AMPEREX TUBE TYPE OA2

The OA2 is a two electrode, inert gas filled, cold cathode tube for use in voltage regulator applications.

ELECTRICAL DATA

Operating voltage (nominal)	150 volts
Anode breakdown voltage with illumination of 50 - 500 ft. candles	180 volts max.
Anode breakdown in complete darkness	225 volts max.
Regulation (Plt. Current = 5 - 30 ma)	6 volts max.

MECHANICAL DATA

Mounting position	any
Base (JETEC base designation)	5BO, 7 pin miniature
Max. overall length	2 5/8 inches
Max. diameter	3/4 inch

MAXIMUM RATINGS (absolute values)

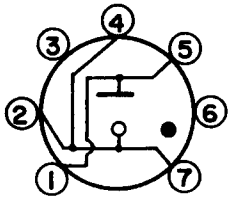
Minimum D.C. anode supply voltage [1]	185 volts
Maximum average starting current	75 ma
Maximum averaging time	10 seconds
Maximum D.C. Cathode current	30 ma
Minimum D.C. Cathode current	5 ma
Maximum frequency [2]	0 cycles/sec.
Max. shunt capacitor [3]	0.1 uf
Ambient temperature limits	-55° to $+90^{\circ}$C

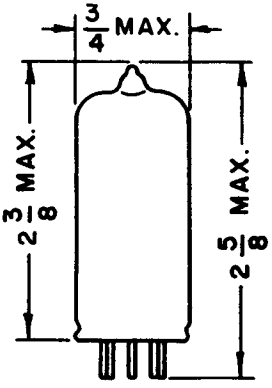
[1] Supply voltage necessary to insure starting throughout tube life with an illumination of 50 - 500 foot candles.

[2] Tube used so that cathode cannot become positive and anode negative.

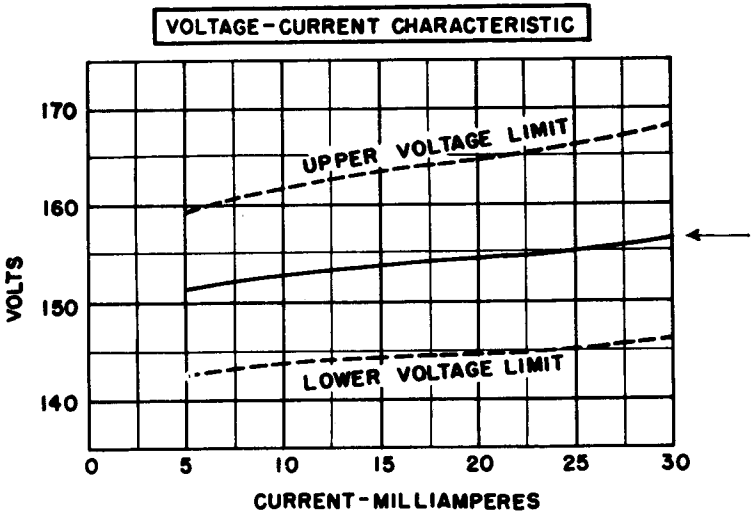
[3] In order to prevent parasitic oscillation, the value of a capacitor in parallel with the tube should be limited to 0.1 uf.

0A2





PIN NO. 1 = ANODE
PIN NO. 2 = CATHODE
PIN NO. 3 = INTERNALLY CONNECTED
PIN NO. 4 = CATHODE
PIN NO. 5 = ANODE
PIN NO. 6 = INTERNALLY CONNECTED
PIN NO. 7 = CATHODE



AMPEREX TUBE TYPE OB2

The OB2 is a two electrode, inert gas filled, cold cathode tube for use in voltage regulator applications.

ELECTRICAL DATA

	Min.	Nom.	Max.	
Operating voltage (Plt. current = 17.5 ma)	106	108	111 volts	←
Anode breakdown voltage with illumination of 50 - 500 ft. candles.			127 volts max.	
Anode breakdown voltage in complete darkness			210 volts max.	
Regulation (Plt. current = 5 - 30 ma)			3.5 volts max.	←
Voltage variation during 500 hrs. operation			4 volts	←

MECHANICAL DATA

Mounting Position	any
Base (JETEC base designation)	5BO, 7 pin miniature
Max. overall length	2 5/8 inches
Max. diameter	3/4 inch

MAXIMUM RATINGS (absolute values)

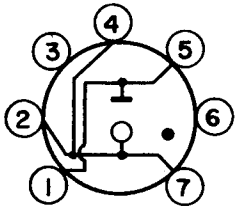
Minimum D.C. anode supply voltage [1]	133 volts
Maximum average anode starting current	75 ma
Maximum averaging time	10 seconds
Maximum D.C. cathode current	30 ma
Minimum D.C. cathode current	5 ma
Maximum frequency [2]	0 cycles/sec.
Max. shunt capacitor [3]	0.1 uf
Ambient temperature limits	-55° to $+90^{\circ}$C

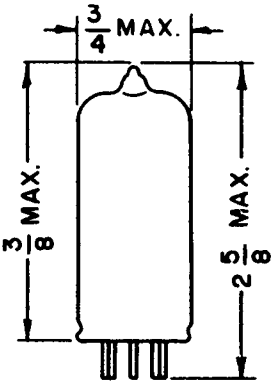
[1] Supply voltage necessary to insure starting throughout tube life with an illumination of 50 - 500 foot candles.

[2] Tube used so that cathode cannot become positive and anode negative.

[3] In order to prevent parasitic oscillation, the value of a capacitor in parallel with the tube should be limited to 0.1 uf.

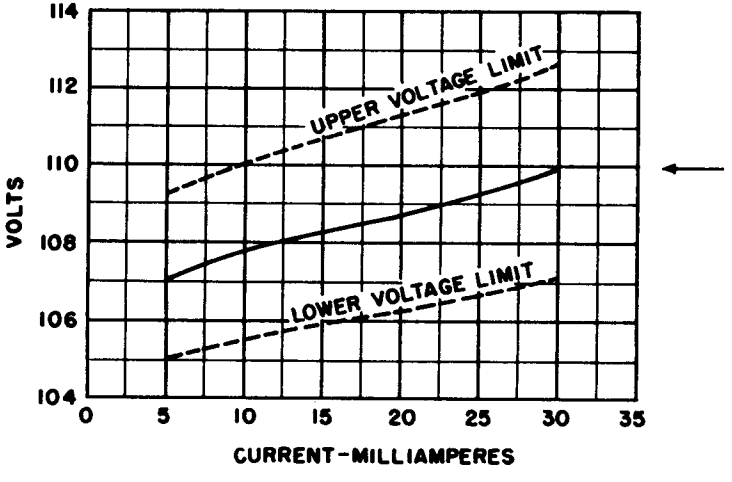
0B2





PIN NO. 1 = ANODE
PIN NO. 2 = CATHODE
PIN NO. 3 = INTERNALLY CONNECTED
PIN NO. 4 = CATHODE
PIN NO. 5 = ANODE
PIN NO. 6 = INTERNALLY CONNECTED
PIN NO. 7 = CATHODE

VOLTAGE-CURRENT CHARACTERISTIC



AMPEREX TUBE TYPE OE3/85A1

The OE3/85A1 is a lock-in voltage reference tube of the cold cathode glow discharge type designed for extremely constant voltage stability. It maintains a D.C. operating voltage of 85 volts; the operating current ranges from 1 to 8 milliamperes and its operating characteristic is independent of ambient temperature.

The OE3/85A1 is particularly distinguished from other types of regulator tubes by the small change in the operating voltage during the life of the tube. Furthermore there is very little difference in the tolerance of the operating voltage as between one tube and another. Due to these properties, the tube is particularly suitable for applications where a constant regulated voltage is required.

This excellent performance is the result of a judicious choice ot the materials used and a special manufacturing process. The cathode is made of molybdenum. Changes in the surface of the cathode due to gas from impurities in the glass bulb have been avoided by coating the inner side of the bulb with a layer of molybdenum. In addition, this layer acts as a screen for outer influences while it also acts as a getter.

Because of its extreme stability throughout life time, the OE3/85A1 is especially useful as a voltage reference tube in the D.C. supply voltage source of electronic tubes and in measuring circuits.

DATA

GENERAL

Cathode	cold
Maximum overall length	3-11/16"
Maximum seated height	2-1/2"
Maximum diameter	1-1/8"
Bulb	tubular
Base	lock-in, 3-pin
Mounting position	any

MAXIMUM RATINGS (absolute values)

D.C. operating current (continuous)	8 ma. max.
Ambient temperature range	−55 to + 90 °C

CHARACTERISTICS AND OPERATING RANGE VALUES

	Min.	Average	Max.	
D.C. starting voltage	-	110	120 [1]	volts
D.C. operating voltage	83	85	87	volts
D.C. operating current	1	4	8	ma
Regulation (1 ma to 8 ma)	-	-	3.15	volts
Stability	-	0.1	0.85 [2]	volt

INSTALLATION AND APPLICATION

The base of the OE3/85A1 fits the loctal 8-pin socket. The socket may be mounted to hold the tube in any position.

A warm-up period of 3 minutes should be allowed each time the equipment is turned on in order to insure minimum voltage drift of the tube.

NOTES

[1] Not less than this value should be provided to insure ignition throughout tube life.

[2] Defined as the maximum voltage fluctuation in the operating voltage throughout 5000 hours.

OE3/85A1

APPLICATION INFORMATION

A minimum D.C. anode supply voltage of 120 volts should always be provided in the equipment design to insure ignition throughout tube life.

A series resistor must always be used with the OE3/85A1. The resistance value must be s chosen that the maximum current ranting (8 ma) of the OE3/85A1 is not exceeded at the highes anode supply voltage applied, so that the minimum current rating (1 ma) is always exceeded at the lowest anode-supply voltage.

Shielding of the OE3/85A1 to insure maximum stability should be utilized when the tube is operated in the presence of strong R.F. or magnetic fields.

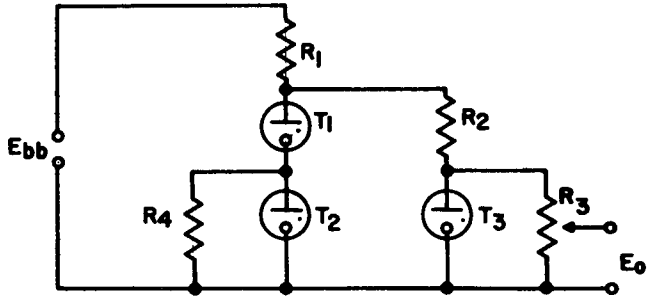
To retain the maximum constancy of the operating voltage it is desirable to mount the tube where it does not get heated too much by other tubes, resistors, etc.

The nature of a gas discharge always gives rise to noise. With a current of 4 ma flowing through the tube and a series resistor of 10,000 ohms the R.M.S. value of the noise voltage in the frequency range 30 - 10,000 c/s amounts to 80 microvolts. This noise voltage increases according to the square root of the series resistance and also increases slightly as the current is reduced. The noise energy is distributed fairly uniformly over the above mentioned-frequency range.

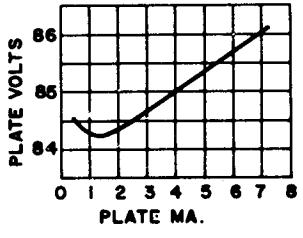
For carrying out accurate electric measurements it is often necessary to have available an extremely constant reference voltage, particularly if relatively small voltage variations are to be measured.

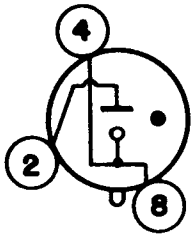
Such a constant voltage supply using the OE3/85A1 as a voltage reference is given in fig. 1. The tubes T_1, T_2 and T_3 are OE3/85A1 tubes. The current flowing through T_3 is stabilized by the tubes T_1 and T_2, as shown in the circuit.

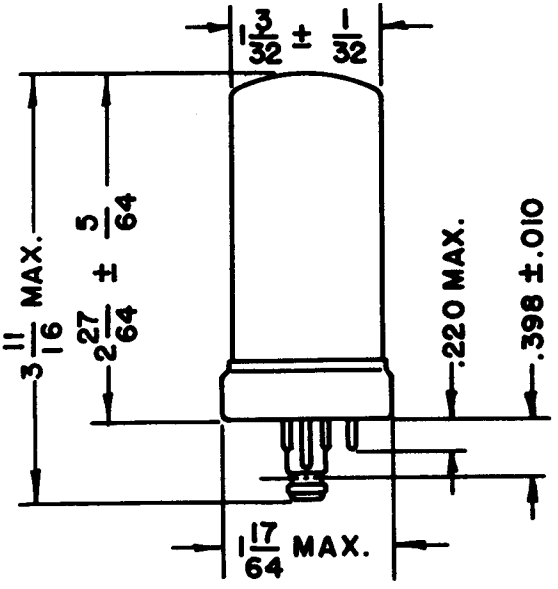
With supply voltage variations from - 10% to + 10% (Ebb = 275 volts) the maximum voltage fluctuation across T_3 does not exceed 40 millivolts (0.05%) whereas the average fluctuation is approx. 15 millivolts.



In this circuit a reference voltage is produced across R_3. This is obtained by stabilizing the current through T_3 by means of two other tubes 85A1 (T_1 and T_2). In this circuit R_1 = 0.1 megohm; R_4 = 1 megohm; Ebb = 275 volts.







CAUTION

Should the OE3/85A1 tube be run with reverse polarity for even a few seconds, its stability will be seriously impaired and it may require some hundreds of hours of operation running in the normal direction before the tube returns to its original performance. Care should be taken, therefore, to test the circuit polarity before the tube is inserted in the socket. This is particularly important in the mass production of equipment where a wiring fault may rapidly ruin a large number of tubes before the effect is noted.

AMPEREX TUBE TYPE OG3/85A2

The OG3/85A2 is a miniature voltage reference tube of the cold cathode discharge type, for use in D.C. Amplifiers, stable regulated power supplies, oscilloscope calibrators and similar applications. Among its features are: (1) better regulation (2) larger allowable operating current range (3) reproducibility between tubes with 5 volt tolerance.

GENERAL CHARACTERISTICS

ELECTRICAL

Maximum ratings, absolute values

D.C. Starting Voltage (max.)	125 volts
D.C. Operating Current (max.)	10 ma
D.C. Operating Current (min.)	1 ma
Ambient Temperature Limits	−55 to + 90°C

Typical Operation

Recommended D.C. Operating Current	6 ma
A.C. Resistance at 6 ma (average value)	300 ohms
A.C. Resistance at 6 ma (max. value)	450 ohms
D.C. Operating Voltage at 6 ma, Variation From Tube to Tube	83 to 87 volts
Temp. Coefficient of Operating Voltage	−2.7 mv/°C
Percentage Variation of Operating Voltage During First 300 hrs. of Life (max.)	0.3 %
Percentage Variation of Operating Voltage During Subsequent 1000 hrs. of Life (max.)	0.2 %
Short-term (100 hrs. max.) Variation of Operating Voltage After First 300 hrs. of Life (max.)	0.1 %

MECHANICAL

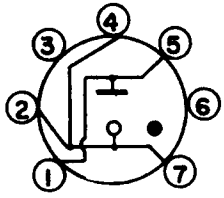
Cathode	Cold Cathode
Base	Miniature Button-7 Pin
Bulb	T 5½
Max. Overall Height	2 1/8"
Max. Seated Height	1 7/8"
Max. Diameter	3/4"
Mounting Position	any

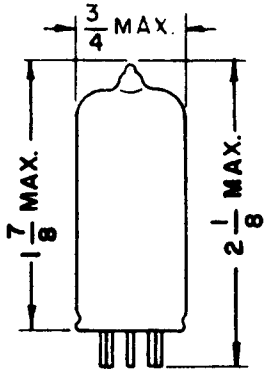
0G3/85A2

NOTES:

1. The tube should be operated only with the cathode negative and the anode positive.
2. Equilibrium conditions are normally reached after 3 minutes of operation.

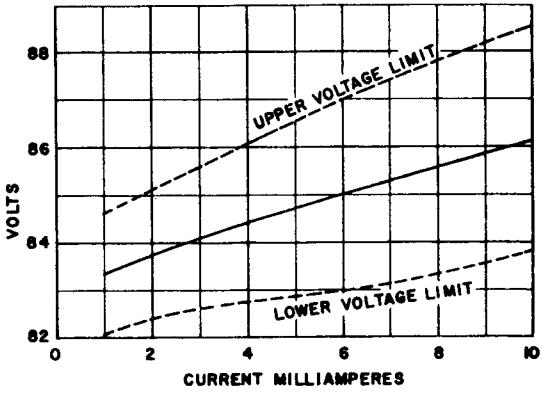
   During life the AC resistance will remain essentially constant, but the temperature coefficient of the operating voltage can be expected to decrease slightly.
3. The greatest constancy of the operating voltage is obtained when the tube is operated at one value of current.
4. The noise of the tube over a frequency band of 30 to 10,000 cycles/sec. is of the order of 60 μV (equivalent noise resistance 22 megohms), and is evenly distributed over the frequency range.
5. The tube should not be subjected to severe shock or continuous vibration.





Basing Connections

Pin 1 - Plate
Pin 2 - Cathode
Pin 3 - Internally Connected
Pin 4 - Cathode
Pin 5 - Plate
Pin 6 - Internally Connected
Pin 7 - Cathode



APPLICATION NOTES

Basically, the OG3 is similar in construction and operation to common voltage regulator tubes such as the OA3 for example. The OA3 is intended to provide a resonably constant D.C. voltage across itself, for varying loads and line voltage, by drawing a compensating current through a voltage dropping resistor. The OG3 is intended as a voltage reference tube and is designed for operating voltage stability over long periods of time.

Especially after a "run-in" period of 300 hours, the voltage across the OG3 remains very constant for a constant current flowing through the tube and compares well with a standard cell in this respect. Instability, such a voltage jumps and oscillations are greatly reduced in this tube. However, this improvement is accompanied by a higher A.C. resistance. The detriment is of little consequence for the application intended since a constant D.C. current is drawn by the tube.

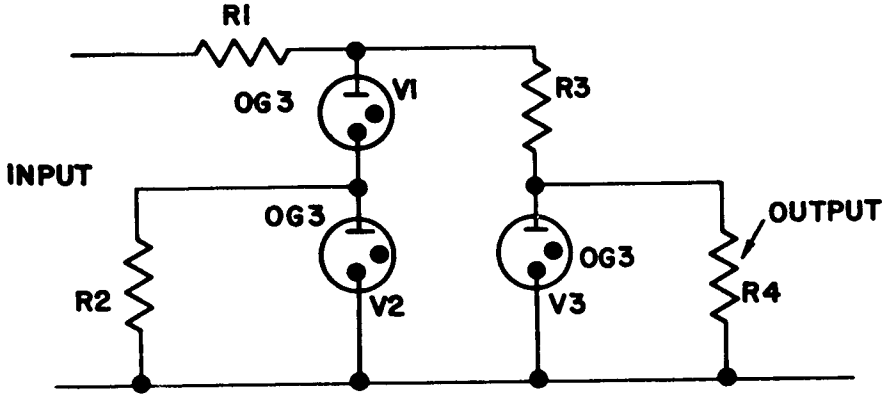


FIGURE 1
ACCURATE D.C. VOLTAGE SOURCE

Fig. 1 shows two OG3's used as regulator tubes, in controlling the input to the OG3 used as a voltage reference tube. This arrangement provides a constant current through the voltage reference tube, thereby providing a very constant 85 volts. This may be tapped off by an accurate voltage dividing network. The resistor R_2 is required to insure firing of V_1 first, followed by the firing of V_2. Parallel operation of the OG3 is not recommended because the tube with the lower striking voltage will take all the load.

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TYPES 100C/N 200C/N SERIES MICA END WINDOW COUNTERS

TENTATIVE DATA

DESCRIPTION

The type 100C or 100CB is a soft X-Ray and beta counter with an argon filling and a 3 to 4 mg/cm^2 end mica window[1].

The type 100N or 100NB is primarily a beta counter with a low voltage neon filling and a 3 to 4 mg/cm^2 window[1].

The type 200C or 200CB is a very soft X-Ray, alpha and beta counter with an argon filling and a 1.4 to 2 mg/cm^2 window[1].

The type 200N or 200NB is an alpha and beta counter with a 1.4 to 2 mg/cm^2 window[1] and a low voltage, neon filling.



GENERAL DATA

Operating Temperature Range	-55°C to + 75°C
Quenching Agent	halogen admixture
Effective Diameter of Mica Window	1-3/32 inches
Cathode Material	Type 446 stainless steel
Effective Cathode Dimensions	1.5 in. long x 1.187 in. O.D. x 0.047 in. wall

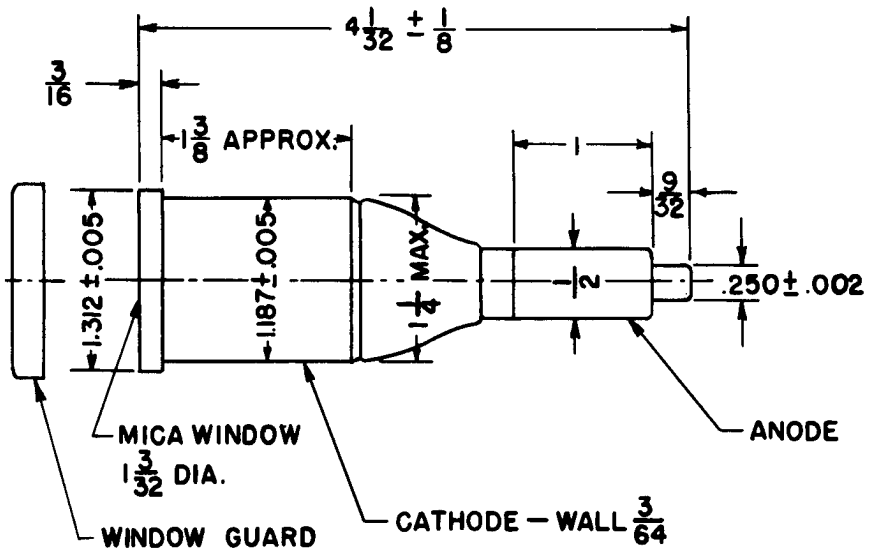
PERFORMANCE DATA

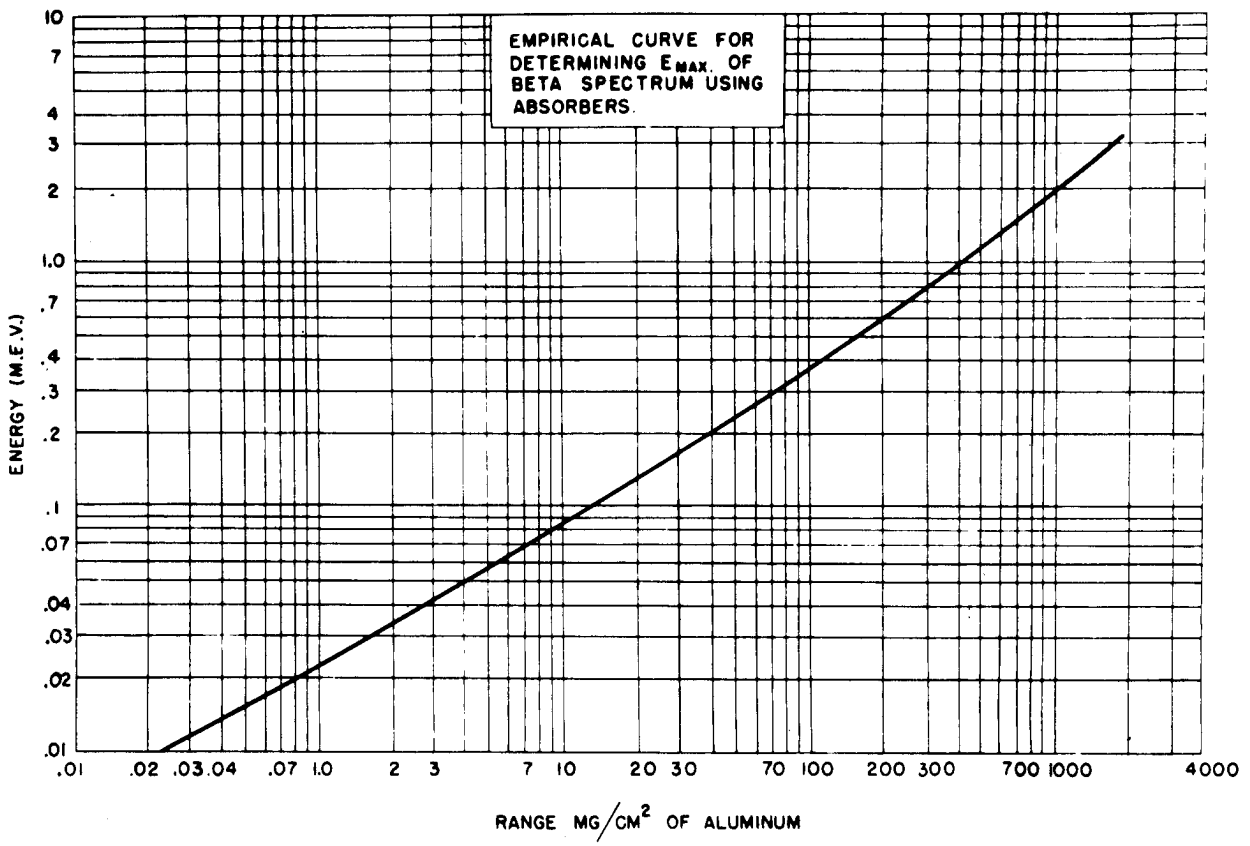
	100N, 100NB, 200N & 200NB	100C, 100CB, 200C & 200CB
Plateau Length[2]	in excess of 200 volts	in excess of 300 volts
Slope of Plateau[2,3]	< 10% per 100 volts	< 10% per 100 volts
Starting Voltage (0.3 volt pulses)[2]	625 volts DC max.	1075 volts DC max.
Capacity at Terminals	1.0 pf	1.0 pf
Radial Sensitivity (approx.)	85% - 90%	80% - 85%
Read Time (approx.)	200 microseconds	200 microseconds
Maximum Counting Rate[4]	830 counts per sec.	830 counts per sec.
Background (Shielded 2 in. lead and 1/8 in. aluminum)	50 counts per min. max.	50 counts per min. max.
Life Expectancy in Counts[5]	unlimited by use	unlimited by use
Maximum Operating Altitude	25,000 feet	25,000 feet

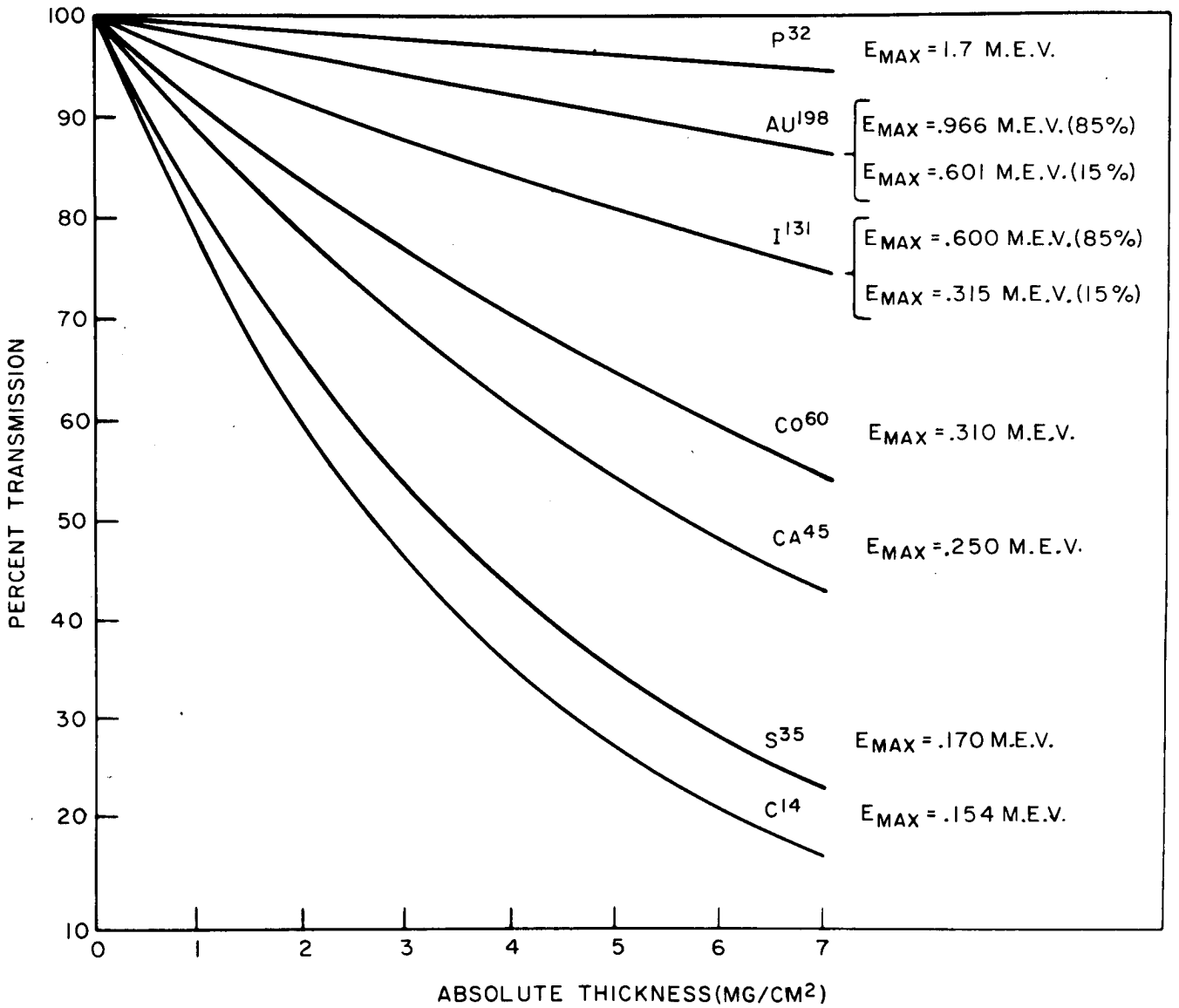
1. 1.4 mg/cm^2 mica = .0002 inch = 5.08 microns., 3.5 mg/cm^2 mica .0005 inch = 12.70 micron.
2. This data is obtained from an automatic plateau trace run on each tube. A print of this trace is shipped with each tube.
3. At an average counting rate of 100 counts per second.
4. For 20% dead time correction (approx.).
5. Guaranteed 5 x 10^{10} counts minimum.

Amperex

September 1962

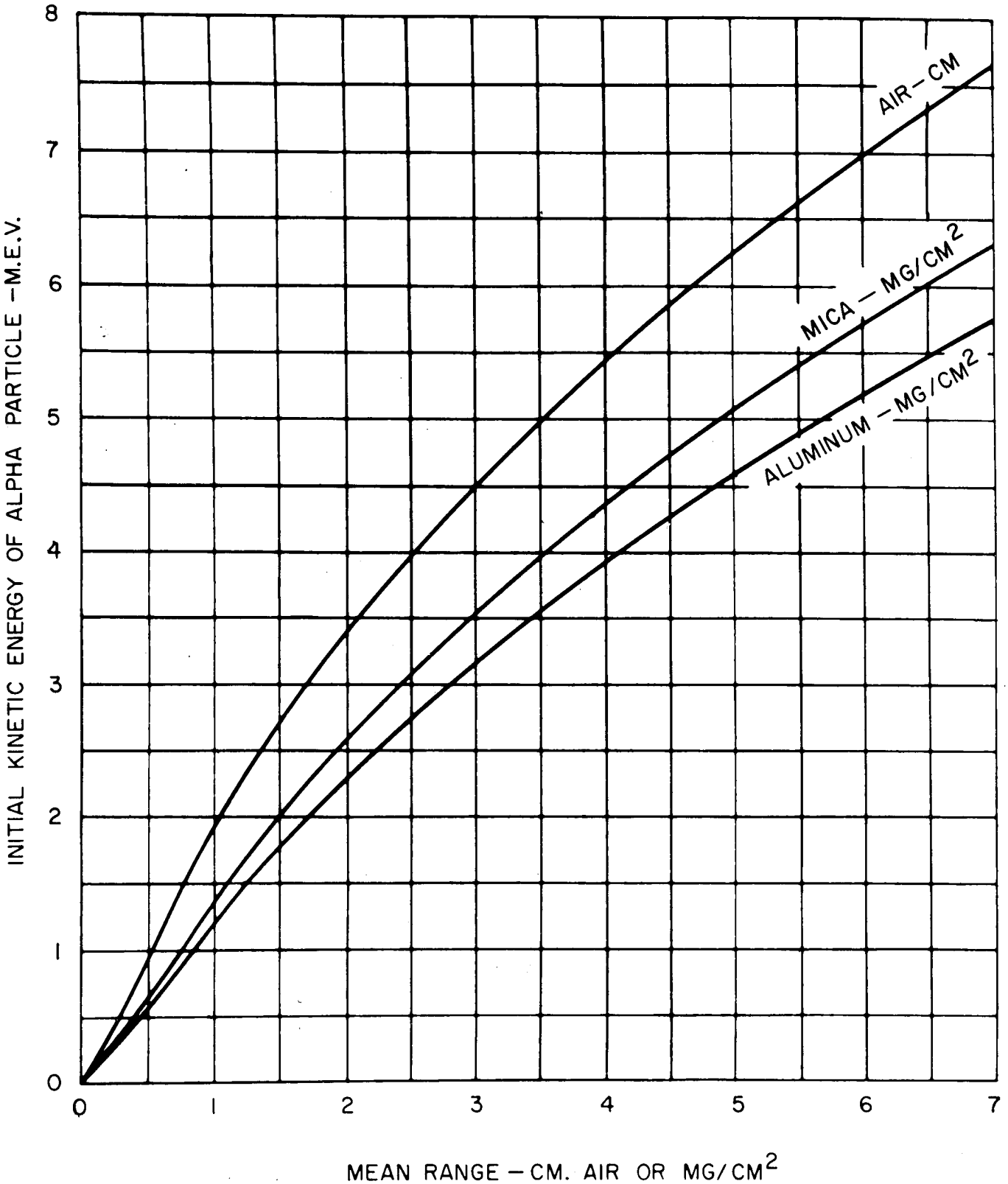

4 1/32 ± 1/8
3/16
1 3/8 APPROX.
1
9/32
1.312 ± .005
1.187 ± .005
1 1/4 MAX.
1/2
.250 ± .002
MICA WINDOW
1 3/32 DIA.
WINDOW GUARD
CATHODE — WALL 3/64
ANODE


EMPIRICAL CURVE FOR DETERMINING E MAX. OF BETA SPECTRUM USING ABSORBERS.
ENERGY (M.E.V.)
10
7
4
3
2
1.0
.7
.4
.3
.2
.1
.07
.04
.03
.02
.01
.01 .02 .03 .04 .07 1.0 2 3 7 10 20 30 70 100 200 300 700 1000 4000
RANGE MG/CM² OF ALUMINUM



CALCULATED TRANSMISSION OF BETA SPECTRUM FROM SOME COMMON RADIOISOTOPES

Adapted from G. I. Gleason, et al — Nucleonics, Vol. 8, No. 5, 18 (1951)



ALPHA PARTICLE MEAN RANGES

JOINT ELECTRON DEVICE ENGINEERING COUNCIL

JEDEC Type Administration Section
Electronic Industries Association
32 Green Street
Newark 2, New Jersey

E. I. A.
REGISTRATION
FILE

Announcement

of

Electron Device Type Registration

Release No. 2556B

July 2, 1962

The Joint Electron Device Engineering Council announces the registration of the following electron device designation

10DX8 *

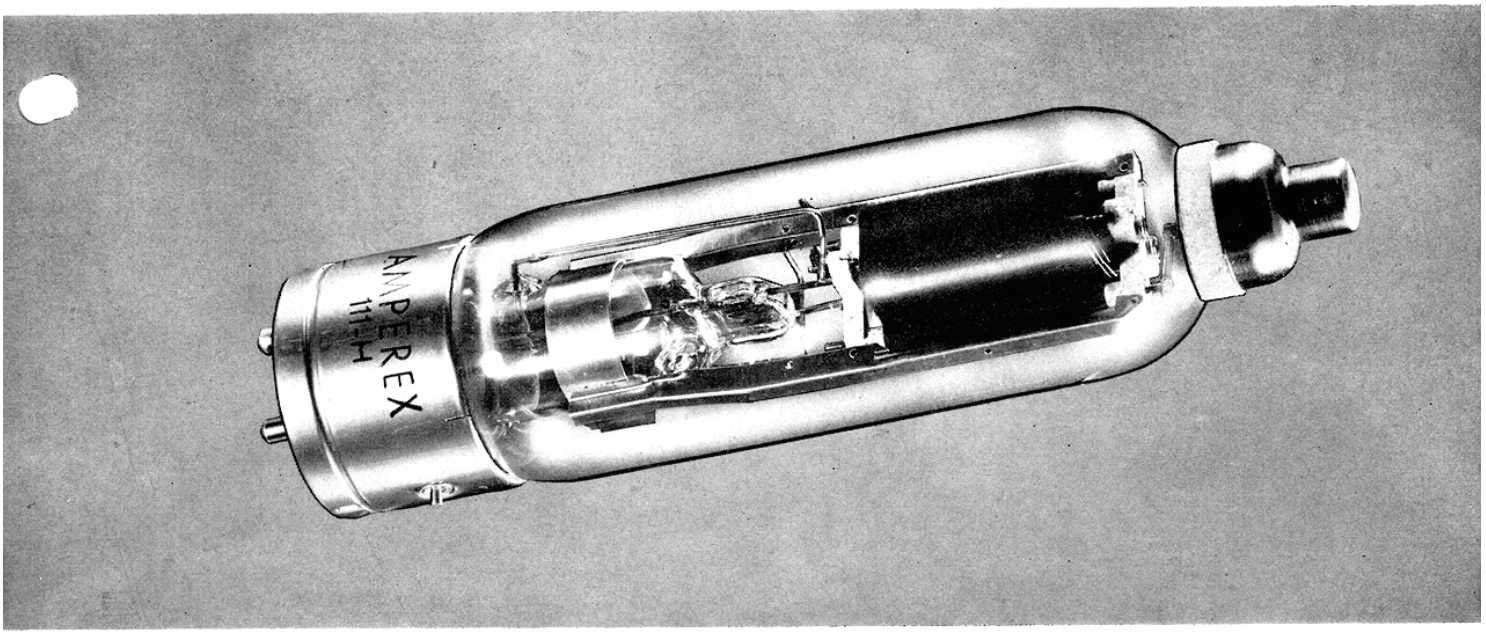
on the application of

Amperex Electronic Corporation
Hicksville, Long Island, New York

* The type 10DX8 is identical to the type 6DX8 as registered in Release No. 2556 except for the following:

Heater Voltage..... 10.2 volts
Heater Current..... 450 milliamperes
Series Supply

AMPEREX TRANSMITTING TUBE 111-H



R.F. Power Amplifier and Oscillator
Class B Audio Amplifier or Modulator

The 111-H is one of a distinctive group of low voltage high current tubes, an original development of the Amperex Engineering Laboratories. It is in addition characterized by an extraordinarily high ratio of transconductance to interelectrode capacitance, a characteristic which is responsible for its outstanding efficiency in high frequency circuits.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 to 10.5 volts
Current	2.5 amperes
Amplification Factor	23
Transconductance (grid to plate) Ip = 100 ma	4200 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	4.6 $\mu\mu$f
Grid to Filament	5.0 $\mu\mu$f
Plate to Filament	2.9 $\mu\mu$f
Frequency for Maximum Ratings	30 megacycles

MECHANICAL

Maximum Overall Dimensions	
Length	8½ inches
Greatest Radius	2 1/16 inches
Base	Standard Jumbo 4-pin Bayonet
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	5 ounces
Shipping Weight (approx.) (one tube)	2 pounds

111-H—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	....	10	10
D.C. Plate Voltage	1750	1500	1750
D.C. Grid Voltage	....	−52	−62
Load Resistance (per tube) (ohms)	....	3000	4000
Effective Load Resistance (Plate to Plate) (ohms)	....	12000	16000
Zero-Signal Plate Current (ma)	....	50	40
Peak A.F. Grid to Grid Voltage	....	264	324
Max. Signal Plate Current (ma)	150	270	270
Max. Signal Plate Input (watts)	240	....	....
Plate Dissipation (watts)	75	....	....
Max. Signal Driving Power (approx.) (watts)	....	2	9
Max. Signal Power Output (approx.) (watts)	....	260	350

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	....	10
D.C. Plate Voltage	1500	1500
D.C. Grid Voltage	....	−55
Peak R.F. Grid Voltage	....	80
D.C. Plate Current (ma)	100	75
Plate Input (watts)	115	112
D.C. Grid Current (approx.) (ma)	....	1.5
Plate Dissipation (watts)	75	70
Grid Driving Power at Modulation Peak (approx.) (watts)	....	3
Power Output (approx.) (watts)	....	42

R.F. Power Amplifier—Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	....	10	10	10
D.C. Plate Voltage	1500	1000	1250	1500
D.C. Grid Voltage	−500	−120	−200	−200
Peak R.F. Grid Voltage	....	250	330	340
D.C. Plate Current (ma)	160	150	130	150
Plate Intput (watts)	225	150	162	225
D.C. Grid Current (approx.) (ma)	30	21	18	18
Plate Dissipation (watts)	75	44	42	55
Driving Power (approx.) (watts)	....	5	6	6
Power Output (approx.) (watts)	....	106	120	170
Frequency Limit for Above Operation (mc.)	30	....	....	....

Plate Modulated R.F. Power Amplifier—Class C

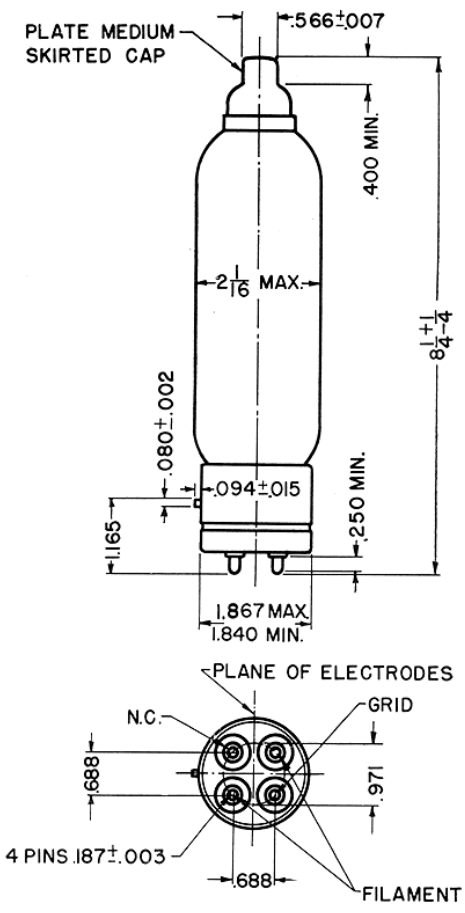
(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage (Total)	−300	−200	−250
Fixed Bias (approx.) (Voltage)	.....	−30	−40
Grid Resistor (approx.) (ohms)	.....	8500	10000
Peak R.F. Grid Voltage	....	330	380
D.C. Plate Current (ma)	120	120	110
Plate Input (watts)	140	120	137
D.C. Grid Current (approx.) (ma)	30	20	21
Plate Dissipation (watts)	50	30	32
Driving Power (approx.) (watts)	....	6.5	8
Plate Power Output (approx.) (watts)	....	90	105
Frequency Limit for Above Operation (mc.)	30	....	....
F.C.C. Broadcast Rating (watts) (Nearest Classification for Final Stage Use)	75	....	....

Grid Modulated R.F. Power Amplifier—Class C

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	....	10.0
D.C. Plate Voltage	1500	1500
D.C. Grid Voltage (Fixed Voltage)	−300	−280
Peak R.F. Grid Voltage	....	340
D.C. Plate Current (ma)	100	72
Plate Input (watts)	110	108
D.C. Grid Current (approx.) (ma)	....	1.5
Plate Dissipation (watts)	75	66
Grid Driving Power at Modulation Peak (approx.) (watts)	....	6
Power Output (approx.) (watts)	....	42
Frequency Limit for Above Operation (mc)	30	.....



JUMBO 4 PIN BASE WITH BAYONET PIN

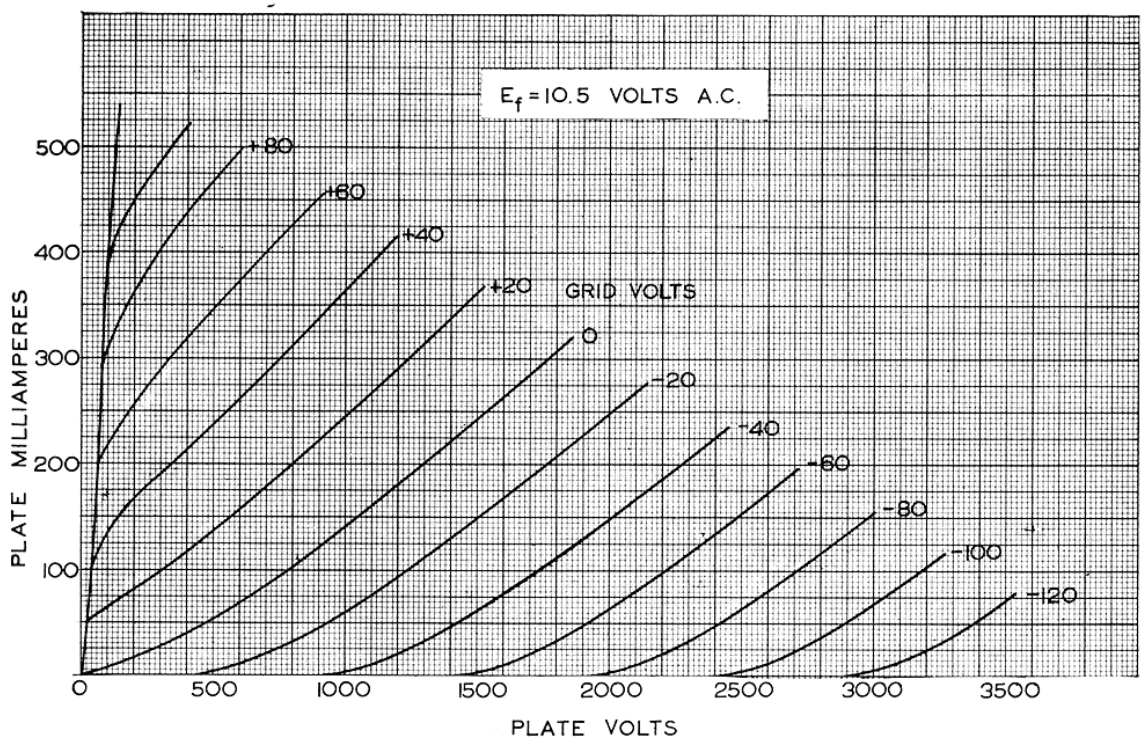
Self-Excited High Frequency Oscillator or Power Amplifier Class C

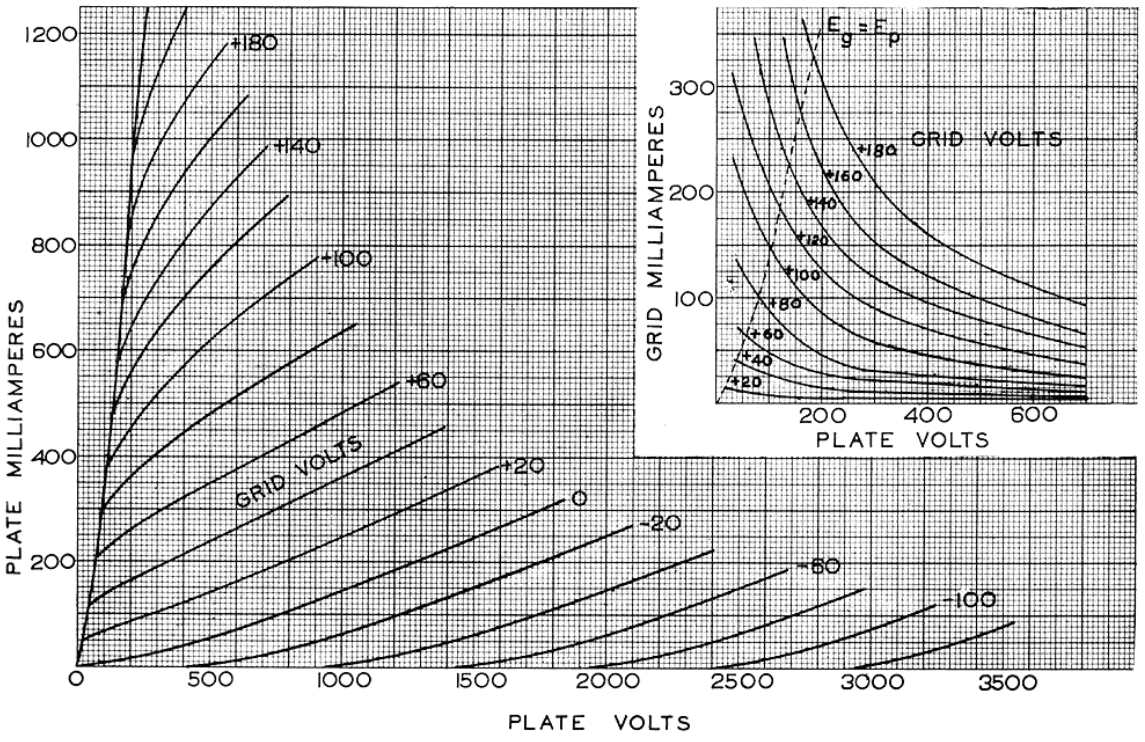
	Maximum Ratings for Operation at 30 mc.	60 mc.
D.C. Plate Voltage	1500	1200
Modulated D.C. Plate Voltage	1250	1000
A.C. Plate Voltage	1500	1500
D.C. Plate Current (ma)	160	160
D.C. Grid Bias Voltage	−500	−250
D.C. Grid Current (ma)	30	30
Plate Dissipation (watts)	75	60

Typical High Frequency Performance of 2 Tubes in Tuned-Grid Tuned-Plate Push-Pull Circuits

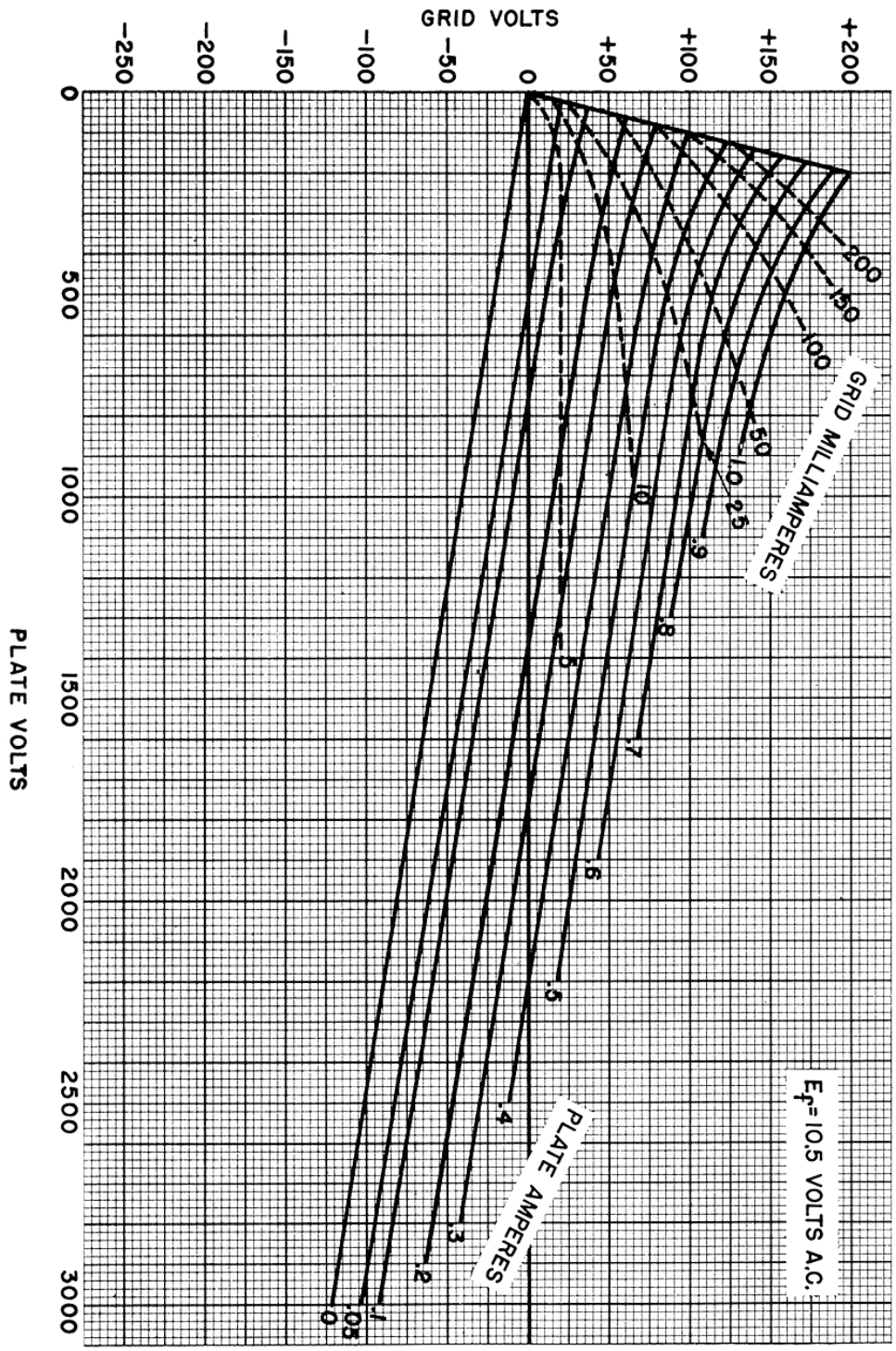
Frequency	30 mc.	60 mc.
Plate Voltage	1500 A.C.	1200 D.C.
Plate Current	280 ma	260 ma
Power Delivered to Load Circuit	260 watts	220 watts

AMPEREX TRANSMITTING TUBE 111-H





111-H—AMPEREX TRANSMITTING TUBE



111-H

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA DATA BUREAU
90 West Street
New York 6, N. Y.

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Amperex Electronic Corp.

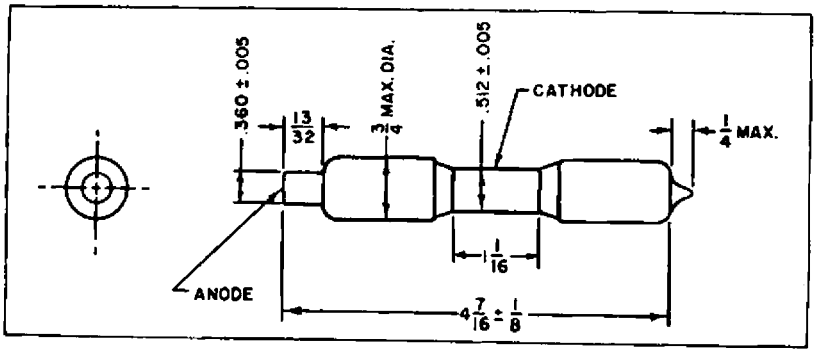
Release No. 657

April 30, 1948

GAMMA COUNTER TUBES

1B69, 1B70

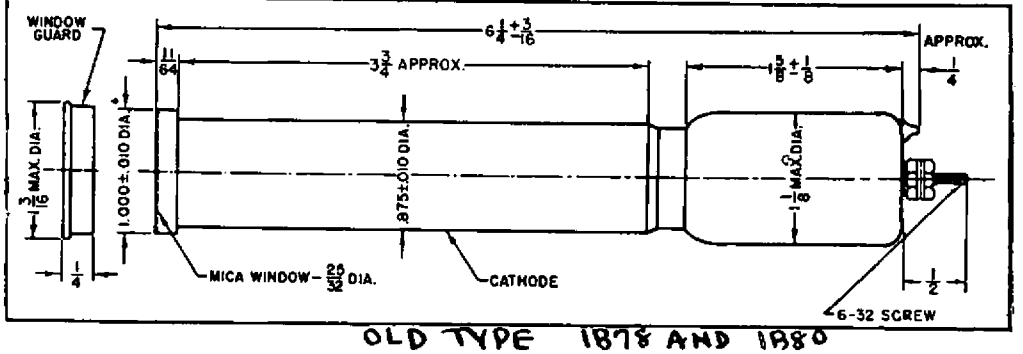
	1B69	1B70
Filling	Argon + quenching vapor	Argon + quenching vapor
Operating Temperature range	−20°C. to + 100°C.	0°C. to + 100°C.
Operating Voltage	1150 volts D.C.	1400 volts D.C.
Plateau	in excess of 300 volts	in excess of 500 volts
Slope of Plateau	2% to 5% per 100 volts	10% per 100 volts
Capacity at terminals	1.5 mmf	1.5 mmf
Cosmic Ray efficiency	greater than 99%	greater than 20%
Dead time	200 microseconds	200 microseconds
Barkground—unshielded	10 counts per minute	2 counts per minute
Life expectancy in counts	greater than 10^{8} counts	greater than 10^{10} counts
Cathode Material	Copper	Copper
Effective Cathode Dimensions	1 1/16" long x 1/2" O.D. x .020" wall	1 1/16" long x 1/2" O.D. x .020" wall



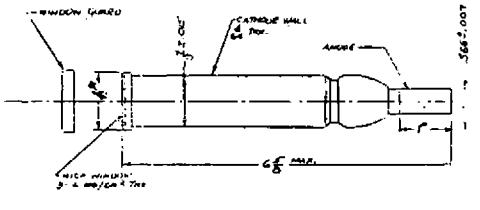
from RMA release # 657A, May 27, 1949

March 26th, 1949

Tube Type	Item	As Registered	As Proposed
1B69	Plateau Slope of Plateau Dead Time	in excess of 300 Volts 2% to 5% per 100 volts 200 microseconds	in excess of 200 volts 5% per 100 volts max. approx. 70 microseconds
1B73	Slope of Plateau Dead Time	2% to 5% per 100 volts 200 microseconds	5% per 100 volts max. approx. 100 microseconds
1B75	Oper. Temp. range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 volts	- 55°C to +75°C 10% per 100 volts max.
1B76	Oper. Temp. range Operating Voltage Plateau Slope of Plateau	- 70°C to + 100°C 450 Volts D.C. in excess of 100 volts 5% per 100 Volts	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max.
1B77	Oper. Temp. range Slope of Plateau Dead time	- 70°C to + 100°C 2% to 5% per 100 volts 200 microseconds	- 55°C to + 75°C 10% per 100 volts max. approx. 320 microseconds
1B78	Oper. Temp Range Slope of Plateau Dead Time Outline drawing	- 70°C to + 100°C 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 10% per 100 volts max. approx 100 microseconds
1B80	Oper. Temp. range Operating voltage Plateau Slope of Plateau Dead time Outline drawing	- 70°C to + 100°C 450 volts D.C. in excess of 100 volts 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max. approx. 180 microseconds
1B81	Oper. Temp. Range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 Volts	- 55°C to + 75°C 10% per 100 volts max.



OLD TYPE 1B78 AND 1B80



(NEW)

(1B78, 1B80)

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA DATA BUREAU
90 West Street
New York 6, N. Y.

sponsor:
Amperex Electronic Corp.

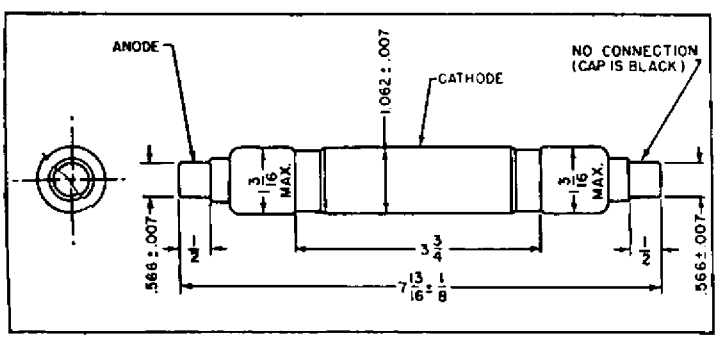
Release No. 657

April 30, 1948

GAMMA COUNTER TUBES

1B71, 1B72

	1B71	1B72
Filling	Argon + quenching vapor	Argon + quenching vapor
Operating Temperature range	−20°C. to + 100°C.	0°C. to + 100°C.
Operating Voltage	1150 volts D.C.	1400 volts D.C.
Plateau	in excess of 300 volts	in excess of 500 volts
Slope of Plateau	2% to 5% per 100 volts	10% per 100 volts
Capacity at terminals	2.4 mmf	2.4 mmf
Cosmic Ray Efficiency	greater than 99%	greater than 20%
Dead time	200 microseconds	200 microseconds
Background—unshielded	90 counts per minute	20 counts per minute
Life Expectancy in counts.	greater than 10^8 counts	greater than 10^{10} counts
Cathode Material	Copper	Copper
Effective Cathode Dimensions	3" long x 1" O.D. x 1/16" wall	3" long x 1" O.D. x 1/16" wall



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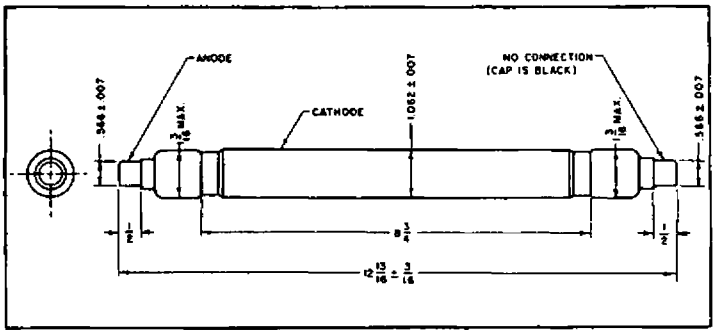
Release No. 657

April 30, 1948

GAMMA COUNTER TUBES

1B73, 1B74

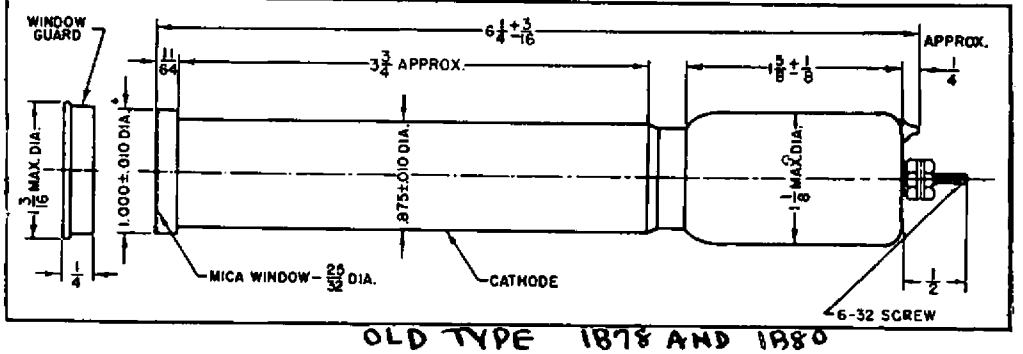
	1B73	1B74
Filling	Argon + quenching vapor	Argon + quenching vapor
Operating Temperature range	−20°C. to + 100°C.	0°C. to + 100°C.
Operating Voltage	1150 volts D.C.	1400 volts D.C.
Plateau	in excess of 300 volts	in excess of 500 volts
Slope of Plateau	2% to 5% per 100 volts	10% per 100 volts
Capacity at terminals	3.6 mmf	3.6 mmf
Cosmic Ray Efficiency	greater than 99%	greater than 20%
Dead time	200 microseconds	200 microseconds
Background—unshielded	200 counts per minute	40 counts per minute
Life Expectancy in counts	greater than 10^8 counts	greater than 10^{10} counts
Cathode Material	Copper	Copper
Effective Cathode Dimensions	8" long x 1" O.D. x 1/16" wall	8" long x 1" O.D. x 1/16" wall



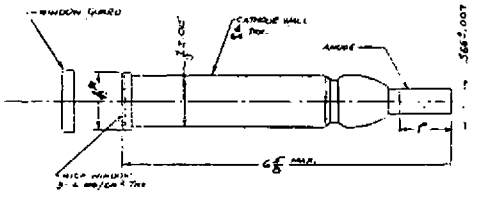
from RMA release # 657A, May 27, 1949

March 26th, 1949

Tube Type	Item	As Registered	As Proposed
1B69	Plateau Slope of Plateau Dead Time	in excess of 300 Volts 2% to 5% per 100 volts 200 microseconds	in excess of 200 volts 5% per 100 volts max. approx. 70 microseconds
1B73	Slope of Plateau Dead Time	2% to 5% per 100 volts 200 microseconds	5% per 100 volts max. approx. 100 microseconds
1B75	Oper. Temp. range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 volts	- 55°C to +75°C 10% per 100 volts max.
1B76	Oper. Temp. range Operating Voltage Plateau Slope of Plateau	- 70°C to + 100°C 450 Volts D.C. in excess of 100 volts 5% per 100 Volts	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max.
1B77	Oper. Temp. range Slope of Plateau Dead time	- 70°C to + 100°C 2% to 5% per 100 volts 200 microseconds	- 55°C to + 75°C 10% per 100 volts max. approx. 320 microseconds
1B78	Oper. Temp Range Slope of Plateau Dead Time Outline drawing	- 70°C to + 100°C 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 10% per 100 volts max. approx 100 microseconds
1B80	Oper. Temp. range Operating voltage Plateau Slope of Plateau Dead time Outline drawing	- 70°C to + 100°C 450 volts D.C. in excess of 100 volts 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max. approx. 180 microseconds
1B81	Oper. Temp. Range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 Volts	- 55°C to + 75°C 10% per 100 volts max.



OLD TYPE 1B78 AND 1B80



(NEW)

(1B78, 1B80)

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA DATA BUREAU
90 West Street
New York 6, N. Y.

sponsor:
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Release No. 657

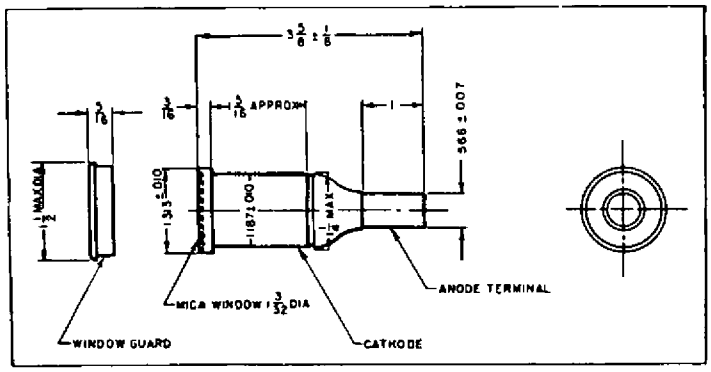
April 30, 1948

BETA COUNTER TUBES

1B75, 1B76

	1B75	1B76
Filling	Argon + quenching admixture	Neon + quenching admixture
Operating Temperature Range	−70°C to +100°C	−70°C to +100°C
Operating Voltage	1200 volts D.C.	450 volts D.C.
Plateau	in excess of 300 volts	in excess of 100 volts
Slope of plateau	2% to 5% per 100 volts	5% per 100 volts
Capacity at terminals	1.0 mmf	1.0 mmf
Cosmic Ray Efficiency	.....	greater than 80%
Dead time	200 microseconds	200 microseconds
Background-unshielded	50 counts per minute	50 counts per minute
Life expectancy in counts	unlimited by use	unlimited by use
Average Mica Window Thickness	.0005 in. = 3.5mg/cm² = 12.70 microns	.0005 in. = 3.5mg/cm² = 12.70 microns
Effective Diameter of Mica Window	1 3/32"	1 3/32"
Cathode Material	Stainless Steel	Stainless Steel
Effective Cathode Dimensions	1½" long x 1 3/16" O.D. x 3/32" wall	1½" long x 1 3/16" O.D. x 3/32" wall

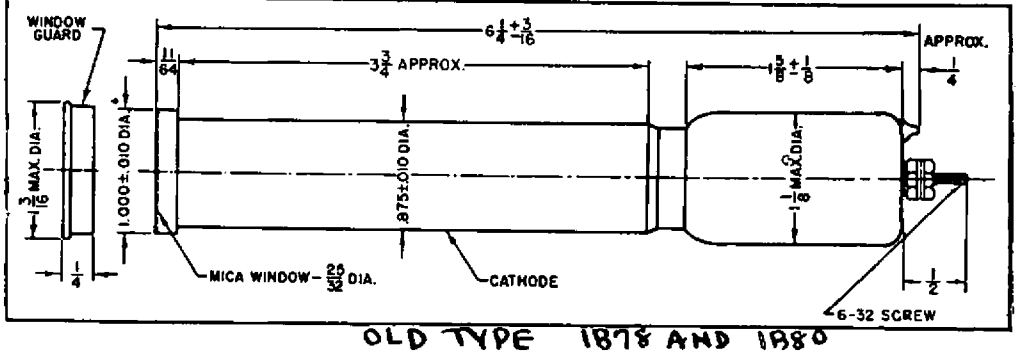
Mica windows 3.5mg/cm² thick will pass all beta radiation of energy in excess of 43 KEV. when the source is in close proximity to the window.



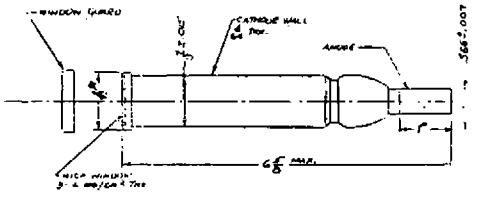
from RMA release # 657A, May 27, 1949

March 26th, 1949

Tube Type	Item	As Registered	As Proposed
1B69	Plateau Slope of Plateau Dead Time	in excess of 300 Volts 2% to 5% per 100 volts 200 microseconds	in excess of 200 volts 5% per 100 volts max. approx. 70 microseconds
1B73	Slope of Plateau Dead Time	2% to 5% per 100 volts 200 microseconds	5% per 100 volts max. approx. 100 microseconds
1B75	Oper. Temp. range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 volts	- 55°C to +75°C 10% per 100 volts max.
1B76	Oper. Temp. range Operating Voltage Plateau Slope of Plateau	- 70°C to + 100°C 450 Volts D.C. in excess of 100 volts 5% per 100 Volts	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max.
1B77	Oper. Temp. range Slope of Plateau Dead time	- 70°C to + 100°C 2% to 5% per 100 volts 200 microseconds	- 55°C to + 75°C 10% per 100 volts max. approx. 320 microseconds
1B78	Oper. Temp Range Slope of Plateau Dead Time Outline drawing	- 70°C to + 100°C 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 10% per 100 volts max. approx 100 microseconds
1B80	Oper. Temp. range Operating voltage Plateau Slope of Plateau Dead time Outline drawing	- 70°C to + 100°C 450 volts D.C. in excess of 100 volts 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max. approx. 180 microseconds
1B81	Oper. Temp. Range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 Volts	- 55°C to + 75°C 10% per 100 volts max.



OLD TYPE 1B78 AND 1B80



(NEW)

(1B78, 1B80)

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA DATA BUREAU
90 WEST STREET
NEW YORK 6, N. Y.

sponsor:
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Release No. 657

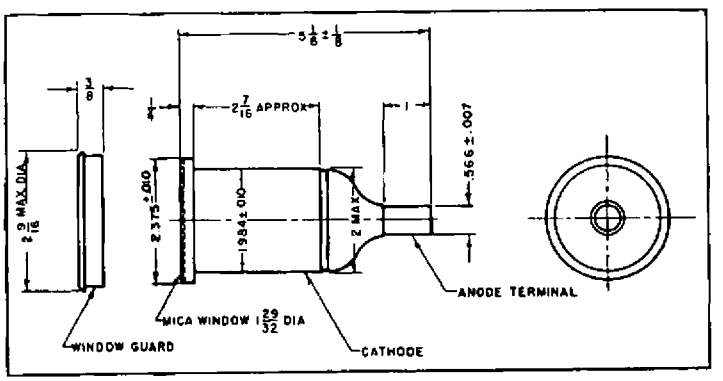
April 30, 1948

BETA COUNTER TUBE

1B77

Filling	Argon + quenching admixture
Operating Temperature Range	−70°C to +100°C
Operating Voltage	1200 volts D.C.
Plateau	in excess of 300 volts
Slope of plateau	2% to 5% per 100 volts
Capacity at terminals	1.0 mmf
Cosmic Ray Efficiency	
Dead time	200 microseconds
Background-unshielded	250 counts per minute
Life expectancy in counts	unlimited by use
Average Mica Window Thickness	.0008 in. = 5.6mg/cm² = 20.32 microns
Effective Diameter of Mica Window	1 29/32"
Cathode Material	Stainless Steel
Effective Cathode Dimensions	2 11/16" long x 2" O.D. x 5/64" wall

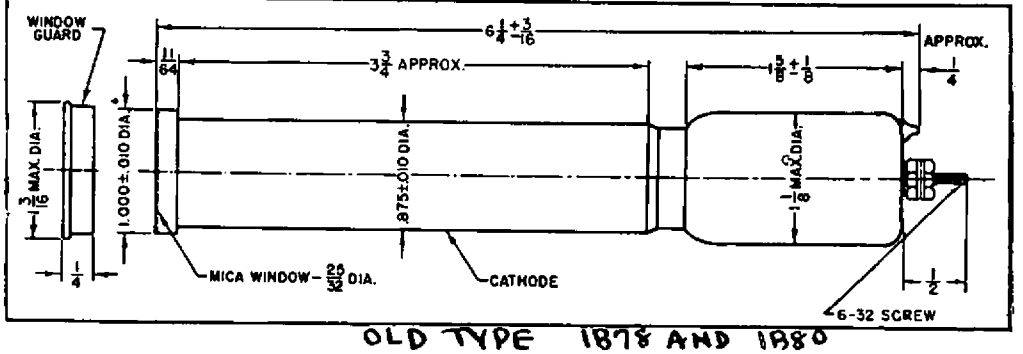
Mica windows 5.6mg/cm² thick will pass all beta radiation of energy in excess of 57 KEV. when the source is in close proximity to the window.



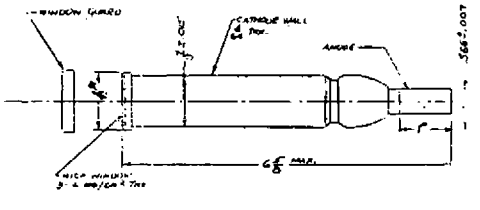
from RMA release # 657A, May 27, 1949

March 26th, 1949

Tube Type	Item	As Registered	As Proposed
1B69	Plateau Slope of Plateau Dead Time	in excess of 300 Volts 2% to 5% per 100 volts 200 microseconds	in excess of 200 volts 5% per 100 volts max. approx. 70 microseconds
1B73	Slope of Plateau Dead Time	2% to 5% per 100 volts 200 microseconds	5% per 100 volts max. approx. 100 microseconds
1B75	Oper. Temp. range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 volts	- 55°C to +75°C 10% per 100 volts max.
1B76	Oper. Temp. range Operating Voltage Plateau Slope of Plateau	- 70°C to + 100°C 450 Volts D.C. in excess of 100 volts 5% per 100 Volts	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max.
1B77	Oper. Temp. range Slope of Plateau Dead time	- 70°C to + 100°C 2% to 5% per 100 volts 200 microseconds	- 55°C to + 75°C 10% per 100 volts max. approx. 320 microseconds
1B78	Oper. Temp Range Slope of Plateau Dead Time Outline drawing	- 70°C to + 100°C 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 10% per 100 volts max. approx 100 microseconds
1B80	Oper. Temp. range Operating voltage Plateau Slope of Plateau Dead time Outline drawing	- 70°C to + 100°C 450 volts D.C. in excess of 100 volts 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max. approx. 180 microseconds
1B81	Oper. Temp. Range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 Volts	- 55°C to + 75°C 10% per 100 volts max.



OLD TYPE 1B78 AND 1B80



(NEW)

(1B78, 1B80)

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA DATA BUREAU
90 West Street
New York 6, N. Y.

sponsor:
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Release No. 657

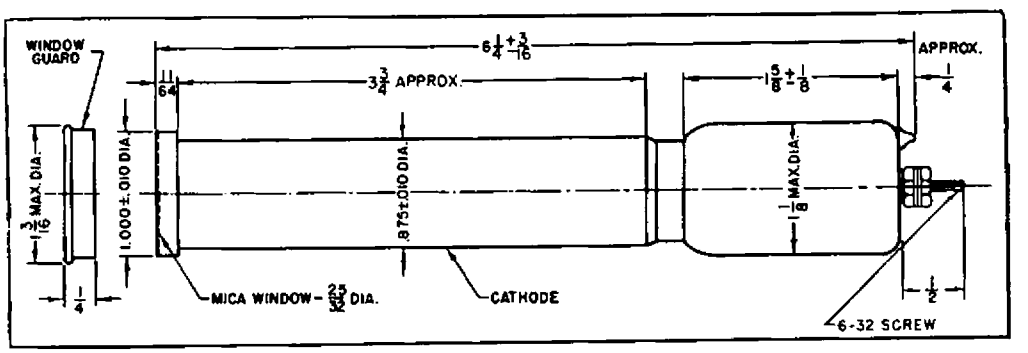
April 30, 1948

COUNTER TUBES

1B78, 1B79

	1B78	1B79
Filling	Argon + quenching admixture	Argon + quenching admixture
Operating Temperature Range	−70°C to +100°C	0°C to +100°C
Operating Voltage	1200 volts D.C.	1400 volts D.C.
Plateau	in excess of 300 volts	in excess of 500 volts
Slope of plateau	5% per 100 volts	10% per 100 volts
Capacity at terminals	2.4 mmf	2.4 mmf
Cosmic Ray Efficiency	greater than 80%	greater than 20%
Dead time	200 microseconds	200 microseconds
Background-unshielded	62 counts per minute	15 counts per minute
Life expectancy in counts	unlimited by use	greater than 10^{10} counts
Average Mica Window Thickness	.0005 in. = 3.5mg/cm^2 = 12.70 microns	.0005 in. = 3.5mg/cm^2 = 12.70 microns
Effective dia. of Mica Window	25/32"	25/32"
Cathode Material	Stainless Steel	Stainless Steel
Effective Cathode Dimensions	4" long x ⅞" O.D. x .047" wall	4" long x ⅞" O.D. x .047" wall

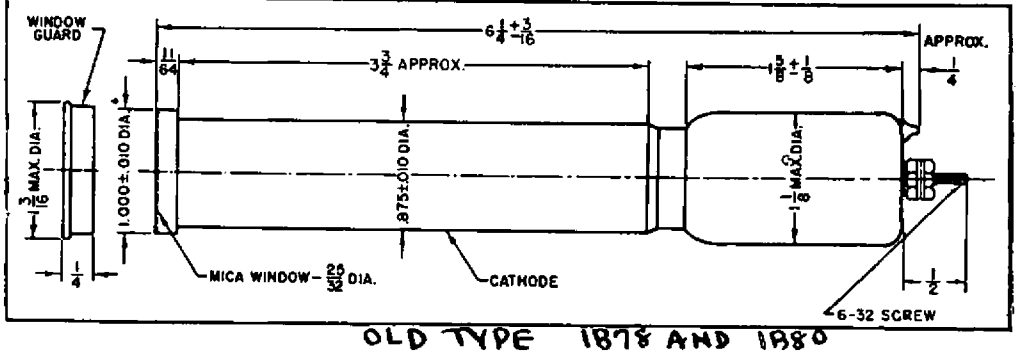
Mica windows 3.5mg/cm^2 thick will pass all beta radiation of energy in excess of 43 KEV. when the source is in close proximity to the window.



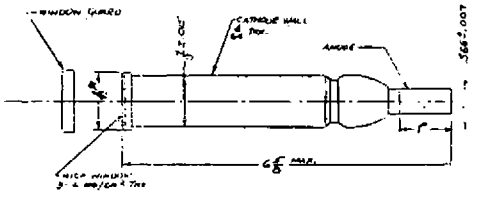
from RMA release # 657A, May 27, 1949

March 26th, 1949

Tube Type	Item	As Registered	As Proposed
1B69	Plateau Slope of Plateau Dead Time	in excess of 300 Volts 2% to 5% per 100 volts 200 microseconds	in excess of 200 volts 5% per 100 volts max. approx. 70 microseconds
1B73	Slope of Plateau Dead Time	2% to 5% per 100 volts 200 microseconds	5% per 100 volts max. approx. 100 microseconds
1B75	Oper. Temp. range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 volts	- 55°C to +75°C 10% per 100 volts max.
1B76	Oper. Temp. range Operating Voltage Plateau Slope of Plateau	- 70°C to + 100°C 450 Volts D.C. in excess of 100 volts 5% per 100 Volts	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max.
1B77	Oper. Temp. range Slope of Plateau Dead time	- 70°C to + 100°C 2% to 5% per 100 volts 200 microseconds	- 55°C to + 75°C 10% per 100 volts max. approx. 320 microseconds
1B78	Oper. Temp Range Slope of Plateau Dead Time Outline drawing	- 70°C to + 100°C 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 10% per 100 volts max. approx 100 microseconds
1B80	Oper. Temp. range Operating voltage Plateau Slope of Plateau Dead time Outline drawing	- 70°C to + 100°C 450 volts D.C. in excess of 100 volts 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max. approx. 180 microseconds
1B81	Oper. Temp. Range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 Volts	- 55°C to + 75°C 10% per 100 volts max.



OLD TYPE 1B78 AND 1B80



(NEW)

(1B78, 1B80)

RADIO MANUFACTURERS ASSOCIATION
ENGINEERING DEPARTMENT

RMA DATA BUREAU
90 West Street
New York 6, N. Y.

Release No. 657

April 30, 1948

COUNTER TUBES

1B80, 1B81

sponsor:
Amperex Electronic Corp.

1B80

Filling	Neon + quenching admixture
Operating Temperature Range	−70°C to +100°C
Operating Voltage	450 volts D.C.
Plateau	in excess of 100 volts
Slope of plateau	5% per 100 volts
Capacity at terminals	2.4 mmf
Cosmic Ray Efficiency	greater than 80%
Dead time	200 microseconds
Background-unshielded	62 counts per minute
Life expectancy in counts	unlimited by use
Average Mica Window Thickness	.0005 in. = 3.5mg/cm² = 12.70 microns
Effective dia. of Mica Window	25/32"
Cathode Material	Stainless Steel
Effective Cathode Dimensions	4" long x ⅞" O.D. x .047" wall

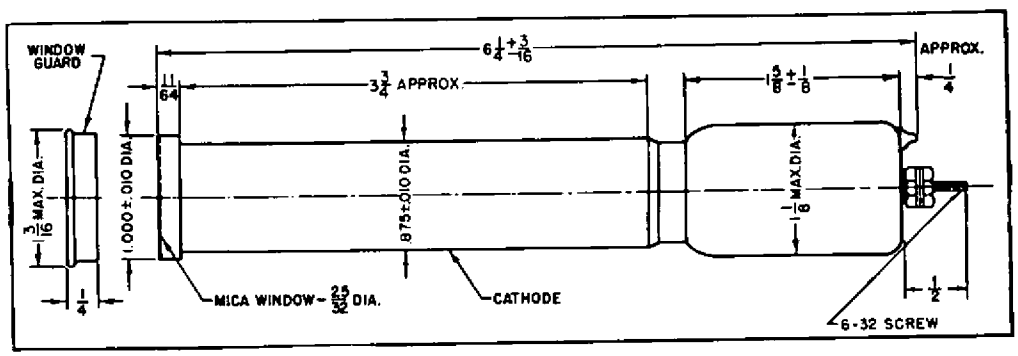
Mica windows 3.5mg/cm² thick will pass all beta radiation of energy in excess of 43 KEV. when the source is in close proximity to the window.

1B81

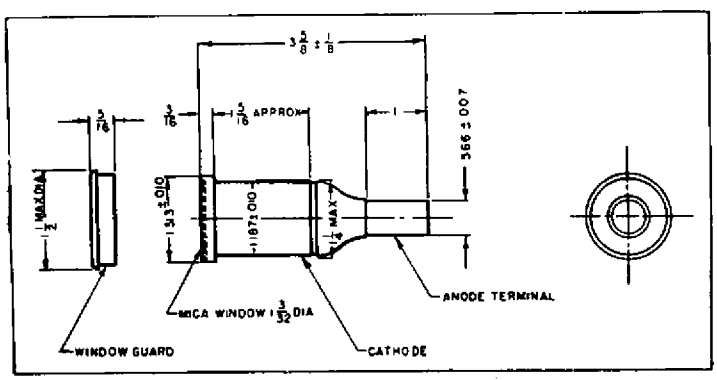
Filling	Argon + quenching admixture
Operating Temperature Range	−70°C to +100°C
Operating Voltage	1200 volts D.C.
Plateau	in excess of 300 volts
Slope of plateau	2% to 5% per 100 volts
Capacity at terminals	1.0 mmf
Cosmic Ray Efficiency	.....
Dead time	200 microseconds
Background-unshielded	50 counts per minute
Life expectancy in counts	unlimited by use
Average Mica Window Thickness	.0002 in. = 1.4mg/cm² = 5.08 microns
Effective Diameter of Mica Window	1 3/32"
Cathode Material	Stainless Steel
Effective Cathode Dimensions	1½" long x 1 3/16" O.D. x 3/32" wall

For alpha radiation, a mica window thickness of 1.4mg/cm² has the equivalent stopping power of one centimeter of air.
Mica windows 1.4mg/cm² thick will pass all beta radiation of energy in excess of 25 KEV. when the source is in close proximity to the window.

1B80.....



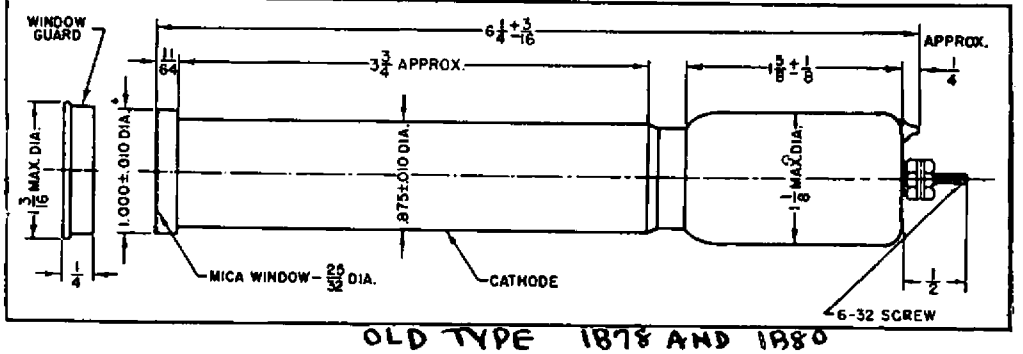
1B81.....



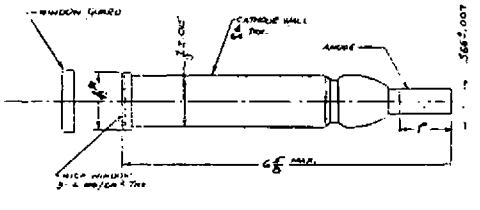
from RMA release # 657A, May 27, 1949

March 26th, 1949

Tube Type	Item	As Registered	As Proposed
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1B77	Oper. Temp. range Slope of Plateau Dead time	- 70°C to + 100°C 2% to 5% per 100 volts 200 microseconds	- 55°C to + 75°C 10% per 100 volts max. approx. 320 microseconds
1B78	Oper. Temp Range Slope of Plateau Dead Time Outline drawing	- 70°C to + 100°C 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 10% per 100 volts max. approx 100 microseconds
1B80	Oper. Temp. range Operating voltage Plateau Slope of Plateau Dead time Outline drawing	- 70°C to + 100°C 450 volts D.C. in excess of 100 volts 5% per 100 volts 200 microseconds see attached sheet	- 55°C to + 75°C 700 Volts D.C. in excess of 200 volts 10% per 100 volts max. approx. 180 microseconds
1B81	Oper. Temp. Range Slope of Plateau	- 70°C to + 100°C 2% to 5% per 100 Volts	- 55°C to + 75°C 10% per 100 volts max.



OLD TYPE 1B78 AND 1B80



(NEW)

(1B78, 1B80)

1B97
1B98
1B99
1B100
1B105

Release No. 776

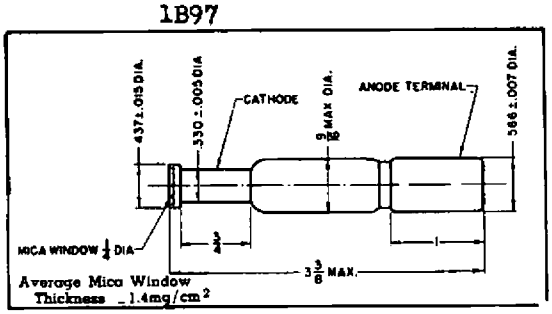
August 18, 1949

COUNTER TUBES

Filling: Neon plus quenching admixture
Operating Temperature Range: -55°C. to +75°C.
Life Expectancy, Counts: Unlimited by use
Guaranteed Counts: 5×10^{10} (minimum)

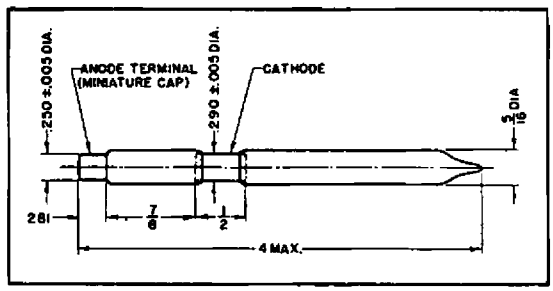
	1B97	1B98	1B99	1B100	1B105
Operating Voltage, dc volts	650	700	700	600	700
Plateau, volts (min)	150	150	200	150	200
Slope of plateau, per 100 v. max.	15%	20%	5 to 10%	15%	5 to 10%
Capacitance, μμf	1.0	0.6	1.0	1.5	1.0
Dead time (approx), μsec	40	30	200	50	300
Cosmic Ray Efficiency	--	--	--	80% (min)	--
Background with 2" shielded lead, counts per min. (max)	10	10	50	15	100

1B97



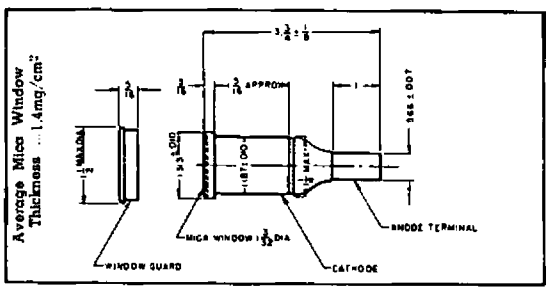
Cathode Material ——— Stainless Steel
Effective Cathode Dimensions ——— ¾" long x .330±.005" O.D. x .040" wall

1B98



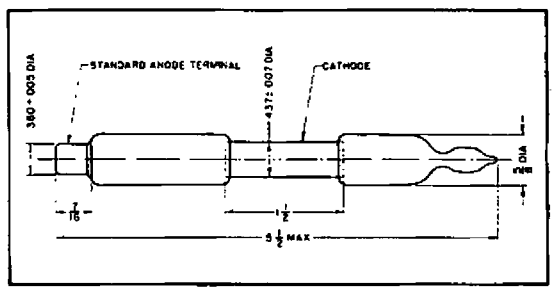
Cathode Material ——— Stainless Steel
Effective Cathode Dimensions ——— 1½" long x .290±.005" O.D. x .020" wall

1B99



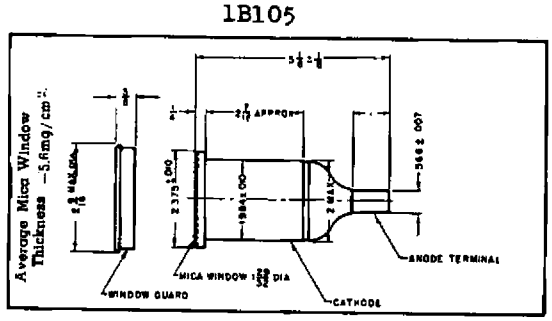
Cathode Material ..... Stainless Steel
Effective Cathode Dimensions ..... 1½" long x 1 3/16" O.D. x 3/32" wall

1B100



Cathode Material ..... Stainless Steel
Effective Cathode Dimensions..... 1½" long x .437±.007" O.D. x 1/32" wall

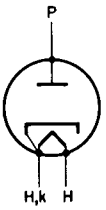
1B105



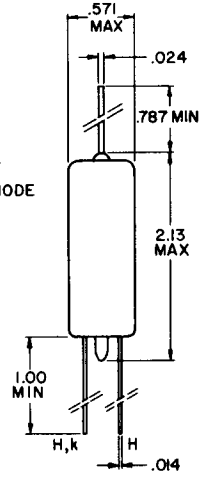
Cathode Material ——— Stainless Steel
Effective Cathode Dimensions ——— 2 11/16" long x 2" O.D. x 5/64" wall

AMPEREX TUBE TYPE 1BG2

The 1BG2 is a half-wave rectifier intended for use for high voltage supplies in portable TV receivers.



PIN CONNECTIONS
P – PLATE
H,k-HEATER,CATHODE
H – HEATER



GENERAL CHARACTERISTICS

MECHANICAL

The tube is provided with flexible leads (see outline).

ELECTRICAL

Heating	indirect
Heater Voltage	1.4 volts
Heater Current	575 ma
Capacitance, Cathode to Heater	0.8 pf

ABSOLUTE MAXIMUM RATINGS

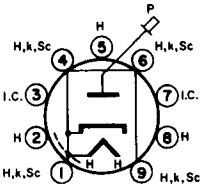
Peak Negative Plate to Cathode Voltage	18 kv
Plate Current Average	350 μa
Peak Plate Current	40 ma
Filter Capacitance	2000 μf
Heater Voltage	
Average Current <200 μa	1.6 volts
Average Current >200 μa	1.3 volts

DIODE CHARACTERISTICS

Diode Voltage	100 volts
Diode Current	13 ma

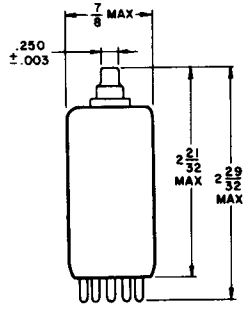
AMPEREX TUBE TYPE IBQ2

This tube is a high-vacuum single-anode rectifier for high tension in television receivers (EHT supply from the line time base). It has a chemically treated envelope which avoids flash-over under conditions of high humidity and low atmospheric pressure.



PIN CONNECTIONS[1,2,3]

1 – HEATER, CATHODE, SCREEN
2 – HEATER
3 – INTERNAL CONNECTION
4 – HEATER, CATHODE, SCREEN
5 – HEATER
6 – HEATER, CATHODE, SCREEN
7 – INTERNAL CONNECTION
8 – HEATER
9 – HEATER, CATHODE, SCREEN
P – PLATE (TOP CAP)



GENERAL CHARACTERISTICS

Mechanical

Dimensions	see outline drawing
Bulb	T 6-1/2, glass
Base	E9-1, noval
Cap	C1-2
Mounting Position	any

Electrical

Heater Characteristics	
Heater Arrangement	parallel supply
Heater Voltage (AC or DC)[4]	1.4 volts ±10%
Heater Current	0.6 amps
Direct Interelectrode Capacitance	
Plate to All	1.0 pf

---

[1] Pins 1, 4, 6 and 9 can be used for fixing an anti-corona ring.

[2] Circuit elements having the same potential as the heater (e.g. a series resistor) may be connected to pins 3 and 7. These pins must never be grounded.

[3] If the tube operates at high inverse plate voltages and/or under conditions of high relative humidity or low pressure the metal cap should get an insulating cover to avoid corona phenomena.

[4] For use as EHT rectifier in television receivers the heater voltage should be adjusted to its nominal value at a D.C. output current of 200 μa. At an increase of the D.C. output current to 400 - 800 μa which may occur during operation, the decrease of the heater voltage may amount to 15% maximum.

These requirements hold for nominal voltage and full horizontal scanning of the picture tube. If the picture width control is such that also the heater voltage of the E.H.T. diode is influenced, the influence of this control must be kept within the 15% limit indicated above.

Operating Characteristics

Output Current	I_o	200 μA
Output Voltage	V_o	20 KV

Maximum Ratings, Design Center Values

Plate Inverse Voltage[5]	20,000 volts
Peak Plate Inverse Voltage[6]	25,000 volts
Average Output Current[7]	500 μa
Peak Output Current	50 ma
Filter Input Capacitance	3,000 pf

---

[5] D.C. component

[6] Max. pulse duration 22% of a cycle, but max. 18 microseconds. The absolute maximum value = 30,000 volts.

[7] During short periods as in TV operation I_b = max. 800 microamps.

AMPEREX TUBE TYPE 1M3/DM70

The 1M3/DM70 is a subminiature tuning indicator tube specially designed for use in FM tuners where the demand for high-fidelity sound reproduction makes highly accurate tuning very desirable. This visual tuning tube is also suitable for application in wire and tape recorders where it simplifies proper recording by indicating the depth of modulation.

The 1M3/DM70 features extreme sensitivity, clear visual indication, low filament consumption, small size and "on-off" signal indication. The filament is directly heated.

GENERAL CHARACTERISTICS

ELECTRICAL

Heater	directly heated, A.C. or D.C., series or parallel connection.

MECHANICAL

Maximum overall length (excluding pins)	1 3/4 inches
Maximum diameter	0.4 inches
Base	miniature, 8 pin.
Socket	Amperex #S-19883

HEATER CIRCUIT

A. In Battery Receivers

Heater Voltage	1.4 volts
Heater Current	25 mA

Either pin 4 or 5 must be connected to the grounded point of the detector circuit.

B. In A.C. Receivers

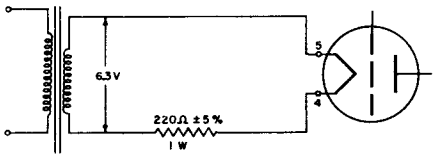


FIG. 1
With 6.3 volt transformer winding

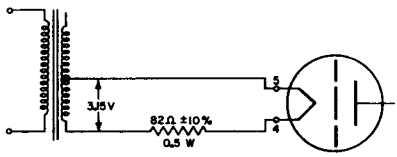


FIG. 2
With 6.3 volt winding with center tap

C. In A.C./D.C. Receivers

The heater, together with a suitable shunt resistor, can be connected in series with other tube heaters providing a negative temperature coefficient resistor is incorporated in the circuit.

Pin 5 must be connected to the grounded point of the detector circuit.

1M3/DM70

GRID CIRCUIT
(A.C. Filament Supply)

In order to minimize hum, a filter is recommended in the grid circuit according to the diagram below. R_1 is the detector resistor. R_2 and C_1 are already a part of the grid circuit in the case of non-delayed A.G.C.

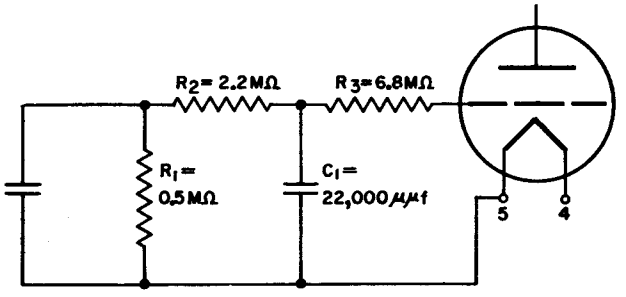
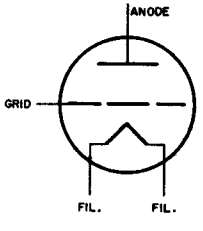


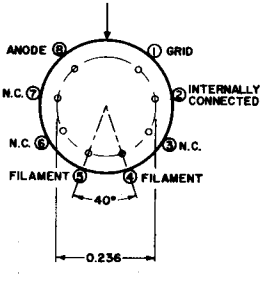
FIG. 3

PLATE CIRCUIT
(A.C. Filament Supply)

In order to minimize hum, an external plate resistar is recommended according to the table below.

Plate Voltage	Plate Resistor
250 volts	1.8 megohms
170 volts	1.0 megohms
110 volts	0.47 megohm





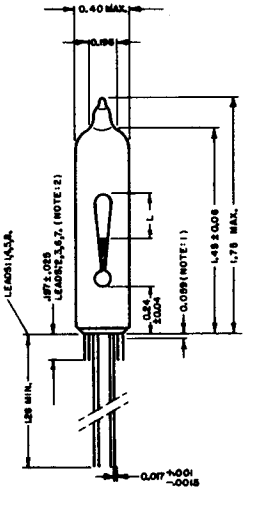


FIG. 4
L = Length of light bar

Maximum Ratings, Design Center Values

Supply Voltage (Plate Current = 0)	450 volts
Supply Voltage	300 volts
Plate Voltage [3]	90 volts
Plate Voltage	45 volts
Plate Dissipation (Plate Voltage $\leq$ 90 volts) [4]	45 mW
Plate Dissipation (Plate Voltage = 200 volts) [4]	10 mW
Cathode Current	0.3 mA
External Resistance Between Grid & Negative Filament	10 megohms

Typical Operating Conditions - Battery Supply

D.C. Filament Voltage	1.4 [3]	1.4 [5]	volts
Supply Voltage	67.5	90	volts
Plate Voltage [6]	60	85	volts
Grid Voltage	0	0	volts
Plate Current	105	170	μA
L (Length of light bar)	10	11	mm
Grid Voltage (L = 0)	−7	−10	volts

Typical Operating Conditions - A.C. Supply

Filament Voltage [7]	1.4	1.4	1.4	volts
Supply Voltage	110	170	250	volts
Plate Resistor	0.47	1.0	1.8	megohms
Grid Voltage	0	0	0	volts
Plate Current	105	110	105	μA
L (Length of light bar)	10	10	10	mW
Grid Voltage (L = 0)	−15	−23	−34	volts

[1] This part of the lead should not be bent.

[2] This part of the lead should not be soldered.

[3] Pin 5 grounded.

[4] At other values of plate voltage, the maximum plate dissipation can be found by linear interpolation.

[5] Pin 4 grounded.

[6] Plate voltage is equal to the supply voltage reduced by the bias for the output tube.

[7] Pin 5 grounded. When the filament voltage is adjusted according to FIG. 1 and FIG. 2, the plate current will be 1 to 2 microamps lower. All other operating conditions remain the same.

1M3/DM70

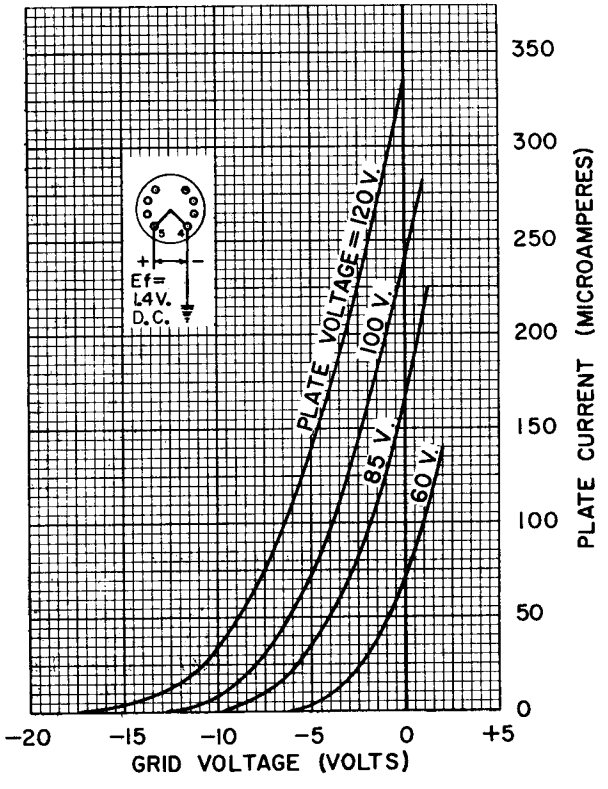


FIG. 5

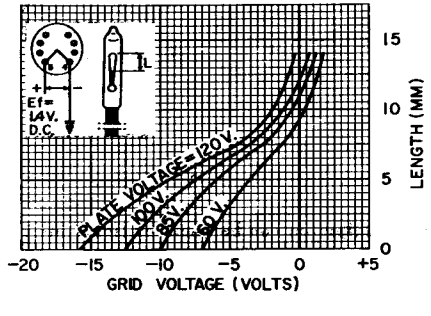


FIG. 6

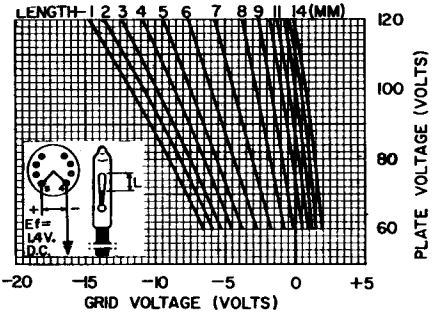


FIG. 7

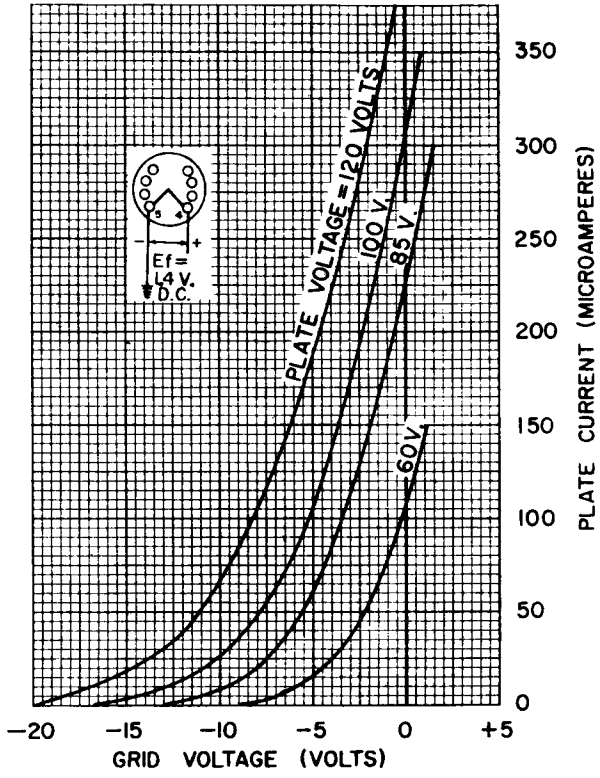


FIG. 8

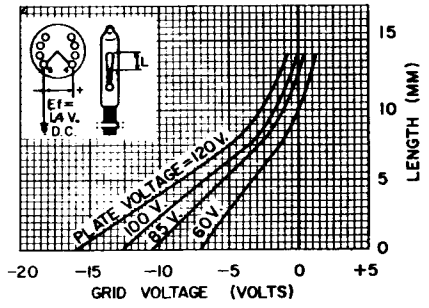


FIG. 9

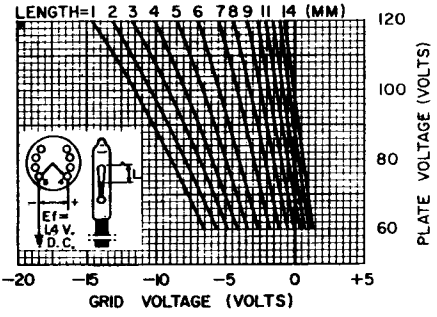


FIG. 10

1M3/DM70

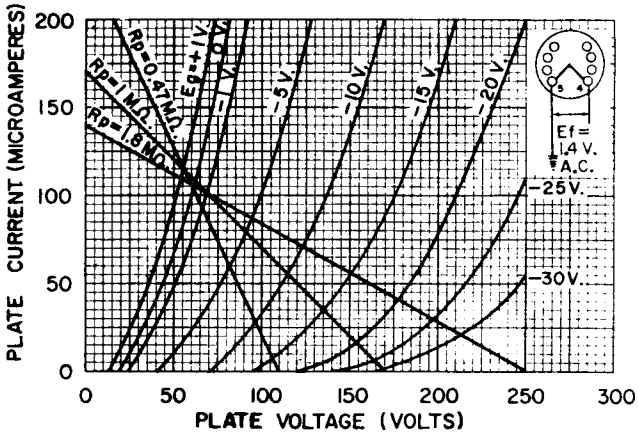


FIG. 11

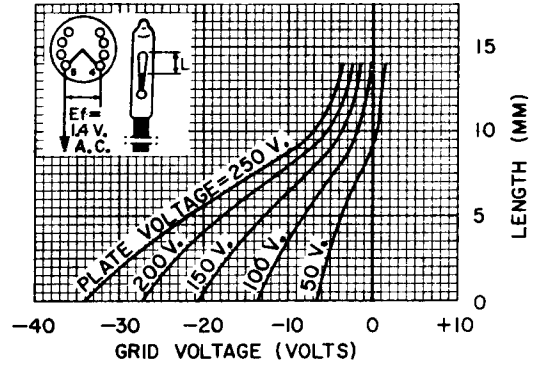


FIG. 12

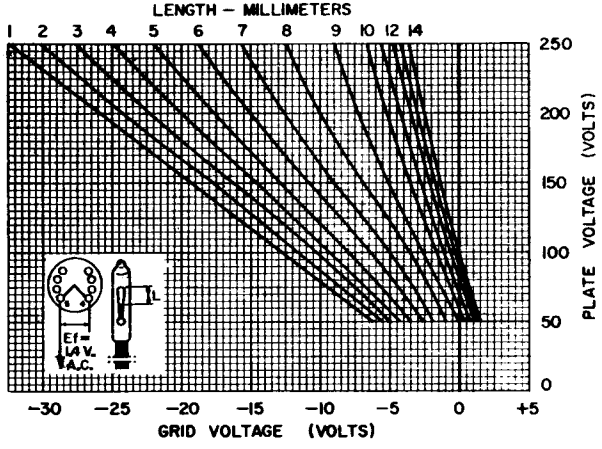
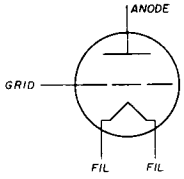


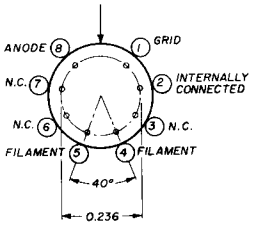
FIG. 13

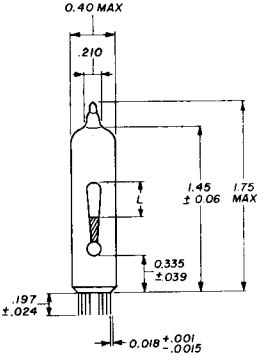
AMPEREX TUBE TYPE 1N3/DM71

The 1N3/DM71 is a subminiature tuning indicator tube specially designed for use in FM tuners where the demand for high-fidelity sound reproduction makes highly accurate tuning very desirable. This visual tuning tube is also suitable for application in wire and tape recorders where it simplifies proper recording by indicating the depth of modulation.

The 1N3/DM71 features extreme sensitivity, clear visual indication, low filament consumption, small size and "on-off" signal indication. The filament is directly heated.







GENERAL CHARACTERISTICS

MECHANICAL

Maximum overall length (excluding pins)	1¾ inches
Maximum Diameter	0.4 inches
Base	Miniature, 8 pin

Accessories

Socket	Amperex #S-19883

ELECTRICAL

Heater	directly heated AC or DC series or parallel connection

1N3/DM71

HEATER CIRCUIT

A. In Battery Receivers

Heater Voltage	1.4 volts
Heater Current	25 mA

Either pin 4 or 5 must be connected to the grounded point of the detector circuit.

B. In A.C. Receivers

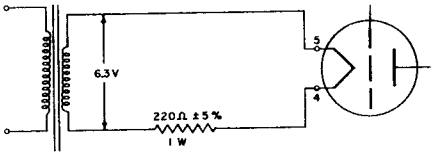


FIG. 1
With 6.3 volt transformer winding

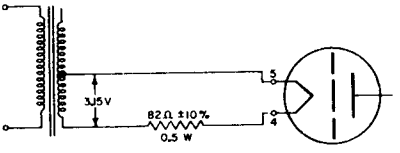


FIG. 2
With 6.3 volt winding with center tap

C. In A.C./D.C. Receivers

The heater, together with a suitable shunt resistor, can be connected in series with other tube heaters providing a negative temperature coefficient resistor is incorporated in the circuit.

Pin 5 must be connected to the grounded point of the detector circuit.

GRID CIRCUIT
(A.C. Filament Supply)

In order to minimize hum, a filter is recommended in the grid circuit according to the diagram below. R_1 is the detector resistor. R_2 and C_1 are already a part of the grid circuit in the case of non-delayed A.G.C.

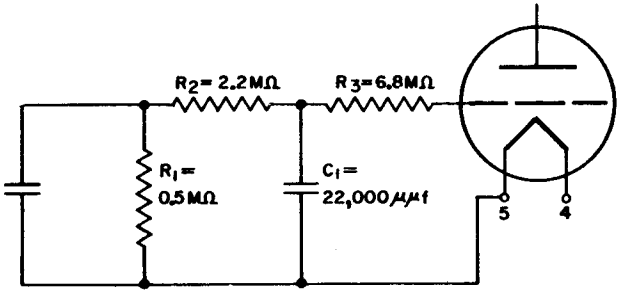


FIG. 3

PLATE CIRCUIT
(A.C. Filament Supply)

In order to minimize hum, an external plate resistor is recommended according to the table below.

Plate Voltage	Plate Resistor
250 volts	1.8 megohms
170 volts	1.0 megohms
110 volts	0.47 megohms

Maximum Ratings, Design Center Values

Supply Voltage (Plate Current = 0)	450 volts
Supply Voltage	300 volts
Plate Voltage [1]	90 volts
Plate Voltage	45 volts
Plate Dissipation (Plate Voltage $\leq$ 90 volts) [2]	45 mW
Plate Dissipation (Plate Voltage = 200 volts) [2]	10 mW
Cathode Current	0.3 mA
External Resistance Between Grid & Negative Filament	10 megohms

Typical Operating Conditions - Battery Supply

D.C. Filament Voltage	1.4[1]	1.4[3] volts
Supply Voltage	67.5	90 volts
Plate Voltage [4]	60	85 volts
Grid Voltage	0	0 volts
Plate Current	105	170 μA
L (Length of light bar)	0.4	0.43 inches
Grid Voltage (L = 0)	−7	−10 volts

Typical Operating Conditions - A.C. Supply

Filament Voltage [5]	1.4	1.4	1.4 volts
Supply Voltage	110	170	250 volts
Plate Resistance	0.47	1.0	1.8 megohms
Grid Voltage	0	0	0 volts
Plate Current	105	110	105 μA
L (Length of light bar)	0.4	0.4	0.4 inches
Grid Voltage (L = 0)	−15	−23	−34 volts

---

[1] Pin 5 grounded.

[2] At other values of plate voltage, the maximum plate dissipation can be found by linear interpolation.

[3] Pin 4 grounded.

[4] Plate voltage is equal to the supply voltage reduced by the bias for the output tube.

[5] Pin 5 grounded. When the filament voltage is adjusted according to Fig. 1 and Fig. 2, the plate current will be 1 to 2 microamps lower. All other operating conditions remain the same.

1N3/DM71

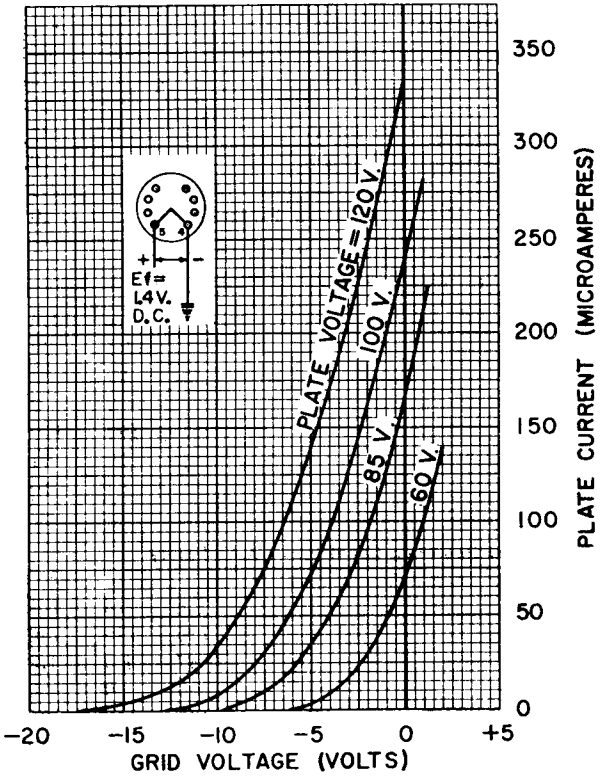


FIG. 5

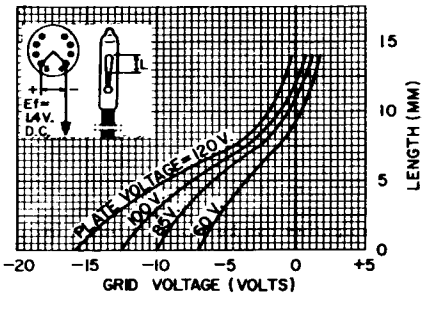


FIG. 6

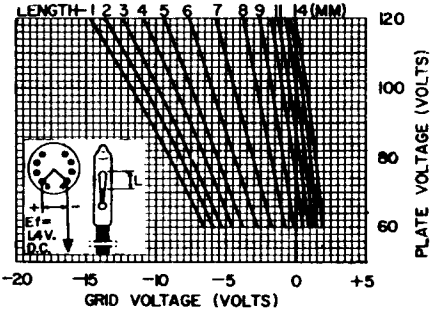


FIG. 7

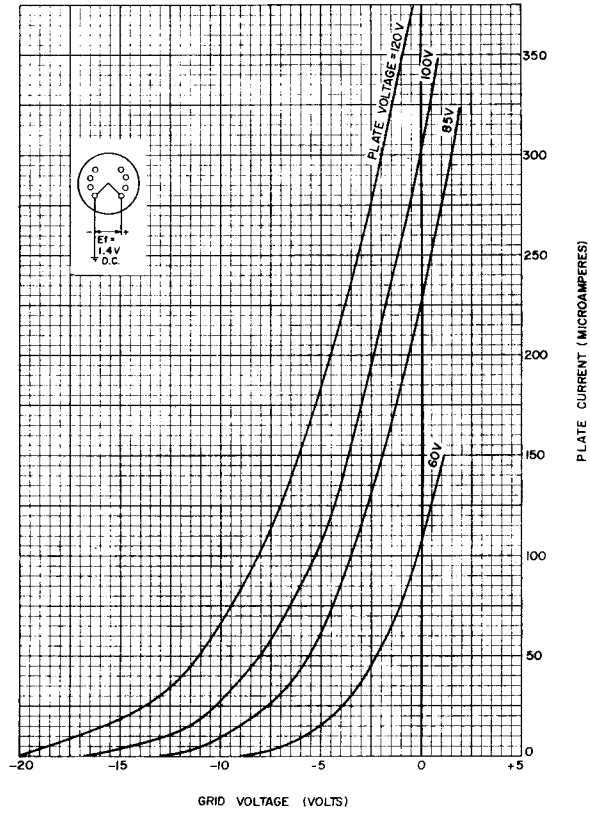


FIG. 8

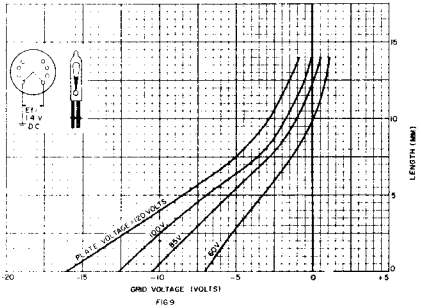


FIG 9

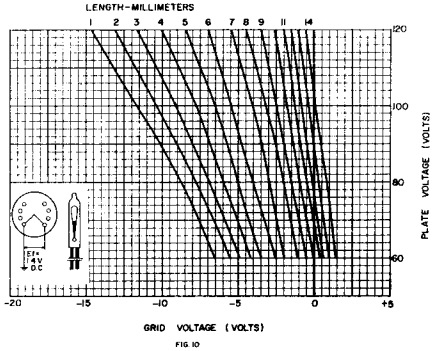


FIG 10

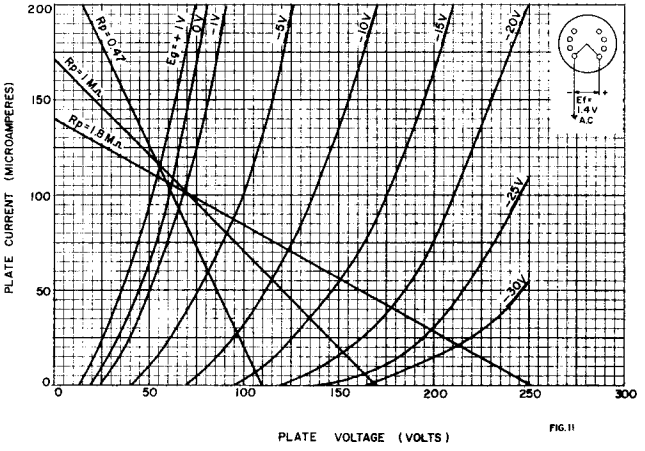


FIG. 11

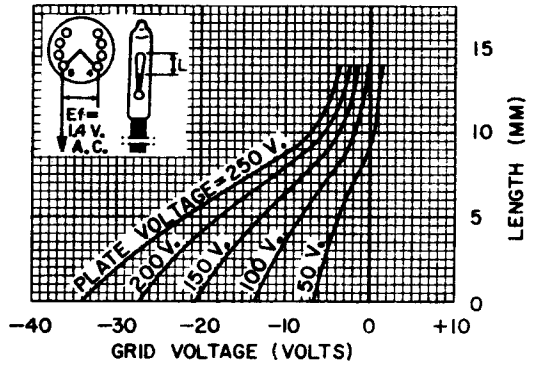


FIG. 12

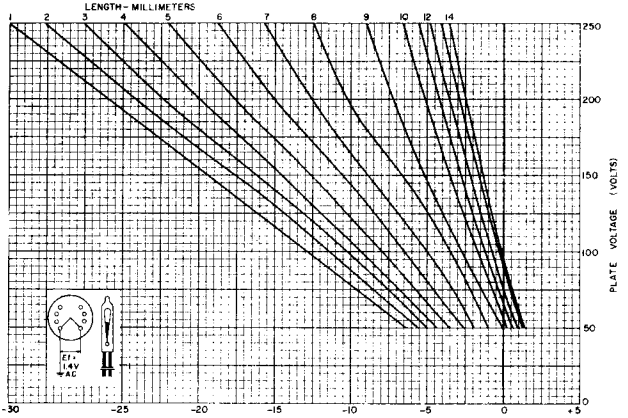
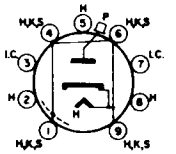


FIG 13

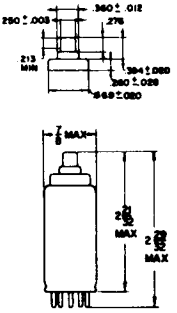
AMPEREX TUBE TYPE 1S2A

The 1S2A is a half wave vacuum rectifier especially designed for use in high voltage, low current applications in television scanning systems. The envelope of this tube is chemically treated to insure that no flash-over will occur under conditions of high humidity and low atmospheric pressure.



PIN CONNECTIONS

1 - HEATER, CATHODE AND SHIELD
2 - HEATER
3 - INTERNALLY CONNECTED
4 - HEATER, CATHODE AND SHIELD
5 - HEATER
6 - HEATER, CATHODE AND SHIELD
7 - INTERNALLY CONNECTED
8 - HEATER
9 - HEATER, CATHODE AND SHIELD



GENERAL CHARACTERISTICS

MECHANICAL

Dimensions	see outline drawing
Plate Cap[1]	see plate cap drawing
Base[2]	E 9-1

ELECTRICAL

Heater Characteristics	
Heater Arrangement	parallel supply
Heater Voltage (AC or DC)[3,4]	1.4 volts
Heater Current	0.55 amps
Output Capacitance (without external shield)	1.55 pf

---

[1] If the tube is operated at high values of peak inverse plate voltage and/or under conditions of high relative humidity or low pressure, an insulating cover should be applied to the plate cap to avoid corona effects.

[2] Pins 1, 4, 6 and 9 can be connected together to form an anti-corona ring.

[3] Circuit elements having the same potential as the heater may be connected to pins 3 and 7.

[4] When the heater is to be operated on RF or flyback pulses, the heater voltage can be adjusted to its nominal value of 1.4 volts at a DC output current of 200 μa by measurement with a thermocouple. When the DC output is increased to 400 - 600 μa, the decrease in heater voltage must be kept within a 15% limit.

1S2A

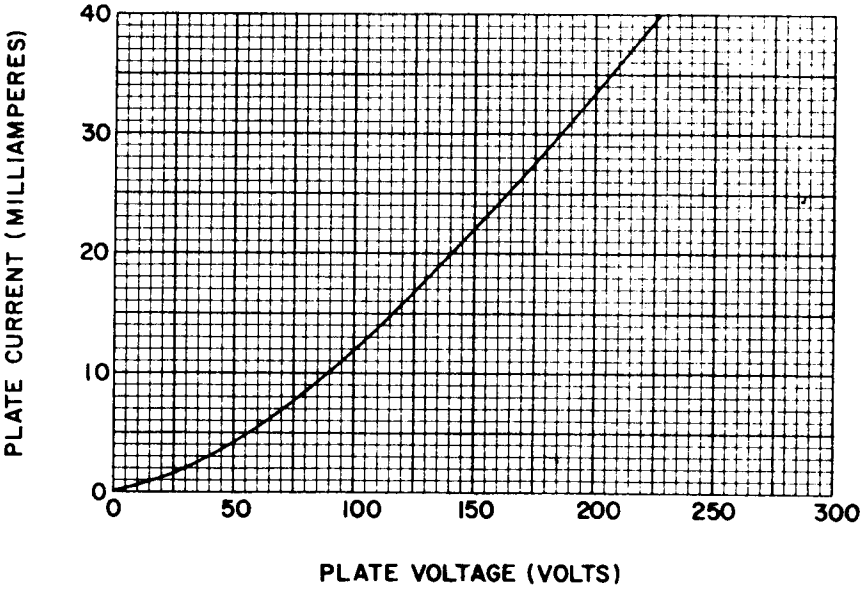
MAXIMUM RATINGS, DESIGN CENTER VALUES

Peak Plate Inverse Voltage[5,6]	22,000 volts
Peak Plate Inverse Voltage (Absolute Limits)[6]	27,000 volts
Output Current	0.8 ma max.
Peak Plate Current[7]	40 ma
Filter Input Capacitor	2,000 pf

TYPICAL CHARACTERISTICS

Output Voltage	18,000 volts
Output Current	0.15 ma

PLATE CHARACTERISTICS

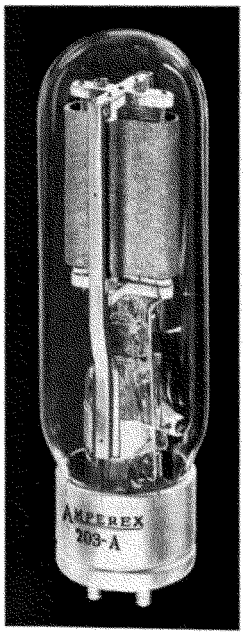


[5] The ratio of the negative peak plate voltage due to ringing in the circuit to the positive DC voltage can be about 1:4.5. This voltage may be 24,000 volts at $I_O = 0$.

[6] Maximum duration is 22% of a line scanning cycle but no more than 18 μsec.

[7] Maximum duration is 10% of a line scanning cycle but no more than 10 μsec.

AMPEREX TRANSMITTING TUBE 203-A



R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	..	—35	—45
Load Resistance (per tube) (ohms)	..	1725	2250
Effective Load Resistance (Plate to Plate) (ohms)	..	6900	9000
Zero Signal Plate Current (ma.)	..	26	26
Peak A.F. Grid to Grid Voltage	..	270	300
Max. Signal D.C. Plate Current (ma.)	175	320	320
Max. Signal Plate Input (watts)	220	320	400
Plate Dissipation (watts)	100	..	..
Max. Signal Driving Power (Approx.) (watts)	..	5	7
Max. Signal Plate Power Output (watts)	..	216	280

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	..	—20	—37
Peak R.F. Grid Voltage	..	80	85
D.C. Plate Current (ma.)	150	130	116
Plate Input (watts)	150	130	145
Plate Dissipation (watts)	100	90	95
D.C. Grid Current (Approx.) (ma.)	..	5	4.5
Driving Power at Peak Modulation (Approx.) (watts)	..	2	3
Plate Power Output (watts)	..	40	50
Frequency Limit for Above Operation (megacycles)	15	20	15

GENERAL CHARACTERISTICS

Filament:		
Voltage	10	volts
Current	3.25	amperes
Amplification Factor	25	
Grid to Plate Transconductance at 100 ma.	4500	micromhos
Direct Interelectrode Capacitances:		
Grid to Plate	13.5	$\mu\mu$f
Grid to Filament	6.5	$\mu\mu$f
Plate to Filament	3.0	$\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

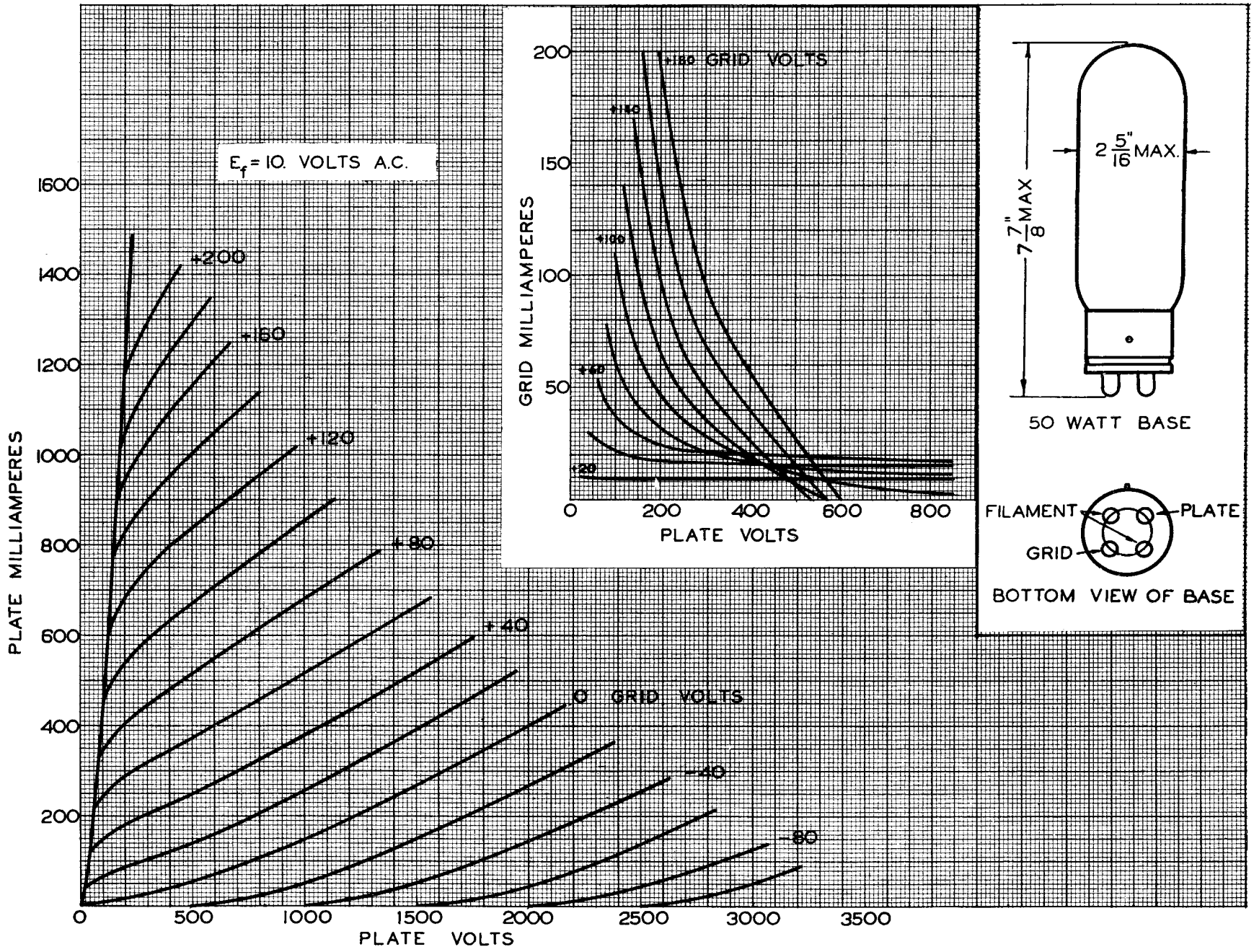
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1000	750	1000
D.C. Grid Voltage	—400	—100	—135
Peak R.F. Grid Voltage	..	230	265
D.C. Plate Current (ma.)	175	150	150
Plate Input (watts)	175	112	150
Plate Dissipation (watts)	67	37	40
D.C. Grid Current (Approx.) (ma.)	60	25	20
Driving Power (Approx.) (watts)	..	5	5
Plate Power Output (watts)	..	75	110
Frequency Limit for Above Operation (megacycles)	15	30	15
F.C.C. Broadcast Rating (watts)	75	..	75

R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—135	—150
Peak R.F. Grid Voltage	—	265	280
D.C. Plate Current (ma.)	175	160	170
Plate Input (watts)	220	160	212
Plate Dissipation (watts)	100	40	60
D.C. Grid Current (Approx.) (ma.)	60	18	11
Driving Power (Approx.) (watts)	..	5	3
Plate Power Output (watts)	..	120	152
Frequency Limit for Above Operation (megacycles)	15	30	15

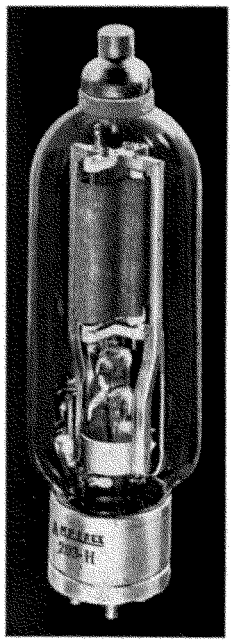
AMPEREX

203-A


E_f = 10. VOLTS A.C.
PLATE MILLIAMPERES
1600
1400
1200
1000
800
600
400
200
+200
+160
+120
+80
+40
0 GRID VOLTS
-40
-80
0
500
1000
1500
2000
2500
3000
3500
PLATE VOLTS
GRID MILLIAMPERES
200
150
100
50
+180 GRID VOLTS
+140
+100
+60
+20
0
200
400
600
800
PLATE VOLTS
$2\frac{5}{16}$" MAX.
$7\frac{7}{8}$" MAX
50 WATT BASE
FILAMENT
PLATE
GRID
BOTTOM VIEW OF BASE

AMPEREX TRANSMITTING TUBE 203-H

FULLY INTERCHANGEABLE WITH HF-125



R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage		10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage		—45	—52
Load Resistance (per tube) (ohms)		2250	2750
Effective Load Resistance (Plate to Plate) (ohms)		9000	11000
Zero Signal Plate Current (ma.)		26	30
Peak A.F. Grid to Grid Voltage		300	304
Max. Signal D.C. Plate Current (ma.)	175	320	320
Max. Signal Plate Input (watts)	250	400	480
Plate Dissipation (watts)	100		
Max. Signal Driving Power (Approx.) (watts)		7	5.5
Max. Signal Plate Power Output (watts)		280	340

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage		10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage		—37	—48
Peak R.F. Grid Voltage		85	84
D.C. Plate Current (ma.)	150	116	100
Plate Input (watts)	150	145	150
Plate Dissipation (watts)	100	95	98
D.C. Grid Current (Approx.) (ma.)		4.5	3
Driving Power at Peak Modulation (Approx.) (watts)		3	2
Plate Power Output (watts)		50	52
Frequency Limit for Above Operation (megacycles)	30	30	30

GENERAL CHARACTERISTICS

Filament:		
Voltage	10	volts
Current	3.25	amperes
Amplification Factor	25	
Grid to Plate Transconductance at 100 ma.	4500	micromhos
Direct Interelectrode Capacitances:		
Grid to Plate	11.5	$\mu\mu$f
Grid to Filament	6.5	$\mu\mu$f
Plate to Filament	1.5	$\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage		10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—135	—160
Peak R.F. Grid Voltage		265	300
D.C. Plate Current (ma.)	175	160	167
Plate Input (watts)	210	160	208
Plate Dissipation (watts)	85	40	48
D.C. Grid Current (Approx.) (ma.)	60	18	19
Driving Power (Approx.) (watts)		4.5	5
Plate Power Output (watts)		120	160
Frequency Limit for Above Operation (megacycles)	30	40	30
F.C.C. Broadcast Rating (watts)	125		125

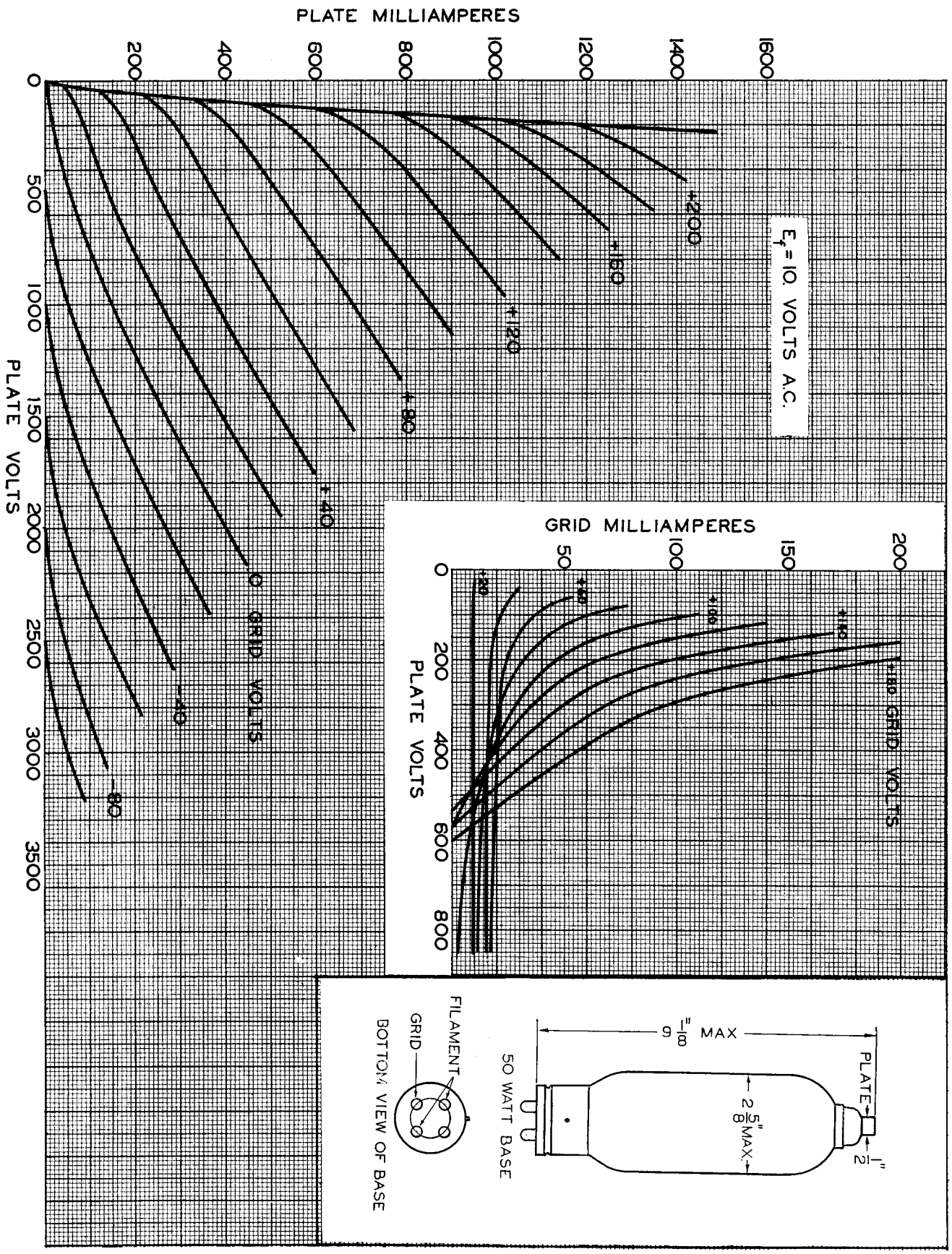
R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage		10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—400	—160	—200
Peak R.F. Grid Voltage		300	340
D.C. Plate Current (ma.)	175	175	170
Plate Input (watts)	260	219	255
Plate Dissipation (watts)	100	49	55
D.C. Grid Current (Approx.) (ma.)	60	15	12
Driving Power (Approx.) (watts)		4	3.8
Plate Power Output (watts)		170	200
Frequency Limit for Above Operation (megacycles)	30	30	30

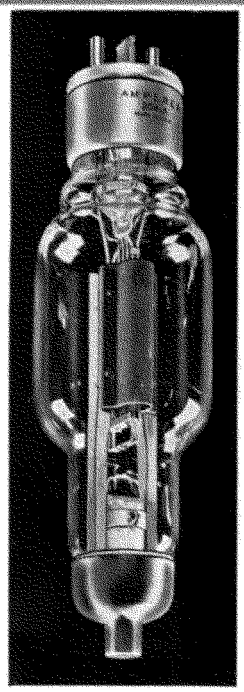
AMPEREX

203-H

203-H—AMPEREX TRANSMITTING TUBE



R.F. Power Amplifier, Oscillator, Class B Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
A.C. Filament Voltage	—	11	11	11
D.C. Plate Voltage	3000	2000	2500	3000
D.C. Grid Voltage	—	—60	—80	—100
Load Resistance (ohms per tube)	—	2200	3400	5000
Effective Load Resistance (Plate to Plate) (ohms)	—	8800	13600	20000
Zero Signal Plate Current (ma.)	—	80	80	80
Peak A.F. Grid to Grid Voltage	—	500	500	500
Max. Signal Plate Current (ma.)	275	500	430	370
Max. Signal Plate Input (watts)	600	1000	1075	1110
Plate Dissipation (watts)	250	—	—	—
Max. Signal Driving Power (Approx.) (watts)	—	15	14	11
Max. Signal Plate Power Output (watts)	—	650	740	750

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	11	11
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	—	—60	—80
Peak R.F. Grid Voltage	—	150	150
D.C. Plate Current (ma.)	225	165	150
Plate Input (watts)	400	330	375
D.C. Grid Current (Approx.) (ma.)	—	5	3
R.F. Grid Current (amps)	8	—	—
Plate Dissipation (watts)	250	223	250
Driving Power (at Peak Modulation) (watts)	—	10	7
Plate Power Output (watts)	—	107	125
Frequency Limit for Above Operation (mc.)	3	—	—
F.C.C. Rating for Use in Final Stage of Broadcast Transmitters (watts)	75	—	—

GENERAL CHARACTERISTICS

Filament Voltage	11
Filament Current (amps)	3.85
Amplification Factor	23
Grid to Plate Transconductance @ 125 ma.	4000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	15 $\mu\mu f$
Grid to Filament	12.5 $\mu\mu f$
Plate to Filament	2.3 $\mu\mu f$

Plate Modulated R.F. Power Amplifier Class C—Telephony

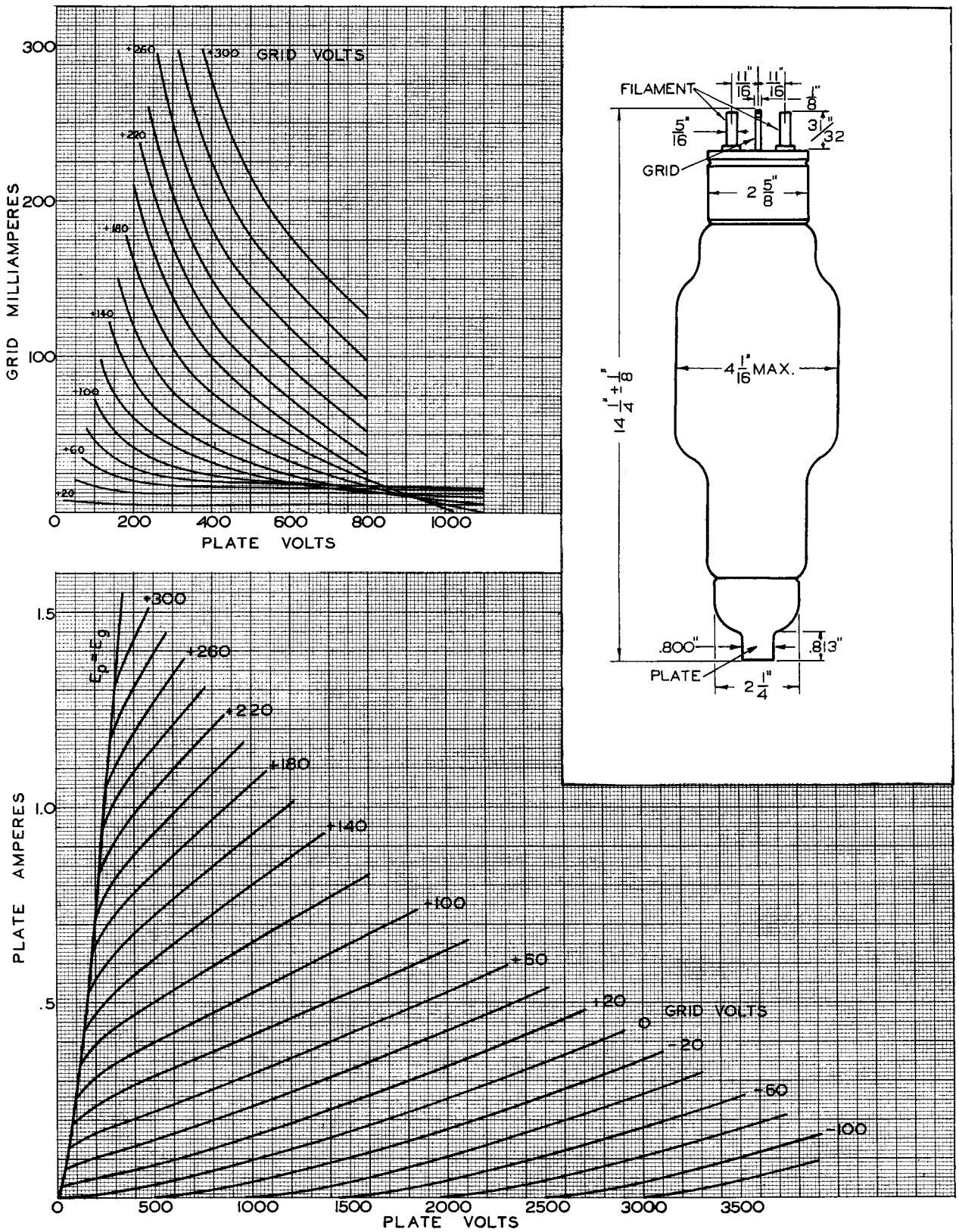
(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	11	11	11
D.C. Plate Voltage	2000	1500	2000	2000
D.C. Grid Voltage	—500	—200	—250	—250
Peak R.F. Grid Voltage	—	440	460	490
D.C. Plate Current (ma.)	275	250	208	250
Plate Input (watts)	550	375	416	500
D.C. Grid Current (Approx.) (ma.)	80	30	16	24
R.F. Grid Current (amps.)	8	—	—	—
Plate Dissipation (watts)	167	115	111	135
Driving Power (Approx.) (watts)	—	12	7	11
Plate Power Output (watts)	—	260	305	365
Frequency Limit for Above Operation (mc.)	3	..	..	..
F.C.C. Rating for Use in Final Stage of Broadcast Transmitters (watts)	250	—	250	—

R.F. Power Amplifier and Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	11	11
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	—500	—175	—200
Peak R.F. Grid Voltage	—	425	440
D.C. Plate Current (ma.)	275	275	275
Plate Input (watts)	690	550	687
D.C. Grid Current (Approx.) (ma.)	80	30	20
R.F. Grid Current (amps.)	10	—	—
Plate Dissipation (watts)	250	160	187
Driving Power (Approx.) (watts)	—	12	8
Plate Power Output (watts)	—	390	500
Frequency Limit for Above Operation (mc.)	3	—	—

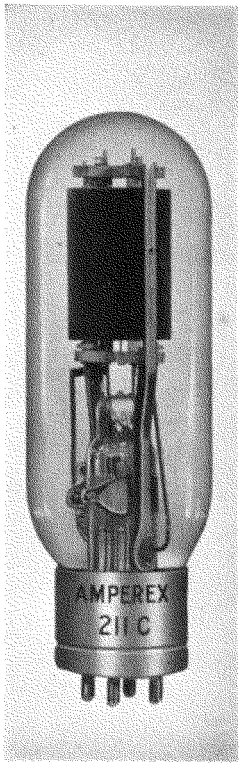
AMPEREX - 204-A



AMPEREX TRANSMITTING TUBE 211-C

FULLY INTERCHANGEABLE WITH AMPEREX HF-130

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1200
D.C. Grid Voltage	—	—55	—70
Peak A.F. Grid Voltage	—	50	65
D.C. Plate Current (ma.)	—	75	80
Plate Dissipation (watts)	100	75	96
Load Resistance (ohms)	—	4800	7600
Power Output (watts)	—	14	21
Distortion (% Second Harmonic)	—	5	3

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	—72	—90
Load Resistance (ohms per tube)	—	1250	1675
Effective Load Resistance (Plate to Plate) (ohms)	—	5000	6700
Zero Signal Plate Current (ma.)	—	60	50
Peak A.F. Grid to Grid Voltage	—	344	380
Max. Signal D.C. Plate Current (ma.)	210	400	400
Max. Signal Plate Input (watts)	260	400	500
Plate Dissipation (watts)	125	—	—
Max. Signal Driving Power (Approx.) (watts)	—	4	4.5
Max. Signal Plate Power Output (watts)	—	240	320

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	—60	—85
Peak R.F. Grid Voltage	—	100	110
D.C. Plate Current (ma.)	150	140	130
Plate Input (watts)	175	140	162
Plate Dissipation (watts)	125	95	107
D.C. Grid Current (Approx.) (ma.)	—	2.5	1.0
Driving Power at Peak Modulation (Approx.) (watts)	—	3.5	3.6
Plate Power Output (watts)	—	45	55
Frequency Limit for Above Operation (mc.)	20	30	20

GENERAL CHARACTERISTICS

Filament Voltage	10-10.5
Filament Current (amps)	3.25
Amplification Factor	12.5
Grid to Plate Transconductance @ 100 ma.	4300 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	9.0 $\mu\mu f$
Grid to Filament	5.5 $\mu\mu f$
Plate to Filament	3.5 $\mu\mu f$

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	—	380	430
D.C. Plate Current (ma.)	175	170	166
Plate Input (watts)	220	170	208
Plate Dissipation (watts)	85	55	60
D.C. Grid Current (Approx.) (ma.)	50	10	8
Driving Power (Approx.) (watts)	—	3.5	3.5
Plate Power Output (watts)	—	115	148
Frequency Limit for Above Operation (mc.)	10	20	10
F.C.C. Broadcast Rating (watts)	125	—	125

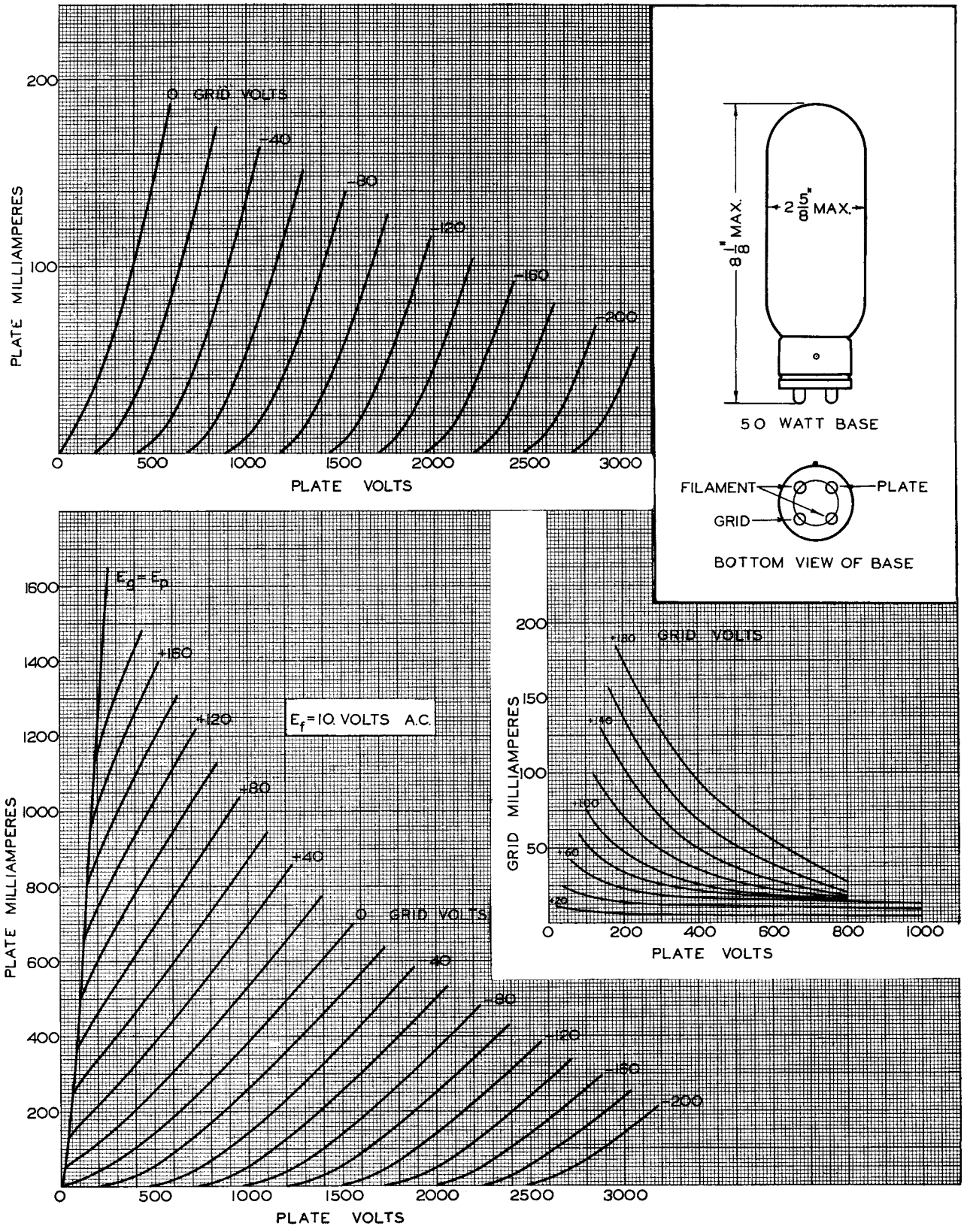
R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—200	—250
Peak R.F. Grid Voltage	—	340	385
D.C. Plate Current (ma.)	210	200	200
Plate Input (watts)	260	200	250
Plate Dissipation (watts)	125	55	80
D.C. Grid Current (Approx.) (ma.)	50	15	10
Driving Power (Approx.) (watts)	—	5	3.5
Plate Power Output (watts)	—	145	170
Frequency Limit for Above Operation (mc.)	20	30	20

AMPEREX

211-C

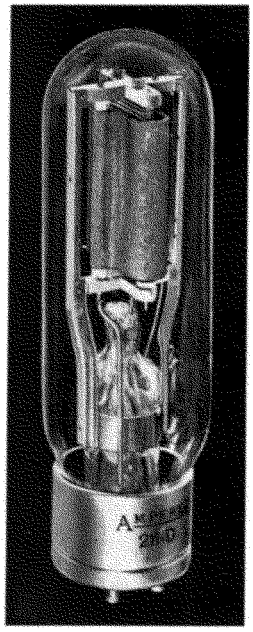
211-C—AMPEREX TRANSMITTING TUBE



AMPEREX TRANSMITTING TUBE 211-D

FULLY INTERCHANGEABLE WITH AMPEREX HF 140

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	..	—55	—77
Peak A.F. Grid Voltage	..	50	72
D.C. Plate Current (ma.)	..	70	60
Plate Dissipation (watts)	75	70	75
Load Resistance (ohms)	..	7600	9200
Power Output (watts)	..	12.2	20
Distortion (% Second Harmonic)	..	2.5	5

A.F. Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	..	—77	—95
Load Resistance (per tube) (ohms)	..	1725	2250
Effective Load Resistance (Plate to Plate) (ohms)	..	6900	9000
Zero Signal Plate Current (ma.)	..	20	20
Peak A.F. Grid to Grid Voltage	..	348	390
Max. Signal D.C. Plate Current (ma.)	175	320	320
Max. Signal Plate Input (watts)	220	320	400
Plate Dissipation (watts)	100	..	..
Max. Signal Driving Power (Approx.) (watts)	..	5.5	7
Max. Signal Plate Power Output (watts)	..	216	280

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	..	—60	—80
Peak R.F. Grid Voltage	..	100	100
D.C. Plate Current (ma.)	150	130	106
Plate Input (watts)	150	130	132
Plate Dissipation (watts)	100	88	86
D.C. Grid Current (Approx.) (ma.)	..	2	1
Driving Power at Peak Modulation (Approx.) (watts)	..	3.5	2.5
Plate Power Output (watts)	..	42	46
Frequency Limit for Above Operation (megacycles)	15	20	15

GENERAL CHARACTERISTICS

Filament:		
Voltage	10	volts
Current	3.25	amperes
Amplification Factor	12	
Grid to Plate Transconductance at 100 ma.	4500	micromhos
Direct Interelectrode Capacitances:		
Grid to Plate	12.5	$\mu\mu f$
Grid to Filament	5.5	$\mu\mu f$
Plate to Filament	3.0	$\mu\mu f$

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—260	—300
Peak R.F. Grid Voltage	..	390	430
D.C. Plate Current (ma.)	175	150	166
Plate Input (watts)	210	150	208
Plate Dissipation (watts)	67	35	60
D.C. Grid Current (Approx.) (ma.)	50	13	8
Driving Power (Approx.) (watts)	..	5	3.5
Plate Power Output (watts)	..	115	148
Frequency Limit for Above Operation (megacycles)	3	15	3
F.C.C. Broadcast Rating (watts)	125	..	125

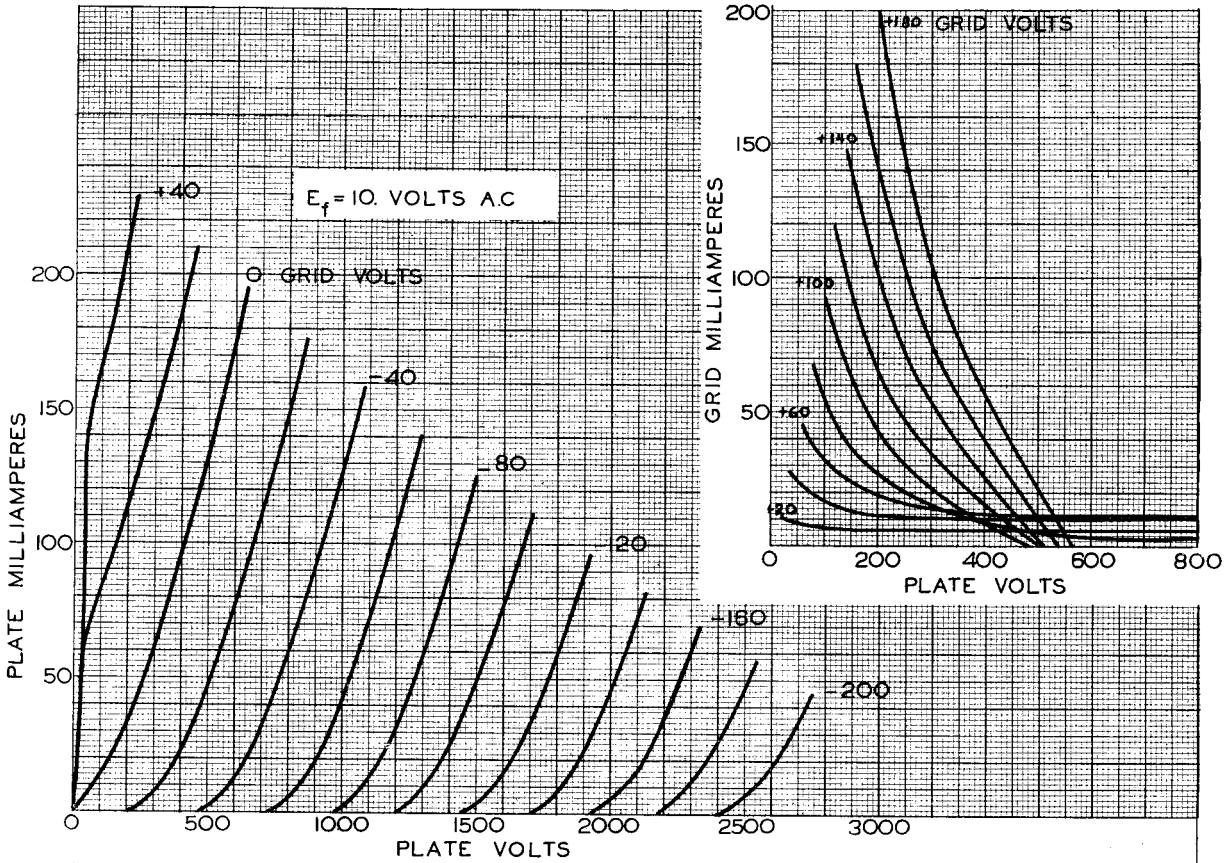
R.F. Power Amplifier or Oscillator—Class C Telegraphy

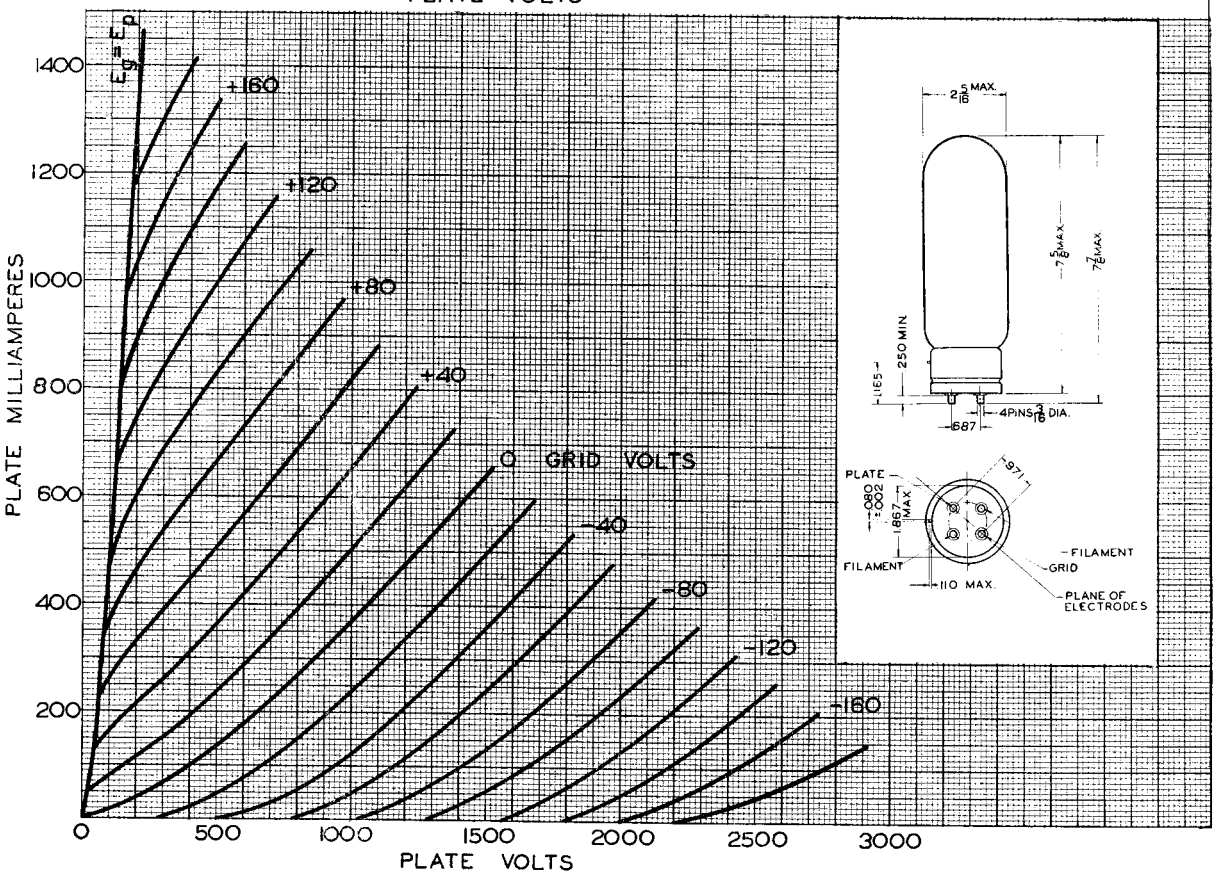
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	..	390	430
D.C. Plate Current (ma.)	175	165	166
Plate Input (watts)	220	165	208
Plate Dissipation (watts)	100	40	60
D.C. Grid Current (Approx.) (ma.)	50	16	8
Driving Power (Approx.) (watts)	..	6	3.5
Plate Power Output (watts)	..	125	148
Frequency Limit for Above Operation (megacycles)	15	20	15

AMPEREX

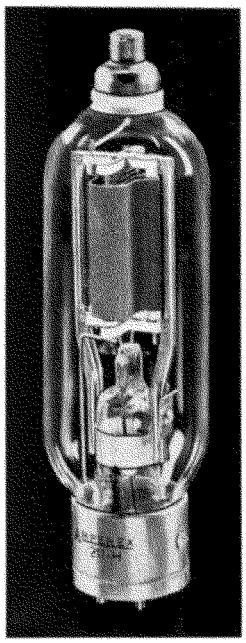
211-D

211-D—AMPEREX TRANSMITTING TUBE





AMPEREX TRANSMITTING TUBE 211-H



FULLY INTERCHANGEABLE WITH AMPEREX HF-150

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator

GENERAL CHARACTERISTICS

Filament Voltage	10-10.5
Filament Current (amps)	3.25
Amplification Factor	12.5
Grid to Plate Transconductance @ 100 ma.	4300 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	7.2 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	1.9 $\mu\mu$f

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1200	1500
D.C. Grid Voltage	—	—70	—97
Peak A.F. Grid Voltage	—	65	92
D.C. Plate Current (ma.)	—	80	66
Plate Dissipation (watts)	100	—	—
Load Resistance (ohms)	—	7600	14500
Power Output (watts)	—	21	30
Distortion (% Second Harmonic)	—	3	2

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—	—90	—110
Load Resistance (ohms per tube)	—	1675	2050
Effective Load Resistance (ohms)	—	6700	8200
Zero Signal D.C. Plate Current (ma.)	—	50	50
Peak A.F. Grid to Grid Voltage	—	380	420
Max. Signal D.C. Plate Current (ma.)	210	400	400
Max. Signal Plate Input (watts)	315	500	600
Plate Dissipation (watts)	125	180	200
Max. Signal Driving Power (Approx.) (watts)	—	4.5	5
Max. Signal Plate Power Output (watts)	—	320	400

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—	—85	—110
Peak R.F. Grid Voltage	—	105	120
D.C. Plate Current (ma.)	150	120	120
Plate Input (watts)	185	150	180
D.C. Grid Current (Approx.) (ma.)	—	.5	.2
Plate Dissipation (watts)	125	100	118
Driving Power at Peak Modulation (Approx.) (watts)	—	2.5	3.5
Plate Power Output (watts)	—	50	62.5
Frequency Limit for Above Operation (mc.)	30	—	—
F.C.C.Rating (for use in final stage of Broadcast Transmitters) (watts)	50	—	—

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	—	380	430
D.C. Plate Current (ma.)	175	170	166
Plate Input (watts)	220	170	207
D.C. Grid Current (Approx.) (ma.)	50	10	8
Plate Dissipation (watts)	85	55	59
Driving Power (Approx.) (watts)	—	3.5	3.5
Plate Power Output (watts)	—	115	148
Frequency Limit for Above Operation (mc.)	30	—	—
F.C.C. Rating (for use in final stage of Broadcast Transmitters) (watts)	125	—	—

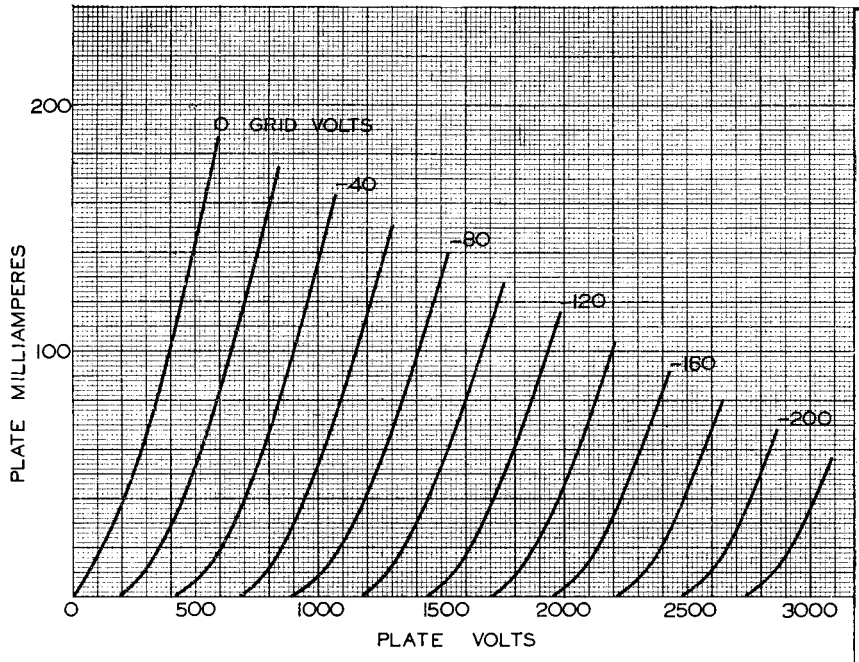
R.F. Power Amplifier and Oscillator—Class C Telegraphy

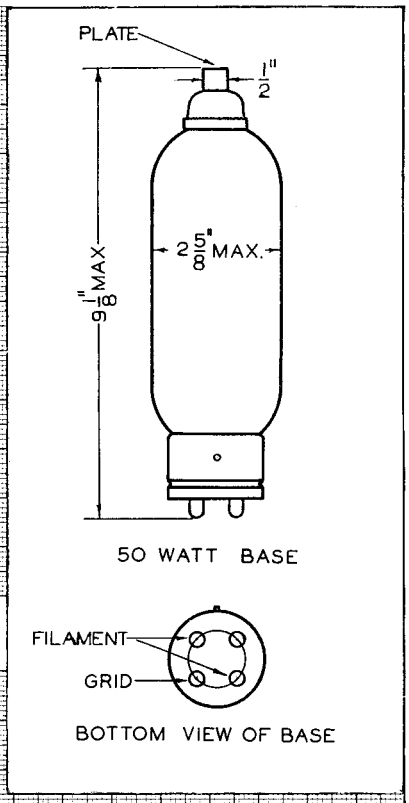
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	—	385	440
D.C. Plate Current (ma.)	210	200	200
Plate Input (watts)	315	250	300
D.C. Grid Current (Approx.) (ma.)	50	10	10
Plate Dissipation (watts)	125	80	80
Driving Power (Approx.) (watts)	—	3.5	4
Plate Power Output (watts)	—	170	220
Frequency Limit for Above Operation (mc.)	30	30	30

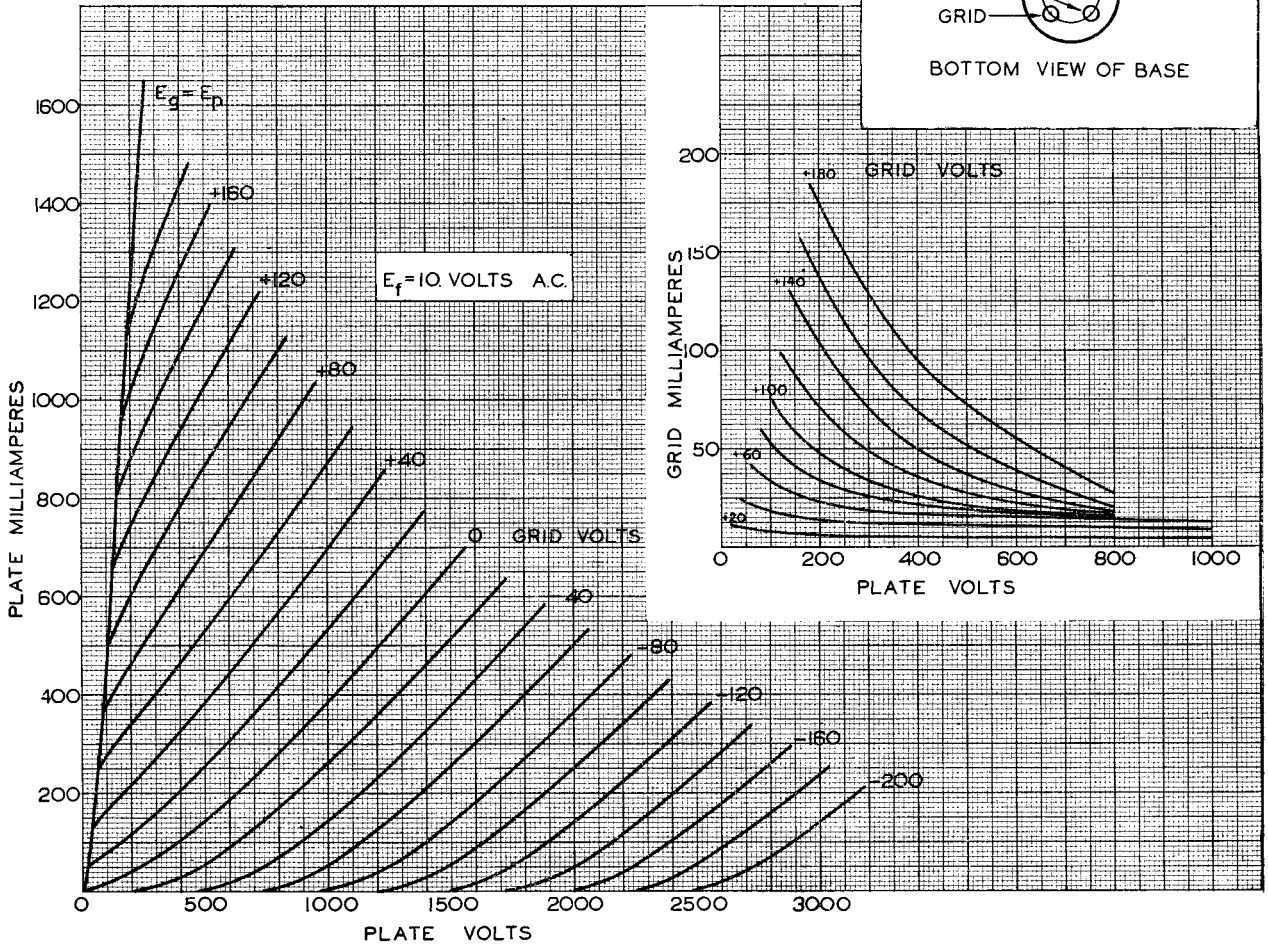
AMPEREX

211-H

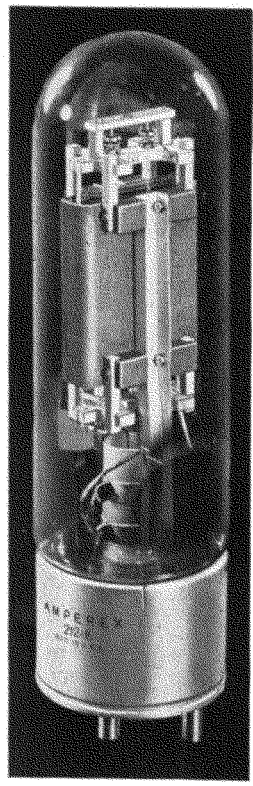
211-H — AMPEREX TRANSMITTING TUBE







Audio Frequency Power Amplifier or Modulator
Radio Frequency Power Amplifier or Oscillator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube		
D.C. Filament Voltage	—	14	14	14
D.C. Plate Voltage	3000	1250	1500	2000
D.C. Grid Voltage*	—	—40	—57	—95
Peak A.F. Grid Voltage	—	52	63	95
D.C. Plate Current (ma.)	—	180	170	130
Plate Input (watts)	300	225	255	260
Plate Dissipation (watts)	300	225	255	260
Load Resistance (ohms)	—	3000	5000	8000
Power Output (watts)	—	40	50	75
Distortion (% Second Harmonic)	—	5	4	4

*With respect to negative filament terminal.

A.F. Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
D.C. Filament Voltage	—	14	14	14
D.C. Plate Voltage	2000	1500	2000	2000
D.C. Grid Voltage	—	—75	—110	—110
Load Resistance (ohms per tube)	—	1475	2000	1900
Effective Load Resistance (Plate to Plate) (ohms)	—	5900	8000	7600
Zero Signal Plate Current (ma.)	—	100	90	90
Peak A.F. Grid to Grid Voltage	—	320	380	420
Max. Signal Plate Current (ma.)*	350	530	520	600
Max. Signal Plate Input (watts)	700	800	1040	1200
Plate Dissipation (watts)*	275	300**	390**	360**
Minimum Grid Input Resistance (ohms)	—	700	900	420
Max. Signal Driving Power (watts)	—	6	5	12
Max. Signal Power Output (watts)	—	500	650	840

*Averaged over any audio-frequency cycle of sine-wave form.

**Averaged over a maximum-signal cycle of sine-wave form.

R.F. Power Amplifier—Class B—Telephony

Carrier conditions for use with a maximum modulation factor of 1.0

	Maximum Rating per Tube	Typical Operation Two Tubes		
D.C. Filament Voltage	—	14	14	14
D.C. Plate Voltage	2000	1500	1500	2000
D.C. Grid Voltage	—	—70	—70	—105
Plate Load Resistance (ohms)	—	2750	2050	3000
Peak R.F. Grid Voltage	—	85	98	112
D.C. Plate Current (ma.)	350	150	200	188
Plate Input (watts)	412	225	300	375
Plate Dissipation (watts)	275	150	200	245
D.C. Grid Current (ma.)	—	0.5	1.5	0.2
Driving Power (watts)*	—	3	6	5
Plate Power Output (watts)	—	75	100	130
Frequency Limit for Above Operation (mc.)	1.5	3	3	1.5
F.C.C. Broadcast Rating (watts)	75	75	100	125

*At crest of a.f. cycle with modulation factor of 1.0.

