

KEN-RAD 12AH7GT



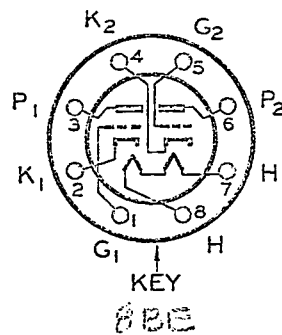
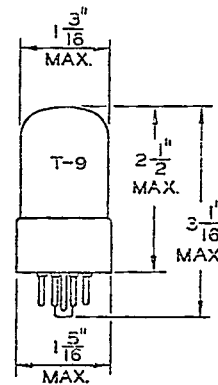
Page One

GENERAL DESCRIPTION

Application: The Ken-Rad 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.

Physical Characteristics:

Mounting Position - Any

Bottom ViewRATINGS AND CHARACTERISTICSHeater:

Voltage
Current

12.6 Volts AC or DC
.150 Ampere

RATINGS:

Maximum Plate Voltage
Maximum Plate Dissipation

300 Volts/Plate
2.5 Watts/Plate

Typical Operating Conditions and Characteristics: (Each Triode Section)

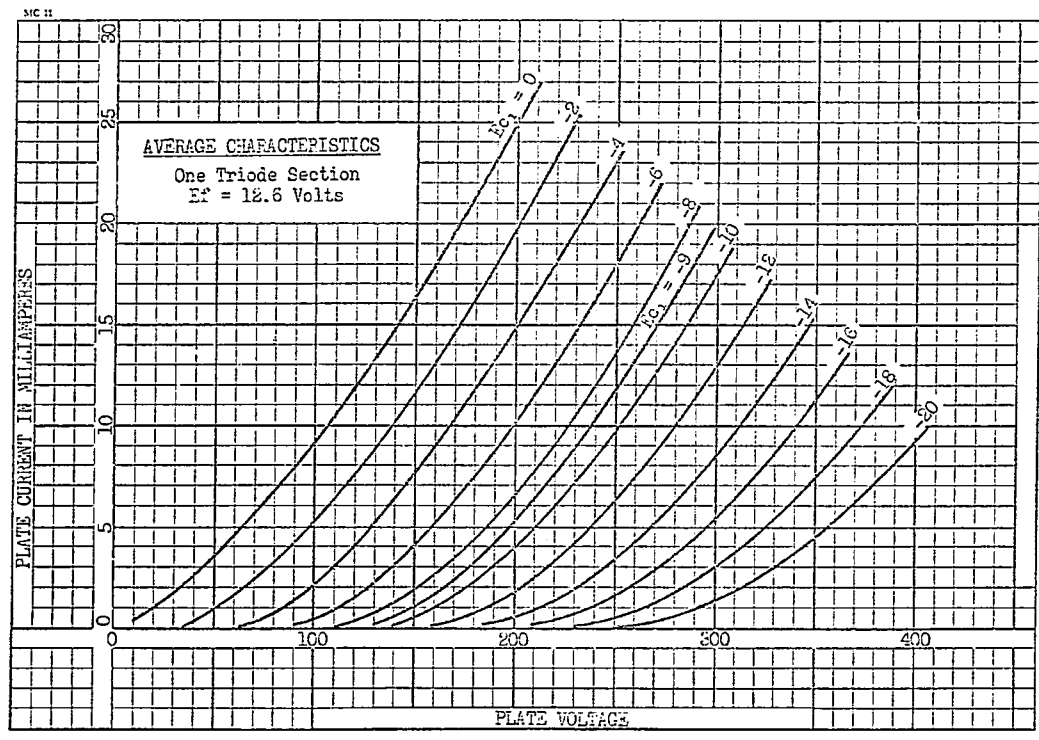
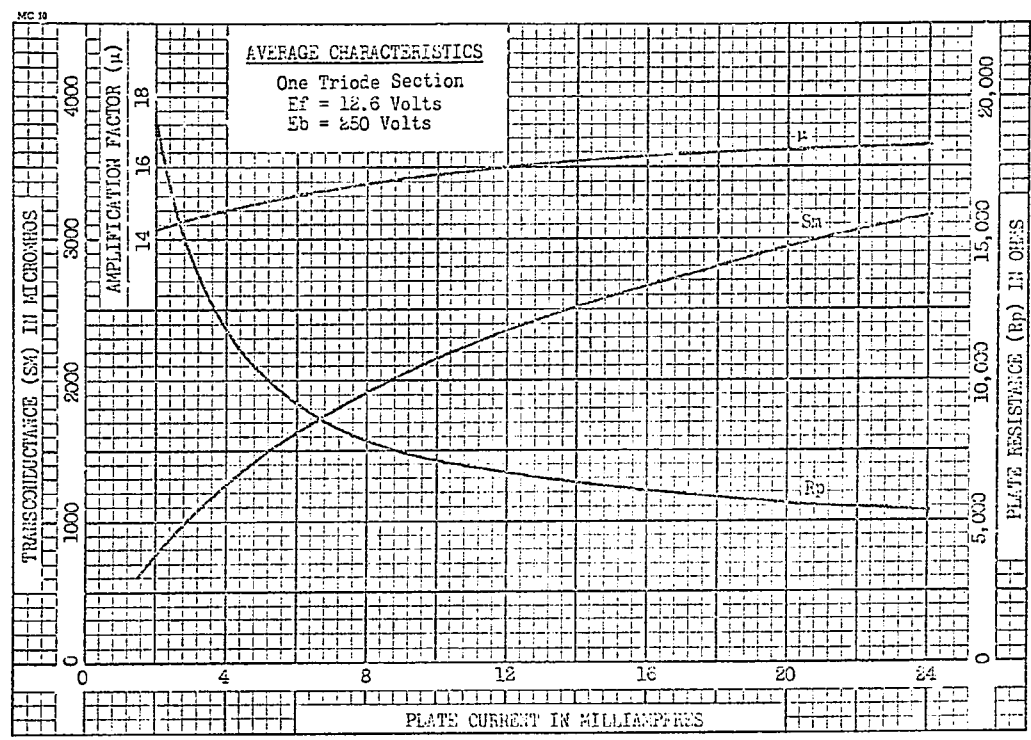
Plate Voltage
Grid Voltage
Amplification Factor
Plate Resistance
Plate Current
Transconductance
Plate Current with $E_c = -30$ Volts

250 Volts
-9 Volts
16
6600 Ohms
12 Ma.
2400 Micromhos
10 μ Amperes

Direct Interelectrode Capacitances: (Max.) With tight fitting shield)

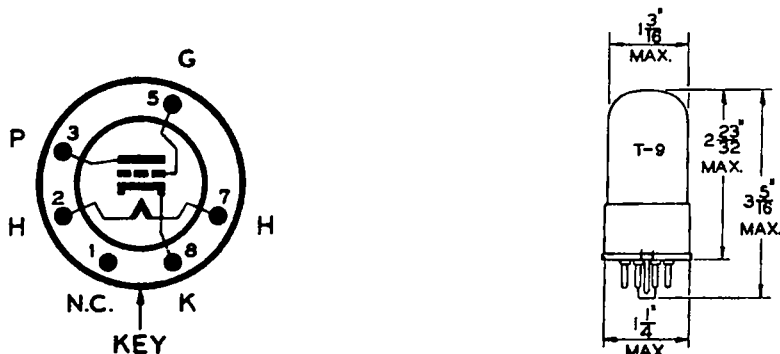
	<u>G - P</u>	<u>G - K</u>	<u>P - K</u>	<u>P - P</u>	<u>G - G</u>
Section 1	2.2	3.2	3.0		
Section 2	3.0	2.9	2.6	.4	.06

7/20
2/5/4



GENERAL DESCRIPTION

Application: The Ken-Rad 12J5GT is a cathode type general purpose amplifier triode designed for use in resistance coupled amplifiers or in super-heterodyne circuits as an oscillator. The high mutual conductance and low output capacitance make the tube especially suited for high frequency oscillator service. The 12J5GT is a glass tube equipped with a small octal base. The electrical characteristics of this type are identical to those of type 6J5GT except for heater requirements.

Physical Characteristics:Bottom ViewRATING AND CHARACTERISTICS**Heater:**

Voltage	12.6	Volts AC or DC
Current	.150	Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

Operating Conditions: (Class A Amplifier)

Plate Voltage	250	Volts	Max.
Grid Voltage	-8	Volts	
Plate Current	9.0	Milliamperes	
Plate Resistance	7700	Ohms	Approx.
Mutual Conductance	8600	Micromhos	Approx.
Amplification Factor	20		

Direct Interelectrode Capacitances:

Grid to Plate	3.4	μ f.
Input	3.8	μ f.
Output	3.3	μ f.

from RMA release #169, March 28, 1939

Note: For characteristic curves refer to type 6J5G.

TRIODE

Coated unipotential cathode

Outline drawing.	9-11 or 9-41	Bulb.	T-9
Base	B5-82 or B6-8	intermediate shell octal	
	or B5-85 or B6-60	short intermediate shell octal	
Maximum diameter			1-9/32"
Maximum overall length			3-5/16"
Maximum seated height.			2-3/4"
Pin connections.			Basing 60

*Pin 1 - No connection

Pin 5 - Grid

Pin 2 - Heater

Pin 7 - Heater

Pin 3 - Plate

Pin 8 - Cathode

*Pin #1 omitted on Base Nos. B5-82 and B5-85.

Mounting position. any

Direct Interelectrode Capacitances**

Grid to plate: (g to p)	3.8	μf
Input: g to (h+k)	4.2	μf
Output: p to (h+k)	5.0	μf

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**External shield #308 connected to pin #8.
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Heater voltage	12.6	volts
Maximum plate voltage	300	volts
Maximum positive dc grid #1 voltage	0	volts
Maximum plate dissipation	2.5	watts
Maximum grid circuit resistance	1.0	megohm
Maximum heater-cathode voltage	90	volts
Maximum cathode current	20	ma

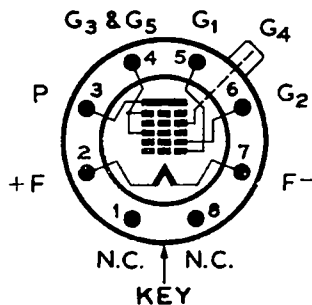
Heater voltage.	12.6	12.6	volts
Heater current.	150	150	ma
Plate voltage.	90	250	volts
Grid voltage	0	-8	volts
Amplification factor.	20	20	
Plate resistance.	6700	7700	ohms
Transconductance.	300	2600	μ mos
Plate current	10	9	ma
Grid #1 voltage (approx.) for $I_b = 10 \mu a$	-7.0	-18	volts

Refer to "Interpretation of Receiving Tube Ratings"

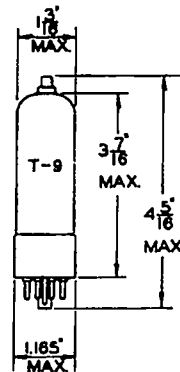
GENERAL DESCRIPTION

Application: The Ken-Rad 1B7G is a filament type pentagrid converter tube, especially designed for service in low drain battery operated receivers. The 1B7G is a glass tube equipped with an octal base.

Physical Characteristics:



Bottom View

RATING AND CHARACTERISTICS

Filament:

Voltage
Current

1.4 Volts
.100 Ampere

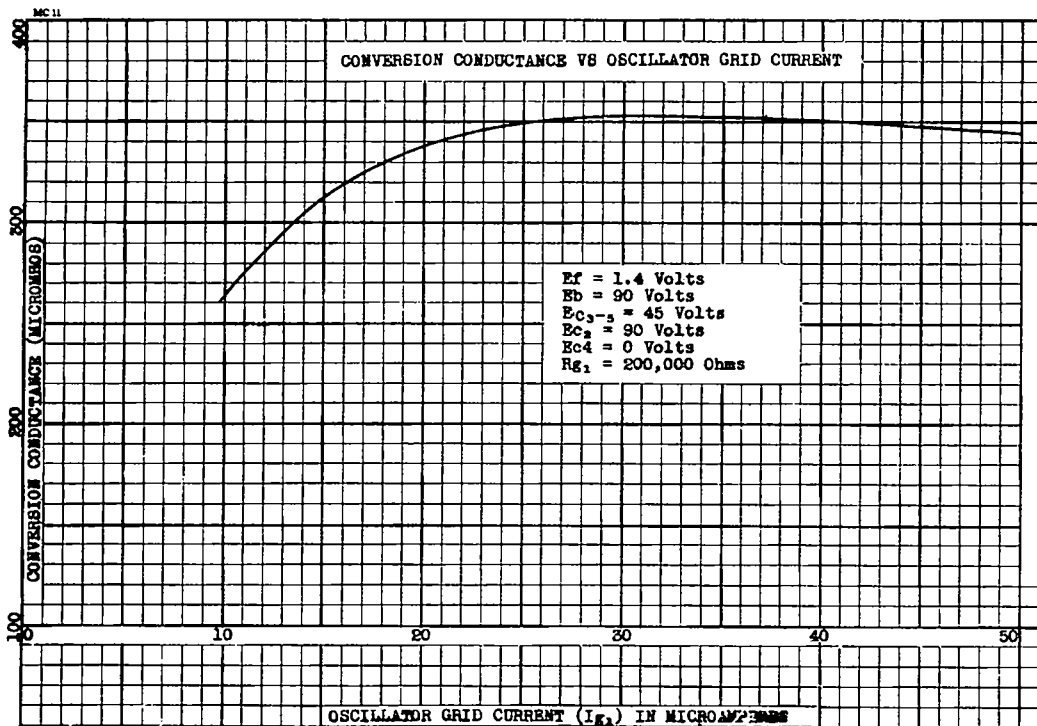
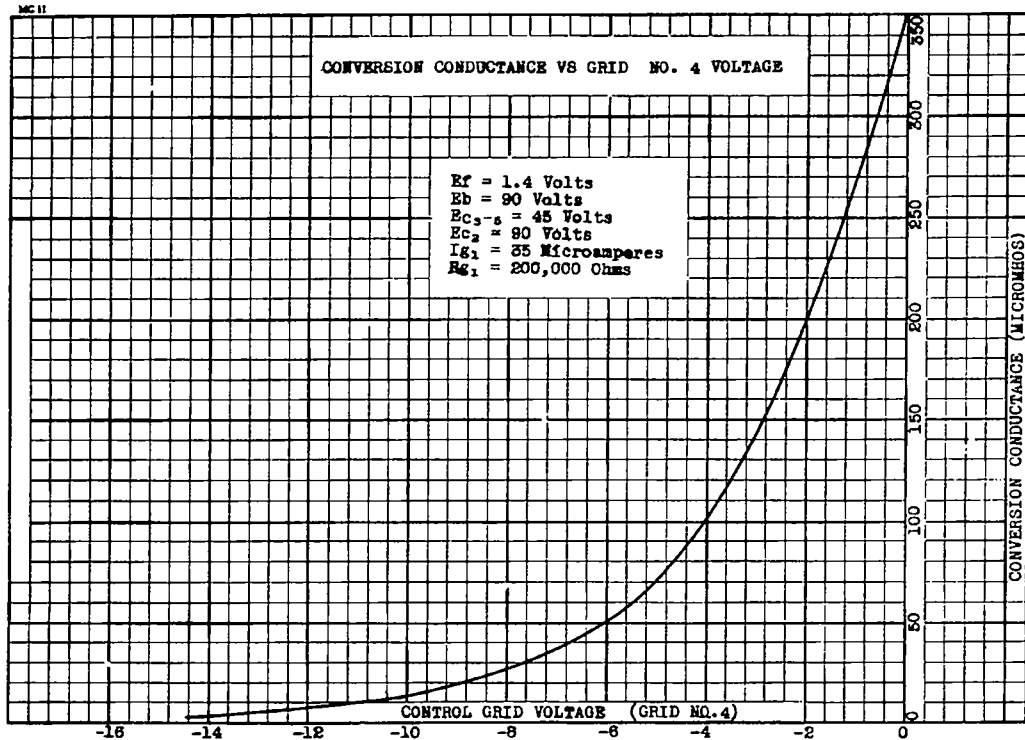
CONVERTER OPERATION

Plate Voltage	90	Volts
Screen Grid Voltage (Grids No. 3 and 5)	45	Volts
Anode Grid Voltage (Grid No. 2)	90	Volts
Control Grid Voltage (Grid No. 4)	0	Volts
Oscillator Grid Resistor (Grid No. 1)	200,000	Ohms
Plate Current	1.5	Milliamperes
Screen Current	1.3	Milliamperes
Oscillator Grid Current	35	Microamperes
Anode Grid Current	1.6	Milliamperes
Plate Resistance	.350	Megohm
Conversion Conductance	350	Micromhos
Conversion Conductance at -14.5 Volts	2	Micromhos Approx.
Oscillator S_m at $E_{c1} = 0$	900	Micromhos

Direct Interelectrode Capacitances: (With tube shield connected to negative filament)

Signal Grid to Mixer Plate (G4-P)	.34	μ mf.
Signal Grid to Oscillator Plate (G4-G2)	.26	μ mf.
Signal Grid to Oscillator Grid (G4-G1)	.12	μ mf.
Oscillator Grid to Oscillator Plate (G1-G2)	.90	μ mf.
Signal Input: G4 to (F+G ₁ +G ₂ +G ₃ +G ₅ +P+Shield)	7.0	μ mf.
Oscillator Output: G2 to (F+G ₁ +G ₂ +G ₃ +G ₅ +P+Shield)	4.2	μ mf.
Oscillator Input: G1 to (F+G ₁ +G ₂ +G ₃ +G ₅ +P+Shield)	4.0	μ mf.
Mixer Output: P to (F+G ₁ +G ₂ +G ₃ +G ₄ +G ₅ +Shield)	7.5	μ mf.

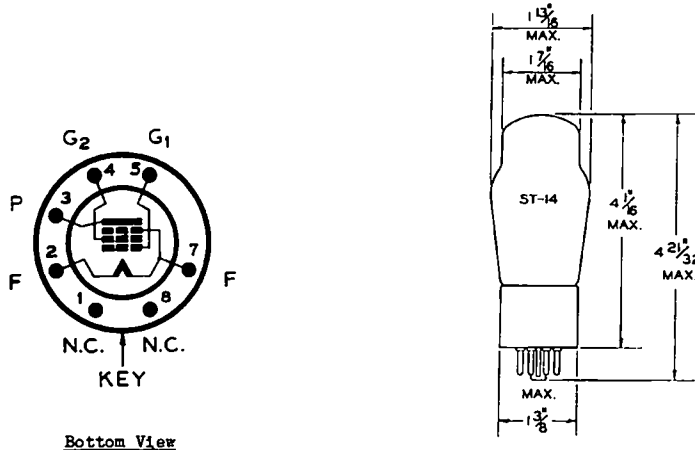
from RMA release #169, March 28, 1939



GENERAL DESCRIPTION

Application: The Ken-Rad 1J5G is a filament type power output pentode designed especially for battery operated receivers. The 1J5G is a glass tube equipped with an octal base and has electrical characteristics identical to those of type 950.

