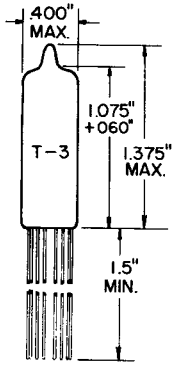
TRIODE

SUBMINIATURE TYPE



GLASS BULB

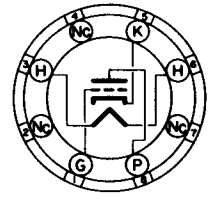
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 LEAD BASE

8DK

THE 5719 IS A SUBMINIATURE HIGH-MU TRIODE DESIGNED FOR USE AS AN AUDIO-FREQUENCY VOLTAGE AMPLIFIER. BECAUSE OF ITS LOW MICROPHONIC CHARACTERISTICS, THE TUBE CAN BE EMPLOYED AT RELATIVELY LOW SIGNAL LEVELS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	0.8	0.8	μμf
INPUT	1.9	1.7	μμf
OUTPUT	2.2	0.6	μμf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO CATHODE.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.1	WATTS
MAXIMUM DC PLATE CURRENT	3.3	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.2	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.15	AMP
PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	1500	OHMS
AMPLIFICATION FACTOR	70	
PLATE RESISTANCE (APPROX.)	41,000	OHMS
TRANSCONDUCTANCE	1700	μMHOS
PLATE CURRENT	0.73	MA.
GRID VOLTAGE (APPROX.) Ib = 10 μAMPS.	−2.5	VOLTS

CLASS A RESISTANCE - COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS			Ebb = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_o	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2000	3.5	30	1200	11	38	1000	22	41
0.10	0.24	2300	5.3	35	1400	14	43	1100	27	46
0.24	0.24	4700	5.1	36	2900	12	44	2100	24	49
0.24	0.51	5100	6.6	39	3300	16	47	2500	30	51
0.51	0.51	9000	5.8	38	5800	13	46	4600	25	49
0.51	1.0	10000	7.6	42	6800	17	48	5600	31	51

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS			E_{bb} = 150 VOLTS			Ebb = 225 VOLTS		
		R_k	E_b	GAIN	R_k	E_o	GAIN	R_k	E_o	GAIN
0.10	0.10	2700	6.7	29	1700	14	37	1300	25	40
0.10	0.24	3200	9.1	34	2000	18	41	1500	32	45
0.24	0.24	5600	8.7	34	3600	17	42	2700	29	47
0.24	0.51	6300	11	38	4200	22	45	3200	37	49
0.51	0.51	11000	9.5	37	7000	19	44	5300	32	49
0.51	1.0	12000	12	40	8000	24	47	6300	40	51

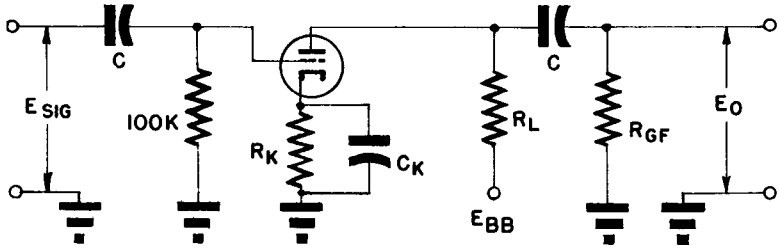
1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.

4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

TUNG-SOL



CHARACTERISTICS LIMITS

		MIN.	MAX.	
HEATER CURRENT	INITIAL	140	160	MA.
Ef = 6.3 V.	500 HR.	138	164	MA.
PLATE CURRENT				
Ef=6.3 V., Eb =100 V., Rk = 1500 OHMS				
(BY-PASSED)	INITIAL	0.5	0.9	MA.
TRANSCONDUCTANCE (1)				
Ef =6.3 V., Eb =100 V., Rk = 1500 OHMS				
(BY-PASSED)	INITIAL	1400	2000	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef =5.7 V., (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500 HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION:				
AVG. OF VALUES FOR 'TRANSCONDUCTANCE CHANGE WITH OPERATION'	500 HR.	---	15	PERCENT
AMPLIFICATION FACTOR:				
Ef =6.3 V., Eb =100 V., Rk = 1500 OHMS				
(BY-PASSED)	INITIAL	60	80	
PLATE CURRENT CUTOFF (1)				
Ef = 6.3 V., Eb =100 V., Ec =-2.5 V.,	INITIAL	---	50	μAMPS.
PLATE CURRENT CUTOFF (2)				
Ef =6.3 V., Eb =100 V., Ec =-1.8 V.	INITIAL	5	---	μAMPS.

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TUNG-SOL

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CHARACTERISTICS LIMITS - cont'd.

		MIN.	MAX.	
AC AMPLIFICATION:				
(RMS OUTPUT VOLTAGE FROM FIXED INPUT SIGNAL)				
Ef =6.3 V., Ebb=100 V., Ecc=0 V				
Esig = 0.2 V., RMS	INITIAL	8.0	---	VOLTS
INTERELECTRODE CAPACITANCES:				
GRID TO PLATE (G TO P)	INITIAL	0.6	1.0	μμf
INPUT (G TO K+H)	INITIAL	1.2	2.2	μμf
OUTPUT (P TO K+H)	INITIAL	0.4	0.8	μμf
(MEASURED WITHOUT EXTERNAL SHIELD)				
NEGATIVE GRID CURRENT				
Ef =6.3 V., Eb =150 V., Rk= 2700 OHMS				
(BY-PASSED), Rg = 1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500 HR.	---	0.6	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef =6.3 V., Ehk =100 V.,				
HEATER POSITIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef =6.3 V., POLARITY OF APPLIED DC				
INTERELECTRODE VOLTAGE IS SUCH THAT				
NO CATHODE EMISSION RESULTS				
GRID TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	25	---	MEGOHMS
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS
	500 HR.	25	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS:				
Ef =6.3 V., Ebb = 100 V., Rk = 1500 OHMS				
(BY-PASSED), R_L = 10,000 OHMS,				
VIBRATIONAL ACCELERATION =15 G AT 40cps	INITIAL	---	25	MV.
GRID EMISSION CURRENT:				
Ef = 7.5 V., Eb =100 V., Ecc =-2.5 V.,				
Rg =1.0 MEG.	INITIAL	---	0.3	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=150 VOLTS, Rk=680 OHMS, Rg=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE =220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec=0 VOLTS, AND Ehk=140 VOLTS RMS.

TUNG-SOL

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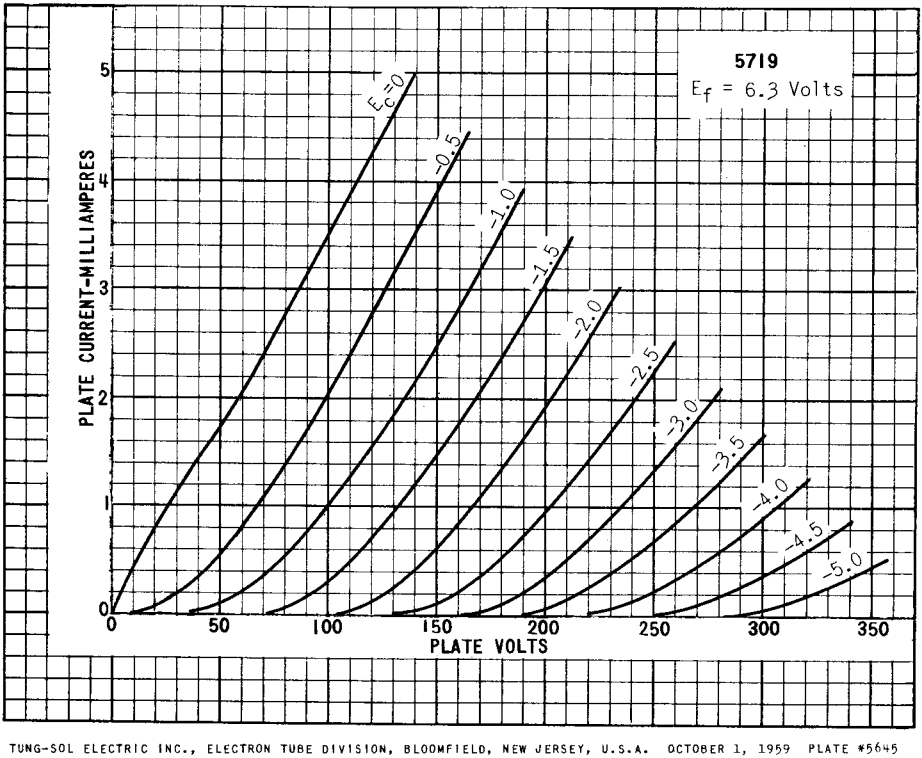
SPECIAL TESTS AND RATINGS - cont'd.

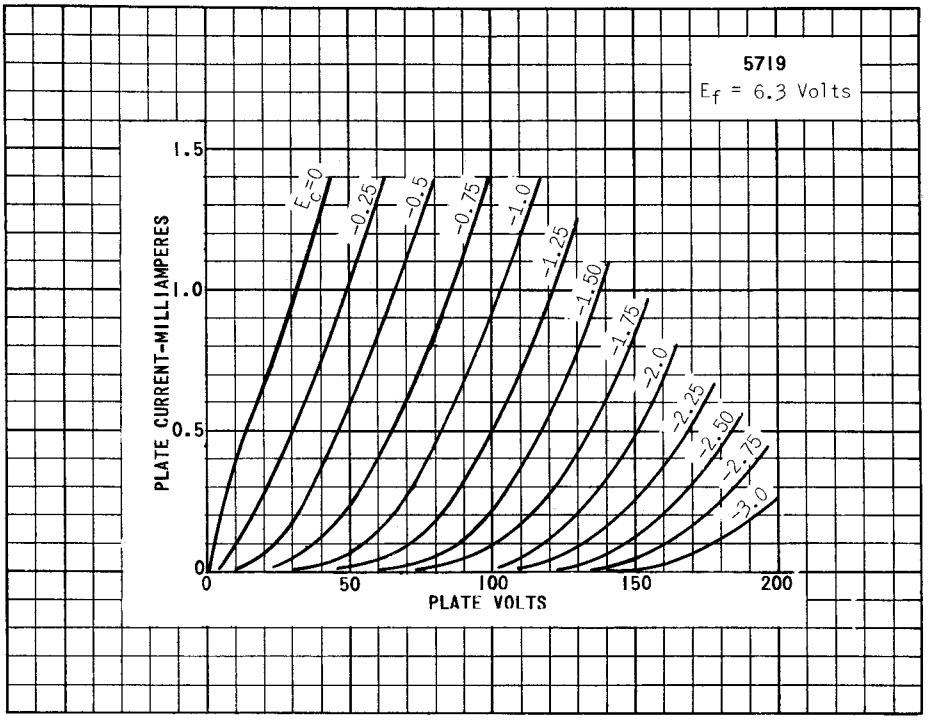
SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

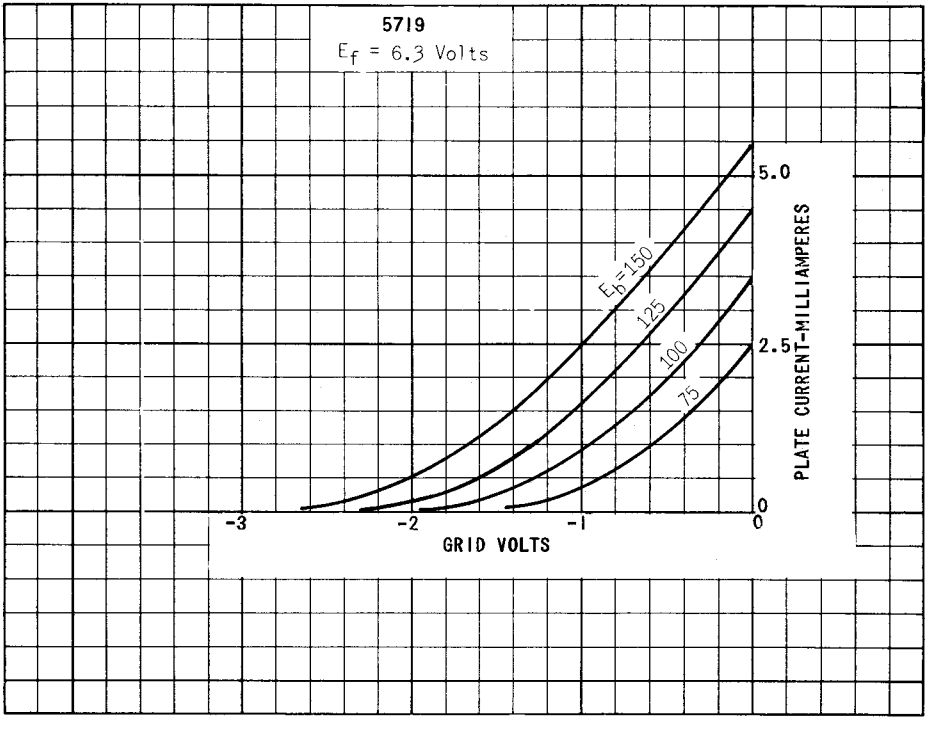
FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

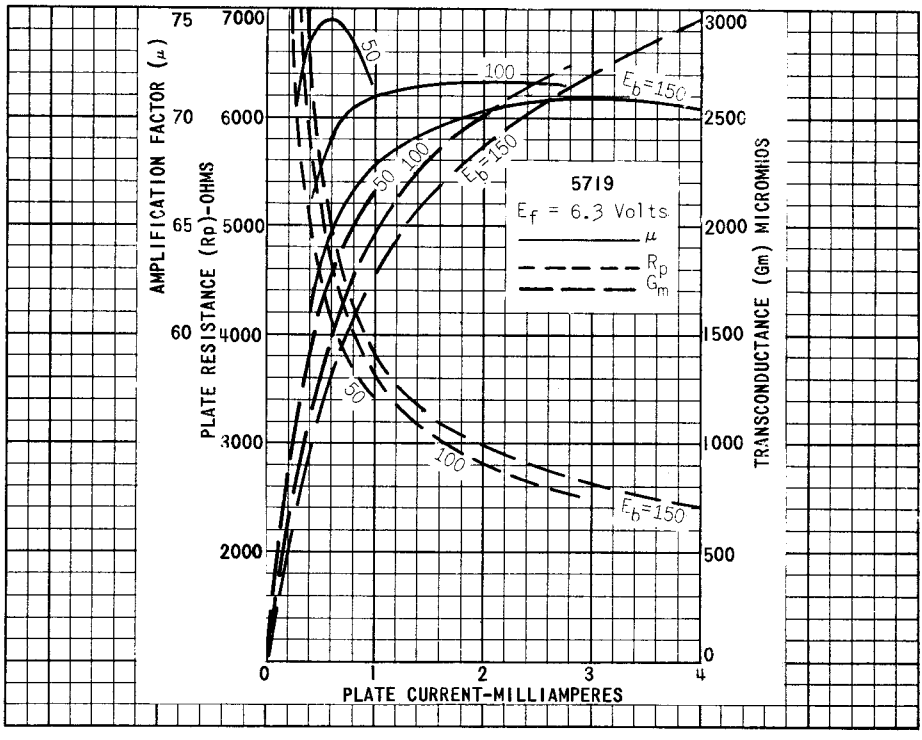
ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

NOTE;
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.




5719
E_f = 6.3 Volts
PLATE CURRENT-MILLIAMPERES
1.5
1.0
0.5
0
E_c=0
-0.25
-0.5
-0.75
-1.0
-1.25
-1.50
-1.75
-2.0
-2.25
-2.50
-2.75
-3.0
0
50
100
150
200
PLATE VOLTS


5719
E_f = 6.3 Volts
E_b=150
125
100
75
5.0
2.5
0
PLATE CURRENT-MILLIAMPERES
-3
-2
-1
0
GRID VOLTS


AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (Rp)-OHMS
TRANSCONDUCTANCE (Gm) MICROMHOS
PLATE CURRENT-MILLIAMPERES
5719
Ef = 6.3 Volts
μ
Rp
Gm
50
100
Eb=150
75
70
65
60
7000
6000
5000
4000
3000
2000
3000
2500
2000
1500
1000
500
0
0
1
2
3
4

TUNG-SOL

DUAL CONTROL PENTODE

MINIATURE TYPE

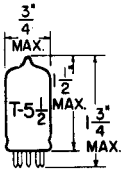
COATED UNIPOTENTIAL CATHODE

HEATER

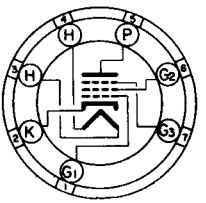
6.3 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7CM

THE 5725/6AS6W/6187 IS A RUGGEDIZED, SHARP CUT-OFF PENTODE VOLTAGE AMPLIFIER OF THE SEVEN PIN MINIATURE CONSTRUCTION. A SEPARATE SUPPRESSOR GRID BASE PIN CONNECTION MAKES DUAL CONTROL APPLICATIONS SUCH AS A CONVERTER, MODULATOR, PHANTASTRON AND GATING SERVICE POSSIBLE, AS WELL AS SINGLE CONTROL USAGE SUCH AS AF, IF, AND RF AMPLIFIERS, MIXERS, ETC. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, SCREEN CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE THIS TUBE MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5725/6AS6W/6187 IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #316	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE (RATED)	0.02	0.025	μμf
INPUT (RATED)	4.0	3.9	μμf
MAXIMUM	4.5	---	μμf
MINIMUM	3.5	---	μμf
OUTPUT (RATED)	3.0	2.2	μμf
MAXUMUM	3.4	---	μμf
MINIMUM	2.6	---	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	200	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	155	VOLTS
MAXIMUM DC GRID #3 VOLTAGE	30	VOLTS
MAXIMUM PLATE DISSIPATION	1.65	WATTS
MAXIMUM GRID #2 DISSIPATION	0.55	WATT
MAXIMUM HEATER CATHODE VOLTAGE	±100	VOLTS
MAXIMUM DC CATHODE CURRENT[A]	20	mA
MAXIMUM BULB TEMPERATURE	+165	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.175	AMP.
PLATE VOLTAGE	120	VOLTS
GRID #3 VOLTAGE	0	VOLTS
GRID #2 VOLTAGE	120	VOLTS
GRID #1 VOLTAGE	-2	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS - CONT'D.

PLATE CURRENT	5.2	mA
GRID #2 CURRENT	3.5	mA
TRANSCONDUCTANCE		
GRID #1 TO PLATE	3200	μMHOS
GRID #3 TO PLATE	470	μMHOS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 120Vdc, E_{c1} =-2Vdc, E_{c2} = 120Vdc, E_{c3} = 0Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_{g1}=0.1 MEG.)	0	-0.1	---	---	0	-0.1	μAdc
PLATE CURRENT (1)	2.5	9.0	4.2	6.2	---	---	mAdc
TRANSCONDUCTANCE (1)	2500	4500	2925	3475	2200	4500	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[B] (E_f=6.3V, E(g_1 TO all)= 100Vdc, g1 neg., E(g_2-all)= 300Vdc, g2 neg., E(g_3-all)= 100Vdc, g3 neg., E(p-all)= 300 Vdc, p neg.)							
R(g1-all)	100	---	---	---	50	---	MEGOHM
R(g2-all)	100	---	---	---	50	---	MEGOHM
R(g3-all)	100	---	---	---	50	---	MEGOHM
R(p -all)	100	---	---	---	50	---	MEGOHM
PLATE CURRENT (2) (E_{c1}=-6Vdc)	5	---	---	---	---	---	μAdc
PLATE CURRENT (3) (E_{c1}=-10Vdc)	---	100	---	---	---	---	μAdc
PLATE CURRENT (4) (E_{c3}=-10Vdc, E_{c1}=-3Vdc)	---	200	---	---	---	---	μAdc
SCREEN CURRENT	1.5	5.5	2.6	4.4	---	---	mAdc
GRID CURRENT (2)[C] (E_f=7.0V)	0	-1.0	---	---	---	---	μAdc
Δ TRANSCONDUCTANCE (2)[D] (E_f=5.7V)	---	15	---	---	---	15	PERCENT
TRANSCONDUCTANCE (3) (E_{c3}=-3Vdc)	500	1300	660	960	---	---	μMHOS
TRANSCONDUCTANCE (4) (E_{c3}=-5Vdc)	900	1700	---	---	---	---	μMHOS
TRANSCONDUCTANCE (5) (E_{c3}=20Vdc)	---	25	---	---	---	---	μMHOS

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION (R_p= 10,000)	---	150	mVac
VIBRATIONAL FATIGUE[E]	---	---	
SHOCK[F] (HAMMER ANGLE = 30°, E_{hk}=100Vdc, HEATER POS, R_{g1}=0.1 MEG)	---	---	

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TUNG-SOL

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SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	450	mVac
HEATER—CATHODE LEAKAGE	---	±30	μAdc
GRID CURRENT (1)	0	-0.4	μAdc
TRANSCONDUCTANCE (1)	2200	---	μMHOS
GLASS STRAIN[G]	---	---	
CONTINUITY AND SHORT[H]			
RF NOISE [J] (E_{c1}=0, E_{ca1}=15.0 mVac, R_k=200, C_k=0.2μf)	---	3.0	mW
NOISE AND MICROPHONICS[KL] (E_f=6.3V, E_{hk}=0, E_{bb}=E_{cc2}=200Vdc, E_{c1}=0, R_p=0.1MEG., R_{g2}=0.5MEG, R_k=1000, C_{g2}=2.0μf)	---	100	mVac
LOW FREQUENCY VIBRATION[M] (R_p=10,000)	---	150	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[N] (PRESSURE =55±5 mm mercury, , TEMP.=25±5°C, HUMIDITY =0, VOLTAGE =500 Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS Δ AVERAGE TRANSCONDUCTANCE (1)	---	10	PERCENT
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_{c1}=E_{c2}=E_b=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE VOLTAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_b=180Vdc, E_{c1}=0, E_{c2}=125Vdc, E_{hk}=135Vdc, HEATER POSITIVE, R_{g1}=0.1MEG, R_k= 130, MIN. BULB TEMP =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAY BE ENCOUNTERED IF THE TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] SEE MIL-E-1C 4.8.2

[C] PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY AFTER PREHEATING. E_f=7.0V, E_{c1}=0Vdc, R_k=130 OHMS, R_{g1}=0.1 MEG., E_b=180Vdc, E_{c2}=125 Vdc.

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] SEE MIL-E-1C 4.9.20.6

[F] SEE MIL-E-1C 4.9.20.5

[G] TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST WILL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[H] SEE MIL-E-1C 4.7.5

[J] SEE MIL-E-1C 4.10.3.1

[K] SEE MIL-E-1C 4.10.3.5

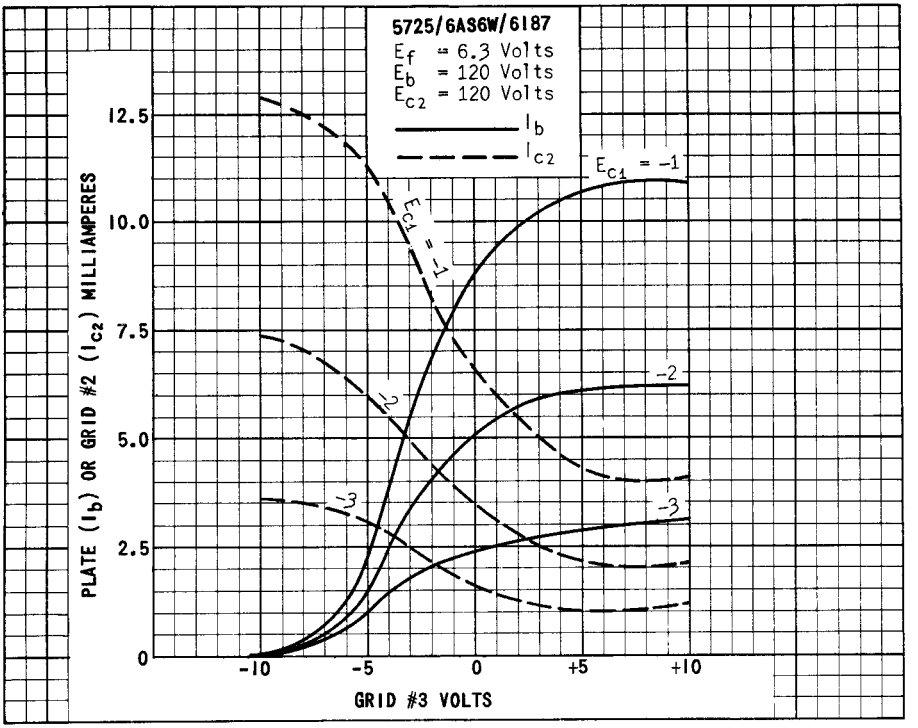
[L] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

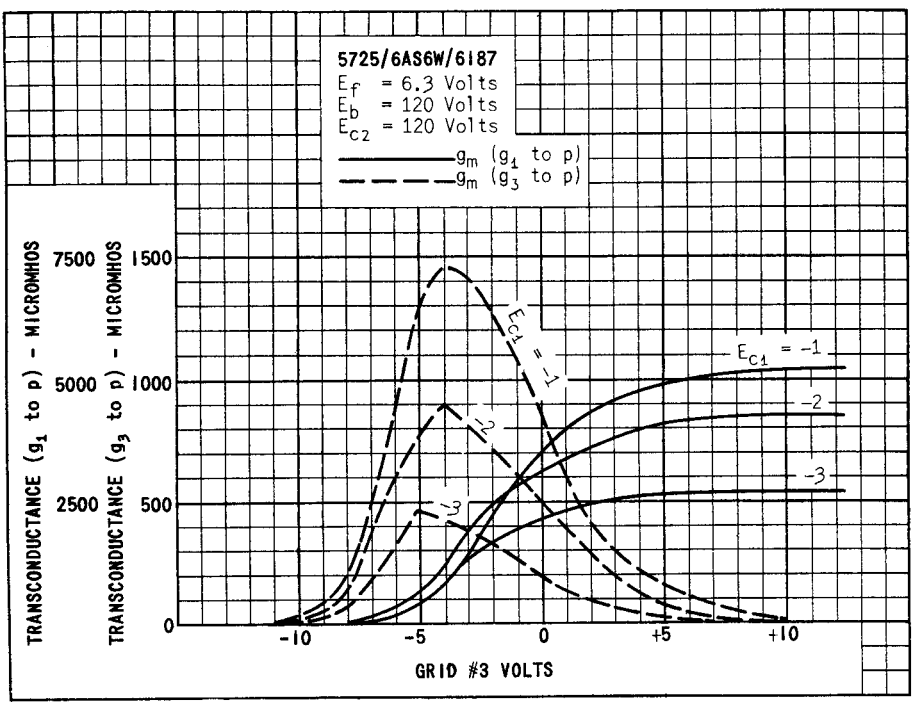
[M] SEE MIL-E-1C 4.9.20.4

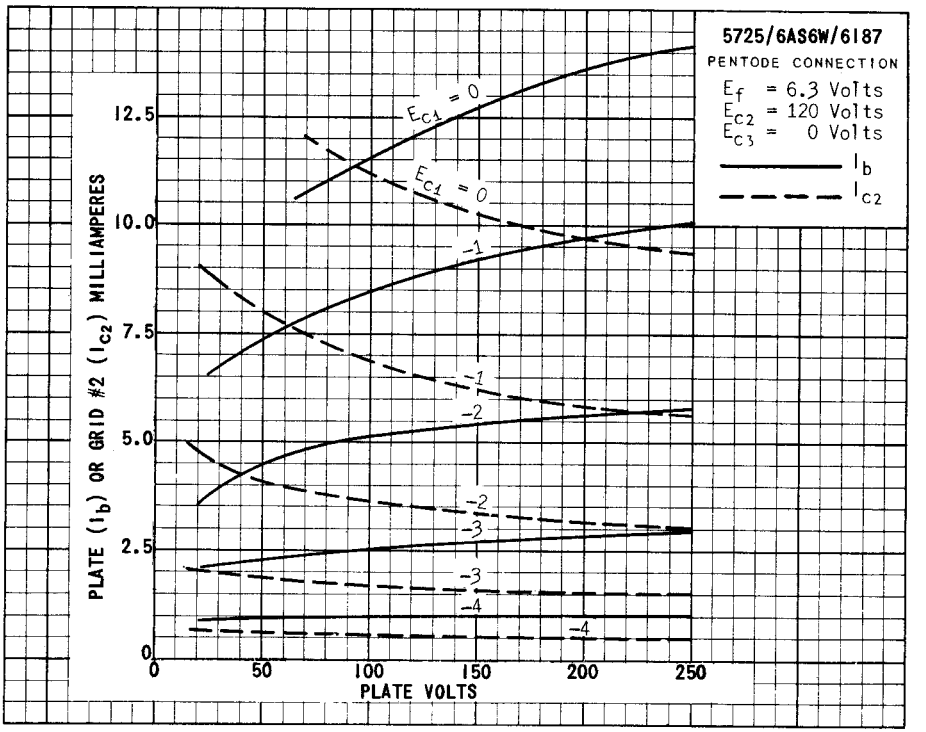
[N] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

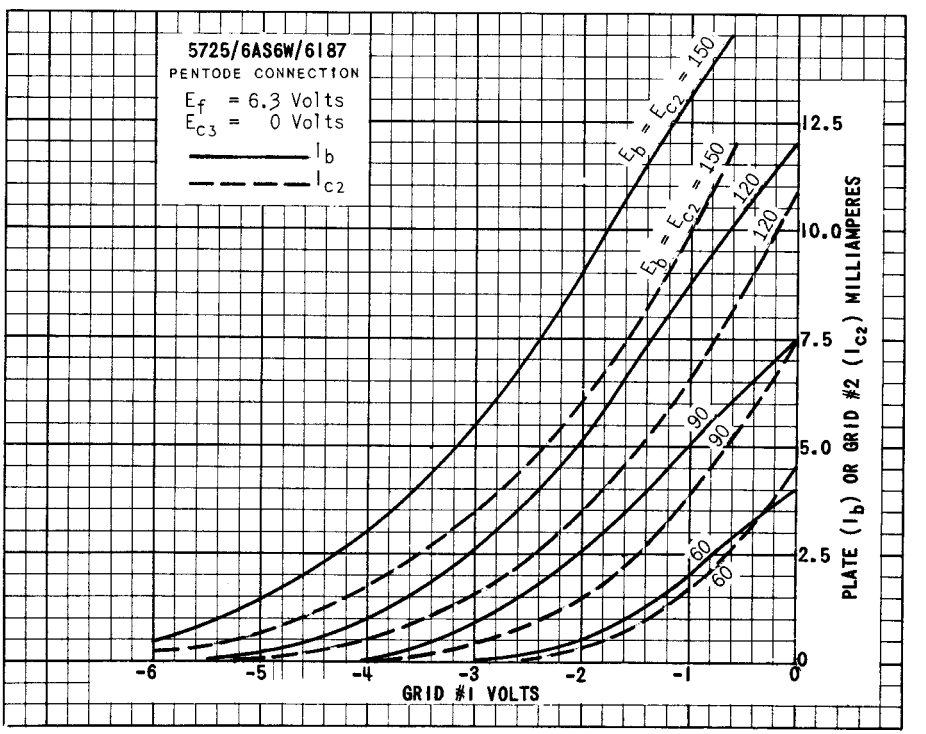
5725/6AS6W/6187

PREMIUM TUBE

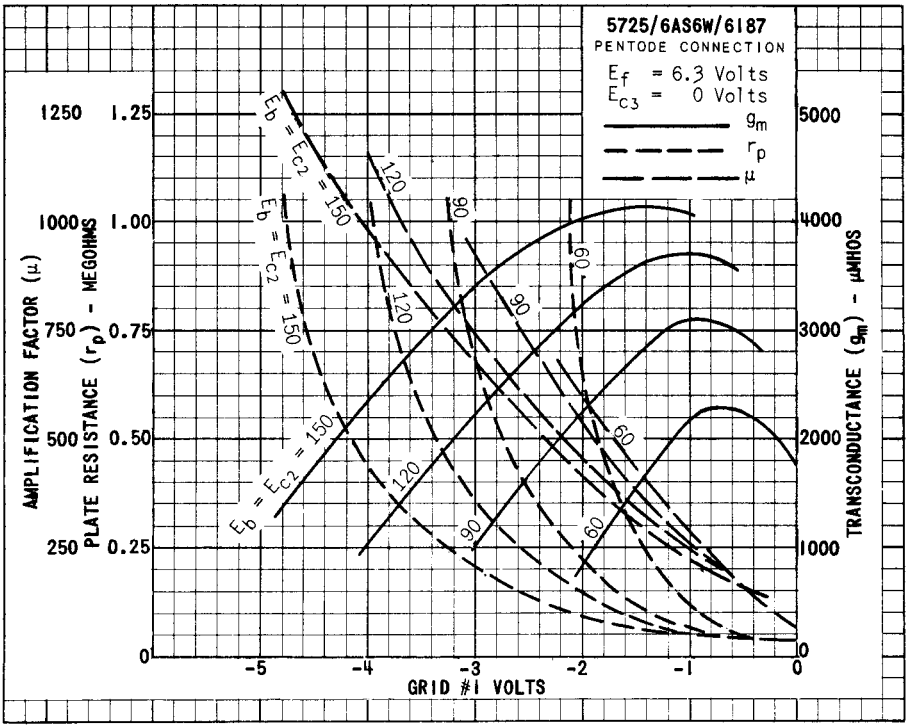


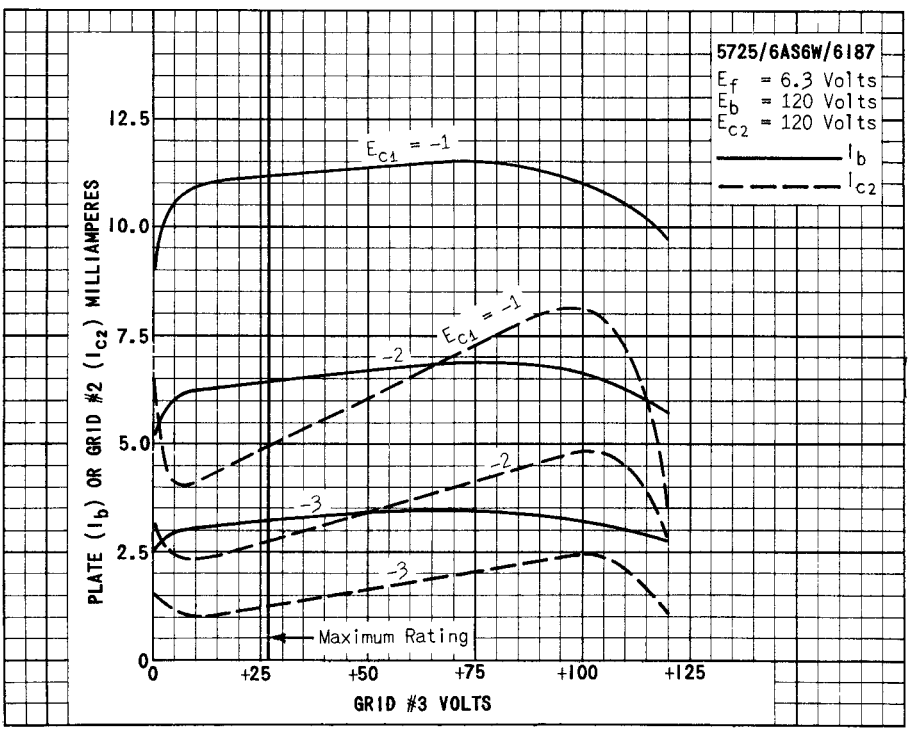



5725/6AS6W/6187
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 120 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-1
-2
-3
-4
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
2.5
5.0
7.5
10.0
12.5
50
100
150
200
250


5725/6AS6W/6187
PENTODE CONNECTION
E_f = 6.3 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
$E_b = E_{c2}$ = 150
150
120
90
60
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
GRID #1 VOLTS
0
2.5
5.0
7.5
10.0
12.5
-6
-5
-4
-3
-2
-1
0

5725/6AS6W/6187
PREMIUM TUBE





TUNG-SOL

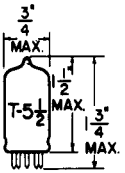
TWIN DIODE

MINIATURE TYPE

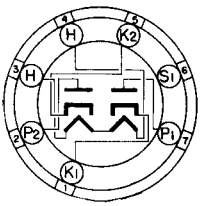
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.30 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
6BT

THE 5726/6AL5W/6097 IS A RUGGEDIZED TWIN DIODE OF THE SEVEN PIN MINIATURE CONSTRUCTION. A SHIELD BETWEEN THE TWO DIODE SECTIONS IS BROUGHT OUT TO A SEPARATE BASE PIN, SO THAT ELECTRICALLY INDEPENDENT OPERATION WILL BE ASSURED. THIS IS USEFUL FOR GENERAL PURPOSE APPLICATIONS SUCH AS CLIPPER AND CLAMPER CIRCUITS, WHERE THE TWO SECTIONS MAY BE USED IN DIFFERENT PARTS OF THE OVERALL CIRCUITRY. ITS HIGH PERVEANCE PERMITS HIGH EFFICIENCY IN EITHER FM OR AM SERVICE, IN RATIO DETECTOR OR PHASE DISCRIMINATOR CIRCUITS. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5726/6AL5W/6097 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD #316	
MAXIMUM PLATE #1 TO PLATE #2 (RATED)	.068	.026	μμf
PLATE TO (heaters) (RATED)	2.5	3.2	μμf
MAXIMUM	---	4.0	μμf
MINIMUM	---	2.4	μμf
CATHODE TO (heaters) (RATED)	3.9*	3.9	μμf
MAXIMUM	---	4.7	μμf
MINIMUM	---	3.1	μμf

* NOMINAL VALUE.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	360	VOLTS
MAXIMUM PEAK DC PLATE CURRENT (EACH SECTION)[A]	60	mA
MAXIMUM DC OUTPUT CURRENT (EACH SECTION)	10	mA
MAXIMUM SURGE CURRENT (EACH SECTION)	350	mA
MAXIMUM HEATER CATHODE VOLTAGE	360	VOLTS
MAXIMUM BULB TEMPERATURE	165	°C

TYPICAL OPERATING CONDITIONS
HALF-WAVE RECTIFIER[B]

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.30	AMP.
AC PLATE VOLTAGE, PER PLATE (RMS)	117	VOLTS
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE, PER PLATE	300	OHMS
DC OUTPUT CURRENT, PER PLATE	9	mA
HEATER CYCLES OF INTERMITTENT OPERATION, MINIMUM	5000	CYCLES

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, $E_{pp/p}$ = 165Vac, R_l = 11,000 OHMS, C_l = 8μf
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	---	---	275	325	mA
HEATER–CATHODE LEAKAGE (E_{hk} =± 100 Vdc)	---	±5	---	---	---	±10	μAdc
GRID EMISSION (1) (E_b = 10 Vdc)	40	---	---	---	35	---	mAdc
GRID EMISSION (2) [CD] (E_b = 7Vac)	---	15	---	---	---	15	PERCENT
OPERATION [EF]	16	---	---	---	---	---	mAdc
PLATE CURRENT (E_{bb}=0, R_p=40,000)	2	20	---	---	2	20	μAdc
PLATE CURRENT DIFFERENCE BETWEEN DIODES	---	5	---	---	---	---	μAdc
INSULATION OF ELECTRODES [G] (E_f=6.3V, E(p-all)=300Vdc, p NEGATIVE, E(sd-all)=300Vdc, sd NEGATIVE)							
R(p-all)	100	---	---	---	50	---	MEGOHMS
R(sd-all)	100	---	---	---	50	---	MEGOHMS

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [H] (NO VOLTAGES)	---	---	
VIBRATIONAL FATIGUE [J]	---	---	
SHOCK [K] (HAMMER ANGLE = 48°, $E_{pp/p}$=0)			
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
HEATER CATHODE LEAKAGE	---	±15	μAdc
OPERATION	14	---	mAdc
GLASS STRAIN [L]	---	---	
CONTINUITY AND SHORT [M]	---	---	
LOW PRESSURE VOLTAGE BREAKDOWN [N] (PRESSURE=55±5 mm MERCURY, TEMP. =25±5°C, HUMIDITY=0, VOLTAGE=500Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	---	Vac
HUM [P] (E_f = 7.0V)	---	10	mVac
1 HOUR STABILITY LIFE TEST INTERMITTENT LIFE TEST CONDITIONS	---	---	
STABILITY LIFE TEST END POINTS EMISSION [Q]	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST [R] (E_f=7.5V, E_{hk}=135Vdc, HEATER POSITIVE, E_{pp}=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS [S] HEATER–CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST [TU] (MIN. BULB TEMP. =+165°C)	---	---	

NOTES

[A] DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] IN HALF-WAVE SERVICE THE TWO UNITS CAN BE USED SEPARATELY OR IN PARALLEL.

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NOTES -CONT'D.

C READINGS AT E_f=5.7V ARE MADE WITH E_b=7.0V.
THE VALUE OF EMISSION (2) SHALL APPLY TO INDIVIDUAL TUBES AS IS EXPRESSED:

MADE WITH E_b=7.0V. $\frac{(Is \text{ AT } 6.3)-(Is \text{ AT } 5.7)}{(Is \text{ AT } 6.3)} \times 100$

D SEE MIL-E-1C 4.10.1.1

E SEE MIL-E-1C 4.10.13

F IN A FULL-WAVE CIRCUIT, ADJUST Zp/p SO THAT A BOGIE TUBE GIVES Io=18mAdc AND Ib NOT LESS THAN 50 MA PER PLATE. A BOGIE TUBE HAS A TUBE DROP OF E_{td}=10Vdc, AT Is=60mAdc PER PLATE. E_{hk}=Eo+117 Vac.

G SEE MIL-E-1C 4.8.2

H SEE MIL-E-1C 4.9.20.3

J SEE MIL-E-1C 4.9.20.6

K SEE MIL-E-1C 4.9.20.5

L GLASS STRAIN CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST 2 LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THE TEST.

M SEE MIL-E-1C 4.7.5

N BREAKDOWN SHALL BE DEFINED AS THAT VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

P THE TEST CIRCUIT TO BE USED IS SHOWN SCHEMATICALLY IN FIGURE #1.

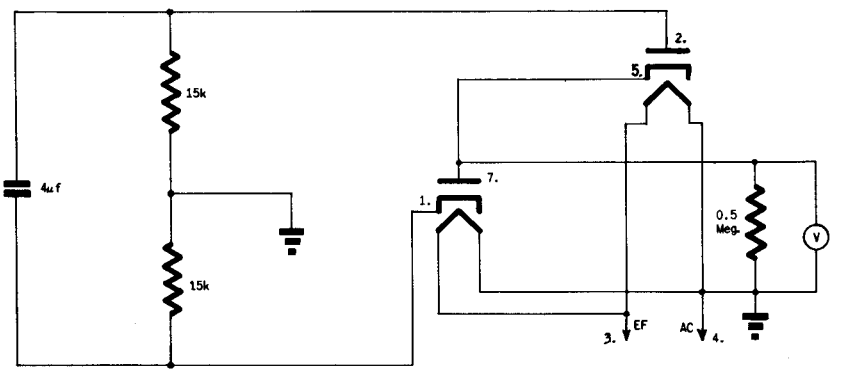


Figure 1.

Pin numbers for the element connections are indicated.

Q THE VALUE OF EMISSION SHALL BE MEASURED AT CONDITION E_b=7.0V FOR INITIAL AND TERMINAL READINGS.

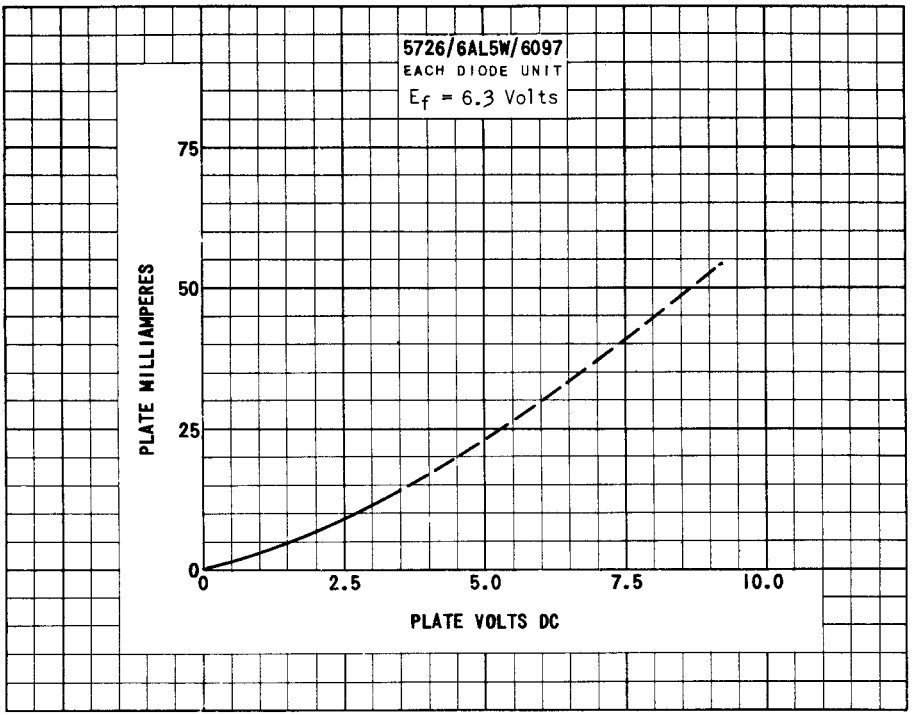
R SEE MIL-E-1C 4.11.7

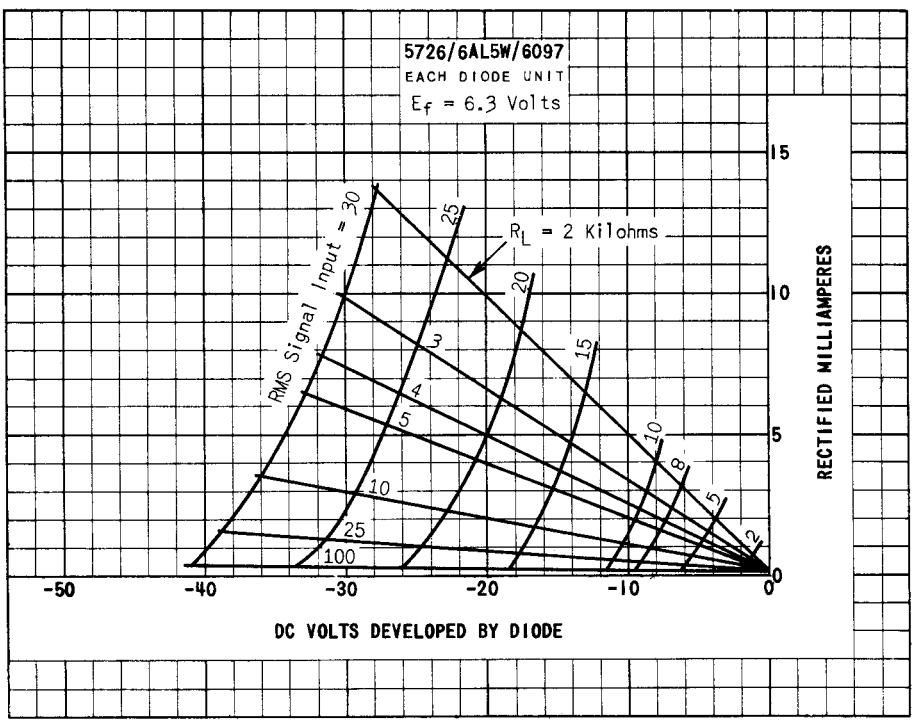
S SEE MIL-E-1C 4.11.4

T SEE MIL-E-1C 4.11.5

U $E_{hk}=E_0+117$Vac. IN A FULL-WAVE LIFE TEST CIRCUIT, THE VALUES SPECIFIED FOR RL AND CL MAY BE CONSIDERED AS APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE NOT LESS THAN I_O = 18 mAdc AND Ib = 50 MA WITH A BOGIE TUBE.

5726/6AL5W/6097
PREMIUM TUBE





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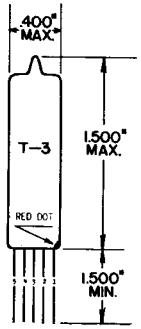
TRIODE

SUBMINIATURE TYPE

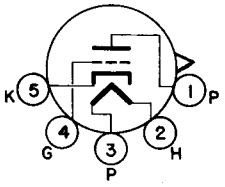


GLASS BULB
COLOR DOT IS ADJACENT TO LEAD 1
IN-LINE LEADS

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 200 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED FLEXIBLE LEADS
0.048" SPACING CENTER-TO-CENTER

THE 5744 IS A HIGH-MU TRIODE, SUITABLE FOR SERVICE AS A HIGH FREQUENCY CONVERTER OR OSCILLATOR UP TO SEVERAL HUNDRED MEGACYCLES. IT IS ALSO USEFUL IN GENERAL PURPOSE AUDIO FREQUENCY VOLTAGE AMPLIFIER SERVICE. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	0.80	0.83	pf
GRID TO CATHODE	2.7	2.6	pf
PLATE TO CATHODE	2.4	0.90	pf

[A] WITH A CYLINDRICAL SHIELD (0.40" I.D. - 1 7/8" LONG) CONNECTED TO LEAD 5.

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

MAXIMUM PLATE VOLTAGE	250	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
CATHODE BIAS RESISTANCE	500	OHMS
PLATE RESISTANCE	17500	OHMS
AMPLIFICATION FACTOR	70	
TRANSCONDUCTANCE	4 000	µMHOS
PLATE CURRENT	4	MA.

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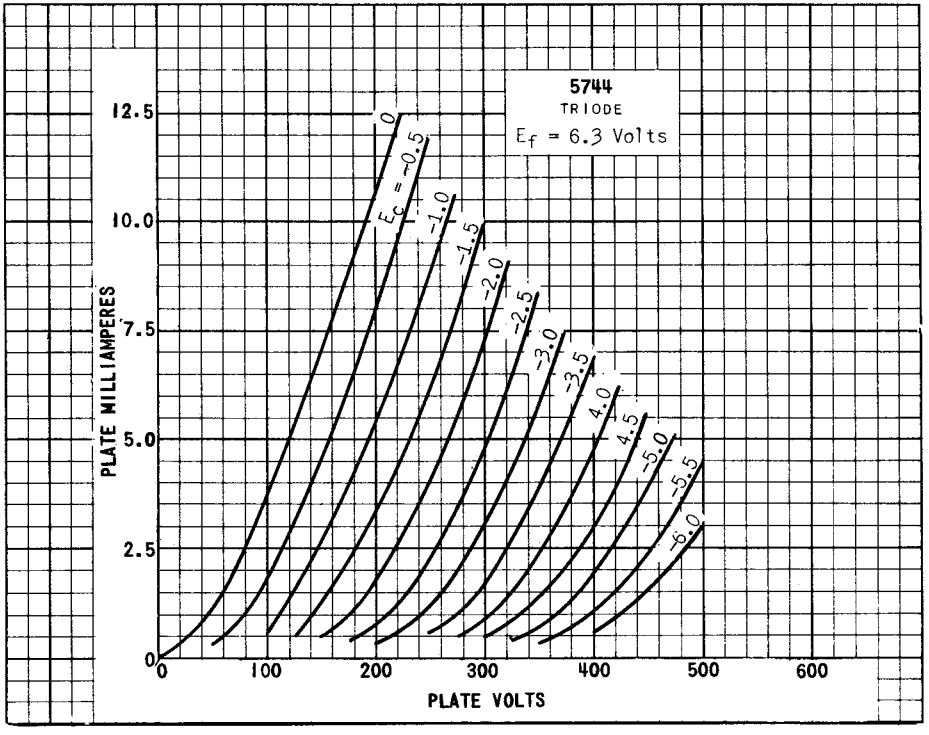
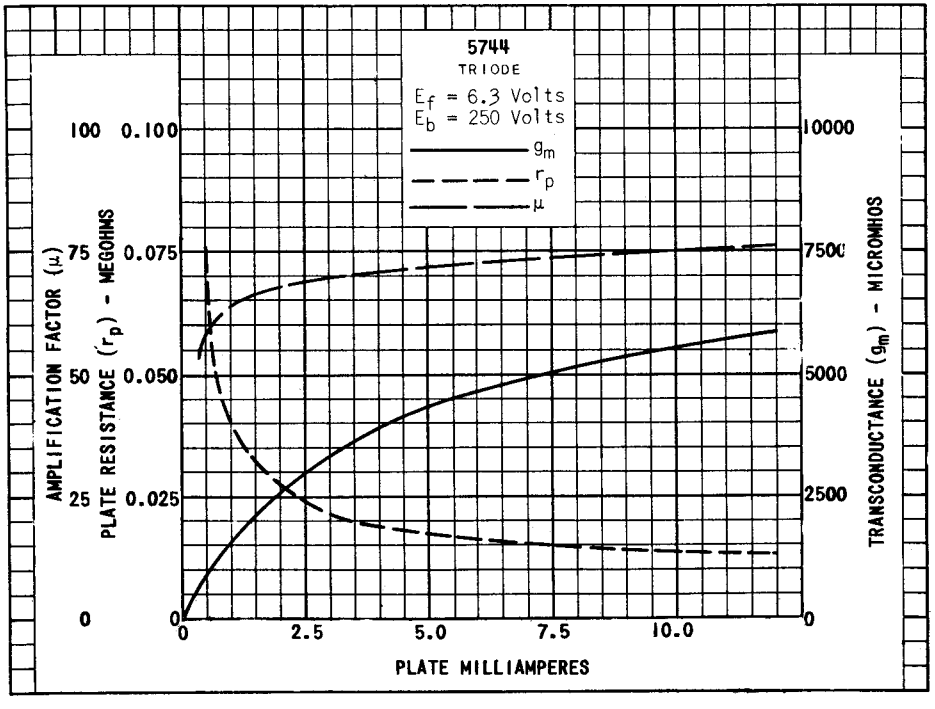

5744
TRIODE
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
12.5
10.0
7.5
5.0
2.5
0
100
200
300
400
500
600
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0


5744
TRIODE
E_f = 6.3 Volts
E_b = 250 Volts
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE MILLIAMPERES
100
75
50
25
0
0.100
0.075
0.050
0.025
0
10000
7500
5000
2500
0
2.5
5.0
7.5
10.0

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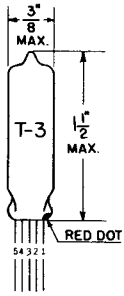
TRIODE

SUBMINIATURE TYPE

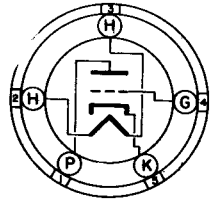


GLASS BULB

DOT IS ADJACENT TO LEAD 1

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" CENTER-TO-CENTER

THE 5744WB IS A HEATER-CATHODE TYPE HIGH-MU TRIODE OF SUBMINIATURE CONSTRUCTION CAPABLE OF OPERATION AS A FREQUENCY CONVERTER OR OSCILLATOR IN THE UHF REGION. IT IS ALSO USEFUL IN GENERAL PURPOSE AUDIO FREQUENCY VOLTAGE AMPLIFIER SERVICE. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD INLINE SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORMAL TEST CONDITIONS NOTE 7	NORMAL OPERATION NOTE 6	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	5.7	6.3	6.3	6.9	VOLTS
PLATE VOLTAGE	Eb:	---	250	250	275	vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	vdc
PLATE DISSIPATION	Pp:	---	---	1.1	1.3	W
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	VOLTS
PLATE CURRENT	Ib:	---	---	4.2	6.5	mAdc
CATHODE RESISTANCE	Rk:	---	500	500	---	OHMS
GRID CIRCUIT RESISTANCE	Rg:	---	---	---	1.2	MEGOHMS
GRID CURRENT	Ic:	---	---	---	1.0	mAdc
TRANSCONDUCTANCE (1):	Sm(1):	---	---	4000	---	μMHOS
AMPLIFICATION FACTOR	Mu:	---	---	70	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG.	UAL.	MAX.	ALD.	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1									
COMBINED AQL = 1.0% EXCLUDING MECHANICAL AND INOPERATIVES									
HEATER CURRENT:	0.65	If:	190	---	200	---	210	---	mA
HEATER-CATHODE LEAKAGE: Ehk=-100Vdc; Ehk =+100 Vdc	0.65	Ihk:	---	---	---	---	5	---	μAdc
GRID CURRENT	0.65	Ic(1):	---	---	---	---	-0.3	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	3.2	3.7	4.2	4.7	5.2	1.2	mAdc
PLATE CURRENT (2): Ec1 =-6.5 Vdc	0.65	Ib(2):	---	---	---	---	50	---	μAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	3400	3700	4000	4300	4600	660	μMHOS
AC AMPLIFICATION: Esig=0.2 Vac; Ebb=100 Vdc; Ecc=0; Rg1=10 MEG; Rk=0; Rp =0.5 MEG.	0.65	Ep:	6.5	---	---	---	---	---	Vac
CONTINUITY AND SHORTS (INOPERATIVES:)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-7)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES: Ef=6.3V. Eg-all =-100 Vdc	2.5	$R_{g1\text{-}all}$:	100	---	---	---	---	---	MEG.
Ep-all=-300 Vdc	2.5	$R_{p\text{-}all}$:	100	---	---	---	---	---	MEG.
PL PLATE CURRENT (3) Ec1=-4.0 Vdc	2.5	Ib(3):	5	---	---	---	---	---	μAdc
TRANSCONDUCTANCE (2): Ef =5.7 V.	2.5	Δ_{Ef} Sm(2):	---	---	---	---	5	---	PERCENT
GRID EMISSION: Ef=7.5V;Rg=1.0MEG. PREHEAT 5 MINUTES AT Ec1=0; TEST AT Ec1=-10 Vdc	2.5	Ic(2):	---	---	---	---	-0.4	---	μAdc
AF NOISE: Esig=50 mVac;Rg=1.0 MEG; Rp=0.2MEG.	2.5	EB:	---	---	---	---	17	---	VU
AMPLIFICATION FACTOR	6.5	Mu:	60	65	70	75	80	7	---
CAPACITANCE:		Cgp:	0.65	---	0.8	---	0.95	---	μμf
CAPACITANCE:(NOTE 2)	6.5	Cin:	2.0	---	2.7	---	3.4	---	μμf
CAPACITANCE:		Cout:	1.6	---	2.3	---	3.0	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE =55±5 mm Hg: VOLTAGE =300 Vac	6.5	---	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOGIE	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 - cont'd.									
COMBINED AQL = 1.0% EXCLUDING MECHANICAL AND INOPERATIVES									
OPERATION TIME (NOTE 10)	4.0	t:	---	---	---	---	20	---	SEC.
VIBRATION (2): F = 40 cps; G = 15; Rp = 10,000 OHMS	2.5	Ep:	---	---	---	---	15	---	mVac.
VIBRATION (3): Rp = 10,000 OHMS; F = 30 -1000 cps; G = 15; POSITION X_1 AND X_2 ONLY.	4.0	ep:	---	---	---	---	75 PEAK TO PEAK	---	mv
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1): HAMMER ANGLE = 30°; Ehk = +100 Vdc; Rg1 = 0.1 MEG.; (NOTE 3)	20	---	---	---	---	---	---	---	----
FATIGUE (1): 96 HOURS; G = 2.5; FIXED FREQUENCY; F = 25 MIN. 60 MAX. (NOTE 5)	6.5	---	---	---	---	---	---	---	----
FATIGUE (2): 6 HOURS; G = 10; FIXED FREQUENCY; F = 25 MIN. 60 MAX. (NOTE 11)	6.5	---	---	---	---	---	---	---	----

	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEFECTS PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN	MAX	MIL-E-1 UNITS
POST SHOCK (1) AND FATIGUE TESTS (1) AND (2) END POINTS; VIBRATION (2): F = 40 cps; G = 15; Rp = 10,000 OHMS			---	Ep:	---	25	mVac
HEATER-CATHODE LEAKAGE: Ehk = ± 100 Vdc			---	Ihk;	---	10	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES; Ef = 6.3 VOLTS			---	Δ_tSm(1):	---	10	PERCENT
GRID CURRENT (1):			---	Ic:	---	-1.0	μAdc

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEFECTS PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS - cont'd.							
SHOCK (3): 75G; (HAMMER ANGLE= 120°+RUBBER PAD); t= 10 MILLISEC. (NOTE 12) Ehk =+100 Vdc; Rg1= 0.1 MEG.			20	---	---	---	---
POST SHOCK TEST (2) END POINTS:							
VIBRATION (2): F=40 cps; G=15; Rp = 10,000 OHMS			---	Ep:	---	25	mVac
HEATER-CATHODE LEAKAGE: Ehk=±100 Vdc			---	Ihk:	---	10	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:: Ef =6.3 VOLTS			---	Δ_tSm(1):	---	10	PERCENT
GRID CURRENT			---	Ic:	---	-1.0	μAdc
GLASS STRAIN (THERMAL SHOCK)			6.5	---	---	---	---
ACCEPTANCE LIFE TESTS							
HEATER CYCLING LIFE TEST: Ef = 7.5 V; Eb = Ec1 =0V; Ehk =140 Vac; 1 MIN. ON, 1 MIN. OFF			1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS; HEATER-CATHODE LEAKAGE: Ehk =±100 Vdc			---	Ihk:	---	20	μAdc
1 HOUR STABILITY LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg1 = 1.0 MEG.			---	---	---	---	---
1 HOUR STABILITY LIFE TEST END POINTS: CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLE SIZE = 50 TUBES)			1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg= 1.0 MEG.			---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TEST - cont'd.							
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)			---	---	---	---	---
INOPERATIVES:			0.65	---	---	---	---
TRANSCONDUCTANCE (1):			1.0	Sm(1):	3800	---	μMHOS
INTERMITTENT HIGH TEMPERATURE LIFE TEST: T BULB = 220 °C; Ehk = +200 Vdc; Rg = 1.0 MEG.			---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)			---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.6	μAdc
HEATER CURRENT:	1	3	---	If:	180	220	mA.
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	2	5	---	Δ_{Eff}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE: Ehk = ±100 Vdc	2	5	---	Ihk:	---	10	μAdc
INSULATION OF ELECTRODES:							
g1 - all	2	5	---	Rg1-all:	50	---	MEG.
p- all	2	5	---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1) AVERAGE CHANGE:	---	---	---	Avg.Δ_t Sm(1):	---	15	PERCENT
TOTAL DEFECTIVES:	4	8	---	---	---	---	---
1000 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES;	2	5	---	---	---	---	---
GRID CURRENT (1):	2	5	---	Ic(1):	---	-1.0	μAdc
HEATER CURRENT:	2	5	---	If:	177	223	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	2	5	---	Δ_tSm(1):	---	30	PERCENT
HEATER-CATHODE LEAKAGE: Ehk = ±100 Vdc	2	5	---	Ihk:	---	15	μAdc
TOTAL DEFECTIVES:	5	10	---	---	---	---	---

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NOTES

1 CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1 "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES," AND MIL-STD-105A.

2 WITH A CYLINDRICAL SHIELD (0.406" I.D.-1 7/8" LONG) CONNECTED TO LEAD 5.

3 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4 CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

5 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

6 THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

7 THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTICS TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

8 FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ± 10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

9 CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef = 6.3 V TO THAT VALUE MEASURED AT Ef = 5.7 V.

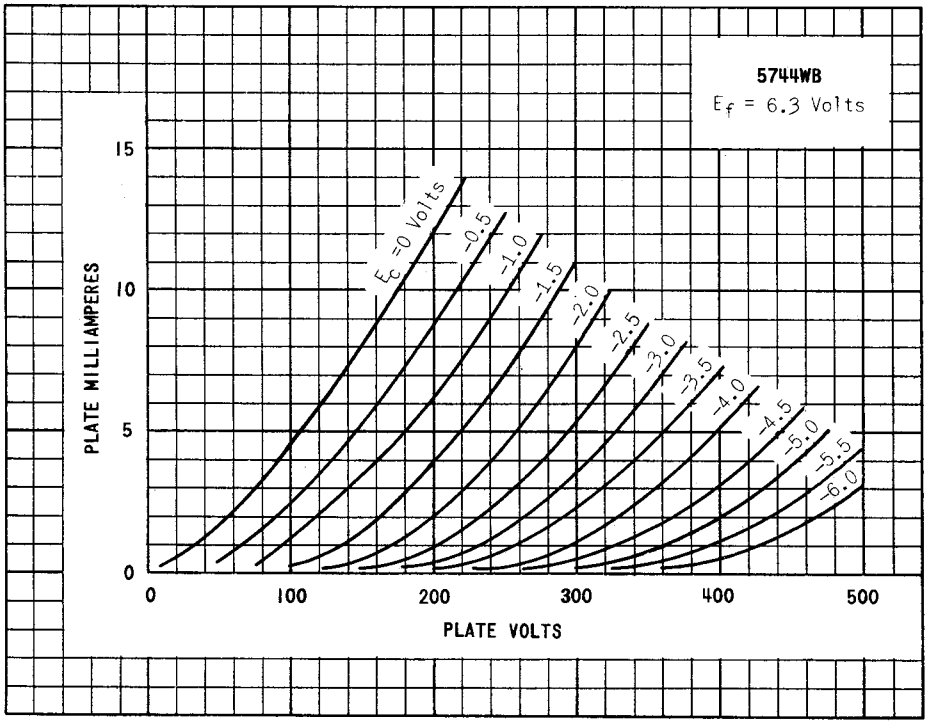
10 OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN PLUS OR MINUS 10% OF THE THREE MINUTE PLATE CURRENT (1) VALUE. NO PREHEATING BEFORE THIS TEST WILL BE ALLOWED.

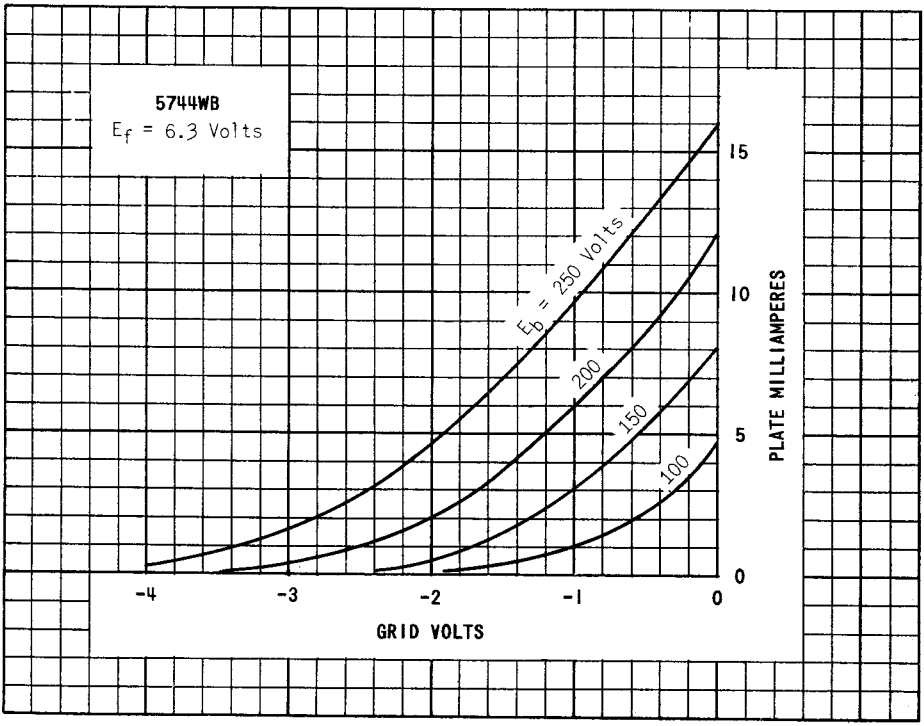
11 THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HRS, 2 HRS. IN EACH OF THREE POSITIONS, X1, X2, Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES:

(A) TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN PARAGRAPH 4.7.2 AND 4.7.3 OF SPECIFICATION MIL-E-1.

(B) TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS. THIS IS DESTRUCTIVE TEST.

12 THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).





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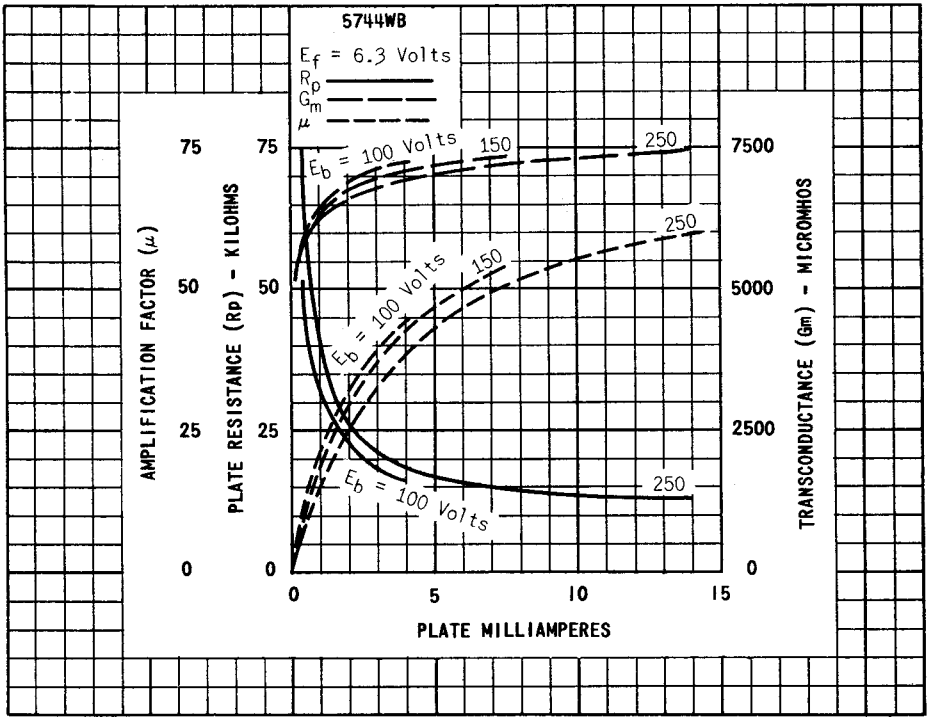

5744WB
E_f = 6.3 Volts
R_p
G_m
μ
E_b = 100 Volts
150
250
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) - KILOHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
PLATE MILLIAMPERES
0
5
10
15
25
50
75
2500
5000
7500

TUNG-SOL

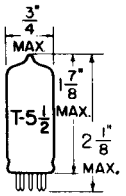
PENTODE

MINIATURE TYPE

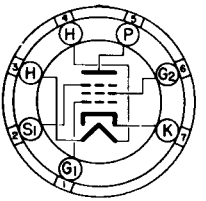
COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



GLASS BULB



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE
7BK

THE 5749/6BA6W IS A RUGGEDIZED, REMOTE CUT-OFF PENTODE VOLTAGE AMPLIFIER OF THE SEVEN PIN MINIATURE CONSTRUCTION. IT HAS EXTREMELY LOW GRID-PLATE CAPACITANCE AND HIGH TRANSCONDUCTANCE TO PERMIT EFFICIENT OPERATION IN SUCH APPLICATIONS AS RF AND IF AMPLIFIERS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, SCREEN GRID CURRENT AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5749/6BA6W IS ESPECIALLY SUITED FOR USE IN MILITARY OR INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #315	WITHOUT SHIELD	
MAXIMUM GRID #1 TO PLATE (RATED)	.0035	.0035	μμf
INPUT (RATED)	5.5	5.5	μμf
MAXIMUM	----	6.6	μμf
MINIMUM	---	4.4	μμf
OUTPUT (RATED)	5.5	5.0	μμf
MAXIMUM	---	6.5	μμf
MINIMUM	---	3.5	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	150	VOLTS
MAXIMUM PLATE DISSIPATION	3.3	WATTS
MAXIMUM GRID #2 DISSIPATION	0.7	WATT
MAXIMUM HEATER-CATHODE VOLTAGE	±100	VOLTS
MAXIMUM BULB TEMPERATURE	165	°C
MAXIMUM ALTITUDE	10 000	FEET
MAXIMUM SHOCK	450	G

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3		VOLTS
HEATER CURRENT	0.3		AMP.
PLATE VOLTAGE	100	250	VOLTS
GRID #3 VOLTAGE	0	0	VOLTS
SCREEN GRID VOLTAGE	100	100	VOLTS

CONTINUED ON FILLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS — CONT'D.

CLASS A_1 AMPLIFIER

CATHODE BIAS RESISTOR	68	68	OHMS
PLATE RESISTANCE (APPROX.)	0.25	1.0	MEGOHM
TRANSCONDUCTANCE	4300	4400	μMHOS
PLATE CURRENT	10.8	11.0	mA
SCREEN CURRENT	4.4	4.2	mA
GRID #1 VOLTAGE, Gm = 40 μMHOS	−20	−20	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 250Vdc, E_{c1} = 0Vdc, E_{c2} = 100Vdc, R_k[A] = 68OHMS, E_{c3}[B]

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	289	311	275	325	mA
HEATER CATHODE-LEAKAGE (E_{hk} =±100 Vdc)	---	10	---	3	---	10	μAdc
GRID CURRENT (E_{c1}=−1.0Vdc, R_{g1}=0.25MEG)	--	-1.0	---	-0.2	---	-1.0	μAdc
PLATE CURRENT	8.5	13.5	9.4	12.6	---	---	mAdc
TRANSCONDUCTANCE (1)	3600	5200	3910	4890	3000	5200	μMHOS
INSULATION OF ELECTRODES[C] (E_f = 6.3V, E(g1−all)= −100Vdc, E(p−all)= −300Vdc)							
R(g1−all)	100	---	---	---	50	---	MEGOHMS
R(p −all)	100	---	---	---	50	---	MEGOHMS
SCREEN CURRENT	---	5.6	---	5.0	---	---	mAdc
TRANSCONDUCTANCE (2)[D] (E_f = 5.5V)	3100	---	3560	---	---	---	μMHOS
Δ AVERAGE TRANS-CONDUCTANCE (1)	---	---	---	---	---	17	PERCENT
TRANSCONDUCTANCE (3) (E_{c1} =−20Vdc, R_k =0, C_k =0)	5	100	20	60	---	---	μMHOS
GRID EMISSION[E] (E_f =7.5V, E_{c1}=−25Vdc, R_{g1} =0.5 MEG, R_k =0, C_k = 0)	---	-1.0	---	---	---	---	μAdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[F] (R_p = 2000)	---	400	mVac
VIBRATIONAL FATIGUE[G]	---	---	
MINIATURE TUBE BASE STRAIN[H] (NO VOLTAGES)	---	---	
STABILIZATION[J] (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
SHOCK[K] (HAMMER ANGLE = 30°, E_{hk} = 100Vdc, R_{g1} =0.1 MEG., C_k =0)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
GRID CURRENT	---	-2.0	μAdc
HEATER−CATHODE LEAKAGE	---	30	μAdc
LOW FREQUENCY VIBRATION	---	450	mVac
TRANSCONDUCTANCE (1)	3000	---	μMHOS
SHORT AND CONTINUITY[L]	---	---	
RF NOISE[M] (E_{sig} = 15mVac, C_k= 0.2 μf)	---	---	

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SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
NOISE AND MICROPHONICS[N] (E_f=6.3Vdc, E_{bb}=E_{cc2}=300Vdc, E_{cg1}=200mVac, R_p=10,000, R_k=200, R_{g2}=60,000, C_{g2}=2μf)	---	200	mVac
LOW FREQUENCY VIBRATION[O] (R_p = 2000)	---	300	mVac
INTERMITTENT LIFE TEST (E_b=300Vdc, E_{c2}=150Vdc, E_{hk}=135, R_{g1}=0.25MEG. R_k=230, C_k=0)	---	---	
HEATER CYCLING LIFE TEST (E_f=7.5V, E_b=E_{c1}=E_{c2}=E_{c3}=0, E_{hk}=135Vdc)	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS HEATER—CATHODE LEAKAGE	---	20	μAdc

NOTES

[A] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS AT 60 CYCLES.

[B] TIE GRID #3 TO THE NEGATIVE TERMINAL OF THE CATHODE RESISTOR.

[C] SEE MIL-E-1C 4.8.2

[D] PREHEAT ALL TUBES TO BE TESTED FOR TRANSCONDUCTANCE (2) UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=5.5V, E_b=250Vdc, E_{c1}=E_{c3}=0, E_{c2}=100Vdc, R_k=68, R_{g1}=0.5MEG.

[E] PREHEAT ALL TUBES TO BE TESTED FOR GRID EMISSION UNDER THE FOLLOWING CONDITIONS FOR A PERIOD OF 5 MINUTES PRIOR TO TESTING. E_f=7.5V, E_b=250Vdc, E_{c1}=E_{c3}=0, E_{c2}=100Vdc, R_k=68, R_{g1}=0.5MEG. TWO SECONDS SHALL BE THE MAXIMUM TIME BETWEEN PREHEAT AND TEST.

[F] SEE MIL-E-1C 4.9.20.3

[G] SEE MIL-E-1C 4.9.20.6

[H] SEE MIL-E-1C 4.9.6.1

[J] SEE MIL-E-1C 4.7.5

[K] SEE MIL-E-1C 4.9.20.5

[L] SEE MIL-E-1C 4.7.5

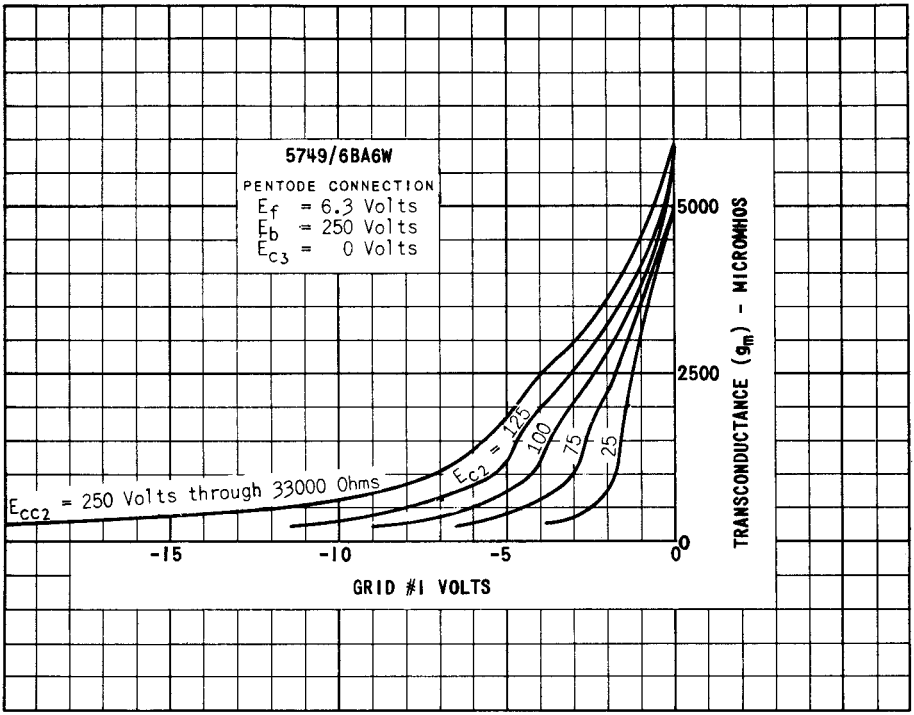
[M] SEE MIL-E-1C 4.10.3.1

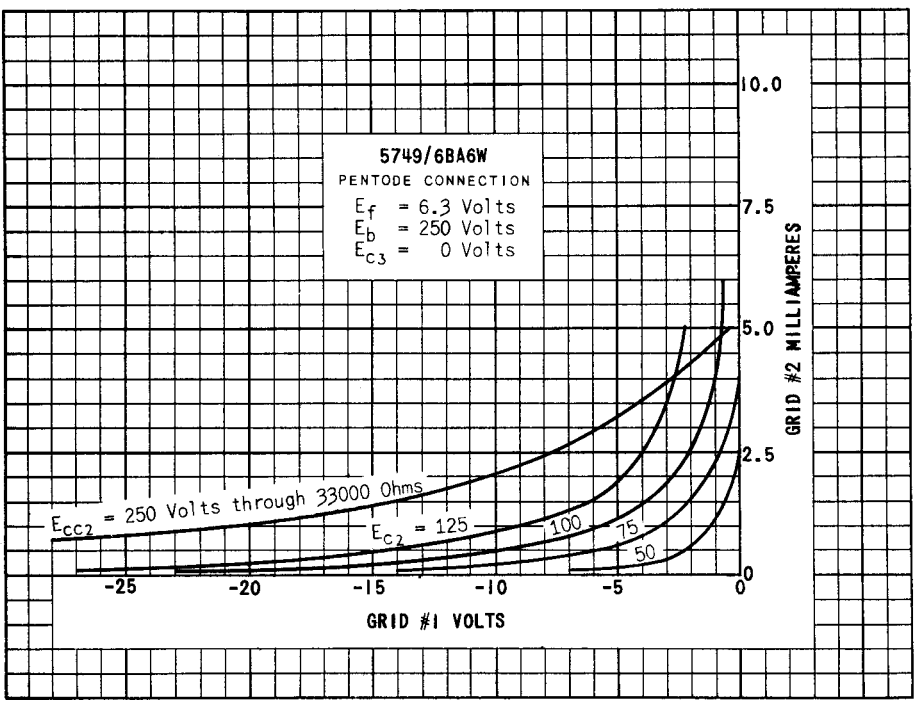
[N] SEE MIL-E-1C 4.10.3.5

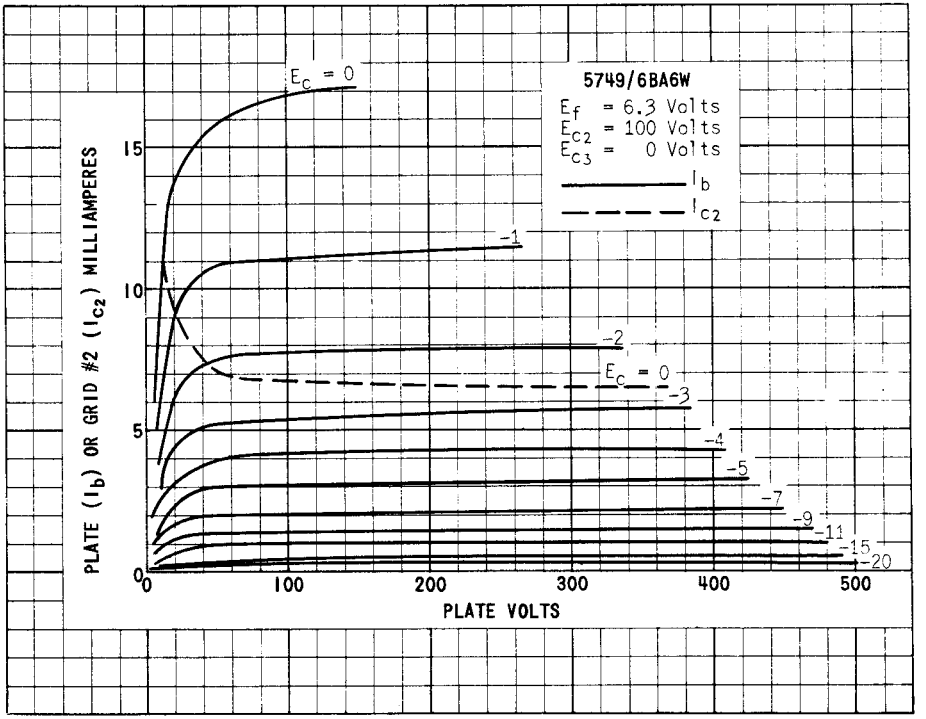
[O] SEE MIL-E-1C 4.9.20.4

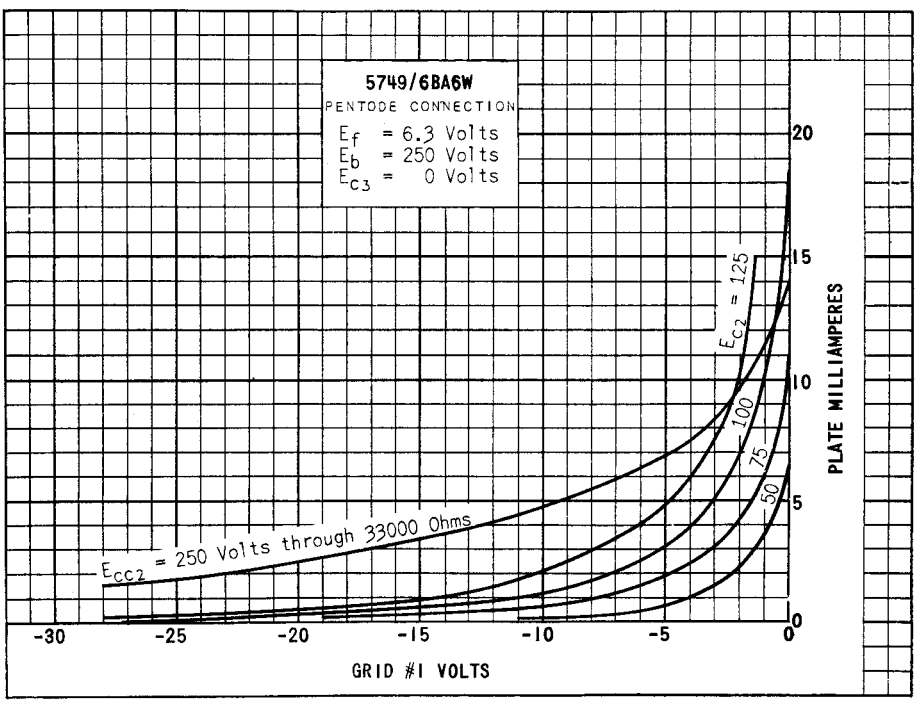
5749/6BA6W

PREMIUM TUBE





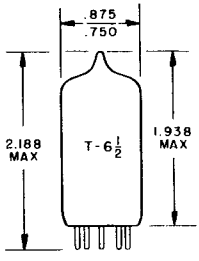

5749/6BA6W
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_c = 0
-1
-2
-3
-4
-5
-7
-9
-11
-15
-20
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
5
10
15
0
100
200
300
400
500


5749/6BA6W
PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 125
100
75
50
E_{cc2} = 250 Volts through 33000 Ohms
PLATE MILLIAMPERES
GRID #1 VOLTS
0
5
10
15
20
-30
-25
-20
-15
-10
-5
0

TUNG-SOL

THIS DATA SHEET ALSO APPLIES TO ANOTHER MILITARY VERSION, DESIGNATED 5751W1

DOUBLE TRIODE
MINIATURE TYPE



GLASS BULB

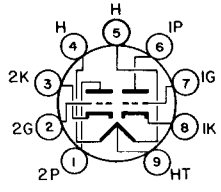
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR GENERAL PURPOSE

VOLTAGE-AMPLIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 5751 IS A 9-PIN MINIATURE, HIGH-MU TUBE WITH TWO TRIODE SECTIONS WITH INDIVIDUAL CATHODE CONNECTIONS. IT INCORPORATES DISTINCTIVE MECHANICAL DESIGN FEATURES, AND INCREASED HEATER CURRENT WHICH PROVIDES A SAFETY FACTOR IN CATHODE PERFORMANCE. THESE FEATURES COMBINE TO PRODUCE A STURDY SHOCK-RESISTANT TUBE AND ONE WHICH WILL GIVE LONG LIFE UNDER CONDITIONS OF INTERMITTENT OPERATION.
THE 5751W1 IS DESIGNED FOR HIGHLY RELIABLE APPLICATIONS BUT IS OTHERWISE IDENTICAL WITH TYPE 5751.

HEATER CHARACTERISTICS AND RATINGS
ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4 + 5	
AVERAGE VALUES - VOLTAGE	12.6	6.3	VOLTS
- CURRENT	175	350	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION	12.6±1.3	6.3±0.6	VOLTS

MAXIMUM RATINGS
ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID VOLTAGE:		
NEGATIVE BIAS VALUE	50	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
PLATE DISSIPATION (EACH SECTION)	0.8	WATTS
ALTITUDE FOR 5751	60,000	FT.
FOR 5751W1	80,000	FT.
ENVELOPE TEMPERATURE	165	°C
GRID RESISTANCE	0.5	MEGOHM

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TUNG-SOL

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TYPICAL OPERATING CHARACTERISTICS

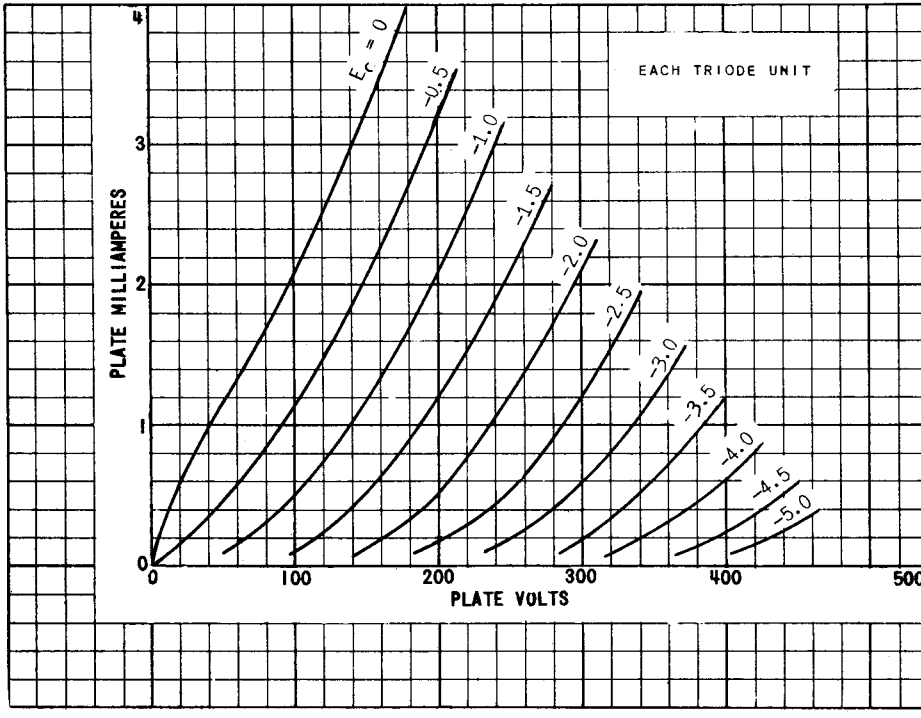
CLASS A1 AMPLIFIER - EACH TRIODE SECTION

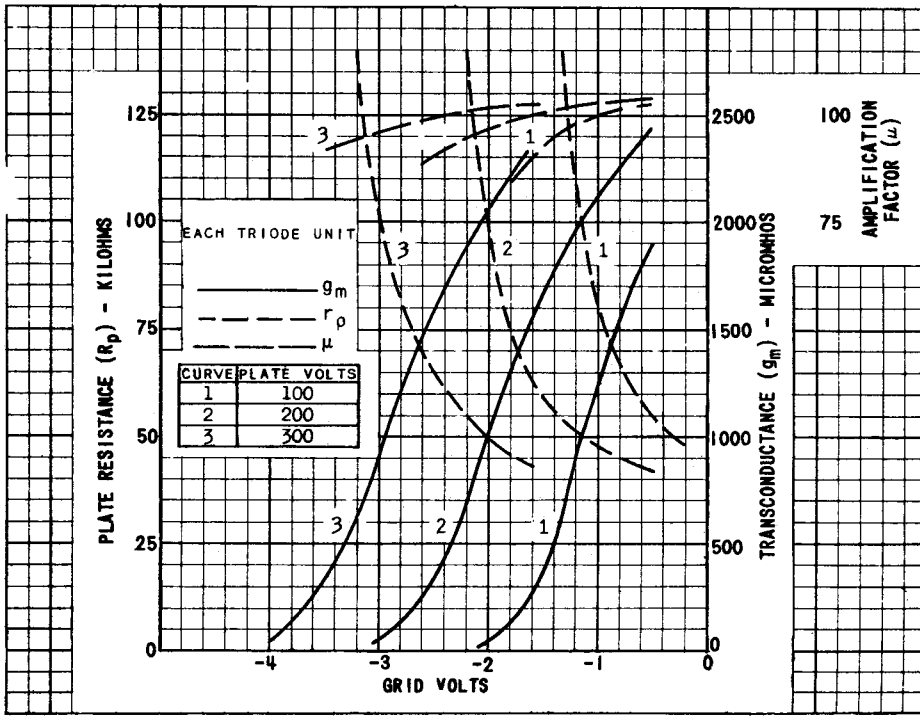
PLATE VOLTAGE	100	250	VOLTS
AMPLIFICATION FACTOR	70	70	
GRID BIAS VOLTAGE	−1	−3	VOLTS
PLATE RESISTANCE	58,000	58,000	OHMS
TRANSCONDUCTANCE	1,200	1,200	μMHOS
PLATE CURRENT	0.8	1.0	MA.

SPECIAL TESTS AND CONTROLS

HEATER-CYCLING LIFE TEST
LOW PRESSURE VOLTAGE BREAKDOWN
SHOCK
FATIGUE
SWEEP FREQUENCY VIBRATION (5751W1 ONLY)
OPERATION AT CUT-OFF 0 PLATE CURRENT (5751W1 ONLY)

SIMILAR TYPE REFERENCE: Similar to the 12AX7.





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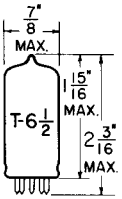
TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

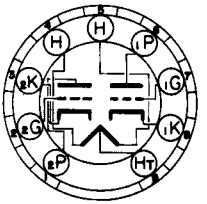
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.35 AMP.
12.6 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9A

THE 5751WA IS A RUGGEDIZED, HIGH MU TWIN TRIODE OF THE NINE-PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE HEATER CENTER-TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. THE 5751WA IS ADAPTABLE TO LOW LEVEL INPUT APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE IMPORTANT CONSIDERATIONS. OTHER GENERAL APPLICATIONS INCLUDE VOLTAGE AMPLIFIERS, PHASE INVERTERS, AND MULTIVIBRATORS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5751WA IS ESPECIALLY SUITED FOR USE IN MILITARY OR INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE #1 (RATED)	1.4	μμf
MAXIMUM	1.70	μμf
MINIMUM	1.10	μμf
GRID TO PLATE #2 (RATED)	1.4	μμf
MAXIMUM	1.70	μμf
MINIMUM	1.10	μμf
INPUT (RATED)	1.4	μμf
MAXIMUM	1.70	μμf
MINIMUM	1.10	μμf
OUTPUT (SECTION #1) (RATED)	0.46	μμf
MAXIMUM	0.70	μμf
MINIMUM	0.22	μμf
OUTPUT (SECTION #2) (RATED)	0.36	μμf
MAXIMUM	0.54	μμf
MINIMUM	0.18	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	0.8		WATT
MAXIMUM HEATER-CATHODE VOLTAGE	±100		VOLTS
MAXIMUM DC CATHODE CURRENT (EACH SECTION)	22		mA
MAXIMUM BULB TEMPERATURE	±165		°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE SECTION

HEATER VOLTAGE	6.3	12.6	6.3	12.6	VOLTS
HEATER CURRENT	0.35	0.175	0.35	0.175	AMP.
PLATE VOLTAGE	100		250		VOLTS
AMPLIFICATION FACTOR	70		70		
GRID BIAS VOLTAGE	-1		-3		VOLTS
PLATE RESISTANCE	58 000		58 000		OHMS
TRANSCONDUCTANCE	1 200		1 200		μMHOS
PLATE CURRENT	0.8		1.0		mA

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 12.6V, E_b = 250Vdc, E_c = -3Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. AVG. MIN.	PROD. AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER–CATHODE LEAKAGE[A] (E_{hk}=±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g=1.0 MEG.)	0	-0.4	---	---	0	-0.4	μAdc
PLATE CURRENT (1)	0.4	1.8	0.7	1.3	---	---	mAdc
AC AMPLIFICATION[B] (E_{BB}=100Vdc, E_c=0, E_{sig}=0.2Vac, R_p=0.5 MEG, R_g=10 MEG.)	7.5	---	---	---	6.5	---	Vac
INSULATION OF ELECTRODES[C] (E_f=12.6V, E (g–all)= 100Vdc, g neg., E(p–all)= 300 Vdc, p neg.)							
R(g–all)	500	---	---	---	250	---	MEGOHMS
R(p–all)	500	---	---	---	250	---	MEGOHMS
PLATE CURRENT (2) (E_c =-10.6Vdc)	---	10	---	---	---	---	μAdc
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	0.6	---	---	---	---	mAdc
TRANSCONDUCTANCE (1)	900	1600	1075	1325	---	---	μMHOS
Δ TRANSCONDUCTANCE (2)[D] E_f=11.4V)	---	15	---	---	---	---	PERCENT
GRID CURRENT (2)[E] (E_f=14V)	0	-1.5	---	---	---	---	μAdc
AMPLIFICATION FACTOR	55	85	62	78	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[FA] (R_p=10,000)	---	100	mVac
VIBRATIONAL FATIGUE[G]	---	---	
SHOCK[H] (HAMMER ANGLE = 42°, E_{hk} =100 Vdc, HEATER POS., R_g = 0.1 MEG)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER–CATHODE LEAKAGE	---	±30	μAdc
AC AMPLIFICATION	6.5	---	Vac
GRID CURRENT (1)	0	-0.6	μAdc
GLASS STRAIN[J]	---	---	
CONTINUITY AND SHORT[K]	---	---	
NOISE AND MICROPHONICS[LAMN] (E_f = 12.6Vac, E_{hk} =0, E_{bb} = 300Vdc, E_c =0, R_p = 0.1 MEG.)	---	100	mVac

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SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
LOW FREQUENCY VIBRATION[OA] (R_p = 2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[P] (PRESSURE = 55±5 mm mercury, TEMP. =25±5°C, HUMIDITY =0, VOLTAGE =500 Vac, 60 CYCLES, SINUSOIDAL WAVEFORM)	500	----	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS			
Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
HEATER CYCLING LIFE TEST (E_f = 7.5V, E_{hk} = 135 Vdc, HEATER POSITIVE, E_{c1} = E_b = 0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_{hk} =135 Vdc, HEATER POSITIVE, R_g =0.5 MEG., MIN. BULB TEMPERATURE = 165°C	---	---	

NOTES

[A] TIE 1_p TO 2_p, 1_g to 2_g, 1_k to 2_k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.

[B] SEE MIL-E-1C 4.10.11.2

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED;

$$\frac{(\text{SM AT } 12.6)-(\text{SM AT } 11.4)}{(\text{SM AT } 12.6)} \times 100$$

[E] PRIOR TO THIS TEST, TUBES TO BE PREHEATED FIVE (5) MINUTES AT CONDITIONS INDICATED. TEST IMMEDIATELY AFTER PRE-HEATING. E_f=14.0V, E_{c1}=-3.0Vdc, R_k=0 OHMS, E_b=250Vdc, R_g/g=0.5 MEG.

[F] SEE MIL-E-1C 4.9.20.3

[G] SEE MIL-E-1C 4.9.20.6

[H] SEE MIL-E-1C 4.9.20.5

[J] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C ±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST (2) LITERS PER 15 TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

[K] SEE MIL-E-1C 4.7.5

[L] SEE MIL-E-1C 4.10.3.5

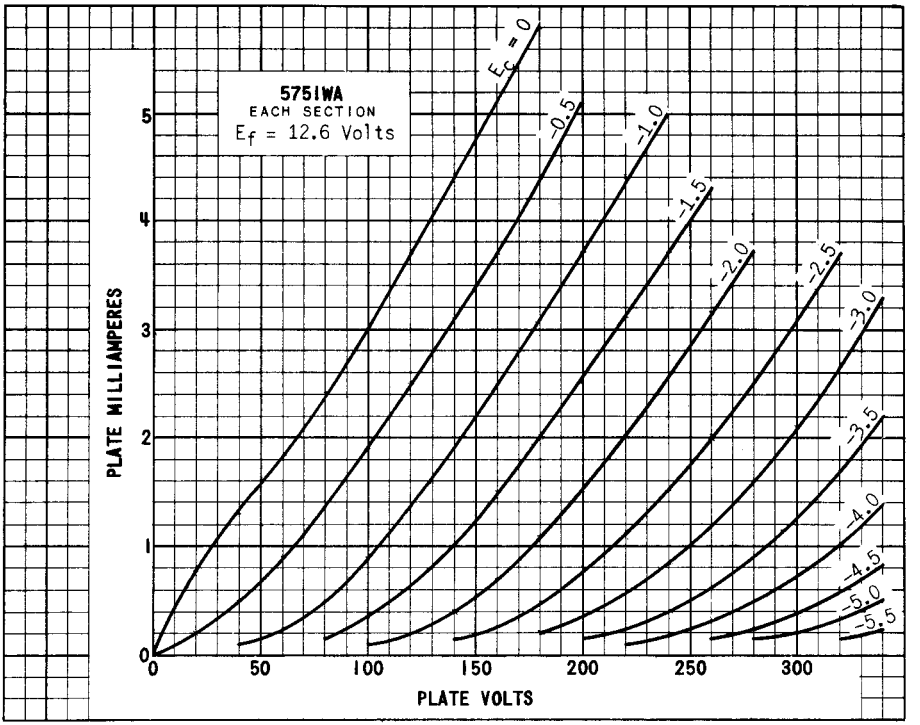
[M] TIE CATHODES TOGETHER AND GROUND THRU A 1500 OHM RESISTOR. GRIDS ARE GROUNDED.

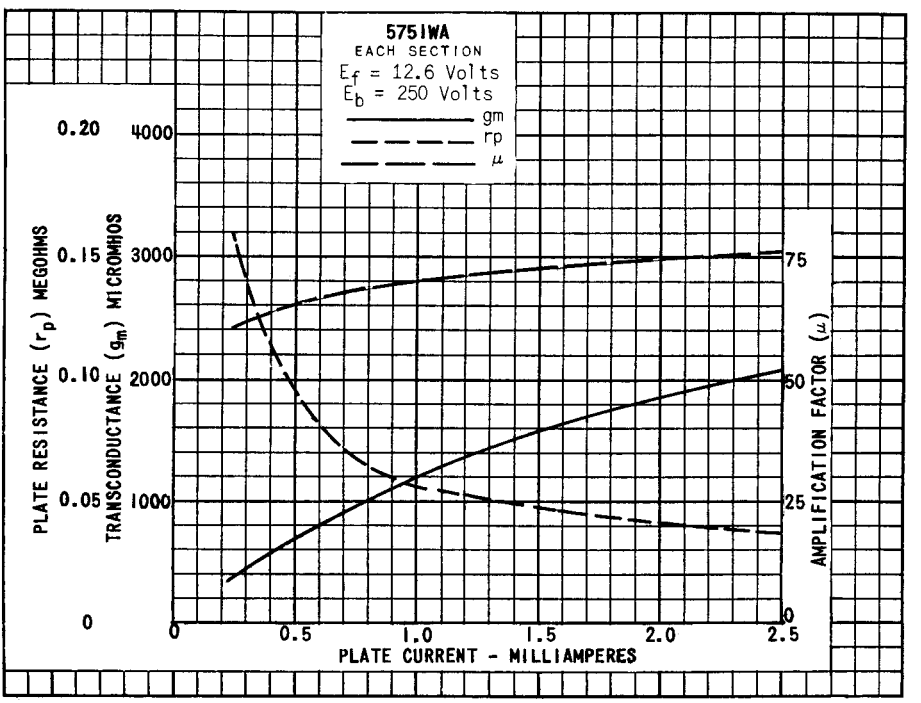
[N] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHMS @ 60 CYCLES.

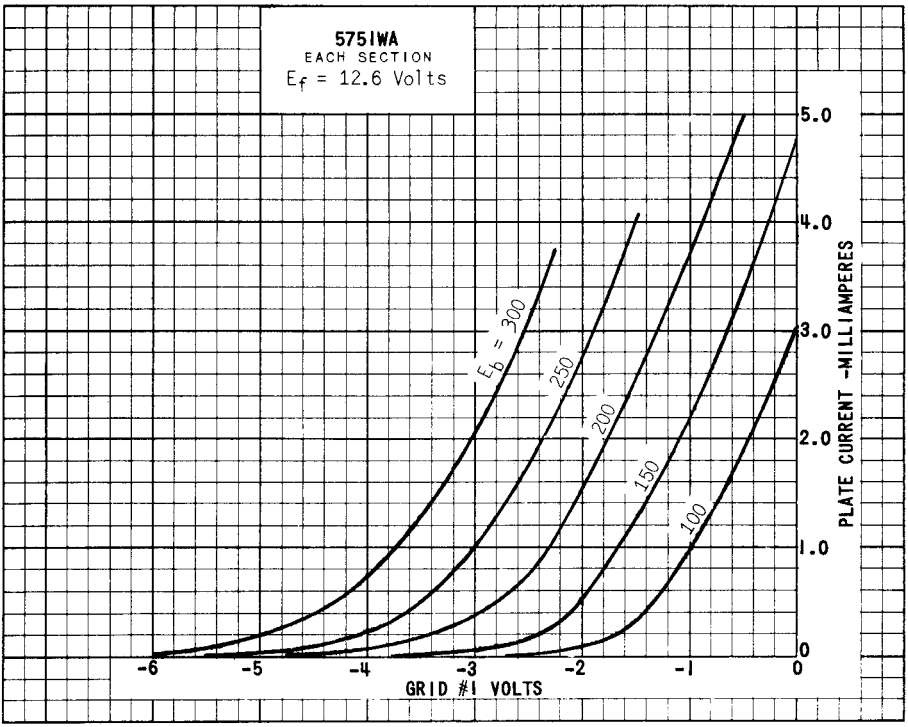
[O] SEE MIL-E-1C 4.9.20.4

[P] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

5751WA
PREMIUM TUBE



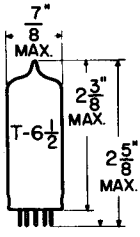



5751WA
EACH SECTION
E_f = 12.6 Volts
E_b = 300
250
200
150
100
5.0
4.0
3.0
2.0
1.0
0
PLATE CURRENT -MILLIAMPERES
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS

TUNG-SOL

AMPLIFIER

MINIATURE TYPE



GLASS BULB

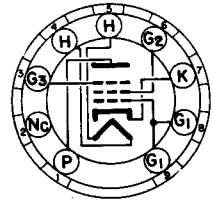
UNIPOTENTIAL CATHODE

HEATER

6.0±10% VOLTS 0.75 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE
9K

THE 5763 IS A HEATER-CATHODE TYPE TRANSMITTING BEAM POWER AMPLIFIER IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN COMPACT, LOW-POWER MOBILE TRANSMITTERS AND IN THE LOW-POWER STAGES OF LARGER FIXED STATION TRANSMITTERS. THE 5763 IS PARTICULARLY USEFUL IN THE DOUBLER AND TRIPLER STAGES OF TRANSMITTERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.3	pf
INPUT	9.5	pf
OUTPUT	4.5	pf

RATINGS

ABSOLUTE VALUES

PLATE-MODULATED RF POWER AMPLIFIER - CLASS C TELEPHONY

CARRIER CONDITIONS PER TUBE FOR USE WITH A MAX. MODULATION FACTOR OF 1.0

	CCS[A]	ICAS[B]	
MAXIMUM DC PLATE VOLTAGE	250	300	VOLTS
MAXIMUM DC GRID #3 (SUPPRESSOR) VOLTAGE	0	0	VOLTS
MAXIMUM DC GRID #2 (SCREEN) VOLTAGE	250	250	VOLTS
MAXIMUM DC GRID #1 (CONTROL-GRID) VOLTAGE	-125	-125	VOLTS
MAXIMUM DC PLATE CURRENT	40	50	MA.
MAXIMUM DC GRID #2 CURRENT	15	15	MA.
MAXIMUM DC GRID #1 CURRENT	5	5	MA.
MAXIMUM PLATE INPUT	10	15	WATTS
MAXIMUM GRID #2 INPUT	1.5	1.5	WATTS
MAXIMUM PLATE DISSIPATION	8	12	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	250	°C

[A] CONTINUOUS COMMERCIAL SERVICE.

[B] INTERMITTENT COMMERCIAL AND AMATEUR SERVICE

CONTINUED ON FOLLOWING PAGE

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TYPICAL OPERATION UP TO 30 MC

DC PLATE VOLTAGE	250	300	
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE[C]	250	250	VOLTS
DC GRID #1 VOLTAGE[D]	-39	-42.5	VOLTS
From a grid resistor of	39000	18000	OHMS
PEAK RF GRID #1 VOLTAGE	46.5	53.5	VOLTS
DC PLATE CURRENT	40	50	MA.
DC GRID #2 CURRENT	5.6	6	MA.
DC GRID #1 CURRENT (APPROX.)	1	2.4	MA.
DRIVING POWER (APPROX.)	0.05	0.15	WATT
USEFUL POWER OUTPUT (APPROX.)	6.4[E]	10[E]	WATTS

MAXIMUM CIRCUIT VALUES
CCS OR ICAS CONDITIONS

GRID #1 CIRCUIT RESISTANCE (MAX.)	0.1	MEGOHM

RATINGS
ABSOLUTE MAXIMUM VALUES

RF POWER AMPLIFIER & OSCILLATOR - CLASS C TELEGRAPHY[G] and RF POWER AMPLIFIER - CLASS C FM TELEPHONY

	CCS[A]	ICAS[B]	
DC PLATE VOLTAGE	300	350	VOLTS
DC GRID #3 (SUPPRESSOR) VOLTAGE	0	0	VOLTS
DC GRID #2 (SCREEN) VOLTAGE	250	250	VOLTS
DC GRID #1 (CONTROL-GRID) VOLTAGE	-125	-125	VOLTS
DC PLATE CURRENT	50	50	MA.
DG GRID #2 CURRENT	15	15	MA.
DC GRID #1 CURRENT	5	5	MA.
PLATE INPUT	15	17	WATTS
GRID #2 INPUT	2	2	WATTS
PLATE DISSIPATION	12	13.5	WATTS
PEAK HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	100	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	250	°C

TYPICAL OPERATION UP TP 30 MC

DC PLATE VOLTAGE	300	350	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE	250	250	VOLTS
DC GRID #1 VOLTAGE[F]	-28.5	-28.5	VOLTS
From a grid resistor of	18000	18000	OHMS
PEAK RF GRID #1 VOLTAGE	37.5	37	VOLTS
DC PLATE CURRENT	50	48.5	MA.
DC GRID #2 CURRENT	6.6	6.2	MA.
DC GRID #1 CURRENT (APPROX.)	1.6	1.6	MA.
DRIVING POWER (APPROX.)	0.1	0.1	WATT
USEFUL POWER OUTPUT (APPROX.)	10.3[E]	12[E]	WATTS

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TUNG-SOL

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TYPICAL OPERATION AT 50 MC

DC PLATE VOLTAGE	300	---	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE	250	---	VOLTS
DC GRID #1 VOLTAGE[F]	-60	---	VOLTS
From a grid resistor of	22000	---	OHMS
PEAK RF GRID #1 VOLTAGE	80	---	VOLTS
DC PLATE CURRENT	50	---	MA.
DC GRID #2 CURRENT	5	---	MA.
DC GRID #1 CURRENT (APPROX.)	3	---	MA.
DRIVING POWER (APPROX.)	0.35	---	WATT
USEFUL POWER OUTPUT (APPROX.)	7[E]	---	WATTS

MAXIMUM CIRCUIT VALUES
CCS OR ICAS CONDITIONS

GRID #1 CIRCUIT RESISTANCE (MAX.)	0.1	MEGOHM

RATINGS
ABSOLUTE MAXIMUM VALUES

FREQUENCY MULTIPLIER

	CCS[A]	
DC PLATE VOLTAGE	300	VOLTS
DC GRID #3 (SUPPRESSOR) VOLTAGE	0	VOLTS
DC GRID #2 (SCREEN) VOLTAGE	250	VOLTS
DC GRID #1 (CONTROL-GRID) VOLTAGE	-125	VOLTS
DC PLATE CURRENT	50	MA.
DC GRID #2 CURRENT	15	MA.
DC GRID #1 CURRENT	5	MA.
PLATE INPUT	15	WATTS
GRID #2 INPUT	2	WATTS
PLATE DISSIPATION	12	WATTS
PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	250	°C

TYPICAL OPERATION

	DOUBLER TO 175 MC	TRIPLER TO 175 MC	
DC PLATE VOLTAGE	300	300	VOLTS
GRID #3	CONNECTED TO CATHODE AT SOCKET		
DC GRID #2 VOLTAGE			
DC GRID #1 VOLTAGE[F]	-75	-100	VOLTS
From grid resistor of	75000	100000	OHMS
PEAK RF GRID #1 VOLTAGE	95	120	VOLTS
DC PLATE CURRENT	40	35	MA.
DC GRID #2 CURRENT	4	5	MA.
DC GRID #1 CURRENT (APPROX.)	1	1	MA.
DRIVING POWER APPROX.	0.6	0.6	WATT
USEFUL POWER OUTPUT (APPROX.)	2.1[E]	1.3[E]	WATTS

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MAXIMUM CIRCUIT VALUES
FOR MAXIMUM RATED CONDITIONS

GRID #1 CIRCUIT RESISTANCE(MAX.)	0.1	MEGOHM

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	NOTE	MIN.	MAX.	
HEATER CURRENT	1	0.69	0.81	AMP.
GRID #1 PLATE CAPACITANCE	2	---	0.3	pf
INPUT CAPACITANCE	2	8.0	11.0	pf
OUTPUT CAPACITANCE	2	3.8	5.2	pf
TRANSCONDUCTANCE	1,3	5100	8900	μMHOS
PLATE CURRENT	1,3	33	57	MA.
GRID #2 CURRENT	1,3	---	10	MA.
REVERSE GRID #1 CURRENT	1,4	---	2	μAMP.

NOTE 1: WITH 6 VOLTS AC OR DC ON HEATER.

NOTE 2: WITH NO EXTERNAL SHIELD

NOTE 3: WITH DC PLATE VOLTAGE OF 250 V., DC GRID #2 VOLTAGE OF 250 V, & DC GRID #1 VOLTAGE OF -7.5 VOLTS.

NOTE 4: WITH DC PLATE VOLTAGE OF 250 V, DC GRID #2 VOLTAGE OF 250 V, DC GRID #1 VOLTAGE OF -7.5 VOLTS, AND GRID #1 CIRCUIT RESISTANCE OF 0.1 MEGOHM.

[A] CONTINUOUS COMMERCIAL SERVICE

[B] INTERMITTENT COMMERCIAL AND AMATEUR SERVICE.

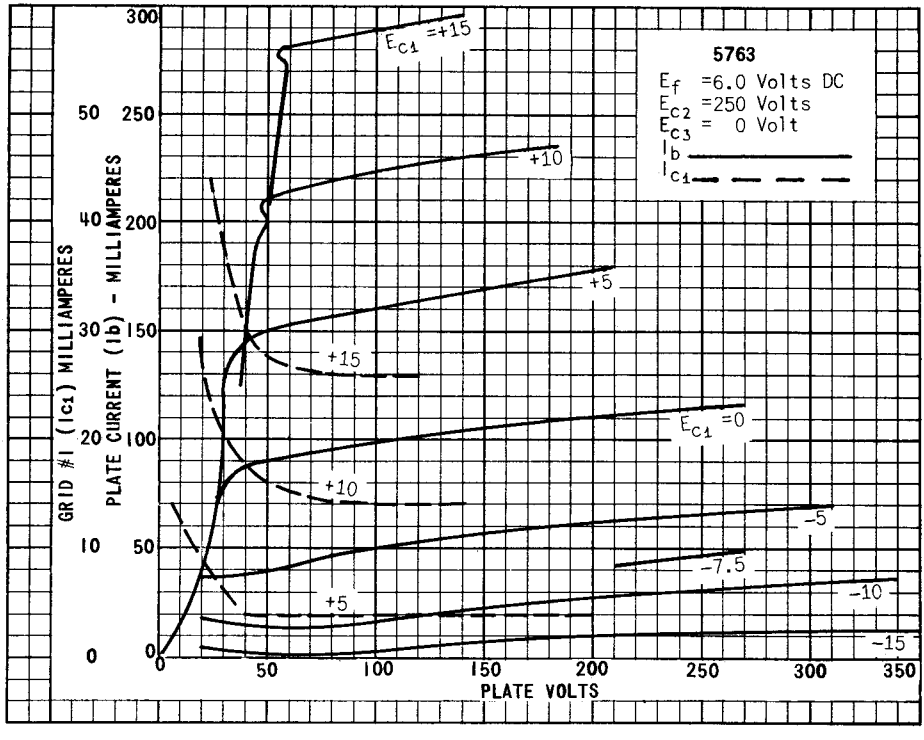
[C] OBTAINED PREFERABLY FROM A SEPARATE SOURCE MODULATED WITH THE PLATE SUPPLY, OR FROM THE MODULATED PLATE SUPPLY THROUGH A SERIES RESISTOR.

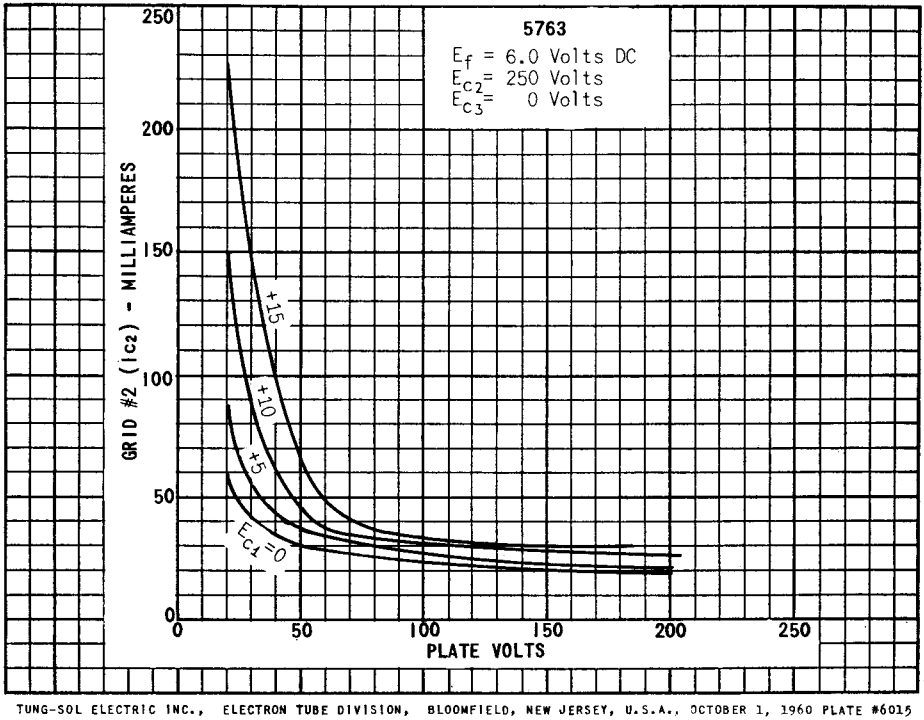
[D] OBTAINED FROM GRID #1 RESISTOR OR FROM A COMBINATION OF GRID #1 RESISTOR WITH EITHER FIXED SUPPLY OR CATHODE RESISTOR.

[E] THIS VALUE OF USEFUL POWER IS MEASURED AT LOAD OF OUTPUT CIRCUIT.

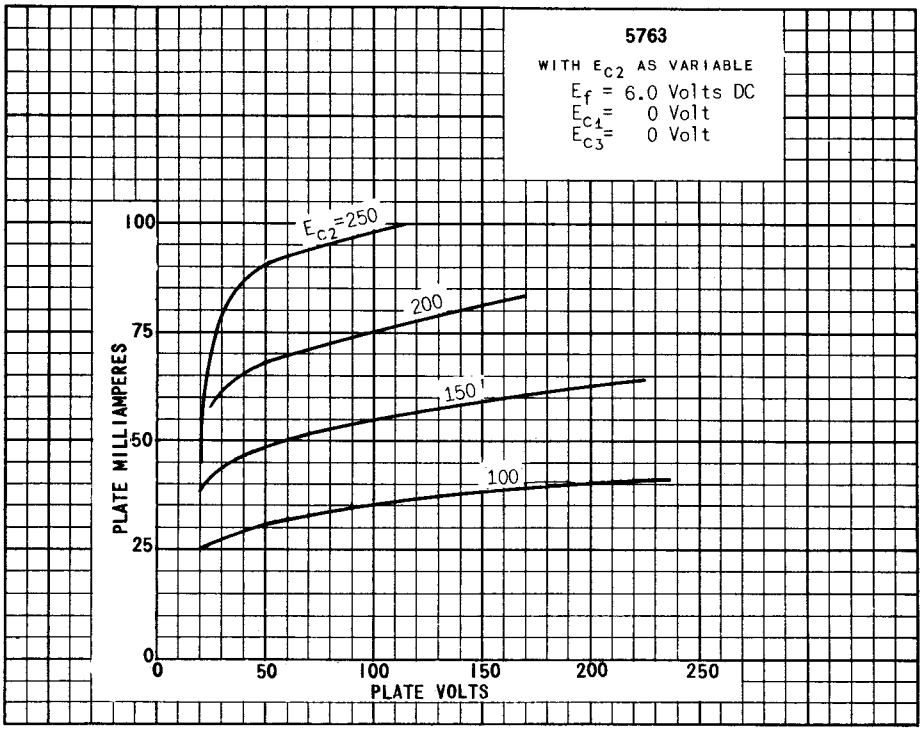
[F] OBTAINED FROM A FIXED SUPPLY, OR BY A GRID #1 RESISTOR OF VALUE SHOWN.

[G] KEY DOWN CONDITIONS PER TUBE WITHOUT AMPLITUDE MODULATION. MODULATION ESSENTIALLY NEGATIVE MY BE USED IF THE POSITIVE PEAK OF THE AUDIO-FREQUENCY ENVELOPE DOES NOT EXCEED 115% OF THE CARRIER CONDITIONS.


5763
Ef =6.0 Volts DC
Ec2 =250 Volts
Ec3 = 0 Volt
Ib
Ic1
GRID #1 (Ic1) MILLIAMPERES
PLATE CURRENT (Ib) - MILLIAMPERES
PLATE VOLTS
Ec1 =+15
+10
+5
+15
Ec1 =0
+10
+5
-5
-7.5
-10
-15
0
50
100
150
200
250
300
350


5763
Ef = 6.0 Volts DC
Ec2= 250 Volts
Ec3= 0 Volts
GRID #2 (Ic2) - MILLIAMPERES
PLATE VOLTS
+15
+10
+5
Ec1=0
0
50
100
150
200
250

TENTATIVE DATA



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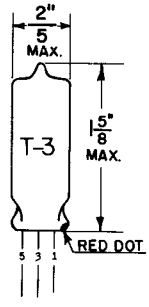
DIODE

SUBMINIATURE TYPE

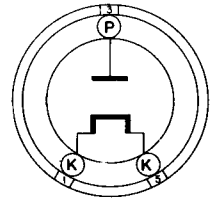


GLASS BULB

DOT IS ADJACENT TO LEAD 1

SUBMINIATURE GAS DIODE

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.10" CENTER-TO-CENTER

THE 5783 IS A COLD CATHODE, GLOW-DISCHARGE TUBE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR SERVICE AS A VOLTAGE REFERENCE TUBE IN ELECTRONICALLY REGULATED DC POWER SUPPLIES. IT HAS AN OPERATING CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERERS OVER WHICH IT MAINTAINS A SUBSTANTIALLY CONSTANT OPERATING VOLTAGE OF 85 VOLTS. VOLTAGE FLUCTUATIONS ARE APPRECIABLY LESS THAN 0.1 VOLTS WITHIN THE RATED OPERATING CURRENT RANGE. TWO CATHODE LEADS ARE PROVIDED WHICH MAY BE USED TO DISCONNECT THE LOAD WHEN THE TUBE IS REMOVED FROM THE SOCKET. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

RATINGS

ABSOLUTE MAXIMUM VALUES

DC OPERATING CURRENT	1.5 TO 3.5	MA.
AMBIENT TEMPERATURE	-55 TO +90	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

MINIMUM DC ANODE SUPPLY VOLTAGE	115	VOLTS
AVERAGE DC OPERATING VOLTAGE	85	VOLTS
DC OPERATING CURRENT RANGE	1.5 TO 3.5	MA
DC OPERATING VOLTAGE RANGE	80 TO 90	VOLTS
MAXIMUM REGULATION (1.5 TO 3.5 MA.)	3.0	VOLTS
STABILITY OF OPERATING VOLTAGE (VOLTAGE FLUCTUATION)	0.1	VOLTS
MAXIMUM SHUNT CAPACITANCE	0.02	μfd

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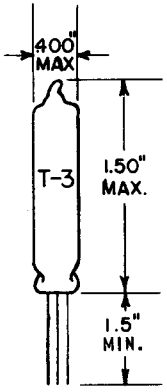
DIODE

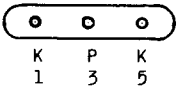
SUBMINIATURE TYPE



GLASS BULB

COLD-CATHODE GLOW DISCHARGE

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.1" CENTER TO CENTER

THE 5783WA IS A SUB-MINIATURE TWO ELECTRODE INERT-GAS-FILLED, COLD CATHODE GLOW DISCHARGE DIODE FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONIC REGULATED SUPPLIES. IT HAS AN OPERATING VOLTAGE OF APPROXIMATELY 86 VOLTS OVER A CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES. THIS TUBE IS IDEALLY SUITED FOR APPLICATIONS IN WHICH SUDDEN FLUCTUATIONS MUST BE KEPT BELOW 5 MILLIVOLTS OVER THE ENTIRE RANGE AND WHICH REQUIRE VERY LOW OPERATING VOLTAGE DRIFT AND LONG LIFE.

THE 5783WA FEATURES HIGH SHOCK AND VIBRATION RATINGS. IT IS PARTICULARLY SUITABLE FOR APPLICATIONS REQUIRING SMALL SIZE AND LIGHT WEIGHT COMPONENTS.

ELECTRICAL DATA

CATHODE	COLD	

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH EXCLUDING LEADS	1 1/2	INCHES
MAXIMUM DIAMETER	0.40	INCHES
BULB	T-3	
BASE	SUBMINIATURE FLAT PRESS WITH THREE FLYING LEADS	
NET WEIGHT (APPROX.)	0.1	OUNCES
MAXIMUM SHOCK RATING	450	G/1MS
MAXIMUM VIBRATION RATING D=.08"@50CPS	10	G

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
ABSOLUTE VALUES

MAXIMUM DC OPERATING CURRENT	3.5	MA.
MINIMUM DC OPERATING CURRENT	1.5	MA.
MAXIMUM INVERSE VOLTAGE	-50	VOLTS
AMBIENT TEMPERATURE RANGE	-55 TO +155	°C
ALTITUDE	60 000	FEET

ADDITIONAL TESTS TO INSURE RELIABILITY
RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

FATIGUE: 25° CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF 3 MUTUALLY PERPENDICULAR PLANES (2.5 G).

POST SHOCK AND FATIGUE LIMITS:		
IONIZATION VOLTAGE (MAX.)	120	VDC
TUBE VOLTAGE DROP (1.5 AND 3.5 MA)	81 TO 91	VDC
REGULATION (1.5 TO 3.5 MA) (MAX.)	4.0	VDC
STABILITY LIFE TEST (1 HOUR):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX.)	200	mVDC
SURVIVAL RATE LIFE TEST (100 HOURS):		
END POINT: CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX.)	1.0	VDC
INTERMITTENT LIFE TEST: END POINTS (500 HOURS):		
CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX)	4.0	VDC
TUBE VOLTAGE DROP	81 TO 91	VDC
REGULATION (MAX.)	4.0	VDC
IONIZATION VOLTAGE (MAX.)	120	VDC

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVERAGE	MAX.	
DC ANODE SUPPLY VOLTAGE IN DARKNESS	140[A]	---	---	VOLTS
DC ANODE SUPPLY VOLTAGE IN LIGHT	120[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	106	120	VOLTS
TUBE VOLTAGE DROP (1) AT 1.5 MA	81	84.5	---	VOLTS
TUBE VOLTAGE DROP (2) AT 3.5 MA	---	86.0	91	VOLTS
REGULATION	---	0.8	2.0	VOLTS/MA.
VOLTAGE JUMP[B]	---	0	5.0	MV
VOLTAGE REPEATABILITY[C]	---	0.01	0.1	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	20	MV.
LEAKAGE CURRENT (E_b=50V, R_p=3000Ω)	---	0	20	μAMPS
GENERATED PLATE VOLTAGE (WHEN VIBRATED AT 40 CPS, 15G, R_p=10,000Ω, I_b=2.5MADC)	---	---	50	MV.
MAXIMUM SHUNT CAPACITOR	---	---	0.02	μFARADS
SERIES RESISTOR	D	---	---	
MAXIMUM CURRENT THROUGH INTER-CONNECTED LEADS	---		0.2	AMP.

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NOTES

[A] TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[B] THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE CURRENT OPERATING CURRENT RANGE.

[C] TUBE IS CYCLED ONE MINUTE ON AND ONE MINUTE OFF FOR FIVE CYCLES. READINGS ARE TAKEN INITIALLY AND AT THE END OF EACH "ON" PERIOD.

[D] SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 3.5 MA. AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 1.5 MA AT THE LOWEST ANODE SUPPLY VOLTAGE.

APPLICATION NOTES

VOLTAGE REFERENCE TUBES ARE OFTEN CONFUSED WITH VOLTAGE REGULATOR TUBES. WHILE A REFERENCE TUBE IS A REGULATOR TUBE, IT IS A SPECIAL FORM OF REGULATOR TUBE, IN WHICH CURRENT RANGE AND REGULATION IS SACRIFICED TO PROVIDE VOLTAGE REPEATABILITY AND TEMPERATURE STABILITY AND TO MINIMIZE VOLTAGE JUMP AND LONG TERM DRIFT.

THE VOLTAGE REGULATION CHARACTERISTIC OF A REFERENCE TUBE IS NOT INDEPENDENT OF THE TUBE CURRENT. THEREFORE THE 5783WA SHOULD BE RUN FROM A CONSTANT SOURCE SUCH AS A VR TUBE, A PENTODE, OR A SIMPLE SERIES REGULATOR. PRACTICAL CIRCUITS ARE GIVEN IN FIGURES 1, 2, AND 3.

IF SO DESIRED, "INPUT AND OUTPUT" CONNECTIONS TO THE CATHODE CAN BE MADE TO DIFFERENT INTERNALLY CONNECTED LEADS, SO THAT THE CIRCUIT WILL BE BROKEN UPON THE REMOVAL OF THE TUBE FROM ITS SOCKET. THE TUBE SHOULD BE SHIELDED IF IT IS TO BE USED IN STRONG RF OR MAGNETIC FIELDS.

THE PRINCIPAL USE OF THE 5783WA IS TO SUPPLY A REFERENCE VOLTAGE IN AN ELECTRONICALLY REGULATED POWER SUPPLY. THIS USE IS ILLUSTRATED IN FIGURE 4. THE 5783WA MAY ALSO BE SUBSTITUTED FOR THE MINIATURE TYPE 5651WA IN MANY CIRCUITS FOUND IN THE HANDBOOK, PREFERRED CIRCUITS, Navy Aeronautical Electronic Equipment (NAVAER 16-1-519). THIS IS AVAILABLE FROM THE SUPERINTENDENT OF DOCUMENTS, US GOVT. PRINTING OFFICE, WASHINGTON 25, D.C. AT $1.75.

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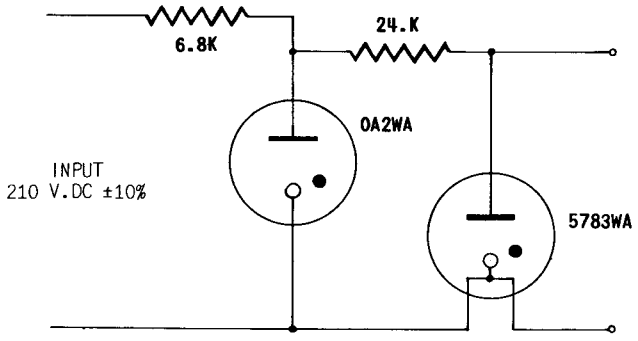

FIGURE 1

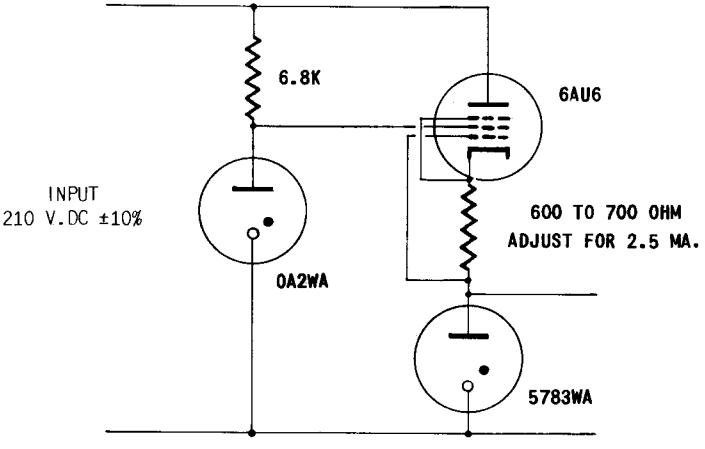

FIGURE 2

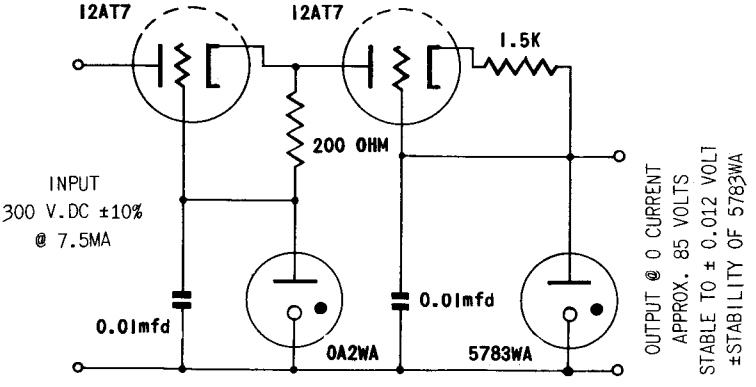

FIGURE 3

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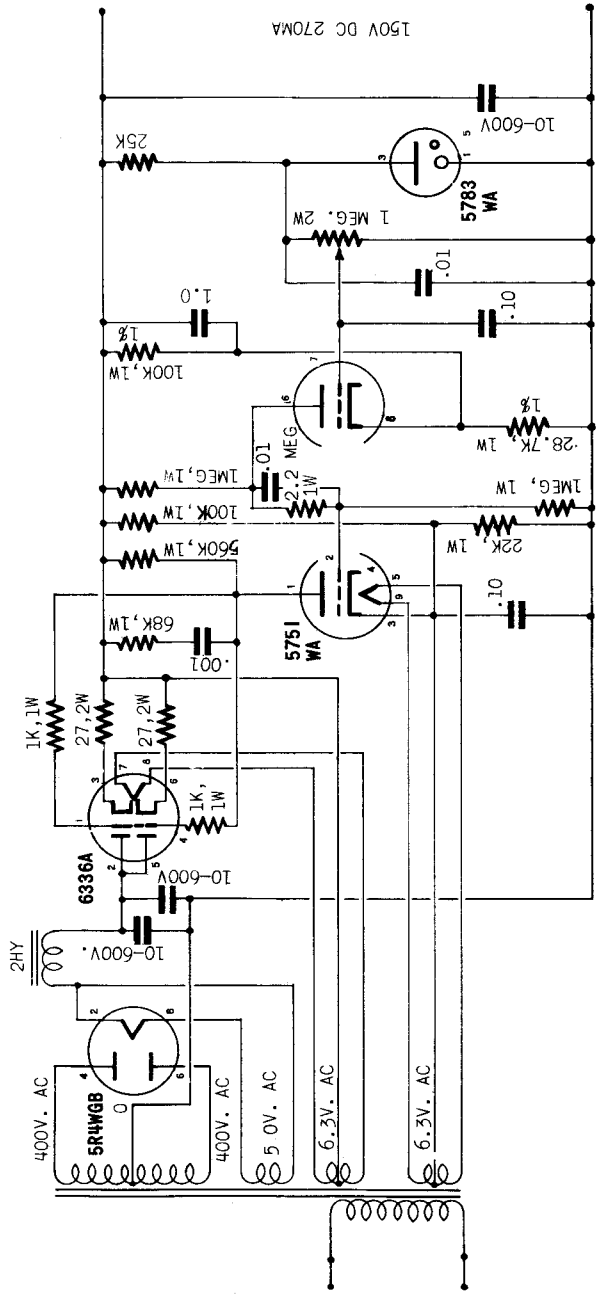
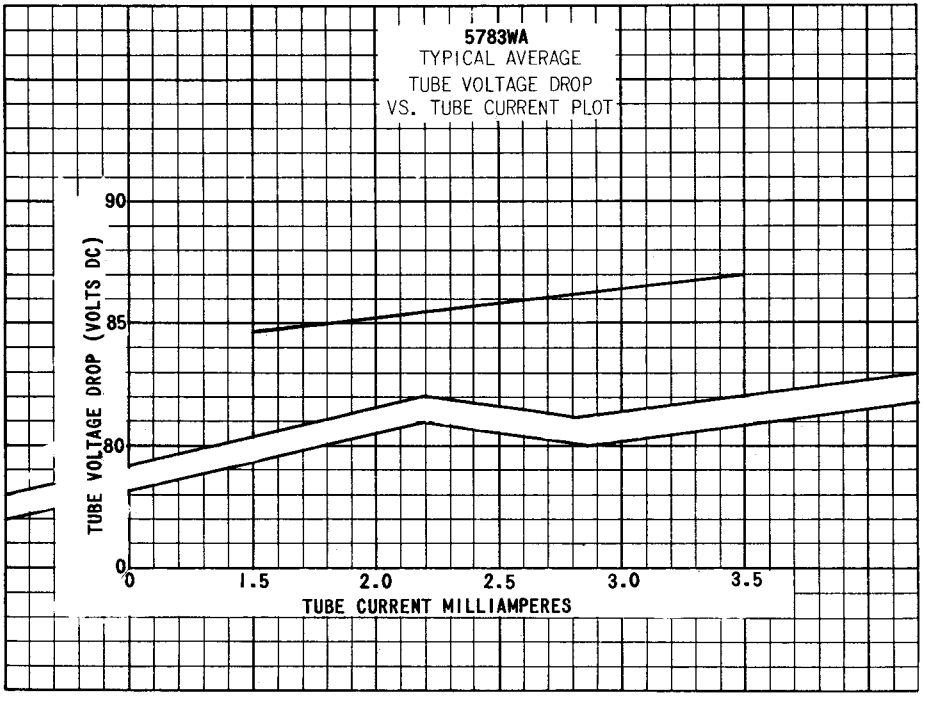
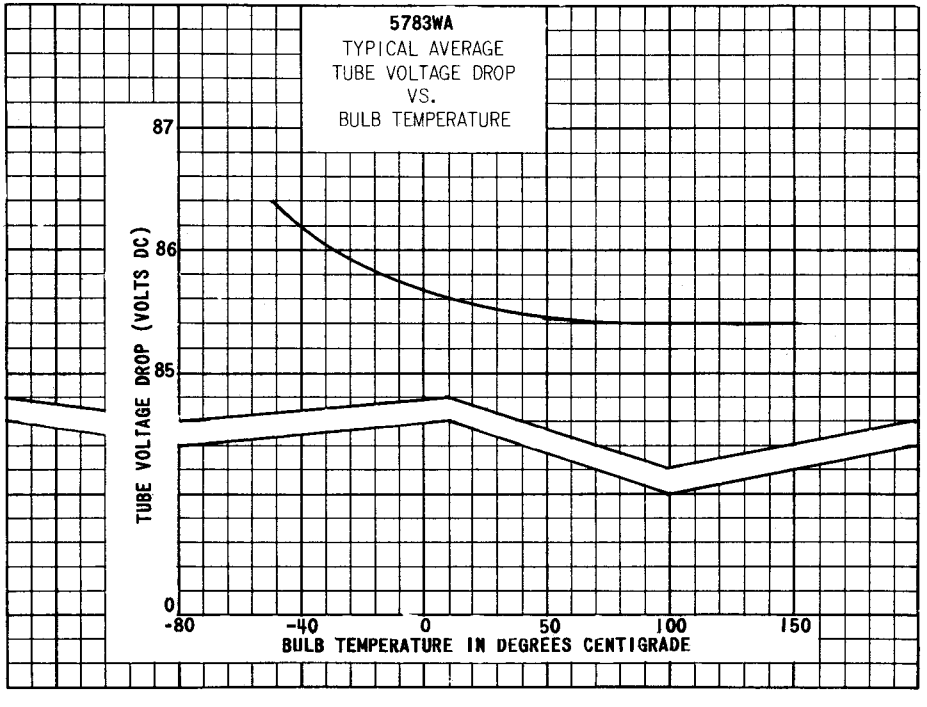


FIGURE 4

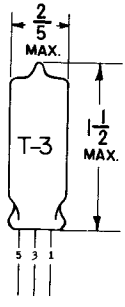

5783WA
TYPICAL AVERAGE
TUBE VOLTAGE DROP
VS. TUBE CURRENT PLOT
TUBE VOLTAGE DROP (VOLTS DC)
90
85
80
0
0
1.5
2.0
2.5
3.0
3.5
TUBE CURRENT MILLIAMPERES


5783WA
TYPICAL AVERAGE
TUBE VOLTAGE DROP
VS.
BULB TEMPERATURE
TUBE VOLTAGE DROP (VOLTS DC)
87
86
85
0
-80
-40
0
50
100
150
BULB TEMPERATURE IN DEGREES CENTIGRADE

TUNG-SOL

DIODE

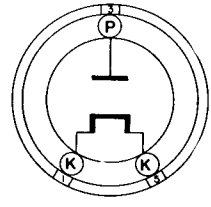
SUBMINIATURE TYPE



GLASS BULB

GAS DIODE

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED FLEXIBLE LEADS
0.096" CENTER-TO-CENTER

THE 5783WB IS A COLD-CATHODE, GAS FILLED, GLOW-DISCHARGE DIODE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR USE AS A VOLTAGE REFERENCE TUBE IN ELECTRONICALLY REGULATED DC POWER SUPPLIES. IT HAS AN OPERATING CURRENT RANGE OF 1.5 TO 3.5 MILLIAMPERES OVER WHICH IT MAINTAINS A SUBSTANTIALLY CONSTANT OPERATING VOLTAGE OF 86 VOLTS. TWO CATHODE LEADS ARE PROVIDED FOR USE IN CIRCUITS WHICH SERVE TO DISCONNECT THE LOAD WHEN THE TUBE IS REMOVED FROM THE SOCKET. THIS TUBE IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST- NOTE 2)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (100 HR. FATIGUE TEST-NOTE 3)	2.5	G
MAXIMUM BULB TEMPERATURE	155	°C

RATINGS

	Ebb Vdc	TOTAL DARKNESS STARTING VOLTAGE Vdc	AMB. LIGHT STARTING VOLTAGE Vdc	OPERATING VOLTAGE RANGE Vdc	OPERATING CURRENT RANGE mAdc (NOTE 7)	AMBIENT TEMP. °C (NOTE 7)
ABSOLUTE:						
MAXIMUM:				91	3.5	+150
MINIMUM:	145	140	115	81	1.5	−55
TEST CONDITIONS:	150					25±5

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE TESTS-GROUP C					
CONTINUITY AND SHORTS	0.4				
ACCEPTANCE TESTS-GROUP D	COMBINED AQL= 1.0%				
IONIZATION VOLTAGE (1): Rp /Ib = 1.5-3.5 mAdc; AMBIENT LIGHT	0.65	(1)Ez:		115	Vdc
TUBE VOLTAGE DROP (1): Rp/Ib = 3.5 mAdc	0.65	(1)Etd:		89.0	Vdc
TUBE VOLTAGE DROP (2): Rp/Ib =1.5 mAdc	0.65	(2)Etd:	83.0		Vdc
REGULATION: (1) Etd -(2) Etd	0.65	Reg.		3.0	Vdc
VOLTAGE JUMP: (NOTE 8)	0.65	Jump:		5.0	mVdc
ACCEPTANCE TESTS-GROUP E					
NOISE: Rp/Ib =3.5 mAdc	1.0	Eb:		20	mVac
OSCILLATION: Esig =100 mVac; Rp/Ib = 1.5 - 3.5 mAdc	1.0				
ACCEPTANCE TESTS-GROUP F					
IONIZATION VOLTAGE (2) Rp/Ib =1 .5 -3.5 mAdc TOTAL DARKNESS	6.5	(2)Ez :		140	Vdc
LEAKAGE CURRENT: Eb = 50 Vdc; Rp =3000 OHMS	6.5	LIB:		20	μAdc
VIBRATION (2) F = 40 cps; G = 15; Rp = 10,000 OHMS; Ebb/I b =2.5 mAdc	6.5	Ep:		50	mVac
TUBE VOLTAGE DROP (3): Rp/Ib =2.5 mAdc	6.5	(3)Etd:	84	98	Vdc
ACCEPTANCE TESTS-GROUP G					
REPEATABILITY: Rp/Ib = 2.5 mAdc (NOTE 5)	6.5	Δ(3)Etd:		100	mVdc
ACCEPTANCE TESTS-GROUP A					
SHOCK: HAMMER ANGLE = 30° (NOTE 2)					
FATIGUE 96 HRS. (NOTE 3)	6.5				
POST SHOCK AND FATIGUE TEST END POINTS:					
IONIZATION VOLTAGE (1): Rp/Ib =1.5-3.5 mAdc		(1)Ez:		115	Vdc
TUBE VOLTAGE DROP (1): Rp/Ib =3.5 mAdc		(1)Etd:	81	91	Vdc
TUBE VOLTAGE DROP (2): Rp/Ib = 1.5 mAdc		(2)Etd:	81	91	Vdc
REGULATION: (1) Etd - (2) Etd		Reg:		4.0	Vdc

TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE TESTS-GROUP B					
SUBMINIATURE:	2.5		4		Arcs
LEAD FATIGUE TEST					
GLASS STRAIN (THERMAL SHOCK):	6.5				
ACCEPTANCE LIFE TESTS					
1 HOUR STABILITY LIFE TEST:					
TA =Room; Rp/Ib = 2.5 mAdc					
1 HOUR STABILITY LIFE TEST					
END POINTS:					
Δ TUBE VOLTAGE DROP (3):					
(NOTE 6) (TYPICAL SAMPLE					
SIZE = 50 TUBES)	6.5	Δ(3)Etd:		200	mVdc
100 HOUR SURVIVAL RATE LIFE					
TEST:					
TA = Room; Rp/Ib = 2.5 mAdc					
100 HOUR SURVIVAL RATE LIFE					
TEST END POINTS:					
INOPERATIVES:					
(TYPICAL SAMPLE SIZE =					
200 TUBES)	0.4				
ΔTUBE VOLTAGE DROP (3):					
(NOTE 6) (TYPICAL SAMPLE					
SIZE = 25 TUBES)	6.5	Δ(3)Etd:		1.0	Vdc
500 HOUR INTERMITTENT HIGH					
TEMPERATURE LIFE TEST (1):					
TA = 150 °C; Rp/Ib =2.5 mAdc					

TEST	MAX. DEF. PER CHARACTERISTICS 1st SAMPLE	MAX. DEF. PER CHARACTERISTICS COMB. SAMPLE	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
500 HOUR INTERMITTENT						
HIGH TEMPERATURE LIFE						
TEST (1) END POINTS:						
(TYPICAL SAMPLE SIZE=						
20 TUBES, 1st SAMPLE;						
40 TUBES 2nd SAMPLE)						
INOPERATIVES:	1	3				
REGULATION (1):	1	3	Reg:		4.0	Vdc
TUBE VOLTAGE DROP (1):	1	3	(1)Etd:	81	91	Vdc
TUBE VOLTAGE DROP (2):	1	3	(2)Etd:	81	91	Vdc
TUBE VOLTAGE DROP (3):	1	3	(3)Etd:	84	89	Vdc
IONIZATION VOLTAGE (1):	1	3	(1)Ez:		115	Vdc
ΔTUBE VOLTAGE DROP (3):						
(NOTE 6)	1	3	Δ(3)Etd:		4	Vdc
TOTAL DEFECTIVES	4	8				
5000 HOUR INTERMITTENT						
LIFE TEST (2):						
TA = Room; Rp/Ib =2.5 mAdc						
5000 HOUR INTERMITTENT LIFE						
TEST (2) END POINTS:						
READ FOR SAME CHARAC-						
TERISTICS AS INTERMITTENT LIFE						
TEST (1) ....LIMITS NOT ESTABLISHED						

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NOTES

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1B, 'INSPECTION INSTRUCTIONS FOR ELECTRON TUBES' AND MIL-STD-105A.

NOTE 2: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1B BASIC SPECIFICATIONS.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1B BASIC SPECIFICATIONS.

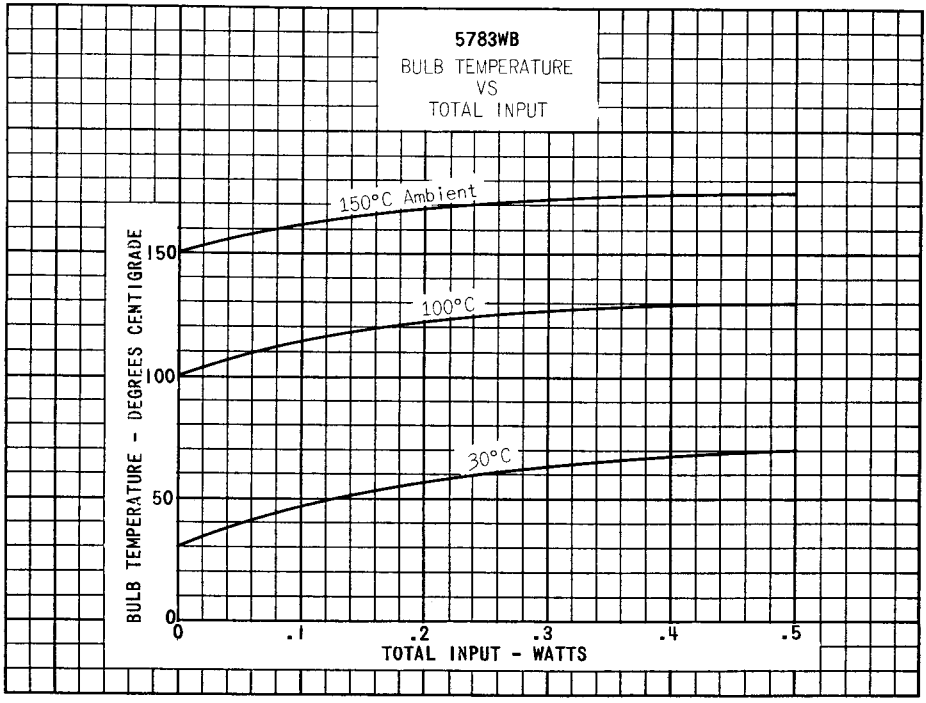
NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

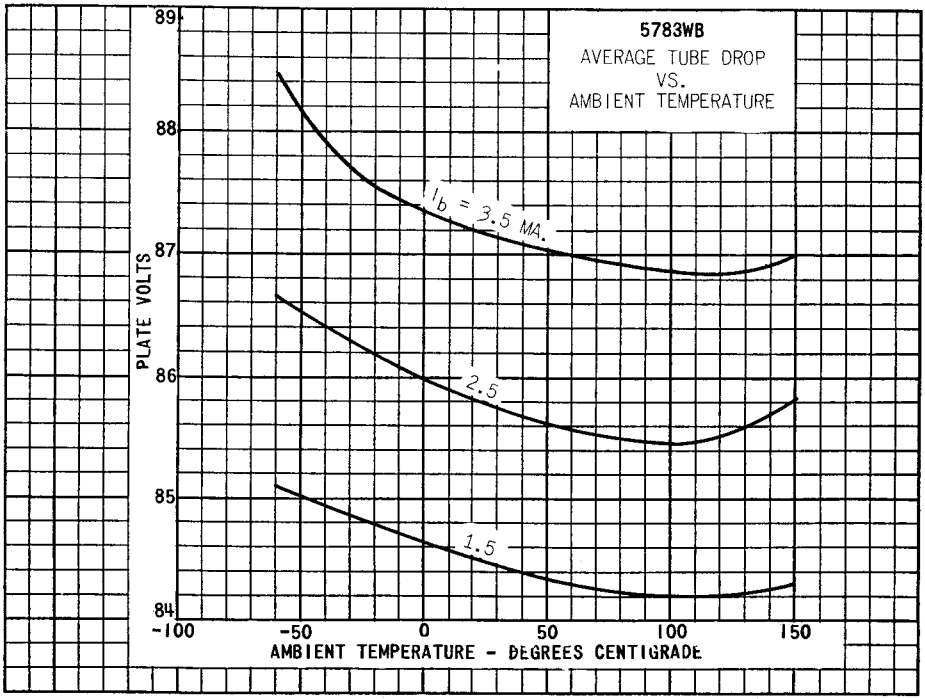
NOTE 5: REPEATABILITY IS THE MAXIMUM SHIFT IN THE TUBE VOLTAGE DROP BETWEEN SUCCESSIVE FIRINGS OF THE TUBE.

NOTE 6: ΔTUBE VOLTAGE DROP IS THE CHANGE IN INDIVIDUAL TUBES OF TUBE VOLTAGE DROP (3) FROM THE BEGINNING OF LIFE TO ITS VALUE AT THE SPECIFIED LIFE HOUR (5).

NOTE 7: LIMITS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPAIRED.

NOTE 8: SUDDEN VOLTAGE JUMPS AS MEASURED ON AN OSCILLOSCOPE CONNECTED ACROSS THE TUBE, WITH THE CURRENT THROUGH THE TUBE VARIED SLOWLY OVER ITS OPERATING RANGE, SHOULD BE LESS THAN 5 mVdc.





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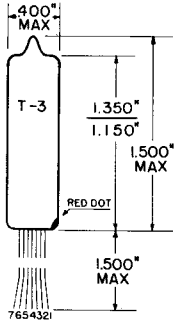
THIS DATA SHEET ALSO APPLIES TO ANOTHER MILITARY VERSION DESIGNATED 5784WB

PENTODE

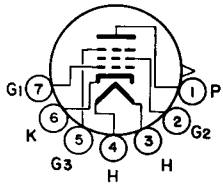
SUBMINIATURE TYPE

FOR MOBILE EQUIPMENT APPLICATIONS

ANY MOUNTING POSITION



GLASS BULB
IN-LINE LEADS
RED DOT IS ADJACENT TO LEAD 1



BOTTOM VIEW
0.016" TINNED
FLEXIBLE LEADS
0.048" CENTER TO CENTER

THE 5784WA IS A HEATER-CATHODE TYPE SUBMINIATURE DUAL-CONTROL PENTODE CAPABLE OF OPERATION IN THE VHF REGION. THE DUAL-CONTROL FEATURE MAKES USE OF THE CONTROL GRID AND SUPPRESSOR GRID AS INDEPENDENT CONTROL ELECTRODES FOR CIRCUITS SUCH AS GATED AMPLIFIERS, MIXERS, AND GAIN CONTROLLED AMPLIFIERS. THE TYPE WILL WITHSTAND SEVERE MECHANICAL SHOCK OR VIBRATION AND HIGH TEMPERATURE SERVICE. THE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF THE CIRCUIT COMPONENTS, OR MAY BE OUT TO A SUITABLE LENGTH FOR USE WITH STANDARD SUBMINIATURE SOCKETS.

THE 5784WB IS DESIGNED FOR HIGHLY RELIABLE APPLICATIONS HAVING CAPABILITIES BEYOND THE 5784WA. IT MAY BE USED AS A DIRECT REPLACEMENT HOWEVER IN EQUIPMENT NOW USING THE 5784WA.

DIRECT INTERELECTRODE CAPACITANCES

WITH 0.405" DIAMETER SHIELD[A]

GRID 1 TO PLATE (MAX)	0.030	pf
INPUT	4.5	pf
OUTPUT	3.6	pf

[A] EXTERNAL SHIELD 318 CONNECTED TO LEAD 6.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	200	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	165	VOLTS
GRID 1 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	55	VOLTS
POSITIVE BIAS VOLTAGE	0	VOLTS
GRID 2 VOLTAGE:	155	VOLTS
GRID 3 VOLTAGE:		
NEGATIVE BIAS VOLTAGE	55	VOLTS
POSITIVE BIAS VOLTAGE	30	VOLTS
PLATE DISSIPATION (DESIGN MAX.)	0.79	WATTS
GRID 2 DISSIPATION (DESIGN MAX.)	0.6	WATTS
GRID 1 CIRCUIT RESISTANCE	1.2	MEGOHM
CATHODE CURRENT	16.5	MADC
ENVELOPE TEMPERATURE	220	°C
ALTITUDE	60,000	FT.

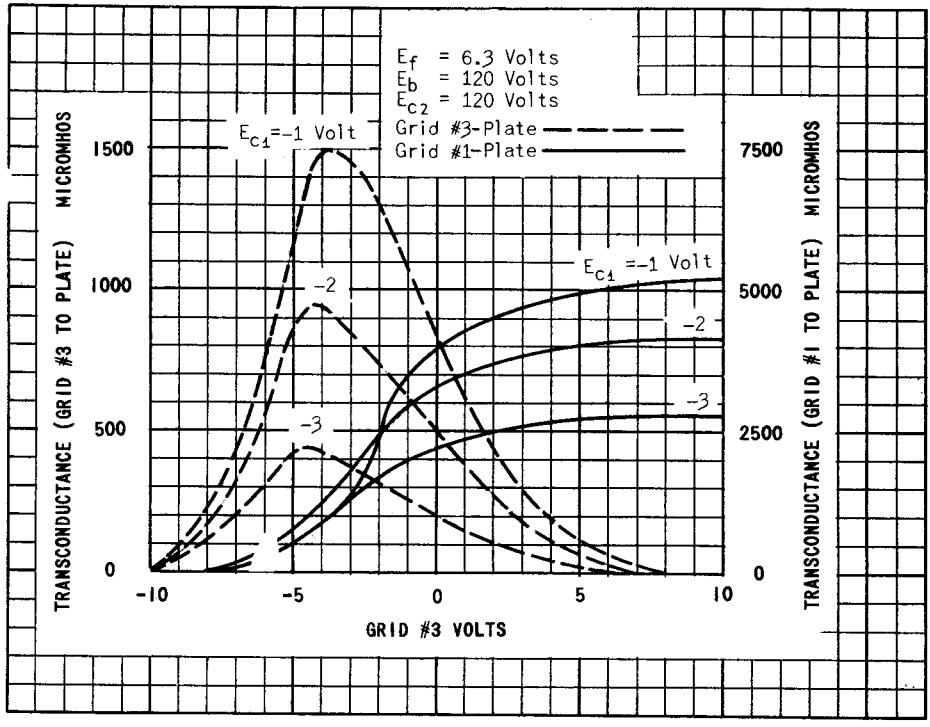
TYPICAL OPERATING CHARACTERISTICS

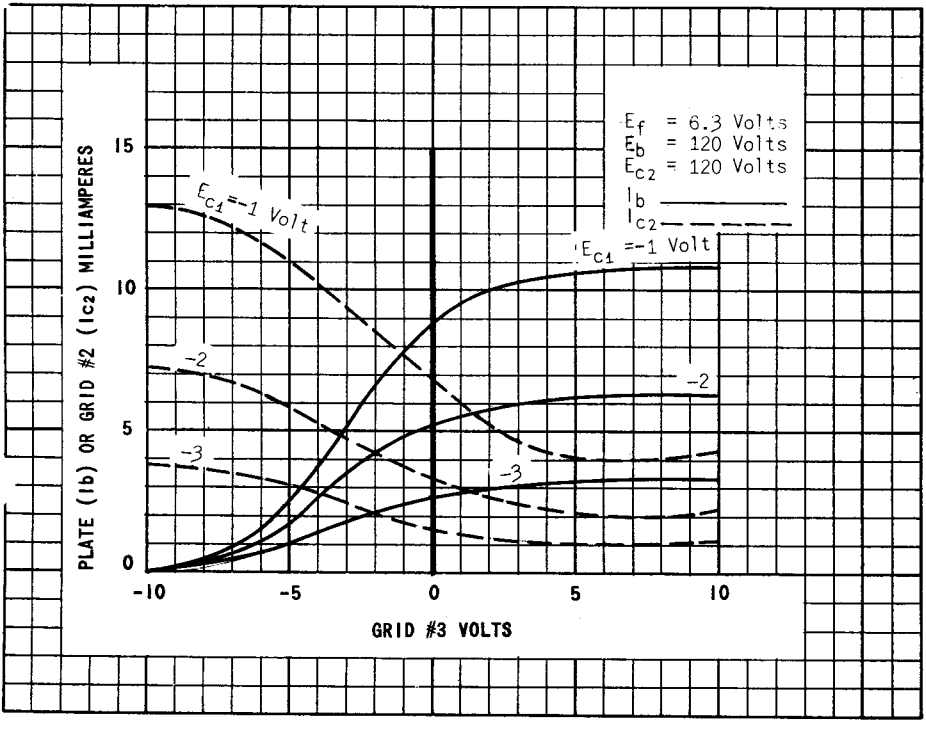
CLASS A1 AMPLIFIER

PLATE VOLTAGE	120	VOLTS
GRID 1 VOLTAGE	0	VOLTS
GRID 2 VOLTAGE	120	VOLTS
GRID 3 VOLTAGE	0	VOLTS
CATHODE BIAS RESISTOR	230	OHMS
PLATE CURRENT	5.5	MA.
TRANSCONDUCTANCE GRID 1 TO PLATE	3200	μMHOS
GRID 2 CURRENT	4.1	MA.

SPECIAL TESTS AND CONTROLS

LOW-PRESSURE VOLTAGE BREAKDOWN
OPERATION TIME (5784WB ONLY)
SWEEP FREQUENCY VIBRATION (5784WB ONLY)
SHOCK (1)
SHOCK (2) (5784WB ONLY)
FATIGUE (1)
FATIGUE (2) (5784WB ONLY)





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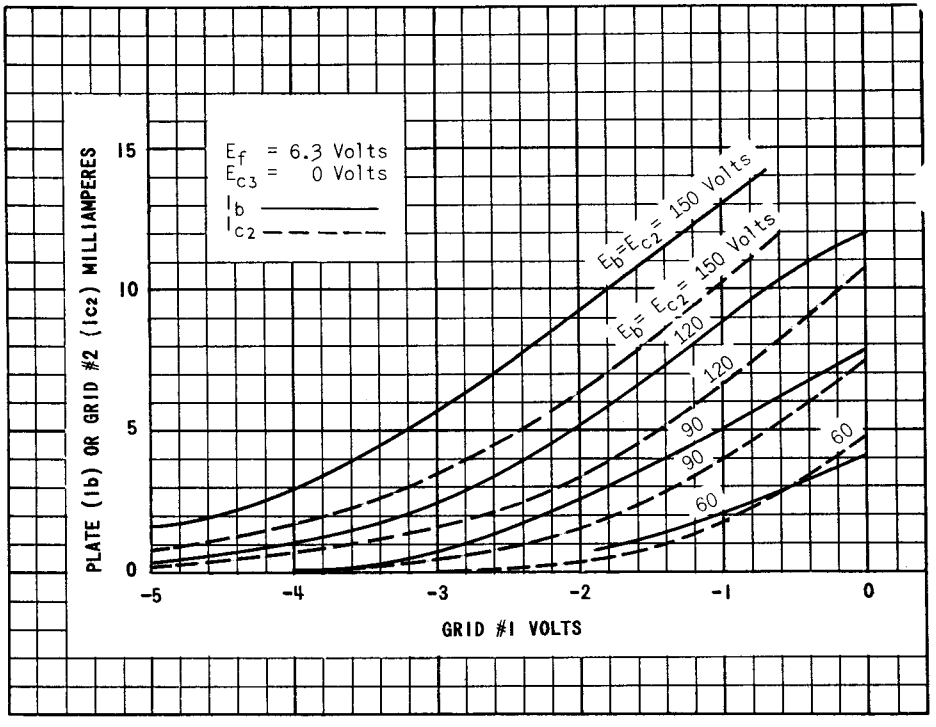
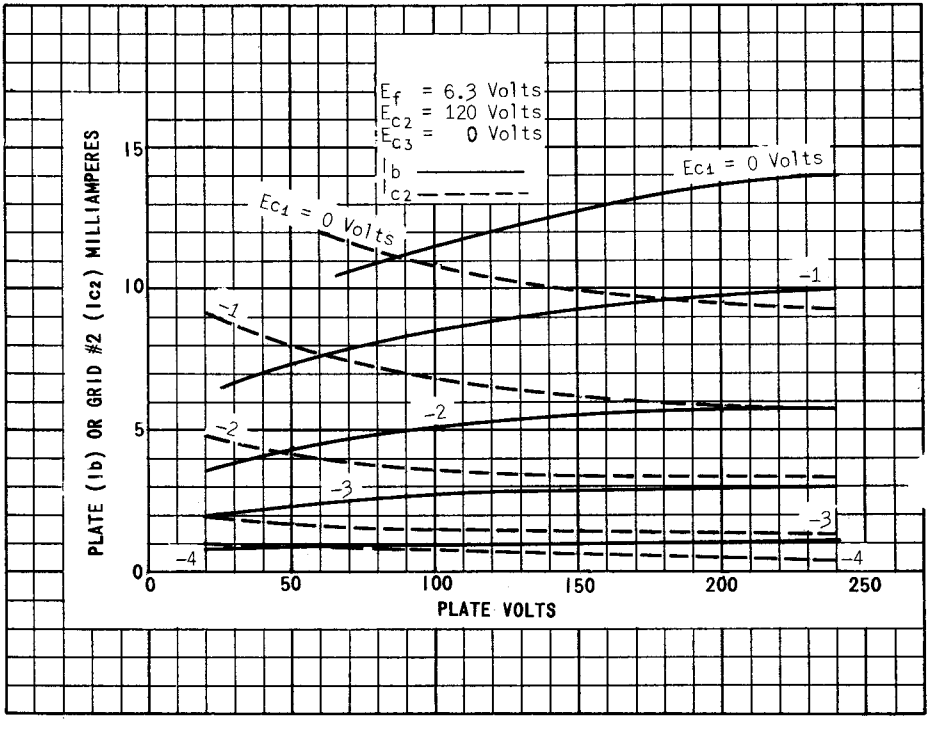
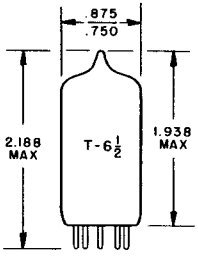

E_f = 6.3 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_b=E_{c2} = 150 Volts
E_b= E_{c2} = 150 Volts
120
120
90
90
60
60
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
15
10
5
0
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


E_f = 6.3 Volts
E_{c2} = 120 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0 Volts
E_{c1} = 0 Volts
-1
-1
-2
-2
-3
-3
-4
-4
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
15
10
5
0
0
50
100
150
200
250
PLATE VOLTS

TUNG-SOL

THIS DATA SHEET ALSO APPLIES TO ANOTHER MILITARY VERSION, DESIGNATED 5814WB

TWIN TRIODE
MINIATURE TYPE

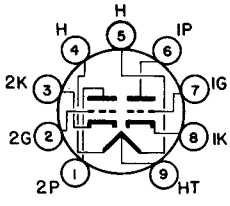


GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

FOR MILITARY AND INDUSTRIAL
GENERAL PURPOSE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9A

THE 5814A IS A 9 PIN MINIATURE MEDIUM-MU TWIN TRIODE, WITH INDIVIDUAL CATHODE CONNECTIONS. IT MAY BE USED FOR A WIDE VARIETY OF APPLICATIONS SUCH AS GENERAL PURPOSE AMPLIFIER, OSCILLATOR OR MULTI-VIBRATOR. THE 5814A IS A SPECIAL QUALITY TUBE WHICH IS RESISTANT TO SHOCK AND VIBRATION AND WILL TOLERATE LONG PERIODS OF OPERATIONS UNDER CUT-OFF CONDITIONS.
THIS TYPE IS SIMILAR TO THE ENTERTAINMENT TYPE 12AU7 EXCEPT FOR HEATER CURRENT.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE, EACH SECTION	1.5	pf
INPUT, EACH SECTION	1.6	pf
OUTPUT, SECTION 1	0.5	pf
OUTPUT, SECTION 2	0.4	pf

HEATER CHARACTERISTICS AND RATINGS
ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4 + 5	
AVERAGE VALUES - VOLTAGE	12.6	6.3	VOLTS
- CURRENT	0.175	0.35	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION	12.6±1.2	6.3±0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		100	VOLTS

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	330	VOLTS
POSITIVE DC GRID VOLTAGE	0	VOLTS
NEGATIVE DC GRID VOLTAGE	55	VOLTS
PLATE DISSIPATION	3.0	WATTS
DC GRID CURRENT	5.0	MA.
DC CATHODE CURRENT	22	MA.
BULB TEMPERATURE AT HOTTEST POINT	165	°C
GRID CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.5	MEGOHMS
WITH CATHODE BIAS	1.0	MEGOHMS

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	3900	10	10	3600	20	11	3500	30	11
0.10	0.24	5000	14	11	4700	27	12	4400	41	12
0.24	0.24	9400	13	11	8700	25	11	8700	38	12
0.24	0.51	11000	17	11	11000	32	12	11000	48	12
0.51	0.51	19000	15	11	18000	29	12	18000	43	12
0.51	1.0	24000	19	11	23000	37	12	23000	54	12

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2600	11	12	2000	22	13	1800	31	13
0.10	0.24	3400	16	12	2800	32	13	2600	44	14
0.24	0.24	7200	15	12	5800	29	13	5000	41	13
0.24	0.51	9400	19	12	8400	37	13	7000	52	13
0.51	0.51	17000	16	12	15000	33	13	13000	46	13
0.51	1.0	22000	20	12	20000	42	13	18000	58	13

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.

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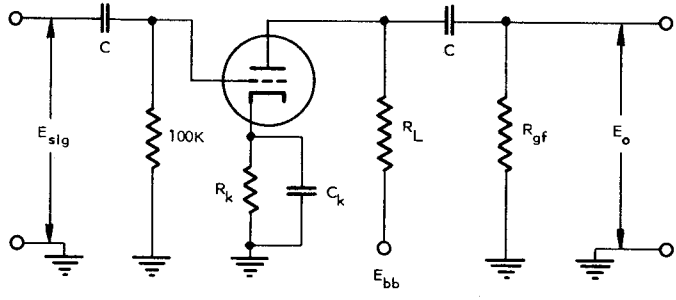

COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

TYPICAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	-8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
TRANSCONDUCTANCE	3100	2200	μMHOS
AMPLIFICATION FACTOR	19.5	17	
PLATE RESISTANCE, APPROXIMATE	6250	7700	OHMS
GRID VOLTAGE, APPROXIMATE			
Ib = 10 μAMPS	------	-22	VOLTS

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST		
SURVIVAL RATE LIFE TEST		
PULSE EMISSION RATINGS		
HEATER-CYCLING LIFE TEST		
SHOCK RATING	40	G
FATIGUE RATING	2.5	G
ALTITUDE RATING	60,000	FEET

NOTE:

THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE LATEST ISSUE OF MIL-E-1.

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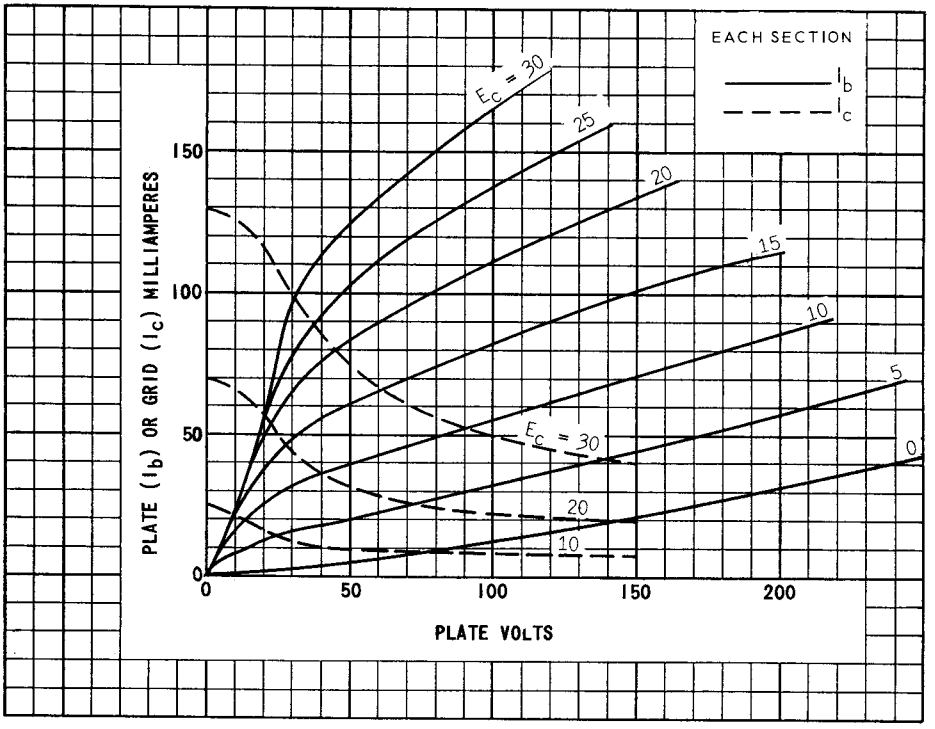
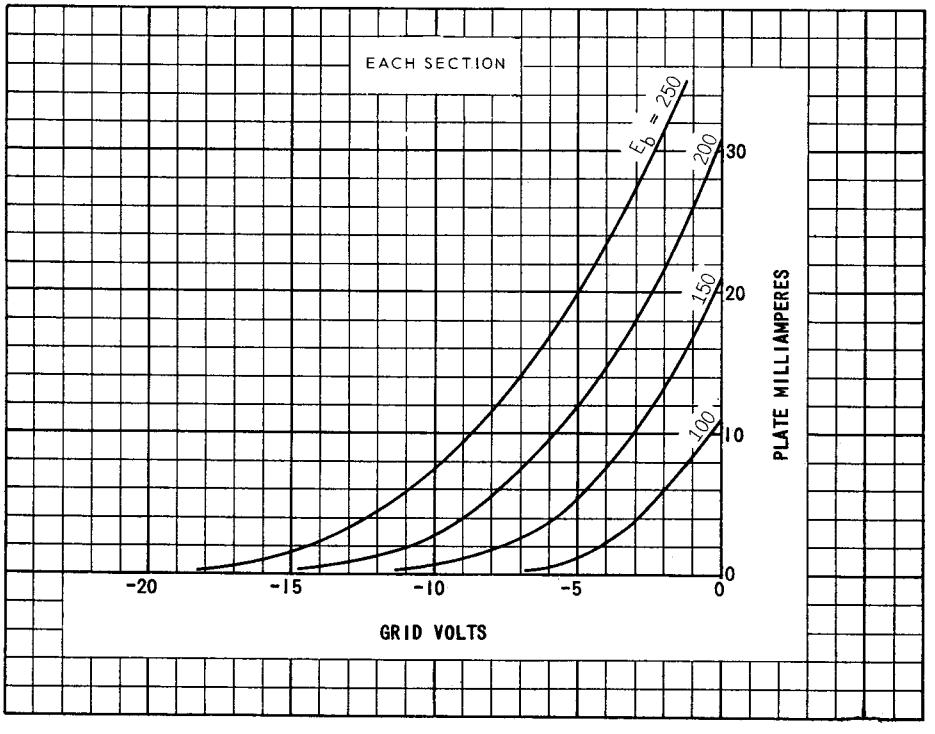
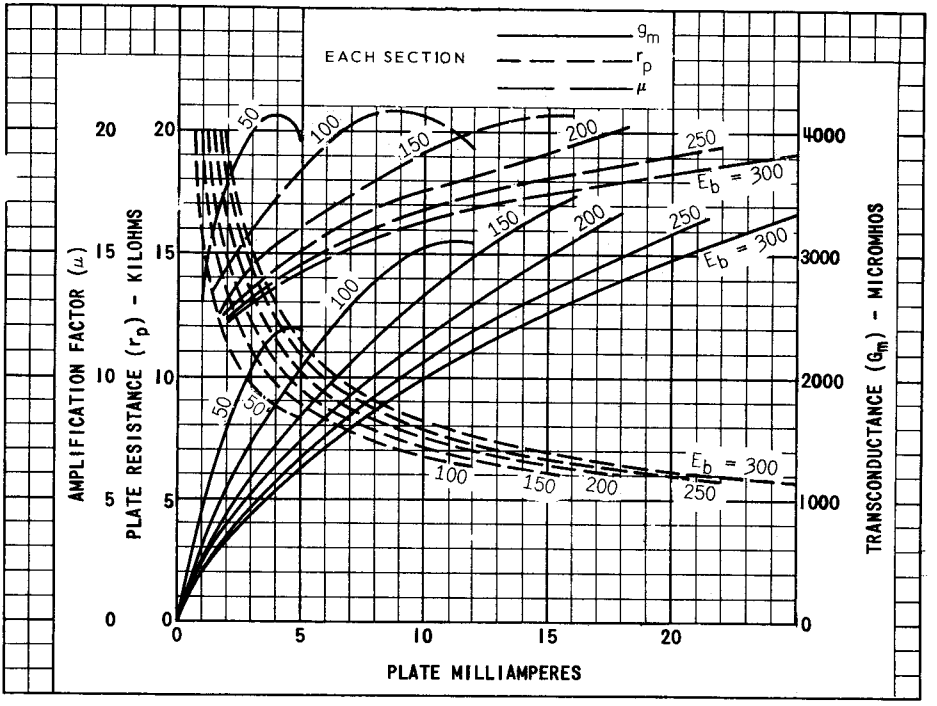
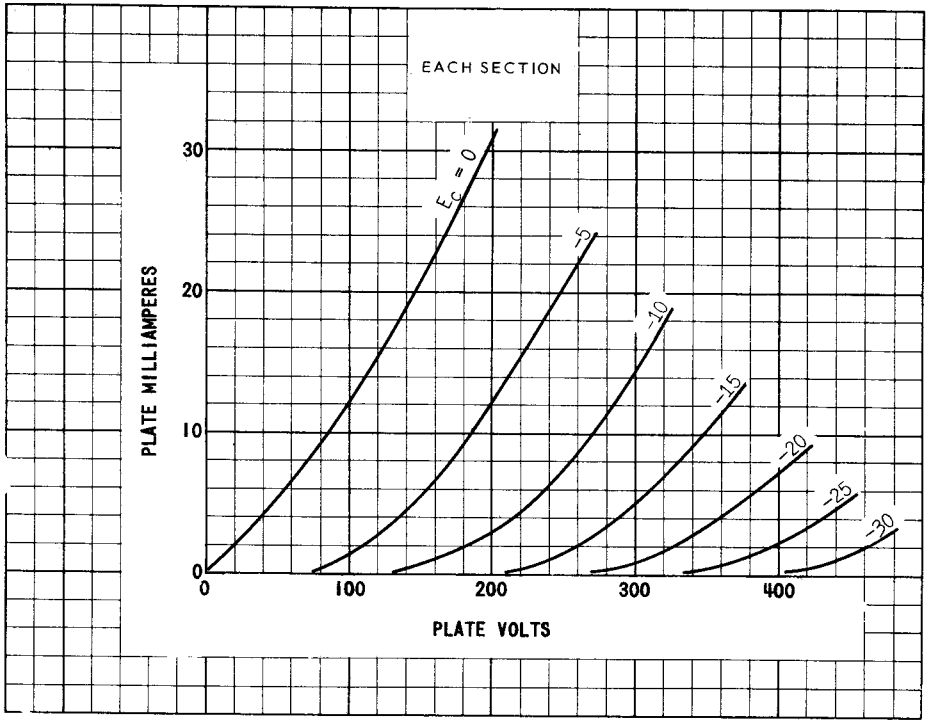

EACH SECTION
I_b
I_c
E_c = 30
25
20
15
10
5
0
E_c = 30
20
10
PLATE (I_b) OR GRID (I_c) MILLIAMPERES
150
100
50
0
0
50
100
150
200
PLATE VOLTS


EACH SECTION
E_b = 250
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS





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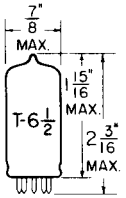
TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



GLASS BULB

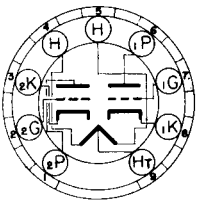
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.35 AMP.
12.6 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

THE 5814WA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE OF THE NINE PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. THE HEATER CENTER TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. THE TUBE MAY BE ADAPTED TO SUCH APPLICATIONS AS VOLTAGE AMPLIFIER, OSCILLATOR-MIXER COMBINATION, MULTIVIBRATOR, OR PHASE INVERTER. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE, AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5814WA IS ESPECIALLY SUITED FOR USE IN MILITARY OR INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD SECT. #1	WITHOUT SHIELD SECT. #2	
GRID TO PLATE (RATED)	1.5	1.5	μμf
INPUT (RATED)	1.6	1.6	μμf
OUTPUT (RATED)	0.50	0.35	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%	12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	330		VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	3.0		WATTS
MAXIMUM DC HEATER-CATHODE VOLTAGE	±200		VOLTS
MAXIMUM DC CATHODE CURRENT[A]	22		mA
MAXIMUM BULB TEMPERATURE	+165		°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH TRIODE SECTION

HEATER VOLTAGE	6.3	12.6	6.3	12.6	VOLTS
HEATER CURRENT	0.35	0.175	0.35	0.175	AMP.
PLATE VOLTAGE	100		250		VOLTS
GRID VOLTAGE [B]	0		-8.5		VOLTS
AMPLIFICATION FACTOR	19.5		17		
PLATE RESISTANCE	6250		7700		OHMS
TRANSCONDUCTANCE	3100		2200		μMHOS
PLATE CURRENT	11.8		10.5		mA

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 12.6V, E_b = 250Vdc, E_c = −8.5Vdc
(EXCEPT AS MODIFIED BELOW)

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	160	190	---	---	160	190	mA
HEATER–CATHODE LEAKAGE[C] (E_{hk} = ±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (R_g = 0.5 MEG.)	0	−0.5	---	---	0	−0.5	μAdc
PLATE CURRENT (1)	6.5	14.5	9.0	12.0	---	---	mAdc
TRANSCONDUCTANCE (1)	1750	2650	2000	2400	1600	2650	μMHOS
Δ AVG. TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[D] (E_f=12.6V, E(g-all)=100Vdc, g NEG., E(p-all)=300Vdc,p NEG.)							
R (g-all)	500	---	---	---	250	---	MEGOHM
R (p-all)	500	---	---	---	250	---	MEGOHM
PLATE CURRENT (2) (E_c=−25Vdc)	---	20	---	---	---	---	μAdc
Δ TRANSCONDUCTANCE (2)[S]	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[E] (E_f=14V)	0	−1.5	---	---	---	---	μAdc
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	3.5	---	---	---	---	mAdc
TRANSCONDUCTANCE (3) (E_b=100Vdc, E_c=0)	2500	3700	2775	3425	---	---	μMHOS
AMPLIFICATION FACTOR	15.5	18.5	16.2	17.8	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION[CF] (R_p = 2000)	---	100	mVac
VIBRATIONAL FATIGUE[G]	---	---	
SHOCK[H] (HAMMER ANGLE=30°, E_{hk}=100Vdc, HEATER POSITIVE, R_g = 0.1 MEG.)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (3)	2000	---	μMHOS
GRID CURRENT (1)	---	1.5	μAdc
CONTINUITY AND SHORT[J]			
GLASS STRAIN[K]			
RF NOISE[LC] (E_c =−9Vdc, E_{cal} =7.0mVac)	---	3.0	mW
NOISE AND MICROPHONICS[MCNP] (Ef=12.6Vac, E_{hk} =0, E_{bb} =300Vdc, Ec =0, R_p = 50,000)	---	50	mVac
LOW FREQUENCY VIBRATION[QC] (R_p = 2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[K] (PRESSURE=55±5 mm MERCURY, TEMP.=25±5°C, HUMIDITY=0, VOLTAGE =500Vac, 60 CYCLES SINUSOIDAL WAVEFORM)	500	---	Vac
1 HOUR STABILITY LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1)	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	

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SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
HEATER CYCLING LIFE TEST (E_f =7.5V, E_{hk} =135 Vdc, HEATER POSITIVE, E_c =E_b=0)	---	---	
HEATER CYCLING LIFE TEST END POINTS HEATER-CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST (E_{hk} =135 Vdc, HEATER POS., R_g=0.5 MEG, MIN. BULB TEMP =+165°C)	---	---	

NOTES

A DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

B THE DC RESISTANCE IN THE GRID CIRCUIT UNDER RATED MAXIMUM CONDITIONS SHOULD NOT EXCEED 0.25.

C TIE 1_p TO 2_p, 1_g TO 2_g, 1_k TO 2_k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM PERMITTED.

D SEE MIL-E-1C 4.8.2

E PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY AFTER PREHEATING. E_f=14.0V, E_{c1}=-8.5V, R_k=0 OHM, E_b=250 Vdc, R_g=0.5 MEG.

F SEE MIL-E-1C 4.9.20.3

G SEE MIL-E-1C 4.9.20.6

H SEE MIL-E-1C 4.9.20.5

J SEE MIL-E-1C 4.7 5

K GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0°C ±3°C). THE AMOUNT OF WATER SHALL BE AT LEAST (2) LITERS PER 15 TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST. REJECT FOR EVIDENCE OF AIR LEAK.

L SEE MIL-E-1C 4.10.3.1

M SEE MIL-E-1C 4.10.3.5

N THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING 3 OHM @ 60 CYCLES.

P TIE CATHODES TOGETHER AND GROUND THRU A 1500 OHM RESISTOR. GRIDS ARE GROUNDED.

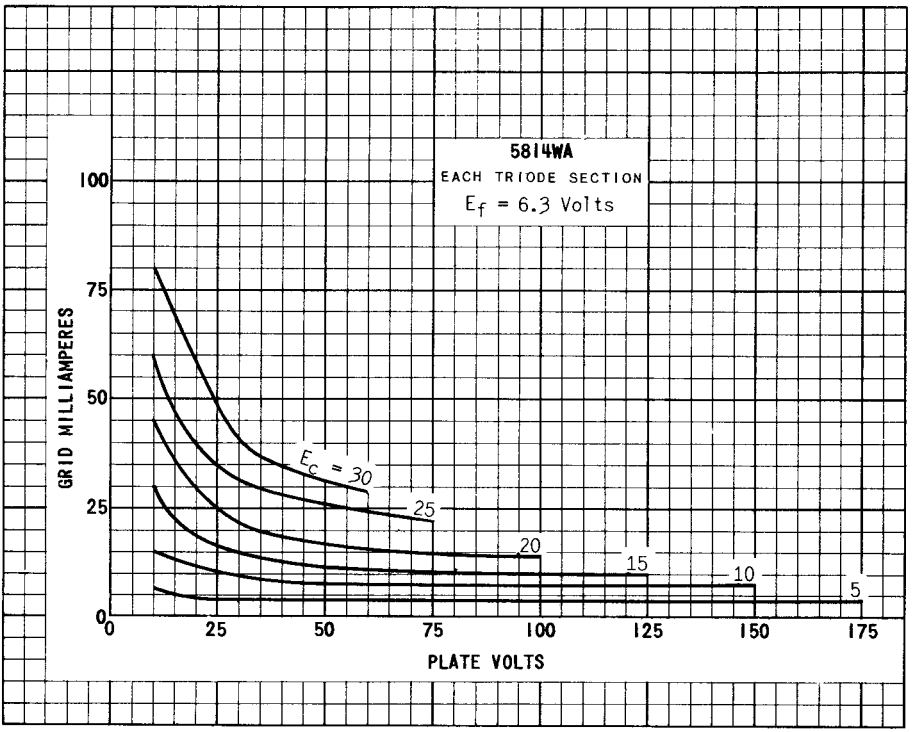
Q SEE MIL-E-1C 4.9.20.4

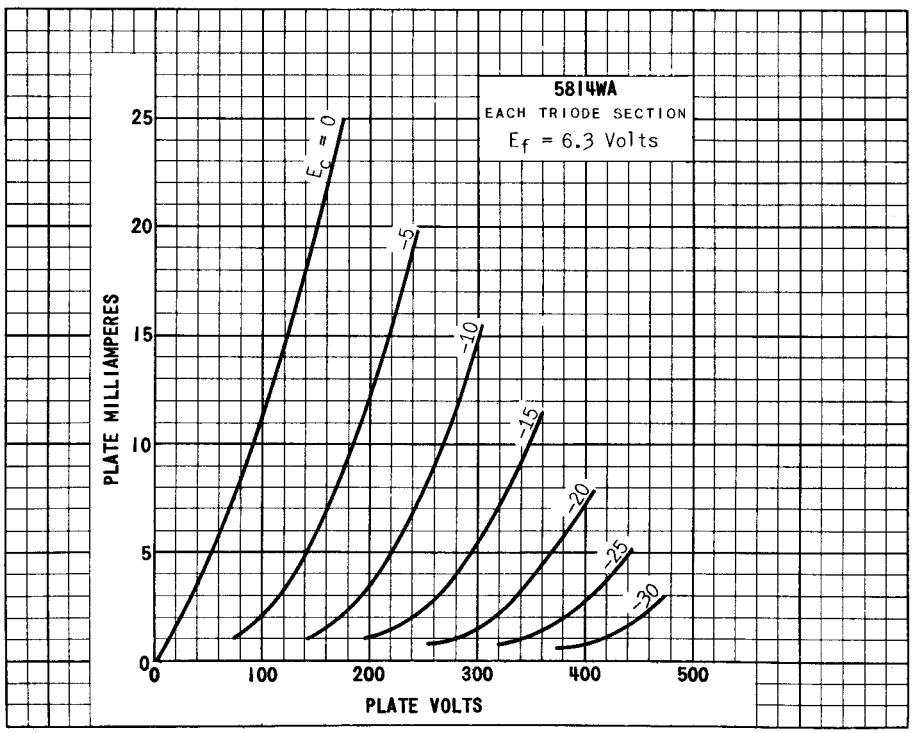
R BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS.

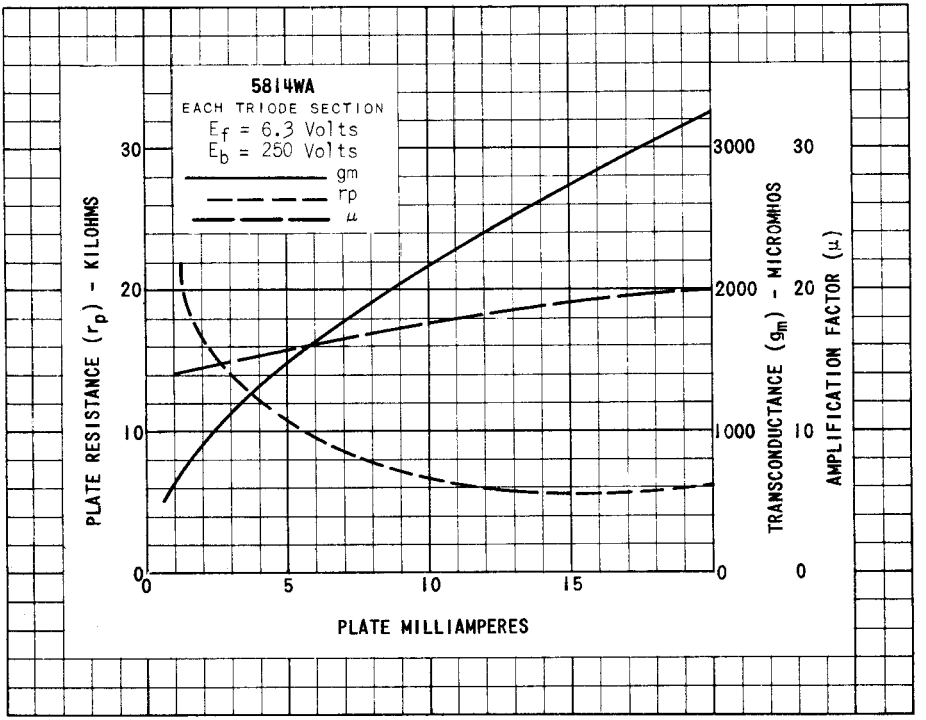
S THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

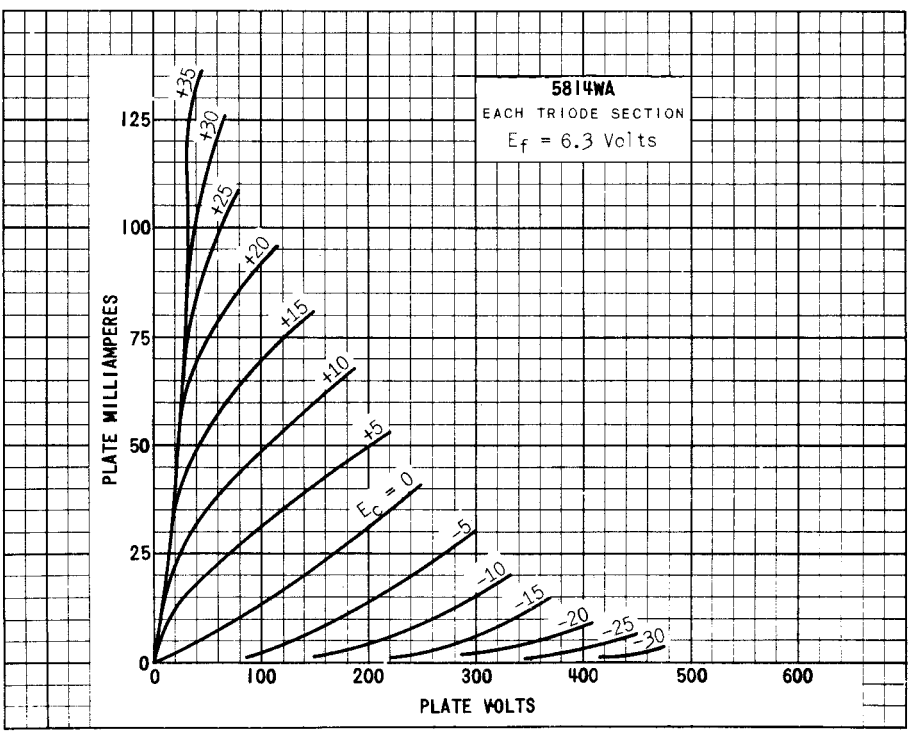
$$\frac{(\text{SM AT } 12.6)-(\text{SM AT } 11.4)}{(\text{SM AT } 12.6)} \times 100$$

5814WA
PREMIUM TUBE





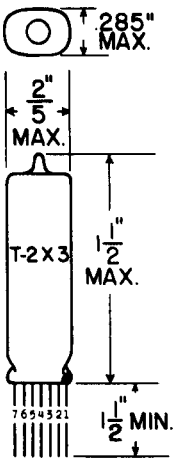

5814WA
EACH TRIODE SECTION
E_f = 6.3 Volts
E_b = 250 Volts
gm
rp
μ
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)
PLATE MILLIAMPERES
0
5
10
15
30
20
10
0
3000
2000
1000
30
20
10
0


5814WA
EACH TRIODE SECTION
E_f = 6.3 Volts
+35
+30
+25
+20
+15
+10
+5
E_c = 0
-5
-10
-15
-20
-25
-30
PLATE MILLIAMPERES
PLATE VOLTS
125
100
75
50
25
0
100
200
300
400
500
600

TUNG-SOL

DOUBLE DIODE

SUBMINIATURE TYPE

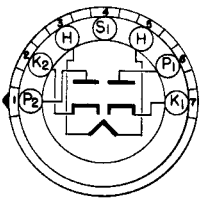


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE — 8 FLEXIBLE LEADS

THE 5829WA IS A CATHODE-TYPE DOUBLE DIODE IN THE SUBMINIATURE CONSTRUCTION, CAPABLE OF OPERATION UP TO ABOUT 400 MC. AN INTERNAL SHIELD IS CONSTRUCTED BETWEEN THE TWO DIODE SECTIONS AND BROUGHT OUT ON A SEPARATE LEAD SO THAT ELECTRICALLY INDEPENDENT OPERATION CAN BE ASSURED. PRODUCT AVERAGE CONTROLS ON SUCH CHARACTERISTICS AS EMISSION AND FULL WAVE OPERATIONAL LOAD CURRENT ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 5829WA IS ESPECIALLY SUITABLE FOR USE IN MILITARY AND INDUSTRIAL EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION SUCH AS AIRBORNE COMMUNICATIONS EQUIPMENT.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
PLATE #1 TO ALL OTHER ELEMENTS (RATED)	2.6	μμf
MAXIMUM	3.5	μμf
MINIMUM	1.9	μμf
PLATE #2 TO ALL OTHER ELEMENTS (RATED)	2.3	μμf
MAXIMUM	3.3	μμf
MINIMUM	1.7	μμf
CATHODE #1 TO ALL OTHER ELEMENTS (RATED)	3.9	μμf
MAXIMUM	4.2	μμf
MINIMUM	2.4	μμf
CATHODE #2 TO ALL OTHER ELEMENTS (RATED)	3.9	μμf
MAXIMUM	4.6	μμf
MINIMUM	2.8	μμf
PLATE #1 TO PLATE #2 (RATED)	0.1	μμf
MAXIMUM	0.12	μμf
MINIMUM	0.06	μμf

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DIRECT INTERELECTRODE CAPACITANCES – CONT'D.

	WITHOUT SHIELD	
CATHODE #1 TO HEATER (RATED)	2.0	μμf
MAXIMUM	2.2	μμf
MINIMUM	1.1	μμf
CATHODE #2 TO HEATER (RATED)	2.0	μμf
MAXIMUM	2.5	μμf
MINIMUM	1.3	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE SUPPLY VOLTAGE (EACH SECTION)	130	VOLTS
MAXIMUM PEAK PLATE INVERSE VOLTAGE	360	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE	±360	VOLTS
MAXIMUM DC OUTPUT CURRENT (EACH SECTION)	5.5	mA.
MAXIMUM PEAK PLATE CURRENT (EACH SECTION)	33	mA.
MAXIMUM SURGE CURRENT (EACH SECTION)	175	mA.
MAXIMUM BULB TEMPERATURE	220	°C
MAXIMUM ALTITUDE	60 000	FEET

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
HALF-WAVE RECTIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.15	AMP.
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE PER PLATE	400	OHMS
DC OUTPUT CURRENT PER PLATE	5	mA.
AVERAGE TUBE VOLTAGE DROP @ 15 mA PER PLATE	5	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN
E_f = 6.3V, $E_{pp/p}$ = 117Vdc, E_{hk} = 0V, R_L = 14000 Ohms, C_L = 8 μf
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	138	162	---	---	135	165	mAdc
HEATER–CATHODE LEAKAGE (Ehk=±100 Vdc)	---	±10	---	---	---	±20	μAdc
INSULATION OF ELECTRODES (Ep TO ALL =- 300 Vdc)	100	---	---	---	50	---	MEGOHMS
PLATE CURRENT (Ebb =0, Rp =400)	2	20	---	---	---	---	μAdc
PLATE CURRENT DIFFERENCE BETWEEN SEC.	---	5.0	---	---	---	---	μAdc
GRID EMISSION (Es=6.5 Vdc)	15	---	16.5	---	---	---	μAdc

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SPECIAL REQUIREMENTS

	MIN.	MAX.	
LOW PRESSURE VOLTAGE BREAKDOWN			
(PRESSURE =55±5mm Hg, VOLTAGE=330 Vac)[A]	---	---	
VARIABLE FREQUENCY VIBRATION[B]			
(NO VOLTAGES, POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY)	---	---	
SUBMINIATURE LEAD FATIGUE[C]	4	---	ARCS
SHOCK[D]			
(HAMMER ANGLE = 30°)	---	---	
VIBRATIONAL FATIGUE[E]			
(G=2.5; FIXED FREQUENCY; F=25MIN, 60MAX)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
HEATER CATHODE LEAKAGE	---	±15	μAdc
OPERATION	7.0	---	mAdc
SHORT AND CONTINUITY[F]	---	---	
GLASS STRAIN[G]	---	---	
HEATER CYCLING LIFE TEST			
(Ef=7.5V, Ehk=140Vac, Eb=0, 1 MIN ON 4 MIN OFF)	---	---	
HEATER CYCLING LIFE TEST END POINTS			
HEATER CATHODE LEAKAGE	---	±20	μAdc
INTERMITTENT LIFE TEST			
(T ENVELOPE= 220°C) [H,J]	---	---	

NOTES

[A] TUBE SHALL BE TESTED IN A CHAMBER UNDER THE CONDITIONS OF PRESSURE SPECIFIED. THE SPECIFIED VOLTAGE SHALL BE APPLIED BETWEEN THE LEADS OF ELEMENTS CARRYING B+ VOLTAGE AND THE ADJACENT LEADS. VOLTAGE SHALL BE OF A SINUSOIDAL WAVE FORM WITH F=60 CYCLES. TUBE SHOWING EVIDENCE OF CORONA OR ARCING SHALL BE CONSIDERED DEFECTIVE.

[B] SEE MIL-E-1C 4.9.20.3

[C] SEE MIL-E-1C 4.9.5.3

[D] SEE MIL-E-1C 4.9.20.5

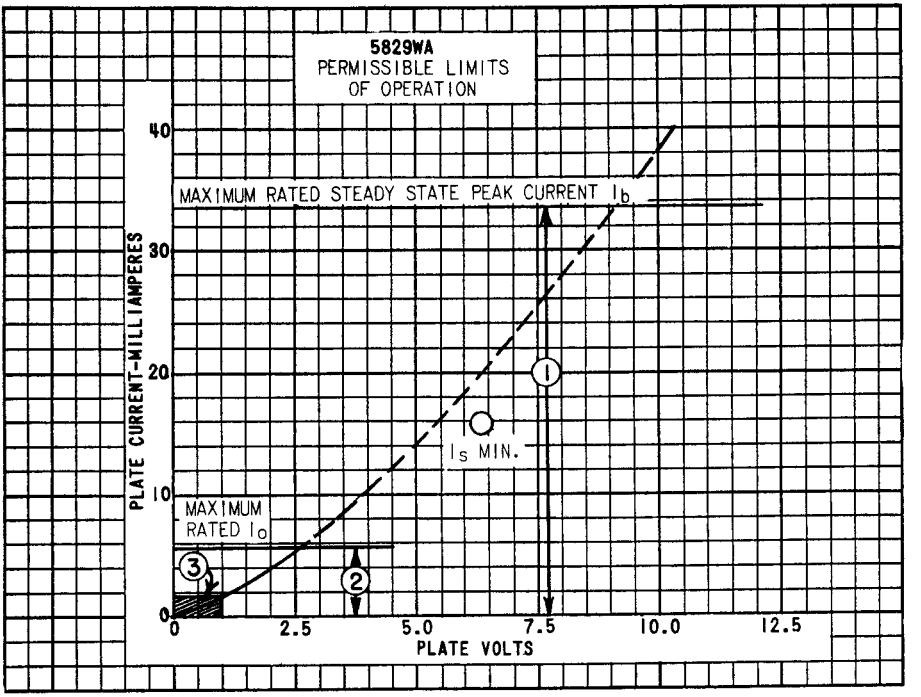
[F] SEE MIL-E-1C 4.7.5

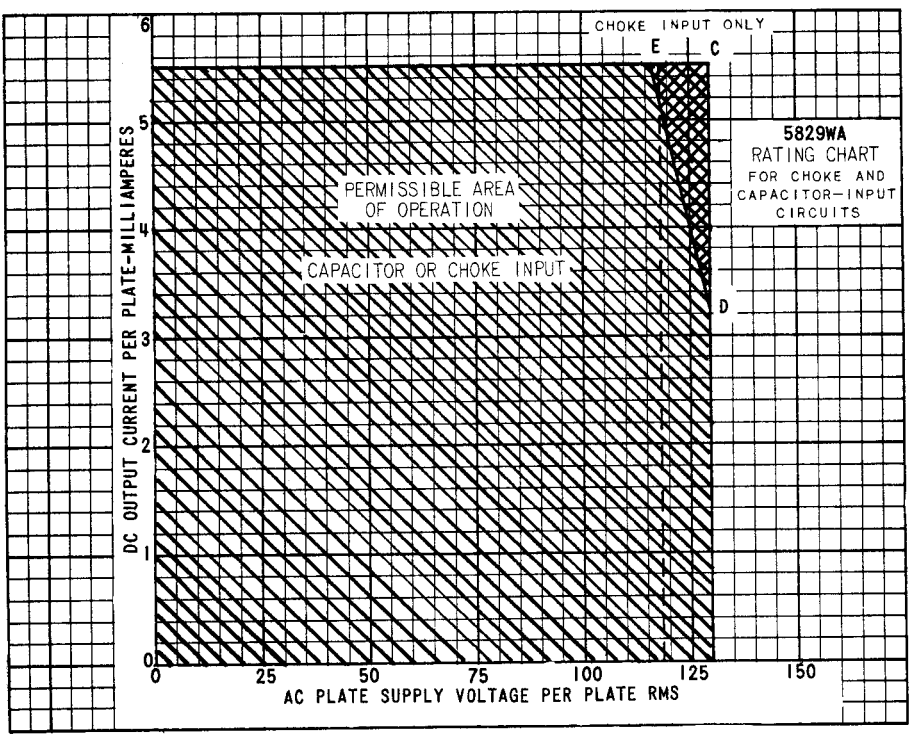
[G] GLASS STRAIN TEST PROCEDURE: ALL TUBES SUBJECTED TO THIS TEST SHALL HAVE BEEN SEALED A MINIMUM OF 48 HOURS PRIOR THERETO. ALL TUBES SHALL BE AT ROOM TEMPERATURE IMMEDIATELY PRIOR TO THIS TEST. THE ENTIRE TUBE SHALL BE IMMERSED IN WATER OF NOT LESS THAN 85°C FOR 15 SECONDS AND IMMEDIATELY THEREAFTER IMMERSED IN WATER OF NOT MORE THAN 5°C FOR 5 SECONDS. THE VOLUME OF WATER SHALL BE LARGE ENOUGH THAT THE TEMPERATURE WILL NOT BE APPRECIABLY EFFECTED BY THE TEST. THE METHOD OF SUBMERSION SHALL BE IN ACCORDANCE WITH DRAWING #245-JAN, AND SUCH THAT A MINIMUM OF HEAT IS CONDUCTED AWAY BY THE HOLDER USED. THE TUBES SHALL BE PLACED IN WATER SO THAT NO CONTACT IS MADE WITH THE CONTAINING VESSEL, NOR SHALL THE TUBES CONTACT EACH OTHER. AFTER THE 5-SECOND SUBMERSION PERIOD, THE TUBES SHALL BE REMOVED AND ALLOWED TO DRY AT ROOM TEMPERATURE ON A WOODEN SURFACE. AFTER DRYING AT ROOM TEMPERATURE FOR 48 HOURS, THE TUBES SHALL BE INSPECTED FOR EVIDENCE OF AIR LEAKS. ELECTRICAL REJECTS, OTHER THAN INOPERATIVES, MAY BE USED IN THE PERFORMANCE TEST.

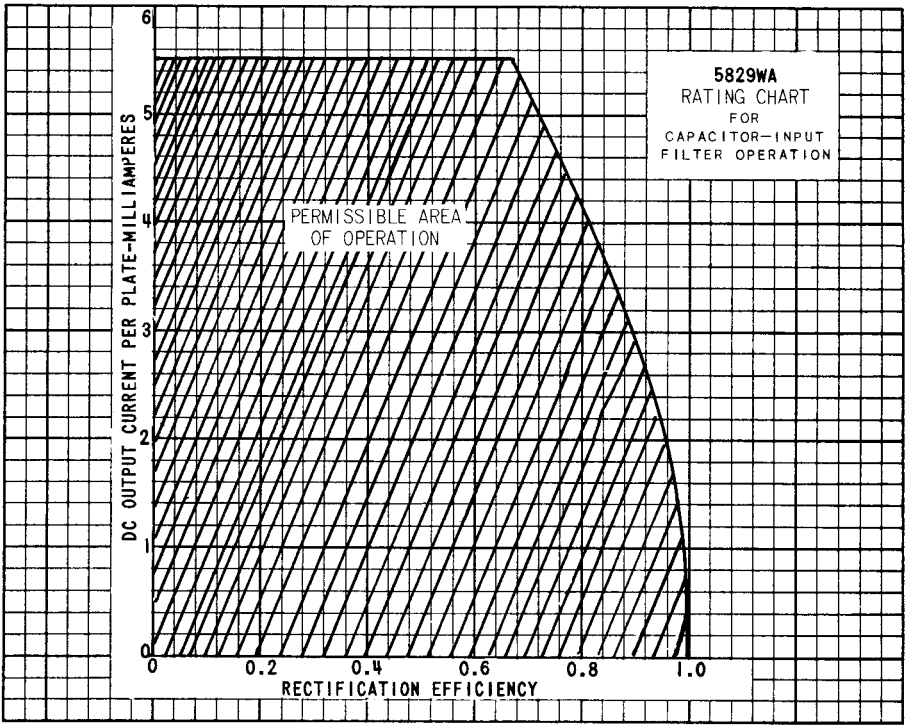
[H] ENVELOPE TEMPERATURE IS DEFINED AS THE HIGHEST TEMPERATURE INDICATED WHEN USING A THERMOCOUPLE OF #40BS OR SMALLER DIAMETER ELEMENTS WELDED TO A RING OF .025 INCH DIAMETER PHOSPHOR BRONZE PLACED IN CONTACT WITH THE ENVELOPE.

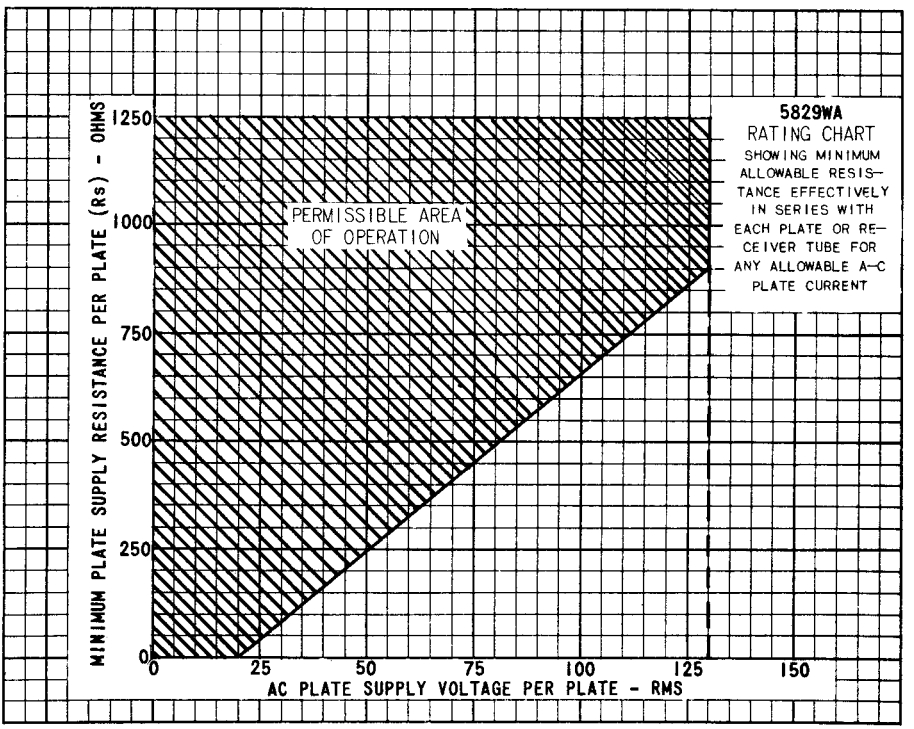
[J] IN FULL-WAVE LIFE TEST CIRCUIT, THE VALUES OF RL AND CL GIVEN IN THE TEST CONDITIONS SHALL BE CONSIDERED AS APPROXIMATE AND SHALL BE ADJUSTED INITIALLY TO GIVE Io EQUAL TO OR GREATER THAN 10 mAdc WITH Ib EQUAL TO OR GREATER THAN 25 mA. Ehk = 117 vac.

[E] SEE MIL-E-1C 4.9.20.6


5829WA
PERMISSIBLE LIMITS
OF OPERATION
MAXIMUM RATED STEADY STATE PEAK CURRENT I_b
I_s MIN.
MAXIMUM
RATED I_o
PLATE CURRENT-MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
2.5
5.0
7.5
10.0
12.5
1
2
3

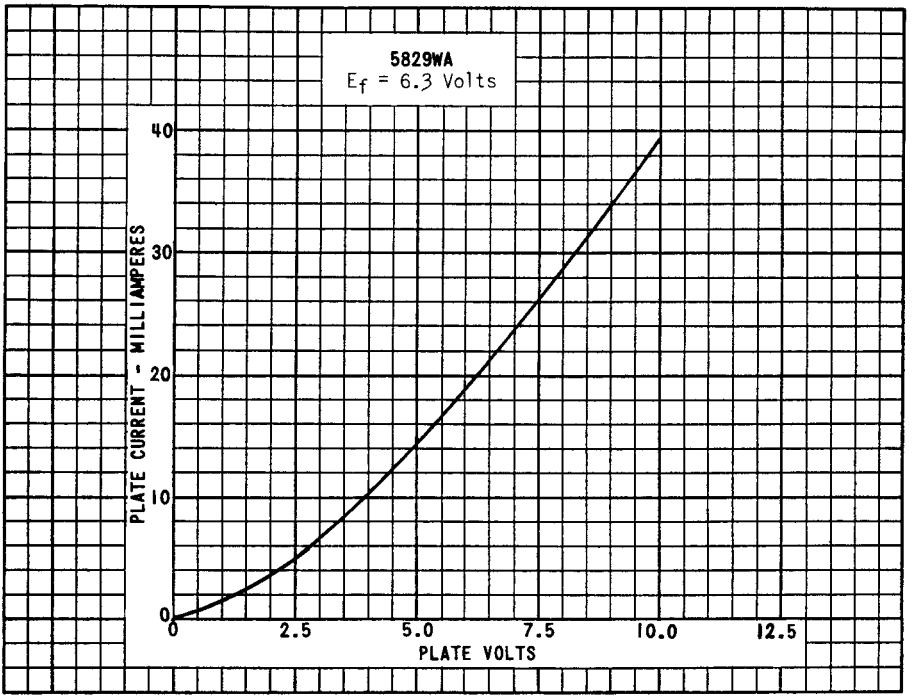

CHOKE INPUT ONLY
E
C
D
5829WA
RATING CHART
FOR CHOKE AND
CAPACITOR-INPUT
CIRCUITS
PERMISSIBLE AREA
OF OPERATION
CAPACITOR OR CHOKE INPUT
DC OUTPUT CURRENT PER PLATE-MILLIAMPERES
AC PLATE SUPPLY VOLTAGE PER PLATE RMS
0
1
2
3
4
5
6
25
50
75
100
125
150


5829WA
RATING CHART
FOR
CAPACITOR—INPUT
FILTER OPERATION
PERMISSIBLE AREA
OF OPERATION
DC OUTPUT CURRENT PER PLATE-MILLIAMPERES
0
1
2
3
4
5
6
0
0.2
0.4
0.6
0.8
1.0
RECTIFICATION EFFICIENCY


5829WA
RATING CHART
SHOWING MINIMUM
ALLOWABLE RESIS-
TANCE EFFECTIVELY
IN SERIES WITH
EACH PLATE OR RE-
CEIVER TUBE FOR
ANY ALLOWABLE A-C
PLATE CURRENT
PERMISSIBLE AREA
OF OPERATION
MINIMUM PLATE SUPPLY RESISTANCE PER PLATE (Rs) - OHMS
0
250
500
750
1000
1250
0
25
50
75
100
125
150
AC PLATE SUPPLY VOLTAGE PER PLATE - RMS

5829WA
PREMIUM TUBE

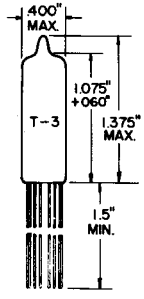
TENTATIVE DATA



TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB

SUBMINIATURE BUTTON
8 PIN LEAD E8-10

OUTLINE DRAWING
JEDEC 3-1

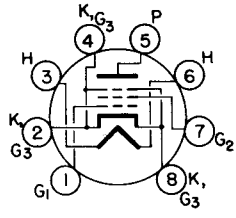
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.3 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8DL

THE 5840 IS A SHARP-CUTOFF PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN HIGH FREQUENCY CIRCUITS. IN ON-OFF CONTROL APPLICATIONS, THE TUBE WILL MAINTAIN ITS EMISSION CAPABILITIES AFTER LONG PERIODS OF OPERATION UNDER CUTOFF CONDITIONS. EXCEPT FOR THE INCORPORATION OF AN INTERNAL CONNECTION FOR THE SUPPRESSOR GRID, THE 5840 IS IDENTICAL TO THE 6205.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
GRID #1 TO PLATE, MAXIMUM	0.015	0.03	pf
INPUT	4.2	4.0	pf
OUTPUT	3.4	1.9	pf

[A] WITH EXTERNAL SHIELD OF 0.405-INCH INSIDE DIAMETER CONNECTED TO CATHODE.

RATINGS

ABSOLUTE MAXIMUM VALUES

PLATE VOLTAGE	165	VOLTS
SCREEN VOLTAGE	155	VOLTS
NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
PLATE DISSIPATION	1.1	WATTS
SCREEN DISSIPATION	0.55	WATTS
DC CATHODE CURRENT	16.5	MA.
HEATER - CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
BULB TEMPERATURE AT HOTTEST POINT	220	°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLI FIER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	150	OHMS
PLATE RESISTANCE, APPROX.	0.26	MEGOHMS
TRANSCONDUCTANCE	5000	μMHOS
PLATE CURRENT	7.5	MA.
SCREEN CURRENT	2.4	MA.
GRID #1 VOLTAGE, APPROX. Ib= 10 μAMPS.	-9.0	VOLTS

CLASS A RESISTANCE;COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 Volts				Ebb = 150 Volts				Ebb = 225 Volts			
		R_k	R_{c2}	E_o	G_{ain}	R_k	R_{c2}	E_o	G_{ain}	R_k	R_{c2}	E_o	G_{ain}
0.10	0.10	1000	0.2	13	50	500	0.3	19	83	400	0.3	29	110
0.10	0.24	1000	0.2	16	73	500	0.3	25	120	400	0.3	38	160
0.24	0.24	1700	0.5	13	72	1500	0.6	20	100	700	0.8	29	160
0.24	0.51	2000	0.6	15	89	1500	0.7	24	140	700	0.9	35	210
0.51	0.51	2500	1.3	11	93	2000	1.5	18	140	1000	1.7	28	200
0.51	1.0	3000	1.5	13	110	2000	1.7	20	180	1000	2.0	31	260

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100 K OHMS)

R_L	R_{gf}	Ebb = 90 Volts				Ebb = 150 Volts				Ebb = 225 Volts			
		R_k	R_{c2}	E_o	G_{ain}	R_k	R_{c2}	E_o	G_{ain}	R_k	R_{c2}	E_o	G_{ain}
0.10	0.10	1200	0.2	13	48	700	0.2	18	77	500	0.3	28	110
0.10	0.24	1300	0.2	16	70	800	0.3	24	110	500	0.3	37	150
0.24	0.24	2800	0.4	12	68	1700	0.6	20	100	1200	0.8	29	150
0.24	0.51	3000	0.5	15	82	1800	0.7	24	140	1300	0.8	35	190
0.51	0.51	5500	1.0	11	76	3500	1.3	18	120	2400	1.6	26	180
0.51	1.0	6200	1.2	12	92	3800	1.6	19	160	2500	1.8	31	230

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY FIVE PERCENT TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

3. R_k IS IN OHMS; R_{c2}, R_L, AND R_{gf} ARE IN MEGOHMS.

4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k AND R_{c2} SHOULD BE ADEQUATELY BY-PASSED.

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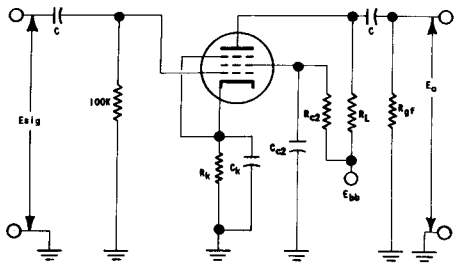

CHARACTERISTICS LIMITS

		MIN.	MAX.	
HEATER CURRENT				
Ef = 6.3 VOLTS	INITIAL	140	160	MA.
	500-HR.	138	164	MA.
PLATE CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	5.5	9.5	MA.
SCREEN CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	1.5	3.3	MA.
TRANSCONDUCTANCE (1):				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	4200	5800	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef= 5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500-HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION:				
AVERAGE OF VALUES FOR 'TRANS-CONDUCTANCE CHANGE WITH OPERATION'	500-HR.	---	15	PERCENT
PLATE RESISTANCE:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Rk=150 OHMS (BY-PASSED)	INITIAL	0.175	---	MEGOHMS
PLATE CURRENT CUTOFF:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=				
100 VOLTS, Ec1=-9.0 VOLTS	INITIAL	---	50	μAMPS.
INTERELECTRODE CAPACITANCES:				
GRID #1 TO PLATE (G1 TO P)	INITIAL	---	0.015	μμf
INPUT (G1 TO H,K, G2 G3)	INITIAL	3.5	4.9	μμf
OUTPUT (P TO H, K, G2 G3)	INITIAL	2.9	3.9	μμf

(MEASURED WITH EXTERNAL SHIELD OF 0.405-INCH INSIDE DIAMETER CONNECTED TO CATHODE)

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CHARACTERISTICS LIMITS - cont'd.

		MIN.	MAX.	
NEGATIVE GRID #1 CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2= 100 VOLTS, Rk=150 OHMS (BY-PASSED), Rg1=1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500-HR.	---	0.8	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef=6.3 VOLTS, Ehk=100 VOLTS, HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef=6.3 VOLTS. POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS				
GRID #1 TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEG.
	500-HR.	50	---	MEG.
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEG.
	500-HR.	50	---	MEG.
VIBRATIONAL NOISE OUTPUT VOLTAGE RMS Ef=6.3 VOLTS, Ebb=100 VOLTS, Ec2=100 VOLTS, Rk=150 OHMS (BY-PASSED), R_L= 10,000 OHMS, VIBRATIONAL ACCELERATION= 15 G AT 40 CPS	INITIAL	---	60	MV.
GRID #1 EMISSION CURRENT:				
Ef=7.5 VOLTS, Eb=100 VOLTS, Ec2= 100 VOLTS, Ecc1=-9.0 VOLTS, Rg1=1.0 MEG.	INITIAL	---	0.5	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=100 VOLTS, Rk=150 OHMS, R_{g1}=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE=220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec2=Ec1=0 VOLTS, AND Ehk=140 VOLTS RMS.

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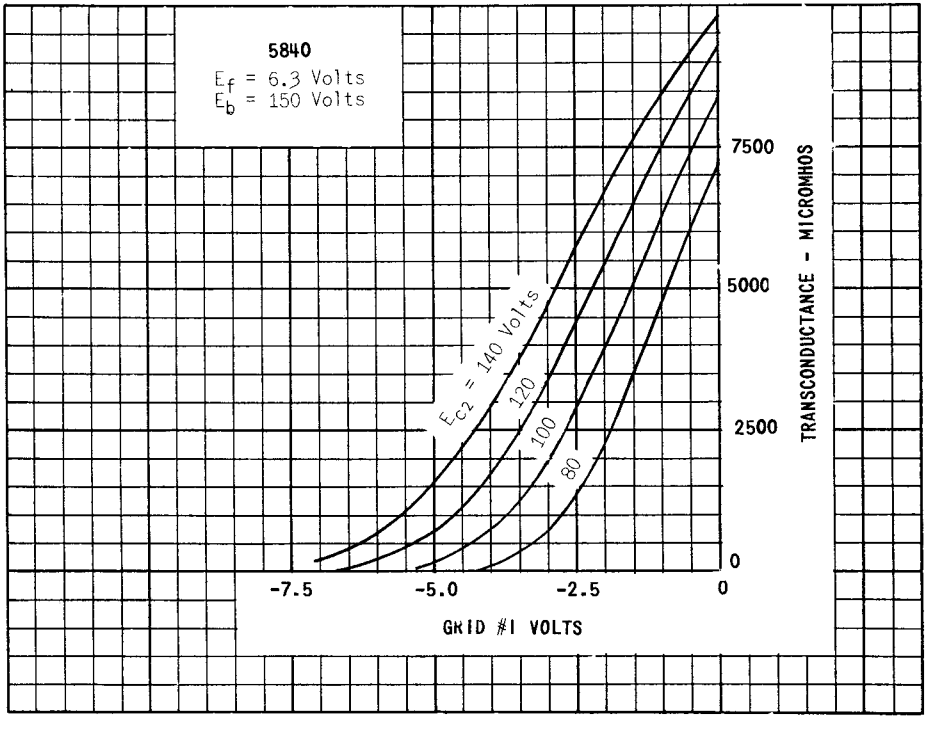
SPECIAL TESTS AND RATINGS - cont'd.

SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

NOTE: THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE BEEN DELIBERATELY SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS. IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



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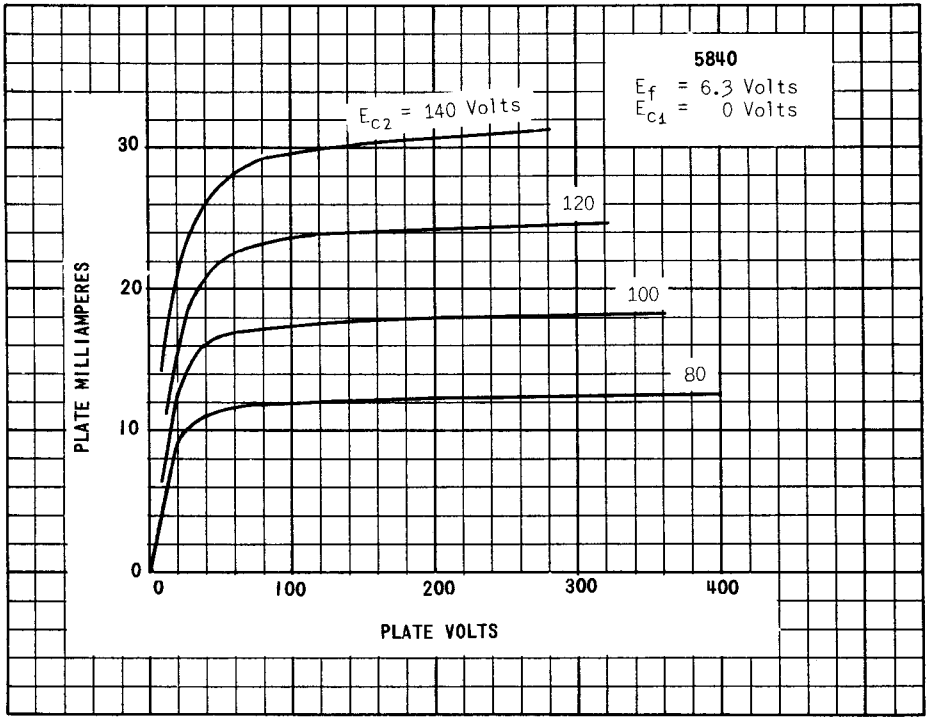
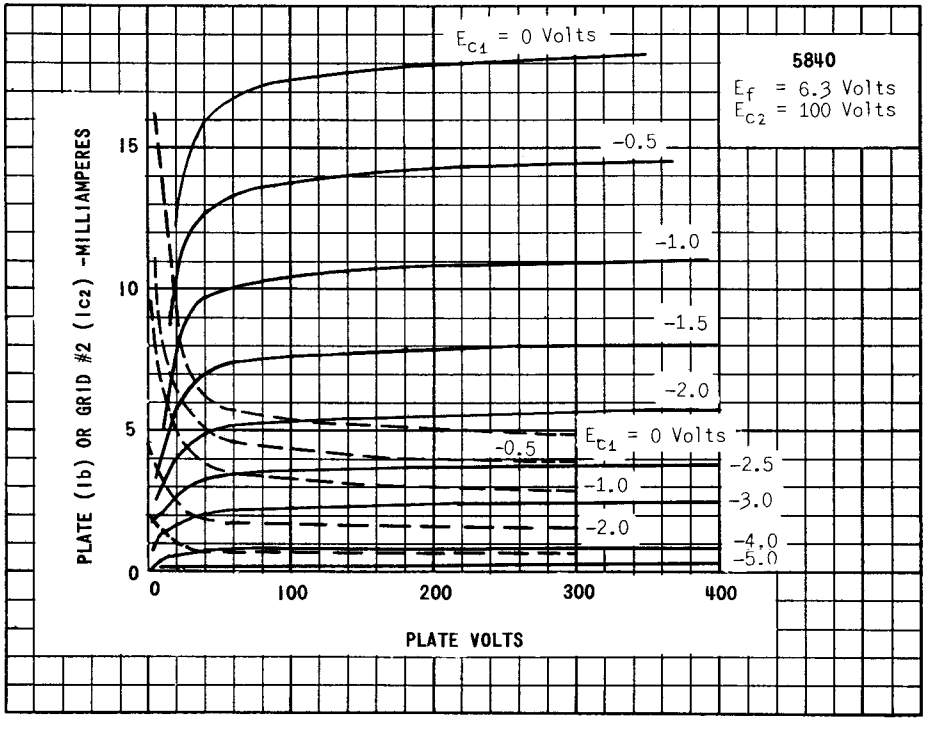
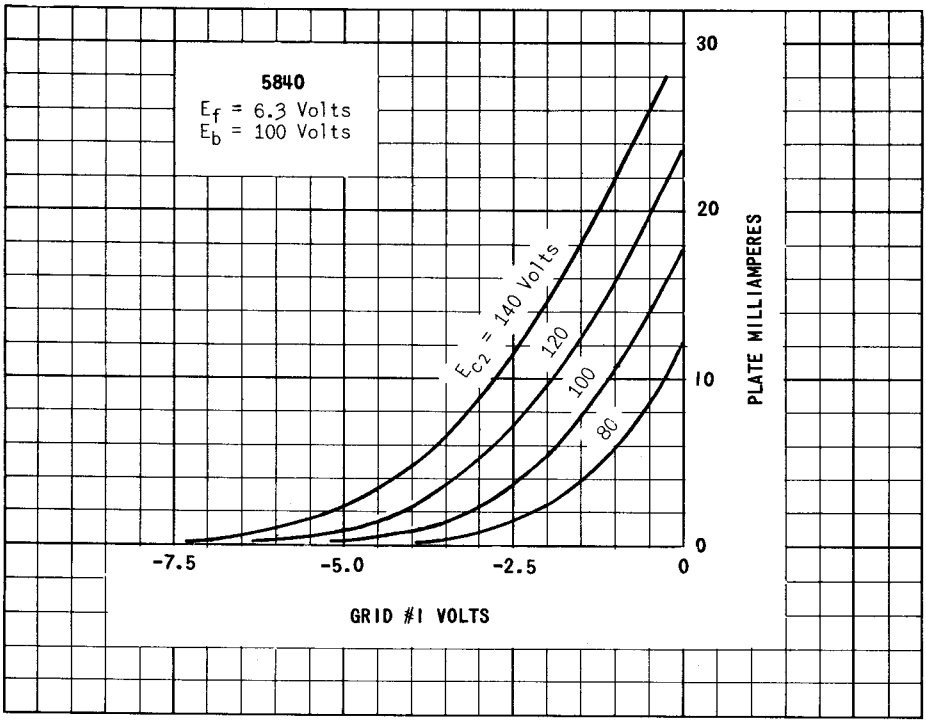
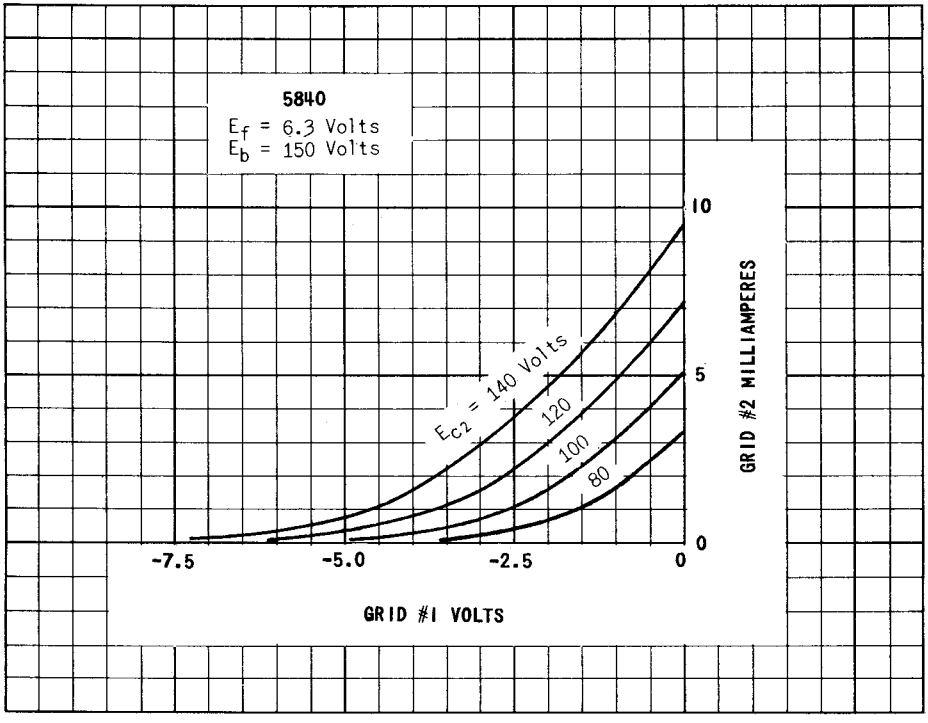

5840
E_f = 6.3 Volts
E_{c1} = 0 Volts
E_{c2} = 140 Volts
120
100
80
PLATE MILLIAMPERES
30
20
10
0
0
100
200
300
400
PLATE VOLTS


5840
E_f = 6.3 Volts
E_{c2} = 100 Volts
E_{c1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
E_{c1} = 0 Volts
-0.5
-1.0
-2.0
-2.5
-3.0
-4.0
-5.0
PLATE (Ib) OR GRID #2 (Ic2) -MILLIAMPERES
15
10
5
0
0
100
200
300
400
PLATE VOLTS





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PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 5847/404A

FEBRUARY 1963

MINIATURE BROADBAND PENTODE

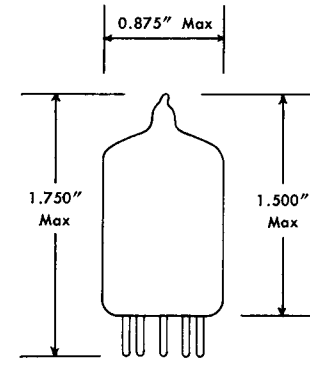
DESCRIPTION — The 5847/404A is a high gain, broadband, nine-pin, miniature pentode. Its low noise and low grid current requirements admirably suit it for use as a broadband amplifier in I-F amplifier and carrier systems as well as in cathode-ray oscilloscope amplifiers. The frame grid construction employed results in a high figure of merit, reduces noise levels, and provides a long and reliable service life.

ELECTRICAL DATA

Heater Voltage	6.3 ± 10%	Volts
Heater Current —E_f = 6.3 Volts	300	Milliamperes
Interelectrode Capacitance — maximum values, with shield		
Grid to Plate	0.04	Micromicrofarads
Input	7.8	Micromicrofarads
Output	3.4	Micromicrofarads

MECHANICAL DATA

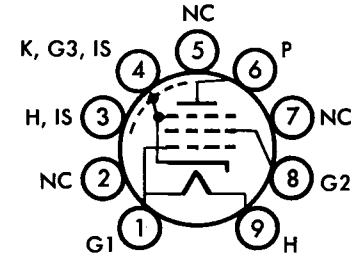
Mounting Position	Any
Bulb	T6½
Base	Small Button Miniature 9-pin, JEDEC No. E9-1
Dimensions	See Outline Drawing
Maximum Net Weight	0.5 Ounce



OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Heater Voltage	5.7	6.9	Volts
Plate Voltage	—	200	Volts dc
Plate Dissipation	—	3.3	Watts
Grid No. 2 Voltage	—	165	Volts dc
Grid No. 2 Dissipation	—	0.85	Watt
Cathode Current	—	40	Milliamperes
Heater — Cathode Voltage	—	55	Volts
Envelope Temperature	—	150	Degrees Centigrade
Altitude for Full Ratings	—	10,000	Feet



LOWER INTERNAL SHIELD — PIN 3

UPPER INTERNAL SHIELD — PIN 4

BASING DIAGRAM
BOTTOM VIEW

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3	Volts
Heater Current	0.3	Amperes
Plate Voltage	150	Volts dc
Grid No. 2 Voltage	150	Volts dc
Cathode Bias Resistance	110	Ohms
Control Grid Voltage	0	Volts
Plate Current	13	Milliamperes dc
Screen Current	4.5	Milliamperes dc
Transconductance	12,500	Micromhos

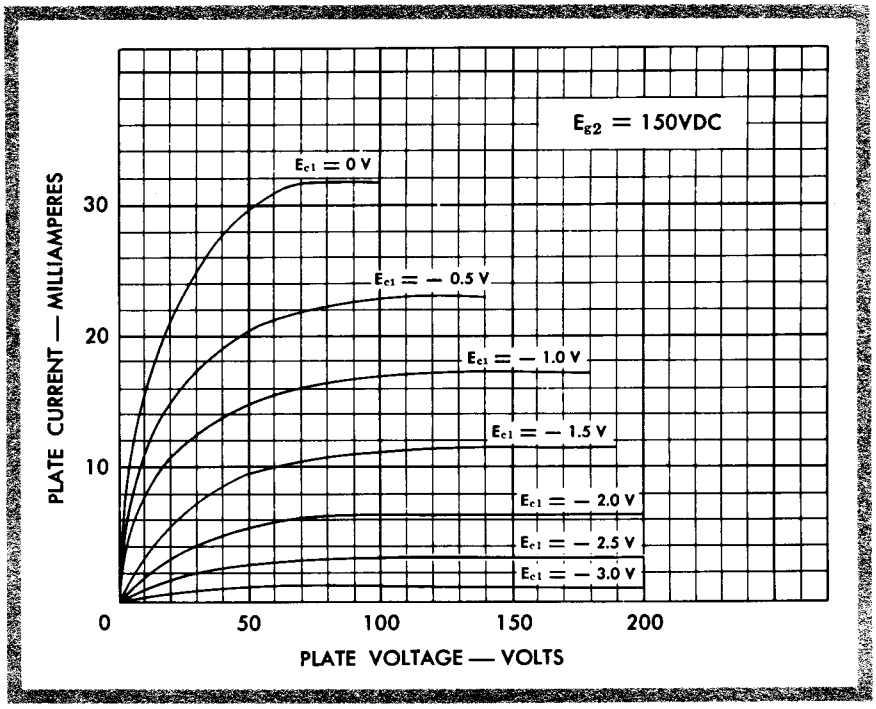
APPLICATION NOTES

The high figure of merit, the good transfer characteristic and the low noise figure of the 5847/404A highly recommend it to the equipment designer who requires a broadband carrier, I-F, or video amplifier tube.

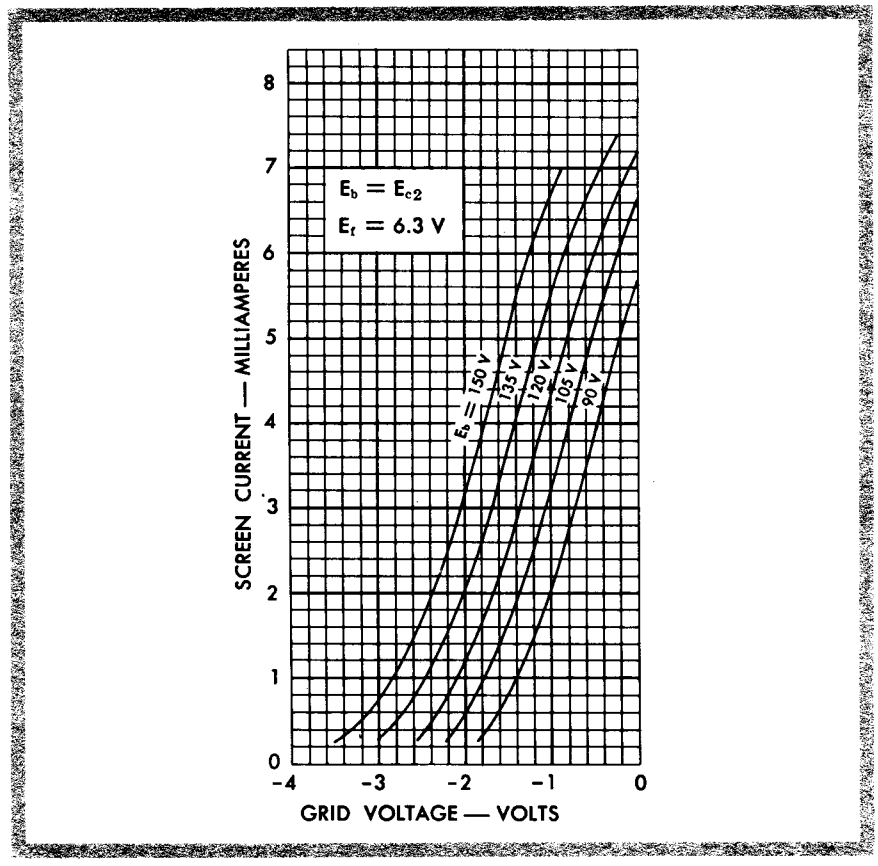
The first two of these characteristics result from the frame-grid type of construction used in this tube. When using this type of construction, the grid wire is tension wound and gold brazed to a rigid, self-supporting frame which is held to close dimension tolerances. The resulting product is a uniform, rugged and electrically constant control grid.

The 5847/404A has low input and output capacitances and has high transconductance. This permits the tube to pass a wideband signal without sacrificing gain. With unity gain at either end, it will pass a band 120 megacycles wide.

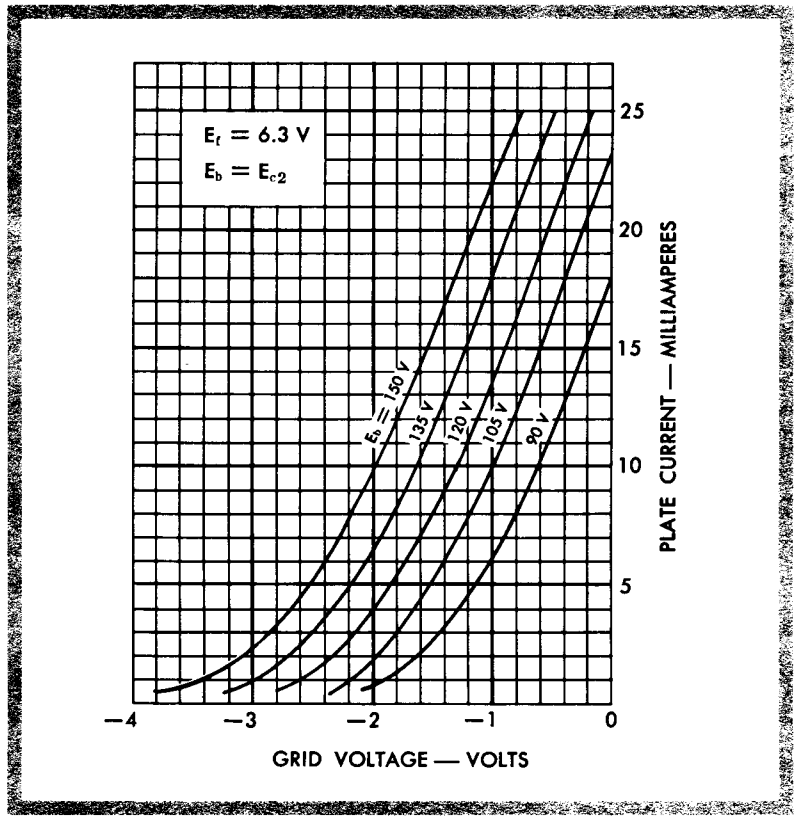
PLATE CHARACTERISTIC CURVES



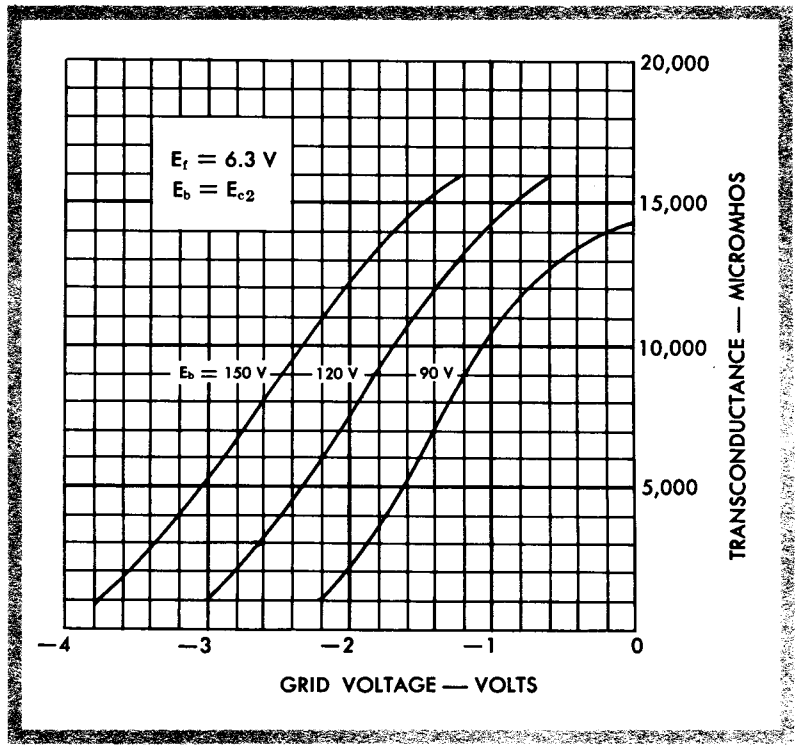
SCREEN CHARACTERISTIC CURVES



TRANSFER CHARACTERISTIC CURVES



TRANSCONDUCTANCE CURVES



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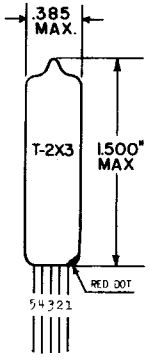
PENTODE

SUBMINIATURE TYPE

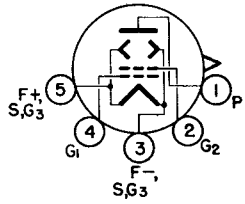


GLASS BULB
COLOR DOT IS ADJACENT
TO LEAD 1
IN-LINE LEADS

COATED FILAMENT

1.25 VOLTS 100 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED
FLEXIBLE LEADS
0.048" SPACING
CENTER-TO-CENTER
GRID #3 IS COMPRISED OF TWO SEPARATE BEAM PLATES, ONE OF WHICH IS CONNECTED TO LEAD #3 THE OTHER TO LEAD #5

THE 5875 IS A FILAMENT TYPE, SHARP CUTOFF PENTODE OF SUBMINIATURE CONSTRUCTION, DESIGNED FOR RADIOSONDE APPLICATIONS. A COATED METALLIC SHIELD IS USED AND CONNECTED TO LEAD #3. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

GRID #1 TO PLATE (MAX.)	0.03	pf
INPUT	4.0	pf
OUTPUT	4.0	pf

RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
TOTAL CATHODE CURRENT	6.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	VOLTS
GRID #2 VOLTAGE	90	VOLTS
GRID #1 VOLTAGE	0	VOLTS
TRANSCONDUCTANCE	2 500	μMHOS
PLATE CURRENT	3.5	MA.
GRID #2 CURRENT	1.0	MA.
GRID #1 VOLTAGE (APPROX.) FOR TRANSCONDUCTANCE = 10 μMHOS	−3.5	VOLTS

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UHF POWER TRIODE

PENCIL TYPE

FOR

RF POWER AMPLIFIER, OSCILLATOR

AND FREQUENCY MULTIPLIER APPLICATIONS

IN MOBILE AND AIRCRAFT EQUIPMENT

PHYSICAL DIMENSIONS SEE OUTLINE DRAWING

ELECTRODE TERMINATIONS SEE OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

THE 5876A IS A COAXIAL METAL-GLASS PENCIL-TYPE MEDIUM MU TRIODE. ITS MAXIMUM PLATE DISSIPATION IS 6¼ WATTS CCS. THE TUBE MAY BE OPERATED WITH FULL RATINGS UP TO A FREQUENCY OF 1,700 MC/S, AND WITH REDUCED RATINGS UP TO 3,000 MC/S.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		1.4	pf
GRID TO CATHODE		2.4	pf
PLATE TO CATHODE	MAX.	0.035	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	135	mA
LIMITS OF APPLIED VOLTAGE - AC OR DC		6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		90	VOLTS
MINIMUM PREHEAT TIME		60	SEC.

AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
CATHODE RESISTOR	75	OHMS
PLATE CURRENT	18	mA
TRANSCONDUCTANCE	6,500	μMHOS
AMPLIFICATION FACTOR	56	

CONTINUED ON FOLLOWING PAGE

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CLASS A_1 – RF AMPLIFIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

CONTINUOUS COMMERCIAL SERVICE

DC PLATE VOLTAGE	300	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	25	mA
PLATE DISSIPATION - SEE NOTE ON OUTLINE	6.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.5	MEGOHMS

CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

CONTINUOUS COMMERCIAL SERVICE

DC PLATE VOLTAGE	360	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	25	mA
DC GRID CURRENT	8	mA
PLATE INPUT	9	WATTS
PLATE DISSIPATION - SEE NOTE ON OUTLINE	6.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

TYPICAL OPERATION - OSCILLATOR IN CATHODE - DRIVE CIRCUIT

RF AMPLIFIER WITH CATHODE DRIVE

CONTINUOUS COMMERCIAL SERVICE

FREQUENCY	500	1,700	3,000	MC/S
DC PLATE -TO-GRID VOLTAGE	262	252	252	VOLTS
DC CATHODE-TO-GRID VOLTAGE OBTAINED FROM A GRID RESISTOR	12	2	2	VOLTS
DC PLATE CURRENT	23	23	25	mA
DC GRID CURRENT - APPROX.	6	3	4	mA
USEFUL POWER OUTPUT - APPROX.	3	0.75	0.1	mW

TYPICAL OPERATION - RF POWER AMPLIFIER IN CATHODE - DRIVE CIRCUIT

FREQUENCY	500	MC/S
DC PLATE - TO - GRID VOLTAGE	326	VOLTS
DC CATHODE - TO - GRID VOLTAGE OBTAINED FROM A GRID RESISTOR	51	VOLTS
DC PLATE CURRENT	23	mA
DC GRID CURRENT - APPROX.	7	mA
DRIVING POWER - APPROX.	2	WATTS
USEFUL POWER OUTPUT - APPROX.	5	WATTS

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CLASS C TELEPHONY - PLATE - MODULATED RF POWER AMPLIFIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

CONTINUOUS COMMERCIAL SERVICE		
DC PLATE VOLTAGE	275	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	22	mA
DC GRID CURRENT	8	mA
PLATE INPUT	6	WATTS
PLATE DISSIPATION - SEE NOTE ON OUTLINE	4.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

FREQUENCY MULTIPLIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

CONTINUOUS COMMERCIAL SERVICE		
DC PLATE VOLTAGE	330	VOLTS
DC GRID VOLTAGE	-100	VOLTS
DC PLATE CURRENT	22	mA
DC GRID CURRENT	8	mA
PLATE INPUT	7.5	WATTS
PLATE DISSIPATION - SEE NOTE ON OUTLINE	6.25	WATTS
FREQUENCY FOR OPERATION AT FULL RATINGS	1,700	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	FEET

TYPICAL OPERATION - CATHODE DRIVE CIRCUITS

CONTINUOUS COMMERCIAL SERVICE	TRIPLER TO 480 MC/S	DOUBLER TO 960 MC/S	
DC PLATE - TO - GRID VOLTAGE	390	370	VOLTS
DC CATHODE - TO - GRID VOLTAGE OBTAINED FROM A GRID RESISTOR	90	70	VOLTS
DC PLATE CURRENT	18	17.3	mA
DC GRID CURRENT - APPROX.	6	7	mA
DRIVING POWER - APPROX.	2.1	2	WATTS
USEFUL POWER OUTPUT - APPROX.	2.1	2	WATTS

SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

VIBRATION TEST
GLASS SEAL FRACTURE TESTS
HEATER CYCLING LIFE TEST
500 HOUR LIFE TEST IN OSCILLATOR

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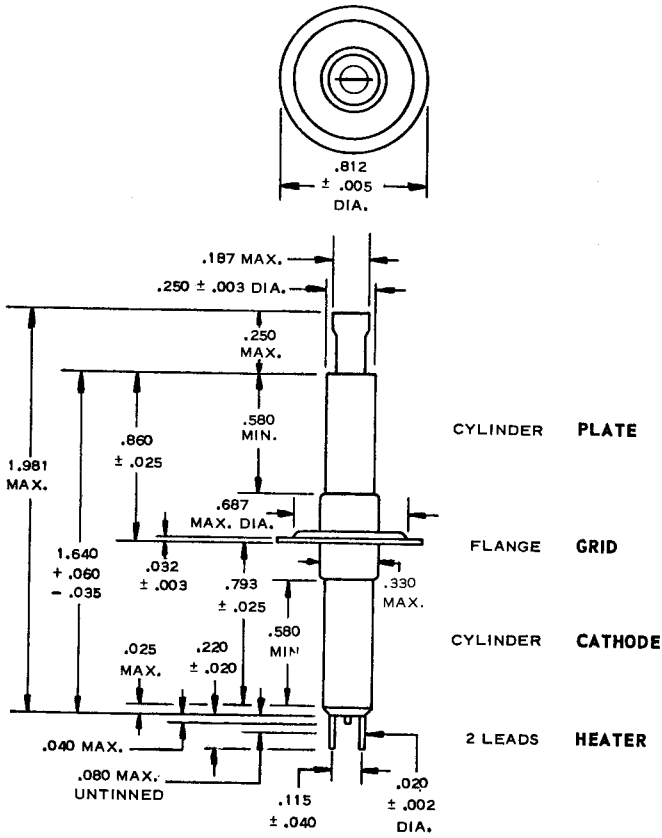
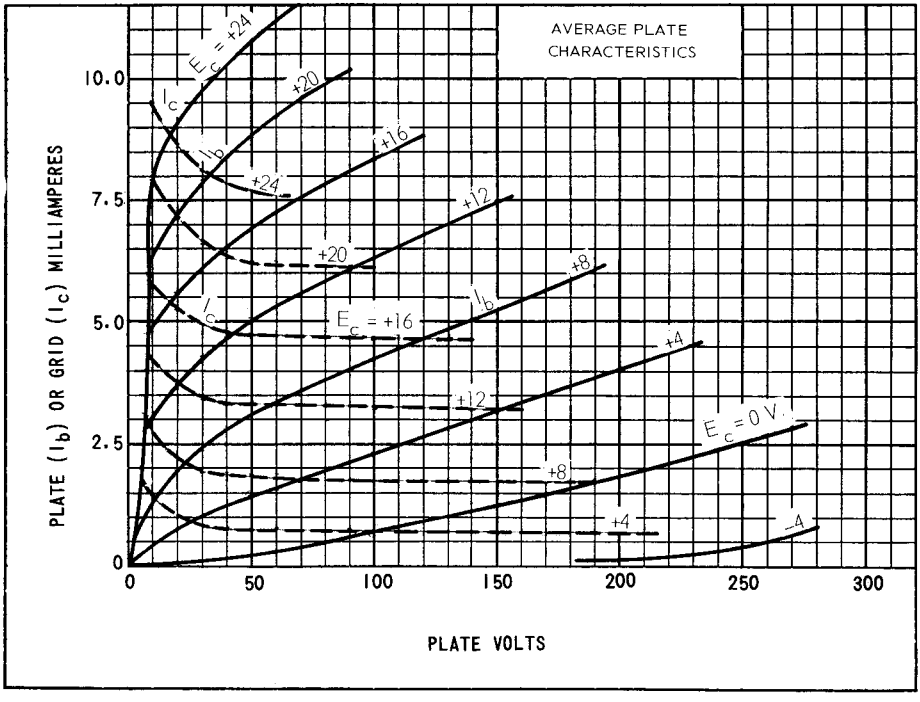
OUTLINE DRAWING



ALL DIMENSIONS IN INCHES

NOTE: COOLING MUST BE ADEQUATE SO AS TO ASSURE THAT TEMPERATURE OF THE PLATE SEAL WILL NOT EXCEED 175 °C.