GENERAL CHARACTERISTICS

Filament Voltage	14
Filament Current (amps)	6
Average Characteristics: At plate voltage of 2000 Volts and grid bias of —132 Volts.	
Amplification Constant	16
Plate Resistance	2000 ohms
Grid to Plate Transconductance	8000 micromhos
Direct Interelectrode Capacitances (Approx.)	
Grid to Plate	19 $\mu\mu f$
Grid to Filament	11 $\mu\mu f$
Plate to Filament	7 $\mu\mu f$

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with a maximum modulation factor of 1.0

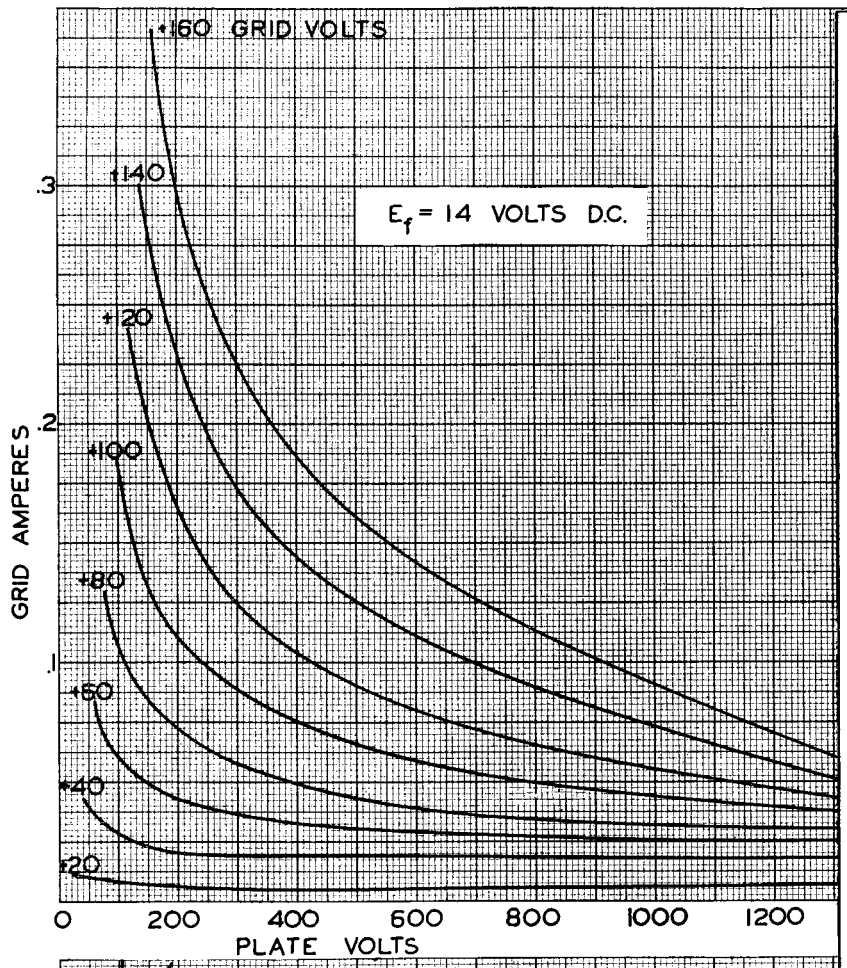
	Maximum Rating per Tube	Typical Operation One Tube	
D.C. Filament Voltage	—	14	14
D.C. Plate Voltage	1500	1500	1000
D.C. Grid Voltage	—400	—200	—150
Plate Load Resistance (ohms)	—	2700	1500
Peak R.F. Grid Voltage	—	340	300
D.C. Plate Current (ma.)	350	278	325
Plate Input (watts)	525	417	325
Plate Dissipation (watts)	200	80	85
D.C. Grid Current (Approx.) (ma.)	75	37	48
Driving Power (Approx.) (watts)	—	12	14
Plate Power Output (watts)	—	337	240
Frequency Limit for Above Operation (mc.)	1.5	1.5	3
F.C.C. Broadcast Rating (watts)	250	250	—

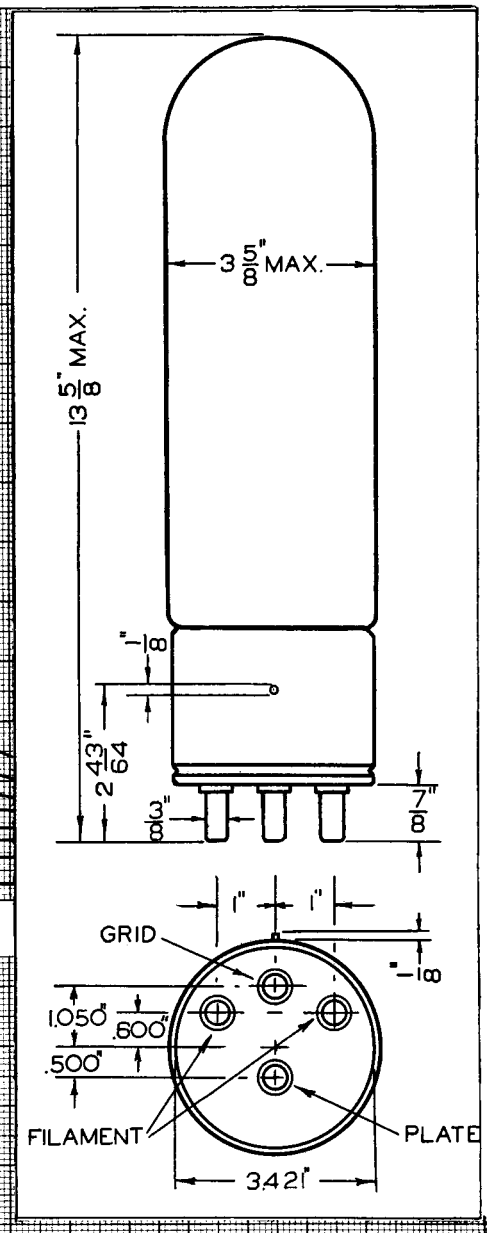
R.F. Power Amplifier or Oscillator—Class C Telegraphy

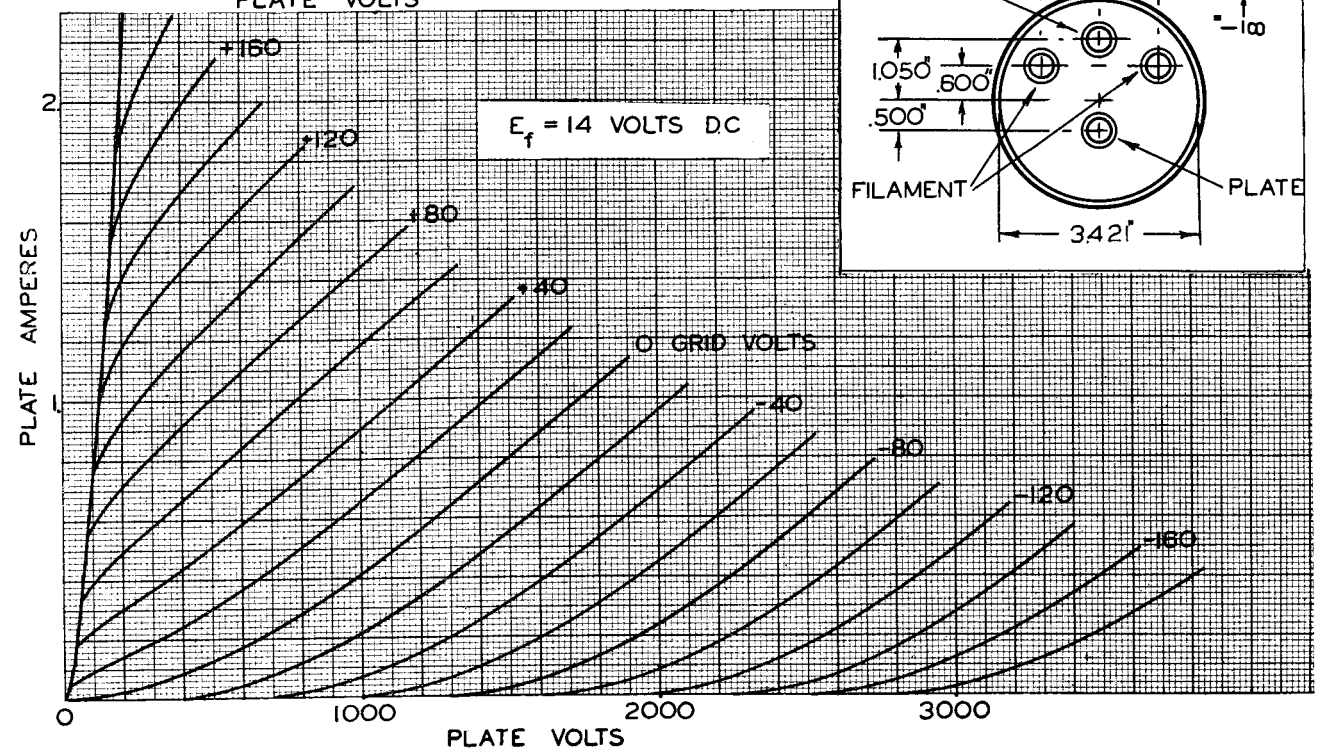
Key-down conditions without modulation

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	14	14
Plate Voltage	2000	1500	2000
D.C. Grid Voltage	—400	—200	—250
Plate Load Resistance (ohms)	—	2000	2900
Peak R.F. Grid Voltage	—	340	380
D.C. Plate Current (ma.)	350	350	325
Plate Input (watts)	700	525	650
Plate Dissipation (watts)	275	125	150
D.C. Grid Current (Approx.) (ma.)	100	32	23
Driving Power (Approx.) (watts)	—	10	8
Plate Power Output (watts)	—	400	500
Frequency Limit for Above Operation (mc.)	1.5	3	1.5

212-E — AMPEREX TRANSMITTING TUBE

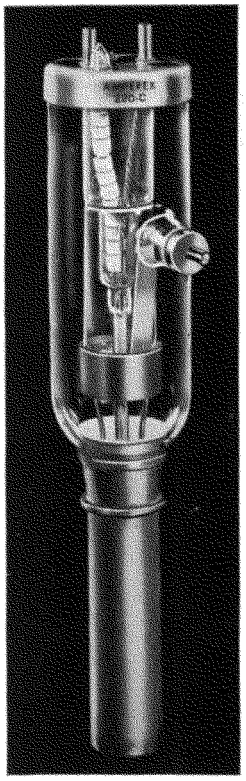






AMPEREX TRANSMITTING TUBE 220-C

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, or Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
D.C. Filament Voltage	—	20	20
D.C. Plate Voltage	15000	12000	10000
D.C. Grid Voltage (Approx.)	—	—200	—150
Peak A.F. Grid Voltage	—	190	150
D.C. Plate Current (amps.)	—	0.38	0.3
Plate Dissipation (watts)	7500	4550	3000
Load Resistance (ohms)	—	10000	17500
Power Output (watts)	—	545	325
Distortion (% Second Harmonic)	—	5	5

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	21	21
D.C. Plate Voltage	15000	6000	12500
D.C. Grid Voltage	—	—75	—270
Load Resistance (ohms per tube)	—	1200	2500
Effective Load Resistance (Plate to Plate) (ohms)	—	4800	10000
Zero Signal Plate Current (ma.)	—	300	400
Peak A.F. Grid to Grid Voltage	—	1540	1920
Max. Signal D.C. Plate Current (amps.)	1.5	2.34	2.56
Max. Signal Plate Input (watts)	2000	14000	32000
Plate Dissipation (watts)	7500	6000*	12000*
Recommended Driving Stage Power (watts)	—	500	300
Max. Signal Plate Power Output (watts)	—	8000	20000

*Averaged over a cycle of sine-wave form under maximum signal conditions

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	21.5	21
D.C. Plate Voltage	15000	7500	10000
D.C. Grid Voltage	—	—200	—300
Plate Load Resistance (ohms)	—	2050	3600
Peak R.F. Grid Voltage	—	700	625
D.C. Plate Current (amps.)	1	1	.75
Plate Input (watts)	15000	7500	7500
Plate Dissipation (watts)	10000	5000	5000
D.C. Grid Current (Approx.) (ma.)	—	—10	—7
Driving Power at Peak Modulation (Approx.) (watts)	—	150	50
Plate Power Output (watts)	—	2500	2500
Frequency Limit for Above Operation (mc.)	4	—	—
F.C.C. Broadcast Rating (watts)	2500	2500	2500

GENERAL CHARACTERISTICS

Filament Voltage	21.5
Filament Current (amps)	41.0
Amplification Factor	35
Grid to Plate Transconductance at a plate current of 0.64 ampere	5000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	22 $\mu\mu$f
Grid to Filament	15 $\mu\mu$f
Plate to Filament	1.6 $\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

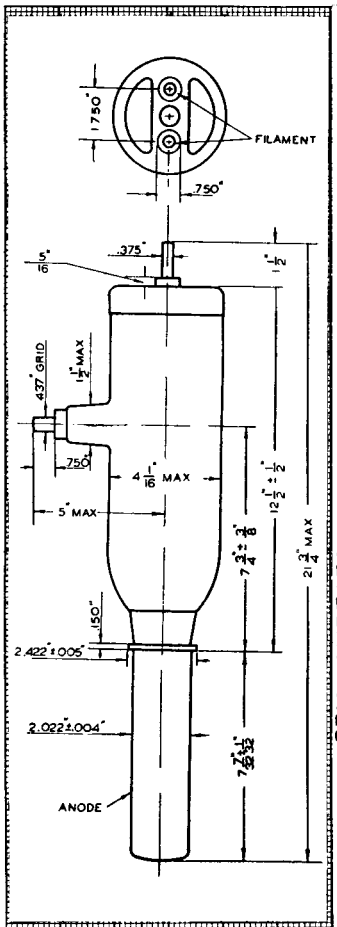
	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	—	21.5
D.C. Plate Voltage	10000	7500
D.C. Grid Voltage	—2000	—700
Plate Load Resistance (ohms)	—	3300
Peak R.F. Grid Voltage	—	1500
D.C. Plate Current (amps.)	1.25	1.03
Plate Input (watts)	10000	7700
Plate Dissipation (watts)	6600	2300
D.C. Grid Current (Approx.) (ma.)	150	60
Driving Power (Approx.) (watts)	—	80
Plate Power Output (watts)	—	5400
Frequency Limit for Above Operation (mc.)	4	—
F.C.C. Broadcast Rating (watts)	5000	5000

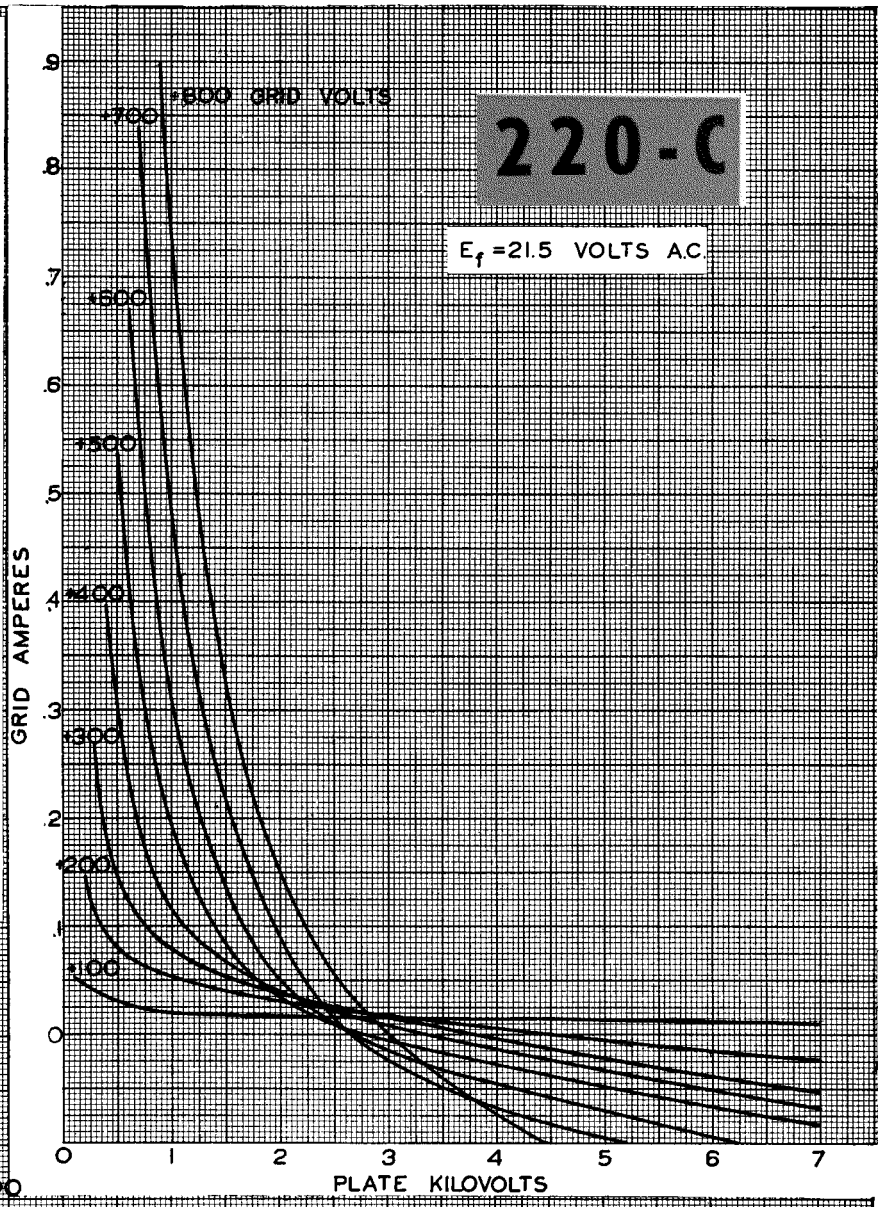
R.F. Power Amplifier or Oscillator—Class C Telegraphy

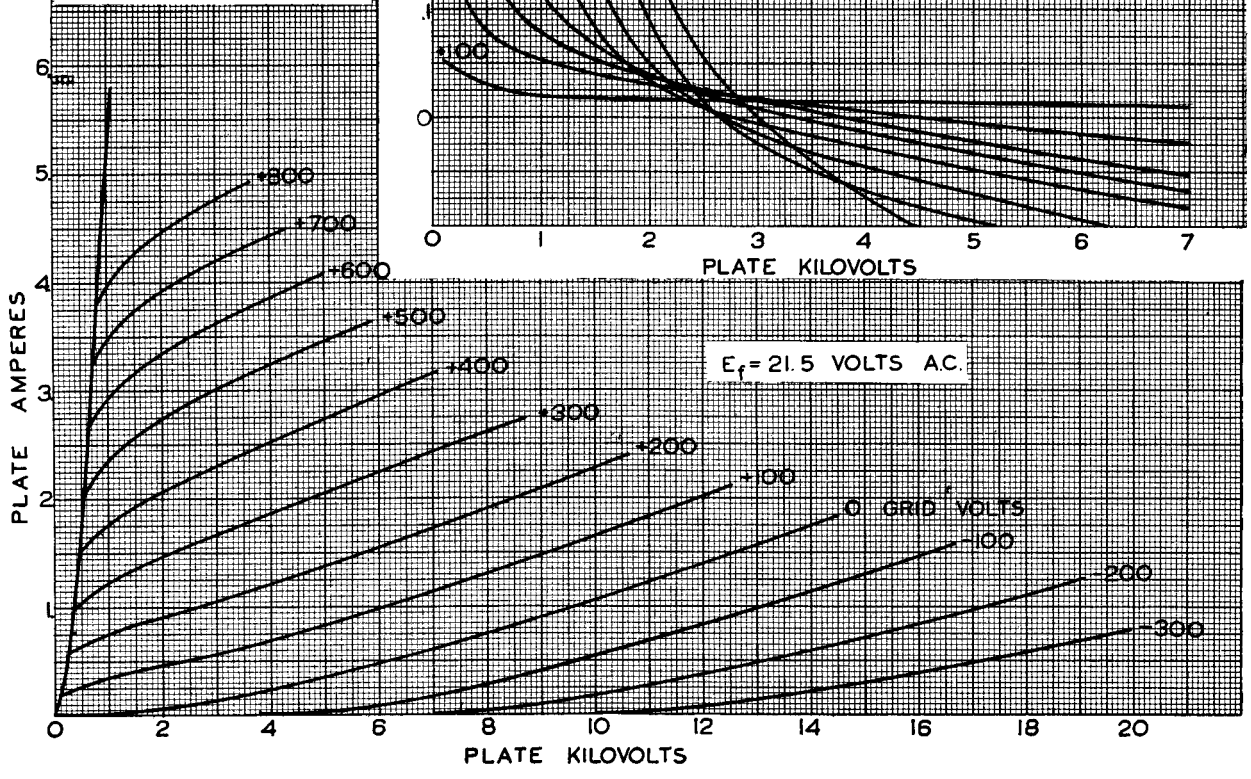
	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	—	21.5
D.C. Plate Voltage	15000	10000
D.C. Grid Voltage	—2000	—500
Plate Load Resistance (ohms)	—	3200
Peak R.F. Grid Voltage	—	1500
D.C. Plate Current (amps.)	1.5	1.5
Plate Input (watts)	22500	15000
Plate Dissipation (watts)	10000	5000
D.C. Grid Current (Approx.) (ma.)	150	50
Driving Power (Approx.) (watts)	—	70
Plate Power Output (watts)	—	10000
Frequency Limit for Above Operation (mc.)	4	7.5

AMPEREX

220-C


.1750"
FILAMENT
.750"
5/16"
.375"
1 1/2"
.437" GRID
1 1/2" MAX
.750"
4 1/16" MAX
5" MAX
12 1/2" ± 1/2"
7 3/4" ± 3/8"
21 3/4" MAX
.150"
2.422" ± .005"
2.022" ± .004"
7 25/32"
ANODE

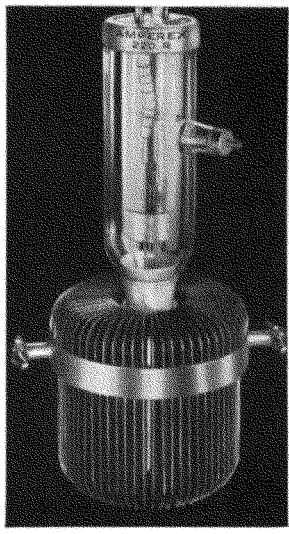

220-C
E_f = 21.5 VOLTS A.C.
+800 GRID VOLTS
+700
+600
+500
+400
+300
+200
+100
0
GRID AMPERES
PLATE KILOVOLTS


E_f = 21.5 VOLTS A.C.
+800
+700
+600
+500
+400
+300
+200
+100
0 GRID VOLTS
-100
-200
-300
PLATE AMPERES
PLATE KILOVOLTS

AMPEREX TRANSMITTING TUBE 220-R

FORCED-AIR COOLED

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, or Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

The following ratings and typical operating conditions assume a minimum air flow of 600 cu. ft. per minute through radiator.

GENERAL CHARACTERISTICS

Filament Voltage	21.5
Filament Current (amps)	57.0
Amplification Factor	35
Grid to Plate Transconductance at a plate current of 0.64 ampere	5000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	22 $\mu\mu$f
Grid to Filament	15 $\mu\mu$f
Plate to Filament	1.6 $\mu\mu$f

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Filament Voltage	. .	20
D.C. Plate Voltage	12500	10000
D.C. Grid Voltage (Approx.)	. .	—150
Peak A.F. Grid Voltage	. .	150
D.C. Plate Current (amps)	. .	0.3
Plate Dissipation (watts)**	3500	3000
Load Resistance (ohms)	. .	17500
Power Output (watts)	. .	325
Distortion (% Second Harmonic)	. .	5

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	. .	21	21
D.C. Plate Voltage	12500	6000	10000
D.C. Grid Voltage	. .	—75	—225
Load Resistance (per tube) (ohms)	. .	1200	2500
Effective Load Resistance (Plate to Plate) (ohms)	. .	4800	10000
Zero Signal Plate Current (ma.)	. .	300	200
Peak A.F. Grid to Grid Voltage	. .	1540	1750
Max. Signal D.C. Plate Current (amps)	1.5	2.34	2.2
Max. Signal Plate Input (watts)	20000	14000	12000
Plate Dissipation (watts)**	5000	6000*	7200
Recommended Driving Stage Power (watts)	. .	500	400
Max. Signal Plate Power Output (watts)	. .	8000	15000

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	. .	21.5	21
D.C. Plate Voltage	12500	7500	10000
D.C. Grid Voltage	. .	—200	—300
Plate Load Resistance (ohms)	. .	2050	3600
Peak R.F. Grid Voltage	. .	700	625
D.C. Plate Current (amps)	1	1	.75
Plate Input (watts)	12000	7500	7500
Plate Dissipation (watts)**	6000	5000	5000
D.C. Grid Current (Approx.) (ma.)	. .	—10	—7
Driving Power at Peak Modulation (Approx.) (watts)	. .	150	50
Plate Power Output (watts)	. .	2500	2500
Frequency Limit for Above Operation (mc.)	10	. .	. .
F.C.C. Broadcast Rating (watts)	2500	2500	2500

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	. .	21.5
D.C. Plate Voltage	9000	7500
D.C. Grid Voltage	—2000	—700
Plate Load Resistance (ohms)	. .	3300
Peak R.F. Grid Voltage	. .	1500
D.C. Plate Current (amps)	1.25	1.03
Plate Input (watts)	10000	7700
Plate Dissipation (watts)**	5000	2300
D.C. Grid Current (Approx.) (ma.)	150	60
Driving Power (Approx.) (watts)	. .	80
Plate Power Output (watts)	. .	5400
Frequency Limit for Above Operation (mc.)	10	. .
F.C.C. Broadcast Rating (watts)	5000	5000

R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	. .	21.5
D.C. Plate Voltage	12500	10000
D.C. Grid Voltage	—2000	—500
Plate Load Resistance (ohms)	. .	3200
Peak R.F. Grid Voltage	. .	1500
D.C. Plate Current (amps)	1.5	1.5
Plate Input (watts)	15000	15000
Plate Dissipation (watts)**	6000	5000
D.C. Grid Current (Approx.) (ma.)	150	50
Driving Power (Approx.) (watts)	. .	70
Plate Power Output (watts)	. .	10000
Frequency Limit for Above Operation (mc.)	10	15

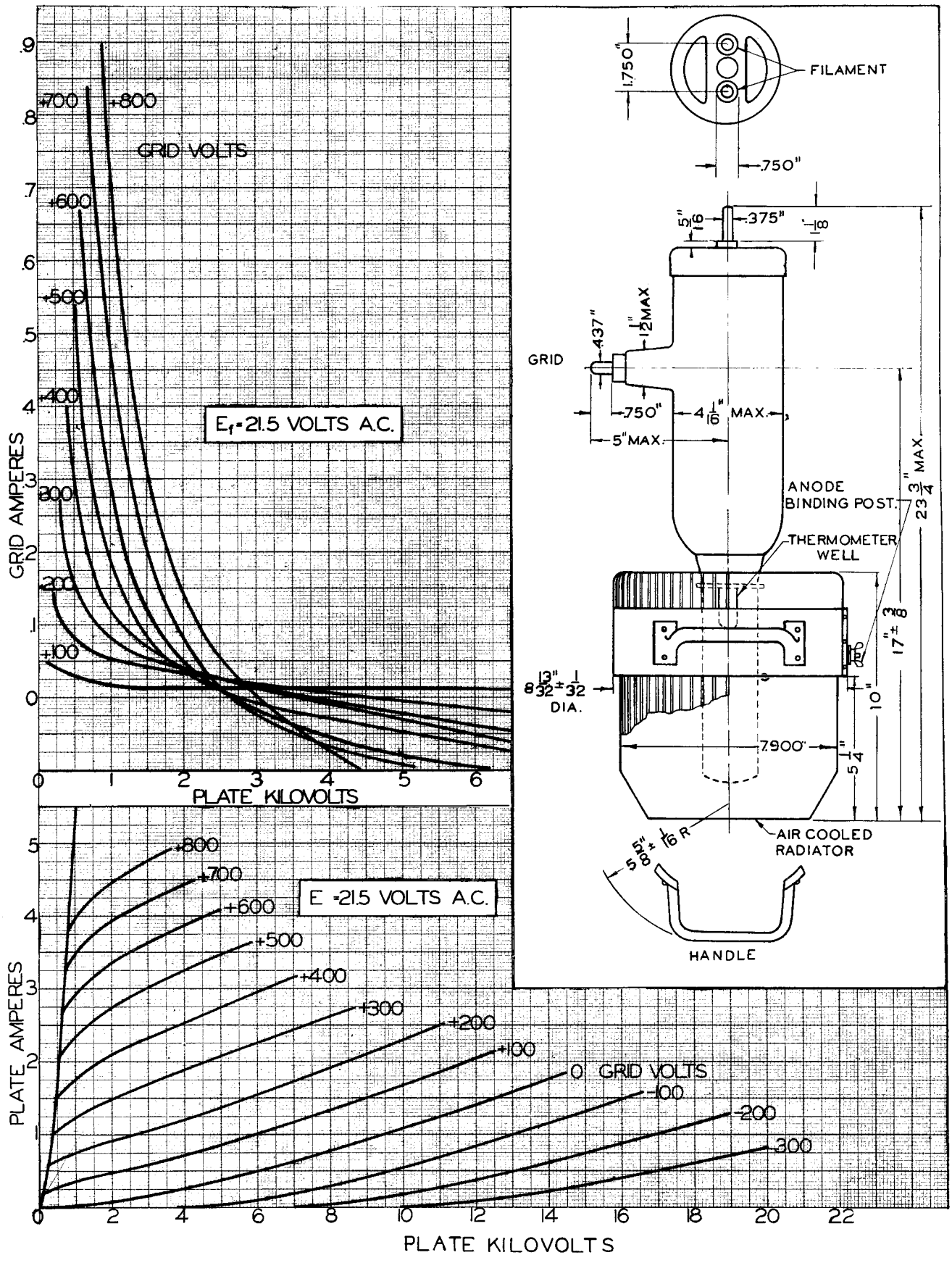
*Averaged over a cycle of sine-wave form under maximum signal conditions.

**Averaged over any audio-frequency cycle of sine-wave form.

AMPEREX

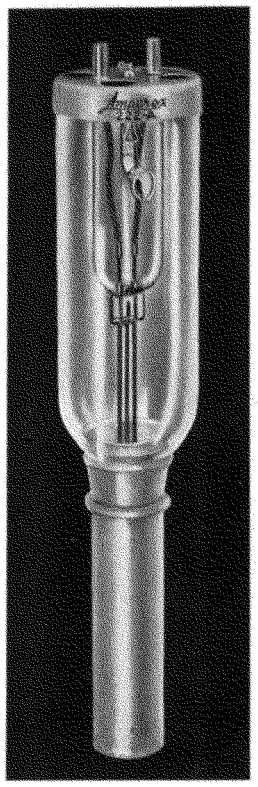
220-R

220-R — AMPEREX TRANSMITTING TUBE



220-R

AMPEREX WATER-COOLED RECTIFIER 222-A



Half Wave, High Voltage, Water-Cooled Rectifier

DIMENSIONS:

Maximum Overall Length	18"
Maximum Diameter	3 7/16"
Water Jacket	Standard or Amperex Type DW 2000

FILAMENT: Tungsten

A.C. Voltage	21.5
Current (amps)	41.0
Average Emission (amps)	7.0

(NOTE: Outline diagram and detailed dimensions are shown on reverse side of this page.)

MAXIMUM RATINGS:

Peak Inverse Voltage	25,000

Maximum Peak Plate Current	At Filament Voltage of
5.5 Amperes	21.5
4.5 Amperes	21.0
3.5 Amperes	20.5
2.8 Amperes	20.0

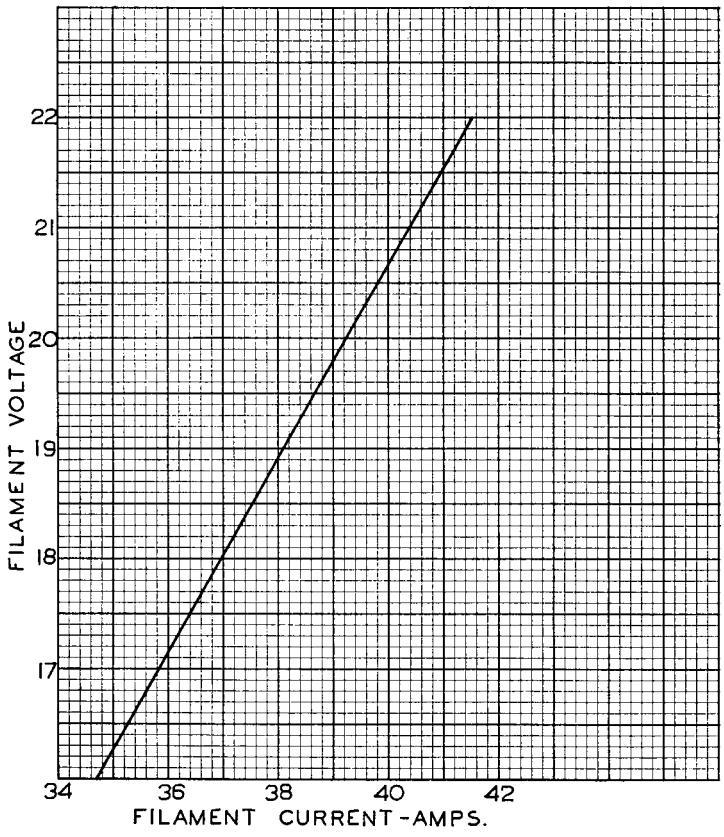
APPROXIMATE MAXIMUM OUTPUTS IN TYPICAL RECTIFIER CIRCUITS

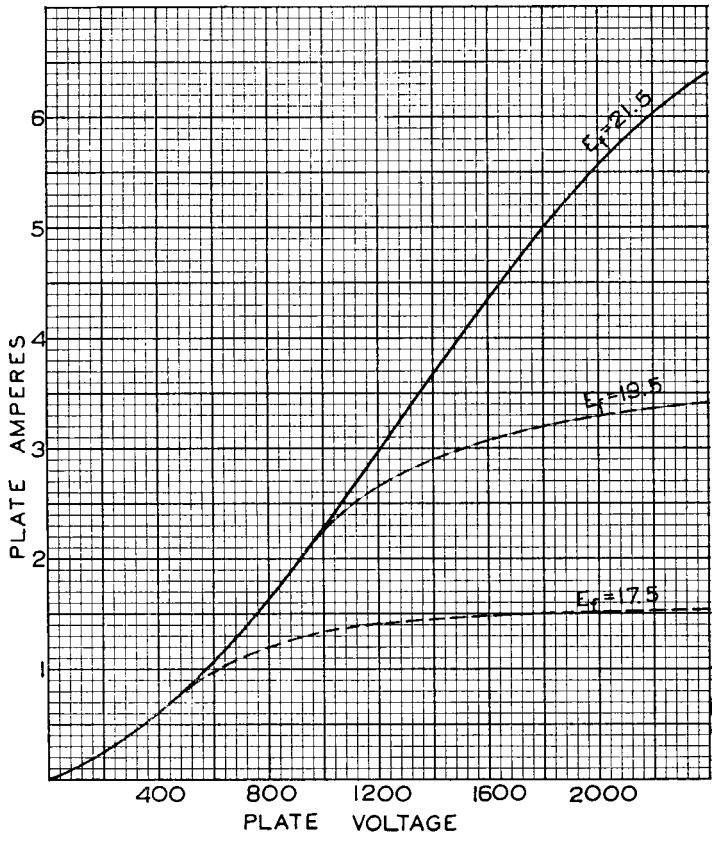
	Output potential in Volts	Output Current in Amperes
Single Phase Full Wave (2 tubes)	7500	3
Single Phase Full Wave Bridge (4 tubes)	15000	3
Three Phase Half Wave (3 tubes)	11000	5
Three Phase Half Wave (6 tubes)	23000	5
Three Phase Double Y Parallel (6 tubes)	11000	9

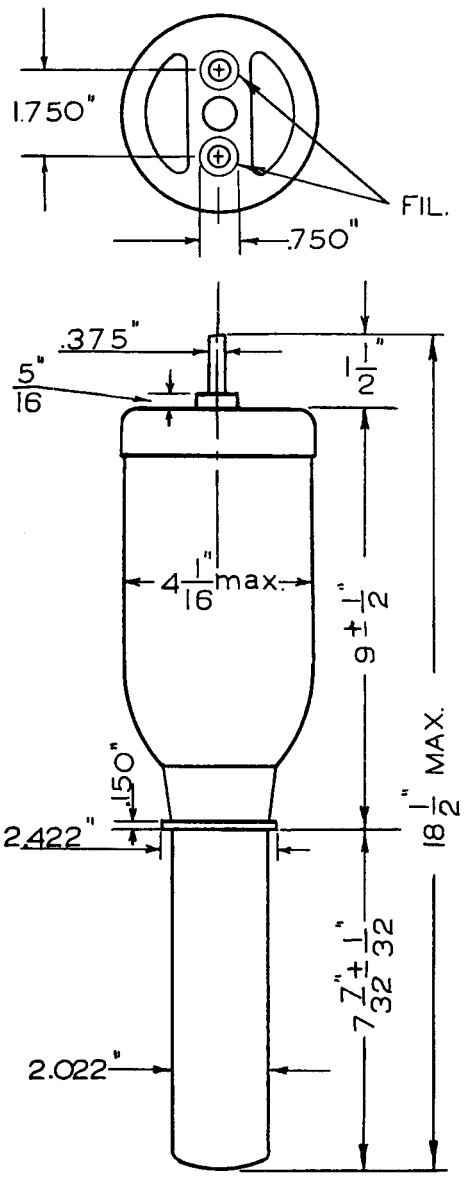
AMPEREX

222-A

222-A — AMPEREX WATER-COOLED RECTIFIER

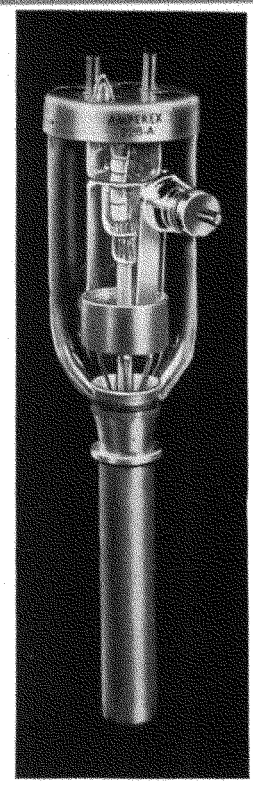






AMPEREX TRANSMITTING TUBE 228-A

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier or Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	21	21.5
D.C. Plate Voltage	6000	5000	6000
D.C. Grid Voltage	—	—265	—325
Load Resistance (ohms per tube)	—	2100	1500
Effective Load Resistance (Plate to Plate) (ohms)	—	8400	6000
Zero Signal Plate Current (ma.)	—	300	300
Peak A.F. Grid to Grid Voltage	—	1030	1650
Max. Signal D.C. Plate Current (amps.)	1.5	1.2	2.2
Max. Signal Plate Input (kw.)	9	6	13.2
Plate Dissipation (kw.)	9	1.125*	4.2*
Max. Signal Driving Power (Approx.) (watts)	—	40	380
Max. Signal Plate Power Output (watts)	—	3750	9000

*Averaged over an audio cycle of sine-wave form under maximum-signal conditions

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	21	21.5
D.C. Plate Voltage	6000	4000	5000
D.C. Grid Voltage	—	—200	—280
Plate Load Resistance (ohms)	—	2900	2200
Peak R.F. Grid Voltage	—	290	415
D.C. Plate Current (ma.)	750	380	606
Plate Input (watts)	4500	1515	3030
Plate Dissipation (watts)	3000	1000	2030
D.C. Grid Current (Approx.) (ma.)	—	8	6
Driving Power at Peak Modulation (Approx.) (watts)	—	60	125
Plate Power Output (watts)	—	515	1000
Frequency Limit for Above Operation (mc.)	3	10	6
F.C.C. Broadcast Rating (watts)	1000	500	1000

GENERAL CHARACTERISTICS

Filament Voltage	21.5
Filament Current (amps)	41.0
Amplification Factor	17
Grid to Plate Transconductance @ .9 ampere	6500 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	23.4 $\mu\mu$f
Grid to Filament	15.0 $\mu\mu$f
Plate to Filament	3.0 $\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	—	21.5
D.C. Plate Voltage	6000	4000
D.C. Grid Voltage	—1000	—500
Plate Load Resistance (ohms)	—	1800
Peak R.F. Grid Voltage	—	1000
D.C. Plate Current (amps.)	1	.96
Plate Input (watts)	6000	3840
Plate Dissipation (watts)	3500	1300
D.C. Grid Current (Approx.) (ma.)	150	105
Driving Power (Approx.) (watts)	—	100
Plate Power Output (watts)	—	2540
Frequency Limit for Above Operation (mc.)	3	7.5
F.C.C. Broadcast Rating (watts)	2500	2500

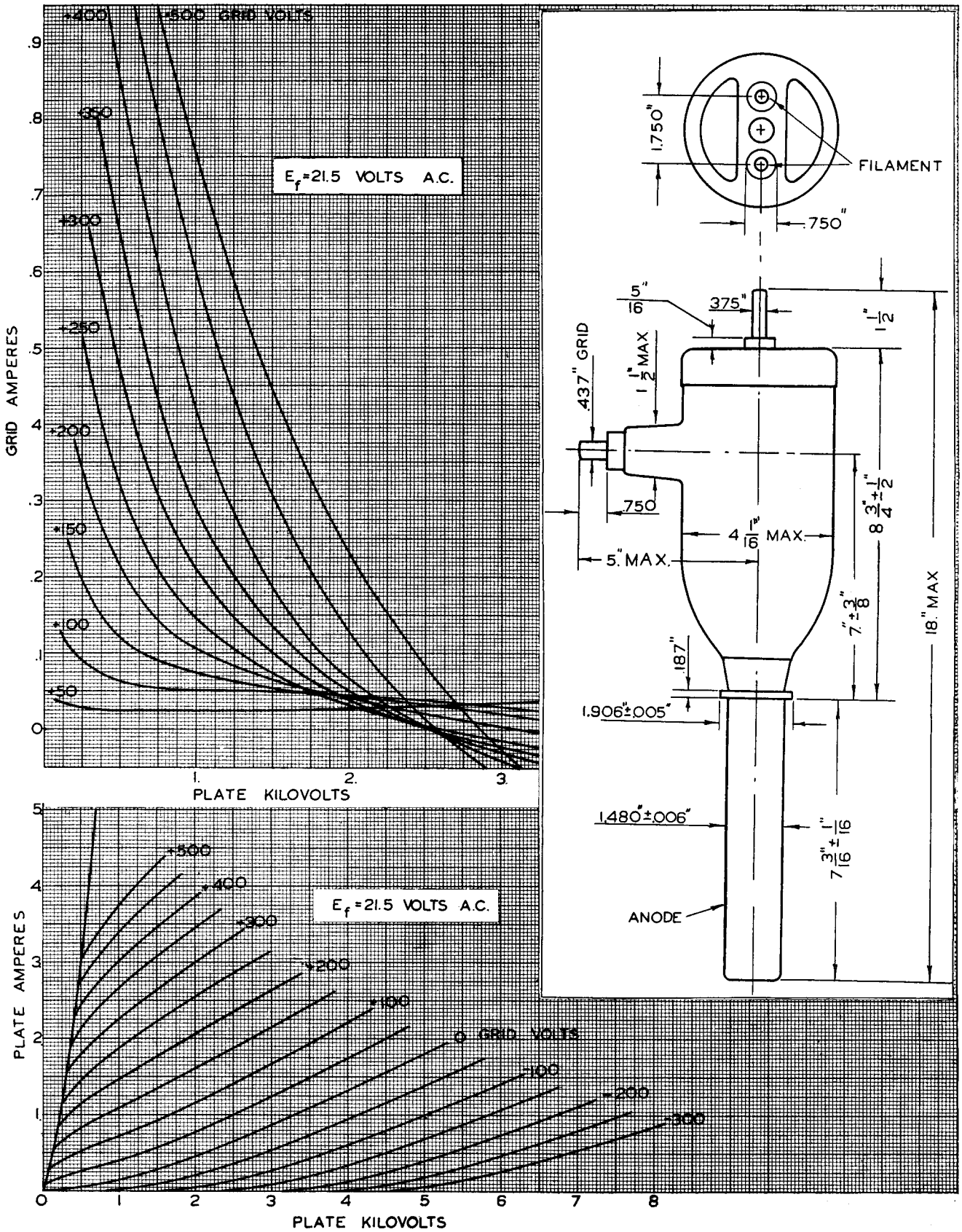
R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	—	21
D.C. Plate Voltage	6000	6000
D.C. Grid Voltage	—1000	—600
Plate Load Resistance (ohms)	—	2200
Peak R.F. Grid Voltage	—	1200
D.C. Plate Current (amps.)	1.5	1.25
Plate Input (watts)	9000	7500
Plate Dissipation (watts)	5000	2400
D.C. Grid Current (Approx.) (ma.)	150	110
Driving Power (Approx.) (watts)	—	120
Plate Power Output (watts)	—	5100
Frequency Limit for Above Operation (mc.)	3	3

AMPEREX

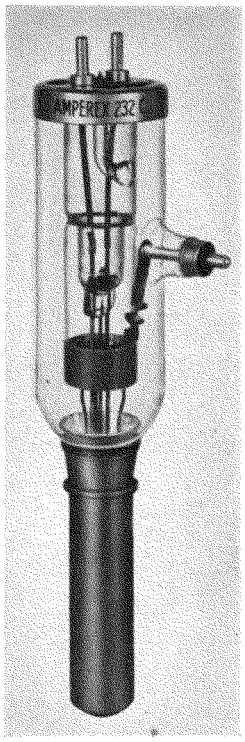
228-A

228-A — AMPEREX TRANSMITTING TUBE



AMPEREX TRANSMITTING TUBE 232-C

Water Cooled Transmitting Tube



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	20	20	20
D.C. Plate Voltage	20000	10000	15000	17500
D.C. Grid Voltage	—	—150	—250	—400
Plate Load Resistance (ohms)	—	1800	2750	3200
Peak R.F. Grid Voltage	—	720	750	800
D.C. Plate Current (amps.)	2.0	1.5	1.5	1.48
Plate Input (kw.)	30	15	22.5	26
Plate Dissipation (kw.)	20	10	15	18.3
D.C. Grid Current (Approx.) (ma.)	—	—25	—20	—30
Driving Power* (Approx.) (watts)	—	200	0	0
Plate Power Ouput (kw.)	—	5.0	7.5	8.7
Frequency Limit for Above Operation (mc.)	3	15	7.5	4
F.C.C. Broadcast Rating (watts)	8500	—	—	8500

*At crest of modulating frequency cycle with 100% modulation

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	20	20
D.C. Plate Voltage	14000	10000	12500
D.C. Grid Voltage (Total)	—3000	—680	—700
Grid Leak Resistor (ohms)	—	3500	3500
With Fixed Bias (volts)	—	—120	—175
Plate Load Resistance (ohms)	—	3400	5400
Peak R.F. Grid Voltage	—	1600	1500
D.C. Plate Current (amps.)	2.0	1.54	1.23
Plate Input (kw.)	28.0	15.4	15.4
Plate Dissipation (kw.)	15.0	3.4	3.0
D.C. Grid Current (Approx.) (ma.)	250	160	150
Driving Power (Approx.) (watts)	—	250	220
Plate Power Output (kw.)	—	12.0	12.4

GENERAL CHARACTERISTICS

Filament Voltage	**20**
Filament Current (amps)	**72**
Thermionic Emission (amps)	**14**
Amplification Constant	**40**
Grid to Plate Transconductance at a plate current of 1.5 amps.	**8000 micromhos**
Direct Interelectrode Capacitances:	
Grid to Plate	**22.0 $\mu\mu$f**
Grid to Filament	**15.0 $\mu\mu$f**
Plate to Filament	**1.5 $\mu\mu$f**
Dimensions:	
Maximum overall length	**21 15/16"**
Maximum Diameter	**4 1/8"**
Water Jacket	**Ampere type DW2000 or Standard**

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

(Continued)

	Maximum Rating per Tube	Typical Operation One Tube	
Frequency Limit for Above Operation (mc.)	3	10	6
F.C.C. Broadcast Rating (watts)	10000	10000	10000

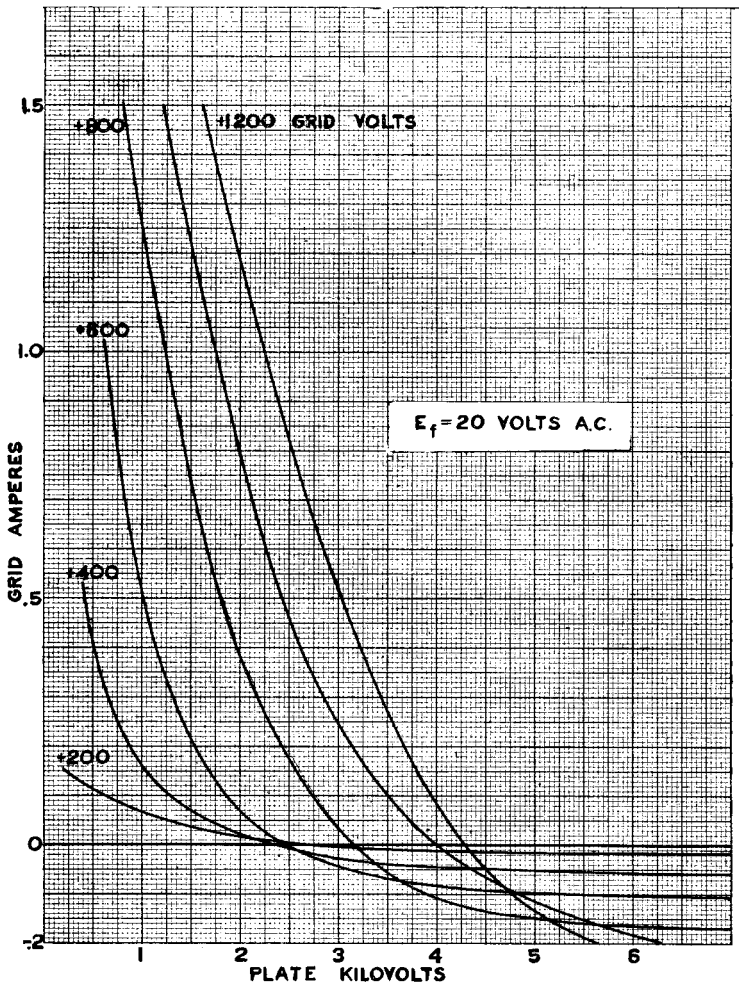
R.F. Power Amplifier—Class C—Telegraphy

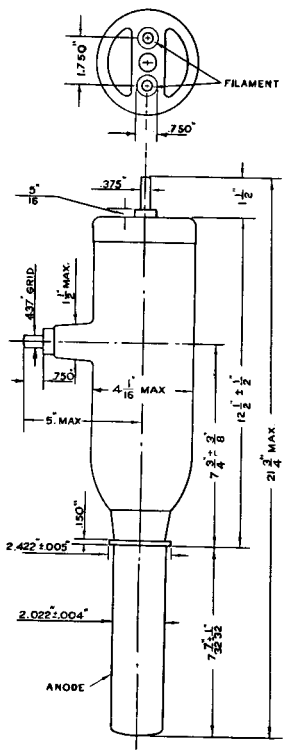
Key down conditions without modulation.

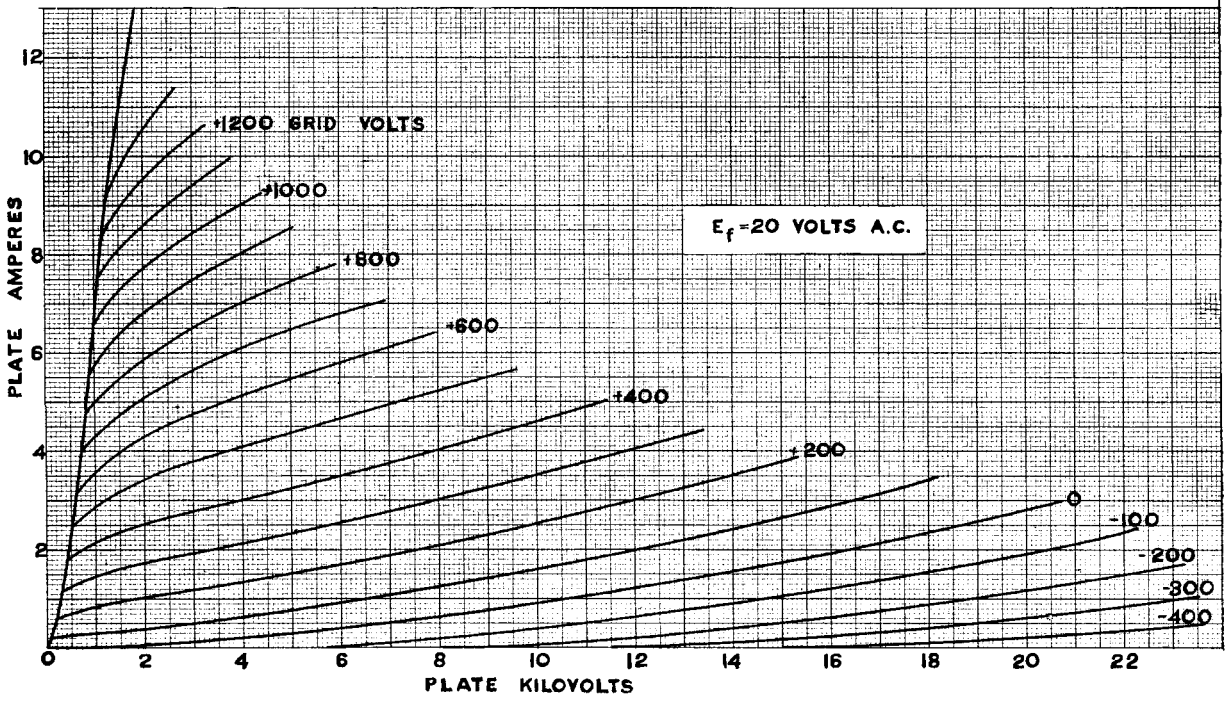
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	20	20
D.C. Plate Voltage	20000	15000	12000
D.C. Grid Voltage	—3000	—1000	—800
Plate Load Resistance (ohms)	—	3000	2400
Peak R.F. Grid Voltage	—	2300	2200
D.C. Plate Current (amps.)	3.0	2.5	2.5
Plate Input (kw.)	50	37.5	30.0
Plate Dissipation (kw.)	25	9.5	8.0
D.C. Grid Current (Approx.) (ma.)	300	110	140
Driving Power (Approx.) (watts)	—	240	300
Plate Power Output (kw.)	—	28.0	22.0
Frequency Limit for Above Operation (mc.)	3	7.5	15

AMPEREX

232-C

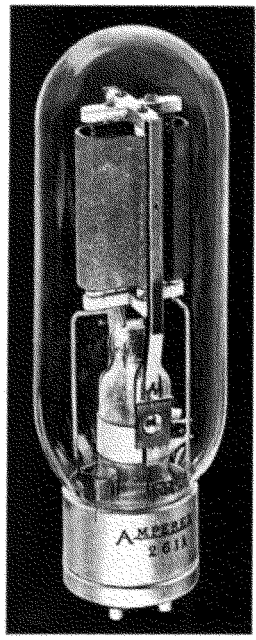

+1200 GRID VOLTS
+800
+600
+400
+200
0
-200
E_f = 20 VOLTS A.C.
GRID AMPERES
PLATE KILOVOLTS


FILAMENT
.437" GRID
5" MAX.
ANODE


+1200 GRID VOLTS
+1000
+800
+600
+400
+200
0
-100
-200
-300
-400
E_f = 20 VOLTS A.C.
PLATE AMPERES
PLATE KILOVOLTS

AMPEREX TRANSMITTING TUBE 261-A

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1200
D.C. Grid Voltage	—	—55	—70
Peak A.F. Grid Voltage	—	50	65
D.C. Plate Current (ma.)	—	75	80
Plate Dissipation (watts)	100	75	96
Load Resistance (ohms)	—	4800	7600
Power Output (watts)	—	14	21
Distortion (% Second Harmonic)	—	5	3

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	—72	—90
Load Resistance (ohms per tube)	—	1250	1675
Effective Load Resistance (Plate to Plate) (ohms)	—	5000	6700
Zero Signal Plate Current (ma.)	—	60	50
Peak A.F. Grid to Grid Voltage	—	344	380
Max. Signal D.C. Plate Current (ma.)	210	400	400
Max. Signal Plate Input (watts)	260	400	500
Plate Dissipation (watts)	125	—	—
Max. Signal Driving Power (Approx.) (watts)	—	4	4.5
Max. Signal Plate Power Output (watts)	—	240	320

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	—60	—85
Peak R.F. Grid Voltage	—	100	110
D.C. Plate Current (ma.)	150	140	130
Plate Input (watts)	175	140	162
Plate Dissipation (watts)	125	95	107
D.C. Grid Current (Approx.) (ma.)	—	2.5	1.0
Driving Power at Peak Modulation (Approx.) (watts)	—	3.5	3.6
Plate Power Output (watts)	—	45	55
Frequency Limit for Above Operation (mc.)	20	30	20

GENERAL CHARACTERISTICS

Filament Voltage	10-10.5
Filament Current (amps)	3.25
Amplification Factor	12.5
Grid to Plate Transconductance @ 100 ma.	4300 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	9.0 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	3.5 $\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
PD.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	—	380	430
D.C. Plate Current (ma.)	175	170	166
Plate Input (watts)	220	170	208
Plate Dissipation (watts)	85	55	60
D.C. Grid Current (Approx.) (ma.)	50	10	8
Driving Power (Approx) (watts)	—	3.5	3.5
Plate Power Output (watts)	—	115	148
Frequency Limit for Above Operation (mc.)	10	20	10
F.C.C. Broadcast Rating (watts)	125	—	125

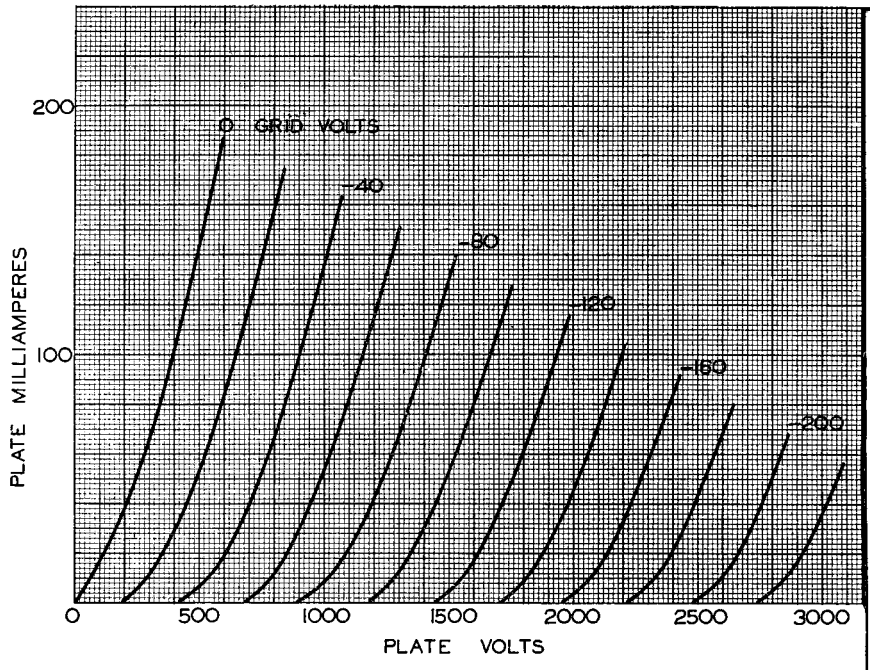
R.F. Power Amplifier or Oscillator—Class C Telegraphy

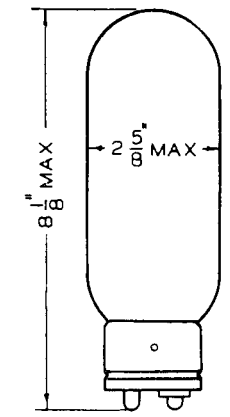
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—200	—250
Peak R.F. Grid Voltage	—	340	385
D.C. Plate Current (ma.)	210	200	200
Plate Input (watts)	260	200	250
Plate Dissipation (watts)	125	55	80
D.C. Grid Current (Approx.) (ma.)	50	15	10
Driving Power (Approx.) (watts)	—	5	3.5
Plate Power Output (watts)	—	145	170
Frequency Limit for Above Operation (mc.)	20	30	20

AMPEREX

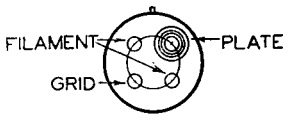
261-A

261-A — AMPEREX TRANSMITTING TUBE

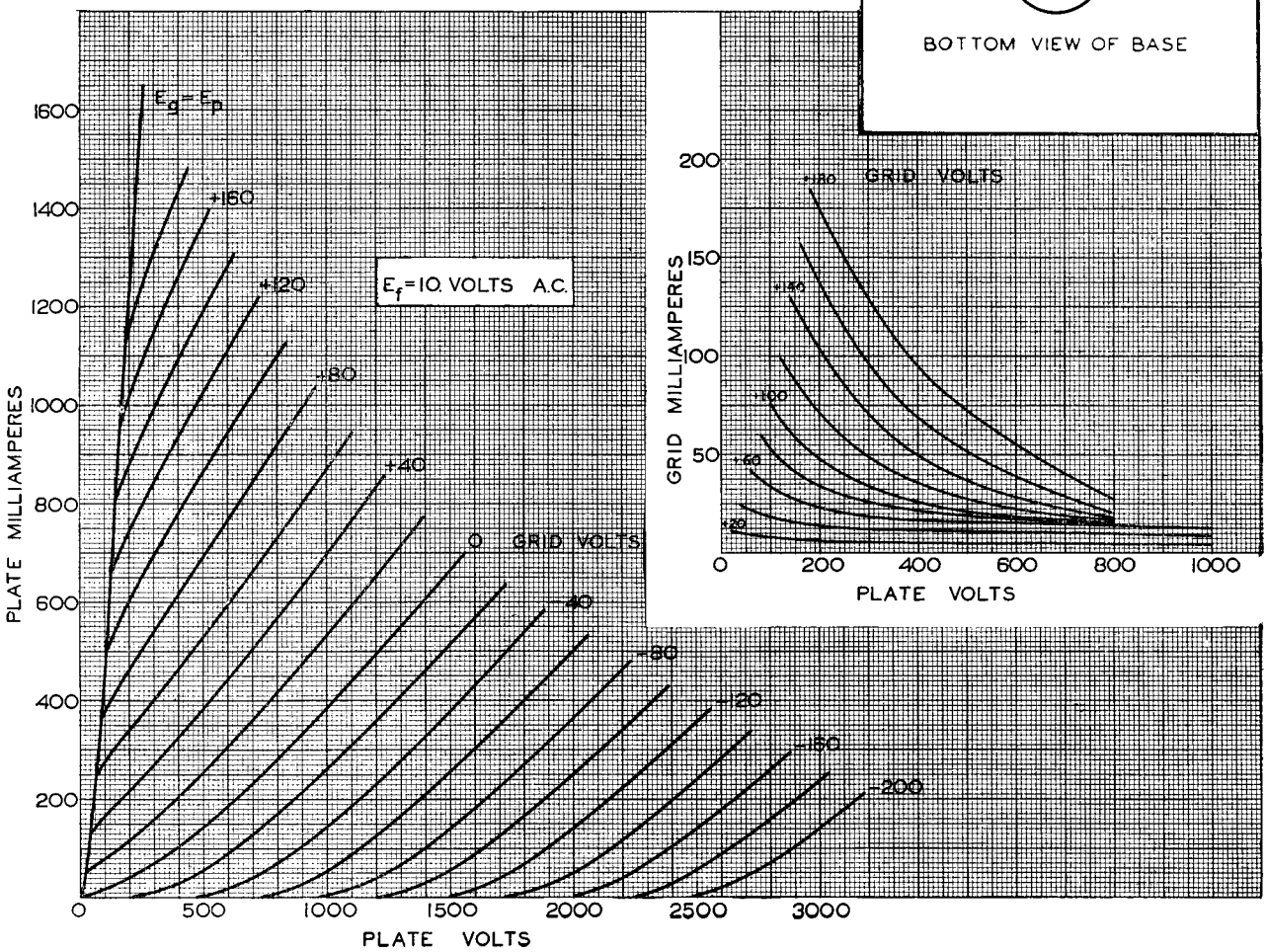




261-A BASE

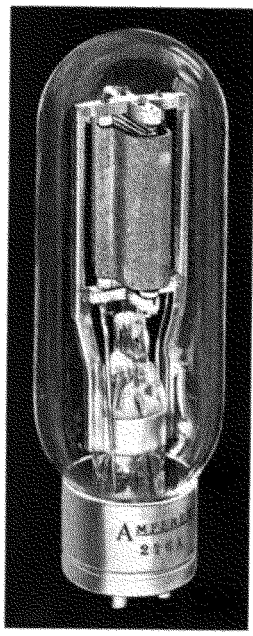


BOTTOM VIEW OF BASE



AMPEREX TRANSMITTING TUBE 276-A

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

GENERAL CHARACTERISTICS

Filament Voltage	10-10.5
Filament Current (amps)	3.25
Amplification Factor	12.5
Grid to Plate Transconductance @ 100 ma.	4300 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	9.0 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	3.5 $\mu\mu$f

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1200
D.C. Grid Voltage	—	—55	—70
Peak A.F. Grid Voltage	—	50	65
D.C. Plate Current (ma.)	—	75	80
Plate Dissipation (watts)	100	75	96
Load Resistance (ohms)	—	4800	7600
Power Output (watts)	—	14	21
Distortion (% Second Harmonic)	—	5	3

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	—72	—90
Load Resistance (ohms per tube)	—	1250	1675
Effective Load Resistance (Plate to Plate) (ohms)	—	5000	6700
Zero Signal Plate Current (ma.)	—	60	50
Peak A.F. Grid to Grid Voltage	—	344	380
Max. Signal D.C. Plate Current (ma.)	210	400	400
Max. Signal Plate Input (watts)	260	400	500
Plate Dissipation (watts)	125	—	—
Max. Signal Driving Power (Approx.) (watts)	—	4	4.5
Max. Signal Plate Power Output (watts)	—	240	320

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	—60	—85
Peak R.F. Grid Voltage	—	100	110
D.C. Plate Current (ma.)	150	140	130
Plate Input (watts)	175	140	162
Plate Dissipation (watts)	125	95	107
D.C. Grid Current (Approx.) (ma.)	—	2.5	1.0
Driving Power at Peak Modulation (Approx.) (watts)	—	3.5	3.6
Plate Power Output (watts)	—	45	55
Frequency Limit for Above Operation (mc.)	20	30	20

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	—	380	430
D.C. Plate Current (ma.)	175	170	166
Plate Input (watts)	220	170	208
Plate Dissipation (watts)	85	55	60
D.C. Grid Current (Approx.) (ma.)	50	10	8
Driving Power (Approx.) (watts)	—	3.5	3.5
Plate Power Output (watts)	—	115	148
Frequency Limit for Above Operation (mc.)	10	20	10
F.C.C. Broadcast Rating (watts)	125		125

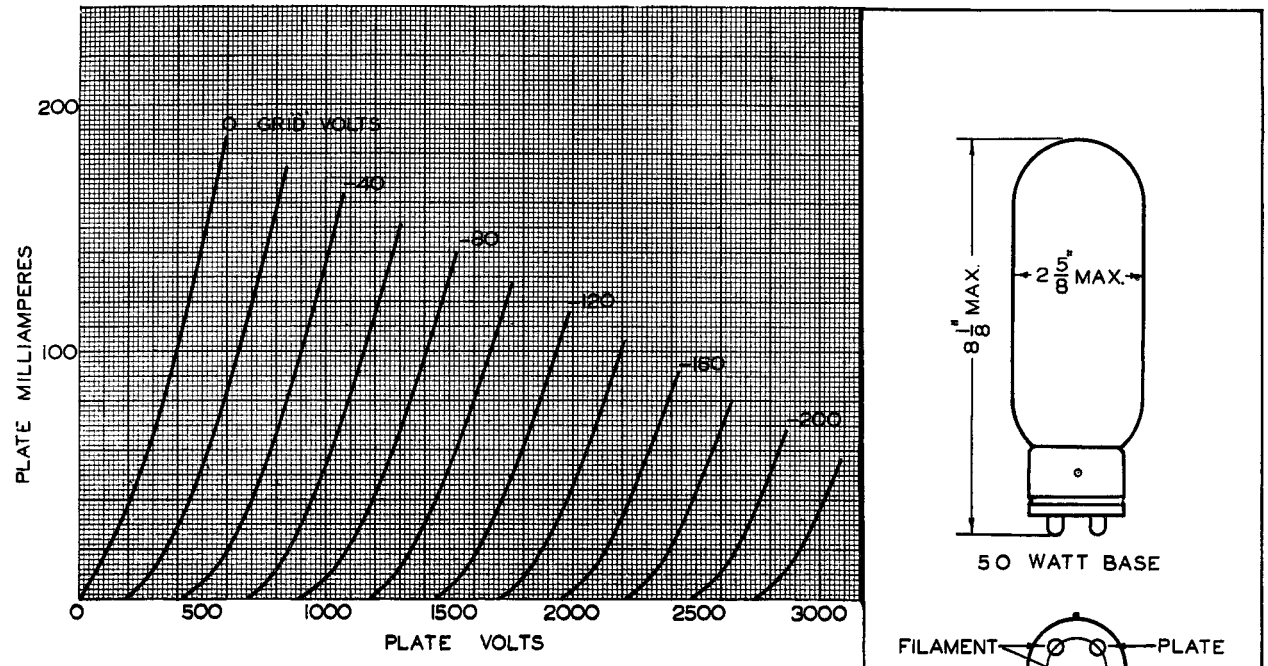
R.F. Power Amplifier or Oscillator—Class C Telegraphy

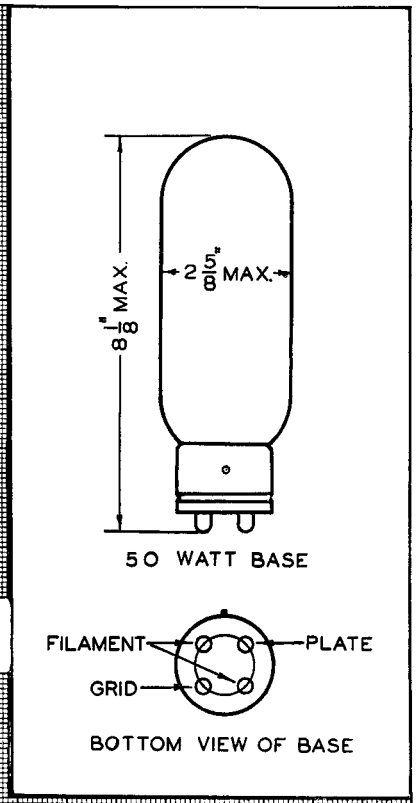
	Maximum Rating per Tube	Typical Operation One Tube	
AC. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—200	—250
Peak R.F. Grid Voltage	—	340	385
D.C. Plate Current (ma.)	210	200	200
Plate Input (watts)	260	200	250
Plate Dissipation (watts)	125	55	80
D.C. Grid Current (Approx.) (ma.)	50	15	10
Driving Power (Approx.) (watts)	—	5	3.5
Plate Power Output (watts)	—	145	170
Frequency Limit for Above Operation (mc.)	20	30	20

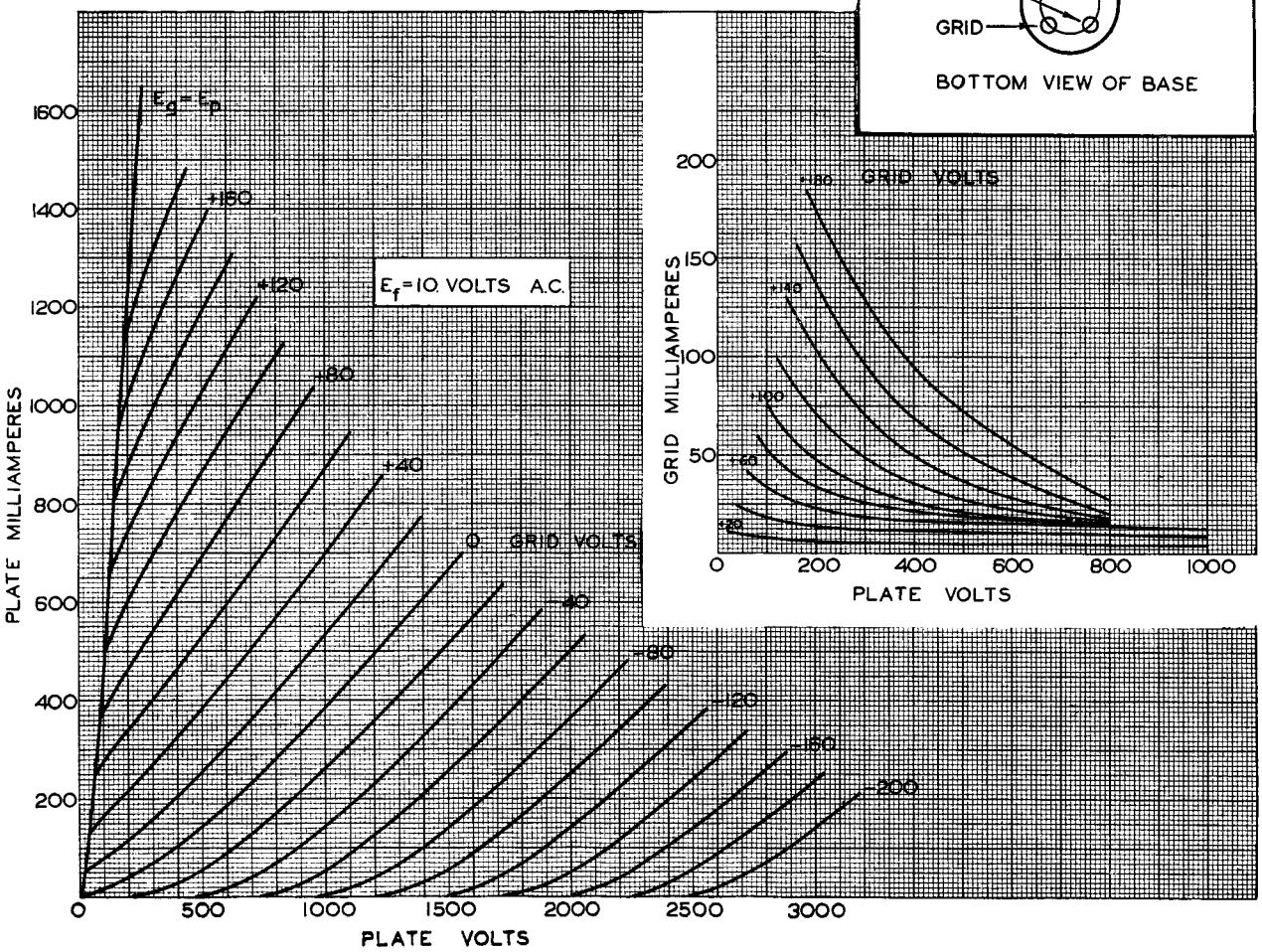
AMPEREX

276-A

276-A—AMPEREX TRANSMITTING TUBE



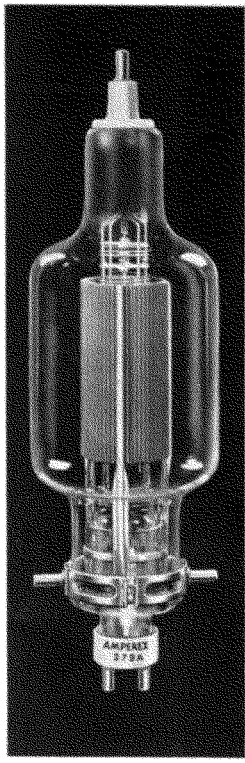




AMPEREX TRANSMITTING TUBE 279-A

Radio Frequency Power Amplifier or Oscillator

Audio Frequency Power Amplifier or Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	2500	2500	2000
D.C. Grid Voltage	—	—170	—110
Peak A.F. Grid Voltage	—	165	105
D.C. Plate Current (ma.)	—	300	375
D.C. Plate Input (watts)	750	750	750
Plate Dissipation (watts)	750	750	750
Load Resistance (ohms)	—	4500	2000
Power Output (watts)	—	155	90
Distortion (% Second Harmonic)		5	5

GENERAL CHARACTERISTICS

Dimensions:	
Maximum Overall Length	21 11/16"
Maximum Diameter	6"
Mounting:	
W.E. 142A or Similar Socket	
Filament Voltage	**10**
Filament Current (amps)	**21**
Amplification Constant	**10**
Grid to Plate Transconductance at 300 Ma. Plate Current	**5400 micromhos**
Direct Interelectrode Capacitances:	
Grid to Plate	18 $\mu\mu$f
Grid to Filament	14 $\mu\mu$f
Plate to Filament	6 $\mu\mu$f

A.F. Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	2500	2500	2000
D.C. Grid Voltage	—	—200	—150
Load Resistance (ohms per tube)		700	560
Effective Load Resistance (Plate to Plate) (ohms)	—	2800	2240
Zero Signal Plate Current (ma.)	—	300	260
Peak A.F. Grid to Grid Voltage	—	870	820
Max. Signal Plate Current (ma.)	1000	1600	1600
Max. Signal Plate Input (watts)	2500	4000	3200
Plate Dissipation (watts)*	1200	—	—
Minimum Grid Input Resistance (ohms)	—	600	500
Max. Signal Driving Power (watts)		20	35
Max. Signal Plate Power Output (watts)	—	2200	1760

*Averaged over any audio frequency cycle of sine-wave form

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	3000	3000	2500
D.C. Grid Voltage	—	—250	—200
Plate Load Resistance (ohms)	—	1680	1140
Peak R.F. Grid Voltage	—	305	310
D.C. Plate Current (ma.)	800	500	600
Plate Input (watts)	1800	1500	1500
Plate Dissipation (watts)	1200	980	990
D.C. Grid Current (Approx.) (ma.)	—	3	4
Driving Power (Approx.) (at peak modulation) (watts)	—	38	60
Plate Power Output (watts)	—	520	510
Frequency Limit for Above Operation (mc.)	20	20	20
F.C.C. Broadcast Rating (watts)	500	500	500

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	2250	2250	1750
D.C. Grid Voltage	—750	—600	—500
Plate Load Resistance (ohms)	—	1300	1100
Peak R.F. Grid Voltage	—	1000	875
D.C. Plate Current (ma.)	800	780	715
Plate Input (watt)	1800	1750	1250
Plate Dissipation (watts)	800	450	350
D.C. Grid Current (Approx.) (ma.)	100	80	80
Driving Power (Approx.) (watts)	—	75	65
Plate Power Output (watts)	—	1300	900
Frequency Limit for Above Operation (mc.)	20	20	30
F.C.C. Broadcast Rating (watts)	750	—	750

R.F. Power Amplifier—Class C—Telegraphy

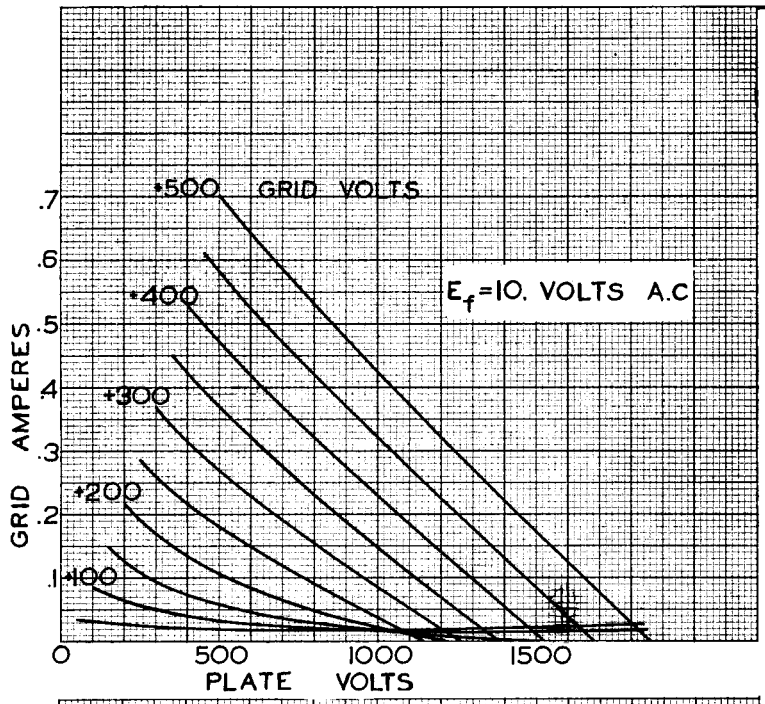
Key down conditions without modulation.

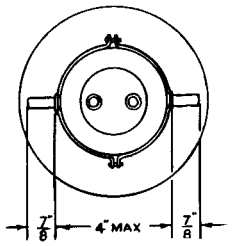
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	3000	3000	2500
D.C. Grid Voltage	—750	—600	—400
Plate Load Resistance (ohms)	—	1550	1150
Peak R.F. Grid Voltage	—	1000	800
D.C. Plate Current (ma.)	1000	900	1000
Plate Input (watts)	3000	2700	2500
Plate Dissipation (watts)	1200	700	750
D.C. Grid Current (Approx.) (ma.)	150	60	70
Driving Power (Approx.) (watts)	—	55	65
Plate Power Output (watts)	—	2000	1750
Frequency Limit for Above Operation (mc.)	20	20	20

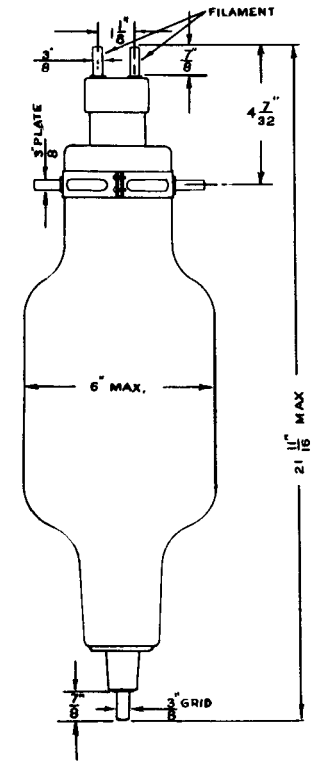
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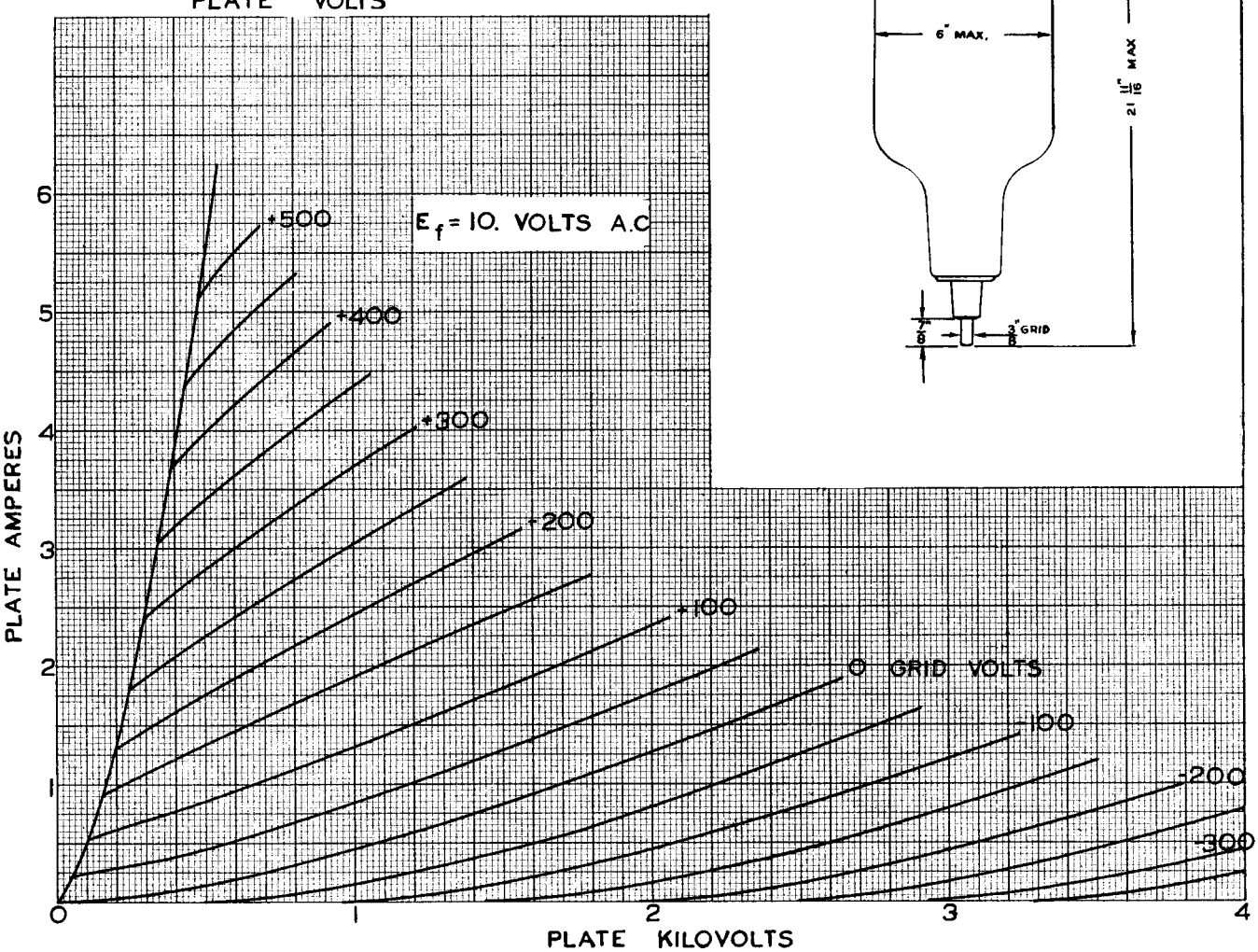
279-A

279-A—AMPEREX TRANSMITTING TUBE









from JEDEC release #4316, June 24, 1963

2HR8
4HR8

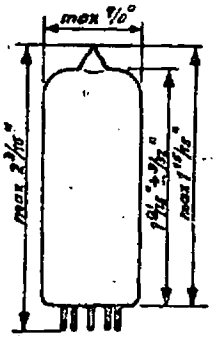
DESCRIPTION

Pentode for use in transitron circuits in television receivers.

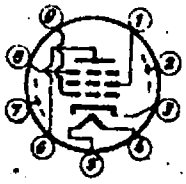
MECHANICAL DATA

Cathode	coated, unipotential
Outline	6-2
Bulb	T6½
Base	E9-1
Basing	9 BJ
Mounting position	any

Tube outline



Bottom view of base



Base pin No.	*Element*
1	Grid No.2
2	Internal shield
3	Cathode
4	Heater
5	Heater
6	Plate
7	Internal shield
8	Grid No.3
9	Grid No.1

HEATER DATA	*2HR8*	*4HR8*	
Heater voltage	2.5	4.5	V
Heater current	0.6	0.3	A

DIRECT INTERELECTRODE CAPACITANCES

Grid No.1 to all other elements except plate		3.5	μμF
Plate to all other elements except grid No.1		5.0	μμF
Plate to grid No.1	max.	0.05	μμF
Grid No.1 to heater	max.	0.003	μμF

MAXIMUM RATINGS (design centre values)

Plate voltage	max.	300	V
Plate voltage without current	max.	550	V
Plate dissipation	max.	1	W
Grid No.2 voltage	max.	200	V
Grid No.2 voltage without current	max.	550	V
Grid No.2 dissipation	max.	0.2	W
Cathode current	max.	4	mA
Peak cathode current	max.	25	mA [1]
Grid No.1 circuit resistance at a plate dissipation less than 0.2 W	max.	10	MΩ
Grid No.1 circuit resistance at a plate dissipation higher than 0.2 W	max.	3	MΩ
Grid No.3 circuit resistance	max.	0.1	MΩ
Voltage between heater and cathode	max.	100	V
Circuit resistance between heater and cathode	max.	20.000	Ω

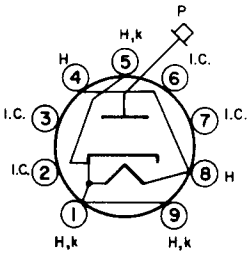
[1]) Max. pulse duration 4% of a cycle with a maximum of [illegible] Vmax 2063

TYPICAL CHARACTERISTICS

Plate voltage	100	250	V
Grid No.3 voltage	-30	0	V
Grid No.2 voltage	35	140	V
Grid No.1 voltage	0	-2	V
Plate current	< 0.01	3	mA
Grid No.2 current		0.6	mA
Transconductance		2000	μU
Plate resistance		2.5	MΩ
Amplification factor of grid No.2 with respect to grid No.1		38	

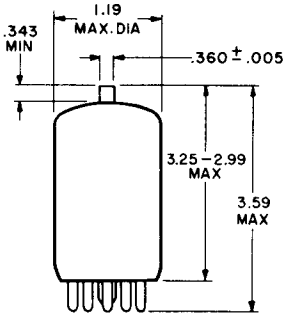
AMPEREX TUBE TYPE 3BH2

The 3BH2 is a high voltage rectifier diode intended for use in color TV receivers.



PIN CONNECTIONS

1 – HEATER, CATHODE
2 – INTERNAL CONNECTION
3 – INTERNAL CONNECTION
4 – HEATER
5 – HEATER, CATHODE
6 – INTERNAL CONNECTION
7 – INTERNAL CONNECTION
8 – HEATER
9 – HEATER, CATHODE
P – PLATE



GENERAL CHARACTERISTICS

MECHANICAL

Base	magnoval
Dimensions	see outline drawing

ELECTRICAL

Heating	Indirect, AC or DC
Heater Voltage	3.15 volts ± 15%
Heater Current	370 ma
Capacitance	1.5 pf, Plate to Cathode

ABSOLUTE MAXIMUM RATINGS

Negative Plate to Cathode Voltage[1]	35 k volts
Output Voltage	27.5 k volts
Plate Current (Design Center)	1.7 ma

OPERATING CHARACTERISTICS

Output Voltage	25 k volts
Plate Current	1.5 ma

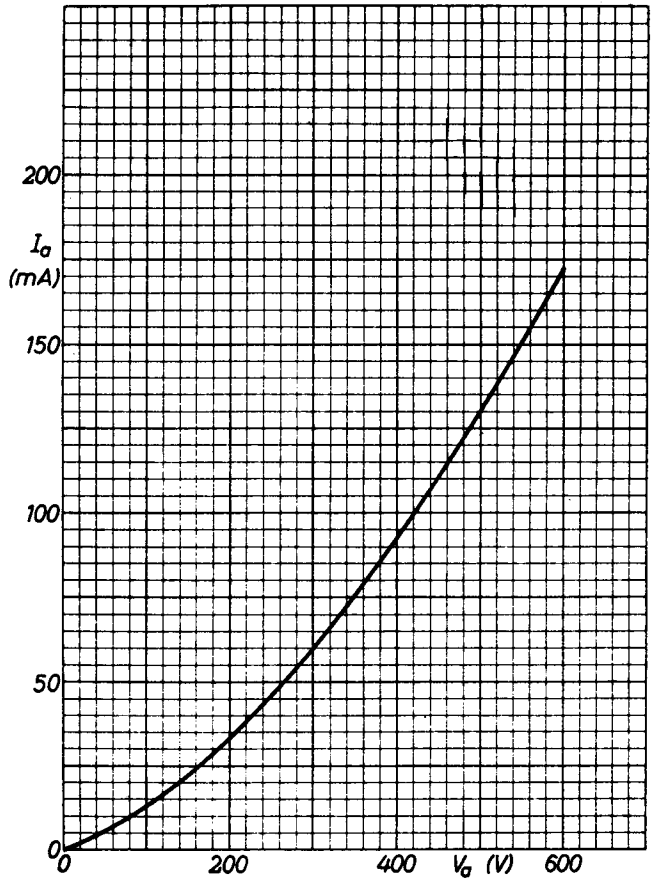
OPERATING NOTES

A. Pins 1, 5 and 9, may be used to connect an anti-corona ring.
B. X-ray shielding may be required for protection against excessive radiation

---

1. Negative peak due to ringing in output transformer should be taken into account. Maximum pulse duration 22% of a cycle and 18 μsec.

3BH2



from JEDEC release #4317, June 24, 1963

3BYP2
3BYP7
3BYP11
3BYP31

DESCRIPTION

Cathode-ray tube with flat face and post deflection acceleration by means of a helical electrode. The tube is intended for use in transistorised oscilloscopes.

ELECTRICAL DATA

Heating	
Heater voltage	6.3 V
Heater current	0.095 A
Focusing method	electrostatic
Deflection method	double electrostatic
	D_1D_2 symmetrical
	D_3D_4 symmetrical
Angle between D_1D_2 and D_3D_4 traces	90° ± 1

Direct interelectrode capacitances		
D_1 to all other electrodes except D_2	4.0	μμF
D_2 to all other electrodes except D_1	4.0	μμF
D_3 to all other electrodes except D_4	3.5	μμF
D_4 to all other electrodes except D_3	3.5	μμF
D_1 to D_2	1.9	μμF
D_3 to D_4	1.7	μμF
Grid No.1 to all other electrodes	5.7	μμF
Cathode to all other electrodes	3.0	μμF

OPTICAL DATA

	P2	*P7*	*P11*	*P31*
Fluorescent colour	yell. green	purplish blue	blue	green
Phosphorescent colour	yell. green	yell. green	blue	green
Persistence	med. short	long	med. short	med. short

Useful screen diameter: 68 mm

MECHANICAL DATA

Cathode	coated, unipotential
Outline	see drawing
Base	14 pin base, see drawing
Bulb contact	recessed cavity button
Socket	is supplied with the tube
Mounting position	any[1])

LINE WIDTH (measured with shrinking raster method)

Grid No.6 voltage	1200	V
Grid No.4 voltage	300	V
Grid No.2 voltage	1200	V
Beam current	10	μA
Line width	0.65	mm

HELIX RESISTANCE

Post deflection acceleration helix resistance min. 40 MΩ

[1]) see foot-notes on page 3.

MAXIMUM RATINGS (design centre values)

Post accelerator (grid No.6) voltage	max.	2500	V
	min.	1200	V
Isolation shield (grid No.5) voltage	max.	2200	V
Accelerator (grid No.4) voltage	max.	2100	V
	min.	300	V
Ratio grid No.6 voltage/grid No.4 voltage	max.	4	
Focusing (grid No.3) voltage	max.	1000	V
Grid No.2 voltage	max.	1600	V
	min.	800	V[2]
Grid No.1 voltage negative	max.	200	V
Grid No.1 voltage positive	max.	0	V
Peak voltage between grid No.4 and any deflection plate	max.	500	V
Voltage between cathode and heater			
cathode positive	max.	100	V
cathode negative	max.	15	V
Screen dissipation	max.	3	mW/cm^2
Cathode current	max.	200	μA_{rms}

MAXIMUM CIRCUIT VALUES

Grid No.1 circuit resistance	max.	1.5	MΩ
Deflection plate resistance	max.	50.000	Ω[3]

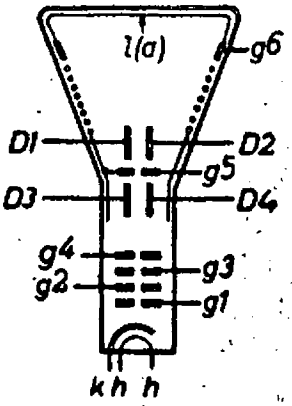
TYPICAL CHARACTERISTICS

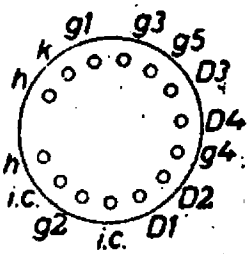
Grid No.6 voltage		1200	V
Grid No.5 voltage		300 ± 30	V
Grid No.4 voltage		$300\ ^{+40}_{-15}$	V
Grid No.3 voltage		20 to 150	V
Grid No.2 voltage		1200	V
Neg. grid No.1 voltage		30 to 80	V[4]
Deflection factor vertical $D_3 - D_4$		3.2 to 4.1	V/cm
Deflection factor horizontal $D_1 - D_2$		9.4 to 12	V/cm
Deviation of the linearity of deflection	max.	2	%[5]
Spot position (undeflected)		4	mm radius[6]
Pattern distortion	max.	2	%[7]
Useful scan		45 × 60	mm

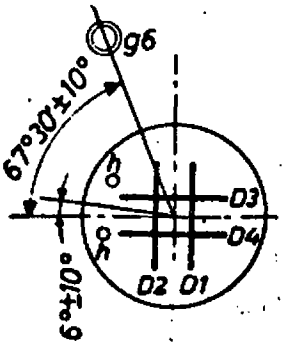
CIRCUIT DESIGN VALUES

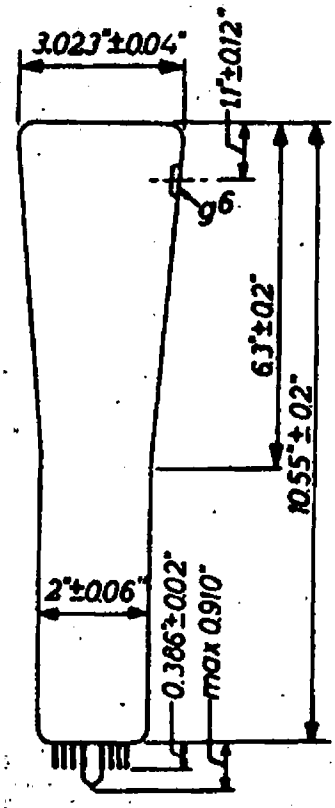
Neg. grid No.1 voltage		30 to 60	V[8]
Deflection factor for grid No.6 voltage/grid No.4 voltage	vertical	6.9 to 8.8	V/cm[9]
	horizontal	17.9 to 22.8	V/cm[9]
Deflection factor for grid No.6 voltage/grid No.4 voltage = 4	vertical	10.7 to 13.7	V/cm[9]
	horizontal	31.3 to 40.0	V/cm[9]
Grid No.3 current		−15 to +10	μA[10]

2,3,4,5,6,7,8,9,10) see foot-notes on page 3.









NOTES

1) The socket should under no circumstances be used to support the tube.

2) In order to obtain satisfactory focus quality and maximum screen current it is recommended not to apply to this electrode a voltage less than the indicated value.

3) If use is made of the full deflection capabilities of the tube, the deflection plates will intercept part of the electron beam near the edge of the scan; a low impedance deflection plate drive is desirable in this case.

4) For visual extinction of the focused spot.

5) The sensitivity (for both D_1D_2 and D_3D_4 plate pairs) for a deflection of less than 75% of the useful scan will not differ from the sensitivity for a deflection of 25% of the useful scan by more than the indicated value.

6) With the tube shielded the spot will be within a circle of 4 mm radius that is centered with respect to the tube face.

7) With a raster pattern the size of which is adjusted so that the widest points of the pattern just touch the sides of a square 40.6 mm on a side, no point of these pattern sides will be within an inscribed square of 39.2 mm on a side.

8) Per kV of grid No.2 voltage.

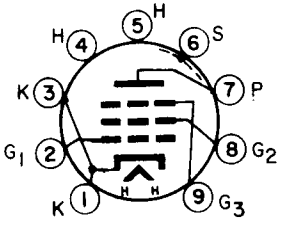
9) Per kV of grid No.4 voltage.

10) For calculating of the grid No.3 potentiometer a grid No.3 current of min. -15 μA and max. +10 μA must be taken into account.

AMPEREX TUBE TYPE 3EH7/XF183

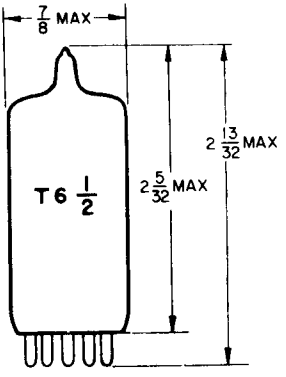
TENTATIVE DATA

The Amperex 3EH7/XF183 is a frame grid remote cut-off pentode designed for use as an IF amplifier in television receivers. Its high variable transconductance, with low interelectrode and low feed back capacitance, enables the construction of simplified broad band amplifiers with high stability. The higher gain per stage in many instances reduces the number of tubes required in the television IF strip. The 3EH7/XF183 is designed for 600 mA controlled warm-up series string operation.



PIN CONNECTIONS

1 - CATHODE
2 - GRID NO. 1
3 - CATHODE
4 - HEATER
5 - HEATER
6 - SHIELD
7 - PLATE
8 - GRID NO.2
9 - GRID NO.3



GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6½
Base	E 9-1
Dimensions	see outline drawing

ELECTRICAL

Cathode	coated, unipotential
Heater current	600 mA
Heater voltage	3.4 volts

Direct Interelectrode Capacitances

→ Input	9.5 μμf
Output	3 μμf
→ Plate to grid No. 1	0.005 μμf max

3EH7/XF183

Maximum Ratings, Design Center

→ Plate voltage, cut-off condition	550 volts max
Plate voltage	250 volts max
Plate dissipation	2.5 watts max
→ Screen grid voltage, cut-off condition	550 volts max
Screen grid voltage	250 volts max
Screen grid dissipation	0.65 watts max
Cathode current	20 mA max
Control grid series resistance	1 megohm max
Heater-cathode voltage	150 volts max
Heater-cathode circuit resistance	20,000 ohms max
Negative grid no. 1 voltage (Grid No. 1 current = + 0.3 μA)	1.3 volts max
Peak negative grid no. 1 voltage	50 volts max

Typical Characteristics

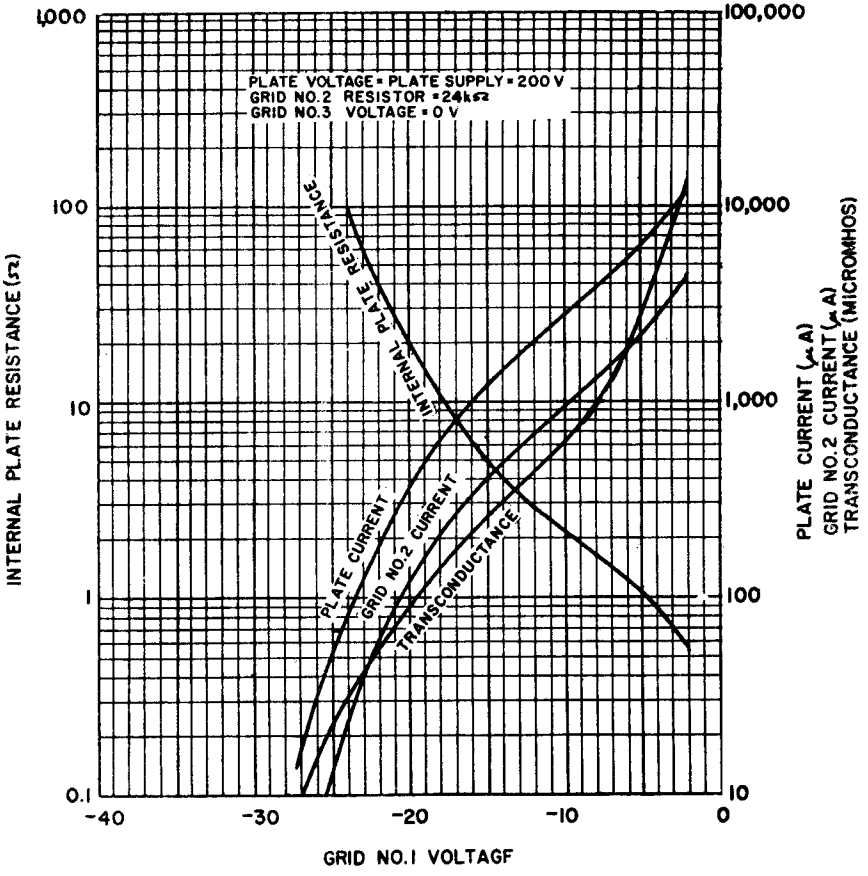
Plate voltage	200 volts
Grid no. 3 voltage	0 volts
Screen grid voltage	90 volts
Control grid voltage	−2 volts
Plate current	12 mA
Screen grid current	4.5 mA
Transconductance	12,500 micromhos
Plate resistance	0.5 megohms
→ Input resistance (f = 40 Mc/s)	10,000 ohms

Typical Operation [1]

Plate voltage				200 volts
Screen grid supply voltage				200 volts
Grid No. 3 voltage				0 volts
→ Screen grid series resistance				24,000 ohms
Negative control grid voltage	2	6.5	9.5	19.5 volts
Transconductance	12,500	1250	625	125 micromhos
Input voltage for cross-modulation = 1%		100	160	450 millivolts

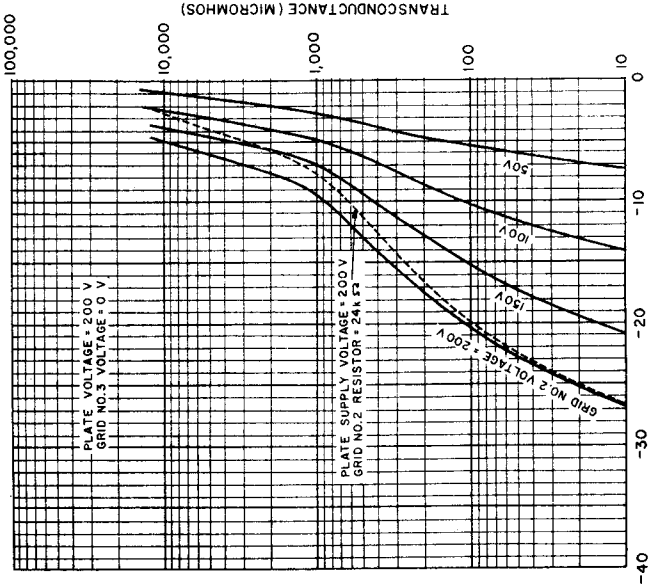
[1] Operation with cathode bias resistor and/or screen grid resistor is recommended.

AVERAGE CHARACTERISTICS

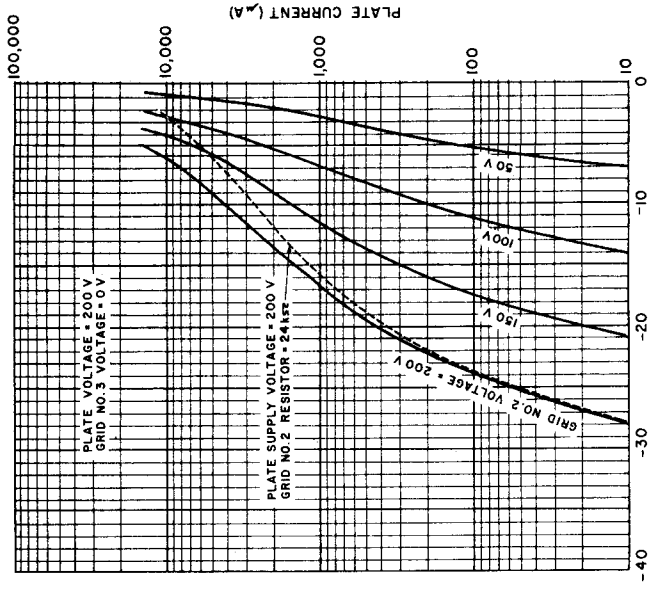


3EH7/XF183

AGC CHARACTERISTICS



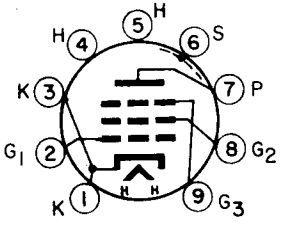
TRANSFER CHARACTERISTICS



AMPEREX TUBE TYPE 3EJ7/XF184

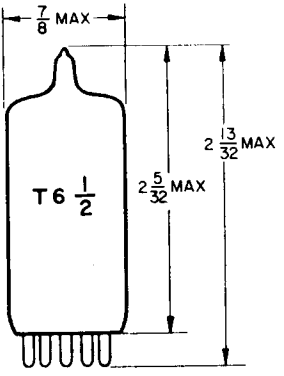
TENTATIVE DATA

The Amperex 3EJ7/XF184 is a frame grid sharp cut-off pentode designed for use as an IF amplifier in television receivers. Its high transconductance with low interelectrode and feed-back capacitance, enables the construction of simplified broad band amplifiers with high stability. The higher gain per stage in many instances reduces the number of tubes required in the television IF strip. The 3EJ7/XF184 is designed for 600 mA controlled warm-up series string operation.



PIN CONNECTIONS

1 - CATHODE
2 - GRID NO. 1
3 - CATHODE
4 - HEATER
5 - HEATER
6 - SHIELD
7 - PLATE
8 - GRID NO.2
9 - GRID NO.3



GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6½
Base	E 9-1
Dimensions	see outline drawing

ELECTRICAL

Cathode	coated, unipotential
Heater current	600 mA
Heater voltage	3.4 volts

Direct Interelectrode Capacitances

Input	10 $\mu\mu$f
Output	3 $\mu\mu$f
→ Plate to grid No. 1	0.005 $\mu\mu$f max

3EJ7/XF184

Maximum Ratings, Design Center Values

→ Plate voltage, cut-off condition	550 volts max
Plate voltage	250 volts max
Plate dissipation	2.5 watts max
→ Screen grid voltage, cut-off condition	550 volts max
Screen grid voltage	250 volts max
Screen grid dissipation	0.9 watts max
Cathode current	25 mA max
Control grid series resistance	1 megohm max
Heater-cathode voltage	150 volts max
Heater-cathode circuit resistance	20,000 ohms max
Negative grid no. 1 voltage (Grid No. 1 current = + 0.3 μA)	1.3 volts max
Peak negative grid no. 1 voltage	50 volts max

Typical Operation [1,2]

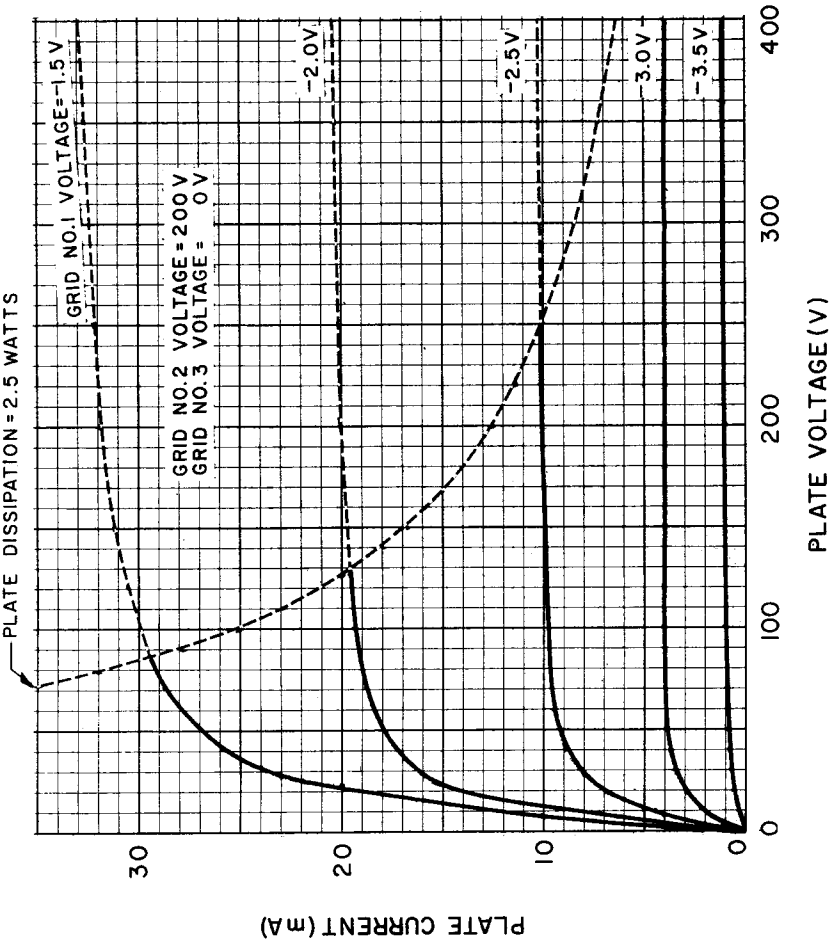
Plate voltage	200 volts
Grid No. 3 voltage	0 volts
Screen grid voltage	200 volts
Negative control grid voltage	2.5 volts
Plate current	10 mA
Screen grid current	4.1 mA
Transconductance	15,000 micromhos
Plate resistance	350,000 ohms
Amplification factor of grid No. 2 with respect to grid no. 1	60
→ Input resistance (f = 40 Mc/s)	10,000 ohms

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[1] Operation with cathode bias resistor is recommended.

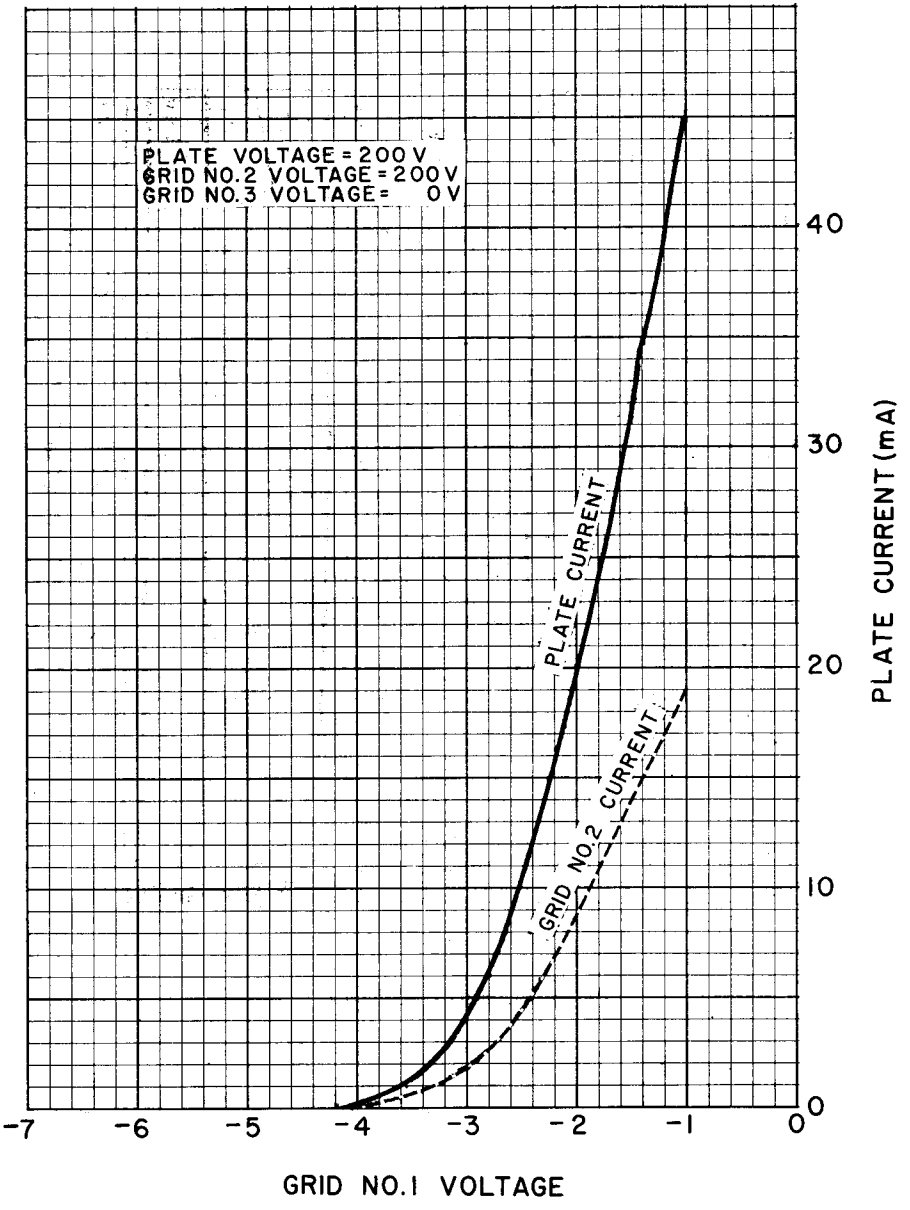
[2] In order to ensure good performance with respect to cross modulation and microphonics, the 3EJ7/XF184 should not be used in circuits with automatic gain control. For such applications a tube with a variable amplification factor is recommended.

PLATE CHARACTERISTICS



3EJ7/XF184

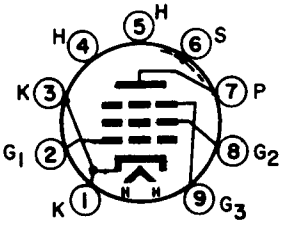
TRANSFER CHARACTERISTICS



AMPEREX TUBE TYPE 4EH7/YF183

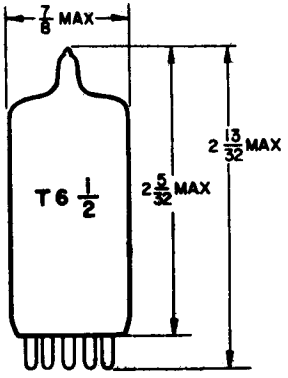
TENTATIVE DATA

The Amperex 4EH7/YF183 is a frame grid remote cut-off pentode designed for use as an IF amplifier in television receivers. Its high variable transconductance, with low interelectrode and low feed back capacitance, enables the construction of simplified broad band amplifiers with high stability. The higher gain per stage in many instances reduces the number of tubes required in the television IF strip. The 4EH7/YF183 is designed for 450 mA controlled warm-up series string operation.



PIN CONNECTIONS

1 - CATHODE
2 - GRID NO. 1
3 - CATHODE
4 - HEATER
5 - HEATER
6 - SHIELD
7 - PLATE
8 - GRID NO.2
9 - GRID NO.3



GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6½
Base	E 9-1
Dimensions	see outline drawing

ELECTRICAL

Cathode	coated, unipotential
Heater current	450 mA
Heater voltage	4.4 volts

Direct Interelectrode Capacitances

Input	9.5 μμf
Output	3 μμf
Plate to grid No. 1	0.005 μμf

4EH7/YF183

Maximum Ratings, Design Center

Plate voltage, cut-off condition	550 volts max
Plate voltage	250 volts max
Plate dissipation	2.5 watts max
Screen grid voltage, cut-off condition	550 volts max
Screen grid voltage	250 volts max
Screen grid dissipation	0.65 watts max
Cathode current	20 mA max
Control grid series resistance	1 megohm max
Heater-cathode voltage	150 volts max
Heater-cathode circuit resistance	20,000 ohms max
Negative grid no. 1 voltage (Grid No. 1 current = + 0.3 μA	1.3 volts max
Peak negative grid no. 1 voltage	50 volts max

Typical Characteristics

Plate voltage	200 volts
Grid no. 3 voltage	0 volts
Screen grid voltage	90 volts
Control grid voltage	– 2 volts
Plate current	12 mA
Screen grid current	4.5 mA
Transconductance	12,500 micromhos
Plate resistance	0.5 megohms
Input resistance (f = 40 Mc/s)	10,000 ohms

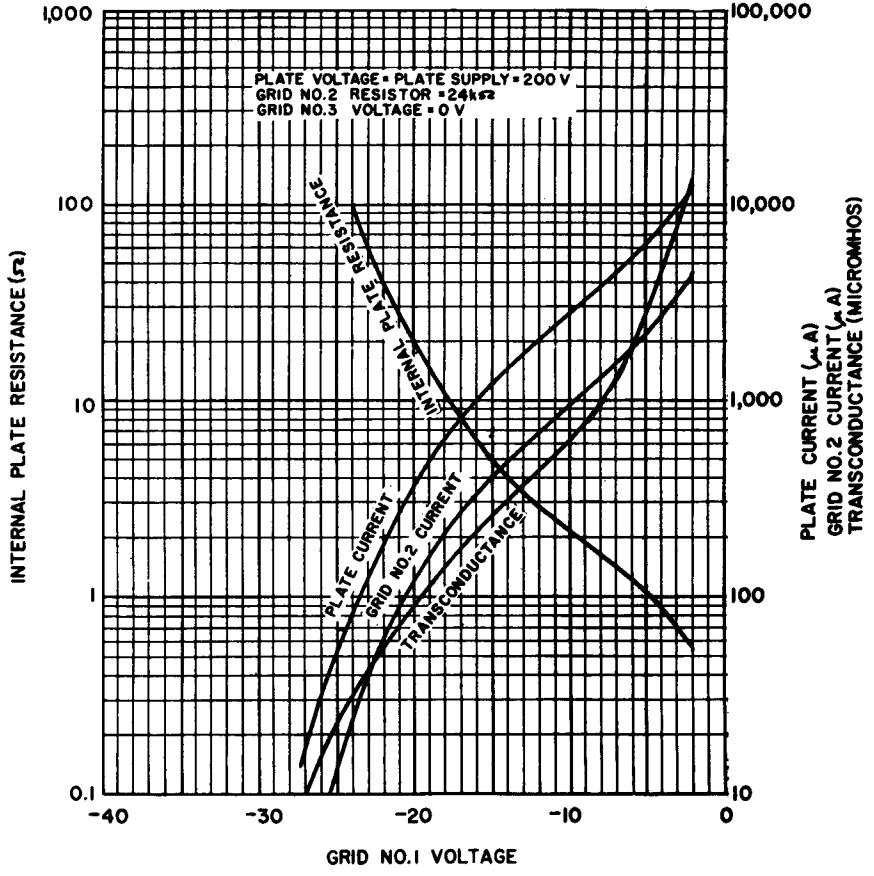
Typical Operation [1]

Plate voltage				200 volts
Screen grid supply voltage				200 volts
Grid No. 3 voltage				0 volts
Screen grid series resistance				24,000 ohms
Negative control grid voltage	2	6.5	9.5	19.5 volts
Transconductance	12,500	1250	625	125 micromhos
Input voltage for cross-modulation = 1%		100	160	450 millivolts

[1] Operation with cathode bias resistor and/or screen grid resistor is recommended.

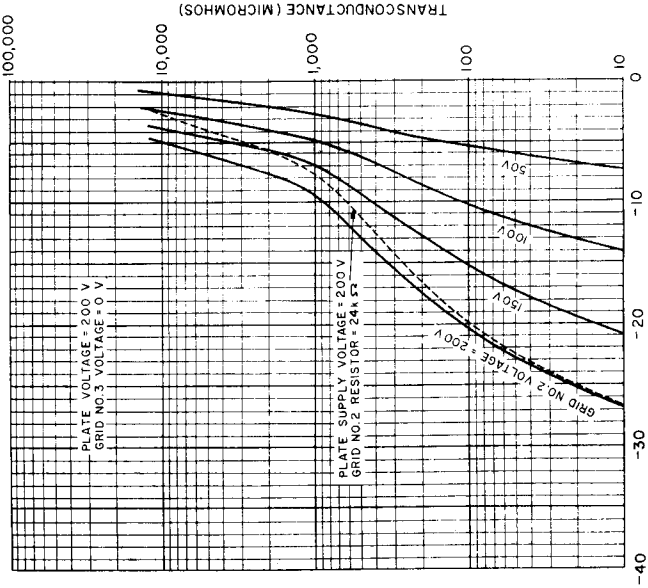
4EH7/YF183

AVERAGE CHARACTERISTICS

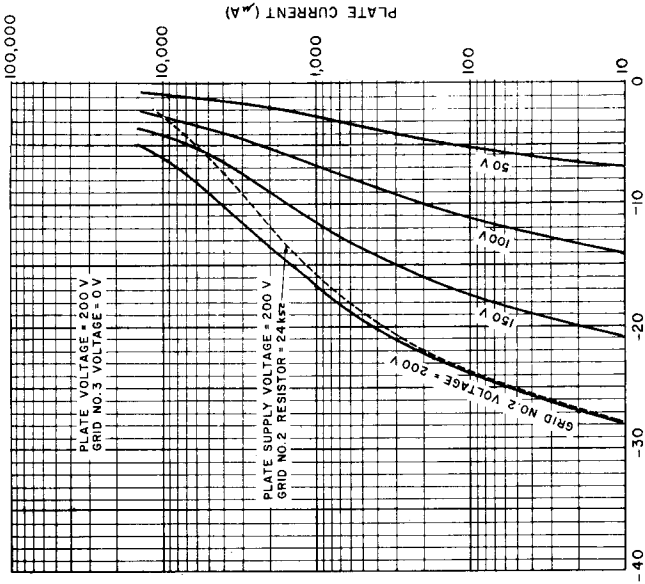


4EH7/YF183

AGC CHARACTERISTICS



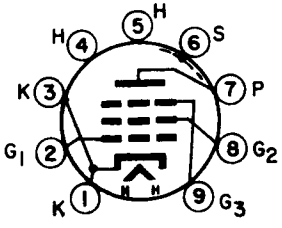
TRANSFER CHARACTERISTICS



AMPEREX TUBE TYPE 4EJ7/YF184

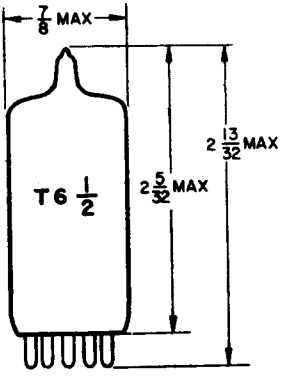
TENTATIVE DATA

The Amperex 4EJ7/YF184 is a frame grid sharp cut-off pentode designed for use as an IF amplifier in television receivers. Its high transconductance, with low interelectrode and feed-back capacitance, enables the construction of simplified broad band amplifiers with high stability. The higher gain per stage in many instances reduces the number of tubes required in the television IF strip. The 4EJ7/YF184 is designed for 450 mA controlled warm-up series string operation.



PIN CONNECTIONS

1 - CATHODE
2 - GRID NO. 1
3 - CATHODE
4 - HEATER
5 - HEATER
6 - SHIELD
7 - PLATE
8 - GRID NO.2
9 - GRID NO.3



GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6½
Base	E 9-1
Dimensions	see outline drawing

ELECTRICAL

Cathode	coated, unipotential
Heater current	450 mA
Heater voltage	4.4 volts

Direct Interelectrode Capacitances

Input	10 $\mu\mu$f
Output	3 $\mu\mu$f
Plate to grid No. 1	0.005 $\mu\mu$f max

4EJ7/YF184

Maximum Ratings, Design Center Values

Plate voltage, cut-off conditon	550 volts max
Plate voltage	250 volts max
Plate dissipation	2.5 watts max
Screen grid voltage, cut-off condition	550 volts max
Screen grid voltage	250 volts max
Screen grid dissipation	0.9 watts max
Cathode current	25 mA max
Control grid series resistance	1 megohm max
Heater-cathode voltage	150 volts max
Heater-cathode circuit resistance	20,000 ohms max
Negative grid no. 1 voltage (Grid No. 1 Current = + 0.3 μA)	1.3 volts max
Peak negative grid no. 1 voltage	50 volts max

Typical Operation [1,2]

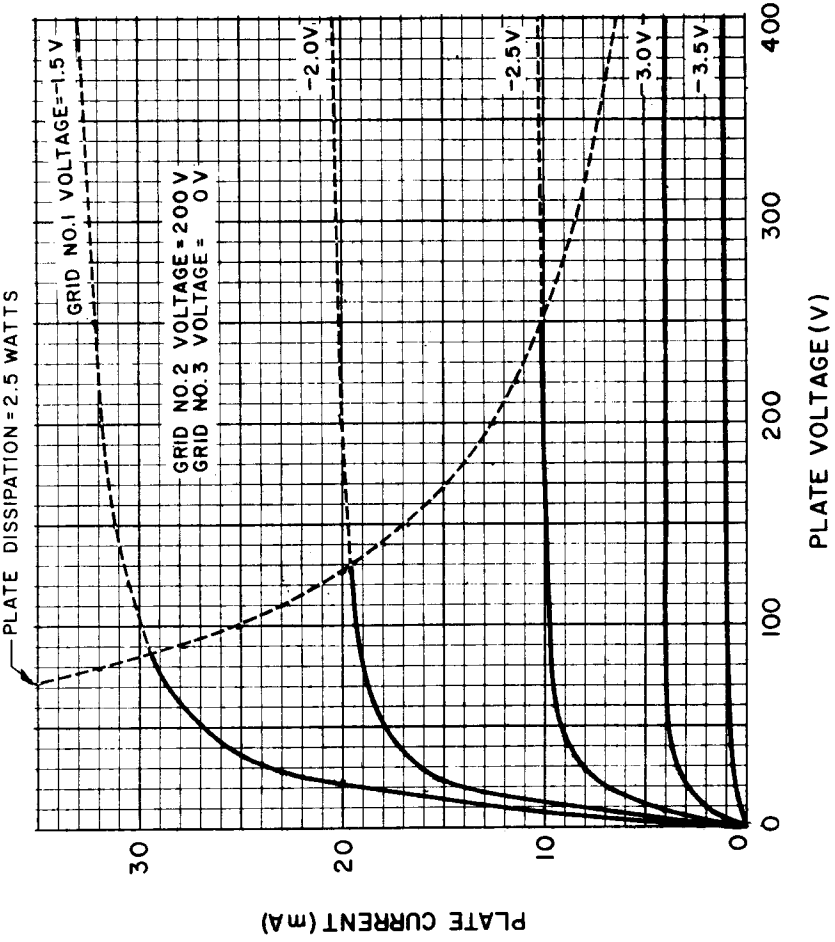
Plate voltage	200 volts
Grid No. 3 voltage	0 volts
Screen grid voltage	200 volts
Negative control grid voltage	2.5 volts
Plate current	10 mA
Screen grid current	4.1 mA
Transconductance	15,000 micromhos
Plate resistance	350,000 ohms
Amplification factor of grid no. 2 with respect to grid no. 1	60
Input resistance (f = 40 Mc/s)	10,000 ohms

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[1] Operation with cathode bias resistor is recommended.

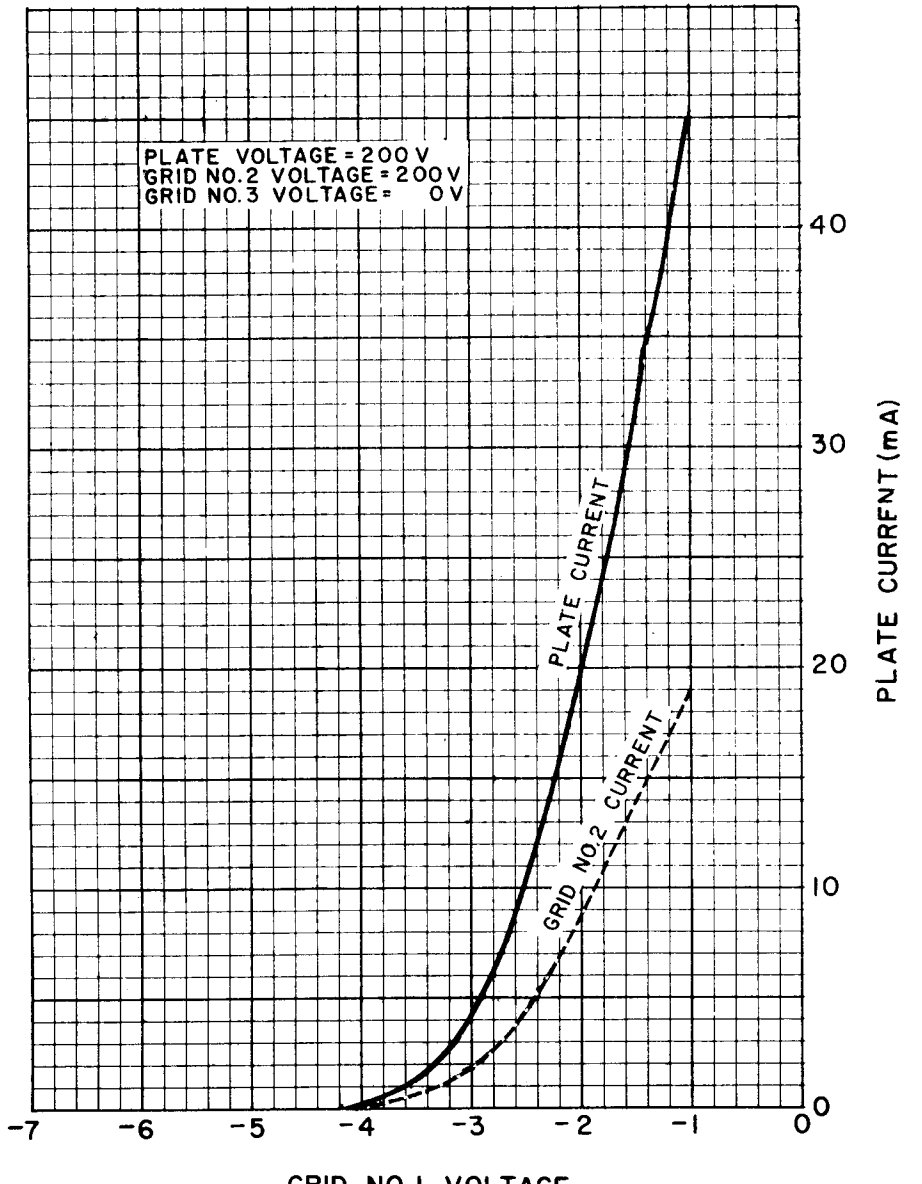
[2] In order to ensure good performance with respect to cross modulation and microphonics, the 4EJ7/YF184 should not be used in circuits with automatic gain control. For such applications a tube with a variable amplification factor is recommended.

PLATE CHARACTERISTICS

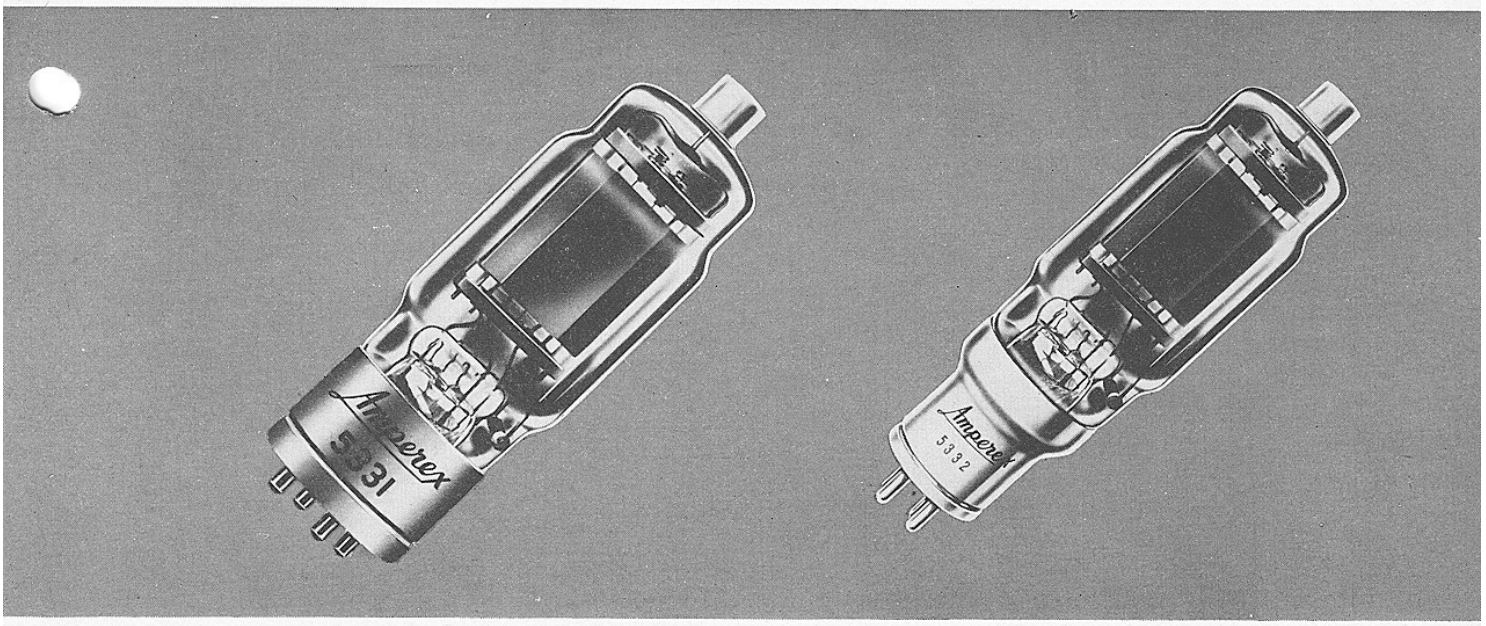


4EJ7/YF184

TRANSFER CHARACTERISTICS



AMPEREX TRANSMITTING TUBE 5331-5332



AF Power Amplifier and Modulator
RF Power Amplifier and Oscillator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10.0 volts (ac or dc)
Current	2.5 amperes
Amplification Factor	14
Grid to Plate Transconductance at Plate Current of 65 ma	4000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	9.0 $\mu\mu$f
Grid to Filament	5.0 $\mu\mu$f
Plate to Filament	2.4 $\mu\mu$f
Frequency for Maximum Ratings	30 Megacycles

MECHANICAL

Maximum Overall Dimensions	5331	5332
Length	6½ inches	7¼ inches
Diameter	2 1/16 inches	2 1/16 inches
Mounting Position—Vertical	Base down	
Horizontal	With plane of electrodes vertical	
Net Weight (approx.)	6 ounces	
Shipping Weight (approx.) (one tube)	3 pounds	

5331-5332—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

Typical Operation:

Unless otherwise specified, values are for 2 tubes

				Maximum Rating per Tube
D.C. Plate Voltage	1000	1250	1500	1500
D.C. Grid Voltage[2]	—70	—90	—110	....
Zero Sig. D.C. Plate Current (ma)	30	30	30	....
Max. Sig. D.C. Plate Current (ma)	240	240	225	150[1]
Load Resistance (ohms) (pl-pl)	8000	11200	14400	....
Plate Dissipation (watts)	....	....	....	65[1]
Power Output (watts)	185	200	215	....

R.F. Power Amplifier—Class B—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Typical Operation:

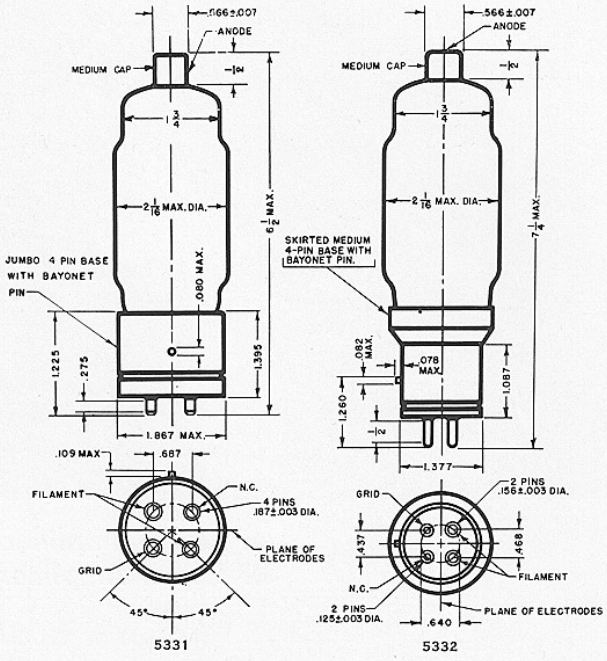
				Maximum Rating per Tube
D.C. Plate Voltage	1000	1250	1500	1500
D.C. Grid Voltage[2]	—70	—90	—110	....
D.C. Plate Current (ma)	95	80	65	120
R.F. Grid Current (amperes)	....	....	....	6
Plate Dissipation (watts)	....	....	....	65
Peak Power Output (watts)	120	128	128	....
Nominal Carrier Power Output (watts)	30	32	32	....

Plate-Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Typical Operation:

			Maximum Rating per Tube
D.C. Plate Voltage	1000	1250	1250
D.C. Grid Voltage[2]	—200	—250	....
D.C. Plate Current (ma)	120	130	150
D.C. Grid Current (ma) (approx.)	7	6	25
R.F. Grid Current (amperes)	....	....	5
Driving Power (watts) (approx.)	3	3	....
Plate Dissipation (watts)	....	....	30
Power Output (watts)	84	120	....



R.F. Power Amplifier and Oscillator Class C—Telegraphy

Key-down conditions without modulation[3]

Typical Operation:

				Maximum Rating per Tube
D.C. Plate Voltage	1000	1250	1500	1500
D.C. Grid Voltage[2]	—145	—180	—215	....
D.C. Plate Current (ma)	130	120	120	150
D.C. Grid Current (ma) (approx.)	6	7	6	25
R.F. Grid Current (amps)	....	....	....	6
Driving Power (watts) (approx.)	3	3	3	....
Plate Dissipation (watts)	....	....	....	65
Power Output (watts)	90	115	140	....

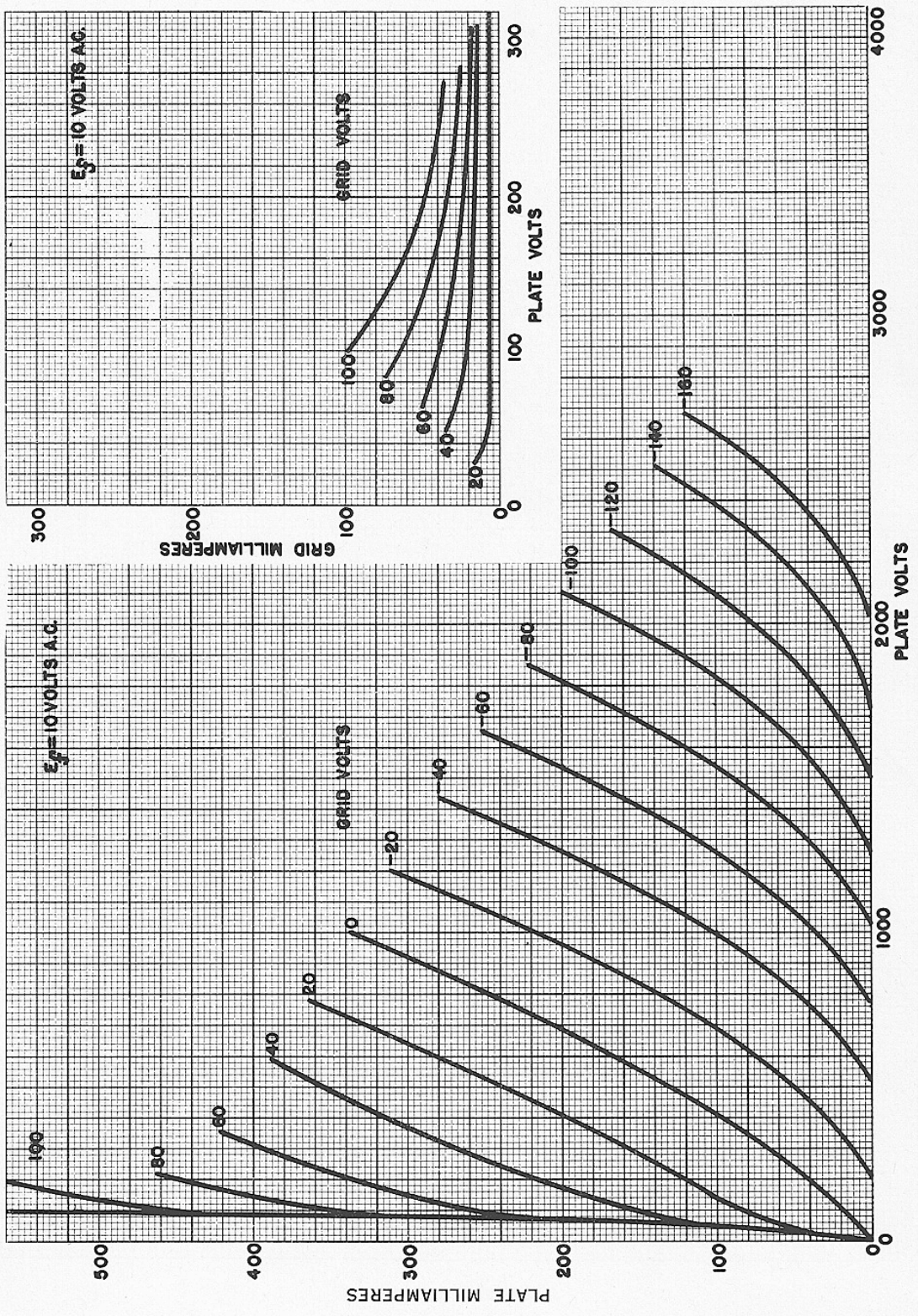
NOTES:

[1]Averaged over any audio-frequency cycle of sine-wave form.

[2]Grid Voltages are given with respect to the mid-point of filament operated on A.C. If D.C. is used, each stated value of grid voltage should be decreased by 5 volts and the circuit returns made to the negative end of the filament.

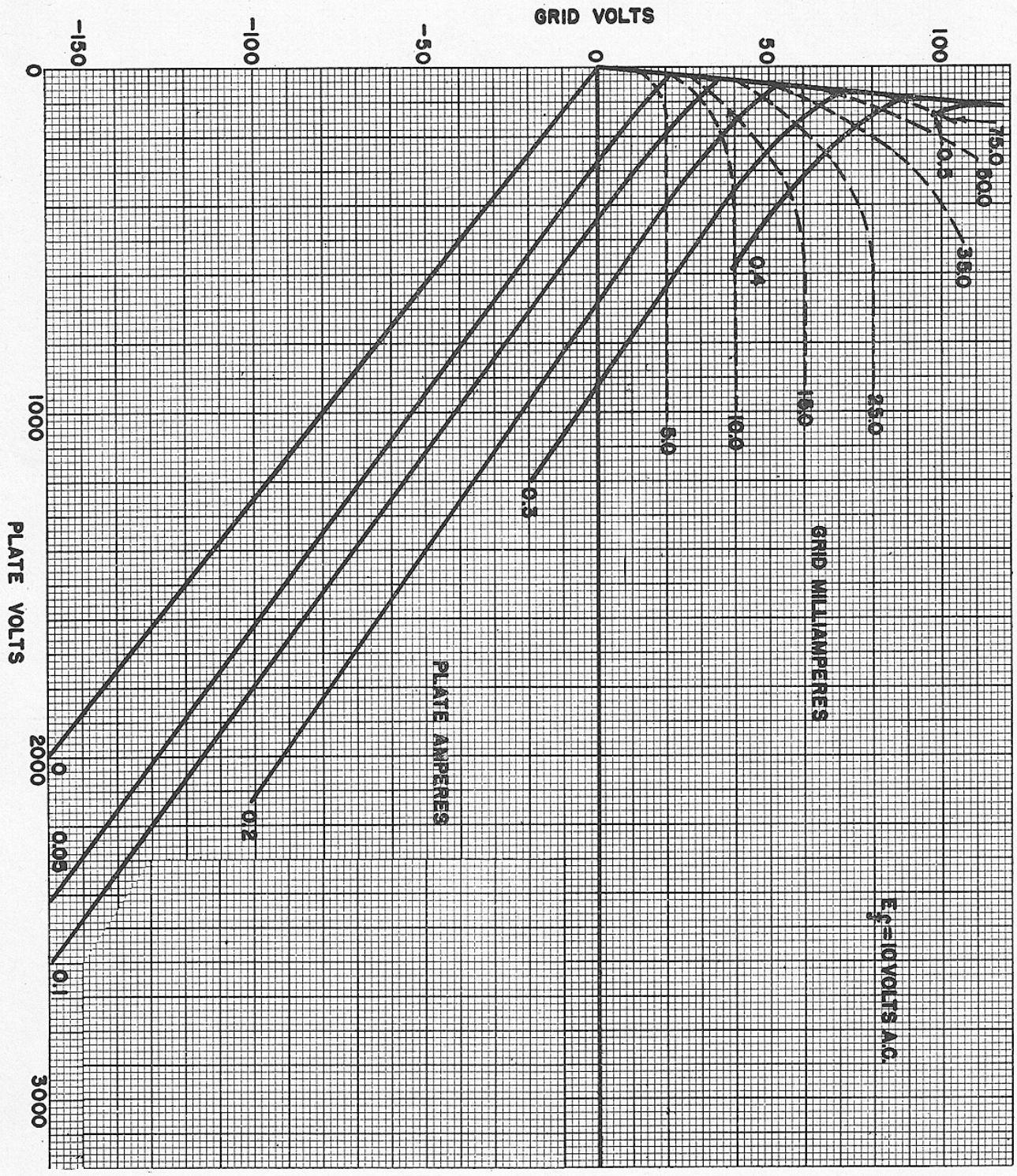
[3]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

AMPEREX TRANSMITTING TUBE 5331-5332



5331-
5332

5331-5332—AMPEREX TRANSMITTING TUBE



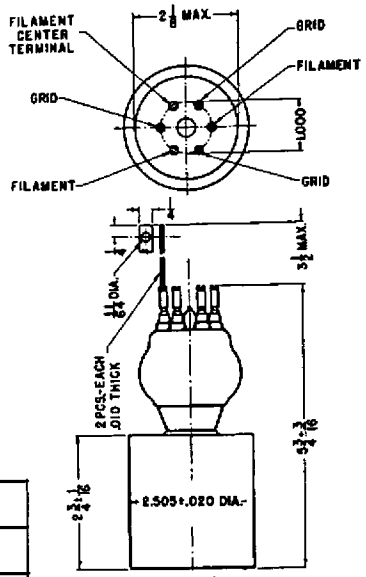
5331-5332

FEBRUARY, 1948

5759

GENERAL CHARACTERISTICS

FORCED AIR COOLED TRIODE

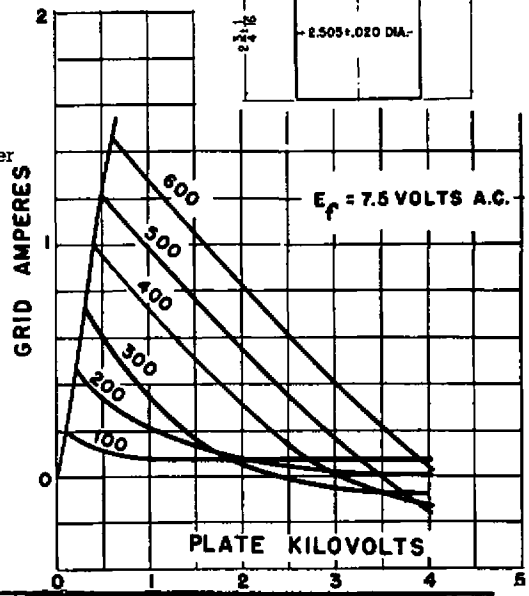


ELECTRICAL

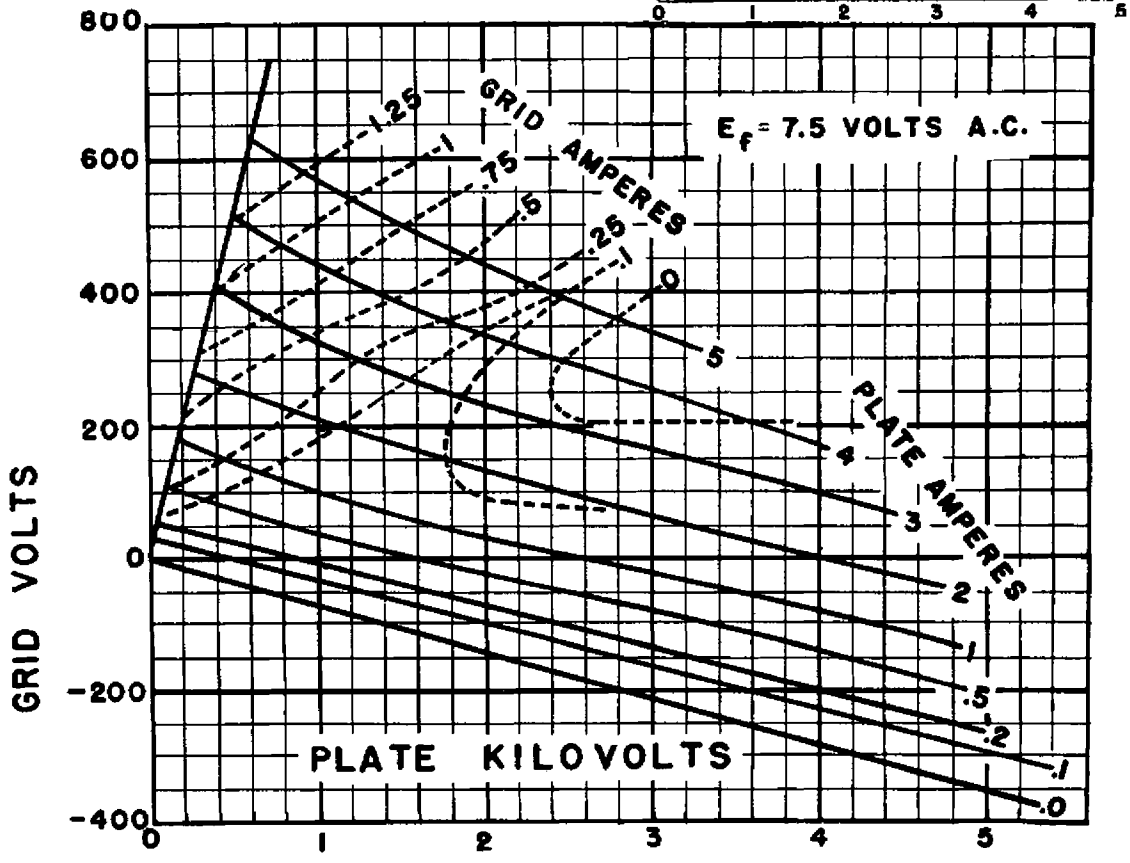
Filament	Thoriated Tungsten
Starting current must never exceed 36 amps.	
Voltage	7.5 volts
Current	24 amperes
Amplification Factor	17
Transconductance (Grid to Plate) Ip = 1.0 amp.	10,000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	10 μμf
Grid to Filament	14 μμf
Plate to Filament	1.3 μμf
Frequency for Maximum Ratings	150 megacycles

MECHANICAL

Maximum Overall Dimensions	
Length	9 7/16 inches
Diameter	2 17/32 inches
Mounting Position—Vertical	Radiator Down
Type of Cooling	Forced Air
Plate Dissipation	1.0 KW
Air Flow to Radiator	50 CFM
Back Pressure	1.4 inches water
Maximum Incoming Air Temperature	45°C
Maximum Glass Temperature	180°C
Net Weight (approx.)	2¼ pounds
Shipping Weight (approx.) (one tube)	4 pounds



Power Amplifier and Oscillator **501-R**



from RTMA release #1037, Nov. 27, 1951, sponsor: Amperex Electronic Corp.

5759

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	—	—200
Effective Load Resistance (plate to plate) (ohms)	—	3920
Zero Signal D.C. Plate Current (amps)	—	0.100
Peak A.F. Grid to Grid Voltage	—	1200
Max. Signal D.C. Plate Cur. (amps)[1]	1.0	1.9
Max. Signal Plate Input (kw)[1]	3.0	....
Plate Dissipation (kw)[1]	1.0	....
Max. Signal Driving Power (approx.) (watts)	—	380
Max. Signal Power Output (kw)	—	4.7

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	3500	3000
D.C. Grid Voltage	—	—160
Peak R.F. Grid Voltage	—	230
D.C. Plate Current (amps)	0.800	0.370
Plate Input (kw)	1.5	....
Plate Dissipation (kw)	1.0	....
D.C. Grid Current	....	0
Driving Power (approx.) (watts)[2]	—	50
Power Output (kw)	—	0.375

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	2750	2500
D.C. Grid Voltage	—600	—600
Grid Resistor (ohms)	—	2900
Cathode Resistor (ohms)	—	45
Peak R.F. Grid Voltage	—	950
D.C. Plate Current (amps)	0.800	0.570
Plate Input (kw)	2.0	—
Plate Dissipation (kw)	.660	....
D.C. Grid Current (approx.) (ma)	150	100
Driving Power (approx.) (watts)	—	90
Power Output (kw)	....	1.0

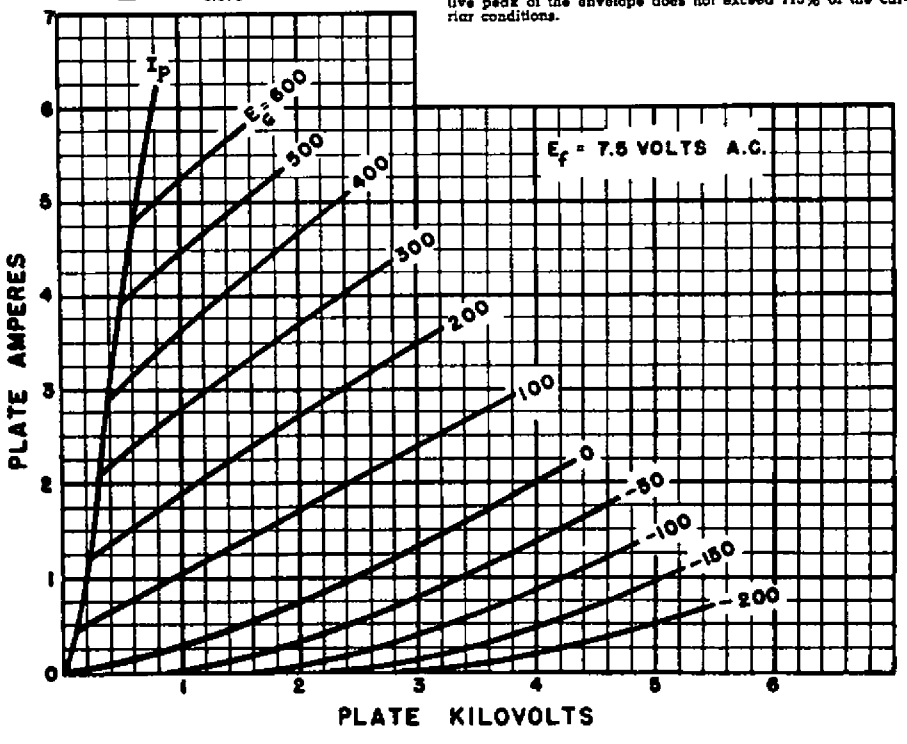
R.F. Power Amplifier and Oscillator—Class C Telegraphy

(Key-down conditions per tube without amplitude modulation[3])

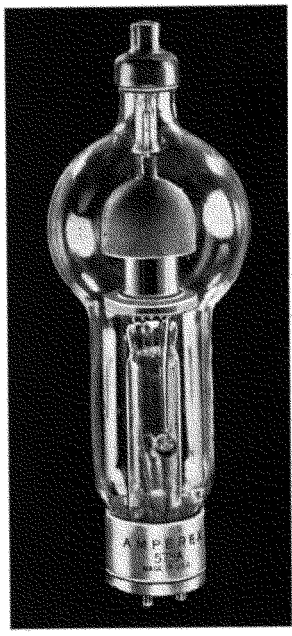
	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	—750	—450
Peak R.F. Grid Voltage	—	880
D.C. Plate Current (amps)	1.0	0.860
Plate Input (kw)	3.0	—
Plate Dissipation (kw)	1.0	....
D.C. Grid Current (approx.) (ma)	150	150
Driving Power (approx.) (watts)	—	120
Plate Power Output (kw)	....	2.175

NOTES:

1. Averaged over any audio-frequency cycle of sine-wave form.
2. At crest of audio-frequency cycle with modulation factor of 1.0.
3. Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115% of the carrier conditions.



AMPEREX MERCURY VAPOR RECTIFIER 575-A



FILAMENT

A.C. Voltage	5.0
Current (amperes)	10.0
Preheating Period (Seconds)*	30

*Before plate voltage is applied.

MAXIMUM RATINGS

For Operation at Supply Frequency Up to 150 Cycles

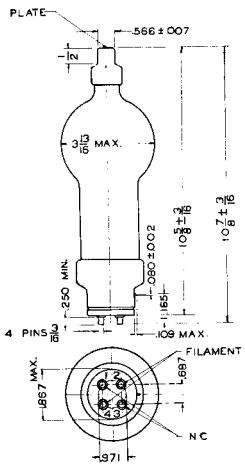
	Filament Excitation In Phase Condensed Mercury Temperature Range 25°C. to 50°C.	Filament Excitation Out of Phase (90° ± 30°) Condensed Mercury Temperature Range 25°C. to 60°C.
Peak Inverse Voltage	15000	10000
Peak Plate Current (amperes)	6.0	10.0
Average Plate Current (amperes)*	1.5	2.5
Approx. Tube Voltage Drop	10.0	10.0

*Averaged over period of 20 seconds.

MAXIMUM OUTPUTS IN TYPICAL CIRCUITS

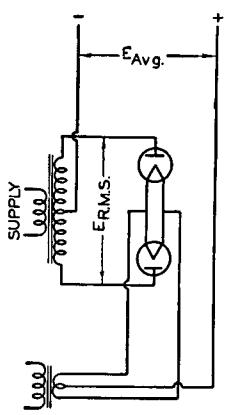
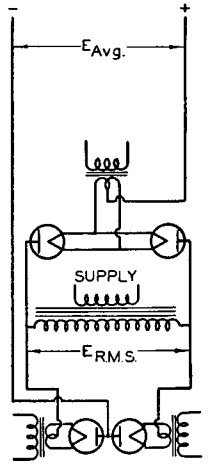
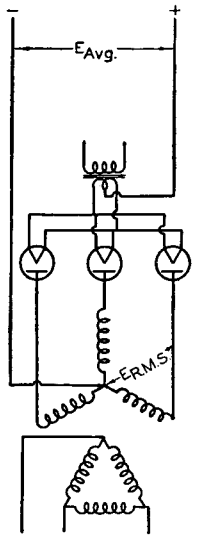
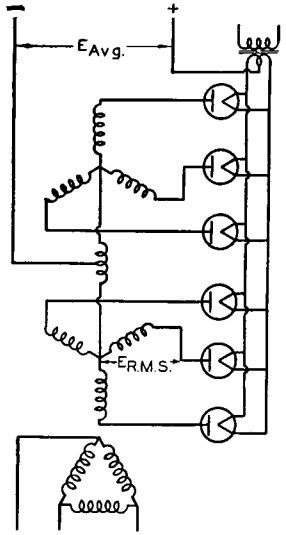
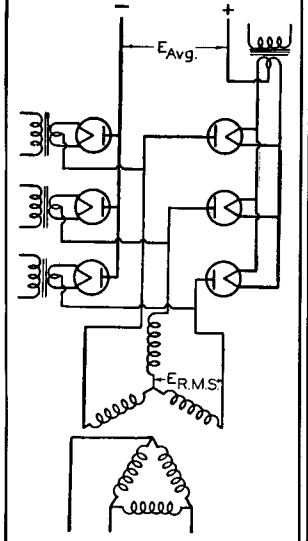
	Filament Excitation in Phase			Filament Excitation Out of Phase		
	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes
Single-Phase Full Wave (2 Tubes)	5300*	4770	3.0	3550*	3195	5.0
Single-Phase Full Wave Bridge (4 Tubes)	10600†	9540	3.0	7100†	6320	5.0
Three-Phase Half Wave (3 Tubes)	6100‡	7140	4.5	4085‡	4785	7.5
Three-Phase Double Y-Parallel (6 Tubes)	6100‡	7140	9.0	4085‡	4785	15.0
Three-Phase Full Wave (6 Tubes)	6100‡	14280	4.5	4085‡	9665	7.5

*Per Tube. †Total. ‡Per Leg.



AMPEREX

575-A

RECTIFIER CIRCUIT	SINGLE PHASE FULL-WAVE 2 TUBES	SINGLE PHASE FULL-WAVE 4 TUBES	THREE PHASE HALF-WAVE	THREE PHASE DOUBLE–Y	THREE PHASE FULL-WAVE
Conditions assumed for following relations 1. Sine-Wave Supply 2. Balanced Phase Voltages 3. Zero Tube Drop 4. Pure Resistance Load 5. No Filter Used NOTE: All rectifier filaments supplied by single phase transformers, with secondaries insulated for voltages greater than the Maximum Peak Inverse Voltage.	FIG. 1 	FIG. 2 	FIG. 3 	FIG. 4 	FIG. 5 
E Average	.450 *E* rms .318 *E* max	.900 *E* rms .636 *E* max	1.170 *E* rms .827 *E* max	1.170 *E* rms .827 *E* max	2.34 *E* rms 1.65 *E* max
E Inverse	3.14 *E* avg	1.57 *E* avg	2.09 *E* avg	2.09 *E* avg	1.045 *E* avg
I Average	.636 *I* max	.636 *I* max	.827 *I* max	1.91 *I* max	.955 *I* max
Ripple Frequency	2 X Supply Freq.	2 X Supply Freq.	3 X Supply Freq.	6 X Supply Freq.	6 X Supply Freq.
Ripple Voltage (Rms)	48.3%	48.3%	18.3%	4.2%	4.2%
† Ratio $\frac{\text{Secondary Kva}}{\text{D.C. Output-Kw}}$	1.57	1.11	1.48	1.48	1.05
† Ratio $\frac{\text{Primary Kva}}{\text{D.C. Output-Kw}}$	1.11	1.11	1.21	1.05	1.05

† These ratios assume that a choke input filter is used to maintain the output current substantially constant.

from RTMA release #1128,
Jan 30, 1953

AMPEREX

Power Amplifier and Oscillator

GENERAL CHARACTERISTICS

WATER COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Starting current must never exceed 36 amps.	
Voltage	7.5 volts
Current	24 amperes
Amplification Factor	17
Transconductance (Grid to Plate) Ip = 1.0 amp.	10,000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	10 $\mu\mu f$
Grid to Filament	14 $\mu\mu f$
Plate to Filament	1.3 $\mu\mu f$
Frequency for Maximum Ratings	150 megacycles

MECHANICAL

Maximum Overall Dimensions	
Length	8⅞ inches
Diameter	2⅛ inches
Mounting Position—Vertical	Anode Down
Type of Cooling	Water
Water Jacket	Amperex Type ±DW-2200
Water Flow	1 gal. per min.
*Pressure Drop (approx.)	1 lb. per sq. in.
Maximum Outlet Water Temperature	70 °C
Maximum Glass Temperature	180 °C
Net Weight (approx.)	5½ pounds
Shipping Weight (approx.) (one tube)	7 pounds

*The approximate water pressure is measured directly across the jacket alone and does not include connecting piping.

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	.....	—200
Effective Load Resistance (plate to plate) (ohms)	.....	3820
Zero Signal D.C. Plate Current (amps)	.....	0.100
Peak A.F. Grid to Grid Voltage	.....	1200
Max. Signal D.C. Plate Current (amps)[1]	1.0	1.9
Max. Signal Plate Input (kw)[1]	4.0	....
Plate Dissipation (kw)[1]	1.5	....
Max. Signal Driving Power (approx.) (watts)	.....	380
Max. Signal Power Output (kw)	.....	4.7
Max. Signal Power Output (kw)	.....	4.7

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	2750	2500
D.C. Grid Voltage	600	600
Grid Resistor (ohms)	....	2900
Cathode Resistor (ohms)	.....	45
Peak R.F. Grid Voltage	.....	950
D.C. Plate Current (amps)	800	570
Plate Input (kw)	2.0	.....
Plate Dissipation (kw)	1.0	
D.C. Grid Current (approx.) (ma)	150	100
Driving Power (approx.) (watts)	....	90
Power Output (kw)		1.0
Power Output (kw)		1.0

AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVE. HICKSVILLE, N.Y.

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	.....	—200
Peak R.F. Grid Voltage	.....	295
D.C. Plate Current (amps)	0.8	0.5
Plate Input (kw)	2.25	....
Plate Dissipation (kw)	1.5	1.2
D.C. Grid Current	....	0
Driving Power (approx.) (watts)[2]	.....	82
Power Output (kw)	.....	.610

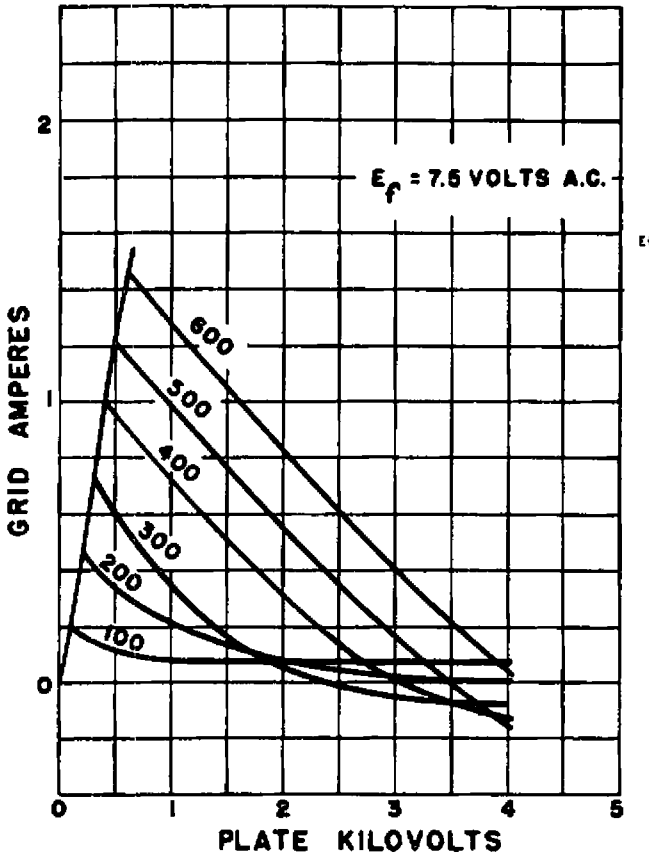
Power Amplifier and Oscillator—Class C Telegraphy

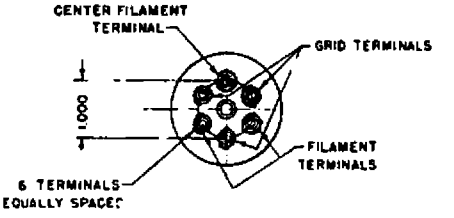
(Key-down conditions per tube without amplitude modulation[3])

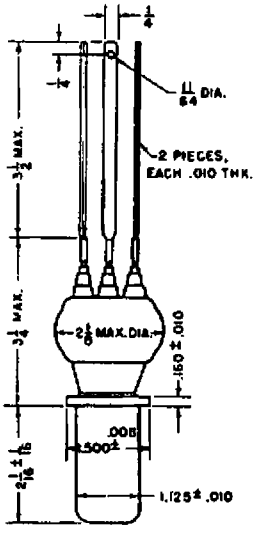
	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	—600	—450
Peak R.F. Grid Voltage	.....	880
D.C. Plate Current (amps)	1.0	860
Plate Input (kw)	3.0	....
Plate Dissipation (kw)	1.5	....
D.C. Grid Current (approx.) (ma)	150	150
Driving Power (approx.) (watts)	.....	120
Plate Power Output (kw)	....	2.175

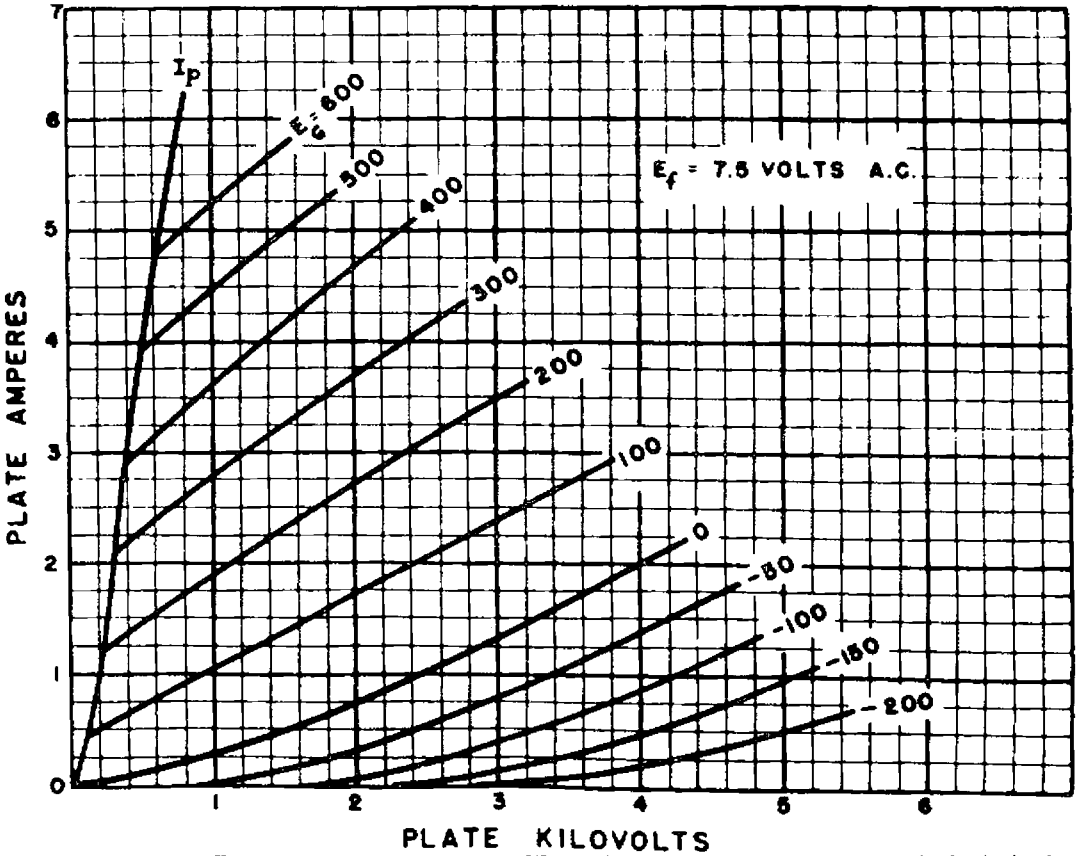
NOTES:

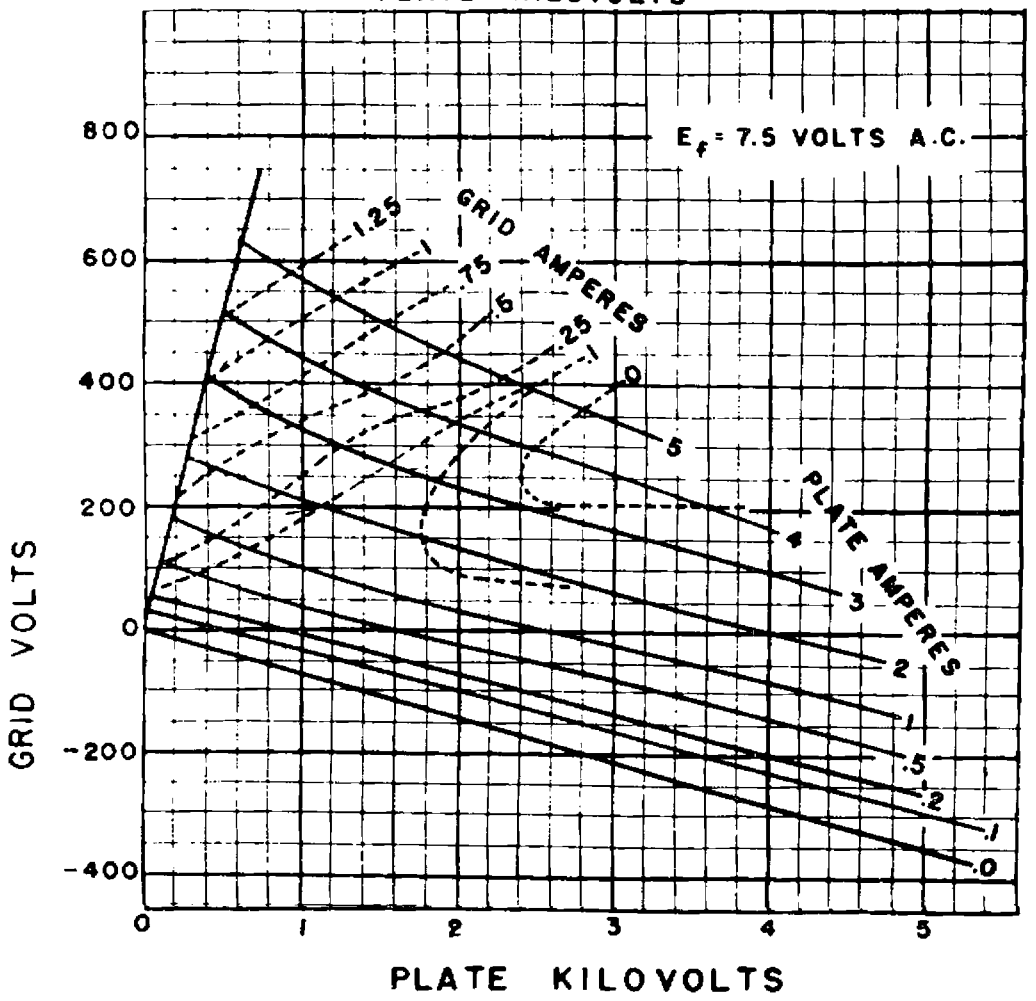
1. Averaged over any audio-frequency cycle of sine-wave form.
2. At crest of audio-frequency cycle with modulation factor of 1.0.
3. Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115% of the carrier conditions.








I_p
E_c = 600
500
400
300
200
100
0
-50
-100
-150
-200
E_f = 7.5 VOLTS A.C.
PLATE AMPERES
PLATE KILOVOLTS


E_f = 7.5 VOLTS A.C.
GRID AMPERES
1.25
1
.75
.5
.25
0
PLATE AMPERES
5
4
3
2
1
.5
.2
.1
.0
GRID VOLTS
PLATE KILOVOLTS

from RTMA release #1128,
Jan. 30, 1953

Power Amplifier and Oscillator

GENERAL CHARACTERISTICS

FORCED AIR COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten			
Starting current must never exceed 36 amps.				
Voltage	7.5	volts		
Current	24	amperes		
Amplification Factor	17			
Transconductance (Grid to Plate) Ip = 1.0 amp.	10,000	micromhos		
Direct Interelectrode Capacitances				
Grid to Plate	10	μμf		
Grid to Filament	14	μμf		
Plate to Filament	1.3	μμf		
Frequency for Maximum Ratings	150	megacycles		

MECHANICAL

Maximum Overall Dimensions				
Length	6 5/16	inches		
Diameter	3⅝	inches		
Mounting Position—Vertical	Radiator Down			
Type of Cooling	Forced Air			
Plate Dissipation	1.0	1.5	*2.0	(KW)
Air Flow to Radiator	70	100	150	(CFM)
Back Pressure	0.4	1.0	2.0	(in. water)
Maximum Incoming Air Temperature	45°C			
Maximum Glass Temperature	180°C			
Net Weight (approx.)	5½	pounds		
Shipping Weight (approx.) (one tube)	6	pounds		

*See Note No. 4 on following page.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	....	—200
Effective Load Resistance (plate to plate) (ohms)	....	3820
Zero Signal D.C. Plate Current (amps)	....	0.100
Peak A.F. Grid to Grid Voltage	....	1200
Max. Signal D.C. Plate Current (amps)[1]	1.0	1.9
Max. Signal Plate Input (kw)[1]	4.0	....
Plate Dissipation (kw)[1]	1.5	....
Max. Signal Driving Power (approx.) (watts)	....	380
Max. Signal Power Output (kw)	....	4.7

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	2750	2500
D.C. Grid Voltage	—600	—600
Grid Resistor (ohms)	....	2900
Cathode Resistor (ohms)	....	45
Peak R.F. Grid Voltage	....	950
D.C. Plate Current (amps)	.800	.570
Plate Input (kw)	2.0	....
Plate Dissipation (kw)	1.0	....
D.C. Grid Current (approx.) (ma)	150	100
Driving Power (approx.) (watts)	....	90
Power Output (kw)	....	1.0

AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVE., HICKSVILLE, N.Y.