Physical Characteristics:

Bottom ViewRATING AND CHARACTERISTICS

Filament:

Voltage	2.0	Volts D.C.
Current	0.12	Ampere

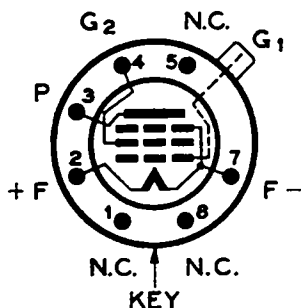
AMPLIFIER OPERATION (CLASS A)

Plate Voltage	135	Volts Max.
Screen Voltage	135	Volts Max.
Grid Voltage	-16.5	Volts
Plate Current	7.0	Milliamperes
Screen Current	2.0	Milliamperes
Mutual Conductance	950	Micromhos
Load Resistance	13,500	Ohms
Power Output	0.45	Watt
Amplification Factor	100	

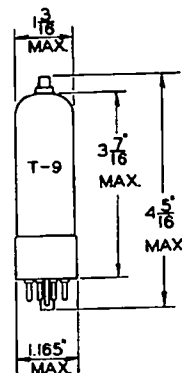
GENERAL DESCRIPTION

Application: The Ken-Rad 1P5G is a filament type RF pentode designed especially for service in low drain battery operated receivers as an RF, IF, or AF amplifier. The 1P5G is a glass tube equipped with an octal base.

Physical Characteristics:



Bottom View

RATING AND CHARACTERISTICS

Filament:

Voltage	1.4	Volts
Current	.05	Ampere

OPERATING CONDITIONS

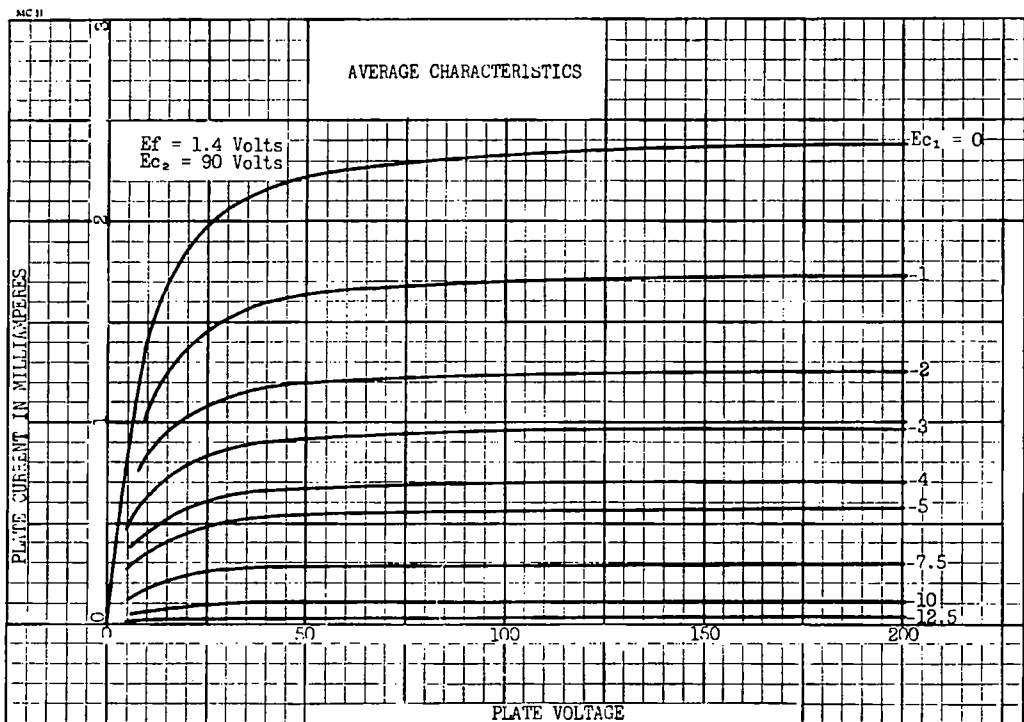
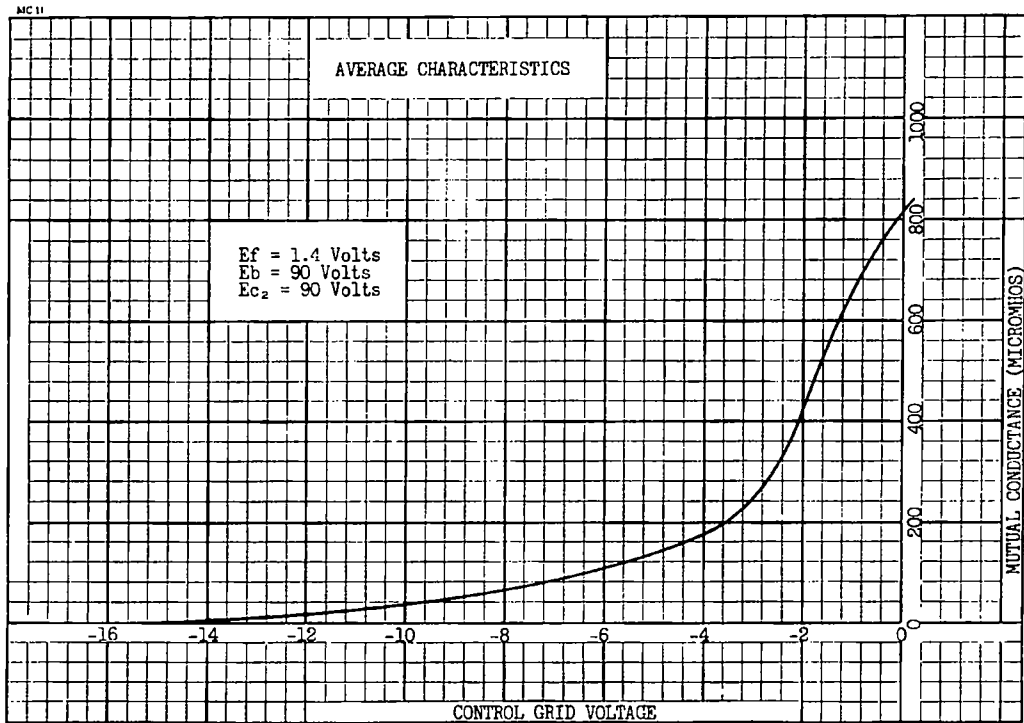
Plate Voltage	90	Volts
Screen Voltage	90	Volts
Grid Voltage*	0	Volts
Plate Current	2.3	Milliamperes
Screen Current	.7	Milliamperes
Plate Resistance (Approx.)	.8	Megohm
Mutual Conductance	800	Micromhos
Amplification Factor (Approx.)	640	
Mutual Conductance at $E_{c1} = -12$ Volts (Approx.)	10	Micromhos

* Negative filament return.

Direct Interelectrode Capacitances:

G_1-P (With tube shield)	.007	$\mu f.$ Max.
$G_2-(F+G_1+G_3)$	2.2	$\mu f.$
$F-(F+G_2+G_3)$	9.0	$\mu f.$

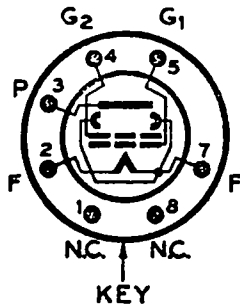
from RMA release #169, March 28, 1939



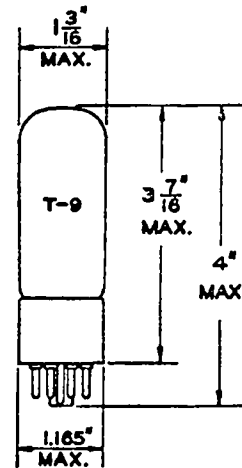
GENERAL DESCRIPTION

Application: The Ken-Rad 1Q5G is a filament type beam power output tube designed for applications requiring high efficiency and low distortion. The 1Q5G is a glass tube equipped with an octal base.

Physical Characteristics:



Bottom View

RATING AND CHARACTERISTICS

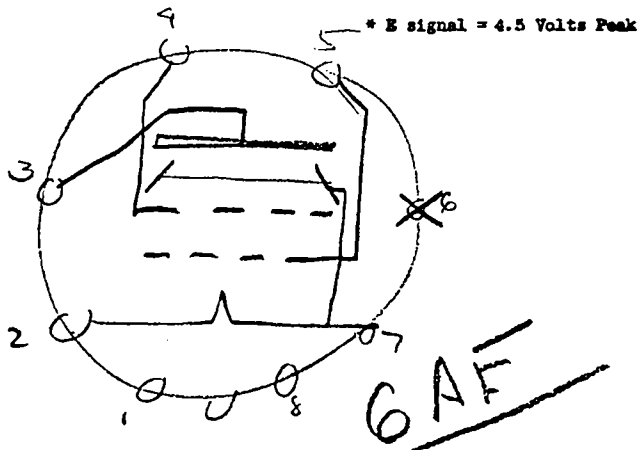
Filament:
Voltage
Current

1.4 Volts D.C.
.100 Ampere

AMPLIFIER OPERATION (CLASS A)

Plate Voltage
Screen Voltage
Control Grid Voltage
Plate Current
Screen Current
Mutual Conductance
Load Resistance
Power Output
Total Harmonic Distortion

90 Volts
90 Volts
-4.5 Volts
9.5 Milliamperes
1.6 Milliamperes
2,100 Micromhos
8,000 Ohms
.27 Watt *
7.5 Percent

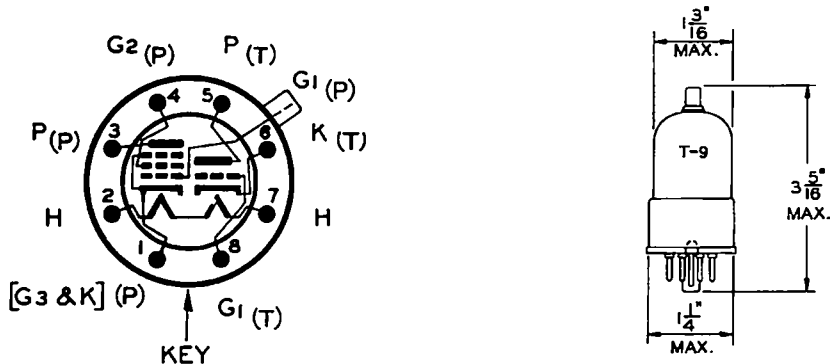


from RMA release #163,
Feb. 17, 1939

GENERAL DESCRIPTION

Application: The Ken-Rad 25B8GT is a cathode type duplex tube consisting of a pentode unit and a triode unit within a single envelope. The 25B8GT is a glass tube equipped with an octal base.

Physical Characteristics:

Bottom ViewRATING AND CHARACTERISTICS

Heater:

Voltage	25	Volts	AC or DC
Current	.150	Ampere	

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

OPERATING CONDITIONS

(Pentode Section)

Plate Voltage	100	Volts
Screen Voltage	100	Volts
Grid Voltage	-3	Volts
Plate Current	7.6	Milliamperes
Screen Current	2.0	Milliamperes
Mutual Conductance	2,000	Micromhos
Amplification Factor	370	
Plate Resistance	.185	Megohm
Control Grid Voltage For $S_m = 2$ Micromhos	-41	Volts

OPERATING CONDITIONS

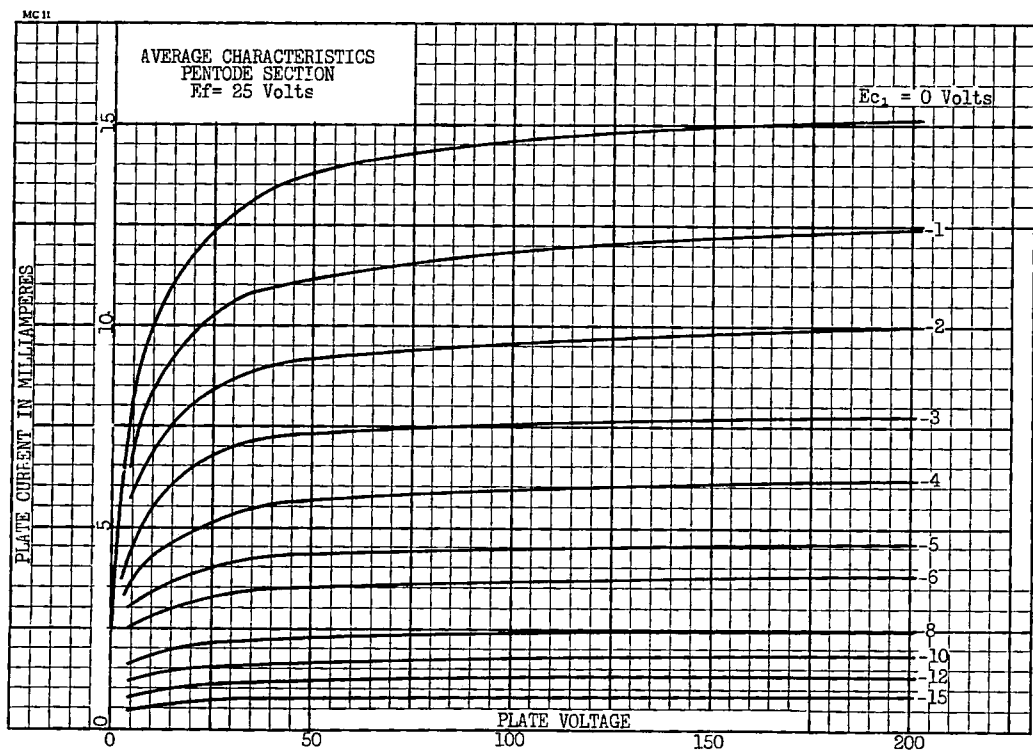
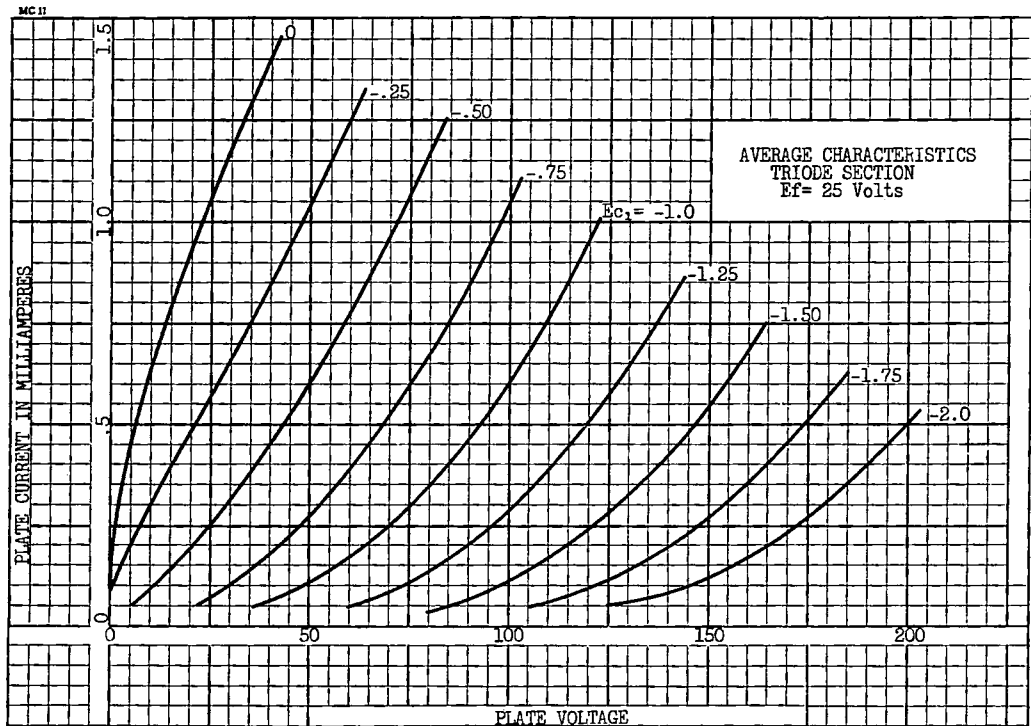
(Triode Section)

Plate Voltage	100	Volts
Grid Voltage	-1	Volt
Plate Current	.60	Milliampere
Mutual Conductance	1,500	Micromhos
Plate Resistance	.075	Megohm
Amplification Factor	112.5	
Approximate Grid Voltage For Plate Current Cut-Off	-2.5	Volts

Direct Interelectrode Capacitances:

Pentode G_1 to Plate	.02	$\mu\text{f.}$
Pentode Input	5.5	$\mu\text{f.}$
Pentode Output	10.0	$\mu\text{f.}$
Triode Grid to Plate	2.2	$\mu\text{f.}$
Triode Grid to Cathode	5.0	$\mu\text{f.}$
Triode Plate to Cathode	4.6	$\mu\text{f.}$
Pentode G_1 to Triode Grid	.02	$\mu\text{f.}$
Pentode Plate to Triode Grid	.075	$\mu\text{f.}$
Pentode G_1 to Triode Plate	.009	$\mu\text{f.}$

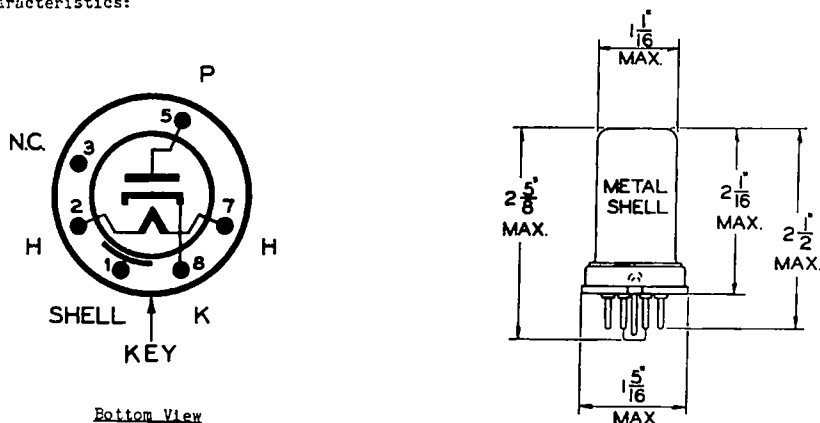
from RMA release #169, March 28, 1939



GENERAL DESCRIPTION

Application: The Ken-Rad 25Z4 is a cathode type half-wave rectifier designed for operation in transformerless receivers having the filaments connected in series. The base is of the small octal type and the tube elements are enclosed in a metal shell which is connected to one of the base pins.