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PENTODE

MINIATURE TYPE

SHARP-CUTOFF PENTODE

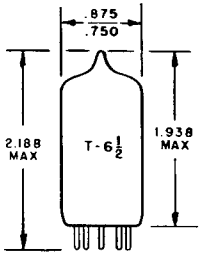
FOR

AUDIO PRE-AMPLIFIER

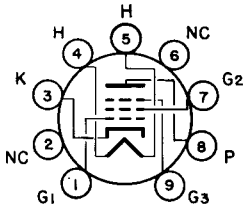
APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON NOVAL
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AD

THE 5879 IS A SHARP-CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN THE INPUT STAGE OF AUDIO AMPLIFIERS. IT COMBINES HIGH GAIN WITH VERY LOW LEVEL OF MICROPHONICS, HUM, AND OTHER AUDIO FREQUENCY NOISES.

DIRECT INTERELECTRODE CAPACITANCES

		PENTODE CONNECTION	TRIODE CONNECTION [A]	
GRID TO PLATE	MAX.	0.11	1.4	pf
INPUT		2.7	1.4	pf
OUTPUT		2.4	0.85	pf

[A] GRID 2 AND 3 CONNECTED TO PLATE.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	150	MA.
LIMITS OF APPLIED VOLTAGE : AC OR DC			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE CONNECTION[A]	PENTODE CONNECTION	
PLATE VOLTAGE	275	330	VOLTS
GRID 3 VOLTAGE	-----	0	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE		See Rating Chart	
PLATE DISSIPATION	1.7	1.25	WATTS
GRID 2 DISSIPATION UP TO 165 VOLTS	-----	0.25	
GRID 1 VOLTAGE:			
NEGATIVE BIAS VALUE	55	55	VOLTS
POSITIVE BIAS VALUE	0	0	VOLTS
GRID 1 CIRCUIT RESISTANCE	2.2	2.2	MEGOHMS

AVERAGE CHARACTERISTICS

		TRIODE CONNECTION[A]		PENTODE CONNECTION	
PLATE VOLTAGE		100	250	250	VOLTS
GRID 3 VOLTAGE		-----	-----	0	VOLTS
GRID 2 VOLTAGE		-----	-----	100	VOLTS
GRID 1 VOLTAGE		-3	-8	-3	VOLTS
PLATE CURRENT		2.2	5.5	1.8	MA.
GRID 2 CURRENT		-----	-----	0.4	MA.
TRANSCONDUCTANCE		1,240	1,530	1,000	μMHOS
AMPLIFICATION FACTOR		21	21		VOLTS
PLATE RESISTANCE	APPROX.	.017	.137	2	MEGOHMS
GRID 1 VOLTAGE FOR Ib = 10 μA				-8	VOLTS

[A] GRIDS 2 AND 3 CONNECTED TO PLATE.

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TYPICAL OPERATION

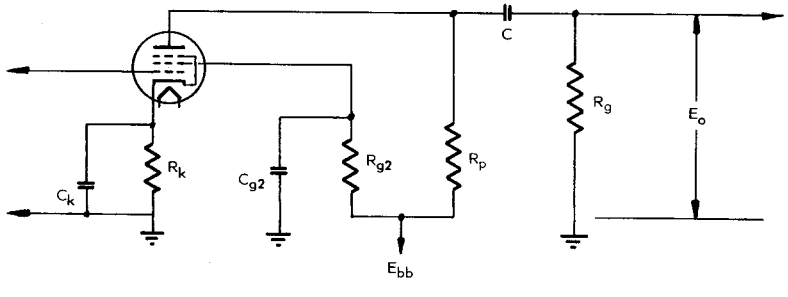
PENTODE CONNECTION

RESISTANCE-COUPLED AMPLIFIER

MAXIMUM VOLTAGE GAIN

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_k	C	E_o	V.G.*
90	0.1	0.1	0.35	1700	0.044	4.6	0.020	13	29
		0.22			0.046	4.5	0.012	17	39
		0.47			0.047	4.4	0.006	20	47
	0.22	0.22	0.80	3000	0.034	3.2	0.010	15	43
		0.47			0.035	3.1	0.005	21	59
		1.0			0.036	3.0	0.003	24	67
	0.47	0.47	1.9	7000	0.021	1.8	0.005	21	59
		1.0			0.022	1.7	0.003	25	75
		2.2			0.023	1.7	0.002	28	87
180	0.1	0.1	0.35	700	0.060	7.4	0.020	24	39
		0.22			0.062	7.3	0.012	28	56
		0.47			0.064	7.2	0.006	33	65
	0.22	0.22	0.80	1200	0.045	5.5	0.010	24	65
		0.47			0.046	5.3	0.005	31	87
		1.0			0.048	5.2	0.003	34	101
	0.47	0.47	1.9	2500	0.033	3.5	0.005	27	98
		1.0			0.034	3.4	0.003	32	122
		2.2			0.035	3.3	0.002	37	140
300	0.1	0.1	0.35	300	0.075	10.8	0.020	25	51
		0.22			0.077	10.6	0.012	32	68
		0.47			0.080	10.5	0.006	35	83
	0.22	0.22	0.80	600	0.056	7.9	0.010	28	81
		0.47			0.057	7.5	0.005	37	109
		1.0			0.058	7.4	0.003	41	123
	0.47	0.47	1.3	1200	0.044	5.3	0.005	35	125
		1.0			0.046	5.2	0.003	42	152
		2.2			0.047	5.1	0.002	48	174

*AT AN OUTPUT VOLTAGE OF 1 VOLT RMS AND GRID 1 BIAS OF 1 VOLT.



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RESISTANCE-COUPLED AMPLIFIER

MAXIMUM VOLTAGE OUTPUT

E_{bb}	R_p	R_g	R_{g2}	R_k	C_{g2}	C_kC	E C	E_o	V.G.
90	0.1	0.1	0.12	2000	0.09	4.8	0.027	22	23
		0.22	0.15	2200	0.08	4.4	0.013	28	32
		0.47	0.17	2400	0.07	4.0	0.007	31	39
	0.22	0.22	0.35	3500	0.06	3.3	0.011	24	33
		0.47	0.40	3800	0.065	3.2	0.006	30	44
		1.0	0.44	4100	0.06	3.0	0.003	32	50
	0.47	0.47	0.90	6800	0.04	2.0	0.005	25	47
		1.0	1.0	7400	0.04	2.0	0.003	30	57
		2.2	1.1	8000	0.04	2.0	0.002	32	64
180	0.1	0.1	0.19	1300	0.08	6.0	0.021	48	33
		0.22	0.20	1400	0.08	5.85	0.013	59	46
		0.47	0.22	1500	0.07	5.45	0.007	68	57
	0.22	0.22	0.44	2000	0.09	4.85	0.011	48	41
		0.47	0.53	2300	0.07	4.45	0.006	62	62
		1.0	0.55	2400	0.065	4.25	0.004	68	72
	0.47	0.47	1.0	3500	0.07	3.5	0.005	51	54
		1.0	1.1	3700	0.07	3.5	0.003	59	66
		2.2	1.2	4000	0.07	3.3	0.002	66	81
300	0.1	0.1	0.18	1000	0.1	7.0	0.022	85	38
		0.22	0.2	1100	0.1	6.8	0.013	110	53
		0.47	0.23	1200	0.075	6.4	0.007	124	66
	0.22	0.22	0.47	1400	0.1	5.75	0.012	88	44
		0.47	0.52	1600	0.1	5.45	0.006	113	64
		1.0	0.58	1700	0.075	5.0	0.004	124	86
	0.47	0.47	1.1	2300	0.1	4.6	0.006	90	58
		1.0	1.2	2500	0.1	4.3	0.004	110	76
		2.2	1.3	2800	0.1	4.2	0.002	121	99

CONTINUED ON FOLLOWING PAGE

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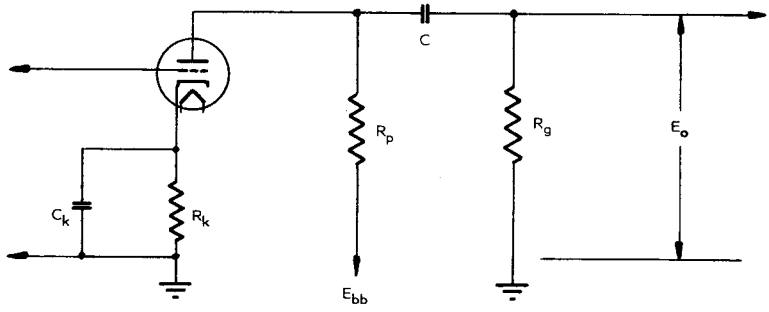
TRIODE
CONNECTION
RESISTANCE-COUPLED AMPLIFIER

MAXIMUM VOLTAGE GAIN

E_{bb}	R_p	R_g	R_k	C_k	C	E_o	V.G.
90	0.047	0.047	1800	2.9	0.060	9	10[A]
		0.1	2100	2.4	0.033	12	11[B]
		0.22	2200	2.3	0.016	14	12[C]
	0.1	0.1	3200	1.8	0.027	10	12[B]
		0.22	3900	1.3	0.015	13	13[C]
		0.47	4300	1.0	0.007	16	13
	0.22	0.22	6200	0.87	0.015	12	13[B]
		0.47	8100	0.53	0.006	16	13
		1.0	9000	0.49	0.003	19	14
180	0.047	0.047	1200	3.5	0.063	21	12
		0.1	1600	2.6	0.033	29	13
		0.22	1800	2.4	0.016	35	13
	0.1	0.1	2200	1.9	0.031	26	13
		0.22	2900	1.35	0.015	33	14
		0.47	3400	1.1	0.007	40	14
	0.22	0.22	4500	0.92	0.015	28	14
		0.47	6400	0.61	0.006	39	14
		1.0	8200	0.52	0.003	47	14
300	0.047	0.047	1100	3.9	0.063	42	13
		0.1	1500	2.8	0.033	65	13
		0.22	1700	2.5	0.016	71	14
	0.1	0.1	2000	2.1	0.032	45	15
		0.22	3400	1.4	0.015	74	15
		0.47	3700	1.1	0.007	83	15
	0.22	0.22	4300	0.97	0.015	50	15
		0.47	7200	0.63	0.007	88	15
		1.0	7400	0.63	0.003	94	15

[A] AT 2 VOLTS (RMS) OUTPUT. [B] AT 3 VOLTS (RMS) OUTPUT. [C] AT 4 VOLTS (RMS) OUTPUT.



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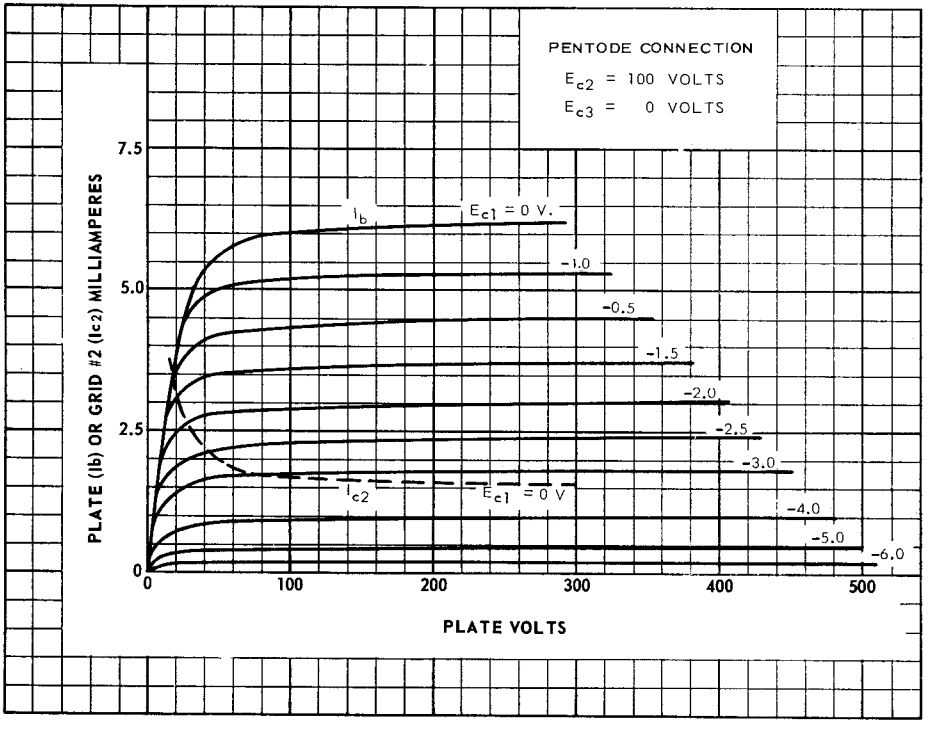
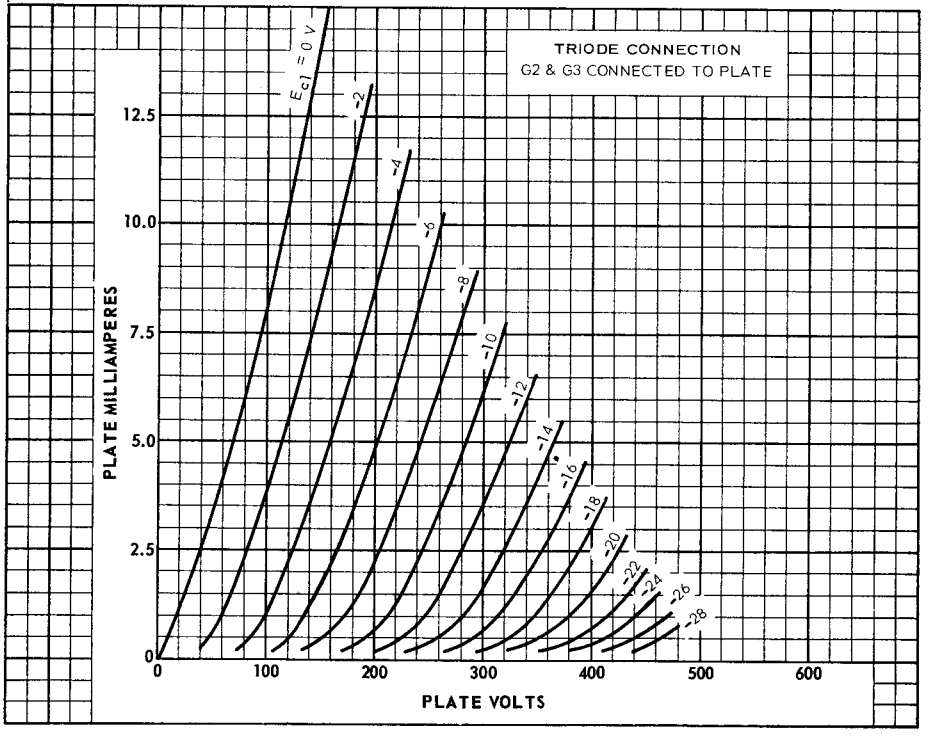
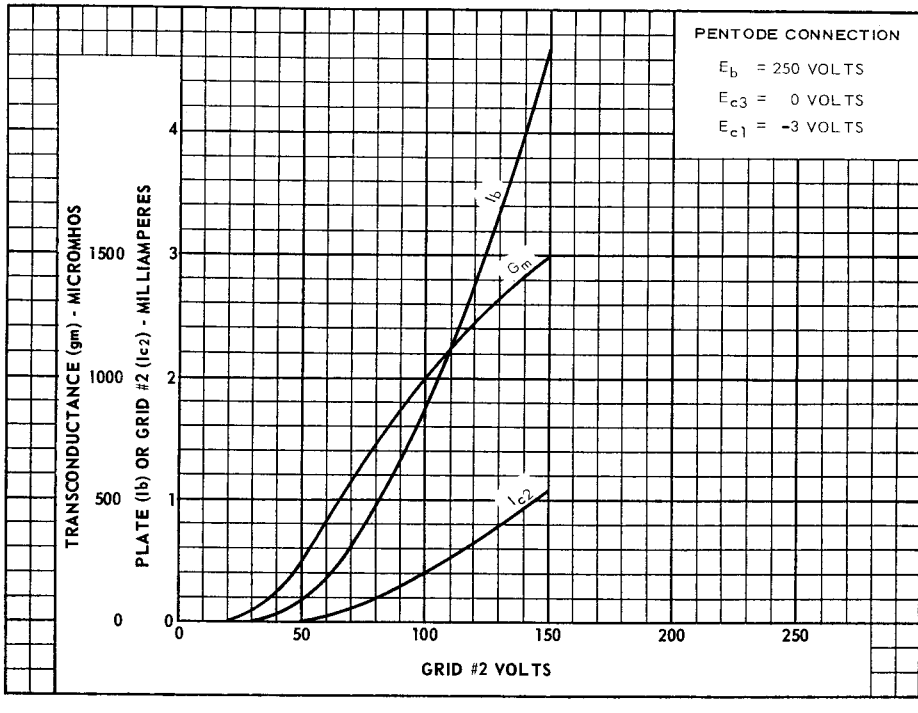
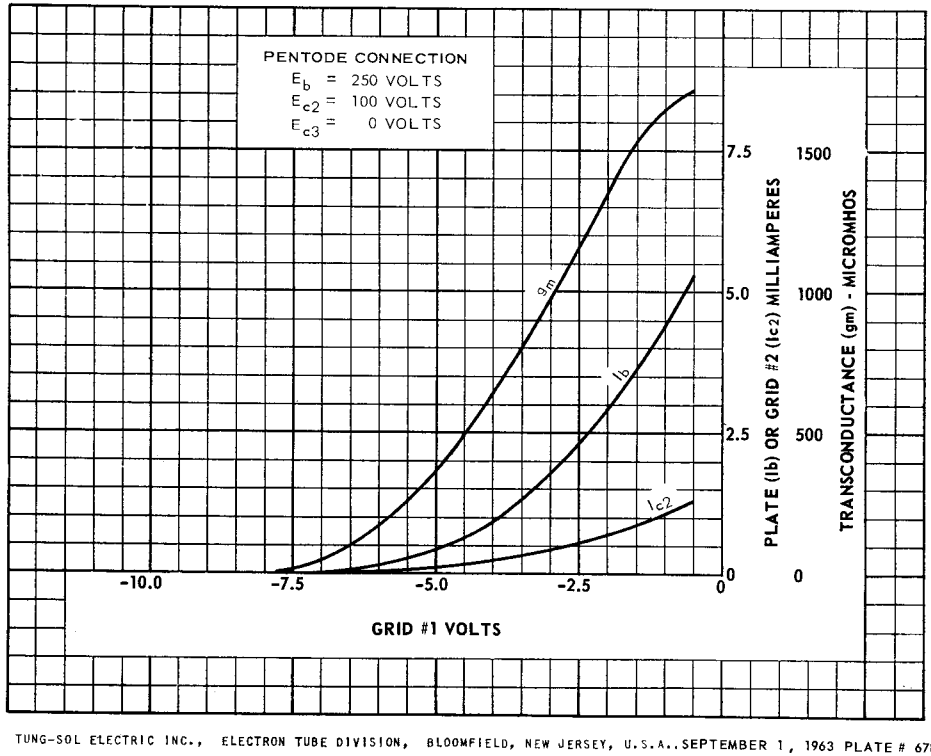

PENTODE CONNECTION
E_{c2} = 100 VOLTS
E_{c3} = 0 VOLTS
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
7.5
5.0
2.5
0
i_b
E_{c1} = 0 V.
-1.0
-0.5
-1.5
-2.0
-2.5
-3.0
i_{c2}
E_{c1} = 0 V
-4.0
-5.0
-6.0
0
100
200
300
400
500
PLATE VOLTS


TRIODE CONNECTION
G2 & G3 CONNECTED TO PLATE
PLATE MILLIAMPERES
12.5
10.0
7.5
5.0
2.5
0
E_{c1} = 0 V
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
0
100
200
300
400
500
600
PLATE VOLTS





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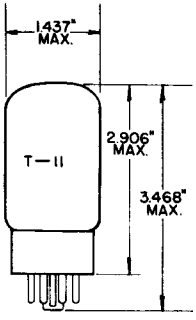
TUNG-SOL

BEAM PENTODE

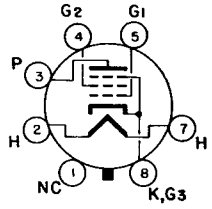


GLASS BULB
SHORT INTERMEDIATE SHELL
7 PIN OCTAL B7-47
OUTLINE 11-1

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 900 MA.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7AC

THE 5881 IS THE ELECTRICAL EQUIVALENT TO TYPES 6L6 AND 6L6G EXCEPT THAT THE PLATE AND SCREEN DISSIPATION RATINGS HAVE BEEN INCREASED APPROXIMATELY 20 PERCENT. IT EMBODIES A COMPLETE MECHANICAL REDESIGN WHICH RESULTS IN GREATER RESISTANCE TO SHOCK AND VIBRATION. THE USE OF TREATED GRIDS AND ANODE GREATLY INCREASES ITS OVERLOAD CAPABILITIES AND THEREBY PROVIDES DESIRABLE IMPROVEMENT IN CONTINUITY OF SERVICE. THE ADDITION OF A LOW-LOSS BARRIER TYPE BASE WILL PROVIDE OBVIOUS ADVANTAGES IN CERTAIN APPLICATIONS.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

MAXIMUM HEATER-CATHODE VOLTAGE	200	VOLTS
MAXIMUM PLATE VOLTAGE	400	VOLTS
MAXIMUM GRID #2 VOLTAGE	400	VOLTS
MAXIMUM PLATE VOLTAGE (TRIODE CONNECTION)	400	VOLTS
MAXIMUM PLATE DISSIPATION	23	WATTS
MAXIMUM GRID #2 DISSIPATION	3	WATTS
MAXIMUM PLATE DISSIPATION (TRIODE CONNECTION)	26	WATTS
MAXIMUM GRID RESISTANCE (FIXED BIAS)	0.1	MEGOHM
MAXIMUM GRID RESISTANCE (SELF BIAS)	0.5	MEGOHM

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE	250	300	350	VOLTS
GRID #2 VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	-14	-12.5	-18	VOLTS
PEAK AF SIGNAL VOLTAGE	14	12.5	18	VOLTS
TRANSCONDUCTANCE	6 100	5 300	5 200	μMHOS
PLATE RESISTANCE	30 000	35 000	48 000	OHMS
ZERO-SIGNAL PLATE CURRENT	75	48	53	MA.
ZERO-SIGNAL GRID #2 CURRENT	4.3	2.5	2.5	MA.
MAXIMUM SIGNAL PLATE CURRENT	80	55	65	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	7.6	4.7	8.5	MA.
LOAD RESISTANCE	2 500	4 500	4 200	OHMS
POWER OUTPUT	6.7	6.5	11.3	WATTS
TOTAL HARMONIC DISTORTION	10	11	13	PERCENT

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CLASS A_1 AMPLIFIER – SINGLE TUBE – TRIODE CONNECTION

GRID #2 CONNECTED TO PLATE

PLATE VOLTAGE	250	300	VOLTS
GRID VOLTAGE	−18	−20	VOLTS
PEAK AF SIGNAL VOLTAGE	18	20	VOLTS
ZERO-SIGNAL PLATE CURRENT	52	78	MA.
MAXIMUM SIGNAL PLATE CURRENT	58	85	MA.
AMPLIFICATION FACTOR	8	---	
TRANSCONDUCTANCE	5 250	---	µMHOS
LOAD RESISTANCE	4 000	4 000	OHMS
TOTAL HARMONIC DISTORTION	6	5.5	PERCENT
POWER OUTPUT	1.4	1.8	WATTS

CLASS A_1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	250	270	VOLTS
GRID #2 VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	−16	−17.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	32	35	VOLTS
TRANSCONDUCTANCE (EACH TUBE)	5 500	5 700	µMHOS
PLATE RESISTANCE (EACH TUBE)	24 500	23 500	OHMS
ZERO-SIGNAL PLATE CURRENT	120	134	MA.
ZERO-SIGNAL GRID #2 CURRENT	10	11	MA.
MAXIMUM SIGNAL PLATE CURRENT	140	155	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	16	17	MA.
LOAD RESISTANCE	5 000	5 000	OHMS
POWER OUTPUT	14.5	17.5	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CLASS AB_1 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	270	270	VOLTS
GRID #1 VOLTAGE	−22.5	−22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	45	45	VOLTS
ZERO-SIGNAL PLATE CURRENT	88	88	MA.
ZERO-SIGNAL GRID #2 CURRENT	5	5	MA.
MAXIMUM SIGNAL PLATE CURRENT	132	140	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	15	11	MA.
LOAD RESISTANCE	6 600	3 800	OHMS
POWER OUTPUT	26.5	18	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT

CONTINUED ON FOLLOWING PAGE

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CLASS AB_1 PUSH-PULL AMPLIFIER – TRIODE CONNECTION

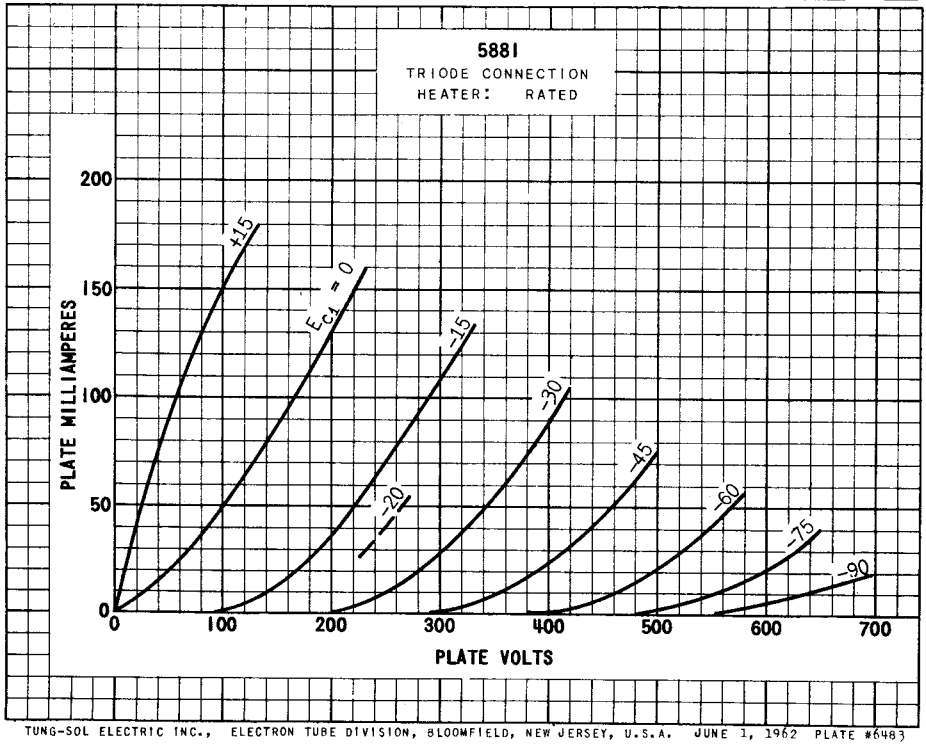
GRID #2 CONNECTED TO PLATE
VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.9	AMP.
PLATE VOLTAGE	400	VOLTS
GRID VOLTAGE	-45	VOLTS
PEAK AF GRID TO GRID VOLTAGE	90	VOLTS
ZERO-SIGNAL PLATE CURRENT	65	MA.
MAXIMUM SIGNAL PLATE CURRENT	130	MA.
LOAD RESISTANCE	4 000	OHMS
TOTAL HARMONIC DISTORTION	4.4	PERCENT
POWER OUTPUT	13.3	WATTS

CLASS AB_2 PUSH-PULL AMPLIFIER

VALUES ARE FOR TWO TUBES

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.9	0.9	AMP.
PLATE VOLTAGE	360	360	VOLTS
GRID #2 VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID TO GRID VOLTAGE	52	72	VOLTS
ZERO-SIGNAL PLATE CURRENT	78	88	MA.
ZERO-SIGNAL GRID #2 CURRENT	3.5	5	MA.
MAXIMUM SIGNAL PLATE CURRENT	142	205	MA.
MAXIMUM SIGNAL GRID #2 CURRENT	11	16	MA.
LOAD RESISTANCE	6 000	3 800	OHMS
POWER OUTPUT	31	47	WATTS
TOTAL HARMONIC DISTORTION	2	2	PERCENT



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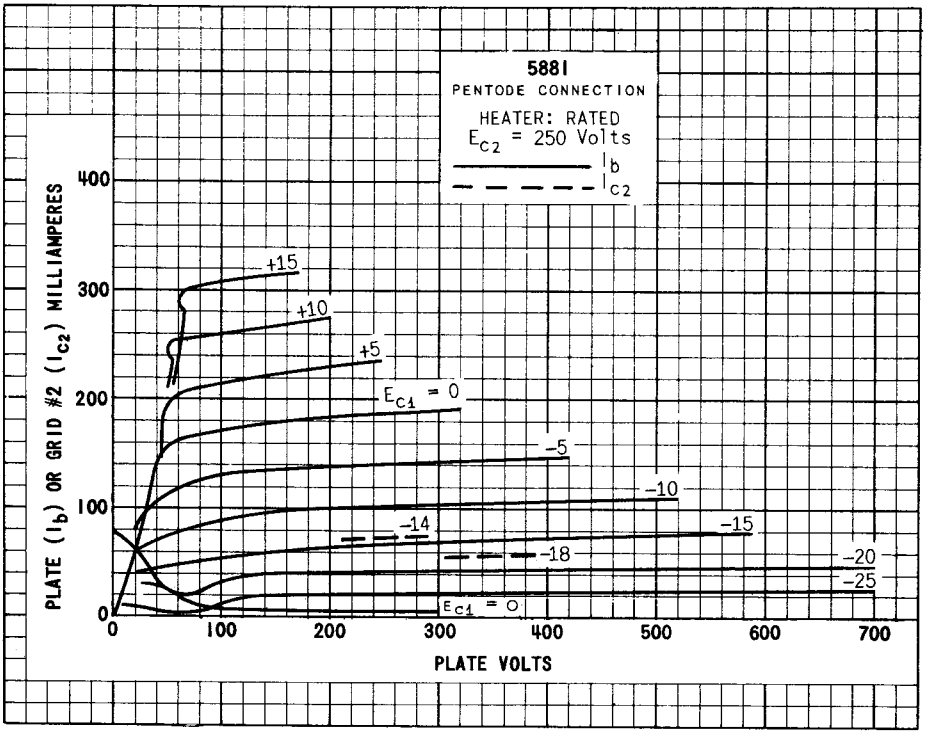
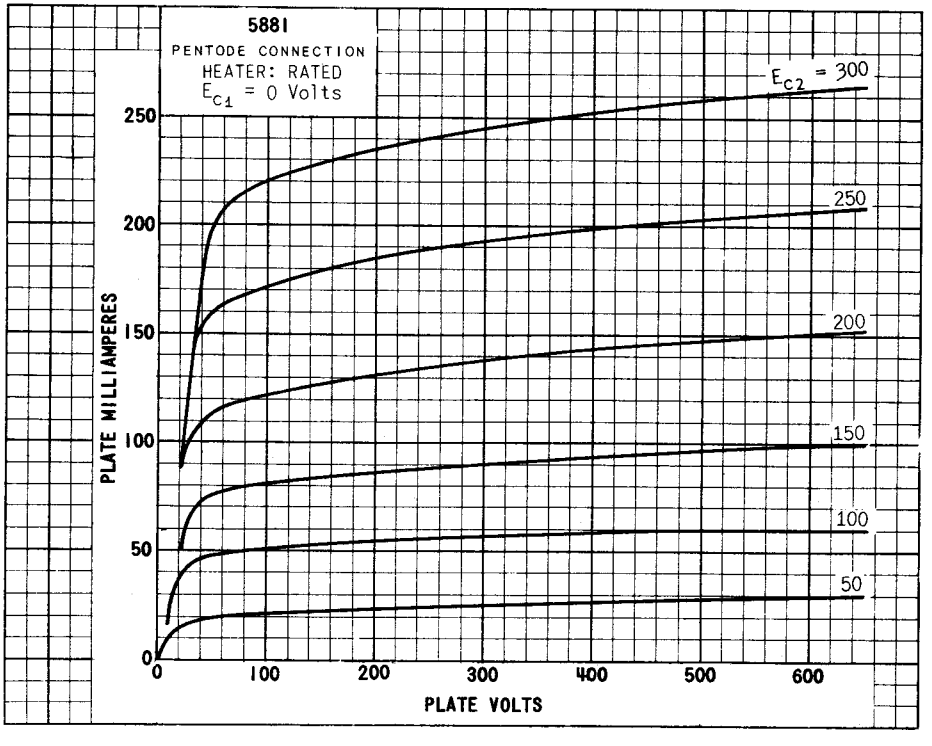
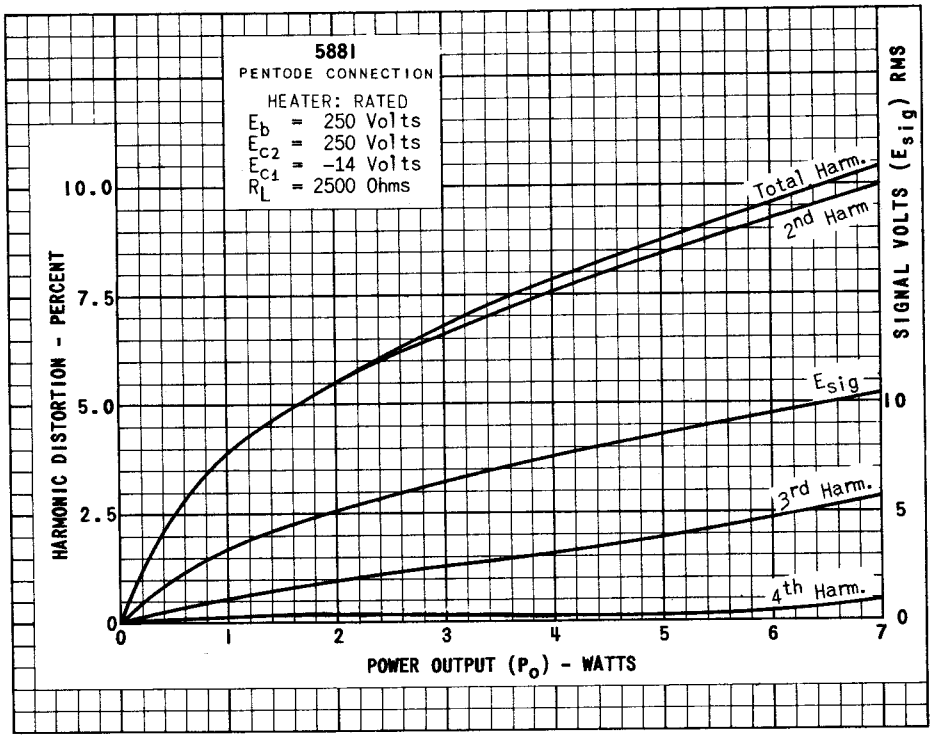
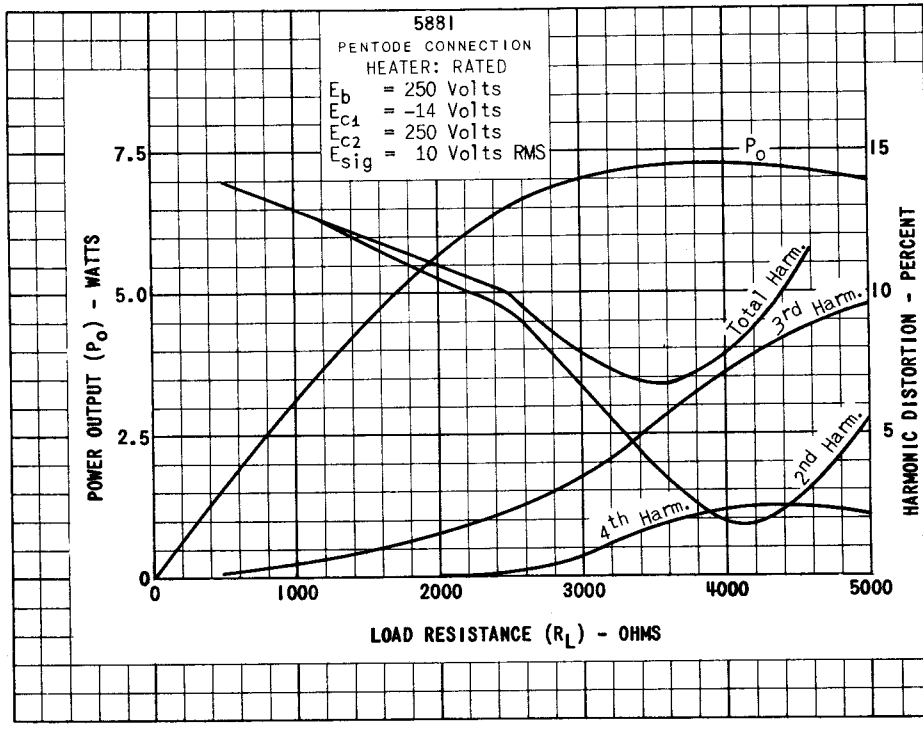

5881
PENTODE CONNECTION
HEATER: RATED
E_{c2} = 250 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
400
300
200
100
0
+15
+10
+5
E_{c1} = 0
-5
-10
-14
-15
-18
-20
-25
E_{c1} = 0
0
100
200
300
400
500
600
700
PLATE VOLTS


5881
PENTODE CONNECTION
HEATER: RATED
E_{c1} = 0 Volts
PLATE MILLIAMPERES
250
200
150
100
50
0
E_{c2} = 300
250
200
150
100
50
0
100
200
300
400
500
600
PLATE VOLTS





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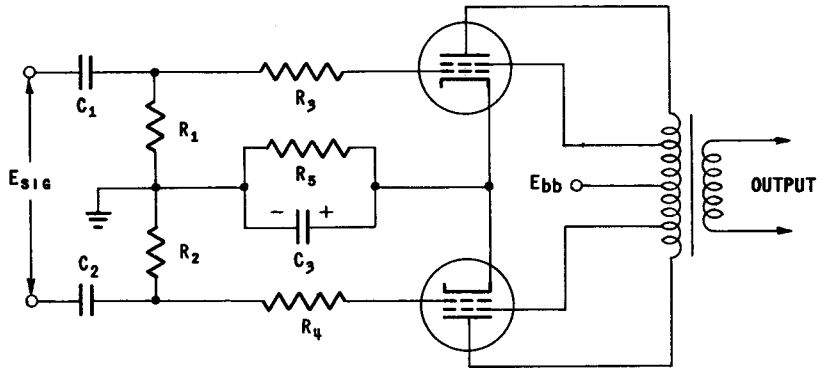
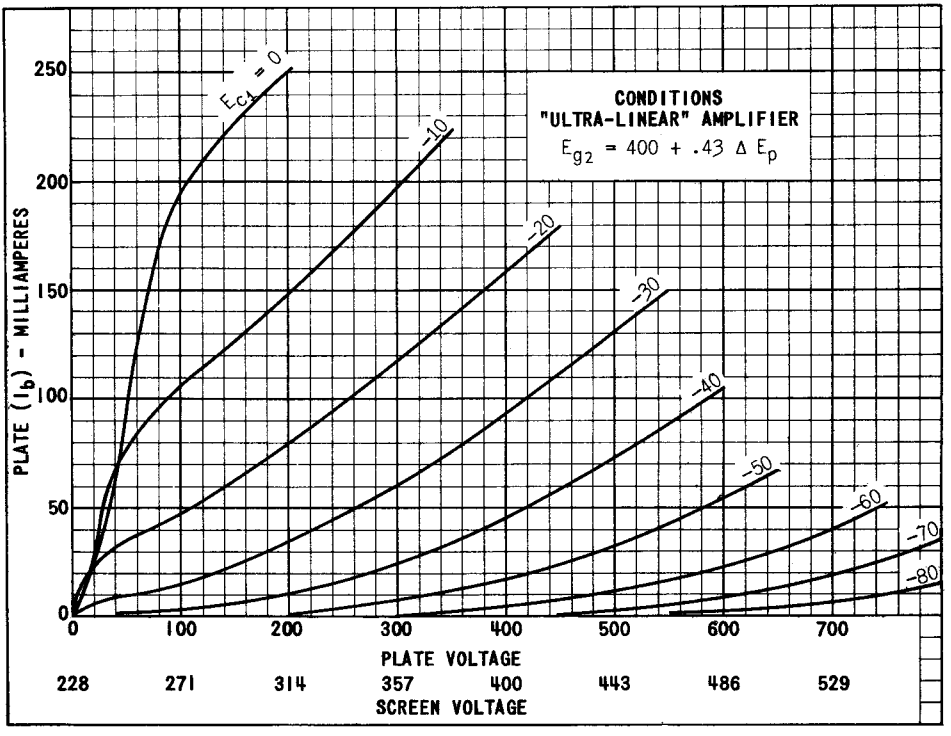
ULTRA-LINEAR OUTPUT STAGE



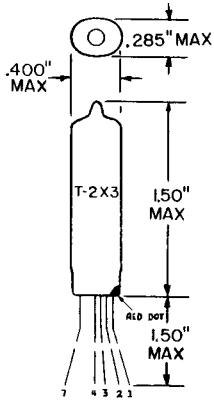
R_1, R_2 = 100 K. 1/2W	E_b = 450V.	DIST. = 2.5%
R_3, R_4 = 1 K. 1/2W	E_{SIG} = 80V. PEAK TO PEAK	P_o = 20W
R_5 = 400 OHMS 10W	C_1, C_2 = 0.2 μf 600V	R_l = 6K
	C_3 = 100 μf 50V	

IN THE ULTRA-LINEAR CIRCUIT THE SCREEN VOLTAGES ARE DERIVED FROM TAPS ON THE PLATE WINDINGS OF THE OUTPUT TRANSFORMER, THE TAPS ARE LOCATED SO AS TO APPLY 43% OF THE PLATE SIGNAL VOLTAGE TO THE SCREEN GRID.

THE PLATE FAMILY FOR THIS CONNECTION IS SHOWN BELOW. THESE CURVES WERE OBTAINED BY STATICALLY VARYING THE PLATE VOLTAGE IN INCREMENTS ABOUT THE QUIESCENT POINT (400 VOLTS PLATE AND SCREEN SUPPLY) AND SIMULTANEOUSLY CHANGING THE SCREEN VOLTAGE BY 43% OF THE INCREMENT. IN THE GRAPH BOTH PLATE AND SCREEN VOLTAGES HAVE BEEN PLOTTED ALONG THE ABSCISSA.



TUNG-SOL



GLASS BULB
DOT IS ADJACENT TO LEAD 1
OUTLINE DRAWING JEDEC 2-5
IN-LINE LEADS

ELECTROMETER PENTODE

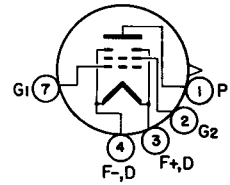
SUBMINIATURE TYPE

FOR

SINGLE STAGE AND MULTI-STAGE

CIRCUIT APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
LEADS 5 & 6 ARE OMITTED

LEADS 0.048" CENTER-TO-CENTER

THE 5886 IS A FILAMENTARY TYPE PENTODE IN THE 5 PIN SUBMINIATURE CONSTRUCTION. OPERATED AS A TRIODE, THE TUBE HAS AN UNUSUALLY HIGH RATIO OF TRANSCONDUCTANCE TO CONTROL GRID CURRENT FOR SINGLE STAGE CIRCUITS. AS A PENTODE, THE AMPLIFICATION FACTOR IS HIGH ENOUGH TO AFFORD CONSIDERABLE VOLTAGE GAIN IN THE ELECTROMETER STAGE OF A MULTI-STAGE CIRCUIT.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO ALL	2.2	pf
GRID 1 TO GRID 2 AND PLATE	2.0	pf

FILAMENT CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25	VOLTS	10	MA.
LIMITS OF APPLIED VOLTAGE			1.25±0.25	VOLTS

FOR USE WITH BATTERIES HAVING AN INITIAL VOLTAGE OF 1.55 VOLTS MAX.

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	22.5	VOLTS
GRID 2 VOLTAGE	22.5	VOLTS
TOTAL CATHODE CURRENT	300	μA

TYPICAL OPERATING CHARACTERISTICS

	TRIODE	PENTODE	
PLATE VOLTAGE	10.5	8.5	VOLTS
GRID 2 VOLTAGE	-----	4.5	VOLTS
GRID 1 VOLTAGE	-3	-2	VOLTS
PLATE CURRENT	200	6	μA
GRID 2 CURRENT	-----	3.6	μA
AMPLIFICATION FACTOR	1.8	-----	
TRANSCONDUCTANCE	175	14	μMHOS
PLATE RESISTANCE	-----	8	MΩ
MAX. GRID 1 CURRENT	2.5×10^{-13}	-----	AMP.
NOMINAL GRID 1 CURRENT		3×10^{-15}	AMP.

B GRID 2 CONNECTED TO PLATE

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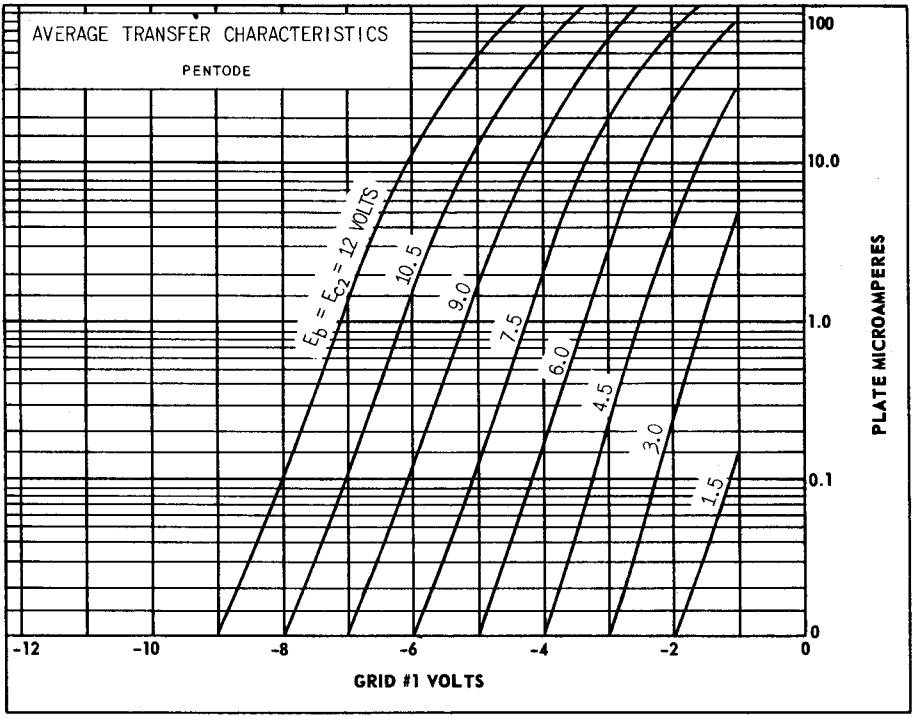
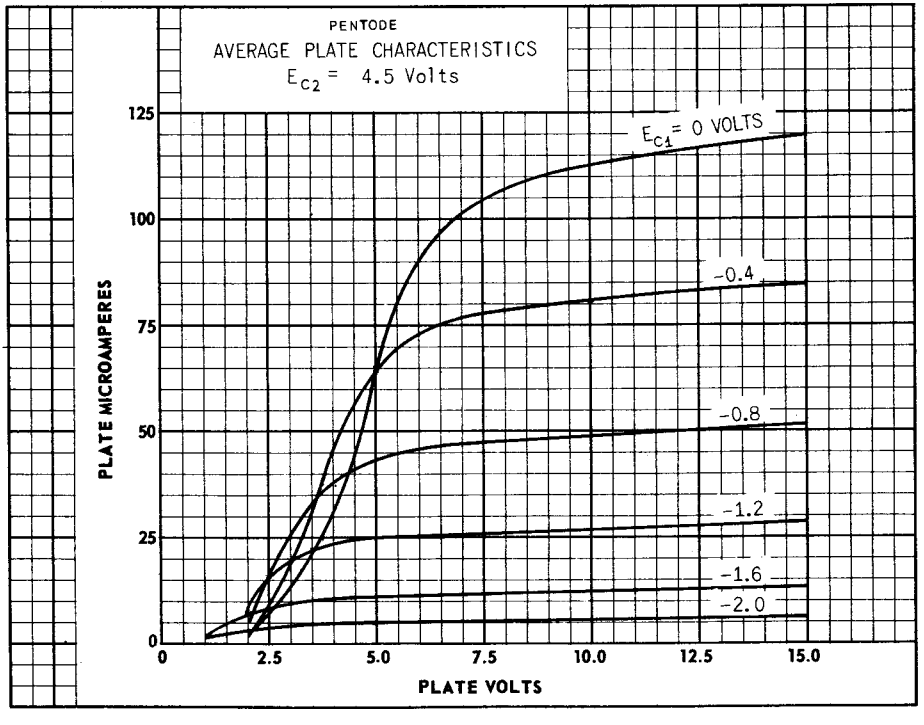
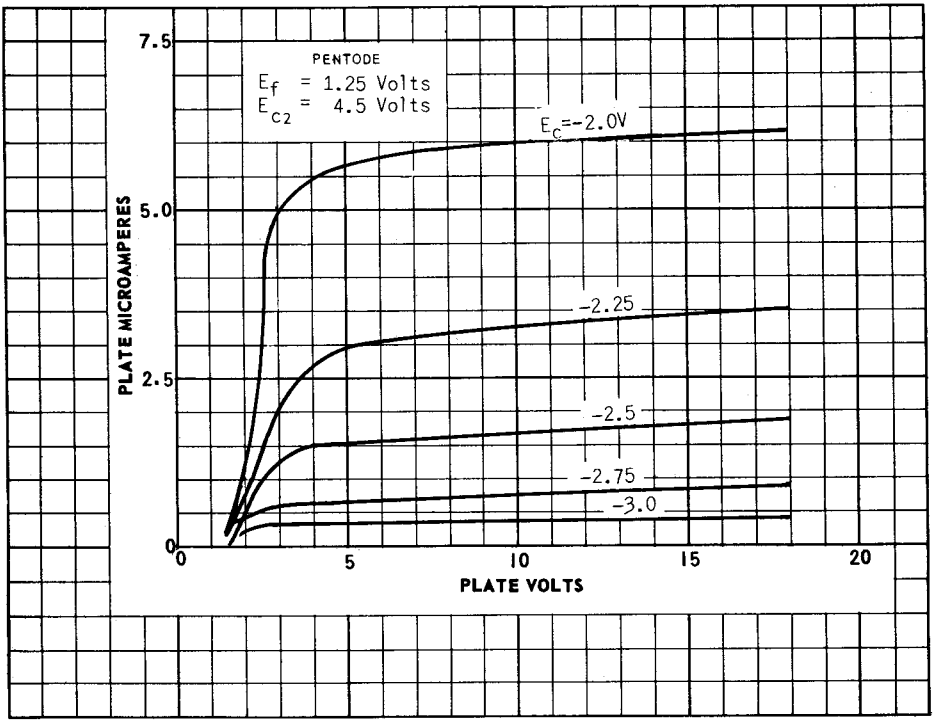
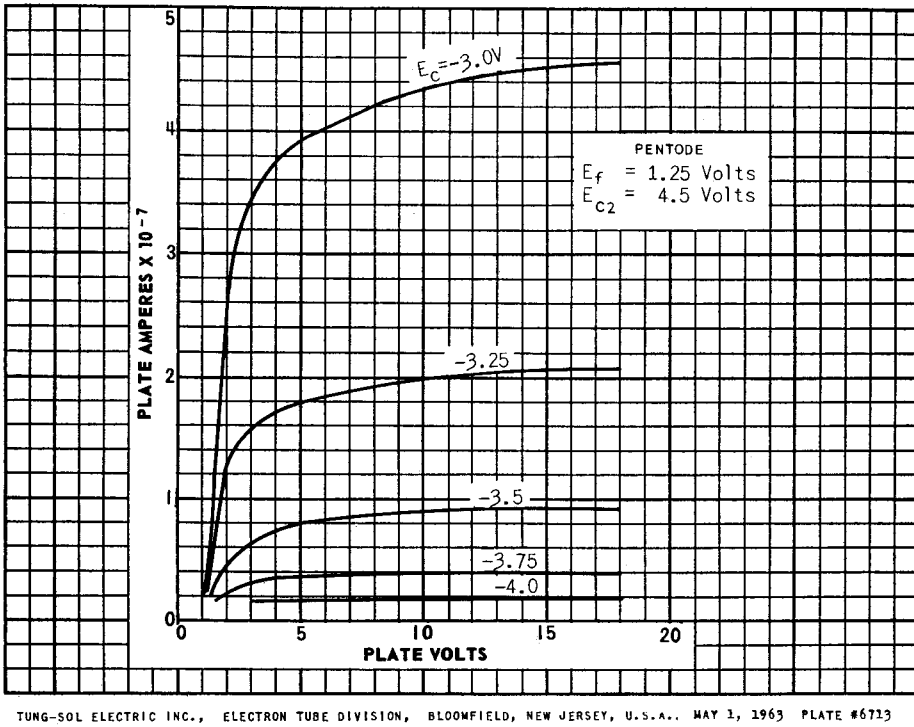

AVERAGE TRANSFER CHARACTERISTICS
PENTODE
$E_b = E_{c2}$ = 12 VOLTS
10.5
9.0
7.5
6.0
4.5
3.0
1.5
100
10.0
1.0
0.1
0
PLATE MICROAMPERES
-12
-10
-8
-6
-4
-2
0
GRID #1 VOLTS


PENTODE
AVERAGE PLATE CHARACTERISTICS
E_{c2} = 4.5 Volts
E_{c1} = 0 VOLTS
-0.4
-0.8
-1.2
-1.6
-2.0
125
100
75
50
25
0
PLATE MICROAMPERES
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE VOLTS





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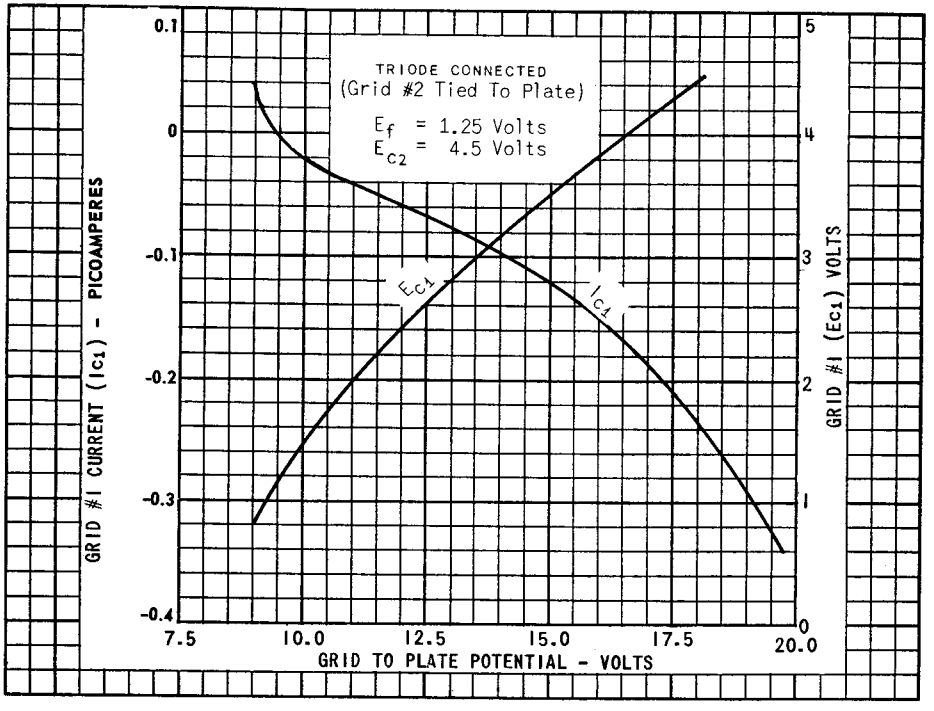
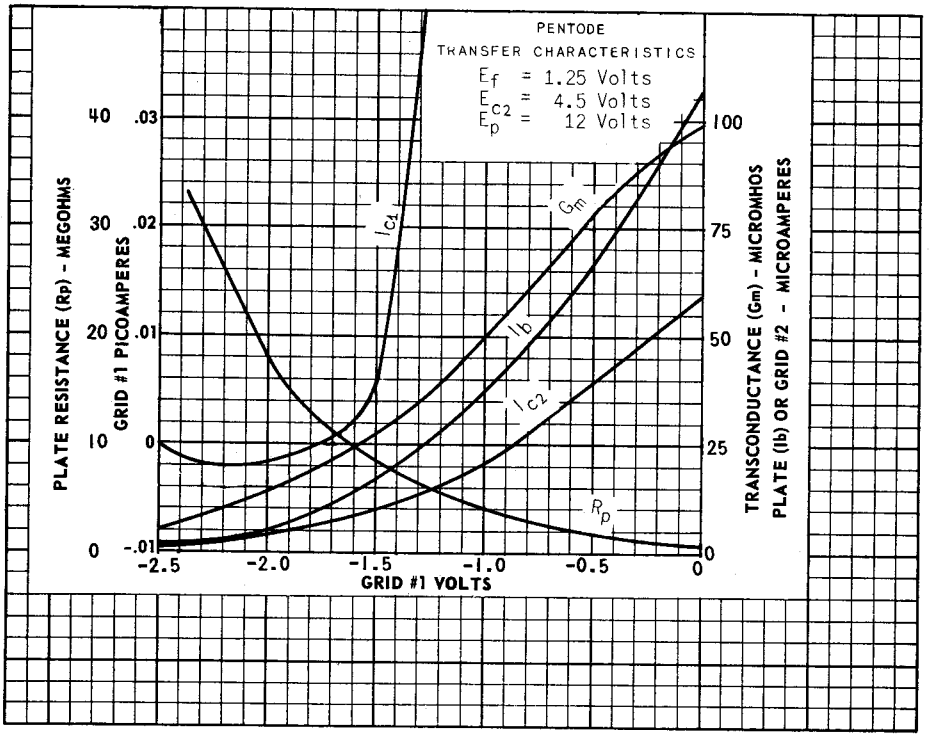
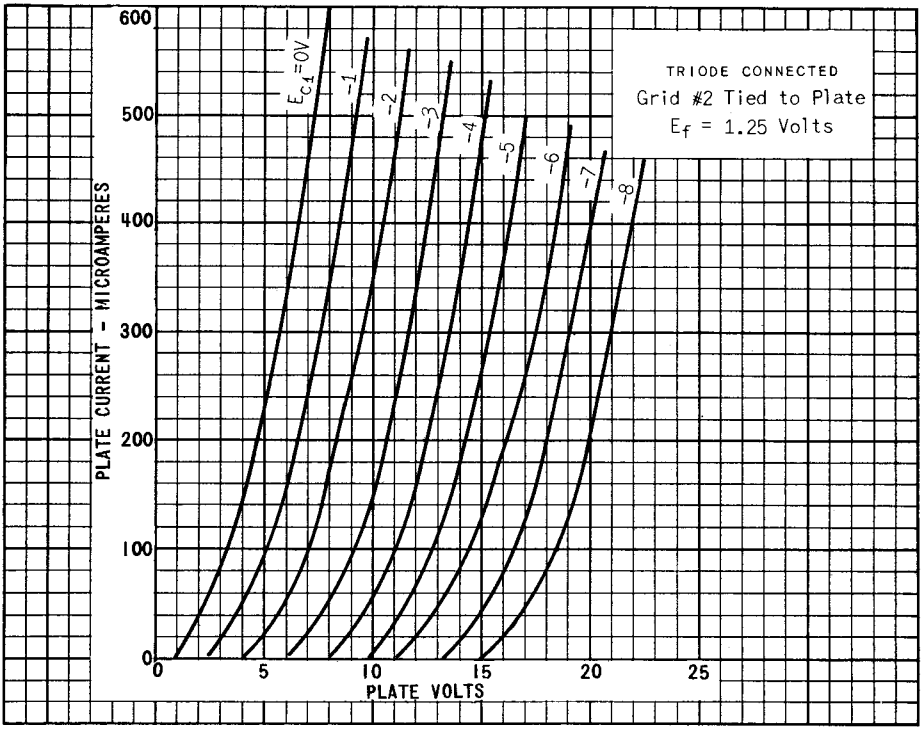
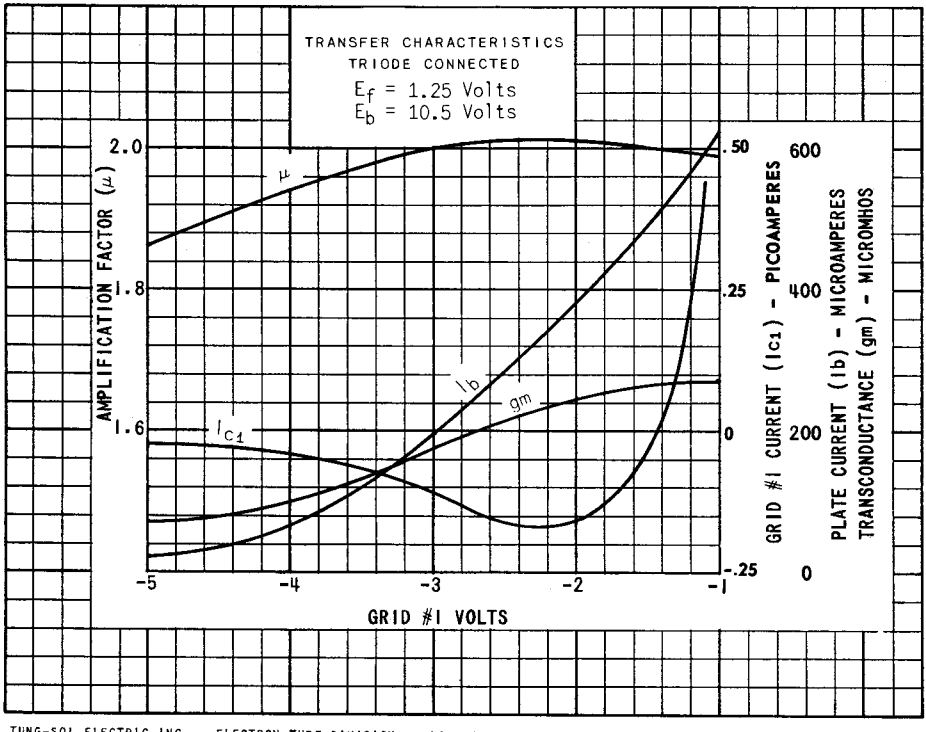

TRIODE CONNECTED
(Grid #2 Tied To Plate)
E_f = 1.25 Volts
E_{c2} = 4.5 Volts
E_{c1}
I_{c1}
GRID #1 CURRENT (I_{c1}) - PICOAMPERES
GRID #1 (E_{c1}) VOLTS
GRID TO PLATE POTENTIAL - VOLTS
0.1
0
-0.1
-0.2
-0.3
-0.4
5
4
3
2
1
0
7.5
10.0
12.5
15.0
17.5
20.0


PENTODE
TRANSFER CHARACTERISTICS
E_f = 1.25 Volts
E_{c2} = 4.5 Volts
E_p = 12 Volts
I_{c1}
G_m
I_b
I_{c2}
R_p
PLATE RESISTANCE (Rp) - MEGOHMS
GRID #1 PICOAMPERES
TRANSCONDUCTANCE (Gm) - MICROMHOS
PLATE (Ib) OR GRID #2 - MICROAMPERES
GRID #1 VOLTS
40
30
20
10
0
.03
.02
.01
0
-.01
100
75
50
25
0
-2.5
-2.0
-1.5
-1.0
-0.5
0





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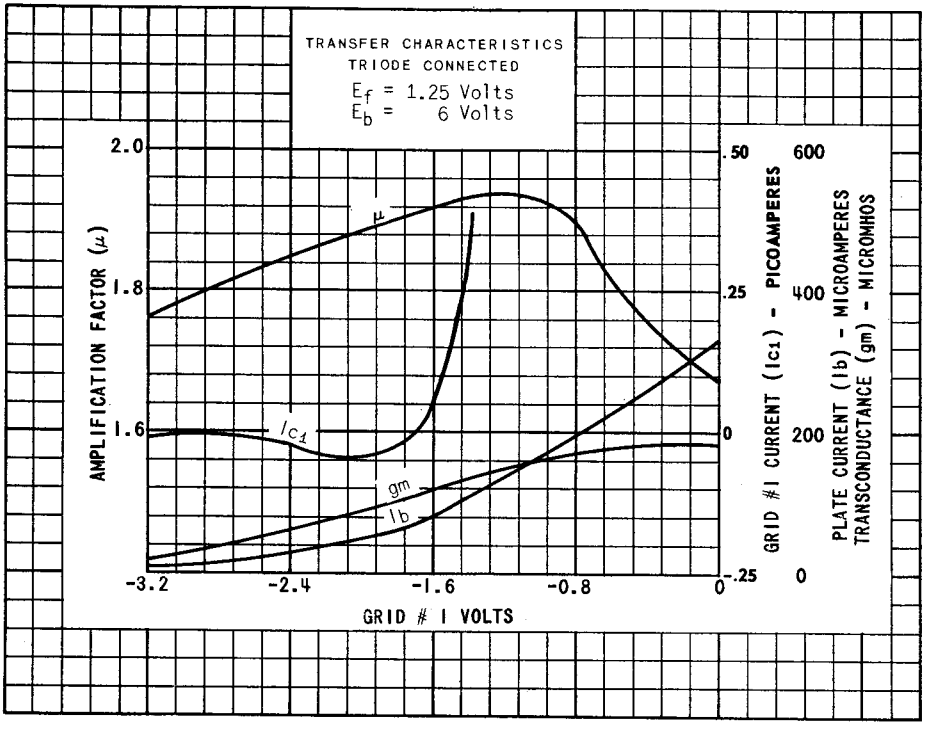
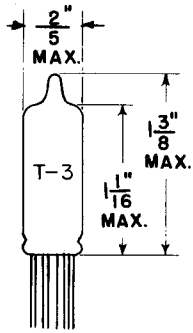

TRANSFER CHARACTERISTICS
TRIODE CONNECTED
E_f = 1.25 Volts
E_b = 6 Volts
AMPLIFICATION FACTOR (μ)
2.0
1.8
1.6
μ
I_{c_1}
gm
Ib
-3.2
-2.4
-1.6
-0.8
0
GRID # 1 VOLTS
.50
.25
0
-.25
GRID #1 CURRENT (I_{c_1}) - PICOAMPERES
600
400
200
0
PLATE CURRENT (Ib) - MICROAMPERES
TRANSCONDUCTANCE (gm) - MICROMHOS

TUNG-SOL

TWIN DIODE

SUBMINIATURE TYPE



GLASS BULB

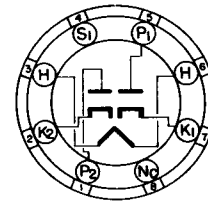
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
8 LEAD BASE
8DJ

THE 5896 IS A SUBMINIATURE TWIN DIODE IN WHICH SEPARATE CATHODES ARE PROVIDED FOR THE TWO SECTIONS. EACH DIODE CAN BE USED INDEPENDENTLY OF THE OTHER OR COMBINED IN PARALLEL OR FULL-WAVE ARRANGEMENTS. IT IS SUITED FOR A WIDE VARIETY OF APPLICATIONS INCLUDING SERVICE AS A DETECTOR, AN AUTOMATIC-GAIN-CONTROL RECTIFIER, OR A LOW-CURRENT POWER RECTIFIER. THE RESONANT FREQUENCY OF EACH UNIT IS GREATER THAN 900 MEGACYCLES.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
PLATE #1 TO CATHODE #1, HEATER AND INTERNAL SHIELD	3.0	2.4	μμf
PLATE #2 TO CATHODE #2, HEATER, AND INTERNAL SHIELD	3.0	2.4	μμf
CATHODE #1 TO PLATE #1, HEATER AND INTERNAL SHIELD	4.2	4.0	μμf
CATHODE #2 TO PLATE #2, HEATER AND INTERNAL SHIELD	4.2	4.0	μμf
PLATE #1 TO PLATE #2, MAXIMUM	0.026	0.15	μμf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO LEAD 3.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PEAK INVERSE PLATE VOLTAGE	460	VOLTS
MAXIMUM AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	165	VOLTS
MAXIMUM STEADY-STATE PEAK PLATE CURRENT PER PLATE	60	MA.
MAXIMUM TRANSIENT PEAK PLATE CURRENT PER PLATE, MAXIMUM DURATION 0.2 SECOND	350	MA.
MAXIMUM DC OUTPUT CURRENT PER PLATE	10	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	360	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	360	VOLTS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	250	C

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TUNG-SOL

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FULL-WAVE RECTIFIER WITH CAPACITOR-INPUT FILTER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.3	AMPS.
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	150	VOLTS
FILTER INPUT CAPACITOR	8	μFARADS
TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE PER PLATE	300	OHMS
LOAD RESISTANCE	11000	OHMS
DC OUTPUT CURRENT	18	MA.
TUBE VOLTAGE DROP		
Ib=18 MA. DC PER PLATE	4.5	VOLTS
RESONANT FREQUENCY (WITH SHORT AT TUBE BASE), MIN.	900	MEGACY.

CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT:				
Ef = 6.3 VOLTS	INITIAL	275	325	MA.
OPERATION CURRENT:				
(DC OUTPUT CURRENT FROM FW RECTIFIER) Ef = 6.3 VOLTS, Ebb PER PLATE = 165 VOLTS RMS, C_L = 8 μf., R_L = AND Rs PER PLATE ADJUSTED WITH A TUBE HAVING A 10-VOLT DROP AT 50 ma. PER PLATE FOR Io = 18 ma. AND PEAK ib = 50 ma APPROXIMATELY	INITIAL	16	---	MA.
	500 HR.[A]	14	---	MA.
EMISSION CURRENT, EACH SECTION Ef =6.3 VOLTS Eb =10 VOLTS	INITIAL	30	---	MA.
PLATE CURRENT, EACH SECTION: Ef = 6.3 VOLTS, Ebb = 0 VOLTS R_L = 40000 OHMS (INCLUDING METER RESISTANCE)	INITIAL	5	25	μAMPS.
PLATE CURRENT DIFFERENCE BETWEEN SECTIONS: DIFFERENCE BETWEEN PLATE CURRENTS FOR EACH SECTION AT Ef =6.3 VOLTS, Ebb= 0 VOLTS, R_L= 40000 OHMS (INCLUDING METER RESISTANCE)	INITIAL	---	5	μAMPS.
INTERELECTRODE CAPACITANCES:				
PLATE INPUT (P TO K,H, I.S.) EA. SECTION	INITIAL	2.5	3.5	μμf
CATHODE INPUT (K TO P,H,I.S.) EA. SECT.	INITIAL	3.5	4.9	μμf
PLATE TO PLATE (P TO P)	INITIAL	---	0.026	μμf
(MEASURED WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO LEAD 3.)				
HEATER-CATHODE LEAKAGE CURRENT, EA. SEC. Ef =6.3 VOLTS, Ehk= 360 VOLTS				
HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	40	μAMPS.
	500 HR.[A]	---	120	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	40	μAMPS.
	500 HR.[A]	---	120	μAMPS.

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TUNG-SOL

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CHARACTERISTICS LIMITS - cont'd.

		MIN	MAX	
INTERELECTRODE LEAKAGE RESISTANCE: Ef = 6.3 VOLTS, POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS. PLATE (EACH SECTION) TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS

A. CONDITIONS OF LIFE-TEST OPERATION AS A FULL-WAVE RECTIFIER ARE Ef = 6.3 VOLTS, Ebb PER PLATE = 165 VOLTS RMS, C_i = 8 μf, R_L AND Rs PER PLATE ADJUSTED WITH A TUBE HAVING A 10-VOLT DROP AT 50 MA PER PLATE FOR Io = 18 MA AND PEAK IB = 50 MA APPROXIMATELY, Ehk = Eo + 117 VOLTS RMS SO PHASED THAT THE 117 VOLTS AND Ef SUBTRACT, AND AMBIENT TEMPERATURE=175°C.

SPECIAL TESTS AND RATINGS

INOPERATIVES CONTROL: MINIMUM CONTINUOUS OPERATING TIME UNDER LIFE-TEST CONDITIONS OR EQUIVALENT FOR ALL TUBES PRIOR TO CHARACTERISTICS TESTING	46	HOURS
HEATER-CYCLING RATING: CYCLES OF INTERMITTENT OPERATION, MINIMUM Ef =7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF. Eb = 0 VOLTS. Ehk =140 VOLTS RMS.	2500	CYCLES
SHOCK RATING: IMPACT ACCELERATION IN ANY DIRECTION FORCES AS APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT	450	G
FATIGUE RATING: VIBRATIONAL ACCELERATION IN ANY DIRECTION VIBRATIONAL FORCES FOR A PERIOD OF AT LEAST 100 HOURS AT A FREQUENCY OF 60 CYCLES PER SECOND.	2.5	G
UNIFORM ACCELERATION RATING UNIFORM ACCELERATION IN ANY DIRECTION FORCES APPLIED GRADUALLY AS IN A CENTRIFUGE	1000	G

NOTE:
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO APPROPRIATE MIL-E-1 SPECIFICATION.

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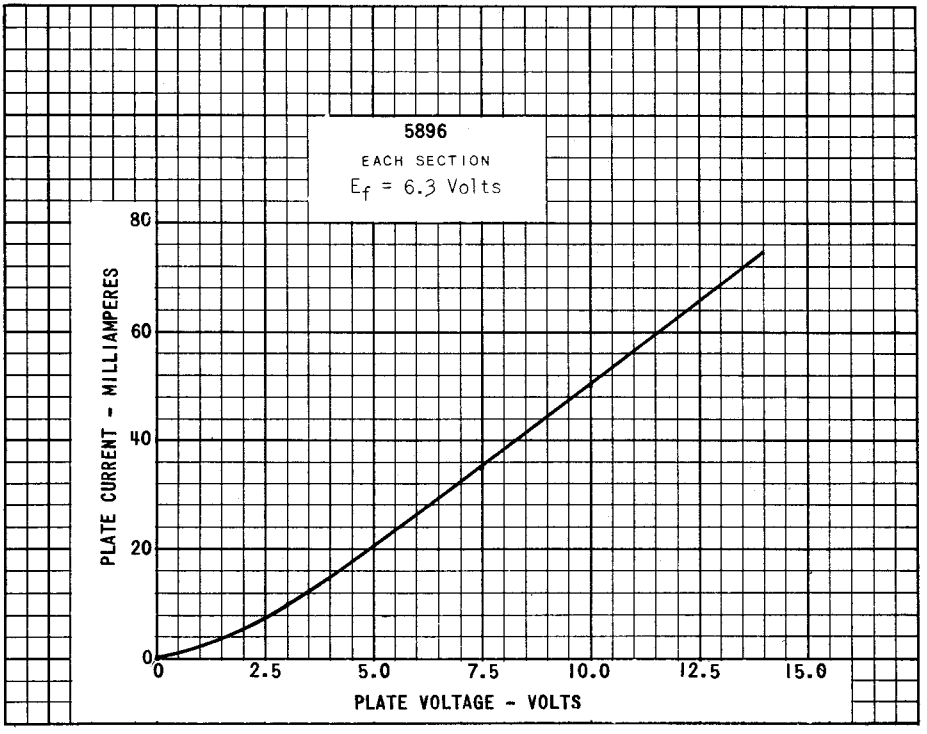
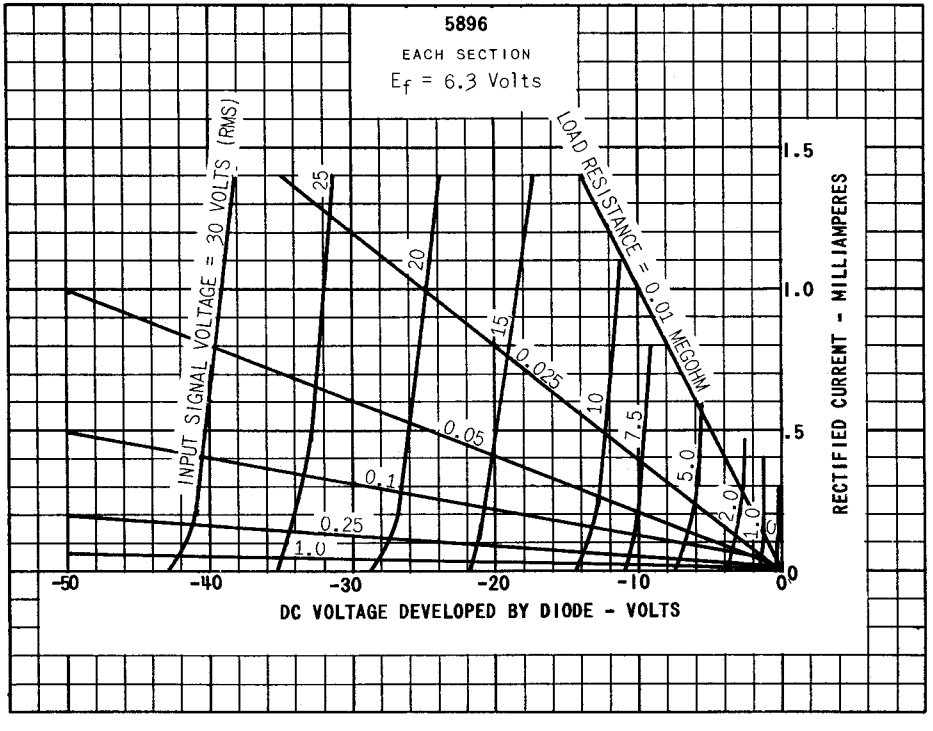
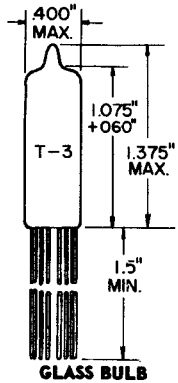

5896
EACH SECTION
E_f = 6.3 Volts
PLATE CURRENT - MILLIAMPERES
0
20
40
60
80
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE VOLTAGE - VOLTS


5896
EACH SECTION
E_f = 6.3 Volts
INPUT SIGNAL VOLTAGE = 30 VOLTS (RMS)
LOAD RESISTANCE = 0.01 MEGOHM
25
20
15
0.025
10
7.5
5.0
2.0
1.0
0.5
0.05
0.1
0.25
1.0
RECTIFIED CURRENT - MILLIAMPERES
1.5
1.0
.5
0
-50
-40
-30
-20
-10
0
DC VOLTAGE DEVELOPED BY DIODE - VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB
SUBMINIATURE BUTTON
CIRCULAR 8 LEAD BASE E8-10
OUTLINE DRAWING
JEDEC 3-1

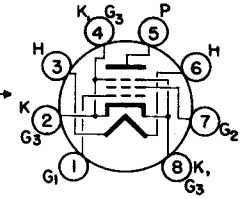
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8DL

THE 5899 IS A SUBMINIATURE, SEMI-REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A WIDE-BAND, HIGH FREQUENCY AMPLIFIER. ITS SEMI-REMOTE CHARACTERISTIC MAKES IT SUITABLE FOR USE IN CIRCUITS TO WHICH IT IS DESIGNED TO APPLY AUTOMATIC-GAIN-CONTROL.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE (MAX.)	0.015	0.03	μμf
INPUT	4.2	4.0	μμf
OUTPUT	3.4	1.9	μμf

[A] WITH EXTERNAL SHIELD #317.

RATINGS

ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM SCREEN VOLTAGE	155	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.75	WATTS
MAXIMUM SCREEN DISSIPATION	0.35	WATTS
MAXIMUM DC CATHODE CURRENT	16.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

→INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	100	VOLTS
SCREEN VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	120	OHMS
PLATE RESISTANCE (APPROX.)	0.26	MEGOHMS
TRANSCONDUCTANCE	4500	μMHOS
PLATE CURRENT	7.2	MA.
SCREEN CURRENT	2.0	MA.
GRID #1 VOLTAGE (APPROX.) Gm = 25 μMHOS	-14	VOLTS

CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT				
Ef = 6.3 VOLTS	INITIAL	140	160	MA.
	500-HR.	138	164	MA.
PLATE CURRENT:				
Ef =6.3 VOLTS, Eb =100 VOLTS Ec2 =100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	5.2	9.2	MA.
SCREEN CURRENT:				
Ef =6.3 VOLTS, Eb =100 VOLTS Ec2 =100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	1.0	3.0	MA.
TRANSCONDUCTANCE (1):				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2=100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	3800	5200	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE: DIFFERENCE BETWEEN TRANSCONDUCTANCE(1) AND TRANSCONDUCTANCE AT Ef =5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500-HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION: DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION: AVERAGE OF VALUES FOR "TRANSCONDUCTANCE CHANGE WITH OPERATION"	500-HR.	---	15	PERCENT
PLATE RESISTANCE:				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2 =100 VOLTS,				
Rk =120 OHMS (BY-PASSED)	INITIAL	0.175	---	MEGOHMS
TRANSCONDUCTANCE CUTOFF:				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2 =100 VOLTS,				
Ec1 =-14 VOLTS	INITIAL	1.0	75	μMHOS
INTERELECTRODE CAPACITANCES:				
GRID #1 TO PLATE (G1 TO P)	INITIAL	---	0.015	μμf
INPUT (G1 TO H, K, G2, G3)	INITIAL	3.8	4.8	μμf
OUTPUT (P TO H, K, G2, G3)	INITIAL	2.9	3.9	μμf

(MEASURED WITH EXTERNAL SHIELD OF 0.405 INCH DIAMETER CONNECTED TO CATHODE)

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TUNG-SOL

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CHARACTERISTICS LIMITS - cont'd.

NEGATIVE GRID #1 CURRENT: Ef =6.3 VOLTS, Eb =100 VOLTS Ec2 = 100 VOLTS, Rk =120 OHMS (BY-PASSED), Rg1 = 1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500-HR.	---	0.8	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT: Ef =6.3 VOLTS, Ehk=100 VOLTS HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 - HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE: Ef =6.3 VOLTS. POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS. GRID #1 TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEGOHMS
	500-HR.	50	---	MEGOHMS
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEGOHMS
	500-HR.	50	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS Ef =6.3 VOLTS, Ebb =100 VOLTS, Ec2 = 100 VOLTS, Rk =120 OHMS (BY-PASSED), R_L =10,000 OHMS, VIBRATIONAL ACCELERATION = 15 G AT 40 cps.	INITIAL	---	60	MV.
GRID #1 EMISSION CURRENT: Ef = 7.5 VOLTS, Eb =100 VOLTS, Ec2 = 100 VOLTS, Ecc1 =-14 VOLTS, Rg1 = 1.0 MEG.	INITIAL	---	0.5	μAMPS.

THE INDICATED 500 HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=100 VOLTS, Rk=120 OHMS, Rg1=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE=220 C MINIMUM.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST

STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST

STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST

STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec2=Ec1=0 VOLTS, AND Ehk=140 VOLTS RMS.

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TUNG-SOL

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SPECIAL TESTS AND RATINGS - cont'd.

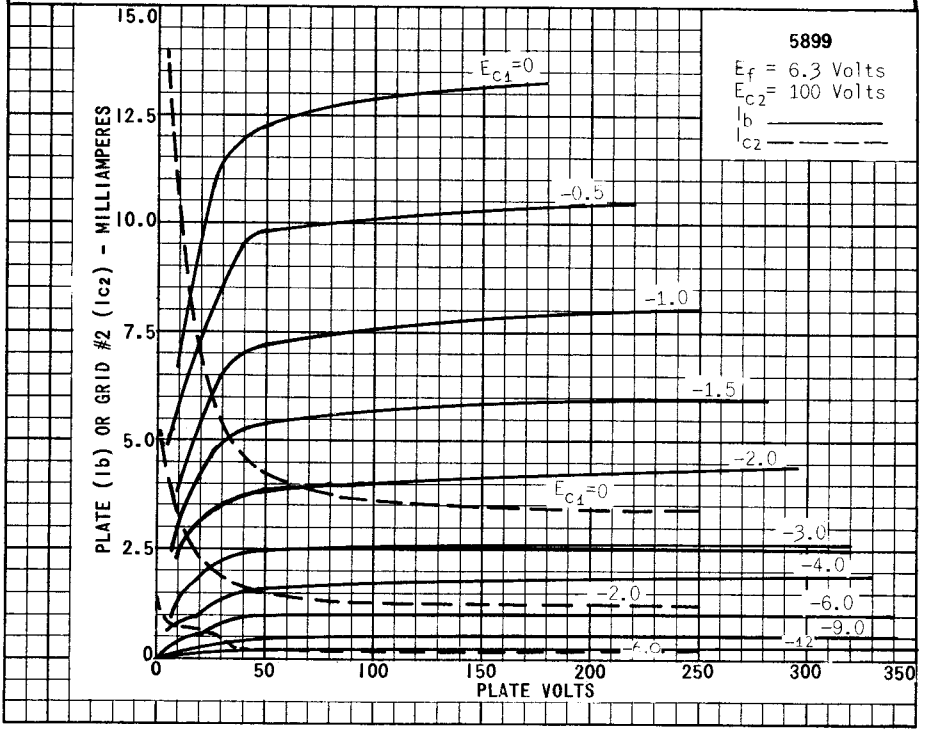
SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

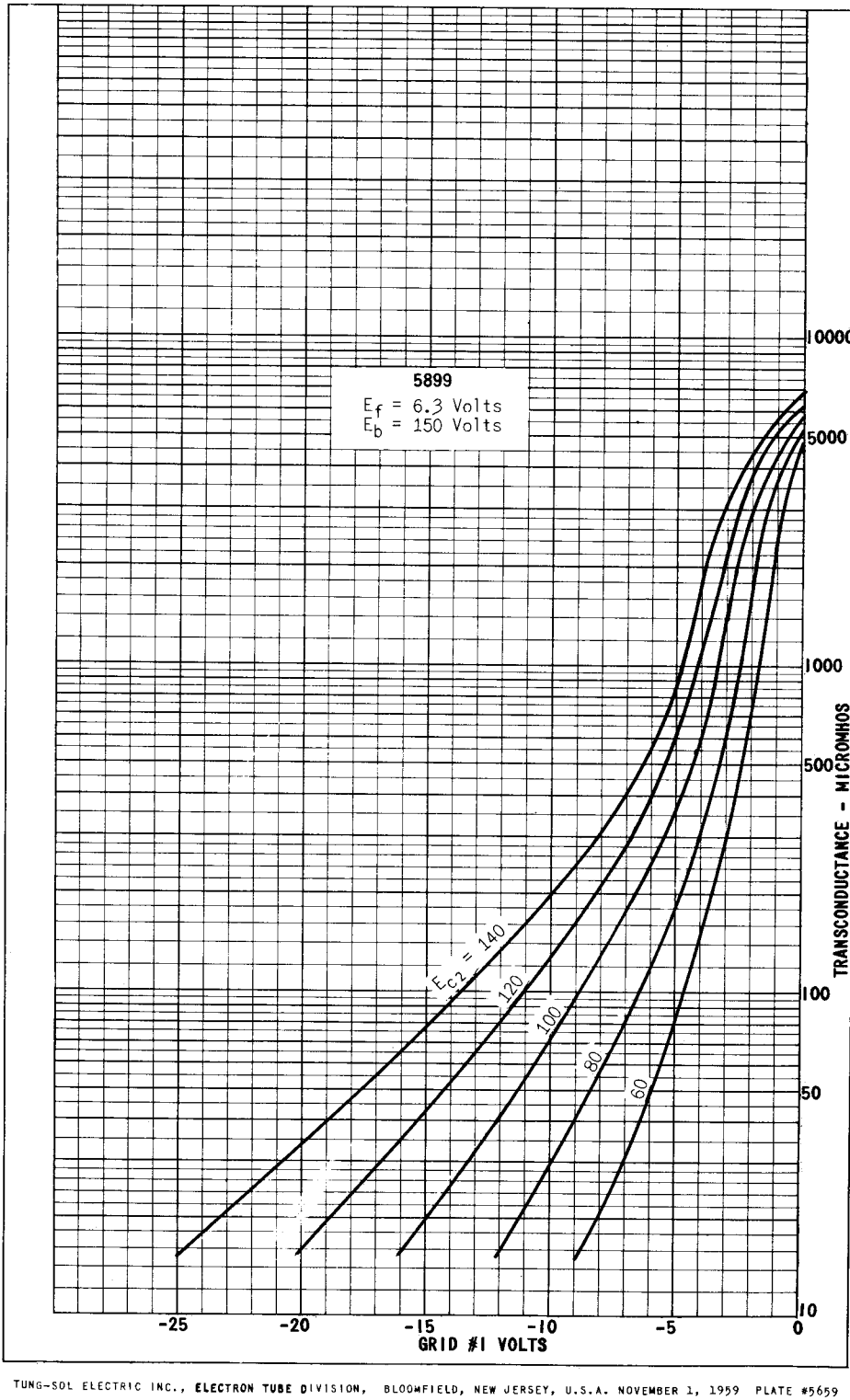
FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

NOTE:
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.





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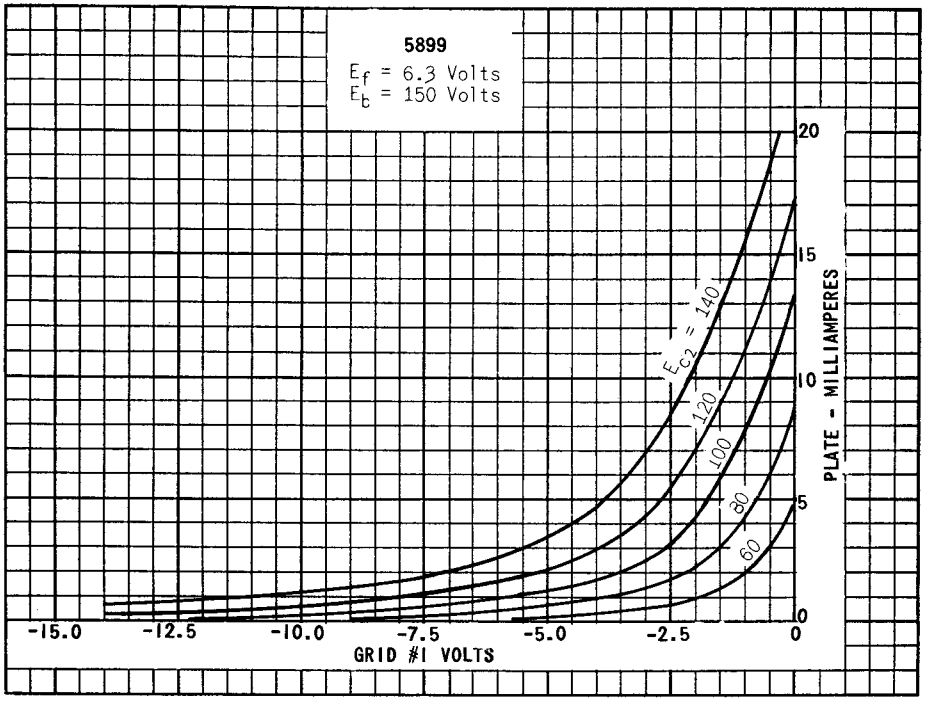
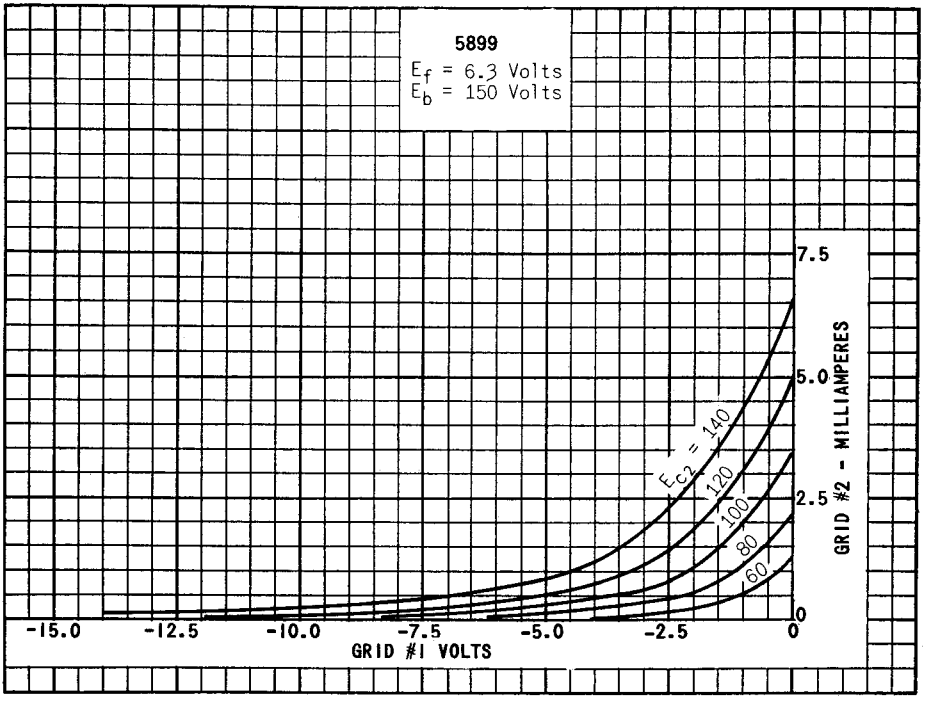
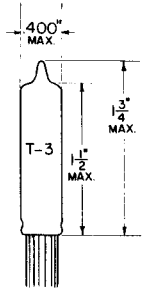

5899
E_f = 6.3 Volts
E_b = 150 Volts
E_{c2} = 140
120
100
80
60
20
15
10
5
0
PLATE - MILLIAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS


5899
E_f = 6.3 Volts
E_b = 150 Volts
E_{c2} = 140
120
100
80
60
7.5
5.0
2.5
0
GRID #2 - MILLIAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

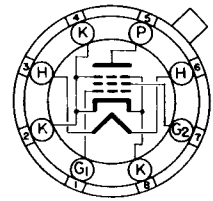


GLASS BULB

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
0.017" TINNED FLEXIBLE LEADS
8 PIN BASE

8DL

THE 5902 IS A HEATER-CATHODE TYPE BEAM PENTODE OF SUBMINIATURE CONSTRUCTION SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. IT IS DESIGNED FOR AUDIO POWER AMPLIFIER SERVICE IN EQUIPMENTS WITH LOW PLATE SUPPLY VOLTAGES, AND IS CAPABLE OF APPROXIMATELY ONE WATT OUTPUT IN THE AUDIO RANGE. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	ABS. MIN.	NORM. TEST CONDITIONS NOTE 7	NORMAL OPERATION NOTE 6	ABS. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	VOLTS
PLATE VOLTAGE	Eb:	---	110	110	165	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	0	Vdc
GRID #2 VOLTAGE	Ec2:	---	110	110	155	Vdc
PLATE DISSIPATION	Pp:	---	---	3.3	4.1	W
GRID #2 DISSIPATION	Pg2:	---	---	0.24	0.3	W
GRID #1 CIRCUIT RESISTANCE	Rg1:	---	---	---	0.55	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	---	+200	VOLTS
CATHODE CURRENT	Ik:	---	---	---	50	mAdc
CATHODE RESISTANCE	Rk:	---	270	270	---	OHMS
PLATE CURRENT (1):	Ib(1):	---	---	30	---	mAdc
GRID #2 CURRENT	Ic2:	---	---	2.2	---	mAdc
TRANSCONDUCTANCE (1)	Sm(1):	---	---	4200	---	μMHOS
PLATE RESISTANCE	rp:	---	---	0.015	---	MEG.

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
HEATER CURRENT:	0.65	If:	420	432	450	468	480	36	mA
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc									
Ehk=+100 Vdc	0.65	Ihk:	---	---	---	---	15	---	μAdc
GRID CURRENT:									
Rg1=1.0 MEG.	0.65	Ic(1):	---	---	---	---	-1.0	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	23.0	27.0	30.0	33.0	37.0	8.0	mAdc
PLATE CURRENT (2):									
Ec1=-40 Vdc	0.65	Ib(2):	---	---	---	---	100	---	μAdc
POWER OUTPUT (1):									
Esig=6.4 Vac;									
Rp=3000 OHMS	0.65	Po(1):	0.75	---	---	---	---	---	W
CONTINUITY AND SHORTS: (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL:									
ENVELOPE (8-4)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V									
Eg1-all=-100 Vdc	2.5	Rg1-all:	50	---	---	---	---	---	MEG.
Ep-all=-300 Vdc	2.5	Rp-all:	50	---	---	---	---	---	MEG.
SCREEN CURRENT:	2.5	Ic2:	0	---	2.2	---	4.0	---	mAdc
TRANSCONDUCTANCE (1):	2.5	Sm(1):	3500	3850	4200	4550	4900	950	μMHOS
GRID EMISSION:									
Rg=0.47meg; Rk=220 OHMS; Ef=7.5 V; PREHEAT 5 MINUTES AT Ec1=0; TEST AT Ec1=-40 Vdc	2.5	Ic(2):	---	---	---	---	-2.0	---	μAdc
POWER OUTPUT (2):									
Ef=5.7 V; Esig=6.4 Vac;									
Rp=3000 OHMS.(NOTE 9)	2.5	Δ_{Ef} Po (2):	---	---	---	---	15	---	PERCENT
AF NOISE:									
Esig=150 mVac; Ec2= 110 Vdc; Ec1=-8.7 Vdc; Rg1=0.5 meg.; Rg2= 0.01 meg.; Rp=2000 OHMS;									
Rk=0; Cg2 =4 μf	2.5	EB:	---	---	---	---	17	---	VU
PLATE RESISTANCE:	6.5	rp:	0.01	---	---	---	---	---	MEG.
CAPACITANCE:		Cgp:	---	---	---	---	0.20	---	μμf
CAPACITANCE: (NOTE 2)	6.5	Cin:	5.5	---	6.5	---	7.5	---	μμf
CAPACITANCE:		Cout:	6.5	---	7.5	---	8.5	---	μμf
LOW PRESSURE VOLTAGE BREAKDOWN:									
PRESSURE =55±5 mm Hg; VOLTAGE = 300 Vac	6.5	---	---	---	---	---	---	---	---

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 cont'd.									
COMBINED AQL =1.0% EXCLUDING MECH. AND INOPERATIVES									
VIBRATION (1) NO VOLTAGES: f VARIABLE FROM 10-50 cps; G max = 10; FIXED AMPLITUDE 0.040 INCH: POST SHOCK AND FATIGUE TEST END POINTS APPLY	---	---	---	---	---	---	---	---	---
VIBRATION (2): F =40cps; G=15; Rp= 2000 OHMS	2.5	Ep:	---	---	---	---	100	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAK FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK: Ehk=+100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE= 30° (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE: 96 HOURS; G= 2.5; FIXED FREQUENCY; F =25 min., 60 max. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS: VIBRATION (2): F = 40 cps; G =15; Rp= 2000 OHMS	---	Ep:	---	---	---	---	300	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc Ehk =± 100 Vdc	---	Ihk:	---	---	---	---	20	---	PERCENT
CHANGE IN POWER OUTPUT (1) OF INDIVIDUAL TUBES:	---	Δ_tPo(1):	---	---	---	---	40	---	μAdc
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	---	---	---	---	---
ACCEPTANCE LIFE TESTS									
HEATER CYCLING LIFE TEST: Ef =7.0 V; Eb=Ec1=Ec2= 0 V; 1 MIN ON, 4 MIN. OFF; Ehk = 140 Vac	2.5	---	2000	---	---	---	---	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS: HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc Ehk =±100 Vdc	---	Ihk:	---	---	---	---	40	---	μAdc

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEFECTS PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEFECTS PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS							
1 HOUR STABILITY LIFE TEST: TA = ROOM; Eb=Ec2= 100 Vdc; Ehk=+200 Vdc; 220 OHMS			---	---	---	---	---
1 HOUR STABILITY LIFE TEST END POINTS: CHANGE IN POWER OUTPUT (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLES SIZE = 50 TUBES)			1.0	Δ_t Po(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA= ROOM; Eb=Ec2= 100 Vdc;Ehk=+200 Vdc; Rg= 0.47 MEG. Rk =220 OHMS			---	---	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)			---	---	---	---	---
INOPERATIVES:			0.65	---	---	---	---
POWER OUTPUT (1):			1.0	Po(1):	0.65	---	W
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST: T BULB =220° C; Eb =Ec2 = 100 Vdc; Ehk =+200 Vdc; Rg =0.47 MEG.; Rk = 220 OHMS			---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)			---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
HEATER CURRENT:	2	5	---	If:	414	492	mA
HEATER-CATHODE LEAKAGE: Ehk=-100 Vdc; Ehk=±100 Vdc	2	5	---	Ihk:	---	60	μAdc
GRID CURRENT (1):	1	3	---	Ic(1)±	---	-2.0	μAdc
POWER OUTPUT (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	Δ_tPo(1):	---	20	PERCENT
POWER OUTPUT (1) AVERAGE CHANGE:	---	---	---	Ave.Δ_tPo(1):	---	15	PERCENT
INSULATION OF ELECTRODES:							
g-all	2	5	---	Rg1-all:	25	---	MEG.
p-all			---	Rp-all:	25	---	MEG.
POWER OUTPUT (2) (NOTE 9)	2	5	---	Δ_{Ef} Po(2):	---	15	PERCENT
TOTAL DEFECTIVES:	4	8	---	---	---	---	---

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

TEST	ALLOWABLE DEF. PER CHARACTERISTIC 1st SAMPLE	ALLOWABLE DEF. PER CHARACTERISTIC COMBINED SAMPLES	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS - cont'd.							
1000 HOUR HIGH TEMPERATURE INFORMATION LIFE TEST: T BULB=220°C; Eb= Ec2=100 Vdc; Ehk=+ 200 Vdc; Rg=0.47 MEG ; Rk =220 OHMS	---	---	---	---	---	---	---
1000 HOUR HIGH TEMPERATURE INFORMATION LIFE TEST END POINTS: READ FOR SAME CHARACTERISTICS AS FOR 500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST. LIMITS NOT ESTABLISHED.	---	---	---	---	---	---	---

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1 "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES," AND MIL-STD-105A.

NOTE 2: WITH A CYLINDRICAL SHIELD (0.405"I.D.-1 7/8" LONG) CONNECTED TO CATHODE LEADS.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

NOTE 7: THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8 FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

NOTE 9: CHANGE OF POWER OUTPUT FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef= 6.3 V TO THAT VALUE MEASURED AT Ef=5.7V.

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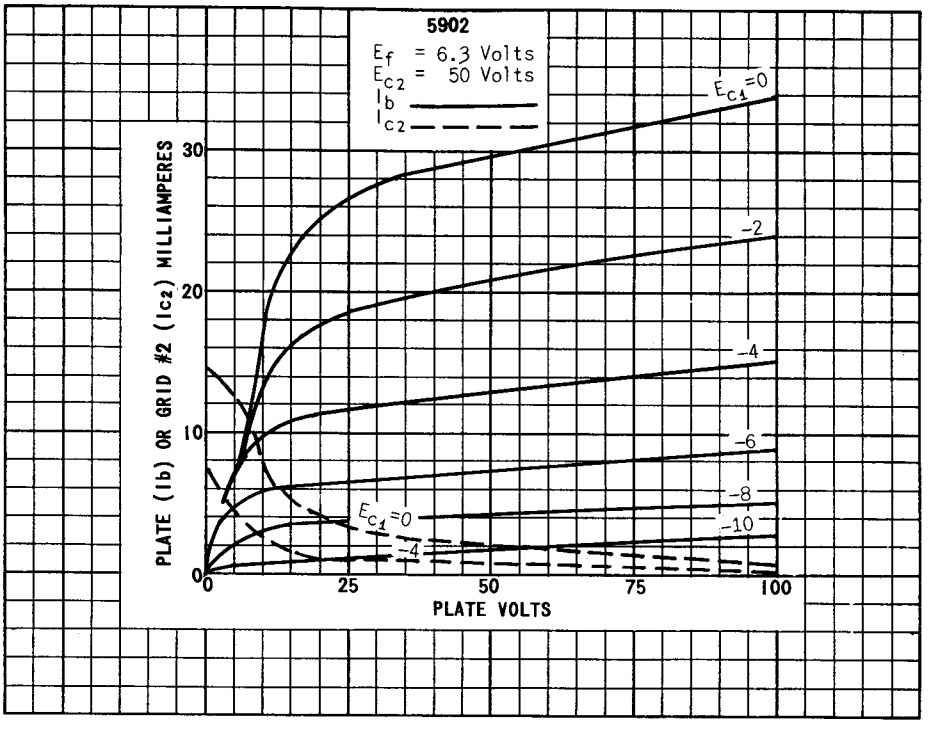
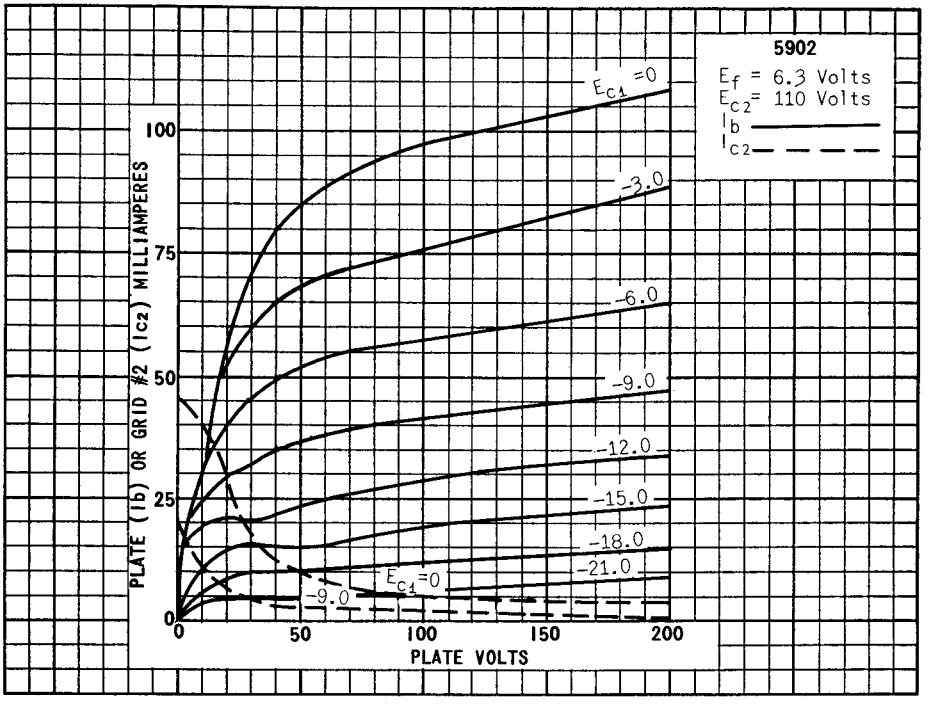
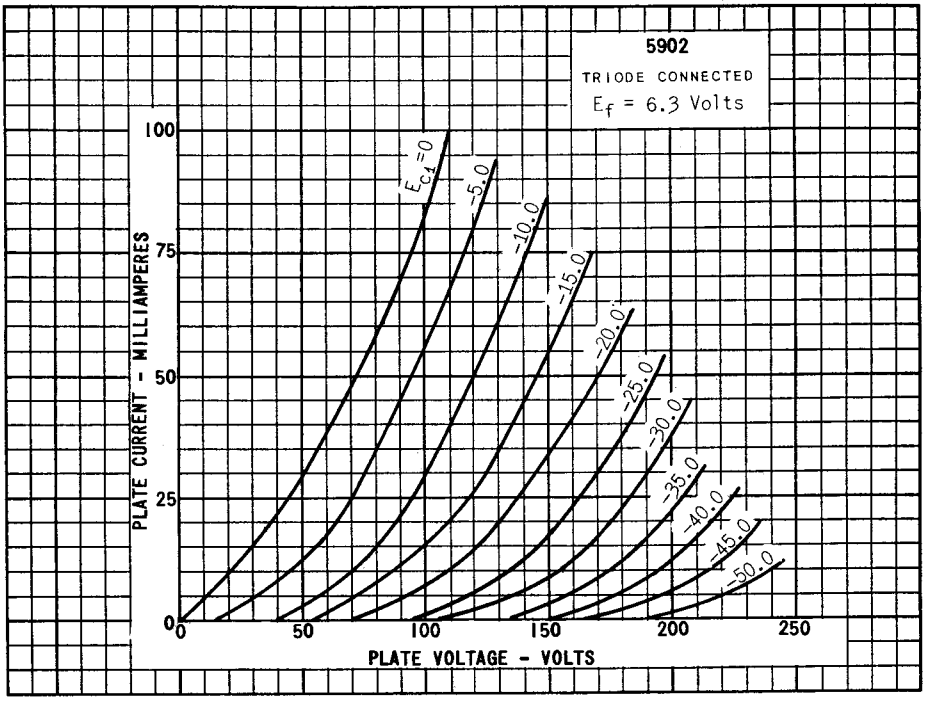
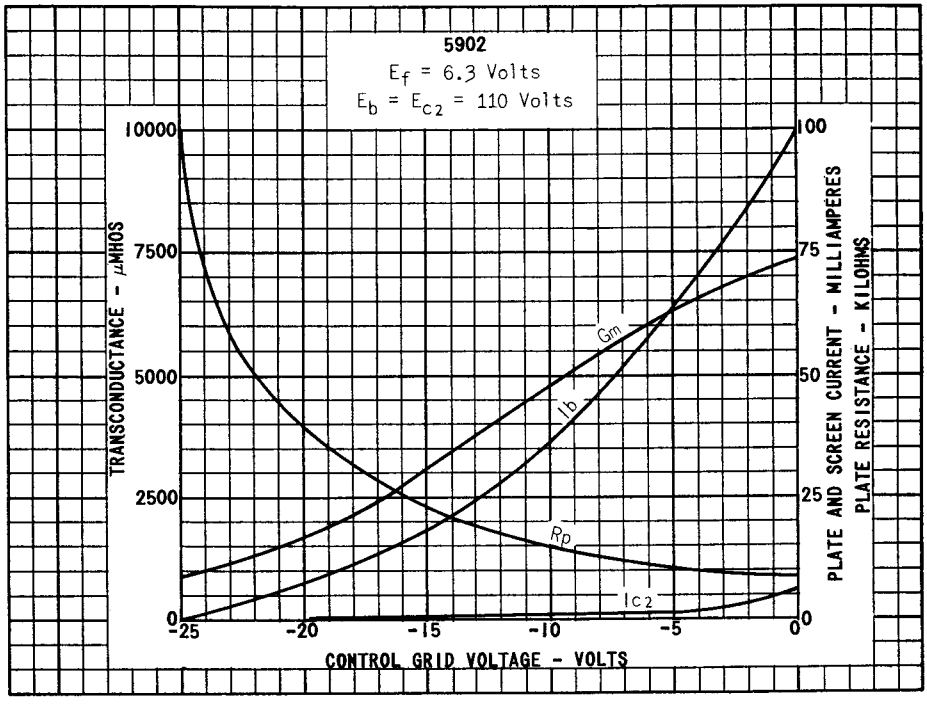

5902
E_f = 6.3 Volts
E_{c2} = 50 Volts
I_b
I_{c2}
E_{c1}=0
-2
-4
-6
-8
-10
E_{c1}=0
-4
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
10
20
30
0
25
50
75
100
PLATE VOLTS


5902
E_f = 6.3 Volts
E_{c2} = 110 Volts
I_b
I_{c2}
E_{c1}=0
-3.0
-6.0
-9.0
-12.0
-15.0
-18.0
-21.0
E_{c1}=0
-9.0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
0
25
50
75
100
0
50
100
150
200
PLATE VOLTS





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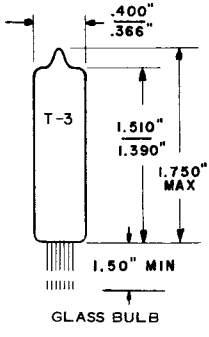
PENTODE

SUBMINIATURE TYPE



SUBMINIATURE
8 PIN BASE E8-10
OUTLINE DRAWING
JEDEC 3-3

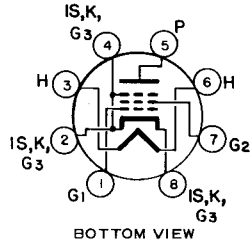
BEAM PENTODE

FOR

AUDIO POWER AMPLIFIER SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

8 FLEXIBLE LEADS
0.017" DIAMETER
BASING DIAGRAM
JEDEC 9DE

THE 5902WA IS A HEATER-CATHODE TYPE BEAM PENTODE OF SUBMINIATURE CONSTRUCTION SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. IT IS DESIGNED FOR AUDIO POWER AMPLIFIER SERVICE IN EQUIPMENTS WITH LOW PLATE SUPPLY VOLTAGES, AND IS CAPABLE OF APPROXIMATELY ONE WATT OUTPUT IN THE AUDIO RANGE.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
LIMITS OF APPLIED VOLTAGE			6.0 TO 6.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			±200	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

DC PLATE VOLTAGE	250	VOLTS
PEAK PLATE VOLTAGE	360	VOLTS
NEGATIVE GRID 1 VOLTAGE	55	VOLTS
GRID 2 VOLTAGE	155	VOLTS
PLATE DISSIPATION	3.7	WATTS
GRID 2 DISSIPATION	0.4	WATTS
DC CATHODE CURRENT	50	MA
GRID 1 CIRCUIT RESISTANCE	155	MEGOHMS
ENVELOPE TEMPERATURE AT HOTTEST POINT	220°	C

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SPECIAL TESTS AND RATINGS

INTERELECTRODE INSULATION		
VIBRATION		
SHOCK		
FATIGUE		
ALTITUDE RATING	80,000	FEET

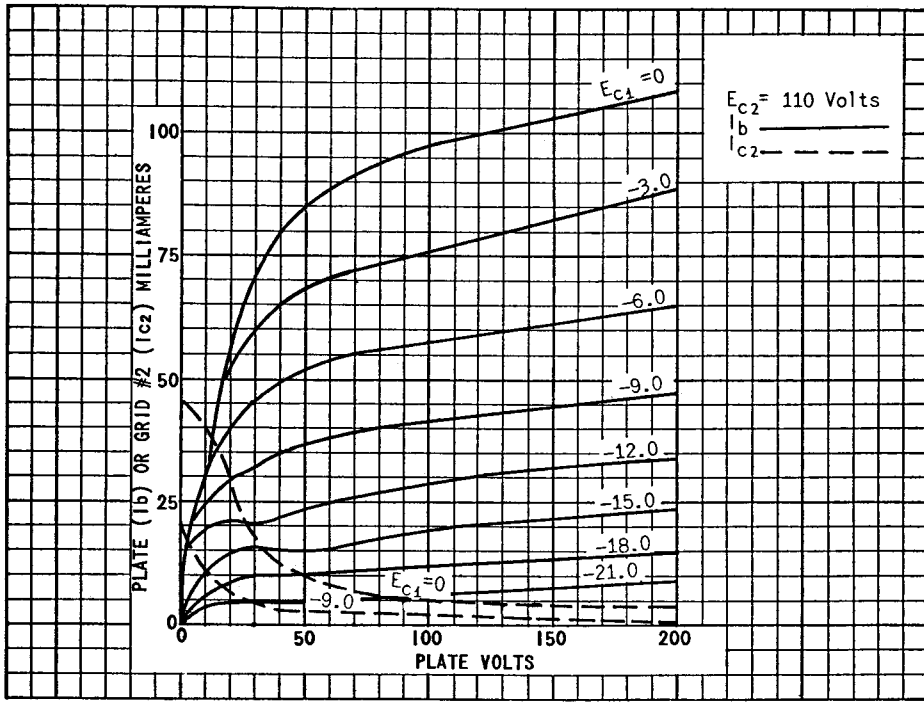
CHARACTERISTICS

PLATE VOLTAGE	110	VOLTS
GRID 2 VOLTAGE	110	VOLTS
CATHODE BIAS RESISTOR	270	OHMS
PLATE CURRENT	30	MA.
GRID 2 CURRENT	2.2	MA
TRANSCONDUCTANCE	4,200	μMHOS
PLATE RESISTANCE	15	K OHMS
GRID 1 VOLTAGE FOR Ib = 10 μA	-40	VOLTS

TYPICAL OPERATING CONDITIONS

CLASS A1 POWER AMPLIFIER

PLATE SUPPLY VOLTAGE		110	VOLTS
GRID 2 VOLTAGE		110	VOLTS
CATHODE BIAS RESISTOR - BYPASSED		270	OHMS
GRID 1 SIGNAL VOLTAGE		6.4	VOLTS RMS
LOAD RESISTANCE		3,000	OHMS
PLATE CURRENT	APPROX.	29	MA.
GRID 2 CURRENT	APPROX.	5.5	MA.
TOTAL HARMONIC DISTORTION		10	PERCENT
SIGNAL POWER OUTPUT		1.0	WATT



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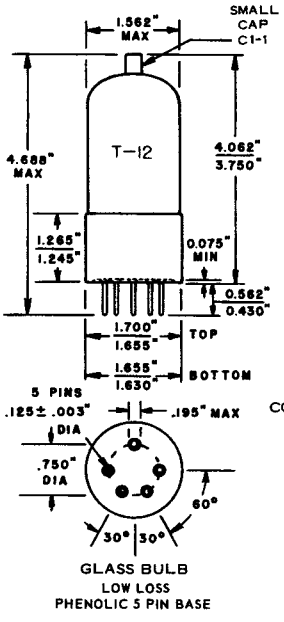


GLASS BULB
LOW LOSS
PHENOLIC 5 PIN BASE

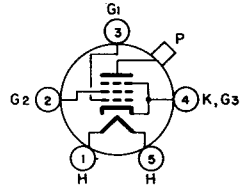
PENTODE

BEAM POWER

BEAM POWER PENTODE
FOR
AUDIO AND RF
AMPLIFIER APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5AW

THE 5933 IS A BEAM POWER PENTODE FOR AUDIO AND RF AMPLIFIER APPLICATIONS CONTAINED IN A T-12 ENVELOPE. IT IS INTENDED FOR APPLICATIONS WHERE CONDITIONS OF SEVERE SHOCK, VIBRATION, HIGH TEMPERATURE AND HIGH ALTITUDE PREVAIL.

DIRECT INTERELECTRODE CAPACITANCES

GRID 1 TO PLATE-SHIELD	MAX.	0.2	pf
INPUT-UNSHIELDED		11	pf
OUTPUT-UNSHIELDED		7	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	900	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
HEATER CATHODE VOLTAGE		135	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES-SEE STANDARD RS-239

DC PLATE VOLTAGE (CLASS B, RF OR AF)	600	VOLTS
DC PLATE VOLTAGE (CLASS C, CONTINUOUS SERVICE)	600	VOLTS
DC PLATE VOLTAGE (CLASS C, AM TELEPHONY)	475	VOLTS
DC PLATE CURRENT (CLASS B, AF)	120	MA.
DC PLATE CURRENT (CLASS B, RF)	80	MA.
DC PLATE CURRENT (CLASS C, CONTINUOUS SERVICE)	100	MA.
DC PLATE CURRENT (CLASS C, AM TELEPHONY)	83	MA.
DC GRID 2 VOLTAGE	300	VOLTS
DC GRID 1 VOLTAGE (CLASS C)	−200	VOLTS
DC GRID 1 CURRENT (CLASS C CONTINUOUS SERVICE)	5	MA.
DC GRID 1 CURRENT (CLASS C, AM TELEPHONY)	5	MA.
PLATE DISSIPATION (CLASS B, RF OR AF)	25	WATTS
PLATE DISSIPATION (CLASS C, CONTINUOUS SERVICE)	25	WATTS
PLATE DISSIPATION (CLASS C, AM TELEPHONY)	16.5	WATTS
GRID 2 DISSIPATION (CLASS B, AF)	3.5	WATTS
GRID 2 DISSIPATION (CLASS B, RF)	2.5	WATTS
GRID 2 DISSIPATION (CLASS C, CONTINUOUS SERVICE)	3.5	WATTS
GRID 2 DISSIPATION (CLASS C, AM TELEPHONY)	2.5	WATTS
PLATE INPUT (CLASS B, AF)	60	WATTS
PLATE INPUT (CLASS B, RF)	37.5	WATTS
PLATE INPUT (CLASS C, CONTINUOUS SERVICE)	60	WATTS
PLATE INPUT (CLASS C, AM TELEPHONY)	40	WATTS
FREQUENCY FOR 100 % RATING	60	MC
FREQUENCY FOR 75% RATING (CLASS B, CLASS C GRID OR SUPPRESSOR MODULATED)	125	MC
FREQUENCY FOR 55% RATING (CLASS C, OR PLATE MODULATED)	125	MC
BULB TEMPERATURE	160	°C
ALTITUDE	80,000	FEET

IF ALTITUDE RATING IS EXCEEDED REDUCTION OF INSTANTANEOUS VOLTAGES (EF EXCLUDED) MAY BE REQUIRED.

CHARACTERISTICS AND LIMITS

PLATE VOLTAGE	600	VOLTS
GRID 2 VOLTAGE	300	VOLTS
GRID 1 VOLTAGE	−29	VOLTS
PLATE CURRENT	36	MA.
GRID 2 CURRENT (MAX.)	4	MA.
GRID VOLTAGE FOR I_b = 0.5 MA. MAX.	−100	VOLTS
MINIMUM POWER OUTPUT AT 15 MC		
E_{cc} = 200 VOLTS DC; I_b = 100 MA.		
I_c = 5-7 MA.; RL = .01 MEG	33	WATTS

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TYPICAL OPERATION

AUDIO AMPLIFIER OR MODULATOR (CLASS AB_2) – TWO TUBES

	CCS			ICAS	
PLATE VOLTAGE	400	500	600	750	VOLTS
GRID 2 VOLTAGE	300	300	300	300	VOLTS
GRID 1 VOLTAGE	–25	–29	–30	–32	VOLTS
PEAK GRID TO GRID SIGNAL VOLTAGE	78	86	78	92	VOLTS
PLATE CURRENT (ZERO SIGNAL)	90	72	60	52	MA.
PLATE CURRENT (MAXIMUM SIGNAL)	240	240	200	240	MA.
GRID 2 CURRENT (ZERO SIGNAL)	5	5	5	5	MA.
GRID 2 CURRENT (MAXIMUM SIGNAL)	10	10	10	10	MA.
LOAD RESISTANCE (PLATE TO PLATE)	3200	4240	6400	6950	OHMS
DRIVING POWER (MAXIMUM SIGNAL) APPROX.	0.2	0.2	0.1	0.2	WATT
POWER OUTPUT APPROX.	55	75	80	120	WATTS

RF POWER AMPLIFIER (CLASS B TELEPHONY)

SINGLE TUBE – 100% MODULATION OF DRIVER STAGE

PLATE VOLTAGE	400	500	600	750	VOLTS
GRID 2 VOLTAGE	250	250	250	300	VOLTS
GRID 1 VOLTAGE	–25	–25	–25	–35	VOLTS
PEAK SIGNAL VOLTAGE	30	30	20	27	VOLTS
PLATE CURRENT	75	75	62.5	60	MA.
GRID 2 CURRENT	4	4	3	3	MA.
GRID 1 CURRENT APPROX.	0	0	0	0	MA.
DRIVING POWER APPROX.	0.25	0.25	0.2	0.12	WATT
POWER OUTPUT APPROX.	9	12.5	12.5	15	WATTS

RF POWER AMPLIFIER (CLASS C TELEPHONY)

SINGLE TUBE – 100% PLATE MODULATION

PLATE VOLTAGE	325	400	475	600	VOLTS
GRID 2 VOLTAGE	225	225	225	275	VOLTS
GRID 2 DROPPING RESISTOR	20000	30000	50000	50000	OHMS
GRID 1 VOLTAGE	–75	–80	–85	–90	VOLTS
GRID LEAK RESISTOR	25000	22800	21300	22500	OHMS
PEAK SIGNAL VOLTAGE	90	95	110	115	VOLTS
PLATE CURRENT	80	80	83	100	MA.
GRID 2 CURRENT	5	5.75	5	6.5	MA.
GRID CURRENT APPROX.	3	3.5	4	4	MA.
DRIVING POWER APPROX.	0.25	0.3	0.4	0.4	WATT
POWER OUTPUT APPROX.	17.5	22.5	27.5	42.5	WATTS

RF POWER AMPLIFIER OR OSCILLATOR (CLASS C TELEGRAPHY)

SINGLE TUBE KEY DOWN UNMODULATED CONDITION

PLATE VOLTAGE	400	500	600	750	VOLTS
GRID 2 VOLTAGE	250	250	250	250	VOLTS
GRID 2 DROPPING RESISTOR	20000	42000	50000	85000	OHMS
GRID 1 VOLTAGE	–45	–45	–45	–45	VOLTS
PEAK SIGNAL VOLTAGE	65	65	65	65	VOLTS
PLATE CURRENT	100	100	100	100	MA.
GRID 2 CURRENT	7.5	6.0	7.0	6.0	MA.
GRID CURRENT APPROX.	3.5	3.5	3.5	3.5	MA.
DRIVING POWER APPROX.	0.2	0.2	0.2	0.2	WATT
POWER OUTPUT APPROX.	25	30	40	50	WATTS

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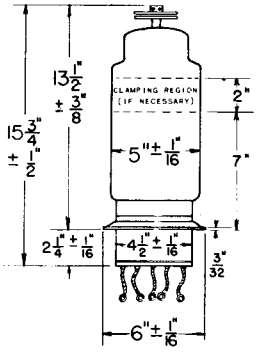
THYRATRON

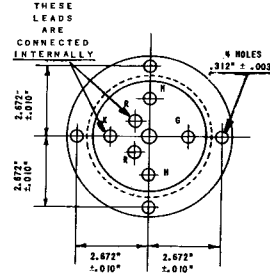
HEATER

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



GLASS BULB



BOTTOM VIEW

THE 5948 IS A THREE ELECTRODE, HYDROGEN FILLED, ZERO BIAS THYRATRON DESIGNED FOR THE GENERATION OF HIGH POWER PULSES. THE PRIMARY APPLICATION OF THE TUBE IS IN HIGH POWER, HIGH VOLTAGE RADAR MUDULATORS. THE 5948 IS CAPABLE OF SUPPLYING 12 MEGAWATT PULSES IN THIS SERVICE. AN INTERNAL HYDROGEN RESERVOIR PROMOTES LONG LIFE AND PERMITS OPTIMUM PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION. THE CATHODE IS UNIPOTENTIAL AND IS CONNECTED TO THE ELECTRICAL CENTER OF THE CATHODE HEATER CIRCUIT IN ORDER TO MINIMIZE TIME JITTER.

FIRM ELECTRICAL CONNECTIONS ARE MADE TO THE CATHODE HEATERS, GRID AND RESERVOIR BY MEANS OF FLEXIBLE CABLES FITTED WITH LUGS. THE TUBE IS RIGIDLY SUPPORTED BY A BASE WITH A FLANGE CONTAINING BOLT HOLES.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE	Ef	5.83	6.3	6.77	VOLTS
HEATER CURRENT (WITH BOGIE HEATER AND RESERVOIR VOLTAGE)	If	25	29	33	AMPS.
CATHODE HEATING TIME	tk	15			MINUTES
RESERVOIR VOLTAGE (SEE APPLICATION NOTES)	Eres	2.5	MARKED ON BASE	5.5	VOLTS
RESERVOIR CURRENT	Ires			11.0	AMPS.
RESERVOIR HEATING TIME	tres	15			MINUTES
ANODE VOLTAGE DROP	etd	100	200	400	VOLTS

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MECHANICAL DATA

TYPE OF COOLING	CONVECTION
(FORCED AIR COOLING ACROSS THE RADIATOR IS RECOMMENDED FOR MAXIMUM TUBE LIFE)	
MOUNTING POSITION	VERTICAL, BASE DOWN
MAXIMUM NET WEIGHT	4 LBS., 10 OZ.
DIMENSIONS:	SEE OUTLINE DRAWING

RATINGS

ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	5% epy	25	KVOLTS
FORWARD (SEE APPLICATION NOTES FOR STARTING PROCEDURE)	epy	10	25	KVOLTS
CATHODE CURRENT				
PEAK	ib		1000	AMPS.
AVERAGE	ib		1	AMPS.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	Ip		33	AMPS.
DC ANODE VOLTAGE	Ebb	5.0		KVOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT OF THE 5948 BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		1500	CPS
PEAK GRID VOLTAGE (NOTE 2)	egy	700	1800	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		650	VOLTS
GRID PULSE RISE TIME (NOTE 5)	tr		0.35	μSEC.
GRID PULSE WIDTH AT 70.7% POINT		2.0		μSEC.
HEATING FACTOR (epy X ib X prr. SEE PAGE 3)	Pb		9×10^9	
CURRENT RATE OF RISE (NOTE 5)			5000	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		1.0	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	-55	+75	°C

NOTES

1: IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05μSEC. MAXIMUM DURATION, SHALL NOT EXCEED 5.0 KILOVOLTS DURING THE FIRST 25μSEC. FOLLOWING THE ANODE PULSE.

2: THE GRID DRIVE REQUIREMENTS OF A 5948 CHANGE CONSIDERABLY DURING THE FIRST FEW MINUTES OF TUBE OPERATION. IN ORDER TO RELIABLY TRIGGER A COLD TUBE, THE GRID PULSE VOLTAGE AND DURATION AND THE GRID CIRCUIT IMPEDANCE SHOULD BE CHOSEN ACCORDING TO THE LIMITING CURVES.

3: ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

4: TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 15 KV AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

5: MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

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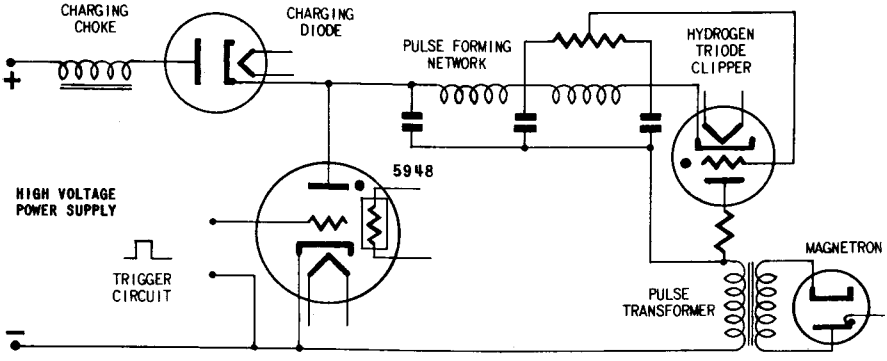
APPLICATION NOTES

THE 5948 HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN HIGH POWER RADAR MODULATOR SERVICE. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNATRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THE 5948 IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENTS WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE 5948 CONTAINS A HYDROGEN RESERVOIR THAT MAINTAINS THE GAS PRESSURE WITHIN THE TUBE IN ACCORDANCE WITH THE VOLTAGE IMPRESSED ACROSS IT. SINCE THE RESERVOIR CAN HOLD MANY TUBE VOLUMES OF GAS, LONG TUBE LIFE IS INSURED. IN ADDITION IT IS POSSIBLE TO SET THE GAS PRESSURE AT THE OPTIMUM VALUE FOR ANY PARTICULAR SET OF OPERATING CONDITIONS. THE RESERVOIR HEATER VOLTAGE STAMPED ON THE TUBE BASE HAS BEEN DETERMINED FOR A PARTICULAR SET OF CONDITIONS SOMEWHAT BEYOND THE MAXIMUM TUBE RATINGS AND WILL BE SATISFACTORY FOR MOST APPLICATIONS. IN GENERAL, IT IS DESIRABLE TO OPERATE AT AS HIGH A RESERVOIR VOLTAGE AS POSSIBLE WITHOUT OBTAINING SPURIOUS DISCHARGES IN THE GRID–ANODE REGION. WHEN THE 5948 IS OPERATED AT OR NEAR MAXIMUM RATINGS, THE RESERVOIR VOLTAGE REGULATION SHOULD NOT EXCEED ±2.5%. IF THE 5948 IS OPERATED AT REDUCED DUTY A WIDER RESERVOIR OPERATING RANGE CAN BE EXPECTED. HOWEVER, CARE SHOULD BE TAKEN WHEN DETERMINING THE RESERVOIR VOLTAGE TO INSURE SATISFACTORY OPERATION WITH THE ANTICIPATED RESERVOIR VOLTAGE REGULATION. UNDER NO CIRCUMSTANCES SHOULD THE RESERVOIR VOLTAGE BE REDUCED TO SUCH AN EXTENT THAT THE ANODE SHOWS COLOR.

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APPLICATION NOTES —CONT'D.

THE INSTANTANEOUS APPLICATION OF ANODE VOLTAGE (INSTANTANEOUS STARTING OR "SLAP ON") IS NOT RECOMMENDED. WHEN IT IS ABSOLUTELY NECESSARY, THE MAXIMUM PERMISSIBLE EPY IS 18 KV AND THIS VALUE SHALL NOT BE ATTAINED IN LESS THAN 0.04 SEC. FOR INITIAL APPLICATION OF MAXIMUM RATED ANODE VOLTAGE, IT IS RECOMMENDED THAT THE FOLLOWING STARTING METHODE BE USED:

APPLY NO MORE THAN 18 KV EPY INITIALLY.
DO NOT INCREASE IN STEPS GREATER THAN 5 KV PER MINUTE.

TYPICAL OPERATION

VARIATIONS IN THE OPERATING PARAMETERS AFFECT THE LIFE EXPECTANCY OF HYDROGEN THYRATRONS; THEREFORE, A SIMPLE METHOD OF RATING FOR ALL CONDITIONS IS DIFFICULT. UNTIL SUCH TIME AS SUFFICIENT INFORMATION IS AVAILABLE TO PREPARE COMPLETE OPERATION RATING CHARTS, WE LIST THE FOLLOWING TYPICAL CONDITIONS OF OPERATION UNDER WHICH CONSIDERABLE TUBE LIFE HAS BEEN OBTAINED. IF THE 5948 IS TO BE EMPLOYED IN AN OPERATION DIFFERING WIDELY FROM THESE CONDITIONS (UNLESS THE REQUIREMENTS ARE OBVIOUSLY LESS SEVERE) IT IS SUGGESTED THAT THE CUSTOMER REQUEST A RECOMMENDATION FOR THE SPECIFIC APPLICATION.

	PEAK ANODE VOLTAGE		PEAK	PULSE WIDTH	di/dt
Prr	FORWARD	INVERSE	CURRENT	70% POINT	
pps	kv	kv	Amps	μs	AMPS/μs
360	25	3	1000	2.5	5000
1500	15	5	500	1.3	5000

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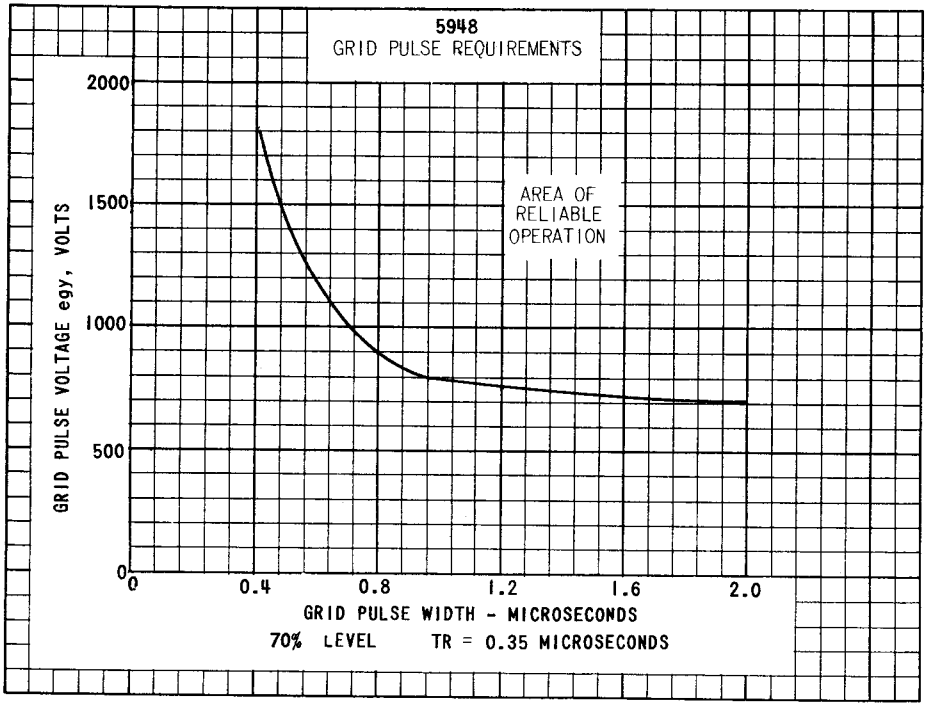
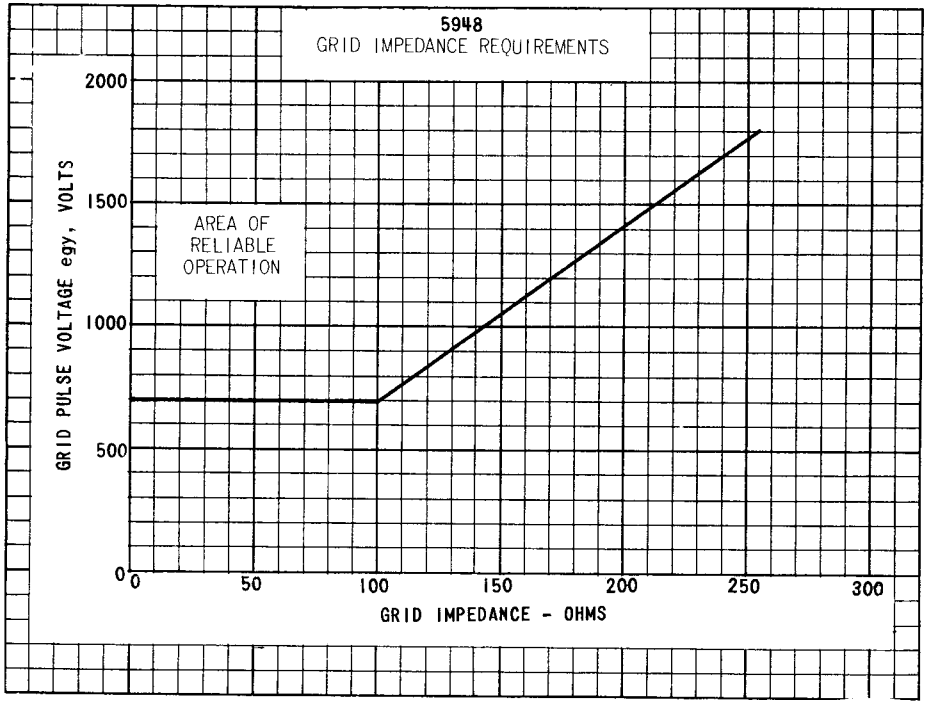

5948
GRID PULSE REQUIREMENTS
AREA OF RELIABLE OPERATION
GRID PULSE VOLTAGE egy, VOLTS
2000
1500
1000
500
0
0
0.4
0.8
1.2
1.6
2.0
GRID PULSE WIDTH - MICROSECONDS
70% LEVEL TR = 0.35 MICROSECONDS


5948
GRID IMPEDANCE REQUIREMENTS
AREA OF RELIABLE OPERATION
GRID PULSE VOLTAGE egy, VOLTS
2000
1500
1000
500
0
0
50
100
150
200
250
300
GRID IMPEDANCE - OHMS

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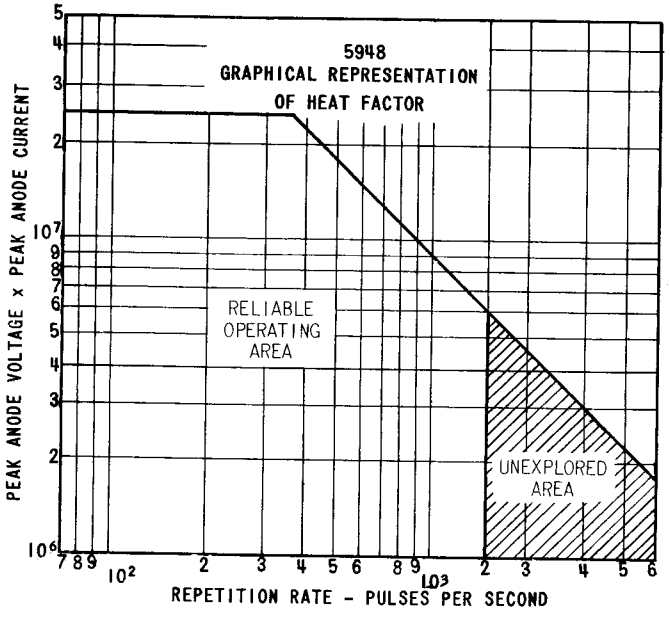
5948
GRAPHICAL REPRESENTATION
OF HEAT FACTOR
RELIABLE
OPERATING
AREA
UNEXPLORED
AREA
PEAK ANODE VOLTAGE x PEAK ANODE CURRENT
REPETITION RATE - PULSES PER SECOND
5
4
3
2
10⁷
9
8
7
6
5
4
3
2
10⁶
7 8 9
10²
2 3 4 5 6 8 9
10³
2 3 4 5 6

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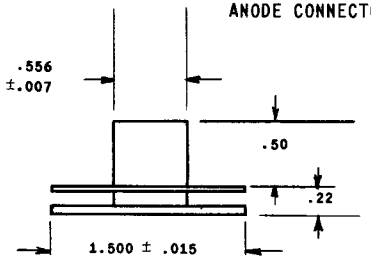
LEAD CONNECTIONS

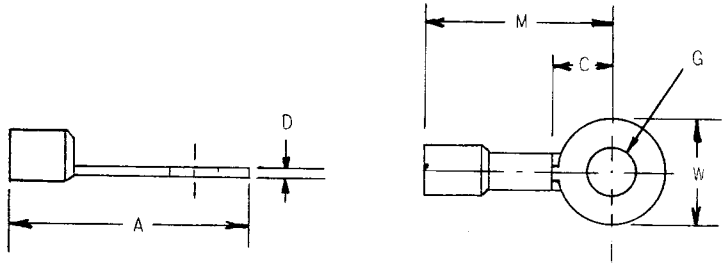
LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	CATHODE & HEATER C–T	BLACK	BLACK	L
3	HEATER	YELLOW	YELLOW	L
4	HEATER	YELLOW	BLACK	L
5	RESERVOIR	RED	YELLOW	S
6	RESERVOIR	RED	RED	S

LEADS ARE FLEXIBLE 5 1/2"±1/2" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.

ANODE CONNECTOR



LUG DIMENSIONS



LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.32"	.30"	.03"	.74"

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PRODUCT BULLETIN

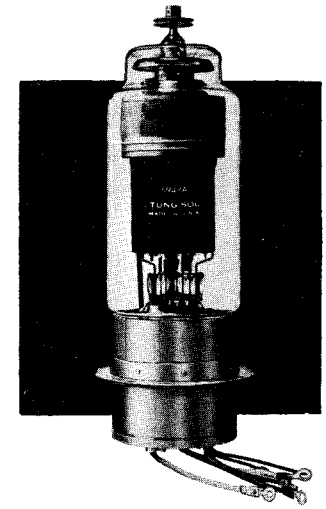
INDUSTRIAL ELECTRON TUBE TYPE 5948A

DECEMBER, 1962

HIGH POWER HYDROGEN THYRATRON

DESCRIPTION — The 5948A is a three electrode, hydrogen filled, zero bias thyratron designed for the generation of high power pulses. The primary application of the tube is in high power, high voltage radar modulators. The 5948A is capable of supplying 12 megawatt pulses in this service. An internal hydrogen reservoir promotes long life and permits optimum pressure adjustment for various conditions of operation. The cathode is unipotential and is connected to the electrical center of the cathode heater circuit in order to minimize time jitter.

Firm electrical connections are made to the cathode, cathode heaters, grid and reservoir by means of flexible cables fitted with lugs. The tube is rigidly supported by a base with a flange containing bolt holes.

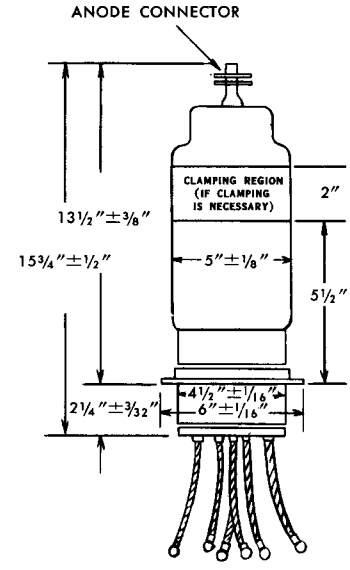


ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current — Ef = 6.3 Volts	25	29	33	Amperes
Reservoir Voltage — See Application Notes	2.5	Marked on Base	5.5	Volts
Reservoir Current —				
Considering all reservoir conditions	3	—	5	Amperes
Cathode and Reservoir Heating Time	3	—	—	Minutes
Tube Voltage Drop	100	200	400	Volts

MECHANICAL DATA

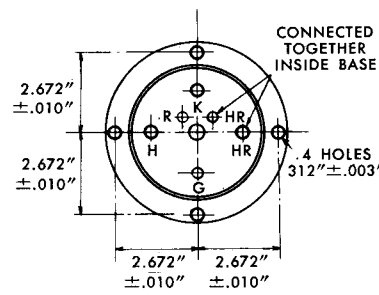
Type of Cooling — Forced air cooling across radiator is recommended for maximum tube life	Convection
Mounting Position	Vertical, base down
Net Weight — Maximum	4 pounds 10 ounces
Dimensions	See outline drawing
Anode Connector	Eitel-McCullough, Inc. No. HR-8 or equivalent



RATINGS, ABSOLUTE VALUES

	Min	Max	
Peak Anode Voltage			
Forward — See Application Notes for starting procedure	10	25	Kilovolts
Inverse — Note 1	Note 2	25	Kilovolts
Cathode Current			
Peak	—	1000	Amperes
Average	—	1	Ampere
RMS — For square pulse application Ip = $\sqrt{lb \times ib}$	—	33	Amperes
D-C Anode Voltage	5000	—	Volts
Pulse Repetition Rate — Note 3	—	1500	Pulses-per-second
Peak Grid Voltage			
Forward — Note 4	700	1800	Volts
Inverse	—	650	Volts
Trigger Pulse Width — at 70.7% Point	2	—	Microseconds
Trigger Pulse — Time of Rise — Note 5	—	0.35	Microseconds
Heating Factor — epy × ib × prr — See page 4	—	9×10^9	
Current Rate of Rise — Note 5	—	5000	Amperes-per-microsecond
Anode Delay Time — Note 6	—	1	Microsecond
Time Jitter — Note 7	—	0.005	Microsecond
Ambient Temperature	−55	+75	Degrees Centigrade

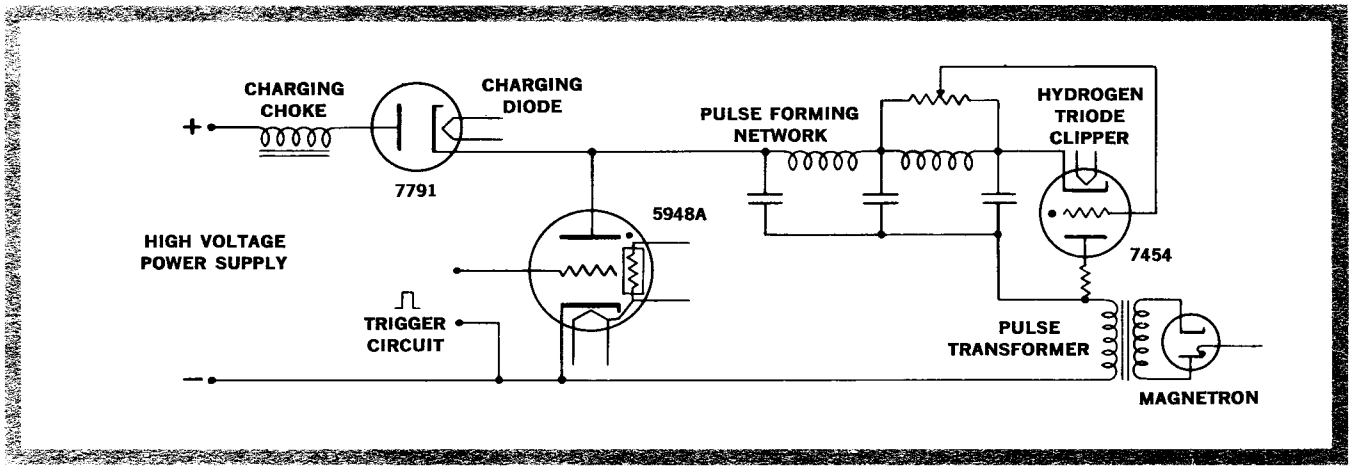
Note 1: In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration spike, shall not exceed 5 kilovolts during the first 25 microseconds following the anode pulse.
Note 2: Five percent of Foward Anode Voltage.
Note 3: This is not necessarily the upper operating frequency limit of this tube, but it represents the highest repetition rate extensively tested to date.
Note 4: The grid drive requirements of this tube change considerably during the first few minutes the tube is in operation. In order to reliably trigger a cold tube, the grid pulse voltage and duration and the grid circuit impedance should be chosen according to the limiting curves on page 3.
Note 5: Measurement made between 26 and 70.7 percent points.
Note 6: Anode delay time is defined as the time interval between the point on the rising portion of the grid voltage pulse which is 26 percent of the maximum unloaded pulse amplitude and the point where anode conduction takes place.
Note 7: Time jitter is measured at 50 percent of pulse amplitude after the tube has been operating for at least one minute. Maximum time jitter of 0.005 microseconds applies at a peak forward anode voltage of 15 kilovolts or greater. At peak forward anode voltages between 10 and 15 kilovolts, the tube has a time jitter rating of 0.01 microsecond.



BASING DIAGRAM
BOTTOM VIEW

APPLICATION NOTES

The 5948A hydrogen thyratron is designed primarily for use in high power radar modulator service. A basic circuit for such service is illustrated below. In such a circuit, the hydrogen thyratron serves as a switch to release into the magnetron or other radio frequency generator, the energy stored in the pulse forming network. The 5948A is admirably suited for such service by its ability to hold off high voltage, and to pass high peak currents with relatively low tube voltage drop. The tube will operate over a wide range of pulse repetition rates, pulse widths and peak currents, thus providing a very flexible circuit element. Triggering requirements are simplified since the tube operates with zero bias.



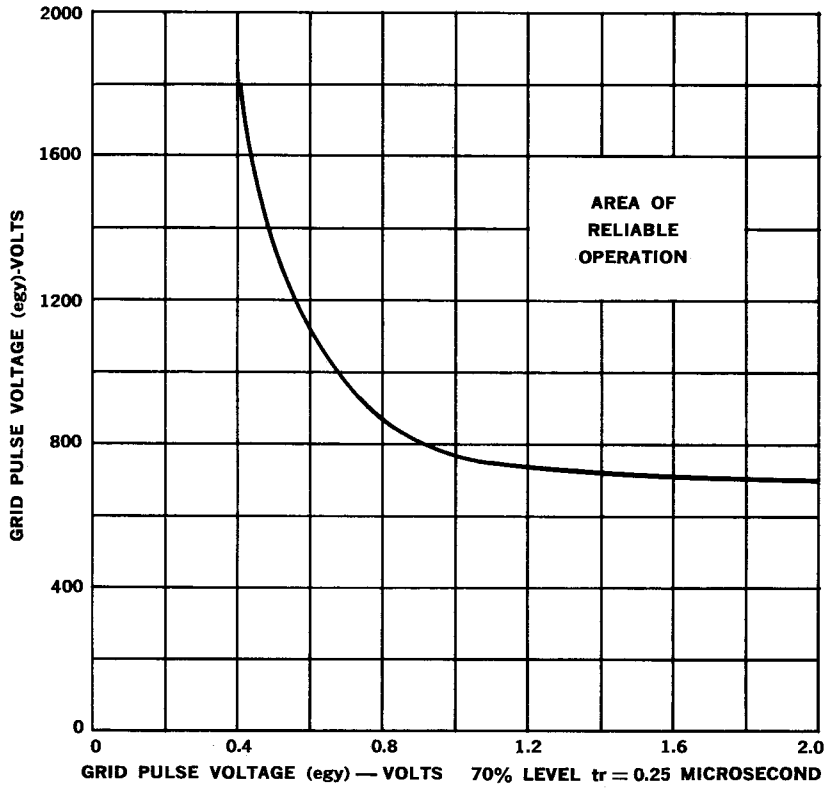
The 5948A contains a hydrogen reservoir that maintains the gas pressure within the tube in accordance with the voltage impressed across it. Since the reservoir can hold many tube volumes of gas, long tube life is insured. In addition it is possible to set the gas pressure at the optimum value for any particular set of operating conditions. The reservoir heater voltage stamped on the tube base has been determined for a particular set of conditions somewhat beyond the maximum tube ratings and will be satisfactory for most applications. In general, it is desirable to operate at as high a reservoir voltage as possible without obtaining spurious discharges in the grid-anode region. When the 5948A is operated at or near maximum ratings, the reservoir voltage regulation should not exceed ± 2.5 percent. If the 5948A is operated at reduced duty a wider reservoir operating range can be expected. However, care should be taken when determining the reservoir voltage to insure satisfactory operation with the anticipated reservoir voltage regulation. Under no circumstances should the reservoir voltage be reduced to such an extent that the anode shows color.

The instantaneous application of anode voltage (instantaneous starting or "slap on") is not recommended. When it is absolutely necessary, the maximum permissible epy is 18 kilovolts and this value shall not be attained in less than 0.04 second. For initial application of maximum rated anode voltage, it is recommended that the following starting method be used: Apply no more than 18 kilovolts epy initially. Do not increase in steps greater than 5 kilovolts per minute.

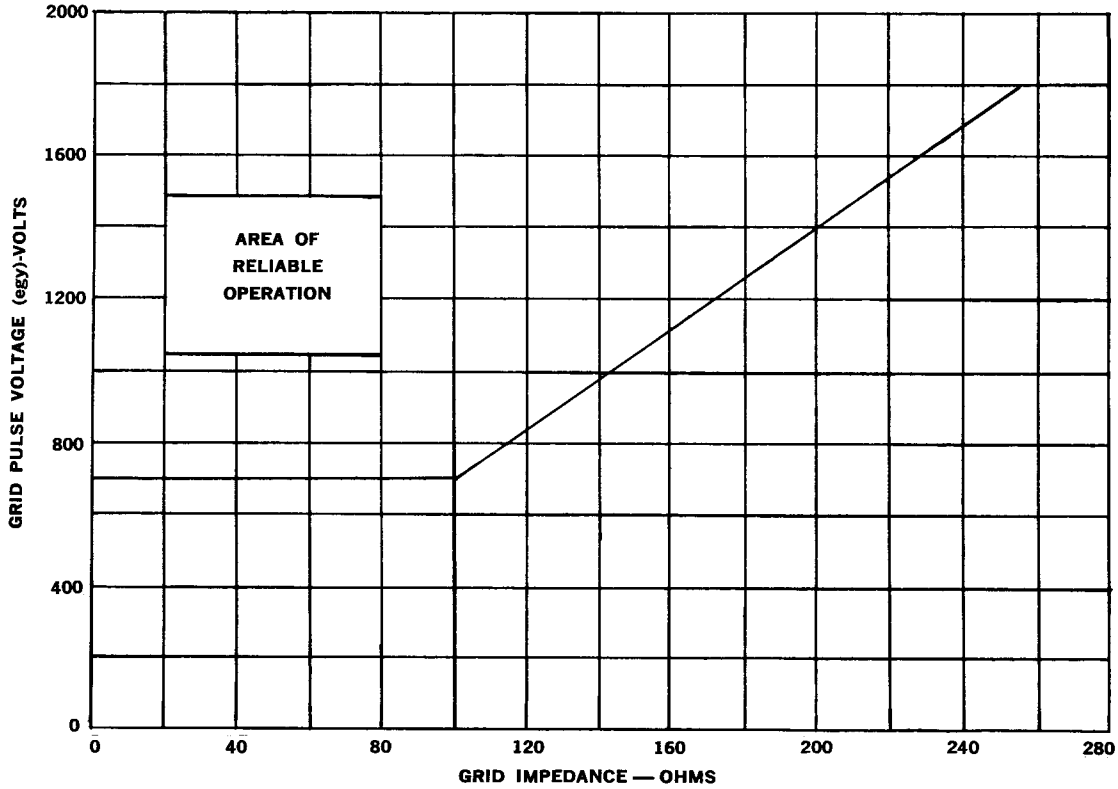
TYPICAL OPERATION

Variations in the operating parameters affect the life expectancy of hydrogen thyratrons; therefore, a simple method of rating for all conditions is difficult. Until such time as sufficient information is available to prepare complete operation rating charts, we list the following typical conditions of operation under which considerable tube life has been obtained. If the 5948A is to be employed in an operation differing widely from these conditions (unless the requirements are obviously less severe) it is suggested that the customer request a recommendation for the specific application.

Pulse Repetition Rate	Peak Anode Voltage		Peak Current	Pulse Width 70% Point	di/dt
	Forward	Inverse			
pps	kv	kv	amp	μs	amp/μs
360	25	3	1000	2.5	5000
1500	15	5	500	1.3	5000

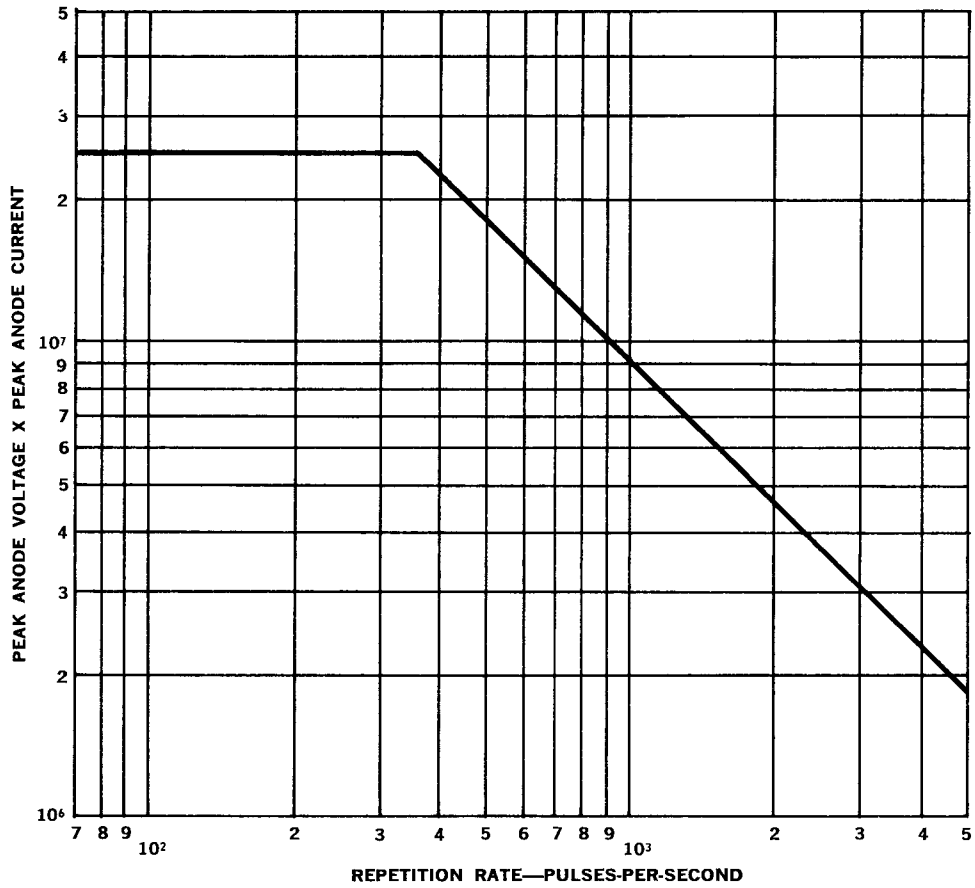


GRID PULSE REQUIREMENTS

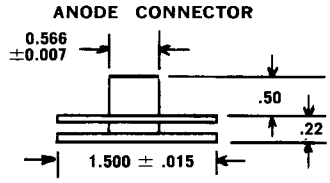


GRID IMPEDANCE REQUIREMENTS

TYPE 5948A



GRAPHICAL REPRESENTATION OF HEATING FACTOR

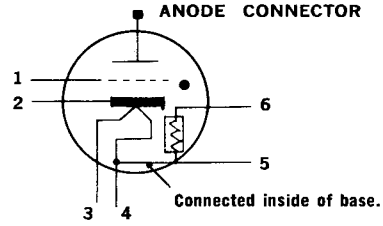


LEAD CONNECTIONS

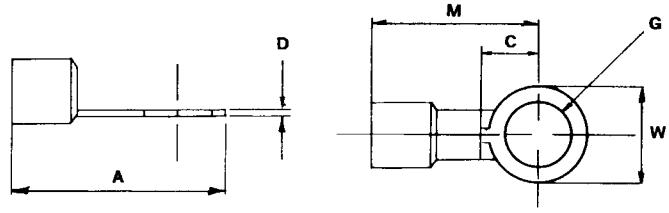
Lead	Function	Lead Color	Lug Color	Lug
1	Grid	Green	Green	S
2	Cathode & Heater C-T	Black	Black	L
3	Heater	Yellow	Yellow	L
4	Heater	Yellow	Black	L
5	Reservoir	Red	Yellow	S
6	Reservoir	Red	Red	S

Leads are flexible 8″ ±¾″ long from bottom of base to center of lug hole. Color coding as well as base marking identifies the leads.

BASING CONNECTIONS

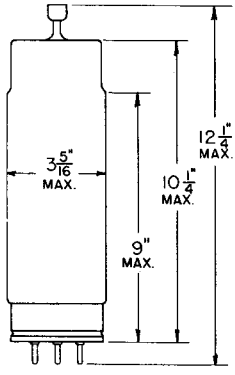


LUG DIMENSIONS



LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	¼″	1.21″	.53″	.41″	.04″	.94″
S	#10	.90″	.31″	.30″	.03″	.74″

TUNG-SOL



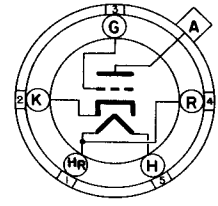
GLASS BULB

THYRATRON

HEATER

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

THE 5949 IS A THREE ELECTRODE, HYDROGEN FILLED, ZERO BIAS THYRATRON DESIGNED FOR THE GENERATION OF HIGH POWER PULSES. THE PRIMARY APPLICATION OF THE TUBE IS IN HIGH POWER, HIGH VOLTAGE RADAR MODULATORS. THE 5949 IS CAPABLE OF SUPPLYING 6.25 MEGAWATT PULSES IN THIS SERVICE. AN INTERNAL HYDROGEN RESERVOIR PROMOTES LONG LIFE AND PERMITS OPTIMUM PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION. THE CATHODE IS UNIPOTENTIAL AND IS CONNECTED TO THE ELECTRICAL CENTER OF THE CATHODE HEATER CIRCUIT IN ORDER TO MINIMIZE TIME JITTER.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER AND RESERVOIR VOLTAGE)	If	15	18.5	22	AMPS.
CATHODE HEATING TIME	tk	15			MINUTES
RESERVOIR VOLTAGE (SEE APPLICATION NOTES)	Eres	3	MARKED ON BASE	5.5	VOLTS
RESERVOIR CURRENT	Ires	.2		5	AMPS.
RESERVOIR HEATING TIME	tres	15			MINUTES
ANODE VOLTAGE DROP	etd	75	125	250	VOLTS

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

MOUNTING POSITION	ANY
MAXIMUM NET WEIGHT	2 1/4 LBS.
DIMENSIONS:	SEE OUTLINE DRAWING
SOCKET	E.F. JOHNSON CO. NO. 122-275 OR EQUIVALENT
ANODE CONNECTOR	EITEL-McCULLOUGH, INC. NO. HR-8 OR EQUIVALENT

RATINGS

ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	5% epy	25	KVOLTS
FORWARD (SEE APPLICATION NOTES FOR STARTING PROCEDURE)	epy	10	25	KVOLTS
CATHODE CURRENT				
PEAK	ib		500	AMPS.
AVERAGE	ib		0.5	AMPS.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		16	AMPS.
DC ANODE VOLTAGE	Ebb	5		KVOLTS
OPERATING FREQUENCY	prr		2000	CPS
(THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT OF THE 5949 BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)				
PEAK GRID VOLTAGE (NOTE 2)	egy	550	1500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		450	VOLTS
GRID PULSE RISE TIME (NOTE 5)	tr		0.14	μSEC.
GRID PULSE WIDTH AT 70.7% POINT	tp	2		μSEC.
HEATING FACTOR (epy X ib X prr. SEE PAGE 3)	P_b		6.25×10^9	
CURRENT RATE OF RISE (NOTE 5)	dik/dt		2500	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		1.0	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	-55	+75	°C

NOTES

1: IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05μSEC. MAXIMUM DURATION, SHALL NOT EXCEED 5.0 KILOVOLTS DURING THE FIRST 25μSEC. FOLLOWING THE ANODE PULSE.

2: THE GRID DRIVE REQUIREMENTS OF A 5949 CHANGE CONSIDERABLY DURING THE FIRST FEW MINUTES OF TUBE OPERATION. IN ORDER TO RELIABLY TRIGGER A COLD TUBE, THE GRID PULSE VOLTAGE AND DURATION AND THE GRID CIRCUIT IMPEDANCE SHOULD BE CHOSEN ACCORDING TO THE LIMITING CURVES.

3: ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

4: TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 15 KV AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

5: MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

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TUNG-SOL

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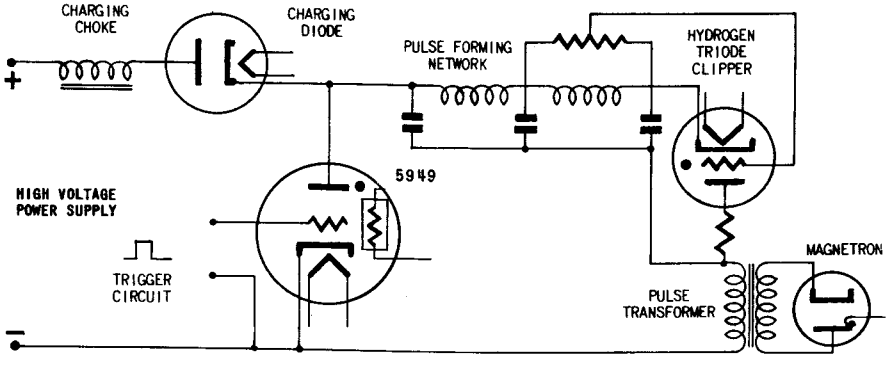
APPLICATION NOTES

THE 5949 HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN HIGH POWER RADAR MODULATOR SERVICE. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNATRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THE 5949 IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENTS WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE 5949 CONTAINS A HYDROGEN RESERVOIR THAT MAINTAINS THE GAS PRESSURE WITHIN THE TUBE IN ACCORDANCE WITH THE VOLTAGE IMPRESSED ACROSS IT. SINCE THE RESERVOIR CAN HOLD MANY TUBE VOLUMES OF GAS, LONG TUBE LIFE IS INSURED. IN ADDITION IT IS POSSIBLE TO SET THE GAS PRESSURE AT THE OPTIMUM VALUE FOR ANY PARTICULAR SET OF OPERATING CONDITIONS. THE RESERVOIR HEATER VOLTAGE STAMPED ON THE TUBE BASE HAS BEEN DETERMINED FOR A PARTICULAR SET OF CONDITIONS SOMEWHAT BEYOND THE MAXIMUM TUBE RATINGS AND WILL BE SATISFACTORY FOR MOST APPLICATIONS. IN GENERAL, IT IS DESIRABLE TO OPERATE AT AS HIGH A RESERVOIR VOLTAGE AS POSSIBLE WITHOUT OBTAINING SPURIOUS DISCHARGES IN THE GRID-ANODE REGION. WHEN THE 5949 IS OPERATED AT OR NEAR MAXIMUM RATINGS, THE RESERVOIR VOLTAGE REGULATION SHOULD NOT EXCEED ±2.5%. IF THE 5949 IS OPERATED AT REDUCED DUTY A WIDER RESERVOIR OPERATING RANGE CAN BE EXPECTED. HOWEVER, CARE SHOULD BE TAKEN WHEN DETERMINING THE RESERVOIR VOLTAGE TO INSURE SATISFACTORY OPERATION WITH THE ANTICIPATED RESERVOIR VOLTAGE REGULATION. UNDER NO CIRCUMSTANCES SHOULD THE RESERVOIR VOLTAGE BE REDUCED TO SUCH AN EXTENT THAT THE ANODE SHOWS COLOR.

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APPLICATION NOTES —CONT'D.

THE INSTANTANEOUS APPLICATION OF ANODE VOLTAGE (INSTANTANEOUS STARTING OR "SLAP ON") IS NOT RECOMMENDED. WHEN IT IS ABSOLUTELY NECESSARY, THE MAXIMUM PERMISSIBLE EPY IS 18 KV AND THIS VALUE SHALL NOT BE ATTAINED IN LESS THAN 0.04 SEC. FOR INITIAL APPLICATION OF MAXIMUM RATED ANODE VOLTAGE, IT IS RECOMMENDED THAT THE FOLLOWING STARTING METHODE BE USED:

APPLY NO MORE THAN 18 KV EPY INITIALLY.
DO NOT INCREASE IN STEPS GREATER THAN 5 KV PER MINUTE.

TYPICAL OPERATION

VARIATIONS IN THE OPERATING PARAMETERS AFFECT THE LIFE EXPECTANCY OF HYDROGEN THYRATRONS; THEREFORE, A SIMPLE METHOD OF RATING FOR ALL CONDITIONS IS DIFFICULT. UNTIL SUCH TIME AS SUFFICIENT INFORMATION IS AVAILABLE TO PREPARE COMPLETE OPERATION RATING CHARTS, WE LIST THE FOLLOWING TYPICAL CONDITIONS OF OPERATION UNDER WHICH CONSIDERABLE TUBE LIFE HAS BEEN OBTAINED. IF THE 5949 IS TO BE EMPLOYED IN AN OPERATION DIFFERING WIDELY FROM THESE CONDITIONS (UNLESS THE REQUIREMENTS ARE OBVIOUSLY LESS SEVERE) IT IS SUGGESTED THAT THE CUSTOMER REQUEST A RECOMMENDATION FOR THE SPECIFIC APPLICATION.

	PEAK ANODE VOLTAGE		PEAK	PULSE WIDTH	di/dt
Prr	FORWARD	INVERSE	CURRENT	70% POINT	
pps	kv	kv	Amps	μs	AMPS/μs
360	25	1.25	500	2	2500
1500	20	7.0	200	1	2500

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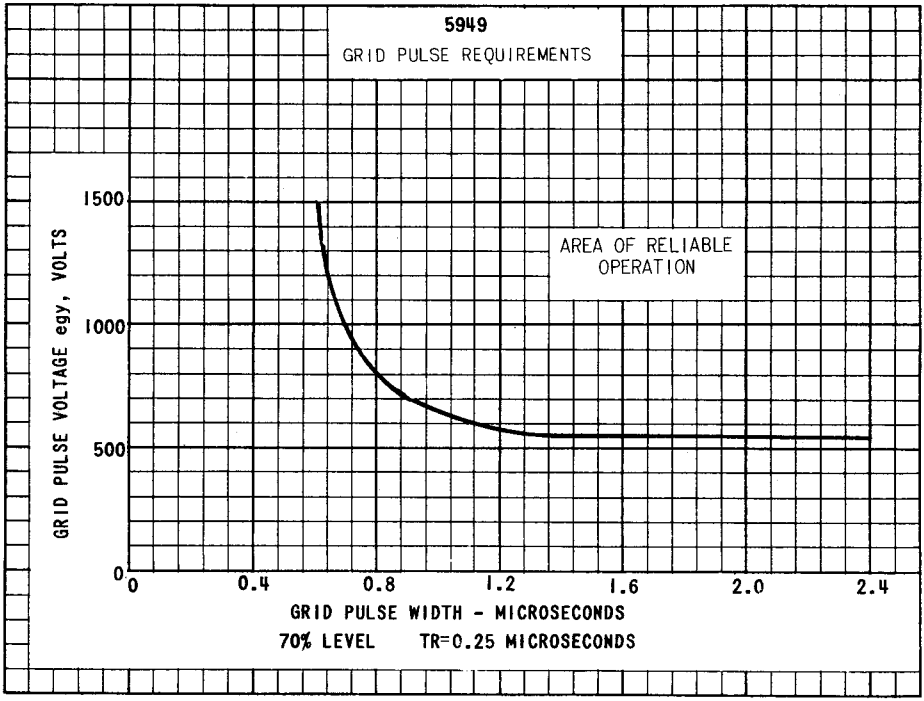

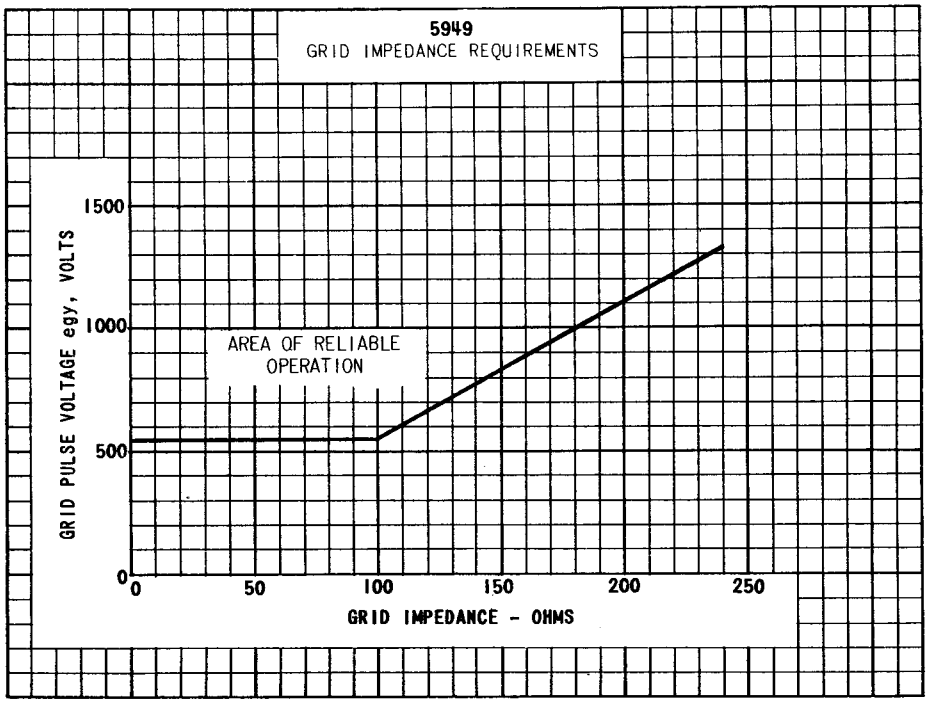

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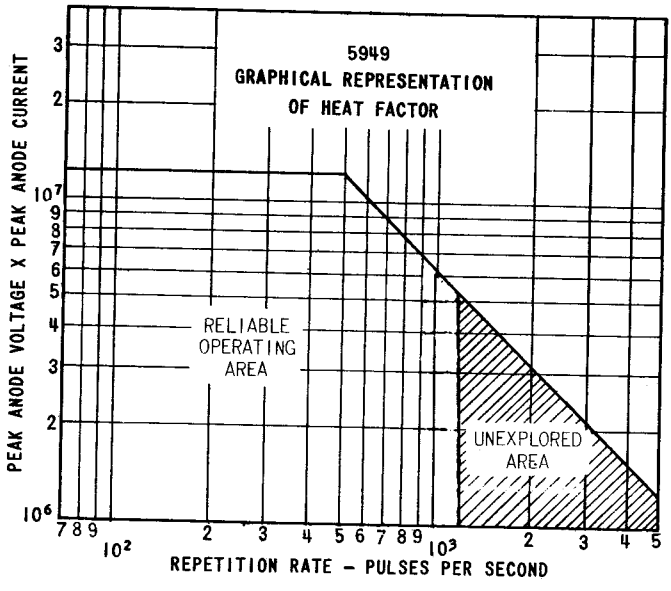

5949
GRAPHICAL REPRESENTATION
OF HEAT FACTOR
PEAK ANODE VOLTAGE X PEAK ANODE CURRENT
RELIABLE OPERATING AREA
UNEXPLORED AREA
REPETITION RATE – PULSES PER SECOND

TUNG-SOL

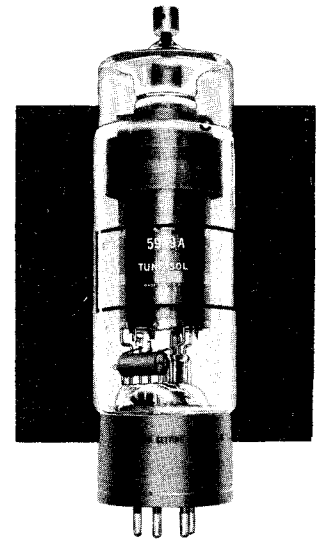
PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 5949A

DECEMBER, 1962

HIGH POWER HYDROGEN THYRATRON

DESCRIPTION — The 5949A is a three electrode, hydrogen filled, zero bias thyratron designed for the generation of high power pulses. The primary application of the tube is in high power, high voltage radar modulators. The 5949A is capable of supplying 6.25 megawatt pulses in this service. An internal hydrogen reservoir promotes long life and permits optimum pressure adjustment for various conditions of operation. The cathode is unipotential and is connected to the electrical center of the cathode heater circuit in order to minimize time jitter.

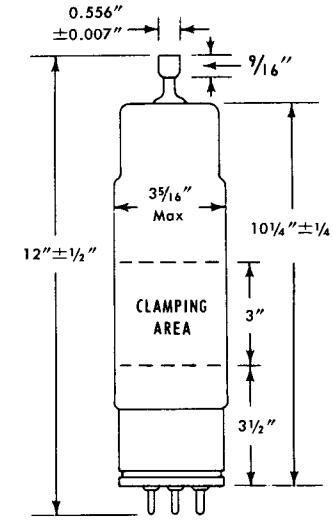


ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current — Ef = 6.3 Volts	15	18.5	22	Amperes
Reservoir Voltage — See Application Notes	3	Marked on base	5.5	Volts
Reservoir Current — Considering all reservoir conditions	3	—	5	Amperes
Cathode and Reservoir Heating Time	3	—	—	Minutes
Tube Voltage Drop	75	125	250	Volts

MECHANICAL DATA

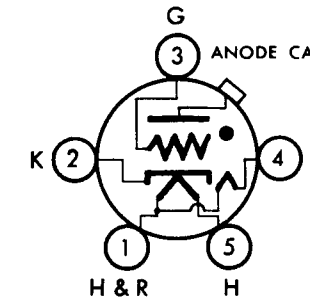
Type of Cooling	Convection
Mounting Position	Any
Net Weight — Maximum	2 pounds 4 ounces
Dimensions	See outline drawing
Base	JEDEC No. A5-98
Socket	E. F. Johnson Co. No. 122-275 or equivalent
Anode Connector	Eitel-McCullough, Inc. No. HR-8 or equivalent



RATINGS, ABSOLUTE VALUES

	Min	Max	
Peak Anode Voltage			
Forward — See Application Notes for starting procedure	10	25	Kilovolts
Inverse — Note 1	Note 2	25	Kilovolts
Cathode Current			
Peak	—	500	Amperes
Average	—	0.5	Ampere
RMS — For square pulse applications $Ip = \sqrt{lb \times ib}$	—	16	Amperes
D-C Anode Voltage	5000	—	Volts
Pulse Repetition Rate — Note 3	—	2000	Pulses-per-second
Peak Grid Voltage			
Forward — Note 4	550	1500	Volts
Inverse	—	450	Volts
Trigger Pulse Width — at 70.7% Point	2	—	Microseconds
Trigger Pulse — Time of Rise — Note 5	—	0.25	Microsecond
Heating Factor — epy × ib × prr — See page 4	—	6.25×10^9	
Current Rate of Rise — Note 5	—	2500	Amperes-per-microsecond
Anode Delay Time — Note 6	—	1	Microsecond
Time Jitter — Note 7	—	0.005	Microsecond
Ambient Temperature	−55	+75	Degrees Centigrade

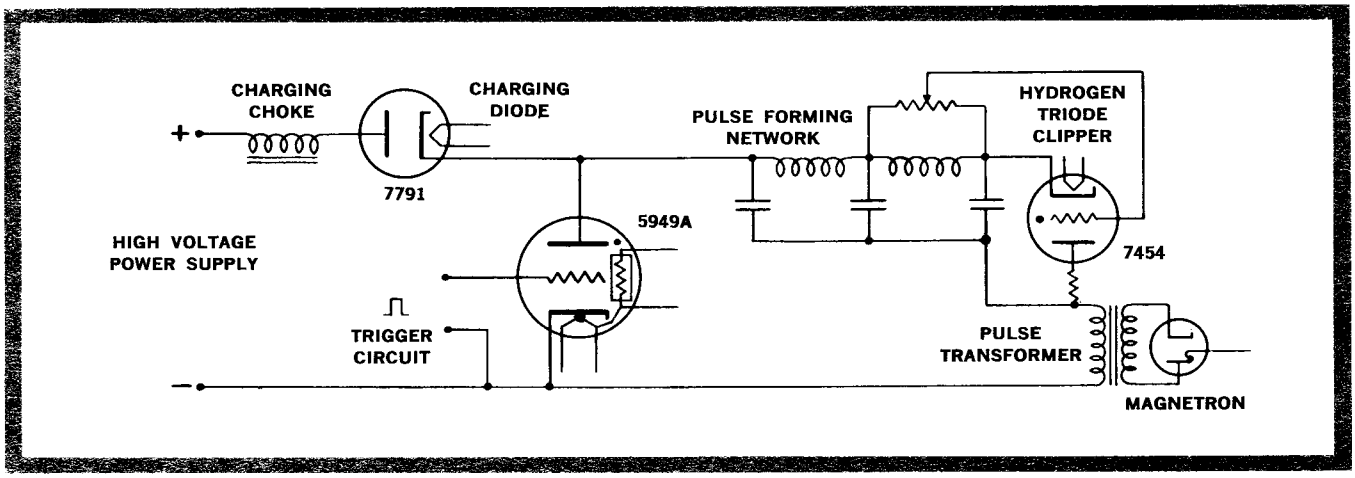
Note 1: In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration spike, shall not exceed 5 kilovolts during the first 25 microseconds following the anode pulse.
Note 2: Five percent of Foward Anode Voltage.
Note 3: This is not necessarily the upper operating frequency limit of this tube, but it represents the highest repetition rate extensively tested to date.
Note 4: The grid drive requirements of this tube change considerably during the first few minutes the tube is in operation. In order to reliably trigger a cold tube, the grid pulse voltage and duration and the grid circuit impedance should be chosen according to the limiting curves on page 3.
Note 5: Measurement made between 26 and 70.7 percent points.
Note 6: Anode delay time is defined as the time interval between the point on the rising portion of the grid voltage pulse which is 26 percent of the maximum unloaded pulse.
Note 7: Time jitter is measured at 50 percent of pulse amplitude after the tube has been operating for at least one minute. Maximum time jitter of 0.005 microseconds applies at a peak forward anode voltage of 18 kilovolts or greater.



BASING DIAGRAM
BOTTOM VIEW
5 CH

APPLICATION NOTES

The 5949A hydrogen thyratron is designed primarily for use in high power radar modulator service. A basic circuit for such service is illustrated below. In such a circuit, the hydrogen thyratron serves as a switch to release into the magnetron or other radio frequency generator, the energy stored in the pulse forming network. The 5949A is admirably suited for such service by its ability to hold off high voltage, and to pass high peak currents with relatively low tube voltage drop. The tube will operate over a wide range of pulse repetition rates, pulse widths and peak currents, thus providing a very flexible circuit element. Triggering requirements are simplified since the tube operates with zero bias.



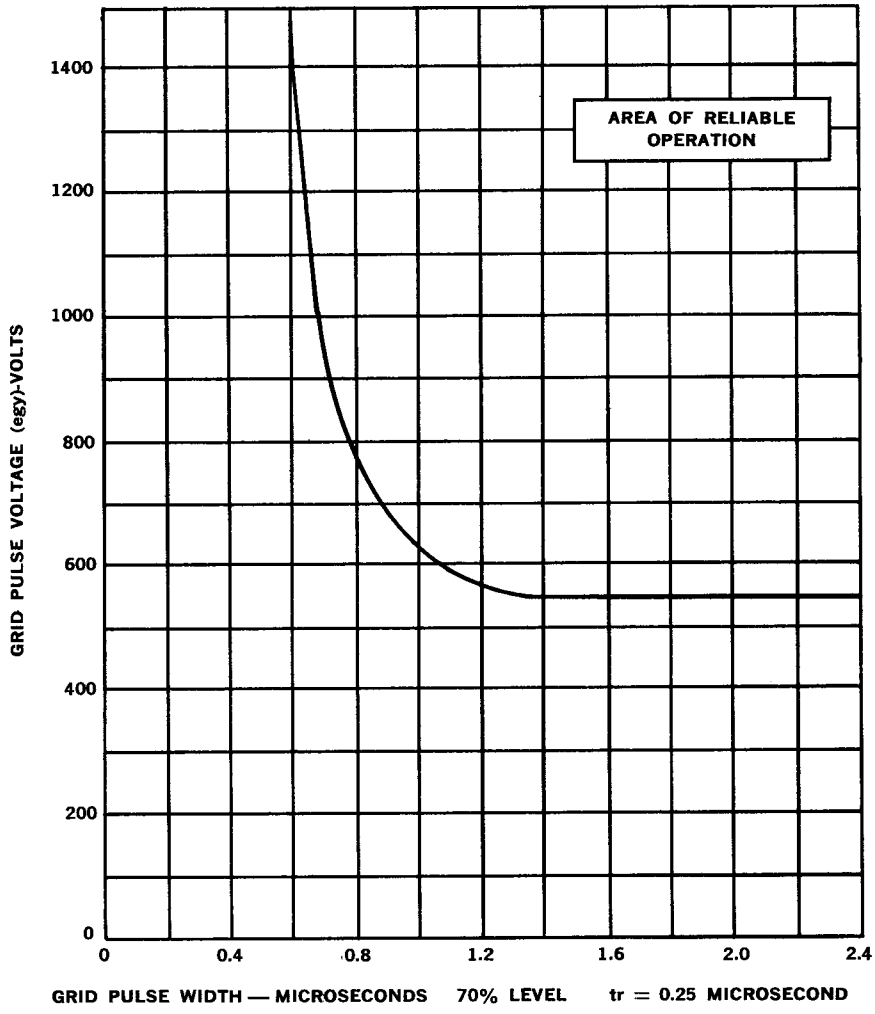
The 5949A contains a hydrogen reservoir that maintains the gas pressure within the tube in accordance with the voltage impressed across it. Since the reservoir can hold many tube volumes of gas, long tube life is insured. In addition it is possible to set the gas pressure at the optimum value for any particular set of operating conditions. The reservoir heater voltage stamped on the tube base has been determined for a particular set of conditions somewhat beyond the maximum tube ratings and will be satisfactory for most applications. In general, it is desirable to operate at as high a reservoir voltage as possible without obtaining spurious discharges in the grid-anode region. When the 5949A is operated at or near maximum ratings, the reservoir voltage regulation should not exceed ± 2.5 percent. If the 5949A is operated at reduced duty a wider reservoir operating range can be expected. However, care should be taken when determining the reservoir voltage to insure satisfactory operation with the anticipated reservoir voltage regulation. Under no circumstances should the reservoir voltage be reduced to such an extent that the anode shows color.

The instantaneous application of anode voltage (instantaneous starting or "slap on") is not recommended. When it is absolutely necessary, the maximum permissible epy is 18 kilovolts and this value shall not be attained in less than 0.04 second. For initial application of maximum rated anode voltage, it is recommended that the following starting method be used: Apply no more than 18 kilovolts epy initially. Do not increase in steps greater than 5 kilovolts per minute.

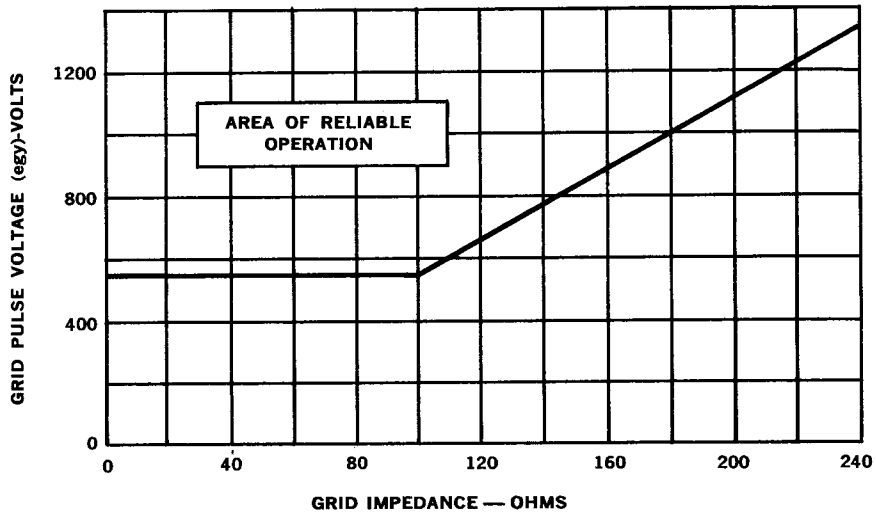
TYPICAL OPERATION

Variations in the operating parameters affect the life expectancy of hydrogen thyratrons; therefore, a simple method of rating for all conditions is difficult. Until such time as sufficient information is available to prepare complete operation rating charts, we list the following typical conditions of operation under which considerable tube life has been obtained. If the 5949A is to be employed in an operation differing widely from these conditions (unless the requirements are obviously less severe) it is suggested that the customer request a recommendation for the specific application.

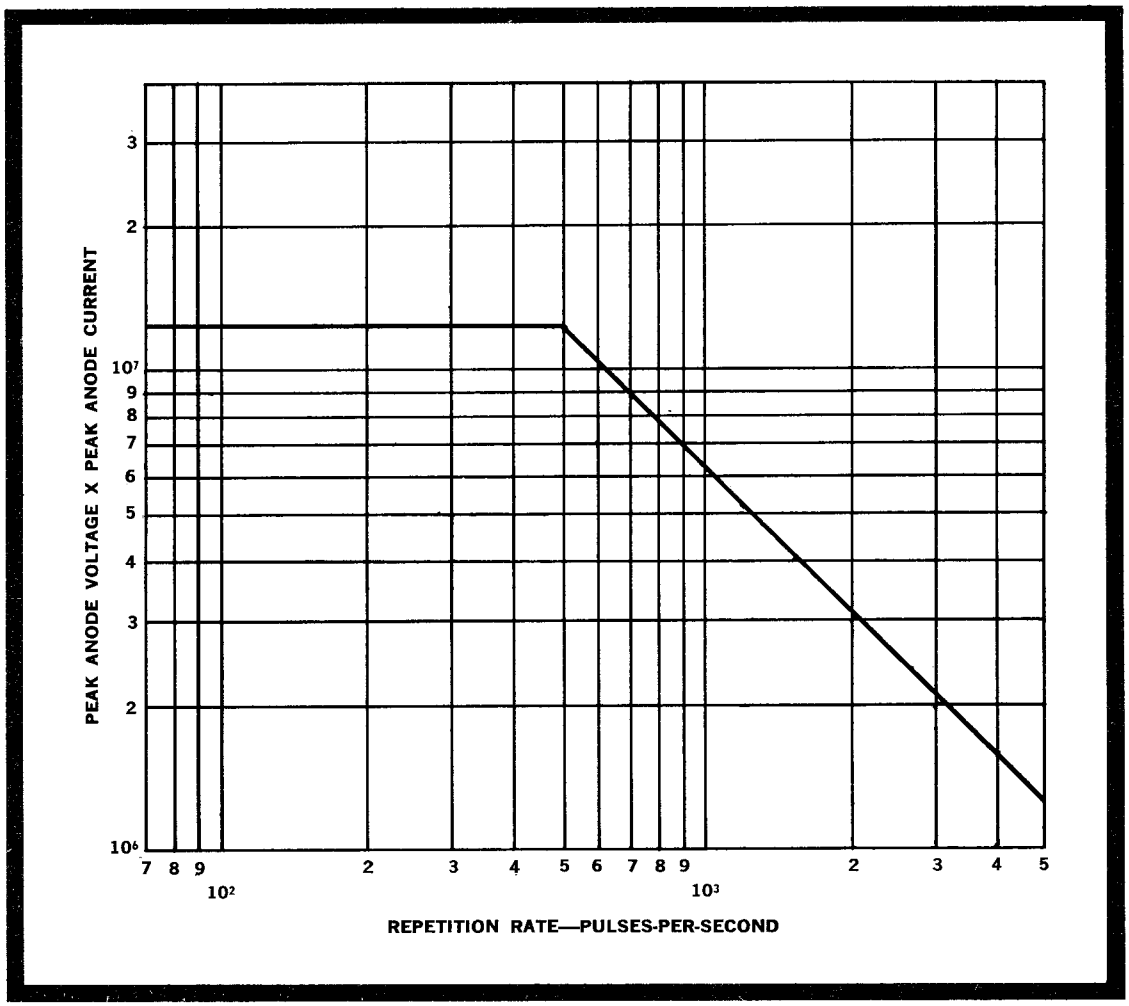
Pulse Repetition Rate	Peak Anode Voltage		Peak Current	Pulse Width 70% Point	di/dt
	Forward	Inverse			
pps	kv	kv	amp	μsec	amp/μsec
360	25	1.25	500	2	2500
1500	20	7.0	200	1	2500



GRID PULSE REQUIREMENTS



GRID IMPEDANCE REQUIREMENTS

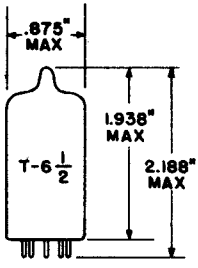


GRAPHICAL REPRESENTATION OF HEATING FACTOR

TUNG-SOL

→ TWIN TRIODE

MINIATURE TYPE



GLASS BULB

SMALL-BUTTON NOVAL 9 PIN BASE E9-1

OUTLINE DRAWING JEDEC 6-2

UNIPOTENTIAL CATHODE

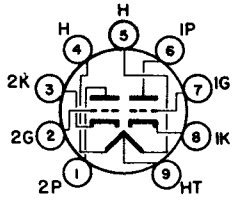
HEATER

SERIES	PARALLEL
12.6± 1.3 VOLTS	6.3± 0.6 VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

OPERATING POSITION*

ANY, BUT FOR UTMOST IN SERVICE, THE TUBE SHOULD BE OPERATED IN A VERTICAL POSITION WITH BASE UP OR DOWN, OR IN A HORIZONTAL POSITION WITH BASE PINS 6 & 9 IN A VERTICAL PLANE.



BOTTOM VIEW

BASING DIAGRAM JEDEC 9A

THE 5963 IS A MEDIUM-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR FREQUENCY-DIVIDER CIRCUITS IN ELECTRONIC COMPUTERS AND OTHER 'ON-OFF' CONTROL APPLICATIONS REQUIRING LONG PERIODS OF OPERATION UNDER CUT-OFF CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE (EACH UNIT)	1.5	pf
GRID TO CATHODE & HEATER (EACH UNIT)	1.9	pf
PLATE TO CATHODE & HEATER (UNIT #1)	0.5	pf
PLATE TO CATHODE & HEATER (UNITS #2)	0.35	pf
GRID OF UNIT #1 TO GRID OF UNIT #2 (MAX.)	0.01	pf

RATINGS
ABSOLUTE MAXIMUM VALUES

EACH UNIT

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE BIAS VALUE	100	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
PEAK NEGATIVE VALUE	200	VOLTS
MAXIMUM PLATE DISSIPATION	2.5	WATTS
MAXIMUM GRID INPUT	0.5	WATT
MAXIMUM DC CATHODE CURRENT	20	MA.
MAXIMUM PEAK CATHODE CURRENT	100	MA.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	120	°C

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER (EACH UNIT)

PLATE VOLTAGE	67.5	VOLTS
GRID VOLTAGE	0	VOLTS
AMPLIFICATION FACTOR	21	
PLATE RESISTANCE	6600	OHMS
TRANSCONDUCTANCE	3200	μMHOS
PLATE CURRENT	8.5	MA.

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

TYPICAL OPERATION AS FREQUENCY HALFER
EACH UNIT

	CUTOFF CONDITION	ZERO-BIAS CONDITION	
PLATE SUPPLY VOLTAGE	150	150	VOLTS
GRID VOLTAGE	−15	0	VOLTS
PLATE CIRCUIT RESISTANCE	20000	20000	OHMS
GRID-CIRCUIT RESISTANCE	47000	47000	OHMS
PLATE CURRENT	0	5.1	MA.

CIRCUIT VALUES

GRID-CIRCUIT RESISTANCE: (MAX.)		
FOR FIXED BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1.0	MEGOHM

RANGE VALUES FOR EQUIPMENT DESIGN

	NOTE	MIN	MAX	
CUTOFF CONDITION				
PLATE CURRENT	1	—	50	μAMP.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	—	—	50	μAMP.
ZERO-BIAS CONDITION				
PLATE CURRENT	2	4.6	5.4	MA.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	—	—	0.8	MA.

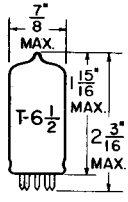
[1]FOR CONDITIONS WITH 12.6 VOLTS ON HEATER, PLATE-SUPPLY VOLTS = 150, PLATE-CIRCUIT RESISTANCE (OHMS) = 20000, GRID-SUPPLY VOLTS = −15, AND GRID-CIRCUIT RESISTANCE (OHMS) = 47000.

[2]CONDITIONS ARE SAME AS FOR NOTE 1 EXCEPT THAT GRID-SUPPLY VOLTS = 0.

TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

UNIPOTENTIAL CATHODE

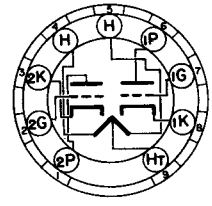
HEATER

SERIES	PARALLEL
12.6±10% VOLTS	6.3±10% VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

ANY MOUNTING POSITION

MICROPHONISM NOT TESTED



BOTTOM VIEW

SMALL-BUTTON NOVAL
9 PIN BASE

9A

THE 5963 IS A MEDIUM-MU TRIODE IN THE 9 PIN MINATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR FREQUENCY-DIVIDER CIRCUITS IN ELECTRONIC COMPUTERS AND OTHER 'ON-OFF' CONTROL APPLICATIONS REQUIRING LONG PERIODS OF OPERATION UNDER CUT-OFF CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE (EACH UNIT)	1.5	μμf
GRID TO CATHODE & HEATER (EACH UNIT)	1.9	μμf
PLATE TO CATHODE & HEATER (UNIT #1)	0.5	μμf
PLATE TO CATHODE & HEATER (UNITS #2)	0.35	μμf
GRID OF UNIT #1 TO GRID OF UNIT #2 (MAX.)	0.01	μμf

RATINGS

ABSOLUTE MAXIMUM VALUES

EACH UNIT

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

	SERIES 12.6±10%	PARALLEL 6.3±10%	
HEATER VOLTAGE			VOLTS
MAXIMUM PLATE VOLTAGE	250		VOLTS
MAXIMUM GRID VOLTAGE:			
NEGATIVE BIAS VALUE	100		VOLTS
POSITIVE BIAS VALUE	0		VOLTS
PEAK NEGATIVE VALUE	200		VOLTS
MAXIMUM PLATE DISSIPATION	2.5		WATTS
MAXIMUM GRID INPUT	0.5		WATT
MAXIMUM DC CATHODE CURRENT	20		MA.
MAXIMUM PEAK CATHODE CURRENT	100		MA.
MAXIMUM PEAK HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	90		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	90		VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	120		°C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER (EACH UNIT)

HEATER VOLTAGE (SERIES)	12.6±10%	VOLTS
HEATER VOLTAGE (PARALLEL)	6.3±10%	VOLTS
HEATER CURRENT (SERIES)	0.15	AMP.
HEATER CURRENT (PARALLEL)	0.3	AMP.
PLATE VOLTAGE	67.5	VOLTS
GRID VOLTAGE	0	VOLTS
AMPLIFICATION FACTOR	21	
PLATE RESISTANCE	6600	OHMS
TRANSCONDUCTANCE	3200	μMHOS
PLATE CURRENT	8.5	MA.

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

TYPICAL OPERATION AS FREQUENCY HALFER
EACH UNIT

	CUTOFF CONDITION	ZERO-BIAS CONDITION	
PLATE SUPPLY VOLTAGE	150	150	VOLTS
GRID VOLTAGE	−15	0	VOLTS
PLATE CIRCUIT RESISTANCE	20000	20000	OHMS
GRID-CIRCUIT RESISTANCE	47000	47000	OHMS
PLATE CURRENT	0	5.1	MA.

CIRCUIT VALUES

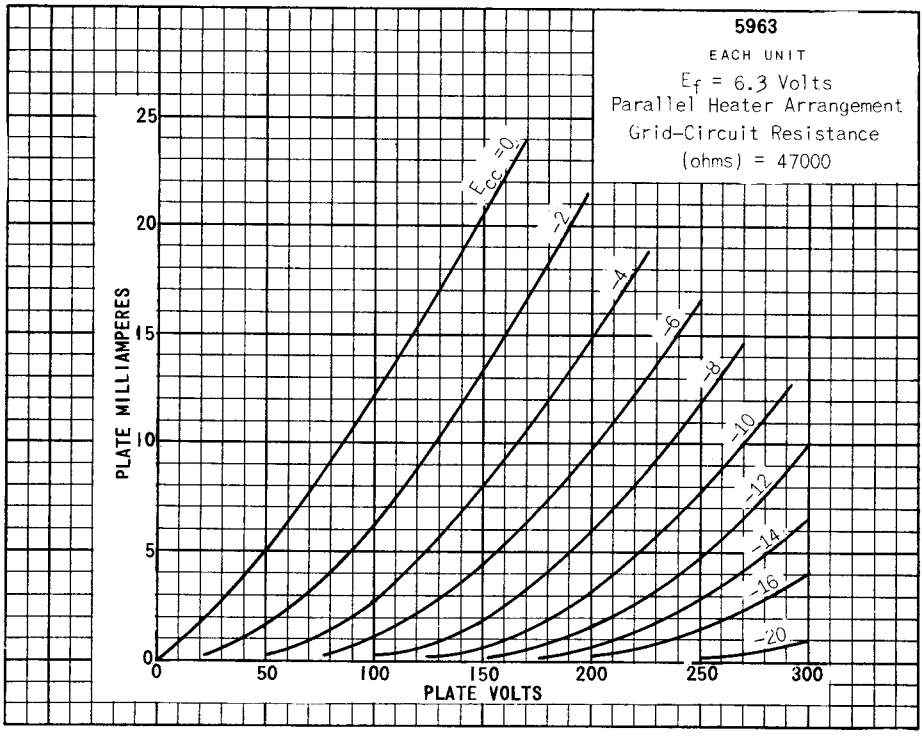
GRID-CIRCUIT RESISTANCE: (MAX.)		
FOR FIXED BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1.0	MEGOHM

RANGE VALUES FOR EQUIPMENT DESIGN

	NOTE	MIN	MAX	
CUTOFF CONDITION				
PLATE CURRENT	1	—	50	μAMP.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	—	—	50	μAMP.
ZERO-BIAS CONDITION				
PLATE CURRENT	2	4.6	5.4	MA.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	—	—	0.8	MA.

[1] FOR CONDITIONS WITH 12.6 VOLTS ON HEATER, PLATE-SUPPLY VOLTS = 150, PLATE-CIRCUIT RESISTANCE (OHMS) = 20000, GRID-SUPPLY VOLTS = −15, AND GRID-CIRCUIT RESISTANCE (OHMS) = 47000.

[2] CONDITIONS ARE SAME AS FOR NOTE 1 EXCEPT THAT GRID-SUPPLY VOLTS = 0.



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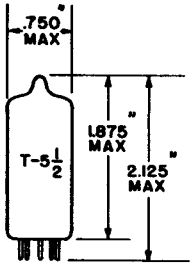
TUNG-SOL

→ TWIN TRIODE

MINIATURE TYPE



GLASS BULB
SMALL-BUTTON MINIATURE
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

UNIPOTENTIAL CATHODE

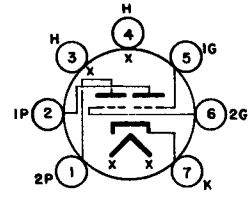
HEATER

6.3±10% VOLTS 0.45 AMP.

AC OR DC

OPERATING POSITION**.

**ANY, BUT FOR UTMOST IN SERVICE, THE TUBE SHOULD BE OPERATED IN A VERTICAL POSITION WITH BASE UP OR DOWN, OR IN A HORIZONTAL POSITION WITH BASE PINS 1 & 6 IN A VERTICAL PLANE.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BF

THE 5964 IS A MEDIUM-MU TWIN TRIODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR FREQUENCY-DIVIDER CIRCUITS IN ELECTRONIC COMPUTERS AND OTHER 'ON-OFF' CONTROL APPLICATIONS REQUIRING LONG PERIODS OF OPERATION UNDER CUT-OFF CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

EACH UNIT

GRID TO PLATE	1.3	pf
GRID TO CATHODE AND HEATER	2.1	pf
PLATE TO CATHODE AND HEATER	0.4	pf
GRID OF UNIT #1 TO GRID OF UNIT #2 (MAX.)	0.5	pf

RATINGS

MAXIMUM ABSOLUTE VALUES

EACH UNIT

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE BIAS VALUE	100	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
PEAK NEGATIVE VALUE	200	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM GRID INPUT	0.1	WATT
MAXIMUM DC CATHODE CURRENT [A]	15	MA.
MAXIMUM PEAK CATHODE CURRENT [A]	75	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	150	°C

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER - EACH UNIT
WITH BOTH UNITS OPERATING

PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	50	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6500	OHMS
TRANSCONDUCTANCE	6000	μMHOS
PLATE CURRENT	9.5	MA.

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

TYPICAL OPERATION AS FREQUENCY HALFER
EACH UNIT

	CUTOFF CONDITION	ZERO-BIAS CONDITION	
PLATE-SUPPLY VOLTAGE	150	150	VOLTS
PLATE-CIRCUIT RESISTANCE	20000	20000	OHMS
GRID-SUPPLY VOLTAGE	-10	0	VOLTS
GRID-CIRCUIT RESISTANCE	47000	47000	OHMS
PLATE CURRENT	0	5	MA.

CIRCUIT VALUES

GRID-CIRCUIT RESISTANCE: (MAX.)		
FOR FIXED-BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1.0	MEGOHM

RANGE VALUES FOR EQUIPMENT DESIGN

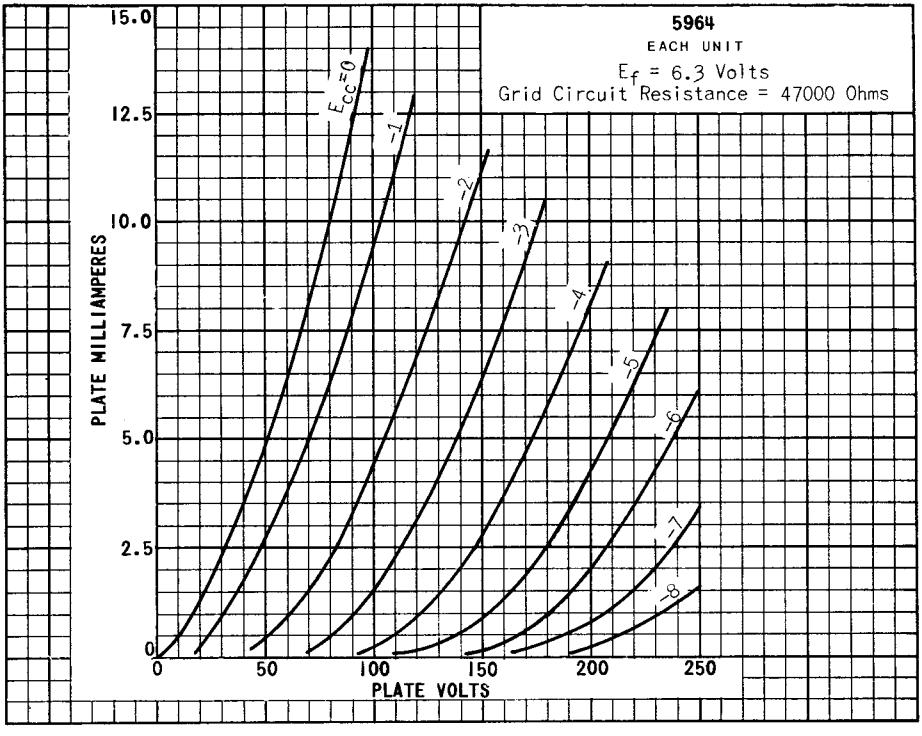
CUTOFF CONDITION	MIN.	MAX.	
PLATE CURRENT (EACH UNIT) [B]	---	0.075	MA.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	---	0.2	MA.
ZERO-BIAS CONDITION			
PLATE CURRENT (EACH UNIT) [C]	4.3	5.7	MA.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	---	1.4	MA.

[A] WITH BOTH UNITS OPERATING, THE DC CATHODE CURRENT SHOULD NOT EXCEED 30 MILLIAMPERES, AND THE PEAK CATHODE CURRENT SHOULD NOT EXCEED 150 MILLIAMPERES.

[B] FOR CONDITIONS WITH 6.3 VOLTS ON HEATER, PLATE-SUPPLY VOLTS = 150, PLATE-CIRCUIT RESISTANCE (OHMS) = 20000, GRID-SUPPLY VOLTS = -10, AND GRID-CIRCUIT RESISTANCE (OHMS) = 47000.

[C] CONDITIONS ARE SAME AS FOR NOTE 1 EXCEPT THAT GRID-SUPPLY VOLTS = 0.

* COMMON TO BOTH UNITS.



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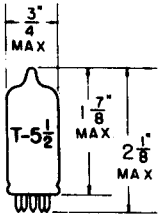
TUNG-SOL

TRIODE

MINIATURE TYPE



GLASS BULB

UNIPOTENTIAL CATHODE

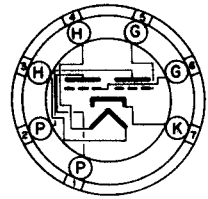
HEATER

6.3±10% VOLTS 0.45 AMP.

AC OR DC

OPERATING POSITION[#]

[#]ANY, BUT FOR UTMOST IN SERVICE, THE TUBE SHOULD BE OPERATED IN A VERTICAL POSITION WITH BASE UP OR DOWN, OR IN A HORIZONTAL POSITION WITH BASE PINS 1 & 6 IN A VERTICAL PLANE.



BOTTOM VIEW

SMALL-BUTTON MINIATURE

7 PIN BASE

7 BF

THE 5964 IS A MEDIUM-MU TRIODE IN THE 7 PIN MINATURE CONSTRUCTION. IT IS ESPECIALLY DESIGNED FOR FREQUENCY-DIVIDER CIRCUITS IN ELECTRONIC COMPUTERS, AND OTHER 'ON-OFF' CONTROL APPLICATIONS REQUIRING LONG PERIODS OF OPERATION UNDER CUT-OFF CONDITIONS.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

EACH UNIT

GRID TO PLATE	1.3	μμf
GRID TO CATHODE AND HEATER	2.1	μμf
PLATE TO CATHODE AND HEATER	0.4	μμf
GRID OF UNIT #1 TO GRID OF UNIT #2 (MAX.)	0.5	μμf

RATINGS

MAXIMUM ABSOLUTE VALUES

EACH UNIT

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM GRID VOLTAGE:		
NEGATIVE BIAS VALUE	100	VOLTS
POSITIVE BIAS VALUE	0	VOLTS
PEAK NEGATIVE VALUE	200	VOLTS
MAXIMUM PLATE DISSIPATION	1.5	WATTS
MAXIMUM GRID INPUT	0.1	WATT
MAXIMUM DC CATHODE CURRENT [A]	15	MA.
MAXIMUM PEAK CATHODE CURRENT [A]	75	MA.
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	90	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	90	VOLTS
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB SURFACE)	150	°C

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A AMPLIFIER - EACH UNIT
WITH BOTH UNITS OPERATING

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	0.45	AMP.
PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	50	OHMS
AMPLIFICATION FACTOR	39	
PLATE RESISTANCE	6500	OHMS
TRANSCONDUCTANCE	6000	μMHOS
PLATE CURRENT	9.5	MA.

FREQUENCY DIVIDER IN COMPUTER SERVICE
AND
'ON-OFF' CONTROL SERVICE

TYPICAL OPERATION AS FREQUENCY HALFER
EACH UNIT

	CUTOFF CONDITION	ZERO-BIAS CONDITION	
PLATE-SUPPLY VOLTAGE	150	150	VOLTS
PLATE-CIRCUIT RESISTANCE	20000	20000	OHMS
GRID-SUPPLY VOLTAGE	-10	0	VOLTS
GRID-CIRCUIT RESISTANCE	47000	47000	OHMS
PLATE CURRENT	0	5	MA.

CIRCUIT VALUES

GRID-CIRCUIT RESISTANCE: (MAX.)		
FOR FIXED-BIAS OPERATION	0.5	MEGOHM
FOR CATHODE-BIAS OPERATION	1.0	MEGOHM

RANGE VALUES FOR EQUIPMENT DESIGN

CUTOFF CONDITION	MIN.	MAX.	
PLATE CURRENT (EACH UNIT) [B]	---	0.075	MA.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	---	0.2	MA.
ZERO-BIAS CONDITION			
PLATE CURRENT (EACH UNIT) [C]	4.3	5.7	MA.
DIFFERENCE IN PLATE CURRENT BETWEEN UNITS	---	1.4	MA.

[A] WITH BOTH UNITS OPERATING, THE DC CATHODE CURRENT SHOULD NOT EXCEED 30 MILLIAMPERES, AND THE PEAK CATHODE CURRENT SHOULD NOT EXCEED 150 MILLIAMPERES.

[B] FOR CONDITIONS WITH 6.3 VOLTS ON HEATER, PLATE-SUPPLY VOLTS = 150, PLATE-CIRCUIT RESISTANCE (OHMS) = 20000, GRID-SUPPLY VOLTS = -10, AND GRID-CIRCUIT RESISTANCE (OHMS) = 47000.

[C] CONDITIONS ARE SAME AS FOR NOTE 1 EXCEPT THAT GRID-SUPPLY VOLTS = 0.

* COMMON TO BOTH UNITS.

→ INDICATES A CHANGE

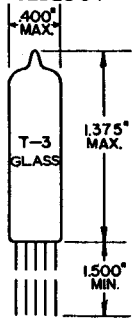
TUNG-SOL

TRIODE

SUBMINIATURE

OUTLINE DRAWING

JEDEC 3-1



SUBMINIATURE BASE 8 PIN BUTTON
JEDEC E8-10

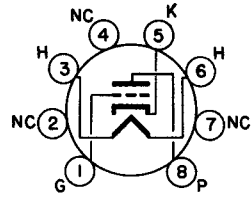
MEDIUM - MU TRIODE
FOR
OPERATION IN
CONTROL CIRCUITS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM

JEDEC 8DK



BOTTOM VIEW

THE 5977 IS A MEDIUM-MU TRIODE IN THE T-3 SUBMINIATURE CONSTRUCTION. IT IS DESIGNED PRIMARILY FOR OPERATION IN CONTROL CIRCUITS WHERE LONG LIFE AND STABLE PERFORMENCE ARE ESSENTIAL. THE RUGGEDIZED CONSTRUCTION MAKE IT SUITABLE FOR SERVICE WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK AND VIBRATION ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

	UNSHIELDED	WITH 0.405" D. EXTERNAL SHIELD CONNECTED TO CATHODE	
GRID TO PLATE	1.3	1.3	pf
INPUT	2.0	2.0	pf
OUTPUT	0.8	2.2	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	150	MA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
HEATER CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	180	VOLTS
GRID VOLTAGE	-55	VOLTS
PLATE DISSIPATION	3.3	WATTS
PLATE CURRENT	22	MA
PEAK GRID CURRENT	4.4	MA
BULB TEMPERATURE	220	°C

CHARACTERISTICS

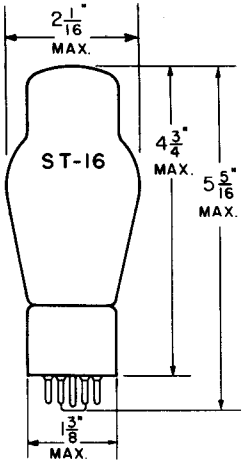
PLATE VOLTAGE - DC	100	VOLTS
CATHODE RESISTOR	270	OHMS
PLATE CURRENT	10.0	MA
AMPLIFICATION FACTOR	16	
TRANSCONDUCTANCE	4,500	μMHOS
GRID VOLTAGE FOR $I_b = 10\ \mu A$	-13.5	VOLTS

SPECIAL TESTS

LOW FREQUENCY VIBRATION TEST
LOW FREQUENCY VIBRATION FATIQUE
SHOCK TEST

TUNG-SOL

TWIN TRIODE

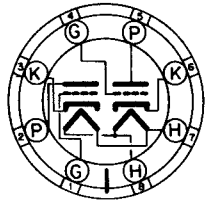


GLASS BULB

HEATER

6.3±10% VOLTS 2.4 AMP.

BASE DOWN MOUNTING POSITION



BOTTOM VIEW
MEDIUM SHELL
8 PIN OCTAL
8BD

THE 5998 IS A MEDIUM MU TWIN POWER TRIODE USED PRIMARILY AS A PASSING TUBE IN SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINISIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 5998 NOT ONLY MEETS THESE REQUIREMENTS BUT POSSESSES THE ADDITIONAL ADVANTAGE OF REQUIRING LITTLE GRID VOLTAGE SWING TO CONTROL THESE CURRENTS. THIS PERMITS THE USE OF SIMPLER CONTROL AMPLIFIER CIRCUITS IN THE REGULATED SUPPLY.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 VOLTS)	2.4	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	14 000	μMHOS
AMPLIFICATION FACTOR	5.5	
INTER-ELECTRODE CAPACITIES PER TRIODE SECTION:		
GRID TO CATHODE	7.7	μμf
GRID TO PLATE	18.3	μμf
CATHODE TO PLATE	2.5	μμf
HEATER TO CATHODE	10.0	μμf
INTER-ELECTRODE CAPACITIES BETWEEN TRIODE SECTIONS:		
SECTION 1 PLATE TO SECTION 2 PLATE	1.7	μμf

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MECHANICAL DATA

MOUNTING POSITION	BASE DOWN	
BULB	ST-16	
BASE	MEDIUM SHELL—OCTAL—8 PIN JETEC #88-11	
AVERAGE NET WEIGHT	2.4	OUNCES
MAXIMUM VIBRATION RATING (O TO 25 CPS)	2.5	G

RATINGS
ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
POWER DISSIPATION PER PLATE	---	15	WATTS
PLATE CURRENT PER PLATE. DC	---	140	MA,DC
IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 50 VOLTS, THIS CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE.			
PLATE VOLTAGE DC	---	275	VOLTS
HEATER—CATHODE VOLTAGE DC	-100	+100	VOLTS
GRID VOLTAGE	---	0	VOLTS
HEATER VOLTAGE	5.7	6.9	VOLTS
ENVELOPE TEMPERATURE	---	*	°C
ALTITUDE FOR FULL RATINGS	---	10 000	FEET
CIRCUIT VALUES:			
TOTAL GRID CIRCUIT RESISTANCE	500	500 000	OHMS
RESISTANCE PER GRID LEG WHEN TRIODE SECTIONS ARE PARALLELED	500	---	OHMS

CATHODE RESISTANCE:

MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL BE 15 OHMS OR THAT RESISTANCE NECESSARY TO PROVIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS GREATER.

*FOR OPTIMUM TUBE LIFE BULB TEMPERATURE SHOULD NOT ESCEED 150° C. AT FULL DISSIPATION ON BOTH TRIODE SECTIONS IT WILL BE NECESSARY TO PROVIDE FORCED AIR COOLING TO KEEP THE BULB TEMPERATURE WITHIN THIS RATING.

RANGE OF VALUES

	MINIMUM	MAXIMUM	
CONDITIONS: E_f=6.3V, E_b=120V, E_c=-14V.			
PLATE CURRENT PER SECTION DC	50	125	MA.
AMPLIFICATION FACTOR	4.8	6.2	
TRANSCONDUCTANCE	11 000	17 000	μMHOS
HEATER CURRENT PER TUBE	2.20	2.60	AMP.
CONDITIONS: E_f=6.3V, E_b=200V, E_c=-55V, R_k=O			
PLATE CURRENT PER SECTION DC	0	10	MA.
CONDITIONS: E_f=6.3V, E_b=60V, E_c=0V.			
PLATE CURRENT PER SECTION DC	135	---	MA.

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APPLICATION NOTES

THE 5998 IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE SIXTH THE VALUE $\left(\frac{R}{\mu + 1}\right)$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE SIXTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (LESS THAN ONE WATT) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATED OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.

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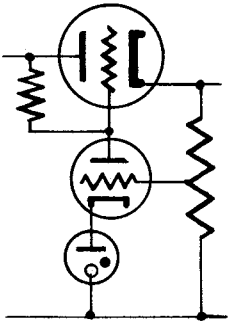


Figure 1

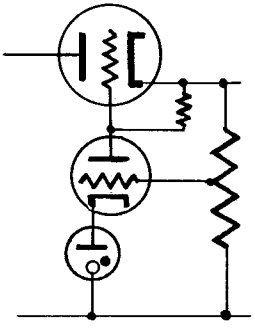


Figure 2

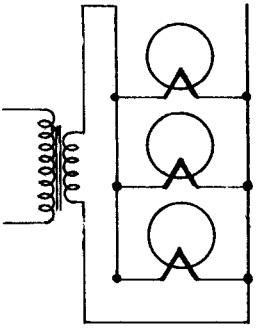
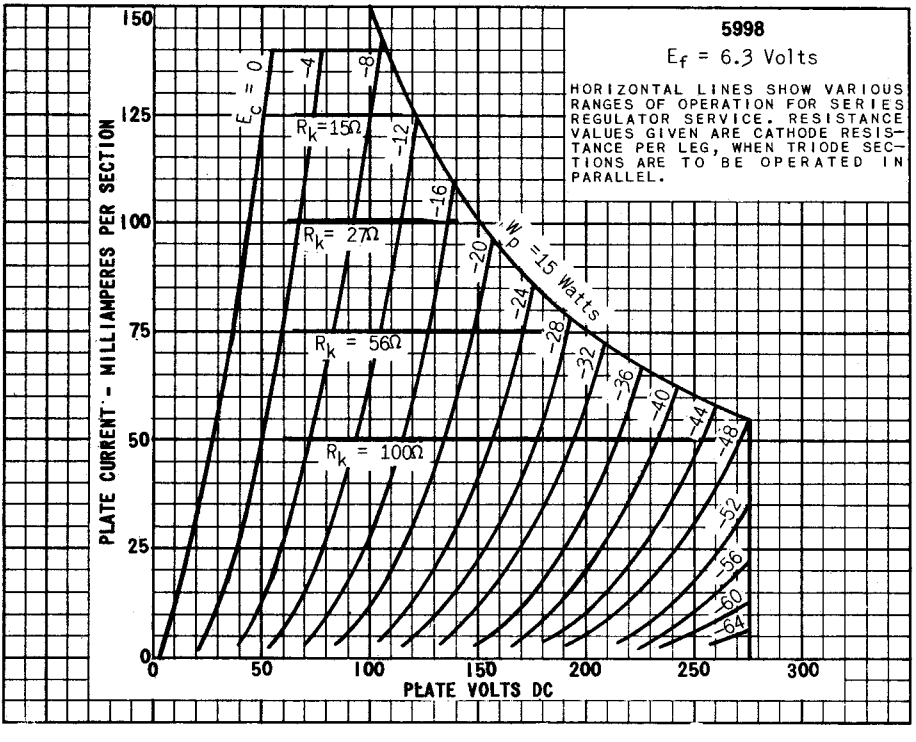
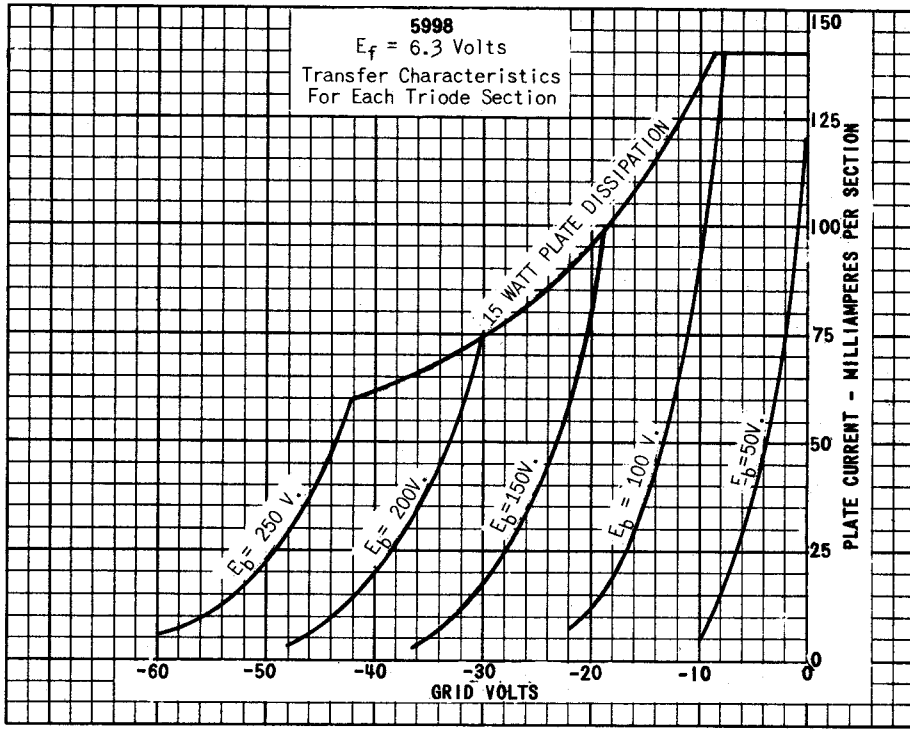
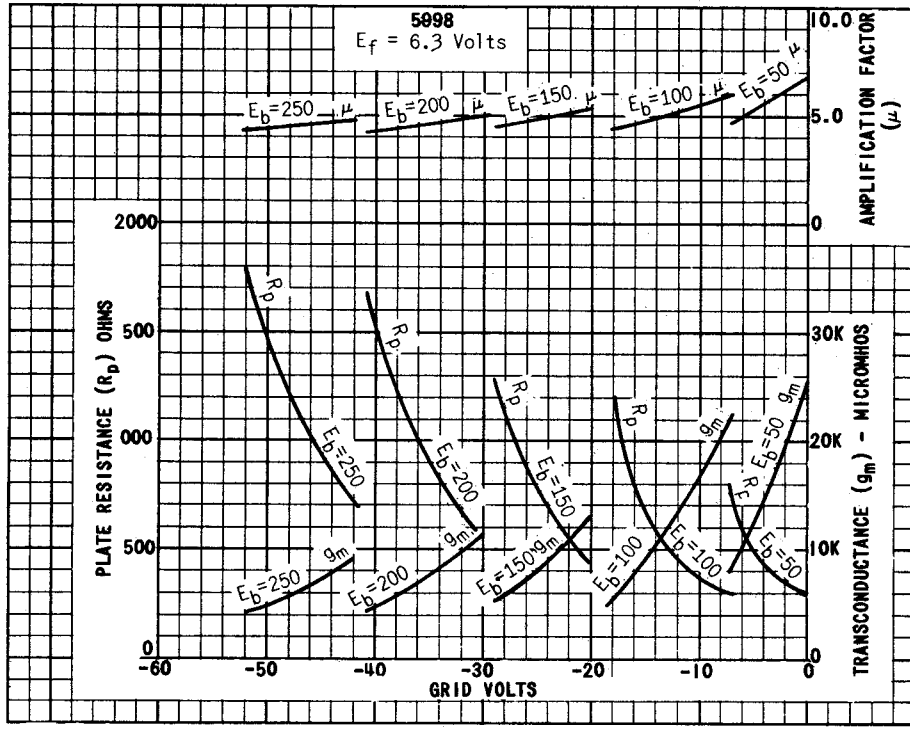


Figure 3

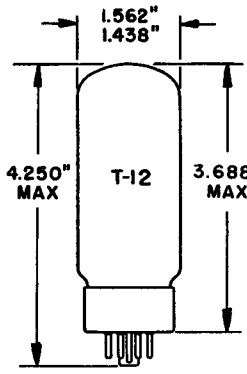



5998
Ef = 6.3 Volts
Transfer Characteristics
For Each Triode Section
.15 WATT PLATE DISSIPATION
Eb = 250 V.
Eb = 200V.
Eb=150V.
Eb = 100 V.
Eb=50V.
PLATE CURRENT - MILLIAMPERES PER SECTION
150
125
100
75
50
25
0
-60
-50
-40
-30
-20
-10
0
GRID VOLTS


5998
Ef = 6.3 Volts
Eb=250 μ
Eb=200 μ
Eb=150 μ
Eb=100 μ
Eb=50 μ
AMPLIFICATION FACTOR (μ)
10.0
5.0
0
PLATE RESISTANCE (Rp) OHMS
2000
500
000
500
0
Rp
Eb=250
Eb=200
Eb=150
Eb=100
Eb=50
gm
TRANSCONDUCTANCE (gm) - MICROMHOS
30K
20K
10K
0
-60
-50
-40
-30
-20
-10
0
GRID VOLTS

TUNG-SOL

TWIN TRIODE



GLASS BULB
SHORT MEDIUM SHELL
8 PIN OCTAL B8-110
OUTLINE DRAWING
JEDEC 12-15

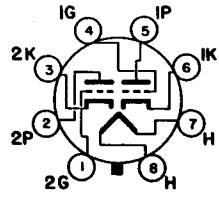
FOR

SERIES REGULATOR

APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8BD

THE 5998A IS A LOW-MU TWIN TRIODE DESIGNED FOR SERVICE AS A SERIES REGULATOR IN DC POWER SUPPLIES. EXCEPT FOR THE USE OF T-12 ENVELOPE AND A DIFFERENT BASE, THE 5998A IS IDENTICAL TO THE 5998.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID TO PLATE, EACH SECTION: (G TO P)	14.5	pf
INPUT, EACH SECTION: G TO (H + K)	6.5	pf
OUTPUT, EACH SECTION: P TO (H + K)	2.0	pf
HEATER TO CATHODE, EACH SECTION: (H TO K)	11	pf
PLATE, SECTION 1 TO PLATE, SECTION 2: (1P TO 2P)	2.0	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

AVERAGE CHARACTERISTICS	6.3	VOLTS	2.4	AMP.
CATHODE HEATING TIME (MINIMUM)			30	SECONDS
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	275	VOLTS
PLATE DISSIPATION	15	WATTS
DC PLATE CURRENT	140	MA.
GRID CIRCUIT RESISTANCE	0.25	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT [A]	200	°C

AVERAGE CHARACTERISTICS

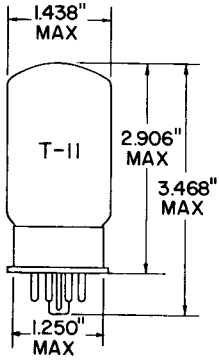
EACH SECTION

PLATE SUPPLY VOLTAGE	110	VOLTS
CATHODE-BIAS RESISTOR	105	OHMS
AMPLIFICATION FACTOR	5.4	
PLATE RESISTANCE, APPROX.	350	OHMS
TRANSCONDUCTANCE	15,500	μMHOS
PLATE CURRENT	100	MA.

[A] FOR OPTIMUM TUBE LIFE, THE BULB TEMPERATURE SHOULD BE MAINTAINED BELOW 150 °C BY FORCED AIR COOLING.

TUNG-SOL

BEAM POWER PENTODE



GLASS BULB
METAL SHELL
SMALL WAFER OCTAL
6 PIN BASE B6-23

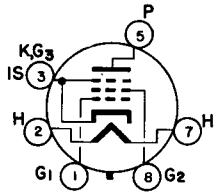
COATED UNIPOTENTIAL CATHODE

HEATER

26.5±2.7 VOLTS 0.28[A] AMP.

[A] AT 26.5 V.

ANY MOUNTING POSITION



BOTTOM VIEW [B]

BASING DIAGRAM
JEDEC 6CK

THE 6000 IS A SINGLE ENDED BEAM POWER PENTODE AMPLIFIER FOR RADIO FREQUENCY APPLICATIONS TO 100 MEGACYCLES. ITS 26.5 VOLT HEATER MAKES IT SUITABLE FOR VEHICULAR OR AIRCRAFT USE. THE RUGGED BUTTON-STEM CONSTRUCTION FEATURES SHORT INTERNAL LEADS AND A LOW-LOSS 6 PIN OCTAL BASE.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID TO PLATE: G1 TO P (MAX.)	0.18	pf
INPUT: G1 TO (H+K+G2+BASE SHELL)	15.0	pf
OUTPUT: P TO (H+K+G2+BASE SHELL)	7.0	pf

RATINGS[C]
INTERPRETED ACCORDING TO ABSOLUTE MAXIMUM SYSTEM

CLASS C AMPLIFIER OR OSCILLATOR

HEATER VOLTAGE	26.5±2.7	VOLTS
DC PLATE VOLTAGE	600	VOLTS
DC #2 GRID VOLTAGE	300	VOLTS
DC #1 GRID VOLTAGE-NEGATIVE	-200	VOLTS
DC PLATE CURRENT	125	MA.
DC GRID CURRENT	7	MA.
PLATE INPUT	60	WATTS
PLATE DISSIPATION	25	WATTS
GRID #2 DISSIPATION	4.0	WATTS
HEATER-CATHODE VOLTAGE, POSITIVE OR NEGATIVE	100	VOLTS

[B] AT THE HIGHER FREQUENCIES IT MAY BE DESIRABLE TO GROUND THE METAL BASE SHELL THROUGH A CLAMPING DEVICE.

[C] TO 100 MC.

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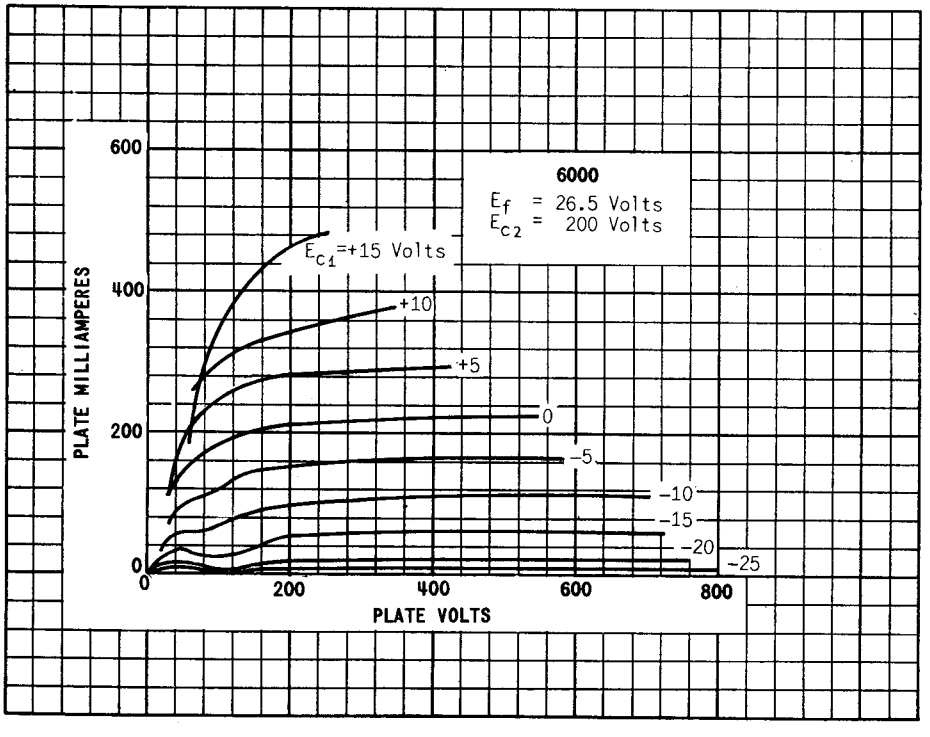
TYPICAL OPERATION

70 MC

PLATE VOLTAGE	400	600	VOLTS
GRID #2 VOLTAGE	200	225	VOLTS
GRID #1 VOLTAGE—DEVELOPED	-60	-60	VOLTS
GRID #1 RESISTOR	12,000	20,000	OHMS
PEAK RF GRID VOLTAGE	75	75	VOLTS
DC PLATE CURRENT	125	100	MA.
DC GRID #2 CURRENT	16	18	MA.
DC GRID #1 CURRENT	5.0	3.0	MA.
DRIVING POWER—MAX.	0.40	0.23	WATTS
POWER OUTPUT	28	35	WATTS

AVERAGE CHARACTERISTICS

TRANSCONDUCTANCE—FOR PLATE CURRENT OF 70 MA.	8000	μMHOS
AMPLIFICATION FACTOR, GRID #2 TO GRID #1	8	



TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6012

DECEMBER, 1962

SHIELD GRID THYRATRON

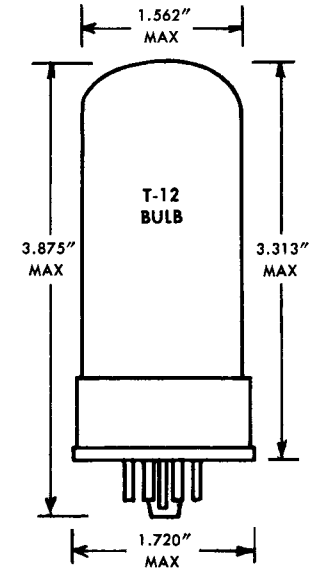
DESCRIPTION — The 6012 is a negative control, xenon filled, four electrode thyratron designed for use in relay and grid-controlled rectifier applications. One type 6012 will carry 0.5 ampere in motor-control and in inverter service.

Use of the shield-grid type of construction permits a very low preconduction control grid current to flow. This permits the use of a high resistance in the control grid circuit. The grid control characteristic is independent of ambient temperature over the range from −75 to +90 degrees Centigrade due to the tube's inert gas filling. The 6012 mounts in a standard octal socket.

ELECTRICAL DATA

Heater Voltage	6.3 ± 10%	Volts
Heater Current (E_f = 6.3 Volts)	2.6	Amperes
Minimum Cathode Heating Time	30	Seconds
Interelectrode Capacitances — Approximate		
Anode to Control Grid	0.65	Micromicrofarads
Control Grid to Cathode (and Shield Grid)	6.5	Micromicrofarads
Anode to Cathode (and Shield Grid)	4.5	Micromicrofarads
Anode Voltage Drop — Approximate	12	Volts
Maximum Critical Grid Current (at Epp = 460 Volts RMS and Ib = 0.5 Ampere)	3	Microamperes
Ionization Time — Approximate		
Anode Volts = 100, Anode Current = 5 Amperes, Shield Grid Volts = 0, Control Grid = + 50 Volt Square Wave Pulse	0.5	Microseconds
Deionization Time — Approximate — Note 1		
Anode Volts = 125, Anode Current = 0.5 Amperes, Shield Grid Resistor = 1000 Ohms, Control Grid Volts = −13, Control Grid Resistor = 1000 Ohms	175	Microseconds
Anode Volts = 125, Anode Current = 0.5 Amperes, Shield Grid Resistor = 1000 Ohms, Control Grid Volts = −100, Control Grid Resistor = 1000 Ohms	100	Microseconds

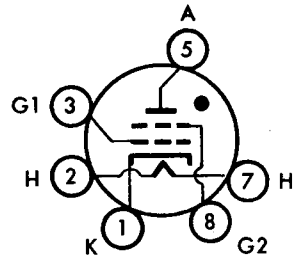
Note 1. Connect shield grid to cathode through 1000 ohm series resistor.



OUTLINE DRAWING

MECHANICAL DATA

Mounting Position	Any
Bulb	T12
Base	Large wafer octal with metal sleeve, 6 pin, JEDEC No. B6-100
Maximum Net Weight	2.5 Ounces



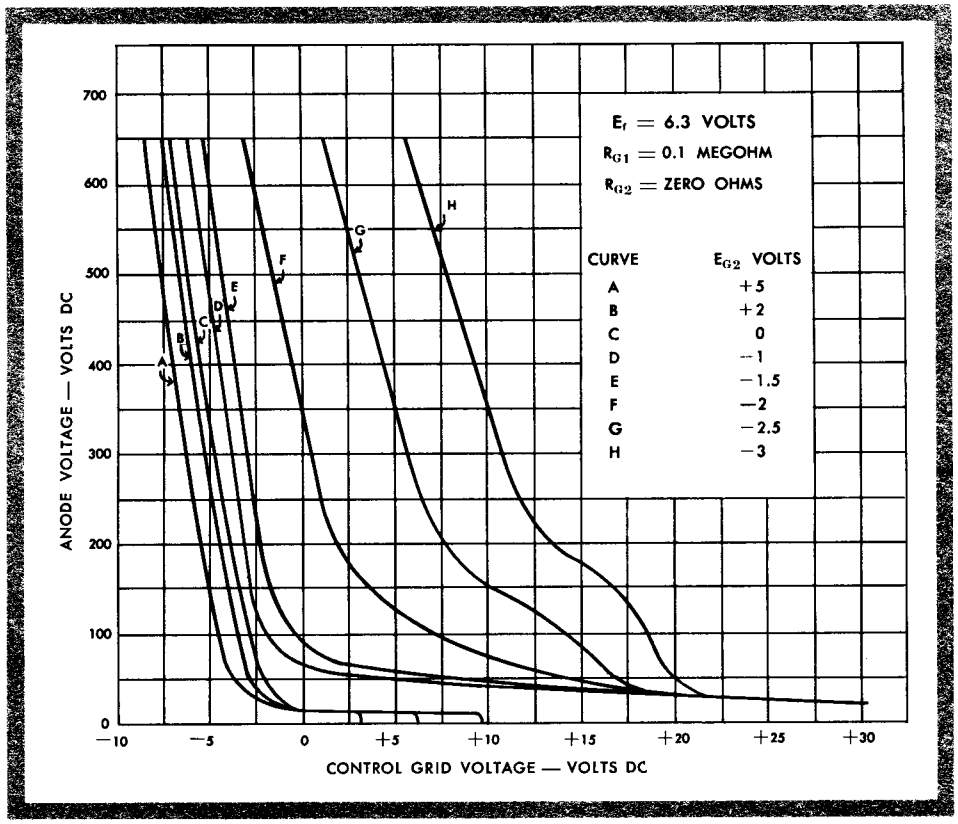
BASING DIAGRAM
BOTTOM VIEW
6CO

RATINGS, ABSOLUTE VALUES
(For Anode-Supply Frequency of 60 CPS)

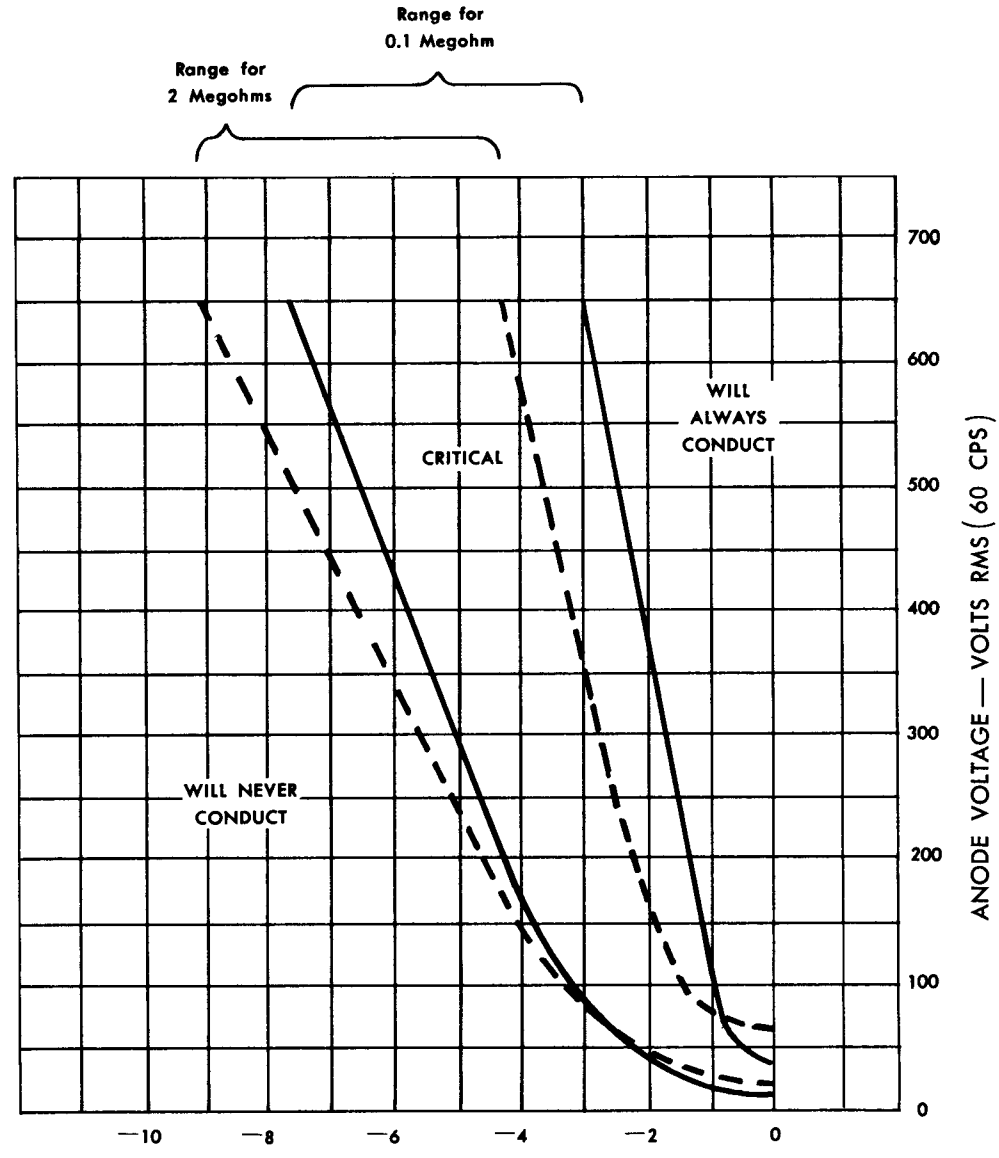
Maximum Peak Anode Voltage		
Forward	650	Volts
Inverse	1300	Volts
Maximum Cathode Current		
Peak	5	Amperes
Average — Note 1	0.5	Ampere
Surge — Maximum Duration 0.1 Second — Note 2	20	Amperes
Maximum Negative Control Grid Voltage		
Before Conduction	200	Volts
During Conduction — Note 1	10	Volts
Maximum Positive Control Grid Current		
Average — Note 1	0.05	Ampere
Maximum Negative Shield Grid Voltage		
Before Conduction	100	Volts
During Conduction — Note 1	10	Volts
Maximum Positive Shield Grid Current — Note 1	0.05	Ampere
Maximum Heater — Cathode Voltage		
Heater Negative	100	Volts
Heater Positive	25	Volts
Maximum Control Grid Circuit Resistance	2	Megohms

Notes 1. Averaged over any interval of 30 seconds maximum.

2. The equipment designer should limit the short circuit current to 20 amperes circuitwise. It should be understood that while the tube may stand several faults at this magnitude of current, each fault will adversely affect tube life.

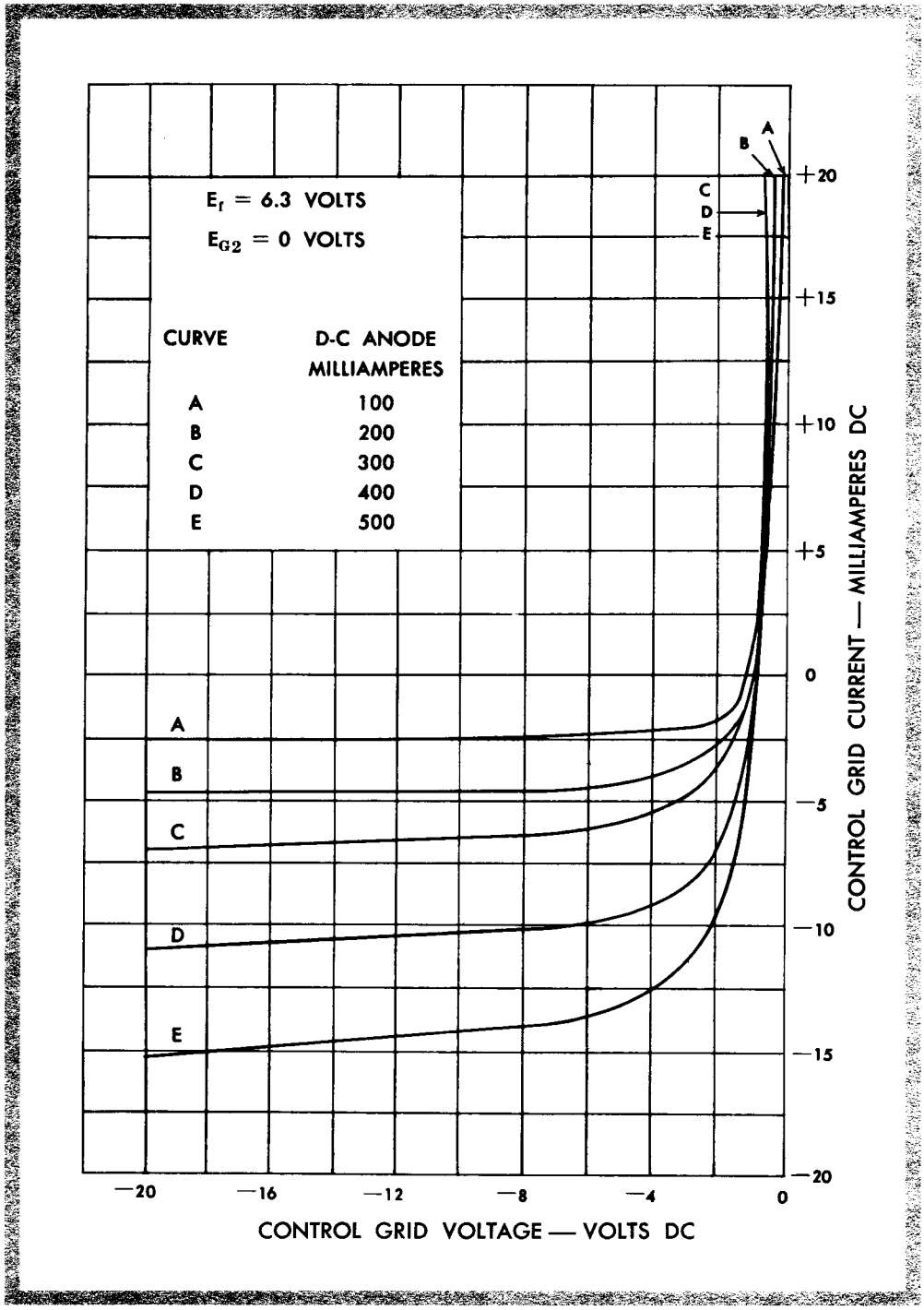


AVERAGE CONTROL CHARACTERISTICS



Critical conduction area is shown for two values of grid resistor, 0.1 megohm and 2 megohms, and zero voltage applied to grid No. 2. Allowance is made for initial differences between individual tubes and variations during tube life for a range of heater voltage from 5.7 to 6.9 volts.

OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

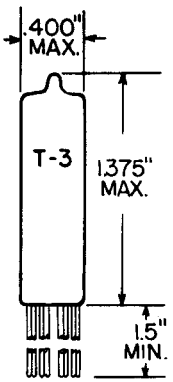


AVERAGE GRID CHARACTERISTICS DURING ANODE CONDUCTION

TUNG-SOL

TWIN TRIODE

SUBMINIATURE TYPE

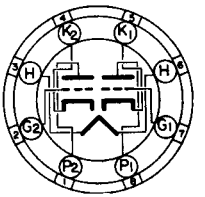


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE — 8 FLEXIBLE LEADS
8DG

THE 6021 IS A RUGGEDIZED MEDIUM MU TWIN TRIODE OF THE LIGHT LEAD, BUTTON, SUBMINIATURE CONSTRUCTION. THE TUBE MAY BE USED AT FREQUENCIES IN THE UHF REGION, PERMITTING APPLICATIONS SUCH AS UHF AND VHF OSCILLATORS AND MIXERS. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS HEATER CURRENT, PLATE CURRENT, AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET THE TEST SEPCIFICATION, THE 6021 IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIR-BORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES — EACH SECTION

	WITH SHIELD*	WITHOUT SHIELD	
GRID TO PLATE (RATED)	1.4	1.5	μμf
MAXIMUM	---	1.7	μμf
MINIMUM	---	1.3	μμf
INPUT (RATED)	2.1	2.4	μμf
MAXIMUM	---	2.8	μμf
MINIMUM	---	2.0	μμf
OUTPUT (SECTION #1) (RATED)	1.3	0.28	μμf
MAXIMUM	---	0.33	μμf
MINIMUM	---	0.23	μμf
OUTPUT (SECTION #2) (RATED)	1.4	0.32	μμf
MAXIMUM	---	0.39	μμf
MINIMUM	---	0.25	μμf
MAXIMUM GRID TO GRID (RATED)	0.011	0.013	μμf
MAXIMUM PLATE TO PLATE (RATED)	0.33	0.52	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM DC PLATE VOLTAGE	165	VOLTS
MAXIMUM DC GRID VOLTAGE	0	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±200	VOLTS
MAXIMUM GRID RESISTANCE (EACH SECTION)	1.1	MEGOHM
MAXIMUM DC PLATE CURRENT (EACH SECTION)	22	mA

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TUNG-SOL

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RATINGS — CONT'D.

ABSOLUTE MAXIMUM VALUES

MAXIMUM DC GRID CURRENT (EACH SECTION)	5.5	mA
MAXIMUM PLATE DISSIPATION (EACH SECTION)	0.7	WATT
MAXIMUM BULB TEMPERATURE	220	°C
MAXIMUM ALTITUDE [A]	60 000	FEET
LIFE EXPECTANCY:		
30°C AMBIENT TEMPERATURE	5 000	HOURS
175°C AMBIENT TEMPERATURE	1 000	HOURS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.3	AMP.
DC PLATE VOLTAGE	100	VOLTS
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	6.5	Ma
TRANSCONDUCTANCE	5 400	μMHOS
AMPLIFICATION FACTOR	35	
GRID VOLTAGE FOR 10μa PLATE CURRENT	-6.5	VOLTS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 100Vdc, E_c = 0 Vdc, Rk/k = 150 OHMS

EXCEPT AS MODIFIED BELOW

	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	500 HOUR LIFE TEST INDIVIDUAL MIN.	500 HOUR LIFE TEST INDIVIDUAL MAX.	
HEATER CURRENT	280	320	288	312	276	328	mA
HEATER-CATHODE LEAKAGE [B] (E_{hk}=±100Vdc)	---	±5.0	---	---	---	±10	μAdc
GRID CURRENT (E_b= 150Vdc, R_k=300, R_{g1}=1.0 MEG.)	0	-0.3	---	---	0	-0.9	μAdc
PLATE CURRENT (1)	4.5	8.5	5.6	7.3	---	---	mAdc
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS	---	1.6	---	---	---	---	mAdc
PLATE CURRENT (2) (E_c=6.5Vdc, R_k=0)	---	100	---	---	---	---	μAdc
TRANSCONDUCTANCE (1)	4450	6350	5000	5800	---	---	μMHOS
CHANGE IN INDIVIDUAL TUBES	---	---	---	---	---	25	PERCENT
AVERAGE CHANGE	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES [C] g-ALL	100	---	---	---	50	---	MEGOHMS
p-ALL	100	---	---	---	50	---	MEGOHMS
Δ TRANSCONDUCTANCE (E_f = 5.7V)	---	15	---	---	---	15	PERCENT
GRID EMISSION [D] (E_f=7.5V, E_c=-7.5Vdc E_b=150Vdc, R_k=0, R_p=1.0MEG)	---	-0.5	---	---	---	---	μAdc
PULSE EMISSION [E] (E_f=6.0V, e PULSE=50V, tp=25 usec, prr=200pps)	300	---	---	---	---	---	ma
AMPLIFICATION FACTOR [F]	30	40	---	---	---	---	

SPECIAL REQUIREMENTS

	MIN.	MAX.	
AF NOISE [GH] (E_{sig}=65mVac, R_g=0.1 meg., R_p=.01 meg., R_k=75, C_k=1000μf)	---	17	VU
LOW PRESSURE VOLTAGE BREAKDOWN [J] (PRESSURE =55±5mm Hg., VOLTAGE =300Vac)	---	---	

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TUNG-SOL

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SPECIAL REQUIREMENTS – CONT'D.