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	....	—200
Peak R.F. Grid Voltage	....	295
D.C. Plate Current (amps)	0.8	0.5
Plate Input (kw)	2.25	....
Plate Dissipation (kw)	1.5	1.2
D.C. Grid Current	....	0
Driving Power (approx.) (watts)[2]	....	82
Power Output (kw)	....	.610

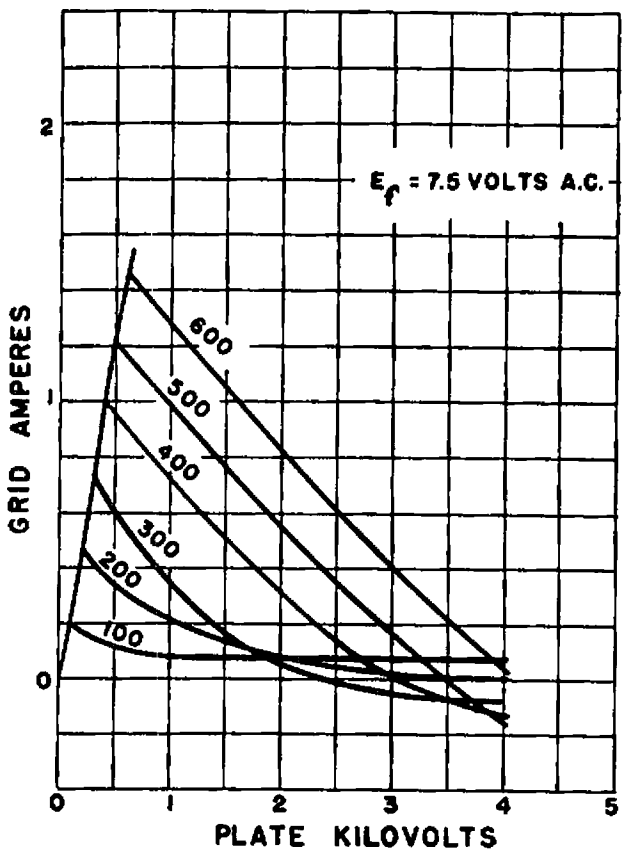
R.F. Power Amplifier and Oscillator—Class C Telegraphy

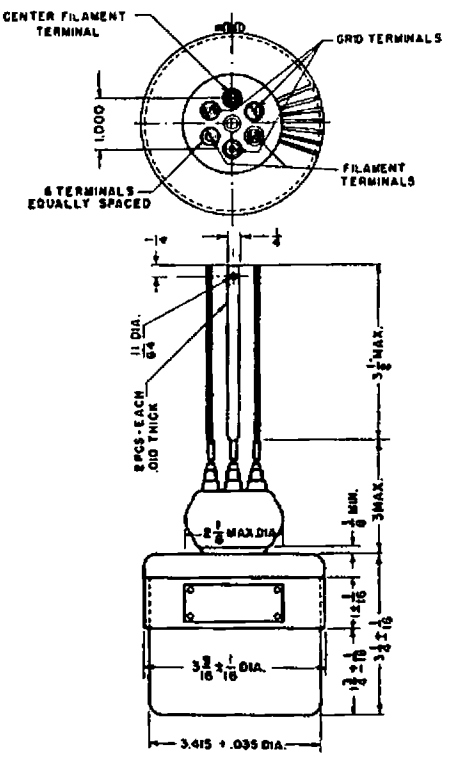
(Key-down conditions per tube without amplitude modulation[3])

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	3500	3500
D.C. Grid Voltage	—600	—450
Peak R.F. Grid Voltage	....	880
D.C. Plate Current (amps)	1.0	860
Plate Input (kw)	3.0	....
Plate Dissipation (kw)[4]	1.5	....
D.C. Grid Current (approx.) (ma)	150	150
Driving Power (approx.) (watts)	....	120
Plate Power Output (kw)	....	2.175

NOTES:

1. Averaged over any audio-frequency cycle of sine-wave form.
2. At crest of audio-frequency cycle with modulation factor of 1.0.
3. Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115% of the carriar conditions.
4. The normal maximum plate dissipation is 1.5 kw. However, for industrial applications where low efficiencies may be expected, an extra margin of safety may be assured by increasing the air flow rate and, therefore, plate dissipation to 2.8 kw.





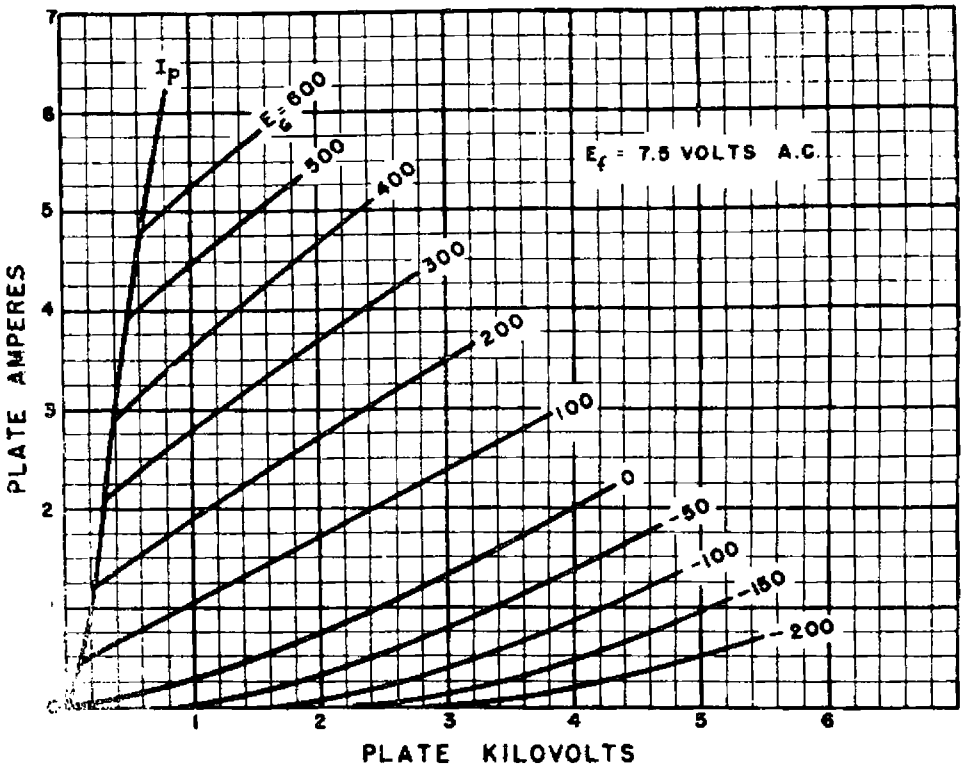
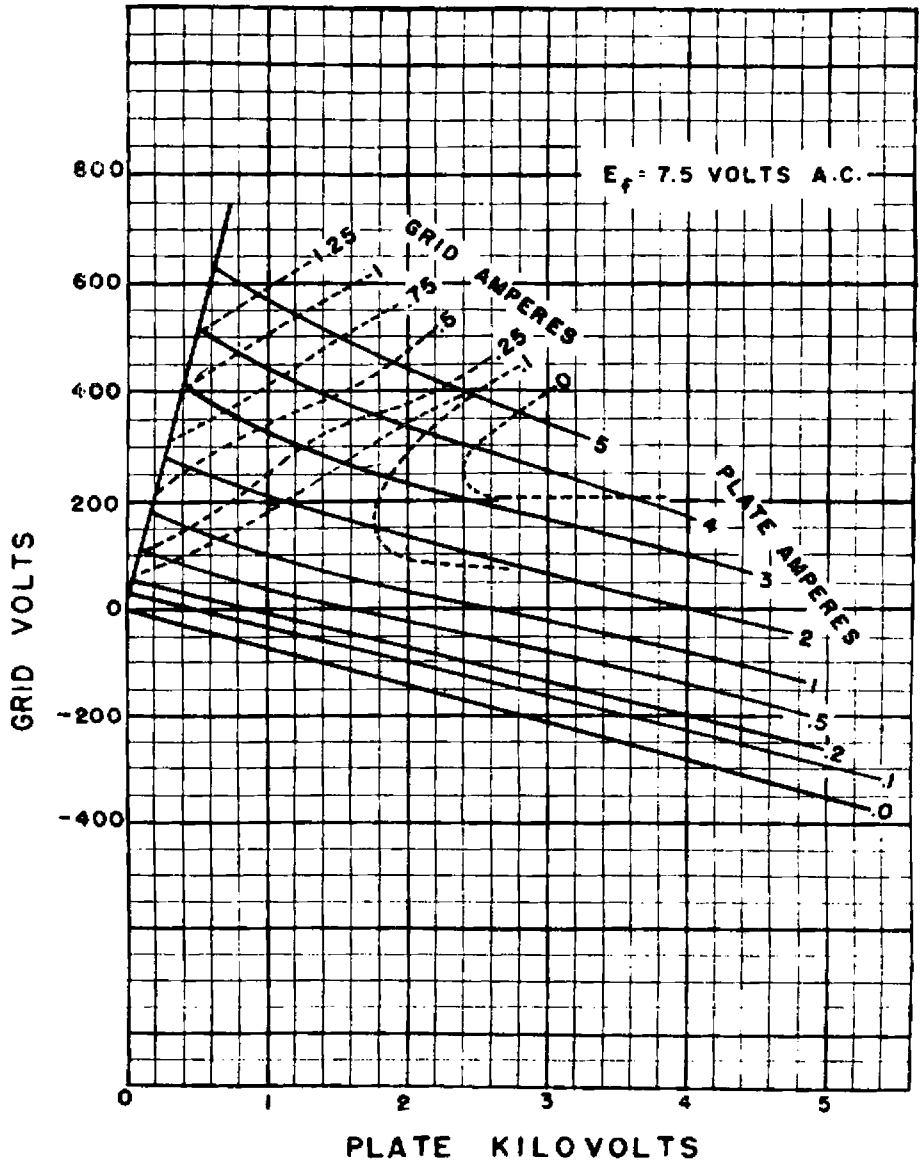


PLATE KILOVOLTS



from JEDEC release #4148, Feb. 18, 1963
Sponsor: Amperex Electronic Corp.

The 5866A is an improved version of the 5866 having an increased plate dissipation of 150 watts. It is designed for use as an RF power amplifier, modulator and oscillator and is particularly suited for high frequency heating and diathermy generators. The tube has a thoriated tungsten filament. Maximum ratings apply up to 150 mc and reduced ratings to 200 mc.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	6.3 volts
Current	5.8 amps
Amplification Factor	25
Direct Interelectrode Capacitances	
Grid to Plate	5 pf
Grid to Filament	4.9 pf
Plate to Filament	.1 pf

MECHANICAL

Maximum Overall Dimensions	
Length	9.13 in.
Diameter	2.44 in.
Mounting Position	Vertical, base up or down
Maximum Temperature of Filament Seal	180°C
Maximum Temperature of Grid and Anode Seals	220°C
Cooling[1]	Radiation/Forced Air

1. The tube when used at or near maximum ratings above 50 mc should be cooled by low velocity air directed at the upper and lower seals.

From release #4148: **This tube type designation is identical with tube type 7986 as registered in Release No. 4094 and is being registered for record purposes only. The use of the designation 5866A is discouraged. It is recommended that the designation 7986 be used to identify this type.**

RF Power Amplifier and Oscillator Class C Telegraphy
Key-down Conditions per Tube
Maximum Ratings, Absolute Values

	CCS
D.C. Plate Voltage	3000 volts
Negative D.C. Grid No. 1 Voltage	300 volts
D.C. Plate Current	255 ma
D.C. Grid No. 1 Current	45 ma
Plate Input	512 watts
Plate Dissipation	150 watts
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operation CCS

Frequency	150	150	150 mc
D.C. Plate Voltage	2500	2000	1500 volts
Negative D.C. Grid No. 1 Voltage	-200	-150	-110 volts
Peak RF Grid No. 1 Voltage	390	340	300 volts
D.C. Plate Current	205	205	205 ma
D.C. Grid No. 1 Current	40	40	40 ma
Driving Power	14	13	11 watts
Power Output	390	295	210 watts

Plate Modulated RF Power Amplifier
Class C Telephony
Maximum Ratings, Absolute Values

	CCS
Frequency	150 mc
D.C. Plate Voltage	2400 volts
D.C. Grid No. 1 Voltage	-300 volts
D.C. Plate Current	170 ma
D.C. Grid No. 1 Current	45 ma
Plate Input	340 watts
Plate Dissipation	100 watts
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operation CCS

D.C. Plate Voltage	1000	1500	2000 volts
D.C. Grid No. 1 Voltage	-130	-180	-225 volts
Peak RF Grid No. 1 Voltage	320	370	415 volts
D.C. Plate Current	128	128	128 ma
D.C. Grid No. 1 Current	40	40	40 ma
Driving Power	12	14	15 watts
Power Output	96	154	205 watts

HF Class C Telegraphy, Grounded Grid
Maximum Ratings, Absolute Values

	CCS
D.C. Plate Voltage	3000 volts
D.C. Grid No. 1 Voltage	-300 volts
D.C. Plate Current	205 ma
D.C. Grid No. 1 Current	45 ma
Plate Input	512 watts
Plate Dissipation	150 watts
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operation for Two Tubes
For Frequencies Up to 100 mc

	CCS	CCS	CCS
Plate Voltage	1500	2000	2500 volts
D.C. Grid No. 1 Voltage	-110	-150	-200 volts
Plate Current	410	410	410 ma
D.C. Grid No. 1 Current	80	80	80 ma
Peak RF Grid No. 1 Voltage	300	340	390 volts
Driving Power	118	136	158 watts
Plate Power Input	615	820	1025 watts
Plate Dissipation	195	230	245 watts
Power Output	420 + 96	590 + 110	780 + 130 watts
Efficiency	68	72	76 %

Class C Oscillator
Industrial Application: R.F. Heating and Diathermy
Plate Voltage from Single Phase Full Wave
Rectifier Without Filter

Maximum Ratings, Absolute Values Up to 150 mc

Plate Voltage Mean Value	2700 volts
Plate Current Maximum	180 ma
Plate Dissipation	150 watts
Plate Power Input	512 watts
Peak RF Grid No. 1 Voltage	300 volts
D.C. Grid No. 1 Current	40 ma
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operation CCS

Frequency	50 mc
D.C. Mean Plate Voltage	2000 volts
D.C. Plate Current	170 ma
D.C. Grid No. 1 Current	34 ma
Grid No. 1 Resistor	3750 ohms
Plate Power Input	420 watts
Plate Dissipation	120 watts
Driving Power	10 watts
Power Output	290 watts
Efficiency	69 %

Class C Oscillator for Industrial Use with Self Rectification

Maximum Ratings, Absolute Values

Frequency	150 mc
Effective Plate Voltage	2825 volts
Plate Current	110 ma
Plate Dissipation	150 watts
Plate Input Power	340 watts
Negative D.C. Grid No. 1 Voltage	300 volts
D.C. Grid No. 1 Current	35 ma
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operation CCS

Frequency	50 mc
Effective Plate Voltage	2500 volts
D.C. Plate Current	90 ma
D.C. Grid No. 1 Current	20 ma
Grid No. 1 Resistor	1700 ohms
Effective Grid No. 1 Voltage	85 volts
Plate Input Power	255 watts
Plate Dissipation	85 watts
Power Output	170 watts
Efficiency	67 %

Class B Telephony

Maximum Ratings, Absolute Values

Frequency	150 mc
Plate Voltage	3000 volts
Plate Current	170 ma
Plate Dissipation	150 watts
Plate Input Power	200 watts
D.C. Grid No. 1 Current	55 ma
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operation CCS

Frequency	150	150	150 mc
Plate Voltage	1500	2000	2500 volts
Grid No. 1 Voltage	-45	-67	-87 volts
Grid No. 1 Current	52	28	20 ma
Plate Current	120	97	77 ma
Peak RF Grid No. 1 Voltage	100	100	100 volts
Plate Input Power	180	194	193 watts
Plate Dissipation	121	130	128 watts
Power Output	59	64	65 watts
Efficiency	33	33	34 %
Driving Power	9.4	5.1	3.6 watts

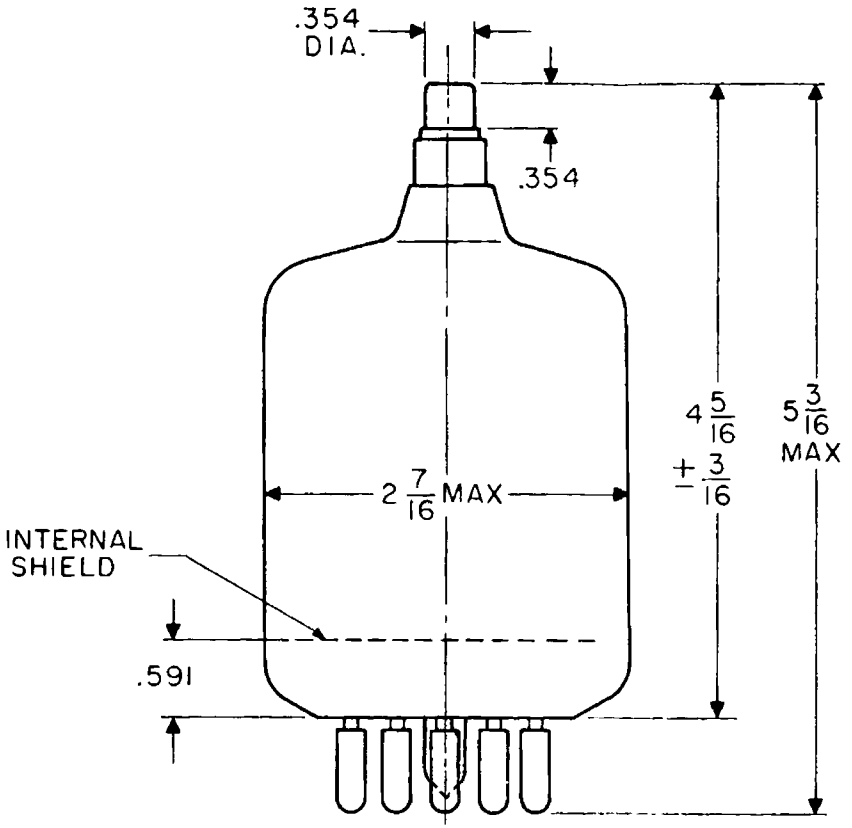
Class AB_2 Amplifier and Modulator

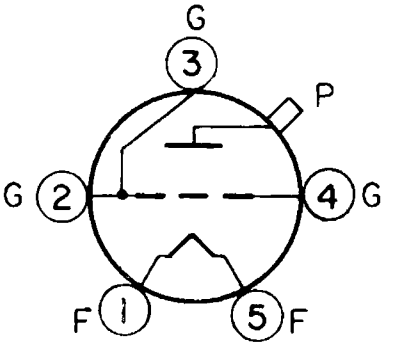
Maximum Ratings, Absolute Values

Plate Voltage	3000 volts
Plate Current	210 ma
Plate Dissipation	150 watts
Plate Input Power	512 watts
Grid No. 1 Current	45 ma
Grid No. 1 Resistor, Fixed Bias	100 k ohms
Grid No. 1 Resistor, Self Bias	200 k ohms

Typical Operating Conditions
Two Tubes

	CCS	CCS
Plate Voltage	1000	2500 volts
Grid No. 1 Voltage	-23	-86 volts
Plate to Plate Load	5000	18, 200 ohms
Peak Grid to Grid Voltage	295	412 volts
Zero Signal Plate Current	60	60 ma
Maximum Signal Plate Current	420	356 ma
Grid No. 1 Current	80	84 ma
Driving Power	10.8	15.6 watts
Zero Signal Plate Input Power	60	150 watts
Maximum Signal Plate Input Power	420	890 watts
Plate Dissipation	146	190 watts
Power Output	274	700 watts
Distortion	2.2	5%
Efficiency	65	78.5 %



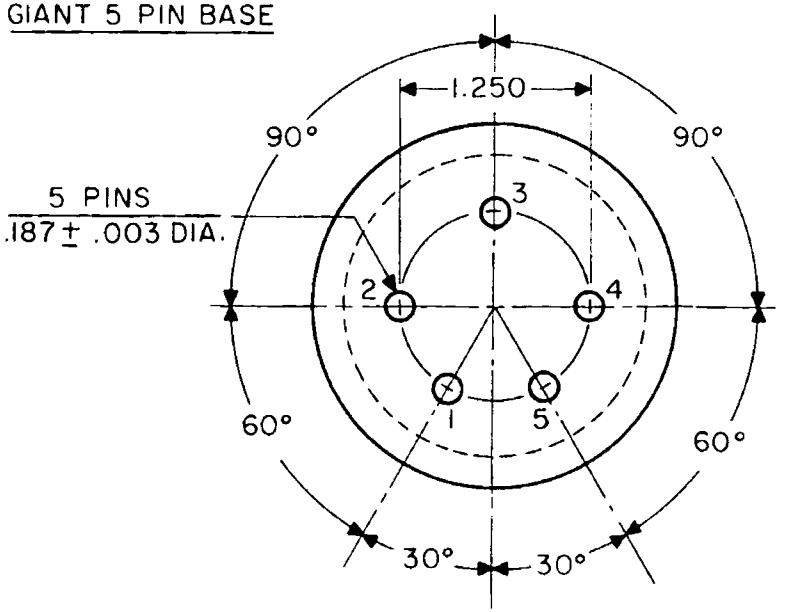


PIN CONNECTIONS

1. FILAMENT
2. GRID
3. GRID
4. GRID
5. FILAMENT

P PLATE

GIANT 5 PIN BASE



AMPEREX ELECTRON TUBE TYPE 5869

The 5869 is a three-electrode mercury-vapor rectifying tube with negative control characteristics. This tube is designed for grid-control rectifier applications of relatively high voltage and current. The cathode is directly heated, oxide-coated.

Maximum Ratings, Absolute Values:

Maximum Peak Anode Voltage			
Inverse	13,000	10,000	volts
Forward	13,000	10,000	volts
Condensed Mercury Temperature Limits	+25 to +55	+25 to +60	centigrade
Maximum Plate Current			
Peak		4.0	amperes
Average		1.0	amperes
Surge, for design only (Maximum duration 0.1 seconds)		40	amperes
Maximum Averaging time		5	seconds
Maximum Negative Control-Grid Voltage Before Conduction		300	volts
Maximum Positive Control-Grid Current			
Average (Averaging time, one cycle)		10	ma
Peak		50	ma
Maximum Grid Resistance		0.1	megohms
Frequency Range		25 to 150	cps

GENERAL

Electrical Data

	Min.	Bogey	Max.	
Filament Voltage	4.75	5.0	5.25	volts
Filament Current at 5.0 volts	---	6.5	7.5	amperes
Filament Heating Time* (before applying Plate Voltage)	120	---	---	seconds
Anode-to-control-grid Capacitance	---	3	---	uuf
Control-grid-to-cathode Capacitance	---	8	---	uuf
Deionization Time, approximate	---	250	---	microseconds
Ionization Time, approximate	---	10	---	microseconds
Typical Bias at 13,000 volts			-100	volts
Typical Bias at 10,000 volts			- 50	volts
Typical Grid Current (Average)			1	ma
Typical Grid Resistance			20,000	ohms
Tube Voltage Drop (Ib = 4 amperes)			15	volts

* The minimum heating time refers only to the filament. Sufficient additional time must be allowed to permit the condensed mercury temperature to rise to the mimimum condensed mercury temperature limit and to permit all the mercury to condense in the lower part of the tube.

from RTMA release #1128, Jan 30, 1953

AMPEREX 5869

Mechanical Data

Type of cooling - Convection

Equilibrium Condensed-Mercury Temperature Rise		
At Full Load, approximate	25	°C
At No Load, approximate	22	°C
Mounting position - Vertical with base down		
Net Weight, approximate	8.5	ounces
Shipping Weight, approximate	22	ounces

OPERATIONAL NOTES

Note 1: In order to obtain maximum life period of the tube it is recommended to apply a filament voltage phase shift of 90° with respect to plate voltage.

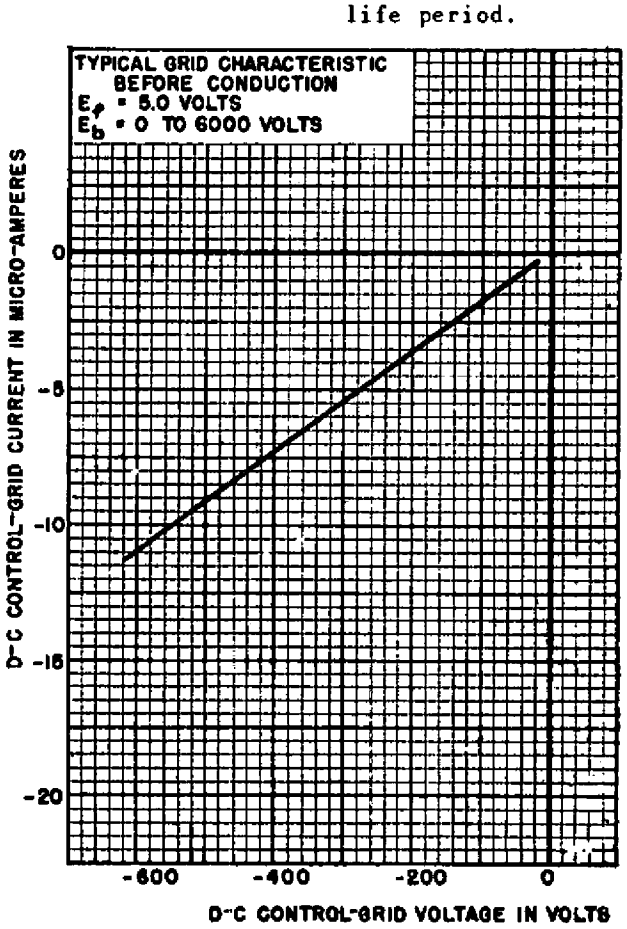
Note 2: Characteristic Curves

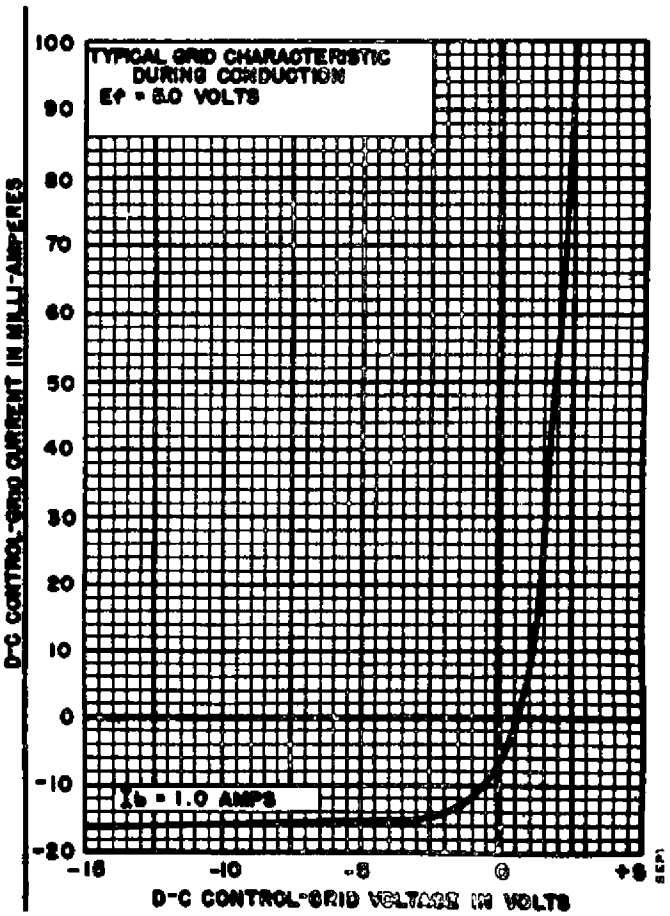
The circuit returns are connected to the center tap of the filament transformer.

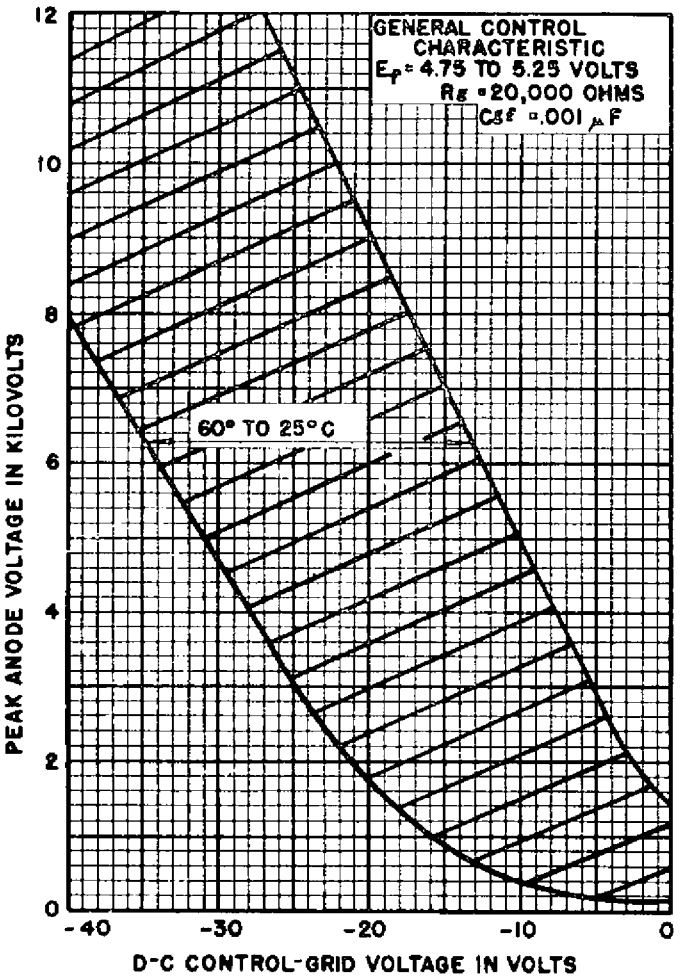
Note 3: General Control Characteristic Curve

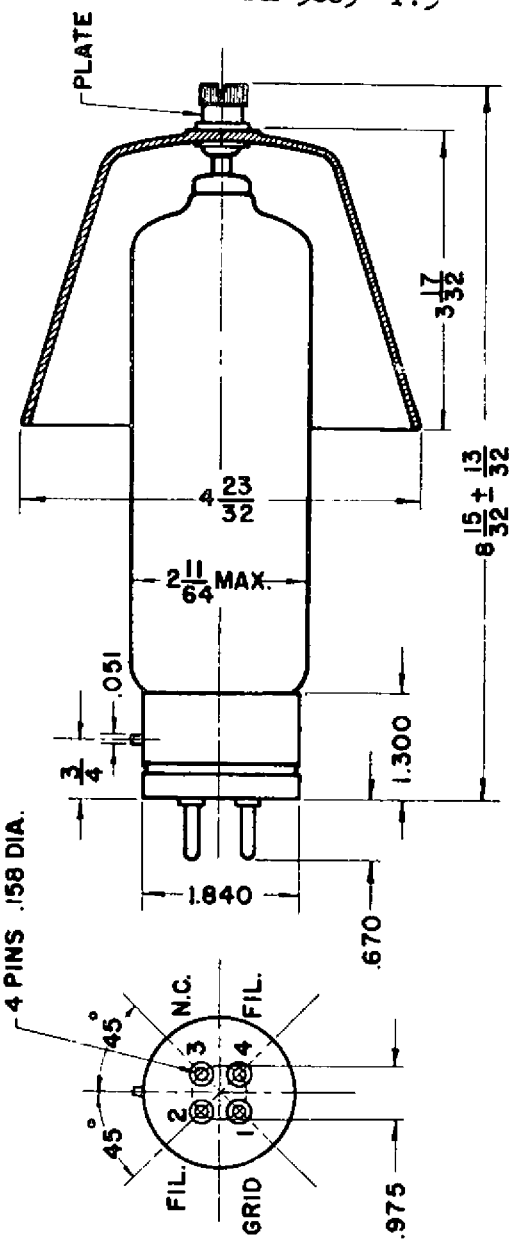
The band width illustrated in this curve includes the unavoidable variations in the characteristics of a mercury thyratron. These include:

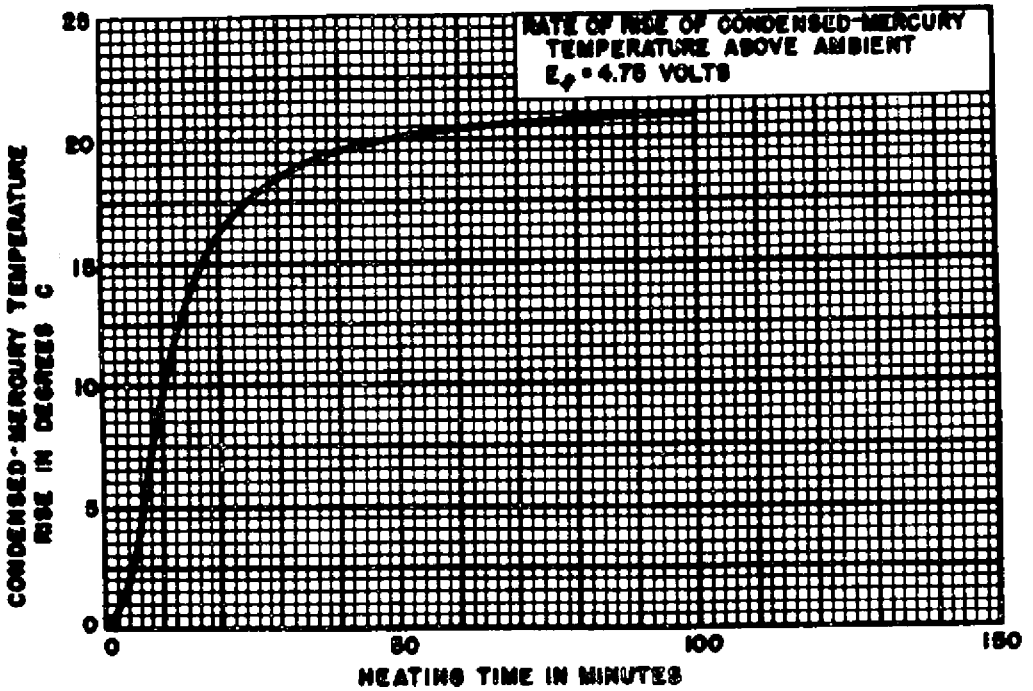
1. Shift due to condensed mercury temperature variation within the rated range.
2. Shift caused by filament voltage variation.
3. Differences from tube to tube due to manufacturing variances.
4. Shift due to aging effects within the guaranteed life period.






GENERAL CONTROL CHARACTERISTIC
E_f = 4.75 TO 5.25 VOLTS
R_g = 20,000 OHMS
C_{sf} = .001 μF
60° TO 25°C
PEAK ANODE VOLTAGE IN KILOVOLTS
D-C CONTROL-GRID VOLTAGE IN VOLTS
0
2
4
6
8
10
12
-40
-30
-20
-10
0


PLATE
3 17/32
8 15/32 ± 13/32
4 23/32
2 11/64 MAX.
.051
3/4
1.300
1.840
.670
4 PINS .158 DIA.
N.C.
FIL.
FIL.
GRID
45°
45°
1
2
3
4
.975


RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE ABOVE AMBIENT
E_f = 4.75 VOLTS
CONDENSED-MERCURY TEMPERATURE RISE IN DEGREES C
HEATING TIME IN MINUTES
0
5
10
15
20
25
0
50
100
150

AMPEREX ELECTRONIC CORPORATION

230 DUFFY AVENUE HICKSVILLE, L. I.

AMPEREX ELECTRON TUBE TYPE 5870

The 5870 is a three-electrode mercury-vapor rectifying tube with negative control characteristics. This tube is designed for grid-control rectifier applications of relatively high voltage and current. The cathode is directly heated, oxide-coated.

Maximum Ratings, Absolute Values:

Maximum Peak Anode Voltage			
Inverse	27,000	10,000	volts
Forward	27,000	10,000	volts
Condensed Mercury Temperature Limits	+ 30 to + 40	+ 25 to + 60	centigrade
Maximum Plate Current			
Peak		10	amperes
Average		2.5	amperes
Surge, for design only (Maximum duration 0.1 seconds)		100	amperes
Maximum Averging time		30	seconds
Maximum Negative Control-Grid Voltage Before Conduction		300	volts
Maximum Positive Control-Grid Current			
Average (Averaging time, one cycle)		25	ma
Peak		125	ma
Maximum Grid Resistance		0.1	megohms
Frequency Range		25 to 150	cps

GENERAL

Electrical Data

	Min.	Bogey	Max.	
Filament Voltage	4.75	5.0	5.25	volts
Filament Current at 5.0 volts	---	14	16	amperes
Filament Heating Time* (before applying Plate Voltage)	120	---	---	seconds
Anode-to-control-grid Capacitance	---	4	---	uuf
Control-grid-to cathode Capacitance	---	13	---	uuf
Deionization Time, approximate	---	250	---	microseconds
Ionization Time, approximate	---	10	---	microseconds
Typical Bias at 21,000 volts			-100	volts
Typical Bias at 10,000 volts			-50	volts
Typical Grid Current (Average)			2	ma
Typical Grid Resistance			10,000	ohms
Tube Voltage Drop (Ib = 10 amperes)			14	volts

The minimum heating time refers only to the filament. Sufficient additional time must be allowed to permit the condensed mercury temperature to rise to the minimum condensed mercury temperature limit and to permit all the mercury to condense in the lower part of the tube.

from RTMA release #1128, Jan 30, 1953

Mechanical Data

Type of cooling - Convection

Equilibrium Condensed-Mercury Temperature Rise		
At Full Load, approximate	15	°C
At No Load, approximate	13	°C
Mounting position - Vertical with base down		
Net Weight, approximate	28	ounces

OPERATIONAL NOTES

Note 1: In order to obtain maximum life from the tube it is recommended that a filament voltage phase shift of 90° be applied with respect to plate voltage.

Note 2: Characteristic Curves

The circuit returns are connected to the center tap of the filament transformer.

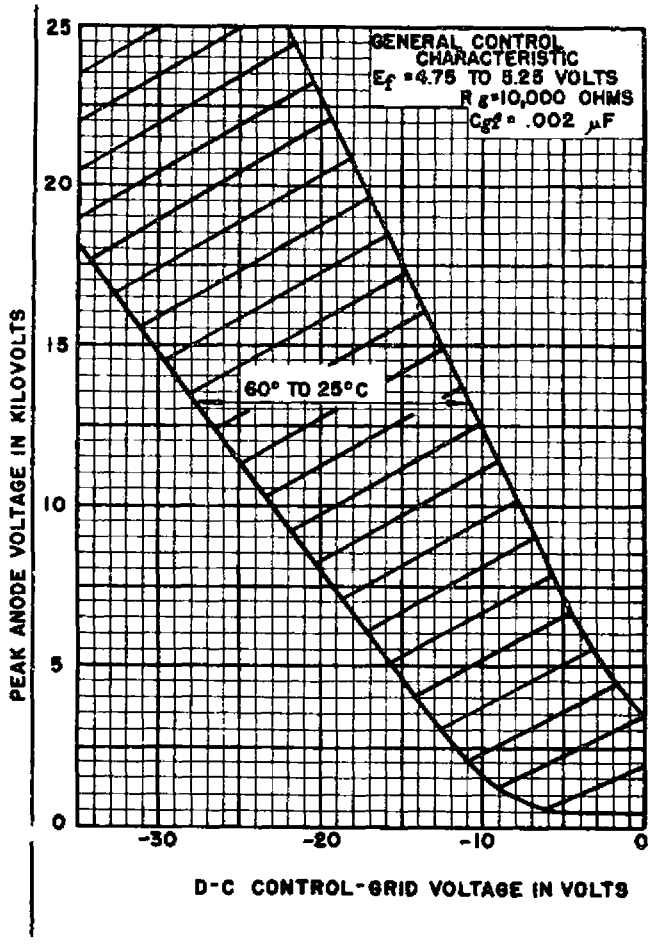
Note 3: General Control Characteristic Curve

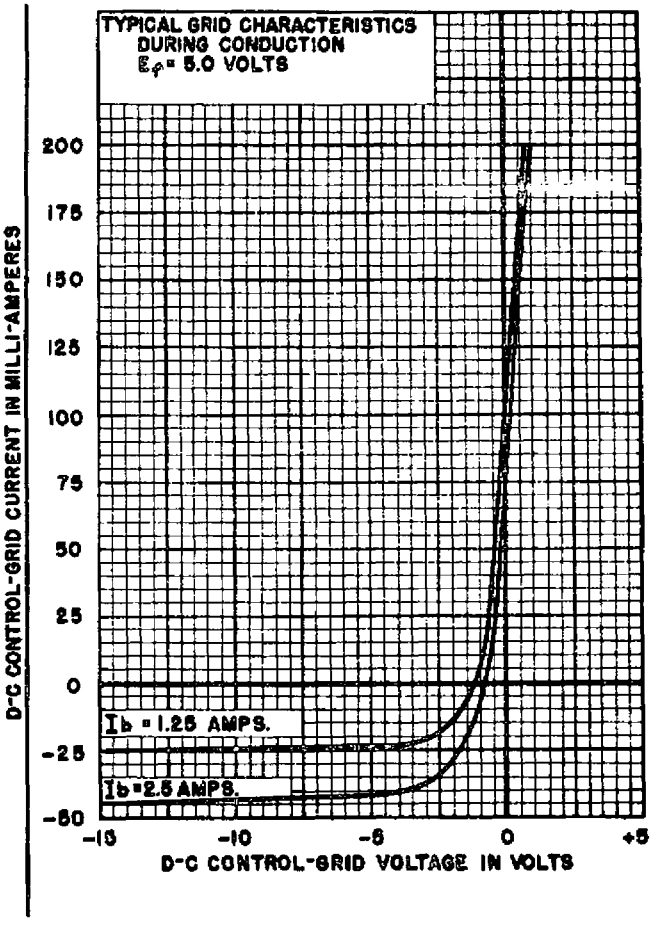
The band width illustrated in this curve includes the unavoidable variations in the characteristics of a mercury thyratron. These include:

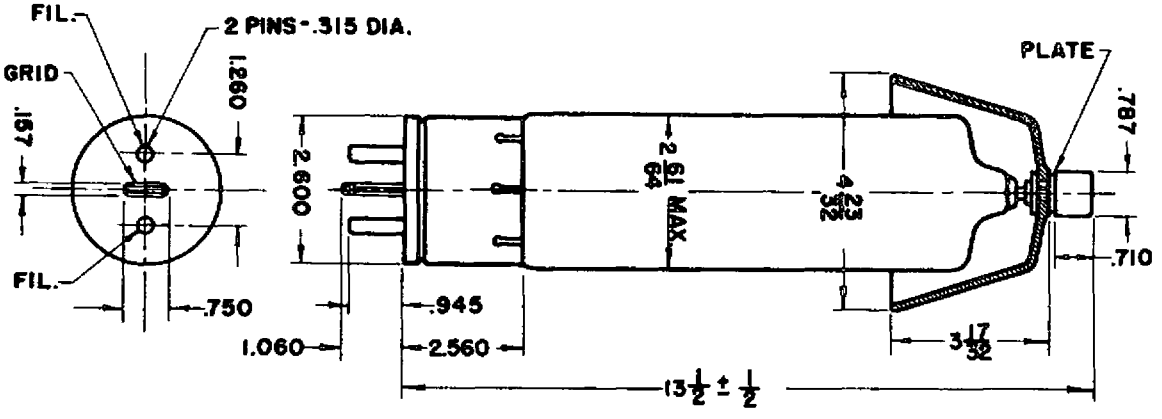
1. Shift due to condensed mercury temperature variation within the rated range.
2. Shift caused by filament voltage variation.
3. Differences from tube to tube due to manufacturing variances.
4. Shift due to aging effects within the guaranteed life period.

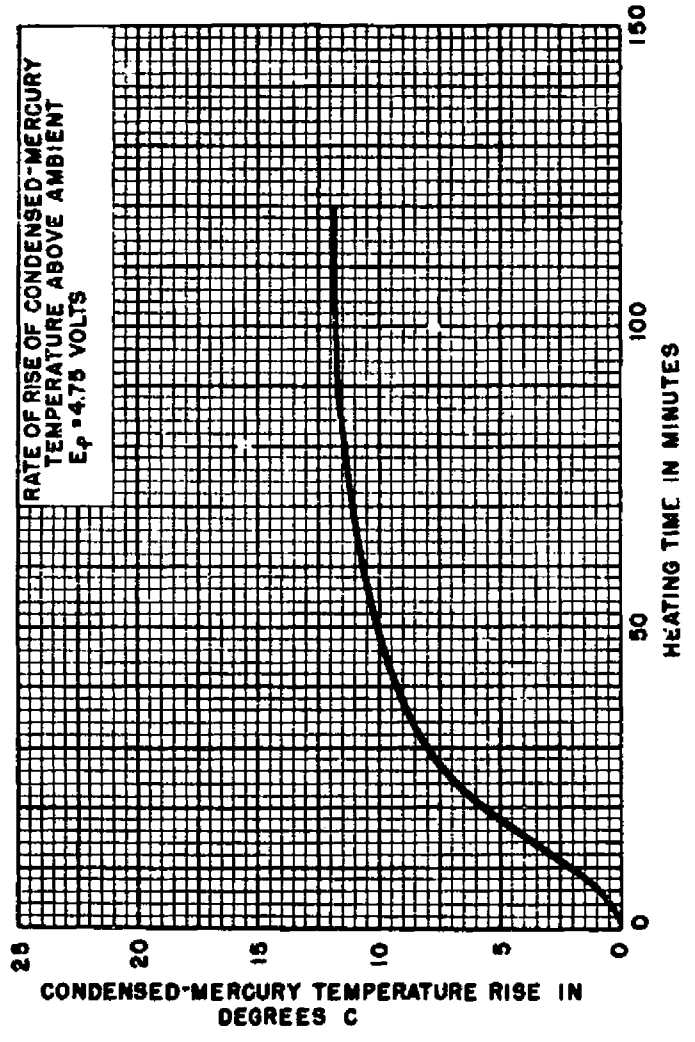
Note 4: The minimum heating time refers only to the filament. Sufficient additional time must be allowed to permit the condensed mercury temperature to rise to the minimum condensed mercury temperature limit and to permit all the mercury to condense in the lower part of the tube.

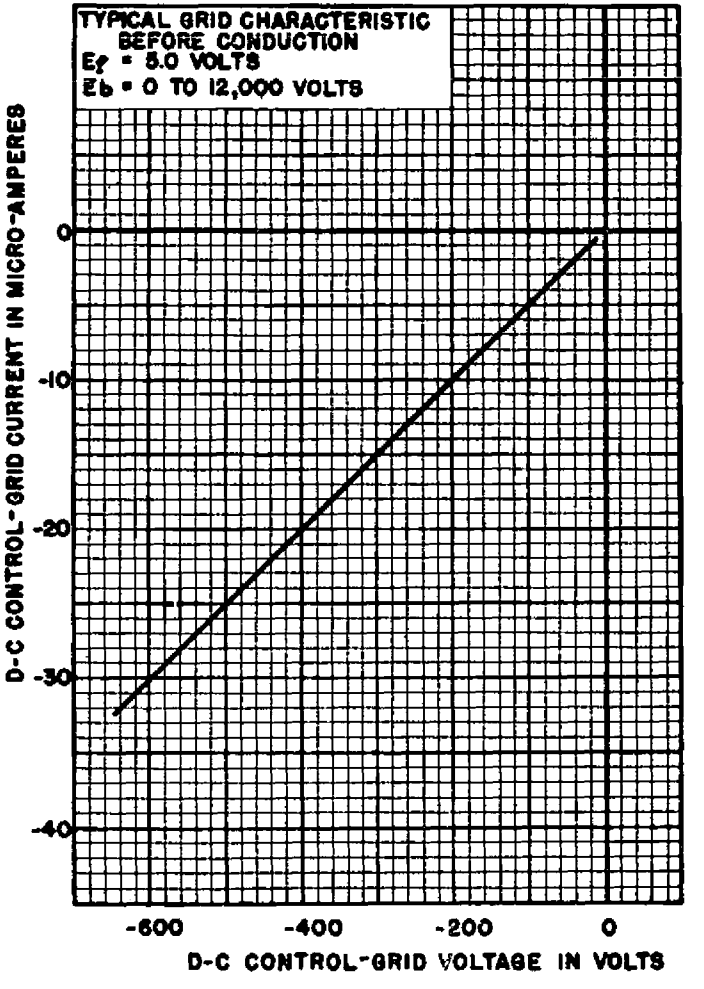
CIRCUIT	INPUT VOLTAGE RMS VALUE (KV)	D.C. OUTPUT VOLTAGE (KV)	D.C. OUTPUT CURRENT (AMPS)
SINGLE-PHASE, FULL WAVE 2 TUBES	9.5	8.6	5
THREE-PHASE, HALF WAVE 3 TUBES	11	12.9	7.5
THREE-PHASE, DOUBLE-Y PARALLEL 6 TUBES	11	12.9	15
FOUR-PHASE, HALF WAVE 4 TUBES	9.5	12.1	10
SINGLE-PHASE, FULL WAVE 4 TUBES	19.1	17.1	5
THREE-PHASE, FULL WAVE 6 TUBES	19.1	25.8	7.5
FOUR-PHASE, FULL WAVE 8 TUBES	19.1	24.3	10


GENERAL CONTROL CHARACTERISTIC
Ef =4.75 TO 5.25 VOLTS
Rg=10,000 OHMS
Cgf = .002 μF
60° TO 25°C
PEAK ANODE VOLTAGE IN KILOVOLTS
D-C CONTROL-GRID VOLTAGE IN VOLTS
25
20
15
10
5
0
-30
-20
-10
0


TYPICAL GRID CHARACTERISTICS
DURING CONDUCTION
Ef = 5.0 VOLTS
Ib = 1.25 AMPS.
Ib=2.5 AMPS.
D-C CONTROL-GRID CURRENT IN MILLI-AMPERES
D-C CONTROL-GRID VOLTAGE IN VOLTS
200
175
150
125
100
75
50
25
0
-25
-50
-15
-10
-5
0
+5


FIL.
2 PINS-.315 DIA.
GRID
1.260
.187
2.600
2 15/64 MAX.
4 21/32
PLATE
.787
.710
FIL.
.750
.945
1.060
2.560
3 17/32
13½ ± ½


RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE ABOVE AMBIENT
Ef = 4.75 VOLTS
150
100
50
0
HEATING TIME IN MINUTES
25
20
15
10
5
0
CONDENSED-MERCURY TEMPERATURE RISE IN DEGREES C


TYPICAL GRID CHARACTERISTIC BEFORE CONDUCTION
Ef = 5.0 VOLTS
Eb = 0 TO 12,000 VOLTS
D-C CONTROL-GRID CURRENT IN MICRO-AMPERES
0
-10
-20
-30
-40
-600
-400
-200
0
D-C CONTROL-GRID VOLTAGE IN VOLTS

Permanent Sensitivity GAMMA COUNTERS

5887 (75N) or 5888 (75NB3)

Description

The type ***75N*** or ***75NB3*** is an inexpensive, rugged gamma counter for survey, demonstration, or monitoring applications. The infinite-life, halogen filling gives this tube an unusual electrical ruggedness to match its mechanical strength.

The absence of flanges or external glass structures enables this tube to be bundled in multiple arrangements with good volumetric efficiency.

General Data

Operating temperature range	—55° to +75°C
Gas filling	Neon plus halogen admixture
Cathode material	stainless steel (28% chromium, 72% iron)
Effective cathode dimensions[8]	2 - 11/16" long x .607" I.D. x .009" wall

Performance

Operating voltage[1,3,4]	700 volts D.C.
Plateau length[1]	in excess of 125 volts
Slope of plateau[1,5]	less than 15% per 100 volts
Starting voltage (0.3 volt pulses)[1]	625 volts max.
Capacity at terminals	1.5 mmf
Radial sensitivity (approx.)	80%
Dead time (approx.)	100 microseconds
Maximum counting rate[6]	1,700 counts per second
Background (Shielded with 2" lead and 1/8" aluminum)	50 counts per minute max.
Roentgen energy dependence[7] (unfiltered)	±30%
Life expectancy in counts[2]	unlimited by use

Notes

[1] This data is obtained from an automatic plateau trace run on each tube.

[2] Guaranteed 5 x 10^{10} counts minimum.

[3] These tubes will operate satisfactorily anywhere on the plateau.

[4] Also available upon request filled at 900 volts operating voltage.

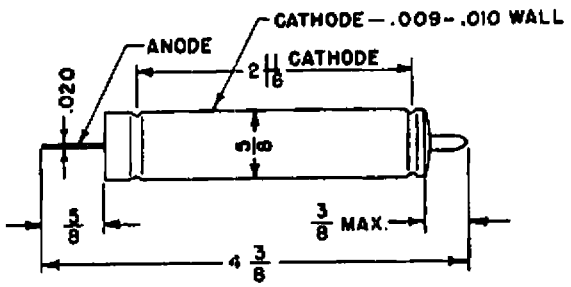
[5] At an average counting rate of 100 counts per second.

[6] For 20% dead time correction (approx.).

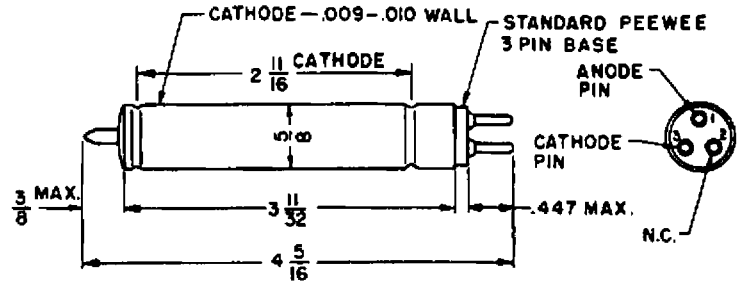
[7] Calculated value based on radiocobalt gamma center value with 100KV to 3 M.E.V. extremes.

[8] This tube is also available with an effective cathode length of 12" upon special request for cosmic ray research, oil well logging, and other applications.

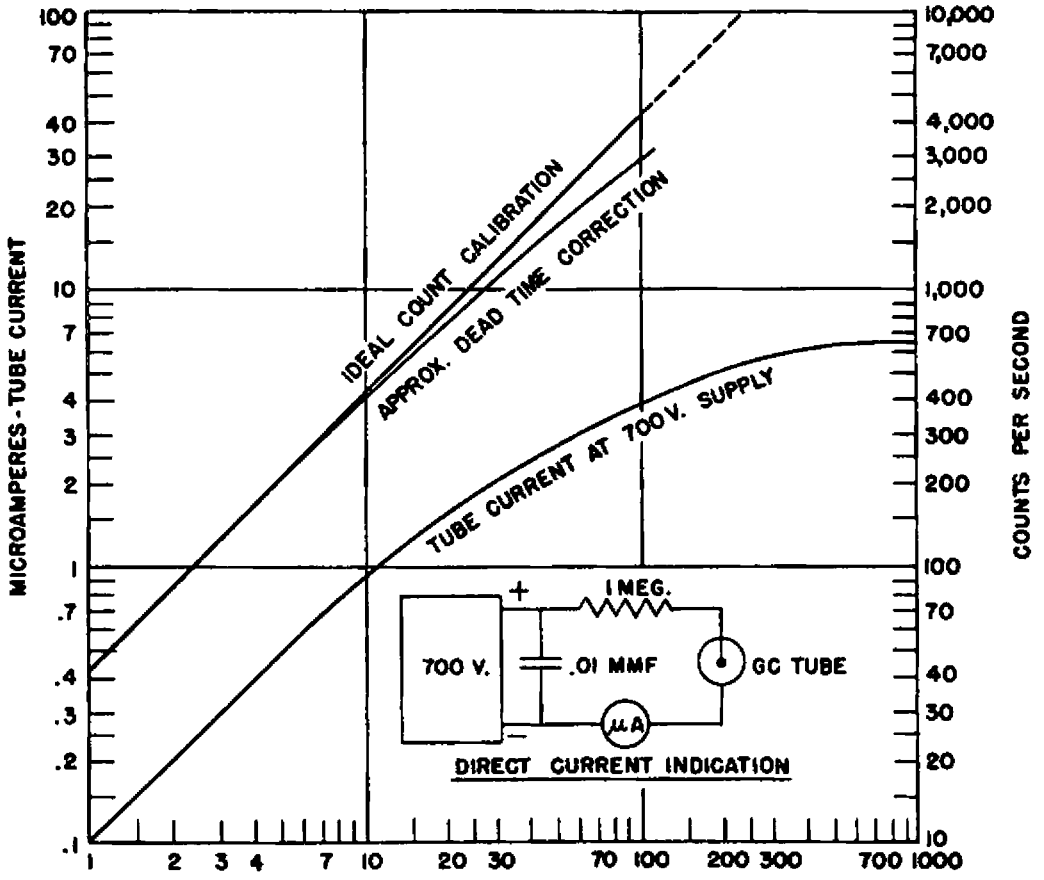
from RTMA release #1128, Jan 30, 1953



75 N



75 NB 3



TYPICAL OPERATION

AMPEREX TUBE TYPE 5895

The 5895/AX-9905 is a twin four-electrode tube designed for use as a radio-frequency power amplifier, oscillator, modulator and frequency multiplier. Each anode is capable of dissipating 6 watts in continuous service and 8 watts in intermittent service. Cooling is accomplished by radiation. The cathode is directly heated, oxide-coated. Maximum ratings apply up to 186 megacycles. At reduced ratings it may be operated up to 300 mc.

GENERAL CHARACTERISTICS

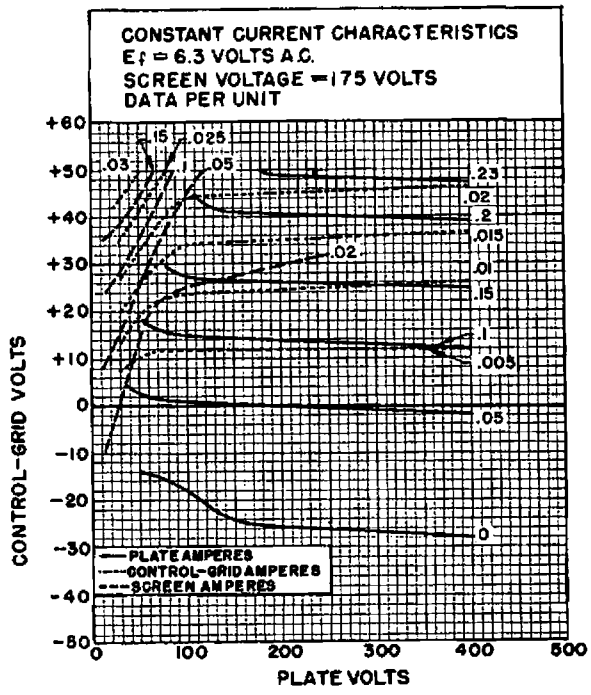
ELECTRICAL DATA

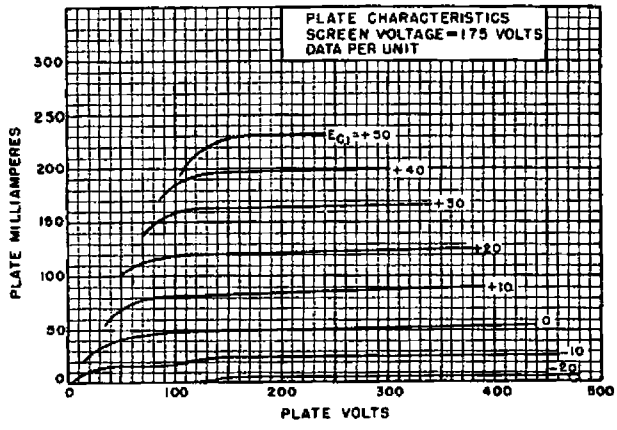
	Min.	Bogey	Max.	
Filament Voltage	5.6	6.3	6.9	volts
Filament Current at Bogey Voltage	0.63	0.68	0.73	amperes
Amplification Factor G1-G2 Mu at Eb=400 volts, Ec2=250 volts, Ib=25 ma	6.0	7.5	9.0	
Peak Cathode Current[1]				
Continuous Service	—	—	240	ma
Intermittent Service	—	—	300	ma
Direct Interelectrode Capacitances				
Per Unit				
Grid-Plate	—	0.05	0.08	μμf
Input	7.7	8.5	9.4	μμf
Output	2.8	3.3	3.8	μμf
Push-pull				
Input	5.0	5.7	6.3	μμf
Output	1.5	1.7	2.0	μμf

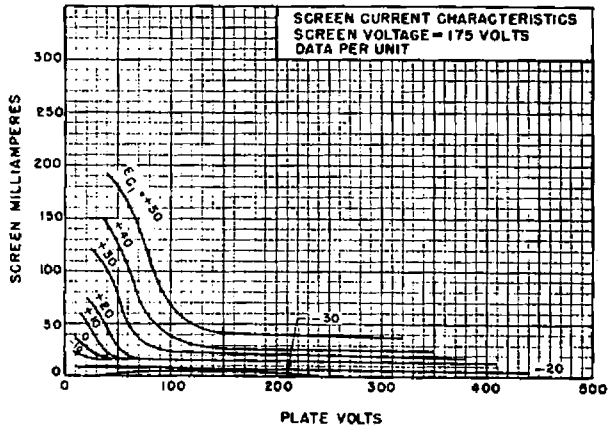
MECHANICAL DATA

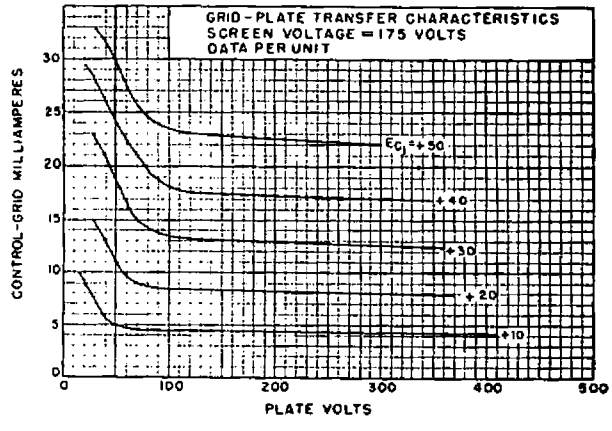
Mounting Position—vertical, base up or down	
Maximum Glass Temperature (anode area)	200° C.
Maximum Pin Temperature	100° C.
Net Weight (approximate)	1.4 ounces

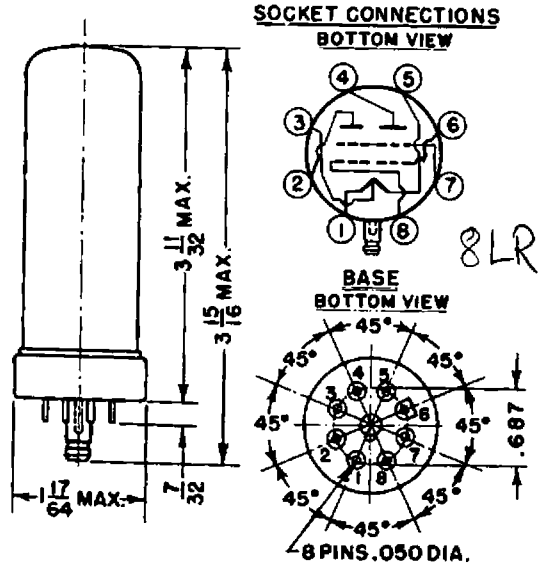
[1] Represents maximum usable cathode current per unit (plate current plus current to each grid) for any condition of operation.











MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

Maximum Ratings, Absolute Values

	CCS	ICAS	
D.C. Plate Voltage	600	600	volts max.
D.C. Grid No. 2 Voltage	250	250	volts max.
D.C. Grid No. 1 Voltage	- 200	- 200	volts max.
Maximum Signal D.C. Plate Current[1]	2x30	2x40	ma max.
Maximum Signal Plate Input[1]	2x18	2x24	watts max.
Maximum Signal Grid No. 2 Input[1]	7	7	watts max.
Plate Dissipation[1]	2x6	2x8	watts max.

Typical Operation

Unless otherwise specified, values are per tube.

	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	250	350	400	450	volts
D.C. Grid No. 2 Voltage	175	200	200	200	volts
D.C. Grid No. 1 Voltage	—20	—24	—24	—24	volts
Peak A.F. Grid No. 1 to Grid No. 1 Voltage	100	104	94	94	volts
Zero Signal D.C. Plate Current	2x2.9	2x2.5	2x2.7	2x2.8	ma
Maximum Signal D.C. Plate Current	2x36	2x37.5	2x35	2x32.5	ma
Zero Signal D.C. Grid No. 2 Current	2x0.20	2x0.14	2x0.15	2x0.16	ma
Maximum Signal D.C. Grid No. 2 Current	2x5.0	2x5.5	2x5.3	2x5.0	ma
Effective Load Resistance, Plate to Plate	8000	12000	16000	20000	ohms
Maximum Signal Driving Power, approx.	0.07	0.07	0.06	0.05	watts
Maximum Signal Power Output, approx.	9	16	17	18	watts

Plate and Screen Grid Modulated R.F. Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

Values per tube.

	CCS	ICAS	
D.C. Plate Voltage	450	480	volts max.[2]
D.C. Grid No. 2 Voltage	250	250	volts max.
D.C. Grid No. 1 Voltage	200	200	volts max.
D.C. Plate Current	2x24	2x32	ma max.
D.C. Grid No. 1 Current	2x5	2x5	ma max.
Plate Input	2x7	2x9.5	watts max.[2]
Grid No. 2 Input	4.5	4.5	watts max.
Plate Dissipation	2x4	2x5	watts max.

Typical Operation

Values are per tube.

	CCS	ICAS	
D.C. Plate Voltage	250	250	volts
Grid No. 2 Series Resistance (supply voltage 250 volts)	10000	10000	ohms
D.C. Grid No. 1 Voltage	70	70	volts
Peak R.F. Grid No. 1 Voltage	110	110	volts
D.C. Plate Current	2x19.5	2x26.5	ma
D.C. Grid No. 2 Current	11	9	ma
D.C. Grid No. 1 Current, approximate	2x1.5	2x1.5	ma
Driving Power, approximate	0.3	0.3	watts
Power Output, approximate	6	7.8	watts

At 300 megacycles[3] the following applies:

	CCS	ICAS	
D.C. Plate Voltage	350	350	volts max.
Plate Input	2x5.25	2x7	watts max.

Push-Pull R.F. Power Amplifier and Oscillator Class C Telegraphy

Key-down conditions per tube without amplitude modulation[4]

Maximum Ratings, Absolute Values

	CCS	ICAS	
D.C. Plate Voltage	600	600	volts max.[2]
D.C. Grid No. 2 Voltage	250	250	volts max.
D. C. Grid No. 1 Voltage	—200	—200	volts max.
D.C. Plate Current	2x30	2x40	ma max.
D.C. Grid No. 1 Current	2x5	2x5	ma max.
Plate Input	2x18	2x24	watts max.[2]
Grid No. 2 Input	7	7	watts max.
Plate Dissipation	2x6	2x8	watts max.

Typical Operation

	CCS	CCS	CCS	
Frequency	60	60	60	Mc
D.C. Plate Voltage	250	400	600	volts
D.C. Grid No. 2 Voltage	175	200	200	volts
D.C. Grid No. 1 Voltage	—70	—80	—80	volts
Peak R.F. Grid No. 1 to Grid No. 1 Voltage	210	210	210	volts
D.C. Plate Current	2x30	2x30	2x30	ma
D.C. Grid No. 2 Current	6.5	6	6	ma
D.C. Grid No. 1 Current, approximate	2x1.8	2x1.2	2x1.0	ma
Driving Power, approximate	2x0.17	2x0.11	2x0.10	watts
Power Output, approximate	10.6	17.6	26.6	watts

At 300 megacycles[3] the following applies:

	CCS	ICAS	
D.C. Plate Voltage	450	450	volts max.
Plate Input	2x9	2x12	watts max.

Push-Pull R.F. Power Amplifier and Oscillator Class C Telegraphy

Key-down conditions per tube without amplitude modulation[1]

Typical Operation

	CCS	CCS	CCS	
Frequency	165	166	166	Mc
D.C. Plate Voltage	250	400	600	volts
D.C. Grid No. 2 Voltage	175	200	200	volts
D.C. Grid No. 1 Voltage	70	80	-80	volts
Peak R.F. Grid No. 1 to Grid No. 1 Voltage	220	210	210	volts
D.C. Plate Current	2x30	2x30	2x33	ma
D.C. Grid No. 2 Current	4.5	3.5	3.0	ma
D.C. Grid No. 1 Current, approximate	2x1.5	2x1.0	2x1.0	ma
Driving Power, approximate	2x0.15	2x0.1	2x0.1	watts
Power Output, approximate	10.2	15.8	25.6	watts

Typical Operation

	ICAS	ICAS	ICAS	
Frequency	60	60	60	Mc
D.C. Plate Voltage	250	400	600	volts
D.C. Grid No. 2 Voltage	175	200	200	volts
D.C. Grid No. 1 Voltage	—70	—80	—80	volts
Peak R.F. Grid No. 1 to Grid No. 1 Voltage	230	220	220	volts
D.C. Plate Current	2x40	2x40	2x40	ma
D.C. Grid No. 2 Current	7.5	6.0	5.5	ma
D.C. Grid No. 1 Current, approximate	2x2.5	2x2.0	2x1.2	ma
Driving Power, approximate	2x0.26	2x0.22	2x0.12	watts
Power Output, approximate	14.0	23.2	35	watts

Typical Operation

	ICAS	ICAS	ICAS	
Frequency	186	186	186	Mc
D.C. Plate Voltage	250	400	600	volts
D.C. Grid No. 2 Voltage	175	200	200	volts
D.C. Grid No. 1 Voltage	—70	—80	—80	volts
Peak R.F. Grid No. 1 to Grid No. 1 Voltage	230	220	220	volts
D.C. Plate Current	2x40	2x40	2x40	ma
D.C. Grid No. 2 Current	7.5	5.0	4.5	ma
D.C. Grid No. 1 Current, approximate	2x2.0	2x1.5	2x1.3	ma
Driving Power, approximate	2x0.25	2x0.15	2x0.13	watts
Power Output, approximate	13.2	22	33.6	watts

Frequency Multiplier—Class C Telegraphy

Values are per tube.

Maximum Ratings, Absolute Values

	CCS	ICAS	
D.C. Plate Voltage	600	600	volts max.[2]
D.C. Grid No. 2 Voltage	250	250	volts max.
D.C. Grid No. 1 Voltage	—200	—200	volts max.
D.C. Plate Current	2x30	2x40	ma max.
D.C. Grid No. 1 Current	2x5	2x5	ma max.
Plate Input	2x12	2x16	watts max.[2]
Grid No. 2 Input	7	7	watts max.
Plate Dissipation	2x6	2x8	watts max.

Typical Operation

	CCS Tripler to 186 Mc	CCS	CCS Tripler to 186 Mc	CCS	
D.C. Plate Voltage	250	400	250	400	volts
D.C. Grid No. 2 Voltage	200	200	200	200	volts
D.C. Grid No. 1 Voltage	—175	-175	175	175	volts
Peak R.F. Grid No. 1 to Grid No. 1 Voltage	430	430	430	430	volts
D.C. Plate Current	2x30	2x24	2x40	2x32	ma
D.C. Grid No. 2 Current	6	3	6.5	4	ma
D.C. Grid No. 1 Current, approximate	2x1.1	2x0.6	2x1.5	2x1.1	ma
Driving Power, approximate	0.45	0.25	0.6	0.45	watts
Power Output, approximate	4.6	7.2	6.2	10	watts

	Doubler to 186 Mc		Doubler to 186 Mc		
D.C. Plate Voltage[5]	250	400	250	400	volts
D.C. Grid No. 2 Voltage	200	200	200	200	volts
D.C. Grid No. 1 Voltage	—175	—175	—175	—175	volts
Peak R.F. Grid No. 1 to Grid No. 1 Voltage[5]	440	420	460	440	volts
D.C. Plate Current	2x30	2x30	2x40	2x40	ma
D.C. Grid No. 2 Current	4	3	6	5	ma
D.C. Grid No. 1 Current, approximate	2x1.5	2x1.2	2x2	2x1.5	ma
Driving Power, approximate	0.6	0.45	0.85	0.6	watts
Power Output, approximate	8	13	9.8	16	watts

At 300 megacycles[3] the following applies:

	CCS	ICAS	
D.C. Plate Voltage	450	450	volts max.
Plate Input	2x9	2x12	watts max.

Electrical Data and Limits

Unless otherwise specified values are for one unit. In that case the other unit should be made non-active by applying a voltage of —100 volts to the control grid of that unit.

Measurements should be carried out at Vf=6.3 V and the mid tap of the transformer grounded.

Characteristic	Conditions		Limits Min.	Bogey	Max.	
Grid Voltage	Eb=100 V Ec$_2$=200 V Ib=160 ma	Ec$_1$:	—	—	35	volts
Grid No. 2 Current	Eb=100 V Ec$_2$=200 V Ib=160 ma	Ic$_2$:	—	—	35	ma
Grid No. 1 Current	Eb=100 V Ec$_2$=200 V Ib=160 ma	Ic$_1$:	—	—	15	ma
Plate Current	Eb=400 V Ec$_2$=250 V Ec$_1$= 5 V	Ib:	37	62	87	ma
Plate Current	Eb=400 V Ec$_2$=250 V Ec$_1$=—20 V	Ib:	11	23	35	ma
Plate Current	Eb=400 V Ec$_2$=250 V Ec$_1$=—45 V	Ib:	—	—	3	ma
Grid No. 2 Current	Eb=400 V Ec$_2$=250 V Ec$_1$=—20 V	Ic$_2$:	—	—	10	ma
Grid No. 1 Current	Eb=400 V Ec$_2$=250 V Ib=70 ma	Ic$_1$:	—	—	—1.5	μa
Power Output	Eb=400 V Ec$_2$=200 V Ec$_1$=—80 V Ib=2x30 ma. f=150 megacycles, two units in push-pull	Po:	14	—	—	watts

[1]Averaged over any audio-frequency cycle of sine-wave form.

[2]This data applies up to 185 megacycles.

[3]Special attention should be given to adequate ventilation of the bulb at these frequencies.

[4]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

[5]Grids in push-pull, plates in parallel.

from RTMA releae #998, July 15, 1951

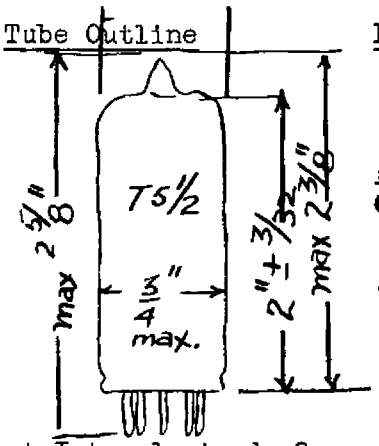
Tube type #5920 Amperex Electronic Corporation
Brooklyn 1, New York

Development No. E8CC

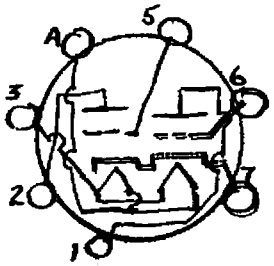
Description: Twin-triode amplifier; heater type (AC or DC); T 5½ miniature; body-length 2 3/8" max.; miniature button 7-pin.

Heater voltage 6.3 volts Heater current 0.4 ampere

Tube Outline



Bottom view of Base



Base Pin No.	Element
1	Plate T 2
2	Plate T 1
3	Heater
4	Heater
5	Grid T 1
6	Grid T 2
7	Cathode (for both sections)

Direct Interelectrode Capacitances (each section) x)

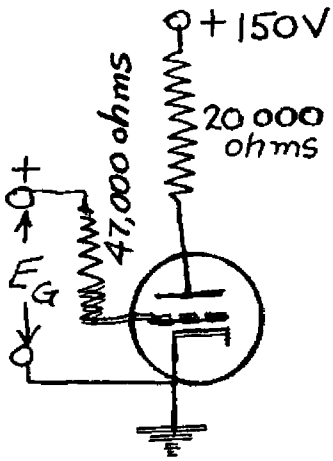
Grid to plate	2.6 uuf
Grid to cathode	3.1 uuf
Plate to cathode	0.3 uuf

Maximum Ratings

Plate voltage	150 volts
Plate dissipation (each section)	1.5 watt
Cathode current	20 ma
Heater cathode voltage	200 volts

Electrical characteristics (for each section)

Plate voltage	100 volts
Grid voltage	- 1.8 volt
Amplification factor	25
Transconductance	5500 micromhos
Plate current	8.5 ma



Operating conditions

Plate supply voltage		150 volts
Load resistance		20000 ohms
External grid resistance		47000 ohms
Grid input voltage	0	- 10 volts
Plate current	min.4.5	max. 0.2 ma

$E_G = 0$ V. $E_L \geq 90$V.

$E_G = -10$ V. $E_L \geq 4$ V

x) Approximate values with no external shield.

Note: In circuits in which the maximum ratings are not exceeded, the life of a group of tubes is guaranteed up to a base of 10,000 hours average life per tube.

AMPEREX TUBE TYPE 5923

The 5923 is a water cooled three-electrode tube designed for use as power amplifier, oscillator and modulator in television and AM/FM transmitters and for industrial applications. Maximum ratings apply up to 75 Mc. At reduced ratings it may be operated up to 220 Mc.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

	Min.	Bogey	Max.	
Filament Voltage	12.0	12.6	13.2	volts
Filament Current at Bogey Voltage	30	33	36	amps
Amplification Factor (Ib=1 amp, Eb=4000 volts)	26	32	38	
Peak Cathode Current[1]			10	amps
Direct Interelectrode Capacitances				
Grid to Plate	9.5	11	12.5	μμf
Grid to Filament	13	16	19	μμf
Plate to Filament	0.2	0.3	0.4	μμf

MECHANICAL DATA

Mounting Position . . . . . vertical with plate down

Max. Temperature of Seals . . . . . 180° C

COOLING : Water and low velocity air flow

COOLING CHARACTERISTICS (See Curves)

Plate Dissipation (kilowatts)	Inlet Water Temperature (° C)	Min. Water Flow (gpm)	Inlet Water Pressure (lbs./sq. inch)
1	20	0.66	1.18
	50	0.79	1.47
2	20	0.66	1.18
	50	1.32	4.41
4	20	1.06	2.65
	50	2.38	13.2
6	20	1.58	5.9
	50	3.70	36.8

Max. Inlet Water Temperature . . . . 50° C

ACCESSORIES

Water Jacket . . . . . Amperex Type #S3737

Filament Connector . . . . . Amperex Type #S3707

Grid Connector . . . . . Amperex Type #S3706

WEIGHT

Tube — Net Weight (approx.) . . . . . 14 ounces

Water Jacket — Net Weight (approx.) . . 21 ounces

[1]Represents max. usable cathode current for any condition of operation.

[2]At frequencies above 30 Mc it is necessary to direct a low velocity air flow to plate and grid seals.

Radio-Frequency Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	6000	volts max.
D.C. Plate Current	1.1	amps max.
Plate Input	6600	watts max.
Plate Dissipation	6000	watts max.

Typical Operation

	CCS	CCS	
D.C. Plate Voltage	6	5	kilovolts
D.C. Grid Voltage	—180	—145	volts
Peak R.F. Grid Voltage	250	225	volts
D.C. Plate Current	0.99	0.9	amp
Driving Power, approximate[2]	140	120	watts
Power Output, approximate	1.9	1.45	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[2]	Up to 220 Mc[2]	
D.C. Plate Voltage	6000	5000	4000	volts
D.C. Plate Current	1.1	1.1	0.9	amps
Plate Input	6600	5500	3600	watts

Grid-Modulated R.F. Power Amplifier Class C—Television Service

Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	5000	volts max.
D.C. Grid No. 1 Voltage—White Level	—1000	volts max.
Plate Current (at crest of modulation)	1.9	amps max.
Plate Input (sync)	9.5	kilowatts max.
Plate Dissipation (sync)	6	kilowatts max.
Grid No. 1 Dissipation (sync)	120	watts max.

Typical Operation in Television Service at 75 Mc and Bandwidth of 5.25 Mc at 85% Antenna Current and 8 Mc at 70% Antenna Current

	2 tubes—push pull	
D.C. Plate Voltage	5000	volts
D.C. Grid No. 1 Voltage		
Synchronizing Level	—200	volts
Pedestal Level	—300	volts
White Level	—550	volts
R.F. Grid No. 1 Voltage Peak to Peak Synchronization Level	1000	volts
D.C. Plate Current		
Synchronization Level	3.8	amps
Pedestal Level	2.6	amps
D.C. Grid Current, approximate		
Synchronization Level	0.5	amp
Pedestal Level	0.35	amp
Driving Power at Synchronization Level, approximate	5.35	kilowatts
Power Output, approximate		
Synchronization Level	9	kilowatts
Pedestal Level	250	watts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[2]	Up to 220 Mc[2]	
Plate Input (Sync.)	6000	5000	4500	volts
D.C. Plate Voltage	1.9	1.9	1.9	amps
Plate Current (Sync.)	11.4	9.5	8.5	kw

Radio-Frequency Amplifier—Class B for Television Service

Negative Modulation and Positive Synchronization

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	5000	volts max.
D.C. Grid Voltage	—1000	volts max.
D.C. Plate Current (at crest of modulation)	1.9	amps max.
Plate Input	9500	watts max.
Plate Dissipation	6000	watts max.
Grid Dissipation	120	watts max.

Typical Operation in Television Service at 75 Mc and Bandwidth of 5.25 Mc at 85% Antenna Current and 8 Mc at 70% Antenna Current

	2 tubes—push pull	
D.C. Plate Voltage	5000	volts
D.C. Grid Voltage	—200	volts
R.F. Grid Voltage Peak to Peak Synchronization Level	1000	volts
Pedestal Level	800	volts
White Level	0	volt
D.C. Plate Current		
Synchronizing Level	3.8	amps
Pedestal Level	3	amps
White Level	0.2	amp
D.C. Grid Current		
Synchronizing Level	0.5	amp
Pedestal Level	0.22	amp
White Level	0	amp
Driving Power at Synchronization Level, approximate	250	watts
Power Output, approximate		
Synchronizing Level	9	kilowatts
Pedestal Level	5.35	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[2]	Up to 220 Mc[2]	
D.C. Plate Voltage	6000	5000	4500	volts
D.C. Plate Current (Sync.)	1.9	1.9	1.9	amps
Plate Input (Sync.)	11.4	9.5	8.5	kw

from RTMA release #1237, Sept. 18, 1953

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TENTATIVE DATA

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator—Class B

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	6000	volts max.
Maximum Signal D.C. Plate Current[1]	1.5	amps max.
Maximum Signal Plate Input[1]	9000	watts max.
Plate Dissipation[1]	6000	watts max.
Grid Resistor	15,000	ohms max.

Typical Operation

Unless otherwise specified, values are for two tubes

	CCS	CCS	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	6000	5000	4500	4000	3500	3000	volts
D.C. Grid Voltage	—165	—138	—125	—112	—100	—80	volts
Peak A-F Grid to Grid Voltage	910	661	655	632	618	570	volts
Zero Signal D.C. Plate Current	250	220	200	200	150	130	milliamps
Maximum Signal D.C. Plate Current	3000	1920	1840	1880	1900	1600	milliamps
Effective Load Resistance, Plate to Plate	4800	5400	6100	4900	4200	4400	ohms
Maximum Signal Driving Power, approx.	230	84	54	108	100	104	watts
Maximum Signal Power Output, approx.	13.3	6.6	6.0	5.3	4.6	3.3	kilowatts

Plate-Modulated Radio-Frequency Power Amplifier—Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	5000	volts max.
D.C. Grid Voltage	—1000	volts max.
D.C. Plate Current	1.3	amps max.
D.C. Grid Current	0.35	amp max.
Plate Input	6.5	kilowatts max.
Plate Dissipation	4	kilowatts max.

Typical Operation

	CCS	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	5	4.5	4	3.5	3	kilovolts
D.C. Grid Voltage[2]	—400	—350	—300	—300	—250	volts
Peak R.F Grid Voltage	690	650	600	600	510	volts
D.C. Plate Current	1.2	1.2	1.2	1.2	1.0	amps
D.C. Grid Current, approx.	0.3	0.3	0.3	0.3	0.3	amp
Driving Power, approx.	190	180	165	165	140	watts
Power Output, approx.	4.7	4.1	3.5	3.0	2.2	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[3]	Up to 220 Mc[3]	
D.C. Plate Voltage	5000	4000	3200	volts
D. C. Plate Current	1.3	1.3	1.1	amps
Plate Input	6.5	5.2	3.5	kw

Radio-Frequency Power Amplifier and Oscillator—Class C—Telegraphy

Key-down conditions per tube without amplitude modulation[4]

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	6000	volts max.
D.C. Grid Voltage	—1000	volts max.
D.C. Plate Current	1.5	amps max.
D.C. Grid Current	0.35	amp max.
Plate Input	9000	watts max.
Plate Dissipation	6000	watts max.

Typical Operation, Grounded-Filament Circuit

	CCS	CCS	CCS	
Frequency	75	75	75	megacycles
D.C. Plate Voltage	6	5	4	kilovolts
D.C. Grid Voltage	—400	—300	—200	volts
Peak R.F Grid Voltage	740	640	500	volts
D.C. Plate Current	1.5	1.5	1.37	amps
D.C. Grid Current, approximate	0.31	0.33	0.35	amps
Driving Power	210	190	160	watts
Power Output, approx.	6.9	5.6	4.0	kilowatts

Typical Operation, Grounded-Grid Circuit, Two Tubes

	CCS	CCS	CCS	CCS	
Frequency[3]	75	110	110	220	megacycles
D.C. Plate Voltage	6	5	4	4	kilovolts
D.C. Grid Voltage	400	300	200	200	volts
Peak R.F Grid Voltage	740	640	500	450	volts
D.C. Plate Current	3	3	2.75	2.5	amps
D.C. Grid Current, approx.	0.62	0.66	0.70	0.40	amp
Driving Power	2240	1840	1350	760	watts
Power Output, approx.[5]	15.6	12.1	8.8	5.6	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[3]	Up to 220 Mc[3]	
D.C. Plate Voltage	6000	5000	4000	volts
D.C. Plate Current	1.5	1.5	1.25	amps
Plate Input	9000	7500	5000	watts

Oscillator—Class C

With Rectified, unfiltered, single-phase, full-wave plate supply

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	5400	volts max.
D.C. Grid Voltage	—900	volts max.
D.C. Plate Current	1.35	amps max.
D.C. Grid Current	0.31	amp max.
Plate Input[7]	9000	watts max.
Plate Dissipation	6000	watts max.
Grid Dissipation	120	watts max.

Typical Operation

Transformer Voltage	6000[8]	5100[9]	volts rms
D.C. Plate Voltage	5.4	4.6	kilovolts
D.C. Plate Current	1.35	1.15	amps
D.C. Grid Current	0.31	0.27	amp
Grid Resistor	1300	1100	ohms
Plate Input	9	6.5	kilowatts
Plate Dissipation	2.3	1.84	kilowatts
Driving Power of Tube, approximate	210	160	watts
Power Output, approximate	6.5	4.5	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[3]	Up to 220 Mc[3]	
D.C. Plate Voltage	5400	4500	3600	volts
D.C. Plate Current	1.35	1.35	1.1	amps
Plate Input[7]	9000	7500	5000	watts

Self-Rectifying Oscillator—Class C §

Maximum Ratings, Absolute Values (per tube)

	CCS	
A.C. Plate Voltage (RMS)	6800	volts max.
D.C. Grid No. 1 Voltage	—640	volts max.
D.C. Plate Current	0.8	amp max.
D.C. Grid Current	0.19	amp max.
Plate Input[10]	9000	watts max.
Plate Dissipation	6000	watts max.
Grid Dissipation	120	watts max.

Typical Operation

	CCS	CCS	
A.C. Plate Voltage (RMS)	6800[8]	5900[9]	volts
D.C. Plate Current	0.8	0.7	amp
D.C. Grid Current	0.19	0.165	amp
Grid Resistor	1050	1050	ohms
Power Output, approximate	4.55	3.38	kilowatts

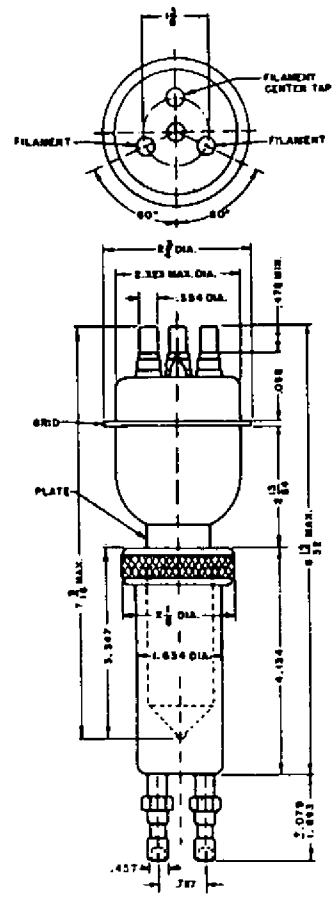
Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc[3]	Up to 220 Mc[3]	
A.C. Plate Voltage (RMS)	6800	5700	4500	volts
D.C. Plate Current	0.8	0.8	0.66	amps
Plate Input	9000	7500	5000	watts

Electrical Data and Limits

Characteristic	Conditions	Limits Min.	Bogey	Max.	
Grid Voltage[11]	Eb=1000 volts Ib=6 amps	Ec:	—	—	420 volts
Grid Current[11]	Eb=1000 volts Ib=6 amps	Ic:	—	—	2.5 amps
Plate Current	Eb=6000 volts Ec=—180 volts	Ib:	—	—	130 milliamps
Grid Current	Eb=6000 volts Ib=0.85 amp	Ic:	—	—	40 microamps
Grid Voltage	Eb=6000 volts Ib=0.85 amp	Ec:	67	94	121 volts
Power Output	Eb=6000 volts Ib=1.5 amps Ec=—400 volts Ic=0.31 amp f=75 megacycles	Po:	6	—	— kilowatts

[1]Averaged over any audio-frequency cycle of sine-wave form.

[2]Grid bias partially obtained by the grid resistor.



[3]When using the tube above 110 megacycles, particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc can only be given after approval of the prototype circuit.

[4]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

[5]Power transferred from driving stage included.

[6]At crest of audio-frequency cycle with modulation factor of 1.0.

[7]Plate input is 1.23 times the product of D.C. Plate Voltage and D.C. Plate Current.

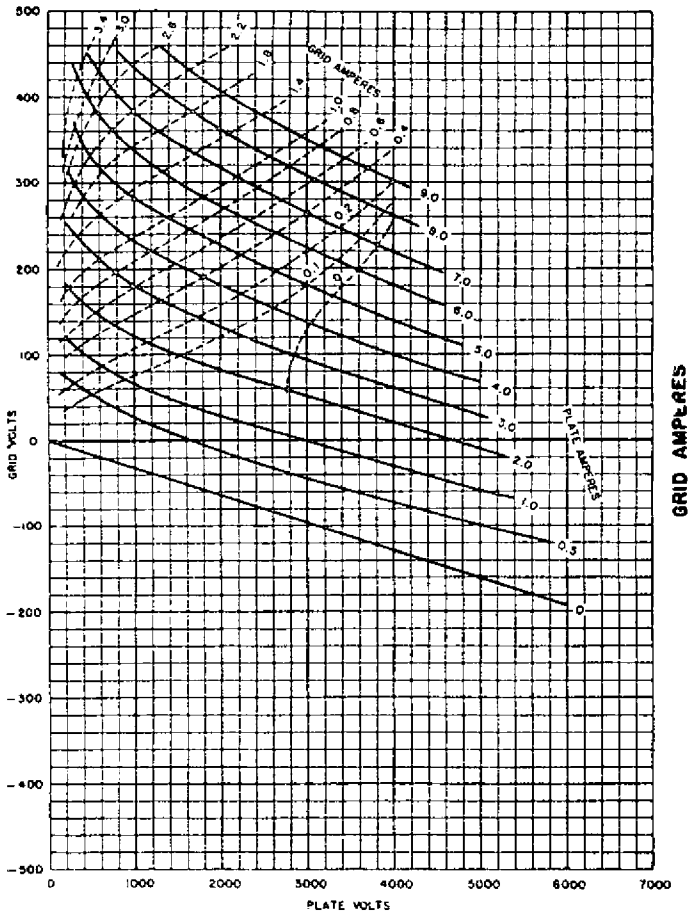
[8]Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

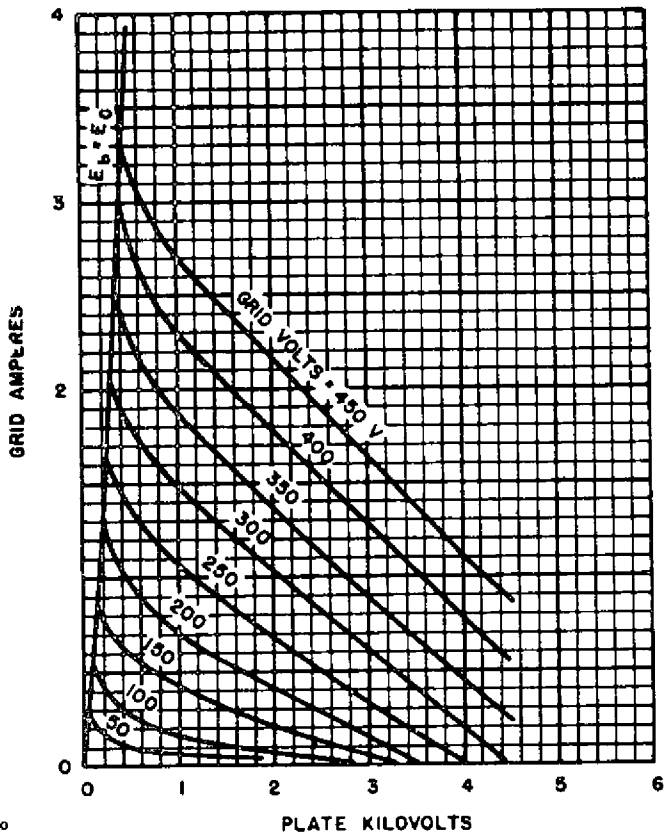
[9]Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.

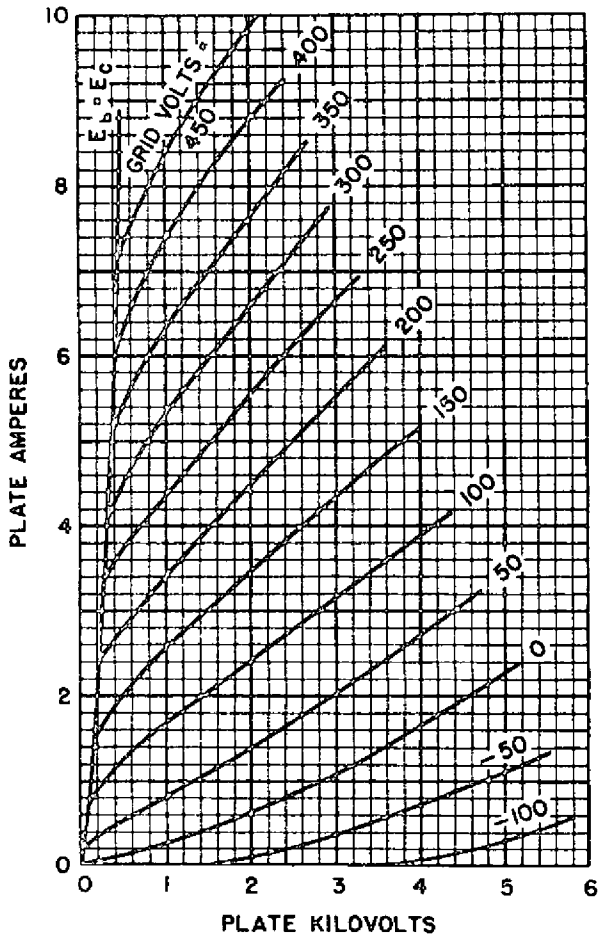
[10]Plate input is 1.11 times the product of A.C. Plate Voltage (RMS) and D.C. Plate Current.

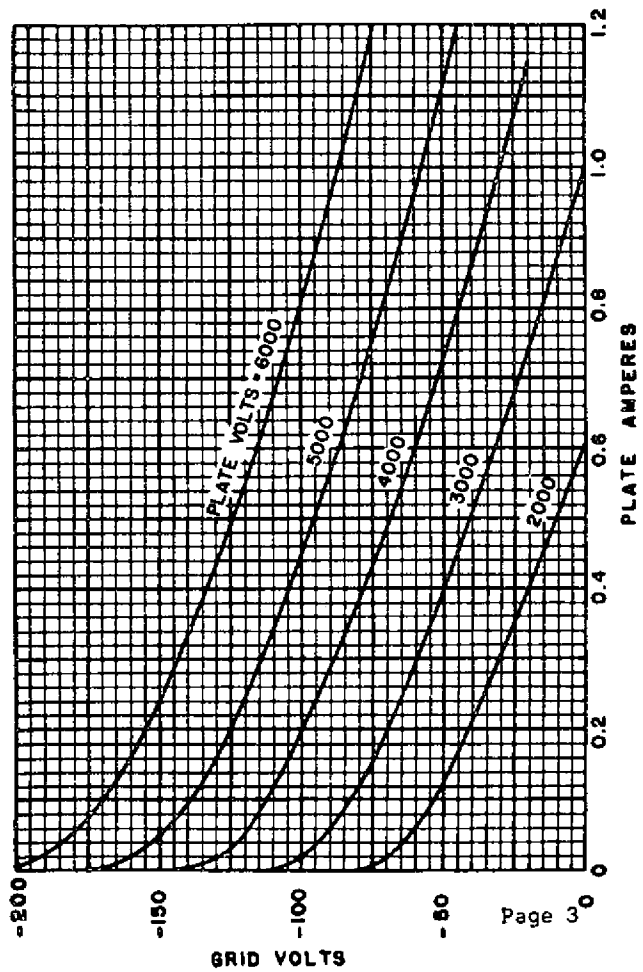
[11]This data is given only for design purposes; not for measurements.

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GRID VOLTS
PLATE VOLTS
GRID AMPERES
PLATE AMPERES

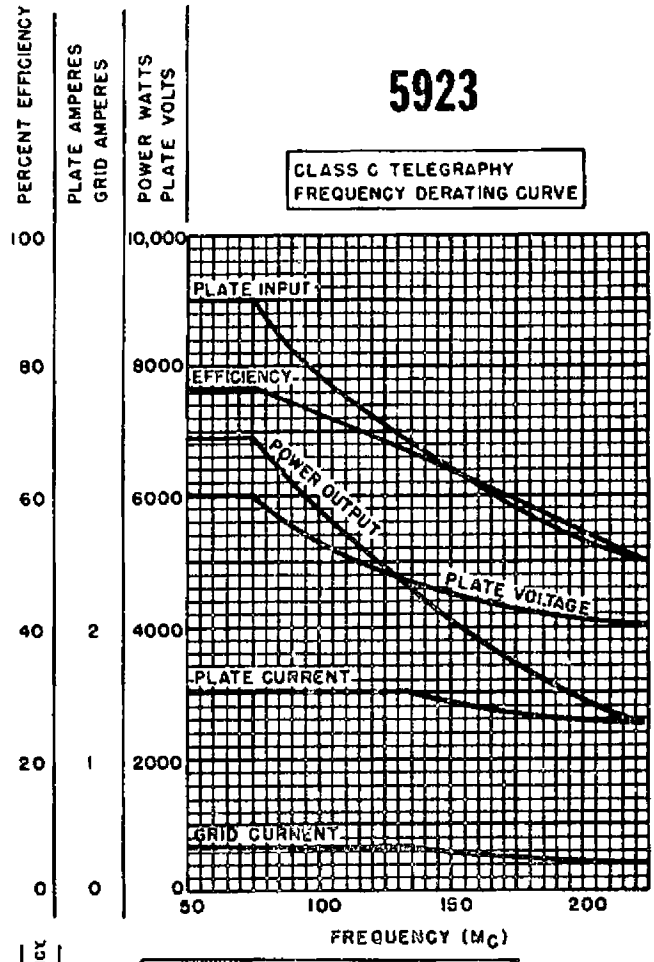

GRID AMPERES
PLATE KILOVOLTS
Eb = Ec
GRID VOLTS = 450 V
400
350
300
250
200
150
100
50
0

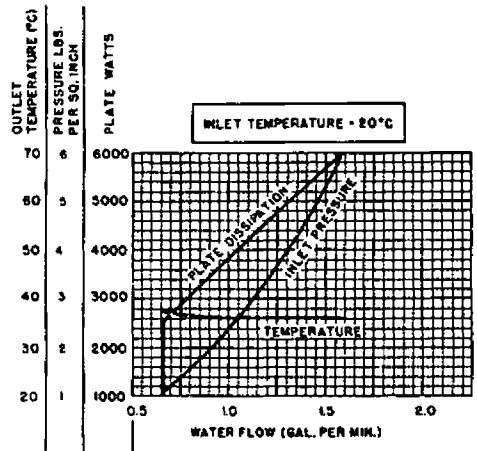

PLATE AMPERES
PLATE KILOVOLTS
Eb = Ec
GRID VOLTS
450
400
350
300
250
200
150
100
50
0
-50
-100

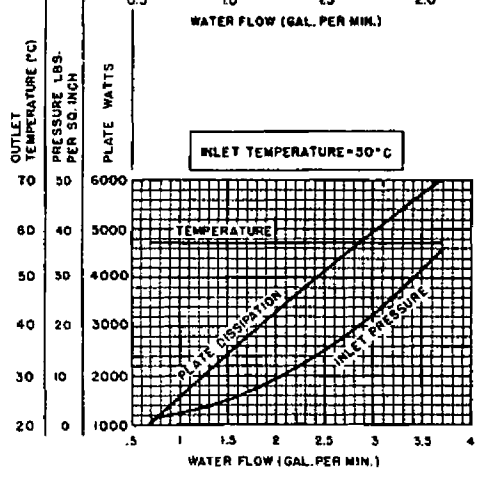

PLATE AMPERES
GRID VOLTS
PLATE VOLTS = 6000
5000
4000
3000
2000

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CLASS C TELEGRAPHY
FREQUENCY DERATING CURVE

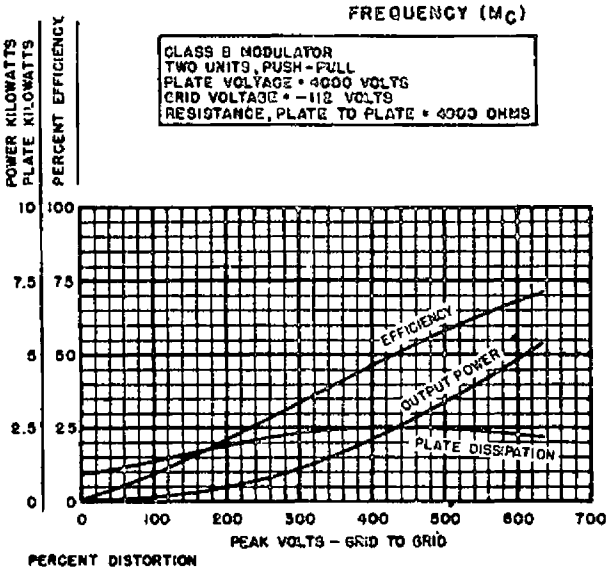




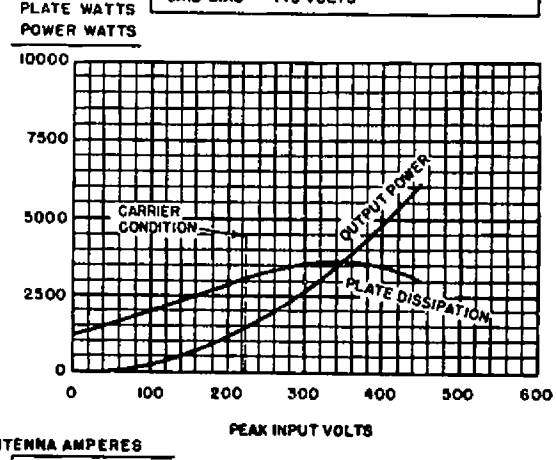


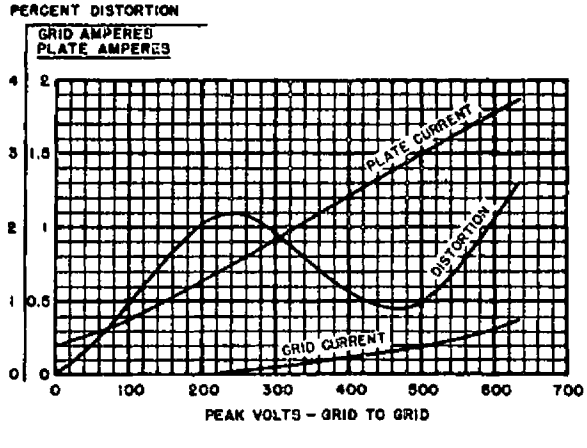
NOTE:
AT INLET TEMPERATURES BETWEEN 20°C AND 50°C, THE REQUIRED WATER FLOW CAN BE FOUND BY PROPORTIONAL INTERPOLATION.

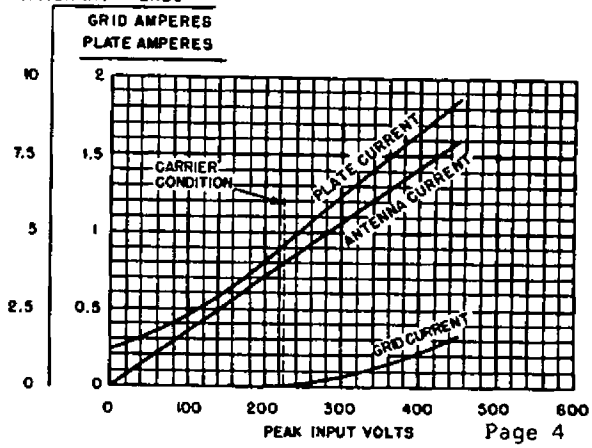
CLASS B MODULATOR
TWO UNITS, PUSH-PULL
PLATE VOLTAGE = 4000 VOLTS
GRID VOLTAGE = −112 VOLTS
RESISTANCE, PLATE TO PLATE = 4000 OHMS



CLASS B TELEPHONY
WAVE LENGTH = 75 MC/SEC
PLATE VOLTAGE = 5000 VOLTS
GRID BIAS = −145 VOLTS







TUBE TYPE 5924

The 5924 is a three-electrode tube designed for use as a radio-frequency power amplifier, modulator and oscillator. The anode is capable of dissipating 5 kilowatts and is forced-air cooled. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 75 mc. At reduced ratings it may be operated up to 220 mc.

ELECTRICAL DATA	Min.	Bogey	Max.	
Filament Voltage	12.0	12.6	13.2	volts
Filament Current at Bogey Voltage	30	33	36	amps
Amplification Factor (I_b=1 amp, E_b=4000 volts)	26	32	38	
Direct Interelectrode Capacitances				
Grid to Plate	9.5	11.0	1.25	uuf
Grid to Filament	13	16	19	uuf
Plate to Filament	0.2	0.3	0.4	uuf
Transconductance (Grid to Plate) (I_b=1.0 amps)			17,000	micromhos
Peak Cathode Current[1]			10	amps

MECHANICAL DATA	
Max. Overall Dimensions	
Length	6-7/8 inches
Diameter	4-7/8 inches
Mounting Position-Vertical	Radiator up or down
Type of Cooling	Forced-air
Plate Dissipation	5 KW
Air Flow to Radiator	325 CFM
Back Pressure	2.7 inches water
Max. Incoming Air Temperature	45° C
Max. Glass Temperature	180° C
Net Weight of Tube (approx.)	10 Lbs.
Accessories	
Filament Connector	Amperex # S-3707
Grid Connector	Amperex # S-3706
Air Flow Chamber	Amperex # S-3705

[1] Represents maximum usable cathode current for any condition of operation.

AMPEREX

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage[2]	6000	volts max.
Max. Signal D.C. Plate Current[2]	1.5	amps max.
Max. Signal Plate Input[2]	9000	watts max.
Plate Dissipation[2]	5000	watts max.
Grid Resistor	15,000	ohms max.

[2] Averaged over any audio-frequency cycle of sine-wave form.

Typical Operation

(Unless otherwise specified, values are for 2 tubes)

	CCS	CCS	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	6000	5000	4500	4000	3500	3000	volts
D.C. Grid Voltage	-165	-138	-125	-112	-100	-90	volts
Peak A.F. Grid to Grid Voltage	910	661	655	632	618	570	volts
Zero Signal D.C. Plate Current	250	220	200	200	150	130	ma
Max. Signal D.C. Plate Current	3000	1820	1840	1880	1900	1600	ma
Effective Load Resistance, Plate to Plate	4900	6400	6100	4900	4200	4400	ohms
Max. Signal Driving Power(approx.)	230	84	54	108	100	104	watts
Max. Signal Power Output(approx.)	13.3	6.6	6.0	5.3	4.6	3.3	KW

PLATE-MODULATED R.F. POWER AMPLIFIER - CLASS C TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Mamimum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage[3]	5000	volts max.
D.C. Grid Voltage[3]	-1000	volts max.
D.C. Plate Current[3]	1.3	amps max.
D.C. Grid Voltage	0.35	amp max.
Plate Input[3]	6.5	KW max.
Plate Dissipation	4	KW max.

Typical Operation

	CCS	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	5	4.5	4	3.5	3	KV
D.C. Grid Voltage[4]	-400	-350	-300	-300	-250	volts
Peak R.F. Grid Voltage	690	650	600	600	510	volts
D.C. Plate Current	1.2	1.2	1.2	1.2	1.0	amps
D.C. Grid Current (approx.)	0.3	0.3	0.3	0.3	0.3	amp
Driving Power (approx.)	190	180	165	165	140	watts
Power Output (approx.)	4.7	4.1	3.5	3.0	2.2	KW

MAXIMUM RATINGS AS A FUNCTION OF FREQUENCY

Frequency (mc)	up to 75	up to 110[5]	up to 220[5]
D.C. Plate Voltage (volts)	5000	4000	3200
D.C. Plate Current (amps)	1.3	1.3	1.1
Plate Input (KW)	6.5	5.2	3.5

[3] This data applies up to 75 megacycles.

[4] Grid Bias partially obtained by the grid resistor.

[5] When using the tube above 110 megacycles, particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc. can only be given after approval of the prototype circuit.

R.F. POWER AMPLIFIER & OSCILLATOR - CLASS C TELEGRAPHY

(Key-down conditions per tube without amplitude modulation[6])

Maximum ratings, Absolute Values

	CCS	
D.C. Plate Voltage[7]	6000	volts max.
D.C. Grid Voltage	-1000	volts max.
D.C. Plate Current[7]	1.5	amps max.
D. C. Grid Current	0.35	amps max.
Plate Input[7]	9000	watts max.
Plate Dissipation	5000	watts max.

Typical Operation, Grounded-Filament Circuit

	CCS	CCS	CCS	
Frequency	75	75	75	mc.
D.C. Plate Voltage	6	5	4	KV
D.C. Grid Voltage	-400	-300	-200	volts
Peak R.F. Grid Voltage	740	640	500	volts
D.C. Plate Current	1.5	1.5	1.37	amps
D.C. Grid Current (approx.)	0.31	0.33	0.35	amp
Driving Power	210	190	160	watts
Power Output (approx.)	6.9	5.6	4.0	KW

Typical Operation, Grounded-Grid Circuit, Two Tubes

	CCS	CCS	CCS	CCS	
Frequency	75	110	110	220	mc.
D.C. Plate Voltage	6	5	4	4	KV
D.C. Grid Voltage	400	300	200	200	volts
Peak R.F., Grid Voltage	740	640	500	450	volts
D.C. Plate Current	3	3	2.75	2.5	amps
D.C. Grid Current (approx.)	0.62	0.66	0.70	0.40	amp
Driving Power	2240	1840	1350	760	watts
Power Output (approx.)[8]	15.6	12.1	8.6	5.6	KW

Maximum Ratings as a Function of Frequency

Frequency (mc)	up to 75	up to 110[9]	up to 220[9]
D.C. Plate Voltage (volts)	6000	5000	4000
D.C. Plate Current (amps)	1.5	1.5	1.25
Plate Input (KW)	9.0	7.5	5.0

[6]Modulation essentially negative may be used if the positive peak of the envelop does not exceed 115 per cent of the carrier conditions.

[7]This data applies up to 75 megacycles.

[8]Power transferred from driving stage included.

[9]When using the tube above 110 megacycles, particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc. can only be given after approval of the prototype circuit.

R.F. POWER AMPLIFIER - CLASS B

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage[10]	6000	volts max.
D.C. Plate Current[10]	1.1	amps max.
Plate Input[10]	6600	watts max.
Plate Dissipation	5000	watts max.

Typical Operation

	CCS	CCS	
D.C. Plate Voltage	6	5	KV
D.C. Grid Voltage	-180	-145	volts
Peak R.F. Grid Voltage	250	225	volts
D.C. Plate Current	0.99	0.9	amp
Driving Power (approx.)[11]	140	130	watts
Power Output (approx.)	1.9	1.45	KW

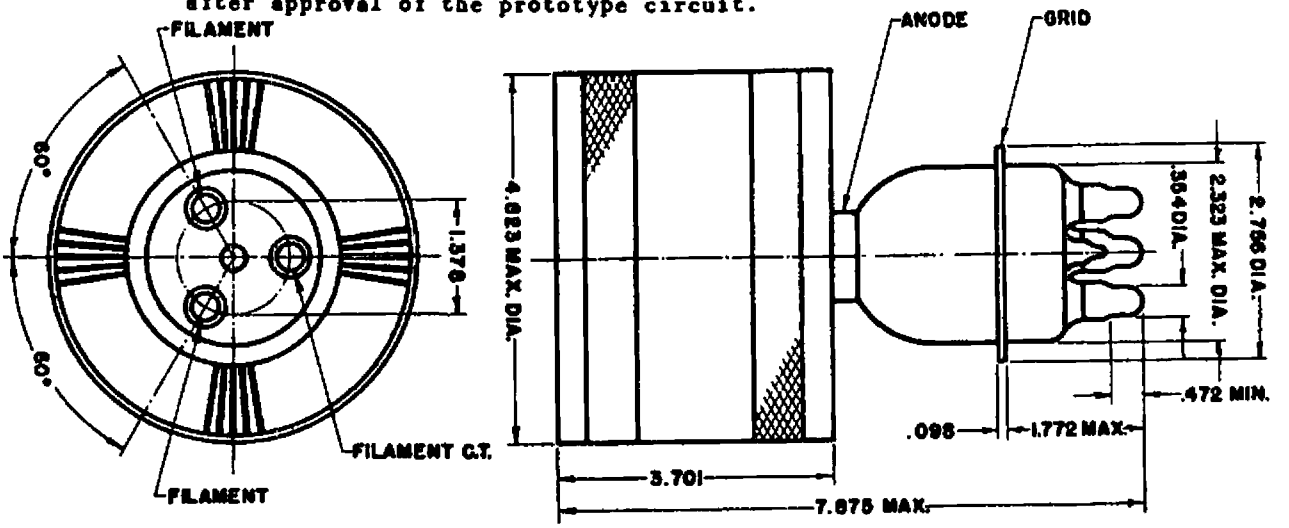
Maximum Ratings as A Function of Frequency

Frequency (mc)	up to 75	up to 110[12]	up to 220[12]
D.C. Plate Voltage (volts)	6000	5000	4000
D.C. Plate Current (amps)	1.1	1.1	0.9
Plate Input (KW)	6.0	5.5	3.6

[10]This data applies up to 75 megacycles.

[11]At crest of audio-frequency cycle with modulation factor of 1.0.

[12]When using the tube above 110 megacycles, particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc. can only be given after approval of the prototype circuit.



Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage[13]	6000	volts max.
D.C. Grid No. 1 Voltage-White Level	-1000	volts max.
Plate Current (sync.)[13]	1.9	amps max.
Plate Input (sync.)[13]	11.4	KW max.
Plate Dissipation (sync.)	5	KW max.
Grid No. 1 Dissipation (sync.)	120	watts max.

Typical Operation in Television Service at 75 mc. and Bandwidth of 5.25 mc. at 85% Antenna Current and 8 mc. at 70% Antenna Current (Values for 2 tubes, Push-Pull)

D.C. Plate Voltage	5000	volts
D.C. Grid No. 1 Voltage		
Synchronizing Level	-200	volts
Pedestal Level	-300	volts
White Level	-550	volts
R.F. Grid No. 1 Voltage, Peak to Peak		
Synchronization Level	1000	volts
D.C. Plate Current		
Synchronization Level	3.8	amps
Pedestal Level	2.6	amps
D.C. Grid Current (approx.)		
Synchronization Level	0.5	amp.
Pedestal Level	0.35	amp.
Driving Power at Synchronization Level (approx.)	250	watts
Power Output (approx.)		
Synchronization Level	9	KW
Pedestal Level	5.35	KW

Maximum Ratings as a Function of Frequency

Frequency (mc)	up to 75	up to 110[14]	up to 220[14]
D.C. Plate Voltage (volts)	6000	5000	4500
Plate Current (sync.) (amps)	1.9	1.9	1.9
Plate Input (sync.) (KW)	11.4	9.5	8.5

[13]This data applies up to 75 megacycles.

[14]When using the tube above 110 megacycles, particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc. can only be given after approval of the prototype circuit.

R.F. AMPLIFIER - CLASS B - TELEVISION SERVICE

Negative Modulation and Positive Synchronization

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage[15]	6000	volts max.
D.C. Grid Voltage	1000	volts max.
D.C. Plate Current (sync.)[15]	1.9	amps max.
Plate Input[15]	11,400	watts max.
Plate Dissipation	5000	watts max.
Grid Dissipation	120	watts max.

Typical Operation in Television Service at 75 mc. and Bandwidth of 5.25 mc. at 85% Antenna Current and 8 mc. at 70% Antenna Current (Values for 2 Tubes, Push-Pull)

D.C. Plate Voltage	5000	volts
D.C. Grid Voltage	-200	volts
R.F. Grid Voltage, Peak to Peak		
Synchronization Level	1000	volts
Pedestal Level	800	volts
White Level	0	volts
D.C. Plate Current		
Synchronization Level	3.8	amps
Pedestal Level	3	amps
White Level	0.2	amp
D.C. Grid Current		
Synchronization Level	0.5	amp
Pedestal Level	0.22	amp
White Level	0	amp
Driving Power at Synchronization Level (approx.)	250	watts
Power Output (approx.)		
Synchronization Level	9	KW
Pedestal Level	5.35	KW

Maximum Ratings As A Function Of Frequency

Frequency	up to 75	up to 110[16]	up to 220[16]
D.C. Plate Voltage (volts)	6000	5000	4500
Plate Current (sync.) (amps)	1.9	1.9	1.9
Plate Input (KW)	11.4	9.5	8.5

[15]This data applies up to 75 megacycles.

[16]When using the tube above 110 mc. particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc. can only be given after approval of the prototype circuit.

OSCILLATOR - CLASS C - RECTIFIED, UNFILTERED, SINGLE-PHASE, FULL-WAVE PLATE SUPPLY

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage[17]	5400	volts max.
D.C. Grid Voltage	-900	volts max.
D.C. Plate Current[17]	1.35	amps max.
D.C. Grid Current	0.31	amp max.
Plate Input[17, 18]	9000	watts max.
Plate Dissipation	5000	watts max.
Grid Dissipation	120	watts max.

Typical Operation

	CCS	CCS	
Transformer Voltage	6000[19]	5100[21]	volts, rms
D.C. Plate Voltage	5.4	4.6	KV
D.C. Plate Current	1.35	1.15	amps
D.C. Grid Current	0.31	0.27	amp
Grid Resistor	1300	1100	ohms
Plate Input	9	6.5	KW
Plate Dissipation	2.3	1.84	KW
Driving Power at Tube[20] (approx.)	210	160	watts
Power Output (approx.)	6.5	4.5	KW

Maximum Ratings As a Function Of Frequency

Frequency (mc)	up to 75	up to 110[22]	up to 220[22]
D.C. Plate Voltage	5400	4500	3600
D.C. Plate Current (amps)	1.35	1.35	1.1
Plate Input (KW)	9.0	7.5	5.0

[17]This data applies up to 75 megacycles

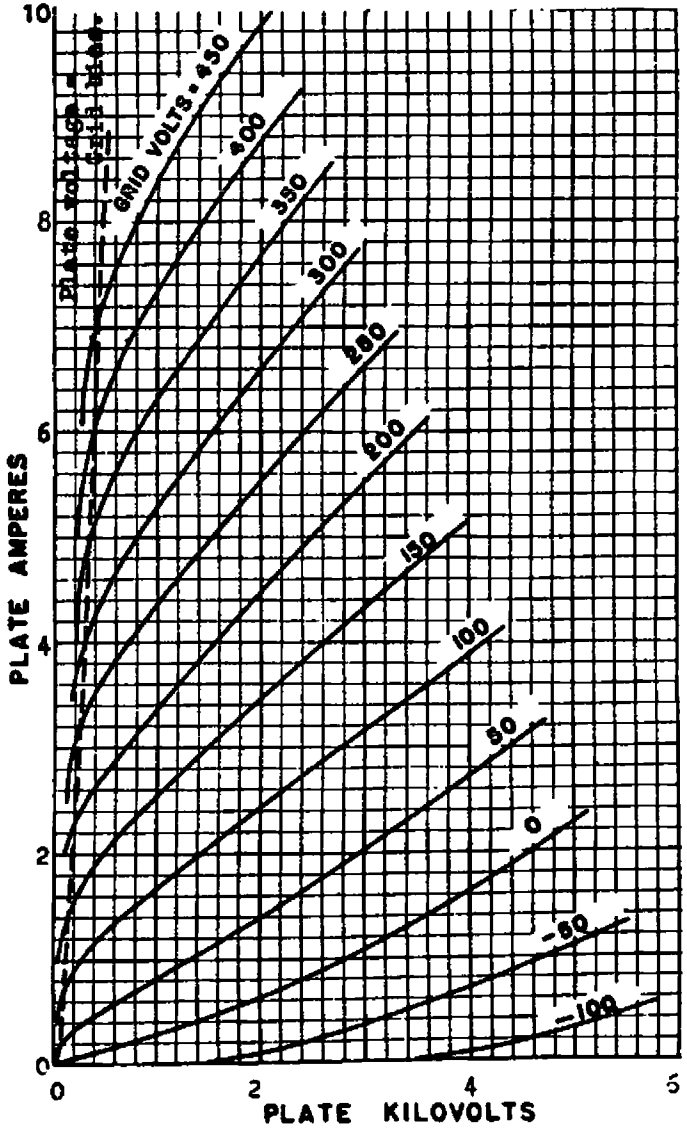
[18]Plate input is 1.23 times the product of D.C. Plate Voltage and D.C. Plate Current.

[19]Care must be taken that, under these operating conditions, the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

[20]From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

[21]Under these conditions normal deviations of voltages and load are permissable. The absolute limiting values of the tube must, however, not be exceeded.

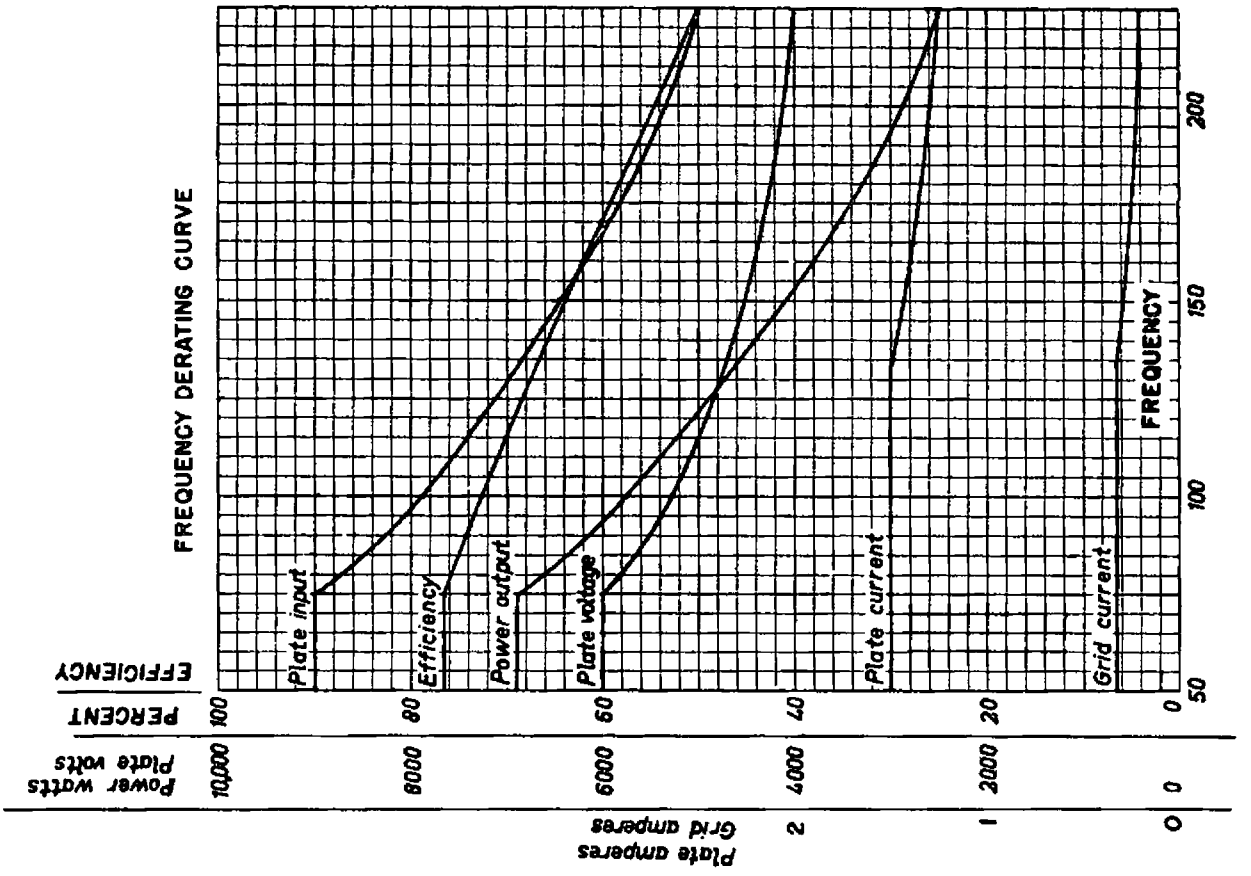
[22]When using the tube above 110 mc., particular attention must be given to a careful design of the installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc. can only be given after approval of the prototype circuit.

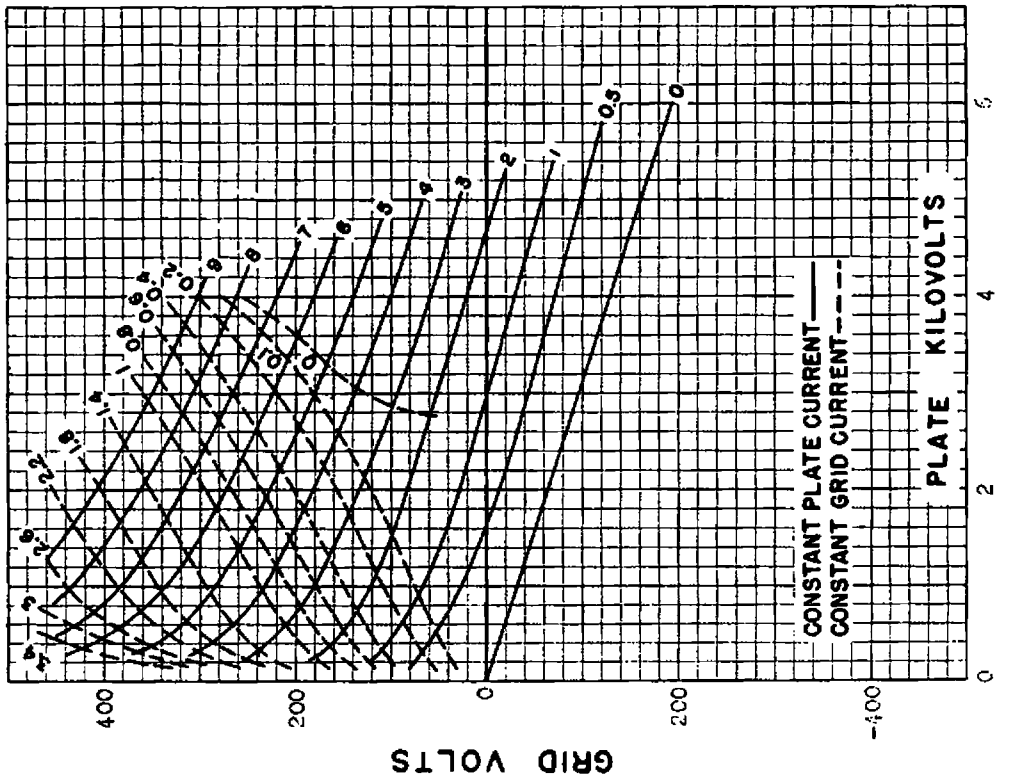


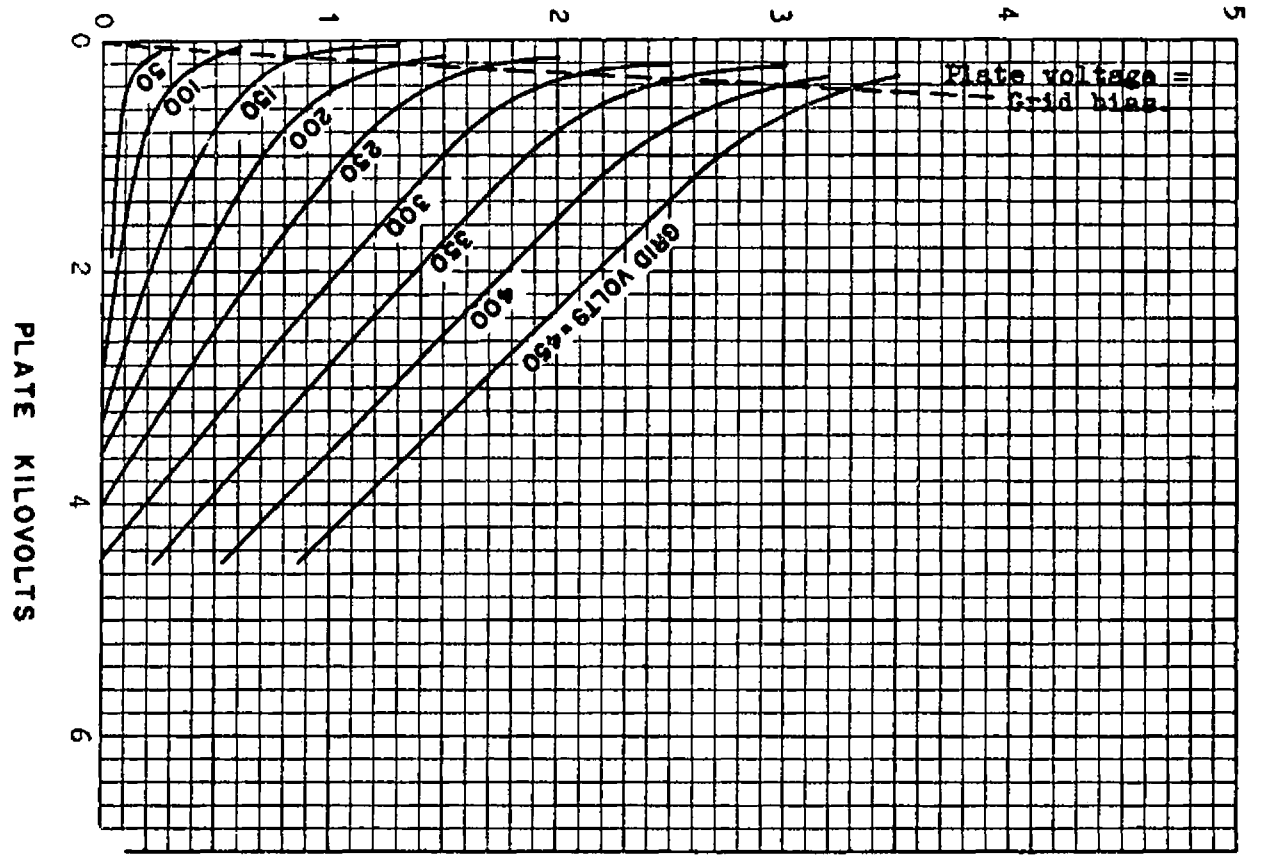
ELECTRICAL DATA & LIMITS

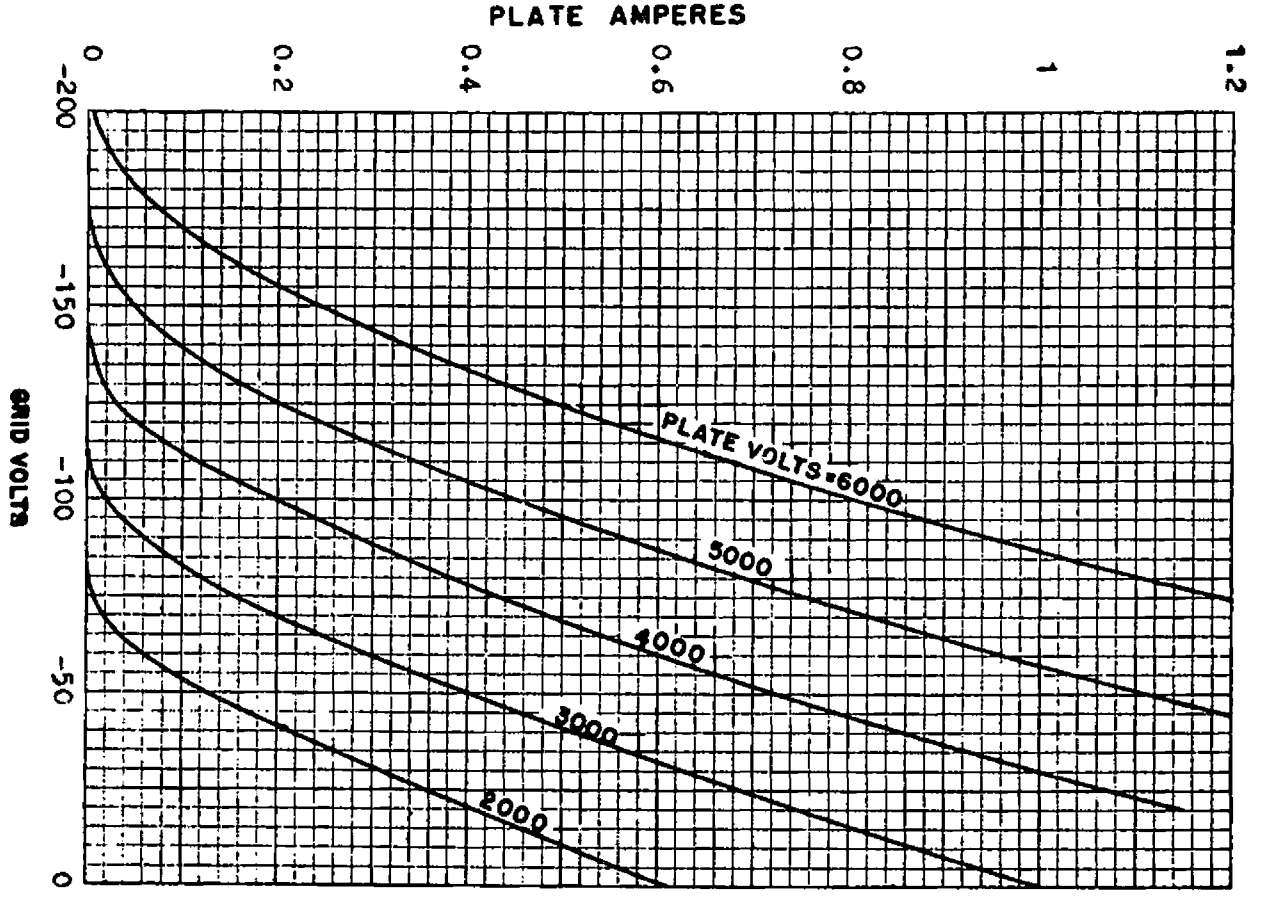
CHARACTERISTIC	CONDITIONS	LIMITS MIN.	BOGEY	MAX.
Grid Voltage[23]	E_b = 1000 volts I_b = 6 amps	E_c: -	-	420 volts
Grid Current[23]	E_b = 1000 volts I_b = 6 amps	ic: -	-	2.5 amps
Plate Current	E_b = 6000 volts E_c = -188 volts	I_b: -	-	130 ma
Grid Current	E_b = 6000 volts E_c = 0.85 amp	ic: -	-	40 microamps
Grid Voltage	E_c = 6000 volts I_b = 0.85 amp	E_c: 67	94	121 volts
Power Output	E_b = 6000 volts I_b = 1.5 amps E_c = -400 volts I_c = 0.31 amp f = 75 megacycles	Po: 6	-	- KW

[23]This data is given only for design purposes, not for measurements.


FREQUENCY DERATING CURVE
EFFICIENCY
PERCENT
Power watts
Plate volts
Plate amperes
Grid amperes
Plate input
Efficiency
Power output
Plate voltage
Plate current
Grid current
FREQUENCY


GRID VOLTS
PLATE KILOVOLTS
CONSTANT PLATE CURRENT——
CONSTANT GRID CURRENT- - - -


GRID AMPERES
PLATE KILOVOLTS
Plate voltage =
Grid bias.
50
100
150
200
250
300
350
400
GRID VOLTS = 450
0
1
2
3
4
5
2
4
6


PLATE AMPERES
GRID VOLTS
0
0.2
0.4
0.6
0.8
1
1.2
-200
-150
-100
-50
0
PLATE VOLTS = 6000
5000
4000
3000
2000

AMPEREX

AMPEREX TUBE TYPE 5924A

The 5924A is a forced air-cooled three electrode tube designed for use as a power amplifier in TV and FM transmitters. The filament is thoriated tungsten. Maximum ratings apply up to 75 megacycles. At reduced ratings it may be operated up to 220 megacycles. All external surfaces are silver plated and the anode cooler shell is brazed to the cooler fins.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Bogey	Max.
Filament Voltage	12.0	12.6	13.2 volts
Filament Current at Bogey Voltage	30	33	36 amperes
Amplification Factor (Ib=1 amp, Eb=4000 volts)	26	32	38
Peak Cathode Current[1]	—	—	10 amperes
Direct Interelectrode Capacitances			
Grid to Plate	9.5	11	12.5 μμf
Grid to Filament	13	16	19 μμf
Plate to Filament	0.2	0.3	0.4 μμf

MECHANICAL

Mounting position: vertical with plate up or down
Max. Temperature of Seals . . . . . 180°C
Cooling — forced air

COOLING CHARACTERISTICS (see curves)

Plate Dissipation (kilowatts)	Altitude (feet)	Inlet Air Temperature (°C)	Min. Air Flow (cu. ft./minute)	Inlet Air Pressure (inches water)
1	0	35	106	0.32
	0	45	109	0.32
	5000	35	131	0.35
	10000	25	145	0.39
3	0	35	183	0.90
	0	45	215	1.14
	5000	35	219	1.03
	10000	25	233	1.03
5	0	35	325	2.68
	0	45	378	3.55
	5000	35	396	3.19
	10000	25	410	3.10

ACCESSORIES

Filament Connector . . . . . Amperex #S-3707
Grid Connector . . . . . Amperex #S-3706
Air Flow Chamber . . . . . Amperex #S-3705

Net Weight (approx.) . . . . . 10 pounds

[1] Represents maximum usable cathode current for any condition of operation.

5924A

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

R.F. Power Amplifier and Oscillator - Class C Telegraphy

Key-down conditions per tube without amplitude modulation.

Maximum Ratings, Absolute Values (per Tube)

	CCS
D.C. Plate Voltage	6000 volts max.
D.C. Grid Voltage	−1000 volts max.
D.C. Plate Current	1.5 amps max.
D.C. Grid Current	0.35 amp max.
Plate Input	9000 watts max.
Plate Dissipation	6000 watts max.

Typical Operation; Grounded-Filament Circuit

	CCS	CCS	CCS	
Frequency	75	75	75	megacycles
D.C. Plate Voltage	6	5	4	kilovolts
D.C. Grid Voltage	−400	−300	−200	volts
Peak R.F. Grid Voltage	740	640	500	volts
D.C. Plate Current	1.5	1.5	1.37	amps
D.C. Grid Current approximate	0.31	0.33	0.35	amps
Driving Power	210	190	160	watts
Power Output, approximate	6.9	5.6	4.0	kilowatts

Typical Operation, Grounded-Grid Circuit, Two Tubes

	CCS	CCS	CCS	CCS	
Frequency [1]	75	110	110	220	megacycles
D.C. Plate Voltage	6	5	4	4	kilovolts
D.C. Grid Voltage	400	-00	200	200	volts
Peak R.F. Grid Voltage	740	640	500	450	volts
D.C. Plate Current	3	3	2.75	2.5	amps
D.C. Grid Current approximate	0.62	0.66	0.70	0.40	amp
Driving Power	2240	1840	1350	760	watts
Power Output approximate [2]	15.6	12.1	8.6	5.6	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc	Up to 220 Mc [1]	
D.C. Plate Voltage	6000	5000	4000	volts
D.C. Plate Current	1.5	1.5	1.5	amps
Plate Input	9000	7500	5000	watts

R.F. Power Amplifier - Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values (per Tube)

	CCS
D.C. Plate Voltage	6000 volts max.
D.C. Plate Current	1.1 amps max.
Plate Input	6600 watts max.
Plate Dissipation	6000 watts max.

Typical Operation

	CCS	CCS	
D.C. Plate Voltage	6	5	kilovolts
D.C. Grid Voltage	−180	−145	volts
Peak R.F. Grid Voltage	250	225	volts
D.C. Plate Current	0.99	0.9	amp
Driving Power, approximate [3]	140	130	watts
Power Output, approximate	1.9	1.45	kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc	Up to 220 Mc [1]	
D.C. Plate Voltage	6000	5000	4000	volts
D.C. Plate Current	1.1	1.1	0.9	amps
Plate Input	6600	5500	3600	watts

Grid-Modulated R.F. Power Amplifier Class C Television Service

Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values (per Tube)

	CCS	
D.C. Plate Voltage	6000	volts
D.C. Grid No. 1 Voltage White Level	1000	volts
Plate current (sync.)	1.9	amps
Plate Input (sync.)	11.4	kilowatts
Plate Dissipation	6	kilowatts
Grid Dissipation	120	watts

Typical Operation in Television Service at 75 Mc and Bandwidth of 5.25 Mc at 85% Antenna Current and 8 Mc at 70% Antenna Current (Two Tubes, Push-Pull)

D.C. Plate Voltage	6000 volts
D.C. Grid No. 1 Voltage	
Synchronizing Level	−200 volts
Pedestal Level	−300 volts
White Level	−550 volts
R.F. Grid No. 1 Voltage Peak to Peak Synchronization Level	1000 volts
D.C. Plate Current	
Synchronization Level	3.8 amps
Pedestal Level	2.6 amps
D.C. Grid Current, approximate	
Synchronization Level	0.5 amp
Pedestal Level	0.35 amp
Driving Power at Synchronization Level, approximate	250 watts
Power Output, approximate	
Synchronization Level	9 kilowatts
Pedestal Level	5.35 kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 110 Mc	Up to 220 Mc [1]	
D.C. Plate Voltage	6000	6000	4500	volts
Plate Current (sync.)	1.9	1.9	1.9	amps
Plate Input (sync.)	11.4	9.5	8.5	kw

[1] When using the tube above 110 megacycles, particular attention must be given to a careful design of installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 Mc can only be given after approval of the prototype circuit by Amperex.

[2] Power transferred from driving stage included.

[3] At crest of audio-frequency cycle with modulation factor of 1.0

R.F. Amplifier - Class B Television Service

Negative Modulation and Positive Synchronization

Maximum Ratings, Absolute Values (per Tube)

	CCS
D.C. Plate Voltage	6000 volts max.
D.C. Grid Voltage	−1000 volts max.
D.C. Plate Current (sync.)	1.9 amps max.
Plate Input (sync.)	11,400 watts max.
Plate Dissipation (sync.)	6000 watts max.
Grid Dissipation (sync.)	120 watts max.

pical Operation in Television Service at 75 Mc and ndwidth of 5.25 Mc at 85% Antenna Current and 8 Mc at 70% Antenna Current (Two tubes, Push-Pull)

C. Voltage	5000 volts
C. Grid Voltage	−200 volts
.F. Grid Voltage Peak to Peak	
Synchronization Level	1000 volts
Pedestal Level	800 volts
White Level	0 volt
D.C. Plate Current	
Synchronization Level	3.8 amps
Pedestal Level	3 amps
White Level	0.2 amp
D.C. Grid Current	
Synchronization Level	0.5 amp
Pedestal Level	0.22 amp
White Level	0 amp
Driving Power at Synchronization Level, approximate	250 watts
Power Output, approximate	
Synchronization Level	9 kilowatts
Pedestal Level	5.35 kilowatts

Max. Ratings (per Tube)	Up to 75 Mc	Up to 220 Mc
D.C. Plate Voltage	6000	5000 volts
D.C. Plate Current (sync.)	1.9	1.9 amps
Plate Input (sync.)	11.4	9.5 kilowatts

Typical Operation in Television Service at 216 Mc.

One tube in a coaxial cavity

(Bandwidth obtained by critical coupling to identical dummy cavity)

D.C. Plate Voltage	4000	5000* volts
D.C. Grid Voltage	−125	−140 volts
Peak R.F. Grid Voltage		
Synchronization Level	405	495 volts
Black Level	305	360 volts
White Level	0	0 volts
C. Plate Current		
ynchronization Level	1.59	1.90 amps
Black Level	1.3	1.53 amps
White Level	0.4	0.4 amps
D.C. Grid Current (approx.)		
Synchronization Level	0.35	0.35 amps
Black Level	0.125	0.125 amps
White Level	0	0 amps
Power Output (approx.)		
Synchronization Level	5.0	6.25 kilowatts
Black Level	3.0	3.53 kilowatts
Power Input		
Synchronization Level	7.15	9.50 kilowatts
Black Level	5.85	7.65

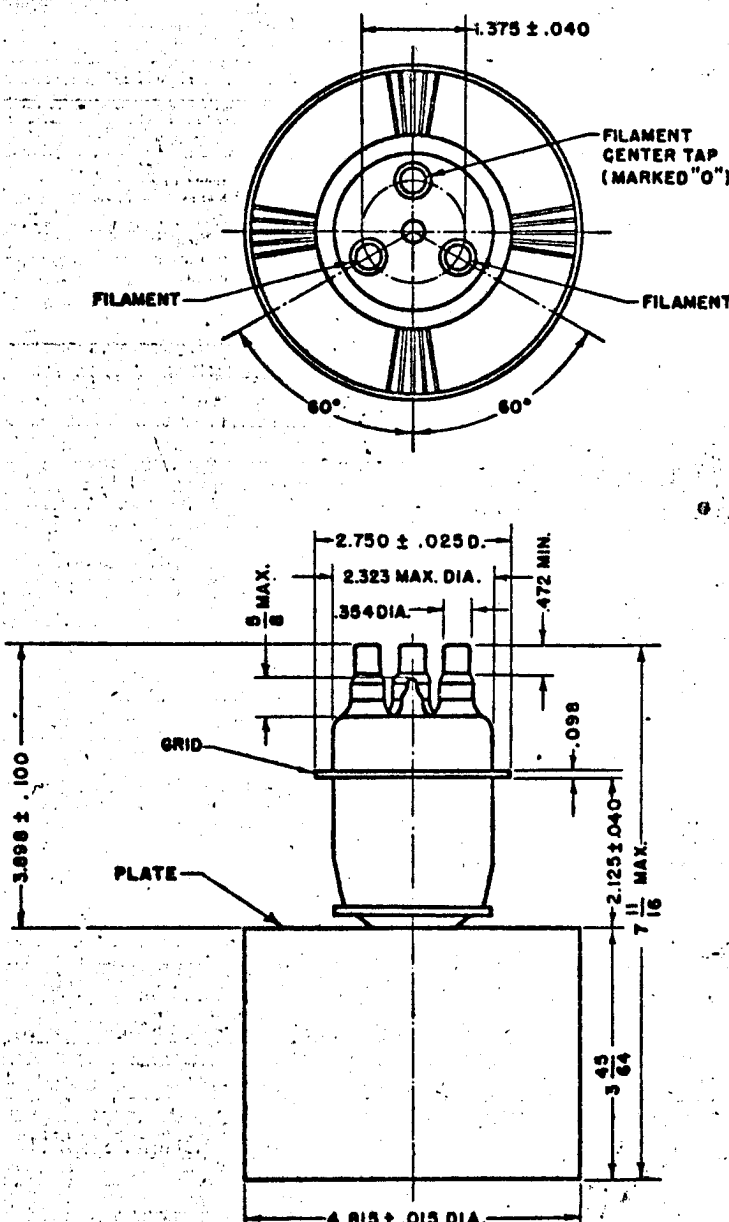
Electrical Data and Limits

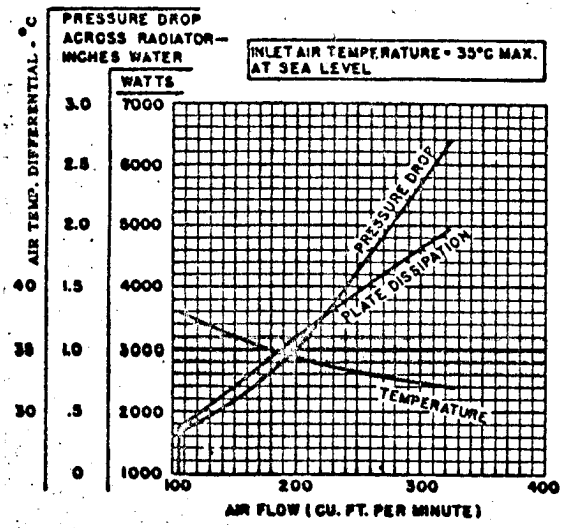
Characteristics	Description		Limits Min.	Bogey	Max.
Grid Voltage [4]	Eb = 1000 volts Ib = 6 amps	Ec:	—	——	420 volts
Grid Current [4]	Eb = 1000 volts Ib = 6 amps	Ic:	—	——	2.8 amps
Plate Current	Eb = 6000 volts Ec = −188 volts	Ib:	—	——	130 milliamps
Grid Current	Eb = 6000 volts Ib = 0.85 amp	Ic:	—	——	40 microamps
Grid Voltage	Eb = 6000 volts Ib = 0.85 amp	Ec:	67	94	121 volts
Power Output	Eb = 6000 volts Ib = 1.5 amps Ec = −400 volts Ic = 0.31 amp f = 75 mc	Po:	6	——	—— kilowatts

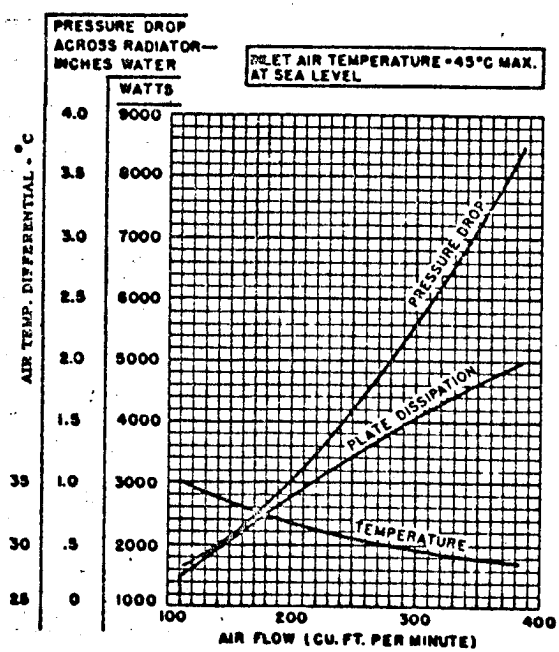
[4] This data is given only for design purposes, not for measurements.

* NOTE: Maximum TV ratings up to 220 Mc are for 25 KW peak power output with 4 tubes operating in approved cavity construction.

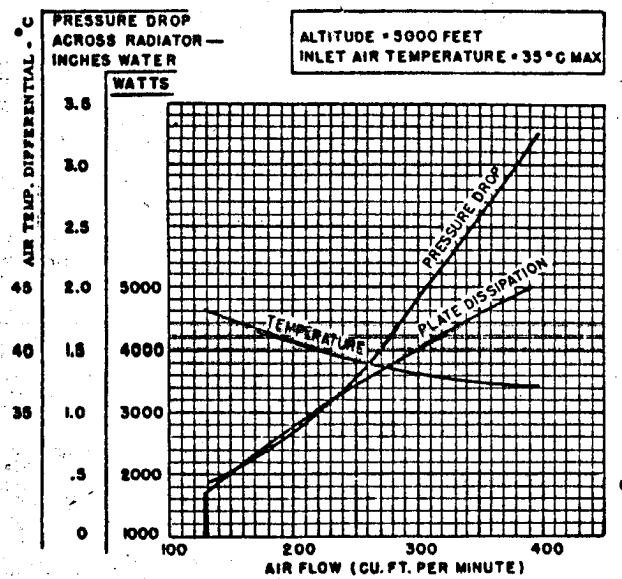
5924A

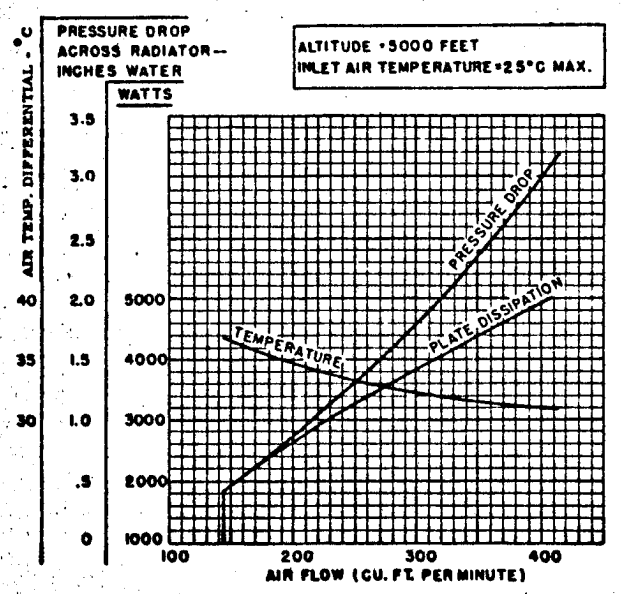

1.375 ± .040
FILAMENT CENTER TAP (MARKED "0")
FILAMENT
FILAMENT
60°
60°
2.750 ± .025 D.
2.323 MAX. DIA.
.354 DIA.
.472 MIN.
9/16 MAX.
.098
GRID
PLATE
3.898 ± .100
2.125 ± .040
7 11/16 MAX.
3 43/64
4.815 ± .015 DIA.

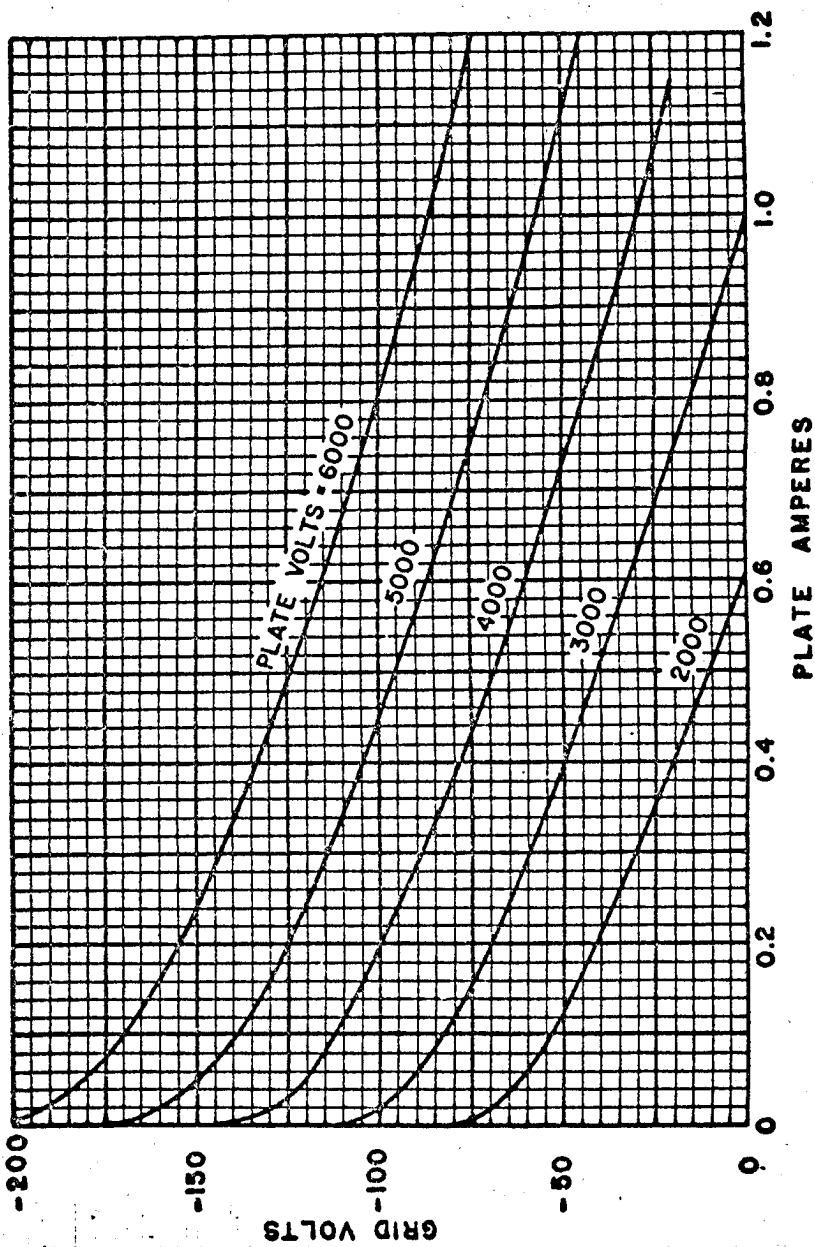

PRESSURE DROP ACROSS RADIATOR— INCHES WATER
WATTS
INLET AIR TEMPERATURE - 35°C MAX. AT SEA LEVEL
AIR TEMP. DIFFERENTIAL - °C
3.0
2.5
2.0
1.5
1.0
.5
0
7000
6000
5000
4000
3000
2000
1000
40
35
30
PRESSURE DROP
PLATE DISSIPATION
TEMPERATURE
100
200
300
400
AIR FLOW (CU. FT. PER MINUTE)


PRESSURE DROP ACROSS RADIATOR— INCHES WATER
WATTS
INLET AIR TEMPERATURE - 45°C MAX. AT SEA LEVEL
AIR TEMP. DIFFERENTIAL - °C
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
9000
8000
7000
6000
5000
4000
3000
2000
1000
35
30
25
PRESSURE DROP
PLATE DISSIPATION
TEMPERATURE
100
200
300
400
AIR FLOW (CU. FT. PER MINUTE)

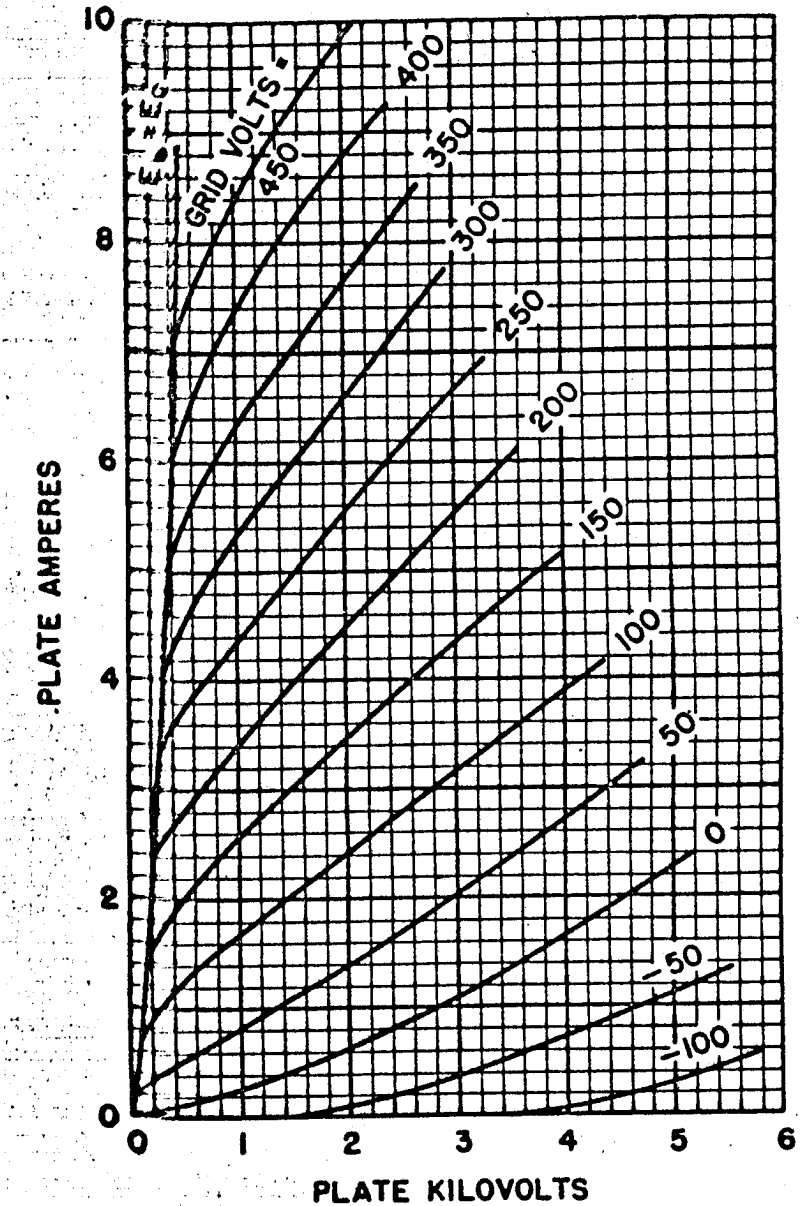
5924A

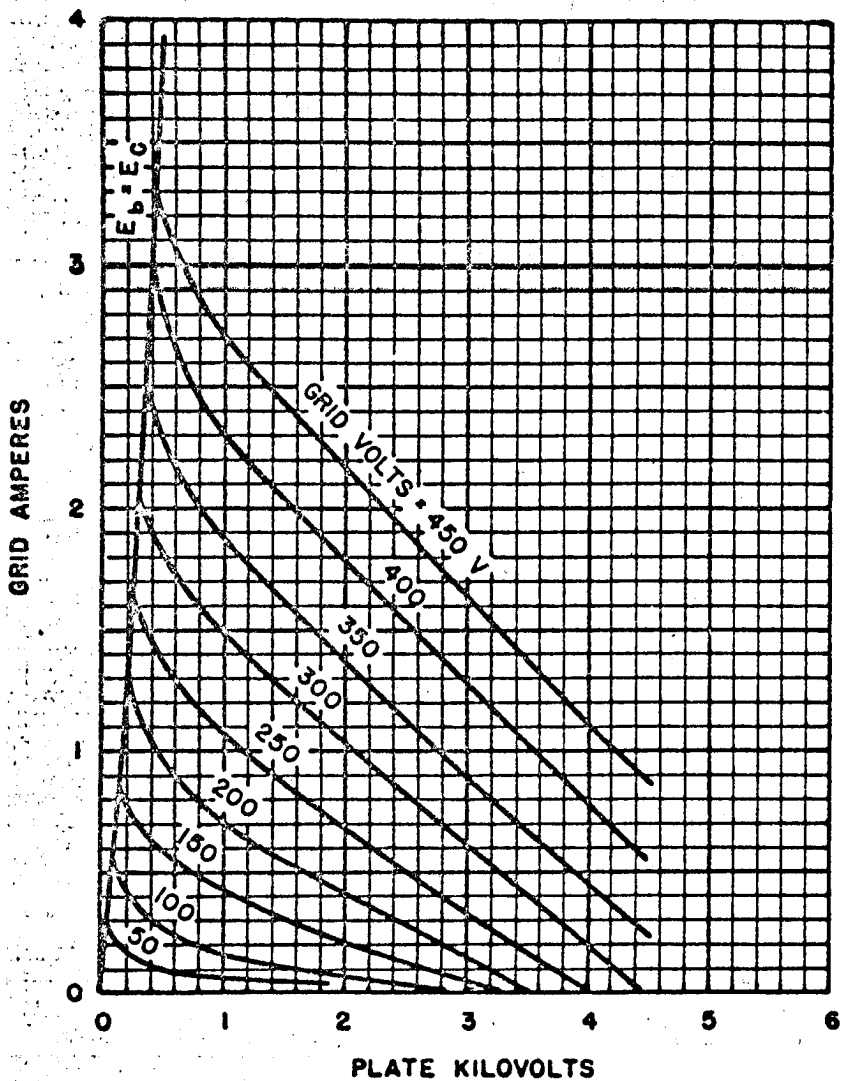

PRESSURE DROP ACROSS RADIATOR — INCHES WATER
WATTS
AIR TEMP. DIFFERENTIAL - °C
ALTITUDE - 5000 FEET
INLET AIR TEMPERATURE - 35°C MAX
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
5000
4000
3000
2000
1000
45
40
35
100
200
300
400
PRESSURE DROP
PLATE DISSIPATION
TEMPERATURE
AIR FLOW (CU. FT. PER MINUTE)


PRESSURE DROP ACROSS RADIATOR — INCHES WATER
WATTS
AIR TEMP. DIFFERENTIAL - °C
ALTITUDE - 5000 FEET
INLET AIR TEMPERATURE - 25°C MAX.
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
5000
4000
3000
2000
1000
40
35
30
100
200
300
400
PRESSURE DROP
PLATE DISSIPATION
TEMPERATURE
AIR FLOW (CU. FT. PER MINUTE)

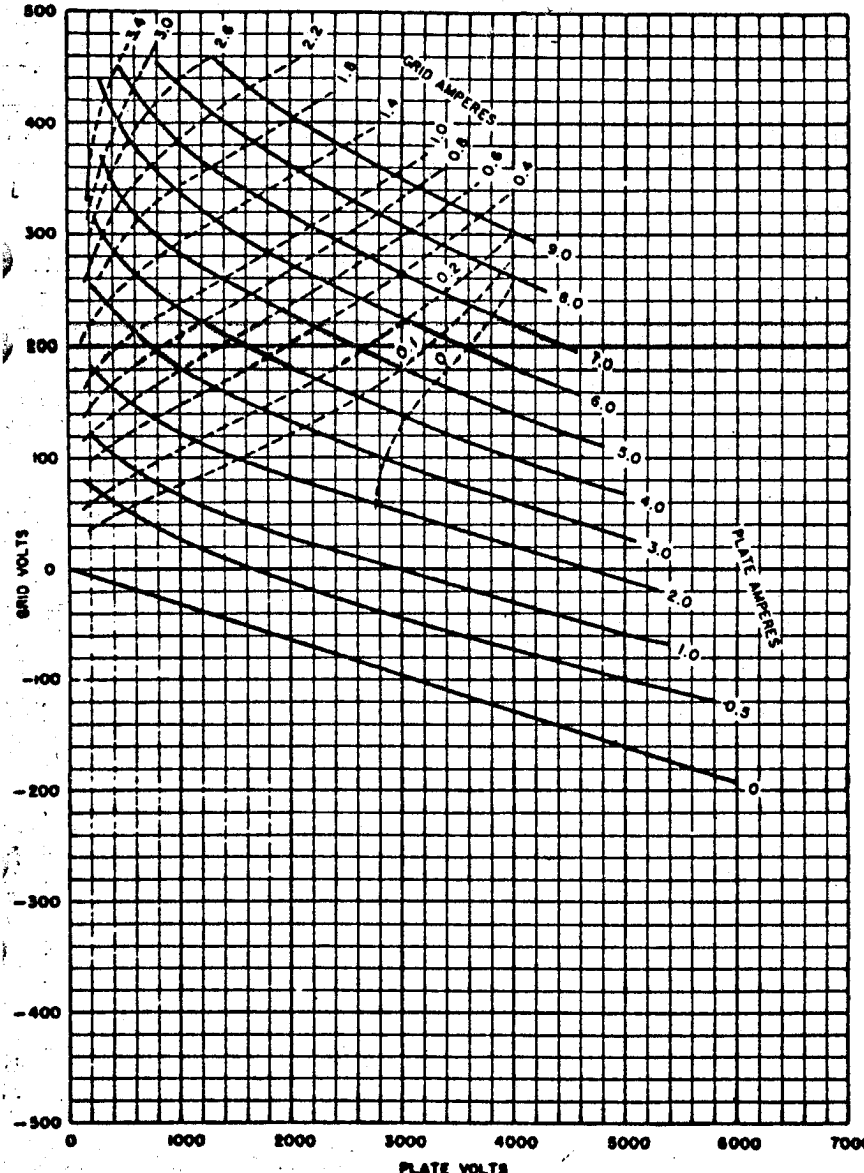

PLATE VOLTS
6000
5000
4000
3000
2000
PLATE AMPERES
0
0.2
0.4
0.6
0.8
1.0
1.2
GRID VOLTS
-200
-150
-100
-50
0

5924A

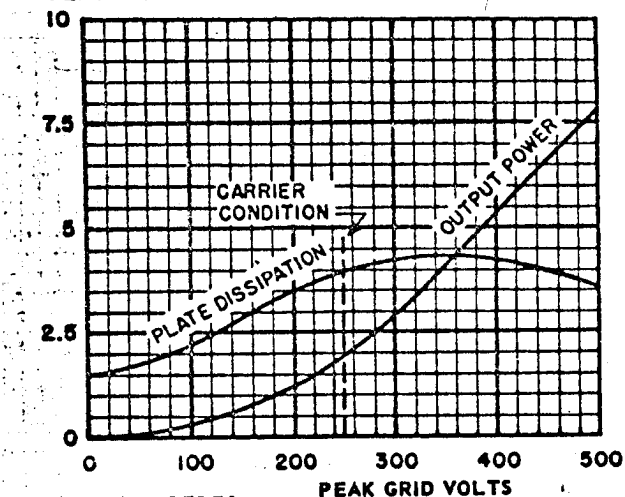

GRID VOLTS
NEG.
400
350
300
250
200
150
100
50
0
-50
-100
PLATE AMPERES
PLATE KILOVOLTS
0
1
2
3
4
5
6
8
10

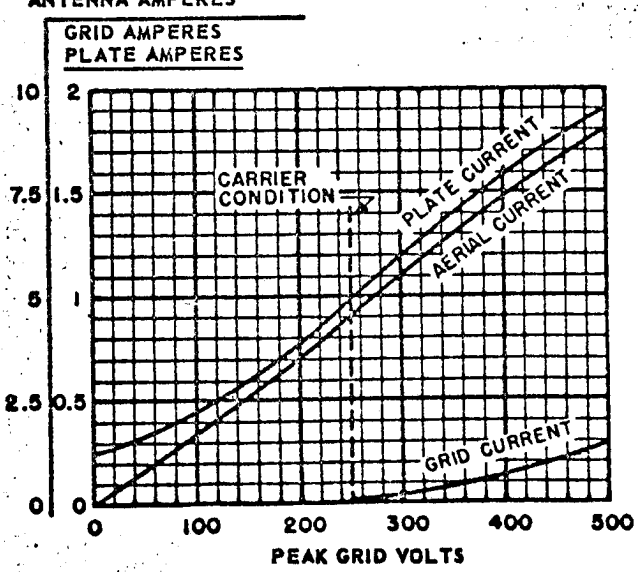

GRID AMPERES
PLATE KILOVOLTS
0
1
2
3
4
5
6
$E_b = E_c$
GRID VOLTS = 450 V
400
350
300
250
200
150
100
50

5924A


GRID AMPERES
PLATE AMPERES
GRID VOLTS
PLATE VOLTS
500
400
300
200
100
0
-100
-200
-300
-400
-500
0
1000
2000
3000
4000
5000
6000
7000
3.4
3.0
2.6
2.2
1.8
1.4
1.0
0.8
0.6
0.4
0.2
0.1
0.1
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.3
0

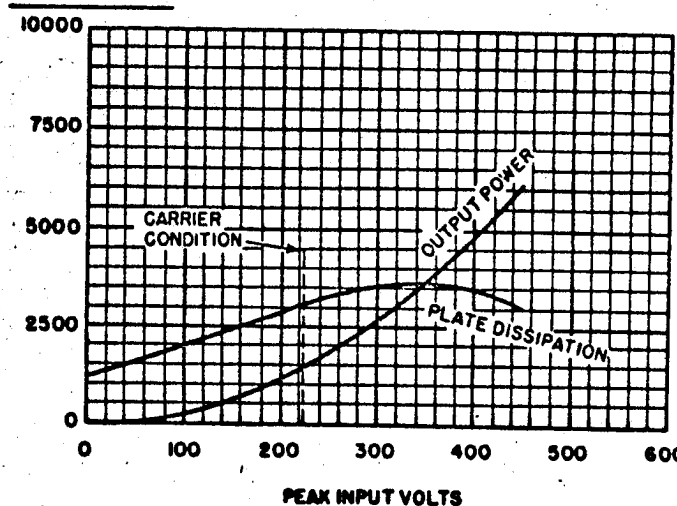
CLASS B TELEPHONY
FREQUENCY = 75 MEGACYCLES
PLATE VOLTAGE = 6000 VOLTS
GRID VOLTAGE = −180 VOLTS

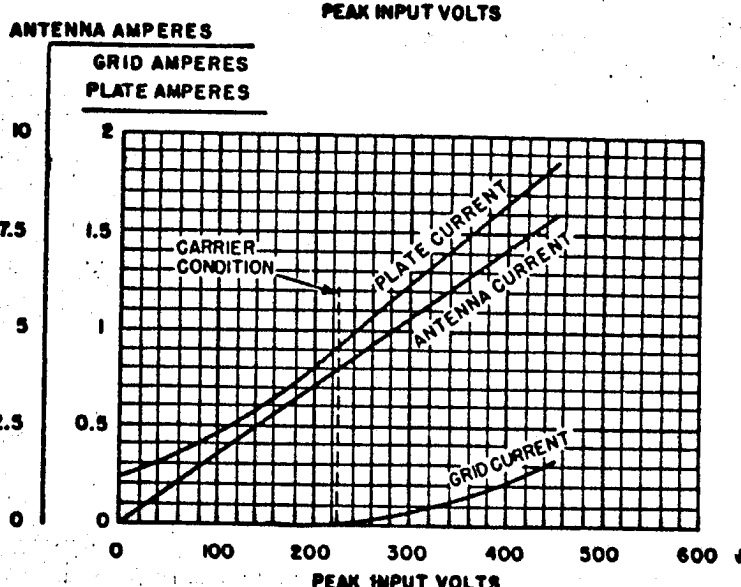


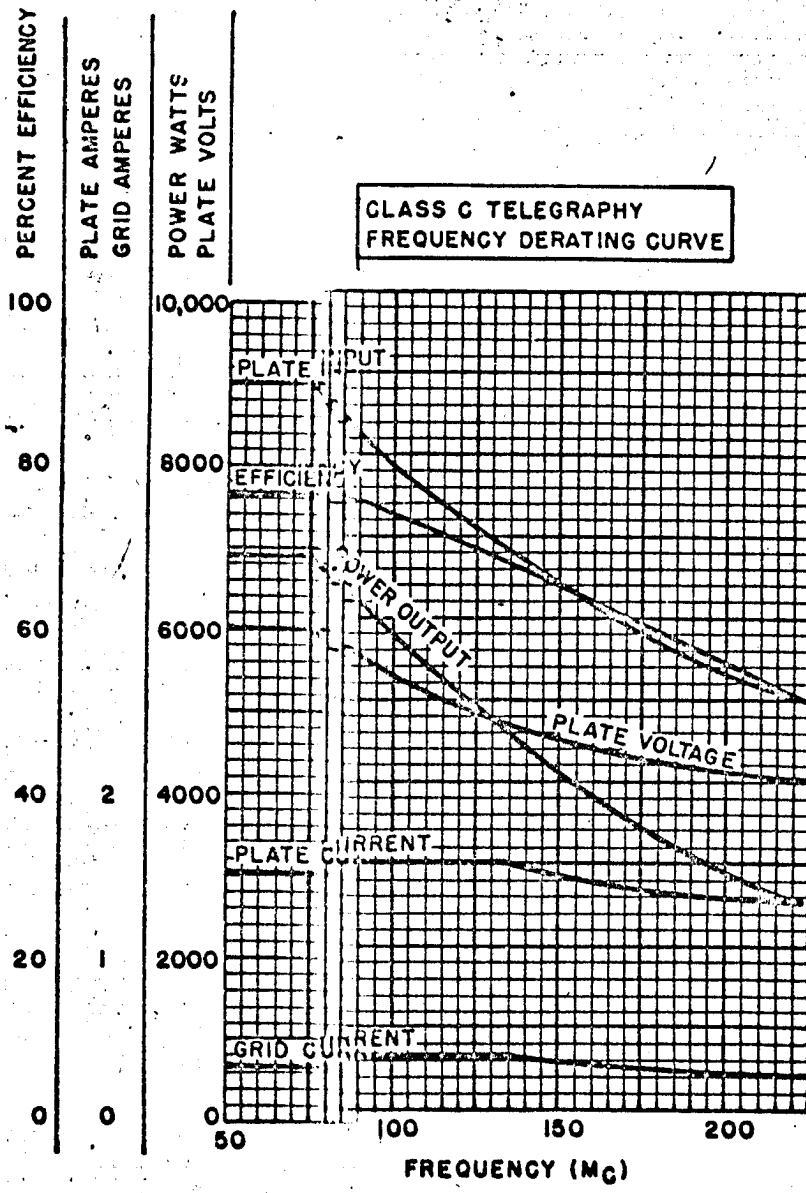


5924A

CLASS B TELEPHONY
WAVE LENGTH = 75MC/SEC
PLATE VOLTAGE = 5000 VOLTS
GRID BIAS = —145 VOLTS






CLASS C TELEGRAPHY
FREQUENCY DERATING CURVE
PERCENT EFFICIENCY
PLATE AMPERES
GRID AMPERES
POWER WATTS
PLATE VOLTS
100
80
60
40
20
0
2
1
0
10,000
8000
6000
4000
2000
0
PLATE INPUT
EFFICIENCY
POWER OUTPUT
PLATE VOLTAGE
PLATE CURRENT
GRID CURRENT
50
100
150
200
FREQUENCY (MC)

AMPEREX TYPE 5942
PERMANENT SENSITIVITY BETA-GAMMA COUNTER

DESCRIPTION:

The type 5942 is a thin, stainless steel wall counter tube whose characteristics are similar to those of the 30 mg/cm^2 glass wall tubes. However, the materials used in this tube and their special processing permits the use of the halogen-quenched Neon filling which has permanent characteristics. The metal wall of this tube is also mechanically stronger than the fragile thin glass walls of comparative types.