Physical Characteristics:

RATING AND CHARACTERISTICS

Heater:

Voltage
Current

25.0 Volts AC or DC
0.3 Ampere

RECTIFIER OPERATION (HALF-WAVE)

A.C. Plate Voltage (RMS)
Load Current
Peak Plate Current

125 Volts Max.
125 Ma. Max.
750 Ma. Max.

Average Tube Voltage Drop

12 Volts at 125 Ma. Load Current

from RMA release #153, Dec. 12, 1938

METAL TUBES



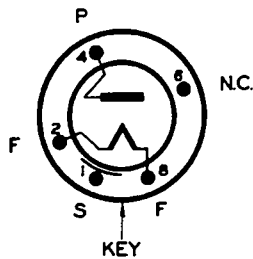
KEN-RAD-2W3

Page One

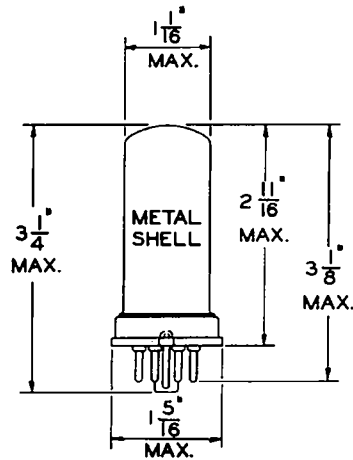
GENERAL DESCRIPTION

Application: The Ken-Rad 2W3 is a filament type half-wave rectifier designed for application where the total "B" drain is not high. The base is of the small octal type and the tube elements are enclosed in a metal shell which is connected to one of the base pins.

Physical Characteristics:



Bottom View



RATINGS AND CHARACTERISTICS

Filament:

Voltage
Current

2.5 Volts A.C.
1.5 Amperes

HALF-WAVE OPERATION

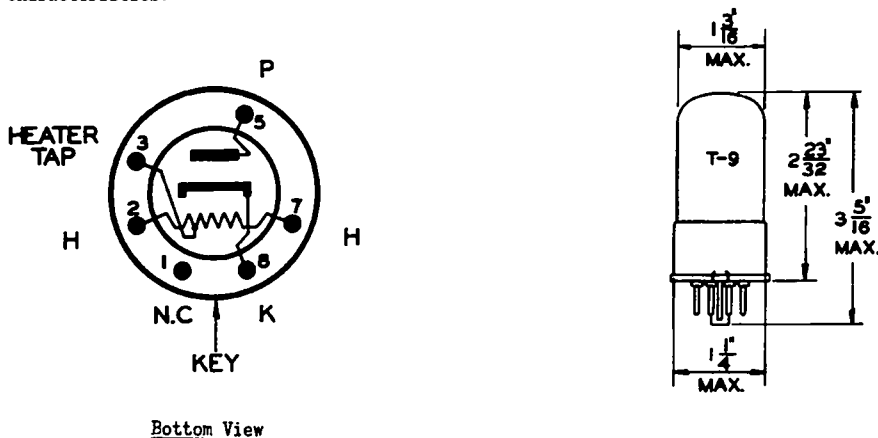
A.C. Plate Voltage (RMS)
D.C. Load Current

350 Volts Max.
55 Ma. Max.

from RMA release #148, May 2, 1938

GENERAL DESCRIPTION

Application: The Ken-Rad 35Z5GT is a cathode type half-wave rectifier designed for service in AC-DC receivers. It features a 35 volt 150 milliamper heater having a tap brought out from the heater so that with proper external connections a single pilot lamp can be lighted to nominal brilliancy. It is recommended that the plate current of the rectifier be passed through the pilot lamp and the tapped section of the heater. This is accomplished by connecting the plate of the rectifier to the tap on the heater. The Ken-Rad 35Z5GT is a glass tube equipped with an octal base.

Physical Characteristics:RATING AND CHARACTERISTICS**Heater:**

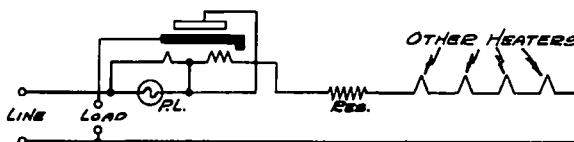
Voltage	35.0	Volts AC or DC
Current	.150	Ampere

Note: With 35 volts RMS between pins 2 and 7, the open circuit voltage between pins 2 and 3 is 7.5 volts RMS.

* MAXIMUM CONDITIONS

AC Plate Voltage (RMS)	125	Volts	Max.
DC Load Current with No. 40 or No. 40A Pilot Lamp	50	Milliamperes	Max.
DC Load Current with No. 50 or No. 51 Pilot Lamp	60	Milliamperes	Max.
DC Load Current without Tap Connected	100	Milliamperes	Max.
<u>Average Tube Voltage Drop</u>	16	Volts at 200 Milliamperes	

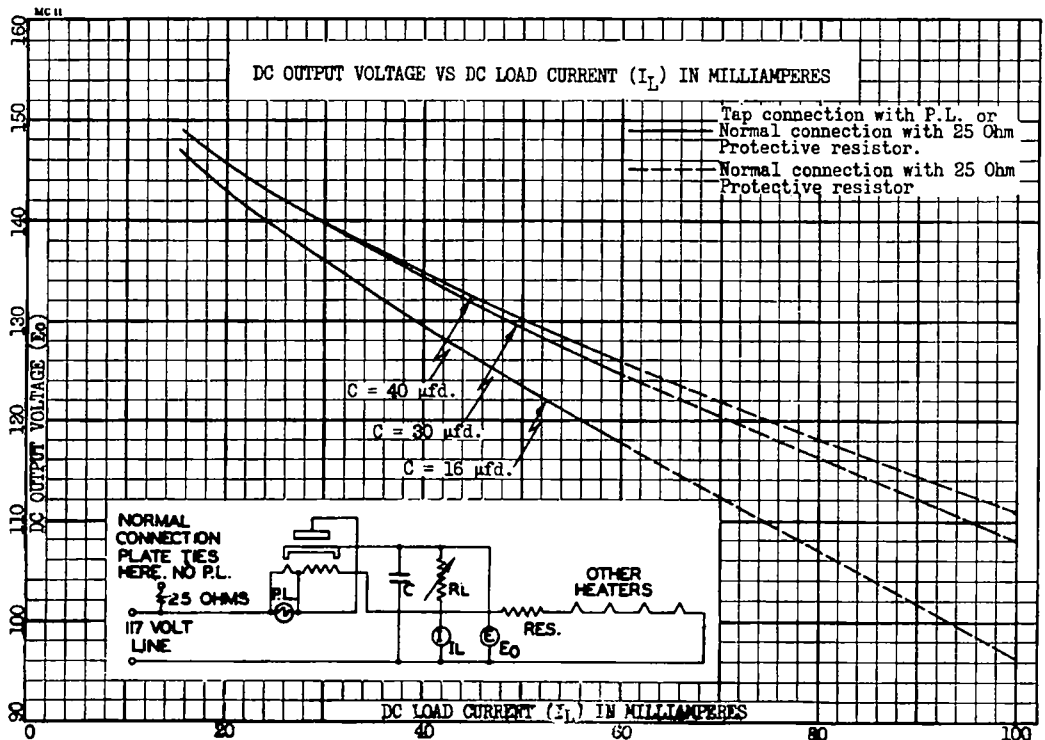
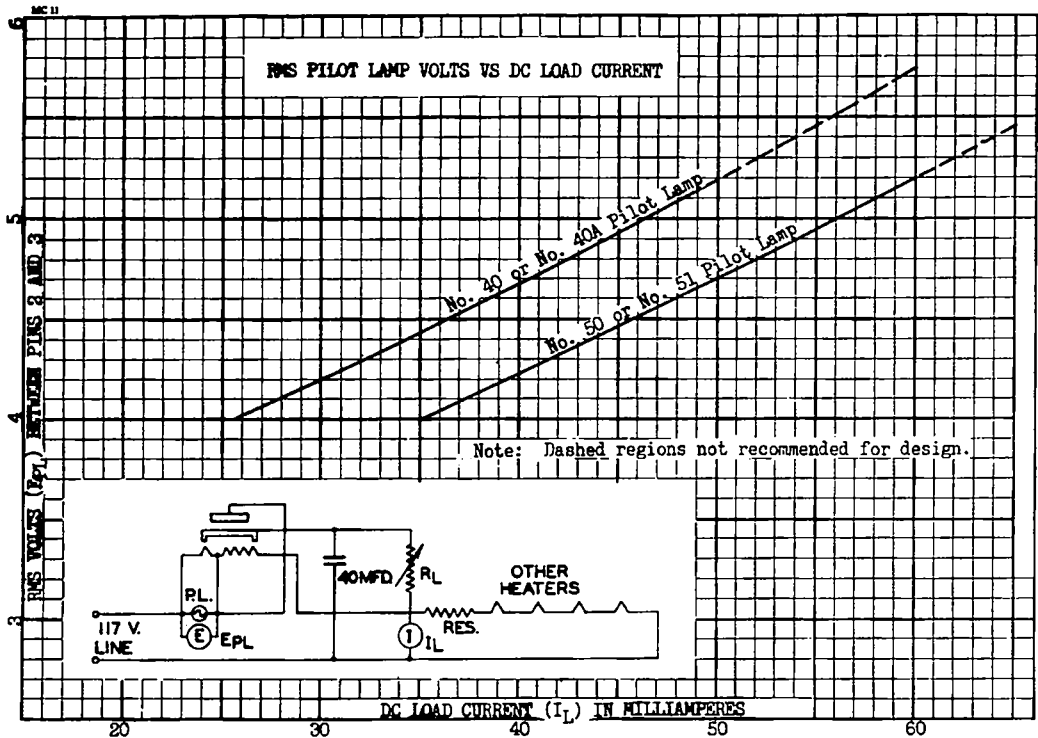
* The ratings marked maximum are design centers for a line voltage of 117 volts.
 Note: No. 40 and No. 40A lamps are .15 Amp. at 6.3 Volts.
 No. 50 and No. 51 lamps are .20 Amp. at 7.5 Volts.

TYPICAL CONDITIONS-TAP CONNECTION

Note: Drop across resistance and all heaters should total 117 volts at .150 Amp.

RECOMMENDATIONS

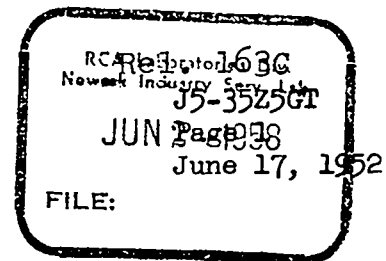
1. It is recommended that the pilot lamp and DC load current should be such that the potential between base pins 2 and 3 does not exceed 5.2 volts RMS at 117 volts line. This voltage should be measured with a thermal meter or a meter that will read RMS voltages. Rectifier type voltmeters, although calibrated in RMS volts, measure average volts and should not be used for this measurement.
2. It is recommended that the input filter condenser be limited to 40 microfarads.
3. Although it is possible to use DC load currents above 60 milliamperes in combination with high current pilot lamps such as the No. 44 and No. 46, this operation is not recommended because with pilot lamp failure excessive voltage appears between pins 2 and 3 causing heater burn out.
4. If the 35Z5GT is used without the tap connection it is recommended that a 25 ohm protective resistor be used in series with the plate.
5. Voltages should not be applied to the socket when installing or removing tubes.



JETEC DATA
JOINT ELECTRON TUBE ENGINEERING COUNCIL
COMMITTEE ON RECEIVING TUBES

JETEC TYPE 35Z5GT

DIODE



MECHANICAL DATA

Coated unipotential cathode	
Outline drawing.	9-11 or 9-41 Bulb. T-9
Base	B6-8 intermediate shell octal 6-pin
	or B6-60 short intermediate shell octal 6-pin
Maximum diameter	1-9/32"
Maximum overall length	3-5/16"
Maximum seated height	2-3/4"
Pin connections.	Basing 6AD
Pin 1 - No connection	Pin 5 - Plate
Pin 2 - Heater	Pin 7 - Heater
*Pin 3 - Heater tap	Pin 8 - Cathode

*Panel lamp heater section is between pins 2 and 3.

Mounting position. any

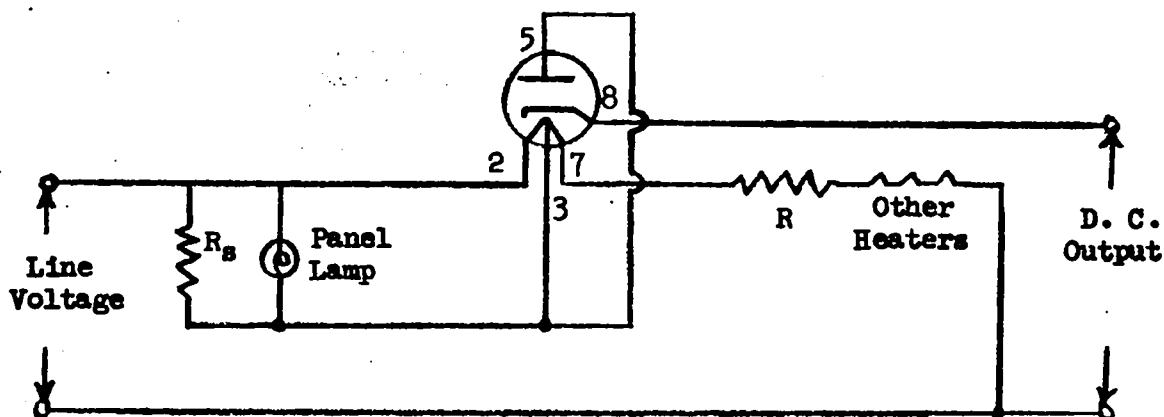
ELECTRICAL DATA

<u>Ratings</u>	<u>Without Panel Lamp</u>	<u>With No. 40 or No. 47 Panel Lamp</u>
Heater voltage (ac or dc)		
Entire heater (pins 2 and 7)	35	35 volts
Panel lamp section (pins 2 and 3).	7.5	5.5 volts
Heater current		
Between pins 2 and 7	150	- ma
Between pins 3 and 7	-	150 ma
Maximum AC plate voltage (r.m.s.)	235	volts
Maximum peak inverse voltage	700	volts
Maximum steady state peak plate current.	600	ma
Maximum DC heater-cathode voltage.	350	volts
Maximum panel lamp section r.m.s. voltage when panel lamp fails.	15	volts
Maximum steady-state DC output current:		
With panel lamp and no shunting resistor . .	60	ma
With panel lamp and shunting resistor. . . .	90	ma
Without panel lamp	100	ma
Maximum 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 with tube conducting 200 ma DC plate current	18	volts

Continued on Page 2

ELECTRICAL DATA (Continued)Typical Operation with No. 40 or No. 47 Panel Lamp
In Circuit Below with Capacitor Input to Filter

A.C. Plate supply voltage (RMS)	117	117	117	117	235	volts
Filter input capacitor	40	40	40	40	40	μ f
Minimum total effective plate supply impedance	15	15	15	15	100	ohms
Panel lamp shunting resistor	-	300	150	100	-	ohms
D.C. output current.	60	70	80	90	60	ma



Drop across R and all heaters (with panel lamp) should equal the line voltage at 0.15 ampere.
 R_s = shunting resistor required when DC output current exceeds 60 milliamperes.

Typical Operation Without Panel Lamp in Conventional Half-wave Circuit With
Capacitor Input to Filter: (plate current must not flow through tap section)

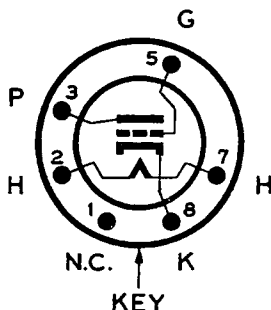
A.C. plate supply voltage (RMS)	117	235	volts
Filter input capacitor.	40	40	μ f
Minimum total effective plate supply impedance	15	100	ohms
D.C. output voltage at input to filter (approx.):			
At 50 ma (half load)	140	280	volts
At 100 ma (full load)	120	235	volts
Difference (voltage regulation)	20	45	volts
Percentage regulation.	14	16	%
D.C. output current.	100	100	ma

Refer to "Interpretation of Receiving Tube Ratings"

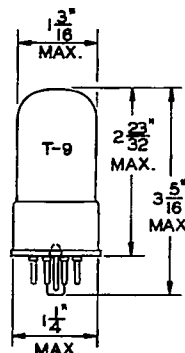
GENERAL DESCRIPTION

Application: The Ken-Rad 6AC5GT is a cathode type power amplifier triode. It may be used for operation in positive grid regions with a type 76 as a driver. The 6AC5GT is a glass tube equipped with an octal base.

Physical Characteristics:



Bottom View

RATING AND CHARACTERISTICS

Heater:

Voltage
Current

6.3 Volts AC or DC
0.4 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

STATIC AND DYNAMIC CHARACTERISTICS

Plate Voltage	250	Volts Max.
Grid Voltage	+13	Volts
Plate Current	32	Milliamperes
Grid Current	5	Milliamperes
Plate Resistance	36,700	Ohms
Mutual Conductance	3,400	Micromhos
Amplification Factor	125	

CLASS B OPERATION WITH TWO TUBES

Plate Voltage	250 Max.	Volts
Peak Plate Current (Per Tube)	110 Max.	Milliamperes
Average Plate Dissipation	10 Max.	Watts
Grid Voltage	0	Volts
Peak AF Voltage Grid to Grid	70	Volts
Zero-Signal DC Plate Current (Per Tube)	2.5	Milliamperes
Load Resistance (Plate to Plate)	10,000	Ohms
Power Output	8	Watts Approx.
Peak Input Power Applied between Grids	950	Milliwatts

DYNAMIC-COUPLED POWER AMPLIFIER OPERATIONWITH TYPE 76 AS DRIVER

Plate Supply Voltage	250	Volts Max.
External Grid Voltage*	0	Volts
Plate Dissipation	10	Watts Max.
Plate Current	32	Milliamperes
Plate Current of Driver	5.5	Milliamperes
Input Signal to Driver	16.5	Volts RMS
Load Resistance	7,000	Ohms
Total Harmonic Distortion	10	Percent
Power Output**	3.7	Watts

*Bias voltage for both the 6AC5GT and driver is developed automatically by the dynamic-coupled connection. A 25,000 ohm resistor should be connected between grid and cathode of the power tube to prevent a current surge occurring when the tube is warming up. Total resistance in the type 76 grid circuit should not exceed 1 megohm.