	MIN.	MAX.	
VARIABLE FREQUENCY VIBRATION [K] (NO VOLTAGES, POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS APPLY)	---	---	
LOW FREQUENCY VIBRATION [MG] (R_p = 10,000, C_k=1,000 μf, F=40cps, G=15)	---	50	mVac
SUBMINIATURE LEAD FATIGUE [N]	4	---	ARCS
SHOCK [P] (HAMMER ANGLE =30°, E_{hk}=+100Vdc, R_g=0.1meg.)	---	---	
VIBRATIONAL FATIGUE [R] (G =2.5; FIXED FREQUENCY; F=25min. 60 max.)			
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	200	mVac
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	20	μAdc
Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	20	PERCENT
GLASS STRAIN [S]	---	---	
1 HOUR STABILITY LIFE TEST [G] (E_{hlc}=+200Vdc, R_{g1g}=1.0 meg., TA=ROOM)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	15	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (STABILITY LIFE TEST CONDITIONS OR EQUIVALENT TA=ROOM)	---	---	
SURVIVAL RATE LIFE TEST END POINTS CONTINUITY AND SHORTS (INOPERATIVES)	---	---	
TRANSCONDUCTANCE (1)	---	4 000	μMHOS
HEATER CYCLING LIFE TEST [U] (E_f=7.0V, 1 min. on, 4 min. off, E_{hk}=140Vac, E_c= E_b=0)	---	---	
INTERMITTENT LIFE TEST (STABILITY LIFE TEST CONDITIONS, BULB TEMP = 220°C)	---	---	

NOTES

[A] IF ALTITUDE RATING IS EXCEEDED, REDUCTION OF INSTANTANEOUS VOLTAGES (Ef EXCLUDED) MAYBE REQUIRED.

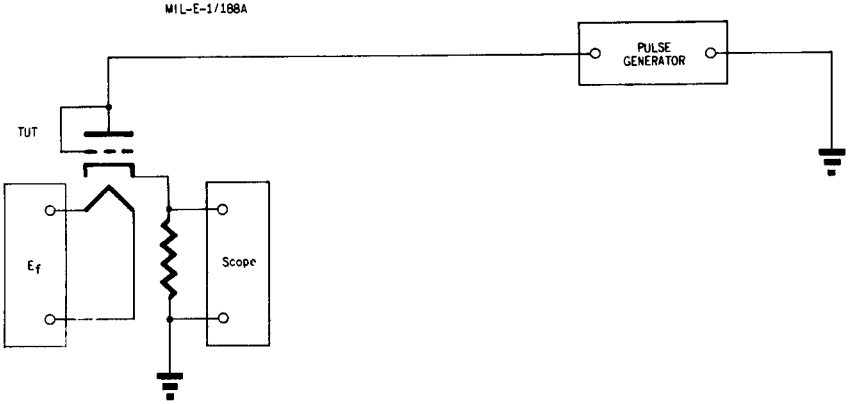
[B] SEE MIL-E-1C 4.10.15

[C] SEE MIL-E-1C 4.8.2

[D] PRIOR TO THIS TEST PRE-HEAT TUBES FOR 5 MINUTES WITH BOTH SECTIONS OPERATING SEPARATELY AT CONDITIONS LISTED BELOW. TEST IMMEDIATELY AFTER PRE-HEATING. (E_f=7.5V, E_c=0Vdc, E_b=150 Vdc, R_k=300 OHMS, R_g=1.0 MEG).

[E] THE PULSE IS ESSENTIALLY A SQUARE WAVE WITH 1.0 USEC RISE TIME AND 0.8 USEC FALL. THE PULSE SHALL BE APPLIED TO PLATE AND GRID TIED TOGETHER. PULSE EMISSION SHALL BE MEASURED IN TERMS OF VOLTAGE DEVELOPED ACROSS A 1.0 OHM RESISTOR IN THE CATHODE CIRCUIT. TEST LIMIT AS MEASURED BY THE LEADING EDGE OF A CALIBRATED TRACE. THE AMPLITUDE OF THE TRAILING EDGE OF WHICH SHALL NOT VARY BY MORE THAN 20% FROM THE VALUE OF THE LEADING EDGE. TEST EACH UNIT SEPARATELY.

MIL-E-1/188A



TUNG-SOL

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NOTES - CONT'D.

F SEE MIL-E-1C 4.10.11.1

G TIE 1K TO 2K, 1g TO 2g, AND 1p TO 2p.

H SEE MIL-E-1C 4.10.3.2

J THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PINS AND ADJACENT PINS WITH NO OTHER VOLTAGES APPLIED.

K SEE MIL-E-1C 4.9.20.3

M SEE MIL-E-1C 4.9.19.1

N SEE MIL-E-1C 4.9.5.3

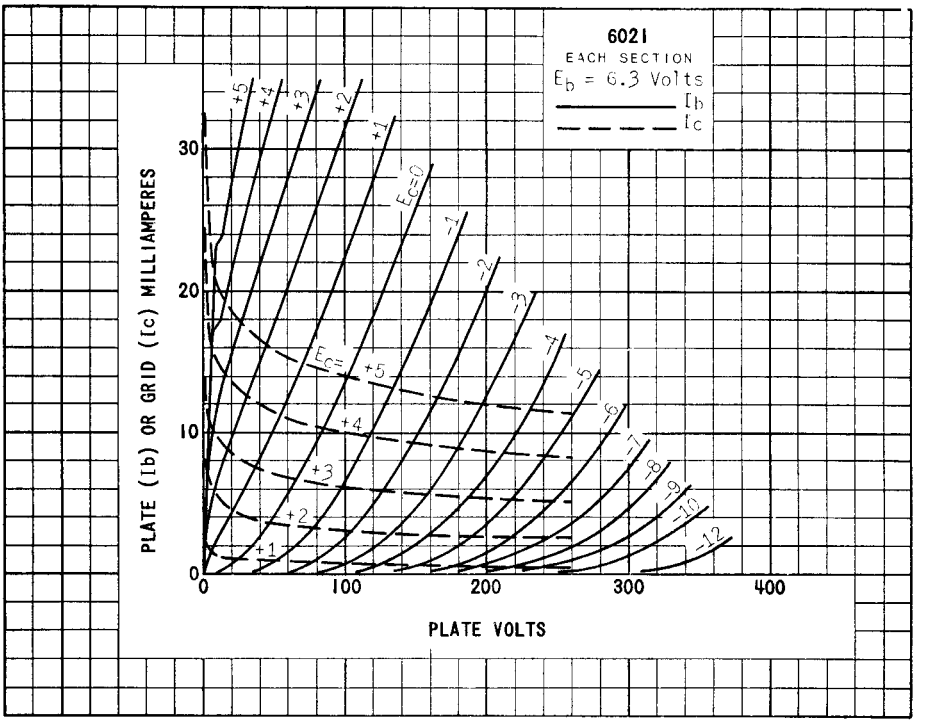
P SEE MIL-E-1C 4.9.20.5

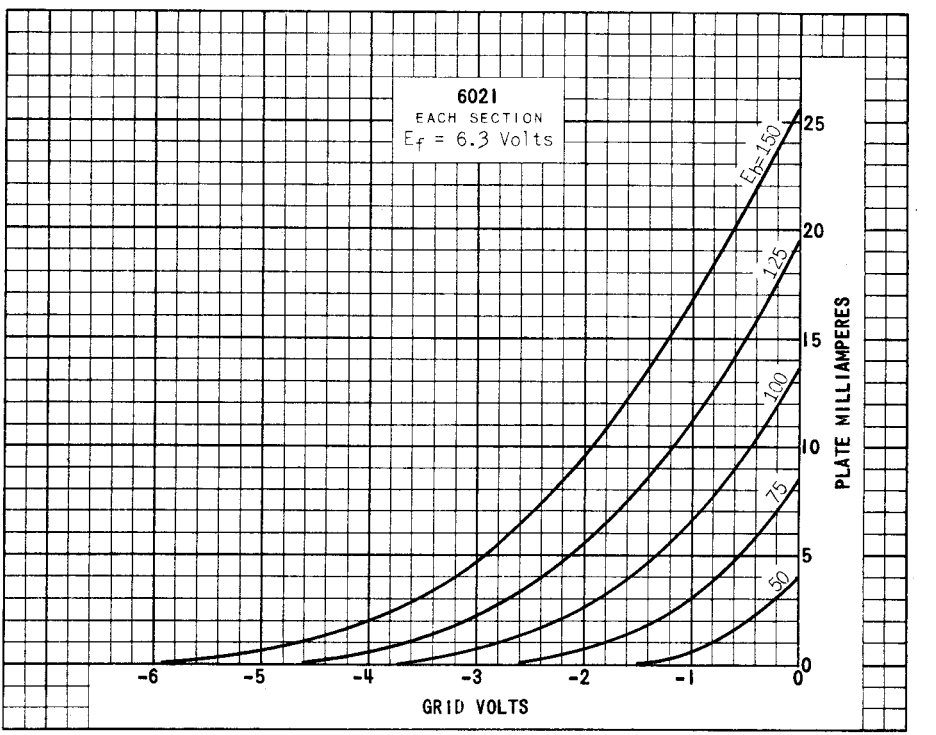
R SEE MIL-E-1C 4.9.20.6

S ALL TUBES SHALL HAVE BEEN SEALED A MINIMUM OF 48 HOURS PRIOR TO CONDUCTING THIS TEST. TUBES SHALL BE AT ROOM TEMPERATURE. ENTIRE TUBE SHALL BE IMMERSED IN WATER NOT LESS THAN 85° C FOR 15 SECONDS AND IMMEDIATELY THEREAFTER IMMERSED IN ICE WATER NOT MORE THAN 50° C FOR 5 SECONDS. TUBES SHALL BE PLACED IN WATER SO THAT NO CONTACT IS MADE WITH THE CONTAINING VESSEL NOR EACH OTHER. TUBES SHALL THEN BE REMOVED AND ALLOWED TO COOL AT ROOM TEMPERATURE ON A WOODEN SURFACE. THE TUBES SHALL BE ALLOWED TO COOL FOR 48 HOURS AND THEN BE INSPECTED FOR EVIDENCE OF AIR LEAKS.

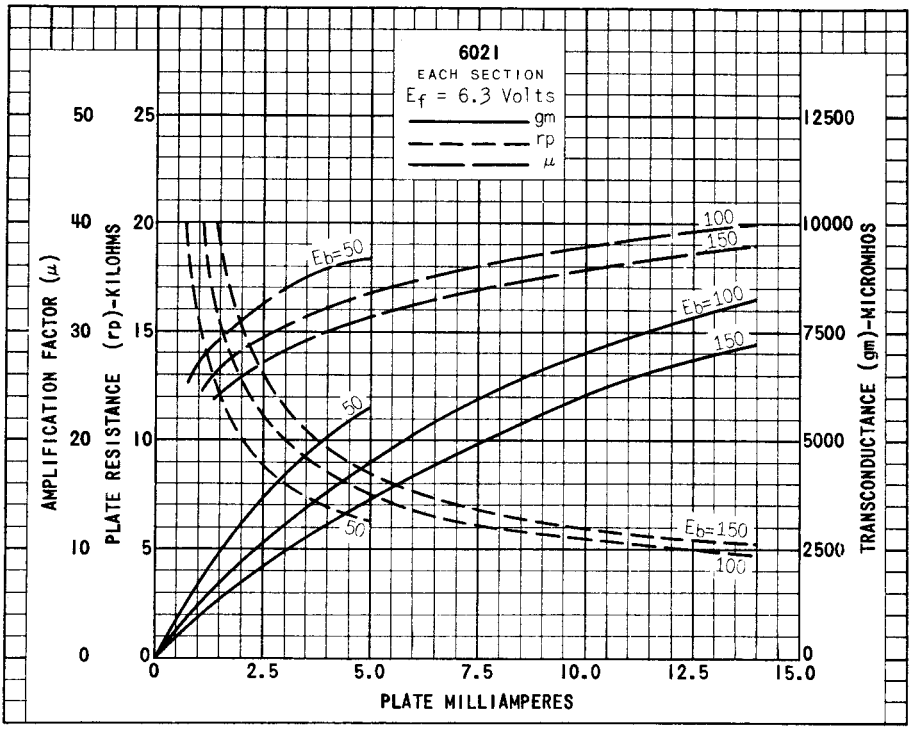
U THE REGULATION OF THE HEATER VOLTAGE SHALL NOT BE MORE THAN 3.0 PERCENT.

* WITH SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE OF SECTION UNDER TEST.


6021
EACH SECTION
Eb = 6.3 Volts
Ib
Ic
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
10
20
30
Eg=0
+5
+4
+3
+2
+1
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-12


6021
EACH SECTION
Ef = 6.3 Volts
Eb=150
125
100
75
50
PLATE MILLIAMPERES
GRID VOLTS
-6
-5
-4
-3
-2
-1
0
5
10
15
20
25

6021
PREMIUM TUBE



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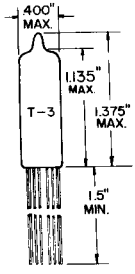
DOUBLE TRIODE

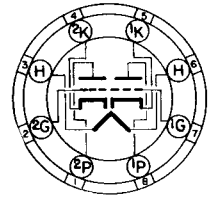
SUBMINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8PIN
0.017" TINNED
FLEXIBLE LEADS

8DG

THE 6021WA IS A HEATER-CATHODE TYPE MEDIUM-MU DOUBLE TRIODE OF SUBMINIATURE CONSTRUCTION CAPABLE OF OPERATION IN THE UHF REGION. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD 8 PIN SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 7	NORM. OPERATION NOTE 6	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	V
PLATE VOLTAGE	Eb:	---	100	100	250	Vdc
PEAK PLATE VOLTAGE	eb:	---	---	---	360	v
GRID VOLTAGE	Ec1:	-55	0	0	---	Vdc
PLATE DISSIPATION (PER PLATE)	Pp/p:	---	---	0.65	0.7	W
GRID #1 CIRCUIT RESISTANCE	Rg/g:	---	---	1.0	1.1	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	Vdc
PLATE CURRENT (PER PLATE)	Ib/p:	0.5	---	6.5	22	mAdc
GRID CURRENT (PER GRID)	Ic/c:	---	---	---	5.5	mAdc
CATHODE RESISTANCE (PER UNIT)	Rk:	---	150	150	---	OHMS
TRANSCONDUCTANCE (PER PLATE)	Sm/p:	---	---	5400	---	μMHOS
AMPLIFICATION FACTOR	Mu/p:	---	---	35	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX.	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 1	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES								
HEATER CURRENT:	0.4	If:	285	---	---	---	315	---	mA.
HEATER-CATHODE LEAKAGE (1):									
Ehk=+100 Vdc	0.4	Ihk(1):	---	---	---	---	3.5	---	μAdc
Ehk=-100 Vdc		Ihk(1):	---	---	---	---	3.5	---	μAdc
GRID CURRENT:									
Eb=150 Vdc; Rk/k=300 OHMS; Rg=1.0 MEG.	0.4	Ic(1):	---	---	---	---	-0.3	---	μAdc
PLATE CURRENT (1):	0.4	Ib(1):	4.5	5.6	6.5	7.3	8.5	2.3	mAdc
PLATE CURRENT (2):									
Ec1=-6.5 Vdc	0.4	Ib(2):	---	---	---	---	100	---	μAdc
TRANSCONDUCTANCE (1):	0.4	Sm(1):	4450	5000	5400	5800	6350	1100	μMHOS
CONTINUITY TO SHORTS (NOTE 11) (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL:									
ENVELOPE (8-1)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V									
Eg-all=-100 Vdc	2.5	Rg1-all:	250	---	---	---	---	---	MEG.
Ep-all=-300 Vdc		Rp-all:	250	---	---	---	---	---	MEG.
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS:	2.5	Ib:	---	---	---	---	1.5	---	mAdc
TRANSCONDUCTANCE (2):									
Ef=5.7 V; (NOTE 9)	2.5	Δ_{Ef}Sm(2):	---	---	---	---	10	---	PERCENT
GRID EMISSION:									
Eb=250 Vdc; Rg/g=1.0 MEG; Rk/k=2200 OHMS; Ef=7.5 V; PREHEAT 5 MINUTES AT Ec=0; TEST AT Ec=-9.0 Vdc	6.5	Isc1:	---	---	---	---	-0.5	---	μAdc
AF NOISE:									
Esig=65 mVac; Rg=0.1 MEG.; Rp=0.01 MEG., Rk=75 OHMS: Ck=1000 μf; UNITS CONNECTED IN PARALLEL	2.5	EB:	---	---	---	---	17	---	VU
PULSE EMISSION (1):									
Eb=150 Vdc; Ec1=-25 Vdc; Egk=+30 V; Rk/k=1.0 OHM; DUTY CYCLE = 1%; tp= 10 μsec (NOTE 12)	2.5	ik:	320	---	---	---	---	---	ma.
		Δ_{tp}ik:	---	---	---	---	10	---	PERCENT

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]-cont'd.

IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 (CONT'D.)									
		COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES							
PULSE EMISSION (2): Ef=5.9V; Eb=150 Vdc; Ec1=-25 Vdc; tp=10μsec, DUTY CYCLE =1%; egk=+30 V; Rk/k=1.0 OHMS; (NOTE 12)	6.5	ik:	300	---	---	---	---	---	ma.
HEATER-CATHODE LEAKAGE (2): Ef=-6.7 V (PIN 6 NEGATIVE); Ehk=+100 Vdc (CATHODE NEG.) t=16 SECONDS (NOTE 13)	6.5	Ihk(2):	---	---	---	---	1.0	---	μAdc
AMPLIFICATION FACTOR:	6.5	mu:	30	---	35	---	40	---	---
CAPACITANCE		Cgp:	1.2	---	1.5	---	1.8	---	μμf
CAPACITANCE:		Cin:	1.8	---	2.4	---	3.0	---	μμf
CAPACITANCE (NOTE 2)	6.5	Cout: (UNIT #1):	0.20	---	0.28	---	0.36	---	μμf
CAPACITANCE:		Cout (UNIT #2):	0.22	---	0.32	---	0.42	---	μμf
CAPACITANCE:		Cgg:	---	---	---	---	0.013	---	μμf
CAPACITANCE:		Cpp:	---	---	---	---	0.52	---	μμf
OPERATION TIME: (NOTE 10)	4.0	t:	---	---	---	---	20	---	SEC.
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE =21 ±3 mmHg; VOLTAGE = 300 Vac.	6.5	---	---	---	---	---	---	---	---
VIBRATION (2): F=40 cps; G=15; Rp=10,000 OHMS	2.5	Ep:	---	---	---	---	20	---	mVac
VIBRATION (3): F=70-2000; t=3 MINUTES; G=15; Rp=10,000 OHMS. POSITIONS X_1 AND X_2 ONLY.	6.5	ep:	---	---	---	---	125 (PEAK TO PEAK)	---	mv.
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK (1): Ehk=+100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE = 30°; (NOTE 3)	20	---	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY

TEST	ALLOWABLE DEF. PER CHARACT. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.							
FATIGUE (1): 96 HOURS; G=2.5; FIXED FREQUENCY; F=25 MIN., 60 MAX. (NOTE 5)			6.5	---	---	---	---
SHOCK (2): Ehk=100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE=120°+RUBBER PAD; t=10 MILLISECONDS; G=75; (NOTE 15)			20	---	---	---	---
FATIGUE (2): 6 HOURS; G=10; F=130-2000-130 cps (NOTE 14)			6.5	---	---	---	---
POST SHOCK (1) & (2) AND FATIGUE (1) & (2) TEST END POINTS:							
VIBRATION (2): F=40cps; G=15; Rp=10,000 OHMS			---	Ep:	---	80	mVac
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc			---	Ihk(1):	---	7.0	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	7.0	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: Ef=6.3 V			---	Δ_tSm(1):	---	15	PERCENT
GRID CURRENT (1):			---	Ic1:	---	-1.0	μAdc
GLASS STRAIN (THERMAL SHOCK):			6.5	---	---	---	---
ACCEPTANCE LIFE TEST							
HEATER CYCLING LIFE TEST: Ef=7.0 V; Eb=Ec1=0V; Ehk=140 Vac; 1 MIN ON, 4 MIN OFF			1.0	---	2000	---	CYCLES
HEATER CYCLE LIFE TEST END POINT: HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc			---	Ihk(1):	---	7.0	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	7.0	μAdc
2 & 20 HOUR STABILITY LIFE TEST: TA=ROOM; Ehk=+200 Vdc; Rg/g=1.0 MEG.			---	---	---	---	---

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]- cont'd.

IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
2 & 20 HOUR STABILITY LIFE TEST END POINTS:							
CHANGE IN TRANS-CONDUCTANCE (1) OF INDIVIDUAL TUBES: (TYPICAL SAMPLE SIZE = 50 TUBES)			1.0	$\Delta_t Sm(1)$:	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA=ROOM; Ehk=+200 Vdc; Rg/g=1.0 MEG.			---	---	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE=200 TUBES)							
INOPERATIVES:			0.65	---	---	---	---
TRANSCONDUCTANCE (1):			1.0	Sm(1):	4000	---	μMHOS
200 HOUR INTERMITTENT LIFE TEST (1): Eb=250 Vdc; Ehk=+200 Vdc; Rg/g=1.0 MEG; Rk/k=2200 OHMS; TA=ROOM	---	---	---	---	---	---	---
200 HOUR INTERMITTENT LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE =20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.9	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
CHANGE IN TRANS-CONDUCTANCE (1) OF INDIVIDUAL TUBES:	1	3	---	$\Delta_t Sm(1)$:	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef} Sm(2)$:	---	20	PERCENT
HEATER-CATHODE LEAKAGE (1): Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc
ELECTRODE INSULATION: g-all:	1	3	---	Rg1-all:	100	---	MEG.
p-all:			---	Rp-all:	100	---	MEG.
TOTAL DEFECTIVES:	3	6	---	---	---	---	---
500 HOUR INTERMITTENT PULSE LIFE TEST: Eb=250 Vdc; Ec1=-25 Vdc; Rk/k=0; RL/p=330 OHMS; tp=10μsec.; DUTY CYCLE= 1.0% egk=+30±1v; TA=ROOM.	---	---	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]-cont'd.

IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY

TEST ACCEPTANCE LIFE TESTS (CONT'D.)	ALLOW. DEF. PER CHAR. 1st SAMP.	ALLOW. DEF. PER CHAR. COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
500 HOUR INTERMITTENT PULSE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
PULSE EMISSION (1):	1	3	---	ik:	300	---	ma.
CHANGE IN PULSE EMISSION (1) OF INDIVIDUAL TUBES FROM INITIAL:	1	3	--- ---	Δ_{ik}: Δ_{ik}:	--- ---	-35 +50	PERCENT PERCENT
TOTAL DEFECTIVES:	2	5	---	---	---	---	---
INTERMITTENT HIGH TEMPERATURE LIFE TEST (2): T BULB=220°C; Ehk=+200 Vdc; Rg/g=1.0 MEG.	---	---	---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.7	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
TRANSCONDUCTANCE (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER=CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc
INSULATION OF ELECTRODES:							
g-all	1	3	---	Rg1-all:	50	---	MEG.
p-all			---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1) AVERAGE CHANGE:	---	---	---	Avg Δ_tSm:	---	15	PERCENT
TOTAL DEFECTIVES:	3	6	---	---	---	---	---
1000 HOUR HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS [1] - cont'd.

IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY

TEST	ALLOW. DEF. PER CHARAC. 1st SAMP.	2nd. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
GRID CURRENT (1):	1	3	---	Ic(1):	---	-1.0	μAdc
HEATER-CURRENT	1	3	---	If:	276	328	mA
TRANSCONDUCTANCE (1) CHANGE OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	Δ_{Ef}Sm(2):	---	20	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc
ELECTRODE INSULATION:							
g-all:	2	5	---	Rg1-all:	25	---	MEG.
p-all:			---	Rp-all:	25	---	MEG.
TOTAL DEFECTIVES:	4	8	---	---	---	---	---

NOTES

1. CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, AND MIL-STD-105A.

2. WITHOUT SHIELD

3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4. CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

5. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

6. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

7. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

8. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

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NOTES - CONT'D.

9. CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef=6.3 V TO THAT VALUE MEASURED AT Ef=5.7 V.

10. OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN ±10% OF THE THREE (3) MINUTE PLATE CURRENT (1) VALUE MEASURED AT PLATE CURRENT (1) TEST CONDITIONS. NO PREHEATING BEFORE THIS TEST IS ALLOWED. A COLD TUBE MUST BE USED.

11. DURING BOTH CONTINUITY AND SHORT TESTING, THE TUBE UNDER TEST SHALL BE TAPPED AT LEAST THREE TIMES IN EACH OF TWO PLANES 90° APART WITH A TAPPER WHICH SHALL BE ADJUSTED TO GIVE AN IMPULSE OF APPROXIMATELY ONE HALF SINE WAVE OF 300±50 MICRO SECONDS DURATION AND HAVING A MINIMUM AVERAGE AMPLITUDE OF 80 G's PEAK ACCELERATION AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DEVICE CAPABLE OF DETECTING AS SHORTS, THE FOLLOWING INTERELEMENT RESISTANCES OF THE GIVEN TIME DURATION.

DURATION	SENSITIVITY
PERMANENT SHORT	600,000 OHMS
500 MICROSECONDS	500,000 OHMS
100 MICROSECONDS	100,000 OHMS
60 MICROSECONDS	1 000 OHMS

TUBES WHICH GIVE AN INDICATION OF ONE OR MORE OF THE FOLLOWING SHALL BE REJECTED AS INOPERABLE:

A) EITHER A PERMANENT OR TAP SHORT AT ANY TIME DURING THE TAPPING PROCEDURE.
B) ANY OPEN CIRCUIT
C) AIR LEAKS

12. PEAK CATHODE CURRENT SHALL BE MEASURED BY MEANS OF A HIGH IMPEDANCE OSCILLOSCOPE OR EQUIVALENT DEVICE CONNECTED ACROSS A 1.0±1% CATHODE RESISTOR. THE SPECIFIED LIMIT REFERS TO THE MAXIMUM OF THE PULSE AMPLITUDE. THE VARIATION OF THE OUTPUT PULSE AMPLITUDE BETWEEN 20% AND 80% TP SHALL NOT EXCEED THE SPECIFIED LIMIT.

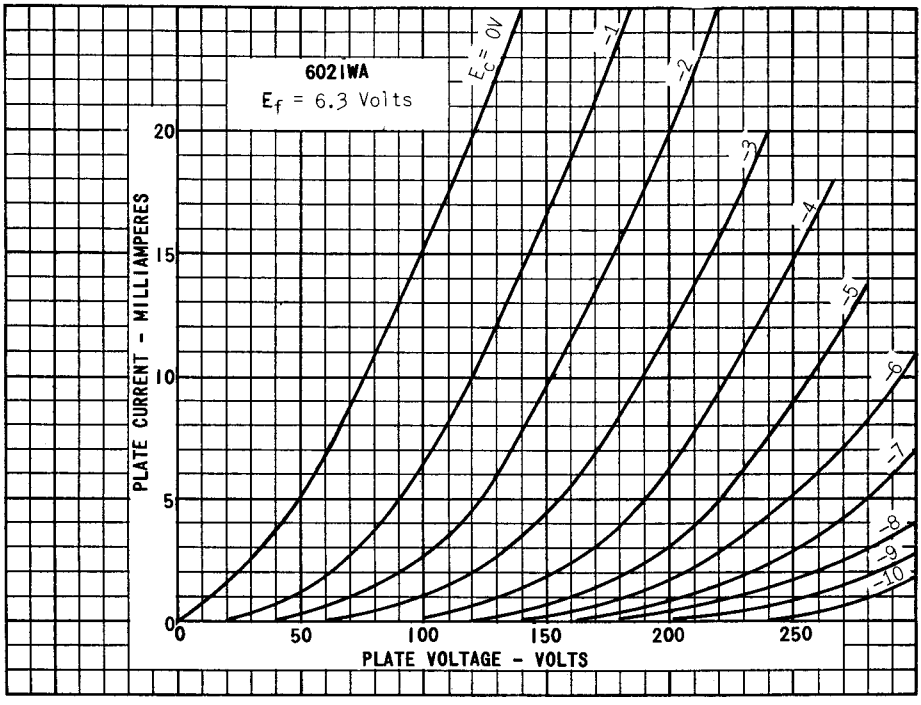
13. HEATER-CATHODE LEAKAGE (2) IS PERFORMED AS FOLLOWS:

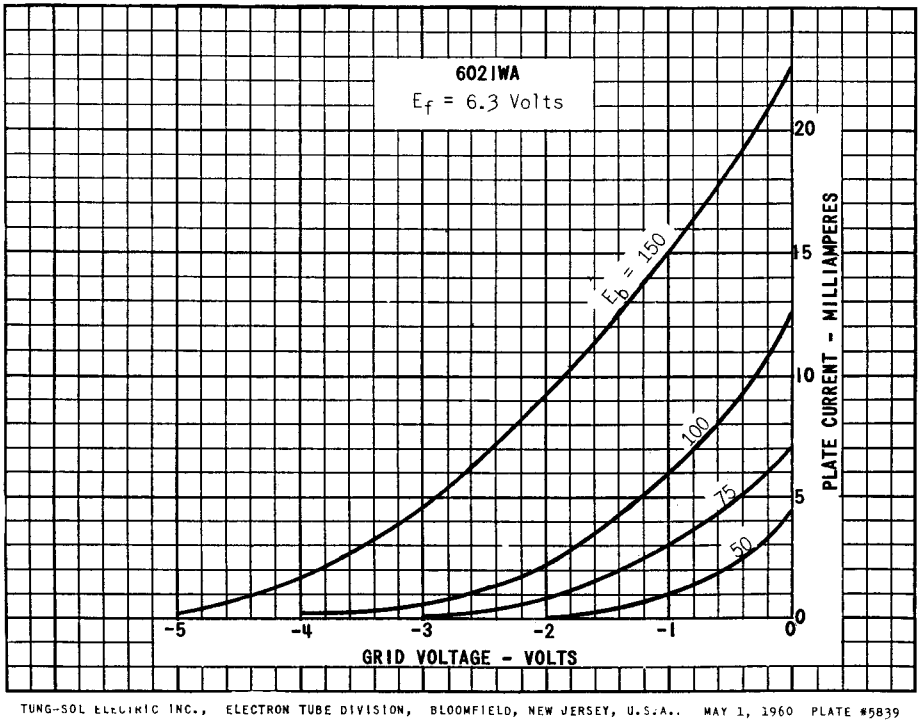
A) PREHEAT TUBES FOR 10 SECONDS WITH Ef=10.5 V.
B) TEST IMMEDIATELY BY THE APPLICATION OF THE SPECIFIED TEST CONDITIONS OF THIS TEST.
C) AFTER 16 SECONDS READ HEATER-CATHODE LEAKAGE OF EACH SECTIONS.

14. THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2, AND Y1. ONLY RATED HEATED VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

A) TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3.
B) TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS. THIS IS A DESTRUCTIVE TEST.

15. THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).





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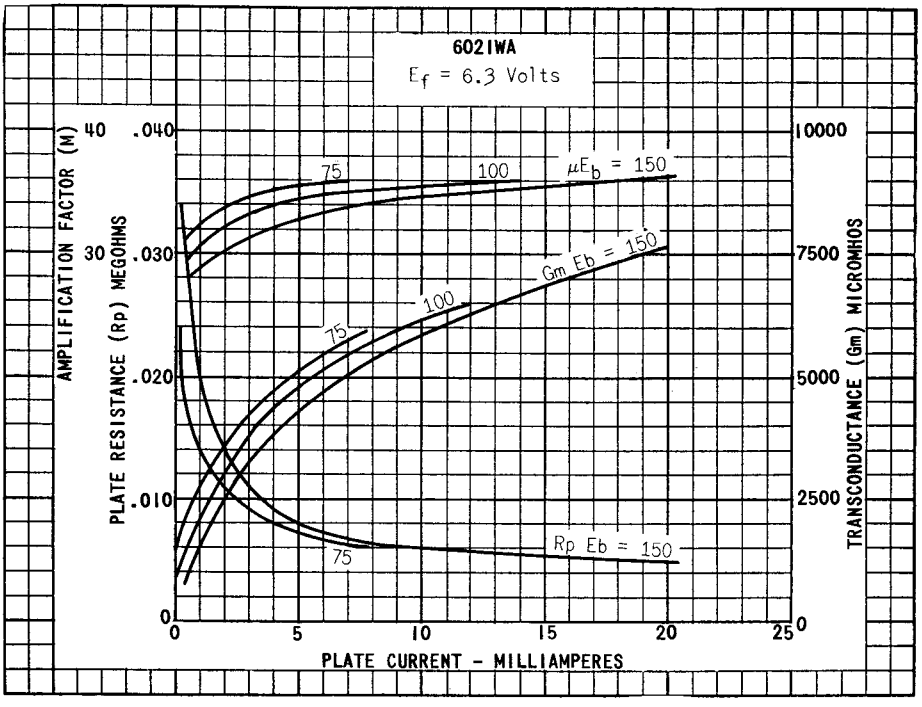
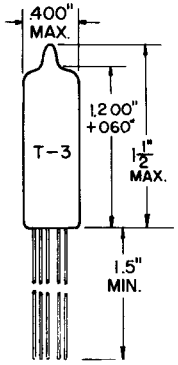
TENTATIVE DATA



TUNG-SOL

TRIODE

SUBMINIATURE



GLASS BULB

BASE - SAME AS E8-10 EXCEPT LEADS 1, 2, & 6 REMOVED

OUTLINE DRAWING

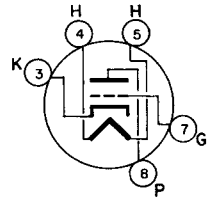
JEDEC 3-2

COATED UNIPOTENTIAL CATHODE

FOR RADIOSONDE SERVICE

OSCILLATOR AT 400 MC

ANY MOUNTING POSITION



BOTTOM VIEW

THE 6026 IS A HIGH-EFFICIENCY OSCILLATOR TRIODE IN A ROUND SUBMINIATURE CONSTRUCTION WITH 5 FLEXIBLE LEADS. IT IS INTENDED PARTICULARLY FOR TRANSMITTING SERVICE IN RADIOSONDE AND SIMILAR APPLICATIONS. AS A CLASS C OSCILLATOR IN SUCH SERVICE, THE TUBE CAN DELIVER A USEFUL POWER OUTPUT OF 1.25 WATTS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.3	pf
INPUT	2.0	pf
OUTPUT	0.42	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	200	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		5.2 TO 6.6	VOLTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE		0	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

OSCILLATOR - CLASS C TELEGRAPHY

DC PLATE VOLTAGE	150	VOLTS
DC GRID VOLTAGE	-50	VOLTS
TOTAL CATHODE CURRENT	40	MA.
DC GRID CURRENT	10	MA.
PLATE INPUT	3.3	WATTS
PLATE DISSIPATION	3.0	WATTS

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TYPICAL OPERATING CHARACTERISTICS

AS OSCILLATOR AT 400 MC

DC PLATE VOLTAGE	135	VOLTS
GRID RESISTOR	1300	OHMS
DC PLATE CURRENT	20	MA.
DC GRID CURRENT (APPROX.)	9.5	MA.
USEFUL POWER OUTPUT	1.25	WATTS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	120	VOLTS
CATHODE RESISTOR	220	OHMS
AMPLIFICATION FACTOR	24	
PLATE RESISTANCE	4000	OHMS
TRANSCONDUCTANCE	5900	μMHOS
PLATE CURRENT	12	MA.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	NOTE	MIN.	MAX.	
HEATER CURRENT:				
WITH 5.2 VOLTS AC ON HEATER	---	0.176	---	AMP.
WITH 6.6 VOLTS AC ON HEATER	---	---	0.225	AMP.
AMPLIFICATION FACTOR	1	17	31	
GRID-TO-PLATE CAPACITANCE	---	1.05	1.55	pf
GRID-TO-CATHODE CAPACITANCE	---	1.55	2.45	pf
PLATE-TO-CATHODE CAPACITANCE	---	0.345	0.495	pf
PLATE CURRENT	2	8	16	MA.
PLATE CURRENT	3	9.5	18.5	MA.
PLATE CURRENT	4	---	300	μAMP.
TRANSCONDUCTANCE	2	4200	7600	μMHOS
TRANSCONDUCTANCE	3	4600	8000	μMHOS

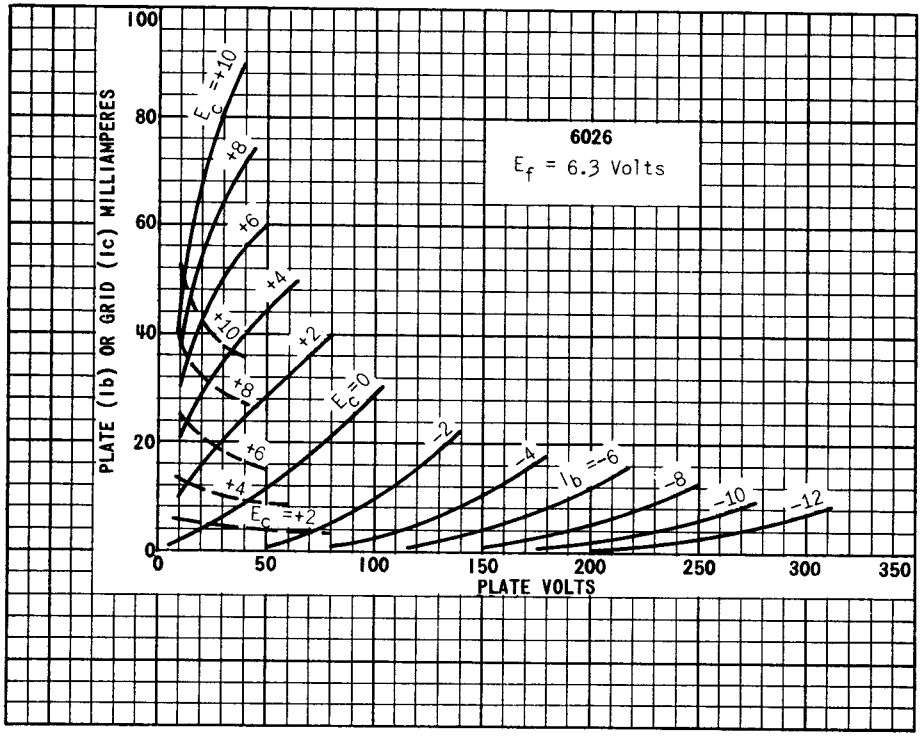
1. WITH 5.2 OR 6.3 VOLTS AC ON HEATER, 120 VOLTS DC ON PLATE, AND CATHODE RESISTOR OF 220 OHMS.

2. WITH 5.2 VOLTS AC ON HEATER, 120 VOLTS DC ON PLATE, AND CATHODE RESISTOR OF 220 OHMS.

3. WITH 6.3 VOLTS AC ON HEATER, 120 VOLTS DC ON PLATE, AND CATHODE RESISTOR OF 220 OHMS.

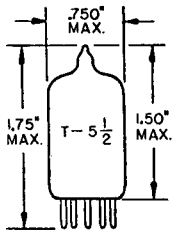
4. WITH 5.2 VOLTS AC ON HEATER, 120 VOLTS DC ON PLATE, -12 VOLTS DC ON GRID, AND CATHODE RESISTOR OF 220 OHMS.

[A] HEATER VOLTAGE RANGE AND MAXIMUM RATINGS ARE ESTABLISHED ON BASIS THAT TUBE HEATER WILL BE SUPPLIED FROM BATTERIES IN RADIOSONDE AND SIMILAR APPLICATIONS UTILIZING EQUIPMENT DESIGNED FOR EXTREME COMPACTNESS AND LIGHT WEIGHT AND REQUIRING TUBE LIFE OF ONLY A FEW HOURS.


6026
E_f = 6.3 Volts
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
PLATE VOLTS
0
20
40
60
80
100
0
50
100
150
200
250
300
350
E_c =+10
+8
+6
+4
+2
E_c =0
-2
-4
Ib =-6
-8
-10
-12

TUNG-SOL

OUTLINE DRAWING
JEDEC 5-1



GLASS BULB
MINIATURE BUTTON
7 PIN E7-1

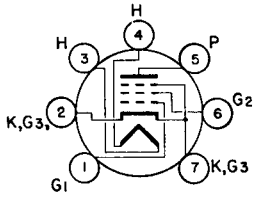
PENTODE

MINIATURE TYPE
FOR
COMMERCIAL AND INDUSTRIAL
RF APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 7BD



BOTTOM VIEW

THE 6028 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR RF APPLICATIONS WHERE A HIGH DEGREE OF RELIABILITY IS REQUIRED. THE TUBE IS CHARACTERIZED BY LONG LIFE AND STABLE PERFORMANCE.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #316 CONNECTED TO CATHODE

GRID 1 TO PLATE	MAX.	0.02	pf
INPUT		3.9	pf
OUTPUT		2.85	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	20.0	VOLTS	50	mA
LIMITS OF APPLIED VOLTAGE			20.0±1.0	VOLTS
HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			75	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			75	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM RATINGS – SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID 2 SUPPLY VOLTAGE	155	VOLTS
GRID 2 VOLTAGE	SEE RATING CHART	
CATHODE CURRENT	20	mA
PLATE DISSIPATION	1.85	WATTS
GRID 2 DISSIPATION FOR GRID 2 VOLTAGES UP TO 77.5 VOLTS	0.55	WATT

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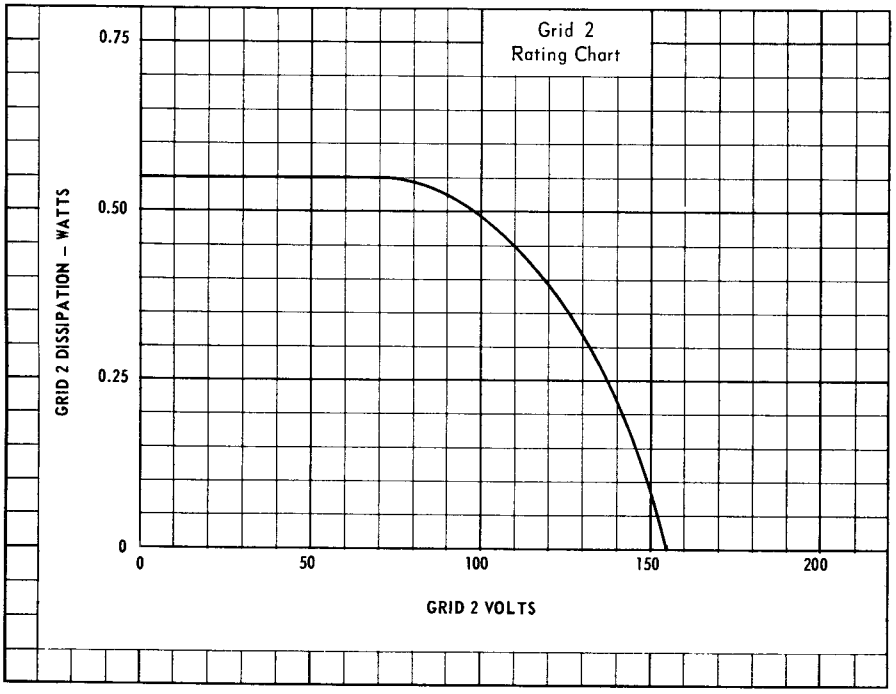
CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE SUPPLY VOLTAGE	120	VOLTS
GRID 2 SUPPLY VOLTAGE	120	VOLTS
CATHODE RESISTOR (FIXED BIAS NOT RECOMMENDED)	200	OHMS
GRID 1 VOLTAGE	0	VOLTS
PLATE CURRENT	7	mA
GRID 2 CURRENT	2.25	mA
TRANSCONDUCTANCE	4,950	μMHOS
PLATE RESISTANCE (APPROX.)	0.34	MEGOHM
GRID 1 VOLTAGE FOR I_b = 200 μA MAX.	-10	VOLTS



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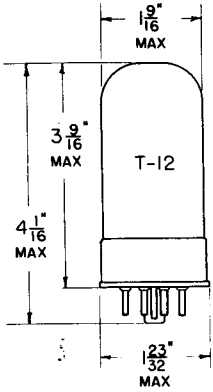
TWIN TRIODE



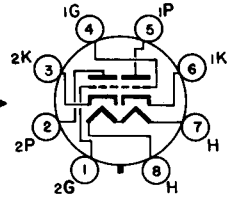
GLASS BULB
LARGE WAFER OCTAL
WITH METAL SLEEVE 88-86

HEATER

6.3±5% VOLTS 2.5 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 86D

THE 6080WA IS A RUGGED VERSION OF THE POPULAR 6080, MANUFACTURED UNDER THE RELIABLE TUBE PROGRAM. IN THIS PROGRAM, TUBES ARE HANDLED IN LOTS WITH MANY DESTRUCTIVE TESTS PERFORMED ON RANDOMLY SELECTED SAMPLES. THUS A TUBE MAY PASS ALL REQUIRED TESTS AND STILL BE REJECTED IF IT IS FROM AN UNSATISFACTORY LOT.

WITH THE MOUNT SHOCK ISOLATED FROM THE BULB BY NINE METAL SPRING CLIPS. AND BY THE USE OF HEAVY DUTY PARTS, THE TUBE WILL WITHSTAND A SHOCK IMPULSE OF 450G AND A VIBRATION AT 50CPS (D=.08"). OTHER FEATURES ARE HIGH ALTITUDE RATING, HIGH BULB TEMPERATURE LIMITS, AND LONG LIFE TESTS WITH MANY LIFE TEST END POINTS. PLATE CURRENT AND TRANSCONDUCTANCE ARE HELD TO CLOSE LIMITS TO PROVIDE GREATER BALANCE BETWEEN TUBE SECTIONS. THIS IS ESPECIALLY ADVANTAGEOUS WHEN MANY TUBES ARE TO BE PARALLELED IN REGULATED POWER SUPPLY SERVICE.

THIS TUBE CAN BE USED FOR ANY APPLICATION REQUIRING HIGH PLATE CURRENT AT LOW PLATE VOLTAGES. IT HAS FOUND WIDE USE IN ELECTRONICALLY REGULATED POWER SUPPLIES.

→ INDICATES A CHANGE.

ELECTRICAL DATA

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	2.5	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	7 000	μMHOS
AMPLIFICATION FACTOR	2.0	
INTER ELECTRODE CAPACITIES PER TRIODE SECTION		
GRID TO CATHODE	6.2	μμf
GRID TO PLATE	8.4	μμf
CATHODE TO PLATE	2.2	μμf
HEATER TO CATHODE	6.3	μμf
INTER ELECTRODE CAPACITIES BETWEEN TRIODE SECTIONS		
SECTION 1 GRID TO SECTION 2 GRID	0.5	μμf
SECTION 1 PLATE TO SECTION 2 PLATE	2.2	μμf

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TUNG-SOL

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MECHANICAL DATA

MOUNTING POSITION	ANY	
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)		
BULB	T-12	
BASE	LARGE WAFER OCTAL WITH METAL SLEEVE, 8 PIN, JEDEC #B8-86	
MAXIMUM NET WEIGHT	3	OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE)	450	G
MAXIMUM VIBRATION RATING (D = .08" @ 50 CPS)	10	G

RATINGS

ABSOLUTE VALUES

	MIN.	MAX.	
HEATER VOLTAGE	6.0	6.6	VOLTS
PLATE VOLTAGE (DC)	---	250	VOLTS
GRID VOLTAGE (DC)	---	0	VOLTS
HEATER-CATHODE VOLTAGE (DC)	-300	+300	VOLTS
GRID CURRENT PER GRID	---	5.	MA.
PLATE CURRENT PER PLATE (DC)	---	125.	MA.
(IF SEVERAL TUBE SECTIONS ARE TO BE USED IN PARALLEL WITH EACH OTHER, IT IS RECOMMENDED NOT TO EXCEED 100 MA PER PLATE.)			
POWER DISSIPATION PER PLATE	---	13	WATTS
ENVELOPE TEMPERATURE	---	230	°C
ALTITUDE FOR FULL RATINGS	---	60 000	FEET
CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE FOR CATHODE BIAS OPERATION	---	1.0	MEGOHM
GRID CIRCUIT RESISTANCE FOR FIXED BIAS OR COMBINATION FIXED AND CATHODE BIAS OPERATION	---	0.1	MEGOHM

ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450 G/MSEC)

FATIGUE; 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES (2.5G)

POST SHOCK AND FATIGUE LIMITS:

VIBRATION (R_p=2000 Ω, E_c=- 7VDC, TIE 1K TO 2K, 1G TO 2G, 1P TO 2P), GENERATED PLATE VOLTAGE (MAX.)		100	MVAC
HEATER-CATHODE LEAKAGE (E_{hk} =±100 VDC) (MAX.)		50	μADC
CHANGE IN TRANSCONDUCTANCE FROM INITIAL VALUE (MAX.)		10	PERCENT
GRID CURRENT (MAX.)		-3	μA
HEATER CYCLING LIFE TEST (E_f=7.5V, E_{hk}=300VDC. DURATIOI OF 2000 CYCLES OF 1 MIN. ON AND 1 MIN. OFF) END POINT (E_{hk}=±100V.) (MAX.)		50	μADC
STABILITY LIFE TEST (1 HR.) END POINT:			
CHANGE IN TRANSCONDUCTANCE FROM INITIAL VALUE (MAX.)		10	PERCENT
SURVIVAL RATE LIFE TEST (100 HRS.) END POINT:			
TRANSCONDUCTANCE (MIN.)		5800	μMHOS
INTERMITTENT LIFE TEST (1000 HRS.) END POINTS:			
GRID CURRENT	MIN. 0 MAX. -10		μADC
TRANSCONDUCTANCE (MIN.)		5500	μMHOS
CHANGE IN TRANSCONDUCTANCE BY REDUCING E_f TO 5.7V. (MAX.)		10	PERCENT
HEATER-CATHODE LEAKAGE E_{hk}=±100VDC. (MAX.)		25	μADC
HEATER CURRENT	MIN. 2.35 MAX. 2.75		AMPS
INSULATION OF ELECTRODES: GRID TO ALL OTHERS AND PLATE TO ALL OTHERS (MIN.)		100	MEGOHM

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RANGE OF VALUES

CONDITIONS: E_f = 6.3V, E_b = 135V, E_c = 0, $R_{k/k}$ = 250 Ω

BOTH SECTIONS OPERATING. EACH SECTION READ SEPARATELY.

INDIVIDUAL PLATE CURRENT (DC)	100	150	MA.
LOT AVERAGE PLATE CURRENT (SAME CONDTIONS)(DC)	115	135	MA.
PLATE CURRENT, DIFFERENCE BETWEEN SECTIONS (DC)	---	25	MA.
INDIVIDUAL SECTION TRANSCONDUCTANCE	6000	8200	μMHOS
LOT AVERAGE TRANSCONDUCTANCE	6600	7400	μMHOS
AMPLIFICATION FACTOR	1.5	2.5	
HEATER CURRENT @ 6.3V.	2.35	2.65	AMP.

SIMILAR TYPE REFERENCE : 7105.

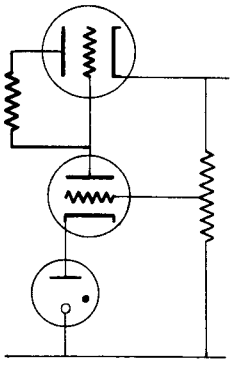

FIGURE 1

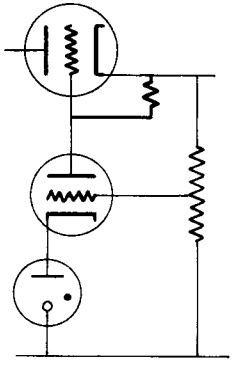

FIGURE 2

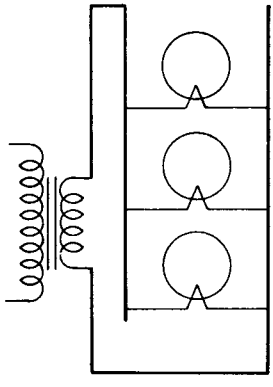

FIGURE 3

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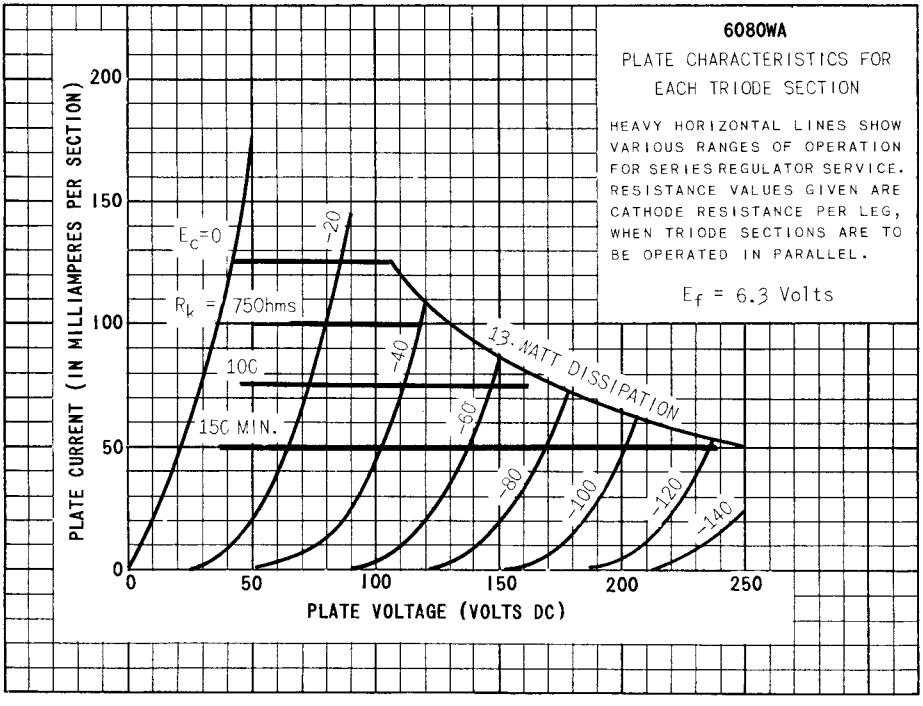
APPLICATION NOTES

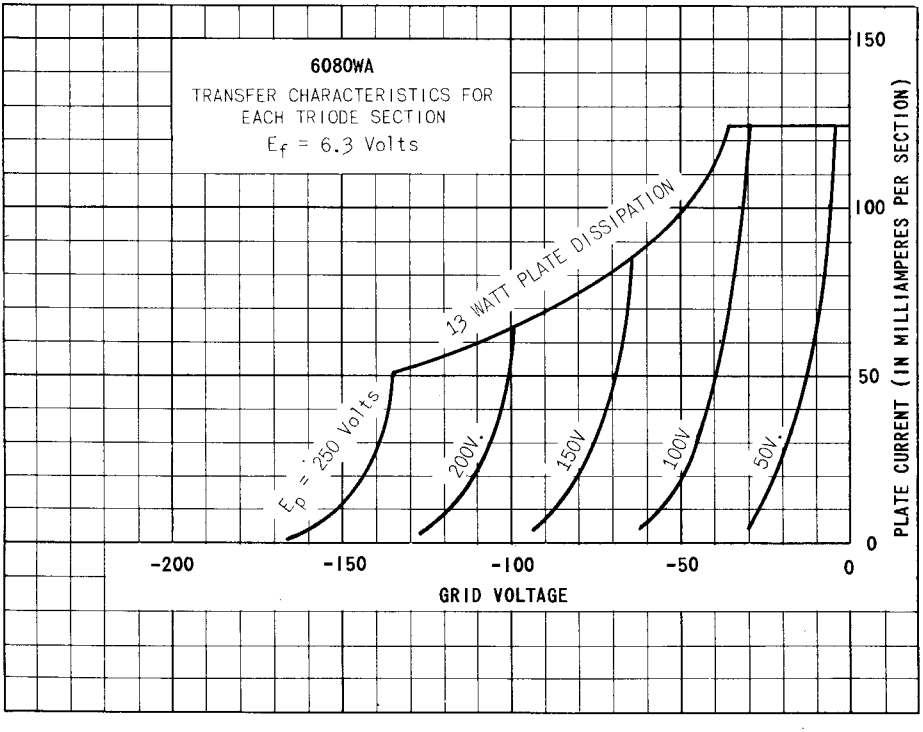
THE 6080WA IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE THIRD THE VALUE $(\frac{R}{U+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE THIRD THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (ABOUT ONE WATTS) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.





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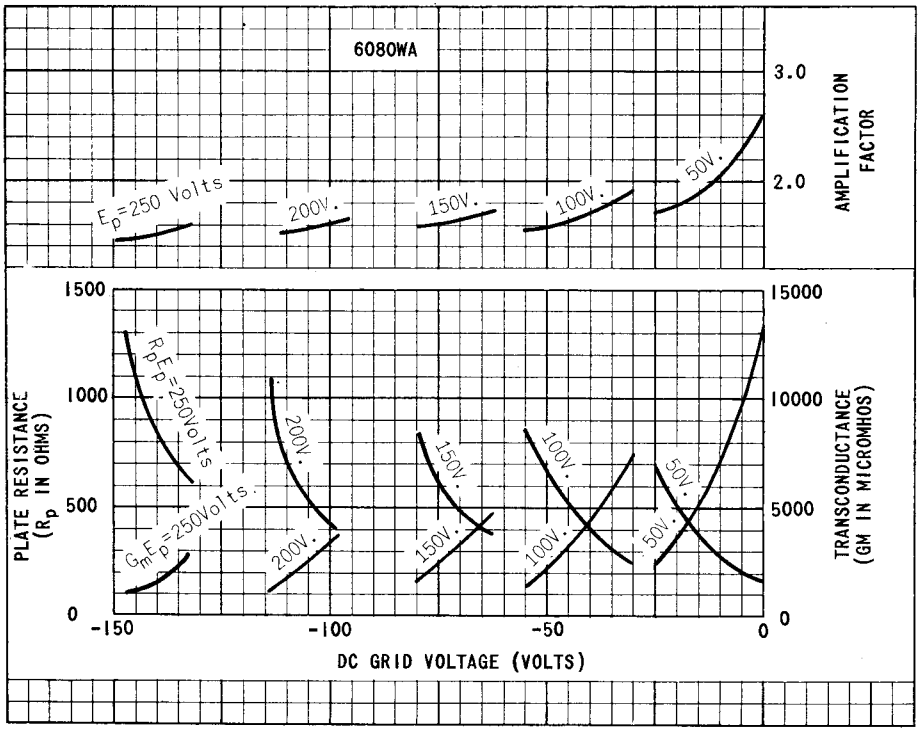
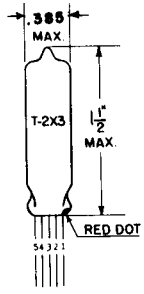

6080WA
3.0
2.0
AMPLIFICATION FACTOR
E_p=250 Volts
200V.
150V.
100V.
50V.
1500
1000
500
0
15000
10000
5000
0
PLATE RESISTANCE (R_p IN OHMS)
TRANSCONDUCTANCE (GM IN MICROMHOS)
$R_p E_p$=250Volts
$G_m E_p$=250Volts.
-150
-100
-50
0
DC GRID VOLTAGE (VOLTS)

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB

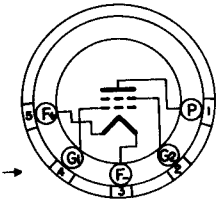
DOT IS ADJACENT TO LEAD 1

FILAMENT

1.25±20% VOLTS 0.02 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS 0.048" CENTER-TO-CENTER

THE 6088 IS A SUBMINIATURE POWER AMPLIFIER PENTODE OF LOW CURRENT DESIGNED FOR USE IN PORTABLE AND WEARABLE EQUIPMENT. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

ABSOLUTE MAXIMUM VALUES

FILAMENT VOLTAGE	1.25±20%	VOLTS
MAXIMUM PLATE VOLTAGE	67.5	VOLTS
MAXIMUM SCREEN GRID VOLTAGE	67.5	VOLTS
MAXIMUM CATHODE CURRENT	1.5	MA.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

FILAMENT VOLTAGE	1.25	VOLTS
FILAMENT CURRENT	0.02	AMP.
PLATE VOLTAGE	45	VOLTS
SCREEN GRID VOLTAGE	45	VOLTS
CONTROL GRID VOLTAGE	−1.25	VOLTS
ZERO-SIGNAL PLATE CURRENT	650	μA.
ZERO-SIGNAL SCREEN GRID CURRENT	150	μA.
TRANSCONDUCTANCE	625	μMHOS
PLATE RESISTANCE (APPROX.)	0.7	MEGOHMS
LOAD RESISTANCE	0.08	MEGOHMS
POWER OUTPUT	10.5	MW.
DISTORTION (APPROX.)	10	PERCENT

→ INDICATES A CHANGE.

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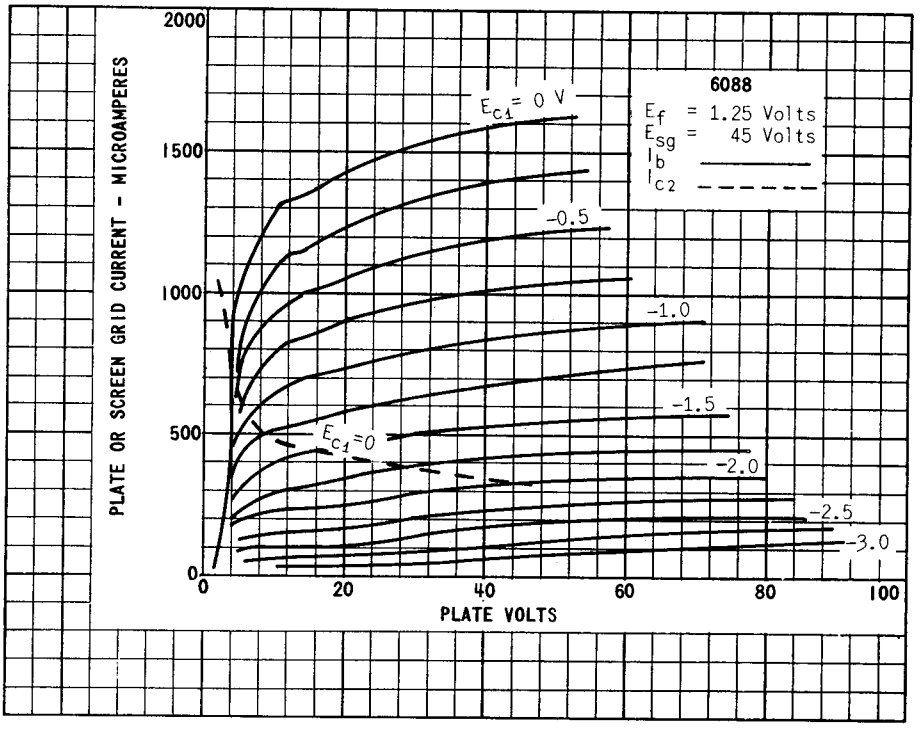
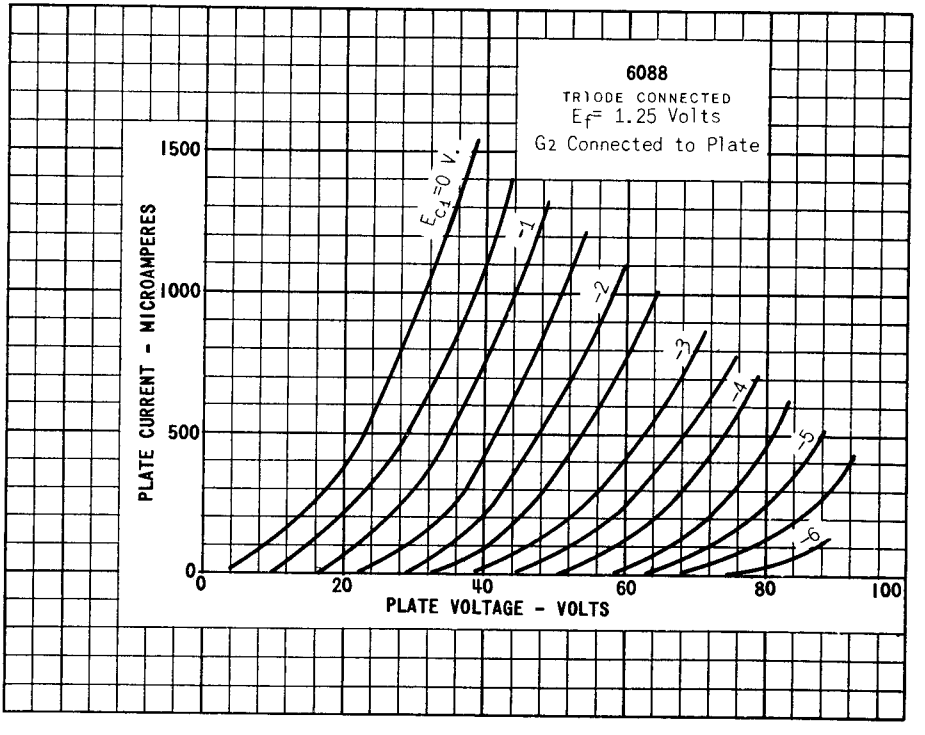
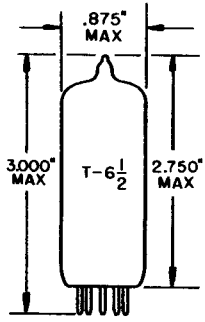

6088
E_f = 1.25 Volts
E_{sg} = 45 Volts
I_b
I_{c2}
E_{c1}= 0 V
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
E_{c1}=0
PLATE OR SCREEN GRID CURRENT - MICROAMPERES
PLATE VOLTS
0
500
1000
1500
2000
0
20
40
60
80
100


6088
TRIODE CONNECTED
E_f= 1.25 Volts
G2 Connected to Plate
E_{c1}=0 V.
-1
-2
-3
-4
-5
-6
PLATE CURRENT - MICROAMPERES
PLATE VOLTAGE - VOLTS
0
500
1000
1500
0
20
40
60
80
100

TUNG-SOL

BEAM PENTODE

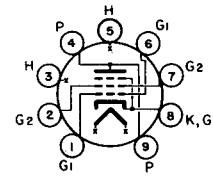
MINIATURE TYPE



FOR
MOBILE EQUIPMENT
APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9DH

HARD GLASS ENVELOPE
MINIATURE BASE E9-1
9PINS-GOLD PLATED TUNGSTEN

THE 6094 IS A BEAM POWER PENTODE IN A T-6 1/2 HARD GLASS ENVELOPE. IT IS DESIGNED FOR SERVICE IN EQUIPMENT WITH HIGH AMBIENT TEMPERATURES AND WHERE HIGH LEVELS OF VIBRATION, SHOCK AND OTHER ACCELERATIONS ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	1.45	pf
INPUT	8.5	pf
OUTPUT	5.3	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM RATING SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	600	MA
LIMITS OF APPLIED VOLTAGE			6.3±0.3	VOLTS
LIMITS OF HEATER-CATHODE VOLTAGE			450	VOLTS

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM RATING SYSTEM - SEE EIA STANDARD RS-239

PLATE VOLTAGE	275	VOLTS
POSITIVE GRID 1 VOLTAGE	5	VOLTS
GRID 2 VOLTAGE	275	VOLTS
PLATE DISSIPATION	12.5	WATTS
GRID 2 DISSIPATION	2.0	WATTS
CATHODE CURRENT	75	MA
ALTITUDE	60,000	FT
ENVELOPE TEMPERATURE	+300°	C

AVERAGE CHARACTERISTICS

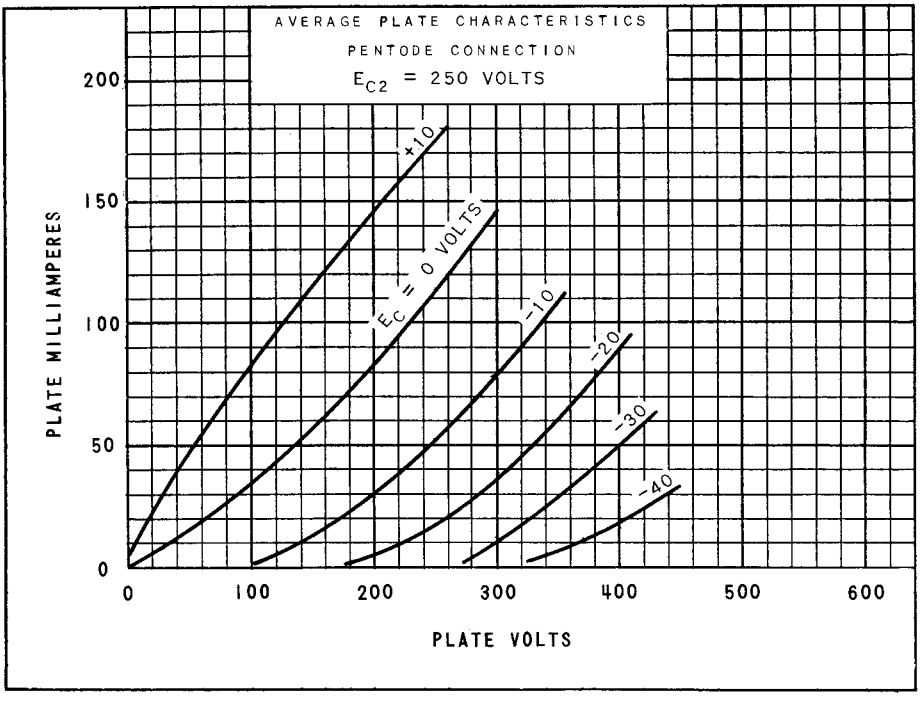
PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID 1 VOLTAGE	-12.5	VOLTS
PLATE CURRENT	45	MA
GRID 2 CURRENT	3.5	MA
TRANSCONDUCTANCE	4,100	μMHOS

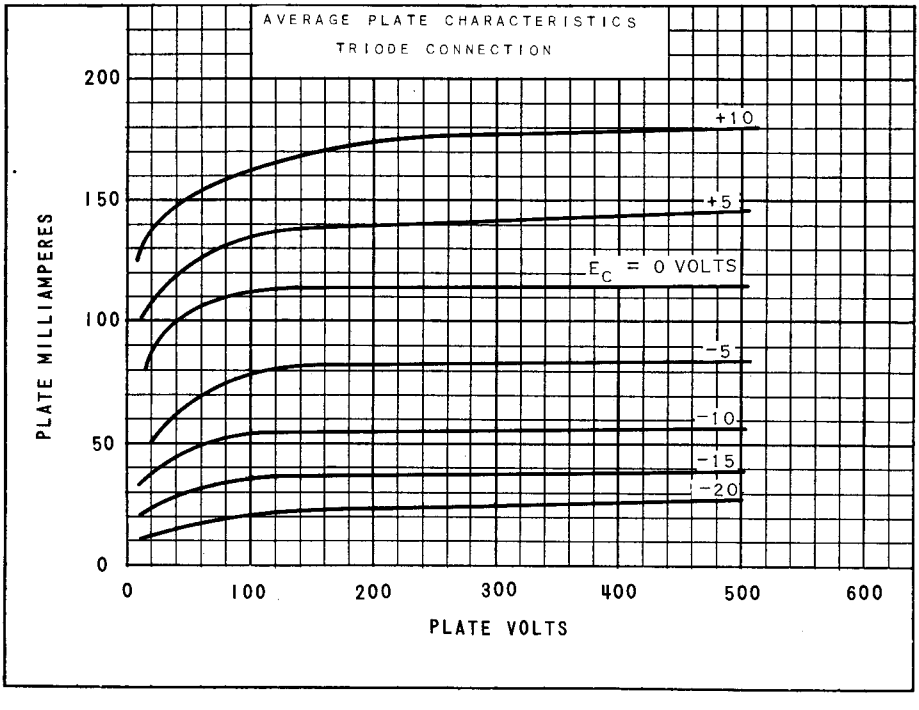
TYPICAL OPERATION

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID 1 VOLTAGE	-12.5	VOLTS
GRID 1 SIGNAL VOLTAGE	8.8	VOLTS RMS
LOAD RESISTANCE	5,000	OHMS
POWER OUTPUT	4.5	WATTS

ADDITIONAL TESTS

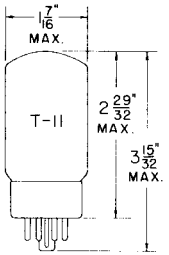
HEATER CYCLING
HIGH TEMPERATURE LIFE
HIGH LEVEL FATIGUE
SHOCK


AVERAGE PLATE CHARACTERISTICS
PENTODE CONNECTION
E_{C2} = 250 VOLTS
PLATE MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
0
100
200
300
400
500
600
+10
E_C = 0 VOLTS
-10
-20
-30
-40


AVERAGE PLATE CHARACTERISTICS
TRIODE CONNECTION
PLATE MILLIAMPERES
PLATE VOLTS
0
50
100
150
200
0
100
200
300
400
500
600
+10
+5
$-E_C$ = 0 VOLTS
-5
-10
-15
-20

TUNG-SOL

BEAM PENTODE

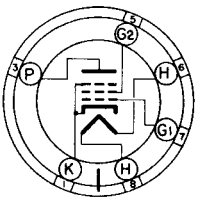


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 1.2 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHORT
SHELL 6 PIN OCTAL
LOW LOSS PHENOLIC

6BQ

THE 6098/6AR6WA IS A RUGGEDIZED SINGLE-ENDED BEAM PENTODE WHICH MAY BE USED IN APPLICATIONS REQUIRING RELATIVELY HIGH PEAK PLATE CURRENTS AT NEGATIVE GRID POTENTIALS. IT IS ELECTRICALLY EQUIVALENT TO THE 6AR6, BUT CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, SCREEN CURRENT, AND TRANSCONDUCTANCE ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATIONS, THE 6098/6AR6WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE COMMUNICATIONS EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID #1 TO PLATE (RATED)	0.55	μμf
MAXIMUM	9.9	μμf
MINIMUM	0.4	μμf
INPUT (RATED)	11.0	μμf
MAXIMUM	13.5	μμf
MINIMUM	8.5	μμf
OUTPUT (RATED)	7.0	μμf
MAXIMUM	9.2	μμf
MINIMUM	5.0	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES

	CLASS A AMPLIFIER	CLASS B AMPLIFIER	
HEATER VOLTAGE	6.3±10%	6.3±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE	400	600	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	315	315	VOLTS
MAXIMUM DC GRID #1 CURRENT	0	---	mA
MAXIMUM PLATE DISSIPATION	21	21	WATTS
MAXIMUM GRID #2 DISSIPATION	3.5	3.5	WATTS
MAXIMUM HEATER-CATHODE VOLTAGE	±200	±200	VOLTS
MAXIMUM DC CATHODE CURRENT [A]	125	60	mA
MAXIMUM BULB TEMPERATURE	225	225	°C
MAXIMUM PEAK FORWARD PLATE VOLTAGE	---	1250	VOLTS

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

	TRIODE CONNECTION	PENTODE CONNECTION	
HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	1.2	1.2	AMP.
DC PLATE VOLTAGE	200	250	VOLTS
DC GRID #2 VOLTAGE	TIED TO PLATE	250	VOLTS
DC GRID #1 VOLTAGE	-12.5	-22.5	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	100 000	100 000	OHMS
DC PLATE CURRENT	90	77	mA
GRID #2 CURRENT	TIED TO PLATE	5	mA
PLATE RESISTANCE (APPROX.)	1 000	21 000	OHMS
DC GRID #1 VOLTAGE FOR PLATE CURRENT CUTOFF	---	-65	VOLTS
TRANSCONDUCTANCE	6 000	5400	μMHOS

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 250Vdc, E_{c2} = 250Vdc, E_{c1} = -22.5Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	1.08	1.32	---	---	1.08	1.32	AMP.
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	75	---	---	---	75	μAdc
#1 GRID CURRENT	0	-1.0	---	---	0	-2.0	μAdc
PLATE CURRENT	55	100	68	86	---	---	mAdc
SCREEN GRID CURRENT	---	8.0	---	6.2	---	---	mAdc
GRID #1 TRANSCONDUCTANCE	4300	6500	4975	5825	4000	6500	μMHOS
INSULATION OF ELECTRODES[B] (E_f=6.3V, $E_{(g1-all)}$=30Vdc, g1 neg; $E_{(p-all)}$=500Vdc, p neg.							
R(g1-all)	25	---	---	---	10	---	MEGOHM
R(p-all)	25				10		MEGOHM
CUTOFF PLATE CURRENT (E_{c1} = 65Vdc)	---	1.0	---	---	---	---	mAdc
GRID #2 CURRENT[C] (E_f = 7.0V)	0	-3.0	---	---	---	---	μAdc
Δ TRANSCONDUCTANCE[D] (E_f = 5.7V)	---	15	---	---	---	15	PERCENT

SPECIAL REQUIREMENTS

	MIN.	MAX.	
VIBRATIONAL FATIGUE[E]	---	---	
SHOCK[F] (HAMMER ANGLE 30°, E_{hk}=100Vdc, HEATER POSITIVE, R_{g1} =0.1 MEG)	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
VIBRATION	---	1500	mVac
HEATER CATHODE LEAKAGE	---	±150	μAdc
GRID #1 CURRENT	0	-2.0	μAdc
GRID #1 TRANSCONDUCTANCE	3500	---	μMHOS
HIGH VOLTAGE TEST[G] (E_{c1}=-150Vdc, E_{c2}=300Vdc, E_{bb}=1250Vdc, I_{c1}=0.2 mAdc, R_1=5000)	1150	---	VOLTS
AF NOISE[H] (E_{c1}=-35Vdc, R_p=2000, E_{ca1}=245mVac)	---	17	VU
LOW FREQUENCY VIBRATION (E_{c1} = 35Vdc, R_p=2000)	---	1000	mVac

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TUNG-SOL

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SPECIAL REQUIREMENTS - CONT'D.

	MIN.	MAX.	
RIPPLE TEST[J] (E_b=325Vdc, E_{c2}=300Vdc, R_p=1000, R_k=500, E_f=6.3Vac, 400CYCLES)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN [K] (VOLTAGE=800Vac, PRESSURE=55±5mm. Hg)	---	---	
STABILITY LIFE TEST (E_{hk}=200Vdc, HEATER POSITIVE, R_{g1}=47,000, MIN. BULB TEMP.=225°C) [L]			
STABILITY LIFE TEST END POINTS Δ GRID #1 TRANSCONDUCTANCE	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST (INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT)	---	---	
INTERMITTENT LIFE TEST (E_{hk}=200Vdc, HEATER POS., R_{g1}=47,000, MIN. BULB TEMP. =+225°C)	---	---	

NOTES

[A] DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

[B] SEE MIL-E-1C 4.8.2

[C] PRIOR TO THIS TEST TUBES TO BE PREHEATED 5 MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY AFTER PREHEATING. E_f=7.0Vac, E_{c1}=-22Vdc, Rk=0 OHMS, R_{g1}=0.1 MEG, E_b=250Vdc, E_{c2}=250 Vdc.

[D] THE VALUE OF #2 TRANSCONDUCTANCE SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

[E] SEE MIL-E-1C 4.9.20.6

[F] SEE MIL-E-1C 4.9.20.5

[G] THIS TEST WILL BE MADE BEFORE THE TRANSCONDUCTANCE #1 AND TRANSCONDUCTANCE #2 TEST. WITH A 60 CYCLE SINUSOIDAL DRIVING VOLTAGE APPLIED TO THE CONTROL GRID, MEASURE THE PEAK TO PEAK VOLTAGE ACROSS THE LOAD.

[H] SEE MIL-E-1C 4.10.3.2

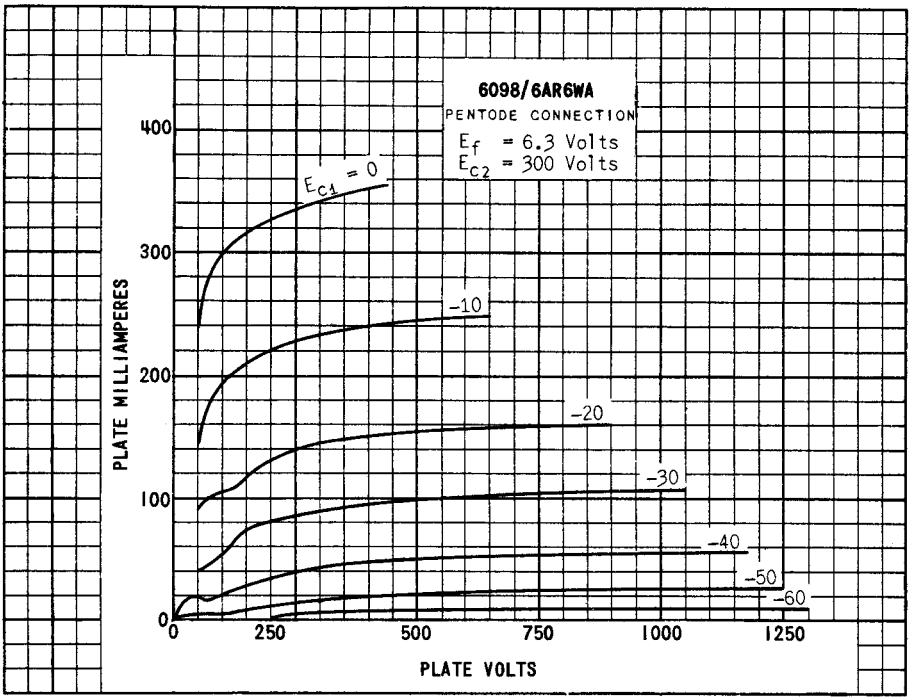
[J] ADJUST E_{c1} SO THAT I_b=55 mAdc. MEASURE RIPPLE BETWEEN PLATE AND GROUND WITH METER HAVING AN IMPEDANCE OF 100,000 OHMS OR GREATER. THE HEATER SHALL BE TIED TO NEGATIVE END OF CATHODE RESISTOR.

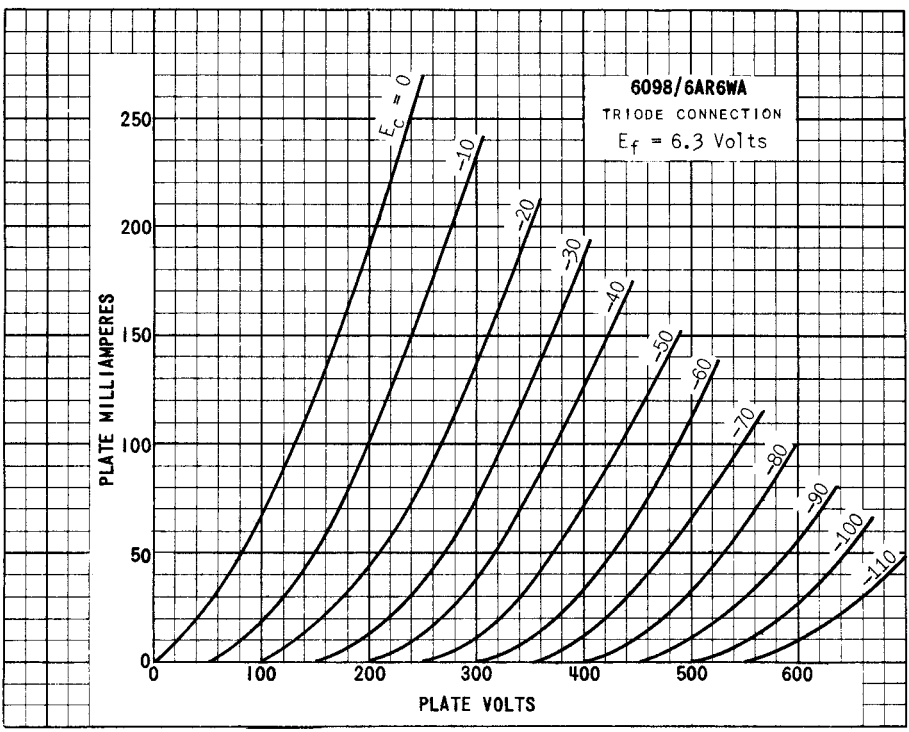
[K] THERE SHALL BE NO EVIDENCE OF ARCING OR CORONA BETWEEN ANODE PIN AND ADJACENT PINS WITH NO OTHER VOLTAGES APPLIED.

[L] BULB TEMPERATURE SHALL BE DEFINED AS THE HIGHEST TEMPERATURE INDICATED WHEN USING A THERMOCOUPLE OF .003 INCH MAXIMUM DIAMETER ELEMENTS WELDED TO A RING OF .025 INCH DIAMETER PHOSPHOR BRONZE PLACED AROUND THE BULB.

6098/6AR6WA

PREMIUM TUBE

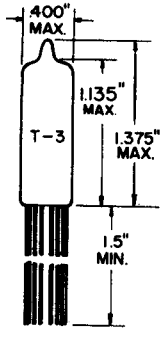




TUNG-SOL

TWIN DIODE

SUBMINIATURE



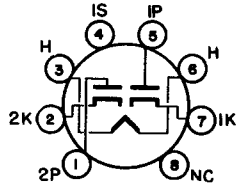
GLASS BULB

SUBMINIATURE BUTTON
FLEXIBLE LEADS
BASE - E8-10
OUTLINE DRAWING
JEDEC 3-1

COATED UNIPOTENTIAL CATHODE

RUGGEDIZED LOW CURRENT
POWER SUPPLY RECTIFIER

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8DJ

THE 6110 IS A TWIN DIODE RECTIFIER IN THE 8 PIN SUBMINIATURE CONSTRUCTION. THIS TYPE IS CHARACTERIZED BY LONG LIFE AND STABLE PERFORMANCE. IT IS SUITABLE FOR HIGH OPERATING TEMPERATURES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK AND VIBRATION ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH[A] SHIELD	
PLATE TO PLATE, (MAX.)	0.15	0.026	pf
INPUT (EACH UNIT) (P TO $K+H+i.s.(e.s.)$)	1.5	2.2	pf
CATHODE TO ALL OTHER ELECTRODES (EACH UNIT)	2.6	2.6	pf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH DIAMETER CONNECTED TO HEATER.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE VALUES

AVERAGE CHARACTERISTICS	6.3 VOLTS	150	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION		6.3±.315	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE		±360	VOLTS

MAXIMUM RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION[D]	450	G
MAXIMUM UNIFORM ACCELERATION[E]	1000	G
MAXIMUM VIBRATIONAL ACCELERATION FOR EXTENDED PERIODS[F]	2.5	G
MAXIMUM BULB TEMPERATURE	250	°C

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MAXIMUM RATINGS[A]

ABSOLUTE VALUES

PLATE SUPPLY VOLTAGE (AC)(EACH UNIT)	165	VOLTS
PEAK INVERSE PLATE VOLTAGE	460	VOLTS
PEAK PLATE CURRENT:		
STEADY STATE (EACH UNIT)	26.5	MA.
TRANSIENT (EACH UNIT)	160	MA.
OUTPUT CURRENT (DC) (EACH UNIT)	4.4	MA.

TYPICAL OPERATING CHARACTERISTICS

FULL-WAVE RECTIFIER
(CAPACITOR INPUT TO FILTER)

PLATE VOLTAGE (AC)(EACH UNIT)	150	VOLTS
FILTER INPUT CAPACITANCE	8	μf
EFFECTIVE PLATE SUPPLY IMPEDANCE	1 500	OHMS
OUTPUT CURRENT (DC)	8	MA.
LIFE EXPECTANCY:		
30°C AMBIENT TEMPERATURE	5 000	HOURS
175°C AMBIENT TEMPERATURE	1 000	HOURS
AVG. DIODE CURRENT (EACH UNIT) AT 10 VOLTS DC	15	MA.

[D]FORCES IN ANY DIRECTION AS APPLIED BY THE NAVY TYPE HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES, OR EQUIVALENT.

[E]FORCES IN ANY DIRECTION APPLIED GRADUALLY, AS IN CENTRIFUGE.

[F]VIBRATIONAL FORCES IN ANY DIRECTION AT 60 CYCLES PER SECOND FOR A PERIOD EXCEEDING 100 HOURS.

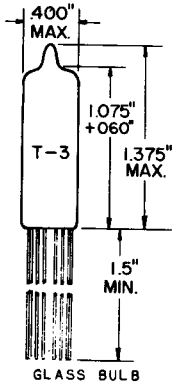
[G]LIMITATIONS BEYOND WHICH NORMAL TUBE PERFORMANCE AND TUBE LIFE MAY BE IMPARIED.

[H]TUBE LIFE AND RELIABILITY OF PERFORMANCE ARE DIRECTLY RELATED TO THE DEGREE OF REGULATION OF THE HEATER VOLTAGE TO ITS CENTER-RATED VALUE OF 6.3 VOLTS.

TUNG-SOL

TWIN TRIODE

SUBMINIATURE TYPE



GLASS BULB
SUBMINIATURE BUTTON
8 LEAD E8-10
OUTLINE DRAWING
JEDEC 3-1

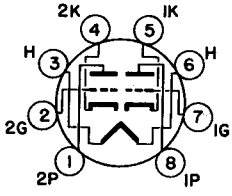
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.3 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8DG

8DG

THE 6111 IS A SUBMINIATURE MEDIUM-MU TWIN TRIODE DESIGNED FOR USE IN GENERAL-PURPOSE AMPLIFIER APPLICATIONS. EACH SECTION HAS AN INDIVIDUAL CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE MAY ALSO BE USED AS A COMBINED OSCILLATOR AND MIXER IN HIGH-FREQUENCY CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE, EACH SECTION	1.4	1.5	pf
INPUT, EACH SECTION	2.1	1.9	pf
OUTPUT, SECTION 1	1.3	0.28	pf
OUTPUT, SECTION 2	1.4	0.32	pf
GRID TO GRID, MAX.	0.010	0.011	pf
PLATE TO PLATE, MAX.	0.3	0.5	pf

[A] WITH EXTERNAL SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

ABSOLUTE MAXIMUM VALUES

EACH SECTION

MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.95	WATTS
MAXIMUM DC PLATE CURRENT	22	MA.
MAXIMUM DC GRID CURRENT	5.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.1	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER - EACH SECTION

PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	20	
PLATE RESISTANCE, APPROX.	4000	OHMS
TRANSCONDUCTANCE	5000	μMHOS
PLATE CURRENT	8.5	MA.
GRID VOLTAGE, APPROX. Ib = 10 μAMPERES	-9.0	VOLTS

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 150 Volts			Ebb = 225 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2400	8.4	13	2100	16	14	1900	25	15
0.10	0.24	3100	12	14	2800	22	15	2600	34	16
0.24	0.24	6200	10	14	5600	19	15	5200	30	16
0.24	0.51	7800	13	14	7200	25	15	7000	38	15
0.51	0.51	14000	11	13	13000	21	14	12000	32	15
0.51	1.0	19000	14	13	17000	26	14	16000	40	15

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 150 Volts			Ebb = 225 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	3200	11	13	2500	21	14	2100	32	15
0.10	0.24	4200	15	14	3400	28	15	3000	43	15
0.24	0.24	8400	13	13	6800	24	14	6000	36	15
0.24	0.51	10000	16	13	8700	29	15	7800	45	15
0.51	0.51	17000	13	13	15000	25	14	13000	38	15
0.51	1.0	21000	17	13	19000	30	14	17000	47	15

NOTES:

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY FIVE PERCENT TOTAL HARMONIC DISTORTION.
2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.
3. R_k IS IN OHMS; R_l AND R_{gf} ARE IN MEGOHMS.
4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

TUNG-SOL

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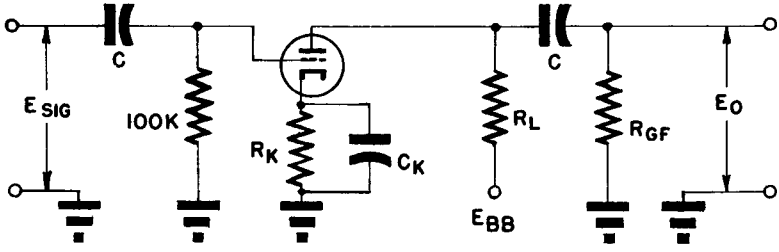

CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT: Ef = 6.3 V	INITIAL	280	320	MA.
	500 HR.	276	328	MA.
PLATE CURRENT, EACH SECTION Ef =6.3 V., Eb =100 V., Rk =220 OHMS (BY PASSED)	INITIAL	6.0	11	MA.
PLATE CURRENT DIFFERENCE BETWEEN SECTIONS: DIFFERENCE BETWEEN PLATE CURRENTS FOR EACH SECTION AT Ef =6.3 V., Eb =100 V., Rk =220 OHMS (BY-PASSED)	INITIAL	---	2.0	MA.
TRANSCONDUCTANCE (1), EACH SECTION Ef =6.3 V., Eb =100 V., Rk =220 OHMS (BY-PASSED)	INITIAL	4100	5900	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE, EACH SECTION: DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef =5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	15	PERCENT
	500 HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION, EACH SECTION DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500 HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION, EACH SECTION: AVERAGE OF VALUES FOR "TRANSCONDUCTANCE CHANGE WITH OPERATION"	500 HR	---	15	PERCENT
AMPLIFICATION FACTOR, EACH SECTION: Ef =6.3 V., Eb = 100 V., Rk = 220 OHMS (BY-PASSED)	INITIAL	17	23	
PLATE CURRENT CUTOFF, EACH SECTION: Ef = 6.3 V., Eb = 100 V., Ec =-9.0 V.	INITIAL	---	100	μAMPS.
INTERELECTRODE CAPACITANCES:				
GRID TO PLATE (G TO P) EACH SECTION	INITIAL	1.2	1.8	μμf
INPUT (G TO K+H), EACH SECTION	INITIAL	1.4	2.4	μμf
OUTPUT (P TO K+H), SECTION 1	INITIAL	0.20	0.36	μμf
OUTPUT (P TO K+H), SECTION 2	INITIAL	0.22	0.42	μμf
GRID TO GRID (G TO G)	INITIAL	---	0.011	μμf
PLATE TO PLATE (P TO P)	INITIAL	---	0.50	μμf

MEASURED WITHOUT EXTERNAL SHIELD.

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CHARACTERISTICS LIMITS - cont'd.

NEGATIVE GRID CURRENT, EACH SECTION				
Ef = 6.3 V., Eb = 100 V., Rk = 220 OHMS				
(BY-PASSED) Rg = 1.0 MEG.	INITIAL	---	0.3	μAMPS.
	500 HR.	---	0.9	μAMPS.
HEATER-CATHODE LEAKAGE CURRENT:				
Ef = 6.3 V., Ehk = 100 V.,				
HEATER POSITIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT				
TO CATHODE	INITIAL	---	5.0	μAMPS.
	500 HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef = 6.3 V., POLARITY OF APPLIED DC				
INTERELECTRODE VOLTAGE IS SUCH				
THAT NO CATHODE EMISSION RESULTS.				
GRID (EACH SECTION) TO ALL AT 100V.DC	INITIAL	100	---	MEGOHMS
	500 HR.	50	---	MEGOHMS
PLATE (EACH SECTION) TO ALL AT 300V.DC	INITIAL	100	---	MEGOHMS
	500 HR.	50	---	MEGOHMS
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS:				
Ef = 6.3 V., Ebb = 100 V., Rk = 220 OHMS				
(BY-PASSED), R_L = 10,000 OHMS, VIBRATIONAL				
ACCELERATION = 15 G AT 40 cps.	INITIAL	---	50	MV.
GRID EMISSION CURRENT, EACH SECTION:				
Ef = 7.5 V., Eb = 100 V., Ecc = -9.0 V.,				
Rg = 1.0 MEG.	INITIAL	---	0.5	μAMPS.
PULSE CATHODE CURRENT:				
Ef = 6.0 V., PULSE OF 25 μSECONDS DURATION,				
200-CYCLE REPETITION RATE, AND 50 VOLT				
AMPLITUDE IS APPLIED TO PLATE AND GRID				
TIED TOGETHER. PULSE CATHODE CURRENT				
IS MEASURED FOR EACH SECTION WITH OP-				
POSITE SECTION FLOATING	INITIAL	300	---	MA.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL IN-OPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec=0 VOLTS, AND Ehk=140 VOLTS RMS.

SHOCK RATING--450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

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TUNG-SOL

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SPECIAL TESTS AND RATINGS - cont'd.

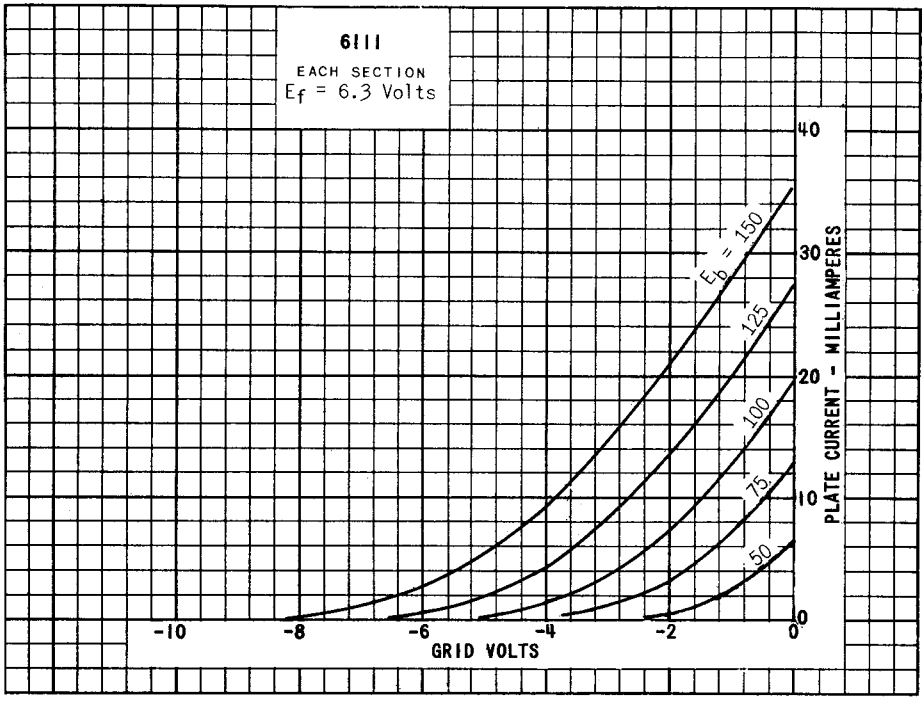
FATIGUE RATING--2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2,5 G FOR 32 HOURS IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

ALTITUDE RATING--60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

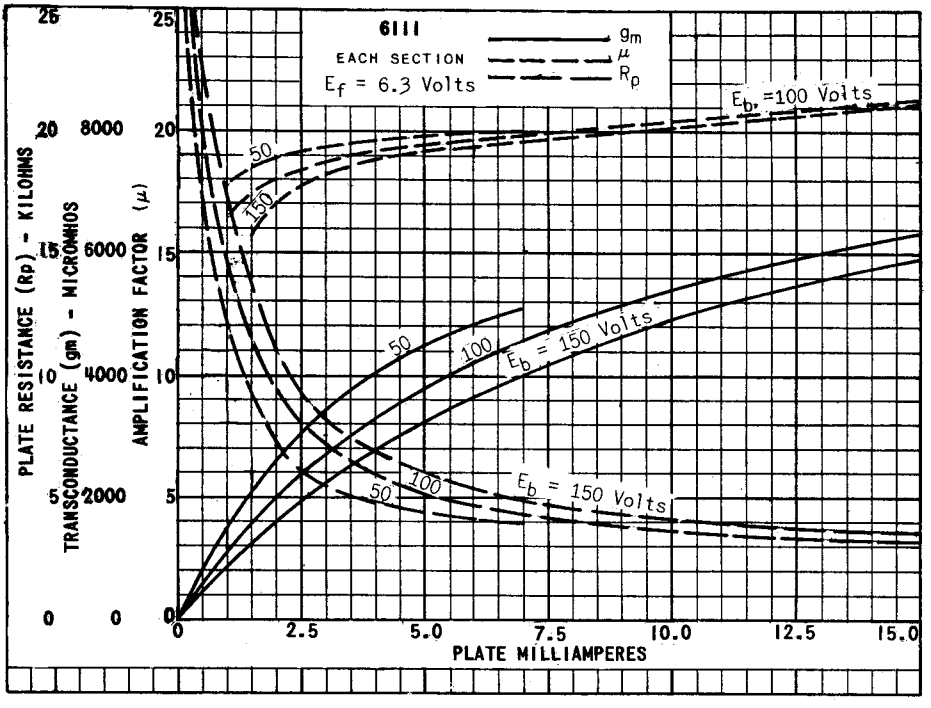
NOTE:

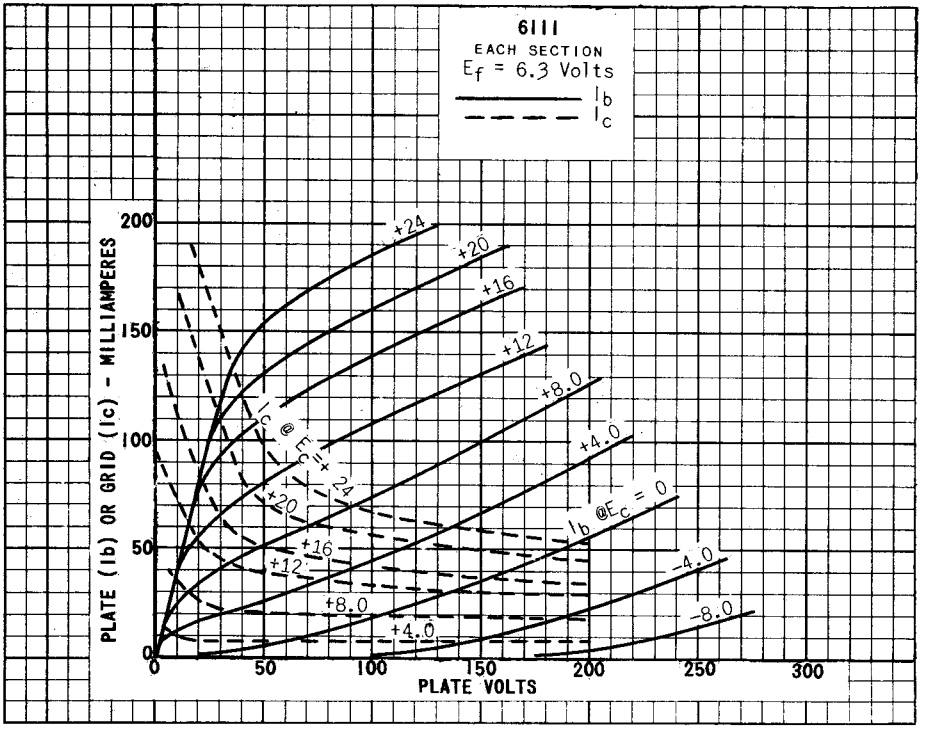
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

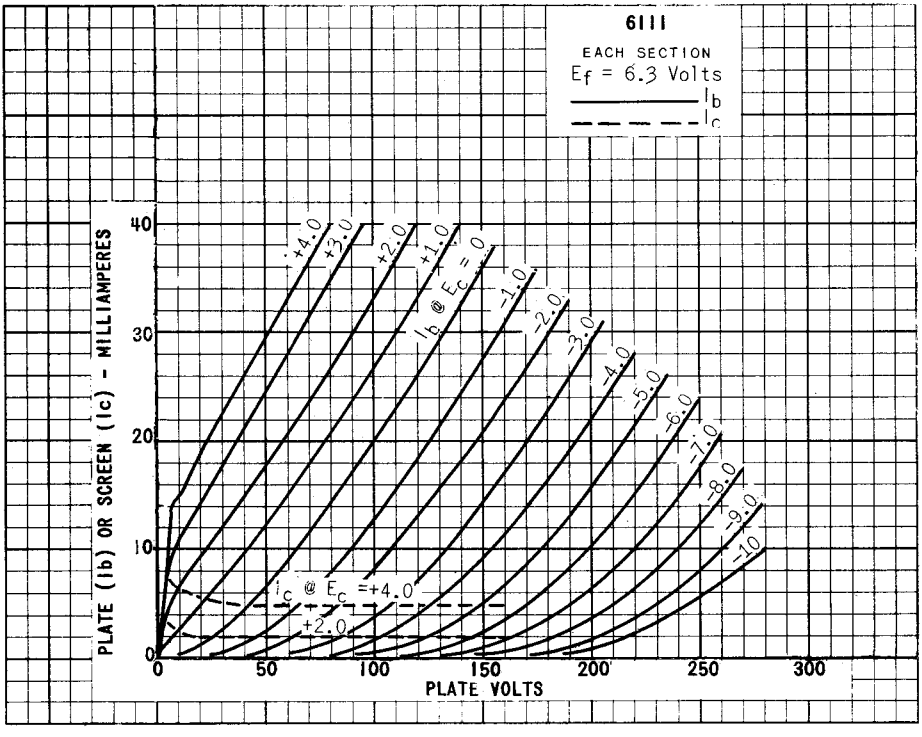
IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



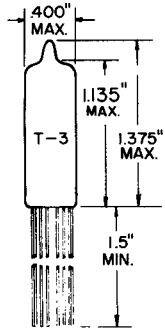
TENTATIVE DATA






6111
EACH SECTION
Ef = 6.3 Volts
Ib
Ic
PLATE (Ib) OR SCREEN (Ic) - MILLIAMPERES
PLATE VOLTS
0
10
20
30
40
50
100
150
200
250
300
+4.0
+3.0
+2.0
+1.0
Ib @ Ec = 0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
-10
Ic @ Ec =+4.0
+2.0

TUNG-SOL



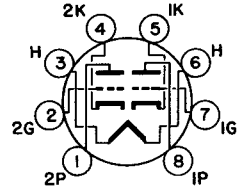
GLASS BULB
SUBMINIATURE BUTTON
8 PIN BASE E8-10
0.17" TINNED
FLEXIBLE LEADS
OUTLINE DRAWING
JEDEC 3-1

TWIN TRIODE

SUBMINIATURE TYPE

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8DG

THE 6111WA IS A HEATER-CATHODE TYPE MEDIUM-MU TWIN TRIODE CAPABLE OF OPERATION IN THE UHF REGION. IT IS OF SUBMINIATURE CONSTRUCTION AND DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED.

RATINGS
MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGUE TEST NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS
AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 7	NORM. OPERATION NOTE 6	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	V
PLATE VOLTAGE	Eb:	---	100	100	250	Vdc
PEAK PLATE VOLTAGE	eb:	---	---	---	360	v
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	Vdc
PLATE DISSIPATION (PER PL.)	Pp/p:	---	---	0.85	0.95	W
GRID #1 CIRCUIT RESISTANCE	Rg/g:	---	---	1.0	1.1	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	v
PLATE CURRENT (PER PLATE)	Ib/p:	0.5	---	8.5	22	mAdc
GRID CURRENT (PER GRID)	Ic/c:	---	---	---	5.5	mAdc
CATHODE RESISTANCE (PER UNIT)	Rk:	---	220	220	---	OHMS
TRANSCONDUCTANCE (PER PLATE)	Sm/p:	---	---	5000	---	μMHOS
AMPLIFICATION FACTOR	Mu/p:	---	---	20	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

IN THE FOLLOWING TEST, EACH UNIT IS TESTED SEPARATELY

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS, PART 1									
		COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES.							
HEATER CURRENT:	0.4	If:	285	---	---	---	315	---	mA
HEATER–CATHODE LEAKAGE (1):									
Ehk=+100 Vdc	0.4	Ihk(1):	---	---	---	---	3.5	---	μAdc
Ehk=-100 Vdc		Ihk(1):	---	---	---	---	3.5	---	μAdc
GRID CURRENT:									
Rg=1.0 MEG.	0.4	Ic(1):	---	---	---	---	-0.3	---	μAdc
PLATE CURRENT (1):	0.4	Ib(1):	6.0	7.5	8.5	9.5	11.0	2.8	mAdc
PLATE CURRENT (2):									
Ec1=-9.0 Vdc	0.4	Ib(2):	---	---	---	---	100	---	μAdc
TRANSCONDUCTANCE (1):	0.4	Sm(1):	4100	4650	→5000	5350	5900	1000	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES): (NOTE 11)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-1)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS, PART 2									
INSULATION OF ELECTRODES: Ef=6.3V									
Eg-all=-100 Vdc	2.5	Rg1-all:	250	---	---	---	---	---	MEG.
Ep-all=-300Vdc		Rp-all:	250	---	---	---	---	---	MEG.
PLATE CURRENT (1) DIFFERENCE BETWEEN SECTIONS:	2.5	Δib:	---	---	---	---	1.5	---	mAdc
TRANSCONDUCTANCE (2): Ef=5.7 V (NOTE 9)	2.5	Δ_{Ef}Sm(2):	---	---	---	---	10	---	PERCENT
GRID EMISSION: Ef=7.5 V; Rg/g=1.0 MEG.; Eb=250 Vdc; Rk/k=2900 OHMS PREHEAT 5 MIN. AT Ec1=0, TEST AT Ec1=-20 Vdc	6.5	Isc1:	---	---	---	---	-0.5	---	μAdc
AF NOISE: Esig=65 mVac; Rg1= 0.1 MEG.; Rp=0.01 MEG.; Rk=100 OHMS; Ck=1000μf UNITS CONNECTED IN PARALLEL	2.5	EB:	---	---	---	---	17	---	VU
AMPLIFICATION FACTOR:	6.5	Mu:	17	---	20	---	23	---	---
PULSE EMISSION (1): Eb=150 Vdc; Ec1 =-25 Vdc; tp=10 μsec; DUTY CYCLE= 1%; egk=+30 V; Rk/k=1.0 OHM; (NOTE 12)	2.5	ik:	320	---	---	---	---	---	ma
		Δ_{tp}ik:	---	---	---	---	10	---	PERCENT
PULSE EMISSION (2): Ef=5.9 V; Eb=150 Vdc; Ec1=-25 Vdc; tp=10μsec DUTY CYCLE =1%; egk=+30 V; Rk/k =1.0 OHM; (NOTE 12)	6.5	ik:	300	---	---	---	---	---	ma

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→INDICATES A CHANGE.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

IN THE FOLLOWING TEST EACH UNIT IS TESTED SEPARATELY

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 - CONT'D.									
HEATER-CATHODE LEAKAGE (2): Ef=-6.7 V(PIN 6 NEG.); Ehk=+100 Vdc;(CATHODE NEGATIVE); t=16 SEC. (NOTE 13)	6.5	Ihk(2):	---	---	---	---	1.0	---	μAdc
CAPACITANCE:		Cgp:	1.2	---	1.5	---	1.8	---	μμf
CAPACITANCE:		Cin:	1.4	---	1.9	---	2.4	---	μμf
CAPACITANCE (NOTE2)	6.5	Cout (UNIT #1)	0.20	---	0.28	---	0.36	---	μμf
CAPACITANCE		Cout (UNIT #2)	0.22	---	0.32	---	0.42	---	μμf
CAPACITANCE		Cgg:	---	---	---	---	0.011	---	μμf
CAPACITANCE:		Cpp:	---	---	---	---	0.50	---	μμf

MEASUREMENTS ACCEPTANCE TESTS, PART 2 cont'd.	ALLOWABLE DEF. PER CHARAC. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
OPERATION TIME: (NOTE 10)	---	---	4.0	t:	---	20	SEC.
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE =21 ±3 mmHg; VOLTAGE = 300 Vac.	---	---	6.5	---	---	---	---
VIBRATION (2): F=40 cps; G=15; Rp= 10,000 OHMS	---	---	2.5	Ep:	---	20	mVac
VIBRATION (3): F=70-2000cps G=10; Rp=10,000 OHMS. POSITIONS X_1 AND X_2 ONLY.	---	---	6.5	ep:	---	125 PEAK TO PEAK	mv.
DEGRADATION RATE ACCEPTANCE TESTS							
SUBMINIATURE LEAD FATIGUE:	---	---	2.5	---	4.0	---	arcs
SHOCK (1): Ehk=+100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE = 30°; (NOTE 3)	---	---	20	---	---	---	---
FATIGUE (1): 96 HOURS; G=2.5; FIXED FREQUENCY; F=25 MIN., 60 MAX. (NOTE 5)	---	---	6.5	---	---	---	---
SHOCK (2): Ehk=100 Vdc; Rg=0.1 MEG.; HAMMER ANGLE=120°+RUBBER PAD; t=10 MILLISECONDS; G=75; (NOTE 15)	---	---	20	---	---	---	---
FATIGUE (2): 6 HOURS; G=10; F=130-2000-130 cps (NOTE 14)	---	---	6.5	---	---	---	---
POST SHOCK TESTS (1) & (2) AND FATIGUE TESTS (1) & (2) END POINTS: VIBRATION (2): F=40cps; G=15; Rp= 10,000 OHMS			---	Ep:	---	80	mVac

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

IN THE FOLLOWING TEST, EACH UNIT IS TESTED SEPARATELY

TEST	ALLOW. DEF. PER CHARAC.		AQL	MIL-E-1	MIN	MAX	MIL-E-1
DEGRADATION RATE ACCEPTANCE TESTS (CONT'D.)	1st SAMP.	COMB. SAMP.	%				
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	---	---	---	Ihk(1):	---	7	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	7	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:							
Ef=6.3 V	---	---	---	Δ_tSm(1).	---	15	PERCENT
GRID CURRENT (1):	---	---	---	Ic(1):	---	-1.0	μAdc
GLASS STRAIN (THERMAL SHOCK).	---	---	6.5	---	---	---	---
ACCEPTANCE LIFE TEST							
HEATER CYCLING LIFE TEST: Ef=7.0V; Eb=Ec=0V; Ehk=140 Vac; 1 MIN. ON, 4 MIN. OFF	---	---	1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS:							
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	---	---	---	Ihk(1):	---	7	μAdc
Ehk=-100 Vdc	---	---	---	Ihk(1):	---	7	μAdc
2 & 20 HOUR STABILITY LIFE TEST: TA=ROOM; Ehk=+200 Vdc; Rg/g= 1.0 MEG.	---	---	---	---	---	---	---
2 & 20 HOUR STABILITY LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 50 TUBES)	---	---	---	---	---	---	---
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	---	---	1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg/g =1.0 MEG.	---	---	---	---	---	---	---
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE= 200 TUBES)	---	---	---	---	---	---	---
CONTINUITY AND SHORTS (INOPERATIVES:	---	---	0.65	---	---	---	---
TRANSCONDUCTANCE (1):	---	---	1.0	Sm(1):	3750	---	μMHOS
200 HOUR INTERMITTENT LIFE TEST (1): Eb=250 Vdc Ec1=0 Vdc; Ehk=+200 Vdc; Rg/g=1.0 MEG.; Rk/k= 2900 OHMS; TA = ROOM							
200 INTERMITTENT LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)							
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic1:	---	-0.9	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES:	1	3	---	Δ_t Sm(1):	---	25	PERCENT

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CHARACTERISTICS AND QUALITY CONTROL TESTS cont'd.

IN THE FOLLOWING TEST, EACH UNIT IS TESTED SEPARATELY

TEST	ALLOW. DEF. PER CHARAC. 1st COMB.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (cont'd.)							
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef}Sm(2)$:	---	20	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc
INSULATION OF ELECTRODES:							
g-all	1	3	---	Rg-all:	100	---	MEG.
p-all			---	Rp-all:	100	---	MEG.
TOTAL DEFECTIVES:	3	6	---	---	---	---	---
500 HOUR INTERMITTENT PULSE LIFE TEST: Eb=250 Vdc; Ec1=-25 Vdc; Rk/k=0; Rl/p=330 OHMS; tp=10 μsec; DUTY CYCLE = 1.0 %; egk=+ 30±1 VOLTS; TA = ROOM							
500 HOUR INTERMITTENT PULSE LIFE TEST END POINTS: (TYPICAL SAMPLSE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)							
INOPERATIVES:	1	3	---	---	---	---	---
PULSE EMISSION:	1	3	---	ik:	300	---	mA
CHANGE IN PULSE EMISSION OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	Δik:	---	-35	PERCENT
			---	Δik:	---	+50	PERCENT
TOTAL DEFECTIVES:	2	5	---	---	---	---	---
INTERMITTENT HIGH TEMPERATURE LIFE TEST (2): T BULB =220° C; Ehk=+200 Vdc; Rg/g=1.0 MEG.	---	---	---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.7	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
TRANSCONDUCTANCE (1) CHANGE IN INDIVIDUAL TUBES FROM INITIAL:	1	3	---	$\Delta_t Sm(1)$:	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef}Sm(2)$:	---	15	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc

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CHARACTERISTICS AND QUALITY CONTROL TEST cont'd.

IN THE FOLLOWING TEST, EACH UNIT IS TESTED SEPARATELY

TEST	ALLOW. DEF. PER CHARAC. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (cont'd.)							
INSULATION OF ELECTRODES:							
g-all:	1	3	---	Rg-all:	50	---	MEG.
p-all:			---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1) AVERAGE CHANGE:	---	---	---	$\underset{\Delta_t Sm:}{Avg}$	---	15	PERCENT
TOTAL DEFECTIVES	3	6	---	---	---	---	---
1000 HOUR HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)							
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-1.0	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
TRANSCONDUCTANCE (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	$\Delta_t Sm(1)$:	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	$\Delta_{Ef} Sm(2)$:	---	20	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc
INSULATION OF ELECTRODES:							
g-all:	2	5	---	Rg-all:	25	---	MEG.
p-all:			---	Rp-all:	25	---	MEG.
TOTAL DEFECTIVES:	4	8	---	---	---	---	---

NOTES

1. CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1, "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES," AND MIL-STD-105A.
2. WITHOUT SHIELD.
3. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.
4. CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.
5. TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

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NOTES CONT'D.

6. THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

7. THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

8. FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ± 5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

9. CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef=6.3 V TO THAT VALUE MEASURED AT Ef=5.7V.

10. OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN ± 10% OF THE THREE (3) MINUTE PLATE CURRENT (1) VALUE MEASURED AT PLATE CURRENT (1) TEST CONDITIONS. NO PREHEATING BEFORE THIS TEST IS ALLOWED. A COLD TUBE MUST BE USED.

11. DURING BOTH CONTINUITY AND SHORT TESTING, THE TUBE UNDER TEST SHALL BE TAPPED AT LEAST THREE TIMES IN EACH OF TWO PLANES 90° APART WITH A TAPPER WHICH SHALL BE ADJUSTED TO GIVE AN IMPULSE OF APPROXIMATELY ONE HALF SINE WAVE OF 300 ± 50 MICROSECONDS DURATION AND HAVING A MINIMUM AVERAGE AMPLITUDE OF 80 G'S PEAK ACCELERATION AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DEVICE CAPABLE OF DETECTING AS SHORTS, THE FOLLOWING INTERELEMENT RESISTANCES OF THE GIVEN TIME DURATION.

DURATION	SENSITIVITY
PERMANENT	600,000 OHMS
500 MICRO SECONDS	500,000 OHMS
100 MICRO SECONDS	100,000 OHMS
60 MICRO SECONDS	1,000 OHMS

TUBES WHICH GIVE AN INDICATION OF ONE OR MORE OF THE FOLLOWING SHALL BE REJECTED AS INOPERABLE:

A. EITHER A PERMANENT OR TAP SHORT AT ANY TIME DURING THE TAPPING PROCEDURE

B. ANY OPEN CIRCUIT

C. ANY LEAKS

12. PEAK CATHODE CURRENT SHALL BE MEASURED BY MEANS OF A HIGH IMPEDANCE OSCILLOSCOPE OR EQUIPMENT DEVICE CONNECTED ACROSS A 1.0 ± 1% CATHODE RESISTOR. THE SPECIFIED LIMIT REFERS TO THE MAXIMUMS OF THE PULSE COMPLITUDE. THE VARIATION OF THE OUTPUT PULSE AMPLITUDE BETWEEN 20% t_p AND 80% t_p SHALL NOT EXCEED THE SPECIFIED LIMIT.

13. HEATER-CATHODE LEAKAGE (2) IS PERFORMED AS FOLLOWS:

A. PREHEAT TUBES FOR 10 SECONDS WITH Ef = 10.5V

B. TEST IMMEDIATELY BY THE APPLICATIONS OF THE SPECIFIED TEST CONDITIONS OF THIS TEST

C. AFTER 16 SECONDS READ HEATER-CATHODE LEAKAGE OF EACH SECTION.

14 THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2 AND Y1. ONLY RATED HEATED VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

A. TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3

B. TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS, THIS IS A DESTRUCTIVE TEST

15 THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).

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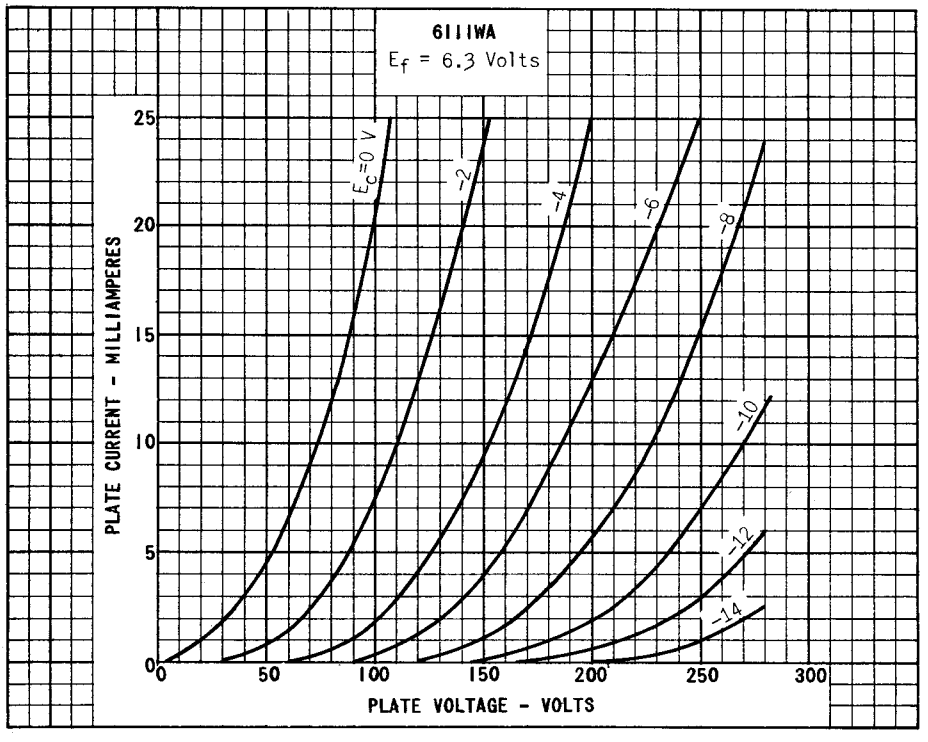

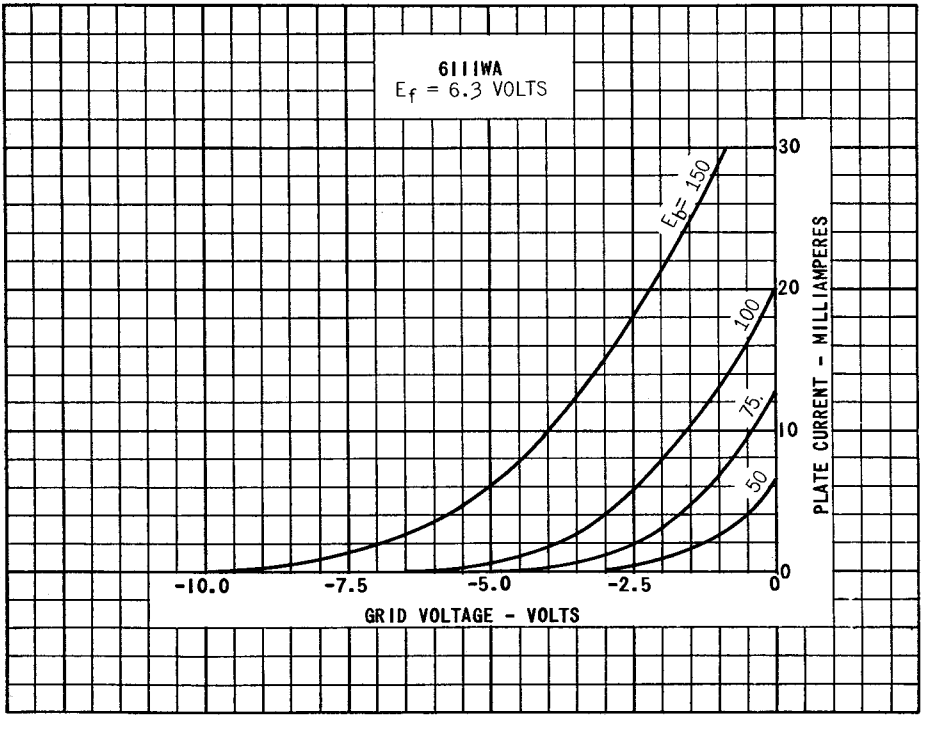

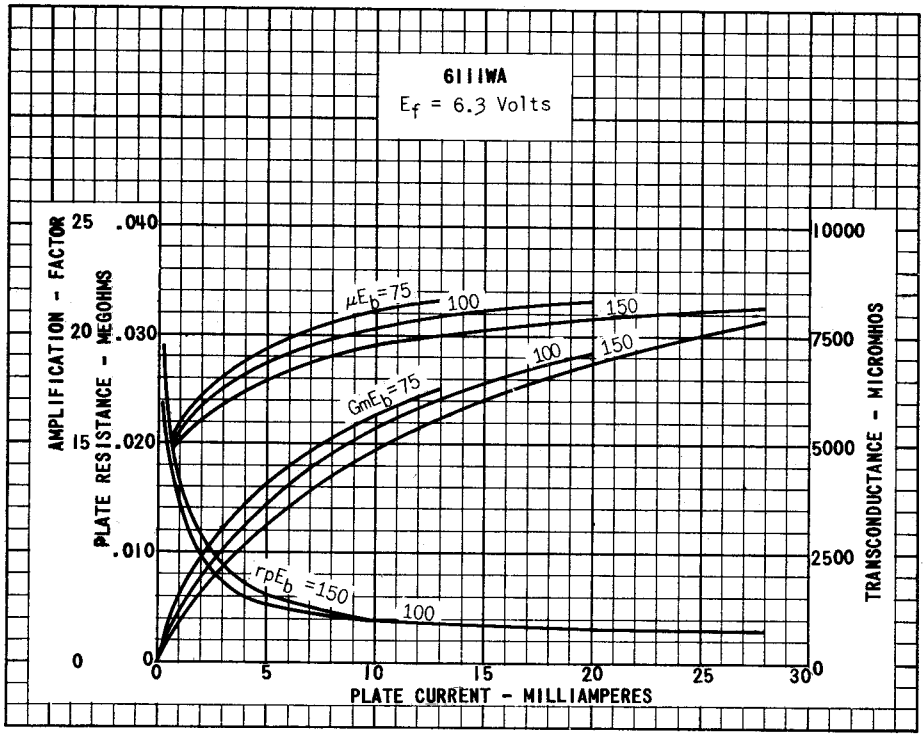

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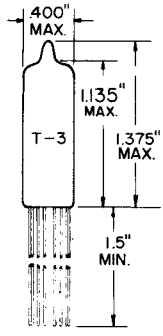
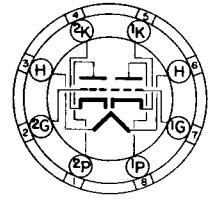
DOUBLE TRIODE

SUBMINIATURE TYPE



GLASS BULB

ANY MOUNTING POSITION



BOTTOM VIEW

SUBMINIATURE BUTTON
8 PIN
0.017" TINNED
FLEXIBLE LEADS

THE 6112 IS A HEATER-CATHODE TYPE HIGH-MU DOUBLE TRIODE OF SUBMINIATURE CONSTRUCTION, CAPABLE OF OPERATION IN THE UHF REGION. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST - NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (100 HOUR FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1B SYMBOL	ABS. MIN.	NORM. TEST CONDITIONS (NOTE 7)	NORM. OPERATION (NOTE 6)	ABS. MAX.	MIL-E-1B UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	V
PLATE VOLTAGE	Eb:	---	100	100	165	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	0	Vdc
PLATE DISSIPATION (PER PLATE)	Pp/p:	---	---	0.08	0.10	W
GRID #1 CIRCUIT RESISTANCE	Rg/g:	---	---	1.0	1.1	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	Vdc
PLATE CURRENT (PER PLATE)	Ib/p:	---	---	---	3.3	mAdc
GRID CURRENT	Ic/c:	---	---	---	---	mAdc
CATHODE RESISTANCE (PER UNIT)	Rk:	---	1500	1500	---	OHMS

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

(IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY)

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	LAL	BOG.	UAL.	MAX.	ALD	MIL-E-1B UNITS
MEASUREMENTS ACCEPTANCE TESTS - PART 1									
	COMBINED AQL=1.0% EXCLUDING MECHANICAL AND INOPERATIVES								
HEATER CURRENT:	0.65	If:	280	288	300	312	320	24	mA.
HEATER-CATHODE LEAKAGE: Ehk=- 100 Vdc	0.65	Ihk:	---	---	---	---	5.0	---	μAdc
Ehk=+100 Vdc			---	---	---	---	5.0	---	μAdc
GRID CURRENT: Eb=150 Vdc: Ec=0; Rk=820 OHMS; Rg= 1.0 MEG.	0.65	Ic(1):	---	---	---	---	-0.3	---	μAdc
PLATE CURRENT (1):	0.65	Ib(1):	0.50	---	0.8	---	1.10	---	mAdc
PLATE CURRENT (2): Ec1 =-2.8 Vdc	0.65	Ib(2):	---	---	---	---	50	---	μAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	1500	1650	1800	1950	2100	350	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES):	0.4	---	---	---	---	---	---	---	---
MECHANICAL: (ENVELOPE (8-1)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS - PART 2									
INSULATION OF ELECTRODES: Ef =6.3 V									
Eg-all=-100 Vdc	2.5	Rg-all:	100	---	---	---	---	---	MEG.
Ep-all=-300 Vdc		Rp-all:	100	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2): Ef =5.7 V (NOTE 9)	2.5	ΔSm(2): Ef:		---	---	---	15	---	PERCENT
GRID EMISSION: Eb=150 Vdc: Rg=1.0 MEG; Rk=820 OHMS; Ef=7.5 V: PREHEAT AT Ec =0; TEST AT Ec=-4.0 Vdc:	2.5	Ic(2):	---	---	---	---	-0.5	---	μAdc
AF NOISE: Esig=45 mVac; Rg=0.5 MEG: Rp=0.02 MEG; Rk= 750 OHMS: CK = 1000 μf; UNITS CONNECTED IN PARALLEL	2.5	EB:	---	---	---	---	17	---	VU
AMPLIFICATION FACTOR;	6.5	Mu:	60	---	70	---	80	---	---
A.C. AMPLIFICATION: Esig=0.2 Vac; Ebb =100 Vdc: Ecc=0; Rk=0;	6.5	Ep:	8.0	---	---	---	---	---	Vac
CAPACITANCE:		Cgp:	0.8	---	1.00	---	1.20	---	μμf
CAPACITANCE:		Cin:	1.30	---	1.70	---	2.10	---	μμf
CAPACITANCE: (NOTE 2)	6.5	Cout (Unit #1)	0.16	---	0.23	---	0.30	---	μμf
CAPACITANCE:		Cout (Unit #2)	0.21	---	0.28	---	0.35	---	μμf
CAPACITANCE:		Cgg:	---	---	---	---	0.014	---	μμf
CAPACITANCE:		Cpp:	---	---	---	---	0.80	---	μμf

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	LAL	BOG.	UAL.	MAX.	ALD	MIL-E-1B UNITS
MEASUREMENTS ACCEPTANCE TESTS - PART 2 (cont'd.)									
LOW PRESSURE VOLTAGE BREAKDOWN: PRESSURE = 55±5mmHG; VOLTAGE = 300 Vac.	6.5								
VIBRATION (1): NO VOLTAGES; F VARIABLE FROM 10 - 50 cps; G MAX. = 10; FIXED AMPLITUDE 0.040"; POST SHOCK AND FATIGUE TEST END POINTS APPLY	10.0	---	---	---	---	---	---	---	---
VIBRATION (2): F= 40cps; G=15; Rp= 10,000 OHMS	2.5	Ep:	---	---	---	---	25	---	mVac
DEGRADATION RATE ACCEPTANCE TESTS									
SUBMINIATURE LEAD FATIGUE:	2.5	---	4.0	---	---	---	---	---	arcs
SHOCK: Ehk =+100 Vdc; Rg =0.1 MEG HAMMER ANGLE =30°. (NOTE 3)	20	---	---	---	---	---	---	---	---
FATIGUE: 96 HOURS; G = 2.5 ; FIXED FREQUENCY; F=25 min; 60 max. (NOTE 5)	6.5	---	---	---	---	---	---	---	---
POST SHOCK AND FATIGUE TEST END POINTS:									
VIBRATION (2): F=40 cps; G=15; Rp= 10,000 OHMS	---	Ep:	---	---	---	---	100	---	mVac
HEATER-CATHODE LEAKAGE: Ehk=± 100 Vdc Ehk=-100 Vdc		Ihk:	---	---	---	---	20	---	μAdc
CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: Ef=6.3 V		ΔtSm(1):	---	---	---	---	20	---	PERCENT
GLASS STRAIN (THERMAL SHOCK):	6.5	---	---	---	---	---	---	---	---

ACCEPTANCE LIFE TESTS

	MAX. DEFECTS PER CHARACTERISTIC 1st SAMPLE	MAX. DEFECTS PER CHARACTERISTIC COMB. SAMPLE	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
HEATER CYCLING: Ef= 7.0 V; Eb=Ec= 0V; Ehk =140 Vac; 1 min. on, 4 min. off.	---	---	2.5	---	2000	---	CYCLES

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	MAX. DEFECTS PER CHARACT. 1st SAMPLE	COMB. SAMPLE	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE LIFE TESTS (cont'd.)							
1 HOUR STABILITY LIFE TEST: TA = ROOM; Ehk=+200 Vdc; Rg/g =1.0 MEG.	---	---	---	---	---	---	---
1 HOUR STABILITY LIFE TEST END POINTS: CHANGE IN TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES: (TYPICALSAMPLE SIZE = 50 TUBES.	---	---	1.0	ΔtSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA = ROOM; Ehk =+200 Vdc; Rg/g =1.0 MEG.							
100 HOUR SURVIVAL RATE LIFE TEST, END POINTS: (TYPICAL SAMPLE SIZE = 200 TUBES)	---	---	---	---	---	---	---
CONTINUITY AND SHORTS (INOPERATIVES):	---	---	0.65	---	---	---	---
TRANSCONDUCTANCE (1):	---	---	1.0	Sm(1):	1200	---	μMHOS
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST: T BULB = 220 °C; Ehk =+200 Vdc; Rg/g =1.0 MEG.	---	---	---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES	1	3	---	---	---	---	---
HEATER CURRENT	2	5	---	If:	276	328	mA
HEATER-CATHODE LEAKAGE: Ehk =±100 Vdc Ehk=-100 Vdc	2	5	---	Ihk:	---	10	μAdc
GRID CURRENT (1)	1	3	---	Ic(1):	---	-0.9	μAdc
TRANSCONDUCTANCE (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	ΔtSm(1):	---	25	PERCENT
TRANSCONDUCTANCE (1) AVERAGE CHANGE:	---	---	---	AveΔtSm(1):	---	15	PERCENT
INSULATION OF ELECTRODES; g1-all	2	5	---	Rg1-all:	50	---	MEG.
p-all	2	5	---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (2):(NOTE 9)	2	5	---	ΔtSm(2):	---	15	PERCENT
TOTAL DEFECTIVES	4	8	---	---	---	---	---
1000 HOUR HIGH TEMPERATURE INFORMATION LIFE TEST: T BULB=220°C; Ehk =+200 Vdc: Rg/g = 1.0 MEG.							
1000 HOUR HIGH TEMPERATURE INFORMATION LIFE TEST END POINTS: READ FOR SAME CHARACTERISTICS AS FOR 500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST. LIMITS NOT ESTABLISHED.							

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NOTES

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1B, 'INSPECTION INSTRUCTIONS FOR ELECTRON TUBES,' AND MIL-STD-105A.

NOTE 2: WITHOUT SHIELD.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1B BASIC SPECIFICATION.

NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

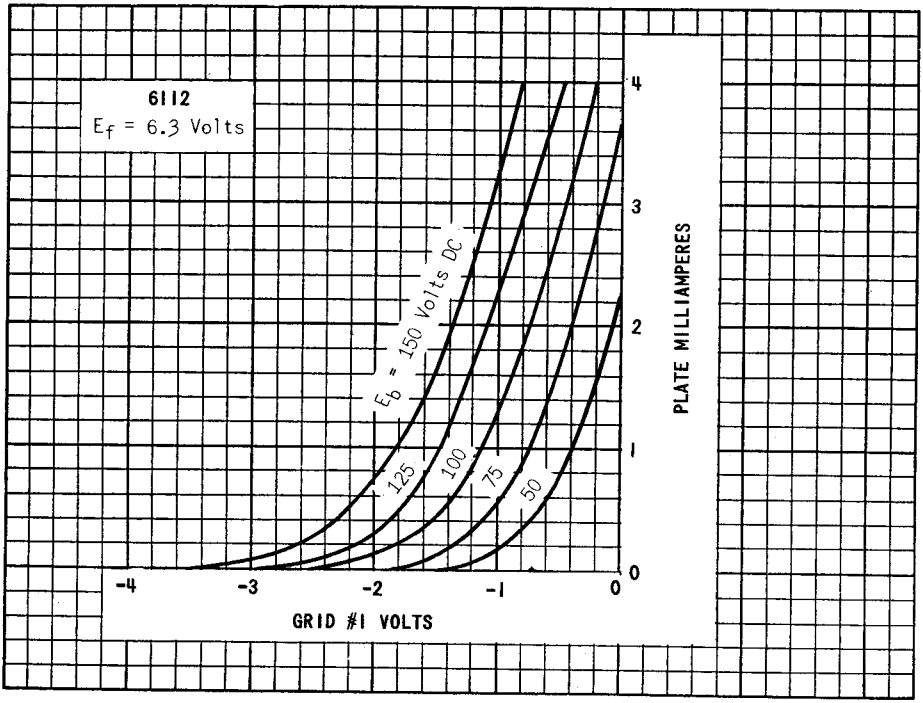
NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1B BASIC SPECIFICATION.

NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

NOTE 7: THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHER WISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8: FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ±5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

NOTE 9: CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef=6.3 V TO THAT VALUE MEASURED AT Ef=5.7 V.



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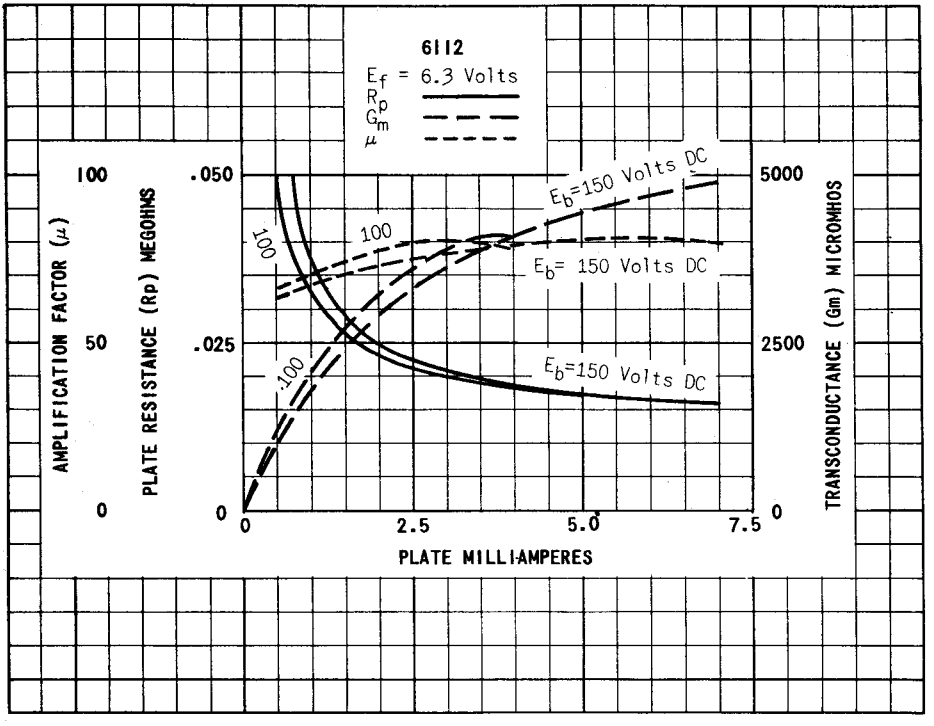
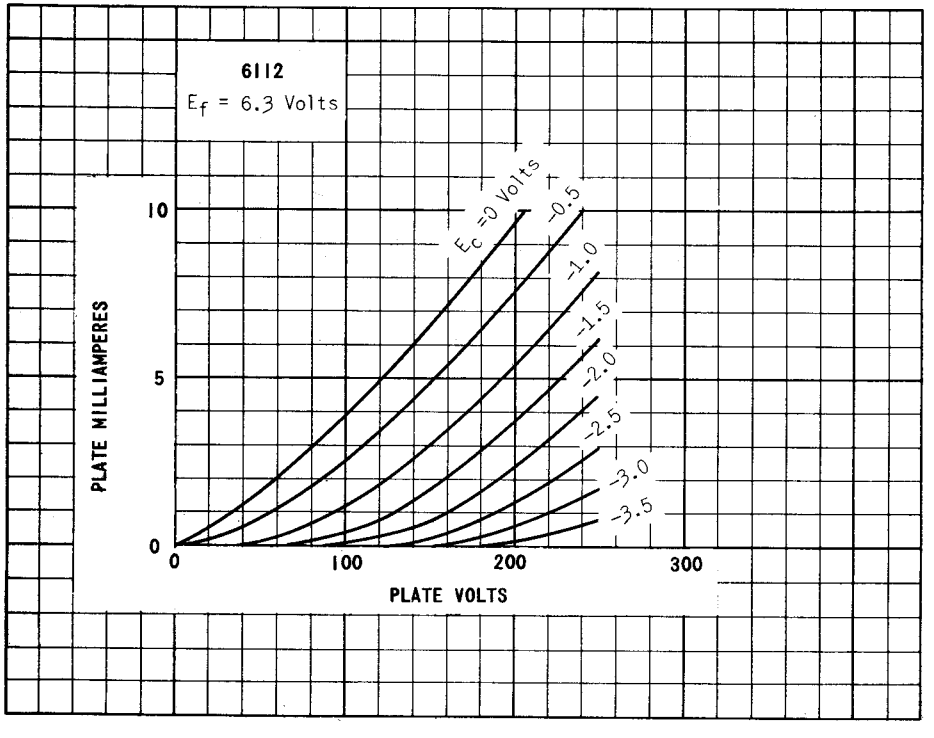

6112
E_f = 6.3 Volts
R_p
G_m
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (R_p) MEGOHMS
TRANSCONDUCTANCE (G_m) MICROMHOS
PLATE MILLIAMPERES
100
50
0
.050
.025
0
5000
2500
0
2.5
5.0
7.5
E_b=150 Volts DC
E_b= 150 Volts DC
E_b=150 Volts DC
100
100
100


6112
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
10
5
0
0
100
200
300
E_c =0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5

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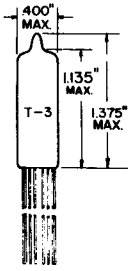
DOUBLE-TRIODE

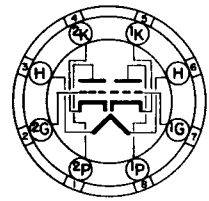
SUBMINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON
8 PIN BASE
0.017" TINNED
FLEXIBLE LEADS
8DG

THE 6112WA IS A HEATER-CATHODE TYPE HIGH-MU DOUBLE TRIODE CAPABLE OF OPERATION IN THE UHF REGION. IT IS OF SUBMINIATURE CONSTRUCTION AND DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HR. FATIGE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	220	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1 SYMBOL	DES. MIN.	NORM. TEST CONDITIONS NOTE 7	NORM. OPERATION NOTE 6	DES. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE (NOTE 8)	Ef:	6.0	6.3	6.3	6.6	V
PLATE VOLTAGE	Eb:	---	100	100	250	Vdc
PEAK PLATE VOLTAGE	ep:	---	---	---	360	v
GRID #1 VOLTAGE	Ec1:	-55	0	0	---	Vdc
PLATE DISSIPATION (PER PLATE)	Pp/p:	---	---	0.08	0.3	W
GRID #1 CIRCUIT RESISTANCE	Rg/g:	---	---	1.0	1.1	MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200	---	100	+200	Vdc
PLATE CURRENT (PER PLATE)	Ib/p:	---	---	0.8	3.3	mAdc
GRID CURRENT	Ic/c:	---	---	---	---	mAdc
CATHODE RESISTANCE (PER UNIT)	Rk:	---	1500	1500	---	OHMS
TRANSCONDUCTANCE (PER PLATE)	Sm/p:	---	---	1800	---	μMHOS
AMPLIFICATION FACTOR	Mμ/p:	---	---	70	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

(IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY)

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS - PART 1	COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES.								
HEATER CURRENT:	0.4	If:	285	---	---	---	315	---	mA
HEATER-CATHODE LEAKAGE:									
Ehk=+100 Vdc	0.4	Ihk:	---	---	---	---	3.5	---	μAdc
Ehk=-100 Vdc		Ihk:	---	---	---	---	3.5	---	μAdc
GRID CURRENT: Eb=150 Vdc; Ec=0; Rk=820 OHMS; Rg= 1.0 MEG.	0.4	Ic(1):	---	---	---	---	-0.3	---	μAdc
PLATE CURRENT (1):	0.4	Ib(1):	0.50	---	0.8	---	1.10	---	mAdc
PLATE CURRENT (2): Ec1=-2.8 Vdc	0.4	Ib(2):	---	---	---	---	50	---	μAdc
TRANSCONDUCTANCE (1):	0.4	Sm(1):	1500	1650	1800	1950	2100	350	μMHOS
CONTINUITY AND SHORTS (INOPERATIVES): (NOTE 11)	0.4	---	---	---	---	---	---	---	---
MECHANICAL: ENVELOPE (8-1)	---	---	---	---	---	---	---	---	---
MEASUREMENTS ACCEPTANCE TESTS - PART 2									
INSULATION OF ELECTRODES:									
Ef=6.3 V; Eg-all=-100Vdc;	2.5	Rg-all:	250	---	---	---	---	---	MEG.
Ep-all=-300 Vdc;		Rp-all:	250	---	---	---	---	---	MEG.
TRANSCONDUCTANCE (2): Ef=5.7 V; (NOTE 9)	2.5	Δ_{Ef}Sm(2):	---	---	---	---	15	---	PERCENT
GRID EMISSION: Eb=250 Vdc; Rg=1.0 MEG; Rk=2700 OHMS; Ef=7.5 V; PREHEAT AT Ec=0; TEST AT Ec=-9.0 Vdc	6.5	Ic(2):	---	---	---	---	-0.5	---	μAdc
AF NOISE: Esig=45mVac; Rg= 0.5 MEG.; Rp=0.2 MEG ; Rk=750 OHMS; Ck= 1000 μf; UNITS CONNECTED IN PARALLEL	2.5	EB:	---	---	---	---	17	---	VU
AMPLIFICATION FACTOR:	6.5	Mu:	60	---	70	---	80	---	---
AC AMPLIFICATION: Esig=0.2 Vac; Ebb=100 Vdc; Ecc=0; Rk=0; Rg1= 10 MEG.;	6.5	Ep:	8.0	---	---	---	---	---	Vac
HEATER-CATHODE LEAKAGE (2): Ef=-6.7V; PIN 6 NEGATIVE; Ehk=+100 Vdc; CATHODE NEGATIVE t= 16 SEC.; (NOTE 12)	6.5	Ihk(2):	---	---	---	---	1.0	---	μAdc

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

(IN THE FOLLOWING TESTS, EACH UNIT IS TESTED SEPARATELY)

TEST	AQL %	MIL-E-1 SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1 UNITS
MEASUREMENTS ACCEPTANCE TESTS PART 2 (CONT'D.)		COMBINED AQL=1.0% EXCLUDING MECH. AND INOPERATIVES							
CAPACITANCE:		Cgp:	0.8	---	1.00	---	1.20	---	μμf
CAPACITANCE:		Cin:	1.30	---	1.70	---	2.10	---	μμf
CAPACITANCE: (NOTE 2)	6.5	Cout: UNIT #1	0.16	---	0.23	---	0.30	---	μμf
CAPACITANCE:		Cout UNIT #2:	0.21	---	0.28	---	0.35	---	μμf
CAPACITANCE:		Cgg:	---	---	---	---	0.014	---	μμf
CAPACITANCE:		Cpp:	---	---	---	---	0.80	---	μμf
LOW PRESSURE BREAKDOWN: PRESSURE=21±3mmHG; VOLTAGE=300 Vac	6.5								
VIBRATION (2): F=40cps; G=15; Rp= 10,000 OHMS	2.5	Ep:	---	---	---	---	20	---	mVac
VIBRATION (3): F=70-2000; t=3 MINUTES; G=15; Rp=10,000 OHMS; POSITIONS X AND X2 ONLY.	6.5	ep:	---	---	---	---	75 peak to peak	---	mv
OPERATION TIME: (NOTE 10)	4.0	t:	---	---	---	---	20	---	sec.

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS							
SUBMINIATURE LEAD FATIGUE:	---	---	2.5	---	4.0	---	arcs
SHOCK (1): Ehk=+100 Vdc; Rg= 0.1 MEG.; HAMMER ANGLE = 30°; (NOTE 3)	---	---	20	---	---	---	---
FATIGUE (1): 96 HOURS; G=2.5; FIXED FREQUENCY; F=25 MIN; 60 MAX.; (NOTE 5)	---	---	6.5	---	---	---	---
SHOCK (2): Ehk=+100 Vdc; Rg= 0.1 MEG.; HAMMER ANGLE = 120 °+ RUBBER PAD; t=10 MILLISECONDS; G= 75 (NOTE 14)	---	---	20	---	---	---	---
FATIGUE (2): 6 HOURS; G=10; F=130-2000-130 cps (NOTE 13)	---	---	6.5	---	---	---	---

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

TEST	ALLOWABLE DEF. PER CHARACT. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN	MAX.	MIL-E-1 UNITS
DEGRADATION RATE ACCEPTANCE TESTS -CONT'D.							
POST SHOCK AND FATIGUE (1) AND (2) TEST END POINTS:							
VIBRATION (2): F=40 cps; G=15; Rp= 10,000 OHMS.	---	---	---	Ep:	80	---	mVac
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	---	---	---	Ihk(1):	---	7	μAdc
Ehk=+100 Vdc	---	---	---	Ihk(1):	---	7	μAdc
CHANGE IN TRANS-CONDUCTANCE (1) OF INDIVIDUAL TUBES:							
Ef=6.3 V	---	---	---	Δ_tSm(1):	---	15	PERCENT
GRID CURRENT (1):	---	---	---	Ic(1):	---	-1.0	μAdc
GLASS STRAIN							
(THERMAL SHOCK):	---	---	6.5	---	---	---	---
ACCEPTANCE LIFE TESTS							
HEATER CYCLING: Ef=7.0V; Eb=Ec=0V; Ehk=140 Vac; 1 MIN. ON, 4 MIN. OFF	---	---	1.0	---	2000	---	CYCLES
HEATER CYCLING LIFE TEST END POINTS:							
HEATER-CATHODE LEAKAGE:							
Ehk=+100 Vdc	---	---	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc	---	---	---	Ihk(1):	---	10	μAdc
2 & 20 HOUR STABILITY LIFE TEST: TA=ROOM; Ehk=+200 Vdc; Rg/g=1.0 MEG.: Eb=150 Vdc; Rk/k=820 OHMS	---	---	---	---	---	---	---
2 & 20 HOUR STABILITY LIFE TEST END POINTS: CHANGE IN TRANSCON-DUCTANCE (1) OF IN-DIVIDUAL TUBES: (TYPICAL SAMPLE SIZE= 50 TUBES)	---	---	1.0	Δ_tSm(1):	---	10	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA=ROOM; Ehk=+200 Vdc; Rg/g=1.0 MEG.; Eb=150 Vdc; Rk/k=820 OHMS							
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: TYPICAL SAMPLE SIZE= 200 TUBES)	---	---	---	---	---	---	---
CONTINUITY AND SHORTS (INOPERATIVES):	---	---	0.65	---	---	---	---
TRANSCONDUCTANCE (1):	---	---	1.0	Sm(1):	1200	---	μMHOS

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] cont'd.

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
200 HOUR INTERMITTENT LIFE TEST (1): TA=ROOM; Eb=250 Vdc; Ehk=+200 Vdc; Rg/g= 1.0 MEG.; Rk/k=2700 OHMS							
200 HOUR INTERMITTENT LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)							
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic1:	---	-0.9	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
CHANGE IN TRANSCONDUCTANCE OF INDIVIDUAL TUBES:	1	3	---	Δ_tSm(1):	---	25	PERCENT
TRANSCONDUCTANCE (2):	1	3	---	Δ_{Ef}Sm(2):	---	20	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc
INSULATION OF ELECTRODES:							
g-all:	1	3	---	Rg-all:	100	---	MEG.
p-all:			---	Rp-all:	100	---	MEG.
TOTAL DEFECTIVES:	3	6	---	---	---	---	---
HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST(2): T BULB=220°C; Ehk=200 Vdc; Rg/g=1.0 MEG.; Eb=150 Vdc; Rk/k=820 OHMS	---	---	---	---	---	---	---
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE= 20 TUBES 1st SAMPLE, 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic(1):	---	-0.7	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
TRANSCONDUCTANCE (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	Δ_tSm(1):	---	20	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	Δ_{Ef}Sm(2):	---	15	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk=+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk=-100 Vdc			---	Ihk(1):	---	10	μAdc

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	AQL %	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS (CONT'D.)							
INSULATION OF ELECTRODES:							
g-all:	1	3	---	Rg-all:	50	---	MEG.
p-all:			---	Rp-all:	50	---	MEG.
TRANSCONDUCTANCE (1) AVERAGE CHANGE:	1	3	---	Avg. Δ_tSm(1):	---	15	PERCENT
TOTAL DEFECTIVES:	3	6	---	---	---	---	---
1000 HOUR HIGH TEMPERATURE LIFE TEST (2) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES 1st SAMPLE; 40 TUBES 2nd SAMPLE)	---	---	---	---	---	---	---
INOPERATIVES:	1	3	---	---	---	---	---
GRID CURRENT (1):	1	3	---	Ic1:	---	-1.0	μAdc
HEATER CURRENT:	1	3	---	If:	276	328	mA
TRANSCONDUCTANCE (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	3	---	Δ_tSm(1):	---	25	PERCENT
TRANSCONDUCTANCE (2): (NOTE 9)	1	3	---	Δ_{Ef}Sm(2):	---	20	PERCENT
HEATER-CATHODE LEAKAGE (1):							
Ehk(1) =+100 Vdc	1	3	---	Ihk(1):	---	10	μAdc
Ehk(1) =+100 Vdc			---	Ihk(1):	---	10	μAdc
INSULATION OF ELECTRODES:							
g1-all:	2	5	---	Rg-all:	25	---	MEG.
p-all:			---	Rp-all:	25	---	MEG.
TOTAL DEFECTIVES:	4	8	---	---	---	---	---

NOTES:

1 CHARACTERISTICS, QUALITY CONTROL TEST PRECEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPH OF MIL-E-1, "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES", AND MIL-STD-105A.

2 WITHOUT SHIELD.

3 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

4 CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

5 TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1 BASIC SPECIFICATIONS.

6 THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

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NOTES - CONT'D.

7 THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

8 FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ± 5% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

9 CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT E_f = 6.3 V TO THAT VALUE MEASURED AT E_f = 5.7 V.

10. OPERATION TIME IS THE TIME IN SECONDS REQUIRED FOR THE PLATE CURRENT TO ATTAIN A VALUE WITHIN ± 10% OF THE THREE (3) MINUTE PLATE CURRENT (1) VALUE MEASURED AT PLATE CURRENT (1) TEST CONDITIONS. NO PREHEATING BEFORE THIS TEST IS ALLOWED, A COLD TUBE MUST BE USED.

11. DURING BOTH CONTINUITY AND SHORT TESTING, THE TUBE UNDER TEST SHALL BE TAPPED AT LEAST THREE TIMES IN EACH OF TWO PLANES 90° APART WITH A TAPPER WHICH SHALL BE ADJUSTED TO GIVE AN IMPULSE OF APPROXIMATELY ONE HALF SINE WAVE OF 300 ± 50 MICRO SECONDS DURATION AND HAVING A MINIMUM AVERAGE AMPLITUDE OF 80 G'S PEAK ACCELERATION AS MEASURED WITH A GULTON A-305 ACCELEROMETER AND KA-1 KIT. THE SHORTS DETECTING EQUIPMENT SHALL BE A DEVICE CAPABLE OF DETECTING AS SHORTS, THE FOLLOWING INTERELEMENT RESISTANCES OF THE GIVEN TIME DURATION.

DURATION	SENSITIVITY
PERMANENT SHORT	600,000 OHMS
500 MICRO SECONDS	500,000 OHMS
100 MICRO SECONDS	100,000 OHMS
60 MICRO SECONDS	1,000 OHMS

TUBES WHICH GIVE AN INDICATION OF ONE OR MORE OF THE FOLLOWING SHALL BE REJECTED AS INOPERABLE:

A. EITHER A PERMANENT OR TAP SHORT AT ANY TIME DURING THE TAPPING PROCEDURE

B. ANY OPEN CIRCUIT

C. AIR LEAKS

12. HEATER-CATHODE LEAKAGE (2) SHALL BE PERFORMED AS FOLLOWS:

A. PREHEAT TUBES FOR 10 SECONDS WITH E_f = 10.5 V

B. TEST IMMEDIATELY BY THE APPLICATION OF THE SPECIFIED TEST CONDITIONS FOR THIS TEST

C. AFTER 16 SECONDS READ HEATER-CATHODE LEAKAGE OF EACH SECTION.

13. THE TUBES SHALL BE RIGIDLY MOUNTED ON A TABLE VIBRATING WITH SIMPLE HARMONIC MOTION. THE TUBES SHALL BE VIBRATED FOR A TOTAL OF 6 HOURS, 2 HOURS IN EACH OF THREE POSITIONS, X1, X2, AND Y1. ONLY RATED HEATER VOLTAGE SHALL BE APPLIED. TUBES WHICH SHOW ONE OR MORE OF THE FOLLOWING DEFECTS SHALL BE CONSIDERED FAILURES.

A. TUBES WHICH SHOW PERMANENT OR TAP SHORTS OR OPEN CIRCUITS FOLLOWING FATIGUE TEST, WHEN TESTED AS SPECIFIED IN 4.7.2 AND 4.7.3

B. TUBES WHICH DO NOT COMPLY WITH POST FATIGUE LIMITS, THIS IS A DESTRUCTIVE TEST

14. THE PROVISIONS OF PARAGRAPH 4.9.20.5 OF SPECIFICATION MIL-E-1 SHALL APPLY, EXCEPT FOR EXCEPT FOR TEST CONDITIONS LISTED FOR SHOCK TEST (2).

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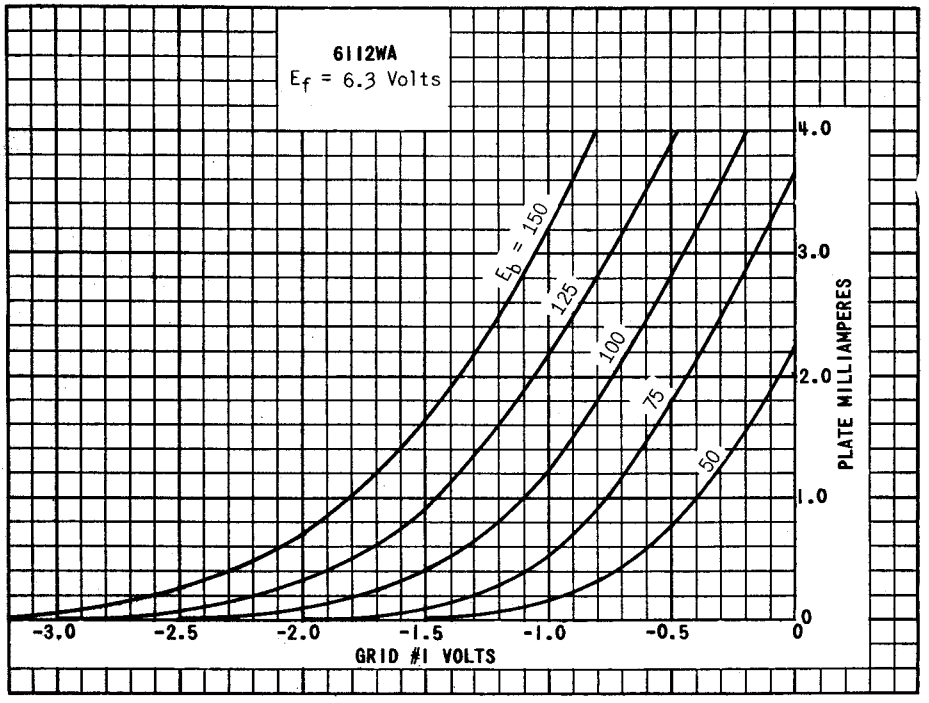
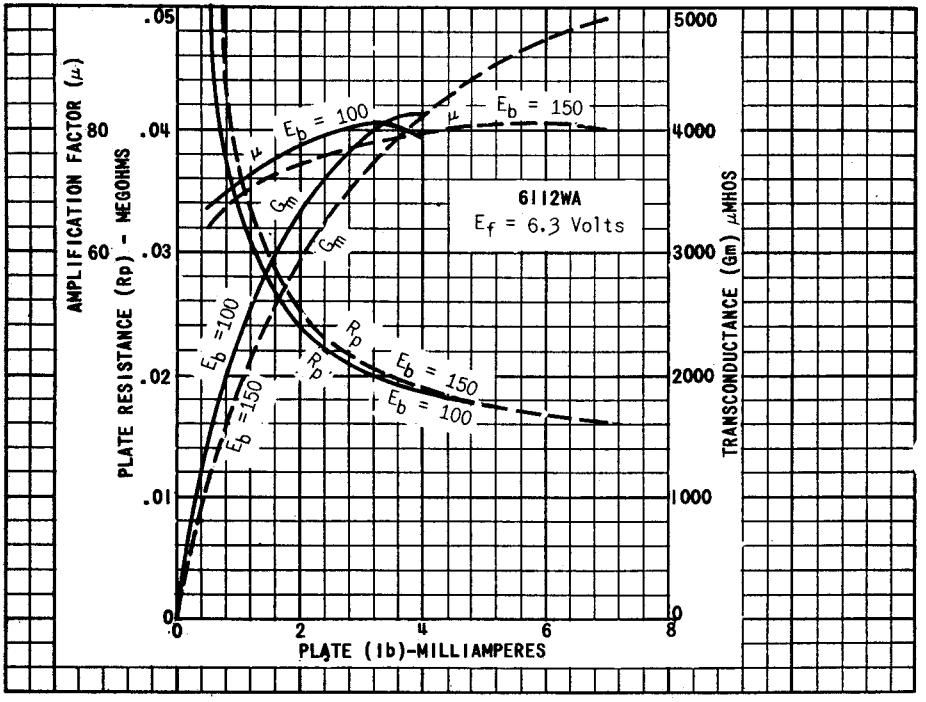
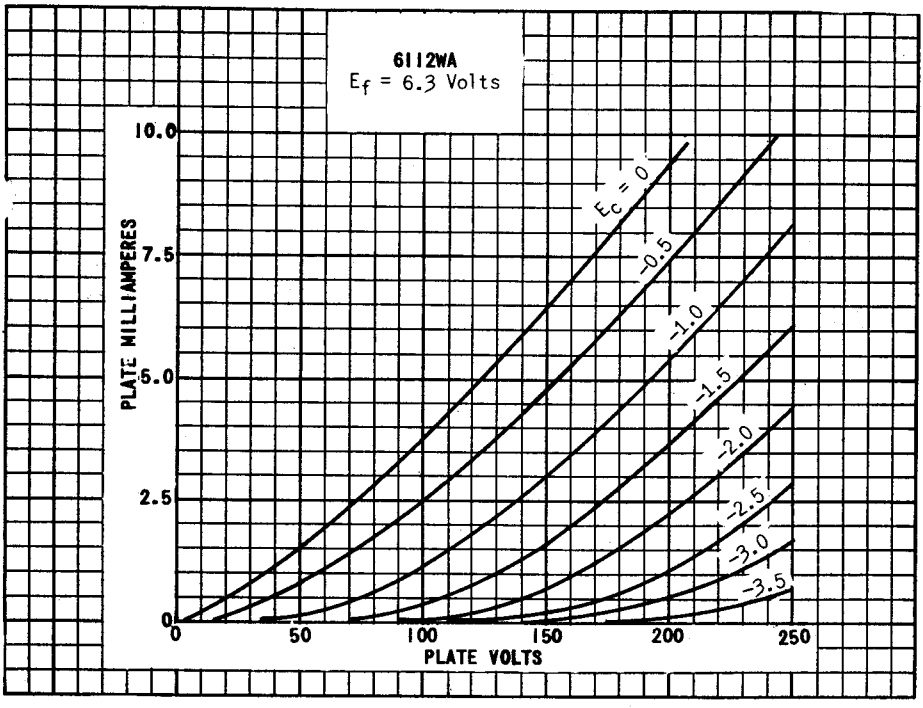
TENTATIVE DATA



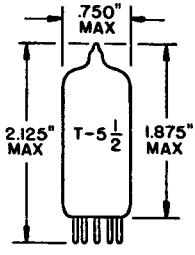



6112WA
E_f = 6.3 Volts
PLATE MILLIAMPERES
10.0
7.5
5.0
2.5
0
0
50
100
150
200
250
PLATE VOLTS
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

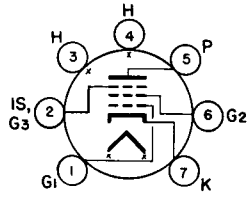
FOR

MOBILE AND AIRCRAFT

APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7BK

THE 6136 IS A SHARP-CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A HIGH-GAIN RF OR IF AMPLIFIER. FEATURES INCLUDE A HIGH DREGEE OF MECHANICAL STRENGTH AND A HEATER-CATHODE CONSTRUCTION DESIGNED TO WITHSTAND MANY THOUSAND CYCLES OF INTERMITTENT OPERATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH [A] SHIELD	WITHOUT SHIELD	
GRID 1 TO PLATE (MAX.)	0.0035	0.0035	pf
INPUT	6.5	6.0	pf
OUTPUT	5.5	5.0	pf

[A] WITH EXTERNAL SHIELD 316 CONNECTED TO PIN 7.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	300	MA.
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

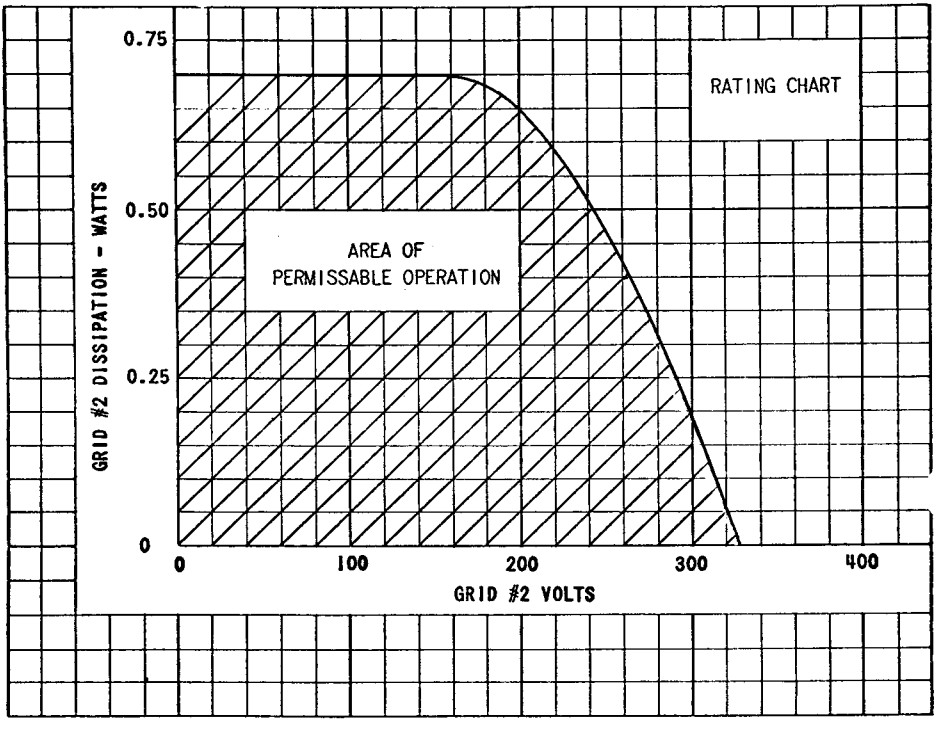
PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE - SEE RATING CHART		
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	50	VOLTS
DC GRID 1 CURRENT	1.0	MA.
PLATE DISSIPATION	→ 3.3	WATTS
GRID 2 DISSIPATION	0.7	WATTS
GRID 1 CIRCUIT RESISTANCE	0.5	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	165°	C

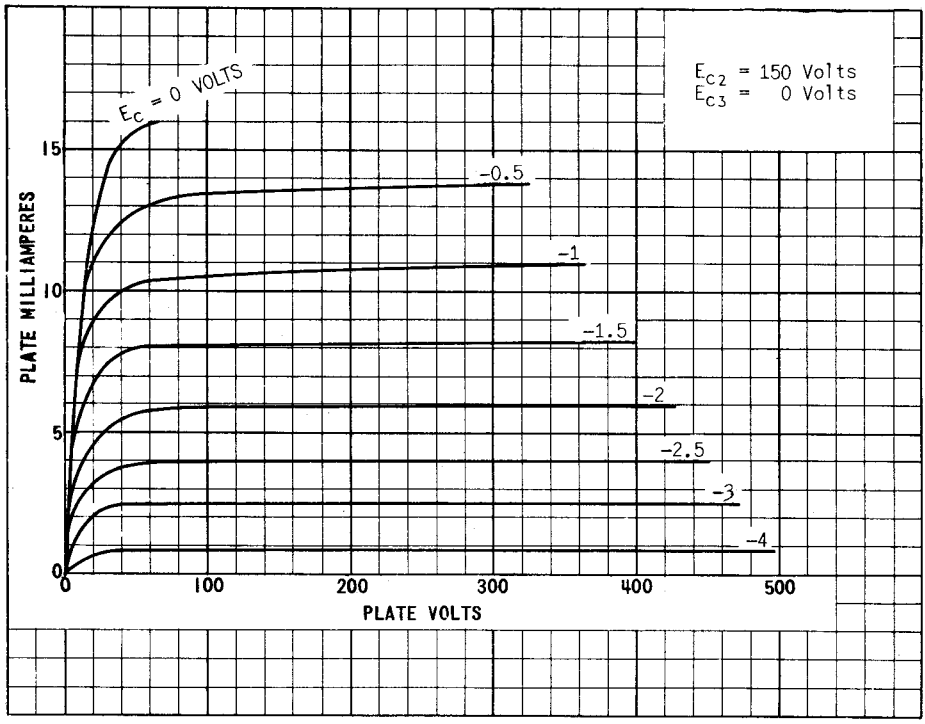
TYPICAL OPERATING CHARACTERISTICS

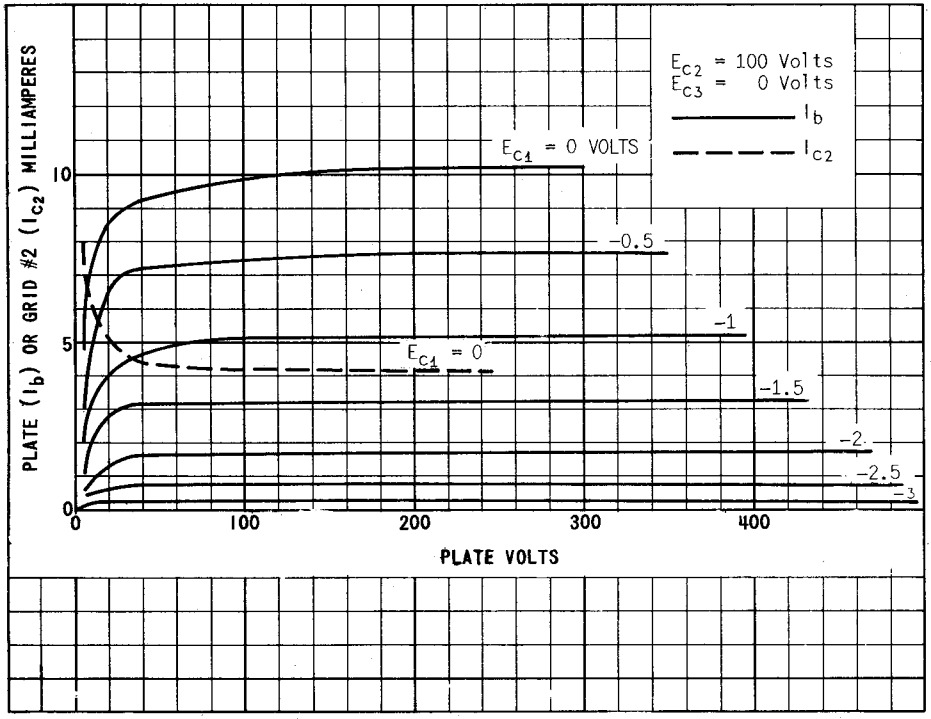
CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID 3 CONNECTED TO CATHODE AT SOCKET			
GRID 2 VOLTAGE	100	150	VOLTS
PLATE CURRENT	5.0	10.6	MA.
GRID 2 CURRENT	2.1	4.3	MA.
CATHODE BIAS RESISTOR	150	68	OHMS
TRANSCONDUCTANCE	3,900	5,200	μMHOS
PLATE RESISTANCE (APPROX.)	0.5	1.0	MEGOHM
GRID 1 VOLTAGE (APPROX.) FOR Ib = 10 μAMPS	-4.2	-6.5	VOLTS

→ INDICATES A CHANGE.







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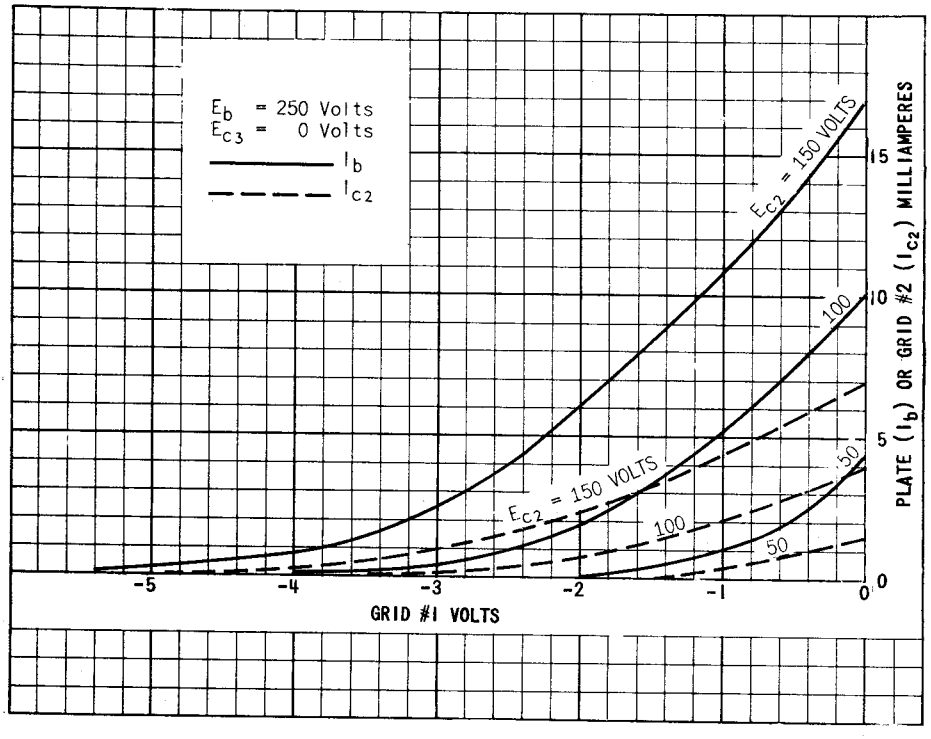
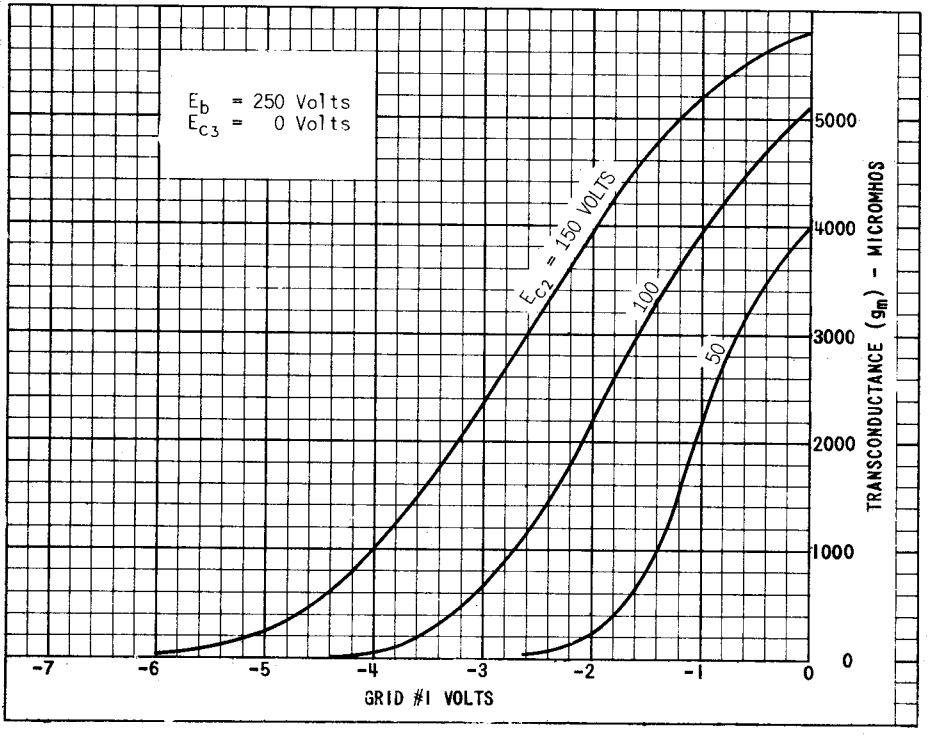
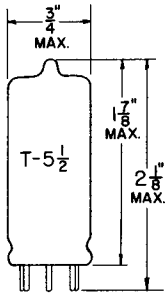

E_b = 250 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c2} = 150 VOLTS
100
50
E_{c2} = 150 VOLTS
100
50
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
0
5
10
15
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES


E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 150 VOLTS
100
50
-7
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS
0
1000
2000
3000
4000
5000
TRANSCONDUCTANCE (g_m) - MICROMHOS

TUNG-SOL

PENTODE
MINIATURE TYPE

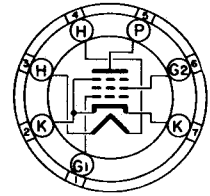


GLASS BULB
6-2

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 0.30 AMP.



BOTTOM VIEW
MINIATURE BUTTON
7 PIN BASE

THE 6186/6AG5WA IS A SHARP CUTOFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS AN INTERMEDIATE FREQUENCY OR RF AMPLIFIER. THROUGH THE USE OF TWO CATHODE LEADS, ISOLATION OF INPUT AND OUTPUT CIRCUITS IS MADE FEASIBLE

RATINGS
AND NORMAL OPERATION

	MIL-E-1 SYMBOL	TEST CONDITIONS	ABS. MAX.	MIL-E-1 UNITS
HEATER VOLTAGE	Ef	6.3	6.3±10%	V
PLATE VOLTAGE	Eb	250	330	Vdc
GRID #1 VOLTAGE	Ec1	0		Vdc
GRID #2 VOLTAGE	Ec2	150	250	Vdc
CATHODE RESISTANCE	Rk	200		OHMS
GRID #2 DISSIPATION	Pg2		0.55	W
PLATE DISSIPATION	Pp		2.5	W
HEATER-CATHODE VOLTAGE	Ehk		100	V
BUBB TEMPERATURE			+165	°C
ALTITUDE		NOTE 11		

CHARACTERISTICS AND QUALITY CONTROL TESTS

TEST QUALIFICATION APPROVAL TESTS	AQL %	MIL-E-1 SYMBOL	MAX.	MIL-E-1 UNITS
QUALIFICATION APPROVAL:				
CARTON DROP:				
(d) PACKAGE GROUP 1; CARTON SIZE B;				
VIBRATION (1):				
Rp = 2000	---	Ep:	100	mVac

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CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	BOG.	MAX.	MIL-E-1 UNITS
ACCEPTANCE TESTS- GROUP A						
FATIGUE:						
NOTE 3	6.5					
SHOCK:						
HAMMER ANGLE=30°						
Ehk=100 Vdc, HEATER						
POSITIVE; Rg1=0.1Meg.	---					
POST SHOCK AND &						
FATIGUE TEST END						
POINTS						
VIBRATION (2):	---	Ep:	---	---	450	mVac
HEATER-CATHODE LEAKAGE:						
HEATER POSITIVE	---	Ihk	---	---	30	μAdc
HEATER NEGATIVE	---	Ihk:	---	---	30	μAdc
TRANSCONDUCTANCE (1):	---	Sm:	3500	---	---	μMHOS
GRID CURRENT (1):	---	Ic1:	0	---	-0.2	μAdc
ACCEPTANCE TESTS- GROUP B						
GLASS STRAIN:	2.5	---	---	---	---	---
ACCEPTANCE TESTS- GROUP C						
CONTINUITY & SHORT:	0.4	---	---	---	---	---
ACCEPTANCE TESTS GROUP D - NOTE 6						
HEATER CURRENT	0.65	If:	275	300	375	mA
HEATER-CATHODE LEAKAGE:						
Ehk=100 Vdc, HEATER POS.	0.65	Ihk:	---	---	10	μAdc
Ehk=100 Vdc, HEATER NEG.			---	---	10	μAdc
GRID CURRENT (1):	0.65	Ic1:	0	---	-0.1	μAdc
PLATE CURRENT (1):	0.65	Ib:	5.2	---	8.8	mAdc
SCREEN GRID CURRENT:	0.65	Ic2:	1.3	---	2.7	mAdc
TRANSCONDUCTANCE (1):	0.65	Sm:	4000	---	6000	μMHOS
ACCEPTANCE TESTS- GROUP E						
INSULATION OF ELECTRODES:						
Ef = 6.3 V						
E(g1-all)=100Vdc, g1 Neg.	2.5	Rg1-all:	100	---	---	MEG
E(p-all)=300Vdc, p Neg.		Rp-all:	100	---	---	MEG.
PLATE CURRENT (2):						
Rk=0; Ec1=-4.5 Vdc	2.5	Ib:	5	---	---	μAdc
PLATE CURRENT (3):						
Rk=0; Ec1=-10Vdc	2.5	Ib:	---	---	100	μAdc
TRANSCONDUCTANCE (2):						
Ef = 5.7 V.	2.5	ΔSm:	---	---	15	PERCENT

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TUNG-SOL

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CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd.

TEST	AQL %	MIL-E-1 SYMBOL	MIN.	BOG.	MAX.	MIL-E-1 UNITS
ACCEPTANCE TESTS- GROUP E- cont'd.						
GRID CURRENT (2): Ef =7.0 V; Rg1= 0.1 Meg.	2.5	Ic1:	0	---	-0.2	μAdc
RF NOISE: Ec1=-2Vdc; Eca1=15.0 mVac	2.5	---	---	---	3	mW
NOISE & MICROPHONICS: Ef=6.3Vac; Ehk=0; Ebb= Ecc2=300Vdc; Rg2=0.06 Meg; Rp=0.01 Meg; Rk= 200	2.5	---	---	---	50	mVac
ACCEPTANCE TESTS- GROUP F						
VIBRATION (2): Rp = 2000	6.5	Ep:	---	---	100	mVac
CAPACITANCE: NO SHIELD		Cgp:	---	---	0.03	pf
NO SHIELD	6.5	Cin:	5.2	---	7.8	pf
NO SHIELD		Cout:	1.3	---	2.3	pf
LOW PRESSURE VOLTAGE BREAKDOWN: NOTE 10	6.5		500	---	---	Vac

	AQL %	ALLOWABLE DEF. PER CHARACTER. 1st SAMP.	COMB. SAMP.	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS:							
STABILITY LIFE TEST: INTERMITTENT LIFE TEST CONDITIONS:NOTE 7	---	---	---		---	---	
STABILITY LIFE TEST END POINTS: TRANSCONDUCTANCE (1):	1.0	---	---	ΔSm:	---	10	PERCENT
SURVIVAL RATE LIFE TEST: INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT: NOTE 7	0.65	---	---		---	---	
INTERMITTENT LIFE TEST: Ehk=100Vdc; HEATER POS.; Rg1=1.0 Meg; MIN. BULB TEMP.=+165°C	---	---	---		---	---	

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TUNG-SOL

CHARACTERISTICS AND QUALITY CONTROL TESTS - cont'd.

TEST	AQL %	ALLOWABLE DEF. PER CHARACTER. 1st. SAMP.	ALLOWABLE DEF. PER CHARACTER. COMB. SAMP.	MIL-E-1 SYMBOL	MIN.	MAX.	MIL-E-1 UNITS
ACCEPTANCE LIFE TESTS:- cont'd.							
INTERMITTENT LIFE TEST END POINTS (500 HOURS):							
INOPERATIVES	---	1	3		---	---	
HEATER CURRENT	---	1	3	If:	275	325	mA
HEATER CATHODE LEAKAGE:							
HEATER POSITIVE	---	1	3	Ihk:	---	10	μAdc
HEATER NEGATIVE				Ihk	---	10	μAdc
GRID CURRENT (1)	---	1	3	Ic1:	0	-0.1	μAdc
TRANSCONDUCTANCE (1)	---	1	3	Sm:	3750	6000	μMHOS
TRANSCONDUCTANCE (1) AVG. CHANGE:	---	---	---	AVG.ΔSm:	---	15	PERCENT
TRANSCONDUCTANCE (2)	---	2	5	ΔSm:	---	15	PERCENT
INSULATION OF ELECTRODES:							
(g1-all)	---	2	5	Rg1-all:	50	---	MEG.
(p-all)				Rp-all)	50	---	MEG.
INTERMITTENT LIFE TEST END POINTS (1000 HRS.)							
INOPERATIVES	---	2	5		---	---	
HEATER CURRENT:	---	2	5	If:	275	325	mA
HEATER CATHODE LEAKAGE:							
HEATER POSITIVE	---	2	5	Ihk:	---	10	μAdc
HEATER NEGATIVE				Ihk:	---	10	μAdc
GRID CURRENT (1)	---	2	5	Ic1:	0	-0.1	μAdc
TRANSCONDUCTANCE (1)	---	2	5	Sm:	3500	6000	μMHOS

GENERAL NOTE:

GENERAL TUBE MARKING REQUIREMENTS AS CONTAINED IN SPECIFICATION MIL-E-1 AND INSPECTION INSTRUCTIONS FOR ELECTRON TUBES SHALL APPLY TO TUBES MANUFACTURED IN ACCORDANCE WITH THIS TEST SPECIFICATION SHEET EXCEPT THAT THE LAST 2 DIGITS OF THE YEAR OF MANUFACTURE SHALL BE SHOWN RATHER THAN THE SINGLE LAST DIGIT. ALSO EACH TUBE SHALL BE MARKED WITH A LOT IDENTIFICATION SYMBOL, LETTER OR FIGURE, SO THAT TUBES OF A GIVEN LOT MAY BE IDENTIFIED.

A LOT AS REFERENCED IN THIS SPECIFICATION SHALL BE AS SPECIFIED IN PARAGRAPH 5.3.1.3 INSPECTION INSTRUCTIONS FOR ELECTRON TUBES.

NOTES:

1, DIFFICULTY MAY BE ENCOUNTERED IF THIS TUBE IS OPERATED FOR LONG PERIODS OF TIME WITH VERY SMALL VALUES OF CATHODE CURRENT.

2, IF IT IS DESIRED TO CHECK QUALITY SUBSEQUENT TO LOT ACCEPTANCE, THE CONDITIONS AND ACCEPTANCE LIMITS SET FORTH IN THIS SPECIFICATION SHALL APPLY. WHEN 100% TESTING IS PERFORMED AND THE RESULTS INDICATE THAT THE PERCENTAGE OF DEFECTIVES IS EQUAL TO OR LESS THAN THE SPECIFIED AQL VALUES, THE LOT IS DEEMED AS COMPLYING WITH THE INTENT OF THE SPECIFICATION.

3, THIS TEST SHOULD BE CONDUCTED ON THE INITIAL PRODUCTION LOT AND THEREAFTER ON A LOT EVERY 30 DAYS APPROXIMATE. IN THE EVENT OF LOT FAILURE, THE LOT IS REJECTED AND SUCCEEDING LOT IS SUBJECTED TO THIS TEST. ONCE A LOT HAS PASSED, THE 30 DAY RULE SHALL APPLY. MIL-STD-105, SAMPLE SIZE CODE LETTER F, NORMAL AND TIGHTENED INSPECTION TABLES TO APPLY.

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TUNG-SOL

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NOTES- cont'd.

4, REFERENCE MIL-STD-105, SAMPLE SIZE CODE LETTER E. NORMAL AND TIGHTENED INSPECTION TABLES TO APPLY.

5, REFERENCE MIL-STD-105, SAMPLE SIZE CODE LETTER I, NORMAL AND TIGHTENED INSPECTION TABLES TO APPLY.

6, THE AQL FOR THE COMBINED DEFECTIVES FOR ATTRIBUTES IN GROUP D SHALL BE ONE (1) PERCENT. A TUBE HAVING ONE (1) OR MORE DEFECTS SHALL BE COUNTED AS ONE (1) DEFECTIVE. MIL-STD-105, INSPECTION LEVEL 2 SHALL APPLY.

7, TUBES TO BE LIFE TESTED AT ROOM TEMPERATURE AMBIENT.

8, APPROVED ALTERNATE TEST - THE INSERTION OF A 1.0 MEG RESISTOR IN THE GRID CIRCUIT SHALL NOT CHANGE THE PLATE CURRENT MORE THAN 0.5 MADC.

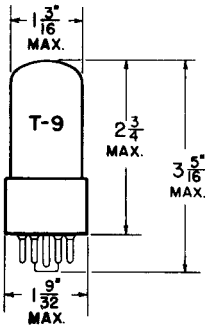
9, THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEEDING THREE (3) OHMS AT 60 CYCLES.

10, BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS. PRESSURE = 55±5M/M MERCURY; TEMPERATURE =25±5°C; HUMIDITY =0; VOLTAGE =500VAC, 60 CYCLES, SINUSOIDAL WAVE FORM.

11, REFERENCE SPECIFICATION SHALL BE OF THE ISSUE IN EFFECT ON THE DATE OF INVITATION FOR BID.

TUNG-SOL

TWIN TRIODE

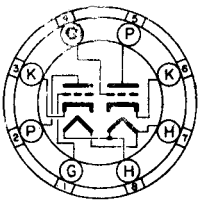


GLASS BULB

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.3 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
INTERMEDIATE SHELL
8 PIN OCTAL
LOW LOSS PHENOLIC
8BD

THE 6188/6SU7WGT IS A RUGGEDIZED, HIGH MU, TWIN TRIODE IN THE OCTAL BASE, BANTAM CONSTRUCTION. THE TWO TRIODES ARE ELECTRICALLY INDEPENDENT, ALLOWING SIMULTANEOUS USE OF THE TWO IN COMPLETELY DIFFERENT APPLICATIONS. TIGHT GAS AND LEAKAGE CONTROLS ON THE TUBE INCREASE STABILITY AND A SPECIAL PLATE CURRENT BALANCE TEST BETWEEN SECTIONS IS SPECIFIED. THEREFORE, IN ADDITION TO GENERAL PURPOSE APPLICATIONS SUCH AS VOLTAGE AMPLIFIERS, OSCILLATORS AND MULTIVIBRATORS, THE 6188/6SU7WGT MAY BE USED IN APPLICATIONS REQUIRING EXTREME STABILITY SUCH AS BALANCED AMPLIFIERS, AND WHERE LARGE GRID RESISTORS MAY BE NECESSARY. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT, TRANSCONDUCTANCE AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET TEST SPECIFICATION, THE 6188/6SU7WGT IS ESPECIALLY SUITED FOR USE IN MILITARY AND INDUSTRIAL AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±0.6	VOLTS
MAXIMUM DC PLATE VOLTAGE	275	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	±100	VOLTS
MAXIMUM PLATE DISSIPATION (EACH SECTION)	1.1	WATTS
MAXIMUM BULB TEMPERATURE	+165	°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER (EACH SECTION)

PLATE VOLTAGE	250	VOLTS
GRID VOLTAGE	-2	VOLTS
PLATE CURRENT	2.3	mA
PLATE RESISTANCE	44 000	OHMS
TRANSCONDUCTANCE	1 600	μMHOS
AMPLIFICATION FACTOR	70	

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TUNG-SOL

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

E_f = 6.3V, E_b = 250 Vdc, E_c = −2.0Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	275	325	---	---	275	325	mA
HEATER CATHODE LEAKAGE (E_{hk}=±100Vdc)	---	5.0	---	---	---	5.0	μAdc
GRID CURRENT (1)[A]	0	−0.5	---	---	0	−0.5	μAdc
PLATE CURRENT (1)[BP]	1.55	3.05	2.00	2.60	---	---	mAdc
AC AMPLIFICATION (E_{bb}=200Vdc, E_c=0, E_{sig}=0.2Vac, R_g 2000)	8.6	---	---	---	---	---	Vac
PLATE CURRENT (2) (E_c =4.50Vdc)	---	200	---	---	---	---	μAdc
PLATE CURRENT (3) (E_c =4.25 dc)	5	---	---	---	---	---	μAdc
INSULATION OF ELECTRODES[C]							
R(g-all)	100	---	---	---	---	50	MEGOHM
R(p-all)	100	---	---	---	---	50	MEGOHM
TRANSCONDUCTANCE (1)	1325	1875	1500	1700	---	---	μMHOS
Δ TRANSCONDUCTANDE[D] (E_f = 5.7V)	---	15	---	---	---	---	PERCENT
AMPLIFICATION FACTOR[E]	55	85	62	78	---	---	
PLATE CURRENT DIFFERENCE[F]	---	±0.1	---	---	---	---	Vdc
GRID CURRENT DIFFERENCE[F]	---	±1.5	---	---	---	---	Vdc

SPECIAL REQUIREMENTS

	MIN.	MAX.	
NOISE AND MICROPHONICS[AG] (E_f=6.3Vac, E_{hk}=0, E_b=200Vdc, E_c=0, R_L=0.1 meg.)	---	50	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[H] (PRESSURE =55±5mm Hg., voltage=500Vac)	---	---	
LOW FREQUENCY VIBRATION[JA] (R_p = 10,000)	---	50	mVac
SHOCK[K] (HAMMER ANGLE = 30°C, E_{hk}=±100Vdc	---	---	
VIBRATIONAL FATIGUE[L]	---	---	
POST SHOCK AND VIBRATIONAL FATIGUE TEST END POINTS			
VIBRATION	---	200	mVac
HEATER CATHODE LEAKAGE (E_{hk}=±100 Vdc)	---	±10	μAdc
GRID CURRENT (1)	0	−0.5	μAdc
AC AMPLIFICATION	8.0	---	Vac
1 HOUR STABILITY LIFE TEST (E_b=250Vdc, E_c=1.0Vdc, E_{hk}=±100Vdc, R_g=1.0meg; TA=Room)	---	---	
STABILITY LIFE TEST END POINTS Δ TRANSCONDUCTANCE (1) OF INDIVIDUAL TUBES	---	10	PERCENT
INTERMITTENT LIFE TEST[N] (STABILITY LIFE TEST CONDITIONS OR EQUIVALENT ENVELOPE TEMPERATURE =+165°C)			

NOTES

[A] TIE 1p TO 2p, 1g TO 2g, 1k TO 2k. (PARASITIC SUPPRESSOR OF 50 OHM MAXIMUM PERMITTED).

[B] SEE MIL-E-1C 4.10.11.2

[C] SEE MIL-E-1C 4.8.2

[D] THE VALUE OF Δ TRANSCONDUCTANCE SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:

$$\frac{(\text{SM AT } 6.3)-(\text{SM AT } 5.7)}{(\text{SM AT } 6.3)} \times 100$$

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TUNG-SOL

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NOTES – CONT'D.

E SEE MIL-E-1C 4.10.11.1

F THE TEST CIRCUIT TO BE USED IS SHOWN SCHEMATICALLY IN FIGURE 1. WITH SWITCH S1 IN POSITION (1) ADJUST Ec ON SECTION 2 TO GIVE E = 0 ON METER M1. MEASURE Ec AT METER M2.

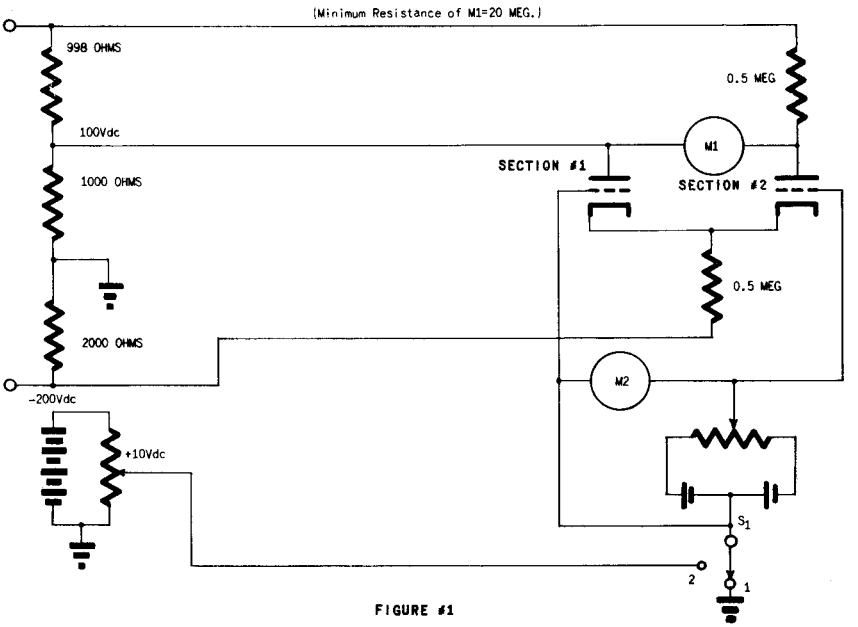

FIGURE #1

G SEE MIL-E-1C 4.10.3.5

H BREAKDOWN IS DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS. TEMP.= 25±5° C, HUMIDITY=0; VOLTAGE SHALL BE OF SINUSOIDAL WAVEFORM AT F=60 CPS. PRESSURE =55±5mm Hg.

J SEE MIL-E-1C 4.9.19.1

K SEE MIL-E-1C 4.9.20.5

L SEE MIL-E-1C 4.9.20.6

N ENVELOPE TEMPERATURE IS DEFINED AS THE HIGHEST TEMPERATURE INDICATED WHEN USING A THERMOCOUPLE OF .003 IN. MAX. DIAMETER ELEMENTS WELDED TO A RING OF .025 IN. DIAMETER PHOSPHOR BRONZE PLACED AROUND THE BULB.

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TUNG-SOL

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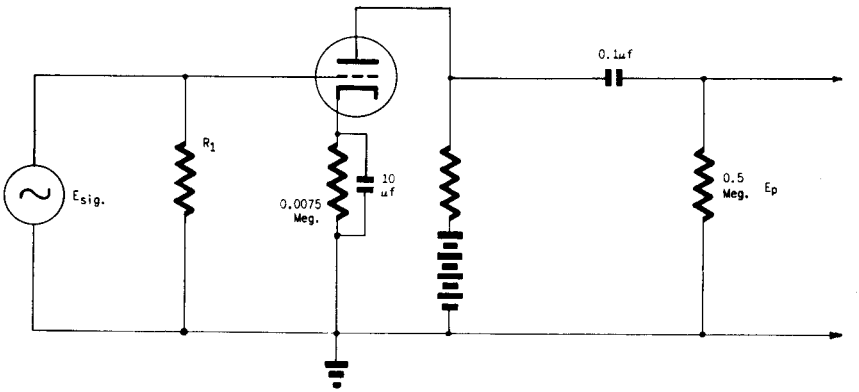
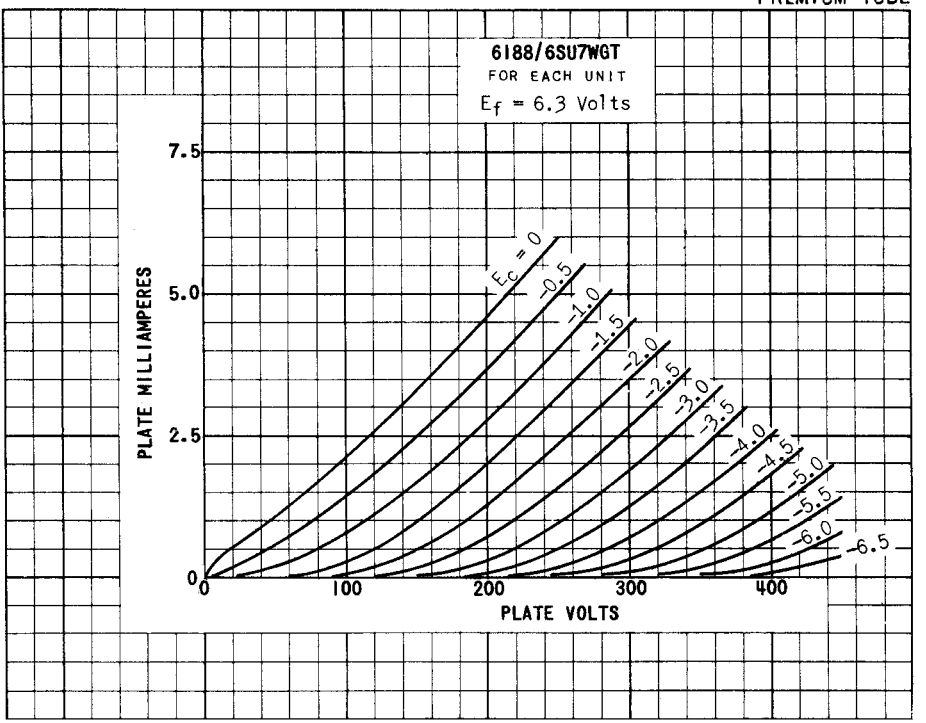
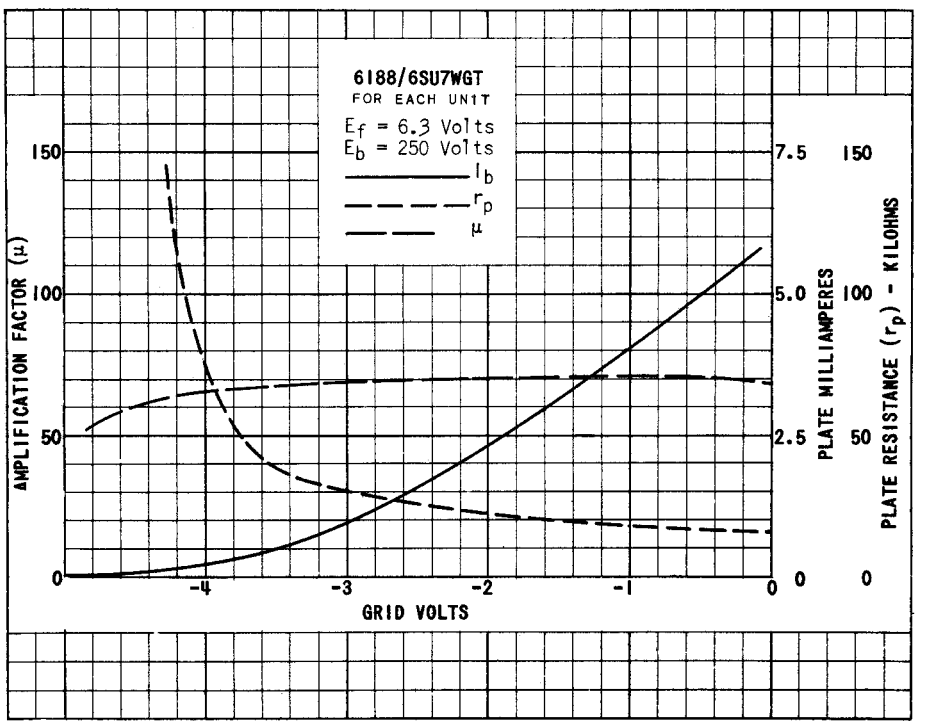
NOTES – CONT'D.

P
E_{sig} = SIGNAL GENERATOR WITH INTERNAL RESISTANCE SUCH THAT IN COMBINATION WITH R_1 GIVES 2000 OHMS RESISTANCE BETWEEN #1 GRID AND GROUND.



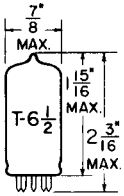

6188/6SU7WGT
FOR EACH UNIT
E_f = 6.3 Volts
PLATE MILLIAMPERES
7.5
5.0
2.5
0
E_c = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
0
100
200
300
400
PLATE VOLTS


6188/6SU7WGT
FOR EACH UNIT
E_f = 6.3 Volts
E_b = 250 Volts
I_b
r_p
μ
AMPLIFICATION FACTOR (μ)
150
100
50
0
PLATE MILLIAMPERES
7.5
5.0
2.5
0
PLATE RESISTANCE (r_p) - KILOHMS
150
100
50
0
-4
-3
-2
-1
0
GRID VOLTS

TUNG-SOL

TWIN TRIODE

MINIATURE BUTTON



GLASS BULB

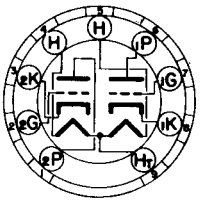
COATED UNIPOTENTIAL CATHODE

HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
0.15 AMP.	0.3 AMP.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.



BOTTOM VIEW
MINIATURE BUTTON
9 PIN BASE
9A

ANY MOUNTING POSITION

THE 6189/12AU7WA IS A RUGGEDIZED, MEDIUM MU, TWIN TRIODE OF THE NINE PIN MINIATURE CONSTRUCTION. THE TWO TRIODE SECTIONS ARE ELECTRICALLY INDEPENDENT ALLOWING SIMULTANEOUS USE OF THE TWO IN WIDELY DIFFERENT APPLICATIONS. IN ADDITION TO GENERAL PURPOSE AUDIO FREQUENCY VOLTAGE AMPLIFIER AND PHASE INVERTER CIRCUITS, THE 6189/12AU7WA IS WELL SUITED TO USE AS OSCILLATOR, MULTIVIBRATOR, COMBINED OSCILLATOR-MIXER, AND RESISTANCE COUPLED AMPLIFIER SERVICE. THE HEATER CENTER TAP PERMITS OPERATION FROM EITHER A 6.3 OR 12.6 VOLT SUPPLY. CONTROLS ON THE PRODUCT AVERAGE FOR SUCH CHARACTERISTICS AS PLATE CURRENT TRANSCONDUCTANCE, AND AMPLIFICATION FACTOR ASSURE THAT THESE CRITICAL CHARACTERISTICS WILL REMAIN WELL CENTERED. SINCE IT MUST BE ABLE TO WITHSTAND SEVERE MECHANICAL TESTS TO MEET THE TEST SPECIFICATION, THE 6189/12AU7WA IS ESPECIALLY SUITED FOR USE IN INDUSTRIAL AND MILITARY AIRBORNE EQUIPMENT WHICH MAY BE SUBJECTED TO SEVERE SHOCK AND VIBRATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD	WITHOUT SHIELD	
TRIODE UNIT #1			
GRID TO PLATE (RATED)	1.5	1.5	μμf
INPUT (RATED)	1.8	1.6	μμf
OUTPUT (RATED)	2.0	0.40	μμf
TRIODE UNIT #2			
GRID TO PLATE (RATED)	1.5	1.5	μμf
INPUT (RATED)	1.8	1.6	μμf
OUTPUT (RATED)	2.0	0.32	μμf

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TUNG-SOL

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RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±10%		12.6±10%	VOLTS
MAXIMUM DC PLATE VOLTAGE		330		VOLTS
MAXIMUM PLATE DISSIPATION (PER PLATE)		3.0		WATTS
MAXIMUM HEATER CATHODE VOLTAGE		±200		VOLTS
MAXIMUM PEAK DC CATHODE CURRENT (EACH SECTION)		22		mA.
MAXIMUM BULB TEMPERATURE		165		°C

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
CLASS A_1 AMPLIFIER – EACH TRIODE UNIT

HEATER VOLTAGE	12.6	6.3	12.6	6.3		VOLTS
HEATER CURRENT	0.15	0.3	0.15	0.3		AMP.
PLATE VOLTAGE	100		250			VOLTS
GRID VOLTAGE	0		−8.5			VOLTS
PLATE CURRENT	11.8		10.5			mA.
PLATE RESISTANCE (APPROX.)	6500		7700			OHMS
TRANSCONDUCTANCE	3100		2200			μMHOS
AMPLIFICATION FACTOR	20		17			
GRID VOLTAGE FOR Ib=10μA (APPROX.)	---		−24			VOLTS

RESISTANCE COUPLED AMPLIFIER
EACH SECTION

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.10	3300	14	13	2200	14	26	1800	14	40
0.10	0.24	0.10	3600	14	16	2700	15	33	2200	15	51
0.24	0.24	0.10	7500	14	16	5100	15	30	4300	15	44
0.24	0.51	0.10	9100	14	19	6800	15	39	5100	15	54
0.51	0.51	0.10	13000	14	16	9100	15	30	6800	16	40
0.51	1.0	0.10	15000	14	19	10000	16	32	7500	16	45
0.24	0.24	10	0	15	13	0	16	33	0	17	46
0.24	0.51	10	0	16	17	0	17	38	0	18	62
0.51	0.51	10	0	16	14	0	18	32	0	18	53
0.51	1.0	10	0	17	18	0	18	41	0	19	68

NOTES: 1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT (5%) TOTAL HARMONIC DISTORTION.

2. GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.

3. FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.

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TUNG-SOL

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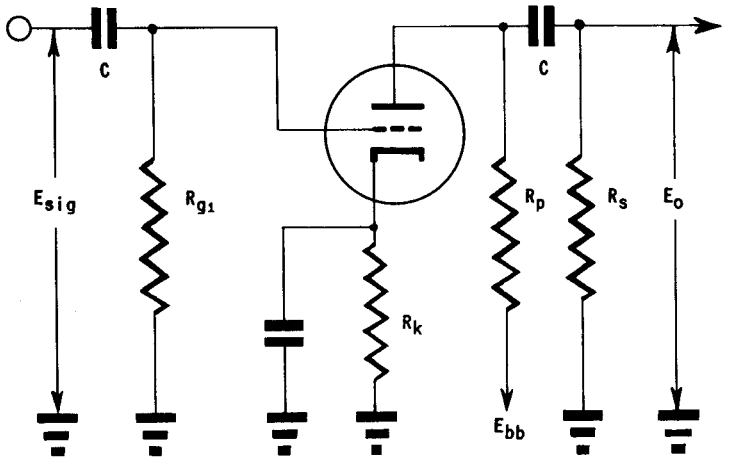

NOTES: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE
R_k SHOULD BE ADEQUATELY BY-PASSED.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Ef=12.6V, Eb=250Vdc, Ec=-8.5Vdc
EXCEPT AS MODIFIED BELOW

	INITIAL				500 HOUR LIFE TEST		
	INDIVIDUAL MIN.	INDIVIDUAL MAX.	PROD. MIN.	AVG. MAX.	INDIVIDUAL MIN.	INDIVIDUAL MAX.	
HEATER CURRENT	138	162	---	---	138	162	mA.
HEATER CATHODE LEAKAGE[A] (Ehk=±100Vdc)	---	±10	---	---	---	±10	μAdc
GRID CURRENT (1) (Rg=0.5 MEG.)	0	-0.5	---	---	0	-0.5	μAdc
PLATE CURRENT (1)	6.5	14.5	9.0	12.0	---	---	mAdc
TRANSCONDUCTANCE (1)	1750	2650	2000	2400	1600	2650	μMHOS
ΔAVERAGE TRANSCONDUCTANCE (1)	---	---	---	---	---	15	PERCENT
INSULATION OF ELECTRODES[B] (Ef=12.6V, E(g-all)= 100Vdc, g NEG.:E(p.all)= 300 Vdc, p NEG.)							
R(g-all)	500	---	---	---	250	---	MEGOHMS
R(p-all)	500	---	---	---	250	---	MEGOHMS
PLATE CURRENT (2) (Ec=-25Vdc)	---	20	---	---	---	---	μAdc
PLATE CURRENT (3) (Ec=-18Vdc)	5	---	---	---	---	---	μAdc
ΔTRANSCONDUCTANCE (2)[C]	---	15	---	---	---	15	PERCENT
GRID CURRENT (2)[D]	0	-1.5	---	---	---	---	μAdc
PLATE CURRENT (1) (DIFFERENCE BETWEEN SEC.)	---	3.5	---	---	---	---	mAdc
TRANSCONDUCTANCE (3) (Eb=100Vdc, Ec=0)	2500	4000	2850	3650	---	---	μMHOS
AMPLIFICATION FACTOR	15.5	18.5	16.2	17.8	---	---	

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TUNG-SOL

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SPECIAL REQUIREMENTS

	MIN.	MAX.	
RF NOISE [AEF] (Ec=-9Vdc, Ecal=7.0mVac)	---	3.0	mW.
NOISE AND MICROPHONICS [AGH] (Ef=12.6Vac, Ehk=0, Ebb=300Vdc, Ec=0, Rp=50,000)	---	50	mVac
LOW FREQUENCY VIBRATION[JA] (Rp=2000)	---	100	mVac
LOW PRESSURE VOLTAGE BREAKDOWN[K]	500	---	Vac
STABILIZATION INTERMITTENT LIFE TEST CONDITIONS OR EQUIVALENT	---	---	
VARIABLE FREQUENCY VIBRATION[LA] (Rp=2000)	---	100	mVac
VIBRATIONAL FATIGUE[M]	---	---	
SHOCK[N] (HAMMER ANGLE=30°; Ehk=100Vdc, HEATER POSITIVE; Rg=0.1MEG.)	---	---	
POST SHOCK AND FATIGUE TEST END POINTS			
LOW FREQUENCY VIBRATION	---	150	mVac
HEATER-CATHODE LEAKAGE	---	±30	μAdc
TRANSCONDUCTANCE (3)	2000	---	μMHOS
GRID CURRENT (4)	0	-1.5	μAdc
SHORT AND CONTINUITY[P]	---	---	
GLASS STRAIN[R]	---	---	

NOTES

[A] TIE 1p TO 2p, 1g TO 2g, 1k TO 2k. (PARASITIC SUPPRESSORS OF 50 OHMS MAXIMUM ARE PERMITTED).

[B] SEE MIL-E-1C 4.8

[C] THE VALUE OF TRANSCONDUCTANCE (2) SHALL APPLY TO INDIVIDUAL TUBES AND IS EXPRESSED:--

$$\frac{(\text{Sm AT } 12.6) - (\text{Sm AT } 11.4)}{(\text{Sm AT } 12.6)} \times 100$$

[E] SEE MIL-E-1C 4.10.3.1

[F] THE OUTPUT INDICATOR SHALL BE A "VU" METER. THE THREE (3) MILLIWATT POINT SHALL BE DETERMINED AS A METER DEFLECTION OF 25 PERCENT THE CALIBRATION POINT.

[G] THE CATHODE RESISTOR SHALL BE SHUNTED WITH A CAPACITIVE REACTANCE NOT EXCEDING THREE (3) OHMS AT 60 CYCLES.

[H] TIE CATHODES TOGETHER AND GROUND THROUGH A 1500 OHM RESISTOR. GRIDS ARE GROUNDED.

[J] SEE MIL-E-1C 4.9.20.4

[K] BREAKDOWN SHALL BE DEFINED AS THE VOLTAGE AT WHICH ARCING OCCURS BETWEEN ANODE BASE PIN AND ADJACENT PINS. PRESSURE=55±5mmHg.; TEMPERATURE=25±5° C; HUMIDITY =0; VOLTAGE=500Vac, 60 CYCLES, SINUSOIDAL WAVE FORM.

[L] SEE MIL-E-1C 4.9.20.3

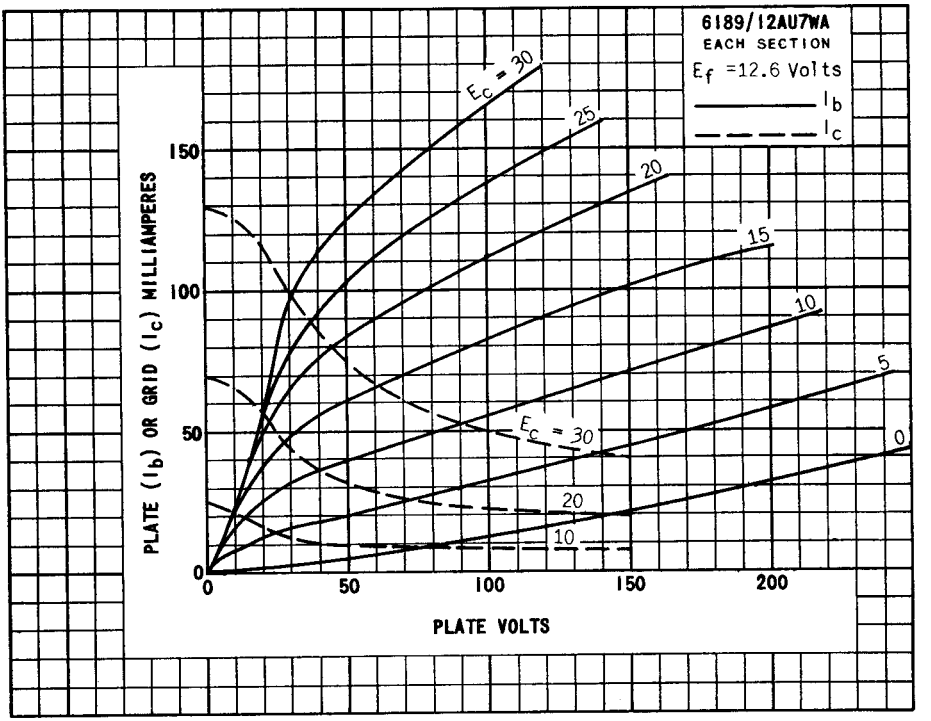
[M] SEE MIL-E-1C 4.9.20.6

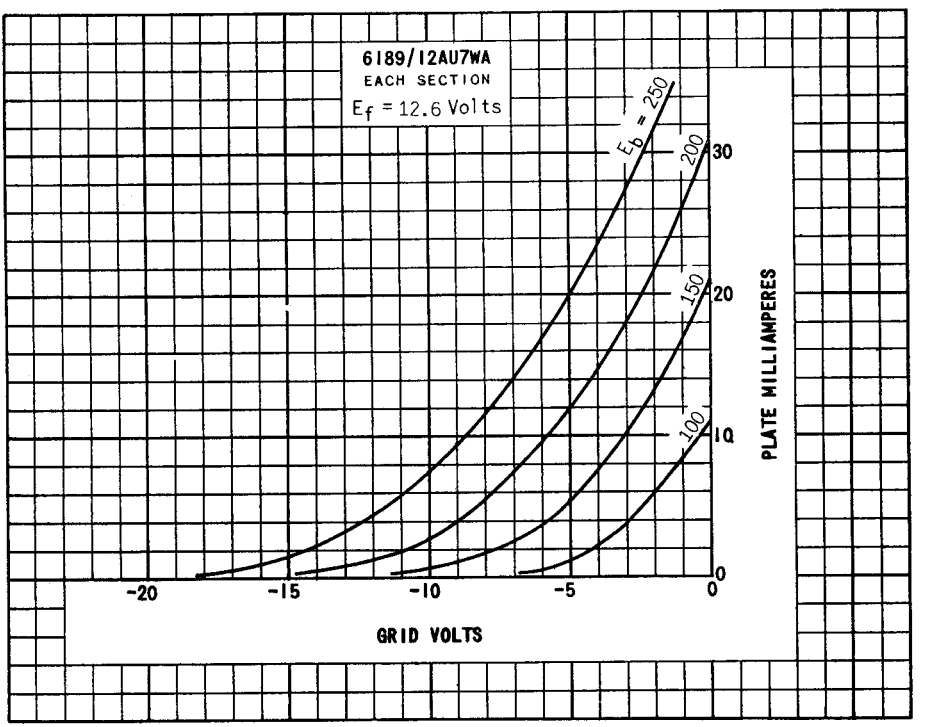
[N] SEE MIL-E-1C 4.9.20.5

[P] SEE MIL-E-1C 4.7.5

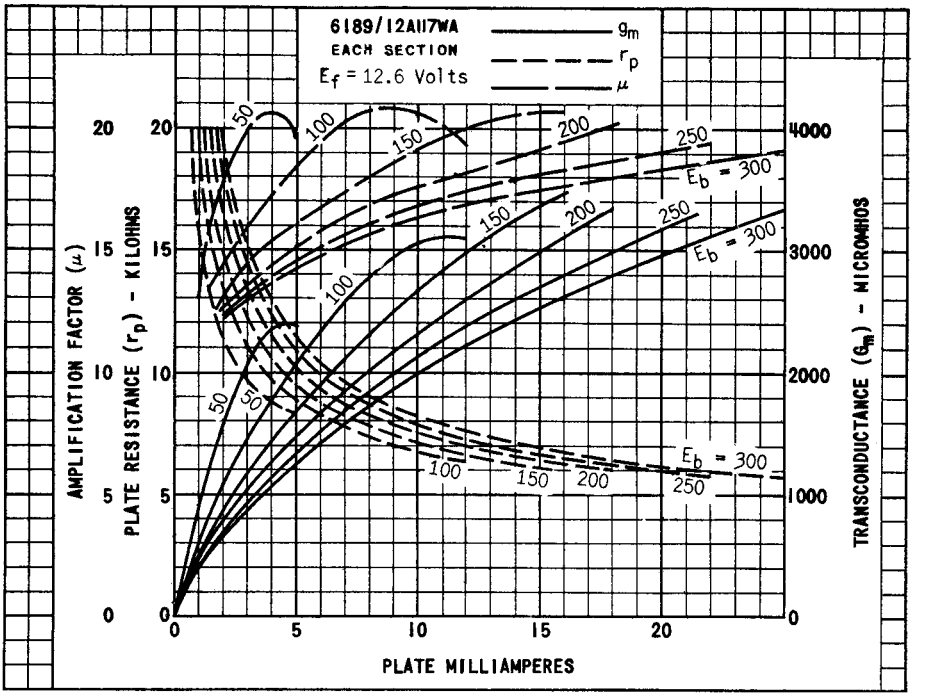
[R] GLASS STRAIN TEST CONSISTS OF COMPLETELY SUBMERGING THE TUBE INTO BOILING WATER (97°C-100°C) FOR A PERIOD OF 15 SECONDS, THEN IMMEDIATELY PLUNGING INTO COLD WATER (0±3° C). THE AMOUNT OF WATER SHALL BE AT LEAST TWO (2) LITERS PER FIFTEEN TUBES. TUBES FOR THIS TEST SHALL HAVE BEEN EXHAUSTED A MINIMUM OF 48 HOURS PRIOR TO PERFORMANCE OF THIS TEST.

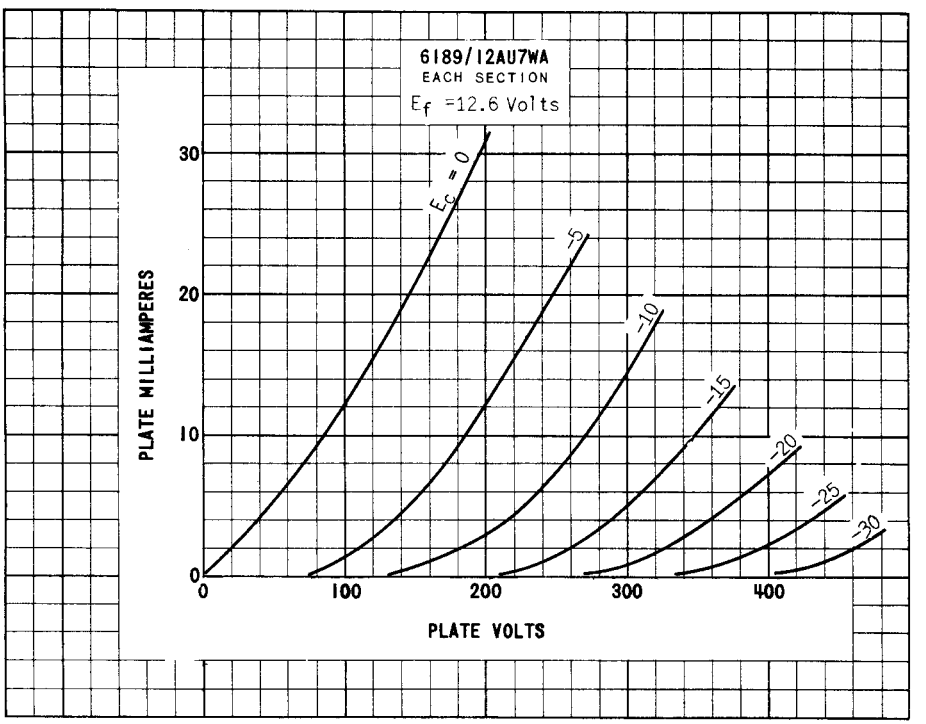
[D] PRIOR TO THIS TEST TUBES TO BE PREHEATED FIVE (5) MINUTES AT CONDITIONS INDICATED BELOW. TEST IMMEDIATELY AFTER PREHEATING Ef=14.0V, Ec=-8.5Vdc, Rk=0 OHMS, Eb=250Vdc, Rg=0.5 MEG.


6189/12AU7WA
EACH SECTION
Ef =12.6 Volts
Ib
Ic
Ec = 30
25
20
15
10
5
0
Ec = 30
20
10
PLATE (Ib) OR GRID (Ic) MILLIAMPERES
150
100
50
0
0
50
100
150
200
PLATE VOLTS


6189/12AU7WA
EACH SECTION
Ef = 12.6 Volts
Eb = 250
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS

6189/12AU7WA
PREMIUM TUBE

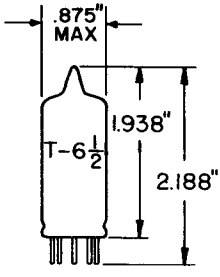




TUNG-SOL

TWIN TRIODE

MINIATURE TYPE



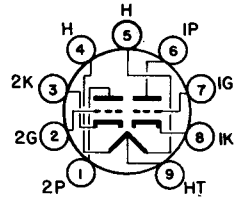
GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODE

FOR MOBILE AND

AIRCRAFT APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 6201 IS A TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A GROUNDED-GRID AMPLIFIER OR AS A FREQUENCY CONVERTER IN VHF APPLICATIONS. THE TUBE IS DESIGNED TO ASSURE DEPENDABLE LIFE AND RELIABLE SERVICE UNDER CONDITIONS ENCOUNTERED IN MOBILE AND AIRCRAFT APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE (EACH SECTION)	1.6	1.6	pf
INPUT (EACH SECTION)	2.5	2.5	pf
OUTPUT (SECTION 1)	1.2	0.45	pf
OUTPUT (SECTION 2)	1.3	0.38	pf
HEATER TO CATHODE (EACH SECTION)	2.8	2.8	pf
PLATE TO PLATE		0.24	pf
	WITH SHIELD[B]	**WITHOUT SHIELD**	
GROUNDED-GRID OPERATION			
PLATE TO CATHODE (SECTION 1)	0.18	0.2	pf
PLATE TO CATHODE (SECTION 2)	0.2	0.24	pf
INPUT (EACH SECTION)	5.0	5.0	pf
OUTPUT (SECTION 1)	2.7	1.9	pf
OUTPUT (SECTION 2)	2.7	1.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	(PARALLEL)	6.3 VOLTS	300	MA.
	(SERIES)	12.6 VOLTS	150	MA.
HEATER SUPPLY LIMITS: VOLTAGE OPERATION			6.3±0.6	VOLTS
			12.6±1.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			90	VOLTS

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MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	300	VOLTS
NEGATIVE DC GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS
PEAK IMPACT ACCELERATION IN ANY DIRECTION	SEE BELOW	G
BULB TEMPERATURE AT HOTTEST POINT, ABS. MAX.	180	C

TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

EACH SECTION

PLATE VOLTAGE	100	250	VOLTS
CATHODE BIAS RESISTOR	270	200	OHMS
AMPLIFICATION FACTOR	57	60	
PLATE RESISTANCE, APPROXIMATE	14 300	10 900	OHMS
TRANSCONDUCTANCE	4 000	5 500	μMHOS
PLATE CURRENT	3.3	10	MA.
GRID VOLTAGE, APPROXIMATE FOR Ib = 10 μAMPS.	-5	-12	VOLTS

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

[B] WITH EXTERNAL SHIELD #315 CONNECTED TO GRID OF SECTION UNDER TEST.

SPECIAL RATINGS AND PERFORMANCE DATA

HEATER-CYCLING RATING

CYCLES OF INTERMITTENT OPERATION, MINIMUM 2000 CYCLES

Ef = 7.5 VOLTS (PARALLEL-HEATER CONNECTION) CYCLED FOR ONE MINUTE ON AND ONE MINUTE OFF. Eb = Ec = 0 VOLTS. Ehk = 135 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE.

SHOCK RATING

IMPACT ACCELERATION (MAX.) 600 G

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN IN A NAVY-TYPE, HIGH-IMPACT (FLY-WEIGHT) SHOCK MACHINE. TUBES ARE HELD RIGID IN FOUR DIFFERENT POSITIONS AND ARE SUBJECTED TO 20 BLOWS AT THE SPECIFIED MAXIMUM IMPACT ACCELERATION. AT THE END OF THIS TEST, TUBES SHALL NOT SHOW PERMANENT OR TEMPORARY SHORTS OR OPEN CIRCUITS, AND ARE REQUIRED TO MEET ESTABLISHED LIMITS FOR VIBRATIONAL ACCELERATION, HEATER-CATHODE LEAKAGE CURRENT, AND TRANSCONDUCTANCE.

FATIGUE RATING

VIBRATIONAL ACCELERATION (MAX.) 2.5 G

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN. TUBES ARE RIGIDLY MOUNTED AND SUBJECTED IN EACH OF THREE POSITIONS AT 2.5 G VIBRATIONAL ACCELERATION AT 25 CYCLES PER SECOND FOR 32 HOURS. AT THE END OF THIS TEST, TUBES SHALL NOT SHOW PERMANENT OR TEMPORARY SHORTS OR OPEN CIRCUITS, AND ARE REQUIRED TO MEET ESTABLISHED LIMITS FOR IMPACT ACCELERATION, HEATER-CATHODE LEAKAGE CURRENT, AND TRANSCONDUCTANCE.

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SPECIAL RATINGS AND PERFORMANCE DATA - CONT'D.

LOW-FREQUENCY VIBRATION PERFORMANCE:

RMS OUTPUT VOLTAGE (MAX.) 100 MV

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN UNDER THE FOLLOWING CONDITIONS; PLATE OF UNIT #1 TIED TO PLATE OF UNIT #2, GRID OF UNIT #1 TIED TO GRID OF UNIT #2, HEATER VOLTS = 12.6, DC PLATE VOLTS = 250, DC GRID VOLTS =-3, PLATE LOAD RESISTANCE = 2000 OHMS, AND VIBRATIONAL ACCELERATION OF 2.5 G AT 25 CYCLES PER SECOND.

AUDIO-FREQUENCY NOISE AND MICROPHONIC PERFORMANCE:

RMS OUTPUT VOLTAGE (MAX.) 100 MV

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN UNDER THE FOLLOWING CONDITIONS: PLATE OF UNIT #1 TIED TO PLATE OF UNIT #2, GRID OF UNIT #1 TIED TO GRID OF UNIT #2, DC HEATER VOLTS = 12.6, PLATE-SUPPLY VOLTS = 300, CATHODE RESISTOR (COMMON TO BOTH UNITS) = 200 OHMS, AND PLATE LOAD RESISTANCE =10000 OHMS.

SHORTS AND CONTINUITY TEST:

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN. IN THIS TEST, A TUBE IS CONSIDERED INOPERATIVE IF IT SHOWS A PERMANENT OR TEMPORARY SHORT ON OPEN CURCUIT, OR A VALUE OF REVERSE GRID CURRENT IN EXCESS OF 1.4MICROAMPERES UNDER CONDITIONS SPECIFIED IN THE CHARACTERISTICS RANGE VALUES FOR REVERSE GRID CURRENT.

1-HOUR STABILITY LIFE PERFORMANCE:

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN TO INSURE THAT THE TUBES HAVE BEEN PROPERLY STABILIZED. WITH BOTH UNITS OPERATING, EACH UNIT IS CHECKED FOR VARIATION IN TRANS-CONDUCTANCE UNDER CONDITIONS OF MAXIMUM RATED PLATE DISSIPATION. AT THE END OF 1 HOUR, THE VALUE OF TRANSCONDUCTANCE IS READ. THE VARIATIONS IN TRANSCONDUCTANCE FROM THE O-HOUR READING SHALL NOT EXCEED 10 PER CENT.

100-HOUR LIFE PERFORMANCE:

THIS TEST IS PERFORMED ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN UNDER THE CONDITIONS OF MAXIMUM RATED PLATE DISSIPATION TO INSURE A LOW PERCENTAGE OF EARLY INOPERATIVES. AT THE END OF 100 HOURS, A TUBE IS CONSIDERED INOPERATIVE IF IT SHOWS A PERMANENT OR TEMPORARY SHORT OR OPEN CIRCUIT, OR A VALUE OF REVERSE GRID CURRENT IN EXCESS OF 1.4 MICROAMPERES UNDER THE CONDITIONS SPECIFIED IN CHARACTERISTICS RANGE VALUES FOR REVERSE GRID CURRENT.

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SPECIAL RATINGS AND PERFORMANCE DATA - CONT'D.

500-HOUR AVERAGE LIFE PERFORMANCE:

THIS TEST IS MADE ON A SAMPLE LOT OF TUBES FROM EACH PRODUCTION RUN TO INSURE HIGH QUALITY OF THE INDIVIDUAL TUBE AND TO GUARD AGAINST EPIDEMIC FAILURES OF ANY OF THE CHARACTERISTICS INDICATED BELOW. WITH BOTH UNITS OPERATING, EACH UNIT IS LIFE TESTED SEPARATELY AT ROOM TEMPERATURE UNDER THE FOLLOWING CONDITIONS: HEATER VOLTS = 12.6 AC OR DC (SERIES CONNECTION), PLATE-SUPPLY VOLTS = 250, CATHODE RESISTOR = 200 OHMS, GRID-CIRCUIT RESISTANCE = 0.5 MEGOHM, HEATER 135 VOLTS POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE = 180°C. AT THE END OF 500 HOURS, TUBE SHALL NOT SHOW PERMANENT SHORTS OR OPEN CIRCUITS AND SHALL BE CRITICIZED FOR THE TOTAL NUMBER OF TUBES FAILING TO PASS THE ESTABLISHED INITIAL LIMITS FOR HEATER CURRENT, REVERSE GRID CURRENT, HEATER-CATHODE LEAKAGE CURRENT, AND 500 HOUR LIMITS FOR TRANSCONDUCTANCE (1), TRANSCONDUCTANCE CHANGE, AND LEAKAGE RESISTANCE AS SHOWN UNDER CHARACTERISTICS RANGE VALUES.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

VALUES ARE FOR EACH UNIT AND ARE INITIAL
UNLESS OTHERWISE SPECIFIED

EACH TUBE IS STABILIZED BEFORE CHARACTERISTICS TESTING BY CONTINUOUS OPERATION FOR AT LEAST 45 HOURS AT ROOM TEMPERATURE AND WITH DISSIPATION VALUES EQUIVALENT TO LIFE TEST CONDITIONS.

	NOTE	MIN.	MAX.	
HEATER CURRENT	1	0.138	0.162	AMP.
DIRECT INTERELECTRODE CAPACITANCES:				
GRID TO PLATE	2	1.3	1.9	pf
GRID TO CATHODE AND HEATER	2	2	3	pf
PLATE TO CATHODE AND HEATER (UNIT #1)	2	0.2	0.7	pf
PLATE TO CATHODE AND HEATER (UNIT #2)	2	0.16	0.6	pf
HEATER TO CATHODE	2	2.1	3.5	pf
PLATE TO PLATE	3	0.15	0.33	pf
AMPLIFICATION FACTOR	1,4	50	70	
PLATE CURRENT (1)	1,4	7	14	MA.
PLATE CURRENT DIFFERENCE BETWEEN UNITS	1,4	---	3.2	MA.
PLATE CURRENT (2)	1,5	---	100	μA
TRANSCONDUCTANCE (1)	1,4	4500	6500	μMHOS
TRANSCONDUCTANCE (1) AT 500 HOURS	1,4	3800	6500	μMHOS
TRANSCONDUCTANCE CHANGE: DIFFERENCE BETWEEN AVERAGE TRANSCONDUCTANCE (1) INITIALLY, AND AVERAGE AFTER 500 HOURS, EXPRESSED AS A PERCENTAGE OF THE INITIAL AVERAGE	1,4	---	20	PERCENT
TRANSCONDUCTANCE (2)	6,4	4000	---	μMHOS
REVERSE GRID CURRENT	1,7	---	0.7	μA
GRID EMISSION CURRENT	8,9	---	1.5	μA
HEATER-CATHODE LEAKAGE CURRENT:				
HEATER NEGATIVE WITH RESPECT TO CATHODE	1,10	---	10	μA
HEATER POSITIVE WITH RESPECT TO CATHODE	1,10	---	10	μA

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN
(CONTINUED)

VALUES ARE FOR EACH UNIT AND ARE INITIAL
UNLESS OTHERWISE SPECIFIED

EACH TUBE IS STABILIZED BEFORE CHARACTERISTICS TESTING BY CONTINUOUS OPERATION FOR AT LEAST 45 HOURS AT ROOM TEMPERATURE AND WITH DISSIPATION VALUES EQUIVALENT TO LIFE TEST CONDITIONS.

	NOTE	MIN.	MAX.	
LEAKAGE RESISTANCE:				
BETWEEN GRID AND ALL OTHER ELECTRODES TIED TOGETHER	1,11	100	---	MEGOHMS
LEAKAGE RESISTANCE:				
BETWEEN PLATE AND ALL OTHER ELECTRODES TIED TOGETHER	1,12	100	---	MEGOHMS
LEAKAGE RESISTANCE AT 500 HOURS:				
BETWEEN GRID AND ALL OTHER ELECTRODES TIED TOGETHER	1,11	50	---	MEGOHMS
BETWEEN PLATE AND ALL OTHER ELECTRODES TIED TOGETHER	1,12	50	---	MEGOHMS

NOTES

1 WITH 12.6 VOLTS AC OR DC ON HEATER (SERIES CONNECTION).

2 WITHOUT EXTERNAL SHIELD AND WITH UNIT NOT UNDER TEST CONNECTED TO GROUND.

3 WITHOUT EXTERNAL SHIELD.

4 WITH DC PLATE-SUPPLY VOLTS = 250, CATHODE RESISTOR = 200 OHMS, AND CATHODE BYPASS CAPACITOR OF 1000 μf. EACH UNIT TESTED SEPARATELY. UNIT NOT UNDER TEST CONNECTED TO GROUND.

5 WITH DC PLATE-SUPPLY VOLTS = 250, PLATE LOAD RESISTANCE = 0.1 MEGOHM, AND DC GRID VOLTS = -20. EACH UNIT TESTED SEPARATELY. UNIT NOT UNDER TEST CONNECTED TO GROUND

6 WITH 11.0 VOLTS AC OR DC ON HEATER (SERIES CONNECTION).

7 WITH DC PLATE-SUPPLY VOLTS = 250, GRID-CIRCUIT RESISTANCE = 0.5 MEGOHM, CATHODE RESISTOR = 200 OHMS, AND CATHODE BYPASS CAPACITOR OF 1000 μf. EACH UNIT IS TESTED SEPARATELY. UNIT NOT UNDER TEST CONNECTED TO GROUND.

8 WITH 15.0 VOLTS AC OR DC ON HEATER (SERIES CONNECTION).

9 WITH DC PLATE VOLTS = 250, GRID-CIRCUIT RESISTANCE = 0.5 MEGOHM, AND DC GRID VOLTS = -20. EACH UNIT TESTED SEPARATELY.

10 WITH 100 VOLTS DC BETWEEN HEATER AND CATHODE AND UNITS CONNECTED IN PARALLEL.

11 WITH GRID 100 VOLTS NEGATIVE WITH RESPECT TO ALL OTHER ELECTRODES TIED TOGETHER.

12 WITH PLATE 300 VOLTS NEGATIVE WITH RESPECT TO ALL OTHER ELECTRODES TIED TOGETHER.

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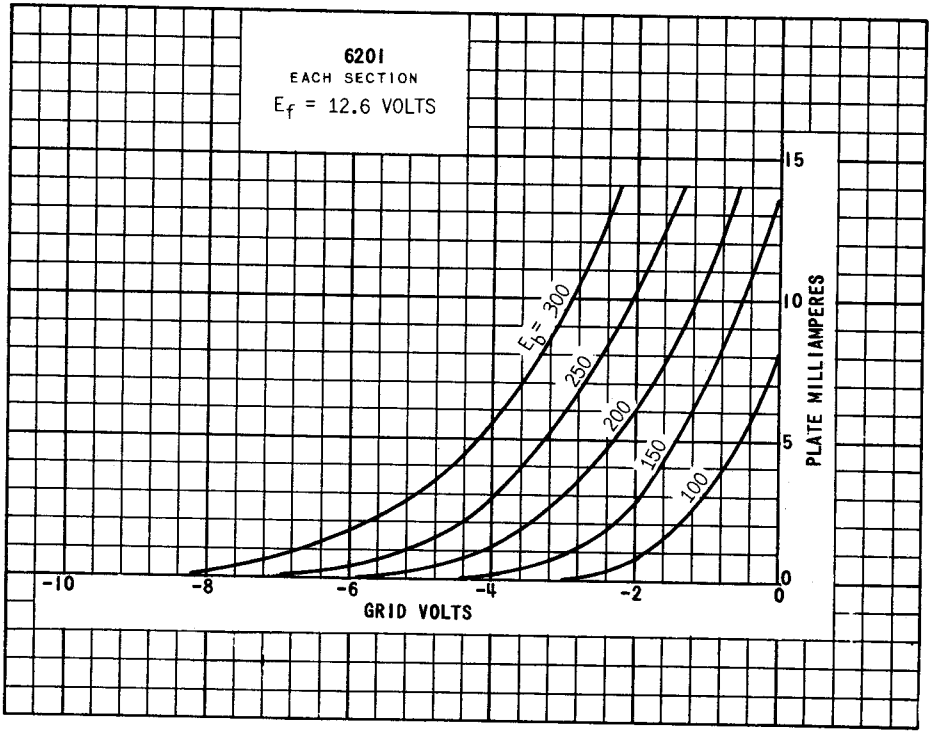
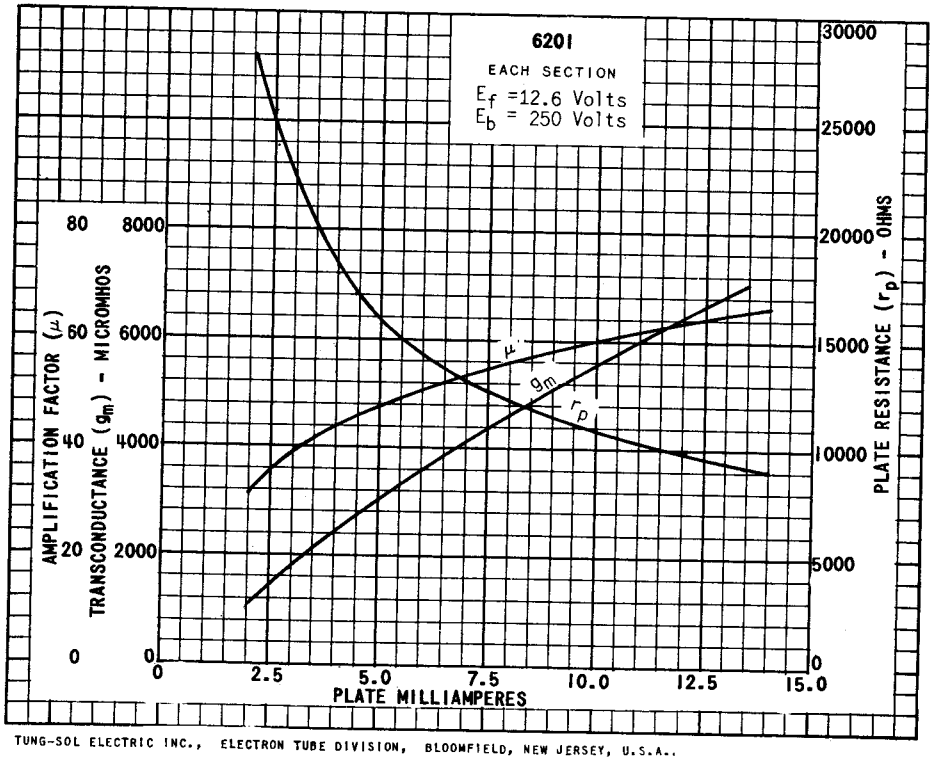
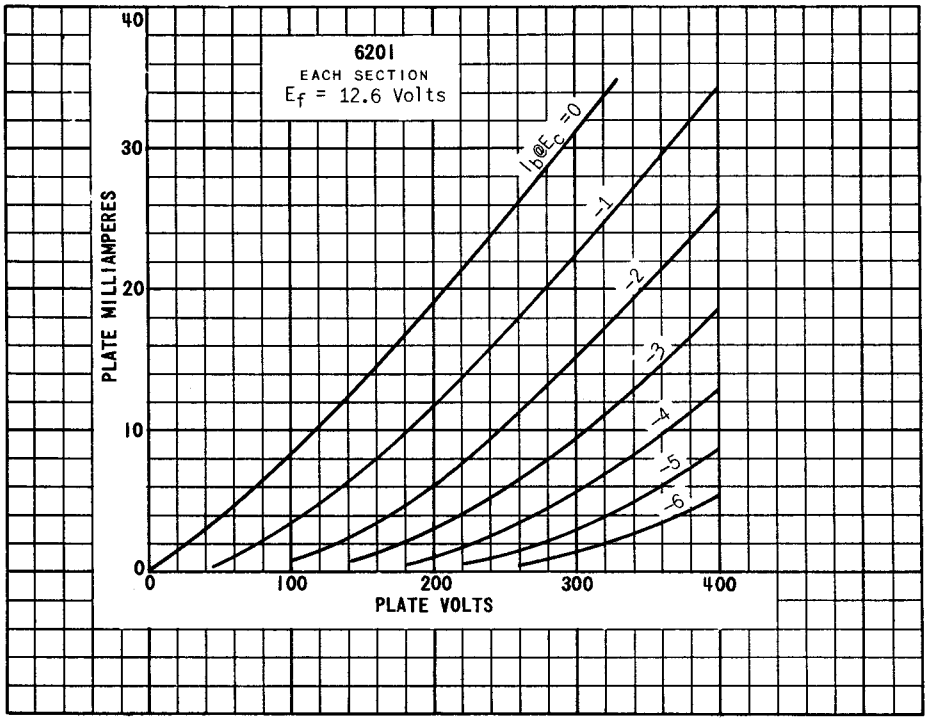
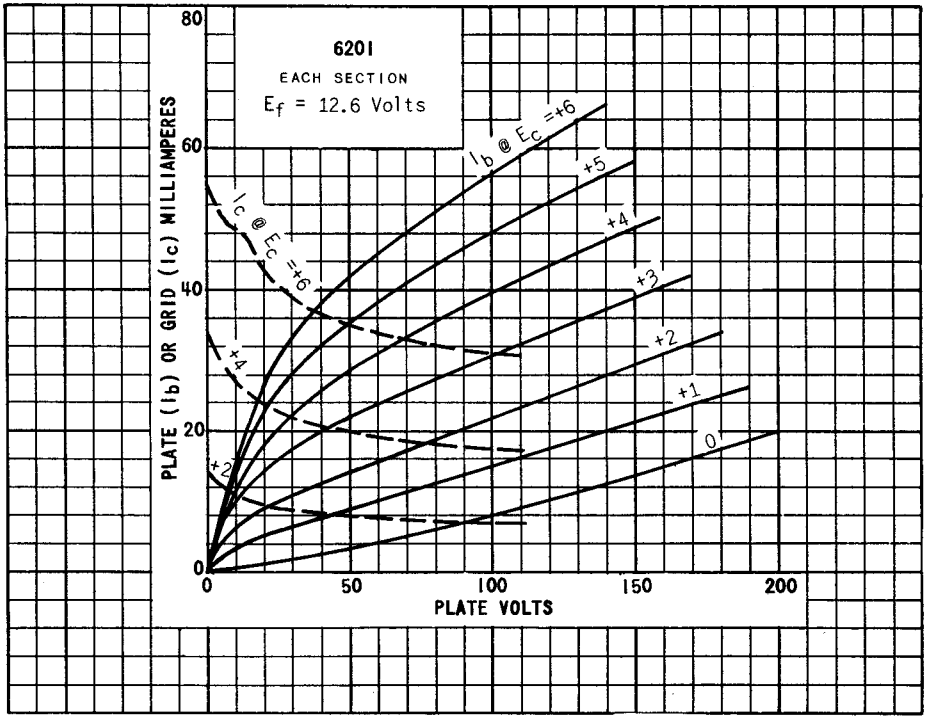

6201
EACH SECTION
E_f = 12.6 VOLTS
E_b = 300
250
200
150
100
15
10
5
0
PLATE MILLIAMPERES
-10
-8
-6
-4
-2
0
GRID VOLTS


6201
EACH SECTION
E_f =12.6 Volts
E_b = 250 Volts
80
60
40
20
0
AMPLIFICATION FACTOR (μ)
8000
6000
4000
2000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
30000
25000
20000
15000
10000
5000
0
PLATE RESISTANCE (r_p) - OHMS
μ
g_m
r_p
0
2.5
5.0
7.5
10.0
12.5
15.0
PLATE MILLIAMPERES





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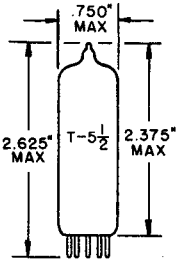
TUNG-SOL

TWIN DIODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3

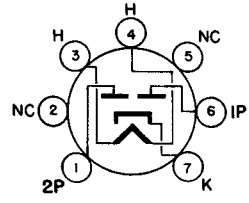
TWIN DIODES

FOR

FULL-WAVE POWER-RECTIFIER
SERVICE IN MOBILE
AND AIRCRAFT APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BS

THE 6202 IS A FULL-WAVE HIGH-VACUUM RECTIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN POWER SUPPLIES IN WHICH THE DC CURRENT REQUIREMENTS DO NOT EXCEED 50 MILLIAMPERES.
THE 6202 IS A DIRECT REPLACEMENT FOR THE 6X4.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	600	MA.
LIMITS OF APPLIED VOLTAGE			6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

RECTIFIER SERVICE

SINUSOIDAL SUPPLY VOLTAGES, FREQUENCY 25 TO 1000 CYCLES PER SECOND

PEAK INVERSE VOLTAGE			
ALTITUDES UP TO 40,000 FEET[A]		1250	VOLTS
ALTITUDES FROM 40,000 TO 60,000 FEET[A]		850	VOLTS
AC PLATE SUPPLY VOLTAGE, PER PLATE RMS	See Chart 1		
STEADY-STATE PEAK PLATE CURRENT PER PLATE		200	MA.
TRANSIENT PEAK PLATE CURRENT PER PLATE MAX. DURATION 0.2 SECOND		1.45	AMP.
DC OUTPUT CURRENT	See Rating Chart 1		
PEAK IMPACT ACCELERATION		700	G
BULB TEMPERATURE AT HOTTEST POINT (ABS. MAX.)		+165	°C

[A]THE ALTITUDE RATINGS AS PRESENTED REFER TO THE LIMITATIONS OF THE TUBE ITSELF. BECAUSE THE SOCKET EMPLOYED CAN BECOME THE LIMITING FACTOR IN HIGH-ALTITUDE OPERATION, CONSIDERATION MUST BE GIVEN TO THE VOLTAGE-BREAKDOWN CAPABILITIES OF THE TUBE AND SOCKET COMBINATION EMPLOYED.