This tube is commonly used in survey instruments for Beta and Gamma detection and in hand and foot monitoring instruments where it is necessary to measure Beta in the presence of Gamma radiation.

GENERAL DATA:

Operating temperature range	-55° to+ 75°C
Gas filling	Neon plus halogen admixture
Length of thin wall section (Cathode wall thickness 30-40 mg/cm^2).	3 inches total
Cathode material	stainless steel 28% chromium, 72% iron)
Overall cathode dimensions	3½" long x .507" I.D. (3" of 30-40 mg/cm^2+ ½" of 176 mg/cm^2)

PERFORMANCE DATA:

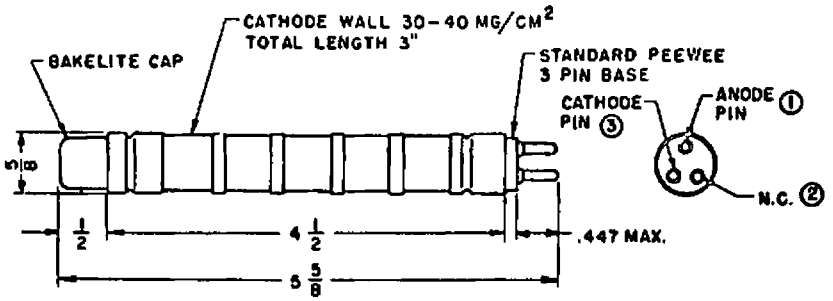
Operating voltage 1,3,	700 volts D.C.
Plateau length 1	in excess of 200 volts
Slope of plateau 1,4	10% per 100 volts max.
Starting voltage (0.3 volt pulses)1	825 volts max.
Capacity at terminals	2.4 mmf
Radial sensitivity (approx.)	80%
Dead time (approx.)	100 microseconds
Maximum counting rate 5	1700 counts per second
Background (Shielded 2" lead and 1/8" aluminum)	50 counts per minute max.
Life expectancy in counts 2	unlimited by use
Roentgen energy dependence 6	± 20%

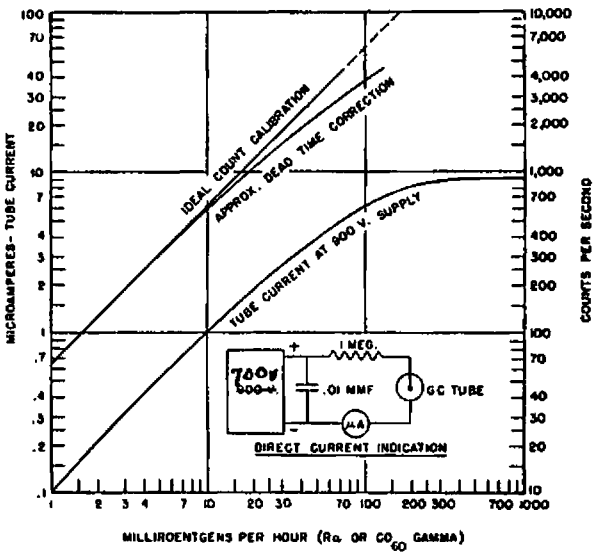
NOTES:

1 This data is obtained from an automatic plateau trace run on each tube. A print of this trace is shipped with each tube.
2 Guaranteed 5 x 10^{10} counts minimum.
3 These tubes will operate satisfactorily anywhere on the plateau.
4 At an average counting rate of 100 counts per second.
5 For 20% dead time correction (approx.).
6 Calculated value based on radiocobalt gamma center value with 100KV to 3 M.E.V. extremes, with gamma shield equivalent to 1/16" thick steel.

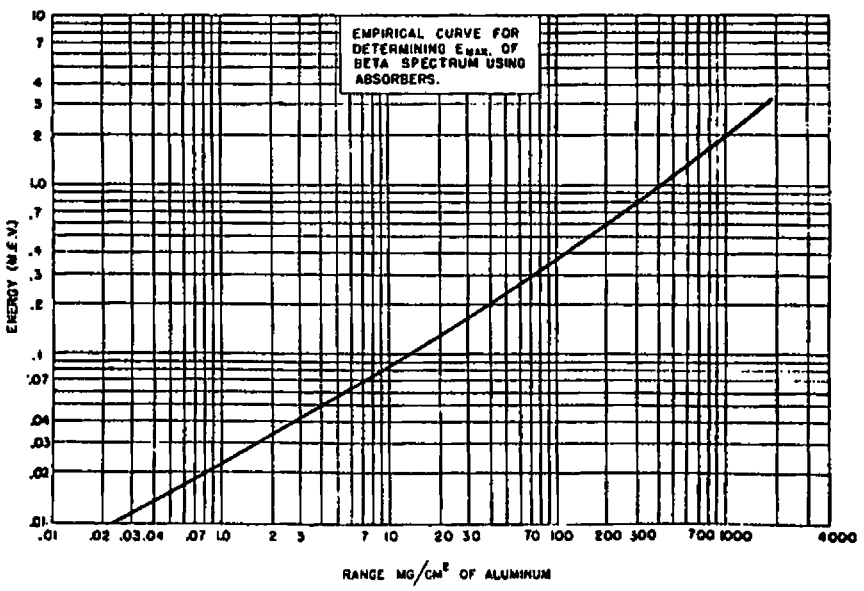
from JEDEC release #1373, Nov. 15, 1954

TYPE 5942 PERMANENT SENSITIVITY BETA-GAMMA COUNTER





TYPICAL OPERATION



Permanent Sensitivity BETA-GAMMA COUNTER

Description

5944 (70NB) is a thin, stainless steel wall counter tube whose characteristics are similar to those of the 30 mg/cm glass wall tubes. However, the materials used in this tube and their special processing permits the use of the halogen-quenched Neon filling which has permanent characteristics. The metal wall of this tube is also mechanically stronger than the fragile thin glass walls of comparative types.

This tube is commonly used in survey instruments for Beta and Gamma detection and in hand and foot monitoring instruments where it is necessary to measure Beta in the presence of Gamma radiation.

General Data

Operating temperature range	—55° to +75°C
Gas filling	Neon plus halogen admixture
Length of thin wall section (Cathode wall thickness 30-40 mg/cm^2)	3 inches total
Cathode material	stainless steel (28% chromium, 72% iron)
Overall cathode dimensions	3½" long x .607" I.D. (3" of 30-40 mg/cm^2 + ½" of 176 mg/cm^2)

Performance Data

Operating voltage[1,3,4]	900 volts D.C.
Plateau length[1]	in excess of 200 volts
Slope of plateau[1,5]	10% per 100 volts max.
Starting voltage (0.3 volt pulses)[1]	825 volts max.
Capacity at terminals	2.4 mmf
Radial sensitivity (approx.)	80%
Dead time (approx.)	100 microseconds
Maximum counting rate[6]	1700 counts per second
Background (Shielded 2" lead and ⅛" aluminum)	50 counts per minute max.
Life expectancy in counts[2]	unlimited by use
Roentgen energy dependence[7]	±20%

Notes

[1] This data is obtained from an automatic plateau trace run on each tube. A print of this trace is shipped with each tube.

[2] Guaranteed 5 x 10^{10} counts minimum.

[3] These tubes will operate satisfactorily anywhere on the plateau.

[4] Also available upon request filled at 700 volts operating voltage. (Specify type 70NB.)

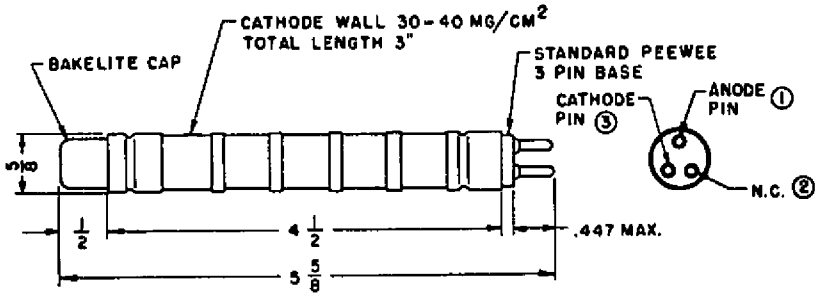
[5] At an average counting rate of 100 counts per second.

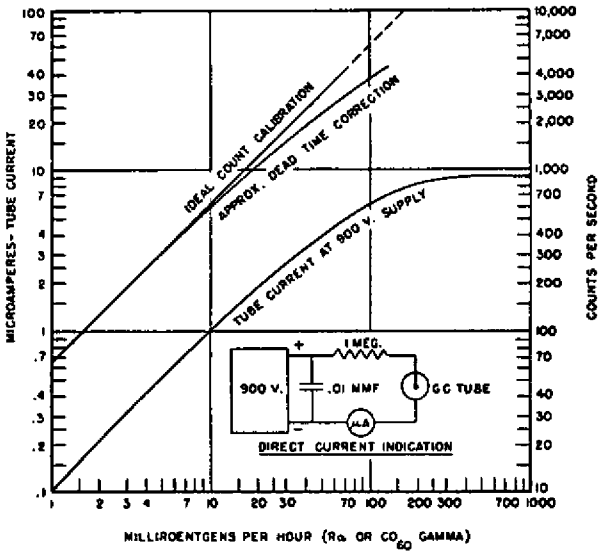
[6] For 20% dead time correction (approx.).

[7] Calculated value based on radiocobalt gamma center value with 100KV to 3 M.E.V. extremes, with gamma shield equivalent to 1/16" thick steel.

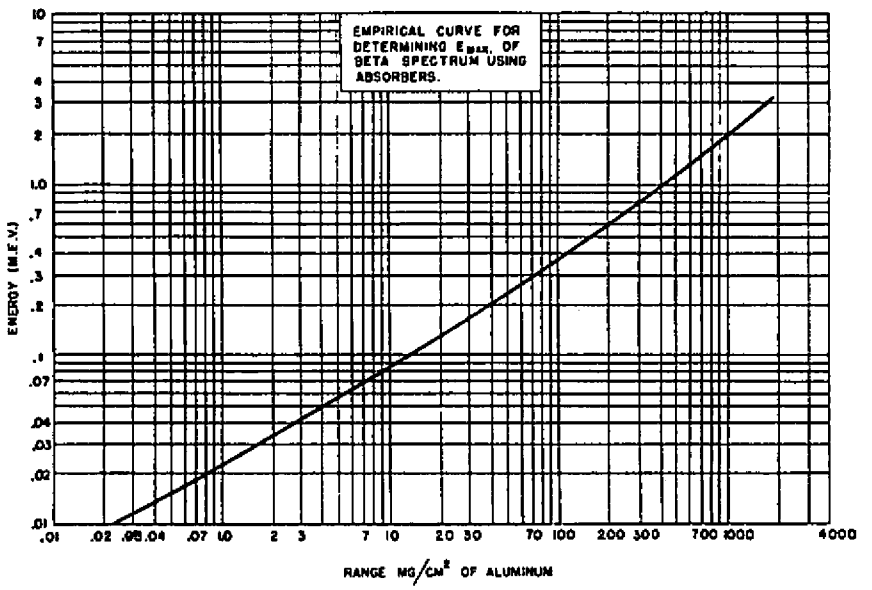
AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVE., HICKSVILLE, N.Y.

from RTMA release #1128, Jan. 30, 1953





TYPICAL OPERATION



AMPEREX TUBE TYPE 5AR4/GZ34

The 5AR4/GZ34 is a high vacuum, full-wave rectifier capable of output currents up to 250 milliamperes. The indirectly heated cathode is connected directly to the heater. Its small size and generous ratings make it particularly suitable for application in new, compact Hi-Fi component designs.

GENERAL CHARACTERISTICS

ELECTRICAL

Heater	Indirectly heated cathode, coated unipotential
Heater Voltage (A.C.)	5.0 volts
Heater Current	1.9 amps

MECHANICAL

Base	Octal, 5 pin
Maximum Overall Length	3 25/64 inches
Maximum Diameter	1½ inches

MAXIMUM RATINGS (DESIGN CENTER VALUES)

Maximum Peak Inverse Voltage	1500 volts
Maximum Peak Current (per plate)	750 Ma
A.C. Supply (plate-to-plate) Voltage (rms)	1100 volts
Maximum D.C. Output Current	250 Ma
Maximum Capacity (condenser input filter)	60 μf

Typical Operating Conditions
Condenser Input Filter

A.C. Supply Voltage (plate to plate) (rms)	2x300	2x350	2x400	2x450	2x500	2x550 volts
Limiting Resistor [2] (minimum)	75	100	125	150	175	200 ohms ←
D.C. Output Current	250	250	250	250	200	160 Ma
D.C. Output Voltage [3]	330	380	430	480	560	640 volts ←

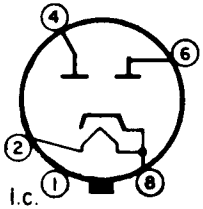
Choke Input Filter

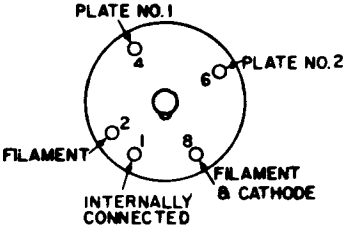
A.C. Supply Voltage (plate to plate) (rms)	2x300	2x350	2x400	2x450	2x500	2x550 volts
Inductance	10	10	10	10	10	10 henries
Limiting Resistor	0	0	0	0	0	0 ohms
D.C. Output Current	250	250	250	250	250	225 mA
D.C. Output Voltage [3]	250	290	330	375	420	465 volts ←

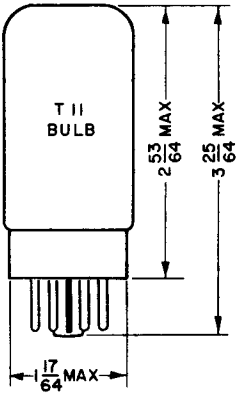
[2] Per Plate

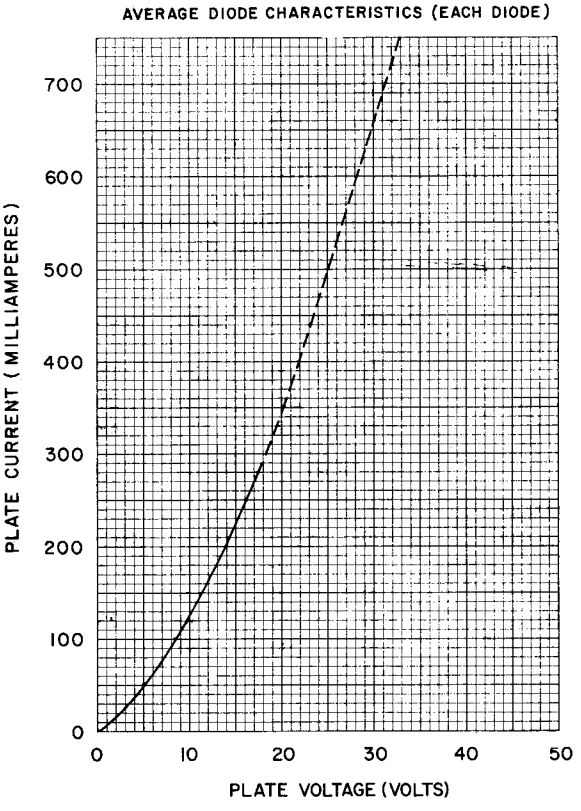
[3] At maximum values

5AR4/GZ34

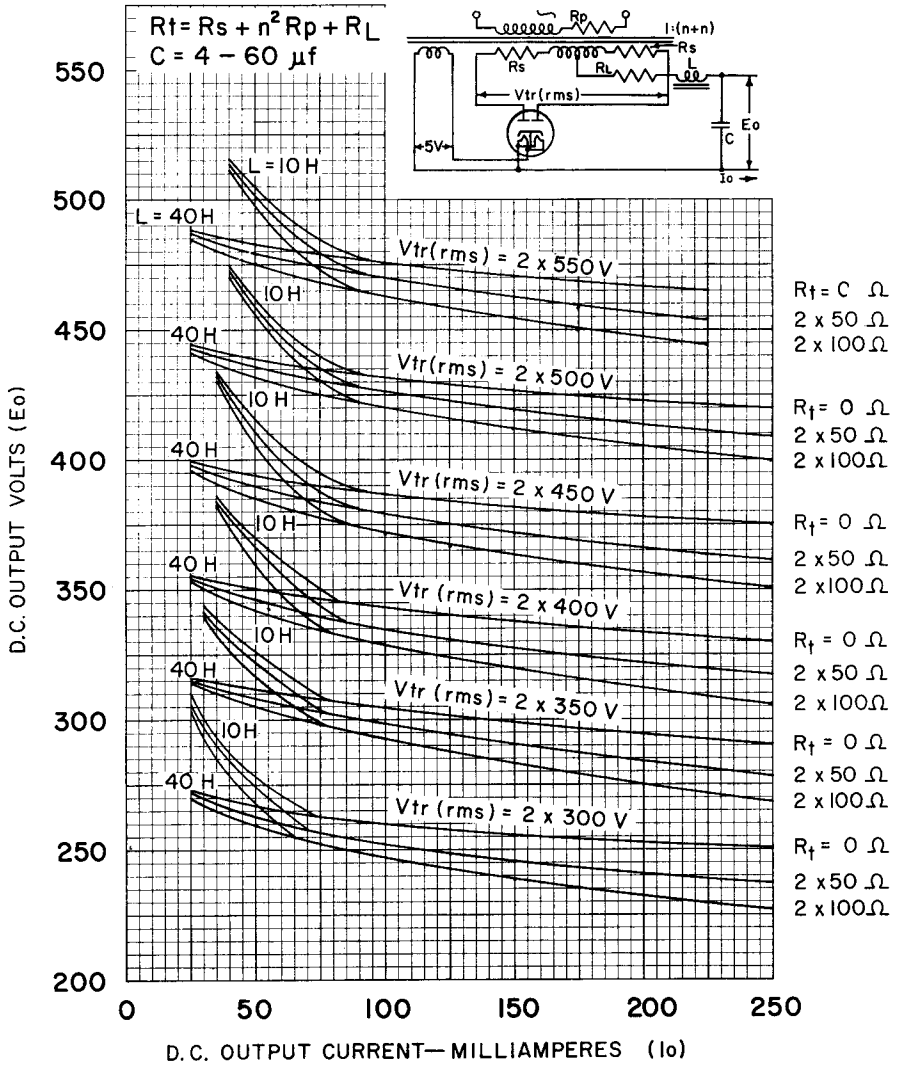

4
6
2
1
8
I.C.


PLATE NO.1
4
PLATE NO.2
6
2
FILAMENT
1
8
FILAMENT
& CATHODE
INTERNALLY
CONNECTED


T 11
BULB
2 53/64 MAX
3 25/64 MAX
1 17/64 MAX

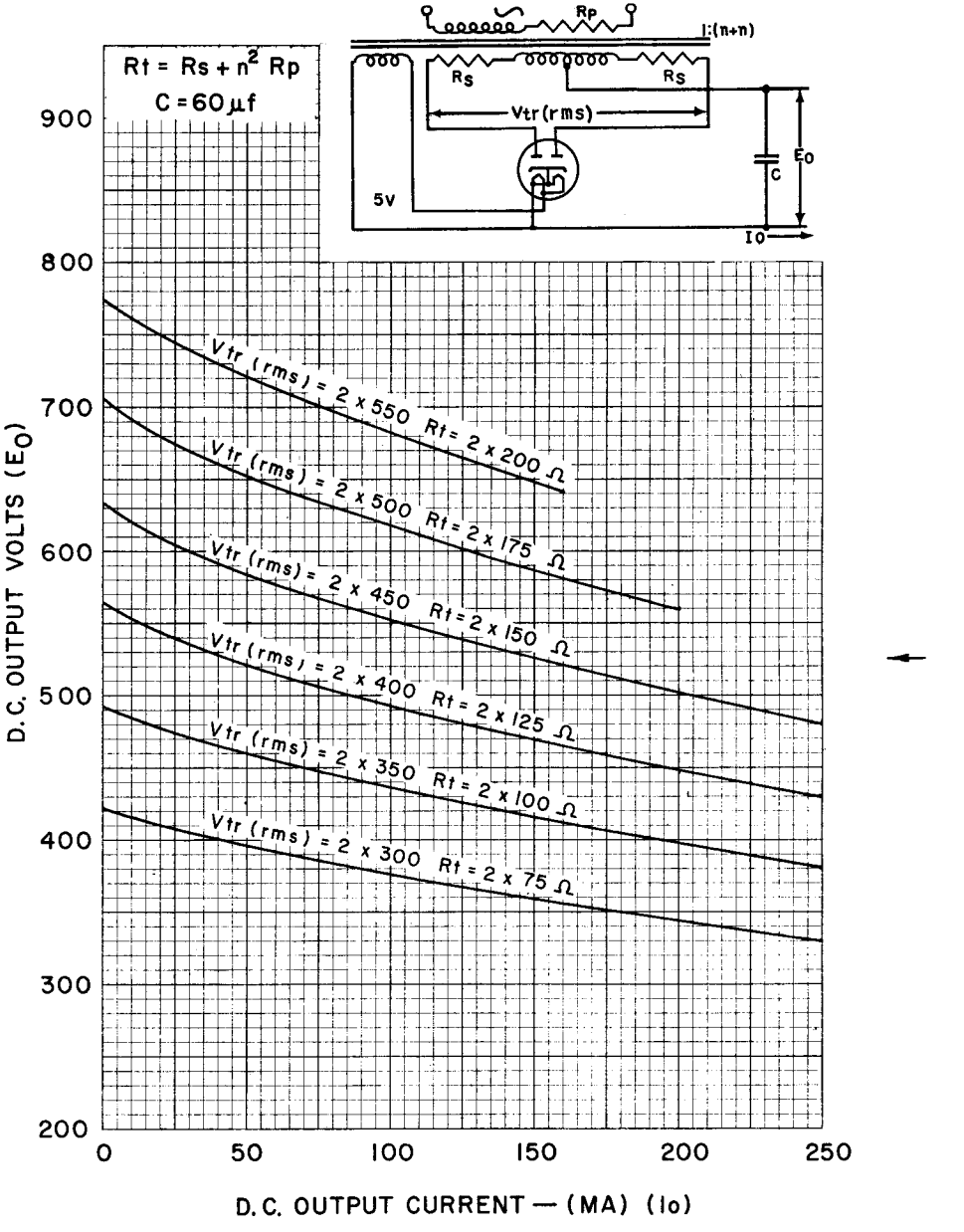

AVERAGE DIODE CHARACTERISTICS (EACH DIODE)
PLATE CURRENT (MILLIAMPERES)
700
600
500
400
300
200
100
0
0
10
20
30
40
50
PLATE VOLTAGE (VOLTS)

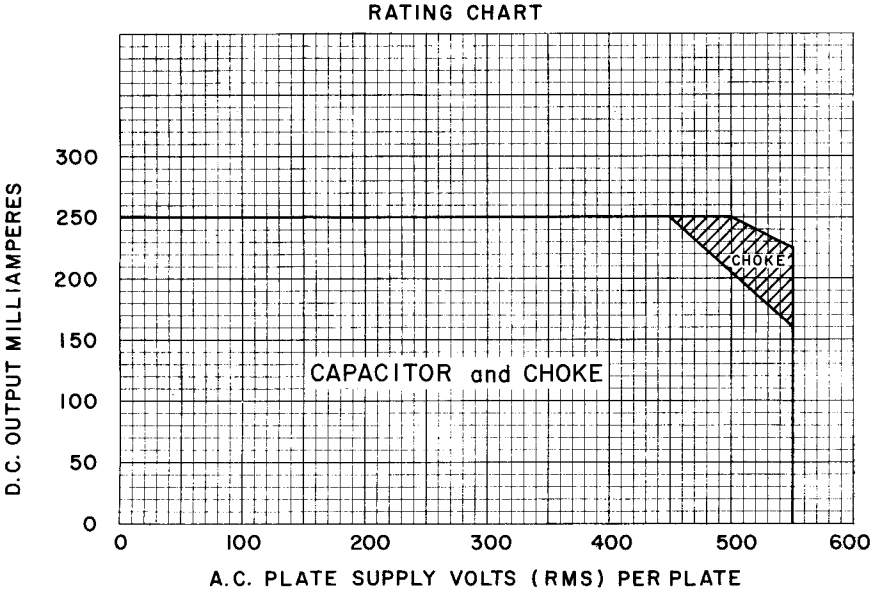
OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CHOKE INPUT TO FILTER



5AR4/GZ34

OPERATION CHARACTERISTICS
FULL-WAVE CIRCUIT, CAPACITOR INPUT TO FILTER




RATING CHART
D.C. OUTPUT MILLIAMPERES
300
250
200
150
100
50
0
CHOKE
CAPACITOR and CHOKE
0
100
200
300
400
500
600
A.C. PLATE SUPPLY VOLTS (RMS) PER PLATE

AMPEREX 6007

DESCRIPTION

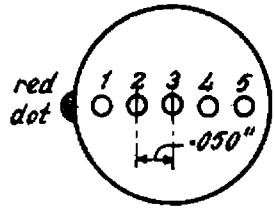
The 6007 is a subminiature pentode output amplifier for hearing-aids and other purposes, where small size, light weight and low battery drain are important.

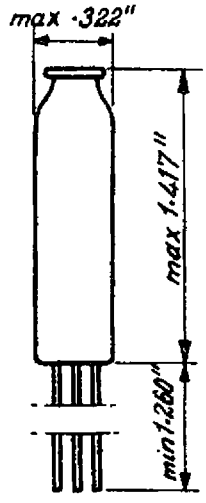
Physical specifications.

Filament	coated
Bulb	T2
Base	none
Maximum diameter	0.322"
Mounting position	any

Basing connections - JETEC basing designation 5J

1. Plate
2. Grid No.2
3. + filament
4. Grid No.1
5. - filament





Wire length	0.2"
Spacing	0.05"
Diameter	0.016"

The 6007 has flexible silvered terminal leads which may be soldered directly to the circuit elements. The wires are arranged in a straight line so that, if they are cut off to a length of 0.2" the tube can be fitted in a standard 5-pin subminiature socket.

General electrical data

Filament voltage	1.25	volt DC
Filament current	13.3	ma

from RTMA release #1128, Jan. 30, 1953

Direct interelectrode capacitances

Grid No.1 to all other electrodes	2.5	μμf
Plate to all other electrodes	2.2	μμf
Plate to Grid No.1 max.	0.2	μμf

Maximum ratings

Plate voltage	45	volts
Plate dissipation	25	milli-watts
Grid No.2 voltage	45	volts
Grid No.2 dissipation	6	milli-watts
Cathode current	600	micro-amps
Grid No.1 voltage(when grid No.1 current = + 0.3 micro-amp)	-0.2	volt
Circuit resistance between grid No.1 and filament	10	megohms
Filament voltage max.	1.55	volt
Filament voltage min.	0.9	volt

Typical characteristics

Plate voltage	22.5	volts
Grid No.2 voltage	22.5	volts
Grid No.1 voltage	-0.2	volt
Plate current	475	micro-amps
Grid No.2 current	100	micro-amps
Transconductance	420	micromhos
Plate resistance	0.4	megohm

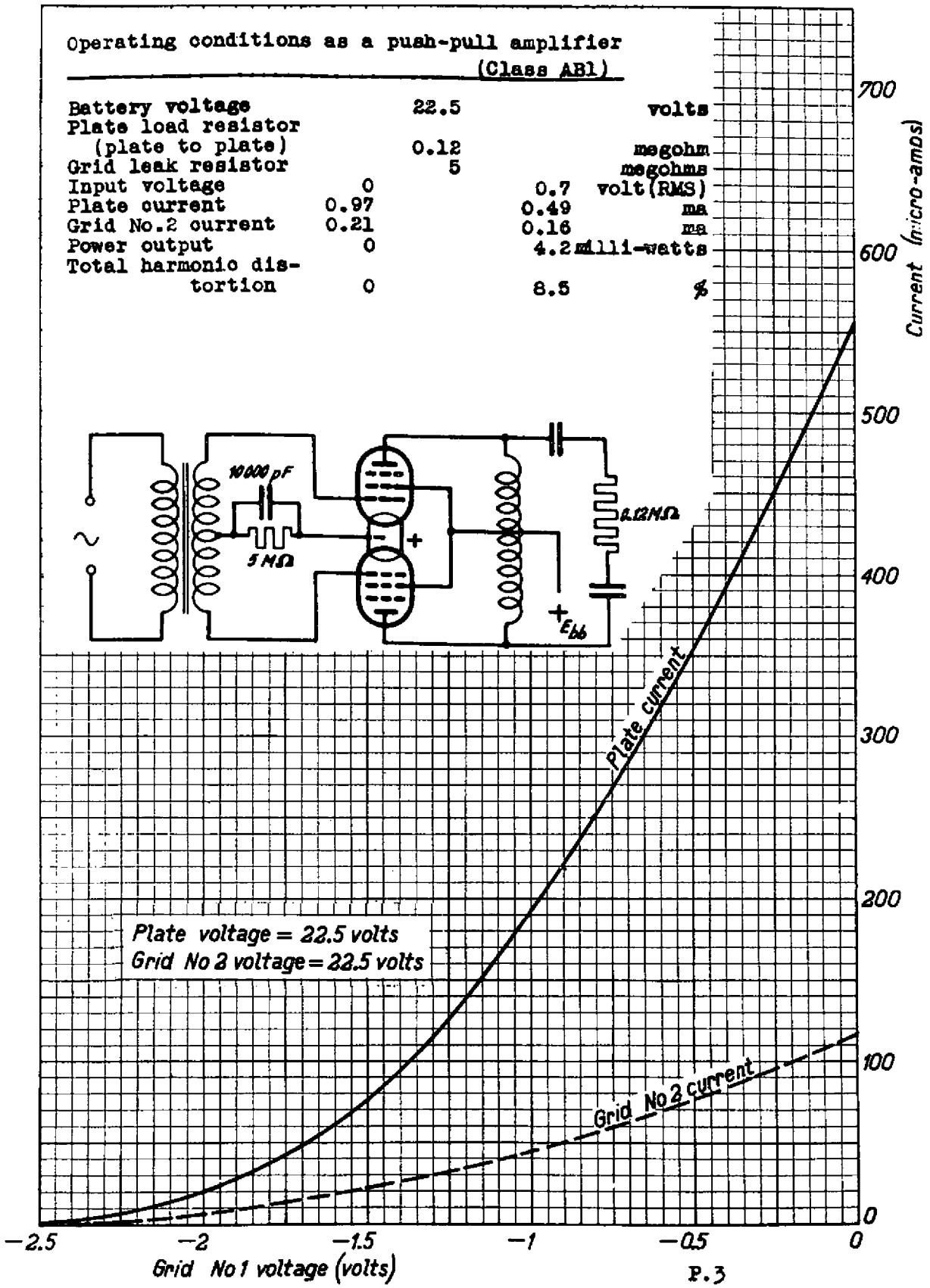
Operating conditions as a single output amplifier

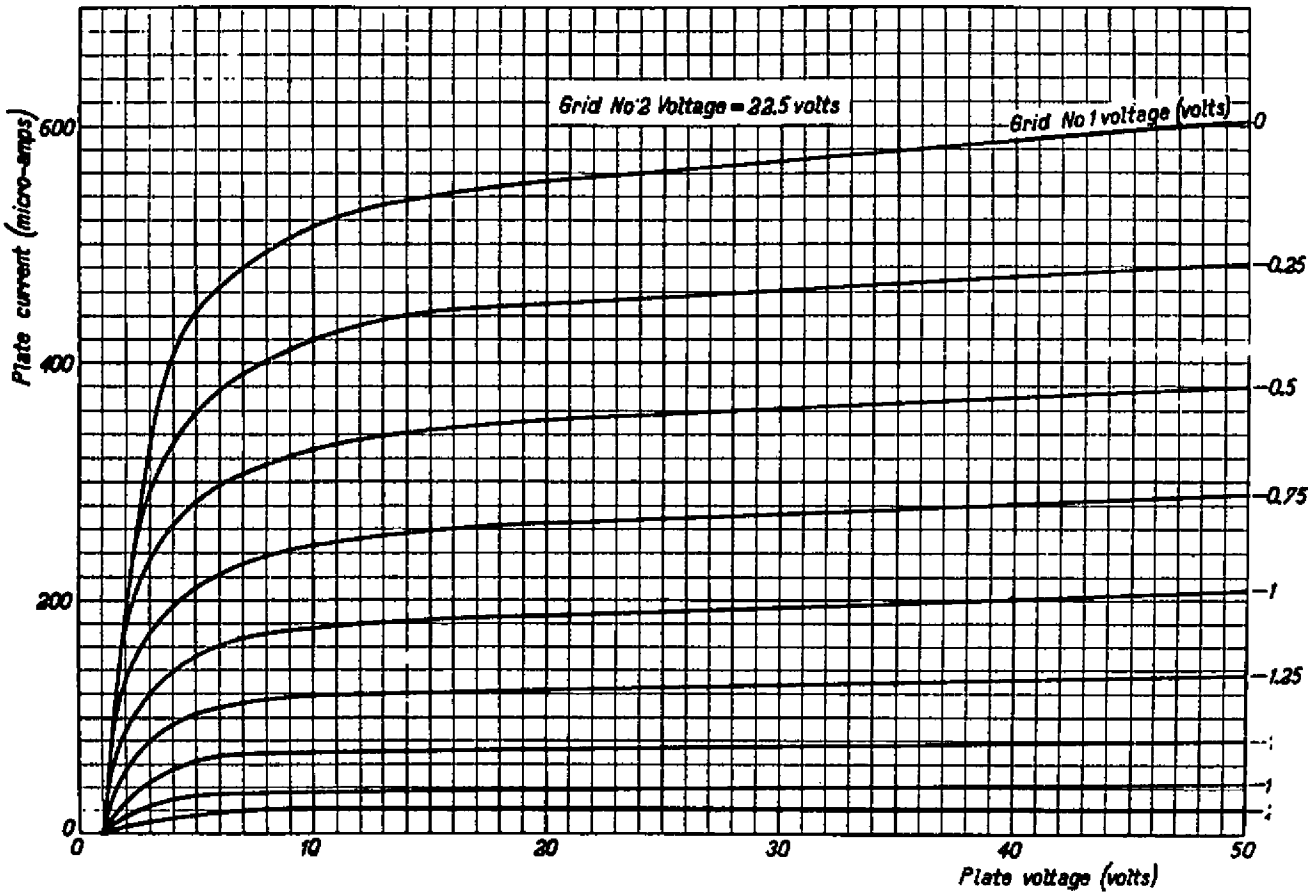
Battery voltage		22.5		volts
Plate load resistor		0.1		megohm
Grid leak resistor		10		megohms
Input voltage	0		0.45	volt(RMS)
Plate current	0.50		0.34	ma
Grid No.2 current	0.095		0.09	ma
Power output	0		1.8	milli-watt
Total harmonic distortion	0		10	%

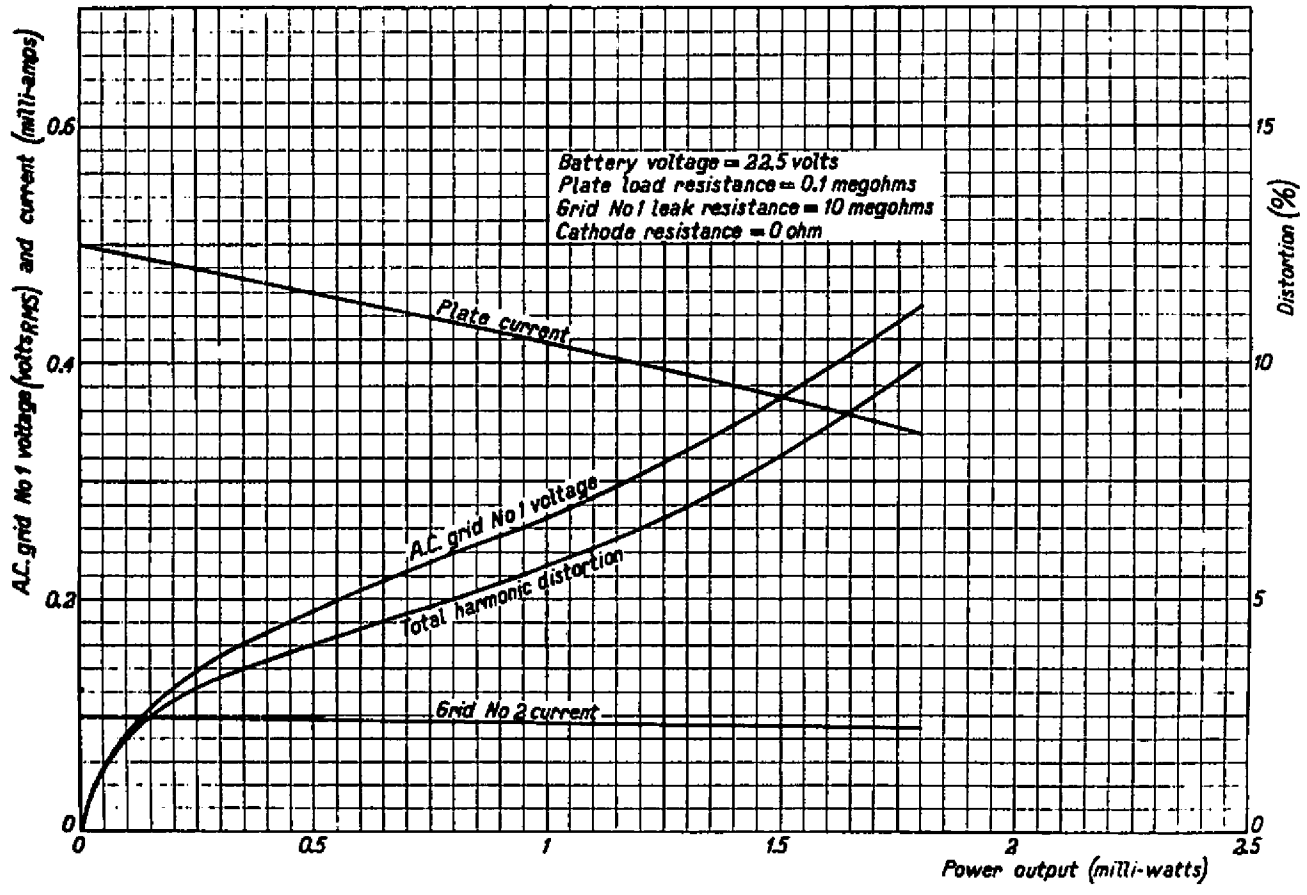
Battery voltage		45		volts
Plate load resistor		0.1		megohm
Grid leak resistor		3		megohms
Cathode resistor		5600		ohms
Input voltage	0		0.8	volt(RMS)
Plate current	0.42		0.42	ma
Grid No.2 current	0.08		0.11	ma
Power output	0		6	milli-watts
Total harmonic distortion	0		10	%

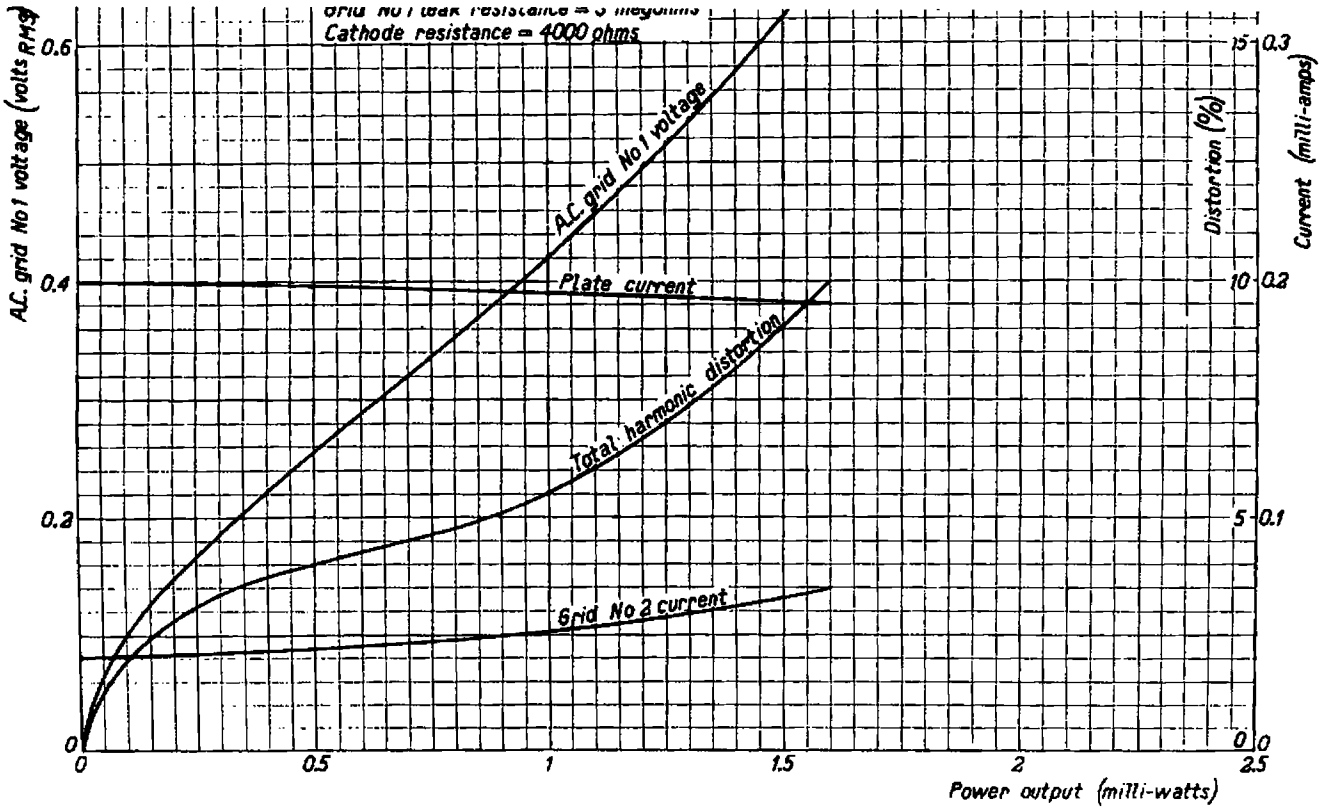
Operating conditions as a push-pull amplifier
(Class AB1)

Battery voltage	22.5		volts
Plate load resistor (plate to plate)	0.12		megohm
Grid leak resistor	5		megohms
Input voltage	0	0.7	volt(RMS)
Plate current	0.97	0.49	ma
Grid No.2 current	0.21	0.16	ma
Power output	0	4.2	milli-watts
Total harmonic distortion	0	8.5	%




Grid No 2 Voltage = 22.5 volts
Grid No 1 voltage (volts)
0
0.25
0.5
0.75
1
1.25
Plate current (micro-amps)
600
400
200
0
0
10
20
30
40
50
Plate voltage (volts)


Battery voltage = 22.5 volts
Plate load resistance = 0.1 megohms
Grid No 1 leak resistance = 10 megohms
Cathode resistance = 0 ohm
Plate current
A.C. grid No 1 voltage
Total harmonic distortion
Grid No 2 current
A.C. grid No 1 voltage (volts RMS) and current (milli-amps)
0.6
0.4
0.2
0
Distortion (%)
15
10
5
0
0
0.5
1
1.5
2
2.5
Power output (milli-watts)


Grid No 1 leak resistance = 5 megohms
Cathode resistance = 4000 ohms
A.C. grid No 1 voltage
Plate current
Total harmonic distortion
Grid No 2 current
A.C. grid No 1 voltage (volts RMS)
Distortion (%)
Current (milli-amps)
Power output (milli-watts)
0
0.2
0.4
0.6
0.5
1
1.5
2
2.5
5
10
15
0.1
0.2
0.3

6008

DESCRIPTION

The 6008 is a sub-miniature pentode voltage amplifier for hearing-aids and other purposes, where small size, light weight and low battery drain are important.

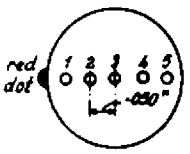
Physical specifications

Filament	coated
Bulb	T2
Base	none
Maximum diameter	0.322"
Mounting position	any

Basing connections- JETEC basing designation 5J

1. Plate
2. Grid No.2
3. + filament
4. Grid No.1
5. - filament



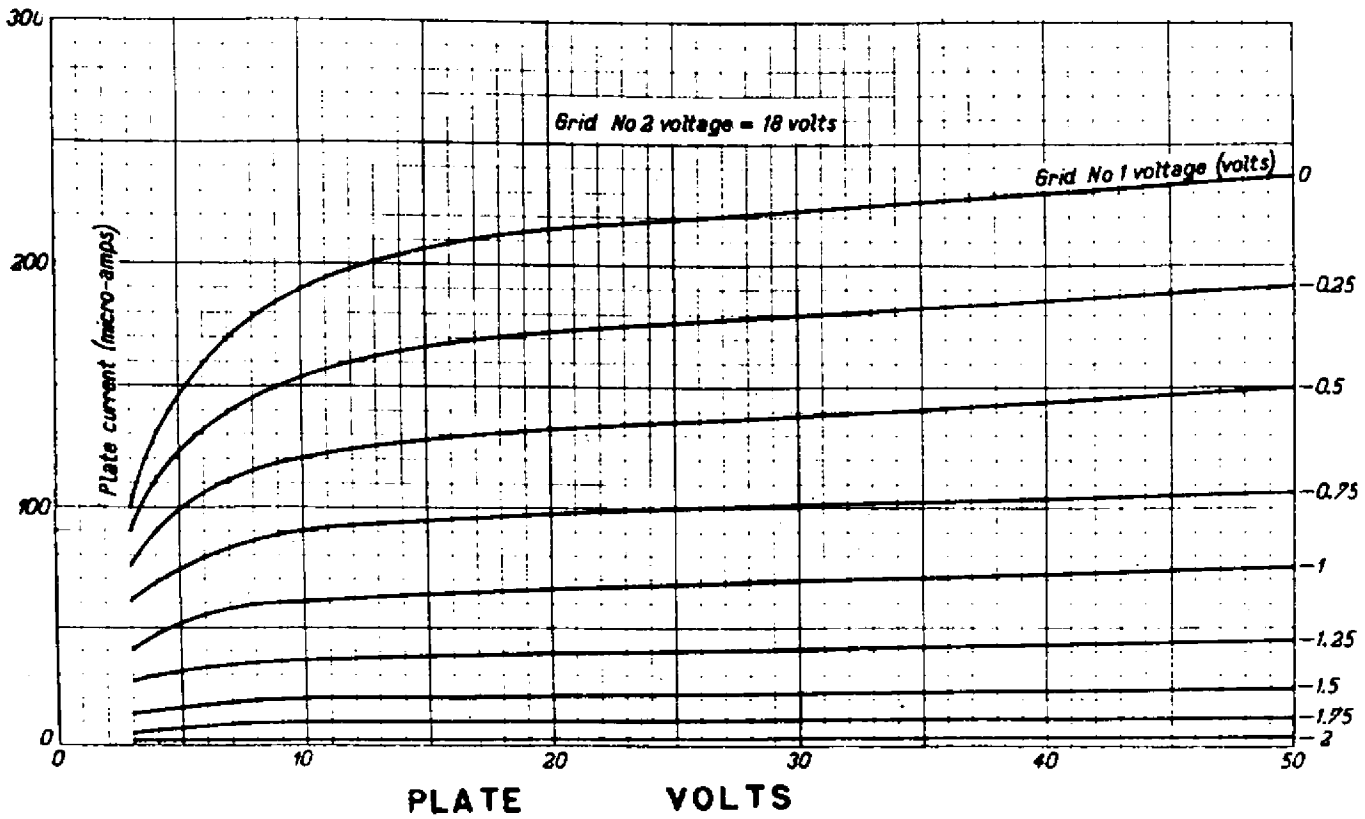


Wire length	0.2"
Spacing	0.05"
Diameter	0.016"

The 6008 has flexible silvered terminal leads which may be soldered directly to the circuit elements. The wires are arranged in a straight line so that, if they are cut off to a length of 0.2" the tube can be fitted in a standard 5-pin sub-miniature socket.

General electrical data

Filament voltage	0.625 volt DC
Filament current	13.3 ma



from RTMA release #1128, Jan. 30, 1953
sponsor: Amperex Electronic Corp.

Direct interelectrode capacitances

Grid No.1 to all other electrodes		1.5 µµf
Plate to all other electrodes		1.5 µµf
Plate to Grid No.1	max.	0.2 µµf

Maximum Ratings

Plate voltage	45	volts
Plate dissipation	1.5	milli-watt
Grid No.2 voltage	45	volts
Grid No.2 dissipation	0.5	milli-watt
Cathode current	75	micro-amps
Grid No.1 voltage (when grid No.1 current = + 0.3 micro-amp)	-0.2	volt
Circuit resistance between grid No.1 and filament	10	megohms
Filament voltage max.	0.78	volt
Filament voltage min.	0.45	volt

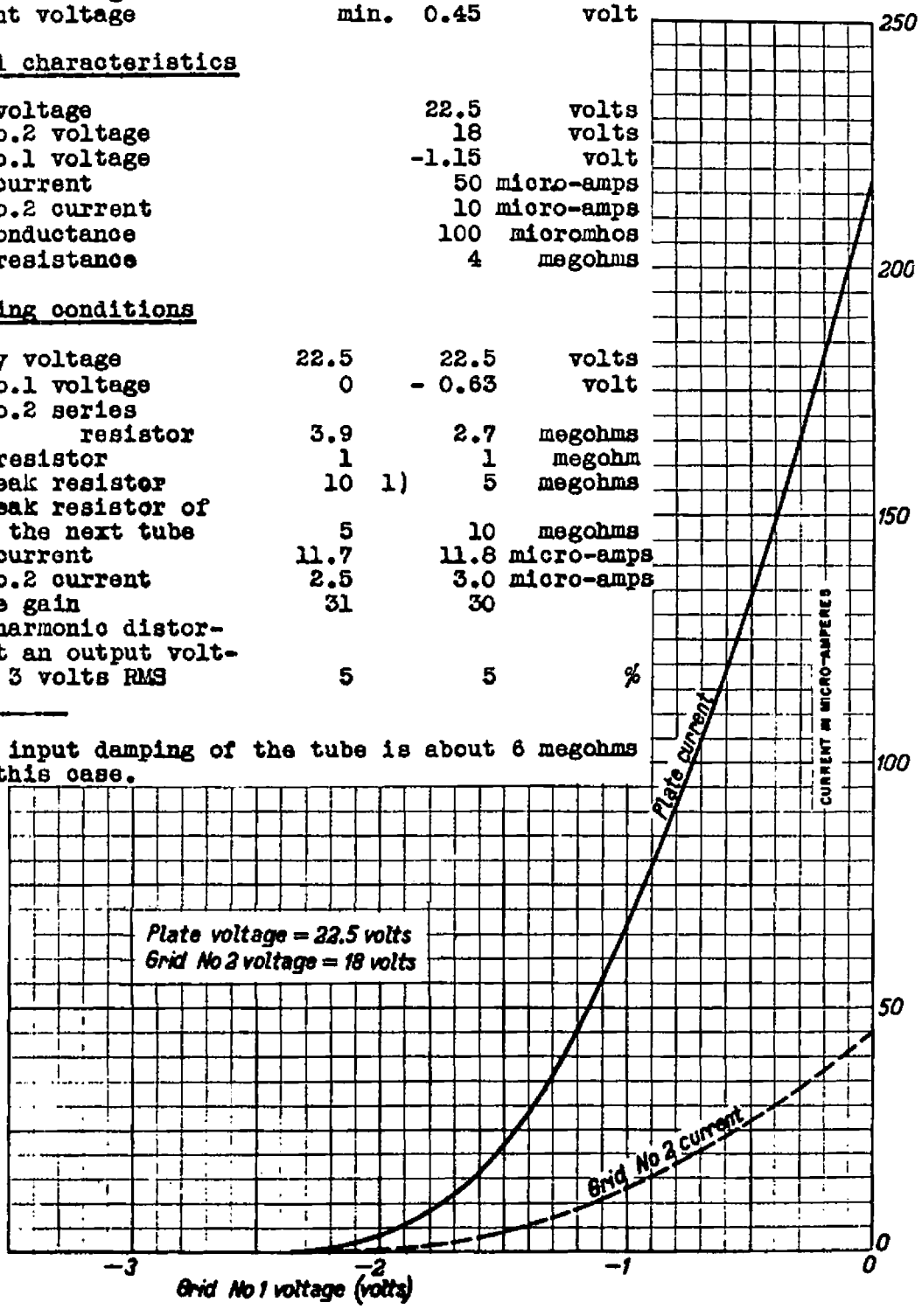
Typical characteristics

Plate voltage	22.5	volts
Grid No.2 voltage	18	volts
Grid No.1 voltage	-1.15	volt
Plate current	50	micro-amps
Grid No.2 current	10	micro-amps
Transconductance	100	micromhos
Plate resistance	4	megohms

Operating conditions

Battery voltage	22.5	22.5	volts
Grid No.1 voltage	0	- 0.63	volt
Grid No.2 series resistor	3.9	2.7	megohms
Plate resistor	1	1	megohm
Grid leak resistor	10 1)	5	megohms
Grid leak resistor of the next tube	5	10	megohms
Plate current	11.7	11.8	micro-amps
Grid No.2 current	2.5	3.0	micro-amps
Voltage gain	31	30	
Total harmonic distortion at an output voltage of 3 volts RMS	5	5	%

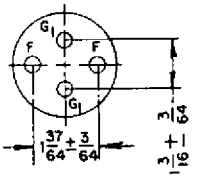
1) The input damping of the tube is about 6 megohms in this case.



from RTMA release #1237,
Sept. 18, 1953

AMPEREX TUBE TYPE 6075.

The 6075 a four-electrode, water-cooled tube designed for use as a R.F. power amplifier, modulator and frequency multiplier. The anode is capable of dissipating 3 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 220 megacycles.



GENERAL CHARACTERISTICS

ELECTRICAL DATA	
Filament voltage	6.3 volts
Filament current	32.5 amps
Amplification factor (G_2G_1 Mu)	8.5
Transconductance (Ib=2 amps)	19,000 micromhos
Direct interelectrode Capacitances	
Grid No. 1 to Plate (max.)	0.35 $\mu\mu$f
Input	23.5 $\mu\mu$f
Output	6.4 $\mu\mu$f
Peak cathode current[1] (max.)	7 amps
MECHANICAL DATA	
Max. overall dimensions	
Length	6-5/16 inches
Length with water jacket	9¼ inches
Diameter	2¾ inches
Mounting position	Vertical, anode down
Control Grid Connection	See note[2]

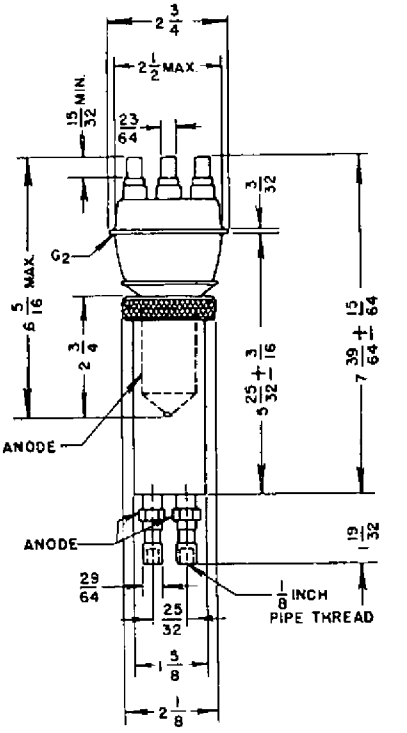
WATER COOLING DATA

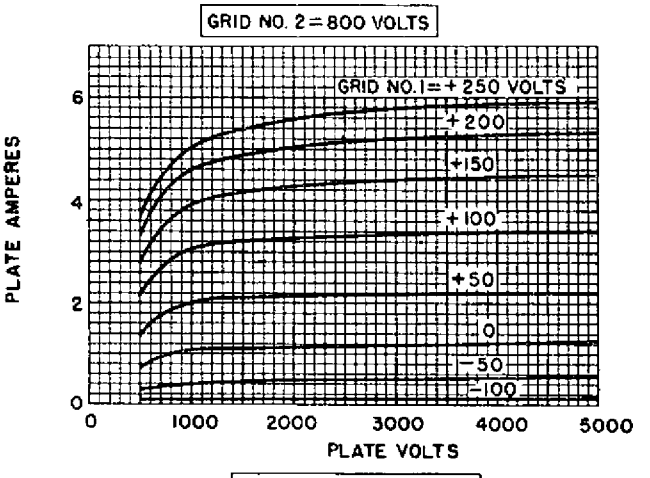
Plate dissipation (kilowatts)	Inlet water temperature[3] (° C)	Min. Water Flow (gal. per min.)	Inlet Pressure (lbs./sq. inch)
1	20	0.65	1.1
1	50	0.8	1.5
2	20	0.65	1.1
2	50	1.25	3.7
3	20	0.8	1.5
3	50	1.8	8

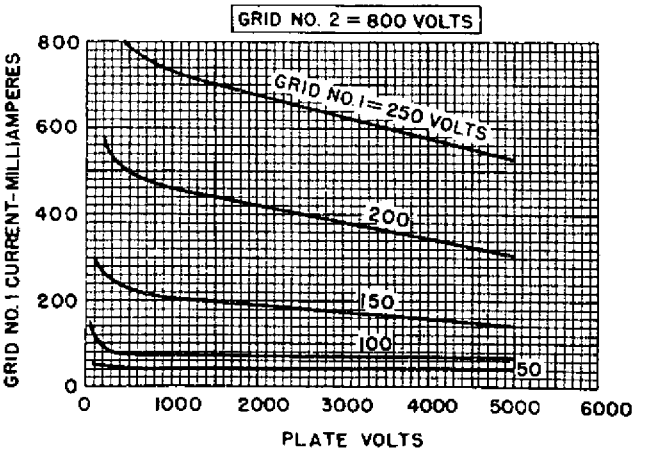
Air Cooling	See note[4]
Max. Bulb Temperature	250° C
Max. Seal Temperature[4]	180° C

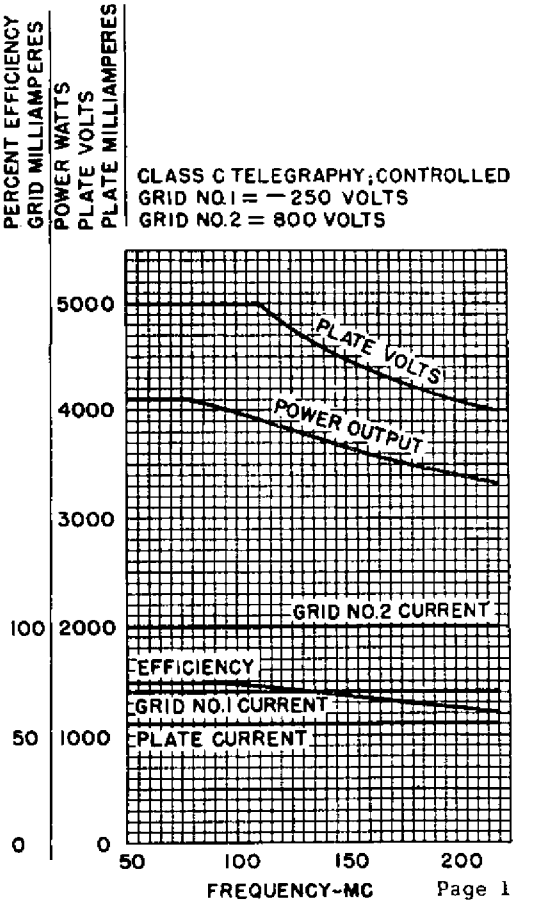
ACCESSORIES

Water Jacket	Amperox #S-3737
Grid Connector	Amperex #S-3706
Filament Connector	Amperex #S-3707
Net Weight—Tube (approx.)	14 oz.
Net Weight—Water Jacket (approx.)	1 lb., 5 oz.









6075

Plate and Screen Grid Modulated, R.F. Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

(Frequencies up to 110 mc.)

	CCS	
D.C. Plate Voltage	4000	max. volts
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Grid No. 1 Voltage	—500	max. volts
D.C. Plate Current	0.9	max. amp
Plate Input	3.7	max. kilowatts
Plate Dissipation	2	max. kilowatts
Grid No. 2 Dissipation	100	max. watts[8]
Grid No. 1 Dissipation	30	max. watts

Typical Operation

(Screen grid supply via a choke of 60 henrys)

	CCS	
D.C. Plate Voltage	4000	volts
D.C. Grid No. 2 Voltage	800	volts
D.C. Grid No. 1 Voltage	—375	volts
Peak R.F. Grid No. 1 Voltage	625	volts
D.C. Plate Current	0.9	amp
D.C. Grid No. 2 Current	120	ma
D.C. Grid No. 1 Current	85	ma
Driving Power	48	watts
Power Output	2.7	kilowatts

Push-Pull R.F. Power Amplifier

Class C Telegraphy

Key-down conditions per tube without amplitude modulation[4]

Maximum Ratings, Absolute Values

(Frequencies up to 110 mc.)

	CCS	
D.C. Plate Voltage	5000	max. volts[7]
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Grid No. 1 Voltage	—500	max. volts
D.C. Plate Current	1.1	max. amps
Plate Input	5.5	max. kilowatts
Plate Dissipation	3	max. kilowatts
Grid No. 2 Dissipation	100	max. watts
Grid No. 1 Dissipation	30	max. watts

Typical Operation

	CCS	CCS	CCS	CCS	
Frequency	75	110	75	110	Mc
D.C. Plate Voltage	4000	4000	5000	5000	volts
D.C. Grid No. 2 Voltage	800	800	800	800	volts
D.C. Grid No. 1 Voltage	—250	—250	—250	—250	volts
D.C. Plate Current	1.1	1.1	1.1	1.1	amps
D.C. Grid No. 2 Current	120	120	100	100	ma
D.C. Grid No. 1 Current	80	80	70	70	ma
Peak R.F. Grid No. 1 Voltage	500	500	480	480	volts
Driving Power	36	36	30	30	watts
Power Output	3.15	2.9	4.1	3.9	kilowatts

Grid Modulated R.F. Power Amplifier

Class C Television Service

Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values

(Frequencies up to 220 mc.)

	CCS	
D.C. Plate Voltage	4000	max. volts
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Grid No. 1 Voltage	—500	max. volts
D.C. Plate Current (sync.)	1.5	max. amps
Plate Input (sync.)	6	max. kilowatts
Plate Dissipation (sync.)	3	max. kilowatts
Grid No. 2 Dissipation (sync.)	100	max. watts
Grid No. 1 Dissipation (sync.)	30	max. watts

Typical Operation

Television Service at 170-220 Mc[5]

	CCS[10,13]	CCS[11,13]	
D.C. Plate Voltage	4000	4000	volts
D.C. Grid No. 2 Voltage	800	800	volts
D.C. Grid No. 1 Voltage			
Synchronization level	—150	—150	volts
Pedestal level	—230	—230	volts
White level	—450	—450	volts
R.F. Grid No. 1 Voltage, peak to peak	850	850	volts[6]
D.C. Plate Current			
Synchronization level	2.75	2.75	amps
Pedestal level	2.1	1.7	amps
D.C. Grid No. 2 Current			
Synchronization level	110	250	ma
Pedestal level	50	80	ma
D.C. Grid No. 1 Current			
Synchronization level	100	80	ma
Pedestal level	50	25	ma
Driving Power at Synchronization level	300-400	200-300	watts[12]
Power Output			
Synchronization level	5	5.9	kilowatts
Pedestal level	2.8	4.0	kilowatts

R.F. Power Amplifier

Class B Television Service

Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values

(Frequencies up to 220 mc.)

	CCS	
D.C. Plate Voltage	4000	max. volts
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Plate Current (sync.)	1.5	max. amps
Plate Input (sync.)	6	max. kilowatts
Plate Dissipation (sync.)	3	max. kilowatts
Grid No. 2 Dissipation (sync.)	100	max. watts
Grid No. 1 Dissipation (sync.)	30	max. watts

Typical Operation

Television Service at 170-220 Mc[5]

	CCS[14]	
D.C. Plate Voltage	4000	volts
D.C. Grid No. 2 Voltage	800	volts
D.C. Grid No. 1 Voltage	—150	volts
R.F. Grid No. 1 Voltage, peak to peak		
Synchronization level[9]	850	volts
Pedestal level[9]	700	volts
D.C. Plate Current		
Synchronization level	2.75	amps
Pedestal level	2.1	amps
D.C. Grid No. 2 Current		
Synchronization level	110	ma
Pedestal level	50	ma
D.C. Grid No. 1 Current		
Synchronization level	100	ma
Pedestal level	50	ma
Driving Power at Synchronization level[13]	300-400	watts
Power Output		
Synchronization level	5	kilowatts
Pedestal level	2.8	kilowatts

[1]Represents maximum usable cathode current for any condition of operation.

[2]Both pins must be used to make connection to the control grid.

[3]The maximum permissible value of the inlet temperature is 50° C.

[4]To keep the temperature of the seals below the values as shown above, it may be necessary to direct an air flow of sufficient velocity to the seals. At frequencies below 75 mc. and a plate voltage below 4 kv, this air cooling will, in general, not be necessary (in the case of R.F., Class C plate and screen grid modulation, below 3.2 kv). At a plate voltage of 5 kv, air cooling at all frequencies is necessary.

[5]For all other modulation methods the grid No. 2 dissipation is max. 65 watts.

[6]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

[7]At 220 Mc the D.C. Plate Voltage 4000 volts max. For other frequencies, see derating curve.

[8]Values for two tubes in push-pull.

[9]Measured by increasing fixed bias until no grid current flows.

[10]Wide band: 6.5 Mc bandwidth at 1.5 db or 12 Mc at —3 db.

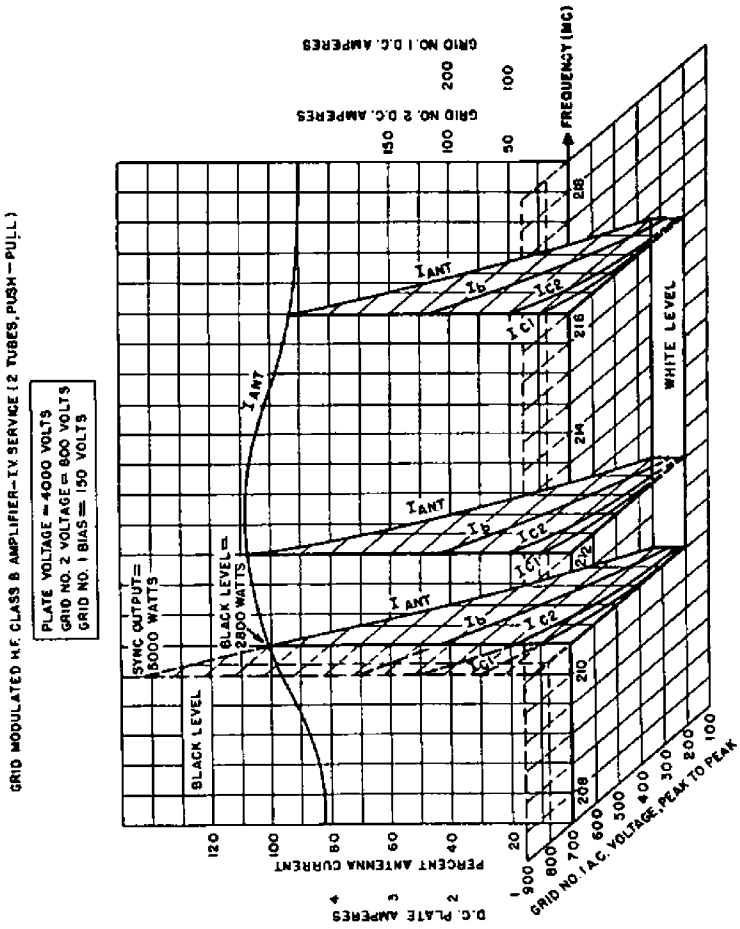
[11]Narrow band: 7.5 Mc bandwidth at 3 db.

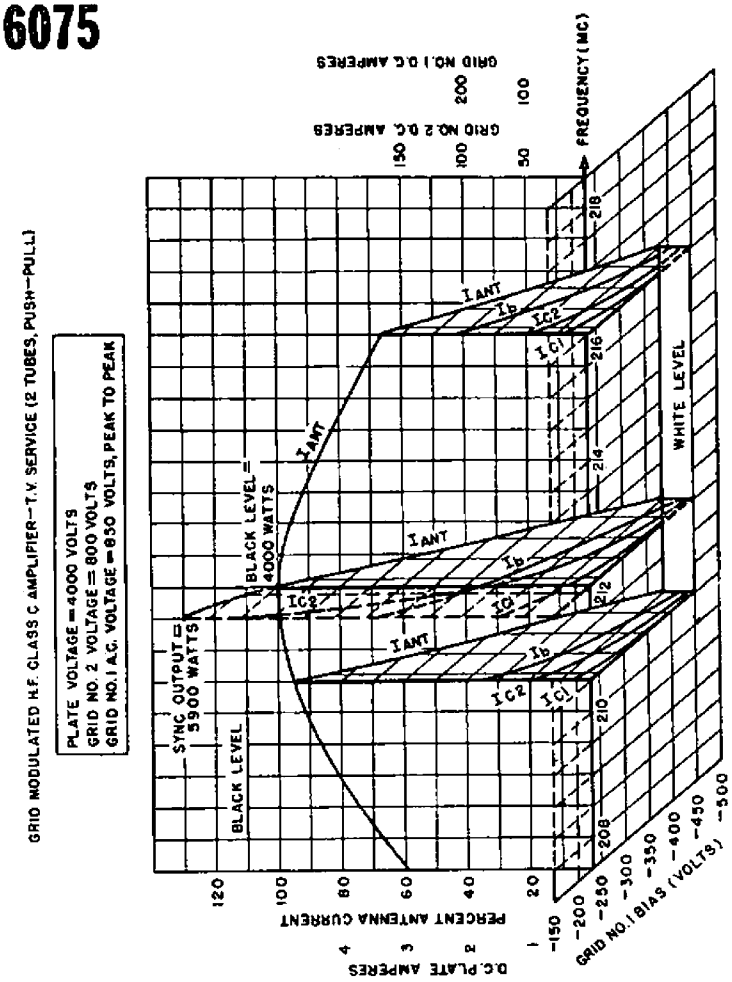
[12]The values of bandwidth are based on measurements on a circuit with a single LC-section.

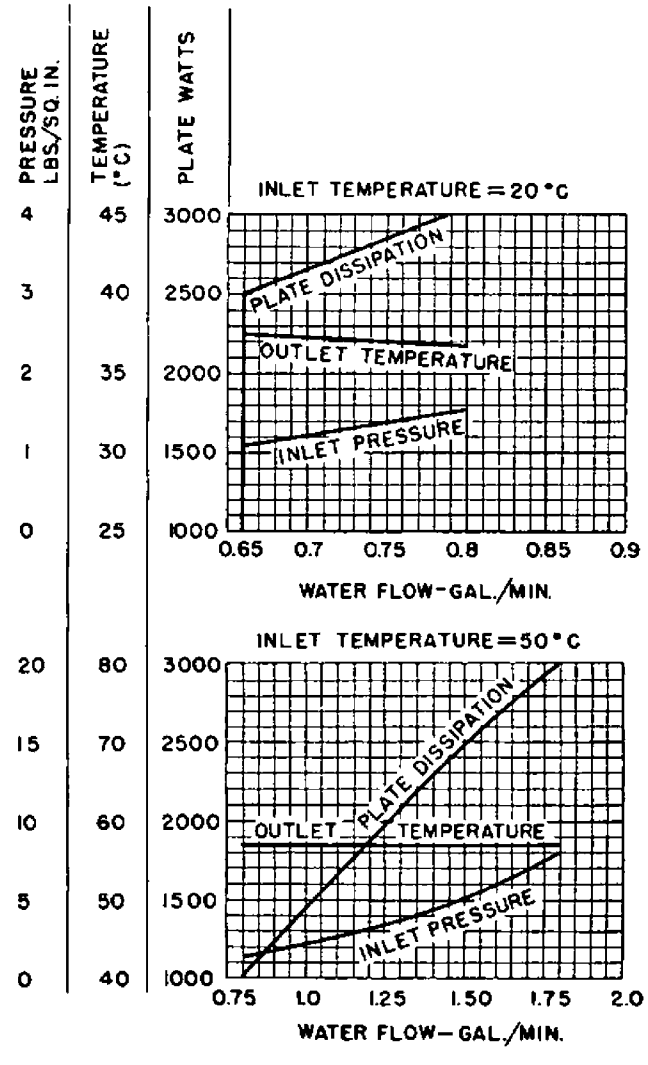
[13]Driving Power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

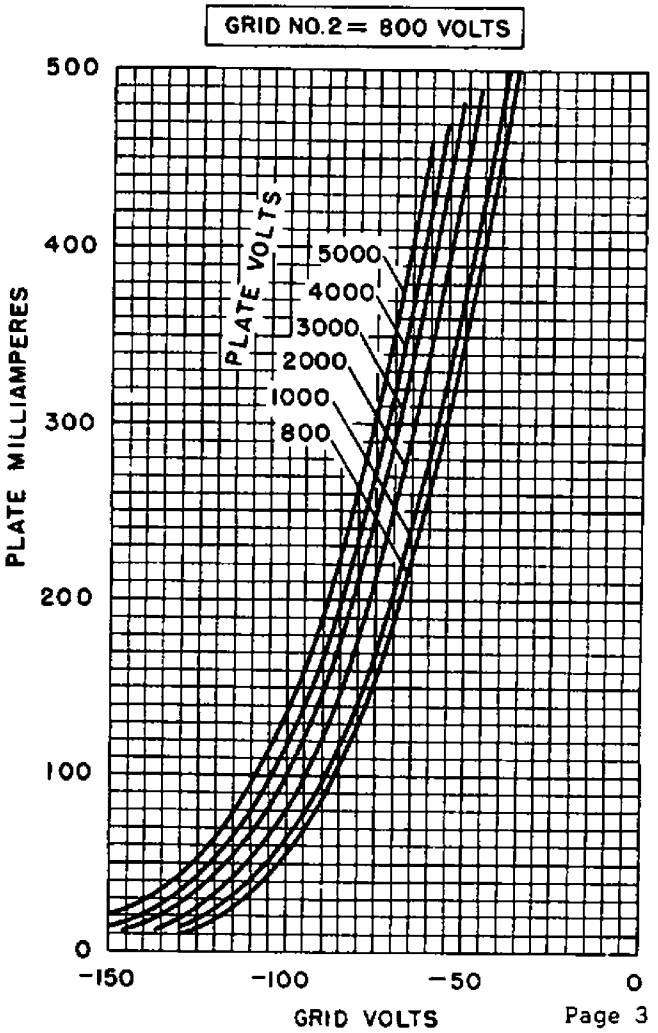
[14]Bandwidth: 6.5 Mc at 1.5 db or 12 Mc at 3 db. The values of bandwidth are based on measurements on a circuit with a single LC-section.

6075


GRID MODULATED H.F. CLASS B AMPLIFIER—T.V. SERVICE (2 TUBES, PUSH—PULL)
PLATE VOLTAGE = 4000 VOLTS
GRID NO. 2 VOLTAGE = 800 VOLTS
GRID NO. 1 BIAS = 150 VOLTS
SYNC OUTPUT = 6000 WATTS
BLACK LEVEL = 2800 WATTS
BLACK LEVEL
WHITE LEVEL
I ANT
Ib
Ic2
Ic1
FREQUENCY (MC)
GRID NO. 2 D.C. AMPERES
GRID NO. 1 D.C. AMPERES
PERCENT ANTENNA CURRENT
D.C. PLATE AMPERES
GRID NO. 1 A.C. VOLTAGE, PEAK TO PEAK


GRID MODULATED H.F. CLASS C AMPLIFIER—T.V. SERVICE (2 TUBES, PUSH—PULL)
PLATE VOLTAGE = 4000 VOLTS
GRID NO. 2 VOLTAGE = 800 VOLTS
GRID NO. 1 A.C. VOLTAGE = 850 VOLTS, PEAK TO PEAK
SYNC OUTPUT = 5900 WATTS
BLACK LEVEL = 4000 WATTS
BLACK LEVEL
WHITE LEVEL
I ANT
Ib
Ic2
Ic1
FREQUENCY (MC)
GRID NO. 2 D.C. AMPERES
GRID NO. 1 D.C. AMPERES
PERCENT ANTENNA CURRENT
D.C. PLATE AMPERES
GRID NO. 1 BIAS (VOLTS)


PRESSURE LBS./SQ. IN.
TEMPERATURE (°C)
PLATE WATTS
INLET TEMPERATURE = 20 °C
PLATE DISSIPATION
OUTLET TEMPERATURE
INLET PRESSURE
WATER FLOW—GAL./MIN.
INLET TEMPERATURE = 50 °C
PLATE DISSIPATION
OUTLET TEMPERATURE
INLET PRESSURE
WATER FLOW—GAL./MIN.


GRID NO. 2 = 800 VOLTS
PLATE MILLIAMPERES
PLATE VOLTS
5000
4000
3000
2000
1000
800
GRID VOLTS

from RTMA release #1237
Sept. 18, 1953

AMPEREX TUBE TYPE 6076

The 6076 is a four-electrode, forced air cooled tube designed for use as an R.F. power amplifier, modulator and frequency multiplier. The anode is capable of dissipating 3 kilowatts. The cathode is a thoriated tungsten filament. Maximum ratings apply up to 220 megacycles.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

Filament voltage	6.3 volts
Filament current	32.5 amps
Amplification factor (G_2-G, Mu)	8.5
Transconductance (Ib=2 amps)	19,000 micromhos
Direct Interelectrode Capacitances	
Input	0.35 μμf
Output	23.5 μμf
Plate to Filament	8.4 μμf
Peak cathode current[1] (max.)	7 amps

MECHANICAL DATA

Max. overall dimensions	
Length	6¾ inches
Diameter	3⅝ inches
Mounting position	Vertical, anode up or down
Control Grid Connection	See note[2]

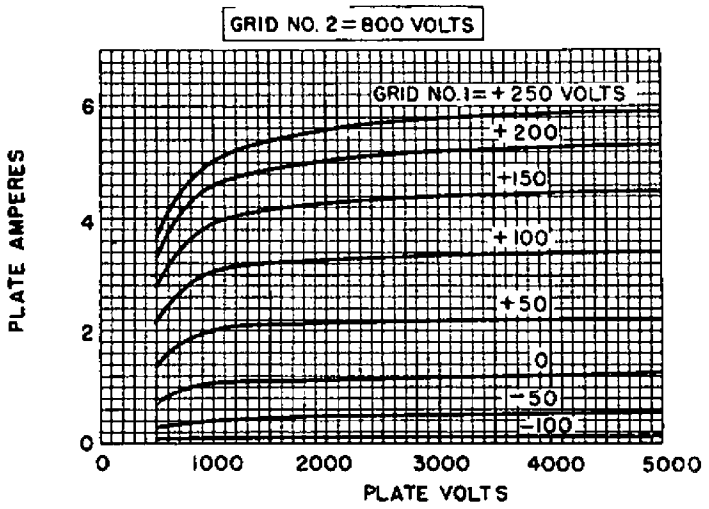
AIR COOLING DATA

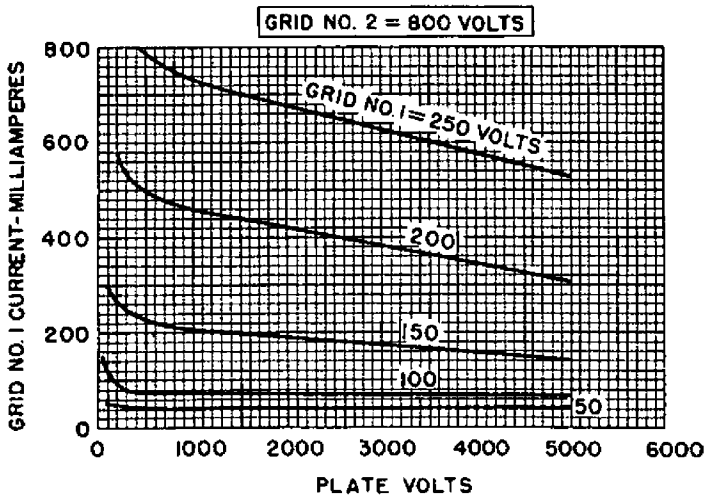
Plate dissipation (kw)	Height above sea level (feet)	Inlet air temp. (° C)	Min. Air flow (cu. ft./min.)	Inlet pressure (inches of water)
1	0	35	65	0.4
1	0	45	80	0.6
1	5,000	35	80	0.5
1	10,000	25	80	0.5
2.5	0	35	160	2.4
2.5	0	45	190	3.4
2.5	5,000	35	190	2.9
2.5	10,000	25	205	3.0
3	0	35	200	3.8

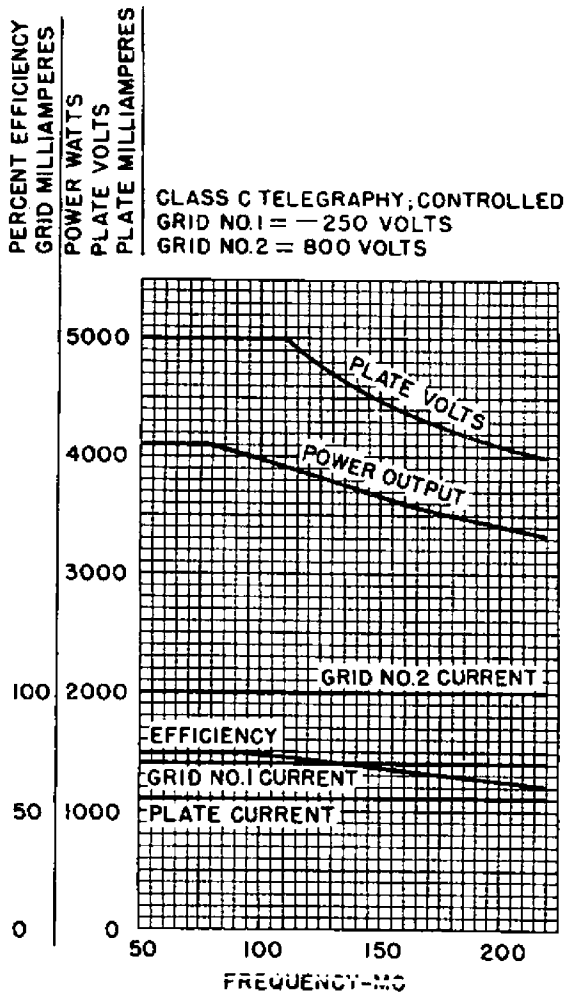
Max. Bulb Temperature	250° C
Max. Seal Temperature[3]	180° C

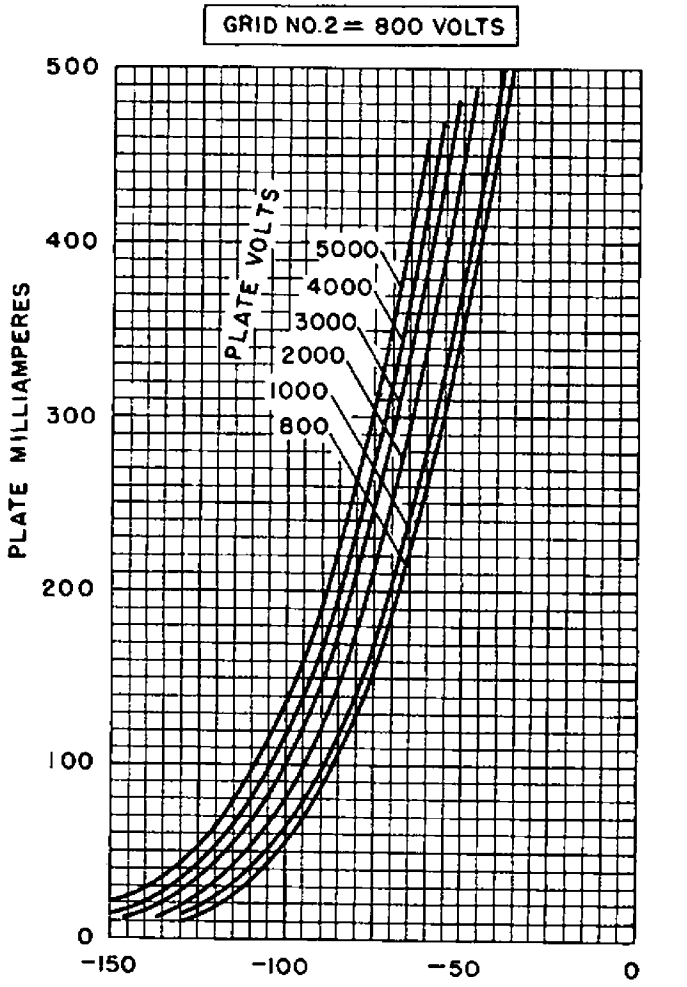
ACCESSORIES

Grid Connector	Amperex #S-3706
Filament Connector	Amperex #S-3707
Air Flow Chamber	Amperex #S-11882
Net Weight (approx.)	5 lbs.









6076

Plate and Screen Grid Modulated, R.F. Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values
(Frequencies up to 110 mc.)

	CCS	
D.C. Plate Voltage	4000	max. volts
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Grid No. 1 Voltage	—500	max. volts
D.C. Plate Current	1.0	max. amp
Plate Input	3.7	max. kilowatts
Plate Dissipation	2	max. kilowatts
Grid No. 2 Dissipation[4]	100	max. watts
Grid No. 1 Dissipation	30	max. watts

Typical Operation
(Screen grid supply via a choke of 60 henrys)

	CCS	
D.C. Plate Voltage	4000	volts
D.C. Grid No. 2 Voltage	800	volts
D.C. Grid No. 1 Voltage	—375	volts
Peak R.F. Grid No. 1 Voltage	525	volts
D.C. Plate Current	0.9	amp
D.C. Grid No. 2 Current	120	ma
D.C. Grid No. 1 Current	85	ma
Driving Power	48	watts
Power Output	2.7	kilowatts

Push-Pull R.F. Power Amplifier
Class C Telegraphy

Key-down conditions per tube without amplitude modulation[5]

Maximum Ratings, Absolute Values
(Frequencies up to 110 mc.)

	CCS	
D.C. Plate Voltage	5000	max. volts[6]
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Grid No. 1 Voltage	—500	max. volts
D.C. Plate Current	1.1	max. amps
Plate Input	5.5	max. kilowatts
Plate Dissipation	3	max. kilowatts
Grid No. 2 Dissipation	100	max. watts
Grid No. 1 Dissipation	30	max. watts

Typical Operation

	CCS	CCS	CCS[6]	CCS	
Frequency	75	110	75	110	Mc
D.C. Plate Voltage	4000	4000	5000	5000	volts
D.C. Grid No. 2 Voltage	800	800	800	800	volts
D.C. Grid No. 1 Voltage	—250	—250	—250	—250	volts
D.C. Plate Current	1.1	1.1	1.1	1.1	amps
D.C. Grid No. 2 Current	120	120	100	100	ma
D.C. Grid No. 1 Current	80	80	70	70	ma
Peak R.F. Grid No. 1 Voltage	500	500	480	480	volts
Driving Power	36	36	30	30	watts
Power Output	3.15	2.9	4.1	3.9	kilowatts

Grid Modulated R.F. Power Amplifier
Class C Television Service

Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values
(Frequencies up to 220 mc.)

	CCS	
D.C. Plate Voltage	4000	max. volts
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Grid No. 1 Voltage	—500	max. volts
D.C. Plate Current (sync.)	1.5	max. amps
Plate Input (sync.)	6	max. kilowatts
Plate Dissipation (sync.)	3	max. kilowatts
Grid No. 2 Dissipation (sync.)	100	max. watts
Grid No. 1 Dissipation (sync.)	30	max. watts

Typical Operation
Television Service at 170-220 Mc[7]

	CCS[9, 10]	CCS[9, 10]	
D.C. Plate Voltage	4000	4000	volts
D.C. Grid No. 2 Voltage	800	800	volts
D.C. Grid No. 1 Voltage			
Synchronization level	—150	—150	volts
Pedestal level	—230	—230	volts
White level	—450	—450	volts
R.F. Grid No. 1 Voltage, peak to peak	850	850	volts[11]
D.C. Plate Current			
Synchronization level	2.75	2.75	amps
Pedestal level	2.1	1.7	amps
D.C. Grid No. 2 Current			
Synchronization level	110	250	ma
Pedestal level	50	80	ma
D.C. Grid No. 1 Current			
Synchronization level	100	80	ma
Pedestal level	50	25	ma
Driving Power at Synchronization level	300-400	200-300	watts[12]
Power Output			
Synchronization level	5	5.9	kilowatts
Pedestal level	2.8	4.0	kilowatts

R.F. Power Amplifier
Class B—Television Service

Maximum Ratings, Absolute Values
(Frequencies up to 220 mc.)

	CCS	
D.C. Plate Voltage	4000	max. volts
D.C. Grid No. 2 Voltage	800	max. volts
D.C. Plate Current (sync.)	1.5	max. amps
Plate Input (sync.)	6	max. kilowatts
Plate Dissipation (sync.)	3	max. kilowatts
Grid No. 2 Dissipation (sync.)	100	max. watts
Grid No. 1 Dissipation (sync.)	30	max. watts

Typical Operation
Television Service at 170-220 Mc[7]

	CCS[13]	
D.C. Plate Voltage	4000	volts
D.C. Grid No. 2 Voltage	800	volts
D.C. Grid No. 1 Voltage	—150	volts
R.F. Grid No. 1 Voltage peak to peak		
Synchronization level[14]	850	volts
Pedestal level[14]	700	volts
D.C. Plate Current		
Synchronization level	2.75	amps
Pedestal level	2.1	amps
D.C. Grid No. 2 Current		
Synchronization level	110	ma
Pedestal level	50	ma
D.C. Grid No. 1 Current		
Synchronization level	100	ma
Pedestal level	50	ma
Driving Power at Synchronization level[12]	300-400	watts
Power Output		
Synchronization level	5	kilowatts
Pedestal level	2.8	kilowatts

[1] Represents maximum usable cathode current for any condition of operation.

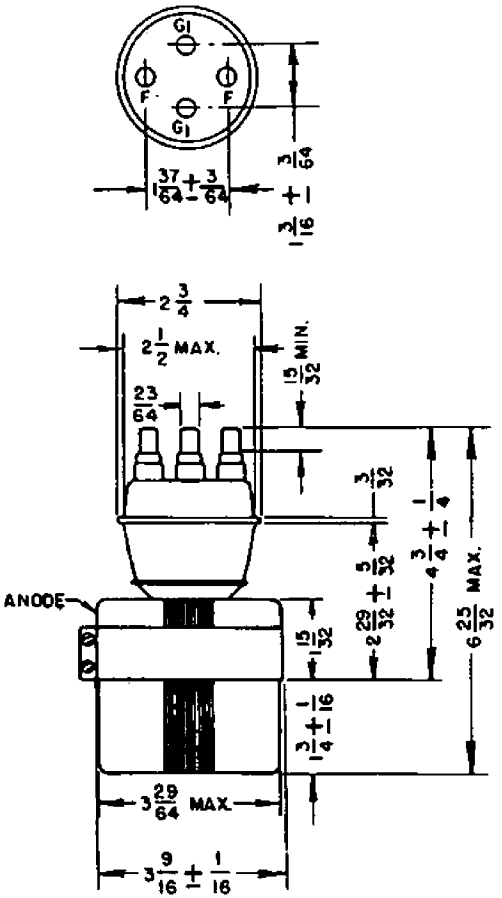
[2] Both pins must be used to make connection to the control grid.

[3] To keep the temperature of the seals below this value, it may be necessary to direct an air flow of sufficient velocity to the seals.

[4] For all other modulation methods the grid No. 2 dissipation is max. 65 watts.

[5] Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

[6] At 220 Mc the D.C. Plate Voltage=4000 volts max. For other frequencies, see derating curve.



[7] Values for two tubes in push-pull.

[8] Wide band: 6.5 Mc bandwidth at —1.5 db or 12 Mc at —3 db.

[9] Narrow band: 7.5 Mc bandwidth at —3 db.

[10] The values of bandwidth are based on measurements on a circuit with a single LC-section.

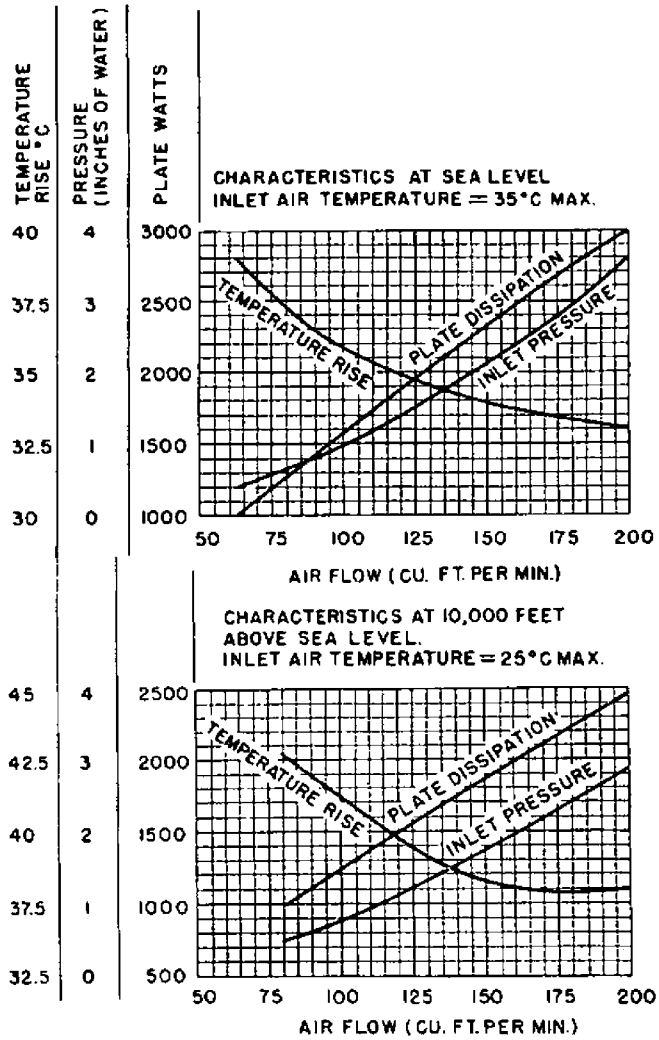
[11] Measured by slide back method.

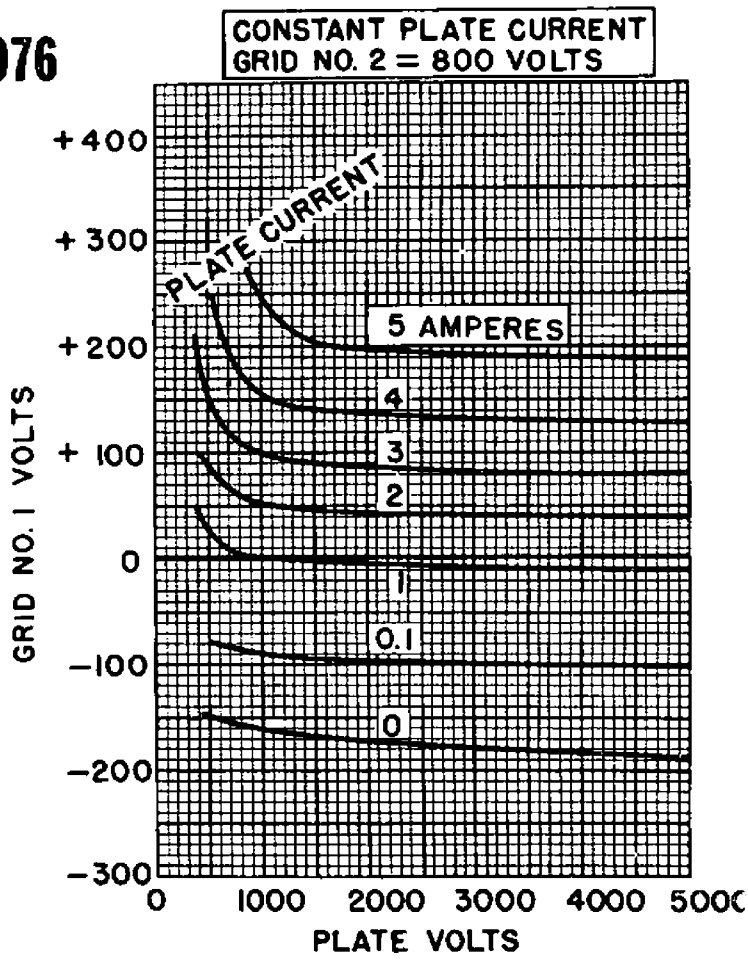
[12] Driving Power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

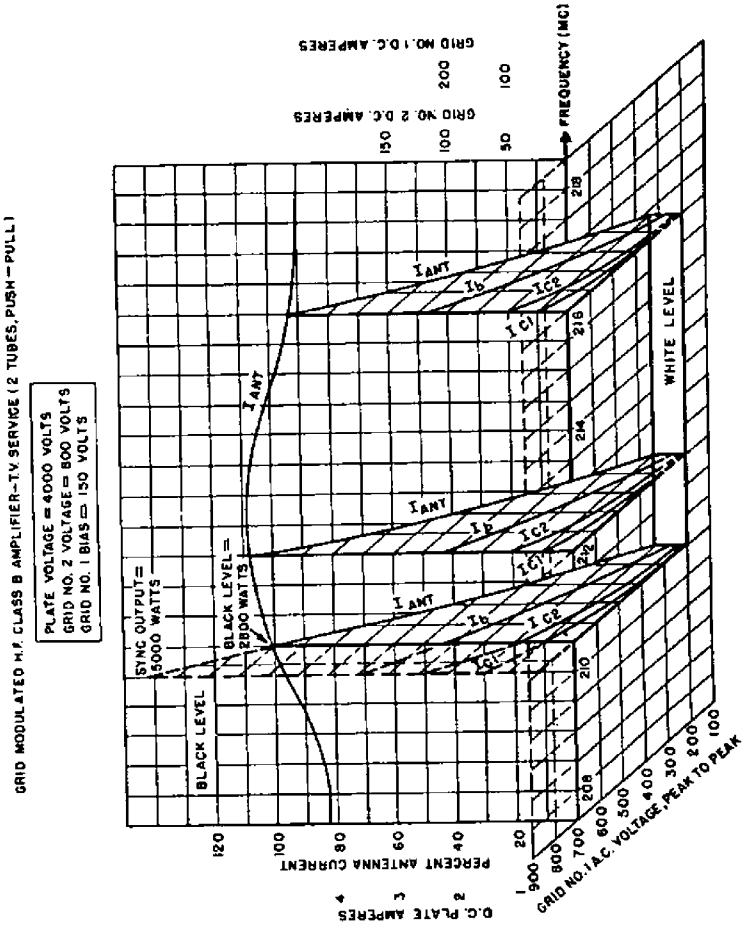
[13] Bandwidth: 6.5 Mc at —1.5 db or 12 Mc at —3 db.

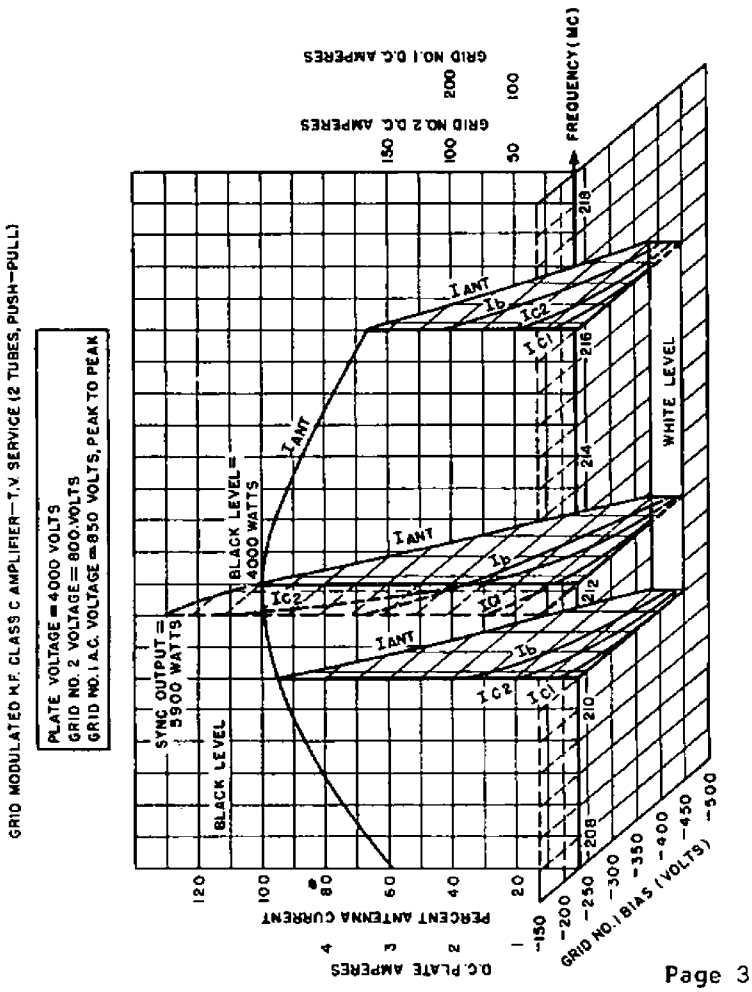
[14] Measured by increasing fixed bias until no grid current flows.

6076


CHARACTERISTICS AT SEA LEVEL
INLET AIR TEMPERATURE = 35°C MAX.
TEMPERATURE RISE °C
PRESSURE (INCHES OF WATER)
PLATE WATTS
TEMPERATURE RISE
PLATE DISSIPATION
INLET PRESSURE
AIR FLOW (CU. FT. PER MIN.)
CHARACTERISTICS AT 10,000 FEET ABOVE SEA LEVEL.
INLET AIR TEMPERATURE = 25°C MAX.
AIR FLOW (CU. FT. PER MIN.)


CONSTANT PLATE CURRENT
GRID NO. 2 = 800 VOLTS
PLATE CURRENT
5 AMPERES
4
3
2
1
0.1
0
GRID NO. 1 VOLTS
PLATE VOLTS


GRID MODULATED H.F. CLASS B AMPLIFIER—T.V. SERVICE (2 TUBES, PUSH—PULL)
PLATE VOLTAGE = 4000 VOLTS
GRID NO. 2 VOLTAGE = 800 VOLTS
GRID NO. 1 BIAS = 150 VOLTS
SYNC OUTPUT = 15000 WATTS
BLACK LEVEL = 2800 WATTS
BLACK LEVEL
WHITE LEVEL
I ANT
Ip
IC2
IC1
FREQUENCY (MC)
GRID NO. 2 D.C. AMPERES
GRID NO. 1 D.C. AMPERES
PERCENT ANTENNA CURRENT
D.C. PLATE AMPERES
GRID NO. 1 A.C. VOLTAGE, PEAK TO PEAK


GRID MODULATED H.F. CLASS C AMPLIFIER—T.V. SERVICE (2 TUBES, PUSH—PULL)
PLATE VOLTAGE = 4000 VOLTS
GRID NO. 2 VOLTAGE = 800 VOLTS
GRID NO. 1 A.C. VOLTAGE = 850 VOLTS, PEAK TO PEAK
SYNC OUTPUT = 5900 WATTS
BLACK LEVEL = 1400 WATTS
BLACK LEVEL
WHITE LEVEL
I ANT
Ip
IC2
IC1
FREQUENCY (MC)
GRID NO. 2 D.C. AMPERES
GRID NO. 1 D.C. AMPERES
PERCENT ANTENNA CURRENT
D.C. PLATE AMPERES
GRID NO. 1 BIAS (VOLTS)

AMPEREX TUBE TYPE 6077

The 6077 is a three-electrode water-cooled tube designed for use as a radio-frequency power amplifier, oscillator and modulator. The anode is capable of dissipating 50 kilowatts in class C telegraphy during Continuous Commercial Service. In radio-frequency class B operation, a plate dissipation of 100 kilowatts may be tolerated. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 15 megacycles. At reduced ratings it may be operated up to 30 megacycles.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

	Min.	Bogey	Max.	
Filament Voltage	16.6	17.5	18.4	volts
Filament Current at Bogey Voltage	180	196	212	amperes
Filament Starting Current[1]	—	—	420	amperes
Filament Cold Resistance	—	0.012	—	ohms
Amplification Factor (Ib=5 amps., Eb=10 kv.)	23	27	31	
Peak Cathode Current[2]	—	—	120	amperes
Direct Interelectrode Capacitances				
Grid-Plate	77	86	95	$\mu\mu$f
Grid-Filament	98	116	134	$\mu\mu$f
Plate-Filament	2.5	3.4	4.3	$\mu\mu$f

MECHANICAL DATA

Mounting Position — vertical, anode down

COOLING DATA[3]

Plate Dissipation	30		50		100		kilowatts
Inlet Temperature	20	50	20	50	20	50	° C.
Water Flow	6.6	12	8.5	17.0	15	32	min. gpm
Water Pressure	2.2	6.6	3.7	12.5	8.8	44	max. psi

Inlet Water Temperature . . . . . max. 50° C.

Air Cooling: Above 6 megacycles the anode-seal and grid-seal must be cooled. (Air supply through the anti-corona ring, attached to the tube.) Air flow must be applied before or simultaneously with filament voltage.

Air Flow required (at 30 megacycles) . . . . . min. 95 cfm

Pressure . . . . . 20 inches water

Glass Temperature at Seals . . . . . max. 180° C.

Net Weight (approx.) . . . . . 31 Pounds

ACCESSORIES

Water Jacket . . . . . Amperex #S-3738

Filament Connector . . . . . Amperex #S-3739

[1]Peak value.

[2]Represents maximum usable cathode current (plate current plus grid current) for any condition of operation.

[3]Water flow must be started before filament voltage is applied, and continued for 5 minutes after filament voltage is removed.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator—Class B

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	12	kilovolts max.
Maximum Signal D.C. Plate Current[1]	12	amperes max.
Maximum Signal Plate Input[1]	162	kilowatts max.
Plate Dissipation	50	kilowatts max.

Typical Operation

Unless otherwise specified, values are for two tubes.

	CCS	CCS	CCS	
D.C. Plate Voltage	8	8.5	9	kilovolts
D.C. Grid Voltage	—300	—325	—350	volts
Peak A.F. Grid to Grid Voltage	1120	1200	1300	volts
Zero Signal D.C. Plate Current	0.5	0.5	0.5	amperes
Maximum Signal D.C. Plate Current	8.2	8.8	9.6	amperes
Effective Load Resistance Plate to Plate	2210	2120	2080	ohms
Maximum Signal Driving Power, approximate	0.5	0.6	0.8	kilowatts
Maximum Signal Power Output, approximate	46.8	54	62	kilowatts
D.C. Plate Voltage	10	10	12	kilovolts
D.C. Grid Voltage	—400	—375	—450	volts
Peak A.F. Grid to Grid Voltage	1460	1480	2060	volts
Zero Signal D.C. Plate Current	0.4	1.0	1.3	amperes
Maximum Signal D.C. Plate Current	10.8	13.2	24	amperes
Effective Load Resistance, Plate to Plate	2060	1700	1200	ohms
Maximum Signal Driving Power, approximate	1	1.2	4.8	kilowatts
Maximum Signal Power Output, approximate	77	93	202	kilowatts

Radio-Frequency Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	12	kilovolts max.[2]
D.C. Plate Current	12.5	amperes max.
Plate Input	150	kilowatts max.[2]
Plate Dissipation	100	kilowatts max.

Typical Operation

	CCS	
D.C. Plate Voltage	12	kilovolts
D.C. Grid Voltage	—420	volts
Peak R.F. Grid Voltage	700	volts
D.C. Plate Current	12.2	amperes
D.C. Grid Current, approximate	0.5	amperes
Driving Power, approximate[3]	5.7	kilowatts
Power Output, approximate	51.5	kilowatts

Plate-Modulated Radio-Frequency Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	10	kilovolts max.
D.C. Grid Voltage	—1200	volts max.
D.C. Plate Current	9	amperes max.
D.C. Grid Current	3	amperes max.
Plate Input	90	kilowatts max.
Plate Dissipation	33	kilowatts max.

Typical Operation

	CCS	
D.C. Plate Voltage	10	kilovolts
D.C. Grid Voltage	—1050	volts
Peak R.F. Grid Voltage	1750	volts
D.C. Plate Current	8.5	amperes
D.C. Grid Current, approximate	2.8	amperes
Driving Power, approximate	4.1	kilowatts
Power Output, approximate	65	kilowatts

Radio-Frequency Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions per tube without amplitude modulation[4]

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	12	kilovolts max.[5]
D.C. Grid Voltage	—1250	volts max.
D.C. Plate Current	12	amperes max.
D.C. Grid Current	3	amperes max.
Plate Input	144	kilowatts max.[5]
Plate Dissipation	50	kilowatts max.

Typical Operation

	CCS	
D.C. Plate Voltage	12	kilovolts
D.C. Grid Voltage	—1000	volts
Peak R.F. Grid Voltage	1700	volts
D.C. Plate Current	12	amperes
D.C. Grid Current, approximate	2.25	amperes
Driving Power, approximate	3.5	kilowatts
Power Output, approximate	108	kilowatts

[1]Averaged over any audio-frequency cycle of sine-wave form.

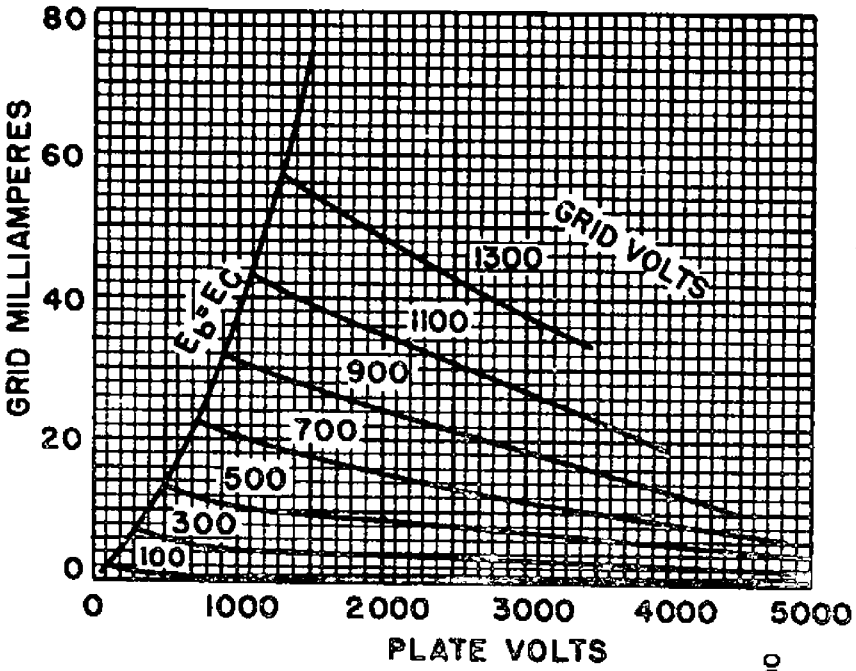
[2]At frequencies up to 4 megacycles the plate voltage and the plate input may be increased to 15 kilovolts and 180 kilowatts respectively.

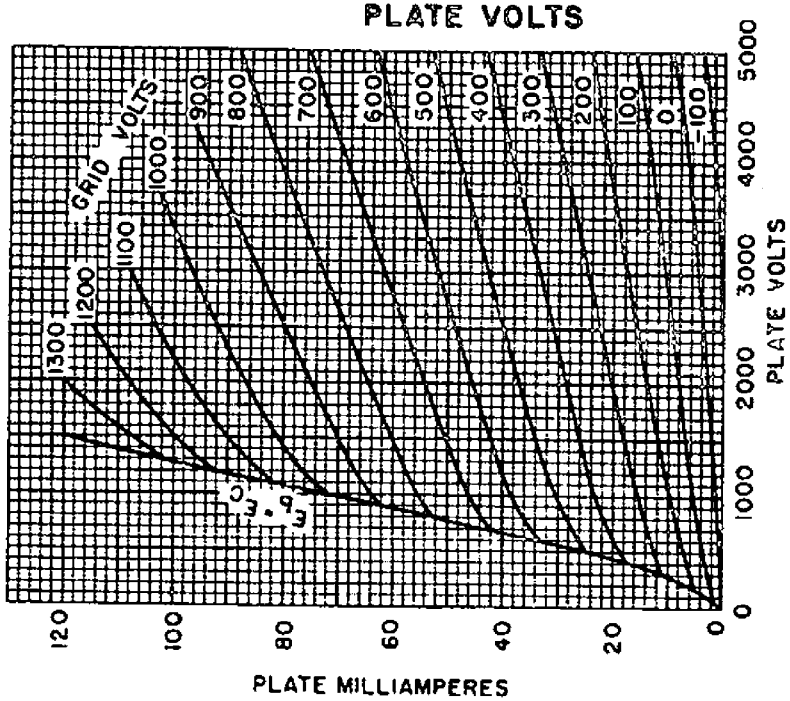
[3]At crest of audio-frequency cycle with modulation factor of 1.0.

[4]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

[5]At frequencies up to 4 megacycles the plate voltage and the plate input may be increased to 15 kilovolts and 180 kilowatts respectively.

from RTMA release #1237, Sept. 18, 1953





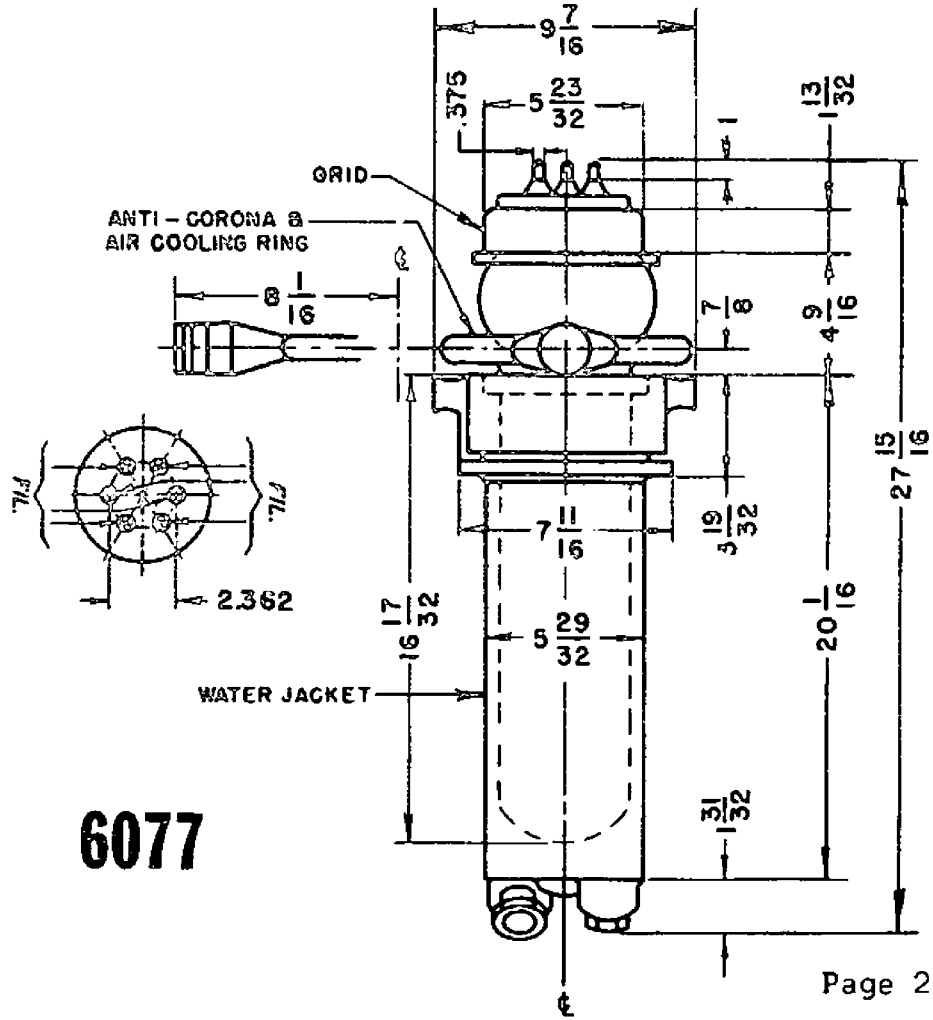
Maximum ratings apply up to 15 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

At frequencies up to 4 megacycles the plate voltage and input in Class C telegraphy and as radio-frequency Class B amplifier may be increased as mentioned under these headings.

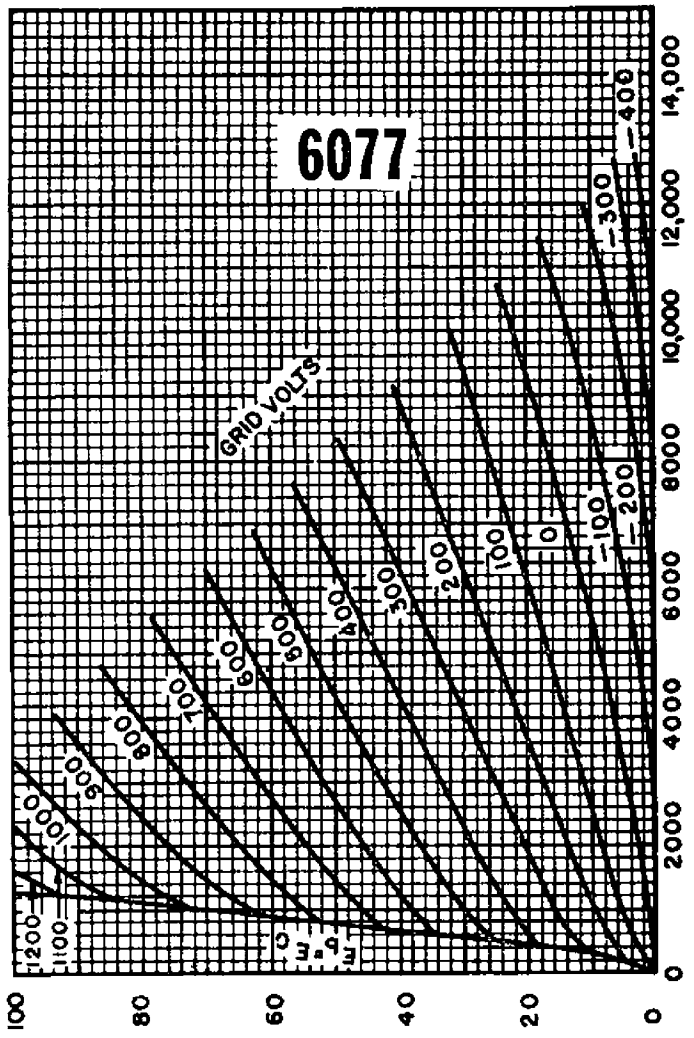
Frequency	15	20	30 megacycles
Percentage of Maximum Rated Plate Voltage			
Class B	100	100	83 per cent
Class C Plate Telephony	100	100	80 per cent
Class C Telegraphy	100	100	83 per cent
Percentage of Maximum Rated Plate Input			
Class B	100	67	47 per cent
Class C Plate Telephony	100	62	50 per cent
Class C Telegraphy	100	67	47 per cent

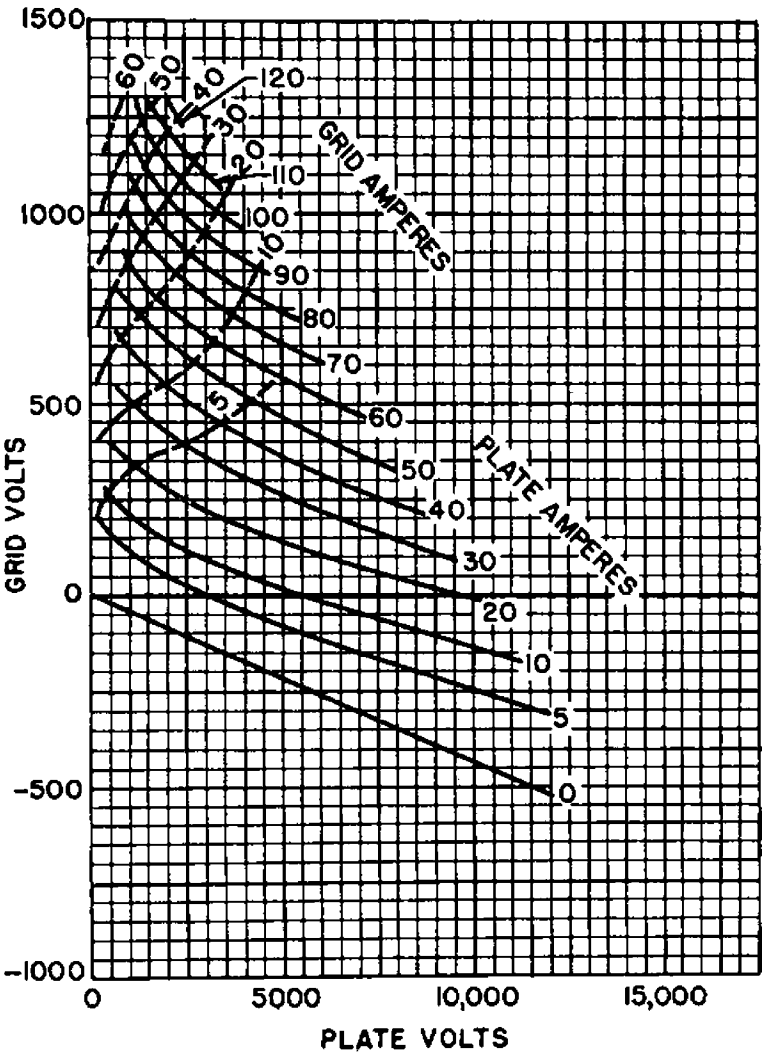
Characteristic Range Values for Equipment Design

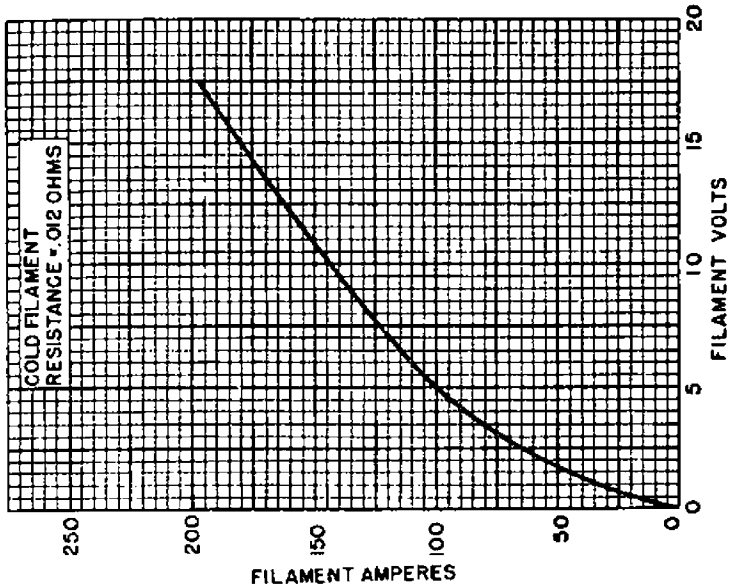
Characteristic	Conditions		Limits Min.	Limits Equiv	Limits Max.
Grid Voltage	Eb=2.5 kilovolts Ib=70 amperes	Ec:	—	—	980 volts
Grid Current	Eb=2.5 kilovolts Ib=70 amperes	Ic:	—	—	25 amperes
Plate Voltage	Ec=0 volts Ib=.5 amperes	Eb:	2.8	3.1	3.6 kilovolts
Grid Voltage	Eb=12 kilovolts Ib=4.2 amperes	Ec:	—280	—330	—375 volts
Plate Power Output	Eb=12 kilovolts Ec=—1000 volts Ib=12 amperes Ic=2.25 amperes f=15 megacycles	Po:	100	—	— kilowatts
Plate Power Output	Eb=10 kilovolts Ec=—800 volts Ib=6.7 amperes Ic=1.4 amperes f=30 megacycles	Po:	45	—	— kilowatts
Plate Current	Eb=12 kilovolts Ec=—500 volts	Ib:	—	—	0.25 amperes

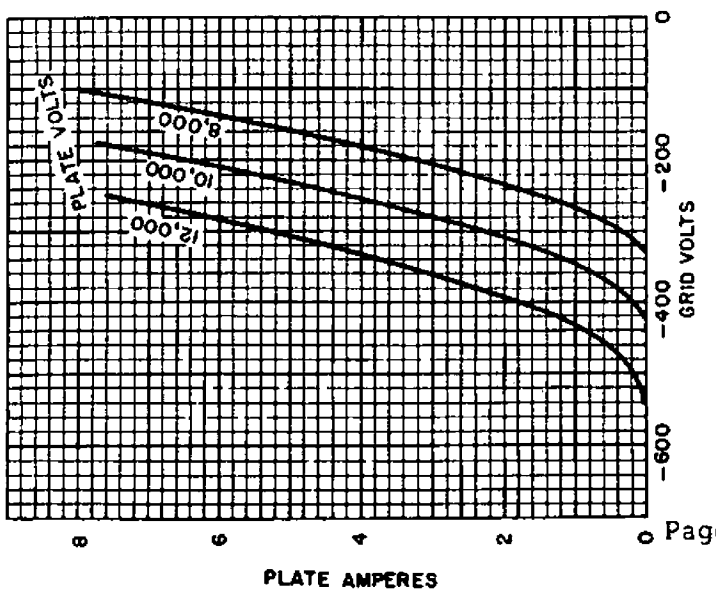


6077


GRID VOLTS
-400
-300
-200
-100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
14,000
12,000
10,000
8000
6000
4000
2000
0
PLATE VOLTS
100
80
60
40
20
0
PLATE AMPERES


GRID AMPERES
PLATE AMPERES
60
50
40
30
20
10
5
120
110
100
90
80
70
60
50
40
30
20
10
5
0
1500
1000
500
0
-500
-1000
GRID VOLTS
0
5000
10,000
15,000
PLATE VOLTS


COLD FILAMENT
RESISTANCE = .012 OHMS
20
15
10
5
0
FILAMENT VOLTS
250
200
150
100
50
0
FILAMENT AMPERES


PLATE VOLTS
8,000
10,000
12,000
0
-200
-400
-600
GRID VOLTS
8
6
4
2
0
PLATE AMPERES

AMPEREX TUBE TYPE 6078

The 6078 is a three-electrode, forced-air cooled tube designed for use as a radio-frequency power amplifier, oscillator and modulator. The anode is capable of dissipating 45 kw. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 15 Mc. At reduced ratings it may be operated up to 30 megacycles.

GENERAL CHARACTERISTICS

ELECTRICAL DATA	Min.	Bogey	Max.	
Filament Voltage	16.6	17.5	18.4	volts
Filament Current at Bogey Voltage	180	196	212	amperes
Filament Starting Current[1]	—	—	420	amperes
Filament Cold Resistance	—	0.012	—	ohms
Amplification Factor (Ib=5 amps., Eb=10 kv.)	23	27	31	
Peak Cathode Current[2]	—	—	120	amperes
Direct Interelectrode Capacitances				
Grid-Plate	77	86	95	$\mu\mu f$
Grid-Filament	98	116	134	$\mu\mu f$
Plate-Filament	2.5	3.4	4.3	$\mu\mu f$

MECHANICAL DATA

Mounting Position—vertical, anode down

Air Cooling of Anode—Cooling must be started before filament voltage is applied, and continued for 5 minutes after filament voltage is removed.

COOLING DATA

Plate Dissipation (kilowatts)	Elevation (feet)	Max. Inlet Air Temperature (degrees C.)	Air Flow (cu. ft./min.)	Inlet Air Pressure (inches water)
30	0	35	1235	4.45
	0	45	1412	5.58
	5,000	35	1483	5.3
	10,000	25	1553	5.15
45	0	35	1907	10.72
	0	45	2205	13.1
	5,000	35	2277	12.56
	10,000	25	2401	12.44

Above 6 Mc the anode and grid-seals must be cooled. This is accomplished by air flowing through the slots provided at the top of the air flow chamber. In certain cases, e.g. at low anode dissipation and cooling with the minimum quantity of air, the air flow to the seals will not be sufficient to maintain the seal temperature below the max. permissible value at frequencies above 6 Mc. Consequently, in these cases, a larger quantity of air must be supplied.

Glass Temperature at Seals	max. 180° C.
Net Weight (approx.)	66 Pounds

ACCESSORIES

Air Flow Chamber	Amperex #S-3740
Filament Connector	Amperex #S-3739

[1]Peak value.

[2]Represents maximum usable cathode current (plate current plus grid current) for any condition of operation.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio-Frequency Power Amplifier and Modulator—Class B

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	12	kilovolts max.
Maximum Signal D.C. Plate Current[1]	12	amperes max.
Maximum Signal Plate Input[1]	162	kilowatts max.
Plate Dissipation	45	kilowatts max.

Typical Operation

Unless otherwise specified, values are for two tubes.

	CCS	CCS	CCS	
D.C. Plate Voltage	8	8.5	9	kilovolts
D.C. Grid Voltage	—300	—325	—350	volts
Peak A.F Grid to Grid Voltage	1120	1200	1300	volts
Zero Signal D.C. Plate Current	0.5	0.5	0.5	amperes
Maximum Signal D.C. Plate Current	8.2	8.8	9.6	amperes
Effective Load Resistance, Plate to Plate	2210	2120	2080	ohms
Maximum Signal Driving Power, approximate	0.5	0.6	0.8	kilowatts
Maximum Signal Power Output, approximate	46.8	54	62	kilowatts
D.C. Plate Voltage	10	10	12	kilovolts
D.C. Grid Voltage	—400	—375	—450	volts
Peak A.F Grid to Grid Voltage	1460	1480	2060	volts
Zero Signal D.C. Plate Current	0.4	1	1.3	amperes
Maximum Signal D.C. Plate Current	10.8	13.2	24	amperes
Effective Load Resistance, Plate to Plate	2060	1700	1250	ohms
Maximum Signal Driving Power, approximate	1	1.2	4.8	kilowatts
Maximum Signal Power Output, approximate	77	93	202	kilowatts

Plate-Modulated Radio-Frequency Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	10	kilovolts max.
D.C. Grid Voltage	—1200	volts max.
D.C. Plate Current	9	amperes max.
D.C. Grid Current	3	amperes max.
Plate Input	90	kilowatts max.
Plate Dissipation	30	kilowatts max.

Typical Operation

	CCS	
D.C. Plate Voltage	10	kilovolts
D.C. Grid Voltage	—1050	volts
Peak R.F Grid Voltage	1750	volts
D.C. Plate Current	8.5	amperes
D.C. Grid Current, approximate	2.6	amperes
Driving Power, approximate	4.1	kilowatts
Power Output, approximate	65	kilowatts

Radio-Frequency Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions per tube without amplitude modulation[1]

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	12	kilovolts max.[2]
D.C. Grid Voltage	—1250	volts max.
D.C. Plate Current	12	amperes max.
D.C. Grid Current	3	amperes max.
Plate Input	144	kilowatts max.[2]
Plate Dissipation	45	kilowatts max.

Typical Operation

	CCS	
D.C. Plate Voltage	12	kilovolts
D.C. Grid Voltage	—1000	volts
Peak R.F. Grid Voltage	1700	volts
D.C. Plate Current	12	amperes
D.C. Grid Current, approximate	2.25	amperes
Driving Power, approximate	3.5	kilowatts
Power Output, approximate	108	kilowatts

Maximum ratings apply up to 15 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

At frequencies up to 4 megacycles the plate voltage and input in Class C telegraphy and as radio-frequency Class B amplifier may be increased as mentioned under these headings.

Frequency	15	20	30	megacycles
Percentage of Maximum Rated Plate Voltage				
Class B	100	100	83	per cent
Class C Plate Telephony	100	100	80	per cent
Class C Telegraphy	100	100	83	per cent
Percentage of Maximum Rated Plate Input				
Class B	100	87	47	per cent
Class C Plate Telephony	100	82	50	per cent
Class C Telegraphy	100	87	47	per cent

Characteristic Range Values for Equipment Design

Characteristic	Conditions		Limits Min.	Bogey	Max.	
Grid Voltage	Eb=2.5 kilovolts Ib=70 amperes	Ec:	—	—	980	volts
Grid Current	Eb=2.5 kilovolts Ib=70 amperes	Ic:	—	—	25	amperes
Plate Voltage	Ec=0 volts Ib=5 amperes	Eb:	2.6	3.1	3.6	kilovolts
Grid Voltage	Eb=12 kilovolts Ib=4.2 amperes	Ec:	—280	—330	—375	volts
Plate Power Output	Eb=12 kilovolts Ec=—1000 volts Ib=12 amperes Ic=2.25 amperes f=15 megacycles	Po:	100	—	—	kilowatts
Plate Power Output	Eb=10 kilovolts Ec=—800 volts Ib=6.7 amperes Ic=1.4 amperes f=30 megacycles	Po:	45	—	—	kilowatts
Plate Current	Eb=12 kilovolts Ec=—500 volts	Ib.	—	—	0.25	amperes

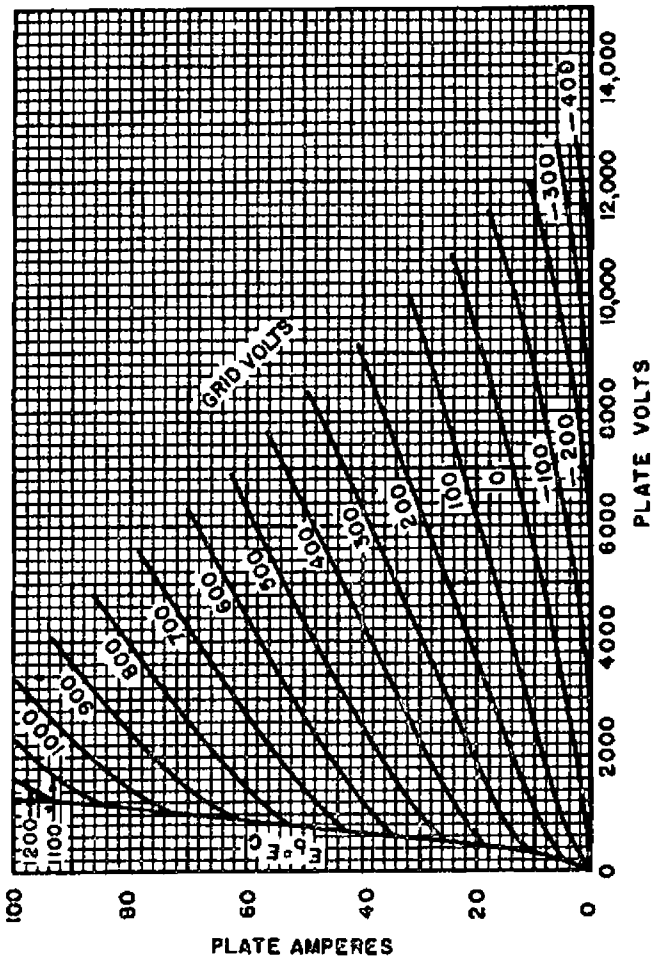
[1]Averaged over any audio-frequency cycle of sine-wave form.

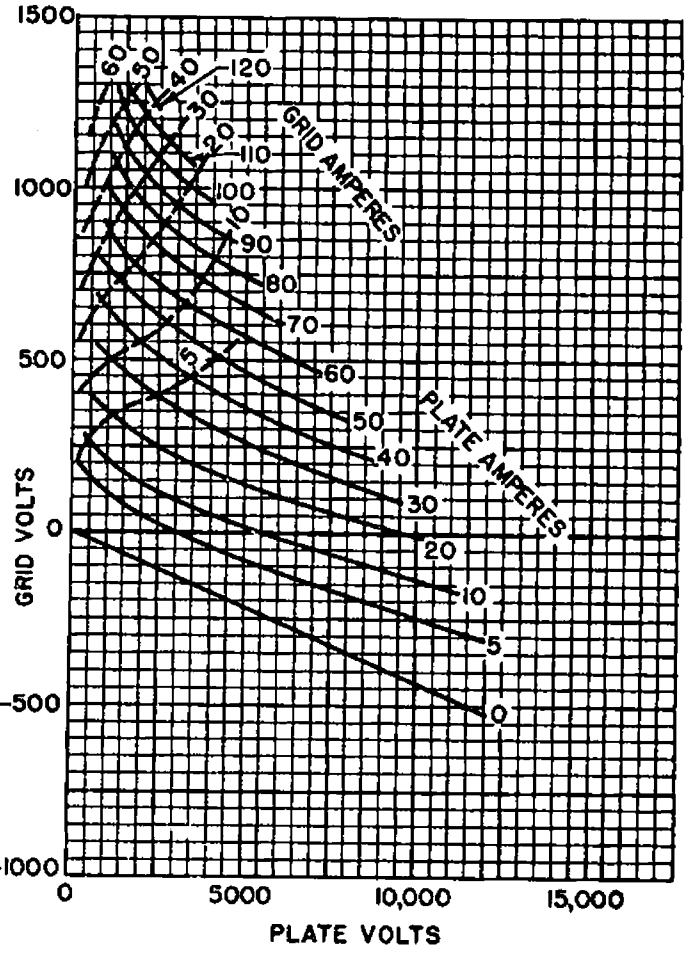
[2]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

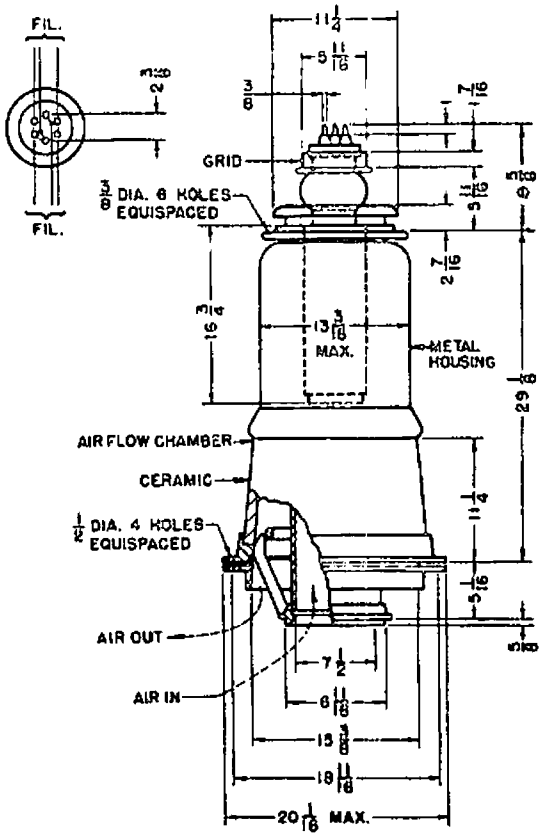
[3]At frequencies up to 4 megacycles the plate voltage and the plate input may be increased to 15 kilovolts and 166 kilowatts respectively.

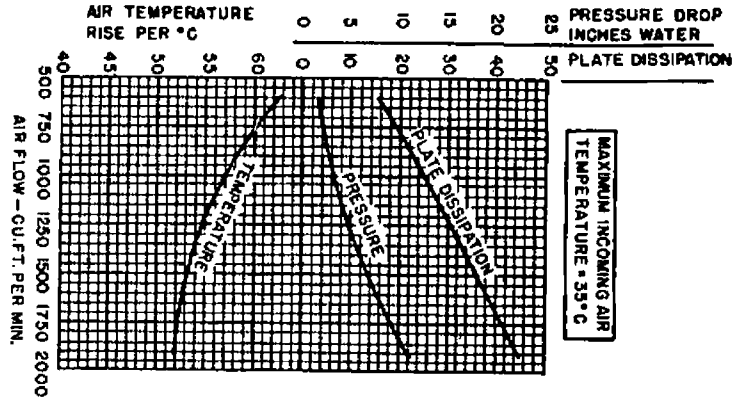
from RTMA release #1237, Sept. 18, 1953

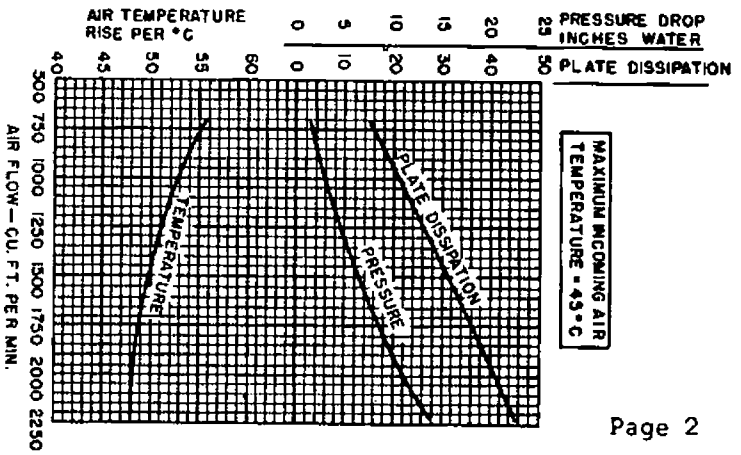
6078


GRID VOLTS
PLATE VOLTS
PLATE AMPERES
14,000
12,000
10,000
8000
6000
4000
2000
0
100
80
60
40
20
0


GRID AMPERES
PLATE AMPERES
GRID VOLTS
PLATE VOLTS
1500
1000
500
0
-500
-1000
0
5000
10,000
15,000

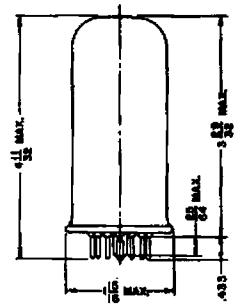

FIL.
GRID
DIA. 6 HOLES EQUISPACED
METAL HOUSING
AIR FLOW CHAMBER
CERAMIC
DIA. 4 HOLES EQUISPACED
AIR OUT
AIR IN
MAX.

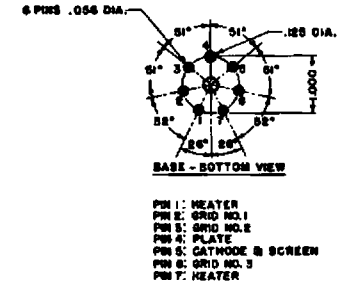

AIR TEMPERATURE RISE PER °C
PRESSURE DROP INCHES WATER
PLATE DISSIPATION
AIR FLOW—CU.FT. PER MIN.
TEMPERATURE
PRESSURE
PLATE DISSIPATION
MAXIMUM INCOMING AIR TEMPERATURE = 35°C


AIR TEMPERATURE RISE PER °C
PRESSURE DROP INCHES WATER
PLATE DISSIPATION
AIR FLOW—CU. FT. PER MIN.
TEMPERATURE
PRESSURE
PLATE DISSIPATION
MAXIMUM INCOMING AIR TEMPERATURE = 45°C

AMPEREX TUBE TYPE 6083

The 6083/AX-9909 is a five-electrode tube designed for use as a radio-frequency power amplifier, oscillator and audio-frequency amplifier. The anode is capable of dissipating 45 watts, and cooling is accomplished by radiation. The cathode is a coated unipotential cathode. Maximum ratings apply up to 60 megacycles.





GENERAL CHARACTERISTICS

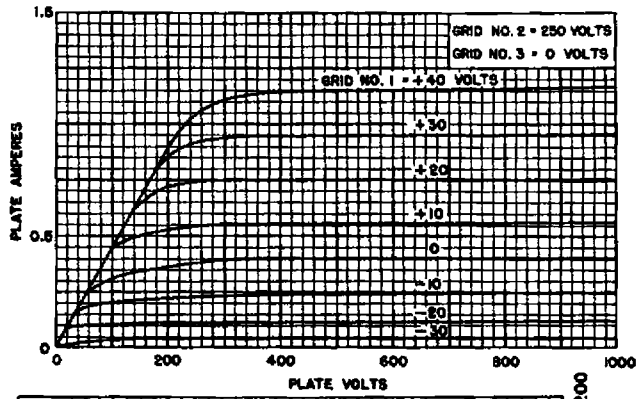
ELECTRICAL

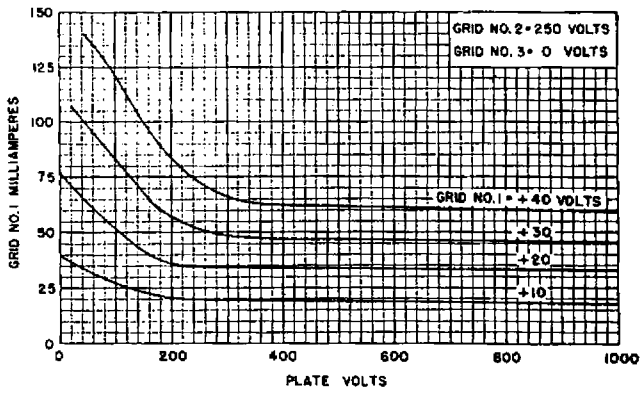
	Min.	Bogey	Max.	
Heater Voltage	11.4	12.6	13.8	volts
Heater Current at Bogey Voltage	1.22	1.35	1.48	amperes
Amplification Factor				
G1-G2 Mu at Eb=1000 volts,				
Ec2=300 volts, Ib=40 ma	5.4	6.7	8.0	
Peak Cathode Current[1]	—	—	1.5	amperes
Direct Interelectrode Capacitances				
Grid-Plate	—	0.1	0.2	$\mu\mu$f
Input	21	22.5	24	$\mu\mu$f
Output	9.8	11	12.2	$\mu\mu$f

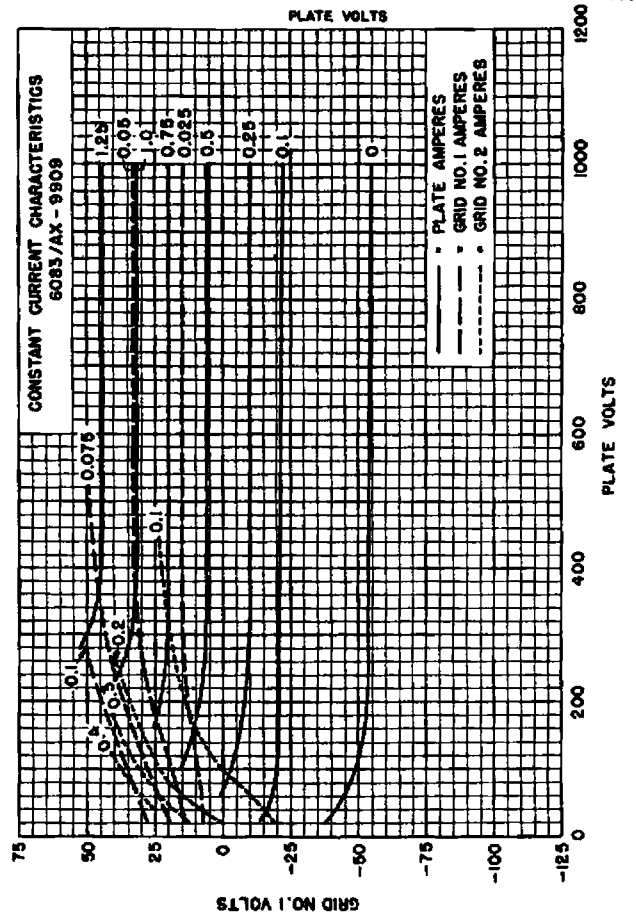
MECHANICAL

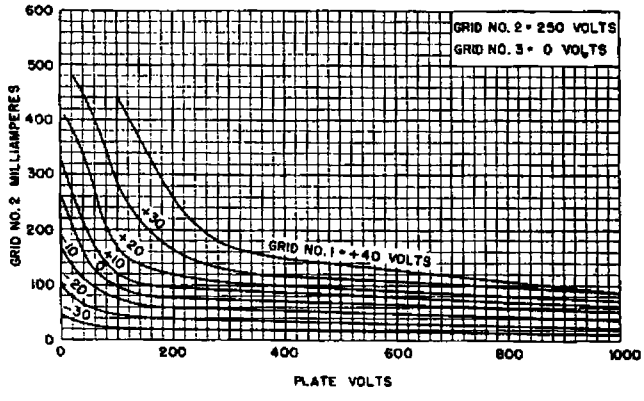
Mounting Position	Any
Maximum Glass Temperature at bottom seals	180° C
Net weight, approximate	2.7 ounces

[1]Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.



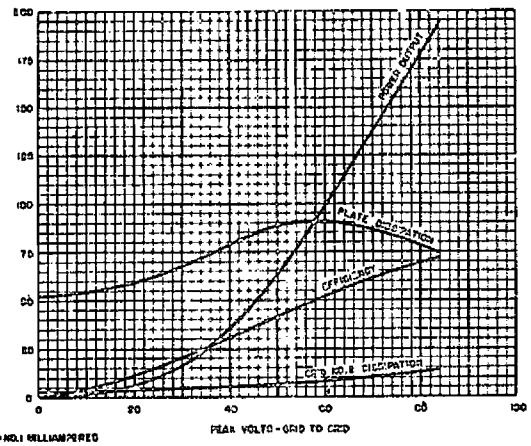






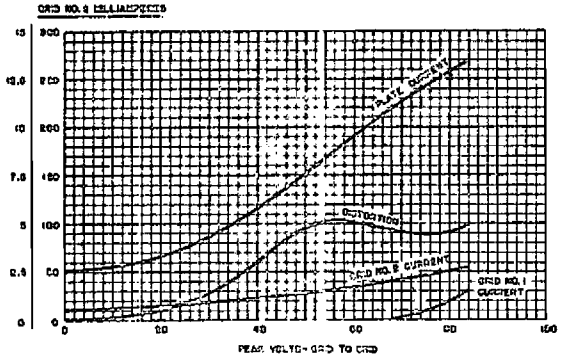
CLASS B MODULATOR
TWO UNITS, PUSH-PULL
PLATE VOLTAGE = 1000 VOLTS
GRID NO. 2 VOLTAGE = 250 VOLTS
GRID NO. 1 VOLTAGE = -40 VOLTS
GRID NO. 3 VOLTAGE = 0
RESISTANCE, PLATE TO PLATE = 6600 OHMS

GRID NO. 2 DISSIPATION - WATTS
PLATE DISSIPATION - WATTS
POWER OUTPUT - WATTS
PERCENT EFFICIENCY



PEAK VOLTS - GRID TO GRID

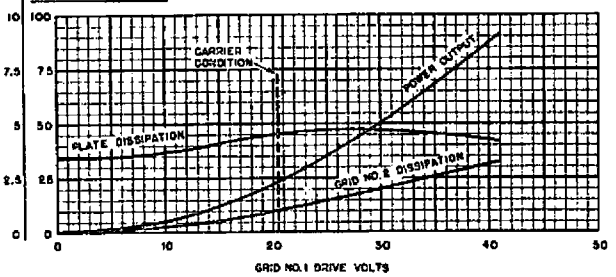
GRID NO. 1 MILLIAMPERES
PERCENT DISTORTION
PLATE MILLIAMPERES
GRID NO. 2 MILLIAMPERES



PEAK VOLTS - GRID TO GRID

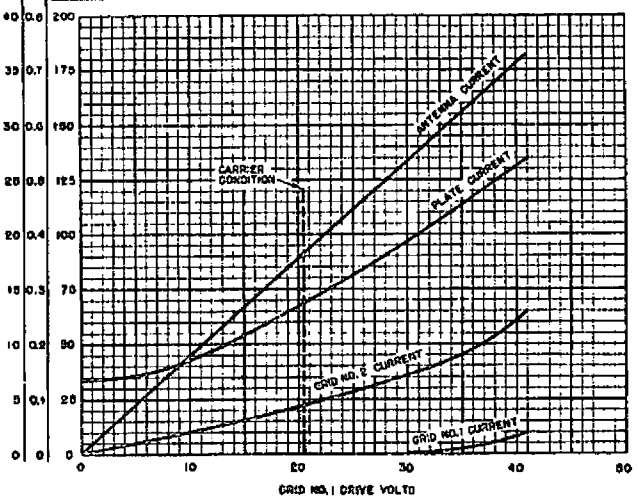
CLASS B TELEPHONY
60 MEGACYCLE MAXIMUM
PLATE VOLTAGE = 1000 VOLTS
GRID NO. 1 VOLTAGE = -34 VOLTS
GRID NO. 2 VOLTAGE = 250 VOLTS
GRID NO. 3 VOLTAGE = 0

GRID NO. 2 DISSIPATION - WATTS
PLATE DISSIPATION - WATTS
POWER OUTPUT - WATTS



GRID NO. 1 DRIVE VOLTS

GRID NO. 1 MILLIAMPERES
GRID NO. 2 MILLIAMPERES
ANTENNA CURRENT - AMPERES
PLATE MILLIAMPERES

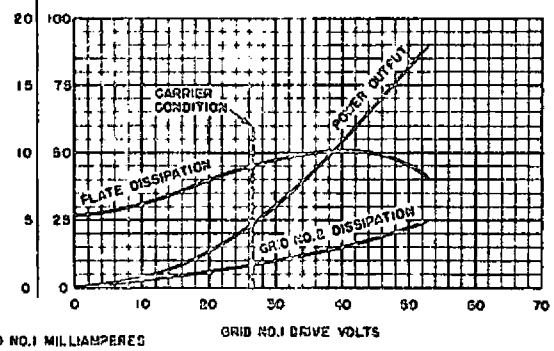


GRID NO. 1 DRIVE VOLTS

6083

CLASS B TELEPHONY
60 MEGACYCLE MAXIMUM
PLATE VOLTAGE = 1000 VOLTS
GRID NO. 1 VOLTAGE = -30.5 VOLTS
GRID NO. 2 VOLTAGE = 250 VOLTS
GRID NO. 3 VOLTAGE = 0

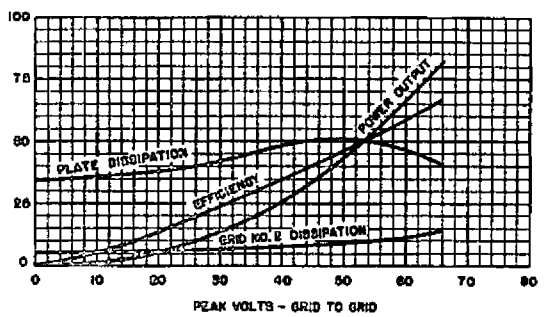
GRID NO. 2 DISSIPATION - WATTS
PLATE DISSIPATION - WATTS
POWER OUTPUT - WATTS



GRID NO. 1 DRIVE VOLTS

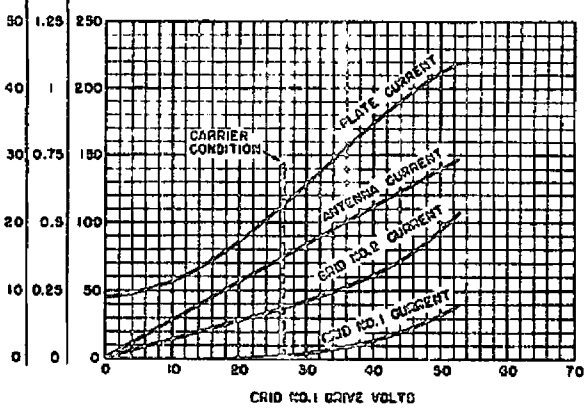
CLASS B MODULATOR
TWO UNITS, PUSH-PULL
PLATE VOLTAGE = 600 VOLTS
GRID NO. 2 VOLTAGE = 250 VOLTS
GRID NO. 1 VOLTAGE = -35 VOLTS
GRID NO. 3 VOLTAGE = 0
RESISTANCE, PLATE TO PLATE = 6320 OHMS

GRID NO. 2 DISSIPATION - WATTS
PLATE DISSIPATION - WATTS
POWER OUTPUT - WATTS
PERCENT EFFICIENCY



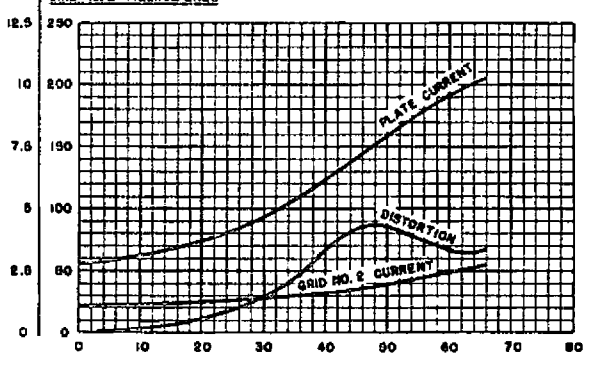
PEAK VOLTS - GRID TO GRID

GRID NO. 1 MILLIAMPERES
GRID NO. 2 MILLIAMPERES
ANTENNA CURRENT - AMPERES
PLATE MILLIAMPERES



GRID NO. 1 DRIVE VOLTS

PERCENT DISTORTION
PLATE MILLIAMPERES
GRID NO. 2 MILLIAMPERES



PEAK VOLTS - GRID TO GRID

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	1000	volts max.
D.C. Grid No. 2 Voltage	300	volts max.
Maximum Signal D.C. Plate Current[1]	210	ma max.
Maximum Signal Plate Input[1]	180	watts max.
Maximum Signal Grid No. 2 Input[1]	7	watts max.
Plate Dissipation[1]	45	watts max.

Typical Operation

Unless otherwise specified, values are for two tubes

	CCS	CCS	CCS	
D.C. Plate Voltage	600	800	1000	volts
D.C. Grid No. 3 Voltage	0	0	0	volts
D.C. Grid No. 2 Voltage	250	250	250	volts
D.C. Grid No. 1 Voltage	-33	-33.5	-34	volts
Peak A.F. Grid No. 1 to Grid No. 1 Voltage	66	68	84	volts
Zero Signal D.C. Plate Current	2x28	2x28	2x26	ma
Maximum Signal D.C. Plate Current	2x102	2x108	2x134	ma
Zero Signal D.C. Grid No. 2 Current	2x11	2x8	2x5	ma
Max. Signal D.C. Grid No. 2 Current	2x28	2x27	2x28	ma
Effective Load Resistance, Plate to Plate	6320	7560	8800	ohms
Max. Signal Driving Power, approx.	0	0	0.06	watts
Max. Signal Power Output, approx.	82	110	194	watts

R.F. Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	1000	volts max.
D.C. Grid No. 3 Voltage	0	volts max.
D.C. Grid No. 2 Voltage	300	volts max.
D.C. Plate Current	170	ma max.
Plate Input	72	watts max.
Grid No. 3 Input	—	watts max.
Grid No. 2 Input	6	watts max.
Plate Dissipation	45	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	600	800	1000	volts
D.C. Grid No. 3 Voltage	0	0	0	volts
D.C. Grid No. 2 Voltage	250	250	250	volts
D.C. Grid No. 1 Voltage	-30.5	-33	-34	volts
Peak R.F. Grid No. 1 Voltage	26.5	22.5	20.5	volts
D.C. Plate Current	114	85	68	ma
D.C. Grid No. 2 Current	7.5	6	4.5	ma
D.C. Grid No. 1 Current, approximate	0	0	0	ma
Driving Power, approximate[2]	0.38	0.17	0.08	watts
Power Output, approximate	23	23	23	watts

Plate and Screen Grid Modulated R.F. Power Amplifier — Class C — Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	800	volts max.
D.C. Grid No. 3 Voltage	0	volts max.
D.C. Grid No. 2 Voltage	300	volts max.
D.C. Grid No. 1 Voltage	-250	volts max.
D.C. Plate Current	170	ma max.
D.C. Grid No. 1 Current	12	ma max.
Plate Input	136	watts max.
Grid No. 2 Input	6	watts max.
Plate Dissipation	30	watts max.

Typical Operation

	CCS	CCS	
D.C. Plate Voltage	600	800	volts
D.C. Grid No. 3 Voltage	0	0	volts
D.C. Grid No. 2 Voltage	250	250	volts
DC. Grid No. 1 Voltage	-120	-120	volts
Peak R.F Grid No 1 Voltage	150	150	volts
D.C. Plate Current	120	120	ma
D.C. Grid No. 2 Current	23	23	ma
D.C. Grid No. 1 Current, approximate	6.5	6.5	ma
Driving Power, approximate	0.9	0.9	watts
Power Output, approximate	51	75	watts

Suppressor-Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	1000	volts max.
D.C. Grid No. 3 Voltage	-150	volts max.
D.C. Grid No. 2 Voltage	300	volts max.
D.C. Grid No. 1 Voltage	-250	volts max.
D.C. Plate Current	136	ma max.
D.C. Grid No. 1 Current	12	ma max.
Plate Input	72	watts max.
Grid No. 3 Input	0	watts max.
Grid No. 2 Input	6	watts max.
Plate Dissipation	45	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	600	800	1000	volts
D.C. Grid No. 3 Voltage	-60	-80	-100	volts
D.C. Grid No. 2 Voltage	150	150	150	volts
D.C. Grid No. 1 Voltage	-100	-100	-100	volts
Peak A.F. Grid No. 3 Voltage	60	80	100	volts
Peak R.F. Grid No. 1 Voltage	150	145	140	volts
D.C. Plate Current	111	98.5	72	ma
D.C. Grid No. 2 Current	26	25	24	ma
D.C. Grid No. 1 Current, approximate	11	11	10	ma
Driving Power, approximate	1.5	1.5	1.3	watts
Power Output, approximate	22	26	27	watts

R.F. Power Amplifier and Oscillator Class C—Telegraphy

Key-down conditions per tube without amplitude modulation[3]

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	1000	volts max.
D.C. Grid No. 3 Voltage	0	volts max.
D.C. Grid No. 2 Voltage	300	volts max.
D.C. Grid No. 1 Voltage	-250	volts max.
D.C. Plate Current	210	ma max.
D.C. Grid No. 1 Current	12	ma max.
Plate Input	210	watts max.
Grid No. 2 Input	7	watts max.
Plate Dissipation	45	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	600	800	1000	volts
D.C. Grid No. 3 Voltage	0	0	0	volts
D.C. Grid No. 2 Voltage	250	250	250	volts
D.C. Grid No. 1 Voltage	-100	-110	-120	volts
Peak R.F. Grid No 1 Voltage	124	134	144	volts
D.C. Plate Current	205	190	177	ma
D.C. Grid No. 2 Current	28	28	28	ma
D.C. Grid No. 1 Current, approximate	7.5	6	5	ma
Driving Power, approximate	0.84	0.73	0.65	watts
Power Output, approximate	78	107	132	watts

Electrical Data and Limits

Maximum ratings apply up to 60 megacycles.

Characteristic	Conditions		Limits Min.	Bogey	Max.	
Grid No. 1 Voltage	Eb=250 V Ec₂=250 V Ib=850 ma	Ec₁:	—	—	-40	volts
Grid No. 2 Current	Eb=250 V Ec₂=250 V Ib=850 ma	Ic₂:	—	—	200	ma
Grid No. 1 Current	Eb=250 V Ec₂=250 V Ib=850 ma	Ic₁:	—	—	70	ma
Plate Current	Eb=1000 V Ec₂=300 V Ec₁=-55 V	Ib:	—	—	5	ma
Plate Current	Eb=1000 V Ec₂=300 V Ec₁=-35 V	Ib:	27	50	73	ma
Plate Current	Eb=1000 V Ec₂=300 V Ec₁=-25 V	Ib:	84	128	172	ma
Grid No. 2 Current	Eb=1000 V Ec₂=300 V Ec₁=-35 V	Ic₂:	—	—	5	ma
Power Output	Eb=1000 V Ec₂=250 V Ec₁=-120 V Ib=175 ma f=60 megacycles	Po:	105	—	—	watts

[1]Averaged over any audio-frequency cycle of sine-wave form.

[2]At crest of audio-frequency cycle with modulation factor of 1.0.

[3]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

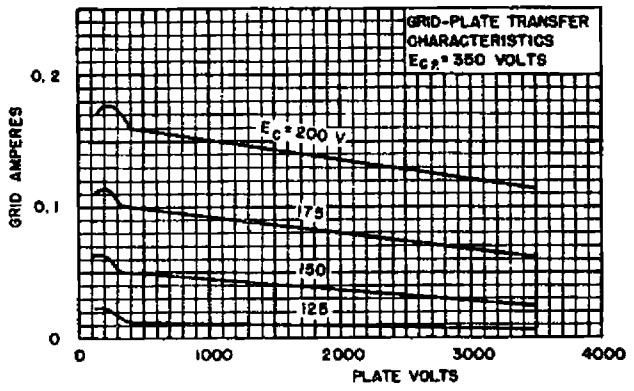
The 6155/4-125-A is a four-electrode tube designed for use as a radio-frequency power amplifier and modulator. The anode is capable of dissipating 125 watts. The cathode is a thoriated-tungsten filament. Maximum ratings apply up to 120 megacycles. At reduced ratings it may be operated up to 200 megacycles.

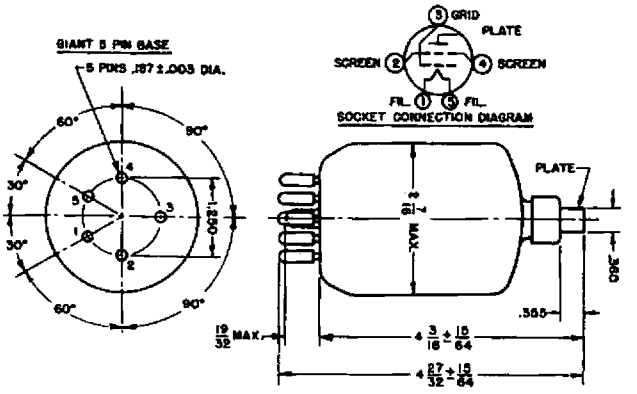
GENERAL CHARACTERISTICS

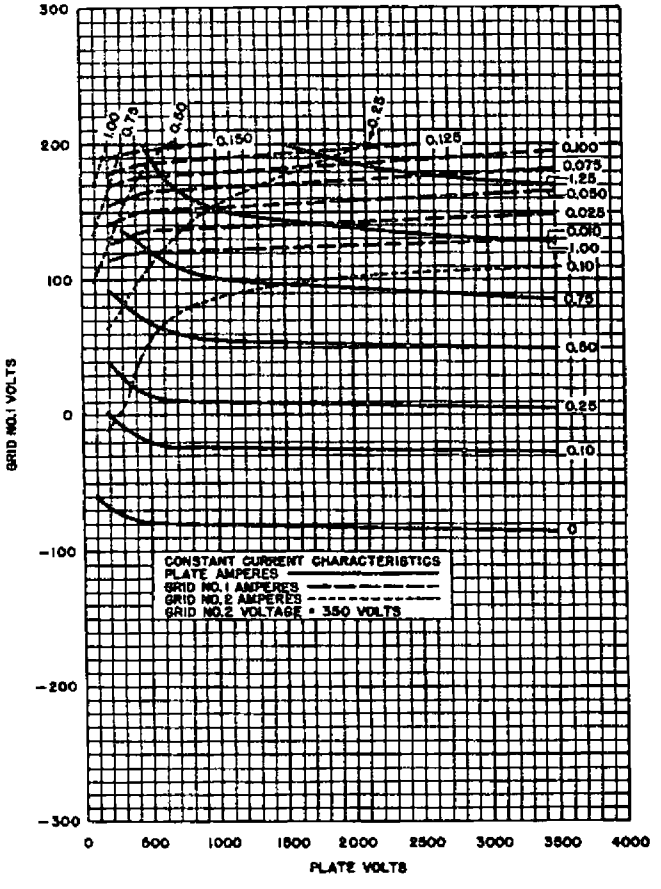
Electrical Data	Min.	Bogey	Max.	
Filament Voltage	4.75	5.0	5.25	volts
Filament Current at Bogey Voltage	6.0	6.5	7.0	amperes
Amplification Factor G_1 -G_2 Mu at Eb = 3000 volts, E_{c_2} = 400 volts, Ib = 50 ma	5.6	6.2	6.8	
Peak Cathode Current[1]	--	--	1600	ma
Direct Interelectrode Capacitances				
Grid-Plate	--	0.05	0.07	uuf
Input	9.2	10.8	12.4	uuf
Output	2.5	3.1	3.5	uuf

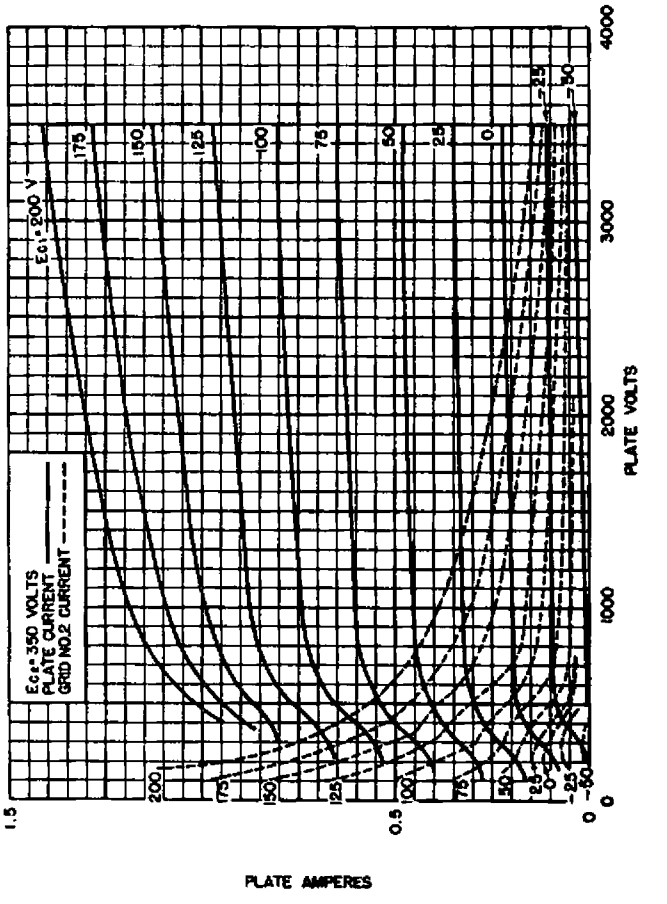
Mechanical Data	
Mounting Position - vertical, base up or down	
Maximum Plate Temperature	850° C
Required Air Flow to Envelope[2]	5 cfm
Maximum Glass Temperature	
at bottom seals	180° C
at plate seal	220° C
Net Weight, approximate	3.5 ounces

1 Represents maximum usable cathode current (plate current plus grid current) for any condition of operation.
2 At maximum ratings and frequencies above 50 megacycles, forced-air cooling at the envelope is required.









A.F. Power Amplifier and Modulator Class AB1

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	3000	volts max.
D.C. Grid No. 2 Voltage	600	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
Maximum Signal D.C. Plate Current[2]	225	ma max.
Maximum Signal Plate Input[3]	350	watts max.
Maximum Signal Grid No. 2 Input[3]	20	watts max.
Plate Dissipation[3]	125	watts max.

Typical Operation

Unless otherwise specified, values are for two tubes

	CCS	CCS	CCS	
D.C. Plate Voltage	1500	2000	2500	volts
D.C. Grid No. 2 Voltage	600	600	600	volts
D.C. Grid No. 1 Voltage	—94	—95.5	—97	volts
Peak A.F Grid No. 1 to Grid No. 1 Voltage	185	186	190	volts
Zero Signal D.C. Plate Current	64	60	60	ma
Maximum Signal D.C. Plate Current	218	222	216	ma
Zero Signal D.C. Grid No. 2 Current	0.3	0.2	0.2	ma
Maximum Signal D.C. Grid No. 2 Current	27	24	26	ma
Effective Load Resistance, Plate to Plate	12,000	17,600	25,000	ohms
Maximum Signal Driving Power[4]	0	0	0	watts
Maximum Signal Power Output	170	260	345	watts

A.F. Power Amplifier and Modulator Class AB2

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	3000	volts max.
D.C. Grid No. 2 Voltage	400	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
Maximum Signal D.C. Plate Current[5]	225	ma max.
Maximum Signal Plate Input[3]	500	watts max.
Maximum Signal Grid No. 2 Input[3]	20	watts max.
Plate Dissipation[3]	125	watts max.

Typical Operation

Unless otherwise specified, values are for two tubes

	CCS	CCS	CCS	
D.C. Plate Voltage	1500	2000	2500	volts
D.C. Grid No. 2 Voltage	350	350	350	volts
D.C. Grid No. 1 Voltage	—48	—50	—51	volts
Peak A.F Grid No. 1 to Grid No. 1 Voltage	330	296	240	volts
Zero Signal D.C. Plate Current	60	60	60	ma
Maximum Signal D.C. Plate Current	455	395	302	ma
Zero Signal D.C. Grid No. 2 Current	0.5	0.3	0.2	ma
Maximum Signal D.C. Grid No. 2 Current	84	64	36	ma
Effective Load Resistance, Plate to Plate	7200	12,000	20,000	ohms
Maximum Signal Driving Power[5]	4.8	3.2	1.8	watts
Maximum Signal Power Output	455	550	550	watts

R.F. Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	3000	volts max.
D.C. Grid No. 2 Voltage	400	volts max.
D.C. Plate Current	135	ma max.
Plate Input	200	watts max.
Grid No. 2 Input	14	watts max.
Plate Dissipation	125	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	2000	2500	3000	volts
D.C. Grid No. 2 Voltage	350	350	350	volts
D.C. Grid No. 1 Voltage	—50	—50	—50	volts
Peak R.F Grid No. 1 Voltage	65	55	50	volts
D.C. Plate Current	83	70	60	ma
D.C. Grid No. 2 Current	1.5	1	1	ma
D.C. Grid No. 1 Current, approximate	1.5	0	0	ma
Driving Power, approximate[6]	0.52	0.44	0.45	watts
Power Output, approximate	54	55	58	watts

Plate and Screen Grid Modulated R.F. Power Amplifier—Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	2500	volts max.
D.C. Grid No. 2 Voltage	400	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
D.C. Plate Current	200	ma max.
D.C. Grid No. 1 Current	15	ma max.
Plate Input	415	watts max.
Grid No. 2 Input	20	watts max.
Plate Dissipation	80	watts max.

Typical Operation

	CCS	CCS	
D.C. Plate Voltage	2000	2500	volts
D.C. Grid No. 2 Voltage	350	350	volts
D.C. Grid No. 1 Voltage	—220	—210	volts
Peak A.F Grid No. 2 Voltage	300	300	volts
Peak R.F Grid No. 1 Voltage	390	380	volts
D.C. Plate Current	150	152	ma
D.C. Grid No. 2 Current	33	30	ma
D.C. Grid No. 1 Current, approximate	5	4.5	ma
Driving Power, approximate	2	1.7	watts
Power Output, approximate	225	300	watts

R.F. Power Amplifier and Oscillator Class C—Telegraphy

Key-down conditions per tube without amplitude modulation[7]

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	3000	volts max.
D.C. Grid No. 2 Voltage	400	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
D.C. Plate Current	225	ma max.
D.C. Grid No. 1 Current	15	ma max.
Plate Input	625	watts max.
Grid No. 2 Input	20	watts max.
Plate Dissipation	125	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	2000	2500	3000	volts
D.C. Grid No. 2 Voltage	350	350	350	volts
D.C. Grid No. 1 Voltage	—100	—150	—150	volts
Peak R.F Grid No. 1 Voltage	260	330	300	volts
D.C. Plate Current	200	200	167	ma
D.C. Grid No. 2 Current	50	40	30	ma
D.C. Grid No. 1 Current, approximate	9	9	6.5	ma
Driving Power, approximate	2.4	3.0	2.0	watts
Power Output, approximate	275	375	375	watts

Maximum ratings apply up to 120 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	120	170	200 megacycles
Percentage of Maximum Rated Plate Input			
Class B	100	85	75 per cent
Class C Plate Telephony	100	80	70 per cent
Class C Telegraphy	100	90	70 per cent.
Percentage of Maximum Rated Plate Voltage			
Class B	100	90	70 per cent
Class C Plate Telephony	100	90	67 per cent
Class C Telegraphy	100	75	67 per cent

Electrical Data and Limits

Characteristic	Conditions	Limits Min.	Bogey	Max.	
Grid Voltage	Eb=500 V				
	Ec₂=350 V				
	Ib=800 ma	Ec₁: —	—	180	volts
Grid No. 2 Current	Eb=500 V				
	Ec₂=350 V				
	Ib=800 ma	Ic₂: —	—	400	ma
Grid No. 1 Current	Eb=500 V				
	Ec₂=350 V				
	Ib=800 ma	Ic₁: —	—	100	ma
Plate Current	Eb=3000 V				
	Ec₂=350 V				
	Ec₁=—25 V	Ib: 71	110	155	ma
Plate Current	Eb=3000 V				
	Ec₂=350 V				
	Ec₁=—45 V	Ib: 25	45	70	ma
Plate Current	Eb=3000 V				
	Ec₂=350 V				
	Ec₁=—85 V	Ib: —	—	6	ma
Grid No. 2 Current	Eb=3000 V				
	Ec₂=350 V				
	Ec₁=—45 V	Ic₂: —	—	6	ma
Power Output	Eb=3000 V				
	Ec₂=350 V				
	Ec₁=—150 V				
	Ib=140 ma				
	Ic₂=30 ma				
	Ic₁=9 ma				
	f=80 megacycles	Po: 250	—	—	watts

[2] Averaged over any audio-frequency cycle of sine-wave form.

[3] The effective resistance per grid No. 1 circuit of the class AB1 stage should be kept below 0.15 megohms.