** A power output of 4.3 watts may be obtained if the driver is operated up to the point of grid current flow. Distortion is approximately 16% under these conditions.

Note: The Ken-Rad Tube and Lamp Corporation assumes no liability for the use of the dynamic-coupled circuit.

Note: For characteristic curves refer to the Type 6AC5G.

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OWENSBORO, KENTUCKY

KEN-RAD 6AH7GT



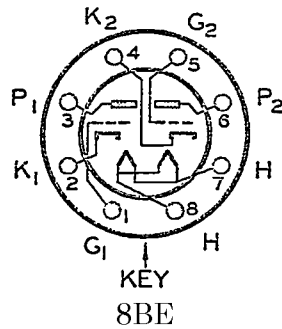
Page One

GENERAL DESCRIPTION

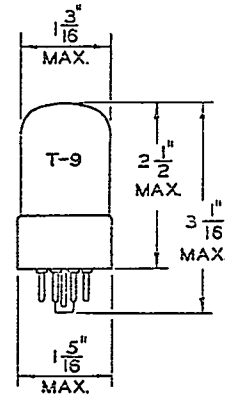
Application: The Ken-Rad 6AH7GT is a cathode type of tube consisting of two triodes within a single envelope. It was designed for use in converter and audio applications. The 6AH7GT is a glass tube equipped with an octal base.

Physical Characteristics:

Mounting Position - Any



Bottom View



RATINGS AND CHARACTERISTICS

Heater:

Voltage
Current

6.3 Volts AC or DC
.3 Ampere

RATINGS

Maximum Plate Voltage	300 Volts/Plate
Maximum Plate Dissipation	2.5 Watts/Plate

Typical Operating Conditions and Characteristics: (Each Triode Section)

Plate Voltage	250 Volts
Grid Voltage	-9 Volts
Amplification Factor	16
Plate Resistance	6600 Ohms
Plate Current	12 Ma.
Transconductance	2400 Micromhos
Plate Current with $E_c = -30$ Volts	10 μ Amperes

Direct Interelectrode Capacitances: (Max.) With tight fitting shield.

	<u>G - P</u>	<u>G - K</u>	<u>P - K</u>	<u>P - P</u>	<u>G - G</u>
Section 1	2.2	3.2	3.0		
Section 2	3.0	2.9	2.6	.4	.06

MCIA

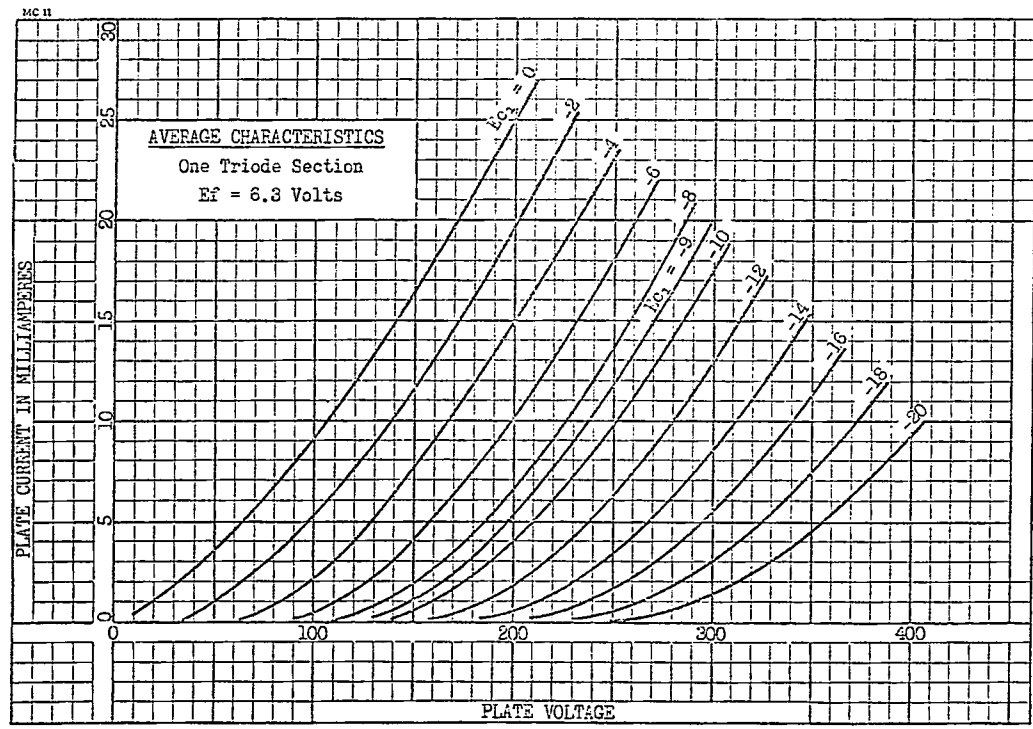
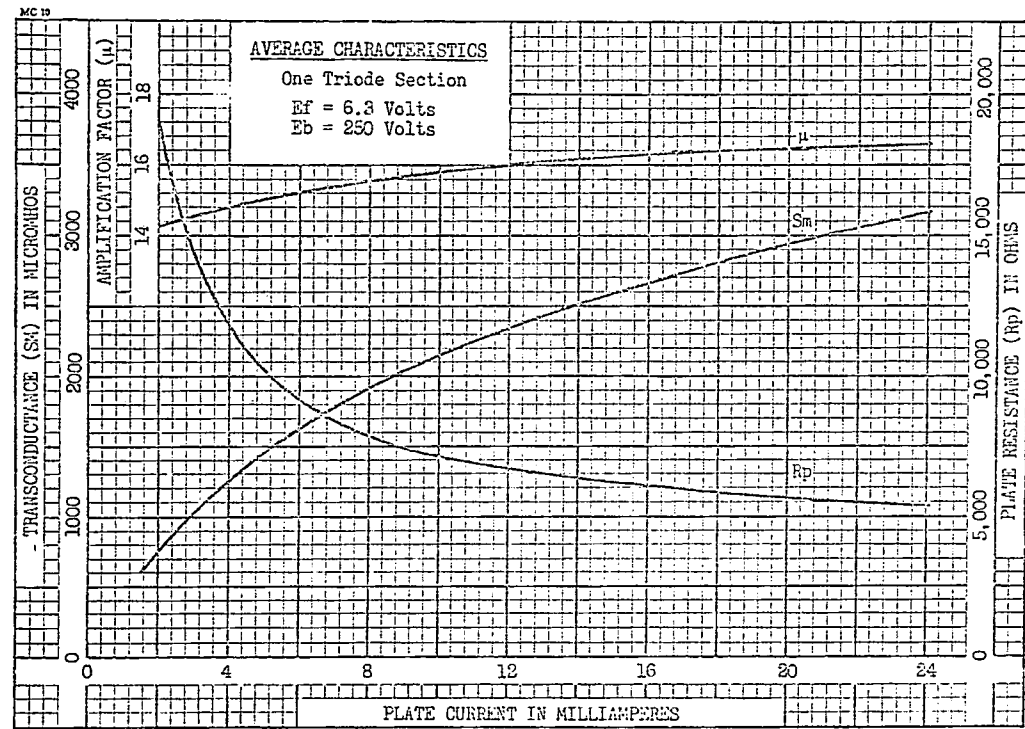
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DATE 1-15-41



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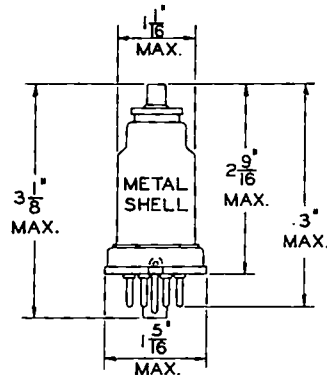
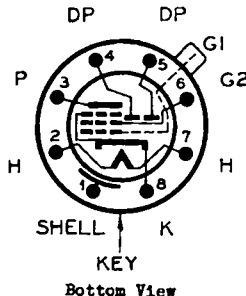




GENERAL DESCRIPTION

Application: The Ken-Rad 6B8 is a cathode type duplex tube consisting of a pentode and two diodes in a single envelope. The pentode section may be operated in radio, intermediate, or audio frequency amplifiers and the diodes used for detection and automatic volume control. The variety of functions which are possible make the tube particularly suited to radio receivers where the number of tubes is a consideration. The suppressor grid of the pentode is internally connected to the cathode. The base is of the small octal type and the tube elements are enclosed in a metal shell which is connected to one of the base pins.

Physical Characteristics:



RATING AND CHARACTERISTICS

Heater:		
Voltage	6.3	Volts AC or DC
Current	0.3	Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

AMPLIFIER OPERATION (R.F. or I.F.) PENTODE SECTION

Plate Voltage	250 Max.	Volts
Screen Voltage	125 Max.	Volts
Grid Voltage	-3	Volts
Plate Current	10.0	Milliamperes
Screen Current	2.3	Milliamperes
Plate Resistance	0.6 Approx.	Megohm
Amplification Factor	800 Approx.	
Mutual Conductance	1325	Micromhos
*Grid Voltage	-21 Approx.	Volts

*Voltage for cathode current cut-off.

DIODE OPERATION

The two diode plates are mounted about the common cathode sleeve but are otherwise isolated from each other and the pentode unit. These diodes may be operated singly as half-wave rectifiers, tied together as a single half-wave rectifier or operated in a full-wave arrangement. The full-wave circuit will provide about half the voltage obtainable from the half-wave circuit.

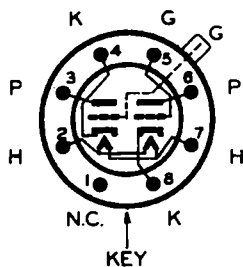
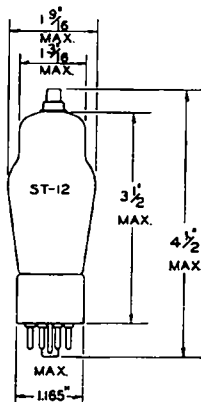
Automatic volume control may be effected by applying the D.C. voltage developed in the diode load to the control elements of preceding amplifier tubes. This D.C. voltage may be obtained from the same diode circuit as used for detection or from one of the diode plates operating separately as a bias rectifier.

Direct Interelectrode Capacitances: Pentode Unit

$G_1 - P$	0.005	$\mu\text{f. Max.}$ ✓
$G_1 - (K + G_2 + G_3)$	6.0	$\mu\text{f.}$ ✓
$P - (K + G_2 + G_3)$	9.0	$\mu\text{f.}$ ✓

KEN-RAD- 6C8G**Page One**GENERAL DESCRIPTION

Application: The 6C8G is a cathode type double-triode designed for use as a voltage amplifier. The cathode, grid, and plate of each triode are brought out to individual connections so that a number of specialized functions are possible. It is especially recommended for phase inverter service in automobile receivers and other applications where heater current consumption must be held to a minimum. The 6C8G is a glass tube equipped with an octal base.

Physical Characteristics:Bottom ViewRATING AND CHARACTERISTICS**Heater:**

Voltage
Current

6.3 Volts AC or DC
.3 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

CLASS A AMPLIFIER - ONE TRIODE

Plate Voltage	250	Volts Max.
Grid Voltage	-4.5	Volts
Plate Current	3.1	Milliamperes
Plate Resistance	26,000	Ohms
Mutual Conductance	1,450	Micromhos
Amplification Factor	38	

TYPICAL PHASE INVERTER OPERATION

*Plate Supply Voltage	250	250	Volts
Grid Voltage	-3.0	-3.0	Volts
Plate Current Per Triode	1.7	1.0	Milliamperes
Plate Load Resistor	50,000	100,000	Ohms
**Grid Return Resistance of Following Tubes	100,000	500,000	Ohms
Voltage Amplification	45	48	
Maximum Output Voltage	60	80	Volts RMS
***Self-Biasing Resistor	900	1,500	Ohms

*Effective plate voltage will be this value minus the voltage drop in the plate resistor.

**For values of voltage divider to inverter grid see figure on page 2.

***No by-pass condenser necessary in this application.

Direct Interelectrode Capacitances:

CG-P	°2.4	°°2.5	µf.
CG-K	°2.5	°°3.4	µf.
CP-K	°3.9	°°3.5	µf.
CG-G		.1	µf.
CP-P		1.5	µf.

°Values for triode having its grid brought out to the top cap.

°°Values for triode having its grid brought out to a base pin.

KEN-RAD - 6F8G

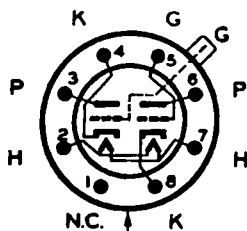


Page One

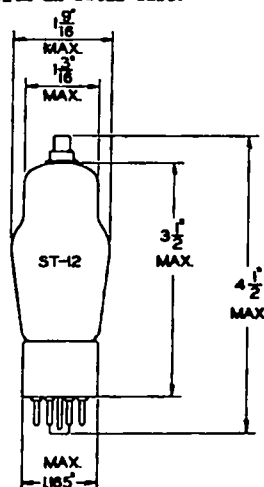
GENERAL DESCRIPTION

Application: The Ken-Rad 6F8G is a cathode type twin triode designed for use as a voltage amplifier. Electrical characteristics of the individual sections of this tube are identical to those of type 6F5G. The 6F8G is a glass tube equipped with an octal base.

Physical Characteristics:



Bottom View



RATING AND CHARACTERISTICS

Heater:

Voltage 6.3 Volts A.C. or D.C.
Current .6 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

CLASS A AMPLIFIER - ONE TRIODE SECTION

Plate Voltage	250	Volts Max.
Grid Voltage	-8	Volts
Plate Current	9.0	Milliamperes
Plate Resistance	7700	Ohms Approx.
Amplification Factor	80	
Mutual Conductance	2600	Micromhos Approx.

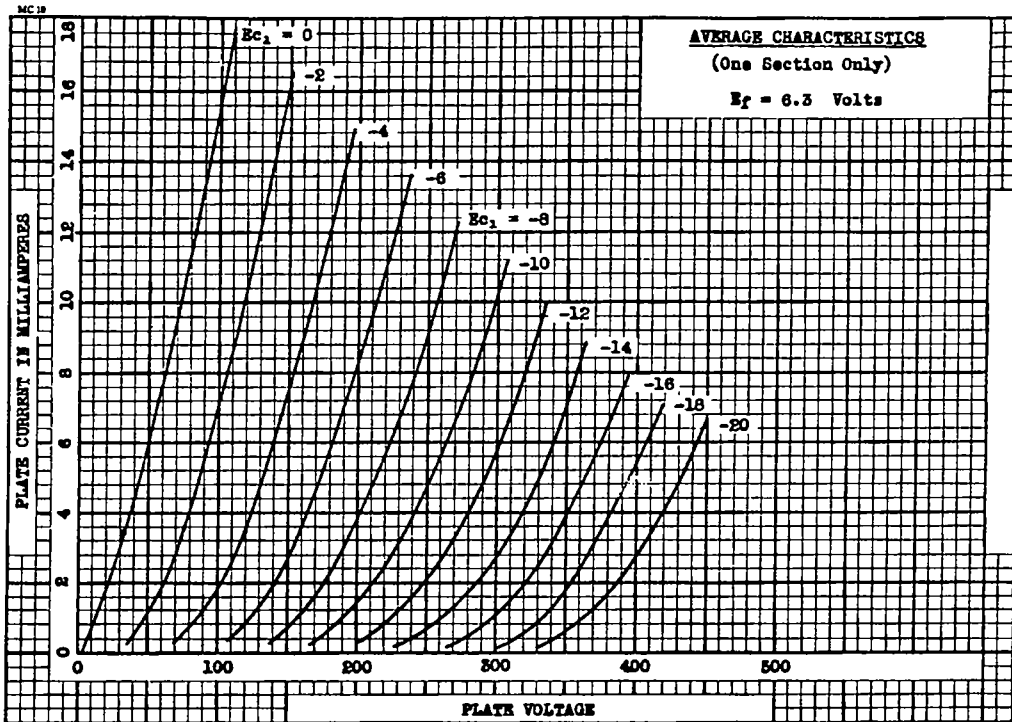
Direct Interelectrode Capacitances:

C _G -P	4.2°	4.5°	μmf.
C _G -K	5.0°	5.5°	μmf.
C _P -K	2.0°	1.5°	μmf.
C _G -G		.18	μmf.
C _P -P		1.2	μmf.
C _G -P		.2*	μmf.

°Values for triode having its grid brought out to the top cap.

°°Values for triode having its grid brought out to a base pin.

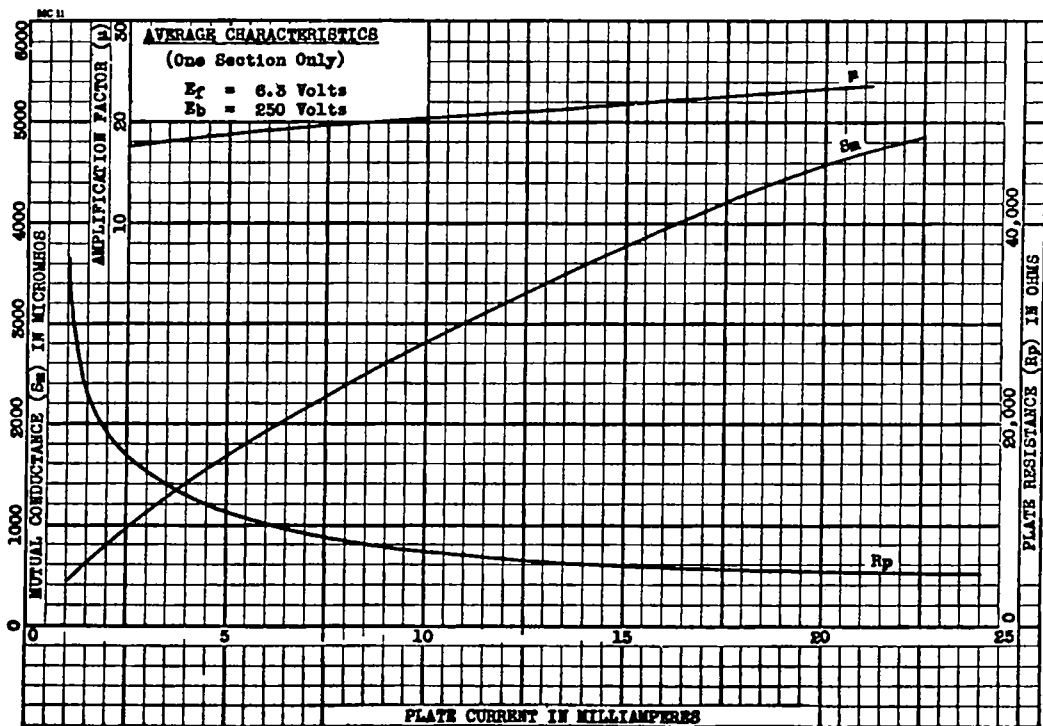
*Measured from top-cap grid to plate of other triode.