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TUNG-SOL

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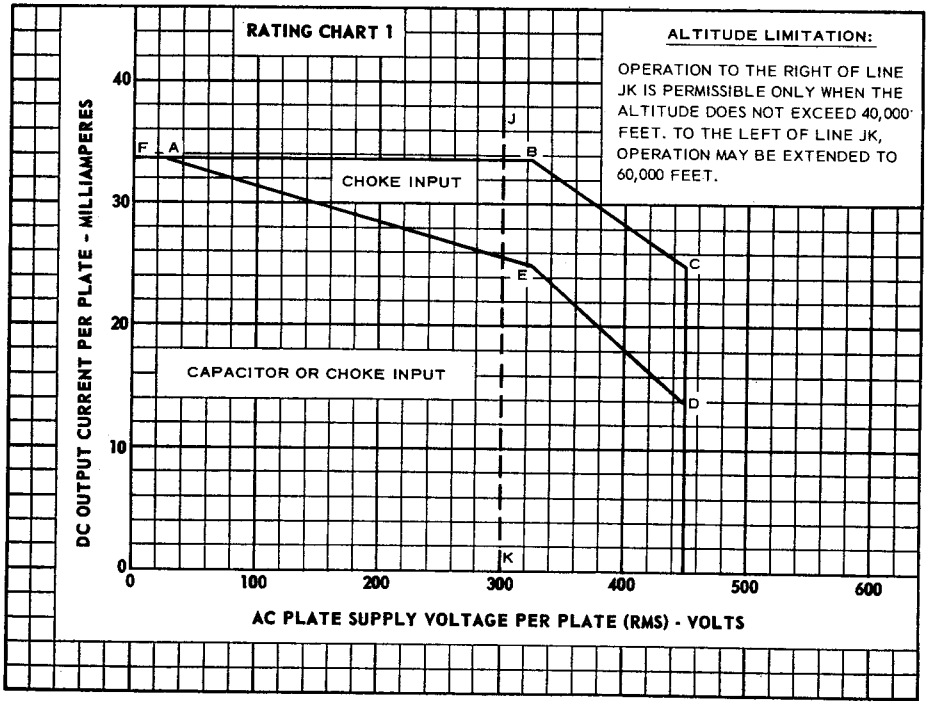
TYPICAL OPERATING CHARACTERISTICS

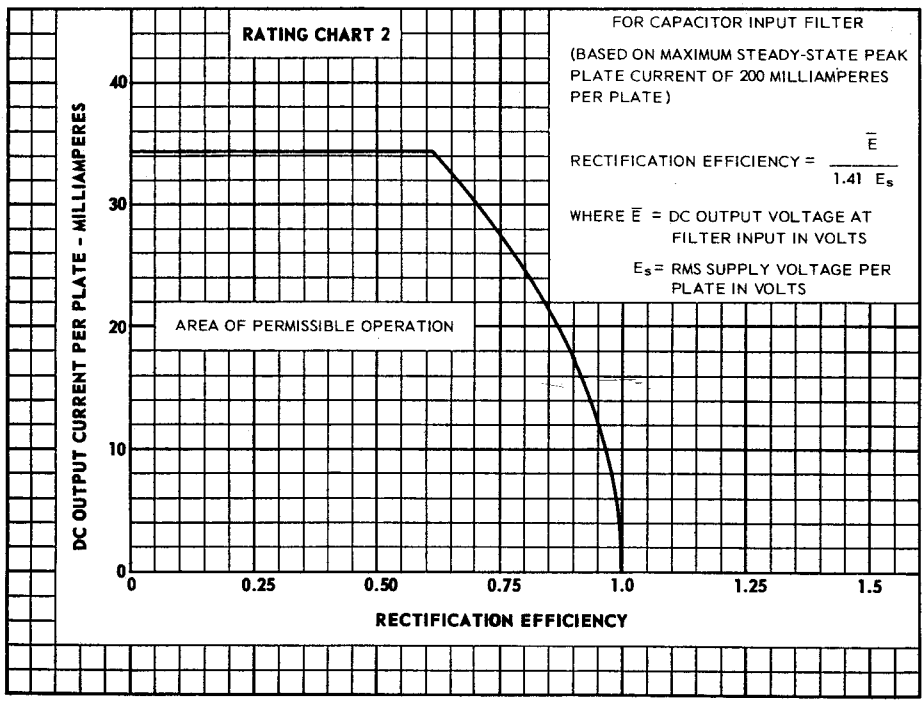
FULL WAVE RECTIFIER
ALTITUDES UP TO 40,000 FEET

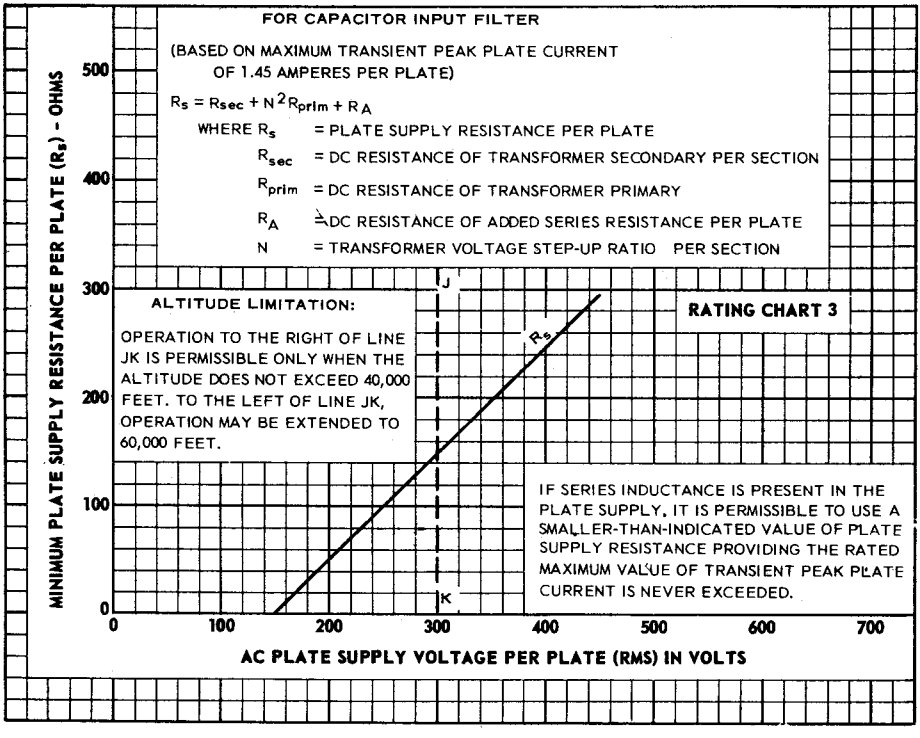
AC PLATE-SUPPLY VOLTAGE PER PLATE, RMS	325	450	VOLTS
FILTER INPUT CAPACITOR	4	-----	μf
FILTER INPUT CHOKE	-----	8	HENRYS
TOTAL PLATE-SUPPLY RESISTANCE PER PLATE	175	-----	OHMS
DC OUTPUT CURRENT	50	50	MA.
DC OUTPUT VOLTAGE AT FILTER INPUT	365	375	VOLTS
TUBE VOLTAGE DROP			
MEASURED WITH APPLIED DC AT 50 MA. PER PLATE		22	VOLTS

SPECIAL TESTS AND RATINGS

HEATER CYCLING RATING			
SHOCK RATING			
VIBRATION RATING			
ALTITUDE RATING	TO	60,000	FEET







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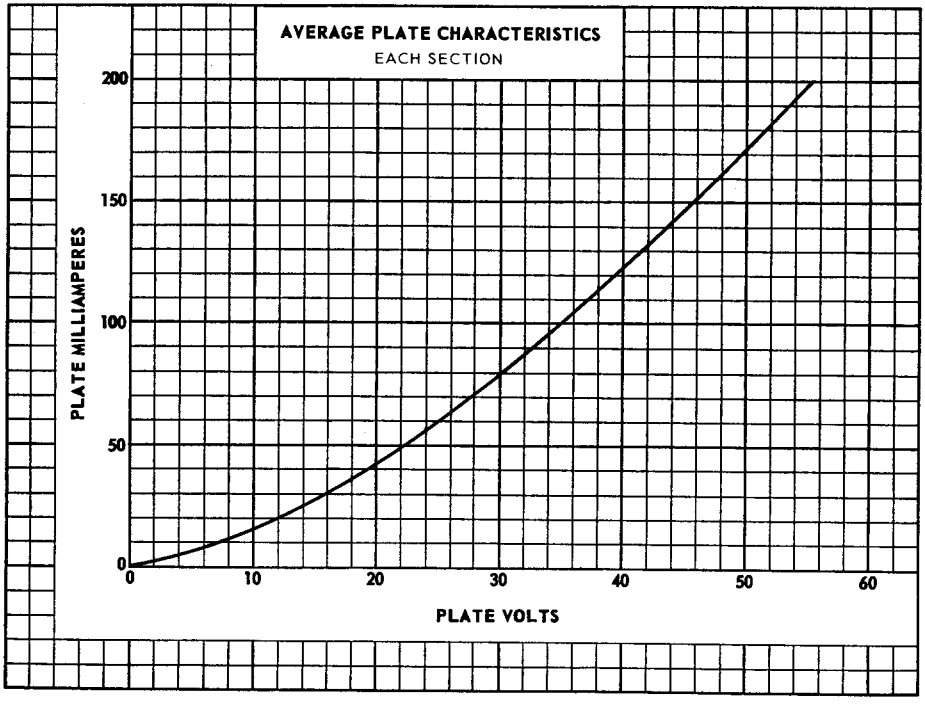
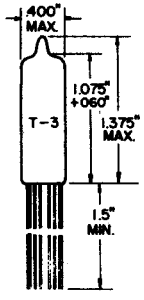

AVERAGE PLATE CHARACTERISTICS
EACH SECTION
PLATE MILLIAMPERES
200
150
100
50
0
0
10
20
30
40
50
60
PLATE VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB
SUBMINIATURE BUTTON
8 LEAD BASE E8-10
OUTLINE DRAWING
JEDEC 3-1

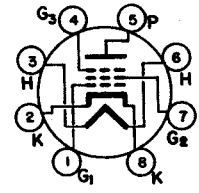
COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 0.15 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8DC

THE 6205 IS A SHARP-CUTOFF PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN HIGH-FREQUENCY CIRCUITS. IN ON-OFF CONTROL APPLICATIONS, THE TUBE WILL MAINTAIN ITS EMISSION CAPABILITIES AFTER LONG PERIODS OF OPERATION UNDER CUTOFF CONDITIONS. EXCEPT FOR THE INCORPORATION OF AN EXTERNAL CONNECTION FOR THE SUPPRESSOR GRID, THE 6205 IS IDENTICAL TO THE 5840.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID #1 TO PLATE, MAX.	0.015	0.03	μμf
INPUT	4.2	4.0	μμf
OUTPUT	3.4	1.9	μμf

[A] WITH EXTERNAL SHIELD OF 0.405 INCH INSIDE DIAMETER CONNECTED TO CATHODE

RATINGS
ABSOLUTE MAXIMUM VALUES

HEATER VOLTAGE	6.3±5%	VOLTS
MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM SCREEN VOLTAGE	155	VOLTS
MAXIMUM SUPPRESSOR VOLTAGE	22	VOLTS
MAXIMUM POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID #1 VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	→ 1.1	WATTS
MAXIMUM SCREEN DISSIPATION	→ 0.55	WATTS
MAXIMUM DC CATHODE CURRENT	16.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID #1 CIRCUIT RESISTANCE	1.1	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

→ INDICATES A CHANGE.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±5%	VOLTS
HEATER CURRENT	0.15	AMP.
PLATE VOLTAGE	100	VOLTS
SUPPRESSOR, CONNECTED TO CATHODE AT SOCKET		
SCREEN VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	150	OHMS
PLATE RESISTANCE, APPROX.	0.26	MEG.
TRANSCONDUCTANCE	5000	μMHOS
PLATE CURRENT	7.5	MA.
SCREEN CURRENT	2.4	MA.
GRID #1 VOLTAGE, APPROX. Ib = 10 μAMPS.	−9.0	VOLTS

CLASS A RESISTANCE COUPLED AMPLIFIER

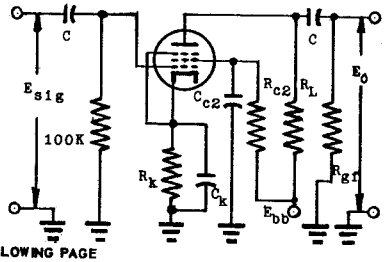
LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS				Ebb = 150 VOLTS				Ebb = 225 VOLTS			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1000	0.2	13	50	500	0.3	19	83	400	0.3	29	110
0.10	0.24	1000	0.2	16	73	500	0.3	25	120	400	0.3	38	160
0.24	0.24	1700	0.5	13	72	1500	0.6	20	100	700	0.8	29	160
0.24	0.51	2000	0.6	15	89	1500	0.7	24	140	700	0.9	35	210
0.51	0.51	2500	1.3	11	93	2000	1.5	18	140	1000	1.7	28	200
0.51	1.0	3000	1.5	13	110	2000	1.7	20	180	1000	2.0	31	260

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100 K OHMS)

R_L	R_{gf}	Ebb = 90 VOLTS				Ebb = 150 VOLTS				Ebb = 225 VOLTS			
		R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain	R_k	R_{c2}	E_o	Gain
0.10	0.10	1200	0.2	13	48	700	0.2	18	77	500	0.3	28	110
0.10	0.24	1300	0.2	16	70	800	0.3	24	110	500	0.3	37	150
0.24	0.24	2800	0.4	12	68	1700	0.6	20	100	1200	0.8	29	150
0.24	0.51	3000	0.5	15	82	1800	0.7	24	140	1300	0.8	35	190
0.51	0.51	5500	1.0	11	76	3500	1.3	18	120	2400	1.6	26	180
0.51	1.0	6200	1.2	12	92	3800	1.6	19	160	2500	1.8	31	230

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.
2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.
3. R_k IS IN OHMS; R_{c2}, R_L, & R_{gf}, ARE IN MEGOHMS.
4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k & R_{c2} SHOULD BE ADEQUATELY BY-PASSED.



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CHARACTERISTICS LIMITS

		MIN.	MAX.	
HEATER CURRENT:				
Ef =6.3 VOLTS	INITIAL	140	160	MA.
	500-HR.	138	164	MA.
PLATE CURRENT:				
Ef=6.3 VOLTS, Eb= 100 VOLTS, Ec2= 100 VOLTS, Rk =150 OHMS (BYPASSED), g^3 TIED TO k	INITIAL	5.5	9.5	MA.
SCREEN CURRENT:				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2= 100 VOLTS, Rk=150 OHMS (BYPASSED) g3 TIED TO k	INITIAL	1.5	3.3	MA.
TRANSCONDUCTANCE (1):				
Ef =6.3 VOLTS, Eb =100 VOLTS, Ec2=100 VOLTS, Rk =150 OHMS (BYPASSED), g^3 TIED TO k	INITIAL	4200	5800	μMHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) AND TRANSCONDUCTANCE AT Ef=5.7 VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSCONDUCTANCE (1)	INITIAL	---	10	PERCENT
	500-HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION:				
DIFFERENCE BETWEEN TRANSCONDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500-HR.	---	20	PERCENT
AVERAGE TRANSCONDUCTANCE CHANGE WITH OPERATION:				
AVERAGE OF VALUES FOR "TRANSCONDUCTANCE CHANGE WITH OPERATION"	500-HR.	---	15	PERCENT
PLATE RESISTANCE:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2= 100 VOLTS, Rk=150 OHMS (BYPASSED), g^3 TIED TO k	INITIAL	0.175	---	MEGOHMS
PLATE CURRENT CUTOFF:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2= 100 VOLTS, Ec1 =-9.0 VOLTS, g3 TIED TO k	INITIAL	---	50	μAMPS.
INTERELECTRODE CAPACITANCES:				
GRID #1 TO PLATE (G1 TO P)	INITIAL	---	0.015	μμf
INPUT (G1 TO H,K,G2,G3)	INITIAL	3.5	4.9	μμf
OUTPUT (P TO H, K, G2G3)	INITIAL	2.9	3.9	μμf

(MEASURED WITH EXTERNAL SHIELD OF 0.405-INCH INSIDE DIAMETER CONNECTED TO CATHODE.

NEGATIVE GRID #1 CURRENT:				
Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2= 100 VOLTS, Rk=150 OHMS (BYPASSED) Rg1 =1.0 MEG., g^3 TIED TO k	INITIAL	0	0.3	μAMPS.
	500-HR.	0	0.8	μAMPS.

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CHARACTERISTICS LIMITS - cont'd.

		MIN.	MAX.	
HEATER-CATHODE LEAKAGE CURRENT:				
Ef =6.3 VOLTS, Ehk=100 VOLTS				
HEATER POSITIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
HEATER NEGATIVE WITH RESPECT TO CATHODE	INITIAL	---	5.0	μAMPS.
	500-HR.	---	10	μAMPS.
INTERELECTRODE LEAKAGE RESISTANCE:				
Ef=6.3 VOLTS. POLARITY OF APPLIED DC INTERELECTRODE VOLTAGE IS SUCH THAT NO CATHODE EMISSION RESULTS.				
GRID #1 TO ALL AT 100 VOLTS DC	INITIAL	100	---	MEG.
	500-HR.	50	---	MEG.
PLATE TO ALL AT 300 VOLTS DC	INITIAL	100	---	MEG.
	500-HR.	50	---	MEG.
VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS: Ef=6.3 VOLTS, Ebb=100 VOLTS, Ec2=100 VOLTS, Rk=150 OHMS (BYPASSED) RL =10,000 OHMS, g3 TIED TO k, VIBRATION ACCELERATION = 15 G AT 40 cps	INITIAL	---	60	MV.
GRID #1 EMISSION CURRENT: Ef=7.5 VOLTS, Eb=100 VOLTS, Ec2 =100 VOLTS, Ec1=-9.0 VOLTS, Rg1=1.0 MEG., g3 TIED TO k	INITIAL	0	0.5	μAMPS.

THE INDICATED 500-HOUR VALUES ARE LIFE-TEST END POINTS FOR THE FOLLOWING CONDITIONS OF OPERATION: Ef=6.3 VOLTS, Eb=100 VOLTS, Ec2=100 VOLTS, Rk=150 OHMS, g3 TIED TO k, Rg1=1.0 MEG, Ehk=200 VOLTS WITH HEATER POSITIVE WITH RESPECT TO CATHODE, AND BULB TEMPERATURE=220 C.

SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST
STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE ELECTRICAL AND MECHANICAL INOPERATIVES.

HEATER-CYCLING LIFE TEST
STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES MINIMUM TO EVALUATE AND CONTROL HEATER-CATHODE DEFECTS. CONDITIONS OF TEST INCLUDE Ef=7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MINUTES OFF, Eb=Ec3=Ec2=Ec1=0 VOLTS, AND Ehk=140 VOLTS RMS.

SHOCK RATING-450 G
STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIFFERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

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TUNG-SOL

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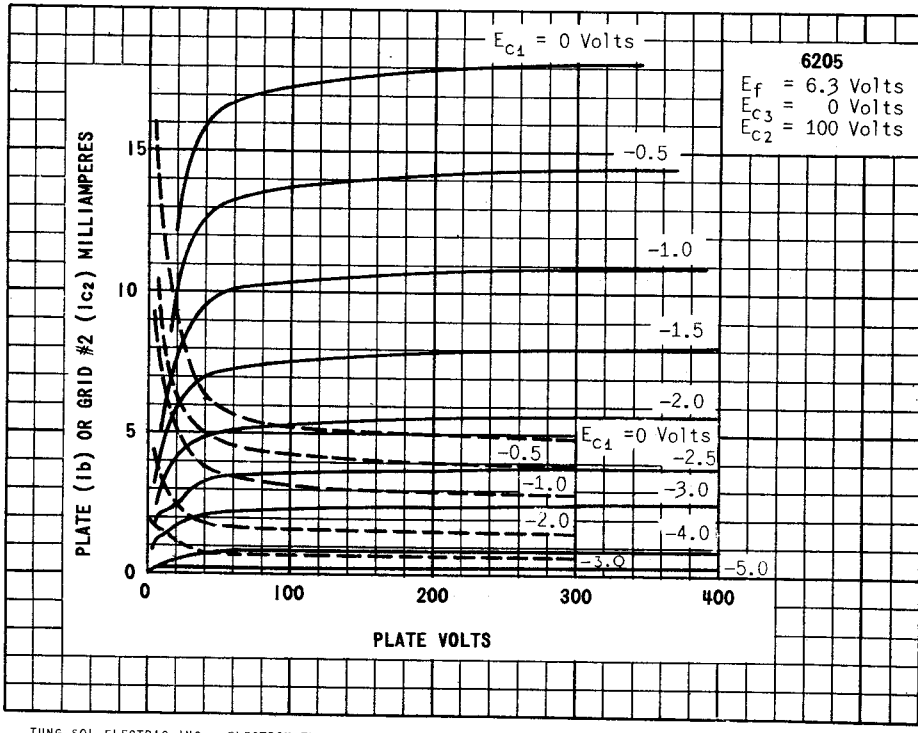
SPECIAL TESTS AND RATINGS

FATIGUE RATING–2.5 G
STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS MINIMUM IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

ALTITUDE RATING–60,000 FEET
STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

NOTE: THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS. IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



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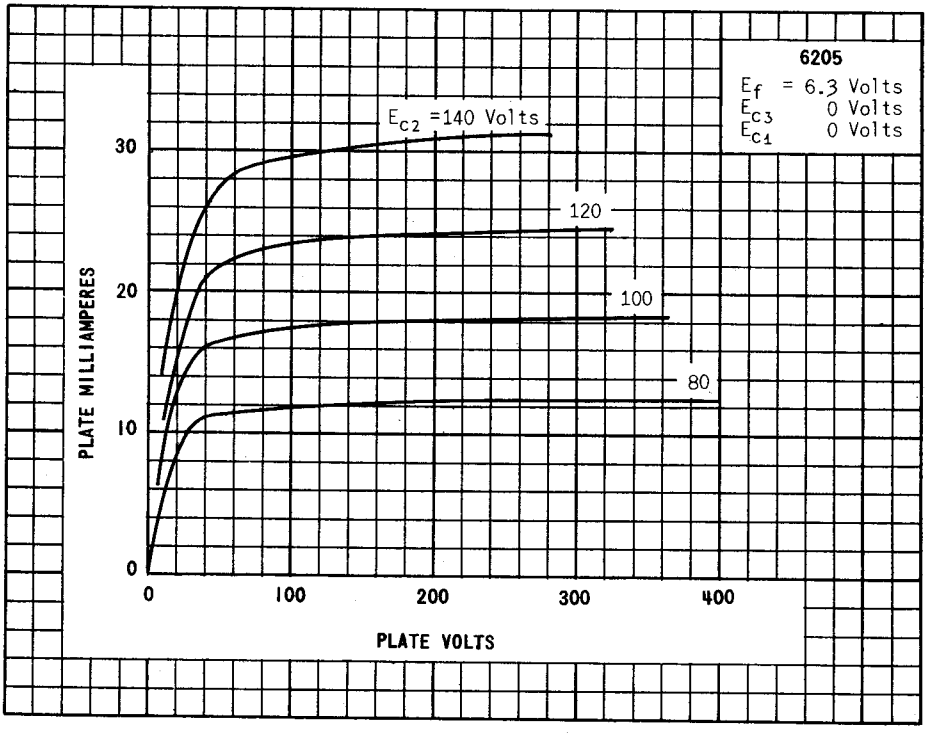
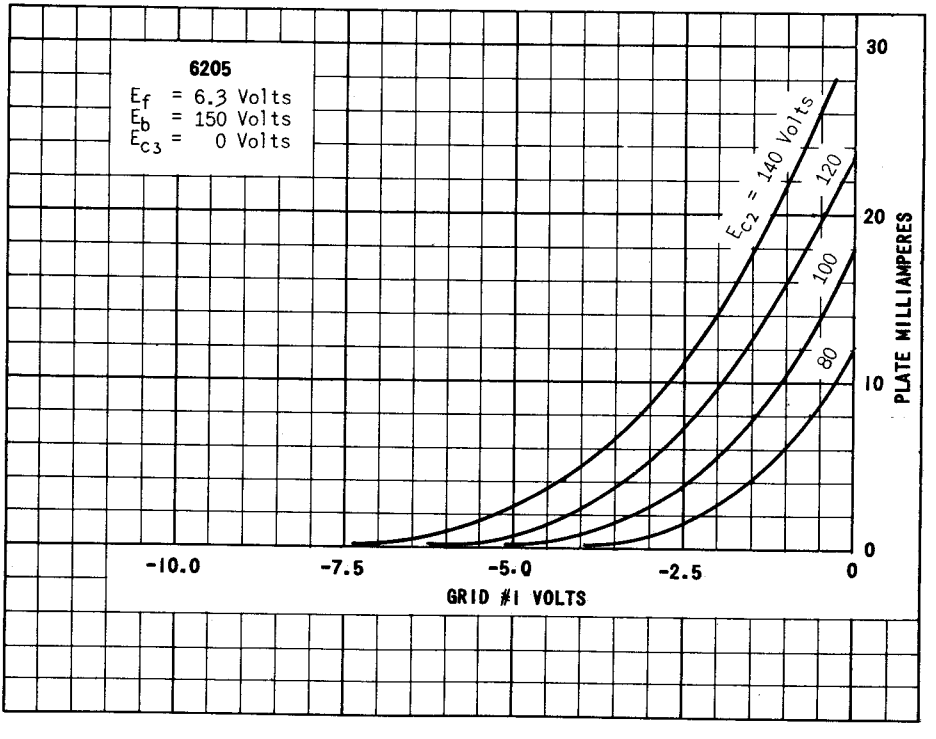
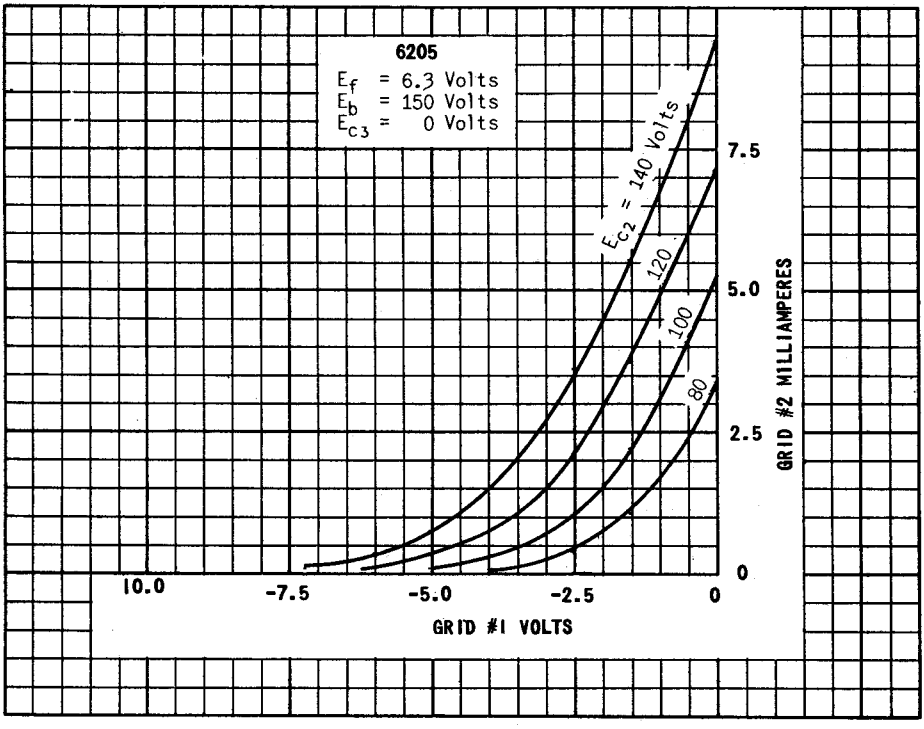
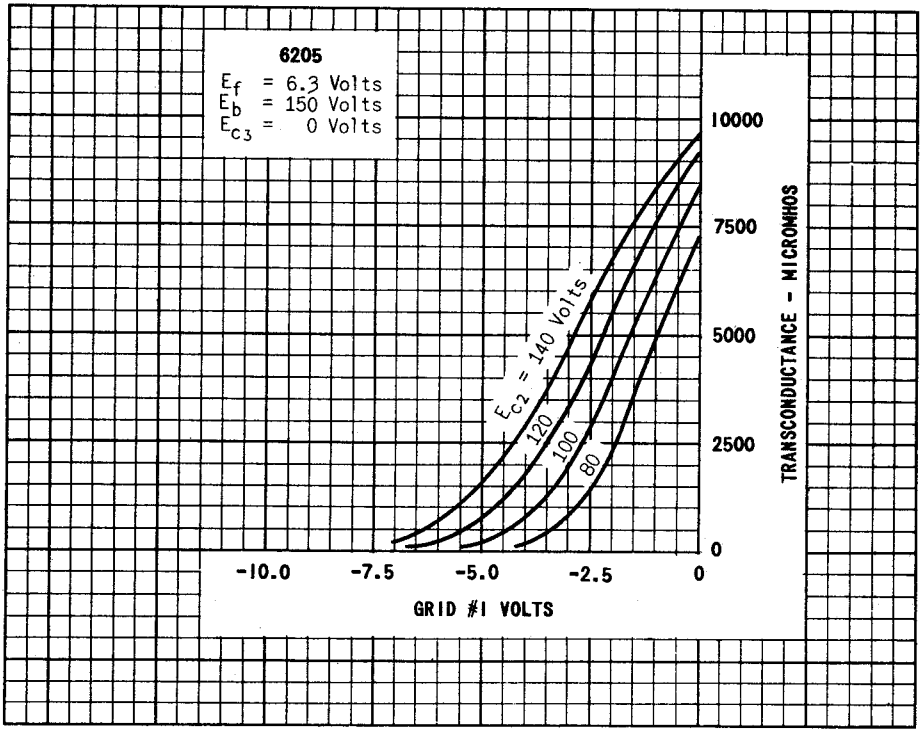
TENTATIVE DATA









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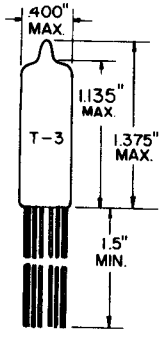
TUNG-SOL

PENTODE

SUBMINIATURE TYPE

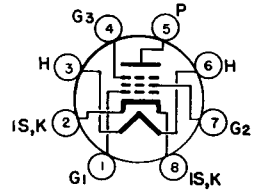


GLASS BULB
SUBMINIATURE BUTTON
FLEXIBLE LEADS
BASE E8-10
OUTLINE DRAWING
JEDEC 3-1

COATED UNIPOTENTIAL CATHODE

FOR MOBILE AND AIRCRAFT
EQUIPMENT APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8DC

THE 6206 IS A SEMI-REMOTE CUTOFF RF PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR OPERATION IN THE UHF REGION UNDER CONDITIONS OF SEVERE SHOCK, VIBRATION, HIGH TEMPERATURE AND HIGH ALTITUDE.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH SHIELD [B]	
GRID #1 TO PLATE, MAX.	0.03	0.015	pf
INPUT	4.0	4.2	pf
OUTPUT	1.9	3.4	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE VALUES

AVERAGE CHARACTERISTICS	6.3 VOLTS	150	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE		±200	VOLTS

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION[C]	450	G
MAXIMUM UNIFORM ACCELERATION[D]	1 000	G
MAXIMUM VIBRATIONAL ACCELERATION FOR EXTENDED PERIODS[E]	2.5	G
MAXIMUM BULB TEMPERATURE	250	°C

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MAXIMUM RATINGS

ABSOLUTE VALUES

PLATE VOLTAGE, DC	165	VOLTS
GRID #2 VOLTAGE, DC	155	VOLTS
PLATE DISSIPATION	1.1	WATTS
GRID #2 DISSIPATION	0.55	WATTS
CATHODE CURRENT	16.5	MA.
NEGATIVE GRID #1 VOLTAGE	55	VOLTS

TYPICAL OPERATING CHARACTERISTICS

CONDITIONS:		
HEATER VOLTAGE	6.3	VOLTS
PLATE VOLTAGE, DC	100	VOLTS
GRID #3 VOLTAGE[F]	0	VOLTS
GRID #2 VOLTAGE, DC	100	VOLTS
CATHODE BIAS RESISTOR	120	OHMS
PLATE CURRENT	7.2	MA.
GRID #2 CURRENT	2.2	MA.
TRANSCONDUCTANCE	4 500	μMHOS
PLATE RESISTANCE	260 000	OHMS
GRID VOLTAGE FOR 25 μMHOS TRANSCONDUCTANCE	-14	VOLTS
NOISE OUTPUT VOLTAGE[G] MAXIMUM	60	MV.
LIFE EXPECTANCY:		
30° C AMBIENT TEMPERATURE	5 000	HOURS
175°C AMBIENT TEMPERATURE	1 000	HOURS

[B] WITH EXTERNAL SHIELD OF 0.405 INCH DIAMETER CONNECTED TO CATHODE.

[C] FORCES IN ANY DIRECTION AS APPLIED BY THE NAVY TYPE HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRIC DEVICES OR EQUIVALENT.

[D] FORCES IN ANY DIRECTION APPLIED GRADUALLY, AS IN CENTRIFUGE.

[E] VIBRATIONAL FORCES IN ANY DIRECTION AT 60 CYCLES PER SECOND FOR A PERIOD EXCEEDING 100 HOURS.

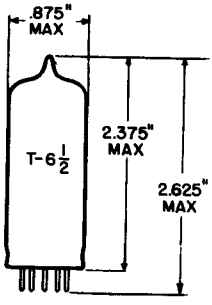
[F] GRID #3 CONNECTED TO CATHODE AT SOCKET.

[G] ACROSS PLATE RESISTOR OF 10,000 OHMS, WITH APPLIED VIBRATIONAL ACCELERATION OF 15G AT 40 CYCLES PER SECOND.

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE



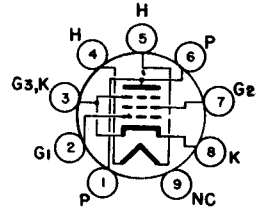
GLASS BULB

MINIATURE
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

COATED UNIPOTENTIAL CATHODE

FOR MOBILE AND
AIRCRAFT APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9CE

THE 6216 IS A BEAM PENTODE POWER AMPLIFIER IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS EXTREMELY RESISTANT TO THE VIBRATIONS ENCOUNTERED IN PRESENT HIGH-SPEED MILITARY AIRCRAFT.

THE 6216 MAY BE USED IN CLASS A, CLASS B, AND CLASS C AMPLIFIER APPLICATIONS, AS A PASSING TUBE IN ELECTRONIC VOLTAGE-REGULATED POWER SUPPLIES, IN WIDE BAND VIDEO AMPLIFIERS, AND IN PASSIVE SWITCHING APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

GRID TO PLATE: (G1 TO P), MAX.	0.370	pf
INPUT: G1 TO (H+K+G2+G3+B.P.+B.S.+I.S.)	12.3	pf
OUTPUT: P TO (H+K+G2+G3+B.P.+B.S.+I.S.)	6.7	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS:		
VOLTAGE	6.3	VOLTS
CURRENT	1200	MA.
MAXIMUM HEATER-CATHODE VOLTAGE	150	VOLTS

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	200	VOLTS
POSITIVE DC GRID #1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	10	WATTS

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MAXIMUM RATINGS - CONT'D.

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

GRID #2 DISSIPATION	1.0	WATTS
CATHODE CURRENT	110	MA.
BULB TEMPERATURE AT ANY POINT	210	°C
GRID #1 CIRCUIT RESISTANCE (FIXED BIAS)	0.1	MEGOHM
GRID #1 CIRCUIT RESISTANCE (SELF BIAS)	0.5	MEGOHM

AVERAGE CHARACTERISTICS

FILTER REACTOR

PLATE VOLTAGE	100	VOLTS
GRID #2 VOLTAGE	100	VOLTS
GRID #1 VOLTAGE	-3	VOLTS
GRID #1 RESISTOR	0.1	MEGOHM
PLATE RESISTANCE (APPROX.)	18 500	OHMS
TRANSCONDUCTANCE	12 800	μMHOS
PLATE CURRENT	72	MA.
GRID #2 CURRENT	3	MA.
GRID #1 VOLTAGE (APPROX.) FOR Ib = 50 μA	-25	VOLTS

TYPICAL OPERATION

FILTER REATOR (SEE CIRCUIT)

DC PLATE SUPPLY VOLTAGE (INPUT TO FILTER)	400	VOLTS
DC PLATE VOLTAGE (PLATE TO CATHODE)	60	VOLTS
DC GRID #2 VOLTAGE	100	VOLTS
DC GRID #1 VOLTAGE	-1	VOLTS
DC OUTPUT VOLTAGE (OUTPUT FROM FILTER)	335	VOLTS
DC CATHODE CURRENT	110	MA DC
RMS RIPPLE VOLTAGE (IN OUTPUT)(NOTE 1)	210	MV.

CLASS A AUDIO AMPLIFIER

PLATE VOLTAGE	200	VOLTS
GRID #2 (SCREEN) VOLTAGE	100	VOLTS
GRID #1 (CONTROL GRID) VOLTAGE	-6	VOLTS
PEAK AF GRID #1 VOLTAGE	6	VOLTS
ZERO SIGNAL PLATE CURRENT	47	MA.
MAX. SIGNAL PLATE CURRENT	51	MA.
ZERO SIGNAL GRID #2 CURRENT	2.0	MA.
MAX. SIGNAL GRID #2 CURRENT	4.0	MA.
PLATE RESISTANCE	38 800	OHMS
TRANSCONDUCTANCE	8 800	μMHOS
LOAD RESISTANCE	4 500	OHMS
TOTAL HARMONIC	10	PERCENT
MAX. SIGNAL POWER OUTPUT	3.8	WATTS

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TYPICAL OPERATION - CONT'D.

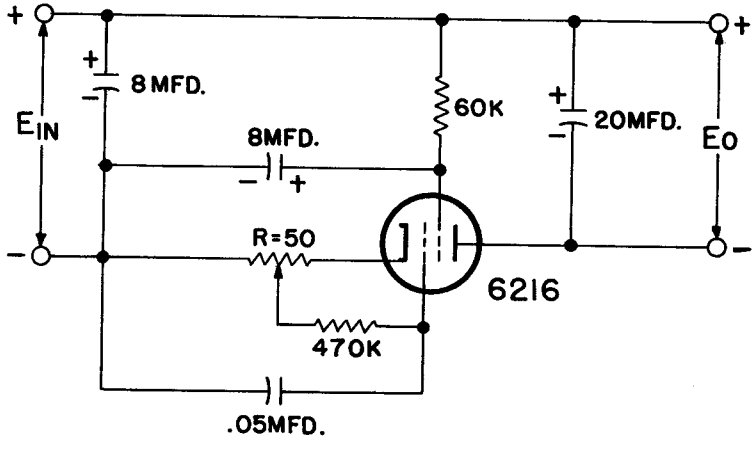
CLASS C OSCILLATOR-AMPLIFIER - 50 MC

DC PLATE VOLTAGE	300	VOLTS
DC GRID #2 VOLTAGE	150	VOLTS
DC GRID #1 VOLTAGE[A]	-50	VOLTS
	22 000	OHMS
PEAK RF GRID #1 VOLTAGE	65	VOLTS
DC PLATE CURRENT	63	MA.
DC GRID #2 CURRENT	8.0	MA.
DC GRID #1 CURRENT	2.0	MA.
GRID #1 DRIVING POWER (APPROX.)	0.3	WATTS
USEFUL POWER OUTPUT	8.8	WATTS

[A] OBTAINED FROM FIXED SOURCE OF GRID RESISTOR OF VALUE SHOWN.

NOTE

[1] WHEN THE 6216 IS USED IN THE CIRCUIT SHOWN BELOW, THE PETENTIOMETER R SHOULD BE ADJUSTED FOR MINIMUM AC OUTPUT VOLTAGE ACROSS THE E_o TERMINALS. THE CURVE SHOWN IN THE APPENDIX REPRESENTS ADJUSTMENT FOR MINIMUM AC OUTPUT VOLTAGE AT 100 MA DC LOAD CURRENT.



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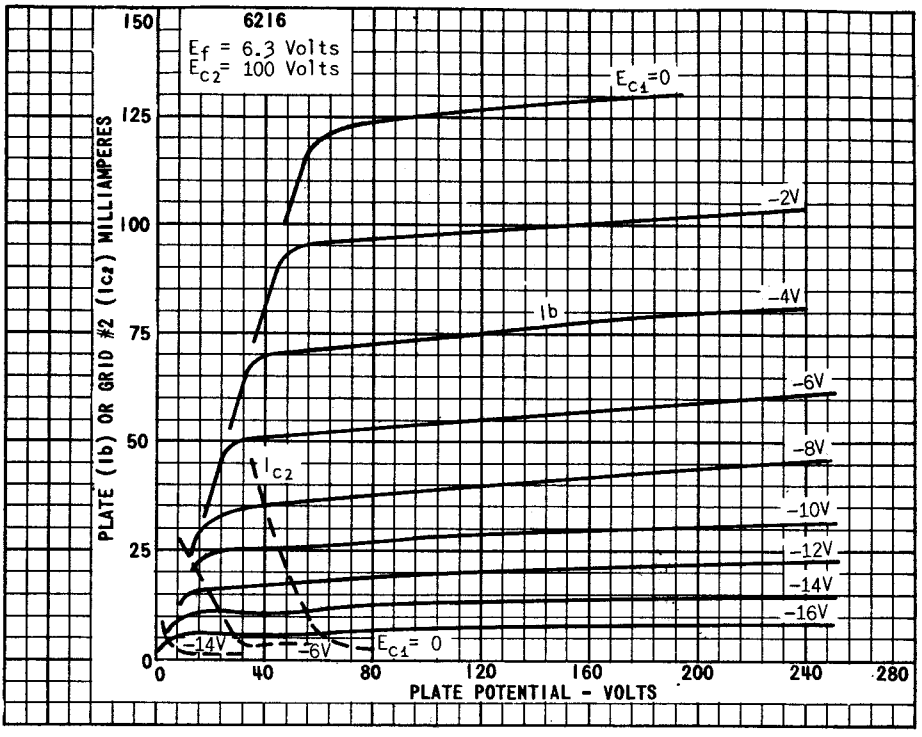
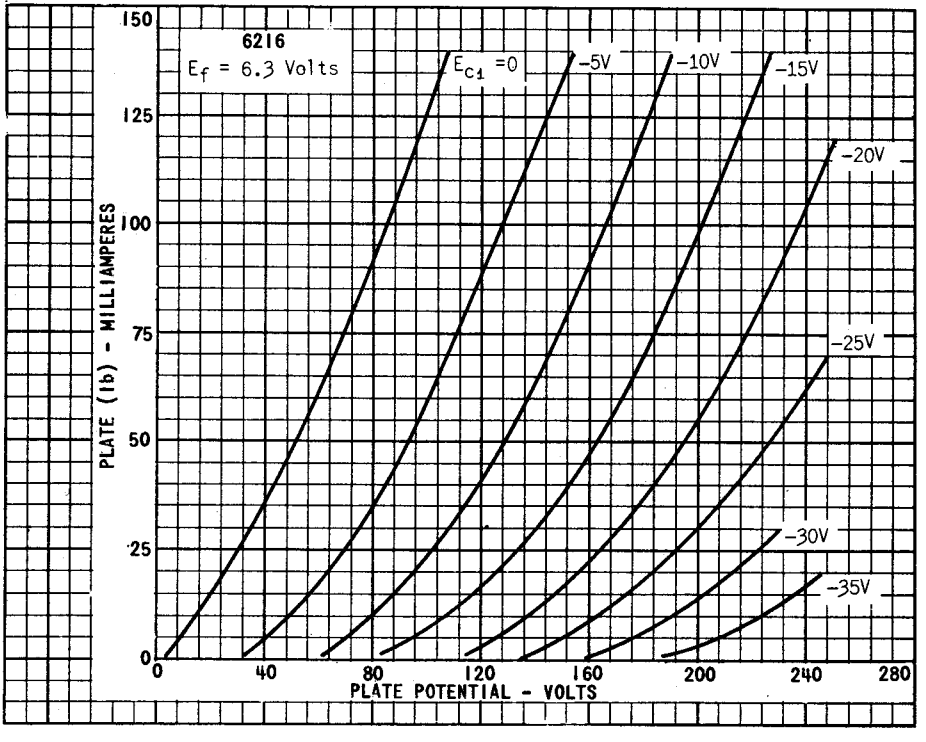
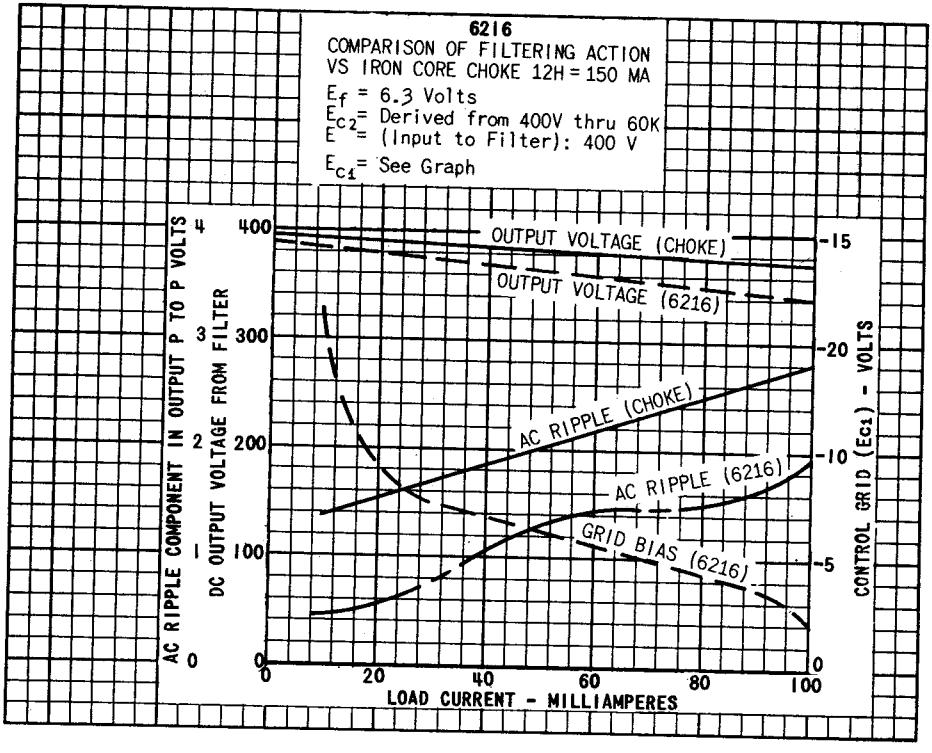

6216
Ef = 6.3 Volts
Ec2 = 100 Volts
PLATE (Ib) OR GRID #2 (Ic2) MILLIAMPERES
PLATE POTENTIAL - VOLTS
Ec1=0
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
Ib
Ic2
-14V
-6V
Ec1= 0
0
25
50
75
100
125
150
0
40
80
120
160
200
240
280


6216
Ef = 6.3 Volts
PLATE (Ib) - MILLIAMPERES
PLATE POTENTIAL - VOLTS
Ec1 =0
-5V
-10V
-15V
-20V
-25V
-30V
-35V
0
25
50
75
100
125
150
0
40
80
120
160
200
240
280



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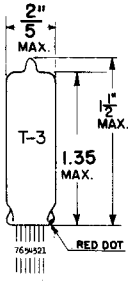
PENTODE

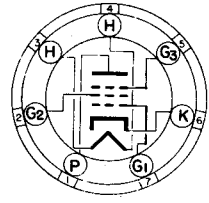
SUBMINIATURE TYPE



GLASS BULB

HEATER

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.048" CENTER-TO-CENTER

THE 6245 IS A HEATER-CATHODE TYPE SHARP-CUTOFF PENTODE OF SUBMINIATURE CONSTRUCTION CAPABLE OF OPERATION IN THE UHF REGION. THE CONTROLLED CHARACTERISTICS GIVE UNIFORM PERFORMANCE AT LOW VOLTAGES. IT IS DESIGNED FOR SERVICE WHERE SEVERE CONDITIONS OF HIGH TEMPERATURE AND MECHANICAL SHOCK OR VIBRATION ARE ENCOUNTERED. A SEPARATE TERMINAL CONNECTION IS PROVIDED FOR GRID #3, WHICH UNDER SELF-BIAS CONDITIONS CAN BE CONNECTED DIRECTLY TO GROUND, PERMITTING THE CATHODE BY-PASS CAPACITOR TO BE OMITTED FOR LOWER GRID LOADING. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO 0.20" LENGTH.

RATINGS

MECHANICAL

MAXIMUM IMPACT ACCELERATION (SHOCK TEST-NOTE 3)	450	G
MAXIMUM UNIFORM ACCELERATION (CENTRIFUGE TEST-NOTE 4)	1000	G
MAXIMUM VIBRATIONAL ACCELERATION (96 HOUR FATIGUE TEST-NOTE 5)	2.5	G
MAXIMUM BULB TEMPERATURE	265	°C

RATINGS

AND NORMAL OPERATION

	MIL-E-1B SYMBOL	ABS MIN.	NORM. TEST CONDITIONS (NOTE 7)	NORMAL OPERATION (NOTE 6)	ABS MAX	MIL-E-1B UNITS
HEATER VOLTAGE (NOTE 8)	Ef	5.7	6.3	6.3	6.9	V
PLATE VOLTAGE	Eb:		120	20	200	Vdc
GRID #1 VOLTAGE	Ec1:	-55	0	0	0	Vdc
GRID #2 VOLTAGE	Ec2:		120	30	155	Vdc
GRID #3 VOLTAGE	Ec3:		0	0	0	Vdc
PLATE DISSIPATION	Pp:			0.05	1.85	W
GRID #2 DISSIPATION	Pg2:			0.03	0.55	W
GRID #1 CIRCUIT RESISTANCE	Rg1:			1.0		MEG.
HEATER-CATHODE VOLTAGE	Ehk:	-200		100	+200	Vdc
CATHODE CURRENT	Ik:	0.5			20	mAdc
CATHODE RESISTANCE	Rk:		200	0		OHMS

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1]

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	LAL	BOG	UAL	MAX	ALD	MIL-E-1B UNITS
CONTINUITY & TAP SHORTS:	0.4								
ACCEPTANCE TESTS GROUP A.	COMBINED AQL=2.5%								
HEATER CURRENT:	0.65	If:	183		200		217		mA
HEATER-CATHODE LEAKAGE (1): Ehk=+100 Vdc	0.65	Ihk(1):					7		μAdc
HEATER-CATHODE LEAKAGE (2): Ehk=-100 Vdc	0.65	Ihk(2):					-7		μAdc
GRID CURRENT (1)	0.65	Ic1(1):					-0.1		μAdc
PLATE CURRENT (1):	0.65	Ib(1):	5.5	6.9	7.5	8.1	9.5	2.3	mAdc
PLATE CURRENT (2): Ec1 =-9.0 Vdc	0.65	Ib(2):					50		μAdc
TRANSCONDUCTANCE (1):	0.65	Sm(1):	4200	4775	5000	5225	5800	860	μMHOS
TRANSCONDUCTANCE (3): Eb =20 Vdc; Ec2=30 Vdc; Ec1=Ec3 =0; Rg1 = 500 OHMS MAX; Rk = 0	0.65	Sm(3):	2250		3275		4300		μMHOS
PLATE CURRENT (3): Eb =20 Vdc; Ec2=30 Vdc; Ec1 = Ec3 = 0; Rg1 = 500 OHMS MAX. Rk =0.	0.65	Ib(3):	1.0		2.5		4.0		mAdc
SCREEN CURRENT (2): Eb = 20 Vdc; Ec2 =30 Vdc; Ec1=Ec3 =0; Rg1 = 500 OHMS MAX. Rk =0.	0.65	Ic2(2):					1.5		mAdc
ACCEPTANCE TEST GROUP B									
INSULATION OF ELECTRODES: Ef =6.3 V									
Eg-all=-100 Vdc	2.5	Rg1-all:	100						MEG.
Ep-all=-300 Vdc	2.5	Rp-all:	100						MEG.
SCREEN CURRENT:	2.5	Ic2)1):	1.7	2.4	2.6	2.8	3.5	0.8	mAdc
TRANSCONDUCTANCE (2): Ef=5.5 V (NOTE 9)	2.5	ΔSm(2):					10		PERCENT
AF NOISE: Esig=50 mVac; Rg1 =0.1 MEG; Ec2 =19 Vdc; Rg2 = 1000 OHMS; Rp =0.2 MEG.	2.5	EB:					17		VU
VIBRATION: F = 40 cps; G= 15; Rp = 10,000 OHMS	2.5	Ep:					50		mVac
SUBMINIATURE LEAD FATIGUE TEST:	2.5		4.0						arcs
ACCEPTANCE TEST GROUP C									
GRID CURRENT (2): AFTER 5 MINUTES AT Ef=7.0 V; MEASURE GRID CURRENT AT Ef =7.0 V; 3 MINUTE TEST NOT PERMITTED.	6.5	Ic1(2):					-0.1		μAdc

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1B SYMBOL	MIN	LAL	BOG	UAL	MAX	ALD	MIL-E-1B UNITS
ACCEPTANCE TESTS GROUP C - cont'd.									
PLATE RESISTANCE:	6.5	Rp:	0.15						MEG.
CAPACITANCE:		Cg1p:					0.03		μμf
CAPACITANCE: (NOTE 2)	6.5	Cin:	3.6		4.35		5.1		μμf
CAPACITANCE:		Cout:	2.6		3.15		3.7		μμf

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE TESTS GROUP D					
SHOCK					
HAMMER ANGLE =30°					
NOTE 3					
POST SHOCK LIMITS:					
VIBRATION:					
F=40 cps; G=15; Rp=10,000 OHMS		Ep:		100	mVac
HEATER-CATHODE LEAKAGE (1):					
Ehk=+100 Vdc		Ihk(1):		20	μAdc
HEATER-CATHODE LEAKAGE (2):					
Ehk=-100 Vdc		Ihk(2):		-20	μAdc
TRANSC. (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:					
Ef = 6.3 V.		ΔSm(1):		20	%
FATIGUE:					
96 HOURS; NOTE 5					
POST FATIGUE LIMITS:					
VIBRATION:					
F=40 cps; G=15; Rp=10,000 OHMS		Ep:		100	mVac
HEATER-CATHODE LEAKAGE (1):					
Ehk=+ 100 Vdc		Ihk(1):		10	μAdc
HEATER-CATHODE LEAKAGE (2):					
Ehk=-100 Vdc		Ihk(2):		-10	μAdc
TRANSC. (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:					
Ef = 6.3 V		ΔSm(1):		15	%

TEST	AQL %
ACCEPTANCE TESTS GROUP E	
GLASS STRAIN (THERMAL SHOCK):	10
VISUAL AND MECHANICAL INSPECTION:	
MAJOR COMBINED	0.4
MINOR A COMBINED	2.5
MINOR B PER ITEM	6.5

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST	AQL %	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
ACCEPTANCE LIFE TESTS					
HEATER CYCLE: Ef =7.5 V; Eb=Ec1=Ec2=Ec3=0V; Ehk=140 Vac; 1 MIN ON, 1 MIN. OFF			2000		CYCLES
1 HOUR STABILITY LIFE TEST: TA=ROOM: Ehk=+200 Vdc; Rg1 = 1.0 MEG.					
1 HOUR STABILITY LIFE TEST END POINTS: TRANSC. (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL: (TYPICAL SAMPLE SIZE = 25 TUBES)	10	ΔSm(1):		8.0	PERCENT
100 HOUR SURVIVAL RATE LIFE TEST: TA = ROOM: Ehk=+200 Vdc; Rg1 = 1.0 MEG.					
100 HOUR SURVIVAL RATE LIFE TEST END POINTS: INOPERATIVES: (TYPICAL SAMPLES SIZE = 200 TUBES)	0.4				
TRANSCOND. (1): (TYPICAL SAMPLE SIZE = 25 TUBES)	1.0	Sm(1):	3250		μMHOS

TEST	MAX. DEFECTS PER CHARACTERISTICS	MIL-E-1B SYMBOL	MIN.	MAX.	MIL-E-1B UNITS
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (1): TA = 200°C; Ehk=+200 Vdc; Rg1 = 1.0 MEG.					
500 HOUR INTERMITTENT HIGH TEMPERATURE LIFE TEST (1) END POINTS: (TYPICAL SAMPLE SIZE = 20 TUBES) (TOTAL ALLOWABLE COMBINED DEFECTS = 4 TUBES)					
INOPERATIVES:	1				
HEATER CURRENT:	4	If:	183	217	mA
HEATER CATHODE LEAKAGE (1):	2	Ihk(1):	0	10	μAdc
HEATER CATHODE LEAKAGE (2):	2	Ihk(2):	0	-10	μAdc
GRID CURRENT (1):	2	Ic1(1):	0	-0.3	μAdc
GRID CURRENT (2):	2	Ic1(2):	0	-0.3	μAdc
TRANSC. (1) CHANGE OF INDIVIDUAL TUBES FROM INITIAL:	1	ΔSm(1):		25	PERCENT
TRANSC. (2) CHANGE OF INDIVIDUAL TUBES FROM Ef=6.3 TO 5.5 V:	4	ΔSm(2):		15	PERCENT
INSULATION OF ELECTRODES:	4	Rg1-all:	50		MEG.
INSULATION OF ELECTRODES:	4	Rp-all:	50		MEG.

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CHARACTERISTICS AND QUALITY CONTROL TESTS[1] - cont'd.

TEST

5000 HOUR INTERMITTENT LIFE TEST (2):
TA = ROOM: Ebk=+200 Vdc; Rg1 =1.0 MEG.

5000 HOUR INTERMITTENT LIFE TEST (2)
END POINTS:
READ FOR SAME CHARACTERISTICS AS FOR LIFE TEST (1): LIMITS NOT ESTABLISHED.

NOTES

NOTE 1: CHARACTERISTICS, QUALITY CONTROL TEST PROCEDURES, AND INSPECTION LEVELS ARE MADE ACCORDING TO THE APPROPRIATE PARAGRAPHS OF MIL-E-1B, "INSPECTION INSTRUCTIONS FOR ELECTRON TUBES" AND MIL-STD-105A.

NOTE 2: WITH A CYLINDRICAL SHIELD (0.405" I.D.-1 7/8" LONG) CONNECTED TO LEAD 6.

NOTE 3: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER SHOCK TEST PROCEDURES OF MIL-E-1B BASIC SPECIFICATION.

NOTE 4: CENTRIFUGE TEST WITH FORCES APPLIED IN ANY DIRECTION.

NOTE 5: TEST CONDITIONS AND ACCEPTANCE CRITERIA PER FATIGUE TEST PROCEDURES OF MIL-E-1B BASIC SPECIFICATIONS.

NOTE 6: THESE NORMAL VALUES REPRESENT CONDITIONS AT WHICH CONTROL OF RELIABILITY MAY BE EXPECTED.

NOTE 7: THESE NORMAL TEST CONDITIONS ARE USED FOR ALL CHARACTERISTIC TESTS UNLESS OTHERWISE STATED UNDER THE INDIVIDUAL TEST ITEM.

NOTE 8: FOR MOST APPLICATIONS THE PERFORMANCE WILL NOT BE ADVERSELY AFFECTED BY ± 10% HEATER VOLTAGE VARIATION, BUT WHEN THE APPLICATION CAN PROVIDE A CLOSER CONTROL OF HEATER VOLTAGE, AN IMPROVEMENT IN RELIABILITY WILL BE REALIZED.

NOTE 9: CHANGE OF TRANSCONDUCTANCE FOR INDIVIDUAL TUBES FROM THAT VALUE MEASURED AT Ef = 6.3 V TO THAT VALUE MEASURED AT Ef = 5.5 V.

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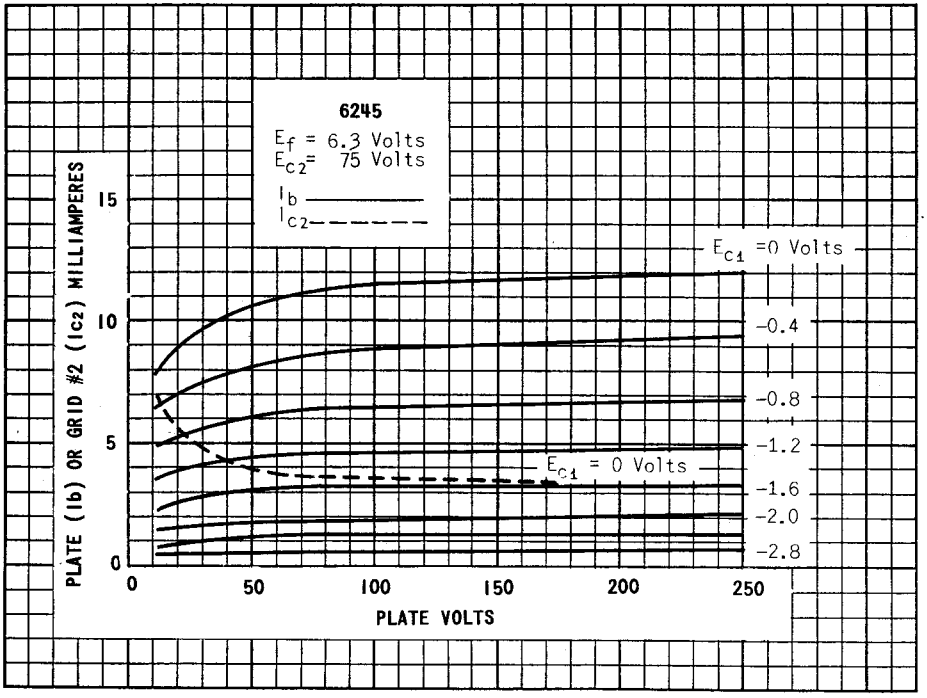
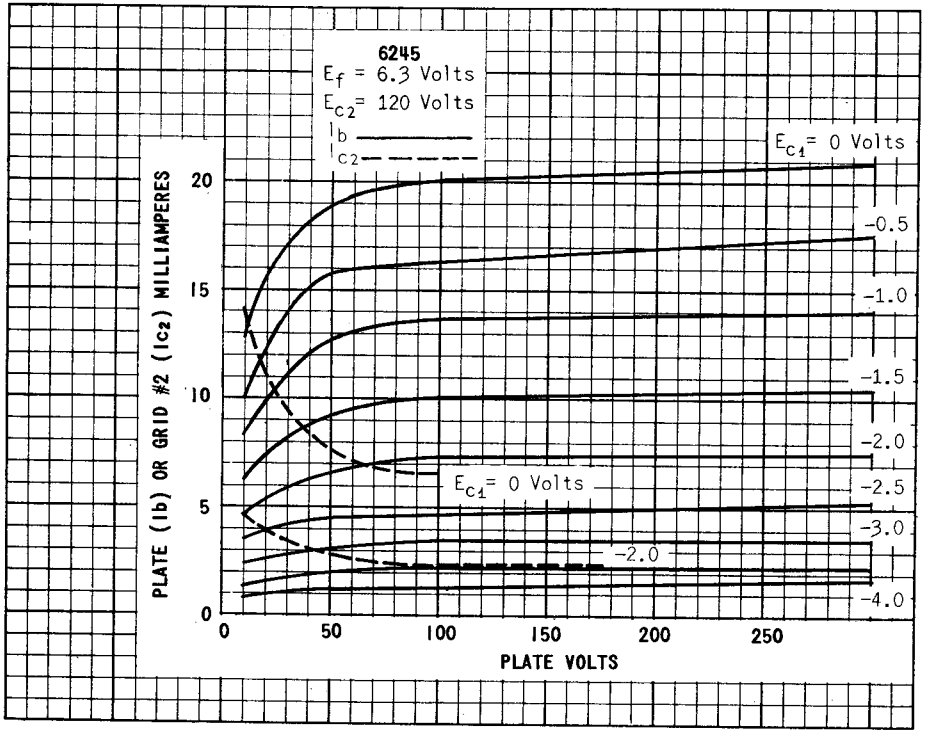
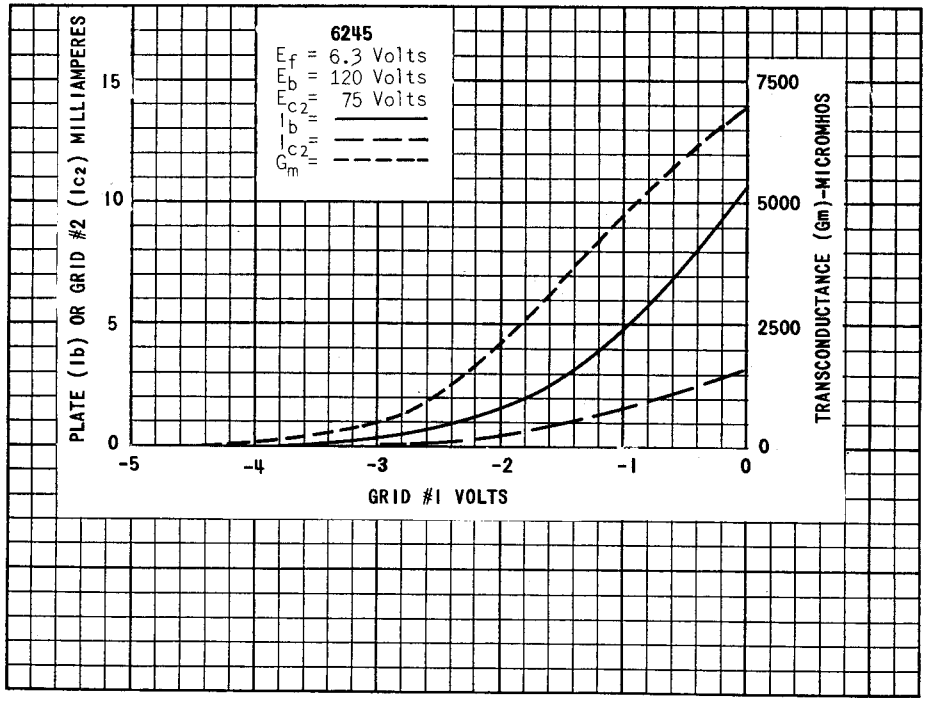
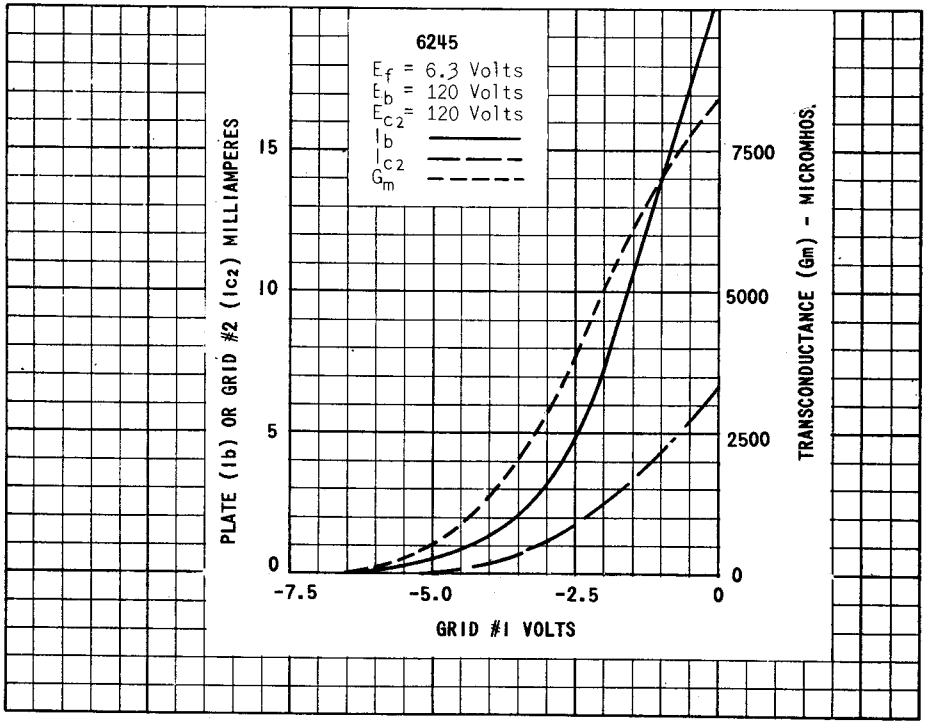

6245
E_f = 6.3 Volts
E_{c2}= 75 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1} =0 Volts
-0.4
-0.8
-1.2
E_{c1} = 0 Volts
-1.6
-2.0
-2.8
0
5
10
15
0
50
100
150
200
250


6245
E_f = 6.3 Volts
E_{c2}= 120 Volts
I_b
I_{c2}
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
E_{c1}= 0 Volts
-0.5
-1.0
-1.5
-2.0
E_{c1}= 0 Volts
-2.5
-3.0
-2.0
-4.0
0
5
10
15
20
0
50
100
150
200
250





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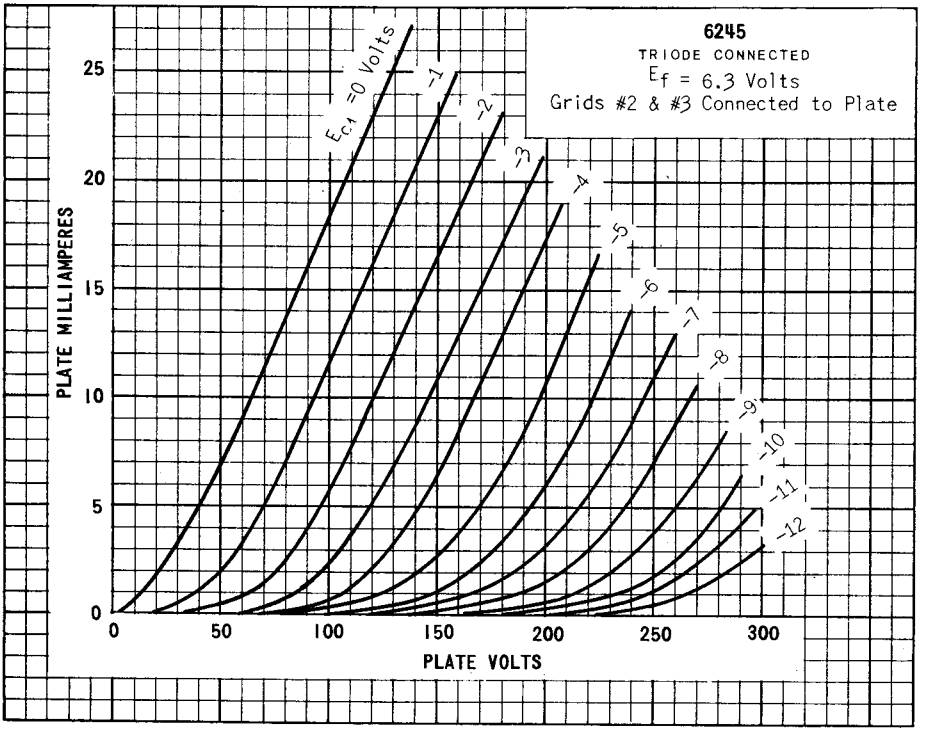
6245
TRIODE CONNECTED
Ef = 6.3 Volts
Grids #2 & #3 Connected to Plate
Ec1 =0 Volts
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
PLATE MILLIAMPERES
0
5
10
15
20
25
0
50
100
150
200
250
300
PLATE VOLTS

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UHF POWER TRIODE

PENCIL TYPE

FOR

RF POWER AMPLIFIER, OSCILLATOR

AND FREQUENCY MULTIPLIER APPLICATIONS

IN MOBILE AND AIRCRAFT EQUIPMENT

PHYSICAL DIMENSIONS SEE OUTLINE DRAWING

ELECTRODE TERMINATIONS SEE OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

THE 6263A IS A COAXIAL METAL-GLASS PENCIL-TYPE MEDIUM MU TRIODE WITH AN EXTERNAL PLATE RADIATOR. ITS MAXIMUM PLATE DISSIPATION IS 13 WATTS ICAS. THE TUBE MAY BE OPERATED WITH FULL RATINGS UP TO A FREQUENCY OF 500 MC/S, AND WITH REDUCED RATINGS UP TO 1700 MC/S.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		1.7	pf
GRID TO CATHODE		2.9	pf
PLATE TO CATHODE	MAX.	0.08	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.0	VOLTS	280	MA.
LIMITS OF APPLIED VOLTAGE				
UNDER TRANSMITTING CONDITIONS			6.0 ± 0.6	VOLTS
UNDER STANDBY CONDITIONS - MAXIMUM			6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			50	VOLTS

AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	200	VOLTS
PLATE CURRENT	27	MA.
TRANSCONDUCTANCE	7,000	μMHOS
AMPLIFICATION FACTOR	27	

CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

	CCS	ICAS	
DC PLATE VOLTAGE	330	400	VOLTS
DC GRID VOLTAGE	-100	-100	VOLTS
DC PLATE CURRENT	40	55	MA.
DC GRID CURRENT	25	25	MA.
DC CATHODE CURRENT	55	70	MA.

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CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR - cont'd.

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

	CCS	ICAS	
PLATE INPUT	13.2	22	WATTS
PLATE DISSIPATION	8	13	WATTS
PLATE SEAL TEMPERATURE	175	175	°C
FREQUENCY FOR OPERATION AT FULL RATINGS	500	500	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	0.1	MEGOHMS

TYPICAL OPERATION AS RF AMPLIFIER WITH CATHODE DRIVE AT 500 MC/S

DC PLATE-TO-GRID VOLTAGE	348	408	VOLTS
DC CATHODE-TO-GRID VOLTAGE	48	58	VOLTS
FROM GRID RESISTOR OR COMBINATION OF GRID RESISTOR WITH FIXED SUPPLY OR CATHODE RESISTOR			
DC PLATE CURRENT	35	40	MA.
DC GRID CURRENT	13	15	MA.
DRIVING POWER	2.2	3	WATTS
USEFUL POWER OUTPUT	7	10	WATTS
WITH APPROX. 75% OUTPUT CIRCUIT EFFICIENCY			

CLASS C TELEPHONY - PLATE-MODULATED RF POWER AMPLIFIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

	CCS	ICAS	
DC PLATE VOLTAGE	275	330	VOLTS
DC GRID VOLTAGE	-100	-100	VOLTS
DC PLATE CURRENT	33	46	MA.
DC GRID CURRENT	25	25	MA.
DC CATHODE CURRENT	50	60	MA.
PLATE INPUT	9	15	WATTS
PLATE DISSIPATION	5.5	9	WATTS
PLATE SEAL TEMPERATURE	175	175	°C
FREQUENCY FOR OPERATION AT FULL RATINGS	500	500	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	0.1	MEGOHMS

TYPICAL OPERATION - CATHODE DRIVEN AT 500 MC/S

DC PLATE-TO-GRID VOLTAGE	317	372	VOLTS
DC CATHODE TO GRID VOLTAGE	42	52	VOLTS
FROM GRID RESISTOR OR COMBINATION OF GRID RESISTOR WITH FIXED SUPPLY OR CATHODE RESISTOR			
DC PLATE CURRENT	35	35	MA.
DC GRID CURRENT	13	12	MA.
DRIVING POWER	2	2.4	WATTS
USEFUL POWER OUTPUT	6.7	8	WATTS
WITH APPROX. 75% OUTPUT CIRCUIT EFFICIENCY			

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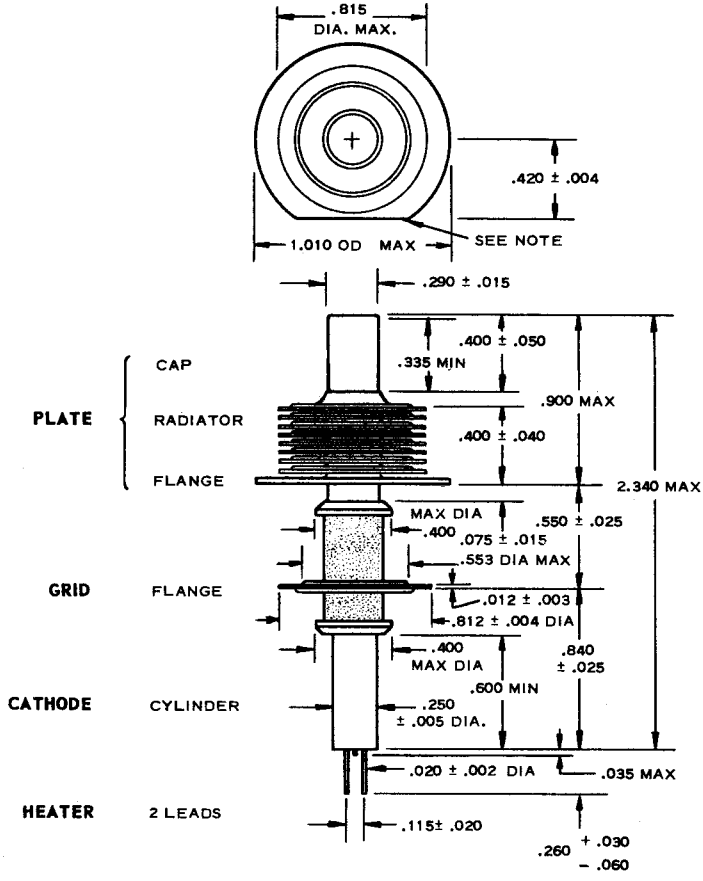
SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

LOW-PRESSURE VOLTAGE BREAKDOWN TEST
HIGH-FREQUENCY VIBRATION TEST
SEAL FRACTURE
HEATER CYCLING
1 - HOUR STABILITY LIFE PERFORMANCE
50 - HOUR SURVIVAL LIFE PERFORMANCE
500 - HOUR INTERMITTENT LIFE PERFORMANCE

OUTLINE DRAWING



NOTE:

THE STRAIGHT EDGE ON THE PERIMETER OF THE LARGE FIN (PLATE TERMINAL) IS PARALLEL TO A PLANE THROUGH THE CENTERS OF THE HEATER PINS AT THEIR SEALS WITHIN 15°.

ALL DIMENSIONS IN INCHES

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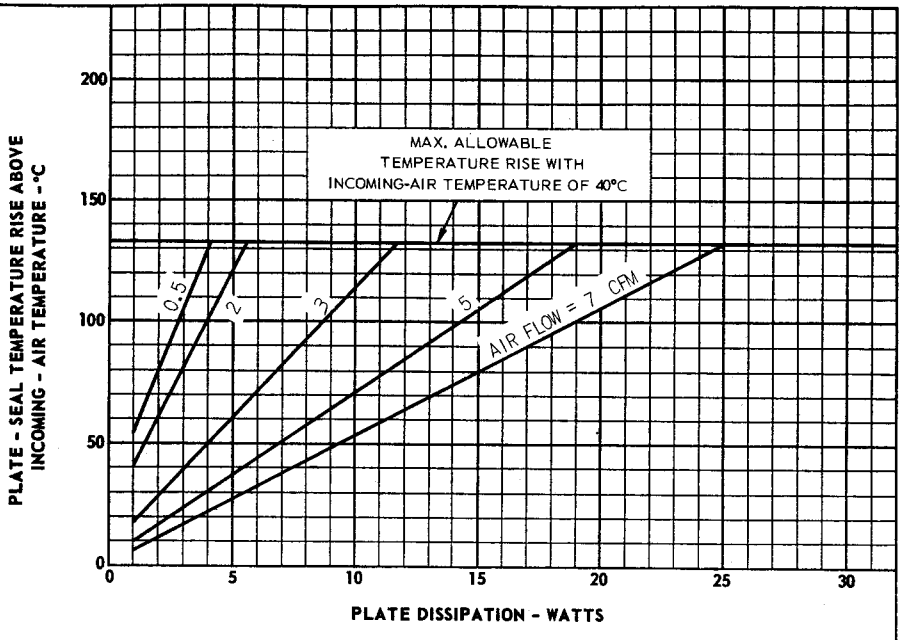
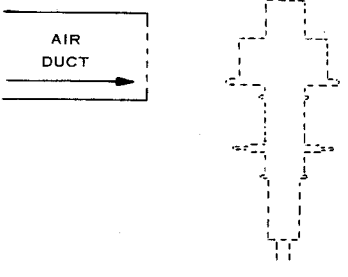
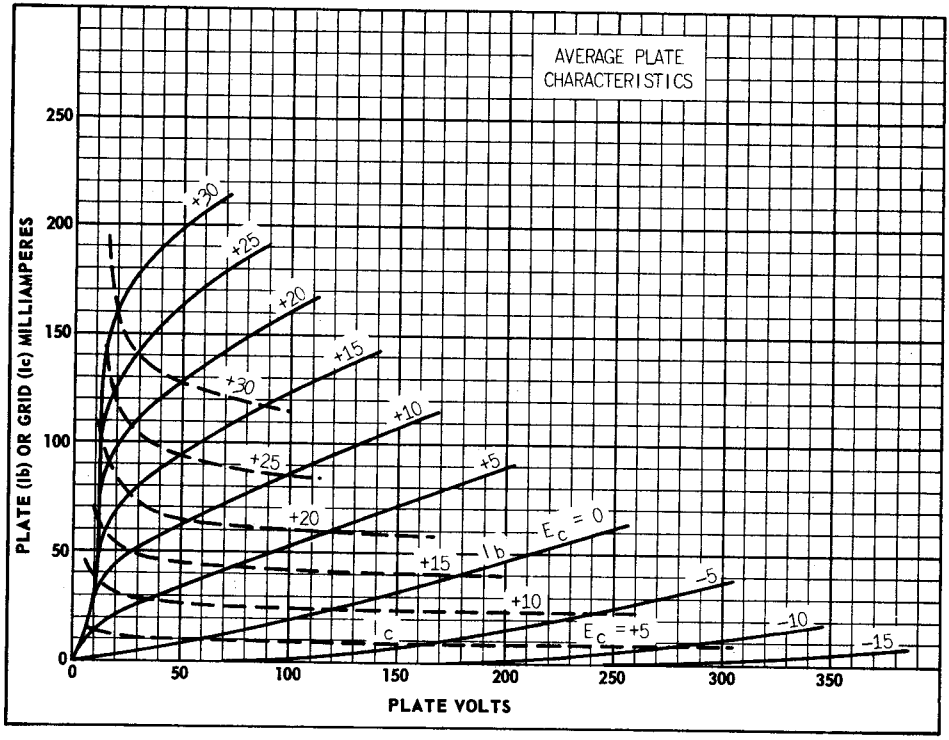
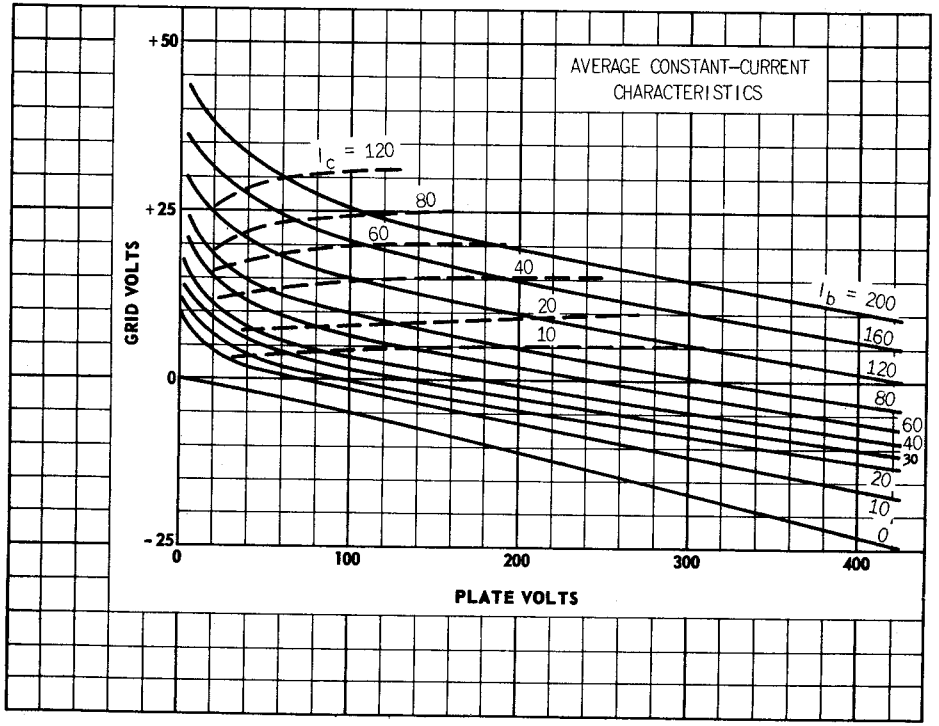


COOLING REQUIREMENTS

MAXIMUM PLATE - SEAL TEMPERATURE = 175° C
AIR-DUCT OPENING = 1 5/32" X 1 5/32"
WITH AIR-DUCT LOCATED AS SHOWN ON SKETCH







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TUNG-SOL

UHF POWER TRIODE

PENCIL TYPE

FOR

RF POWER AMPLIFIER, OSCILLATOR

AND FREQUENCY MULTIPLIER APPLICATIONS

IN MOBILE AND AIRCRAFT EQUIPMENT

PHYSICAL DIMENSIONS SEE OUTLINE DRAWING

ELECTRODE TERMINATIONS SEE OUTLINE DRAWING

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

THE 6264A IS A COAXIAL METAL-GLASS PENCIL-TYPE MEDIUM MU TRIODE WITH AN EXTERNAL PLATE RADIATOR. ITS MAXIMUM PLATE DISSIPATION IS 13 WATTS ICAS. THE TUBE MAY BE OPERATED WITH FULL RATINGS UP TO A FREQUENCY OF 500 MC/S, AND WITH REDUCED RATINGS UP TO 1700 MC/S.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		1.75	pf
GRID TO CATHODE		2.95	pf
PLATE TO CATHODE	MAX.	0.07	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.0	VOLTS	280	MA.
LIMITS OF APPLIED VOLTAGE				
UNDER TRANSMITTING CONDITIONS			6.0 ± 0.6	VOLTS
UNDER STANDBY CONDITIONS - MAXIMUM			6.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			50	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			50	VOLTS

AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	200	VOLTS
PLATE CURRENT	18.5	MA.
TRANSCONDUCTANCE	6,800	μMHOS
AMPLIFICATION FACTOR	40	

CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

	CCS	ICAS	
DC PLATE VOLTAGE	330	400	VOLTS
DC GRID VOLTAGE	-100	-100	VOLTS
DC PLATE CURRENT	40	55	MA.
DC GRID CURRENT	25	25	MA.
DC CATHODE CURRENT	55	70	MA.

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CLASS C TELEGRAPHY - RF POWER AMPLIFIER AND OSCILLATOR - cont'd.

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

	CCS	ICAS	
PLATE INPUT	13.2	22	WATTS
PLATE DISSIPATION	8	13	WATTS
PLATE SEAL TEMPERATURE	175	175	°C
FREQUENCY FOR OPERATION AT FULL RATINGS	500	500	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	0.1	MEGOHMS

TYPICAL OPERATION AS RF AMPLIFIER WITH CATHODE DRIVE AT 500 MC/S

DC PLATE-TO-GRID VOLTAGE	342	395	VOLTS
DC CATHODE-TO-GRID VOLTAGE	42	45	VOLTS
FROM GRID RESISTOR OR COMBINATION OF GRID RESISTOR WITH FIXED SUPPLY OR CATHODE RESISTOR			
DC PLATE CURRENT	35	40	MA.
DC GRID CURRENT	13	15	MA.
DRIVING POWER	2.2	3	WATTS
USEFUL POWER OUTPUT WITH APPROX. 75% OUTPUT CIRCUIT EFFICIENCY	7	10	WATTS

FREQUENCY MULTIPLIER

MAXIMUM RATINGS - ABSOLUTE MAXIMUM SYSTEM

	CCS	ICAS	
DC PLATE VOLTAGE	300	350	VOLTS
DC GRID VOLTAGE	-125	-140	VOLTS
DC PLATE CURRENT	33	45	MA.
DC GRID CURRENT	25	25	MA.
DC CATHODE CURRENT	45	55	MA.
PLATE INPUT	9.9	15.9	WATTS
PLATE DISSIPATION	6	9.5	WATTS
PLATE SEAL TEMPERATURE	175	175	°C
FREQUENCY FOR OPERATION AT FULL RATINGS	500	500	MC/S
ALTITUDE FOR OPERATION AT FULL RATINGS	60,000	60,000	FEET
GRID CIRCUIT RESISTANCE	0.1	0.1	MEGOHMS

TYPICAL OPERATION - TRIPLER TO 510 MC/S
CATHODE DRIVE CIRCUIT

DC PLATE-TO-GRID VOLTAGE	410	472	VOLTS
DC CATHODE TO GRID VOLTAGE	110	122	VOLTS
FROM GRID RESISTOR OR COMBINATION OF GRID RESISTOR WITH FIXED SUPPLY OR CATHODE RESISTOR			
DC PLATE CURRENT	26	36.5	MA.
DC GRID CURRENT	4.1	5.8	MA.
DRIVING POWER	2.75	4.5	WATTS
USEFUL POWER OUTPUT WITH APPROX. 75% OUTPUT CIRCUIT EFFICIENCY	2.1	3.4	WATTS

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TUNG-SOL

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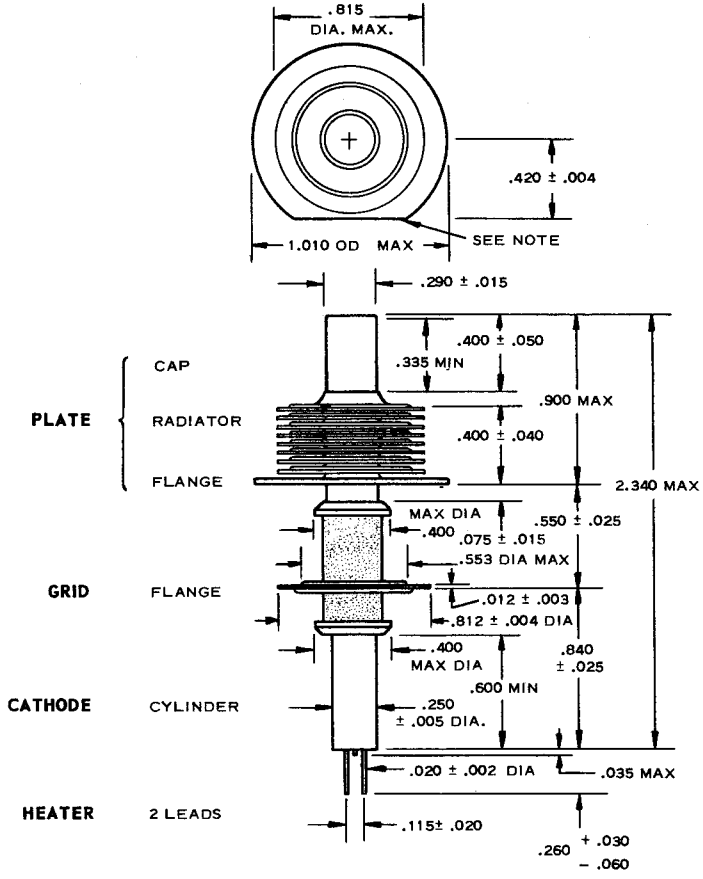
SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

LOW-PRESSURE VOLTAGE BREAKDOWN TEST
HIGH-FREQUENCY VIBRATION TEST
SEAL FRACTURE
HEATER CYCLING
1 - HOUR STABILITY LIFE PERFORMANCE
50 - HOUR SURVIVAL LIFE PERFORMANCE
500 - HOUR INTERMITTENT LIFE PERFORMANCE

OUTLINE DRAWING



NOTE:

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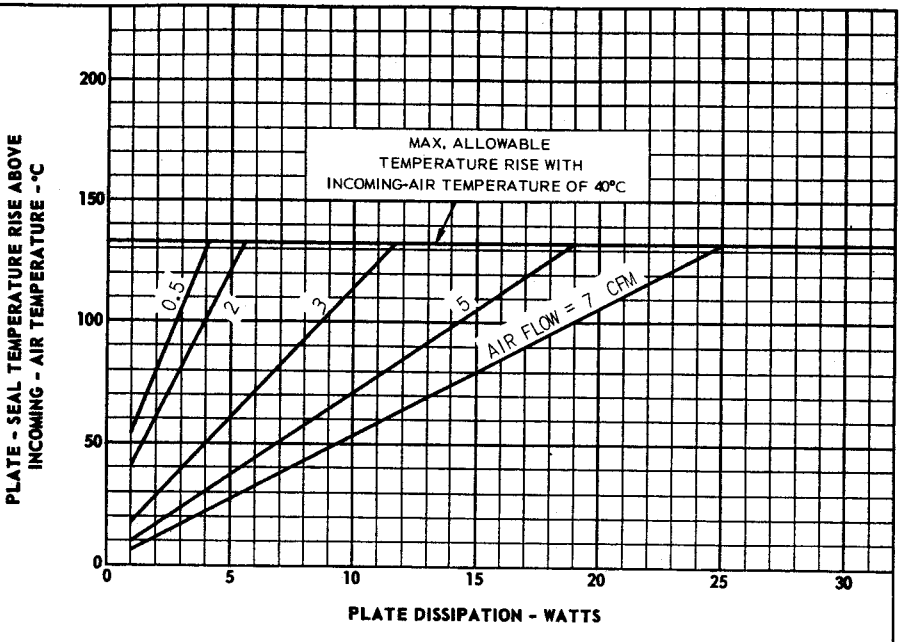

COOLING REQUIREMENTS

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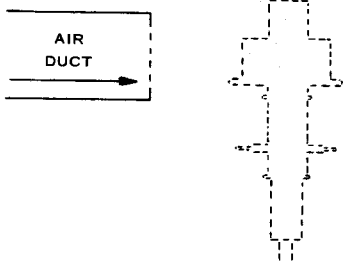
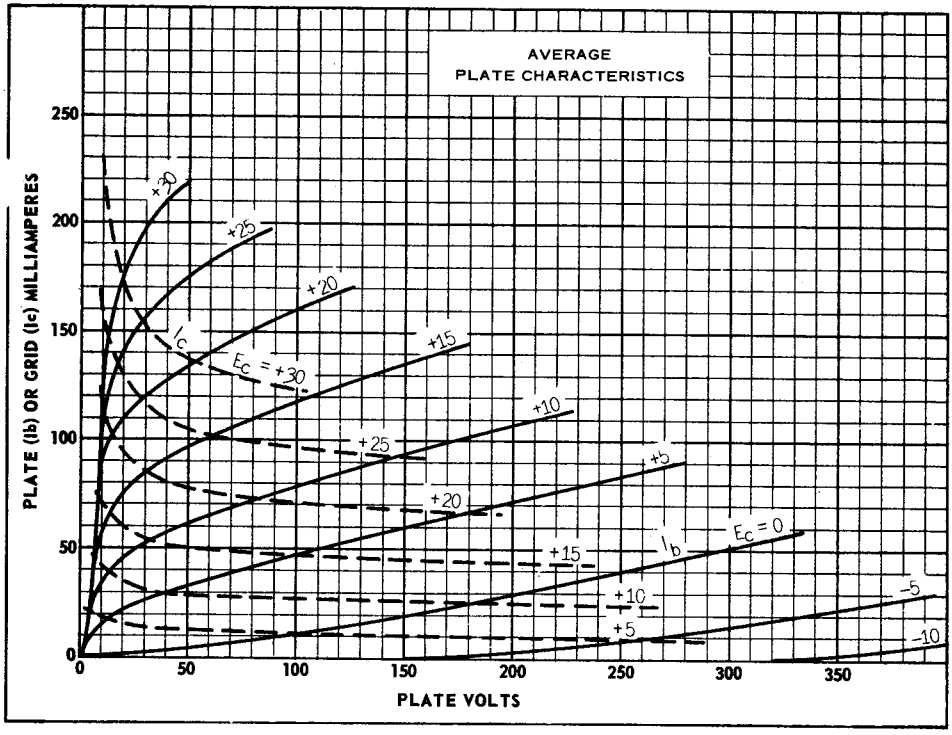
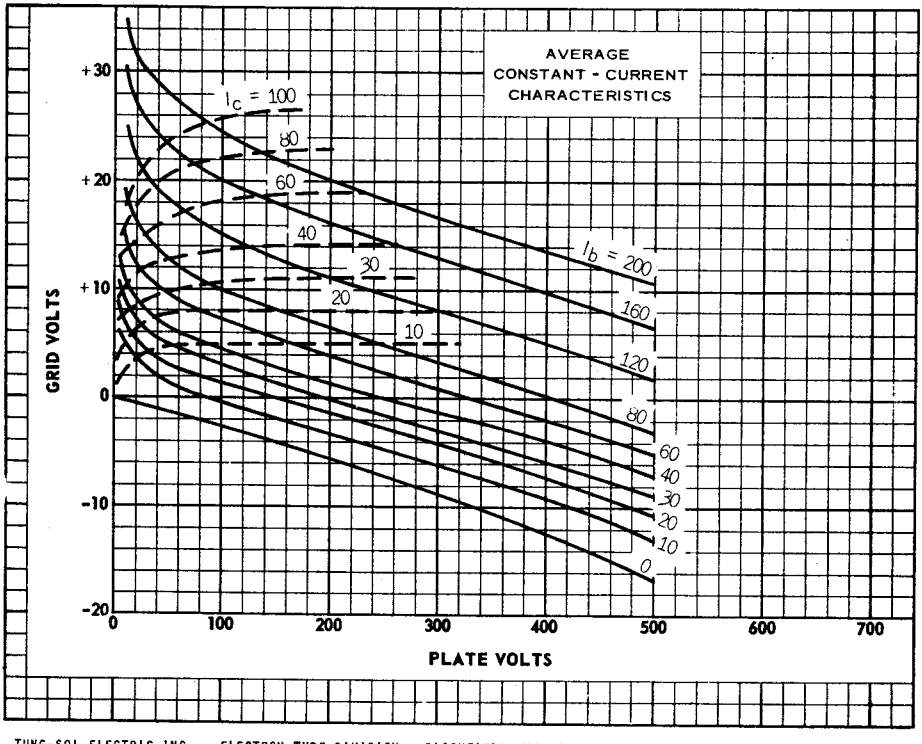
AIR - DUCT OPENING = 1 5/32" X 1 5/32"
WITH AIR-DUCT LOCATED AS SHOWN ON SKETCH







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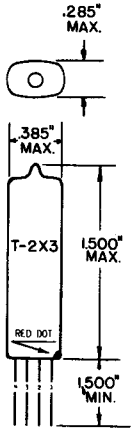


GLASS BULB

DOT IS ADJACENT TO LEAD 1

TRIODE

SUBMINIATURE TRIODE

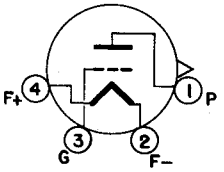
FOR

AMPLIFIER OR OSCILLATOR

APPLICATIONS

COATED FILAMENT

ANY MOUNTING POSITION



BOTTOM VIEW
0.016" TINNED
FLEXIBLE LEADS
0.048" CENTER-TO-CENTER
IN-LINE

THE 6286 IS A FILAMENTARY TYPE TRIODE OF SUBMINIATURE CONSTRUCTION WITH 4 FLEXIBLE LEADS. IT IS DESIGNED FOR USE AS AN AMPLIFIER OR OSCILLATOR IN MILITARY APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.6	pf
GRID TO FILAMENT	1.3	pf
PLATE TO FILAMENT	2.1	pf

FILAMENT CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25	VOLTS	125	MA.
LIMITS OF APPLIED VOLTAGE			1.25±.25	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	100	VOLTS
PLATE DISSIPATION	0.45	WATT
PLATE CURRENT	7.0	MA.

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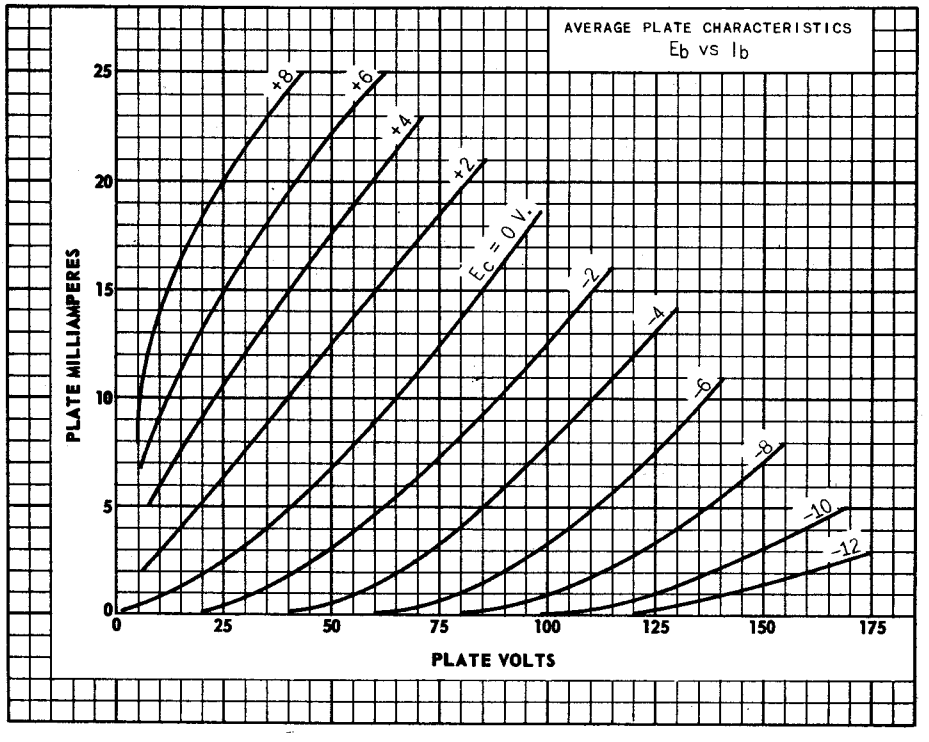
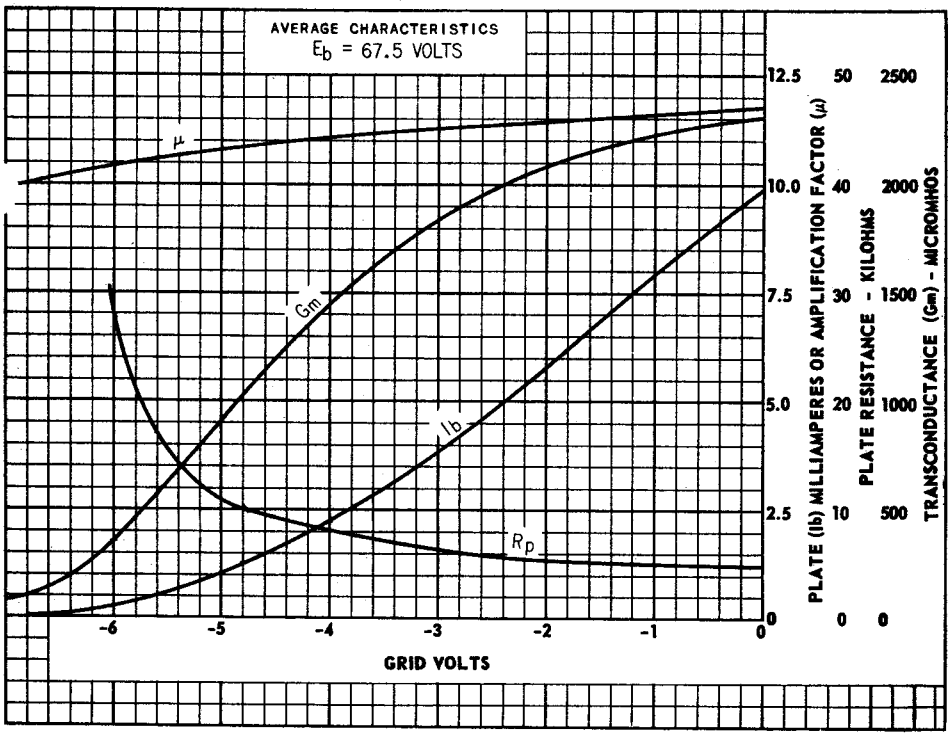
CHARACTERISTICS

PLATE VOLTAGE	67.5	VOLTS
GRID VOLTAGE	-2.0	VOLTS
PLATE CURRENT	6.0	MA.
TRANSCONDUCTANCE	2,100	μMHOS
AMPLIFICATION FACTOR	11.5	
GRID VOLTAGE (APPROX.) FOR Ib = 50 μA	-8.5	VOLTS

TYPICAL OSCILLATOR CHARACTERISTICS AT 25 MC/S

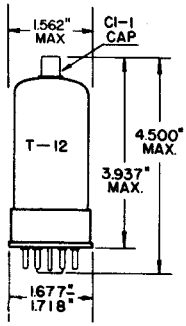
PLATE VOLTAGE	67.5	VOLTS
PLATE SUPPLY RESISTANCE	1,500	OHMS
GRID RESISTANCE	18,000	OHMS
PLATE CURRENT	5.25	MA.
GRID CURRENT	325	μA




AVERAGE CHARACTERISTICS
E_b = 67.5 VOLTS
μ
Gm
Ib
Rp
-6
-5
-4
-3
-2
-1
0
GRID VOLTS
12.5
10.0
7.5
5.0
2.5
0
50
40
30
20
10
0
2500
2000
1500
1000
500
0
PLATE (Ib) MILLIAMPERES OR AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE - KILOHMS
TRANSCONDUCTANCE (Gm) - MICROMHOS

TUNG-SOL

PENTODE



GLASS BULB

LARGE WAFER MICANOL 8 PIN OCTAL WITH EXTERNAL BARRIERS AND SLEEVE

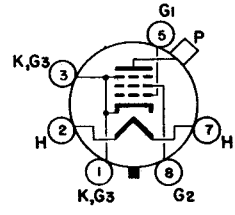
BASE B8-98

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±5% VOLTS 800 MA.

ANY MOUNTING POSITION



BOTTOM VIEW

THE 6327 IS A BEAM POWER PENTODE PRIMARILY DESIGNED FOR RADAR DEFLECTION AMPLIFIER SERVICE. IT WILL PERFORM ESSENTIALLY THE SAME FUNCTION AS TWO 6AR6'S CONNECTED IN PARALLEL. A TOP CAP CONNECTION FOR THE PLATE LEAD (AND A BUTTON STEM) PROVIDES ADEQUATE INSULATION FOR OPERATION AT 60,000 FEET PROVIDED THE MAXIMUM BULB TEMPERATURE IS NOT EXCEEDED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.60	pf
INPUT	13.0	pf
OUTPUT	13.0	pf

RATINGS

ABSOLUTE MAXIMUM

MAXIMUM HEATER-CATHODE VOLTAGE	±200	VOLTS
MAXIMUM DC PLATE VOLTAGE	1 650	VOLTS
MAXIMUM DC GRID #2 VOLTAGE	330	VOLTS
MAXIMUM DC GRID #1 VOLTAGE	-330	VOLTS
MAXIMUM PEAK PLATE VOLTAGE	3 300	VOLTS
MAXIMUM PLATE DISSIPATION	35	WATTS
MAXIMUM GRID #2 DISSIPATION	6.0	WATTS
MAXIMUM DC CATHODE CURRENT	165	MA.
MAXIMUM PEAK CATHODE CURRENT	660	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	250	KILOHMS
MAXIMUM BULB TEMPERATURE	250[A]	°C

[A] FOR OPTIMUM LIFE MAINTAIN A BULB TEMPERATURE OF 175°C MAX. WITH FORCED AIR COOLING.

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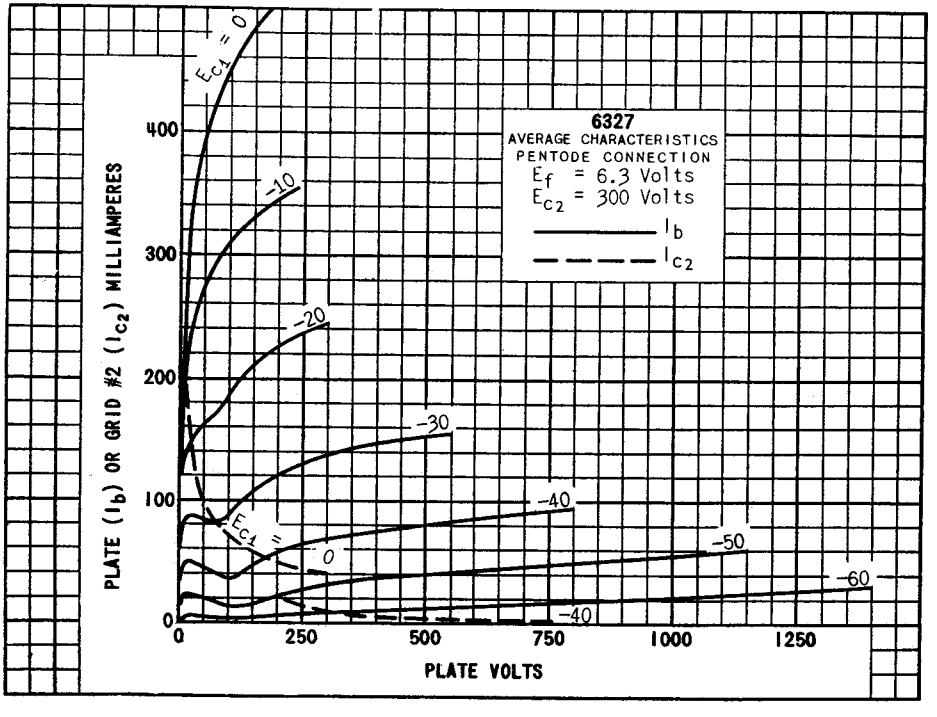
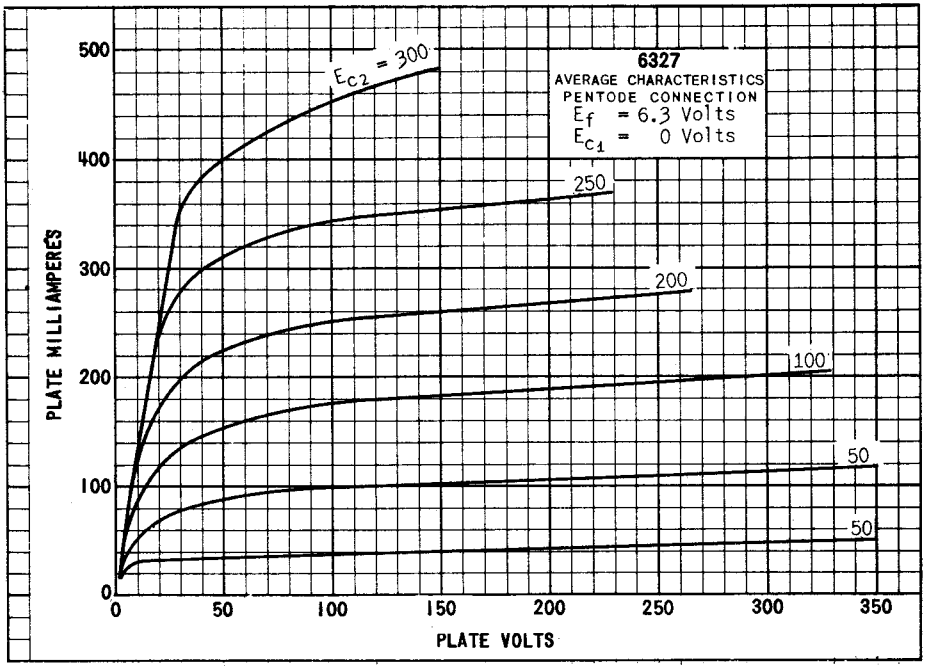
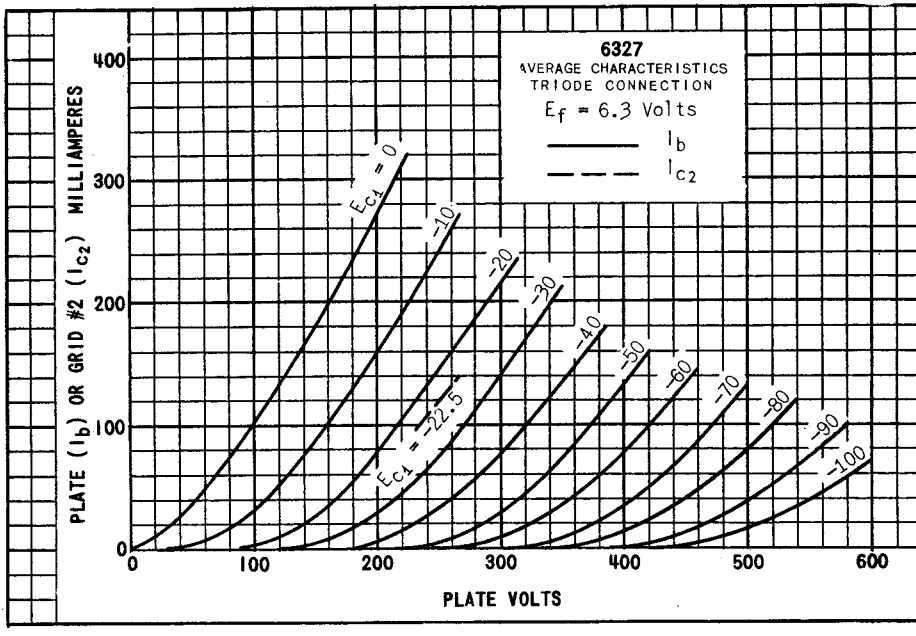
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

DC PLATE VOLTAGE	250	400	VOLTS
DC GRID #2 VOLTAGE	250	300	VOLTS
DC GRID #1 VOLTAGE	-22.5	-40	VOLTS
DC PLATE CURRENT	120	75	MA.
DC GRID #2 CURRENT	7.0	3.5	MA.
TRANSCONDUCTANCE	8 000	5 500	μMHOS
TRIODE AMPLIFICATION FACTOR	5.0	5.0	
PLATE RESISTANCE (APPROX.)	---	20.0	KILOHMS
DC GRID #1 VOLTAGE FOR 1 MA. PLATE CURRENT	-65	-80	VOLTS







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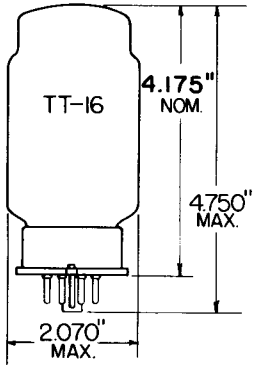
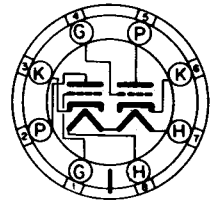
TWIN POWER TRIODE



GLASS BULB

HEATER
6.3±10% VOLTS 5.0 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
LARGE WAFER WITH
METAL SLEEVE
8 PIN BASE

THE 6336A IS A LONG LIFE, MECHANICALLY RUGGED, TWIN POWER TRIODE DEVELOPED ESPECIALLY FOR USE AS A PASSING TUBE IN SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINSIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 6336A ADEQUATELY MEETS THESE REQUIREMENTS.

THE DESIGN FEATURES ZIRCONIUM COATED GRAPHITE ANODES THAT, WHILE LIGHTER IN WEIGHT THAN SIMILAR METAL ANODES, REMAIN WARP FREE DURING LIFE AND PROVIDE ONE OF THE BEST GAS "GETTERING" MEANS KNOWN. THE ANODES ARE SUPPORTED BY CERAMIC INSULATORS. THE USE OF THESE INSULATORS AND THE HARD GLASS ENVELOPE PERMIT THE TUBE TO BE OUTGASSED AT HIGH TEMPERATURES DURING THE MANUFACTURING EXHAUST PROCESS. THIS ALLOWS THE TUBE TO BE RUN AT HIGH TEMPERATURES DURING OPERATION, WITHOUT THE EVOLUTION OF HARMFUL GAS FROM THE TUBE PARTS.

MASSIVE CATHODES PROVIDE ADEQUATE EMISSION CURRENT RESERVE. GOLD PLATED MOLYBDENUM WIRES ARE EMPLOYED IN THE RUGGED GRID STRUCTURE. THE TUBE MOUNT IS BUILT ON A RUGGED BUTTON STEM, AND IS SUPPORTED FROM THE BULB BY MEANS OF FLEXIBLE METAL VIBRATION SNUBBERS.

IN MANY CIRCUITS, ONE 6336A HAS REPLACED TWO OR THREE TUBE TYPE 6080WA OR 6AS7G REGULATOR TUBES. FOR EVEN HIGHER LEVELS OF CURRENT OF POWER, MANY 6336A TUBE SECTIONS CAN BE PARALLED AS EXPLAINED IN THE APPLICATION NOTES.

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ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3 VOLTS)	5.0	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	13 500	μMHOS
AMPLIFICATION FACTOR	2.7	
INTER ELECTRODE CAPACITANCES PER TRIODE SECTION:		
GRID TO CATHODE	16.7	μμf
GRID TO PLATE	21.8	μμf
CATHODE TO PLATE	3.8	μμf
HEATER TO CATHODE	15.0	μμf
INTER ELECTRODE CAPACITANCES BETWEEN TRIODE SECTIONS:		
SECTION #1 PLATE TO SECTION #2 PLATE	0.6	μμf

MECHANICAL DATA

MOUNTING POSITION	ANY	
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)		
BULB	TT 16	NONEX
BASE	LARGE WAFER OCTAL WITH METAL SLEEVE, 8 PIN, JETEC #B8-98	
AVERAGE NET WEIGHT	3.5	OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE)	720	G
MAXIMUM VIBRATION RATING:		
(0 TO 50 CPS)	10	G
(50 TO 500 CPS)	5	G

RATINGS

ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
POWER DISSIPATION PER PLATE	---	30	WATTS
PLATE CURRENT PER PLATE	---	400	MADC
IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 6 VOLTS, THIS CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE			
PLATE VOLTAGE	0	400	VOLTS DC
HEATER-CATHODE VOLTAGE	-300	+300	VOLTS DC
GRID VOLTAGE	-300	0	VOLTS DC
GRID CURRENT PER GRID	---	0	MA.
HEATER VOLTAGE	5.7	6.9	VOLTS
ENVELOPE TEMPERATURE	---	250	°C
ALTITUDE FOR FULL RATINGS	---	10 000	FEET
IF COOLING IS PROVIDED TO KEEP BULB TEMPERATURE WITHIN RATINGS, ALTITUDE RATING CAN BE EXTENDED TO 60,000 FEET			
CIRCUIT VALUES			
TOTAL GRID CIRCUIT RESISTANCE	500	500000	OHMS
RESISTANCE PER GRID LEG WHEN TRIODE SECTIONS ARE PARALLELED	500	---	OHMS

CATHODE RESISTANCE: MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL BE 27 OHMS OR THAT RESISTANCE NECESSARY TO PROVIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS GREATER.

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TUNG-SOL

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 48° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (720G/MSEC)

LIFE TEST: 1000 HOURS UNDER PLATE CURRENT TEST CONDITIONS

POST SHOCK AND LIFE TEST END POINTS:

PLATE CURRENT (MIN.)	150	MA
TRANSCONDUCTANCE PER SECTION (MIN.)	9 000	μMHO
HK LEAKAGE (MAX.)	100	μA
GRID CURRENT (MAX.)	-8	μA

RANGE OF VALUES

CONDITIONS: E_f = 6.3V, E_b = 190V.
E_c =-O, $R_{k/k}$ = 200 Ω, $R_{g/g}$= 500Ω
BOTH SECTIONS OPERATING. READINGS TAKEN AFTER 5 MINUTES POWER PRE-HEATING. EACH SECTION READ SEPARATELY.

PLATE CURRENT PER SECTION	165	200	MA,DC
AMPLIFICATION FACTOR	2.0	3.4	
TRANSCONDUCTANCE	11 000	16 000	μMHOS
HEATER CURRENT PER TUBE	4.75	5.25	AMP.

CONDITIONS: E_f = 6.3V, E_b = 200V.
E_c =- 100V, R_k = O

PLATE CURRENT PER SECTION	0	10	MA.

CONTINUED ON FOLLOWING PAGE

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APPLICATION NOTES

THE 6336A IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE FOURTH THE VALUE $(\frac{R}{\mu+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE FOURTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (ABOUT TWO WATTS) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.

TUNG-SOL

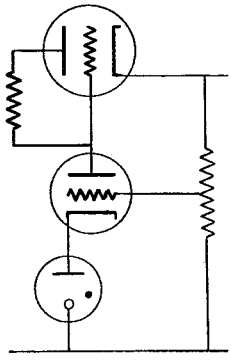


FIGURE 1

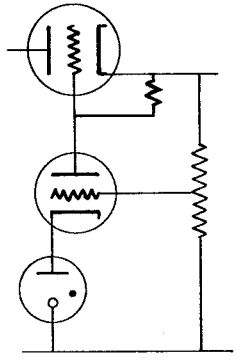


FIGURE 2

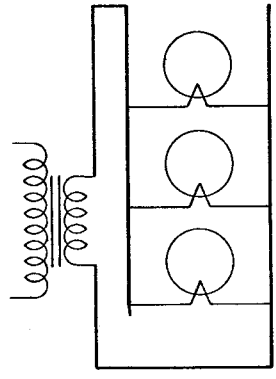
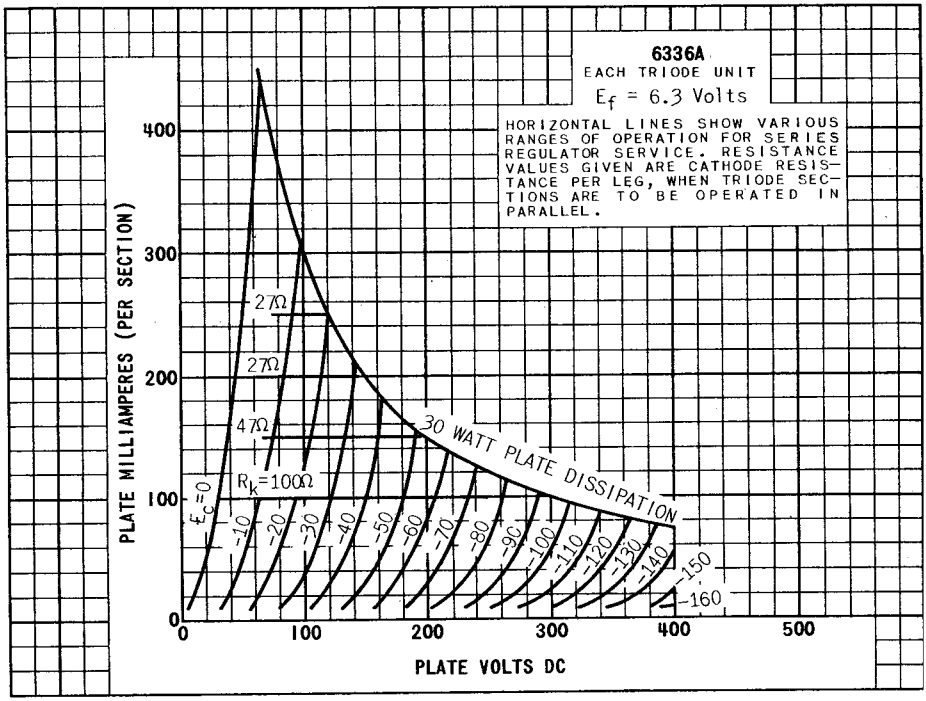


FIGURE 3



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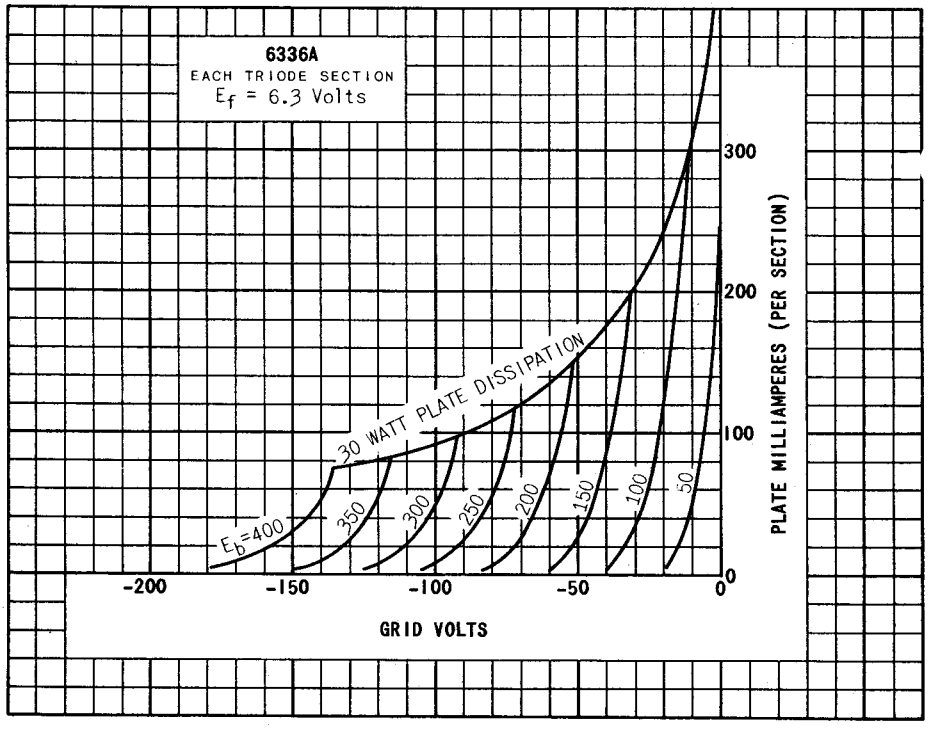
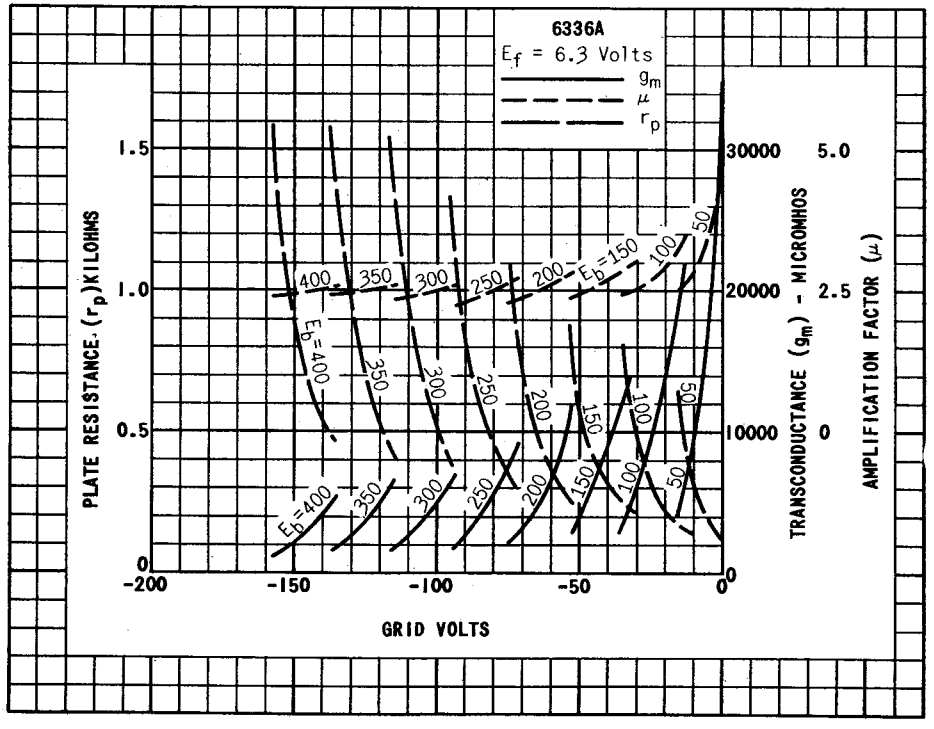

6336A
EACH TRIODE SECTION
E_f = 6.3 Volts
30 WATT PLATE DISSIPATION
E_b=400
350
300
250
200
150
100
50
-200
-150
-100
-50
0
300
200
100
0
GRID VOLTS
PLATE MILLIAMPERES (PER SECTION)


6336A
E_f = 6.3 Volts
g_m
μ
r_p
E_b=400
350
300
250
200
150
100
50
1.5
1.0
0.5
0
30000
20000
10000
0
5.0
2.5
0
-200
-150
-100
-50
0
GRID VOLTS
PLATE RESISTANCE. (r_p) KILOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)

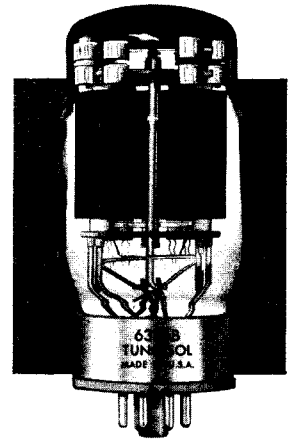
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6336B

JUNE 1965

TWIN POWER TRIODE FOR SERIES REGULATOR SERVICE



DESCRIPTION — The 6336B is a rugged, twin power triode particularly well suited for use as a pass tube in series regulated power supplies. Tubes of this design will meet the test requirements of MIL-E-1/1478.

The 6336B is capable of withstanding prolonged exposure to continuous vibration. This performance extra is achieved by using ceramic spacers, rather than mica, to hold the electrode in position. Also, gold plated strap frame grids are used for extra mechanical stiffness.

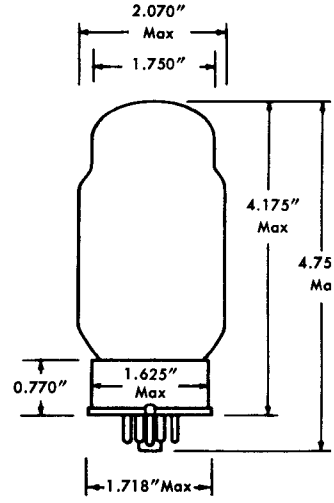
The 6336B will replace the 6336A in any application. Also, one 6336B will replace two or three 6080WB or 6AS7G tubes working in parallel.

ELECTRICAL DATA

Heater Voltage	6.3 ±10%	Volts
Heater Current — E_f = 6.3 Volts	5.0	Amperes
Minimum Cathode Heating Time	30	Seconds
Transconductance-per Section	13,500	Umhos
Amplification Factor	2.7	
Interelectrode Capacities — per Section		
Grid to Cathode	16.7	pf
Grid to Plate	21.8	pf
Cathode to Plate	3.8	pf
Heater to Cathode	15.0	pf
Interelectrode Capacities — Between Sections		
Section 1 Plate to Section 2 Plate	0.6	pf

MECHANICAL DATA

Mounting Position	Any
(If tube is to be mounted in a horizontal position it is recommended that it be mounted so that the base lug key be either directly up or directly down)	
Bulb	T 16 Nonex
Base	Large wafer octal, glass bonded mica, with metal sleeve, JEDEC type B8-98
Average Net Weight	3.5 ounces



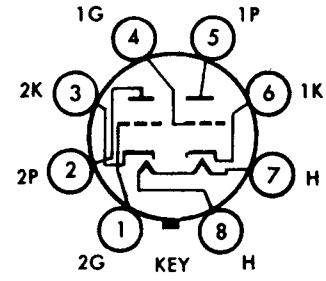
RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Plate Dissipation per Plate	—	30	Watts
Plate Voltage	0	400	Volts dc
Plate Current per Plate — Note 1	—	400	Milliamperes dc
Heater-Cathode Voltage	−300	+300	Volts dc
Grid Voltage	−300	0	Volts dc
Envelope Temperature	—	250	Degrees Centigrade
Altitude for Full Ratings — Note 2	—	10,000	Feet
Grid Circuit Resistance Values — Note 3			
For Fixed Bias, or Cathode and Fixed Bias Operation	500	200,000	Ohms
For Cathode Bias Operation	500	500,000	Ohms

Note 1. If tube voltage drop is to be swung more than 6 volts, this current cannot be realized. See Plate Characteristics Curve.

Note 2. If cooling is provided to keep bulb temperature within ratings, altitude rating can be extended to 60,000 feet.

Note 3. When sections are paralleled, minimum cathode resistance per cathode shall be 27 ohms or that resistance necessary to produce 10 percent of the grid bias voltage, whichever is greater.



BASING DIAGRAM
BOTTOM VIEW
8BD

APPLICATION NOTES

The 6336B is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance at relatively low plate voltages. To provide the desired output current, many triode sections can be paralleled. If tube sections are to be paralleled however, the designer is strongly urged to use sufficient resistance in each cathode leg to equalize current division among the triode sections. Recommended values for various operating currents are shown on the plate characteristics curve. If the output current of the supply is not fixed, use the resistance indicated for the lowest current that approaches the maximum plate dissipation line. Cathode resistance is superior to anode resistance because it helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one quarter the value $\left(\frac{R}{u+1}\right)$ of a plate resistor, and therefore will dissipate only one quarter the power. In any case, the only losses incurred in using a resistor is the insertion loss of the resistor itself (about two watts) and the additional voltage (less than 10 volts) necessary from the unregulated supply. A cathode resistor adds a small additional loss by causing the passing tube to work with higher bias and hence with greater tube drop.

The regulator circuit shown in Figure 2 is preferable from the consideration of the safety of the passing tube both during warmup and in the event of trouble in the amplifier circuit or if the amplifier tube is removed from its socket. It has the additional advantage of providing a constant voltage for the amplifier circuit. However, if the regulated output voltage is low (below 250 volts), it will be necessary to provide additional negative voltage for the reference tube circuit. Also, if the regulated output voltage is to be variable, it may be necessary to follow Figure 1. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it, during warmup the amplifier tube draws little current, there is little IR drop across the resistor, and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

Passing tube operation conditions should be chosen to provide as low a tube drop as possible. A safety margin of at least 5 volts from the zero bias line should be allowed however, for variations of individual tubes. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 7.5 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high enough to prevent parasitic oscillation but not large enough to prevent loss of control due to a small amount of "gas" grid current. A value of grid resistance that meets both these conditions is 1,000 ohms. Heater voltage should be kept as close as possible to 6.3 volts as measured on the tube pins. When connecting many high drain tube heaters across a single transformer, bus bars feeding from "alternate ends" (Figure 3) should be used with a stranded pair feeding individual sockets.

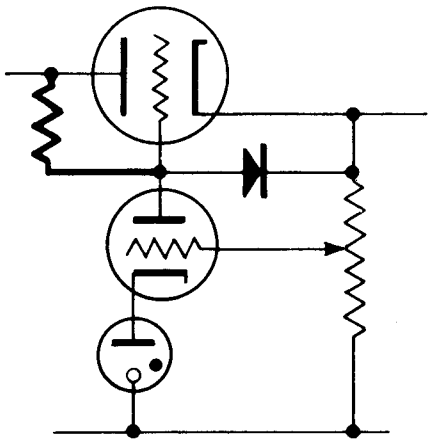


FIGURE 1

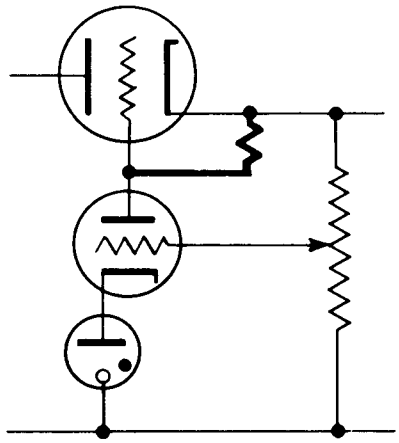


FIGURE 2

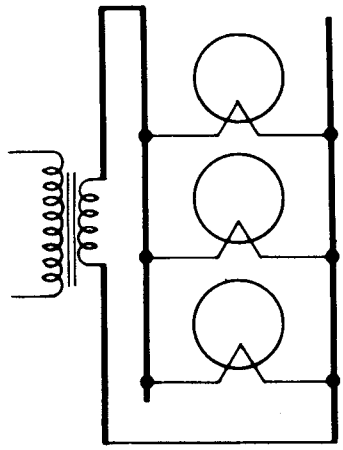


FIGURE 3

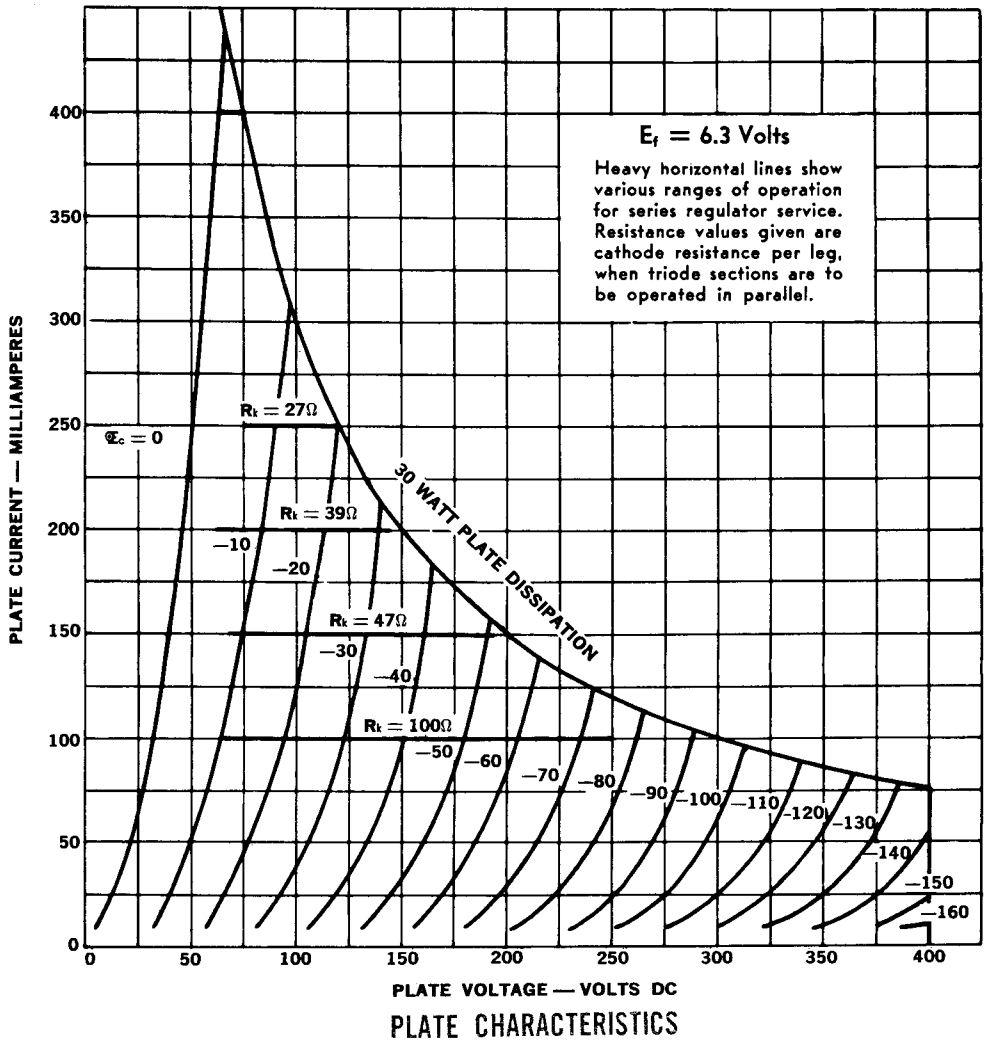
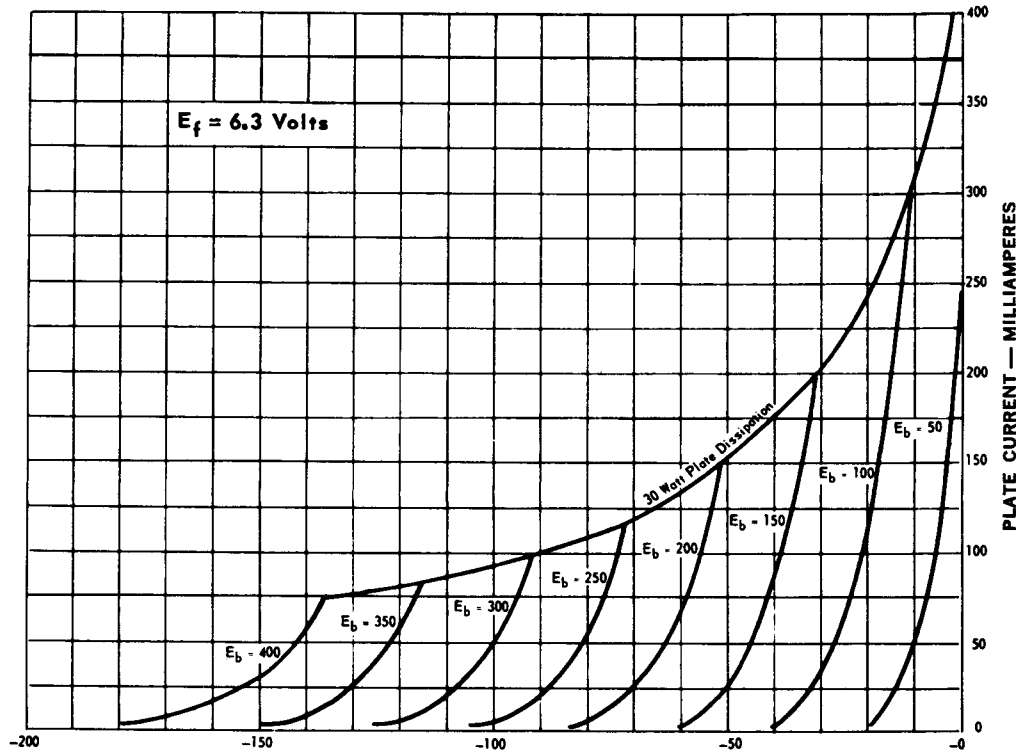
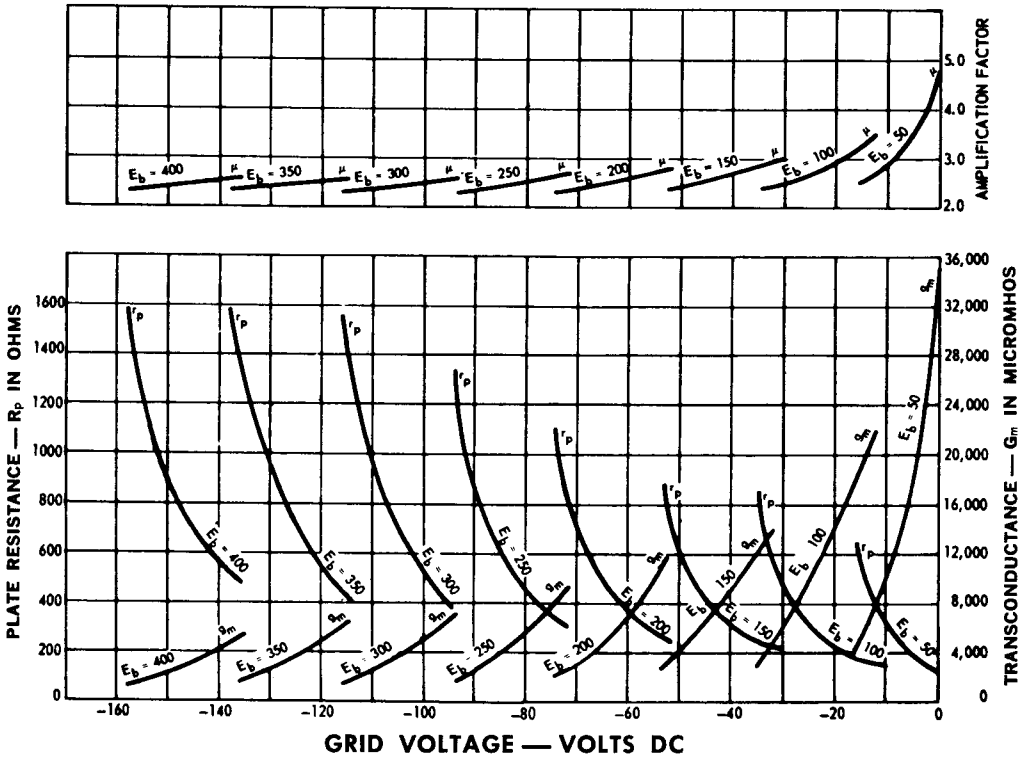


PLATE CHARACTERISTICS



GRID VOLTAGE — VOLTS DC

TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION



GRID VOLTAGE — VOLTS DC

AMPLIFICATION FACTOR, PLATE RESISTANCE AND TRANSCONDUCTANCE CURVES

from JEDEC release #3799, July 9, 1962

TYPE 6345

LONG LIFE BALLAST TUBE

The 6345 is a seven-pin, miniature ballast tube. A special alloy filament wire minimizes hot spot formation and insures long operating life. The tube will regulate in the 140 to 160 milliampere range from 4.5 to 11.2 volts.

ELECTRICAL DATA

	Min	Max	
Filament Voltage	4.5	11.2	Volts
Steady State Current	140	160	Milliamperes
Heating Time - E_f = 11.2 Vdc	---	5	Seconds
Ambient Temperature Range	-40	+85	Degrees Centigrade

MECHANICAL DATA

Bulb	JEDEC T5½ (5-3)
Height - Overall	2.625 in. maximum
- Seated	2.375 in. maximum
Diameter	0.750 in. maximum
Connections	
Pin No. 1	Filament - Start
No. 2	Filament - Start
No. 3	No connection
No. 4	No connection
No. 5	No connection
No. 6	Filament - End
No. 7	Filament - End

TUNG-SOL ELECTRIC INC.
ONE SUMMER AVE. NEWARK 4, N. J.

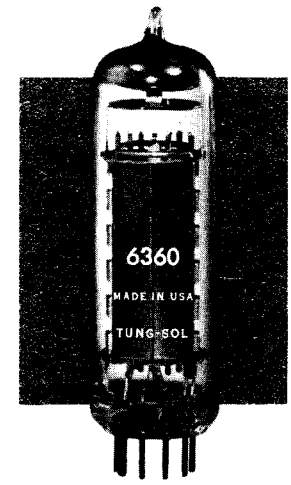
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6360

FEBRUARY 1963

TWIN BEAM POWER TUBE



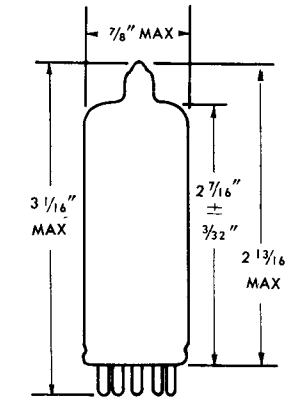
DESCRIPTION — The 6300 is a twin beam tetrode for service as a Class C amplifier, oscillator, or frequency multiplier, for frequencies to 200 mc. This type is also rated for A.F. modulator service. The 6360 is capable of producing 16 watts of power output at 200 mc under ICAS conditions.

The two sections of the tube share a common cathode and a common screen grid which reduce the effects of lead inductance in push pull VHF service. The 6360 also has internal neutralization for push pull operation. The two sections may be used for separate functions, e.g. section 1 may be used as an oscillator and section 2 as a frequency multiplier. The Center-tapped heater is designed for satisfactory operation from either 6.3 or 12.6 volt supplier.

ELECTRICAL DATA

Cathode — Oxide coated, indirectly heated

	Parallel	Series	
Heater Voltage	6.3	12.6	Volts
Heater Current	0.82	0.41	Amperes
Interelectrode Capacitance	**Push-Pull**	**Per Unit**	
Output	1.4	2.6	Picofarads
Input	5.1	6.2	Picofarads
Plate to Grid No. 1 — Maximum		0.1	Picofarads
Mu — Grid No. 2 to Grid No. 1			
I_b = 30 mA		7.5	
Transconductance — I_b = 30 mA		3300	Micromhos



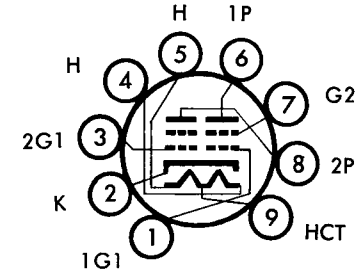
OUTLINE DRAWING

MECHANICAL DATA

Bulb	T6½
Base	Small button, 9 pin, E9-1
Mounting Position	Any — Note 1
Cooling	Convection — Note 2
Maximum Pin Temperature	120 °C
Maximum Bulb Temperature	225 °C
Net Weight — Approximate	0.6 ounce

Note 1: If a horizontal mounting position is used it is recommended that pins No. 2 and No. 7 be in a vertical plane.

Note 2: Use of a closed metal shield can is not allowed unless it is used with heat dissipating type of inner liner in contact with the bulb walls.



BOTTOM VIEW

TYPICAL POWER OUTPUT WITH PUSH PULL OPERATION

	ICS	ICAS	
Class C — CW Telegraphy — FM Telephony — to 200 mc	12.0	16.0	Watts
Class C — Frequency Multiplier — to 200 mc	3.5	4.8	Watts
Class C — Plate and Screen Grid AM Modulation — to 200 mc	7.1	8.8	Watts
	Class AB_1	**Class AB_2**	
AF Amplifier and Modulator	12.0	17.5	Watts

TYPE 6360

R.F. POWER AMPLIFIER & MODULATOR — CLASS C TELEPHONY

MAXIMUM RATINGS, ABSOLUTE VALUES

	CCS	
D.C. Plate Voltage	300	Volts
D.C. Grid No. 2 Voltage	200	Volts
Max. Signal D.C. Plate Current	2x50	mA
Max. Signal Plate Input	2x15	Watts
Plate Dissipation	2x7	Watts
Grid No. 2 Dissipation	2x1	Watts
Peak Grid No. 2 Dissipation	2x2	Watts
D.C. Grid No. 1 Voltage	−150	Volts
Grid Resistor	100	Kohms
Peak Heater-Cathode Voltage	100	Volts

TYPICAL OPERATION, 2 UNITS OF ONE TUBE

	CCS	CCS	CCS	
D.C. Plate Voltage	300	250	200	Volts
D.C. Grid No. 2 Voltage	200	200	200	Volts
D.C. Grid No. 1 Voltage (Fixed Bias)[3]	−21.5	−21.5	−21.5	Volts
Peak A.F. Grid No. 1 to Grid No. 1 Voltage	43.5	44.5	43.5	Volts
Zero Signal D.C. Plate Current	30	30	30	mA
Max. Signal D.C. Plate Current	72	69	66	mA
Zero Signal D.C. Grid No. 2 Current	1.2	1.4	2.4	mA
Max. Signal D.C. Grid No. 2 Current	12.6	12.4	14.0	mA
Effective Load Resistance Plate-to-Plate	10,000	8,000	6,500	Ohms
Max. Signal Output (approx.)	12	9.3	7.0	Watts
Total Distortion	2.5	2.7	3.2	%
Efficiency	56	54	53	%

A.F. POWER AMPLIFIER & MODULATOR CLASS AB2 PUSH-PULL

MAXIMUM RATINGS, ABSOLUTE VALUES

	CCS	
D.C. Plate Voltage	300	Volts
D.C. Grid No. 2 Voltage	200	Volts
Max. Signal D.C. Plate Current	2x50	mA
Max. Signal Plate Input	2x15	Watts
Plate Dissipation	2x7	Watts
Grid No. 2 Dissipation	2x1	Watts
Peak Grid No. 2 Dissipation	2x2	Watts
D.C. Grid No. 1 Voltage	−150	Volts
Grid No. 1 Dissipation	2x0.2	Watts
Grid No. 1 Current	2x4	mA
Grid No. 1 Resistor	100	Kohms
Cathode Current	2x60	mA
Peak Cathode Current	2x300	mA
Peak Heater-Cathode Voltage	100	Volts

TYPICAL OPERATION, 2 UNITS OF ONE TUBE

	CCS	CCS	CCS	
D.C. Plate Voltage	300	250	200	Volts
D.C. Grid No. 2 Voltage	200	200	200	Volts
D.C. Grid No. 1 Voltage (Fixed Bias) Note 1	−21.5	−21.5	−21.5	Volts
Peak A.F. Grid No. 1 to Grid No. 1 Voltage	64	67	54	Volts
Zero Signal D.C. Plate Current	30	30	30	mA
Max. Signal D.C. Plate Current	100	100	82.2	mA
Zero Signal D.C. Grid No. 2 Current	1.2	1.4	2.4	mA
Max. Signal D.C. Grid No. 2 Current	11.4	13	19	mA
Effective Load Resistance Plate-to-Plate	6,500	5,000	5,000	Ohms
Max. Signal Grid No. 1 Current	2x0.56	2x0.62	2x0.22	mA
Driving Power	0.04	0.04	0.02	Watts
Max. Signal Power Output (approx.)	17.5	14.0	8.7	Watts
Total Distortion	5	5.5	6	%
Efficiency	58	56	53	%

Note 1 Individual adjustment of the grid bias of each unit is recommended.

FREQUENCY TRIPLER - TO 200 MC

MAXIMUM RATINGS, ABSOLUTE VALUES

	CCS	ICAS	
D.C. Plate Voltage	300	300	Volts
D.C. Grid No. 2 Voltage	200	200	Volts
D.C. Grid No. 1 Voltage	−150	−150	Volts
D.C. Plate Current	2x30	2x42	mA
D.C. Grid No. 1 Current	2x2	2x3	mA
Plate Input	2x7.5	2x10	Watts
Grid No. 2 Input	2x1	2x1	Watts
Plate Dissipation	2x5	2x7	Watts
Peak Heater Voltage	100	100	Volts
D.C. Cathode Current	2x35	2x45	mA
Peak Cathode Current	2x225	2x300	mA

TYPICAL OPERATION, 2 UNITS OF ONE TUBE IN PUSH-PULL

	CCS			ICAS				
D.C. Plate Voltage	300	250	200	300	300	250	200	Volts
D.C. Grid No. 2 Voltage	150	160	155	150	175	175	175	Volts
Grid No. 2 Resistor	—	47	15	—	—	18	4.7	Kohms
D.C. Grid No. 1 Voltage—Fixed	−100	—	—	−100	−100	—	—	Volts
or from Common Resistor of	—	47	33	—	—	27	22	Kohms
Peak RF Grid No. 1 to Grid No. 1 Voltage	230	230	230	240	230	230	230	Volts
D.C. Plate Current	2x24	2x25	2x28.5	2x32.5	2x32.5	2x36	2x39	Ma
D.C. Grid No. 2 Current	2.0	1.9	3.0	3.5	2.7	4.1	5.2	mA
D.C. Grid No. 1 Current (approx.)	2x1	2x1	2x1.6	2x1.9	2x1.2	2x1.9	2x2.3	mA
Driving Power (approx.)	0.23	0.23	0.35	0.45	0.28	0.43	0.52	Watts
Power Output (approx.)	6.5	5	3.8	7.8	7.2	6.2	4.5	Watts
Efficiency	45	40	33.5	40	37	34.5	29	%
Useful Power Output	3.5	3.0	2.8	4.8	4.2	4.2	3.5	Watts

PLATE AND SCREEN GRID MODULATOR, PUSH-PULL, R.F. POWER AMPLIFIER — CLASS C TELEPHONY

Carrier conditions per tube for use with a max. modulation factor of 1.0 — to 200 mc.

MAXIMUM RATINGS, ABSOLUTE VALUES

	CCS	ICAS	
D.C. Plate Voltage	240	240	Volts
D.C. Grid No. 2 (Screen) Volts	200	200	Volts
D.C. Grid No. 1 (Control Grid) Volts	−150	−150	Volts
D.C. Plate Current	2x37.5	2x46	mA
D.C. Grid No. 1 Current	2x3	2x4	mA
Plate Input	2x7.5	2x10	Watts
Grid No. 2 Input	2x0.65	2x0.65	Watts
Plate Dissipation	2x3.3	2x4.6	Watts
Peak Heater Cathode Voltage	100	100	Volts
D.C. Cathode Current	2x40	2x52	mA
Peak Cathode Current	2x180	2x240	mA

TYPICAL OPERATION, 2 UNITS OF ONE TUBE

	CCS	ICAS	
D.C. Plate Voltage	200	200	Volts
D.C. Grid No. 2 Voltage	Figure 1	Figure 2	
D.C. Grid No. 1 Voltage from Common Resistor of	33	15	Kohms
Peak R.F. Grid No. 1 to Grid No. 1 Volts	130	130	Volts
D.C. Plate Current	2x33.5	2x43	mA
D.C. Grid No. 2 Current	2.6	3.1	mA
D.C. Grid No. 1 Current (approx.)	1.5	3.3	mA
Driving Power (approx.)	0.1	0.2	Watts
Power Output (approx.)	8.1	9.8	Watts
Efficiency	60	57	%
Useful Output Power	7.1	8.8	Watts
Modulation Power (for 100% modulation)	6.7	8.6	Watts

FIGURE 1

TO TUBE PLATES & CENTER TAP OF RF COIL

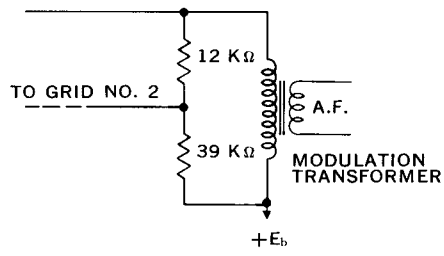
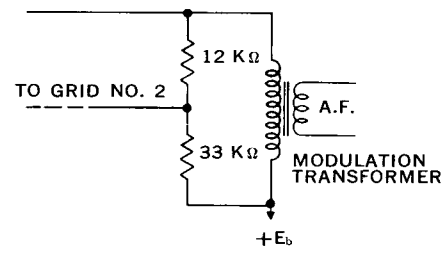


FIGURE 2

TO TUBE PLATES & CENTER TAP OF RF COIL



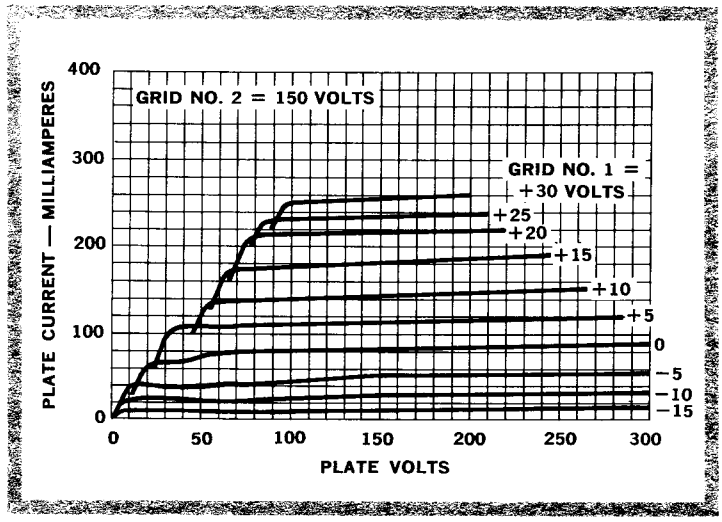
MAXIMUM RATINGS, ABSOLUTE VALUES

	CCS	ICAS	
D.C. Plate Voltage	300	300	Volts
D.C. Plate Current	2x45	2x55	mA
D.C. Grid No. 2 Voltage	200	200	Volts
D.C. Grid No. 1 Voltage	−150	−150	Volts
D.C. Grid No. 1 Current	2x3	2x4	mA
D.C. Cathode Current	2x50	2x65	mA
Peak Cathode Current	2x225	2x300	mA
Plate Input	2x11.25	2x15	Watts
Plate Dissipation	2x5	2x7	Watts
Grid No. 2 Dissipation	2x1	2x1	Watts
Grid No. 1 Dissipation	2x0.2	2x0.2	Watts
Peak Heater-Cathode Voltage	100	100	Volts

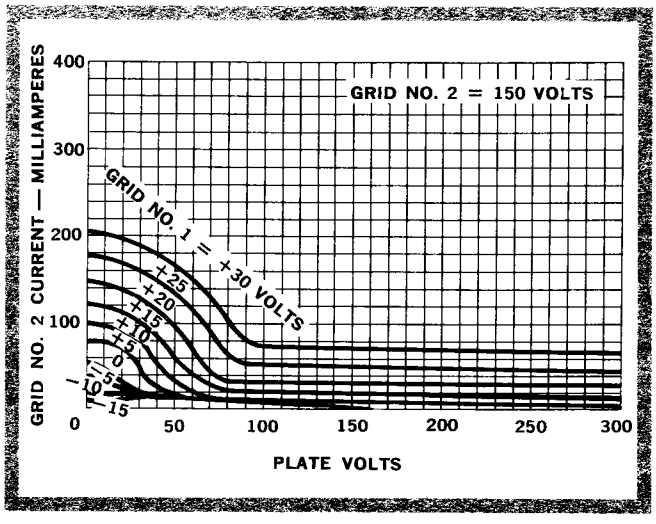
TYPICAL OPERATION, 2 UNITS OF ONE TUBE IN PUSH-PULL

	CCS			ICAS			
D.C. Plate Voltage	300	250	200	300	250	200	Volts
D.C. Grid No. 2 Voltage	175	—	—	200	—	—	Volts
Grid No. 2 Resistor	—	47	22	—	27	8.2	Kohms
D.C. Grid No. 1 Voltage—Fixed	−40	—	—	−45	—	—	Volts
or from Common Resistor of	—	18	15	—	18	15	Kohms
Peak R.F. Grid No. 1 to Grid No. 1 Voltage	110	110	115	130	120	130	Volts
D.C. Plate Current	2x37.5	2x33.5	2x35	2x50	2x40	2x42	mA
D.C. Grid No. 2 Current	2.3	1.8	2.2	3.0	2.4	3.1	mA
D.C. Grid No. 1 Current (approx.)	1.8	2.2	2.7	3.0	2.5	3.0	mA
Driving Power (approx.)	0.10	0.12	0.14	0.20	0.15	0.18	Watts
Plate Dissipation	2x4	2x2.9	2x2.8	2x6	2x3.5	2x3.4	Watts
Grid No. 2 Dissipation	0.4	0.3	0.33	0.6	0.45	0.55	Watts
Grid No. 1 Dissipation	2x0.05	2x0.12	2x0.14	2x0.1	2x0.15	2x0.18	Watts
Power Output (approx.)	14.5	11	8.4	18.5	13	10	Watts
Efficiency	65	65	60	62	60	65	%
Useful Output Power	12	9	7.4	16	11.2	9.0	Watts

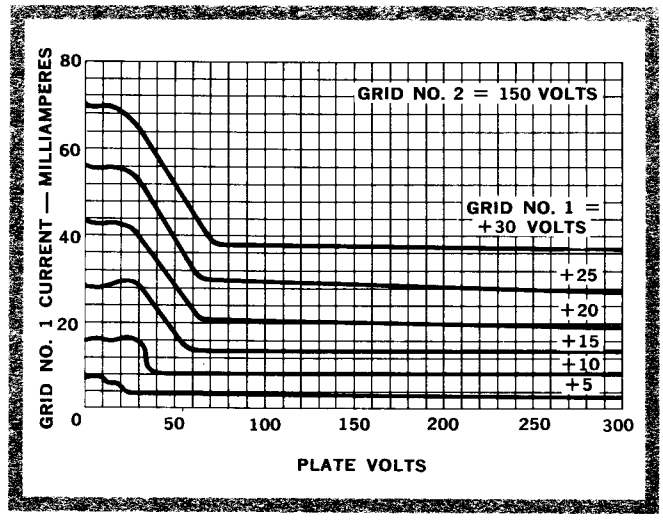
PLATE CURRENT CHARACTERISTIC — PER UNIT



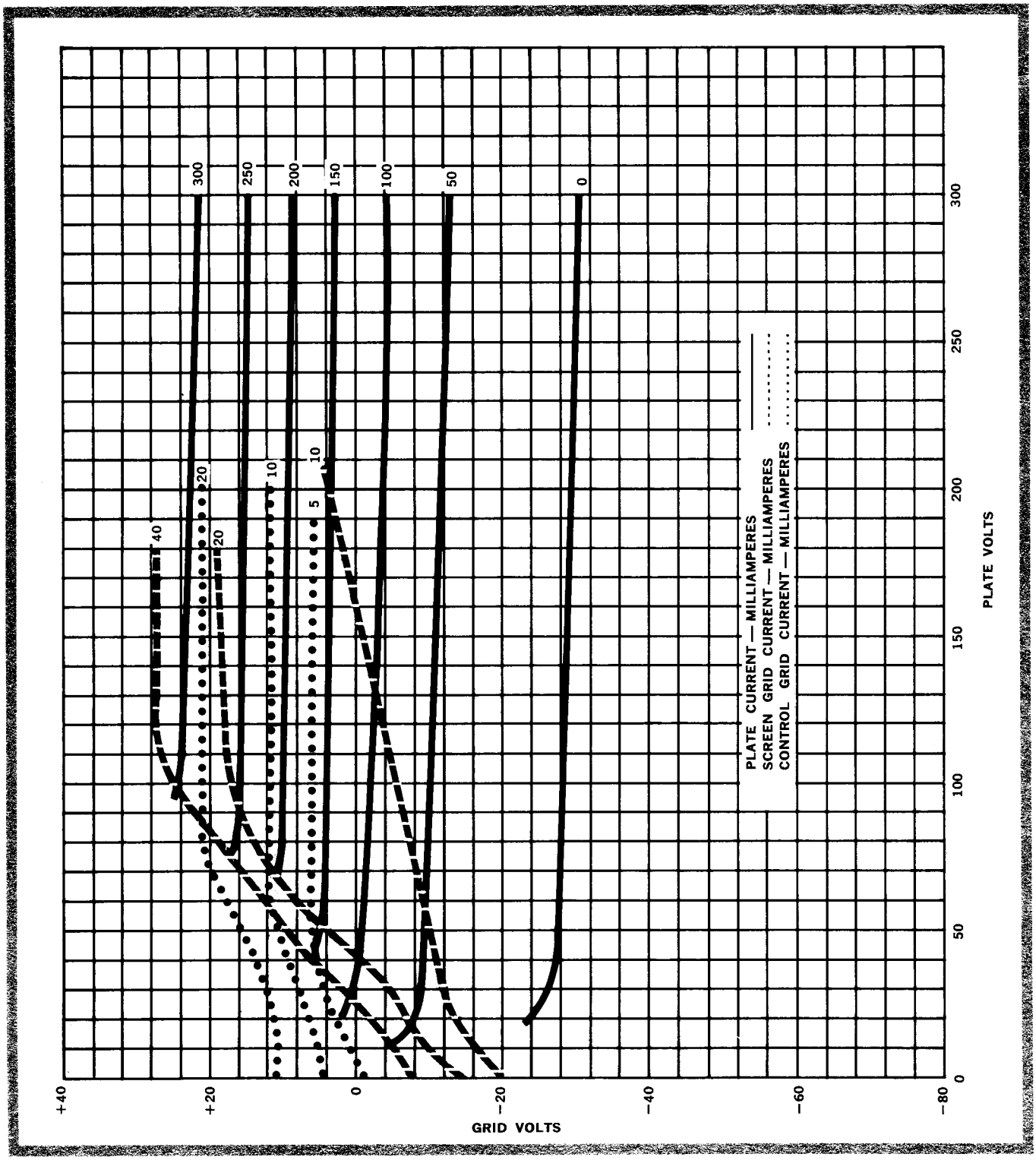
SCREEN CURRENT CHARACTERISTIC — PER UNIT



GRID CURRENT CHARACTERISTIC — PER UNIT



CONSTANT CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 200 VOLTS



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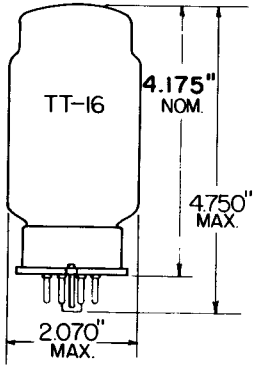
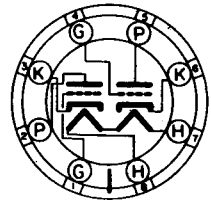
TWIN POWER TRIODE



GLASS BULB

HEATER
26.5±10% VOLTS 1.30 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
LARGE WAFER WITH METAL SLEEVE 8 PIN BASE

THE 6394A IS A LONG LIFE, MECHANICALLY RUGGED, TWIN POWER TRIODE DEVELOPED ESPECIALLY FOR USE AS A PASSING TUBE IN SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINSIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 6394A ADEQUATELY MEETS THESE REQUIREMENTS.

THE DESIGN FEATURES ZIRCONIUM COATED GRAPHITE ANODES THAT, WHILE LIGHTER IN WEIGHT THAN SIMILAR METAL ANODES, REMAIN WARP FREE DURING LIFE AND PROVIDE ONE OF THE BEST GAS "GETTERING" MEANS KNOWN. THE ANODES ARE SUPPORTED BY CERAMIC INSULATORS. THE USE OF THESE INSULATORS AND THE HARD GLASS ENVELOPE PERMIT THE TUBE TO BE OUTGASSED AT HIGH TEMPERATURES DURING THE MANUFACTURING EXHAUST PROCESS. THIS ALLOWS THE TUBE TO BE RUN AT HIGH TEMPERATURES DURING OPERATION, WITHOUT THE EVOLUTION OF HARMFUL GAS FROM THE TUBE PARTS.

MASSIVE CATHODES PROVIDE ADEQUATE EMISSION CURRENT RESERVE. GOLD PLATED MOLYBDENUM WIRES ARE EMPLOYED IN THE RUGGED GRID STRUCTURE. THE TUBE MOUNT IS BUILT ON A RUGGED BUTTON STEM, AND IS SUPPORTED FROM THE BULB BY MEANS OF FLEXIBLE METAL VIBRATION SNUBBERS.

IN MANY CIRCUITS, ONE 6394A HAS REPLACED TWO OR THREE TUBE TYPE 6080WA OR 6AS7G REGULATOR TUBES. FOR EVEN HIGHER LEVELS OF CURRENT OF POWER, MANY 6394A TUBE SECTIONS CAN BE PARALLED AS EXPLAINED IN THE APPLICATION NOTES.

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ELECTRICAL DATA

HEATER VOLTAGE	26.5	VOLTS
HEATER CURRENT (E_f=26.5 VOLTS)	1.30	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	13 500	μMHOS
AMPLIFICATION FACTOR	2.7	
INTER ELECTRODE CAPACITANCES PER TRIODE SECTION:		
GRID TO CATHODE	16.7	μμf
GRID TO PLATE	21.8	μμf
CATHODE TO PLATE	3.8	μμf
HEATER TO CATHODE	15.0	μμf
INTER ELECTRODE CAPACITANCES BETWEEN TRIODE SECTIONS:		
SECTION #1 PLATE TO SECTION #2 PLATE	0.6	μμf

MECHANICAL DATA

MOUNTING POSITION	ANY	
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)		
BULB	TT 16	NONEX
BASE	LARGE WAFER OCTAL WITH METAL SLEEVE, 8 PIN, JETEC #B8-98	
AVERAGE NET WEIGHT	3.5	OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE)	720	G
MAXIMUM VIBRATION RATING:		
(0 TO 50 CPS)	10	G
(50 TO 500 CPS)	5	G

RATINGS

ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
POWER DISSIPATION PER PLATE	---	30	WATTS
PLATE CURRENT PER PLATE	---	400	MADC
IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 6 VOLTS, THIS CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE			
PLATE VOLTAGE	0	400	VOLTS DC
HEATER-CATHODE VOLTAGE	-300	+300	VOLTS DC
GRID VOLTAGE	-300	0	VOLTS DC
GRID CURRENT PER GRID	---	0	MA.
HEATER VOLTAGE	24.0	29.0	VOLTS
ENVELOPE TEMPERATURE	---	250	°C
ALTITUDE FOR FULL RATINGS	---	10 000	FEET
IF COOLING IS PROVIDED TO KEEP BULB TEMPERATURE WITHIN RATINGS, ALTITUDE RATING CAN BE EXTENDED TO 60,000 FEET			
CIRCUIT VALUES			
TOTAL GRID CIRCUIT RESISTANCE	500	500000	OHMS
RESISTANCE PER GRID LEG WHEN TRIODE SECTIONS ARE PARALLELED	500	---	OHMS

CATHODE RESISTANCE: MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL BE 27 OHMS OR THAT RESISTANCE NECESSARY TO PROVIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS GREATER.

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TUNG-SOL

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 48° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (720G/MSEC)

LIFE TEST: 1000 HOURS UNDER PLATE CURRENT TEST CONDITIONS

POST SHOCK AND LIFE TEST END POINTS:

PLATE CURRENT (MIN.)	150	MA
TRANSCONDUCTANCE PER SECTION (MIN.)	9 000	μMHO
HK LEAKAGE (MAX.)	100	μA
GRID CURRENT (MAX.)	−8	μA

RANGE OF VALUES

CONDITIONS: E_f = 26.5V, E_b = 190V. E_c = −0, $R_{k/k}$ = 200 Ω, $R_{g/g}$ = 500Ω BOTH SECTIONS OPERATING. READINGS TAKEN AFTER 5 MINUTES POWER PRE-HEATING. EACH SECTION READ SEPARATELY.

PLATE CURRENT PER SECTION	165	200	MA,DC
AMPLIFICATION FACTOR	2.0	3.4	
TRANSCONDUCTANCE	11 000	16 000	μMHOS
HEATER CURRENT PER TUBE	4.75	5.25	AMP.

CONDITIONS: E_f = 26.5V, E_b = 200V. E_c = − 100V, R_k = 0

PLATE CURRENT PER SECTION	0	10	MA.

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APPLICATION NOTES

THE 6394A IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE FOURTH THE VALUE $(\frac{R}{u+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE FOURTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (ABOUT TWO WATTS) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 26.5 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.

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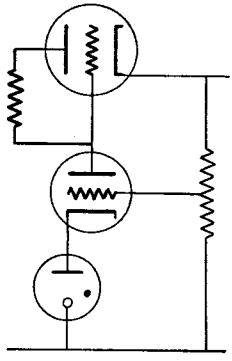


FIGURE 1

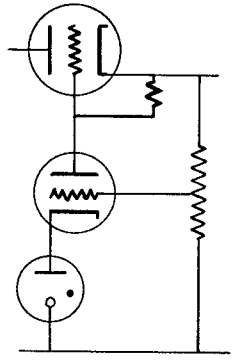


FIGURE 2

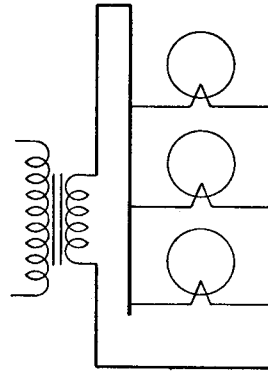
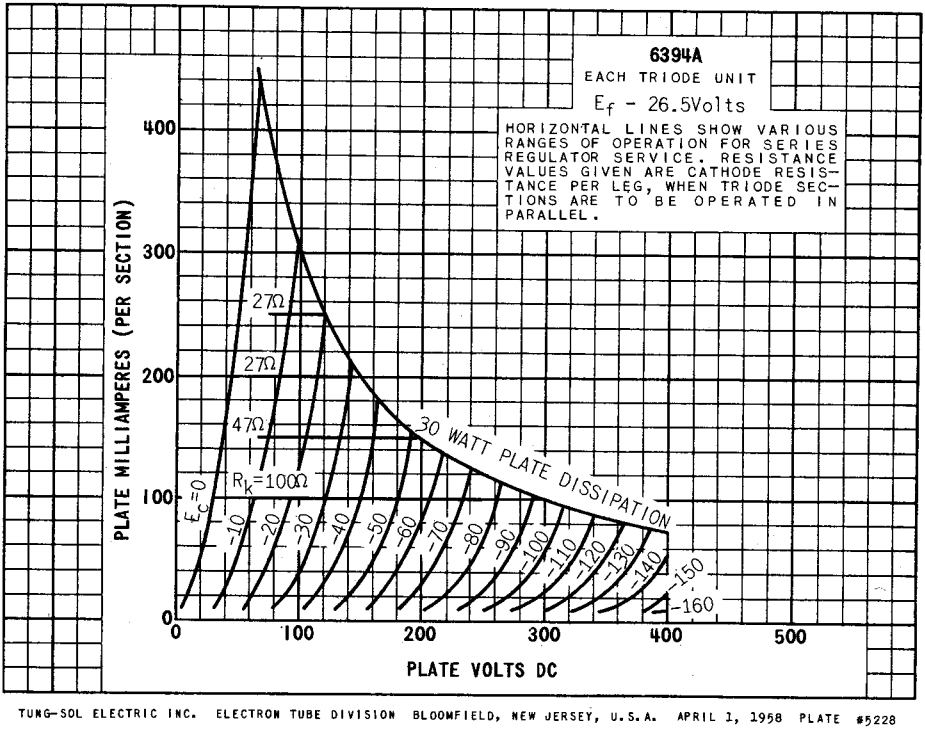


FIGURE 3



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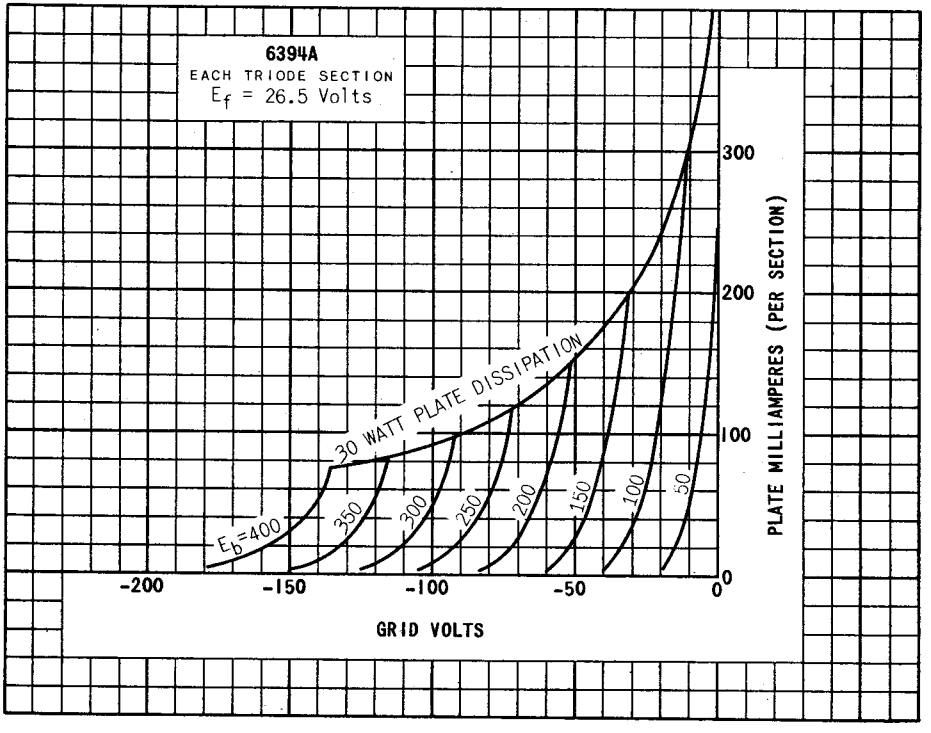
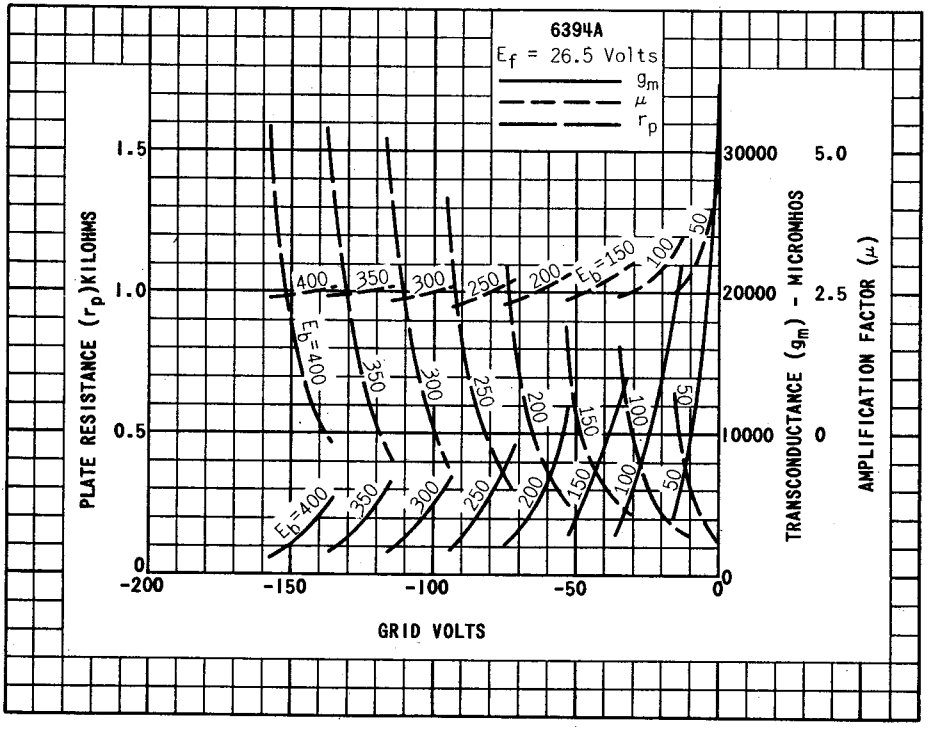

6394A
EACH TRIODE SECTION
E_f = 26.5 Volts
30 WATT PLATE DISSIPATION
E_b=400
350
300
250
200
150
100
50
-200
-150
-100
-50
0
300
200
100
0
PLATE MILLIAMPERES (PER SECTION)
GRID VOLTS


6394A
E_f = 26.5 Volts
g_m
μ
r_p
1.5
1.0
0.5
0
PLATE RESISTANCE (r_p) KILOHMS
400
350
300
250
200
E_b=150
100
50
E_b=400
350
300
250
200
150
100
50
E_b=400
350
300
250
200
150
100
50
-200
-150
-100
-50
0
30000
20000
10000
0
5.0
2.5
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS

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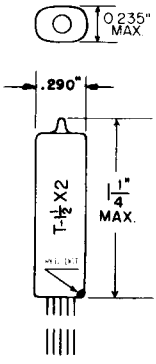
PENTODE

SUBMINIATURE TYPE



GLASS BULB

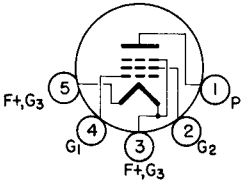
DOT IS ADJACENT TO LEAD 1

FILAMENT

1.25±.25 VOLTS 10 MA.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW A

0.016" TINNED FLEXIBLE LEADS 0.040" CENTER-TO-CENTER IN LINE

THE 6418 IS A FILAMENT TYPE PENTODE OF SUBMINIATURE CONSTRUCTION DESIGNED FOR USE AS A POWER AMPLIFIER IN PORTABLE AND WEARABLE EQUIPMENT. THE FLEXIBLE LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS WITHOUT THE USE OF SOCKETS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

RATINGS

ABSOLUTE MAXIMUM VALUES

FILAMENT VOLTAGE	1.25±20%	VOLTS
MAXIMUM PLATE VOLTAGE	30	VOLTS
MAXIMUM GRID #2 VOLTAGE	30	VOLTS
MAXIMUM CATHODE CURRENT	0.5	MA.

CHARACTERISTICS AND TYPICAL OPERATION - CLASS A AMPLIFIER

FILAMENT VOLTAGE	1.25	1.25	VOLTS
FILAMENT CURRENT	.01	.01	AMP.
PLATE VOLTAGE	15	22.5	VOLTS
GRID #2 VOLTAGE	15	22.5	VOLTS
GRID #1 VOLTAGE	−0.8	−1.2	VOLTS
ZERO-SIGNAL PLATE CURRENT.	100	240	μA.
ZERO-SIGNAL GRID #2 CURRENT	25	60	μA.
PEAK AF GRID #1 VOLTAGE	0.8	1.2	VOLTS
TRANSCONDUCTANCE	190	300	μMHOS
PLATE RESISTANCE	0.72	0.42	MEGOHMS
LOAD RESISTANCE	150	100	KILOHMS
TOTAL DISTORTION (APPROX.)	12	12	PERCENT
POWER OUTPUT	0.6	2.2	MW.

A
GRID #3 IS COMPOSED OF TWO DEFLECTOR PLATES, ONE BEING CONNECTED TO LEAD 3 AND THE OTHER TO LEAD 5.

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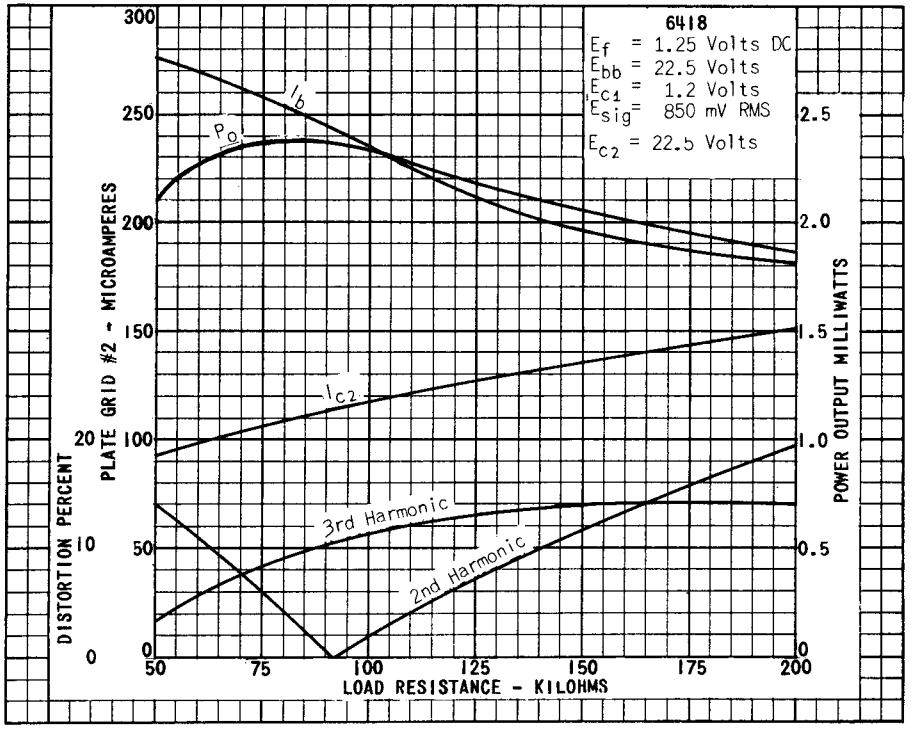
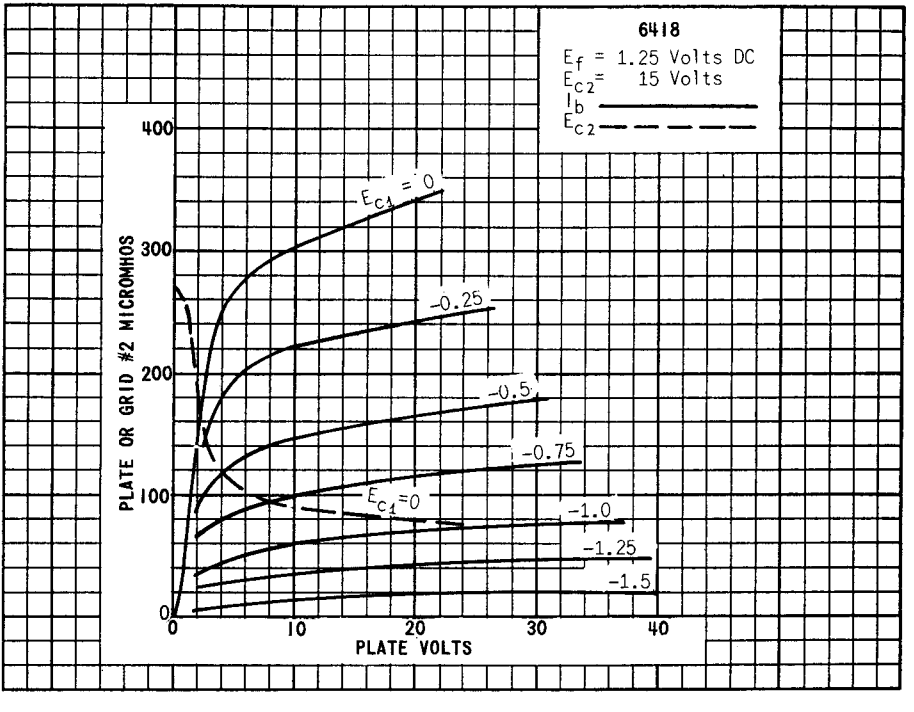
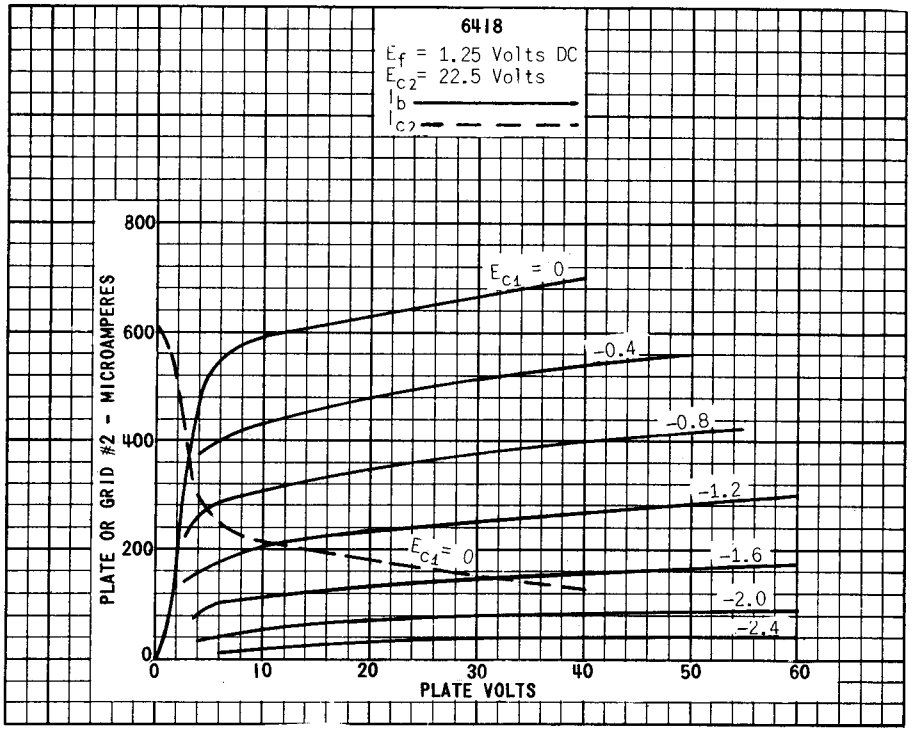
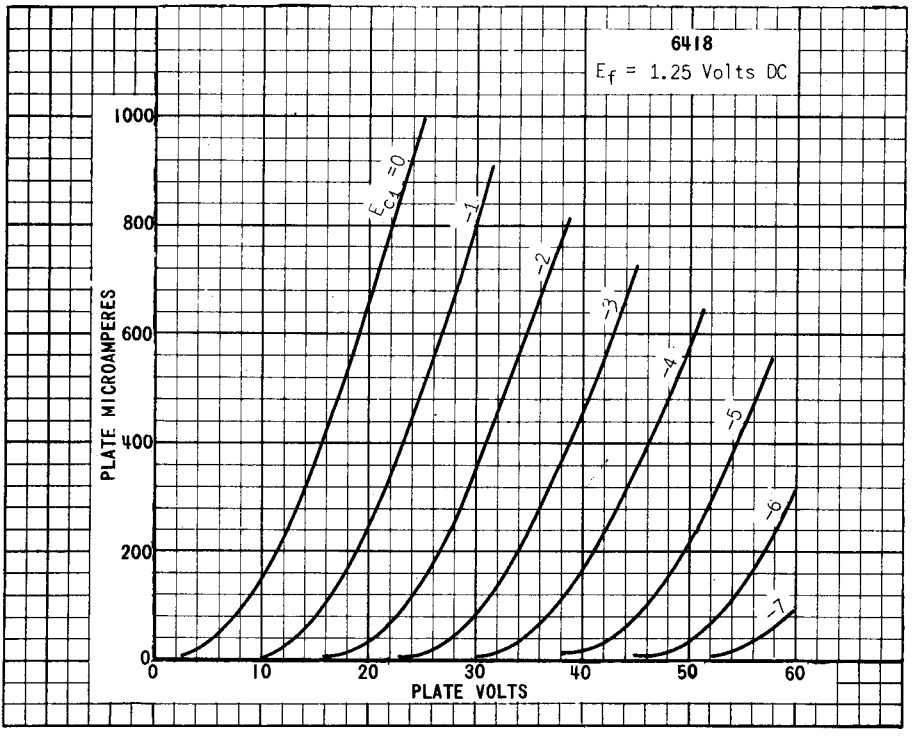

6418
E_f = 1.25 Volts DC
E_{bb} = 22.5 Volts
E_{c1} = 1.2 Volts
E_{sig} = 850 mV RMS
E_{c2} = 22.5 Volts
I_b
P_o
I_{c2}
3rd Harmonic
2nd Harmonic
PLATE GRID #2 - MICROAMPERES
DISTORTION PERCENT
POWER OUTPUT MILLIWATTS
LOAD RESISTANCE - KILOHMS
300
250
200
150
100
50
0
20
10
2.5
2.0
1.5
1.0
0.5
0
50
75
100
125
150
175
200


6418
E_f = 1.25 Volts DC
E_{c2} = 15 Volts
I_b
E_{c2}
E_{c1} = 0
-0.25
-0.5
-0.75
E_{c1}=0
-1.0
-1.25
-1.5
PLATE OR GRID #2 MICROMHOS
PLATE VOLTS
400
300
200
100
0
0
10
20
30
40

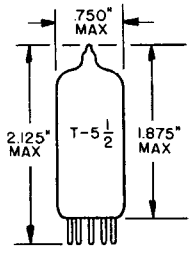

6418
E_f = 1.25 Volts DC
E_{c2} = 22.5 Volts
I_b
I_{c2}
PLATE OR GRID #2 - MICROAMPERES
800
600
400
200
0
E_{c1} = 0
-0.4
-0.8
-1.2
E_{c1} = 0
-1.6
-2.0
-2.4
0
10
20
30
40
50
60
PLATE VOLTS


6418
E_f = 1.25 Volts DC
PLATE MICROAMPERES
1000
800
600
400
200
0
E_{c1} =0
-1
-2
-3
-4
-5
-6
-7
0
10
20
30
40
50
60
PLATE VOLTS

TUNG-SOL

PENTODE

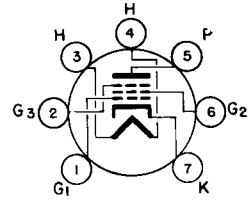
MINIATURE TYPE



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

FOR
VOLTAGE AMPLIFIER SERVICE
IN TV APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CC

THE 6485 IS A HIGH TRANSCONDUCTANCE, SHARP CUT-OFF PENTODE IN THE 7 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A WIDE BAND OR IF AMPLIFIER. THE TUBE WILL MAINTAIN ITS EMISSION AND FREEDOM FROM EXCESSIVE CATHODE INTERFACE RESISTANCE EVEN AFTER LONG PERIODS OF OPERATION UNDER CUT-OFF CONDITIONS. OTHERWISE, THE 6485 IS IDENTICAL TO THE 6AH6.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	WITH [A] SHIELD	
GRID 1 TO PLATE: (G1 TO P) (MAX.)	0.030	0.020	pf
INPUT: G1 to (H + K + G2 + G3)	10	10	pf
OUTPUT: P TO (H + K + G2 + G3)	2.0	3.6	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.

MAXIMUM RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	300	VOLTS
GRID 2 VOLTAGE	150	VOLTS
PLATE DISSIPATION [B]	3.2	WATTS
GRID 2 DISSIPATION	0.6	WATT
CATHODE CURRENT	25	MA.

[A] USING JEDEC SHIELD 316 CONNECTED TO CATHODE.

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TYPICAL OPERATING CHARACTERISTICS

	PENTODE CONNECTED	TRIODE CONNECTED	
PLATE VOLTAGE	300	150	VOLTS
GRID 2 VOLTAGE	150	D	VOLTS
CATHODE RESISTOR	160	160	OHMS
PLATE CURRENT	10	12.5	MA.
TRANSCONDUCTANCE	9000	11000	μMHOS
AMPLIFICATION FACTOR		40	
PLATE RESISTANCE	0.5	.0036	MEGOHMS
GRID 2 CURRENT	2.5		MA.
GRID 1 VOLTAGE FOR Ib = 10 μA. (APPROX.)	−7	−7	VOLTS
TRANSCONDUCTANCE (GRID 3 - PLATE)	C		

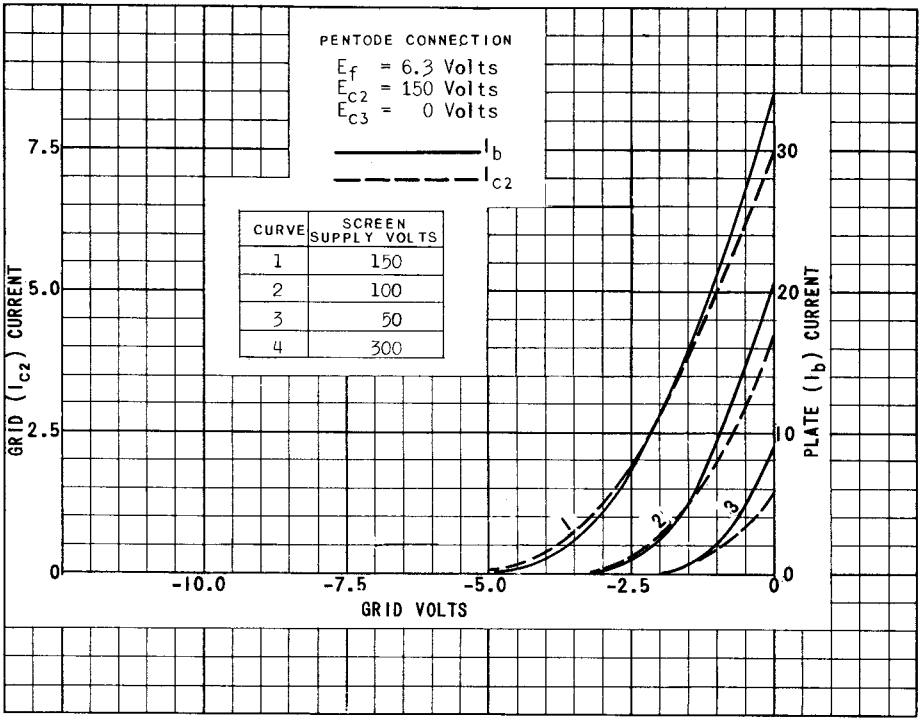
B AT MAXIMUM RATINGS, IT IS NECESSARY THAT AT LEAST ONE SURFACE OF THE SHIELD, IF USED BE BLACKENED.

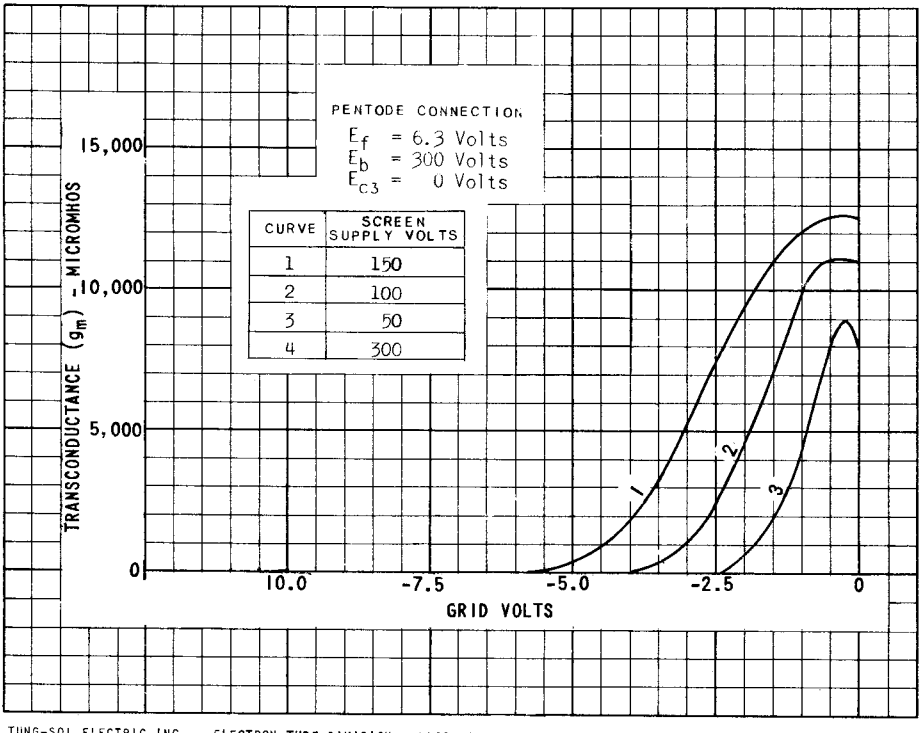
C GRID 3 HAS PRACTICALLY NO CONTROL CHARACTERISTICS AND IT IS NOT INTENDED TO BE USED AS A CONTROL ELECTRODE. ITS TRANSCONDUCTANCE TO THE PLATE APPROXIMATES 2 MICROMHOS AND THE μ IS 0.7 TO 1.0

D GRID 2 AND GRID 3 TIED TO PLATE

INPUT COUPLING AND SYNC. POLARITY	OUTPUT VOLTS P P	VOLTAGE GAIN	MAX. WATTS DISSIPATION SCREEN	MAX. WATTS DISSIPATION PLATE	CATHODE RESISTOR OHMS	CATHODE CURRENT NO SIG. (MA.)	CATHODE CURRENT WITH SIG. (MA.)	GRID RESISTOR OHMS
DC−	66	22	0.6	3.2	39	20	13	5000
DC+	100	25	0.4	3.2	270	8	15	5000
AC−	100	25	0.4	3.2	39	20	21	1 meg.
AC+	100	25	0.6	3.2	39	20	18	1 meg.

ALL DATA TAKEN WITH SCREEN VOLTAGE OF 150 AND PLATE LOAD OF 4000 OHMS WITH TYPICAL ON-THE-AIR TELEVISION SIGNALS AND AVERAGE PRODUCTION TUBES





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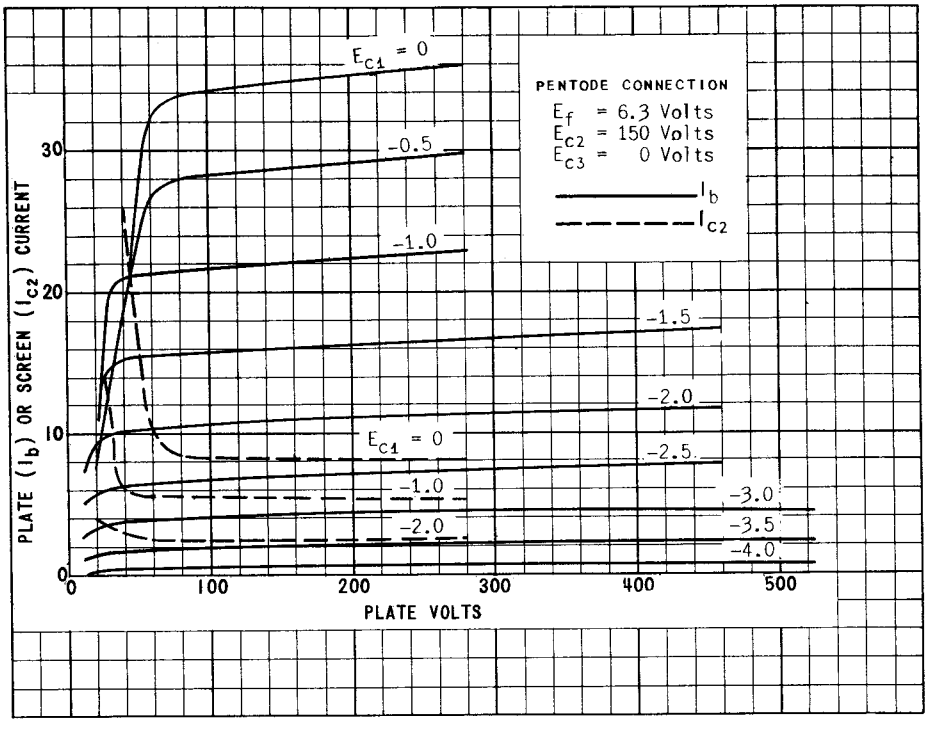
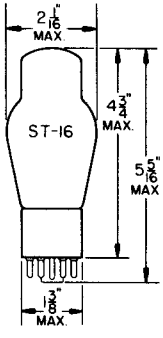

PENTODE CONNECTION
E_f = 6.3 Volts
E_{c2} = 150 Volts
E_{c3} = 0 Volts
I_b
I_{c2}
E_{c1} = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
PLATE (I_b) OR SCREEN (I_{c2}) CURRENT
PLATE VOLTS
0
10
20
30
100
200
300
400
500

TUNG-SOL

TWIN TRIODE



GLASS BULB

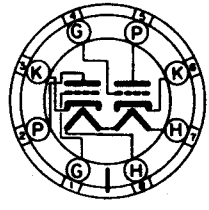
UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 2.5 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
MEDIUM SHELL
8 PIN OCTAL

THE 6520 IS A LOW-MU, HIGH PERVEANCE, TWIN POWER TRIODE OF THE HEATER-CATHODE TYPE INTENDED FOR USE AS A REGULATOR TUBE IN DC POWER SUPPLY UNITS, WHERE UTMOST RELIABILITY IS REQUIRED IN RESPECT TO TRIODE BALANCE, ABSENCE OF EXCESSIVE PLATE CURRENT DRIFT AND GRID TO PLATE INSULATION. IN ADDITION TO THE STANDARD 6AS7G CHARACTERISTICS, THE 6520 FEATURES A 600 VOLT POTENTIAL INSULATION BETWEEN GRID AND PLATE AND A COMBINED CATHODE AND FIXED BIAS TEST TO GUARANTEE RELIABLE PERFORMANCE WITHOUT EXCESSIVE TRIODE UNBALANCE OR PLATE CURRENT DRIFT.

GENERAL DATA

HEATER VOLTAGE (AC OR DC)	6.3±10%	VOLTS
HEATER CURRENT	2.5	AMP.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

EACH UNIT

GRID TO PLATE	9.4	μμf
INPUT	8.4	μμf
OUTPUT	2.2	μμf
HEATER TO CATHODE:		
TRIODE UNIT #1	6.5	μμf
TRIODE UNIT #2	6.1	μμf
GRID OF UNIT #1 TO GRID OF UNIT #2	0.50	μμf
PLATE OF UNIT #1 TO PLATE OF UNIT #2	2.20	μμf

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TUNG-SOL

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CHARACTERISTICS

EACH UNIT

CATHODE BIAS CONDITIONS		
PLATE-SUPPLY VOLTAGE	135	VOLTS
CATHODE-BIAS RESISTOR	250	OHMS
AMPLIFICATION FACTOR	2	
PLATE RESISTANCE	280	OHMS
TRANSCONDUCTANCE	7000	μMHOS
PLATE CURRENT	112	MA.
COMBINED FIXED AND CATHODE BIAS OPERATION		
PLATE-SUPPLY VOLTAGE	150	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
FIXED GRID BIAS	55	VOLTS
PLATE CURRENT	58	MA.

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	5.32	INCHES
MAXIMUM SEATED LENGTH	4.77	INCHES
MAXIMUM DIAMETER	2.0	INCHES
BULB	ST-16	
BASE	MEDIUM SHELL OCTAL 8 PIN	

RATINGS

ABSOLUTE MAXIMUM VALUES

D C AMPLIFIER

VALUES ARE FOR EACH UNIT

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	2.5	AMP.
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE CURRENT	125	MA.
MAXIMUM PLATE DISSIPATION	14	WATTS
MAXIMUM PEAK HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	300	VOLTS
PEAK SIMULTANEOUS GRID TO PLATE VOLTAGE:		
PLATE	+300	VOLTS
GRID	-300	VOLTS
MAXIMUM BULB TEMPERATUBE (AT HOTTEST POINT ON BULB SURFACE)	200	°C

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

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MAXIMUM CIRCUIT VALUES

MAXIMUM GRID-CIRCUIT RESISTANCE:		
FOR CATHODE-BIAS OPERATION	1.0	MEGOHM
FOR FIXED-BIAS OPERATION[A]	0.1	MEGOHM
FOR COMBINED FIXED-AND CATHODE-BIAS OPERATION[B]	0.1	MEGOHM

[A] WHEN FIXED BIAS IS USED, THE PLATE CIRCUIT SHOULD CONTAIN A PROTECTIVE RESISTANCE TO PROVIDE A MINIMUM DROP OF 15 VOLTS DC AT THE NORMAL OPERATING CONDITIONS. EXCLUSIVE FIXED BIAS IS NOT RECOMMENDED.

[B] WHEN COMBINED FIXED-AND CATHODE-BIAS IS USED, THE CATHODE-BIAS PORTION SHOULD HAVE A MINIMUM VALUE OF 7.5 VOLTS DC AT THE NORMAL OPERATING CONDITIONS.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.	MAX.	
HEATER CURRENT[C]	2.26	2.74	AMP.
GRID-PLATE CAPACITANCE (EACH UNIT)	6.9	9.9	μμf
INPUT CAPACITANCE (EACH UNIT)	4.7	7.7	μμf
OUTPUT CAPACITANCE (EACH UNIT)	1.7	2.7	μμf
HEATER-CATHODE CAPACITANCE:			
TRIODE UNIT #1	4.5	8.5	μμf
TRIODE UNIT #2	4.1	8.1	μμf
AMPLIFICATION FACTOR (EACH UNIT)[C,D]	1.9	2.5	
PLATE CURRENT (EACH UNIT)[C,D]	100	125	MA.
TRANSCONDUCTANCE (EACH UNIT)[C,D]	6400	7800	μMHOS
REVERSE GRID CURRENT (EACH UNIT)[C,E]	---	2.5	μAMP

[C] WITH 6.3 VOLTS AC OR DC ON HEATER.

[D] WITH PLATE-SUPPLY VOLTAGE OF 135 VOLTS, AND CATHODE-BIAS RESISTOR OF 250 OHMS IN EACH CATHODE (BOTH TRIODE UNITS OPERATING).

[E] WITH PLATE-SUPPLY VOLTAGE OF 135 VOLTS, AND GRID RESISTOR OF 1 MEGOHM IN EACH GRID (BOTH TRIODE UNITS OPERATING).

OPERATING NOTES

THE MAXIMUM RATINGS IN THE TABULATED DATA FOR THE 6520 ARE LIMITING VALUES ABOVE WHICH THE SERVICEABILITY OF THE 6520 MAY BE IMPAIRED FROM THE VIEWPOINT OF THE LIFE AND SATISFACTORY PERFORMANCE. THEREFORE, IN ORDER NOT TO EXCEED THESE ABSOLUTE RATINGS, THE EQUIPMENT DESIGNER HAS THE RESPONSIBILITY OF DETERMINING AN AVERAGE DESIGN VALUE FOR EACH RATING BELOW THE ABSOLUTE VALUE OF THAT RATING BY AN AMOUNT SUCH THAT THE ABSOLUTE VALUES WILL NEVER BE EXCEEDED UNDER ANY USUAL CONDITION OF SUPPLY-VOLTAGE VARIATION IN THE EQUIPMENT ITSELF.

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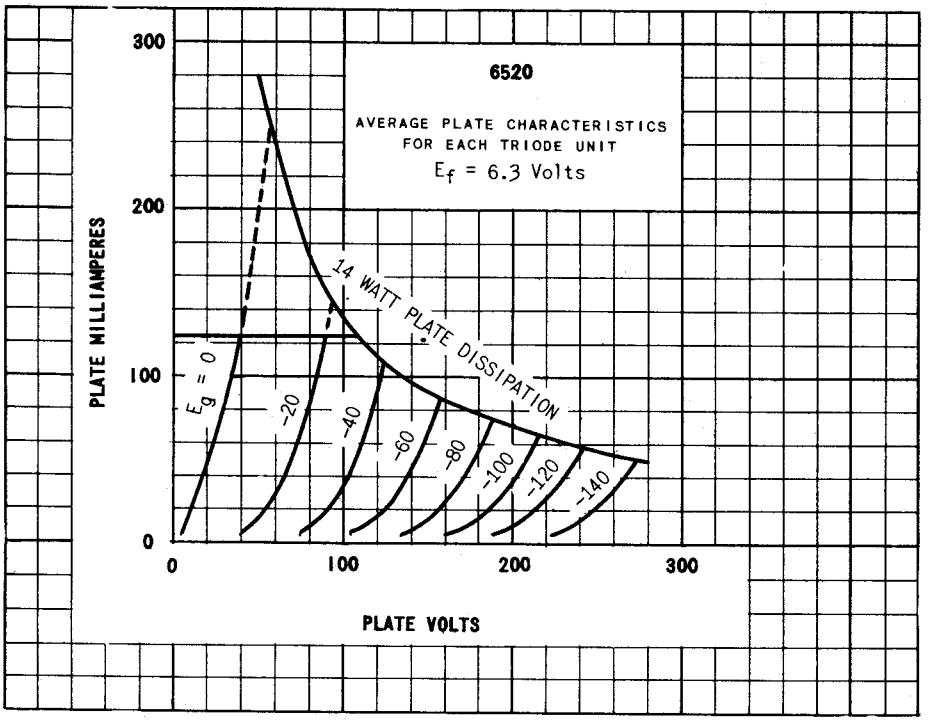
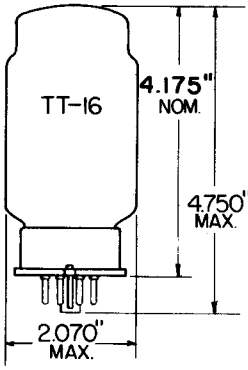

6520
AVERAGE PLATE CHARACTERISTICS
FOR EACH TRIODE UNIT
E_f = 6.3 Volts
14 WATT PLATE DISSIPATION
E_g = 0
-20
-40
-60
-80
-100
-120
-140
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300

TUNG-SOL

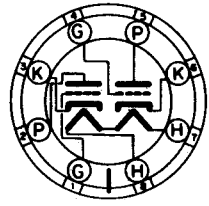
TWIN POWER TRIODE



GLASS BULB

HEATER
6.3±10% VOLTS 5.0 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
LARGE WAFER WITH
METAL SLEEVE
8 PIN BASE

THE 6528 IS A LONG LIFE, MECHANICALLY RUGGED, TWIN POWER TRIODE DEVELOPED ESPECIALLY FOR USE AS A PASSING TUBE IN SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINSIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 6528 ADEQUATELY MEETS THESE REQUIREMENTS.

THE DESIGN FEATURES ZIRCONIUM COATED GRAPHITE ANODES THAT, WHILE LIGHTER IN WEIGHT THAN SIMILAR METAL ANODES, REMAIN WARP FREE DURING LIFE AND PROVIDE ONE OF THE BEST GAS "GETTERING" MEANS KNOWN. THE ANODES ARE SUPPORTED BY CERAMIC INSULATORS. THE USE OF THESE INSULATORS AND THE HARD GLASS ENVELOPE PERMIT THE TUBE TO BE OUTGASSED AT HIGH TEMPERATURES DURING THE MANUFACTURING EXHAUST PROCESS. THIS ALLOWS THE TUBE TO BE RUN AT HIGH TEMPERATURES DURING OPERATION, WITHOUT THE EVOLUTION OF HARMFUL GAS FROM THE TUBE PARTS.

MASSIVE CATHODES PROVIDE ADEQUATE EMISSION CURRENT RESERVE. GOLD PLATED MOLYBDENUM WIRES ARE EMPLOYED IN THE RUGGED GRID STRUCTURE. THE TUBE MOUNT IS BUILT ON A RUGGED BUTTON STEM, AND IS SUPPORTED FROM THE BULB BY MEANS OF FLEXIBLE METAL VIBRATION SNUBBERS.

IN MAKING CIRCUITS ONE 6528 WILL REPLACE TWO OR THREE TYPE 6080WA OR THREE OR FOUR BEAM POWER TUBES. FOR EVEN HIGHER LEVELS OF CURRENT OR POWER, MANY 6528 TUBE SECTIONS CAN BE PARALLELED AS EXPLAINED IN THE APPLICATION NOTES.

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TUNG-SOL

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ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f=6.3 VOLTS)	5.0	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	37 000	μMHOS
AMPLIFICATION FACTOR	9.0	
INTER ELECTRODE CAPACITANCES PER TRIODE SECTION:		
GRID TO CATHODE	17.8	μμf
GRID TO PLATE	23.8	μμf
CATHODE TO PLATE	2.9	μμf
HEATER TO CATHODE	15.0	μμf
INTER ELECTRODE CAPACITANCES BETWEEN TRIODE SECTIONS:		
SECTION #1 PLATE TO SECTION #2 PLATE	0.6	μμf
PLATE RESISTANCE	245	OHMS

MECHANICAL DATA

MOUNTING POSITION	ANY	
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)		
BULB	TT 16	NONEX
BASE	LARGE WAFER OCTAL WITH METAL SLEEVE, 8 PIN, JETEC #B8-86	
AVERAGE NET WEIGHT	3.5	OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE)	720	G
MAXIMUM VIBRATION RATING:		
(0 TO 50 CPS)	10	G
(50 TO 500 CPS)	5	G

RATINGS

ABSOLUTE VALUES

	MINIMUM	MAXIMUM	
POWER DISSIPATION PER PLATE	---	30	WATTS
PLATE CURRENT PER PLATE	---	300	MADC
IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 6 VOLTS, THIS CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE			
PLATE VOLTAGE	0	400	VOLTS DC
HEATER–CATHODE VOLTAGE	−300	+300	VOLTS DC
GRID VOLTAGE	−300	0	VOLTS DC
GRID CURRENT PER GRID	---	0	MA.
HEATER VOLTAGE	5.7	6.9	VOLTS
ENVELOPE TEMPERATURE	---	250	°C
ALTITUDE FOR FULL RATINGS	---	10 000	FEET
IF COOLING IS PROVIDED TO KEEP BULB TEMPERATURE WITHIN RATINGS, ALTITUDE RATING CAN BE EXTENDED TO 60,000 FEET			
TOTAL GRID CIRCUIT RESISTANCE IN REGULATOR SERVICE OR WITH FIXED BIAS	500	50000	OHMS
TOTAL GRID CIRCUIT RESISTANCE WITH CATHODE BIAS ONLY	500	500000	OHMS
RESISTANCE PER GRID LEG WHEN TRIODE SECTIONS ARE PARALLELED	500	---	OHMS

CATHODE RESISTANCE: MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL BE 10 OHMS OR THAT RESISTANCE NECESSARY TO PROVIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS GREATER.

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TUNG-SOL

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 48° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (720G/MSEC)

LIFE TEST: 1000 HOURS UNDER PLATE CURRENT TEST CONDITIONS

POST SHOCK AND LIFE TEST END POINTS:

PLATE CURRENT (MIN.)	(R_g / I_g = .05 MEG.)	130	MA
TRANSCONDUCTANCE PER SECTION (MIN.)		23 500	μMHO
HK LEAKAGE (MAX.)		100	μA
GRID CURRENT (MAX.)		-4	μA

RANGE OF VALUES

CONDITIONS: E_f = 6.3V, E_b = 100V.
E_c = -4, $R_{g/g}$ = 500Ω

BOTH SECTIONS OPERATING. READINGS TAKEN AFTER 2 MIN. PREHEATING UNDER CONDITIONS OF E_f = 6.3, E_{bb} = 190 V, E_c = 0, R_c = 200 OHMS. EACH SECTION READ SEPARATELY.

PLATE CURRENT PER SECTION	140	230	MA, DC
AMPLIFICATION FACTOR	7.0	11.0	
TRANSCONDUCTANCE	29 000	45 000	μMHOS
HEATER CURRENT PER TUBE	4.75	5.25	AMP.

CONDITIONS: E_f = 6.3V, E_b = 400V.
E_c = -75V, R_k = 0

PLATE CURRENT PER SECTION	0	3	MA.

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APPLICATION NOTES

THE 6528 IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE TENTH THE VALUE $\left(\frac{R}{\mu+1}\right)$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE TENTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (LESS THAN ONE WATT) AND THE ADDITIONAL VOLTAGE (LESS THAN 6 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.

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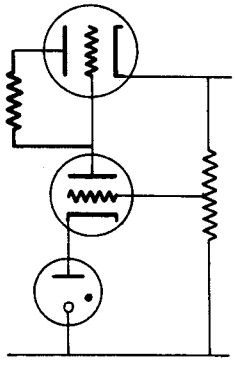


FIGURE 1

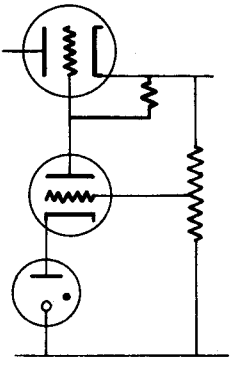


FIGURE 2

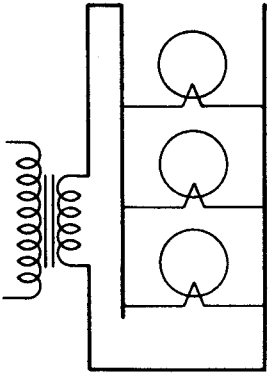
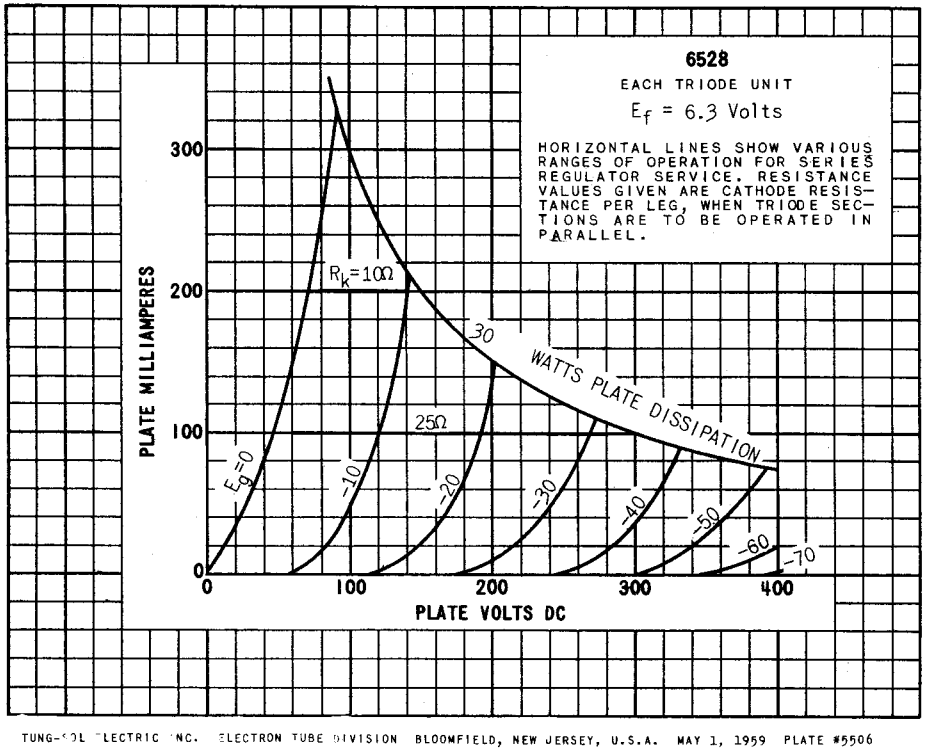
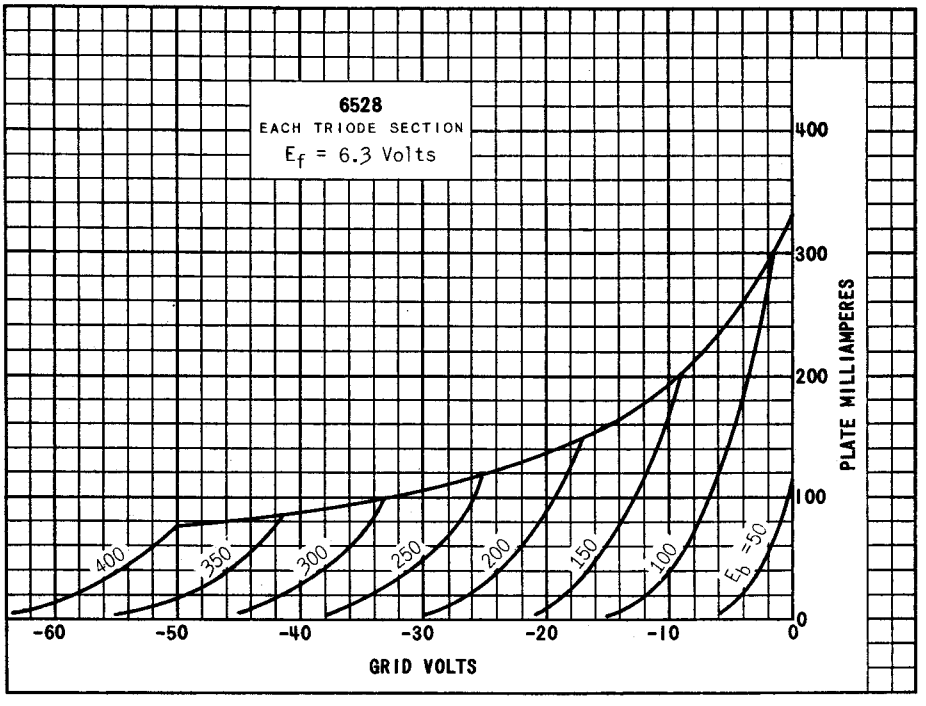
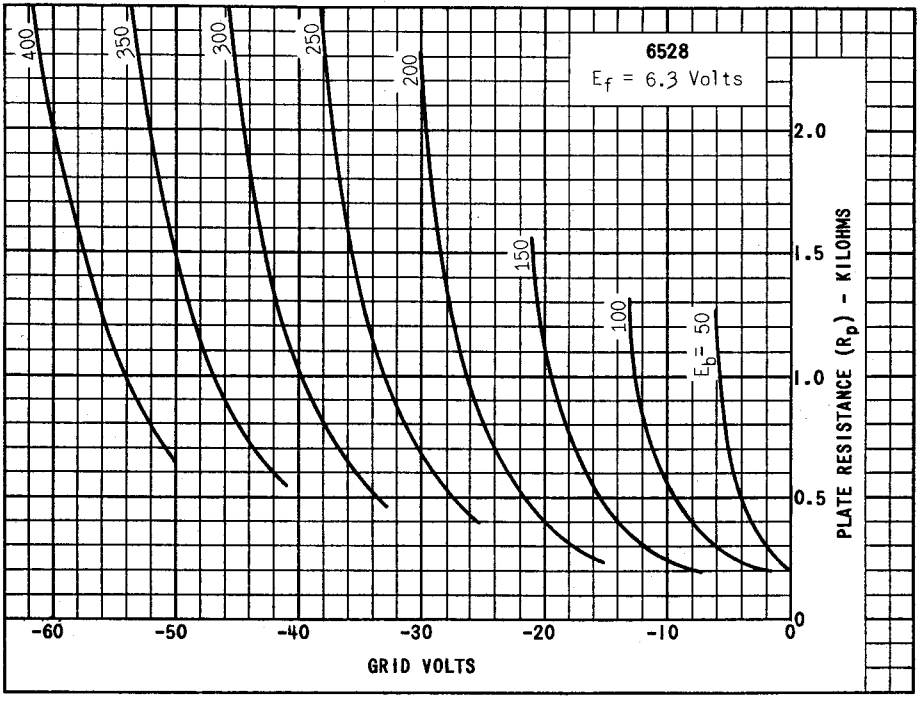


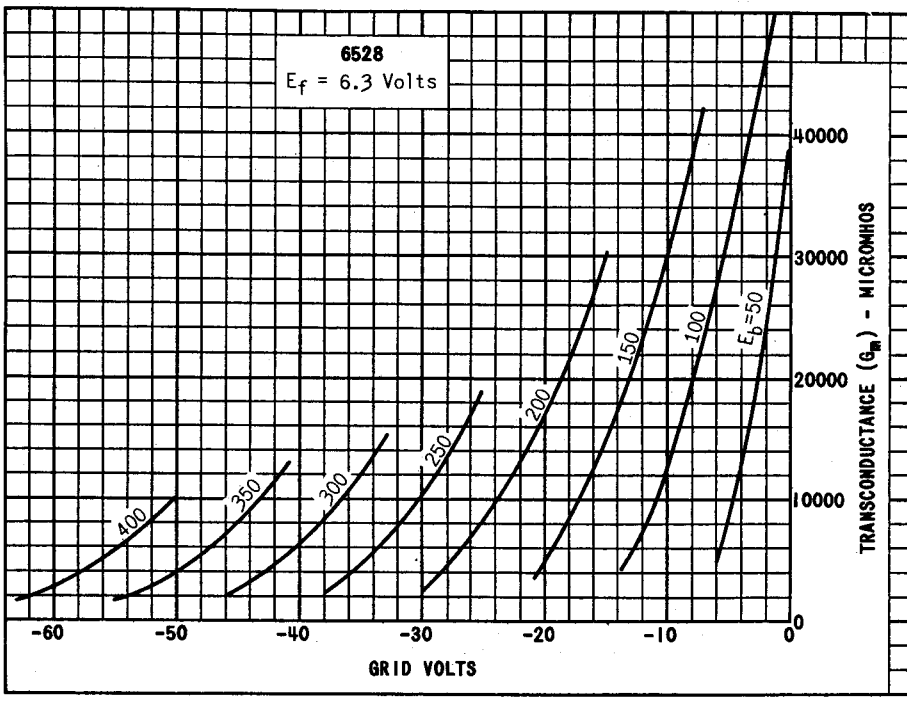
FIGURE 3

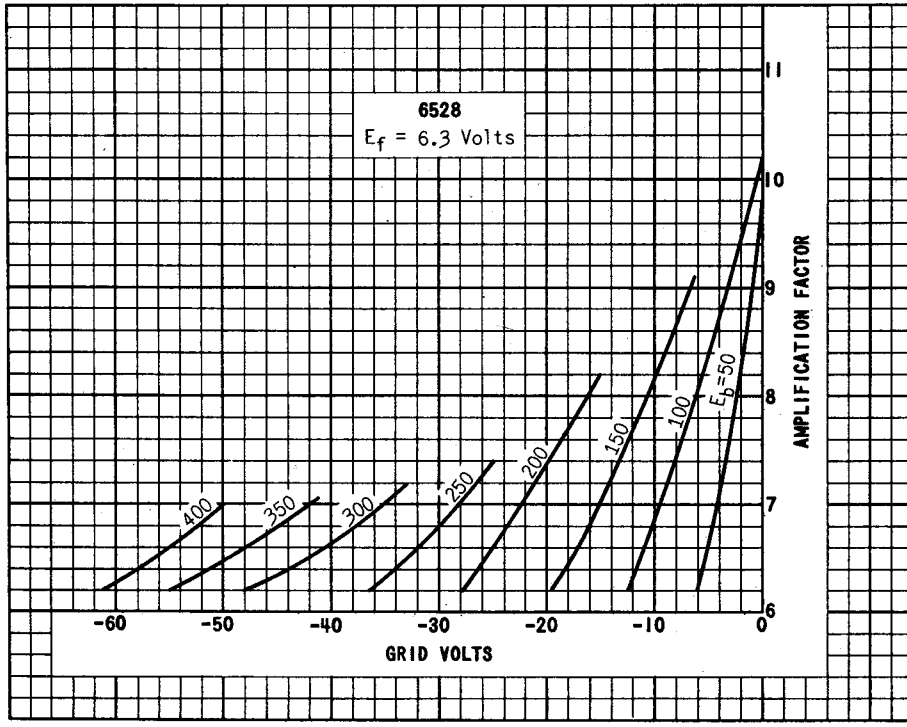




* INDICATES AN ADDITION




6528
E_f = 6.3 Volts
400
350
300
250
200
150
100
E_b=50
-60
-50
-40
-30
-20
-10
0
GRID VOLTS
40000
30000
20000
10000
0
TRANSCONDUCTANCE (G_m) - MICROMHOS


6528
E_f = 6.3 Volts
400
350
300
250
200
150
100
E_b=50
-60
-50
-40
-30
-20
-10
0
GRID VOLTS
11
10
9
8
7
6
AMPLIFICATION FACTOR

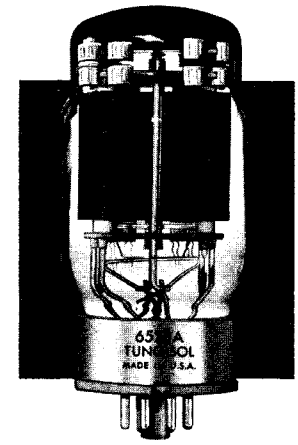
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6528A

JUNE 1965

MEDIUM MU TWIN POWER TRIODE FOR SERIES REGULATOR SERVICE



DESCRIPTION The 6528A is a rugged twin power triode well suited for use as a pass tube in series regulated power supplies. Tubes of this design will meet all the requirements of MIL-E-1/1479.

The 6528A is capable of withstanding prolonged exposure to continuous vibration. This performance extra is achieved by using ceramic spacers, rather than mica, to hold electrodes in position. Also, gold plated strap frame grids are used for extra mechanical stiffness.

The 6528A will replace the 6528 in any application.

ELECTRICAL DATA

Heater Voltage	6.3 ± 10% Volts
Heater Current (E_f = 6.3 volts)	5.0 Amperes
Minimum Cathode Heating Time	30 Seconds
Transconductance (per section)	37,000 Micromhos
Amplification Factor	9.0
Plate Resistance	245 Ohms

Inter Electrode Capacities per Triode Section

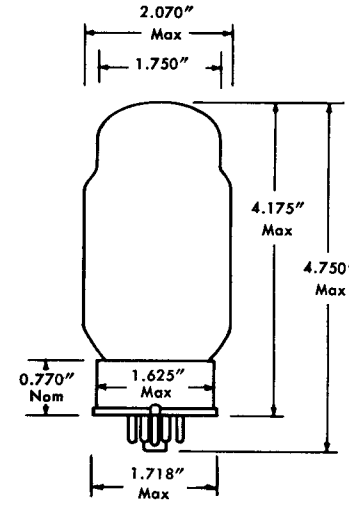
Grid to Cathode	17.8 uuf
Grid to Plate	23.8 uuf
Cathode to Plate	2.9 uuf
Heater to Cathode	15.0 uuf

Inter Electrode Capacities Between Triode Sections

Section 1 Plate to Section 2 Plate 0.6 uuf

MECHANICAL DATA

Mounting Position	Any
If tube is to be mounted in a horizontal position it is recommended that it be mounted so that the base lug key be either directly up or directly down.	
Bulb	T-16 Nonex
Base	Large wafer octal 8 pin with metal sleeve, JEDEC type B8-98

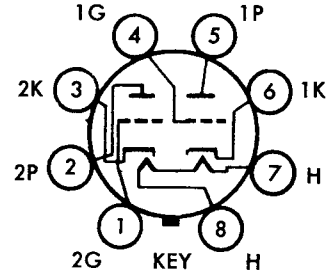


OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Plate Dissipation per Plate	—	30	Watts
Plate Current per Plate	—	300	Milliamperes d. c.
If tube voltage drop is to be swung more than 6 volts, this current cannot be realized. See Plate Characteristics Curve.			
Plate Voltage	0	400	Volts d. c.
Heater-Cathode Voltage	−300	+300	Volts d. c.
Grid Voltage	−300	0	Volts d. c.
Grid Current per Grid	—	0	Milliamperes
Heater Voltage	5.7	6.9	Volts
Envelope Temperature	—	250	Degrees Centigrade
Altitude for Full Ratings	—	10,000	Feet
If cooling is provided to keep bulb temperature within ratings, altitude rating can be extended to 60,000 feet.			
Grid Circuit Resistance Values			
For Fixed Bias, or Cathode and Fixed Bias Operation	500	50,000	Ohms
For Cathode Bias Operation	500	500,000	Ohms
Resistance per grid leg when triode sections are paralleled	500	—	Ohms

Cathode Resistance: Minimum cathode resistance per cathode leg shall be 10 ohms or that resistance necessary to provide 10% of the grid bias volatge, whichever is greater.



BASING DIAGRAM
BOTTOM VIEW
8BD

APPLICATION NOTES

The 6528A is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance at relatively low plate voltages. To provide the desired output current, many triode sections can be paralleled. If tube sections are to be paralleled however, the designer is strongly urged to use sufficient resistance in each cathode leg to equalize current division among the triode sections. Recommended values for various operating currents are shown on the plate characteristics curve. If the output current of the supply is not fixed, use the resistance indicated for the lowest current that approaches the maximum plate dissipation line. Cathode resistance is superior to anode resistance because it helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one tenth the value $\left(\frac{R}{u+1}\right)$ of a plate resistor, and therefore will dissipate only one tenth the power. In any case, the only losses incurred in using a resistor is the insertion loss of the resistor itself (less than one watt) and the additional voltage (less than 6 volts) necessary from the unregulated supply. A cathode resistor adds a small additional loss by causing the passing tube to work with higher bias and hence with greater tube drop.

The regulator circuit shown in Figure 2 is preferable from the consideration of the safety of the passing tube both during warmup and in the event of trouble in the amplifier circuit or if the amplifier tube is removed from its socket. It has the additional advantage of providing a constant voltage for the amplifier circuit. However, if the regulated output voltage is low, it may be necessary to provide additional negative voltage for the reference tube circuit. Also, if the regulated output voltage is to be variable, it may be necessary to follow Figure 1. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it there is little IR drop across the resistor during warmup of the amplifier tube and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

Passing tube operation conditions should be chosen to provide as low a tube drop as possible. A safety margin of at least 5 volts from the zero bias line should be allowed however, for variations of individual tubes. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 5.0 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high enough to prevent parasitic oscillation but not large enough to prevent loss of control due to a small amount of "gas" grid current. A value of grid resistance that meets both these conditions is 1,000 ohms. Heater voltage should be kept as close as possible to 6.3 volts as measured on the tube pins. When connecting many high drain tube heaters across a single transformer, bus bars feeding from "alternate ends" (Figure 3) should be used with a pair of stranded wires feeding individual sockets.

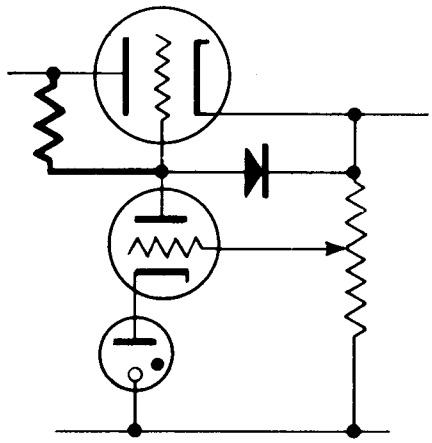


FIGURE 1

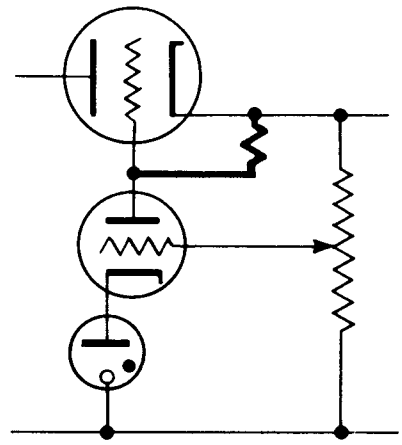


FIGURE 2

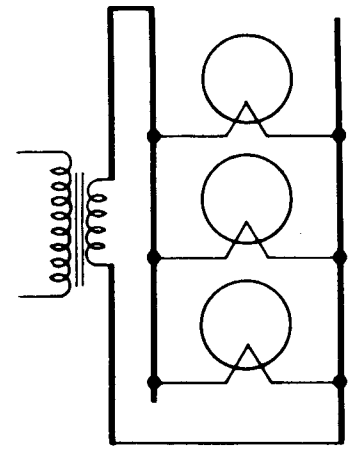
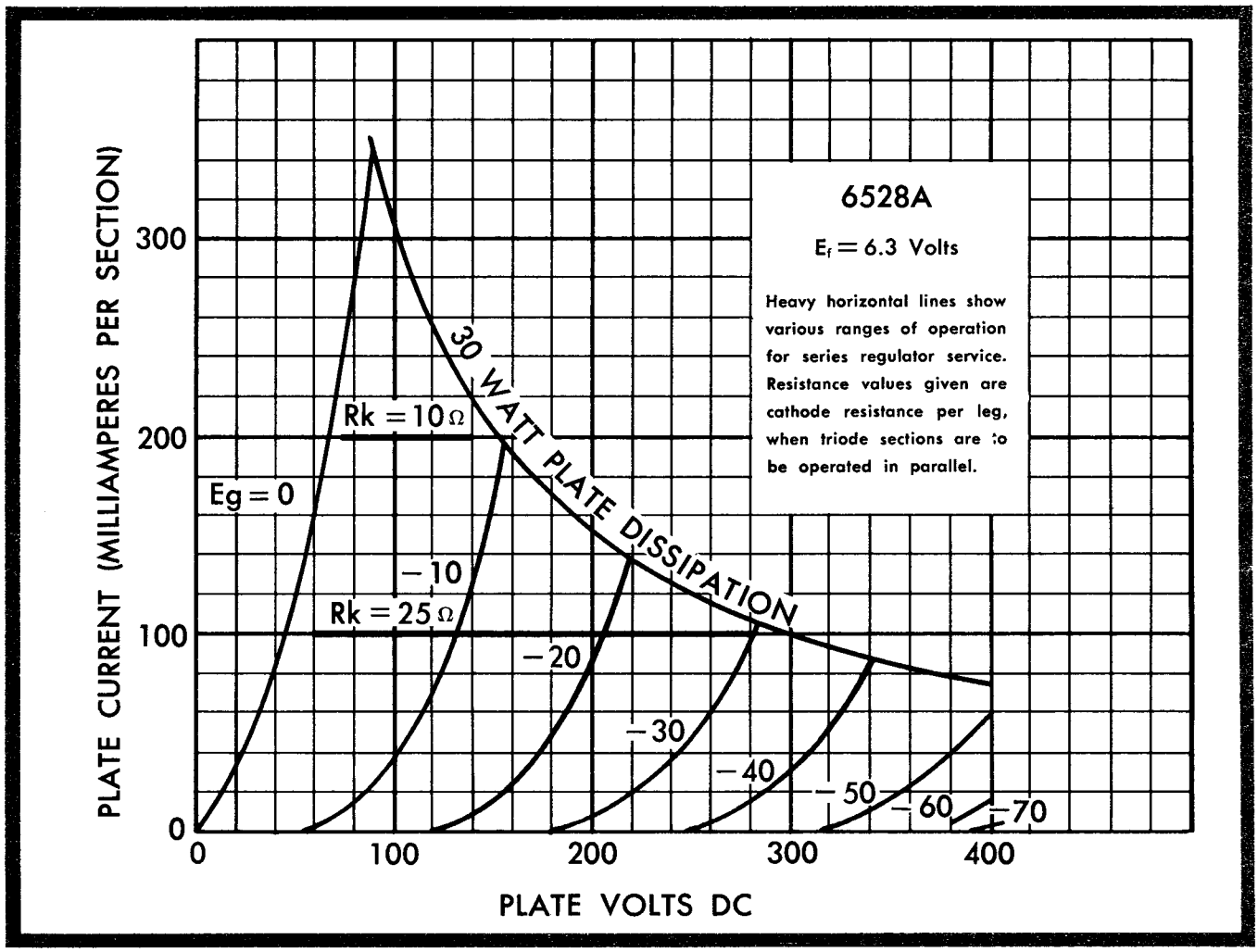


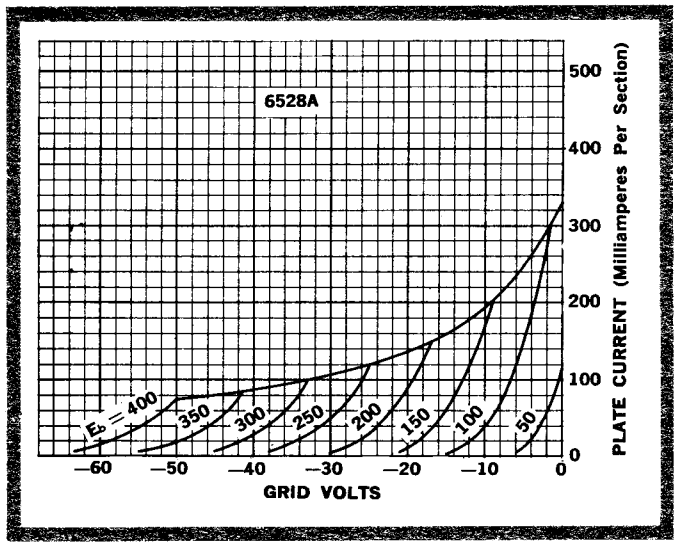
FIGURE 3

AVERAGE PLATE CHARACTERISTICS FOR EACH TRIODE UNIT

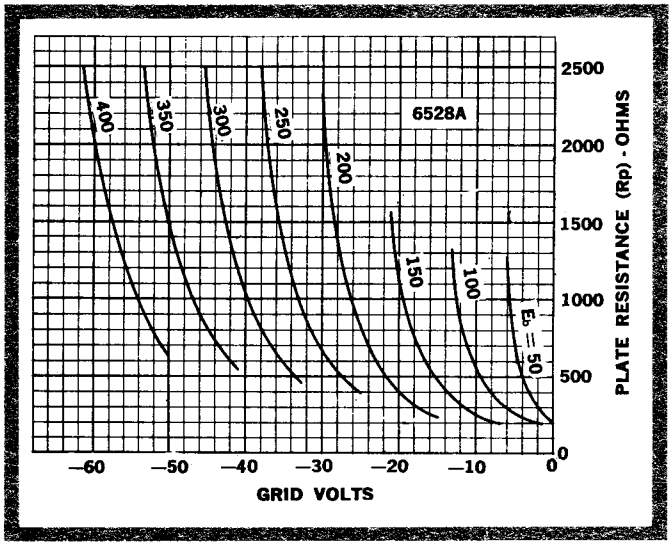


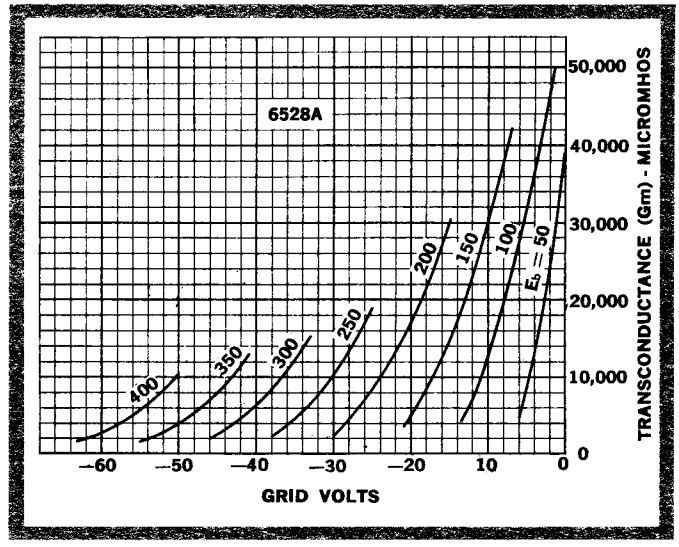
TYPE 6528A

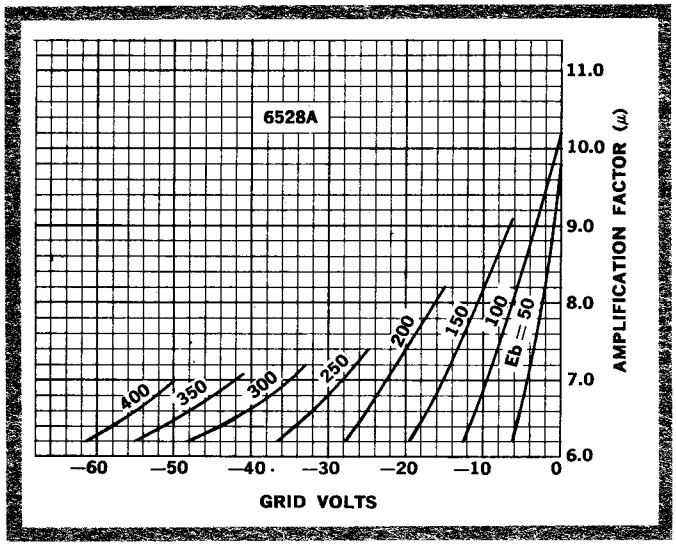
TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION



AVERAGE CHARACTERISTICS







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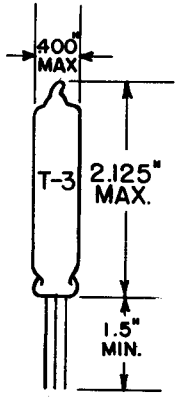
VOLTAGE REGULATOR

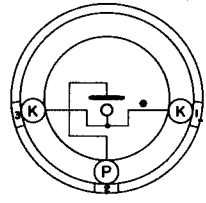
SUB-MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.096" CENTER TO CENTER

THE 6542 IS A TWO ELECTRODE, INERT-GAS-FILLED COLD CATHODE SUBMINIATURE TUBE INTENDED FOR USE AS A VOLTAGE REGULATOR. THE TUBE HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 150 VOLTS OVER A CURRENT RANGE OF 5 TO 25 MA. THE 6542 IS EXCELLENT FOR APPLICATIONS WHICH REQUIRE GOOD VOLTAGE REGULATION AND LONG LIFE, CONSISTENT WITH SMALL SIZE AND LOW WEIGHT.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2.125	INCHES
MAXIMUM DIAMETER	0.400	INCHES
WEIGHT (APPROX.)	0.16	OUNCES
BULB	T-3	
BASE	SUB-MINIATURE FLAT PRESS WITH 3 FLYING LEADS	

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TUNG-SOL

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RATINGS
ABSOLUTE VALUES

MAXIMUM DC CATHODE CURRENT	25	MA.
MINIMUM DC CATHODE CURRENT	5	MA.
MAXIMUM BULB TEMPERATURE	155	°C
MINIMUM AMBIENT TEMPERATURE	−55	°C
MAXIMUM ALTITUDE	60 000	FEET

CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR	0.1	μf
SERIES RESISTOR	SEE OPERATION NOTES	

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	AVG.	MAX.	
DC ANODE SUPPLY VOLTAGE	185*	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	150	180	VOLTS
TUBE VOLTAGE DROP	140	147	168	VOLTS
REGULATION (5 TO 30 MA.)	---	0.8	6	VOLTS

* IN ORDER TO ASSURE STARTING THROUGH TUBE LIFE NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

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TUNG-SOL

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OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP ON THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_L IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_L}{R_1 + R_L} < V \text{ STARTING}$$

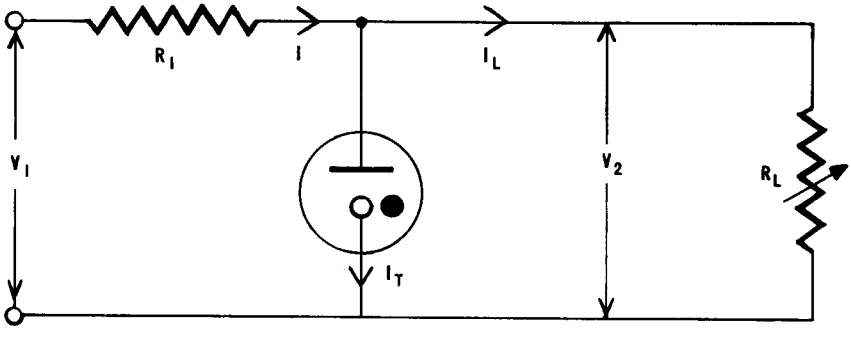

FIGURE 1

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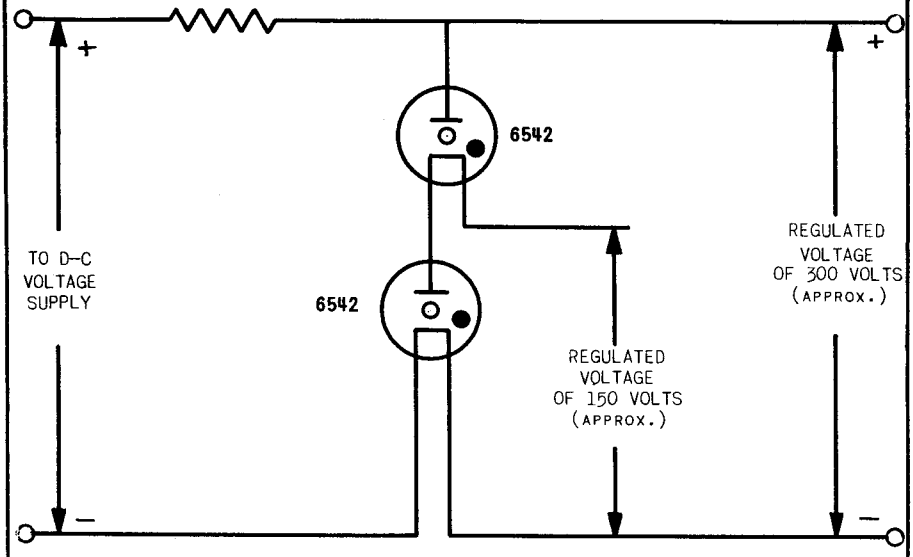
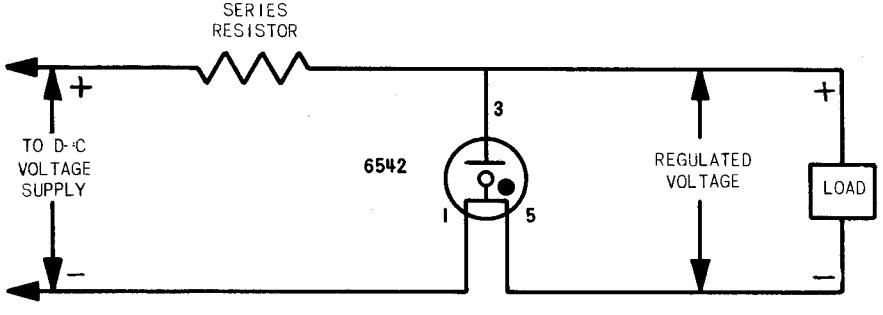


OPERATION OF REGULATOR TUBES IN SERIES
FIGURE 2



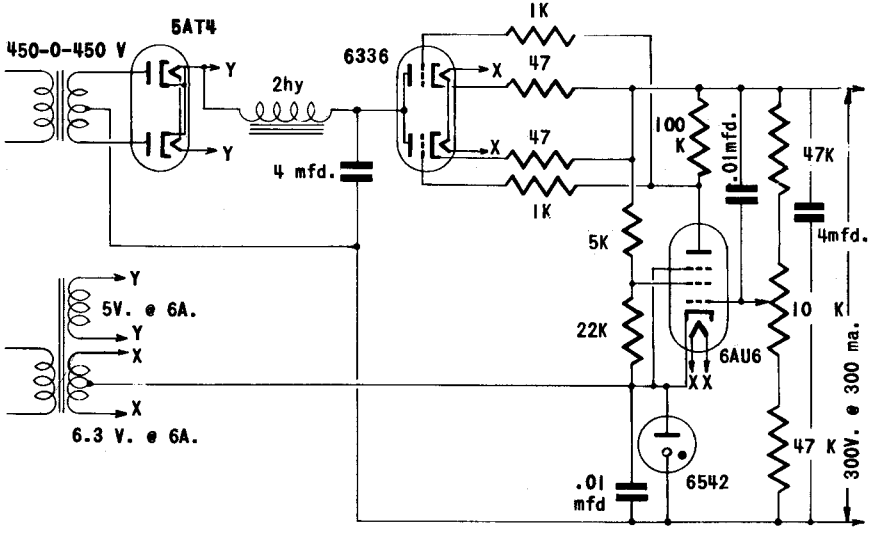
TYPICA CIRCUIT FOR VOLTAGE REGULATOR
FIGURE 3

WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE 6542 SHOULD BE LIMITED IN VALUE TO 0.1 μf, LARGER VALUES MIGHT CAUSE OSCILLATIONS.

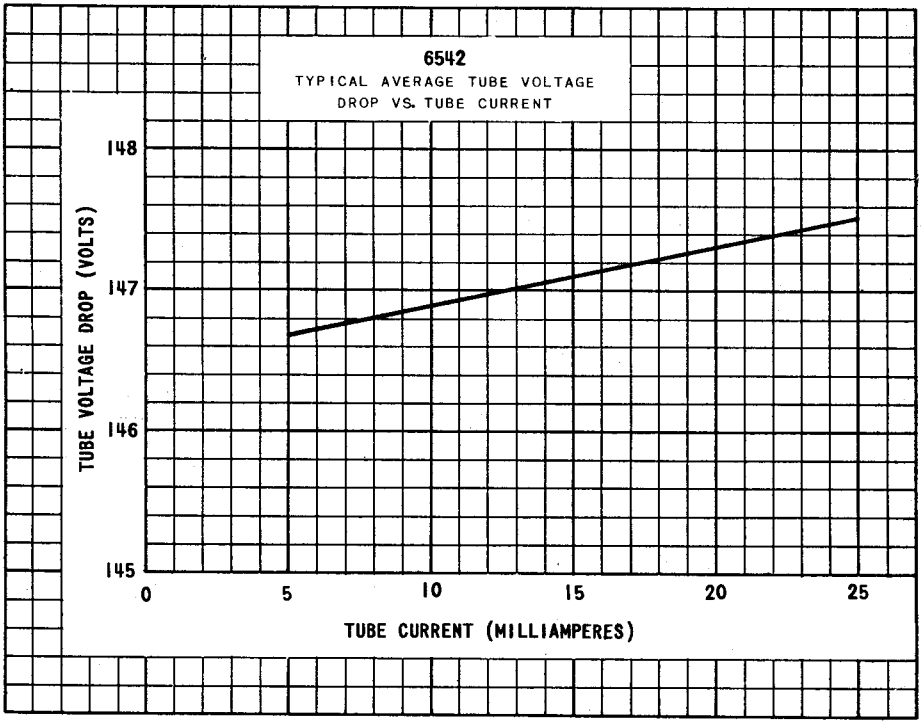
OPERATION OF THE 6542 IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH 6542 TO EQUILIZE DIVISION OF CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS ENABLES ONE TO HANDLE MORE LOAD CURRENT IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.



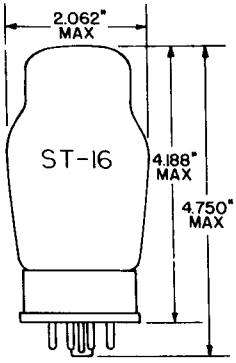
TYPICAL APPLICATION OF 6542
USED IN VOLTAGE REGULATED POWER SUPPLY
FIGURE 4

TENTATIVE DATA



TUNG-SOL

PENTODE

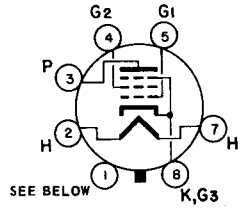


GLASS BULB
LARGE WAFER OCTAL ←
WITH BARRIERS
7 PIN LOW LOSS B7-99

FOR
AUDIO SERVICE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7AC

PIN 1 - NO CONNECTION
OR BASE SHELL

THE 6550 IS A BEAM PENTODE POWER AMPLIFIER PRIMARILY DESIGNED FOR AUDIO SERVICE. IT CARRIES A 42 WATT PLATE DISSIPATION RATING WHICH PROVIDES FOR PUSH-PULL AMPLIFIER DESIGNS UP TO 100 WATTS OUTPUT. CONSTRUCTION FEATURES PROVIDE FOR RELIABLE OPERATION AT FULL RATINGS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

GRID 1 TO PLATE	0.8	pf
INPUT	15	pf
OUTPUT	10	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	→ 1.6	AMP.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE, DC	660	VOLTS
GRID 2 VOLTAGE, DC		
PENTODE CONNECTION	440	VOLTS
TRIODE AND ULTRA-LINEAR CONNECTION	500	VOLTS
GRID 1 VOLTAGE, DC	−300 TO 0	VOLTS
PLATE DISSIPATION	42	WATTS
GRID 2 DISSIPATION		
CONTINUOUS	6.0	WATTS
INTERMITTENT-MUSIC OR SPEECH PEAKS	10.0	WATTS
CATHODE CURRENT, DC	190	MA.
GRID 1 CIRCUIT RESISTANCE		
FIXED BIAS	50	KOHMS
SELF BIAS	250	KOHMS
BULB TEMPERATURE	250	°C

AVERAGE CHARACTERISTICS

PENTODE CONNECTION

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID 1 VOLTAGE	−14	VOLTS
PLATE CURRENT	140	MA.
GRID 2 CURRENT	12	MA.
TRANSCONDUCTANCE	11,000	μMHOS
PLATE RESISTANCE, APPROX.	15,000	OHMS
TRIODE AMPLIFICATION FACTOR	8	
GRID 1 VOLTAGE FOR 1 MA PLATE CURRENT	−40	VOLTS

TYPICAL OPERATING CONDITIONS

CLASS A1 AUDIO AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE, DC	250	400	VOLTS
GRID 2 VOLTAGE, DC	250	225	VOLTS
GRID 1 VOLTAGE, DC	−14	−16.5	VOLTS
PEAK SIGNAL VOLTAGE	14	16.5	VOLTS
ZERO-SIGNAL PLATE CURRENT, DC	140	87	MA.
MAX. - SIGNAL PLATE CURRENT, DC	150	105	MA.
ZERO-SIGNAL GRID 2 CURRENT, DC	12	4	MA.
MAX. - SIGNAL GRID 2 CURRENT, DC	22	14	MA.
LOAD RESISTANCE	1500	3000	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	7	13.5	PERCENT
MAX. - SIGNAL POWER OUTPUT	12.5	20	WATTS

CONTINUTED ON FOLLOWING PAGE

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TYPICAL OPERATING CONDITIONS - CONT'D.