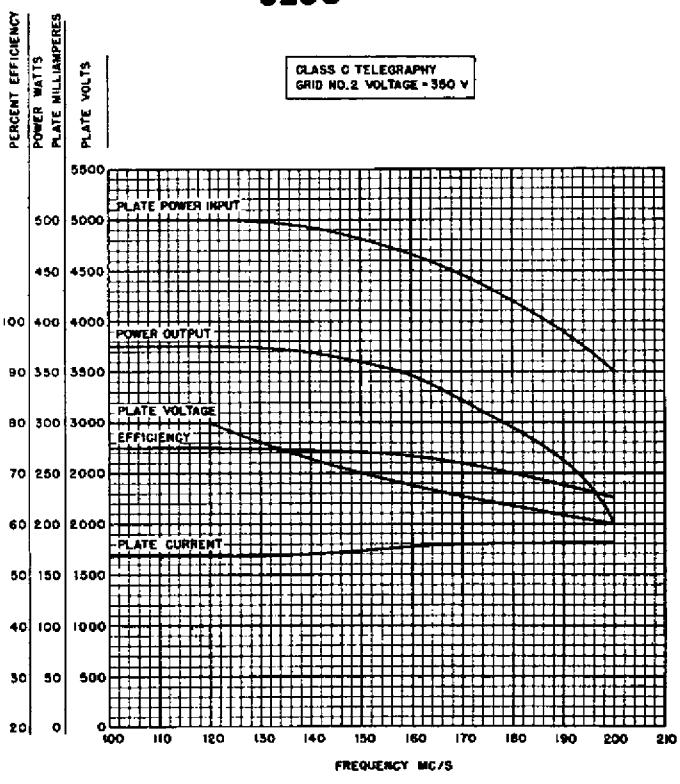
[4] Driver stage should be capable of supplying the No. 1 grids of the class AB2 stage with the specified driving power at low distortion. When a bias supply is used, the DC resistance of the bias source should not exceed 250 ohms.

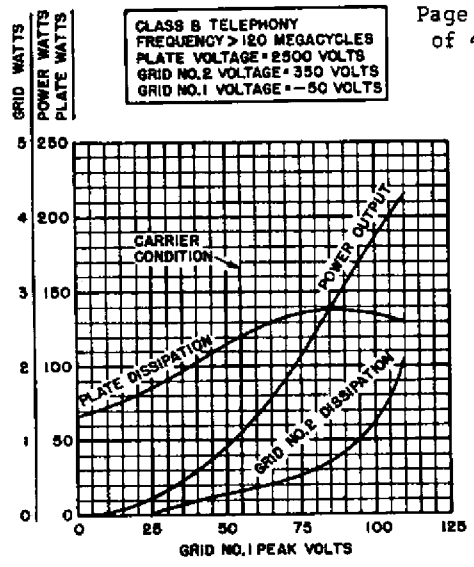
[5] At crest of audio-frequency cycle with modulation factor of 1.0.

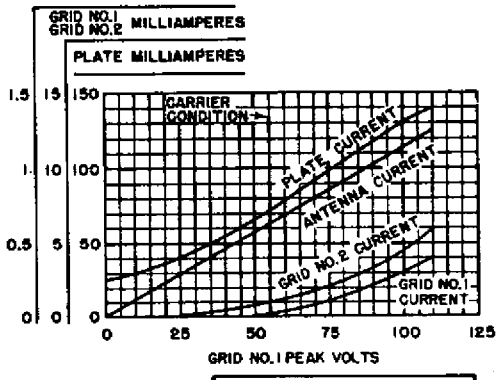
[6] Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

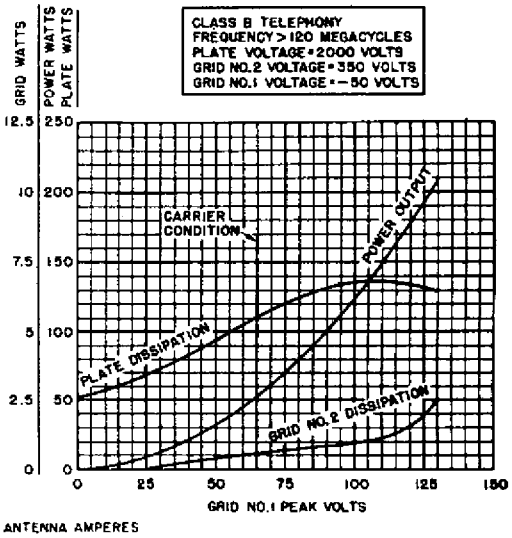
AMPEREX

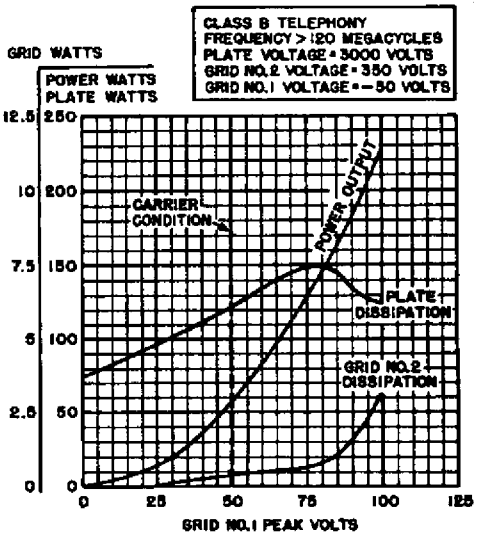
6155

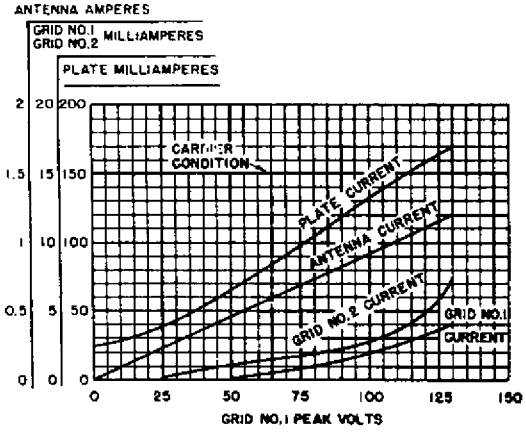


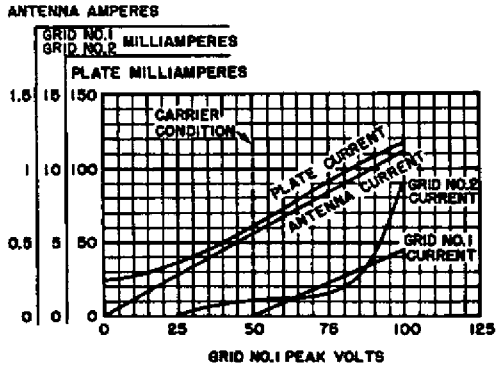






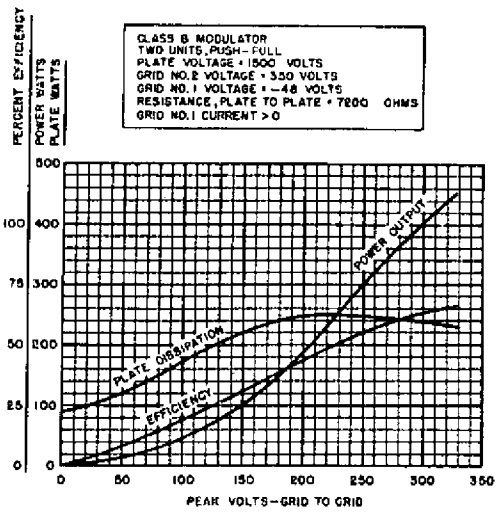


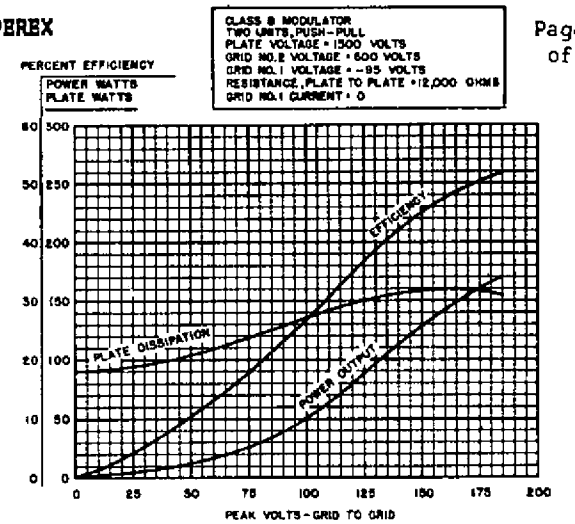


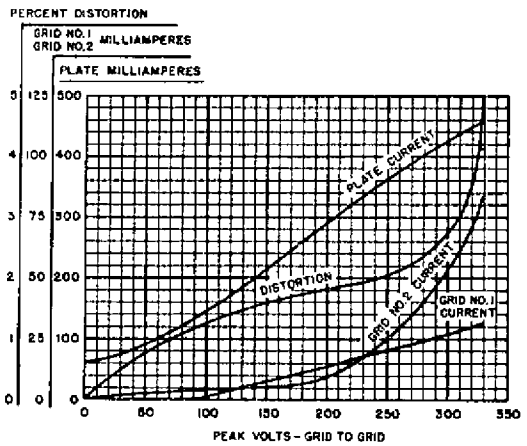


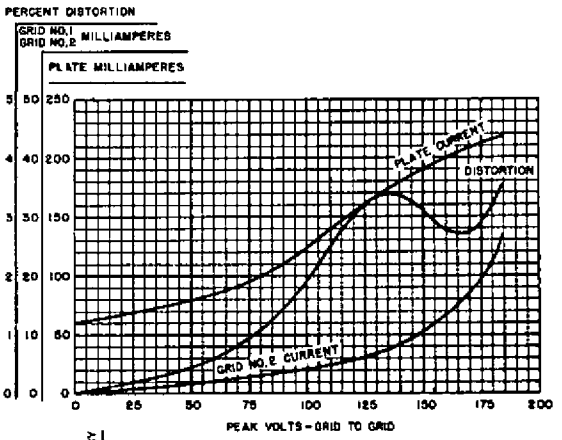
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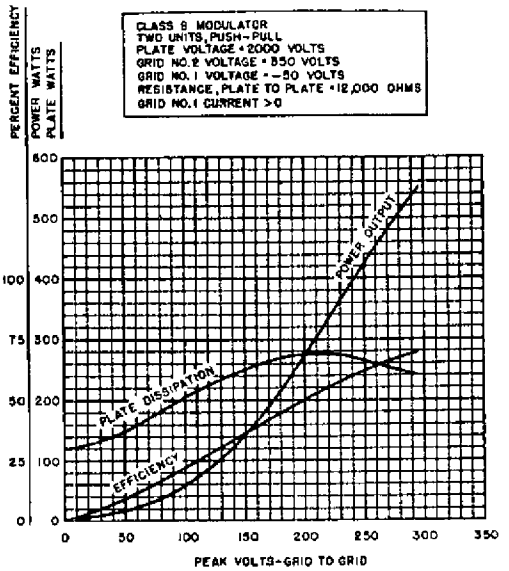
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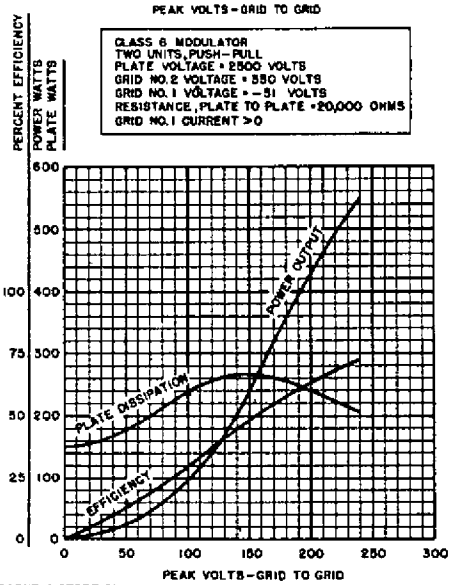


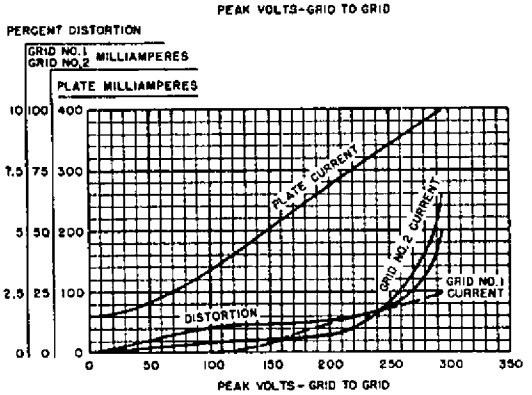


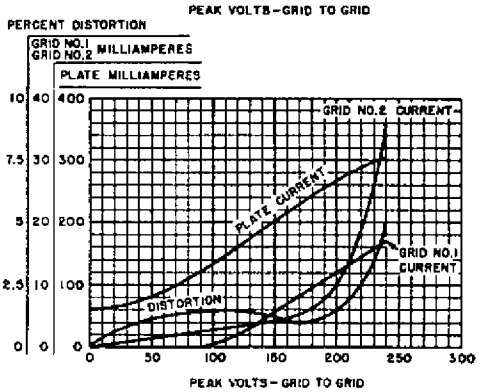












AMPEREX TUBE TYPE 6156

The 6156/4-250-A is a four-electrode tube designed for use as a radio-frequency power amplifier and modulator. The anode is capable of dissipating 250 watts. Maximum ratings apply up to 75 megacycles. At reduced ratings it may be operated up to 120 megacycles.

GENERAL CHARACTERISTICS

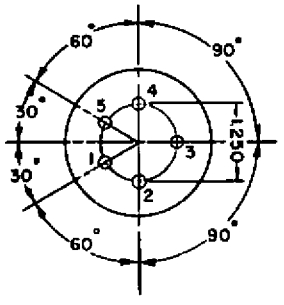
Electrical Data	Min.	Bogey	Max.	
Filament Voltage	4.75	5.0	5.25	volts
Filament Current at Bogey Voltage	13.5	14.1	14.7	amperes
Amplification Factor				
G_1 -G_2 Mu at Eb = 3000 volts				
Ec_2 = 500 volts, Ib = 100 ma	4.5	5.1	6.0	
Peak Cathode Current[1]	--	--	2600	ma
Direct Interelectrode Capacitances				
Grid-Plate	--	--	0.14	uuf
Input	10.7	12.7	14.5	uuf
Output	3.7	4.5	5.1	uuf

Mechanical Data	
Mounting Position - vertical, base up or down	
Maximum Plate Temperature	850° C.
Required Air Flow to Base	5 cfm
Required Air Flow to Envelope[2]	5 cfm
Maximum Glass Temperature[3]	
at bottom seals	180° C.
at plate seal	220° C.
Net Weight, approximate	6.4 ounces

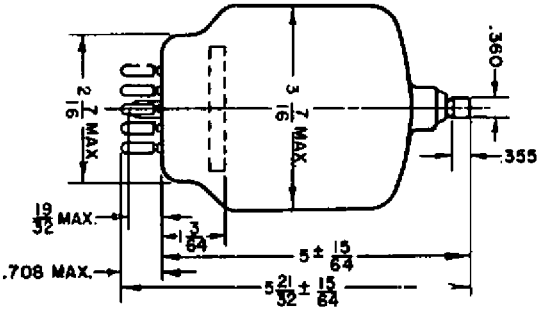
1 Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

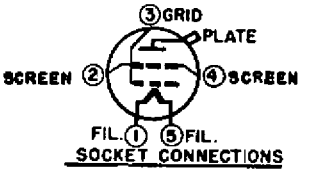
2 Maximum ratings, frequency above 30 megacycles.

3 In cases where the maximum permissible temperatures are likely to be exceeded, as would normally be the the case at frequencies above 30 Mc/s with full ratings, a low velocity air flow should be directed on the anode seal and the bottom of the envelope.

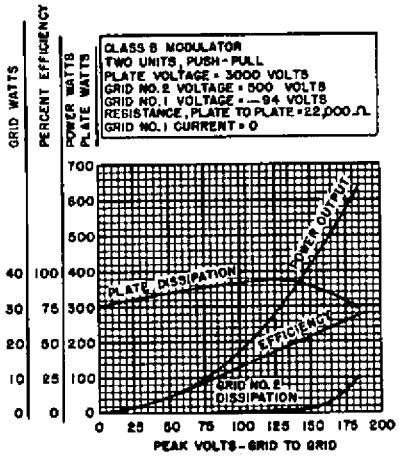


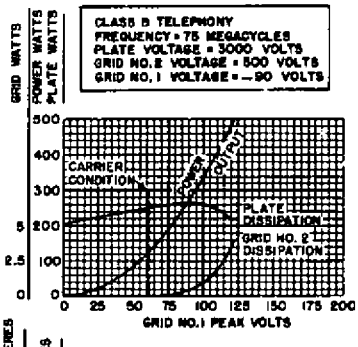
GIANT 5 PIN BASE
PINS-.187 DIA.

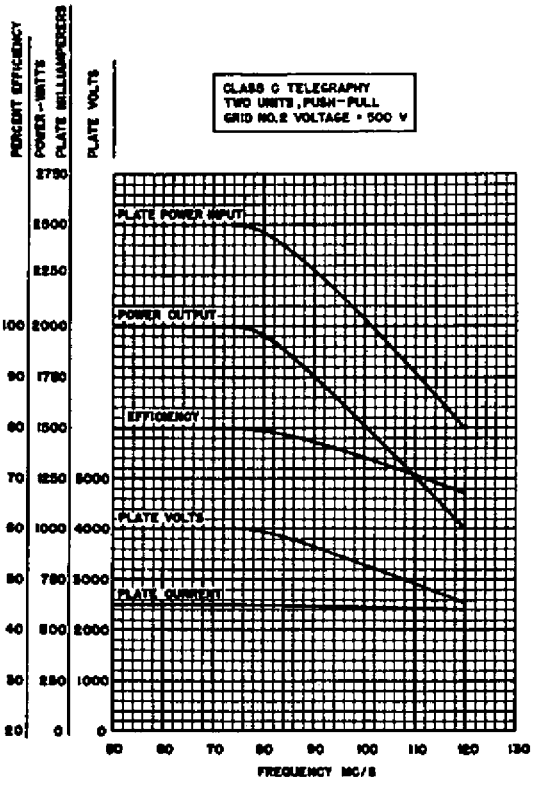


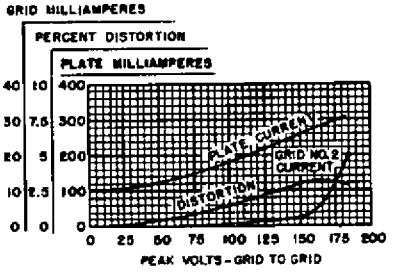


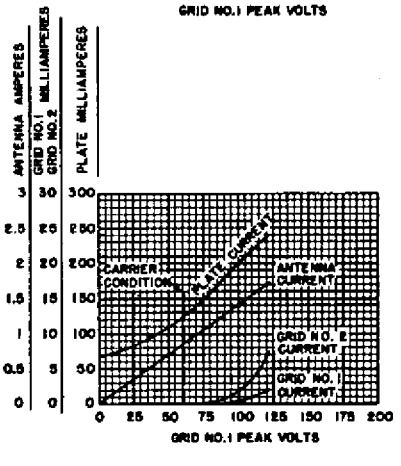
SOCKET CONNECTIONS











MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator Class AB1

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	4000	volts max.
D.C. Grid No. 2 Voltage	600	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
Maximum Signal D.C. Plate Current[4]	350	ma max.
Maximum Signal Plate Input[4]	750	watts max.
Maximum Signal Grid No. 2 Input[4]	35	watts max.
Plate Dissipation[4]	250	watts max.

Typical Operation

Unless otherwise specified, values are for two tubes.

	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	1500	2000	2500	3000	volts
D.C. Grid No. 2 Voltage	500	500	500	500	volts
D.C. Grid No. 1 Voltage	—85	—88	—91	—94	volts
Peak A.F. Grid No. 1 to Grid No. 1 Voltage	167	173	178	184	volts
Zero Signal D.C. Plate Current	100	100	100	100	ma
Maximum Signal D.C. Plate Current	300	300	310	310	ma
Effective Load Resistance, Plate to Plate	10000	14500	18000	22000	ohms
Maximum Signal Driving Power[5]	0	0	0	0	watts
Maximum Signal Power Output	268	390	510	635	watts

A.F. Power Amplifier and Modulator Class AB2

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	4000	volts max.
D.C. Grid No. 2 Voltage	600	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
Maximum Signal D.C. Plate Current[4]	350	ma max.
Maximum Signal Plate Input[4]	1000	watts max.
Maximum Signal Grid No. 2 Input[4]	35	watts max.
Plate Dissipation[4]	250	watts max.

Typical Operation

Unless otherwise specified, values are for two tubes.

	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	1500	2000	2500	3000	volts
D.C. Grid No. 2 Voltage	300	300	300	300	volts
D.C. Grid No. 1 Voltage	—45	—49	—51	—55	volts
Peak A.F. Grid No. 1 to Grid No. 1 Voltage	323	328	306	280	volts
Zero Signal D.C. Plate Current	100	100	100	100	ma
Maximum Signal D.C. Plate Current	694	694	624	550	ma
Zero Signal D.C. Grid No. 2 Current	0	0	0	0	ma
Maximum Signal D.C. Grid No. 2 Current	116	110	88	69	ma
Effective Load Resistance, Plate to Plate	4550	6600	9200	14000	ohms
Maximum Signal Driving Power[6]	8.0	8.0	5.8	3.8	watts
Maximum Signal Power Output	660	974	1140	1240	watts

R.F. Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	4000	volts max.
D.C. Grid No. 2 Voltage	600	volts max.
D.C. Plate Current	210	ma max.
Plate Input	400	watts max.
Grid No. 2 Input	23	watts max.
Plate Dissipation	250	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	2500	3500	4000	volts
D.C. Grid No. 2 Voltage	500	500	500	volts
D.C. Grid No. 1 Voltage	—84	—80	—100	volts
Peak R.F. Grid No. 1 Voltage	66	61	55.5	volts
D.C. Plate Current	150	125	94	ma
D.C. Grid No. 2 Current	0	0	0	ma
D.C. Grid No. 1 Current, approximate	0	0	0	ma
Driving Power, approximate[7]	0.75	0.25	0.06	watts
Power Output, approximate	125	125	126	watts

Plate and Screen Grid Modulated R.F. Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	3200	volts max.
D.C. Grid No. 2 Voltage	600	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
D.C. Plate Current	275	ma max.
D.C. Grid No. 1 Current	20	ma max.
Plate Input	825	watts max.
Grid No. 2 Input	35	watts max.
Plate Dissipation	165	watts max.

Typical Operation

	CCS	CCS	
D.C. Plate Voltage	2500	3000	volts
D.C. Grid No. 2 Voltage	400	400	volts
D.C. Grid No. 1 Voltage	—200	—310	volts
Peak A.F. Grid No. 2 Voltage	350	350	volts
Peak R.F. Grid No. 1 Voltage	326	484	volts
D.C. Plate Current	200	225	ma
D.C. Grid No. 2 Current	30	30	ma
D.C. Grid No. 1 Current, approximate	9	9	ma
Driving Power, approximate	3.0	4.4	watts
Power Output, approximate	375	510	watts

R.F. Power Amplifier and Oscillator Class C Telegraphy

Key-down conditions per tube without amplitude modulation[8]

Maximum Ratings, Absolute Values

	CCS	
D.C. Plate Voltage	4000	volts max.
D.C. Grid No. 2 Voltage	600	volts max.
D.C. Grid No. 1 Voltage	—500	volts max.
D.C. Plate Current	350	ma max.
D.C. Grid No. 1 Current	20	ma max.
Plate Input	1250	watts max.
Grid No. 2 Input	35	watts max.
Plate Dissipation	250	watts max.

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	2500	3000	4000	volts
D.C. Grid No. 2 Voltage	500	500	500	volts
D.C. Grid No. 1 Voltage	—150	—180	—225	volts
Peak R.F. Grid No. 1 Voltage	284	327	374	volts
D.C. Plate Current	300	345	312	ma
D.C. Grid No. 2 Current	60	60	45	ma
D.C. Grid No. 1 Current, approximate	9	10	9	ma
Driving Power, approximate	2.4	3.3	3.4	watts
Power Output, approximate	575	800	1000	watts

Maximum ratings apply up to 75 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

Frequency	75	100	120 megacycles
Percentage of Maximum Rated Plate Voltage and Plate Input			
Class B	100	80	60 per cent
Class C Plate Telephony	100	80	60 per cent
Class C Telegraphy	100	80	60 per cent

Electrical Data and Limits

Characteristic	Conditions		Limits Min.	Limits Bogey	Limits Max.	
Grid Voltage	Eb=600 V, Ec2=500 V, Ib=2000 ma	E_{c_1}:	—	—	150	volts
Grid No. 2 Current	Eb=600 V, Ec2=500 V, Ib=2000 ma	I_{c_2}:	—	—	1100	ma
Grid No. 1 Current	Eb=600 V, Ec2=500 V, Ib=2000 ma	I_{c_1}:	—	—	250	ma
Plate Current	Eb=3000 V, Ec2=500 V, Ec1=—48 V	Ib:	170	280	360	ma
Plate Current	Eb=3000 V, Ec2=500 V, Ec1=—75 V	Ib:	60	110	165	ma
Plate Current	Eb=3000 V, Ec2=500 V, Ec1=—140V	Ib:	—	—	7	ma
Grid No. 2 Current	Eb=3000 V, Ec2=500 V, Ec1=—75 V	I_{c_2}:	—	—	4	ma
Power Output	Eb=4000 V, Ec2=500 V, Ec1=—225V, Ib=250 ma, Ic2=45 ma, Ic1=9 ma, f=60 megacycles	Po:	750	—	—	watts

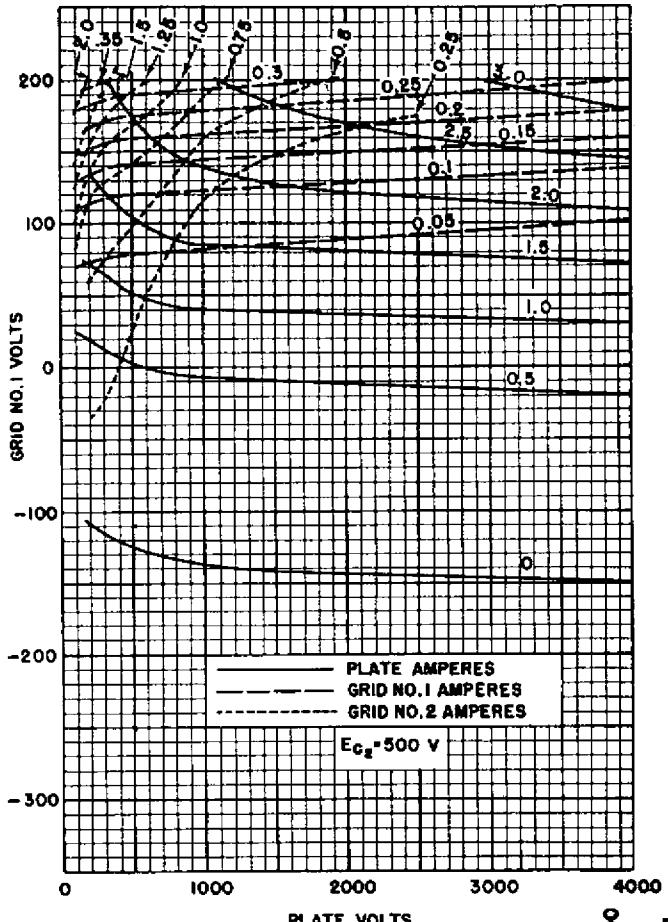
[4]Averaged over any audio-frequency cycle of sine-wave form.

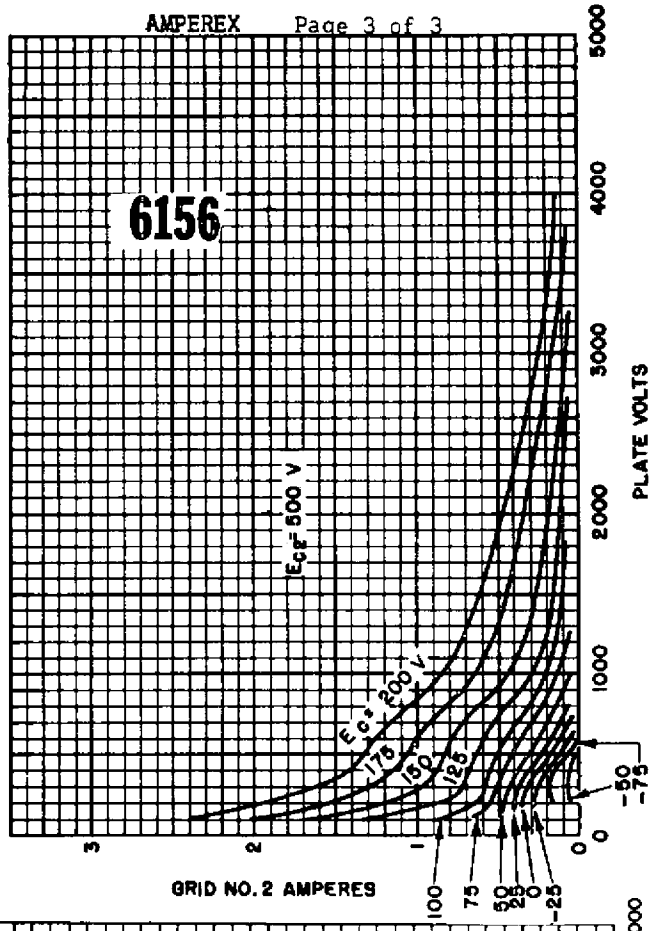
[5]The effective resistance per grid No. 1 circuit of the class AB1 stage should be kept below 0.25 megohms.

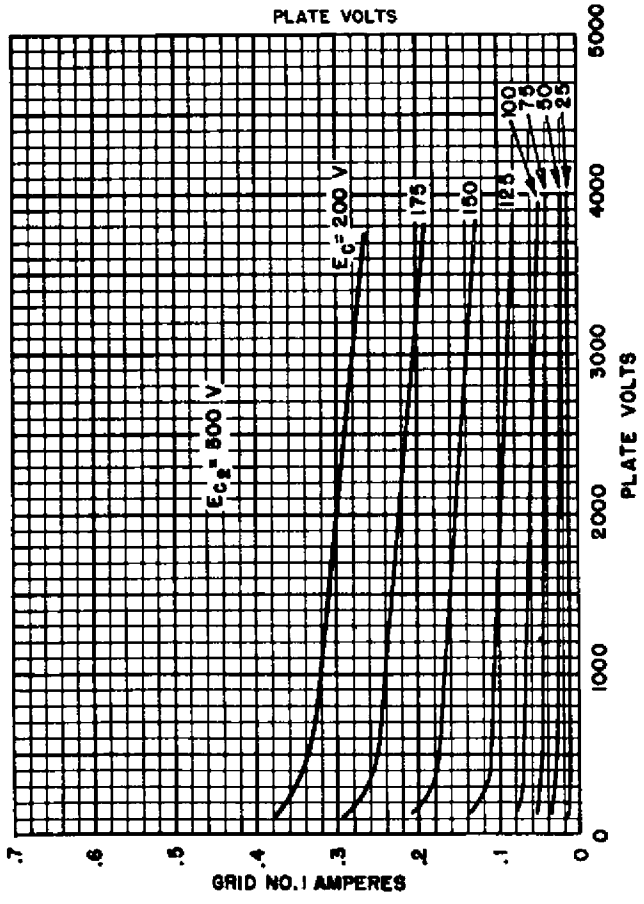
[6]Driver stage should be capable of supplying the No. 1 grids of the class AB2 stage with the specified driving power at low distortion. When a bias supply is used, the DC-resistance of the bias source should not exceed 250 ohms.

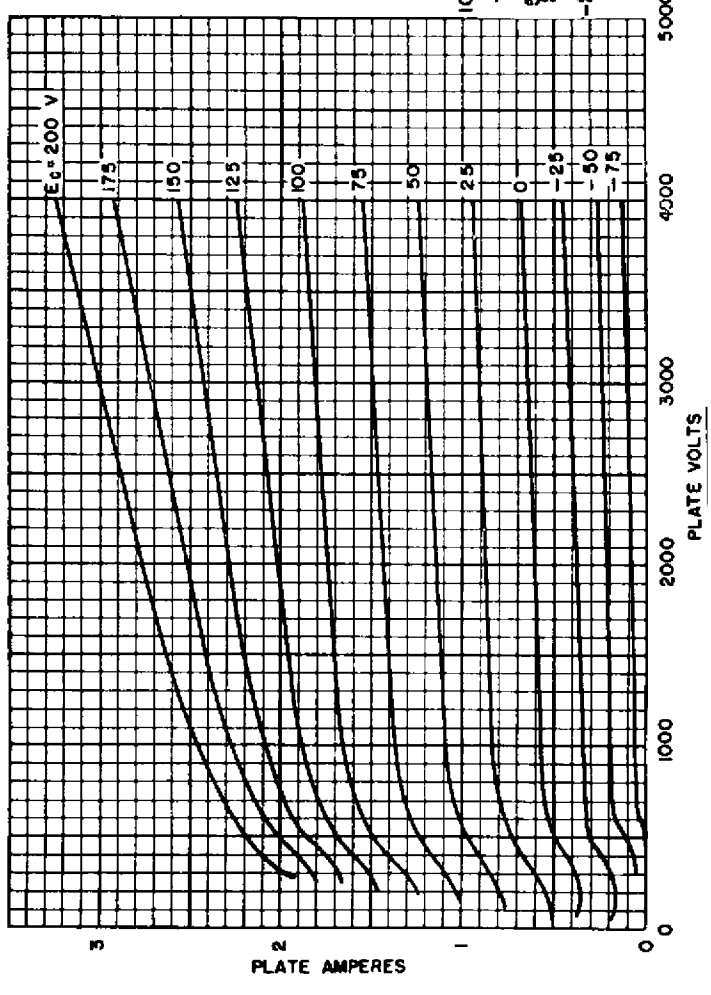
[7]At crest of audio-frequency cycle with modulation factor of 1.0.

[8]Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.


GRID NO.1 VOLTS
PLATE VOLTS
PLATE AMPERES
GRID NO.1 AMPERES
GRID NO.2 AMPERES
E_{c_2}=500 V


6156
E_{c_2}=500 V
E_c=200 V
PLATE VOLTS
GRID NO. 2 AMPERES


E_{c_2}=500 V
E_c=200 V
PLATE VOLTS
GRID NO.1 AMPERES


E_c=200 V
PLATE VOLTS
PLATE AMPERES

Permanent Sensitivity X-RAY COUNTER

Description 6207 (153C)

The type *153C* is an **optimum design** for an end mica window, X-Ray diffraction and fluorescence analysis counter. It has maximum sensitivity to the characteristic radiation of the usual X-Ray diffraction targets. The infinite-life, halogen filling allows the exposure of the tube to the direct X-Ray beam without any adverse effect.

General Data

Operating temperature range	—55° to +75°C
Gas filling	Argon plus halogen admixture
Cathode material	stainless steel (28% chromium, 72% iron)
Mica window[6]	3 to 4 mg/cm^2
Mica window diameter	25/32"
Length of sensitive gas path	100 mm
Recommended X-Ray beam width	1.2 cm
Effective cathode dimensions	4⅜" long x ⅞" O.D. x 3/64" wall

Performance Data

Operating voltage[1,3]	1500 volts D.C.
Plateau length[1]	in excess of 400 volts
Slope of plateau[1,4]	3% to 8% per 100 volts
Starting voltage (0.3 volt pulses)[1]	1300 to 1400 volts
Capacity at terminals	2.4 mmf
Radial sensitivity	65% to 70%
Dead time (approx.)	150 microseconds
Maximum counting rate[5]	1100 counts per second
Background (Shielded 2" lead and ½" aluminum)	60 counts per minute max.
Life expectancy in counts[2]	unlimited by use

Notes

[1] This data is obtained from an automatic plateau trace run on each tube. A print of this trace is shipped with each tube.

[2] Guaranteed 5 x 10^{10} counts minimum.

[3] These tubes will operate satisfactorily anywhere on the plateau.

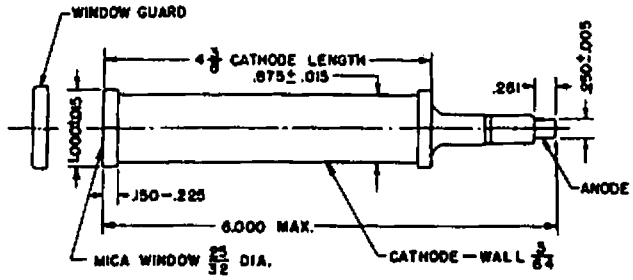
[4] At an average counting rate of 100 counts per second.

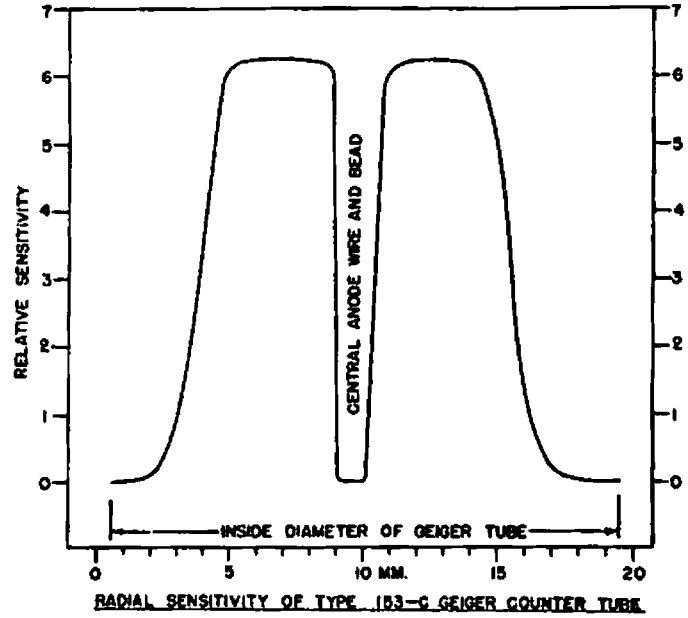
[5] For 20% dead time correction (approx.).

[6] 3.5 mg/cm^2 mica = .0005 inch = 12.70 microns.

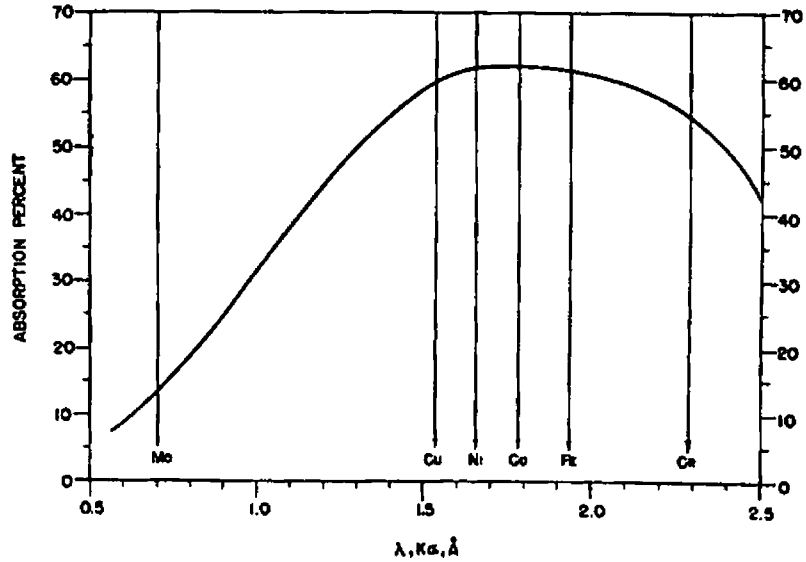
AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVE., HICKSVILLE, N.Y.

from RTMA release #1128, Jan. 30, 1953





RADIAL SENSITIVITY OF TYPE 153-C GEIGER COUNTER TUBE



QUANTUM EFFICIENCY OF TYPE 153-C GEIGER COUNTER TUBE

Permanent Sensitivity ALPHA-BETA GEIGER COUNTER

AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVE., HICKSVILLE, N.Y.

TENTATIVE DATA

Description

The type ***230N*** Geiger counter is a small, end window tube with optimum dimensions for medical isotopes work. It has a low background count and a thin mica window (1. to 2 mg/cm²)[6]. It is filled with Neon and an infinite-life, halogen quench admixture for low voltage operation. The absence of external flanges and the uniformity of electrical characteristics enables this tube to be bundled in multiple arrangements for greater directional sensitivity.

General Data

Operating temperature range	—55° to +75°C
Gas filling	Neon plus halogen admixture
Cathode material	stainless steel (28% chromium, 72% iron)
Mica window[6]	1.4 to 2 mg/cm²
Mica window diameter	13/32"
Effective cathode dimensions	1¼" long x .603" I.D. x .010" wall

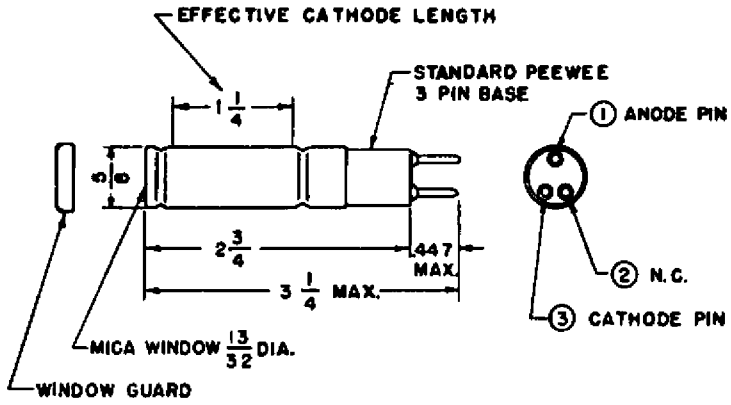
Performance Data

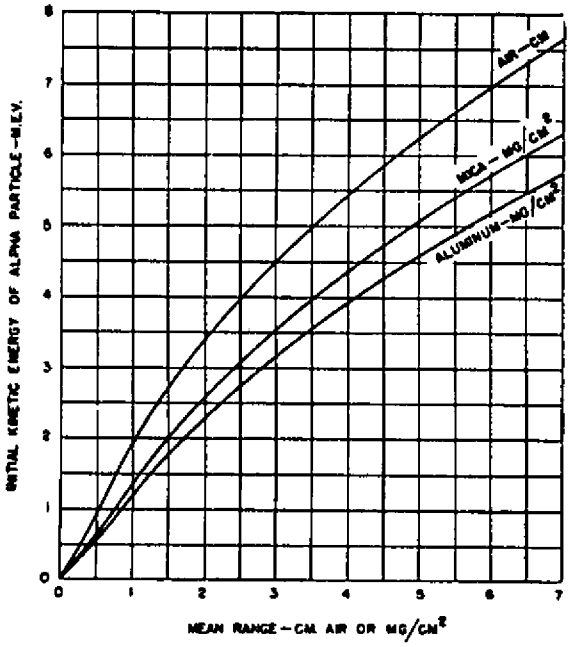
Operating voltage[1,3]	850 volts D.C.
Plateau length[1]	in excess of 150 volts
Slope of plateau[1,4]	less than 15% per 100 volts
Starting voltage (0.3 volt pulses)[1]	775 volts max.
Capacity at terminals	1.5 mmf
Radial sensitivity, beta (through mica window)	99%
Radial sensitivity, gamma (approx.)	80%
Photosensitivity & hysteresis	none
Dead time (approx.)	100 microseconds
Maximum counting rate[5]	1700 counts per second
Background (Shielded with 2" lead and ⅛" aluminum)	15 counts per minute max.
Life expectancy in counts[2]	unlimited by use

Notes

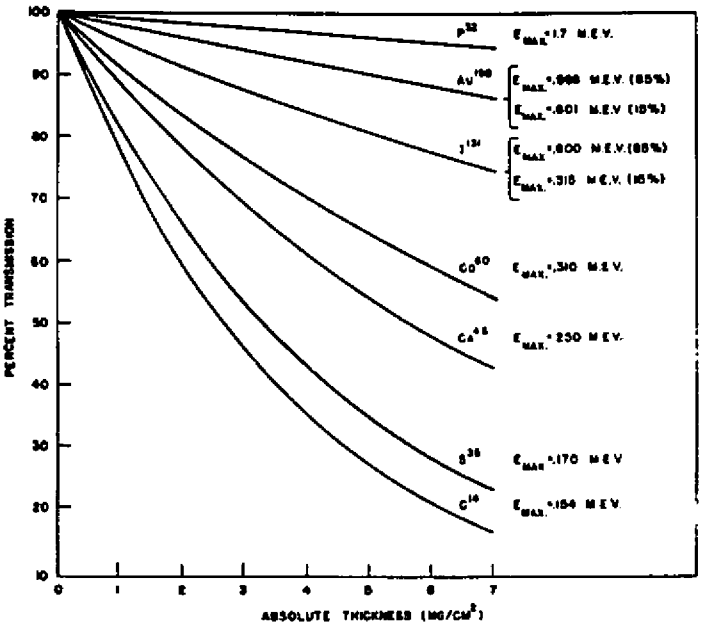
[1] This data is obtained from an automatic plateau trace run on each tube. A print of this trace is shipped with each tube.
[2] Guaranteed 5 x 10^{10} counts minimum.
[3] These tubes will operate satisfactorily anywhere on the plateau.
[4] At an average counting rate of 100 counts per second.
[5] For 20% dead time correction (approx.).
[6] 1.4 mg/cm² mica = .0002 inch = 5.08 microns.

from RTMA release #1128, Jan. 30, 1953



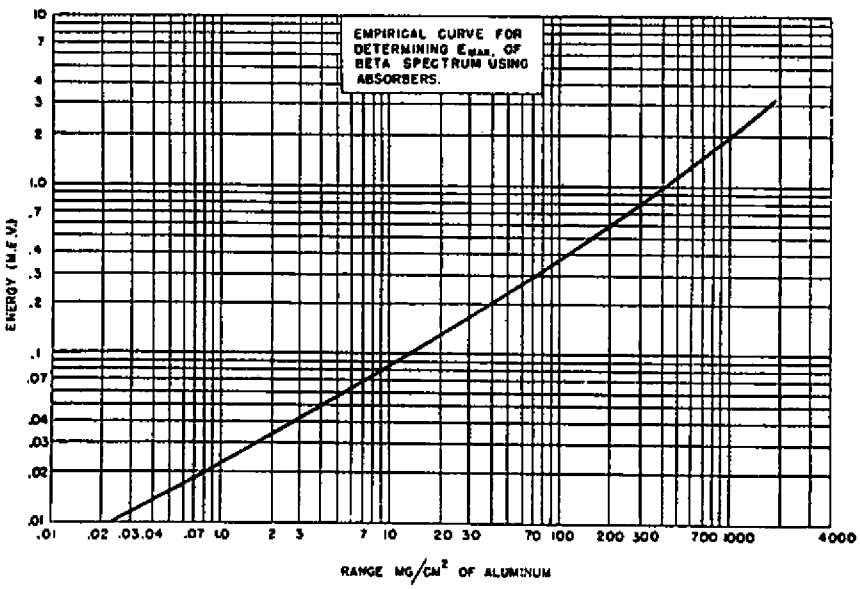


ALPHA PARTICLE MEAN RANGES.



CALCULATED TRANSMISSION OF BETA SPECTRUM FROM SOME COMMON RADIOISOTOPES

Adapted from G. I. Gleason, et al — Nucleonics, Vol. 8, No. 5, 18 (1951)



Permanent Sensitivity ALPHA-BETA GAMMA, X-RAY COUNTERS

TENTATIVE DATA

Description

The type **240N** is a probe tube with a long cathode that makes it sensitive to Gamma radiation at tolerance dosage levels. The 1.4 to 2 mg/cm^2 mica window[7] on a tube of this general size and shape gives Alpha and Beta sensitivity to survey instruments using this tube in place of similar Gamma tube types. The 3 pin base fits into a standard socket and makes the tube readily interchangeable with other types.

The type **240C** is a small diameter X-Ray counter. The long sensitive volume and thin window gives high total soft X-Ray efficiency, and the short dead time expands the sensitivity range for which linear response is possible. Since there are no external flanges the tubes can be bundled in multiple arrangements for higher sensitivity to wide beams.

General Data

Operating temperature range	—55° to +75°C
Gas filling —240N	Neon plus halogen admixture
—240C	Argon plus halogen admixture
Cathode material	stainless steel (28% chromium, 72% iron)
Mica window[7]	1.4 to 2 mg/cm^2
Mica window diameter	13/32"
Effective cathode dimensions	4" long x .605" I.D. x .010" wall

Performance Data	*240N*	*240C*
Operating voltage[1,3,4]	850-900 volts D.C.	1200 volts D.C.
Plateau length[1]	in excess of 150 volts	in excess of 200 volts
Slope of plateau[1,5]	less than 15% per 100 volts	less than 10% per 100 volts
Starting voltage (0.3 volt pulses)[1]	800 volts max.	1100 volts max.
Capacity at terminals	2.4 mmf	2.4 mmf
Radial sensitivity, beta or X-Ray (through window)	99%	99%
Radial sensitivity, gamma (approx.)	80%	80%
Photosensitivity & hysteresis	none	none
Dead time (approx.)	100 microseconds	100 microseconds
Maximum counting rate[6]	1700 counts per second	1700 counts per second
Background (Shielded with 2" lead and 1/8" aluminum)	50 counts per minute max.	50 counts per minute max.
Roentgen energy dependence[8]	±20%	.....
Life expectancy in counts[2]	unlimited by use	unlimited by use

Notes

[1] This data is obtained from an automatic plateau trace run on each tube. A print of this trace is shipped with each tube.

[2] Guaranteed 5 x 10^{10} counts minimum.

[3] These tubes will operate satisfactorily anywhere on the plateau.

[4] Also available at 700 volts operating voltage upon special request.

[5] At an average counting rate of 100 counts per second.

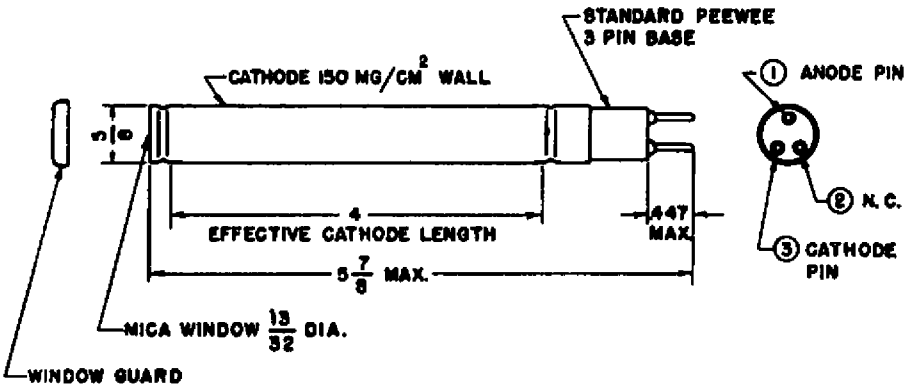
[6] For 20% dead time correction (approx.).

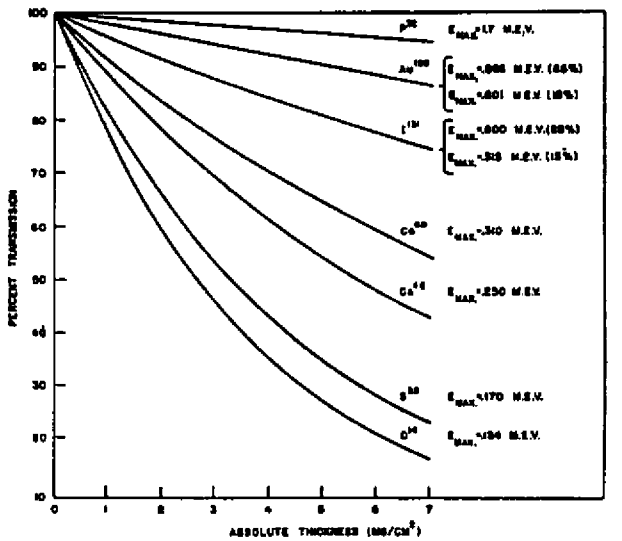
[7] 1.4 mg/cm^2 mica = .0002 inch = 5.08 microns.

[8] Calculated value based on radiocobalt gamma center value with 100KV to 3 M.E.V. extremes.

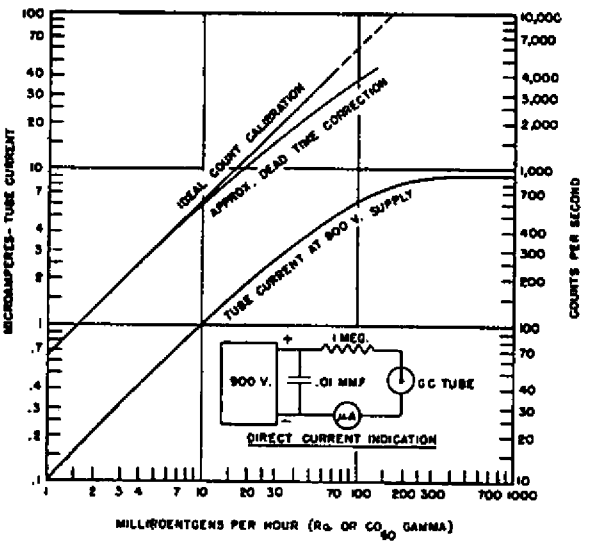
AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVE, HICKSVILLE, N.Y.

from RTMA release #1128, Jan. 30, 1953



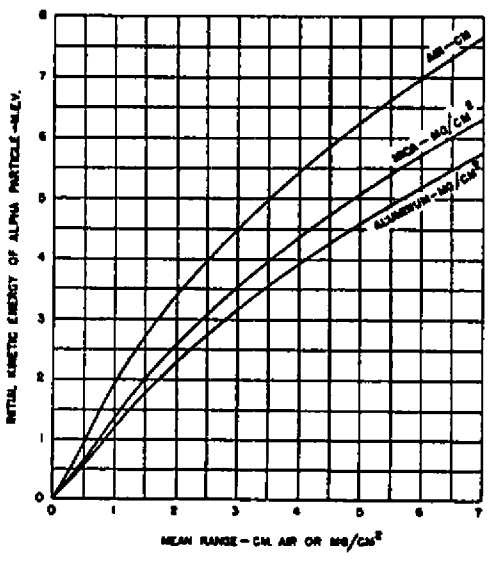


CALCULATED TRANSMISSION OF BETA SPECTRUM FROM SOME COMMON RADIOISOTOPES

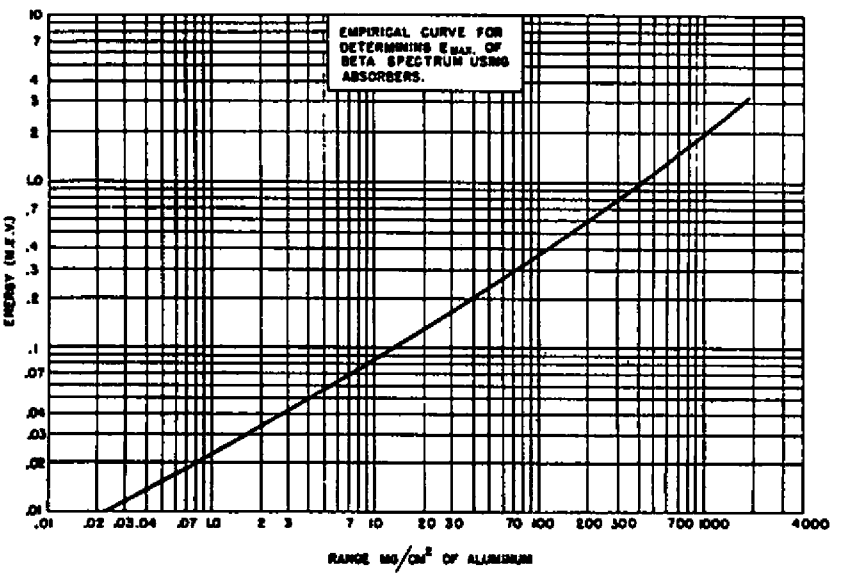


TYPICAL OPERATION

Adapted from G. I. Gleason, et al — Nucleonics, Vol. 8, No. 5, 18 (1951)



ALPHA PARTICLE MEAN RANGES



R.F. Power Amplifier and Oscillator Class B Audio Amplifier or Modulator

GENERAL CHARACTERISTICS

WATER COOLED TRIODE

ELECTRICAL

Filament		Tungsten
Voltage		30 volts
Current		80 amperes
Amplification Factor		28
Transconductance (grid to plate) Ip	1.0 amp	17000 microhmos
Direct Interelectrode Capacitances		
Grid to Plate		17 $\mu\mu$f
Grid to Filament		26 $\mu\mu$f
Plate to Filament		2.5 $\mu\mu$f
Frequency for Maximum Ratings		40 megacycles

MECHANICAL

Overall Dimensions	
Length	25¼ inches
Maximum Radius	5 inches
Mounting Position	Vertical, Anode Down
Type of Cooling	Water
Water Jacket	Amperex Type =DW-2500
[1]Water Flow	8-15 gal. per min.
[2]Pressure drop (approx.)	7 lbs. per sq. in.
Maximum Outlet Water Temperature	70 C.
Net Weight (approx.)	9 pounds
Shipping Weight (approx.) (one tube)	23 pounds

[1] Rated water flow must be continuous between the time any voltage is applied and for 5 minutes after voltage is removed.

[2] The approximate water pressure is measured directly across the jacket alone and does not include connecting piping.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes
D.C. Plate Voltage	15000	15,000
D.C. Grid Voltage	—	—400
Load Resistance (per tube) (ohms)	—	1500
Effective Load Resistance (Plate to Plate) (ohms)	—	6000
Zero Signal Plate Current (amp.)	—	1.00
Peak A.F. Grid to Grid Voltage	—	2000
Max. Signal Plate Current (amps.)*	4.0	6.0
Max. Signal Plate Input (kilowatts)*	60	90
Plate Dissipation (kilowatts)*	25	—
Max. Signal Driving Power (watts) (approx.)	—	550
Max. Signal Plate Power Output (kilowatts)	—	61.5

*Averaged over any audio-frequency cycle.

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a max. modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	15000	15,000
D.C. Grid Voltage	—	—400
Peak R.F. Grid Voltage	—	600
D.C. Plate Current (amps.)	2.0	1.80
Plate Input (kilowatts)	30	27
Plate Dissipation (kilowatts)	20	—
Driving Power (at Modulation Peak (watts) (approx.)	—	750
Plate Power Output (kilowatts)	—	10

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with a max. modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	12000	12,000
D.C. Grid Voltage	—3000	—1000
Peak R.F. Grid Voltage (approx.)	—	1650
D.C. Plate Current (amps.)	2.0	2.0
Plate Input (kilowatts)	24	—
D.C. Grid Current (approx.)	1.0	.485
Plate Dissipation (kilowatts)	12	—
Driving Power (watts) (approx.)	—	750
Plate Power Output (kilowatts)	—	20

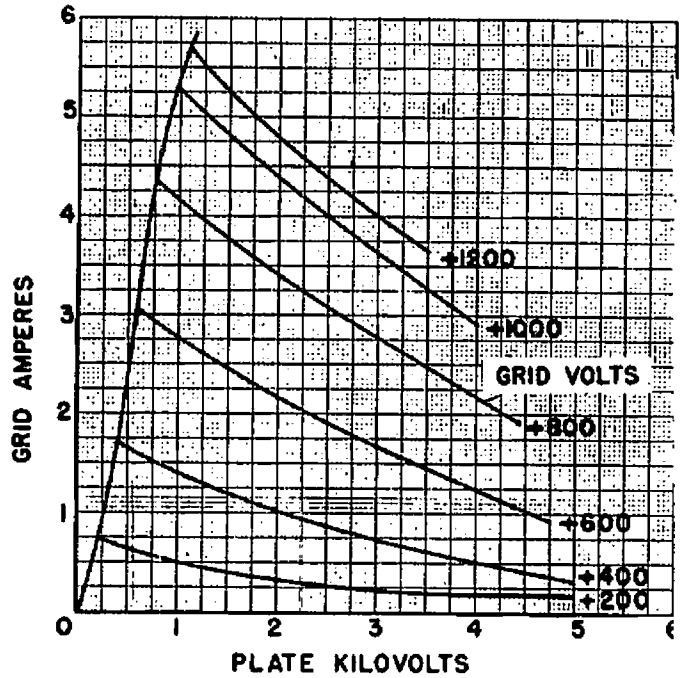
R.F. Power Amplifier and Oscillator—Class C Telegraphy

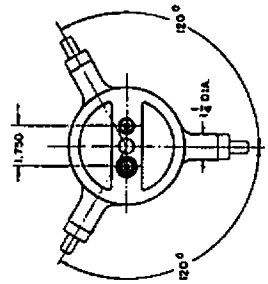
(Key-down conditions without modulation)**

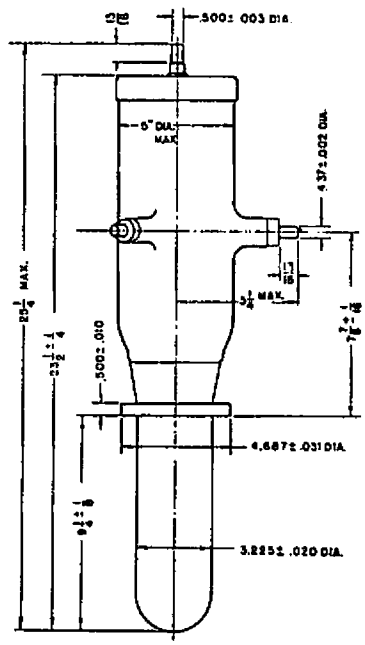
	Maximum Rating per Tube	Typical Operation One Tube
D.C. Plate Voltage	15000	15,000
D.C. Grid Voltage	—3000	—900
Peak R.F. Grid Voltage (approx.)	—	1,740
D.C. Plate Current (amps.)	4.0	3.75
Plate Input (kilowatts)	60	—
D.C. Grid Current (amps) (approx.)	1.0	.42
Plate Dissipation (kilowatts)	25	—
Driving Power (watts) (approx.)	—	830
Plate Power Output (kilowatts)	—	40.0

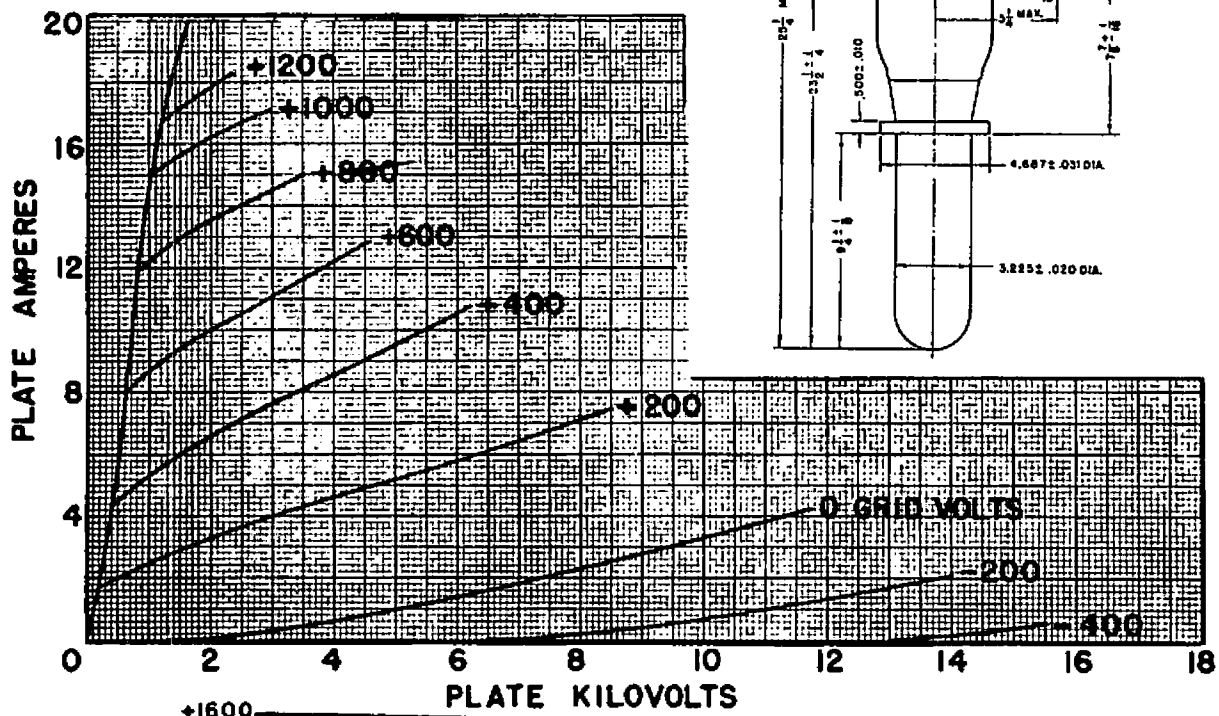
**Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of carrier conditions

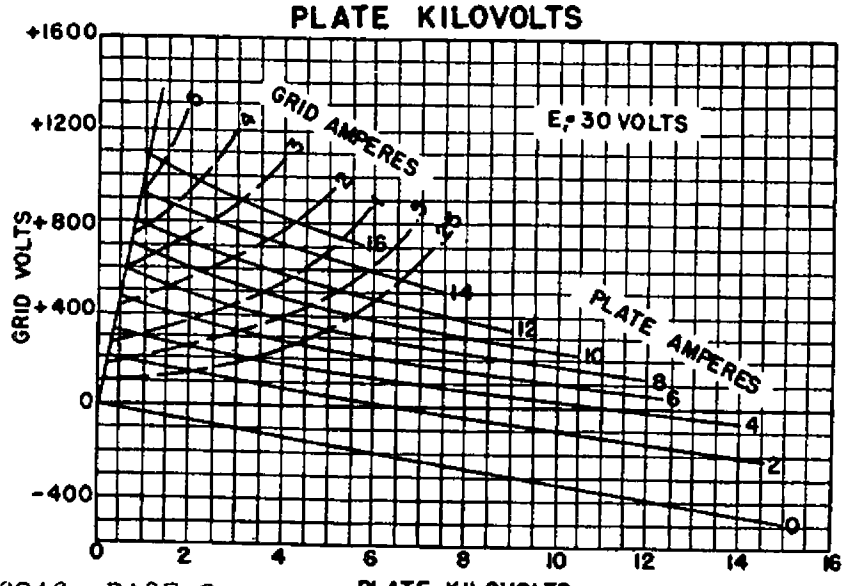
from RTMA release #1128, Jan. 30, 1953


GRID AMPERES
PLATE KILOVOLTS
GRID VOLTS
+1200
+1000
+800
+600
+400
+200






PLATE AMPERES
PLATE KILOVOLTS
+1200
+1000
+800
+600
+400
+200
0 GRID VOLTS
-200
-400


GRID VOLTS
PLATE KILOVOLTS
GRID AMPERES
PLATE AMPERES
E, = 30 VOLTS
+1600
+1200
+800
+400
0
-400

AMPEREX ELECTRONIC CORPORATION

230 DUFFY AVENUE HICKSVILLE, L. I.

AMPEREX ELECTRON TUBE 6252/AX-9910

The 6252/AX-9910 is a double tetrode primarily intended for use as class C amplifier at frequencies up to 600 Mc. Each anode is capable of dissipating 10 watts. The cathode is indirectly heated, oxide coated.

GENERAL

ELECTRICAL DATA

	Min.	Nominal	Max.
Heater sections connected in series			
Heater voltage	11.35	12.6	13.85 volts
Heater current	0.55	0.65	0.75 amp
Heater sections connected in parallel			
Heater voltage	5.7	6.3	6.9 volts
Heater current	1.1	1.3	1.5 amps
Amplification factor			
$G_2 - G_1$ Mu at I_b = 20 ma	6.5	8.0	9.5
Transconductance at I_b = 20 ma		2500	micromhos

DIRECT INTERELECTRODE CAPACITANCES

Input (each section)	5.9	6.5	7.1 uuf
Output (each section)	2.1	2.6	3.1 uuf
Input (push-pull)		4.4	uuf
Output (push-pull)		1.6	uuf

MECHANICAL DATA

Mounting position	any
Temperature of seals	max. 180 °C

Plate connectors providing a high degree of heat transfer by radiation or by conduction should be used. Generally natural cooling is sufficient with a plate voltage of

600 volts at frequencies up to 150 Mc
500 volts at frequencies up to 200 Mc
300 volts at frequencies up to 430 Mc

Above these limits or with high ambient temperatures it may be necessary to direct an airflow of about 0.5 cu. ft. per min. on top of the bulb to keep the seal temperature within the stated limit.

Net weight 2 Oz.

from RETMA release #1258,
Nov. 13, 1953

Key-down conditions per tube without modulation. (2)

MAXIMUM RATINGS, ABSOLUTE VALUES	CCS
D-C Plate Voltage	600 max. volts
D-C Grid No. 2 Voltage	250 max. volts
D-C Grid No. 1 Voltage	−75 max. volts
D-C Cathode Current	2×55 max. ma
Peak Cathode Current	2×260 max. ma
Grid No. 2 Input	2×1.5 max. watts
Plate dissipation	2×10 watts
Grid No. 1 circuit resistance with fixed bias	50 000 max. ohms
Grid No. 1 circuit resistance with automatic bias.	0.1 max. megohm

TYPICAL OPERATION	CCS	CCS	CCS	CCS
Frequency	200	200	200	200 Mc
D-C Plate Voltage	600	400	300	200 volts
D-C Grid No. 2 Voltage	250	250	250	200 volts
D-C Grid No. 1 Voltage	−60	−50	−40	−30 volts
D-C Plate Current	2×50	2×50	2×50	2×50 ma
D-C Grid No. 2 Current	2×4	2×4	2×4.5	2×4 ma
D-C Grid No. 1 Current, approx.	2×0.7	2×0.7	2×0.7	2×1.0 ma
Driving Power (3)	1.5	1.0 max.	1.0 max.	1.0 watt
Power Output	48	30	21	13 watts

(2) Modulation essentially negative may be used if the positive peak of the evnelope does not exceed 115 per cent of the carrier conditions.

(3) Driving power includes typical grid-circuit loss.

TYPICAL OPERATION (continued)

Frequency	400	400	400	600 Mc
D-C Plate Voltage	400	300	200	400 volts
D-C Grid No. 2 Voltage	250	250	200	250 volts
D-C Grid No. 1 Voltage	−50	−40	−30	−50 volts
D-C Plate Current	2x50	2x50	2x50	2x50 ma
D-C Grid No. 2 Current	2x2.5	2x2.5	2x3	2x2.5 ma
D-C Grid No. 1 Current, approx.	2x0.7	2x0.6	2x0.5	2x0.7 ma
Driving power (4)	2	1.5	1	- watt
Power output, approx.	25	17	11	20 watts

Frequency Tripler - Class C Telegraphy

MAXIMUM RATINGS, ABSOLUTE VALUES	CCS
D-C Plate Voltage	600 max. volts
D-C Grid No. 2 Voltage	250 max. volts
D-C Grid No. 1 Voltage	−200 max. volts
D-C Cathode Current	2x50 max. ma
Peak Cathode Current	2x275 max. ma
Grid No. 2 Input	2x1.5 max. watts
Grid No. 1 Input	2x0.5 max. watt
Plate dissipation	2x10 max. watts
Grid No. 1 circuit resistance with fixed bias	50 000 max. ohms
Grid No. 1 circuit resistance with automatic bias	0.1 max. megohm

TYPICAL OPERATION	CCS	CCS
Frequency	66.7/200	133/400 Mc
D-C Plate Voltage	300	300 volts
D-C Grid No. 2 Voltage	250	250 volts
D-C Grid No. 1 Voltage	−175	−175 volts
D-C Plate Current	2x45	2x45 ma
D-C Grid No. 2 Current	2x3	2x2.8 ma
D-C Grid No. 1 Current, approx.	2x1.5	2x1.2 ma
Driving Power (4)	4	5 watts
Power output	10.0	8.0 watts

(4) Driving power includes typical fixed frequency grid-circuit loss.

Plate and Screen Grid Modulated R. F. Power Amplifier
Class C telephony

Carrier conditions with two systems in push-pull for use with a maximum modulation factor of 1.0

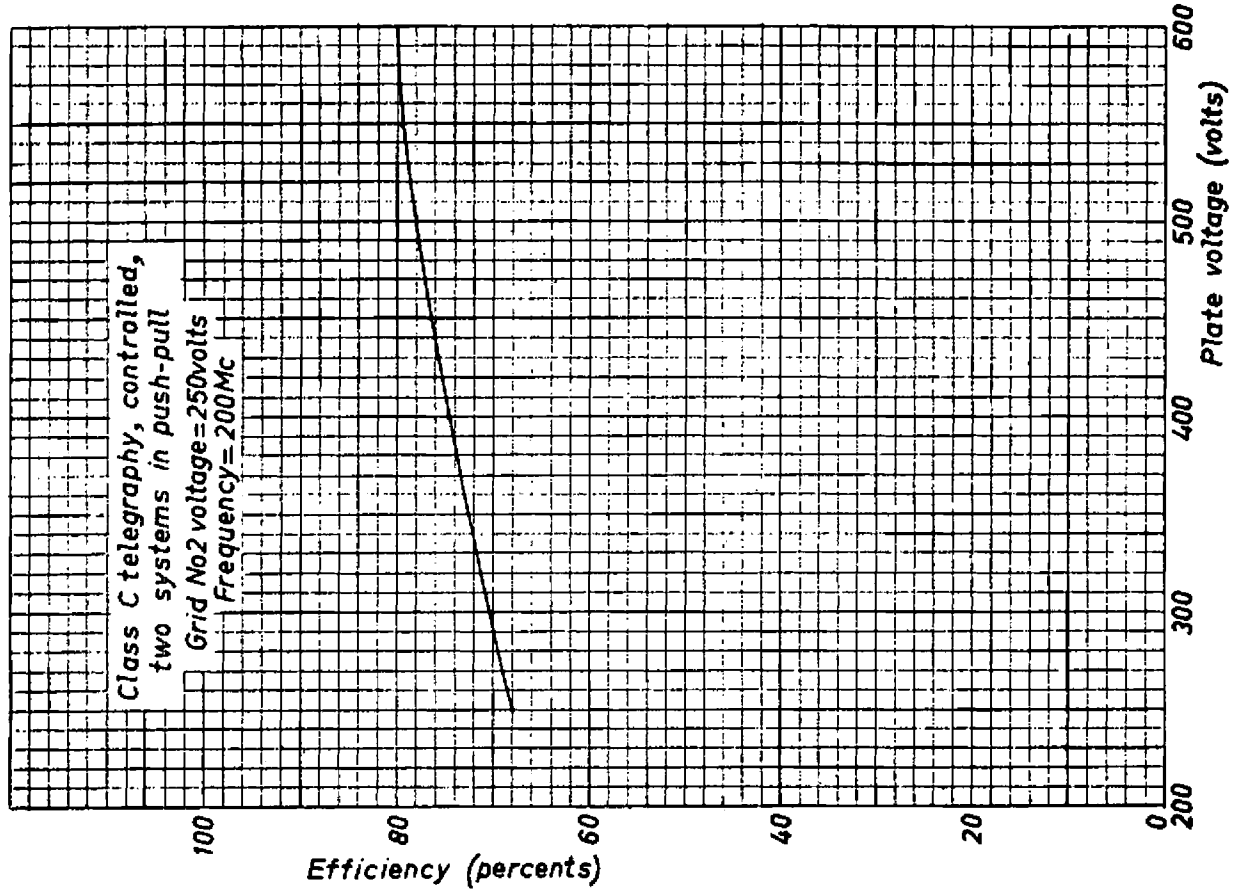
MAXIMUM RATINGS, ABSOLUTE VALUES	CCS
D-C Plate Voltage	500 max. volts
D-C Grid No. 2 Voltage	250 max. volts
D-C Grid No. 1 Voltage	−100 max. volts
D-C Cathode Current	2x50 max. ma
Peak Cathode Current	2x400 max. ma
Grid No. 2 input	2x1.5 max. watts
Grid No. 1 input	2x0.5 max. watt
Plate dissipation	2x10 max. watts

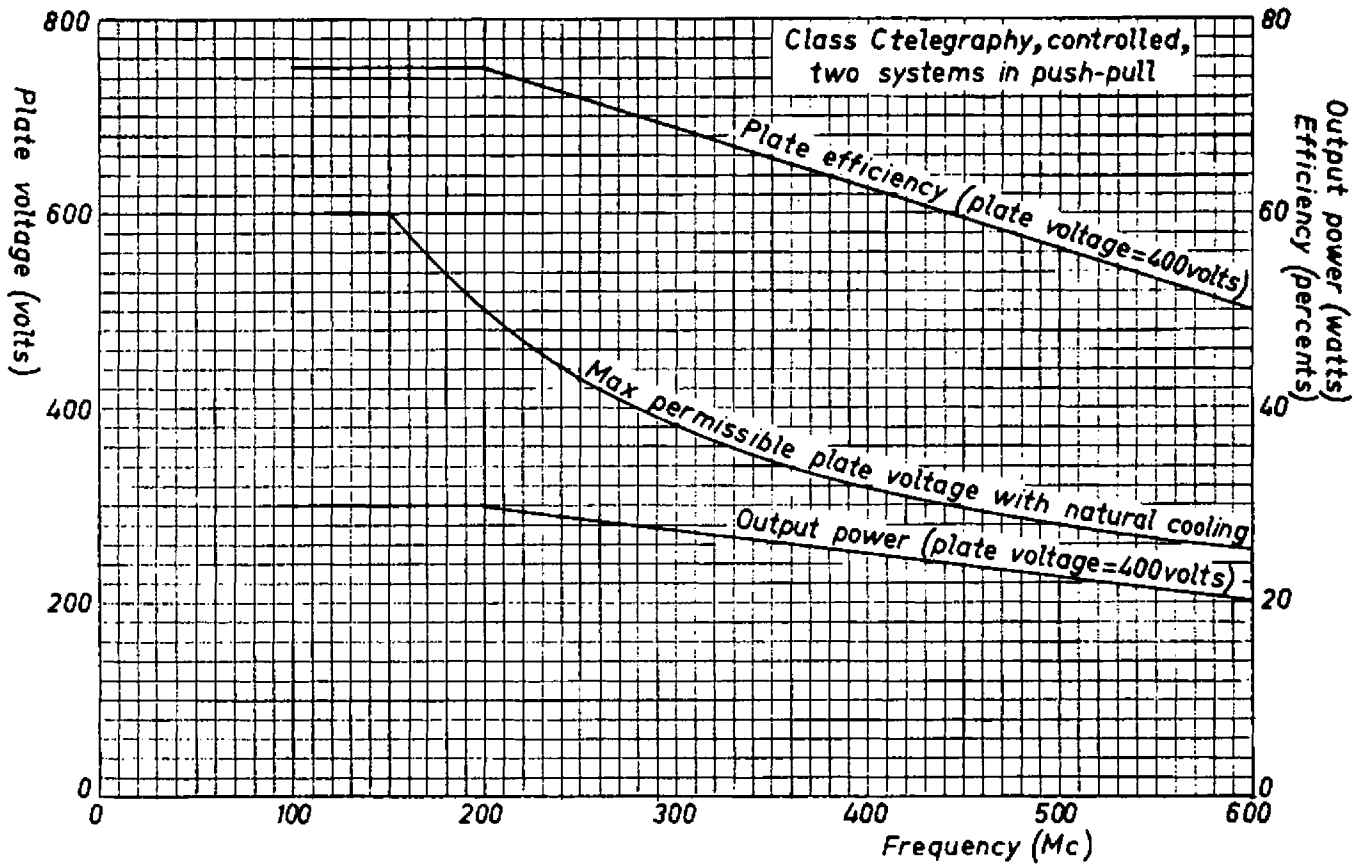
TYPICAL OPERATION	CCS	CCS	CCS
Frequency	200	200	400 Mc
D-C Plate Voltage	500	300	300 volts
D-C Grid No. 2 Voltage	250	250	250 volts
D-C Grid No. 1 Voltage	−80	−50	−50 volts
D-C Plate Current	2x40	2x40	2x40 ma
D-C Grid No. 2 Current	2x4	2x4	2x3 ma
D-C Grid No. 1 Current, approx.	2x1	2x1	2x1 ma
Driving Power ①	3	1.5	- watts
Power Output, approx.	31	17	13 watts

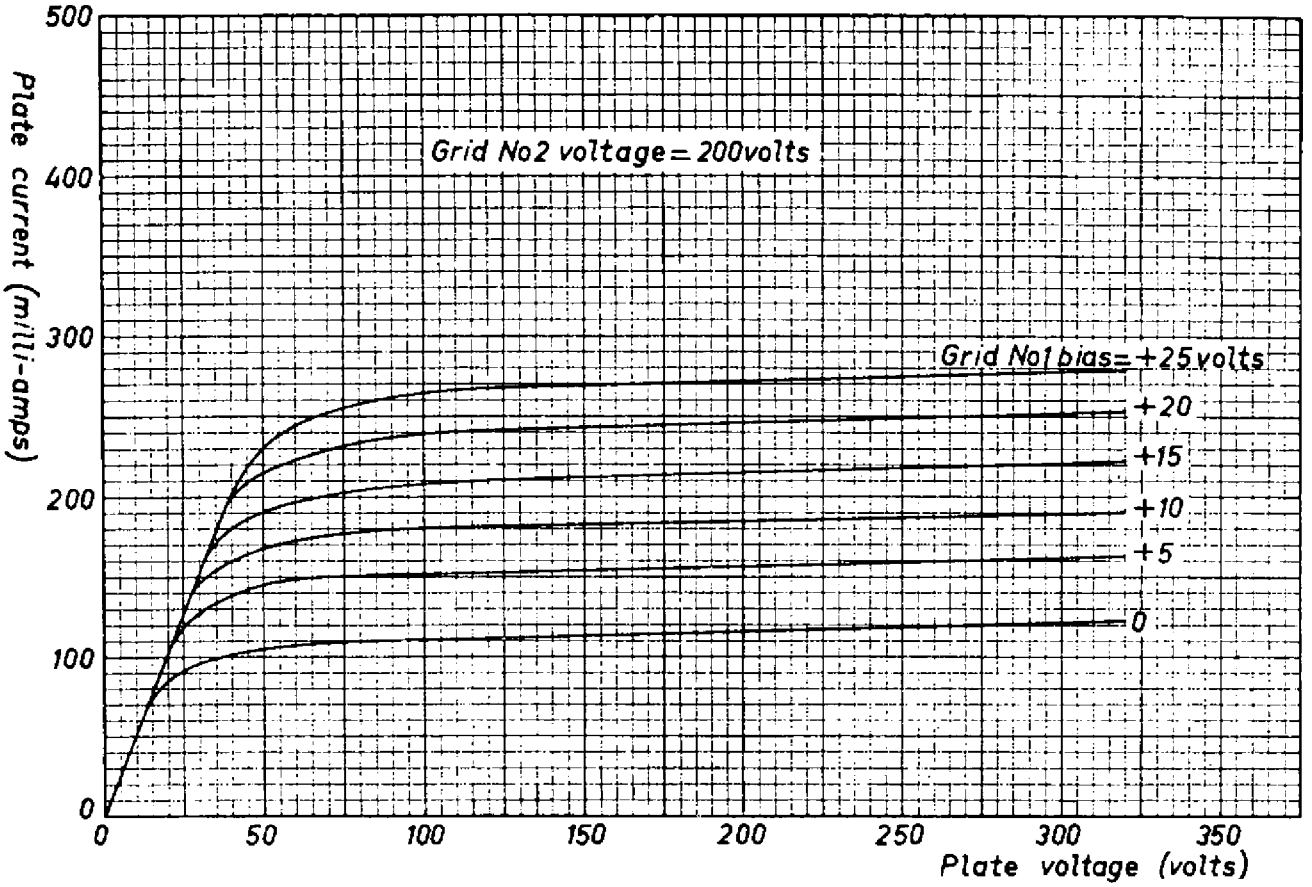
① Driving power includes typical fixed-frequency grid-circuit loss.

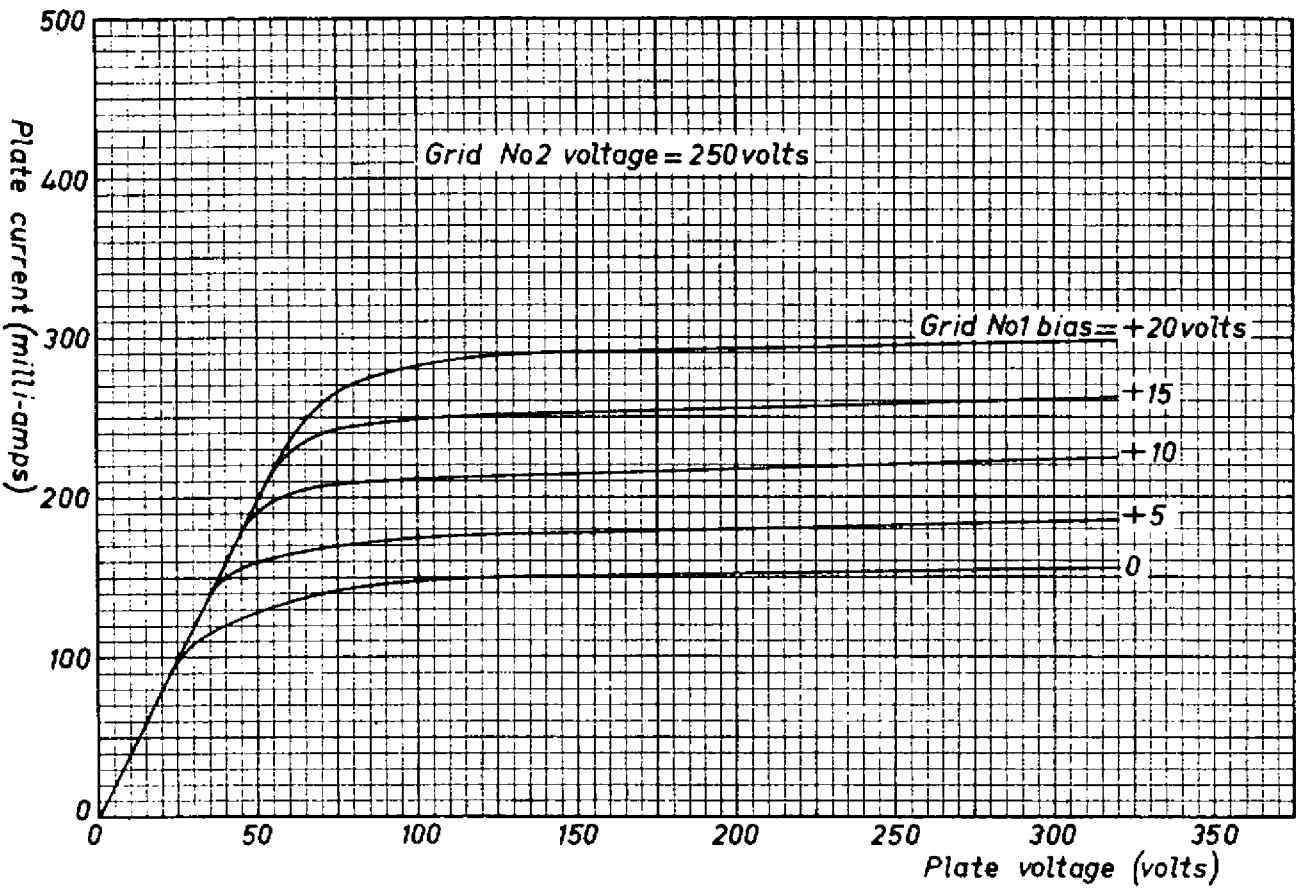
ELECTRICAL DATA AND LIMITS

Characteristics	Conditions		Limits	
			Min.	Max.
Plate Current	E_b = 300 V E_{c2} = 250 V E_{c1} = −40 V	I_b		1.5 ma
Plate Current	E_b = 300 V E_{c2} = 250 V E_{c1} = −25 V	I_b	2	26 ma
Plate Current	E_b = 300 V E_{c2} = 250 V E_{c1} = −12 V	I_b	40	80 ma
Grid No. 2 Current	E_b = 300 V E_{c2} = 250 V E_{c1} = −25 V	I_{c2}		3.5 ma
Power Output	E_b = 600 V E_{c2} = 250 V E_{c1} = −60 V I_b = 100 mA f = 150 Mc	P_o	40	watts

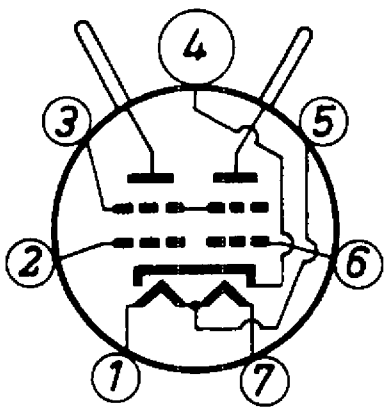

Class C telegraphy, controlled, two systems in push-pull
Grid No2 voltage=250volts
Frequency=200Mc
Plate voltage (volts)
600
500
400
300
200
100
80
60
40
20
0
Efficiency (percents)


Class C telegraphy, controlled, two systems in push-pull
Plate efficiency (plate voltage=400volts)
Max permissible plate voltage with natural cooling
Output power (plate voltage=400volts)
Plate voltage (volts)
800
600
400
200
0
Output power (watts)
Efficiency (percents)
80
60
40
20
0
100
200
300
400
500
600
Frequency (Mc)


Grid No2 voltage = 200volts
Grid No1 bias = +25volts
+20
+15
+10
+5
0
Plate current (milli-amps)
Plate voltage (volts)
0
100
200
300
400
500
0
50
100
150
200
250
300
350


Grid No2 voltage = 250volts
Grid No1 bias = +20volts
+15
+10
+5
0
Plate current (milli-amps)
Plate voltage (volts)
0
100
200
300
400
500
0
50
100
150
200
250
300
350

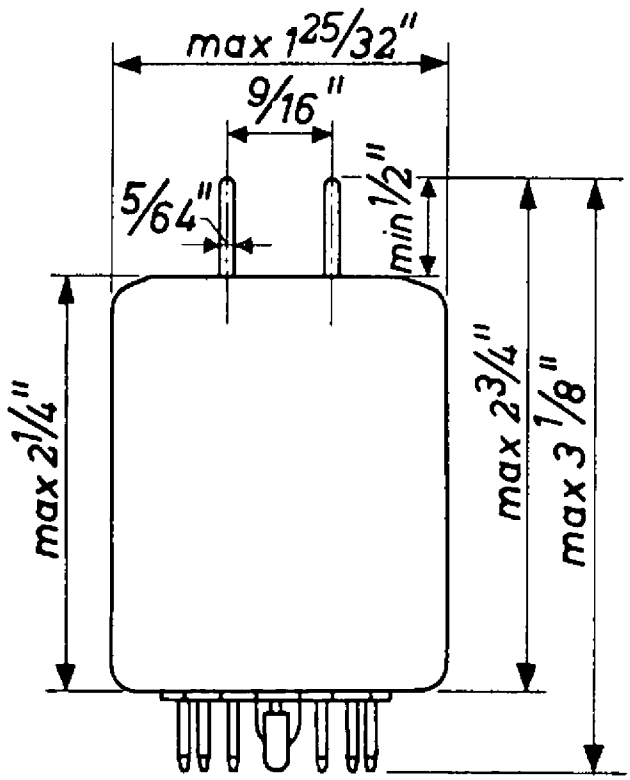
BOTTOM VIEW



Pin 1 - Heater
Pin 2 - Grid No. 1 triode No. 1
Pin 3 - Grid No. 2, triodes No. 1 and 2.
Pin 4 - Cathode
Pin 5 - Heater mid-tap
Pin 6 - Grid No. 1, triode No. 2
Pin 7 - Heater

Top Connections - Plate, triode No. 1
Plate, triode No. 2

DIMENSIONAL CUTLINE



Septar 7 - pin Base

AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVENUE HICKSVILLE, L. I.

TENTATIVE DATA

AMPEREX TYPE 6268/AX-9911

The 6268/AX-9911 is a three electrode, hydrogen filled thyratron with a self-contained and self-regulating source of hydrogen. This tube has a positive control characteristic and is designed for long-life pulse modulator applications. The life expectancy of this tube is over 1000 hours. IT IS COMPLETELY INTERCHANGEABLE IN EVERY RESPECT WITH THE STANDARD TYPE 4C35 TUBE.

GENERAL CHARACTERISTICS

ELECTRICAL

	MIN.	BOGEY	MAX.	
Heater Voltage	5.8	6.30	6.60	volts
Heater Current (at 6.3 volts)	5.50	6.10	6.70	amps
Cathode Heating Time Required	180	——	——	sec.
Tube Drop (egk)	——	——	150	volts
Trigger Voltage (Source Unloaded)	130	——	——	volts
Trigger Rise Time	——	——	0.5	microsec.
Trigger Source Impedance	——	——	1500	ohms
Trigger Width (70.7%)	2.0	——	——	microsec.
D.C. Anode Striking Voltage at 130 volts Peak Trigger Voltage	——	——	1500	volts
Anode Delay Time (From 26% of Trigger Pulse to start of Current Pulse)	——	——	0.6	microsec.
Anode Delay Time Drift	——	——	0.15	microsec.
Time Jitter	——	——	0.02	microsec.

MECHANICAL

Dimensions	
Length	6 5/8 inches
Diameter	2 1/2 inches
Mounting Position	any
Cooling	see note 1
Clamping	see note 2
Weight (approx.)	7 ounces

Notes:
1. Cooling of the anode lead is permissible, but there shall be no air blast directly on the bulb.
2. Clamping is permissible at the base and/or the bulb in the area up to 2 1/2 inches above the top of the base only.

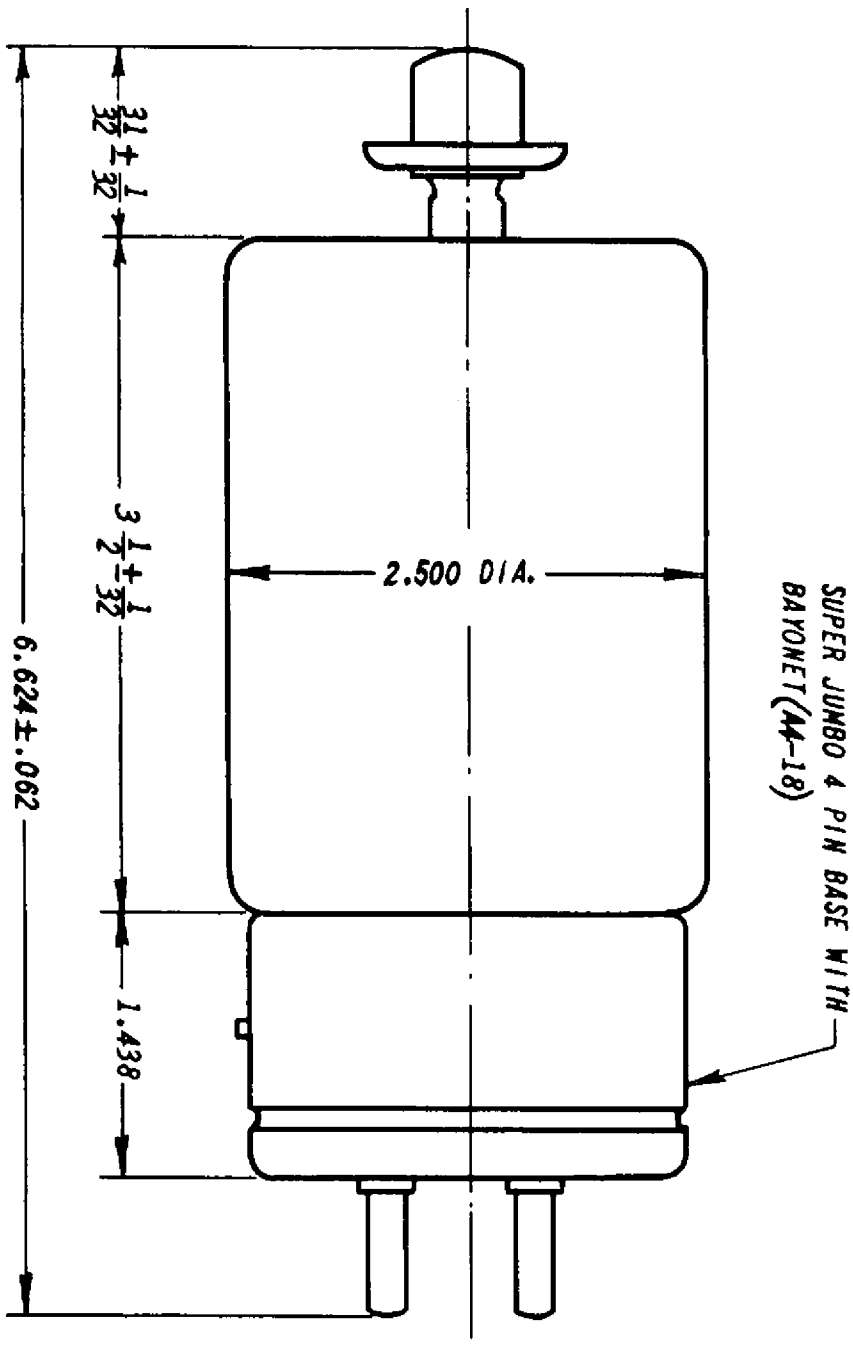
MAXIMUM RATINGS

ABSOLUTE VALUES

Max. Peak Anode Voltage	
Inverse	8.0 KV*
Forward	8.0 KV**
Max. Cathode Current	
Peak	90 amps
Average	100 ma
Max. Value of (Forward Voltage)X (Pulse Repitition Rate)X (Peak Current)	2.0×10^9
Max. Rate of Rise of Cathode Current	1000 amps/microsec.
Max. Trigger Source Impedance	1500 ohms
Max. Trigger Rise Time (26%-70.7%)	0.5 microsec.
Max. Inverse Grid Voltage	2000 volts
Ambient Temperature Limits	-55° C to + 90° C

* For instantaneous starting applications where plate voltage is applied instantaneously, the maximum permissible forward voltage is 7000 volts and shall not be attained in less than 0.04 seconds.

** In pulsed operation, the peak inverse voltage, exclusive of spike of 0.05 microsecond maximum duration, shall not exceed 2.5 KV during the first 25 microseconds after the pulse.


31/32 ± 1/32
3 1/2 ± 1/32
6.624 ± .062
2.500 DIA.
1.438
SUPER JUMBO 4 PIN BASE WITH
BAYONET (M-18)

AMPEREX ELECTRONIC CORPORATION
230 DUFFY AVENUE HICKSVILLE, L. I.

TENTATIVE DATA

AMPEREX TYPE 6279/AX-9912

The 6279/AX-9912 is a three electrode, hydrogen filled thyratron with a self-contained and self-regulating source of hydrogen. This tube has a positive control characteristic and is designed for long-life pulse modulator applications. The life expectancy of this tube is over 1000 hours. IT IS COMPLETELY INTERCHANGEABLE IN EVERY RESPECT WITH THE STANDARD TYPE 5C22 TUBE.

GENERAL CHARACTERISTICS

ELECTRICAL

	MIN.	BOGEY	MAX.	
Heater Voltage	5.83	6.30	6.77	volts
Heater Current (at 6.3 volts)	9.6	——	11.6	amps
Cathode Heating Time Required	300	——	——	sec.
Tube Drop (egk)	——	——	175	volts
Trigger Voltage (Source Unloaded)	200	——	——	volts
Trigger Rise Time	——	——	0.5	microsec.
Trigger Source Impedance	——	——	500	ohms
Trigger Width (70.7%)	2.0	——	——	microsec.
D.C. Anode Striking Voltage at 150 V. Peak Trigger Voltage	——	——	2500	volts
Anode Delay Time (From 26% of Trigger Pulse to start of Current Pulse)	——	——	1.0	microsec.
Anode Delay Time Drift	——	——	0.15	microsec.
Time Jitter	——	——	0.02	microsec.

MECHANICAL

Dimensions	
Length	8 1/2 inches
Diameter	2 1/2 inches
Mounting Position	any
Cooling	see note 1
Clamping	see note 2
Weight (approx.)	9 1/2 ounces

Notes:
1. Cooling of the anode lead is permissible, but there shall be no air blast directly on the bulb.
2. Clamping is permissible at the base and/or the bulb in the area up to 4 1/4 inches above the top of the base only.

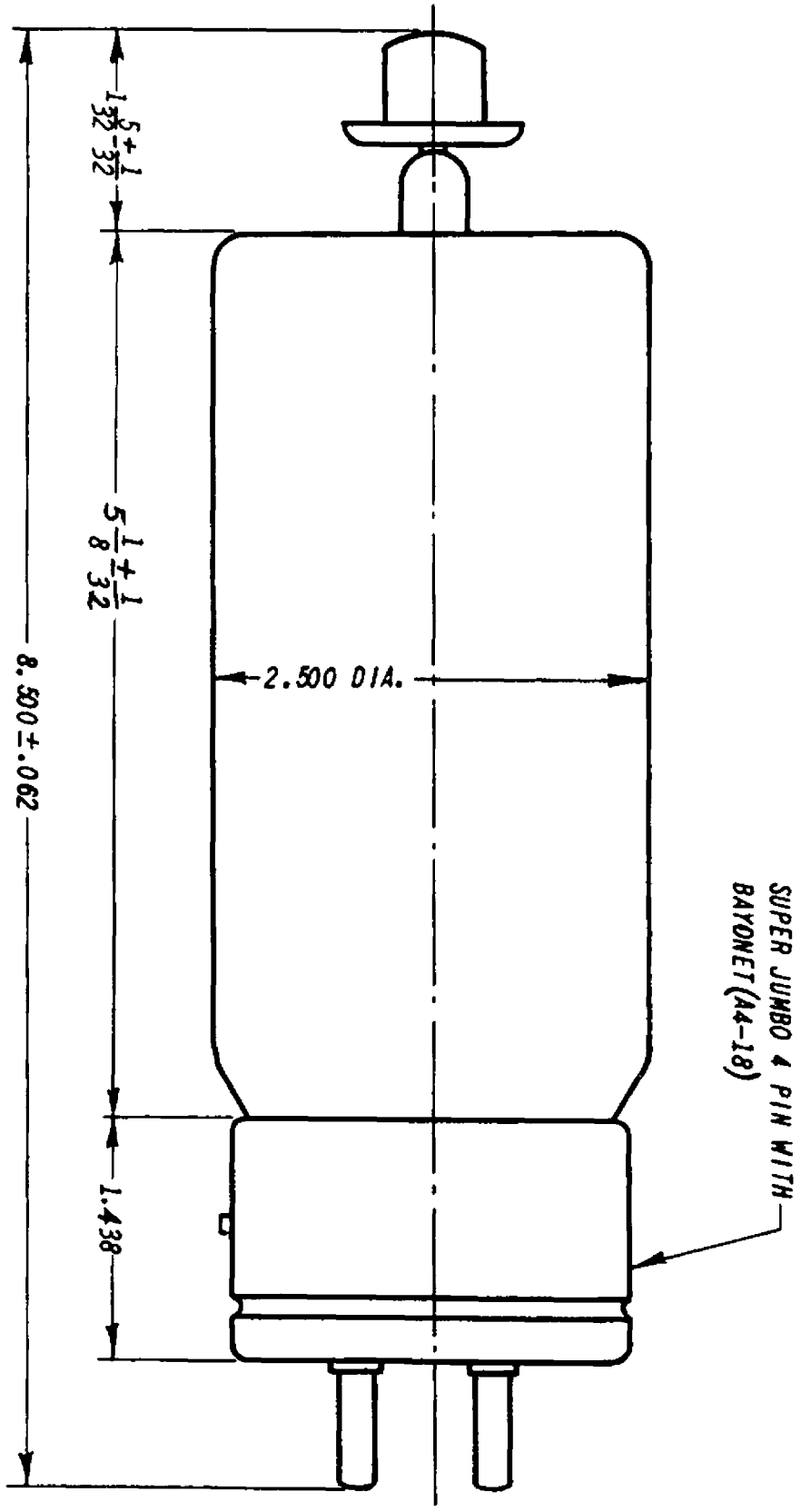
MAXIMUM RATINGS

ABSOLUTE VALUES

Max. Peak Anode Voltage		
Inverse	16.0	KV*
Forward	16.0	KV**
Max. Cathode Current		
Peak	325	amps
Average	200	ma
Max. Value of (Forward Voltage)X (Pulse Repitition Rate)X (Peak Current)	3.2×10^9	
Max. Rate of Rise of Cathode Current	1500	amps/microsec.
Max. Trigger Source Impedance	500	ohms
Max. Trigger Rise Time	0.5	microsec.
Max. Inverse Grid Voltage	200	volts
Ambient Temperature Limits	-50° C to + 90° C	

* For instantaneous starting applications where plate voltage is applied instantaneously, the maximum permissible epy is 13.5 KV and shall not be attained in less than 0.04 seconds.

** In pulsed operation, the peak inverse voltage, exclusive of a spike of 0.05 microsecond maximum duration, shall not exceed 5.0 KV during the first 25 microseconds after the pulse.


1 5/32 +1/32 -1/32
5 1/8 +1/32
8.500 ±.062
2.500 DIA.
1.438
SUPER JUMBO 4 PIN WITH
BAYONET (A4-18)

from JETEC release #1550, Dec. 12, 1955

AMPEREX TUBE TYPE 6333

6333

AF Power Amplifier and Modulator
RF Power Amplifier and Oscillator

GENERAL CHARACTERISTICS

WATER COOLED TRIODE

ELECTRICAL

Filament	Tungsten
Two unit type, for single-phase or two-phase A.C., or D.C. operation	
Voltage (per unit)	11 volts
Current (per unit)	60 amperes
Starting current must never exceed 2.0 times the normal current.	
Amplification Factor	50
Grid to Plate Transconductance at a Plate Current of 0.75 amperes	7000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	32 uuf
Grid to Filament	17 uuf
Plate to Filament	1.8 uuf

MECHANICAL

Overall Dimensions	
Length (approx.)	17½ inches
Maximum Dia. (approx.)	4 inches
Mounting Position - Vertical	Anode Down
Type of Cooling	Water
Water Jacket	Amperex Type # DW-1580
Water Flow [1,2]	3-8 gal. per min.
Pressure Drop [2] (approx.)	4 lbs. per sq. in.
Max. Outlet Water Temp.	70°C.

ACCESSORIES

Stand-off Insulator	Amperex Type # SI-5000
External Fil. Lead	Amperex Type # S-13484
External Grid Connector	Amperex Type # Y-13326 (Supplied with tube without charge)
Net Weight (approx.)	3 lbs.
Shipping Weight (approx.) (one tube)	10 lbs.

1 Rated water flow must be continuous between the time any voltage is applied and for 5 minutes after voltage is removed.

2 The approximate water pressure is measured directly across the jacket alone and does not include connecting piping.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
A.C. Filament Voltage[1]		21	22	22
D.C. Plate Voltage	15000	6000	10000	12500
D.C. Grid Voltage		25	130	200
Load Resistance (per tube) (ohms)		1050	1600	2500
Effective Load Resistance (plate to plate) (ohms)		4200	6400	10000
Zero Signal D.C. Plate Current (amps)		0.4	0.4	0.2
Peak A.F. Grid to Grid Voltage		1200	1620	1580
Max. Signal D.C. Plate Current[2] (amps)	2	2.5	3.2	2.7
Max. Signal Plate Input[2] (kw)	20	15	32	34
Plate Dissipation[2] (kw)	7.5	7[4]	12[4]	12[4]
Minimum Grid Input Resistance (approx.) (ohms)		400	300	300
Max. Signal Driving Power (approx.) (watts)		150	240	170
Max. Signal Power Output (kw)		8	20	22

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with 1.0 maximum modulation factor)

Plate Volts & Input Max. %	100	85	75
For Frequencies Indicated (mc)	1.6	7.5	20

	Maximum Rating per Tube	Typical Operation One Tube		
D.C. Filament Voltage[1]		21	22	22
D.C. Plate Voltage	15000	6000	10000	14000
D.C. Grid Voltage	....	60	-120	200
Plate Load Resistance (ohms)		3300	3600	4000
Peak R.F. Grid Voltage		310	410	500
D.C. Plate Current (amps)	1	0.5	0.75	0.95
Plate Input (kw)	15	3	7.5	13.3
Plate Dissipation (kw)	10	2	5	8.8
D.C. Grid Current (approx.) (ma)	....	38	20	13
Driving Power (approx.)[3] (watts)	....	95	100	80
Power Output (kw)	....	1	2.5	4.5
F.C.C. Broadcast Rating (kw)	2.5	1	2.5	....

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

Plate Volts & Input Max. %	100	85	75
For Frequencies Indicated (mc)	1.6	7.5	20

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage[1]		22	22	22
D.C. Plate Voltage	10000	6000	8000	10000
D.C. Grid Voltage	3000	1000	1250	1600
Plate Load Resistance (ohms)		3500	3740	6100
Peak R.F. Grid Voltage		1650	2000	2300
D.C. Plate Current (amps)	1	0.77	0.96	0.77
Plate Input (kw)	10	4.62	7.68	7.7
Plate Dissipation (kw)	6.8	1.12	1.68	1.33
D.C. Grid Current (approx.) (ma)	400	160	160	135
Driving Power (approx.) (watts)		250	310	300
Power Output (kw)		3.5	6	6.37
F.C.C. Broadcast Rating (kw)	5	....	5	5

R.F. Power Amplifier and Oscillator Class C—Telegraphy

(Key-down conditions without modulation)[5]

Plate Volts & Input Max. %	100	75	50
For Frequencies Indicated (mc)	1.6	7.5	20

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage[1]		22	22	22
D.C. Plate Voltage	15000	8000	10000	12000
D.C. Grid Voltage	3000	1000	1300	1600
Plate Load Resistance (ohms)		3000	3200	3500
Peak R.F. Grid Voltage		1800	2200	2600
D.C. Plate Current (amps)	2	1.2	1.4	1.55
Plate Input (kw)	30	9.6	14	18.60
Plate Dissipation (kw)	10	2.5	3.5	4.35
D.C. Grid Current (approx.) (ma)	400	165	160	165
Driving Power (approx.) (watts)	....	280	340	420
Plate Power Output (kw)	....	7.1	10.5	14.25

NOTES:

1 Two filament units in series.

2 Averaged over any audio-frequency cycle of sine-wave form.

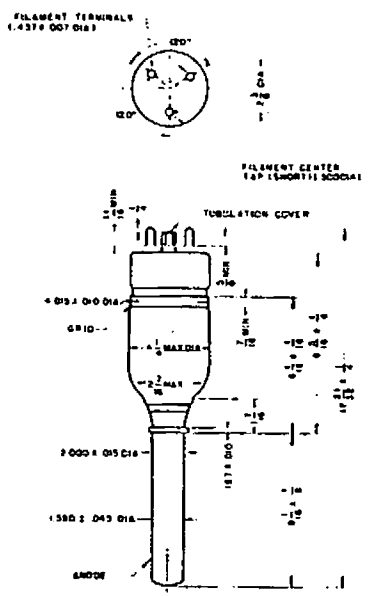
3 At crest of audio frequency cycle with modulation factor of 1.0.

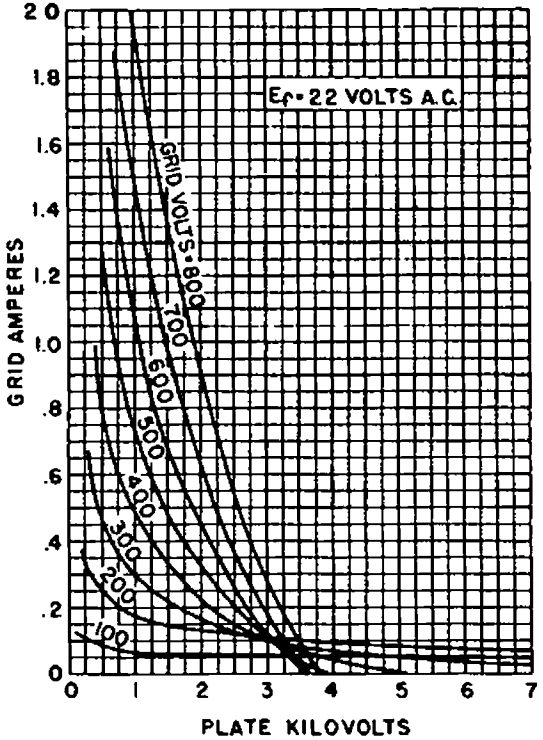
4 Averaged over an audio-frequency cycle of sine-wave form under maximum signal conditions.

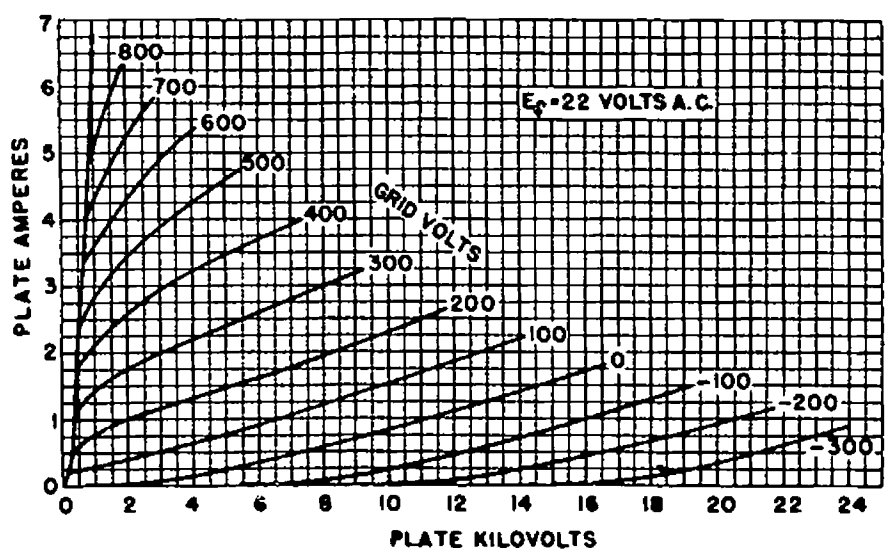
5 Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

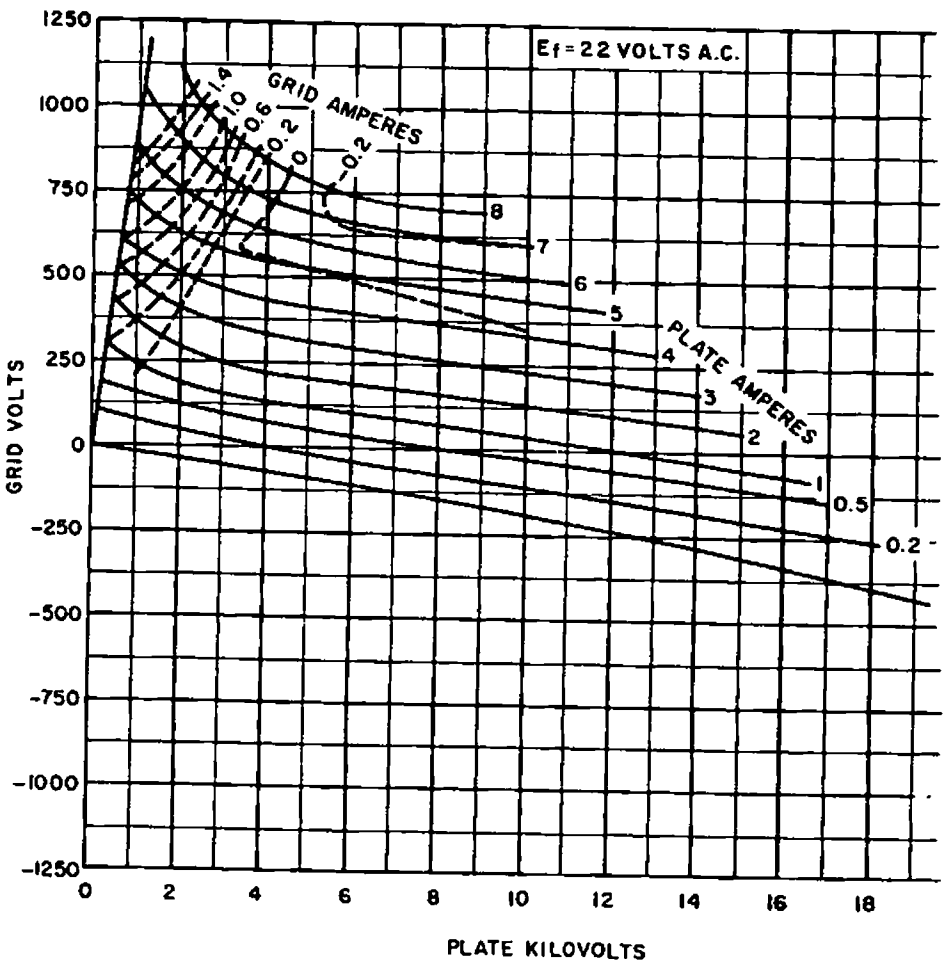
6333

6333


FILAMENT TERMINALS
FILAMENT CENTER TAP TERMINAL SOCKET
TUBULATION COVER
GRID
ANODE


Ef = 22 VOLTS A.C.
GRID VOLTS
800
700
600
500
400
300
200
100
GRID AMPERES
PLATE KILOVOLTS


Ef = 22 VOLTS A.C.
800
700
600
500
400
300
200
100
0
-100
-200
-300
GRID VOLTS
PLATE AMPERES
PLATE KILOVOLTS


Ef = 22 VOLTS A.C.
GRID AMPERES
1.4
1.0
0.6
0.2
0
-0.2
PLATE AMPERES
8
7
6
5
4
3
2
1
0.5
0.2
GRID VOLTS
PLATE KILOVOLTS

AMPEREX TUBE TYPE 6339

from JETEC release #1550, Dec. 12, 1955

The 6339 is a high vacuum, external anode clipper diode and rectifier tube which is only 2 inches long (without leads) and 3/4 inch in diameter. A miniaturized and ruggedized version of the 3B29, the 6339 operates under more stringent conditions than its prototype. It is designed to be enclosed in a complete liquid cooled package including power supply and pulse modulator components.

Operation in air at reduced ratings is allowed for applications where oil cooling is not necessary or required.

Although developed primarily for radar applications, it shows interesting possibilities for use in high voltage circuitry where space requirements are critical

GENERAL CHARACTERISTICS

ELECTRICAL DATA	MIN.	BOGEY	MAX.	
Filament Voltage	5.7	6.3	6.9	volts
Filament Current at Bogey Voltage	1.40	1.55	1.70	amps
Filament Warm-up Time	60	--	--	sec.
Peak Cathode current [1]	--	--	8.0	amps
Peak Inverse Voltage	--	--	16.0	KV
Plate-Cathode Capacity	--	2.2	--	uuf

MECHANICAL DATA

Mounting Position	any
Cooling	liquid immersion (silicone oil)[2]
Coolant Temperature Range	−65° to + 165° C
Shock Resistance	300 G impact
Vibration Resistance	10 − 60 cycles per sec. 0.080 inches total displacement.
Dimensions (without leads)	
Length	2 1/16 inches
Diameter	13/16 inches
Length of leads (approx.)	1 1/2 inches
Lead Connections - Heavy	Heater, cathode terminal
Thin	Heater terminal
Socket for anode end	Standard 60 amp. fuse clip or equal
Connection (filament leads)	Lugs as shown or banana plug optional
Weight (approx.)	1 1/2 oz.

[1] Represents maximum useable cathode current for any condition of operation.

[2] Dow Corning #510 fluid, viscosity 50 - 60 centistokes, or an equivalent. For air cooling see data following.

6339

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

RECTIFIER (In Oil)

(Maximum ratings, absolute values)

Peak Inverse Voltage	10,000	16,000 volts
Peak Current	400	250 mA
Average Current	100	65 mA dc
Silicone Oil Coolant Temp.	−65° C to + 165° C	

Typical Operation (In Oil)

One Tube, Half-wave, Capacitor-Input Filter

Peak Inverse Voltage	10,000	16,000 volts
Peak Current	400	250 mA
Average Current - Load Current	100	65 mA
Load Voltage (approx.)	3300	5500 volts

Two Tubes, Single Phase, Full wave

Choke Input Filter

Peak Current (per tube)	200	130 mA
Average Current (per tube)	100	65 mA
Peak Inverse Voltage	10,000	16,000 volts
Load Current	200	130 mA
Load Voltage	2900	4900 volts

Three Phase Operation

Choke Input Filter

	Half Wave	Double Y	Bridge
No. of Tubes	3	6	6
Peak Inverse Voltage	10,000	10,000	16,000 volts
Peak Anode Current	300	300	195 mA
Average Anode Current (per tube)	100	100	65 mA dc
Output Voltage	4500	4500	14,000 volts dc
Ouptut Current	300	600	195 mA dc

6339

RECTIFIER - (In Air)

(Maximum ratings, absolute values - air cooled at sea level)

	Without Auxiliary Cooler	With Auxiliary Cooler	
Peak Inverse Voltage	12,000	12,000	volts
Peak Current	200	400	mA
Average Current	50	100	mA dc
Ambient Temperature	−55 to + 85	−55 to + 85	°C

Typical Operation In Air Without Auxiliary Cooler

	Single Phase Operation Choke Input Filter Full Wave	Three Phase Operation Choke Input Filter Half Wave	Three Phase Operation Choke Input Filter Bridge	
No. of Tubes	2	3	6	
Peak Inverse Voltage	12,000	10,000	12,000	volts
Peak Anode Current	100	150	100	mA
Average Anode Current (per tube)	50	50	33	mAdc
Output Voltage	3500	4500	10,500	volts dc
Output Current	100	150	100	mAdc

With Auxilary Cooler

No. of Tubes	2	3	6	
Peak Inverse Voltage	12,000	10,000	12,000	volts
Peak Anode Current	200	300	200	mA
Average Anode Current (per tube)	100	100	67	mAdc
Output Voltage	3500	4500	10,500	volts dc
Output Current	200	300	200	mAdc

SHUNT DIODE (In Oil)

(Maximum ratings, absolute values)

Peak Inverse Voltage	10,000 volts
Peak Current	8 amps
Average Current	18 mA
Pulse Duration in 100 microsecond interval	25 microseconds

Typical Operation (In Oil)

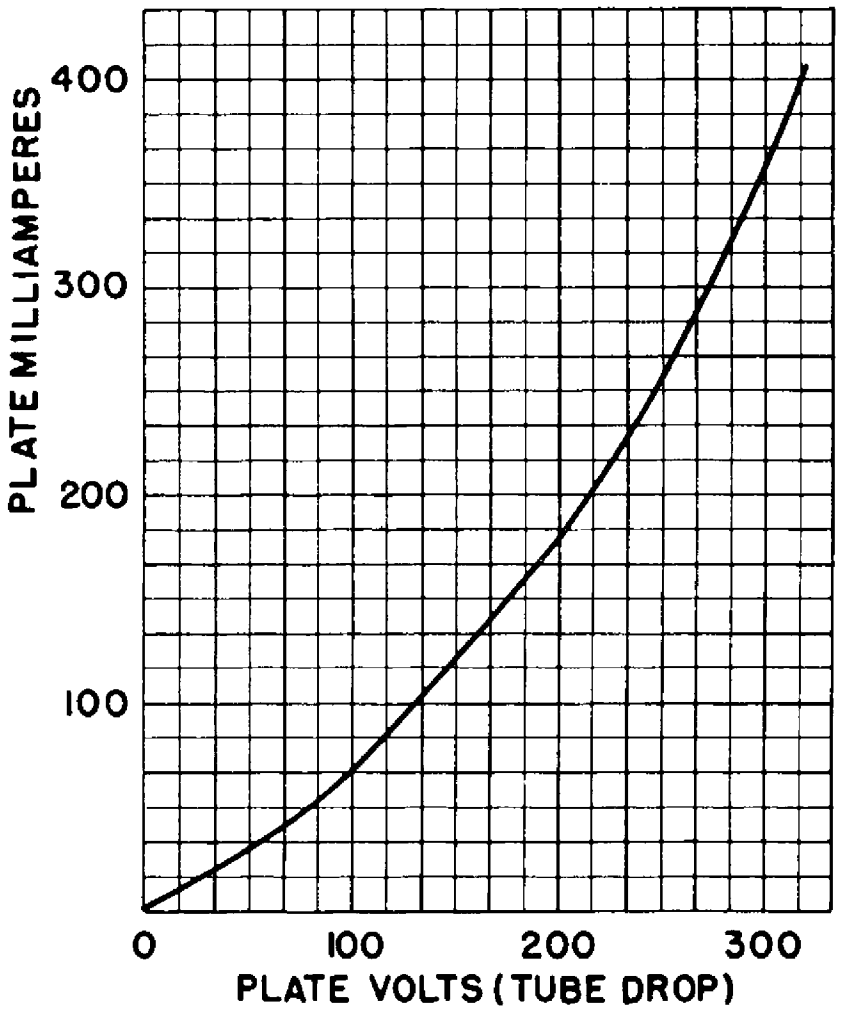
(One tube in hydrogen thyratron modulator circuit)

Pulse Time	1.0 microsecond
Network Impedance	50 ohms
Peak Thyratron Forward Voltage	10 KV
Repetition Rate	280 pulses per sec.
Diode Series Resistor	1000 ohms
Load Resistor[3]	0 ohms
Average Current Plate[3]	22 mA dc

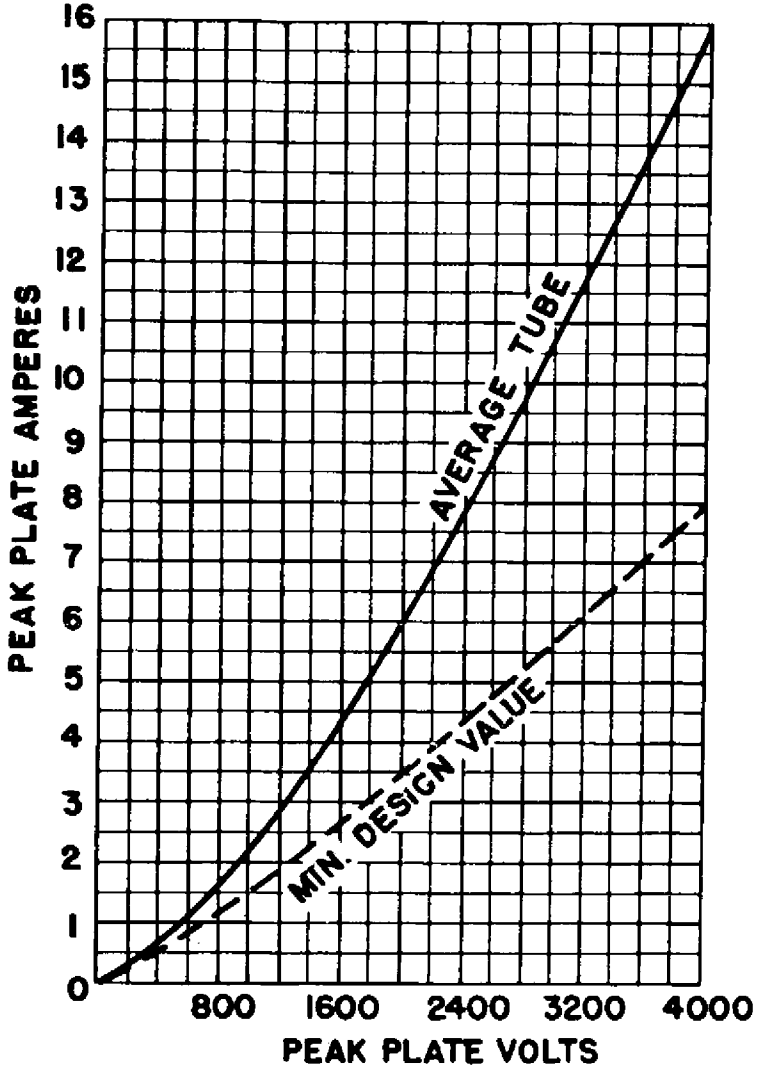
[3] This load resistor represents a short circuit or arc in the load. As a result, the average diode plate current of 22 MA, D.C. will momentarily exceed the maximum rating of 18 MA, D.C. This circuit should be so designed that the high voltage will automatically shut off if continual short circuit exists in the load. The 6339 will operate, however, for longer than 500 hours under short circuit conditions which produce the average current as shown.

6339

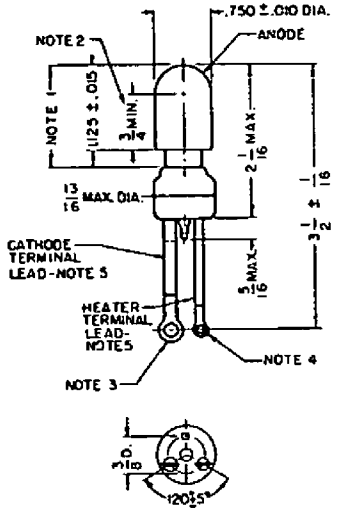
AMPEREX TUBE TYPE 6339
AVERAGE PLATE CURRENT VS.
PLATE VOLTAGE
(TUBE DROP CURVE FOR
RECTIFIER APPLICATION)



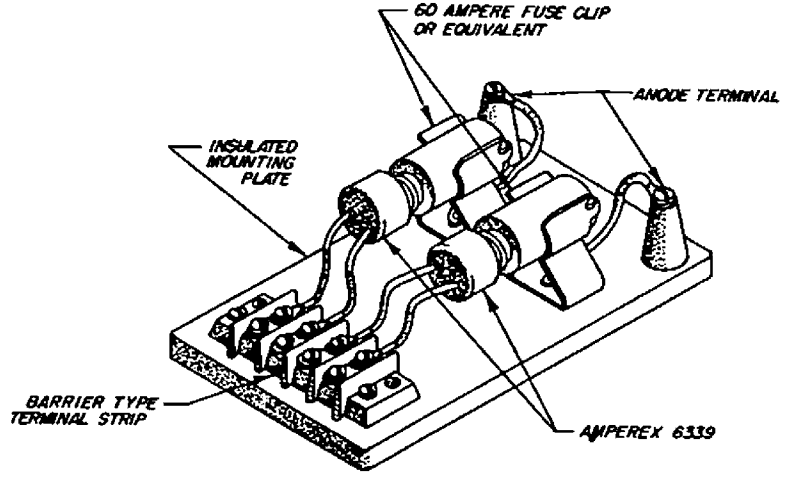
AMPEREX TUBE TYPE 6339
PEAK PLATE CURRENT VS. PEAK
PLATE VOLTAGE.
(TOTAL TUBE EMISSION CURVE
FOR SHUNT DIODE APPLICATION)



6339



NOTES:
1. THIS SURFACE SILVER-PLATED.
2. SURFACE AVAILABLE FOR SUPPORT.
3. TINNED LUG FOR NO.8 SCREW-CRIMPED AND SOLDERED.
4. TINNED LUG FOR NO.6 SCREW-CRIMPED AND SOLDERED.
5. FLEXIBLE LEAD-INSULATED WITH FIBERGLASS.

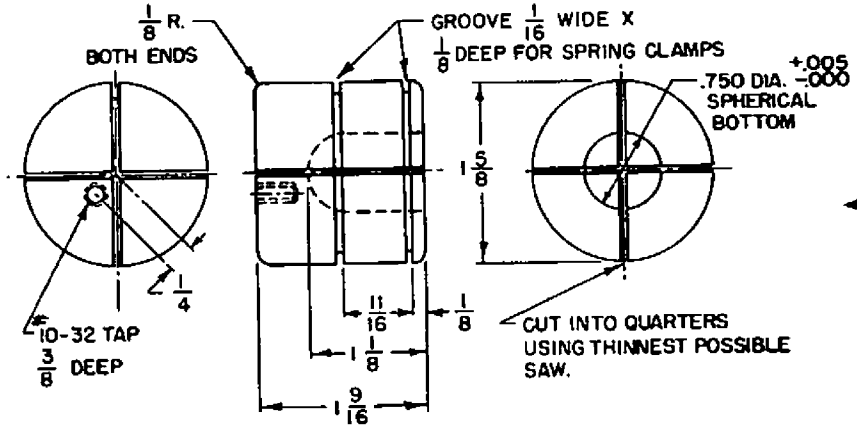


SUGGESTED MOUNTING FOR 6339 AIR COOLED OR LIQUID COOLED.

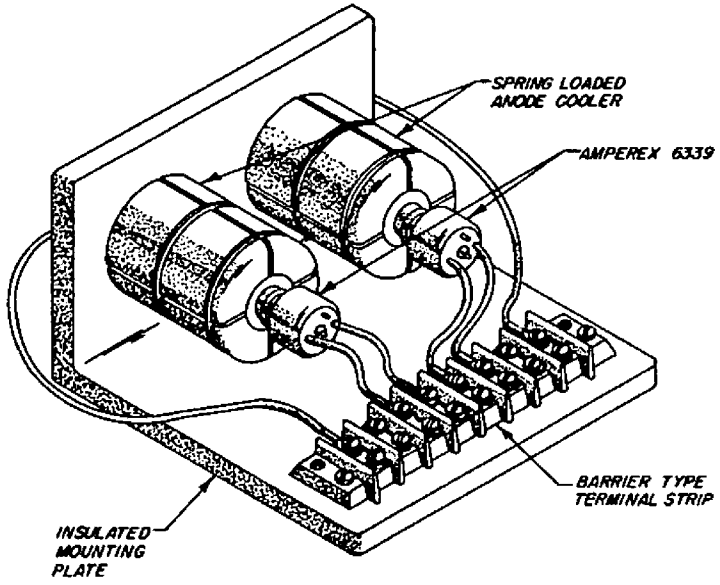
RECOMMENDED DESIGN

6339 ANODE HOLDER
(AUXILIARY COOLER)

MATERIAL: ALUMINUM



TWO SPRING CLAMPS OF HEAVY MUSIC WIRE REQUIRED.



SUGGESTED MOUNTING FOR 6339 WITH AUXILIARY COOLER

from JETEC release #1550, Dec. 12, 1955

AMPEREX TUBE TYPE 6445

The 6445 is an improved version of the standard type 892R, forced air-cooled triode, and is interchangeable with it in every respect. Incorporating the latest developments in tube design and techniques, the 6445 fills industrial and communication requirements for a tube which is completely interchangeable with the popular 892R and is superior in mechanical construction and electrical performance.

Among the outstanding features of the new AMPEREX 6445 are:

1. A rugged, powdered glass stem which replaces the conventional stem press construction.
2. A Kovar ring grid connection instead of the projecting feather-edge seal grid arm.
3. Lower grid lead inductance because of a strong conical internal grid support instead of the 3 legged, riveted construction.
4. Shorter overall length - approx. 3 inches.
5. A rugged Kovar anode seal to eliminate the more fragile feather-edge, copper seal.
6. A new, stronger spiral filament providing more uniform heat distribution over the anode surface.

GENERAL CHARACTERISTICS

FORCED AIR-COOLED TRIODE

ELECTRICAL

Filament	Two unit, tungsten type for single or two phase AC or DC operation.	
Voltage (per unit)	11	volts
Current (per unit)	60	amps
(Starting current must never exceed 120 amps per unit, even momentarily)		
Amplification Factor	50	
Transconductance (Grid to Plate at I_b = 0.75A)	7000	micromhos
Direct Interelectrode Capacitances		
Plate to grid	32	uuf
Grid to filament	17	uuf
Plate to filament	1.8	uuf

MECHANICAL

Maximum Overall Dimensions		
Length	19 1/8	inches
Diameter (incl. radiator handles)	11	inches

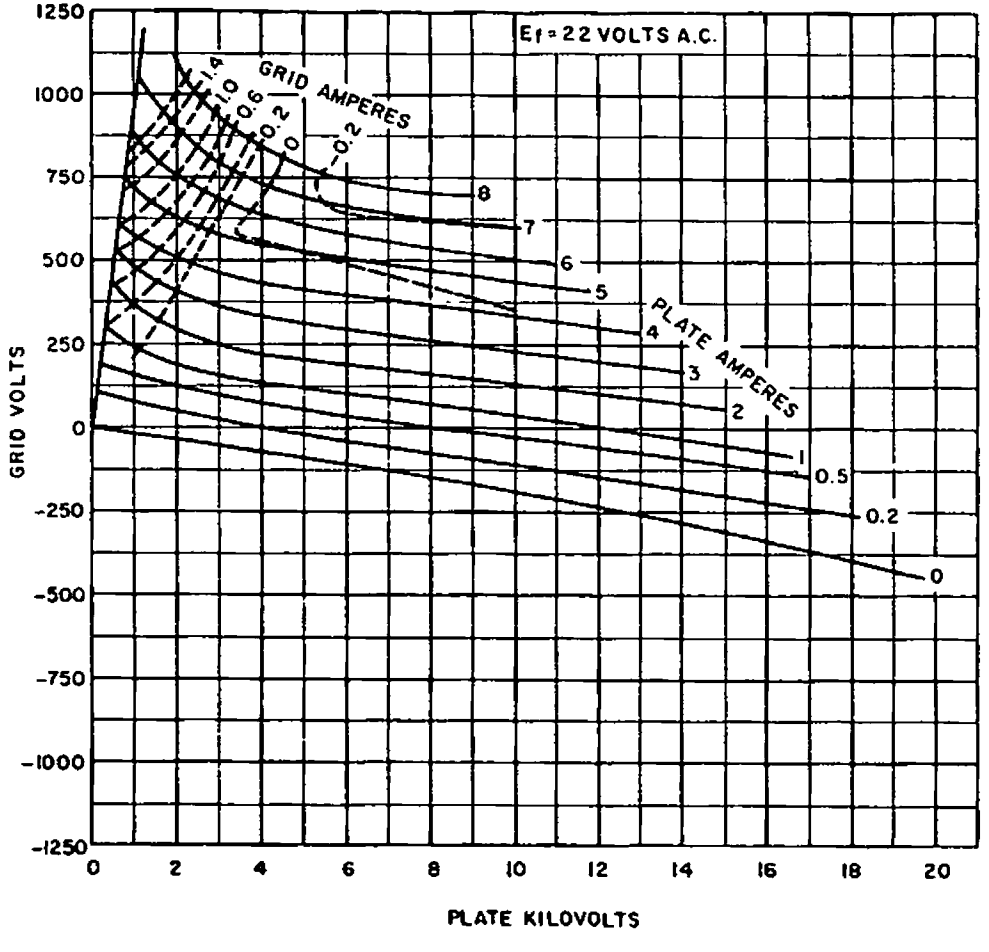
MECHANICAL (Con't)

Mounting Position				Vertical - anode down
Type of cooling [1]				Forced - air
Plate Dissipation	5.0	4.0	3.0	KW
Air Flow to Radiator	530	450	360	cfm
Back Pressure	0.67	0.50	0.33	inches water
Maximum Temperatures				
Glass-to-Metal Seals				180°C
Radiator				230°C
Incoming Air				45°C
Net Weight (approx.)				35 lbs.

ACCESSORIES

External Filament Connector	AMPEREX # S-13484
External Grid Connector	AMPEREX # Y-13326 (supplied with tube without charge)

[1] Rated air flow must be continuous between the time any voltage is applied and for 5 minutes after voltage is removed.



6445

6445

MAXIMUM RATINGS AND TYPICAL OPERATION CONDITIONS

A.F. POWER AMPLIFIER OR MODULATOR - CLASS B

Maximum Ratings

D.C. Plate Voltage	12,500 volts
D.C. Plate Current, Max. Signal [2]	2.0 amps
Plate Input, Max. Signal [2]	12,500 watts
Plate Dissipation [2]	5,000 watts

Typical Operation
(Values are for two tubes)

A.C. Filament Voltage [3]	21	22 volts
D.C. Plate Voltage	6,000	10,000 volts
D.C. Plate Current, Zero Signal	0.4	0.5 amps
D.C. Plate Current, Max. Signal	2.5	2.5 amps
D.C. Grid Voltage	−25	−120 volts
Grid to Grid Voltage, Peak AF	1200	1400 volts
Effective Load, Plate to Plate	4200	8400 ohms
Minimum Grid Input Resistance	400	300 ohms
Maximum Signal Drive Power (approx.)	150	300 watts
Maximum Signal Plate Input [2]	15	25 kilowatts
Maximum Signal Power Output	8	17 kilowatts

R.F. POWER AMPLIFIER - CLASS B

(Carrier conditions per tube for use with a maximum modulation of 1.0)

Maximum Ratings

D.C. Plate Voltage	12,500 volts
D.C. Plate Current	1.1 amps
Plate Input	6,000 watts
Plate Dissipation	5,000 watts

Typical Operation

D.C. Filament Voltage [3]	21	22 volts
D.C. Plate Voltage	6000	8000 volts
D.C. Plate Current	0.5	0.75 amps
D.C. Grid Voltage	−60	−80 volts
D.C. Grid Current (approx.)	38	20 ma
Grid Voltage, Peak R.F.	310	380 volts
Driving Power (approx.)	96	30 watts
Power Output	1000	2000 watts

PLATE MODULATED, R.F. POWER AMPLIFIER CLASS C - TELEPHONY

(Carrier conditions per tube for use with a maximum modulation factor of 1.0)

Maximum Ratings

D.C. Plate Voltage	10,000 volts
D.C. Plate Current	1.0 amp
Plate Input	10,000 watts
Plate Dissipation	3,000 watts
D.C. Grid Voltage	−3,000 volts
D.C. Grid Current	0.4 amps

Typical Operation

A.C. Filament Voltage [3]	22	22 volts
D.C. Plate Voltage	6,000	8,000 volts
D.C. Plate Current	0.77	0.96 amp
D.C. Grid Voltage	−1000	−1250 volts
Grid Voltage, Peak R.F.	1650	2000 volts
D.C. Grid Current (approx.)	0.160	0.156 amp
Driving Power (approx.)	250	310 watts
Power Output	3500	6000 watts

R.F. POWER AMPLIFIER OR OSCILLATOR CLASS C - TELEGRAPHY

(Key down conditions per tube without modulation)

Maximum Ratings

D.C. Plate Voltage	12,500 volts
D.C. Plate Current	2.0 amps
Plate Input	18,000 watts
Plate Dissipation	5,000 watts
D.C. Grid Voltage	−3,000 volts
D.C. Grid Current	0.4 amp

Typical Operation

A.C. Filament Voltage [3]	22	22 volts
D.C. Plate Voltage	8000	10,000 volts
D.C. Plate Current	1.2	1.4 amp
D.C. Grid Voltage	−1000	−1300 volts
Grid Voltage, Peak R.F.	1800	2200 volts
D.C. Grid Current (approx.)	0.165	0.160 amp
Driving Power (approx.)	280	340 watts
Power Output	7100	10,500 watts

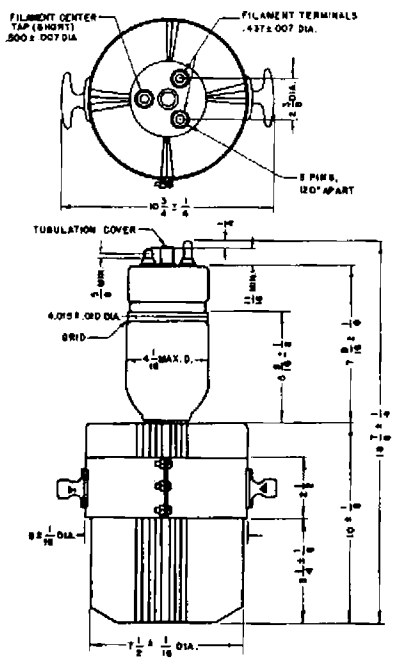
Maximum ratings apply up to 5 megacycles, but operation at higher frequencies is possible provided the input is reduced according to the following chart and the glass-to-metal seal temperatures are not exceeded.

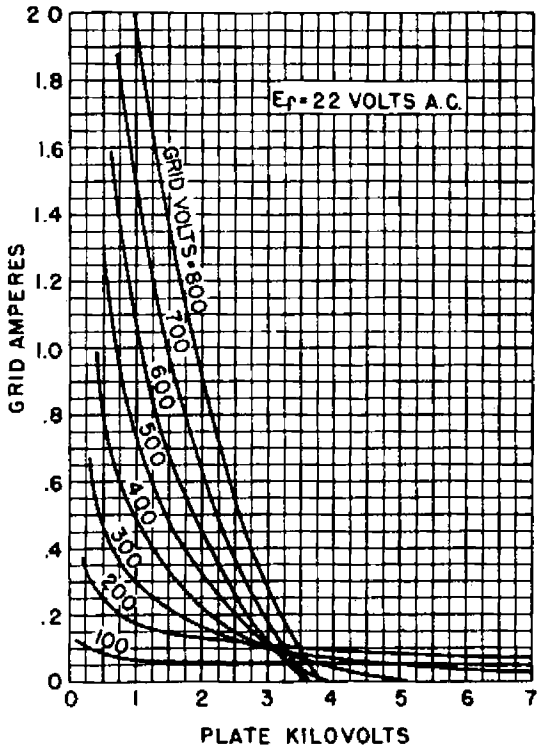
Frequency	5	12.5	20 mc.
Percent of Maximum Rated Plate Voltage and Plate Input	100	75	50 percent

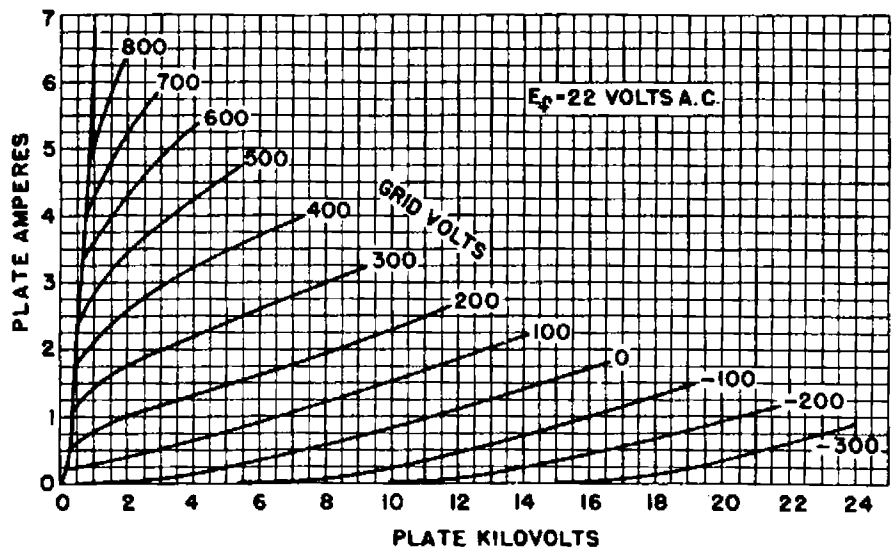
[2] Averaged over any audio-frequency cycle of sine-wave form.

[3] Two filament units in series

[4] At crest of audio-frequency cycle with modulation factor of 1.0.







AMPEREX TUBE TYPE 6446

The 6446 is an improved, ruggedized, heavy wall version of the standard type 892 tube.

Incorporating the latest developments in tube design and techniques, the 6446 fills the requirements of the industrial field for a tube which is electrically similiar to the 892 tube, but with higher dissipation reserve allowing for extreme mismatch of load to tube impedance. The tube is, therefore, protected against maladjustment of misuse of equipment.

Among the outstanding features of the new AMPEREX tube are the following:

1. Heavy wall, high conductivity copper anode (7/16" thick)
2. Rugged powdered glass stem which takes the place of the stem press construction.
3. Elimination of the projecting feather-edge seal grid arm by the incorporation of a Kovar ring grid connection.
4. Addition of a strong, conical internal grid support instead of the 3 legged riveted construction. This also provides much lower inductance.
5. Elimination of the more fragile copper feather-edge anode seal and replacement with a Kovar seal.
6. New, stronger spital filament providing more uniform heat distribution over the anode surface.
7. Only one-half the water flow required for 892 for equivalent anode dissipation.

RF Power Amplifier and Oscillator

TENTATIVE DATA

GENERAL CHARACTERISTICS

WATER COOLED TRIODE

ELECTRICAL

Filament	Tungsten
Two unit type, for single-phase or two-phase A.C., or C.D. operation	
Voltage (per unit)	11 volts
Current (per unit)	60 amperes
Starting current must never exceed 2.0 times the normal current.	
Amplification Factor	50
Grid to Plate transconductance at a Plate Current of 0.75 amperes	7000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	32 uuf
Grid to Filament	17 uuf
Plate to Filament	1.8 uuf

MECHANICAL

Overall Dimensions	
Length (approx.)	17½ inches
Maximum Dia. (approx.)	4 inches
Mounting Position - Vertical	Anode Down
Type of Cooling	Water
Water Jacket	Amperex Type # S-15096
Water Flow [1]	3-8 gal. per min.
Pressure Drop [2] (approx.)	1-5 lbs. per sq. in.
Max. Outlet Water Temp.	70°C.

ACCESSORIES

External Fil. Lead	Amperex Type # S-13484
External Grid Connector	Amperex Type # Y-13326 (supplied with tube without charge)
Net Weight (approx.)	10 lbs.
Shipping Weight (approx.) (one tube)	18 lbs.

[1] Rated water flow must be continuous between the time any voltage is applied and for 5 minutes after voltage is removed.

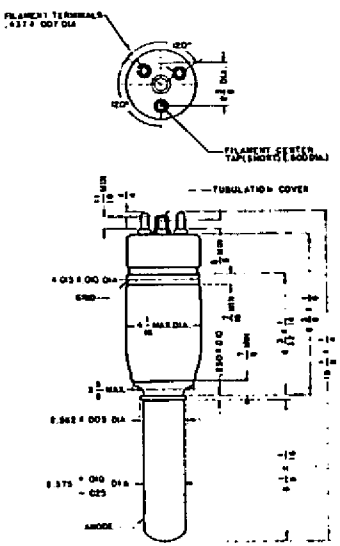
[2] The approximate water pressure is measured directly across the jacket alone and does not include connecting piping.

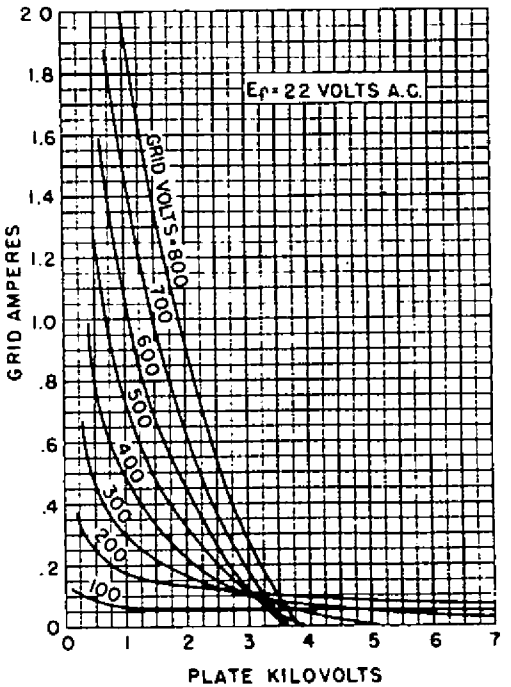
MAXIMUM RATING AND TYPICAL OPERATING CONDITIONS

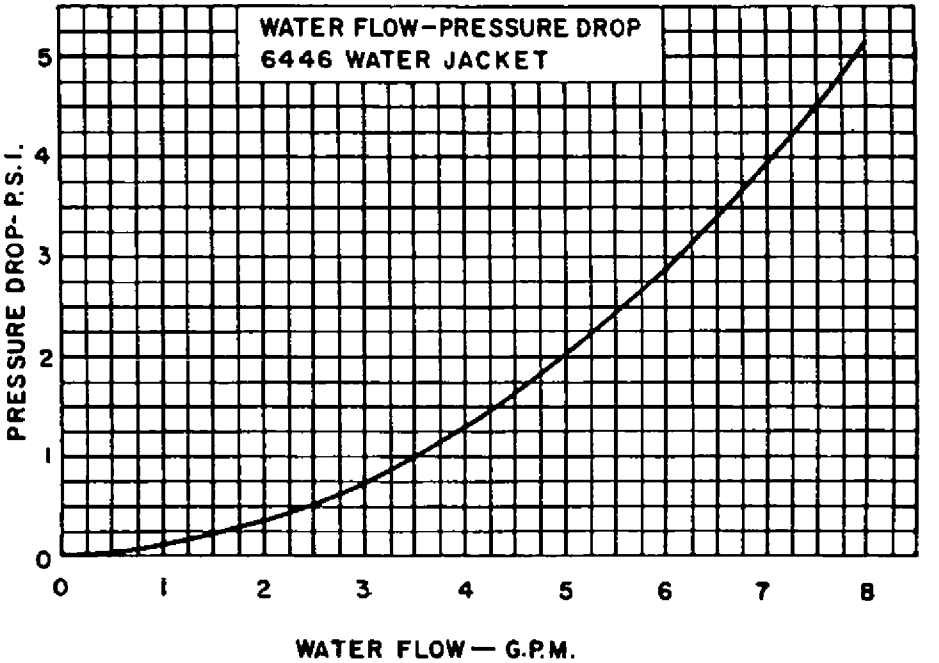
RF POWER AMPLIFIER AND OSCILLATOR - CLASS "C"

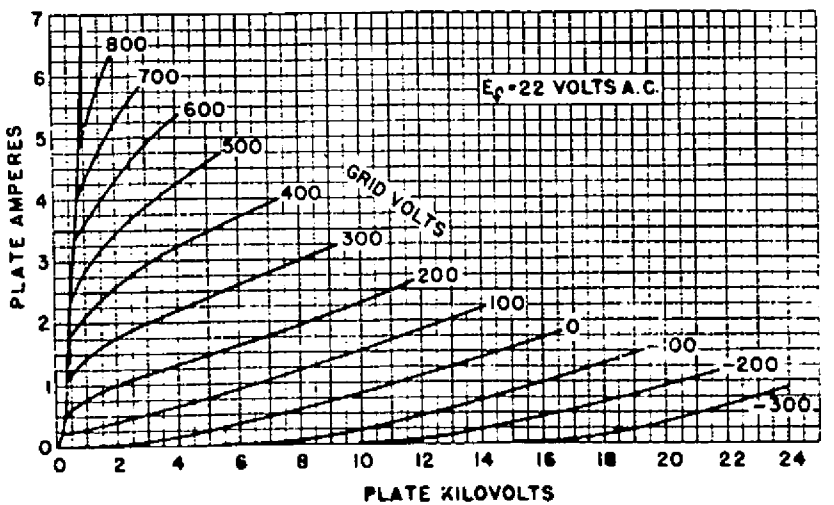
PLATE VOLTS AND INPUT MAX. %		100	75	50	
FOR FREQUENCIES INDICATED (mc)		5	12.5	20	
	MAXIMUM RATING PER TUBE	TYPICAL OPERATION ONE TUBE			
A.C. Filament Voltage	———	21.2	21.5	21.8	22.0 volts
D.C. Plate Voltage	15,000	8,000	10,000	12,000	15,000 volts
D.C. Grid Voltage	−3,000	−300	−400	−500	−1,250 volts
Peak R.F. Grid Voltage	———	1,000	1,200	1,400	2,400 volts
D.C. Plate Current	2.0	1.6	1.8	2.0	2.0 amps
Plate Input	30	12.8	18.0	24.0	30.0 KW
Plate Dissipation	20	4.1	5.2	6.5	10.0 KW
D.C. Grid Current	400	210	220	230	250 mA
Drive Power (Approx.)	———	200	250	300	620 watts
Plate Power Output	———	8.7	12.8	17.5	20.0 KW
Tube Output	———	494	715	996	1138BTU/Min

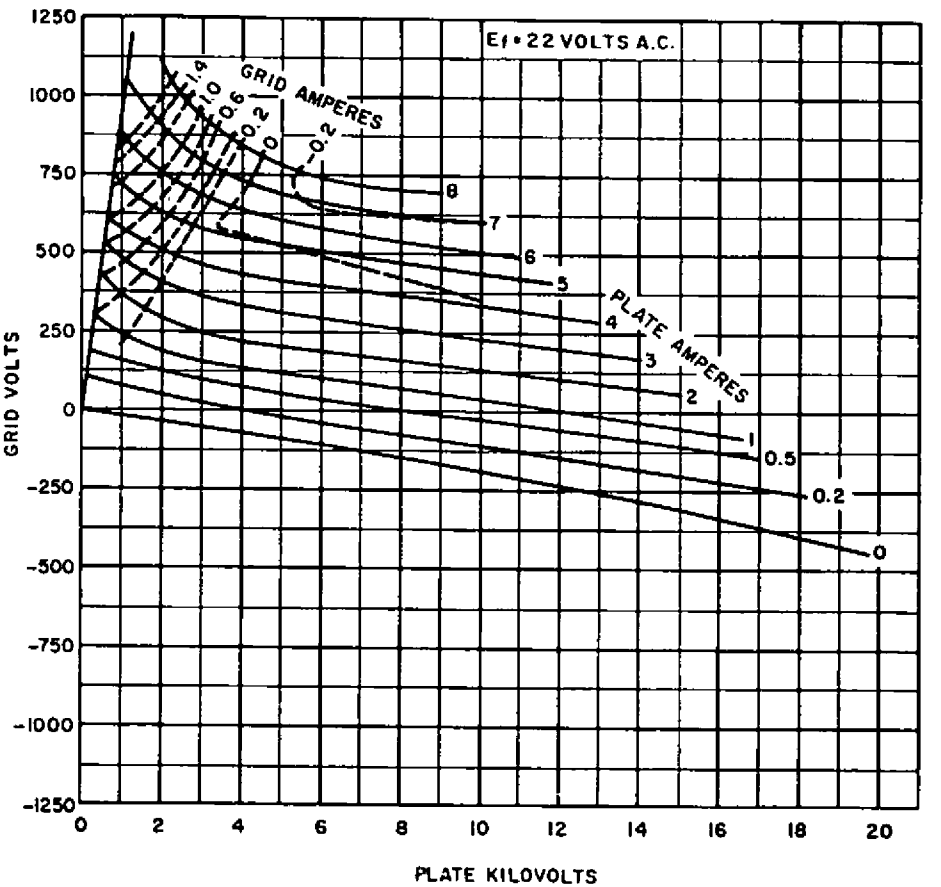
6446


TUBULATION COVER
ANODE


Ef = 22 VOLTS A.C.
GRID VOLTS
800
700
600
500
400
300
200
100
GRID AMPERES
PLATE KILOVOLTS


WATER FLOW—PRESSURE DROP
6446 WATER JACKET
PRESSURE DROP-P.S.I.
WATER FLOW — G.P.M.


Eg = 22 VOLTS A.C.
GRID VOLTS
800
700
600
500
400
300
200
100
0
-100
-200
-300
PLATE AMPERES
PLATE KILOVOLTS


Ef = 22 VOLTS A.C.
GRID AMPERES
PLATE AMPERES
GRID VOLTS
PLATE KILOVOLTS

AMPEREX TUBE TYPE 6447

The 6447 is an improved, ruggedized, heavy-wall version of the standard type 892R tube. Incorporating the latest developments in tube design and techniques, the 6447 fills the requirements of the industrial field for a tube similar to the 892R but with higher anode dissipation reserve. This allows for extreme mismatch of load to tube impedance and, therefore, protects the tube against maladjustment or misuse of equipment which cause excessive dissipation.

Among the outstanding features of the new AMPEREX tube are the following:

1. Heavy wall, high conductivity copper anode (7/16" thick)
2. Rugged powdered glass stem which takes the place of the stem press construction.
3. Elimination of the projecting feather-edge seal grid arm by the incorporation of a Kovar ring grid connection.
4. Addition of a strong, conical internal grid support instead of the 3 legged riveted construction. This also provides much lower inductance.
5. Elimination of the more fragile copper feather-edge anode seal and replacement with a Kovar seal.
6. New, stronger spiral filament providing more uniform heat distribution over the anode surface.

GENERAL CHARACTERISTICS

FORCED AIR-COOLED TRIODE

ELECTRICAL	
Filament	Tungsten
Two unit type for single-phase or two-phase A.C., or D.C. operation	
Voltage (per unit)	11 volts
Current (per unit)	60 amps
Starting current must never exceed 120 amps/unit, even momentarily	
Amplification Factor	50
Transconductance (Grid to Plate at I_b = 0.75 amp)	7000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	32 uuf
Grid to Filament	17 uuf
Plate to Filament	1.8 uuf
MECHANICAL	
Maximum Overall Dimensions	
Length	19 1/8 inches
Diameter	11 inches
Mounting Position	Vertical-anode down
Type of Cooling [1]	Forced air

[1] Rated air flow must be continuous between the time any voltage is applied and for 5 minutes after voltage is removed.

Cooling Characteristics

Plate Dissipation	10.0	8.0	6.0	KW
Air Flow to Radiator	700	500	350	cfm
Back Pressure	0.9	0.6	0.3	inches water
Maximum Temperatures				
Glass-to-metal Seals				180°C
Radiator				230°C
Net Weight (approx.)				60 lbs.

ACCESSORIES

External Filament Connector	AMPEREX #S-13484
External Grid Connector	AMPEREX #Y-13326 (supplied with tube without charge)

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Maximum ratings apply up to 5 megacycles. Operation at higher frequencies is permissible provided the input is reduced and attention given to the glass-to-metal seal temperature:

Frequency	5	12.5	20	mc
Percent of Maximum Rated Plate Voltage and Plate Input	100	75	50	%

R.F. POWER AMPLIFIER AND OSCILLATOR - CLASS C - TELEGRAPHY

(Key down conditions per tube without modulation)

Maximum Ratings

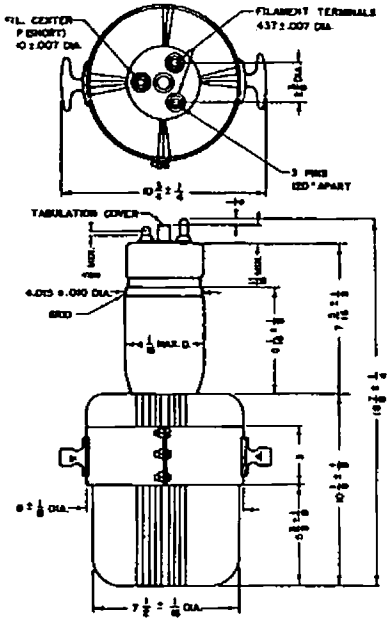
D.C. Plate Voltage	14.0 KV
D.C. Plate Current	2.0 amps
Plate Input	26.0 KW
Plate Dissipation	10.0 KW
D.C. Grid Voltage	− 3.0 KV
D.C. Grid Current	0.40 amp

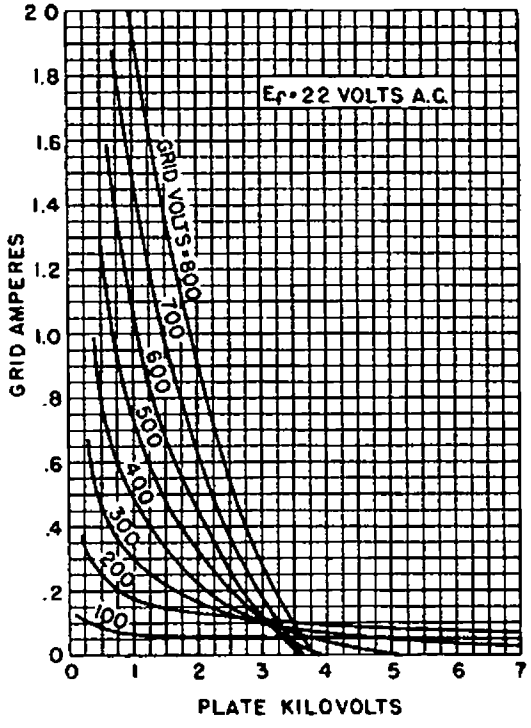
Typical Operation

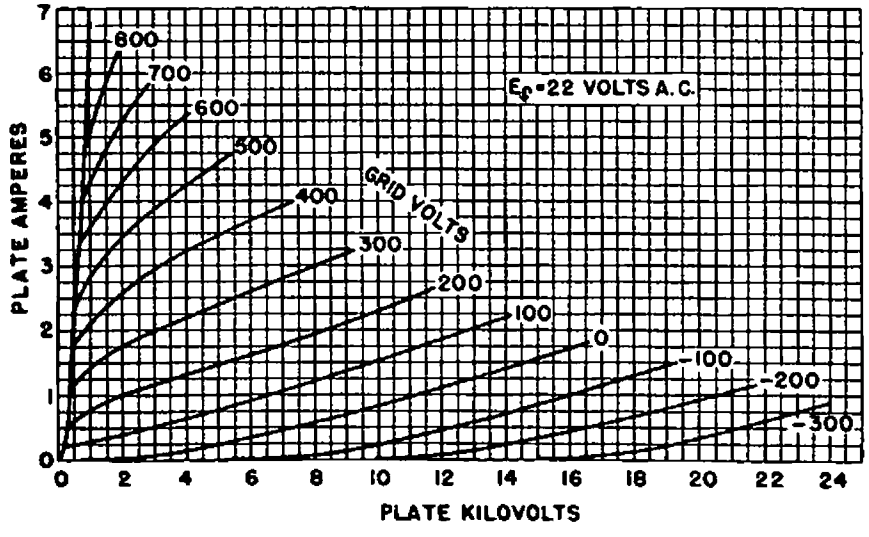
Filament Voltage	21.4	21.5	21.8 volts
D.C. Plate Voltage	8.0	10.0	12.0 KV
D.C. Plate Current	1.75	1.8	2.0 amps
D.C. Grid Voltage	−500	−600	−800 volts
Grid Voltage, Peak RF	1300	1420	1740 KV
D.C. Grid Current	0.21	0.20	0.20 amps
Driving Power (approx.)	273	284	348 watts
Power Output	9.4	12.3	17.1 KW
Tube Output	530	700	970 BTU/min.

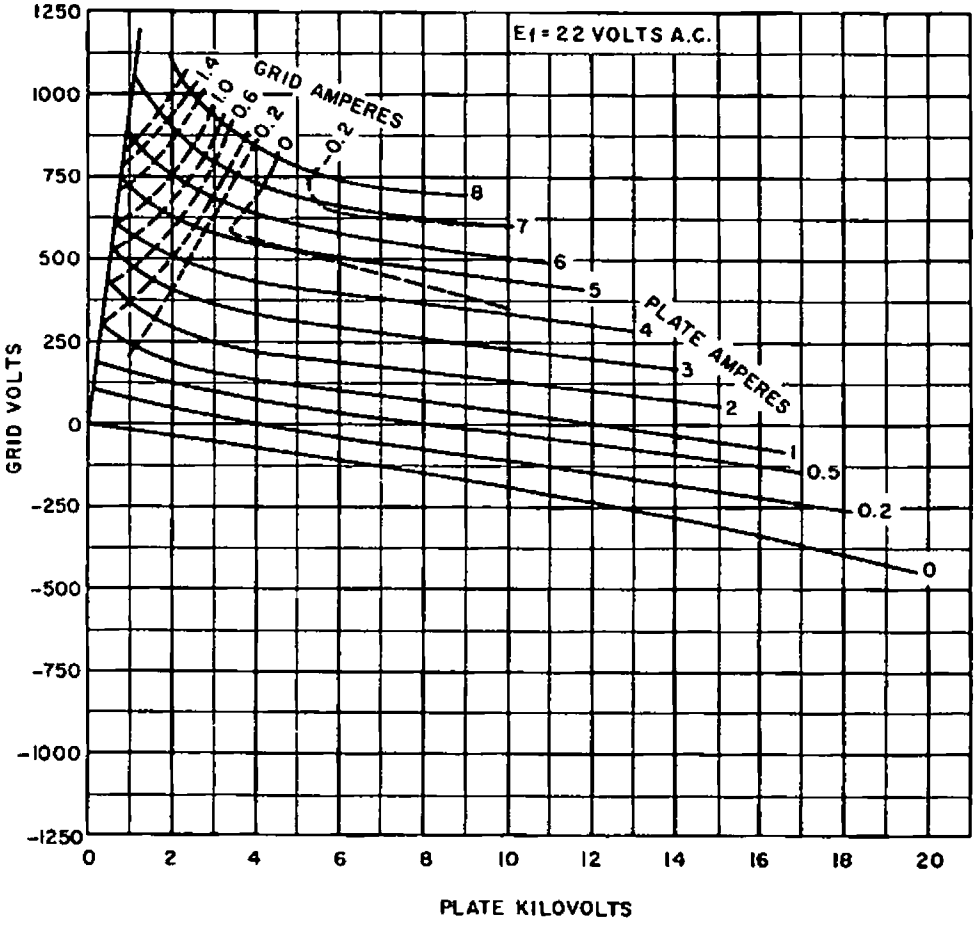
6447

6447


FILAMENT TERMINALS
TABULATION COVER


Ef = 22 VOLTS A.C.
GRID VOLTS
800
700
600
500
400
300
200
100
GRID AMPERES
PLATE KILOVOLTS


Ef = 22 VOLTS A.C.
800
700
600
500
400
GRID VOLTS
300
200
100
0
-100
-200
-300
PLATE AMPERES
PLATE KILOVOLTS


E1 = 22 VOLTS A.C.
GRID AMPERES
1.4
1.0
0.6
0.2
0
-0.2
8
7
6
5
4
3
2
1
0.5
0.2
0
PLATE AMPERES
GRID VOLTS
PLATE KILOVOLTS

from JETEC release
#1550, Dec. 12, 1955

AMPEREX TUBE TYPE 6508

The 6508 is a two electrode mercury-vapor rectifier tube and is designed for rectifier application of relatively high voltage and current. The cathode is directly heated, oxide coated. The physical design of this tube is similar to the popular AMPEREX types 5869 and 5870 thyratrons. The top bakelite cup is intended to prevent mercury condensation on the anode and thus eliminates arc-back.

Maximum Ratings, Absolute Values

Peak Inverse Voltage (max.)	21,000	15,000	10,000 volts
Condensed Mercury Temperature Limits	+25 to +45	+25 to +50	+25 to +60 °C
Maximum plate current			
Peak		10 amps	
Average (Averaging time max. 30 sec)		2.5 amps	
Surge, for design only (Maximum duration 0.1 second)		100 amps	
Frequency Range		25 - 150 cps	

Electrical Data

	Min.	Bogey	Max.	
Filament Voltage	4.75	5.0	5.25	volts
Filament Current at 5.0 volts	—	12.5	13.7	amps
Filament Heating Time (Note 3) (before applying plate voltage)	90	—	—	seconds
Tube Voltage Drop (Output current = 2.5 amps)	—	12	—	volts

Operating conditions for 21 KV, Peak Inverse Voltage

Circuit	Input Voltage rms value kv	DC Output voltage to filter kv	DC Output current amp
Single-phase full-wave 2 tubes	7.4	6.7	5
Three-phase half-wave 3 tubes	8.6	10	7.5
Three-phase, double Y 6 tubes parallel	8.6	10	15
Four-phase half-wave 4 tubes	7.4	9.5	10
Single-phase full-wave 4 tubes	14.8	13.4	5
Three-phase full-wave 6 tubes	14.8	20	7.5
Four-phase full-wave 8 tubes	14.8	19	10

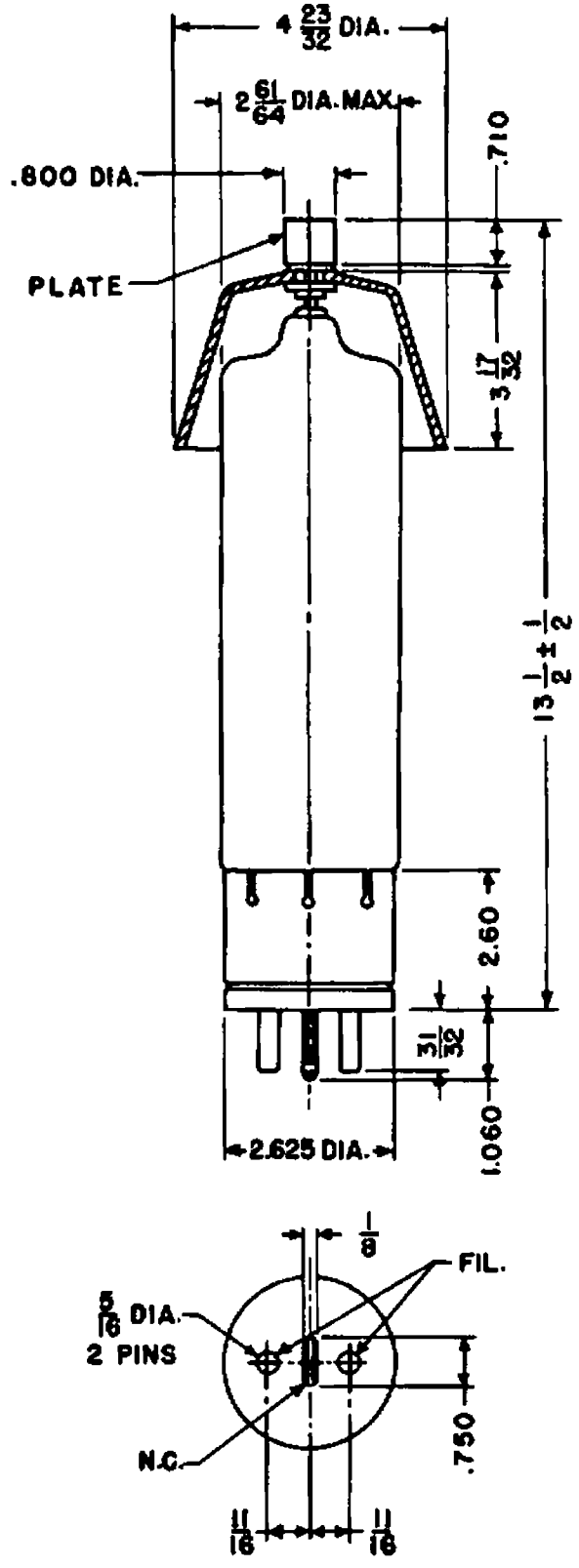
Mechanical Data

Type of cooling	Convection
Equilibrium Condensed-Mercury Temperature Rise	
At Full Load, approximate	+15 °C
At No Load, approximate	+13 °C
Mounting position	Vertical with base down
Net weight (approximate)	25 ounces

NOTES:

1. In order to obtain maximum life it is recommended that a filament voltage phase shift of 90° ± 30° with respect to plate voltage be applied.
2. The tube should always be used with the bakelite cap attached.
3. The minimum heating time refers only to the filament. Sufficient additional time must be allowed to permit the condensed mercury temperature to rise to the minimum condensed mercury temperature limit and to permit all the mercury to condense on the lower part of the bulb.
4. The metallic shell of the base should not be allowed to reach a potential different from the cathode potential.

6508


4 23/32 DIA.
2 61/64 DIA. MAX.
.800 DIA.
.710
PLATE
3 17/32
13 1/2 ± 1/2
2.60
31/32
1.060
2.625 DIA.

1/8
FIL.
5/16 DIA.
2 PINS
N.C.
.750
11/16
11/16

AMPEREX TUBE TYPE 6693

The 6693 is a single anode, high voltage, mercury vapor rectifier having ratings intermediate between the standard tube types 575A and 869B. It is particularly suitable for use in conjunction with modern power oscillator and amplifier tubes operating at high currents and lower voltages.

GENERAL CHARACTERISTICS

ELECTRICAL

Cathode	Directly heated, oxide coated
Filament Voltage	5 volts [1]
Filament Current	11.5 amps
Heating Time (minimum)	60 sec. [2]
Tube Voltage Drop	12 volts [3] ←
Equilbrium condensed mercury temperature rise over ambient (see curve)	
No Load	19°C
Full Load	21°C

MECHANICAL

Mounting Position	Vertical, base down
Max. Overall Length	12 inches
Max. Seated Height	11 5/16 inches
Max. Diameter	2 27/32 inches
Plate Cap	Medium
Base	Super Jumbo, 4 pin with bayonnet
Socket	Johnson 123-206 or equal ←

[1] For optimum performance, a phase shift of 90° ± 30° between the anode and filament voltages and use of a center tapped filament transformer are recommended.

[2] For average conditions, e.g. temperatures within limits and proper distribution of mercury. To insure proper distribution of mercury, upon installation and after a long interruption of service, a longer heating time is required before anode voltage is applied. In general, a time of 30 minutes will be sufficient.

[3] Measured at an average anode current of 3 amps.

MAXIMUM RATINGS

Peak Inverse Anode Voltage [4]	15	2.5	max. KV
Average Anode Current [5]	3	5	max. amps
Peak Anode Current	12	20	max. amps
Surge Anode Current for max. of 0.1 second	120	200	max. amps

Relation Between Condensed Mercury Temperature, Ambient Temperature and Peak Inverse Voltage [6] (see curve)

Peak Inverse Anode Voltage	15	10	2.5	KV
Condensed Mercury Temp.	25-55	25-60	25-75	°C
Ambient Temp. [7]	15-35	15-40	15-55	°C

MAXIMUM OPERATING CONDITIONS

PEAK INVERSE ANODE VOLTAGE = 15 KV

(Transformer regulation and tube voltage drop are not included)

Circuit Diagram	Type of Circuit	Max transformer sec. rms voltage (Vtr) KV	DC output voltage to filter (Vo) KV	Max DC output current to filter (Io) Amps	Max DC output to filter (Wo) KW
a.	Single-phase, full-wave, 2 tubes	5.3	4.8	6	28.8
b.	Single-phase, full-wave, 4 tubes	10.6	9.6	6	57.6
c.	Three-phase, half-wave, 3 tubes	6.1	7.2	9	64.8
d.	Three-phase, full-wave, 6 tubes	10.6	14.4	9	129.6
e.	Three-phase, double Y, 6 tubes parallel	5.3	6.2	18	111.6
f.	Four-phase, half-wave, 4 tubes	5.3	6.7	12	80.4
g.	Four-phase, full-wave, 8 tubes	10.6	13.5	12	162.0

[4] For supply frequency up to 150 cycles per second.

[5] Averaged over 10-sec. interval

[6] If the equipment is started at most twice daily is is permissable to apply high voltage at a condensed mercury temperature of 20° C.