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KEN-RAD TUBE & LAMP CORPORATION
OWENSBORO, KENTUCKY

DATE 9-24-37



COMMERCIAL ENGINEERING DEPARTMENT

KEN-RAD TUBE & LAMP CORPORATION
OWENSBORO, KENTUCKY

DATE 9-24-37

Issue of 9-24-37

KEN-RAD- 6G6G



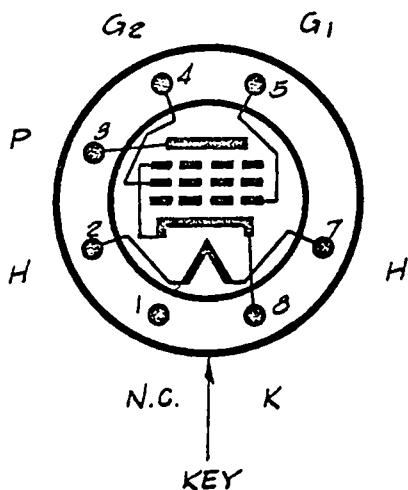
Page One

Tentative Data

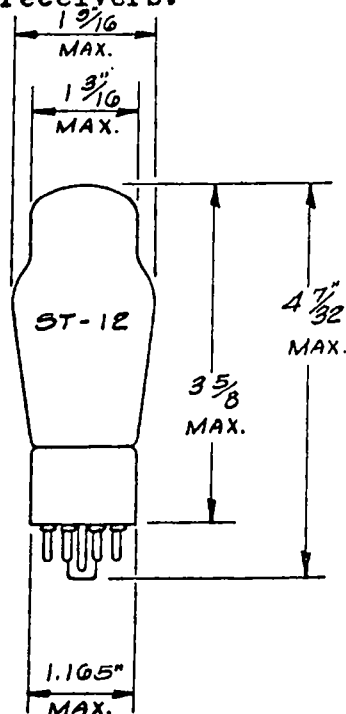
GENERAL DESCRIPTION

Application: The Ken-Rad 6G6G is a cathode type power amplifier pentode designed for use in output stages where low power output suffices and where maximum efficiency is of prime importance. The 6G6G is a glass tube equipped with an octal base. This tube is not recommended for service in automobile receivers.

Physical Characteristics:



Bottom View



RATING AND CHARACTERISTICS

Heater:

Voltage	6.3 Volts AC or DC
Current	.15 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible



Tentative Data

AMPLIFIER OPERATION - SINGLE TUBE CLASS A

Plate Voltage	135	180 Max.	Volts
Screen Voltage	135	180 Max.	Volts
Grid Voltage	-6.0 ^o	-9.0*	Volts
Plate Current	11.5	15.0	Ma
Screen Current	2.0	2.5	Ma
Plate Resistance	170,000	175,000	Ohms
Amplification Factor	360	400	
Mutual Conductance	2100	2300	Micromhos
Load Resistance	12,000	10,000	Ohms
Power Output	.6	1.1	Watts
Total Harmonic Distortion	7.5	10	Per cent
**Self-Bias Resistor	440	510	Ohms

^oTransformer or impedance-coupled input systems are recommended. If resistance coupling is used the DC resistance in the grid return must be limited to .5 megohm for self-biased and fixed-bias conditions provided that the heater voltage does not exceed rated value by more than 10% under all operating conditions.

*Transformer or impedance-coupled input systems are recommended. If resistance coupling is used the DC resistance in the grid return must be limited to .5 megohm for self-biased conditions and .05 megohm for fixed-biased conditions provided that the heater voltage does not exceed rated value by more than 10% under all operating conditions.

**Single tube.



Ken-Rad

Radio Tubes



ENGINEERING BULLETIN

"OPERATION CHARACTERISTICS OF THE TYPE 6L7"

CEB 36-6

April 1 1936

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THE KEN-RAD CORPORATION
INCORPORATED

OWENSBORO - KENTUCKY



"OPERATION CHARACTERISTICS OF THE TYPE 6L7"

The 6L7 pentagrid mixer, because of its numerous electrodes and their control action, is a versatile tube and may be used in many types of radio and audio frequency circuits. Although designed for mixer operation, it may be used as a radio frequency amplifier having advantage over conventional pentodes, or as an audio amplifier with fixed or variable bias. The control action of the No. 3 grid enables the tube to be used as a controlled audio amplifier tube. This feature can be used to advantage to improve the overall A.V.C. curve of a receiver or to effect some special function as volume expansion. This bulletin shows typical operation of the tube as a mixer, and characteristic curves that will be helpful in the design of other circuits.

Though concerned mainly with the characteristics of the 6L7 when used in conventional mixer circuits, it is not out of place to mention the advantages of this type of mixer over converter operation with the pentagrid types or operation of suppressor-modulated pentode mixers.

The 6L7 construction incorporates a cathode, five grids, and a plate. The functions of the grids in mixer operation are as follows. The No. 1 grid is the signal-input grid. The



No. 2 grid and the No. 4 grid are screen grids to shield the oscillator (No. 3) grid from the input circuit and to raise the effective plate resistance of the tube. The No. 3 grid is the oscillator-input grid and the No. 5 grid is a suppressor. The 6L7 construction minimizes the space charge coupling between oscillator input and signal input grids and results in a mixer tube having satisfactory conversion gain even at high frequencies. This space charge coupling is one of the inherent shortcomings of the pentagrid mixer tubes. The suppressor modulated pentode minimizes this space-charge coupling but it has the disadvantage of a low internal impedance and requires a large oscillator swing for a satisfactory conversion conductance. The high oscillator voltage required causes difficulty in oscillator design, especially at high frequencies. The high internal impedance of the 6L7 is also of advantage in receivers having high-gain intermediate frequency systems.

The 6L7 has a high input capacity to its oscillator grid, and in receivers requiring a wide tuning range, the oscillator constants must be designed to minimize the effect of this capacity. An oscillator coil with the 6L7 No. 3 grid connected across only a portion of the total inductance reduces the effective capacity and results in a wider frequency coverage. Two families of curves, showing conversion conductance versus oscillator grid current, taken with a tapped coil, are



included in this bulletin.

Ratings for amplifier and mixer operation are shown on page 8 . As a radio frequency amplifier the tube operates with -3 volts on the No. 1 and No. 3 grids, 100 volts on the screen, and 250 volts on the plate. Performance as an amplifier is similar to conventional R.F. pentodes but this tube may be controlled in a manner to improve the A.V.C. characteristic of a receiver. This is accomplished by applying A.V.C. voltage to both No. 1 and No. 3 grids. A curve showing transconductance from grid No. 1 to plate versus grid No. 1 volts for several values of grid No. 3 volts is shown on page 9 . The curve taken with grid No. 3 equal to -3 volts is similar to most remote cut-off R.F. pentodes and indicates that with a fixed bias of -3 volts on the No. 3 grid more than 30 volts negative is required on the No. 1 grid to reduce the transconductance below 10 micromhos. If both grid No. 3 and grid No. 1 are A.V.C. controlled the effect is a sharp cut-off with actual operation over a remote cut-off curve. For example, with the potential of grid No. 1 and grid No. 3 both equal to -15 volts the transconductance is 4.6 micromhos. The operating line is the solid curve marked $E_{c_3} = -15$. It can be seen that large signal amplitude may be applied with little resulting distortion.

There are two ratings for mixer operation. One condition



is with a No. 1 grid voltage of -3, and a screen voltage of 100. The other condition is with a No. 1 grid voltage of -6 and a screen grid voltage of 150. These two ratings are necessary because of an unusual phenomenon that takes place at high frequencies with the low voltage rating. With the low bias at high frequencies the No. 1 grid draws current in spite of its negative potential. This is the result of a relation between the time of the electron travel between cathode and No. 3 grid and the frequency at which the potential of the No. 3 grid is fluctuating. At these high frequencies electrons approaching the No. 3 grid are repelled on negative swings of the grid and fall back to the No. 1 grid and cause a current to flow in the external circuit. A negative bias of -6 volts is required to overcome this effect. With the additional bias the screen potential must be increased to 150 volts to raise the conversion conductance to a value comparable to the low voltage condition. The 150 volt rating is recommended for all-wave receivers and the 100 volt rating for use only at broadcast frequencies.

On page 10 are curves of conversion conductance versus oscillator-grid bias for several values of oscillator grid swing. A family of curves is shown for both mixer ratings. With these curves performance of the 6L7 can be predicted. Although for the same oscillator swing the 100 volt rating



gives the highest conversion conductance, the curves for the 150 volt rating show less variation and would give more uniform performance. In all-wave sets, where a wide tuning range is employed and oscillator design is difficult, this is an advantage.

On page 11 are two families of curves showing variation of conversion conductance versus oscillator-grid (No. 3) current with the oscillator voltage capacity coupled to the No. 3 grid. Curves are shown for several values of resistance in the grid return and indicate that a grid resistor of the order of 50,000 ohms gives the maximum conversion conductance. These curves are shown versus grid current because it is believed that in most cases it is more convenient to measure a D.C. grid current than an R.F. voltage. The circuit shown indicates the tube conditions. With the aid of these curves 6L7 performance in a similar set-up can be predicted simply by measuring grid current.

Another form of oscillator coupling is the direct-coupled circuit shown on page 12. The oscillator is the conventional feed-back oscillator utilizing a 6C5. A variable-coupled oscillator coil was used so that several values of oscillator grid current could be produced. The curves on this page show variation of conversion conductance and are also plotted with a D.C. current as the independent variable.



In this case the oscillator-grid (No. 1) current of the 6C5 was measured. Curves are shown for three values of oscillator grid leak (R_{g_L}) for both 6L7 mixer conditions. Oscillator and mixer performance can be checked with these data.

The operation characteristics of a system having a wide tuning range are shown by the direct-coupled curves of page 13. They were taken with a modified electron-coupled oscillator. The tuning range is increased by minimizing the effect of the oscillator input capacity by tapping down on the oscillator coil. Conversion conductance versus oscillator-grid (No. 1) current of the 6J7 is plotted for several different taps on the oscillator coil. The curves are labelled indicating percent of total turns included between tap and ground.

The oscillator shown is not a true electron-coupled oscillator, but it could be converted into one by using individual screen and plate resistors. The ratio of screen to plate voltage then could be adjusted so that the frequency would be practically independent of terminal voltage. The modified circuit shown is usually satisfactory and was used for these curves. This type of oscillator is inherently more stable than conventional feed-back oscillators. With the coil used for these measurements a change of tuning capacity



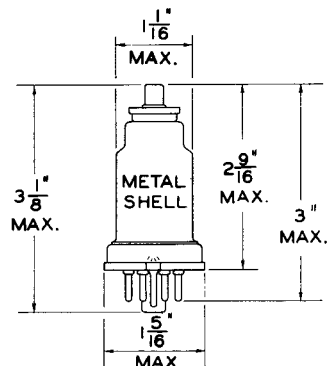
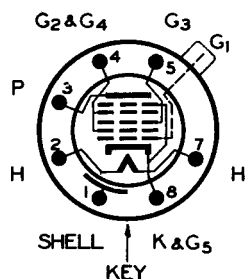
from 50 to 1500 micromicrofarads produced only a slight change in oscillator grid current. Oscillators of this type can be recommended for all-wave receivers because of their wide tuning range, their inherent stability, and the simplicity of coil switching design resulting from only two leads not being connected directly to ground.

The curve sheets of pages 14, 15, and 16 show several characteristic curves of the 6L7. These curves are self-explanatory and should be of much help in the design of other circuits utilizing the 6L7.

***** ***** *****

RATING AND CHARACTERISTICS

Physical Characteristics:



Heater:
Voltage
Current

6.3 Volts AC or DC
0.3 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

MIXER OPERATION

Plate Voltage	250	250 Max. ** Volts
Screen Voltage (Grids No. 2 and 4)	100	150 Max. ** Volts
Signal-Grid Voltage (Grid No. 1)	-3	-6 Min. ** Volts
*Oscillator-Grid Voltage (Grid No. 3)	-10	-15 Volts
Peak Oscillator Voltage (Applied to Grid No. 3)	12	18 Volts Min.
Plate Current	2.4	3.3 Milliamperes
Screen Current	6.2	8.3 Milliamperes
Plate Resistance	1.0	1.0 Megohm or greater
Conversion Conductance	350	350 Micromhos
Signal-Grid Voltage (Grid No.1)		
For Conversion Conductance of 5 Micromhos	-30	-45 Volts

*D.C. circuit resistance of Grid No. 3 must not exceed 50,000 ohms.

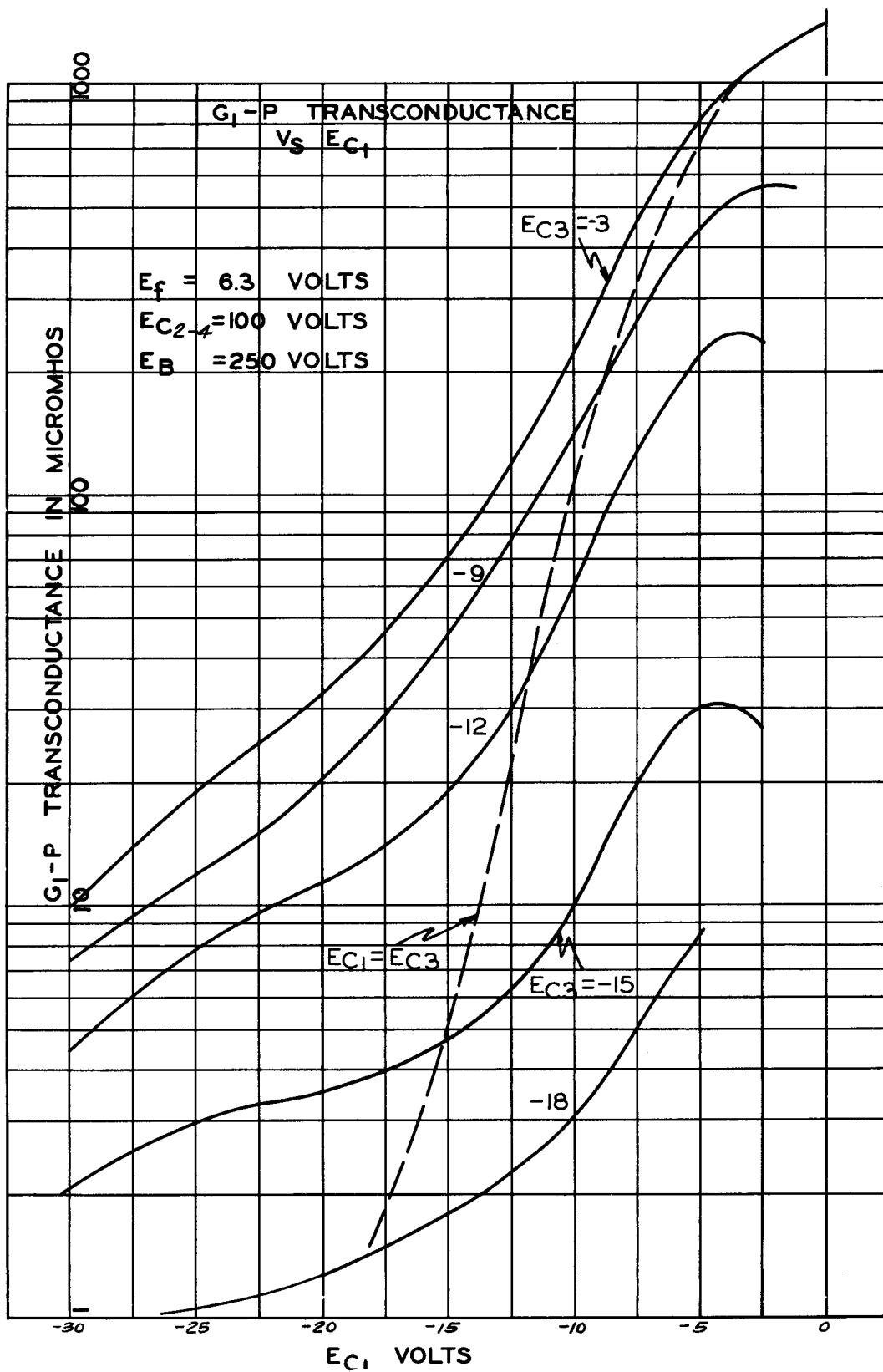
**Values recommended for all-wave receivers.