PUSH-PULL CLASS AB1 AUDIO AMPLIFIER
PENTODE CONNECTION

AVERAGE VALUES FOR TWO MATCHED TUBES[A]

	SELF BIAS	FIXED BIAS			
PLATE VOLTAGE, DC	400	400	450	600	VOLTS
GRID 2 VOLTAGE, DC	310	270	310	300	VOLTS
GRID 1 VOLTAGE, DC	---	-23	-29.5	-32.5	VOLTS
COMMON CATHODE RESISTOR BYPASSED	140	---	---	---	OHMS
PEAK GRID-TO-GRID SIGNAL VOLTAGE	43	46	58	65	VOLTS
ZERO-SIGNAL PLATE CURRENT, DC	170	170	150	100	MA.
MAX.-SIGNAL PLATE CURRENT, DC	185	275	295	270	MA.
ZERO-SIGNAL GRID 2 CURRENT, DC	10	9	9	5	MA.
MAX.-SIGNAL GRID 2 CURRENT, DC	25	35	38	33	MA.
EFFECTIVE LOAD, PLATE-TO-PLATE	5,000	3,500	3,500	5,000	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	0.7	0.6	1.5	3.0	PERCENT
MAX.-SIGNAL POWER OUTPUT	40	60	77	100	WATTS

PUSH-PULL AUDIO AMPLIFIER, ULTRA-LINEAR OPERATION
GRID 2 TAPPED AT 40% OF PRIMARY TURNS
AVERAGE VALUES FOR TWO MATCHED TUBES[A]

	SELF BIAS CLASS A1	FIXED BIAS CLASS AB1	
PLATE AND GRID 2 VOLTAGE, DC	395	450	VOLTS
GRID 1 VOLTAGE, DC	---	-48	VOLTS
COMMON CATHODE RESISTOR -BYPASSED	200	---	OHMS
PEAK GRID-TO-GRID SIGNAL VOLTAGE	70	96	VOLTS
ZERO-SIGNAL PLATE CURRENT, DC	170	150	MA.
MAX.-SIGNAL PLATE CURRENT, DC	174	265	MA.
ZERO-SIGNAL GRID 2 CURRENT, DC	12.5	12	MA.
MAX.-SIGNAL GRID 2 CURRENT, DC	23	38	MA.
EFFECTIVE LOAD, PLATE-TO-PLATE	5600	4000	OHMS
TOTAL HARMONIC DISTORTION (APPROX.)	1.5	2.4	PERCENT
MAX.-SIGNAL POWER OUTPUT	34	70	WATTS

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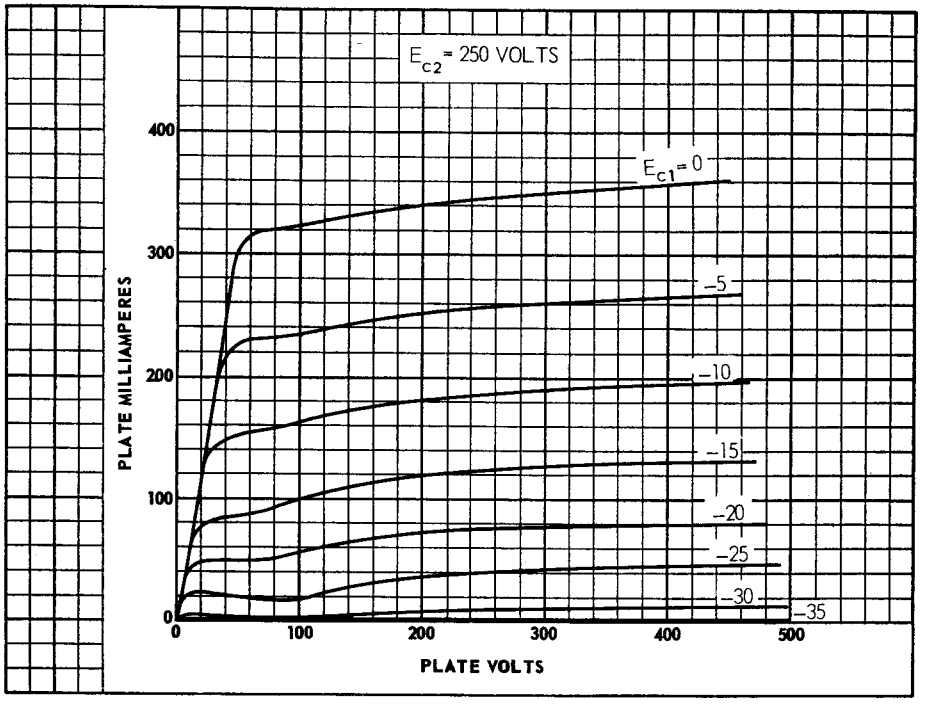
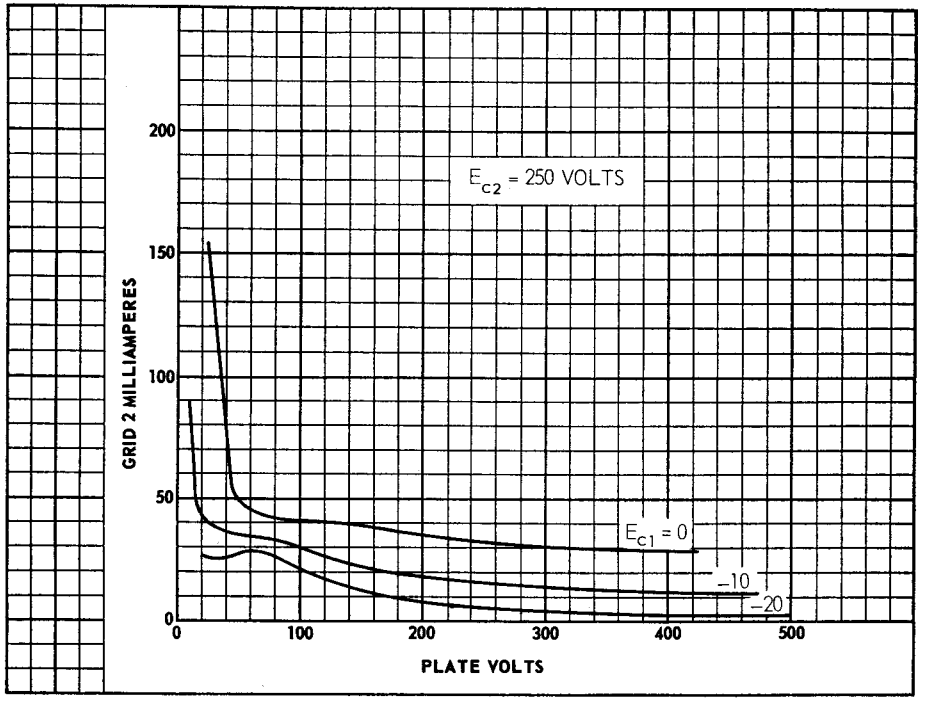
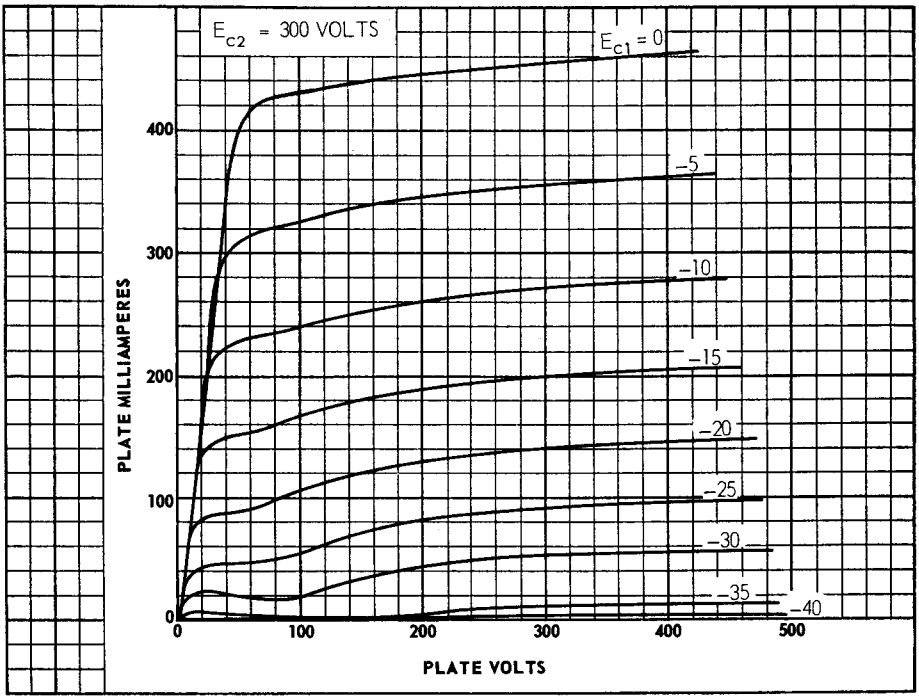
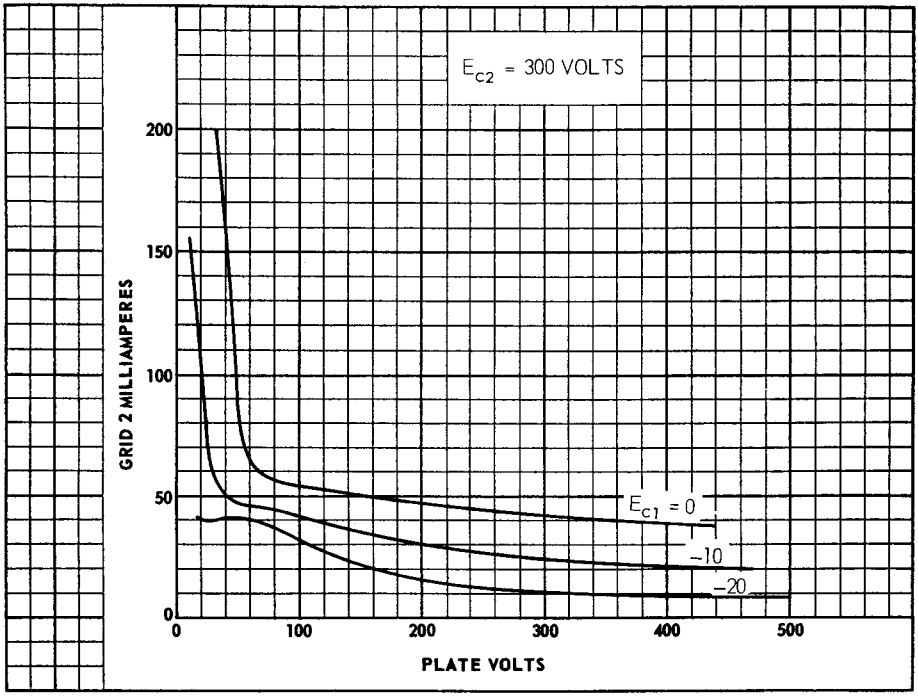
A
A SMALL RESISTOR IN SERIES WITH EACH CATHODE IS RECOMMENDED FOR BETTER MAINTENANCE OF BALANCE BETWEEN TUBES.


E_{c2} = 250 VOLTS
E_{c1} = 0
-5
-10
-15
-20
-25
-30
-35
PLATE MILLIAMPERES
0
100
200
300
400
PLATE VOLTS
0
100
200
300
400
500


E_{c2} = 250 VOLTS
E_{c1} = 0
-10
-20
GRID 2 MILLIAMPERES
0
50
100
150
200
PLATE VOLTS
0
100
200
300
400
500





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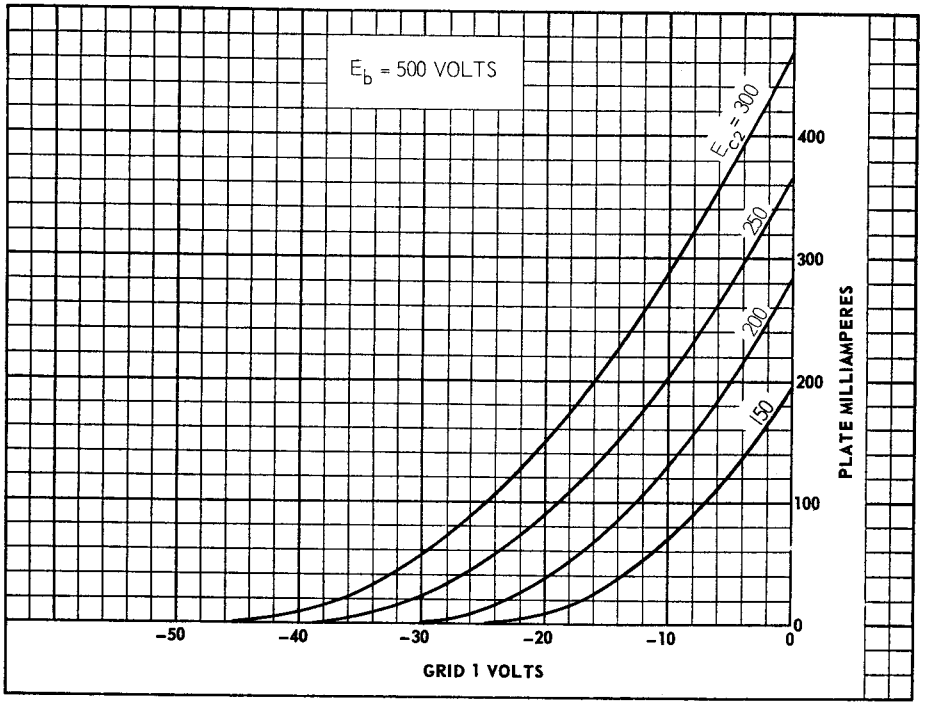
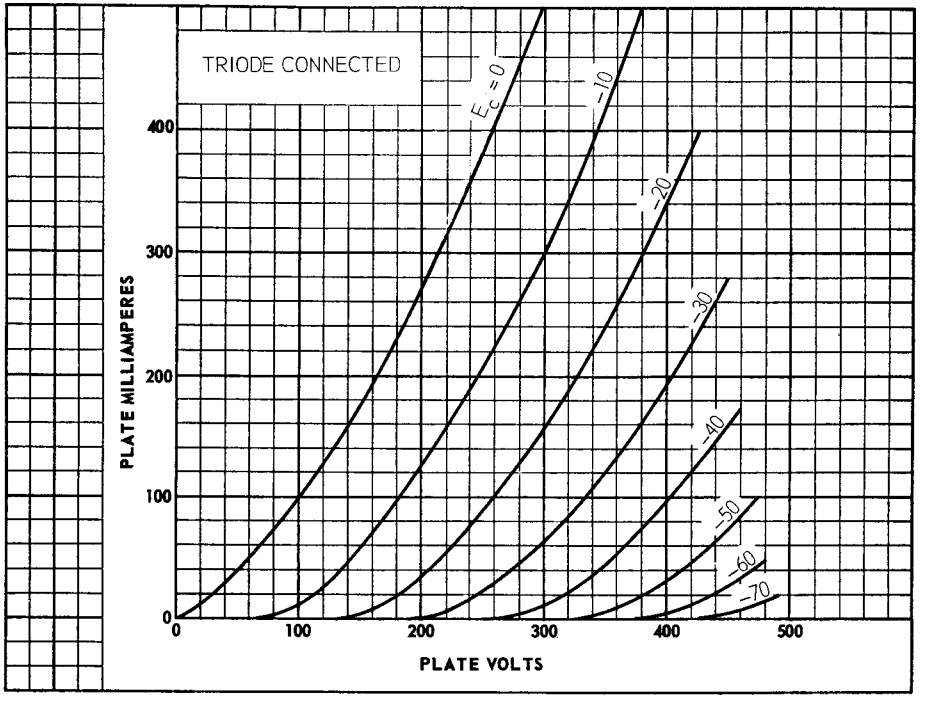
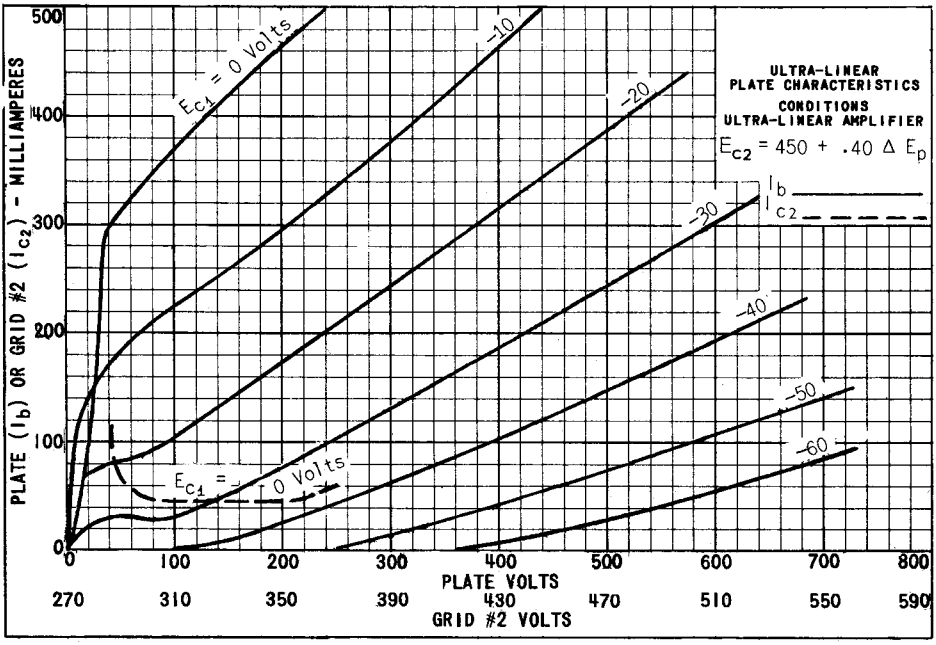
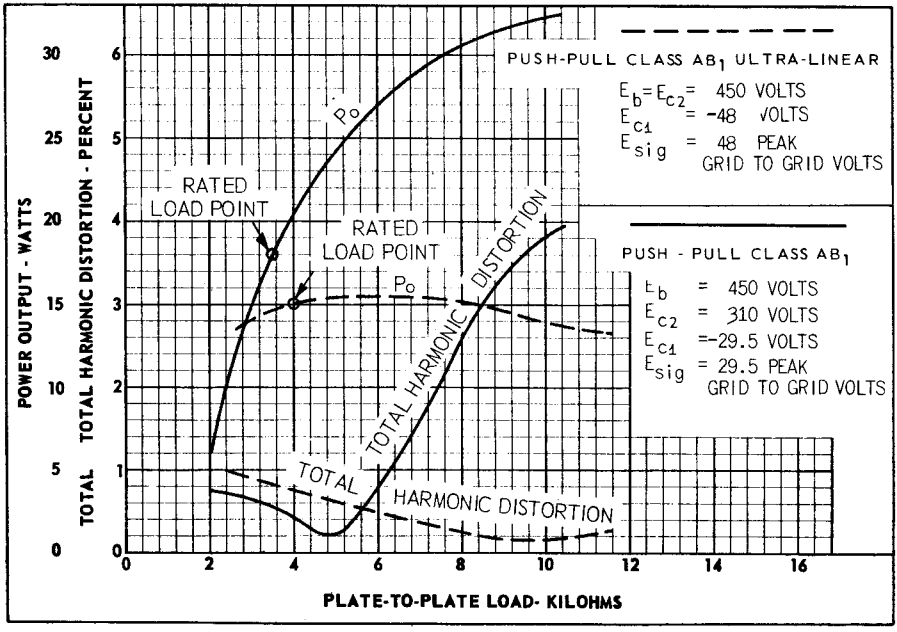
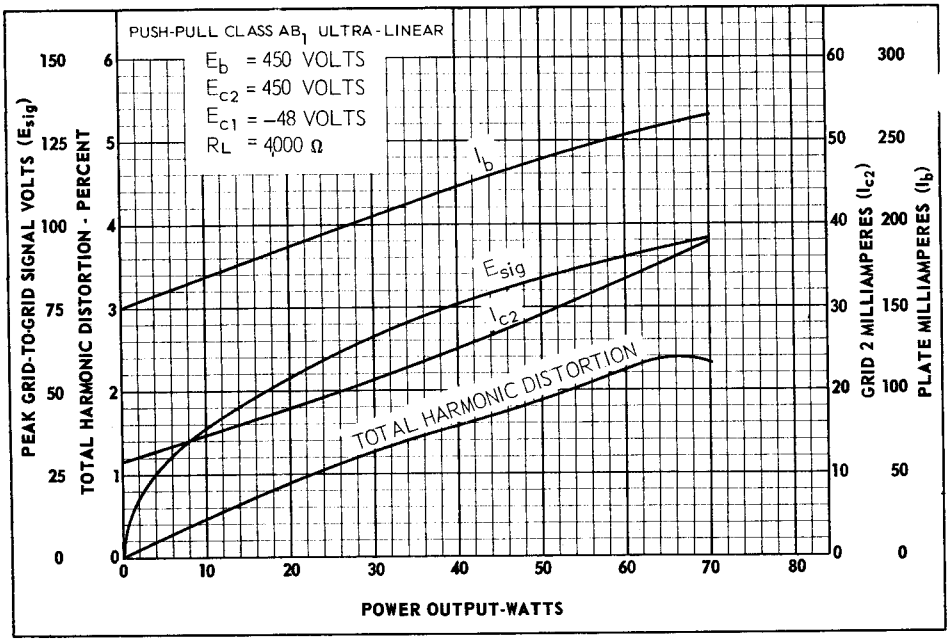

E_b = 500 VOLTS
E_{c2} = 300
250
200
150
400
300
200
100
0
PLATE MILLIAMPERES
−50
−40
−30
−20
−10
0
GRID 1 VOLTS

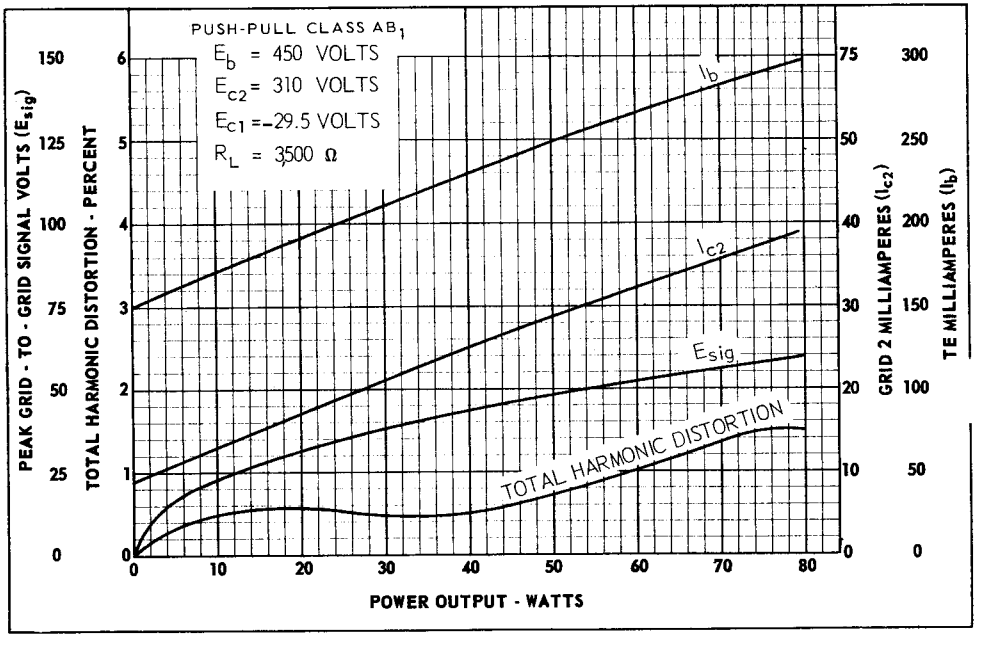

TRIODE CONNECTED
E_c = 0
−10
−20
−30
−40
−50
−60
−70
400
300
200
100
0
PLATE MILLIAMPERES
0
100
200
300
400
500
PLATE VOLTS





TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., MARCH 1, 1963 PLATE #6681


PUSH-PULL CLASS AB1 ULTRA-LINEAR
Eb = 450 VOLTS
Ec2 = 450 VOLTS
Ec1 = −48 VOLTS
RL = 4000 Ω
Ib
Esig
Ic2
TOTAL HARMONIC DISTORTION
PEAK GRID-TO-GRID SIGNAL VOLTS (Esig)
TOTAL HARMONIC DISTORTION - PERCENT
GRID 2 MILLIAMPERES (Ic2)
PLATE MILLIAMPERES (Ib)
POWER OUTPUT-WATTS


PUSH-PULL CLASS AB1
Eb = 450 VOLTS
Ec2 = 310 VOLTS
Ec1 = −29.5 VOLTS
RL = 3500 Ω
Ib
Ic2
Esig
TOTAL HARMONIC DISTORTION
PEAK GRID - TO - GRID SIGNAL VOLTS (Esig)
TOTAL HARMONIC DISTORTION - PERCENT
GRID 2 MILLIAMPERES (Ic2)
TE MILLIAMPERES (Ib)
POWER OUTPUT - WATTS

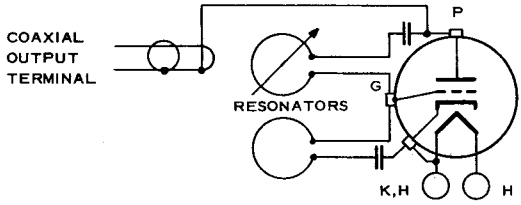
TUNG-SOL

TRIODE OSCILLATOR

THE 6562 IS AN INTEGRAL-CAVITY OSCILLATOR ASSEMBLY DESIGNED FOR TRANSMITTING SERVICE IN BATTERY POWERED RADIOSONDES OPERATING NEAR 1680 MC/S. IT INCORPORATES A PENCIL TRIODE WITH UNUSUALLY LOW HEATER POWER BATTERY DRAIN, RELATIVELY HIGH PLATE CIRCUIT EFFICIENCY, LOW FREQUENCY DRIFT AND A WEIGHT OF ONLY 0.8 OUNCES. THE OUTPUT FREQUENCY CAN BE ADJUSTED BETWEEN 1668 AND 1692 MC/S BY MEANS OF AN ADJUSTMENT SCREW POSITIONED IN THE PLATE RESONATOR. THE CATHODE RESONATOR IS PRE-TUNED FOR UNIFORM POWER OUTPUT OVER THE TUNEABLE FREQUENCY RANGE. THE COAXIAL TERMINAL IS LOOP COUPLED TO THE PLATE RESONATOR.

MECHANICAL DATA

TERMINAL CONNECTIONS



PHYSICAL DIMENSIONS — SEE OUTLINE AND NOTES

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.0	VOLTS	160	MA.
LIMITS OF APPLIED VOLTAGE			5.2 TO 6.6	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

FOR ALTITUDES UP TO 100,000 FEET

DC PLATE-TO-GRID VOLTAGE	120	VOLTS
PLATE DISSIPATION	3.6	WATTS
PLATE INPUT	4	WATTS
DC PLATE CURRENT	34	MA.
DC GRID CURRENT	8	MA.
AMBIENT TEMPERATURE	−55 TO +75	°C

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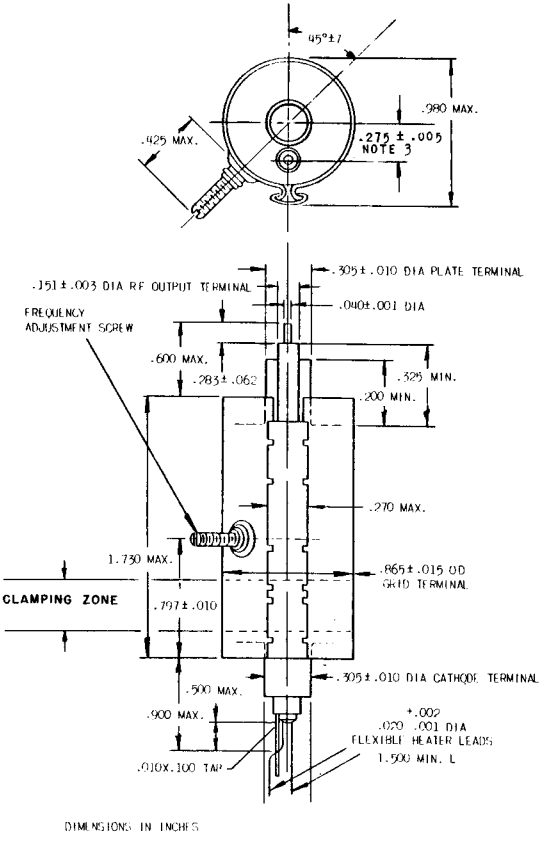
OUTLINE



NOTES:

1. THE AXES OF THE INNER AND OUTER CONDUCTORS OF THE COAXIAL OUTPUT TERMINAL COINCIDE WITHIN 0.010".

2. THE END OF THE INSULATOR IN THE COAXIAL OUTPUT TERMINAL ALIGNS WITH THE EDGE OF THE OUTER CONDUCTOR (0.151" ± 0.003" DIAMETER) WITHIN 0.005"

3. DISTANCE BETWEEN CENTER LINE OF PLATE TERMINAL AND CENTER LINE OF INNER CONDUCTOR (0.040" ± 0.001" DIAMETER).

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

OPERATION AS CLASS C OSCILLATOR

OPERATING FREQUENCY	1680	MC/S
CHARACTERISTICS IMPEDANCE OF COAXIAL OUTPUT TERMINAL (APPROX.)	50	Ω
DC PLATE SUPPLY VOLTAGE	105	VOLTS
GRID RESISTOR - ADJUSTED FOR STATED PLATE CURRENT AVG. VALUE	1800	Ω
DC PLATE CURRENT	25.5	MA.
DC GRID CURRENT	3.5	MA.
USEFUL POWER OUTPUT (APPROX.)	370	MW.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.	MAX.	
TUNING RANGE	1668	1692	MC/S
LOAD ADJUSTED FOR VOLTAGE STANDING WAVE RATIO		1.1	
HEATER CURRENT AT Ef = 5.2 V.	135	157	MA.
GRID RESISTOR - SEE NOTE	1300	2400	Ω
USEFUL POWER OUTPUT AT Ef = 5.2 V., Ebb = 95 V.	300	------	MW.

SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

LOW-PRESSURE VOLTAGE BREAKDOWN TEST

HIGH-FREQUENCY VIBRATION TEST

MILITARY SPECIFICATIONS SHORTS AND CONTINUITY TEST PERFORMED ON ALL DEVICES

TEMPERATURE-FREQUENCY PERFORMANCE

5 HOUR RADIOSONDE LIFE PERFORMANCE TEST

NOTE:

ADJUSTED TO GIVE PLATE CURRENT AS CLOSE AS POSSIBLE, BUT NOT EXCEEDING 33 MA. OPERATE WITH Ef = 6.6 V., Ebb = 117 V., PLATE LOAD RESISTANCE OF 50 Ω, FREQUENCY ADJUSTED TO 1660 +3, −1 MC/S.

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TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6587

MARCH 1964

HYDROGEN THYRATRON TYPE 6587

DESCRIPTION — The 6587 is a unipotential cathode three electrode glass envelope hydrogen thyratron designed for pulse modulator service.

This design may be put into operation in 3 minutes at −50° centigrade. Very careful attention has been exercised to place any serious resonances above 750 cycles. The reverse side of the anode is in direct contact with the atmosphere thereby greatly increasing its heat dissipation capability.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	5.7	6.3	6.8	Volts
Heater Current — Eh = 6.3 volts	9.6	—	11.6	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Delay Time		—	0.5	Microsecond
Anode Delay Time Drift		—	0.1	Microsecond
Time Jitter — Note 1		—	4	Nanoseconds
Anode Voltage Drop	75	—	250	Volts

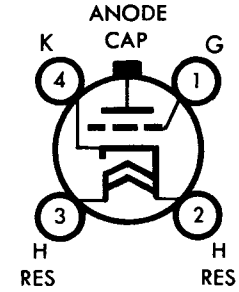
MECHANICAL DATA

Type of Cooling	Convection
Mounting Position	Any
Dimensions and Mounting	See page 2
Maximum Net Weight	11 Ounces
Base	JEDEC A4-18

See Page 2 for Outline Drawing

RATINGS — ABSOLUTE VALUES

	Min	Max	
Anode Voltage — Peak			
Forward	—	16,000	Volts
Inverse — Note 2	—	16,000	Volts
Cathode Current			
Peak	—	325	Amperes
Average	—	225	Milliamperes
RMS	—	6.3	Amperes
D-C Anode Voltage	3,500	—	Volts
Grid Voltage — Peak — Note 3	200	300	Volts
Heating Factor — epy x ib x prr	—	3.9×10^9	
Current Rate of Rise	—	1,500	Amperes per microsecond
Ambient Temperature	−50°	+90°	Centigrade
Shock (Navy Flyweight Machine)		24	Degrees (360 G's)



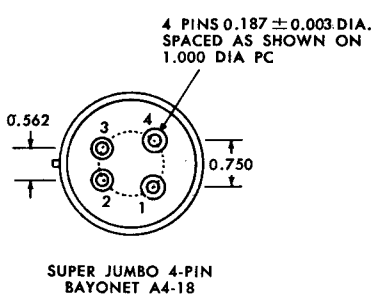
ENVIRONMENTAL TEST

Vibration:

0.1 inch double amplitude	5-20 cps
0.62 G	20-35 cps
0.01 inch double amplitude	35-100 cps
5.0 G	100-750 cps

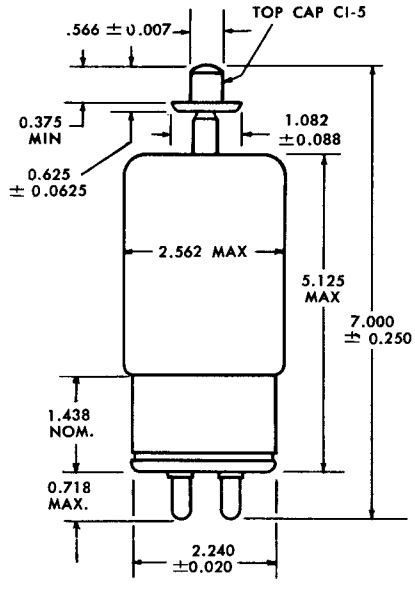
NOTES:

1. The time jitter limit as stated is the maximum allowable variation in firing time measured at 50 percent of pulse amplitude after the tube has been operating for at least 60 seconds.
2. In pulse operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration, shall not exceed 5 kilovolts during the 25 microseconds after the pulse.
3. The driver pulse is measured at the tube socket with the thyratron grid disconnected. Time of rise equals 0.5 microsecond maximum, grid pulse duration equals 2 microsecond minimum, and impedance of driver circuit is between 50 ohms and 500 ohms.



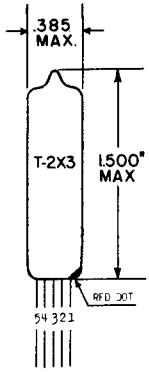
SUPER JUMBO 4-PIN
BAYONET A4-18

NOTE: 1. CLAMPING PERMISSIBLE IN AREA OF BASE AND UP TO 2½" ABOVE TOP OF BASE
2. ALL DIMENSIONS IN INCHES



TUNG-SOL

OUTLINE DRAWING
JEDEC 2-1



GLASS BULB
BULB ENTIRELY COATED WITH METALLIC SHIELD CONNECTED TO LEAD #3

COLOR DOT IS ADJACENT TO LEAD #1

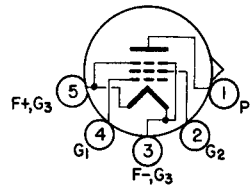
PENTODE

SUBMINIATURE
FILAMENTARY TYPE

FOR RF APPLICATIONS

ANY MOUNTING POSITION

BASING DIAGRAM



BOTTOM VIEW
5 FLEXIBLE IN-LINE TINNED LEADS 0.016" DIA. 0.048" CENTER-TO-CENTER

THE 6611 IS A FILAMENTARY TYPE, FULLY SHIELDED PENTODE IN THE T-2 X 3 SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE IN RF APPLICATIONS WHERE ECONOMY OF SPACE, WEIGHT AND BATTERY DRAIN IS ESSENTIAL.

DIRECT INTERELECTRODE CAPACITANCES

GRID 1 TO PLATE	MAX. 0.008	pf
INPUT	4.0	pf
OUTPUT	4.0	pf

FILAMENT CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25	VOLTS	20	MA
LIMITS OF APPLIED VOLTAGE			1.25 ± 0.35	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

PLATE VOLTAGE	50	VOLTS
GRID 2 VOLTAGE	50	VOLTS
PLATE DISSIPATION	0.10	WATT
GRID 2 DISSIPATION	0.02	WATT
TOTAL CATHODE CURRENT	1.9	MA

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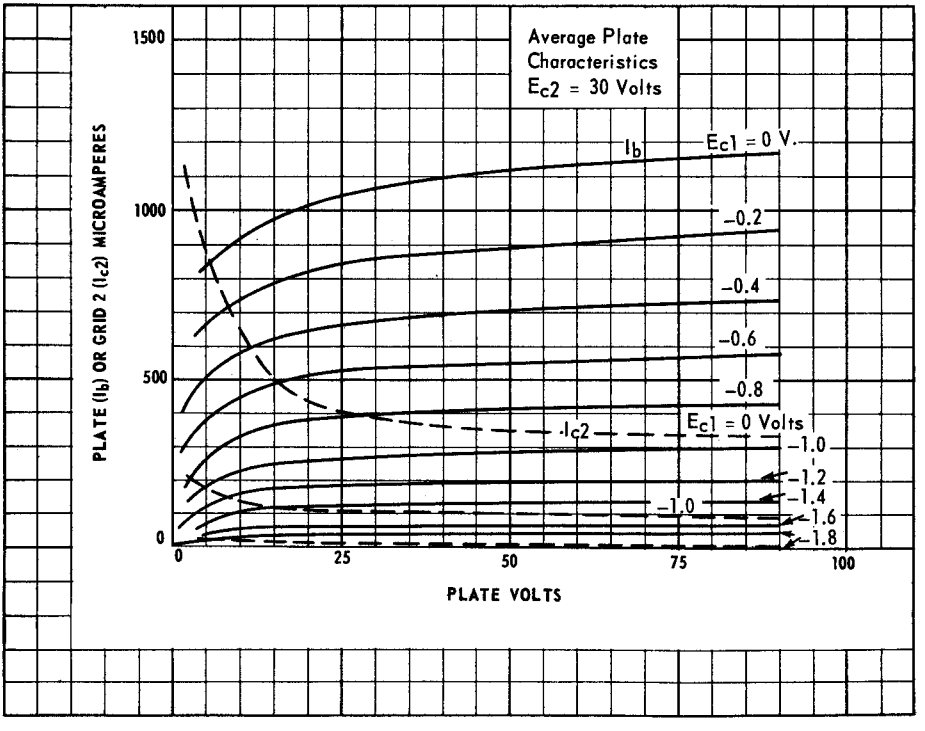
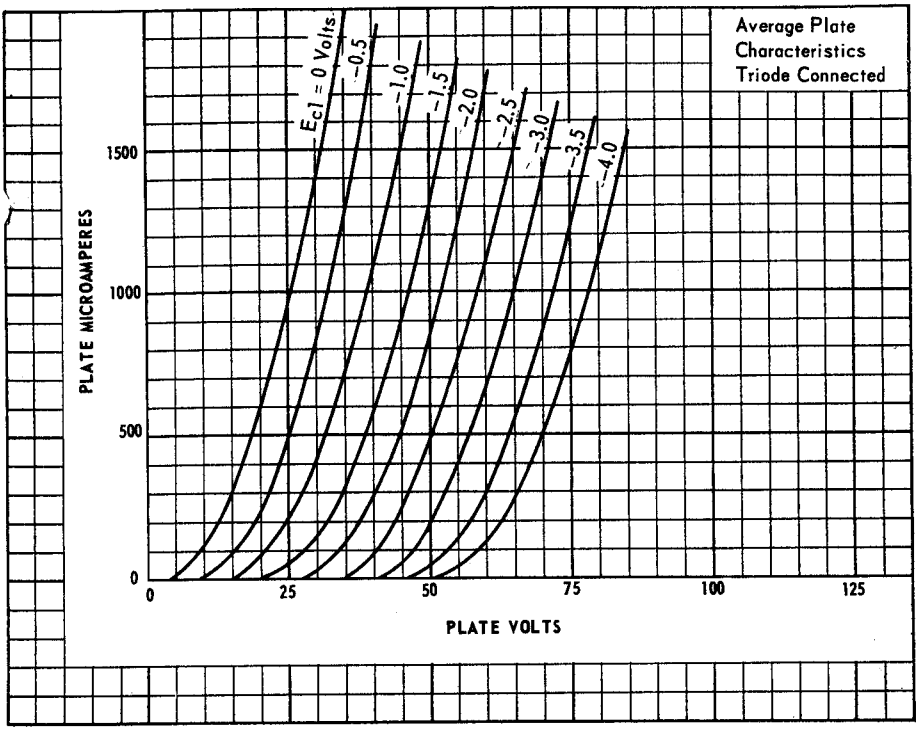
CHARACTERISTICS AND TYPICAL OPERATION

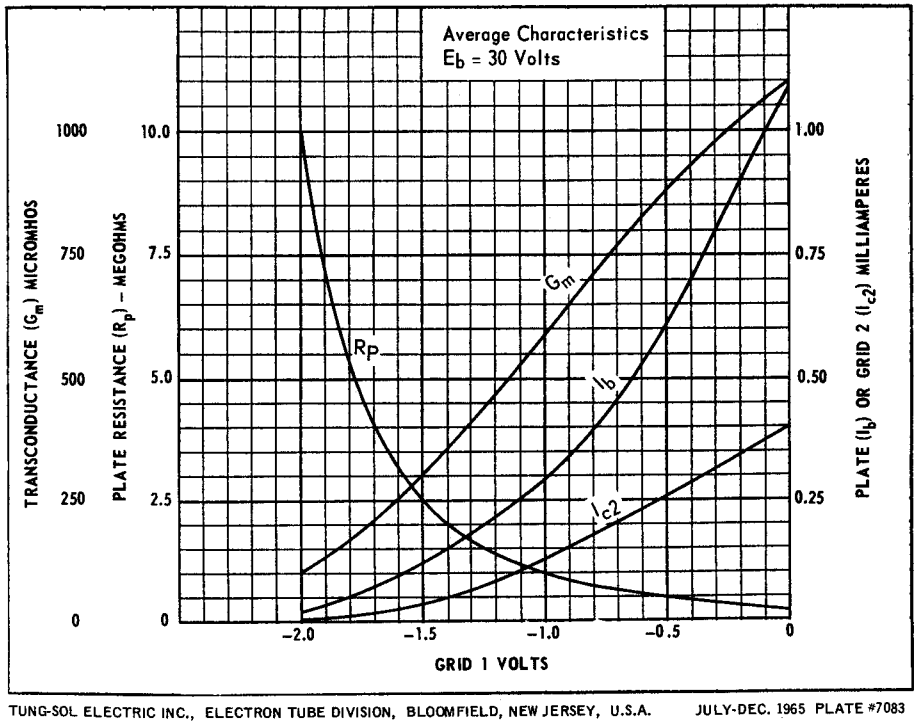
CLASS A_1 AMPLIFIER

PLATE VOLTAGE	30	45	VOLTS
GRID 2 VOLTAGE	30	*45	VOLTS
GRID 1 VOLTAGE (GRID RESISTOR = 5 MEGOHMS)	0	0	VOLTS
PLATE CURRENT	1.0	1.0	MA
GRID 2 CURRENT	0.35	0.35	MA
TRANSCONDUCTANCE	1,000	1,000	μMHOS
PLATE RESISTANCE – APPROX.	0.4	0.4	MEGOHM
GRID 1 VOLTAGE (APPROX.) FOR G_m = 10 μMHOS	–3.0	–	VOLTS

*GRID 2 SUPPLY VOLTAGE THROUGH SERIES 47,000 OHMS SUPPLY RESISTOR.



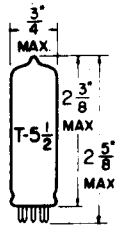

Average Plate
Characteristics
Triode Connected
E_{c1} = 0 Volts
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
PLATE MICROAMPERES
1500
1000
500
0
0
25
50
75
100
125
PLATE VOLTS


Average Characteristics
E_b = 30 Volts
TRANSCONDUCTANCE (G_m) MICROMHOS
1000
750
500
250
0
PLATE RESISTANCE (R_p) – MEGOHMS
10.0
7.5
5.0
2.5
0
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
1.00
0.75
0.50
0.25
G_m
R_P
I_b
I_{c2}
-2.0
-1.5
-1.0
-0.5
0
GRID 1 VOLTS

TUNG-SOL

VOLTAGE REGULATOR

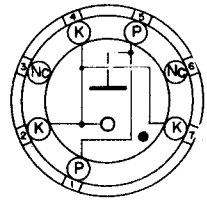
MINIATURE TYPE



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

SMALL-BUTTON MINIATURE
7 PIN BASE

THE 6627/0B2WA IS A MINIATURE, TWO ELECTRODE, INERT-GAS-FILLED, COLD CATHODE TUBE FOR USE AS A VOLTAGE REGULATOR. IT MAINTAINS PRACTICALLY CONSTANT OPERATING VOLTAGE OVER A CURRENT RANGE OF 5 TO 30 MILLIAMPERES. IT HAS BEEN DESIGNED TO GIVE EXTREMELY SMALL VOLTAGE DRIFT THROUGHOUT LIFE BY CONTROLLED MANUFACTURING PROCESSES. THIS TUBE HAS BEEN SPECIALLY DESIGNED TO MAINTAIN STABLE OPERATING VOLTAGES THROUGH LIFE, EVEN IN APPLICATIONS WHICH REQUIRE TUBES TO OPERATE CONTINUOUSLY UNDER ENVIRONMENTAL CONDITIONS WHICH RAISE THE BULB TEMPERATURE TO A MAXIMUM OF 150°C

OVER THE RANGE OF 6 TO 10 MILLIAMPERES, THIS TUBE EXHIBITS REFERENCE TUBE CHARACTERISTICS. THE 6627/0B2WA ALSO HAS IMPROVED CHARACTERISTICS FOR SHOCK, VIBRATION, AND DARK BREAKDOWN VOLTAGE.

ELECTRICAL DATA

CATHODE	COLD

MECHANICAL DATA

MOUNTING POSITION	ANY	
MAXIMUM OVERALL LENGTH	2 5/8	INCHES
MAXIMUM SEATED LENGTH	2 3/8	INCHES
MAXIMUM DIAMETER	3/4	INCHES
WEIGHT (APPROX.)	0.3	OUNCES
BULB	T-5 1/2	
BASE	SMALL-BUTTON MINIATURE 7 PIN (JEDEC E7-1)	

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TUNG-SOL

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RATINGS
ABSOLUTE VALUES

MAXIMUM DC CATHODE CURRENT	30	MA.
MINIMUM DC CATHODE CURRENT	5	MA.
MAXIMUM BULB TEMPERATURE	150	°C
MINIMUM AMBIENT TEMPERATURE	-55	°C
MAXIMUM ALTITUDE	120 000	FEET
MAXIMUM INVERSE VOLTAGE	-50.	VOLTS
SHOCK IMPACT	450	G/ms
VIBRATION FATIGUE	2.5	G

CIRCUIT VALUES

MAXIMUM SHUNT CAPACITOR	0.1	μf
SERIES RESISTOR	SEE OPERATION NOTES	

ADDITIONAL TESTS TO INSURE RELIABILITY
RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450 G/msec).

FATIGUE: 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN OF 3 MUTUALLY PERPENDICULAR PLANES (2.5 G).

POST SHOCK AND FATIGUE LIMITS:

IONIZATION VOLTAGE (MAX.)	130	VDC
TUBE VOLTAGE DROP (5. & 30. MA.)	105 TO 111	VDC
REGULATION (5. TO 30. MA.) (MAX.)	2.5	VDC

SURVIVAL RATE LIFE TEST (100 HOURS): END POINT:

CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALVE	5	PERCENT
VOLTAGE REPEATABILITY (MAX.)	0.4	VDC

INTERMITTENT LIFE TEST: END POINTS (500 HOURS):

CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX.)	3	PERCENT
TUBE VOLTAGE DROP	103 TO 113	VDC.
REGULATION (MAX.)	3.0	VDC.
IONIZATION VOLTAGE (MAX.)	130	VDC

END POINTS (1000 HOURS):

CHANGE IN TUBE VOLTAGE DROP FROM INITIAL VALUE (MAX.)	4	PERCENT
TUBE VOLTAGE DROP	103 TO 116	VDC
REGULATION (MAX.)	3.0	VDC
IONIZATION VOLTAGE (MAX.)	130	VDC
VOLTAGE REPEATABILITY (MAX.)	0.4	VDC

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TUNG-SOL

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EQUIPMENT DESIGN AND RANGE VALUES

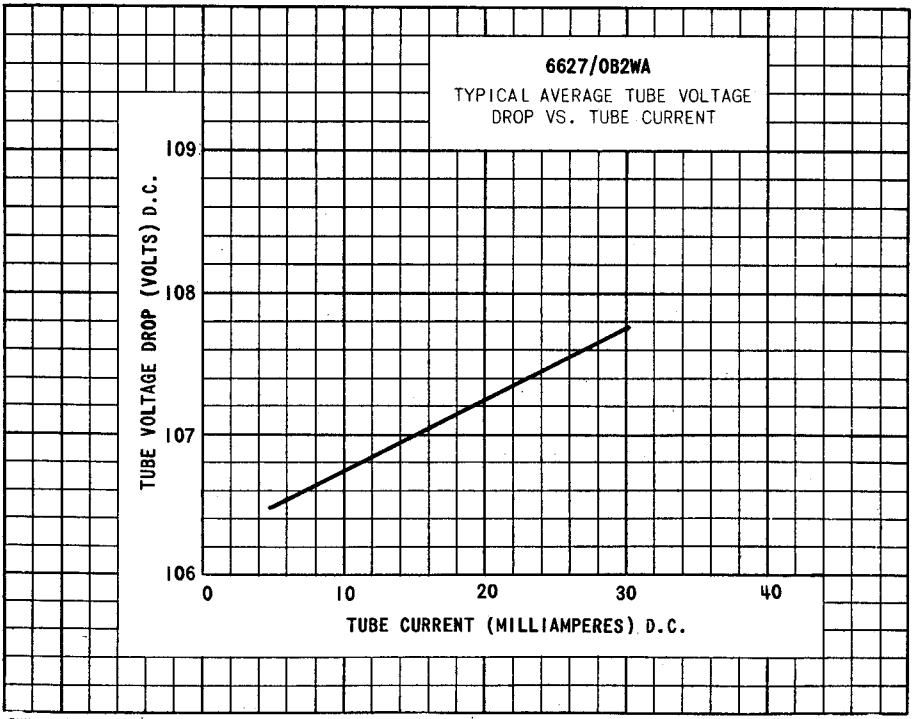
	MIN.	AVG.	MAX.	
DC ANODE SUPPLY VOLTAGE IN DARKNESS	130[A]	---	---	VOLTS
DC ANODE SUPPLY VOLTAGE IN LIGHT	130[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	118	130	VOLTS
TUBE VOLTAGE DROP (1) AT 5.MA.	103	107	---	VOLTS
TUBE VOLTAGE DROP (2) AT 30. MA.	---	108	116	VOLTS
REGULATION	---	1.1	2.5	VOLTS
VOLTAGE JUMP[B]	---	0	100	MVOLTS
VOLTAGE REPEATABILITY[C]	---	0.1	0.4	VOLTS
OSCILLATION (AURAL CHECK)	---	---	---	
NOISE	---	0	5.0	MVOLTS
LEAKAGE CURRENT (E_b= 50V, R_p=3000Ω)	---	0	5.0	μAMPS
MAXIMUM SHUNT CAPACITOR	---	---	0.1	μf
SERIES RESISTOR	D	---	---	
MAXIMUM CURRENT THROUGH INTERCONNECTED LEADS	---	---	1.0	AMP.

[A] TO ASSURE STARTING THROUGHOUT TUBE LIFE, THE SUPPLY VOLTAGE SHOULD NOT BE LESS THAN THIS VALUE.

[B] THE MAXIMUM VOLTAGE FLUCTUATION AT ANY CURRENT LEVEL WITHIN THE CURRENT RANGE OF 6 TO 10 MA.

[C] TUBE IS CYCLED ONE MINUTE ON AND ONE MINUTE OFF FOR FIVE CYCLES. READINGS ARE TAKEN INITIALLY AND AT THE END OF EACH "ON" PERIOD.

[D] SUFFICIENT SERIES RESISTANCE MUST BE USED TO LIMIT THE CURRENT TO A MAXIMUM OF 30. MA. AT THE HIGHEST ANODE SUPPLY VOLTAGE AND TO LIMIT THE CURRENT TO A MINIMUM OF 5. MA. AT THE LOWEST ANODE SUPPLY VOLTAGE.



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OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT V_1 IS THE UNREGULATED SUPPLY VOLTAGE, V_2 IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R_1 IS THE SERIES LIMITING RESISTOR, R_2 IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (V_1 MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (V_2 MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R_1 > \frac{V_1 \text{ MAX.} - V_2 \text{ MIN.}}{I_T \text{ MAX.} + I_L \text{ MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R_1 IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R_1 < \frac{V_1 \text{ MIN.} - V_2 \text{ MAX.}}{I_T \text{ MIN.} + I_L \text{ MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$V_1 \text{ MIN.} \frac{R_2}{R_1 + R_2} > V \text{ STARTING}$$

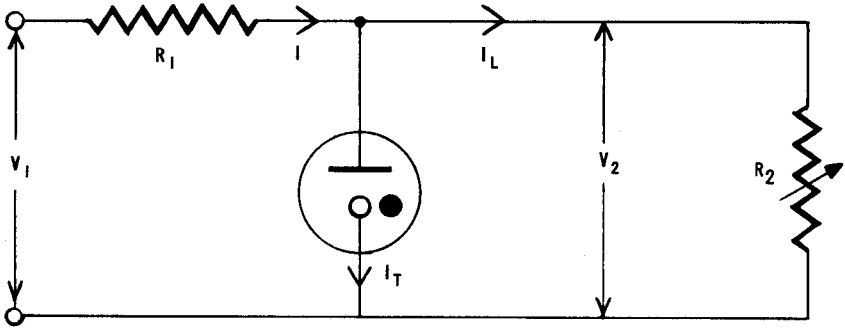

FIGURE 1

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TUNG-SOL

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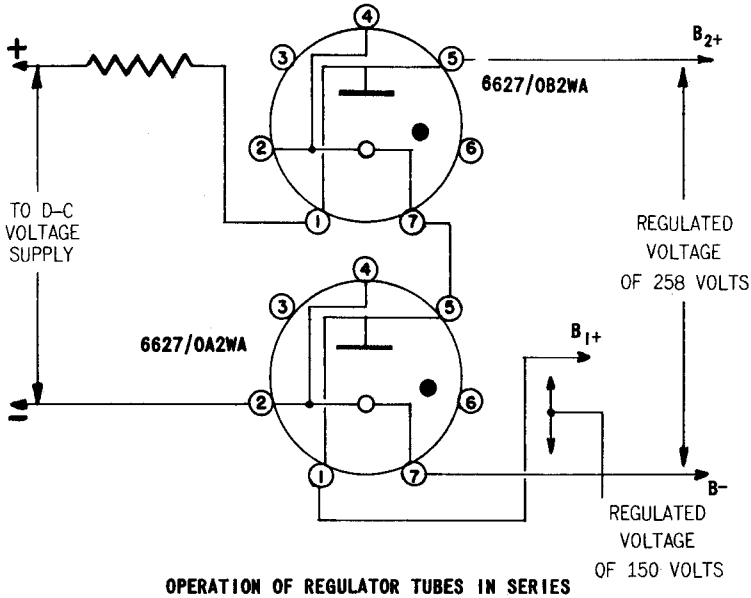
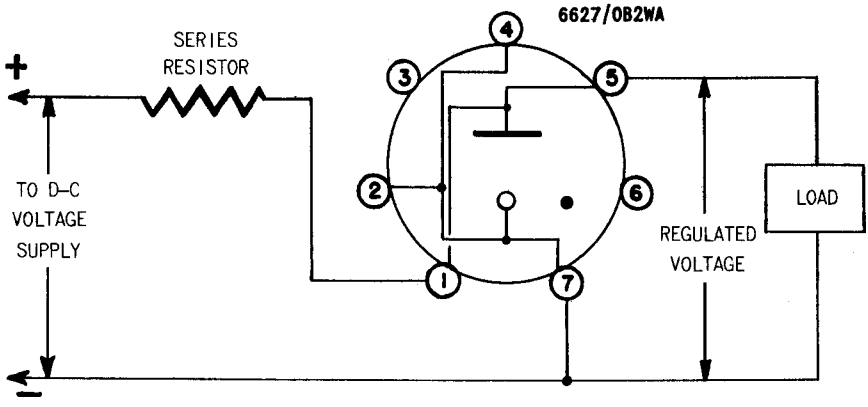


OPERATION OF REGULATOR TUBES IN SERIES
FIGURE 2



TYPICAL CIRCUIT FOR VOLTAGE REGULATOR
FIGURE 3

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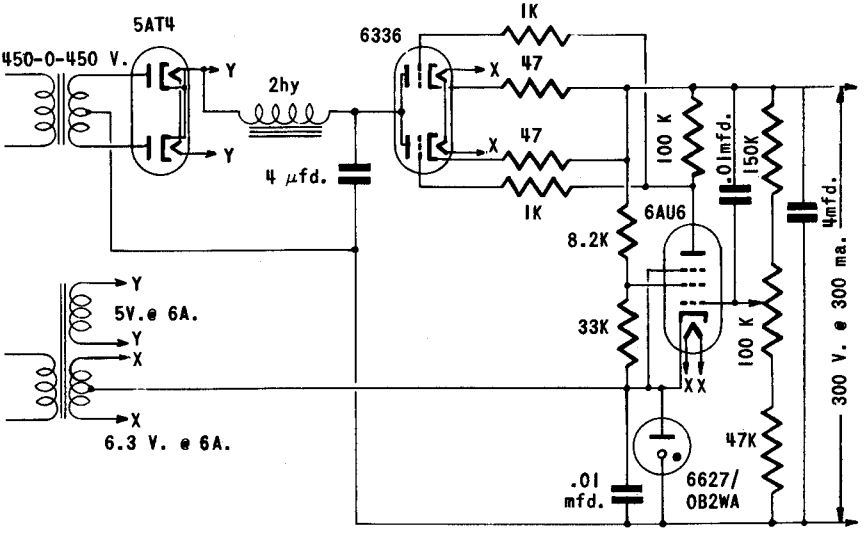
WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

CIRCUITS WHICH HAVE A CAPACITOR IN SHUNT WITH THE 6627/0B2WA SHOULD BE LIMITED IN VALUE TO 0.1 μfd; LARGER VALUES MAY CAUSE THE TUBE TO OSCILLATE.

OPERATION OF THE 6627/0B2WA IN PARALLEL IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH 6627/0B2WA TO EQUALIZE DIVISION OF THE CURRENT. HOWEVER, IT SHOULD BE NOTED THAT WHILE THIS TYPE OF OPERATION ENABLES ONE TO HANDLE MORE LOAD CURRENT, IT REDUCES THE REGULATION THAT CAN BE OBTAINED.

IF IT IS DESIRED TO OBTAIN HIGHER REGULATING VOLTAGES, TUBES MAY BE OPERATED IN SERIES AS INDICATED IN FIGURE 2. HOWEVER, CARE SHOULD BE TAKEN TO SEE THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES.



TYPICAL APPLICATION OF 6627/0B2WA
USED IN VOLTAGE REGULATED POWER SUPPLY
FIGURE 4

TUNG-SOL

PENTODE

MINIATURE TYPE

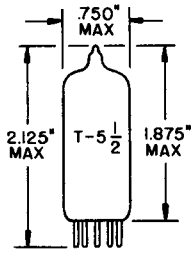
FOR

MOBILE COMMUNICATIONS

EQUIPMENT

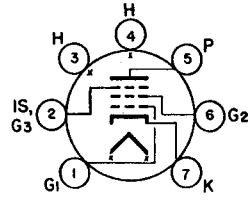
COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7CC

THE 6660 IS A MINIATURE REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER. FEATURES OF THE TUBE INCLUDE LOW GRID-PLATE CAPACITANCE AND RELATIVELY HIGH TRANSCONDUCTANCE. ITS ELECTRICAL CHARACTERISTICS ARE ESSENTIALLY EQUIVALENT TO THOSE OF THE 6BA6.

THE 6660 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALTHOUGH THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID 1 TO PLATE, MAXIMUM	0.0035	0.0035	pf
INPUT	5.5	5.5	pf
OUTPUT	5.5	5.0	pf

[A] WITH EXTERNAL SHIELD 316 CONNECTED TO PIN 7.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	300	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3±1.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PLATE DISSIPATION	3.3	WATTS
GRID 2 DISSIPATION	0.65	WATTS

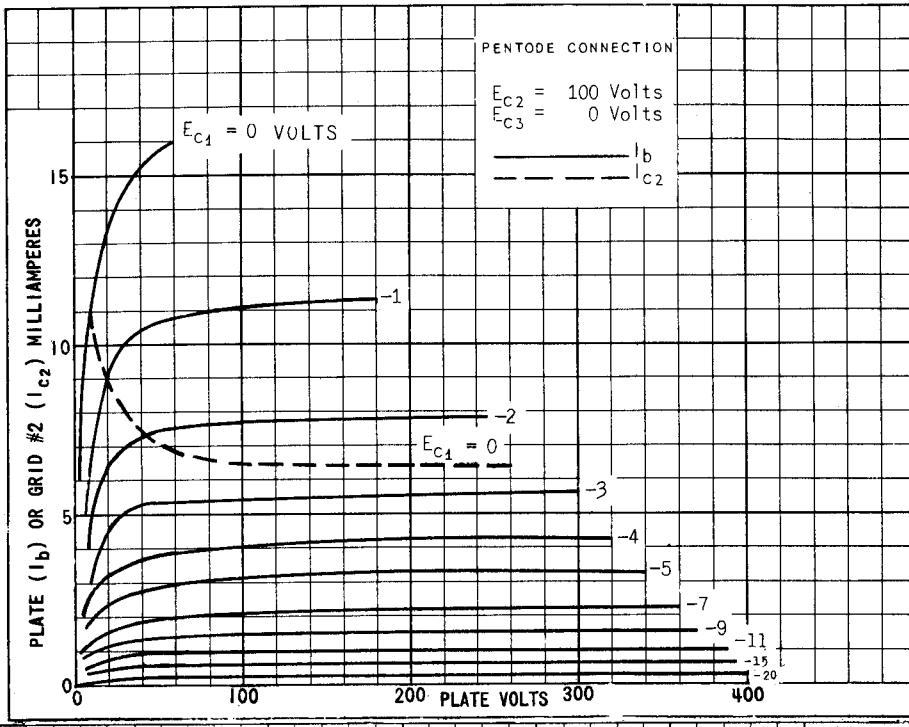
TYPICAL OPERATING CHARACTERISTICS

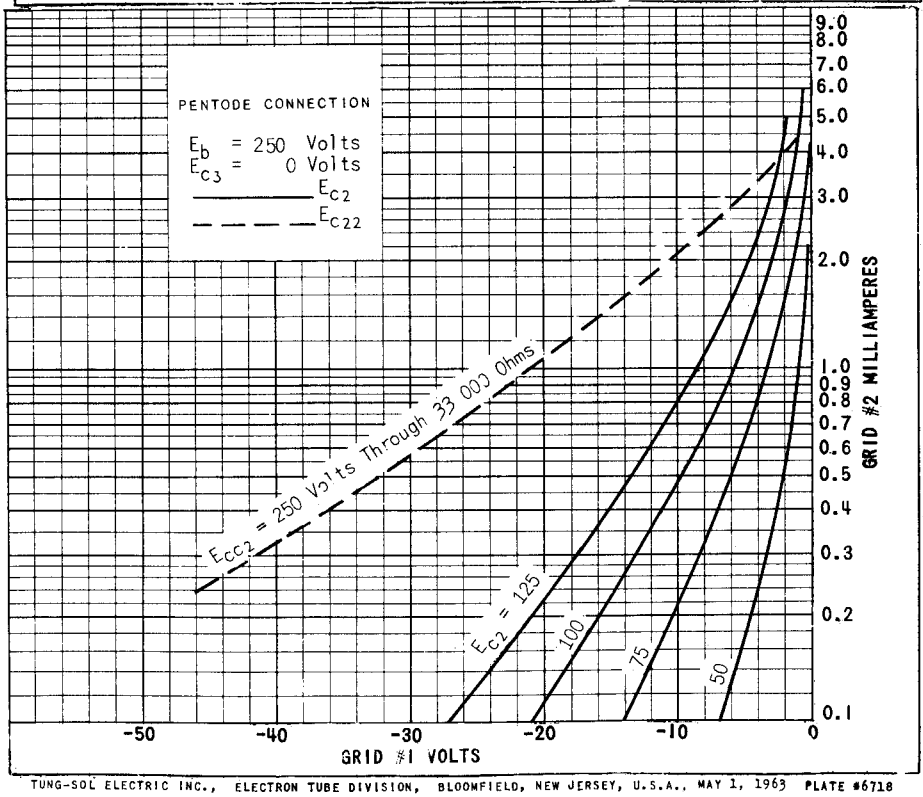
CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID 3 VOLTAGE	0	0	VOLTS
GRID 2 VOLTAGE	100	100	VOLTS
CATHODE-BIAS RESISTOR	68	68	OHMS
PLATE CURRENT	10.8	11	MA.
GRID 2 CURRENT	4.4	4.2	MA.
TRANSCONDUCTANCE	4,300	4,400	μMHOS
PLATE RESISTANCE, APPROXIMATE	0.25	1.0	MEGOHMS
GRID 1 VOLTAGE, APPROXIMATE Gm = 40 μMHOS	−20	−20	VOLTS

SPECIAL TESTS AND RATINGS

HEATER-CYCLING RATING





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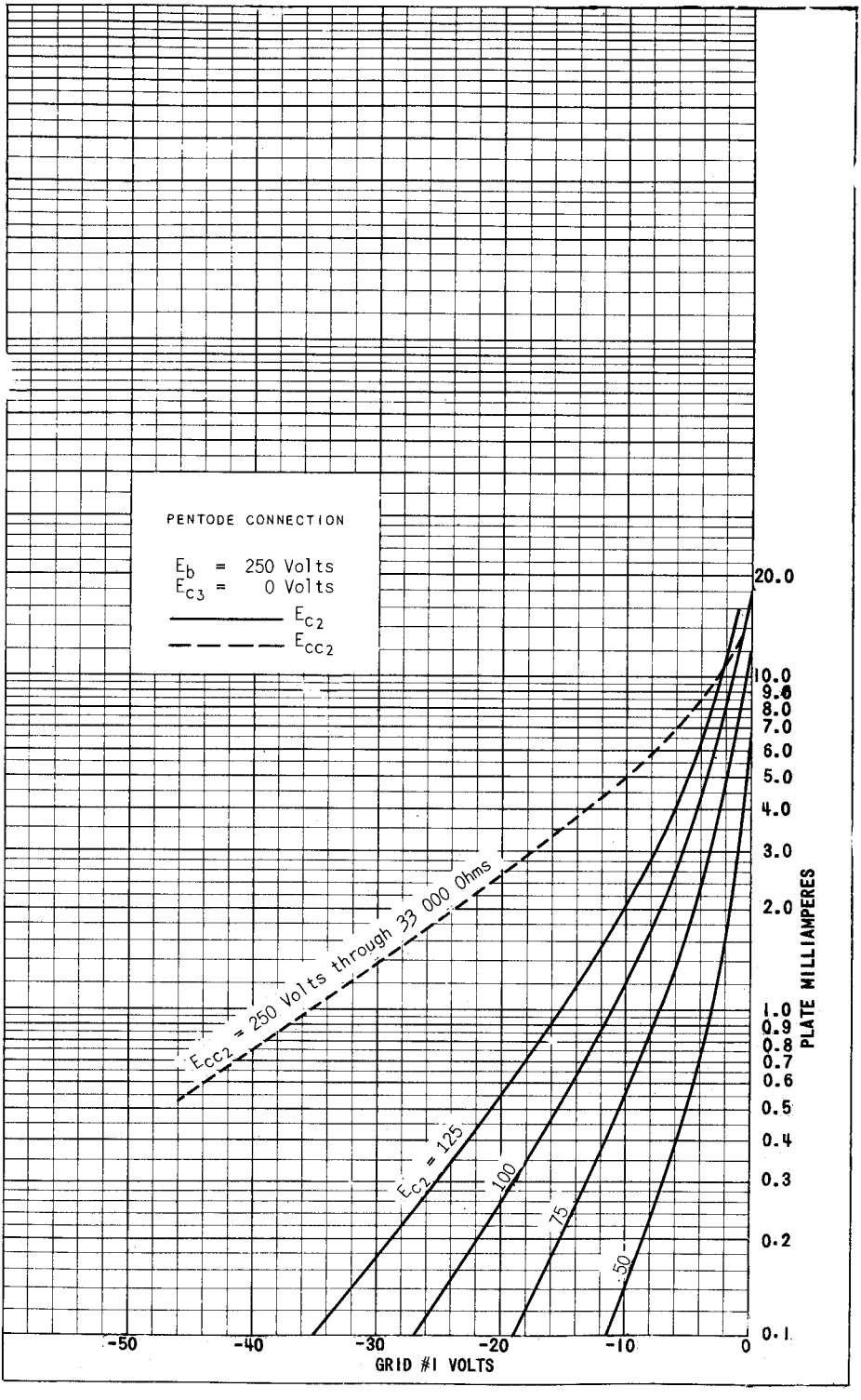
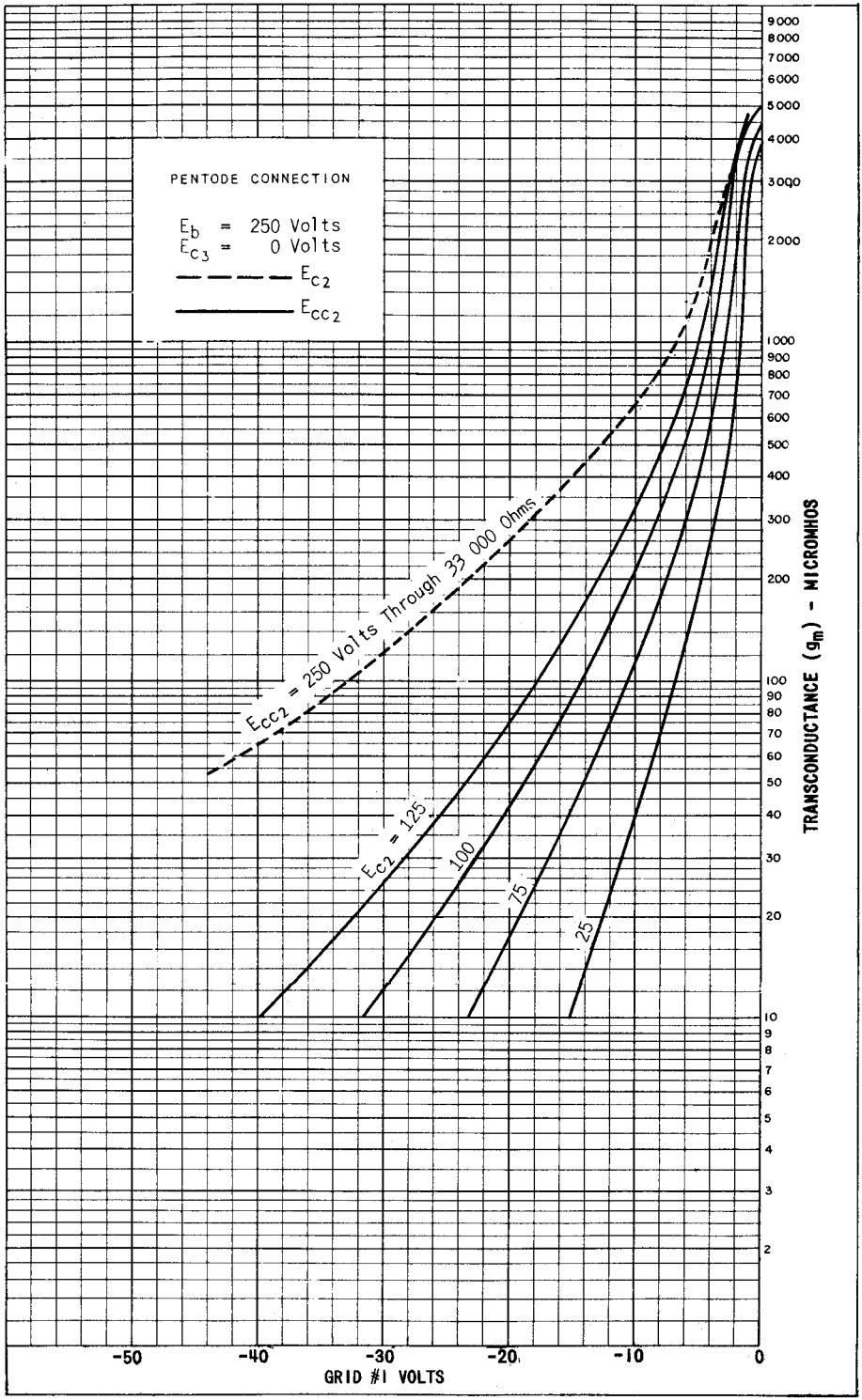

PENTODE CONNECTION
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2}
E_{cc2}
E_{cc2} = 250 Volts through 33 000 Ohms
E_{c2} = 125
100
75
50
20.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
PLATE MILLIAMPERES
-50
-40
-30
-20
-10
0
GRID #1 VOLTS



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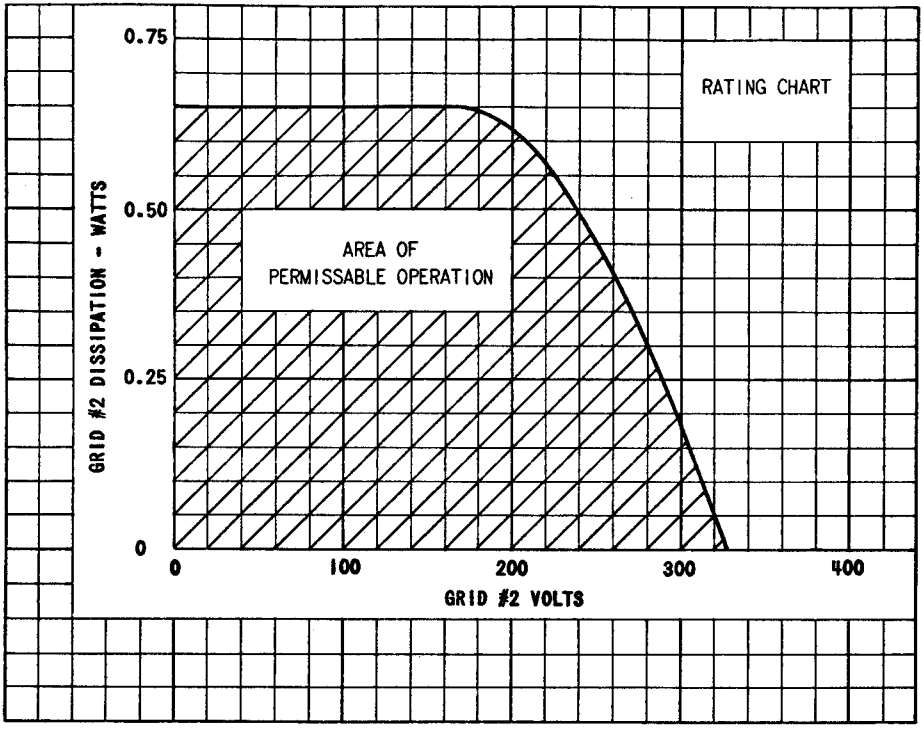

RATING CHART
AREA OF
PERMISSABLE OPERATION
GRID #2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
GRID #2 VOLTS

TUNG-SOL

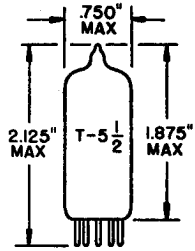
PENTODE

MINIATURE TYPE

FOR

MOBILE COMMUNICATIONS

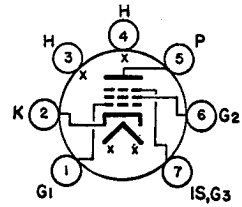
EQUIPMENT



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6661 IS A MINIATURE REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER.

THE 6661 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALTHOUGH THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

THE ELECTRICAL CHARACTERISTICS OF THE 6661 ARE EQUIVALENT TO THE 6BH6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID 1 TO PLATE, MAXIMUM	0.0035	0.0035	pf
INPUT	5.4	5.4	pf
OUTPUT	4.4	4.4	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	150	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3±1.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS

[A] WITH EXTERNAL SHIELD 316 CONNECTED TO PINS 2 AND 7.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PLATE DISSIPATION	3.3	WATTS
GRID 2 DISSIPATION	0.55	WATTS

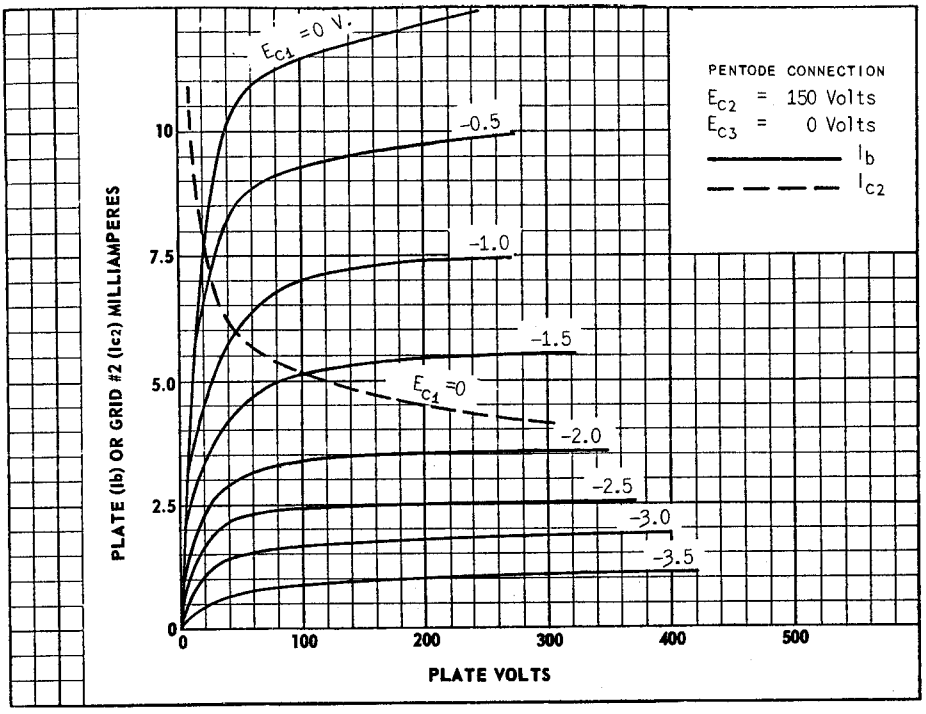
TYPICAL OPERATING CHARACTERISTICS

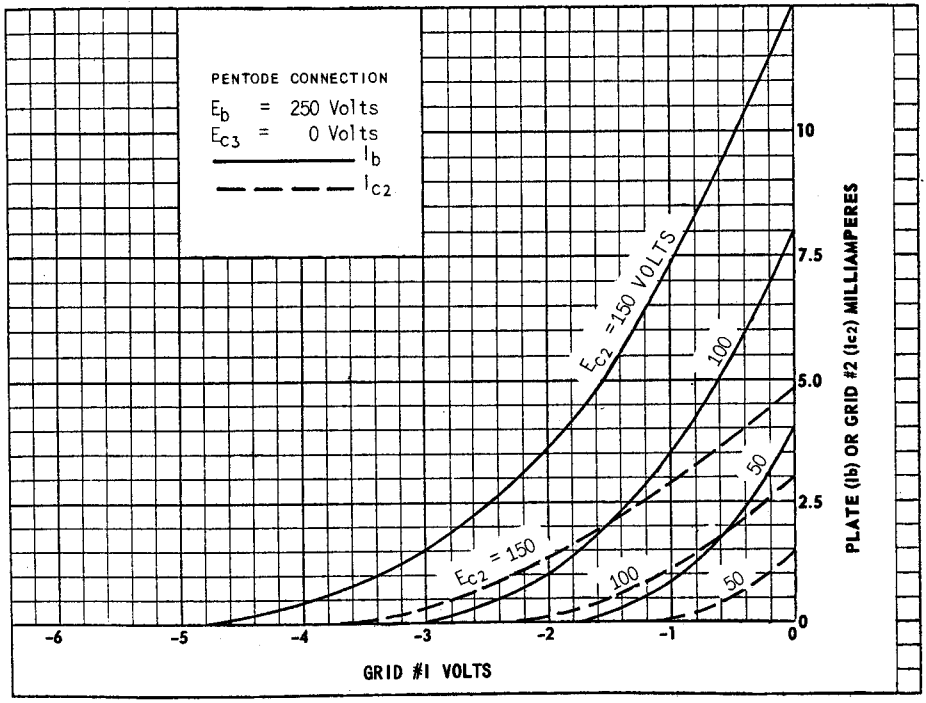
CLASS A1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
GRID 3 VOLTAGE	0	VOLTS
GRID 2 VOLTAGE	150	VOLTS
CATHODE-BIAS RESISTOR	100	OHMS
PLATE CURRENT	7.4	MA.
GRID 2 CURRENT	2.6	MA.
TRANSCONDUCTANCE	4,600	μMHOS
PLATE RESISTANCE, APPROX.	1.4	MEGOHMS
GRID 1 VOLTAGE (APPROX.) FOR I_b = 10 μAMPS.	-7.7	VOLTS

SPECIAL TESTS AND RATINGS

HEATER-CYCLING RATING





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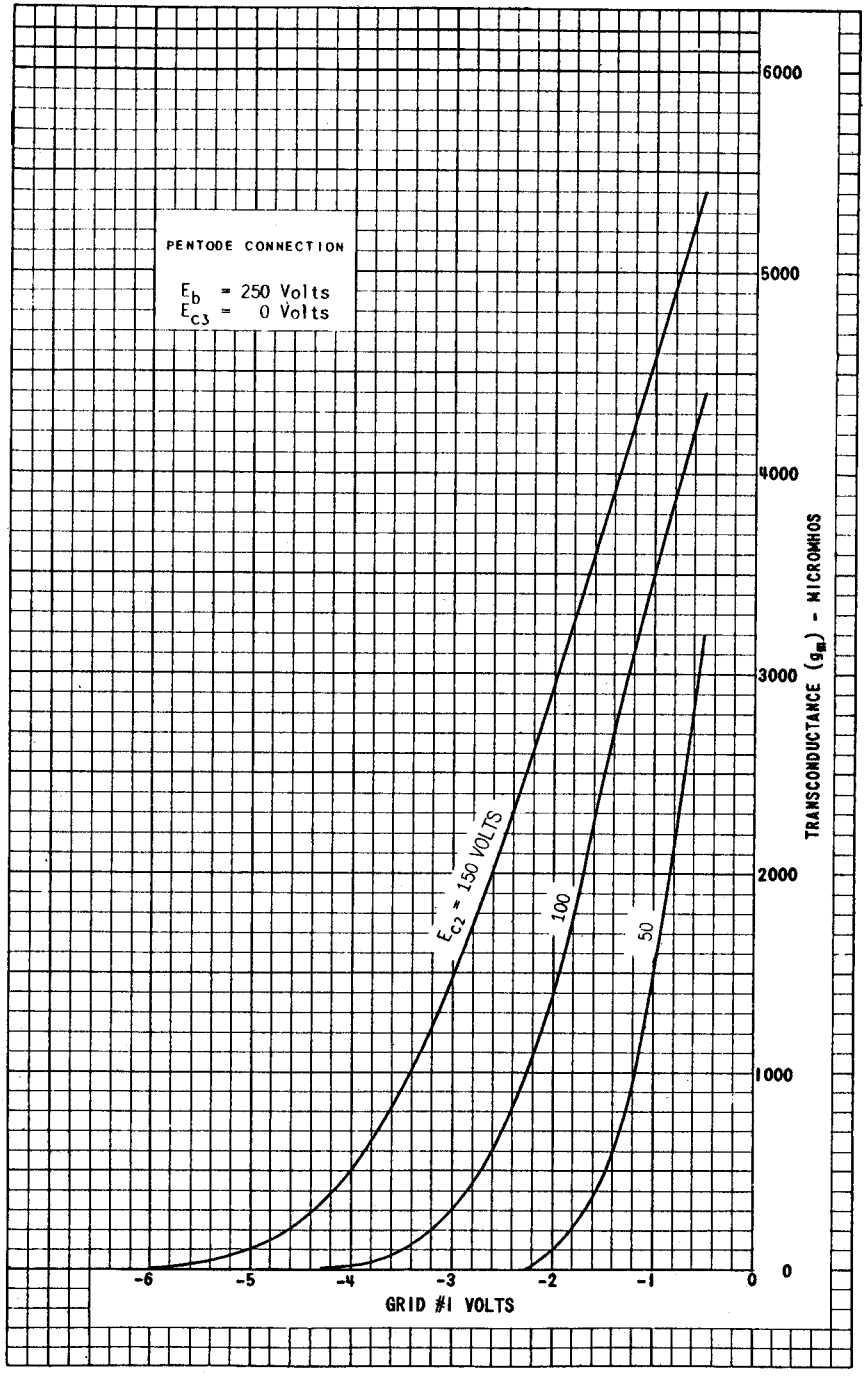
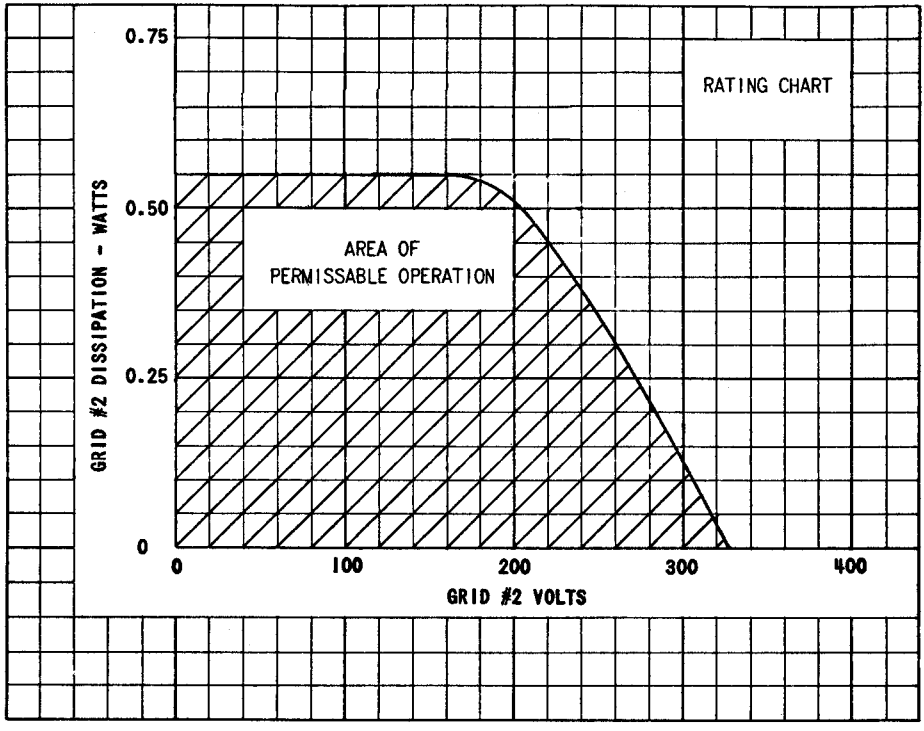

PENTODE CONNECTION
E_b = 250 Volts
E_{c3} = 0 Volts
E_{c2} = 150 VOLTS
100
50
6000
5000
4000
3000
2000
1000
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
-6
-5
-4
-3
-2
-1
0
GRID #1 VOLTS


RATING CHART
AREA OF
PERMISSABLE OPERATION
GRID #2 DISSIPATION - WATTS
0.75
0.50
0.25
0
0
100
200
300
400
GRID #2 VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE

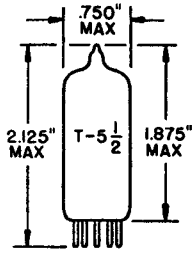
FOR

MOBILE COMMUNICATIONS

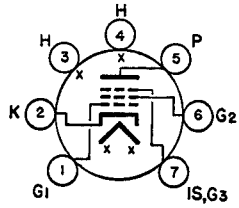
EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 7CM

THE 6662 IS A MINIATURE REMOTE-CUTOFF PENTODE DESIGNED FOR USE AS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER.

THE 6662 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALTHOUGH THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

THE ELECTRICAL CHARACTERISTICS OF THE 6662 ARE EQUIVALENT TO THE 6BJ6.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID 1 TO PLATE, MAXIMUM	0.0035	0.0035	pf
INPUT	4.5	4.5	pf
OUTPUT	5.5	5.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	150	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3±1.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS

[A] WITH EXTERNAL SHIELD 316 CONNECTED TO PINS 2 AND 7.

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 SUPPLY VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	See Rating Chart	
POSITIVE DC GRID 1 VOLTAGE	0	VOLTS
NEGATIVE DC GRID 1 VOLTAGE	55	VOLTS
PLATE DISSIPATION	3.3	WATTS
GRID 2 DISSIPATION	0.65	WATTS

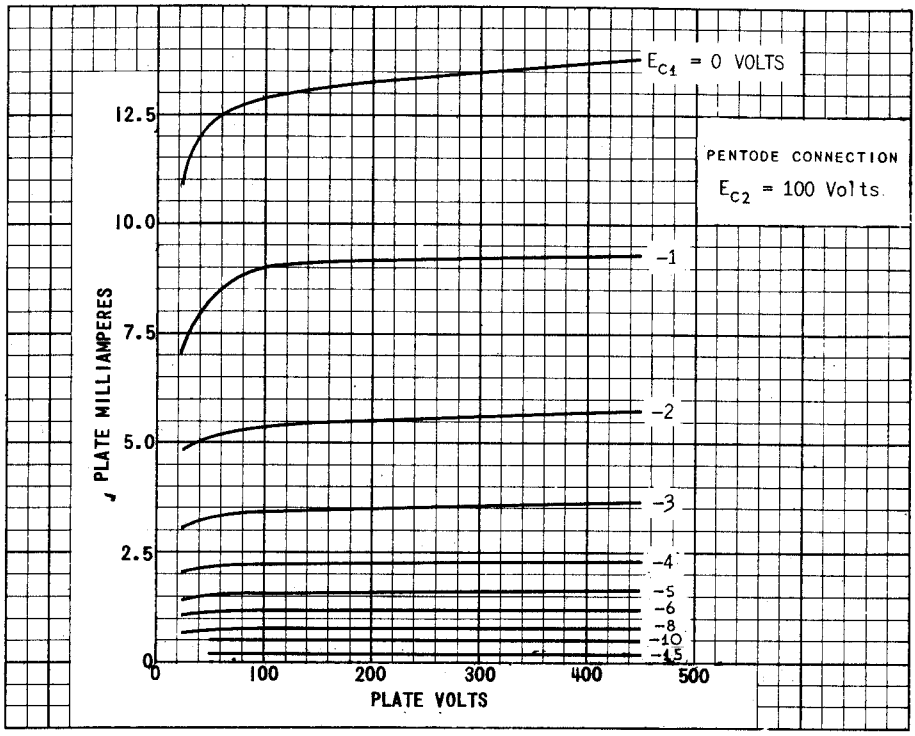
TYPICAL OPERATING CHARACTERISTICS

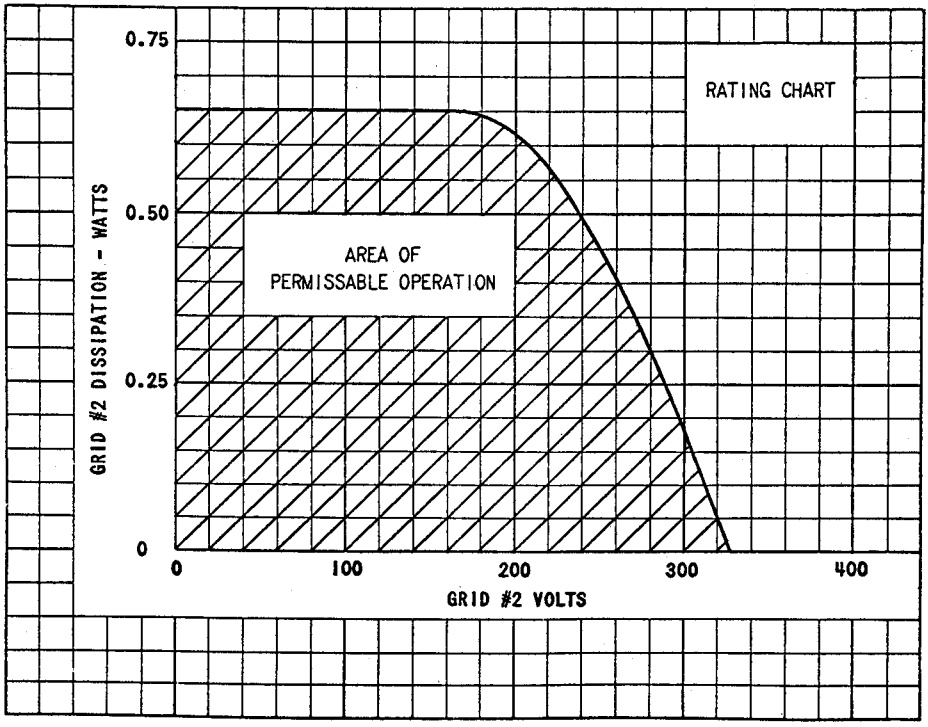
CLASS A1 AMPLIFIER

PLATE VOLTAGE	100	250	VOLTS
GRID 3 VOLTAGE	0	0	VOLTS
GRID 2 VOLTAGE	100	100	VOLTS
CATHODE-BIAS RESISTOR	80	80	OHMS
PLATE CURRENT	9.0	9.2	MA.
GRID 2 CURRENT	3.5	3.3	MA.
TRANSCONDUCTANCE	3,650	3,600	μMHOS
PLATE RESISTANCE, APPROX.	0.25	1.3	MEGOHMS
GRID 1 VOLTAGE (APPROX.) FOR $G_m = 10 \mu MHOS$	-20	-20	VOLTS

SPECIAL TESTS AND RATINGS

HEATER-CYCLING RATING





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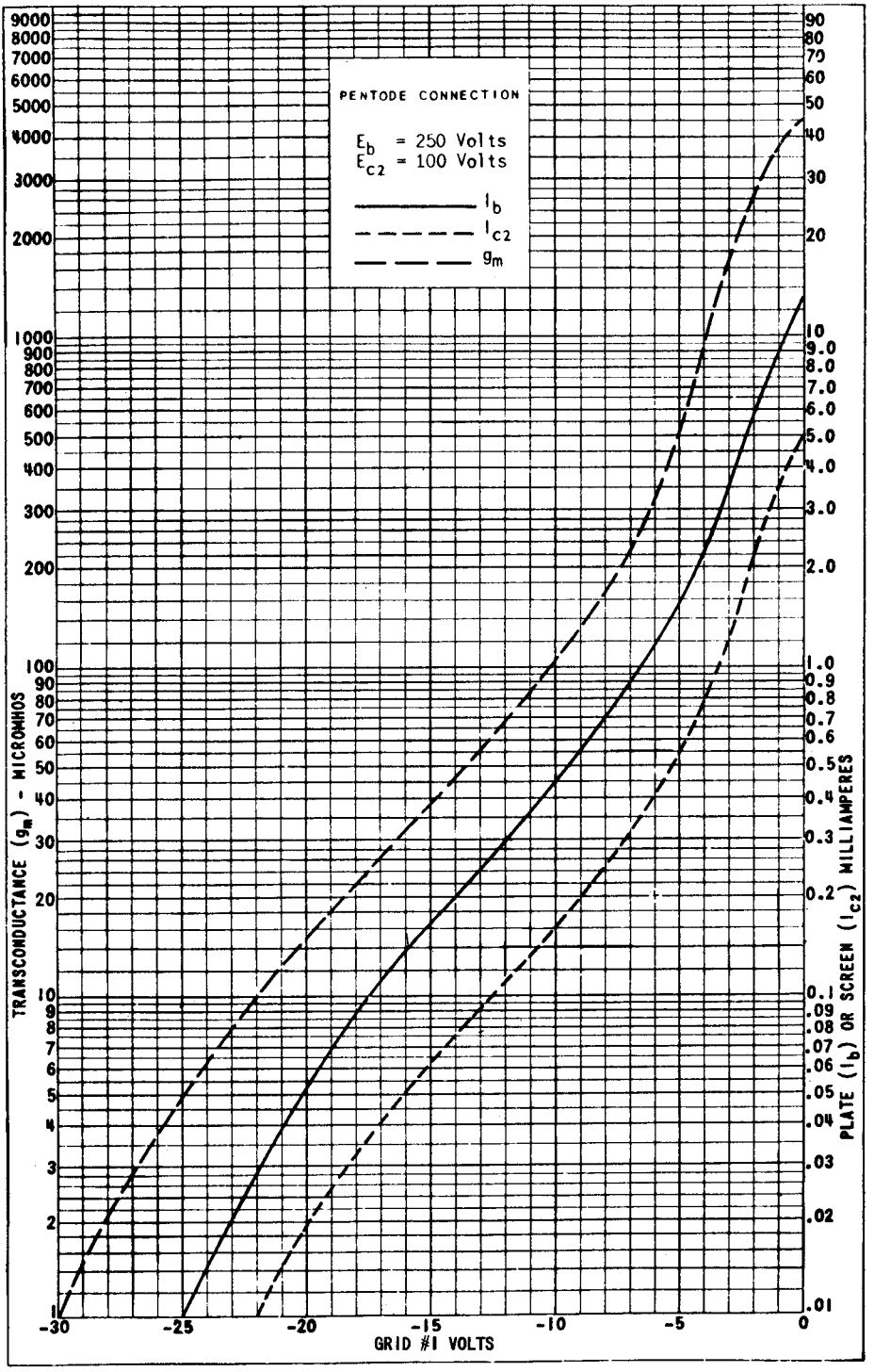
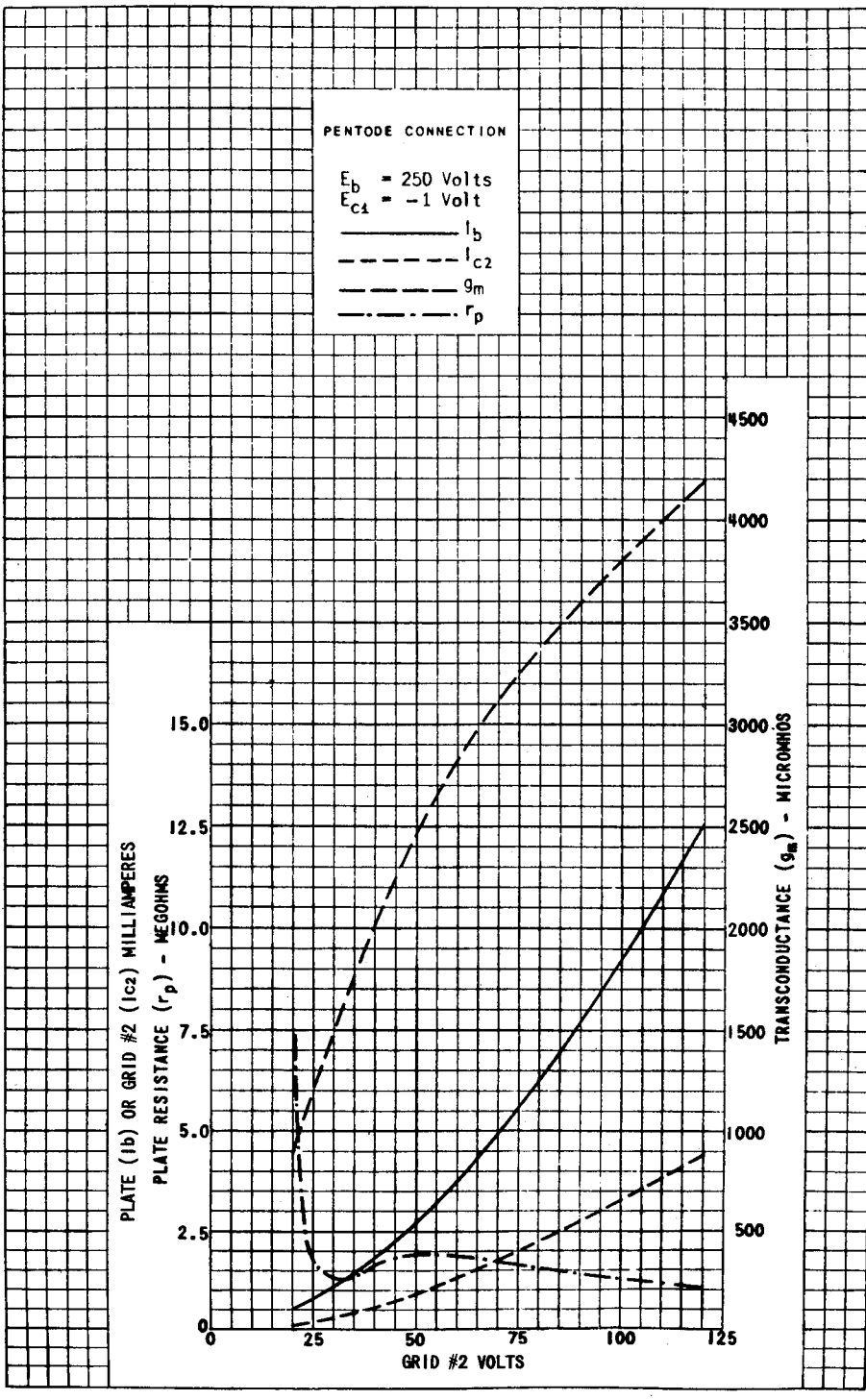

PENTODE CONNECTION
E_b = 250 Volts
E_{c2} = 100 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
PLATE (I_b) OR SCREEN (I_{c2}) MILLIAMPERES
GRID #1 VOLTS
9000
8000
7000
6000
5000
4000
3000
2000
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
90
80
70
60
50
40
30
20
10
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
.09
.08
.07
.06
.05
.04
.03
.02
.01
-30
-25
-20
-15
-10
-5
0


PENTODE CONNECTION
E_b = 250 Volts
E_{c1} = −1 Volt
I_b
I_{c2}
g_m
r_p
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE RESISTANCE (r_p) - MEGOHMS
TRANSCONDUCTANCE (g_m) - MICROMHOS
GRID #2 VOLTS
0
2.5
5.0
7.5
10.0
12.5
15.0
500
1000
1500
2000
2500
3000
3500
4000
4500
25
50
75
100
125

TUNG-SOL

TWIN DIODE
MINIATURE TYPE

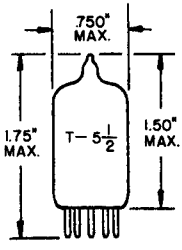
FOR

MOBILE COMMUNICATIONS

EQUIPMENT

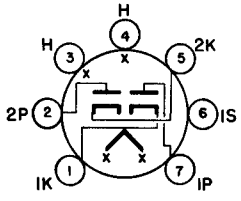
COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1



BOTTOM VIEW

BASING DIAGRAM
JEDEC 6BT

THE 6663 IS A MINIATURE HIGH-PERVEANCE TWIN DIODE SUITABLE FOR A WIDE VARIETY OF LOW-CURRENT APPLICATIONS WHICH INCLUDE SERVICE IN FM DISCRIMINATOR CIRCUITS AND IN CLIPPING, SWITCHING AND ISOLATION CIRCUITS. FOR FLEXIBILITY IN CIRCUIT DESIGN, EACH SECTION INCORPORATES A SEPARATE CATHODE CONNECTION AND CAN BE USED INDEPENDENTLY.

THE 6663 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALTHOUGH THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY VOLTAGE REGULATION. THE ELECTRICAL CHARACTERISTICS OF THE 6663 ARE EQUIVALENT TO THE 6AL5.

DIRECT INTERELECTRODE CAPACITANCES

	WITH[A] SHIELD	WITHOUT SHIELD	
PLATE 1 TO CATHODE 1, HEATER, & INTERNAL SHIELD	3.2	2.5	pf
PLATE 2 TO CATHODE 2, HEATER, & INTERNAL SHIELD	3.2	2.5	pf
CATHODE 1 TO PLATE 1, HEATER, & INTERNAL SHIELD	3.6	3.4	pf
CATHODE 2 TO PLATE 2, HEATER, & INTERNAL SHIELD	3.6	3.4	pf
PLATE 1 TO PLATE 2 (MAX.)	0.026	0.068	pf

[A] WITH EXTERNAL SHIELD 316 CONNECTED TO PIN 6.

HEATER CHARACTERISTICS AND RATINGS
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	300	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE OPERATION			6.3 ± 1.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			275	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

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TUNG-SOL

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

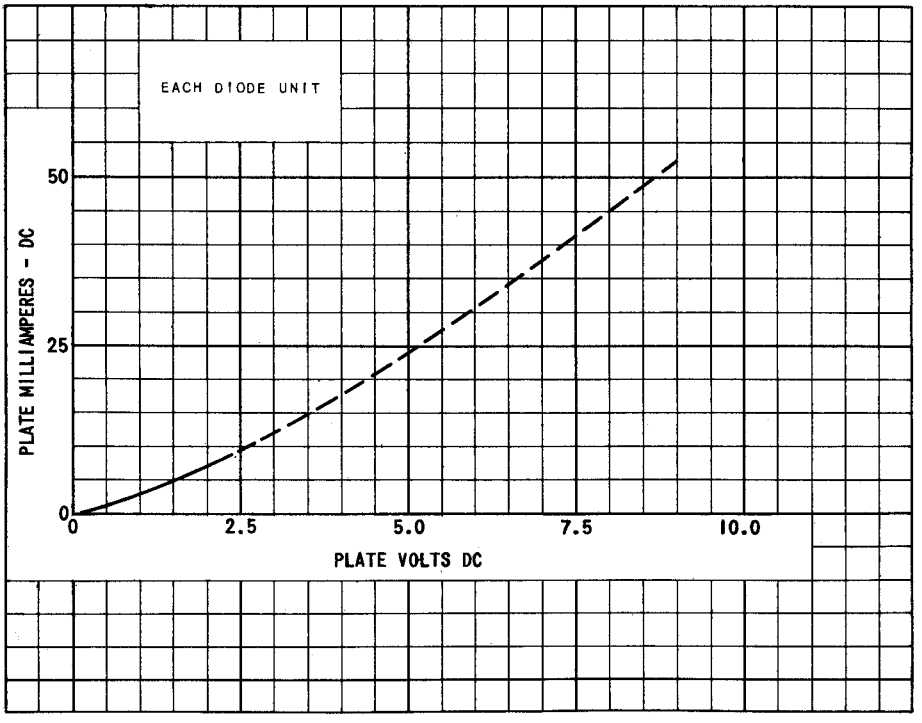
PEAK INVERSE PLATE VOLTAGE	275	VOLTS
STEADY-STATE PEAK PLATE CURRENT PER PLATE	60	MA.
TRANSIENT PEAK PLATE CURRENT PER PLATE MAX. DURATION 0.1 SECOND	350	MA.
DC OUTPUT CURRENT PER PLATE	10	MA.

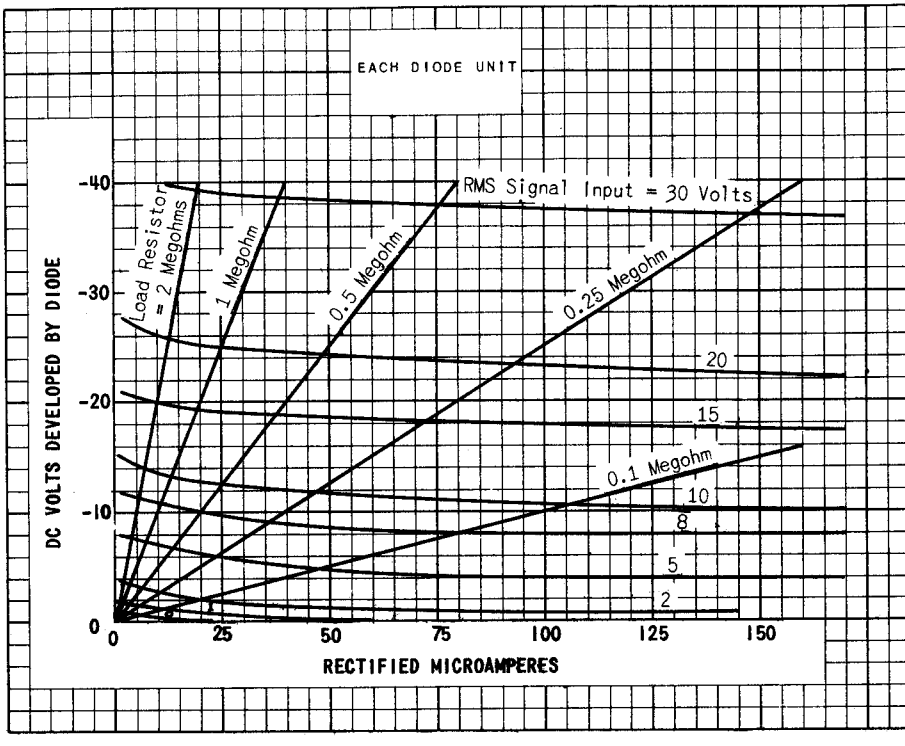
AVERAGE CHARACTERISTICS

TUBE VOLTAGE DROP AT Ib = 60 MA. DC PER PLATE	10	VOLTS

SPECIAL TESTS AND RATINGS

HEATER-CYCLING RATING





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TUNG-SOL

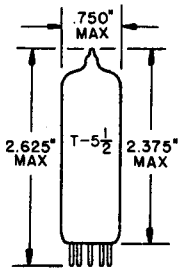
PENTODE

MINIATURE TYPE

BEAM PENTODE
FOR
MOBILE COMMUNICATIONS
EQUIPMENT

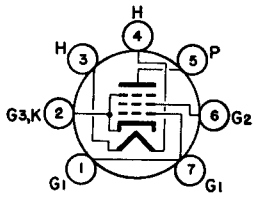
COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-3



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BZ

THE 6669 IS A MINIATURE BEAM-POWER PENTODE DESIGNED FOR USE AS AN AUDIO-FREQUENCY POWER AMPLIFIER.

THE 6669 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALTHOUGH THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

THE ELECTRICAL CHARACTERISTICS OF THE 6669 ARE EQUIVALENT TO THE 6AQ5.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE	0.4	pf
INPUT	8.0	pf
OUTPUT	8.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	450	MA.
LIMITS OF APPLIED VOLTAGE			6.3±1.25	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			100	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			100	VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	275	VOLTS
GRID 2 VOLTAGE	275	VOLTS
PLATE DISSIPATION	12	WATTS
GRID 2 DISSIPATION	2.0	WATTS
GRID 1 CIRCUIT RESISTANCE:		
WITH FIXED BIAS	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	MEGOHMS
BULB TEMPERATURE AT HOTTEST POINT	225°	C

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER

PLATE VOLTAGE		250	VOLTS
GRID 2 VOLTAGE		250	VOLTS
GRID 1 VOLTAGE		−12.5	VOLTS
PEAK AF GRID 1 VOLTAGE		12.5	VOLTS
ZERO-SIGNAL PLATE CURRENT		45	MA.
MAXIMUM-SIGNAL PLATE CURRENT		47	MA.
ZERO-SIGNAL GRID 2 CURRENT		4.5	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT		7.0	MA.
PLATE RESISTANCE,	(APPROX.)	52,000	OHMS
TRANSCONDUCTANCE		4,100	μMHOS
LOAD RESISTANCE		5,000	OHMS
TOTAL HARMONIC DISTORTION,	(APPROX.)	8	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT		4.5	WATTS

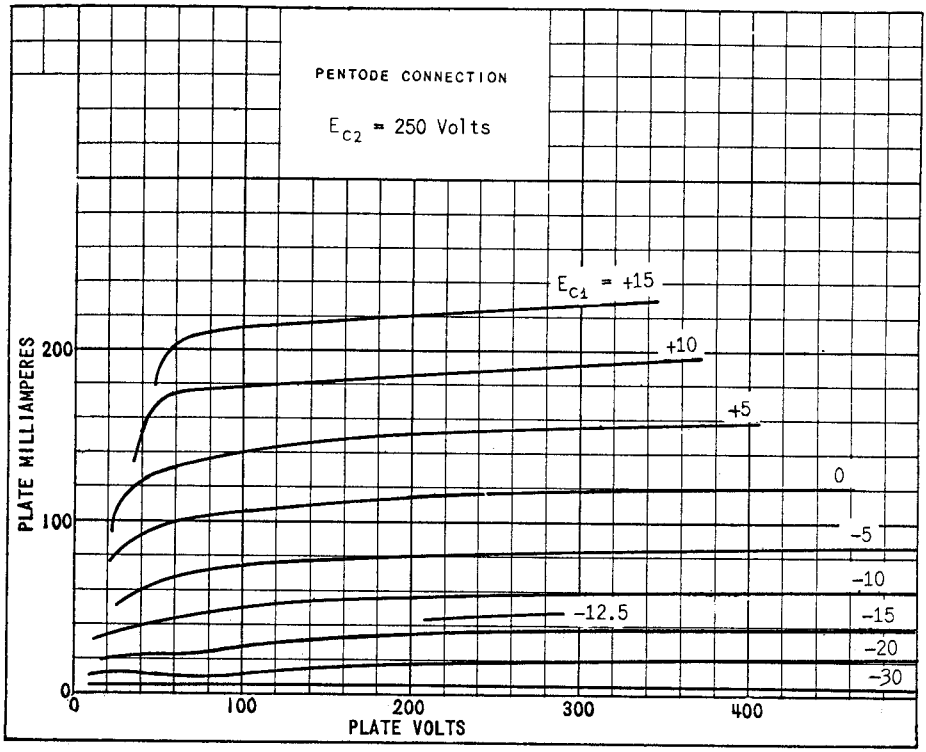
PUSH-PULL CLASS AB_1 AMPLIFIER

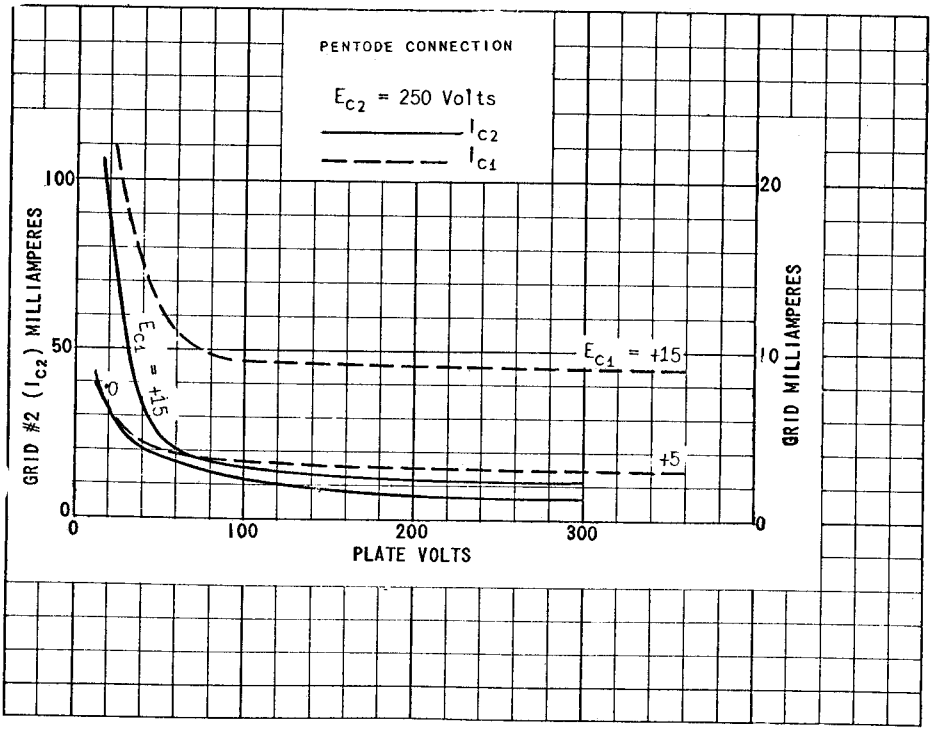
VALUES FOR TWO TUBES

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	250	VOLTS
GRID 1 VOLTAGE	−15	VOLTS
PEAK AF GRID TO GRID VOLTAGE	30	VOLTS
ZERO-SIGNAL PLATE CURRENT	70	MA.
MAXIMUM-SIGNAL PLATE CURRENT	79	MA.
ZERO-SIGNAL GRID 2 CURRENT	5.0	MA.
MAXIMUM-SIGNAL GRID 2 CURRENT	13	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	10,000	OHMS
TOTAL HARMONIC DISTORTION	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	10	WATTS

SPECIAL TESTS AND RATINGS

HEATER-CYCLING LIFE TEST





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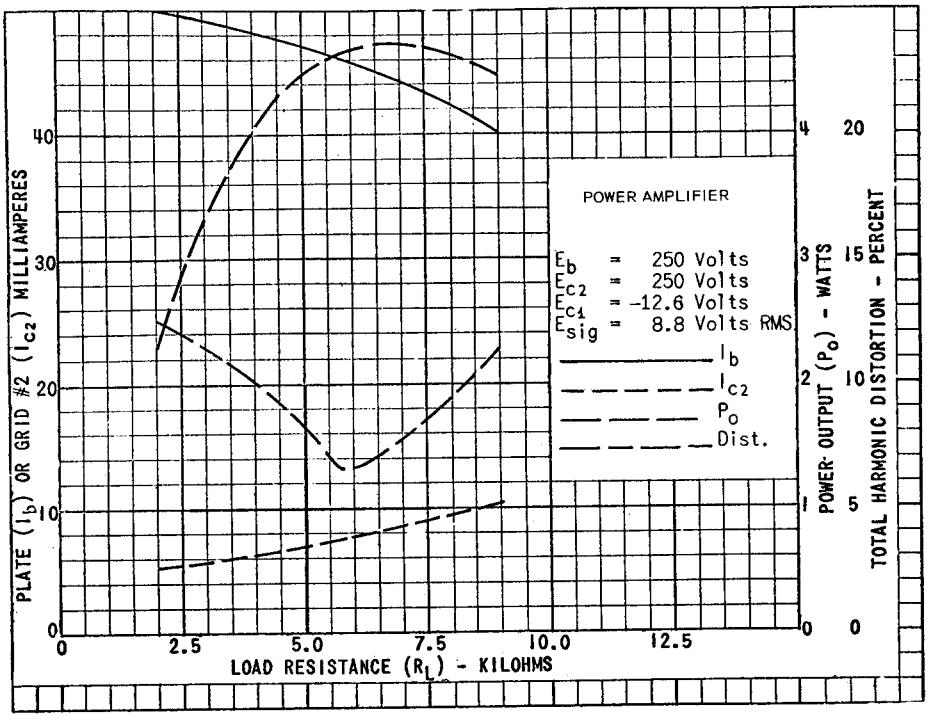
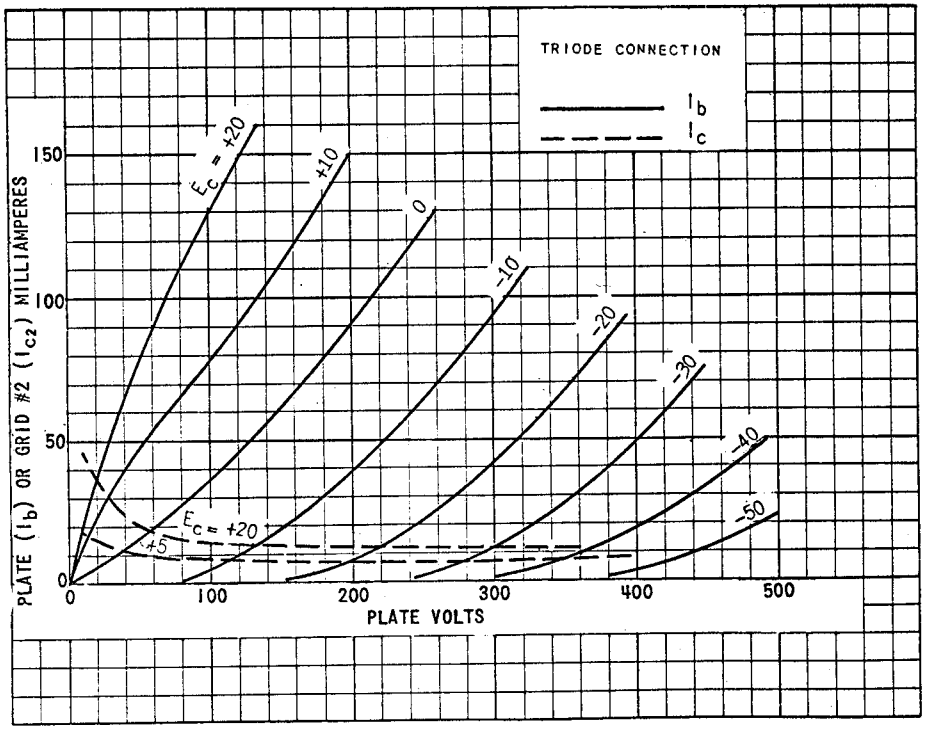

POWER AMPLIFIER
E_b = 250 Volts
E_{c2} = 250 Volts
E_{c1} = -12.6 Volts
E_{sig} = 8.8 Volts RMS
I_b
I_{c2}
P_o
Dist.
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
POWER OUTPUT (P_o) - WATTS
TOTAL HARMONIC DISTORTION - PERCENT
LOAD RESISTANCE (R_L) - KILOHMS
0
2.5
5.0
7.5
10.0
12.5
10
20
30
40
1
2
3
4
5
15
20


TRIODE CONNECTION
I_b
I_c
E_c = +20
+10
0
-10
-20
-30
-40
-50
+5
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
50
100
150

TUNG-SOL

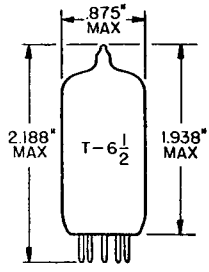
TWIN TRIODE

MINIATURE TYPE

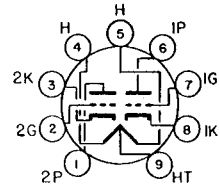
FOR
MOBILE COMMUNICATIONS
EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 6679 IS A HIGH-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS SUITABLE FOR USE AS A GROUNDED-GRID AMPLIFIER OR AS A FREQUENCY CONVERTER AT FREQUENCIES BELOW APPROXIMATELY 300 MEGACYCLES.

THE 6679 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALSO, THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODES, BUT HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.

THE ELECTRICAL CHARACTERISTICS OF THE 6679 ARE EQUIVALENT TO THE 12AT7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE, EACH SECTION	1.5	1.5	pf
INPUT, EACH SECTION	2.2	2.2	pf
OUTPUT, SECTION 1	1.2	0.5	pf
OUTPUT, SECTION 2	1.5	0.4	pf
HEATER TO CATHODE, EACH SECTION	2.4[B]	2.4	pf
PLATE TO CATHODE, EACH SECTION	0.2	0.2	pf
GROUNDED GRID INPUT, EACH SECTION	4.6	4.6	pf
GROUNDED GRID OUTPUT, EACH SECTION	2.6	1.8	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4+5	
AVERAGE VALUES - VOLTAGE	12.6	6.3	VOLTS
CURRENT	150	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION	12.6±2.5	6.3±1.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE	100		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	100		VOLTS

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	330	VOLTS
POSITIVE DC GRID VOLTAGE	0	VOLTS
NEGATIVE DC GRID VOLTAGE	55	VOLTS
PLATE DISSIPATION	2.8	WATTS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - EACH SECTION

PLATE VOLTAGE	250	VOLTS
CATHODE-BIAS RESISTOR	200	OHMS
PLATE CURRENT	10	MA.
TRANSCONDUCTANCE	5500	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE, APPROX.	10,900	OHMS
GRID VOLTAGE, APPROX. Ib = 10 μAMPS.	-12	VOLTS

[A] WITH EXTERNAL SHIELD 315 CONNECTED TO HEATER UNLESS OTHERWISE SPECIFIED.

[B] WITH EXTERNAL SHIELD 315 CONNECTED TO GROUND.

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)										
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	1600	5.3	26	1100	12	31	1000	22	32
0.10	0.24	1800	7.8	29	1400	17	33	1200	30	33
0.24	0.24	3800	7.2	28	2800	16	32	2300	28	34
0.24	0.51	4200	9.4	30	3300	20	33	2800	35	33
0.51	0.51	8000	8.3	28	5600	18	31	4900	31	33
0.51	1.0	9600	10	29	6700	23	32	6000	38	33
HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)										
R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2000	9.9	25	1200	17	31	900	35	33
0.10	0.24	2400	13	27	1400	28	33	1200	47	33
0.24	0.24	4700	12	27	2900	25	32	2300	42	34
0.24	0.51	5300	15	28	3600	31	33	2900	52	34
0.51	0.51	9300	13	27	6000	27	31	5000	45	33
0.51	1.0	11000	16	28	7100	33	32	6400	55	34

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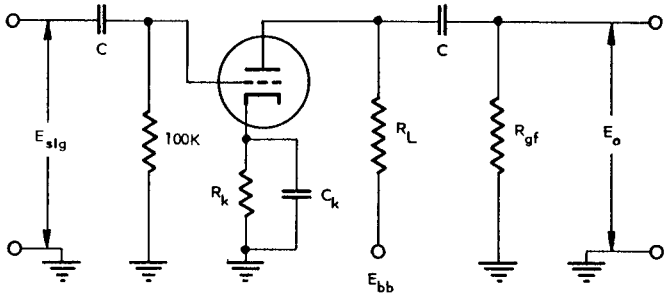
NOTES:

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.
2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.
3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.



COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

SPECIAL TESTS AND RATINGS

HEATER-CYCLING LIFE TEST

AVERAGE TRANSCONDUCTANCE
AT REDUCED HEATER VOLTAGE, EACH SECTION — 4400 — μMHOS
E_f = 10.0 VOLTS, E_b = 250 VOLTS, R_k = 200 OHMS (BYPASSED)

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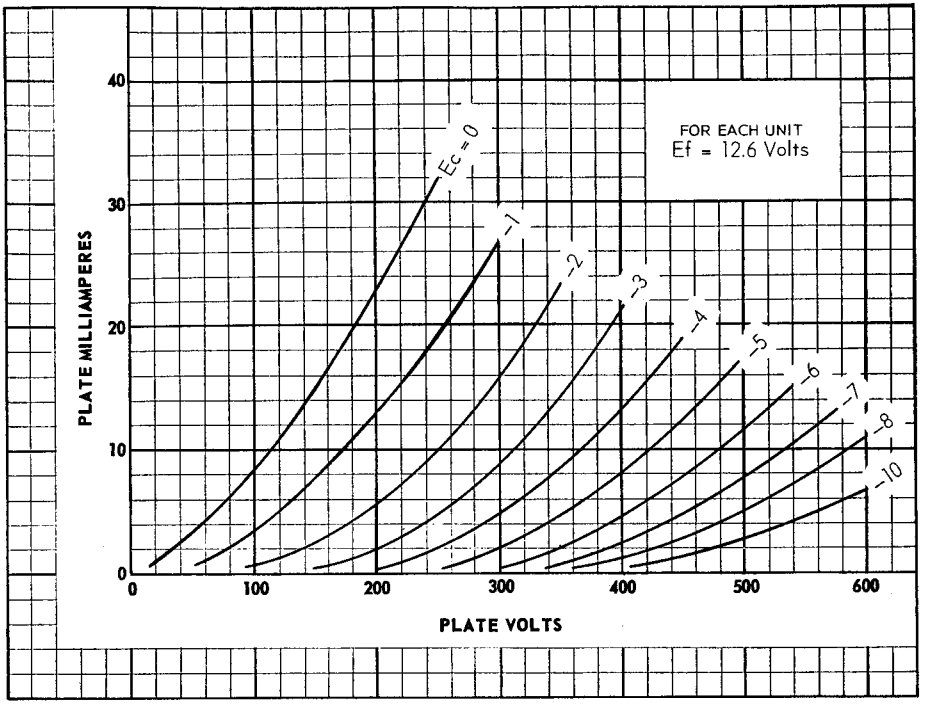
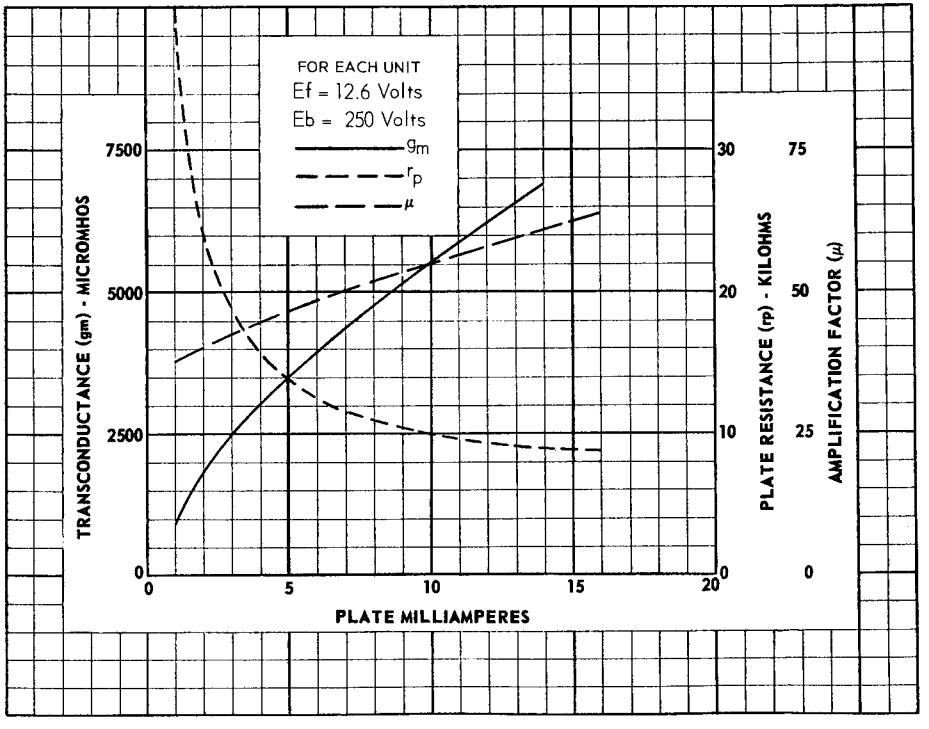

FOR EACH UNIT
Ef = 12.6 Volts
Ec = 0
-1
-2
-3
-4
-5
-6
-7
-8
-10
PLATE MILLIAMPERES
0
10
20
30
40
PLATE VOLTS
0
100
200
300
400
500
600


FOR EACH UNIT
Ef = 12.6 Volts
Eb = 250 Volts
gm
rp
μ
TRANSCONDUCTANCE (gm) - MICROMHOS
0
2500
5000
7500
PLATE RESISTANCE (rp) - KILOHMS
0
10
20
30
AMPLIFICATION FACTOR (μ)
0
25
50
75
PLATE MILLIAMPERES
0
5
10
15
20

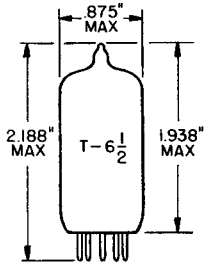
TUNG-SOL

TWIN TRIODE
MINIATURE TYPE

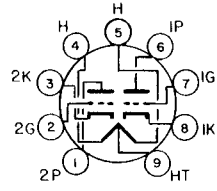
FOR
MOBILE COMMUNICATIONS
EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 6080 IS A MEDIUM-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS PARTICULARLY SUITED FOR USE IN GENERAL-PURPOSE AMPLIFIER AND PHASE-INVERTER CIRCUITS AS WELL AS FOR MULTI-VIBRATOR AND OSCILLATOR APPLICATIONS.
THE 6680 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALSO, THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, BUT HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.
THE ELECTRICAL CHARACTERISTICS OF THE 6680 ARE EQUIVALENT TO THE 12AU7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE, EACH SECTION	1.5	1.5	pf
INPUT, EACH SECTION	1.8	1.6	pf
OUTPUT, SECTION 1	2.0	0.4	pf
OUTPUT, SECTION 2	2.0	0.32	pf

[A] WITH EXTERNAL SHIELD (RETMA 315) CONNECTED TO CATHODE OF SECTION UNDER TEST.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4 + 5	
AVERAGE VALUES -VOLTAGE	12.6	6.3	VOLTS
-CURRENT	150	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION	12.6±2.5	6.3±1.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			VOLTS
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	330	VOLTS
POSITIVE DC GRID VOLTAGE	0	VOLTS
PLATE DISSIPATION	3.0	WATTS
GRID CIRCUIT RESISTANCE		
WITH FIXED BIAS	0.25	MEGOHMS
WITH CATHODE BIAS	1.0	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - EACH SECTION

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	0	−8.5	VOLTS
PLATE CURRENT	11.8	10.5	MA.
TRANSCONDUCTANCE	3100	2200	μMHOS
AMPLIFICATION FACTOR	20	17	
PLATE RESISTANCE, APPROX.	6500	7700	OHMS
GRID VOLTAGE, APPROX.			
Ib = 10 μAMPS	------	−24	VOLTS

CLASS A RESISTANCE - COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	3900	10	10	3600	20	11	3500	30	11
0.10	0.24	5000	14	11	4700	27	12	4400	41	12
0.24	0.24	9400	13	11	8700	25	11	8700	38	12
0.24	0.51	11000	17	11	11000	32	12	11000	48	12
0.51	0.51	19000	15	11	18000	29	12	18000	43	12
0.51	1.0	24000	19	11	23000	37	12	23000	54	12

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	E_{bb} = 90 Volts			E_{bb} = 180 Volts			E_{bb} = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2600	11	12	2000	22	13	18000	31	13
0.10	0.24	3400	16	12	2800	32	13	2600	44	14
0.24	0.24	7200	15	12	5800	29	13	5000	41	13
0.24	0.51	9400	19	12	8400	37	13	7000	52	13
0.51	0.51	17000	16	12	15000	33	13	13000	46	13
0.51	1.0	22000	20	12	20000	42	13	18000	58	13

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.

TUNG-SOL

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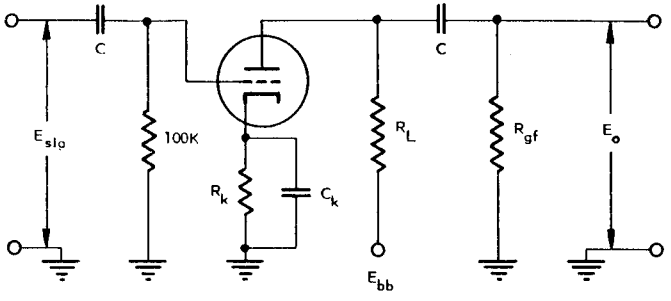
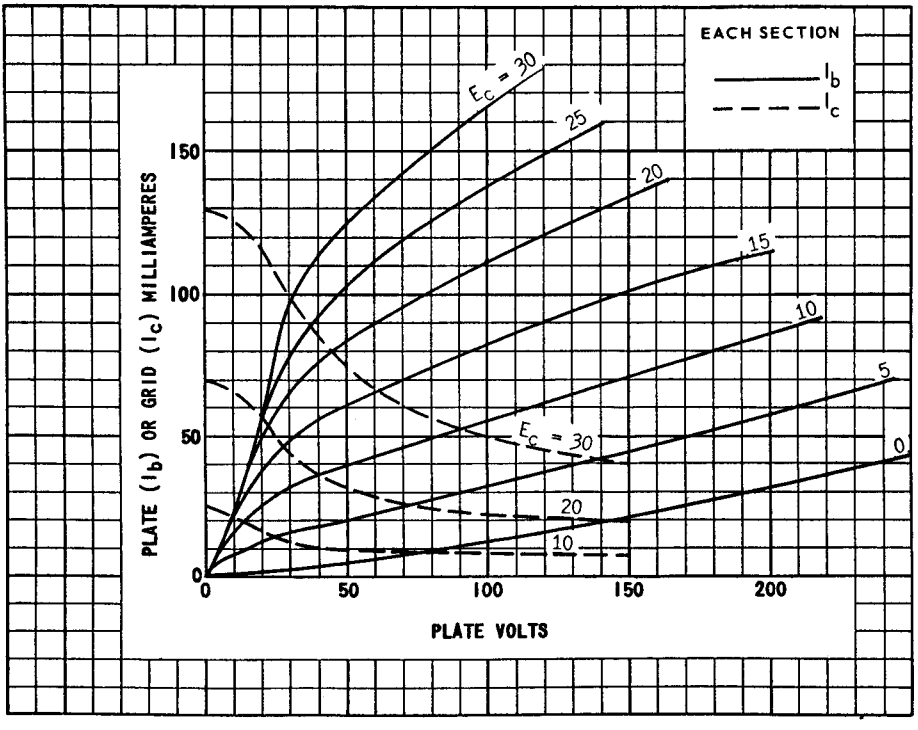


COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

SPECIAL TESTS AND RATINGS

HEATER-CYCLING LIFE TEST		
AVERAGE TRANSCONDUCTANCE AT REDUCED HEATER VOLTAGE		
EACH SECTION	,750	μMHOS
Ef = 10.0 V., Eb = 250 V., Ec = −8.5 V.		



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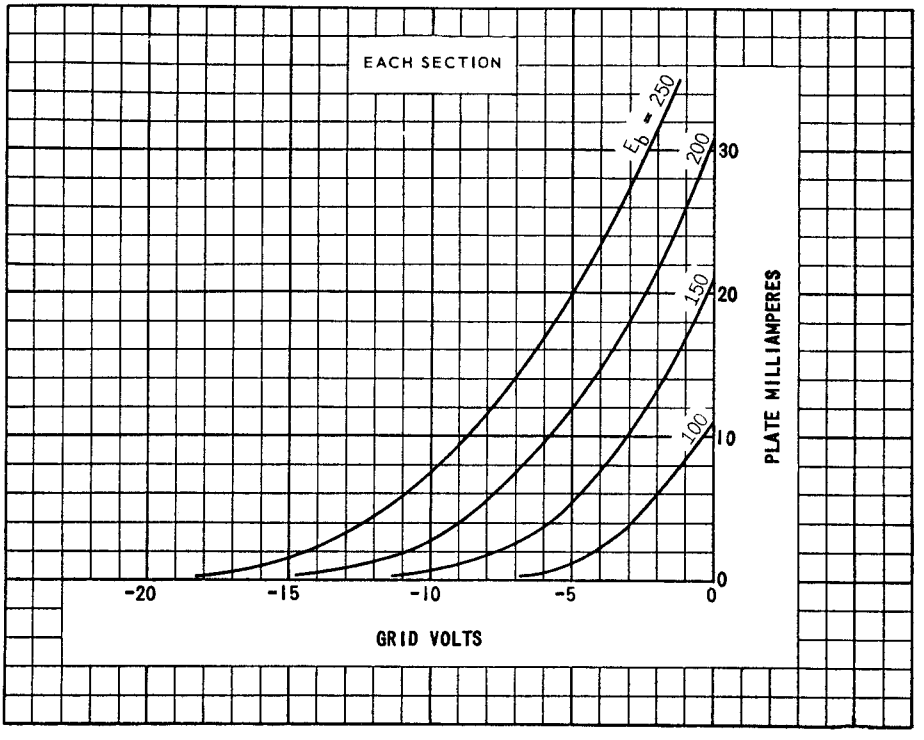
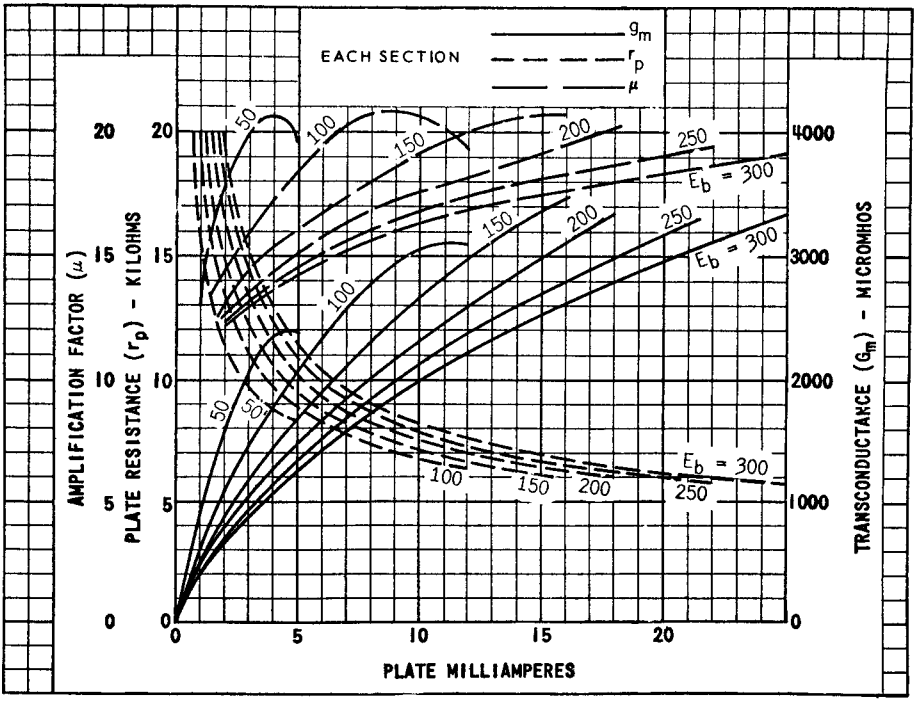
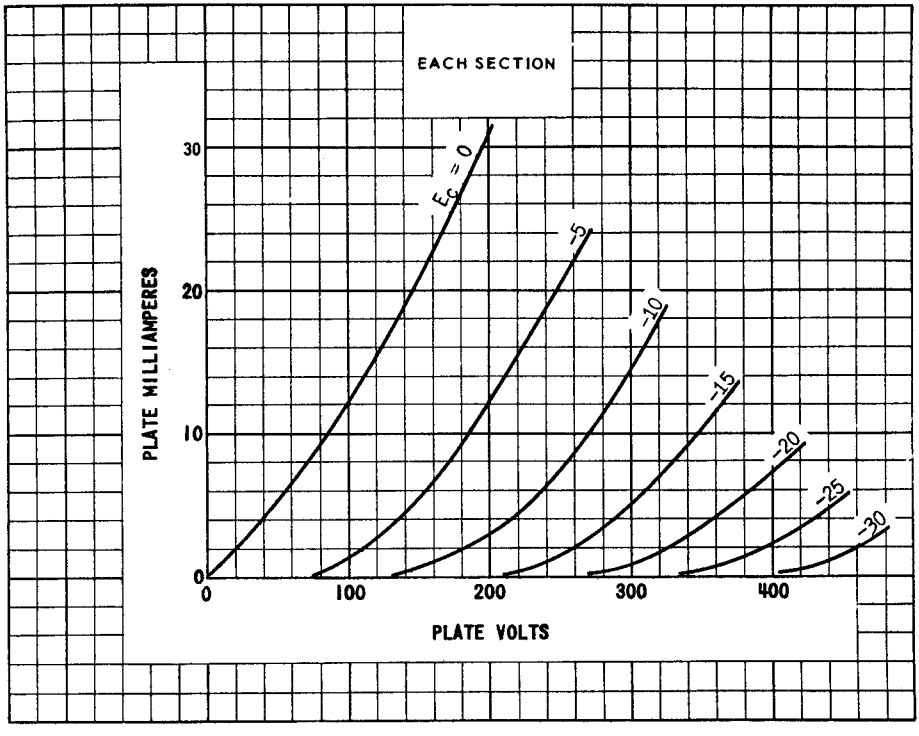

EACH SECTION
E_b = 250
200
150
100
30
20
10
0
PLATE MILLIAMPERES
-20
-15
-10
-5
0
GRID VOLTS


EACH SECTION
g_m
r_p
μ
AMPLIFICATION FACTOR (μ)
PLATE RESISTANCE (r_p) - KILOHMS
TRANSCONDUCTANCE (G_m) - MICROMHOS
50
100
150
200
250
E_b = 300
20
15
10
5
0
4000
3000
2000
1000
0
5
10
15
20
PLATE MILLIAMPERES



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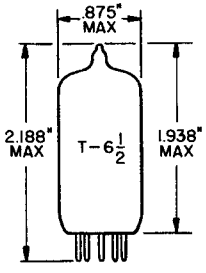
TUNG-SOL

TWIN TRIODE
MINIATURE TYPE

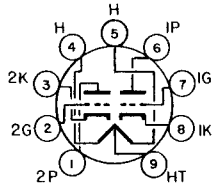
FOR
MOBILE COMMUNICATIONS
EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 6681 IS A HIGH-MU TWIN TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ESPECIALLY SUITED FOR USE IN RESISTANCE-COUPLED VOLTAGE AMPLIFIERS, PHASE INVERTERS, MULTIVIBRATORS, AND OTHER APPLICATIONS IN WHICH HIGH VOLTAGE GAIN IS DESIRED.
THE 6681 MAY BE OPERATED WITHOUT SERIOUS DEGRADATION UNDER NORMAL VARIATIONS IN SUPPLY VOLTAGE AS ENCOUNTERED WITH AUTOMOTIVE ELECTRICAL SYSTEMS. ALSO, THE TUBE WILL TOLERATE LARGE HEATER VOLTAGE VARIATIONS FOR SHORT PERIODS, BUT HIGHER EQUIPMENT RELIABILITY CAN BE ACHIEVED WITH IMPROVED SUPPLY-VOLTAGE REGULATION.
THE ELECTRICAL CHARACTERISTICS OF THE 6681 ARE EQUIVALENT TO THE 12AX7.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE, EACH SECTION	1.7	1.7	pf
INPUT, EACH SECTION	1.8	1.6	pf
OUTPUT, SECTION 1	1.9	0.46	pf
OUTPUT, SECTION 2	1.9	0.34	pf

[A] WITH EXTERNAL SHIELD (RETMA 315) CONNECTED TO CATHODE OF SECTION UNDER TEST.

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	4 AND 5	9 AND 4 + 5	
AVERAGE VALUES -VOLTAGE	12.6	6.3	VOLTS
-CURRENT	150	300	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION	12.6±2.5	6.3±1.3	VOLTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			VOLTS
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

EACH SECTION

PLATE VOLTAGE	330	VOLTS
POSITIVE DC GRID VOLTAGE	0	VOLTS
NEGATIVE DC GRID VOLTAGE	55	VOLTS
PLATE DISSIPATION	1.1	WATTS

TYPICAL OPERATING CHARACTERISTICS

CLASS A1 AMPLIFIER - EACH SECTION

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
TRANSCONDUCTANCE	1250	1600	μMHOS
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE, APPROX.	80,000	62,500	OHMS

CLASS A RESISTANCE - COUPLED AMPLIFIER

EACH SECTION

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	2500	4.3	32	1500	15	40	1100	33	43
0.10	0.24	2600	6.5	40	1500	22	49	1200	44	53
0.24	0.24	4400	6.3	45	2500	21	56	2000	44	60
0.24	0.51	4800	8.5	50	2800	27	62	2200	54	66
0.51	0.51	8500	7.3	50	4200	21	63	3500	45	69
0.51	1.0	10000	9.4	55	6500	28	66	4700	55	72

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

R_L	R_{gf}	Ebb = 90 Volts			Ebb = 180 Volts			Ebb = 300 Volts		
		R_k	E_o	Gain	R_k	E_o	Gain	R_k	E_o	Gain
0.10	0.10	3400	7.1	28	1900	18	34	1400	35	40
0.10	0.24	3700	9.4	37	2100	25	46	1600	47	50
0.24	0.24	6100	9.8	42	3500	25	53	2500	47	59
0.24	0.51	6800	12	47	3900	30	58	3000	58	63
0.51	0.51	11000	11	47	6200	27	60	4500	52	66
0.51	1.0	12000	14	50	6900	34	64	5300	64	69

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY 5% TOTAL HARMONIC DISTORTION.

2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.

3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.

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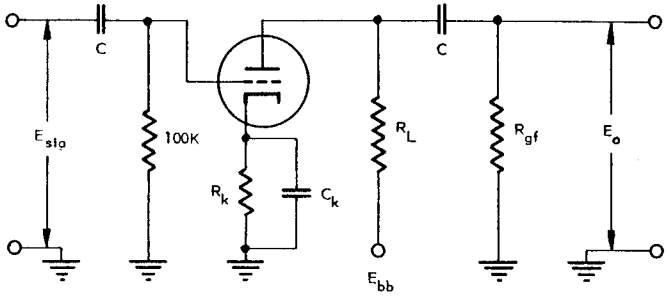
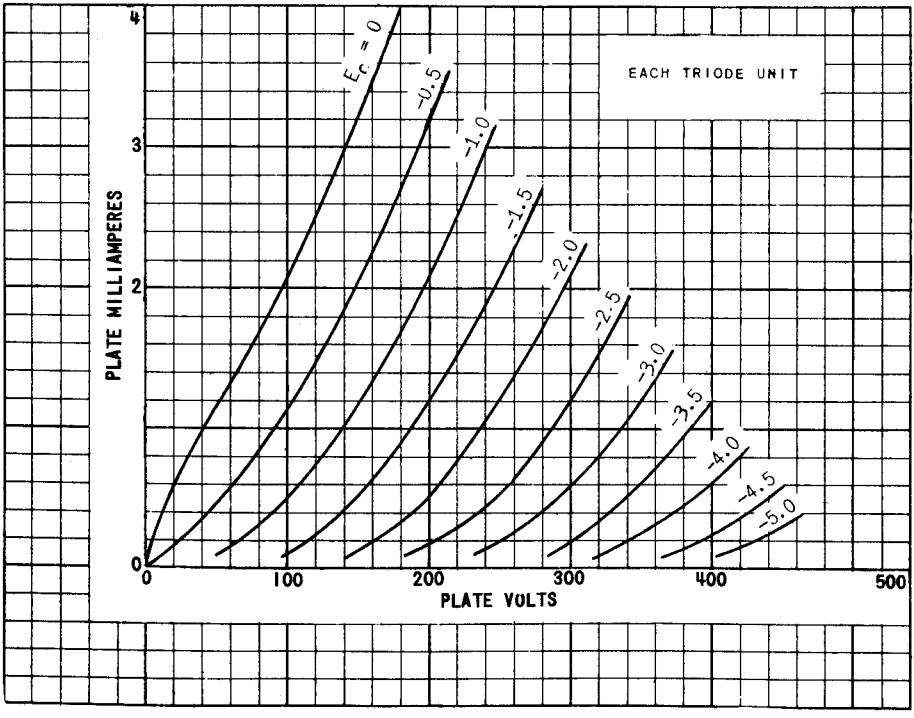


COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

SPECIAL TESTS AND RATINGS

HEATER-CYCLING LIFE TEST



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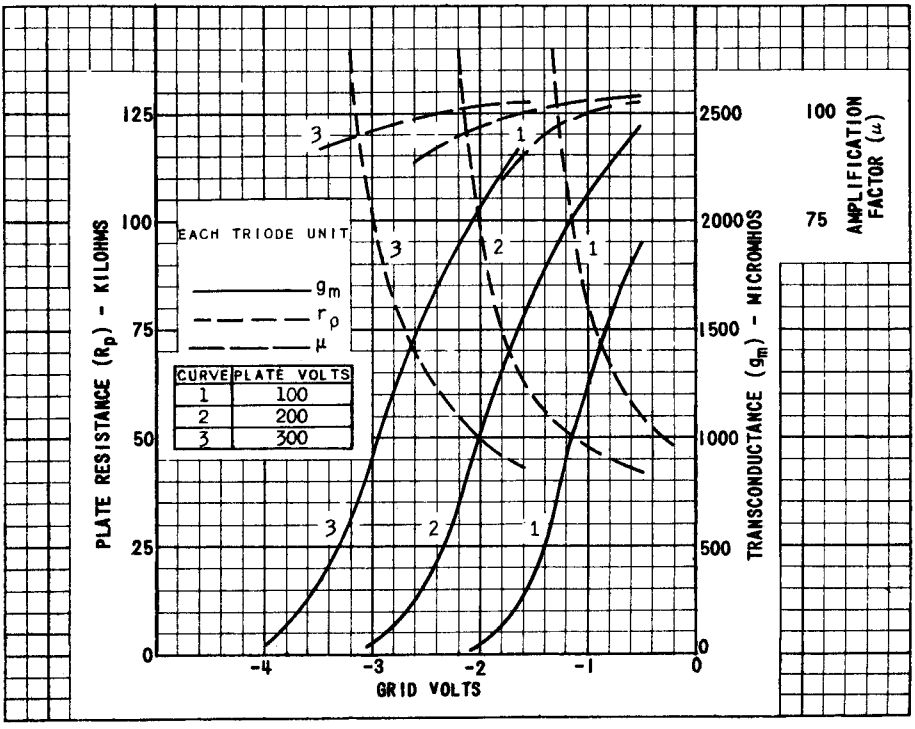
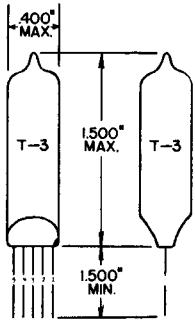

EACH TRIODE UNIT
g_m
r_p
μ
CURVE PLATE VOLTS
1 100
2 200
3 300
PLATE RESISTANCE (R_p) - KILOHMS
125
100
75
50
25
0
TRANSCONDUCTANCE (g_m) - MICROMHOS
2500
2000
1500
1000
500
0
AMPLIFICATION FACTOR (μ)
100
75
-4
-3
-2
-1
0
GRID VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE TYPE

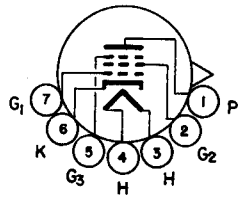


GLASS BULB

OUTLINE DRAWING
JEDEC 3-6
DOT IS ADJACENT TO LEAD #1

RELIABLE
SEMI-REMOTE-CUTOFF
PENTODE
FOR
AGC AMPLIFIER SERVICE
IN MOBILE AND AIRBORNE
EQUIPMENT

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION



BOTTOM VIEW
7 LEADS 0.048" CENTER-TO-CENTER IN-LINE
LEAD DIAMETER
.016" +.002" -.001"

THE 6872 IS A HEATER-CATHODE TYPE SEMI-REMOTE CUTOFF PENTODE OF SUBMINIATURE CONSTRUCTION. IT IS APPLICABLE TO AMPLIFIER SERVICE IN WHICH AGC IS DESIRABLE. STANDARD INLINE SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE FLEXIBLE LEADS TO A SUITABLE LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

WITH A CYLINDRICAL SHIELD 0.405" I.D. - 1-7/8" LONG CONNECTED TO LEAD 6.

GRID 1 TO PLATE	MAX.	0.03	pf
INPUT		5.0	pf
OUTPUT		3.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	200	MA.
LIMITS OF APPLIED VOLTAGE			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:			200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	165	VOLTS
GRID 1 VOLTAGE	-55	VOLTS
GRID 2 VOLTAGE	155	VOLTS
GRID 3 VOLTAGE	0	VOLTS
PLATE DISSIPATION	1.1	WATTS
GRID 2 DISSIPATION	0.4	WATTS
CATHODE CURRENT	16.5	MA.
GRID 1 CIRCUIT RESISTANCE	1.2	MEGOHMS
TEMPERATURE AT HOTTEST POINT ON BULB	+220	°C

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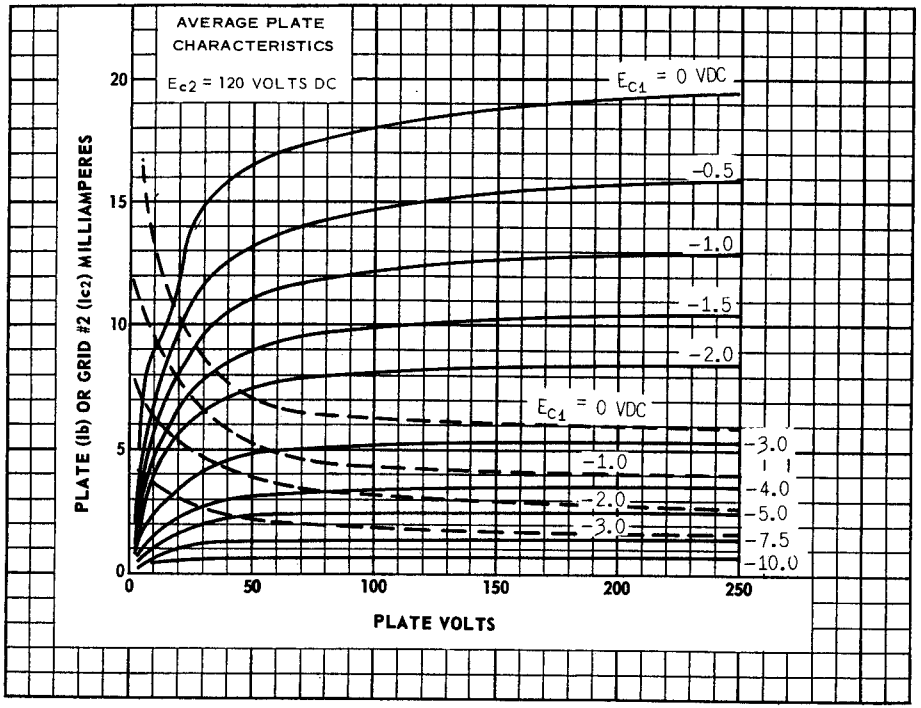
CONTINUED FROM PRECEDING PAGE

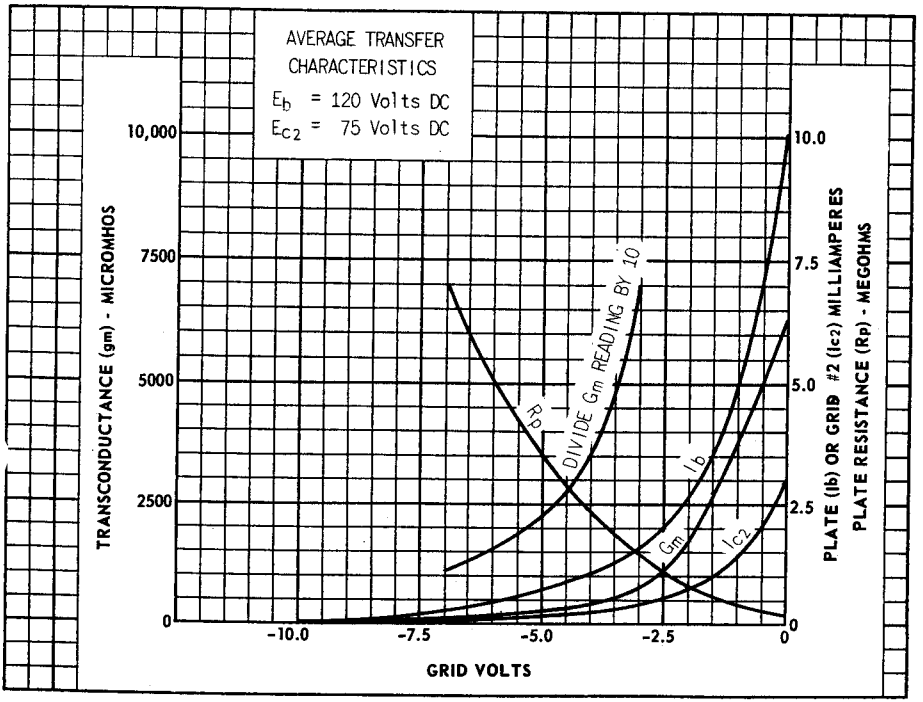
TYPCAL OPERATING CHARACTERISTICS

PLATE VOLTAGE	120	VOLTS
GRID 1 VOLTAGE	0	VOLTS
GRID 2 VOLTAGE	120	VOLTS
GRID 3 VOLTAGE	0	VOLTS
CATHODE BIAS RESISTOR	200	OHMS
PLATE CURRENT	7.75	MA.
GRID 2 CURRENT	2.7	MA.
TRANSCONDUCTANCE	4,100	μMHOS
PLATE RESISTANCE	0.34	MEGOHMS

SPECIAL TESTS AND RATINGS

INTERMITTANT LIFE TEST		
HEATER CYCLING TEST		
SHOCK TEST		
VIBRATION TEST		
ALTITUDE RATING	60,000	FEET





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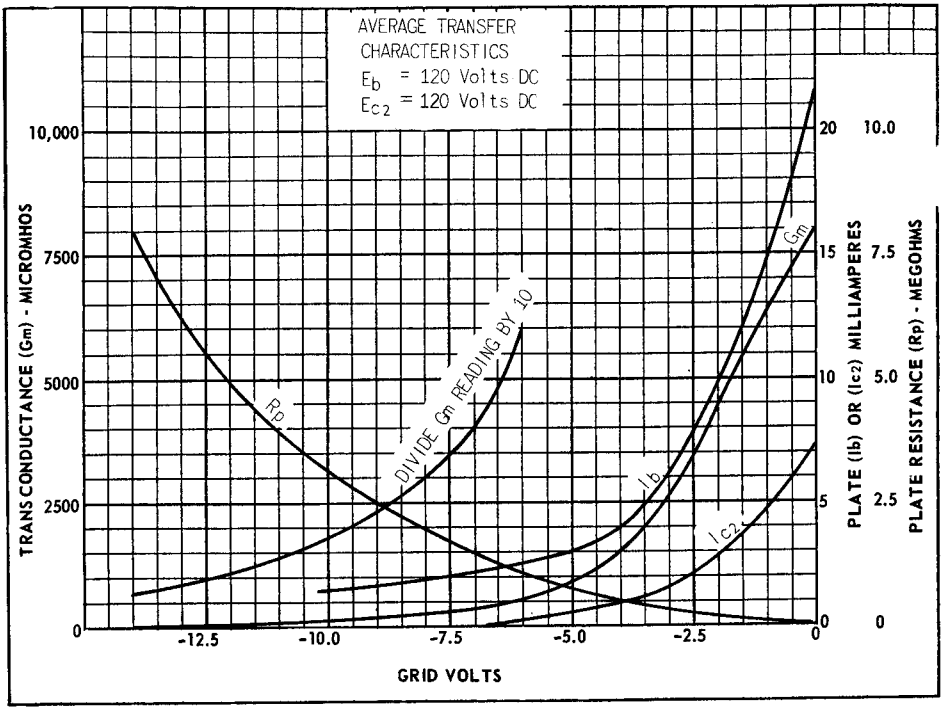
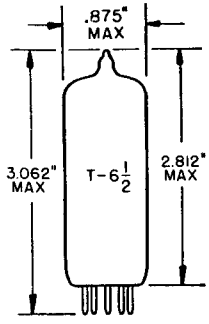
6872


AVERAGE TRANSFER
CHARACTERISTICS
E_b = 120 Volts DC
E_{c2} = 120 Volts DC
TRANSCONDUCTANCE (Gm) - MICROMHOS
10,000
7500
5000
2500
0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS
Rp
DIVIDE Gm READING BY 10
Ib
Ic2
Gm
20
15
10
5
0
10.0
7.5
5.0
2.5
0
PLATE (Ib) OR (Ic2) MILLIAMPERES
PLATE RESISTANCE (Rp) - MEGOHMS

TUNG-SOL

OUTLINE DRAWING
JEDEC 6-4



GLASS BULB
MINIATURE BUTTON
BASE 9 PIN E9-1

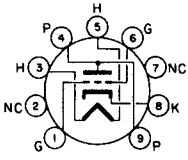
POWER TRIODE

MINIATURE TYPE

FOR
MILITARY AND INDUSTRIAL
AIRBORNE APPLICATIONS

COATED UNIPOTENTIAL CATHODE
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9GB



BOTTOM VIEW
IF TUBE IS MOUNTED IN A HORIZONTAL POSITION, PINS 1 AND 6 SHOULD LIE IN A VERTICAL PLANE.

THE 6877 IS A HARD GLASS, LOW-MU TRIODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR SERVICE AS A PASSING OR REGULATOR TUBE IN REGULATED DC POWER SUPPLIES, CAPABLE OF OPERATION AT HIGH TEMPERATURES AND HIGH ALTITUDES.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	800	mA
CATHODE HEATING TIME		30	SECONDS
LIMITS OF APPLIED VOLTAGE		6.3±0.3	VOLTS
HEATER-CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		450	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM RATINGS – SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
POSITIVE DC GRID VOLTAGE	5.0	VOLTS
NEGATIVE DC GRID VOLTAGE	150	VOLTS
PLATE DISSIPATION	12	WATTS
DC CATHODE CURRENT	100	mA
DC GRID CURRENT	5	mA
GRID CIRCUIT RESISTANCE	1	MEGOHM

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TUNG-SOL

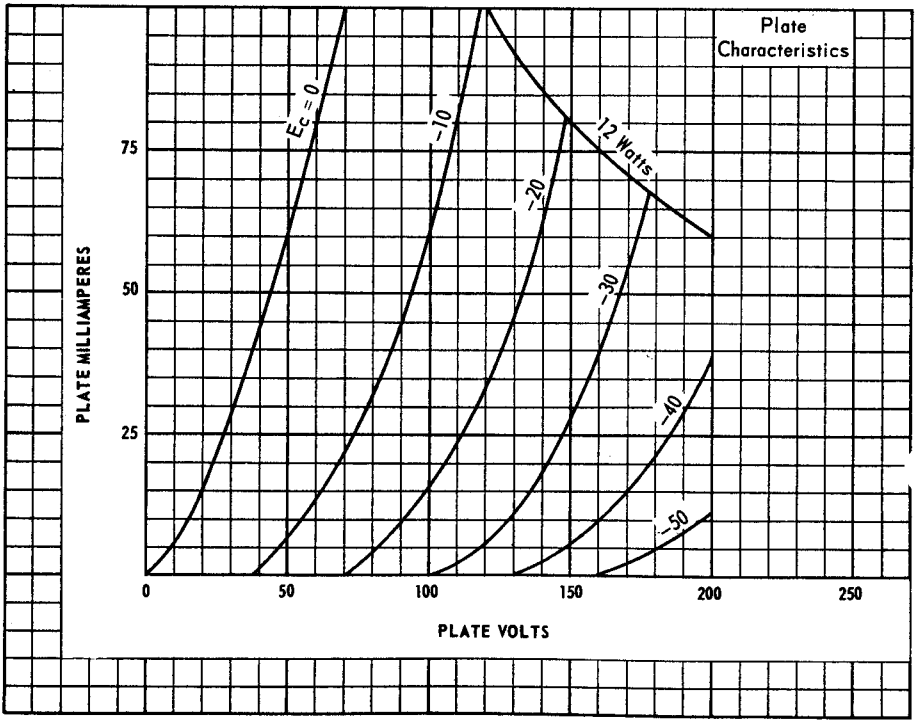
CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS AND TYPICAL OPERATION

PLATE VOLTAGE	150	VOLTS
GRID VOLTAGE	-12	VOLTS
PLATE CURRENT	75	mA
TRANSCONDUCTANCE	6,500	μMhos
AMPLIFICATION FACTOR	3.75	
PLATE RESISTANCE	2,000	OHMS

SPECIAL TESTS AND RATINGS

SHOCK		
VIBRATION		
HEATER-CYCLING LIFE		
INTERMITTENT LIFE		
BULB TEMPERATURE – ABSOLUTE MAX.	300	°C.
ALTITUDE – ABSOLUTE MAX.	80,000	Ft.

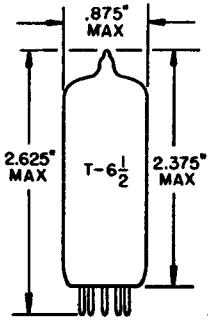


TUNG-SOL

TWIN TRIODE

MINIATURE TYPE

OUTLINE DRAWING
JEDEC 6-8



BUTTON 9 PIN MINIATURE
BASE JEDEC E9-1
GOLD PLATED PINS

FOR

PULSE APPLICATIONS

IN MISSILES, AIRCRAFT

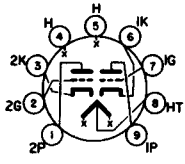
AND MILITARY AND INDUSTRIAL

INSTALLATIONS.

TUNGSTEN HEATER

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9H



BOTTOM VIEW

THE 6900 IS A MEDIUM-MU TWIN TRIODE IN THE 9 PIN MINIATURE HARD GLASS CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR PULSE APPLICATIONS IN MISSILES, AIRCRAFT AND OTHER MILITARY AND INDUSTRIAL INSTALLATIONS. REQUISITES IN SUCH APPLICATIONS INCLUDE FREEDOM FROM EARLY FAILURES, LONG AVERAGE SERVICE LIFE AND UNIFROM OPERATING CHARACTERISTICS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE		4.0	pf
INPUT	MAX.	6.5	pf
OUTPUT-SECTION 1		0.8	pf
OUTPUT-SECTION 2		0.61	pf
HEATER TO CATHODE		3.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN CENTER VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	1.0	AMPS
	12.6 VOLTS	0.5	AMPS
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
		12.6 ± 0.6	VOLTS
HEATER- CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE		500	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		500	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

DESIGN CENTER VALUES – SEE EIA STANDARD RS-239

PLATE VOLTAGE	600	VOLTS
PEAK GRID VOLTAGE		
POSITIVE VALUE	100	VOLTS
NEGATIVE VALUE	200	VOLTS
PEAK CATHODE CURRENT ⊕SEE CHART	4.5	AMPS
PLATE DISSIPATION PER PLATE	4.25	WATTS
GRID CIRCUIT RESISTANCE	1.0	MEGOHM
AVERAGE WARM-UP TIME	45	SEC.

AVERAGE CHARACTERISTICS – EACH SECTION

PLATE VOLTAGE	120	VOLTS
GRID VOLTAGE	−2.0	VOLTS
PLATE CURRENT	36	mA
TRANSCONDUCTANCE	11,500	μMHOS
AMPLIFICATION FACTOR	18.5	

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS – PULSE

BOTH SECTIONS IN PARALLEL

PLATE VOLTAGE	500	VOLTS
GRID PULSE (e_{gk})	+50	VOLTS
GRID VOLTAGE	−100	VOLTS
PLATE BIAS VOLTAGE	4.25	AMPS.
GRID CURRENT	0.50	AMP
PULSE TIME	10	μSEC
PULSE REPETITION RATE	250	PPS

SPECIAL TESTS AND RATINGS

ALTITUDE ⊕SEE APPLICATION NOTE	80,000	FT.
BULB TEMPERATURE AT HOTTEST POINT ON BULB	300	°C
IMPACT SHOCK	500	G
VIBRATIONAL ACCELERATION	50	G
LIFE		
HEATER CYCLING LIFE		
FATIGUE		
SHOCK		
GLASS STRAIN		

⊕ TO OBTAIN GREATEST LIFE EXPECTANCY FROM TUBE, AVOID DESIGNS WHERE THE TUBE IS SUBJECT TO ALL MAXIMUM RATINGS SIMULTANEOUSLY.

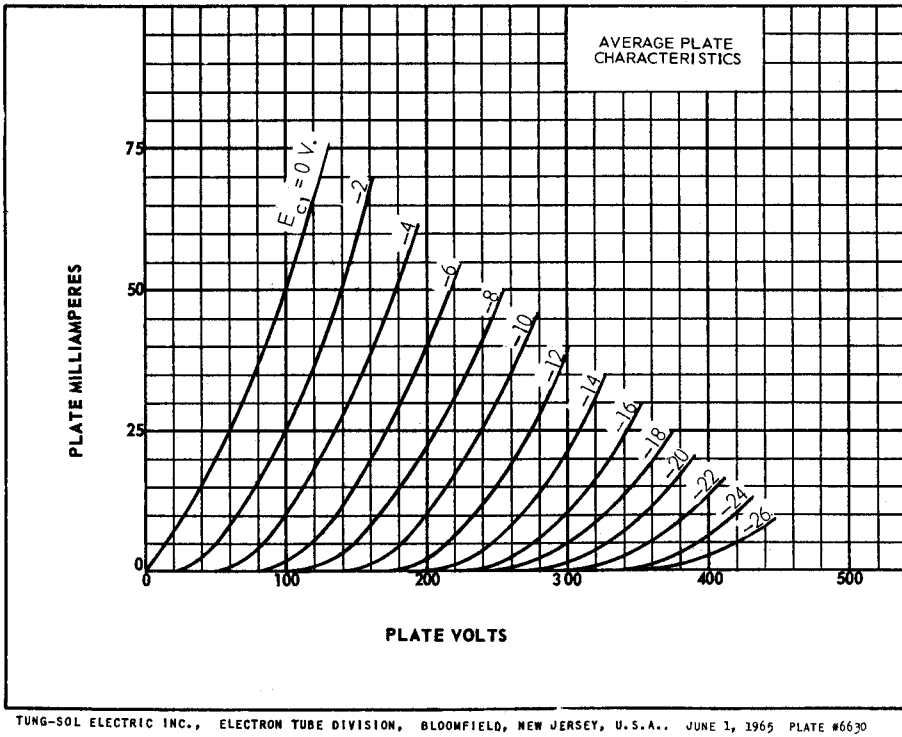
TUNG-SOL

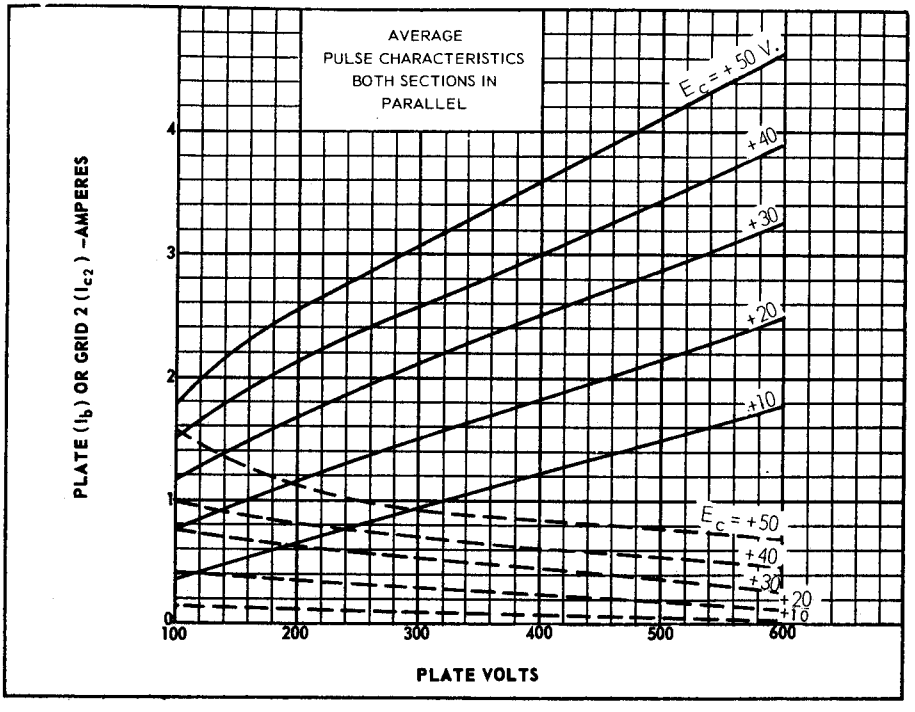
APPLICATION NOTES

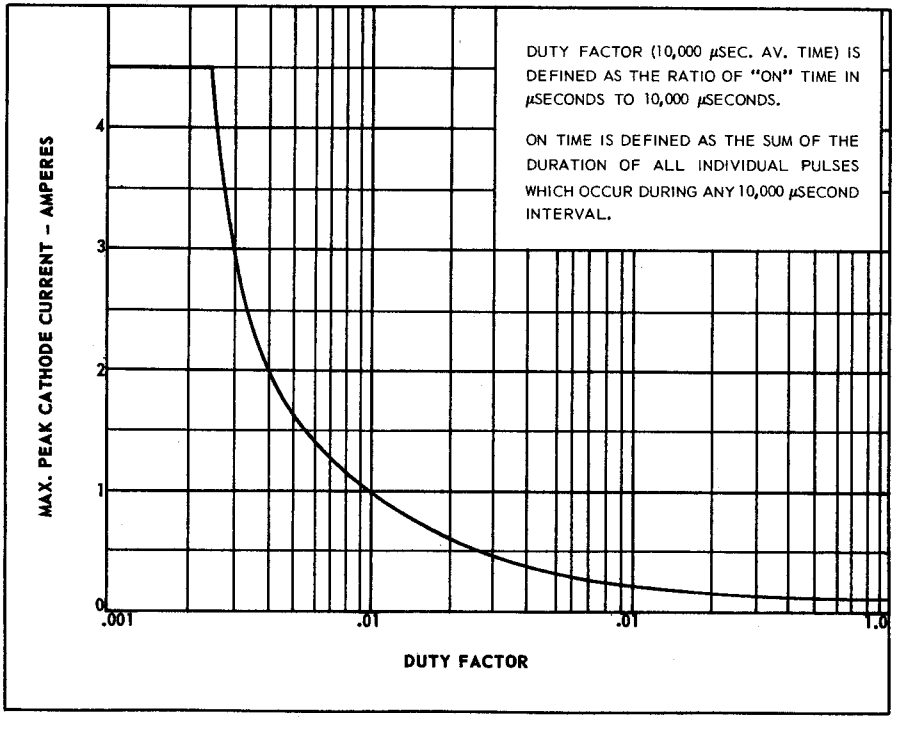
SPECIAL ATTENTION SHOULD BE GIVEN TO THE TEMPERATURES AT WHICH THE TUBES ARE TO BE OPERATED. RELIABILITY WILL BE SERIOUSLY IMPAIRED IF MAXIMUM BULB TEMPERATURE IS EXCEEDED. THE LIFE EXPECTANCY WILL BE REDUCED APPRECIABLY IF ABSOLUTE MAXIMUM RATINGS ARE EXCEEDED. BOTH RELIABILITY AND PERFORMANCE WILL BE JEOPARDIZED IF FILAMENT VOLTAGE RATINGS ARE EXCEEDED. LIFE AND RELIABILITY OF PERFROMANCE ARE DIRECTLY RELATED TO THE DEGREE THAT REGULATION OF THE HEATER VOLTAGE IS MAINTAINED AT ITS CENTER RATED VALUE.

THIS TUBE IS CONSTRUCTED USING NONEX GLASS AND THUS CAN WITHSTAND HIGHER AMBIENT TEMPERATURES IN OPERATION. HOWEVER, THE BULB TEMPERATURE SHOULD NEVER EXCEED 300°C AT ITS HOTTEST POINT AND COOLING SHOULD BE EMPLOYED IF NECESSITATED BY THE ADDITIVE EFFECTS OF OPERATION AT HIGH ALTITUDES AND HIGH DISSIPATION SIMULTANEOUSLY OR BY OTHER SOURCES OF HEAT IN THE EQUIPMENT.

THE PLATE VOLTAGE RATING AND HIGH-PERVEANCE OF THE 6900 MAKE IT READILY ADAPTABLE TO VARIED PULSE APPLICATIONS. IN ORDER TO INSURE MAXIMUM RELIABILITY IN PULSE SERVICE THE PEAK CATHODE CURRENT SHOULD NOT EXCEED THE VALUE SHOWN IN PULSE RATING CHART FOR THE REQUIRED DUTY FACTOR.




AVERAGE
PULSE CHARACTERISTICS
BOTH SECTIONS IN
PARALLEL
E_c = +50 V.
+40
+30
+20
+10
E_c = +50
+40
+30
+20
+10
PLATE (I_b) OR GRID 2 (I_{c2}) - AMPERES
0
1
2
3
4
100
200
300
400
500
600
PLATE VOLTS


DUTY FACTOR (10,000 μSEC. AV. TIME) IS DEFINED AS THE RATIO OF "ON" TIME IN μSECONDS TO 10,000 μSECONDS.
ON TIME IS DEFINED AS THE SUM OF THE DURATION OF ALL INDIVIDUAL PULSES WHICH OCCUR DURING ANY 10,000 μSECOND INTERVAL.
MAX. PEAK CATHODE CURRENT - AMPERES
0
1
2
3
4
.001
.01
.01
1.0
DUTY FACTOR

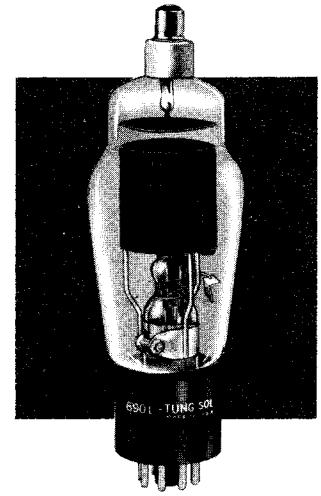
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6901

JANUARY, 1963

GAS AND MERCURY-VAPOR THYRATRON



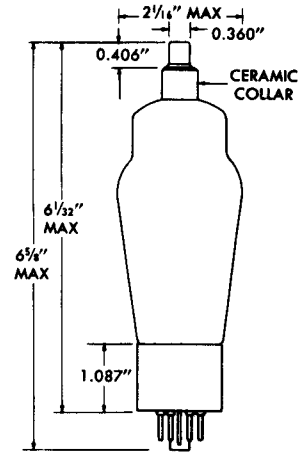
DESCRIPTION — The 6901 is a three electrode, inert-gas and mercury-vapor filled thyratron with negative control characteristics. This tube is similar to the type 393A except that the design and test schedule have been modified to provide long life at low temperatures.

In some applications, the 6901 provides many times the useful tube life of the 393A. In addition, the peak voltage and frequency limits have been raised. The 6901 finds use as a grid-controlled rectifier and a relay tube especially where many "starts" at extremely low temperatures are anticipated.

The 6901 employs a 7-pin octal base.

ELECTRICAL DATA

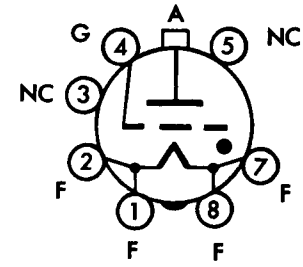
Filament Voltage	2.5 ± 0.125	Volts
Filament Current @ E_f = 2.5 Volts	7	Amperes
Cathode Heating Time — From −40 to +70°C	15	Seconds minimum
— From −55 to −40°C	30	Seconds minimum
Anode to Control Grid Capacitance	1.8	Micromicrofarads
De-ionization Time—Approximate		
Anode Volts = 120, Anode Current = 1.5 Amperes		
Grid Volts = −20, Grid Resistor = 10,000 Ohms	180	Microseconds
Anode Volts = 120, Anode Current = 1.5 Amperes		
Grid Volts = −500, Grid Resistor = 100,000 Ohms	30	Microseconds
Anode Voltage Drop—Approximate		
Initial	10	Volts
End fo Life	20	Volts



OUTLINE DRAWING

MECHANICAL DATA

Mounting Position	Vertical, base down
Type of Cooling	Convection
Bulb	ST16
Base	B7-12 Medium shell octal
Cap	C1-1 Small with ceramic collar
Net Weight	3 Ounces maximum
Socket	Octal



BASING DIAGRAM BOTTOM VIEW 5AV

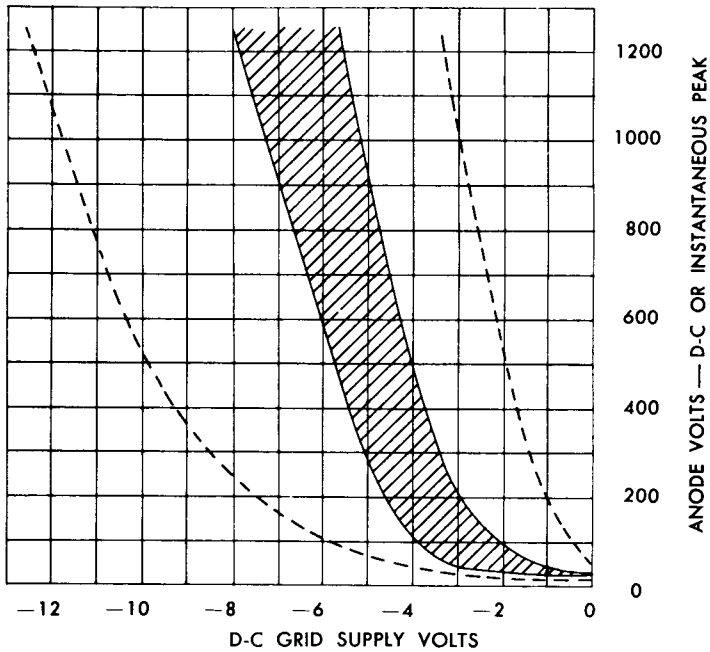
TYPE 6901

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Peak Anode Voltage			
Forward	—	1700	Volts
Reverse	—	1700	Volts
Grid Voltage			
Peak or DC before tube conduction	—	—500	Volts
Average during tube conduction — Note 1	—	—10	Volts
Anode Current			
Peak	—	6	Amperes
Average—Note 2	—	1.5	Amperes
Fault—for duration of 0.1 second maximum—Note 3	—	120	Amperes
Grid Current			
Average—Note 4	—	+0.01	Ampere
Operating Frequency	—	420	Cycles per second
Altitude	—	10,000	Feet
Temperature Range — Note 5	40	80	Degrees Centigrade
Filament Voltage	2.37	2.63	Volts

NOTES: 1. Averaged over one conducting period.
2. Averaged over any interval of five seconds maximum.
3. The equipment designer should limit the short circuit current to 120 amperes circuitwise. It should be understood that while the tube may stand several faults at this magnitude of current, each fault will adversely affect tube life.
4. Averaged over the period of grid conduction.
5. The recommended operating range for this tube is from 40° to 80° Centigrade. Operation between —55° and +40° Centigrade at reduced ratings, or "starts" in this temperature range are permissible, but will result in considerably shortened life.

Shaded area shows usual control region. Dotted limits show nominal range of grid control voltage taking into consideration differences between individual tubes, and variations due to filament voltage, temperature and changes during life.



OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

APPLICATION NOTES

Thyratron tubes, if correctly used, will give many thousands of hours of reliable service. The correct use of a tube involves among other things adherence to the following rules:

1. Avoid cold starts. The heat shielded, oxide coated filament should be energized before the anode voltage is applied in order to obtain maximum life.
2. Avoid operating the tube outside of the specified filament voltage range.
3. Avoid exceeding the rated peak inverse voltage. Excess inverse voltage can cause either an immediate failure or a rapid decline in useful life.

No clear cut method of foretelling tube failure has been devised. Periodic replacement of a tube as a routine preventive maintenance device is not recommended as a tube that has operated for several thousand hours may be good for several more thousand hours of useful operation. Quite often maintenance personnel can, after some experience with a piece of equipment, anticipate tube failure by observation. Visual checks of tube (arc) drop will indicate tubes approaching end of life. Tube drop voltages considerably higher than that of the last readings, or readings above 20 volts indicate tubes that may soon fail. While such a reading can be taken directly at the tube in the operating equipment, it is a dangerous practice. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL. A more practical and exact measurement is observing the tube voltage drop in a test jig while it passes one or two high current pulses. Such a jig is illustrated in figure 1. The oscilloscope is calibrated by first setting switch S2 to CURRENT CHECK. Momentary contact switch S1 is then tapped while CURRENT SET resistor R2 is adjusted until a pattern 8 volts high appears on the oscilloscope screen. This indicates that a peak current of eight amperes is flowing through the tube under test and through calibrating resistor R3. The tube voltage drop can then be read directly in volts on the oscilloscope scale by setting switch S2 to the TEST position and tapping switch S1. A new tube will have a voltage drop of approximately 10 volts. A tube approaching the end of life may have a voltage drop of 20 volts.

Grid-controlled thyratrons can be incorporated into circuits to provide numerous services including the speed control of d-c motors, dc to ac inversion, ac to dc rectification, and supplying variable a-c power from an a-c source.

Figure 2 illustrates one method of converting ac to dc. The magnitude of the d-c output voltage is controlled by the variable resistor which controls the firing angle, or grid voltage phase, of the thyratrons. The use of thyratrons to supply a variable a-c output from a fixed a-c source is shown in figure 3. Again, the variable resistor serves to control the phase angle of the applied grid voltage and thus the output voltage.

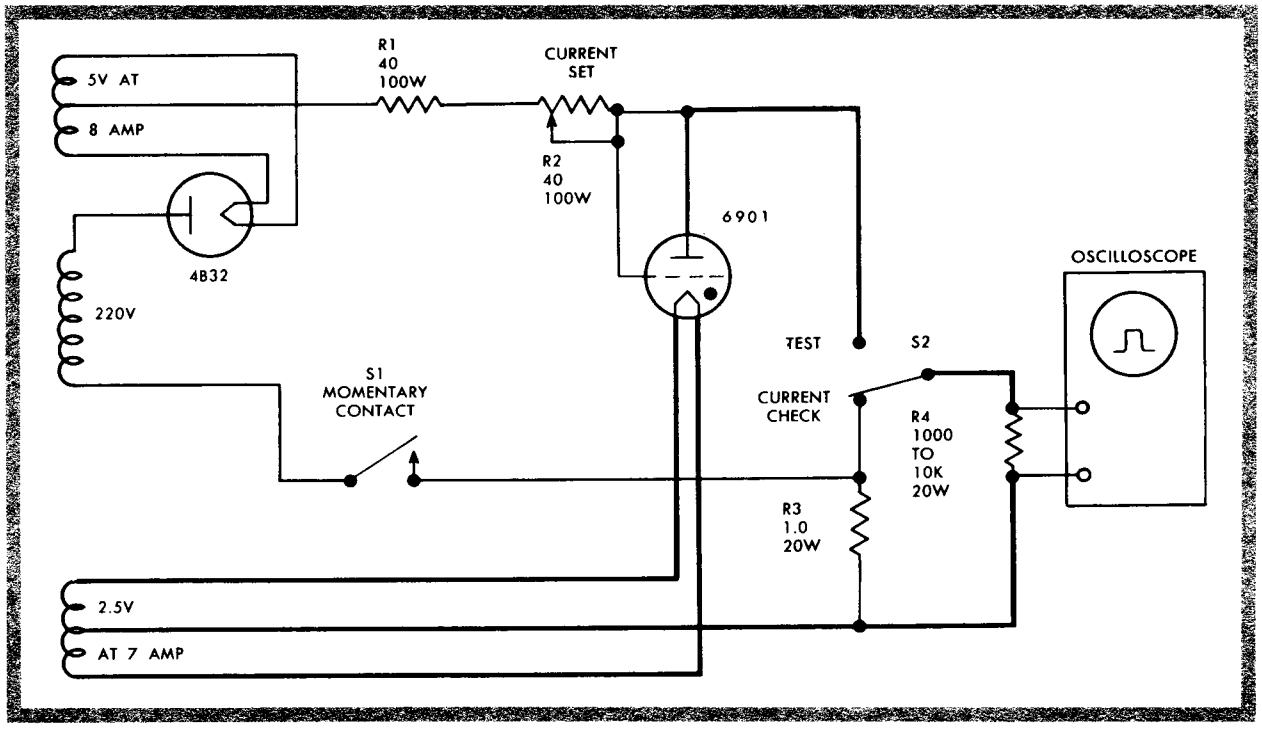


FIGURE 1. TEST JIG FOR MEASURING EMISSION BY TUBE VOLTAGE DROP

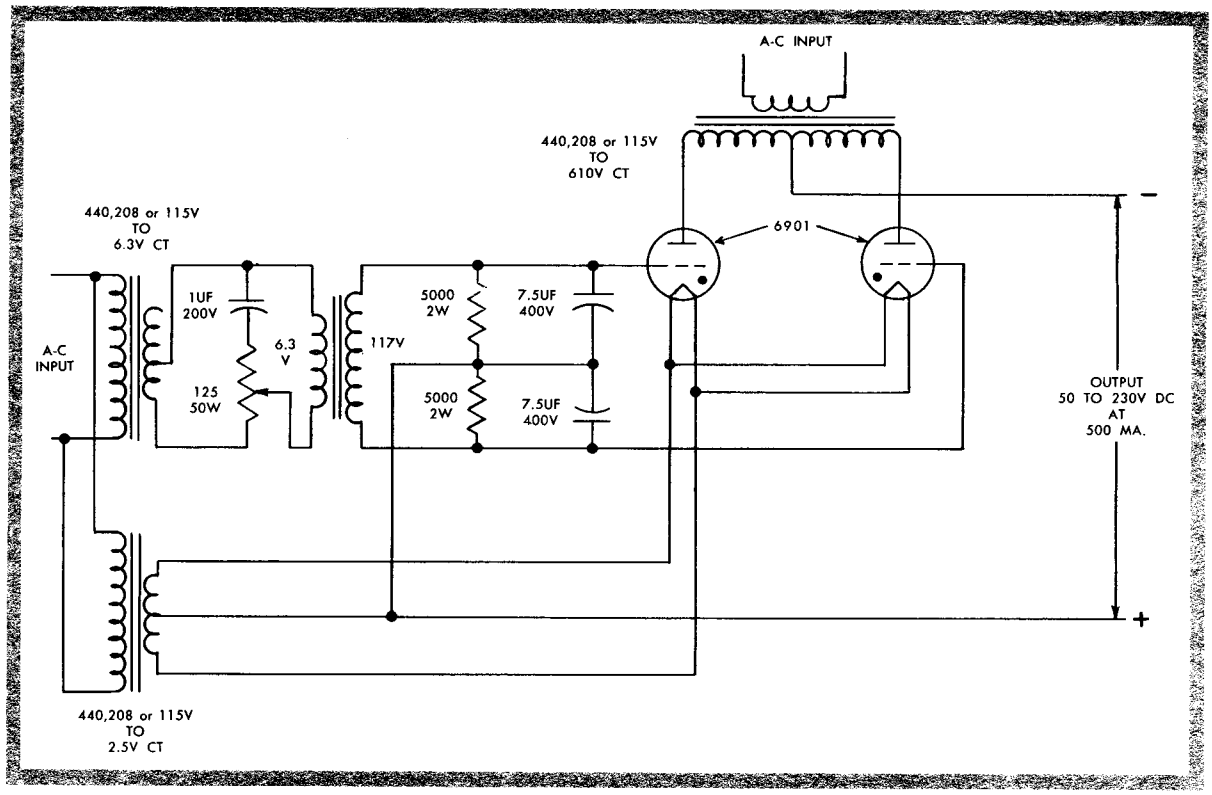


FIGURE 2. THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

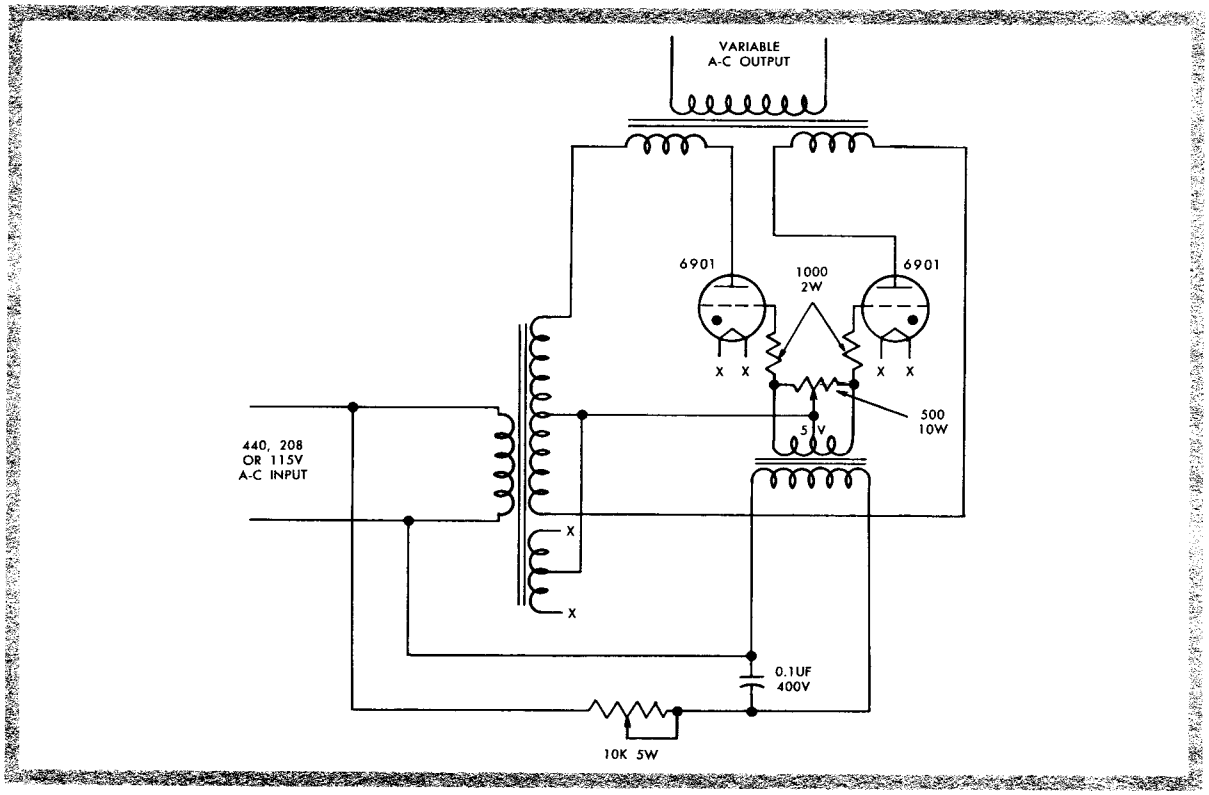


FIGURE 3. THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT

TUNG-SOL

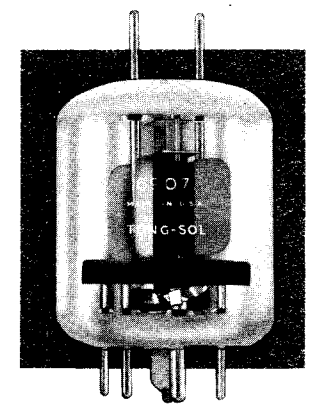
PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 6907

JANUARY 1963

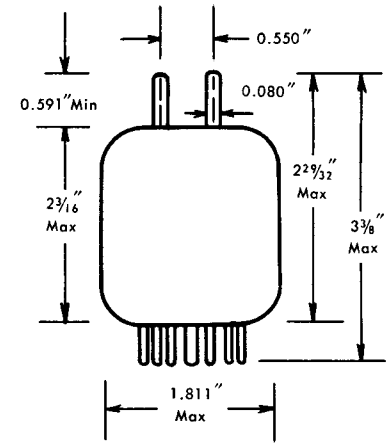
R-F BEAM POWER TUBE

DESCRIPTION The 6907 is an all glass, UHF, twin tetrode transmitting tube designed to operate up to 600 megacycles. A compact, power sensitive, linear characteristic tube, the 6907 is rated for either 6.3 or 12.6 heater volts for use in both fixed station and mobile equipment. As a straight through RF amplifier at 150 megacycles, the 6907 will handle 90 watts input (more under ICAS ratings) with 20 watts total plate dissipation.



ELECTRICAL DATA

	Min	Bogey	Max	
Heater — Series Connected				
Voltage	11.35	12.6	13.85	Volts
Current	0.55	0.65	0.75	Amperes
Heater — Parallel Connected				
Voltage	5.7	6.3	6.9	Volts
Current	1.1	1.3	1.5	Amperes
Amplification Factor —				
Grid No. 2—Grid No. 1 at I_b = 20 milliamperes	6.5	8.0	9.5	
Transconductance —				
At I_b = 20 milliamperes	—	2500	—	Micromhos
Interelectrode Capacitances				
Input — Each Section	6.0	6.5	7.0	Micromicrofarads
Output — Each Section	2.0	2.5	3.0	Micromicrofarads
Input — Push-pull	—	4.4	—	Micromicrofarads
Output — Push-pull	—	1.6	—	Micromicrofarads
Heater-Cathode Voltage	—	—	100	Volts



OUTLINE DRAWING

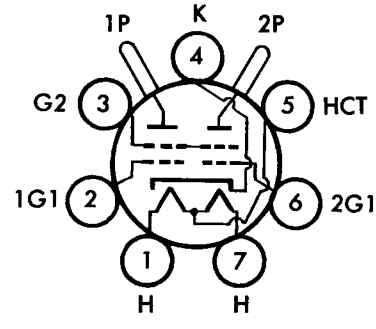
MECHANICAL DATA

Mounting Position	Any
Maximum Bottom Seal Temperature	180 degrees Centigrade
Maximum Top Anode Seal Temperature	200 degrees Centigrade
Maximum Bulb temperature	250 degrees Centigrade
Base	Septar, JEDEC E7-20
Socket	E. F. Johnson Co., 122-105 or equal
Net Weight	2½ ounces

Plate connectors should be used that provide a high degree of heat transfer by radiation or by convection. Under normal conditions, natural cooling is sufficient with a plate voltage of:

600 volts at frequencies up to 150 magacycles
500 volts at frequencies up to 200 megacycles
300 volts at frequencies up to 470 megacycles.

Above these limits or with high ambient temperatures, it may be necessary to direct an airflow of about 0.5 cubic foot-per-minute on top of the bulb to keep the anode seal within the stated limits.



BOTTOM VIEW

R-F POWER AMPLIFIER & OSCILLATOR — CLASS C TELEGRAPHY

Key down conditions per tube without modulation — Note 1

TYPICAL OPERATION

	CCS				
Frequency	462	462	462	600	Megacycles
D-C Plate Voltage	200	300	400	400	Volts
D-C Grid No. 2 Voltage	200	250	250	250	Volts
D-C Grid No. 1 Voltage	—30	—40	—50	—50	Volts
D-C Plate Current	2x50	2x50	2x50	2x50	Milliamperes
D-C Grid No. 2 Current	2x3	2x2.5	2x2.5	2x2.5	Milliamperes
D-C Grid No. 1 Current—Approximate	2x0.5	2x0.6	2x0.7	2x0.7	Milliamperes
Driving Power	1.5	2.0	3.0	—	Watts
Power Output-Approximate	11	17	25	20	Watts

TYPE 6907

FREQUENCY TRIPLER — CLASS C TELEGRAPHY

TYPICAL OPERATION

	CCS			ICAS	
Frequency	66.7/200	133/400	154/462	154/462	Megacycles
D-C Plate Voltage	300	300	350	350	Volts
D-C Grid No. 2 Voltage	250	250	250	250	Volts
D-C Grid No. 1 Voltage	—175	—175	—175	—175	Volts
D-C Plate Current	2x45	2x45	2x45	2x55	Milliamperes
D-C Grid No. 2 Current	2x3	2x2.8	5.5	5	Milliamperes
D-C Grid No. 1 Current—Approximate	2x1.5	2x1.2	2x1.2	2x1.8	Milliamperes
Driving Power — Note 2	4	5	5	6	Watts
Power Output	10	8	9.5	11.5	Watts

PLATE & SCREEN MODULATED R-F POWER AMPLIFIER — CLASS C TELEPHONY

Carrier conditions with two units in push-pull for use with a maximum modulation factor of 1.0

TYPICAL OPERATION

	CCS	
Frequency	400	Megacycles
D-C Plate Voltage	300	Volts
D-C Grid No. 2 Voltage	250	Volts
D-C Grid No. 1 Voltage	—50	Volts
D-C Plate Current	2x40	Milliamperes
D-C Grid No. 2 Current	2x3	Milliamperes
D-C Grid No. 1 Current—Approximate	2x1	Milliamperes
Driving Power — Note 2	—	Watts
Power Output — Approximate	13	Watts

A-F POWER AMPLIFIER & MODULATOR — CLASS B

TYPICAL OPERATION

	CCS		
D-C Plate Voltage	300	500	Volts dc
Grid No. 2 Voltage	250	250	Volts dc
Grid No. 1 Voltage	—25	—26	Volts dc
Plate-to-Plate Effective Load Resistance	11,000	20,000	Ohms
Peak A-F Grid No. 1-to-Grid No. 1 Voltage	50	52	Volts
Zero Signal D-C Plate Current	2x12.5	2x12.5	Milliamperes
Maximum Signal D-C Plate Current	2x35	2x36.5	Milliamperes
Zero Signal D-C Grid No. 2 Current	2x0.6	2x0.35	Milliamperes
Maximum Signal D-C Grid No. 2 Current	2x9.5	2x8.1	Milliamperes
Maximum Signal Plate Input	21	36.5	Watts
Maximum Signal Plate Dissipation	2x3.9	2x6.5	Watts
Power Output	13.2	23.5	Watts
Distortion	3.5	3.5	Percent
Efficiency	63	63	Percent

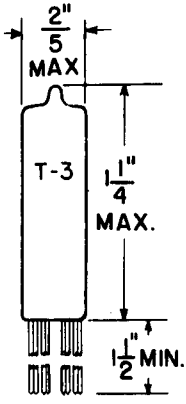
NOTES:

1. Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.
2. Driving power includes typical fixed frequency grid-circuit loss.

TUNG-SOL

PENTODE

SUBMINIATURE TYPE



GLASS BULB

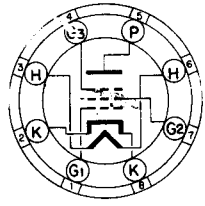
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.175 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SUBMINIATURE BUTTON

8DC

THE 6943 IS A SUBMINIATURE SHARP CUTOFF PENTODE DESIGNED FOR RADIO FREQUENCY AMPLIFIER SERVICE. THIS TYPE IS CHARACTERIZED BY EXTRAORDINARY FREEDOM FROM INTERELEMENT SHORT CIRCUITS OF SHORT TERM DURATION, BY HIGH RESISTANCE TO INTERELEMENT LEAKAGE, AND BY STABLE PERFORMANCE. IN ADDITION, VIBRATIONAL OUTPUT WHEN THE TUBE IS SUBJECTED TO WIDE BAND (WHITE NOISE) VIBRATION IS HELD TO A VERY LOW VALUE. IT IS SUITABLE FOR SERVICE AT HIGH ALTITUDES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK, VIBRATION AND HIGH TEMPERATURE ARE ENCOUNTERED. THESE CHARACTERISTICS GIVE THE TYPE SPECIAL VALUE IN GUIDED MISSILE APPLICATIONS.

DIRECT INTERELECTRODE CAPACITANCES[12]

GRID #1 TO PLATE (MAX.)	0.015	μμf
INPUT: G1 TO (H+K+G2+G3+I.S.+E.S.)	3.0	μμf
OUTPUT: P TO (H+K+G2+G3+I.S.+E.S.)	3.0	μμf

RATINGS[1]

ABSOLUTE VALUES

HEATER VOLTAGE	6.3	VOLTS
HEATER VOLTAGE VARIATION	6.3±10%	VOLTS
INSTANTANEOUS PLATE VOLTAGE	360	VOLTS
PLATE VOLTAGE	250	VDC
GRID #2 VOLTAGE	150	VDC
PLATE DISSIPATION	1.0	W
GRID #2 DISSIPATION	0.33	W
POSITIVE GRID #1 VOLTAGE	0	VDC
NEGATIVE GRID #1 VOLTAGE	55	VDC
EXTERNAL GRID #1 CIRCUIT RESISTANCE	1.0	MEG.
AVERAGE CATHODE CURRENT	15	mAdc
HEATER-CATHODE VOLTAGE	200	VOLTS
BULB TEMPERATURE (AT HOTTEST POINT)	250	°C
OPERATIONAL ALTITUDE	80,000	FT.

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AVERAGE CHARACTERISTICS

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.175	AMP.
CONDITIONS:		
HEATER VOLTAGE	6.3	VOLTS
PLATE VOLTAGE	100	VDC
GRID #2 VOLTAGE	100	VDC
GRID #3 VOLTAGE	0	
CATHODE BIAS RESISTOR	150	OHMS
PLATE CURRENT	8.0	mAdc
GRID #2 CURRENT	2.3	mAdc
TRANSCONDUCTANCE	3600	μMHOS
PLATE RESISTANCE	300,000	OHMS
GRID #1 VOLTAGE FOR Ib = 10 μA	−7.5	VDC
GRID #1 VOLTAGE FOR Ib = 200 μA	−5.5	VDC
OPERATION TIME (MAX.)[13]	20	SECS.

DURABILITY CHARACTERISTICS[2]

IMPACT ACCELERATION [3]	100	G
VIBRATIONAL ACCELERATION FOR AN EXTENDED PERIOD[4]	10	G
ON-OFF HEATER CYCLES [5]	2000	

CONTROLLED DETRIMENTS

INTERELECTRODE INSULATION (MIN) [6]	250	MEG.
TOTAL GRID CURRENT (MAX.)[7]	−0.1	μAdc
GRID EMISSION[8] (MAX.)	−0.5	μAdc
HUM OUTPUT[9] (MAX.)	15	MV, pk-pk
WHITE NOISE VIBRATION OUTPUT[10] (MAX.)	350	MV. pk-pk
	50	MV rms
HEATER-CATHODE LEAKAGE[11] (MAX.)	5.0	μAdc

NOTES:

1. LIMITING VALUES BEYOND WHICH NORMAL TUBE LIFE AND NORMAL TUBE PERFORMANCE MAY BE IMPAIRED.
2. TESTS PERFORMED AS A MEASURE OF THE MECHANICAL DURABILITY OF THE TUBE STRUCTURE.
3. FORCE AS APPLIED IN ANY DIRECTION BY THE NAVY TYPE HIGH IMPACT (FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES. SHOCK DURATION = 4 MILLISECONDS.
4. VIBRATIONAL FORCES APPLIED IN ANY DIRECTION FOR A PERIOD OF SIX HOURS REPEATEDLY SWEEPING THE RANGE FROM 30 CPS TO 3000 CPS AND BACK, WITH THE PERIOD OF THE SWEEP CYCLE BEING THREE MINUTES.
5. ONE CYCLE CONSISTS OF THE APPLICATION OF Ef = 7.0 V FOR ONE MINUTE AND INTERRUPTION OF THE FILAMENT VOLTAGE FOR FOUR MINUTES. A VOLTAGE OF Ehk = 140 Vac IS APPLIED CONTINUOUSLY.
6. MEASURED WITH Ef = 6.3 V, Ep-all = -300 Vdc; Eg2-all = -200 Vdc; Eg1-all = -100 Vdc; CATHODE IS POSITIVE SO THAT NO CATHODE EMISSION OCCURS.
7. MEASURED WITH Ef = 6.3 V; Eb = Ec2 = 100 Vdc; Rk = 150 OHMS; Rg1 = 1.0 MEG.
8. PREHEATED FOR FIVE MINUTES WITH Ef = 7.5 V; Eb = 250 Vdc; Ec2 = 150 Vdc; Rk = 1000 OHMS; Rg1 = 1.0 MEG; THEN TESTED WITH Ef = 7.5 V; Eb = Ec2 = 100 Vdc; Ec1 = -7.5 Vdc; Rg1 = 1.0 MEG. THIS IS A DESTRUCTIVE TEST AND THEREFORE MUST BE CONDUCTED ON A SAMPLE BASIS.

9. TEST WITH Ef = 6.3 V (400 CPS), Eb = Ec2 = 100 Vdc; Rk = 150 OHMS; Rg2 = 30,000 OHMS; RL = 10,000 OHMS; MEASURE THE HUM OUTPUT ACROSS R1 IN THE FREQUENCY BAND FROM 20 CPS TO 5,000 CPS.

10. TEST WITH Ef = 6.3 V; Eb = Ec2 = 100 Vdc; Rk = 150 OHMS; Rp = 10,000 OHMS. THE WHITE NOISE VOLTAGE ACROSS Rp IS FILTERED TO ROLL OFF APPROXIMATELY 35 db BETWEEN 10,000 CPS AND 13,000 CPS AND IS THEN MEASURED WITH BOTH A PEAK TO PEAK METER AND AN RMS READING METER. THE VIBRATIONAL FORCE APPLIED TO THE TUBE UNDER TEST IS SUCH THAT THE INSTANTANEOUS VALUES OF ACCELERATION FORM A WHITE NOISE SPECTRUM FROM 100 CPS TO 5000 CPS. ENERGY WITHIN THIS SPECTRUM IS DISTRIBUTED SUCH THAT EACH OCTAVE OF BAND-WIDTH DELIVERS 2.3 G'S RMS ACCELERATION. THE DEGREE OF CLIPPING IS SUCH THAT PEAK VALUES OF ACCELERATION EXCEED 15 G'S.

11. MEASURED WITH Ef = 6.3 V; Ehk = ± 100Vdc.

12. CAPACITANCES ARE MEASURED WITH AN EXTERNAL SHIELD OF 0.405"I.D.

13. OPERATION TIME IS THE TIME REQUIRED FOR A TUBE TO REACH A VALUE OF PLATE CURRENT EQUAL TO 85% OF THAT VALUE ATTAINED AFTER THREE MINUTES.

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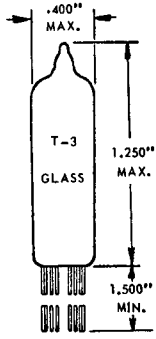
TUNG-SOL

PENTODE

SUBMINIATURE

OUTLINE DRAWING
JEDEC 3-11



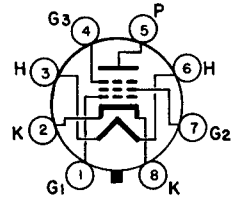
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
JEDEC E8-10

FOR
GUIDED MISSILE
SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8DC



BOTTOM VIEW

THE 6943 IS A SHARP-CUTOFF RF PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR GUIDED MISSILE SERVICE. THIS TYPE IS CHARACTERIZED BY STABLE PERFORMANCE FOR OPERATION AT HIGH ALTITUDES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK, VIBRATION AND HIGH TEMPERATURE ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #318 CONNECTED TO CATHODE

GRID 1 TO PLATE	MAX.	0.015	pf
INPUT		3.0	pf
OUTPUT		3.0	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	175	mA
LIMITS OF APPLIED VOLTAGE			5.5 TO 6.9	VOLTS
HEATER-CATHODE VOLTAGE				
HEATER POSITIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

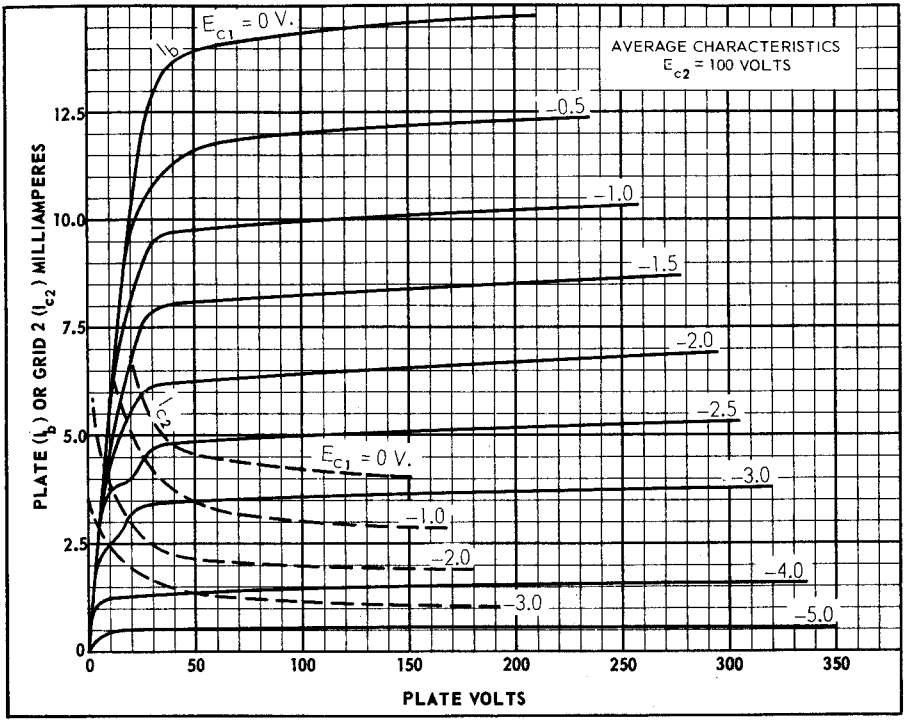
DC PLATE VOLTAGE	250	VOLTS
PEAK – PLATE FORWARD VOLTAGE	360	VOLTS
DC GRID 3 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	20	VOLTS
DC GRID 2 VOLTAGE	150	VOLTS
DC GRID 1 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	55	VOLTS
PLATE DISSIPATION	1.0	WATTS
GRID 2 DISSIPATION	0.33	WATTS
CATHODE CURRENT	15	mA
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHM
BULB TEMPERATURE	250	°C

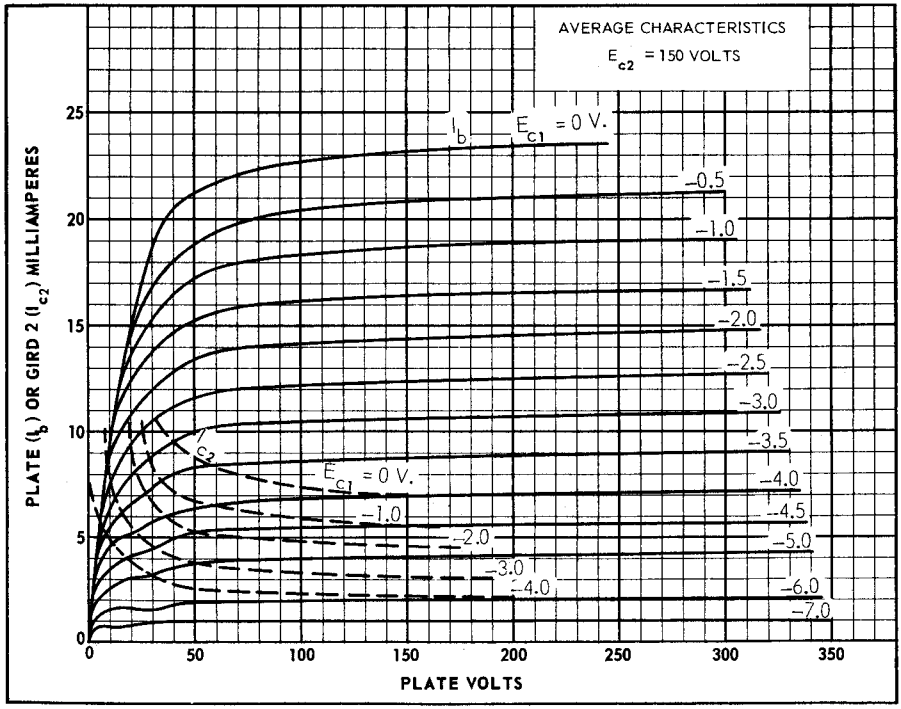
CHARACTERISTICS

DC PLATE VOLTAGE	100	VOLTS
DC GRID 3 VOLTAGE	0	VOLTS
DC GRID 2 VOLTAGE	100	VOLTS
CATHODE RESISTOR	150	OHMS
DC PLATE CURRENT	8.0	mA
DC GRID 2 CURRENT	2.3	mA
TRANSCONDUCTANCE	3,600	μMHOS
PLATE RESISTANCE	300,000	OHMS
DC GRID 1 VOLTAGE FOR I_b = 100 μADC MAX.	–7.5	VOLTS

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION		
FATIGUE		
FAILURE RATE		
ALTITUDE – ABSOLUTE MAXIMUM	80,000	FT.
RADIATION – ABSOLUTE MAXIMUM		
TOTAL DOSAGE– NEUTRONS/SQ. CM	10^{16}	NVT
DOSE RATE – NEUTRONS/SQ. CM/SEC	10^{12}	NV





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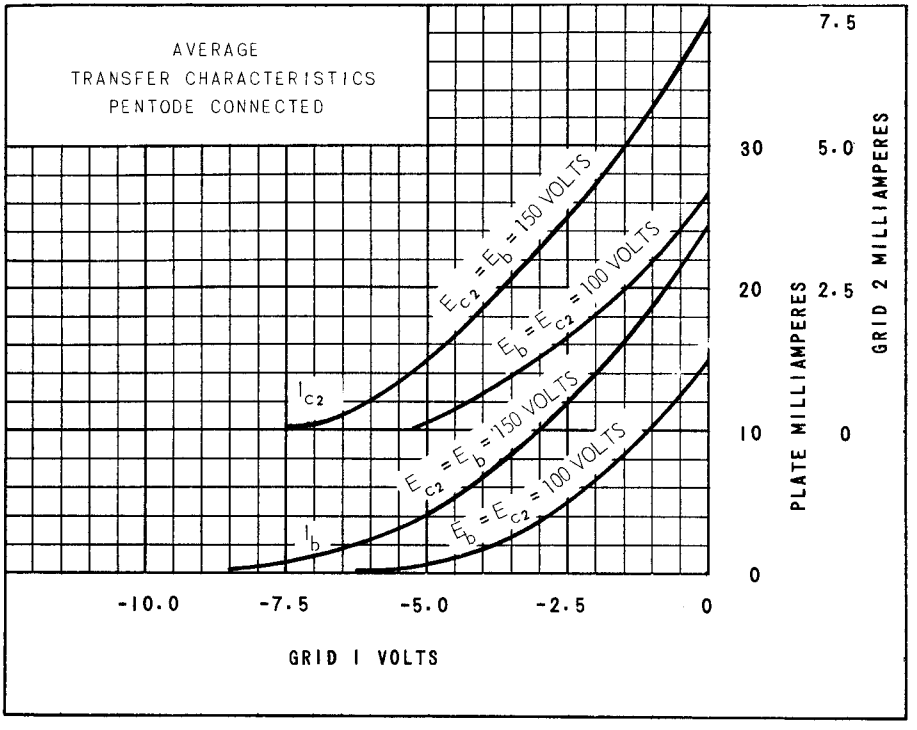
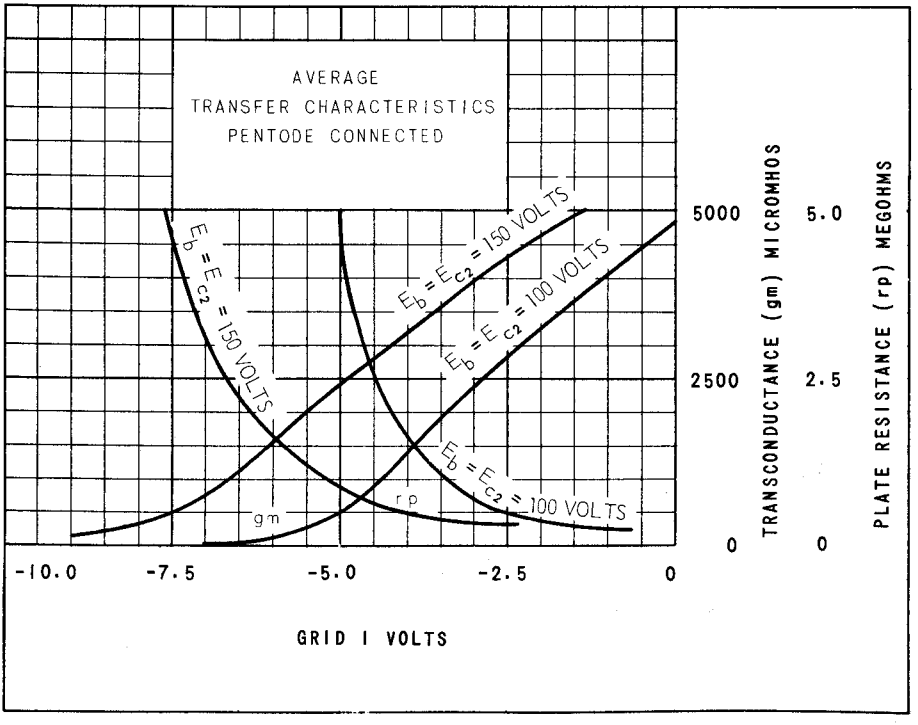

AVERAGE
TRANSFER CHARACTERISTICS
PENTODE CONNECTED
$E_{c2} = E_b = 150$ VOLTS
$E_b = E_{c2} = 100$ VOLTS
$E_{c2} = E_b = 150$ VOLTS
$E_b = E_{c2} = 100$ VOLTS
I_{c2}
I_b
-10.0
-7.5
-5.0
-2.5
0
GRID 1 VOLTS
7.5
30
5.0
20
2.5
10
0
0
PLATE MILLIAMPERES
GRID 2 MILLIAMPERES


AVERAGE
TRANSFER CHARACTERISTICS
PENTODE CONNECTED
$E_b = E_{c2} = 150$ VOLTS
$E_b = E_{c2} = 150$ VOLTS
$E_b = E_{c2} = 100$ VOLTS
$E_b = E_{c2} = 100$ VOLTS
gm
rp
-10.0
-7.5
-5.0
-2.5
0
GRID 1 VOLTS
5000
5.0
2500
2.5
0
0
TRANSCONDUCTANCE (gm) MICROMHOS
PLATE RESISTANCE (rp) MEGOHMS

TUNG-SOL

PENTODE

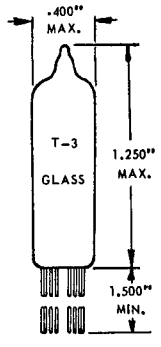
SUBMINIATURE

FOR GUIDED MISSILE SERVICE

COATED UNIPOTENTIAL CATHODE

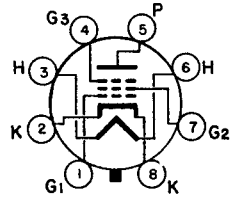
ANY MOUNTING POSITION

OUTLINE DRAWING
JEDEC 3-11



SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
JEDEC E8-10

BASING DIAGRAM
JEDEC 8DC



BOTTOM VIEW

THE 6944 IS A SEMI-REMOTE CUTOFF RF PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR GUIDED MISSILE SERVICE. THIS TYPE IS CHARACTERIZED BY STABLE PERFORMANCE IN OPERATION AT HIGH ALTITUDES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK, VIBRATION AND HIGH TEMPERATURE ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #318 CONNECTED TO CATHODE

GRID 1 TO PLATE	0.015	pf
INPUT	2.9	pf
OUTPUT	3.1	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	6.3 VOLTS	175	mA
LIMITS OF APPLIED VOLTAGE		5.5 TO 6.9	VOLTS
HEATER-- CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

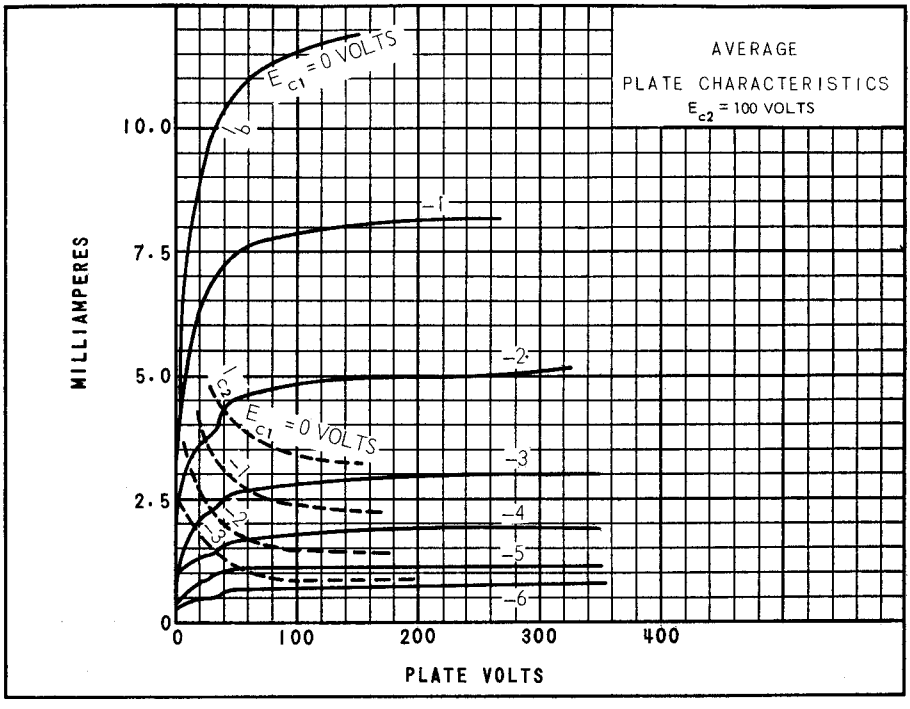
DC PLATE VOLTAGE	250	VOLTS
PEAK-PLATE FORWARD VOLTAGE	360	VOLTS
DC GRID 3 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	20	VOLTS
DC GRID 2 VOLTAGE	150	VOLTS
DC GRID 1 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	55	VOLTS
PLATE DISSIPATION	1.0	WATTS
GRID 2 DISSIPATION	0.36	WATTS
GRID 1 CIRCUIT RESISTANCE	1.0	MEGOHM
BULB TEMPERATURE	250	°C

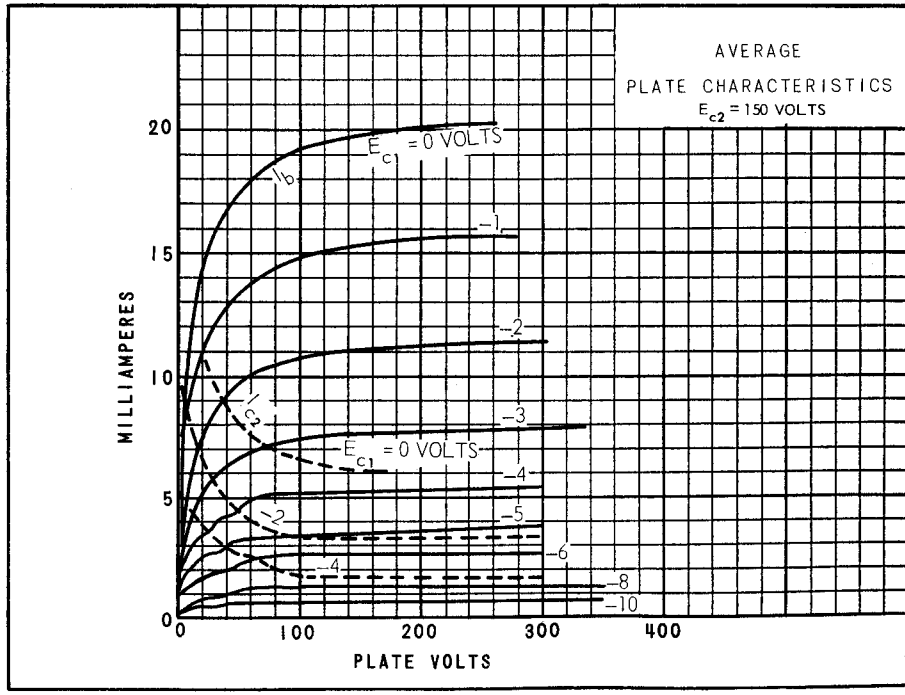
CHARACTERISTICS

DC PLATE VOLTAGE	100	VOLTS
DC GRID 3 VOLTAGE	0	VOLTS
DC GRID 2 VOLTAGE	100	VOLTS
CATHODE RESISTOR	150	OHMS
DC PLATE CURRENT	7.0	mA
DC GRID 2 CURRENT	2.0	mA
TRANSCONDUCTANCE	3,200	μMHOS
PLATE RESISTANCE	280,000	OHMS
DC GRID 1 VOLTAGE FOR G_m = 25 μMHOS APPROX. (75μMHOS MAX.)	–12	VOLTS

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION		
FATIGUE		
FAILURE RATE		
ALTITUDE – ABSOLUTE MAXIMUM	80,000	FT.
RADIATION – ABSOLUTE MAXIMUM		
TOTAL DOSAGE – NEUTRONS/SQ. CM	10^{16}	NVT
DOSE RATE – NEUTRONS/SQ. CM/SEC.	10^{12}	NV





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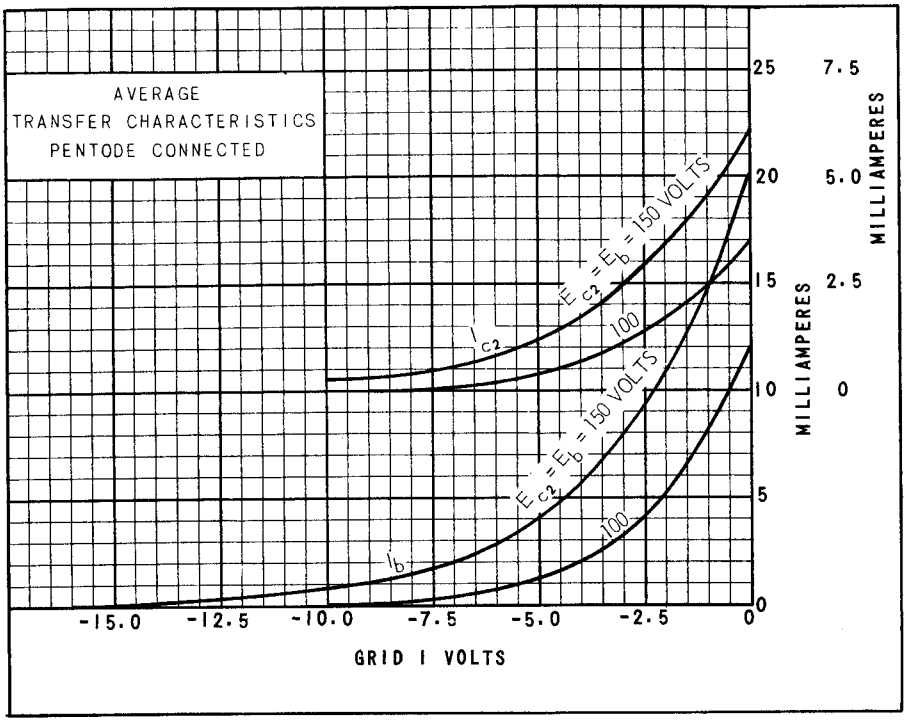
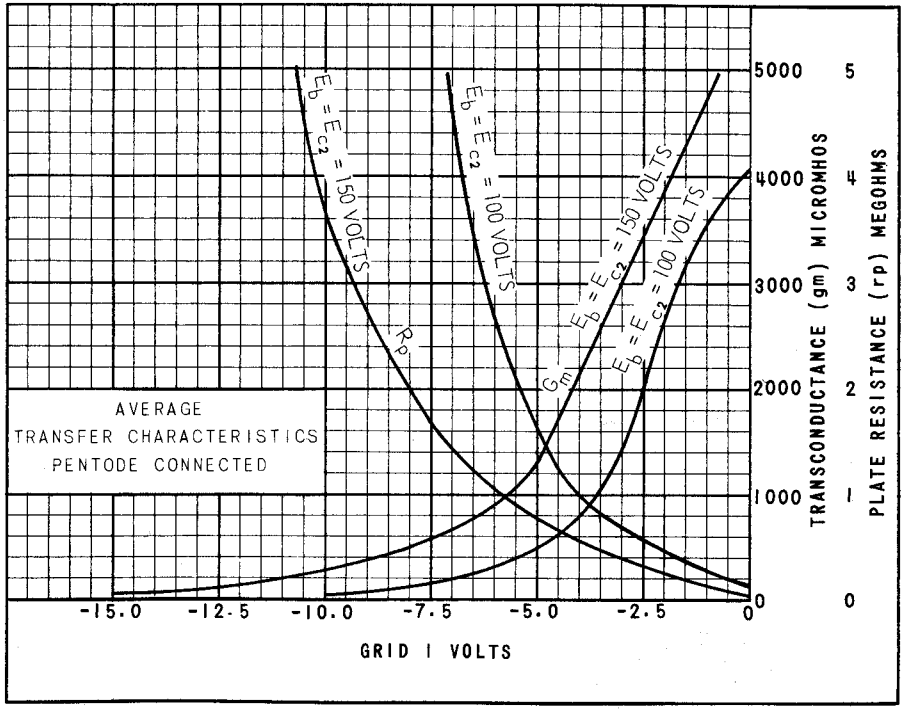

AVERAGE
TRANSFER CHARACTERISTICS
PENTODE CONNECTED
$E_{c2} = E_b = 150$ VOLTS
100
I_{c2}
$E_{c2} = E_b = 150$ VOLTS
100
I_b
25
20
15
10
5
0
7.5
5.0
2.5
0
MILLIAMPERES
MILLIAMPERES
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID 1 VOLTS

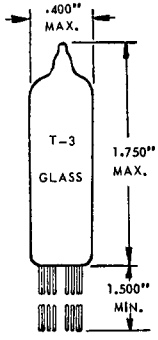

AVERAGE
TRANSFER CHARACTERISTICS
PENTODE CONNECTED
$E_b = E_{c2} = 150$ VOLTS
R_p
$E_b = E_{c2} = 100$ VOLTS
G_m
$E_b = E_{c2} = 150$ VOLTS
$E_b = E_{c2} = 100$ VOLTS
5000
4000
3000
2000
1000
0
5
4
3
2
1
0
TRANSCONDUCTANCE (gm) MICROMHOS
PLATE RESISTANCE (rp) MEGOHMS
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID 1 VOLTS

TUNG-SOL

BEAM PENTODE

SUBMINATURE

OUTLINE DRAWING
JEDEC 3-3



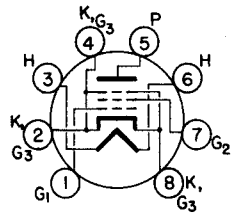
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
JEDEC E8-10

FOR
GUIDED MISSILE
SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8DL



BOTTOM VIEW

THE 6945 IS A BEAM POWER PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR GUIDED MISSILE SERVICE. THIS TYPE IS CHARACTERIZED BY STABLE PERFORMANCE IN OPERATION AT HIGH ALTITUDES WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK, VIBRATION AND HIGH TEMPERATURE ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITH EXTERNAL SHIELD #318 CONNECTED TO CATHODE

GRID 1 TO PLATE	MAX.	0.13	pf
INPUT		5.0	pf
OUTPUT		5.5	pf

HEATER CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	6.3 VOLTS	350	mA
LIMITS OF APPLIED VOLTAGE		5.5 TO 6.9	VOLTS
HEATER CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

DC PLATE VOLTAGE	250	VOLTS
PEAK-PLATE FORWARD VOLTAGE	360	VOLTS
GRID 2 VOLTAGE	150	VOLTS
DC GRID 1 VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	55	VOLTS
PLATE DISSIPATION	3.0	WATTS
GRID 2 DISSIPATION	0.33	WATTS
CATHODE CURRENT	40	mADC
GRID 1 CIRCUIT RESISTANCE	0.5	MEGOHM
BULB TEMPERATURE	250	°C

AVERAGE CHARACTERISTICS

	TRIODE CONNECTED	PENTODE CONNECTED	
DC PLATE VOLTAGE	100	100	VOLTS
DC GRID 2 VOLTAGE	100	100	VOLTS
CATHODE BIAS RESISTOR	270	270	OHMS
DC PLATE CURRENT	26	25	mA
DC GRID 2 CURRENT	–	1.5	mA
TRANSCONDUCTANCE	3,700	3,500	μMHOS
AMPLIFICATION FACTOR	5.0		
PLATE RESISTANCE - APPROX.	1,500	20,000	OHMS
DC GRID 1 VOLTAGE FOR I_b = 35 μA		−40	VOLTS

CHARACTERISTICS AND TYPICAL OPERATION

CLASS A_1 AMPLIFIER - SINGLE TUBE

	TRIODE CONNECTED		PENTODE CONNECTED	
PLATE VOLTAGE	150	250	150	VOLTS
GRID 2 VOLTAGE	–	–	110	VOLTS
CATHODE RESISTOR	680	2,700	470	OHMS
PEAK AF GRID 1 VOLTAGE	16.3	38.2	10.6	VOLTS
ZERO - SIGNAL PLATE CURRENT	23.8	14.2	21.5	mA
MAX. – SIGNAL PLATE CURRENT	25.3	15.5	20.5	mA
ZERO – SIGNAL GRID 2 CURRENT	–	–	0.8	mA
MAX. – SIGNAL GRID 2 CURRENT	–	–	3.23	mA
MAX. – SIGNAL POWER OUTPUT	0.43	0.94	1.22	WATTS
LOAD RESISTANCE	2,200	6,000	7,000	OHMS
TOTAL HARMONIC DISTORTION	11.0	16.7	11.0	PERCENT

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CHARACTERISTICS AND TYPICAL OPERATION (Cont'd)

PUSH-PULL - TWO TUBES

	CLASS A_1		CLASS AB_2	
PLATE VOLTAGE	150	200	185	VOLTS
GRID 2 VOLTAGE	110	125	110	VOLTS
GRID 1 VOLTAGE	-	-	-15	VOLTS
CATHODE RESISTOR	270	560	-	OHMS
PEAK AF GRID TO GRID VOLTAGE	21.2	39.6	31.2	VOLTS
ZERO-SIGNAL PLATE CURRENT	37.5	27.0	26.7	mA
MAX. - SIGNAL PLATE CURRENT	38.0	31.6	46.0	mA
ZERO - SIGNAL GRID 2 CURRENT	1.35	0.8	0.67	mA
MAX.-SIGNAL GRID 2 CURRENT	4.67	4.30	5.90	mA
MAX. SIGNAL POWER OUTPUT	2.42	3.41	4.76	WATTS
LOAD RESISTANCE - PLATE TO PLATE	12,000	13,000	10,000	OHMS
TOTAL HARMONIC DISTORTION - APPROX.	4.1	4.9	1.02	PERCENT

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION		
FATIGUE		
FAILURE RATE		
RADIATION: ABSOLUTE MAXIMUM		
TOTAL DOSAGE - NEUTRONS/SA.CM.	10^{16}	NVT
DOSE RATE - NEUTRONS/SQ. CM/SEC	10^{12}	NV
ALTITUDE - ABSOLUTE MAXIMUM	80,000	FT

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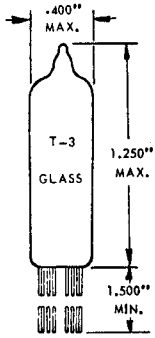
TUNG-SOL

TRIODE

SUBMINIATURE

OUTLINE DRAWING
JEDEC 3-11



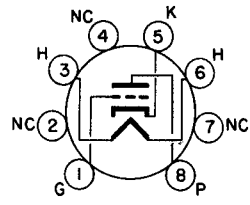
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
JEDEC E8-10

FOR
GUIDED MISSI LE
SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

OUTLINE DRAWING
JEDEC 8DK



BOTTOM VIEW

THE 6946 IS GENERAL PURPOSE MEDIUM-MU TRIODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR GUIDED MISSILE SERVICE. THIS TYPE IS CHARACTERIZED BY STABLE PERFORMANCE IN OPERATION AT HIGH ALTITUDES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK VIBRATION AND HIGH TEMPERATURES ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.0	pf
INPUT	1.6	pf
OUTPUT	0.75	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	175	mA
LIMITS OF APPLIED VOLTAGE		5.5 TO 6.9	VOLTS
HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

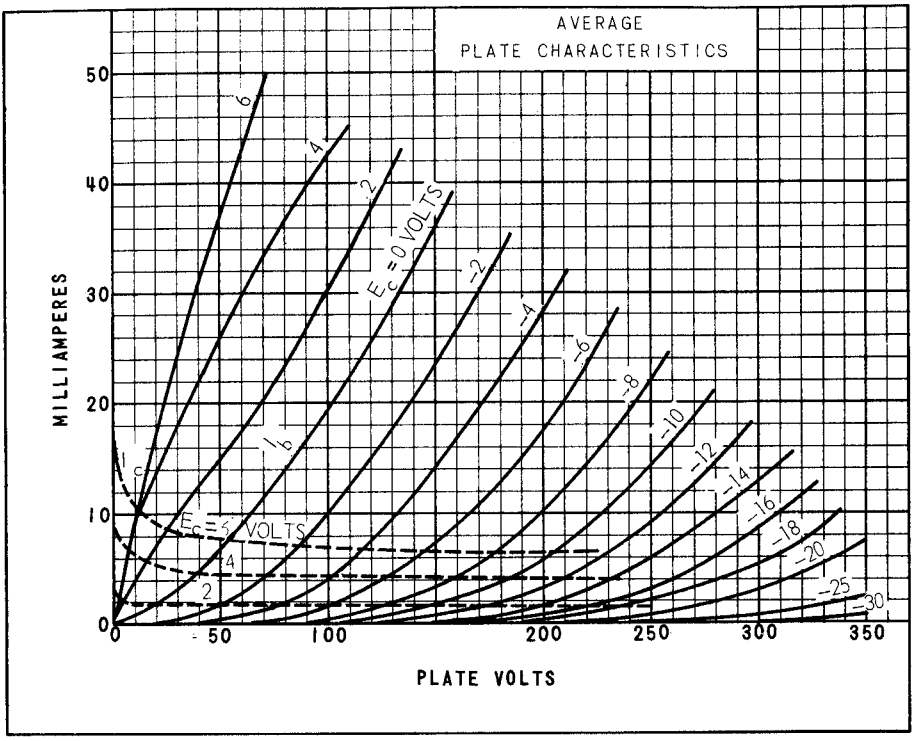
DC PLATE VOLTAGE	250	VOLTS
PEAK-PLATE FORWARD VOLTAGE	360	VOLTS
DC GRID VOLTAGE:		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	55	VOLTS
PLATE DISSIPATION	1.5	WATTS
DC CATHODE CURRENT	15	mA
GRID CIRCUIT RESISTANCE	1.0	MEGOHM
BULB TEMPERATURE	250	°C

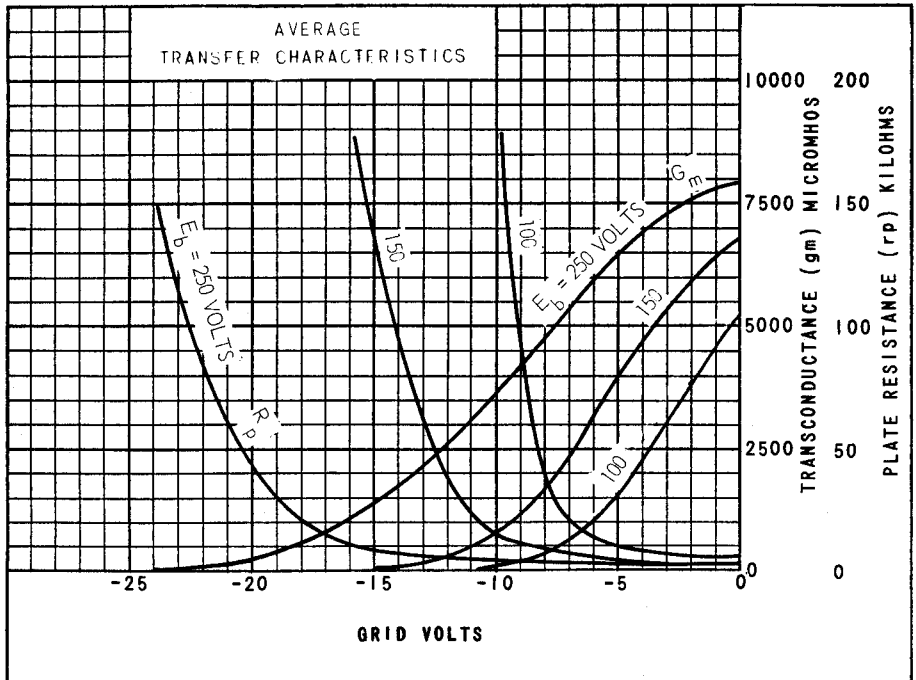
CHARACTERISTICS

DC PLATE VOLTAGE	100	VOLTS
CATHODE RESISTOR	270	OHMS
DC PLATE CURRENT	9.0	mA
AMPLIFICATION FACTOR	16.5	
TRANSCONDUCTANCE	3,800	μMHOS
DC GRID VOLTAGE FOR I_b = 150 μADC MAX.	−11.5	VOLTS
DC GRID VOLTAGE FOR I_b = 5 μADC MIN.	−8.5	VOLTS

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION		
FATIGUE		
FAILURE RATE		
ALTITUDE-ABSOLUTE MAXIMUM	80,000	FT.
RADIATION-ABSOLUTE MAXIMUM		
TOTAL DOSAGE-NEUTRONS/SQ. CM	10^{16}	NVT
DOSE RATE- NEUTRONS/SQ. CM/SEC	10^{12}	NV





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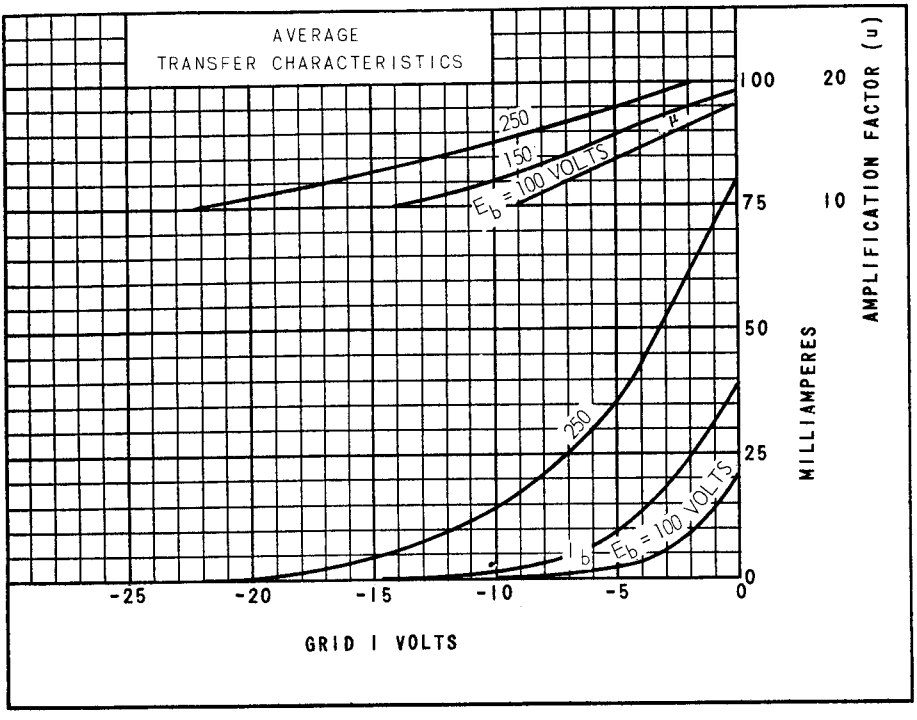
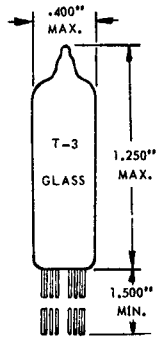

AVERAGE
TRANSFER CHARACTERISTICS
250
150
100 VOLTS
E_b =
μ
250
I_b
E_b = 100 VOLTS
100
75
50
25
0
20
10
MILLIAMPERES
AMPLIFICATION FACTOR (u)
-25
-20
-15
-10
-5
0
GRID I VOLTS

TUNG-SOL

TWIN TRIODE

SUBMINIATURE

OUTLINE DRAWING
JEDEC 3-11



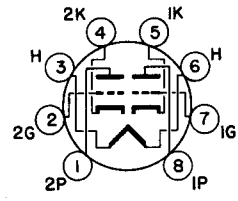
SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
JEDEC E8-10

FOR
GUIDED MISSILE
SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 8DG



BOTTOM VIEW

THE 6947 IS A SUBMINIATURE GENERAL PURPOSE MEDIUM-MU TWIN TRIODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR GUIDED MISSILE SERVICE. THIS TYPE IS CHARACTERIZED BY STABLE PERFORMANCE IN OPERATION AT HIGH ALTITUDES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK, VIBRATION AND HIGH TEMPERATURE ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE-EACH SECTION		1.2	pf
INPUT-EACH SECTION		1.6	pf
OUT			
SECTION 1		0.20	pf
SECTION 2		0.25	pf
GRID TO GRID	MAX.	0.013	pf
PLATE TO PLATE	MAX.	0.45	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES-SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	350	mA
LIMITS OF APPLIED VOLTAGE		5.5 TO 6.9	VOLTS
HEATER-CATHODE VOLTAGE			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS – EACH SECTION

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

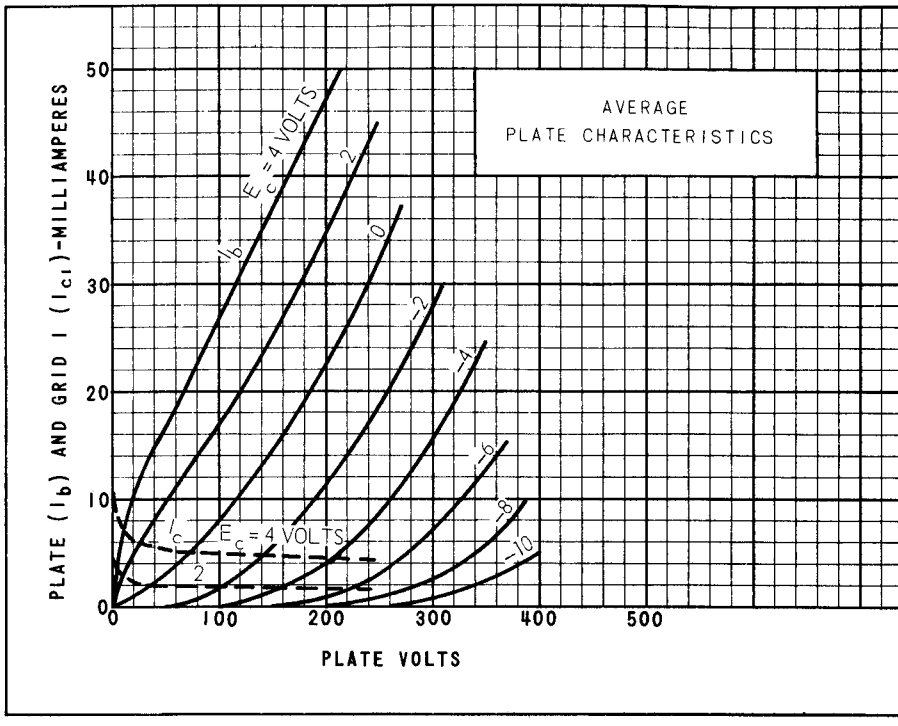
DC PLATE VOLTAGE	250	VOLTS
PEAK – PLATE FORWARD VOLTAGE	360	VOLTS
DC GRID VOLTAGE		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	55	VOLTS
PLATE DISSIPATION	0.75	WATTS
PLATE CURRENT	13	mA
GRID CIRCUIT RESISTANCE	1.0	MEGOHM
BULB TEMPERATURE	250	°C

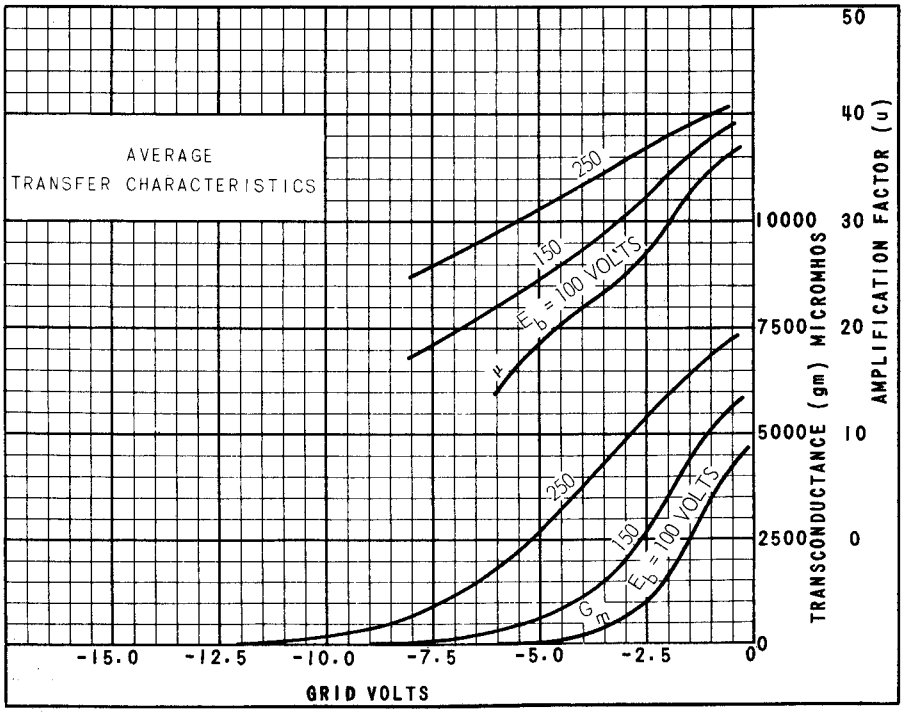
CHARACTERISTICS – EACH SECTION

DC PLATE VOLTAGE	150	VOLTS
CATHODE RESISTOR	270	OHMS
PLATE CURRENT	6.5	mA
AMPLIFICATION FACTOR	35	
TRANSCONDUCTANCE	4,000	μMHOS
GRID VOLTAGE FOR I_b = 50 μADC MAXIMUM	–9.0	VOLTS

SPECIAL TESTS AND RATINGS

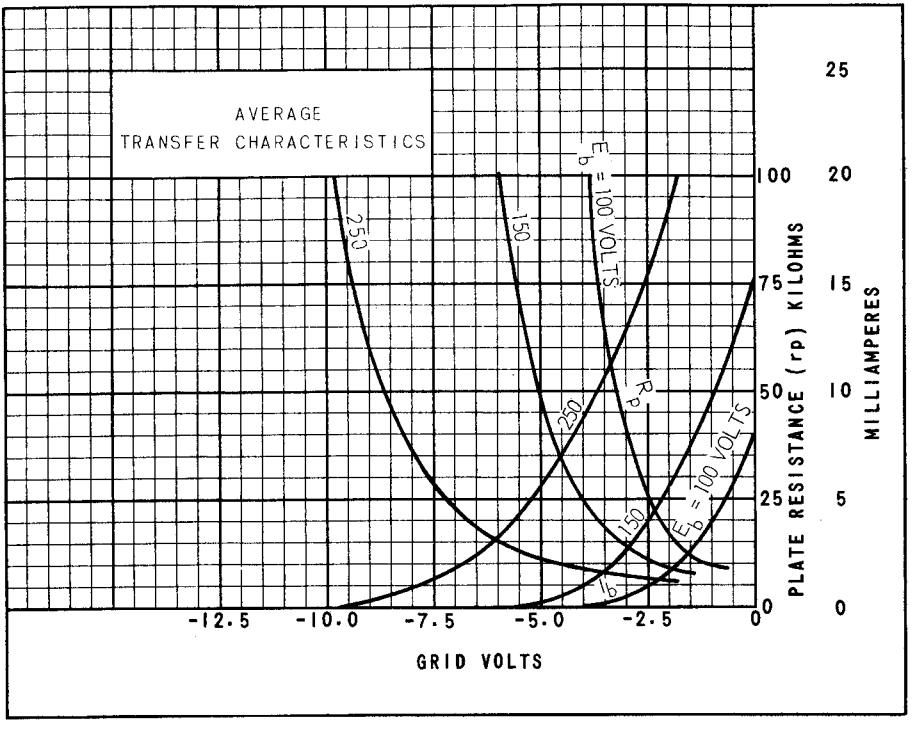
IMPACT ACCELERATION		
FATIGUE		
FAILURE RATE		
ALTITUDE – ABSOLUTE MAXIMUM	80,000	FT.
RADIATION – ABSOLUTE MAXIMUM		
TOTAL DOSAGE – NEUTRONS/SQ.CM	10^{16}	NVT
DOSE RATE – NEUTRONS/SQ. CM./SEC.	10^{12}	NV





TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A., MARCH 1, 1965 PLATE #6626

6947


AVERAGE
TRANSFER CHARACTERISTICS
E_b = 100 VOLTS
250
150
R_p
250
150
E_b = 100 VOLTS
I_b
-12.5
-10.0
-7.5
-5.0
-2.5
0
GRID VOLTS
100
75
50
25
0
PLATE RESISTANCE (rp) KILOHMS
25
20
15
10
5
0
MILLIAMPERES

TUNG-SOL

TWIN TRIODE

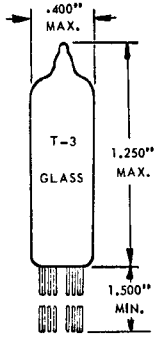
SUBMINIATURE

FOR GUIDED MISSILE SERVICE

COATED UNIPOTENTIAL CATHODE

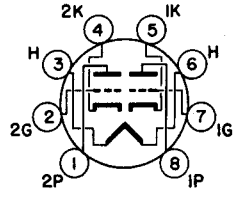
ANY MOUNTING POSITION

OUTLINE DRAWING
JEDEC 3-11



SUBMINIATURE BUTTON
8 FLEXIBLE LEADS
JEDEC E8-10

BASING DIAGRAM
JEDEC 8DG



BOTTOM VIEW

THE 6948 IS A GENERAL PURPOSE HIGH-MU TWIN TRIODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED SPECIFICALLY FOR GUIDED MISSILE SERVICE. THIS TYPE IS CHARACTERIZED BY STABLE PERFORMANCE IN OPERATION AT HIGH ALTITUDES AND WHERE SEVERE CONDITIONS OF MECHANICAL SHOCK, VIBRATION AND HIGH TEMPERATURE ARE ENCOUNTERED.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE – EACH SECTION		0.75	pf
INPUT – EACH SECTION		1.6	pf
OUTPUT			
SECTION 1		0.20	pf
SECTION 2		0.25	pf
GRID TO GRID	MAX.	0.014	pf
PLATE TO PLATE	MAX.	0.86	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	350	mA
LIMITS OF APPLIED VOLTAGE		5.5 TO 6.9	VOLTS
HEATER-CATHODE VOLTAGE:			
HEATER POSITIVE WITH RESPECT TO CATHODE		200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE		200	VOLTS

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MAXIMUM RATINGS – EACH SECTION

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

DC PLATE VOLTAGE	250	VOLTS
PEAK-PLATE FORWARD VOLTAGE	360	VOLTS
DC GRID VOLTAGE:		
POSITIVE VALUE	0	VOLTS
NEGATIVE VALUE	55	VOLTS
PLATE DISSIPATION	0.5	WATTS
DC PLATE CURRENT	10	mA
GRID CIRCUIT RESISTANCE	1.0	MEGOHM
BULB TEMPERATURE	250	°C

CHARACTERISTICS – EACH SECTION

DC PLATE VOLTAGE	100	VOLTS
CATHODE RESISTOR	1,500	OHMS
DC PLATE CURRENT	0.8	mA
AMPLIFICATION FACTOR	70	
TRANSCONDUCTANCE	1,650	μMHOS
DC GRID VOLTAGE FOR I_b = 50 μADC MAXIMUM	−3.5	VOLTS

SPECIAL TESTS AND RATINGS

IMPACT ACCELERATION		
FATIGUE		
FAILURE RATE		
ALTITUDE– ABSOLUTE MAXIMUM	80,000	FT.
RAD ATION – ABSOLUTE MAXIMUM		
TOTAL DOSAGE– NEUTRONS/SQ. CM	10^{16}	NVT
DOSE RATE – NEUTRONS/SQ. CM/SEC	10^{12}	NV

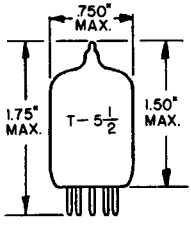
TUNG-SOL

PENTODE

MINIATURE TYPE

RUGGEDIZED FOR MILITARY

AND INDUSTRIAL APPLICATIONS

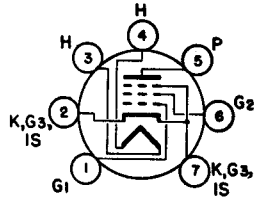


GLASS BULB

MINIATURE BUTTON
7 PIN BASE E7-1
OUTLINE DRAWING
JEDEC 5-1

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7BD

THE 6968 IS A WIDE-BAND HIGH-FREQUENCY AMPLIFIER IN THE 7 PIN MINIATURE CONSTRUCTION. THE DESIGN OF THE HEATER CATHODE PERMITS INTERMITTENT OPERATION WITH LONG PERIODS OF CUTOFF IN ON-OFF CONTROL APPLICATIONS WITHOUT IMPAIRMENT TO EMISSION. THE ELECTRICAL CHARACTERISTICS OF THE 6968 ARE SIMILAR TO THOSE OF THE 6AK5.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD 316 CONNECTED TO CATHODE

GRID TO PLATE: G1 TO P, MAX.	0.02	pf
INPUT: G1 TO K+H+G2+G3+I.S.	4.0	pf
OUTPUT: P TO K+H+G2+G3+I.S.	2.85	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	175	MA.
HEATER SUPPLY LIMITS:				
VOLTAGE/OPERATION			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			135	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			135	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	200	VOLTS
GRID 2 VOLTAGE	155	VOLTS
GRID 1 VOLTAGE, NEGATIVE, DC	50	VOLTS
GRID 1 VOLTAGE, POSITIVE, DC	0	VOLTS
PLATE DISSIPATION	1.65	WATTS
GRID 2 DISSIPATION	0.55	WATT
CATHODE CURRENT, DC	20	MA.
GRID 1 CURRENT, DC	1.0	MA.
GRID 1 CIRCUIT RESISTANCE	0.1	MEGOHM
BULB TEMPERATURE AT HOTTEST POINT	165	°C
ALTITUDE[A]	60000	FEET

[A] INCREASE IN ALTITUDE OVER THIS VALUE MAY REQUIRE A DECREASE IN INSTANTANEOUS VOLTAGES (Ef EXCEPTED)

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

CLASS A AMPLIFIER

	MIN.	AVG.	MAX.	
PLATE VOLTAGE		120		VOLTS
GRID 2 (SCREEN) VOLTAGE		120		VOLTS
GRID 1 (CONTROL-GRID) VOLTAGE		−2.0		VOLTS
TRANSCONDUCTANCE (1)	3800	5000	6200	μMHOS
PLATE CURRENT	5.0	7.5	11	MA.
GRID 2 CURRENT	0.8	2.5	4.0	MA.
GRID 1 VOLTAGE (APPROX.) FOR Ib = 10 μA.	------	−8.5	------	VOLTS
TRANSCONDUCTANCE PERCENTAGE CHANGE WITH Ef = 5.7 V. $\frac{\Delta Gm}{Gm\ (1)} \times 100$			15	PERCENT
CHARACTERISTICS WITH EF=6.3 VOLTS, Eb = Ec2 = 120 VOLTS				
PLATE CURRENT CUTOFF, Ec1 = −10V AND R_L = 0.1 MEG.	------	------	200	μA
PLATE CURRENT CUTOFF, Ec1 = − 5.5 V	5.0	------	200	μA
NEGATIVE GRID 1 CURRENT, Ecc1 = −2.0 V, Rg1 = 0.5 MEG.	0	------	0.1	μA
GRID 1 EMISSION CURRENT Ef = 7.5 V, Ecc1 = −45V, Rg1 = 0.1 MEG.	------	------	−0.5	μA.
TRIODE CONNECTED (GRID 2 TIED TO PLATE)[B]				
PLATE VOLTAGE	------	150	------	VOLTS
MAXIMUM PLATE CURRENT (Ec1 = −15.0 V)	------	------	100	μA
MINIMUM PLATE CURRENT (Ec1 = −7.0 V)	250	------	------	μA.