[7] With natural cooling, approx. values.

from JETEC release #2031, Oct. 28, 1957

PEAK INVERSE VOLTAGE = 2.5 KV

(Transformer regulation and tube voltage drop are not included)

Circuit Diagram	Type of Circuit	Max transformer sec. rms voltage (Vtr) KV	DC output voltage to filter (Vo) KV	Max DC output current to filter (Io) Amps	Max DC output to filter (Wo) KW
a.	Single-phase, full-wave, 2 tubes	0.88	0.79	10	7.9
b.	Single-phase, full-wave, 4 tubes	1.76	1.58	10	15.8
c.	Three-phase, half-wave, 3 tubes	1.02	1.19	15	17.9
d.	Three-phase, full wave, 6 tubes	1.76	2.38	15	35.8
e.	Three-phase, double Y, 6 tubes	0.88	1.03	30	30.9
f.	Four-phase, half-wave, 4 tubes	0.88	1.13	20	22.6
g.	Four-phase, full-wave, 8 tubes	1.76	2.26	20	45.2

TYPICAL OPERATING CONDITIONS

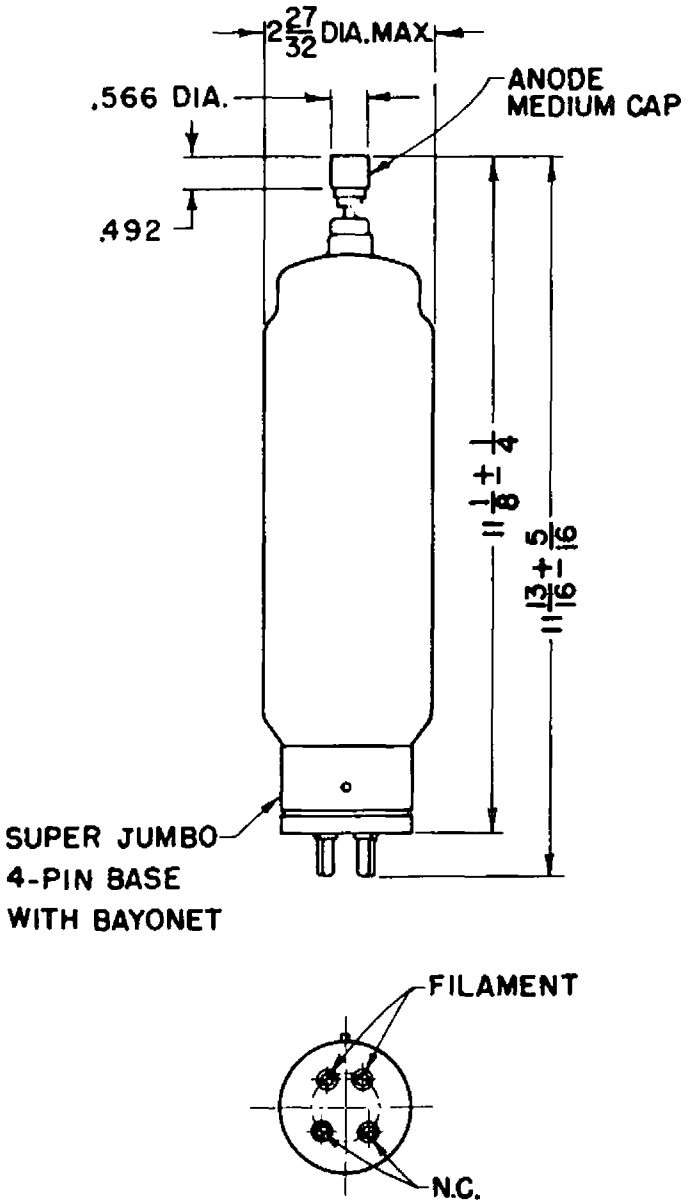
PEAK INVERSE VOLTAGE = MAX. 15 KV [8]

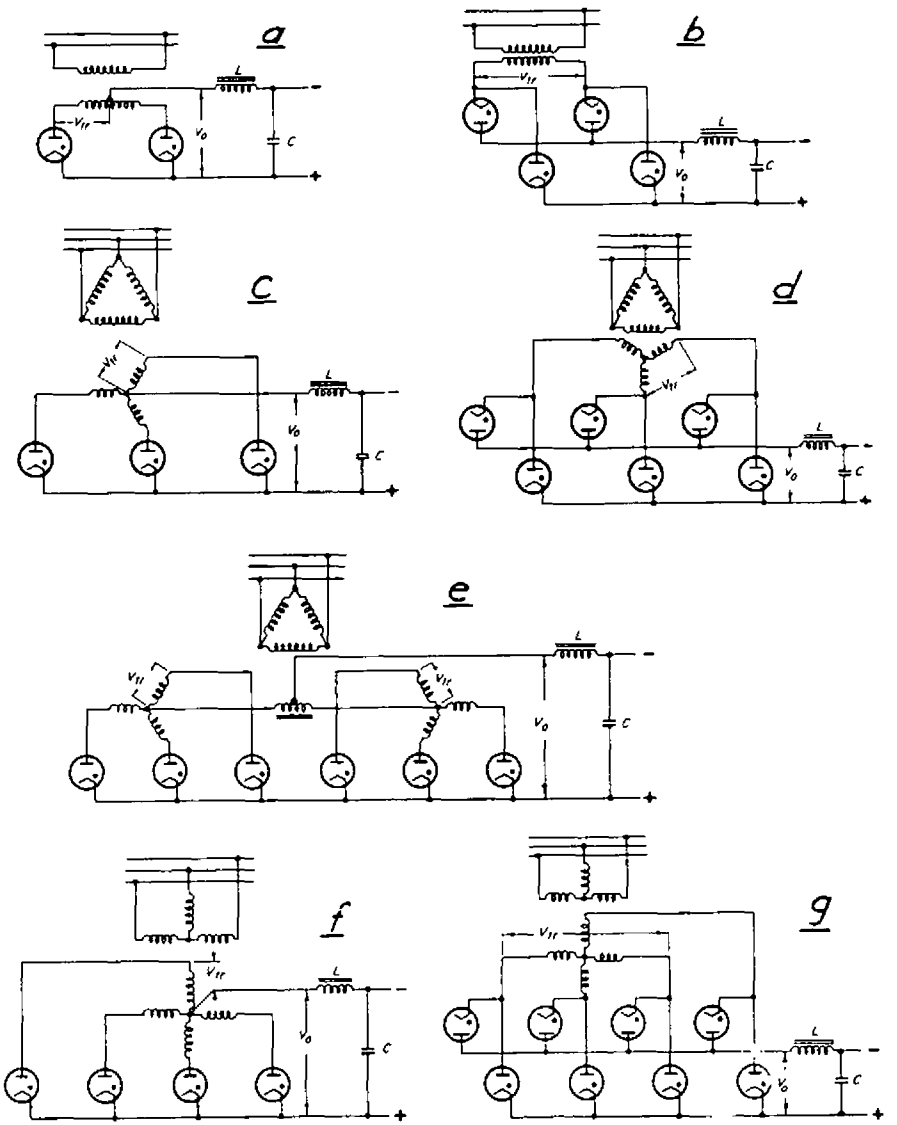
Circuit Diagram	Type of Circuit	No load transformer sec. rms voltage (Vtr) KV	DC output voltage to load [9] (Vo_1) KV	Max DC output current (Io) Amps	DC output to load (Wo_1) KW
a.	Single-phase, full-wave, 2 tubes	4.80	4.0	6	24
b.	Single-phase, full-wave, 4 tubes	9.60	8.0	6	48
c.	Three-phase, half-wave, 3 tubes	5.55	6.0	9	54
d.	Three-phase, full-wave, 6 tubes	9.60	12.0	9	108
e.	Three-phase, double Y, 6 tubes	4.80	5.15	18	93
f.	Four-phase, half-wave, 4 tubes	4.80	5.6	12	67
g.	Four-phase, full-wave, 8 tubes	9.60	11.2	12	134

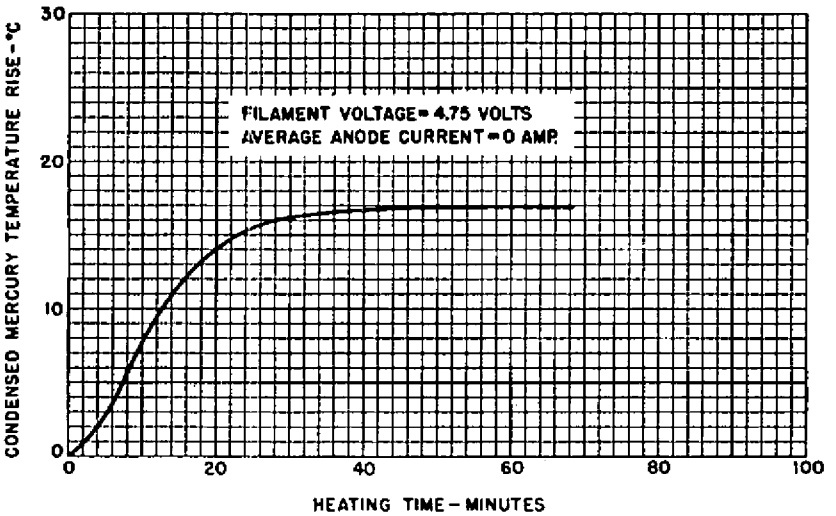
[8] This value corresponds to a nominal peak inverse anode voltage of 13.6 KV, allowing a line fluctuation of ± 10%.

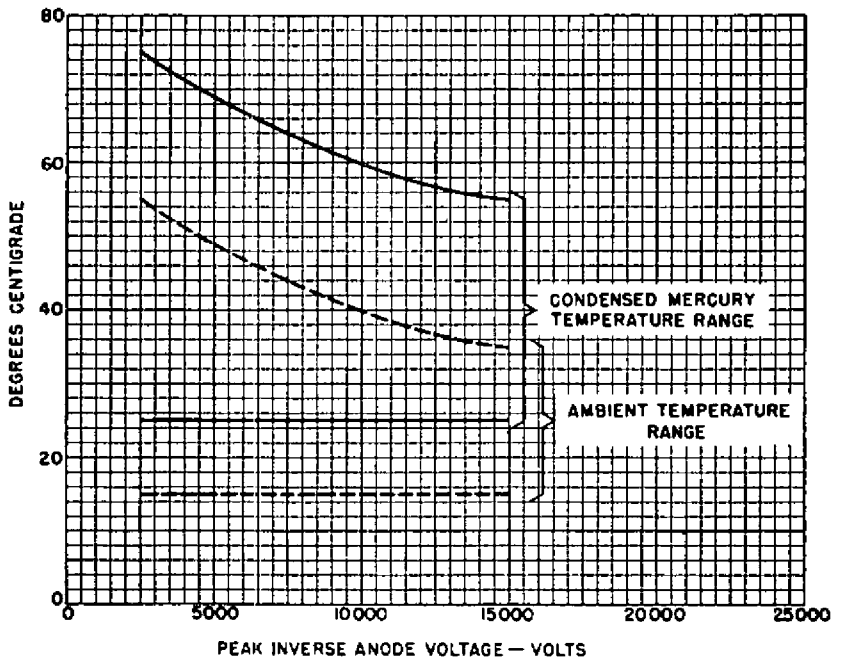
[9] Tube voltage drop and losses in transformer, filter, ammeter, etc. amounting to 8% of Vo_1 have already been deducted.

6693


2 27/32 DIA. MAX.
.566 DIA.
ANODE
MEDIUM CAP
.492
11 1/8 + 1/4
11 13/16 + 5/16
SUPER JUMBO
4-PIN BASE
WITH BAYONET
FILAMENT
N.C.


a
b
c
d
e
f
g


CONDENSED MERCURY TEMPERATURE RISE - °C
30
20
10
0
FILAMENT VOLTAGE = 4.75 VOLTS
AVERAGE ANODE CURRENT = 0 AMP.
0
20
40
60
80
100
HEATING TIME - MINUTES


DEGREES CENTIGRADE
80
60
40
20
0
CONDENSED MERCURY TEMPERATURE RANGE
AMBIENT TEMPERATURE RANGE
0
5000
10000
15000
20000
25000
PEAK INVERSE ANODE VOLTAGE — VOLTS

4.

MANUFACTURERS OF POWER TRANSMITTING TUBES AND RECTIFIERS

Amperex ELECTRONIC CORPORATION

CABLE: AMPRONICS, NEW YORK

230 DUFFY AVENUE, HICKSVILLE, L. I., NEW YORK • WEIls 1-6200

AMPEREX TUBE TYPE 6756

TENTATIVE DATA

The 6756 is a three electrode, water-cooled tube designed with special characteristics as a low impedance, R.F. industrial oscillator to deliver maximum power under varying load conditions.

The filament is thoriated tungsten. The anode is capable of dissipating 20 KW.

The 6756 has a heavy wall, high dissipation and heat storage copper anode and an extremely rigid, coaxial grid structure.

Filament connections are made with heavy, heat dissipating, permanently attached, flexible leads eliminating difficulties due to contact resistance at the terminals.

The tube design also incorporates wide spacings between the elements which, together with the rugged mechanical supports, prevent internal shorting.

Features of this tube are -

Greatly prolonged filament life.
High transconductance and low mu characteristics for industrial service.
Extra heavy wall copper anode to absorb short-time overload operation.
Platinum-clad grid for stable grid operation.
Rugged, "powdered-glass" stem construction.
Coaxial grid seal for efficient, high frequency performance and maximum physical strength.
AMPEREX designed gettering material.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

Filament	Thoriated tungsten
Filament Voltage	7.5 volts
Filament Current	100 amperes
Starting Current (cannot be exceeded even momentarily)	210 amperes
Peak Cathode Current [1]	28 amperes
Amplification Factor (I_b = 3 amperes, E_b = 4000 volts)	13.5
Transconductance (I_b = 3 amperes, E_b = 4000 volts)	11,400 micromhos
Plate Resistance (I_b = 3 amperes, E_b = 4000 volts)	1180 ohms
Direct Interelectrode Capacitances	
Grid to Plate	47.6 mmf
Grid to Filament	25.1 mmf
Plate to Filament	1.5 mmf

MECHANICAL DATA

Maximum Overall Dimensions	
Length (without leads)	16½ inches
Diameter	4¼ inches
Mounting Position	vertical, anode down
Cooling	water (see curves)

[1] Represents maximum usable cathode current for any condition of operation.

Revised 11/55

from JETEC release #1565, Jan. 9, 1956

6756

COOLING CHARACTERISTICS (See Curves)

ACCESSORIES

Water Jacket	Amperex Type #S-15096
External Grid Connector (furnished with tube without charge)	Amperex Type #Y-13326
Net Weight (approx.)	12.5 lbs.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Oscillator, Class C - Three Phase, Full-Wave Supply

Maximum Ratings, Absolute Values (per tube)

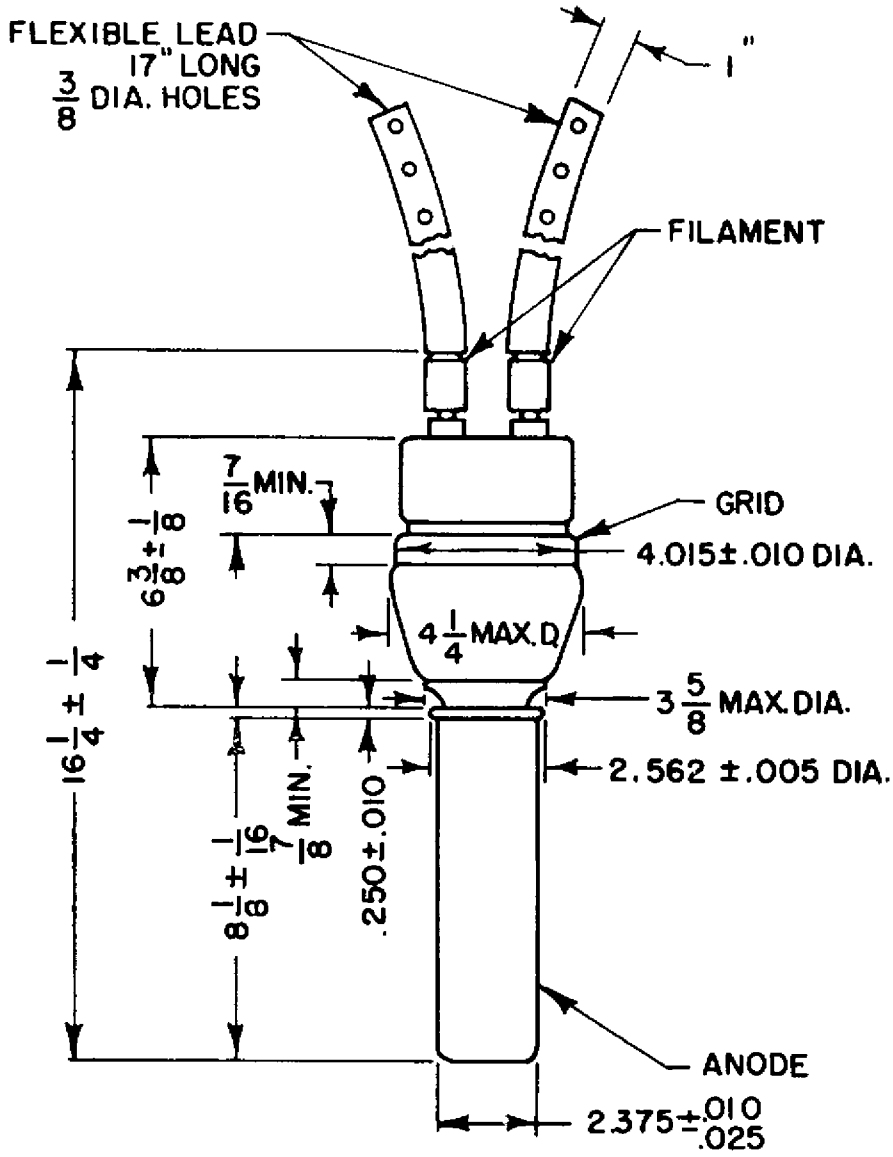
	CCS	
DC Plate Voltage	12500	volts max.
DC Plate Current	3.5	amperes max.
DC Grid Voltage	−2000	volts max.
DC Grid Current (full load)	0.220	amperes max.
DC Grid Current (no load) [2]	0.300	amperes max.
Plate Input	42.0	kilowatts max.
Plate Dissipation	20.0	kilowatts max.

Typical Operation (per tube)

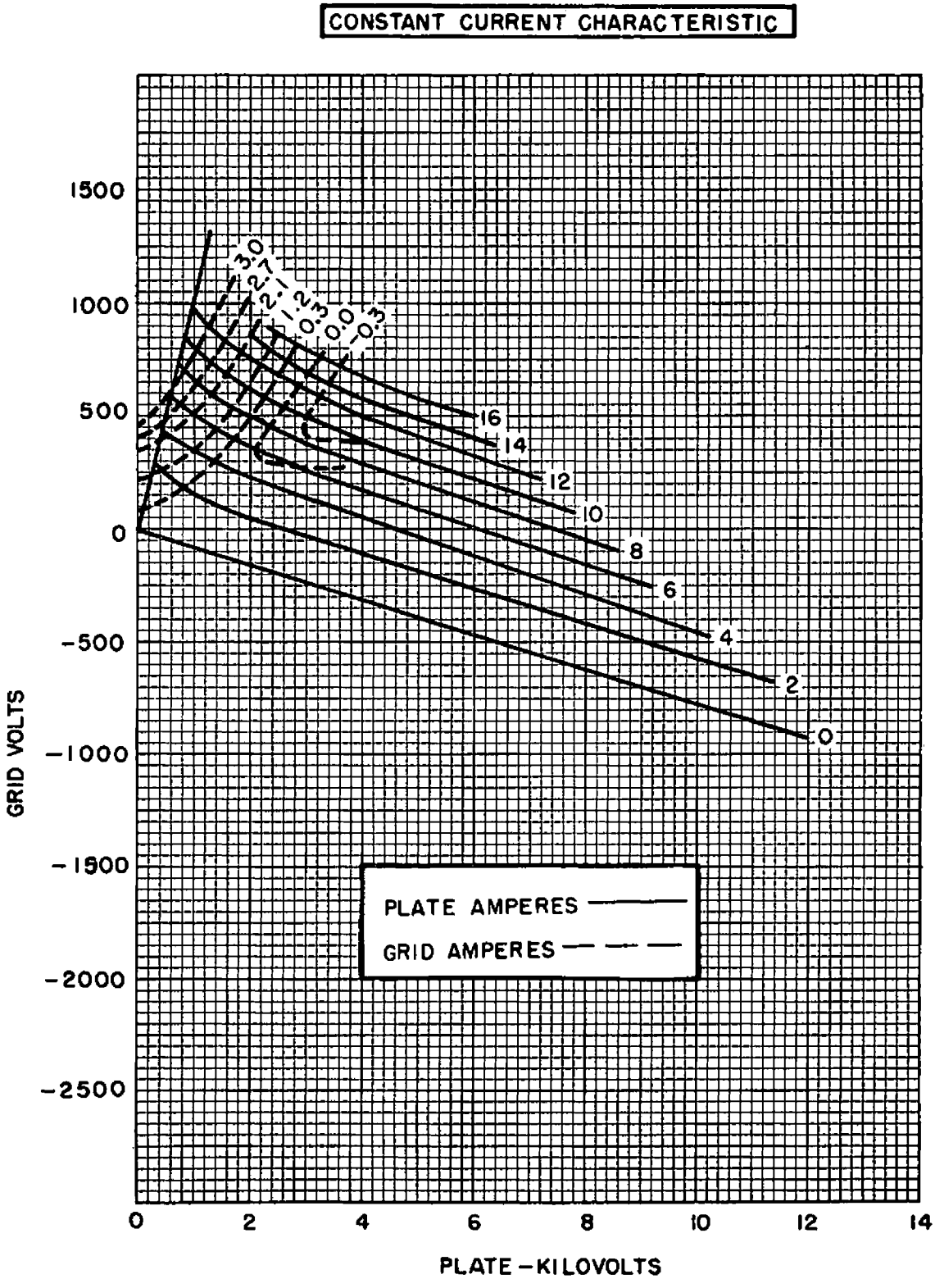
	CCS Full Load	CCS 2A Load	CCS No Load	
DC Plate Voltage	12000	12000	12000	volts d-c
DC Plate Current	3.5	2.0	0.430	amperes d-c
DC Grid Voltage	−1220	−1380	−1710	volts d-c
RF Grid Voltage	2050	2030	—	volts
DC Grid Current	0.210	0.238	0.295	amperes d-c
Grid Resistor	5.8	5.8	5.8	kilohms
Plate Input	42.0	24.0	5.16	kilowatts
Plate Dissipation	11.25	4.9	—	kilowatts
Plate Power Output	30.75	19.1	—	kilowatts
Efficiency	73.30	79.4	—	per cent
Load Impedance	1755	3120	—	ohms
MEASURED[3]				
Plate Dissipation	11.36	6.87	—	kilowatts
Plate Power Output	30.64	17.13	—	kilowatts
Plate Efficiency	[redacted] 73	71.40	—	[redacted] %

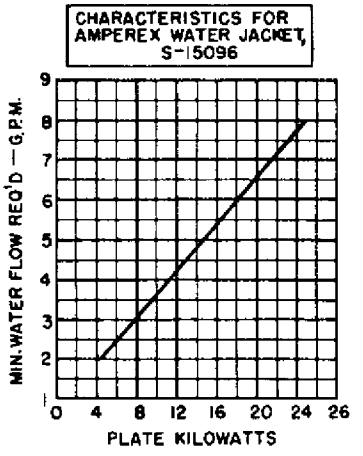
[2] No load condition is valid for plate current of 0.500 amperes d-c or less.

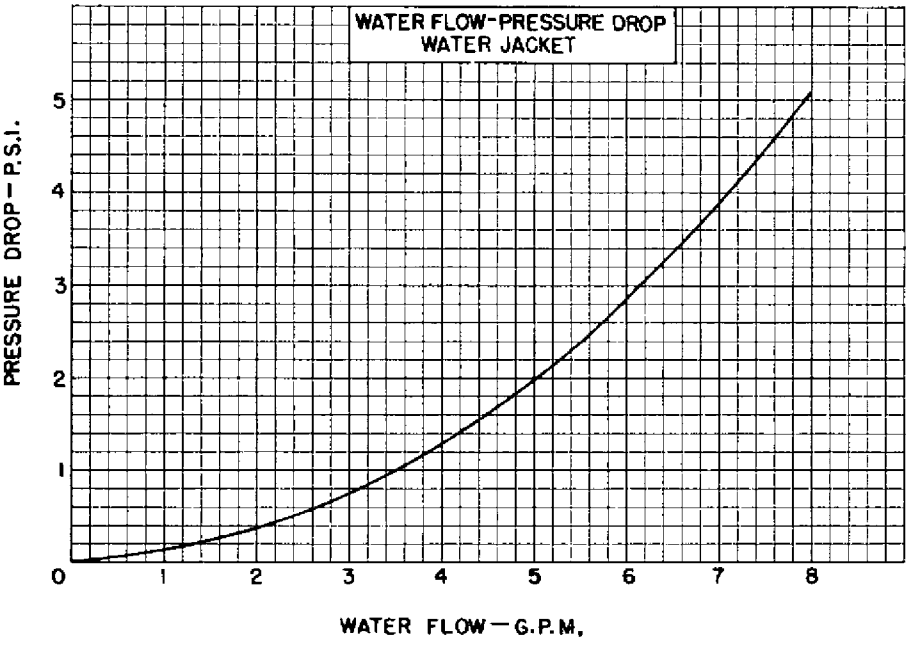
[3] Measured in an industrial R.F. oscillator.


FLEXIBLE LEAD
17" LONG
3/8 DIA. HOLES
1"
FILAMENT
7/16 MIN.
6 3/8 ± 1/8
GRID
4.015±.010 DIA.
4 1/4 MAX. D.
16 1/4 ± 1/4
3 5/8 MAX. DIA.
2.562 ±.005 DIA.
8 1/8 ± 1/16
7/8 MIN.
.250±.010
ANODE
2.375 +.010 -.025

6756


CONSTANT CURRENT CHARACTERISTIC
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
GRID VOLTS
3.0
2.7
2.1
1.2
0.3
0.0
-0.3
16
14
12
10
8
6
4
2
0
PLATE AMPERES
GRID AMPERES
0
2
4
6
8
10
12
14
PLATE-KILOVOLTS


CHARACTERISTICS FOR
AMPEREX WATER JACKET,
S-15096
MIN. WATER FLOW REQ'D — G.P.M.
9
8
7
6
5
4
3
2
1
0
4
8
12
16
20
24
26
PLATE KILOWATTS


WATER FLOW-PRESSURE DROP
WATER JACKET
PRESSURE DROP — P.S.I.
5
4
3
2
1
0
1
2
3
4
5
6
7
8
WATER FLOW — G.P.M.

MANUFACTURERS OF POWER TRANSMITTING TUBES AND RECTIFIERS

Amperex ELECTRONIC CORPORATION

CABLE: AMPRONICS, NEW YORK

230 DUFFY AVENUE, HICKSVILLE, L. I., NEW YORK • WEIls 1-6200

AMPEREX TUBE TYPE 6757

TENTATIVE DATA

The 6757 is a three electrode, forced air-cooled tube designed with special characteristics as a low impedance, RF industrial oscillator to deliver maximum power under varying load conditions.

The filament is thoriated tungsten. The anode is capable of dissipating 15 KW.

The 6757 has a heavy wall, high heat dissipation and heat storage copper anode and an extremely rigid coaxial grid structure.

Filament connections are made with heavy, heat dissipating, permanently attached, flexible leads eliminating difficulties due to contact resistance at the terminals.

The tube design also incorporates wide spacings between the elements which, together with the rugged mechanical supports, prevent internal shorting.

Features of this tube are -

Greatly prolonged filament life.
High transconductance and low mu characteristics for industrial service.
Extra heavy wall copper anode to absorb short-time overload operation.
Platinum-clad grid for stable grid operation.
Rugged "powdered-glass" stem construction.
Coaxial grid seal for efficient, high frequency performance and maximum physical strength.
AMPEREX designed gettering material.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

Filament	Thoriated tungsten	
Filament Voltage	7.5	volts
Filament Current	100	amperes
Starting Current (cannot be exceeded even momentarily)	210	amperes
Peak Cathode Current [1]	28	amperes
Amplification Factor (I_b = 3 amperes, E_b = 4000 volts)	13.5	
Transconductance (I_b = 3 amperes, E_b = 4000 volts)	11,400	micromhos
Plate Resistance (I_b = 3 amperes, E_b = 4000 volts)	1180	ohms
Direct Interelectrode Capacitances		
Grid to Plate	50.0	mmf
Grid to Filament	25.1	mmf
Plate to Filament	2.0	mmf

COOLING CHARACTERISTICS (Forced Air)

Plate Dissipation	8	10	15	KW
Air Flow	500	700	1050	CFM
Static Pressure	0.6	0.9	1.8	inches of water

1 Represents maximum usable cathode current for any condition of operation.

Revised 11/55

from JETEC release #1565, Jan. 9, 1956

6757

MECHANICAL DATA

Maximum Overall Dimensions	
Length (without leads)	17 1/8 inches
Diameter	11 inches
Mounting Position	Vertical, anode down
Net Weight (approx,)	56½ lbs.

ACCESSORIES

External Grid Connector (furnished with tube without charge)	Amperex No. Y-13326

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Oscillator, Class C - Three Phase, Full-Wave Supply

Maximum Ratings, Absolute Values (per tube)

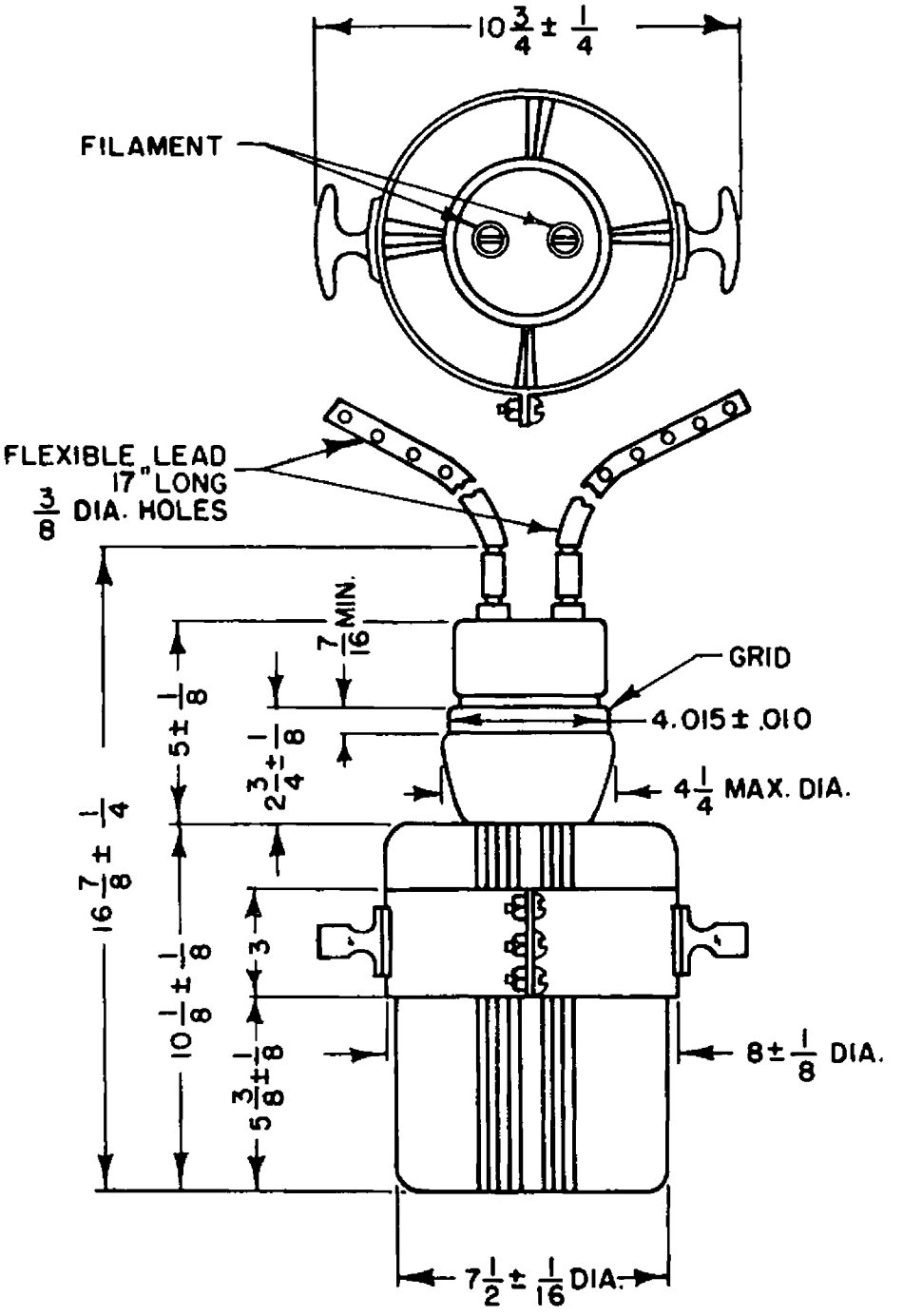
	CCS	
DC Plate Voltage	12500	volts max.
DC Plate Current	3.5	amperes max.
DC Grid Voltage	−2000	volts max.
DC Grid Current (full load)	0.220	amperes max.
DC Grid Current (no load) [2]	0.300	amperes max.
Plate Input	42.0	kilowatts max.
Plate Dissipation	15.0	kilowatts max.

Typical Operation (per tube)

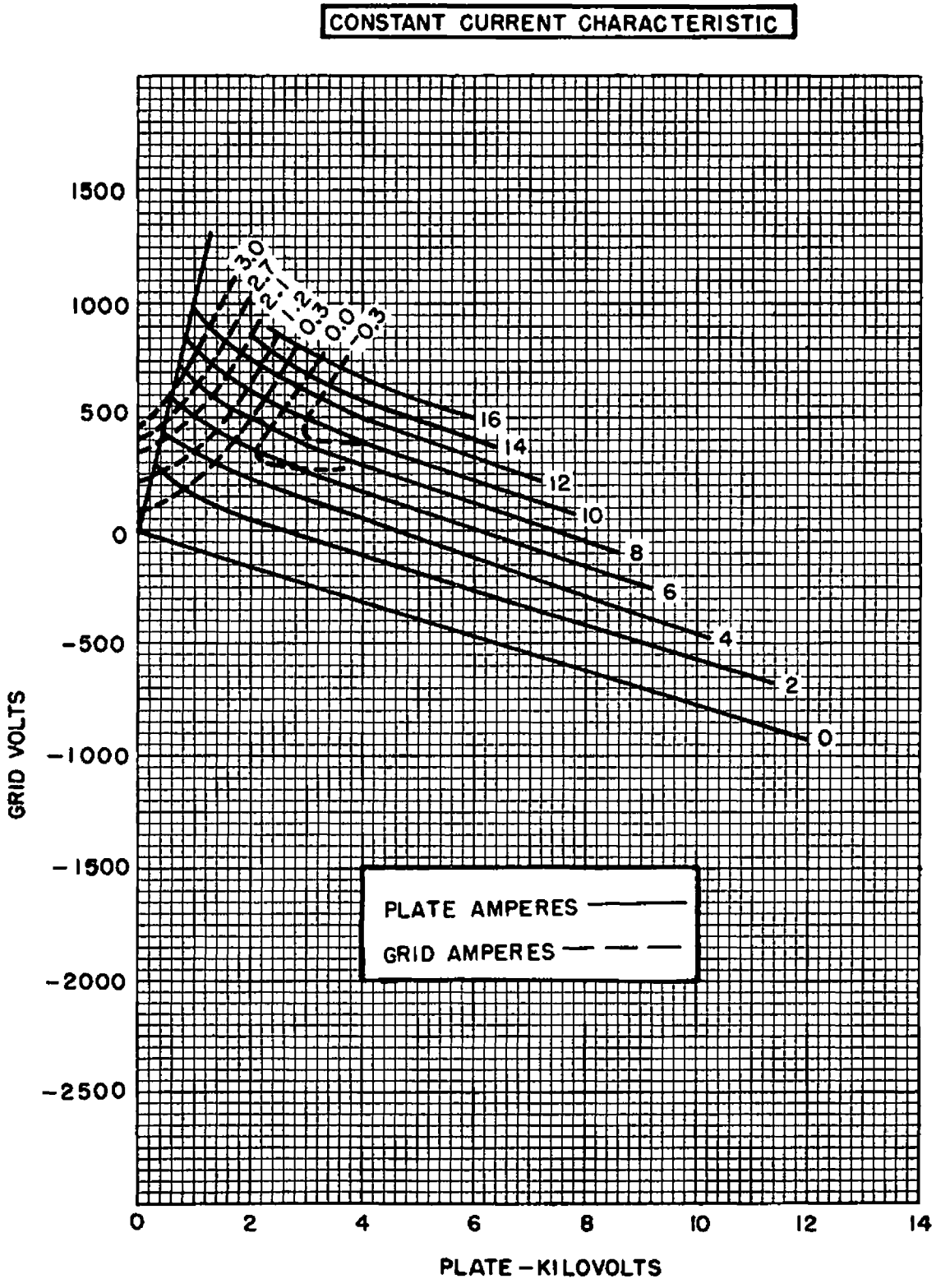
	CCS Full Load	CCS 2A Load	CCS No Load	
DC Plate Voltage	12000	12000	12000	volts d-c
DC Plate Current	3.5	2.0	0.430	amperes d-c
DC Grid Voltage	−1220	−1380	−1710	volts d-c
RF Grid Voltage	2050	2030	—	volts
DC Grid Current	0.210	0.238	0.295	amperes d-d
Grid Resistor	5.8	5.8	5.8	kilohms
Plate Input	42.0	24.0	5.16	kilowatts
Plate Dissipation	11.25	4.9	—	kilowatts
Plate Power Output	30.75	19.1	—	kilowatts
Efficiency	73.30	79.4	—	per cent
Load Impedance	1755	3120	—	ohms
MEASURED [3]				
Plate Dissipation	11.36	6.87	—	kilowatts
Plate Power Output	30.64	17.13	—	kilowatts
Plate Efficiency	73.0	71.40	—	per cent

[2] No load condition is valid for plate current of 0.500 amperes d-c or less.

[3] Measured in an industrial R.F. oscillator.


10 3/4 ± 1/4
FILAMENT
FLEXIBLE LEAD
17" LONG
3/8 DIA. HOLES
7/16 MIN.
GRID
4.015 ± .010
4 1/4 MAX. DIA.
1/8
5 ± 1/8
2 3/4 ± 1/8
1/4
16 7/8 ± 1/8
10 1/8 ± 1/8
3
5 3/8 ± 1/8
8 ± 1/8 DIA.
7 1/2 ± 1/16 DIA.

6757


CONSTANT CURRENT CHARACTERISTIC
1500
1000
500
0
-500
-1000
-1500
-2000
-2500
GRID VOLTS
3.0
2.7
2.1
1.2
0.3
0.0
-0.3
16
14
12
10
8
6
4
2
0
PLATE AMPERES
GRID AMPERES
0
2
4
6
8
10
12
14
PLATE-KILOVOLTS

from JEDEC release #4505, Nov. 25, 1963

AMPEREX TUBE TYPE 6758

6758

TENTATIVE DATA

The 6758 is a three electrode, water-cooled tube designed with special characteristics as a low impedance, RF industrial oscillator to deliver maximum power under varying load conditions.

The filament is thoriated tungsten. The anode is capable of dissipating 6KW. Maximum ratings apply up to 30 mc.

The 6758 has a heavy wall, high dissipation and heat storage copper anode and an extremely rigid, coaxial grid structure.

Filament connections are made with heavy, heat dissipating, permanently attached, flexible leads eliminating difficulties due to contact resistance at the terminals.

The tube design also incorporates wide spacings between the elements which, together with the rugged mechanical supports, prevent internal shorting.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

Filament	Thoriated tungsten
Filament Voltage	12.6 volts
Filament Current	33 amperes
Starting Current (cannot be exceeded even momentarily)	63 amperes
Peak Cathode Current [1]	10 amperes
Amplification Factor (I_b = 1 amp., E_b = 2000 volts)	9
Transconductance (I_b = 1 amp., E_b = 2000 volts)	7700 micromhos
Plate Resistance	1180 ohms
Direct Interelectrode Capacitance	
Grid to Plate	14.0 mmf
Grid to Filament	12.0 mmf
Plate to Filament	1.0 mmf

MECHANICAL DATA

Mounting Position	vertical with plate down
Max. Temperature of Seals	180° C
Tube Net Weight (approx.)	17 oz.

COOLING [2]

Water and low velocity air flow.

[1] Represents maximum usable cathode current for any condition of operation.

[2] At frequencies above 30 MC it is necessary to direct a low velocity air flow to plate and grid seals.

COOLING CHARACTERISTICS (Max. Inlet Water Temp. = 50° C)

Plate Dissipation (kilowatts)	Inlet Water Temperature °C	Minimum Water Flow (GPM)	Inlet Water Pressure (lbs/sq. inch)
1	20	0.87	1.56
	35	0.96	1.74
	50	1.05	1.94
2	20	0.87	1.56
	35	1.31	3.70
	50	1.74	5.82
4	20	1.40	3.50
	35	2.28	10.50
	50	3.14	17.4
6	20	2.09	7.80
	35	3.50	28.2

ACCESSORIES

Water Jacket	Amperex Type #S-3737
Grid Connector	Amperex Type #S-17288

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Oscillator, Class C - Three Phase, Full-Wave Supply

Maximum Ratings, Absolute Values (per tube)

	CCS
DC Plate Voltage	7000 volts d-c
DC Plate Current	1.9 amperes d-c
DC Grid Voltage	−1550 volts d-c
DC Grid Current (full load)	0.090 amperes d-c
DC Grid Current (no load) [3]	0.135 amperes d-c
Grid Dissipation	55 watts
Plate Input	12 kilowatts
Plate Dissipation	6 kilowatts

Typical Operation (per tube)

	CCS Full Load	CCS No Load
DC Plate Voltage	7000	7000 volts d-c
DC Plate Current	1.72	0.550 amperes d-c
DC Grid Voltage	− 820	− 1220 volts d-c
RF Grid Voltage	1470	—— volts
DC Grid Current	0.082	0.122 amperes d-c
Grid Resistor	10	10 kilohms
Plate Input	12	3.8 kilowatts
Plate Dissipation	3.85	—— kilowatts
Plate Power Output	8.15	—— kilowatts
Tube Efficiency	68	—— per cent
Equipment Power Output (approx.)	6	—— kilowatts

[3] No load condition is valid for plate current of 0.500 amperes d-c or less

6758

Oscillator, Class C - Single Phase, Full Wave Supply

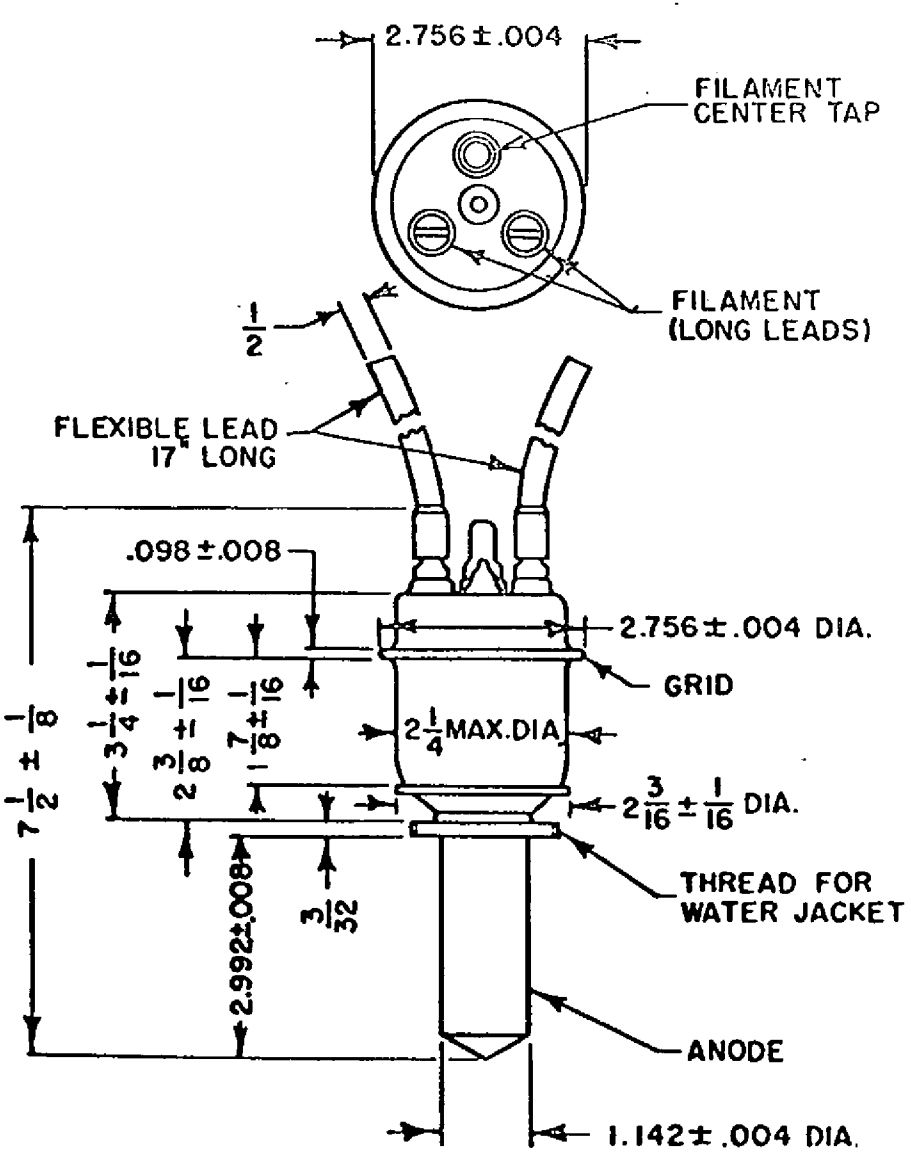
Maximum Ratings, Absolute Values (per tube)

	CCS
DC Plate Voltage	6300 volts d-c
DC Plate Current	1.7 amperes d-c
DC Grid Voltage	−1350 volts d-c
D.C. Grid Current (Full Load)	0.074 amperes d-c
D.C. Grid Current (No Load) [3]	0.110 amperes d-c
Grid Dissipation	55 watts
Plate Input	12 kilowatts
Plate Dissipation	6 kilowatts

Typical Operation (per tube)

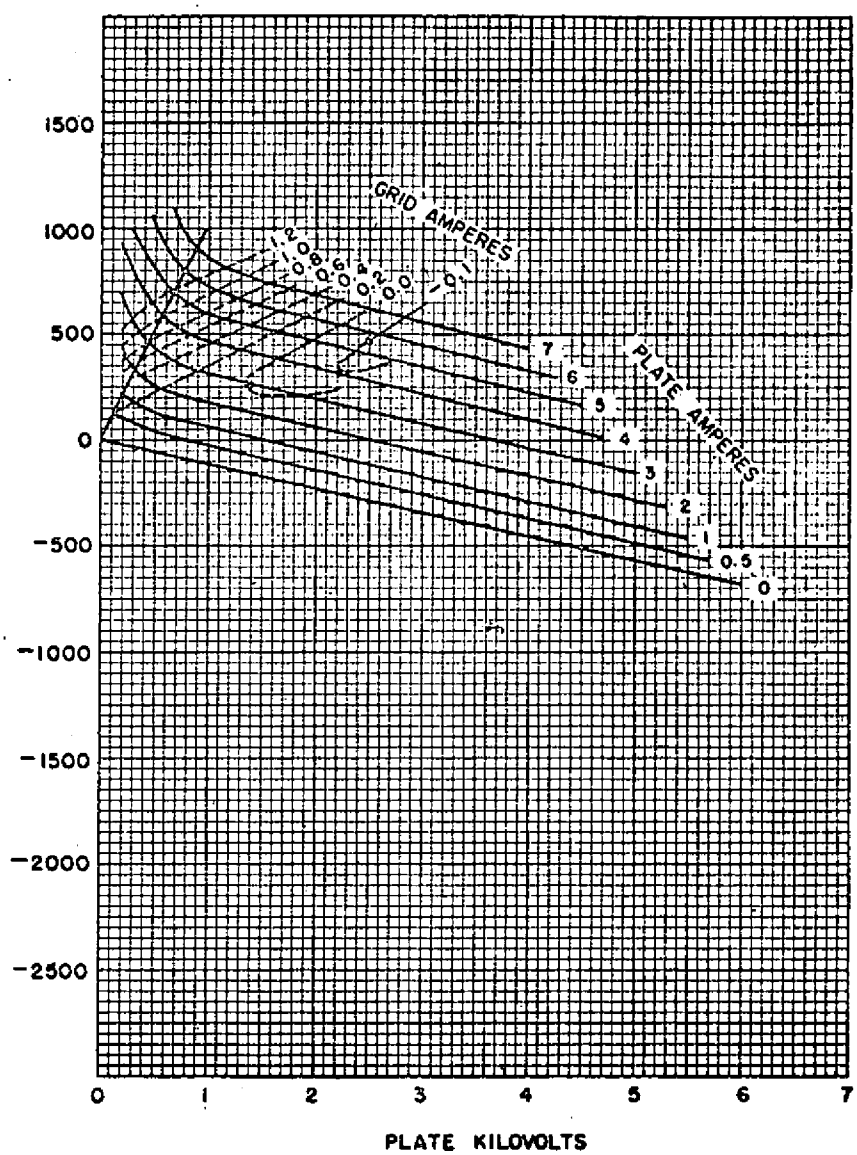
	CCS Full Load	CCS No Load
DC Plate Voltage	6300	6300 volts d-c
DC Plate Current	1.55	0.490 amperes d-c
DC Grid Voltage	−740	−1100 volts d-c
DC Grid Current	0.074	0.110 amperes d-c
Grid Resistor	10	10 kilohms
Plate Input	12	3.8 kilowatts
Plate Dissipation	3.85	— kilowatts
Plate Power Output	8.15	— kilowatts
Tube Efficiency	68	— per cent
Equipment Power Output (approx.)	6	— kilowatts

[3] No load condition is valid for plate current of 0.500 amperes d-c or less



6758

6758 CONSTANT CURRENT CHARACTERISTIC



from JEDEC release #4505, Nov. 25, 1963

AMPEREX TUBE TYPE 6759

6759

TENTATIVE DATA

The 6759 is a three electrode, forced air-cooled tube designed with special characteristics as a low impedance, RF industrial oscillator to deliver maximum power under varying load conditions.

The filament is thoriated tungsten. The anode is capable of dissipating 6 KW. Maximum ratings apply up to 30 mc.

The 6759 has a heavy wall, high dissipation and heat storage copper anode and an extremely rigid, coaxial grid structure.

Filament connections are made with heavy, heat dissipating, permanently attached, flexible leads eliminating difficulties due to contact resistance at the terminals.

The tube design also incorporates wide spacings between the elements which, together with the rugged mechanical supports, prevent internal shorting.

GENERAL CHARACTERISTICS

ELECTRICAL DATA

Filament	Thoriated tungsten	
Filament Voltage	12.6	volts
Filament Current	33	amperes
Starting Current (cannot be exceeded even momentarily)	63	amperes
Peak Cathode Current [1]	10	amperes
Amplification Factor (I_b = 1 amp., E_b = 2000 volts)	9	
Transconductance (I_b = 1 amp., E_b = 2000 volts)	7700	micromhos
Plate Resistance	1180	ohms
Direct Interelectrode Capacitance		
Grid to Plate	15.0	uuf
Grid to Filament	12.0	uuf
Plate to Filament	2.0	uuf

MECHANICAL DATA

Mounting Position	vertical with cooler down	
Max. Temperature of Seals	180° C	
Net Weight (approx.)	8½	lbs.

COOLING CHARACTERISTICS - Forced Air

Plate Dissipation	3	4.5	6.0	KW
Min. Air Flow	190	250	350	CFM
Min. Static Pressure	1.21	1.50	2.50	inches of water

ACCESSORIES

Air Flow Chamber	Amperex Type #S-3705
External Grid Connector	Amperex Type #S-17288

[1] Represents maximum usable cathode current for any condition of operation.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Oscillator, Class C - Three Phase, Full-Wave Supply

Maximum Ratings, Absolute Values (per tube)

	CCS	
DC Plate Voltage	7000	volts d-c
DC Plate Current	1.9	amperes d-c
DC Grid Voltage	−1550	volts d-c
DC Grid Current (Full Load)	0.090	amperes d-c
DC Grid Current (No Load) [2]	0.135	amperes d-c
Grid Dissipation	55	watts
Plate Input	12	kilowatts
Plate Dissipation	6	kilowatts

Typical Operation (per tube)

	CCS Full Load	CCS No Load	
DC Plate Voltage	7000	7000	volts d-c
DC Plate Current	1.72	0.550	amperes d-c
DC Grid Voltage	− 820	− 1220	volts d-c
RF Grid Voltage	1470	——	volts
DC Grid Current	0.082	0.122	amperes d-c
Grid Resistor	10	10	kilohms
Plate Input	12	3.8	kilowatts
Plate Dissipation	3.85	——	kilowatts
Plate Power Output	8.15	——	kilowatts
Efficiency	68	——	per cent
Equipment Power Output (approx.)	6	——	kilowatts

Oscillator, Class C - Single Phase, Full Wave Supply

Maximum Ratings, Absolute Values (per tube)

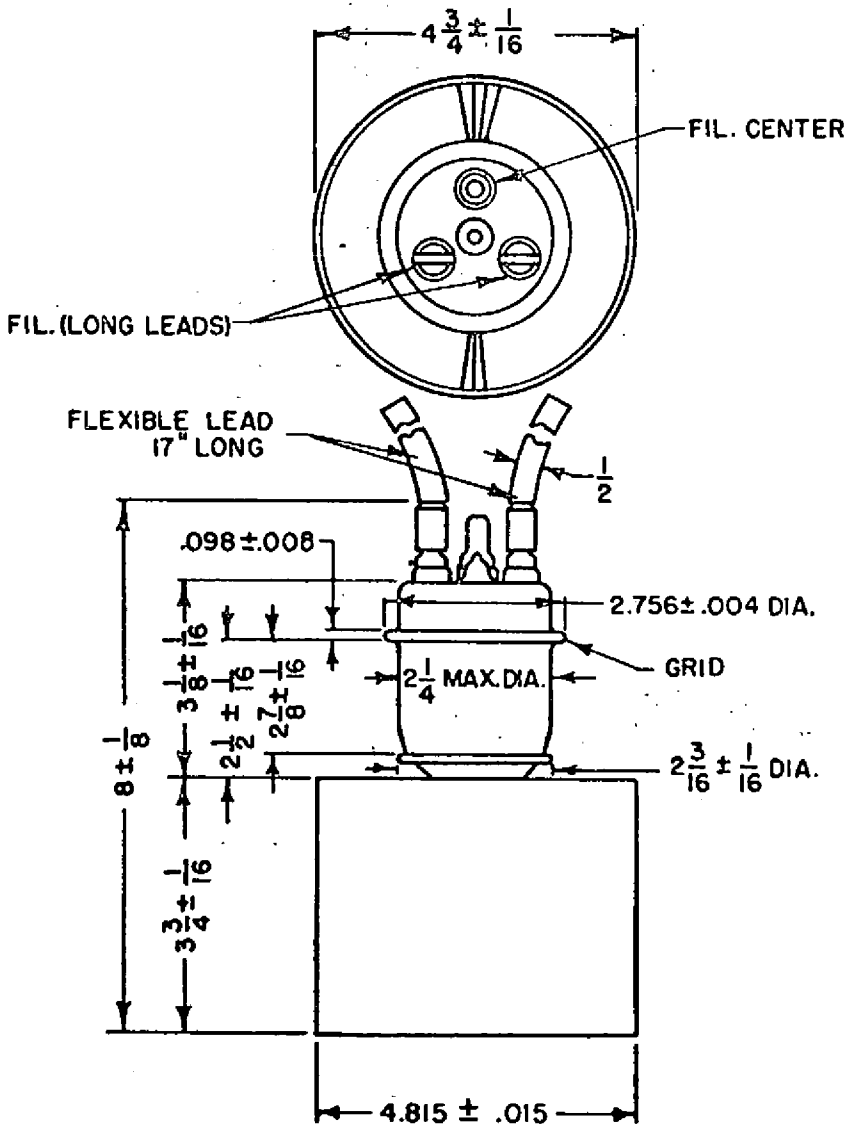
	CCS	
DC Plate Voltage	6300	volts d-c
DC Plate Current	1.7	amperes d-c
DC Grid Voltage	−1350	volts d-c
DC Grid Current (Full Load)	0.074	amperes d-c
DC Grid Current (No Load) [2]	0.110	amperes d-c
Grid Dissipation	55	watts
Plate Input	12	kilowatts
Plate Dissipation	6	kilowatts

Typical Operation (per tube)

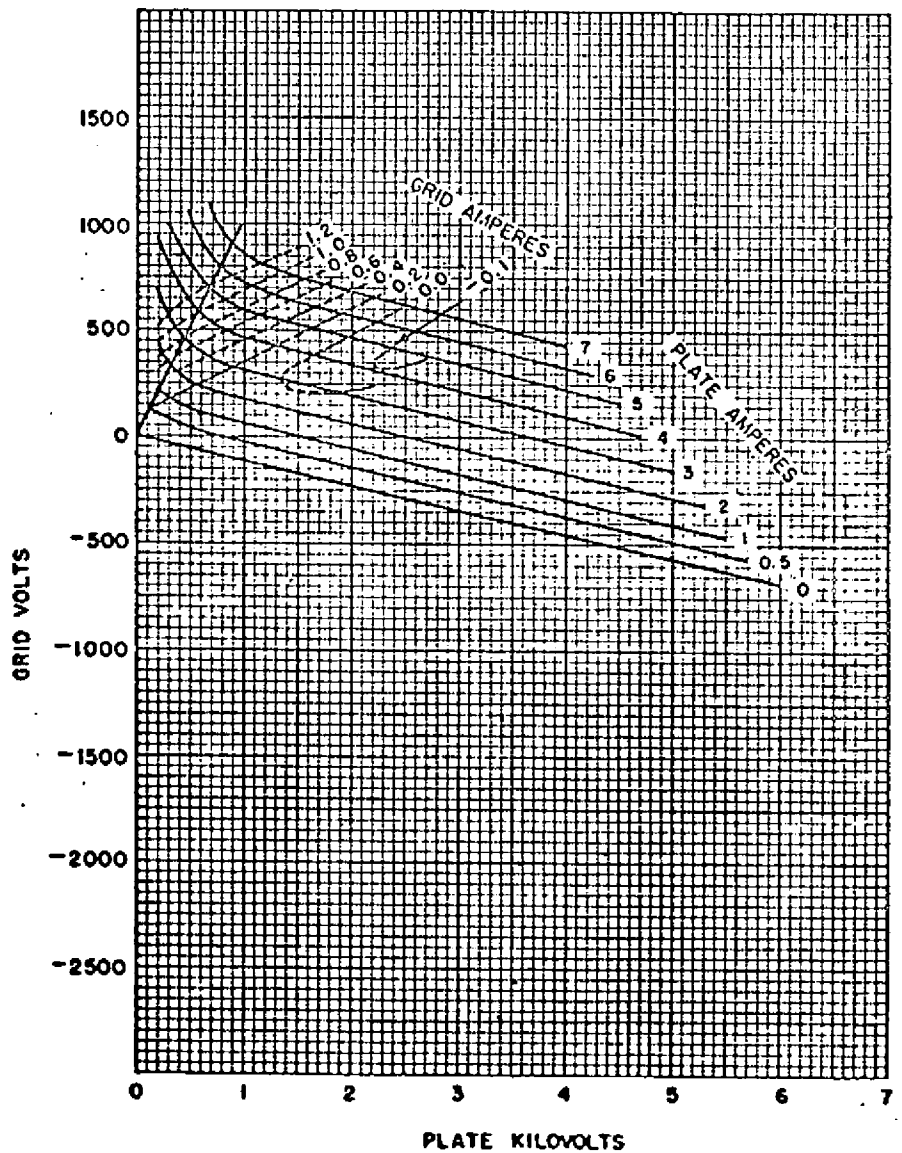
	CCS Full Load	CCS No Load	
DC Plate Voltage	6300	6300	volts d-c
DC Plate Current	1.55	0.490	amperes d-c
DC Grid Voltage	−740	− 1100	volts d-c
DC Grid Current	0.074	0.110	amperes d-c
Grid Resistor	10	10	kilohms
Plate Input	12	3.8	kilowatts
Plate Dissipation	3.85	——	kilowatts
Plate Power Output	8.15	——	kilowatts
Tube Efficiency	68	——	per cent
Equipment Power Output (approx.)	6	——	kilowatts

[2] No load condition is valid for plate current of 0.500 amperes d-c or less

6759 6759



6759 CONSTANT CURRENT CHARACTERISTIC



from JETEC release #2055, Dec. 9, 1957

AMPEREX THYRATRON TYPE 6786

TENTATIVE DATA

The type 6786 is a mercury vapor thyratron with a peak inverse rating of 15 KV and an average plate current of 10 amperes. For intermittent operation, a maximum plate current of 15 amperes may be used.

The 6786 is designed for high current power supplies in industrial R.F. generators and radio transmitters.

Under normal ambient temperature conditions, no forced air cooling is required or necessary. In addition to the unusual high current characteristics which make this tube unique in its class, the grid control offers the following advantages:

IN INDUSTRIAL R.F. GENERATORS

1. The grid control is a special advantage for the rapid protection of the equipment in case of load arc-overs or short circuits.
2. The tube can be used where accurate stabilization of the R.F. current is required. The grid control features make it unusally suitable for accurate control of R.F. output by phase shifting the grid voltage.
3. For intermittent industrial applications, the 6786 allows for electronic control of the time of "on" and "off" cycles without the need for any mechanical components and associated relays.

IN RADIO TRANSMITTERS

4. The use of this tube allows the plate voltage to be brought up slowly, thus increasing the life of the associated equipment and R.F. power tubes. In addition the grid control may be used to stabilize or adjust the plate voltage of the transmitter.
5. The grid control may be used as a protection device for the equipment. It allows for ultra rapid switching-off of the high voltage and subsequently, a rapid "come-back" with minimun "off-the-air" time.

The tube has a convenient "plate" type mounting support base and ceramic insulated flexible leads which make installation in equipment rapid and simple.

GENERAL CHARACTERISTICS

ELECTRICAL	
Cathode	indirectly heated, oxide coated
Heater Voltage	5 volts
Heater Current	20 amperes max.
Heating Time, minimum [1]	10 minutes
Tube Voltage Drop [2]	12 volts
Equilibrium condensed mercury temperature rise over ambient	
No Load	27° C
Full Load	30° C
Direct Interelectrode Capacitances	
Grid to Plate	8 $\mu\mu f$
Grid to Cathode	35 $\mu\mu f$
MECHANICAL	
Mounting Position	vertical, anode terminal up
Max. Overall Length (without leads)	15 1/4 inches
Max. Diameter	4 5/8 inches
Net Weight (approx.)	2 lbs, 9 ozs.

[1] For average conditions; temperature within limits and proper distribution of mercury. After transportation and also long interruption of service, a longer heating time is required before the anode voltage is applied, to insure proper distribution of the mercury. In general, a period of 45 minutes is sufficient. In addition 10 minutes after the heater voltage is applied, preheating of the anode must be started by connecting the anode to a supply voltage of max. 500 volts via a resistor limiting the anode current to 6 amperes.

[2] Measured at an average current of 15 amperes.

6786

MAXIMUM RATINGS

Peak Inverse Anode Voltage [3]	15 KV max.
Peak Forward Anode Voltage	15 KV max.
Average Anode Current [4]	
Continuous Operation	10 amps. max.
Intermittent Operation	15 amps. max.
Peak Anode Current	45 amps. max.
Surge Anode Current (max. 0.1 sec.)	600 amps. max.
Peak Grid Voltage	600 volts max.
Grid Resistance	20,000 ohms max.

Relation Between Condensed Mercury Temperature, Ambient Temperature and Peak Inverse Voltage [5]

Peak Inverse Anode Voltage	15	10 KV
Condensed Mercury Temp.	25-60	25-65 °C
Ambient Temp. [6]	10-30	10-35 °C

MAXIMUM OPERATING CONDITIONS
PEAK INVERSE ANODE VOLTAGE = 15 KV

(Transformer regulation and tube voltage drop are not included)

Circuit Diagram	Type of Circuit	Max transformer sec. rms voltage (Vtr) KV	DC output voltage to filter (Vo) KV	Max DC output current to filter (Io) Amps	Max DC output to filter (Wo) KW
a.	Single-phase, full-wave, 2 tubes	5.3	4.8	20	96
b.	Single-phase, full-wave, 4 tubes	10.6	9.6	20	192
c.	Three-phase, half-wave, 3 tubes	6.1	7.2	30	216
d.	Three-phase, full-wave, 6 tubes	10.6	14.4	30	432
e.	Three-phase, double Y, 6 tubes parallel	5.3	6.2	60	372
f.	Four-phase, half-wave, 4 tubes	5.3	6.7	40	268
g.	Four-phase, full-wave, 8 tubes	10.6	13.5	40	540

[3] For frequencies up to 150 cps.

[4] Averaged over 10 second interval.

[5] If the equipment is started at most twice daily, it is permissible to apply high voltage at a condensed mercury temperature of 20° C.

[6] With natural cooling, approximate values. The tube may be operated at higher ambient temperatures than the maximum values given when the difference between the ambient and condensed mercury temperature (28° C with natural cooling) is reduced by an air flow directed on the bulb just above the base. A reduction to less than 10° C can easily be obtained with a simple air jet.

When a tube must be operated instantly, a reduction is recommended in heater voltage to 60-80% of the given nominal value for stand-by periods of more than 30 minutes.

TYPICAL OPERATING CONDITIONS

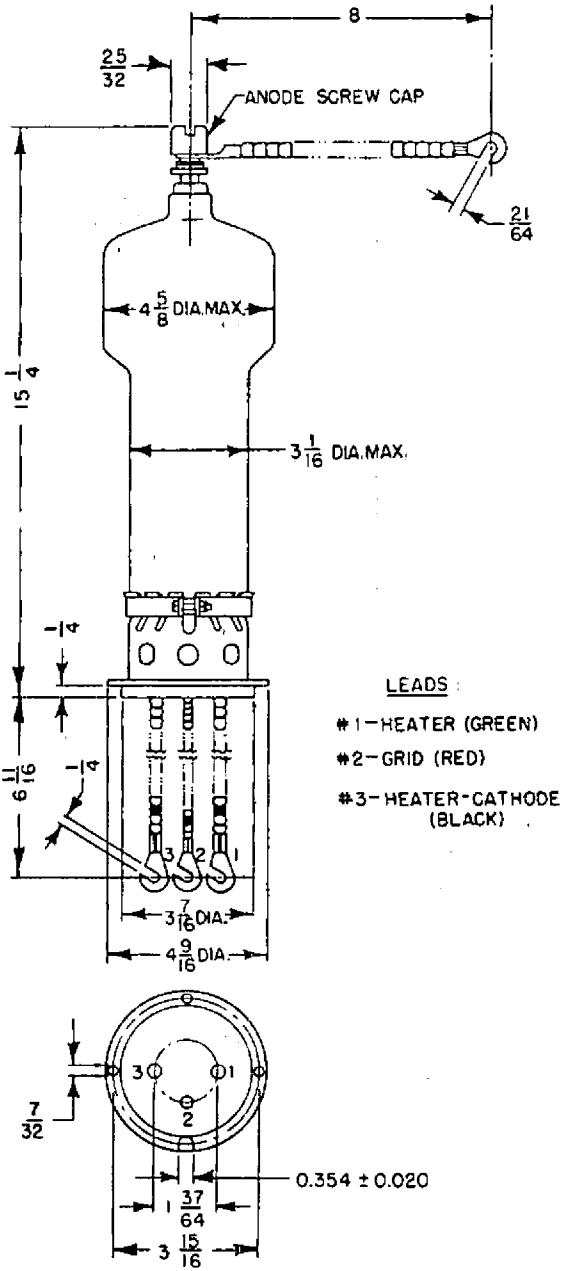
PEAK INVERSE VOLTAGE = MAX. 15 KV [7]

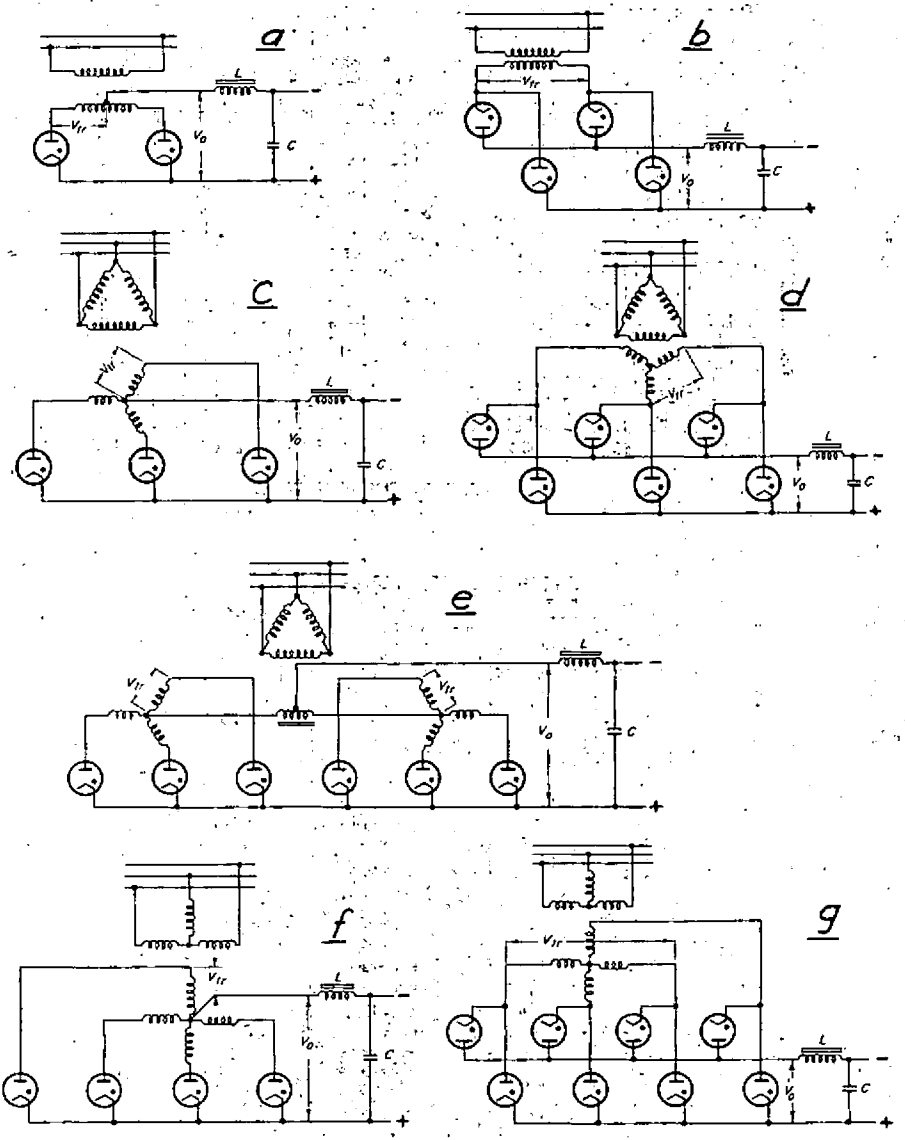
Circuit Diagram	Type of Circuit	No load transformer sec. rms voltage (Vtr) KV	DC output voltage to load [8] (Vo_1) KV	Max DC output current (Io) Amps	DC output to load (Wo_1) KW
a.	Single-phase, full-wave, 2 tubes	4.80	4.0	20	80
b.	Single-phase, full-wave, 4 tubes	9.60	8.0	20	160
c.	Three-phase, half-wave, 3 tubes	5.55	6.0	30	180
d.	Three-phase, full-wave, 6 tubes	9.60	12.0	30	360
e.	Three-phase, double Y, 6 tubes	4.80	5.15	60	309
f.	Four-phase, half-wave, 4 tubes	4.80	5.6	40	224
g.	Four-phase, full-wave, 8 tubes	9.60	11.2	40	448

[7] This value corresponds to a nominal peak inverse anode voltage of 13.6 KV, allowing a line fluctuation of ± 10%.

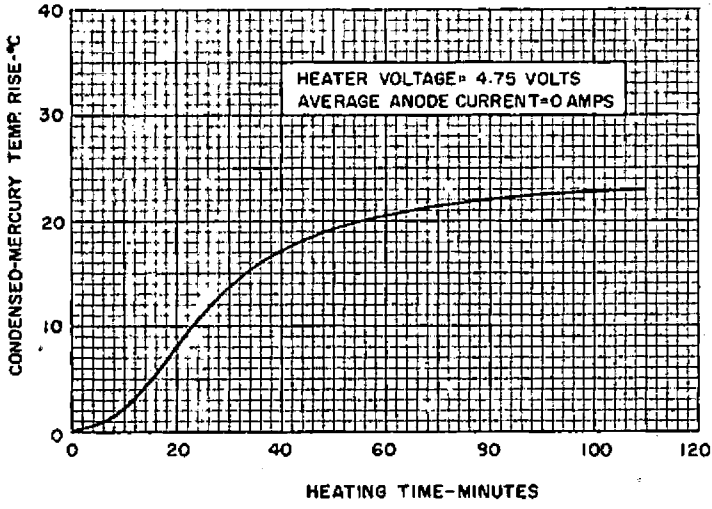
[8] Tube voltage drop and losses in transformer, filter, ammeter, etc. amounting to 8% of Vo_1 have already been deducted.

6786

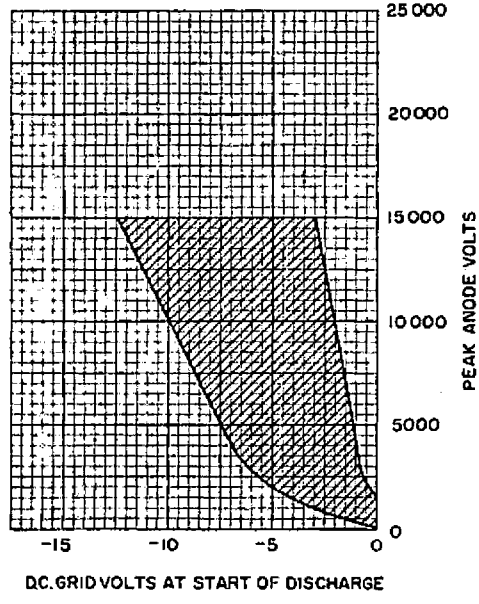

8
25/32
ANODE SCREW CAP
21/64
4 5/8 DIA.MAX.
15 1/4
3 1/16 DIA.MAX.
1/4
6 11/16
1/4
3
2
1
3 7/16 DIA.
4 9/16 DIA.
LEADS:
#1-HEATER (GREEN)
#2-GRID (RED)
#3-HEATER-CATHODE (BLACK)
7/32
0.354 ± 0.020
1 37/64
3 15/16


a
b
c
d
e
f
g
L
C
V_{fr}
V_o

RATE OF RISE OF CONDENSED-MERCURY TEMPERATURE



CONTROL CHARACTERISTIC



from JEDEC release #4505, Nov. 25, 1963

AMPEREX TUBE TYPE 6960

The 6960 is a water-cooled triode designed for use in industrial RF generators and communication transmitters. The construction and characteristics of the 6960 are similar to the AMPEREX tube type 5923. However, the 6960 features an exclusive, specially processed grid which makes possible its high grid current rating and overload characteristics. This is particularly desirable in heavy-duty industrial applications.

The filament is thoriated tungsten. Maximum ratings apply up to 30 megacycles. Typical conditions for Class C industrial oscillator operation at 50 megacycles is presented herein.

GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	vertical, plate up or down
Max. Temperature of Filament Seals	210°C
Max. Temperature of Grid & Plate Seals	180°C
Cooling [1]	water & low velocity air flow (see curves)
Max. Inlet Water Temperature	50°C

ACCESSORIES

Filament Connector	Amperex No. S-3707
Filament Center Pin Connector [2]	Amperex No. S-21000
Grid Connector (for use up to 30 mc)	Amperex No. S-17288
Grid Connector (for use above 30 mc)	Amperex No. S-3706
Water Jacket	Amperex No. S-3737
Net Weight (approx.)	1 lb.

ELECTRICAL

Filament Voltage	12.6 volts
Filament Current	33 amps
Amplification Factor (I_b = 1 amp; E_b = 6000 volts)	32
Transconductance (I_b = 1 amp; E_b = 6000 volts)	15,000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	11 $\mu\mu f$
Grid to Filament	16 $\mu\mu f$
Plate to Filament	0.3 $\mu\mu f$

[1] At frequencies above 30 Mc it is necessary to direct a low velocity air flow to plate and grid seals.

[2] The filament center tap pin (0.413 dia.) must not be used for filament current supply. The filament center pin connector (S-21000) must, however be used for cooling of this pin.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier & Modulator
Class B

Maximum Ratings, Absolute Values (per tube)

	CCS
D.C. Plate Voltage	7.2 KV
D.C. Plate Current	2.2 amps
Plate Input	14 KW
Plate Dissipation	6 KW
Grid Resistor	15,000 ohms

Typical Operation (two tubes)

	CCS	CCS	CCS	CCS
D.C. Plate Voltage	7000	5000	5000	4000 volts
D.C. Grid Voltage	−210	−145	−145	−120 volts
Peak AF Grid to Grid Voltage	1220	840	690	900 volts
Zero Signal D.C. Plate Current	2x0.2	2x0.15	2x0.15	2x0.1 amps
Max. Signal D.C. Plate Current	2x2	2x1.25	2x1.1	2x1.25 amps
Effective Load Resistance, Plate to Plate	4150	4800	5500	3800 ohms
Max. Signal Drive Power (approx.)	2x310	2x130	2x65	2x140 watts
Max. Signal Power Output (approx.)	20	9	8	7.1 KW

Plate Modulated R.F. Power Amplifier
Class C - Telephony

Carrier conditions per tube with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values (per tube)

	CCS
Frequency	30 Mc
D.C. Plate Voltage	5.5 KV
D.C. Grid Voltage	1250 volts
D.C. Plate Current	1.8 amps
D.C. Grid Current	0.6 amps
Plate Input	9 KW
Plate Dissipation	4 KW

Typical Operation

	CCS	CCS	CCS
D.C. Plate Voltage	5	5	4 KV
D.C. Grid Voltage [3]	−400	−400	−300 volts
Peak RF Grid Voltage	800	730	680 volts
D.C. Plate Current	1.6	1.4	1.6 amps
D.C. Grid Current	0.6	0.5	0.6 amps
Driving Power	432	328	367 watts
Power Output	6.4	5.6	5.0 KW

[3] Grid bias partially obtained by the grid resistor.

6960

R.F. Power Amplifier & Oscillator
Class C - Telegraphy

Maximum Ratings, Absolute Values (per tube)

	CCS
Frequency	30 Mc
D.C. Plate Voltage	7.2 KV
D.C. Grid Voltage	−1250 volts
D.C. Plate Current	2.2 amps
D.C. Grid Current	0.6 amp
Plate Input	14 KW
Plate Dissipation	6 KW

Typical Operation

f = 30 Mc	CCS	CCS	CCS
D.C. Plate Voltage	6.5	6.0	5.0 KV
D.C. Grid Voltage	−450	−400	−300 volts
Peak RF Grid Voltage	820	780	660 volts
D.C. Plate Current	2.0	2.0	2.0 amps
D.C. Grid Current	0.5	0.5	0.5 amp
Driving Power	370	350	297 watts
Power Output	9.5	8.5	7.1 KW
Plate Power Input	13	12	10 KW
Plate Dissipation	3.5	3.5	2.9 KW
Efficiency	73	71	71 %

Class C Oscillator
Rectified, Unfiltered, Three-Phase, Half-Wave Plate Supply

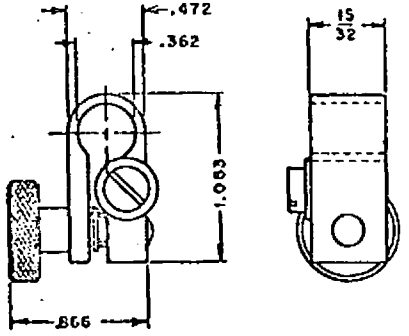
Maximum Ratings, Absolute Values (per tube)

Frequency	55 Mc
D.C. Plate Voltage	7 KV
D.C. Grid Voltage	−1250 volts
D.C. Plate Current	1.8 amps
D.C. Grid Current (Full Load)	0.5 amp
D.C. Grid Current (No Load)	0.7 amp
Plate Power Input	11 KW
Plate Dissipation	6 KW
Grid Resistor	10 Kilohms

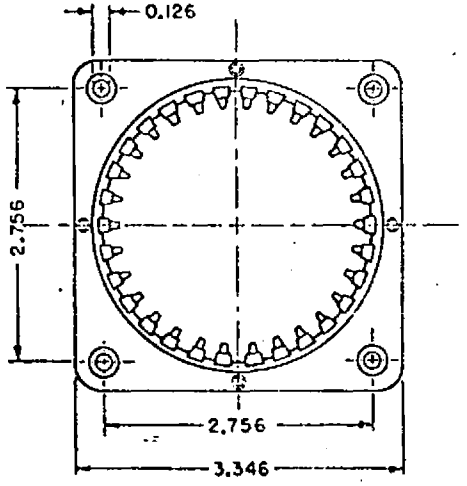
Typical Operation

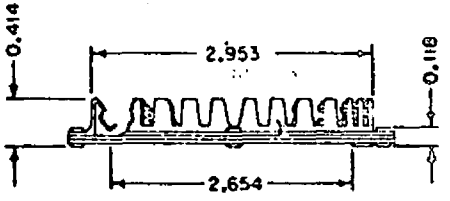
Frequency	50 Mc
Transformer Secondary Voltage (rms)	5.1 KV
D.C. Plate Voltage	6 KV
D.C. Plate Current	1.5 amps
D.C. Grid Current (Full Load)	0.4 amp
D.C. Grid Current (No Load)	0.7 amp
Grid Resistor	1000 ohms
Plate Power Input	9 KW
Plate Dissipation	2.7 KW
Plate Power Output	6 KW

6960

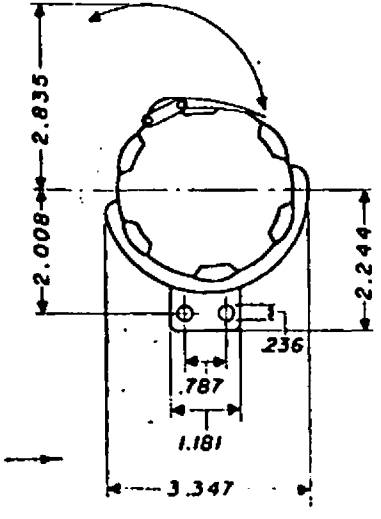


FILAMENT CONNECTOR S-3707

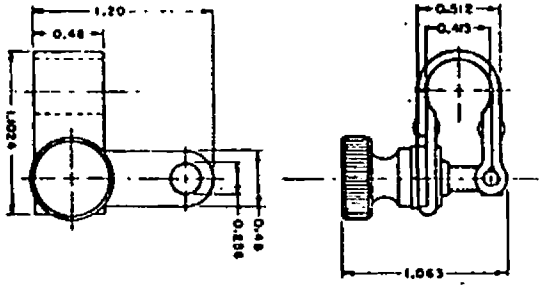




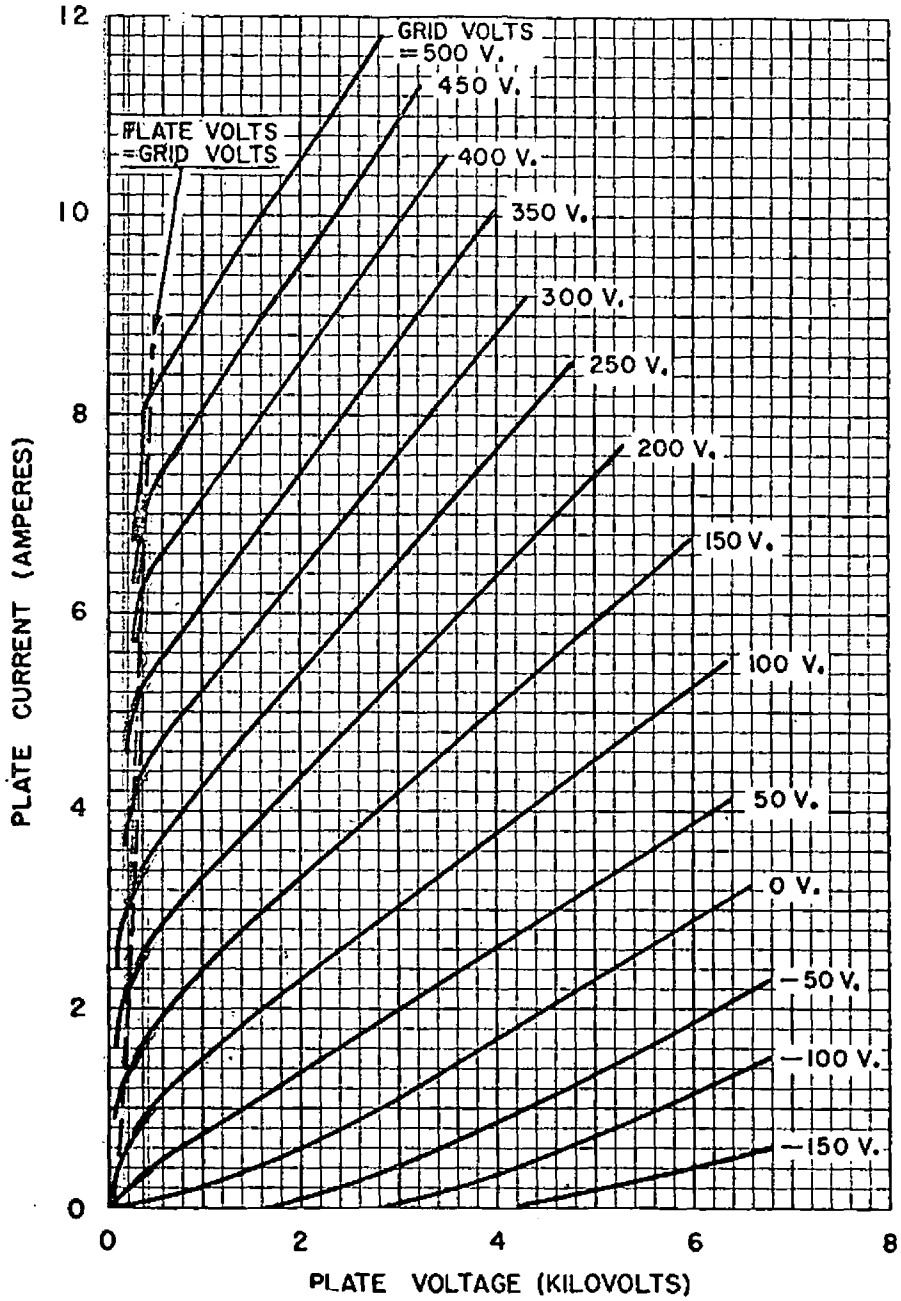
GRID CONNECTOR
S-3706

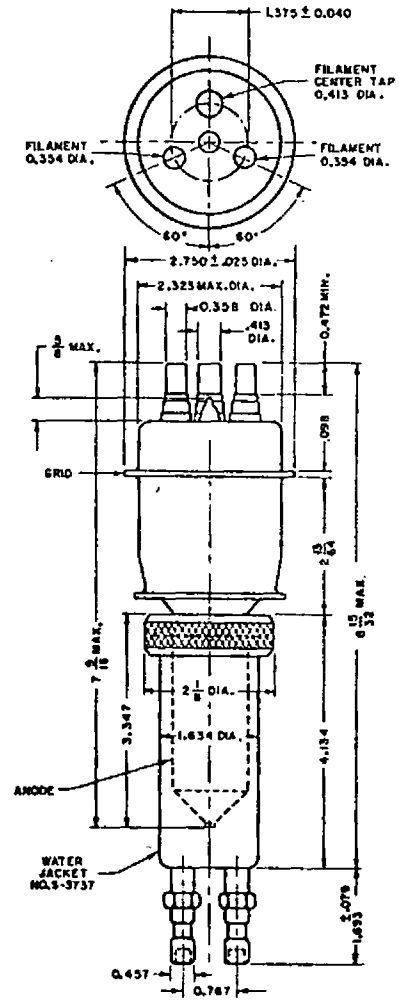


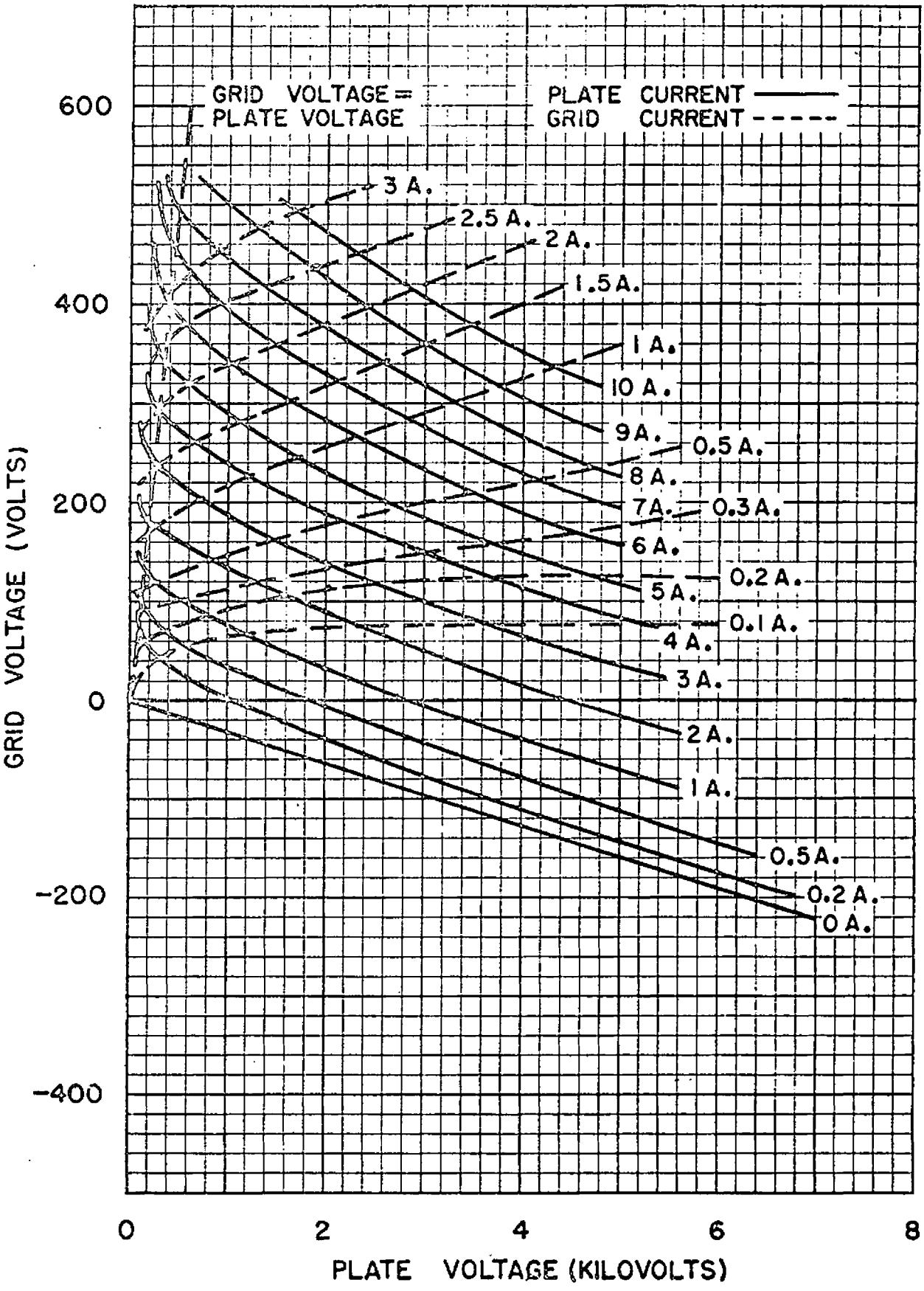
GRID CONNECTOR
S-17288



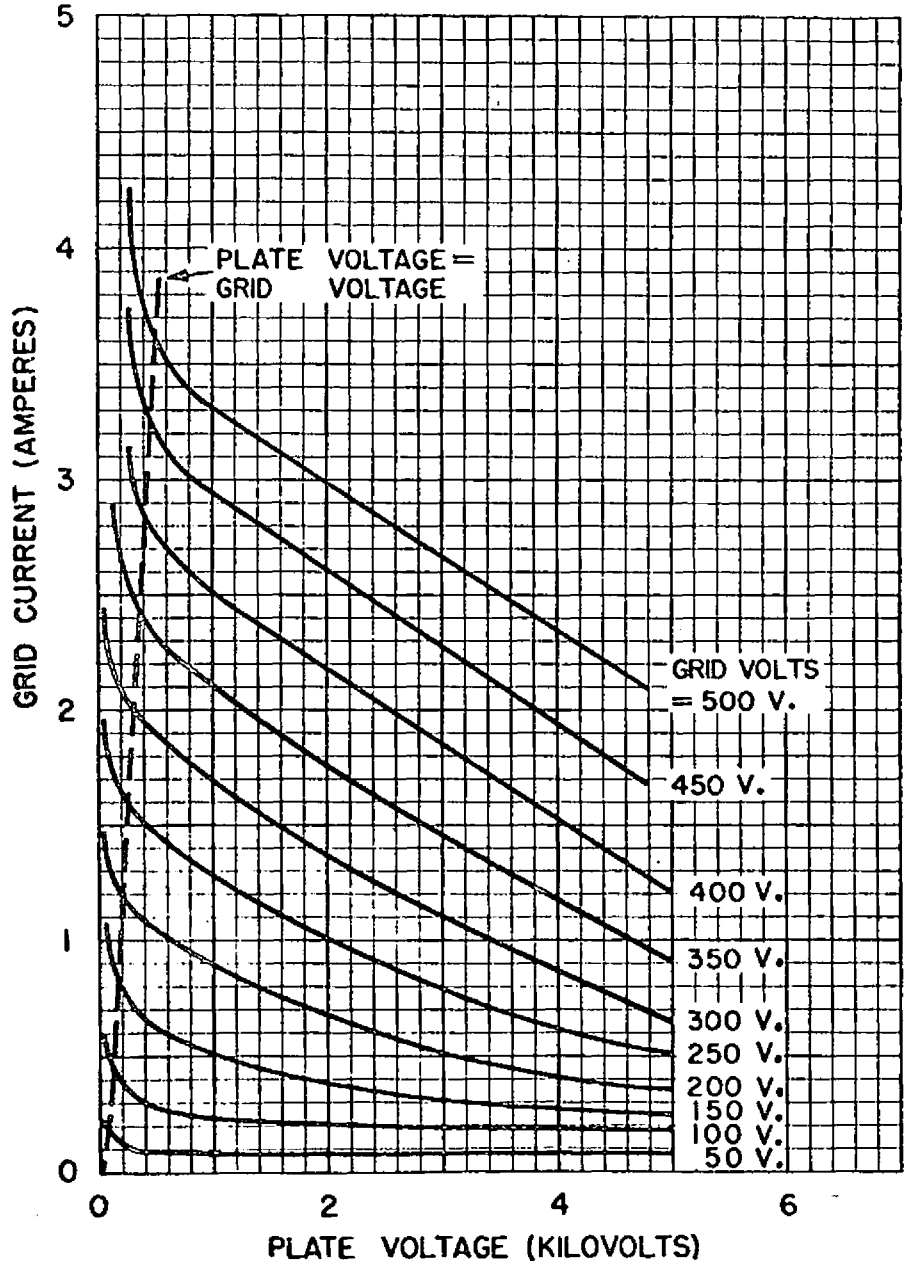
FILAMENT CENTER PIN CONNECTOR
S-21000

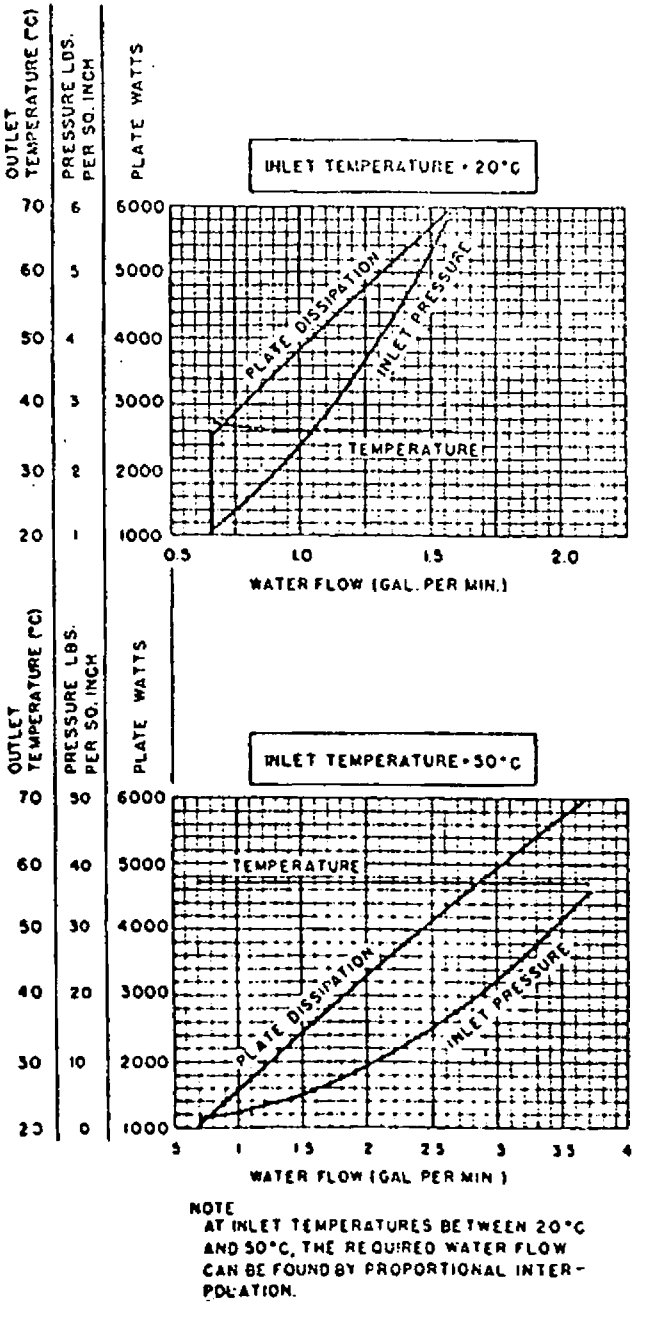

GRID VOLTS
=500 V.
450 V.
PLATE VOLTS
=GRID VOLTS
400 V.
350 V.
300 V.
250 V.
200 V.
150 V.
100 V.
50 V.
0 V.
−50 V.
−100 V.
−150 V.
PLATE CURRENT (AMPERES)
PLATE VOLTAGE (KILOVOLTS)
0
2
4
6
8
10
12


FILAMENT CENTER TAP 0.413 DIA.
FILAMENT 0.354 DIA.
FILAMENT 0.354 DIA.
60°
60°
GRID
ANODE
WATER JACKET NO. 9-3737
0.457
0.787


GRID VOLTAGE =
PLATE VOLTAGE
PLATE CURRENT
GRID CURRENT
600
400
200
0
-200
-400
GRID VOLTAGE (VOLTS)
3 A.
2.5 A.
2 A.
1.5 A.
1 A.
10 A.
9 A.
0.5 A.
8 A.
7 A.
0.3 A.
6 A.
5 A.
0.2 A.
0.1 A.
4 A.
3 A.
2 A.
1 A.
0.5 A.
0.2 A.
0 A.
0
2
4
6
8
PLATE VOLTAGE (KILOVOLTS)

6960

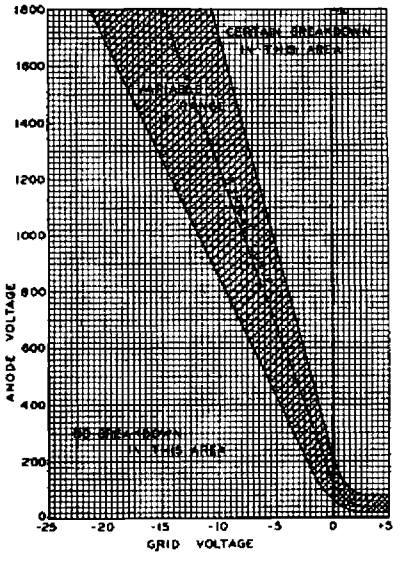




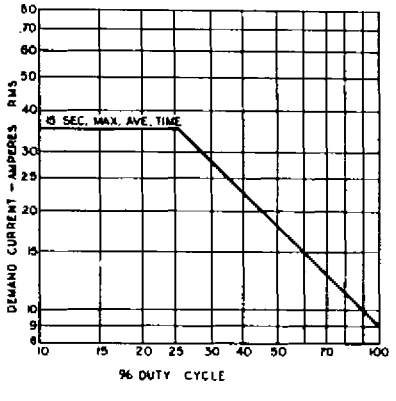
NOTE
AT INLET TEMPERATURES BETWEEN 20°C AND 50°C, THE REQUIRED WATER FLOW CAN BE FOUND BY PROPORTIONAL INTERPOLATION.

GRID CONTROL RECTIFIER TUBE
Xenon Gas Filling

6984 **EL C4H-1**
6985 **EL C4H-2**
6986 **EL C4H-3**
8065 **EL C4H-4**
8066 **EL C4H-5**



Control Characteristic



Back-To-Back Contactor Rating

Two tubes connected in inverse parallel demand current with full conduction during each half cycle.

Maximum Rated Anode Current	
D-c. Meter Value — Continuous	4.0 amps
D-c. Meter Value — Overload less than 3 sec.	8.0 amps
Averaging Time	15 secs
Oscillograph Peak — Continuously recurring	50 amps
Peak Forward Voltage (Max. Instantaneous)	1700 volts
Peak Inverse Voltage (Max. Instantaneous)	1700 volts
Max. Commutation Factor ($V/\mu sec \times A/\mu sec$)	130
Min. Frequency	25 cycles
Filament	
Voltage	2.5 volts
Current	17 ± 2 amps
Heating Time (minimum)	60 secs
Average Arc Drop	
Average Tube	11 volts
Highest Tube	15 volts
Anode Starting Voltage @ +3V d-c grid voltage	
Average Tube	40 volts
Highest Tube	80 volts
Max. Anode Reverse Current	100 μamps
Grid Characteristics	
Critical Grid Voltage @ 1700 p.f.v.	—10.0 to —20.0 volts
Critical Grid Current	Less than 20 μamps
Grid-Anode Capacitance	approx. 5 $\mu\mu$f
Grid-Filament Capacitance	approx. 21 $\mu\mu$f
Maximum Negative Grid Voltage	100 volts
Deionization Time	Less than 1000 μsecs
Max. Peak A-c Fault Current (Max. duration 0.1 sec.)	500 amps
Ambient Temperature Limits	—55° to +75° C
Overall Dimensions	(See outline drawing on back page)

The filament must be lit before drawing load current.

The above values are for return to filament transformer center tap.

Filament phasing during conduction must be as indicated on drawings.

The Engineering Manual contains additional information which should be considered in circuit design.

from JEDEC release #3311, June 19, 1961

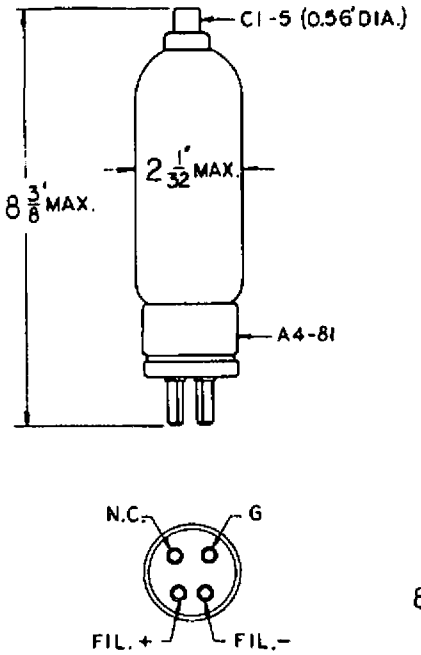
EL C4H-1
EL C4H-2
EL C4H-3
EL C4H-4
EL C4H-5

OUTLINE DRAWINGS

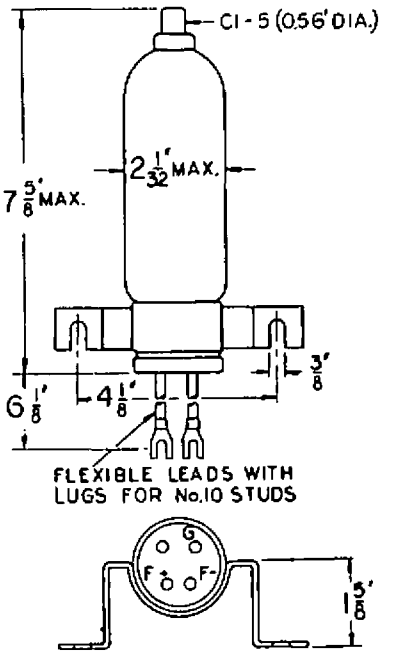
EL C4H Series

(NOTE: Dimensions nominal unless otherwise stated.)

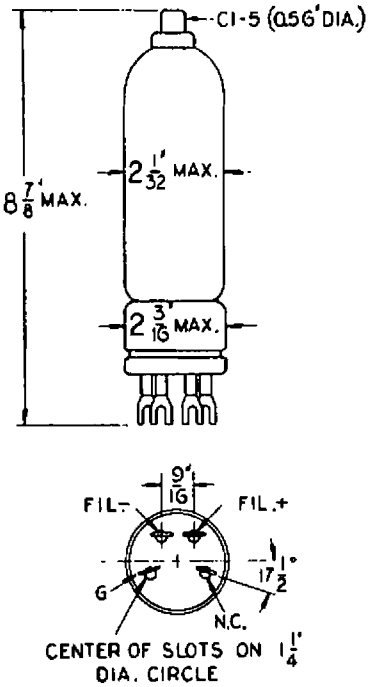
EL C4H-1



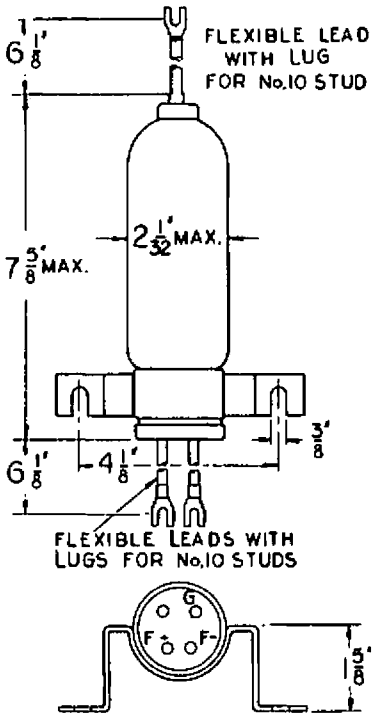
EL C4H-2



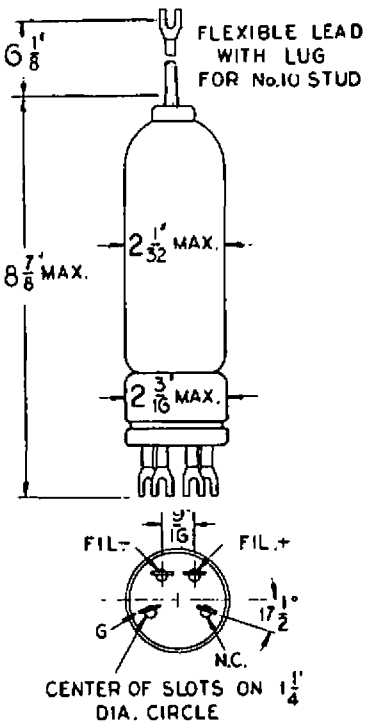
EL C4H-3



EL C4H-4



EL C4H-5

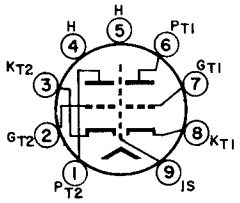


ELECTRONS
INCORPORATED
127 SUSSEX AVENUE, NEWARK 3, N. J.

AMPEREX TUBE TYPE 6GM8/ECC86

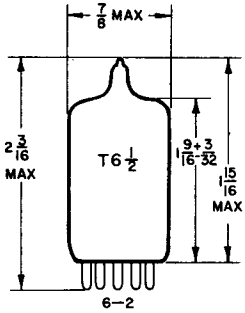
TENTATIVE DATA

The Amperex 6GM8/ECC86 is a frame grid, twin triode designed for low supply voltage applications. It is especially suitable for instrumentation and industrial applications as a direct-coupled wide band amplifier and for automobile radio sets as an RF amplifier and self-oscillating mixer. The tube can be directly operated from a storage battery.



PIN CONNECTIONS

1 – PLATE, TRIODE NO.2
2 – GRID , TRIODE NO.2
3 – CATHODE , TRIODE NO.2
4 – HEATER
5 – HEATER
6 – PLATE, TRIODE NO.1
7 – GRID , TRIODE NO.1
8 – CATHODE, TRIODE NO.1
9 – INTERNAL SHIELD



GENERAL CHARACTERISTICS

MECHANICAL

Maximum Dimensions	see outline drawing
Bulb	T6½
Outline	6-2
Base	E9-1
Basing	9DE
Mounting position	any

ELECTRICAL

Cathode	coated, unipotential
Heater voltage	6.3 volts
Heater current	330 mA

Direct Interelectrode Capacitances (Each Section)

Output	1.8 $\mu\mu$f
Input	3 $\mu\mu$f
Plate to grid	1.3 $\mu\mu$f

Between the 2 sections

Plate to plate	max.	0.05 $\mu\mu$f
Grid to grid	max.	0.005 $\mu\mu$f
Plate section 1 to grid section 2	max.	0.005 $\mu\mu$f
Plate section 2 to grid section 1	max.	0.005 $\mu\mu$f

6GM8/ECC86

Typical Characteristics (each section)

Plate Voltage	6.3 volts
Grid voltage	− 0.4 volt
Plate current	0.9 mA
Transconductance	2600 micromhos
Amplification Factor	14

Maximum Ratings (Design Center Values)

Plate Voltage	max.	30 volts
Plate dissipation	max.	0.6 watt
Cathode current	max.	20 mA
Grid circuit resistance	max.	1 megohm
Voltage between cathode and heater	max.	30 volts
Circuit resistance between cathode and heater	max.	20,000 ohms

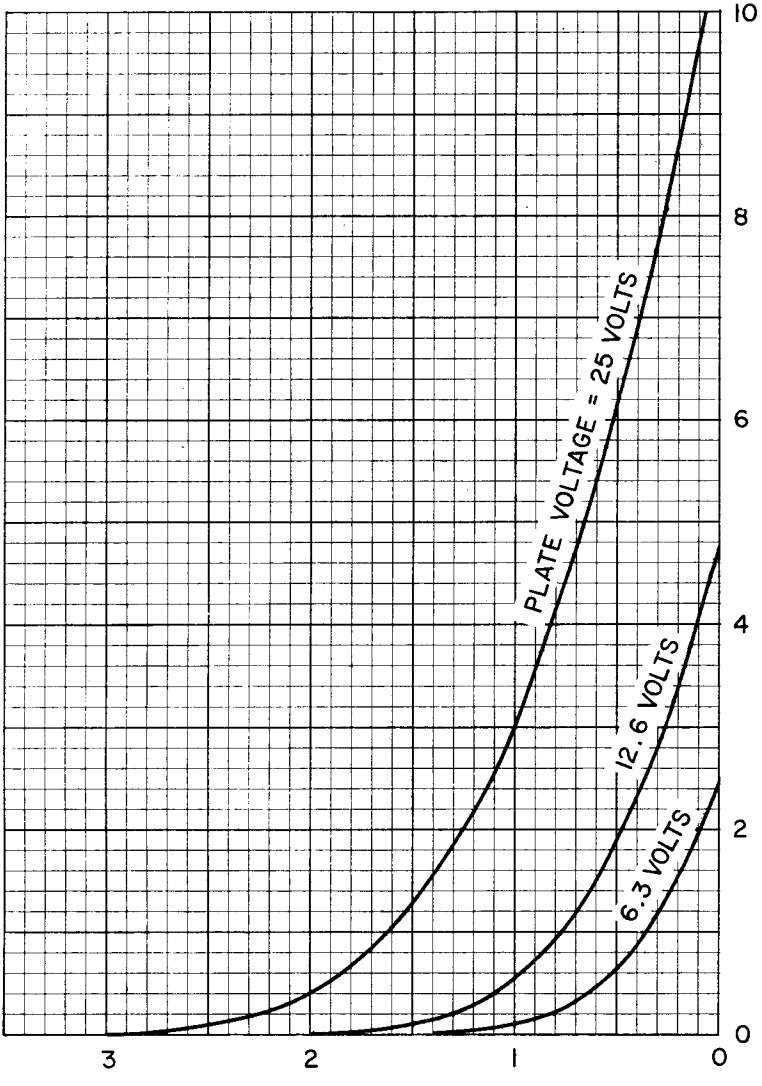
Operating Characteristics as RF Amplifier (each section)

Plate Voltage	6.3	12.6	25 volts
Grid supply voltage	0	0	0 volts
Grid circuit resistance	0.1	0.1	0.1 megohm
Plate current	0.9	2.5	7.5 mA
Transconductance	2600	4600	7800 micromhos
Internal resistance	5000	3400	2100 ohms
Equivalent noise resistance	1000	--	-- ohms

Operating Characteristics As Self-Oscillating Mixer (each section)

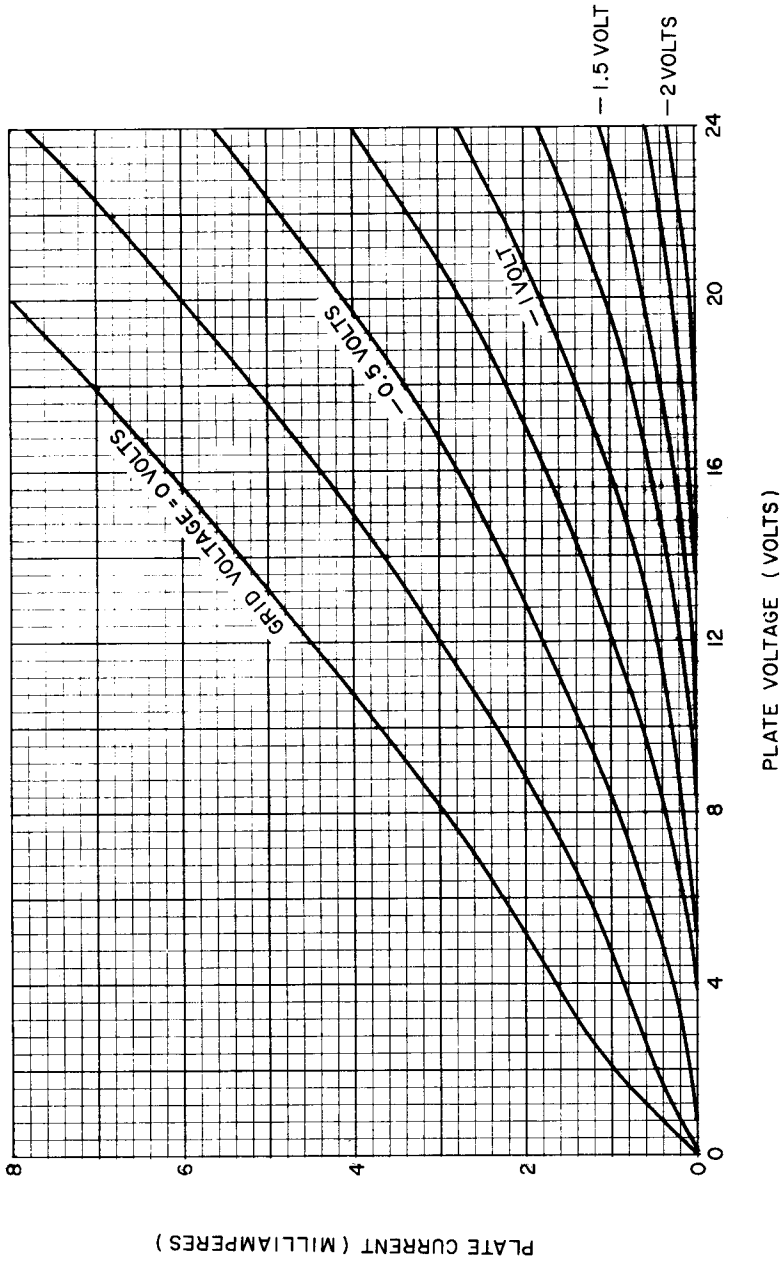
Plate supply voltage	6.3	12.6	25 volts
Plate circuit resistance	500	500	500 ohms
Grid circuit resistance	0.22	0.22	0.22 megohm
Oscillator voltage	0.7	1.0	1.5 volts (rms)
Plate Current	0.4	1.0	2.6 mA
Conversion transconductance	800	1300	2000 micromhos
Internal resistance	11000	8000	5300 micromhos

PLATE CHARACTERISTICS

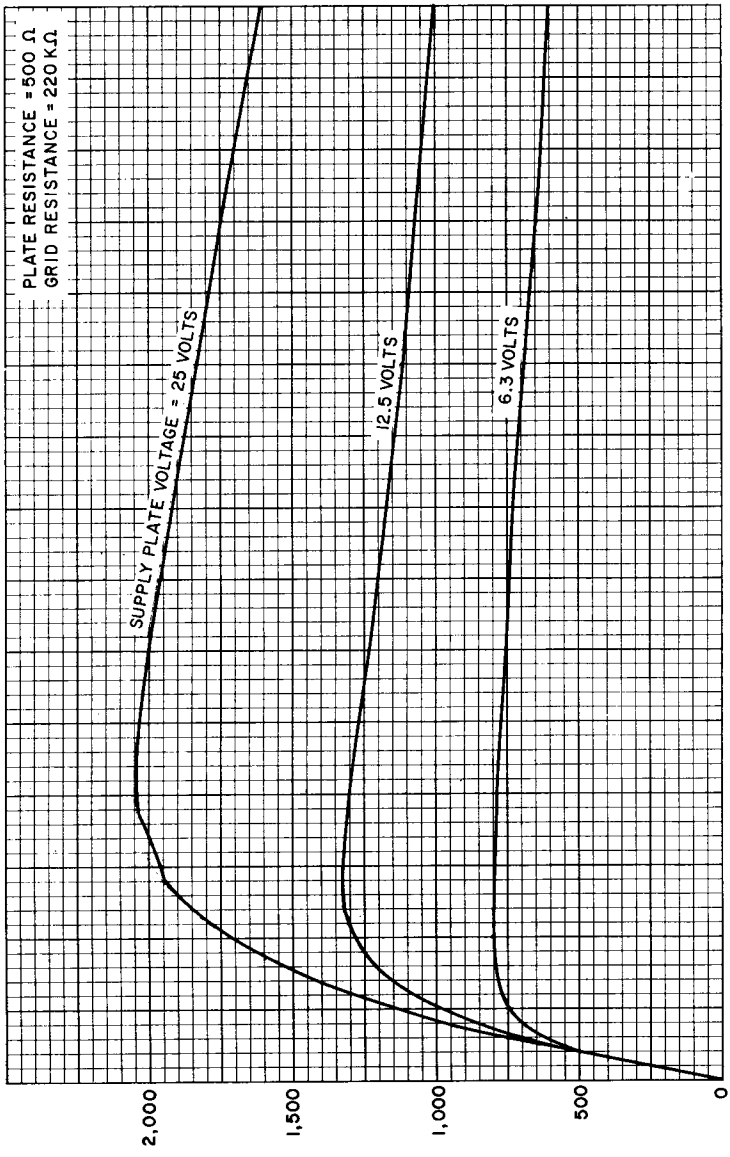


6GM8/ECC86

PLATE CHARACTERISTICS

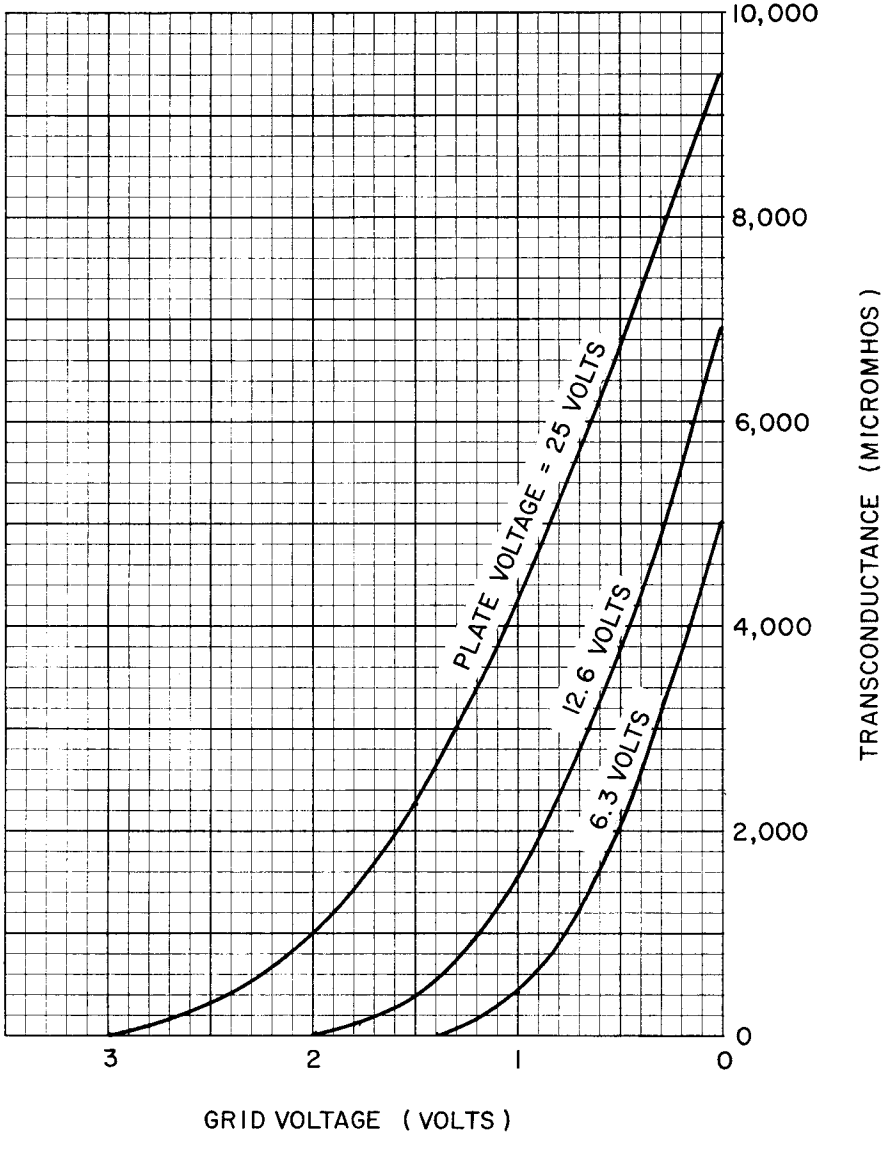


CONVERSION CHARACTERISTICS



6GM8/ECC86

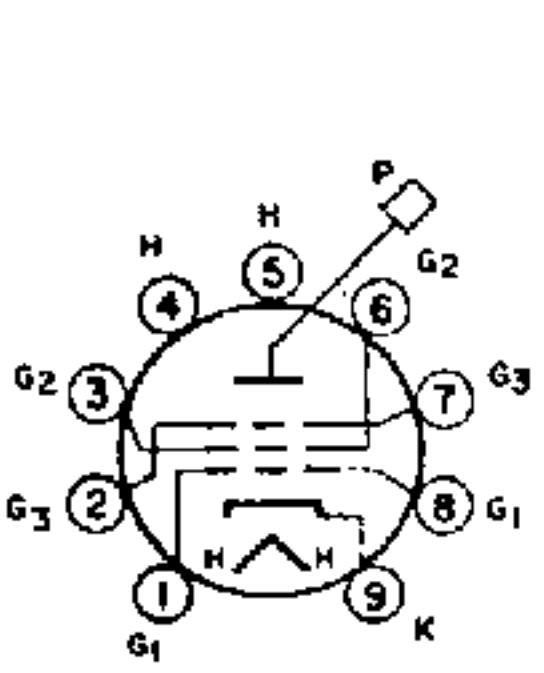
TRANSCONDUCTANCE CHARACTERISTICS



Amperex Tube Type 6KG6/EL509

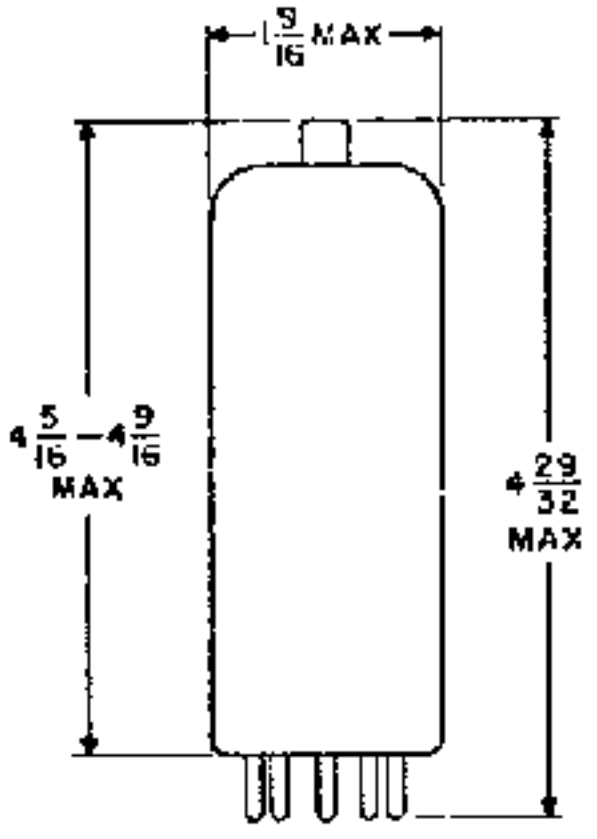
Except for filament voltage and current, equivalent to type 40KG6/PL519.

The 6KG6A is an output pentode designed for use in horizontal deflection circuits of color television receivers.



PIN CONNECTIONS

1– GRID NO.1
2– GRID NO.3
3– GRID NO.2
4– HEATER
5– HEATER
6– GRID NO.2
7– GRID NO.3
8– GRID NO.1
9– CATHODE
P– CAP–PLATE



GENERAL CHARACTERISTICS

MECHANICAL [1]

Base	magnoval
Dimensions	see outline drawing

ELECTRICAL

Heating	AC or DC, parallel supply
Heater Voltage	6.3 volts
Heater Current	2 amps

Interelectrode Capacitances

Plate to Grid No. 1	2.5 pf 3.0 pf (max.)
Input	37 pf
Output	18.5 pf

TYPICAL CHARACTERISTICS (measured under pulse conditions)

	Min.	Max.	During flyback	
Plate Voltage	50	160	7000	volts
Beam Plate Voltage	0	0	0	volts
Grid No. 2 Voltage	175	160	175	volts
Grid No. 1 Voltage	-10	0	-185	volts
Plate Current	800	1400	<0.05	mA
Grid No. 2 Current	70	45	-	mA

---

1) This tube must be supported at top.

6KG6A

LIMITING VALUES

	Design Center	Design Max.	
Plate Voltage at Zero Current	max. 700	max. 990	Volts
Peak Positive Plate Voltage	max. 7000	max. 8000	volts 1)
Plate Dissipation	max. 30	max. 40	Watts
Beam Plate Voltage	max. 50	max. 50	Volts
Grid No. 2 Voltage at Zero Current	max. 700	max. 770	Volts
Grid No. 2 Voltage	max. 250	max. 275	Volts
Grid No. 2 Dissipation	max. 7	max. 9	Watts 2)
Cathode to Heater Voltage	max. 250	max. 275	Volts
Beam Plates Circuit Resistor	max. 10000	max. 10000	Ohms 3)
Peak Negative Grid No. 1 Voltage	-	max. 550	volts 4)
Bulb Temperatures	-	max. 300° C	
Grid No. 1 Circuit Resistance	-	-	Ohms 5)

Remarks:

1) Max. pulse duration is 22% of a cycle, max. 18 micro seconds.

2) To prevent an excessive value of Pg2 the minimum Rc2 values are given in Fig. 1

3) With Rc3 10.000 ohms, capacitive decoupling of grid No. 3 is not required.

4) Abs. max. value

5) Circuit design has to be such that negative control grid currents up to 5 micro-amperes do not have any detrimental effect upon tube adjustment or circuit performance.
Care should be taken, that with 5 micro-amperes grid current the limiting values for Ik, Pp and Pc2 are not exceeded.

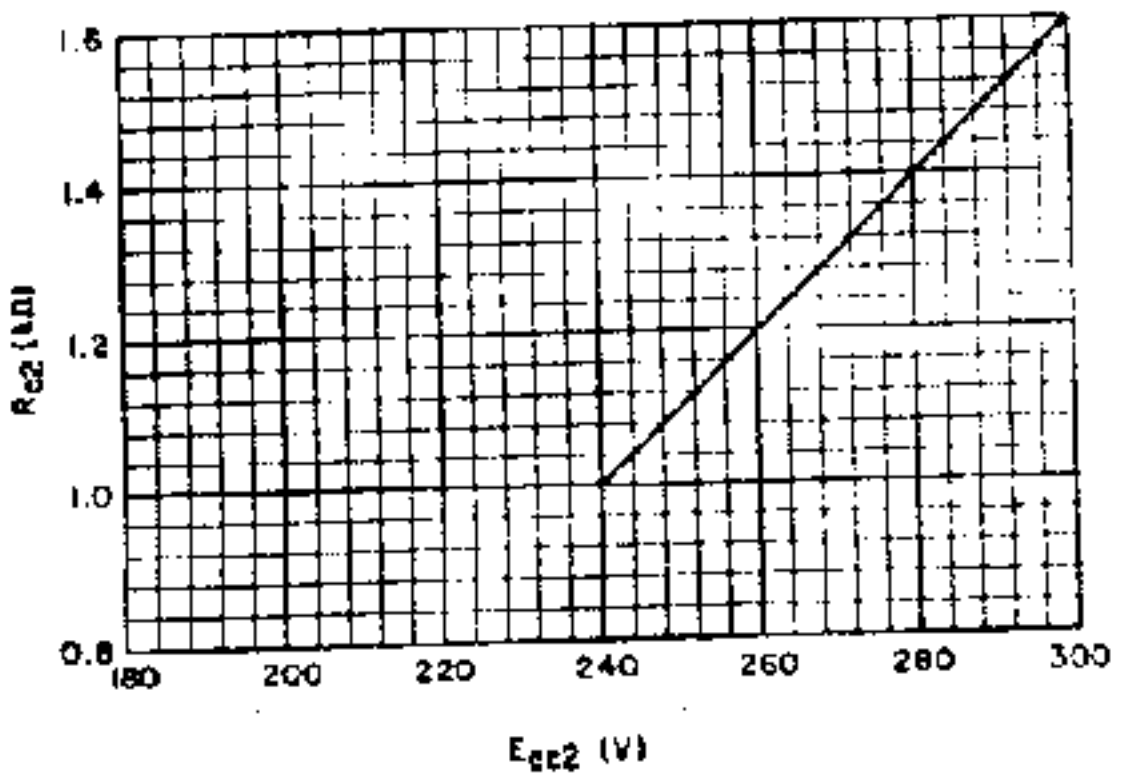
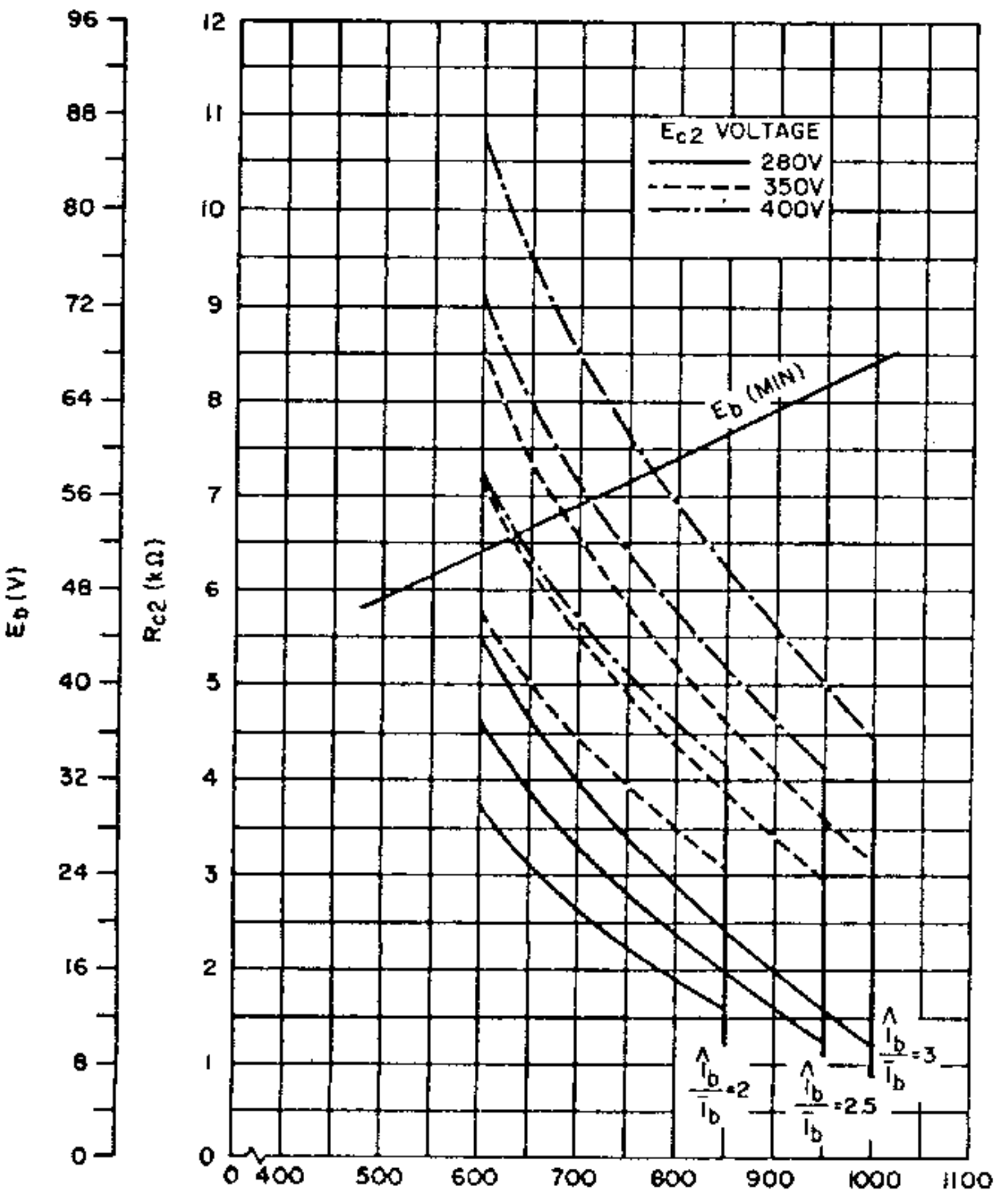


Figure 1

OPERATING CHARACTERISTICS

Stabilized circuits (D.C. Feedback)

Supply voltage: Refer to Figure 2, minimum plate voltage and maximum screen grid series resistance, when the tube is used in a line output stage. The curves refer to nominal line voltage, provided specified values of E_b are increased by 10% of the plate supply voltage. The specified values of I_b will be available throughout the life of the tube at supply voltages 10% below nominal. Barkenhausen interference and loss of stability can be prevented by ensuring the plate voltage is above the specified minimum E_b, during the scanning period. When optimum suppression of Barkenhausen oscillations and/or snivets is required, Grid No. 3 may be connected to a positive voltage of approximate 20 volts.



6KG6A

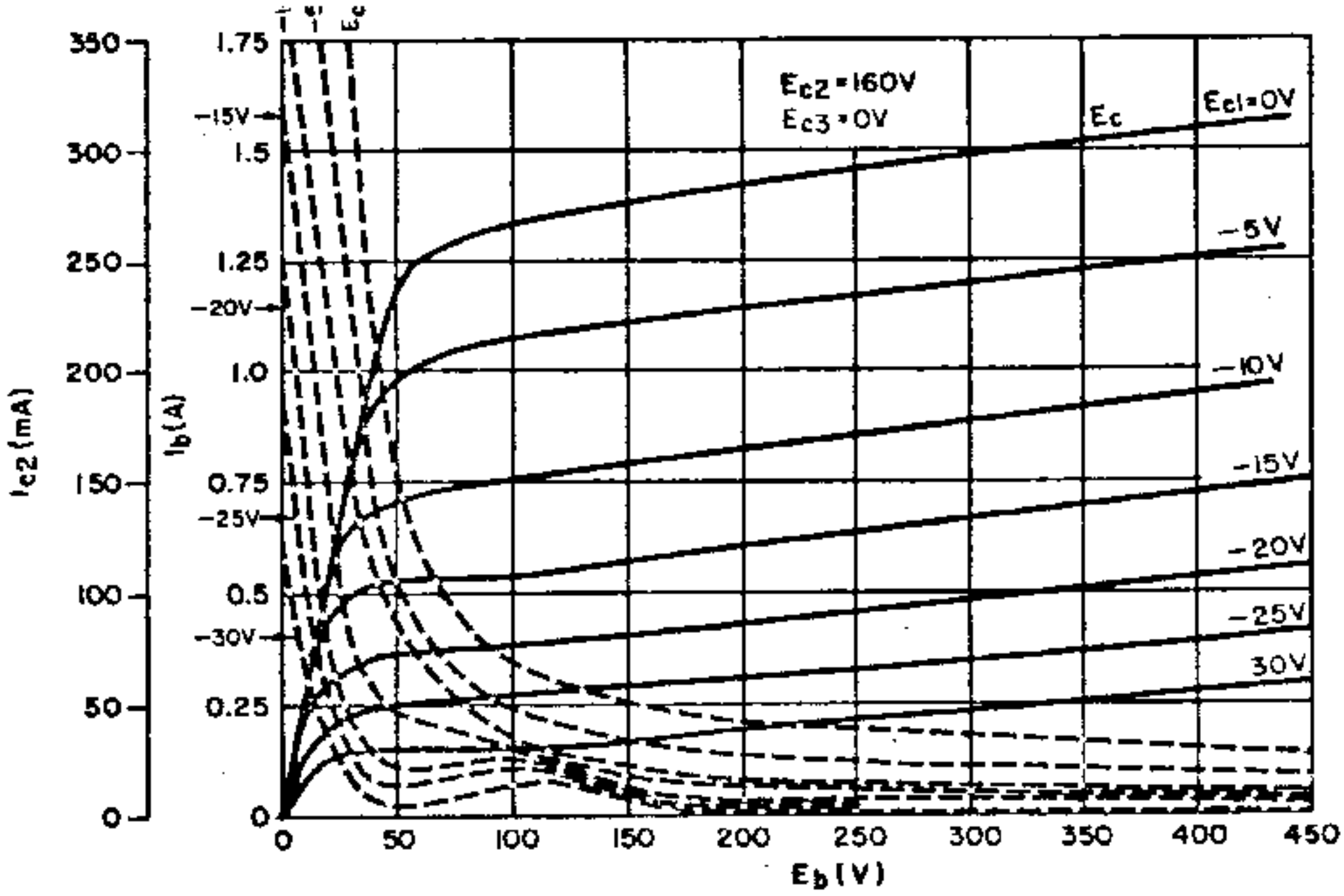


Plate Characteristics

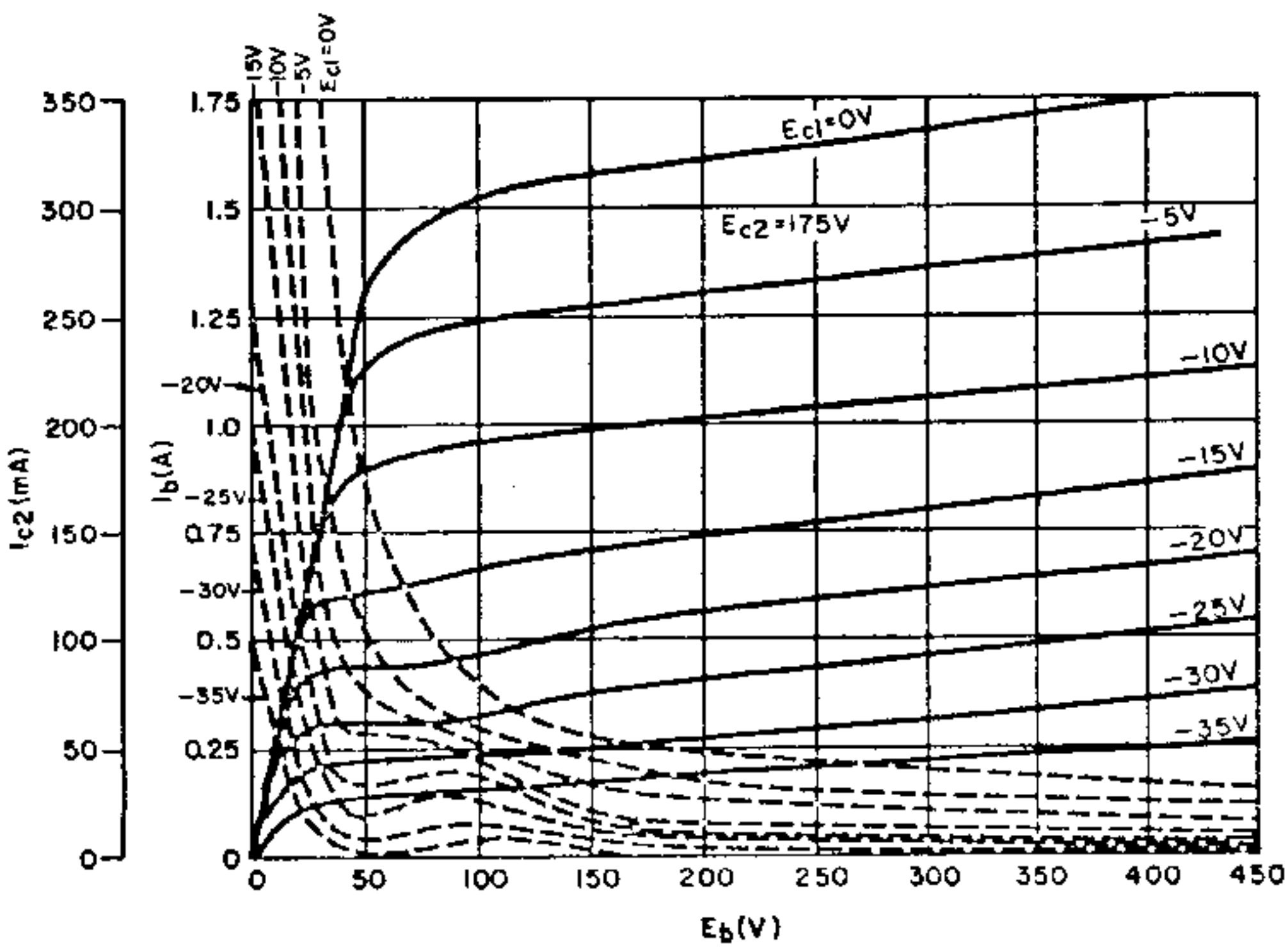


Plate Characteristics

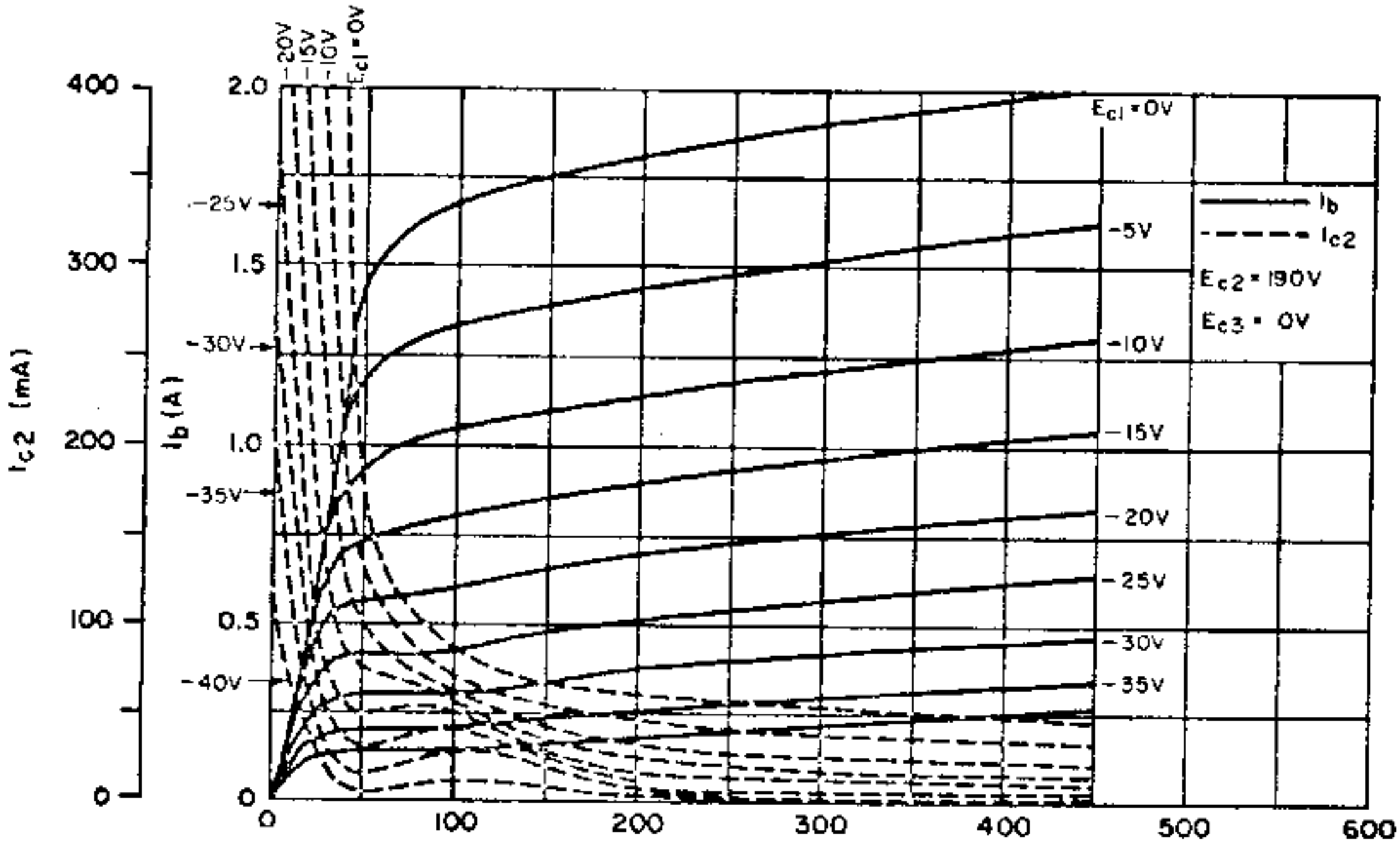
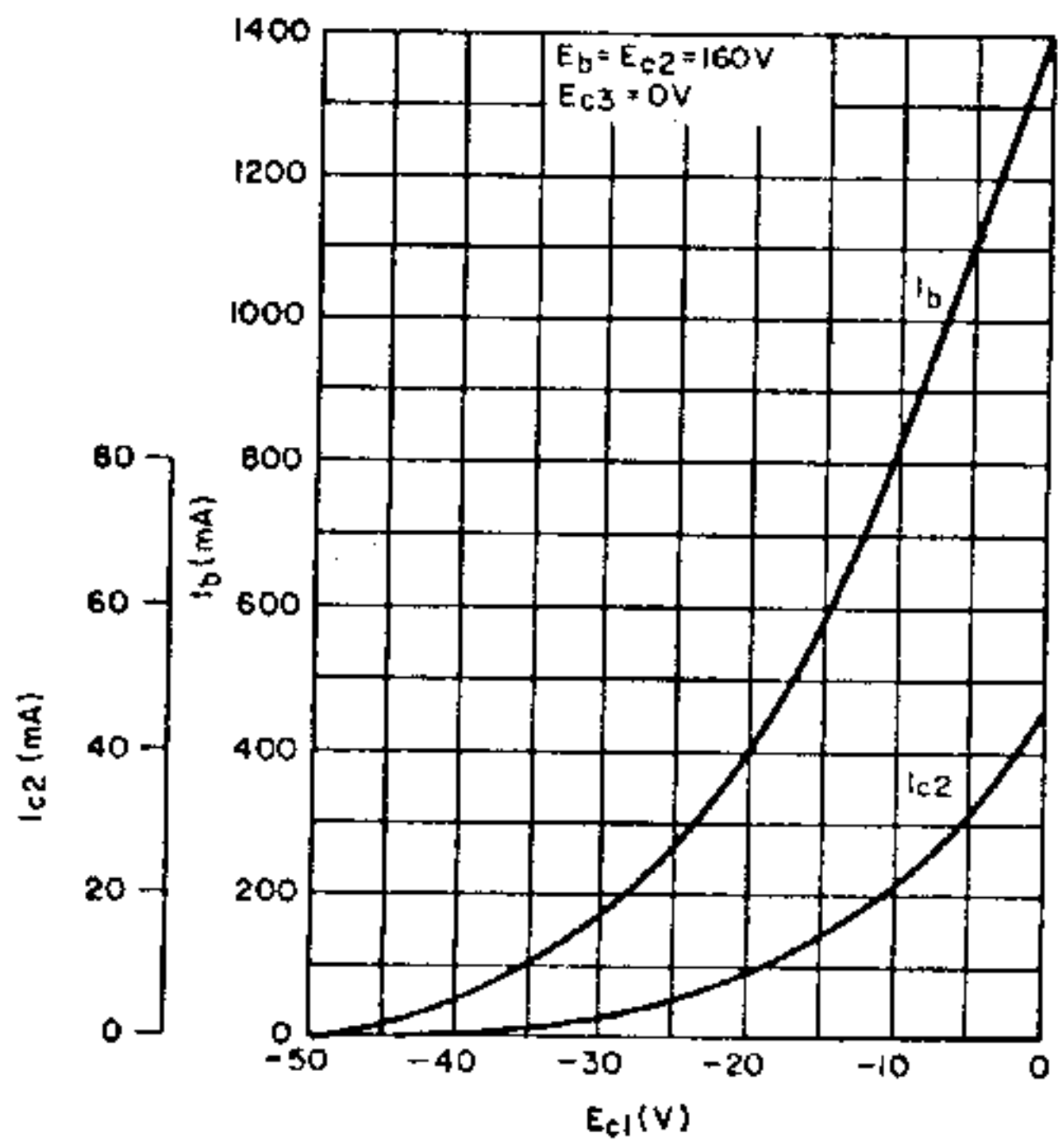


Plate Characteristics



Transfer Characteristics

AMPERITE® Solving your relay requirements since 1922

Amperite Co.
567 52nd Street
P.O. Box 329
West New York, NJ 07093
(800) 752-2329
www.Amperite.com

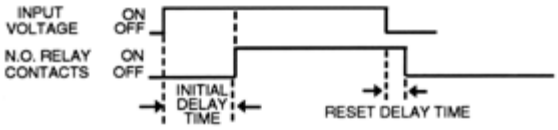
G Series TDR



… Hermetically sealed
… Delay on Make or Delay on Break timing modes
… Thermal device
… 3 AMP rating
… 1 - 115V input voltage range - works on AC or DC
… Isolated output contacts
… Fixed delay times only
… Initial and reset (release) delay device
… Long life
… UL File #E96739 (M)

Timing Mode:
Timing cycle begins upon application of power to the heater terminals. At the end of the initial delay time the relay contacts transfer and remain in a transferred state until input power is removed. When the heater input power is removed, the contacts transfer back to their original state at the end of a reset (release) delay period.

Timing Diagram:



Contact Information:
Arrangement: 1 form A (SPST - Normally open) - Delay on Make
1 form B (SPST - Normally closed) - Delay on Break
Contact Material: Silver - Cadmium Oxide
Rating (Resistive): 3A @ 115V AC
Expected Life @ 25°C: 500,000 operations minimum at rated loads

Environmental Information:
Temperature Range: Operating & storage: -55°C to +80°C, (-67°F to +176°F)

Mechanical Information:
Termination & Enclosure: Octal style, or 9-pin miniature style glass envelope. See Diagram A & B.
Weight: 1 oz. (28g)

Outline Dimensions:

AMPERITE® Solving your relay requirements since 1922

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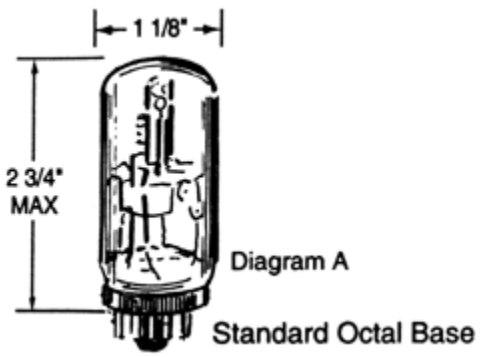


Diagram A
Standard Octal Base

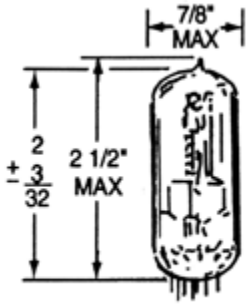


Diagram B
9-Pin Miniature Base

Timing Specifications:
Timing - Fixed: 1 through 300 secs. - (octal style) or 1 - 120 secs. (9-pin miniature style)
Timing Tolerance: ±20% - Tighter tolerances are available.
Repeatability: ±5%
Release Time: Contact factory
Timing Cycle Interrupt Transfer: none

Initial Dielectric Strength:
1-10 Second Type: Between open contacts: 250V RMS; Between contacts & coil: 500V RMS
15 - 300 Second Type: Between open contacts: 800V RMS; Between contacts & coil: 500V RMS

Input Information:
Voltage: AC or DC - 6V, 12V, 26V, 50V and 115V. **Other voltages are available.**
Power Requirement: 2.0 Watts approx.
Transient Protection: impervious to transients
Polarity Protection: None required

Input Voltages & Limits:

Nominal	Minimum	Maximum
6V AC/DC	4V	8V
12V AC/DC	10V	14V
26V AC/DC	22V	30V
50V AC/DC	42	58V

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115V AC/DC	90V	130V

Wiring Diagrams:

Base Wiring 9-Pin Miniature
Pins 1 & 6 - Heater
Pins 3 & 4 - First Contact
Pins 8 & 9 - Second Contact

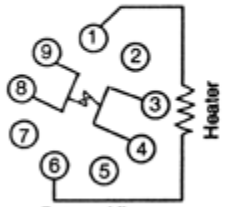


Diagram C

Base Wiring Standard Octal
Pins 2 & 3 - Heater
Pin 5 - First Contact
Pin 7 - Second Contact

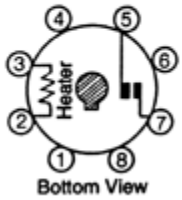


Diagram D

Ordering Information:
Definition of a part number for the Amperite G Series Time Delay Relay.
Example:

115 NO 60 T
A B C D

A: Denotes nominal Input voltage. Voltages Available: 6, 12, 26, 50 & 115V AC/DC. **Custom Voltages are available.**

B: Denotes contact form:
NO = normally open (Delay on Make) -1 form A - SPST
C = normally closed (Delay on Break) -1 form B - SPST

C: Denotes timing value: Factory preset time delays from 1 - 300 secs. are available (octal style) and 1 - 120 secs. (9-pin miniature style)

D: Denotes type of glass envelope: Blank = octal style. T = 9-pin miniature style.

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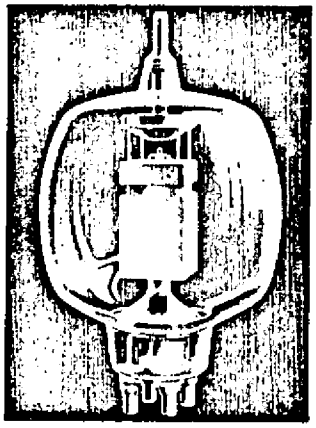
from JEDEC release #4514, Dec. 2, 1963

Amperex® ELECTRONIC CORPORATION
HICKSVILLE, L. I., N. Y., 11802

TUBE TYPE 7092

The Amperex 7092 is a directly heated triode especially designed for industrial oscillator and amplifier applications for both intermittent and continuous operation. This tube features rugged construction and excellent overload characteristics and can operate at frequencies up to 50 megacycles.

GENERAL CHARACTERISTICS



MECHANICAL

Maximum Overall Dimensions	
Length	10-1/64 inches
Diameter	6-1/8 inches
Mounting Position	vertical, base up or down
Maximum Seal Temperature	220°C
Maximum Bulb Temperature	350°C
Auxiliary Cooling[1]	forced air
Net Weight	1.32 lbs.
Accessories	
Plate Connector	S-3702
Socket	S-21421

ELECTRICAL

Cathode	thoriated tungsten
Filament Voltage	6.3 volts
Filament Current	32.5 amps
Amplification Factor	
E_b = 40KV, I_b = 190 ma	22
Transconductance	
E_b = 4 KV, I_b = 190 ma	5100 μmhos
Direct Interelectrode Capacitances	
Grid to Plate	6.2 pf
Grid to Filament	10.5 pf
Plate to Filament	0.25 pf

Amperex

[1] Cooling is generally not required under matched load conditions up to 50 Mc when the plate voltage does not exceed 3000 volts. At higher plate voltages, higher frequencies, and non-matched load operation, a low velocity air flow directed at the tube, preferably below the tube socket, is required. A small fan or centrifugal blower will be sufficient.

Industrial Oscillator - Class C
Continuous Duty Three Phase Rectified Unfiltered Plate Supply
Maximum Ratings, Absolute Values

Frequency	50 Mc
DC Plate Voltage	7000 volts
DC Grid Voltage	-1250 volts
DC Plate Current	750 ma
DC Grid Current	300 ma
DC Grid Current (no load)	400 ma
Plate Dissipation	800 watts
Plate Power Input	4000 watts
Grid Resistor	10,000 ohms

Typical Operation

Frequency	50	50	50	50 Mc
DC Plate Voltage	6000	5000	4000	3000 volts
DC Grid Voltage	-450	-400	-360	-300 volts
Peak RF Grid Voltage	760	770	730	670 volts
DC Plate Current (full load)	600	700	700	700 ma
DC Plate Current (no load)	120	150	170	200 ma
DC Grid Current (full load)	150	160	180	200 ma
DC Grid Current (no load)	260	280	300	340 ma
Grid Resistor	3000	2500	2000	1500 ohms
Driving Power (approx.)	114	123	131	134 watts
Plate Input	3600	3500	2800	2100 watts
Plate Dissipation	760	780	640	540 watts
Plate Power Output	2840	2720	2160	1560 watts
Efficiency	79	78	77	74 %
Plate Load Impedance	5400	3800	3000	2250 ohms
Feedback Ratio	7.5	6	5	4

Industrial Oscillator - Class C
Continuous Duty Single Phase Rectified Unfiltered Plate Supply
Maximum Ratings, Absolute Values

Frequency	50 Mc
DC Plate Voltage	6300 volts
DC Plate Input	4000 watts
DC Grid Voltage	-1250 volts
DC Plate Current	670 ma
DC Grid Current (loaded)	270 ma
DC Grid Current (unloaded)	400 ma
Plate Dissipation	800 watts
Grid Resistor	10,000 ohms

Typical Operation

Frequency	50	50	50	50 Mc
DC Plate Voltage	5400	4500	3600	2700 volts
DC Grid Voltage	-420	-375	-325	-270 volts
Peak RF Grid Voltage	750	715	685	625 volts
DC Plate Current (full load)	530	600	630	630 ma
DC Plate Current (no load)	100	120	155	180 ma
DC Grid Current (full load)	140	150	160	180 ma
DC Grid Current (no load)	240	260	270	305 ma
Grid Resistor	3000	2500	2000	1500 ohms
Driving Power (approx.)	105	107	110	113 watts
Plate Input	3820	3320	2800	2100 watts
Plate Dissipation	770	770	640	540 watts
Plate Power Output	2750	2550	2160	1560 watts
Efficiency	78	77	77	74 %
Plate Load Impedance	5400	3800	2850	2140 ohms
Feedback Ratio (full load)	7.5	6.5	6.35	5

Self Rectified Industrial Oscillator - Class C
Maximum Ratings, Absolute Values

Frequency	50 Mc
Secondary Transformer Voltage (RMS)	5600 volts
DC Grid Voltage[2]	-1250 volts
DC Plate Current[3]	400 ma
DC Grid Current[3]	160 ma
DC Grid Current (no load)	210 ma
Plate Dissipation	800 watts
Plate Power Input	2250 watts
Grid Resistor	10,000 ohms

Typical Operation[4]

Frequency	50 Mc
Secondary Transformer Voltage (RMS)	5200 volts
DC Plate Current (full load)[3]	360 ma
DC Plate Current (no load)[3]	90 ma
DC Grid Current (full load)[3]	100 ma
DC Grid Current (no load)[3]	140 ma
Grid Resistor	1800 ohms
Plate Load Impedance (matched)	3200 ohms
Feedback Ratio (Plate to Grid RF Voltage)	6
Plate Input Power	2080
Plate Dissipation	520 watts
Plate Power Output	1560 watts
Efficiency	75 %

Industrial Oscillator - Class C - Intermittent Duty
Three Phase Rectified Unfiltered Plate Supply
Maximum Ratings, Absolute Values

Frequency	50 Mc
DC Plate Voltage	7000 volts
DC Grid Voltage	-1250 volts
DC Plate Current	1000 ma
DC Grid Current	300 ma
DC Grid Current (no load)	400 ma
Plate Dissipation[5]	800 watts
Grid Resistor	10,000 ohms
DC Plate Input	7000 watts

Typical Operation

Frequency	50	50 Mc
DC Plate Voltage	6000	5000 volts
DC Grid Voltage	-475	-380 volts
Peak RF Grid Voltage	920	900 volts
DC Plate Current (full load)	950	900 ma
DC Plate Current (no load)	180	200 ma
DC Grid Current (full load)	190	190 ma
DC Grid Current (no load)	390	390 ma
Grid Resistor	2500	2000 ohms
Driving Power (approx.)	175	170 watts
Plate Input	5700	4500 watts
Plate Dissipation	1300	1125 watts
Plate Power Output	4400	3375 watts
Efficiency	77	75 %
Plate Load Impedance	3200	2700 ohms
Feedback Ratio (full load)	6	5

---

[2] At peak of line sinewave.
[3] Averaged over line frequency cycle.
[4] Recommended grid blocking capacitor:
low frequency (1 Mc) 1000 pf
high frequency (50 Mc) 100 pf
[5] See: Intermittent Duty Curves.

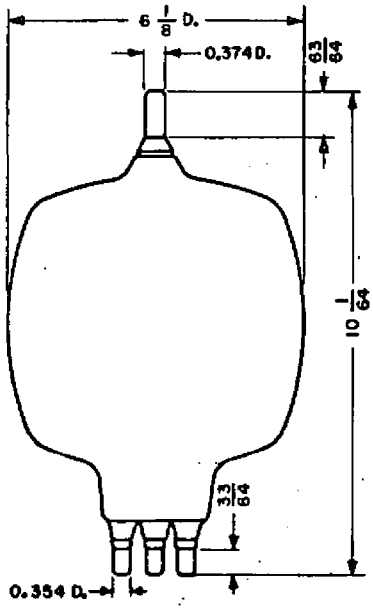
Industrial Oscillator - Class C - Intermittent Duty
Single Phase Rectified Unfiltered Plate Supply

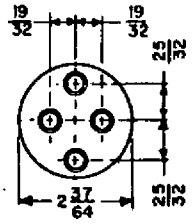
• Maximum Ratings, Absolute Values

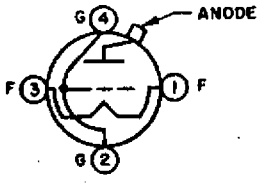
Frequency	50 Mc
DC Plate Voltage	6300 volts
DC Grid Voltage	-1250 volts
DC Plate Current	900 ma
DC Grid Current	270 ma
DC Grid Current (no load)	360 ma
Plate Dissipation[5]	800 watts
Grid Resistor	10,000 ohms

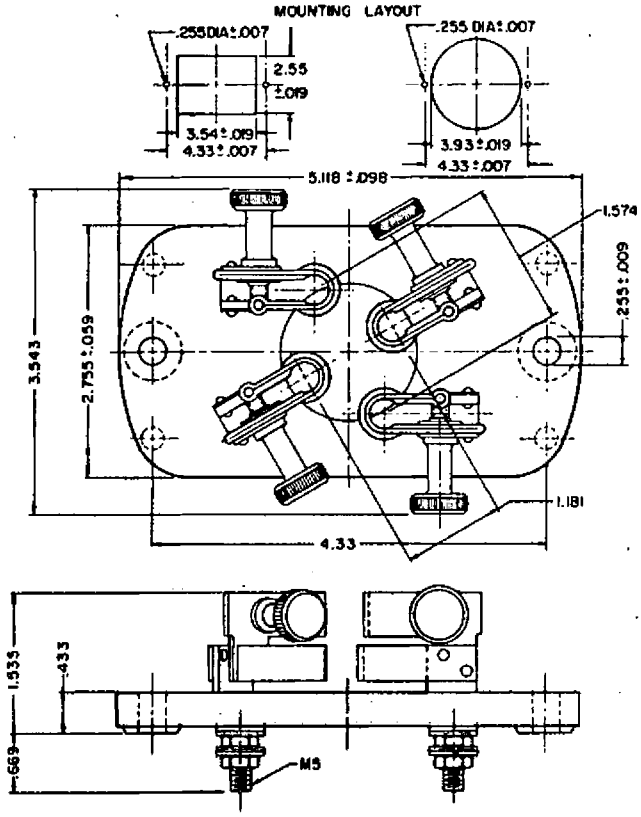
Typical Operation

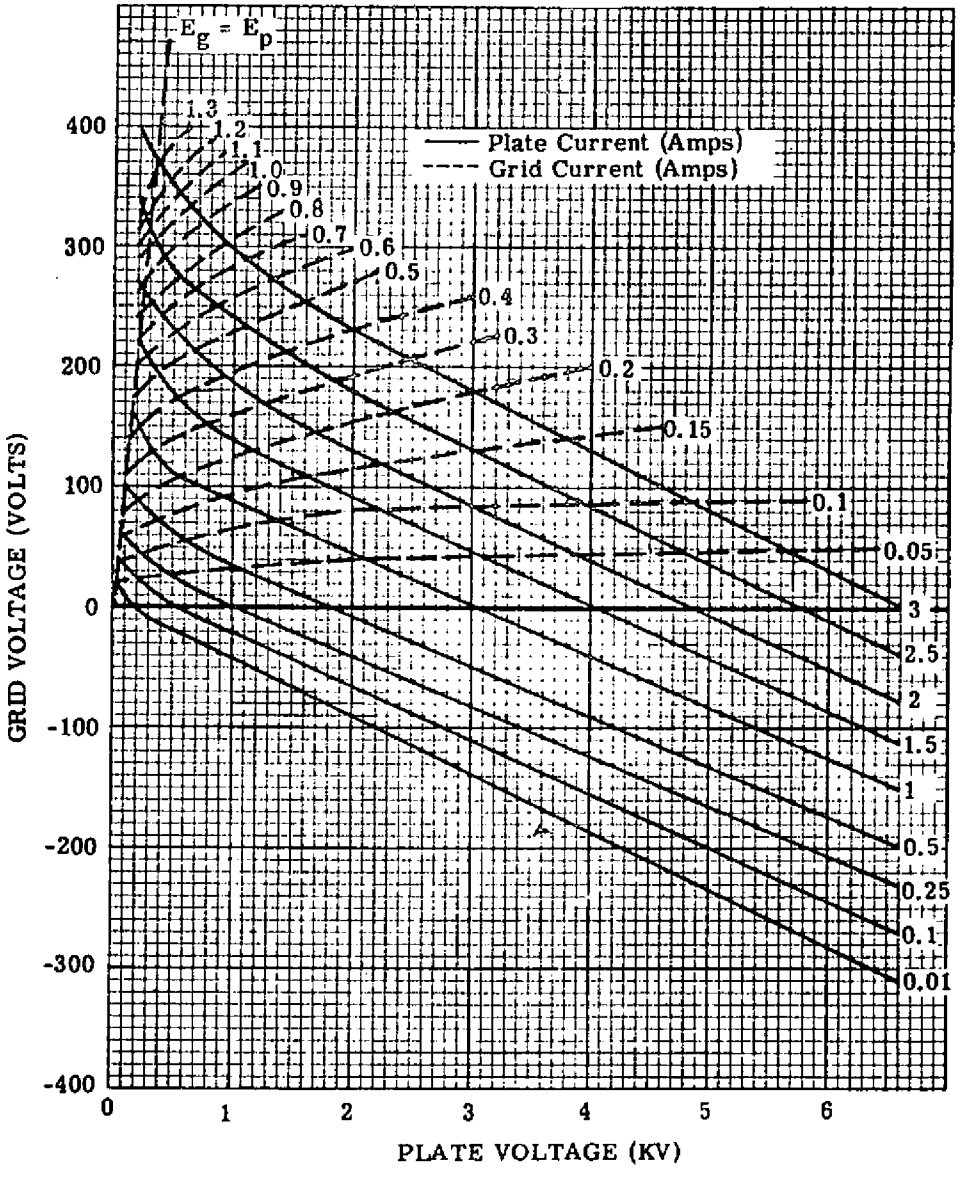
Frequency	50 Mc
DC Plate Voltage	5000 volts
DC Grid Voltage	-440 volts
Peak RF Grid Voltage	865 volts
DC Plate Current	770 ma
DC Grid Current	175 ma
Grid Resistor	2500 ohms
Driving Power (approx.)	169 watts
Plate Load Impedance	3320 ohms
Plate Dissipation	1050 watts
Plate Power Input	4735 watts
Plate Power Output	3685 watts

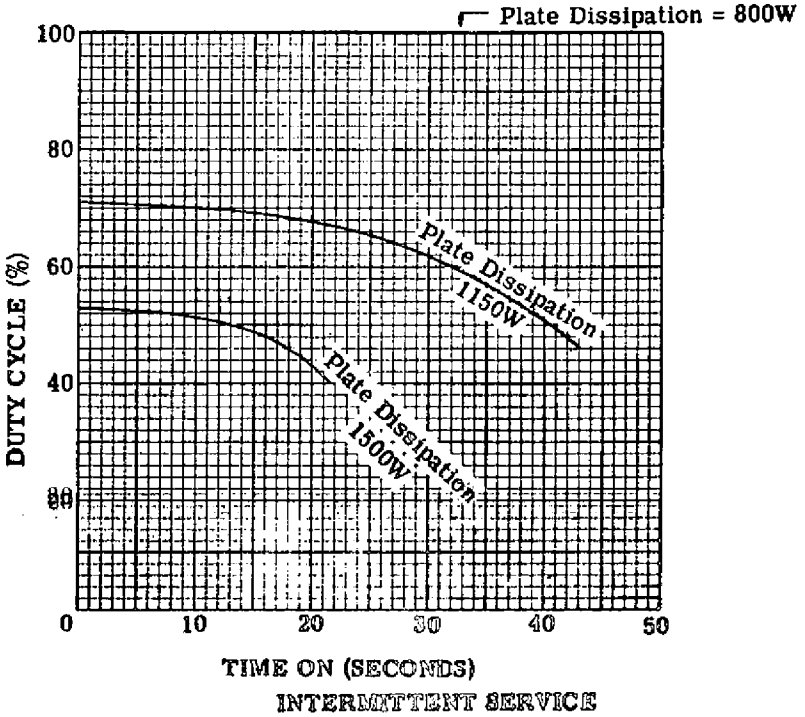









$E_g = E_p$
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.15
0.1
0.05
3
2.5
2
1.5
1
0.5
0.25
0.1
0.01
Plate Current (Amps)
Grid Current (Amps)
GRID VOLTAGE (VOLTS)
400
300
200
100
0
-100
-200
-300
-400
0
1
2
3
4
5
6
PLATE VOLTAGE (KV)


Plate Dissipation = 800W
Plate Dissipation 1150W
Plate Dissipation 1500W
DUTY CYCLE (%)
100
80
60
40
20
0
10
20
30
40
50
TIME ON (SECONDS)

from JEDEC release #4505, Nov. 25, 1963

AMPEREX TUBE TYPE 7136

The 7136 is a single anode, high-voltage, mercury vapor rectifier having plate current ratings intermediate between the standard types 575A and 6693. It has a cathode and anode design similar to the 6693 and is based for the 575A socket. It is recommended for use as a replacement for the 575A in existing equipment when greater reliability is desired. For new equipment design, the use of the Amperex 6693 is preferred.

GENERAL CHARACTERISTICS

ELECTRICAL

Cathode	Directly heated, oxide coated
Filament Voltage	5 volts [1]
Filament Current	11.5 amps
Heating Time (minimum)	60 sec. [2]
Tube Voltage Drop	12 volts [3]
Equilbrium condensed mercury temperature rise over ambient (see curve)	
No Load	19°C
Full Load	21°C

MECHANICAL

Mounting Position	Vertical, base down
Max. Overall Length	11 9/16 inches
Max. Diameter	2 27/32 inches
Plate Cap	Medium
Base	Jumbo, 4 pin with bayonnet
Socket	Johnson 123-211-100 or equal

[1] For optimum performance, a phase shift of 90° ± 30° between the anode and filament voltages and use of a center tapped filament transformer are recommended.

[2] For average conditions, e.g. temperatures within limits and proper distribution of mercury. To insure proper distribution of mercury, upon installation and after a long interruption of service, a longer heating time is required before anode voltage is applied. In general, a time of 30 minutes will be sufficient.

[3] Measured at an average anode current of 3 amps.

MAXIMUM RATINGS

Peak Inverse Anode Voltage [4]	15 max. KV
Average Anode Current [5]	2.5 max. amps
Peak Anode Current	12 max. amps.
Surge Anode Current for max. of 0.1 second	120 max. amps

Relation Between Condensed Mercury Temperature, Ambient Temperature and Peak Inverse Voltage [6] (see curve)

Peak Inverse Anode Voltage	15	10	2.5 KV
Condensed Mercury Temp.	25-55	25-60	25-75°C
Ambient Temp. [7]	15-35	15-40	15-55°C

MAXIMUM OPERATING CONDITIONS
PEAK INVERSE ANODE VOLTAGE = 15 KV

(Transformer regulation and tube voltage drop are not included)

Circuit Diagram	Type of Circuit	Max transformer sec. rms voltage (Vtr) KV	DC output voltage to filter (Vo) KV	Max DC output current to filter (Io) Amps	Max DC output to filter (Wo) KW
a.	Single-phase full-wave, 2 tubes	5.3	4.8	5	24
b.	Single-phase full-wave, 4 tubes	10.6	9.6	5	48
c.	Three-phase half-wave, 3 tubes	6.1	7.2	7.5	54
d.	Three-phase, double Y, 6 tubes parallel with balance coil	5.3	6.2	15	93
e.	Three-phase full-wave, 6 tubes	10.6	14.4	7.5	108

[4] For supply frequency up to 150 cycles per second.

[5] Averaged over 10-sec. interval.

[6] If the equipment is started at most twice daily it is permissable to apply high voltage at a condensed mercury temperature of 20°C.

[7] With natural cooling, approx. values.

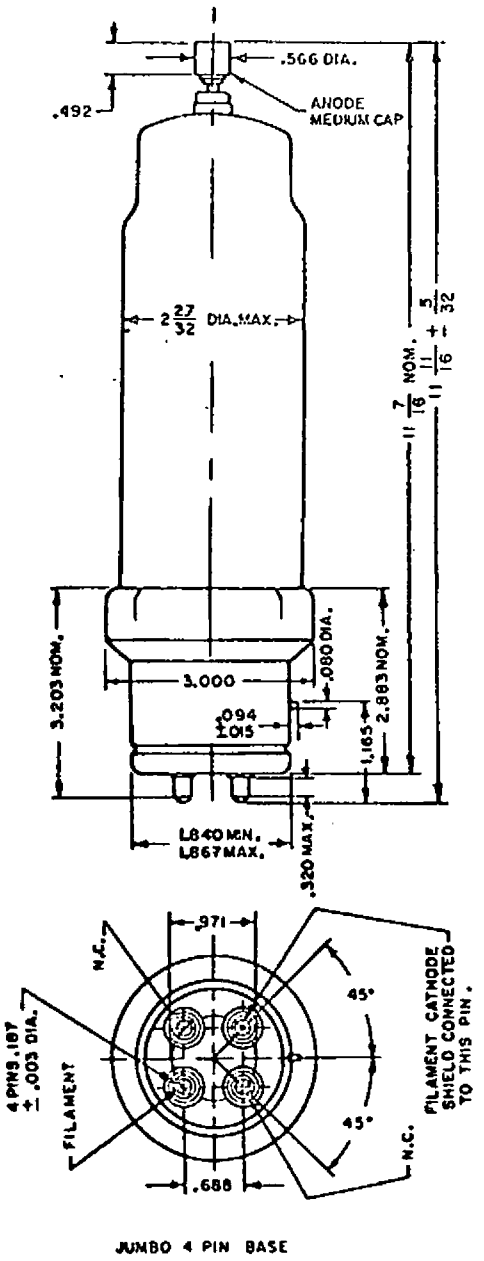
7136

TYPICAL OPERATING CONDITIONS
PEAK INVERSE VOLTAGE = MAX. 15 KV [8]

Circuit Diagram	Type of Circuit	No load transformer sec. rms voltage (Vtr) KV	DC output voltage to load [9] (Vo_1) KV	Max DC output current (Io) Amps	DC output to load (Wo_1) KW
a.	Single-phase full-wave, 2 tubes	4.80	4.0	5	20
b.	Single-phase full-wave, 4 tubes	9.60	8.0	5	40
c.	Three-phase, half-wave, 3 tubes	5.55	6.0	7.5	45
→ d.	Three-phase, double Y, 6 tubes	4.80	5.15	15	77.25
→ e.	Three-phase full-wave, 6 tubes	9.60	12.0	7.5	90

[8] This value corresponds to a nominal peak inverse anode voltage of 13.6 KV, allowing a line fluctuation of ± 10%.

[9] Tube voltage drop and losses in transformer, filter, ammeter, etc. amounting to 8% of Vo_1 have already been deducted.



JUMBO 4 PIN BASE

7136

RECTIFIER CIRCUIT	SINGLE PHASE FULL-WAVE 2 TUBES	SINGLE PHASE FULL-WAVE 2 TUBES	THREE PHASE HALF-WAVE	THREE PHASE DOUBLE-Y WITH BALANCE COIL	THREE PHASE FULL-WAVE
Conditions assumed for following relations 1. Sine-Wave Supply 2. Balanced Phase Voltages 3. Zero Tube Drop 4. Pure Resistance Load 5. No Filter Used NOTE: All rectifier filaments supplied by single phase transformers, with secondaries insulated for voltages greater than the Maximum Peak Inverse Voltage.	FIG. A	FIG. B	FIG. C	FIG. D	FIG. E
E Average	.450 *E* rms .318 *E* max	.900 *E* rms .636 *E* max	1.170 *E* rms .827 *E* max	1.170 *E* rms .827 *E* max	2.34 *E* rms 1.65 *E* max
E Inverse	3.14 *E* avg	1.57 *E* avg	2.09 *E* avg	2.09 *E* avg	1.045 *E* avg
I Average	.636 *I* max	.636 *I* max	.718 *I* max	1.91 *I* max	.955 *I* max
Ripple Frequency	2 X Supply Freq.	2 X Supply Freq.	3 X Supply Freq.	6 X Supply Freq.	6 X Supply Freq.
Ripple Voltage (Rms)	48.3%	48.3%	18.3%	4.2%	4.2%
† Ratio $\frac{\text{Secondary Kva}}{\text{D.C. Output-Kw}}$	1.57	1.11	1.21	1.05	1.05
† Ratio $\frac{\text{Primary Kva}}{\text{D.C. Output-Kw}}$	1.11	1.11	1.21	1.05	1.05

† These ratios assume that a choke input filter is used to maintain the output current substantially constant.

from JETEC release #2214, June 16, 1958

AMPEREX TUBE TYPE 7237

The 7237 is a forced air-cooled triode designed for use in industrial RF generators and communication transmitters. The 7237 features an exclusive specially processed grid which makes possible its high grid current rating and overload characteristics. This is particularly desirable in heavy-duty, industrial applications.