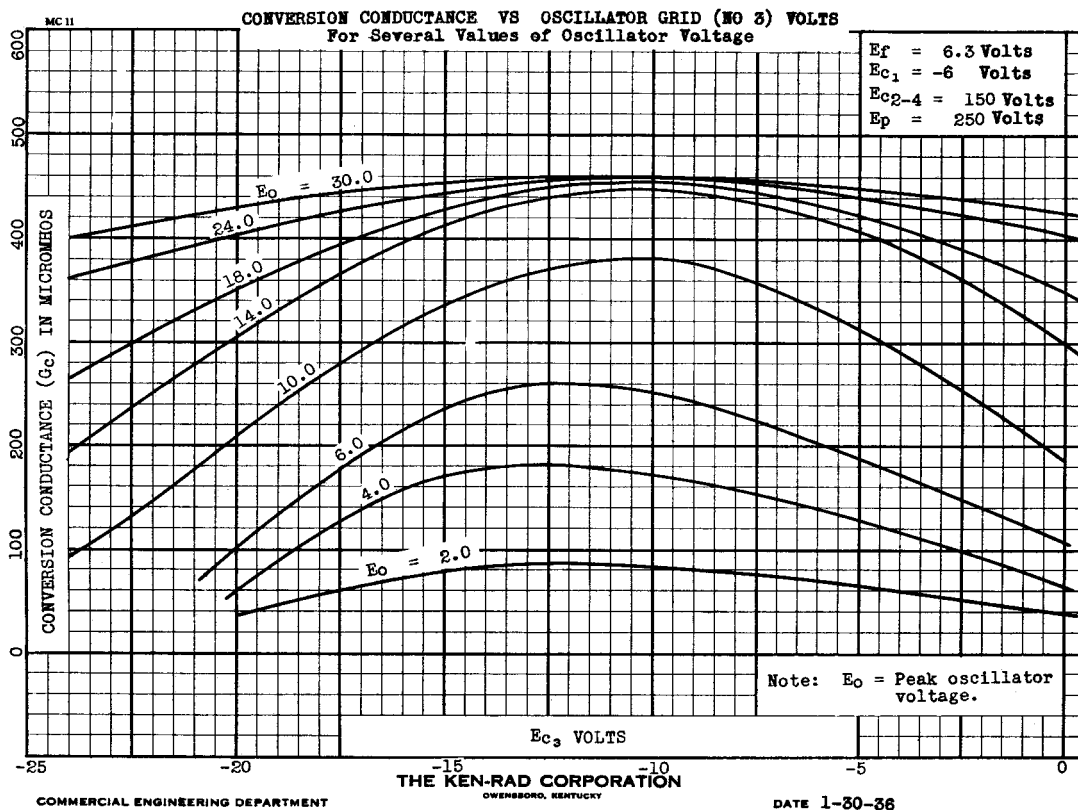
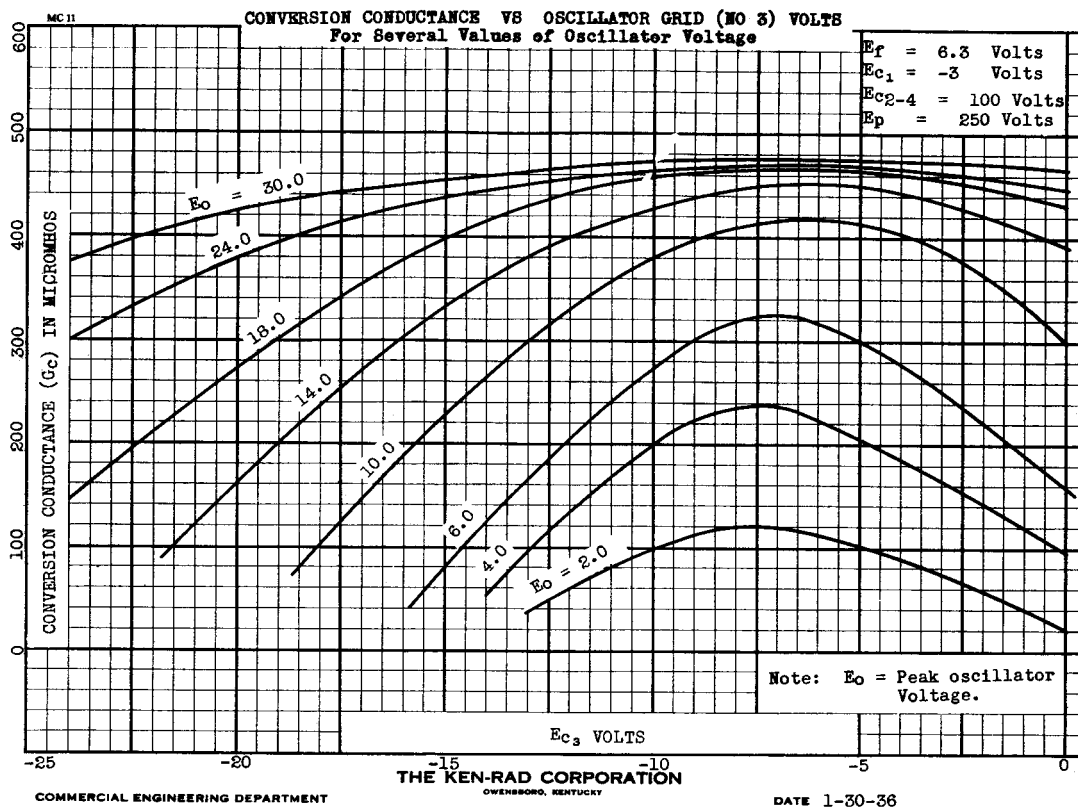
AMPLIFIER OPERATION

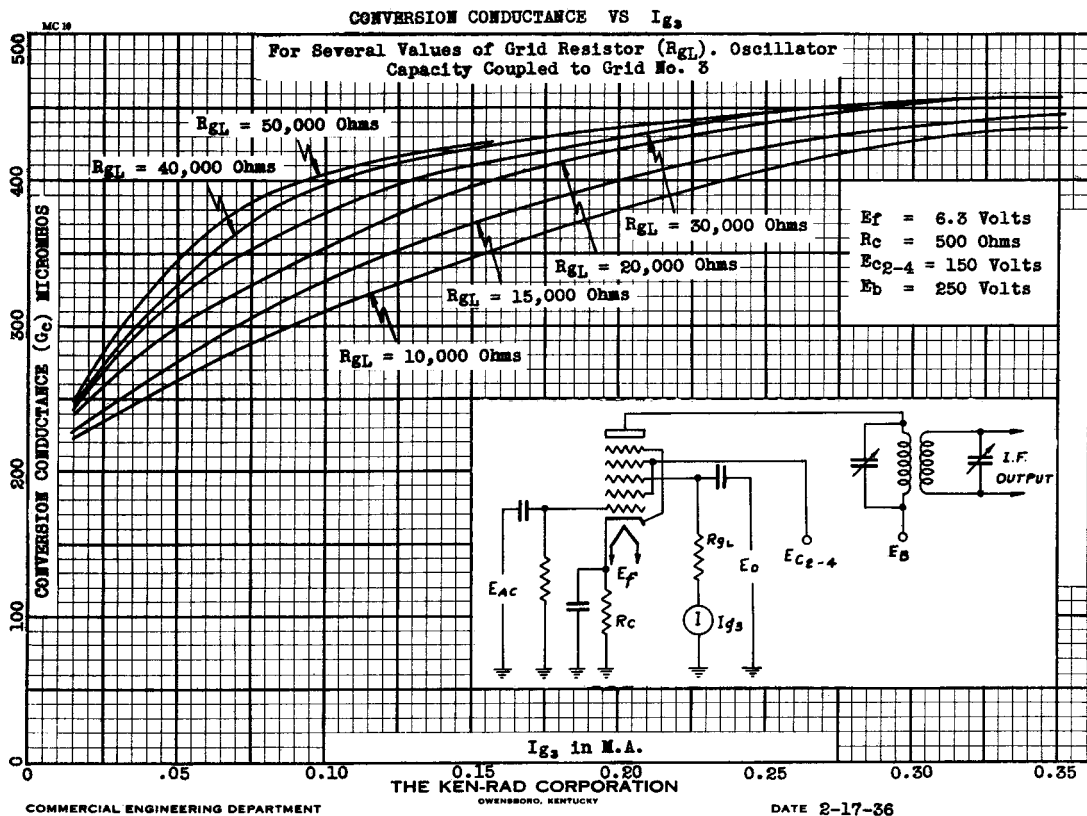
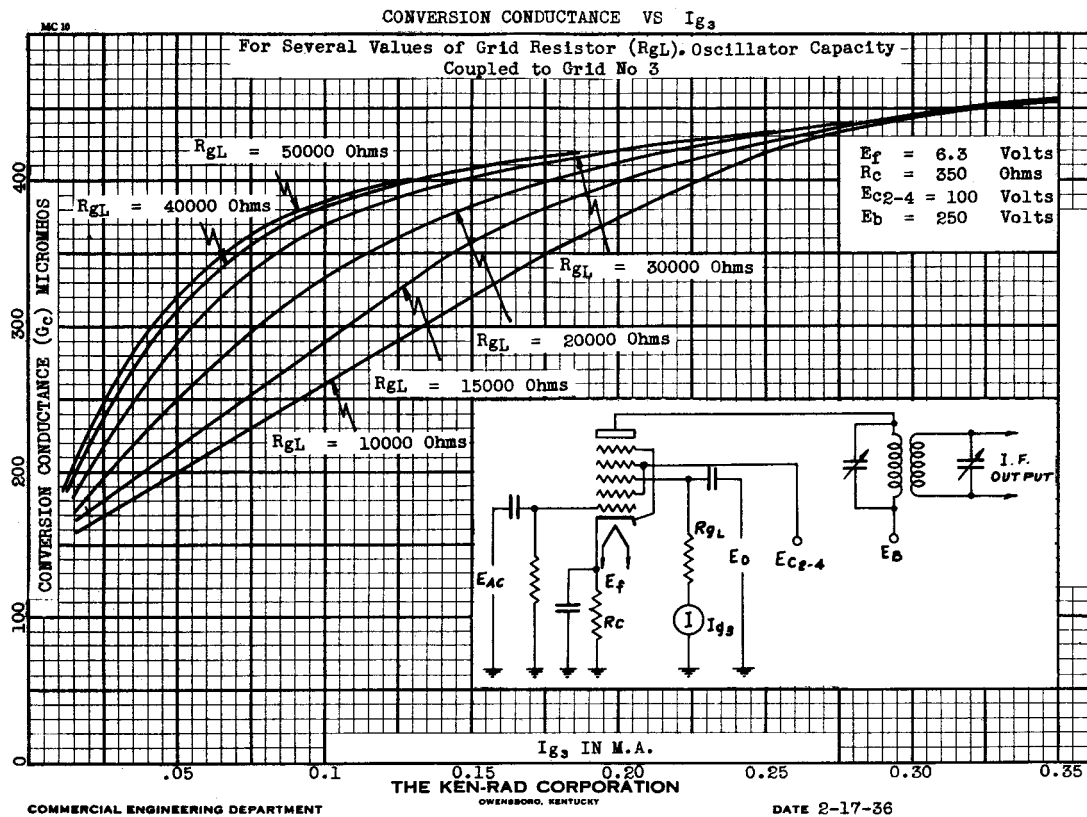
Plate Voltage	250	Volts Max.
Screen Voltage (Grids No. 2 and 4)	100	Volts Max.
Control Grid Voltage (Grid No. 1)	-3	Volts Min.
Control Grid Voltage (Grid No. 3)	-3	Volts Min.
Plate Current	5.3	Milliamperes
Screen Current	5.5	Milliamperes
Plate Resistance	800,000	Ohms
Mutual Conductance	1100	Micromhos
Mutual Conductance (-15 Volts on Grid No. 1)		
Mutual Conductance (-15 Volts on Grid No. 3)	5	Micromhos
Amplification Factor	880	

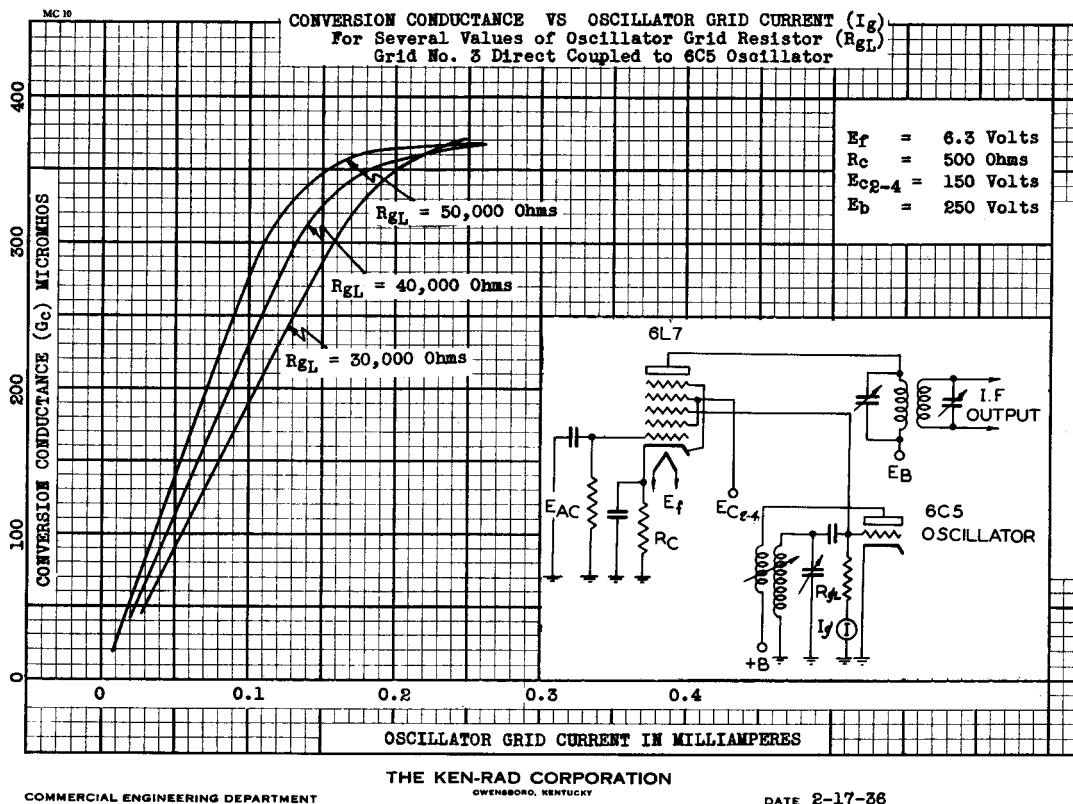
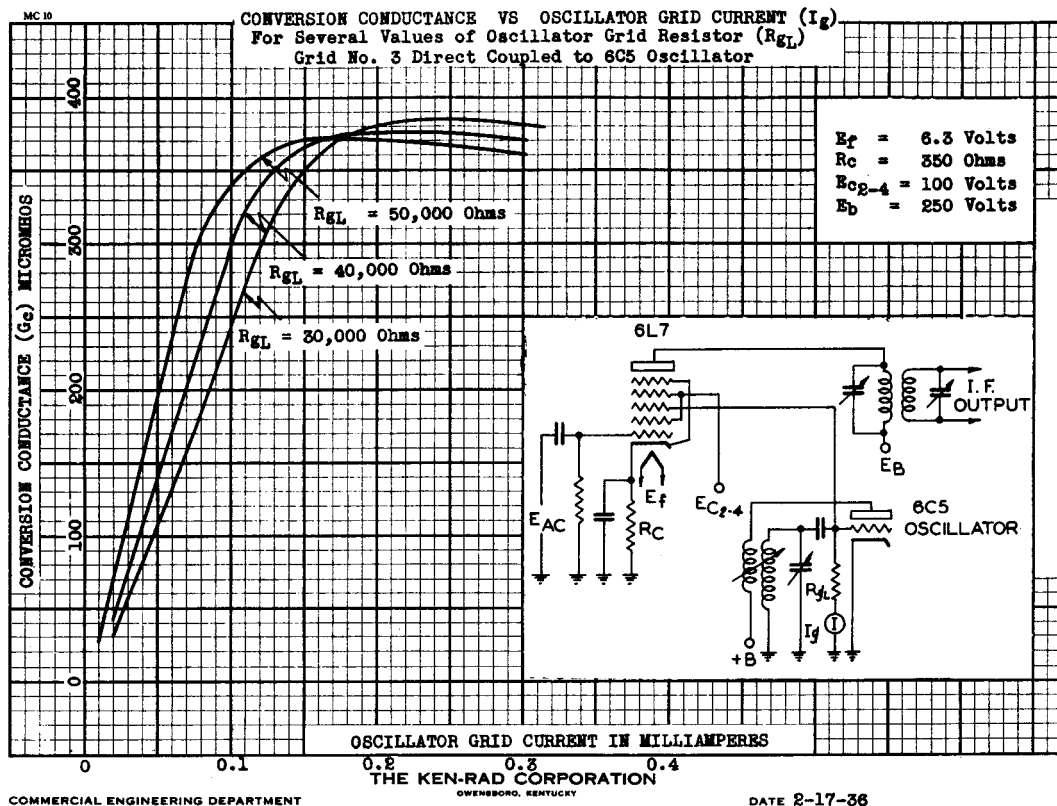
Direct Interelectrode Capacitances: (With shell tied to cathode.)