[B] MEASUREMENT OF CURRENT IN CATHODE CIRCUIT

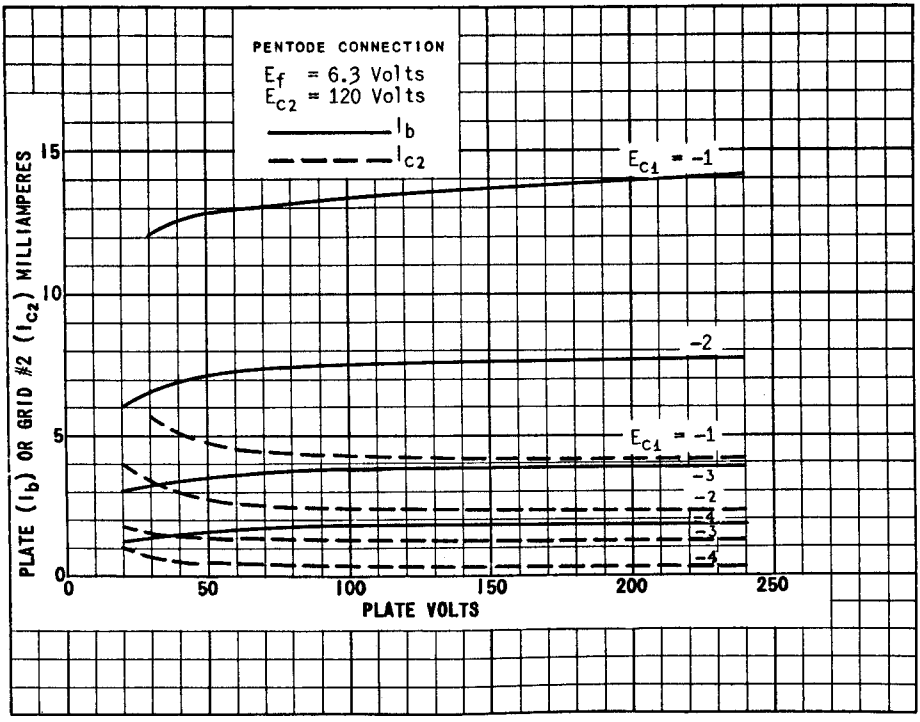
CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

SPECIAL TESTS AND RATINGS

VIBRATION NOISE OUTPUT VOLTAGE, RMS (MIL-E-1C 4.9.19.1)
SHOCK RATING
FATIGUE RATING



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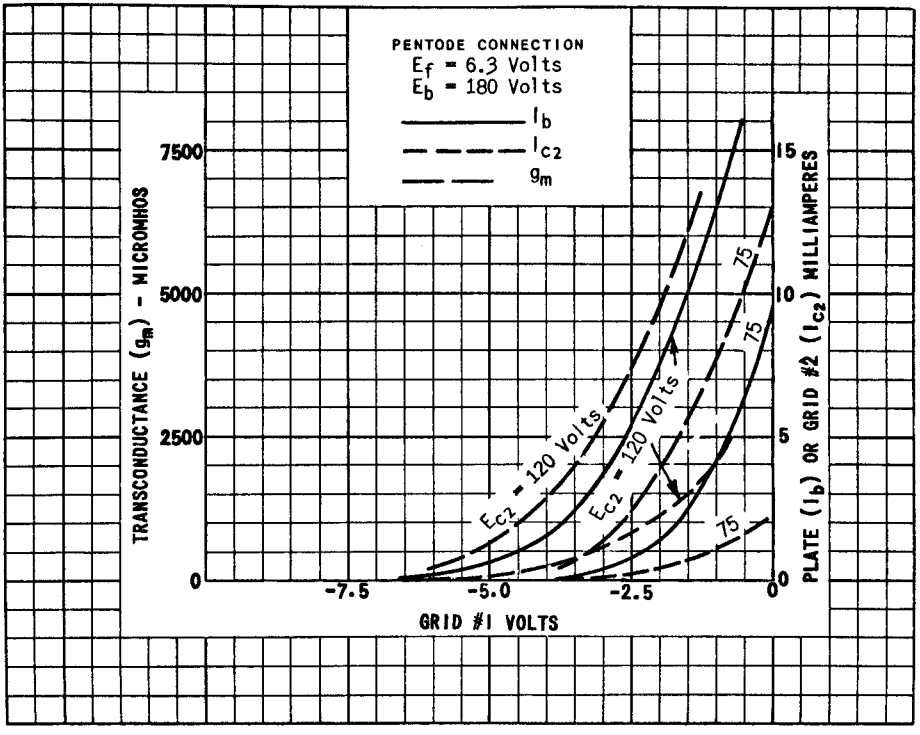

PENTODE CONNECTION
E_f = 6.3 Volts
E_b = 180 Volts
I_b
I_{c2}
g_m
TRANSCONDUCTANCE (g_m) - MICROMHOS
7500
5000
2500
0
PLATE (I_b) OR GRID #2 (I_{c2}) MILLIAMPERES
15
10
5
0
-7.5
-5.0
-2.5
0
GRID #1 VOLTS
E_{c2} = 120 Volts
E_{c2} = 120 Volts
75
75
75

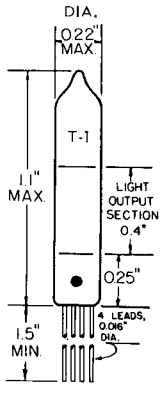
TUNG-SOL

INDICATOR TRIODE

SUBMINIATURE TYPE

FOR

LOW VOLTAGE APPLICATIONS



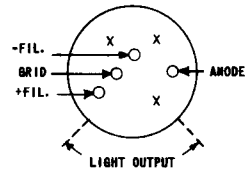
GLASS BULB

DOT INDICATES CENTER LINE OF LIGHT OUTPUT AREA

4 TINNED LEADS
0.016 DIA.

FILAMENTARY CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

DOT ON LIGHT OUTPUT AXIS
O- LEAD WIRE
X - CLIPPED OFF LEAD

→ THE 6977 IS A FILAMENTARY, HIGH-VACUUM SUBMINIATURE INDICATOR TRIODE. ITS GRID-SHAPED PLATE IS COATED WITH A PHOSPHOR WHICH GIVES A BRIGHT BLUE-GREEN LIGHT PROPORTIONAL TO THE PLATE CURRENT. IT IS DESIGNED FOR APPLICATIONS IN ELECTRONIC COMPUTERS, WHERE ITS SMALL SIZE, LOW ENERGY REQUIREMENTS, HIGH SENSITIVITY AND FREEDOM FROM NOISE MAKE IT VERY USEFUL IN COMBINATION WITH TRANSISTORIZED CIRCUITS. THE TUBE IS CONTROLLED TO MILITARY STANDARDS FOR HIGH RELIABILITY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.8	pf
GRID TO FILAMENT	1.0	pf
PLATE TO FILAMENT	1.1	pf

FILAMENT CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.0	VOLTS	30	MA.
SUPPLY			AC OR DC	
LIMITS OF APPLIED FILAMENT VOLTAGE			0.95-1.05	VOLTS

→ INDICATES A CHANGE.

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDRD RS-239

PLATE VOLTAGE	65	VOLTS
POSITIVE GRID SUPPLY VOLTAGE	0	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE CURRENT	750	μA
GRID CIRCUIT RESISTANCE	1	MEGOHMS
MINIMUM GRID CIRCUIT RESISTANCE	0.1	MEGOHMS

AVERAGE CHARACTERISTICS

FILAMENT: DC, NEGATIVE GROUNDED

PLATE VOLTAGE	50	VOLTS
GRID VOLTAGE	0	
PLATE CURRENT	440	μA
TRANSCONDUCTANCE	450	μMHOS
AMPLIFICATION FACTOR	30	

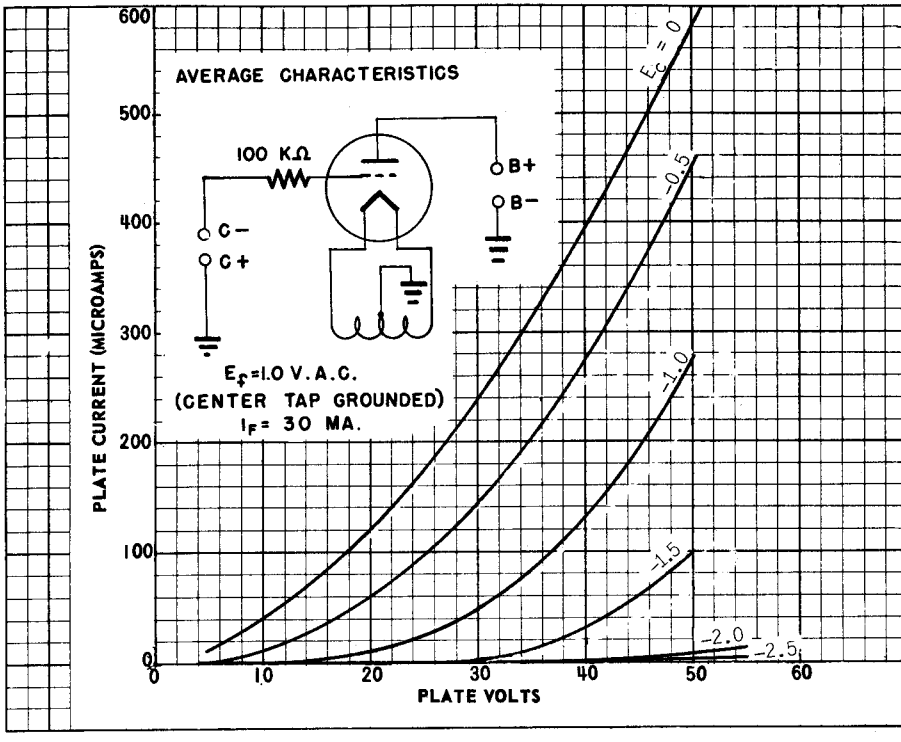
TYPICAL OPERATION

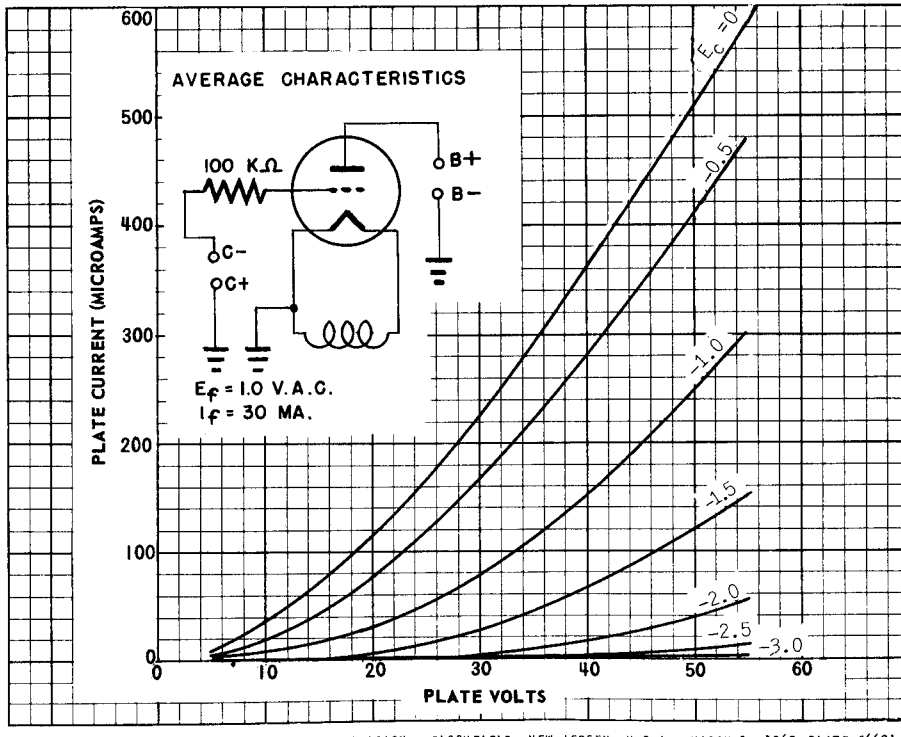
FILAMENT: SUPPLIED FROM TRANSFORMER, CENTER TAP GROUNDED

PLATE VOLTAGE	50	VOLTS
GRID RESISTOR	100	KOHMS
WITH GRID SUPPLY VOLTAGE 0		
PLATE CURRENT	580	μA
LIGHT OUTPUT	6	mCANDLES
WITH GRID SUPPLY VOLTAGE -3.0 VOLTS		
PLATE CURRENT	<5	μA
LIGHT OUTPUT	NOT VISIBLE	

NOTE:

LIGHT OUTPUT MEASURED BY COMPARISON WITH A TUNGSTEN LAMP OF 2,870 °K COLOR TEMPERATURE USING AN S4 PHOTO DEVICE.





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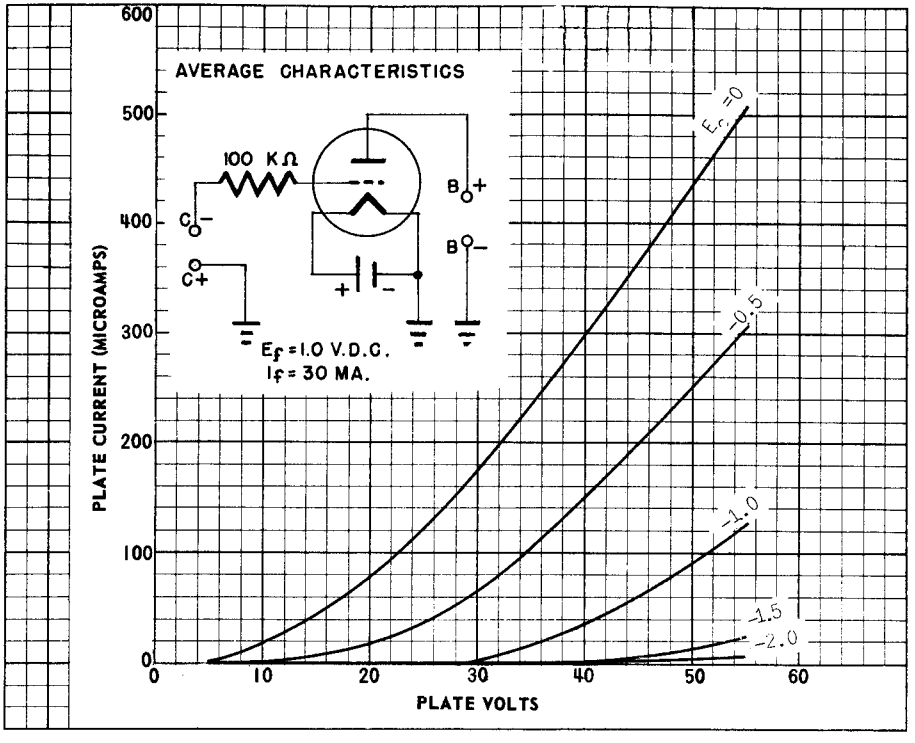
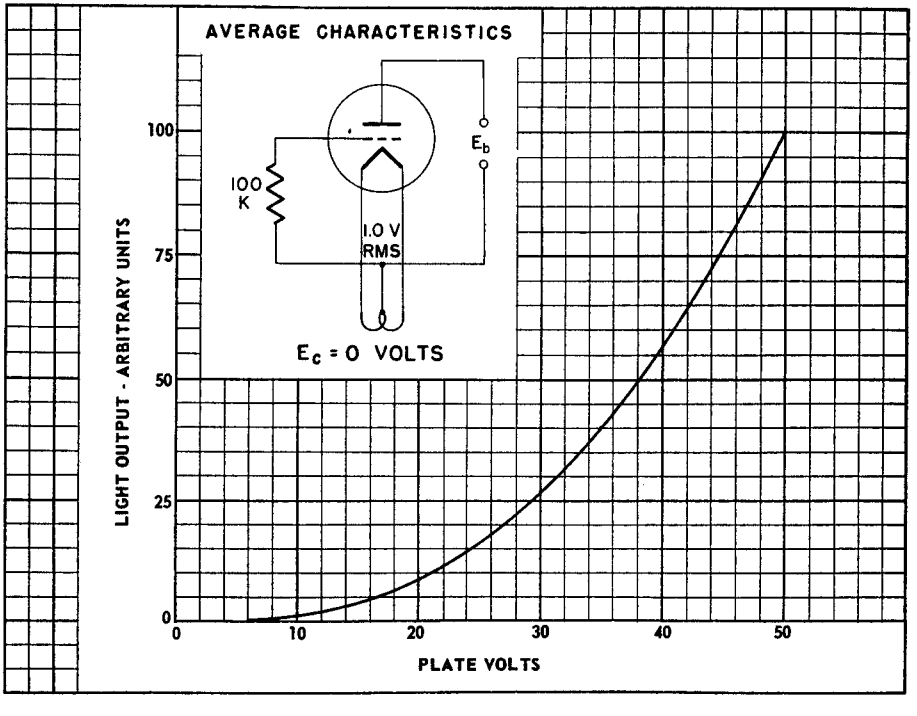
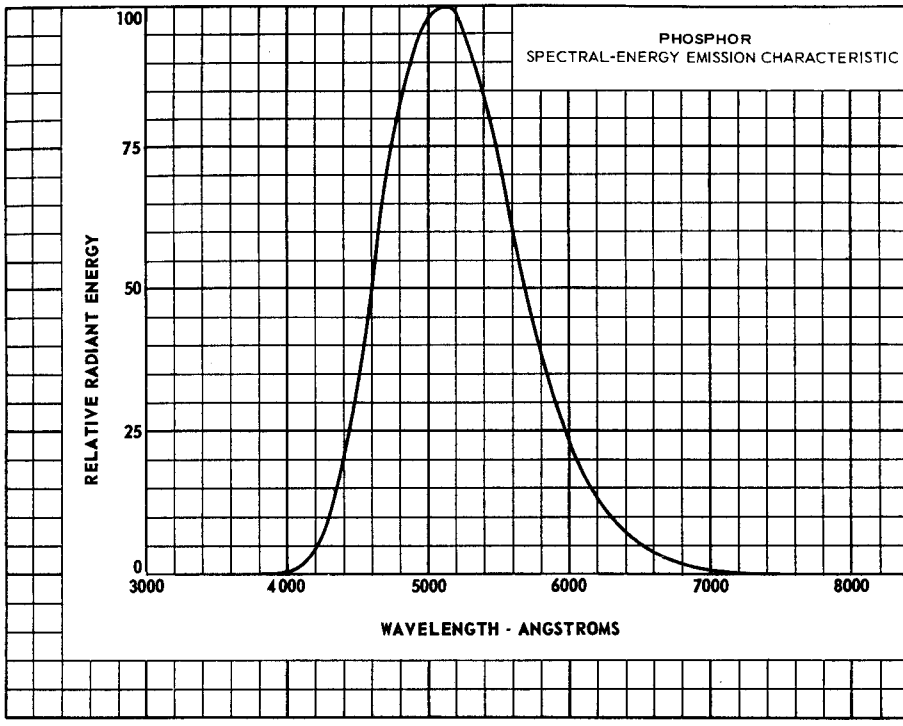
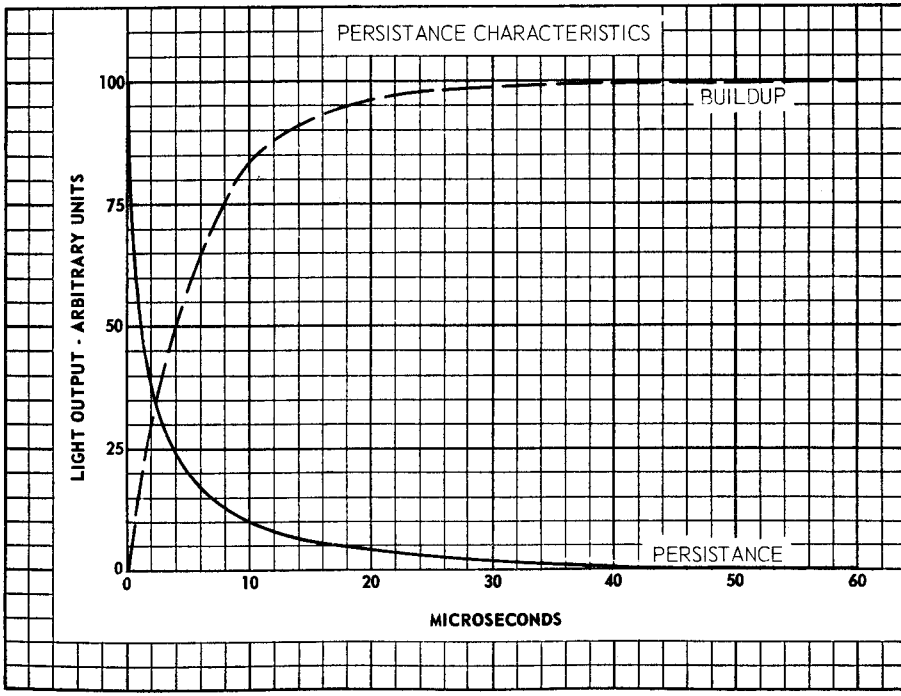

AVERAGE CHARACTERISTICS
100 KΩ
B+
C−
B−
C+
Ef = 1.0 V.D.C.
If = 30 MA.
PLATE CURRENT (MICROAMPS)
600
500
400
300
200
100
0
0
10
20
30
40
50
60
PLATE VOLTS
Ec = 0
-0.5
-1.0
-1.5
-2.0


AVERAGE CHARACTERISTICS
Eb
100 K
1.0 V RMS
Ec = 0 VOLTS
LIGHT OUTPUT - ARBITRARY UNITS
100
75
50
25
0
0
10
20
30
40
50
PLATE VOLTS





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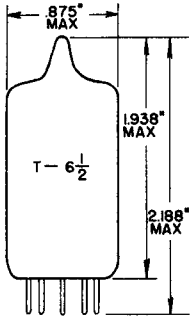
TUNG-SOL



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

TWIN TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

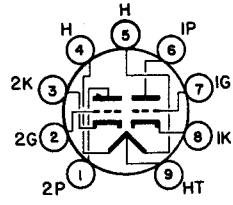
HEATER

SERIES	PARALLEL
12.6 VOLTS	6.3 VOLTS
150 MA.	300 MA.

AC OR DC

FOR 12.6 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PINS #4 AND #5. FOR 6.3 VOLT OPERATION APPLY HEATER VOLTAGE BETWEEN PIN #9 AND PINS #4 AND #5 CONNECTED TOGETHER.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9A

THE 7025 COMBINES TWO COMPLETELY INDEPENDENT HIGH-MU TRIODES IN THE SMALL 9 PIN BUTTON CONSTRUCTION. IT IS INTENDED FOR APPLICATIONS WHERE HIGH VOLTAGE GAIN AND LOW HEATER POWER ARE THE IMPORTANT CONSIDERATION, SUCH AS VOLTAGE AMPLIFIER, PHASE INVERTERS AND MULTIVIBRATORS. LOW NOISE AND LOW HUM IS A SPECIAL FEATURE OF THIS TYPE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD[A]	WITHOUT SHIELD	
GRID TO PLATE	1.7	1.7	pf
INPUT	1.8	1.6	pf
OUTPUT (SECTION 1)	1.9	0.46	pf
OUTPUT (SECTION 2)	1.9	0.34	pf

[A] WITH EXTERNAL SHIELD #315 CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER VALUES

EACH SECTION

MAXIMUM HEATER—CATHODE VOLTAGE	180	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM POSITIVE DC GRID VOLTAGE	0	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	−50	VOLTS
MAXIMUM PLATE DISSIPATION	1	WATT

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH SECTION

PLATE VOLTAGE	100	250	VOLTS
GRID VOLTAGE	−1	−2	VOLTS
PLATE CURRENT	0.5	1.2	MA.
AMPLIFICATION FACTOR	100	100	
PLATE RESISTANCE	80 000	62 500	OHMS
TRANSCONDUCTANCE	1 250	1 600	μMHOS

ADDITIONAL CHARACTERISTICS

EQUIVALENT NOISE AND HUM VOLTAGE (REFERENCED TO GRID, EACH UNIT):

AVERAGE VALUE 1.8 MICROVOLTS RMS

MEASURED IN "TRUE RMS" UNITS UNDER THE FOLLOWING CONDITIONS: HEATER VOLTAGE (PARALLEL CONNECTION), 6.3 VOLTS AC; CENTER TAP OF HEATER TRANSFORMER GROUNDED; PLATE SUPPLY VOLTAGE, 250 VOLTS DC; PLATE LOAD RESISTOR, 100000 OHMS; CATHODE RESISTOR, 2700 OHMS BYPASSED BY 100-μf CAPACITOR; GRID RESISTOR, 0 OHMS; AND AMPLIFIER COVERING FREQUENCY RANGE BETWEEN 25 & 10000 CPS.

MAXIMUM VALUE 7 MICROVOLTS RMS

MEASURED IN "TRUE RMS" UNITS UNDER THE SAME CONDITIONS AS FOR "AVERAGE VALUE" EXCEPT THAT THE CATHODE RESISTOR IS UNBYPASSED AND THAT THE GRID RESISTOR HAS A VALUE OF 50000 OHMS.

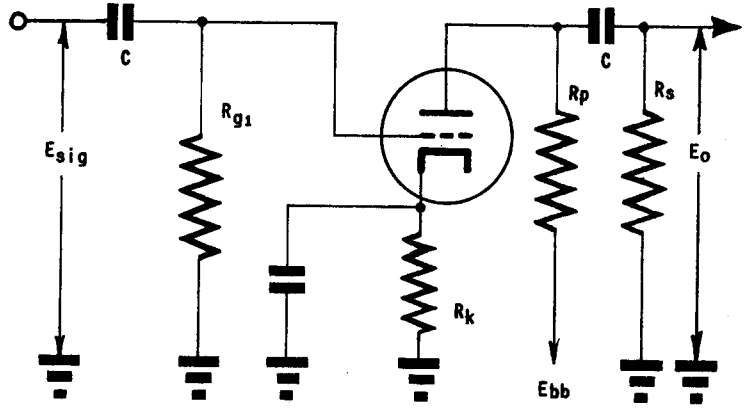
SIMILAR TYPE REFERENCE: 12AX7.

TUNG-SOL

RESISTANCE COUPLED AMPLIFIER

R_p MEG.	R_s MEG.	R_{g1} MEG.	E_{bb} = 90 VOLTS			E_{bb} = 180 VOLTS			E_{bb} = 300 VOLTS		
			R_k	GAIN	E_o	R_k	GAIN	E_o	R_k	GAIN	E_o
0.10	0.10	0.1	1700	31	5.0	1000	40	15	760	43	30
0.10	0.24	0.1	2000	38	6.9	1100	46	20	900	50	40
0.24	0.24	0.1	3500	43	6.5	2000	54	18	1600	58	37
0.24	0.51	0.1	3900	49	8.6	2300	59	24	1800	64	47
0.51	0.51	0.1	7100	50	7.4	4300	62	19	3100	66	39
0.51	1.0	0.1	7800	53	9.1	4800	64	24	3600	69	46
0.24	0.24	10	0	37	3.9	0	53	15	0	62	32
0.24	0.51	10	0	44	5.4	0	60	19	0	67	41
0.51	0.51	10	0	44	5.0	0	61	17	0	69	35
0.51	1.0	10	0	49	6.4	0	66	21	0	71	41

E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR FIVE PERCENT TOTAL HARMONIC DISTORTION.
GAIN MEASURED AT 2.0 VOLTS RMS OUTPUT.
FOR ZERO-BIAS DATA, GENERATOR IMPEDANCE IS NEGLIGIBLE.



NOTE: COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. Rk SHOULD BE ADEQUATELY BY-PASSED.

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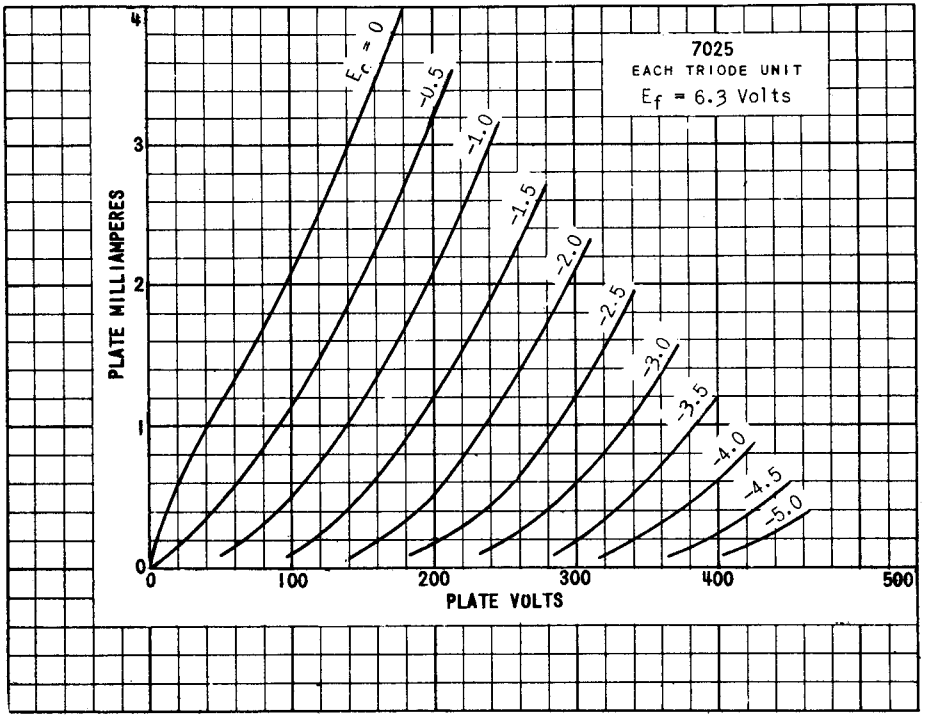
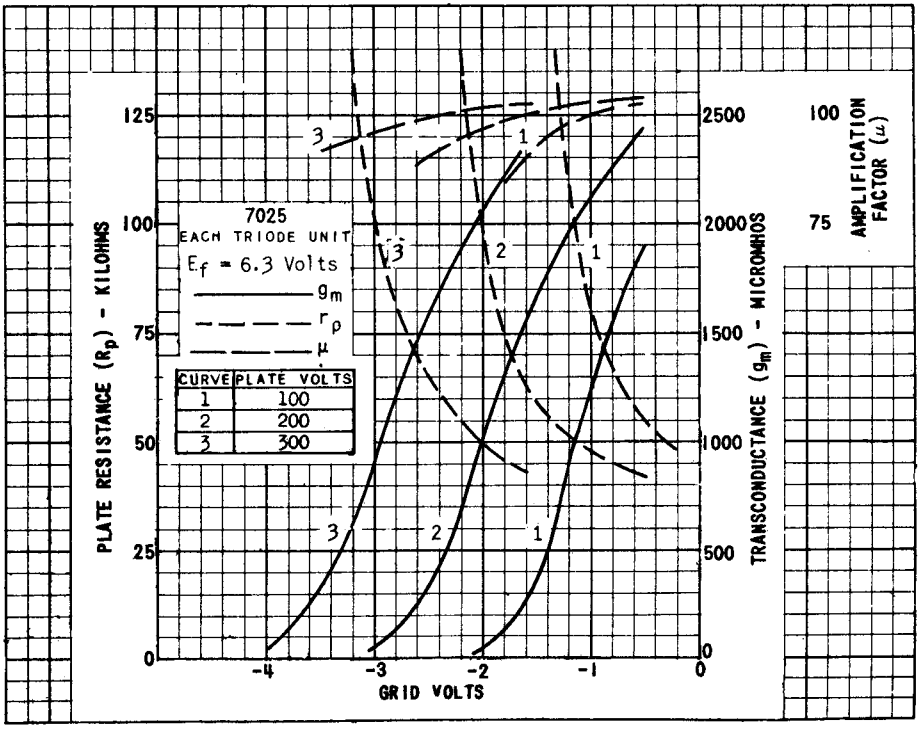
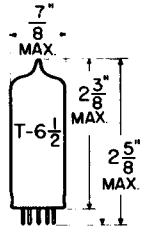

7025
EACH TRIODE UNIT
Ef = 6.3 Volts
Ec = 0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
-4.5
-5.0
PLATE MILLIAMPERES
PLATE VOLTS
0
1
2
3
4
0
100
200
300
400
500


7025
EACH TRIODE UNIT
Ef = 6.3 Volts
gm
rp
μ
CURVE PLATE VOLTS
1 100
2 200
3 300
PLATE RESISTANCE (Rp) - KILOHMS
TRANSCONDUCTANCE (gm) - MICROMHOS
AMPLIFICATION FACTOR (μ)
GRID VOLTS
0
25
50
75
100
125
500
1000
1500
2000
2500
75
100
-4
-3
-2
-1
0

TUNG-SOL

DOUBLE TRIODE

MINIATURE TYPE



SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3
GLASS BULB

COATED UNIPOTENTIAL CATHODE

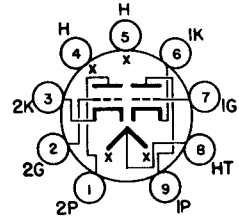
SERIES HEATER	PARALLEL
12.6±5% VOLTS	6.3±5% VOLTS
0.45 AMP	0.90 AMP

AC OR DC

MOUNTING POSITION

PREFERRED: UPRIGHT OR WITH PLATE MAJORS IN A VERTICAL POSITION

PERMISSIBLE.....ANY



BASING DIAGRAM
JEDEC 9H

BOTTOM VIEW

THE 7044 IS A DOUBLE TRIODE DESIGNED FOR USE IN ELECTRONIC COMPUTERS. THE TUBE IS CHARACTERIZED BY HIGH ZERO BIAS PLATE CURRENT AND EXCEPTIONAL FREEDOM FROM THE DEVELOPMENT OF CATHODE INTERFACE.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

	SECTION 1		SECTION 2	
GRID TO PLATE: (G TO P)	6.0		6.0	μμf
INPUT: G TO (H+K)	4.8		4.8	μμf
OUTPUT: P TO (H+K)	0.65		0.55	μμf
GRID #1 TO GRID #2 (1G TO 2G)		0.10		μμf
PLATE #1 TO PLATE #2 (1P TO 2P)		1.4		μμf
HEATER TO CATHODE: (H+K)	6.0		6.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

	SERIES	PARALLEL	
HEATER VOLTAGE	12.6±5%	6.3±5%	VOLTS
HEATER CURRENT	0.45	0.90	AMP.
HEATER POWER	5.7	5.7	WATTS
MAXIMUM HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC PLUS PEAK	200		
HEATER POSITIVE WITH RESPECT TO CATHODE[A]			
DC	100		VOLTS
TOTAL DC PLUS PEAK	200		VOLTS
MAXIMUM AVERAGE PLATE VOLTAGE [D]	300		VOLTS
MAXIMUM PEAK PLATE VOLTAGE			
(MEASURED BETWEEN PLATE AND CATHODE)[E]	600		VOLTS

CONTINUED ON FOLLOWING PAGE

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RATINGS - CONT'D.

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

EACH UNIT [C]

HEATER VOLTAGE	12.6±5%	6.3±5%	VOLTS
MAXIMUM GRID VOLTAGE:			
NEGATIVE BIAS VALUE DC	100		VOLTS
POSITIVE BIAS VALUE DC	1.0		VOLTS
PEAK NEGATIVE VALUE [E]	300		VOLTS
PEAK POSITIVE VALUE [E]	30		VOLTS
MAXIMUM AVERAGE PLATE DISSIPATION [D]	4.5		WATTS
MAXIMUM AVERAGE TOTAL PLATE DISSIPATION (BOTH UNITS) [D]	8.0		WATTS
MAXIMUM AVERAGE POSITIVE GRID CURRENT [D]	5.0		MA.
MAXIMUM PEAK POSITIVE GRID CURRENT [E]	200		MA.
MAXIMUM AVERAGE CATHODE CURRENT [D]	50		MA.
MAXIMUM PEAK CATHODE CURRENT [E]	400		MA.
MAXIMUM BULB TEMPERATURE (AT HOTTEST POINT ON BULB)	160		°C
MAXIMUM GRID CIRCUIT RESISTANCE			
FIXED BIAS	0.1		MEGOHM
CATHODE BIAS	0.47		MEGOHM

INITIAL CHARACTERISTICS LIMITS

RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.		MAX.	
HEATER VOLTAGE (SERIES)		12.6±5%		VOLTS
HEATER VOLTAGE (PARALLEL)		6.3±5%		VOLTS
HEATER CURRENT (SERIES)		0.45		AMP.
HEATER CURRENT (PARALLEL)		0.90		AMP.
HEATER CURRENT @ Ef= 12.6 VOLTS	410		490	MA.
PLATE CURRENT				
Ef = 12.6 V., Eb = 90 V., Ec ADJUSTED FOR Ic = 250 μA	→ 34		→ 60	MA.
PLATE CURRENT				
Ef = 12.6 V., Eb = 120 V., Ec = − 2 V.	26		45	MA.
REVERSE GRID CURRENT				
Ef = 12.6 V Eb = 120 V Ec=−2 V.	---		1.5	μA
CUTOFF PLATE CURRENT				
Ef = 12.6 V Eb = 150 V., Ec = − 14 V.	---		200	μA
HEATER–CATHODE LEAKAGE AT				
Ef = 12.6 V. AND Ehk = ± 100 V.	---		30	μA
MINIMUM INTERELECTRODE RESISTANCE (EXCEPT HEATER CATHODE)				
GRID TO ALL MEASURED WITH 300 VOLTS, GRID NEGATIVE	50		---	MEGOHMS
PLATE TO ALL MEASURED WITH 500 VOLTS PLATE NEGATIVE	50		---	MEGOHMS
INTERMITTENT LEAKAGE [F]				

→ INDICATES A CHANGE.

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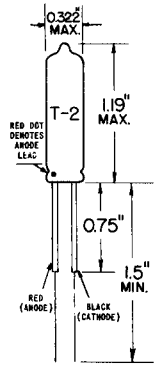
TUNG-SOL

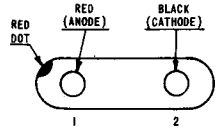
VOLTAGE REGULATOR



GLASS BULB

COLD CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
FLAT PRESS WITH 2 FLYING LEADS

THE 7099 IS A LOW CURRENT, TWO ELEMENT, INERT-GAS-FILLED, COLD CATHODE, VOLTAGE REGULATOR TUBE. THE TUBE COVERS A RANGE NOT ADEQUATELY HANDLED BY OTHER VR TUBES OR BY ZENER DIODES. IT HAS A MAINTAINING VOLTAGE OF APPROXIMATELY 155 VOLTS OVER A CURRENT RANGE FROM 0.075 TO 0.300 MILLI-AMPERES.

THE 7099 PROVIDES A HIGH DEGREE OF STABILITY AND VOLTAGE REPEATABILITY OVER ITS OPERATING TEMPERATURE RANGE. IT IS ESPECIALLY SUITED FOR SERVICE IN APPLICATIONS WHICH REQUIRE LONG LIFE, AND MINIMUM SIZE AND WEIGHT. ITS FLYING LEADS CAN BE SOLDERED DIRECTLY INTO A CIRCUIT OR CAN BE CLIPPED TO ONE-QUARTER INCH FOR INSERTION IN A STANDARD SUBMINIATURE SOCKET.

ELECTRICAL DATA

CATHODE	COLD	

MECHANICAL DATA

MOUNTING POSITION	ANY	
LENGTH — OVERALL	SEE OUTLINE DRAWING	
DIAMETER (MAX.)	0.322	INCH
WEIGHT — APPROXIMATE	0.16	OUNCE
BULB	T-2	
BASE	FLAT PRESS WITH 2 FLYING LEADS	

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RATINGS
ABSOLUTE VALUES

MAXIMUM DC CATHODE CURRENT	0.300	MA.
MINIMUM DC CATHODE CURRENT	0.075	MA.
BULB TEMPERATURE (MAX.)	100	°C
AMBIENT TEMPERATURE (MIN.)	-55	°C
ALTITUDE (MAX.)	60 000	FEET

CIRCUIT VALUES

SHUNT CAPACITOR (MAX.)	0.1	μf
SERIES RESISTOR	SEE APPLICATION NOTES	

EQUIPMENT DESIGN AND RANGE VALUES

	MIN.	BOGEY	MAX.	
DC ANODE SUPPLY VOLTAGE	225[A]	---	---	VOLTS
ANODE BREAKDOWN VOLTAGE	---	180	200	VOLTS
TUBE VOLTAGE DROP AT 0.075 MA.	152	155.0	---	VOLTS
TUBE VOLTAGE DROP AT 0.3 MA.	---	155.5	162	VOLTS
REGULATION - 0.075 THROUGH 0.150 MA.	---	0.4	2.5	VOLTS
REGULATION - 0.150 THROUGH 0.300 MA.	---	0.6	4.0	VOLTS
LEAKAGE CURRENT AT - 100 VOLTS	---	---	2	μAMP.

[A] IN ORDER TO ASSURE STARTING THROUGHOUT LIFE OF TUBE, NOT LESS THAN THE SPECIFIED SUPPLY VOLTAGE SHOULD BE PROVIDED.

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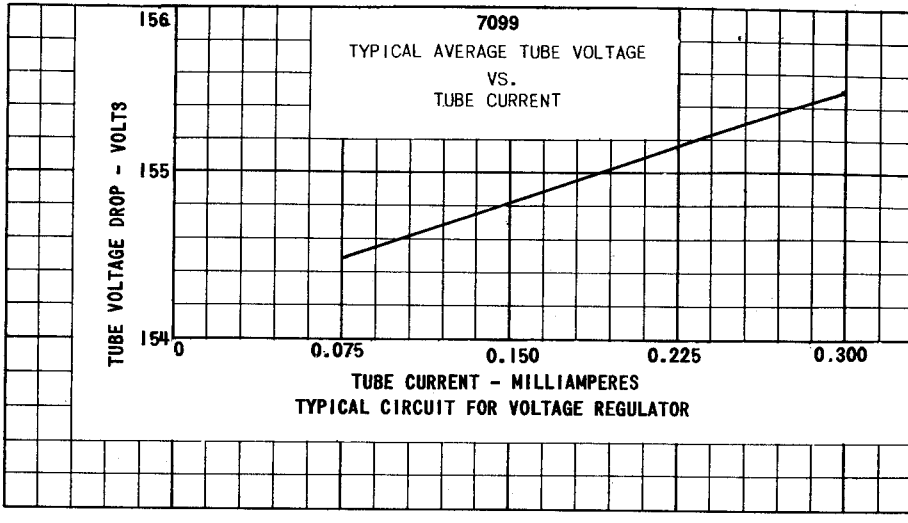

TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

OPERATING NOTES

IN THE OPERATION OF A GLOW TUBE THERE ARE SEVERAL REQUIREMENTS WHICH MUST ALWAYS BE MET. THE FIRST IS THAT THE SUPPLY VOLTAGE MUST ALWAYS BE GREATER THAN THE ANODE BREAKDOWN VOLTAGE AND THE SECOND IS THAT SUFFICIENT RESISTANCE MUST ALWAYS BE PUT IN SERIES WITH THE TUBE IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM AND MAXIMUM VALUES GIVEN IN THE RATINGS.

IN ORDER TO ILLUSTRATE HOW TO CALCULATE THE VALUE OF THE SERIES RESISTANCE A TYPICAL REGULATOR CIRCUIT IS SHOWN IN FIGURE 1.

FROM FIGURE 1 WE SEE THAT E_{BB} IS THE UNREGULATED SUPPLY VOLTAGE, E_L IS THE TUBE VOLTAGE DROP OR THE REGULATED VOLTAGE SUPPLIED TO THE LOAD, R IS THE SERIES LIMITING RESISTOR, R_L IS THE VARIABLE LOAD, I_T IS THE TUBE CURRENT AND I_L IS THE LOAD CURRENT.

WE SEE THAT THE TUBE CURRENT WILL BE A MAXIMUM WHEN THE SUPPLY VOLTAGE IS A MAXIMUM (E_{BB} MAX.); WHEN THE LOAD CURRENT IS A MINIMUM (I_L MIN.); AND WHEN THE TUBE VOLTAGE DROP IS A MINIMUM (E_L MIN.). THEREFORE THE CONDITIONS WHICH DETERMINE THE LOWER LIMIT FOR THE SERIES RESISTANCE R_1 ARE THAT

$$R > \frac{E_{BB\,MAX.} - E_{L\,MIN.}}{I_{T\,MAX.} + I_{L\,MIN.}}$$

IN A LIKE MANNER IT CAN BE SHOWN THAT THE VALUE OF R IN ORDER TO LIMIT THE CURRENT TO THE MINIMUM VALUE REQUIRES THAT

$$R < \frac{E_{BB\,MIN.} - E_{L\,MAX.}}{I_{T\,MIN.} + I_{L\,MAX.}}$$

WHEN THESE VALUES HAVE BEEN COMPUTED, ONE SHOULD CHECK TO SEE IF THERE IS SUFFICIENT STARTING VOLTAGE BY THE FOLLOWING RELATION

$$E_{BB\,MIN.} \frac{R_L}{R + R_L} > E_{STARTING}$$

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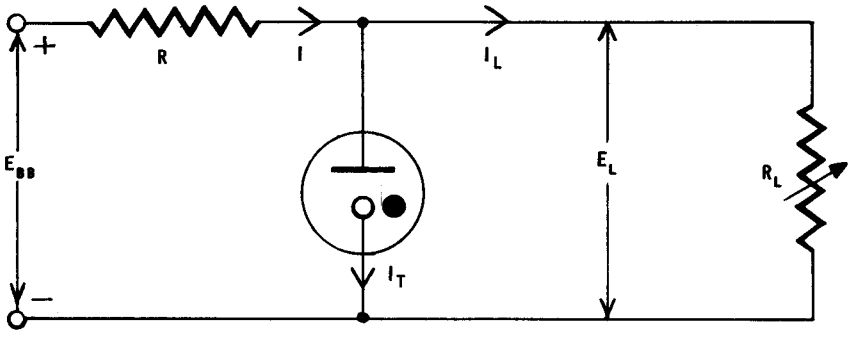


TYPICAL CIRCUIT FOR VOLTAGE REGULATOR

FIGURE 1

WHEN THESE CALCULATIONS HAVE BEEN MADE AND THERE IS INSUFFICIENT STARTING VOLTAGE, A NEW LOAD CURRENT OF LOWER VALUE MUST BE USED AND THE CALCULATIONS REPEATED.

WHERE THE REGULATOR TUBE IS SHUNTED BY A CAPACITOR, THE VALUE OF SUCH CAPACITOR SHOULD BE LIMITED TO 0.1 μf AS A LARGER VALUE MIGHT CAUSE OSCILLATION.

OPERATION OF TWO TUBES IN PARALLEL TO INCREASE THE CURRENT RATING IS NOT RECOMMENDED UNLESS A RESISTANCE OF APPROXIMATELY 100 OHMS IS USED IN SERIES WITH EACH TUBE TO EQUALIZE THE DIVISION OF CURRENT. IT SHOULD BE NOTED THAT PARALLEL OPERATION REDUCES THE REGULATION THAT CAN BE OBTAINED.

HIGHER REGULATED VOLTAGES CAN BE OBTAINED BY CONNECTING TWO TUBES IN SERIES AS SHOWN IN FIGURE 2. HOWEVER, CARE SHOULD BE EXERCISED TO MAKE CERTAIN THAT SUFFICIENT SUPPLY VOLTAGE IS AVAILABLE TO START BOTH TUBES. THIS CAN BE ACCOMPLISHED BY SHUNTING THE LOWER TUBE WITH A HIGH RESISTANCE.

TUNG-SOL

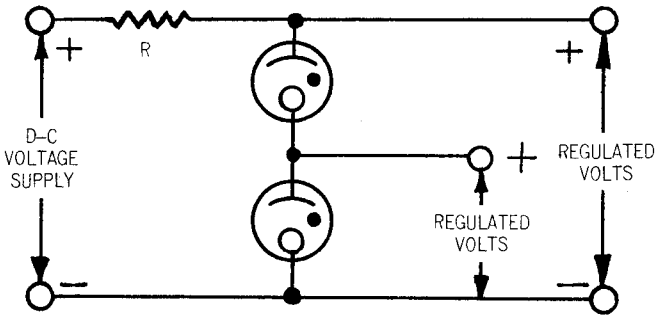
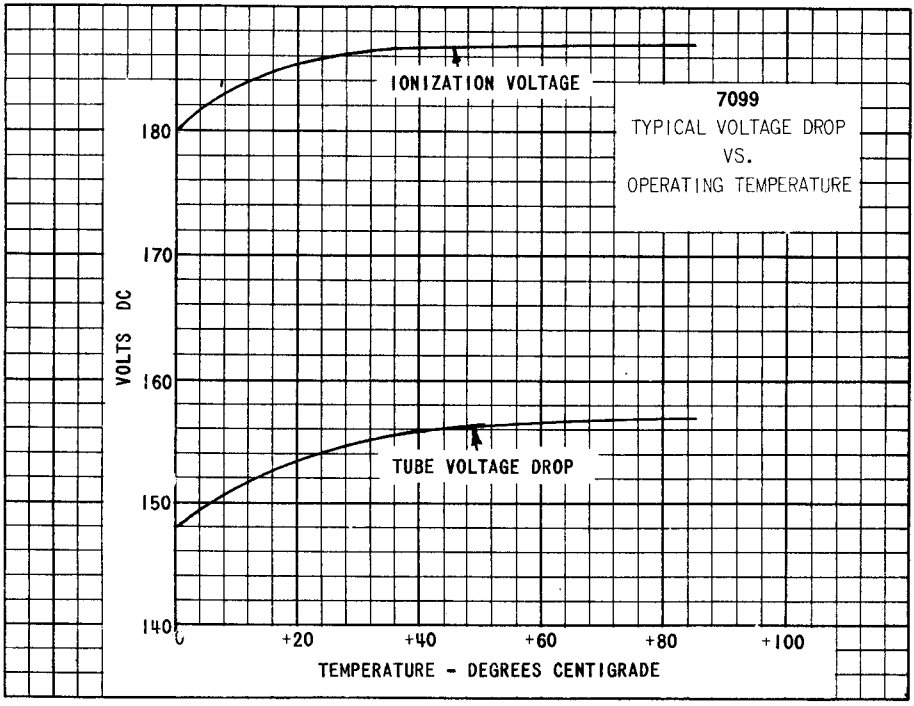


FIGURE 2. OPERATION OF REGULATOR TUBES IN SERIES



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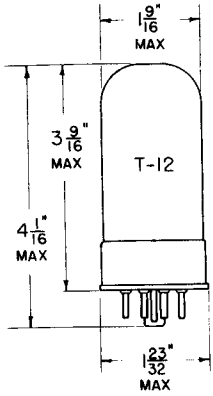
TUNG-SOL

TWIN TRIODE



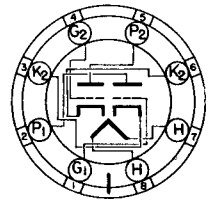
GLASS BULB

HEATER

12.6±5% VOLTS 1.25 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

LARGE WAFER OCTAL WITH METAL SLEEVE

8BD

THE 7105 IS A 12.6 VOLT VERSION OF THE POPULAR RUGGEDIZED RELIABLE TYPE 6080WA. IN A RELIABLE PROGRAM, TUBES ARE HANDLED IN LOTS WITH MANY DESTRUCTIVE TESTS PERFORMED ON RANDOMLY SELECTED SAMPLES. THUS A TUBE MAY PASS ALL REQUIRED TESTS AND YET BE REJECTED IF IT IS FROM AN UNSATISFACTORY LOT.

WITH THE MOUNT SHOCK ISOLATED FROM THE BULB BY NINE METAL SPRING CLIPS, AND BY THE USE OF HEAVY DUTY PARTS, THE TUBE WILL WITHSTAND A SHOCK IMPULSE OF 450G AND A VIBRATION FORCE OF 10G. OTHER FEATURES ARE HIGH ALTITUDE RATINGS, HIGH BULB TEMPERATURE LIMITS, AND LONG LIFE TESTS WITH MANY LIFE TEST END POINTS. PLATE CURRENT AND TRANSCONDUCTANCE ARE HELD TO CLOSE LIMITS TO PROVIDE GREATER BALANCE BETWEEN TUBE SECTIONS. THIS IS ESPECIALLY ADVANTAGEOUS WHEN MANY TUBES ARE TO BE PARALLELED IN REGULATED POWER SUPPLY SERVICE.

THIS TUBE CAN BE USED FOR ANY APPLICATION REQUIRING HIGH PLATE CURRENT AT LOW PLATE VOLTAGES. THE 12.6 VOLT FILAMENT IS PARTICULARLY ADAPTABLE TO MOBILE EQUIPMENT. ITS PRIMARY USE IS IN ELECTRONICALLY REGULATED POWER SUPPLIES.

ELECTRICAL DATA

HEATER VOLTAGE	12.6±5%	VOLTS
HEATER CURRENT (E_f=6.3VOLTS)	1.25	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE (PER SECTION)	7 000	μMHOS
AMPLIFICATION FACTOR	2.0	
INTER ELECTRODE CAPACITIES PER TRIODE SECTION		
GRID TO CATHODE	6.2	μμf
GRID TO PLATE	8.4	μμf
CATHODE TO PLATE	2.2	μμf
HEATER TO CATHODE	6.3	μμf
INTER ELECTRODE CAPACITIES BETWEEN TRIODE SECTIONS		
SECTION 1 GRID TO SECTION 2 GRID	0.5	μμf
SECTION 1 PLATE TO SECTION 2 PLATE	2.2	μμf

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TUNG-SOL

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MECHANICAL DATA

MOUNTING POSITION	ANY	
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)		
BULB	T-12	
BASE	LARGE WAFER OCTAL WITH METAL SLEEVE, 8 PIN, JEDEC #B8-86	
MAXIMUM NET WEIGHT	3	OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE)	450	G
MAXIMUM VIBRATION RATING (D = .08" @ 50 CPS)	10	G

RATINGS

ABSOLUTE VALUES

	MIN.	MAX.	
HEATER VOLTAGE	12.0	13.2	VOLTS
PLATE VOLTAGE (DC)	---	250	VOLTS
GRID VOLTAGE (DC)	---	0	VOLTS
HEATER-CATHODE VOLTAGE (DC)	-300	+300	VOLTS
GRID CURRENT PER GRID	---	5.	MA.
PLATE CURRENT PER PLATE (DC)	---	125.	MA.
(IF SEVERAL TUBE SECTIONS ARE TO BE USED IN PARALLEL WITH EACH OTHER, IT IS RECOMMENDED NOT TO EXCEED 100 MA PER PLATE.)			
POWER DISSIPATION PER PLATE	---	13	WATTS
ENVELOPE TEMPERATURE	---	230	°C
ALTITUDE FOR FULL RATINGS	---	60 000	FEET
CIRCUIT VALUES:			
GRID CIRCUIT RESISTANCE FOR CATHODE BIAS OPERATION	---	1.0	MEGOHM
GRID CIRCUIT RESISTANCE FOR FIXED BIAS OR COMBINATION FIXED AND CATHODE BIAS OPERATION	---	0.1	MEGOHM

ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450 G/MSEC)

FATIGUE; 25 CPS, 0.08" TOTAL DISPLACEMENT, FOR 32 HOURS IN EACH OF THREE MUTUALLY PERPENDICULAR PLANES (2.5G)

POST SHOCK AND FATIGUE LIMITS:

VIBRATION (R_p=2000 Ω, E_c=- 7VDC, TIE 1K TO 2K, 1G TO 2G, 1P TO 2P), GENERATED PLATE VOLTAGE (MAX.)		100	MVAC
HEATER-CATHODE LEAKAGE (E_{hk} =±100 VDC) (MAX.)		50	μADC
CHANGE IN TRANSCONDUCTANCE FROM INITIAL VALUE (MAX.)		10	PERCENT
GRID CURRENT (MAX.)		-3	μA
HEATER CYCLING LIFE TEST (E_f= 15V, E_{hk}=300VDC. DURATION OF 2000 CYCLES OF 1 MIN. ON AND 1 MIN. OFF) END POINT (E_{hk}=±100V.) (MAX.)		50	μADC
STABILITY LIFE TEST (1 HR.) END POINT:			
CHANGE IN TRANSCONDUCTANCE FROM INITIAL VALUE (MAX.)		10	PERCENT
SURVIVAL RATE LIFE TEST (100 HRS.) END POINT:			
TRANSCONDUCTANCE (MIN.)		5800	μMHOS
INTERMITTENT LIFE TEST (1000 HRS.) END POINTS:			
GRID CURRENT	MIN. 0	MAX. -10	μADC
TRANSCONDUCTANCE (MIN.)		5500	μMHOS
CHANGE IN TRANSCONDUCTANCE BY REDUCING E_f TO 5.7V. (MAX.)		10	PERCENT
HEATER-CATHODE LEAKAGE E_{hk}=±100VDC. (MAX.)		25	μADC
HEATER CURRENT	MIN. 1.15	MAX. 1.35	AMPS
INSULATION OF ELECTRODES: GRID TO ALL OTHERS AND PLATE TO ALL OTHERS (MIN.)		100	MEGOHM

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

RANGE OF VALUES

CONDITIONS: E_f = 12.6V, E_b = 135V, E_c = 0, $R_{k/k}$ = 250 Ω

BOTH SECTIONS OPERATING. EACH SECTION READ SEPARATELY.

INDIVIDUAL PLATE CURRENT (DC)	100	150	MA.
LOT AVERAGE PLATE CURRENT (SAME CONDTIONS)(DC)	115	135	MA.
PLATE CURRENT, DIFFERENCE BETWEEN SECTIONS (DC)	---	25	MA.
INDIVIDUAL SECTION TRANSCONDUCTANCE	6000	8200	μMHOS
LOT AVERAGE TRANSCONDUCTANCE	6600	7400	μMHOS
AMPLIFICATION FACTOR	1.5	2.5	
HEATER CURRENT @ 6.3V.	1.15	1.35	AMP.

SIMILAR TYPE REFERENCE: 6080WA.

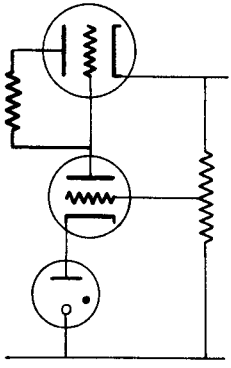

FIGURE 1

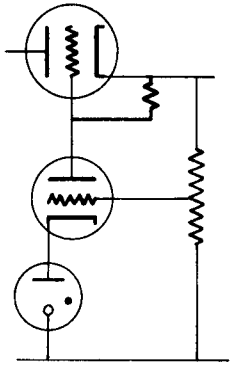

FIGURE 2

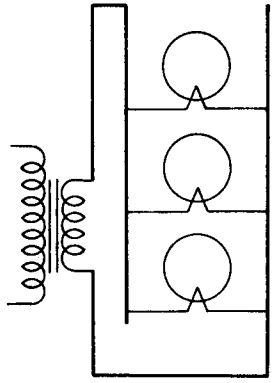

FIGURE 3

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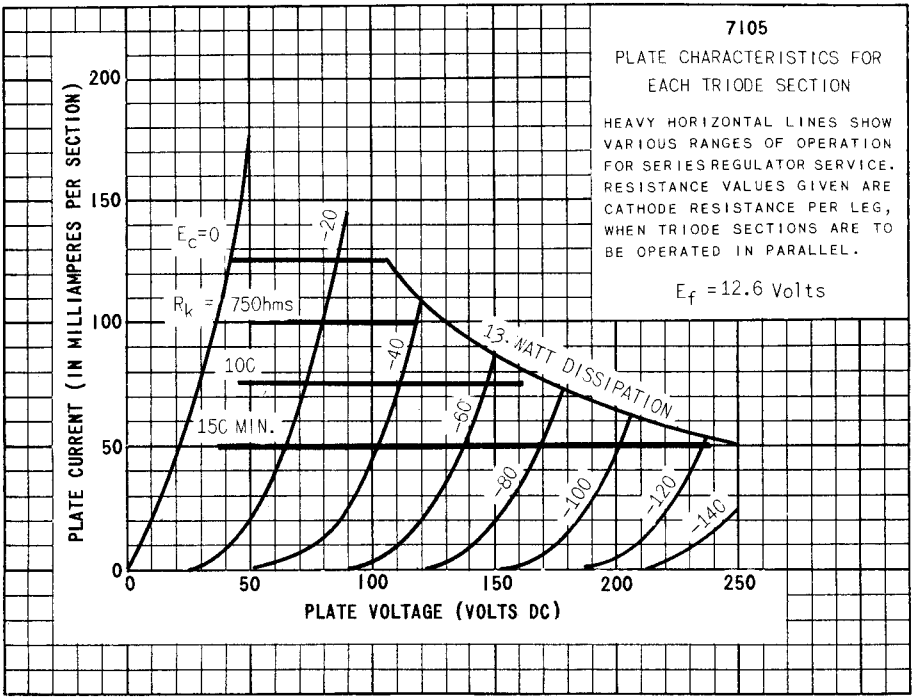
APPLICATION NOTES

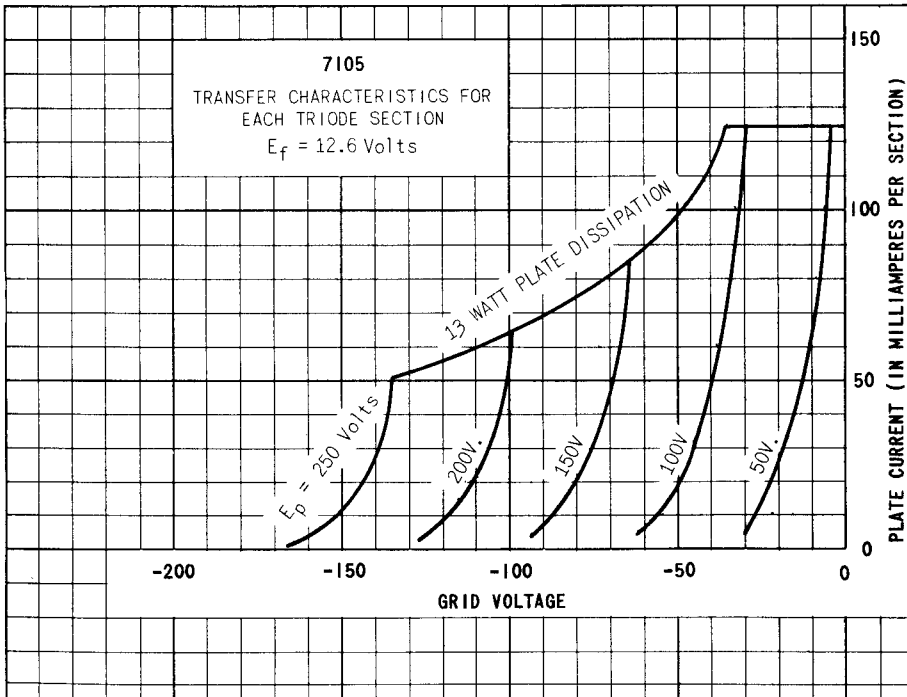
THE 7105 IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE THIRD THE VALUE $(\frac{R}{U+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE THIRD THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (ABOUT ONE WATTS) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

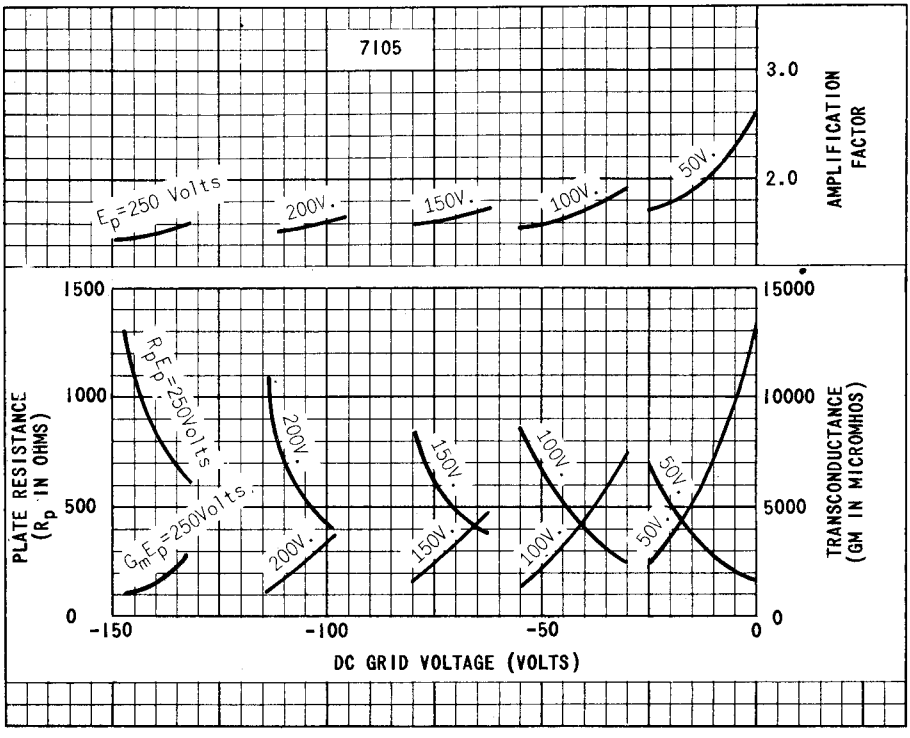
A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 12.6 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.


7105
PLATE CHARACTERISTICS FOR EACH TRIODE SECTION
HEAVY HORIZONTAL LINES SHOW VARIOUS RANGES OF OPERATION FOR SERIES REGULATOR SERVICE. RESISTANCE VALUES GIVEN ARE CATHODE RESISTANCE PER LEG, WHEN TRIODE SECTIONS ARE TO BE OPERATED IN PARALLEL.
E_f = 12.6 Volts
PLATE CURRENT (IN MILLIAMPERES PER SECTION)
PLATE VOLTAGE (VOLTS DC)
E_c=0
-20
-40
-60
-80
-100
-120
-140
R_k = 750hms
100
150 MIN.
13 WATT DISSIPATION
0
50
100
150
200
250

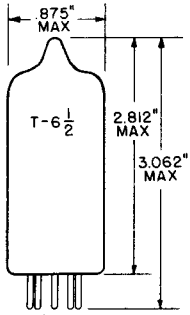

7105
TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION
E_f = 12.6 Volts
PLATE CURRENT (IN MILLIAMPERES PER SECTION)
GRID VOLTAGE
13 WATT PLATE DISSIPATION
E_p = 250 Volts
200V.
150V
100V
50V.
0
50
100
150
-200
-150
-100
-50
0


7105
3.0
2.0
AMPLIFICATION FACTOR
E_p=250 Volts
200V.
150V.
100V.
50V.
1500
1000
500
0
PLATE RESISTANCE (R_p IN OHMS)
15000
10000
5000
0
TRANSCONDUCTANCE (GM IN MICROMHOS)
R_p E_p=250Volts
G_m E_p=250Volts
-150
-100
-50
0
DC GRID VOLTAGE (VOLTS)

TUNG-SOL

PENTODE

MINIATURE TYPE



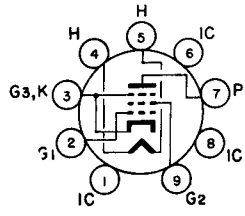
GLASS BULB
OUTLINE DRAWING
JEDEC 6-4

COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 760 MA.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9CV

THE 7189 IS A POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A POWER AMPLIFIER IN HIGH FIDELITY AUDIO EQUIPMENT, INTENDED FOR USE IN AMPLIFIERS OF OVER 20 WATT CAPABILITIES.

DIRECT INTERELECTRODE CAPACITANCES

INPUT CAPACITANCE	10.8	pf
OUTPUT CAPACITANCE	6.5	pf
PLATE TO GRID #1	0.5	pf
GRID #1 TO HEATER	0.25	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS AB_1 FIXED BIAS AUDIO AMPLIFIER

PENTODE CONNECTION

MAXIMUM PLATE VOLTAGE	400	VOLTS
MAXIMUM PLATE DISSIPATION	12	WATTS
MAXIMUM GRID #2 VOLTAGE	300	VOLTS
MAXIMUM GRID #2 DISSIPATION (ZERO SIGNAL)	2.0	WATTS
MAXIMUM GRID #2 DISSIPATION (MAX. SIGNAL)	4.0	WATTS
MAXIMUM CATHODE CURRENT	65	MA.
MAXIMUM GRID RESISTANCE (FIXED BIAS)	300 000	OHMS
MAXIMUM HEATER TO CATHODE VOLTAGE	100	VOLTS

TYPICAL CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID #2 VOLTAGE	250	VOLTS
PLATE CURRENT	48	MA.
GRID #2 CURRENT	5.5	MA.
GRID #1 VOLTAGE	-7.3	VOLTS
TRANSCONDUCTANCE	11 300	μMHOS
PLATE RESISTANCE	40 000	OHMS
AMPLIFICATION FACTOR (GRID #1 TO GRID #2)	19.5	

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TYPICAL OPERATION

FIXED BIAS – TWO TUBES – PUSH PULL

PLATE VOLTAGE	400	VOLTS
GRID #2 VOLTAGE	300	VOLTS
GRID #1 VOLTAGE	−15	VOLTS
PLATE TO PLATE LOAD RESISTANCE	8 000	OHMS
PLATE CURRENT (ZERO SIGNAL)	2x7.5	MA.
PLATE CURRENT (MAX. SIGNAL)	2x52.5	MA.
GRID #2 CURRENT (ZERO SIGNAL)	2x0.8	MA.
GRID #2 CURRENT (MAX. SIGNAL)	2x12.5	MA.
INPUT SIGNAL VOLTAGE (RMS)	10.5	VOLTS
POWER OUTPUT	24	WATTS
PERCENT DISTORTION	4.0	PERCENT

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM

CLASS AB_1 AUDIO AMPLIFIER

ULTRA-LINEAR AMPLIFIER

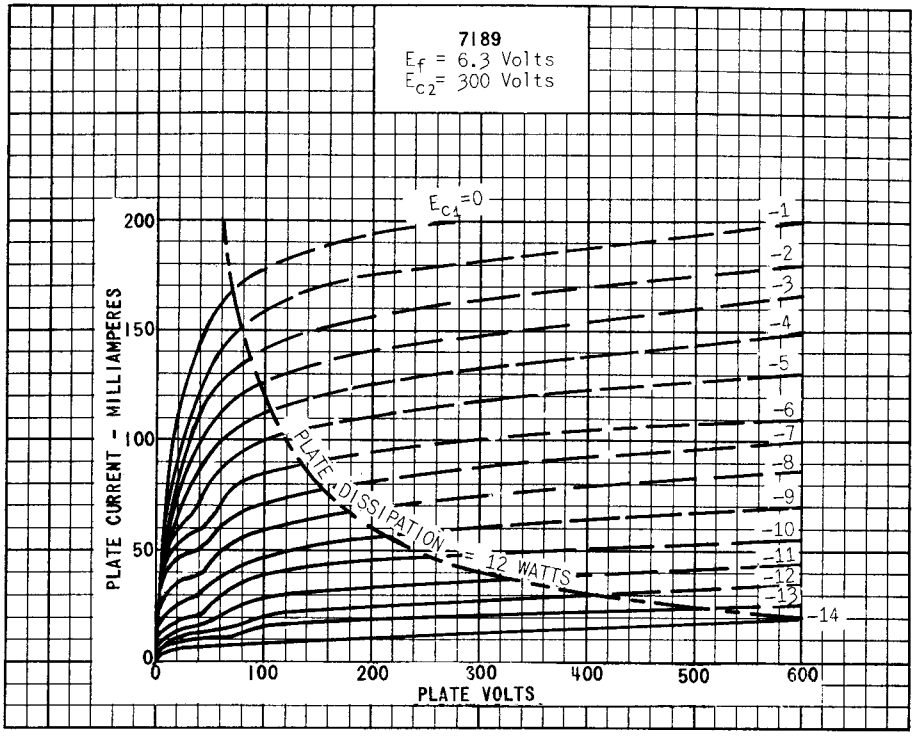
PLATE AND GRID #2 SUPPLY VOLTAGE	375	VOLTS
PLATE DISSIPATION	12	WATTS
GRID #2 DISSIPATION (ZERO SIGNAL)	2	WATTS
GRID #2 INPUT (MAX SIGNAL)	4	WATTS
CATHODE CURRENT	65	MA.
GRID RESISTANCE (CATHODE BIAS)	1	MEGOHM
HEATER TO CATHODE VOLTAGE	100	VOLTS

TYPICAL OPERATION

CATHODE BIAS – TWO TUBES – PUSH PULL

PLATE SUPPLY VOLTAGE	375	VOLTS
GRID #2 SUPPLY VOLTAGE[A]		
COMMON CATHODE RESISTANCE	220	OHMS
PLATE TO PLATE LOAD RESISTANCE	11 000	OHMS
PLATE AND GRID #2 CURRENT (ZERO SIGNAL)	2x35	MA.
PLATE AND GRID #2 CURRENT (MAX. SIGNAL)	2x40.5	MA.
INPUT SIGNAL VOLTAGE, RMS	12.5	VOLTS
POWER OUTPUT	16.5	WATTS
PERCENT DISTORTION	3	PERCENT

[A] SCREEN VOLTAGE IS OBTAINED FROM TAPS LOCATED AT 43% OF THE PLATE WINDING TURNS.



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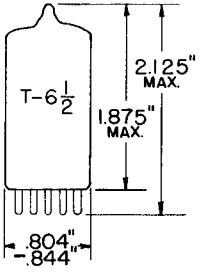
TUNG-SOL

THYRATRON

MINIATURE TYPE

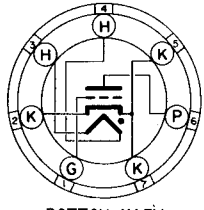


GLASS BULB
HARD

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW.
SMALL BUTTON MINIATURE
7 PIN BASE
7FJ

THE 7190 IS A ZERO BIAS MINIATURE HYDROGEN THYRATRON DESIGNED PRIMARILY FOR THE GENERATION OF PULSE VOLTAGES UNDER EXTREME CONDITIONS OF MECHANICAL VIBRATION. THIS TUBE CAN SUPPLY PEAK PULSE POWER OF 10 KILOWATTS AND THEREFORE WILL REPLACE PHYSICALLY LARGER TYPES IN MANY RADAR APPLICATIONS. BECAUSE OF ITS CLOSE ELECTRODE SPACING AND SMALL SIZE, MADE POSSIBLE BY HARD GLASS CONSTRUCTION, THE 7190 IS CAPABLE OF RELATIVELY HIGH PULSE REPETITION RATES.

THE 7190, 7191, AND 7192 DIFFER ONLY IN THEIR ELECTRODE TERMINALS. ALL OF THESE TYPES HAVE FOUND USE IN MISSILE APPLICATIONS. THE 7190, 7191, AND 7192 HAVE BEEN DESIGNED INTO SOME EQUIPMENT UNDER THE CHATHAM DEVELOPMENTAL DESIGNATIONS CH1062, CH1092, AND CH1055 RESPECTIVELY.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE					
(WHEN Ip IS LESS THAN 0.75 Aac, REFER TO RECOMMENDED HEATER VOLTAGE CURVE)	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT					
(WITH BOGIE HEATER VOLTAGE)	If	1.6	1.8	2.0	AMP.
CATHODE HEATING TIME	tk	30			SECONDS
ANODE VOLTAGE DROP (AT RECOMMENDED Ef)	etd	45		125	VOLTS

MECHANICAL DATA

TYPE OF COOLING	CONVECTION
(HEAT DISSIPATING SHIELDS MAY BE USED. FORCED AIR COOLING IS NOT RECOMMENDED.)	
ALTITUDE	SEE APPLICATION NOTES
MOUNTING POSITION	ANY
MAXIMUM NET WEIGHT	0.5 OUNCES
DIMENSIONS: SEE OUTLINE DRAWINGS	SEE OUTLINE DRAWINGS
MAXIMUM VIBRATION CONDITIONS	50-2000 CPS @ 15 G
MAXIMUM SHOCK CONDITIONS	720 G/1MSEC.
(48° HAMMER BLOW IN NAVY FLY WEIGHT, HIGH IMPACT SHOCK MACHINE)	
MICROSCOPIC INSPECTION PER MIL-E-1775 1B (N ORD)	SEE APPLICATION NOTES

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RATINGS
ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	---	1200	VOLTS
FORWARD	epy	300	1200	VOLTS
CATHODE CURRENT				
PEAK	ib		.20.0	AMP.
AVERAGE	Ib		50	MA.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		1.0	AMP.
DC ANODE VOLTAGE	E_{bb}	300		VOLTS
HEATER–CATHODE VOLTAGE	Ehk	−100	+25	VOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		5000	CPS
PEAK GRID VOLTAGE (SEE RECOMMENDED GRID PULSE CONDITIONS.)	egy	175	500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		150	VOLTS
HEATING FACTOR (epy x ib x prr.)	Pb		1×10^8	
CURRENT RATE OF RISE (NOTE 2)			400	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.6	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	−60	+125	°C

NOTES

[1] IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05 μSEC. MAXIMUM DURATION, SHALL NOT EXCERD 500 VOLTS DURING THE FIRST 25 μSEC, FOLLOWING THE ANODE PULSE.

[2] MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

[3] ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

[4] TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 600 VOLTS AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

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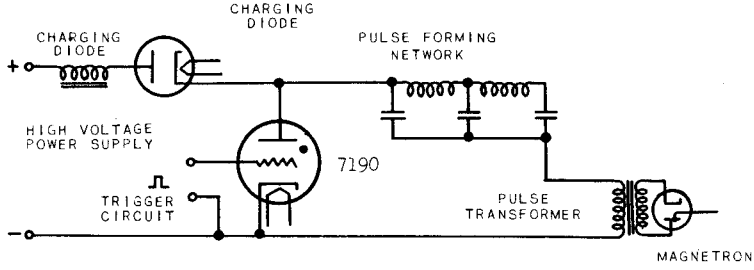
APPLICATION NOTES

THIS FAMILY OF MINIATURE HYDROGEN THYRATRONS IS DESIGNED FOR USE IN LINE TYPE RADAR MODULATORS. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO, RELEASE INTO THE MAGNETRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THESE TUBES ARE ADMIRABLY SUITED FOR SUCH SERVICE BY THEIR ABILITY TO HOLD OFF RELATIVELY HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENT WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBES WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING VERY FLEXIBLE CIRCUIT ELEMENTS. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBES OPERATE WITH ZERO BIAS.



THE SMALL SIZE, LIGHT WEIGHT, EXTREME RUGGEDNESS, AND ABILITY TO OPERATE AT HIGH AMBIENT TEMPERATURES, MAKE THESE TUBES PARTICULARLY SUITABLE FOR AIRBORNE USE. THE TUBES CAN BE OPERATED IN ANY POSITION. ALL TUBES ARE TESTED IN ACCORDANCE WITH MIL-E-1775 1B (N ORD), THE MILITARY SPECIFICATION FOR ELECTRON TUBES FOR GUIDED MISSILES. THIS ENTAILS 100% MICROSCOPIC INSPECTION WITH A 10 POWER BINOCULAR MICROSCOPE FOR SUCH ITEMS AS SEALS, LEADS AND SPOT WELDS. SAMPLE TUBES ARE VIBRATED WITH VOLTAGES APPLIED OVER A RANGE OF 50 TO 2000 TO 50CPS AT 15G IN 4 MINUTES.

THE 7190 AND THE 7191 FIT A STANDARD 7 PIN MINIATURE SOCKET. THE TUBE PINS, HOWEVER, ARE STIFF, AND CARE SHOULD BE TAKEN TO HAVE THE SOCKET CLIPS IN PERFECT ALIGNMENT BEFORE ATTEMPTING TO INSERT A TUBE. AS THE TUBE OPERATES AT HIGH TEMPERATURES, A CERAMIC TYPE SOCKET SHOULD BE EMPLOYED. CONNECTIONS TO THE SOCKET SHOULD BE MADE WITH FLEXIBLE LEADS TO PROVIDE FLOATING ACTION FOR THE SOCKET CLIPS. PIN STRAIGHTENERS SHOULD NEVER BE USED ON THESE TUBE TYPES, AS ANY ATTEMPT TO BEND THE PINS WILL RESULT IN CRACKED BUTTON BASES!

THE ANODE CONNECTION ON TYPE 7191 IS A SOLDERING TERMINAL BROUGHT OUT THE TOP OF THE ENVOLOPE. THIS DESIGN PROVIDES A MAXIMUM SPACING BETWEEN THE ANODE LEAD AND THE GRID AND CATHODE PINS TO PREVENT ARC-OVER AT REDUCED AIR PRESSURES. THE 7191 WILL OPERATE FOR SHORT PERIODS AT 80,000 FEET WITHOUT FORCED AIR COOLING. THE NOMINAL ALTITUDE RATING FOR THE 7190 AND 7192 IS 10,000 FEET. HOWEVER, IF PROVISION IS MADE TO PREVENT ARC-OVER BETWEEN PINS, THESE TYPES ALSO WILL OPERATE AT 80,000 FEET. ONE METHOD OF PREVENTING ARC-OVER BETWEEN PINS IS TO POT THE BASE END OF THE TUBE. IF THE ENTIRE ENVELOPE IS TO BE POTTED, HOWEVER, PRECAUTION MUST BE TAKEN TO KEEP BULB TEMPERATURE BELOW 225°C.

TYPE 7192 IS SUPPLIED WITH LONG, FLEXIBLE STRANDED LEAD CONNECTORS THAT MAY BE CRIMPED OR SOLDERED DIRECTLY IN THE CIRCUIT. THE TUBE ITSELF CAN BE SECURED BY ANY SUITABLE MECHANICAL MEANS. ONE SUCH METHOD IS TO HOLD IT IN POSITION WITH A HEAT DISSIPATING CLAMP SUCH AS THE BIRTCHER 6A3.

CATHODE TEMPERATURE IS DETERMINED BY RMS CATHODE CURRENT AS WELL AS BY HEATER POWER. THE BOGEY HEATER VOLTAGE OF 6.3 VOLTS HEREFORE IS APPLICABLE ONLY NEAR FULL OPERATING CONDITIONS. AT LIGHT LOADING IT IS RECOMMENDED TO OPERATE THE HEATER VOLTAGE HIGHER. RECOMMENDED FIGURES FOR VARIOUS OPERATING CONDITIONS ARE SHOWN ON THE CURVES.

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TYPICAL OPERATION

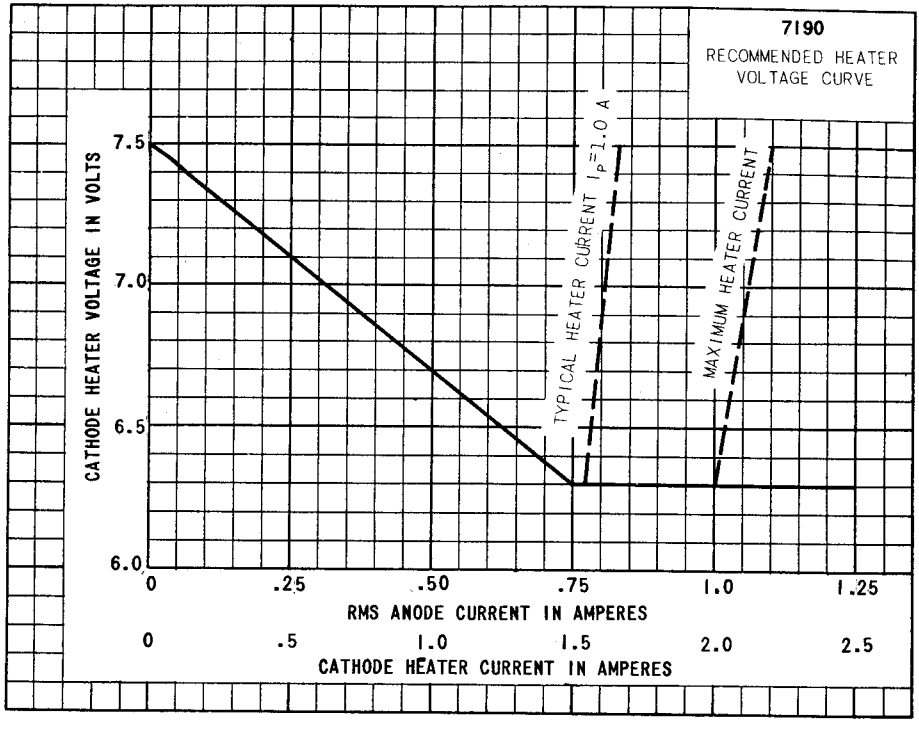
PRR (pps)	ANODE CURRENT PEAK (Amps)	RMS Amps AC	AVG. mAd.c.	Peak Anode Voltage VOLTS	PULSE WIDTH μ sec	GRID μ sec	DRIVE VOLTS
5000	20.0	1.0	50.	1000	0.5	1.0	250
10000	6.6	0.5	37.	316	0.56	2.0	250
33000*	3.5	0.46	60.	350	0.5	BLOCKING OSCILLATOR	200

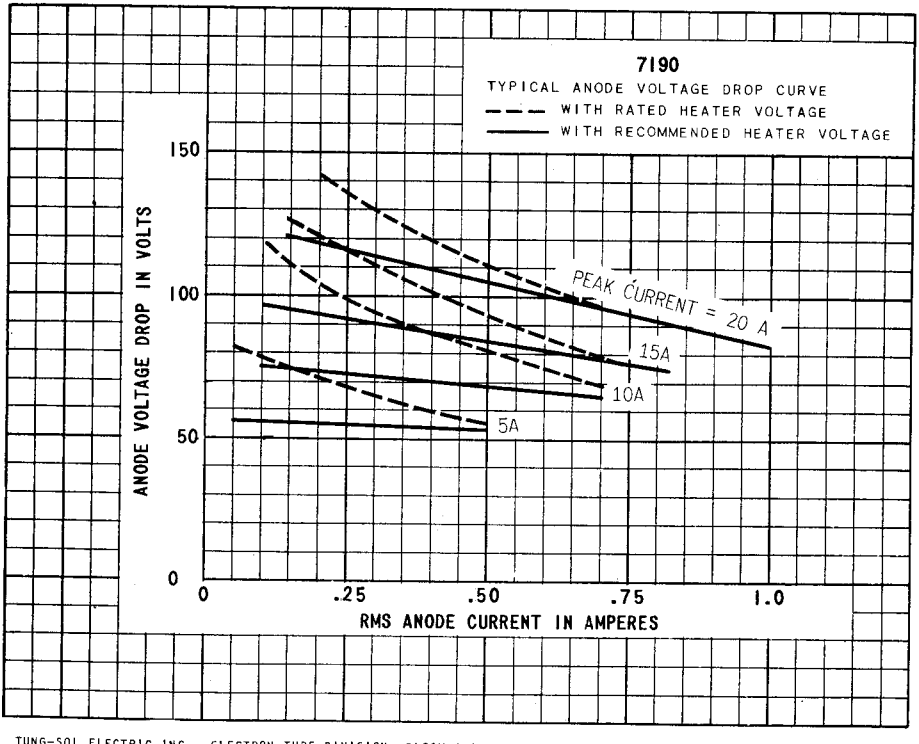
*LIMITED TEST INFORMATION.

RECOMMENDED GRID PULSE VALUES

	MIN.	MAX.	
PEAK VOLTAGE	200	500	VOLTS
DRIVER CIRCUIT IMPEDANCE	200	1000	OHMS
VOLTAGE RATE OF RISE μ SEC.	350		VOLTS

THESE VALUES ARE AS MEASURED AT THE TUBE SOCKET WITH THE THYRATRON REMOVED. THE GRID PULSE WIDTH SHOULD NOT BE LONGER THAN THE ANODE PULSE EXCEPT IN CASES WHERE THE DRIVER CIRCUIT IMPEDANCE IS HIGH. THE MINIMUM PEAK TRIGGER VOLTAGE RECOMMENDED WILL INCREASE WITH DECREASING TRIGGER PULSE WIDTH. HOWEVER, THIS EFFECT IS IMPORTANT ONLY AT PULSE WIDTHS LESS THAN 0.5 MICROSECONDS.





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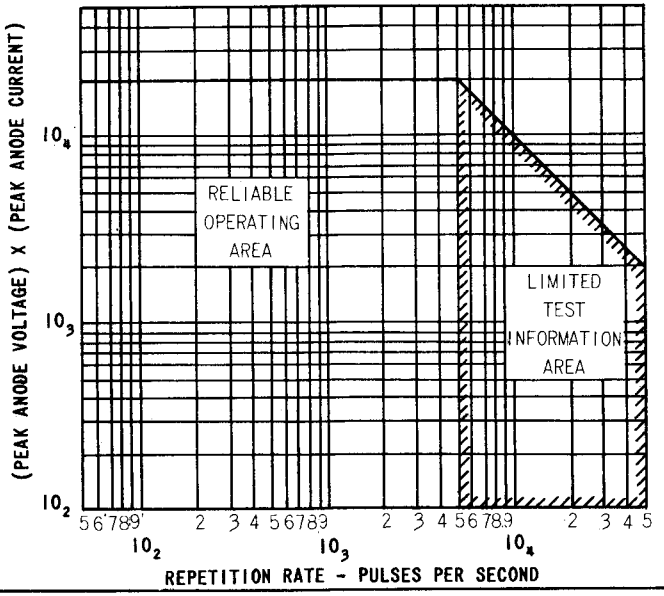
7190

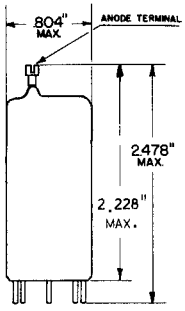
GRAPHICAL REPRESENTATION OF HEAT FACTOR



TUNG-SOL

THYRATRON

MINIATURE TYPE

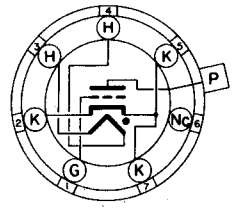


GLASS BULB
HARD

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON MINIATURE
7 PIN BASE
7FK

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ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE (WHEN Ip IS LESS THAN 0.75 Aac, REFER TO RECOMMENDED HEATER VOLTAGE CURVE)	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER VOLTAGE)	If	1.6	1.8	2.0	AMP.
CATHODE HEATING TIME	tk	30			SECONDS
ANODE VOLTAGE DROP (AT RECOMMENDED Ef)	etd	45		125	VOLTS

MECHANICAL DATA

TYPE OF COOLING (HEAT DISSIPATING SHIELDS MAY BE USED. FORCED AIR COOLING IS NOT RECOMMENDED.)	CONVECTION	
ALTITUDE	SEE APPLICATION NOTES	
MOUNTING POSITION	ANY	
MAXIMUM NET WEIGHT	0.5	OUNCES
DIMENSIONS: SEE OUTLINE DRAWINGS	SEE OUTLINE DRAWINGS	
MAXIMUM VIBRATION CONDITIONS	50–2000 CPS @ 15 G	
MAXIMUM SHOCK CONDITIONS (48° HAMMER BLOW IN NAVY FLY WEIGHT, HIGH IMPACT SHOCK MACHINE)	720	G/1MSEC.
MICROSCOPIC INSPECTION PER MIL-E-1775 1B (N ORD)	SEE APPLICATION NOTES	

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RATINGS

ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	---	1200	VOLTS
FORWARD	epy	300	1200	VOLTS
CATHODE CURRENT				
PEAK	ib		20.0	AMP.
AVERAGE	Ib		50	MA.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		1.0	AMP.
DC ANODE VOLTAGE	E_{bb}	300		VOLTS
HEATER-CATHODE VOLTAGE	Ehk	-100	+25	VOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		5000	CPS
PEAK GRID VOLTAGE (SEE RECOMMENDED GRID PULSE CONDITIONS.)	egy	175	500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		150	VOLTS
HEATING FACTOR (epy X ib X prr.)	Pb		1×10^8	
CURRENT RATE OF RISE (NOTE 2)			400	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.6	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	-60	+125	°C

NOTES

1 IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05 μSEC. MAXIMUM DURATION, SHALL NOT EXCERD 500 VOLTS DURING THE FIRST 25 μSEC, FOLLOWING THE ANODE PULSE.

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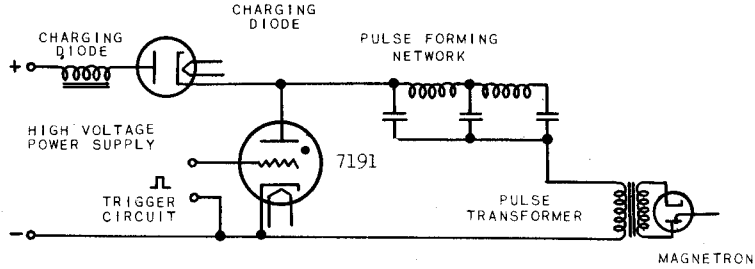

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TYPICAL OPERATION

PRR (pps)	ANODE CURRENT PEAK (Amps)	RMS Amps AC	AVG. mAd.c.	Peak Anode Voltage VOLTS	PULSE WIDTH μ sec	GRID μ sec	DRIVE VOLTS
5000	20.0	1.0	50.	1000	0.5	1.0	250
10000	6.6	0.5	37.	316	0.56	2.0	250
33000*	3.5	0.46	60.	350	0.5	BLOCKING OSCILLATOR	200

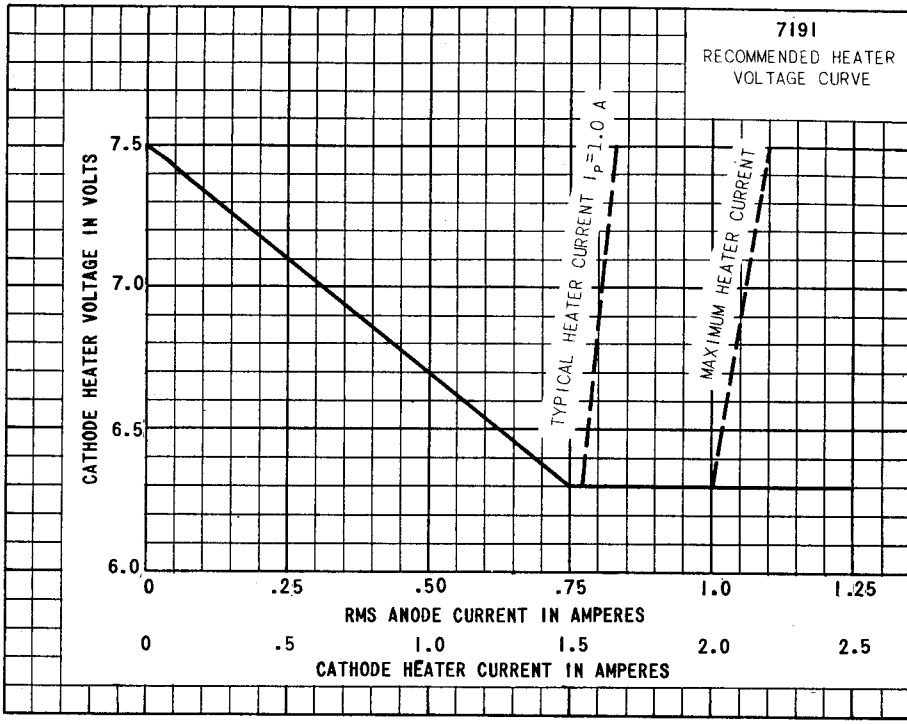
* LIMITED TEST INFORMATION.

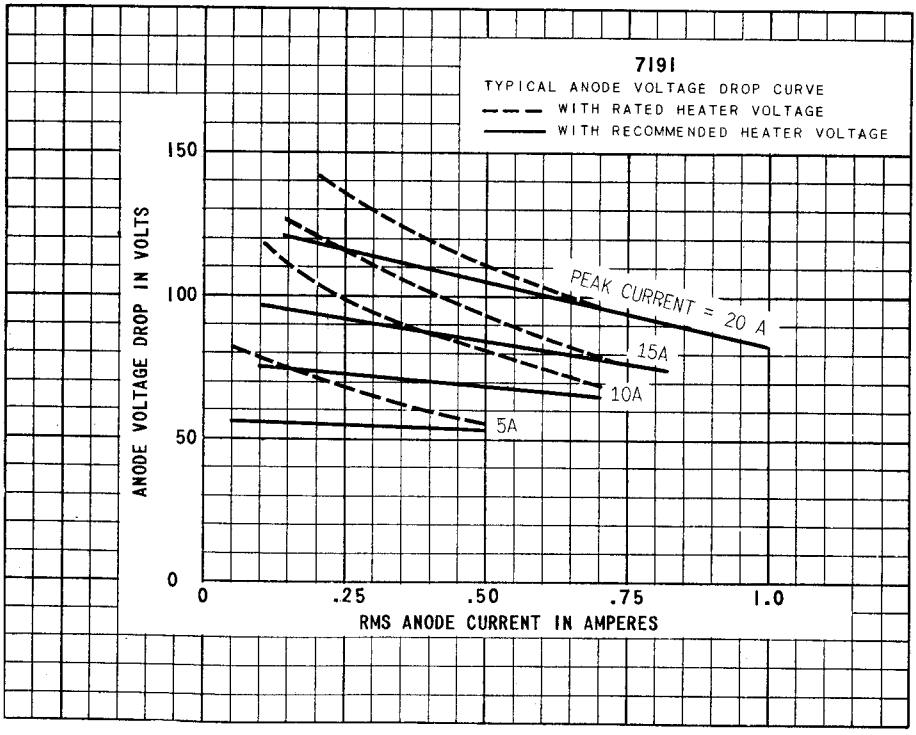
RECOMMENDED GRID PULSE VALUES

	MIN.	MAX.	
PEAK VOLTAGE	200	500	VOLTS
DRIVER CIRCUIT IMPEDANCE	200	1000	OHMS
VOLTAGE RATE OF RISE μ SEC.	350		VOLTS

THESE VALUES ARE AS MEASURED AT THE TUBE SOCKET WITH THE THYRATRON REMOVED. THE GRID PULSE WIDTH SHOULD NOT BE LONGER THAN THE ANODE PULSE EXCEPT IN CASES WHERE THE DRIVER CIRCUIT IMPEDANCE IS HIGH. THE MINIMUM PEAK TRIGGER VOLTAGE RECOMMENDED WILL INCREASE WITH DECREASING TRIGGER PULSE WIDTH. HOWEVER, THIS EFFECT IS IMPORTANT ONLY AT PULSE WIDTHS LESS THAN 0.5 MICROSECONDS.

SIMILAR TYPE REFERENCE: Type 7191 is similar in all respects to type 7190 except that the anode connector is a terminal extending from the top of the bulb. This permits operation at high altitudes in unpressurized equipment as explained in the application notes.





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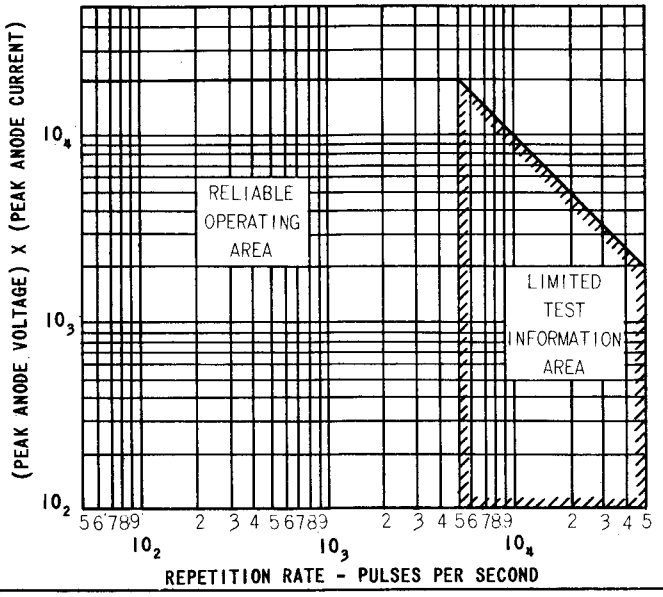
7191

GRAPHICAL REPRESENTATION OF HEAT FACTOR



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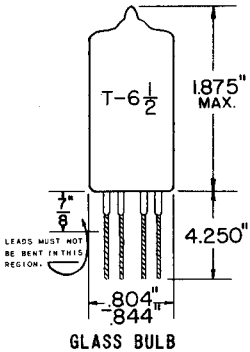


GLASS BULB
HARD

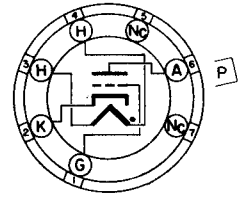
THYRATRON

MINIATURE TYPE

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON MINIATURE
7 PIN BASE
7FK

THE 7192 IS A ZERO BIAS MINIATURE HYDROGEN THYRATRON DESIGNED PRIMARILY FOR THE GENERATION OF PULSE VOLTAGES UNDER EXTREME CONDITIONS OF MECHANICAL VIBRATION. THIS TUBE CAN SUPPLY PEAK PULSE POWER OF 10 KILOWATTS AND THEREFORE WILL REPLACE PHYSICALLY LARGER TYPES IN MANY RADAR APPLICATIONS. BECAUSE OF ITS CLOSE ELECTRODE SPACING AND SMALL SIZE, MADE POSSIBLE BY HARD GLASS CONSTRUCTION, THE 7190 IS CAPABLE OF RELATIVELY HIGH PULSE REPETITION RATES.

THE 7190, 7191, AND 7192 DIFFER ONLY IN THEIR ELECTRODE TERMINALS. ALL OF THESE TYPES HAVE FOUND USE IN MISSILE APPLICATIONS. THE 7190, 7191, AND 7192 HAVE BEEN DESIGNED INTO SOME EQUIPMENT UNDER THE CHATHAM DEVELOPMENTAL DESIGNATIONS CH1062, CH1092, AND CH1055 RESPECTIVELY.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE (WHEN Ip IS LESS THAN 0.75 Aac, REFER TO RECOMMENDED HEATER VOLTAGE CURVE)	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER VOLTAGE)	If	1.6	1.8	2.0	AMP.
CATHODE HEATING TIME	tk	30			SECONDS
ANODE VOLTAGE DROP (AT RECOMMENDED Ef)	etd	45		125	VOLTS

MECHANICAL DATA

TYPE OF COOLING (HEAT DISSIPATING SHIELDS MAY BE USED. FORCED AIR COOLING IS NOT RECOMMENDED.)	CONVECTION	
ALTITUDE	SEE APPLICATION NOTES	
MOUNTING POSITION	ANY	
MAXIMUM NET WEIGHT	0.5	OUNCES
DIMENSIONS: SEE OUTLINE DRAWINGS	SEE OUTLINE DRAWINGS	
MAXIMUM VIBRATION CONDITIONS	50-2000 CPS @ 15 G	
MAXIMUM SHOCK CONDITIONS (48° HAMMER BLOW IN NAVY FLY WEIGHT, HIGH IMPACT SHOCK MACHINE)	720	G/1MSEC.
MICROSCOPIC INSPECTION PER MIL-E-1775IB (N ORD)	SEE APPLICATION NOTES	

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RATINGS
ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	---	1200	VOLTS
FORWARD	epy	300	1200	VOLTS
CATHODE CURRENT				
PEAK	ib		20.0	AMP.
AVERAGE	Ib		50	MA.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		1.0	AMP.
DC ANODE VOLTAGE	E_{bb}	300		VOLTS
HEATER-CATHODE VOLTAGE	Ehk	-100	+25	VOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		5000	CPS
PEAK GRID VOLTAGE (SEE RECOMMENDED GRID PULSE CONDITIONS.)	egy	175	500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		150	VOLTS
HEATING FACTOR (epy x ib x prr.)	Pb		1×10^8	
CURRENT RATE OF RISE (NOTE 2)			400	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.6	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	-60	+125	°C

NOTES

1 IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05 μSEC. MAXIMUM DURATION, SHALL NOT EXCERD 500 VOLTS DURING THE FIRST 25 μSEC, FOLLOWING THE ANODE PULSE.

2 MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

3 ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

4 TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 600 VOLTS AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

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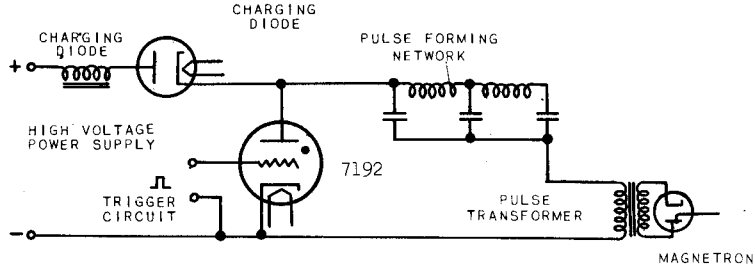
APPLICATION NOTES

THIS FAMILY OF MINIATURE HYDROGEN THYRATRONS IS DESIGNED FOR USE IN LINE TYPE RADAR MODULATORS. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO, RELEASE INTO THE MAGNETRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THESE TUBES ARE ADMIRABLY SUITED FOR SUCH SERVICE BY THEIR ABILITY TO HOLD OFF RELATIVELY HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENT WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBES WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING VERY FLEXIBLE CIRCUIT ELEMENTS. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBES OPERATE WITH ZERO BIAS.



THE SMALL SIZE, LIGHT WEIGHT, EXTREME RUGGEDNESS, AND ABILITY TO OPERATE AT HIGH AMBIENT TEMPERATURES, MAKE THESE TUBES PARTICULARLY SUITABLE FOR AIRBORNE USE. THE TUBES CAN BE OPERATED IN ANY POSITION. ALL TUBES ARE TESTED IN ACCORDANCE WITH MIL-E-1775 1B (N ORD), THE MILITARY SPECIFICATION FOR ELECTRON TUBES FOR GUIDED MISSILES. THIS ENTAILS 100% MICROSCOPIC INSPECTION WITH A 10 POWER BINOCULAR MICROSCOPE FOR SUCH ITEMS AS SEALS, LEADS AND SPOT WELDS. SAMPLE TUBES ARE VIBRATED WITH VOLTAGES APPLIED OVER A RANGE OF 50 TO 2000 TO 500PS AT 15G IN 4 MINUTES.

THE 7190 AND THE 7191 FIT A STANDARD 7 PIN MINIATURE SOCKET. THE TUBE PINS, HOWEVER, ARE STIFF, AND CARE SHOULD BE TAKEN TO HAVE THE SOCKET CLIPS IN PERFECT ALIGNMENT BEFORE ATTEMPTING TO INSERT A TUBE. AS THE TUBE OPERATES AT HIGH TEMPERATURES, A CERAMIC TYPE SOCKET SHOULD BE EMPLOYED. CONNECTIONS TO THE SOCKET SHOULD BE MADE WITH FLEXIBLE LEADS TO PROVIDE FLOATING ACTION FOR THE SOCKET CLIPS. PIN STRAIGHTENERS SHOULD NEVER BE USED ON THESE TUBE TYPES, AS ANY ATTEMPT TO BEND THE PINS WILL RESULT IN CRACKED BUTTON BASES!

THE ANODE CONNECTION ON TYPE 7191 IS A SOLDERING TERMINAL BROUGHT OUT THE TOP OF THE ENVOLOPE. THIS DESIGN PROVIDES A MAXIMUM SPACING BETWEEN THE ANODE LEAD AND THE GRID AND CATHODE PINS TO PREVENT ARC-OVER AT REDUCED AIR PRESSURES. THE 7191 WILL OPERATE FOR SHORT PERIODS AT 80,000 FEET WITHOUT FORCED AIR COOLING. THE NOMINAL ALTITUDE RATING FOR THE 7190 AND 7192 IS 10,000 FEET. HOWEVER, IF PROVISION IS MADE TO PREVENT ARC-OVER BETWEEN PINS, THESE TYPES ALSO WILL OPERATE AT 80,000 FEET. ONE METHOD OF PREVENTING ARC-OVER BETWEEN PINS IS TO POT THE BASE END OF THE TUBE. IF THE ENTIRE ENVELOPE IS TO BE POTTED, HOWEVER, PRECAUTION MUST BE TAKEN TO KEEP BULB TEMPERATURE BELOW 225°C.

TYPE 7192 IS SUPPLIED WITH LONG, FLEXIBLE STRANDED LEAD CONNECTORS THAT MAY BE CRIMPED OR SOLDERED DIRECTLY IN THE CIRCUIT. THE TUBE ITSELF CAN BE SECURED BY ANY SUITABLE MECHANICAL MEANS. ONE SUCH METHOD IS TO HOLD IT IN POSITION WITH A HEAT DISSIPATING CLAMP SUCH AS THE BIRTCHER 6A3.

CATHODE TEMPERATURE IS DETERMINED BY RMS CATHODE CURRENT AS WELL AS BY HEATER POWER. THE BOGEY HEATER VOLTAGE OF 6.3 VOLTS HEREFORE IS APPLICABLE ONLY NEAR FULL OPERATING CONDITIONS. AT LIGHT LOADING IT IS RECOMMENDED TO OPERATE THE HEATER VOLTAGE HIGHER. RECOMMENDED FIGURES FOR VARIOUS OPERATING CONDITIONS ARE SHOWN ON THE CURVES.

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TYPICAL OPERATION

PRR (pps)	ANODE CURRENT PEAK (Amps)	RMS Amps AC	AVG. mAd.c.	Peak Anode Voltage VOLTS	PULSE WIDTH μ sec	GRID μ sec	DRIVE VOLTS
5000	20.0	1.0	50.	1000	0.5	1.0	250
10000	6.6	0.5	37.	316	0.56	2.0	250
33000*	3.5	0.46	60.	350	0.5	BLOCKING OSCILLATOR	200

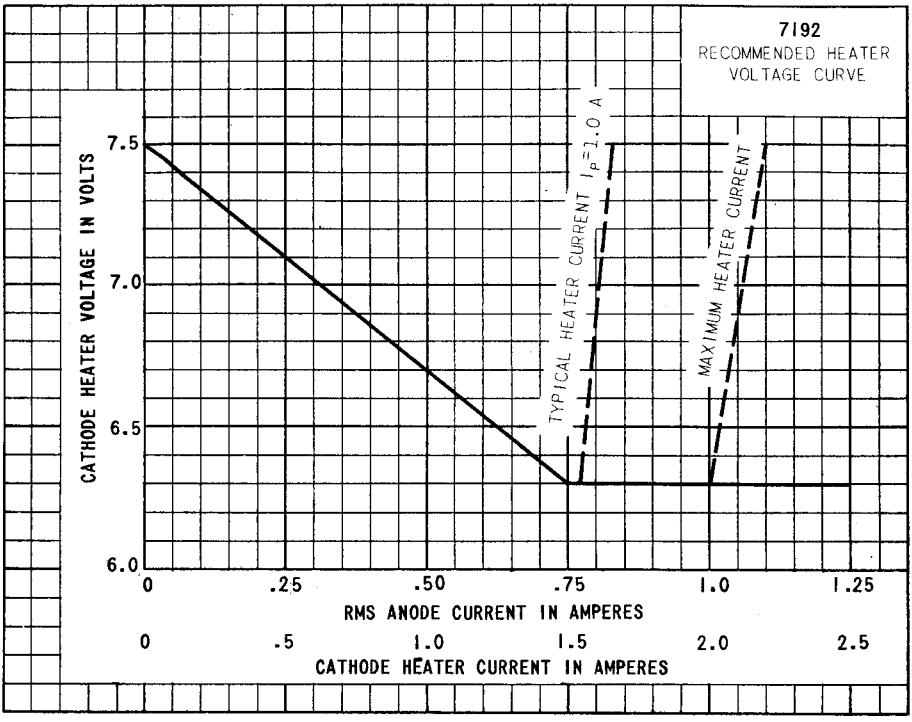
* LIMITED TEST INFORMATION.

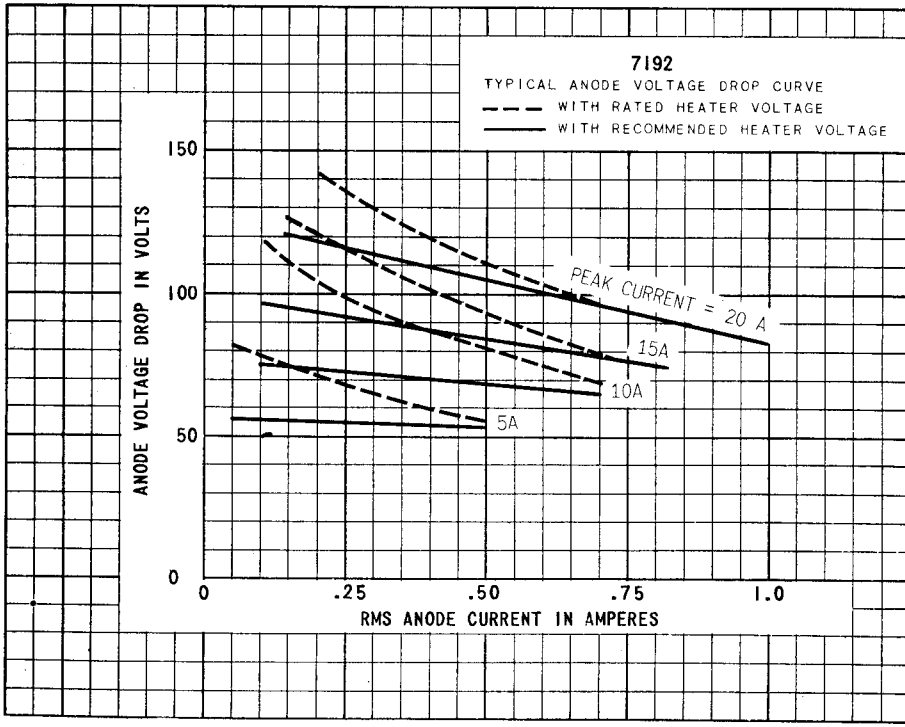
RECOMMENDED GRID PULSE VALUES

	MIN.	MAX.	
PEAK VOLTAGE	200	500	VOLTS
DRIVER CIRCUIT IMPEDANCE	200	1000	OHMS
VOLTAGE RATE OF RISE μ SEC.	350		VOLTS

THESE VALUES ARE AS MEASURED AT THE TUBE SOCKET WITH THE THYRATRON REMOVED. THE GRID PULSE WIDTH SHOULD NOT BE LONGER THAN THE ANODE PULSE EXCEPT IN CASES WHERE THE DRIVER CIRCUIT IMPEDANCE IS HIGH. THE MINIMUM PEAK TRIGGER VOLTAGE RECOMMENDED WILL INCREASE WITH DECREASING TRIGGER PULSE WIDTH. HOWEVER, THIS EFFECT IS IMPORTANT ONLY AT PULSE WIDTHS LESS THAN 0.5 MICROSECONDS.

SIMILAR TYPE REFERENCE: Type 7192 is similar in all respects to type 7190 except that long flexible leads are provided to permit the connection of the tube directly into a circuit without the use of a tube socket. This is discussed in the application notes.





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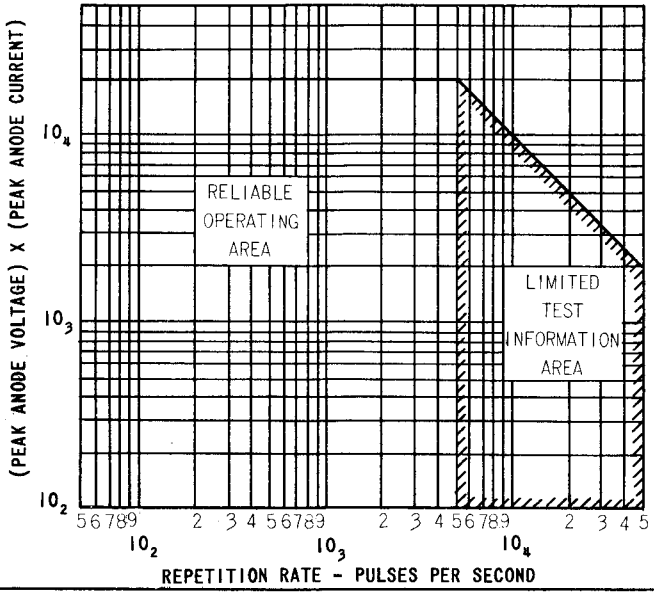
7192
GRAPHICAL REPRESENTATION OF HEAT FACTOR



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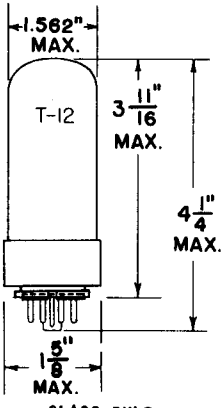
TWIN TRIODE



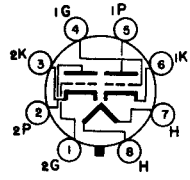
GLASS BULB
SMALL WAFER
8 PIN OCTAL 88-197

COATED UNIPOTENTIAL CATHODE

HEATER NOMINAL

6.3±.3 VOLTS 2.4 AMP.
AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8BD

THE 7236 IS A LOW MU DOUBLE TRIODE INTENDED FOR LONG LIFE SERVICE AS A POWER AMPLIFIER IN COMPUTER SERVICE. IT HAS THE ABILITY TO PASS LARGE CURRENTS WITH A LOW VOLTAGE DROP.

DIRECT INTERELECTRODE CAPACITANCES
EACH UNIT

INPUT	9.0	μμf
OUTPUT	3.3	μμf
GRID TO PLATE	10.0	μμf
HEATER TO CATHODE	11.0	μμf
PLATE TO PLATE	0.5	μμf

RATINGS
ABSOLUTE MAXIMUM VALUES.

OPTIMUM SERVICE LIFE

HEATER VOLTAGE	6.3±.3	VOLTS
MAXIMUM PLATE VOLTAGE	300	VOLTS
MAXIMUM PLATE CURRENT PER PLATE	190	MA.
MAXIMUM PLATE DISSIPATION PER PLATE	15	WATTS
MAXIMUM GRID RESISTANCE	0.25	MEGOHM
MAXIMUM BULB TEMPERATURE[A]	150	°C
MAXIMUM POSITIVE GRID VOLTAGE	+1	VOLT
MAXIMUM NEGATIVE GRID VOLTAGE	100	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE	100	VOLTS

[A] FORCED AIR COOLING IS NECESSARY TO OBTAIN THIS BULB TEMPERATURE.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS
EACH TRIODE

HEATER VOLTAGE		6.3±5%		VOLTS
HEATER CURRENT	2.4	2.4	2.4	AMP.
PLATE VOLTAGE	120	60	150	VOLTS
DC GRID VOLTAGE	−14	0	−24	VOLTS
PLATE CURRENT	100	150	60	MA.
AMPLIFICATION FACTOR	4.8	---	---	
TRANSCONDUCTANCE	12 500	---	---	μMHOS
I_b (AT E_{c1} =−65 V.) (MAX.)	----	---	100	μA.

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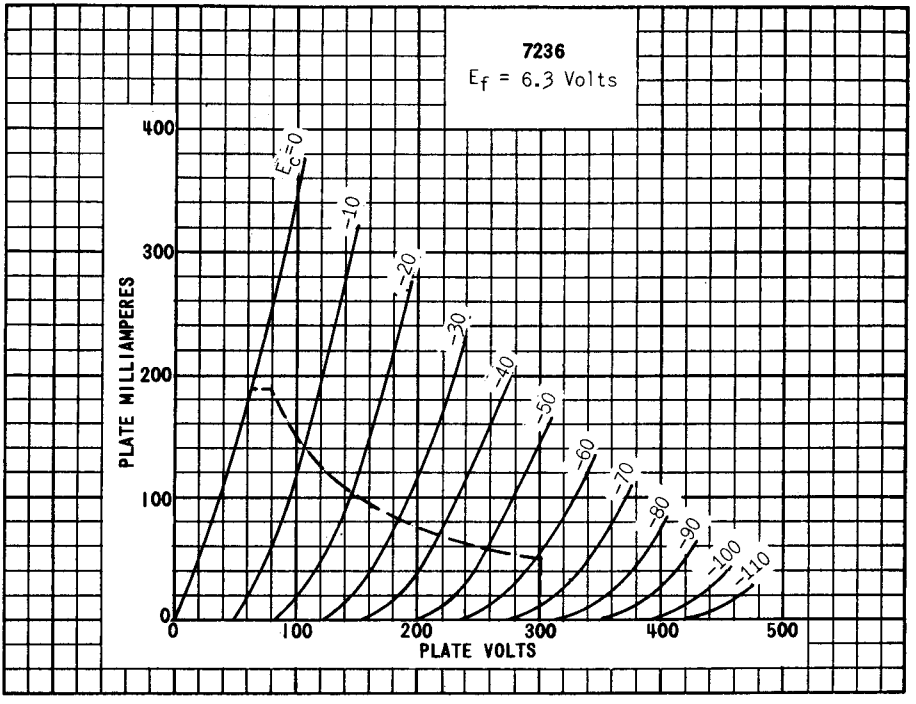
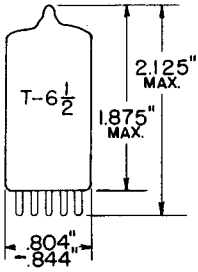

7236
E_f = 6.3 Volts
PLATE MILLIAMPERES
PLATE VOLTS
0
100
200
300
400
500
E_c=0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110

TUNG-SOL

THYRATRON

MINIATURE TYPE

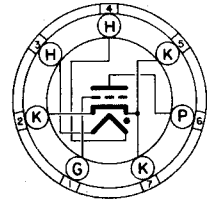


GLASS BULB
HARD

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
SMALL BUTTON MINIATURE
7 PIN BASE
7FJ

THE 7240 IS A ZERO BIAS MINIATURE HYDROGEN THYRATRON DESIGNED PRIMARILY FOR THE GENERATION OF PULSE VOLTAGES UNDER EXTREME CONDITIONS OF MECHANICAL VIBRATION. THIS TUBE CAN SUPPLY PEAK PULSE POWER OF 10 KILOWATTS AND THEREFORE WILL REPLACE PHYSICALLY LARGER TYPES IN MANY RADAR APPLICATIONS. BECAUSE OF ITS CLOSE ELECTRODE SPACING AND SMALL SIZE, MADE POSSIBLE BY HARD GLASS CONSTRUCTION, THE 7240 IS CAPABLE OF RELATIVELY HIGH PULSE REPETITION RATES. IN ADDITION ITS 28 VOLT HEATER MAKES IT PARTICULARLY SUITABLE FOR USE WITH AIRBORNE AND MISSILE POWER SUPPLIES. THE 7240 HAS BEEN DESIGNED INTO SOME EQUIPMENT UNDER THE DEVELOPMENTAL DESIGNATION CH-1046.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE (WHEN Ip IS LESS THAN 0.75 Aac, REFER TO RECOMMENDED HEATER VOLTAGE CURVE)	Ef	26.6	28.0	29.4	VOLTS
HEATER CURRENT (WITH BOGIE HEATER VOLTAGE)	If	0.37	0.42	0.46	AMP
CATHODE HEATING TIME	tk	30			SECONDS
ANODE VOLTAGE DROP (AT RECOMMENDED Ef)	etd			45	VOLTS

MECHANICAL DATA

TYPE OF COOLING (HEAT DISSIPATING SHIELDS MAY BE USED. FORCED AIR COOLING IS NOT RECOMMENDED.)	CONVECTION
ALTITUDE	SEE APPLICATION NOTES
MOUNTING POSITION	ANY
MAXIMUM NET WEIGHT	0.5 OUNCES
DIMENSIONS	SEE OUTLINE DRAWINGS
MAXIMUM VIBRATION CONDITIONS	50-2000 CPS @ 15 G
MAXIMUM SHOCK CONDITIONS (48° HAMMER BLOW IN NAVY FLY WEIGHT, HIGH IMPACT SHOCK MACHINE)	720 G/1MSEC.
MICROSCOPIC INSPECTION PER MIL-E-1775IB (N ORD)	SEE APPLICATION NOTES

CONTINUED ON FOLLOWING PAGE

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RATINGS
ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	---	1200	VOLTS
FORWARD	epy	300	1200	VOLTS
CATHODE CURRENT				
PEAK	ib		20.0	AMP.
AVERAGE	Ib		50	MA.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		1.0	AMP.
DC ANODE VOLTAGE	E_{bb}	300		VOLTS
HEATER-CATHODE VOLTAGE	Ehk	-100	+25	VOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		5000	CPS
PEAK GRID VOLTAGE (SEE RECOMMENDED GRID PULSE CONDITIONS.)	egy	175	500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		150	VOLTS
HEATING FACTOR (epy x ib x prr.)	Pb		1×10^8	
CURRENT RATE OF RISE (NOTE 2)			400	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.6	μSEC.
TIME JITTER (NOTE 4)	tj		.005	μSEC.
AMBIENT TEMPERATURE	TA	-60	+125	°C

NOTES

1 IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05 μSEC. MAXIMUM DURATION, SHALL NOT EXCERD 500 VOLTS DURING THE FIRST 25 μSEC, FOLLOWING THE ANODE PULSE.

2 MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

3 ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

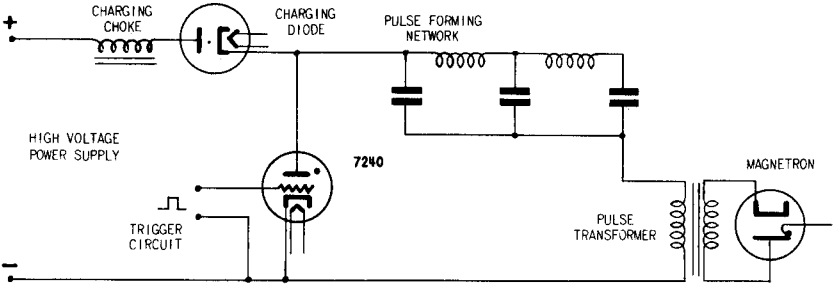
4 TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 600 VOLTS AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

APPLICATION NOTES

THIS MINIATURE HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN LINE TYPE RADAR MODULATORS. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNETRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THIS TUBE IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF RELATIVELY HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENT WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE SMALL SIZE, LIGHT WEIGHT, EXTREME RUGGEDNESS, AND ABILITY TO OPERATE AT HIGH AMBIENT TEMPERATURES, MAKES THIS TUBE PARTICULARLY SUITABLE FOR AIRBORNE USE. THE TUBE CAN BE OPERATED IN ANY POSITION. THE 7240 IS TESTED IN ACCORDANCE WITH MIL-E-1775 1B (N ORD), THE MILITARY SPECIFICATION FOR ELECTRON TUBES FOR GUIDED MISSILES. THIS ENTAILS 100% MICROSCOPIC INSPECTION WITH A 10 POWER BINOCULAR MICROSCOPE FOR SUCH ITEMS AS SEALS, LEADS AND SPOT WELDS. SAMPLE TUBES ARE VIBRATED WITH VOLTAGES APPLIED OVER A RANGE OF 50 TO 2000 TO 500PS AT 15G IN FOUR MINUTES.

THE 7240 FITS A STANDARD 7 PIN MINIATURE SOCKET. THE TUBE PINS, HOWEVER, ARE STIFF, AND CARE SHOULD BE TAKEN TO HAVE THE SOCKET CLIPS IN PERFECT ALIGNMENT BEFORE ATTEMPTING TO INSERT A TUBE. AS THE TUBE OPERATES AT HIGH TEMPERATURES, A CERAMIC TYPE SOCKET SHOULD BE EMPLOYED. CONNECTIONS TO THE SOCKET SHOULD BE MADE WITH FLEXIBLE LEADS TO PROVIDE FLOATING ACTION FOR THE SOCKET CLIPS. PIN STRAIGHTENERS SHOULD NEVER BE USED ON THIS TUBE TYPE, AS ANY ATTEMPT TO BEND THE PINS WILL RESULT IN CRACKED BUTTON BASES.

THE NOMINAL ALTITUDE RATING FOR THE 7240 IS 10,000 FEET. HOWEVER, IF PROVISION IS MADE TO PREVENT ARC-OVER BETWEEN PINS, THIS TYPE WILL OPERATE AT 80,000 FEET. ONE METHOD OF PREVENTING ARC-OVER BETWEEN PINS IS TO POT THE BASE END OF THE TUBE. IF THE ENTIRE ENVELOPE IS TO BE POTTED, HOWEVER, PRECAUTION MUST BE TAKEN TO KEEP BULB TEMPERATURE BELOW 225°C.

CATHODE TEMPERATURE IS DETERMINED BY RMS CATHODE CURRENT AS WELL AS BY HEATER POWER. THE BOGEY HEATER VOLTAGE OF 28.0 VOLTS THEREFORE IS APPLICABLE ONLY NEAR FULL OPERATING CONDITIONS. AT LIGHT LOADING IT IS RECOMMENDED TO OPERATE THE HEATER VOLTAGE HIGHER. RECOMMENDED FIGURES FOR VARIOUS OPERATING CONDITIONS ARE SHOWN ON THE CURVES.

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TUNG-SOL

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TYPICAL OPERATION

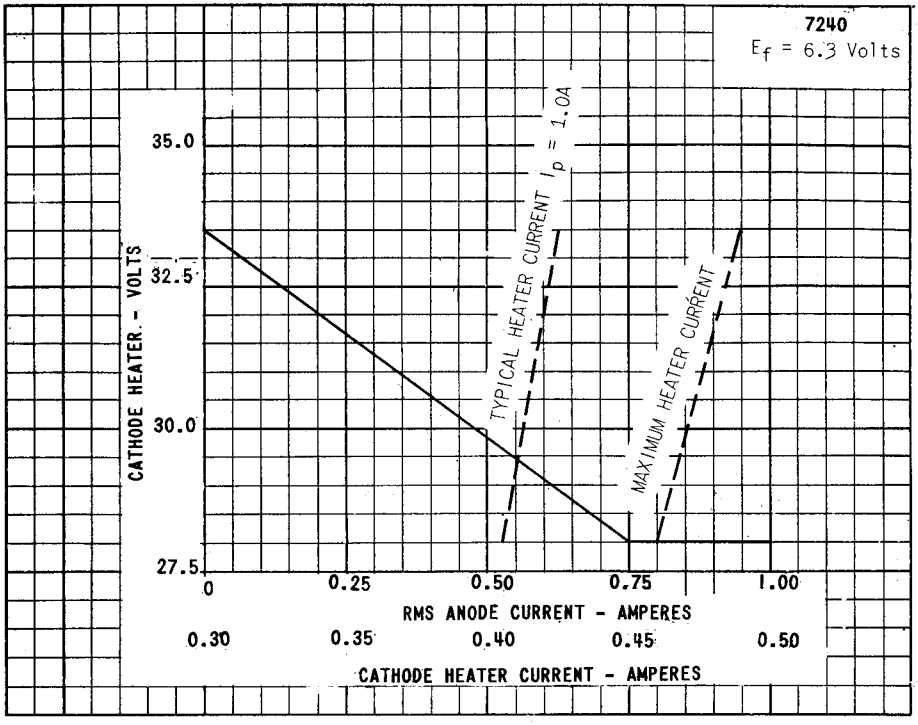
PRR	ANODE CURRENT			PEAK ANODE VOLTAGE	PULSE WIDTH	GRID DRIVE	
	PEAK	RMS	AVG.				
(pps)	(Amps)	Amps AC	mAd.c.	VOLTS	μ sec	μ sec	VOLTS
5000	20.0	1.0	50.	1000	0.5	1.0	250
10000	6.6	0.5	37.	316	0.56	2.0	250
33000*	3.5	0.46	60.	350	0.5	BLOCKING OSCILLATOR	200

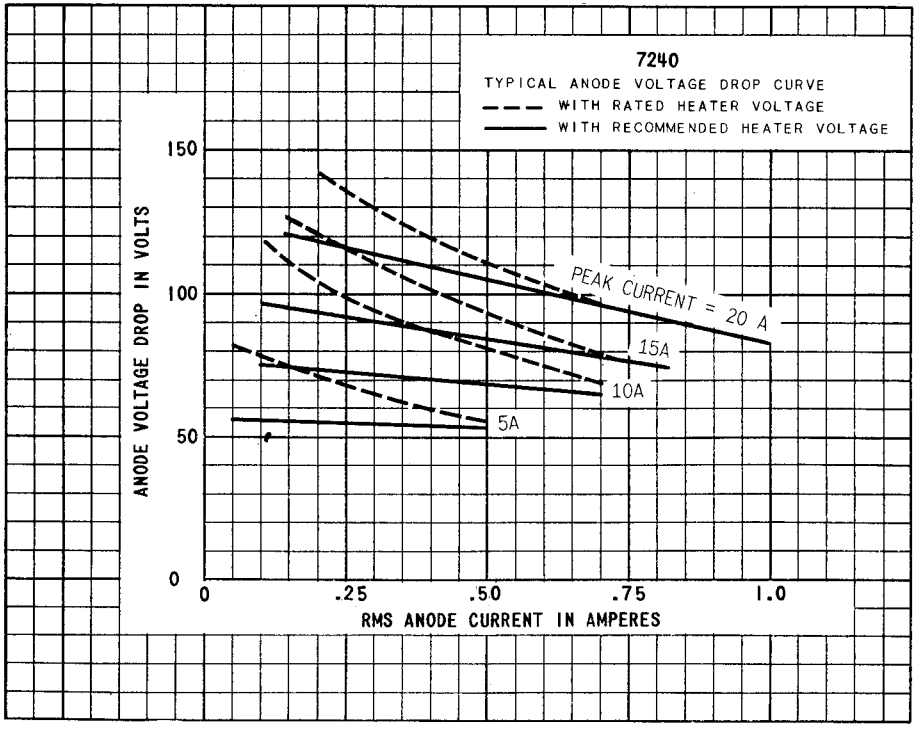
* LIMITED TEST INFORMATION.

RECOMMENDED GRID PULSE VALUES

	MIN.	MAX.	
PEAK VOLTAGE	200	500	VOLTS
DRIVER CIRCUIT IMPEDANCE	200	1000	OHMS
VOLTAGE RATE OF RISE PER μSEC.	350		VOLTS

THESE VALUES ARE AS MEASURED AT THE TUBE SOCKET WITH THE THYRATRON REMOVED. THE GRID PULSE WIDTH SHOULD NOT BE LONGER THAN THE ANODE PULSE EXCEPT IN CASES WHERE THE DRIVER CIRCUIT IMPEDANCE IS HIGH. THE MINIMUM PEAK TRIGGER VOLTAGE RECOMMENDED WILL INCREASE WITH DECREASING TRIGGER PULSE WIDTH. HOWEVER, THIS EFFECT IS IMPORTANT ONLY AT PULSE WIDTHS LESS THAN 0.5 MICROSECONDS.





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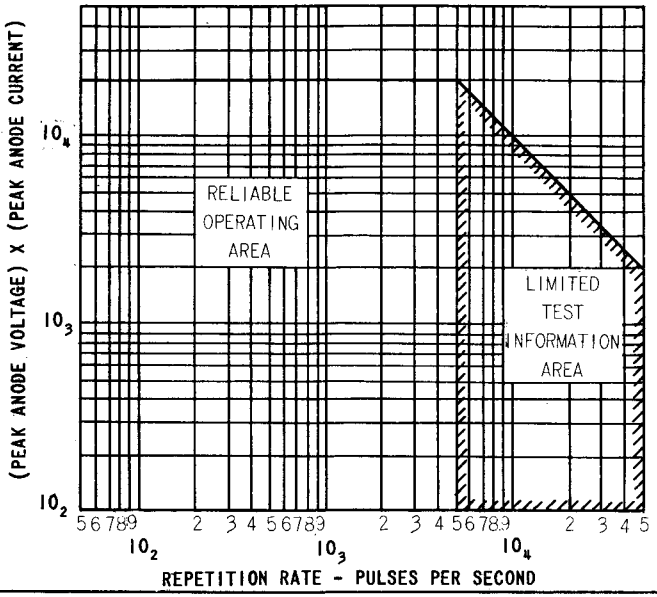
7240

GRAPHICAL REPRESENTATION OF HEAT FACTOR



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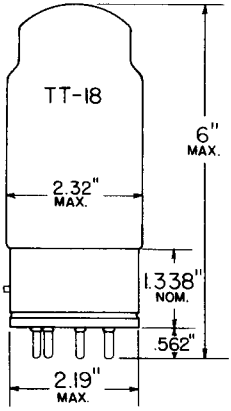
TRIODE



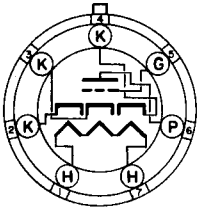
GLASS BULB

HEATER

6.3±10% VOLTS 7.5 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

GIANT WITH CERAMIC INSERT 7 PIN BASE

THE 7241 IS A LONG LIFE, HIGH POWER TRIODE DEVELOPED ESPECIALLY FOR USE AS A PASSING TUBE IN THE SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINSIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 7241 ADEQUATELY MEETS THESE REQUIREMENTS. ONE TYPE 7241 CAN PASS MORE THAN ONE AMPERE AT 100 WATTS PLATE DISSIPATION.

THE 7241 FEATURES ONE LARGE ZIRCONIUM COATED GRAPHITE ANODE, WITH THREE SEPARATE GRID-CATHODES STRUCTURES. THIS ANODE, WHILE LIGHTER IN WEIGHT THAN SIMILAR METAL ANODES, REMAINS WARP FREE DURING LIFE AND PROVIDES ONE OF THE BEST GAS "GETTERING" MEANS KNOWN. THE ANODE IS SUPPORTED BY CERAMIC INSULATORS. THE USE OF THESE INSULATORS AND THE HARD GLASS ENVELOPE PERMIT THE TUBE TO BE OUTGASSED AT HIGH TEMPERATURES DURING THE MANUFACTURING EXHAUST PROCESS. THIS ALLOWS THE TUBE TO BE RUN AT HIGH TEMPERATURES DURING OPERATION, WITHOUT THE EVOLUTION OF HARMFUL GAS FROM THE TUBE PARTS.

MASSIVE CATHODES PROVIDE ADEQUATE EMISSION CURRENT RESERVE. GOLD PLATED MOLYBDENUM WIRES ARE EMPLOYED IN THE RUGGED GRID STRUCTURE. THE TUBE MOUNT IS BUILT ON A RUGGED BUTTON STEM, AND IS SUPPORTED FROM THE BULB BY MEANS OF FLEXIBLE METAL VIBRATION SNUBBERS.

IN MANY CIRCUITS, ONE 7241 CAN REPLACE FOUR TYPE 6080WA OR 6AS7G REGULATOR TUBES. FOR EVEN HIGHER LEVELS OF CURRENT OR POWER, SEVERAL 7241 TUBES CAN BE PARALLELED AS EXPLAINED IN THE APPLICATION NOTES.

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ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f = 6.3 V.)	7.5	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE	40 000	μMHOS
AMPLIFICATION FACTOR	2.7	
PLATE RESISTANCE	67	OHMS

MECHANICAL DATA

MOUNTING POSITION	ANY	
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)		
BULB	TT 18	NONEX
BASE	GIANT 7 PIN WITH CERAMIC INSERT, JETEC #A7-17	
SOCKET	E.F. JOHNSON #122-237 OR EQUIVALENT	
AVERAGE NET WEIGHT	6.0	OUNCES
MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE)	450	G
MAXIMUM VIBRATION RATING (10 TO 25 CPS)	2.5	G

RATINGS
ABSOLUTE VALUES

TOTAL PLATE DISSIPATION	---	100	WATTS
TOTAL PLATE CURRENT DC	---	1.2	AMP.
IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 6 VOLTS, THIS CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE			
CURRENT PER CATHODE (DC)	---	400	MA.
PLATE VOLTAGE (DC)	0	400	VOLTS
HEATER-CATHODE VOLTAGE (DC)	-300	+300	VOLTS
GRID VOLTAGE (DC)	-300	0	VOLTS
GRID CURRENT PER GRID	---	0	MA.
HEATER VOLTAGE	5.7	6.9	VOLTS
ENVELOPE TEMPERATURE	---	300	°C
ALTITUDE FOR FULL RATINGS	---	10,000	FEET
IF COOLING IS PROVIDED TO KEEP BULB TEMPERATURE WITHIN RATINGS, ALTITUDE RATING CAN BE EXTENDED TO 60,000 FT.			
CIRCUIT VALUES			
TOTAL GRID CIRCUIT RESISTANCE IN REGULATED SERVICE OR WITH FIXED BIAS	500	50,000	OHMS
TOTAL GRID CIRCUIT RESISTANCE WITH CATHODE BIAS ONLY	500	200,000	OHMS
RESISTANCE PER GRID LEG WHEN TUBES ARE PARALLELED	500	---	OHMS

CATHODE RESISTANCE: MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL BE 27 OHMS OR THAT RESISTANCE NECESSARY TO PROVIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS GREATER.

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

LIFE TEST: 1000 HOURS UNDER PLATE CURRENT TEST CONDITIONS

POST SHOCK AND LIFE TEST END POINTS:

PLATE CURRENT (MIN.)	450	MA
TRANSCONDUCTANCE (MIN.)	27 000	μMHO
HK LEAKAGE (MAX.)	150	μA
GRID CURRENT (MAX.)	-12	μA

RANGE OF VALUES

CONDITIONS: E_f = 6.3V, E_b = 190V.
E_c = -0, $R_{k/k}$ = 200 Ω, R_g = 500Ω
READINGS TAKEN AFTER 5 MINUTES POWER PRE-HEATING.

TOTAL PLATE CURRENT	495	600	MA,DC
AMPLIFICATION FACTOR	2.0	3.4	
TRANSCONDUCTANCE	33 000	48 000	μMHOS
HEATER CURRENT PER TUBE	7.12	7.88	AMP.

CONDITIONS: E_f = 6.3V, E_b = 200V.
E_c = -100V, R_k = 0

CURRENT PER CATHODE	0	10	MA.

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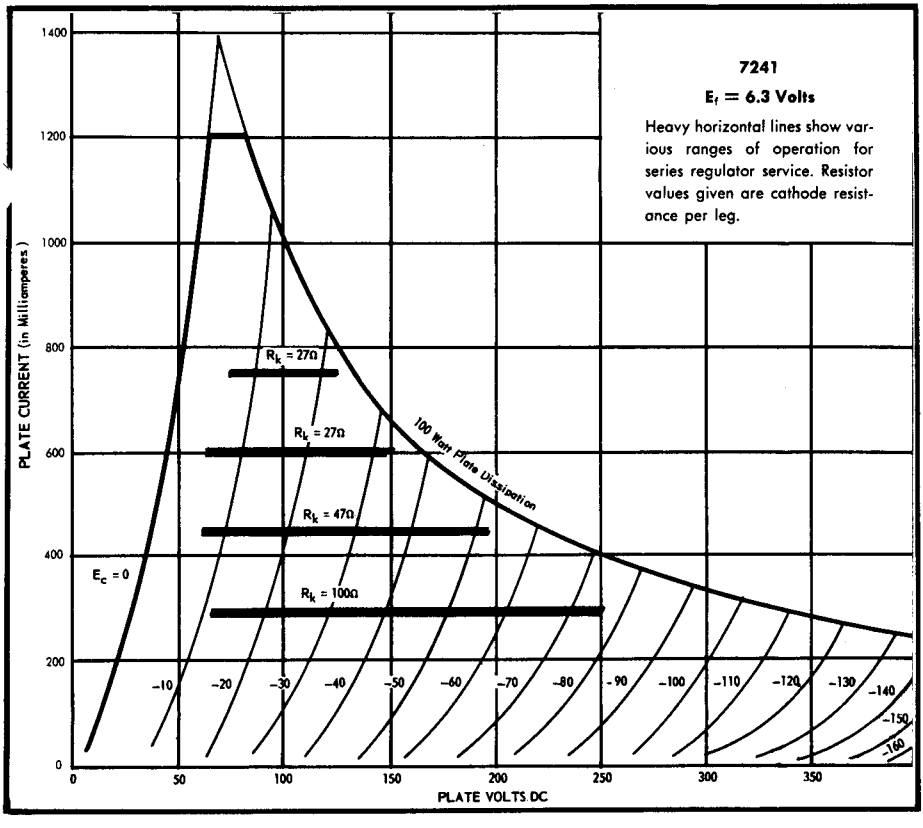
APPLICATION NOTES

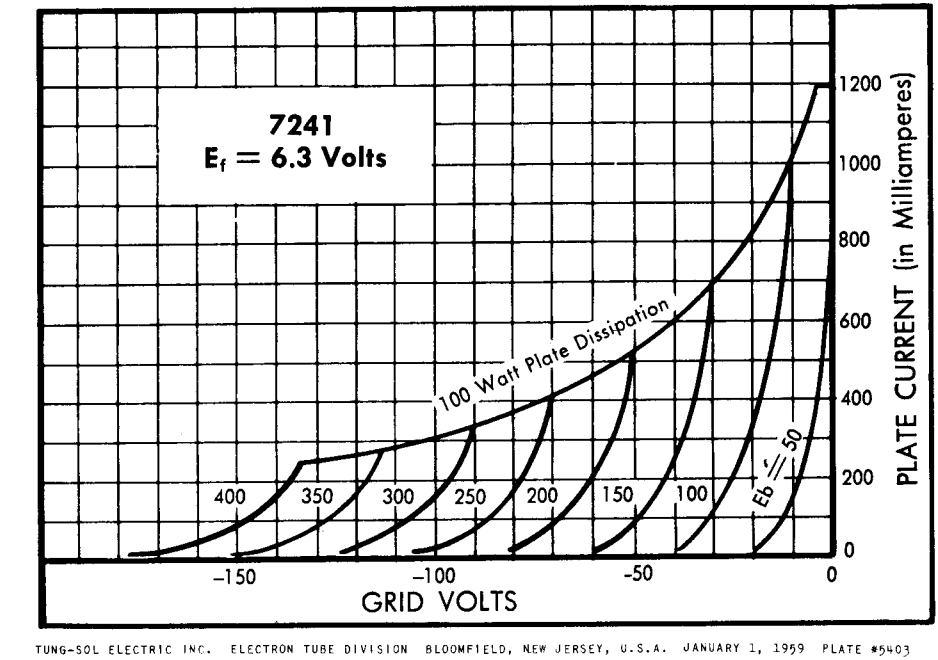
THE 7241 IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE FOURTH THE VALUE $(\frac{8}{\mu+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE FOURTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (ABOUT TWO WATTS) AND THE ADDITIONAL VOLTAGE (LESS THAN 10 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.





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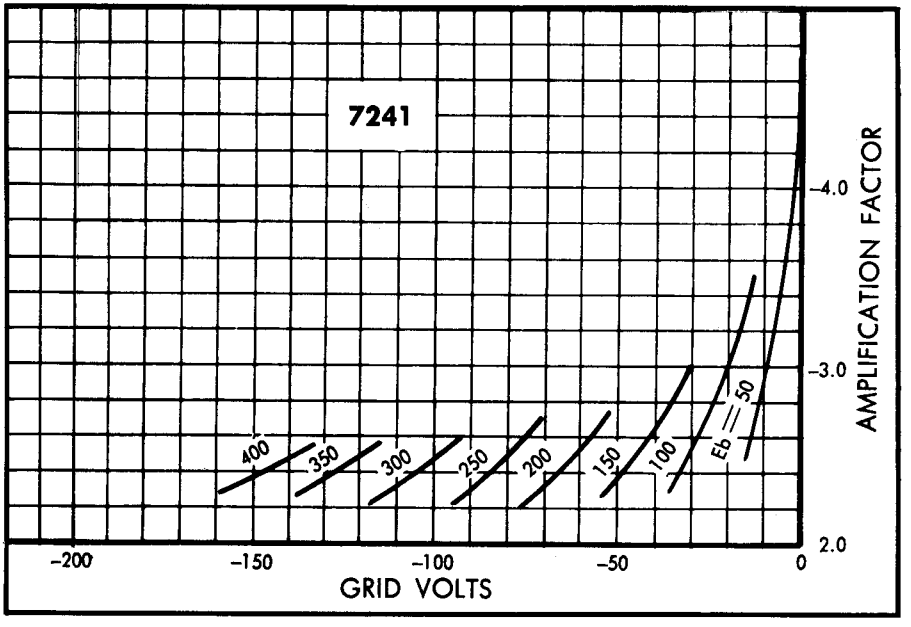
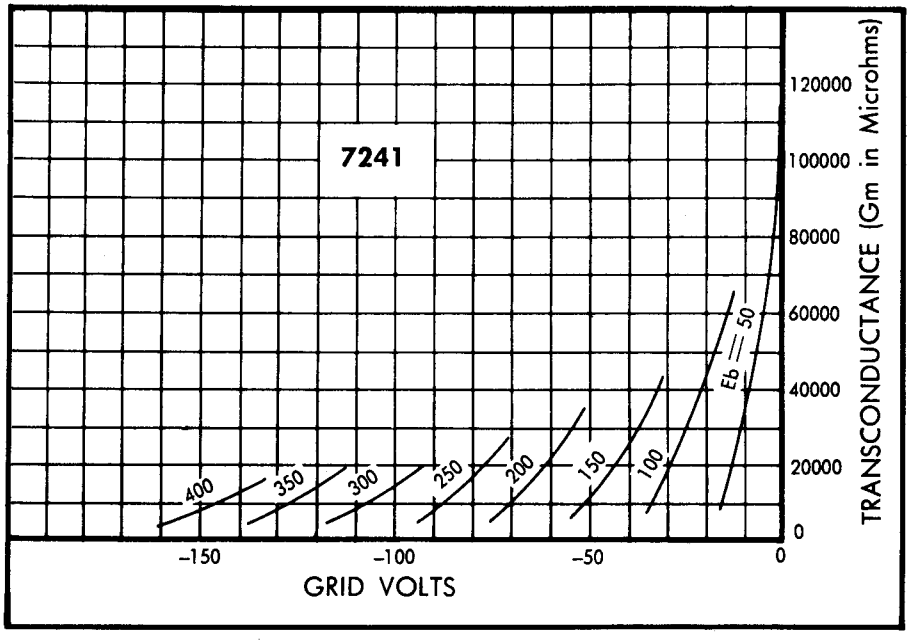
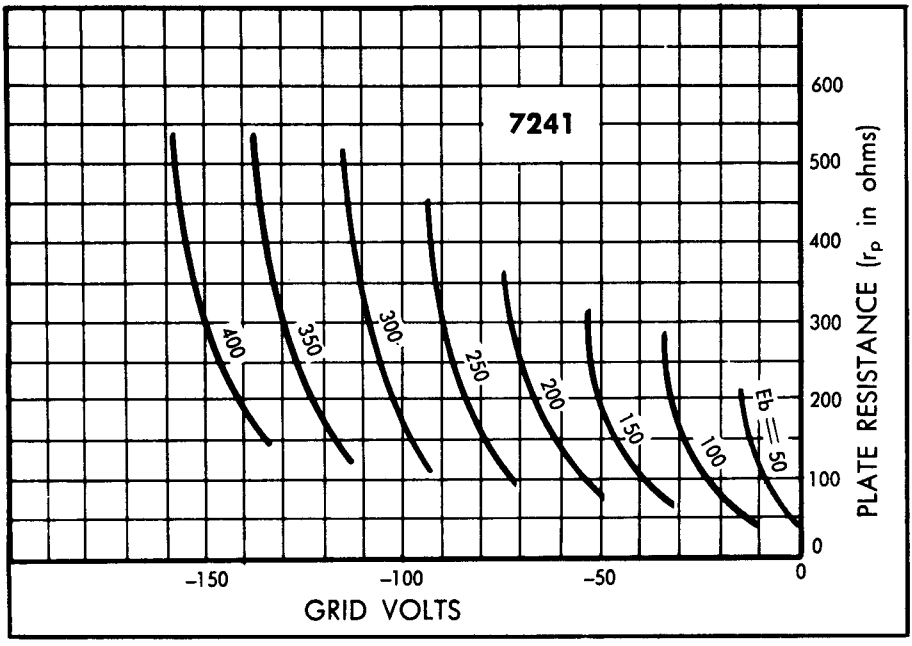

7241
AMPLIFICATION FACTOR
4.0
3.0
2.0
400
350
300
250
200
150
100
Eb = 50
-200
-150
-100
-50
0
GRID VOLTS


7241
TRANSCONDUCTANCE (Gm in Microhms)
120000
100000
80000
60000
40000
20000
0
400
350
300
250
200
150
100
Eb = 50
-150
-100
-50
0
GRID VOLTS



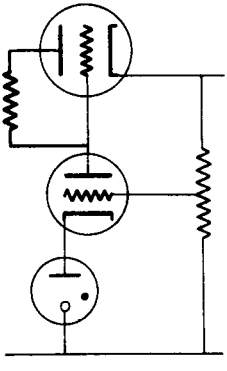


FIGURE 1

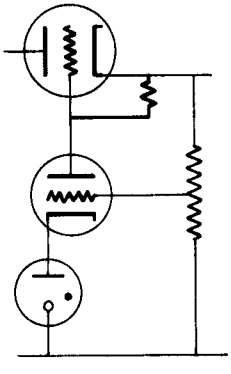


FIGURE 2

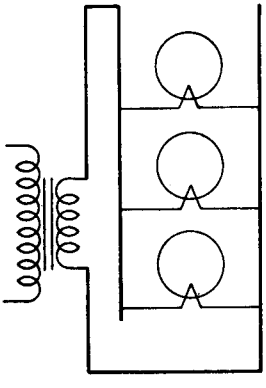


FIGURE 3

TUNG-SOL ELECTRIC INC. ELECTRON TUBE DIVISION BLOOMFIELD, NEW JERSEY, U.S.A. JANUARY 1, 1959 PLATE #5404

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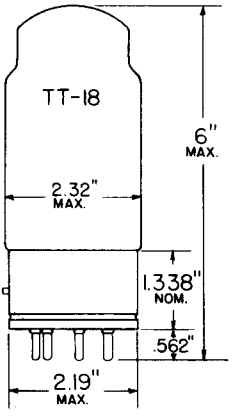
TRIODE



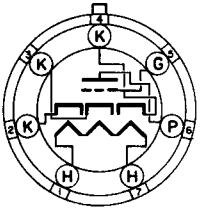
GLASS BULB

HEATER

6.3±10% VOLTS 7.5 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

GIANT WITH CERAMIC INSERT 7 PIN BASE

THE 7242 IS A LONG LIFE, HIGH POWER TRIODE DEVELOPED ESPECIALLY FOR USE AS A PASSING TUBE IN SERIES REGULATED POWER SUPPLIES. FOR THIS SERVICE, A TUBE MUST BE ABLE TO PASS LARGE CURRENTS OVER A WIDE VOLTAGE RANGE AND STILL EXHIBIT A LOW INTRINSIC VOLTAGE DROP WHEN OPERATED "WIDE OPEN". THE 7242 NOT ONLY MEETS THESE REQUIREMENTS BUT POSSESSES THE ADDITIONAL ADVANTAGE OF REQUIRING LITTLE GRID VOLTAGE SWING TO CONTROL THESE CURRENTS. THIS PERMITS THE USE OF SIMPLER CONTROL AMPLIFIER CIRCUITS IN THE REGULATED SUPPLY.

THE 7242 FEATURES ONE LARGE ZIRCONIUM COATED GRAPHITE ANODE, WITH THREE SEPARATE GRID-CATHODES STRUCTURES. THIS ANODE, WHILE LIGHTER IN WEIGHT THAN SIMILAR METAL ANODES, REMAINS WARP FREE DURING LIFE AND PROVIDES ONE OF THE BEST GAS "GETTERING" MEANS KNOWN. THE ANODE IS SUPPORTED BY CERAMIC INSULATORS. THE USE OF THESE INSULATORS AND THE HARD GLASS ENVELOPE PERMIT THE TUBE TO BE OUTGASSED AT HIGH TEMPERATURES DURING THE MANUFACTURING EXHAUST PROCESS. THIS ALLOWS THE TUBE TO BE RUN AT HIGH TEMPERATURES DURING OPERATION, WITHOUT THE EVOLUTION OF HARMFUL GAS FROM THE TUBE PARTS.

MASSIVE CATHODES PROVIDE ADEQUATE EMISSION CURRENT RESERVE. GOLD PLATED MOLYBDENUM WIRES ARE EMPLOYED IN THE RUGGED GRID STRUCTURE. THE TUBE MOUNT IS BUILT ON A RUGGED BUTTON STEM, AND IS SUPPORTED FROM THE BULB BY MEANS OF FLEXIBLE METAL VIBRATION SNUBBERS.

IN MANY CIRCUITS, ONE 7242 CAN REPLACE FOUR TYPE 5998 REGULATOR TUBES. FOR EVEN HIGHER LEVELS OF CURRENT OR POWER, SEVERAL 7242 TUBES CAN BE PARALLELED AS EXPLAINED IN THE APPLICATION NOTES.

CONTINUED ON FOLLOWING PAGE

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ELECTRICAL DATA

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT (E_f= 6.3 V.)	7.5	AMP.
MINIMUM CATHODE HEATING TIME	30	SECONDS
TRANSCONDUCTANCE	111,000	μMHOS
AMPLIFICATION FACTOR	9.0	
PLATE RESISTANCE	82	OHMS

MECHANICAL DATA

MOUNTING POSITION — ANY
(IF TUBE IS TO BE MOUNTED IN A HORIZONTAL POSITION IT IS RECOMMENDED THAT IT BE MOUNTED SO THAT THE BASE LUG KEY BE EITHER DIRECTLY UP OR DIRECTLY DOWN)

BULB — TT 18 — NONEX

BASE — GIANT 7 PIN WITH CERAMIC INSERT, JETEC #A7-17

SOCKET — E.F. JOHNSON #122-237 OR EQUIVALENT

AVERAGE NET WEIGHT — 6.0 — OUNCES

MAXIMUM SHOCK RATING (NAVY HI IMPACT SHOCK MACHINE) — 450 — G

MAXIMUM VIBRATION RATING (10 TO 25 CPS) — 2.5 — G

RATINGS
ABSOLUTE VALUES

TOTAL PLATE DISSIPATION	---	100	WATTS
TOTAL PLATE CURRENT DC	---	0.9	AMP.
IF TUBE VOLTAGE DROP IS TO BE SWUNG MORE THAN 6 VOLTS, THIS CURRENT CANNOT BE REALIZED. SEE PLATE CHARACTERISTICS CURVE			
CURRENT PER CATHODE (DC)	---	300	MA.
PLATE VOLTAGE (DC)	0	400	VOLTS
HEATER-CATHODE VOLTAGE (DC)	-300	+300	VOLTS
GRID VOLTAGE (DC)	-300	0	VOLTS
GRID CURRENT PER GRID	---	0	MA.
HEATER VOLTAGE	5.7	6.9	VOLTS
ENVELOPE TEMPERATURE	---	300	°C
ALTITUDE FOR FULL RATINGS	---	10,000	FEET
IF COOLING IS PROVIDED TO KEEP BULB TEMPERATURE WITHIN RATINGS, ALTITUDE RATING CAN BE EXTENDED TO 60,000 FT.			
CIRCUIT VALUES			
TOTAL GRID CIRCUIT RESISTANCE IN REGULATED SERVICE OR WITH FIXED BIAS	500	50,000	OHMS
TOTAL GRID CIRCUIT RESISTANCE WITH CATHODE BIAS ONLY	500	200,000	OHMS
RESISTANCE PER GRID LEG WHEN TUBES ARE PARALLELED	500	---	OHMS

CATHODE RESISTANCE: MINIMUM CATHODE RESISTANCE PER CATHODE LEG SHALL BE 27 OHMS OR THAT RESISTANCE NECESSARY TO PROVIDE 10% OF THE GRID BIAS VOLTAGE, WHICHEVER IS GREATER.

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TUNG-SOL

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ADDITIONAL TESTS TO INSURE RELIABILITY

RANDOMLY SELECTED SAMPLES ARE SUBJECTED TO THE FOLLOWING TESTS

SHOCK: 30° HAMMER ANGLE IN NAVY, FLYWEIGHT, HIGH IMPACT MACHINE (450G/MSEC)

LIFE TEST: 1000 HOURS UNDER PLATE CURRENT TEST CONDITIONS (R_g = .05 MEG.)

POST SHOCK AND LIFE TEST END POINTS:

PLATE CURRENT (MIN.)	390	MA
TRANSCONDUCTANCE (MIN.)	70,000	μMHO
HK LEAKAGE (MAX.)	150	μA
GRID CURRENT (MAX.)	-12	μA

RANGE OF VALUES

CONDITIONS: E_c = 6.3V, E_b = 100V.
E_c =-4, R_g = 500 Ω
READINGS TAKEN AFTER 2 MINUTES PREHEATING UNDER CONDITIONS OF E_f = 6.3, E_{bb} =190 V, E_c = O, R_k = 6.3 OHMS.

TOTAL PLATE CURRENT	420	690	MA,DC
AMPLIFICATION FACTOR	7.0	11.0	
TRANSCONDUCTANCE	87,000	135,000	μMHOS
HEATER CURRENT PER TUBE	7.12	7.88	AMP.

CONDITIONS: E_f = 6.3V, E_b = 400 V.
E_c =- 75 V, R_k = O

CURRENT PER CATHODE	0	10	MA.

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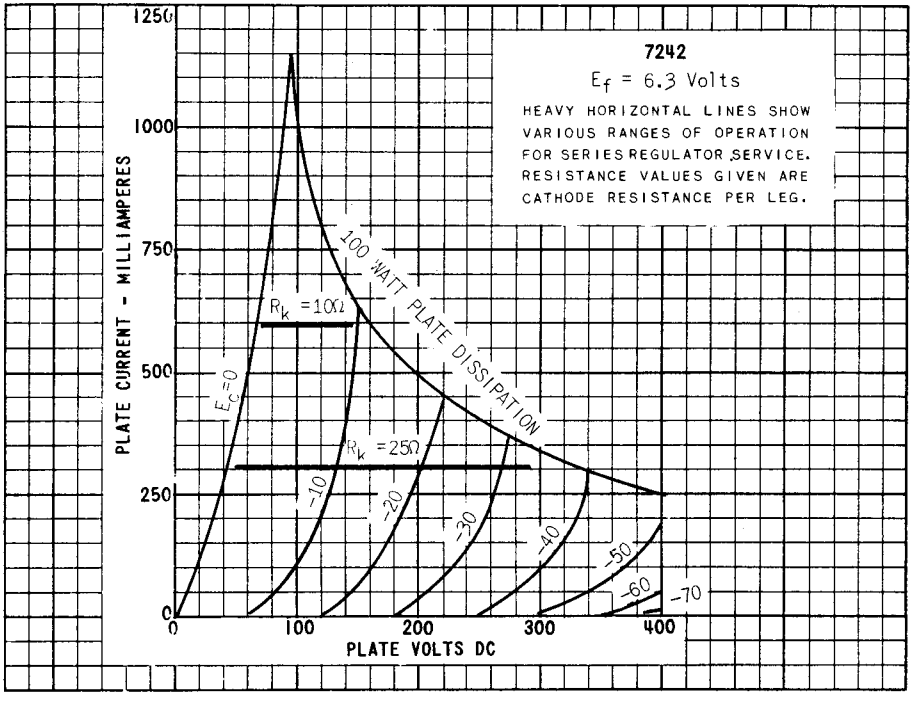
APPLICATION NOTES

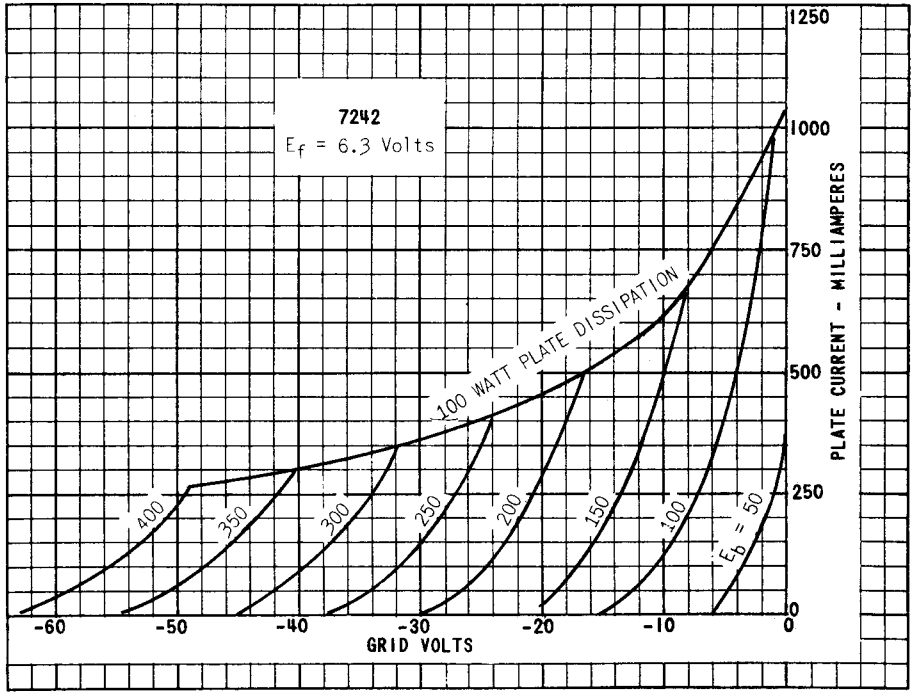
THE 7242 IS WIDELY USED AS A "PASSING" TUBE OR SERIES REGULATOR IN CONTROLLED POWER SUPPLIES BECAUSE OF ITS HIGH TRANSCONDUCTANCE AT RELATIVELY LOW PLATE VOLTAGES. TO PROVIDE THE DESIRED OUTPUT CURRENT, MANY TRIODE SECTIONS CAN BE PARALLELED. IF TUBE SECTIONS ARE TO BE PARALLELED, HOWEVER, THE DESIGNER IS STRONGLY URGED TO USE SUFFICIENT RESISTANCE IN EACH CATHODE LEG TO EQUALIZE CURRENT DIVISION AMONG THE TRIODE SECTIONS. RECOMMENDED VALUES FOR VARIOUS OPERATING CURRENTS ARE SHOWN ON THE PLATE CHARACTERISTICS CURVE. IF THE OUTPUT CURRENT OF THE SUPPLY IS NOT FIXED, USE THE RESISTANCE INDICATED FOR THE LOWEST CURRENT THAT APPROACHES THE MAXIMUM PLATE DISSIPATION LINE. CATHODE RESISTANCE IS SUPERIOR TO ANODE RESISTANCE BECAUSE IT PROVIDES MORE BIAS ON THE SECTIONS TAKING GREATER PLATE CURRENT. A CATHODE RESISTOR NEED BE ONLY ONE TENTH THE VALUE $(\frac{R}{u+1})$ OF A PLATE RESISTOR, AND THEREFORE WILL DISSIPATE ONLY ONE TENTH THE POWER. IN ANY CASE, THE ONLY LOSSES INCURRED IN USING A RESISTOR IS THE INSERTION LOSS OF THE RESISTOR ITSELF (LESS THAN ONE WATT) AND THE ADDITIONAL VOLTAGE (LESS THAN 6 VOLTS) NECESSARY FROM THE UNREGULATED SUPPLY. A CATHODE RESISTOR ADDS A SMALL ADDITIONAL LOSS BY CAUSING THE PASSING TUBE TO WORK WITH HIGHER BIAS AND HENCE WITH GREATER TUBE DROP.

A THIRTY SECOND CATHODE WARMUP TIME IS RECOMMENDED BEFORE THE PLATE VOLTAGE IS APPLIED. THIS IS ESPECIALLY NECESSARY IN CIRCUITS WHERE THE AMPLIFIER TUBE PLATE RESISTOR IS RETURNED TO THE PLATE SIDE OF THE PASSING TUBE, AS ILLUSTRATED IN THE SIMPLIFIED CIRCUIT IN FIGURE 1. IN THIS CASE DURING WARMUP THE AMPLIFIER TUBE DRAWS LITTLE CURRENT, THERE IS LITTLE IR DROP ACROSS THE RESISTOR, AND THE GRID OF THE PASSING TUBE IS EFFECTIVELY, TIED TO THE PLATE. THE PLATE WILL ATTEMPT TO DRAW EXCESSIVE CURRENT FROM THE PASSING TUBE'S CATHODE AND MAY SERIOUSLY IMPAIR TUBE LIFE. THE CIRCUIT IN FIGURE 2 IS PREFERABLE FROM THE CONSIDERATION OF THE SAFETY OF THE PASSING TUBE BOTH DURING WARMUP AND IN THE EVENT OF TROUBLE IN THE AMPLIFIER CIRCUIT OR IF THE AMPLIFIER TUBE IS REMOVED FROM ITS SOCKET. IT HAS THE ADDITIONAL ADVANTAGE OF PROVIDING A CONSTANT VOLTAGE FOR THE AMPLIFIER CIRCUIT. HOWEVER, IF THE REGULATOR OUTPUT IS LOW (BELOW 250 VOLTS) IT WILL BE NECESSARY TO PROVIDE ADDITIONAL NEGATIVE VOLTAGE FOR THE REFERENCE TUBE CIRCUIT. ALSO, IF THE REGULATED OUTPUT VOLTAGE IS TO BE VARIABLE, IT MAY BE NECESSARY TO FOLLOW FIGURE 1.

PASSING TUBE OPERATION CONDITIONS SHOULD BE CHOSEN TO PROVIDE AS LOW A TUBE DROP AS POSSIBLE. A SAFETY MARGIN OF AT LEAST 5 VOLTS FROM THE ZERO BIAS LINE SHOULD BE ALLOWED HOWEVER, FOR VARIATIONS OF INDIVIDUAL TUBES. SUFFICIENT BIAS EXCURSION SHOULD BE ALLOWED FOR OVERCOMING RIPPLE. THE AMPLIFIER CIRCUIT SHOULD BE ABLE TO COUNTERACT THE EFFECT OF UNBALANCE DUE TO TUBE AGING.

A GRID RESISTOR SHOULD BE USED FOR EACH TRIODE SECTION. THIS SHOULD BE ENOUGH TO PREVENT PARASITIC OSCILLATION BUT NOT LARGE ENOUGH TO PREVENT LOSS OF CONTROL DUE TO A SMALL AMOUNT OF "GAS" GRID CURRENT. A VALUE OF GRID RESISTANCE THAT MEETS BOTH THESE CONDITIONS IS 1,000 OHMS. HEATER VOLTAGE SHOULD BE KEPT AS CLOSE AS POSSIBLE TO 6.3 VOLTS AS MEASURED ON THE TUBE PINS. WHEN CONNECTING MANY HIGH DRAIN TUBE HEATERS ACROSS A SINGLE TRANSFORMER, BUS BARS FEEDING FROM "ALTERNATE ENDS" (FIGURE 3) SHOULD BE USED WITH A STRANDED PAIR FEEDING INDIVIDUAL SOCKETS.





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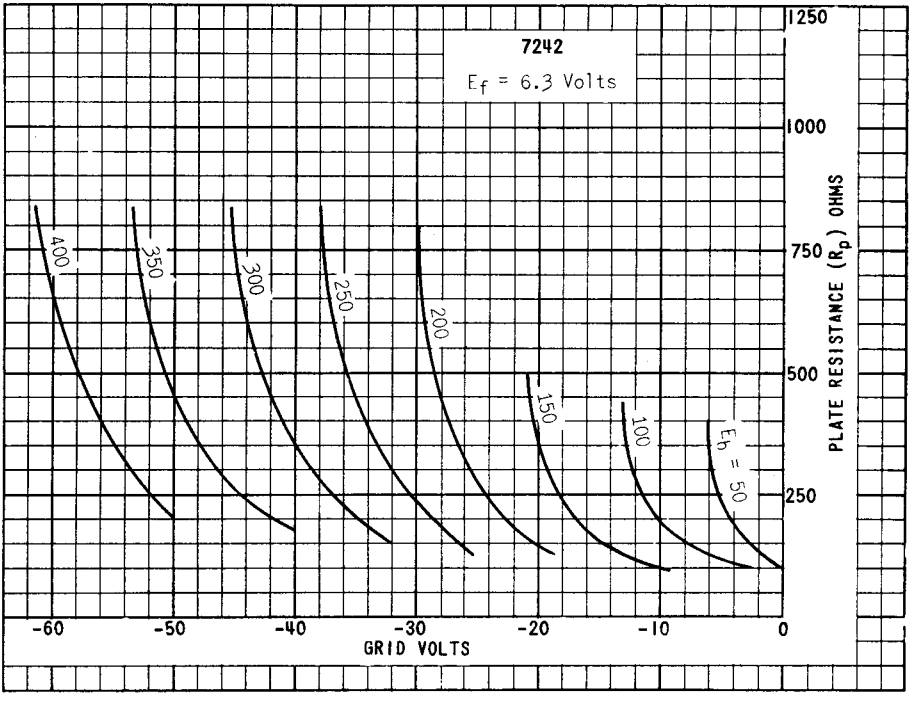
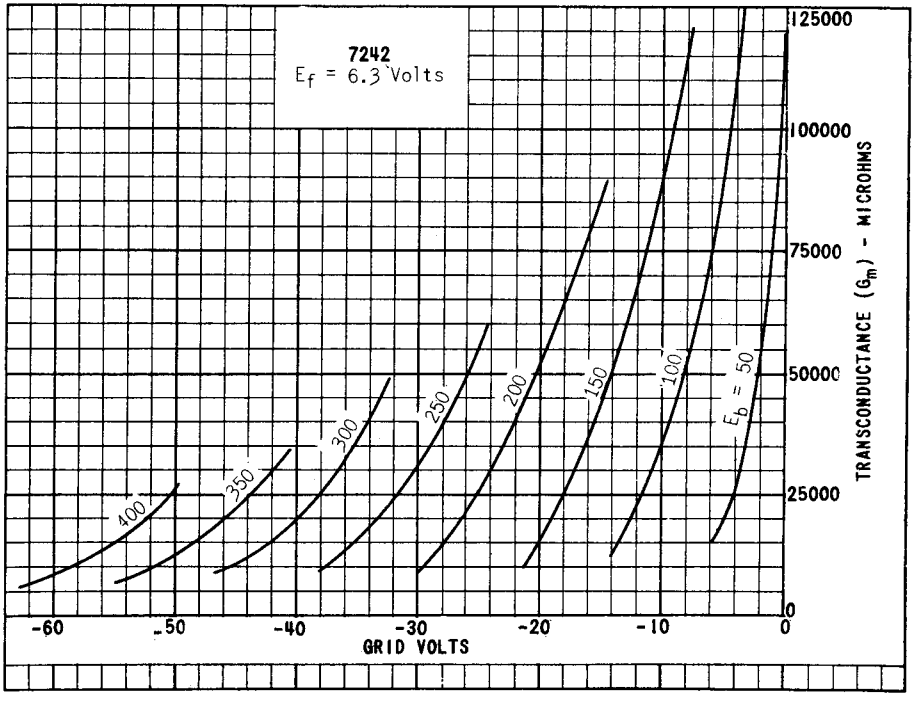
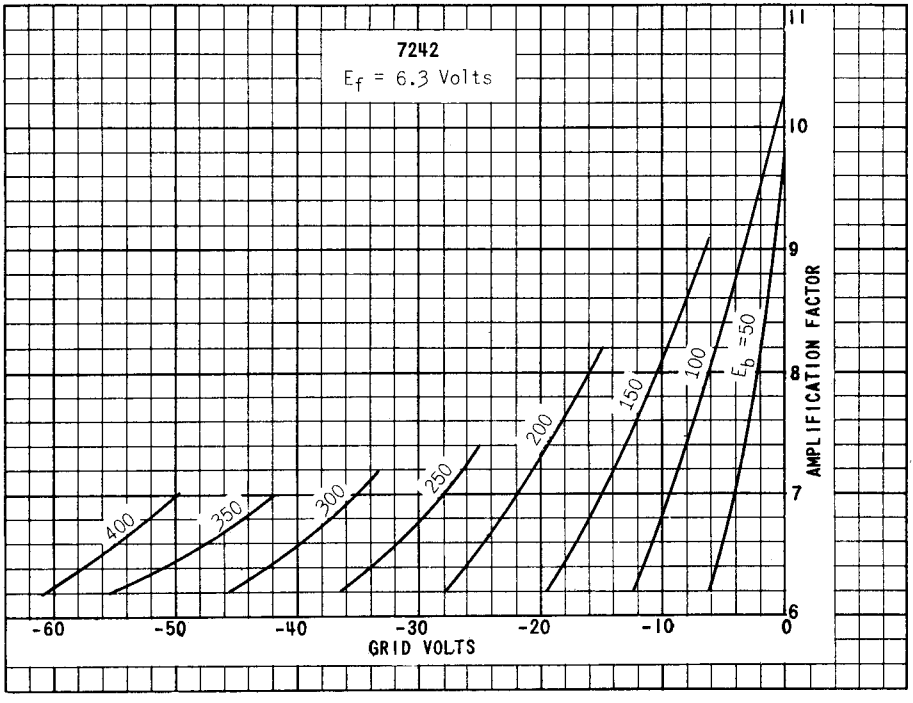

7242
E_f = 6.3 Volts
400
350
300
250
200
150
100
E_b = 50
1250
1000
750
500
250
PLATE RESISTANCE (R_p) OHMS
-60
-50
-40
-30
-20
-10
0
GRID VOLTS


7242
E_f = 6.3 Volts
400
350
300
250
200
150
100
E_b = 50
125000
100000
75000
50000
25000
0
TRANSCONDUCTANCE (G_m) - MICROHMS
-60
-50
-40
-30
-20
-10
0
GRID VOLTS



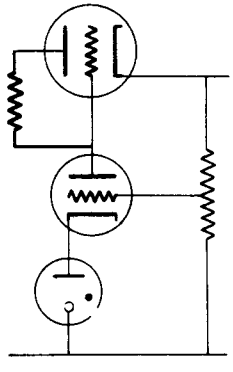


FIGURE 1

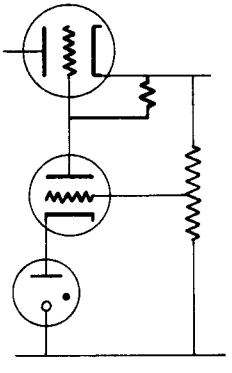


FIGURE 2

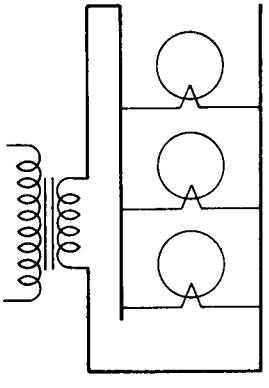
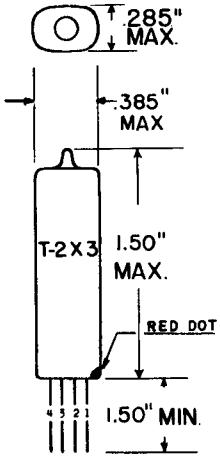


FIGURE 3

TUNG-SOL

TRIODE

SUBMINIATURE



GLASS BULB

RED DOT IS ADJACENT TO LEAD 1 IN LINE BASE OUTLINE DRAWING

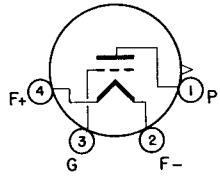
JEDEC 2-1

FOR APPLICATIONS REQUIRING

ECONOMY OF SPACE, WEIGHT

AND BATTERY DRAIN

ANY MOUNTING POSITION



BASE: — NONE

0.016" TINNED FLEXIBLE LEADS

0.048" CENTER-TO-CENTER

THE 7246 IS A 500 MEGACYCLE, FILAMENT TYPE TRIODE IN THE 4 PIN SUBMINIATURE CONSTRUCTION. IT IS DESIGNED FOR USE AS A HIGH FREQUENCY OSCILLATOR, CLASS C AMPLIFIER, SUPERREGENERATIVE DETECTOR, FREQUENCY MULTIPLIER OR MIXER. THE FLEXIBLE TERMINAL LEADS MAY BE SOLDERED OR WELDED DIRECTLY TO THE TERMINALS OF CIRCUIT COMPONENTS. STANDARD SUBMINIATURE SOCKETS MAY BE USED BY CUTTING THE LEADS TO A SUITABLE LENGTH.

DIRECT INTERELECTRODE CAPACITANCES

	WITHOUT SHIELD	
GRID TO PLATE	1.5	pf
INPUT	1.6	pf
OUTPUT	1.9	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	1.25 VOLTS	150	MA.
HEATER SUPPLY LIMITS: FILAMENT OPERATION		1.25±.15	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	150	VOLTS
PLATE CURRENT	7.5	MA.
GRID CURRENT	1.2	MA.
GRID VOLTAGE	-30	VOLTS
PLATE DISSIPATION	0.7	WATTS

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TUNG-SOL

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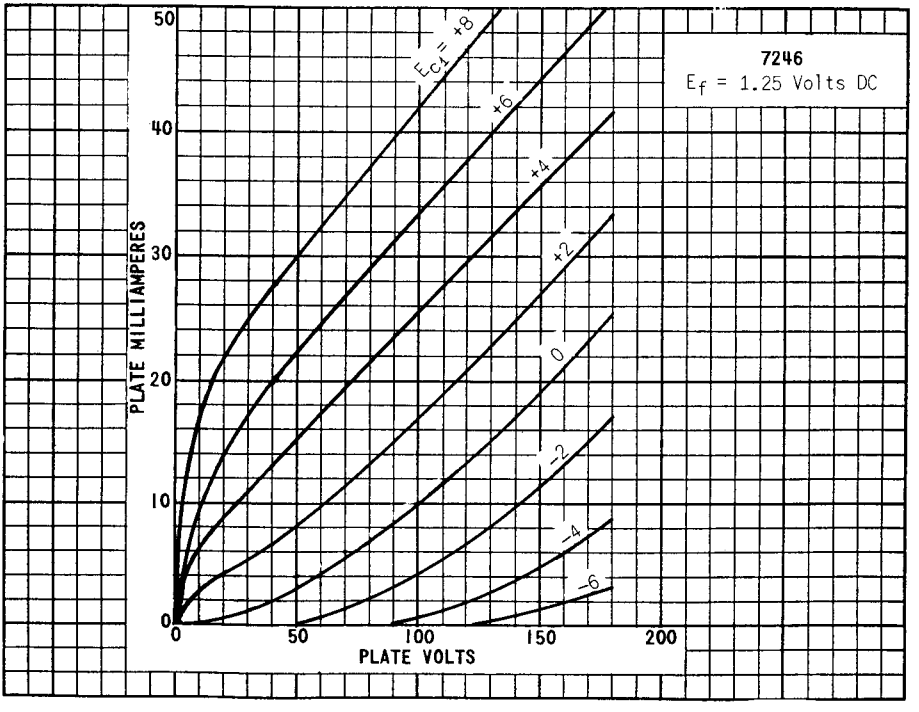
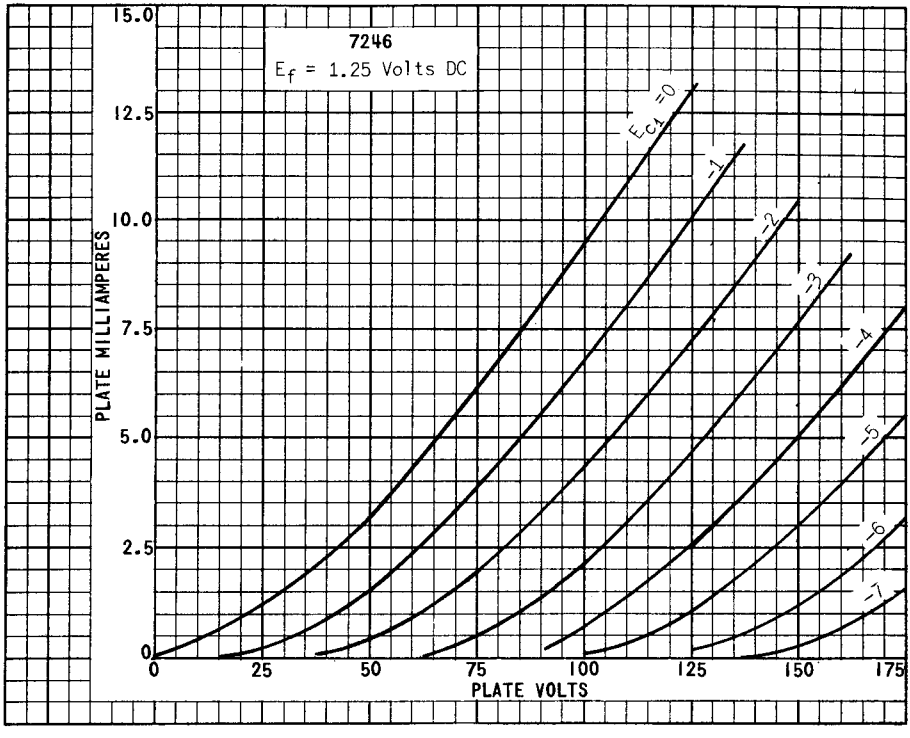
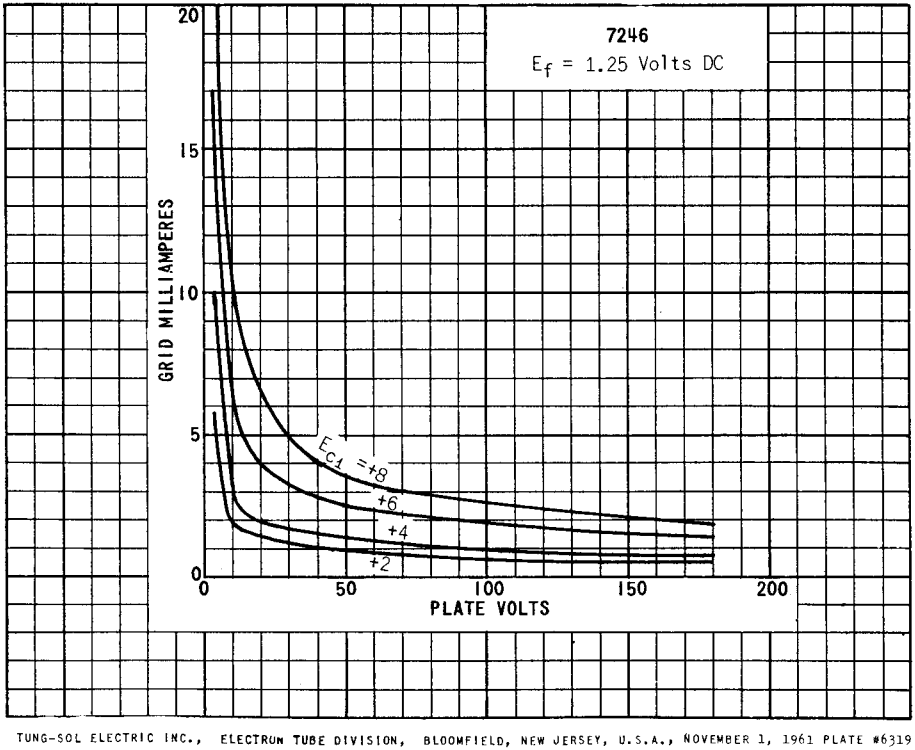
TYPICAL OPERATING CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	105	VOLTS
GRID VOLTAGE	-2.5	VOLTS
TRANSCONDUCTANCE	2700	μMHOS
AMPLIFICATION FACTOR	22	
PLATE CURRENT	4.5	MA.







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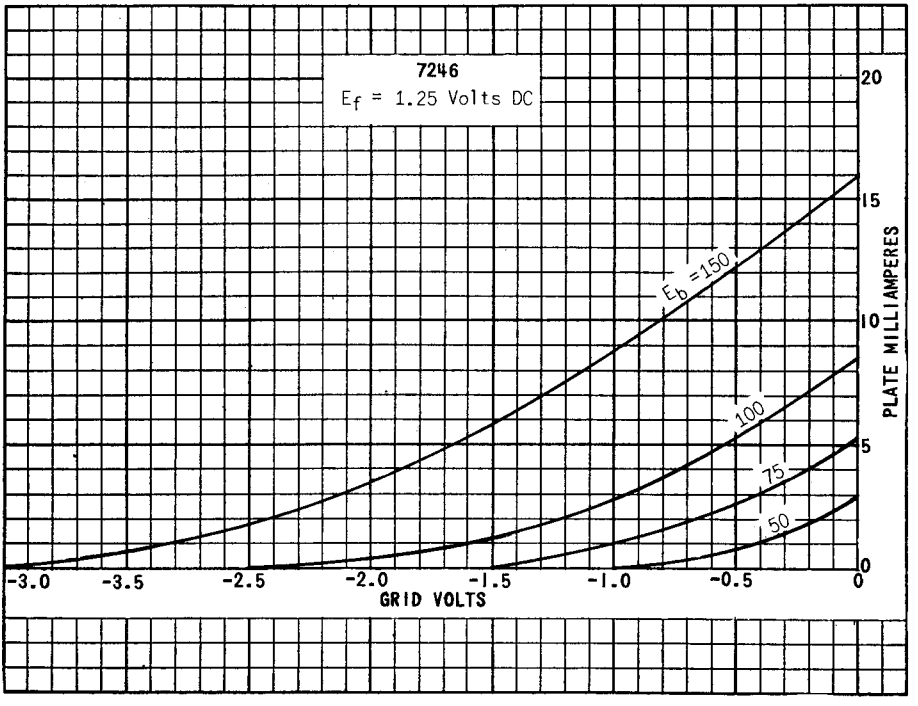
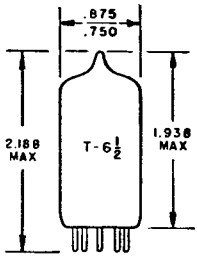

7246
E_f = 1.25 Volts DC
E_b =150
100
75
50
20
15
10
5
0
PLATE MILLIAMPERES
-3.0
-3.5
-2.5
-2.0
-1.5
-1.0
-0.5
0
GRID VOLTS

TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE



GLASS BULB
SMALL BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

SHARP CUTOFF PENTODE AND

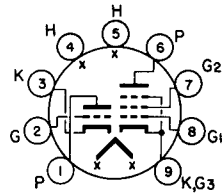
MEDIUM MU TRIODE

FOR

MOBILE APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 9DA

THE 7258 CONTAINS A MEDIUM MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. THE TRIODE SECTION MAY BE USED AS A LOW FREQUENCY OSCILLATOR OR GENERAL PURPOSE AMPLIFIER, THE PENTODE SECTION AS AN RF, IF, OR REACTANCE TUBE. IT IS DESIGNED FOR USE OVER A WIDE RANGE OF HEATER VOLTAGES NORMALLY ENCOUNTERED IN MOBILE APPLICATIONS. EXCEPT FOR HEATER CHARACTERISTICS, TYPE 7258 IS SIMILAR TO TYPE 6AN8.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

PENTODE			
GRID 1 TO PLATE: G1 TO P	MAX.	0.04	pf
INPUT: G1 TO (H + KP + G2 + G3 + I.S.)		7.0	pf
OUTPUT: P TO (H + KP + G2 + G3 + I.S.)		2.4	pf
TRIODE			
GRID TO PLATE: G TO P		1.5	pf
INPUT: G TO (H + KT + KP + I.S.)		2.0	pf
OUTPUT: P TO (H + KT + KP + I.S.)		1.5	pf
COUPLING			
TRIODE GRID TO PENTODE PLATE	MAX.	0.02	pf
PENTODE GRID TO TRIODE PLATE	MAX.	0.02	pf
PENTODE PLATE TO TRIODE PLATE	MAX.	0.15	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	13.5	VOLTS	210	MA.
LIMITS OF APPLIED VOLTAGE			13.5±1.5	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE		330	VOLTS
GRID 2 VOLTAGE		See Rating Chart	
POSITIVE GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.8	2.3	WATTS
GRID 2 DISSIPATION		0.55	WATTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.25	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM

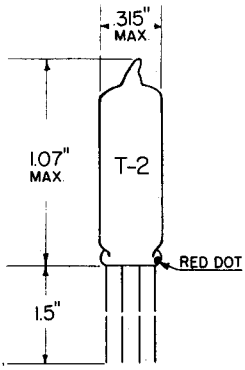
AVERAGE CHARACTERISTICS

	TRIODE SECTION	PENTODE SECTION	
PLATE VOLTAGE	150	125	VOLTS
GRID 2 VOLTAGE	-----	125	VOLTS
GRID 1 VOLTAGE	-3		VOLTS
CATHODE BIAS RESISTOR		56	OHMS
PLATE CURRENT	15	12	MA.
GRID 2 CURRENT	-----	3.8	MA.
TRANSCONDUCTANCE	4,500	7,800	μMHOS
AMPLIFICATION FACTOR	21		
PLATE RESISTANCE (APPROX.)	4,700	170,000	OHMS
GRID 1 VOLTAGE FOR Ib = 20 μA. (APPROX.)	-17	-6	VOLTS
PLATE CURRENT AT Ec1 =-3 VDC, Rk = 0		1.6	MA.

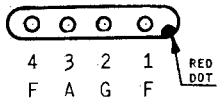
TUNG-SOL

THYRATRON

SELF INDICATING*



GLASS BULB



BOTTOM VIEW

0.016" TINNED FLEXIBLE LEADS

0.048" CENTER TO CENTER

THE 7323 IS A SUBMINIATURE THYRATRON WITH NEGATIVE CONTROL GRID CHARACTERISTICS. THE GASEOUS GLOW IT EXHIBITS WHILE CONDUCTING IS SEVERAL TIMES BRIGHTER THAN AN NE-2 GLOW LAMP (BOTH DEVICES AT MAXIMUM RATINGS) AND MAKES THE USE OF AUXILIARY READOUT DEVICES UNNECESSARY. IT MAY BE VIEWED EITHER "END ON" OR FROM THE SIDE.

BECAUSE OF ITS SMALL SIZE, LOW OPERATING VOLTAGES, MINUTE TRIGGERING REQUIREMENTS AND LOW FILAMENT POWER, THE 7323 IS PARTICULARLY SUITED FOR USE IN TRANSISTOR CIRCUITS. THE TERMINAL LEADS MAY BE SOLDERED DIRECTLY INTO A CIRCUIT OR MAY BE CLIPPED FOR INSERTION IN AN IN-LINE SUBMINIATURE SOCKET.

THE 7323 REPLACES TYPE CK1050 IN ALL APPLICATIONS.

ELECTRICAL DATA

FILAMENT VOLTAGE	1.25±10%	VAC
FILAMENT CURRENT	280.	MA.
ANODE VOLTAGE DROP @ 3 MA.	18	VDC

MECHANICAL DATA

MOUNTING POSITION	ANY	
BULB	T-2	
DIAMETER (MAX.)	0.315	INCHES
LENGTH (WITHOUT LEADS) (MAX.)	1.07	INCHES
CONNECTIONS	FLEXIBLE LEADS	
WEIGHT (APPROX.)	0.06	OUNCES

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* INDICATES AN ADDITION.

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TUNG-SOL

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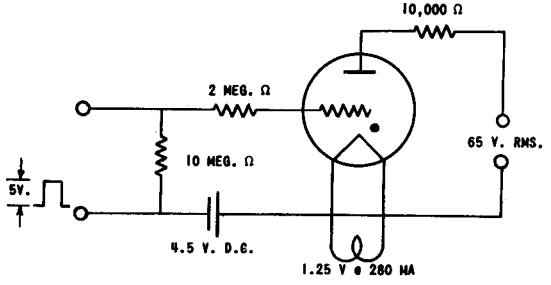
RATINGS
ABSOLUTE VALUES

ANODE SUPPLY VOLTAGE (RMS) (MAX.)	80	VAC
CATHODE CURRENT (MAX.)	3	MADC
PRECONDUCTION GRID (TRANSFER) CURRENT @ E_b = 75 VOLTS RMS (MAX.)	0.5	μADC

TYPICAL OPERATING CONDITIONS

ANODE SUPPLY VOLTAGE (RMS)	65	VAC
ANODE CIRCUIT RESISTANCE	10,000	OHMS
ANODE CURRENT	2	MADC
GRID BIAS VOLTAGE	-4.5	VDC
GRID SERIES RESISTANCE	2	MEGOHMS



PULSE OPERATED RELAY

APPLICATION NOTES

IT IS OFTEN NECESSARY TO PROVIDE A RELAY DEVICE TO OPERATE AT LOW LEVEL, LOW VOLTAGE, SHORT DURATION PULSES SUCH AS ARE FOUND IN TRANSISTOR CIRCUITS. THE 7323 SELF INDICATING THYRATRON PERFORMS THIS FUNCTION AS WELL AS PROVIDING AN ADEQUATE, VISUAL READOUT INDICATOR. ALTHOUGH NOT AS BRILLIANT AN INDICATOR AS COMPARABLE COLD CATHODE THYRATRONS, THE 7323 OPERATING AT 3 MILLIAMPERES IS MANY TIMES BRIGHTER THAN AN NE-2 NEON GLOW LAMP. THE EFFICIENT FILAMENT CONSUMES ONLY ABOUT ONE THIRD WATT OF HEATER POWER.

AS WITH ANY GAS TUBE, ONCE THE TUBE CONDUCTS, THE TUBE VOLTAGE DROP REMAINS VIRTUALLY CONSTANT AND THE CURRENT THROUGH THE TUBE IS LIMITED BY THE CIRCUIT RESISTANCE. THE GRID CIRCUIT SHOULD CONTAIN A 1,000 OHM SERIES RESISTANCE IF THE SOURCE RESISTANCE IS LOWER THAN THIS FIGURE.

THE 7323 IS NORMALLY MOUNTED BEHIND A PANEL CUT OUT FOR EITHER END-ON OR SIDE VIEWING. A SUBMINIATURE HEAT DISSIPATING TYPE OF TUBE CLAMP PROVIDES BOTH A CONVENIENT MEANS OF MOUNTING AS WELL AS SHIELDING TO MINIMIZE THE THE EFFECT OF HAND CAPACITY OR ELECTRICAL FIELDS.

THE 7323 CAN BE OPERATED FROM EITHER AN A.C. OR D.C. ANODE SUPPLY VOLTAGE. IF DC OPERATED, IT IS NECESSARY TO BREAK THE ANODE CIRCUIT (EITHER BY A MECHANICAL SWITCH OR NEGATIVE PULSE) TO RESTORE CONTROL AFTER THE TUBE HAS FIRED. THIS IS PARTICULARLY ADVANTAGEOUS IN THE "HOLD UNTIL RESET" TYPE OF APPLICATION.

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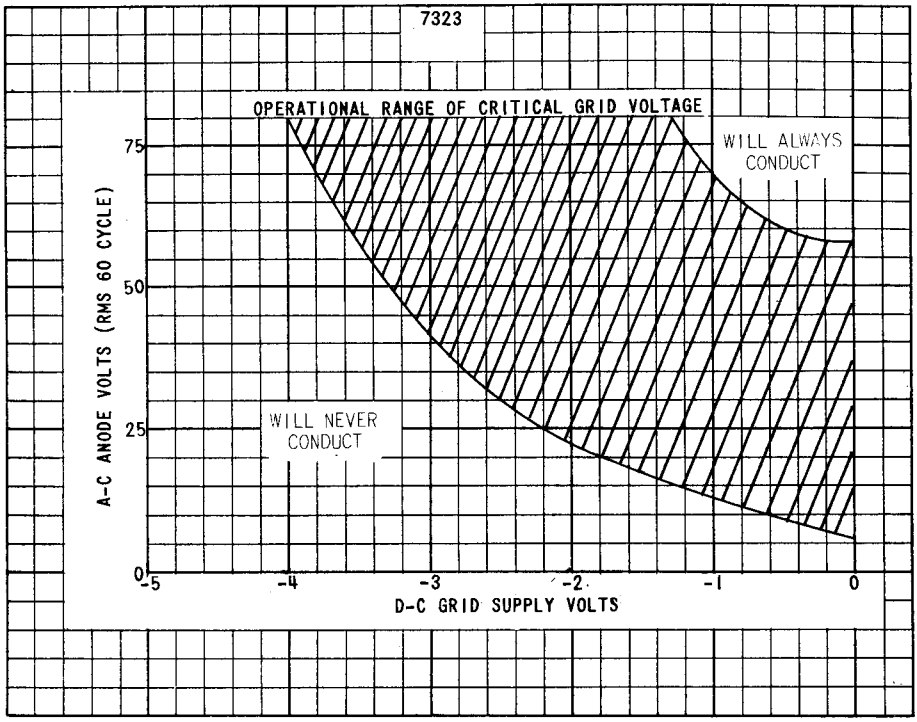

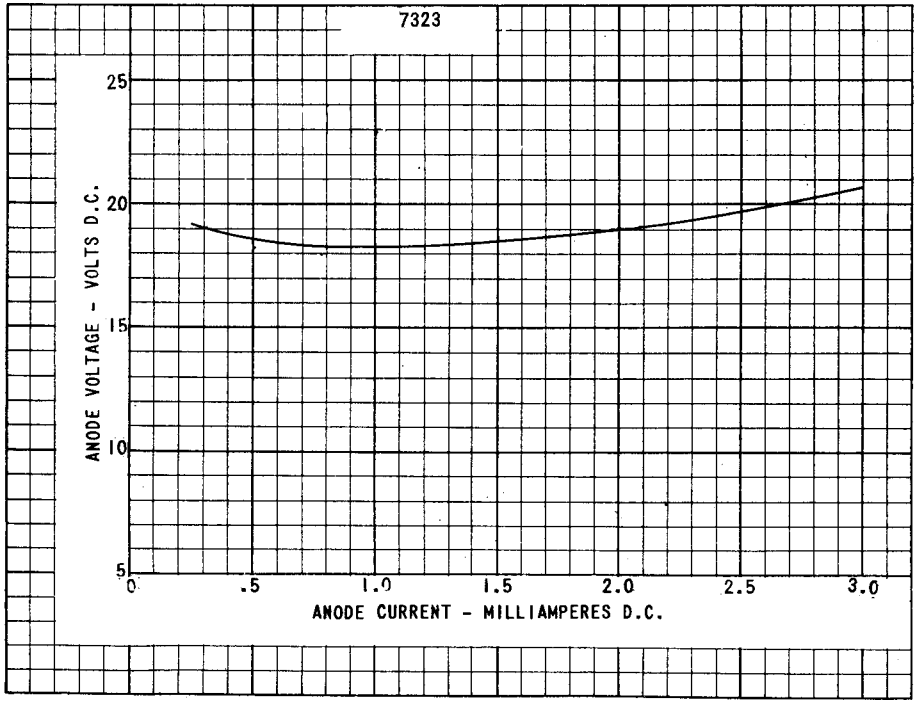

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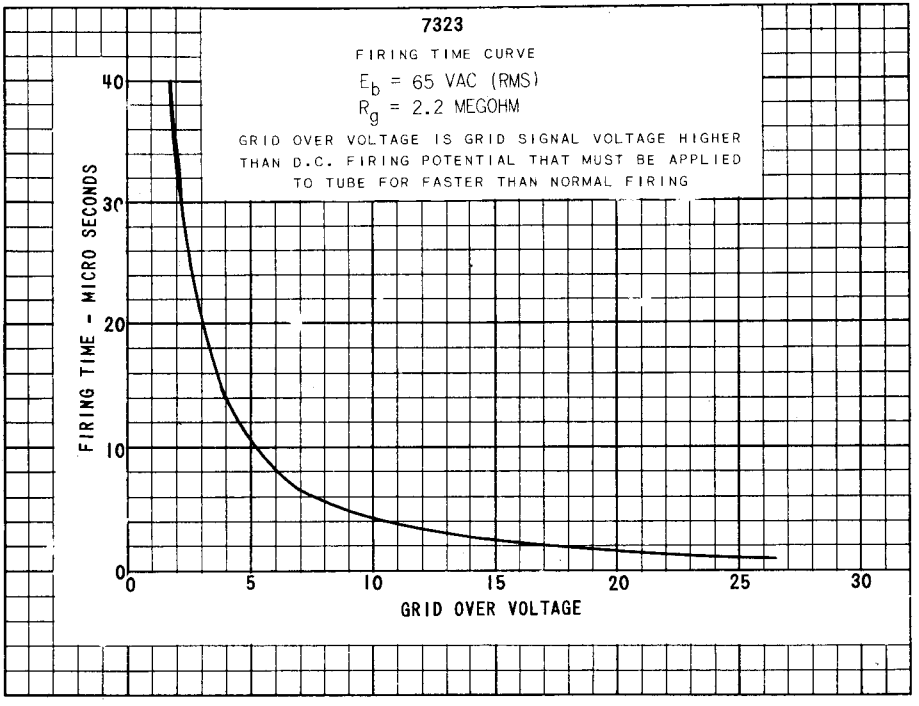
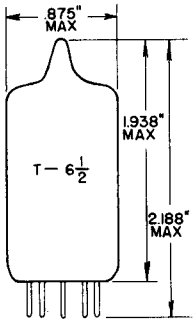

7323
FIRING TIME CURVE
E_b = 65 VAC (RMS)
R_g = 2.2 MEGOHM
GRID OVER VOLTAGE IS GRID SIGNAL VOLTAGE HIGHER THAN D.C. FIRING POTENTIAL THAT MUST BE APPLIED TO TUBE FOR FASTER THAN NORMAL FIRING
FIRING TIME - MICRO SECONDS
40
30
20
10
0
0
5
10
15
20
25
30
GRID OVER VOLTAGE

TUNG-SOL



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

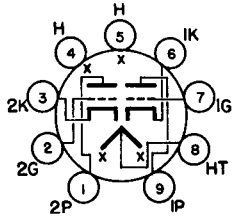
DOUBLE TRIODE

MINIATURE TYPE

COATED UNIPOTENTIAL CATHODE

HEATER	SERIES	PARALLEL
	40±5% VOLTS	20±5% VOLTS
	130 MA.	260 MA.

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM

JEDEC 9H

THE 7370 IS A GENERAL PURPOSE MEDIUM MU DOUBLE TRIODE USING THE 9 PIN BUTTON ALL GLASS CONSTRUCTION. EACH TRIODE IS ELECTRICALLY INDEPENDENT ALTHOUGH THE TWO HEATERS HAVE A COMMON CONNECTION. THE TUBE IS CHARACTERIZED BY HIGH PERVEANCE AND HIGH EMISSION CAPABILITIES. WITH THE EXCEPTION OF THE HEATER VOLTAGE AND CURRENT THE TUBE IS IDENTICAL TO THE 5687.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

EACH TRIODE UNIT

GRID TO PLATE: (G TO P')	4.0	pf
GRID TO CATHODE:(G TO K+H)	4.0	pf
PLATE TO CATHODE:(P TO K+H)		
SECTION #1	0.6	pf
SECTION #2	0.5	pf
HEATER TO CATHODE:(H TO K)	5.0	pf
PLATE TO PLATE: (1P TO 2P) (APPROX.)	0.75	pf
GRID TO GRID: (1G TO 2G) (APPROX.)	0.025	pf

RATINGS

ABSOLUTE MAXIMUM VALUES

	SERIES		PARALLEL	
HEATER VOLTAGE[A]	40±5%		20±5%	VOLTS
MAXIMUM PLATE VOLTAGE		330		VOLTS
MAXIMUM INVERSE PLATE VOLTAGE		1000		VOLTS
MAXIMUM PLATE DISSIPATION (EACH UNIT)		4.75		WATTS
MAXIMUM TOTAL PLATE DISSIPATION (BOTH UNITS)		8.5		WATTS
MAXIMUM BULB TEMPERATURE (AT ANY PART OF ENVELOPE)		230		°C
MAXIMUM DC GRID CURRENT (EACH UNIT)		6		MA.
MAXIMUM EXTERNAL GRID CIRCUIT RESISTANCE (EACH UNIT)		1		MEGOHM
MAXIMUM DC CATHODE CURRENT (EACH SECTION)		65		MA.
MAXIMUM HEATER-CATHODE VOLTAGE		100		VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER – EACH UNIT

PLATE VOLTAGE	120	180	250	VOLTS
GRID VOLTAGE	−2	−7	−12.5	VOLTS
PLATE CURRENT	36.0	23.0	12.0	MA.
PLATE RESISTANCE (APPROX.)	1560	2000	3000	OHMS
TRANSCONDUCTANCE	11500	8500	5400	μMHOS
AMPLIFICATION FACTOR	18.0	17.0	16.0	
GRID VOLTAGE FOR I_b = 100 μA (APPROX.)	−9.0	−14.0	−19.0	VOLTS

[A] THE EQUIPMENT DESIGNER SHOULD SO DESIGN THE EQUIPMENT SO THAT THE HEATER IS OPERATED AT THE BOGIE VALUE. HEATER SUPPLY VARIATION SHOULD BE RESTRICTED SO AS TO REMAIN WITHIN THE SPECIFIED TOLERANCES.

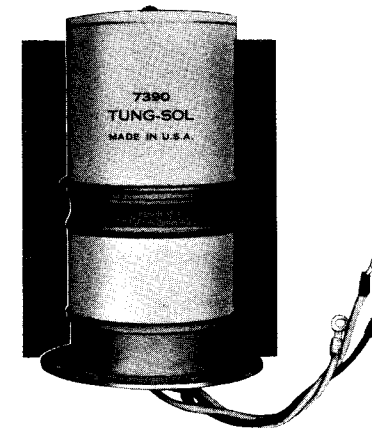
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7390

SEPTEMBER, 1963

CERAMIC HYDROGEN THYRATRON



DESCRIPTION — The 7390 is a ceramic, three element, zero bias hydrogen filled thyratron designed for the generation of high power pulses. The primary application of this tube is in high power, high voltage, radar modulators. In such modulator service, the 7390 is capable of switching a 33 megawatt pulse at an average power of 42 kilowatts. The tube is capable of handling a maximum average power of 66 kilowatts.

The external anode design and ceramic envelope of the 7390 allow operation at high power levels. An externally connected reservoir promotes stable performance and long life by replenishing hydrogen lost by cleanup.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current — E_f = 6.3 Volts	22	—	35	Amperes
Reservoir Voltage	3.5	Note 1	5.5	Volts
Reservoir Current — E_f = 4.5 Volts	8	—	10	Amperes
Cathode Heating Time	5	—	—	Minutes
Anode Delay Time	—	—	1.0	Microsecond
Time Jitter — Note 2	—	—	5	Nanoseconds
Anode Voltage Drop	—	—	250	Volts

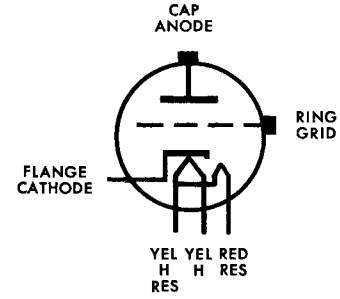
See Page 2 For Outline Drawing

MECHANICAL DATA

Type of Cooling	Convection, see Note 3
Mounting Position	Vertical, base down
Dimensions, Mounting and Terminations	See drawings

RATINGS — ABSOLUTE VALUES

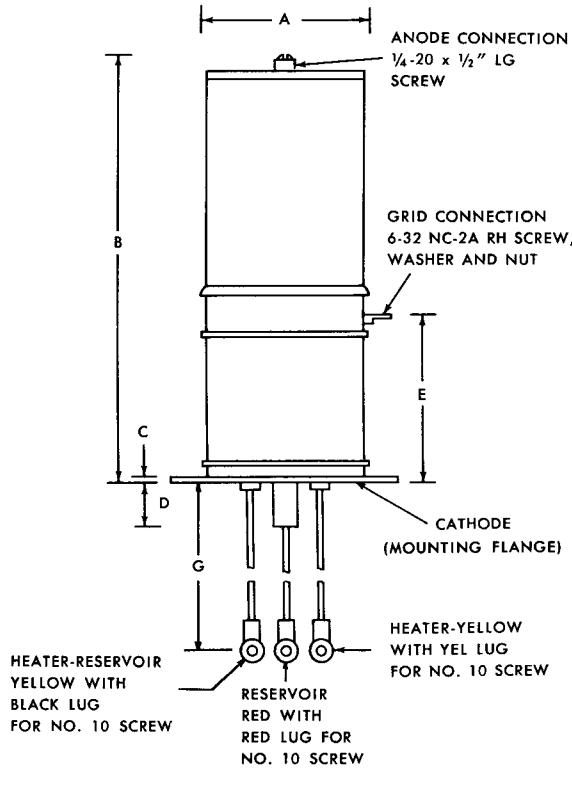
	Min	Max	
Anode Voltage — Peak			
Forward	—	33,000	Volts
Inverse — Note 4	—	33,000	Volts
Cathode Current			
Peak	—	2,000	Amperes
Average	—	4	Amperes
RMS	—	72	Amperes
D-C Anode Voltage	3,500	—	Volts
Grid Voltage — Peak — Note 5	1,300	2,500	Volts
Heating Factor — epy x ib x prr	—	30×10^9	
Current Rate of Rise	—	10,000	Amperes per microsecond
Ambient Temperature	−55	+75	Degrees Centigrade

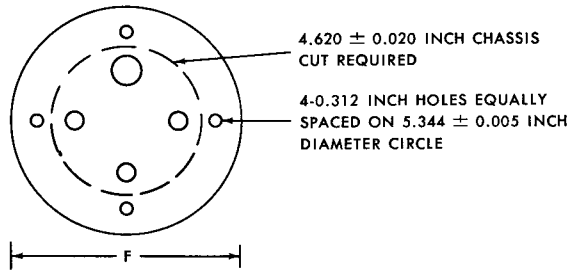


BASING DIAGRAM

NOTES:

1. The optimum reservoir voltage for operation in accordance with operation (1) conditions is inscribed on the base of the tube and must be held within ±2.5 percent. Applications involving other operating conditions will necessitate the redetermination of the optimum reservoir voltage.
2. The time jitter limit as stated is the maximum allowable variation in firing time measured at 50 percent of pulse amplitude after the tube has been operating for at least 60 seconds. To obtain the lowest possible jitter, the tube should be operated above 15 kilovolts with maximum grid trigger voltage, maximum rate of rise of cathode pulse, and minimum values of driver circuit impedance.
3. Maintain grid seal temperature within 225° above ambient temperature by air flow directed at seal and lower ceramic cylinder. Approximately 15 cfm of air is required at rated power levels.
4. In pulsed operation, the peak inverse voltage, exclusive of 0.05 microsecond maximum duration spike, shall not exceed 5 kilovolts during the first 25 microseconds following the pulse.
5. The driver pulse, is measured at the tube socket with tube out of socket. Time of rise equals 0.35 microseconds maximum, pulse duration equals 2.0 microseconds minimum, and driver circuit impedance to be from 10 to 25 ohms.





INCHES

SYMBOL	MIN	MAX
A	—	5.625
B	8.0	10.875
C	0.125	Nominal
D	—	1.25
E	3.75	5.75
F	5.970	6.030
G	9.50	10.50

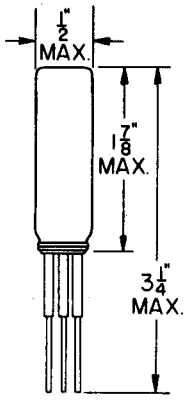
TUNG-SOL

THYRATRON

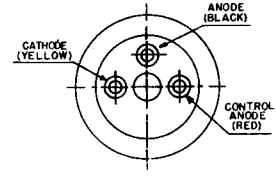
SELF INDICATING*

COLD CATHODE

ANY MOUNTING POSITION



GLASS VIEW



BOTTOM VIEW

COLORS INDICATED FOR TUBE LEADS ARE THE COLORS OF THE INSULATION SLEEVES.

THE 7400 IS A SMALL, LIGHT WEIGHT, COLD CATHODE THYRATRON FOR RELAY SERVICE. WHEN THE TUBE IS CONDUCTING, THE DISK SHAPED CATHODE GLOWS BRIGHTLY WITH THE CHARACTERISTIC NEON COLOR. THE TUBE IS DESIGNED FOR END ON VIEWING.

THE 7400 HAS "REFERENCE TUBE" CONSTRUCTION AND PROCESSING TO KEEP ITS FIRING CHARACTERISTICS CONSTANT DURING LIFE. THIS FEATURE, COUPLED WITH THE LOW LEVEL OF TRIGGER PULSE VOLTAGE, MAKES THE 7400 PARTICULARLY ADAPTABLE TO TRANSISTOR CIRCUITS.

THIS TUBE TYPE WAS DESIGNED INTO SOME CIRCUITS UNDER THE ORIGINAL DEVELOPMENT TYPE DESIGNATION, CH1116.

ELECTRICAL DATA
(TYPICAL VALUES)

ANODE VOLTAGE DROP @ 1 MA.	102	VDC
ANODE VOLTAGE DROP @ 10 MA.	117	VDC
GRID VOLTAGE DROP @ 1 MA.	88	VDC
ANODE IONIZATION VOLTAGE	210	VOLTS
GRID IONIZATION VOLTAGE	109	VOLTS
MINIMUM ANODE CURRENT FOR BRIGHT READ OUT INDICATION	250	μAMPS

MECHANICAL DATA

MOUNTING POSITION	ANY	
BULB	FLAT END VIAL	
DIAMETER (MAX.)	0.50	INCHES
LENGTH (WITHOUT LEADS) (MAX.)	1.88	INCHES
CONNECTIONS	COLOR CODED FLEXIBLE LEADS	
WEIGHT (APPROX.)	0.17	OZ.

* INDICATES AN ADDITION.

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RATINGS
ABSOLUTE VALUES

POSITIVE ANODE VOLTAGE (MAX.)	180	VDC
NEGATIVE ANODE VOLTAGE (WITHOUT DISCHARGE TO A POSITIVE GRID) (MAX.)	100	VDC
POSITIVE GRID BIAS VOLTAGE (WITHOUT GRID IONIZATION) (MAX.)	102	VDC
TRANSFER CURRENT @ E_b = 150 VDC (MAX.)	15	μAMPS
CATHODE CURRENT (MAX.)	12	MA DC

TYPICAL OPERATING CONDITIONS

ANODE SUPPLY VOLTAGE	150	VDC
ANODE CIRCUIT RESISTANCE	5,000	OHMS
ANODE CURRENT	7	MA.
POSITIVE GRID BIAS	102	VDC
GRID TRIGGER SIGNAL	5	VOLTS
GRID TRANSFER CURRENT	7	μAMPS
CURRENT AMPLIFICATION	1,000	

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

APPLICATION NOTES

IT IS OFTEN NECESSARY TO PROVIDE A RELAY DEVICE FOR CIRCUITRY OPERATING * AT LOW POWER LEVEL, LOW VOLTAGE PULSES. THE 7400 SELF INDICATING THYRATRON PERFORMS THIS CIRCUIT FUNCTION AS WELL AS PROVIDING A BRILLIANT, VISUAL READOUT INDICATOR. NO HEATER POWER IS REQUIRED FOR ITS OPERATION.

THE 7400 THYRATRON CONTAINS A CATHODE, A TRIGGER GRID AND AN ANODE WITHIN A GASEOUS ATMOSPHERE. IF AN INCREASING POSITIVE VOLTAGE IS APPLIED TO THE GRID, A MINUTE PRE-IONIZATION CURRENT WILL FLOW UNTIL THE CRITICAL GRID CURRENT OF ABOUT SEVEN MICROAMPERES IS REACHED. AT THIS POINT THE REGION BETWEEN THE GRID AND CATHODE "BREAKS DOWN" OR IONIZES. IF THE APPLIED ANODE VOLTAGE IS EQUAL TO OR GREATER THAN THE GRID VOLTAGE, THE GLOW WILL THEN TRANSFER TO THE CATHODE-ANODE REGION. THUS, A VERY LOW ENERGY SIGNAL IN THE GRID CIRCUIT CAN CONTROL MUCH HIGHER ENERGY IN THE ANODE CIRCUIT. IF, IN THIS ILLUSTRATION AN ANODE CURRENT OF 7 MILLIAMPERES WERE TO FLOW; THE TUBE HAS PROVIDED CURRENT AMPLIFICATION OF 1,000.

AS WITH ANY GAS TUBE, ONCE THE TUBE CONDUCTS, THE TUBE VOLTAGE DROP REMAINS VIRTUALLY CONSTANT AND THE CURRENT THROUGH THE TUBE IS LIMITED BY THE CIRCUIT RESISTANCE. IN THE ANODE CIRCUIT THIS MAY BE THE RESISTANCE OF THE LOAD ITSELF, OR, THE LOAD PLUS ADDITIONAL LIMITING RESISTANCE. THE GRID CIRCUIT SHOULD CONTAIN A 5,000 OHM SERIES RESISTANCE IF THE SOURCE RESISTANCE IS LOWER THAN THIS FIGURE. IF THE GRID CIRCUIT RESISTANCE IS ABOVE 10 MEGOHMS, HOWEVER, IT MAY BE NECESSARY TO CONNECT A SMALL CAPACITANCE BETWEEN THE GRID AND CATHODE. THIS IS TO STORE ENOUGH ENERGY TO INSURE GRID IONIZATION.

RADIOACTIVE DOSING IS USED TO ELIMINATE ANY CHANGE OF FIRING CHARACTERISTICS DUE TO ILLUMINATION. THE MAGNITUDE OF ACTIVITY IS NOT GREAT ENOUGH TO INSTITUTE A PERSONAL HAZARD. HOWEVER, PERSONS ARE CAUTIONED NOT TO HANDLE BROKEN TUBES TO AVOID GETTING THE ACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF A PERSON CUTS HIMSELF ON A BROKEN TUBE THE CUT SHOULD BE CLEANSED IMMEDIATELY. AN OPEN CUT CAN BE CLEANSED BY HOLDING IT IN RUNNING WATER.

THE 7400 IS DESIGNED FOR END ON VIEWING AND WILL PROVIDE A BRILLIANT SURFACE GLOW PATTERN WHEN CONDUCTING ONLY A FRACTION OF A MILLIAMPERE. THE TUBE IS NORMALLY MOUNTED BEHIND A METAL PANEL WITH THE FLAT END OF THE BULB FLUSH WITH THE PANEL SURFACE. IF IT IS NOT SO MOUNTED, THE BULB SIDES SHOULD BE SHIELDED (eg: COPPER MESH) TO PREVENT HAND CAPACITY OR STRONG ELECTRIC FIELDS FROM ALTERING FIRING POTENTIALS. A HEAT DISSIPATING TYPE OF TUBE CLAMP PROVIDES A CONVENIENT METHOD OF TUBE MOUNTING THAT REQUIRES NO FURTHER SHIELDING.

TYPICAL CIRCUIT CONFIGURATIONS ARE ILLUSTRATED ABOVE. AS WITH ANY THYRATRON CIRCUIT, ONCE THE TUBE CONDUCTS, THE GRID WILL NOT REGAIN CONTROL UNTIL THE ANODE VOLTAGE FALLS LOW ENOUGH TO EXTINGUISH THE CATHODE-ANODE GLOW. THIS IS USUALLY ACCOMPLISHED BY BREAKING THE ANODE CIRCUIT. HOWEVER, IT CAN ALSO BE DONE UNDER D.C. OPERATION, BY CAUSING THE ANODE CURRENT TO FLOW IN SAW TOOTH STEPS. THE SAW TOOTH IS GENERATED BY RUNNING THE TUBE AS A RELAXATION OSCILLATOR BY INSERTING SUFFICIENT CAPACITY BETWEEN THE CATHODE AND ANODE. FIGURE 3 ILLUSTRATES AN APPLICATION OF THIS IDEA. THE 7400 WILL ALSO REGAIN GRID CONTROL ON EACH CYCLE IF IT IS RUN FROM HALF WAVE RECTIFIED A.C. FIGURE 4 ILLUSTRATES AN APPLICATION OF THE TUBE ON A.C. OPERATION OF THE TUBE ON A.C. WITHOUT THE SERIES DIODE IS NOT RECOMMENDED.

*INDICATES AN ADDITION.

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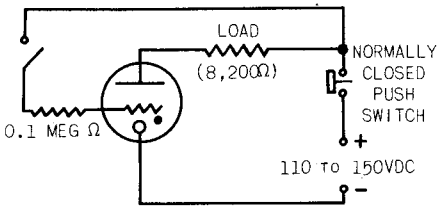
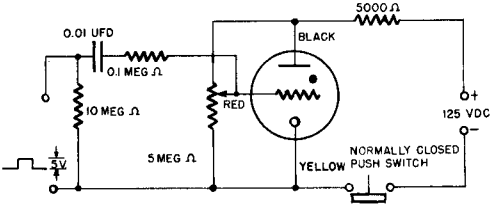
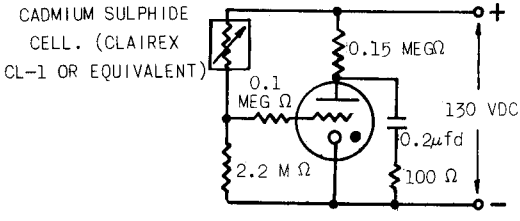


7400 USED AS A MECHANICALLY OPERATED RELAY

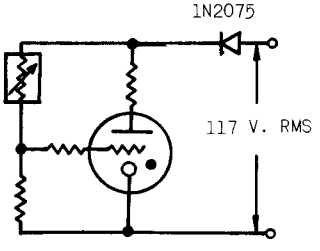
FIG. 1





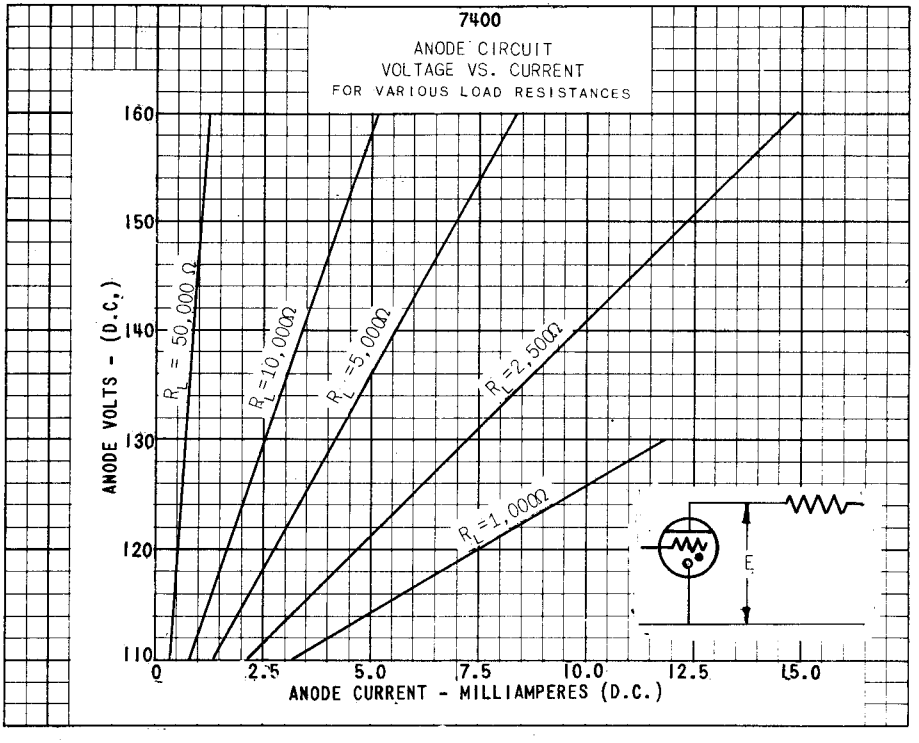
7400 ACTING AS A RELAY FOR A CADMIUM SULPHIDE PHOTO CELL

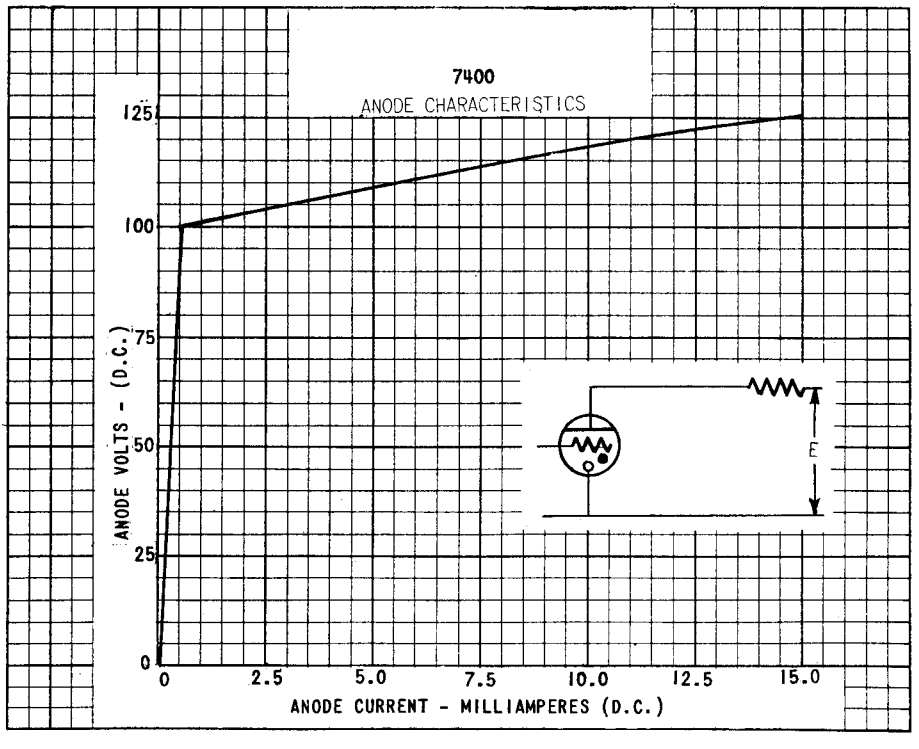
FIG. 3

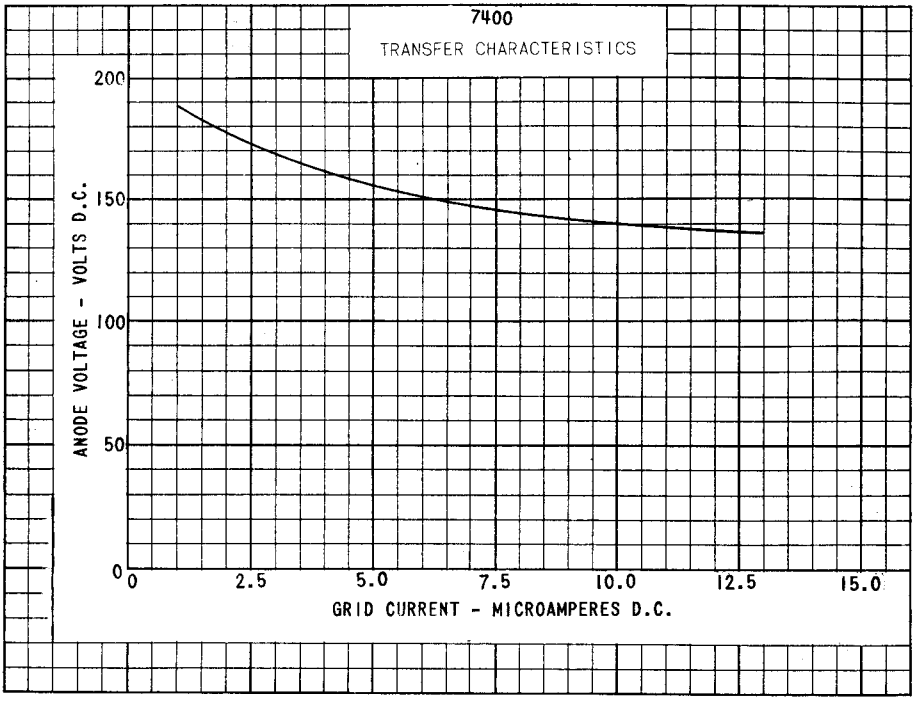


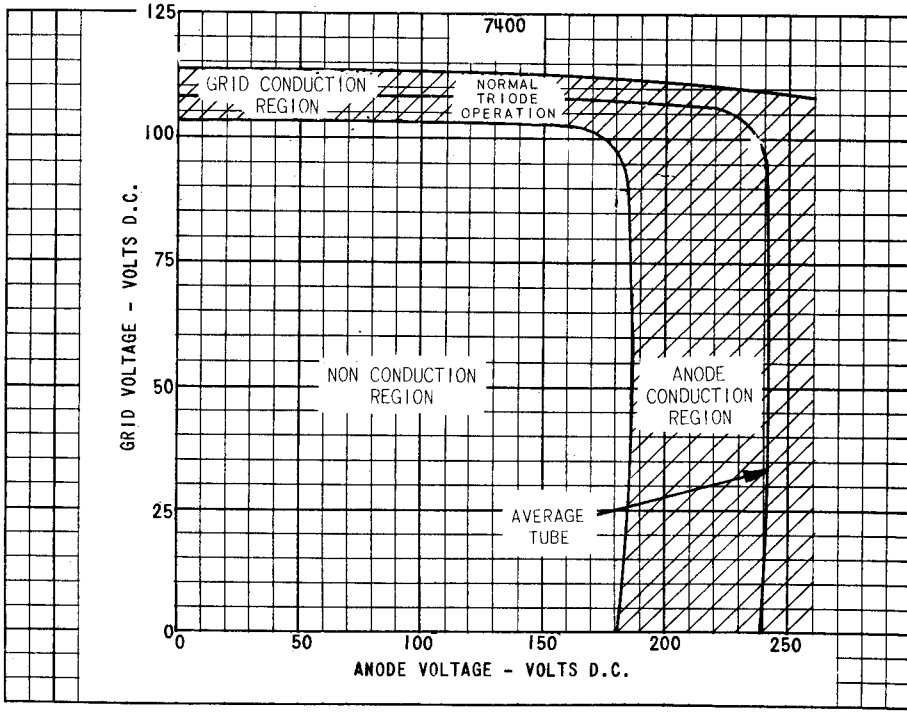
SAME AS FIGURE 3 BUT OPERATED FROM A.C. LINE

FIG. 4


7400
ANODE CIRCUIT
VOLTAGE VS. CURRENT
FOR VARIOUS LOAD RESISTANCES
ANODE VOLTS - (D.C.)
160
150
140
130
120
110
R_L = 50,000 Ω
R_L = 10,000Ω
R_L = 5,000Ω
R_L = 2,500Ω
R_L = 1,000Ω
E
0
2.5
5.0
7.5
10.0
12.5
15.0
ANODE CURRENT - MILLIAMPERES (D.C.)


7400
ANODE CHARACTERISTICS
ANODE VOLTS - (D.C.)
125
100
75
50
25
0
E
0
2.5
5.0
7.5
10.0
12.5
15.0
ANODE CURRENT - MILLIAMPERES (D.C.)





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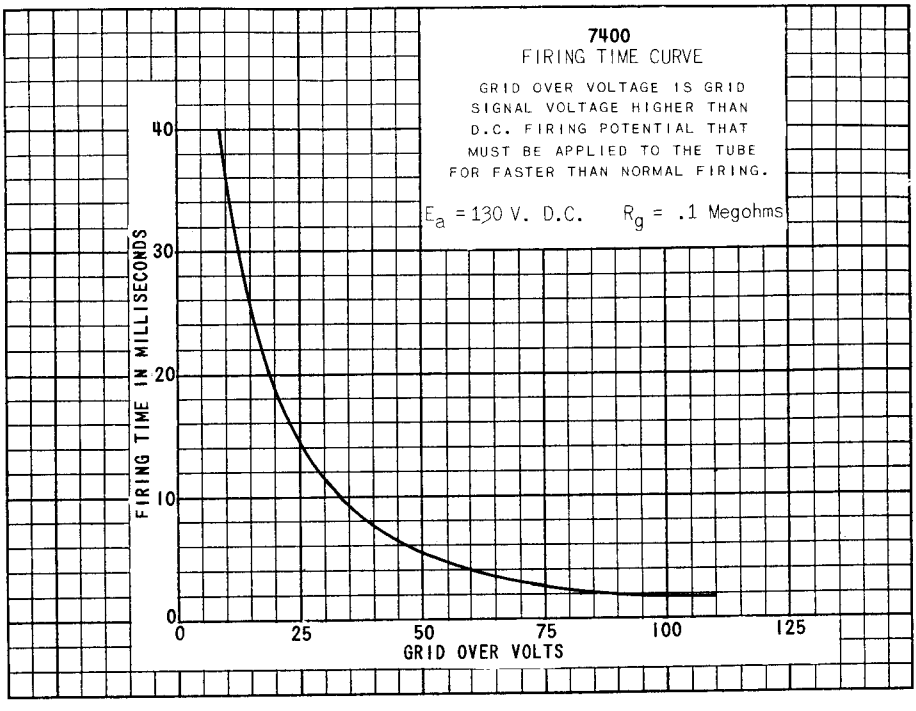

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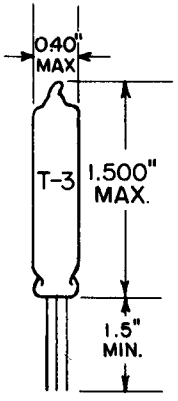
TUNG-SOL

THYRATRON

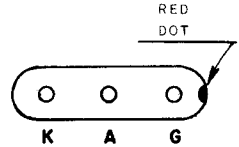
SELF INDICATING*

COLD CATHODE

ANY MOUNTING POSITION



GLASS VIEW



BOTTOM VIEW

0.016" TINNED
FLEXIBLE LEADS
0.100" CENTER TO CENTER

THE 7401 IS A SUBMINIATURE, LIGHTWEIGHT, COLD CATHODE THYRATRON FOR RELAY SERVICE. WHEN THE TUBE IS CONDUCTING, THE DISK SHAPED CATHODE GLOWS BRIGHTLY WITH THE CHARACTERISTIC NEON COLOR. THE TUBE IS DESIGNED FOR END ON VIEWING IN SMALL APACES.

THE 7401 HAS "REFERENCE TUBE" CONSTRUCTION AND PROCESSING TO KEEP ITS FIRING CHARACTERISTICS CONSTANT DURING LIFE. THIS FEATURE, COUPLED WITH THE LOW LEVEL OF TRIGGER PULSE VOLTAGE, MAKES THE 7401 PARTICULARLY ADAPTABLE TO TRANSISTOR CIRCUITS.

THIS TUBE TYPE WAS DESIGNED INTO SOME CIRCUITS UNDER THE ORIGINAL DEVELOPMENT TYPE DESIGNATION, CH1125.

ELECTRICAL DATA
(TYPICAL VALUES)

ANODE VOLTAGE DROP @ 1 MA.	105	VDC
ANODE VOLTAGE DROP @ 8 MA.	115	VDC
GRID VOLTAGE DROP	87	VDC
ANODE IONIZATION VOLTAGE	200	VOLTS
GRID IONIZATION VOLTAGE	107	VOLTS
MINIMUM ANODE CURRENT FOR BRIGHT READ OUT INDICATION	250	μAMPS

MECHANICAL DATA

MOUNTING POSITION	ANY	
BULB	T-3	
DIAMETER (MAX.)	0.40	INCHES
LENGTH (WITHOUT LEADS) (NOM.)	1.50	INCHES
CONNECTIONS	FLEXIBLE LEADS	
WEIGHT (APPROX.)	0.11	OZ.

* INDICATES AN ADDITION.

CONTINUED ON FOLLWING PAGE

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CONTINUED FROM PRECEDING PAGE

RATINGS
ABSOLUTE VALUES

POSITIVE ANODE VOLTAGE (MAX.)	180	VDC
NEGATIVE ANODE VOLTAGE (WITHOUT DISCHARGE TO A POSITIVE GRID) (MAX.)	100	VDC
POSITIVE GRID BIAS VOLTAGE (WITHOUT GRID IONIZATION) (MAX.)	102	VDC
TRANSFER CURRENT @ E_b = 150 VDC (MAX.)	15	μAMPS
CATHODE CURRENT (MAX.)	8	MA DC

TYPICAL OPERATING CONDITIONS

ANODE SUPPLY VOLTAGE	150	VDC
ANODE CIRCUIT RESISTANCE	5,000	OHMS
ANODE CURRENT	7	MA.
POSITIVE GRID BIAS	102	VDC
GRID TRIGGER SIGNAL	5	VOLTS
GRID TRANSFER CURRENT	7	μAMPS
CURRENT AMPLIFICATION	1,400	

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

APPLICATION NOTES

IT IS OFTEN NECESSARY TO PROVIDE A RELAY DEVICE FOR CIRCUITRY OPERATING AT LOW POWER LEVEL, LOW VOLTAGE PULSES. THE 7401 SELF INDICATING THYRATRON PERFORMS THIS CIRCUIT FUNCTION AS WELL AS PROVIDING A BRILLIANT, VISUAL READOUT INDICATOR. NO HEATER POWER IS REQUIRED FOR ITS OPERATION. *

THE 7401 THYRATRON CONTAINS A CATHODE, A TRIGGER GRID AND AN ANODE WITHIN A GASEOUS ATMOSPHERE. IF AN INCREASING POSITIVE VOLTAGE IS APPLIED TO THE GRID, A MINUTE PRE-IONIZATION CURRENT WILL FLOW UNTIL THE CRITICAL GRID CURRENT OF ABOUT FIVE MICROAMPERES IS REACHED. AT THIS POINT THE REGION BETWEEN THE GRID AND CATHODE "BREAKS DOWN" OR IONIZES. IF THE APPLIED ANODE VOLTAGE IS EQUAL TO OR GREATER THAN THE GRID VOLTAGE, THE GLOW WILL THEN TRANSFER TO THE CATHODE-ANODE REGION. THUS, A VERY LOW ENERGY SIGNAL IN THE GRID CIRCUIT CAN CONTROL MUCH HIGHER ENERGY IN THE ANODE CIRCUIT. IF, IN THIS ILLUSTRATION AN ANODE CURRENT OF 7 MILLIAMPERES WERE TO FLOW; THE TUBE HAS PROVIDED CURRENT AMPLIFICATION OF 1,400.

AS WITH ANY GAS TUBE, ONCE THE TUBE CONDUCTS, THE TUBE VOLTAGE DROP REMAINS VIRTUALLY CONSTANT AND THE CURRENT THROUGH THE TUBE IS LIMITED BY THE CIRCUIT RESISTANCE. IN THE ANODE CIRCUIT THIS MAY BE THE RESISTANCE OF THE LOAD ITSELF, OR, THE LOAD PLUS ADDITIONAL LIMITING RESISTANCE. THE GRID CIRCUIT SHOULD CONTAIN A 5,000 OHM SERIES RESISTANCE IF THE SOURCE RESISTANCE IS LOWER THAN THIS FIGURE. IF THE GRID CIRCUIT RESISTANCE IS ABOVE 10 MEGOHMS, HOWEVER, IT MAY BE NECESSARY TO CONNECT A SMALL CAPACITANCE BETWEEN THE GRID AND CATHODE. THIS IS TO STORE ENOUGH ENERGY TO INSURE GRID IONIZATION.

RADIOACTIVE DOSING IS USED TO ELIMINATE ANY CHANGE OF FIRING CHARACTERISTICS DUE TO ILLUMINATION. THE MAGNITUDE OF ACTIVITY IS NOT GREAT ENOUGH TO INSTITUTE A PERSONAL HAZARD. HOWEVER, PERSONS ARE CAUTIONED NOT TO HANDLE BROKEN TUBES TO AVOID GETTING THE ACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF A PERSON CUTS HIMSELF ON A BROKEN TUBE THE CUT SHOULD BE CLEANSED IMMEDIATELY. AN OPEN CUT CAN BE CLEANSED BY HOLDING IT IN RUNNING WATER.

THE 7401 IS DESIGNED FOR END ON VIEWING AND WILL PROVIDE A BRILLIANT SURFACE GLOW PATTERN WHEN CONDUCTING ONLY A FRACTION OF A MILLIAMPERE. THE TUBE IS NORMALLY MOUNTED BEHIND A METAL PANEL WITH THE END OF THE BULB FLUSH WITH THE PANEL SURFACE. IF IT IS NOT SO MOUNTED, THE BULB SIDES SHOULD BE SHIELDED (eg: COPPER MESH) TO PREVENT HAND CAPACITY OR STRONG ELECTRIC FIELDS FROM ALTERING FIRING POTENTIALS. A HEAT DISSIPATING TYPE OF TUBE CLAMP PROVIDES A CONVENIENT METHOD OF TUBE MOUNTING THAT REQUIRES NO FURTHER SHIELDING.

TYPICAL CIRCUIT CONFIGURATIONS ARE ILLUSTRATED ABOVE. AS WITH ANY THYRATRON CIRCUIT, ONCE THE TUBE CONDUCTS, THE GRID WILL NOT REGAIN CONTROL UNTIL THE ANODE VOLTAGE FALLS LOW ENOUGH TO EXTINGUISH THE CATHODE-ANODE GLOW. THIS IS USUALLY ACCOMPLISHED BY BREAKING THE ANODE CIRCUIT. HOWEVER, IT CAN ALSO BE DONE UNDER D.C. OPERATION, BY CAUSING THE ANODE CURRENT TO FLOW IN SAW TOOTH STEPS. THE SAW TOOTH IS GENERATED BY RUNNING THE TUBE AS A RELAXATION OSCILLATOR BY INSERTING SUFFICIENT CAPACITY BETWEEN THE CATHODE AND ANODE. FIGURE 3 ILLUSTRATES AN APPLICATION OF THIS IDEA. THE 7401 WILL ALSO REGAIN GRID CONTROL ON EACH CYCLE IF IT IS RUN FROM HALF WAVE RECTIFIED A.C. FIGURE 4 ILLUSTRATES AN APPLICATION OF THE TUBE ON A.C. OPERATION OF THE TUBE ON A.C. WITHOUT THE SERIES DIODE IS NOT RECOMMENDED.

*INDICATES AN ADDITION.