The filament is thoriated tungsten. Maximum ratings apply up to 30 megacycles Typical conditions for Class C industrial oscillator operation at 50 megacycles is presented herein.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament Voltage	12.6 volts
Filament Current	33 amps
Amplification Factor (I_b = 1 amp; E_b = 6000 volts)	32
Transconductance (I_b = 1 amp; E_b = 6000 volts)	15,000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	11 $\mu\mu$f
Grid to Filament	16 $\mu\mu$f
Plate to Filament	0.3 $\mu\mu$f

MECHANICAL

Mounting Position	vertical, anode up or down
Max. Temperature of Filament Seals	210° C
Max. Temperature of Grid & Anode Seals	180° C
Cooling	forced-air

COOLING CHARACTERISTICS

Plate Dissipation (kilowatts)	Altitude (feet)	Inlet Air Temperature (°C)	Min. Air Flow (cu. ft./minute)	Inlet Air Pressure (inlet water)
2	0	35	75	0.26
	0	45	90	0.35
	5000	35	90	0.33
	10000	25	97	0.33
4	0	35	230	1.75
	0	45	270	2.30
	5000	35	270	2.20
	10000	25	310	2.90
6	0	35	301	2.80
	0	45	350	3.65
	5000	35	367	3.65
	10000	25	385	4.40

ACCESSORIES

Filament Connector	Amperex No. S-3707
Filament Center Pin Connector [1]	Amperex No. S-21000
Grid Connector (for use up to 30 mc)	Amperex No. S-17288
Grid Connector (for use above 30 mc)	Amperex No. S-3706
Net Weight (approx.)	7 lbs.

[1] The filament center tap pin (0.413 dia.) must not be used for filament current supply. The filament center pin connector (S-21000) must, however, be used for cooling of this pin.

7237

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier & Modulator
Class B

Maximum Ratings, Absolute Values (per tube)

	CCS	
D.C. Plate Voltage	7.2	KV
D.C. Plate Current	2.2	amps
Plate Input	14	KW
Plate Dissipation	6	KW
Grid Resistor	15,000	ohms

Typical Operation (two tubes)

	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	7000	5000	5000	4000	volts
D.C. Grid Voltage	−210	−145	−145	−120	volts
Peak AF Grid to Grid Voltage	1220	840	690	900	volts
Zero Signal D.C. Plate Current	2x0.2	2x0.15	2x0.15	2x0.1	amps
Max. Signal D.C. Plate Current	2x2	2x1.25	2x1.1	2x1.25	amps
Effective Load Resistance, Plate to Plate	4150	4800	5500	3800	ohms
Max. Signal Drive Power (approx.)	2x310	2x130	2x65	2x140	watts
Max. Signal Power Output (approx.)	20	9	8	7.1	KW

Plate Modulated R.F. Power Amplifier
Class C - Telephony

Carrier conditions per tube with a maximum modulation factor of 1.0

Maximum Ratings, Absolute Values (per tube)

	CCS	
Frequency	30	Mc.
D.C. Plate Voltage	5.5	KV
D.C. Grid Voltage	1250	volts
D.C. Plate Current	1.8	amps
D.C. Grid Current	0.6	amps
Plate Input	9	KW
Plate Dissipation	4	KW

Typical Operation

	CCS	CCS	CCS	
D.C. Plate Voltage	5	5	4	KV
D.C. Grid Voltage [2]	−400	−400	−300	volts
Peak RF Grid Voltage	800	730	680	volts
D.C. Plate Current	1.6	1.4	1.6	amps
D.C. Grid Current	0.6	0.5	0.6	amps
Driving Power	432	328	367	watts
Power Output	6.4	5.6	5.0	KW

[2] Grid bias partially obtained by the grid resistor.

R.F. Power Amplifier & Oscillator
Class C - Telegraphy

7237

Maximum Ratings, Absolute Values (per tube)

	CCS	
Frequency	30	Mc.
D.C. Plate Voltage	7.2	KV
D.C. Grid Voltage	−1250	volts
D.C. Plate Current	2.2	amps
D.C. Grid Current	0.6	amp
Plate Input	14	KW
Plate Dissipation	6	KW

Typical Operation

	CCS	CCS	CCS	CCS	CCS	CCS	
D.C. Plate Voltage	6.5	6.5	6.0	6.0	5.0	5.0	KV
D.C. Grid Voltage	−450	−450	−400	−400	−300	−300	volts
Peak RF Grid Voltage	850	820	820	780	700	660	volts
D.C. Plate Current	2.0	2.0	2.0	2.0	2.0	2.0	amps
D.C. Grid Current	0.6	0.5	0.6	0.5	0.6	0.5	amp
Driving Power	460	370	443	350	378	297	watts
Power Output	10	9.5	9.2	8.5	7.3	7.1	KW

Class C Oscillator

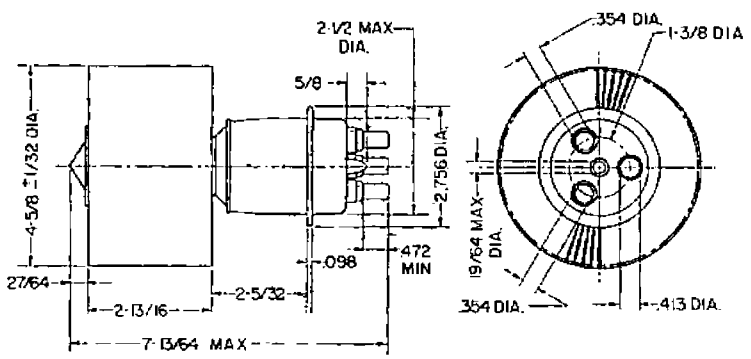
Rectified, Unfiltered, Three-Phase, Half-Wave Plate Supply

Maximum Ratings, Absolute Values (per tube)

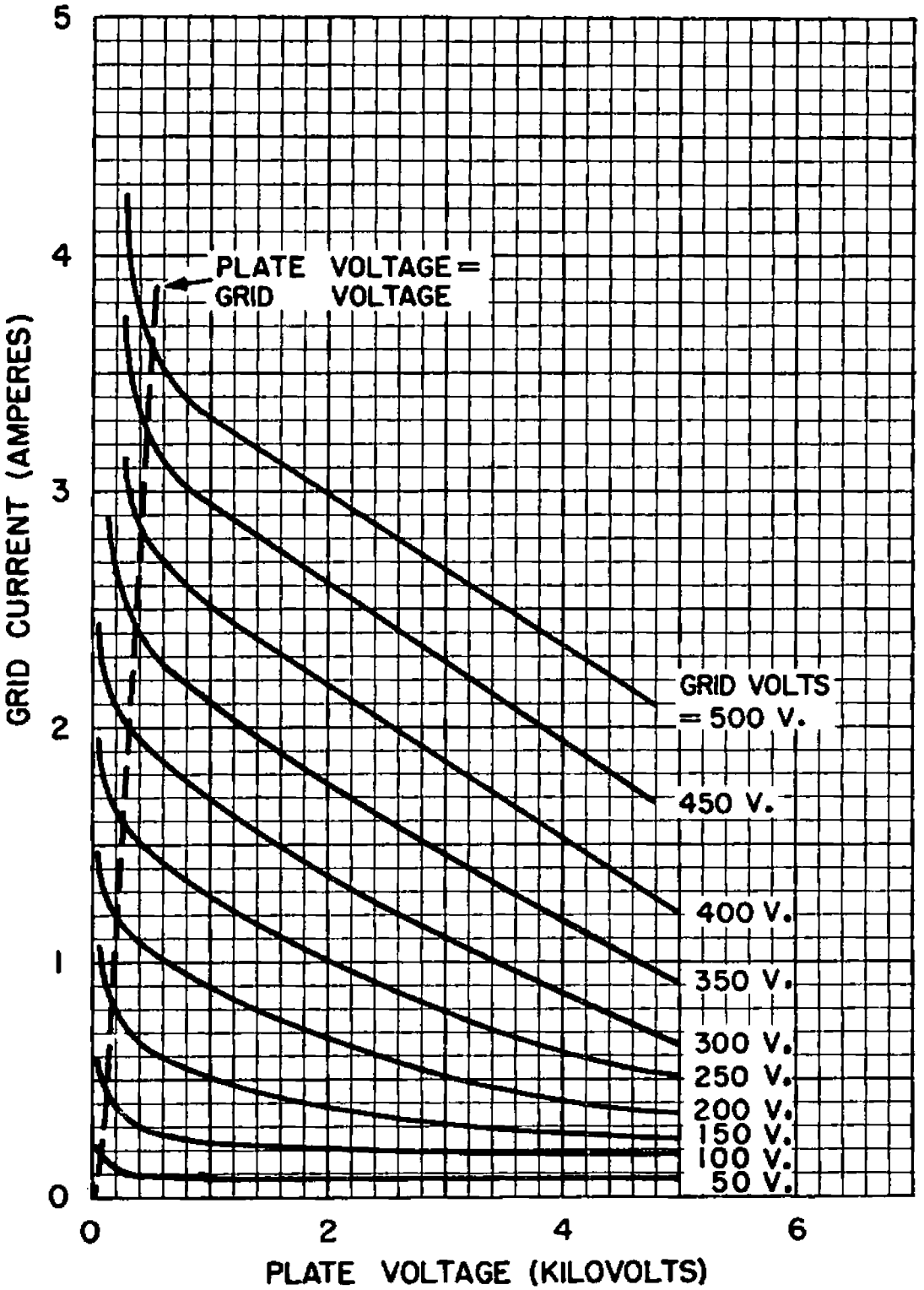
Frequency	55	Mc.
D.C. Plate Voltage	7	KV
D.C. Grid Voltage	−1250	volts
D.C. Plate Current	1.8	amps
D.C. Grid Current (Full Load)	0.5	amp
D.C. Grid Current (No Load)	0.7	amp
Plate Power Input	11	KW
Plate Dissipation	6	KW
Grid Resistor	10	Kilohms

Typical Operation

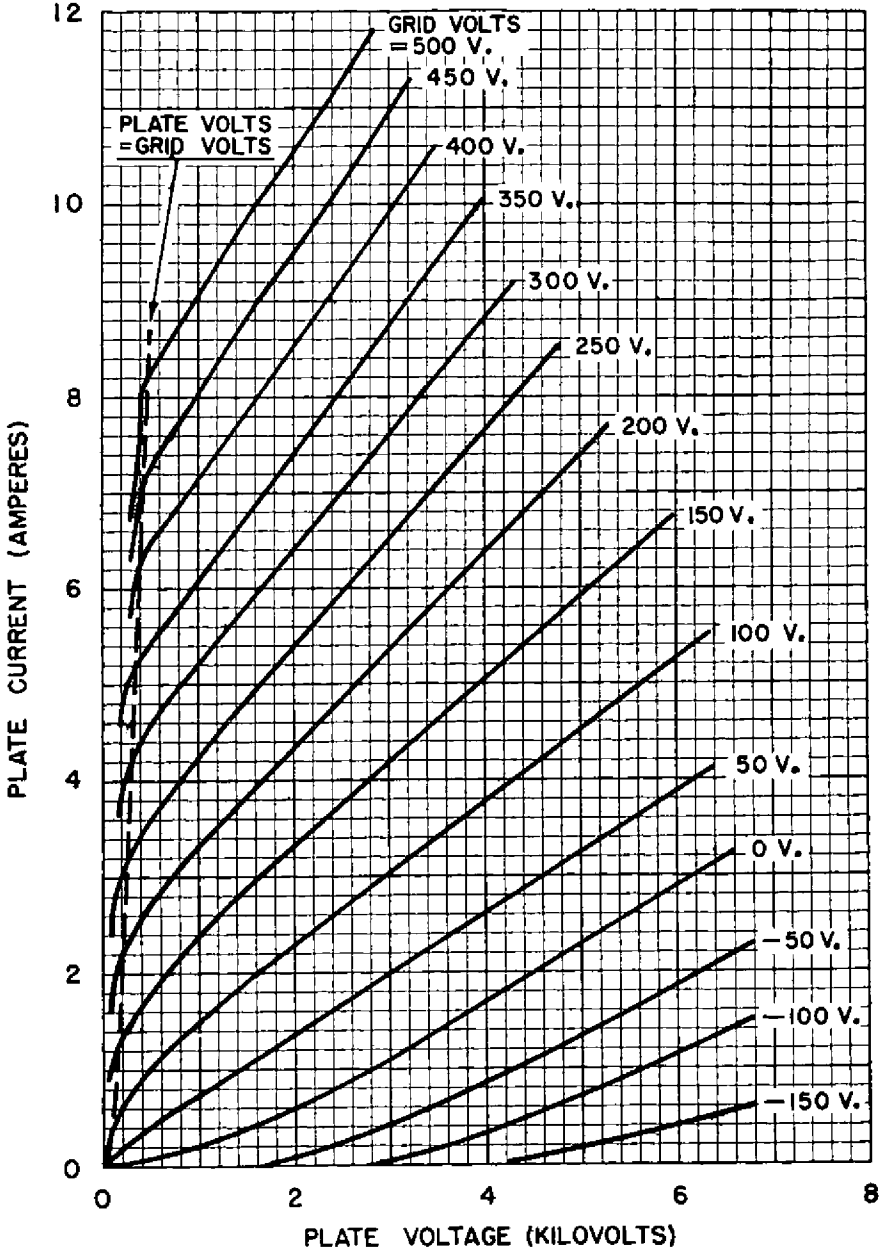
Frequency	50	Mc.
Transformer Secondary Voltage (rms)	5.1	KV
D.C. Plate Voltage	6	KV
D.C. Plate Current	1.5	amps
D.C. Grid Current (Full Load)	0.4	amp
D.C. Grid Current (No Load)	0.7	amp
Grid Resistor	1000	ohms
Plate Power Input	9	KW
Plate Dissipation	2.7	KW
Plate Power Output	6	KW



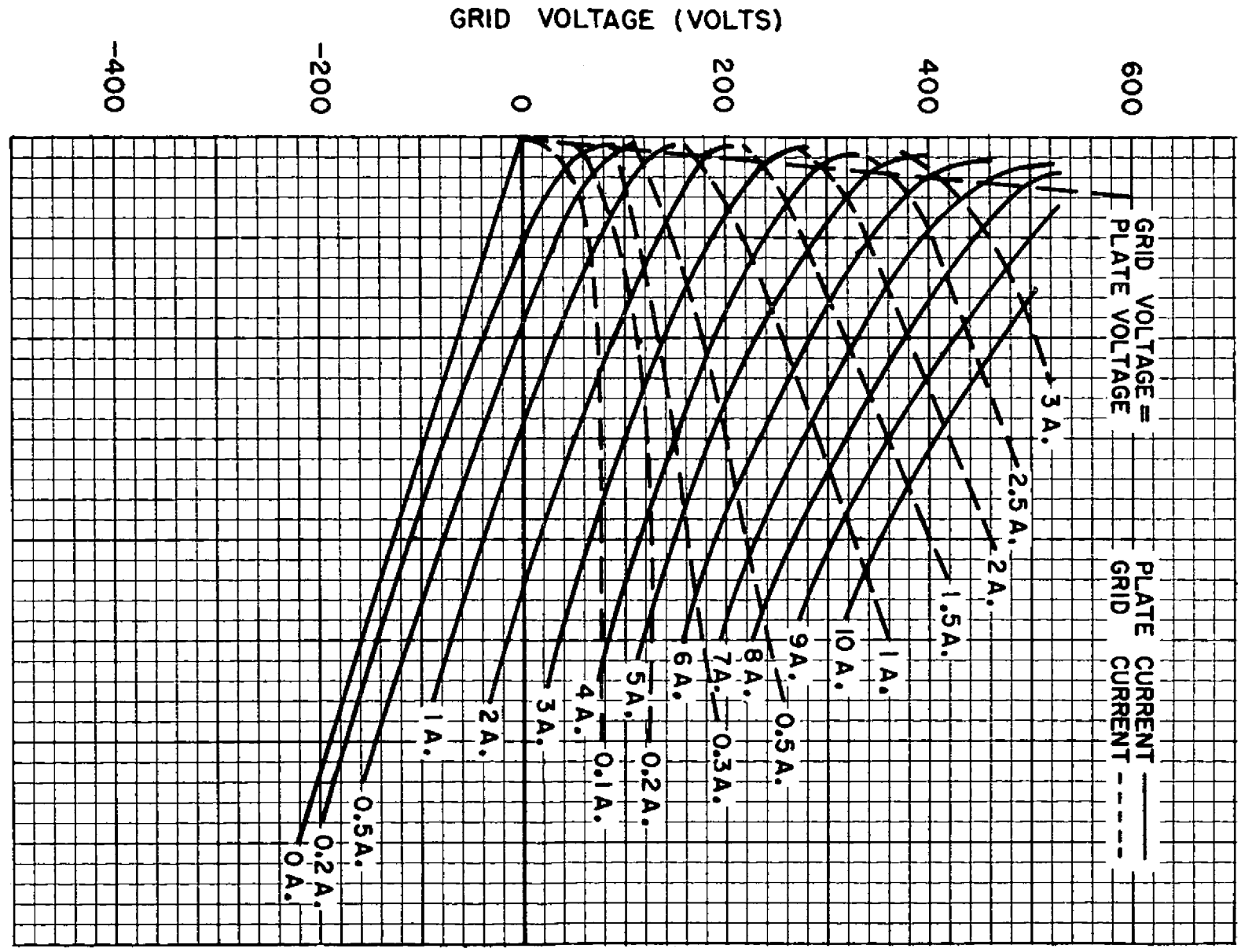
7237

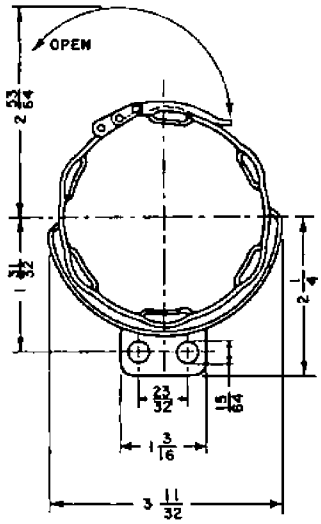

5
4
3
2
1
0
GRID CURRENT (AMPERES)
PLATE VOLTAGE = GRID VOLTAGE
GRID VOLTS = 500 V.
450 V.
400 V.
350 V.
300 V.
250 V.
200 V.
150 V.
100 V.
50 V.
0
2
4
6
PLATE VOLTAGE (KILOVOLTS)

7237

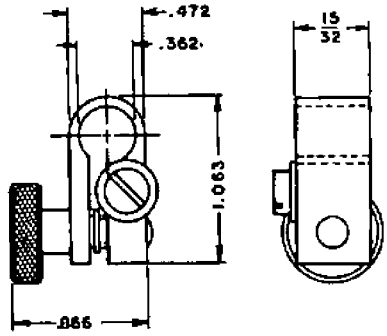

GRID VOLTS
=500 V.
450 V.
400 V.
350 V.
300 V.
250 V.
200 V.
150 V.
100 V.
50 V.
0 V.
−50 V.
−100 V.
−150 V.
PLATE VOLTS
=GRID VOLTS
PLATE CURRENT (AMPERES)
PLATE VOLTAGE (KILOVOLTS)
0
2
4
6
8
10
12

7237

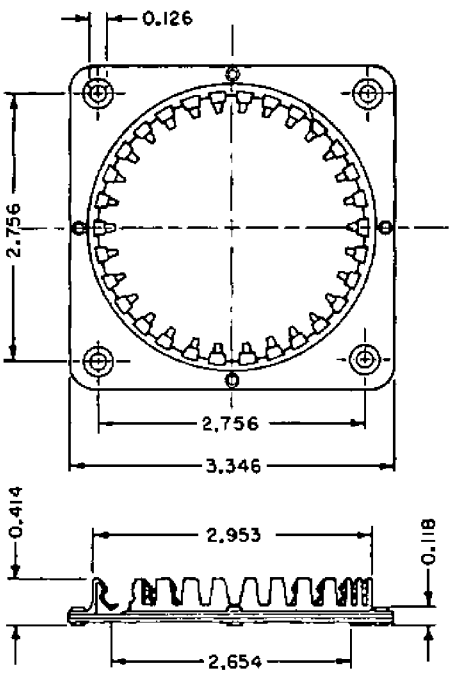

GRID VOLTAGE (VOLTS)
600
400
200
0
-200
-400
PLATE VOLTAGE (KILOVOLTS)
0
2
4
6
8
GRID VOLTAGE =
PLATE VOLTAGE
PLATE CURRENT
GRID CURRENT
3 A.
2.5 A.
2 A.
1.5A.
1 A.
10 A.
9A.
8 A.
7A.
6 A.
5A.
4 A.
3A.
2A.
1A.
0.5A.
0.2A.
0A.
0.5 A.
0.3A.
0.2A.
0.1A.



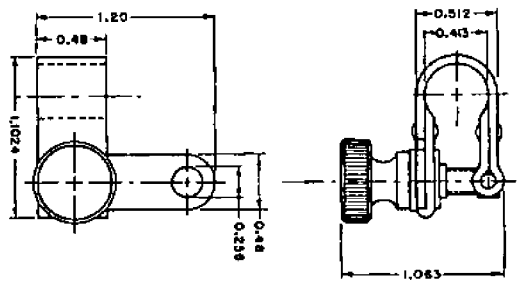
GRID CONNECTOR
S-17288



FILAMENT CONNECTOR S-3707



GRID CONNECTOR
S-3706



FILAMENT CENTER PIN CONNECTOR
S-21000

AMPEREX TUBE TYPE 7377

The 7377 is a radiation cooled, indirectly heated twin tetrode having low internal capacitances and short lead lengths which permit efficient operation at ultra-high frequencies. The 7377 is designed for push-pull class C operation at frequencies up to 1000 Mc/s. Rated at 8 watts plate dissipation per section (CCS), this tube will deliver 4 watts into a load at 960 Mc/s under CCS conditions and 5 watts under ICAS conditions.

GENERAL CHARACTERISTICS

MECHANICAL

Nominal Overall Length	1.97 inches
Nominal Diameter	1.75 inches
Mounting Position	any
Cooling	radiation
Max Bulb and Seal Temperature	220° C

ACCESSORIES

Socket	S-25230

ELECTRICAL

Cathode	oxide coated, unipotential	
Heater Characteristics	Parallel	Series
Heater Voltage	6.3	12.6 volts
Heater Current	0.6	0.3 amps

Direct Interelectrode Capacitances	
Each Section	
Input	4.5 $\mu\mu$f
Output	1.35 $\mu\mu$f
Plate to Grid No. 1	0.145 $\mu\mu$f
Both Sections, Push-Pull	
Input	2.40 $\mu\mu$f
Output	0.82 $\mu\mu$f
Amplification Factor (Each Section), G_1, G_2	28
Transconductance (E_p = 350 V, E_{g2} = 200 V, I_p = 25 mA)	10,500 micromhos

from JEDEC release #2431, April 6, 1959

7377

FM AMPLIFIER - CLASS C
Two Units in Push-Pull

Maximum Ratings, Absolute Values
(Frequency to 1000 Mc/s)

	CCS	ICAS	
Plate Voltage	400	400	volts
Grid No. 2 Voltage	225	225	volts
Negative Grid Voltage	100	100	volts
Plate Current	2 x 45	2 x 50	mA
Grid No. 1 Current	2 x 4	2 x 5	mA
Plate Input Power	2 x 10	2 x 12	watts
Plate Dissipation	2 x 8	2 x 10	watts
Grid No. 2 Dissipation	2 x 1.5	2 x 1.75	watts

Typical Operation

Frequency	960	960	Mc/s
Plate Voltage	250	250	volts
Grid No. 2 Voltage	160 [1]	170 [2]	volts
Negative Grid Voltage	15	15	volts
Plate Current	2 x 35	2 x 40	mA
Grid No. 2 Current	15	15	mA
Grid No. 1 Current	2 x 0.75	2 x 0.75	mA
Grid No. 1 Resistor	2 x 20	2 x 20	kilohms
Drive Power	1.4	1.4	watts
Plate Input Power	2 x 8.8	2 x 10	watts
Plate Dissipation	2 x 5.4	2 x 5.4	watts
Grid No. 2 Dissipation	2.5	2.9	watts
Plate Power Output	7	8	watts
Load Power Output	4	5	watts

FREQUENCY TRIPLER
Two Units in Push-Pull

Maximum Ratings, Absolute Values
(Frequency to 1000 Mc/s)

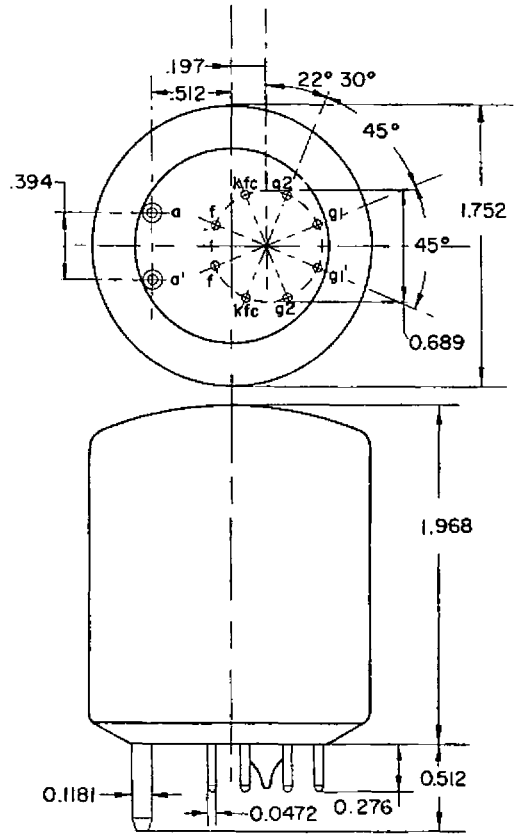
	CCS	ICAS	
Plate Voltage	400	400	volts
Grid No. 2 Voltage	225	250	volts
Negative Grid Voltage	100	100	volts
Plate Current	2 x 40	2 x 40	volts
Grid No. 1 Current	2 x 4	2 x 5	mA
Plate Input Power	2 x 10	2 x 12	watts
Plate Dissipation	2 x 8	2 x 10	watts
Grid No. 2 Dissipation	2 x 1.5	2 x 1.75	watts

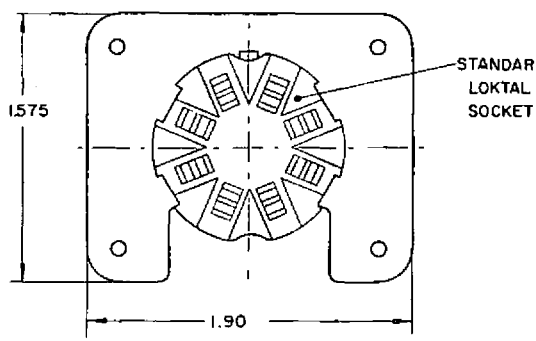
Typical Operation
(Frequencies between 320 - 960 Mc/s)

Plate Voltage	250	250	volts
Grid No. 2 Voltage	150	170	volts
Plate Current	2 x 37.5	2 x 40	mA
Grid No. 2 Current	15	16	mA
Grid No. 1 Current	2 x 2.25	2 x 2.25	mA
Grid No. 1 Resistor	2 x 0.02	2 x 0.02	megohm
Driving Power	3	3	watts
Plate Power Input	2 x 9.5	2 x 10	watts
Plate Dissipation	2 x 8	2 x 8.5	watts
Plate Power Output	2.75	3	watts
Load Power Output	1.5	1.8	watts

[1] Adjust the screen voltage so that $I_b = 2 \times 35$ mA at maximum output power.

[2] Adjust the screen voltage so that $I_b = 2 \times 40$ mA at maximum output power.





SOCKET S-25230

7377

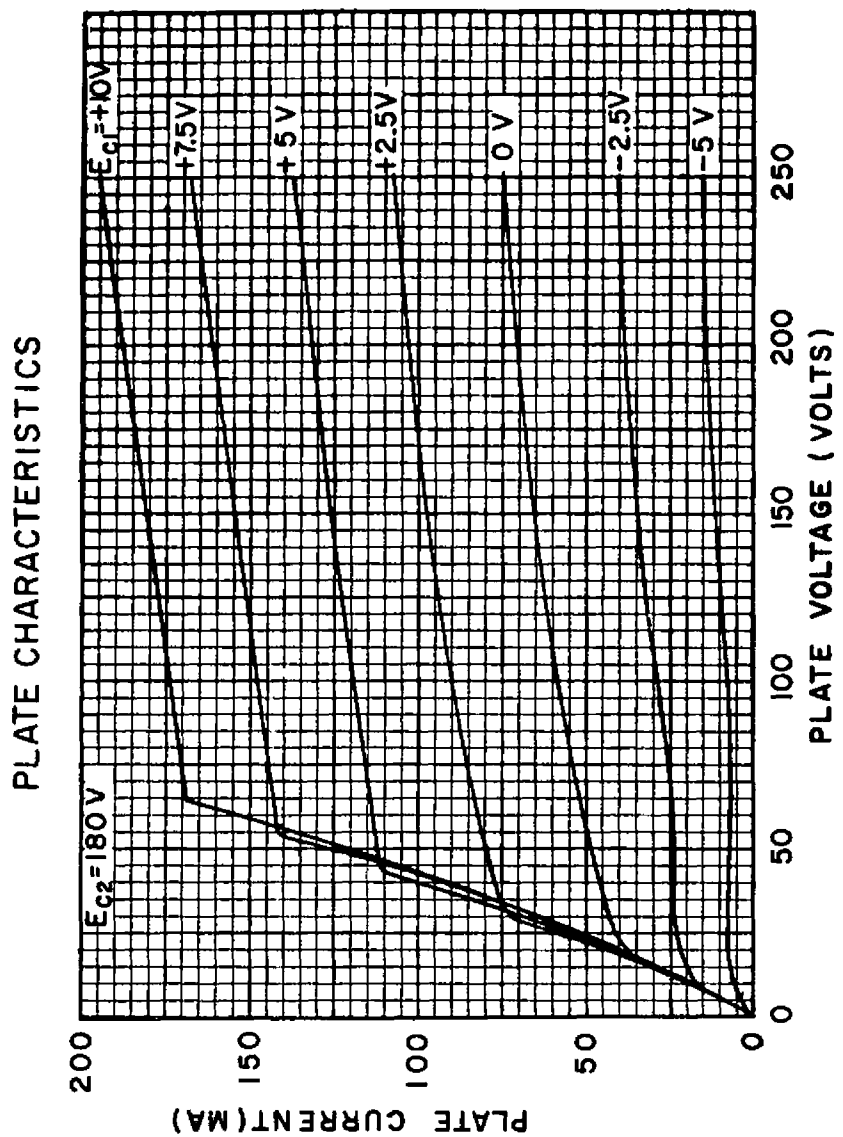
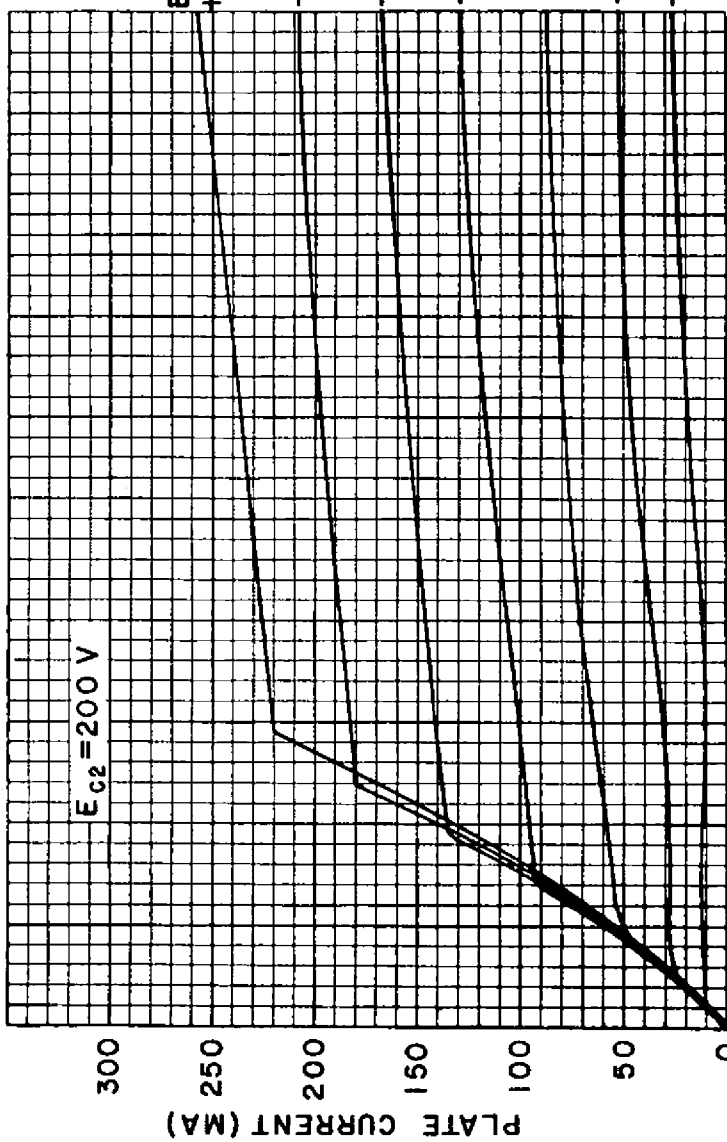
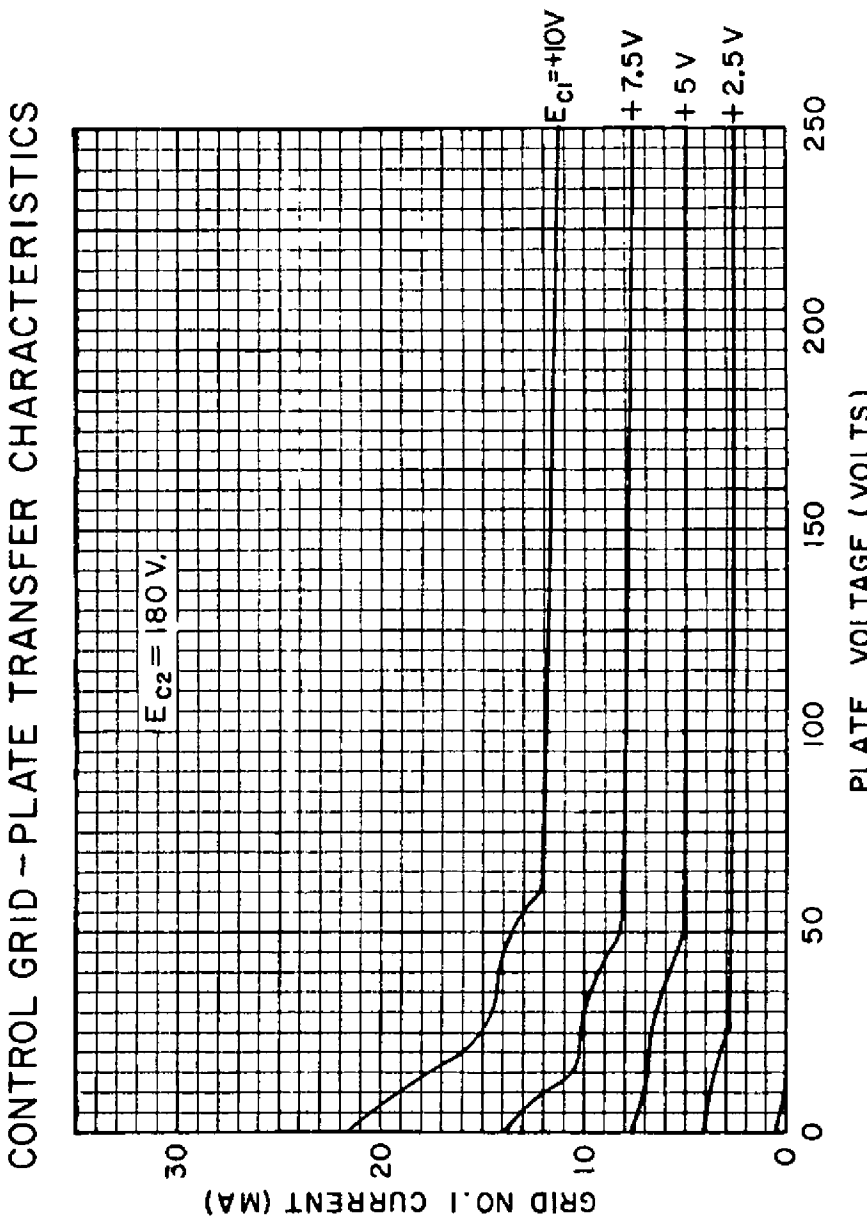

PLATE CHARACTERISTICS
PLATE CURRENT(MA)
200
150
100
50
0
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)
E_{c2}=180V
E_{c1}=+10V
+7.5V
+5V
+2.5V
0V
-2.5V
-5V

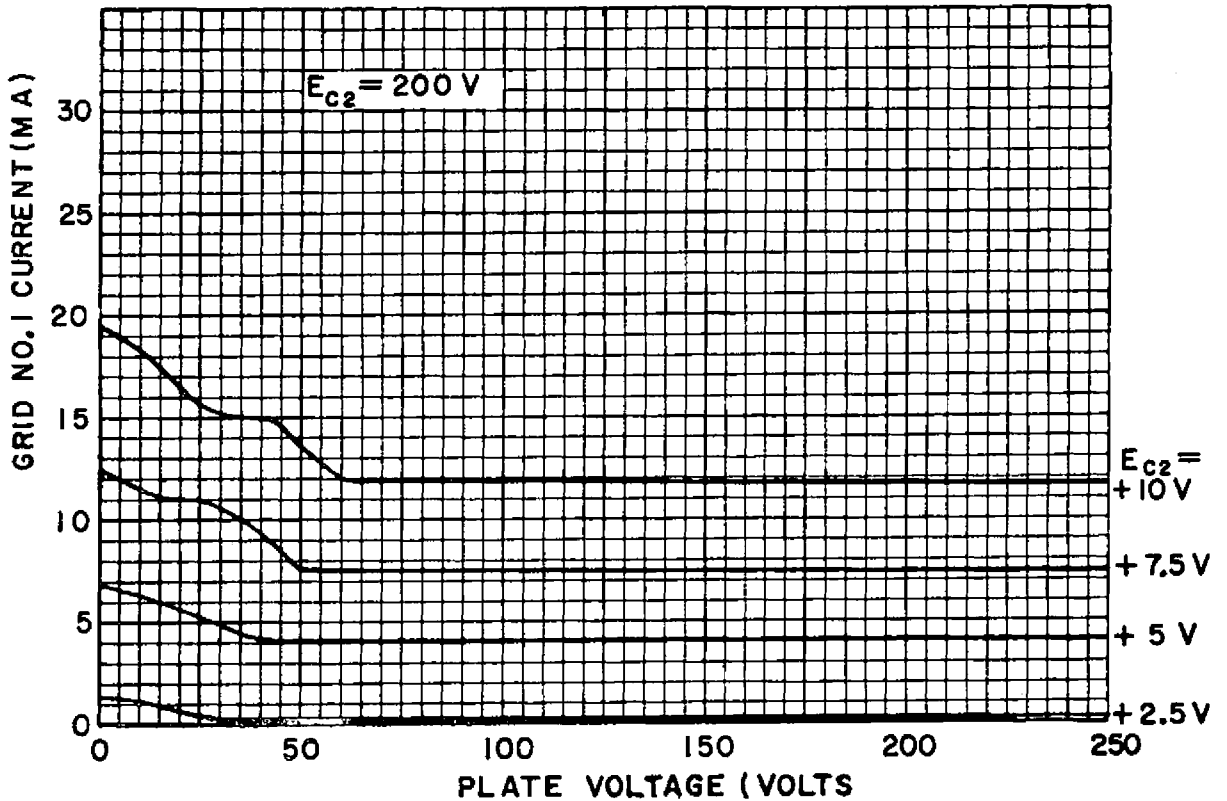
PLATE CHARACTERISTICS



7377

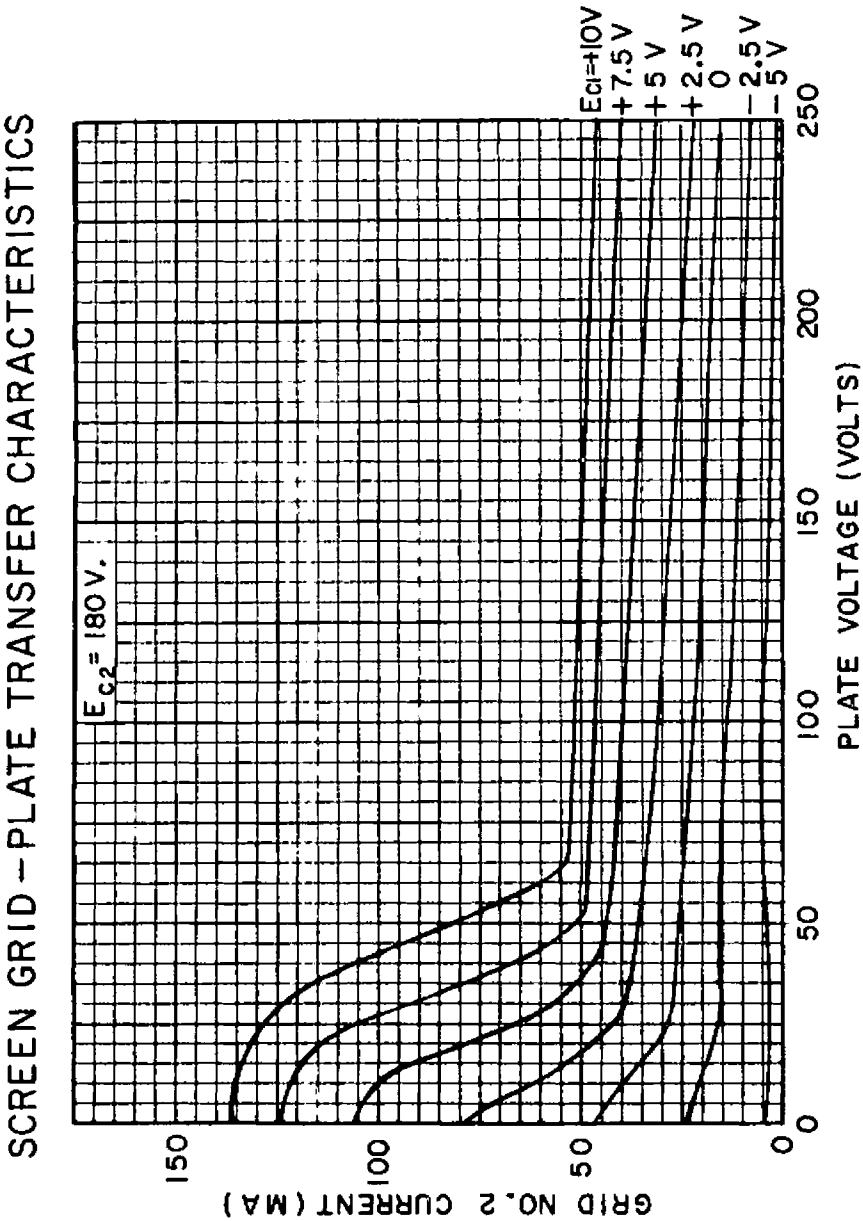

CONTROL GRID – PLATE TRANSFER CHARACTERISTICS
E_{c2} = 180 V.
E_{c1}=+10V
+ 7.5V
+ 5 V
+ 2.5 V
GRID NO.1 CURRENT (MA)
0
10
20
30
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)

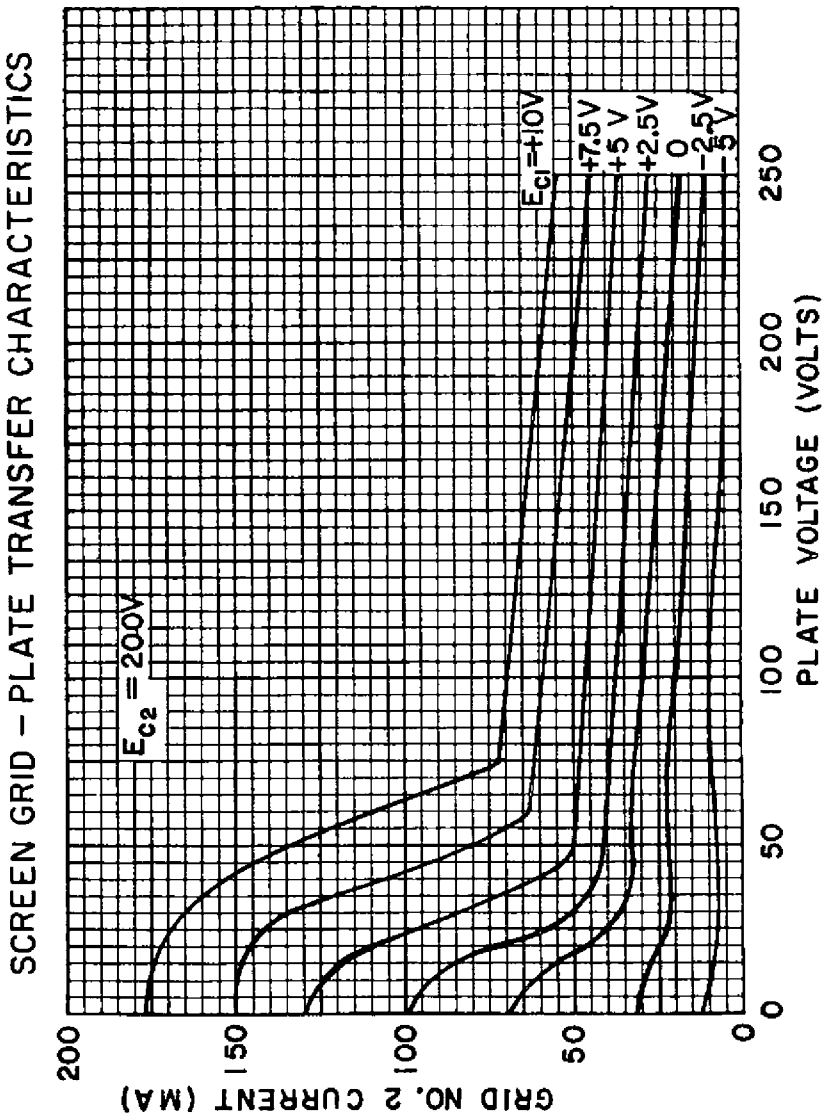
CONTROL GRID–PLATE TRANSFER CHARACTERISTICS



7377

7377


SCREEN GRID-PLATE TRANSFER CHARACTERISTICS
E_{c2} = 180 V.
Ec1=+10V
+7.5 V
+5 V
+2.5 V
0
−2.5 V
−5 V
GRID NO. 2 CURRENT (MA)
0
50
100
150
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)


SCREEN GRID – PLATE TRANSFER CHARACTERISTICS
E_{c2} = 200V
E_{c1}=+10V
+7.5V
+5 V
+2.5V
0
-2.5V
-5 V
GRID NO. 2 CURRENT (MA)
200
150
100
50
0
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)

from JEDEC release #4514, Dec. 2, 1963

AMPEREX TUBE TYPE 7378

The Amperex 7378 is an all-glass, beam power tetrode having a maximum plate dissipation of 100 watts at frequencies up to 30 Mc/s. It is designed for AF or RF amplifier, oscillator, and frequency multiplier service and for single sideband applications.

GENERAL CHARACTERISTICS

MECHANICAL

Dimensions	see outline drawing
Base	giant 5 pin
Maximum Operating Temperature	
Plate seal	220° C
Bottom pins	180° C
Glass Bulb	300° C
Cooling	radiation and convection
Mounting position	vertical or horizontal with plane of plate vertical
Accessories	
Socket	S-25722
Plate clip	S-25723
Net weight	7.8 ounces

ELECTRICAL

Cathode	coated, unipotential
Heater voltage	6.3 volts
Heater current	3.9 amps
Amplification factor, G1 to G2 (E_b = 750 V, E_{c2} = 250 V, I_b = 100 mA)	5.7
Transconductance (E_b = 750 V, E_{c2} = 250 V, I_b = 100 mA)	9000 micromhos
Direct Interelectrode Capacitances	
Input	30 μμf
Output	12.7 μμf
Plate to grid	0.9 μμf

RF POWER AMPLIFIER OR OSCILLATOR - CLASS C
TELEGRAPHY OR FM TELEPHONY
(Key Down Conditions)

Maximum Ratings, Absolute Values

	CCS
Frequency	30 Mc/s
D-C plate voltage	825 volts max
D-C screen voltage	300 volts max
Negative D-C grid voltage	150 volts max
Heater-cathode voltage	125 volts max
D-C plate current	400 mA max
D-C grid current	30 mA max
Plate input power	300 watts max
Screen dissipation	12 watts max
Plate dissipation	100 watts max
Grid resistor	25,000 ohms max

Typical Operation

	CCS
Frequency	30 Mc/s
D-C plate voltage	750 volts
D-C screen voltage	250 volts
Negative D-C grid voltage	90 volts
Peak Drive voltage	120 volts
D-C plate current	385 mA
D-C screen current	20 mA
D-C grid current	7 mA
Driving power	1 watt
Plate Input Power	285 watts
Screen Dissipation	5 watts
Plate Dissipation	85 watts
Plate Output Power	200 watts
Efficiency	70 %

RF AMPLIFIER - CLASS C - TELEPHONY
PLATE AND SCREEN GRID MODULATED
(Carrier Conditions)

Maximum Ratings, Absolute Values

	CCS
Frequency	30 Mc/s
D-C Plate Voltage	650 volts max
D-C Grid Voltage	—150 volts max
D-C Screen Voltage	300 volts max
Heater-Cathode Voltage	125 volts max
D-C Plate Current	350 mA max
D-C Grid Current	30 mA max
Plate Input Power	200 watts max
Screen Dissipation	10 watts max
Plate Dissipation	67 watts max
Grid resistor	25,000 ohms max

Typical Operation

	CCS
Frequency	30 Mc/s
D-C Plate Voltage	600 volts
D-C Screen Voltage	250 volts
D-C Grid Voltage	—100 volts
Peak Drive Voltage	120 volts
D-C Plate Current	300 mA
D-C Screen Current	20 mA
D-C Grid Current	4 mA
Driving Power	0.4 watts
Plate Input Power	180 watts
Screen dissipation	5 watts
Plate dissipation	50 watts
Power Output	130 watts
Efficiency	72%
Modulation depth	100 %
Peak Screen Voltage (AF)	220 volts
Modulation power	90 watts

7378

7378

AF POWER AMPLIFIER AND MODULATOR - CLASS AB_2

Maximum Ratings, Absolute Values

	CCS
D-C Plate Voltage	825 volts max
D-C Screen Voltage	300 volts max
D-C Grid Voltage	−150 volts max
Heater-Cathode Voltage	125 volts max
D-C Plate Current	400 mA max
D-C Grid Current	30 mA max
Screen Dissipation	12 watts max
Plate Dissipation	100 watts max
Bias Resistance	25,000 ohms max

Typical Operation
(Two Tubes)

	CCS		CCS		
D-C Plate Voltage	750		600		volts
D-C Screen Voltage	250		250		volts
D-C Grid Voltage	−45		−45		volts
Load Resistance (Plate to Plate)	3600		3500		ohms
Peak Driving Voltage (Grid to Grid)	0	110	0	105	volts
D-C Plate Current	2 x 45	2 x 280	2 x 25	2 x 235	mA
D-C Screen Current	0	2 x 40	2 x 0.5	2 x 24	mA
D-C Grid Current	0	2 x 1	0	2 x 0.5	mA
Plate Input Power	2 x 34	2 x 210	2 x 15	2 x 140	watts
Screen Dissipation	0	2 x 10	0	2 x 6	watts
Plate Dissipation	2 x 34	2 x 60	2 x 15	2 x 40	watts
Plate Output Power	0	300	0	200	watts
Total Distortion	--	6.5	--	5	%
Efficiency	--	71.5	--	71.5	%

LINEAR RF AMPLIFIER - CLASS AB_1
SINGLE SIDEBAND SUPPRESSED CARRIER OPERATION

Maximum Ratings, Absolute Values

	CCS
Frequency	30 Mc/s max
D-C Plate Voltage	825 volts max
D-C Grid No. 2 Voltage	350 volts max
D-C Grid No. 1 Voltage	−100 volts max
D-C Plate Current	400 mA max
Plate Input	300 watts max
Plate Dissipation	100 watts max
Grid No. 2 Dissipation	12 watts max

Typical Operation
Single Tone and/or Two Tone Modulation

	CCS	ICAS
D-C Plate Voltage	750	750 volts
D-C Grid No. 2 Voltage	310	310 volts
D-C Grid No. 1 Voltage	46	48 volts
Zero-Signal D-C Plate Current	95	73 mA
Zero-Signal D-C Grid No. 2 Current	2	2 mA
Effective RF Load Resistance	1300	1000 ohms

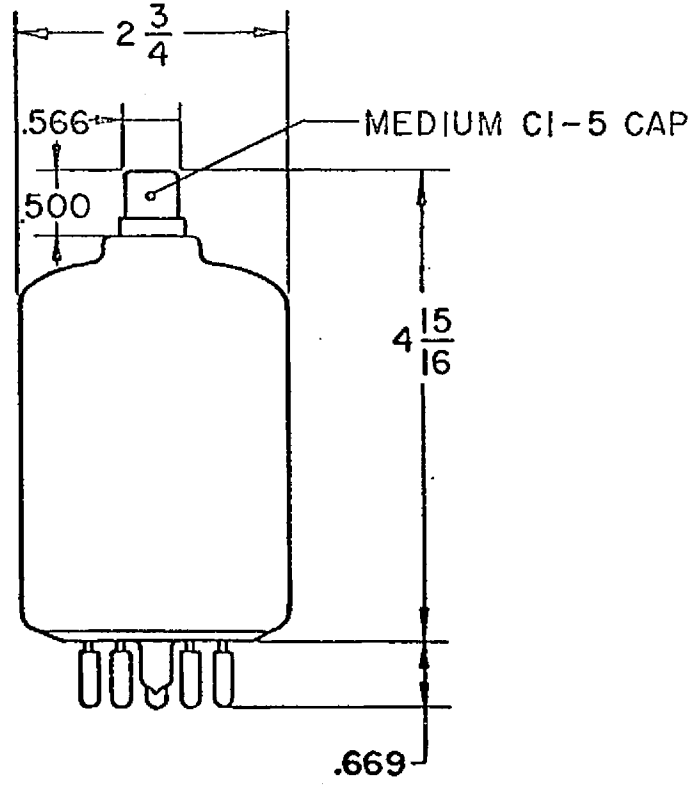
Single-Tone Modulation

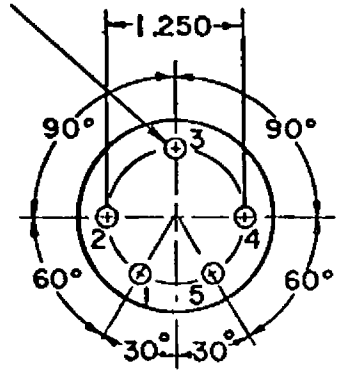
	CCS	ICAS
Max Signal D-C Plate Current	338	435 mA
Max Signal D-C Grid No. 2 Current	38	38 mA
Max Signal D-C Grid No. 1 Current	0	1.6 mA
Max Signal D-C Peak RF grid Voltage	46	58 volts
Max Signal Driving Power	0	0.09 watts
Max Signal Plate Power Output	167	228 watts

Two-Tone Modulation

Average D-C Plate Current	230	272 mA
Average D-C Grid No. 2 Current	22	21 mA
Average D-C Grid No. 1 Current	0	0.32 mA
Max Resultant Peak RF Grid Voltage	46	58 volts
Average Plate Power Output	83.5	114 watts
Peak Envelope Plate Power Output	167	228 watts
3rd Order Intermodulation Distortion	35	27 db

7378





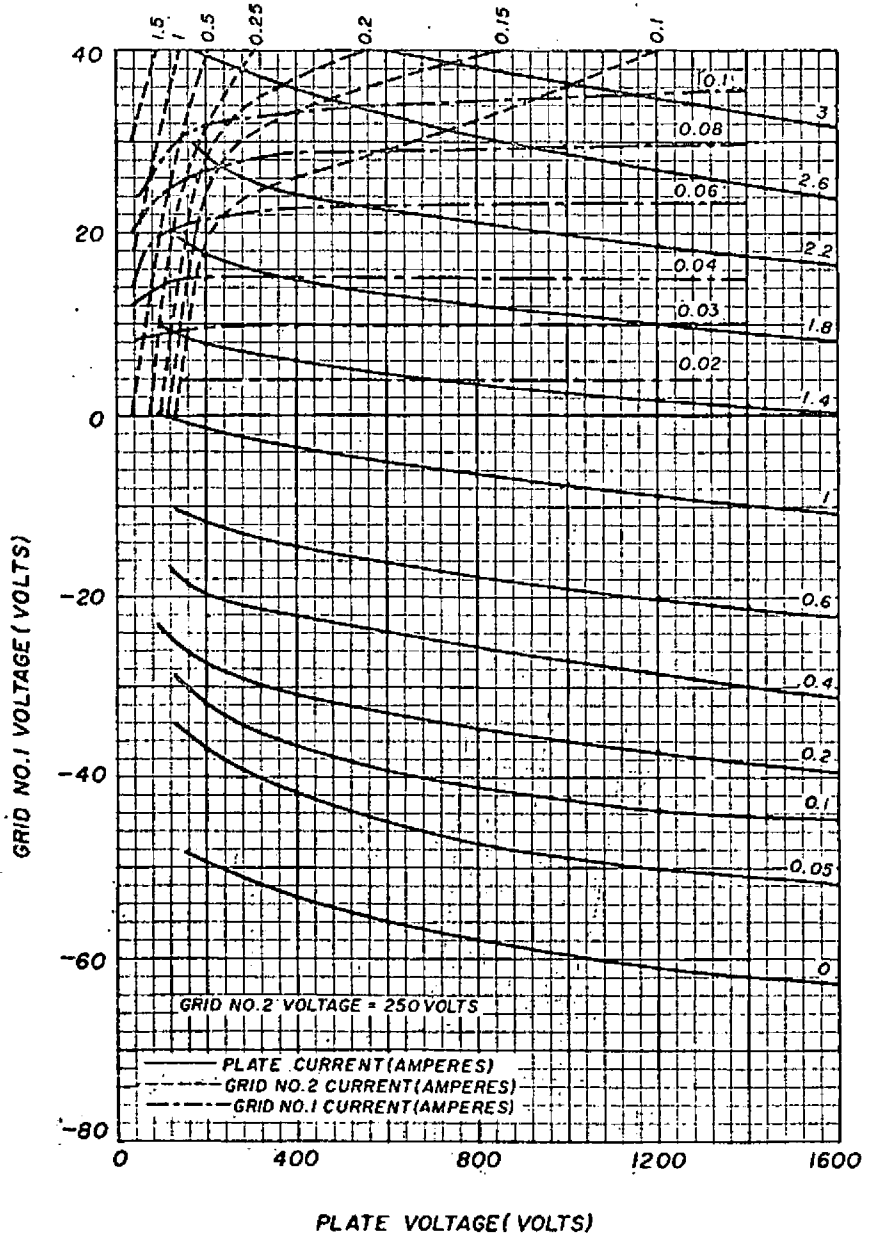
PIN CONNECTIONS

1 - HEATER
2 - CATHODE
3 - GRID NO. 1
4 - GRID NO. 2
5 - HEATER

GIANT 5 PIN BASE

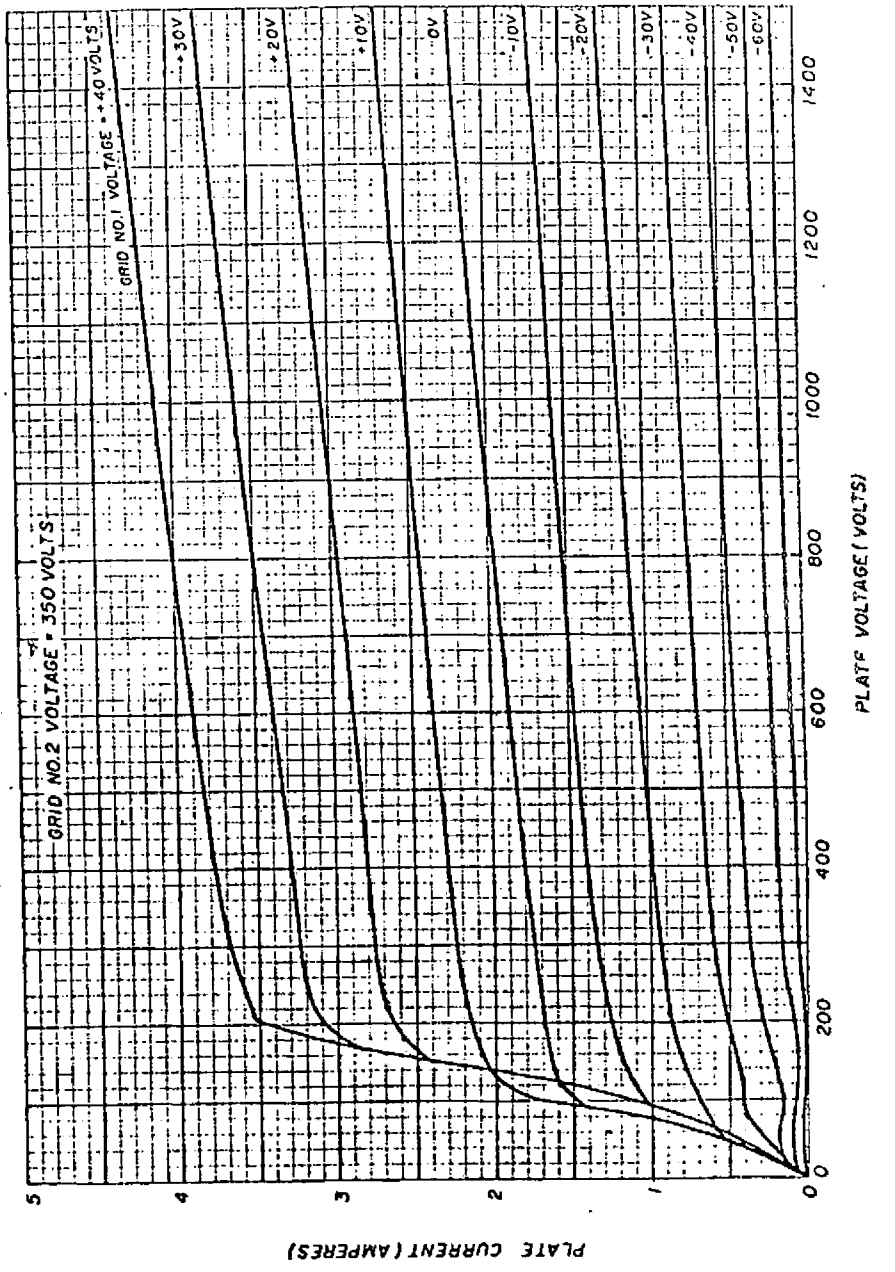
5 PINS .187 ±.003 DIA.

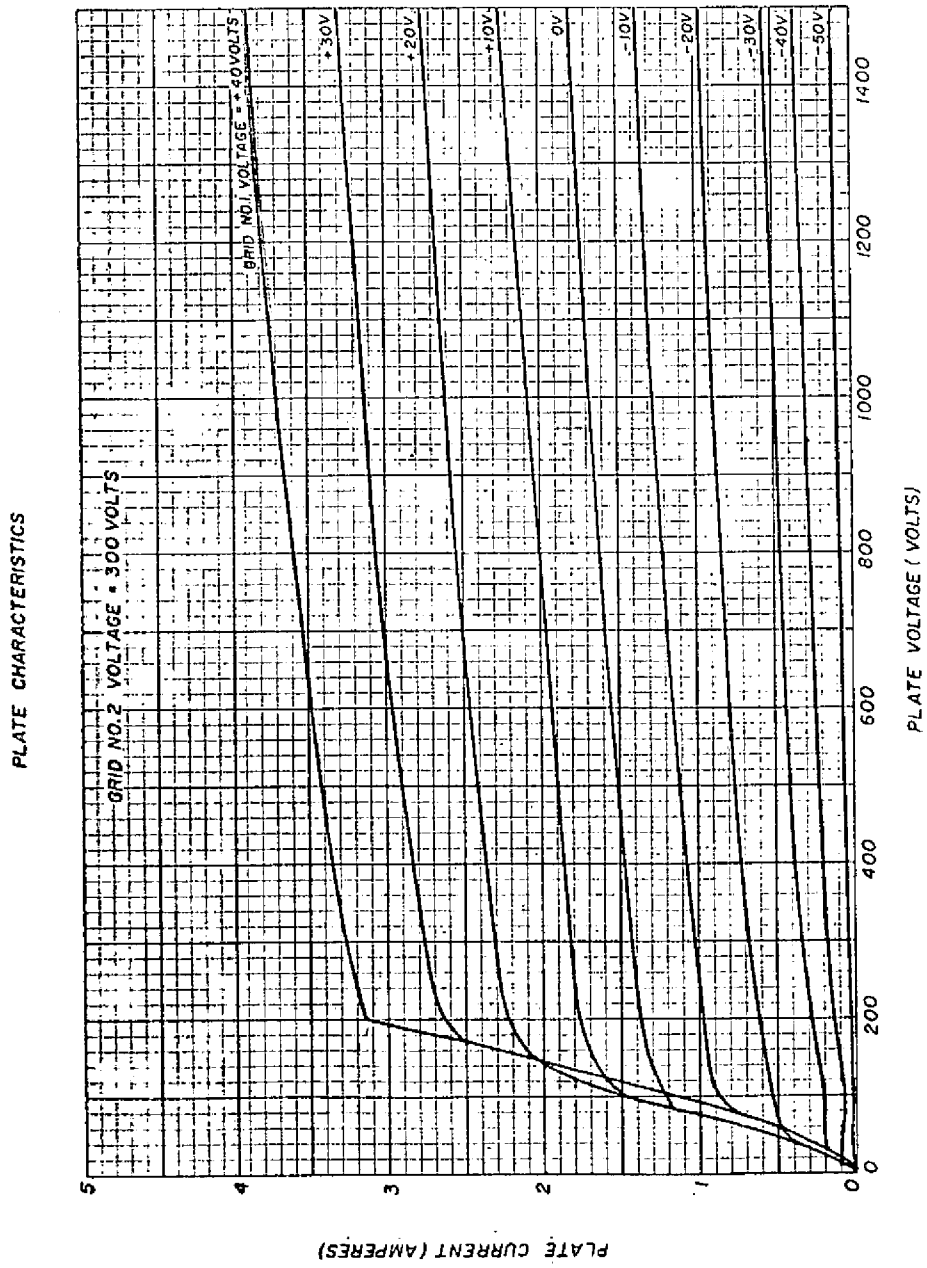
CONSTANT CURRENT CHARACTERISTICS



7378

PLATE CHARACTERISTICS




PLATE CHARACTERISTICS
GRID NO.2 VOLTAGE = 300 VOLTS
GRID NO.1 VOLTAGE = +40VOLTS
+30V
+20V
+10V
0V
-10V
-20V
-30V
-40V
-50V
PLATE CURRENT (AMPERES)
PLATE VOLTAGE (VOLTS)
0
1
2
3
4
5
200
400
600
800
1000
1200
1400

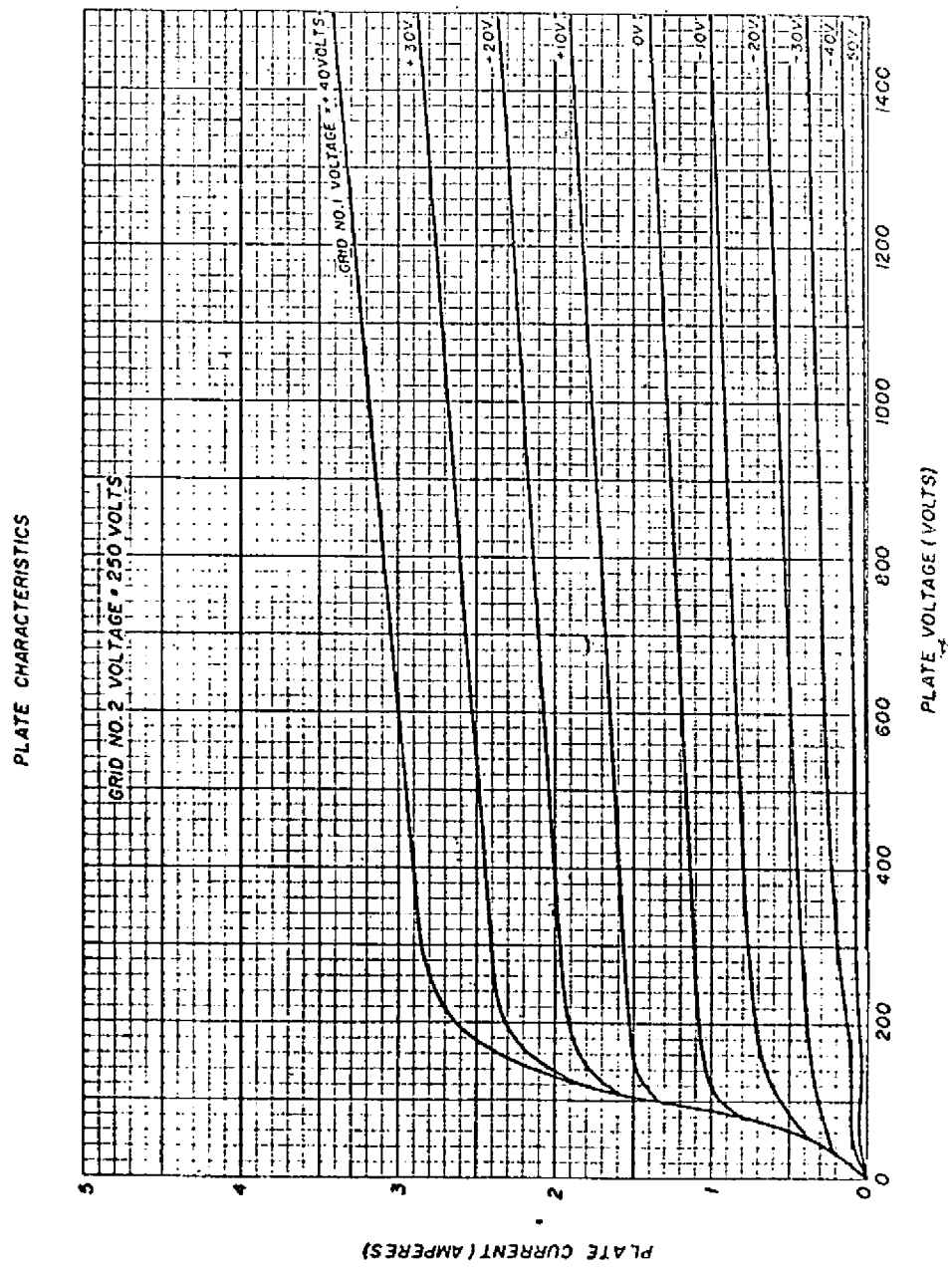
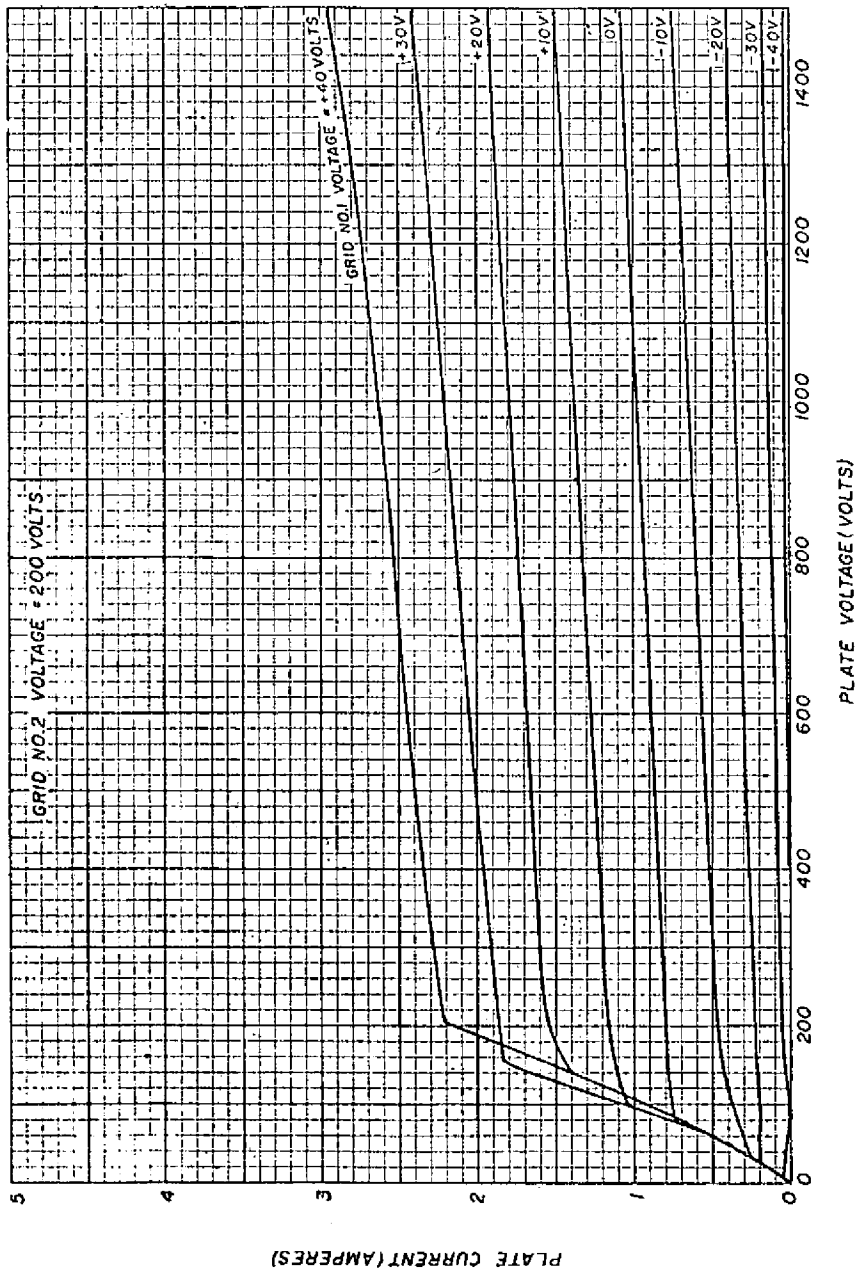
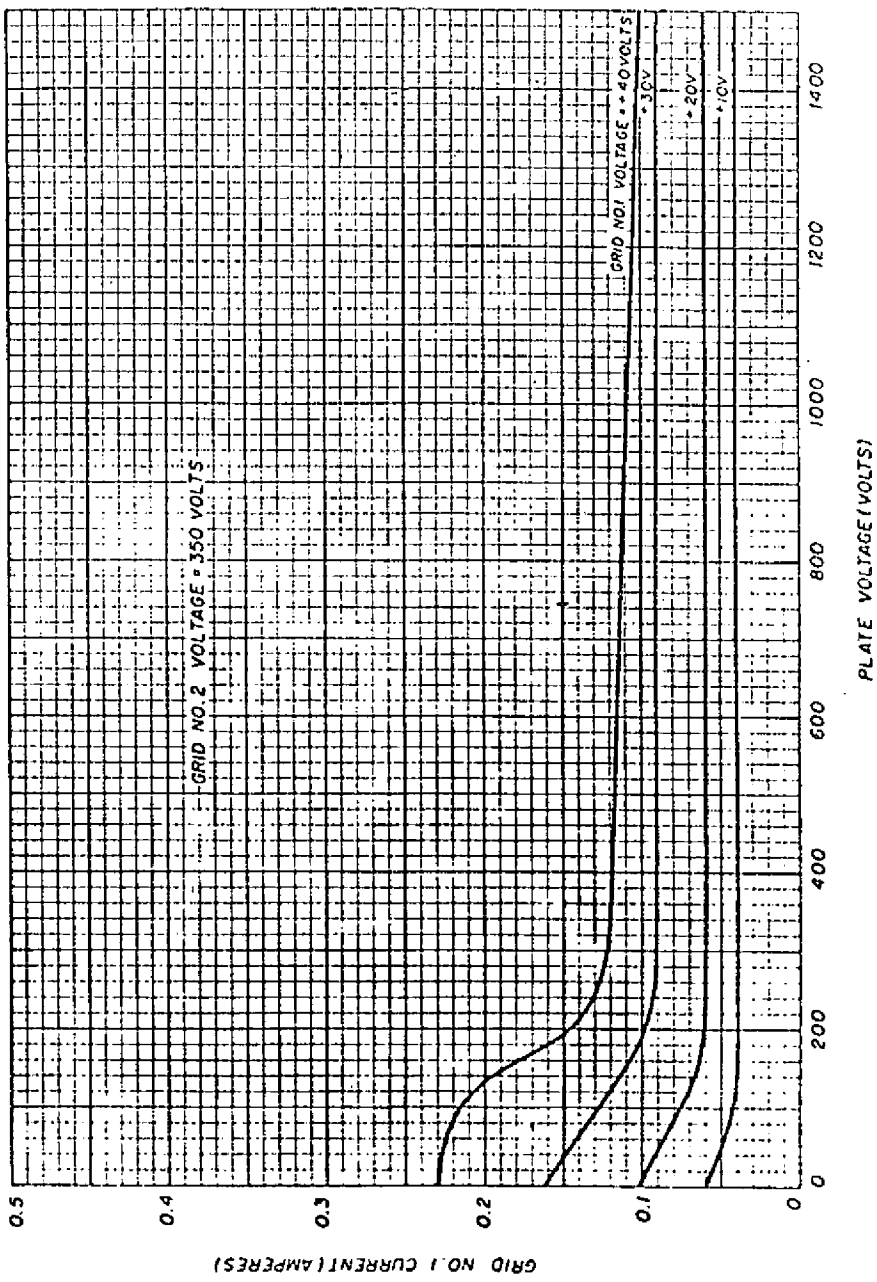

PLATE CHARACTERISTICS
GRID NO.2 VOLTAGE = 250 VOLTS
GRID NO.1 VOLTAGE = +40VOLTS
+30V
+20V
+10V
0V
-10V
-20V
-30V
-40V
-50V
PLATE CURRENT (AMPERES)
PLATE VOLTAGE (VOLTS)
0
1
2
3
4
5
200
400
600
800
1000
1200
1400

PLATE CHARACTERISTICS

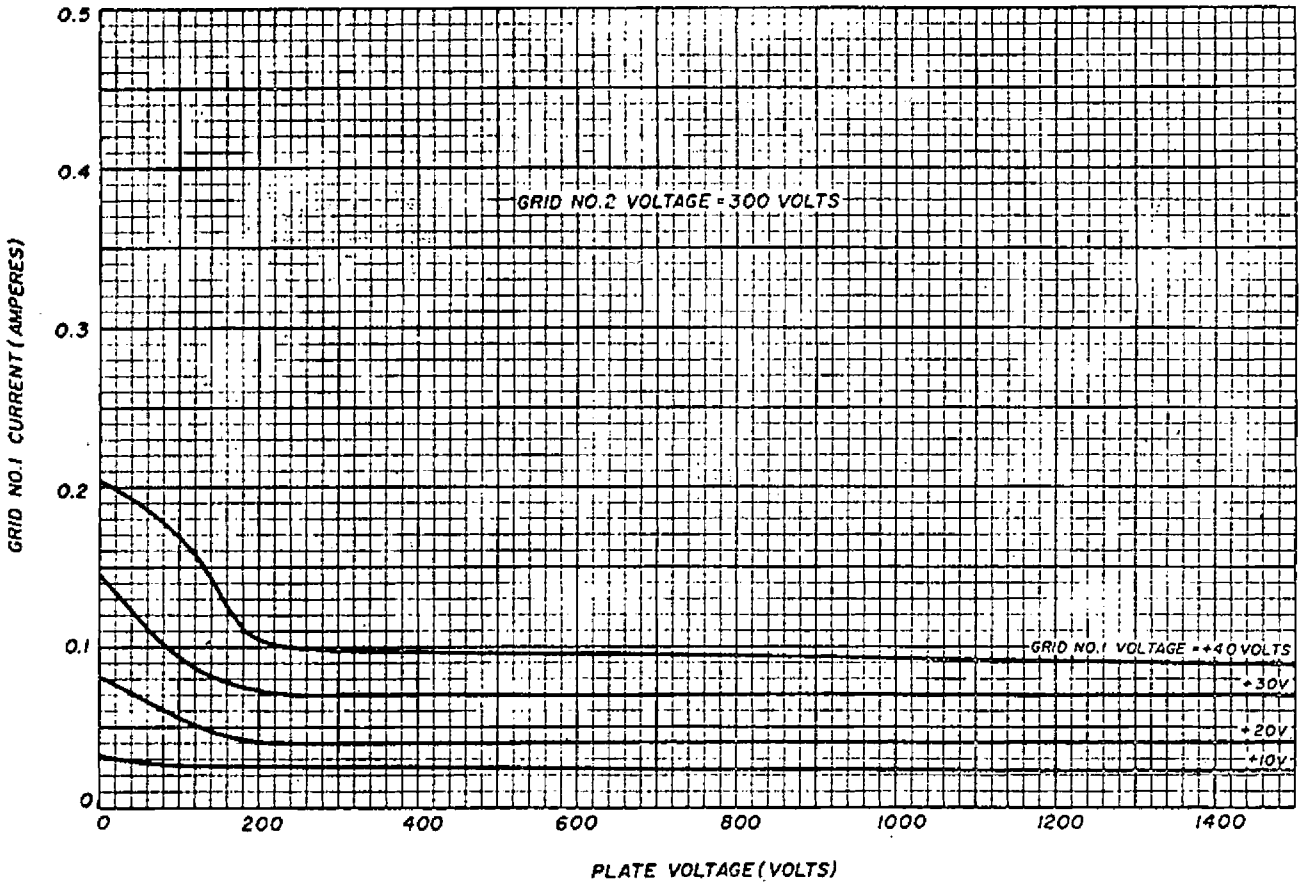


7378

GRID NO.1 CHARACTERISTICS

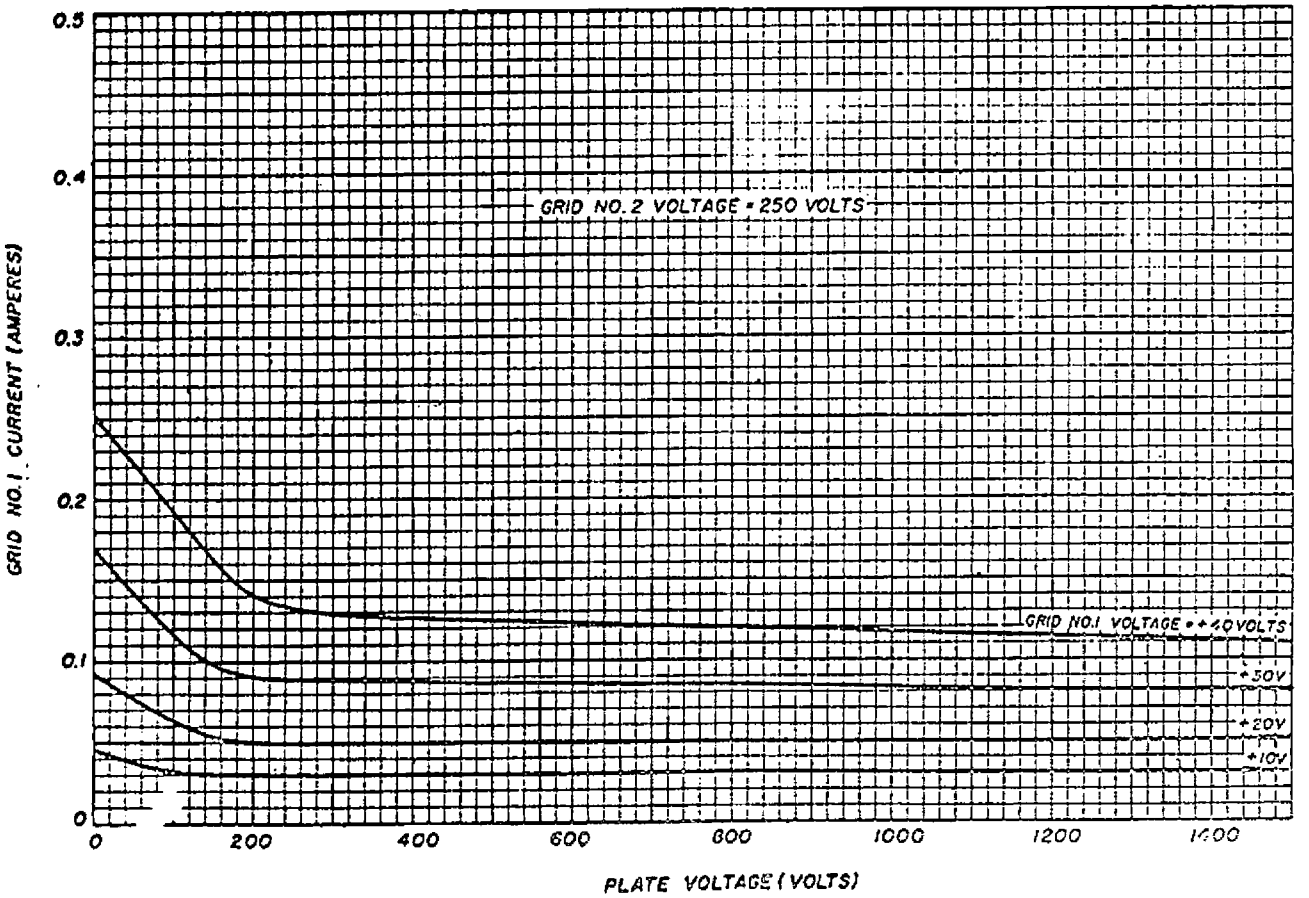


GRID NO.1 CHARACTERISTICS



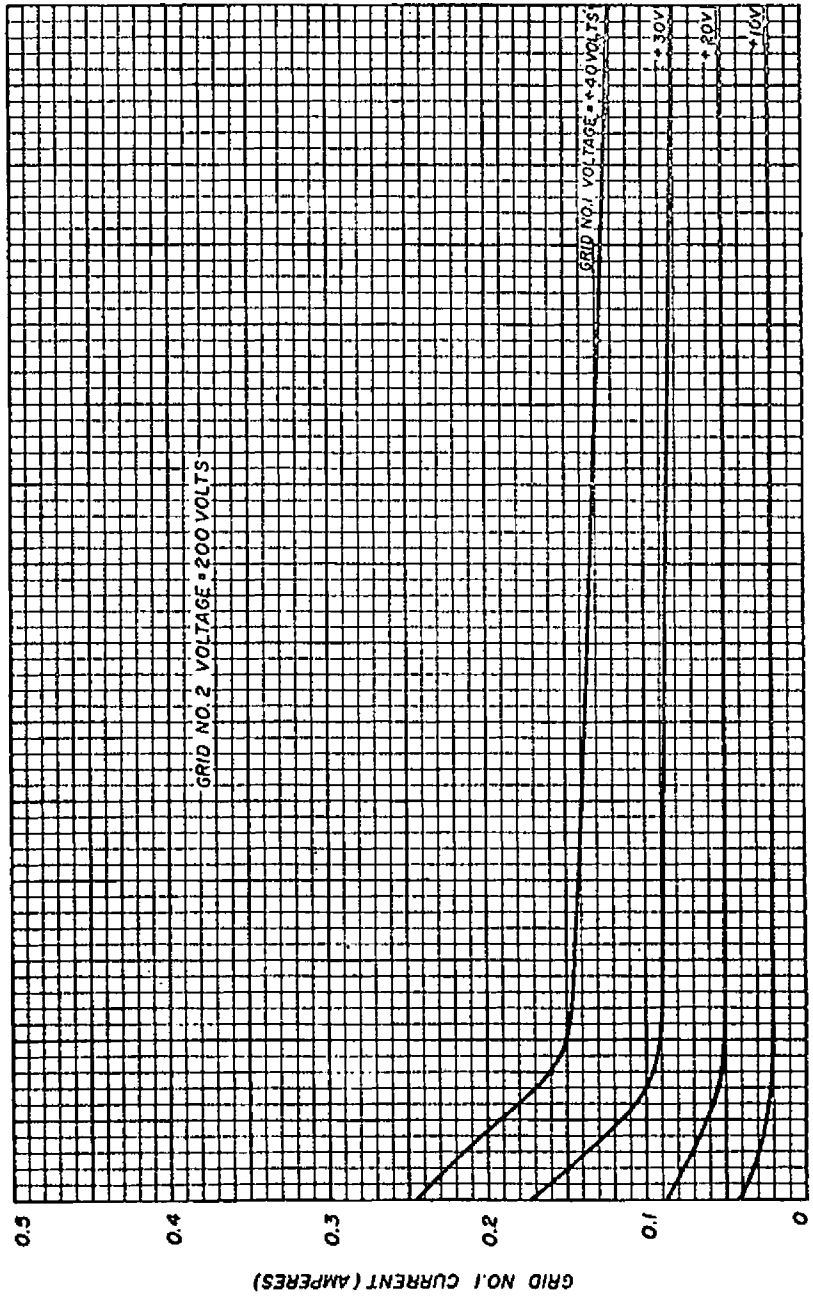
7378

GRID NO.1 CHARACTERISTICS



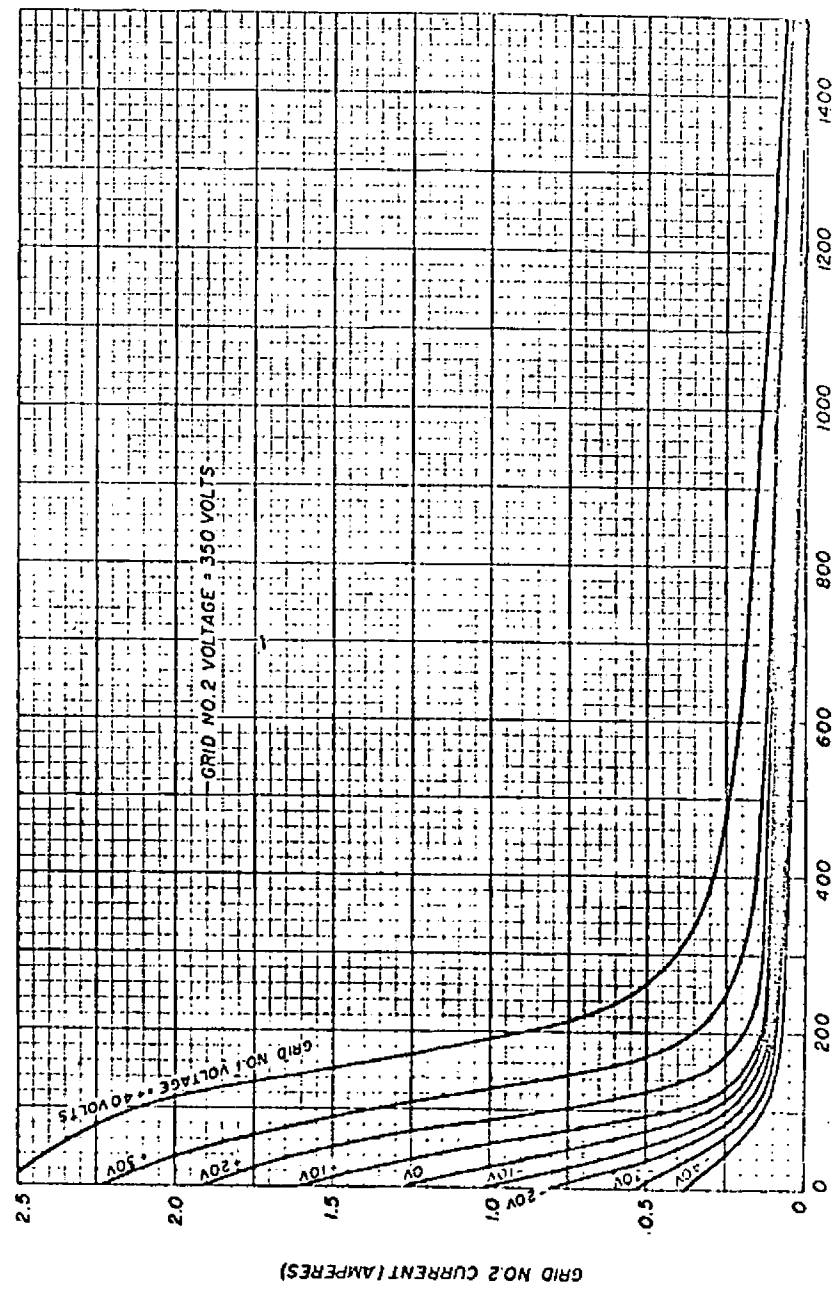
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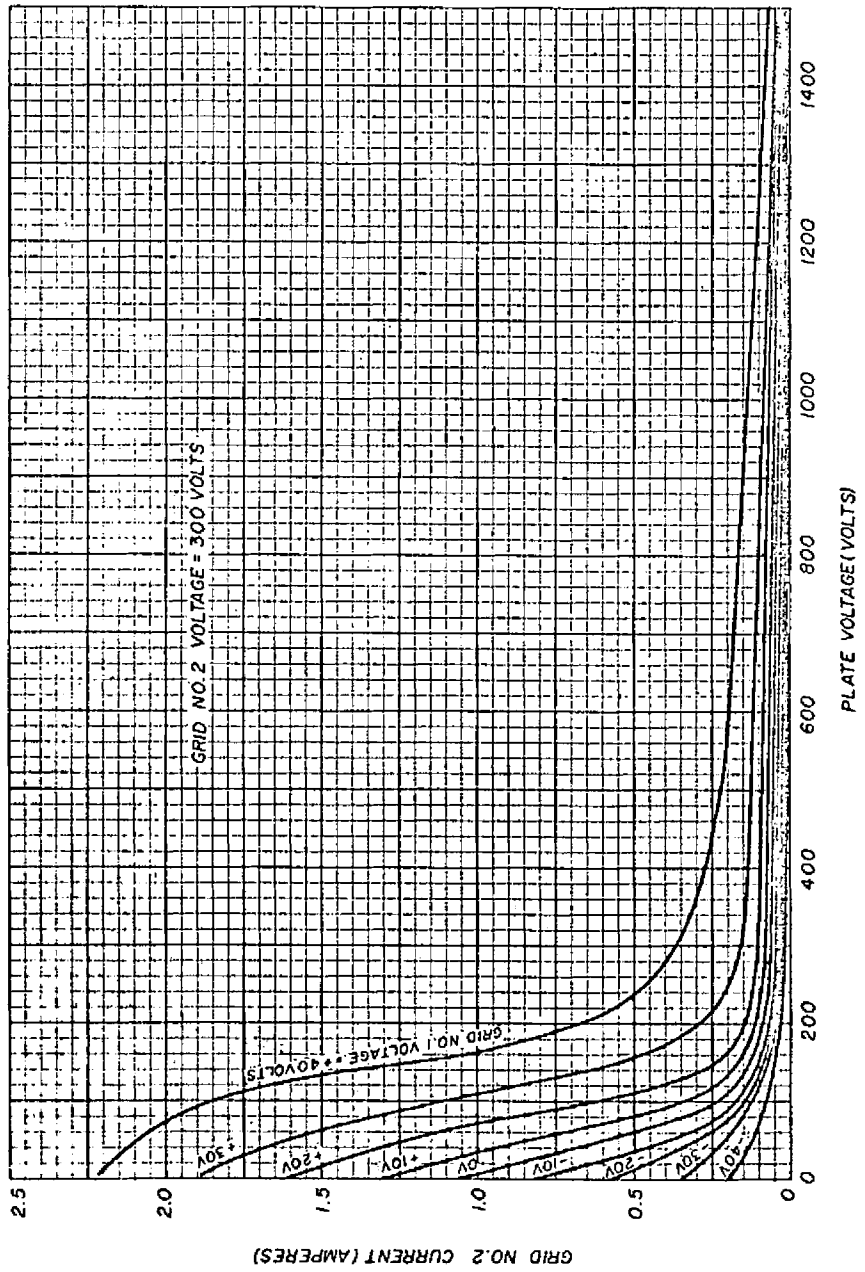
GRID NO.1 CHARACTERISTICS



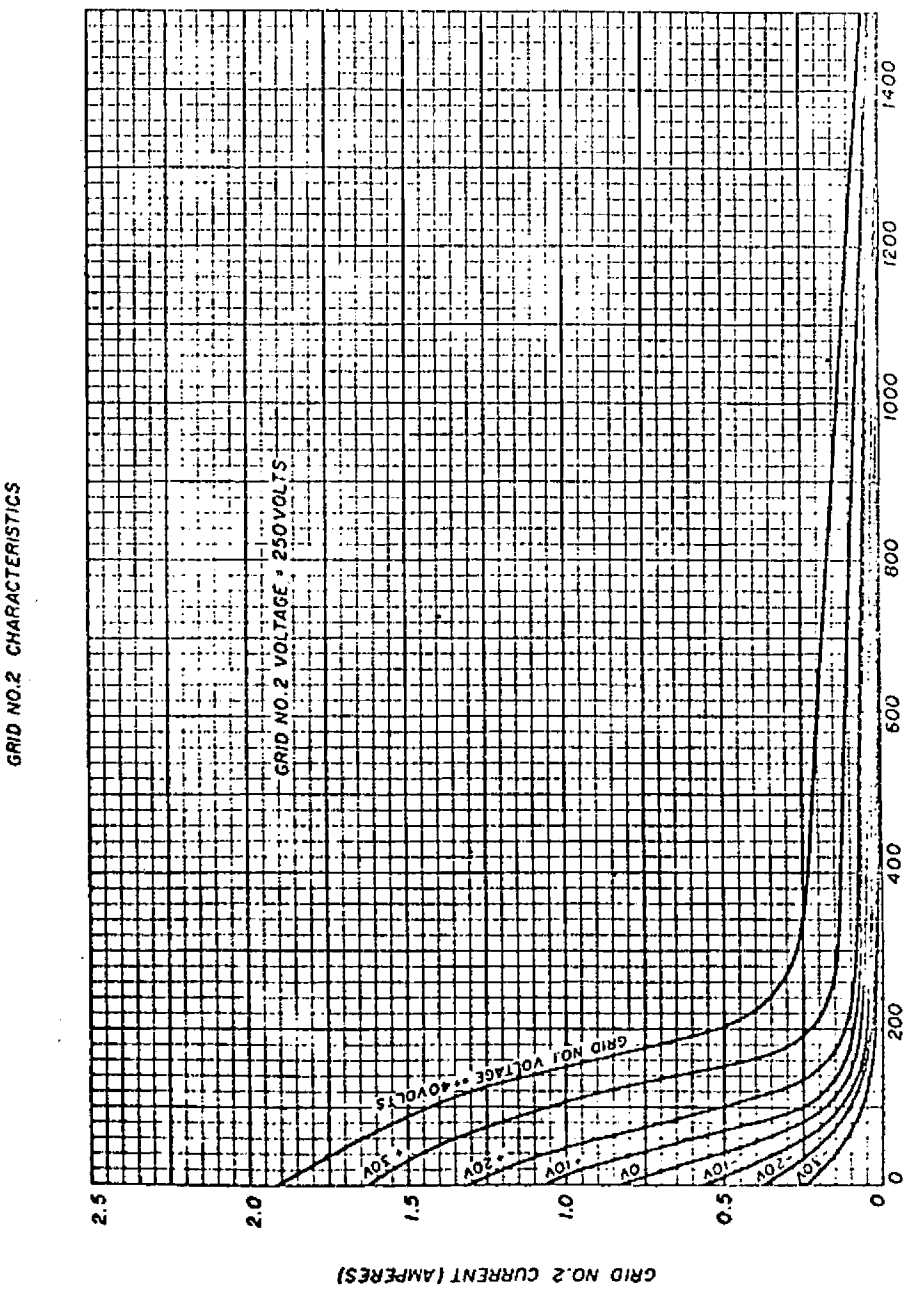
7378

GRID NO.2 CHARACTERISTICS

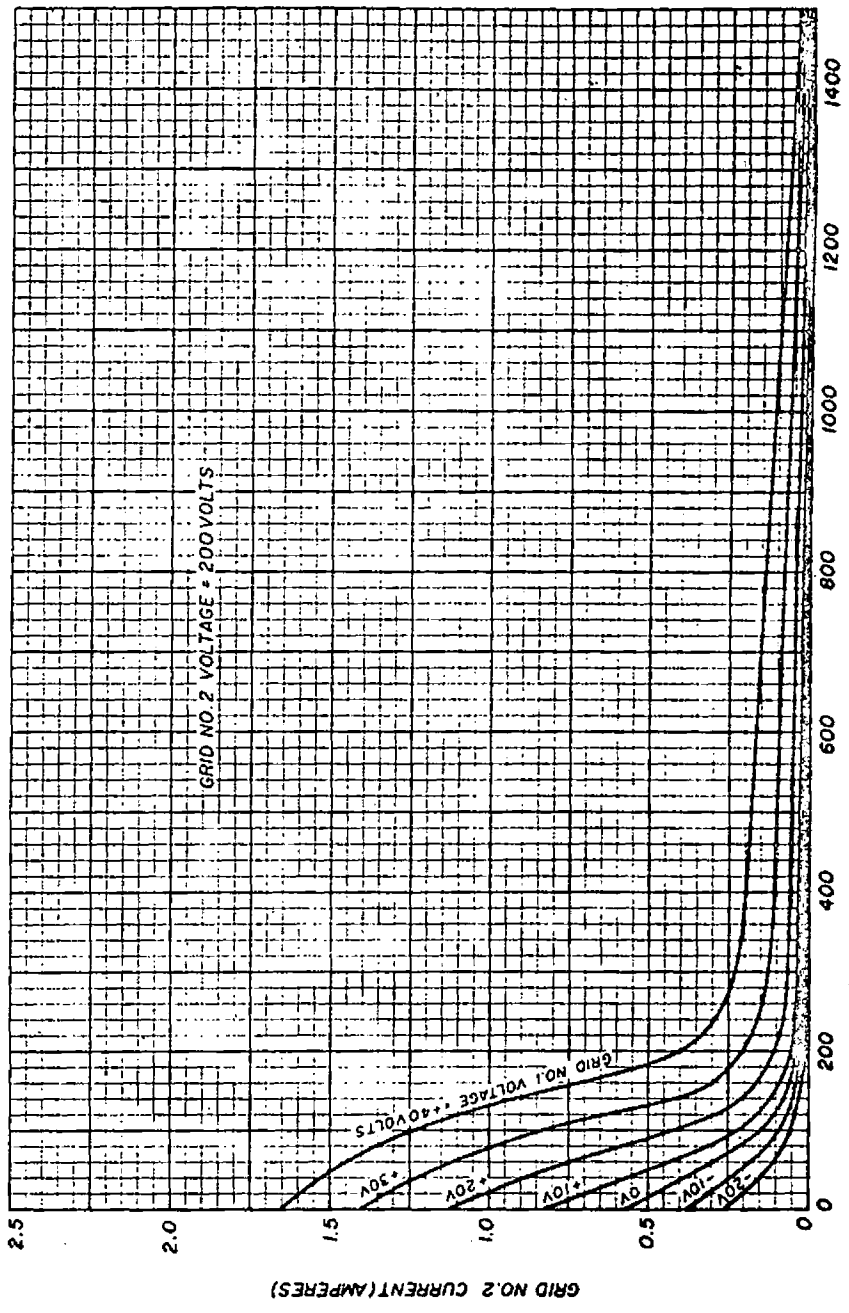



GRID NO.2 CHARACTERISTICS
GRID NO.2 VOLTAGE = 300 VOLTS
GRID NO.1 VOLTAGE = +40VOLTS
+30V
+20V
+10V
0V
-10V
-20V
-30V
-40V
GRID NO.2 CURRENT (AMPERES)
2.5
2.0
1.5
1.0
0.5
0
PLATE VOLTAGE (VOLTS)
0
200
400
600
800
1000
1200
1400

7378


GRID NO.2 CHARACTERISTICS
GRID NO.2 VOLTAGE = 250VOLTS
GRID NO.1 VOLTAGE = +40VOLTS
+30V
+20V
+10V
0V
-10V
-20V
GRID NO.2 CURRENT (AMPERES)
2.5
2.0
1.5
1.0
0.5
0
PLATE VOLTAGE (VOLTS)
0
200
400
600
800
1000
1200
1400

7378


GRID NO.1 CHARACTERISTICS
GRID NO.2 VOLTAGE = 200 VOLTS
GRID NO.1 VOLTAGE +40 VOLTS
+30V
+20V
+10V
0V
-10V
-20V
2.5
2.0
1.5
1.0
0.5
0
0
200
400
600
800
1000
1200
1400
GRID NO.2 CURRENT (AMPERES)
PLATE VOLTAGE (VOLTS)

from JEDEC release #2472, May 25, 1959

ELECTRON TUBES AND SEMICONDUCTORS

Amperex® ELECTRONIC CORPORATION

CABLE: AMPRONICS, NEW YORK
TWX - HICKSVILLE, NY 2199

230 DUFFY AVENUE, HICKSVILLE, L. I., NEW YORK • Wells 1-6200

AMPEREX TUBE TYPE 7459

TENTATIVE DATA

The 7459 is a forced-air-cooled triode designed for use in broadcast FM and TV communication transmitters. Its construction and characteristics are similar to the Amperex tube type 5924A. However, the 7459 features an exclusive specially processed grid which makes possible its high grid current rating and extremely stable characteristics.

The maximum ratings of this tube apply up to 110 megacycles. [1]

GENERAL CHARACTERISTICS

ELECTRICAL

Filament	thoriated tungsten
Voltage	12.6 volts
Current [2]	30 amps
Amplification Factor (I_b = 1 amp; E_b = 6000 volts)	32
Transconductance (I_b = 1 amp; E_b = 6000 volts)	15,000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	11 $\mu\mu$f
Grid to Filament	16 $\mu\mu$f
Plate to Filament	0.3 $\mu\mu$f

MECHANICAL

Maximum Overall Dimensions	
Length	11 inches
Diameter	4 5/8 inches
Mounting Position	vertical, anode up or down
Max Temperature of Filament Seals	210°C
Max Temperature of Grid and Anode Seals	180°C
Cooling	forced air

COOLING CHARACTERISTICS

Plate Dissipation (kilowatts)	Altitude (feet)	Inlet Air Temperature (°C)	Min. Air Flow (cu. ft/minute)	Inlet Air Pressure (inlet water)
2	0	35	75	0.26
	0	45	90	0.35
	5000	35	90	0.33
	10,000	25	97	0.33
4	0	35	230	1.75
	0	45	270	2.30
	5000	35	270	2.20
	10,000	25	310	2.90

[1] For use and ratings at frequencies up to 220 Mc/s, consult the Amperex Applications Engineering Laboratory.

[2] The filament center tap pin must not be used for filament current supply.

7459

MAXIMUM RATING AND TYPICAL OPERATING CONDITIONS

AF Power Amplifier and Modulator - Class B

Maximum Ratings, Absolute Values (per tube)

	CCS
D-C Plate Voltage	6500 volts
D-C Plate Current	1.6 amps
Plate Input	10,000 watts
Plate Dissipation	4000 watts
Grid Resistor	15,000 ohms

Typical Operation (two tubes)

	CCS	CCS	CCS
D-C Plate Voltage	5000	5000	4000 volts
D-C Grid Voltage	−145	−145	−120 volts
Peak AF Grid to Grid Voltage	840	690	900 volts
Zero Signal D-C Plate Current	2 x 0.15	2 x 0.15	2 x 0.1 amps
Max Signal D-C Plate Current	2 x 1.25	2 x 1.1	2 x 1.25 amps
Effective Load Resistance, Plate to Plate	4800	5500	3800 ohms
Max Signal Drive Power (approx)	2 x 130	2 x 65	2 x 140 watts
Max Signal Power Output (approx)	9000	8000	7100 watts

Plate Modulated RF Power Amplifier

Class C - Telephony

(Carrier Conditions Per Tube with a Maximum Modulation Factor of 1.0)

Maximum Ratings, Absolute Values (per tube)

	CCS
Frequency	30 Mc/s
D-C Plate Voltage	5.5 kilovolts
D-C Grid Voltage	−1100 volts
D-C Plate Current	1.7 amps
D-C Grid Current	0.6 amps
Plate Input	7000 watts
Plate Dissipation	3000 watts

Typical Operation

	CCS	CCS
D-C Plate Voltage	5000	4000 volts
D-C Grid Voltage [3]	−400	−300 volts
Peak RF Grid Voltage	765	680 volts
D-C Plate Current	1.5	1.6 amps
D-C Grid Current	0.55	0.6 amps
Driving Power	375	367 watts
Power Output	6000	5000 watts

[3] Grid Bias partially obtainted by the grid resistor.

RF Power Amplifier and Oscillator - Class C - Telegraphy - FM

(Key-down conditions per tube without amplitude modulation)

Maximum Ratings, Absolute Values (per tube)

	CCS
D-C Plate Voltage [4]	6500 volts
D-C Grid Voltage	−1100 volts
D-C Plate Current [4]	1.5 amps
D-C Grid Current	0.35 amps
Plate Input [4]	9000 watts
Plate Dissipation	4000 watts

Typical Operation, Grounded Filament Circuit

	CCS	CCS	CCS
Frequency [5]	75	75	75 Mc/s
D-C Plate Voltage	6000	5000	4000 volts
D-C Grid Voltage	−400	−300	−200 volts
Peak RF Grid Voltage	740	640	500 volts
D-C Plate Current	1.5	1.5	1.37 amps
D-C Grid Current (approx)	0.31	0.33	0.35 amps
Driving Power	210	190	160 watts
Power Output (approx)	6900	5600	4000 watts

Typical Operation, Grounded Grid Circuit (two tubes)

Frequency [5]	75	110	110	220 Mc/s
D-C Plate Voltage	6000	5000	4000	4000 volts
D-C Grid Voltage	400	300	200	200 volts
Peak RF Grid Voltage	740	640	500	450 volts
D-C Plate Current	3	3	2.75	2.5 amps
D-C Grid Current (approx)	0.62	0.66	0.70	0.40 amps
Driving Power	2240	1840	1350	760 watts
Power Output [6] (approx)	15,600	12,100	8600	5600 watts

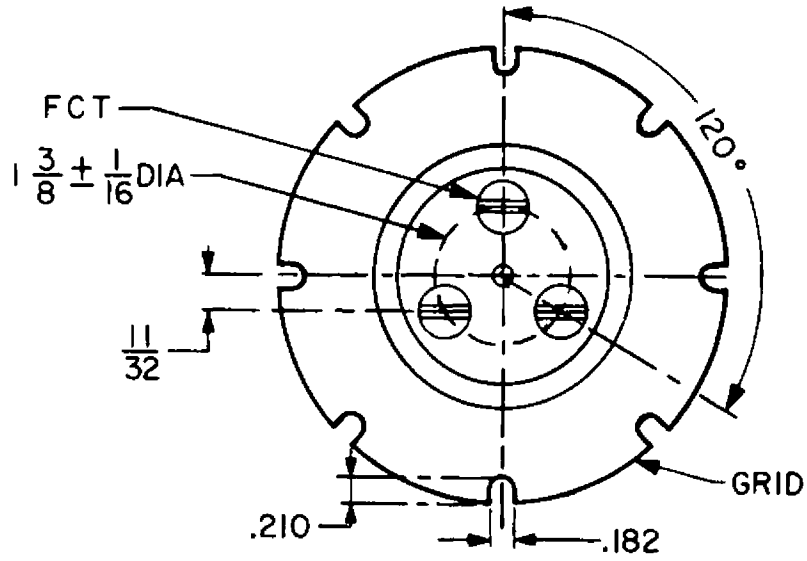
[4]

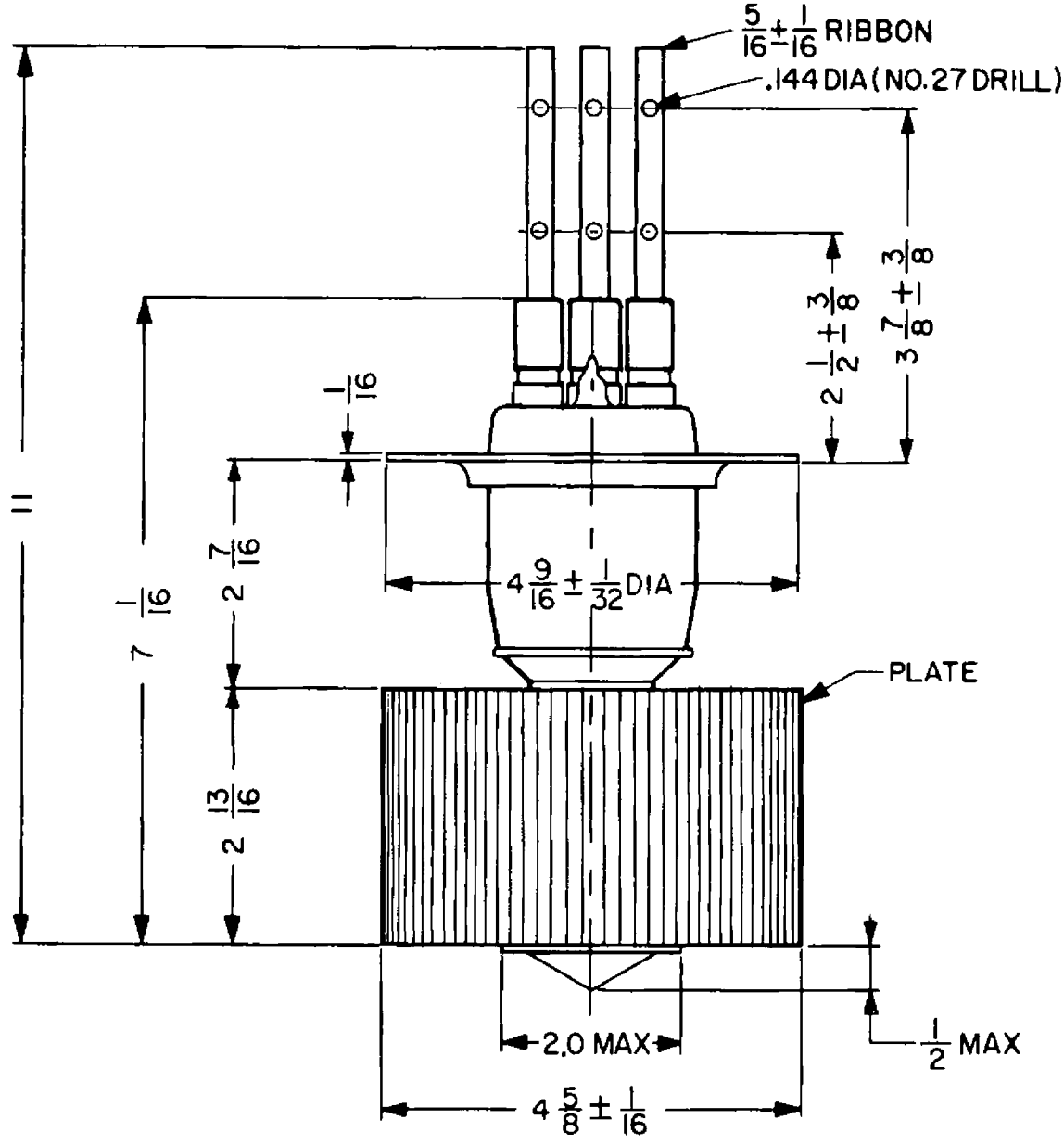
Maximum Ratings per tube	Up to 75 Mc	Up to 110 Mc	Up to 220 Mc	
D-C Plate Voltage	6000	5000	4000	volts
D-C Plate Current	1.5	1.5	1.5	amps
Plate Input	9000	7500	5000	watts

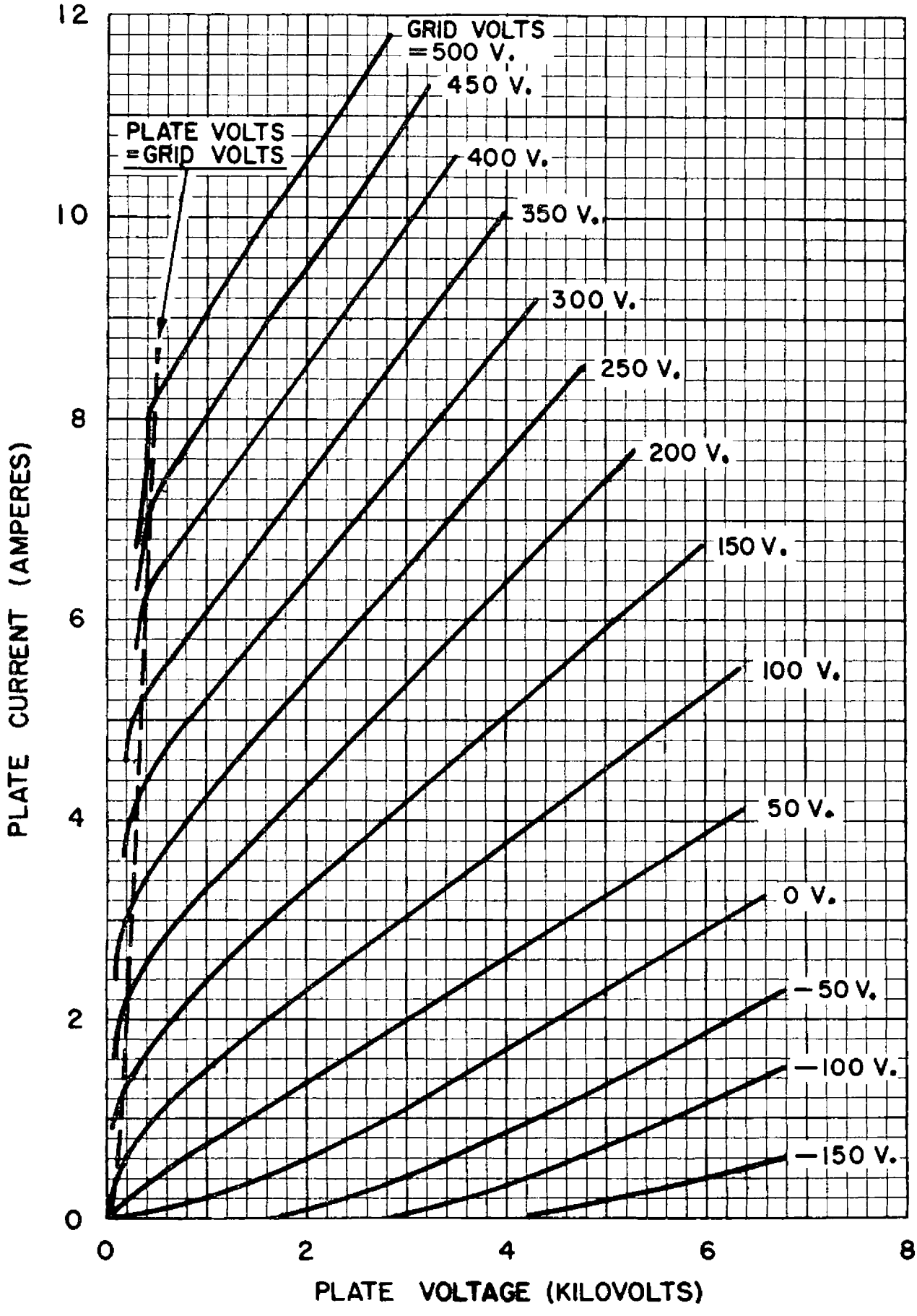
[5] When using the tube above 110 megacycles, particular attention must be given to a careful design of installation. Otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 Mc can only be given after approval of the prototype circuit by Amperex.

[6] Power transferred from driving stage included.

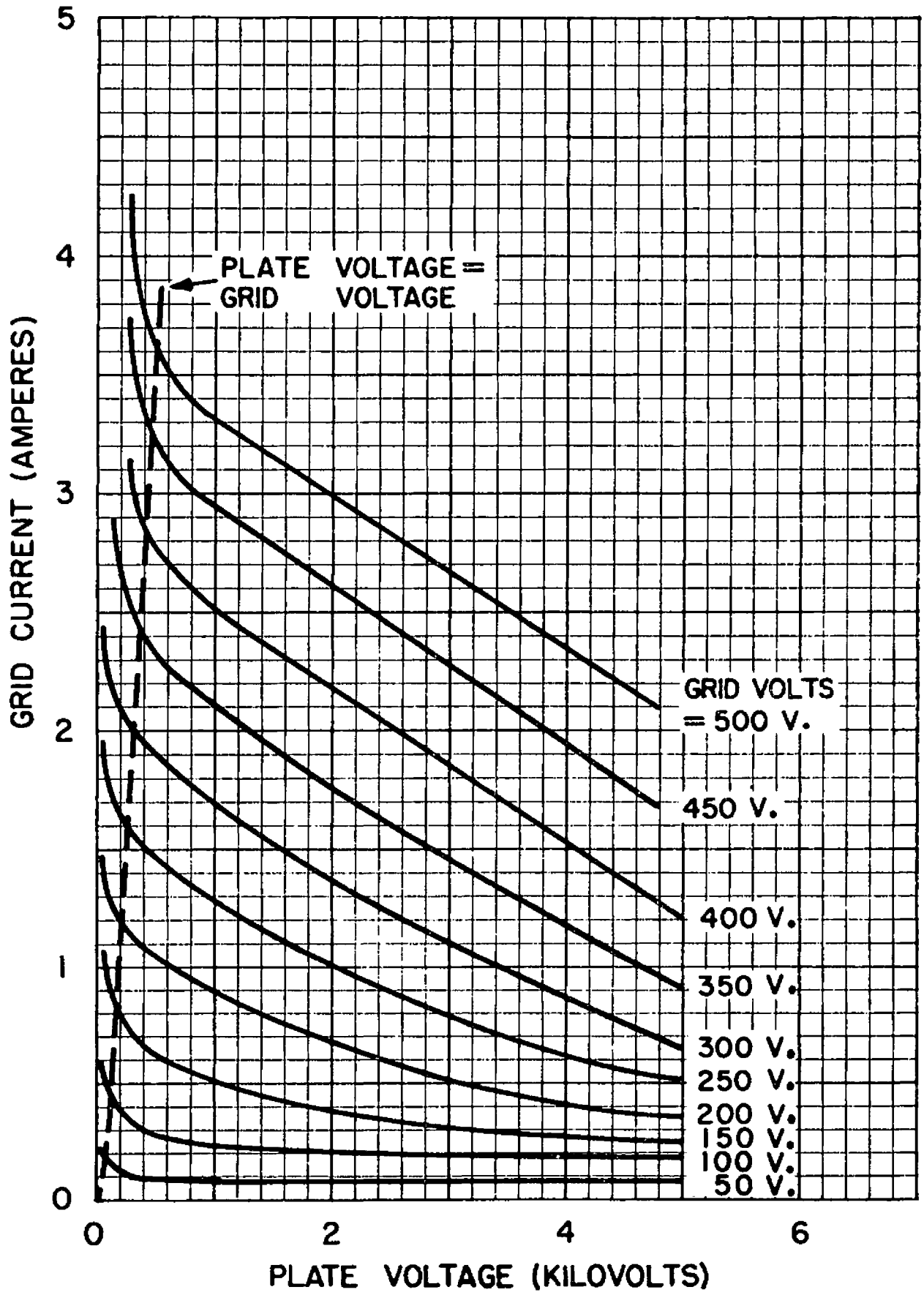
7459


FCT
1 3/8 ± 1/16 DIA
11/32
120°
GRID
.210
.182

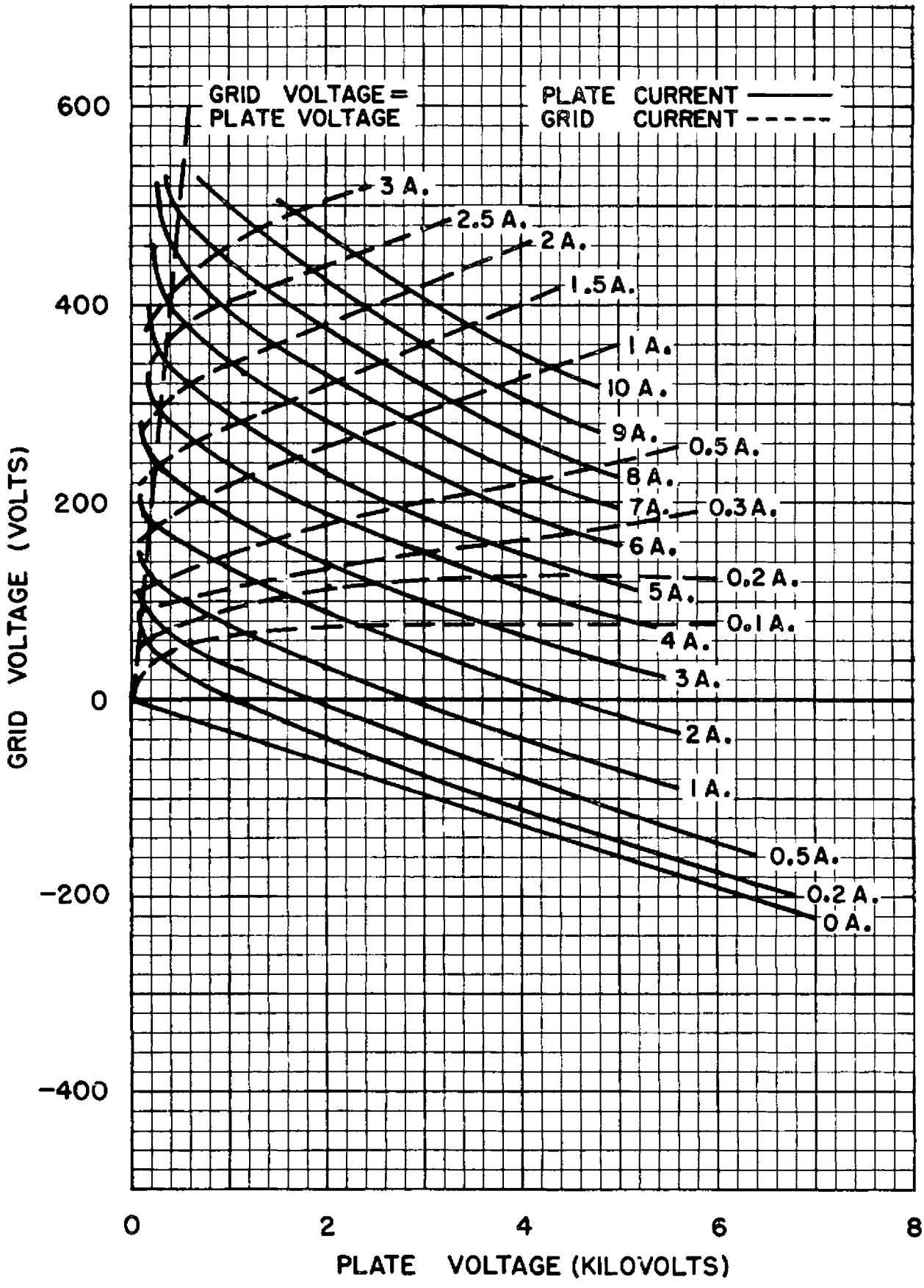

5/16 ± 1/16 RIBBON
.144 DIA (NO. 27 DRILL)
3 7/8 ± 1/8
2 1/2 ± 1/8
1/16
11
7 1/16
2 7/16
2 13/16
4 9/16 ± 1/32 DIA
PLATE
2.0 MAX
1/2 MAX
4 5/8 ± 1/16


GRID VOLTS
=500 V.
450 V.
400 V.
350 V.
300 V.
250 V.
200 V.
150 V.
100 V.
50 V.
0 V.
−50 V.
−100 V.
−150 V.
PLATE VOLTS
=GRID VOLTS
PLATE CURRENT (AMPERES)
PLATE VOLTAGE (KILOVOLTS)
0
2
4
6
8
10
12

7459


GRID CURRENT (AMPERES)
5
4
3
2
1
0
PLATE VOLTAGE = GRID VOLTAGE
GRID VOLTS = 500 V.
450 V.
400 V.
350 V.
300 V.
250 V.
200 V.
150 V.
100 V.
50 V.
0
2
4
6
PLATE VOLTAGE (KILOVOLTS)

7459


GRID VOLTAGE = PLATE VOLTAGE
PLATE CURRENT
GRID CURRENT
3 A.
2.5 A.
2 A.
1.5 A.
1 A.
10 A.
9 A.
0.5 A.
8 A.
7 A.
0.3 A.
6 A.
5 A.
0.2 A.
0.1 A.
4 A.
3 A.
2 A.
1 A.
0.5 A.
0.2 A.
0 A.
600
400
200
0
-200
-400
GRID VOLTAGE (VOLTS)
0
2
4
6
8
PLATE VOLTAGE (KILOVOLTS)

AMPEREX TUBE TYPE 7527

The Amperex 7527 is an all-glass power tetrode designed for amplifier, oscillator or modulator service extending in the VHF region, maximum ratings to 110 Mc/s. It features a maximum plate dissipation of 400 watts combined with a low drive power and low grid-plate capacitance.

GENERAL CHARACTERISTICS

MECHANICAL

Maximum overall dimensions	see outline drawing
Mounting position	vertical
Base	giant 5 pin

Accessories

Socket	Johnson #122-275 or equiv.
Plate connector	S-25671
Chimney	S-25672
Net Weight	6.7 ounces
Cooling	see note 1

Maximum Operating Temperatures

Plate seal	220°C
Pin seal	180°C
Bulb	350°C

ELECTRICAL

Filament	thoriated tungsten,
Filament voltage	5 volts
Filament current	14.1 amps

Direct Interelectrode Capacitances

Input	12.7 $\mu\mu$f
Output	4.9 $\mu\mu$f
Plate to grid	0.12 $\mu\mu$f
Amplification factor (G2 to G1) (E_b = 2500 V, E_{c2} = 500 V, I_b = 100 mA)	5.1
Transconductance (E_b = 2500 V, E_{c2} = 500 V, I_b = 100 mA)	4000 micromhos

NOTES

1 At plate dissipations up to 250 watts a low velocity airflow directed on the plate seal and the base will generally provide sufficient cooling. At higher dissipations the glass chimney should be used for circulating forced air along the bulb.

At plate dissipation of 400 watts at least 15 cfm of air should be passed through the chimney. For this purpose the static pressure below the chassis should be a min of 0.2 inches water pressure.

from JEDEC release #3503, Nov. 27, 1961

7527

RF Class C - Telegraphy

Maximum Ratings, Absolute Values
(Frequencies up to 110 Mc/s)

	CCS
D-C plate voltage	4000 volts max
D-C plate current	350 mA max
Plate dissipation	400 watts max
Plate input power	1400 watts max
D-C grid No. 2 voltage	600 volts max
Screen-grid dissipation	35 watts max
D-C grid No. 1 voltage	— 500 volts max
D-C grid No. 1 current	25 mA max

Typical Operation

	CCS	CCS	CCS	CCS	CCS
Frequency	75	75	75	100	100 Mc/s
D-C plate voltage	4000	3000	2500	4000	3500 volts
D-C Grid No. 2 voltage	500	500	500	500	500 volts
D-C grid No. 1 voltage	— 220	— 220	—200	—170	—170 volts
D-C plate current	350	350	350	270	250 mA
D-C grid No. 2 current	25	30	35	16	17 mA
D-C grid No. 1 current	6	6	6.5	9.5	9 mA
Peak RF grid No. 1 voltage	305	305	290	240	235 volts
Driving power	1.8	1.8	1.8	2	1.8 watts
Grid No. 2 dissipation	12.5	15	17.5	8	8.5 watts
Plate input power	1400	1050	875	1080	875 watts
Plate dissipation	300	250	235	280	225 watts
Output power	1100	800	640	800	650 watts
Efficiency	78.5	76	73	74	74 %

RF Class C - Telephony

Plate and Screen Modulation
(Carrier Conditions for Use with a Modulation factor of 1.0)

Maximum Ratings, Absolute Values

	CCS	ICAS
At frequencies up to	75	30 Mc/s max
D-C plate voltage	3200	4000 volts max
D-C plate current	275	275 mA max
Plate dissipation	270	270 watts max
Plate input power	880	1100 watts max
D-C grid No. 2 voltage	600	600 volts max
D-C grid No. 2 dissipation	35	35 watts max
D-C grid No. 1 voltage	— 500	—500 volts max
D-C grid No. 1 current	25	25 mA max

Typical Operation

	CCS	CCS	CCS	ICAS
Frequency	75	75	75	30 Mc/s
D-C plate voltage	3000	2500	2000	3650 volts
D-C grid No. 2 current	500	500	500	500 volts
D-C grid No. 1 voltage	— 220	— 220	— 220	— 225 volts
D-C plate current	275	275	275	275 mA
D-C grid No. 2 current	36	38	40	30 mA
D-C grid No. 1 current	6	6	6	6 mA
Peak RF grid No. 1 voltage	305	308	305	308 volts
Driving power	1.6	1.7	1.6	1.7 watts
Grid No. 2 dissipation	18	19	20	15 watts
Plate input power	825	688	550	1000 watts
Plate dissipation	195	178	170	235 watts
Output power	630	510	380	765 watts
Efficiency	75.5	74	69	76.5 %
Modulation depth	100	100	100	100 %
Peak AF grid No. 2 voltage	400	400	400	400 volts [2]
Modulation power	413	344	275	500 watts

[2] Grid No. 2 modulated via transformer.

AF Class AB_2 Amplifier
Maximum Ratings, Absolute Values

	CCS
D-C plate voltage	4000 volts max
D-C plate Current	350 mA max
Plate dissipation	400 watts max
D-C grid No. 2 voltage	800 volts max
Grid No. 2 dissipation	35 watts max
D-C grid No. 1 current	25 mA max

Typical Operation
(Two Tubes)

	CCS	CCS	CCS	CCS
D-C plate voltage	2500	3000	3500	4000 volts
D-C grid No. 2 voltage	500	500	500	500 volts
D-C grid No. 1 voltage	−75	−80	−85	−90 volts
Load resistance (plate to plate)	8000	10,000	11,300	15,000 ohms
Peak AF grid No. 1 to grid No. 1 voltage	290	292	305	290 volts
Zero signal D-C plate current	2x95	2x90	2x80	2x80 mA
Max signal D-C plate current	2x350	2x350	2x350	2x319 mA
Max signal D-C grid No. 2 current	2x30	2x20	2x20	2x20 mA
Max signal D-C grid No. 1 current	2x7	2x6.5	2x6.5	2x6 mA
Max signal grid No. 2 dissipation	2x15	2x10	2x10	2x10 watts
Max signal driving power	2x0.91	2x0.85	2x0.9	2x0.8 watts
Zero signal plate input power	2x238	2x270	2x280	2x320 watts
Max signal plate input power	2x875	2x1050	2x1225	2x1275 watts
Zero signal plate dissipation	2x238	2x270	2x280	2x320 watts
Max signal plate dissipation	2x320	2x362	2x400	2x400 watts
Max signal output power	1110	1375	1650	1750 watts
Efficiency	63.5	65.5	67.5	68.5 %

AF Class AB_1 Amplifier
Maximum Ratings, Absolute Values

D-C plate voltage	4000 volts max
D-C plate current	350 mA max
Plate dissipation	400 watts max
D-C grid No. 2 voltage	800 volts max
Grid No. 2 dissipation	35 watts max
D-C grid No. 1 current	25 mA max

Typical Operation
(Two Tubes)

D-C plate voltage	2500	3000	3500	4000 volts
D-C grid No. 2 voltage	750	750	750	750 volts
D-C grid No. 1 voltage	−130	−137	−145	−150 volts
Load resistance (plate to plate)	6800	8900	11,500	14,500 ohms
Peak AF grid No. 1 to grid No. 1 voltage	260	274	290	300 volts
Zero signal D-C plate current	2x95	2x80	2x70	2x60 mA
Max signal D-c plate current	2x318	2x318	2x305	2x293 mA
Max signal D-C grid No. 2 current	2x11.6	2x11	2x13.5	2x15 mA
Max signal grid No. 2 dissipation	2x8.7	2x10.25	2x10.4	2x11.2 watts
Zero signal plate input power	2x366	2x240	2x245	2x240 watts
Max signal plate input power	2x795	2x955	2x1065	2x1170 watts
Zero signal plate dissipation	2x366	2x240	2x245	2x240 watts
Max signal plate dissipation	2x370	2x400	2x400	2x400 watts
Output power	850	1110	1330	1540 watts
Efficiency	53.5	58	62.5	66 %

7527

Single Sideband Class AB_1 Linear Amplifier

Maximum Ratings, Absolute Values
(Frequencies up to 110 Mc/s)

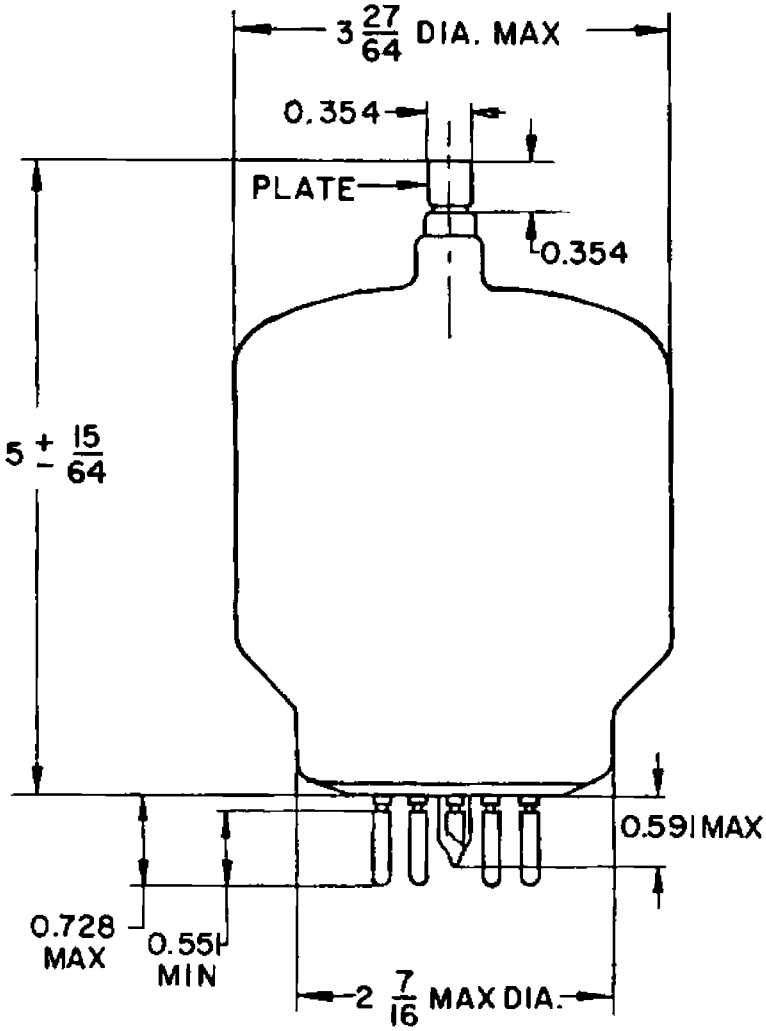
	CCS
D-C plate voltage	4000 volts max
D-C grid No. 2 voltage	850 volts max
D-C grid No. 1 voltage	−500 volts max
D-C plate current	350 mA max
Plate input	1600 watts max
Plate dissipation	400 watts max
Grid No. 2 dissipation	35 watts max
Grid No. 1 current	25 watts max

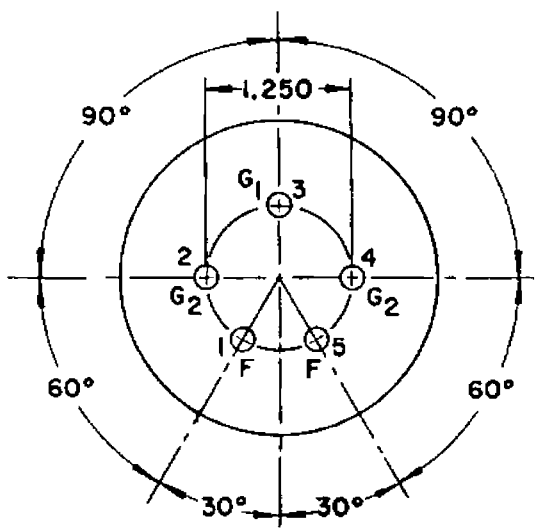
Typical Operation
Single Tone and/or Two Tone Modulation

	CCS	CCS	CCS	CCS	
D-C plate voltage	4000	3500	3000	2500	volts
D-C grid No. 2 voltage	705	750	840	840	volts
D-C grid No. 1 voltage [4]	−130	−135	−148	−144	volts
Zero signal D-C plate current	80	90	100	100	mA
Zero signal D-C grid No. 2 current	0	0	0	0	mA
Effective RF load resistance	9150	7150	5700	4460	ohms
Single Tone Modulation					
Max signal D-C plate current	270	272	306	307	mA
Max signal D-C grid No. 2 current	14	12	16	18	mA
Max signal D-C grid No. 1 current	0	0	0	0	mA
Max signal peak RF grid No. 1 voltage	130	135	148	144	volts
Max signal driving power	0	0	0	0	watts
Max signal plate power output	723	612	590	466	watts
Two Tone Modulation					
Average D-C plate current	176	189	215	215	mA
Average D-C screen-grid current	4	4	5	6	mA
Average D-C control-grid current	0	0	0	0	mA
Max resultant peak RF grid voltage	130	135	148	144	volts
Average plate power output	362	306	295	233	mA
Peak envelope plate power output	723	612	590	466	mA
3rd order intermodulation distortion	35	35	35	35	db

[3] If the temperature of the pin seals is kept below 120°C, the maximum value of screen-grid voltage may be increased to 1000 volts.

[4] Adjust to give stated zero signal D-C plate current.





GIANT 5 PIN BASE

PINS, .187 ± .003 DIA.

7527

PLATE CHARACTERISTICS

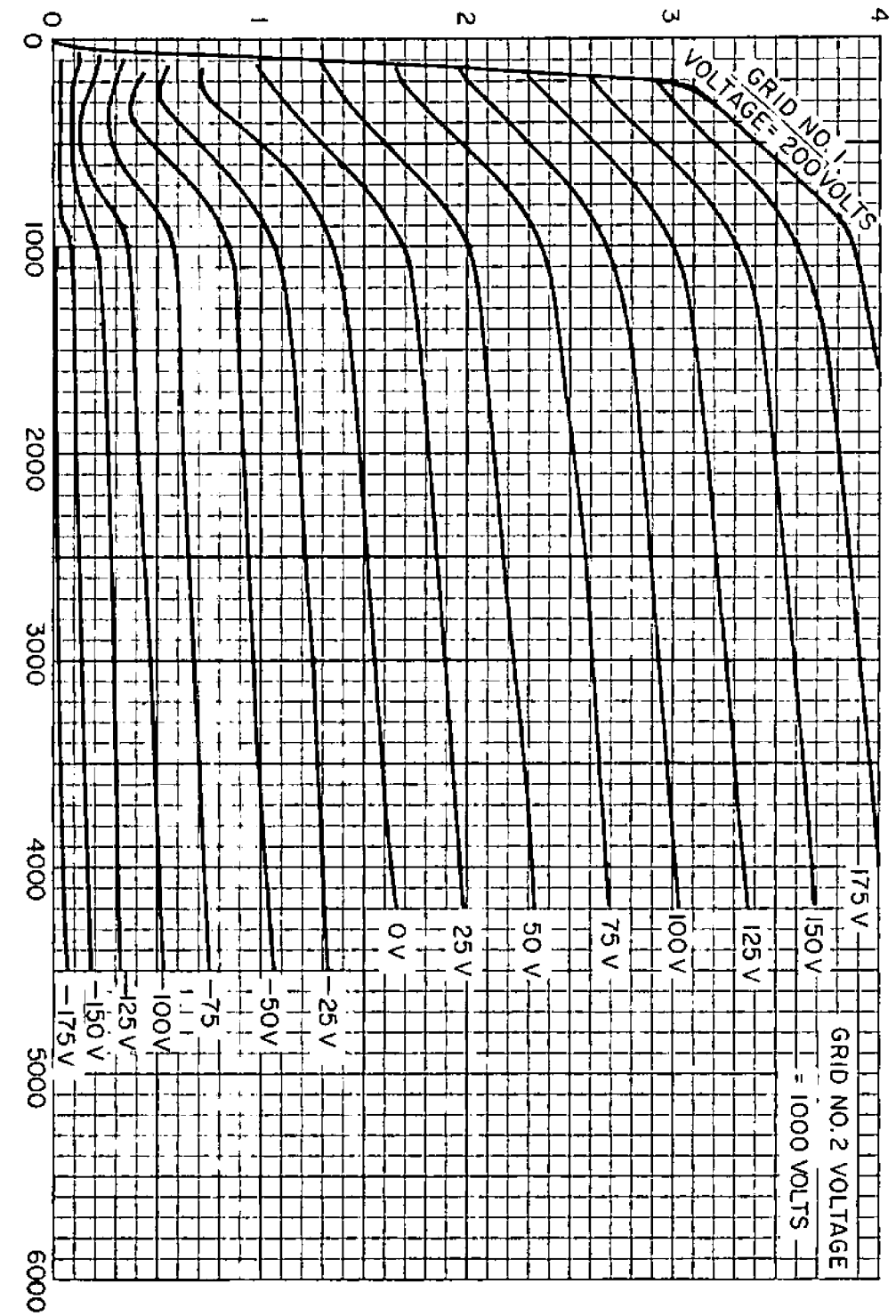
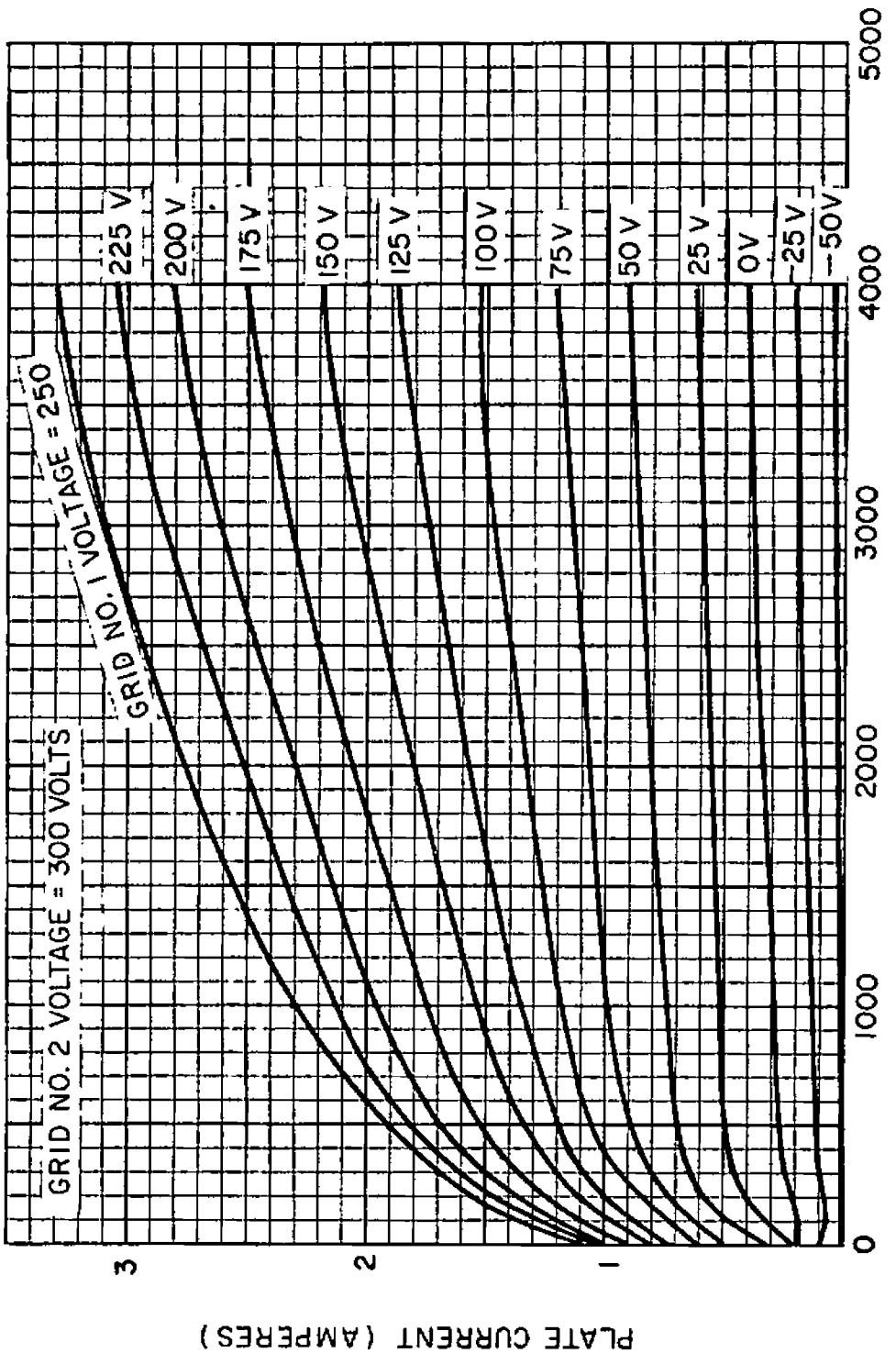


PLATE CHARACTERISTICS

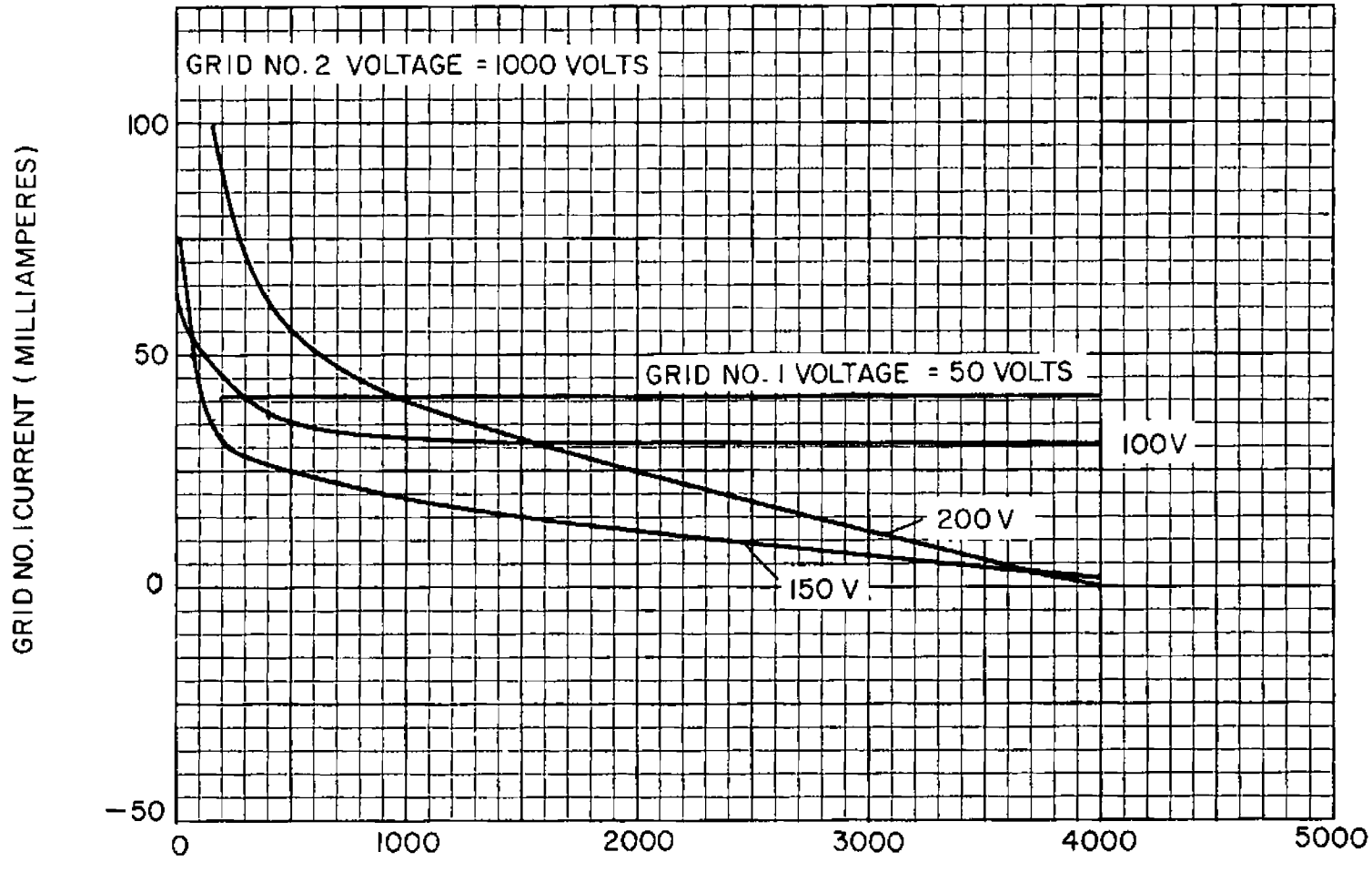


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PLATE CHARACTERISTICS

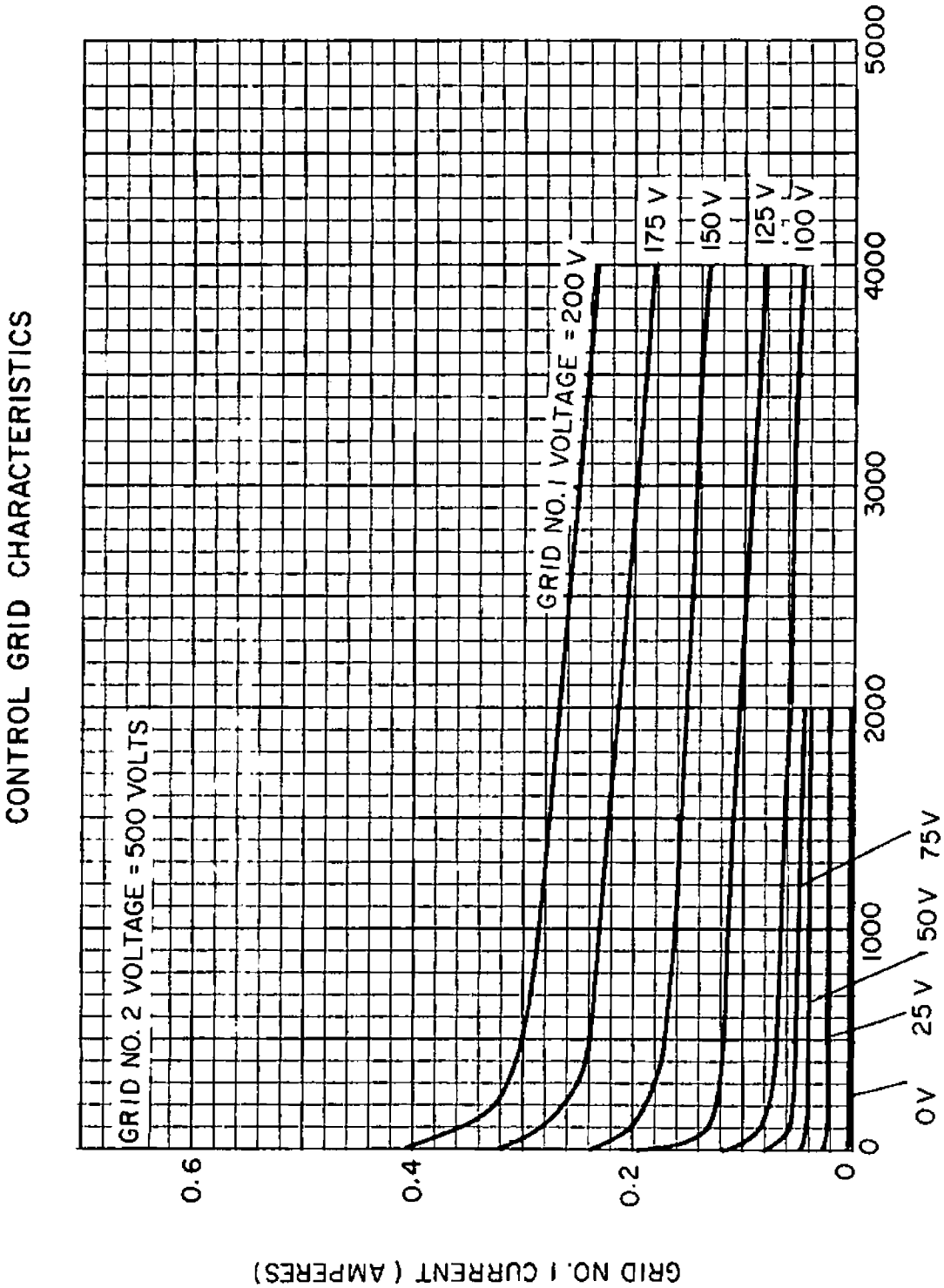


CONTROL GRID CHARACTERISTICS

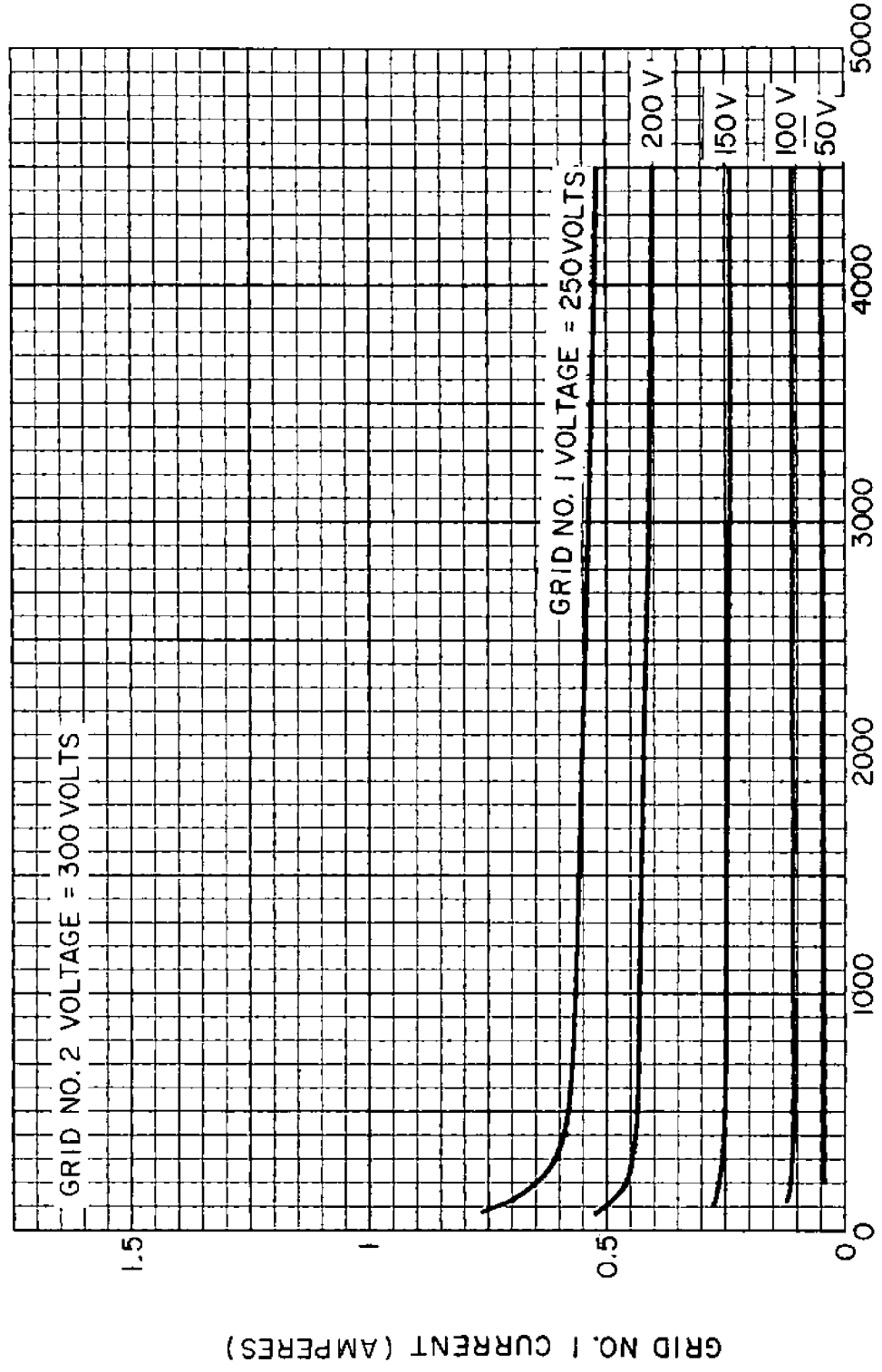


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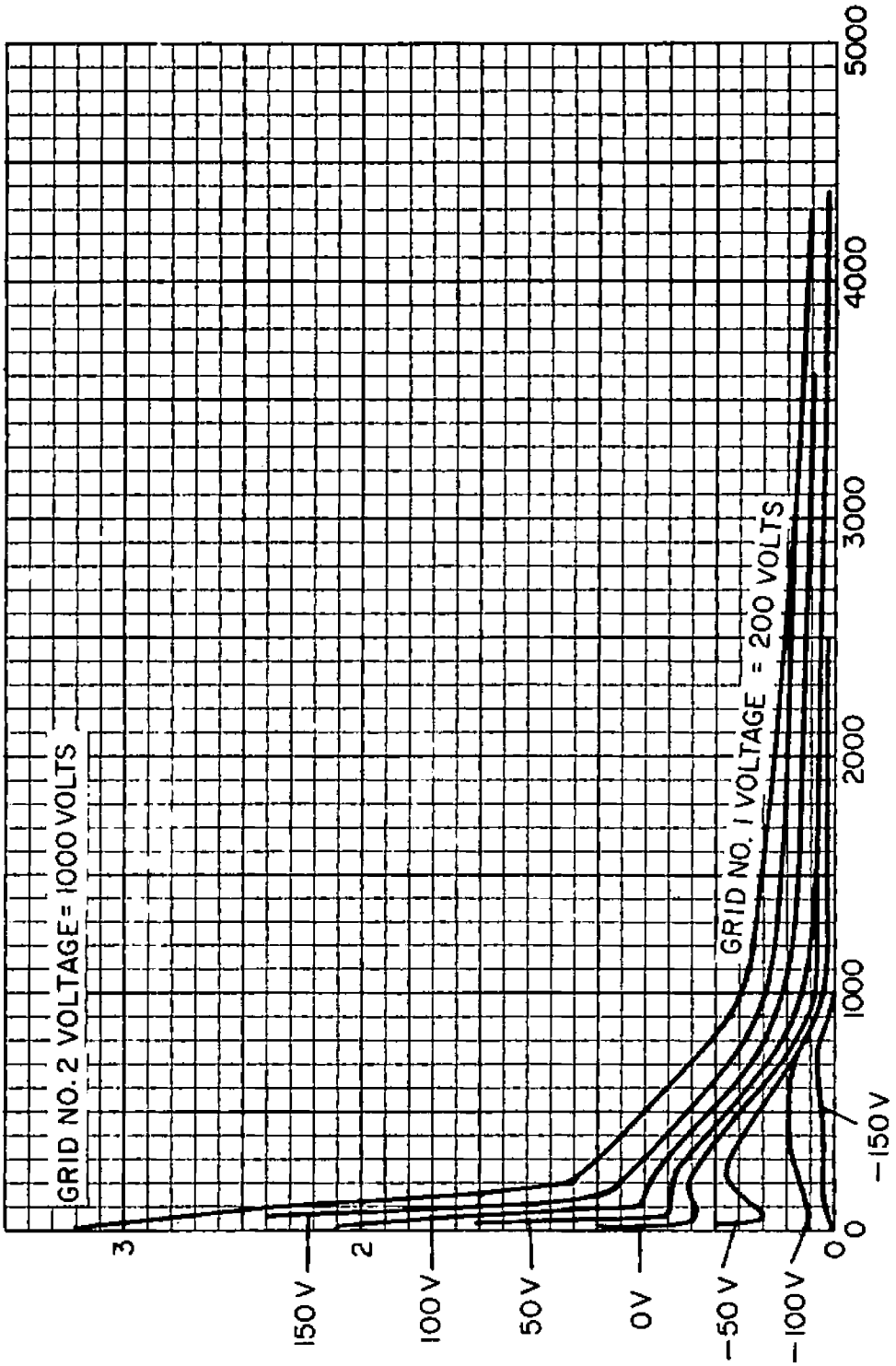

CONTROL GRID CHARACTERISTICS
GRID NO. 2 VOLTAGE = 500 VOLTS
GRID NO. 1 VOLTAGE = 200 V
175 V
150 V
125 V
100 V
75V
50V
25 V
0V
0.6
0.4
0.2
0
0
1000
2000
3000
4000
5000
GRID NO. 1 CURRENT (AMPERES)
PLATE VOLTAGE (KILOVOLTS)

CONTROL GRID CHARACTERISTICS

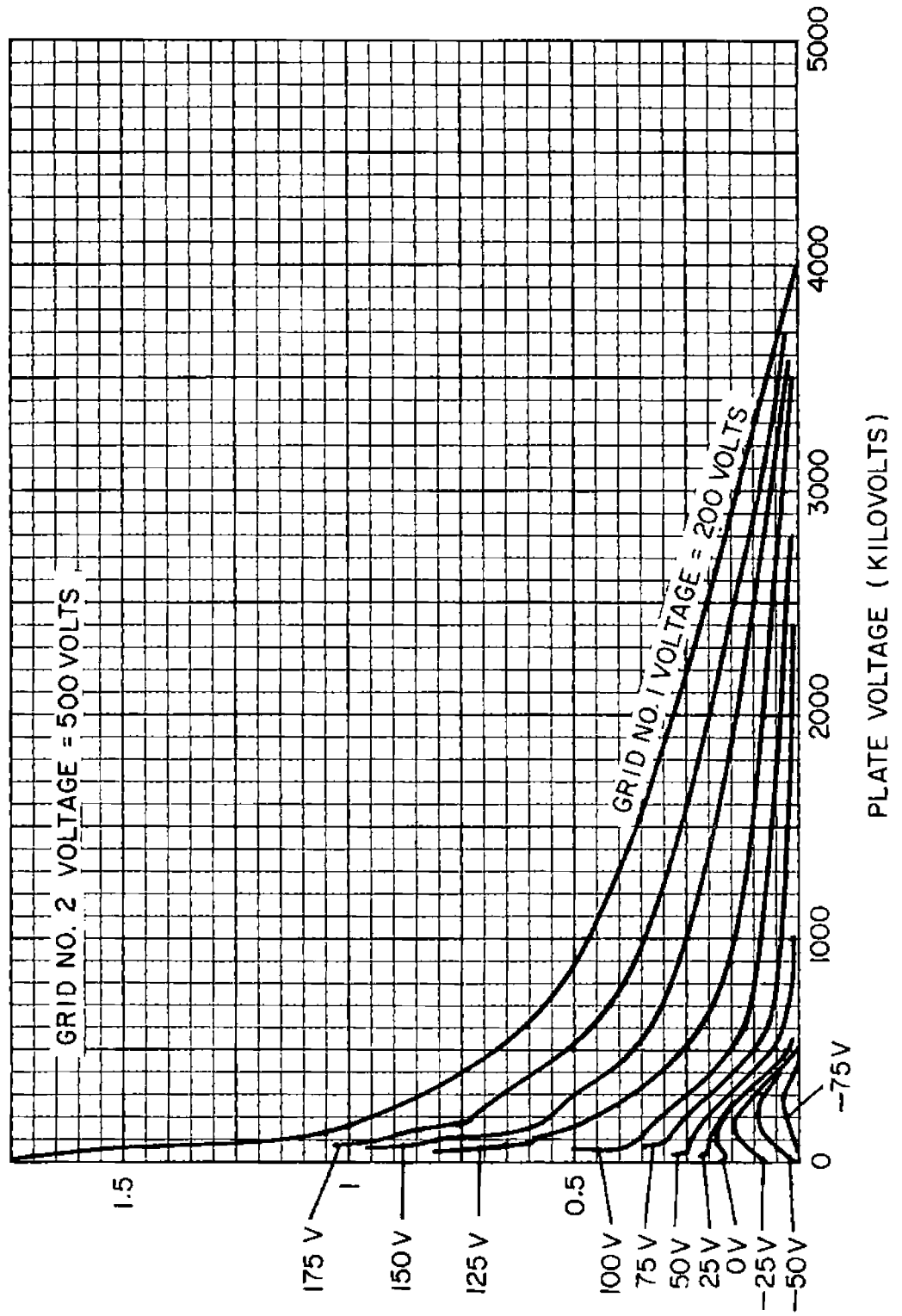


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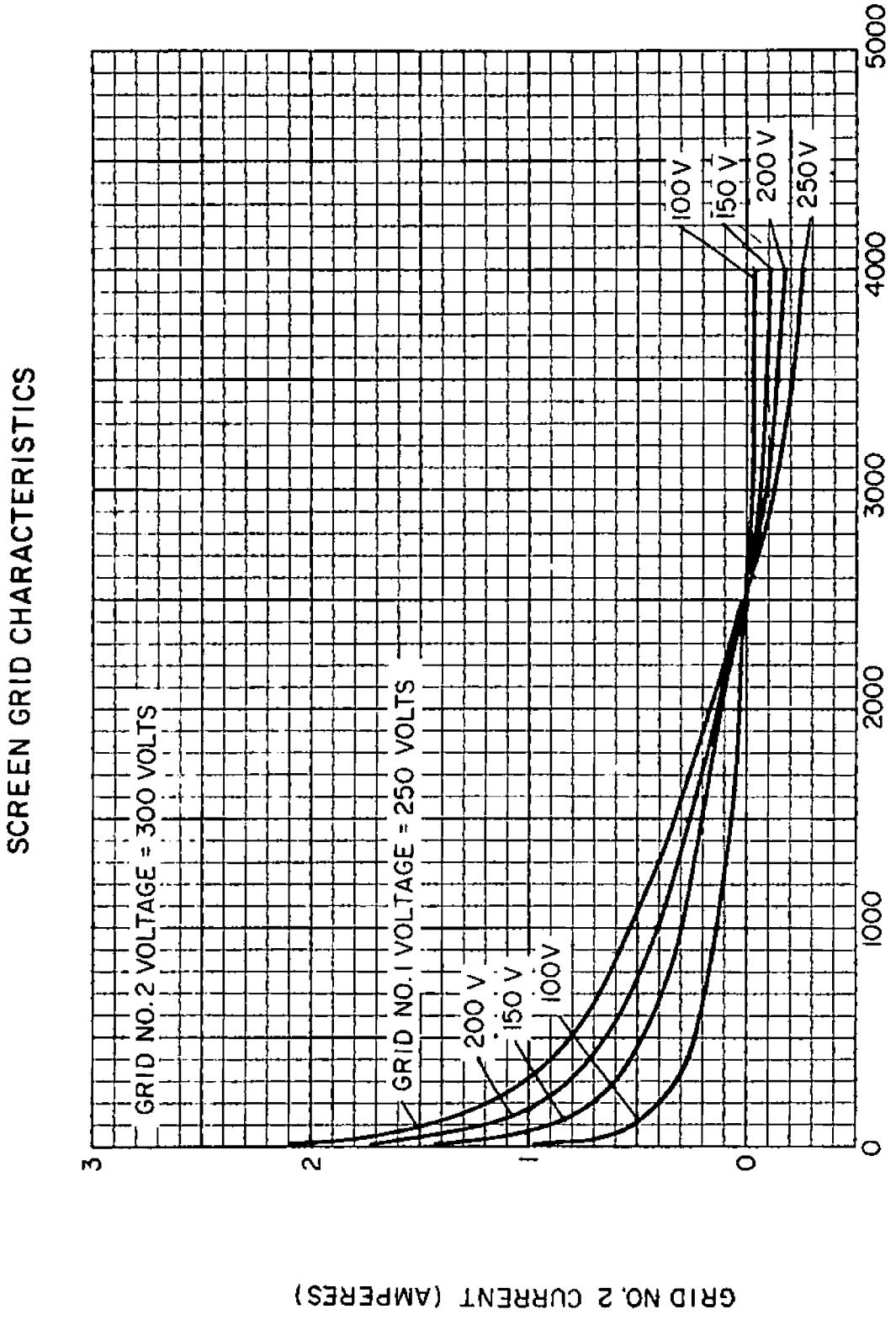
SCREEN GRID CHARACTERISTICS

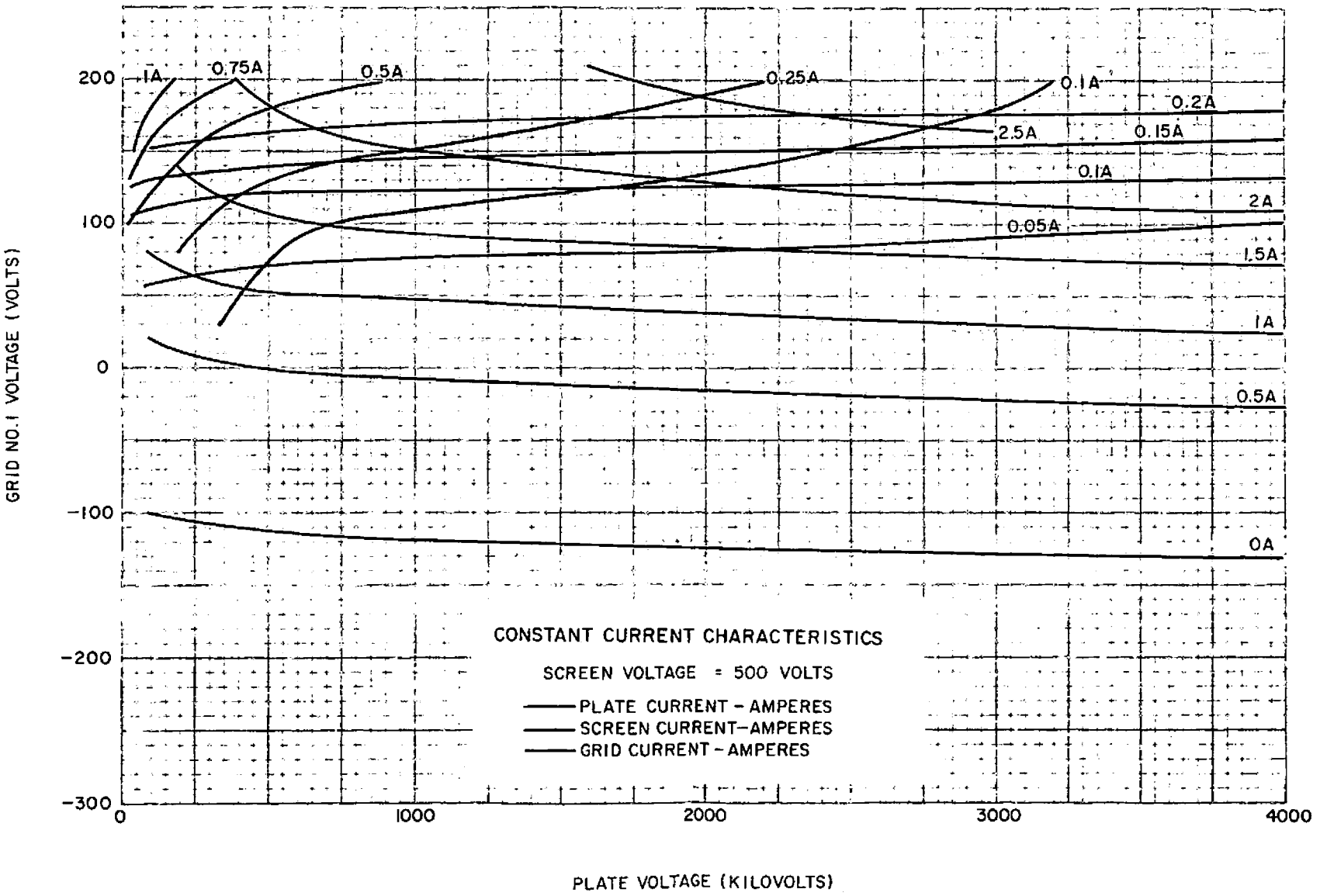


SCREEN GRID CHARACTERISTICS

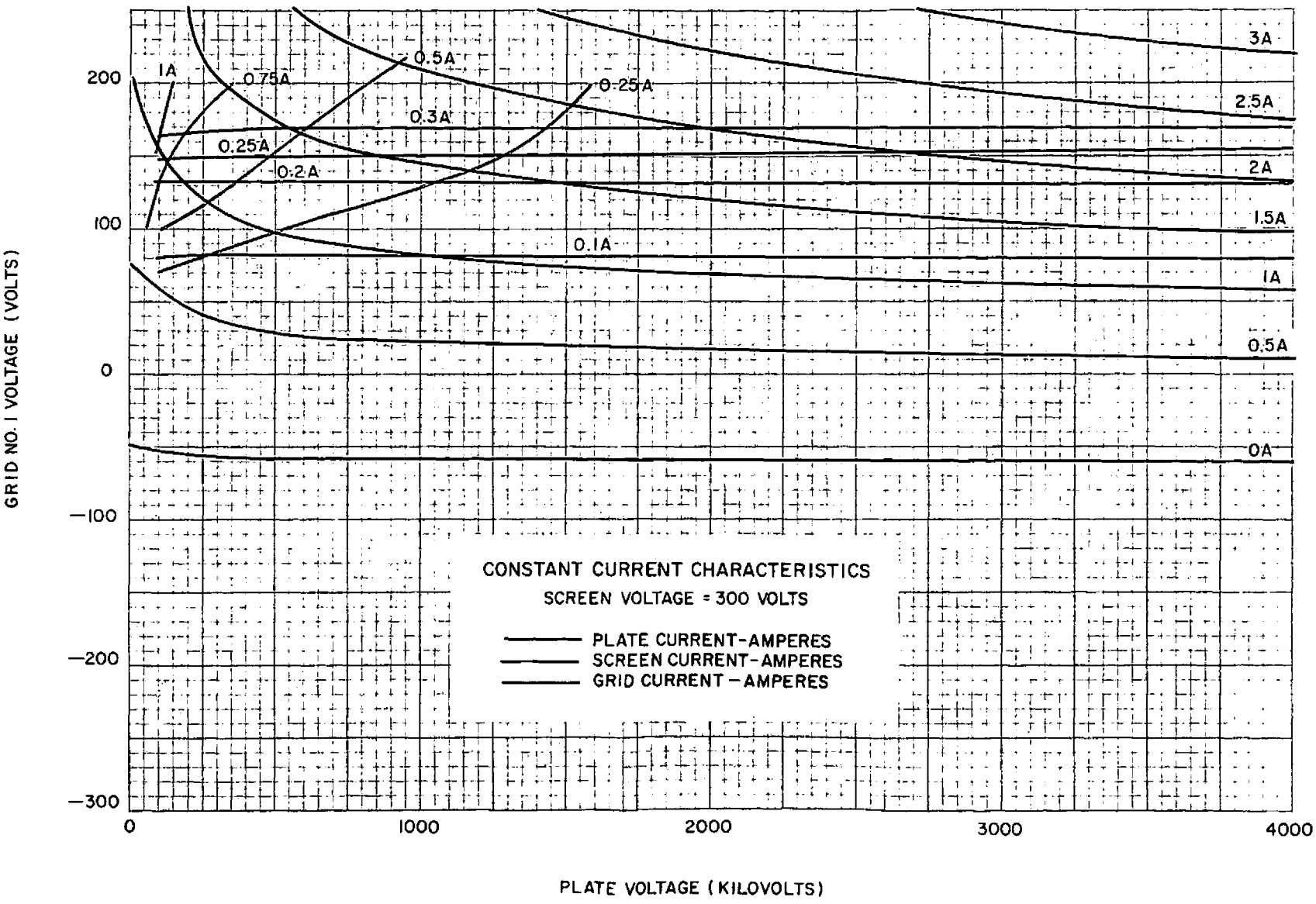


7527


SCREEN GRID CHARACTERISTICS
GRID NO.2 VOLTAGE = 300 VOLTS
GRID NO.1 VOLTAGE = 250 VOLTS
100 V
150 V
200 V
250 V
100V
150 V
200 V
0
1
2
3
0
1000
2000
3000
4000
5000
GRID NO. 2 CURRENT (AMPERES)
PLATE VOLTAGE (KILOVOLTS)


GRID NO.1 VOLTAGE (VOLTS)
200
100
0
-100
-200
-300
0
1000
2000
3000
4000
PLATE VOLTAGE (KILOVOLTS)
1A
0.75A
0.5A
0.25A
0.1A
0.2A
2.5A
0.15A
0.1A
2A
0.05A
1.5A
1A
0.5A
0A
CONSTANT CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 500 VOLTS
PLATE CURRENT - AMPERES
SCREEN CURRENT-AMPERES
GRID CURRENT - AMPERES

7527


CONSTANT CURRENT CHARACTERISTICS
SCREEN VOLTAGE = 300 VOLTS
PLATE CURRENT-AMPERES
SCREEN CURRENT-AMPERES
GRID CURRENT – AMPERES
3A
2.5A
2A
1.5A
1A
0.5A
0A
1A
0.75A
0.5A
0.25A
0.3A
0.2A
0.1A
200
100
0
−100
−200
−300
0
1000
2000
3000
4000
GRID NO. 1 VOLTAGE (VOLTS)
PLATE VOLTAGE (KILOVOLTS)

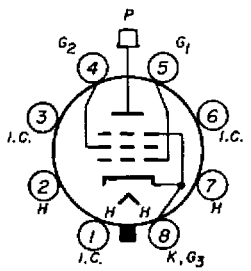
AMPEREX TUBE TYPE 7534

TENTATIVE DATA

The Amperex 7534 is a high transconductance output pentode designed for use as a wide-band amplifier, as a cathode follower, as a series stabilizer in electronic power supplies or as an output tube in class B push-pull circuits.