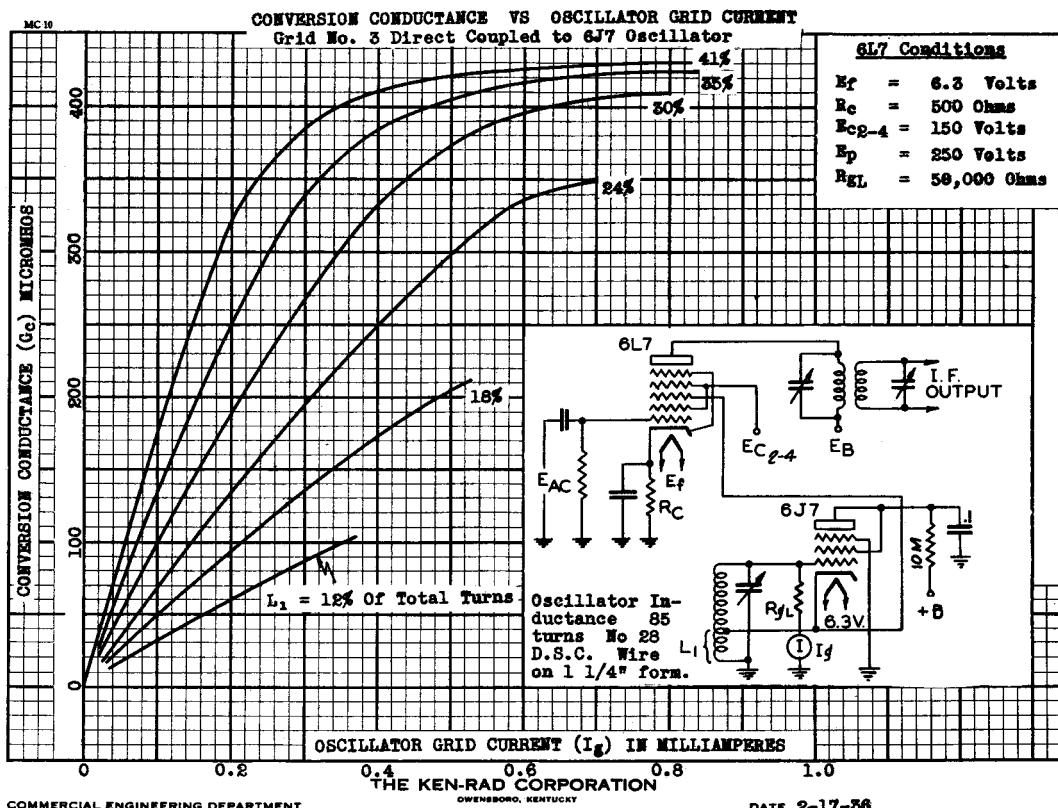
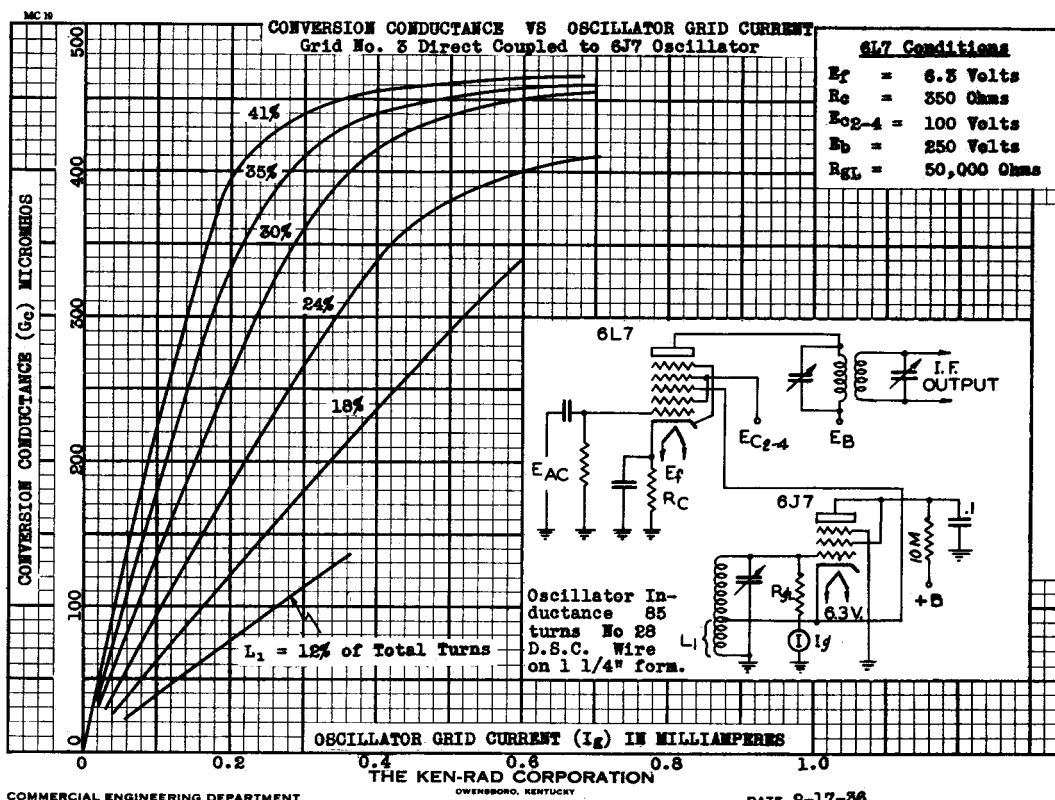
Grid No. 1 to Plate	.0005	μf. Max.
Grid No. 3 to Plate	.25	μf.
Grid No. 1 to Grid No. 3	.12	μf.
Grid No. 1 to all other electrodes	8.5	μf.
Grid No. 3 to all other electrodes	11.5	μf.
Plate to all other electrodes	12.5	μf.

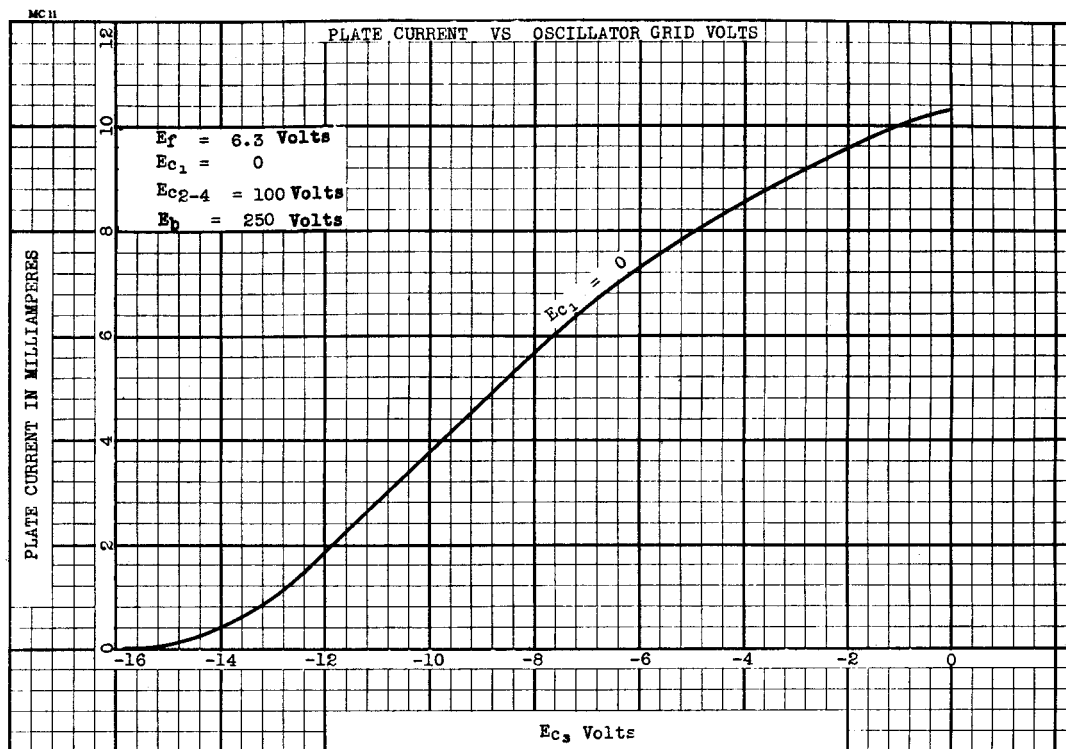










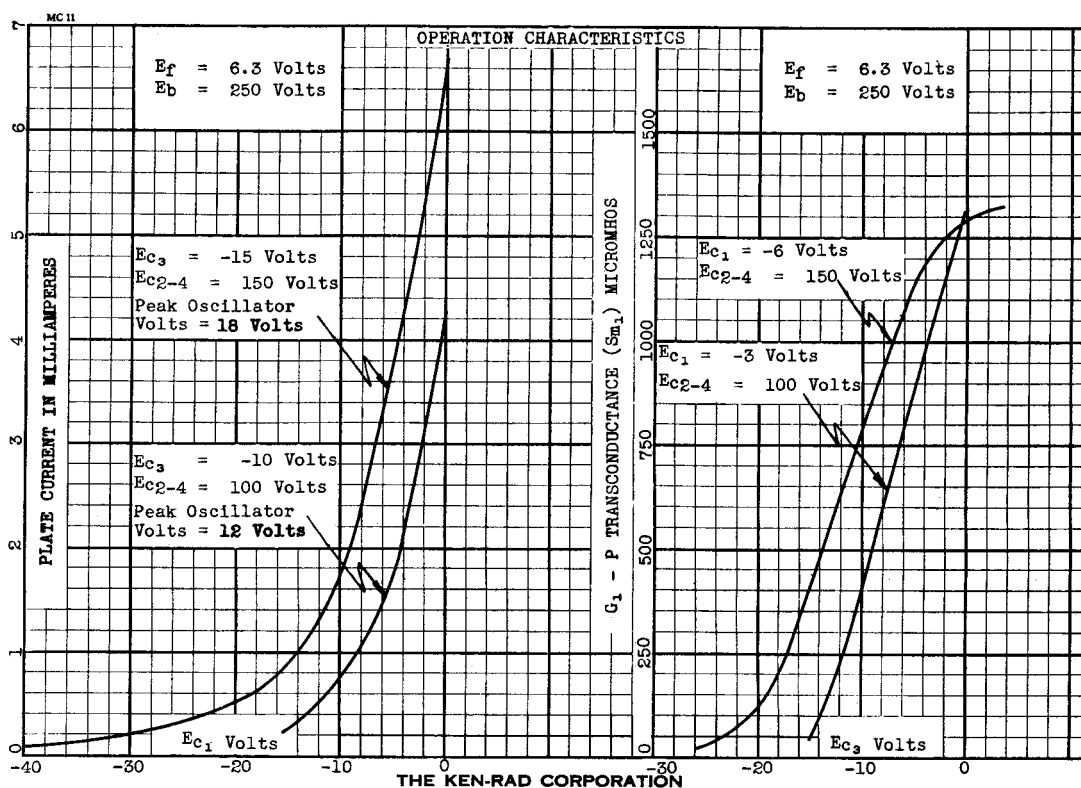


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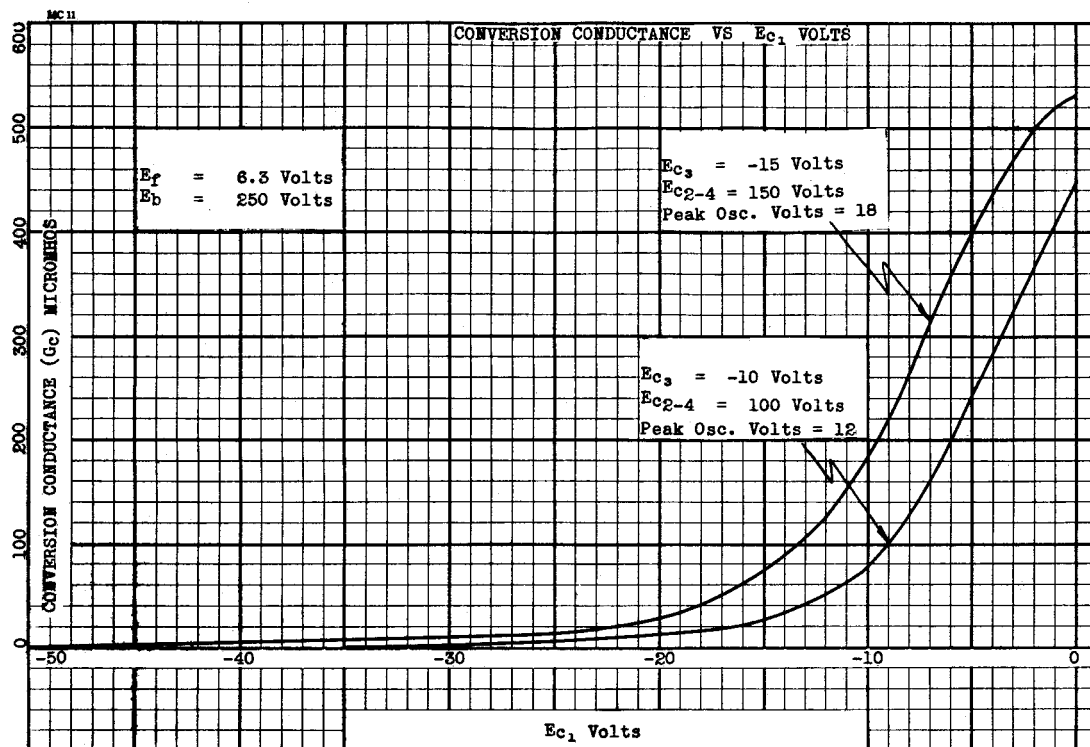


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OWENSBORO, KENTUCKY

COMMERCIAL ENGINEERING DEPARTMENT

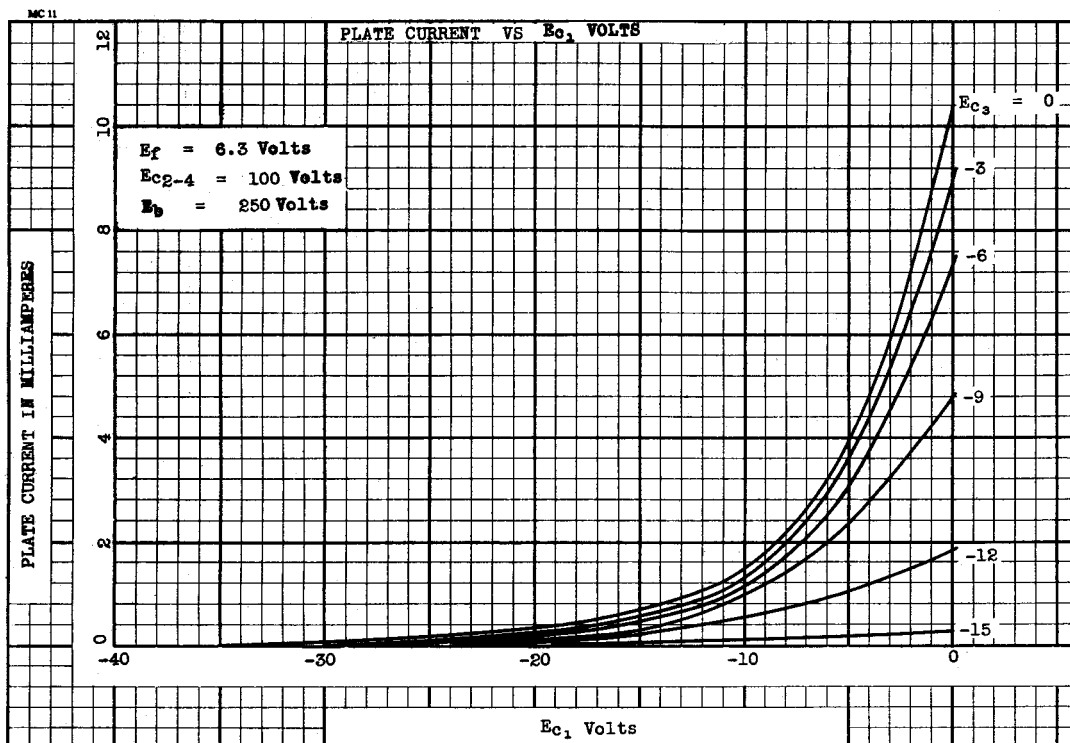
DATE 2-17-36



THE KEN-RAD CORPORATION
OWENSBORO, KENTUCKY

COMMERCIAL ENGINEERING DEPARTMENT

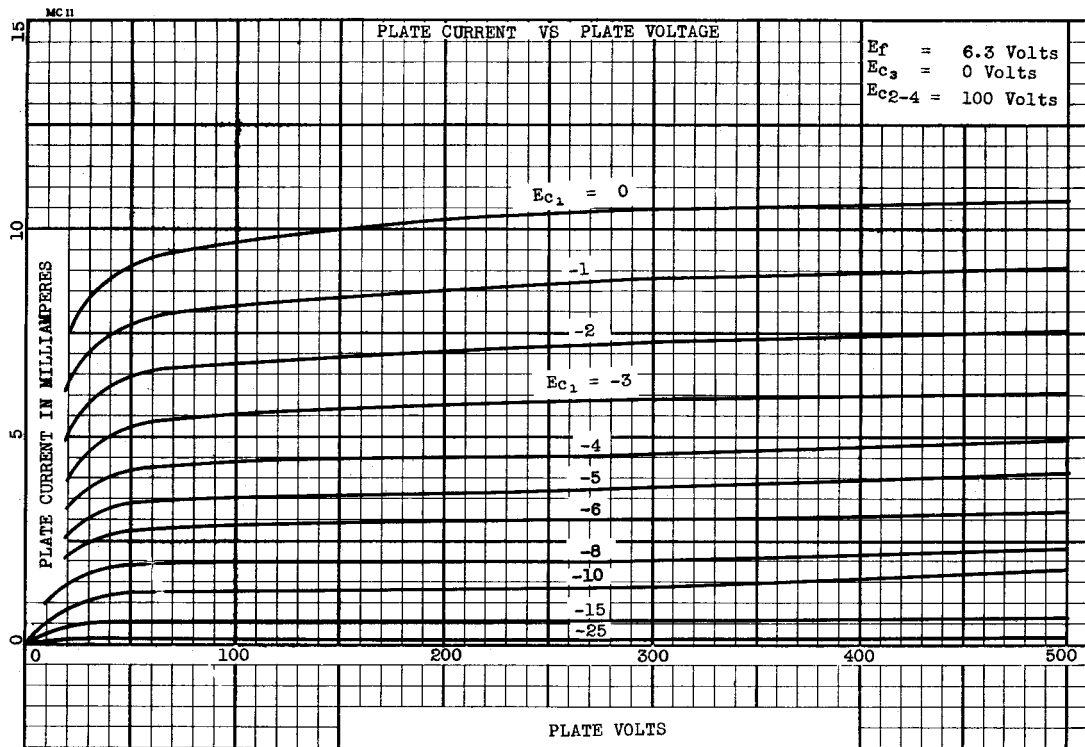
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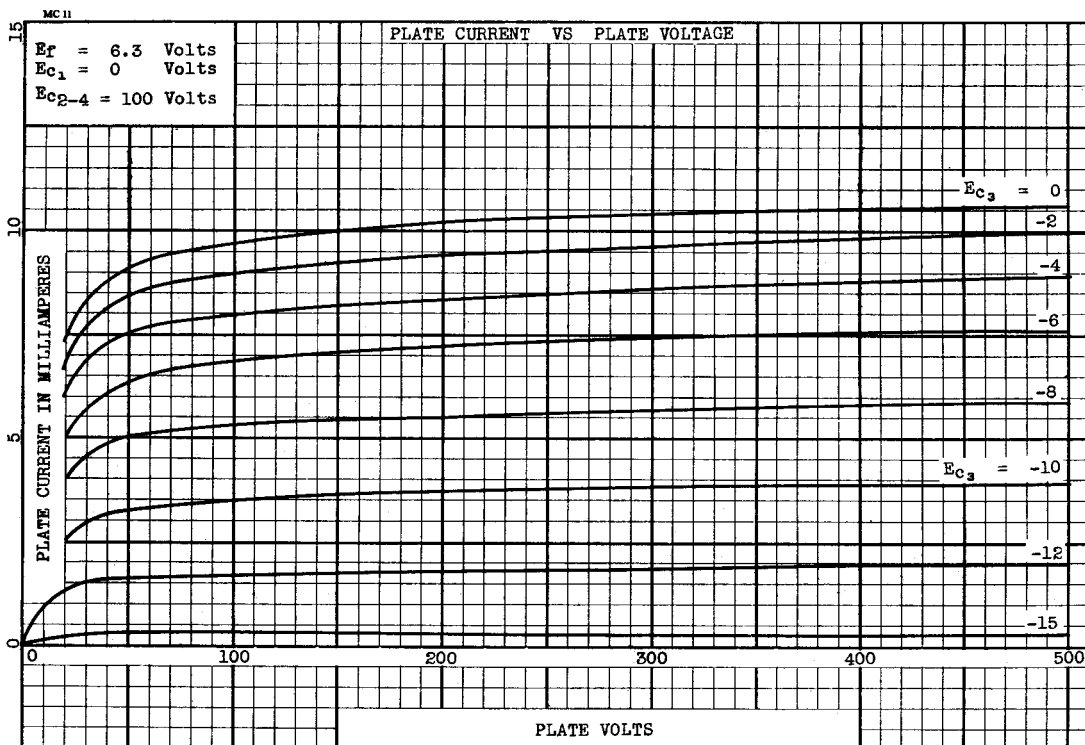
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DATE 2-15-36