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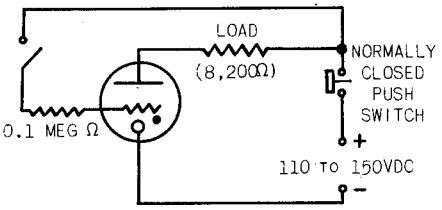
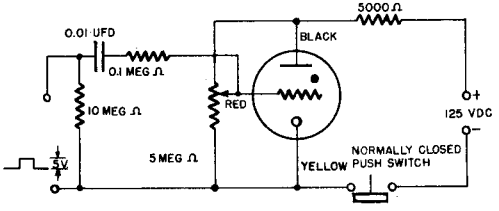
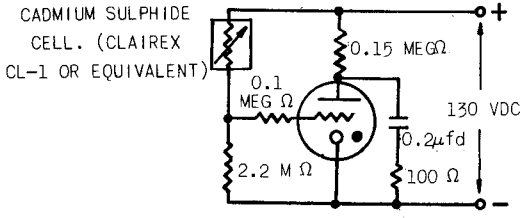


7401 USED AS A MECHANICALLY OPERATED RELAY

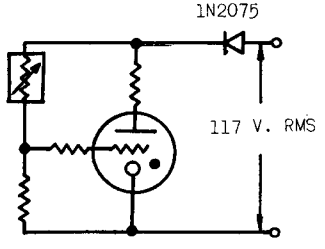
FIG. 1





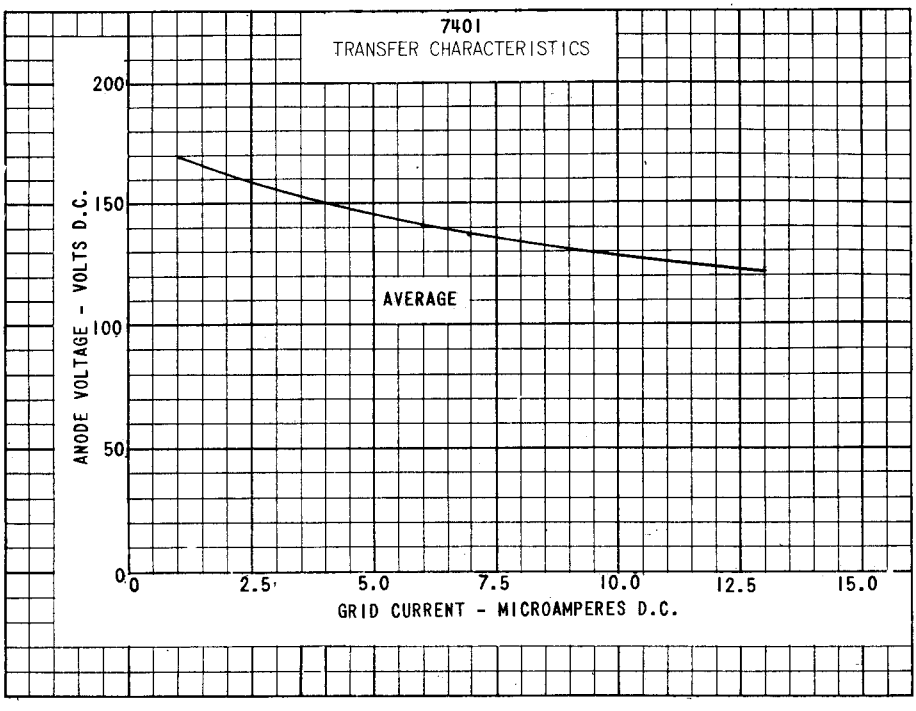
7401 ACTING AS A RELAY FOR A CADMIUM SULPHIDE PHOTO CELL

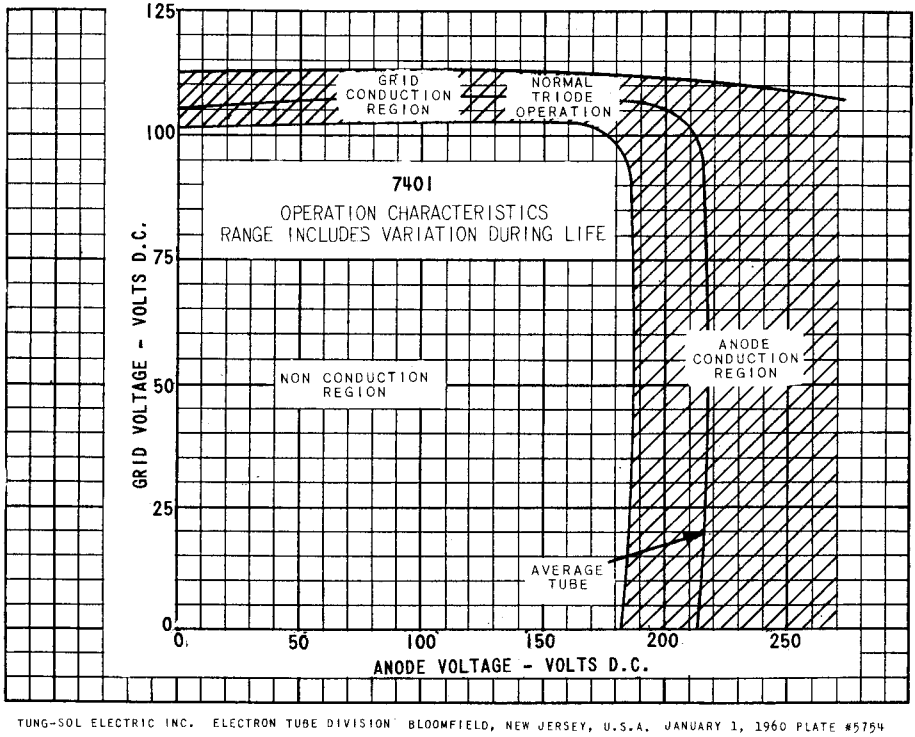
FIG. 3



SAME AS FIGURE 3 BUT OPERATED FROM A.C. LINE

FIG. 4





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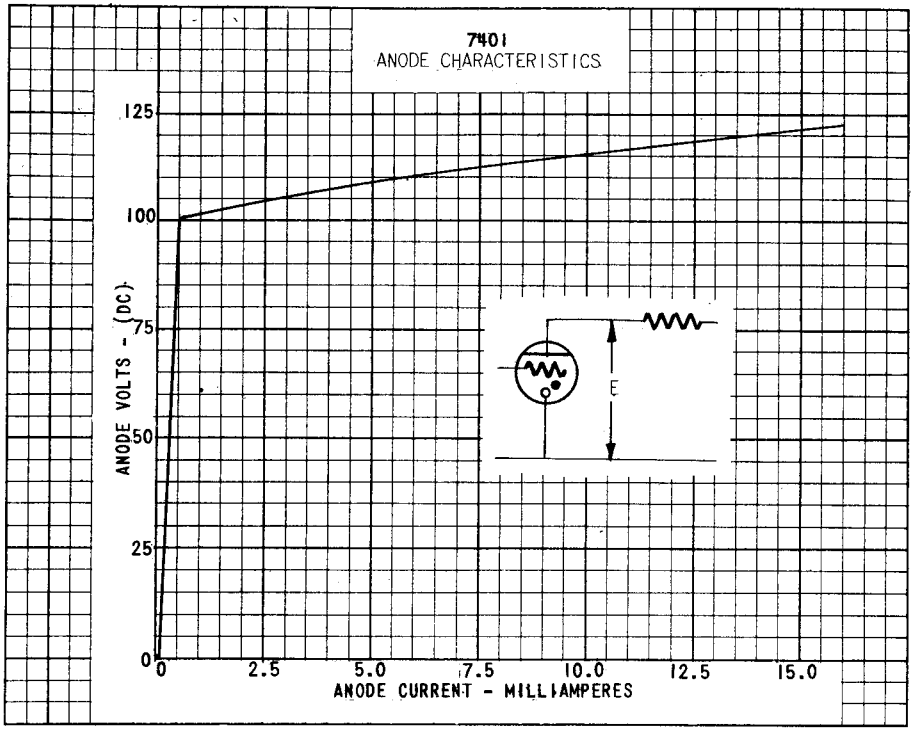
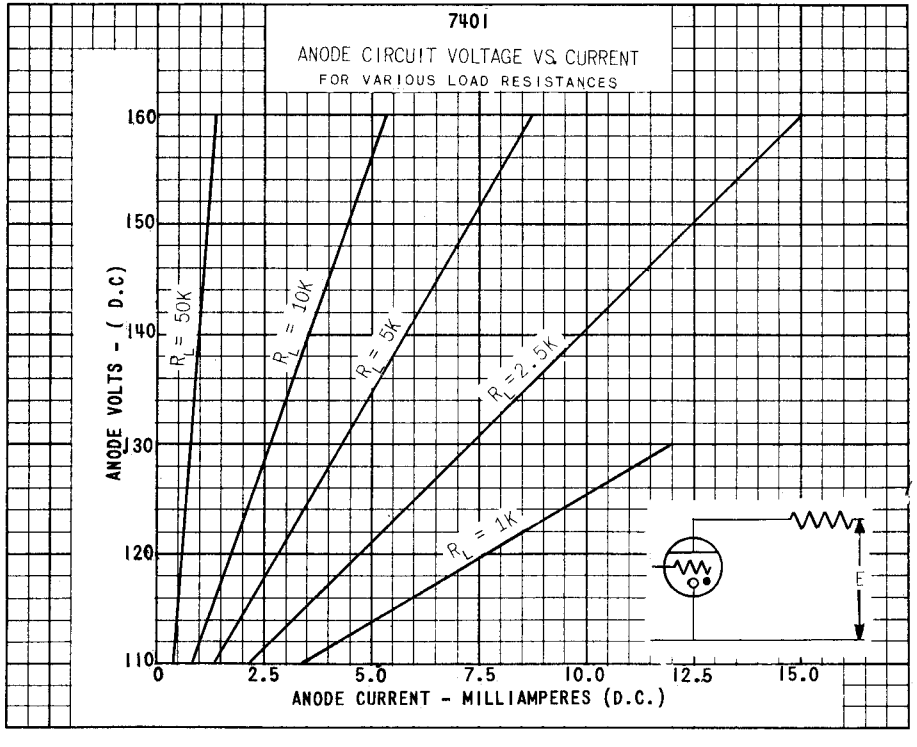
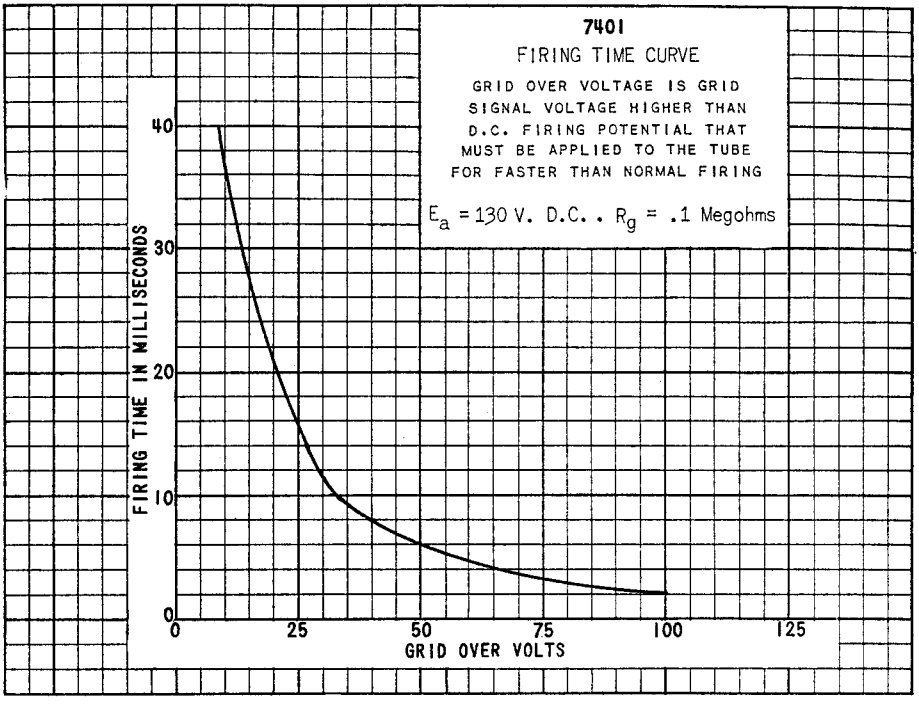

7401
ANODE CHARACTERISTICS
ANODE VOLTS - (DC)
125
100
75
50
25
0
0
2.5
5.0
7.5
10.0
12.5
15.0
ANODE CURRENT - MILLIAMPERES
E


7401
ANODE CIRCUIT VOLTAGE VS. CURRENT
FOR VARIOUS LOAD RESISTANCES
ANODE VOLTS - (D.C)
160
150
140
130
120
110
R_L = 50K
R_L = 10K
R_L = 5K
R_L = 2.5K
R_L = 1K
0
2.5
5.0
7.5
10.0
12.5
15.0
ANODE CURRENT - MILLIAMPERES (D.C.)
E



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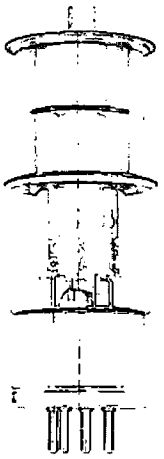
TUNG-SOL / CHATHAM

CLIPPER THYRATRON

TYPE
7454

DESCRIPTION — The 7454 is a zero bias, short ionization time hydrogen thyratron specially designed to pass high fault currents as an inverse clipper in line-type radar modulators. The tube, when triggered, terminates the pulse-forming network in its characteristic impedance thereby reducing the inverse voltage to zero during both normal and load fault conditions. It also reduces to a minimum the inverse spike energy that otherwise would have to be dissipated by the switch tube anode.

The low anode 'firing' voltage and ability to carry very large peak (fault) currents make a hydrogen clipper thyratron ideal for this application. The 7454 is capable of clipping at a switch-tube power level of 12.5 megawatts in a line-type modulator. A hydrogen reservoir is included to promote long life by providing a method of automatically replenishing hydrogen lost by 'cleanup'.

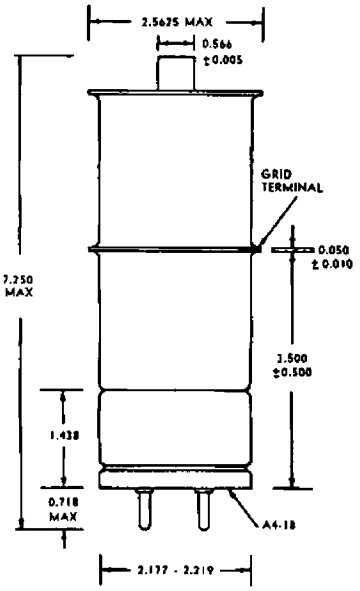


ELECTRICAL DATA

	Minimum	Bogey	Maximum	
Heater Voltage	4.75	5.00	5.25	Volts
Heater Current—Ef = 5.0 volts	10	13	16	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	—	—	200	Volts
Altitude	—	—	10,000	Feet
Ambient Temperature	—55	—	+75	Degrees Centigrade

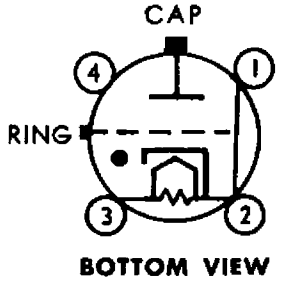
MECHANICAL DATA

Type of Cooling	Convection
Mounting Position	Base down or horizontal
Maximum Net Weight	14 ounces
Base	JETEC A4-18
Socket	E. F. Johnson Co. 123-206-100 or equal
Grid Connector	Tung-Sol/Chatham Part No. 2563-A
Shock—Maximum	500G acceleration with 1 millisecond duration



MAXIMUM RATINGS — ABSOLUTE VALUES

	Min	Max	
D-C Anode Voltage, Inverse (Note 1)	—	25	Kilovolts
D-C Anode Voltage, Critical (Note 2)	1,000	—	Volts
Cathode Current (Note 3)			
RMS—Averaging time 3 seconds	—	6.3	Amperes
Peak—Continuous	—	325	Amperes
Peak—Fault	—	1,200	Amperes
Operating Frequency (Note 4)	—	2,500	Cycles-per-second
Grid Voltage—Peak Forward	500	—	Volts
Grid Voltage—Peak Inverse	—	3,000	Volts
Grid Trigger Current	7	12	Amperes
Trigger Pulse Width (Note 5)	0.5	—	Microsecond
Trigger Lead Time (Notes 6 & 7)	0.2	—	Microsecond



BOTTOM VIEW

Notes:

1. Inverse anode voltage in a clipper tube is defined as the peak voltage that can be impressed between anode and cathode with a polarity opposite to that producing current flow in the tube. Generally, it has the same magnitude as the maximum network voltage.
2. Critical anode voltage in the clipper tube is defined as the minimum anode voltage at which anode conduction occurs. The actual rating allows sufficient safety factor to enable minimum delay of anode conduction.
3. Cathode Current
   a. RMS cathode current is defined as the maximum effective current flowing through the clipper tube under any condition of operation for a period not exceeding the average time. The interval over which the averaging time is applied must include the period in which the maximum rms fault current is encountered.
   b. Peak fault current is defined as the maximum value of instantaneous current flowing in a clipper tube when a fault occurs in the load circuit.
   c. In determining circuit parameters, care must be observed to insure that the nominal rms current (without load faulting) is of such a value as to prevent the rms current (with load faulting) from exceeding the rating during the specified average time.
4. The maximum operating frequency does not necessarily represent the upper limit, but is the highest frequency at which tests have been conducted.
5. The trigger pulse width should not exceed the load pulse width plus the trigger pulse lead time.
6. The minimum trigger lead time is defined as the period between the time at which the leading edge of the unloaded grid pulse reaches 50 percent of its maximum value and the time at which the clipper tube anode becomes positive.
7. The maximum trigger pulse lead time should not exceed 80 percent of the trigger pulse width.

from JEDEC release #3079, Dec. 18, 1960

APPLICATION NOTES

The typical line-type radar modulator comprises a switch tube, a load, a pulse-forming network, and usually a clipping device. The load is normally a magnetron, or klystron coupled to the modulator by a pulse transformer, Most often, the network is negatively matched, that is, the impedance of the load is smaller than the characteristic impedance of the network. The result of this mismatch is that a negative voltage remains on the network after the main discharge pulse, and the voltage is added to the supply voltage on the next charging cycle. When a load fault occurs, the mismatch is increased and the negative voltage rises placing a higher positive voltage on the pulse-forming network. Prolonged faults produce successively higher network voltages resulting in dangerously high voltages on the circuit components. The negative mismatch voltage also produces an inverse current pulse in the switch tube immediately after the main discharge pulse. As this current decays very rapidly, an inverse spike voltage appears across the tube. The resulting energy must be dissipated by the switch tube anode.

The main advantages gained by employing a clipper device in a modulator circuit include:

a. protection of components from excess voltage produced during load faults,

b. regulation of output pulse amplitude, and

c. reduction of inverse spike energy that has to be dissipated by the switch tube.

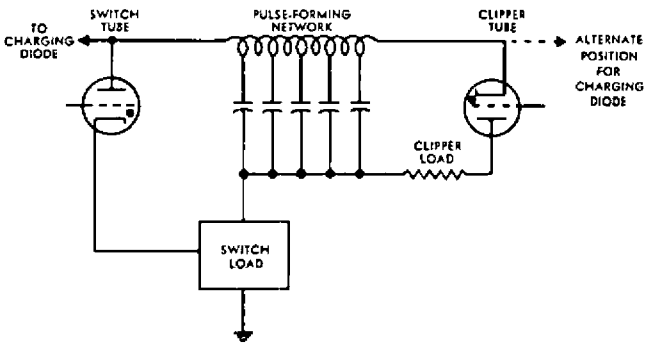


FIGURE 1. END OF LINE CLIPPER

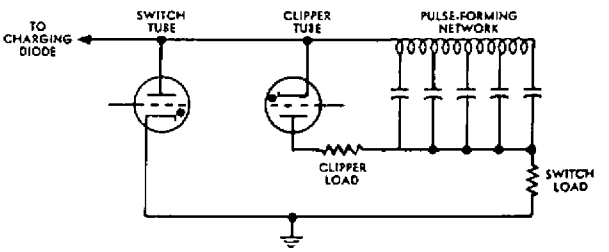


FIGURE 2. FRONT OF LINE CLIPPER

A gas tube with its inherent low internal impedance and high peak and average current handling capacity is ideally suited for clipper applications as it is not practical to obtain optimum clipping with a vacuum device.

Two of the most popular clipping methods are illustrated in figures 1 and 2. The configuration of figure 1 is preferred. In it the clipper tube is connected across the far end of the pulse-forming network in series with a resistive load the value of which approximates the network impedance. With the clipper in this location, the inverse spike can be almost completely eliminated and simple triggering means can be employed. In the front-of-line clipper, illustrated in figure 2, if the load impedance is less than the network impedance, as is usually the case, a resistor must be inserted in series with the clipper tube. The value of this resistance should be chosen to approximate the network impedance.

The relation between switch-tube currents and clipper-tube currents in a line modulator are shown in graphic form in figures 3, 4 and 5. The ratio of switch tube to clipper tube peak current as a function of R_L/Z_O is shown in figure 3. During normal operation, the clipper tube peak current is usually no greater than one-half the switch tube peak current. However, under a fault condition, the clipper tube peak current is 0.7 times the switch tube fault current, and may be four times the normal clipper tube peak current depending on the ratio R_L/Z_O The ratio of the rms clipper tube to switch tube currents as a function of R_L/Z_O with the ratio of rise time to pulse width (f) as a parammeter, is shown in figure 4. During a load fault, R_L becomes zero and the rms clipper current is just one-half the rms switch tube fault current. However, under certain conditions the rms clipper current may be as much as four times the steady-state value. A similar graph, figure 5, presents the relationship between the average currents in the switch tube and the clipper tube.

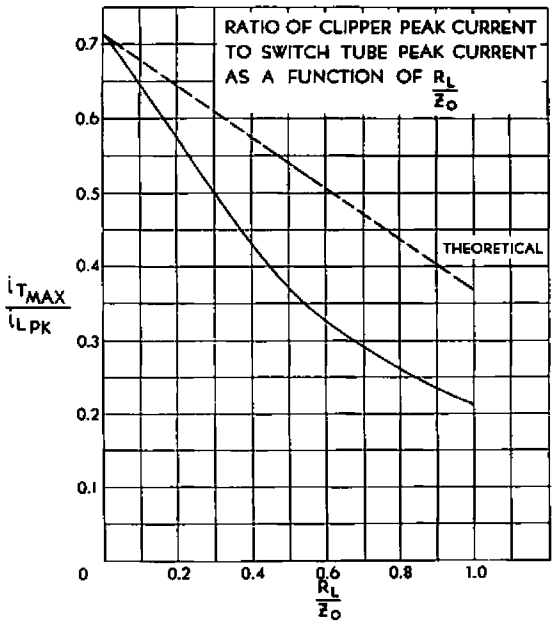


FIGURE 3

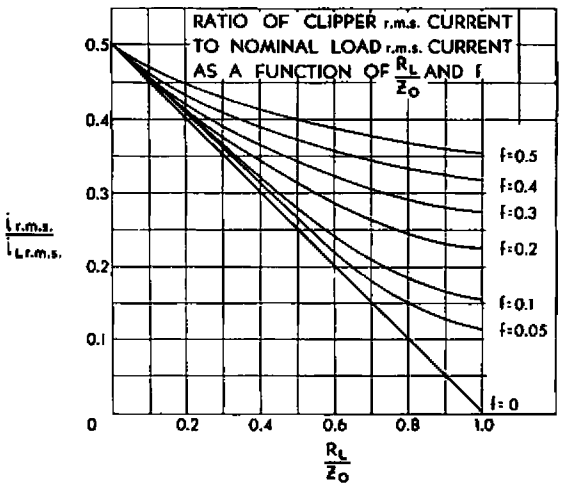


FIGURE 4

$i_{T\,max}$ = peak clipper tube current
$i_{L\,peak}$ = peak load current
R_L = load resistance
Z_O = characteristic network impedance
f = ratio of load current rise time to pulse width
i_{rms} = rms clipper tube current
i_{Lrms} = rms load current
i_{av} = average clipper tube current
i_{Lav} = average load current

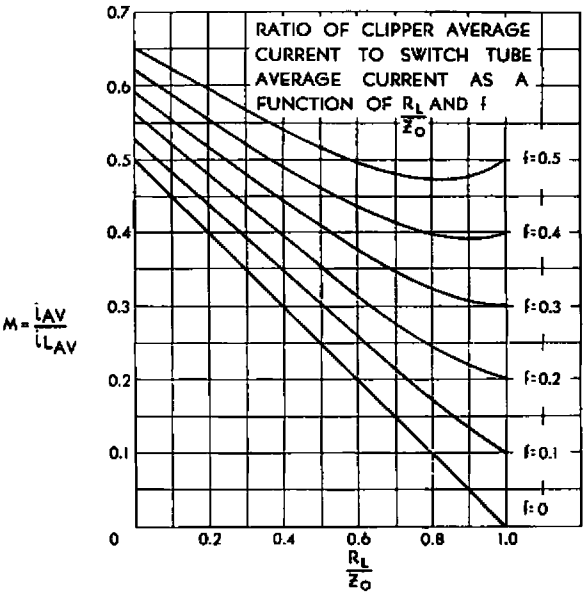


FIGURE 5

While a thyratron clipper requires an additional grid connection not needed for a diode clipper, the thyratron can be triggered at the optimum time demanded by the circuit. This fact, plus the inherent ability of a grided tube to hold off high inverse voltage, makes the thyratron a trouble-free clipping device.

The clipper tube may be triggered in a number of ways. It has been determined that the most effective clipping occurs when the clipper tube grid is triggered at least several hundred millimicroseconds before the initial voltage wave reaches the far end of the line. The simplest triggering method consists of a one-turn primary pulse transformer and is illustrated in figure 6. In this circuit, a trigger pulse of the proper lead time, polarity and amplitude is obtained directly from the pulse-forming network. Thus triggering is accomplished in a simple manner without loading the pulse-forming line. The methods shown in figures 7 and 8 will also fill the triggering time requirement. However, if the divider impedances are too low, the output pulse shape will be affected. The trigger circuit of figure 8 can also be employed in "tailbiting" and voltage clamping service.

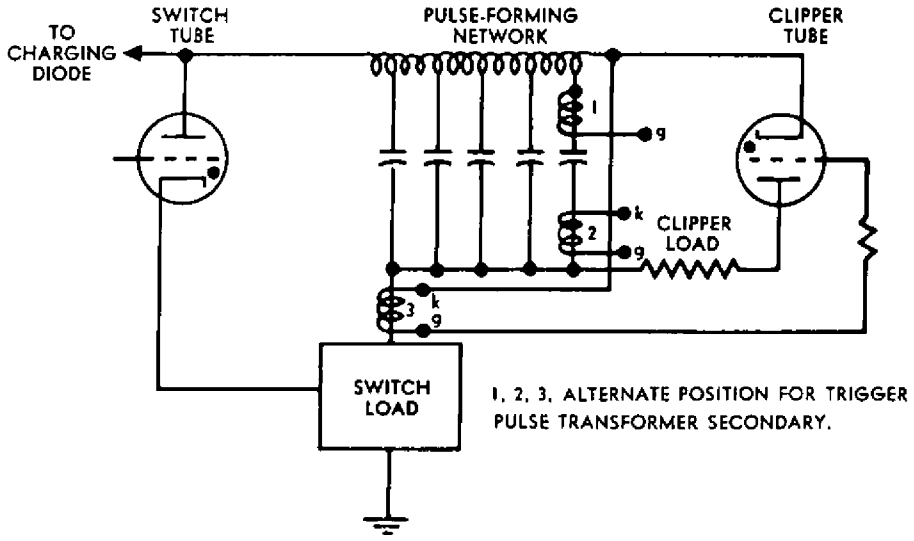


FIGURE 6. TRANSFORMER-COUPLED TRIGGERING CIRCUIT

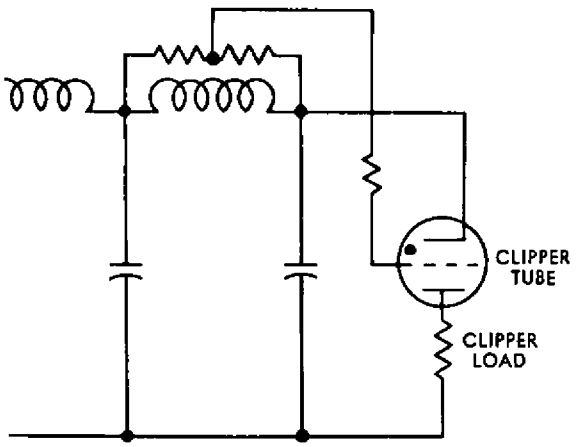


FIGURE 7.
RESISTOR-COUPLED TRIGGERING CIRCUIT

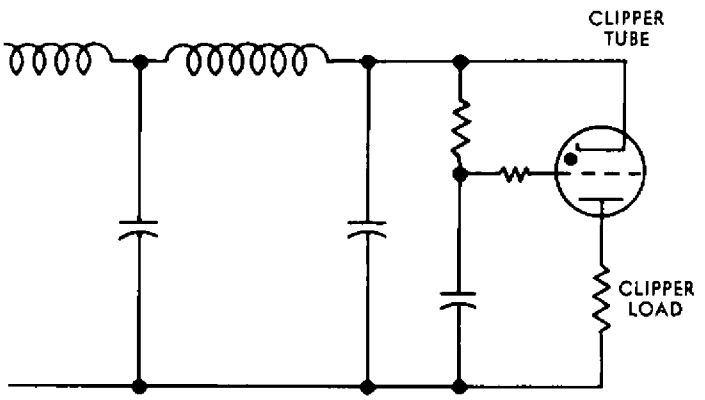


FIGURE 8.
R-C TRIGGERING CIRCUIT

TUNG-SOL

PRODUCT BULLETIN

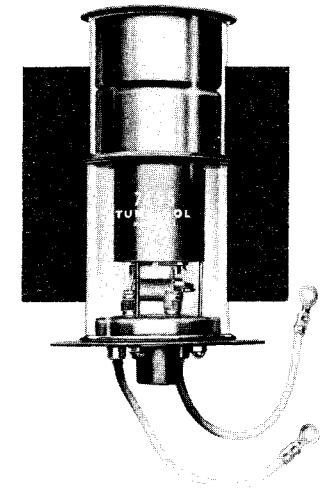
INDUSTRIAL ELECTRON TUBE TYPE 7455

JANUARY 1963

CLIPPER THYRATRON

DESCRIPTION—The 7455 is a zero bias, short ionization time hydrogen thyratron specially designed to pass high fault currents as an inverse clipper in line-type radar modulators. The tube, when triggered, terminates the pulse-forming network in its characteristic impedance thereby reducing the inverse voltage to zero during both normal and load fault conditions. It also reduces to a minimum the inverse spike energy that otherwise would have to be dissipated by the switch tube anode.

The low anode 'firing' voltage and ability to carry very large peak (fault) currents make a hydrogen clipper thyratron ideal for this application. The 7455 is capable of clipping at a switch-tube power level of 33 megawatts in a line-type modulator. A hydrogen reservoir is included to promote long life by providing a method of automatically replenishing hydrogen lost by 'cleanup'.



ELECTRICAL DATA

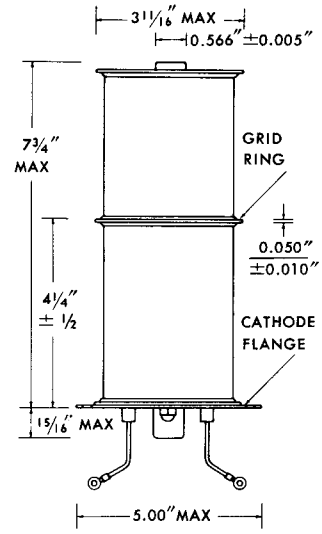
	Minimum	Bogey	Maximum	
Heater Voltage	4.75	5.00	5.25	Volts
Heater Current—Ef = 5.0 volts	15	20	25	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	—	—	300	Volts
Altitude	—	—	10,000	Feet
Ambient Temperature	−55	—	+75	Degrees Centigrade

MECHANICAL DATA

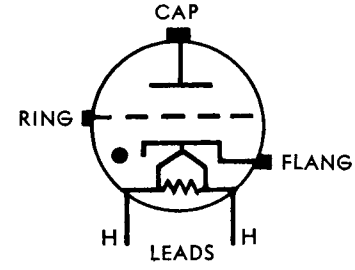
Type of Cooling	Convection
Mounting Position	Base down or horizontal
Maximum Net Weight	2¼ pounds
Mounting Data	Three 5/16 in. diameter holes spaced 120° on 4⅜ in. diameter
Chassis Hole	3 inches
Grid Connector	Tung-Sol/Chatham Part No. 2556-A
Shock—Maximum	500G acceleration with 1 millisecond duration

MAXIMUM RATINGS — ABSOLUTE VALUES

	Min.	Max.	
D C Anode Voltage, Inverse (Note 1)	—	33	Kilovolts
D C Anode Voltage, Critical (Note 2)	1,000	—	Volts
Cathode Current (Note 3)			
RMS—Continuous	—	8.5	Amperes
RMS—Fault—Averaging Time 3 seconds	—	16	Amperes
Peak—Continuous	—	800	Amperes
Peak—Fault	—	2,900	Amperes
Operating Frequency (Note 4)	—	2,500	Cycles-per-second
Grid Voltage—Peak Forward	600	—	Volts
Grid Voltage—Peak Inverse	—	3,000	Volts
Grid Trigger Current—Peak	6	15	Amperes
Trigger Pulse Width (Note 5)	0.5	—	Microsecond
Trigger Lead Time (Notes 6 & 7)	0.2	—	Microsecond



OUTLINE DRAWING



BOTTOM VIEW

Notes:

1. Inverse anode voltage in a clipper tube is defined as the peak voltage that can be impressed between anode and cathode with a polarity opposite to that producing current flow in the tube. Generally, it has the same magnitude as the maximum network voltage.
2. Critical anode voltage in the clipper tube is defined as the minimum anode voltage at which anode conduction occurs. The actual rating allows sufficient safety factor to enable minimum delay of anode conduction.
3. Cathode Current
   a. RMS cathode current is defined as the maximum effective current flowing through the clipper tube under any condition of operation for a period not exceeding the average time. The interval over which the averaging time is applied must include the period in which the maximum rms fault current is encountered.
   b. Peak fault current is defined as the maximum value of instantaneous current flowing in a clipper tube when a fault occurs in the load circuit.
   c. In determining circuit parameters, care must be observed to insure that the nominal rms current (without load faulting) is of such a value as to prevent the rms current (with load faulting) from exceeding the rating during the specified average time.
4. The maximum operating frequency does not necessarily represent the upper limit, but is the highest frequency at which tests have been conducted.
5. The trigger pulse width should not exceed the load pulse width plus the trigger pulse lead time.
6. The minimum trigger lead time is defined as the period between the time at which the leading edge of the unloaded grid pulse reaches 50 percent of its maximum value and the time at which the clipper tube anode becomes positive.
7. The maximum trigger pulse lead time should not exceed 80 percent of the trigger pulse width.

APPLICATION NOTES

The typical line-type radar modulator comprises a switch tube, a load, a pulse-forming network, and usually a clipping device. The load is normally a magnetron, or klystron coupled to the modulator by a pulse transformer. Most often, the network is negatively matched, that is, the impedance of the load is smaller than the characteristic impedance of the network. The result of this mismatch is that a negative voltage remains on the network after the main discharge pulse, and the voltage is added to the supply voltage on the next charging cycle. When a load fault occurs, the mismatch is increased and the negative voltage rises placing a higher positive voltage on the pulse-forming network. Prolonged faults produce successively higher network voltages resulting in dangerously high voltages on the circuit components. The negative mismatch voltage also produces an inverse current pulse in the switch tube immediately after the main discharge pulse. As this current decays very rapidly, an inverse spike voltage appears across the tube. The resulting energy must be dissipated by the switch tube anode.

The main advantages gained by employing a clipper device in a modulator circuit include:

a. protection of components from excess voltage produced during load faults,

b. regulation of output pulse amplitude, and

c. reduction of inverse spike energy that has to be dissipated by the switch tube.

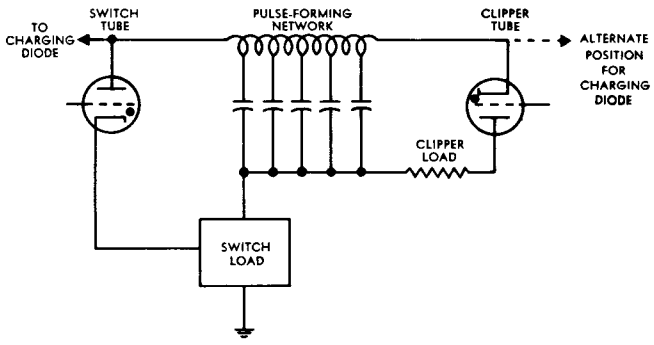


FIGURE 1. END OF LINE CLIPPER

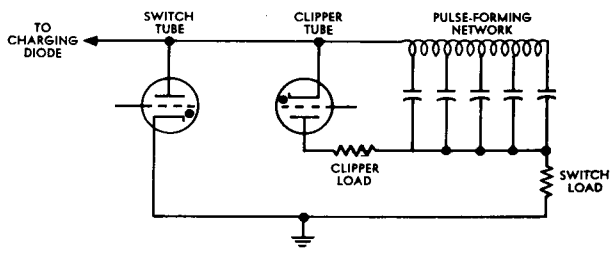


FIGURE 2. FRONT OF LINE CLIPPER

A gas tube with its inherent low internal impedance and high peak and average current handling capacity is ideally suited for clipper applications as it is not practical to obtain optimum clipping with a vacuum device.

Two of the most popular clipping methods are illustrated in figures 1 and 2. The configuration of figure 1 is preferred. In it the clipper tube is connected across the far end of the pulse-forming network in series with a resistive load the value of which approximates the network impedance. With the clipper in this location, the inverse spike can be almost completely eliminated and simple triggering means can be employed. In the front-of-line clipper, illustrated in figure 2, if the load impedance is less than the network impedance, as is usually the case, a resistor must be inserted in series with the clipper tube. The value of this resistance should be chosen to approximate the network impedance.

The relation between switch-tube currents and clipper-tube currents in a line modulator are shown in graphic form in figures 3, 4 and 5. The ratio of switch tube to clipper tube peak current as a function of R_L/Z_O is shown in figure 3. During normal operation, the clipper tube peak current is usually no greater than one-half the switch tube peak current. However, under a fault condition, the clipper tube peak current is 0.7 times the switch tube fault current, and may be four times the normal clipper tube peak current depending on the ratio R_L/Z_O .The ratio of the rms clipper tube to switch tube currents as a function of R_L/Z_O with the ratio of rise time to pulse width (f) as a parammeter, is shown in figure 4. During a load fault, R_L becomes zero and the rms clipper current is just one-half the rms switch tube fault current. However, under certain conditions the rms clipper current may be as much as four times the steady-state value. A similar graph, figure 5, presents the relationship between the average currents in the switch tube and the clipper tube.

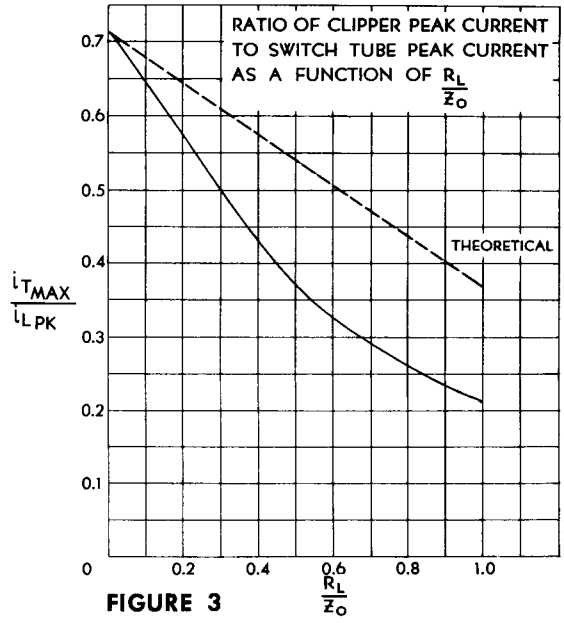


FIGURE 3

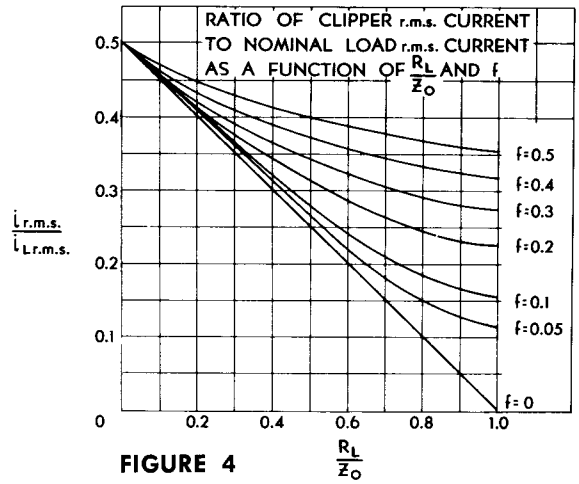


FIGURE 4

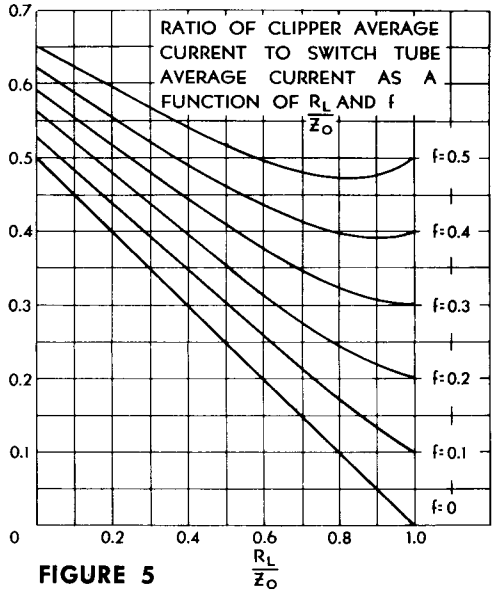


FIGURE 5

$i_{T\,max}$ = peak clipper tube current
$i_{L\,peak}$ = peak load current
R_L = load resistance
Z_o = characteristic network impedance
f = ratio of load current rise time to pulse width
i_{rms} = rms clipper tube current
i_{Lrms} = rms load current
i_{av} = average clipper tube current
i_{Lav} = average load current

While a thyratron clipper requires an additional grid connection not needed for a diode clipper, the thyratron can be triggered at the optimum time demanded by the circuit. This fact, plus the inherent ability of a grided tube to hold off high inverse voltage, makes the thyratron a trouble-free clipping device.

The clipper tube may be triggered in a number of ways. It has been determined that the most effective clipping occurs when the clipper tube grid is triggered at least several hundred millimicroseconds before the initial voltage wave reaches the far end of the line. The simplest triggering method consists of a one-turn primary pulse transformer and is illustrated in figure 6. In this circuit, a trigger pulse of the proper lead time, polarity and amplitude is obtained directly from the pulse-forming network. Thus triggering is accomplished in a simple manner without loading the pulse-forming line. The methods shown in figures 7 and 8 will also fill the triggering time requirement. However, if the divider impedances are too low, the output pulse shape will be affected. The trigger circuit of figure 8 can also be employed in "tailbiting" and voltage clamping service.

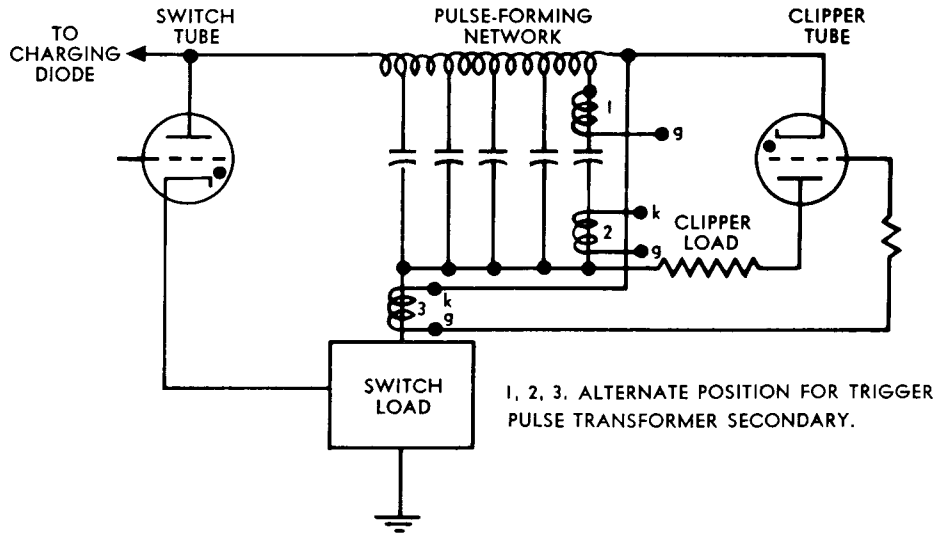


FIGURE 6. TRANSFORMER-COUPLED TRIGGERING CIRCUIT

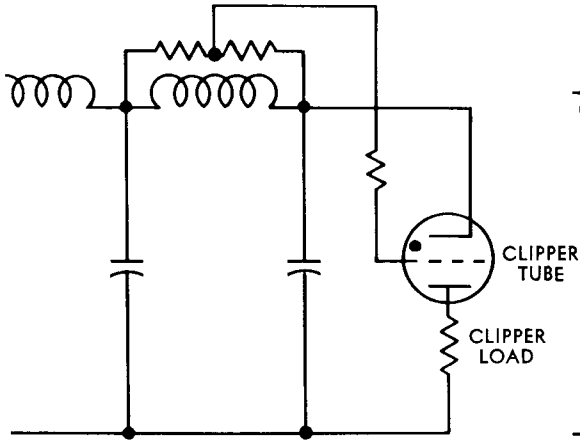


FIGURE 7.
RESISTOR-COUPLED TRIGGERING CIRCUIT

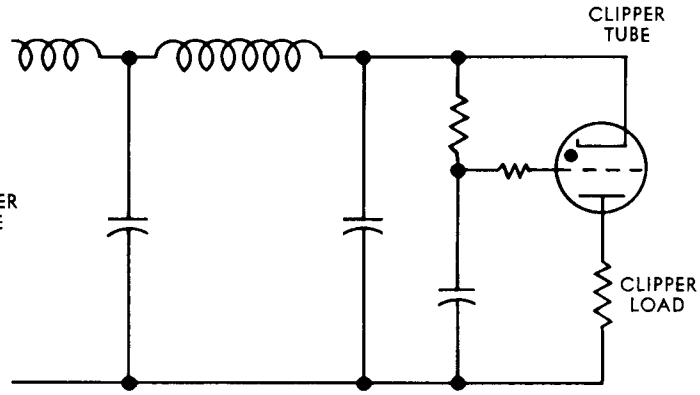


FIGURE 8.
R-C TRIGGERING CIRCUIT

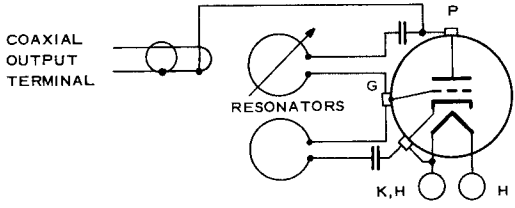
TUNG-SOL

TRIODE OSCILLATOR

THE 7533 IS AN INTEGRAL-CAVITY OSCILLATOR ASSEMBLY DESIGNED FOR TRANSMITTING SERVICE IN BATTERY POWERED RADIOSONDES OPERATING NEAR 1680 MC/S. IT INCORPORATES A PENCIL TRIODE WITH UNUSUALLY LOW HEATER POWER BATTERY DRAIN, RELATIVELY HIGH PLATE CIRCUIT EFFICIENCY, LOW FREQUENCY DRIFT AND A WEIGHT OF ONLY 0.8 OUNCES. THE OUTPUT FREQUENCY CAN BE ADJUSTED BETWEEN 1660 AND 1700 MC/S BY MEANS OF 2 ADJUSTMENT SCREWS POSITIONED IN THE PLATE RESONATOR. THE CATHODE RESONATOR IS PRE-TUNED FOR UNIFORM POWER OUTPUT OVER THE TUNEABLE FREQUENCY RANGE. THE COAXIAL TERMINAL IS LOOP COUPLED TO THE PLATE RESONATOR.

MECHANICAL DATA

TERMINAL CONNECTIONS



H: HEATER
K: CATHODE
G: GRID
P: PLATE

PHYSICAL DIMENSIONS — SEE OUTLINE AND NOTES

ELECTRICAL DATA

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.0	VOLTS	160	MA.
LIMITS OF APPLIED VOLTAGE			5.2 TO 6.6	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

FOR ALTITUDES UP TO 100,000 FEET

DC PLATE-TO-GRID VOLTAGE	130	VOLTS
PLATE DISSIPATION	3.6	WATTS
PLATE INPUT	4	WATTS
DC PLATE CURRENT	34	MA.
DC GRID CURRENT	8	MA.
AMBIENT TEMPERATURE	−55 TO +75	°C

CONTINUED ON FOLLOWING PAGE

PRINTED IN U. S. A.

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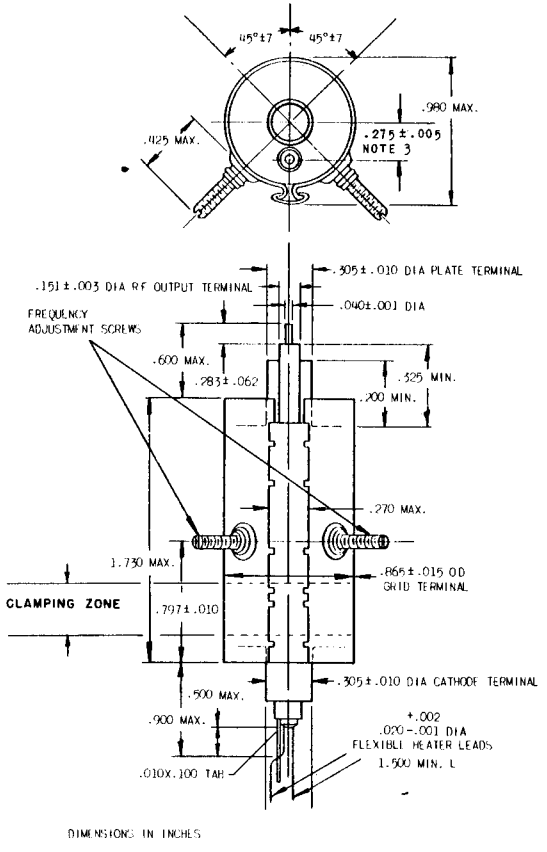
OUTLINE



DIMENSIONS IN INCHES

NOTES:

1. THE AXES OF THE INNER AND OUTER CONDUCTORS OF THE COAXIAL OUTPUT TERMINAL COINCIDE WITHIN 0.010".

2. THE END OF THE INSULATOR IN THE COAXIAL OUTPUT TERMINAL ALIGNS WITH THE EDGE OF THE OUTER CONDUCTOR (0.151" ±0.003" DIAMETER) WITHIN 0.005"

3. DISTANCE BETWEEN CENTERLINE OF PLATE TERMINAL AND CENTER LINE OF INNER CONDUCTOR (0.040" ±0.001" DIAMETER).

CONTINUED ON FOLLOWING PAGE

CONTINUED FROM PRECEDING PAGE

OPERATION AS CLASS C OSCILLATOR

OPERATING FREQUENCY	1680	MC/S
CHARACTERISTICS IMPEDANCE OF COAXIAL OUTPUT TERMINAL (APPROX.)	50	Ω
DC PLATE SUPPLY VOLTAGE	117	VOLTS
GRID RESISTOR - ADJUSTED FOR STATED PLATE CURRENT AVG. VALUE	1500	Ω
DC PLATE CURRENT	27	MA.
DC GRID CURRENT	4.5	MA.
USEFUL POWER OUTPUT (APPROX.)	575	MW.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.	MAX.	
TUNING RANGE	1660	1700	MC/S
LOAD ADJUSTED FOR VOLTAGE STANDING WAVE RATIO		1.1	
HEATER CURRENT AT Ef = 5.2 V.	135	157	MA.
GRID RESISTOR - SEE NOTE	1300	2400	Ω
USEFUL POWER OUTPUT AT Ef = 5.2 V., Ebb = 95 V.	250	------	MW.

SPECIAL TESTS AND PERFORMANCE DATA

CONTROLLED ON A SAMPLING BASIS

LOW-PRESSURE VOLTAGE BREAKDOWN TEST

HIGH-FREQUENCY VIBRATION TEST

MILITARY SPECIFICATIONS SHORTS AND CONTINUITY TEST PERFORMED ON ALL DEVICES

TEMPERATURE-FREQUENCY PERFORMANCE

5 HOUR RADIOSONDE LIFE PERFORMANCE TEST

NOTE:

ADJUSTED TO GIVE PLATE CURRENT AS CLOSE AS POSSIBLE, BUT NOT EXCEEDING 33 MA. OPERATE WITH Ef = 6.6 V., Ebb = 117 V., PLATE LOAD RESISTANCE OF 50 Ω, FREQUENCY ADJUSTED TO 1660 +3, −1 MC/S.

PRINTED IN U.S.A.

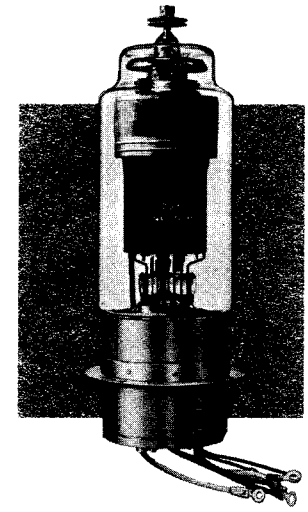
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBES TYPE 7559

MARCH, 1963

CROWBAR THYRATRON



—The 7559 is a zero bias hydrogen thyratron designed to pass high currents in "crowbar" protective circuits. As described in the application notes, destructive arc currents are short circuited by the crowbar tube before damage occurs to other tubes or circuit elements.

The instantaneous response, and ability to repeatedly carry extremely large currents, makes the hydrogen thyratron particularly attractive for this application. One type 7559 can handle a peak current of 1500 Amperes at 25 Kilovolts. This tube contains a hydrogen reservoir which promotes long life and permits optimum gas pressure adjustment for various conditions of operation.

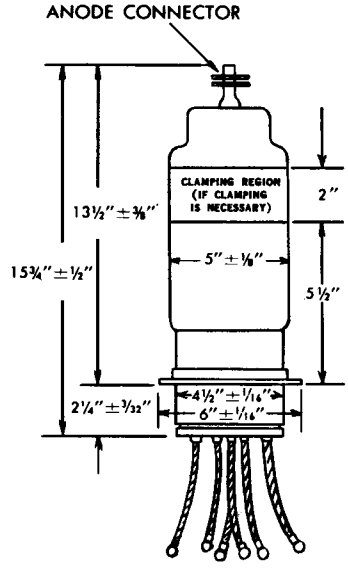
This tube was designed into some circuits under development type designation CH1096.

ELECTRICAL DATA

	Min	Bogey	Max	
Cathode Heater Voltage	6.0	6.3	6.6	Volts
Cathode Heater Current (at Ef = 6.3 volts)	27	30	33	Amperes
Cathode Heating Time	3	—	—	Minutes
Reservoir Voltage	2.5	Marked on base	5.5	Volts
Reservoir Current	—	—	6.5	Amperes
Reservoir Heating Time	3	—	—	Minutes

MECHANICAL DATA

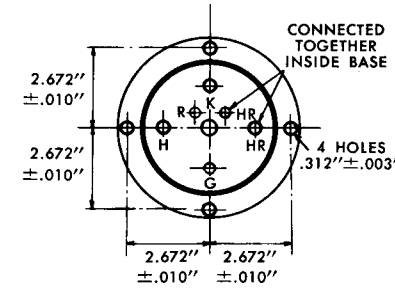
Type of Cooling	Convection
Max Net Weight	4⅝ pounds
Mounting Position	Vertical, Base down
Dimensions: See outline drawings	



OUTLINE DRAWING

MAXIMUM RATINGS — ABSOLUTE VALUES

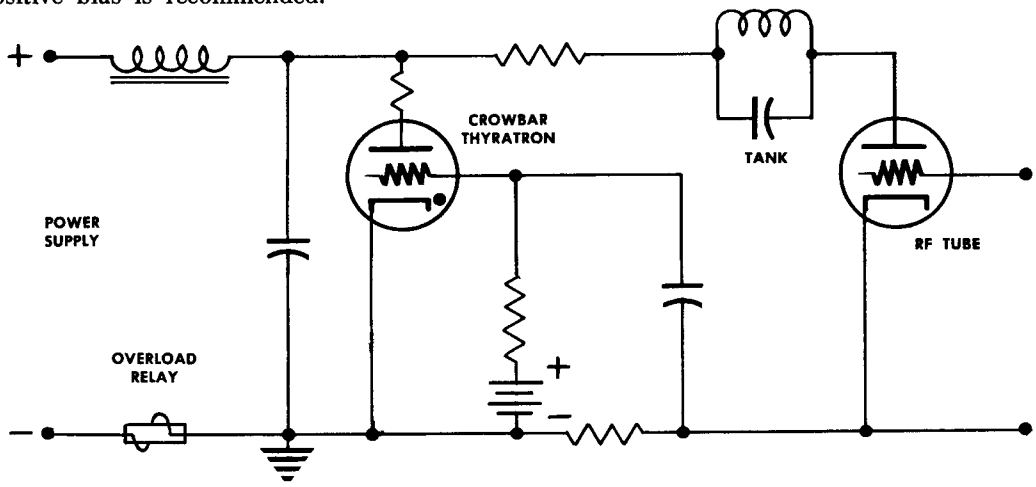
	Min	Max	
D-C Anode Voltage			
Forward	5	25	Kilovolts
Inverse	—	15	Kilovolts
Cathode Current			
Peak			
Filter discharge period			
0 to 1.5 Milliseconds	—	1500 or 1.0	Amperes Coulomb
Rectifier short circuit period			
1.5 to 100 Milliseconds	—	50	Amperes
1.5 to 50 Milliseconds	—	100	Amperes
1.5 to 30 Milliseconds	—	170	Amperes
Average	—	1	Ampere
Conduction Time per Fault	—	0.1	Second
Averaging Time	—	10	Seconds
Recovery Time	—	75	Microseconds
D-C Grid Bias	+100	+200	Volts
D-C Grid Bias Current	5	10	Milliamperes
Grid Signal Voltage	1000	2500	Volts
Grid Impedance	50	200	Ohms
Grid Voltage Rate of Rise	1800	—	Volts per microsecond
Anode Delay Time	—	0.6	Microsecond
Anode Voltage Drop	50	300	Volts
Ambient Temperature Range	−55	+75	Degrees Centigrade



BOTTOM VIEW

APPLICATION NOTES

In a typical application, a crowbar thyratron is connected in series with a suitable impedance across the filter of the high voltage power supply for a high frequency triode amplifier. Whenever an arc occurs in the amplifier tube, the rising current is used to deliver a suitable signal to the grid of the thyratron. The thyratron immediately conducts to short circuit the power supply until the protective circuit breaker opens approximately 0.1 second later. To insure minimum anode delay time, positive bias is recommended.



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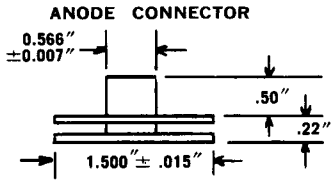
The Fault Diverter — A Protective Device for High-Power Electron Tubes. Report UCRL-3701 Rev. University of California, Radiation Laboratories, Berkeley, Calif.

PARKER, W. N.
and
HOOVER, M. V.:
Gas Tubes Protect High-Power Transmitters. Electronics, Jan. 1956.

DOOLITTLE, H. D.:
High Powered Hydrogen Thyratrons. Cathode Press, V1, P6, 1954.

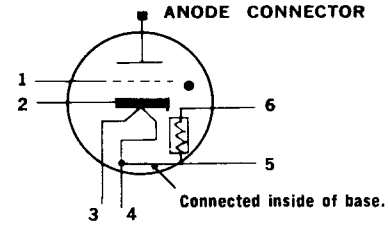


LEAD CONNECTIONS

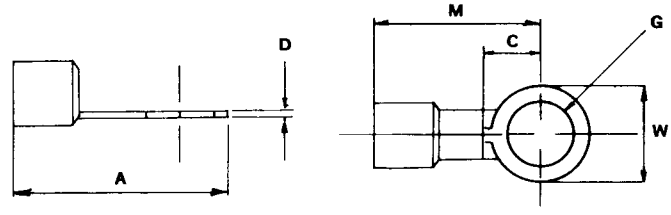
Lead	Function	Lead Color	Lug Color	Lug
1	Grid	Green	Green	S
2	Cathode & Heater C-T	Black	Black	L
3	Heater	Yellow	Yellow	L
4	Heater	Yellow	Black	L
5	Reservoir	Red	Yellow	S
6	Reservoir	Red	Red	S

Leads are flexible 5½″ ±½″ long from bottom of base to center of lug hole. Color coding as well as base marking identifies the leads.

BASING CONNECTIONS



LUG DIMENSIONS



LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	¼″	1.21″	.53″	.41″	.04″	.94″
S	#10	.90″	.31″	.30″	.03″	.74″

TUNG-SOL / CHATHAM

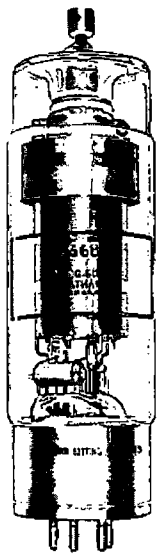
CROWBAR THYRATRON

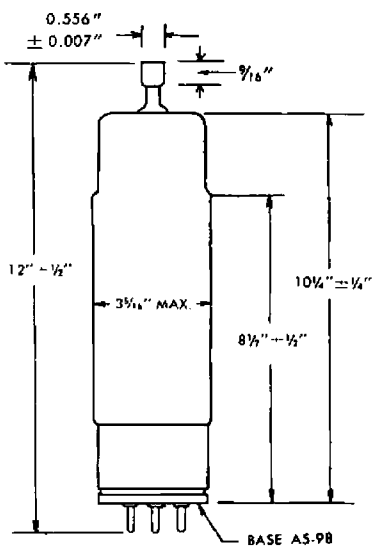
TYPE 7568

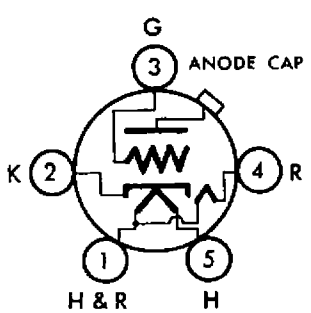
DESCRIPTION: The 7568 is a zero bias hydrogen thyratron designed to pass high currents in "crowbar" protective circuits. As described in the application notes, destructive arc currents are short circuited by the crowbar tube before damage occurs to other tubes or circuit elements.

The instantaneous response, and ability to repeatedly carry extremely large currents, makes the hydrogen thyratron particularly attractive for this application. One type 7568 can handle a peak current of 800 Amperes at 25 Kilovolts. This tube contains a fast warmup hydrogen reservoir which promotes long life and permits optimum gas pressure adjustment for various conditions of operation.

This tube type was designed into some circuits under development type designation CH1095.







BOTTOM VIEW

ELECTRICAL DATA

	Min	Bogey	Max	
Cathode Heater Voltage	6.0	6.3	6.6	Volts
Cathode Heater Current (at Ef = 6.3 volts)	15	16	22	Amperes
Cathode Heating Time	3			Minutes
Reservoir Voltage	2.5	Marked on base	5.5	Volts
Reservoir Current			6.5	Amperes
Reservoir Heating Time	3			Minutes

MECHANICAL DATA

Type of Cooling	Convection
Maximum Net Weight	2¼ lbs
Mounting Position	Any
Dimensions	See Outline Drawing

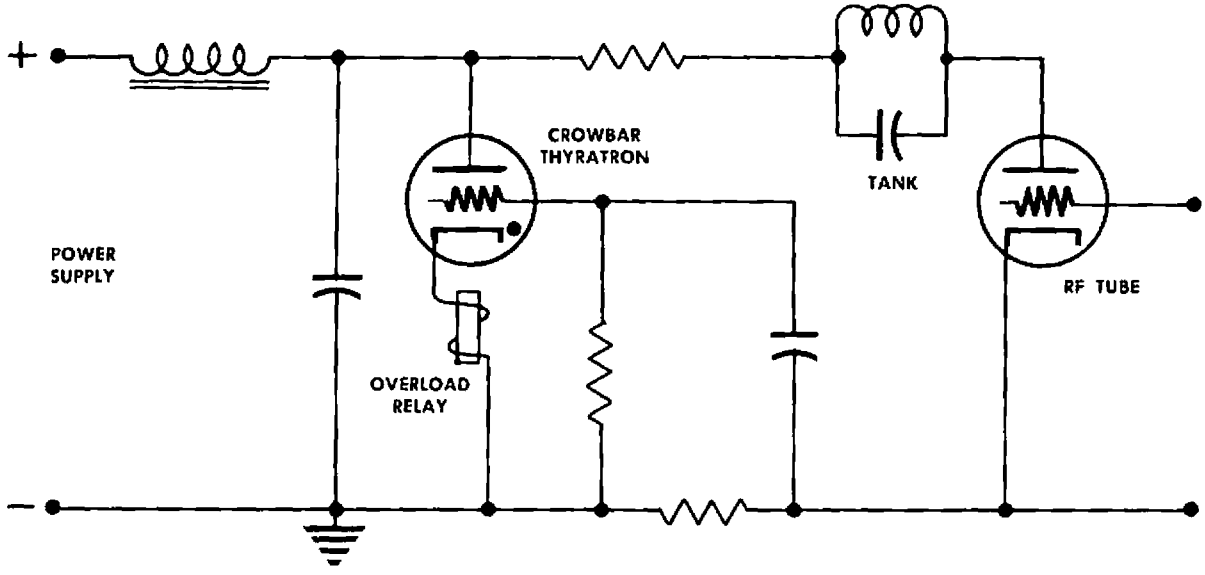
MAXIMUM RATINGS — ABSOLUTE VALUES

	Min	Max	
D-C Anode Voltage			
Forward	5	25	Kilovolts
Inverse		15	Kilovolts
Cathode Current			
Peak			
Filter discharge period			
0 to 1.5 Microseconds		800 or 0.8	Amperes Coulomb
Rectifier short circuit period			
1.5 to 100 Microseconds		40	Amperes
1.5 to 50 Microseconds		80	Amperes
1.5 to 30 Microseconds		125	Amperes
Average		0.5	Ampere
Conduction Time per Fault		0.1	Second
Averaging Time		10	Seconds
Recovery Time		50	Microseconds
Grid Signal Voltage	1000	2500	Volts
Grid Impedance	50	200	Ohms
Grid Voltage Rate of Rise	1800		Volts per Microsecond
Anode Delay Time		0.6	Microsecond
Anode Voltage Drop	50	300	Volts
Ambient Temperature Range	−55	+75	Degrees Centigrade

from JEDEC release #2849, June 20, 1960

Application Notes

In a typical application, a crowbar thyratron is connected in series with a suitable impedance across the filter of the high voltage power supply for a high frequency triode oscillator. Whenever an arc occurs in the oscillator tube, the rising current is used to deliver a suitable signal to the grid of the thyratron. The thyratron immediately conducts to short circuit the power supply until the protective circuit breaker opens 0.1 second later. In this latter case, the oscillator tube is protected with a minimum interruption in operating time.



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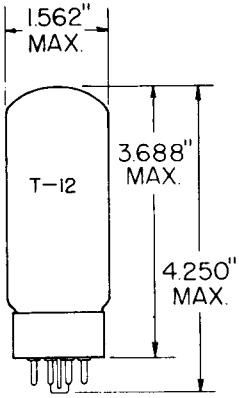
Gas Tubes Protect High-Power Transmitters. Electronics, Jan. 1956.

DOOLITTLE, H. D.:
High Powered Hydrogen Thyratrons. Cathode Press, VI, P6, 1954.

TUNG-SOL

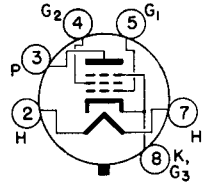
BEAM-POWER PENTODE



GLASS BULB
SHORT MEDIUM SHELL
6 PIN OCTAL B6-248
LOW LOSS MATERIAL
OUTLINE DRAWING
JEDEC 19-15

COATED UNIPOTENTIAL CATHODE

AUDIO-FREQUENCY POWER AMPLIFIER



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7AC

THE 7581 IS A BEAM-POWER PENTODE PRIMARILY DESIGNED FOR USE IN AUDIO-FREQUENCY POWER-AMPLIFIER APPLICATIONS. THE TUBE IS A DIRECT REPLACEMENT FOR THE 6L6GC, BUT FEATURES ADDITIONAL CONTROLLED ZERO-BIAS CHARACTERISTICS AND A LOW-LOSS BASE.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
INPUT	10	pf
OUTPUT	6.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	900	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
HEATER-CATHODE VOLTAGE, MAX.			
HEATER POSITIVE WITH RESPECT TO CATHODE	200⊕	200●	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200⊕	200●	VOLTS

⊕PENTODE CONNECTION.

●TRIODE CONNECTION.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

→ DESIGN MAXIMUM VALUES – SEE EIA STANDARD RS-239

	PENTODE CONNECTION	TRIODE CONNECTION[A]	
PLATE VOLTAGE	500	450	VOLTS
SCREEN VOLTAGE	450[B]	---	VOLTS
PLATE DISSIPATION	30	---	WATTS
SCREEN DISSIPATION	5.0	---	WATTS
GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.1	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	0.5	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	70	250	VOLTS
SCREEN VOLTAGE	300	250	VOLTS
GRID #1 VOLTAGE	0[C]	-14	VOLTS
PEAK AF GRID #1 VOLTAGE	---	14	VOLTS
PLATE RESISTANCE, APPROX.	---	22500	OHMS
TRANSCONDUCTANCE	---	6000	MICROMHOS
PLATE CURRENT	210	72	MA.
SCREEN CURRENT	25	5.0	MA.

CLASS A_1 AMPLIFIER – TRIODE CONNECTION[A]

PLATE VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-20	VOLTS
PEAK AF GRID #1 VOLTAGE	20	VOLTS
AMPLIFICATION FACTOR	8	
PLATE RESISTANCE, APPROX.	1700	OHMS
TRANSCONDUCTANCE	4700	MICROMHOS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAXIMUM-SIGNAL PLATE CURRENT	44	MA.
LOAD RESISTANCE	5000	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	1.4	WATTS

CLASS A_1 AMPLIFIER – PENTODE CONNECTION

PLATE VOLTAGE	250	300	350	VOLTS
SCREEN VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	-14	-12.5	-18	VOLTS
PEAK AF GRID #1 VOLTAGE	14	12.5	18	VOLTS
PLATE RESISTANCE, APPROX.	22500	35000	33000	OHMS
TRANSCONDUCATANCE	6000	5300	5200	MICROMHOS
ZERO-SIGNAL PLATE CURRENT	72	48	54	MA.
MAX.-SIGNAL PLATE CURRENT	79	55	66	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	2.5	2.5	MA.
MAX.-SIGNAL SCREEN CURRENT	7.3	4.7	7.0	MA.
LOAD RESISTANCE	2500	4500	4200	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	10	11	15	PERCENT
MAX.-SIGNAL POWER OUTPUT	6.5	6.5	10.8	WATTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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TYPICAL OPERATING CHARACTERISTICS - CONT'D.

PUSH-PULL CLASS A_1 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	250	270	VOLTS
SCREEN VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	32	35	VOLTS
ZERO-SIGNAL PLATE CURRENT	120	134	MA.
MAX.-SIGNAL PLATE CURRENT	140	155	MA.
ZERO-SIGNAL SCREEN CURRENT	10	11	MA.
MAX.-SIGNAL SCREEN CURRENT	16	17	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	5000	5000	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAX.-SIGNAL POWER OUTPUT	14.5	17.5	WATTS

PUSH-PULL CLASS AB_1 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	450	VOLTS
SCREEN VOLTAGE	270	270	400	VOLTS
GRID #1 VOLTAGE	-22.5	-22.5	-37	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	45	45	70	VOLTS
ZERO-SIGNAL PLATE CURRENT	88	88	116	MA.
MAX.-SIGNAL PLATE CURRENT	132	140	210	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	5.0	5.6	MA.
MAX.-SIGNAL SCREEN CURRENT	15	11	22	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	6600	3800	5600	OHMS
TOTAL HARMONIC DISTORTION	2	2	1.8	PERCENT
MAX.-SIGNAL POWER OUTPUT	26.5	18	55	WATTS

PUSH-PULL CLASS AB_2 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	VOLTS
SCREEN VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	52	72	VOLTS
ZERO-SIGNAL PLATE CURRENT	78	88	MA.
MAX.-SIGNAL PLATE CURRENT	142	205	MA.
ZERO-SIGNAL SCREEN CURRENT	3.5	5.0	MA.
MAX.-SIGNAL SCREEN CURRENT	11	16	MA.
EFFECTIVE LOAD RESISTANCE, PLATE TO PLATE	6000	3800	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAX.-SIGNAL POWER OUTPUT	31	47	WATTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH SCREEN CONNECTED TO PLATE.

[B] THE MAXIMUM SCREEN VOLTAGE RATING IS 500 VOLTS IN PUSH-PULL CIRCUITS WHERE THE SCREEN OF EACH TUBE IS CONNECTED TO A TAP ON THE PLATE WINDING OF THE OUTPUT TRANSFORMER.

[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

CONTINUED ON FOLLOWING.

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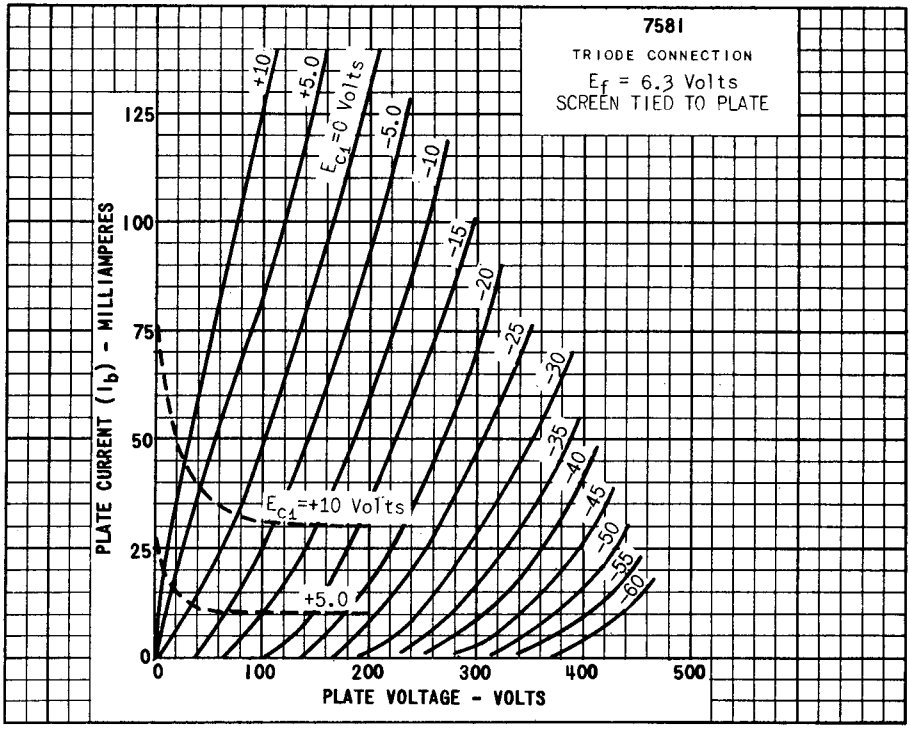
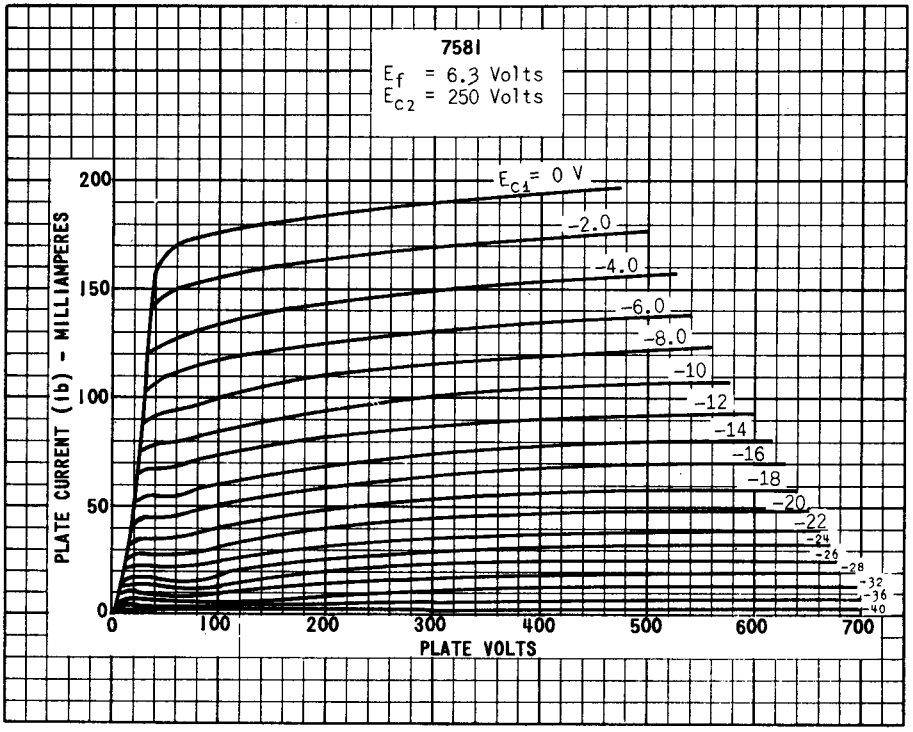
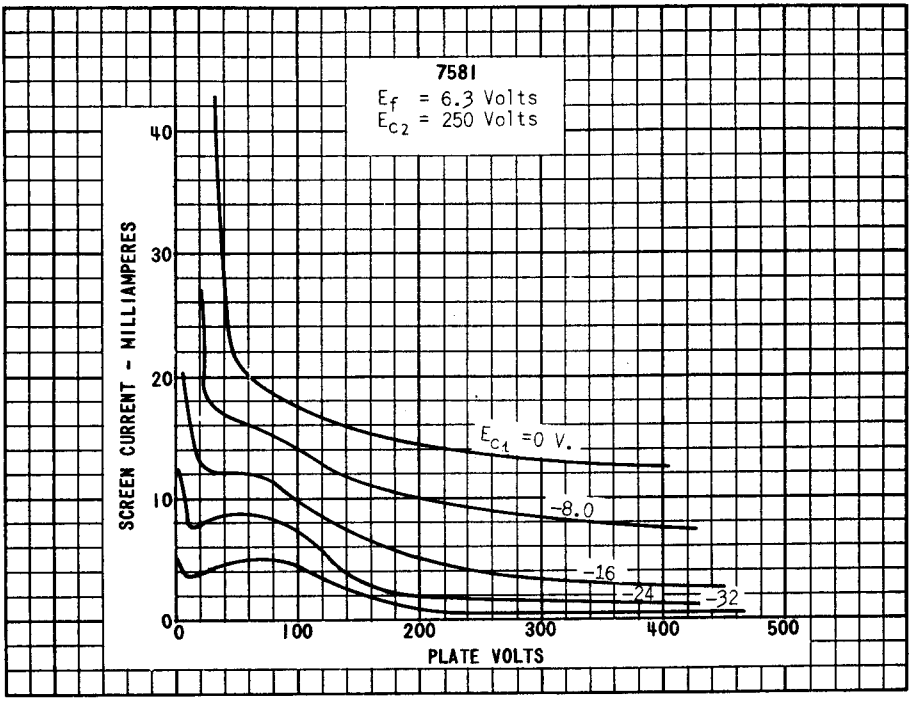
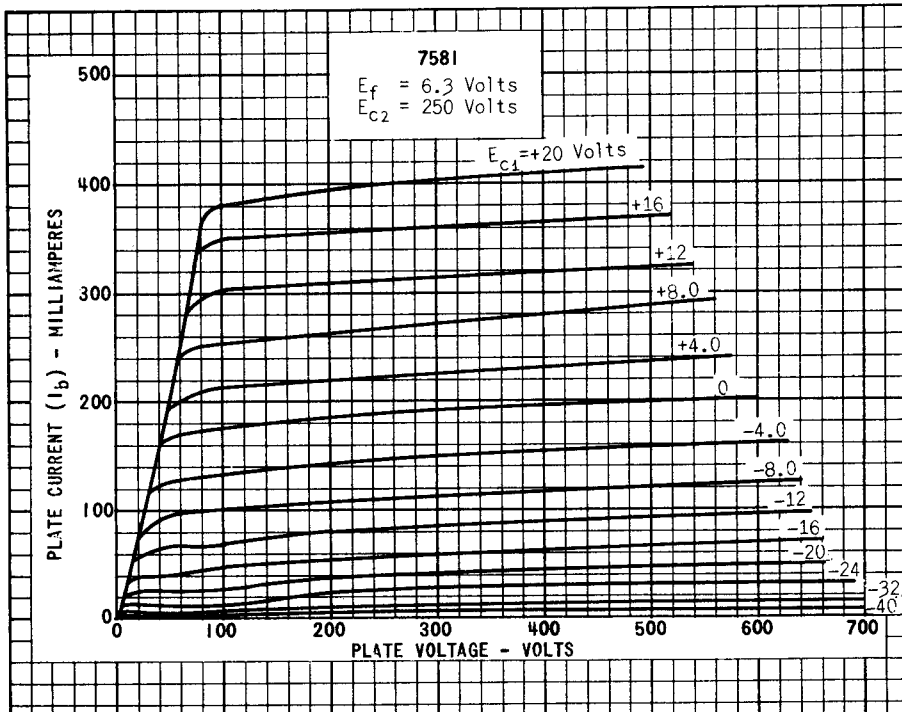

7581
TRIODE CONNECTION
E_f = 6.3 Volts
SCREEN TIED TO PLATE
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE - VOLTS
E_{c1}=+10 Volts
+5.0
E_{c1}=0 Volts
+10
+5.0
-5.0
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
0
25
50
75
100
125
0
100
200
300
400
500


7581
E_f = 6.3 Volts
E_{c2} = 250 Volts
PLATE CURRENT (Ib) - MILLIAMPERES
PLATE VOLTS
E_{c1}= 0 V
-2.0
-4.0
-6.0
-8.0
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-32
-36
-40
0
50
100
150
200
0
100
200
300
400
500
600
700





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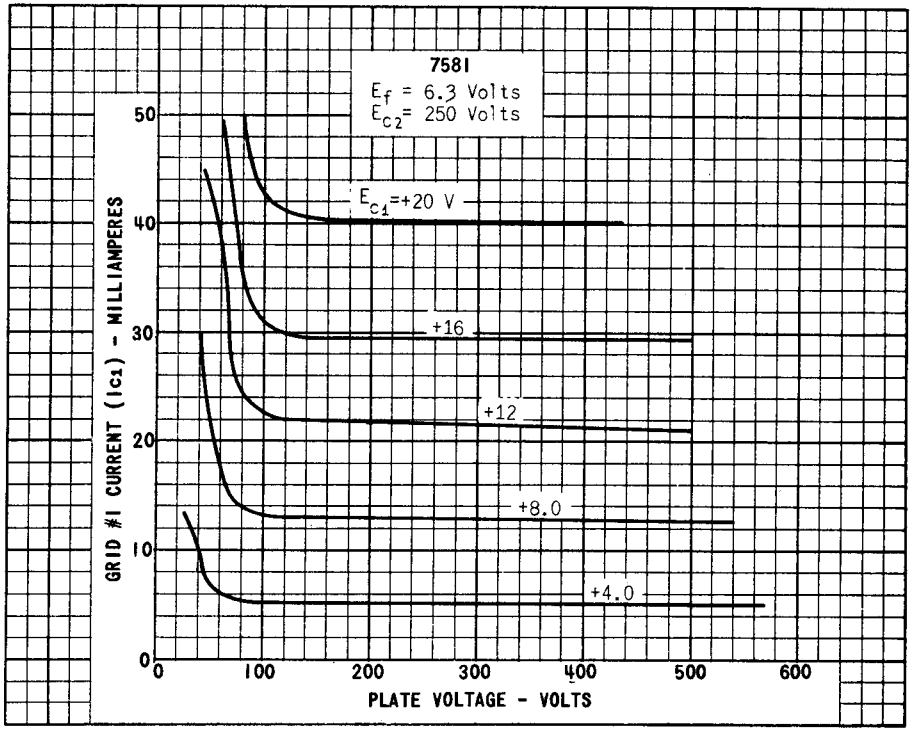
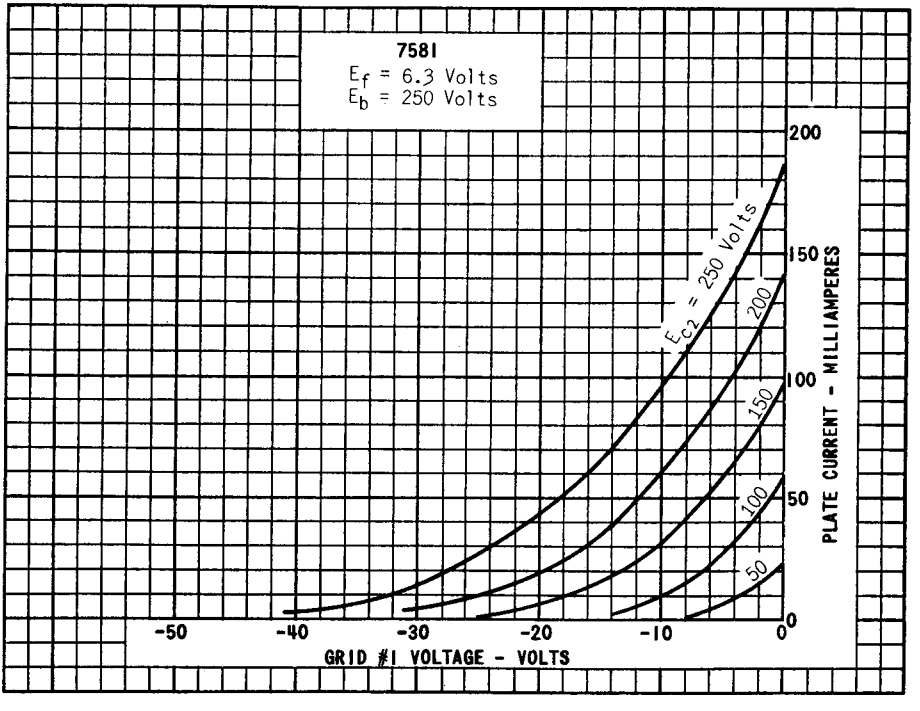
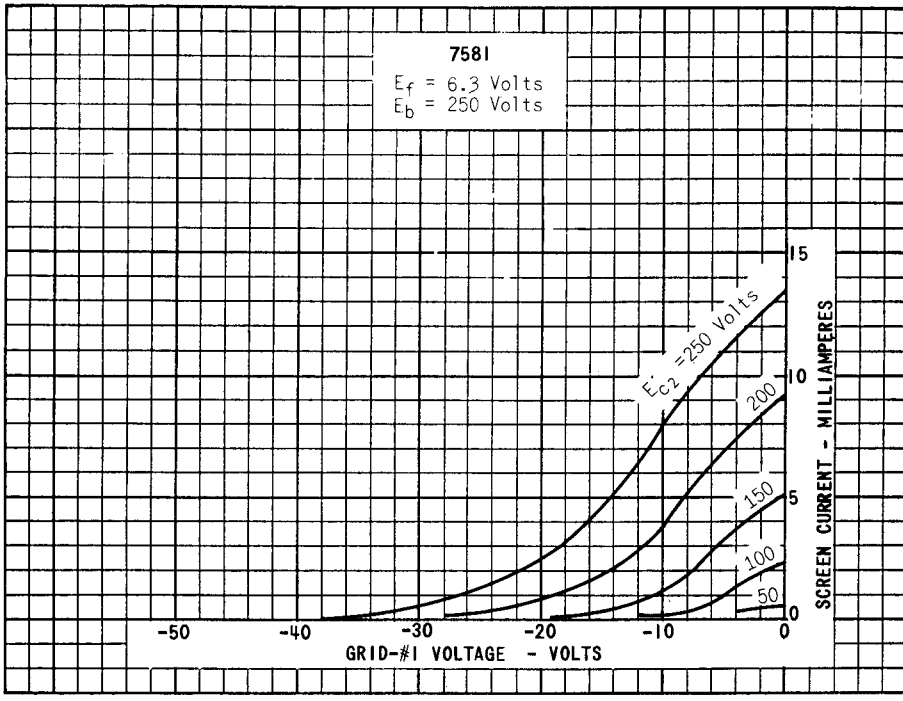
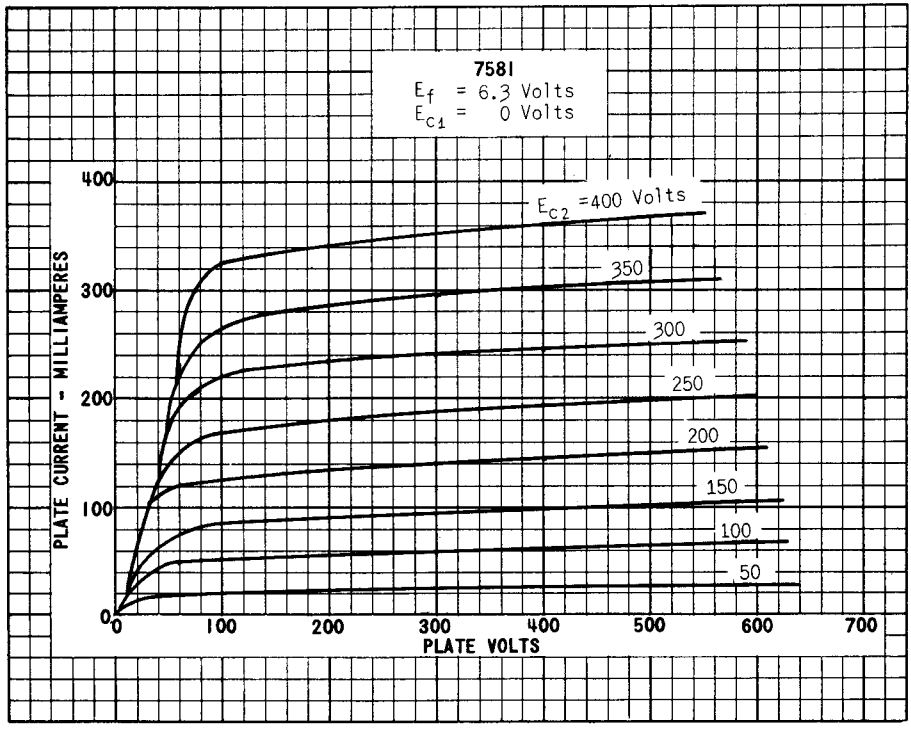

7581
E_f = 6.3 Volts
E_{c2}= 250 Volts
E_{c1}=+20 V
+16
+12
+8.0
+4.0
GRID #1 CURRENT (I_{c1}) - MILLIAMPERES
0
10
20
30
40
50
0
100
200
300
400
500
600
PLATE VOLTAGE - VOLTS


7581
E_f = 6.3 Volts
E_b = 250 Volts
E_{c2} = 250 Volts
200
150
100
50
PLATE CURRENT - MILLIAMPERES
0
50
100
150
200
-50
-40
-30
-20
-10
0
GRID #1 VOLTAGE - VOLTS





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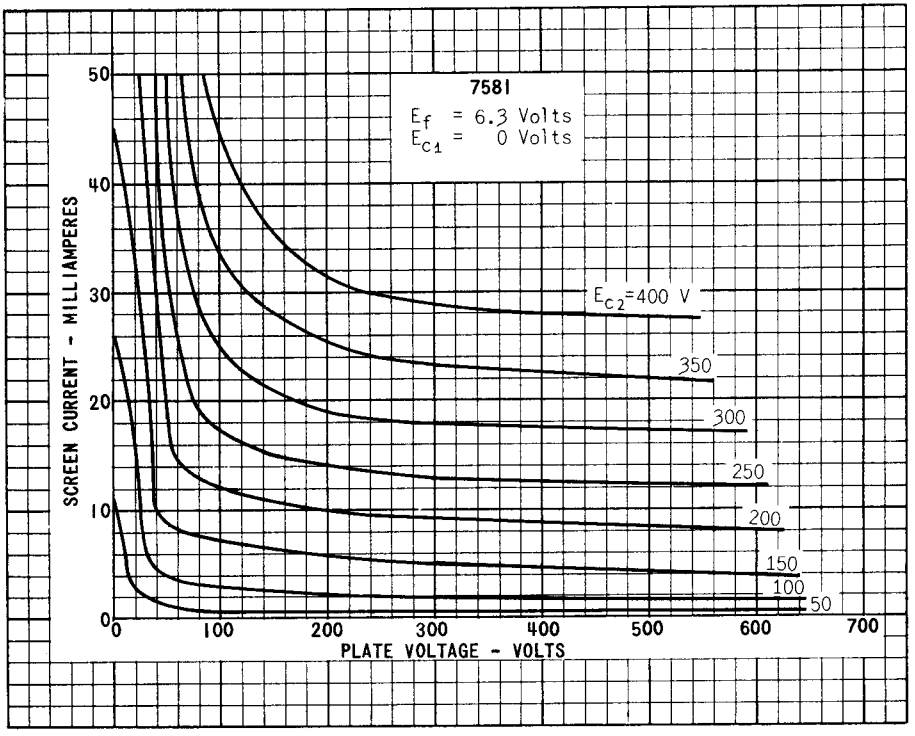
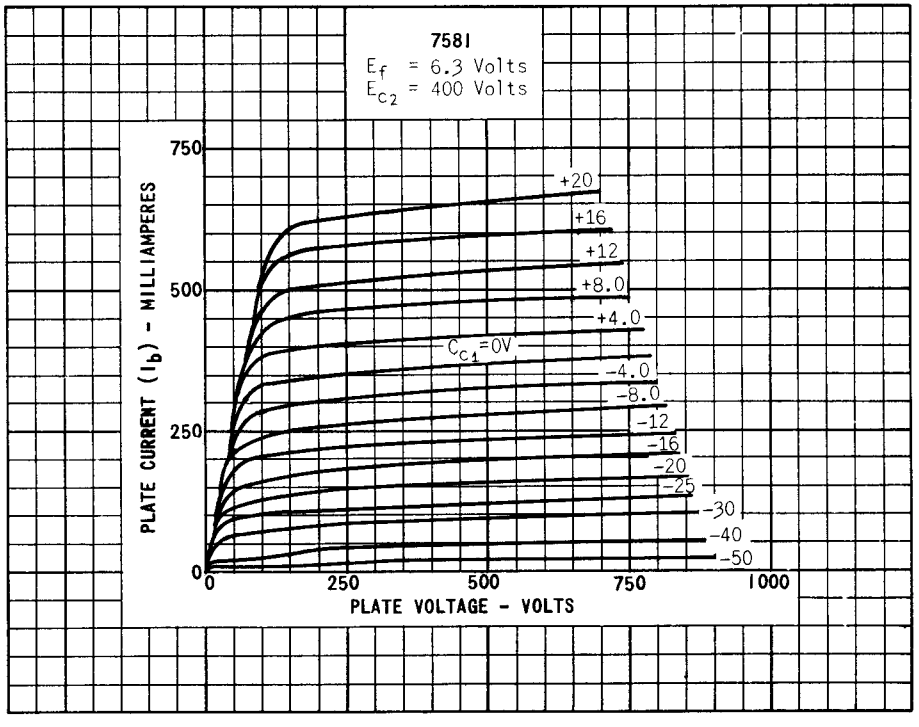
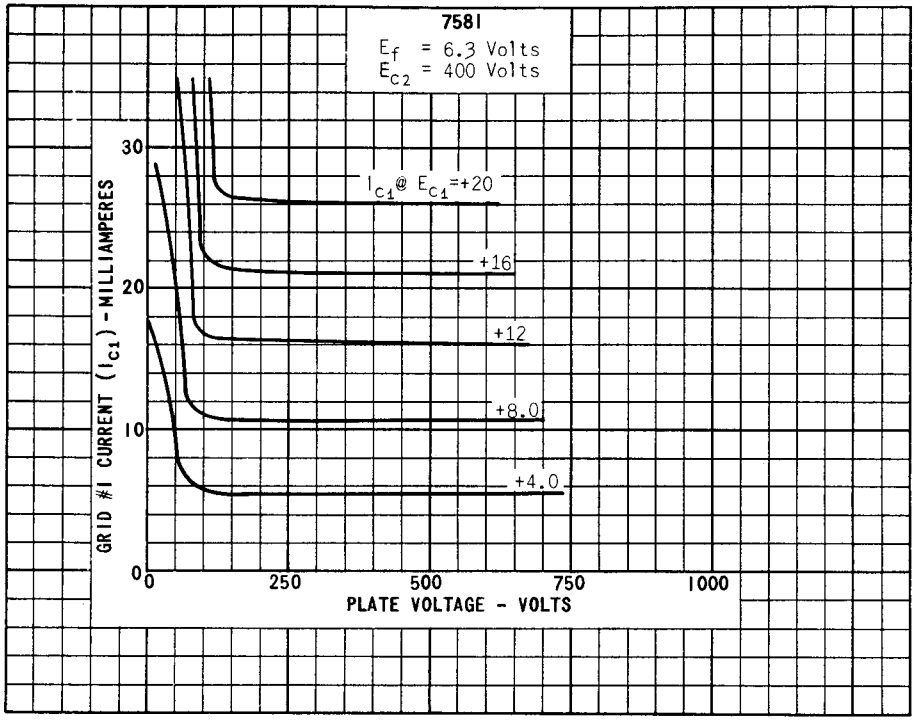
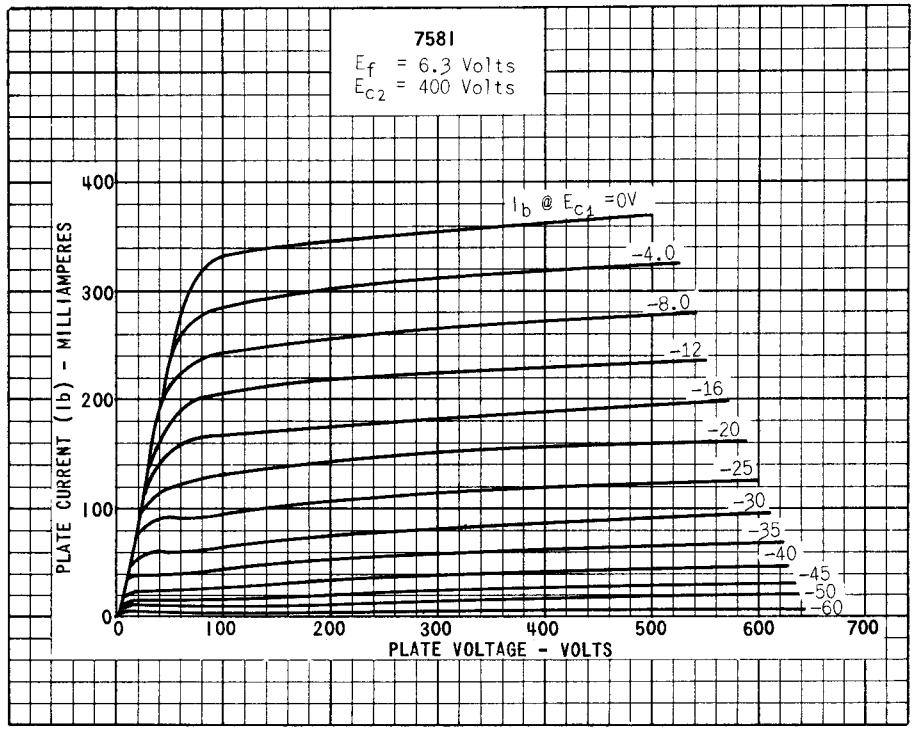

7581
E_f = 6.3 Volts
E_{c_1} = 0 Volts
SCREEN CURRENT - MILLIAMPERES
PLATE VOLTAGE - VOLTS
E_{c_2}=400 V
350
300
250
200
150
100
50
0
10
20
30
40
50
0
100
200
300
400
500
600
700


7581
E_f = 6.3 Volts
E_{c_2} = 400 Volts
PLATE CURRENT (I_b) - MILLIAMPERES
PLATE VOLTAGE - VOLTS
+20
+16
+12
+8.0
+4.0
C_{c_1}=0V
-4.0
-8.0
-12
-16
-20
-25
-30
-40
-50
0
250
500
750
1000





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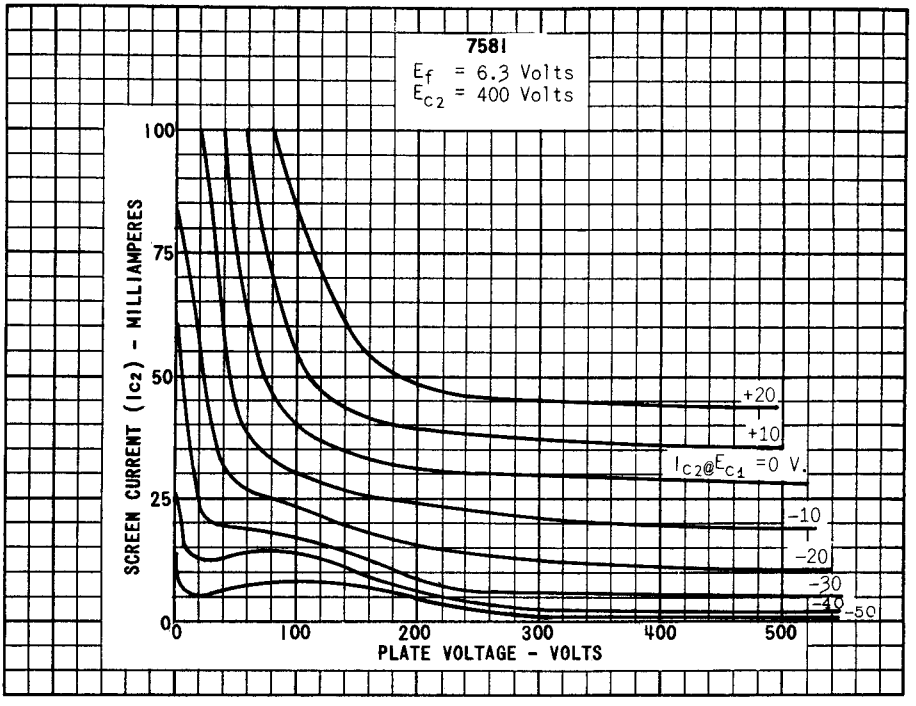
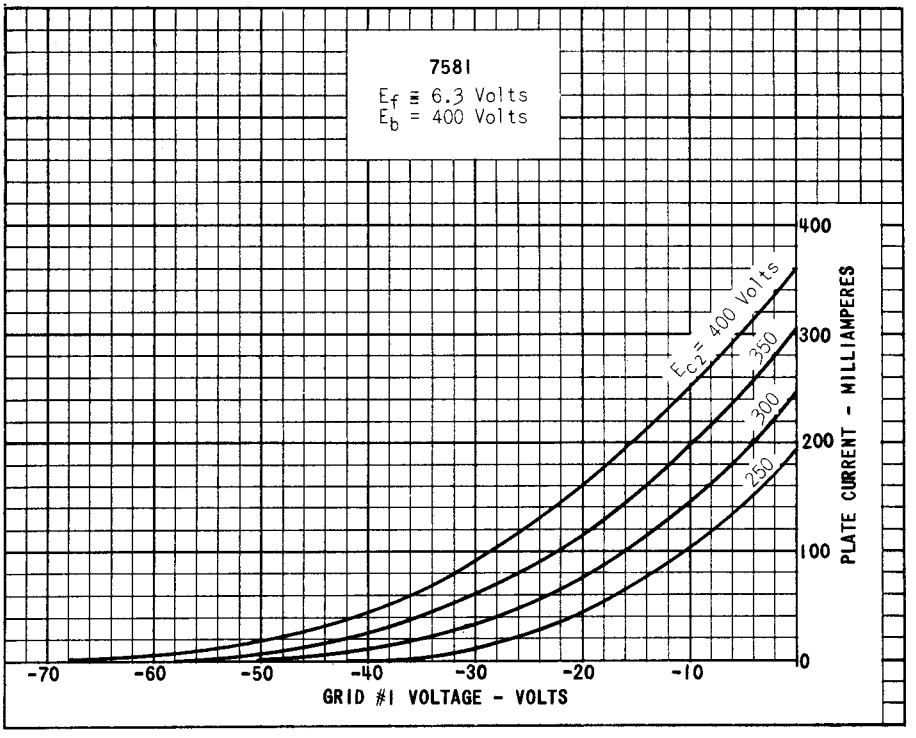
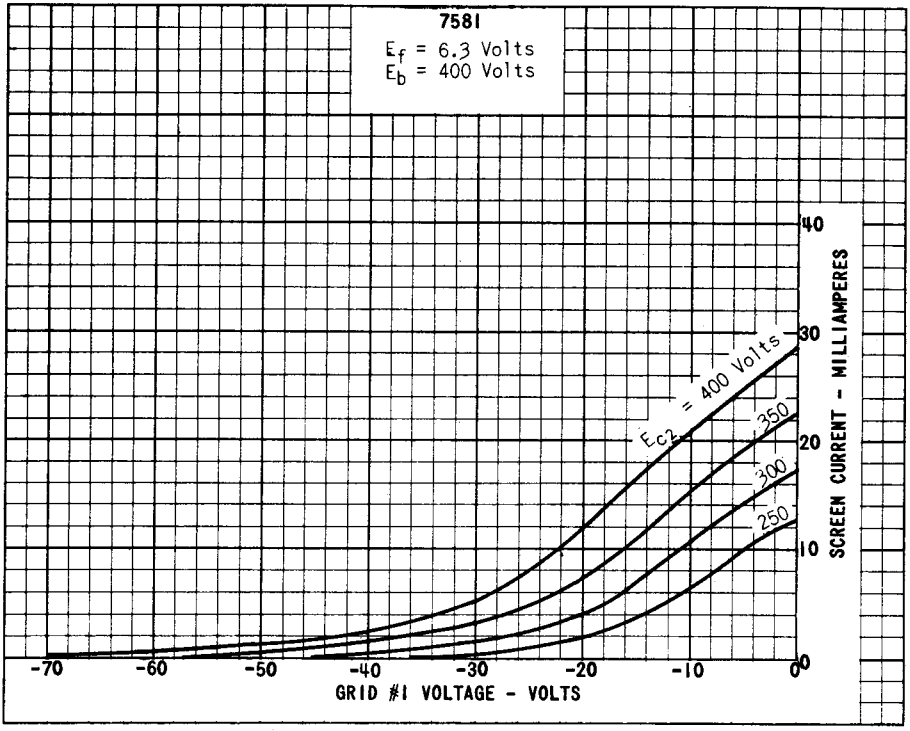
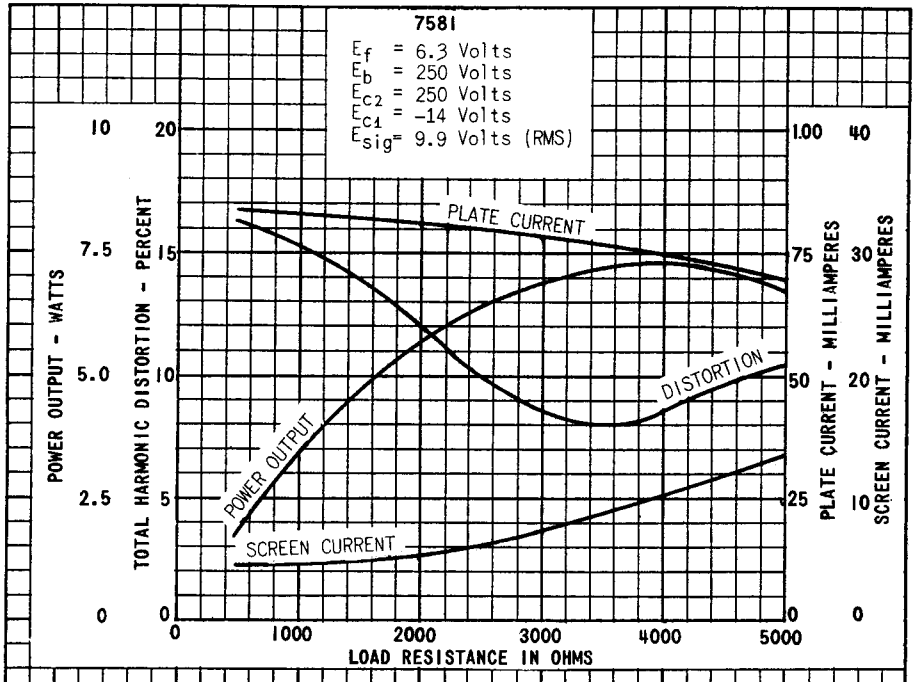
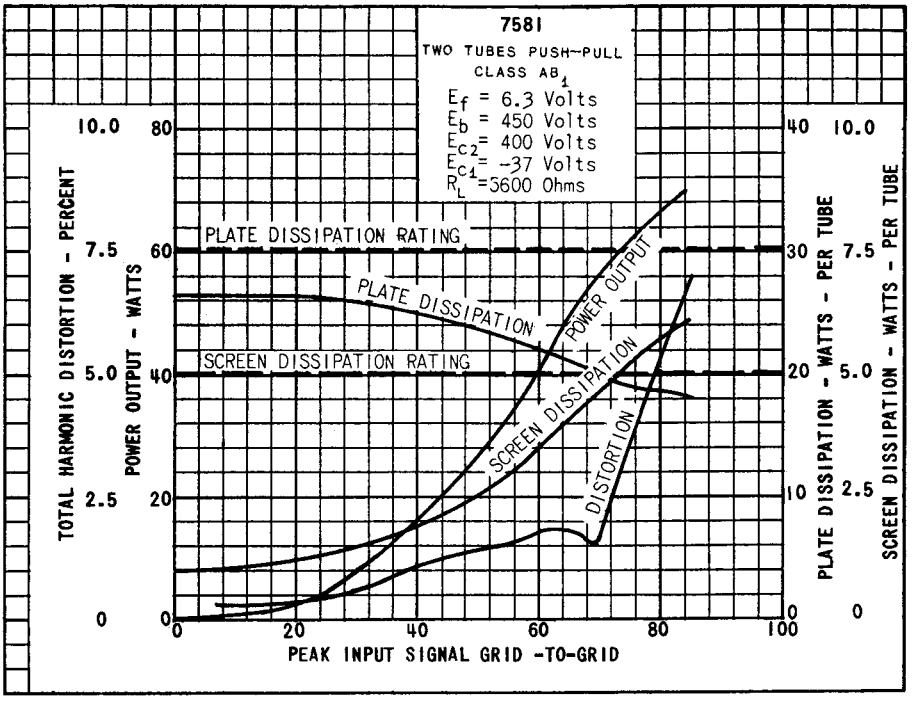

7581
E_f = 6.3 Volts
E_{c2} = 400 Volts
SCREEN CURRENT (I_{c2}) - MILLIAMPERES
100
75
50
25
0
0
100
200
300
400
500
PLATE VOLTAGE - VOLTS
+20
+10
I_{c2}@E_{c1} =0 V.
-10
-20
-30
-40
-50


7581
E_f = 6.3 Volts
E_b = 400 Volts
PLATE CURRENT - MILLIAMPERES
400
300
200
100
0
E_{c2} = 400 Volts
350
300
250
-70
-60
-50
-40
-30
-20
-10
GRID #1 VOLTAGE - VOLTS



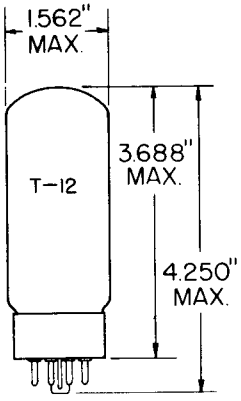


TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A. ,MARCH 1, 1962 PLATE #6422


7581
TWO TUBES PUSH-PULL
CLASS AB1
Ef = 6.3 Volts
Eb = 450 Volts
Ec2 = 400 Volts
Ec1 = -37 Volts
RL = 3600 Ohms
PLATE DISSIPATION RATING
SCREEN DISSIPATION RATING
PLATE DISSIPATION
POWER OUTPUT
SCREEN DISSIPATION
DISTORTION
TOTAL HARMONIC DISTORTION - PERCENT
POWER OUTPUT - WATTS
PLATE DISSIPATION - WATTS - PER TUBE
SCREEN DISSIPATION - WATTS - PER TUBE
PEAK INPUT SIGNAL GRID -TO-GRID
10.0
7.5
5.0
2.5
0
80
60
40
20
0
40
30
20
10
0
100

TUNG-SOL

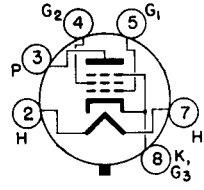
BEAM-POWER PENTODE



GLASS BULB
SHORT MEDIUM SHELL
6 PIN OCTAL B6-148
LOW LOSS MATERIAL
OUTLINE DRAWING
JEDEC 12-15

COATED UNIPOTENTIAL CATHODE

AUDIO-FREQUENCY POWER AMPLIFIER



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7AC

THE 7581A IS A BEAM-POWER PENTODE PRIMARILY DESIGNED FOR USE IN AUDIO-FREQUENCY POWER-AMPLIFIER APPLICATIONS. THE 7581A IS UNILATERALLY INTERCHANGEABLE WITH THE 7581 AND THE 6L6GC.

DIRECT INTERELECTRODE CAPACITANCES - APPROX.

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE	0.6	pf
INPUT	10	pf
OUTPUT	6.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	900	MA.
HEATER SUPPLY LIMITS:			
VOLTAGE OPERATION		6.3±0.6	VOLTS
HEATER-CATHODE VOLTAGE, MAX.			
HEATER POSITIVE WITH RESPECT TO CATHODE	200⊕	200●	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200⊕	200●	VOLTS

⊕PENTODE CONNECTION.

●TRIODE CONNECTION.

CONTINUED ON FOLLOWING PAGE

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MAXIMUM RATINGS

→ DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	PENTODE CONNECTION	TRIODE[A] CONNECTION	
PLATE VOLTAGE	500	450	VOLTS
SCREEN VOLTAGE	450[B]	---	VOLTS
PLATE DISSIPATION	35	35	WATTS
SCREEN DISSIPATION	5.0	---	WATTS
GRID #1 CIRCUIT RESISTANCE:			
WITH FIXED BIAS	0.1	0.1	MEGOHMS
WITH CATHODE BIAS	0.5	0.5	MEGOHMS

TYPICAL OPERATING CHARACTERISTICS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	70	250	**VOLTS**
SCREEN VOLTAGE	300	250	**VOLTS**
GRID #1 VOLTAGE	0[C]	-14	**VOLTS**
PLATE RESISTANCE, APPROX.	---	22500	OHMS
TRANSCONDUCTANCE	---	6000	MICROMHOS
PLATE CURRENT	210	72	MA.
SCREEN CURRENT	25	5.0	MA.

CLASS A_1 AMPLIFIER - TRIODE CONNECTION[A]

PLATE VOLTAGE	250	VOLTS
GRID #1 VOLTAGE	-20	VOLTS
PEAK AF GRID #1 VOLTAGE	20	VOLTS
AMPLIFICATION FACTOR	8	
PLATE RESISTANCE, APPROX.	1700	OHMS
TRANSCONDUCTANCE	4700	MICROMHOS
ZERO-SIGNAL PLATE CURRENT	40	MA.
MAXIMUM-SIGNAL PLATE CURRENT	44	MA.
LOAD RESISTANCE	5000	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	5	PERCENT
MAXIMUM-SIGNAL POWER OUTPUT	1.4	WATTS

CLASS A_1 AMPLIFIER - PENTODE CONNECTION

PLATE VOLTAGE	250	300	350	VOLTS
SCREEN VOLTAGE	250	200	250	VOLTS
GRID #1 VOLTAGE	-14	-12.5	-18	VOLTS
PEAK AF GRID #1 VOLTAGE	14	12.5	18	VOLTS
PLATE RESISTANCE, APPROX.	22500	35000	33000	OHMS
TRANSCONDUCATANCE	6000	5300	5200	MICROMHOS
ZERO-SIGNAL PLATE CURRENT	72	48	54	MA.
MAX.-SIGNAL PLATE CURRENT	79	55	66	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	2.5	2.5	MA.
MAX.-SIGNAL SCREEN CURRENT	7.3	4.7	7.0	MA.
LOAD RESISTANCE	2500	4500	4200	OHMS
TOTAL HARMONIC DISTORTION, APPROX.	10	11	15	PERCENT
MAX.-SIGNAL POWER OUTPUT	6.5	6.5	10.8	WATTS

CONTINUED ON FOLLOWING PAGE

→ INDICATES A CHANGE.

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CHARACTERISTICS - CONT'D.

PUSH-PULL CLASS A_1 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	250	270	VOLTS
SCREEN VOLTAGE	250	270	VOLTS
GRID #1 VOLTAGE	-16	-17.5	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	32	35	VOLTS
ZERO-SIGNAL PLATE CURRENT	120	134	MA.
MAX.-SIGNAL PLATE CURRENT	140	155	MA.
ZERO-SIGNAL SCREEN CURRENT	10	11	MA.
MAX.-SIGNAL SCREEN CURRENT	16	17	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	5000	5000	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAX.-SIGNAL POWER OUTPUT	14.5	17.5	WATTS

PUSH-PULL CLASS AB_1 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	450	VOLTS
SCREEN VOLTAGE	270	270	400	VOLTS
GRID #1 VOLTAGE	-22.5	-22.5	-37	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	45	45	70	VOLTS
ZERO-SIGNAL PLATE CURRENT	88	88	116	MA.
MAX.-SIGNAL PLATE CURRENT	132	140	210	MA.
ZERO-SIGNAL SCREEN CURRENT	5.0	5.0	5.6	MA.
MAX.-SIGNAL SCREEN CURRENT	15	11	22	MA.
EFFECTIVE LOAD RESISTANCE, PLATE-TO-PLATE	6600	3800	5600	OHMS
TOTAL HARMONIC DISTORTION	2	2	1.8	PERCENT
MAX.-SIGNAL POWER OUTPUT	26.5	18	55	WATTS

PUSH-PULL CLASS AB_2 AMPLIFIER - VALUES FOR TWO TUBES

PLATE VOLTAGE	360	360	VOLTS
SCREEN VOLTAGE	225	270	VOLTS
GRID #1 VOLTAGE	-18	-22.5	VOLTS
PEAK AF GRID-TO-GRID VOLTAGE	52	72	VOLTS
ZERO-SIGNAL PLATE CURRENT	78	88	MA.
MAX.-SIGNAL PLATE CURRENT	142	205	MA.
ZERO-SIGNAL SCREEN CURRENT	3.5	5.0	MA.
MAX.-SIGNAL SCREEN CURRENT	11	16	MA.
EFFECTIVE LOAD RESISTANCE, PLATE TO PLATE	6000	3800	OHMS
TOTAL HARMONIC DISTORTION	2	2	PERCENT
MAX.-SIGNAL POWER OUTPUT	31	47	WATTS

DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[A] WITH SCREEN CONNECTED TO PLATE.

[B] THE MAXIMUM SCREEN VOLTAGE RATING IS 500 VOLTS IN PUSH-PULL CIRCUITS WHERE THE SCREEN OF EACH TUBE IS CONNECTED TO A TAP ON THE PLATE WINDING OF THE OUTPUT TRANSFORMER.

[C] APPLIED FOR SHORT INTERVAL (TWO SECONDS MAXIMUM) SO AS NOT TO DAMAGE TUBE.

CONTINUED ON FOLLOWING.

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PRODUCT BULLETIN

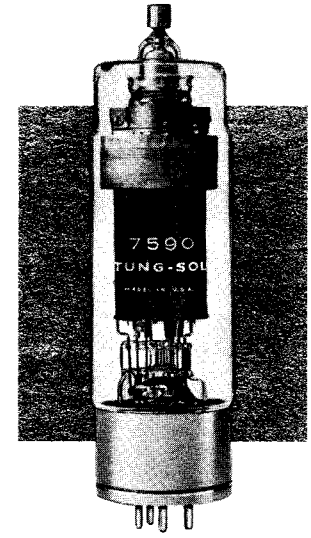
INDUSTRIAL ELECTRON TUBE TYPE 7590

JANUARY 1963

CROWBAR THYRATRON

DESCRIPTION The 7590 is a zero bias hydrogen thyratron designed to pass high currents in "crowbar" protective circuits. As described in the application notes, destructive arc currents are short circuited by the crowbar tube before damage occurs to other tubes or circuit elements.

The instantaneous response, and ability to repeatedly carry extremely large currents, makes the hydrogen thyratron particularly attractive for this application. One type 7590 can handle a peak current of 1000 Amperes at 30 Kilovolts. This tube contains a fast warmup hydrogen reservoir which promotes long life and permits optimum gas pressure adjustment for various conditions of operation.



ELECTRICAL DATA

	Minimum	Bogey	Maximum	
Cathode Heater Voltage	6.0	6.3	6.6	Volts
Cathode Heater Current — Ef = 6.3 volts	12	16	22	Amperes
Cathode Heating Time	3	—	—	Minutes
Reservoir Voltage	2.5	Marked on base	5.5	Volts
Reservoir Current	—	—	6.5	Amperes
Reservoir Heating Time	3	—	—	Minutes

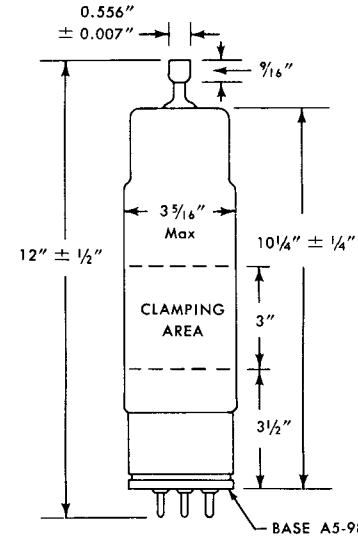
MECHANICAL DATA

Type of Cooling	Convection
Maximum Net Weight	2¼ lbs
Mounting Position	Any
Dimensions	See Outline Drawing

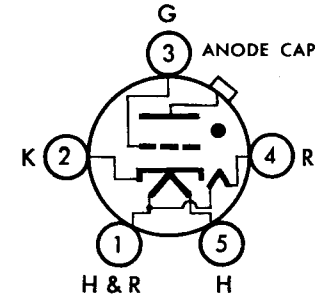
MAXIMUM RATINGS — ABSOLUTE VALUES

	Minimum	Maximum	
D-C Anode Voltage			
Forward — See Note Below	10	25	Kilovolts
Inverse	—	15	Kilovolts
Cathode Current			
Peak			
Filter discharge period			
0 to 1.5 Milliseconds	—	1000	Amperes
		or 0.8	Coulomb
Rectifier short circuit period			
1.5 to 100 Milliseconds	—	25	Amperes
1.5 to 50 Milliseconds	—	50	Amperes
1.5 to 30 Milliseconds	—	85	Amperes
Average	—	0.5	Ampere
Conduction Time per Fault	—	0.1	Second
Averaging Time	—	10	Seconds
Recovery Time	—	50	Microseconds
Grid Signal Voltage	550	2500	Volts
Grid Impedance	50	200	Ohms
Grid Voltage Rate of Rise	1800	—	Volts per Microsecond
Duration of Grid Signal	2	—	Microseconds
Anode Delay Time	—	0.6	Microsecond
Anode Voltage Drop	50	200	Volts
Ambient Temperature Range	−55	+75	Degrees Centigrade

Note: A maximum forward voltage of 30 kilovolts will apply to a transient voltage condition wherein the duration of the transient does not exceed 2 seconds.



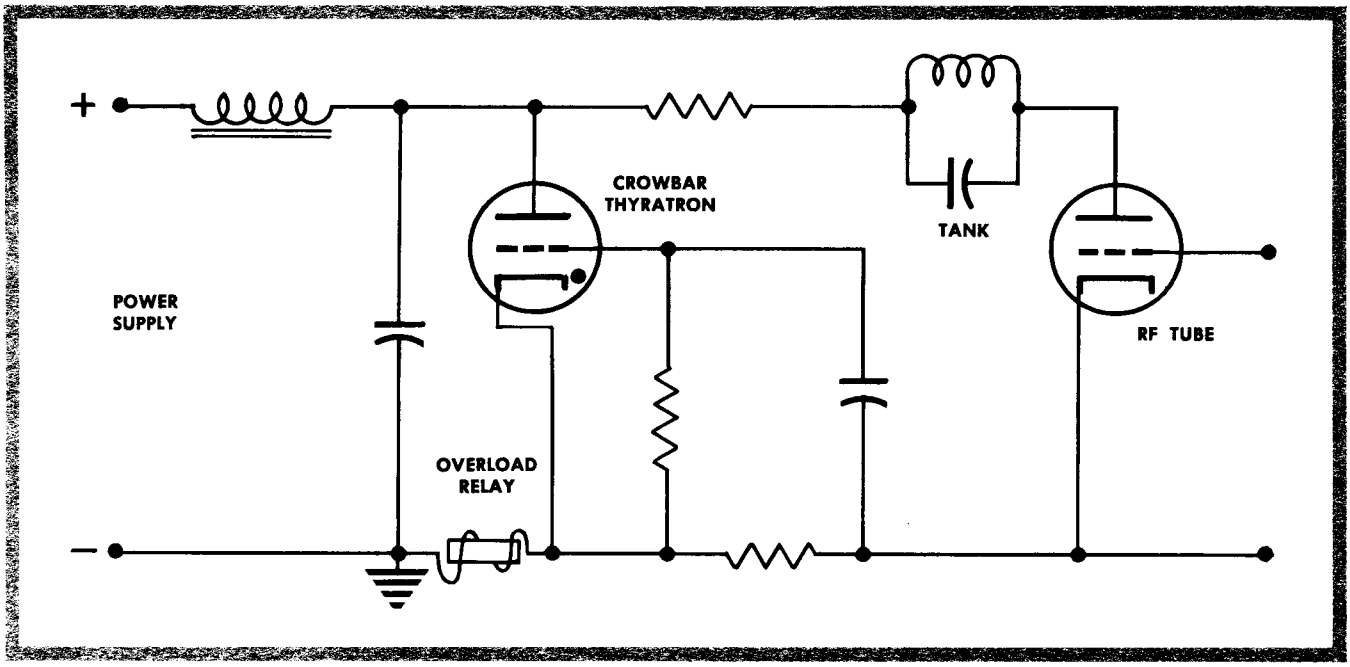
OUTLINE DRAWING



BASING DIAGRAM
BOTTOM VIEW

APPLICATION NOTES

In a typical application, a crowbar thyratron is connected in series with a suitable impedance across the filter of the high voltage power supply for a high frequency triode oscillator. Whenever an arc occurs in the oscillator tube, the rising current is used to deliver a suitable signal to the grid of the thyratron. The thyratron immediately conducts to short circuit the power supply until the protective circuit breaker opens 0.1 second later. In this latter case, the oscillator tube is protected with a minimum interruption in operating time.



REFERENCES:

SMITH, BOB:
The Fault Diverter — A Protective Device for High-Power Electron Tubes. Report UCRL-3701 Rev. University of California, Radiation Laboratories, Berkeley, Calif.

PARKER, W. N.
and
HOOVER, M. V.:
Gas Tubes Protect High-Power Transmitters. Electronics, Jan. 1956.

DOOLITTLE, H. D.:
High Powered Hydrogen Thyratrons. Cathode Press, VI, P6, 1954.

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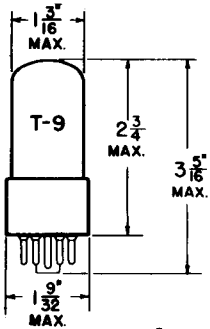
PENTODE



GLASS BULB *

INTERMEDIATE SHELL
7 PIN OCTAL B7-233
WITH BARRIERS
OR
INTERMEDIATE SHELL
8 PIN OCTAL B8-142
WITH BARRIERS
OR
INTERMEDIATE SHELL
7 PIN OCTAL B7-238

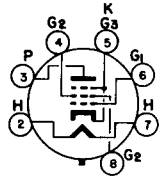
COATED UNIPOTENTIAL CATHODE

HEATER

6.3 VOLTS 0.80 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

THE 7591 IS A BEAM POWER PENTODE DESIGNED FOR USE AS AN AUDIO FREQUENCY POWER OUTPUT TUBE. IT HAS HIGH POWER SENSITIVITY AND HIGH EFFICIENCY AND IS ESPECIALLY DESIGNED FOR APPLICATIONS WHERE HIGH POWER OUTPUT IS REQUIRED.

DIRECT INTERELECTRODE CAPACITANCES

GRID TO PLATE	.25	μμf
INPUT: G1 TO (H+K+G2+G3)	10.0	μμf
OUTPUT: P TO (H+K+G2+G3	5.0	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM

HEATER VOLTAGE	6.3	VOLTS
MAXIMUM PLATE VOLTAGE	550	VOLTS
MAXIMUM SCREEN VOLTAGE	440	VOLTS
MAXIMUM PLATE DISSIPATION	19.0	WATTS
MAXIMUM SCREEN DISSIPATION[A]	3.3	WATTS
MAXIMUM CATHODE CURRENT	85	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE:		
WITH FIXED BIAS	0.3	MEGOHMS
WITH CATHODE BIAS	1.0	MEGOHMS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

*INDICATES AN ADDITION.

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3	VOLTS
HEATER CURRENT	0.80	AMP.
PLATE VOLTAGE	300	VOLTS
SCREEN VOLTAGE	300	VOLTS
GRID #1 VOLTAGE	−10	VOLTS
PEAK AF GRID VOLTAGE	10.0	VOLTS
PLATE CURRENT (ZERO SIGNAL)	60	MA.
PLATE CURRENT (MAX. SIGNAL)	75	MA.
SCREEN CURRENT (ZERO SIGNAL)	8.0	MA.
SCREEN CURRENT (MAX. SIGNAL)	15.0	MA.
TRANSCONDUCTANCE	10 200	μMHOS
PLATE RESISTANCE	29 000	OHMS
TRIODE AMPLIFICATION FACTOR	16.8	
LOAD RESISTANCE	3000	OHMS
POWER OUTPUT	11	WATTS
TOTAL HARMONIC DISTORTION	13	PERCENT

PUSH-PULL CLASS AB_1 – PENTODE CONNECTION

VALUES FOR TWO TUBES

	FIXED BIAS					CATHODE BIAS	
PLATE SUPPLY VOLTAGE	300	350	400	450	450	450	VOLTS
SCREEN SUPPLY VOLTAGE	300	350	350	350	400	400	VOLTS
GRID #1 VOLTAGE	−12.5	−15.5	−16.0	−16.5	−21		VOLTS
COMMON CATHODE RESISTOR						200	OHMS
PEAK AF GRID TO GRID VOLTAGE	25	31	32	33	42	28	VOLTS
ZERO SIGNAL PLATE CURRENT	86	92	85	77	66	82	MA.
MAX. SIGNAL PLATE CURRENT	116	130	143	153	144	94	MA.
ZERO SIGNAL SCREEN CURRENT	12.6	13.0	11.0	9.6	9.4	11.5	MA.
MAX. SIGNAL SCREEN CURRENT	26.0	28.6	27.0	27.0	30.0	22	MA.
EFFECTIVE LOAD, PLATE TO PLATE	6600	6600	6600	6600	6600	9000	OHMS
TOTAL HARMONIC DISTORTION	2.5	2.0	1.5	1.5	1.5	2.0	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	23	30	37	43	45	28	WATTS

PUSH-PULL CLASS AB_1 – ULTRA-LINEAR[B] OPERATION

VALUES FOR TWO TUBES

	FIXED BIAS	CATHODE BIAS	
PLATE SUPPLY VOLTAGE	400	425	VOLTS
GRID #1 VOLTAGE	−20.5		VOLTS
CATHODE RESISTOR (COMMON TO TWO TUBES)		185	OHMS
PEAK AF GRID TO GRID VOLTAGE	41	42	VOLTS
ZERO SIGNAL PLATE CURRENT	80	88	MA.
MAXIMUM SIGNAL PLATE CURRENT	138	104	MA.
ZERO SIGNAL SCREEN CURRENT	11.5	13.0	MA.
MAXIMUM SIGNAL SCREEN CURRENT	26.4	17.5	MA.
EFFECTIVE LOAD, PLATE TO PLATE	6600	6600	OHMS
TOTAL HARMONIC DISTORTION	1.0	2.0	PERCENT
MAXIMUM SIGNAL POWER OUTPUT	32	26	WATTS

A. SCREEN DISIPATION MAY BE PERMITTED TO REACH 6 WATTS DURING THE PERIODS OF MAXIMUM INPUT OF SPEECH AND MUSIC SIGNALS. FOR EFFICIENT OPERATION OF THE SCREEN, THE TWO SCREEN CONNECTIONS, PINS 4 AND 8 SHOULD BE EXTERNALLY TIED TOGETHER.

B. SCREEN TAPPED AT 40% OF PRIMARY TURNS.

TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7605

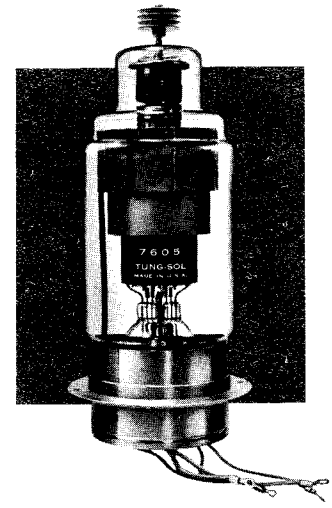
JULY 1963

CROWBAR THYRATRON

DESCRIPTION–The 7605 is a zero bias hydrogen thyratron designed to pass high currents in "crowbar" protective circuits. As described in the application notes, destructive arc currents are short circuited by the crowbar tube before damage occurs to other tubes or circuit elements.

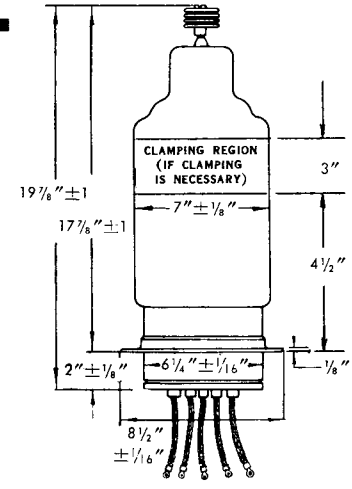
The instantaneous response, and ability to repeatedly carry extremely large currents, makes the hydrogen thyratron particularly attractive for this application. One type 7605 can handle a peak current of 3000 Amperes at 30 Kilovolts. This tube utilizes a hydrogen reservoir which promotes long life and permits optimum gas pressure adjustment for various conditions of operation.

This tube type was designed into some circuits under development type designation CH1097.



ELECTRICAL DATA

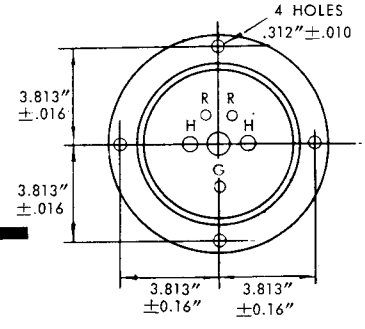
	Min	Bogey	Max	
Cathode Heater Voltage	6.0	6.3	6.6	Volts
Cathode Heater Current (at Ef = 6.3 volts)	20	23	40	Amperes
Cathode Heating Time	15	—	—	Minutes
Reservoir Voltage	3.5	Marked on base	6.0	Volts
Reservoir Current (Respectively)	3.5	—	12	Amperes
Reservoir Heating Time	15	—	—	Minutes



LEAD AND LUG DIMENSIONS ARE GIVEN WITH BASE CONNECTION INFORMATION ON PAGE 4

MECHANICAL DATA

Type of Cooling ..... Convection
Max Net Weight ..... 10 pounds
Mounting Position ..... Vertical, Base down
Dimensions: See outline drawings



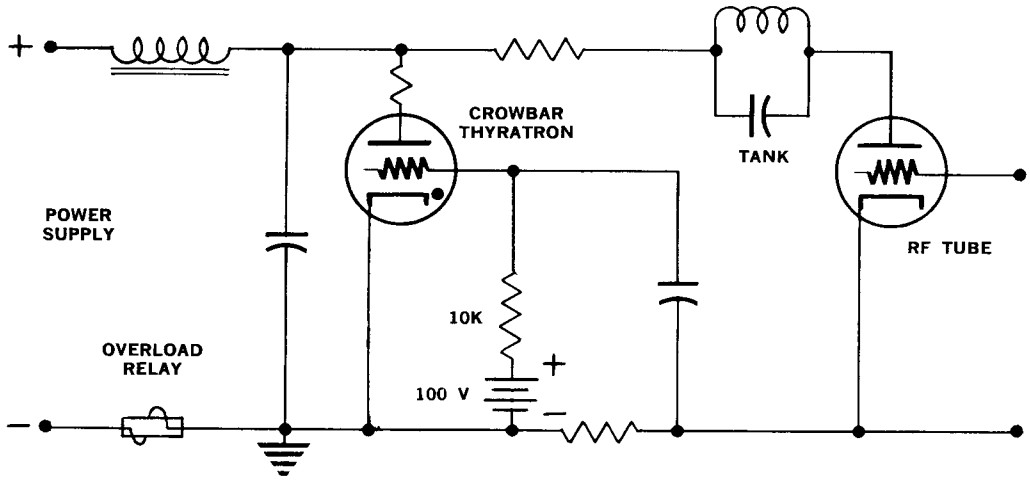
MAXIMUM RATINGS — ABSOLUTE VALUES

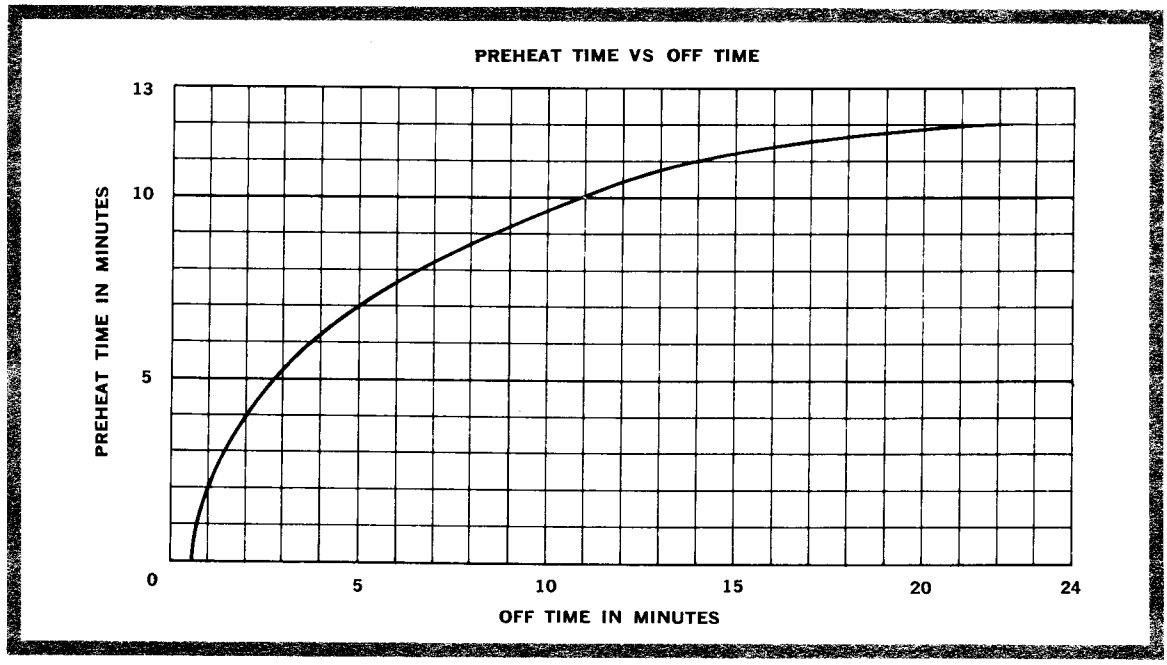
	Min	Max	
D-C Anode Voltage			
Forward	5	30	Kilovolts
Inverse	—	15	Kilovolts
Cathode Current			
Peak			
Filter discharge period			
0 to 1.5 Milliseconds	—	3000	Amperes
	—	or 1.2	Coulomb
Rectifier short circuit period			
1.5 to 100 Milliseconds	—	90	Amperes
1.5 to 50 Milliseconds	—	180	Amperes
1.5 to 30 Milliseconds	—	300	Amperes
Average	—	2.5	Amperes
Conduction Time per Fault	—	0.1	Second
Averaging Time	—	10	Seconds
D-C Grid Bias Supply Voltage	+100	+200	Volts
D-C Grid Bias Current	5	10	Milliamperes
Grid Trigger Pulse	1500	2000	Volts
Grid Trigger Pulse Rate of Rise	2000	—	Volts per microsecond
Grid Trigger Pulse Width —			
1500 Volt Amplitude	0.8	—	Microsecond
Grid Impedance	10	25	Ohms
Anode Delay Time	—	0.6	Microsecond
Anode Voltage Drop	50	350	Volts
Ambient Temperature Range	−55	+75	Degrees Centigrade

APPLICATION NOTES

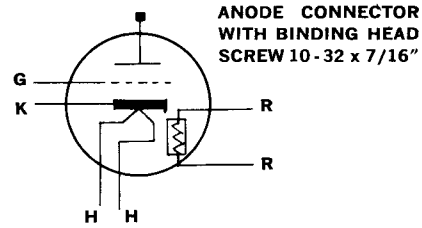
In a typical application, a crowbar thyratron is connected in series with a suitable impedance across the filter of the high voltage power supply for a high frequency triode amplifier. Whenever an arc occurs in the amplifier tube, the rising current is used to deliver a suitable signal to the grid of the thyratron. The thyratron immediately conducts to short circuit the power supply until the protective circuit breaker opens approximately 0.1 second later. To insure minimum anode delay time, positive bias is recommended.

TYPICAL CROWBAR APPLICATION





BASING CONNECTIONS

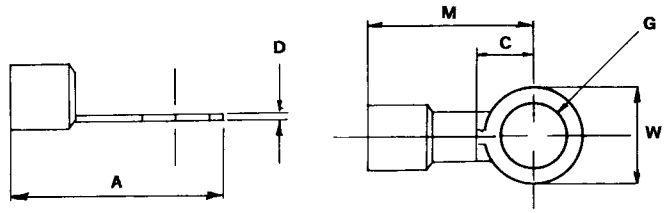


LEAD CONNECTIONS

Lead	Function	Lead Color	Lug Color	Lug
G	Grid	Green	Green	S
H	Heater	Yellow	Yellow	L
H	Heater	Yellow	Yellow	L
R	Reservoir	Red	Red	S
R	Reservoir	Red	Red	S
K	Cathode	Tube Base Flange		

Leads are flexible 8″ ±¾″ long from bottom of base to center of lug hole. Color coding as well as base marking identifies the leads.

LUG DIMENSIONS



LUG	G STUD	A MAX	W MAX	C MIN	D	M MAX
L	¼″	1.21″	.53″	.41″	.04″	.94″
S	#10	.90″	.31″	.30″	.03″	.74″

References:

SMITH, BOB:
The Fault Diverter — A Protective Device for High-Power Electron Tubes. Report UCRL-3701 Rev. University of California, Radiation Laboratories, Berkeley, Calif.

PARKER, W. N.
and
HOOVER, M. V.:
Gas Tubes Protect High-Power Transmitters. Electronics, Jan. 1956.

DOOLITTLE, H. D.:
High Powered Hydrogen Thyratrons. Cathode Press, V1, P6, 1954.

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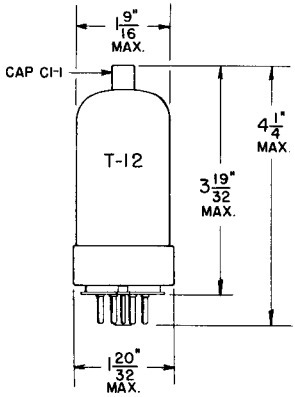
PENTODE



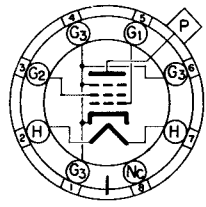
GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

6.3±10% VOLTS 1.6 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW
8 PIN OCTAL
WITH
BARRIERS
STEPPED SLEEVE
7CK

THE 7607 IS A BEAM POWER PENTODE INTENDED FOR SERVICE AS A CLASS C RF POWER AMPLIFIER AND OSCILLATOR AND AS A LINEAR AMPLIFIER IN SINGLE SIDE BAND AMPLIFIERS AND TRANSMITTERS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (MAX.)	0.28	μμf
INPUT (G1 TO ALL)	15	μμf
OUTPUT (P TO ALL)	8.5	μμf

RATINGS

INTERPRETED ACCORDING TO ABSLUTE MAXIMUM SYSTEM

HEATER VOLTAGE	6.3±10%	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE PEAK	300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

TYPICAL CHARACTERISTICS

HEATER VOLTAGE	6.3±10%	VOLTS
HEATER CURRENT	1.6	AMP.
PLATE VOLTAGE	300	VOLTS
GRID #2 VOLTAGE	225	VOLTS
GRID #1 VOLTAGE	-17	VOLTS
PLATE CURRENT	80	MA.
GRID #2 CURRENT	6.0	MA.
TRANSCONDUCTANCE	8000	μMHOS
TRIODE AMPLIFICATION FACTOR	8.0	
PLATE RESISTANCE	40	KOHMS
GRID #1 VOLTAGE FOR 1 MA PLATE CURRENT	-35	VOLTS

CONTINUED ON FOLLOWING PAGE

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RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR -CLASS C TELEGRAPHY

MAXIMUM RATINGS
(ABSOLUTE VALUES)

	CCS	ICAS	
DC PLATE VOLTAGE	600	900	VOLTS
DC GRID #2 VOLTAGE	400	450	VOLTS
DC GRID VOLTAGE	-300	-350	VOLTS
DC PLATE CURRENT	150	175	MA.
DC GRID #1 CURRENT	12	12	MA.
PLATE INPUT	85	115	WATTS
PLATE DISSIPATION	23	28	WATTS
GRID #2 DISSIPATION	4	6	WATTS
COMBINED PLATE AND GRID #2 DISSIPATION	25	32	WATTS
MAXIMUM BULB TEMPERATURE	220	245	°C.

TYPICAL OPERATION
CLASS C RADIO FREQUENCY AMPLIFIER

	CCS	ICAS	
DC PLATE VOLTAGE	600	800	VOLTS
DC GRID #2 VOLTAGE	200	220	VOLTS
DC GRID VOLTAGE	-50	-50	VOLTS
PEAK R.F. GRID VOLTAGE	70	70	VOLTS
DC PLATE CURRENT	123	137	MA.
DC GRID #2 CURRENT	11	12.5	MA.
DC GRID #1 CURRENT	10	10	MA.
DRIVING POWER	0.65	0.65	WATTS
POWER OUTPUT	54	84	WATTS
GRID RESISTANCE	5,000	5,000	OHMS

RADIO FREQUENCY LINEAR POWER AMPLIFIER CLASS AB_1
(one tube)

MAXIMUM RATINGS
(ABSOLUTE VALUES)

DC PLATE VOLTAGE	900	VOLTS
DC GRID #2 VOLTAGE	450	VOLTS
DC PLATE CURRENT	175	MA.
PLATE DISSIPATION	28	WATTS
GRID #2 DISSIPATION	6	WATTS
COMBINED PLATE AND GRID #2 DISSIPATION	32	WATTS

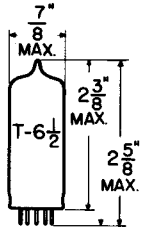
TYPICAL OPERATION
CLASS AB_1 RADIO FREQUENCY LINEAR AMPLIFIER
(ONE TUBE)

DC PLATE VOLTAGE	600	800	VOLTS
DC SCREEN VOLTAGE	310	310	VOLTS
DC GRID #1 VOLTAGE	-39	-39	VOLTS
ZERO SIGNAL DC PLATE CURRENT	20	20	MA.
SINGLE TONE R.F. GRID VOLTAGE (PEAK)	39	39	VOLTS
SINGLE TONE D.C. PLATE CURRENT	120	120	MA.
SINGLE TONE D.C. GRID #2 CURRENT	12.5	12	MA.
SINGLE TONE D.C. GRID #1 CURRENT	0	0	
SINGLE TONE PLATE POWER INPUT	72	96	WATTS
SINGLE TONE POWER OUTPUT	50	68	WATTS
TWO TONE AVERAGE D.C. GRID #2 CURRENT	5	5	MA.
TWO TONE AVERAGE D.C. PLATE CURRENT	75	76	MA.

TUNG-SOL

TRIODE

MINIATURE TYPE



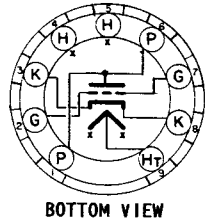
GLASS BULB

UNIPOTENTIAL CATHODE

HEATER

PARALLEL	SERIES
6.3±0.3 VOLTS	12.6±0.6 VOLTS
.45 AMP.	.225 AMP.

ANY MOUNTING POSITION



BOTTOM VIEW

MINIATURE BUTTON
9 PIN BASE

9MX

THE 7719 IS A SINGLE INDIRECTLY HEATED HIGH PERVEANCE TRIODE INTENDED FOR COMPUTER APPLICATIONS. THE CATHODE MATERIAL IS CHOSEN TO MINIMIZE THE DEVELOPMENT OF INTERFACE IMPEDANCE.

DIRECT INTERELECTRODE CAPACITANCES – APPROX.

WITHOUT EXTERNAL SHIELD

INPUT	6.5	μμf
OUTPUT	1.0	μμf
GRID TO PLATE	5.5	μμf

RATINGS

INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[A]

HEATER VOLTAGE (SERIES)	12.6±0.6	VOLTS
HEATER VOLTAGE (PARALLEL)	6.3±0.3	VOLTS
MAXIMUM PLATE VOLTAGE	330	VOLTS
MAXIMUM PLATE DISSIPATION	6.0	WATTS
MAXIMUM DC CATHODE CURRENT	40	MA.
MAXIMUM HEATER–CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS
MAXIMUM BULB TEMPERATURE	175	°C

AVERAGE CHARACTERISTICS

CLASS A_1 AMPLIFIER

HEATER VOLTAGE	6.3±0.3	12.6±0.6	VOLTS
HEATER CURRENT	.45[B]	.225[C]	AMP.
PLATE VOLTAGE	300		VOLTS
GRID VOLTAGE	-10.5		VOLTS
PLATE CURRENT	4		MA.
AMPLIFICATION FACTOR	25		
TRANSCONDUCTANCE	3500		μMHOS
PLATE RESISTANCE	7100		OHMS
GRID VOLTAGE FOR PLATE CURRENT OF 50μA(APPROX.)	-15		VOLTS

CONTINUED ON FOLLOWING PAGE

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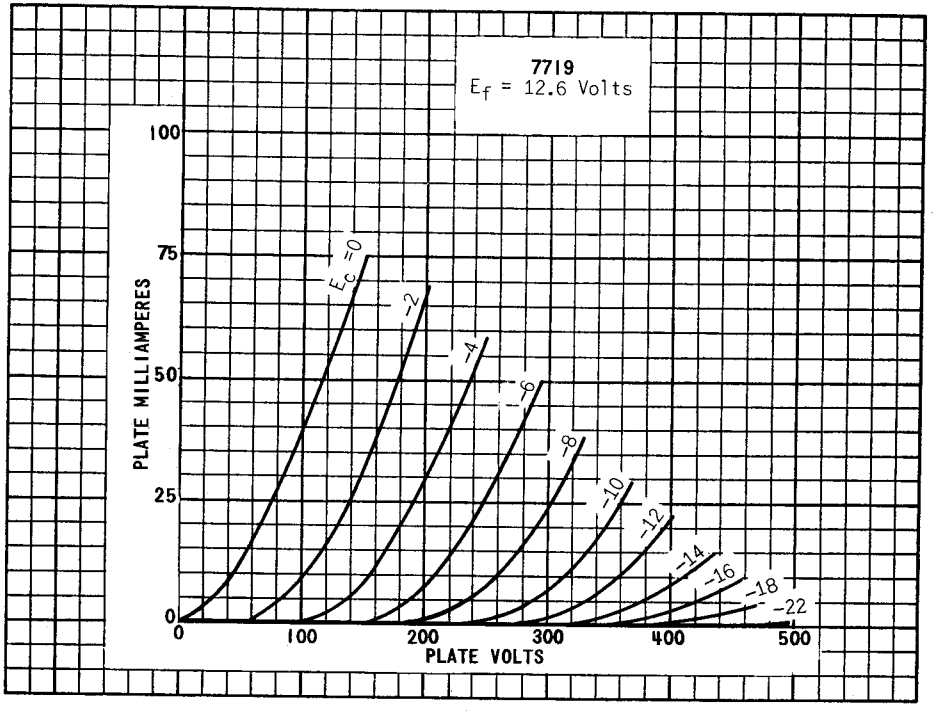
TUNG-SOL

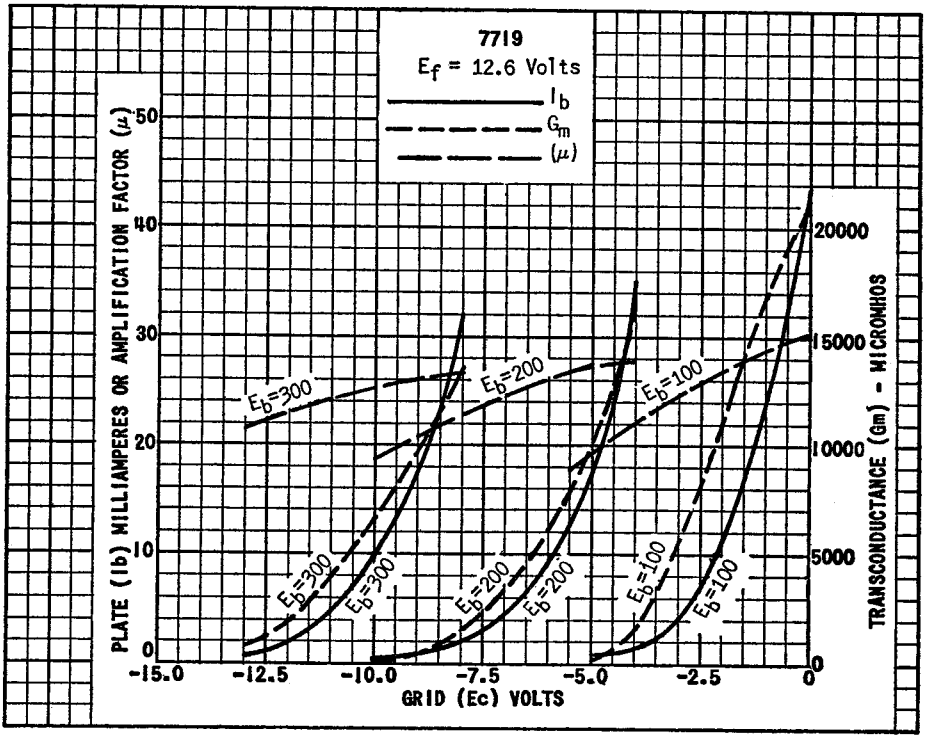
CONTINUED FROM PRECEDING PAGE

[A] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[B] MEASURED AT 6.3 VOLTS.

[C] MEASURED AT 12.6 VOLTS.



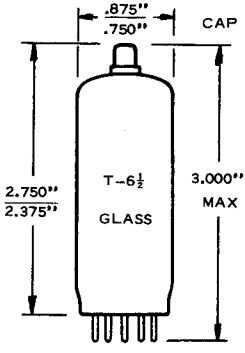

7719
Ef = 12.6 Volts
Ib
Gm
(μ)
PLATE (Ib) MILLIAMPERES OR AMPLIFICATION FACTOR (μ)
TRANSCONDUCTANCE (Gm) - MICROMHOS
GRID (Ec) VOLTS
Eb=300
Eb=200
Eb=100
0
10
20
30
40
50
5000
10000
15000
20000
-15.0
-12.5
-10.0
-7.5
-5.0
-2.5
0

TUNG-SOL

BEAM PENTODE

MINIATURE TYPE

OUTLINE DRAWING

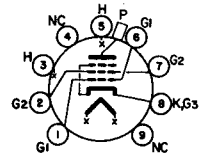


BUTTON 9 PIN MINIATURE
BASE E9-1
GOLD PLATED PINS

FOR
PULSE AND HIGH VOLTAGE
REGULATOR SERVICE

TUNGSTEN HEATER
ANY MOUNTING POSITION

BASING DIAGRAM
JEDEC 9NE



BOTTOM VIEW

THE 7757 IS A HIGH PERVEANCE BEAM POWER AMPLIFIER IN THE 9 PIN MINIATURE HARD GLASS CONSTRUCTION. IT IS DESIGNED FOR HIGH VOLTAGE PULSE MODULATOR AND DEFLECTION AMPLIFIER USE IN AIRCRAFT, MILITARY AND INDUSTRIAL APPLICATIONS WHERE RELIABLE OPERATIONS AT HIGH VOLTAGES DURING SHOCK AND VIBRATION, AND FREEDOM FROM INTERNAL ARCING ARE IMPORTANT.

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	600	mA
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
HEATER–CATHODE VOLTAGE			
HEATER NEGATIVE WITH RESPECT TO CATHODE		450	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		450	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES – SEE EIA STANDARD RS-239

DC PLATE VOLTAGE	3,000	VOLTS
DC GRID 2 VOLTAGE	700	VOLTS
PLATE DISSIPATION	14	WATTS
GRID 2 DISSIPATION	3	WATTS
DC CATHODE CURRENT	75	mA
PEAK CATHODE CURRENT –PULSE	2	AMPS
GRID RESISTANCE	0.1	MEGOHM
AVERAGE CATHODE WARM-UP TIME	45	SECONDS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATION CONDITIONS AND CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTS	250	VOLTS
GRID 1 VOLTS	−12.5	VOLTS
PLATE CURRENT	45	mA
GRID 2 CURRENT	3.5	mA
TRANSCONDUCTANCE	4,100	μMHOS

TYPICAL OPERATING CONDITIONS – PULSE ⊕

⊕ SEE RATING CHART

PLATE VOLTAGE	750	VOLTS
GRID 2 VOLTAGE	325	VOLTS
GRID 1 BIAS VOLTAGE	−100	VOLTS
PULSE VOLTAGE – e_{gk}	+100	VOLTS
PULSE PLATE CURRENT	.75	AMP.

SPECIAL TESTS AND RATINGS

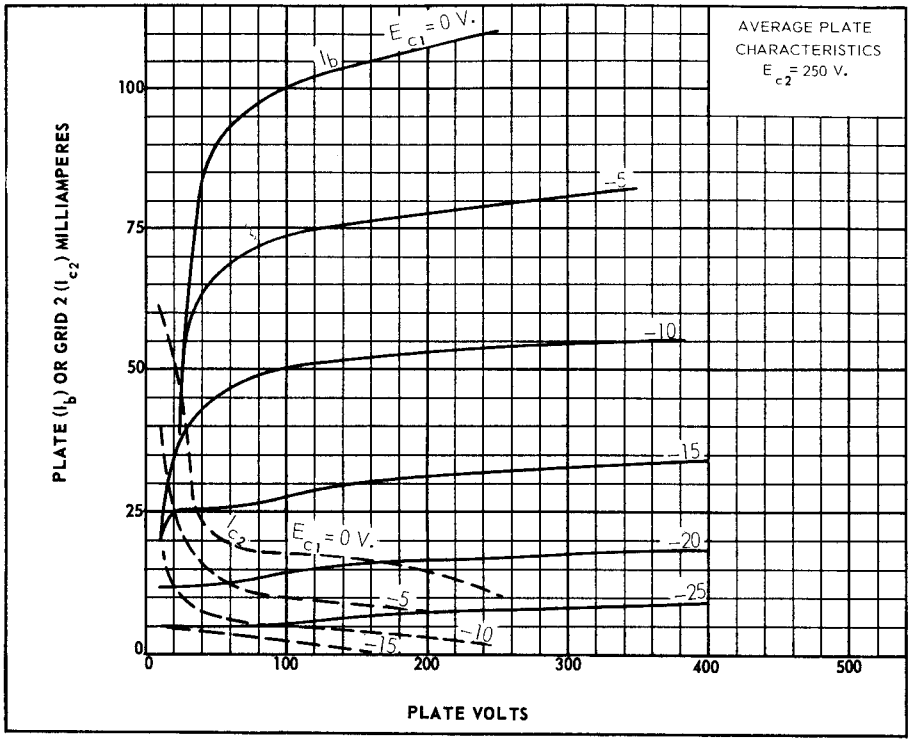
ALTITUDE	70,000	FT.
BULB TEMPERATURE	300	°C
IMPACT SHOCK	500	G
VIBRATIONAL ACCELATION	50	G
HEATER CYCLING LIFE		
LIFE		
FATIGUE		
GLASS STRAIN		

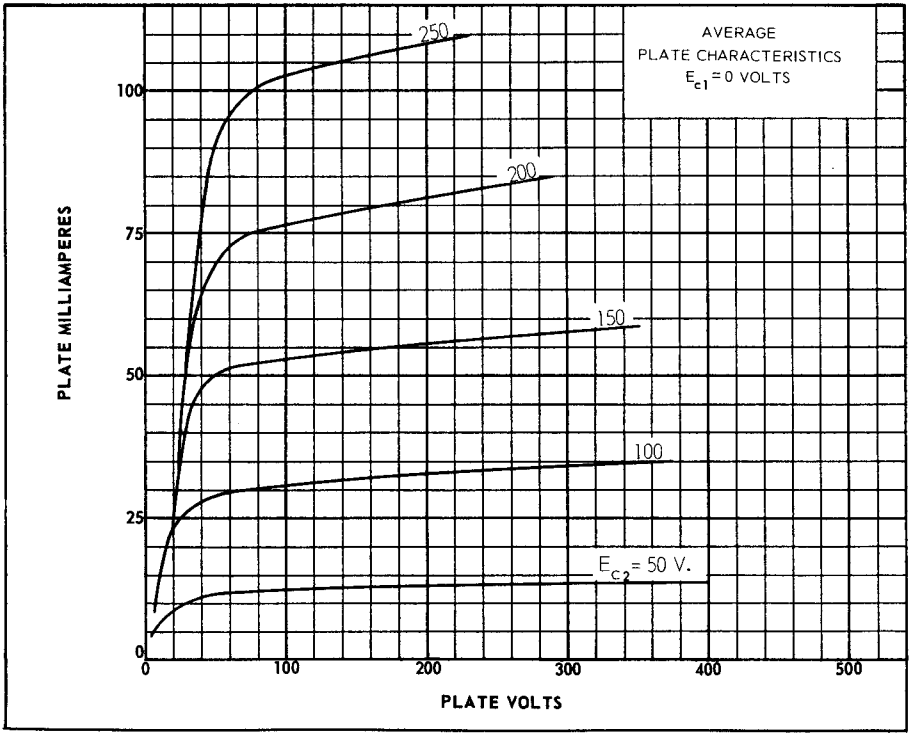
APPLICATION NOTES

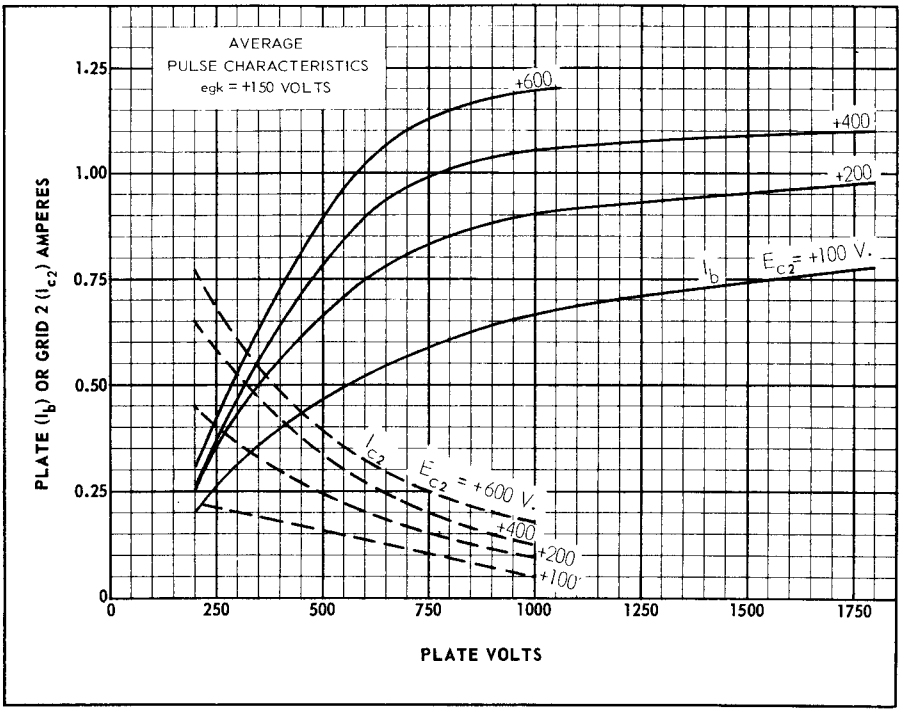
SPECIAL ATTENTION SHOULD BE GIVEN TO THE TEMPERATURES AT WHICH THE TUBES ARE TO BE OPERATED. RELIABILITY WILL BE SERIOUSLY IMPAIRED IF MAXIMUM BULB TEMPERATURE IS EXCEEDED. THE LIFE EXPECTANCY WILL BE REDUCED IF CONDITIONS OTHER THAN THOSE SPECIFIED FOR LIFE TEST ARE IMPOSED ON THE TUBE AND WILL BE REDUCED APPRECIABLY IF ABSOLUTE MAXIMUM RATINGS ARE EXCEEDED. BOTH RELIABILITY AND PERFORMANCE WILL BE JEOPARDIZED IF FILAMENT VOLTAGE RATINGS ARE EXCEEDED. LIFE AND RELIABILITY OF PERFORMANCE ARE DIRECTLY RELATED TO THE DEGREE THAT REGULATION OF THE HEATER VOLTAGE IS MAINTAINED AT ITS CENTER RATED VALUE.

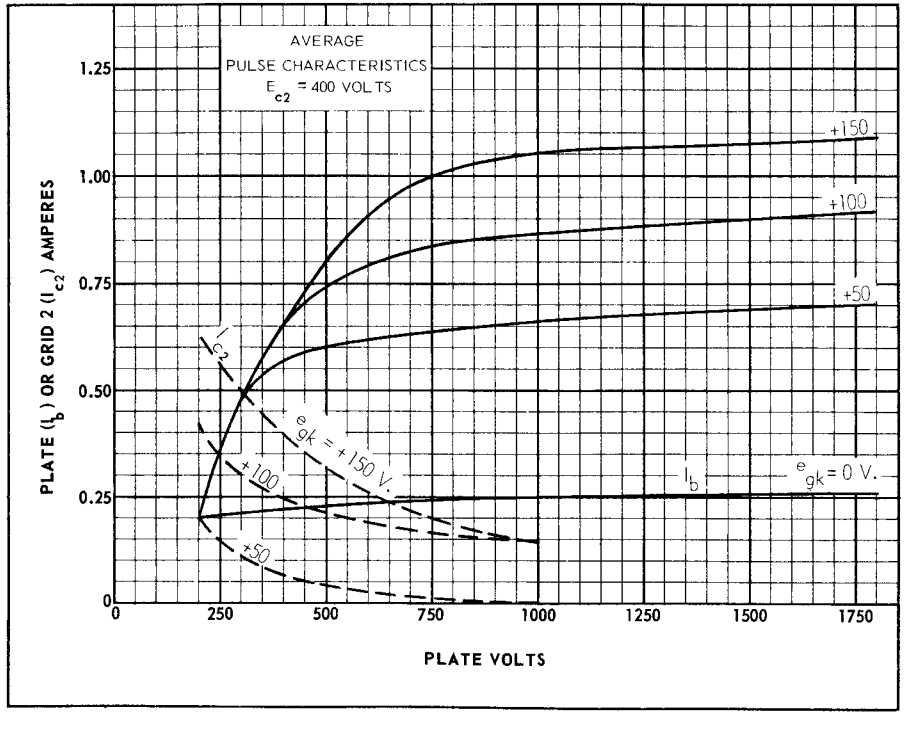
THIS TUBE IS CONSTRUCTED USING NONEX GLASS AND THUS CAN WITHSTAND HIGHER AMBIENT TEMPERATURES IN OPERATION. HOWEVER, THE BULB TEMPERATURE SHOULD NEVER EXCEED 300°C AT ITS HOTTEST POINT AND COOLING SHOULD BE EMPLOYED IF NECESSITATED BY THE ADDITIVE EFFECTS OF OPERATION AT HIGH ALTITUDES AND HIGH DISSIPATION SIMULTANEOUSLY OR BY OTHER SOURCES OF HEAT IN THE EQUIPMENT.

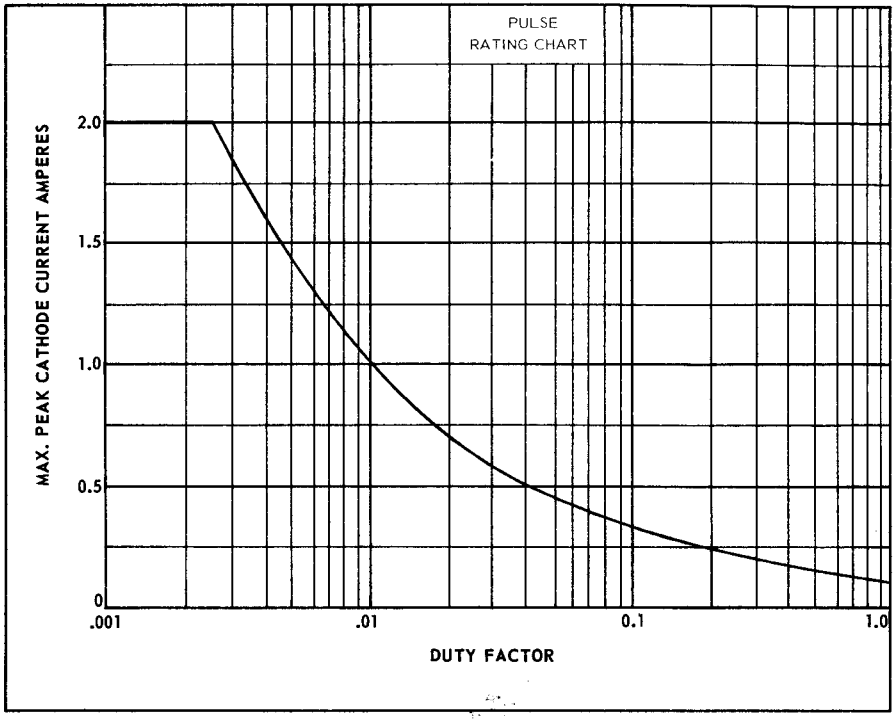
THE PLATE VOLTAGE RATING AND HIGH-PERVEANCE OF THE 7757 MAKE IT READILY ADAPTABLE TO VARIED PULSE APPLICATIONS. IN ORDER TO INSURE MAXIMUM RELIABILITY IN PULSE SERVICE THE PEAK CATHODE CURRENT SHOULD NOT EXCEED THE VALUE SHOWN IN PULSE RATING CHART FOR THE REQUIRED DUTY FACTOR.

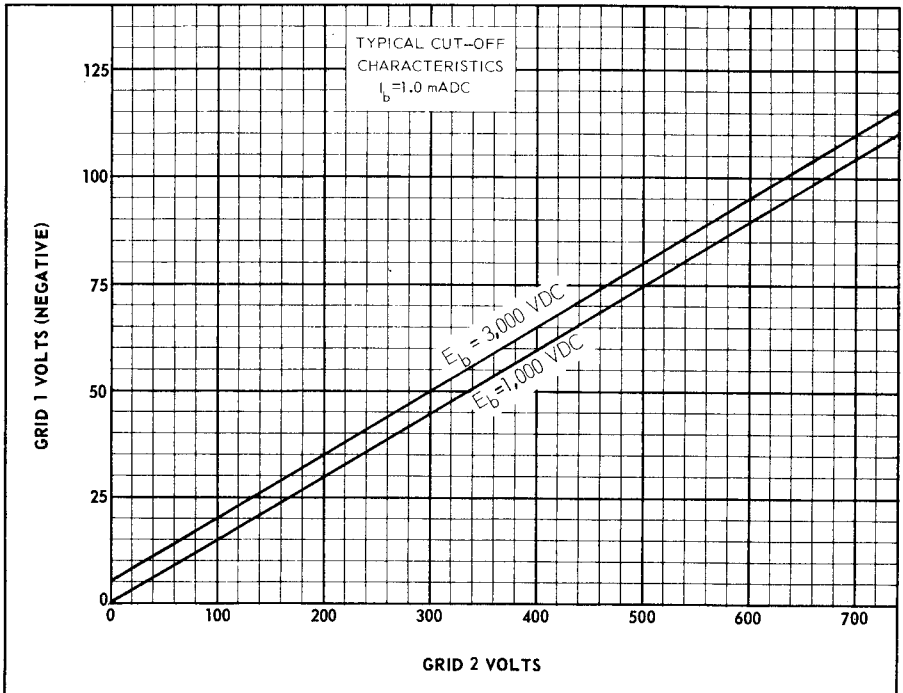

AVERAGE PLATE CHARACTERISTICS
E_{c2} = 250 V.
PLATE (I_b) OR GRID 2 (I_{c2}) MILLIAMPERES
PLATE VOLTS
I_b
I_{c2}
E_{c1} = 0 V.
-5
-10
-15
-20
-25
0
25
50
75
100
0
100
200
300
400
500


AVERAGE PLATE CHARACTERISTICS
E_{c1} = 0 VOLTS
PLATE MILLIAMPERES
PLATE VOLTS
250
200
150
100
E_{c2} = 50 V.
0
25
50
75
100
0
100
200
300
400
500


AVERAGE
PULSE CHARACTERISTICS
egk = +150 VOLTS
+600
+400
+200
I_b
E_{c2} = +100 V.
I_{c2}
E_{c2} = +600 V.
+400
+200
+100
PLATE (I_b) OR GRID 2 (I_{c2}) AMPERES
PLATE VOLTS
0
0.25
0.50
0.75
1.00
1.25
0
250
500
750
1000
1250
1500
1750


AVERAGE
PULSE CHARACTERISTICS
E_{c2} = 400 VOLTS
+150
+100
+50
I_{c2}
e_{gk} = +150 V.
+100
+50
I_b
e_{gk} = 0 V.
PLATE (I_b) OR GRID 2 (I_{c2}) AMPERES
PLATE VOLTS
0
0.25
0.50
0.75
1.00
1.25
0
250
500
750
1000
1250
1500
1750





TUNG-SOL ELECTRIC INC., ELECTRON TUBE DIVISION, BLOOMFIELD, NEW JERSEY, U.S.A.. JUNE 1, 1965 PLATE#6633

PRINTED IN U. S. A.

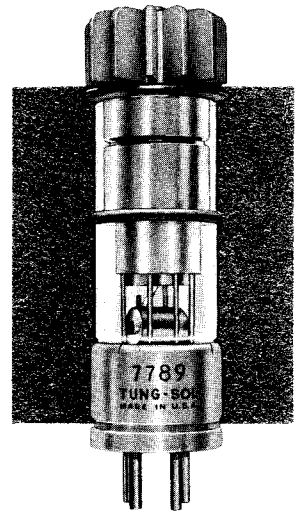
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7789

JANUARY, 1963

HYDROGEN DIODE



DESCRIPTION The 7789 is an indirectly heated, hydrogen filled, half-wave diode designed for use in high-voltage rectifier circuits. The 7789 is a rugged diode that can handle higher voltage than comparable xenon-filled tubes, and is more efficient than vacuum rectifiers. An internally-connected hydrogen generator prevents gas clean-up.

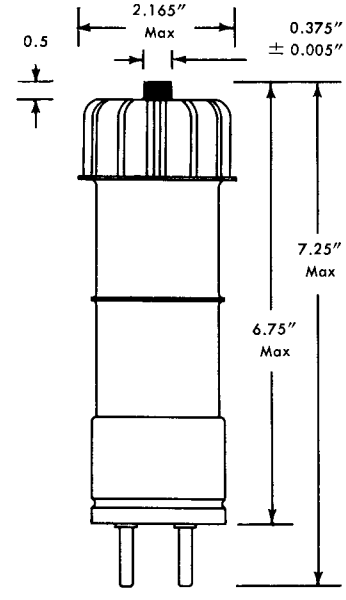
Contrasted with a solid state rectifier, the 7789 can withstand high current and inverse voltage surges. This diode also has the advantage of being temperature free and has a wide range of mounting positions as compared with mercury-vapor tubes. The 7789 is capable of delivering 0.4 ampere average at 15 kilovolts peak inverse voltage.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	4.75	5.00	5.25	Volts
Heater Current — E_f = 5.0 Volts	7.7	8.5	9.3	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	40	50	Volts
Initial Firing Voltage	—	—	70	Volts
Recurrent Firing Voltage	30	—	50	Volts

MECHANICAL DATA

Type of Cooling	Convection
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	12 Ounces
Dimensions	See Outline Drawing
Base	JEDEC A4-81
Anode Connection	See Outline Drawing

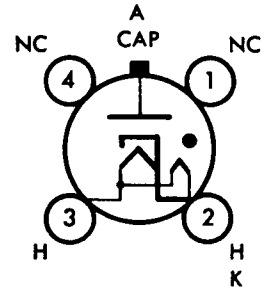


OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	SHUNT DIODE SERVICE		RECTIFIER SERVICE		
	Minimum	Maximum	Minimum	Maximum	
Peak Inverse Anode Voltage	—	10,000	—	15,000	Volts
Cathode Current					
Peak	—	150	—	1.6	Amperes
Average	—	0.2	—	0.4	Ampere
RMS	—	5.5	—	—	Amperes
Fault — 0.1 Second Maximum Duration	—	200	—	30	Amperes
Averaging Time	—	—	—	15	Seconds
Ambient Temperature	−55	+75	−55	+75	Degrees Centigrade
Altitude	—	10,000	—	10,000	Feet

CAUTION — In order to avoid damage to tube, the cathode connection must be made to pin 2 only.



(SEE CAUTION NOTE)

BASIC DIAGRAM
BOTTOM VIEW

MAXIMUM RATING CHART *

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	A-C SECONDARY VOLTAGE E_{RMS} VOLTS	D-C OUTPUT — APPROX E_{DC} VOLTS	D-C OUTPUT — APPROX I_{DC} AMPS	RIPPLE VOLTS RMS	RIPPLE FREQ
1	Half-wave 1-phase	1-phase	1	10,500	4,800	0.4	5,250	f
2	Full-wave 1-phase	1-phase C-T	2	5,250	4,800	0.8	2,250	2f
3	Bridge circuit 1-phase	1-phase	4	10,500	9,500	0.8	4,500	2f
4	Half-wave 3-phase	Delta-Wye	3	6,150	7,200	1.2	1,300	3f
5	Full-wave 3-phase	Delta-Wye	6	6,150	14,300	1.2	600	6f
6	Full-wave 3-phase	Delta-Delta	6	10,500	14,300	1.2	600	6f
7	Half-wave 6-phase (3-phase supply)	Delta-Star	6	5,250	7,200	2.4	290	6f

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.

The 7789 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

* Values for Figure 1 assume pure resistive load. Values for all other Figures assume infinite inductance choke input filter.

TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7790

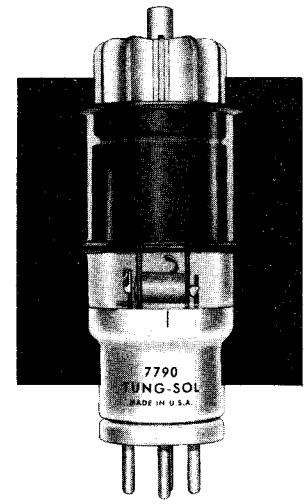
DECEMBER, 1962

HYDROGEN DIODE

DESCRIPTION — The 7790 is an indirectly heated, hydrogen filled, half-wave diode designed for use in high-voltage rectifier circuits. The 7790 is a rugged diode that can handle higher voltage than comparable xenon-filled tubes, and is more efficient than vacuum rectifiers. An internally-connected hydrogen generator prevents gas clean-up.

Contrasted with a solid state rectifier, the 7790 can withstand high current and inverse voltage surges. This diode also has the advantage of being temperature free and has a wide range of mounting positions as compared with mercury-vapor tubes. The 7790 is capable of delivering 1.0 ampere average at 20 kilovolts peak inverse voltage.

In many cases the 7790 will function as a low impedance, direct replacement for the 576A vacuum rectifier tube.

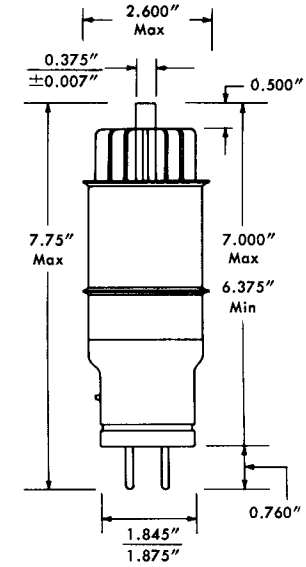


ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	4.75	5.00	5.25	Volts
Heater Current — E_f = 5.0 Volts	9.5	11.0	12.5	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	—	50	Volts
Initial Firing Voltage	—	—	70	Volts
Recurrent Firing Voltage	30	—	50	Volts

MECHANICAL DATA

Type of Cooling	See Rating Graph. Convection or Forced Air — 30 cfm directed at top of radiator
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	1 Pound 2 Ounces
Dimensions	See Outline Drawing
Base	JEDEC A4-107
Anode Connection	See Outline Drawing

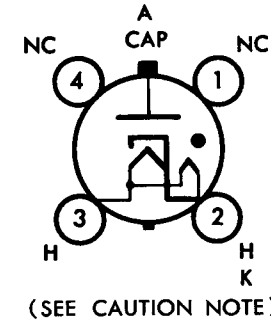


RATINGS, ABSOLUTE VALUES

	SHUNT DIODE SERVICE Minimum	SHUNT DIODE SERVICE Maximum	RECTIFIER SERVICE Minimum	RECTIFIER SERVICE Maximum	
Peak Inverse Anode Voltage	—	25,000	—	20,000	Volts
Cathode Current					
Peak	—	200	—	4	Amperes
Average	—	0.3	—	1	Ampere
RMS	—	7.7	—	—	Amperes
Fault — 0.1 Second Maximum Duration	—	400	—	30	Amperes
Averaging Time	—	—	—	15	Seconds
Ambient Temperature	−55	+75	−55	+75	Degrees Centigrade
Altitude	—	10,000	—	10,000	Feet

CAUTION — In order to avoid damage to tube, the cathode connection must be made to pin 2 only.

OUTLINE DRAWING



(SEE CAUTION NOTE)

BASIC DIAGRAM BOTTOM VIEW

MAXIMUM RATING CHART FOR INFINITE INDUCTANCE CHOKE INPUT FILTER

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	*	A-C SECONDARY VOLTAGE E_{RMS} KILOVOLTS	D-C OUTPUT—APPROX		RIPPLE	
						E_{DC} KILOVOLTS	I_{DC} AMPS	KILOVOLTS RMS	FREQ
1	Half-wave 1-phase	1-phase	1	A B	11.0 14.0	5.0 6.4	1.0 1.0	5.50 7.00	f
2	Full-wave 1-phase	1-phase C-T	2	A B	5.5 7.0	5.5 6.4	2.0 2.0	2.30 3.00	2f
3	Bridge circuit 1-phase	1-phase	4	A B	11.3 14.0	10.0 12.8	2.0 2.0	4.70 6.00	2f
4	Half-wave 3-phase	Delta-Wye	3	A B	6.5 8.0	7.5 9.5	3.0 3.0	1.50 1.70	3f
5	Full-wave 3-phase	Delta-Wye	6	A B	6.5 8.0	15.0 19.0	3.0 3.0	0.60 0.80	6f
6	Full-wave 3-phase	Delta-Delta	6	A B	11.0 14.0	15.0 19.0	3.0 3.0	0.60 0.76	6f

* See RATING GRAPH

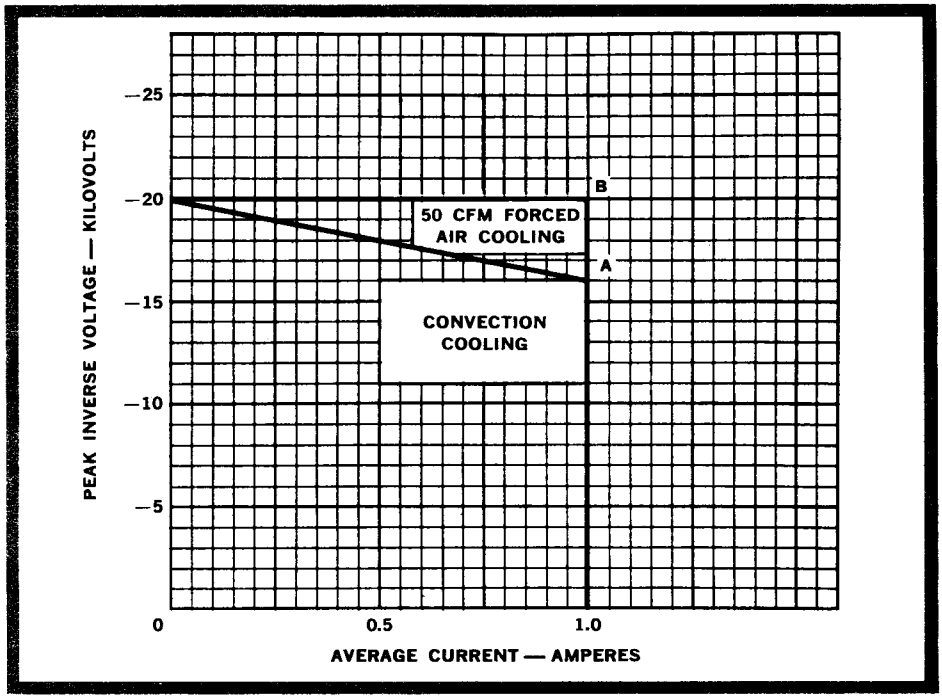
A: Convection cooling at maximum current rating.

B: Forced air cooling at maximum voltage and current rating.

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.

The 7790 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

RATING GRAPH



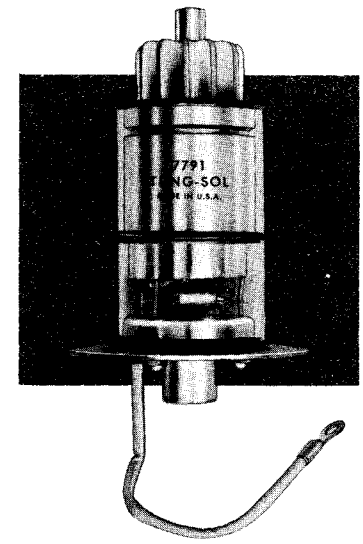
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7791

DECEMBER, 1962

HYDROGEN DIODE



DESCRIPTION—The 7791 is an indirectly heated, hydrogen filled, half-wave diode designed for use in high-voltage rectifier circuits. The 7791 is a rugged diode that can handle higher voltage than comparable xenon-filled tubes, and is more efficient than vacuum rectifiers. An internally-connected hydrogen generator prevents gas clean-up.

Contrasted with a solid state rectifier, the 7791 can withstand high current and inverse voltage surges. This diode also has the advantage of being temperature free and has a wide range of mounting positions as compared with mercury-vapor tubes. The 7791 is capable of delivering 2.0 amperes average and withstanding 25 kilovolts peak inverse voltage as shown on rating graph.

The 7791 employs flange mounting for minimum overall height consistent with good electrical connections and ease of installation.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	4.75	5.0	5.25	Volts
Heater Current — E_f = 5.0 Volts	13	15	17	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	—	60	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	30	—	75	Volts

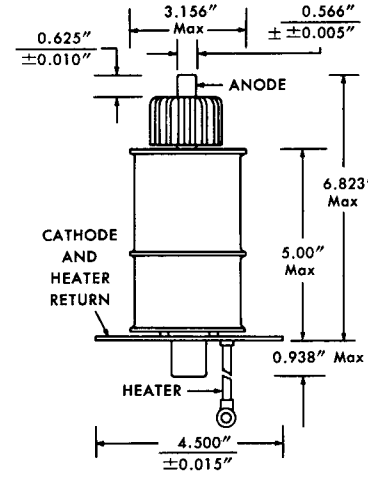
MECHANICAL DATA

Type of Cooling	See Rating Graph. Convection or Forced Air — 50 cfm directed at top of radiator
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	1 Pound 13 Ounces
Dimensions	See Outline Drawing
Mounting Data	See Mounting Data Drawing
Anode Connection	See Outline Drawing
Heater Connection	7 ± ½-inch long lead with lug for ¼-inch diameter screw

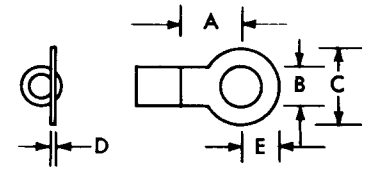
RATINGS, ABSOLUTE VALUES

	SHUNT DIODE SERVICE		RECTIFIER SERVICE		
	Minimum	Maximum	Minimum	Maximum	
Peak Inverse Anode Voltage	—	30,000	—	25,000	Volts
Cathode Current					
Peak	—	750	—	8	Amperes
Average	—	0.5	—	2	Amperes
RMS	—	20	—	—	Amperes
Fault — 0.1 Second Maximum Duration	—	1,000	—	60	Amperes
Averaging Time	—	—	—	15	Seconds
Ambient Temperature	−55	+75	−55	+75	Degrees Centigrade
Altitude	—	10,000	—	10,000	Feet

CAUTION — In order to avoid damage to tube, the cathode connection must be made to the base flange only.



(SEE CAUTION NOTE)



Symbol	Dimension
A	0.380" MIN
B	0.260" – 0.313"
C	0.605" MAX
D	0.04" MIN
E	0.305" MAX

OUTLINE DRAWING

TYPE 7791

MAXIMUM RATING CHART FOR INFINITE INDUCTANCE CHOKE INPUT FILTER

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	*	A-C SECONDARY VOLTAGE E_{RMS} Kilovolts	D-C OUTPUT — APPROX E_{DC} Kilovolts	D-C OUTPUT — APPROX I_{DC} AMPS	RIPPLE KILOVOLTS RMS	RIPPLE FREQ
1	Half-wave 1-phase	1-phase	1	A	7.10	3.20	1.75	3.50	f
				B	14.20	4.80	1.00	5.25	
				C	14.20	4.80	2.00	5.25	
				D	17.50	8.00	1.00	8.75	
2	Full-wave 1-phase	1-phase C-T	2	A	3.55	3.20	3.50	1.50	2f
				B	7.10	4.80	2.00	2.25	
				C	7.10	4.80	4.00	2.25	
				D	8.80	8.00	2.00	3.75	
3	Bridge circuit 1-phase	1-phase	4	A	7.10	6.40	3.50	3.00	2f
				B	14.20	9.60	2.00	4.50	
				C	14.20	9.60	4.00	4.50	
				D	17.50	16.00	2.00	7.50	
4	Half-wave 3-phase	Delta-Wye	3	A	4.10	4.80	5.25	0.85	3f
				B	8.20	7.20	3.00	1.30	
				C	8.20	7.20	6.00	1.30	
				D	10.00	12.00	3.00	2.30	
5	Full-wave 3-phase	Delta-Wye	6	A	4.10	9.50	5.25	0.40	6f
				B	8.20	14.25	3.00	0.60	
				C	8.20	14.25	6.00	0.60	
				D	10.00	23.75	3.00	1.15	
6	Full-wave 3-phase	Delta-Delta	6	A	7.10	9.50	5.25	0.40	6f
				B	14.20	14.25	3.00	0.60	
				C	14.20	14.25	6.00	0.60	
				D	17.50	23.75	3.00	1.15	

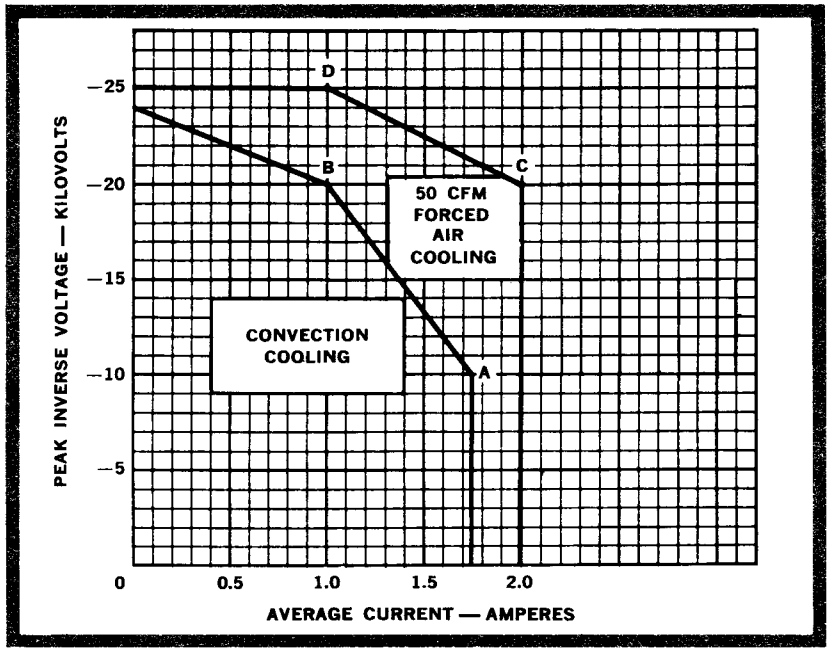
*See RATING GRAPH

A: Convection cooled at maximum current rating.
B: Convection cooled at maximum voltage rating.
C: Forced air cooled at maximum current rating.
D: Forced air cooled at maximum voltage rating.

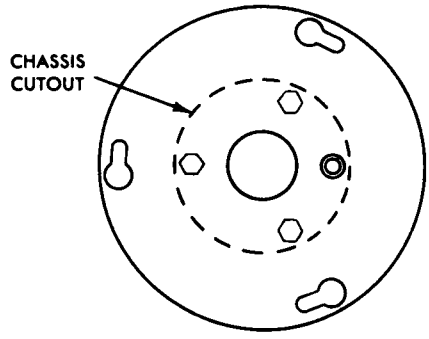
For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.

The 7791 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

RATING GRAPH



MOUNTING DATA



NOTES

1. 2.625 inch minimum diameter mounting hole required.
2. Three mounting slots for 0.50 inch maximum head ¼-inch screws spaced 120 degrees on 3.750 ± 0.010 inch diameter circle.

TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7792

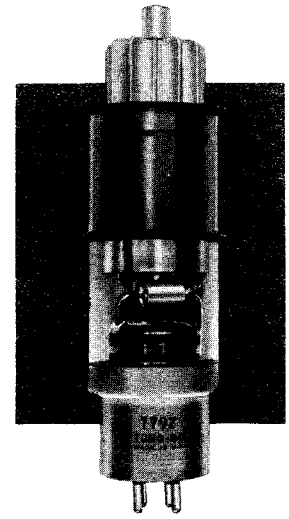
JULY 1964

HYDROGEN DIODE

DESCRIPTION — The 7792 is an indirectly heated, hydrogen filled, half-wave diode designed for use in high-voltage rectifier circuits. The 7792 is a rugged diode that can handle higher voltage than comparable xenon-filled tubes, and is more efficient than vacuum rectifiers. An internally-connected hydrogen generator prevents gas clean-up.

Contrasted with a solid state rectifier, the 7792 can withstand high current and inverse voltage surges. This diode also has the advantage of being temperature free and has a wide range of mounting positions as compared with mercury-vapor tubes. The 7792 is capable of delivering 2.0 amperes average at 25 kilovolts peak inverse voltage.

In many cases, the 7792 will function as a low impedance, direct plug-in replacement for the X80 vacuum rectifier tube.

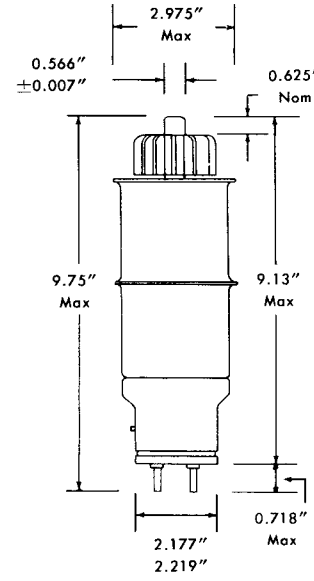


ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	11.0	11.5	12.0	Volts
Heater Current — E_f = 11.5 Volts	6.9	8.5	10.5	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	—	60	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	30	—	75	Volts

MECHANICAL DATA

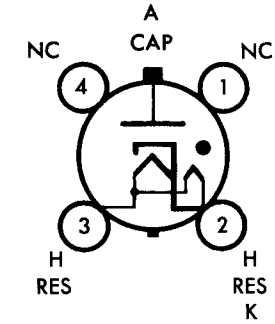
Type of Cooling	See Rating Graph. Convection or Forced Air — 50 cfm directed at top of radiator
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	1 Pound 14 Ounces
Dimensions	See Outline Drawing
Base	Super Jumbo, 4-pin With Bayonet, JEDEC A4-106
Anode Connection	Cap, See Outline Drawing



RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Peak Inverse Anode Voltage	—	25,000	Volts
Cathode Current			
Peak	—	8	Amperes
Average	—	2	Amperes
Surge — Maximum Duration 0.1 Second	—	60	Amperes
Averaging Time	—	15	Seconds
Ambient Temperature	−55	+75	Degrees Centigrade

CAUTION — The Cathode connection should be made to Pin 2 in order not to damage tube.



(SEE CAUTION NOTE)

BOTTOM VIEW

TYPE 7792

MAXIMUM RATING CHART

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	*	A-C SECONDARY VOLTAGE E_{RMS} Kilovolts	D-C OUTPUT — APPROX E_{DC} Kilovolts	D-C OUTPUT — APPROX I_{DC} AMPS	RIPPLE KILOVOLTS RMS	RIPPLE FREQ
1	Half-wave 1-phase	1-phase	1	A B C	10.5 17.5 12.5	4.75 8.0 5.75	1.5 1.0 2.0	5.25 8.8 6.25	f
2	Full-wave 1-phase	1-phase C-T	2	A B C	5.25 8.8 6.25	4.75 8.0 5.75	3.0 2.0 4.0	2.25 3.75 2.8	2f
3	Bridge circuit 1-phase	1-phase	4	A B C	10.5 17.5 12.5	9.5 15.8 11.5	3.0 2.0 4.0	4.5 7.5 5.6	2f
4	Half-wave 3-phase	Delta-Wye	3	A B C	6.15 10.0 7.35	7.2 12.0 8.6	4.5 3.0 6.0	1.3 2.2 1.55	3f
5	Full-wave 3-phase	Delta-Wye	6	A B C	6.15 10.0 7.35	14.3 23.9 17.2	4.5 3.0 6.0	0.6 1.0 0.72	6f
6	Full-wave 3-phase	Delta-Delta	6	A B C	10.5 17.5 12.5	14.3 23.9 17.2	4.5 3.0 6.0	0.6 1.0 0.72	6f
7	Half-wave 6-phase (3-phase supply)	Delta-Star	6	A B C	5.25 8.8 6.25	7.2 12.0 8.6	9.0 6.0 12.0	0.29 0.48 0.35	6f

*See RATING GRAPH

A: Convection cooled, at maximum tube ratings

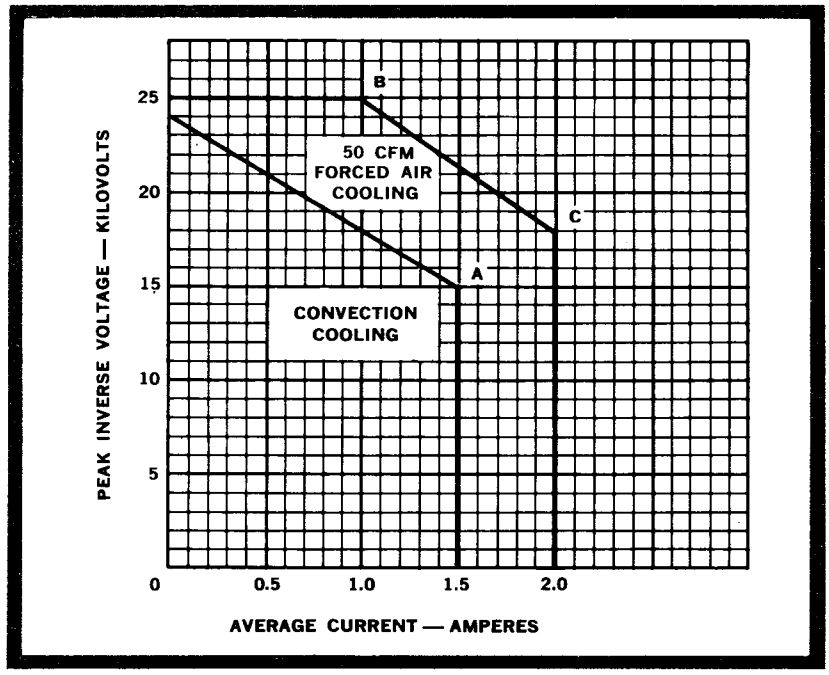
B: Forced air cooled at maximum voltage ratings

C: Forced air cooled at maximum current ratings

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.

The 7792 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

RATING GRAPH



TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7793

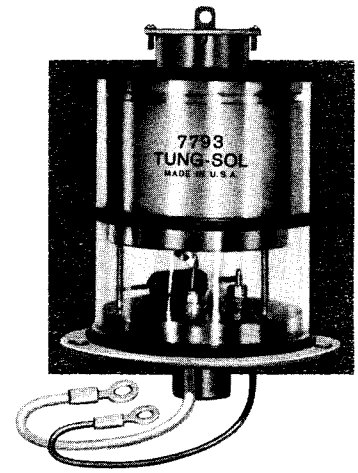
MARCH, 1964

HYDROGEN DIODE

DESCRIPTION — The 7793 is an indirectly heated, hydrogen filled, half-wave diode for use in high-voltage rectifier, clipper, or backswing diode applications. It has a hydrogen reservoir with external electrical connections to assure long life and stable operation.

The rugged 7793 can handle higher voltage than comparable xenon tubes. The range of ambient operating temperatures and the variety of mounting positions are greater for the 7793 than is possible with mercury vapor tubes. This diode has a greater safety factor for voltage and current surges than is practical in semi-conductor stacks.

The 7793 employs flange mounting for minimum overall height, good electrical connections, and ease of installation.



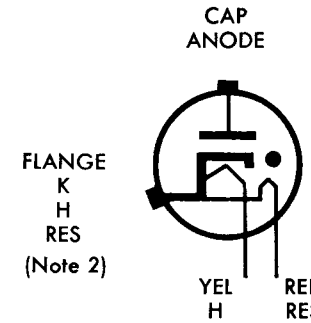
See Page 2 for Outline Drawing

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	4.75	5.0	5.25	Volts
Heater Current $-E_f = 5.0$ Volts	18	21.5	25	Amperes
Reservoir Voltage	4.75	5.0	5.25	Volts
Reservoir Current $-E_r = 5.0$ Volts	3.0	4.0	5.0	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	—	60	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	30	—	75	Volts

MECHANICAL DATA

Type of Cooling	Forced Air — 50 cfm directed into anode stem—See Mounting Data Drawing
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	1 Pound 13 Ounces
Dimensions	See Outline Drawing
Mounting Data	See Mounting Data Drawing
Anode Connection	See Outline Drawing
Heater Connection	8 ± ½-inch long yellow lead with yellow lug for ¼-inch diameter screw
Reservoir Connection	8 ± ½-inch long red lead with red lug for ¼-inch diameter screw



BASING DIAGRAM

RATINGS, ABSOLUTE VALUES

	SHUNT DIODE SERVICE		RECTIFIER SERVICE		
	Minimum	Maximum	Minimum	Maximum	
Peak Inverse Anode Voltage—Note 1	—	30,000	—	30,000	Volts
Cathode Current					
Peak	—	1,500	—	16	Amperes
Average	—	1.0	—	4	Amperes
RMS	—	40	—	—	Amperes
Fault — 0.1 Second Maximum Duration	—	2,000	—	90	Amperes
Averaging Time	—	—	—	15	Seconds
Ambient Temperature	−55	+75	−55	+75	Degrees Centigrade
Altitude	—	10,000	—	10,000	Feet

NOTES:

1. See Rectifier Rating Graph on page 2.
2. **CAUTION** — In order to avoid damage to tube, the cathode connection must be made to the base flange only.

TYPE 7793

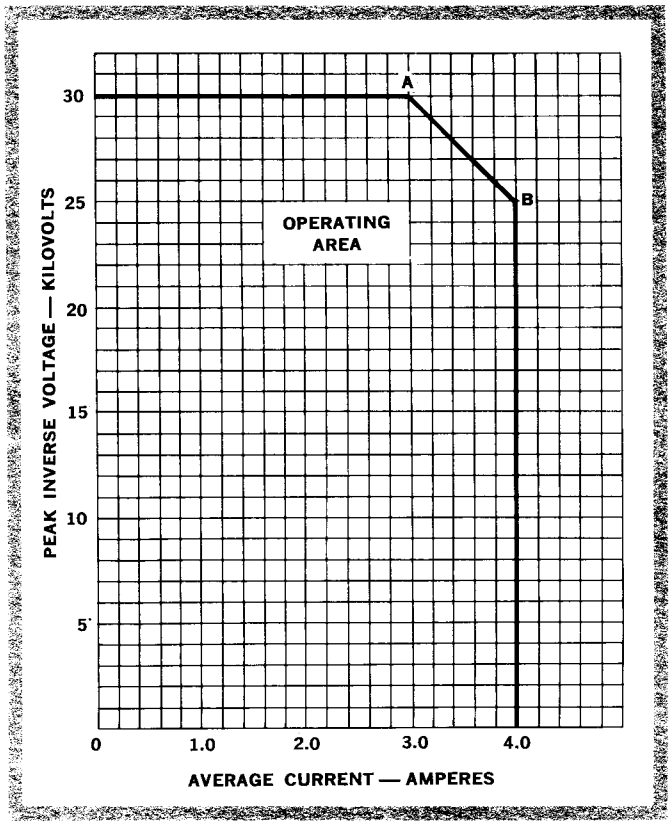
MAXIMUM RATING CHART FOR INFINITE INDUCTANCE CHOKE INPUT FILTER

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	*	A-C SECONDARY VOLTAGE E_{RMS} Kilovolts	D-C OUTPUT — APPROX		RIPPLE	
						E_{DC} Kilovolts	I_{DC} AMPS	KILOVOLTS RMS	FREQ
2	Full-wave 1-phase	1-phase C-T	2	A B	8.85 10.6	7.95 9.56	8.00 6.00	3.75 4.50	2f
3	Bridge circuit 1-phase	1-phase	4	A B	17.7 21.2	15.9 19.1.	8.00 6.00	7.50 9.00	2f
4	Half-wave 3-phase	Delta-Wye	3	A B	10.2 12.2	11.9 14.3	12.0 9.00	2.11 2.54	3f
5	Full-Wave 3-phase	Delta-Wye	6	A B	10.2 12.5	23.8 28.6	12.0 9.00	0.915 1.16	6f
6	Full-wave 3-phase	Delta-Delta	6	A B	17.6 21.2	23.8 28.6	12.0 9.00	0.915 1.16	6f

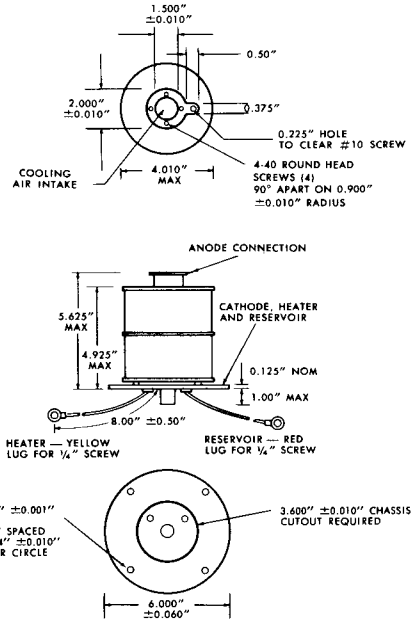
* See RATING GRAPH
A: Forced air cooled at maximum current rating.
B: Forced air cooled at maximum voltage rating.

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.
The 7793 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

RECTIFIER RATING GRAPH

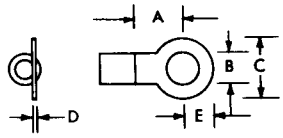


OUTLINE DRAWING AND MOUNTING DATA



HEATER AND RESERVOIR LUG DETAIL

Symbol	Dimension
A	0.380" MIN
B	0.260" – 0.313"
C	0.605" MAX
D	0.04" MIN
E	0.305" MAX



TUNG-SOL

PRODUCT BULLETIN

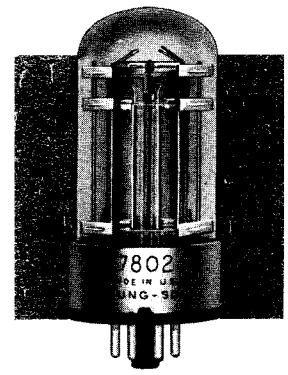
INDUSTRIAL ELECTRON TUBE TYPE 7802

JANUARY 1963

MEDIUM-MU TWIN POWER TRIODE

DESCRIPTION — The 7802 is a medium-mu, high current twin triode designed for use in electronically regulated power supplies. The high perveance of this tube permits the passage of large currents at low plate voltages, thus providing for efficient series regulation.

A smaller signal voltage is needed to control the 7802 as compared with that required by equivalent low-mu tubes.

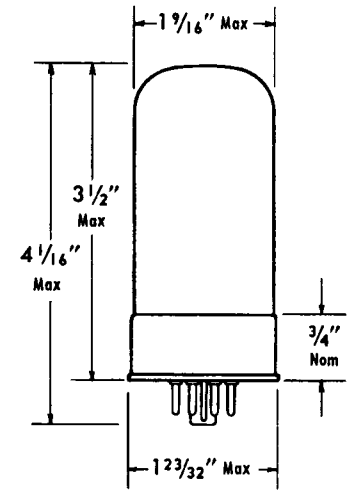


ELECTRICAL DATA

Heater Voltage	6.3 ±10%	Volts
Heater Current — E_f = 6.3 Volts	2.5	Amperes
Cathode Heating Time — Minimum	30	Seconds
Transconductance per Section	20,000	Micromhos
Amplification Factor	9	
Interelectrode Capacitance — per Section		
Grid to Cathode	7.8	Micromicrofarads
Grid to Plate	9.5	Micromicrofarads
Cathode to Plate	1.3	Micromicrofarads
Cathode to Heater	7.8	Micromicrofarads
Interelectrode Capacitance — Between Sections		
Grid to Grid	0.82	Micromicrofarad
Plate to Plate	2.3	Micromicrofarads

MECHANICAL DATA

Mounting Position	Any
If tube is mounted in a horizontal position, it should be mounted so that the base lug key is directly up or down.	
Bulb	T12
Base	Large wafer octal 8-pin with metal sleeve, JEDEC type B8-98
Maximum Net Weight	3 ounces

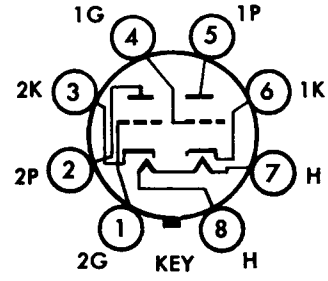


OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Heater Voltage	5.7	6.9	Volts
Plate Voltage	—	250	Volts dc
Plate Current per Section — Note 1	—	160	Milliamperes
Power Dissipation per Section	—	13	Watts
Grid Voltage	—	0	Volts dc
Grid Current per Section	—	5	Milliamperes
Heater — Cathode Leakage	−300	+300	Volts
Envelope Temperature	—	200	Degrees Centigrade
Altitude for Full Ratings	—	10,000	Feet
Grid Circuit Resistance Values			
For Cathode Bias Operation	500	500,000	Ohms
For Fixed Bias, or Cathode and Fixed Bias Operation	500	50,000	Ohms

Note 1. If several tube sections are used in parallel with each other, do not exceed 125 milliamperes per section.



BOTTOM VIEW

RANGE OF VALUES

Conditions — E_f = 6.3 Volts
E_b = 100 Volts dc
E_c = −4 Volts dc
$R_k/_k$ = 0
$R_g/_g$ = 500 Ohms minimum

Both sections operating, test each section separately.

	Minimum	Maximum	
Plate Current per Section	80	150	Milliamperes dc
Plate Current — Difference Between Sections	—	35	Milliamperes dc
Transconductance per Section	16,500	23,500	Micromhos
Amplification Factor	6.5	10.5	

Conditions — E_f = 6.3 Volts
E_b = 250 Volts dc
E_c = −75 Volts dc
$R_k/_k$ = 0

	Minimum	Maximum	
Plate Current per Section	—	3	Milliamperes dc

APPLICATION NOTES

The 7802 is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance at relatively low plate voltages. To provide the desired output current, many triode sections can be paralleled. If tube sections are to be paralleled however, the designer is strongly urged to use sufficient resistance in each cathode leg to equalize current division among the triode sections. Recommended values for various operating currents are shown on the plate characteristics curve. If the output current of the supply is not fixed, use the resistance indicated for the lowest current that approaches the maximum plate dissipation line. Cathode resistance is superior to anode resistance because it helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one third the value $\left(\frac{R}{\mu + 1}\right)$ of a plate resistor, and therefore will dissipate only one third the power. In any case, the only losses incurred in using a resistor is the insertion loss of the resistor itself (less than one watt) and the additional voltage (less than 10 volts) necessary from the unregulated supply. A cathode resistor adds a small additional loss by causing the passing tube to work with higher bias and hence with greater tube drop.

The regulator circuit shown in Figure 2 is preferable from the consideration of the safety of the passing tube both during warmup and in the event of trouble in the amplifier circuit or if the amplifier tube is removed from its socket. It has the additional advantage of providing a constant voltage for the amplifier circuit. However, if the regulated output voltage is low (below 250 volts), it will be necessary to provide additional negative voltage for the reference tube circuit. Also, if the regulated output voltage is to be variable, it may be necessary to follow Figure 1. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it, during warmup the amplifier tube draws little current, there is little IR drop across the resistor, and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

Passing tube operation conditions should be chosen to provide as low a tube drop as possible. A safety margin of at least 5 volts from the zero bias line should be allowed however, for variations of individual tubes. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 5.0 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high enough to prevent parasitic oscillation but not large enough to prevent loss of control due to a small amount of "gas" grid current. A value of grid resistance that meets both these conditions is 1,000 ohms. Heater voltage should be kept as close as possible to 6.3 volts as measured on the tube pins. When connecting many high drain tube heaters across a single transformer, bus bars feeding from "alternate ends" (Figure 3) should be used with a stranded pair feeding individual sockets.

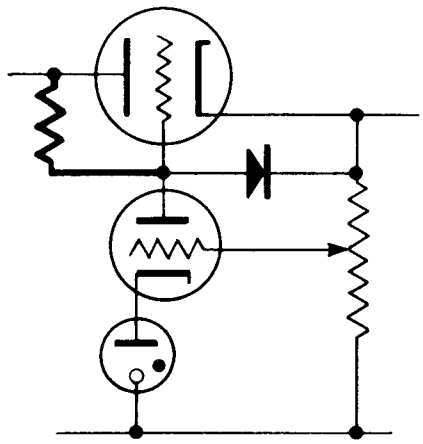


FIGURE 1

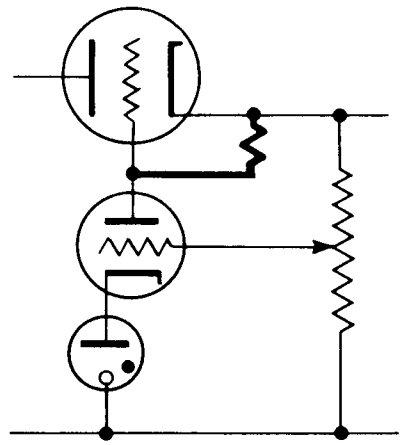


FIGURE 2

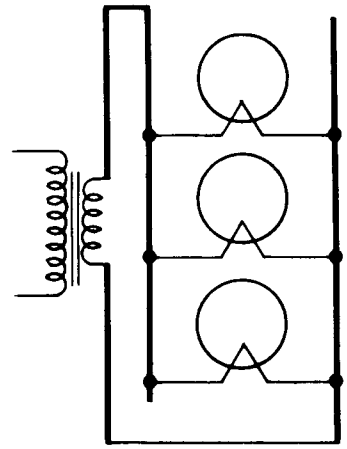


FIGURE 3

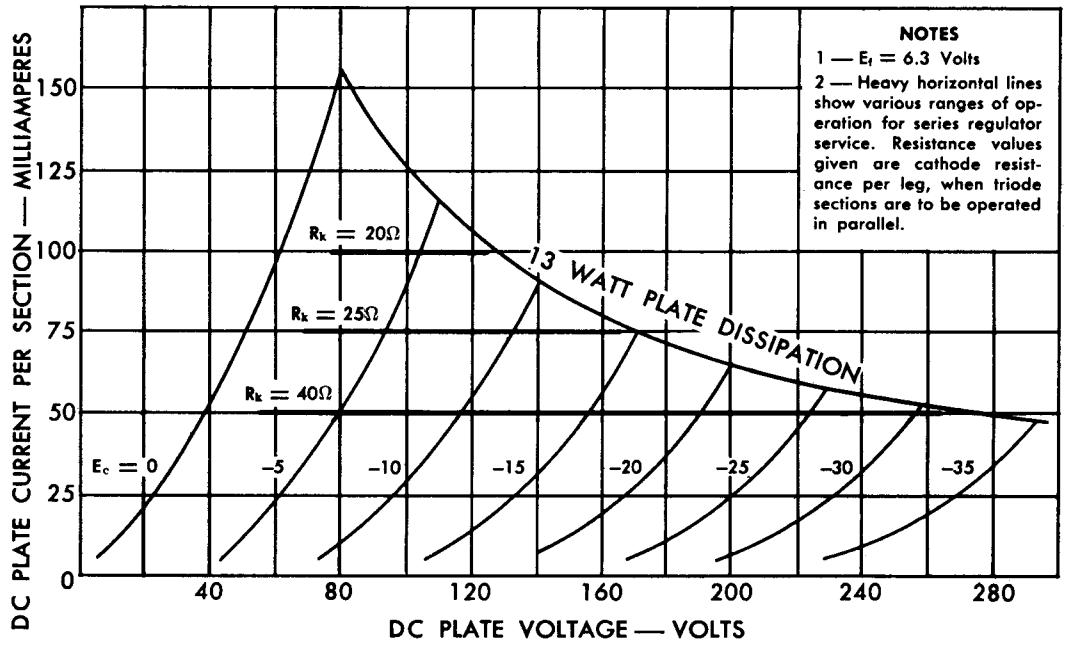


FIGURE 4. PLATE CHARACTERISTICS FOR EACH TRIODE SECTION

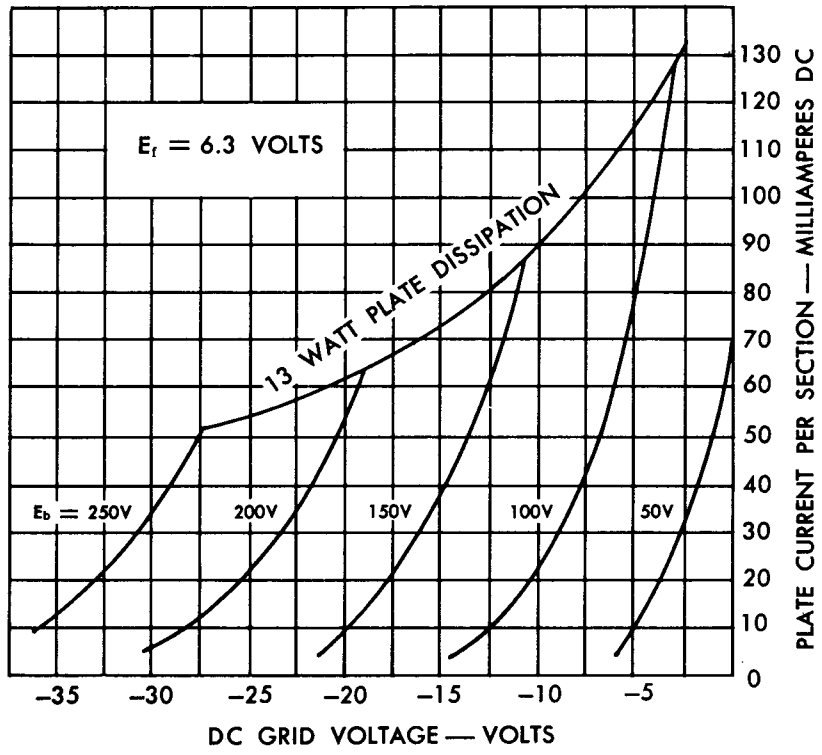


FIGURE 5 TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION

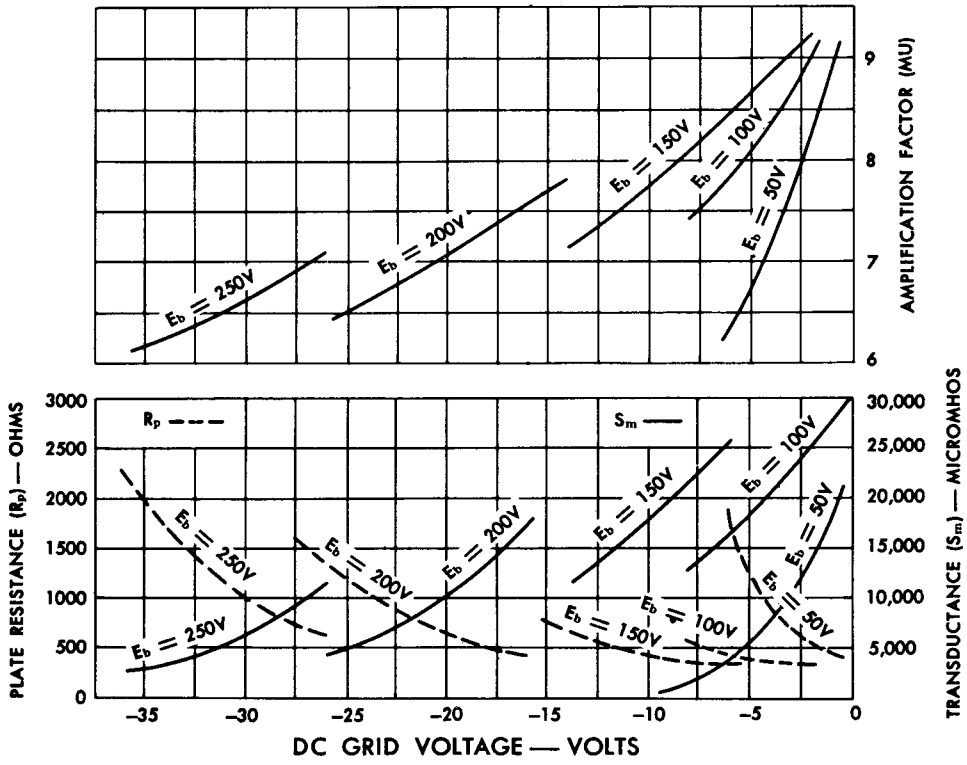


FIGURE 6. AMPLIFICATION FACTOR, PLATE RESISTANCE AND TRANSDUCTANCE CURVES

TUNG-SOL

PRODUCT BULLETIN

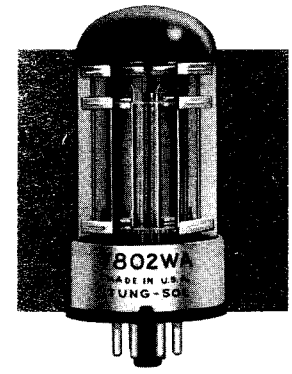
INDUSTRIAL ELECTRON TUBE TYPE 7802WA

JANUARY 1963

RUGGED, RELIABLE MEDIUM-MU TWIN POWER TRIODE

DESCRIPTION — The 7802WA is a rugged, reliable version of the 7802 medium-mu, high current twin triode designed for use in electronically regulated power supplies. Its high perveance permits passage of large currents at low plate voltages, thus providing for efficient series regulation. The medium-mu 7802WA requires a smaller signal voltage as compared with that required by equivalent low-mu types.

The 7802WA is run in lots with many destructive tests performed on randomly selected samples. Thus a tube may pass all required tests and still be rejected if it is from an unsatisfactory lot. Longer life tests with multiple and closer test limits assure a highly reliable tube with a long life expectancy.

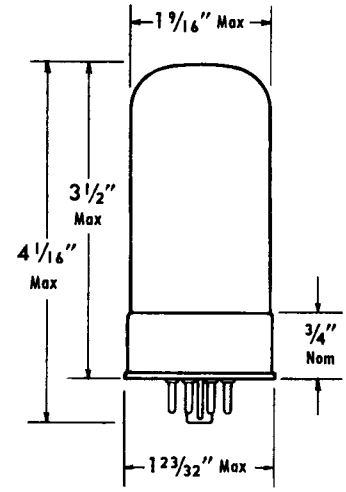


ELECTRICAL DATA

Heater Voltage	6.3 ±5%	Volts
Heater Current — E_f = 6.3 Volts	2.5	Amperes
Cathode Heating Time — Minimum	30	Seconds
Transconductance per Section	20,000	Micromhos
Amplification Factor	9	
Interelectrode Capacitance — per Section		
Grid to Cathode	7.8	Micromicrofarads
Grid to Plate	9.5	Micromicrofarads
Cathode to Plate	1.3	Micromicrofarads
Cathode to Heater	7.8	Micromicrofarads
Interelectrode Capacitance — Between Sections		
Grid to Grid	0.82	Micromicrofarad
Plate to Plate	2.3	Micromicrofarads

MECHANICAL DATA

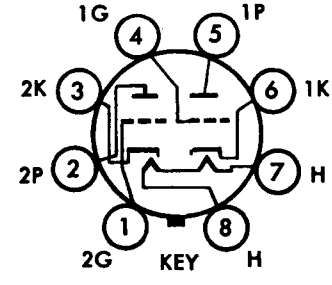
Mounting Position	Any
If tube is mounted in a horizontal position, it should be mounted so that the base lug key is directly up or down.	
Bulb	T12
Base	Large wafer octal 8-pin with metal sleeve, JEDEC type B8-98
Maximum Net Weight	3 ounces



OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Heater Voltage	6.0	6.6	Volts
Plate Voltage	—	250	Volts dc
Plate Current per Section — Note 1	—	160	Milliamperes
Power Dissipation per Section	—	13	Watts
Grid Voltage	—	0	Volts dc
Grid Current per Section	—	5	Milliamperes
Heater — Cathode Voltage	−300	+300	Volts
Envelope Temperature	—	230	Degrees Centigrade
Altitude for Full Ratings	—	60,000	Feet
Grid Circuit Resistance Values			
For Cathode Bias Operation	500	500,000	Ohms
For Fixed Bias, or Cathode and Fixed Bias Operation	500	50,000	Ohms



BOTTOM VIEW

Note 1. If several tube sections are used in parallel with each other, do not exceed 125 milliamperes per section.

ADDITIONAL TESTS TO INSURE RELIABILITY

Randomly Selected Samples Are Subjected to the Following Tests.

Shock: 30° Hammer angle in Navy Flyweight High Impact Machine (450 G/msec)

Fatigue: 25 cps at 2.5 G for 32 hours in each of three mutually perpendicular planes

Post Shock and Fatigue Limits:

Vibration (R_p = 2000 ohms, E_c = −7vdc, Tie 1k to 2k, 1g to 2g, 1p to 2p), Generated Plate Voltage	300 mVac max
Heater-Cathode Leakage (E_{hk} = ±100 Vdc)	50 uAdc max
Change in Transconductance from Initial Value	15% max
Grid Current	−4.5 uA max

Heater Cycling Life Test (E_f = 7.5v, E_{hk} = 300 Vac. Duration of 2000 cycles of 1 minute on and 4 minutes off)

End Point E_{hk} = ±100 Vdc)	50 uAdc max
Stability Life Test (1 hour) End Point: Change in Transconductance from Initial Value	10% max
Survival Rate Life Test (100 hours) End Point: Transconductance	13,500 umhos min

Intermittent Life Test (1000 hours, bulb temperature = 300°C min) End Points:

Grid Current	−5 uAdc max
Change in Transconductance by reducing E_f to 5.7v	15% max
Change in Transconductance from zero hour reading	15% max
Heater-Cathode Leakage E_{hk} = ±100Vdc	25 uAdc max
Heater Current	2.35 min 2.75 max amperes
Insulation of Electrodes: Grid to all others and Plate to all others	100 megohm min

RANGE OF VALUES

Test Conditions: E_f = 6.3V, E_b = 100V, E_c = −4 Vdc, $R_{g/g}$ = 500 ohms min

	Min	Max	
Individual Section Plate Current	80	150	Milliamperes dc
Lot Average Plate Current	100	130	Milliamperes dc
Plate Current, Difference between Sections	—	35	Milliamperes dc
Individual Section Transconductance	16,500	23,500	Micromhos

Both sections operating, each section read separately

	Min	Max	
Lot Average Transconductance	18,800	21,000	Micromhos
Amplification Factor	6.5	10.5	
Heater Current @ 6.3 v	2.35	2.65	Amperes

APPLICATION NOTES

The 7802 WA is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance at relatively low plate voltages. To provide the desired output current, many triode sections can be paralleled. If tube sections are to be paralleled however, the designer is strongly urged to use sufficient resistance in each cathode leg to equalize current division among the triode sections. Recommended values for various operating currents are shown on the plate characteristics curve. If the output current of the supply is not fixed, use the resistance indicated for the lowest current that approaches the maximum plate dissipation line. Cathode resistance is superior to anode resistance because it helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one third the value $\left(\frac{R}{u+1}\right)$ of a plate resistor, and therefore will dissipate only one third the power. In any case, the only losses incurred in using a resistor is the insertion loss of the resistor itself (less than one watt) and the additional voltage (less than 10 volts) necessary from the unregulated supply. A cathode resistor adds a small additional loss by causing the passing tube to work with higher bias and hence with greater tube drop.

The regulator circuit shown in Figure 2 is preferable from the consideration of the safety of the passing tube both during warmup and in the event of trouble in the amplifier circuit or if the amplifier tube is removed from its socket. It has the additional advantage of providing a constant voltage for the amplifier circuit. However, if the regulated output voltage is low (below 250 volts), it will be necessary to provide additional negative voltage for the reference tube circuit. Also, if the regulated output voltage is to be variable, it may be necessary to follow Figure 1. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it, during warmup the amplifier tube draws little current, there is little IR drop across the resistor, and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

Passing tube operation conditions should be chosen to provide as low a tube drop as possible. A safety margin of at least 5 volts from the zero bias line should be allowed however, for variations of individual tubes. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 5.0 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high enough to prevent parasitic oscillation but not large enough to prevent loss of control due to a small amount of "gas" grid current. A value of grid resistance that meets both these conditions is 1,000 ohms. Heater voltage should be kept as close as possible to 6.3 volts as measured on the tube pins. When connecting many high drain tube heaters across a single transformer, bus bars feeding from "alternate ends" (Figure 3) should be used with a stranded pair feeding individual sockets.

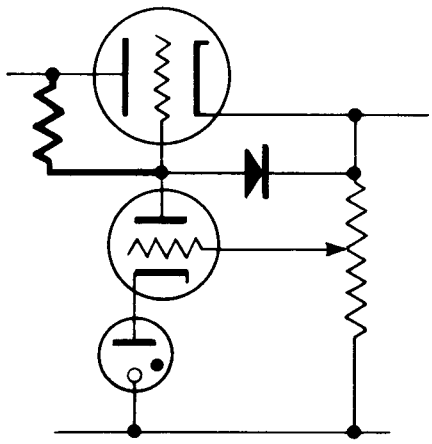


FIGURE 1

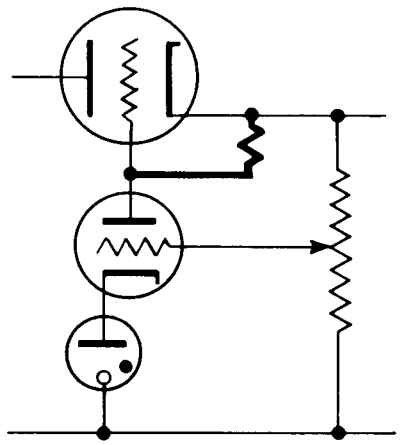


FIGURE 2

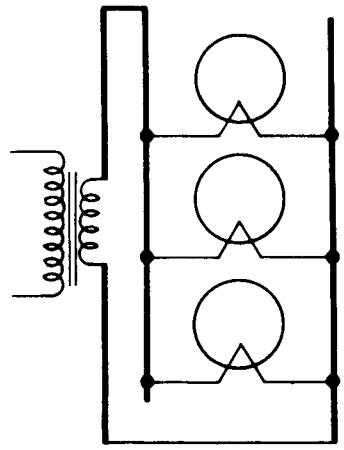


FIGURE 3

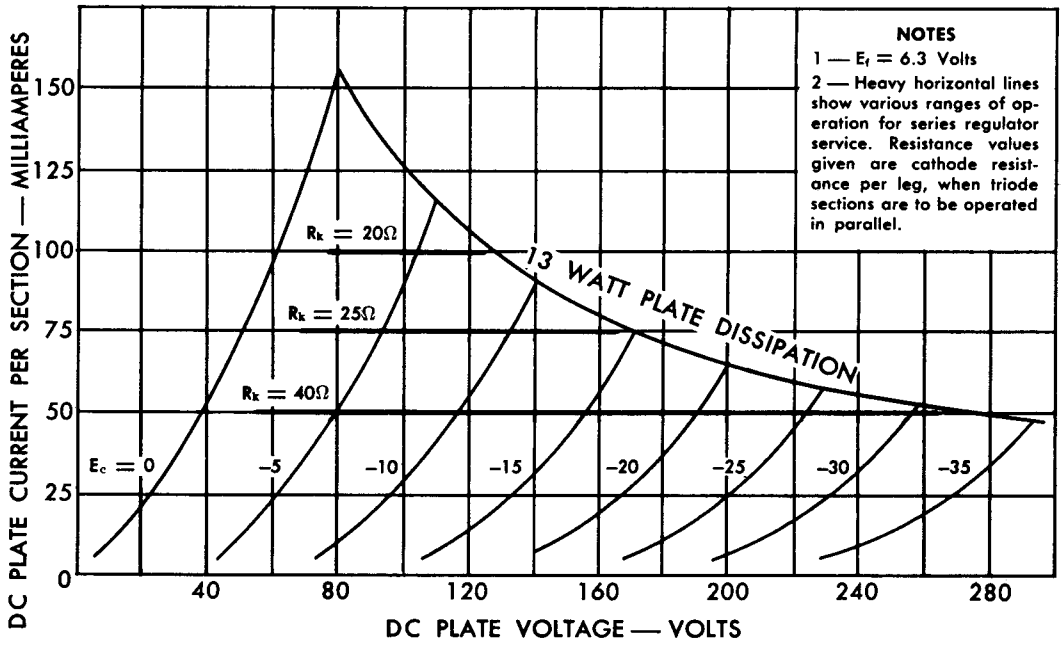


FIGURE 4. PLATE CHARACTERISTICS FOR EACH TRIODE SECTION

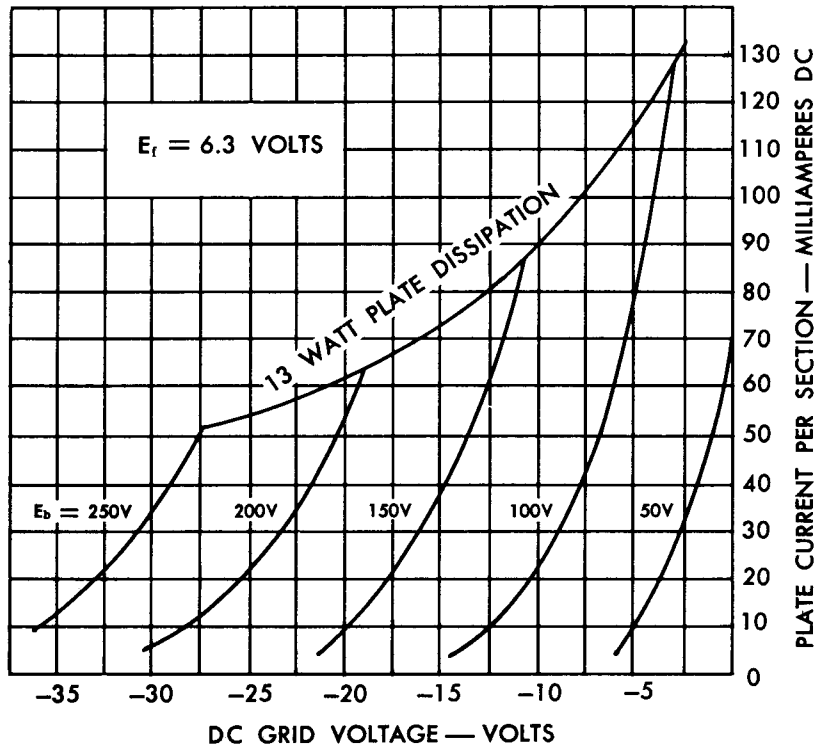


FIGURE 5. TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION

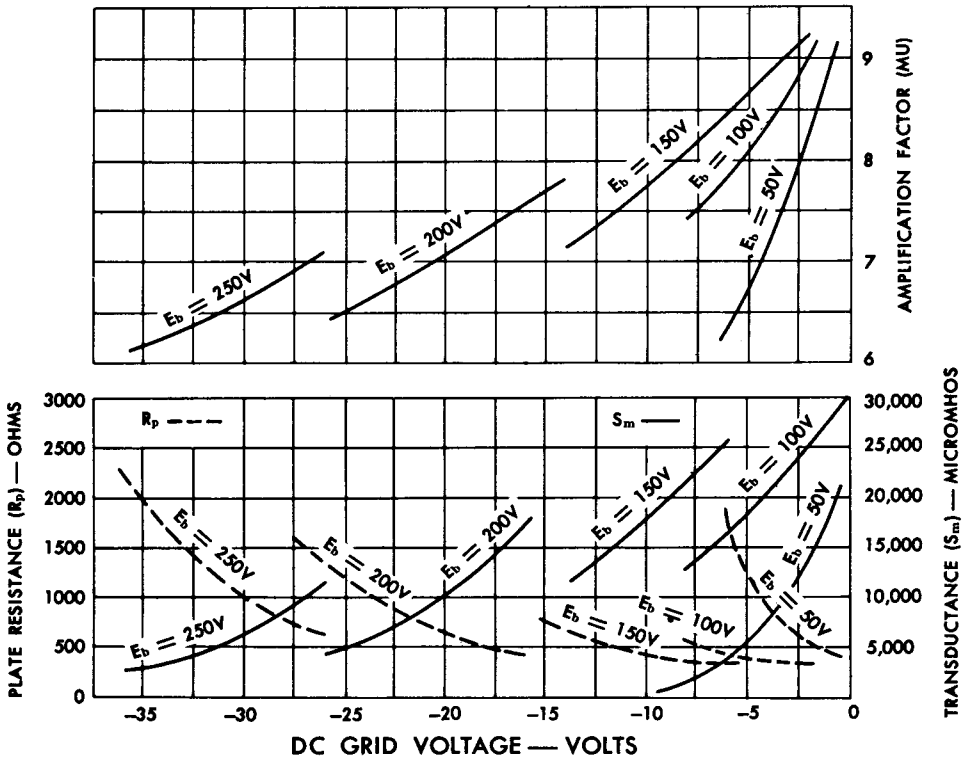


FIGURE 6. AMPLIFICATION FACTOR, PLATE RESISTANCE AND TRANSDUCTANCE CURVES

TUNG-SOL

PRODUCT BULLETIN

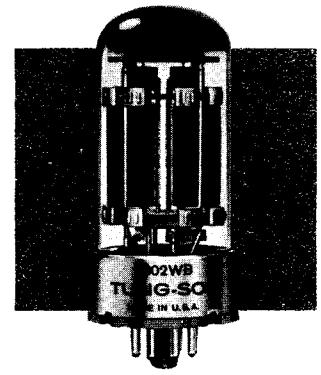
INDUSTRIAL ELECTRON TUBE TYPE 7802WB

DECEMBER, 1962

HIGH TEMPERATURE, RUGGED, RELIABLE MEDIUM-MU, TWIN POWER TRIODE

DESCRIPTION — The 7802WB is a high temperature, rugged, reliable version of the 7802 medium-mu, high current twin triode. Its high perveance permits passage of large currents at low plate voltages, thus providing for efficient series regulation in electronically regulated power supplies. The 7802WB requires a smaller signal voltage as compared with that required by equivalent low-mu types.

The use of heavy duty parts such as ceramic element spacers, heater insulators and standoff insulators; warp-free graphite anodes; non-char glass-bonded mica base wafer; and nine mount snubbers insures this tube passing a 450G shock test and a 50 to 500 cps vibration fatigue test. The 7802WB will operate at considerably higher altitudes and higher bulb temperatures than its prototype. Tighter environmental tests and longer life tests with multiple and closer test limits assure a rugged, highly reliable tube with a long, trouble-free life.

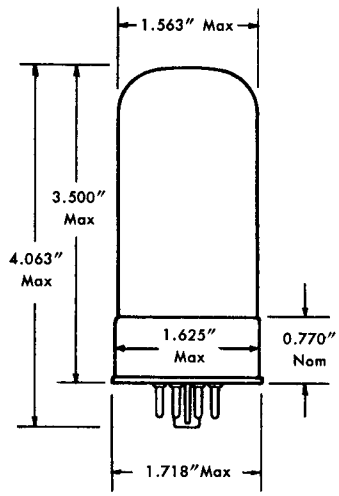


ELECTRICAL DATA

Heater Voltage	6.3 ±5%	Volts
Heater Current — E_f = 6.3 Volts	2.5	Amperes
Cathode Heating Time — Minimum	30	Seconds
Transconductance per Section	20,000	Micromhos
Amplification Factor	9	
Interelectrode Capacitance — per Section		
Grid to Cathode	9.0	Micromicrofarads
Grid to Plate	12.5	Micromicrofarads
Cathode to Plate	1.7	Micromicrofarads
Cathode to Heater	8.3	Micromicrofarads
Interelectrode Capacitance — Between Sections		
Grid to Grid	1.1	Micromicrofarads
Plate to Plate	0.52	Micromicrofarads

MECHANICAL DATA

Mounting Position	Any
If tube is mounted in a horizontal position, it should be mounted so that the base lug key is directly up or down.	
Bulb	T12 Nonex
Base	Large wafer octal 8-pin with metal sleeve, JEDEC type B8-98
Maximum Net Weight	3 ounces

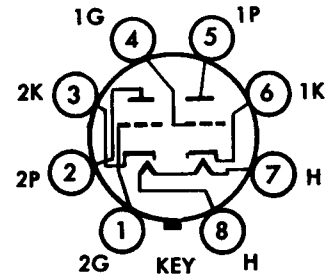


OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Heater Voltage	6.0	6.6	Volts
Plate Voltage	—	250	Volts dc
Plate Current per Section — Note 1	—	160	Milliamperes
Power Dissipation per Section	—	15	Watts
Grid Voltage	−300	0	Volts dc
Heater — Cathode Voltage	450	+450	Volts
Envelope Temperature	—	300	Degrees Centigrade
Altitude for Full Ratings	—	60,000	Feet
Grid Circuit Resistance Values			
For Cathode Bias Operation	500	500,000	Ohms
For Fixed Bias, or Cathode and Fixed Bias Operation	500	50,000	Ohms

Note 1. If several tube sections are used in parallel with each other, do not exceed 125 milliamperes per section.



BASING DIAGRAM
BOTTOM VIEW
8BD

ADDITIONAL TESTS TO INSURE RELIABILITY

Randomly Selected Samples Are Subjected to the Following Tests.

Shock: 30° Hammer angle in Navy Flyweight High Impact Machine (450 G/msec)

Fatigue: 50 to 500 cps at 2.5 G for 32 hours in each of three mutually perpendicular planes

Post Shock and Fatigue Limits:

Vibration (R_p = 2000 ohms, E_c = −7vdc, Tie 1k to 2k, 1g to 2g, 1p to 2p), Generated Plate Voltage	500 mVac max
Heater-Cathode Leakage (E_{hk} = ±450 Vdc)	50 uAdc max
Change in Transconductance from Initial Value	15% max
Grid Current	−4.5 uA max

Heater Cycling Life Test (E_f = 7.5v, E_{hk} = 300 Vac. Duration of 2000 cycles of 1 minute on and 4 minutes off)

End Point (E_{hk} = ±450vdc)	50 uAdc max
Stability Life Test (1 hour) End Point: Change in Transconductance from Initial Value	10% max
Survival Rate Life Test (100 hours) End Point: Transconductance	13,500 umhos min

Intermittent Life Test (1000 hours, bulb temperature = 300°C min) End Points:

Grid Current	−5 uAdc max
Change in Transconductance by reducing E_f to 5.7v	15% max
Change in Transconductance from zero hour reading	15% max
Heater-Cathode Leakage E_{hk} = ±450 Vdc	25 uAdc max
Heater Current	2.35 min 2.75 max amperes
Insulation of Electrodes: Grid to all others and Plate to all others	100 megohm min

RANGE OF VALUES

Test Conditions: E_f = 6.3V, E_b = 100V
E_c = −4 Vdc, $R_{g/g}$ = 500 ohms min

Both sections operating, each section read separately

	Min	Max	
Individual Section Plate Current	80	150 Milliamperes dc	
Lot Average Plate Current	100	130 Milliamperes dc	
Plate Current, Difference between Sections	—	35 Milliamperes dc	
Individual Section Transconductance	16,500	23,500 Micromhos	
Lot Average Transconductance	18,800	21,200 Micromhos	
Amplification Factor	6.5	10.5	
Heater Current @ 6.3 v	2.35	2.65 Amperes	

APPLICATION NOTES

The 7802WB is widely used as a "passing" tube or series regulator tube in controlled power supplies because of its high transconductance at relatively low plate voltages. To provide the desired output current, many triode sections can be paralleled. If tube sections are to be paralleled however, the designer is strongly urged to use sufficient resistance in each cathode leg to equalize current division among the triode sections. Recommended values for various operating currents are shown on the plate characteristics curve. If the output current of the supply is not fixed, use the resistance indicated for the lowest current that approaches the maximum plate dissipation line. Cathode resistance is superior to anode resistance because it helps to provide increasing bias on the sections taking greater plate current. A cathode resistor too, need be only one tenth the value $\left(\frac{R}{u+1}\right)$ of a plate resistor, and therefore will dissipate only one tenth the power. In any case, the only losses incurred in using a resistor is the insertion loss of the resistor itself (less than one watt) and the additional voltage (less than 6 volts) necessary from the unregulated supply. A cathode resistor adds a small additional loss by causing the passing tube to work with higher bias and hence with greater tube drop.

The regulator circuit shown in Figure 2 is preferable from the consideration of the safety of the passing tube both during warmup and in the event of trouble in the amplifier circuit or if the amplifier tube is removed from its socket. It has the additional advantage of providing a constant voltage for the amplifier circuit. However, if the regulated output voltage is low, it may be necessary to provide additional negative voltage for the reference tube circuit. Also, if the regulated output voltage is to be variable, it may be necessary to follow Figure 1. If Figure 1 is used, a clamping diode rated at 300 volts piv should be employed to prevent the grid from swinging positive. The use of this diode is of extreme importance for without it, during warmup the amplifier tube draws little current, there is little IR drop across the resistor, and the grid of the passing tube is effectively tied to the plate. The grid then will attempt to draw excessive current from the passing tube's cathode and may seriously impair cathode life.

Passing tube operation conditions should be chosen to provide as low a tube drop as possible. A safety margin of at least 5 volts from the zero bias line should be allowed however, for variations of individual tubes. If the cathode resistors as suggested on the plate characteristic curve are used, a minimum bias of 5.0 volts will be provided. Sufficient bias excursion should be allowed for overcoming ripple. The amplifier circuit should be able to swing the passing tube grid far enough to counteract the effect of unbalance due to tube ageing.

A grid resistor should be used for each triode section. This should be high enough to prevent parasitic oscillation but not large enough to prevent loss of control due to a small amount of "gas" grid current. A value of grid resistance that meets both these conditions is 1,000 ohms. Heater voltage should be kept as close as possible to 6.3 volts as measured on the tube pins. When connecting many high drain tube heaters across a single transformer, bus bars feeding from "alternate ends" (Figure 3) should be used with a stranded pair feeding individual sockets.

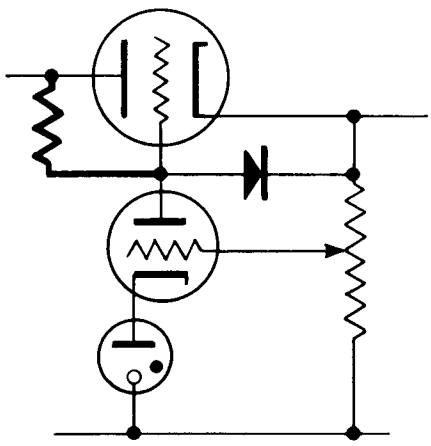


FIGURE 1

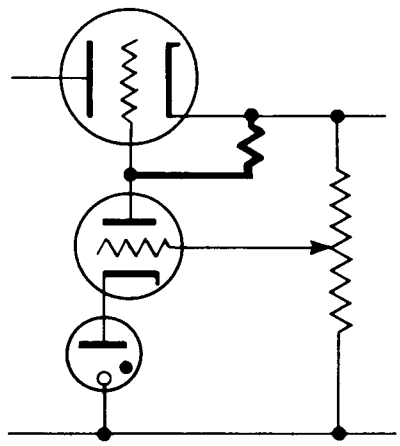


FIGURE 2

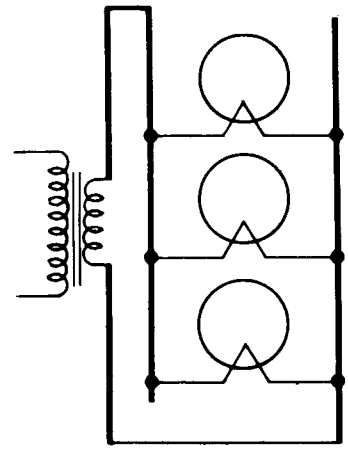


FIGURE 3

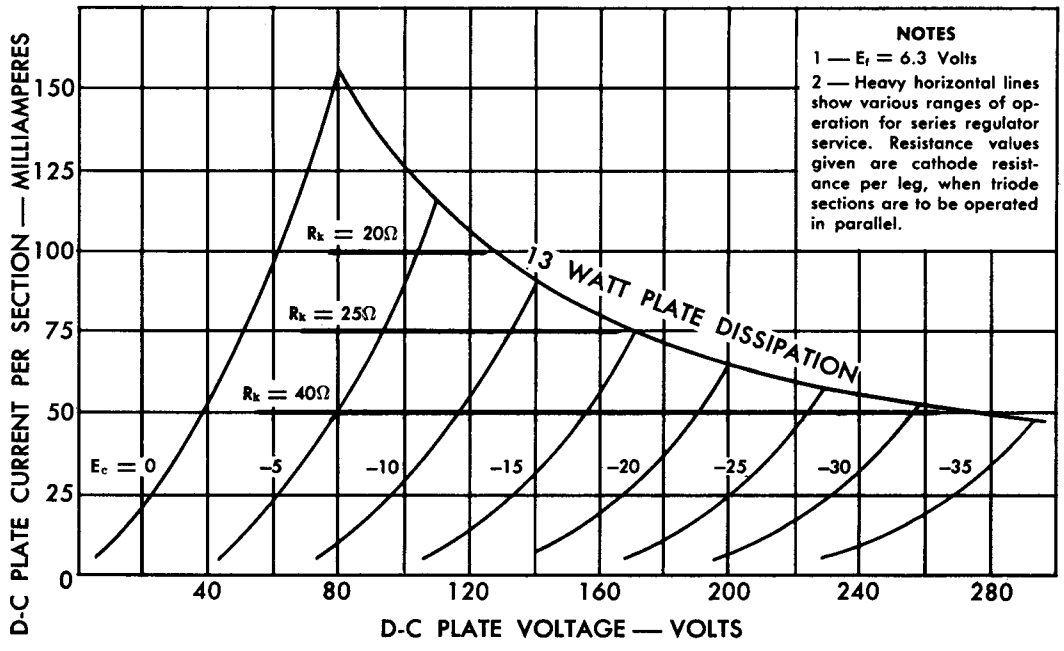


FIGURE 4. PLATE CHARACTERISTICS FOR EACH TRIODE SECTION

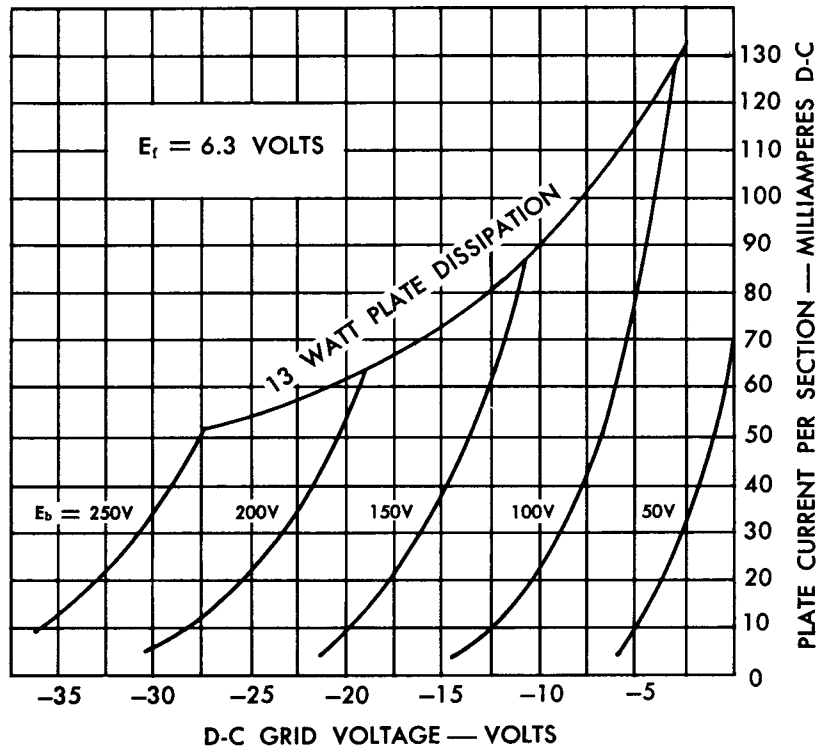


FIGURE 5. TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION

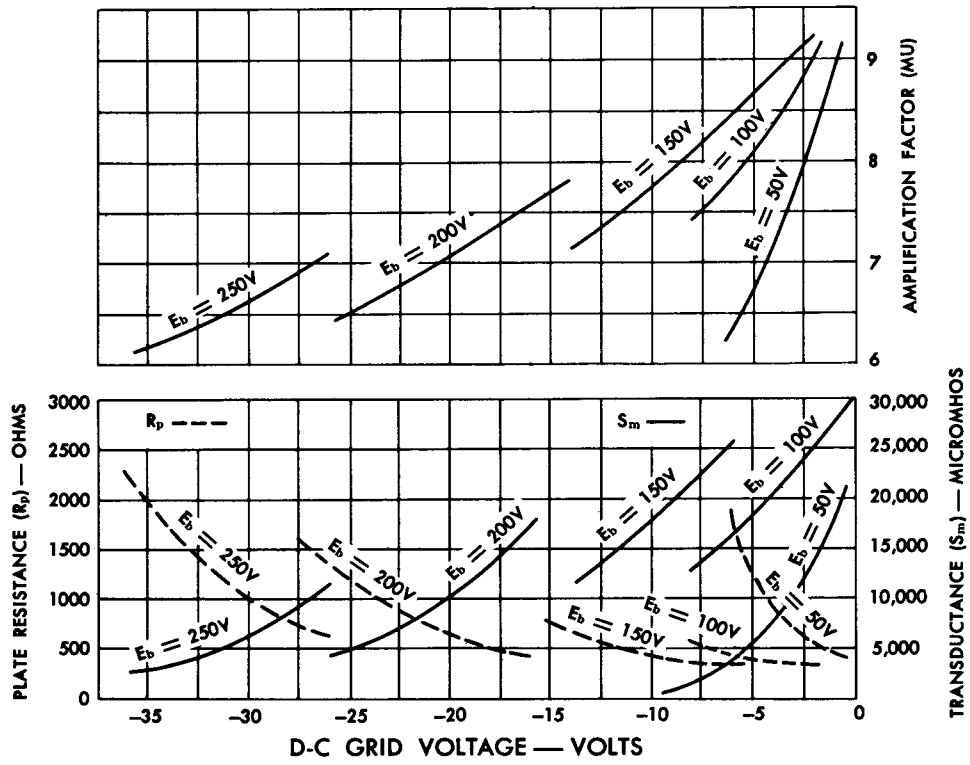
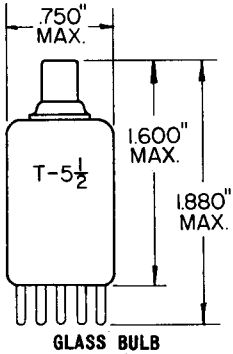


FIGURE 6. AMPLIFICATION FACTOR, PLATE RESISTANCE AND TRANSDUCTANCE CURVES

TUNG-SOL

ELECTROMETER TETRODE

MINIATURE TYPE



GLASS BULB

7 PIN MINIATURE

OUTLINE DRAWING
JEDEC E7-1

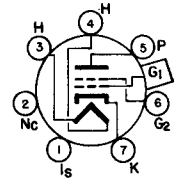
COATED UNIPOTENTIAL CATHODE

HEATER

2.5 VOLTS .200 AMPS.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7GE

THE 7851 IS A SCREEN GRID TETRODE ELECTROMETER TUBE. ITS HIGH TRIODE MU, WHICH DISTINGUISHES IT FROM CONVENTIONAL ELECTROMETER TUBES, MAKES IT PARTICULARLY USEFUL AS AN EXTREMELY HIGH GAIN CURRENT AMPLIFIER IN APPLICATIONS WHEREIN THE INPUT SIGNAL IS IN THE ORDER OF MICRO-MICRO-AMPERES. CAREFUL SHIELDING FROM LIGHT AS WELL AS ELECTROMAGNETIC FIELDS MUST BE OBSERVED, AS WITH ALL ELECTROMETER TUBES.