COMMERCIAL ENGINEERING DEPARTMENT

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OWENSBORO, KENTUCKY

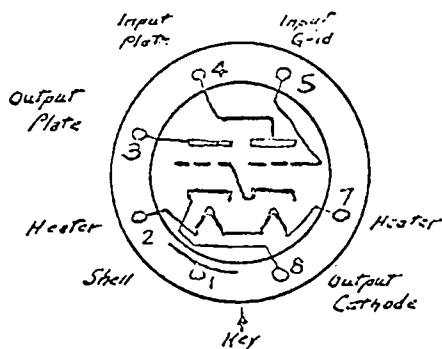
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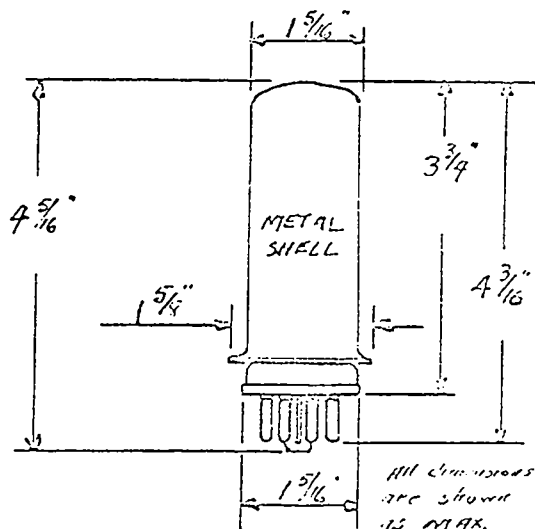
GENERAL DESCRIPTION

Application: The Ken-Rad 6N6 is a cathode type power output tube comprising two triodes so connected internally as to form a direct coupled amplifier. Although the internal construction and theory of operation is different from conventional output tubes, external circuit considerations are very similar to Class A triodes and pentodes. Operation of the 6N6 is characterized by high power output, low distortion, and simplicity of circuit components. The base is of the small octal type and the tube elements are enclosed in a metal shell which is connected to one of the base pins.

Physical Characteristics:



Bottom View



Rating And Characteristics

Heater:

Voltage
Current

6.3 Volts AC or DC
.8 Ampere

Note: Voltage between heater and cathode should not exceed 50 volts. In no case should the heater be left floating.

AMPLIFIER OPERATION SINGLE TUBE (CLASS A)

Plate Voltage (Output)	250	300	Volts
Plate Voltage (Input)	250	300	Volts
Grid Voltage	0	0	Volts
Plate Current (Output)	33	45	Milliamperes
Plate Current (Input)	6.5	8.0	Milliamperes
Plate Resistance		24100	Ohms
Amplification Factor		58	
Mutual Conductance		2400	Micromhos
Load Resistance	7000	7000	Ohms
Power Output	2.5	4	Watts
Total Harmonic Distortion	5	5	Per Cent
Input Volts for Rated Output	13.5	15	RMS Volts

° Static Plate Current. °° DC Resistance in grid return should not exceed .5 megohm.

AMPLIFIER OPERATION (CLASS A) - PUSH PULL - TWO TUBES

Plate Voltage (Output)	250	300	Volts
Plate Voltage (Input)	250	300	Volts
°°Grid Voltage	0	0	Volts
°Plate Current (Output)	33	45	Milliamperes
°Plate Current (Input)	6.5	8.0	Milliamperes
Load Resistance (Plate to Plate)	10000	10000	Ohms
Power Output	8.5	10	Watts
Total Harmonic Distortion	5	5	Per Cent
**Input Volts for Rated Output	38	38	RMS Volts

°° DC Resistance in grid return should not exceed .5 megohm.

° Static plate current. (Per tube)

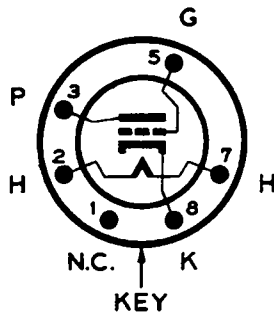
** Grid to Grid.



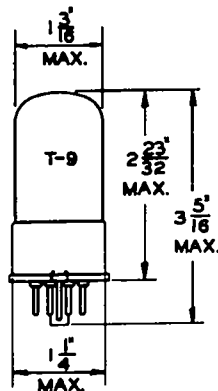
GENERAL DESCRIPTION

Application: The Ken-Rad 6P5GT is a cathode type triode recommended for use as detector, oscillator, or amplifier. It can be used as an audio amplifier in a resistance coupled stage or in a power driver stage transformer coupled to the output stage. The 6P5GT is a glass tube equipped with an octal base and has electrical characteristics identical to those of type 76.

Physical Characteristics:



Bottom View



RATINGS AND CHARACTERISTICS

Heater:

Voltage	6.3 Volts AC or DC
Current	.3 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

AMPLIFIER OPERATION (CLASS A)

	<u>Transformer-Coupled</u>		<u>Resistance-Coupled</u>	
Plate Voltage	100 250 Max.		250*	Volts
Grid Voltage	-5 -13.5		-9	Volts
Plate Current	2.5 5.0		1 to 2	Milliamperes
Load Resistance	-		50,000 to 100,000	Ohms
Plate Resistance	12,000 9,500		-	Ohms
Amplification Factor	13.8 13.8		-	Micromhos
Mutual Conductance	1,150 1,450		-	

* This is a plate supply voltage value. The voltage effective at the plate will be plate supply voltage minus the voltage drop in load caused by plate current. Voltage effective at plate should not exceed 250 volts.

DETECTOR OPERATION

	<u>Biased</u>		<u>Grid Leak</u>	
Plate Voltage	100 250 Max.		45	Volts
Grid Voltage	-8 -20		Return to Cathode	Volts (Approx.)
Plate Current	Adjusted to .2 ma. with no input signal.		-	
Self-Bias Resistor	** **		-	
Grid Leak	-		1 to 5	Megohms
Grid Condenser	-		250	μf.

** Not critical 30,000 to 150,000 ohms being suitable.

Direct Interelectrode Capacitances:

G-P	2.8 μf.
G-(F+K)	3.5 μf.
F-(F+K)	2.5 μf.

Note: For characteristic curves refer to type 76.

RMA Release # 226-A

KEN-RAD 6S6GT



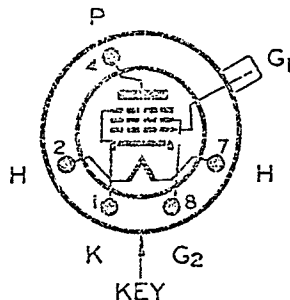
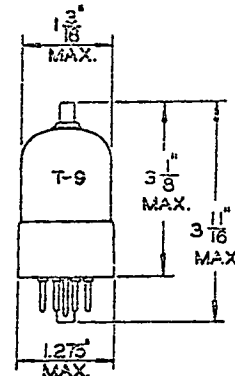
Page One

GENERAL DESCRIPTION

Application: The Ken-Rad 6S6GT is a cathode type remote cut-off RF pentode featuring high mutual conductance and low output capacitance. The 6S6GT is a glass tube equipped with an octal base.

Physical Characteristics:

Mounting Position -- Any

Bottom ViewRATINGS AND CHARACTERISTICSHeater:

Voltage	6.3	Volts
Current	.450	Ampere

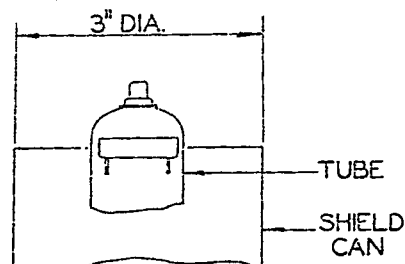
OPERATING CONDITIONS

Plate Voltage	250	Volts	Max.
Screen Voltage	100	Volts	Max.
Grid Voltage	-2	Volts	Min.
Plate Current	13	Milliamperes	
Screen Current	3	Milliamperes	
Mutual Conductance	4,000	Micromhos	
Amplification Factor	1,400		
Plate Resistance	350,000	Ohms	
Control Grid Voltage for $S_m = 20 \mu\text{mhos}$	-20	Volts	

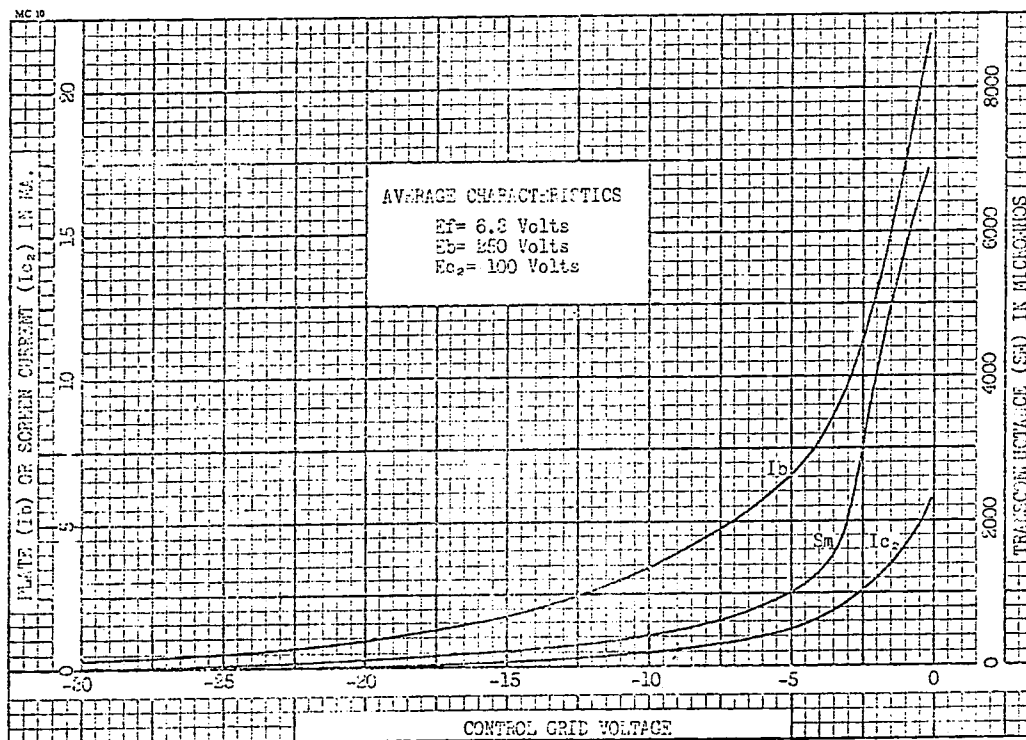
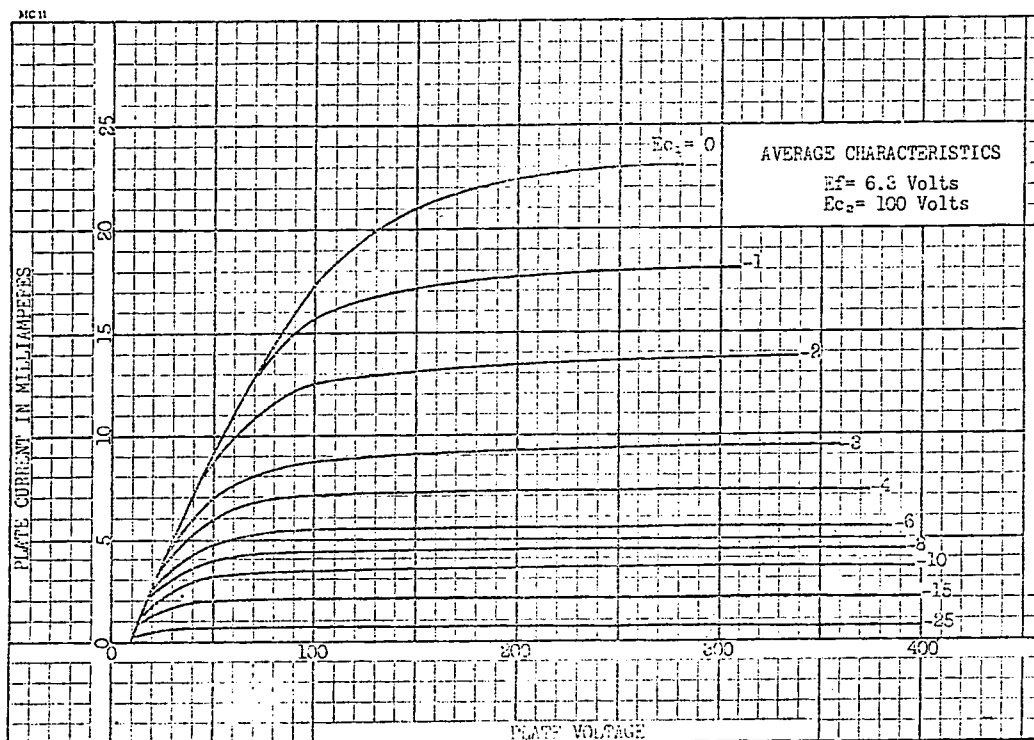
Direct Interelectrode Capacitances:

G ₁ -Plate	.01	$\mu\text{f.}$
Input	7.00	$\mu\text{f.}$
Output (Without Shield)	4.60	$\mu\text{f.}$
Output (With Tight Fitting Shield)	6.40	$\mu\text{f.}$
Output (With Large Shield 3 Inch Diameter See Drawing)	5.30	$\mu\text{f.}$

Note: External Shield Connected to Cathode.



MCA

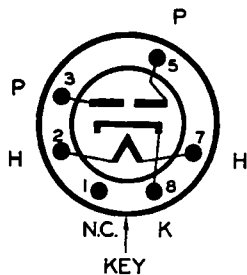
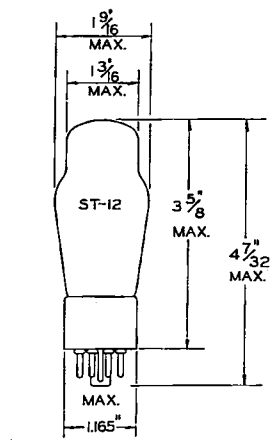


MC 1A

GENERAL DESCRIPTION

Application: The Ken-Rad 6W5G is a cathode type rectifier designed particularly for use in automobile receivers. The 6W5G is a glass tube equipped with an octal base and is interchangeable with the 6X5 and 6X5G.

Physical Characteristics:

Bottom ViewRATING AND CHARACTERISTICS

Heater:

Voltage	6.3 Volts AC or DC
Current	.9 Ampere

Note: Voltage between heater and cathode should not exceed 500 volts DC.

FULL-WAVE OPERATION

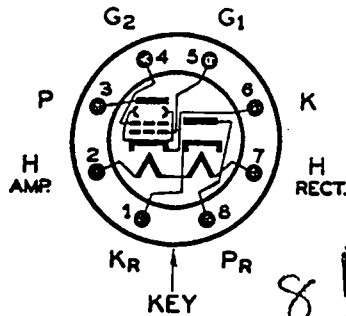
AC Plate Voltage (RMS per plate)	350	Volts Max.
Load Current	100	Milliamperes Max.



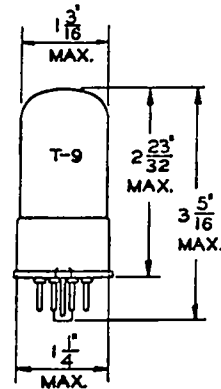
GENERAL DESCRIPTION

Application: The Ken-Rad 70L7GT is a cathode type duplex tube consisting of a beam power amplifier and a half-wave rectifier in a single envelope. It is especially designed for use in small AC-DC receivers where space and heat dissipation are prime considerations. The 70L7GT is a glass tube equipped with an octal base.

Physical Characteristics:



Bottom View



RATING AND CHARACTERISTICS

Heater:

Voltage
Current

70 Volts AC or DC
.150 Ampere

OPERATING CONDITIONS

Beam Power Amplifier Section

Plate Voltage	110	Volts	Max.
Screen Voltage	110	Volts	Max.
Grid Voltage	-7.5	Volts	Min.
Plate Current (Zero Signal)	40	Milliamperes	
Plate Current (Max. Signal)	43	Milliamperes	
Screen Current (Zero Signal)	3.0	Milliamperes	
Screen Current (Max. Signal)	6.0	Milliamperes	
Peak Signal	7.5	Volts	
Mutual Conductance	7,500	Micromhos	
Plate Resistance	15,000	Ohms	
Load Resistance	2,000	Ohms	
Total Harmonic Distortion	9.5	Percent	
Second Harmonic Distortion	5.5	Percent	
Third Harmonic Distortion	7.0	Percent	
Power Output	1.8	Watts	

OPERATING CONDITIONS

Rectifier Section

AC Plate Voltage (RMS)	125	Volts	Max.
DC Load Current	70	Milliamperes	Max.
Peak Plate Current	350	Milliamperes	Max.
Average Tube Voltage Drop	20	Volts at 140 Milliamperes	

Note: The ratings marked maximum and minimum are design centers for a line voltage of 117 volts.

RECOMMENDATIONS

1. It is recommended that the end of heater used for the power amplifier section be connected so that a minimum voltage results between this point and ground.
2. Transformer or impedance-coupled input systems are recommended. If resistance coupling is used the DC resistance in the grid return must be limited to .5 megohm for self-biased conditions and .1 megohm for fixed-bias conditions.

from RMA release #168, March 29, 1939