DIRECT INTERELECTRIC CAPACITANCES

(APPROX.)

WITHOUT EXTERNAL SHIELD

GRID TO PLATE: G1 TO P	0.19	pf
INPUT: G1 TO (H+K+G2,S)	2.6	pf
OUTPUT: P TO (H+K+G2,S)	1.8	pf

RATINGS

INTERPRETED ACCORDING TO DESIGN CENTER SYSTEM[A]

HEATER VOLTAGE	2.5	VOLTS
MAXIMUM PLATE VOLTAGE	12	VOLTS
MAXIMUM GRID #2 VOLTAGE	12	VOLTS
MAXIMUM NEGATIVE GRID #1 VOLTAGE	-12	VOLTS
MAXIMUM POSITIVE GRID #1 VOLTAGE	0	VOLTS
MAXIMUM GRID #1 CURRENT -(SEE BELOW)		
MAXIMUM HEATER-CATHODE VOLTAGE	±16	VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

PLATE SUPPLY VOLTAGE	11.0	VOLTS
GRID #2 VOLTAGE	11.0	VOLTS
GRID #1 VOLTAGE APPLIED	-2.2	VOLTS
PLATE CURRENT	16	μAMPS
TRANSCONDUCTANCE	40	μMHOS
PLATE RESISTANCE - APPROX.	1.7	MEGOHMS
TRIODE AMPLIFICATION FACTOR	5	
GRID CURRENT - MAXIMUM	10×10^{-13}	AMPS.

[A] REFER TO EIA STANDARD RS-239.

WITH HIGH INPUT IMPEDANCES, CHARACTERISTICS VARY GREATLY WITH HEATER VOLTAGE; THE DEGREE OF STABILITY OBTAINED DEPENDS LARGELY UPON THE DEGREE OF REGULATION OF HEATER VOLTAGE OR CURRENT.

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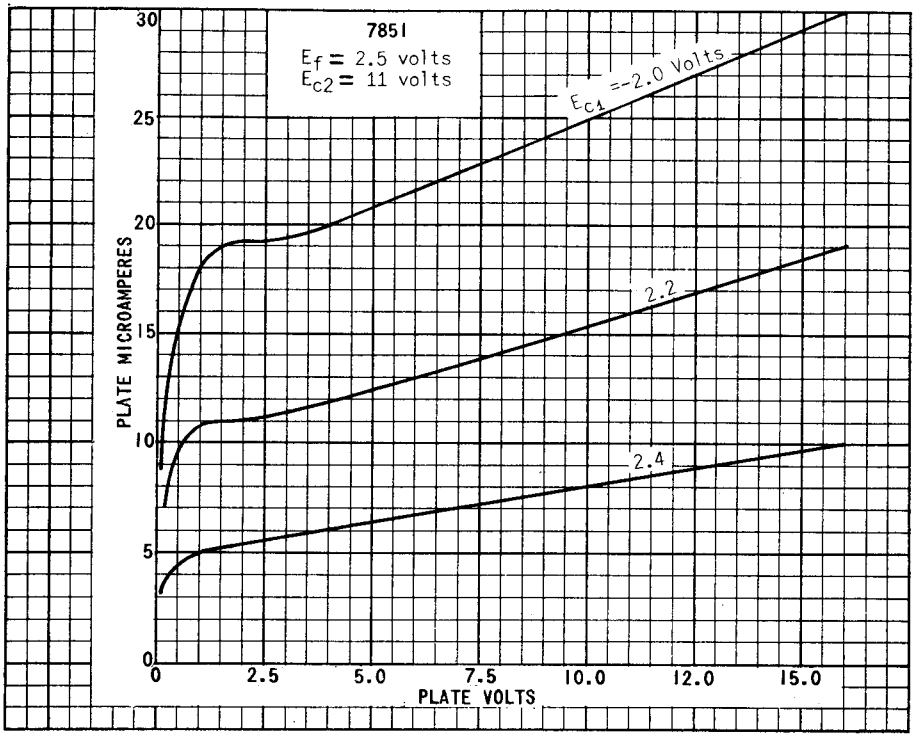
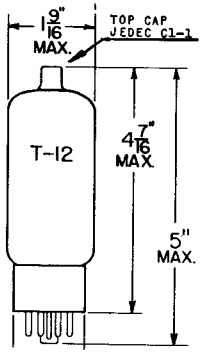

7851
E_f = 2.5 volts
E_{c2} = 11 volts
E_{c1} = -2.0 Volts
2.2
2.4
PLATE MICROAMPERES
PLATE VOLTS
0
5
10
15
20
25
30
0
2.5
5.0
7.5
10.0
12.0
15.0

TUNG-SOL

BEAM POWER PENTODE

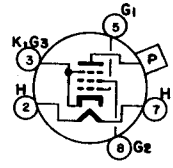


GLASS BULB
OUTLINE DRAWING
JEDEC 12-21
BASE JEDEC B5-123

COATED UNIPOTENTIAL CATHODE

HEATER

6.3±0.6 VOLTS 2.5 AMP.



BOTTOM VIEW
BASING DIAGRAM
JEDEC 5BT

THE 7867 IS A BEAM POWER PENTODE DESIGNED WITH HIGH POWER SENSITIVITY AND HIGH EFFICIENCY FOR SERVICE IN AUDIO OUTPUT STAGES. IT IS CAPABLE OF HANDLING HIGH POWER AT A VERY LOW HARMONIC DISTORTION LEVEL.

DIRECT INTERELECTRODE CAPACITANCES
WITHOUT EXTERNAL SHIELD

GRID #1 TO PLATE (APPROX.)	1.1	pf
INPUT	22	pf
OUTPUT	8.5	pf

RATINGS
INTERPRETED ACCORDING TO DESIGN MAXIMUM SYSTEM[B]

HEATER VOLTAGE[A]	6.3±0.6	VOLTS
MAXIMUM PLATE VOLTAGE	700	VOLTS
MAXIMUM GRID #2 VOLTAGE	175	VOLTS
MAXIMUM PLATE DISSIPATION	24	WATTS
MAXIMUM GRID #2 DISSIPATION	3.6	WATTS
MAXIMUM CATHODE CURRENT—AVERAGE	220	MA.
MAXIMUM GRID #1 CIRCUIT RESISTANCE	0.5	MEGOHM
MAXIMUM BULB TEMPERATURE (HOTTEST POINT)	225	°C
MAXIMUM HEATER—CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC	100	VOLTS
TOTAL DC AND PEAK	200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AUDIO SERVICE

CLASS A_1 AMPLIFIER – SINGLE TUBE

PLATE VOLTAGE[C]	250	VOLTS
GRID #2 CURRENT[C]	90	VOLTS
CATHODE RESISTOR	120	OHMS
PEAK GRID #1 SIGNAL	10	VOLTS
ZERO SIGNAL PLATE CURRENT	80	MA.
MAX. SIGNAL PLATE CURRENT	81	MA.
ZERO SIGNAL GRID #2 CURRENT	1	MA.
MAX. SIGNAL GRID #2 CURRENT	6	MA.
PLATE RESISTANCE	12,000	OHMS
TRANSCONDUCTANCE	10,000	μMHOS
LOAD RESISTANCE	3,000	OHMS
TOTAL HARMONIC DISTORTION	10	PERCENT
MAX. SIGNAL POWER OUTPUT	7.5	WATTS

PUSH-PULL AMPLIFIER

VALUES FOR TWO TUBES

CLASS OF OPERATION	A_1	AB_1	AB_1	
PLATE VOLTAGE[C]	250	250	450	VOLTS
GRID #2 VOLTAGE[C]	90	150	150	VOLTS
CATHODE RESISTOR	60	200	---	OHMS
GRID #1 VOLTAGE	---	---	-35	VOLTS
PEAK GRID #1 TO GRID #1 SIGNAL	19.5	47	69	VOLTS
ZERO SIGNAL PLATE CURRENT	160	114	58	MA.
MAX. SIGNAL PLATE CURRENT	166	128	210	MA.
ZERO SIGNAL GRID #2 CURRENT	2	2	1.4	MA.
MAX. SIGNAL GRID #2 CURRENT	10.5	17	36	MA.
LOAD RESISTANCE (PLATE TO PLATE)	5000	6000	5000	OHMS
TOTAL HARMONIC DISTORTION	1.4	3.0	5.5	PERCENT
MAX. SIGNAL POWER OUTPUT	16	28	65	WATTS

[A] THE EQUIPMENT DESIGNER SHALL SO DESIGN THE EQUIPMENT THAT THE HEATER VOLTAGE IS CENTERED AT THE SPECIFIED BOGEY VALUE. HEATER SUPPLY VARIATIONS SHALL BE RESTRICTED TO MAINTAIN HEATER VOLTAGE WITHIN THE SPECIFIED TOLERANCE.

[B] DESIGN-MAXIMUM RATINGS ARE LIMITING VALUES OF OPERATING AND ENVIRONMENTAL CONDITIONS APPLICABLE TO A BOGEY ELECTRON DEVICE OF A SPECIFIED TYPE AS DEFINED BY ITS PUBLISHED DATA, AND SHOULD NOT BE EXCEEDED UNDER THE WORST PROBABLE CONDITIONS. THE DEVICE MANUFACTURER CHOOSES THESE VALUES TO PROVIDE ACCEPTABLE SERVICEABILITY OF THE DEVICE, TAKING RESPONSIBILITY FOR THE EFFECTS OF CHANGES IN OPERATING CONDITIONS DUE TO VARIATIONS IN DEVICE CHARACTERISTICS. THE EQUIPMENT MANUFACTURER SHOULD DESIGN SO THAT INITIALLY AND THROUGHOUT LIFE NO DESIGN-MAXIMUM VALUE FOR THE INTENDED SERVICE IS EXCEEDED WITH A BOGEY DEVICE UNDER THE WORST PROBABLE OPERATING CONDITIONS WITH RESPECT TO SUPPLY-VOLTAGE VARIATION, EQUIPMENT COMPONENT VARIATION, EQUIPMENT CONTROL ADJUSTMENT, LOAD VARIATION, SIGNAL VARIATION, AND ENVIRONMENTAL CONDITIONS.

[C] SPECIFIED VOLTAGE IS WITH RESPECT TO GROUND.

TUNG-SOL

PRODUCT BULLETIN

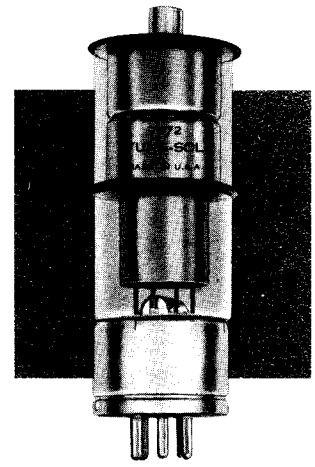
INDUSTRIAL ELECTRON TUBE TYPE 7872

SEPTEMBER, 1963

HYDROGEN THYRATRON

DESCRIPTION — The 7872 is a three-electrode, hydrogen-filled thyratron designed for high-power switching applications.

A hydrogen reservoir, with a separate external base connection, promotes long life and permits optimum pressure adjustment for various operating conditions. The control grid is brought out to both a base pin and to a grid ring for flexibility in circuit design. Termination to the grid ring is made in applications where grid lead inductance is critical.



ELECTRICAL DATA

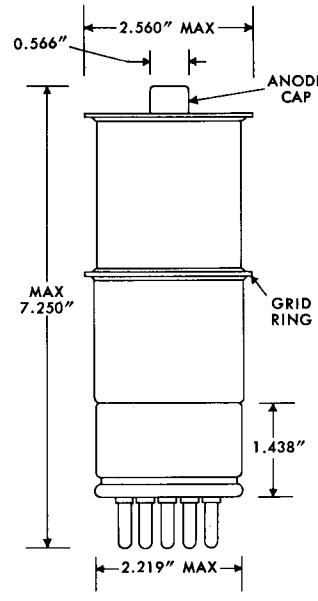
	Min	Bogey	Max	
Heater Voltage	5.8	6.3	6.8	Volts
Heater Current — E_f = 6.3 Volts	5	—	9	Amperes
Cathode Heating Time	3	—	—	Minutes
Reservoir Voltage	3	Marked on Base	6.8	Volts
Reservoir Current	2	—	4	Amperes
Reservoir Heating Time	3	—	—	Minutes
Anode Voltage Drop	75	—	150	Volts
Ambient Temperature	−50	—	+90	Degrees Centigrade

MECHANICAL DATA

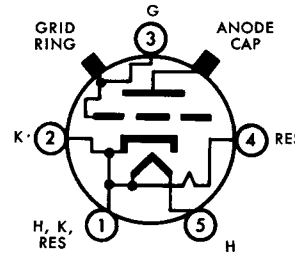
Type of Cooling	Convection
Mounting Position	Any
Maximum Net Weight	16 Ounces
Base	JEDEC A5-109

RATINGS — ABSOLUTE VALUES

	Min	Max	
Anode Voltage — Peak			
Forward	—	18,000	Volts
Inverse — Note 1	—	18,000	Volts
Cathode Current			
Peak	—	365	Amperes
Average	—	250	Milliamperes
RMS	—	7	Amperes
D-C Anode Voltage	3,000	—	Volts
Grid Voltage — Peak — Note 2	200	500	Volts
Heating Factor — epy x ib x prr	—	5×10^9	
Current Rate of Rise	—	1,500	Amperes per microsecond
Anode Delay Time	—	0.6	Microseconds
Time Jitter — Note 3	—	0.005	Microseconds



OUTLINE DRAWING



BASING DIAGRAM BOTTOM VIEW

NOTES:

1. In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration, shall not exceed 5 kilovolts during the first 25 microseconds after the pulse.
2. The driver pulse is measured at the tube socket with the thyratron grid disconnected. Time of rise equals 0.5 microsecond maximum, grid pulse duration equals 2 microseconds minimum, and impedance of driver circuit equals 500 ohms maximum.
3. The time jitter limit as stated is the maximum allowable variation in firing time measured at 50 percent of pulse amplitude after the tube has been operating for at least 60 seconds. The maximum jitter as stated is only valid at anode voltages of 5 kilovolts and above.

TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 7890

SEPTEMBER, 1963

CERAMIC HYDROGEN THYRATRON

DESCRIPTION — The 7890 is a ceramic, four element, hydrogen filled, zero bias thyratron designed for the generation of very high power pulses. The primary application for this tube is in high-power radar modulators in which it is capable of a peak power of 48 megawatts at an average power of 46 kilowatts. The tube is capable of handling a maximum average power of 80 kilowatts. The gradient grid makes it possible to obtain a more effective d-c holdoff at the maximum forward voltage rating than is possible in a conventional thyratron.

The external anode and forced air or liquid cooling of the 7890 provide high heat dissipation in a size considerably smaller than that of similar tubes of lower electrical ratings. An externally connected reservoir promotes stable operation and long life by maintaining a constant hydrogen density.

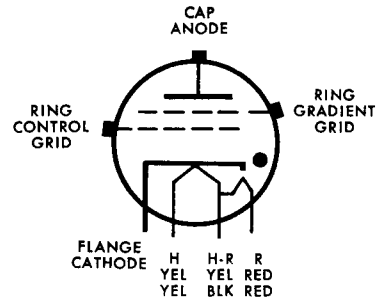
See Page 2 For Outline Drawing

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	6.0	6.3	6.6	Volts
Heater Current — E_f = 6.3 Volts	20	—	40	Amperes
Reservoir Voltage	2.5	—	5.5	Volts
Reservoir Current — E_{res} = 3.5 Volts	8	—	12	Amperes
Cathode and Reservoir Heating Time	5	—	—	Minutes
Tube Voltage Drop	—	—	400	Volts
Anode Delay Time	—	—	0.5	Microsecond
Time Jitter — Note 1	—	—	5	Nanoseconds

RATINGS — ABSOLUTE VALUES

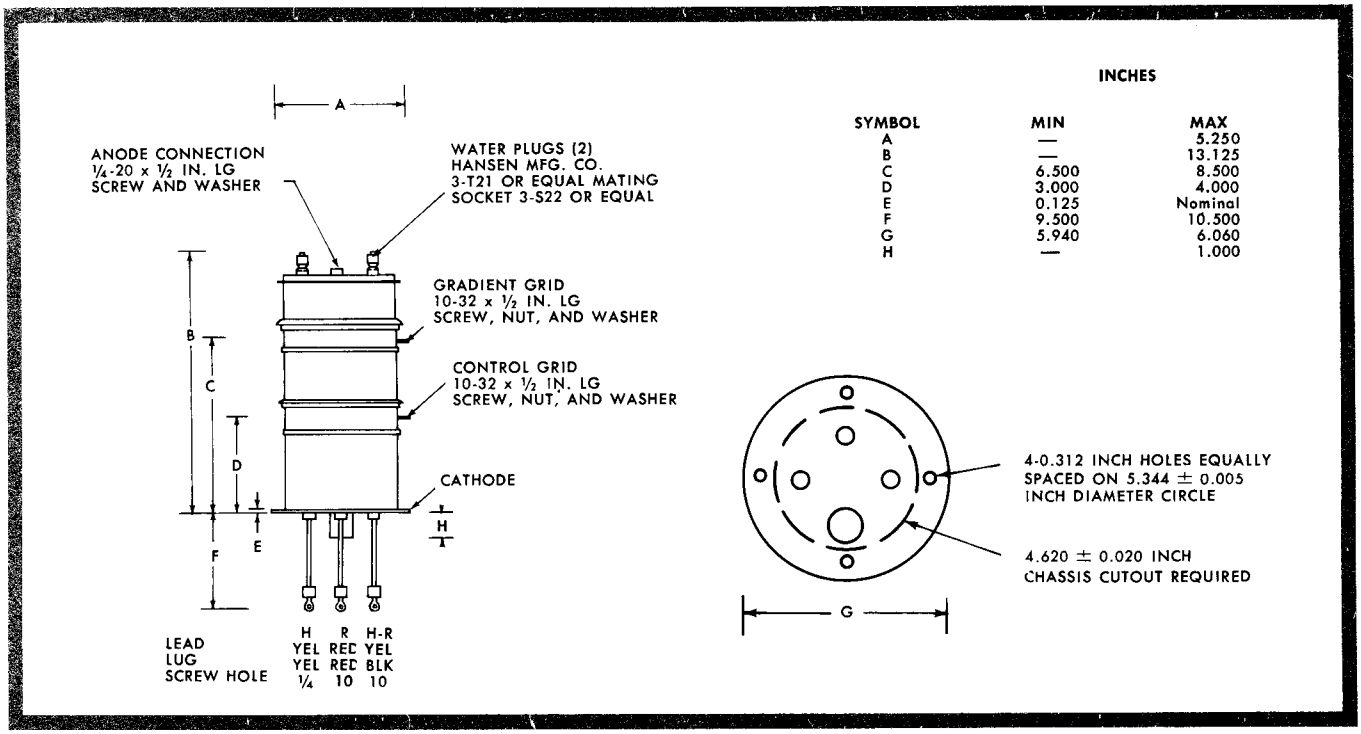
	Min	Max	
Anode Voltage — Peak			
Forward	—	40,000	Volts
Inverse — Note 2	—	40,000	Volts
Cathode Current			
Peak	—	2,400	Amperes
Average	—	2.6	Amperes
RMS	—	75	Amperes
D-C Anode Voltage	3,500	—	Volts
Control Grid Voltage — Note 3	—	—	
Peak Forward	1,300	2,500	Volts
Peak Inverse	—	−650	
Gradient Grid Voltage — Note 4	—	—	
Heating Factor — Pb = epy x ib x prr — Note 5	—	55×10^9	
Current Rate of Rise	—	10,000	Amperes per microsecond
Ambient Temperature — Note 6	−55	+75	Degrees Centigrade



BASING DIAGRAM
BOTTOM VIEW

NOTES:

1. The time jitter limit as stated is the maximum allowable variation in firing time measured at 50 percent of pulse amplitude after the tube has been operating for at least 60 seconds. To obtain the lowest possible jitter, the tube should be operated above 15 kilovolts with maximum grid trigger voltage, maximum rate of rise of cathode pulse, and minimum value of driver circuit impedance.
2. In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration spike, shall not exceed 10 kilovolts during the first 25 microseconds after the pulse.
3. The driver pulse is measured at the tube socket with the tube out of socket. Time of rise equals 0.35 microseconds maximum, pulse duration equals 2.0 microseconds minimum, and driver circuit impedance to be from 10 to 25 ohms.
4. Greatest stability of operation will be achieved by connecting the gradient grid to the midpoint of a resistance divider, consisting of two 20 megohm resistors in series, connected between anode and cathode, or ground.
5. For operation at Pb = 30 x 10^9 or lower, convection cooling is adequate. Operation above Pb = 30 x 10^9 requires cooling of the anode. The product of gallons of liquid per minute and temperature rise in degrees Centigrade shall not exceed five. Minimum liquid flow shall be one gallon per minute. For forced air cooling, a minimum of 6 cfm at an inlet temperature of not over 40 degrees Centigrade is required.
6. When water cooling is employed, the tube is rated for operation up to an ambient temperature of +90 degrees Centigrade provided that the water temperature at the input of the anode cooling coil does not exceed +75 degrees Centigrade.



from JEDEC release #3189, March 13, 1961

TUNG-SOL ELECTRON TUBE DATA

March 1, 1961

TWIN TRIODE

TYPE 7892

GENERAL DESCRIPTION

The Tung-Sol 7892 is a medium mu, high perveyance, twin triode intended only for pulse amplifier and oscillator service. Each triode section is electrically independent, although the two heaters have a common connection permitting either 6.3 Volt or 12.6 Volt heater operation.

MECHANICAL DATA

Cathode	Coated Unipotential
Outline drawing	JEDEC 6-2
Maximum diameter	.875 inches
Maximum overall length	2.118 inches
Maximum seated height	1.312 inches
Bulb	T-6 1/2
Base	Miniature button 9-pin JEDEC E9-1
Basing Diagram	JEDEC 9H
Pin 1 - Triode 2 plate	Pin 6 - Triode 1 cathode
Pin 2 - Triode 2 grid	Pin 7 - Triode 1 grid
Pin 3 - Triode 2 cathode	Pin 8 - Heater center tap
Pin 4 - Heater	Pin 9 - Triode 1 plate
Pin 5 - Heater	
Mounting Position	Any

ELECTRICAL DATA

Heater Characteristics and Ratings-Design Maximum System[A]

When connected to pins:	8 and 4 - 5	4 and 5	
Heater voltage	6.3±0.3	12.6±0.6	volts
Heater current at center voltage	900	450	ma
Maximum heater-cathode voltage			
Total dc and peak		±200	volts

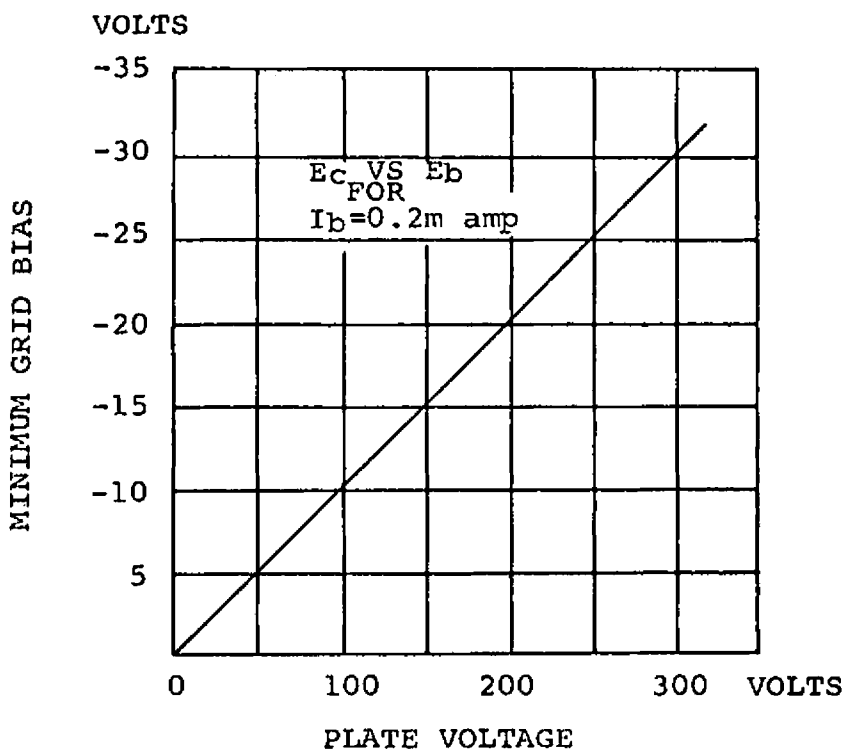
Direct Interelectrode Capacitances-No external shield

Grid to plate - each triode	4.0 pf
Input: g to(h+k) - each triode	4.0 pf
Output: p to(h+k)- triode 1	0.6 pf
triode 2	0.5 pf
Grid to grid - maximum	.025 pf
Plate to plate - maximum	.75 pf

ELECTRICAL DATA-Cont'd

Maximum Ratings-Design-Maximum System[A]	
Plate to cathode voltage-Pulse amplitude[B]	330 volts
Spike amplitude[B]	1000 volts
Grid to cathode voltage - DC positive	0 volts
DC negative	100 volts
Peak positive	200 volts
Peak negative	200 volts
Plate dissipation - each plate	4.2 watts
both plates	7.5 watts
Grid dissipation - each grid	1.0 watts
Cathode current-see rating chart page 3	
Grid circuit resistance	1.1 megohm
Bulb temperature - at hottest point	225 °C
Altitude[C]	60,000 feet

Typical Operating Conditions and Characteristics	
Pulse amplifier - each unit	
Plate voltage	+175 volts
Grid voltage	+175 volts
Peak cathode current	5.0 amps
Ratio plate current to grid current	1.5
Plate current cut-off - see curve below	



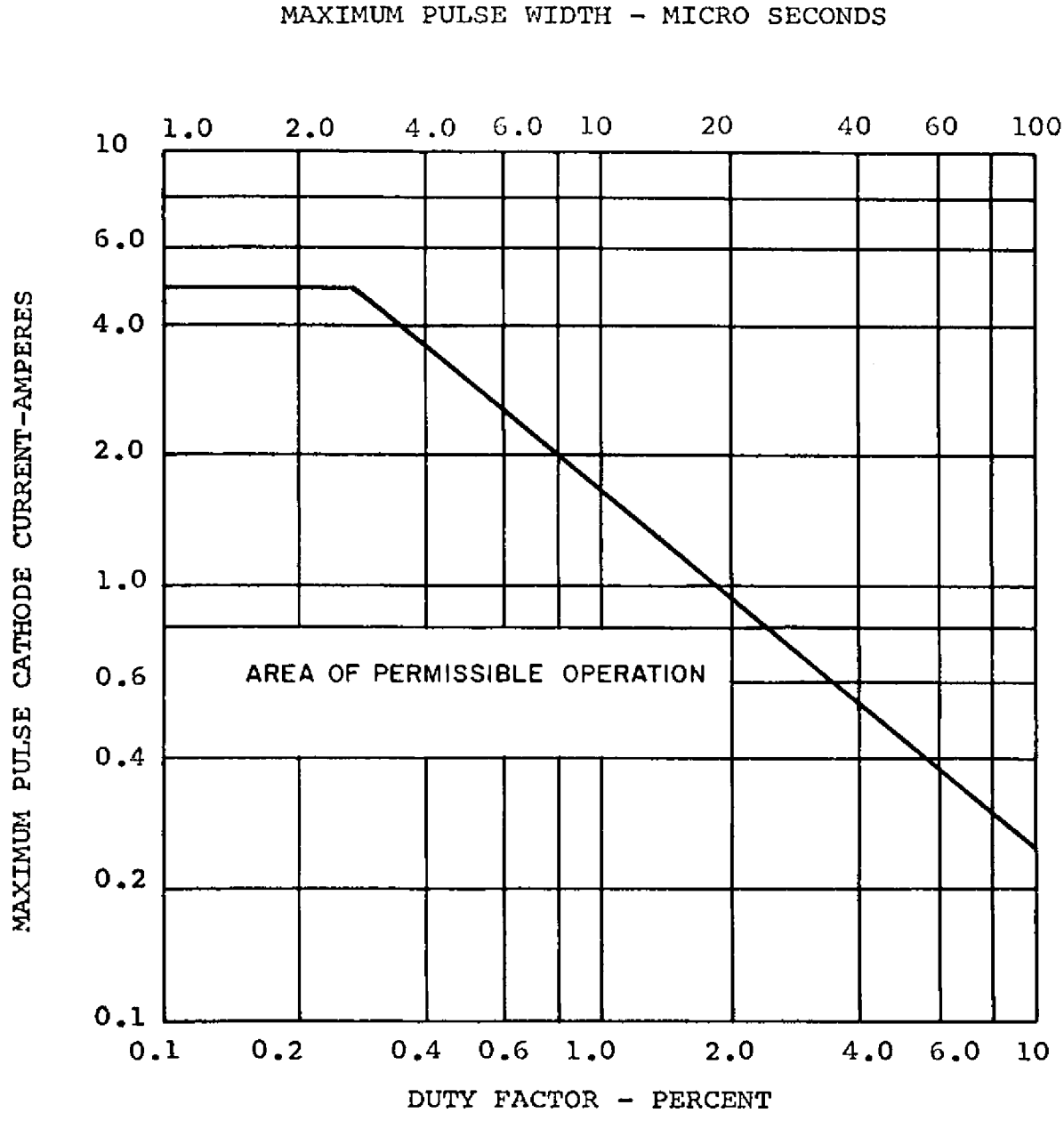
Notes:

A. Limiting values beyond which normal tube life and normal tube performance may be impaired.

B. For definition of terms, refer to MIL-E-1D, paragraph 4.10.7.5.

C. If altitude exceeds this rating, reduction of instantaneous voltages (Ef excluded) and dissipation may be necessary.

Pulse Rating Chart



This chart defines the "area of permissible operation" beyond which normal tube life and normal tube performance may be impaired. The manufacturer performs life tests at peak currents outside this area in order to assure satisfactory life performance within the "area of permissible operation".

This chart is applicable for operation when the duty factor does not exceed 10% and the pulse width does not exceed 100μs. Greater duty factors and longer pulse widths are in the region of Class A, B, and C operation for which this tube is not rated.

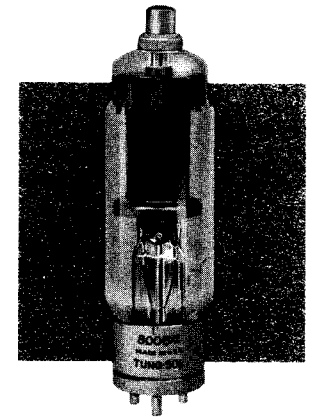
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBES TYPE 8008XE

MARCH, 1963

HALF-WAVE GAS RECTIFIER



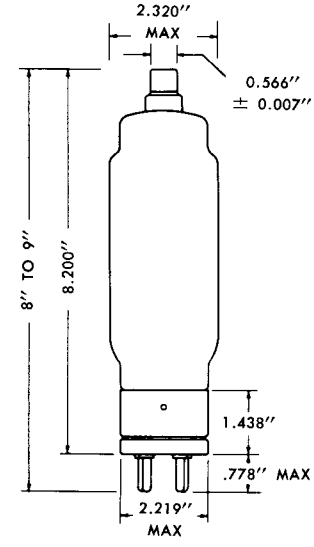
DESCRIPTION The 8008XE is a xenon filled half wave rectifier for use in high voltage circuits. The tube is designed to operate over a wide temperature range without the necessity of heating or cooling devices. Its hard glass envelope and well supported mount make it particularly suited for military and industrial use. As contrasted to the mercury-vapor type 8008, the 8008XE may be mounted in any position and is not subject to mercury splash problems. Its efficient oxide coated filament is fast heating. As consistent with filamentary gas and vapor rectifier tube practice, quadrature excitation of the filament is recommended for obtaining the longest tube life. In quadrature operation, the filament is phased to be at a minimum when the peak anode current flows. However the tube carries full ratings for in phase operation of the filament.

ELECTRICAL DATA

Filament Voltage	5.0±5%	Volts
Filament Current — EF=5.0 Volts	7.25	Amperes
Cathode Heating Time — Minimum	30	Seconds
Critical Anode Voltage	50	Volts
Peak Anode Voltage Drop	16	Volts
Average Anode Voltage Drop	12	Volts

MECHANICAL DATA

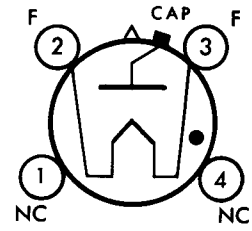
Type of Cooling	Convection
Mounting Position	Any
Average Net Weight	7½ Ounces
Bulb	T18 Nonex
Base	Super Jumbo, 4 pin with Bayonet, JEDEC A4-18
Cap	Medium, JEDEC C1-5
Dimensions	See Outline Drawing



OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Peak Inverse Anode Voltage	—	10,000	Volts
Cathode Current			
Peak	—	5	Amperes
Average	—	1.25	Amperes
Surge — Maximum Duration 0.1 Second	—	50	Amperes
Averaging Time	—	15	Seconds
Supply Frequency	—	150	Cycles-per-second
Ambient Temperature	−55	+70	Degrees Centigrade



JEDEC 2P BASING DIAGRAM BOTTOM VIEW

MAXIMUM RATING CHART*

FIG.	CIRCUIT	TRANSFORMER	FILAMENT OPERATION	NO. of TUBES	A-C SEC VOLTAGE E rms VOLTS	D-C OUTPUT—APPROX		RIPPLE	
						Edc VOLTS	Idc AMPS	VOLTS RMS	FREQ
1	Half-wave 1-phase	1-phase	In-phase	1	7,000	3,200	1.25	3,500	f
2	Full-wave 1-phase	1-phase C-T	In-phase	2	3,500	3,200	2.50	1,500	2f
3	Bridge circuit 1-phase	1-phase	In-phase	4	7,000	6,400	2.50	3,000	2f
4	Half-wave 3-phase	Delta-Wye	—	3	4,000	4,800	3.75	860	3f
5	Full-wave 3-phase	Delta-Wye	Quadrature	6	4,000	9,500	3.75	400	6f
6	Full-wave 3-phase	Delta-Delta	Quadrature	6	7,000	9,500	3.75	400	6f
7	Half-wave 6-phase (3-phase supply)	Delta-Star	Quadrature	6	3,500	4,800	5.00	200	6f

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet. Values are for a maximum 10 kilowatt peak inverse voltage and 1.25 ampere average current per tube.

*Values for Figure 1 assume pure resistive load. Values for all other Figures assume infinite inductance choke input filter.

TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 8036

SEPTEMBER, 1963

CERAMIC HYDROGEN THYRATRON TYPE 8036

DESCRIPTION—The 8036 is a three element, zero-bias, hydrogen thyratron designed for high-power switching applications. The primary application of this tube is in high-voltage radar modulators.

The 8036 utilizes a ceramic, ring-disk type of construction to minimize the tube envelope size and to maximize heat transfer from the internal elements. It has been designed to withstand high environmental conditions, particularly high temperature. An internal hydrogen reservoir promotes long life and permits optimum pressure adjustment for various conditions of operation. The tube is flange mounted for maximum support, with standard-size lugs on the ends of flexible leads used for heater and reservoir terminations. The grid connection is made to a grid ring to keep inductance to a minimum.

The 8036 will supply 6.5 megawatts of peak pulse power making it the electrical equivalent of the 5949/1907, with a tube volume of one-quarter and a weight of one-half of the latter.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	5.8	6.3	6.6	Volts
Heater Current — E_h = 6.3 volts	8	—	12	Amperes
Reservoir Voltage	3.0	Marked	5.5	Volts
Reservoir Current (Respectively)	1.5	on Flange	3.0	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Delay Time		—	1.0	Microsecond
Time Jitter — Note 1		—	4	Nanoseconds
Anode Voltage Drop	75	—	250	Volts

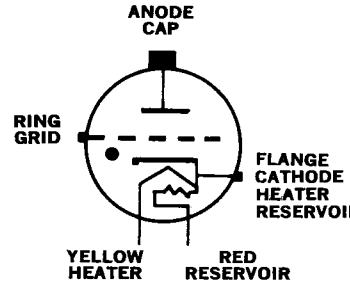
See Page 2 For Outline Drawing

MECHANICAL DATA

Envelope Temperature — Maximum	400 Degrees C
Type of Cooling	Convection
Mounting Position	Any
Dimensions, Mounting and Terminations	See page 2

RATINGS — ABSOLUTE VALUES

	Min	Max	
Anode Voltage — Peak			
Forward	—	25,000	Volts
Inverse — Note 2	—	25,000	Volts
Cathode Current			
Peak	—	500	Amperes
Average	—	500	Milliamperes
RMS	—	15	Amperes
D-C Anode Voltage	5,000	—	Volts
Grid Voltage — Peak — Note 3	550	1000	Volts
Heating Factor — epy x ib x prr	—	6.25×10^9	
Current Rate of Rise	—	2,500	Amperes per microsecond

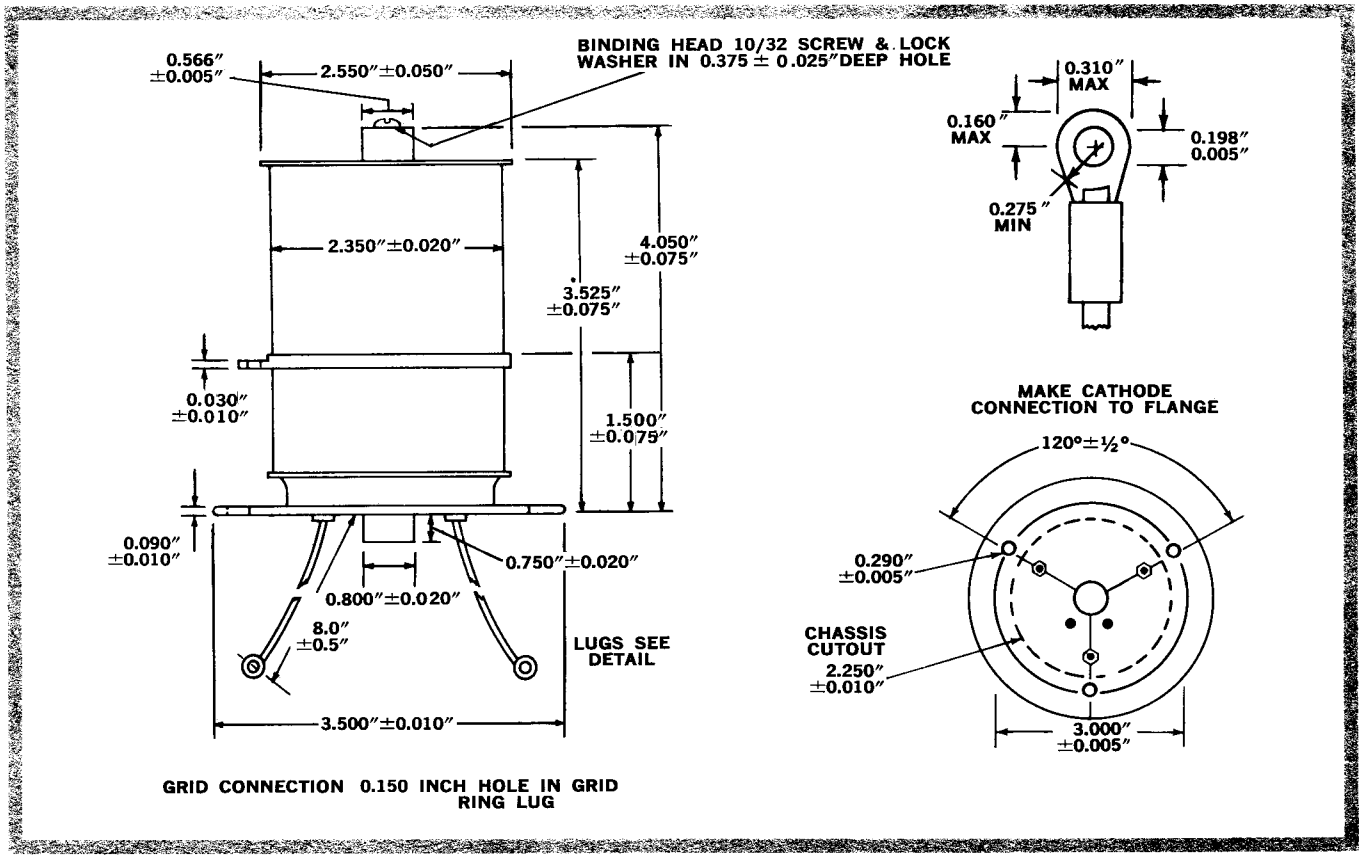


ENVIRONMENTAL TEST

Shock (Navy High Impact Shock Machine) ..... 500 G

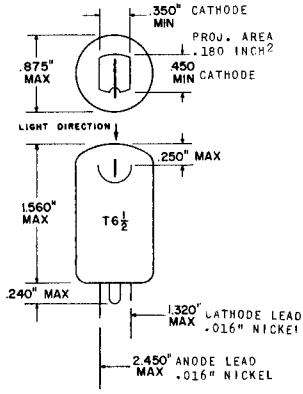
NOTES:

1. The time jitter limit as stated is the maximum allowable variation in firing time measured at 50 percent of pulse amplitude after the tube has been operating for at least 60 seconds. The maximum jitter as stated is only valid at anode voltages of 5 kilovolts and above.
2. In pulsed operation, the peak inverse voltage, exclusive of a 0.05 microsecond maximum duration, shall not exceed 5 kilovolts during the 25 microseconds after the pulse.
3. The driver pulse is measured at the tube socket with the thyratron grid disconnected. Time of rise equals 0.5 microsecond maximum, grid pulse duration equals 2 microsecond minimum, and impedance of driver circuit is between 50 ohms and 200 ohms.



TUNG-SOL

VACUUM PHOTO DIODE



CYLINDRICAL CATHODE

ANY MOUNTING POSITION

BASE
NONE
FLYING LEADS

THE 8049 IS A CESIUM-ANTIMONY TYPE HEAD-ON PHOTO DIODE. IT IS DESIGNED FOR OPERATION AT LOW LIGHT LEVELS AND AT LOW APPLIED VOLTAGES. ITS CURRENT-VOLTAGE CHARACTERISTICS SHOW SATURATION AT VERY LOW KNEE VOLTAGES. THIS PERMITS THE TUBE TO BE USED DIRECTLY WITH EITHER ELECTRON TUBES OR SEMICONDUCTOR DEVICES. CATHODE AND ANODE CONNECTIONS ARE THROUGH FLYING LEADS AT THE BOTTOM.

GENERAL

SPECTRAL RESPONSE	S4	
WAVELENGTH OF MAXIMUM RESPONSE	4000±500	ANGSTROMS
DIRECT INTERELECTRODE CAPACITANCE	1.3	pf

RATINGS

→ ABSOLUTE MAXIMUM

→ MAXIMUM ANODE SUPPLY VOLTAGE (DC OR PEAK AC)	→ 30	VOLTS
MAXIMUM PEAK CATHODE CURRENT	20	μAMP
MAXIMUM PEAK CATHODE CURRENT DENSITY	125	μAMP/IN²
MAXIMUM AVERAGE CATHODE CURRENT	5	μAMP
MAXIMUM AMBIENT TEMPERATURE	75	°C

CHARACTERISTICS

	MIN.	AVG.	MAX.	
DARK CURRENT AT 25 VOLTS, 27°C	---	---	50	PAMP
LUMINOUS SENSITIVITY	15	30	60	μA/LUMEN

→ INDICATES A CHANGE.

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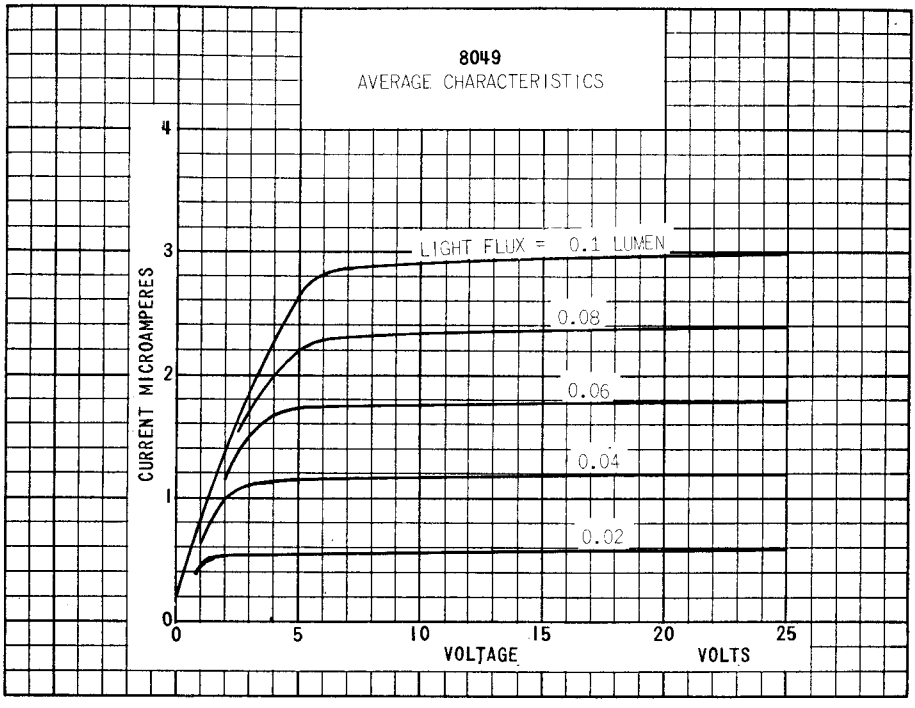
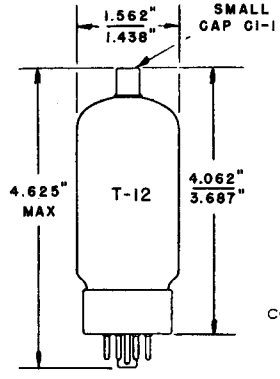

8049
AVERAGE CHARACTERISTICS
CURRENT MICROAMPERES
VOLTAGE
VOLTS
LIGHT FLUX = 0.1 LUMEN
0.08
0.06
0.04
0.02
0
1
2
3
4
5
10
15
20
25

TUNG-SOL

PENTODE



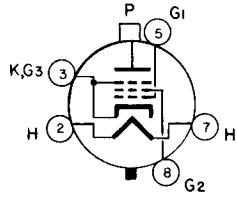
GLASS BULB
SHORT MEDIUM-SHELL
5 PIN OCTAL
B5-123 OR B5-149
OUTLINE DRAWING
JEDEC 12-20

BEAM PENTODE

SERIES REGULATOR IN
HIGH VOLTAGE POWER
SUPPLY APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8LC

THE 8068 IS A BEAM PENTODE DESIGNED FOR USE AS A SERIES REGULATOR IN HIGH-VOLTAGE POWER SUPPLIES.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	0.6	pf
INPUT: G TO (H + K + G2 + G3)	10.0	pf
OUTPUT: P TO (H + K + G2 + G3)	5.5	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3	VOLTS	900	MA.
LIMITS OF APPLIED VOLTAGE - AC OR DC			6.3 ± 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			± 200	VOLTS

CONTINUED ON FOLLOWING PAGE

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CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	3500	VOLTS
GRID 2 VOLTAGE	250	VOLTS
PLATE DISSIPATION	35	WATTS
GRID 2 DISSIPATION	1.0	WATTS
DC CATHODE CURRENT	100	MA.
GRID 1 CIRCUIT RESISTANCE	0.1	MEGOHMS

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	3500	600	VOLTS
GRID 2 VOLTAGE	100	125	VOLTS
GRID 1 VOLTAGE	-30	-7.5	VOLTS
PLATE CURRENT	1.0	36	MA.
GRID 2 CURRENT	-----	1.0	MA.
TRANSCONDUCTANCE	-----	5200	μMHOS
PLATE RESISTANCE, APPROX.	-----	54,500	OHMS

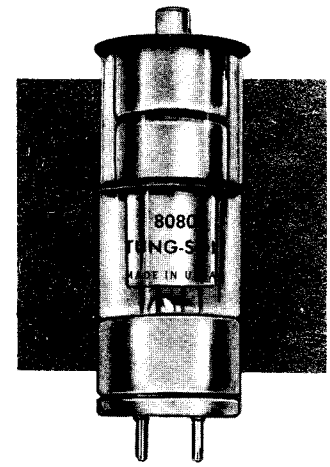
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 8080

JULY 1963

CLAMPER THYRATRON



DESCRIPTION—The 8080 is a zero bias, short ionization time hydrogen thyratron specially designed for clamper service.

A hydrogen reservoir, with a separate external base connection, promotes long life and permits optimum pressure adjustments for various operating conditions. The tube employs ring-disk type construction to achieve small size and to reduce lead inductance.

ELECTRICAL DATA

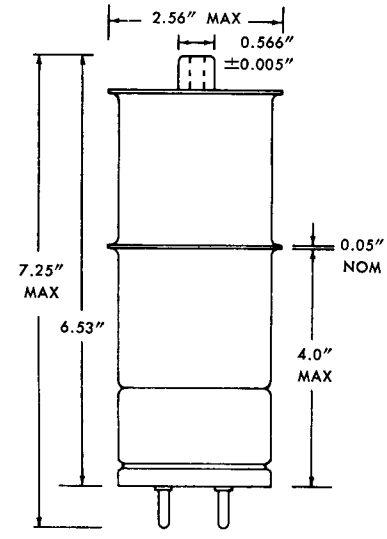
	Min	Bogey	Max	
Heater Voltage	4.75	5.0	5.25	Volts
Heater Current — Ef = 5.0 volts	7.0	—	10.5	Amperes
Cathode Heating Time	3	—	—	Minutes
Reservoir Voltage	3.5	—	5.0	Volts
Reservoir Current	3.0	—	5.0	Amperes
Reservoir Heating Time	3	—	—	Minutes
Altitude	—	—	10,000	Feet
Ambient Temperature	—55	—	+75	Degrees Centigrade

MECHANICAL DATA

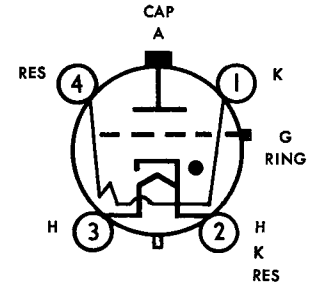
Type of Cooling	Convection
Mounting Position	Vertical — base down or horizontal
Net Weight	14 ounces
Base	JEDEC A4-18, super-jumbo bayonet 4 pin

MAXIMUM RATINGS — ABSOLUTE VALUES

	Min	Max	
D-C Anode Voltage, Inverse — Note 1	—	25	Kilovolts
D-C Anode Voltage, Critical — Note 2	600	—	Volts
Cathode Current — Note 3			
RMS — Continuous	—	6.5	Amperes
RMS — Fault — Averaging time 3 seconds	—	8.0	Amperes
Peak — Continuous	—	325	Amperes
Peak — Fault	—	1,200	Amperes
Operating Frequency — Note 4	—	10,000	Pulses—per second
Grid Voltage — Peak Forward	500	3,000	Volts
Grid Voltage — Peak Inverse	—	1,500	Volts
Peak Grid Trigger Current	5	12	Amperes
Trigger Pulse Width — Note 5	0.5	—	Microsecond
Anode Breakdown Time	See Graph		
Fault Averaging Time	—	3	Seconds

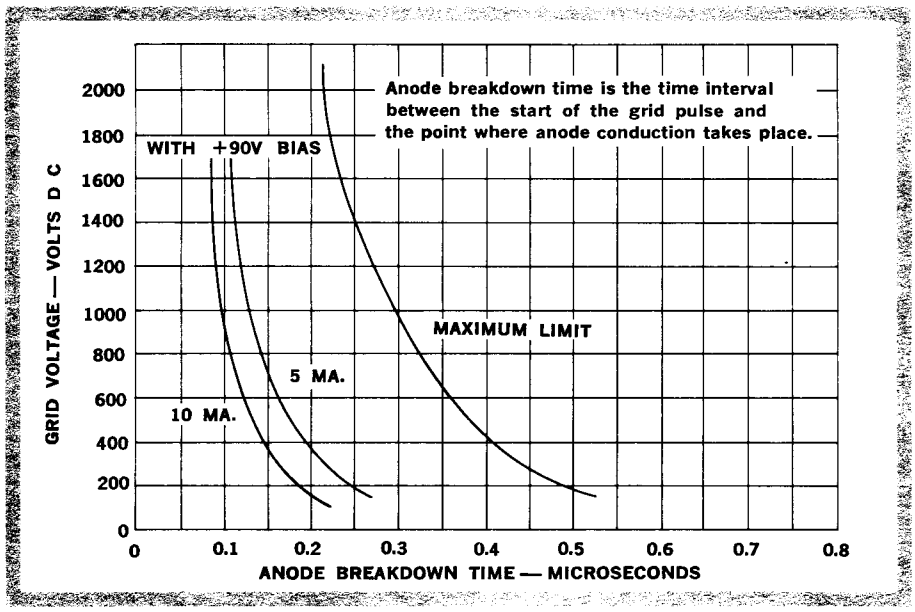


OUTLINE DRAWING



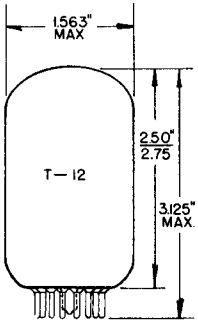
BASING DIAGRAM
BOTTOM VIEW

1. Inverse anode voltage in a clamper tube is defined as the peak voltage than can be impressed between anode and cathode with a polarity opposite to that producing current flow in the tube. Generally, it has the same magnitude as the maximum network voltage.
2. Critical anode voltage in the clamper tube is defined as the minimum anode voltage at which anode conduction occurs. The actual rating allows sufficient safety factor to enable minimum delay of anode conduction.
3. Cathode Current
   a. RMS cathode current is defined as the maximum effective current flowing through the clamper tube under any condition of operation for a period not exceeding the average time. The interval over which the averaging time is applied must include the period in which the maximum rms fault current is encountered.
   b. Peak fault current is defined as the maximum value of instantaneous current flowing in a clamper tube when a fault occurs in the load circuit.
   c. In determining circuit parameters, care must be observed to insure that the nominal rms current (without load faulting) is of such a value as to prevent the rms current (with load faulting) from exceeding the rating during the specified average time.
4. The maximum operating frequency does not necessarily represent the upper limit, but is the highest frequency at which tests have been conducted.
5. The trigger pulse width should not exceed the load pulse width plus the trigger pulse lead time.



TUNG-SOL

PENTODE



GLASS BULB

BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-57

BEAM POWER VHF PENTODE

COMPACTRON

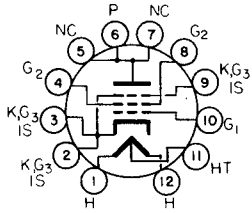
FOR

RF POWER AMPLIFIER

AND OSCILLATOR APPLICATIONS

ANY MOUNTING POSITION

COATED UNIPOTENTIAL CATHODE



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12DT

PINS 5, 6 & 7 MUST BE USED IN PARALLEL

THE 8149 IS A BEAM POWER AMPLIFIER PENTODE IN THE SINGLE-ENDED T-12 COMPACTRON DESIGN. IT IS INTENDED FOR USE AS AN RF POWER AMPLIFIER AND OSCILLATOR AT FREQUENCIES UP TO 175 MEGACYCLES, WITH A MAXIMUM PLATE DISSIPATION RATING OF 35 WATTS UNDER ICAS CONDITIONS. IT FEATURES A CENTER-TAPPED HEATER SO IT MAY BE OPERATED FROM EITHER A 3-CELL OR A 6-CELL STORAGE BATTERY SYSTEM.
A SIMILAR TUBE IN A DOUBLE-ENDED DESIGN IS REGISTERED AS TYPE 8150.

→ DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.35	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	13.0	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	6.0	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	1 & 12	11 & 1+12	
AVERAGE VALUES - VOLTAGE	13.0	6.5	VOLTS
- CURRENT	0.60	1.20	AMPS.
LIMITS OF APPLIED HEATER VOLTAGE	11.0 - 15.0	5.5 - 7.5	VOLTS
MIXIMUM HEATER-CATHODE VOLTAGE EITHER POLARITY	135		VOLTS

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AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	200	VOLTS
GRID 2 VOLTAGE	200	VOLTS
PLATE CURRENT	100	MA.
TRANSCONDUCTANCE	7500	μMHOS
AMPLIFICATION FACTOR, TRIODE CONNECTED	4.5	

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

RF POWER AMPLIFIER AND OSCILLATOR - CLASS C TELEGRAPHY

RF POWER AMPLIFIER - CLASS C TELEPHONY

ICAS INTERMITTENT COMMERCIAL AND AMATEUR SERVICE

FOR FREQUENCIES UP TO	175	60	MC
PLATE VOLTAGE -DC	450	750	VOLTS
GRID 2 VOLTAGE	250	250	VOLTS
GRID 1 VOLTAGE - DC	-150	150	VOLTS
CATHODE CURRENT-DC	→ 220	→ 220	MA.
PLATE DISSIPATION	35	35	WATTS
GRID 2 DISSIPATION	3.3	3.3	WATTS
BULB TEMPERATURE	240		°C

→ TYPICAL OPERATION

CLASS C AMPLIFIER AT 175 MC/S

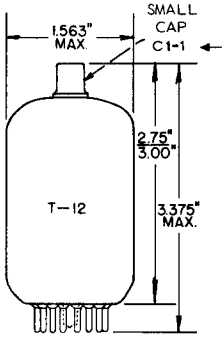
PLATE VOLTAGE	380	VOLTS
GRID 2 SUPPLY VOLTAGE	380	VOLTS
GRID 2 DROPPING RESISTOR	10	KOHMS
GRID 1 VOLTAGE	-78	VOLTS
FROM GRID 1 RESISTOR	27	KOHMS
ADDITIONAL FIXED BIAS	-24	VOLTS
PEAK RF GRID 1 VOLTAGE	120	VOLTS
PLATE CURRENT	180	MA.
GRID 2 CURRENT	12	MA.
GRID 1 CURRENT	2.0	MA.
DRIVING POWER - APPROX.	2	WATTS
POWER OUTPUT	40	WATTS

→ INDICATES A CHANGE.

TUNG-SOL

PENTODE

COMPACTRON



GLASS BULB

BUTTON
12 PIN BASE E12-74
OUTLINE DRAWING
JEDEC 12-86

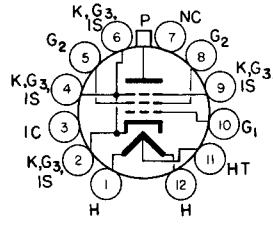
BEAM POWER VHF PENTODE

FOR

RF POWER AMPLIFIER

AND OSCILLATOR APPLICATIONS

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 12DU

THE 8150 IS A BEAM POWER AMPLIFIER PENTODE IN THE DOUBLE-ENDED T-12 COMPACTRON DESIGN. IT IS INTENDED FOR USE AS AN RF POWER AMPLIFIER AND OSCILLATOR AT FREQUENCIES UP TO 175 MEGACYCLES, WITH A MAXIMUM PLATE DISSIPATION RATING OF 35 WATTS UNDER ICAS CONDITIONS. IT FEATURES A CENTER-TAPPED HEATER SO IT MAY BE OPERATED FROM EITHER A 3-CELL OR A 6-CELL STORAGE BATTERY SYSTEM. THE 8150 IS SIMILAR TO THE SINGLE-ENDED TYPE 8149.

→ DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE: G1 TO P	0.2	pf
INPUT: G1 TO (H+K+G2+G3+I.S.)	13.0	pf
OUTPUT: P TO (H+K+G2+G3+I.S.)	6.5	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	1 & 12	11 & 1+12	
AVERAGE VALUES - VOLTAGE	13.0	6.5	VOLTS
- CURRENT	0.60	1.20	AMPS.
LIMITS OF APPLIED HEATER VOLTAGE	11.0 - 15.0	5.5 - 7.5	VOLTS
MIXIMUM HEATER-CATHODE VOLTAGE EITHER POLARITY	135		VOLTS

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AVERAGE STATIC CHARACTERISTICS

PLATE VOLTAGE	200	VOLTS
GRID 2 VOLTAGE	200	VOLTS
PLATE CURRENT	100	MA.
TRANSCONDUCTANCE	7500	μMHOS
AMPLIFICATION FACTOR, TRIODE CONNECTED	4.5	

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

RF POWER AMPLIFIER AND OSCILLATOR - CLASS C TELEGRAPHY

RF POWER AMPLIFIER - CLASS C TELEPHONY

ICAS INTERMITTENT COMMERCIAL AND AMATEUR SERVICE

FOR FREQUENCIES UP TO	175	60	MC
PLATE VOLTAGE -DC	450	750	VOLTS
GRID 2 VOLTAGE	250	250	VOLTS
GRID 1 VOLTAGE - DC	-150	150	VOLTS
CATHODE CURRENT-DC	→ 220	→ 220	MA.
PLATE DISSIPATION	35	35	WATTS
GRID 2 DISSIPATION	3.3	3.3	WATTS
BULB TEMPERATURE	240		°C

→ TYPICAL OPERATION

CLASS C AMPLIFIER AT 175 MC/S

PLATE VOLTAGE	380	VOLTS
GRID 2 SUPPLY VOLTAGE	380	VOLTS
GRID 2 DROPPING RESISTOR	10	KOHMS
GRID 1 VOLTAGE	-78	VOLTS
FROM GRID 1 RESISTOR	27	KOHMS
ADDITIONAL FIXED BIAS	-24	VOLTS
PEAK RF GRID 1 VOLTAGE	120	VOLTS
PLATE CURRENT	180	MA.
GRID 2 CURRENT	12	MA.
GRID 1 CURRENT	2.0	MA.
DRIVING POWER - APPROX.	2	WATTS
POWER OUTPUT	40	WATTS

→ INDICATES A CHANGE.

CONTINUED FROM FOLLOWING PAGE

LINEAR RF POWER AMPLIFIER, CLASS AB$_1$

SINGLE-SIDEBAND SUPPRESSED-CARRIER SERVICE

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

FOR FREQUENCIES UP TO 60 M.C.

INTERMITTENT COMMERCIAL AND AMATEUR SERVICE

PLATE VOLTAGE - DC	750	VOLTS
GRID NO. 2 VOLTAGE - DC	250	VOLTS
GRID NO. 1 VOLTAGE - DC	-150	VOLTS
PLATE CURRENT - DC AT PEAK OF ENVELOPE	220	MA.
PLATE DISSIPATION	35	WATTS
GRID NO. 2 DISSIPATION	3.3	WATTS
BULB TEMPERATURE	240	° C
MAXIMUM GRID NO. 1 CIRCUIT RESISTANCE	30,000	OHMS

TYPICAL OPERATION

WITH TWO-TONE MODULATION

FREQUENCY	30	MC/S
DC PLATE VOLTAGE	750	VOLTS
DC GRID NO. 2 VOLTAGE (A)	215	VOLTS
DC GRID NO. 1 VOLTAGE (B)	-41	VOLTS
ZERO SIGNAL DC PLATE CURRENT	25	MA.
ZERO SIGNAL DC GRID NO. 2 CURRENT	0.3	MA.
EFFECTIVE R.F. LOAD RESISTANCE	3,200	OHMS
MAXIMUM SIGNAL PEAK R.F. GRID VOLTAGE (C)	41	VOLTS
DC PLATE CURRENT AT PEAK OF ENVELOPE	125	MA.
DC PLATE CURRENT - AVERAGE	86	MA.
DC GRID NO. 2 CURRENT AT PEAK OF ENVELOPE	8.5	MA.
DC GRID NO. 2 CURRENT - AVERAGE	4.5	MA.
DC GRID NO. 1 CURRENT - AVERAGE (D)	0.02	MA.
POWER OUTPUT AT PEAK OF ENVELOPE	61	WATTS
POWER OUTPUT - AVERAGE	30.5	WATTS
3rd ORDER INTERMODULATION PRODUCTS (E)	-24	db
5th ORDER INTERMODULATION PRODUCTS (E)	-37	db

(A) PREFERABLY OBTAINED FROM A WELL REGULATED SOURCE SUCH AS TWO OB2 VOLTAGE REGULATOR TUBES CONNECTED IN SERIES.

(B) PREFERABLY OBTAINED FROM A SEPARATE, WELL REGULATED SOURCE. ADJUST FOR 25 MA. PLATE CURRENT WITH NO SIGNAL.

(C) THE PEAK SIGNAL VOLTAGE SHOULD BE EQUAL TO THE DC GRID VOLTAGE.

(D) THIS VALUE IS THE APPROXIMATE GRID NO.1 CURRENT DUE TO INITIAL ELECTRON VELOCITY EFFECTS WHEN THE GRID IS DRIVEN TO ZERO VOLTS AT MAXIMUM SIGNAL.

(E) REFERENCED TO EITHER OF THE TWO TONES AND WITHOUT THE USE OF FEEDBACK TO IMPROVE LINEARITY.

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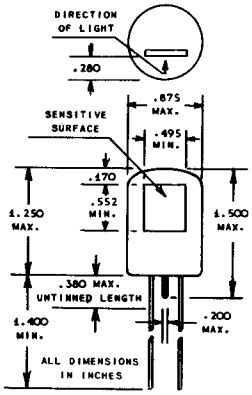
TUNG-SOL

PHOTOCONDUCTIVE CELL



FOR LIGHT CONTROLLED RELAY OPERATIONS

2 FLEXIBLE LEADS TINNED DIA. .018"±.003"

ANY MOUNTING POSITION

THE 8217 IS A SIDE ILLUMINATED CADMIUM SULPHIDE PHOTOCONDUCTIVE NON-POLARIZED CELL, HERMETICALLY SEALED IN A GLASS ENVELOPE WITH TWO FLEXIBLE DUMET LEADS. THIS CELL WAS DESIGNED FOR STREET LIGHT CONTROLLER SERVICE AND FOR OTHER LIGHT CONTROLLED RELAY OPERATIONS.

GENERAL

SPECTRAL RESPONSE (SEE FIGURE 1)	S15	
WAVELENGTH OF MAXIMUM RESPONSE	5800±500	ANGSTROM UNITS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

APPLIED VOLTAGE (DC OR PEAK AC)	300	VOLTS
CURRENT[A]	20	MA.
POWER DISSIPATION[A]	SEE FIGURE 3	
AT 25°C	400	MW.
AT 70°C	170	MW
AMBIENT TEMPERATURE RANGE	-40 TO +70	°C

[A] WITH UNIFORM ILLUMINATION OF SENSITIVE SURFACE.

CONTINUED ON FOLLOWING PAGE

TUNG-SOL

CONTINUED FROM PRECEDING PAGE

CHARACTERISTICS

AT 25°C AMBIENT TEMPERATURE

VOLTAGE–CURRENT CHARACTERISTICS — SEE FIGURE #4

	MIN.	AVG.	MAX.	
LIGHT RESISTANCE[B]	5	7	10	KOHMS
DARK RESISTANCE[C]	1	---	---	MEGOHMS
RISE TIME	SEE FIGURE #5			
DECAY TIME	SEE FIGURE #6			

[B] MEASURED WITH 10 FOOT-CANDLES ILLUMINATION OF 2870°K COLOR TEMPERATURE.

[C] MEASURED 20 SECONDS AFTER REMOVAL OF 10 FOOT-CANDLES ILLUMINATION.

FIGURE 1 - AVERAGE SPECTRAL RESPONSE

FOR EQUAL VALUES OF RADIANT FLUX AT ALL WAVELENGTHS

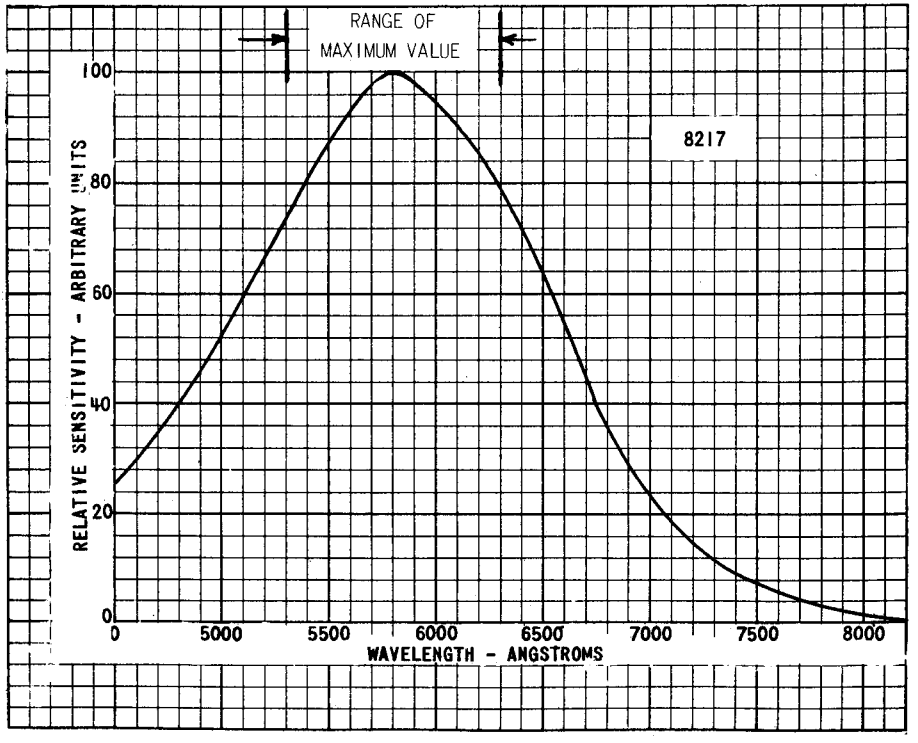


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FIGURE 3 - POWER DISSIPATION RATING CHART

RATINGS APPLY WHEN SENSITIVE SURFACE IS UNIFORMLY ILLUMINATED WITH 10 FOOT-CANDLES.

DERATING IS NECESSARY FOR NON-UNIFORM ILLUMINATION.

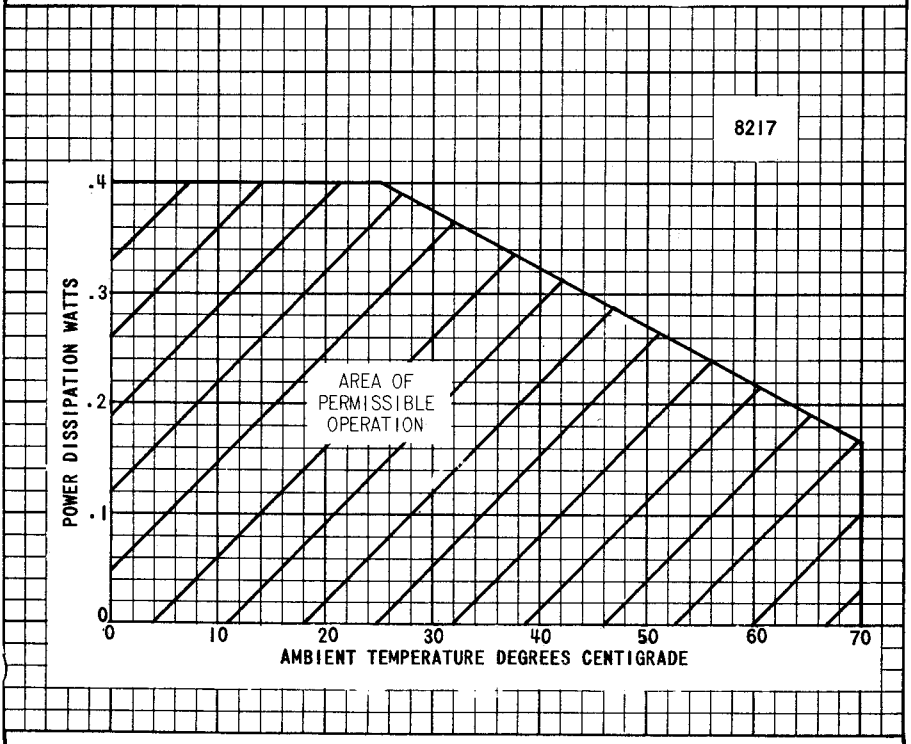

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FIGURE 4 - AVERAGE VOLTAGE-CURRENT CHARACTERISTICS
ILLUMINATION OF 2870 °K COLOR TEMPERATURE
DISSIPATION LIMIT APPLIES UP TO 20 °C

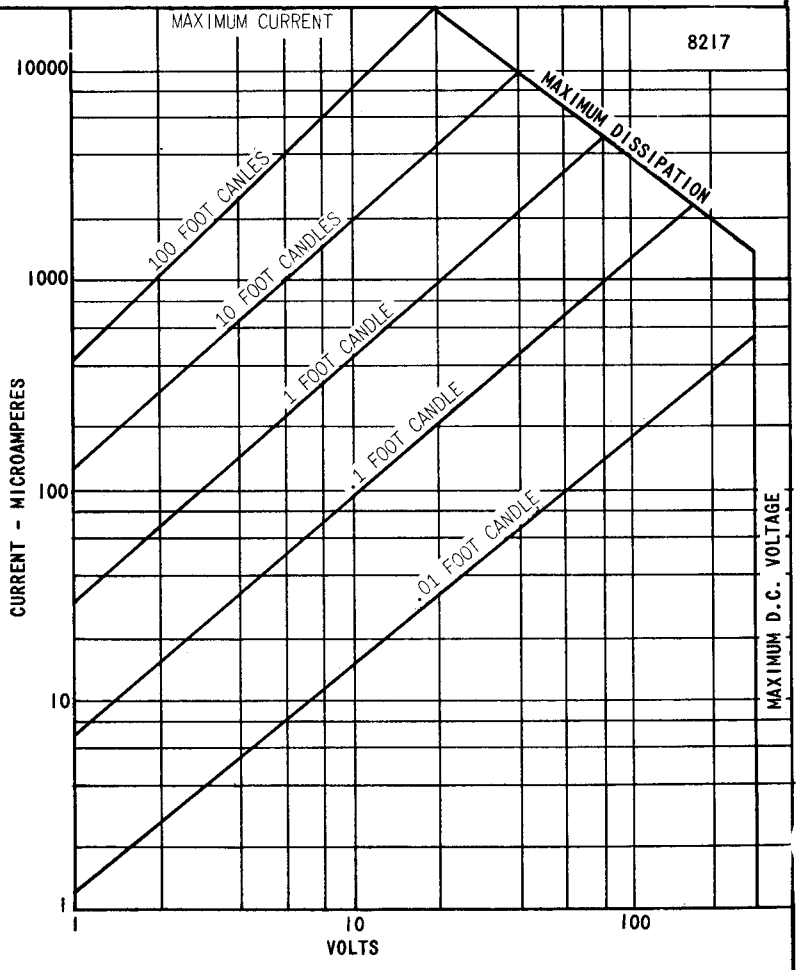

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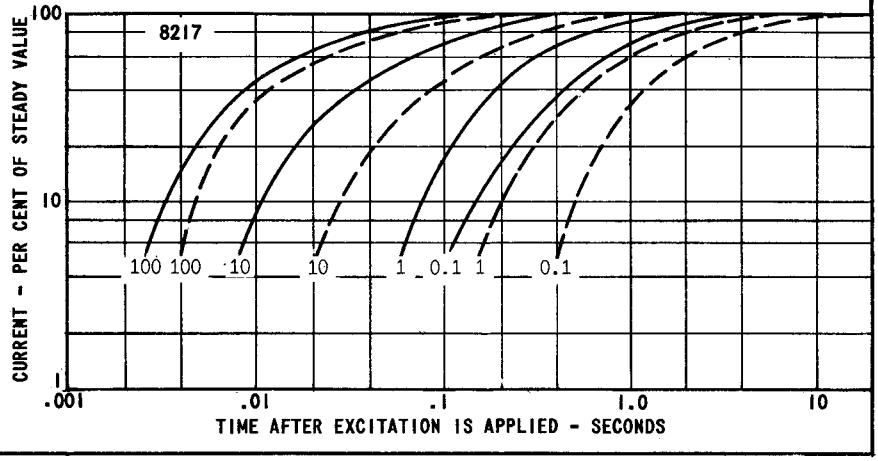
FIGURE 5 - AVERAGE RISE CHARACTERISTICS

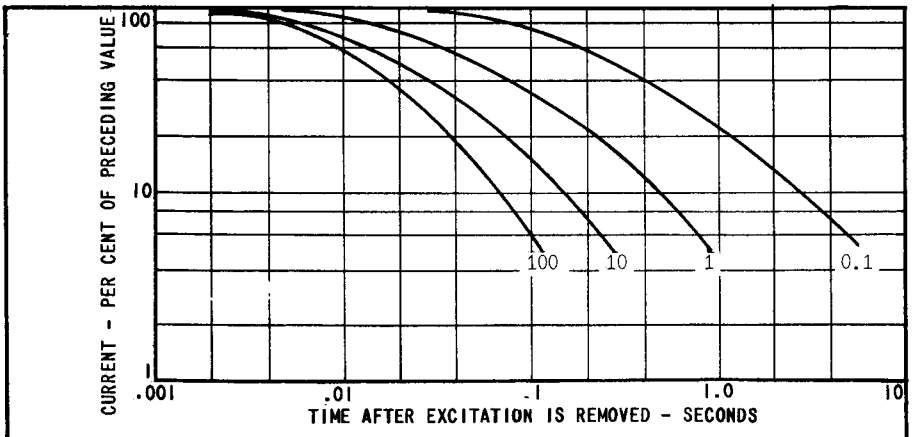


NUMBERS ON CURVES GIVE FOOT-CANDLES OF ILLUMINATION OF COLOR TEMPERATURE 2870°K.

SOLID LINES APPLY TO 5 SEC. STORAGE IN DARKNESS PRIOR TO EXCITATION.

DASHED LINES APPLY TO 5 MIN. STORAGE IN DARKNESS PRIOR TO EXCITATION.

FIGURE 6 - AVERAGE DECAY CHARACTERISTICS



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TUNG-SOL

PRODUCT BULLETIN

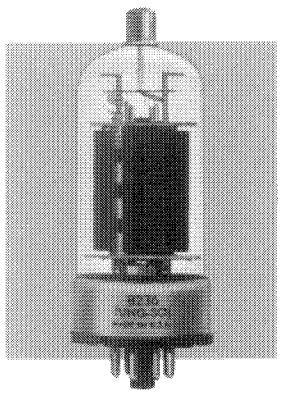
INDUSTRIAL ELECTRON TUBE TYPE 8236

FEBRUARY 1963

BEAM POWER PENTODE

DESCRIPTION — The Tung-Sol 8236 is an all service beam power pentode particularly suited for use in horizontal deflection circuits and as an R-F power amplifier up to 30 megacycles. Its carbon anode and hard glass bulb permit continuous operation at 50-watt plate dissipation.

In most cases, the 8236 will function as a high dissipation, direct plug-in replacement for the 6DQ5.

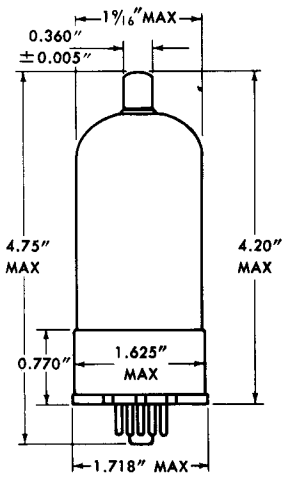


ELECTRICAL DATA

Heater Voltage	6.3 ± 10%	Volts
Heater Current — E_f = 6.3 Volts	2.5	Amperes
Transconductance	10,500	Micromhos
Mu, Grid No. 2 to Grid No. 1	3.3	
Direct Interelectrode Capacitances		
Grid No. 1 to Plate	0.5	Picofarad
Input	23	Picofarads
Output	11	Picofarads

MECHANICAL DATA

Mounting Position	Any
Bulb	JEDEC T-12
Base	Large wafer octal with sleeve, JETEC No. B8-98
Cap	JEDEC C1-1 (Small)
Maximum Net Weight	3.75 ounces



OUTLINE DRAWING

R-F POWER AMPLIFIER

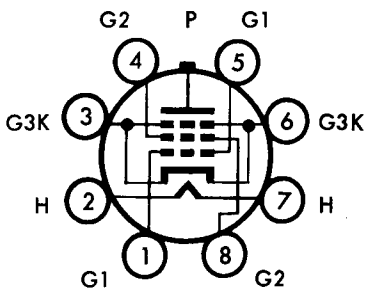
Class C Telegraphy and F-M Telephony

MAXIMUM RATINGS: (Up to 30 Mc)

	CCS	ICAS	
D-C Plate Voltage	1,000	1,200	Volts
D-C Grid No. 2 Voltage	200	200	Volts
D-C Grid No. 1 Voltage	−150	−150	Volts
D-C Plate Current	200	230	Milliamperes
D-C Grid No. 1 Current	3.5	4.0	Milliamperes
Plate Input	150	200	Watts
Grid No. 2 Input	3.2	3.2	Watts
Plate Dissipation	50	60	Watts
Peak Heater-Cathode Voltage	±135	±135	Volts
Bulb Temperature	250	250	Degrees Centigrade

TYPICAL OPERATION — As Amplifier up to 30 Megacycles

D-C Plate Voltage	700	900	Volts
D-C Grid No. 2 Voltage	140	145	Volts
from Series Resistor of	40,000	70,000	Ohms
D-C Grid No. 1 Voltage	−75	−77	Volts
from Grid No. 1 Resistor of	27,000	24,000	Ohms
Peak R-F Grid No. 1 Voltage	90	97	Volts
D-C Plate Current	200	227	Milliamperes
D-C Grid No. 2 Current	14	11	Milliamperes
D C Grid No. 1 Current—Approximate	2.8	3.3	Milliamperes
Driving Power—Approximate	0.23	0.28	Watts
Plate Power Input	140	200	Watts
Power Output	105	141	Watts



BOTTOM VIEW

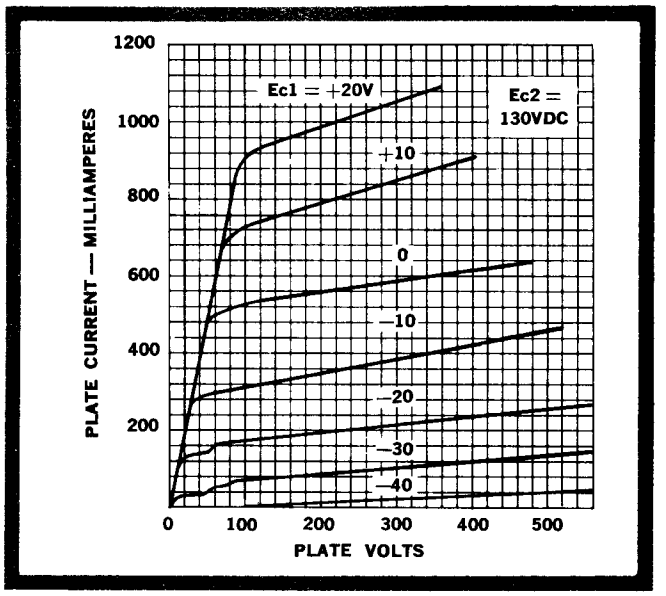


PLATE CHARACTERISTIC CURVE

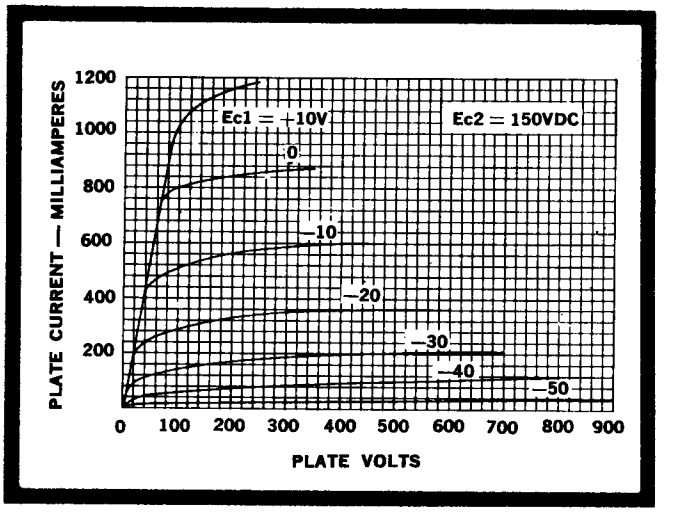
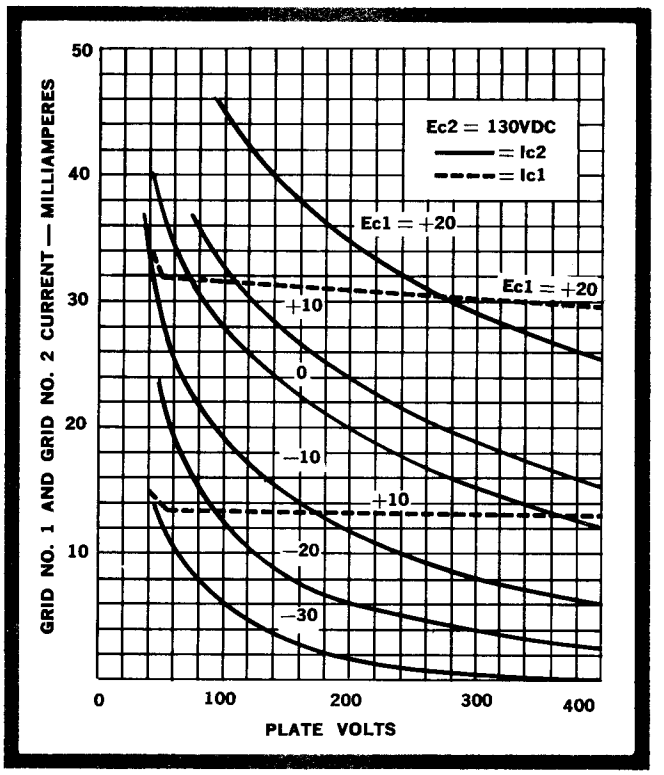
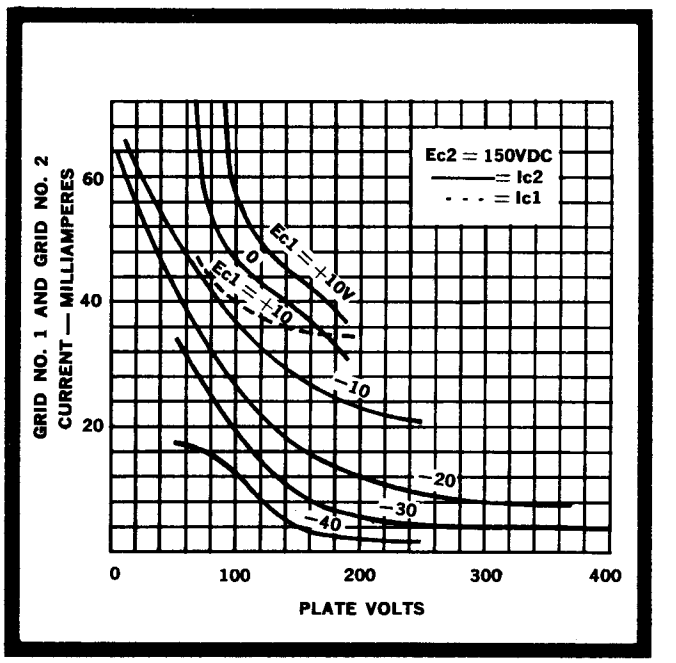


PLATE CHARACTERISTIC CURVE



GRID NO. 1 AND GRID NO. 2 CURRENT
VS. PLATE VOLTAGE



GRID NO. 1 AND GRID NO. 2 CURRENT
VS. PLATE VOLTAGE

TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 8375

SEPTEMBER, 1963

CERAMIC HYDROGEN DIODE

DESCRIPTION — The 8375 is a ceramic, indirectly heated hydrogen-filled diode designed for use in high-voltage rectifier, clipper, backswing and hold-off diode applications. Incorporated with the tube is a reservoir that promotes stable operation and long life by maintaining a constant hydrogen density.

Contrasted with a solid-state rectifier, the tube can withstand high current and high inverse voltage surges. It also has the advantage of being free of the temperature and mounting restrictions of mercury vapor tubes. The 8375 has been designed into some equipment under the developmental designation CH1161.

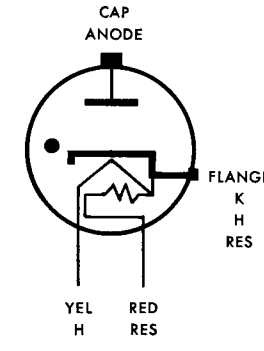
See Page 2 For Outline Drawing

ELECTRICAL DATA

	Min	Bogey	Max	
Heater and Reservoir Voltage (Note 1)	4.75	5.00	5.25	Volts
Heater Current (Note 2)	9	—	12	Amperes
Reservoir Current (Note 2)	2	—	3	Amperes
Cathode and Reservoir Heating Time	3	—	—	Minutes
Tube Voltage Drop	30	—	50	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	—	—	60	Volts
Ambient Temperature	−55	—	+150	Degrees Centigrade
Envelope Temperature	—	—	400	Degrees Centigrade

NOTES:

1. The bogey reservoir voltage for externally connected reservoir is 5 volts. This may be obtained by connecting the reservoir in parallel with the cathode heater. The reservoir voltage can be adjusted slightly lower or higher for optimum pressure when operating tube in certain types of clipper service.
2. Heater and reservoir currents at bogey heater and reservoir voltage.



MAKE CATHODE CONNECTION TO FLANGE

BASING DIAGRAM

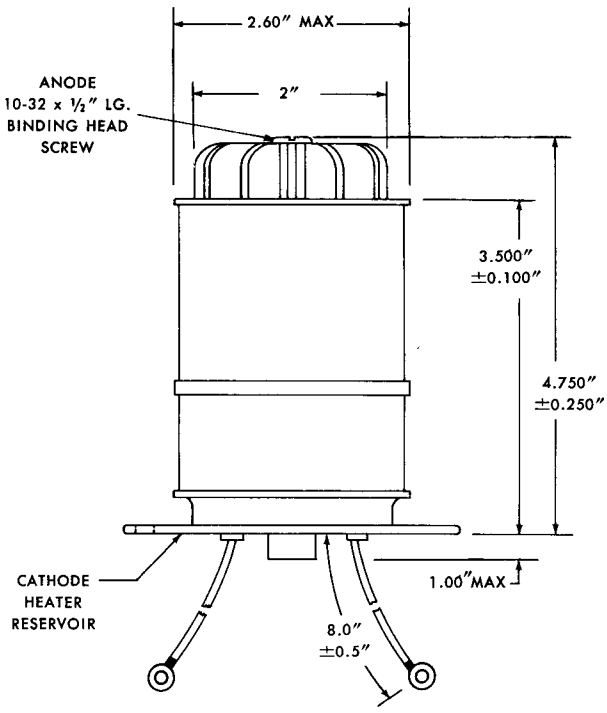
MECHANICAL DATA

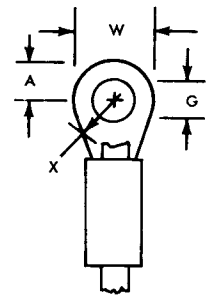
Type of Cooling	Convection
Mounting Position	Horizontal or vertical base down
Maximum Net Weight	1.3 Pounds
Dimensions, Mounting And Terminations	See Drawings

MAXIMUM RATINGS, ABSOLUTE VALUES
RECTIFIER SERVICE

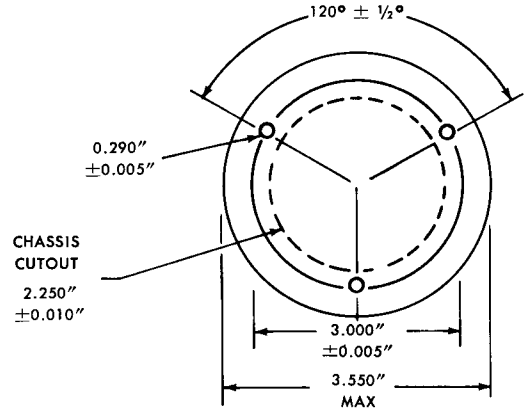
Anode Voltage — Peak	
Inverse	20 Kilovolts
Anode Current	
Peak	4 Amperes
Average	1 Ampere
Fault-Maximum Duration 0.1 Second	30 Amperes

Rating Information for specific Clipper, Backswing Diode or Hold off Diode applications may be obtained by contacting Tung Sol's Commercial Engineering Dept.





DIMENSION	INCHES
A	0.160 MAX
G	0.193-0.203
W	0.310 MAX
X	0.275 MIN



TUNG-SOL

PRODUCT BULLETIN

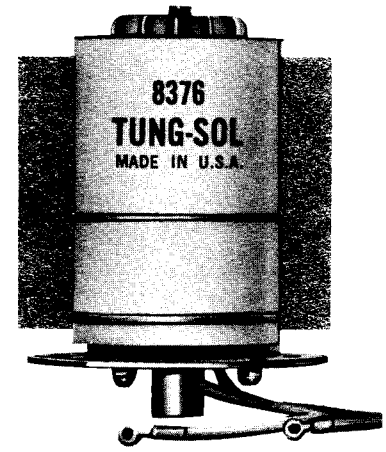
INDUSTRIAL ELECTRON TUBE TYPE 8376

MARCH, 1964

CERAMIC HYDROGEN DIODE

DESCRIPTION — The 8376 is a ceramic, indirectly heated hydrogen-filled diode designed for use in high-voltage rectifier applications. Incorporated in the tube is a reservoir that promotes stable operation and long life by maintaining a constant hydrogen pressure.

Contrasted with a solid-state rectifier, the tube can withstand high current and high inverse voltage surges. They also have the advantage of being free of the temperature and mounting restrictions of mercury vapor tubes.



See Page 2 For Outline Drawing

ELECTRICAL DATA

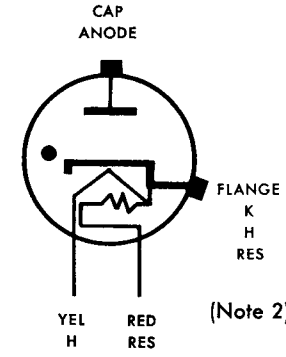
	Min	Bogey	Max	
Heater and Reservoir Voltage (Note 1)	4.75	5.00	5.25	Volts
Heater Current (Note 2)	12	—	15	Amperes
Reservoir Current (Note 2)	2	—	3	Amperes
Cathode and Reservoir Heating Time	3	—	—	Minutes
Tube Voltage Drop	—	—	70	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	—	—	60	Volts
Ambient Temperature	−55	—	+150	Degrees Centigrade
Envelope Temperature	—	—	400	Degrees Centigrade

NOTES:

1. The bogey reservoir voltage for externally connected reservoir is 5 volts. This may be obtained by connecting the reservoir in parallel with the cathode heater.
2. Heater and reservoir currents at bogey heater and reservoir voltage.

MECHANICAL DATA

Type of Cooling	Convection or forced air
Mounting Position	Horizontal or vertical with base down
Maximum Net Weight	3 Pounds
Dimensions, Mounting and Terminals	See Drawings



BASING DIAGRAM

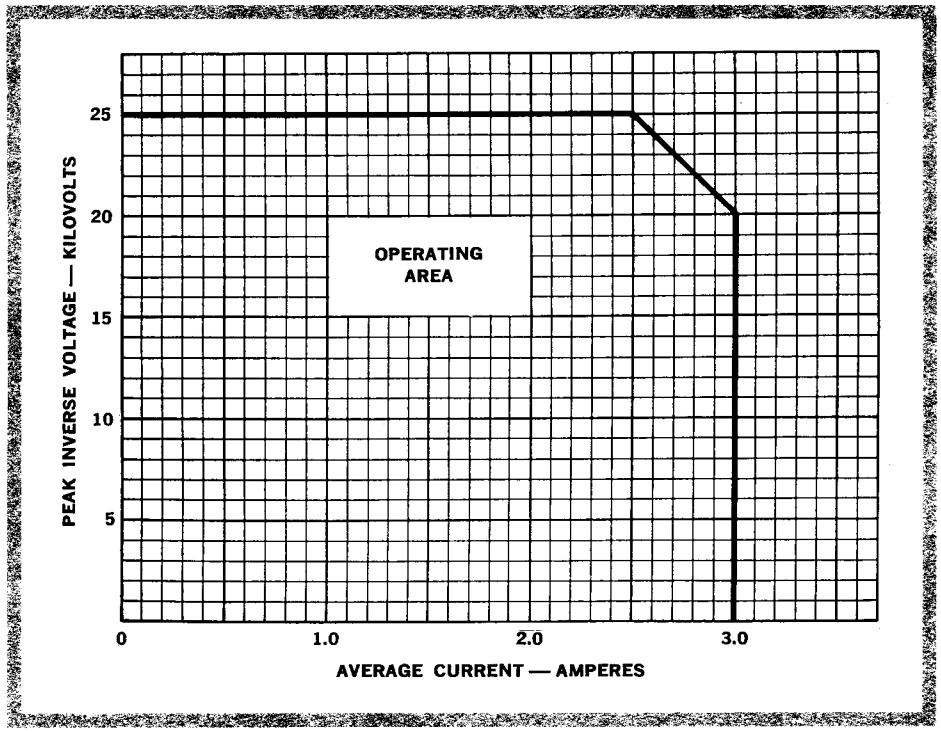
MAXIMUM RATINGS, ABSOLUTE VALUES
RECTIFIER SERVICE

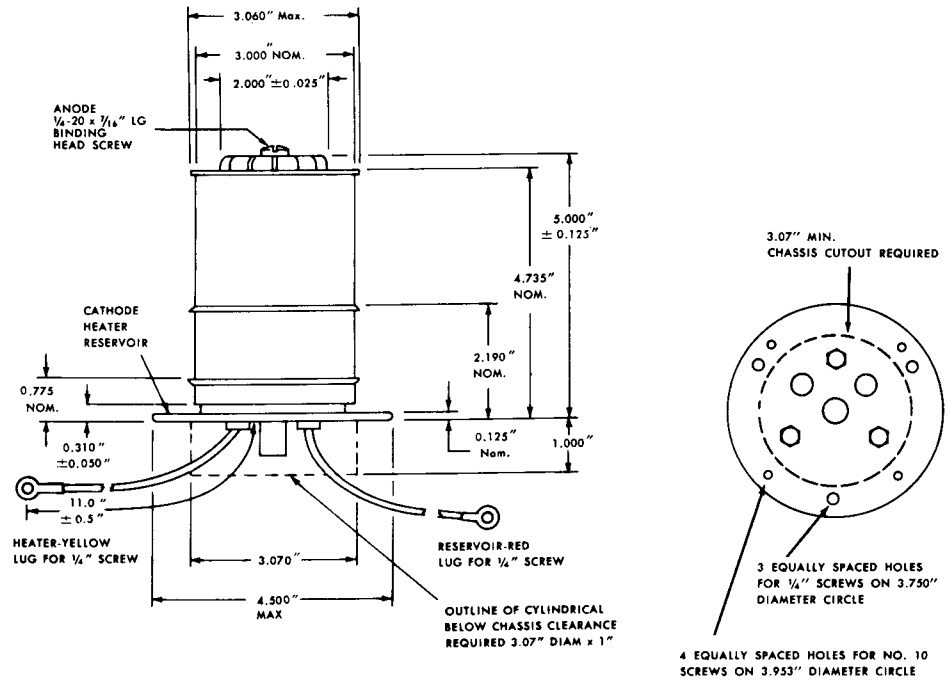
Anode Voltage — Peak	
Inverse — See Rating Graph on page 2	25 Kilovolts
Anode Current	
Peak	12 Amperes
Average — See Rating Graph on page 2	3 Amperes
Fault — Maximum Duration 0.1 Second	90 Amperes

NOTES:

1. See Rectifier Rating Graph on page 2.
2. **CAUTION** — In order to avoid damage to tube, the cathode connection must be made to the base flange only.

RECTIFIER RATING GRAPH





TUNG-SOL

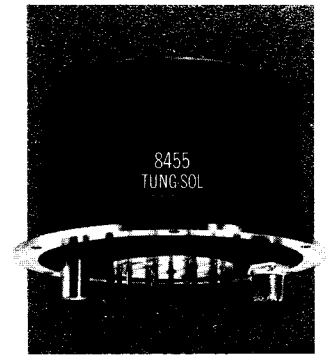
PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPES 8428, 8455

AUGUST 1964

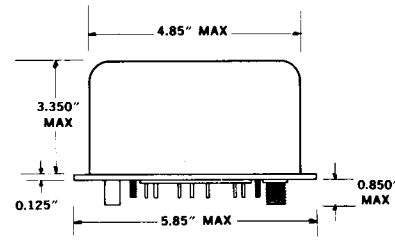
HIGH PULSE POWER, GRID-CONTROLLED, ELECTRON MULTIPLIER TUBES

DESCRIPTION The 8428 and 8455 are multi-stage secondary emission multiplier tubes capable of supplying high peak power pulses with negligible input power. Because of their extremely fast rise time, low delay time and positive going output pulse they are excellent for modulating travelling wave tubes and hydrogen thyratrons. They are, in general, capable of replacing complete multi-stage pulse amplifiers, without the delay time inherent in the latter devices.



ELECTRICAL DATA

	8428	8455	
Load	150	250	Ohms
Peak Pulse Output Voltage	600	1000	Volts
Peak Pulse Output Current (Note 1)	4	4	Amps
Peak Pulse Output Power	2.4	4.0	Kilowatts
Average Output Power	24	40	Watts
Output Capacitance—Typical	70	70	Picofarads
Output Inductance—Typical	0.1	0.1	μHENRY
Input Capacitance—Typical	13	13	Picofarads
Delay Time—Max. (Note 2)	20	20	Nanoseconds
Rise Time—Max. (Note 2)	10	10	Nanoseconds
Heater Voltage	6.3	6.3	Volts
Heater Current	1.2	1.2	Amps
Grid #1 Voltage	−15	−15	Volts
Grid Drive	20	20	Volts
Peak Input Driving Power—Typical	300	300	Milliwatts
Average Input Driving Power—Typical	3.0	3.0	Milliwatts
Duty Cycle	1.0	1.0	Percent



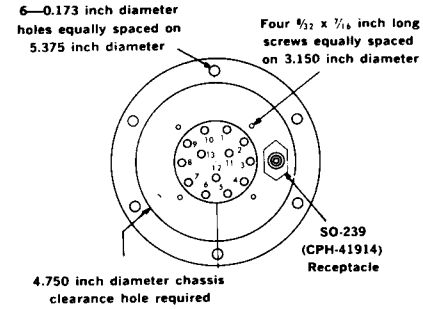
OUTLINE DRAWING

MAXIMUM RATINGS

	8428	8455	
Duty Cycle	1.0	1.0	Percent
Peak Grid #1 Voltage	35	35	Volts
Max. Anode to Cathode Voltage	3.4	4.0	Kilovolts
Pulse Width (Note 3)	10	10	μsec

MECHANICAL DATA

	8428	8455	
Weight—Approximate	3.3	3.3	lbs.
Dimensions	See Drawing		
Chassis Clearance Hole	4.75"	4.75"	
Socket (Note 4)	T.S. X4473	T.S. X4473	
Shock ..... MIL-E-1/1494 NAVY	NOTE 7		
Vibration MIL-E-1	PAR 4.9.20.3		

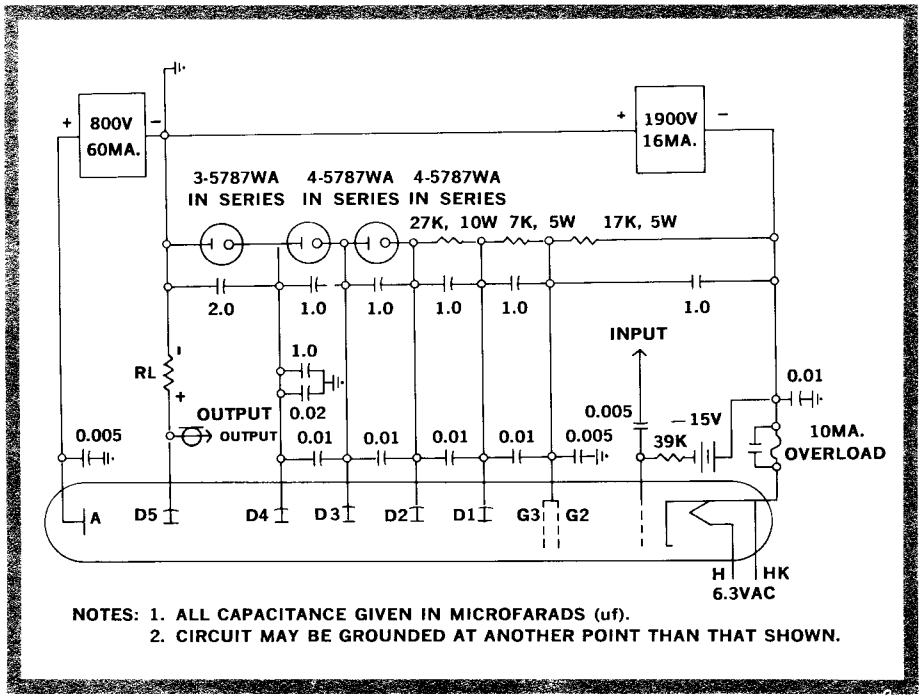


BOTTOM VIEW

BASING DATA

Pin	Element	Pin	Element
1	Getter	8	Grid 3
2	Getter	9	Grid 2
3	Anode	10	Getter
4	Dynode 4	11	Heater
5	Dynode 3	12	Heater-Cathode
6	Dynode 2	13	Grid 1
7	Dynode 1	UHF Female Coax Receptacle	Dynode 5

TYPICAL PULSE AMPLIFIER CIRCUIT

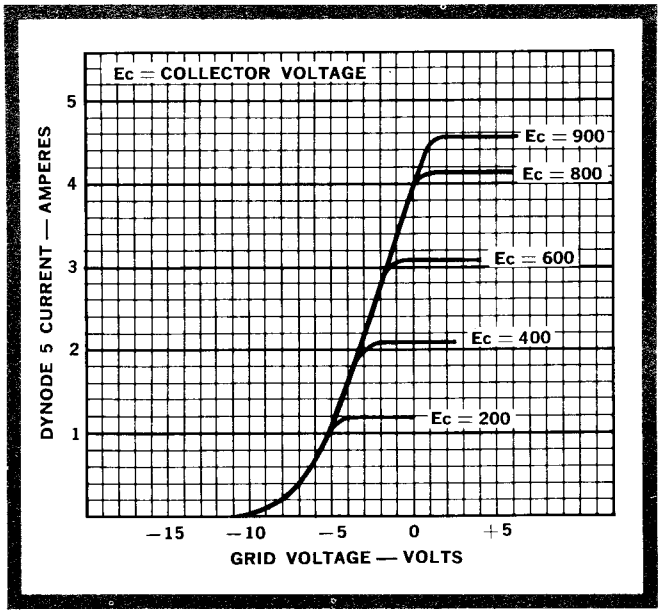


NOTES: 1. ALL CAPACITANCE GIVEN IN MICROFARADS (uf).
2. CIRCUIT MAY BE GROUNDED AT ANOTHER POINT THAN THAT SHOWN.

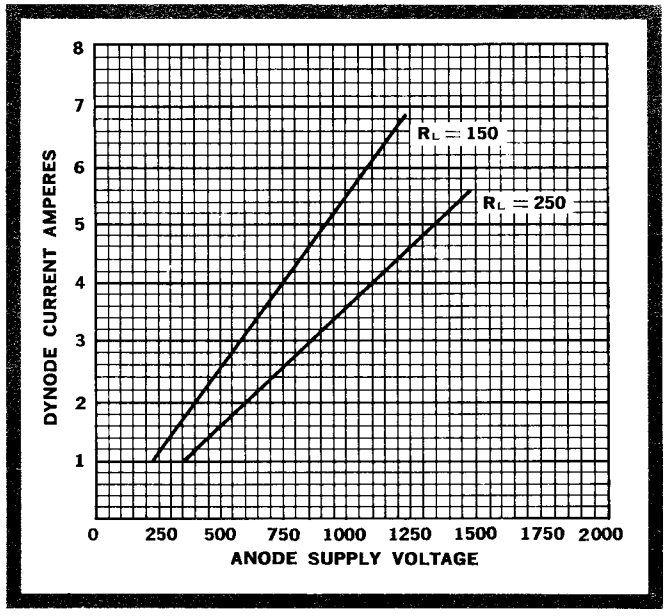
NOTES

1. Peak output current is a function of load and peak current capabilities of power supply. Peak currents greater than 4 amperes can be delivered to proper load; however, under these conditions pulse width must be reduced to keep duty cycle under maximum.
2. Under purely resistive loads.
3. Variation in peak output voltage ±10 pc. from leading edge of pulse to trailing.
4. Alden Products Company 223FP Special. Drawing showing modifications are available.

DYNODE 5 OUTPUT CURRENT VS GRID INPUT VOLTAGE



OUTPUT CURRENT VS ANODE SUPPLY VOLTAGE



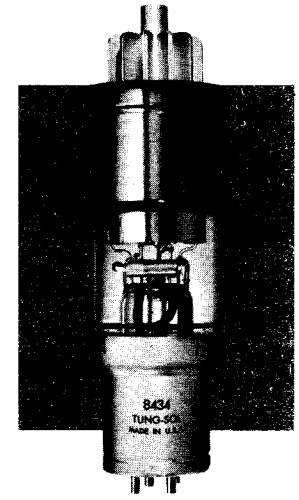
TUNG-SOL

PRODUCT BULLETIN

INDUSTRIAL ELECTRON TUBE TYPE 8434

JULY 1963

HYDROGEN DIODE



DESCRIPTION — The 8434 is an indirectly heated, hydrogen filled, half-wave diode designed for use in high voltage rectifier circuits. In comparison with mercury-vapor tubes, the 8434 is virtually temperature free, and is not subject to long warmup times or splash problems. Also when subjected to nuclear radiation, the gas filling does not act as a radioactive "keeper" as does mercury. Contrasted with solid state rectifiers, the 8434 can withstand high current and inverse voltage surges. Long life is assured by an internally connected hydrogen reservoir.

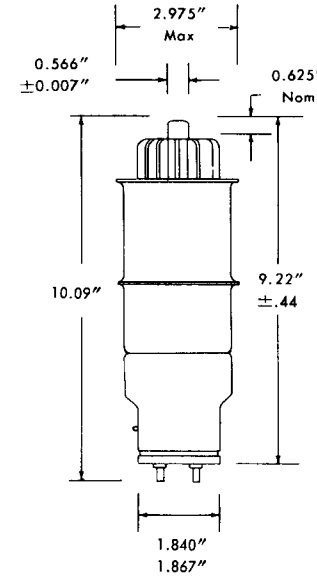
The 8434 is capable of delivering 1.8 amperes average at 20 kilovolts peak inverse voltage. It will function as a direct plug-in replacement for mercury-vapor types 6894 and 575A.

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	4.75	5.0	5.25	Volts
Heater Current — E_f = 11.5 Volts	9.5	11.5	13.8	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	—	60	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	30	—	75	Volts

MECHANICAL DATA

Type of Cooling	See Rating Graph. Convection or Forced Air — 50 cfm directed at top of radiator
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	1 Pound 14 Ounces
Dimensions	See Outline Drawing
Base	Skirted medium metal shell Jumbo, 4-pin With Bayonet
Anode Connection	Cap, See Outline Drawing

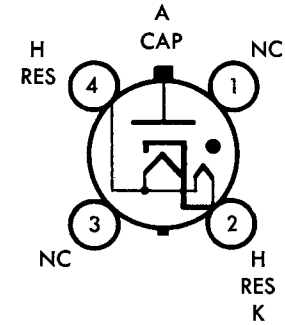


OUTLINE DRAWING

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Peak Inverse Anode Voltage	—	20,000	Volts
Cathode Current			
Peak	—	8	Amperes
Average	—	1.8	Amperes
Surge — Maximum Duration 0.1 Second	—	60	Amperes
Averaging Time	—	15	Seconds
Ambient Temperature	−55	+75	Degrees Centigrade

CAUTION — The Cathode connection should be made to Pin 2 in order not to damage tube.



(SEE CAUTION NOTE)
BOTTOM VIEW

TYPE 8434

MAXIMUM RATING CHART

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	*	A-C SECONDARY VOLTAGE E_{RMS} Kilovolts	D-C OUTPUT — APPROX		RIPPLE	
						E_{DC} Kilovolts	I_{DC} AMPS	KILOVOLTS RMS	FREQ
1	Half-wave 1-phase	1-phase	1	A	10.5	4.75	1.5	5.25	f
				B	12.5	5.75	1.8	6.25	
2	Full-wave 1-phase	1-phase C-T	2	A	5.25	4.75	3.0	2.25	2f
				B	6.25	5.75	3.6	2.8	
3	Bridge circuit 1-phase	1-phase	4	A	10.5	9.5	3.0	4.5	2f
				B	12.5	11.5	3.6	5.6	
4	Half-wave 3-phase	Delta-Wye	3	A	6.15	7.2	4.5	1.3	3f
				B	7.35	8.6	5.4	1.55	
5	Full-wave 3-phase	Delta-Wye	6	A	6.15	14.3	4.5	0.6	6f
				B	7.35	17.2	5.4	0.72	
6	Full-wave 3-phase	Delta-Delta	6	A	10.5	14.3	4.5	0.6	6f
				B	12.5	17.2	5.4	0.72	
7	Half-wave 6-phase (3-phase supply)	Delta-Star	6	A	5.25	7.2	9.0	0.29	6f
				B	6.25	8.6	10.8	0.35	

*See RATING GRAPH

A: Convection cooled, at maximum tube ratings

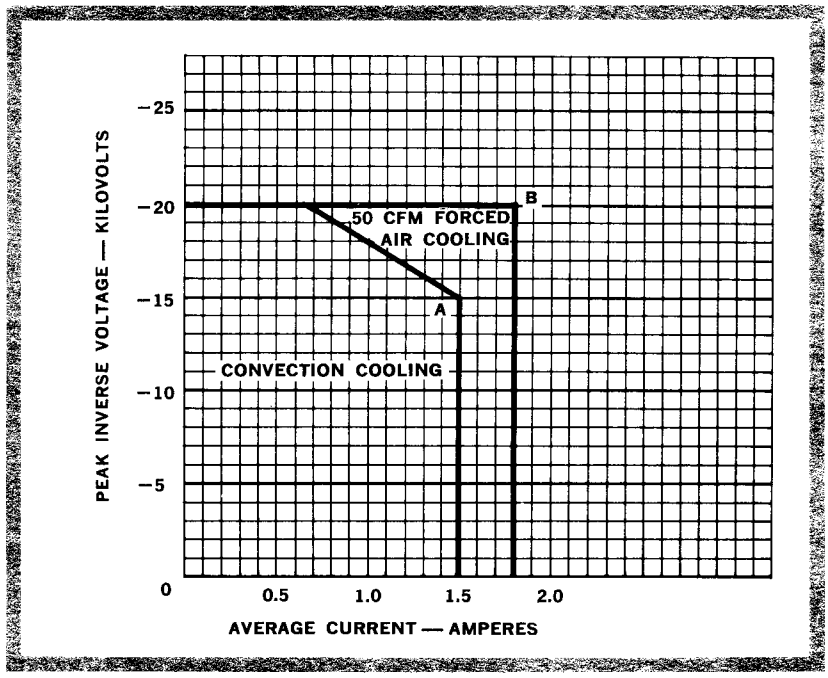
B: Forced air cooled at maximum voltage ratings

C: Forced air cooled at maximum current ratings

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.

The 8434 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

RATING GRAPH



TUNG-SOL

PRODUCT BULLETIN

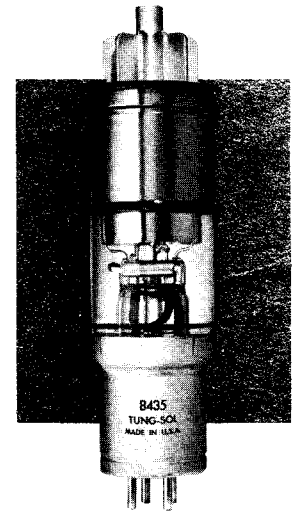
INDUSTRIAL ELECTRON TUBE TYPE 8435

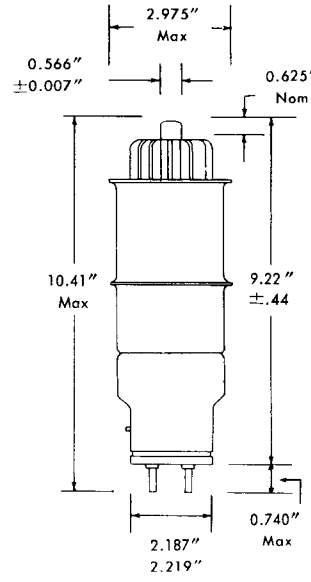
JULY 1963

HYDROGEN DIODE

DESCRIPTION — The 8435 is an indirectly heated, hydrogen filled, half-wave diode designed for use in high voltage rectifier circuits. In comparison with mercury-vapor tubes, the 8435 is virtually temperature free, and is not subject to long warmup times or splash problems. Also when subjected to nuclear radiation, the gas filling does not act as a radioactive "keeper" as does mercury. Contrasted with solid state rectifiers, the 8435 can withstand high current and inverse voltage surges. Long life is assured by an internally connected hydrogen reservoir.

The 8435 is capable of delivering 1.8 amperes average at 20 kilovolts peak inverse voltage. It will function as a direct plug-in replacement for mercury-vapor types 6895 and 673.





OUTLINE DRAWING

ELECTRICAL DATA

	Min	Bogey	Max	
Heater Voltage	4.75	5.0	5.25	Volts
Heater Current — E_f = 11.5 Volts	9.5	11.5	13.8	Amperes
Cathode Heating Time	3	—	—	Minutes
Anode Voltage Drop	30	—	60	Volts
Initial Firing Voltage	—	—	100	Volts
Recurrent Firing Voltage	30	—	75	Volts

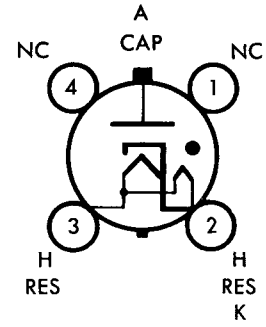
MECHANICAL DATA

Type of Cooling	See Rating Graph. Convection or Forced Air — 50 cfm directed at top of radiator
Mounting Position	Horizontal or Vertical (Base Down)
Average Net Weight	1 Pound 14 Ounces
Dimensions	See Outline Drawing
Base	Skirted, Super Jumbo, 4-pin With Bayonet,
Anode Connection	Cap, See Outline Drawing

RATINGS, ABSOLUTE VALUES

	Minimum	Maximum	
Peak Inverse Anode Voltage	—	20,000	Volts
Cathode Current			
Peak	—	8	Amperes
Average	—	1.8	Amperes
Surge — Maximum Duration 0.1 Second	—	60	Amperes
Averaging Time	—	15	Seconds
Ambient Temperature	−55	+75	Degrees Centigrade

CAUTION — The Cathode connection should be made to Pin 2 in order not to damage tube.



(SEE CAUTION NOTE)
BOTTOM VIEW

TYPE 8435

FIG.	CIRCUIT	TRANSFORMER	NO. OF TUBES	*	A-C SECONDARY VOLTAGE E_{RMS} Kilovolts	D-C OUTPUT — APPROX E_{DC} Kilovolts	D-C OUTPUT — APPROX I_{DC} AMPS	RIPPLE KILOVOLTS RMS	RIPPLE FREQ
1	Half-wave 1-phase	1-phase	1	A	10.5	4.75	1.5	5.25	f
				B	12.5	5.75	1.8	6.25	
2	Full-wave 1-phase	1-phase C-T	2	A	5.25	4.75	3.0	2.25	2f
				B	6.25	5.75	3.6	2.8	
3	Bridge circuit 1-phase	1-phase	4	A	10.5	9.5	3.0	4.5	2f
				B	12.5	11.5	3.6	5.6	
4	Half-wave 3-phase	Delta-Wye	3	A	6.15	7.2	4.5	1.3	3f
				B	7.35	8.6	5.4	1.55	
5	Full-wave 3-phase	Delta-Wye	6	A	6.15	14.3	4.5	0.6	6f
				B	7.35	17.2	5.4	0.72	
6	Full-wave 3-phase	Delta-Delta	6	A	10.5	14.3	4.5	0.6	6f
				B	12.5	17.2	5.4	0.72	
7	Half-wave 6-phase (3-phase supply)	Delta-Star	6	A	5.25	7.2	9.0	0.29	6f
				B	6.25	8.6	10.8	0.35	

*See RATING GRAPH

A: Convection cooled, at maximum tube ratings

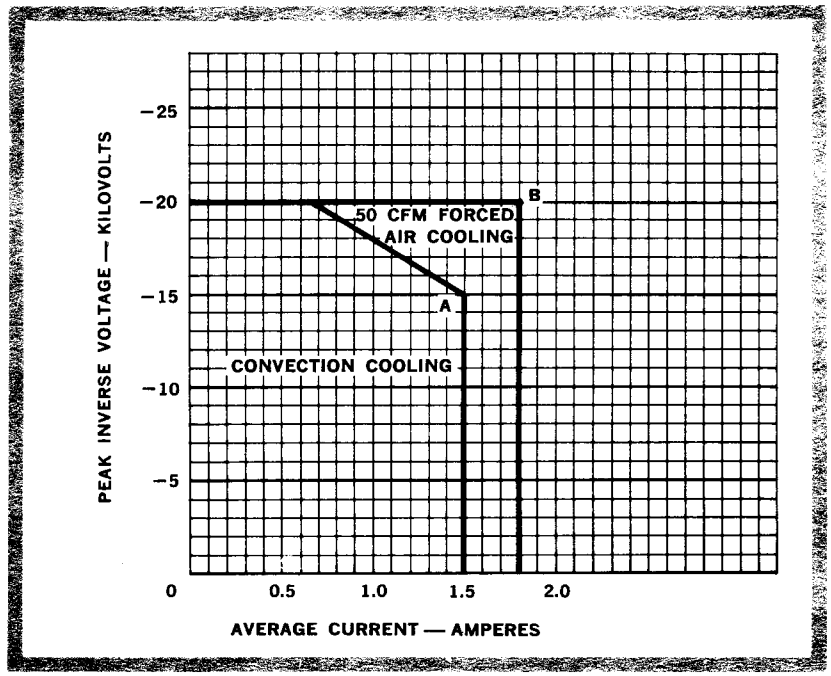
B: Forced air cooled at maximum voltage ratings

C: Forced air cooled at maximum current ratings

For figure references see STANDARD RECTIFIER CIRCUITS AND RATINGS sheet.

The 8435 should be protected from transient voltages in excess of the maximum rating by spark gaps installed either directly across the tube or across each plate transformer secondary leg.

RATING GRAPH



TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

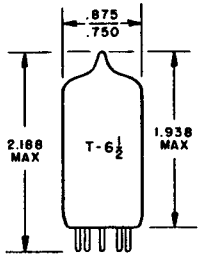
MEDIUM MU TRIODE AND
SHARP CUT-OFF PENTODE

FOR

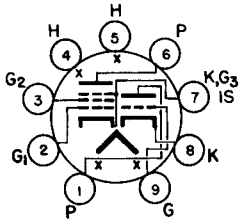
MOBILE COMMUNICATIONS EQUIPMENT

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9AE

THE 8445 CONTAINS A MEDIUM MU TRIODE AND A SHARP CUT-OFF HIGH-FREQUENCY PENTODE WITH SEPARATE CATHODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTED TO GIVE IMPROVED RELIABILITY IN MOBILE RADIO COMMUNICATION EQUIPMENT. ITS HEATER IS DESIGNED TO BE OPERATED FROM AN AUTOMOTIVE BATTERY.
ELECTRICALLY THE SAME TYPE, BUT WITH DIFFERENT BASING ARRANGEMENT, IS THE 8446.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

TRIODE SECTION:			
GRID TO PLATE: (TG TO TP)		1.5	pf
INPUT: TG TO (TK + H + PK + PG3 + I.S.)		2.5	pf
OUTPUT: TP TO (TK + H + PK + PG3 + I.S.)		1.8	pf
PENTODE SECTION:			
GRID 1 TO PLATE: (PG1 TO PP)	MAX.	0.025	pf
INPUT: PG1 TO (H + PK + PG2 + PG3 + I.S.)		5.5	pf
OUTPUT: PP TO (H + PK + PG2 + PG3 + I.S.)		3.8	pf
COUPLING:			
TRIODE GRID TO PENTODE PLATE	MAX.	0.02	pf
PENTODE GRID 1 TO TRIODE PLATE	MAX.	0.16	pf
PENTODE PLATE TO TRIODE PLATE	MAX.	0.07	pf

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CONTINUED FROM PRECEDING PAGE

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.75	VOLTS	440	MA.
LIMITS OF APPLIED HEATER VOLTAGE			6.0 TO 7.5	VOLTS
HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE		200	VOLTS
POSITIVE GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.0	1.7	WATTS
GRID 2 DISSIPATION		0.5	WATTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	100	170	VOLTS
GRID 2 VOLTAGE	-----	170	VOLTS
GRID 1 VOLTAGE	-1.0	-2.0	VOLTS
PLATE CURRENT	12.5	10.0	MA.
GRID 2 CURRENT	-----	2.5	MA.
TRANSCONDUCTANCE	7,000	6,200	μMHOS
AMPLIFICATION FACTOR	43		
PLATE RESISTANCE (APPROX.)	-----	0.4	MEGOHMS
GRID VOLTAGE (APPROX.) FOR Ib = 50 μA	-10	-----	VOLTS
GRID 1 VOLTAGE (APPROX.) FOR Ib = 100 μA.	-----	-7	VOLTS

TUNG-SOL

TRIODE PENTODE

MINIATURE TYPE

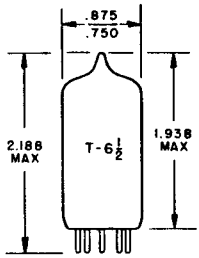
MEDIUM MU TRIODE AND
SHARP CUT-OFF PENTODE

FOR

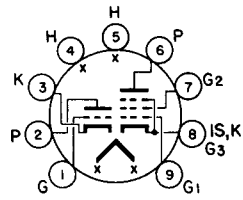
MOBILE COMMUNICATIONS EQUIPMENT

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION



GLASS BULB
MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW
BASING DIAGRAM
JEDEC 9FA

THE 8446 CONTAINS A MEDIUM MU TRIODE AND A SHARP CUT-OFF HIGH-FREQUENCY PENTODE WITH SEPARATE CATHODES IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS ADAPTED TO GIVE IMPROVED RELIABILITY IN MOBILE RADIO COMMUNICATION EQUIPMENT. ITS HEATER IS DESIGNED TO BE OPERATED FROM AN AUTOMOTIVE BATTERY.
ELECTRICALLY THE SAME TYPE, BUT WITH DIFFERENT BASING ARRANGEMENT, IS THE 8445.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

TRIODE SECTION:			
GRID TO PLATE: (TG TO TP)		1.5	pf
INPUT: TG TO (TK + H + PK + PG3 + I.S.)		2.5	pf
OUTPUT: TP TO (TK + H + PK + PG3 + I.S.)		2.2	pf
PENTODE SECTION:			
GRID 1 TO PLATE: (PG1 TO PP)	MAX.	0.046	pf
INPUT: PG1 TO (H + PK + PG2 + PG3 + I.S.)		5.0	pf
OUTPUT: PP TO (H + PK + PG2 + PG3 + I.S.)		3.5	pf
COUPLING:			
TRIODE GRID TO PENTODE PLATE	MAX.	0.02	pf
PENTODE GRID 1 TO TRIODE PLATE	MAX.	0.16	pf
PENTODE PLATE TO TRIODE PLATE	MAX.	0.07	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.75	VOLTS	440	MA.
LIMITS OF APPLIED HEATER VOLTAGE			6.0 TO 7.5	VOLTS
HEATER CATHODE VOLTAGE:				
HEATER NEGATIVE WITH RESPECT TO CATHODE				
TOTAL DC AND PEAK			200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE				
DC			100	VOLTS
TOTAL DC AND PEAK			200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 VOLTAGE		200	VOLTS
POSITIVE GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.0	1.7	WATTS
GRID 2 DISSIPATION		0.5	WATTS
GRID 1 CIRCUIT RESISTANCE			
FIXED BIAS	0.5	0.5	MEGOHM
CATHODE BIAS	1.0	1.0	MEGOHM

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	100	170	VOLTS
GRID 2 VOLTAGE	-----	170	VOLTS
GRID 1 VOLTAGE	-1.0	-2.0	VOLTS
PLATE CURRENT	12.5	10.0	MA.
GRID 2 CURRENT	-----	2.5	MA.
TRANSCONDUCTANCE	7,000	6,200	μMHOS
AMPLIFICATION FACTOR	43		
PLATE RESISTANCE (APPROX.)	-----	0.4	MEGOHMS
GRID VOLTAGE (APPROX.) FOR Ib = 50 μA	-10	-----	VOLTS
GRID 1 VOLTAGE (APPROX.) FOR Ib = 100 μA.	-----	-7	VOLTS

TUNG-SOL

DOUBLE-DIODE-TRIODE

MINIATURE TYPE

HIGH PERVEANCE DOUBLE DIODE

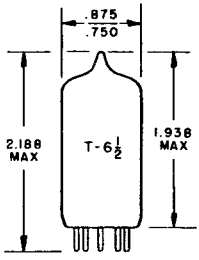
AND HIGH MU TRIODE

FOR

MOBILE COMMUNICATIONS EQUIPMENT

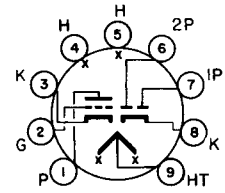
COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9CF

THE 8447 IS A HIGH PERVEANCE DOUBLE DIODE AND HIGH MU TRIODE WITH SEPARATE CATHODES IN THE 9 PIN MINIATURE CONSTRUCTION FOR USE IN RELIABLE MOBILE RADIO COMMUNICATION EQUIPMENT. IT IS INTENDED TO REPLACE THE 12BR7 WHERE RELIABILITY IS THE PRIMARY CONSIDERATION. ITS HEATER IS DESIGNED TO OPERATE DIRECTLY FROM A 3 OR 6-CELL AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #315
CONNECTED TO CATHODE OF THE SECTION UNDER TEST

DIODE		
EACH: P TO (K + H)	2.0	pf
TRIODE		
GRID TO PLATE: G TO P	1.9	pf
INPUT: G TO (H + K)	2.8	pf
OUTPUT: P TO (H + K)	1.0	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS:	9 AND 4+5	4 AND 5	
AVERAGE VALUES - VOLTAGE	6.75	13.5	VOLTS
CURRENT	380	190	MA.
LIMITS OF APPLIED HEATER VOLTAGE	6.0 – 7.5	12.0 – 15.0	VOLTS
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM RATINGS - SEE EIA STANDARD RS-239

DIODE SECTION:

PEAK INVERSE VOLTAGE	300	VOLTS
PEAK CURRENT, EACH	60	MA.

TRIODE SECTION:

PLATE VOLTAGE	300	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE DISSIPATION	2.5	WATTS

AVERAGE CHARACTERISTICS

DIODE SECTION:

AVERAGE DIODE CURRENT WITH 5 VOLTS DC APPLIED (EACH SECTION)	17	MA.

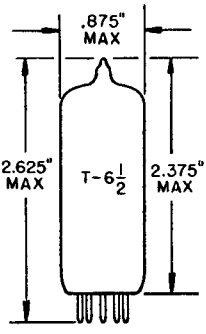
TRIODE SECTION:

PLATE VOLTAGE	250	VOLTS
CATHODE BIAS RESISTOR	200	OHMS
PLATE CURRENT	10	MA.
TRANSCONDUCTANCE	5,500	μMHOS
AMPLIFICATION FACTOR	60	
PLATE RESISTANCE (APPROX.)	10,900	OHMS
GRID VOLTAGE (APPROX.) FOR $I_b \approx 10\ \mu A$	−12	VOLTS

TUNG-SOL

PENTODE

MINIATURE TYPE



GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-3

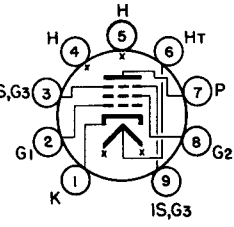
POWER PENTODE

FOR

MOBILE COMMUNICATIONS EQUIPMENT

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM

JEDEC 9BF

THE 8448 IS A POWER PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION FOR USE IN RELIABLE MOBILE RADIO COMMUNICATION EQUIPMENT. IT IS INTENDED TO REPLACE THE 12BY7A WHERE RELIABILITY IS THE PRIMARY CONSIDERATION. ITS HEATER IS DESIGNED TO OPERATE DIRECTLY FROM A 3 OR 6-CELL AUTOMOTIVE BATTERY.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID 1 TO PLATE - G1 TO P	MAX.	0.063	pf
INPUT: G1 TO (H + K + G2 + G3 + I.S.)		10.2	pf
OUTPUT: P TO (H + K + G2 + G3 + I.S.)		3.5	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

SUPPLY CONNECTED TO PINS	6 AND 4 + 5	4 AND 5	
AVERAGE VALUES - VOLTAGE	6.75	13.5	VOLTS
CURRENT	520	260	MA.
LIMITS OF APPLIED HEATER VOLTAGE	6.0 - 7.5	12.0 - 15.0	VOLTS
HEATER CATHODE VOLTAGE:			
HEATER NEGATIVE WITH RESPECT TO CATHODE			
TOTAL DC AND PEAK	200		VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE			
DC	100		VOLTS
TOTAL DC AND PEAK	200		VOLTS

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MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

PLATE VOLTAGE	330	VOLTS
GRID 2 VOLTAGE	190	VOLTS
NEGATIVE GRID VOLTAGE	55	VOLTS
POSITIVE GRID 1 VOLTAGE	0	VOLTS
PLATE DISSIPATION	6.5	WATTS
GRID 2 DISSIPATION	1.2	WATTS
GRID 1 CIRCUIT RESISTANCE		
FIXED BIAS	0.25	MEGOHM
CATHODE BIAS	1.0	MEGOHM

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	250	VOLTS
GRID 2 VOLTAGE	180	VOLTS
CATHODE BIAS RESISTOR	100	OHMS
PLATE CURRENT	26	MA.
GRID 2 CURRENT	5.7	MA.
TRANSCONDUCTANCE	11,000	μMHOS
PLATE RESISTANCE (APPROX.)	93,000	OHMS
TRIODE AMPLIFICATION FACTOR	28.5	
GRID 1 VOLTAGE (APPROX.) FOR Ib = 100 μA	−8.5	VOLTS

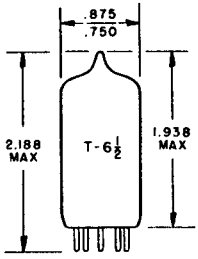
TUNG-SOL

TRIODE-PENTODE

MINIATURE TYPE

MEDIUM MU TRIODE AND

SHARP CUTOFF PENTODE

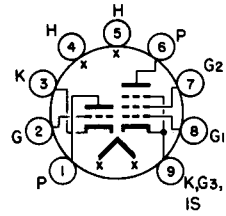


GLASS BULB

MINIATURE BUTTON
9 PIN BASE E9-1
OUTLINE DRAWING
JEDEC 6-2

COATED UNIPOTENTIAL CATHODES

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 9DA

THE 8489 CONTAINS A MEDIUM MU TRIODE AND A SHARP CUTOFF PENTODE IN THE 9 PIN MINIATURE CONSTRUCTION. IT IS INTENDED FOR USE IN CIRCUITS WITH HIGH VALUES OF CONTROL GRID RESISTANCE. LEAKAGE IS MINIMIZED BY USE OF SPECIAL MATERIALS AND PROCESSING; MAINTENANCE OF THIS CHARACTERISTICS IS ASSURED BY SPECIAL LIFE TESTS.

DIRECT INTERELECTRODE CAPACITANCES

PENTODE			
GRID 1 TO PLATE: G1 TO P	(MAX.)	0.04	pf
INPUT: G1 TO (H + KP + G2 + G3 + I.S.)		7.0	pf
OUTPUT: P TO (H + KP + G2 + G3 + I.S.)		2.4	pf
TRIODE			
GRID TO PLATE: G TO P		1.5	pf
INPUT: G TO (H + KT + KP + I.S.)		2.0	pf
OUTPUT: P TO (H + KT + KP + I.S.)		1.5	pf
COUPLING			
TRIODE GRID TO PENTODE PLATE	MAX.	0.02	pf
PENTODE GRID TO TRIODE PLATE	MAX.	0.02	pf
PENTODE PLATE TO TRIODE PLATE	MAX.	0.15	pf

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HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE VALUES - VOLTAGE	6.3	VOLTS
- CURRENT	450	MA.
LIMITS OF APPLIED HEATER VOLTAGE	6.3±0.6	VOLTS
HEATER CATHODE VOLTAGE:		
HEATER NEGATIVE WITH RESPECT TO CATHODE		
TOTAL DC AND PEAK (MAX.)	200	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE		
DC (MAX.)	100	VOLTS
TOTAL DC AND PEAK (MAX.)	200	VOLTS

MAXIMUM RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

	TRIODE	PENTODE	
PLATE VOLTAGE	330	330	VOLTS
GRID 2 SUPPLY VOLTAGE	-----	330	VOLTS
GRID 2 VOL TAGE		See Rating Chart J5-C4-2	
POSITIVE GRID 1 VOLTAGE	0	0	VOLTS
PLATE DISSIPATION	2.8	2.3	WATTS
GRID 2 DISSIPATION (UP TO 165 VOLTS)		0.55	WATTS
GRID 1 CIRCUIT RESISTANCE	1.0	1.0	MEGOHMS
AT 10% OR LESS OF MAXIMUM PLATE AND SCREEN DISSIPATION	5	10	MEGOHMS

AVERAGE CHARACTERISTICS

	TRIODE	PENTODE	
PLATE VOLTAGE	150	125	VOLTS
GRID 2 VOLTAGE	-----	125	VOLTS
GRID 1 VOLTAGE	-3.0	-1.0	VOLTS
PLATE CURRENT	15	12	MA.
GRID 2 CURRENT	-----	3.8	MA.
TRANSCONDUCTANCE	4,500	7,000	μMHOS
AMPLIFICATION FACTOR	21	-----	
PLATE RESISTANCE (APPROX.)	4,700	170,000	OHMS
GRID VOLTAGE (APPROX.) FOR Ib = 50 μA	-15	-----	VOLTS
GRID 1 VOLTAGE (APPROX.) FOR Ib = 100 μA	-----	-7	VOLTS

TUNG-SOL

PENTODE

SUBMINIATURE

FOR

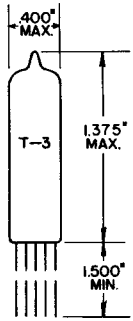
CLASS C OSCILLATOR

AND FREQUENCY MULTIPLIER

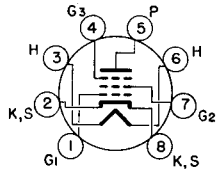
APPLICATIONS

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



GLASS BULB
SUBMINIATURE BUTTON
8 PIN BASE E8-10
OUTLINE DRAWING
JEDEC 3-1



BOTTOM VIEW
BASING DIAGRAM
JEDEC 8DC

THE 8517 IS A PENTODE IN THE 8 PIN SUBMINIATURE CONSTRUCTION. IT IS INTENDED FOR CLASS C OSCILLATOR AND FREQUENCY MULTIPLIER APPLICATIONS WHERE LONG LIFE AND RESISTANCE TO SHOCK AND VIBRATION ARE ESSENTIAL.

DIRECT INTERELECTRODE CAPACITANCES

WITH SHIELD #318 TIED TO CATHODE

GRID 1 TO PLATE	MAX.	0.02	pf
GRID 1 TO ALL OTHER ELECTRODES		4.3	pf
PLATE TO ALL OTHER ELECTRODES		3.5	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	150	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
TOTAL DC AND PEAK-EITHER POLARITY		200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

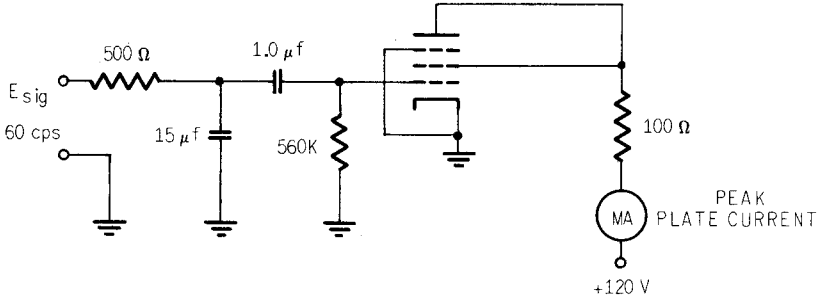
PLATE VOLTAGE	165	VOLTS
GRID 2 VOLTAGE	155	VOLTS
GRID 1 VOLTAGE	0	VOLTS
GRID 3 VOLTAGE	30	VOLTS
PLATE DISSIPATION	.80	WATTS
GRID 2 DISSIPATION	.55	WATTS
CATHODE CURRENT	16	MA.
GRID 1 CIRCUIT RESISTANCE	1.1	MEGOHMS
ENVELOPE TEMPERATURE	220	°C
ALTITUDE	60,000	FEET

AVERAGE CHARACTERISTICS

PLATE VOLTAGE	100	VOLTS
GRID 2 VOLTAGE	100	VOLTS
GRID 1 VOLTAGE	0	VOLTS
GRID 3 VOLTAGE	0	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	6.1	MA.
GRID 2 CURRENT	4.2	MA.
GRID 1 VOLTAGE FOR I_b = 100 μA	-6.0	VOLTS
PEAK PLATE CURRENT-TRIODE CONNECTED-SEE DIAGRAM	48	MA.

CIRCUIT DIAGRAM

THIS CIRCUIT SIMULATES A CLASS C OSCILLATOR WITH HIGH-ORDER HARMONIC OUTPUT.

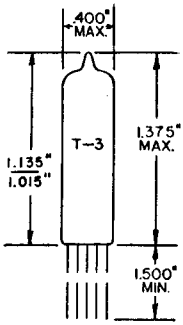


ADJUST E_{sig} FOR E_{g1} = 21 VOLTS RMS

TUNG-SOL

DUAL-CONTROL PENTODE

SUBMINIATURE



GLASS BULB

SUBMINIATURE BUTTON
8 PIN BASE E8-10
OUTLINE DRAWING
JEDEC 3-1

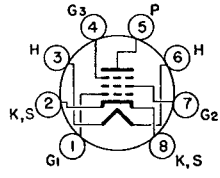
FOR

AMPLIFIER, MIXER

MODULATOR AND GATING SERVICE

COATED UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 8DC

THE 8522 IS A PREMIUM SUBMINIATURE DUAL-CONTROL PENTODE USEFUL AS AN AMPLIFIER OR MIXER UP TO UHF, AND FOR MODULATOR AND GATING SERVICE. IT REPLACES TYPE 5636 WHEN BETTER CONTROL OF INSULATION RESISTANCE AND MICROPHONICS ARE REQUIRED, OR WHEN CONTROL OF GRID #1 TRANSCONDUCTANCE AT SEVERAL GRID #3 BIAS POINTS IS DESIRABLE.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD #318 CONNECTED TO CATHODE	WITHOUT SHIELD	
GRID 1 TO PLATE - MAX.	0.02	0.03	pf
GRID 3 TO PLATE - MAX.	1.1	1.1	pf
GRID 1 TO ALL OTHER ELECTRODES	4.0	4.0	pf
GRID 3 TO ALL OTHER ELECTRODES	4.0	3.8	pf
PLATE TO ALL OTHER ELECTRODES	3.4	1.9	pf
GRID 1 TO GRID 3 - MAX.	0.15	0.17	pf

HEATER CHARACTERISTICS AND RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTICS	6.3 VOLTS	150	MA.
LIMITS OF APPLIED VOLTAGE		6.3 ± 0.3	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE			
TOTAL DC AND PEAK-EITHER POLARITY		200	VOLTS

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MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

PLATE VOLTAGE	165	VOLTS
GRID 2 VOLTAGE	155	VOLTS
GRID 1 VOLTAGE	0,-55	VOLTS
GRID 3 VOLTAGE	+30	VOLTS
PLATE DISSIPATION	0.70	WATTS
GRID 2 DISSIPATION	0.55	WATTS
CATHODE CURRENT	16	MA.
GRID 1 CIRCUIT RESISTANCE	1.1	MEGOHMS
ENVELOPE TEMPERATURE	220	^{0}C
ALTITUDE	60,000	FEET

AVERAGE CHARACTERISTICS

ALL VOLTAGES REFERRED TO NEGATIVE END OF CATHODE RESISTOR

DUAL CONTROL AMPLIFIER

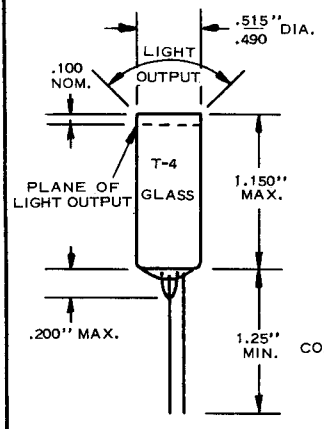
PLATE VOLTAGE	100	100	VOLTS
GRID 2 VOLTAGE	100	100	VOLTS
GRID 1 SUPPLY VOLTAGE	0	0	VOLTS
GRID 3 VOLTAGE	CATHODE POTENTIAL	SEE BELOW	
CATHODE RESISTOR	150	330	OHMS
PLATE CURRENT	5.3	-	MA.
GRID 2 CURRENT	3.6	-	MA.
GRID 1 TRANSCONDUCTANCE	3,200	-	μMHOS
PLATE RESISTANCE	.11	-	MEGOHM
GRID 3 TRANSCONDUCTANCE			
AT GRID 3 SUPPLY VOLTAGE OF - 1 VOLTS	1050	-	μMHOS
GRID 1 TRANSCONDUCTANCE			
AT GRID 3 SUPPLY VOLTAGE OF +0.5 VOLTS	-	2,250	μMHOS
AT GRID 3 SUPPLY VOLTAGE OF -1.65 VOLTS	-	1,300	μMHOS
AT GRID 3 SUPPLY VOLTAGE OF -3.0 VOLTS	-	700	μMHOS
AT GRID 3 SUPPLY VOLTAGE OF -4.0 VOLTS	-	275	μMHOS
GRID 1 VOLTAGE FOR PLATE CURRENT OF 10 μA	-7.5	-	VOLTS
GRID 3 VOLTAGE FOR PLATE CURRENT OF 10 μA	-8	-	VOLTS
LOW - FREQUENCY - VIBRATION OUTPUT			
ACROSS R_L = 10,000 OHMS AT 15 G 40 CPS	Max. 60	-	M VOLTS

MIXER

PLATE VOLTAGE	100	VOLTS
GRID 2 VOLTAGE	100	VOLTS
GRID 3 VOLTAGE - DC	0	VOLTS
AC	15	VOLTS RMS
GRID 1 VOLTAGE - DC	0	VOLTS
CATHODE RESISTOR	150	OHMS
PLATE CURRENT	3.5	MA.
GRID 2 CURRENT	5.7	MA.
CONVERSION TRANSCONDUCTANCE	1,400	μMHOS
PLATE RESISTANCE	0.32	MEGOHMS

TUNG-SOL

OUTLINE



INDICATOR TRIODE

SUBMINIATURE TYPE

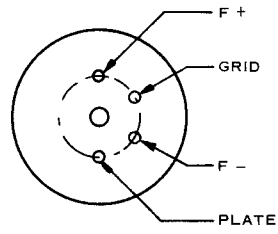
FOR

ELECTRONIC COMPUTER

APPLICATIONS

COATED FILAMENTARY CATHODE

BASE DIAGRAM



BOTTOM VIEW

THE 8569 IS A LONG-LIFE FILAMENTARY HIGH-VACUUM END-VIEW INDICATOR TRIODE IN A T-4 GLASS ENVELOPE. ITS GRID SHAPED PLATE IS COATED WITH A PHOSPHOR WHICH GIVES A BRIGHT BLUE GREEN LIGHT PROPORTIONAL TO PLATE CURRENT. IT IS DESIGNED FOR APPLICATIONS IN ELECTRONIC COMPUTERS, WHERE ITS SMALL SIZE, LOW ENERGY REQUIREMENTS, HIGH SENSITIVITY, AND FREEDOM FROM NOISE MAKE IT VERY USEFUL IN COMBINATION WITH TRANSISTORIZED CIRCUITS.

OPTICAL DATA

LIGHT OUTPUT	SEE TYPICAL OPERATION
SPECTRAL OUTPUT OF PHOSPHOR	SEE CURVE 1
PERSISTANCE CHARACTERISTICS	SEE CURVE 2
LIGHT OUTPUT VS. PLATE VOLTAGE	SEE CURVE 3

NOTE: LIGHT OUTPUT MEASURED BY COMPARISON WITH A TUNGSTEN LAMP OF 2 870°K COLOR TEMPERATURE USING AN S4 PHOTO DEVICE.

ELECTRICAL DATA

FILAMENT CHARACTERISTICS AND RATINGS

AVERAGE CHARACTERISTICS	0.70 VOLTS	35	mA
LIMITS OF APPLIED VOLTAGE - AC OR DC		0.65 – 0.75	VOLTS

MAXIMUM RATINGS

ABSOLUTE MAXIMUM SYSTEM - SEE EIA STANDARD RS-239

PLATE VOLTS	65	VOLTS
POSITIVE GRID VOLTAGE	0	VOLTS
NEGATIVE GRID VOLTAGE	50	VOLTS
PLATE CURRENT	750	μA
GRID CIRCUIT RESISTANCE	1	MEGOHM
MINIMUM GRID CIRCUIT RESISTANCE	0.1	MEGOHM

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AVERAGE CHARACTERISTICS

FILAMENT DC, NEGATIVE GROUNDED

PLATE VOLTAGE	50	VOLTS
GRID VOLTAGE	0	VOLTS
GRID RESISTOR	100	KOHMS
PLATE CURRENT	380	μA
AMPLIFICATION FACTOR	22	

TYPICAL OPERATION

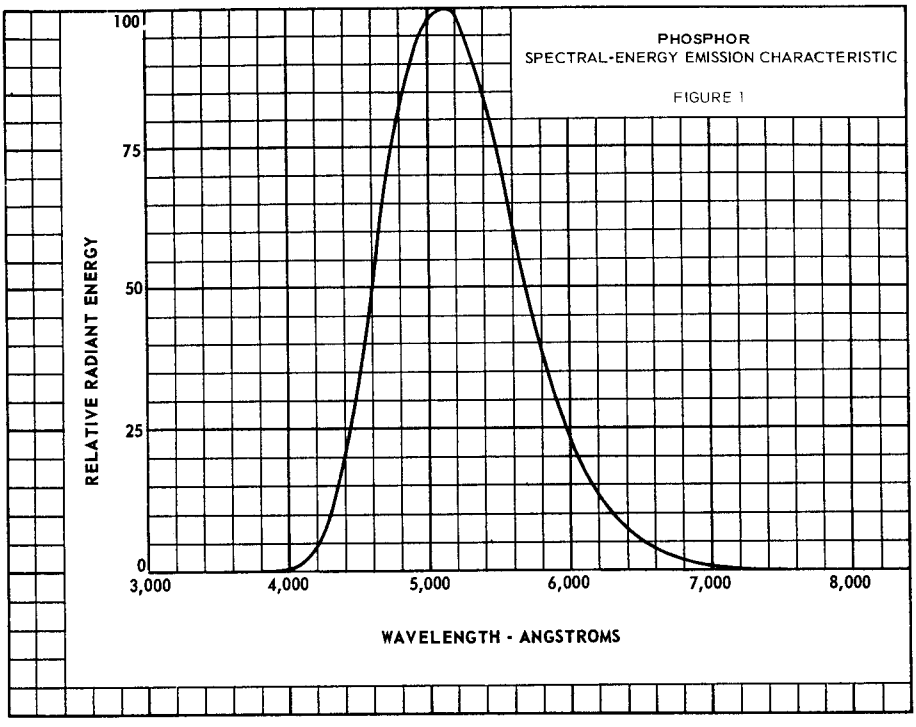
FILAMENT AC, TRANSFORMER CENTER TAP GROUNDED

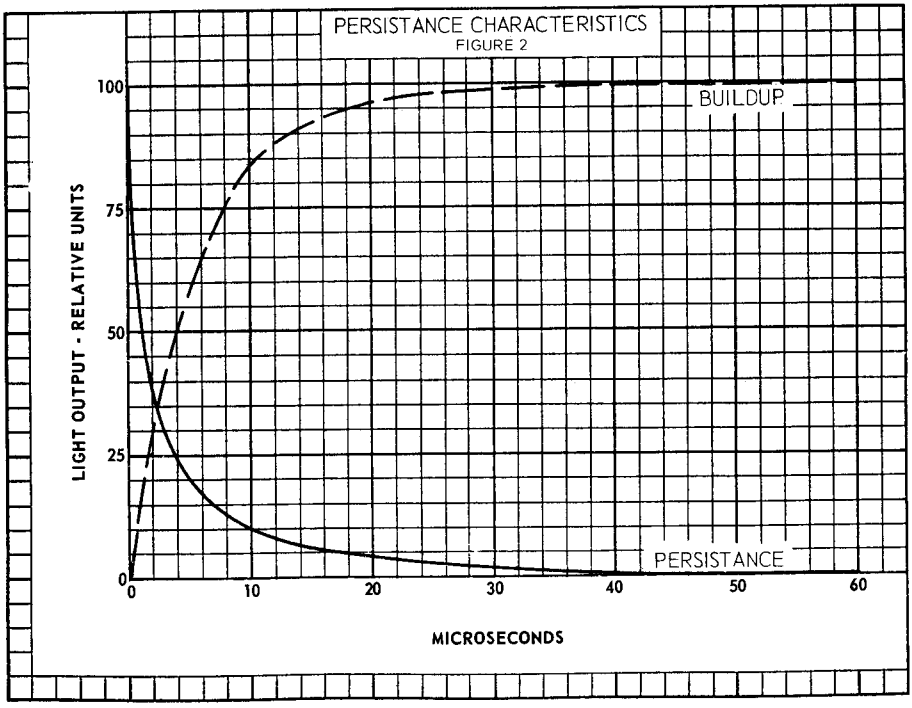
PLATE VOLTAGE	50	VOLTS
GRID RESISTOR	100	KOHMS
WITH GRID VOLTAGE = 0		
PLATE CURRENT	450	μA
LIGHT OUTPUT	5	m CANDLES
WITH GRID VOLTAGE = -3.0 VOLTS		
PLATE CURRENT	<5	μA
LIGHT OUTPUT	NOT VISIBLE	

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT EXTERNAL SHIELD

GRID TO PLATE	1.9	pf
INPUT	1.6	pf
OUTPUT	1.7	pf





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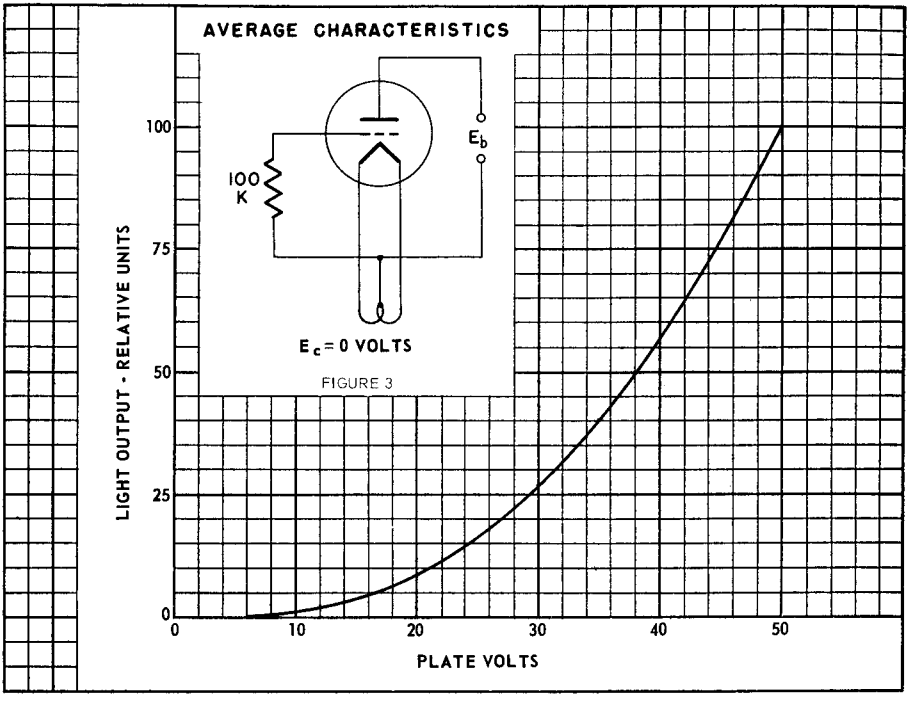
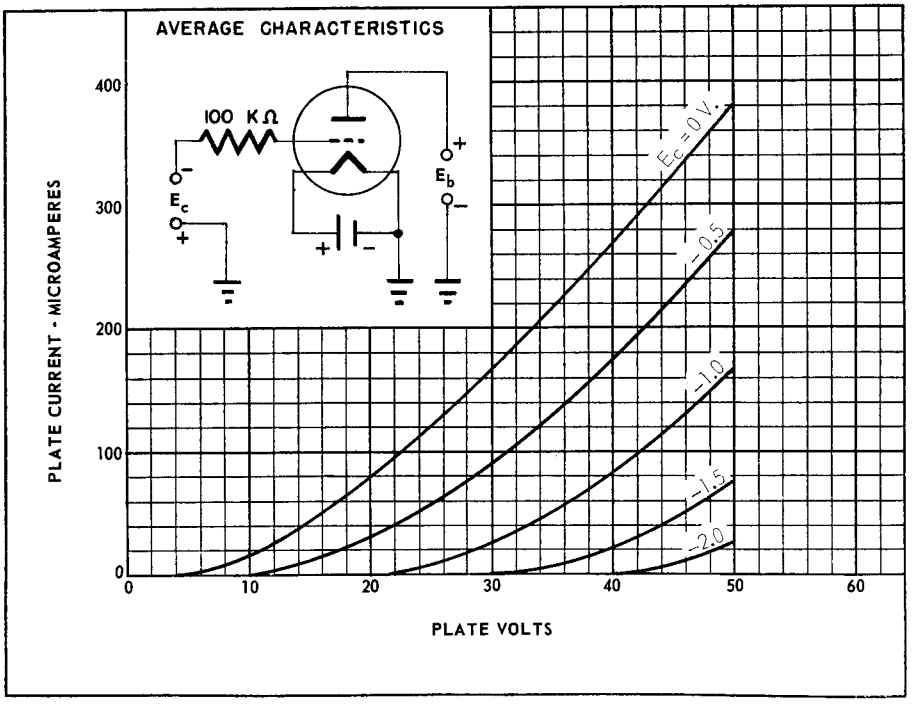
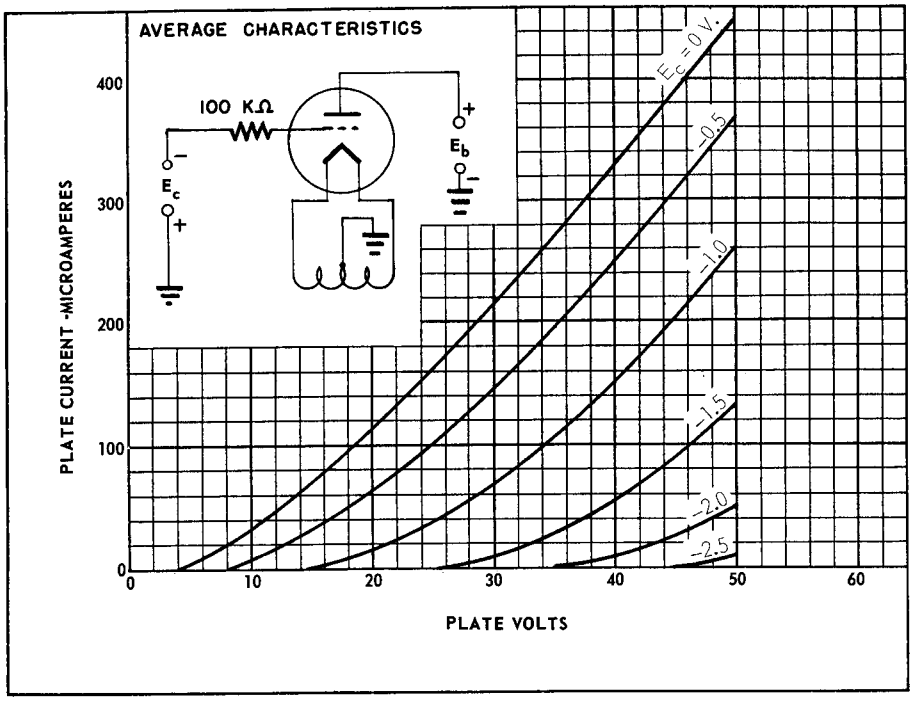

AVERAGE CHARACTERISTICS
100 K
E_b
E_c = 0 VOLTS
LIGHT OUTPUT - RELATIVE UNITS
0
25
50
75
100
0
10
20
30
40
50
PLATE VOLTS

FIGURE 3


AVERAGE CHARACTERISTICS
100 KΩ
E_c
E_b
E_{c_1} = 0 V.
-0.5
-1.0
-1.5
-2.0
PLATE CURRENT - MICROAMPERES
0
100
200
300
400
0
10
20
30
40
50
60
PLATE VOLTS



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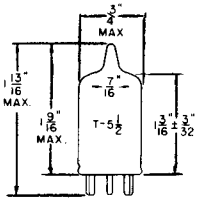
TUNG-SOL

DETECTOR AMPLIFIER PENTODE

MIDGET TYPE

COATED UNIPOTENTIAL CATHODE

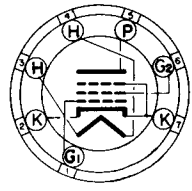


HEATER[A]
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

MINIATURE BUTTON 7 PIN BASE

MOUNTING POSITION – ANY



BOTTOM VIEW

THE 9001 IS A SHARP CUT-OFF MIDGET TYPE PENTODE INTENDED FOR USE AS A DETECTOR AND AMPLIFIER AT ULTRA HIGH FREQUENCIES. ITS CONSTRUCTION, INCLUDING DOUBLE CATHODE LEADS, PERMITS CIRCUITS TO BE DESIGNED WITH EXTREMELY SHORT LEADS AND WITH MINIMUM INTER-CIRCUIT COUPLING. ELECTRICALLY ITS CHARACTERISTICS ARE IDENTICAL WITH TYPE 954.

RATINGS*

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM GRID VOLTAGE	-3	VOLTS
PLATE DISSIPATION	0.5	WATT
SCREEN DISSIPATION	0.1	WATT

*INTERPRETED ACCORDING TO RMA STANDARD M8-210

DIRECT INTERELECTRODE CAPACITANCES

MAXIMUM GRID TO PLATE (WITH EXTERNAL SHIELD)	0.01	μμf
INPUT (WITH NO EXTERNAL SHIELD)	3.6	μμf
OUTPUT (WITH NO EXTERNAL SHIELD)	3.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	250	VOLTS
SCREEN VOLTAGE	90	100	VOLTS
GRID VOLTAGE	-3	-3	VOLTS
PLATE RESISTANCE (APPROX.)	1.0	GREATER THAN 1.0 MEGOHM	
TRANSCONDUCTANCE	1100	1400	μMHOS
PLATE CURRENT	1.2	2.0	MA.
SCREEN CURRENT	0.5	0.7	MA.

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PLATE 1403
MARCH 15 1944

CONTINUED NEXT PAGE

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CONTINUED FROM PRECEDING PAGE

MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	100	VOLTS
GRID VOLTAGE (APPROX.)[B]	-5	VOLTS
CONVERSION TRANSCONDUCTANCE (APPROX.)	550	μMHOS

[A] WHEN THE CATHODE IS NOT CONNECTED DIRECTLY TO THE HEATER THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.

[B] VALUES INDICATED ARE OPTIMUM. FOR AN OSCILLATOR PEAK VOLTAGE OF 4 VOLTS, THE GRID BIAS IS MINIMUM.

TO PROVIDE THE SHORTEST POSSIBLE CIRCUIT RETURNS AND TO PREVENT INTER-STAGE COUPLING AT ULTRA HIGH FREQUENCIES, EACH RF AMPLIFIER STAGE MAY REQUIRE RF BY-PASSING AND SHIELDING. THIS CAN BE ACCOMPLISHED BY PLACING SMALL CONDENSERS CLOSE TO THE TUBE TERMINALS. IN ADDITION RF CHOKES MAY BE REQUIRED IN THE SUPPLY OF RETURN LEADS OF THE TUBE ELEMENTS.

THIS TUBE HAS TWO CATHODE LEADS. IF THE GRID RETURN IS CONNECTED TO ONE CATHODE TERMINAL AND THE PLATE AND SCREEN RETURNS ARE CONNECTED TO THE OTHER CATHODE TERMINAL, THE PLATE AND SCREEN RF CIRCUITS WILL BE COMPLETED WITH A MINIMUM OF INDUCTANCE IN COMMON WITH THE GRID CIRCUIT.

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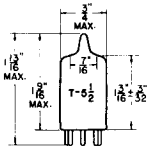
TUNG-SOL

DETECTOR, AMPLIFIER, OSCILLATOR

MIDGET TYPE



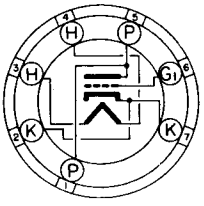
COATED UNIPOTENTIAL CATHODE

HEATER [A]

6.3 VOLTS 0.15 AMPERE

AC OR DC

GLASS BULB



BOTTOM VIEW

MINIATURE BUTTON 7 PIN BASE [B]

TYPE 9002 IS A MIDGET TYPE TRIODE INTENDED FOR USE AS A DETECTOR, AMPLIFIER AND OSCILLATOR AT ULTRA HIGH FREQUENCIES.

RATINGS

INTERPRETED ACCORDING TO RMA STANDARD M8-210

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM PLATE DISSIPATION	1.6	WATTS

DIRECT INTERELECTRODE CAPACITANCES

WITH NO EXTERNAL SHIELD

GRID TO PLATE	1.4	μμf
INPUT	1.2	μμf
OUTPUT	1.1	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	90	135	180	250	VOLTS
GRID VOLTAGE	-2.5	-3.75	-5	-7	VOLTS
AMPLIFICATION FACTOR	25	25	25	25	
PLATE RESISTANCE	14700	13200	12500	11400	OHMS
TRANSCONDUCTANCE	1700	1900	2000	2200	μMHOS
PLATE CURRENT	2.5	3.5	4.5	6.3	MA.

[A] WHEN THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER, THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE. UNDER NO CONDITIONS SHOULD IT EXCEED 100 VOLTS.

[B] THE CENTER HOLE IN SOCKETS DESIGNED FOR THIS BASE PROVIDES FOR THE POSSIBILITY THAT THIS TUBE TYPE MAY BE MANUFACTURED WITH THE EXHAUST-TUBE TIP AT THE BASE END. FOR THIS REASON IT IS RECOMMENDED THAT IN EQUIPMENT EMPLOYING THIS TUBE TYPE, NO MATERIAL BE PERMITTED TO OBSTRUCT THE SOCKET HOLE.

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PLATE 1482

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TUNG-SOL

SUPER CONTROL RF AMPLIFIER PENTODE

MIDGET TYPE

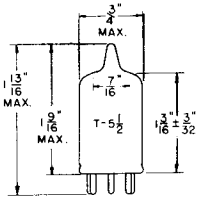
COATED UNIPOTENTIAL CATHODE

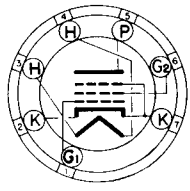
HEATER[A]
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

MINIATURE BUTTON 7 PIN BASE

MOUNTING POSITION – ANY





BOTTOM VIEW

THE 9003 IS A REMOTE CUT-OFF MIDGET TYPE PENTODE INTENDED FOR USE AS AN AMPLIFIER AND MIXER AT ULTRA HIGH FREQUENCIES. ITS CONSTRUCTION, INCLUDING DOUBLE CATHODE LEADS, PERMITS CIRCUITS TO BE DESIGNED WITH EXTREMELY SHORT LEADS AND WITH MINIMUM INTER-CIRCUIT COUPLING. ELECTRICALLY ITS CHARACTERISTICS ARE IDENTICAL WITH TYPE 956.

RATINGS*

MAXIMUM PLATE VOLTAGE	250	VOLTS
MAXIMUM SCREEN VOLTAGE	100	VOLTS
MINIMUM GRID VOLTAGE	−3	VOLTS
MAXIMUM PLATE DISSIPATION	1.7	WATTS
MAXIMUM SCREEN DISSIPATION	0.3	WATT

*INTERPRETED ACCORDING TO RMA STANDARD M8-210

DIRECT INTERELECTRODE CAPACITANCES

MAXIMUM GRID TO PLATE (WITH EXTERNAL SHIELD)	0.01	μμf
INPUT (WITH NO EXTERNAL SHIELD)	3.4	μμf
OUTPUT (WITH NO EXTERNAL SHIELD)	3.0	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A_1 AMPLIFIER

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	100	VOLTS
GRID VOLTAGE	−3	VOLTS
PLATE RESISTANCE (APPROX.)	0.7	MEGOHM
TRANSCONDUCTANCE	1800	μMHOS
GRID BIAS FOR TRANSCONDUCTANCE OF 15 μMHOS	−35	VOLTS
GRID BIAS FOR TRANSCONDUCTANCE OF 2 μMHOS	−45	VOLTS
PLATE CURRENT	6.7	MA.
SCREEN CURRENT	2.7	MA.

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CONTINUED FROM PRECEDING PAGE

MIXER IN SUPERHETERODYNE CIRCUIT

PLATE VOLTAGE	250	VOLTS
SCREEN VOLTAGE	100	VOLTS
GRID VOLTAGE (APPROX.)[B]	--10	VOLTS
CONVERSION TRANSCONDUCTANCE (APPROX.)	600	μMHOS

[A] WHEN THE CATHODE IS NOT DIRECTLY CONNECTED TO THE HEATER THE POTENTIAL DIFFERENCE BETWEEN HEATER AND CATHODE SHOULD BE KEPT AS LOW AS POSSIBLE.

[B] VALUES INDICATED ARE OPTIMUM. FOR AN OSCILLATOR PEAK VOLTAGE OF 9 VOLTS THE GRID BIAS IS MINIMUM.

TO PROVIDE THE SHORTEST POSSIBLE CIRCUIT RETURNS AND TO PREVENT INTER-STAGE COUPLING AT ULTRA HIGH FREQUENCIES, EACH RF AMPLIFIER STAGE MAY REQUIRE RF BY-PASSING AND SHIELDING. THIS CAN BE ACCOMPLISHED BY PLACING SMALL CONDENSERS CLOSE TO THE TUBE TERMINALS. IN ADDITION RF CHOKES MAY BE REQUIRED IN THE SUPPLY OF RETURN LEADS OF THE TUBE ELEMENTS.

THIS TUBE HAS TWO CATHODE LEADS. IF THE GRID RETURN IS CONNECTED TO ONE CATHODE TERMINAL AND THE PLATE AND SCREEN RETURNS ARE CONNECTED TO THE OTHER CATHODE TERMINAL, THE PLATE AND SCREEN RF CIRCUITS WILL BE COMPLETED WITH A MINIMUM OF INDUCTANCE IN COMMON WITH THE GRID CIRCUITS.

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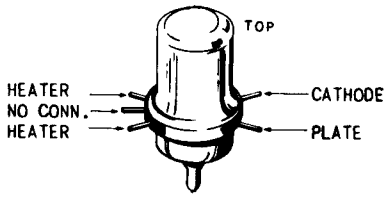
TUNG-SOL

ULTRA HIGH FREQUENCY DIODE

ACORN TYPE



PIN CONNECTIONS

COATED UNIPOTENTIAL CATHODE

HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

MOUNTING POSITION – ANY

THE 9004 IS AN ACORN TYPE DIODE INTENDED FOR USE AS AN ULTRA HIGH FREQUENCY DETECTOR.

RATINGS*

MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM DC OUTPUT CURRENT	5	MA.

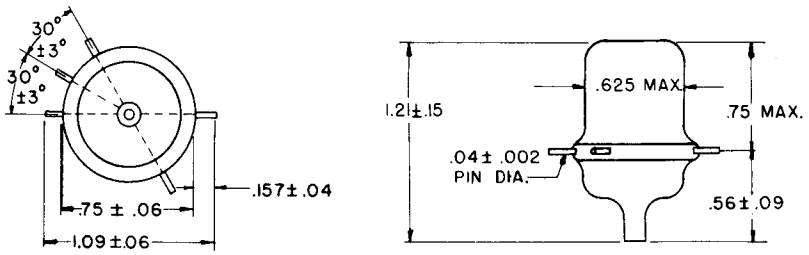
*INTERPRETED ACCORDING TO RMA STANDARD M8-210

DIRECT INTERELECTRODE CAPACITANCES

(WITH NO EXTERNAL SHIELD)

PLATE TO CATHODE	1.3	μμf
PLATE TO HEATER (APPROX.)	0.3	μμf
HEATER TO CATHODE (APPROX.)	2.2	μμf

RESONANT FREQUENCY APPROXIMATELY 850 MC.



TUBE DIMENSIONS

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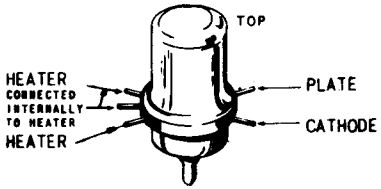
9005

TUNG-SOL

ULTRA HIGH FREQUENCY DIODE

ACORN TYPE



PIN CONNECTIONS

COATED UNIPOTENTIAL CATHODE

HEATER
3.6 VOLTS 0.165 AMPERE
AC OR DC

GLASS BULB

MOUNTING POSITION – ANY

THE 9005 IS AN ACORN TYPE DIODE INTENDED FOR USE AS AN ULTRA HIGH FREQUENCY DETECTOR.

RATINGS*

MAXIMUM AC PLATE VOLTAGE (RMS)	117	VOLTS
MAXIMUM DC OUTPUT CURRENT	1.0	MA.

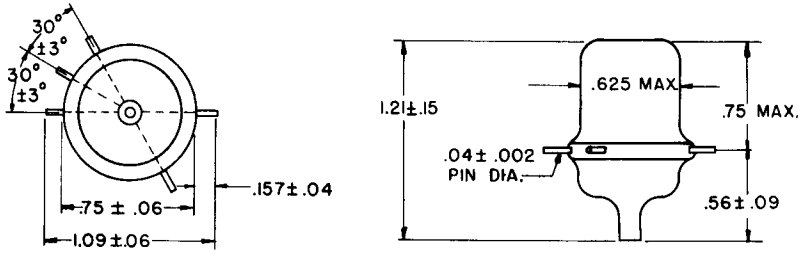
*INTERPRETED ACCORDING TO RMA STANDARD M8-210

DIRECT INTERELECTRODE CAPACITANCES

(WITH NO EXTERNAL SHIELD)

PLATE TO CATHODE	0.8	μμf
PLATE TO HEATER (APPROX.)	0.2	μμf
HEATER TO CATHODE (APPROX.)	1.1	μμf

RESONANT FREQUENCY APPROXIMATELY 1500 MC.



TUBE DIMENSIONS

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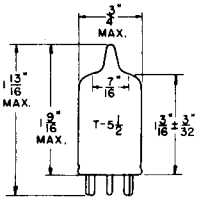
TUNG-SOL

ULTRA HIGH FREQUENCY DIODE

MIDGET TYPE

COATED UNIPOTENTIAL CATHODE

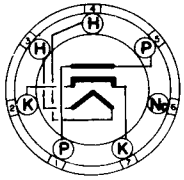


HEATER
6.3 VOLTS 0.15 AMPERE
AC OR DC

GLASS BULB

MINIATURE BUTTON 7 PIN BASE

MOUNTING POSITION – ANY



BOTTOM VIEW

THE 9006 IS A MIDGET TYPE DIODE INTENDED FOR USE AS AN ULTRA HIGH FREQUENCY DETECTOR.

RATINGS*

MAXIMUM PEAK INVERSE PLATE VOLTAGE	750	VOLTS
MAXIMUM PEAK PLATE CURRENT	15	MA.
MAXIMUM DC OUTPUT CURRENT	5	MA.
MAXIMUM DC HEATER CATHODE POTENTIAL	100	VOLTS

*INTERPRETED ACCORDING TO RMA STANDARD M8-210

DIRECT INTERELECTRODE CAPACITANCES

(WITH NO EXTERNAL SHIELD)

PLATE TO CATHODE	1.4	μμf
PLATE TO HEATER	0.2	μμf
CATHODE TO HEATER	2.2	μμf

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

AC PLATE SUPPLY VOLTAGE (RMS)	270	VOLTS
MINIMUM TOTAL EFFECTIVE PLATE SUPPLY IMPEDANCE	100	OHMS
DC OUTPUT CURRENT	5	MA.

RESONANT FREQUENCY APPROXIMATELY 700 MC.

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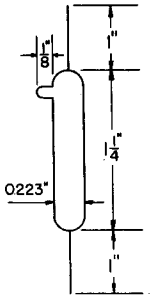
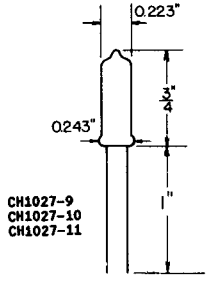
TUNG-SOL

CURPISTOR, MINUTE CURRENT REGULATOR



CH1027-12

ANY MOUNTING POSITION



CH1027-9
CH1027-10
CH1027-11

THE CH1027 FAMILY IS A SERIES OF SUBMINIATURE, TWO ELECTRODE, RADIOACTIVE, NITROGEN FILLED CONSTANT CURRENT TUBES. THEY ARE AVAILABLE IN CURRENT RATINGS FROM 10^{-12} TO 10^{-9} AMPERES. FOR THE TOLERANCES SHOWN BELOW, CURRENT PLATEAUS CAN EXTEND AS LOW AS 25 VOLTS AND AS HIGH AS 500 VOLTS.

BECAUSE OF THEIR CLOSE TOLERANCES AND EXTREMELY LONG LIFE, CURPISTORS PROVIDE A CIRCUIT FUNCTION NOT OBTAINABLE BY ANY OTHER SIMPLE COMPONENT.

CURRENT RATING

CH1027 - 9	10^{-9}	AMPS
CH1027- 10	10^{-10}	AMPS
CH1027- 11	10^{-11}	AMPS
CH1027- 12	10^{-12}	AMPS.

NET WEIGHT - approx.

CH1027 - 9, - 10, & -11	0.03	OUNCES
CH1027-12	0.06	OUNCES

BASE

CH1027 -9, -10, & -11 .....SUBMINIATURE FLAT PRESS WITH TWO FLYING LEADS

CH1027 -12 .....DOUBLE ENDED (SEE DIAGRAM)

MOUNTING POSITION.....ANY

LIFE.....UNLIMITED (HALF LIFE = 1620 YEARS)

AMBIENT TEMPERATURE RATING -70 TO +80 °C

ACTIVE MATERIAL.....RADIUM 226

MAXIMUM CURRENT VARIATION FROM CENTER VALUE

FOR PLATEAUS FROM 25 TO 500 VOLTS

CH1027-9 & CH1027-10	±1	PERCENT
CH1027-11 & CH1027-12	±2	PERCENT

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

CONTINUED FROM PRECEDING PAGE

ACTIVITY

CH1027-9	18.75	μCURIES
CH1027-10	1.875	μCURIES
CH1027-11	0.1875	μCURIES
CH1027-12	0.01875	μCURIES

LEAD MATERIAL..... (TINNED) COPPER

TYPICAL APPLICATIONS

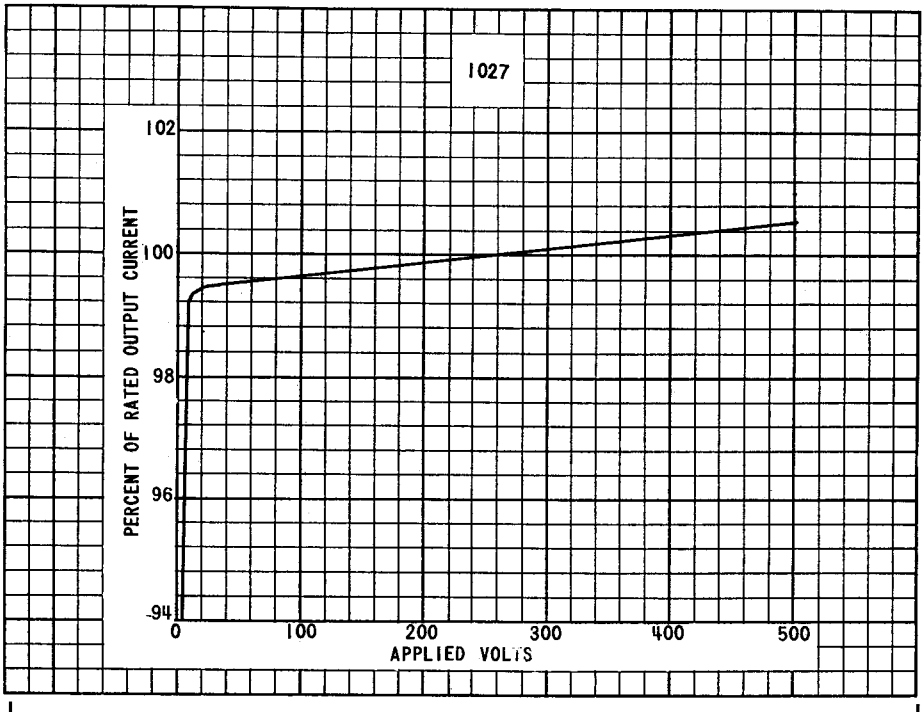
THE CURPISTOR IS SUITABLE AS A COMPONENT TO BE USED FOR:

CONSTANT CAPACITOR DRAIN OR CHARGE IN:
- MISSILE TIMING CIRCUITS
- ORDNANCE MINE TIMING CIRCUITS

INSTRUMENT BIAS

IONIZATION CHAMBER TESTING

CALIBRATION (AS A STANDARD)



THE CURPISTOR SHOULD BE HANDLED IN ACCORDANCE WITH THE ATOMIC ENERGY COMMISSION'S REGULATIONS FOR THE ACTIVITY OF THE MAGNITUDE INDICATED FOR THE VARIOUS UNITS. THESE MAGNITUDES ARE NOT GREAT ENOUGH TO CONSTITUTE A HAZARD TO PERSONNEL IF PROPER PRECAUTIONS ARE TAKEN. PERSONNEL ARE CAUTIONED NOT TO HANDLE BROKEN TUBES SO AS TO AVOID THE ENTRANCE OF THE RADIOACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF ONE IS CUT ON A BROKEN TUBE, THE CUT SHOULD BE CLEANED IMMEDIATELY. AN OPEN CUT CAN BE CLEANED BY HOLDING IT IN RUNNING WATER. IF A TUBE IS BROKEN, CARE SHOULD BE TAKEN THAT THE GAS IS NOT INHALED.

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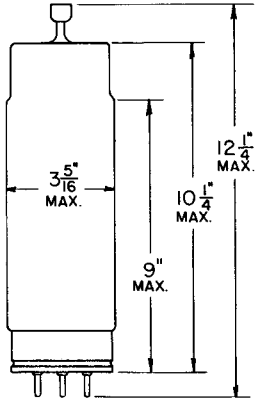
TUNG-SOL

THYRATRON



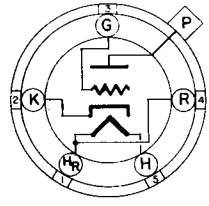
GLASS BULB

HEATER

6.3 VOLTS 23. AMP.

VERTICAL MOUNTING POSITION

(BASE DOWN)



BOTTOM VIEW

THE CH1095 IS A ZERO BIAS HYDROGEN THYRATRON DESIGNED TO PASS HIGH CURRENTS IN "CROWBAR" PROTECTIVE CIRCUITS. AS DESCRIBED IN THE APPLICATION NOTES, DESTRUCTIVE ARC CURRENTS ARE SHORT CIRCUITED BY THE CROWBAR TUBE BEFORE DAMAGE OCCURS TO OTHER TUBES OR CIRCUIT ELEMENTS.

THE INSTANTANEOUS RESPONSE, AND ABILITY TO REPEATEDLY CARRY EXTREMELY LARGE CURRENTS, MAKES THE HYDROGEN THYRATRON PRATICULARLY ATTRACTIVE FOR THIS APPLICATION. ONE TYPE CH1095 CAN HANDLE A PEAK CURRENT OF 800 AMPS AT 18 KILOVOLTS. THIS TUBE CONTAINS A HYDROGEN RESERVOIR WHICH PROMOTES LONG LIFE AND PERMITS OPTIMUM GAS PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION.

ELECTRICAL DATA

	MIN.	BOGEY	MAX.	
CATHODE HEATER VOLTAGE	6.0	6.3	6.6	VOLTS
CATHODE HEATER CURRENT (E_f = 6.3 VOLTS)	15.	16.	22.	AMP.
CATHODE HEATING TIME	10.			MINUTES
RESERVOIR VOLTAGE	3.0	MARKED ON BASE	5.5	VOLTS
RESERVOIR CURRENT			6.5	AMP.
RESERVOIR HEATING TIME	10.			MINUTES

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
MAX. NET WEIGHT	2 1/4	LBS.
MOUNTING POSITION	ANY	
DIMENSIONS	SEE OUTLINE DRAWINGS	

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

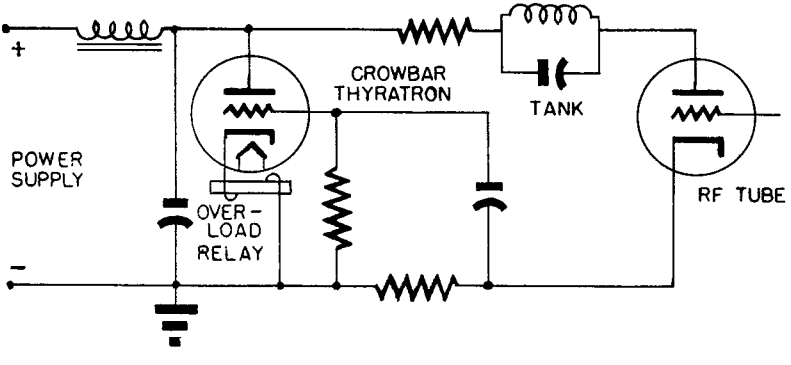
CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
D.C. ANODE VOLTAGE			
FORWARD	2	18	KVOLTS
INVERSE		5	KVOLTS
CATHODE CURRENT			
PEAK		800	AMP.
AVERAGE		1.	AMP.
CONDUCTION TIME PER FAULT		0.1	SECONDS
AVERAGING TIME		80	SECONDS
RECOVERY TIME		50	μSECONDS
GRID SIGNAL VOLTAGE	1000	2000	VOLTS
GRID IMPEDANCE	50	500	OHMS
GRID VOLTAGE RATE OF RISE	1800		V/μSEC.
ANODE DELAY TIME		0.6	μSECONDS
ANODE VOLTAGE DROP	50	200	VOLTS
AMBIENT TEMPERATURE RANGE	−50	+75	°C

APPLICATION NOTES

IN A TYPICAL APPLICATION, A CROWBAR THYRATRON IS CONNECTED IN SERIES WITH A SUITABLE IMPEDANCE ACROSS THE FILTER OF THE HIGH VOLTAGE POWER SUPPLY FOR A HIGH FREQUENCY TRIODE OSCILLATOR. WHENEVER AN ARC OCCURS IN THE OSCILLATOR TUBE, THE RISING CURRENT IS USED TO DELIVER A SUITABLE SIGNAL TO THE GRID OF THE THYRATRON. THE THYRATRON IMMEDIATELY CONDUCTS TO SHORT CIRCUIT THE POWER SUPPLY UNTIL THE PROTECTIVE CIRCUIT BREAKER OPENS 0.1 TO 0.5 SECOND LATER. WITH PROPER CIRCUITRY, THE THYRATRON CAN BE MADE TO RECOVER CONTROL BEFORE THE POWER SUPPLY BREAKER OPENS. IN THIS LATTER CASE, THE OSCILLATOR TUBE IS PROTECTED WITH A MINIMUM INTERRUPTION IN OPERATING TIME.



REFERENCES:

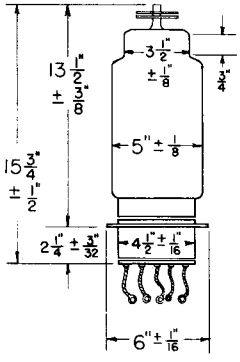
SMITH, BOB: THE FAULT DIVERTER - A PROTECTIVE DEVICE FOR HIGH-POWER ELECTRON TUBES. REPORT UCRL-8701 REV. UNIVERSITY OF CALIFORNIA, RADIATION LABORATORIES, BERKELEY, CALIF.

PARKER, W.N.
AND
HOOVER, W.A.: GAS TUBES PROTECT HIGH-POWER TRANSMITTERS. ELECTRONICS, JAN. 1956.

BOOLOTTLE, H.D.: [illegible] MERCURY VAPOR THYRATRONS. CATHODE PRESS, VOL. 84, 1954.

TUNG-SOL

THYRATRON



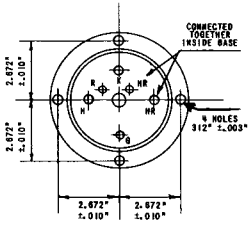
GLASS BULB

HEATER

6.3 VOLTS 23. AMP.

VERTICAL MOUNTING POSITION

(BASE DOWN)



BOTTOM VIEW

THE CH1096 IS A ZERO BIAS HYDROGEN THYRATRON DESIGNED TO PASS HIGH CURRENTS IN "CROWBAR" PROTECTIVE CIRCUITS. AS DESCRIBED IN THE APPLICATION NOTES, DESTRUCTIVE ARC CURRENTS ARE SHORT CIRCUITED BY THE CROWBAR TUBE BEFORE DAMAGE OCCURS TO OTHER TUBES OR CIRCUIT ELEMENTS.

THE INSTANTANEOUS RESPONSE, AND ABILITY TO REPEATEDLY CARRY EXTREMELY LARGE CURRENTS, MAKES THE HYDROGEN THYRATRON PRATICULARLY ATTRACTIVE FOR THIS APPLICATION. ONE TYPE CH1096 CAN HANDLE A PEAK CURRENT OF 1500 AMPS AT 18 KILOVOLTS. THIS TUBE CONTAINS A HYDROGEN RESERVOIR WHICH PROMOTES LONG LIFE AND PERMITS OPTIMUM GAS PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION.

ELECTRICAL DATA

	MIN.	BOGEY	MAX.	
CATHODE HEATER VOLTAGE	6.0	6.3	6.6	VOLTS
CATHODE HEATER CURRENT (E_f = 6.3 VOLTS)	27.	30.	33.	AMP.
CATHODE HEATING TIME	15.			MINUTES
RESERVOIR VOLTAGE	2.5	MARKED ON BASE	5.5	VOLTS
RESERVOIR CURRENT			12.	AMP.
RESERVOIR HEATING TIME	15.			MINUTES

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
MAX. NET WEIGHT	4 5/8	LBS.
MOUNTING POSITION	VERTICAL, BASE DOWN	
DIMENSIONS	SEE OUTLINE DRAWINGS	

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

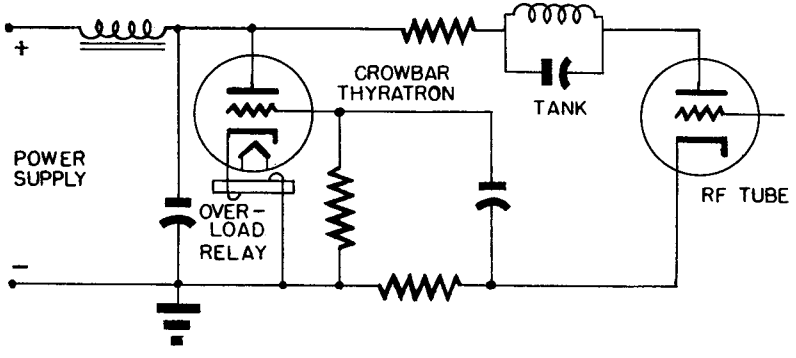
CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
D.C. ANODE VOLTAGE			
FORWARD	5	18	KVOLTS
INVERSE		5	KVOLTS
CATHODE CURRENT			
PEAK		1500	AMP.
AVERAGE		2	AMP.
CONDUCTION TIME PER FAULT		0.1	SECONDS
AVERAGING TIME		75	SECONDS
RECOVERY TIME		50	μSECONDS
GRID SIGNAL VOLTAGE	1000	2500	VOLTS
GRID IMPEDANCE	50	200	OHMS
GRID VOLTAGE RATE OF RISE	2200		V/μSEC.
ANODE DELAY TIME		0.6	μSECONDS
ANODE VOLTAGE DROP	50	300	VOLTS
AMBIENT TEMPERATURE RANGE	-50	+75	°C

APPLICATION NOTES

IN A TYPICAL APPLICATION, A CROWBAR THYRATRON IS CONNECTED IN SERIES WITH A SUITABLE IMPEDANCE ACROSS THE FILTER OF THE HIGH VOLTAGE POWER SUPPLY FOR A HIGH FREQUENCY TRIODE OSCILLATOR. WHENEVER AN ARC OCCURS IN THE OSCILLATOR TUBE, THE RISING CURRENT IS USED TO DELIVER A SUITABLE SIGNAL TO THE GRID OF THE THYRATRON. THE THYRATRON IMMEDIATELY CONDUCTS TO SHORT CIRCUIT THE POWER SUPPLY UNTIL THE PROTECTIVE CIRCUIT BREAKER OPENS 0.1 TO 0.5 SECOND LATER. WITH PROPER CIRCUITRY, THE THYRATRON CAN BE MADE TO RECOVER CONTROL BEFORE THE POWER SUPPLY BREAKER OPENS. IN THIS LATTER CASE, THE OSCILLATOR TUBE IS PROTECTED WITH A MINIMUM INTERRUPTION IN OPERATING TIME.



REFERENCES:

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DOOLITTLE, H.D.:
HIGH POWERED HYDROGEN THYRATRONS. CATHODE PRESS, V1, P6, 1954.

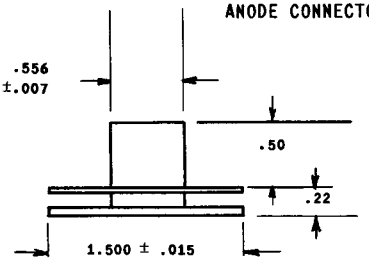
TUNG-SOL

LEAD CONNECTIONS

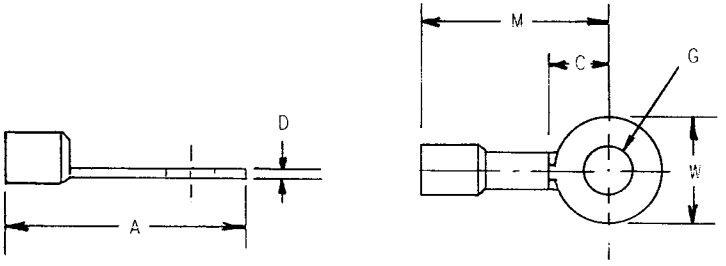
LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	CATHODE & HEATER C-T	BLACK	BLACK	L
3	HEATER	YELLOW	YELLOW	L
4	HEATER	YELLOW	BLACK	L
5	RESERVOIR	RED	YELLOW	S
6	RESERVOIR	RED	RED	S

LEADS ARE FLEXIBLE 5 1/2"±1/2" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.

ANODE CONNECTOR



LUG DIMENSIONS



LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

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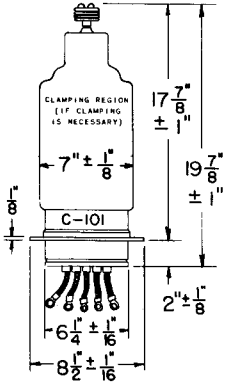
TUNG-SOL

THYRATRON



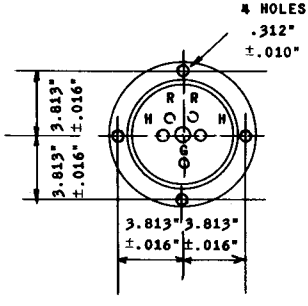
GLASS BULB

HEATER

6.3 VOLTS 23. AMP.

VERTICAL MOUNTING POSITION

(BASE DOWN)



BOTTOM VIEW

THE CH1097 IS A ZERO BIAS HYDROGEN THYRATRON DESIGNED TO PASS HIGH CURRENTS IN "CROWBAR" PROTECTIVE CIRCUITS. AS DESCRIBED IN THE APPLICATION NOTES, DESTRUCTIVE ARC CURRENTS ARE SHORT CIRCUITED BY THE CROWBAR TUBE BEFORE DAMAGE OCCURS TO OTHER TUBES OR CIRCUIT ELEMENTS.

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ELECTRICAL DATA

	MIN.	BOGEY	MAX.	
CATHODE HEATER VOLTAGE	6.0	6.3	6.6	VOLTS
CATHODE HEATER CURRENT (E_f = 6.3 VOLTS)	20.	23.	40.	AMP.
CATHODE HEATING TIME	15.			MINUTES
RESERVOIR VOLTAGE	3.5	MARKED ON BASE	6.0	VOLTS
RESERVOIR CURRENT			12	AMP.
RESERVOIR HEATING TIME	15.			MINUTES

MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
MAX. NET WEIGHT	10	LBS.
MOUNTING POSITION	VERTICAL, BASE DOWN	
DIMENSIONS	SEE OUTLINE DRAWINGS	

CONTINUED ON FOLLOWING PAGE

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TUNG-SOL

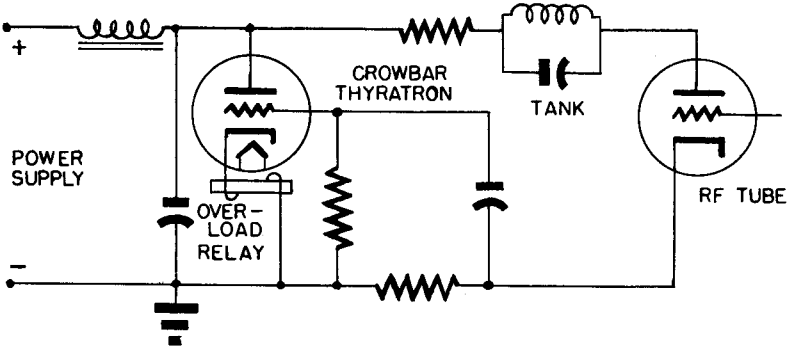
CONTINUED FROM PRECEDING PAGE

MAXIMUM RATINGS
ABSOLUTE VALUES

	MIN.	MAX.	
D.C. ANODE VOLTAGE			
FORWARD	7	25	KVOLTS
INVERSE		5	KVOLTS
CATHODE CURRENT			
PEAK		2500	AMP.
AVERAGE		5	AMP.
CONDUCTION TIME PER FAULT		0.1	SECONDS
AVERAGING TIME		50	SECONDS
RECOVERY TIME		50	μSECONDS
GRID SIGNAL VOLTAGE	1400	2500	VOLTS
GRID IMPEDANCE	20	50	OHMS
GRID VOLTAGE RATE OF RISE	2500		V/μSEC.
ANODE DELAY TIME		0.6	μSECONDS
ANODE VOLTAGE DROP	50	300	VOLTS
AMBIENT TEMPERATURE RANGE	-55	+75	°C

APPLICATION NOTES

IN A TYPICAL APPLICATION, A CROWBAR THYRATRON IS CONNECTED IN SERIES WITH A SUITABLE IMPEDANCE ACROSS THE FILTER OF THE HIGH VOLTAGE POWER SUPPLY FOR A HIGH FREQUENCY TRIODE OSCILLATOR. WHENEVER AN ARC OCCURS IN THE OSCILLATOR TUBE, THE RISING CURRENT IS USED TO DELIVER A SUITABLE SIGNAL TO THE GRID OF THE THYRATRON. THE THYRATRON IMMEDIATELY CONDUCTS TO SHORT CIRCUIT THE POWER SUPPLY UNTIL THE PROTECTIVE CIRCUIT BREAKER OPENS 0.1 TO 0.5 SECOND LATER. WITH PROPER CIRCUITRY, THE THYRATRON CAN BE MADE TO RECOVER CONTROL BEFORE THE POWER SUPPLY BREAKER OPENS. IN THIS LATTER CASE, THE OSCILLATOR TUBE IS PROTECTED WITH A MINIMUM INTERRUPTION IN OPERATING TIME.



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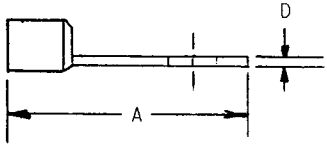
TUNG-SOL

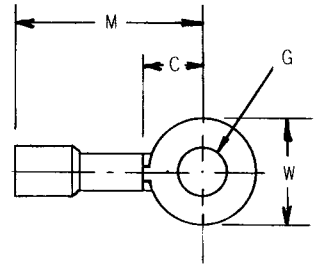
LEAD CONNECTIONS

LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	HEATER	YELLOW	YELLOW	L
3	HEATER	YELLOW	YELLOW	L
4	RESERVOIR	RED	RED	S
5	RESERVOIR	RED	RED	S
6	CATHODE	TUBE BASE FLANGE		

LEADS ARE FLEXIBLE 8"±3/4" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.

LUG DIMENSIONS

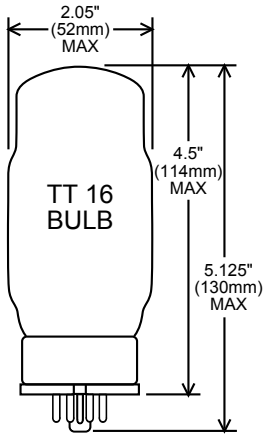




LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

TUNG-SOL

PENTODE

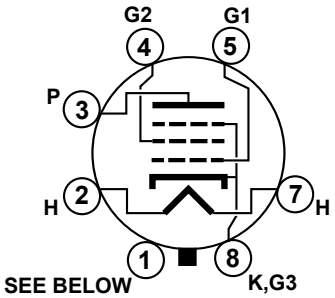


GLASS BULB
LARGE WAFER OCTAL
WITH BARRIERS
7 PIN LOW LOSS B7-99

FOR
AUDIO SERICE APPLICATIONS

OXIDE COATED INDIRECTLY HEATED
UNIPOTENTIAL CATHODE

ANY MOUNTING POSITION



BOTTOM VIEW

BASING DIAGRAM
JEDEC 7AC
PIN 1 - NO CONNECTION
OR BASE SHELL

THE KT120 IS A BEAM PENTODE POWER AMPLIFIER PRIMARILY DESIGNED FOR AUDIO SERVICE. IT CARRIES A 60 WATT PLATE DISSIPATION RATING WHICH PROVIDES FOR PUSH-PULL AMPLIFIER DESIGNS UP TO 200 WATTS OUTPUT. CONSTRUCTION FEATURES PROVIDE FOR RELIABLE OPERATION AT FULL RATINGS.

DIRECT INTERELECTRODE CAPACITANCES

WITHOUT SHIELD

GRID 1 TO PLATE	1.8	pf
INPUT	29	pf
OUTPUT	10	pf

HEATER CHARACTERISTICS AND RATINGS

DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

AVERAGE CHARACTERISTCS	6.3	VOLTS	1.7 - 1.95	AMP
HEATER SUPPLY LIMITS VOLTAGE OPERATION			6.3 +/- 0.6	VOLTS
MAXIMUM HEATER-CATHODE VOLTAGE HEATER NEGATIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK			300	VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE TOTAL DC AND PEAK			200	VOLTS

CONTINUED ON FOLLOWING PAGE

→ **INDICATES A CHANGE**

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TUNG-SOL

CONTINUED FROM PREVIOUS PAGE

MAXIMUM RATINGS

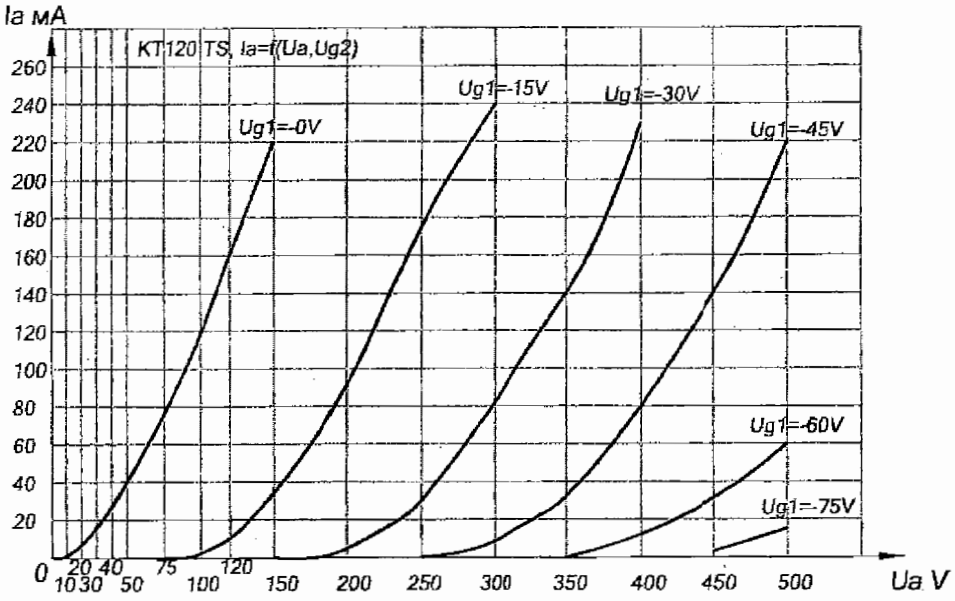
DESIGN MAXIMUM VALUES - SEE EIA STANDARD RS-239

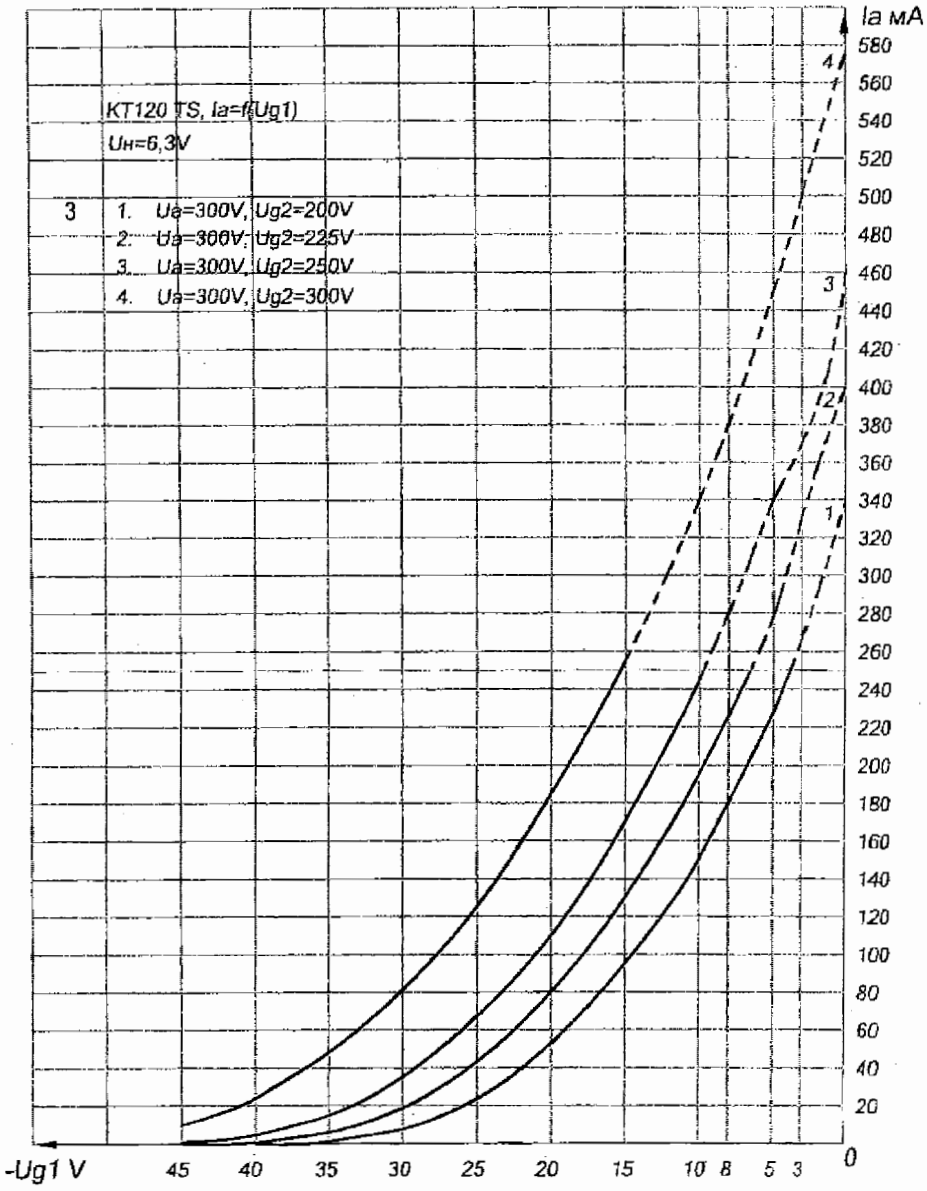
PLATE VOLTAGE, DC		
TETRODE	850	VOLTS
TRIODE	650	VOLTS
GRID 2 VOLTAGE, DC		
PENTODE CONNECTION	650	VOLTS
TRIODE & ULTRALINEAR CONNECTION	600	VOLTS
GRID 1 VOLTAGE, DC	-200	VOLTS
PLATE DISSIPATION	60	WATTS
GRID 2 DISSIPATION	8.0	WATTS
CATHODE CURRENT		
PENTODE CONNECTION	250	MA
TRIODE & ULTRALINEAR CONNECTION	230	MA
GRID 1 CIRCUIT RESISTANCE		
FIXED BIAS	51,000	OHMS
SELF BIAS	240,000	OHMS
BULB TEMPERATURE	250	CELSIUS

AVERAGE CHARACTERISTICS

CLASS A1 AUDIO AMPLIFIER - SINGLE TUBE

PLATE VOLTAGE	400	VOLTS
GRID 2 VOLTAGE	225	VOLTS
GRID 1 VOLTAGE	-14	VOLTS
PLATE CURRENT (RANGE)	135 - 165	MA
GRID 2 CURRENT (NOT MORE THAN)	14	MA
TRANSCONDUCTANCE (NOT LESS THAN)	12.5	mA/V
PLATE RESISTANCE (APROX.)	3000	OHMS
MAX. SIGNAL POWER OUTPUT (NOT LESS THAN)	20	WATTS
TOTAL HARMONIC DISTORION (NOT MORE THAN)	14	PERCENT
CATHODE TO HEATER LEAKAGE (NOT MORE THAN) (WITH ±300V HEATER TO CATHODE DIFFERENCE)	30	uA





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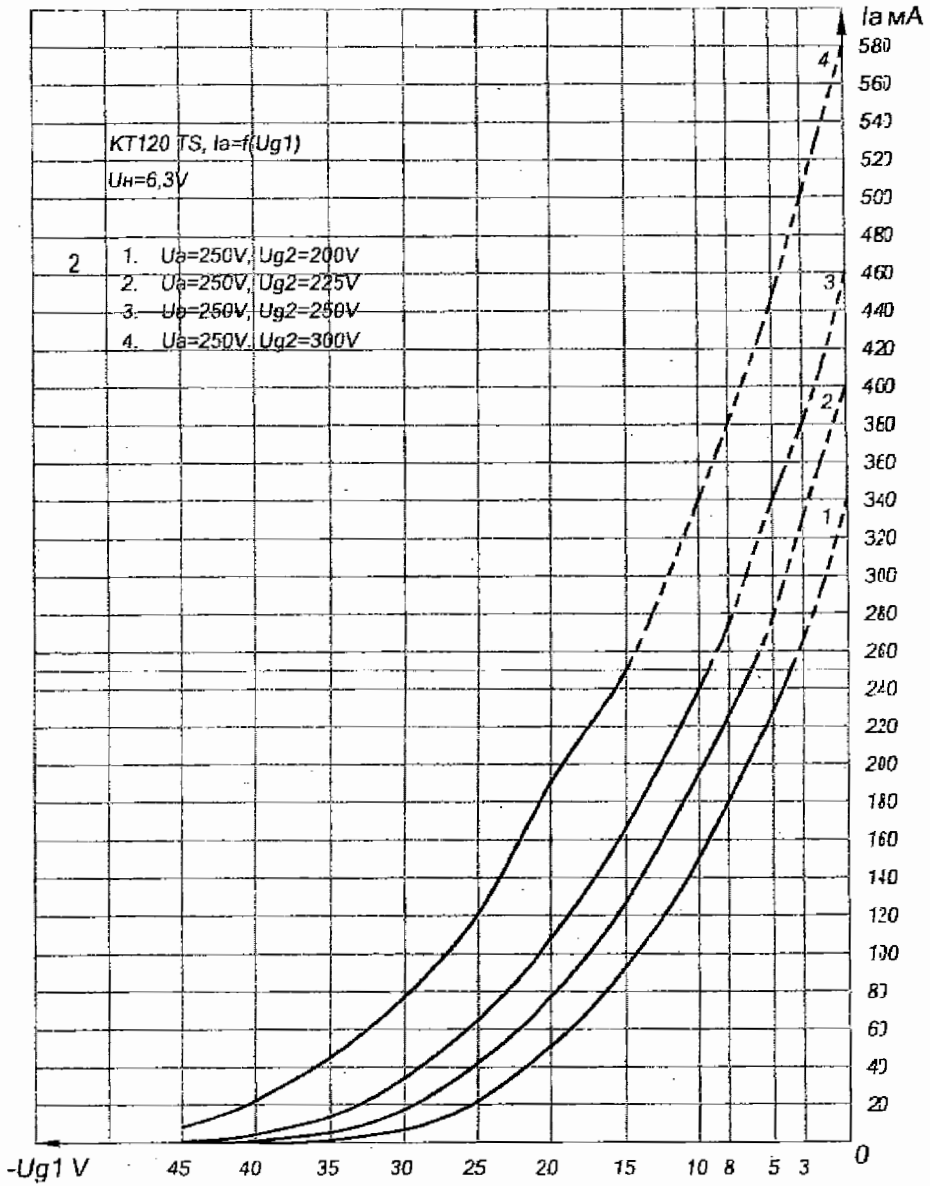
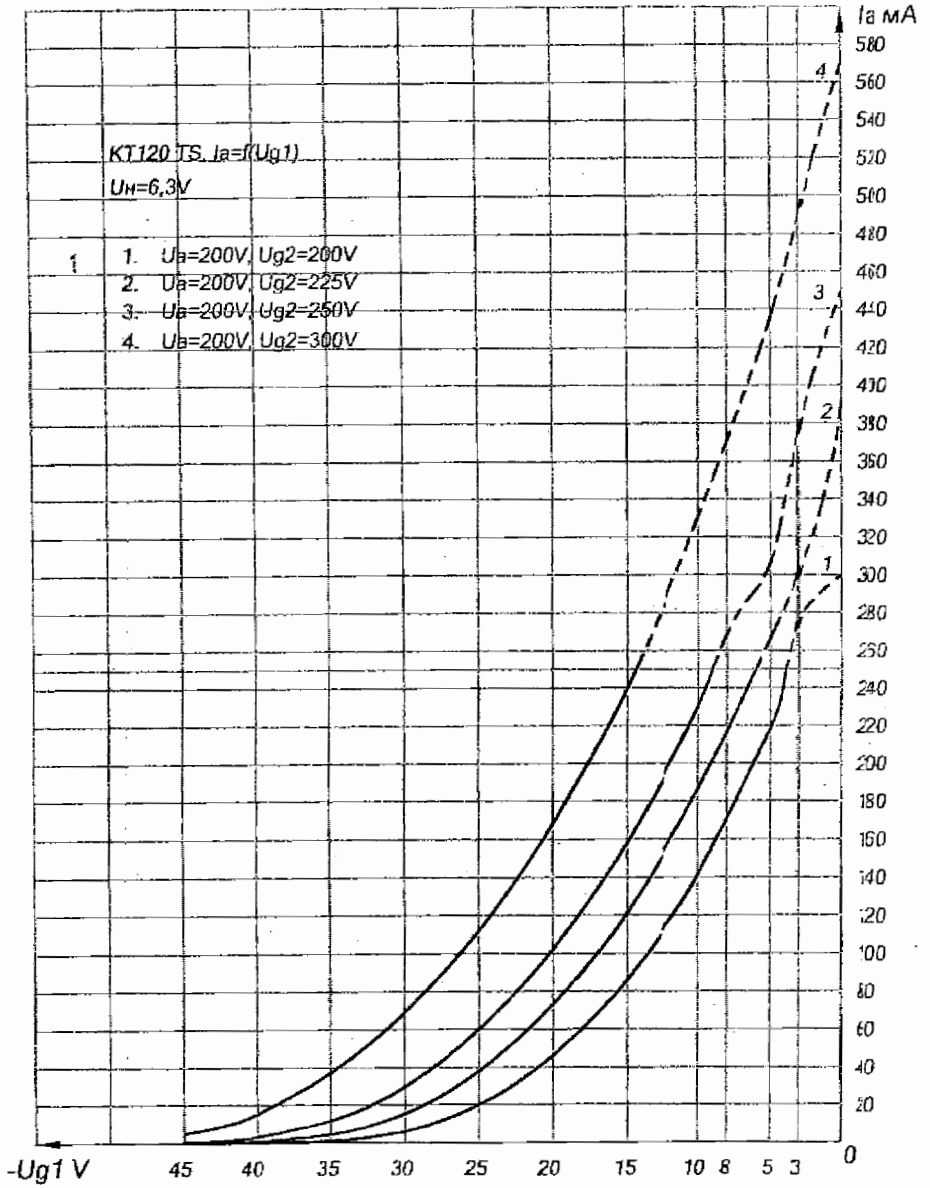
26.01.2010г.





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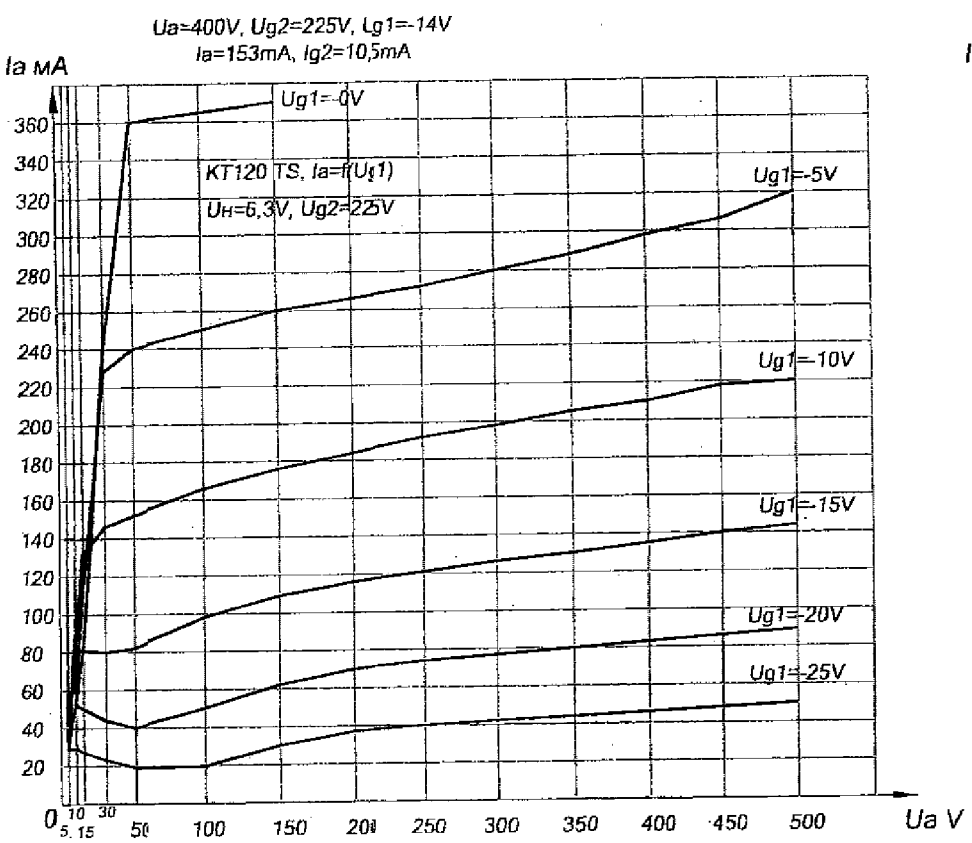
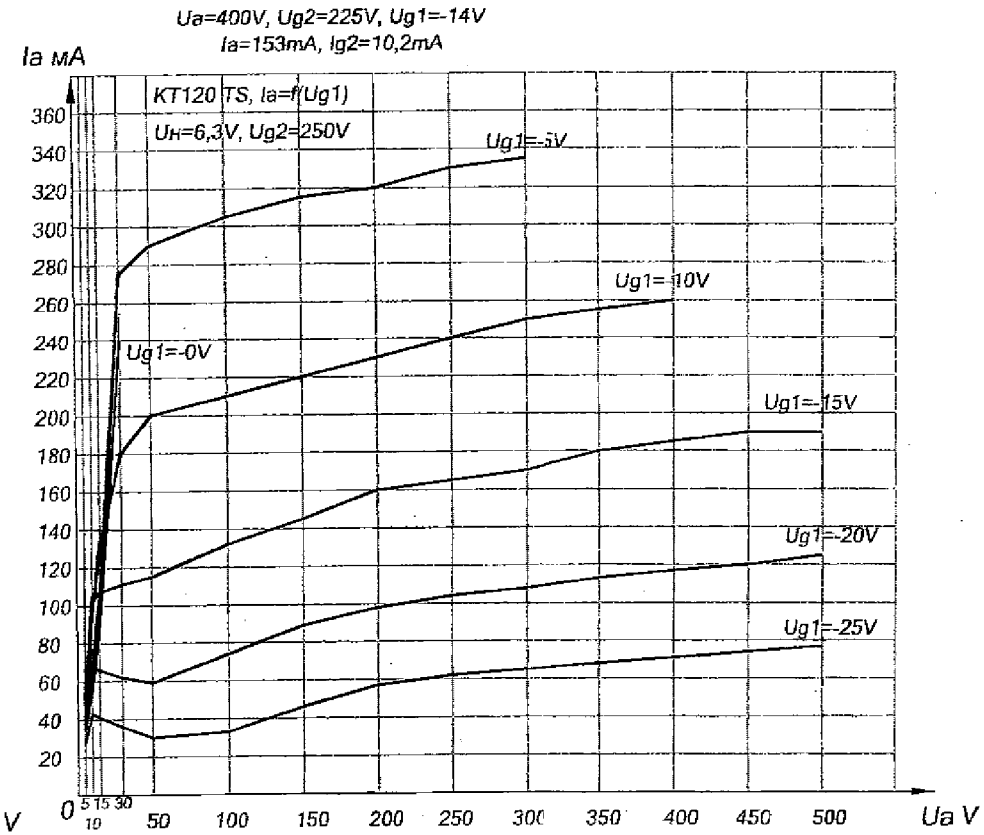
26 01 2010г.



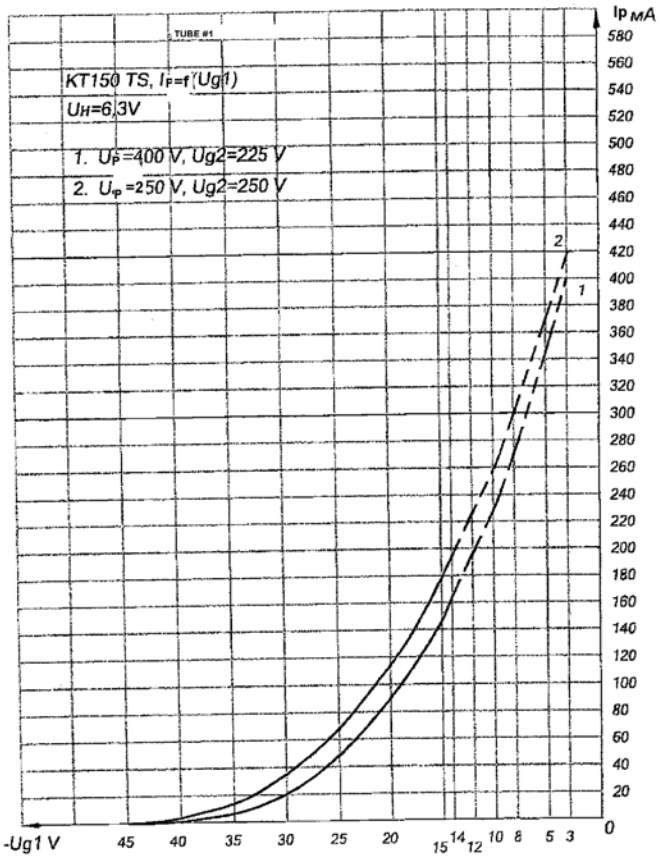


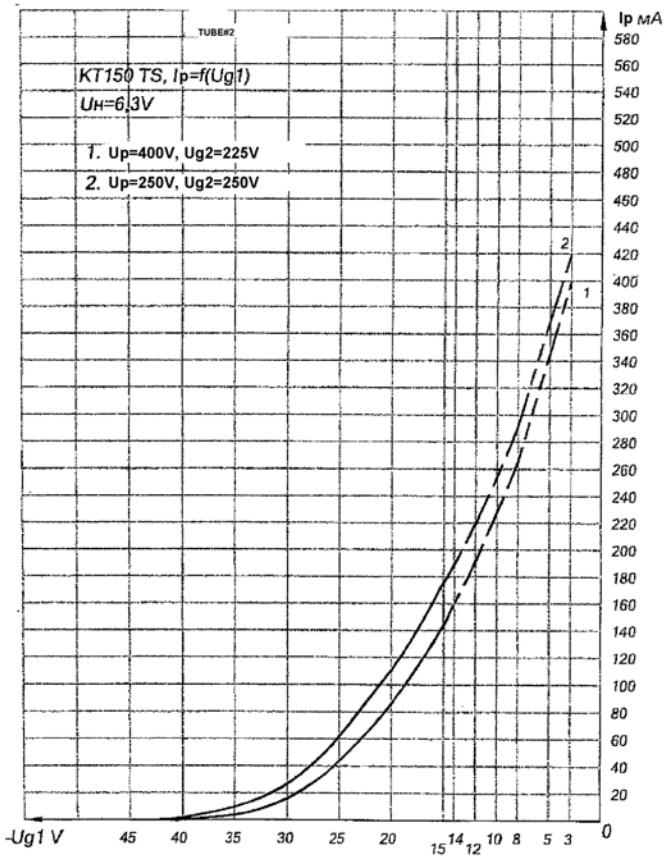
16.01.2010г

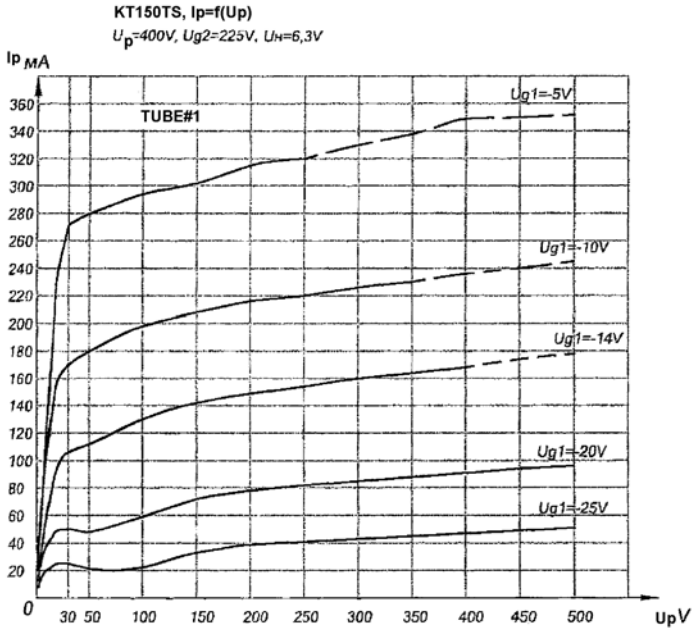
26/01 '10 TUE 10:48 [TX/RX NO 9763] 002

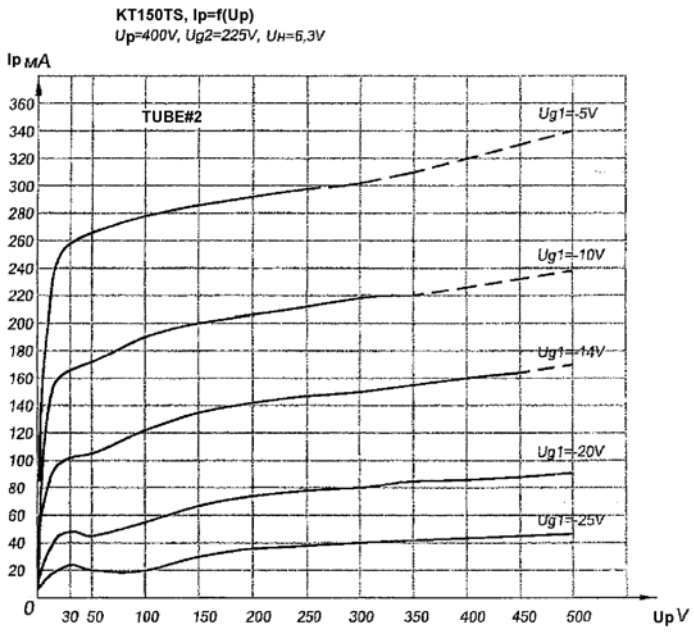
Electro-Harmonix, 55-01 2nd Street, Long Island City, NY 11101
tel: 718-937-8300 800-633-5477 fax: 718-937-9222
www.newsensor.com www.ehx.com

Grid-plate characteristics







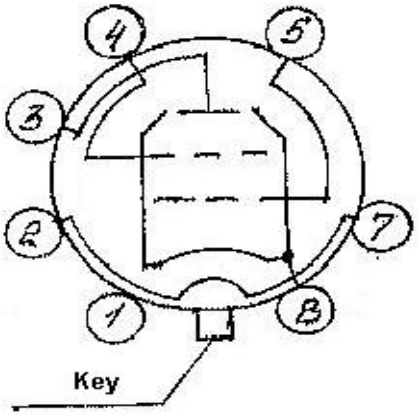


KT 150 VACUUM TUBE

	KT150TS	KT120TS
Heater Current	1,75 - 2,0A	1,7 - 1,95 A
Least Output Power, BT	20 W	18 W
Plate current	150 thru 180 mA	125 thru 165 mA
Grid 2 current	not more than	not more than 14 mA
Transconductance (slope)	not less than 12,6 mA/V	not less than 11,5 mA/V
Plate dissipation power	not more than 70 W	not more than 60 W
Grid 2 dissipation power	not more than 9 W	not more than 8 W

KT150 Tung-Sol

Terminal connections



Pin #	Electrode name
1	-
2,7	Heater
3	Plate
4	The second grid
5	The first grid
6	-
8	Cathode,beam-forming plates

Electrical data

Cathode	Oxide, indirect heating
Filament voltage (AC, DC)	6.3 V
Cathode to heater voltage:	
Under positive polarity at cathode	300 V
Under negative polarity at cathode	300V
Interelectrode capacitance:	
Input (nominal)	20.5 pF
Output (nominal)	10 pF
Transfer (nominal)	1.75 pF

Mechanical data

Envelope	Glass balloon
Socket	Octal
Operating position	Any
Dimensions:	
Maximum height	140 mm
Balloon diameter, max	60 mm
Maximum weight	130 g

Basic specifications

Electric Characteristics At delivery

Parameter name	Norms		Measurement mode
	not less	not more	
Heater current, A	1.75	2.0	Uf=6.3V
Plate current, mA	150	180	Uf=6.3V Ua=400V

			Uc2=225V Uc1= -14V
The second grid current, mA	-	15	Uf=6.3V Ua=400V Uc2=225V Uc1= -14V
Transconductance, mA/V	12.6	-	Uf=6.3V Ua=400V Uc2=225V Uc1= -14V
Output power, W	20.0	-	Uf=6.3V Ua=400V Uc2=225V Uc1= -14V Uc1eff.=9.9V load resistance =3 KOhm
Non-linear harmonic distortion coefficient, %	-	14	Uf=6.3V Ua=400V Uc2=225V Uc1= -14V Uc1eff.=9.9V load resistance =3 KOhm
Cathode to heater leakage current, µA	-	50	Uf=6.3V Uk-h=±300V

Limiting values

	min	max
Filament voltage (AC, DC)	6.0 V	6.6 V
Plate voltage, DC		850 V
Grid 2 voltage, DC		650 V
Grid 1 negative voltage		200 V
Plate dissipation		70 W
Grid 2 dissipation		9.0 W
Cathode current		275 mA
Resistance in grid1 circuit		
at fixed (clamp) bias		0.51 MOh
Envelope temperature at hottest point		250° C

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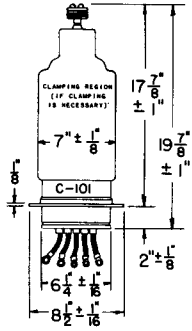
THYRATRON

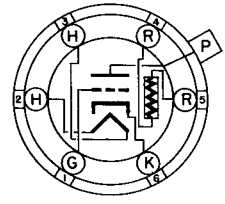


GLASS BULB

HEATER

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

THE VC-1257 IS A THREE ELECTRODE, HYDROGEN FILLED, ZERO BIAS THYRATRON DESIGNED FOR THE GENERATION OF HIGH POWER PULSES. THE PRIMARY APPLICATION OF THE TUBE IS IN HIGH POWER, HIGH VOLTAGE RADAR MUDULATORS. THE VC-1257 IS CAPABLE OF SUPPLYING 33 MEGAWATT PULSES IN THIS SERVICE. AN INTERNAL HYDROGEN RESERVOIR PROMOTES LONG LIFE AND PERMITS OPTIMUM PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION. THE CATHODE IS UNIPOTENTIAL AND IS CONNECTED TO THE ELECTRICAL CENTER OF THE CATHODE HEATER CIRCUIT IN ORDER TO MINIMIZE TIME JITTER.

FIRM ELECTRICAL CONNECTIONS ARE MADE TO THE CATHODE HEATERS, GRID AND RESERVOIR BY MEANS OF FLEXIBLE CABLES FITTED WITH LUGS. THE TUBE IS RIGIDLY SUPPORTED BY A BASE WITH A FLANGE CONTAINING BOLT HOLES. THE CATHODE CONNECTION IS MADE THROUGH THE BASE FLANGE.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER AND RESERVOIR VOLTAGE)	If	20	23	40	AMPS.
CATHODE HEATING TIME	tk	15			MINUTES
RESERVOIR VOLTAGE (SEE APPLICATION NOTES)	Eres	3.5	MARKED ON BASE	6.0	VOLTS
RESERVOIR CURRENT	Ires			12	AMPS.
RESERVOIR HEATING TIME	tres	15			MINUTES
ANODE VOLTAGE DROP	etd	100	200	400	VOLTS

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MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
(FORCED AIR COOLING ACROSS THE RADIATOR IS RECOMMENDED FOR MAXIMUM TUBE LIFE)		
MOUNTING POSITION	VERTICAL, BASE DOWN	
MAXIMUM NET WEIGHT	10	POUNDS
DIMENSIONS:	SEE OUTLINE DRAWING	

RATINGS

ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	0.5	33	KVOLTS
FORWARD (SEE APPLICATION NOTES FOR STARTING PROCEDURE)	epy	7.	33	KVOLTS
CATHODE CURRENT				
PEAK	ib		2000	AMPS.
AVERAGE	ib		2.6	AMPS.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		60	AMPS.
DC ANODE VOLTAGE	Ebb		3.5	KVOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT OF THE VC-1257 BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		1500	CPS
PEAK GRID VOLTAGE (NOTE 2)	egy	1100	2500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		650	VOLTS
GRID TIME OF RISE OF GRID PULSE (NOTE 5)	tr		0.35	μSEC.
GRID PULSE WIDTH AT 70.7% POINT		2.0		μSEC.
HEATING FACTOR (epy X ib X prr. SEE FIG. 3)	Pb		20×10^9	
CURRENT RATE OF RISE (NOTE 5)			10 000	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.5	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	−55	+75	°C

NOTES

1: IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05μSEC. MAXIMUM DURATION, SHALL NOT EXCEED 5.0 KILOVOLTS DURING THE FIRST 25μSEC. FOLLOWING THE ANODE PULSE.

2: THE GRID DRIVE REQUIREMENTS OF A VC-1257 CHANGE CONSIDERABLY DURING THE FIRST FEW MINUTES OF TUBE OPERATION. IN ORDER TO RELIABLY TRIGGER A COLD TUBE, THE GRID PULSE VOLTAGE AND DURATION AND THE GRID CIRCUIT IMPEDANCE SHOULD BE CHOSEN ACCORDING TO THE LIMITING CURVES.

3: ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

4: TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 20 KV AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

5: MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

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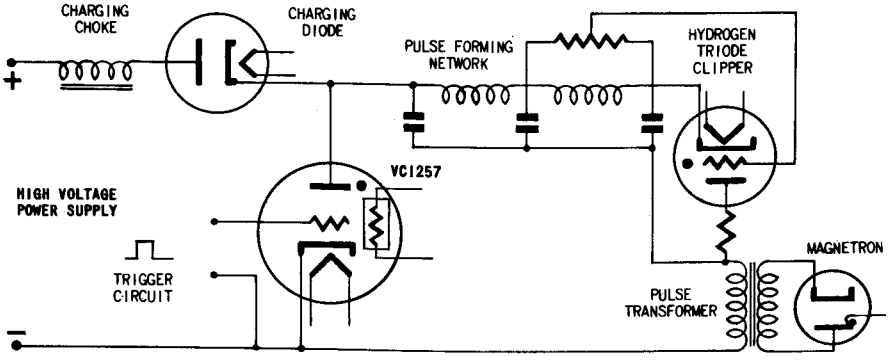
APPLICATION NOTES

THE VC-1257 HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN HIGH POWER RADAR MODULATOR SERVICE. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNATRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THE VC-1257 IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENTS WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE VC-1257 CONTAINS A HYDROGEN RESERVOIR THAT MAINTAINS THE GAS PRESSURE WITHIN THE TUBE IN ACCORDANCE WITH THE VOLTAGE IMPRESSED ACROSS IT. SINCE THE RESERVOIR CAN HOLD MANY TUBE VOLUMES OF GAS, LONG TUBE LIFE IS INSURED. IN ADDITION IT IS POSSIBLE TO SET THE GAS PRESSURE AT THE OPTIMUM VALUE FOR ANY PARTICULAR SET OF OPERATING CONDITIONS. THE RESERVOIR HEATER VOLTAGE STAMPED ON THE TUBE BASE HAS BEEN DETERMINED FOR A PARTICULAR SET OF CONDITIONS SOMEWHAT BEYOND THE MAXIMUM TUBE RATINGS AND WILL BE SATISFACTORY FOR MOST APPLICATIONS. IN GENERAL, IT IS DESIRABLE TO OPERATE AT AS HIGH A RESERVOIR VOLTAGE AS POSSIBLE WITHOUT OBTAINING SPURIOUS DISCHARGES IN THE GRID-ANODE REGION. WHEN THE VC-1257 IS OPERATED AT OR NEAR MAXIMUM RATINGS, THE RESERVOIR VOLTAGE REGULATION SHOULD NOT EXCEED ±2.5%. IF THE VC-1257 IS OPERATED AT REDUCED DUTY A WIDER RESERVOIR OPERATING RANGE CAN BE EXPECTED. HOWEVER, CARE SHOULD BE TAKEN WHEN DETERMINING THE RESERVOIR VOLTAGE TO INSURE SATISFACTORY OPERATION WITH THE ANTICIPATED RESERVOIR VOLTAGE REGULATION. UNDER NO CIRCUMSTANCES SHOULD THE RESERVOIR VOLTAGE BE REDUCED TO SUCH AN EXTENT THAT THE ANODE SHOWS COLOR.

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APPLICATION NOTES —CONT'D.

THE INSTANTANEOUS APPLICATION OF ANODE VOLTAGE (INSTANTANEOUS STARTING OR "SLAT ON") IS NOT RECOMMENDED. WHEN IT IS ABSOLUTELY NECESSARY, THE MAXIMUM PERMISSIBLE EPY IS 22 KV AND THIS VALUE SHALL NOT BE ATTAINED IN LESS THAN 0.04 SEC. FOR INITIAL APPLICATION OF MAXIMUM RATED ANODE VOLTAGE, IT IS RECOMMENDED THAT ONE OF THE FOLLOWING STARTING METHODS BE USED:

A) *Step Starting.* APPLY NO MORE THAN 22 KV EPY INITIALLY. DO NOT INCREASE IN STEPS GREATER THAN 5 KV PER MINUTE.

B) *Reduced Reservoir Voltage.* THIS METHOD IS SUITABLE FOR AUTOMATIC CONTROL. DURING WARM-UP AND STANDBY PERIODS, THE RESERVOIR VOLTAGE IS HELD AT 92.5 PERCENT OF THE NOMINAL VALUE. AFTER INITIAL ANODE VOLTAGE APPLICATION OF NOT GREATER THAN 22KV, THE ANODE VOLTAGE MAY BE INCREASED AT A MAXIMUM RATE OF 1 KV PER SECOND, AFTER 7.5 MINUTES OF ANODE OPERATION AT MAXIMUM VOLTAGE, THE RESERVOIR VOLTAGE IS INCREASED TO ITS NOMINAL VALUE. OTHER STARTING METHODS CAN BE SUPPLIED TO MEET VARIOUS PARTICULAR APPLICATIONS.

TYPICAL OPERATION

VARIATIONS IN THE OPERATING PARAMETERS AFFECT THE LIFE EXPECTANCY OF HYDROGEN THYRATRONS; THEREFORE, A SIMPLE METHOD OF RATING FOR ALL CONDITIONS IS DIFFICULT. UNTIL SUCH TIME AS SUFFICIENT INFORMATION IS AVAILABLE TO PREPARE COMPLETE OPERATION RATING CHARTS, WE LIST THE FOLLOWING TYPICAL CONDITIONS OF OPERATION UNDER WHICH CONSIDERABLE TUBE LIFE HAS BEEN OBTAINED. IF THE VC-1257 IS TO BE EMPLOYED IN AN OPERATION DIFFERING WIDELY FROM THESE CONDITIONS (UNLESS THE REQUIREMENTS ARE OBVIOUSLY LESS SEVERE) IT IS SUGGESTED THAT THE CUSTOMER REQUEST A RECOMMENDATION FOR THE SPECIFIC APPLICATION.

	PEAK ANODE VOLTAGE		PEAK	PULSE WIDTH	di/dt
Prr	FORWARD	INVERSE	CURRENT	70% POINT	AMPS/μS
pps	kv	kv	Amps	μS	
310	33	5.	2000	2.5	10000
500	30	1.7	1250	3.6	3400
900*	30	1.6	1250	1.0	4200
1500	20	5.	667	1.3	6670

* OPERATION MADE POSSIBLE BY USE OF HYDROGEN TRIODE CLIPPER.

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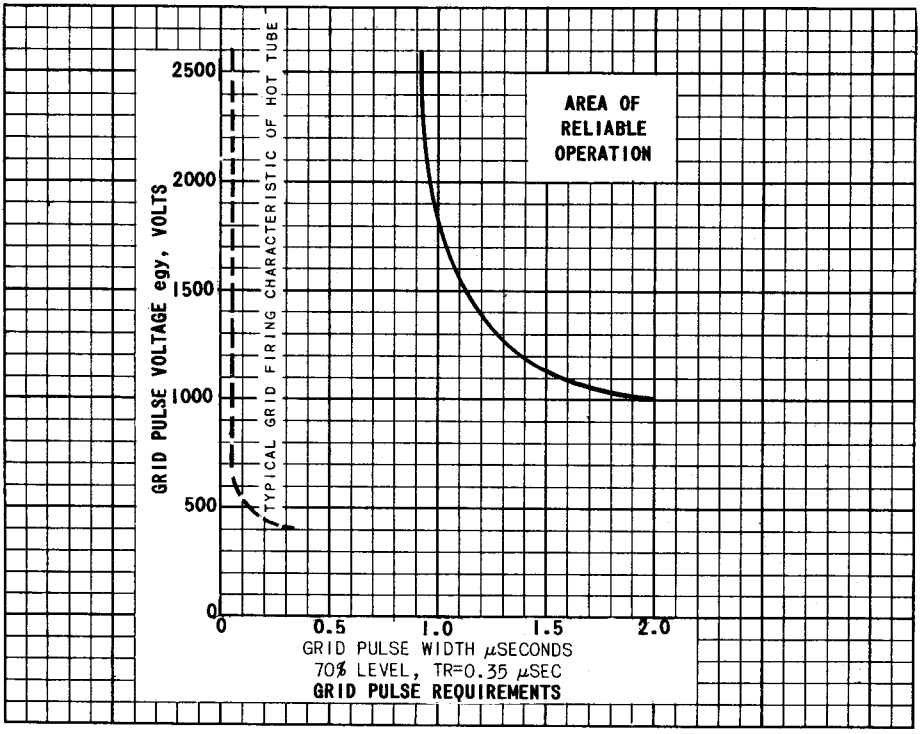
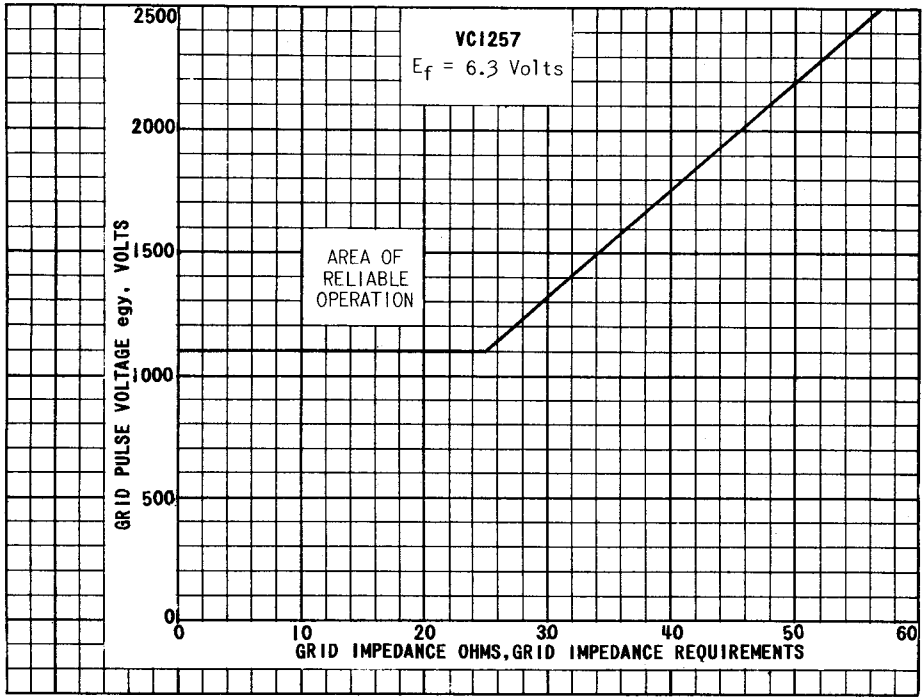

GRID PULSE VOLTAGE egy, VOLTS
2500
2000
1500
1000
500
0
TYPICAL GRID FIRING CHARACTERISTIC OF HOT TUBE
AREA OF RELIABLE OPERATION
0
0.5
1.0
1.5
2.0
GRID PULSE WIDTH μSECONDS
70% LEVEL, TR=0.35 μSEC
GRID PULSE REQUIREMENTS


VC1257
E_f = 6.3 Volts
GRID PULSE VOLTAGE egy, VOLTS
2500
2000
1500
1000
500
0
AREA OF RELIABLE OPERATION
0
10
20
30
40
50
60
GRID IMPEDANCE OHMS, GRID IMPEDANCE REQUIREMENTS

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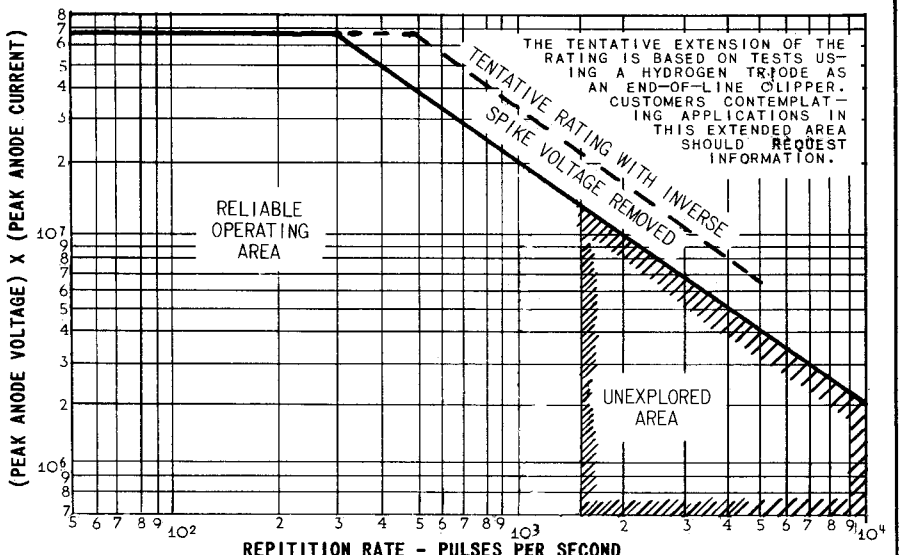

GRAPHICAL REPRESENTATION OF HEAT FACTOR

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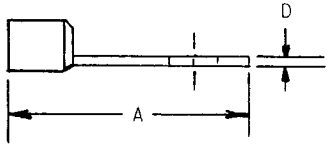
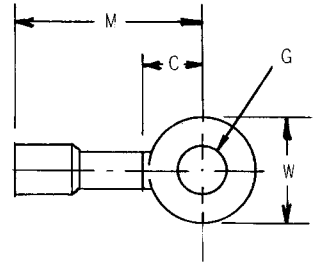
LEAD CONNECTIONS

LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	HEATER	YELLOW	YELLOW	L
3	HEATER	YELLOW	YELLOW	L
4	RESERVOIR	RED	RED	S
5	RESERVOIR	RED	RED	S
6	CATHODE	TUBE BASE FLANGE		

LEADS ARE FLEXIBLE 8"±3/4" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.





LUG DIMENSIONS

LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"

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TWIN TRIODE AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER	UNIPOTENTIAL CATHODE	PIN CONNECTIONS			
BASE	LOCKING-IN 8 PIN	PIN 1	HEATER	PIN 7	CATHODE #1
CAP	NONE	PIN 2	CATHODE #2	PIN 8	HEATER
BULB	T-9	PIN 3	PLATE #2		
MAXIMUM DIAMETER	1 3/16"	PIN 4	GRID #2		
MAXIMUM OVERALL LENGTH	2 25/32"	PIN 5	GRID #1	TOP CAP	NONE
MAXIMUM SEATED HEIGHT	2 1/4"	PIN 6	PLATE #1		

RATINGS

HEATER OR FILAMENT VOLTAGE (NOMINAL)	14.0	VOLTS
HEATER OR FILAMENT CURRENT (NOMINAL)	0.160	AMP.
MAXIMUM PLATE VOLTAGE		VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

HEATER VOLTAGE	12.6	VOLTS
HEATER CURRENT	0.15	AMPERE
PLATE VOLTAGE	250	VOLTS
CONTROL GRID VOLTAGE	−10	VOLTS
PLATE CURRENT	9.0	MA.
PLATE RESISTANCE	7600	OHMS
TRANSCONDUCTANCE	2100	μMHOS
AMPLIFICATION FACTOR	16	

DIRECT INTERELECTRODE CAPACITANCES[S]

	TRIODE UNIT 1		TRIODE UNIT 2	
GRID TO CATHODE	2.2		2.2	μμf
PLATE TO CATHODE	1.6		1.6	μμf
GRID TO PLATE	2.3		2.3	μμf
GRID #1 TO GRID #2		0.20		μμf
PLATE #1 TO PLATE #2		0.60		μμf
GRID #1 TO PLATE #2		0.06		μμf
GRID #2 TO PLATE #1		0.10		μμf

[S] WITH BASE SHELL GROUNDED.

PLATE 1165-1

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TRIODE AMPLIFIER

PHYSICAL SPECIFICATIONS

EMITTER	UNIPOTENTIAL CATHODE	PIN CONNECTIONS	
BASE	LOCKING—IN 6 PIN	PIN 1 HEATER	PIN 7 CATHODE
CAP	NONE	PIN 2 PLATE	PIN 8 HEATER
BULB	T-9	PIN 3 NO CONN.	
MAXIMUM DIAMETER	1 3/16"	PIN 4 NO CONN.	
MAXIMUM OVERALL LENGTH	2 25/32"	PIN 5 NO CONN.	TOP CAP NONE
MAXIMUM SEATED HEIGHT	2 1/4"	PIN 6 GRID	

RATINGS

HEATER OR FILAMENT VOLTAGE	(NOMINAL)	7	VOLTS
HEATER OR FILAMENT CURRENT	(NOMINAL)	0.32	AMP.
MAXIMUM PLATE VOLTAGE			VOLTS

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A1 AMPLIFIER

HEATER VOLTAGE	6.3	6.3	VOLTS
HEATER CURRENT	0.3	0.3	AMPERE
PLATE VOLTAGE	100	250	VOLTS
CONTROL GRID VOLTAGE	0	-8	VOLTS
PLATE CURRENT	10.0	8.0	MA.
PLATE RESISTANCE	7000	8700	OHMS
TRANSCONDUCTANCE	3600	2300	μMHOS
AMPLIFICATION FACTOR	25	20	

DIRECT INTERELECTRODE CAPACITANCES[S]

CONTROL GRID TO CATHODE	3.4	μμf
PLATE TO CATHODE	2.6	μμf
GRID TO PLATE	2.0	μμf

[S] WITH BASE SHELL GROUNDED.

PLATE 1166-1
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