The 7534 contains two frame grids, one as control grid and one as screen grid. This modern construction makes a transconductance of 25,000 micromhos possible at the unusually low screen-grid current of 4 mA.

This tube is one of the Amperex "Premium Quality 10,000 Hour" tubes.

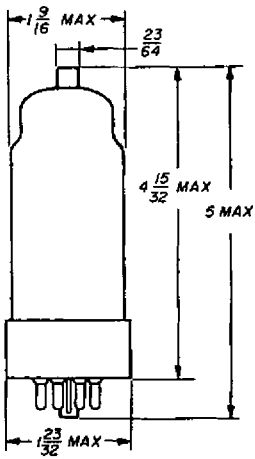


8KE

PIN CONNECTION

1- INTERNAL CONNECTION
2- HEATER
3- INTERNAL CONNECTION
4- GRID NO. 2
5- GRID NO. 1
6- INTERNAL CONNECTION
7- HEATER
8- CATHODE, GRID NO. 3

TOP CAP - PLATE



GENERAL CHARACTERISTICS

MECHANICAL

Base	octal
Mounting Position	any
Dimensions	see outline drawing

ELECTRICAL

Heating	parallel supply
Heater Voltage	6.3 volts
Heater Current	1.7 amps

Direct Interelectrode Capacitances

Input	35 μμf
Output	17 μμf
Plate to Grid No. 1	2 μμf max
Transconductance	25,000 micromhos
Amplification Factor, Grid No. 2 to Grid No. 1	6.5
Internal Plate Resistance	10,000 ohms

from JEDEC release #2831, June 6, 1960

7534

Maximum Ratings, Absolute Values

Plate Voltage (Zero Current)	2000 volts max
Plate Voltage	900 volts max
Peak Plate Voltage [1]	6000 volts max
Grid No. 2 Voltage (Zero Current)	550 volts max
Grid No. 2 Voltage	250 volts max
Negative Grid No. 1 Voltage	150 volts max
Plate Dissipation	27.5 watts max
Grid No. 2 Dissipation	5.0 watts max
Grid No. 1 Dissipation	0.1 watts max
Cathode Current	300 mA max
Peak Cathode Current [2]	1.5 amps max
Series Grid Resistor (Automatic Bias)	1 megohm max
Series Grid Resistor (Fixed Bias)	.5 megohm max
Heater-Cathode Voltage (Cathode Pos. with respect to heater)	200 volts max
Heater-Cathode Voltage (Cathode Neg. with respect to Heater)	100 volts max
Cathode-Heater Circuit Resistance	20,000 ohms max
Bulb Temperature	225°C max

Typical Operation

Plate Voltage	250 volts
Grid No. 2 Voltage	150 volts
Negative Grid No. 1 Voltage	15.5 volts
Plate Current	100 mA
Grid No. 2 Current	4 mA
Grid No. 1 Voltage for Plate Current = 1 mA	30 volts

---

[1] Maximum pulse duration 18% of a cycle with a maximum of 18 microseconds.

[2] Maximum pulse duration 10% of a cycle with a maximum of 4 milliseconds.

Push-Pull - Class B
(Two Tubes)

Typical Operation

Plate Voltage		300	volts
Grid No. 2 Voltage		150	volts
Negative Grid No. 1 Voltage		17	volts
Load Resistance (Plate to Plate)		1600	ohms
Input Voltage	0	0.245	9 volts rms
Plate Current	2x80	-	2x180 mA
Grid No. 2 Current	2x2.5	-	2x22 mA
Output Power	0	0.05	60 watts
Total Harmonic Distortion			5 %

End of Life [3]

The end of life is reached when one or more of the characteristics given below have changed to the indicated values:

Plate Current	< 60 mA
Transconductance	< 17,500 micromhos
Negative Grid No. 1 Current	>1 μA

Shock and Vibration Resistance

The tube can withstand during short time vibrational forces of 2.5 g at 50 c/s in various directions and impact shocks up to 500 g.

---

[3] Conditions of life test are:

Heater Voltage	6.3 volts
Plate Supply Voltage	275 volts
Grid No. 2 Supply Voltage	180 volts
Grid No. 1 Supply Voltage	+ 15 volts
Cathode Resistor	300 ohms
Series Grid Resistor	47,000 ohms
Plate Current	100 mA
Heater-Cathode voltage (Cathode Pos)	220 volts

7534

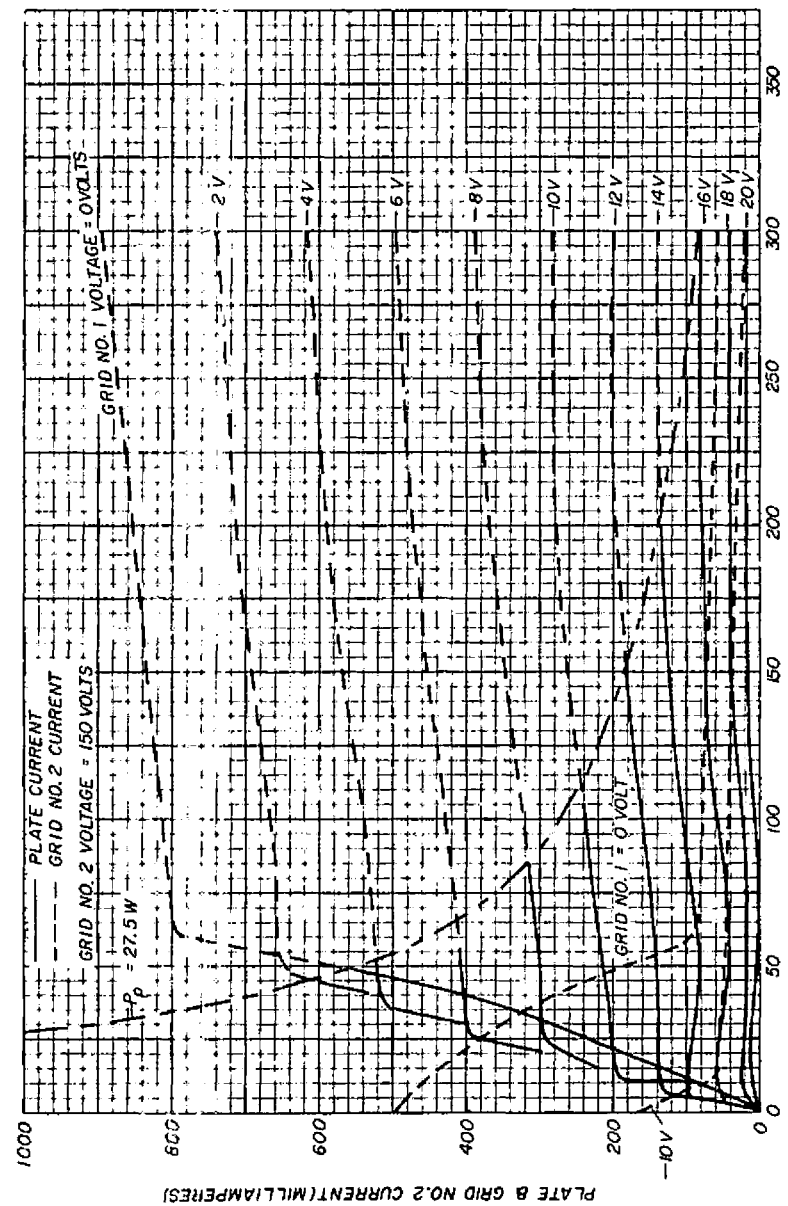
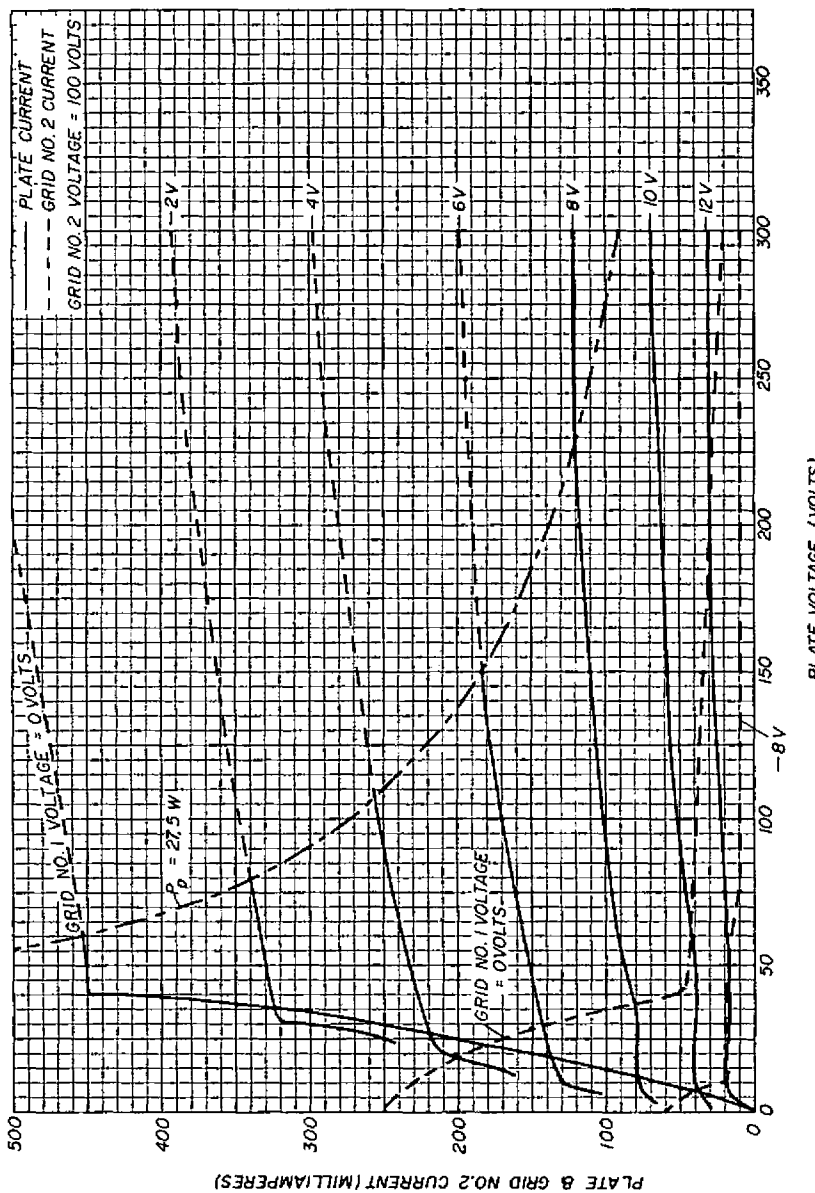
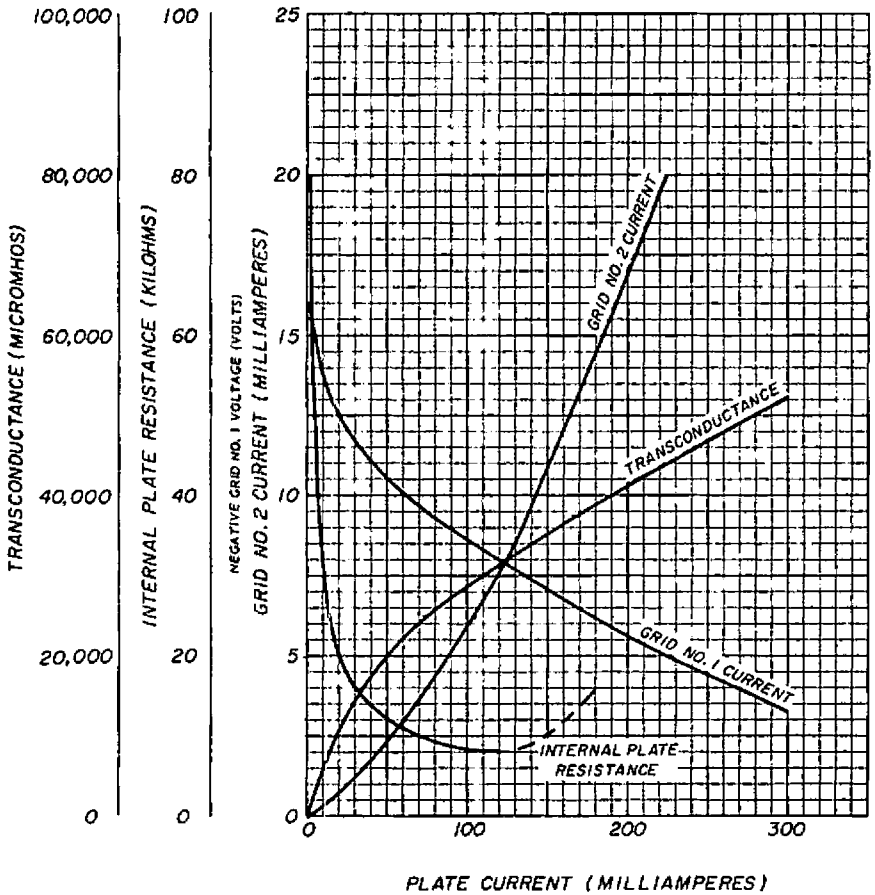

PLATE & GRID NO. 2 CHARACTERISTICS
PLATE CURRENT
GRID NO. 2 CURRENT
GRID NO. 2 VOLTAGE = 150 VOLTS
P_p = 27.5 W
GRID NO. 1 VOLTAGE = 0 VOLTS
2 V
4 V
6 V
8 V
10 V
12 V
14 V
16 V
18 V
20 V
GRID NO. 1 = 0 VOLT
-10 V
PLATE & GRID NO.2 CURRENT (MILLIAMPERES)
1000
800
600
400
200
0
0
50
100
150
200
250
300
350
PLATE VOLTAGE (VOLTS)

PLATE & GRID NO. 2 CHARACTERISTICS

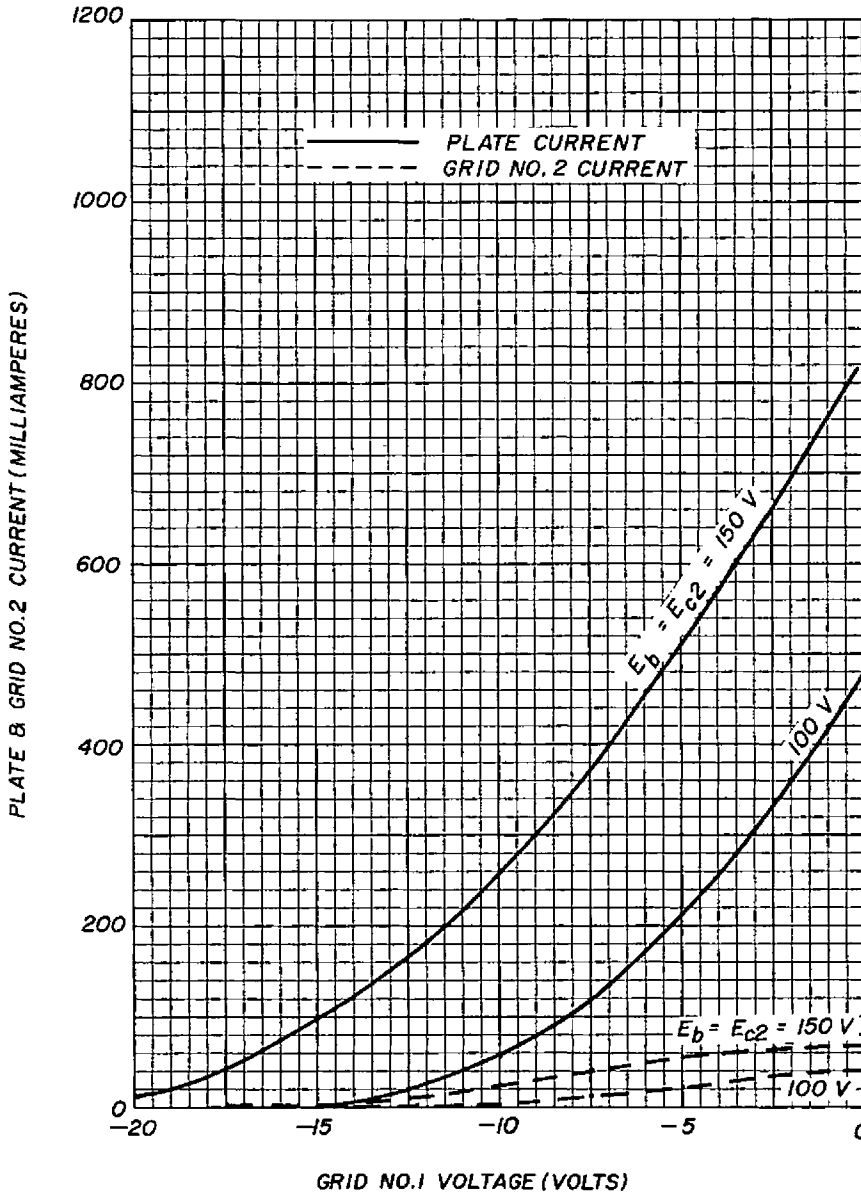


7534

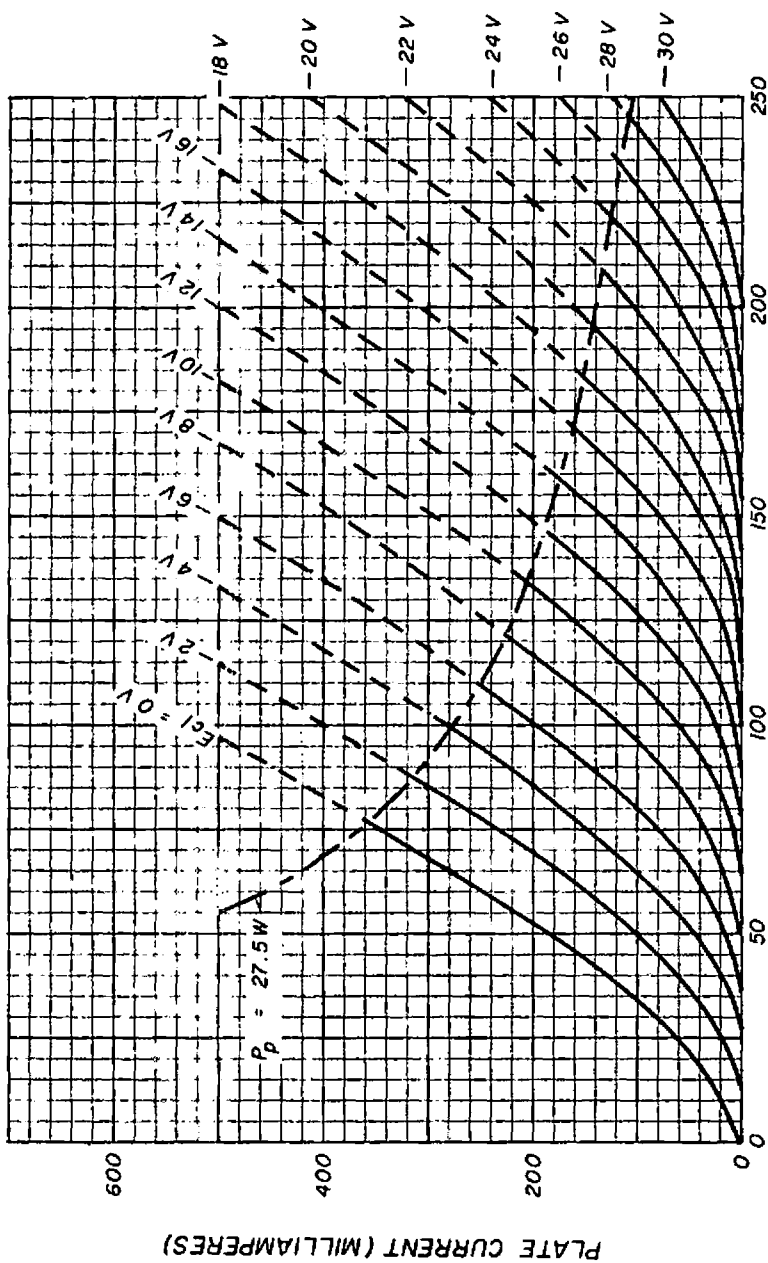
TYPICAL PERFORMANCE CHART



AVERAGE CHARACTERISTICS



7534

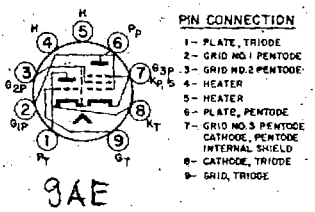

PLATE CHARACTERISTICS
TRIODE CONNECTED
PLATE CURRENT (MILLIAMPERES)
PLATE VOLTAGE (VOLTS)
P_p = 27.5 W
E_{c1} = 0 V
2 V
4 V
6 V
8 V
10 V
12 V
14 V
16 V
18 V
20 V
22 V
24 V
26 V
28 V
30 V
0
50
100
150
200
250
0
200
400
600

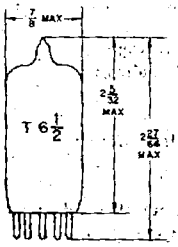
AMPEREX TUBE TYPE 7643

TENTATIVE DATA

The Amperex 7643 is a premium quality, long life, ruggedized triode-pentode with separate cathode leads. The pentode section is designed for use as a mixer, RF or AF amplifier. The triode section is designed for use as an oscillator up to 300 Mc/s, multivibrator or blocking oscillator.

The 7643 will maintain its emission capabilities after long periods of operation under cut-off conditions.





GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6½
Base	E9-1
Dimensions	see outline drawing
Mounting position	any

ELECTRICAL

Cathode	unipotential
Heater arrangement	parallel supply
Heater voltage [1]	6.3 volts
Heater current	330 mA

Direct Interelectrode Capacitances

Pentode Section	
Control grid (between pins 2 and 3+4+5+7)	5.2 μμf
Plate (between pins 6 and 3+4+5+7)	3.4 μμf
Plate to control grid (between pins 6 and 2)	< 0.025 μμf
Control grid to filament (between pins 2 and 4+5)	< 0.160 μμf
Triode Section	
Control grid (between pins 9 and 4+5+7+8)	2.5 μμf
Plate (between pins 1 and 4+5+7+8)	1.5 μμf
Plate to control grid (between pins 1 and 9)	1.5 μμf
Control grid to filament (between pins 9 and 4+5)	< 0.220 μμf
Between Pentode and Triode Sections	
Plate to plate (between pins 6 and 1)	< 0.07 μμf
Plate of pentode to grid of triode (between pins 6 and 9)	< 0.02 μμf
Control grid of pentode to plate of triode (between pins 2 and 1)	< 0.16 μμf

fro, JEDEC release #2806, May 9, 1960

7643

Maximum Ratings, Absolute Values
Triode Section

Plate voltage, cut-off condition	550 volts max
Plate voltage	275 volts max
Plate dissipation	1.75 watts max
Peak grid voltage [2]	30 volts max
Grid dissipation	0.1 watts max
Cathode current	18 mA max
Peak cathode current [2]	100 mA max
Grid resistor	0.5 megohms max
Cathode to filament voltage	100 volts max
Negative control grid voltage	100 volts max

Pentode Section

Plate voltage, cut-off condition	550 volts max
Plate voltage	275 volts max
Plate dissipation	2.15 watts max
Screen grid voltage, cut-off condition	550 volts max
Screen grid voltage (I_k > 10 mA)	200 volts max
Screen grid voltage (I_k < 10 mA)	225 volts max
Screen grid dissipation (P_p > 1.2 W)	0.7 watts max
Screen grid dissipation (P_p < 1.2 W)	0.8 watts max
Cathode current	18 mA max
Control grid dissipation	0.1 watts max
Control grid resistor (automatic grid bias)	1 megohm max
Control grid resistor (fixed grid bias)	0.5 megohms max
Cathode to filament voltage	100 volts max
Negative control grid voltage	100 volts max
Bulb temperature	170°C max

Typical Operation
Triode Section

Plate supply voltage	100 volts
Cathode resistor	120 ohms
Plate current [3]	14 mA
Transconductance [3]	5000 micromhos
Negative grid current [3]	< 0.3 μA
Amplification factor	18

Pentode Section

Plate supply voltage	170 volts
Screen grid supply voltage	170 volts
Cathode resistor	155 ohms
Plate current [3]	10 mA
Screen grid current	2.8 mA
Transconductance [3]	6200 micromhos
Amplification factor (Grid No. 2 to Grid No. 1)	40
Plate resistance	0.4 megohms
Negative control grid current [3]	< 0.3 μA

[1] In order to obtain a prolonged tube life, the maximum variation of the heater voltage should be less than ±5% (absolute limits).

[2] Max pulse duration 4% of a cycle with a max of 0.8 milliseconds.

[3] The end point of life is reached when one or more of these characteristics have changed to the following values:

	Pentode	Triode
Plate Current	< 6	< 8.4 mA
Transconductance	< 4300	< 3500 micromhos
Negative control grid voltage	≧ 1	≧ 1 μA

Operating Characteristics
For Use as a Frequency Converter [4]

Plate supply voltage	170 volts
Screen grid supply voltage	170 volts
Input resistance	0.1 megohm
Cathode resistor	330 ohms
Oscillator voltage	3.5 volts rms
Plate current	8 mA
Screen grid current	2.5 mA
Control grid current	12 μA
Conversion conductance	2400 micromhos
Plate resistance	0.5 megohms

Operating Characteristics
Pentode Section
For Use as an RF Amplifier

Plate supply voltage	170 volts
Screen grid supply voltage	170 volts
Cathode resistor	155 ohms
Plate current	10 mA
Screen grid current	2.8 mA
Transconductance	6200 micromhos
Amplification factor (Grid No. 2 to Grid No. 1)	40
Plate resistance	0.4 megohms
Input resistance (f = 50 Mc/s)	10,000 ohms
Equivalent resistance	1500 ohms

Special Ratings

The pentode section of this tube can be used without special precautions against microphonic effect in AF circuits in which the input voltage = 50 mV for an output of 50 mW of the output tube.

Shock Resistance [5]

Shock rating = about 500 g

Forces as applied by the NRL inpact machine for electronic devices caused by 5 blows of the hammer, lifted over an angle of 30° in each of four different positions of the tube.

Vibration Resistance [5]

Vibration rating = 2.5 g

Vibrational forces for a period of 32 hours at a frequency of 50 c/s in each of 3 positions of the tube.

---

[4] Use of the triode in a Colpitts type of circuit and not in a Hartley type is recommended.

[5] These test conditions are only given for evaluation of the ruggedness of the tube. They are by no means to be interpreted as suitable operating conditions.

7643

PLATE CHARACTERISTICS

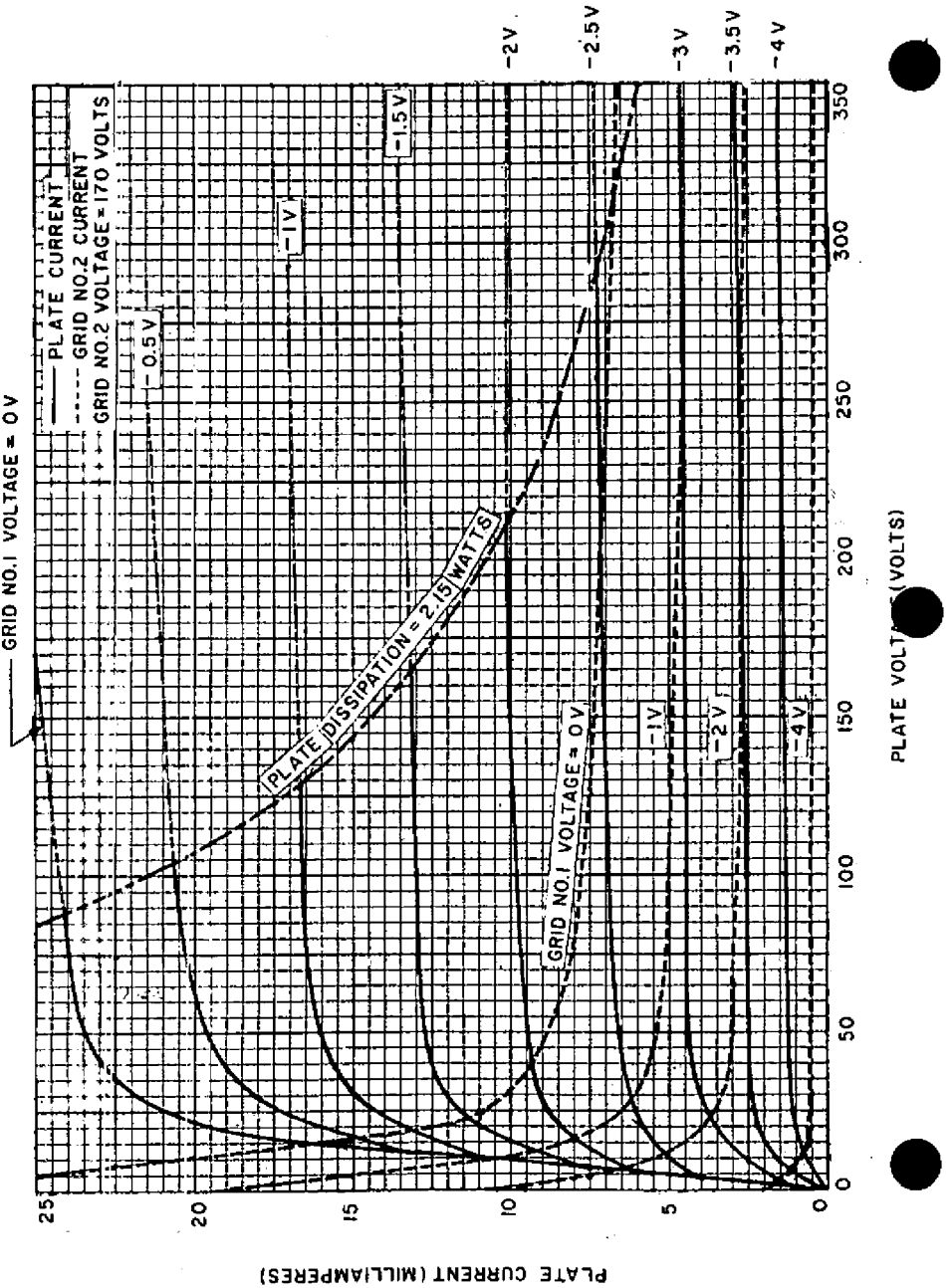
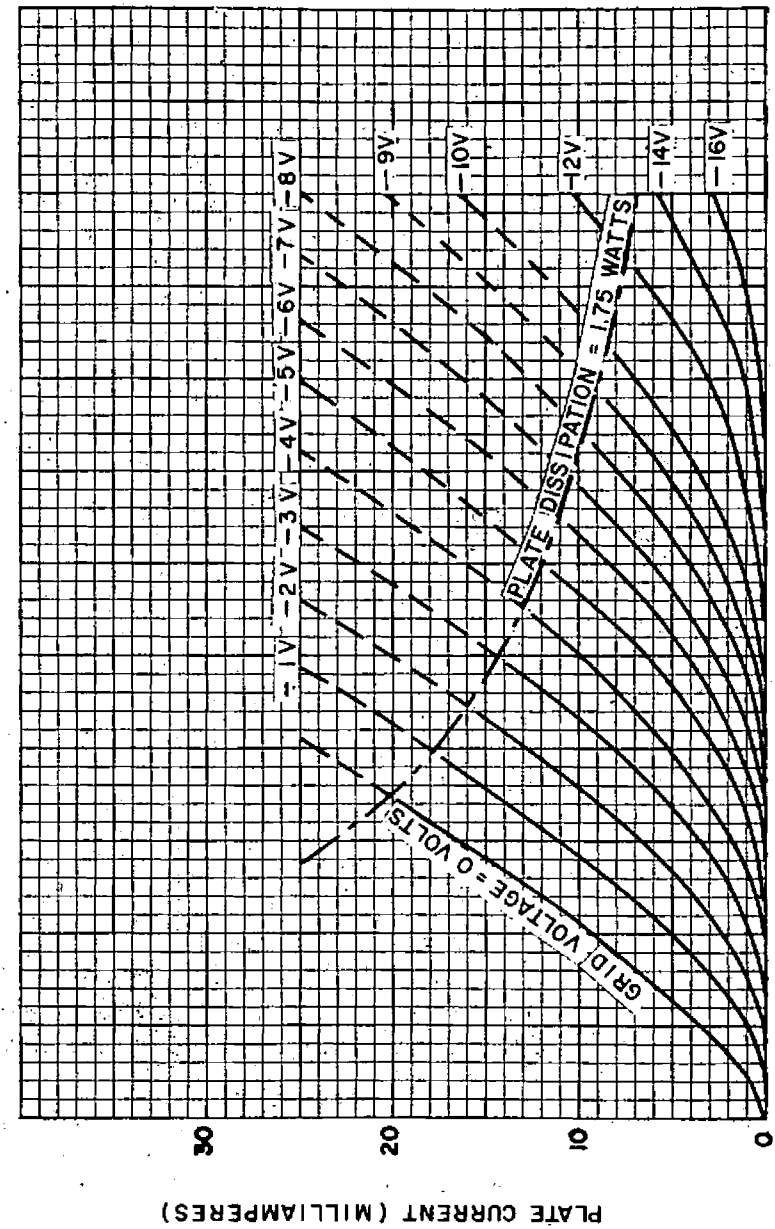


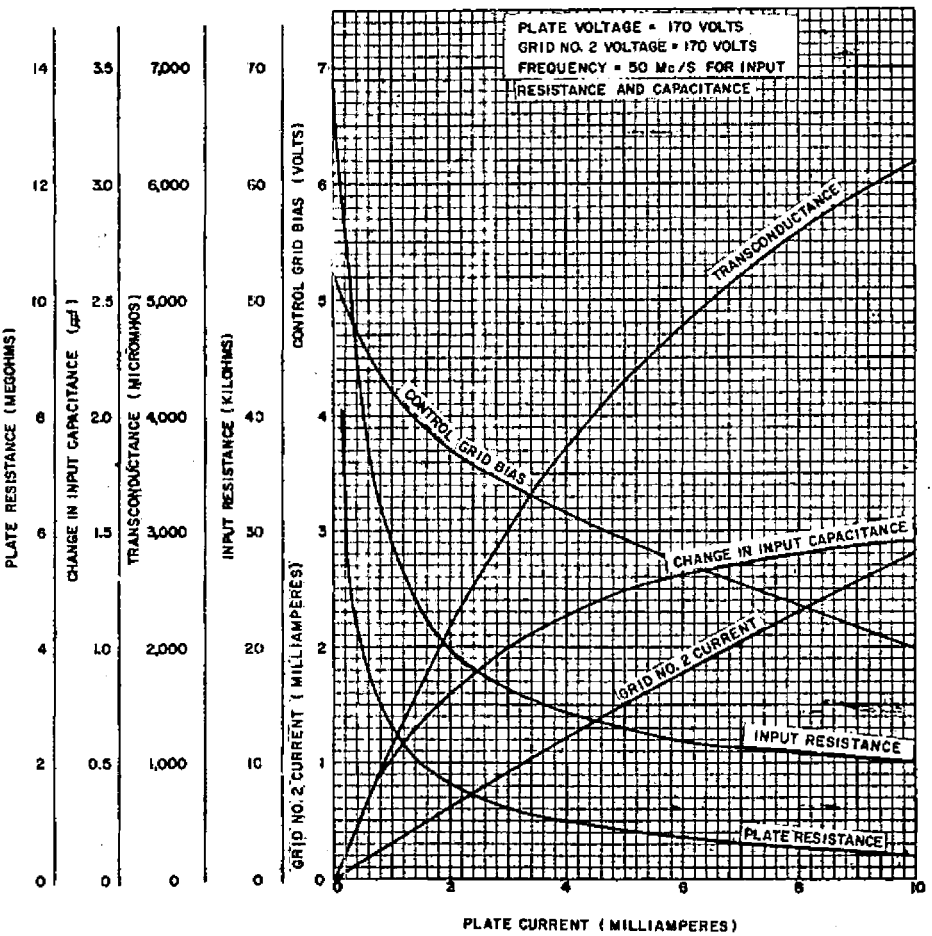
PLATE VOLTAGE (VOLTS)

AVERAGE PLATE CHARACTERISTICS

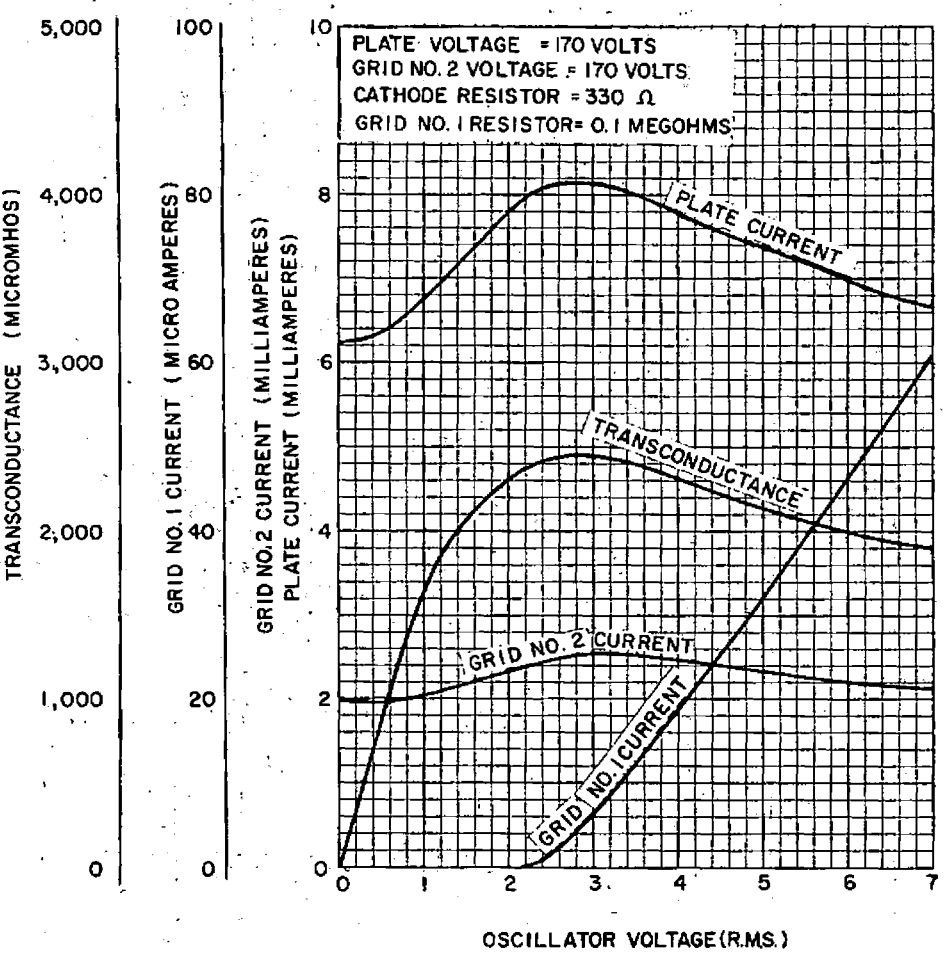


7643

CHARACTERISTICS - PENTODE SECTION

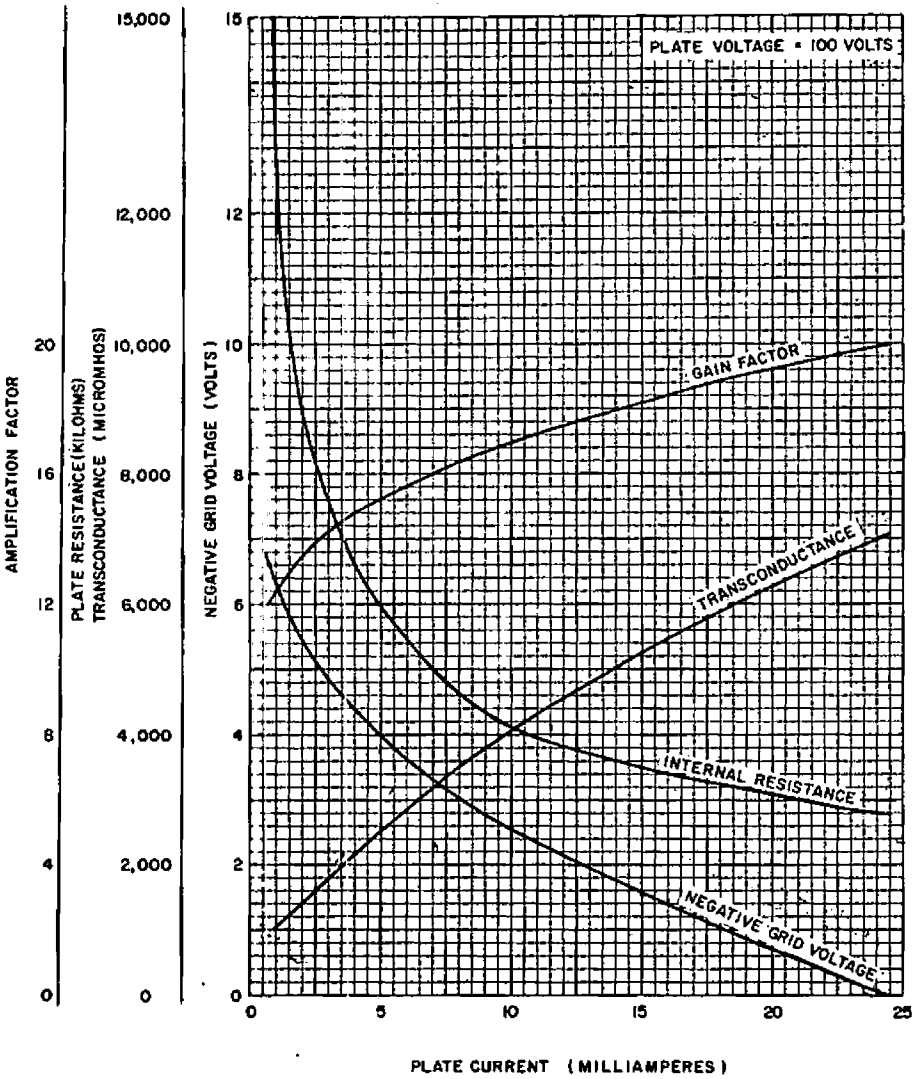


CONVERTOR CHARACTERISTICS—PENTODE

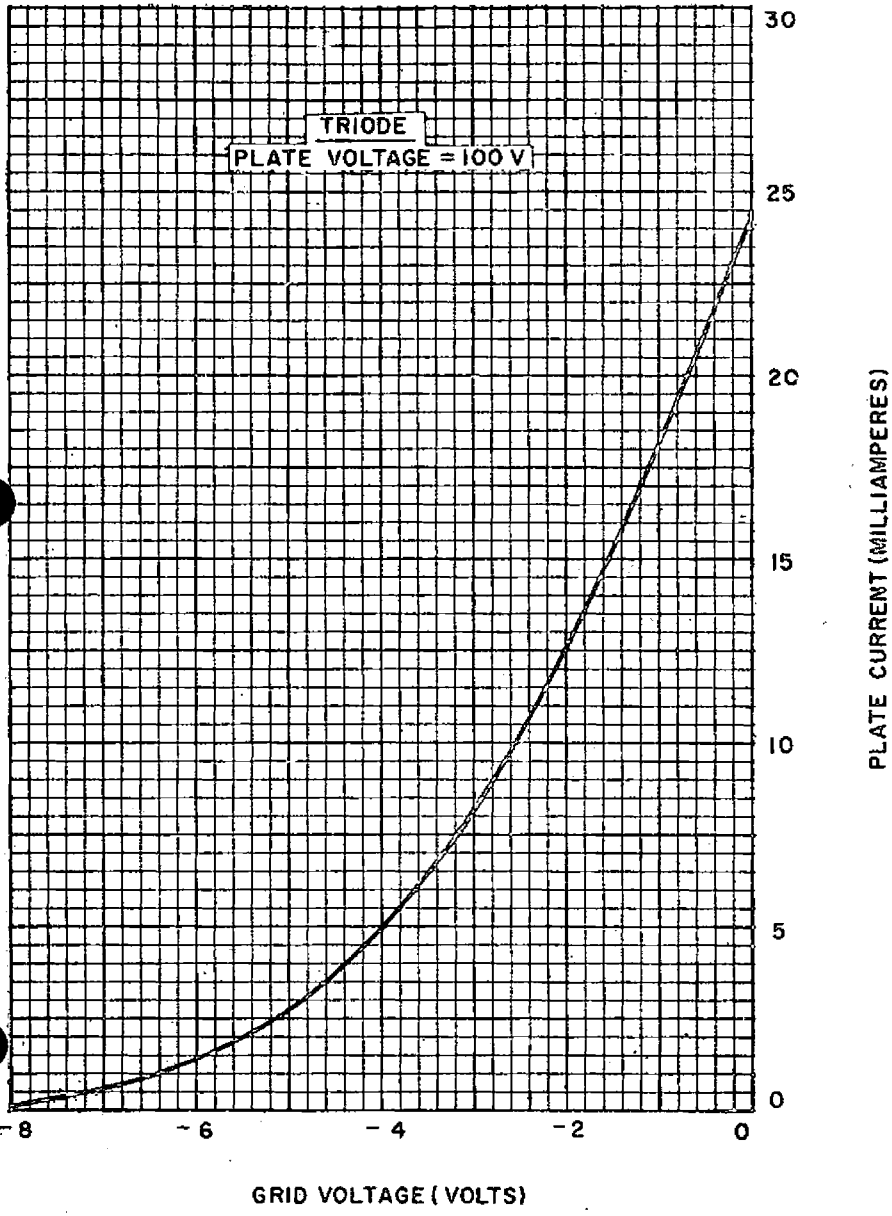


7643

AVERAGE CHARACTERISTICS-TRIODE SECTION



TRANSFER CHARACTERISTICS

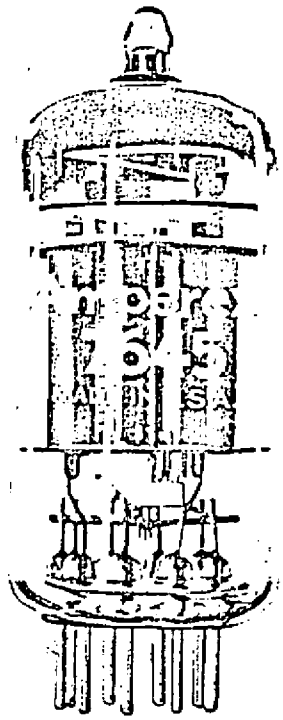


Amperex® ELECTRONIC CORPORATION
210 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE 7645

The 7645 is a miniature twin tetrode designed for use in communication equipment as a frequency multiplier and for special amplifier service. The 7645 is identical in characteristics to the 6939 except that the bulb is reduced in height and the internal neutralization is removed. As a tripler it can deliver an actual plate power output of 1.5 watts CCS and 1.75 watts ICAS. Maximum ratings apply to 500 Mc.

The 7645 features a frame grid construction which results in improved performance and reliability.



GENERAL CHARACTERISTICS

MECHANICAL

Max. Bulb Temperature	225°C
Max. Overall Length	2-3/16 inches
Max. Seated Height	1-15/16 inches
Max. Diameter	7/8 inch
Base	Noval, 9 pin, JETEC E9-1

ELECTRICAL

Cathode — Indirectly heated, oxide coated

	Parallel[1]	Series[1]	
Heater Voltage	6.3	12.6	volts
Heater Current	0.6	0.3	amp

Direct Interelectrode Capacitances

	Each Unit	Both Units Push-Pull	
Output	1.6	0.95	pf
Input	6.4	3.8	pf
Plate to Grid No. 1	0.15		pf

Amplification Factor (Each Unit)
Grid No. 2 to Grid No. 1 ($E_b = E_{c2}$ = 150 V; I_b = 25 ma) — 31

Mutual Conductance (Each Unit)
($E_b = E_{c2}$ = 150 V; I_b = 25 ma) — 10,500 micromhos

1. Occasional operation at 6.7 V or 7.0 V with parallel connected heaters (11.4 or 14.0 V with series connection) is possible with battery supply (mobile operation).

Amperex

FREQUENCY MULTIPLIER AND TRIPLER

MAXIMUM RATINGS, ABSOLUTE VALUES

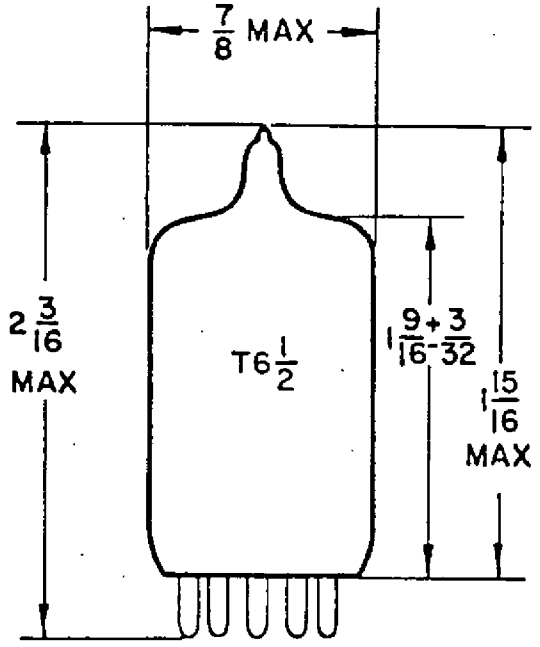
(FREQUENCY UP TO 500 MC)

	CCS	ICAS	
Plate Voltage	250	250	volts
Plate Current	2x30	2x40	ma
Plate Dissipation	2x2.75	2x3.5	watts
Plate Input Power	2x3.6	2x4.5	watts
Grid No. 2 Voltage	200	200	volts
Grid No. 2 Dissipation	2x1.5	2x1.75	watts
Grid No. 1 Voltage	-100	-100	volts
Grid No. 1 Dissipation	2x0.1	2x0.12	watts
Grid No. 1 Current	2x3	2x4	ma
Cathode Current	2x35	2x40	ma
Voltage Between Cathode and Heater	±100	±100	volts

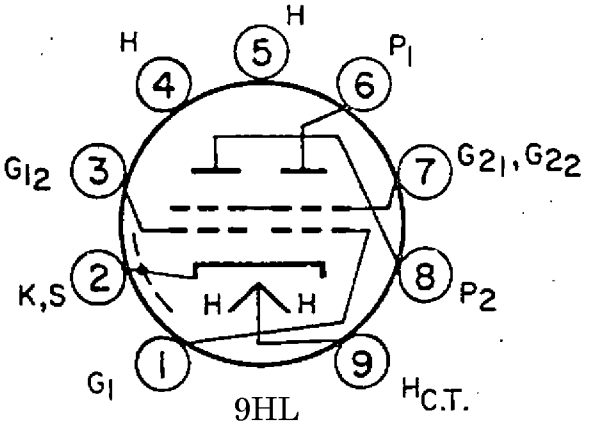
TYPICAL OPERATION

	CCS	ICAS	
Frequency	166.6-500	166.6-500	Mc
Plate Voltage	170	200	volts
Grid No. 2 Voltage	150	185	volts
Grid No. 1 Resistance[2]	100	100	k ohms
Plate Current	2x20	2x20	ma
Grid No. 2 Current	10.0	11.0	ma
Grid No. 1 Current	2x1.0	2x1.0	ma
Driving Power[3]	1.1	1.1	watt
Plate Input Power	2x3.4	2x4.0	watts
Plate Dissipation	2x2.65	2x3.1	watts
Grid No. 2 Dissipation	2x0.75	2x1.0	watts
Output Power	1.5	1.75	watts
Useful Power in Load	1.2	1.4	watt
Circuit Efficiency	80	80	%

2. Each section.
3. Includes circuit losses.



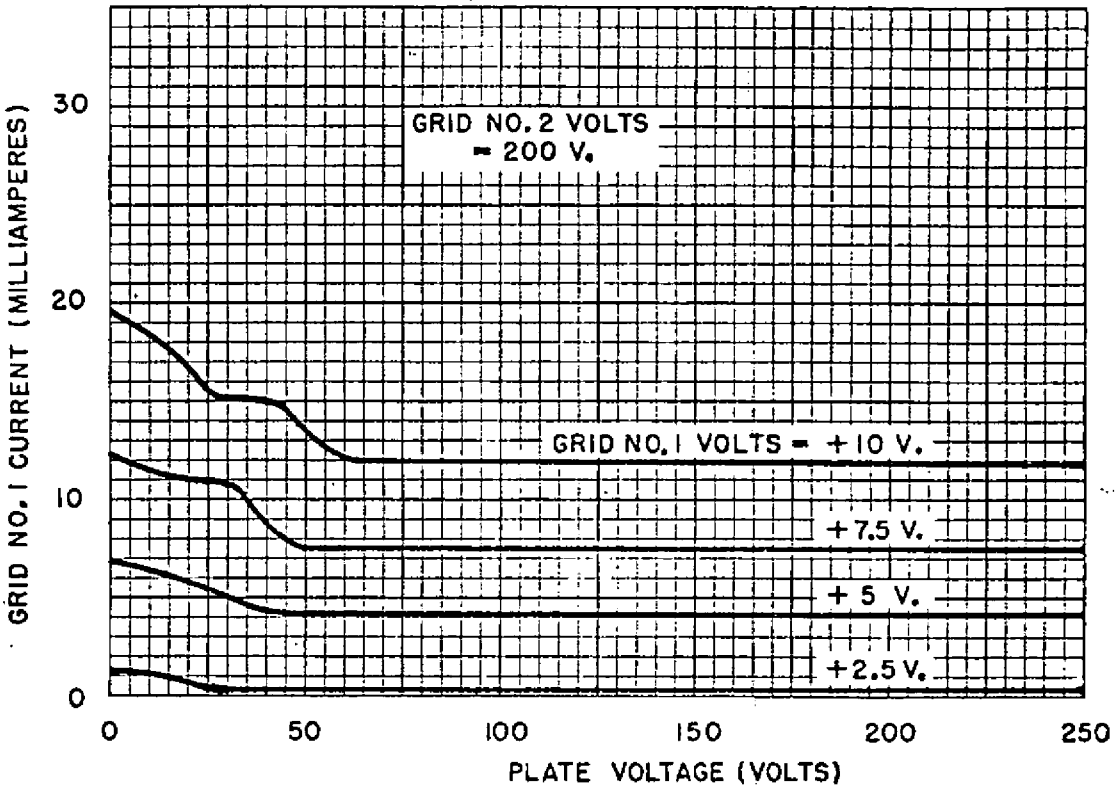
6-2

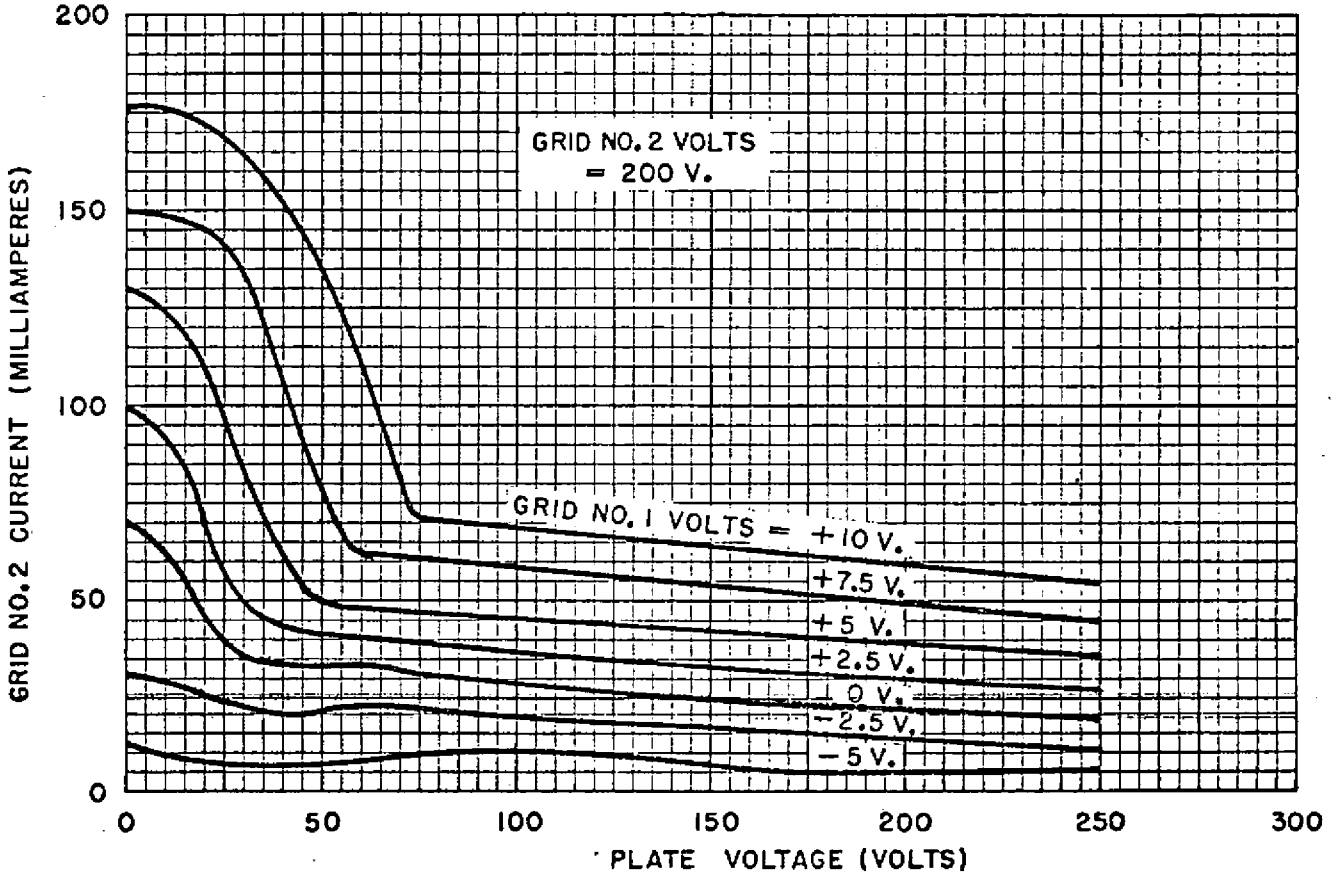


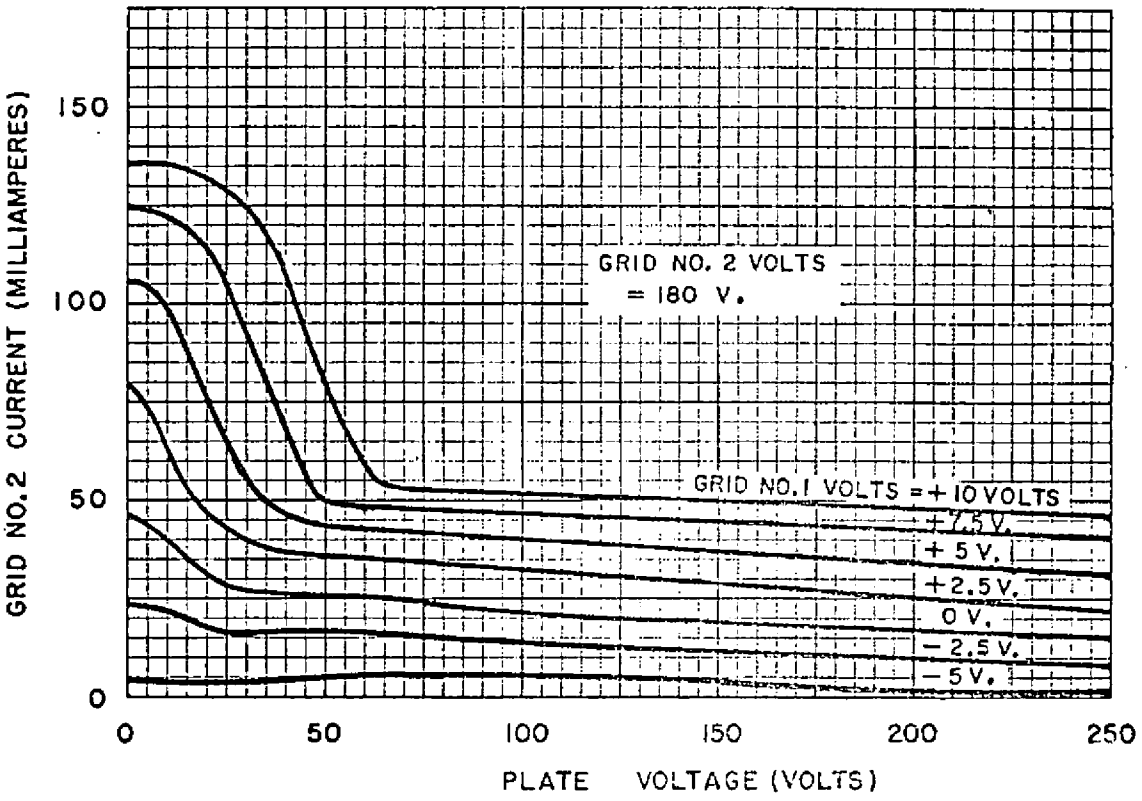
9HL

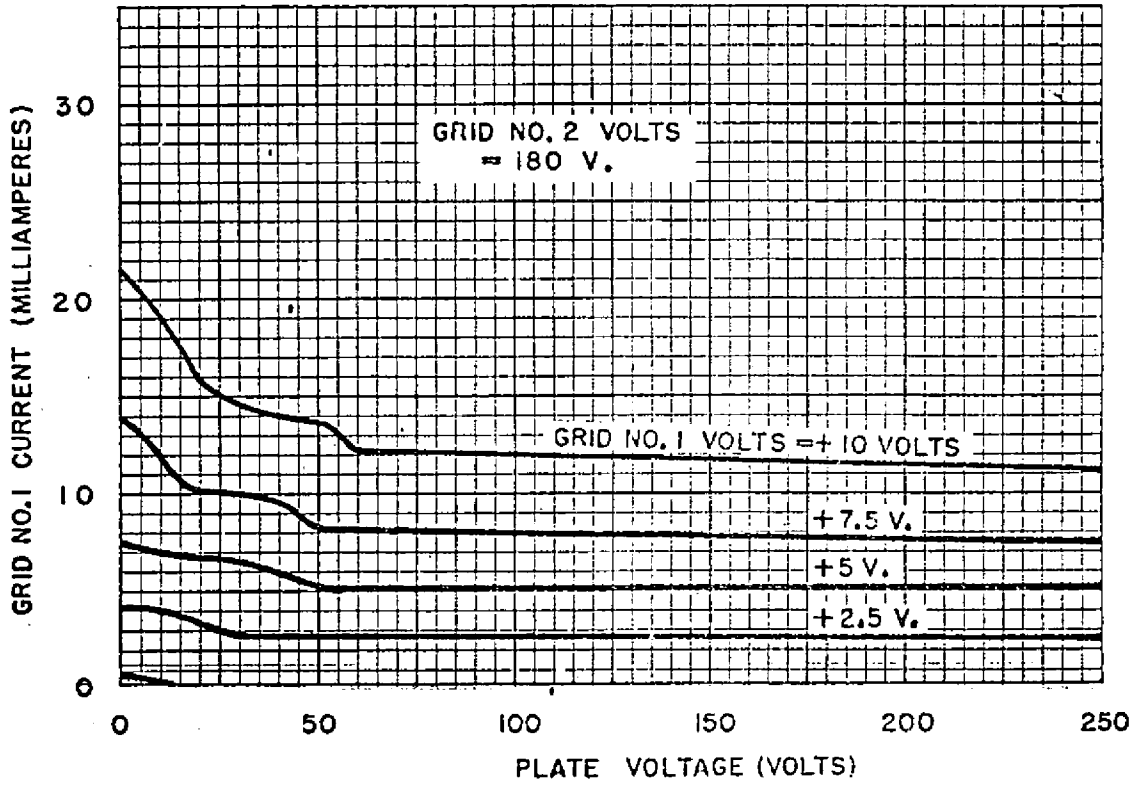
PIN CONNECTIONS

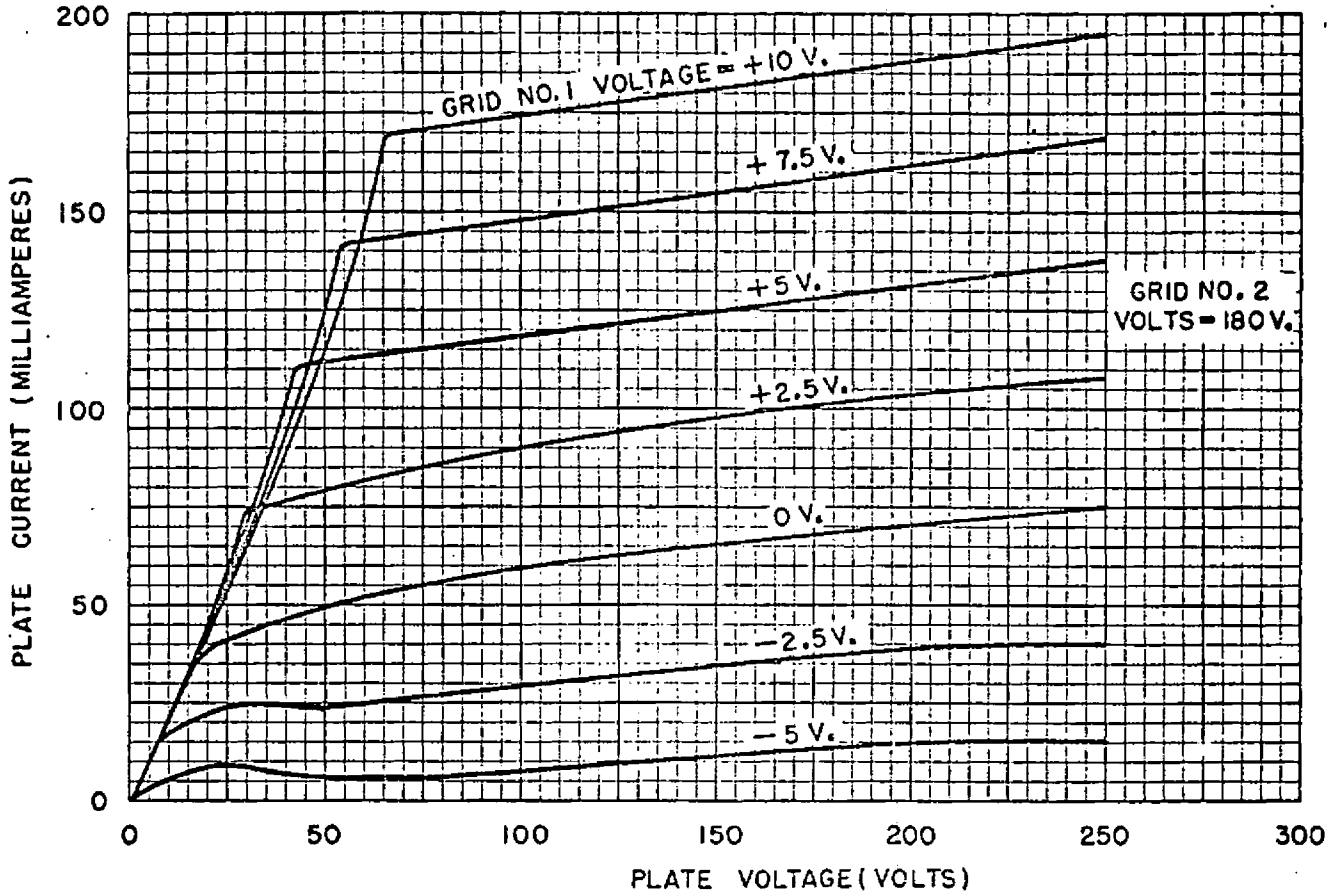
1— CONTROL GRID, UNIT NO.1
2— CATHODE & BEAM PLATES
3— CONTROL GRID, UNIT NO.2
4— HEATER
5— HEATER
6— PLATE, UNIT NO.1
7— SCREEN GRID
8— PLATE, UNIT NO.2
9— HEATER CENTER TAP

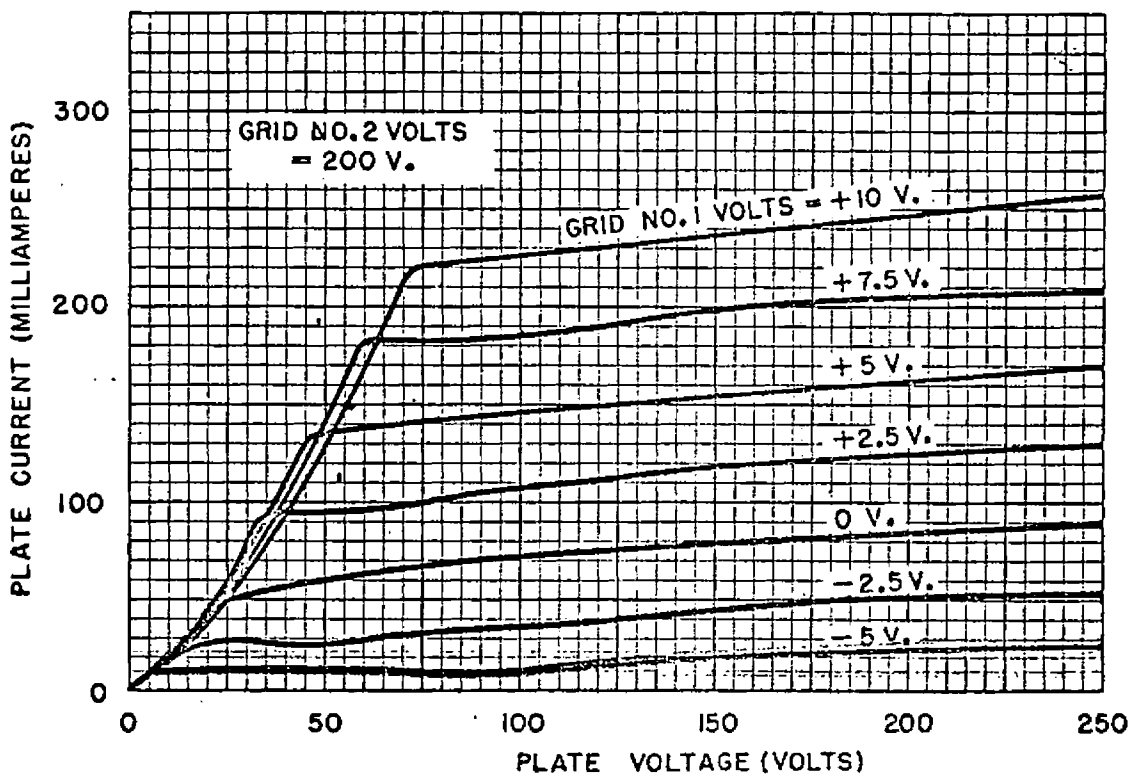

GRID NO. 2 VOLTS = 200 V.
GRID NO. 1 VOLTS = +10 V.
+7.5 V.
+5 V.
+2.5 V.
GRID NO. 1 CURRENT (MILLIAMPERES)
PLATE VOLTAGE (VOLTS)
0
10
20
30
0
50
100
150
200
250


GRID NO. 2 VOLTS = 200 V.
GRID NO. 1 VOLTS = +10 V.
+7.5 V.
+5 V.
+2.5 V.
0 V.
−2.5 V.
−5 V.
GRID NO. 2 CURRENT (MILLIAMPERES)
PLATE VOLTAGE (VOLTS)
0
50
100
150
200
0
50
100
150
200
250
300


GRID NO. 2 CURRENT (MILLIAMPERES)
150
100
50
0
GRID NO. 2 VOLTS = 180 V.
GRID NO. 1 VOLTS = + 10 VOLTS
+7.5 V.
+5 V.
+2.5 V.
0 V.
−2.5 V.
−5 V.
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)


GRID NO. 1 CURRENT (MILLIAMPERES)
30
20
10
0
GRID NO. 2 VOLTS = 180 V.
GRID NO. 1 VOLTS = + 10 VOLTS
+7.5 V.
+5 V.
+2.5 V.
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)


GRID NO. 1 VOLTAGE = +10 V.
+7.5 V.
+5 V.
+2.5 V.
0 V.
−2.5 V.
−5 V.
GRID NO. 2 VOLTS = 180 V.
PLATE CURRENT (MILLIAMPERES)
PLATE VOLTAGE (VOLTS)
0
50
100
150
200
250
300


GRID NO. 2 VOLTS = 200 V.
GRID NO. 1 VOLTS = +10 V.
+7.5 V.
+5 V.
+2.5 V.
0 V.
−2.5 V.
−5 V.
PLATE CURRENT (MILLIAMPERES)
PLATE VOLTAGE (VOLTS)
0
50
100
150
200
250
300

AMPEREX ELECTRONIC CORPORATION JEDEC NO. 7693

E90F

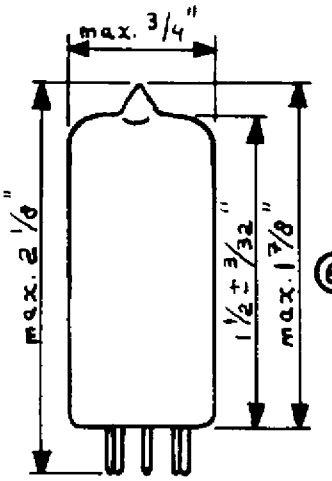
DESCRIPTION

Shock and vibration resistant special quality sharp cut-off R.F. pentode for use in industrial and mobile equipment.
Heater voltage variations of ± 20% are allowed during short periods.

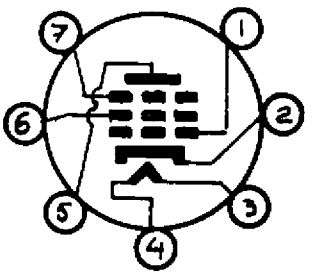
MECHANICAL DATA

Cathode	coated, unipotential
Base	E7-1
Bulb	T5 1/2
Outline	5-2
Basing	7EN
Mounting position	any

TUBE OUTLINE



BOTTOM VIEW OF BASE



BASE PIN No.	ELEMENTS
1	grid No.1
2	cathode
3	heater
4	heater
5	plate
6	grid No.2
7	grid No.3, internal screen

HEATER DATA

Heater voltage	6.3 volts[1])
Heater current	150 mamps

DIRECT INTERELECTRODE CAPACITANCES

(measured without external shield)

	min.	avg.	max.	
Plate to all other elements except grid No.1	3.6	4.2	4.8	µµF
Grid No.1 to all other elements except plate	4.4	5.0	5.6	µµF
Plate to grid No.1			0.0035	µµF

[1])Heater voltage variations of 20% are allowed during short periods.

from JEDEC release #2833, June 13, 1960

MAXIMUM RATINGS (absolute limits)

Plate voltage	330 volts max.
Plate voltage without current	600 volts max.
Grid No.2 voltage	see curve
Grid No.2 voltage without current	600 volts max.
Negative grid No.1 voltage	55 volts max.
Positive grid No.1 voltage	0 volt max.
Plate dissipation	2.6 watts max.
Grid No.2 dissipation	see curve
Cathode current	15 mamps max.
Heater to cathode voltage	100 volts max.
Grid No.1 circuit resistance	
fixed bias	0.5 megohm max.
automatic bias	1 megohm max.
Bulb temperature	140 °C max. [2]

TYPICAL CHARACTERISTICS [3]

Heater voltage	6.3 volts
Plate supply voltage	250 volts
Grid No.3 voltage	0 volt
Grid No.2 supply voltage	150 volts
Cathode resistor	100 ohms
Plate current	7.4 mamps
Grid No.2 current	2.9 mamps
Transconductance	4600 micromhos
Amplification factor of grid No.2 with respect to grid No.1	48
Plate resistance	1.3 megohm
Equivalent noise resistance	2500 ohms
Plate current at grid No.1 voltage = -6.5 volts	10 microamps

2) Tube life and reliability of performance will be enhanced by operation at lower temperature

3) Circuit operation with cathode bias is recommended.

4) At heater voltage = 5.0 volts the typical value of transconductance will decrease to about 4000 micromhos.

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

A. Measured at:

Heater voltage = 6.3 volts
Plate supply voltage = 250 volts
Grid No.3 voltage = 0 volt
Grid No.2 supply voltage = 150 volts

	Range new tubes		Data indicating end point of life	
	min.	max.		
Heater current	142	158	142-158	mamps
Plate current (cathode resistor = 100 ohms)	5.4	9.4	4.6	mamps
Grid No.2 current (cathode resistor = 100 ohms)	2.2	3.6		mamps
Transconductance (cathode resistor = 100 ohms)	3500	5700	3200	micromhos
Plate current (grid No.1 voltage = -8.5 volts, plate series resistance = 0.25 megohm)		35		microamps
Grid No.1 current (cathode resistor = 100 ohms, grid No.1 supply voltage = -0.5 volt, grid No.1 series resistance = 0.5 megohm		0.2	0.5	microamps

B. Measured at:

Heater voltage = 6.3 volts
Heater to cathode voltage = 100 volts
Series resistance = 1 megohm

Leakage current between heater and cathode		15	15	microamps

C. Measured at:

Heater voltage = 6.3 volts
Voltage between two arbitrary electrodes = 300 volts
(is one of these electrodes the cathode than the polarity must be such that the cathode is positive)

Insulation resistance between two arbitrary electrodes	100		50	megohms

LIFE EXPECTANCY

The life expectancy is 1000 hours under the following life test conditions

Heater voltage	=	6.3 volts
Plate supply voltage	=	250 volts
Grid No.3 voltage	=	0 volts
Grid No.2 supply voltage	=	150 volts
Cathode resistor	=	100 ohms
Grid No.1 circuit resistance	=	0.5 megohm
Heater cathode voltage (cathode negative)	=	135 volts[5]

SHOCK RESISTANCE [6] about 500 *g*

Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer, lifted over an angle of 30° in each of of four different positions of the tube.

VIBRATION RESISTANCE [6] 2.5 *g*

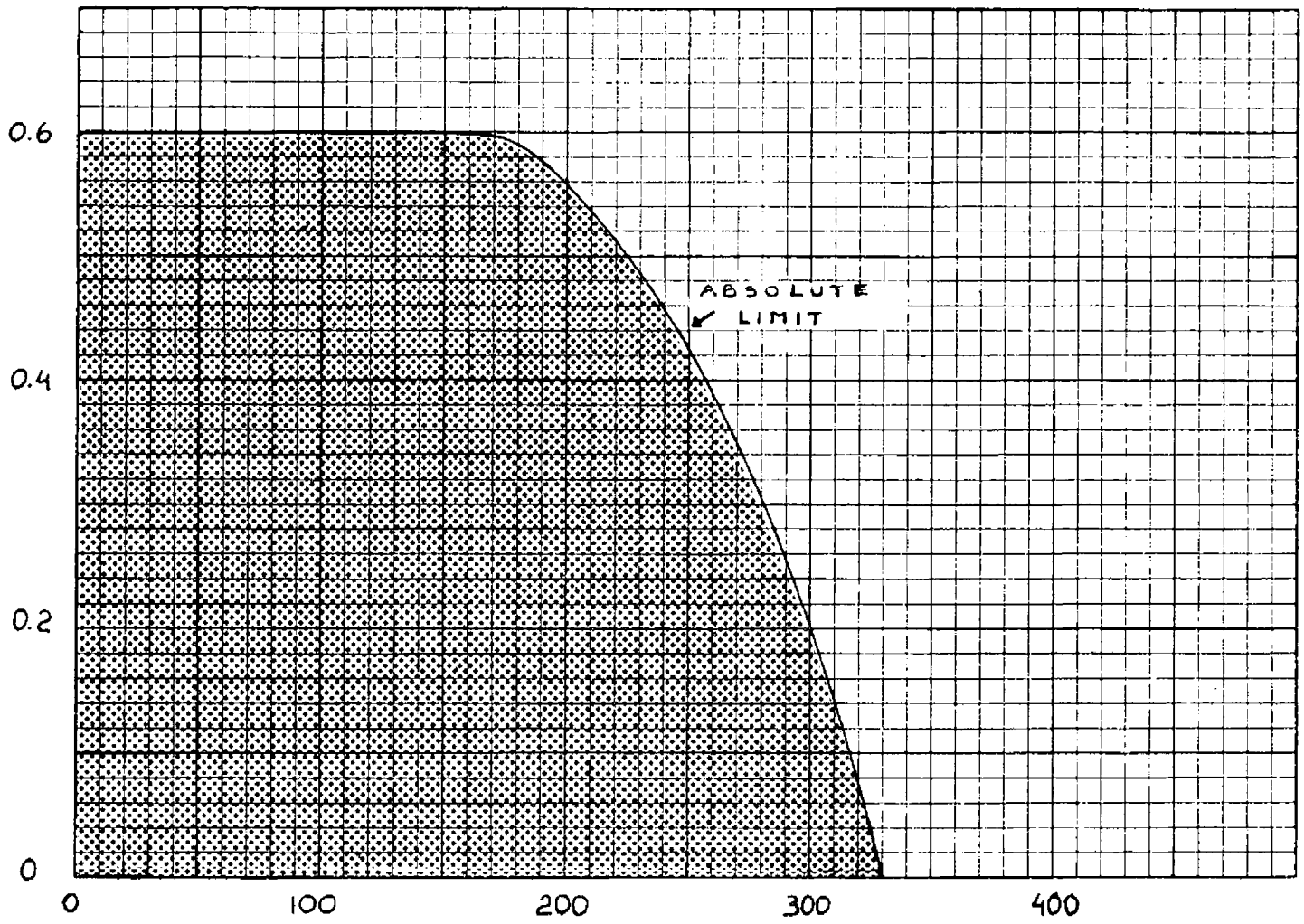
Vibrational forces for a period of 32 hours at a frequency of 25 c/s in each of 3 positions of the tube.

---

5) The value of 135 volts for the heater to cathode voltage should not be interpreted as a suitable operating condition.

6) These test conditions are only given for evaluation of the ruggedness of the tube. They are by no means to be interpreted as suitable operating conditions

GRID No 2 DISSIPATION (W)



AMPEREX ELECTRONIC CORPORATION JEDEC NO. 7694

E99F

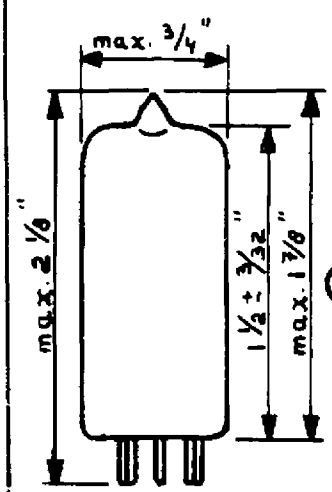
DESCRIPTION

Shock and vibration resistant special quality pentode with variable transconductance for use in mobile equipment.
Heater voltage variations of ± 20% are allowed during short periods.

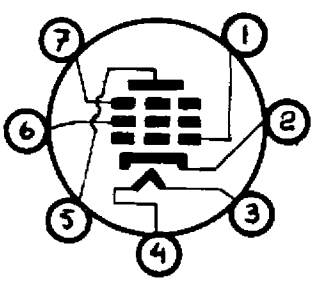
MECHANICAL DATA

Cathode	coated, unipotential
Base	E7-1
Bulb	T5 1/2
Outline	5-2
Basing	7EN
Mounting position	any

TUBE OUTLINE



BOTTOM VIEW OF BASE



BASE PIN No.	ELEMENTS
1	grid No.1
2	cathode
3	heater
4	heater
5	plate
6	grid No.2
7	grid No.3, internal screen

HEATER DATA

Heater voltage	6.3 volts[1])
Heater current	150 mamps

DIRECT INTERELECTRODE CAPACITANCES

(measured without external shield)

	min.	avg.	max.	
Plate to all other elements except grid No.1	4.4	5.0	5.6	µµF
Grid No.1 to all other elements except plate	3.9	4.5	5.1	µµF
Plate to grid No.1			0.0035	µµF

[1]) Heater voltage variations of 20% are allowed during short periods.

from JEDEC release #2833, June 13, 1960

MAXIMUM RATINGS (absolute limits)	
Plate voltage	330 volts max.
Plate voltage without current	600 volts max.
Grid No.2 voltage	see curve
Grid No.2 voltage without current	600 volts max.
Negative grid No.1 voltage	55 volts max.
Positive grid No.1 voltage	0 volt max.
Plate dissipation	3.3 watts max.
Grid No.2 dissipation	see curve
Cathode current	17 mamps max.
Heater to cathode voltage	100 volts max.
Grid No.1 circuit resistance	
fixed bias	0.5 megohm max.
automatic bias	1 megohm max.
Bulb temperature	140 °C max.[2]

TYPICAL CHARACTERISTICS [3]	
Heater voltage	6.3 volts
Plate supply voltage	250 volts
Grid No.3 voltage	0 volt
Grid No.2 supply voltage	100 volts
Cathode resistor	80 ohms
Plate current	9.2 mamps
Grid No.2 current	3.3 mamps
Transconductance	3800 micromhos[4]
Amplification factor of grid No.2 with respect to grid No.1	25
Plate resistance	1.0 megohms
Equivalent noise resistance	3500 ohms
Transconductance at grid No.1 voltage = -20 volts	10 micromhos

[2] Tube life and reliability of performance will be enhanced by operation at lower temperature

[3] Circuit operation with cathode bias is recommended.

[4] At heater voltage = 5.0 volts the typical value of transconductance will decrease to about 3400 micromhos

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

A. Measured at:

Heater voltage = 6.3 volts
Plate supply voltage = 250 volts
Grid No.3 voltage = 0 volts
Grid No.2 supply voltage = 100 volts

	Range new tubes		Data indicating end point of life	
	min.	max.		
Heater current	142	158	142-158	amps
Plate current (cathode resistor = 80 ohms)	7.2	-11.2	6.2	amps
Grid No.2 current (cathode resistor = 80 ohms)	2.6	4.0		amps
Transconductance (cathode resistor = 80 ohms)	3100	4500	2800	micromhos
Transconductance (grid No.1 voltage = -20 volts)	1	50		micromhos
Grid No.1 current (cathode resistor = 80 ohms, grid No.1 supply voltage = -0.5 volt, grid No.1 series resistance = 0.5 megohm		0.2	0.5	microamp

B. Measured at:

Heater voltage = 6.3 volts
Heater to cathode voltage = 100 volts
Series resistance = 1 megohm

Leakage current between heater and cathode		15	15	microamps

C. Measured at:

Heater voltage = 6.3 volts
Voltage between two arbitrary electrodes = 300 volts
(is one of these electrodes the cathode than the polarity must be such that the cathode is positive)

Insulation resistance between two arbitrary electrodes	100		50	megohms

LIFE EXPECTANCY

The life expectancy is 1000 hours under the following life test conditions

Heater voltage	=	6.3 volts
Plate supply voltage	=	250 volts
Grid No.3 voltage	=	0 volts
Grid No.2 supply voltage	=	100 volts
Cathode resistor	=	80 ohms
Grid No.1 circuit resistance	=	0.5 megohm
Heater cathode voltage (cathode negative)	=	135 volts [5]

SHOCK RESISTANCE [6] about 500 g

Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer, lifted over an angle of 30° in each of of four different positions of the tube.

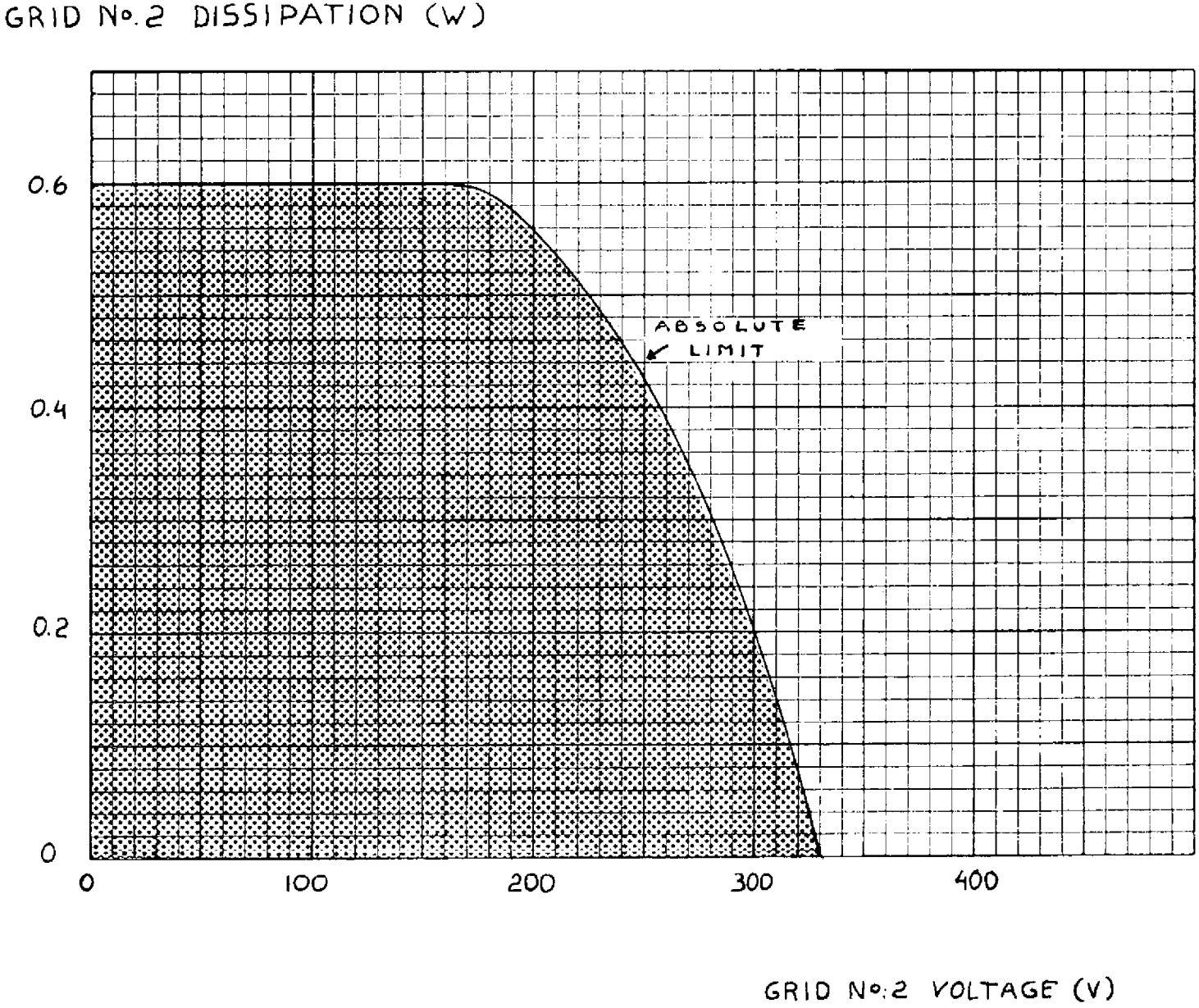
VIBRATION RESISTANCE [6] 2.5 g

Vibrational forces for a period of 32 hours at a frequency of 25 c/s in each of 3 positions of the tube.

---

5) The value of 135 volts for the heater to cathode voltage should not be interpreted as a suitable operating condition.

6) These test conditions are only given for evaluation of the ruggedness of the tube. They are by no means to be interpreted as suitable operating conditions.


GRID No.2 DISSIPATION (W)
0.6
0.4
0.2
0
ABSOLUTE
LIMIT
0
100
200
300
400
GRID No.2 VOLTAGE (V)

ELECTRON TUBES AND SEMICONDUCTORS

Amperex® ELECTRONIC CORPORATION

CABLE: AMPRONICS, NEW YORK

230 DUFFY AVENUE, HICKSVILLE, L. I., NEW YORK • Wells 1-6200

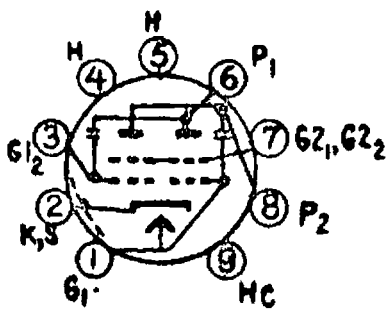
AMPEREX TUBE TYPE **7699**

The Amperex **7699** is a wide band push-pull amplifier tube for application in test instruments, distributed amplifiers and computers. Stability of the Class A characteristics and low cathode interface are important features of this tube. The push-pull construction offers a high gain band width product coupled with low output capacity. The screen and cathode, common to both halves of the tube, result in high input impedance due to low internal inductance. A high dissipation of 3 W per section enables the tube to drive low load impedances. This tube is intended for long-life reliable circuits, and not for transmitting purposes.

GENERAL CHARACTERISTICS

MECHANICAL

Bulb temperature	225°C max
Overall length	2-5/8 inches max
Seated height	2-3/8 inches max
Diameter	7/8 inches max
Base	Noval, 9 pin, JETEC E9-1



PIN CONNECTIONS

Pin No. 1 - Control grid of unit No. 1
Pin No. 2 - Cathode and beam plates
Pin No. 3 - Control grid of unit No. 2
Pin No. 4 - Heater
Pin No. 5 - Heater
Pin No. 6 - Plate of unit No. 1
Pin No. 7 - Screen grid
Pin No. 8 - Plate of unit No. 2
Pin No. 9 - Heater center tap

Push-Pull, Class A Amplifier
Maximum Ratings, Absolute Values
(Frequency up to 500 Mc)

	CCS
Plate voltage	275 volts
Plate current	2x45 mA
Plate dissipation	2x3 watts
Plate input power	2x3 watts
Screen grid dissipation	2x1.25 watts
Control grid voltage	-100 volts
Cathode current	2x50 mA
Voltage between cathode and heater	± 90 volts

Typical Operation, Push-Pull

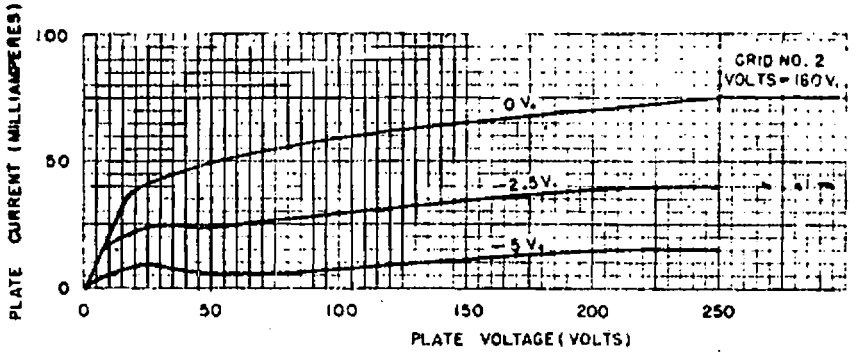
	CCS	CCS	
Plate voltage	150	200	volts
Screen grid voltage	150	150	volts
Effective load resistance (plate to plate)	10,560	17,400	ohms
Grid No. 1 voltage	-3.5	-3.5	volts
Peak grid No. 1 to grid No. 1 voltage	7	7	volts
Zero signal plate current	2x13.5	2x14	mA
Maximum signal plate current	2x15.8	2x15.8	mA
Zero signal screen current	2x1.8	2x3.0	mA
Maximum signal screen current	2x6.1	2x7.7	mA
Transconductance (per section)	7000	7500	micromhos
Total distortion	1.0	2.0	%
Tube power output	1.75	2.66	watts

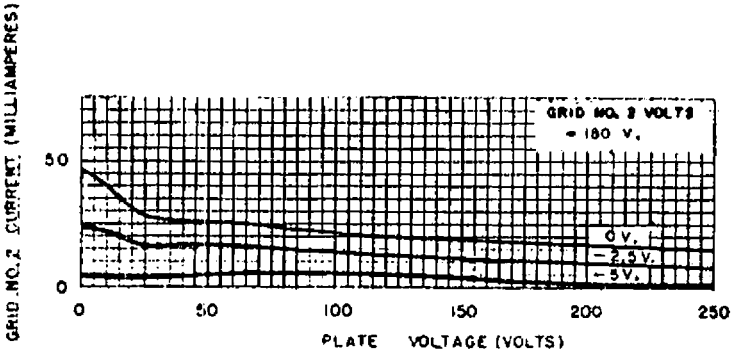
ELECTRICAL

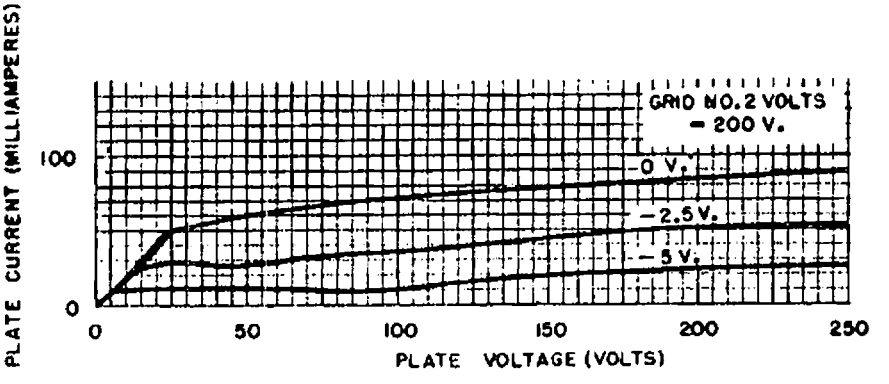
Cathode	indirectly heated, oxide coated		
	Parallel	Series	
Heater voltage	6.3	12.6	volts
Heater current	0.6	0.3	amps

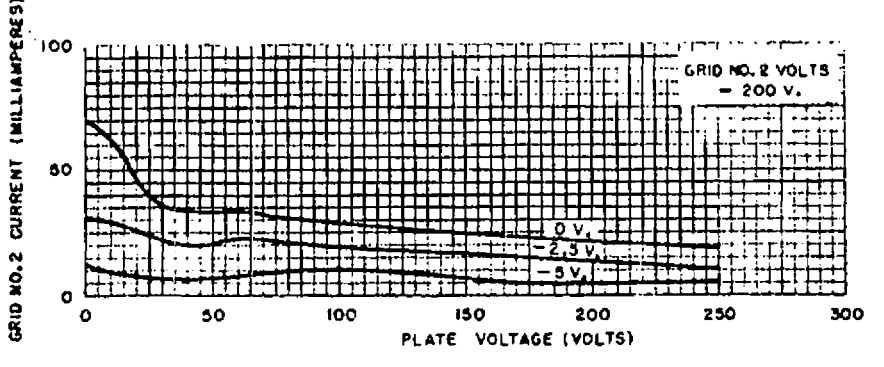
Direct Interelectrode Capacitances

	Each Unit	Both Units Push-Pull	
Output	1.6	0.95	uuf
Input	6.4	3.8	uuf
Plate to grid No. 1 (internally neutralized)	0.15		
Amplification Factor (each unit) Grid No. 2 to Grid No. 1 (E_p = E_{g2} = 150V; I_p = 25 mA)	31		
Mutual Conductance (each unit) (E_p = E_{g2} = 150V; I_p = 25 mA)	10,500		micromhos


PLATE CURRENT (MILLIAMPERES)
100
50
0
GRID NO. 2 VOLTS = 180 V.
0 V.
-2.5 V.
-5 V.
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)


GRID NO.2 CURRENT (MILLIAMPERES)
50
0
GRID NO. 2 VOLTS = 180 V.
0 V.
-2.5 V.
-5 V.
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)


PLATE CURRENT (MILLIAMPERES)
100
0
GRID NO.2 VOLTS = 200 V.
0 V.
-2.5 V.
-5 V.
0
50
100
150
200
250
PLATE VOLTAGE (VOLTS)


GRID NO.2 CURRENT (MILLIAMPERES)
100
50
0
GRID NO. 2 VOLTS = 200 V.
0 V.
-2.5 V.
-5 V.
0
50
100
150
200
250
300
PLATE VOLTAGE (VOLTS)

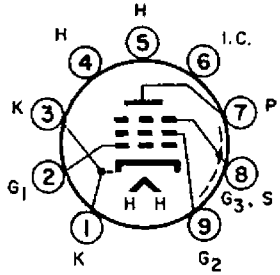
from JEDEC release #4450, Oct. 7, 1963

AMPEREX TUBE TYPE 7737

TENTATIVE DATA

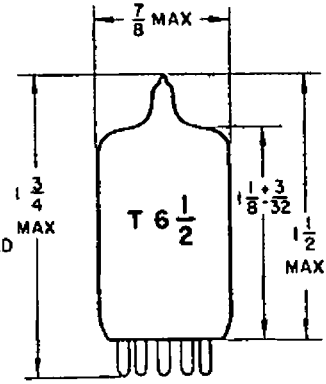
The Amperex 7737 is a ruggedized tube intended for use in environment subject to unusually high shock and vibration conditions and where freedom from microphony is essential. It has application in coaxial cable amplifiers, video amplifiers, broad-band IF amplifiers in communication links, and TV equipment.

It is one of the Amperex "Premium Quality 10,000 Hour" tubes.



PIN CONNECTIONS

1- CATHODE
2- GRID NO. 1
3- CATHODE
4- HEATER
5- HEATER
6- INTERNALLY CONNECTED
7- PLATE
8- GRID NO. 3 & SHIELD
9- GRID NO. 2



6-1

GENERAL CHARACTERISTICS

MECHANICAL

Dimensions	see outline drawing
Mounting Position	any
Bulb	T-6½
Base	small button, 9 pin E9-1
Basing	9MZ

ELECTRICAL

Heating	parallel supply
Heater Voltage [1]	6.3 volts
Heater Current	320 mA
Direct Interelectrode Capacitances	
Plate to all other Elements	3.3 μμf
Grid No. 1 to all other Elements	7.6 μμf
Plate to Grid No. 1	0.03 μμf max
Transconductance	16,500 micromhos
Amplification Factor - Grid No. 2 to Grid No. 1	53

[1] Minimum value of Heater Voltage = 6.0 V; Maximum Value of Heater Voltage = 6.6 V.

7737

Maximum Ratings, Absolute Values

Plate Voltage, Cut-Off Condition	400 volts max
Plate Voltage	210 volts max
Plate Dissipation	3.0 watts max
Grid No. 2 Voltage, Cut-Off Condition	400 volts max
Grid No. 2 Voltage	175 volts max
Grid No. 2 Dissipation	0.7 watts max
Grid No. 1 Voltage	0 volts max
Negative Grid No. 1 Voltage	50 volts max
Peak Negative Grid No. 1 Voltage	100 volts max
Cathode Current	25 mA max
Heater-Cathode Voltage	60 volts max
Series Grid Resistor (Automatic Bias)	0.5 megohms max
Series Grid Resistor (Fixed Bias)	0.25 megohms max
Heater to Cathode Resistance	20,000 ohms max
Bulb Temperature	165°C max
Negative Grid No. 1 Voltage (Grid No. 1 Current = 0.3 μA)	0.5 volts

Typical Operation [2]

	I	II	
Plate Supply Voltage	190	180	volts
Grid No. 3 Voltage	0	0	volts
Grid No. 2 Supply Voltage	160	150	volts
Grid No. 1 Supply Voltage	9	0	volts
Cathode Resistor	630	100	ohms
Plate Current	13	11.5	mA
Grid No. 2 Current	3.3	2.9	mA
Transconductance	16,500	15,900	micromhos
Amplification Factor - Grid No. 2 to Grid No. 1	53		
Internal Plate Resistance	100,000		ohms
Equivalent Noise Resistance (f = 45 Mc/s)	160		ohms

[2] Operation of the tube under the conditions as given in Column I is recommended because of the small spread in characteristics.

Characteristic Range Value for Equipment Design

	Initial		End of Life [3]		
	Min	Max	Min	Max	
Heater Current (E_f = 6.3 V)	295	345	295	345	mA
Plate Current (E_f = 6.3 V, E_{bb} = 190 V, E_{c3} = 0 V, E_{cc2} = 160 V, E_{c1} = 9 V, R_k = 630 ohms)	12.2	13.8	11.5		mA
Grid No. 2 Current (E_f = 6.3 V, E_{bb} = 190 V, E_{c3} = 0 V, E_{cc2} = 160 V, E_{c1} = 9 V, R_k = 630 ohms)	2.9	3.7			mA
Transconductance (E_f = 6.3 V, E_{bb} = 190 V, E_{c3} = 0 V, E_{cc2} = 160 V, E_{c1} = 9 V, R_k = 630 ohms)	14,200	18,800	11,000		micromhos
Negative Grid No. 1 Current (E_f = 6.3 V, E_{bb} = 190 V, E_{c3} = 0 V, E_{cc2} = 160 V, E_{c1} = 9 V, R_k = 630 ohms, R_g = 0.1 megohms)		0.2		0.5	μA
Heater-Cathode Current (E_f = 6.3 V, $E_{k/f}$ = 100 V, R_{series} = 0.1 megohms, cathode positive or negative)		10		20	μA
Insulation Resistance (E_f = 6.3 V, V_{grid} ; all electrodes = 100 V, V_{plate} - all electrodes = 300 V, cathode positive)	100		50		megohms
Equivalent Signal Grid Hum Voltage [4] (E_f = 6.3 V, E_{bb} = 207 V, R_p = 2000 ohms, E_{cc2} = 150 V, R_k = 78 ohms, C_k = 1000 μf, R_{g1} = 0.5 meghoms)		100			microvolts
Vibrational Noise Output [5] (E_f = 6.3 V, E_{bb} = 180 V, R_p = 2000 ohms, E_{c2} = 150 V, E_{c3} = 0 V, R_k = 78 ohms (not bypassed)		500			millivolts
Vibrational Noise Output [6] (E_f = 6.3 V, E_{bb} = 180 V, R_p = 2000 ohms, E_{c2} = 150 V, E_{c3} = 0 V, R_k = 78 ohms (not bypassed)		200			millivolts
Plate Current (E_f = 6.3 V, E_b = 180 V, E_{c3} = 0 V, E_{c2} = 150 V, E_{c1} = −4.5 V)		0.8			mA

SPECIAL RATINGS [7]

Shock Rating abt. 500 g

Forces as applied by the NRL impact machine for electronic devices caused by 5 blows of the hammer lifted over an angle of 30° in each of four different directions.

Fatigue Rating 2.5 g

Vibrational forces for a period of 32 hours at a frequency of 50 c/s in each of three directions.

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[3] Life test conditions:

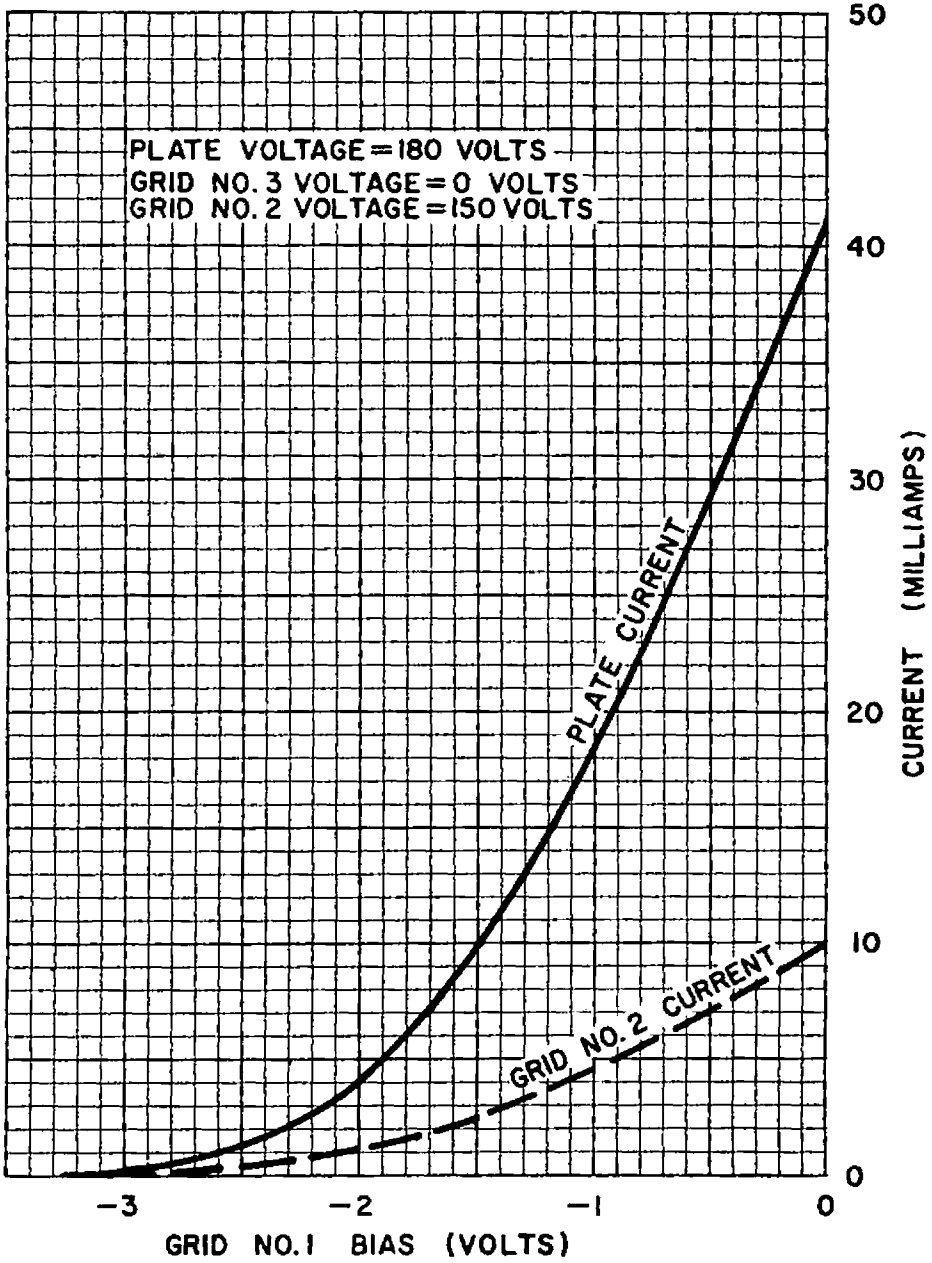
Heater Voltage	6.3 volts
Plate Supply Voltage	190 volts
Grid No. 3 Voltage	0 volts
Grid No. 2 Supply Voltage	160 volts
Grid No. 1 Voltage	9 volts
Cathode Resistor	630 ohms
Life Expectancy = 10,000 hours	

[4] Center tap of the heater supply transformer grounded and cathode resistor decoupled by a capacitor of 1000μf. Measured with a line frequency of 50 c/s and a filter with a linear band-pass characteristic.

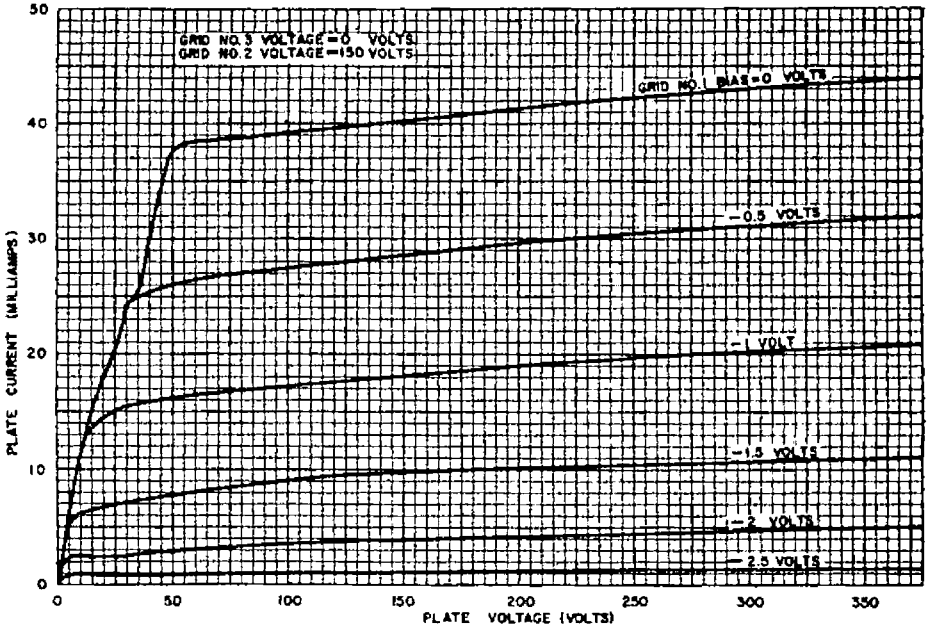
[5] Vibrational acceleration 10 g peak, frequency range 50 to 2000 c/s.

[6] Vibrational acceleration = 10 g peak, frequency 50 c/s

[7] These test conditions are only given for evaluation of the ruggedness of the tube and should by no means be interpreted as suitable operating conditions.


PLATE VOLTAGE=180 VOLTS
GRID NO. 3 VOLTAGE=0 VOLTS
GRID NO. 2 VOLTAGE=150 VOLTS
PLATE CURRENT
GRID NO. 2 CURRENT
50
40
30
20
10
0
CURRENT (MILLIAMPS)
−3
−2
−1
0
GRID NO. 1 BIAS (VOLTS)

7737


GRID NO. 3 VOLTAGE = 0 VOLTS
GRID NO. 2 VOLTAGE = 150 VOLTS
GRID NO. 1 BIAS = 0 VOLTS
-0.5 VOLTS
-1 VOLT
-1.5 VOLTS
-2 VOLTS
-2.5 VOLTS
PLATE CURRENT (MILLIAMPS)
PLATE VOLTAGE (VOLTS)
0
10
20
30
40
50
0
50
100
150
200
250
300
350

from JEDEC release #3443, Oct. 9, 1961

AMPEREX TUBE TYPE 7800

The Amperex type 7800 is a high vacuum power triode of the external plate type requiring forced-air cooling. The radiator is an integral part of the tube.

The 7800 is designed primarily for use as an RF or AF amplifier and oscillator at frequencies up to 30 mc.

GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	vertical
Accessories	
Air Flow Chamber	S-25688
Grid Connector	S-25403
Clips with Cable for Filament	S-25401
Net Weight (approx)	42 lbs
Shipping Weight (approx)	186 lbs
Seal Temperature	220° C max.

Cooling Characteristics

Plate Dissipation (kW)	Altitude (ft.)	Max Air Inlet Temp. (°C)	Min Airflow (cu. ft./min)	Total Pressure (inches water)
7	0	35	233.1	0.39
	0	45	271.9	0.51
	5000	35	278.9	0.47
	10,000	25	293.1	0.47
10	0	35	370.8	0.91
	0	45	434.3	1.22
	5000	35	444.9	1.10
	10,000	25	466.1	1.06
15	0	35	639.1	2.36
	0	45	748.6	3.11
	5000	35	766.2	2.87
	10,000	25	805.1	2.76

ELECTRICAL

Filament	thoriated tungsten, directly heated
Filament Voltage	8 volts
Filament Current [1]	130 amps
Direct Interelectrode Capacitances	
Plate to Grid	27 $\mu\mu$f
Plate to Filament	0.6 $\mu\mu$f
Filament to Grid	45 $\mu\mu$f
Amplification Factor (I_b = 2 A, E_b = 12 kv)	33
Transconductance (I_b = 2 A, E_b = 12 kv)	25,000 micromhos

[1] The filament current must never exceed a peak value of 280 amps instantaneously at any time during the energizing schedule.

7800

RF Class C Telegraphy
Maximum Ratings, Absolute Values

Frequency	30 mc
Plate Voltage	13 kv max
Plate Current	4.8 amps max
Negative Grid Bias	1500 volts max
Grid Current	1.0 amps max
Plate Input	60 kw max
Plate Dissipation	15 kw max
Bias Resistance	10 k ohms max

Typical Operation

Frequency	30 mc
Plate Voltage	12 kv
Plate Current	4.5 amps
Negative Grid Bias	1000 volts
Grid Current	0.8 amps
Peak Grid Voltage	1600 volts
Grid Input	1150 watts
Plate Input	54 kw
Plate Dissipation	13 kw
Power Output	41 kw max
Efficiency	76 %

RF Class C Plate Modulation
Maximum Ratings, Absolute Values

Frequency	30 mc
Plate Voltage [2]	10 kv max
Plate Current	3.8 amps max
Negative Grid Bias	1500 volts max
Grid Current	1.0 amps max
Plate Input	40 kw max
Plate Dissipation	10 kw max
Bias Resistance	10 k ohms

Typical Operation

Frequency	30 mc
Plate Voltage	10 kv
Plate Current	3.5 amps
Negative Grid Bias [3]	1000 volts
Grid Current	0.8 amps
Peak Grid Voltage	1500 volts
Grid Input	1080 watts
Plate Input	35 kw
Plate Dissipation	7.5 kw
Power Output	27.5 kw
Efficiency	78.5 %
Modulation Factor	100 %
Modulation Power	17.5 kw

[2] At modulation of 120% and at an altitude of 10,000 feet.

[3] Grid bias partially obtained by grid resistance.

7800

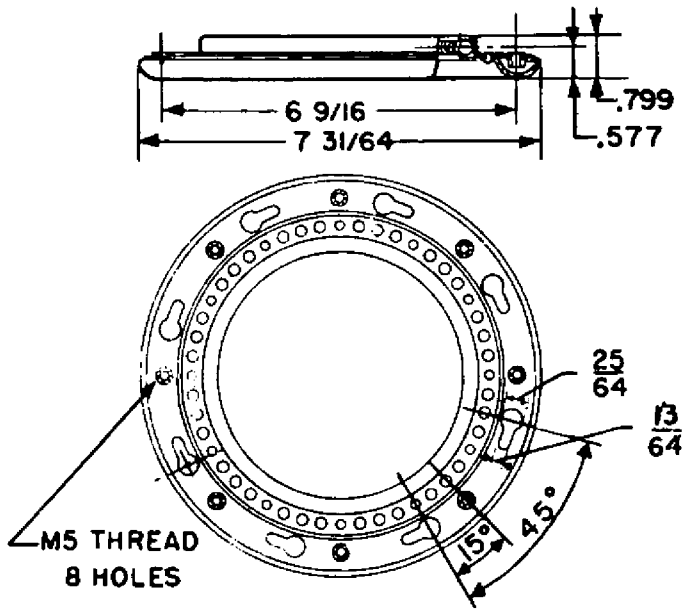
AF Class B Amplifier and Modulator
(Especially for use with Cathode Followers)

Maximum Ratings, Absolute Values

Plate Voltage	13 kv max
Plate Current	4.5 amps max
Plate Input	60 kw max
Plate Dissipation	15 kw max
Bias Resistance	10 k ohms max

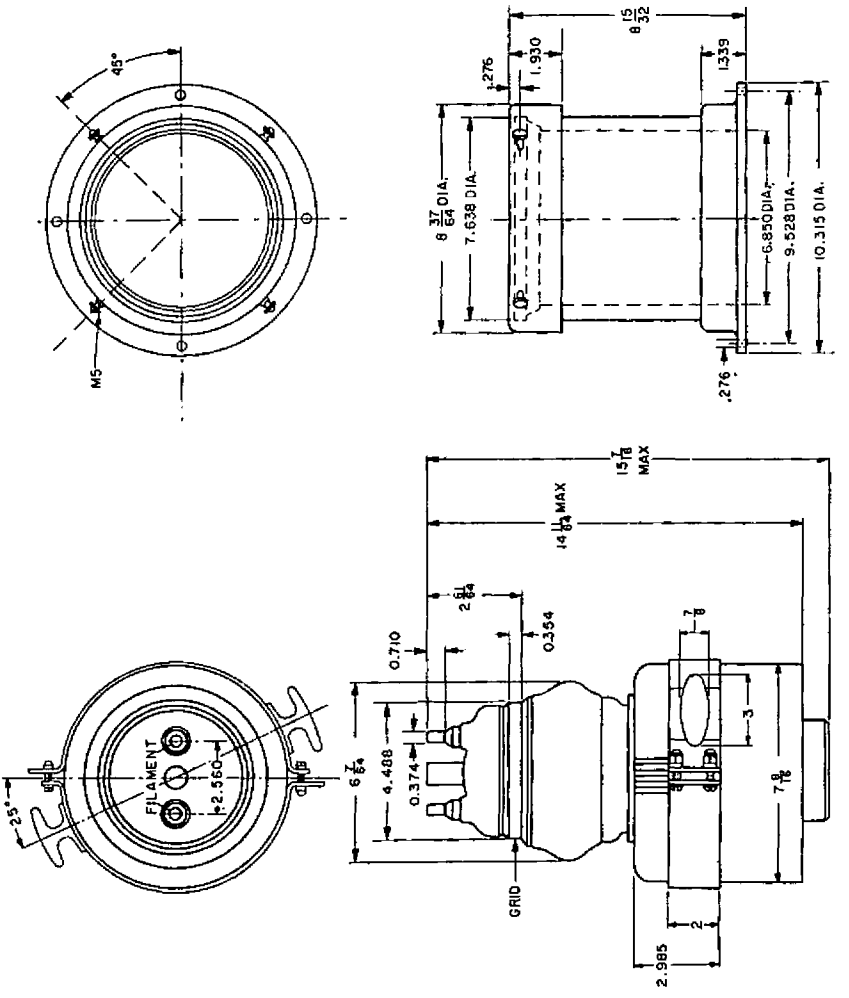
Typical Operation

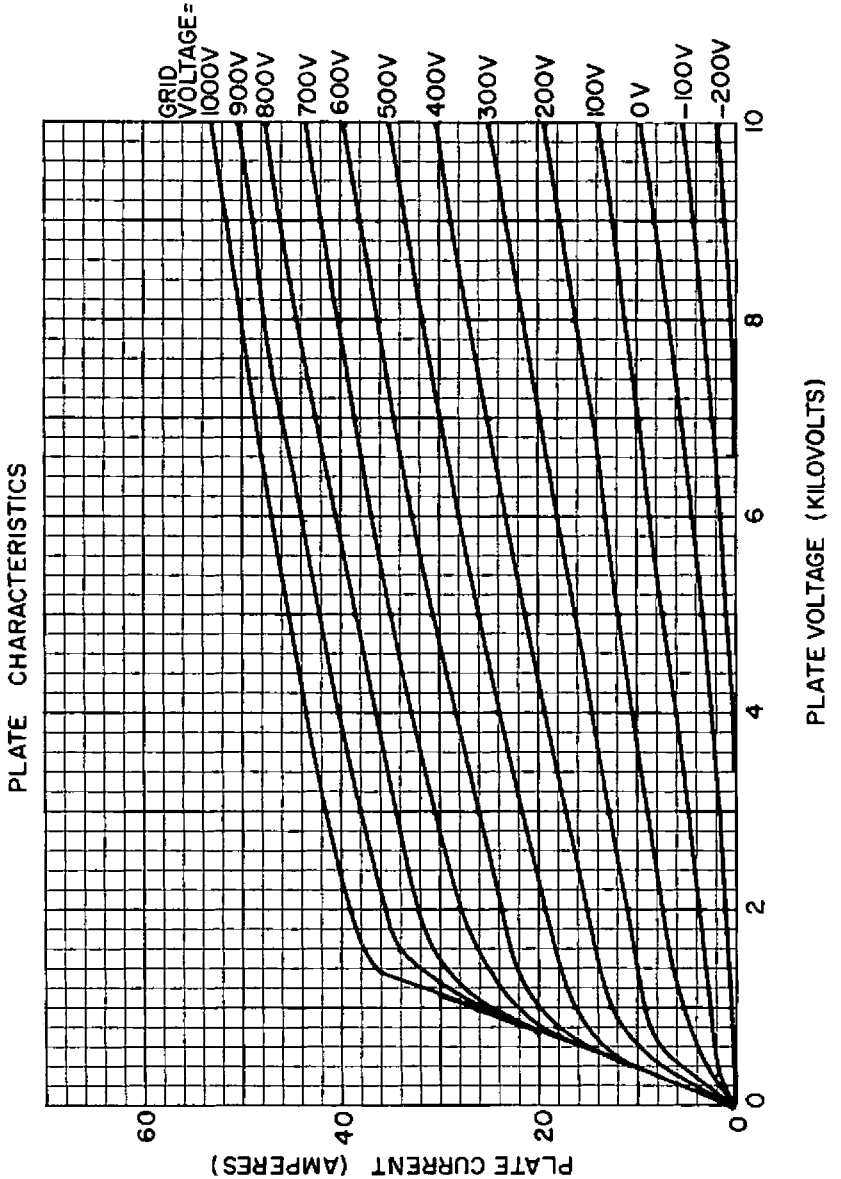
Plate Voltage		10 kv	
Negative Grid Bias		290 volts	
Load Resistance (Plate to Plate)		6240 ohms	
Peak Grid-to-Grid Voltage	0		900 volts
Plate Current	2x0.1		2x1.6 amps
Grid Current	0		2x0.035 amps
Peak Grid Current	0		2x0.24 amps
Grid Input	0		2x14 watts
Plate Input	2x1.0		2x16 kw
Plate Dissipation	2x1.0		2x6.4 kw
Power Output	0		19.2 kw
Efficiency			60 %



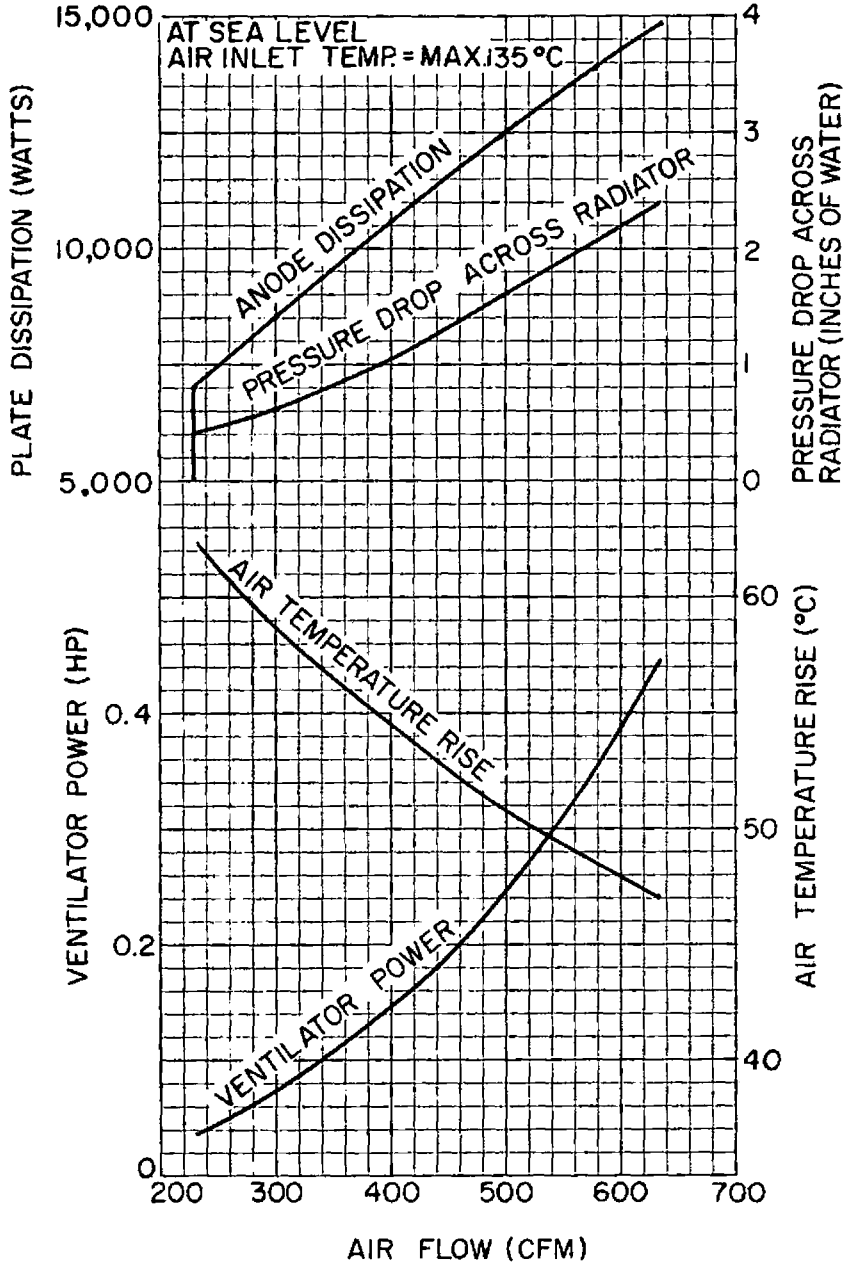
GRID CONNECTOR S-25403

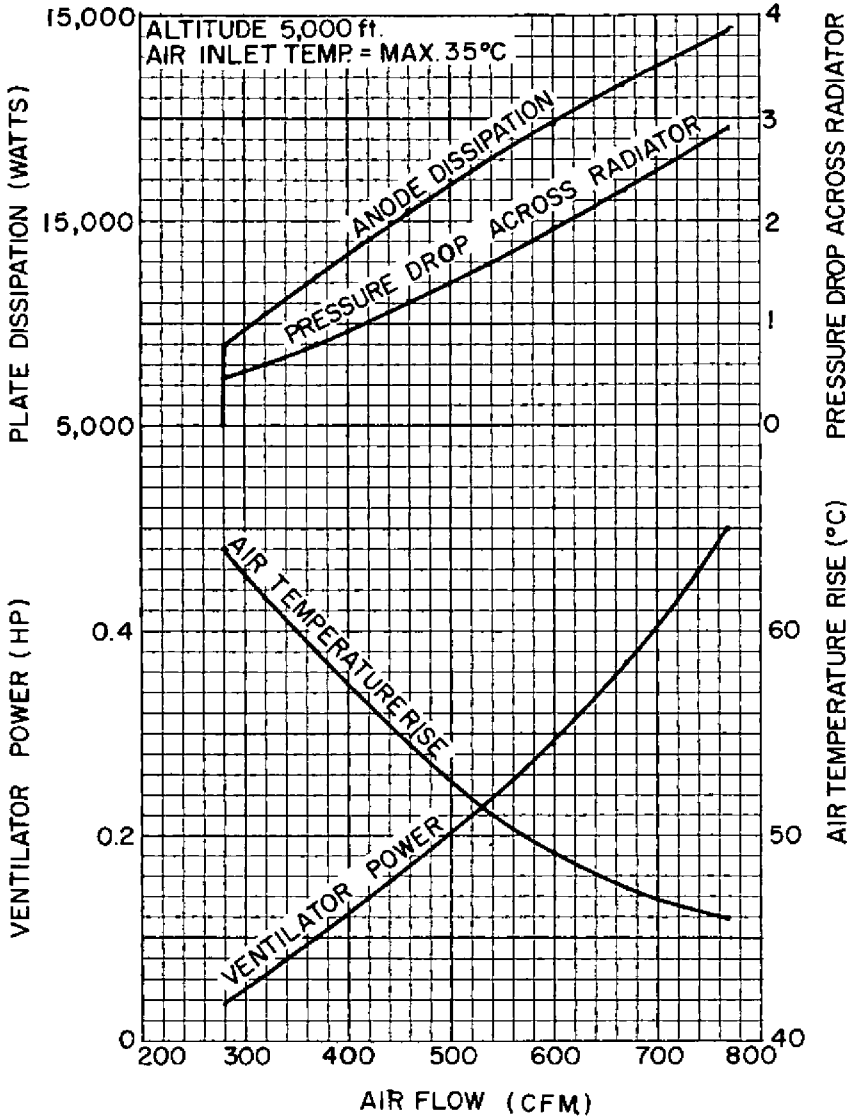
7800


45°
M5
8 37/64 DIA.
7.638 DIA.
.276
1.930
8 15/32
1.339
6.890 DIA.
9.528 DIA.
10.315 DIA.
.276
15 7/8 MAX
14 1/4 MAX
2 61/64
0.710
0.354
7/8
3
7 1/8
6 7/64
4.488
0.374
GRID
2
2.985
25°
FILAMENT
2.560

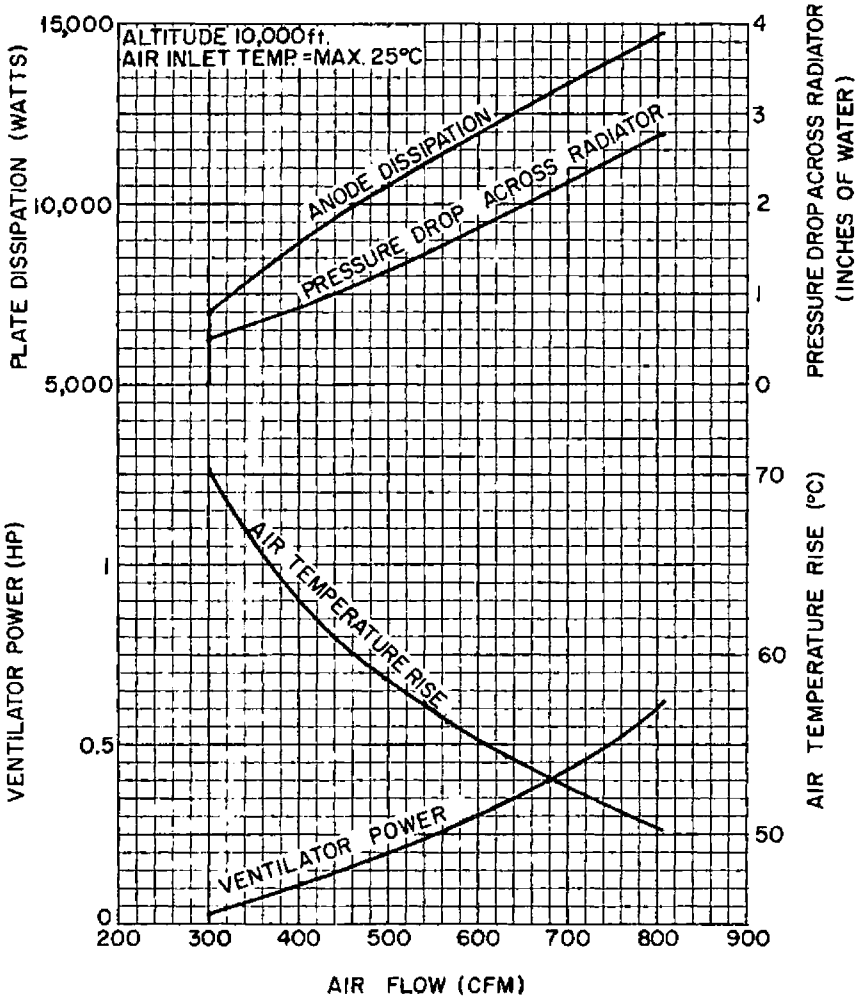

PLATE CHARACTERISTICS
GRID VOLTAGE=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V
-200V
PLATE CURRENT (AMPERES)
0
20
40
60
0
2
4
6
8
10
PLATE VOLTAGE (KILOVOLTS)

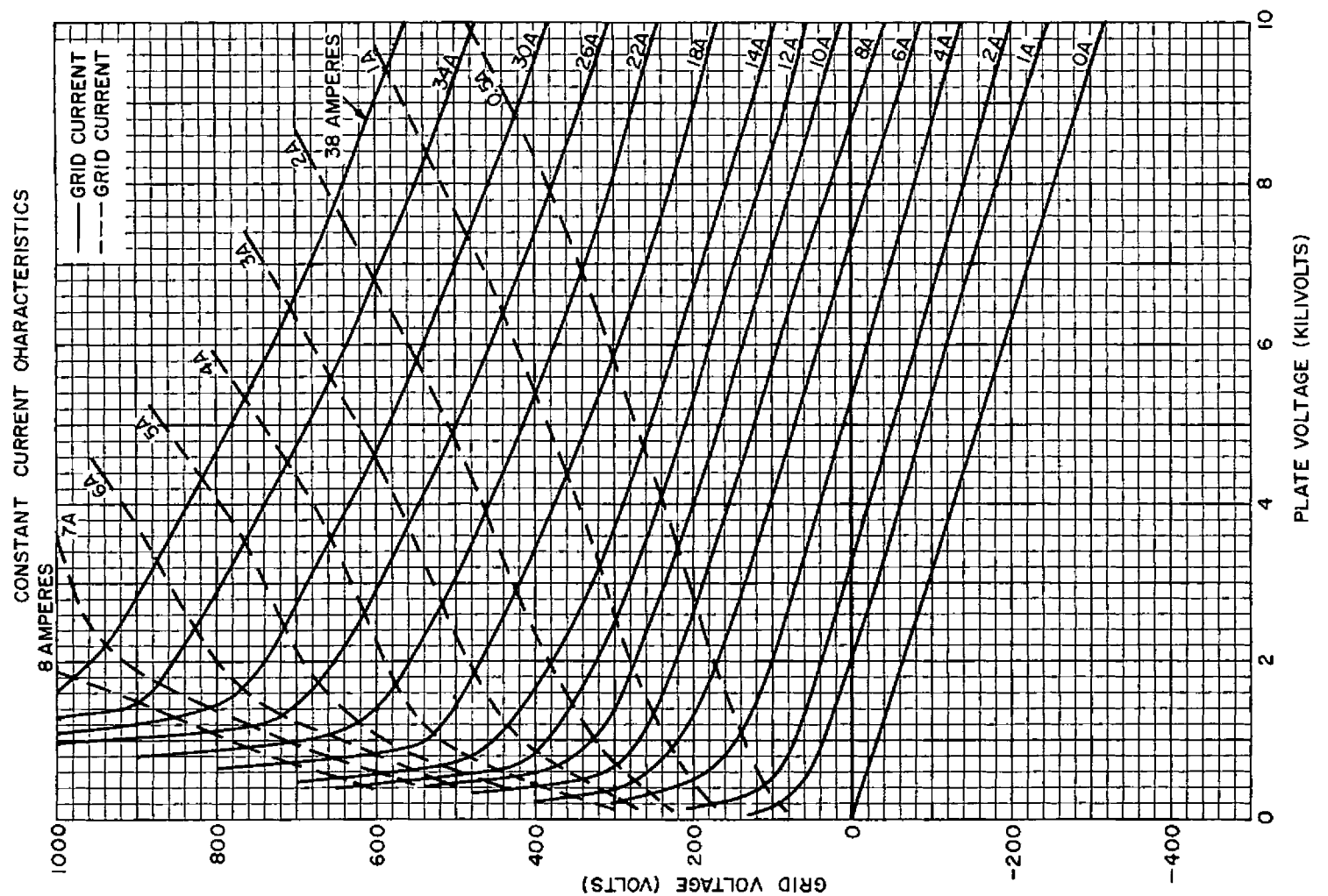
7800


AT SEA LEVEL
AIR INLET TEMP. = MAX. 35°C
ANODE DISSIPATION
PRESSURE DROP ACROSS RADIATOR
AIR TEMPERATURE RISE
VENTILATOR POWER
PLATE DISSIPATION (WATTS)
15,000
10,000
5,000
0
VENTILATOR POWER (HP)
0.4
0.2
0
PRESSURE DROP ACROSS RADIATOR (INCHES OF WATER)
4
3
2
1
0
AIR TEMPERATURE RISE (°C)
60
50
40
200
300
400
500
600
700
AIR FLOW (CFM)


ALTITUDE 5,000 ft.
AIR INLET TEMP. = MAX. 35°C
ANODE DISSIPATION
PRESSURE DROP ACROSS RADIATOR
AIR TEMPERATURE RISE
VENTILATOR POWER
PLATE DISSIPATION (WATTS)
VENTILATOR POWER (HP)
PRESSURE DROP ACROSS RADIATOR
AIR TEMPERATURE RISE (°C)
AIR FLOW (CFM)
15,000
15,000
5,000
0.4
0.2
0
4
3
2
1
0
60
50
40
200
300
400
500
600
700
800

7800


ALTITUDE 10,000ft.
AIR INLET TEMP.=MAX. 25°C.
ANODE DISSIPATION
PRESSURE DROP ACROSS RADIATOR
AIR TEMPERATURE RISE
VENTILATOR POWER
PLATE DISSIPATION (WATTS)
VENTILATOR POWER (HP)
PRESSURE DROP ACROSS RADIATOR (INCHES OF WATER)
AIR TEMPERATURE RISE (°C)
AIR FLOW (CFM)
15,000
10,000
5,000
1
0.5
0
4
3
2
1
0
70
60
50
200
300
400
500
600
700
800
900


CONSTANT CURRENT CHARACTERISTICS
8 AMPERES
GRID CURRENT
GRID CURRENT
7A
6A
5A
4A
3A
2A
38 AMPERES
1A
34A
0.5A
30A
26A
22A
18A
14A
12A
10A
8A
6A
4A
2A
1A
0A
1000
800
600
400
200
0
-200
-400
GRID VOLTAGE (VOLTS)
0
2
4
6
8
10
PLATE VOLTAGE (KILIVOLTS)

from JEDEC release #3421, Sept. 18, 1961

AMPEREX TUBE TYPE 7854

TENTATIVE DATA

The Amperex 7854 is a twin, four-electrode tube designed for use as a radio frequency power amplifier, oscillator, modulator and frequency multiplier. Each anode is capable of dissipating 30 watts. The cathode is indirectly heated, oxide coated. Maximum ratings apply up to 175 mc. At reduced ratings it may be operated up to 500 mc. The tube has built-in cross-neutralizing capacitors, the values of which are adjusted to be equal to the direct grid-plate capacities. This insures neutralization over the entire operating band. The plate characteristics of the 7854 are identical to the Amperex tube type 5894.

GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical, base up or down Horizontal with anode pins in any plane, horizontal plane preferred.
Maximum Glass and Seal Temperatures [1]	250°C
Accessories	
Socket	Johnson 122-105 or equal
Net Weight, Approx.	2.5 ounces

ELECTRICAL

	Min.	Bogey	Max
Heater Voltage			
Series	11.4	12.6	13.8 volts
Parallel	5.7	6.3	6.9 volts
Heater Current at Bogey Voltage			
Series	0.8	0.9	1.0 amps
Parallel	1.6	1.8	2.0 amps
Amplification Factor (Each Section)			
G1-G2 Mu at Eb = 600 volts			
Ec2 = 250 volts, Ib = 40 ma	6.7	8.2	9.6

Direct Interelectrode Capacitances
(Unit not Under Test, Tied to Ground)

	Push-Pull	Per Unit	
	Bogey	Min.	Max.
Grid to Plate	- - -	0.06	0.09 μμf
Input	6.7	9.4	11.6 μμf
Output	2.1	2.6	3.7 μμf

[1] When operating the tube at maximum ratings, with forced air cooling, it is necessary to cool both the lateral bulb surface as well as the plate pin seals by directing the flow of air toward the top and sides of the bulb. In most cases approximately 20 cfm is sufficient. At reduced ratings, the use of a heat sink is permissable. However, regardless of the type of cooling being used, the degree of cooling should be determined by direct temperature measurement of both the seals and the bulb.

The temperature may be measured by means of temperature sensitive compounds such as Tempolaq, made by the Tempil Corp., New York, N.Y.

7854

Push-Pull RF Power Amplifier and Oscillator
Class C Telegraphy
Forced Air Cooling
Maximum Ratings, Absolute Values

	CCS	ICAS
Frequency	175	175 Mc max.
D.C. Plate Voltage	1000	1000 volts max.
D.C. Grid No. 2 Voltage	300	300 volts max.
D.C. Grid No. 1 Voltage	−175	−175 volts max.
D.C. Plate Current	2x110	2x120 ma max.
D.C. Grid No. 1 Current	2x5	2x5 ma max.
Grid No. 2 Dissipation	7	8 watts max.
Plate Dissipation	2x30	2x34 watts max.
Plate Input	2x100	2x120 watts max.
Heater-Cathode Voltage	100	100 volts max.

Typical Operation

	CCS	CCS	ICAS	ICAS
D.C. Plate Voltage	900	1000	900	1000 volts
D.C. Grid No. 2 Voltage	244	230	260	262 volts
D.C. Grid No. 1 Voltage				
Fixed or from common resistor of	2x30	2x30	2x30	2x30 Kohm
D.C. Plate Current	2x110	2x100	2x120	2x120 ma
D.C. Grid No. 2 Current	12.5	11.2	17.0	16.5 ma
D.C. Grid No. 1 Current	5.9	5.7	5.7	5.7 ma
Driving Power [2]	3.5	3.5	3.5	3.5 watts
Power Output [3]	132	125	147	163 watts
Efficiency	66.6	62.5	68	68 %
Frequency	175	175	175	175 Mc

Push-Pull RF Power Amplifier and Oscillator
Class C Telegraphy
Heat Sink Operation

Maximum Ratings, Absolute Values

	CCS	ICAS
Frequency	175	175 Mc max
DC Plate Voltage	800	800 volts max
DC Grid No. 2 Voltage	300	300 volts max
DC Grid No. 1 Voltage	−175	−175 volts max
DC Plate Current	2x110	2x120 ma max
DC Grid No. 1 Current	2x5	2x5 ma max
Grid No. 2 Dissipation	7	8 watts max
Plate Dissipation	2x30	2x34 watts max
Plate Input	2x82.5	2x92.5 watts max
Heater-Cathode Voltage	100	100 volts max

Typical Operation

	CCS	ICAS
DC Plate Voltage	750	750 volts
DC Grid No. 2 Voltage	230	260 volts
DC Grid No. 1 Voltage		
Fixed or from common resistor of	2x30	2x30 k ohms
DC Plate Current	2x105	2x120 ma
DC Grid No. 2 Current	8.0	12.7 ma
DC Grid No. 1 Current	5.5	5.5 ma
Driving Power [2]	3.0	3.5 watts
Power Output [3]	105	123 watts
Efficiency	66.6	68.2 %
Frequency	175	175 mc

[2] Includes circuit losses as measured in a laboratory test amplifier.

[3] Actual measured power delivered to a load.

Plate and Screen Grid Modulated RF Power Amplifier
Class C Telephony Push-Pull

Carrier conditions per tube for use with a maximum modulation factor of 1.0 [4]
Forced Air Cooling
Maximum Ratings, Absolute Values

	CCS	ICAS
Frequency	175	175 Mc max.
DC Plate Voltage	800	800 volts max.
DC Grid No. 2 Voltage	250	250 volts max.
DC Grid No. 1 Voltage	−175	−175 volts max.
DC Plate Voltage	2x92	2x100 ma max.
DC Grid No. 1 Current	2x5	2x5 ma max.
Grid No. 2 Dissipation	5	5.5 watts max.
Plate Dissipation	2x21	2x23.5 watts max.
Plate Input	2x70	2x80 watts max.
Heater-Cathode Voltage	100	100 volts max.

Typical Operation

DC Plate Voltage	750	800 volts
DC Grid No. 2 Voltage	250	225 volts
DC Grid No. 1 Voltage fixed or from common resistor of		2x30 Kohm
DC Plate Current	2x90	2x100 ma
DC Grid No. 2 Current	10.4	8.8 ma
DC Grid No. 1 Current	4.4	5.0 ma
Driving Power [2]	3.4	3.0 watts
Power Output [3]	85	107 watts
Efficiency	63	66.9 %
Frequency	175	175 Mc

Plate and Screen Grid Modulated RF Power Amplifier
Class C Telephony Push-Pull

Carrier conditions per tube for use with a maximum modulation factor of 1.0
Heat Sink Operation
Maximum Ratings, Absolute Values

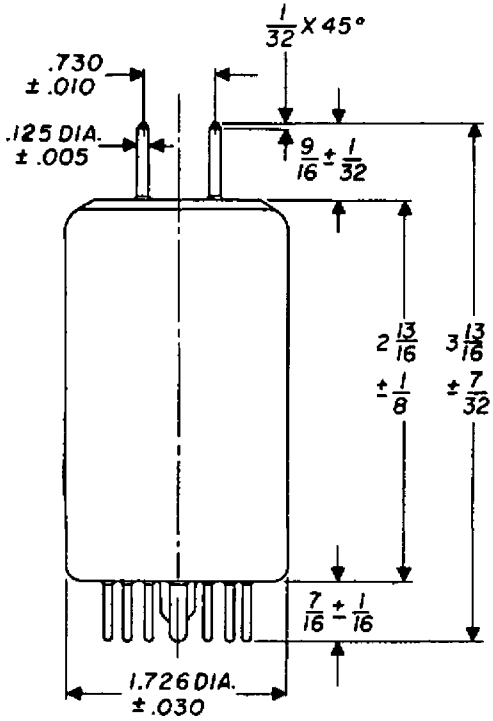
	CCS	ICAS
Frequency	175	175 Mc max.
DC Plate Voltage	640	640 volts max
DC Grid No. 2 Voltage	250	250 volts max
DC Grid No. 1 Voltage	−175	−175 volts max
DC Plate Current	2x92	2x100 ma max
DC Grid No. 1 Current	2x5	2x5 ma max
Grid No. 2 Dissipation	5	5.5 watts max
Plate Dissipation	2x21	2x23.5 watts max
Plate Input	2x57.5	2x64 watts max
Heater-Cathode Voltage	100	100 volts max

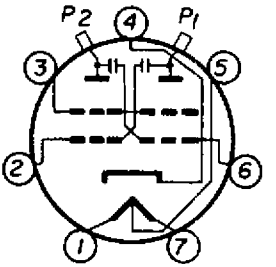
Typical Operation

	CCS	CCS	ICAS
DC Plate Voltage	600	500	600 volts
DC Grid No. 2 Voltage	210	200	225 volts
DC Grid No. 1 Voltage Fixed or from common-resistor of	2x30	2x30	2x30 k ohms
DC Plate Current	2x92	2x90	2x100 ma
DC Grid No. 2 Current	7.5	6.4	7.8 ma
DC Grid No. 1 Current	5.5	5.6	5.5 ma
Driving Power [2]	3.5	3.5	3.5 watts
Power Output [3]	80.0	64	85 watts
Efficiency	72.5	71	70.8 %
Frequency	175	175	175 mc

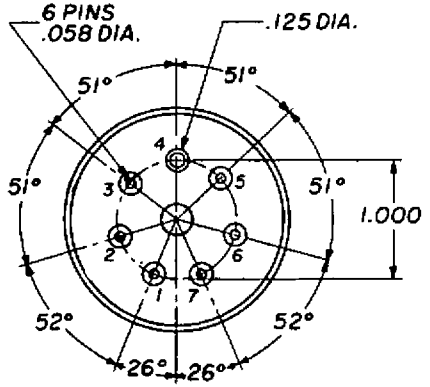
[4] Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

7854

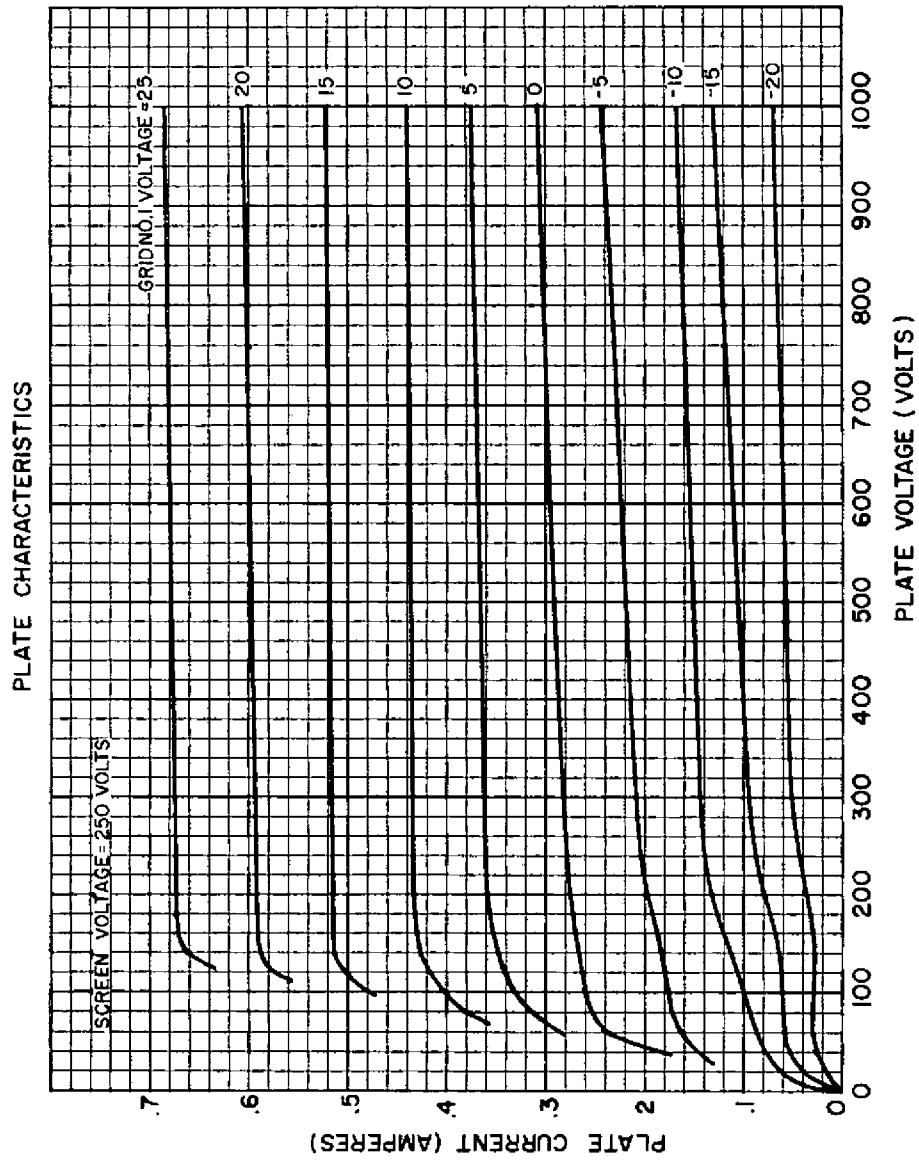




BASE-BOTTOM VIEW

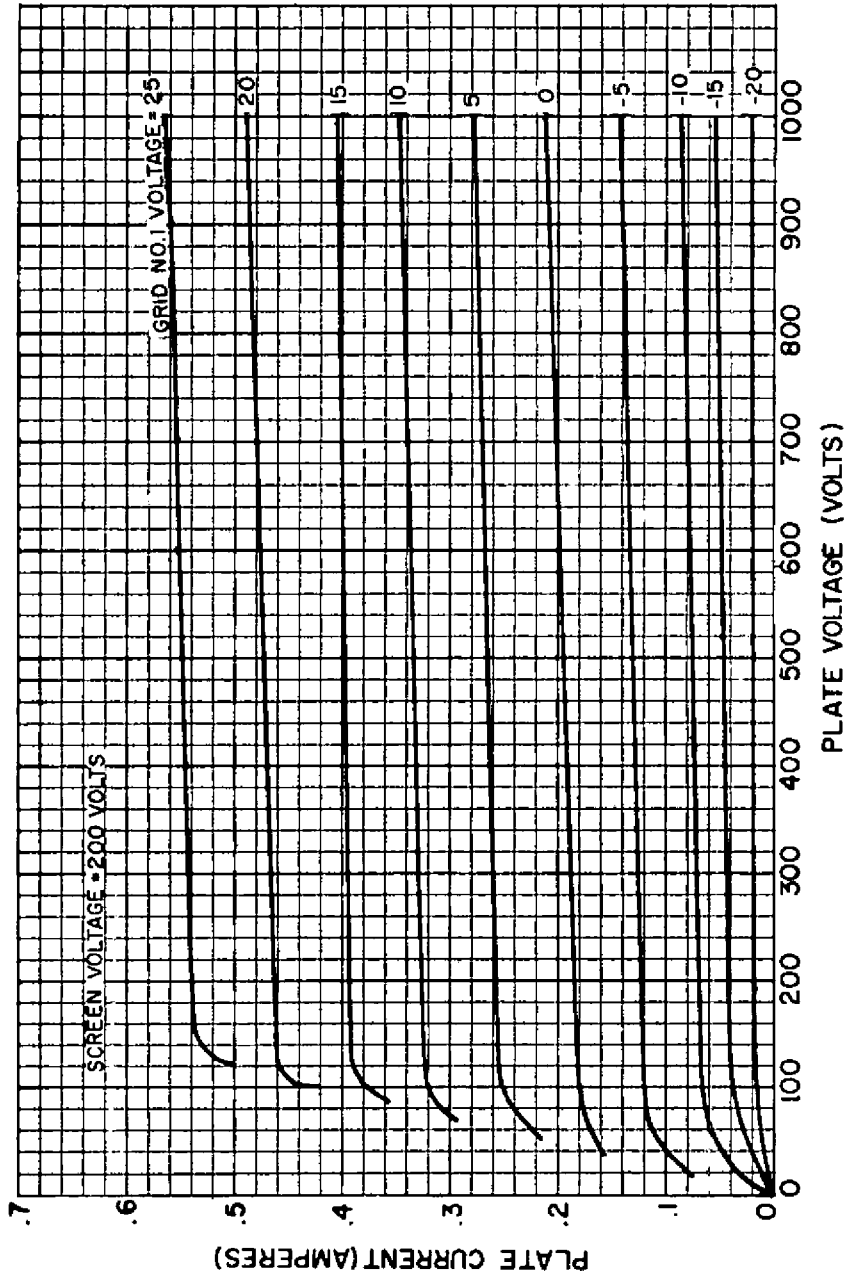


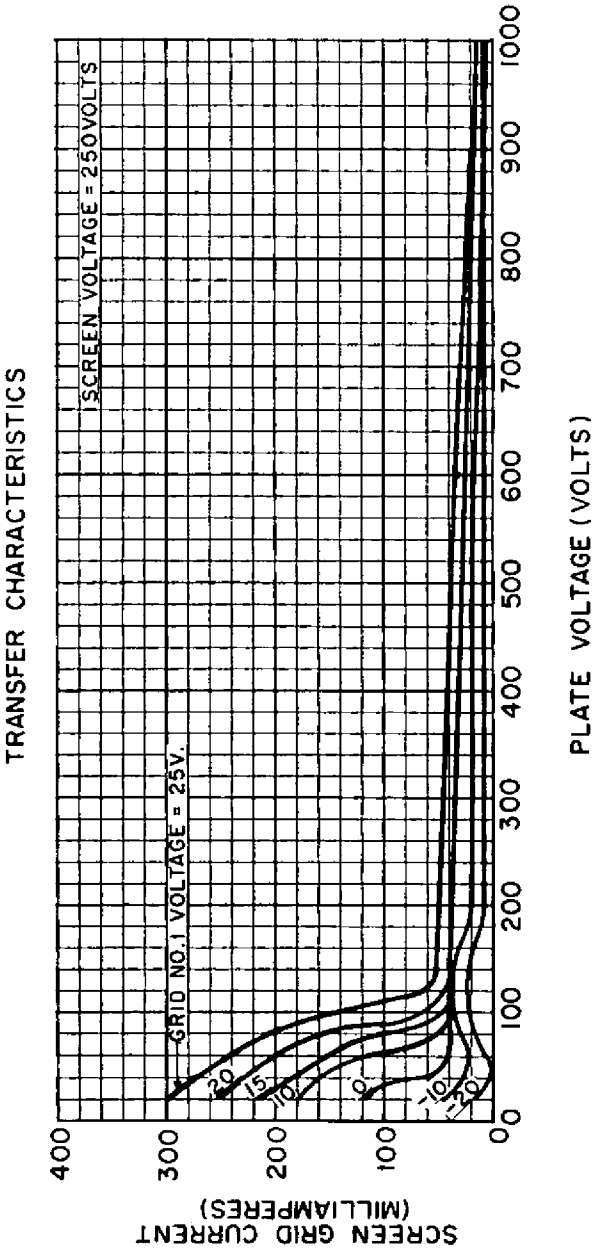
PIN 1 – HEATER
PIN 2 – GRID NO.1 OF UNIT NO.2
PIN 3 – GRID NO.2
PIN 4 – CATHODE & INTERNAL SHIELD
PIN 5 – HEATER CENTER TAP
PIN 6 – GRID NO.1 OF UNIT NO.1
PIN 7 – HEATER
P1 – PLATE OF UNIT NO.1
P2 – PLATE OF UNIT NO.2


PLATE CHARACTERISTICS
SCREEN VOLTAGE=250 VOLTS
GRID NO.1 VOLTAGE=25
20
15
10
5
0
-5
-10
-15
-20
PLATE CURRENT (AMPERES)
0
.1
.2
.3
.4
.5
.6
.7
0
100
200
300
400
500
600
700
800
900
1000
PLATE VOLTAGE (VOLTS)

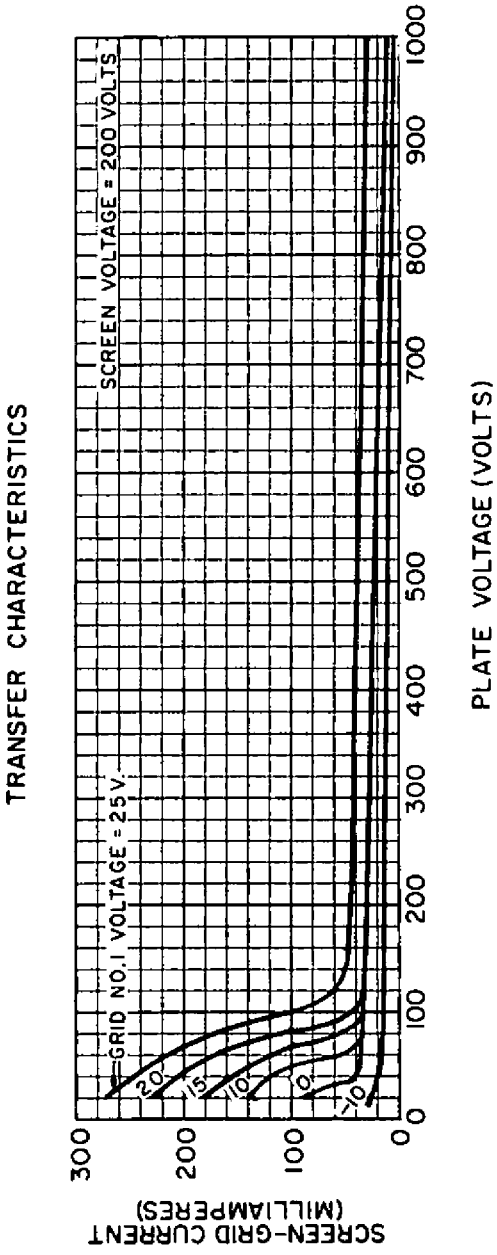
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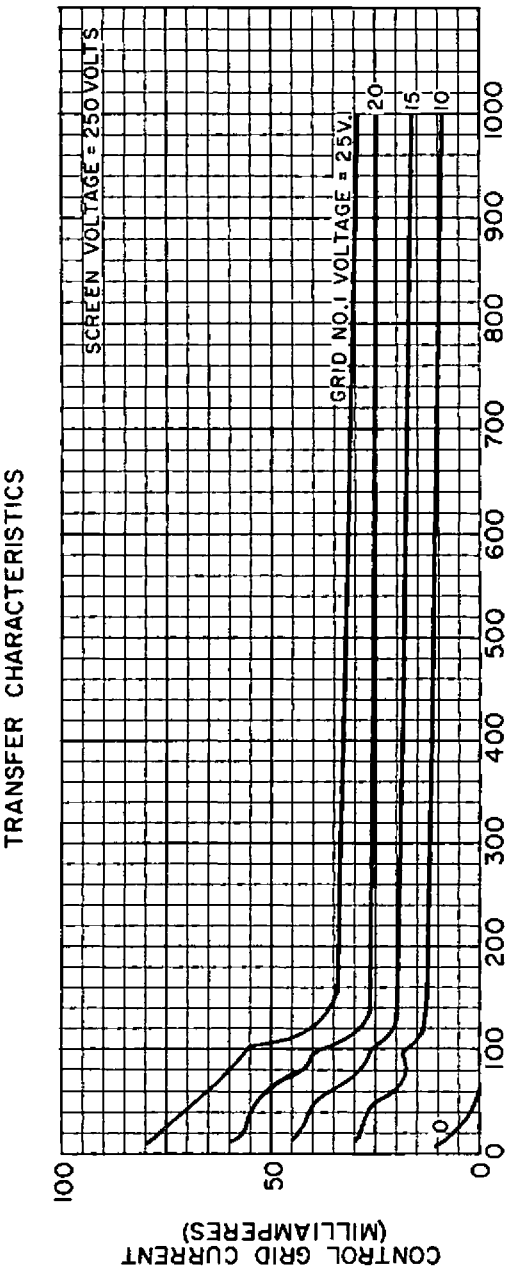
PLATE CHARACTERISTICS



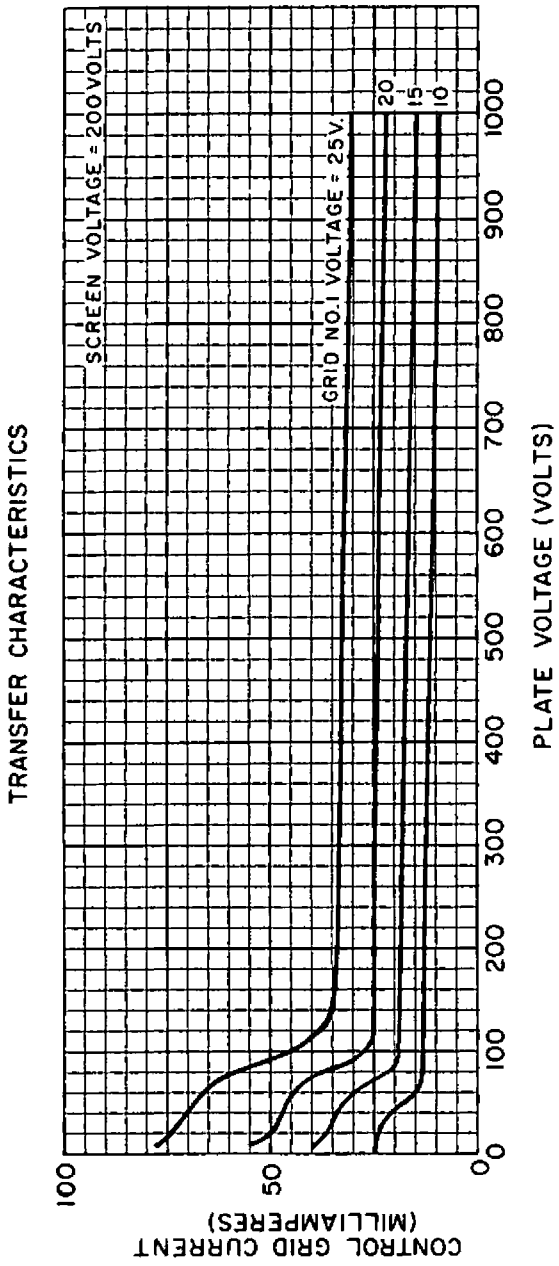

TRANSFER CHARACTERISTICS
SCREEN VOLTAGE = 250VOLTS
GRID NO.1 VOLTAGE = 25V.
30
15
10
0
-10
-20
SCREEN GRID CURRENT
(MILLIAMPERES)
400
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
PLATE VOLTAGE (VOLTS)

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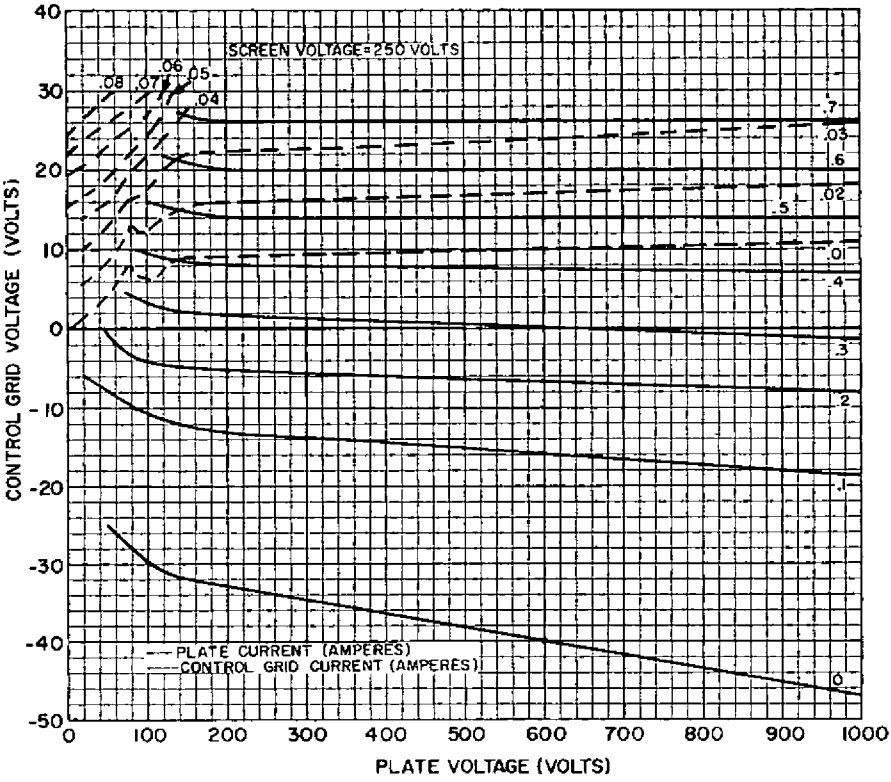

TRANSFER CHARACTERISTICS
SCREEN VOLTAGE = 200 VOLTS
GRID NO.1 VOLTAGE = 25 V.
20
15
10
0
-10
SCREEN-GRID CURRENT (MILLIAMPERES)
300
200
100
0
0
100
200
300
400
500
600
700
800
900
1000
PLATE VOLTAGE (VOLTS)


TRANSFER CHARACTERISTICS
SCREEN VOLTAGE = 250 VOLTS
GRID NO.1 VOLTAGE = 25V.
20
15
10
0
100
50
0
0
100
200
300
400
500
600
700
800
900
1000
CONTROL GRID CURRENT
(MILLIAMPERES)
PLATE VOLTAGE (VOLTS)

7854

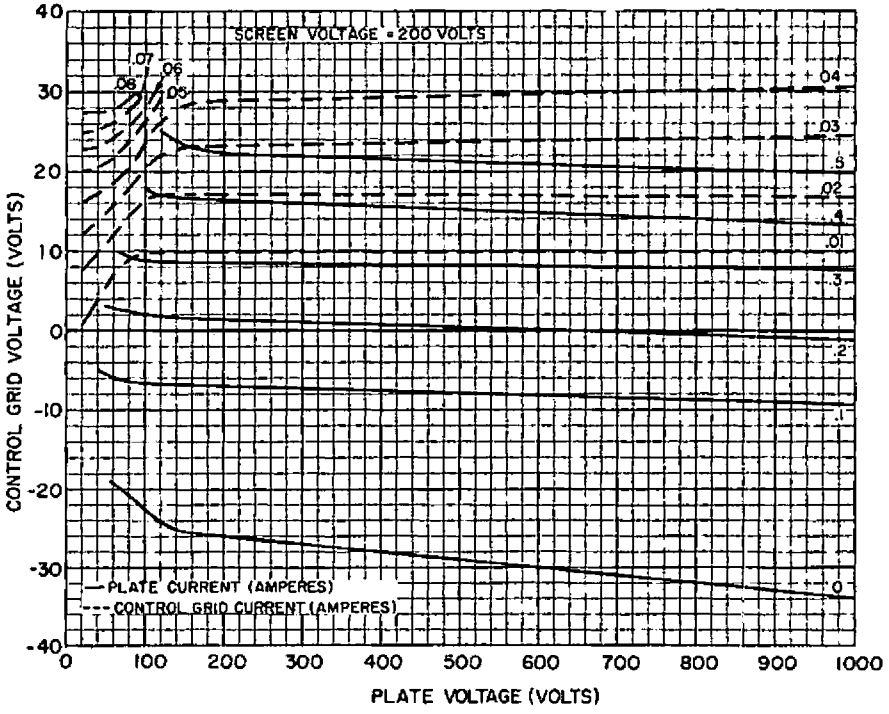

TRANSFER CHARACTERISTICS
SCREEN VOLTAGE = 200 VOLTS
GRID NO.1 VOLTAGE = 25V.
20
15
10
100
50
0
CONTROL GRID CURRENT
(MILLIAMPERES)
0
100
200
300
400
500
600
700
800
900
1000
PLATE VOLTAGE (VOLTS)

CONSTANT CURRENT CHARACTERISTICS



7854

CONSTANT CURRENT CHARACTERISTICS



from JEDEC release #3443, Oct. 9, 1961

AMPEREX TUBE TYPE 7899

The Amperex 7899 is a three electrode tube designed for pulse application as a hard tube modulator or pulsed rf amplifier. The anode is capable of dissipating 7.5 kilowatts. Cooling is accomplished by forced air. The thoriated tungsten filament is designed to supply high pulse currents while operating at a relatively low temperature insuring an unusually long life.

GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	vertical
Type of Cooling	forced air
Max Incoming Air Temperature	45° C

Cooling Characteristics

Plate Dissipation (kw)	Altitude (ft.)	Max Air Inlet Temp. (°C)	Min. Airflow (cu. ft./min.)	Total Pressure (inches water)
7.5	0	35	207	1.40
	0	45	241	1.83
	5000	35	247	1.69
	10,000	25	260	1.65

ELECTRICAL

Filament Voltage	8.0 volts $^{+0.4}_{-0.0}$
Filament Current	130 amps
Amplification Factor [1] (I_b = 2 A, E_b = 12 kV)	33
Transconductance [1] (I_b = 2 A, E_b = 12 kV)	25,000 micromhos

Direct Interelectrode Capacitances

Grid-Plate	27 $\mu\mu$f
Grid-Filament	45 $\mu\mu$f
Plate-Filament	0.6 $\mu\mu$f

[1] Electrical characteristics are given under conditions which are not allowed continuously. They are measured under pulsed conditions.

7899

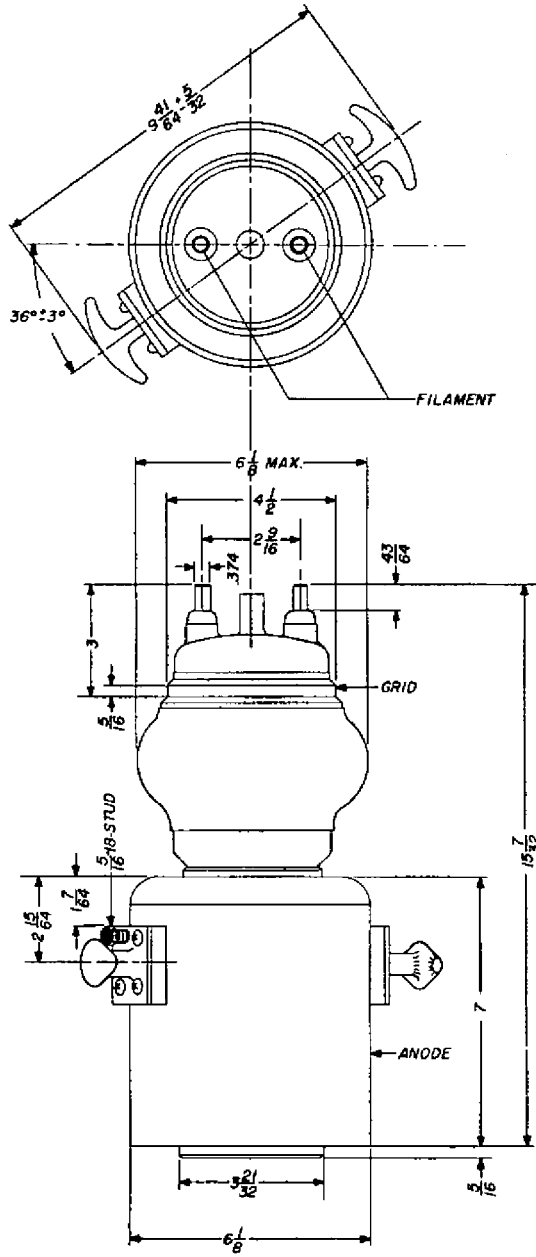
PULSED RF AMPLIFIER

Maximum Ratings, Absolute Values

Filament Voltage	8.4 volts max
DC Plate Voltage	20,000 volts max
Peak Positive Plate Voltage (Instantaneous)	35,000 volts max
DC Grid Voltage	−1500 volts max
Peak Positive Grid Voltage	2500 volts max
Peak Plate Current	85 amps max
Peak Grid Current	20 amps max
Peak Cathode Current	100 amps max
Plate Dissipation	7,500 watts max
Grid Dissipation	500 watts max
Duty Factor	0.025 max
Pulse Length	100 μsec max

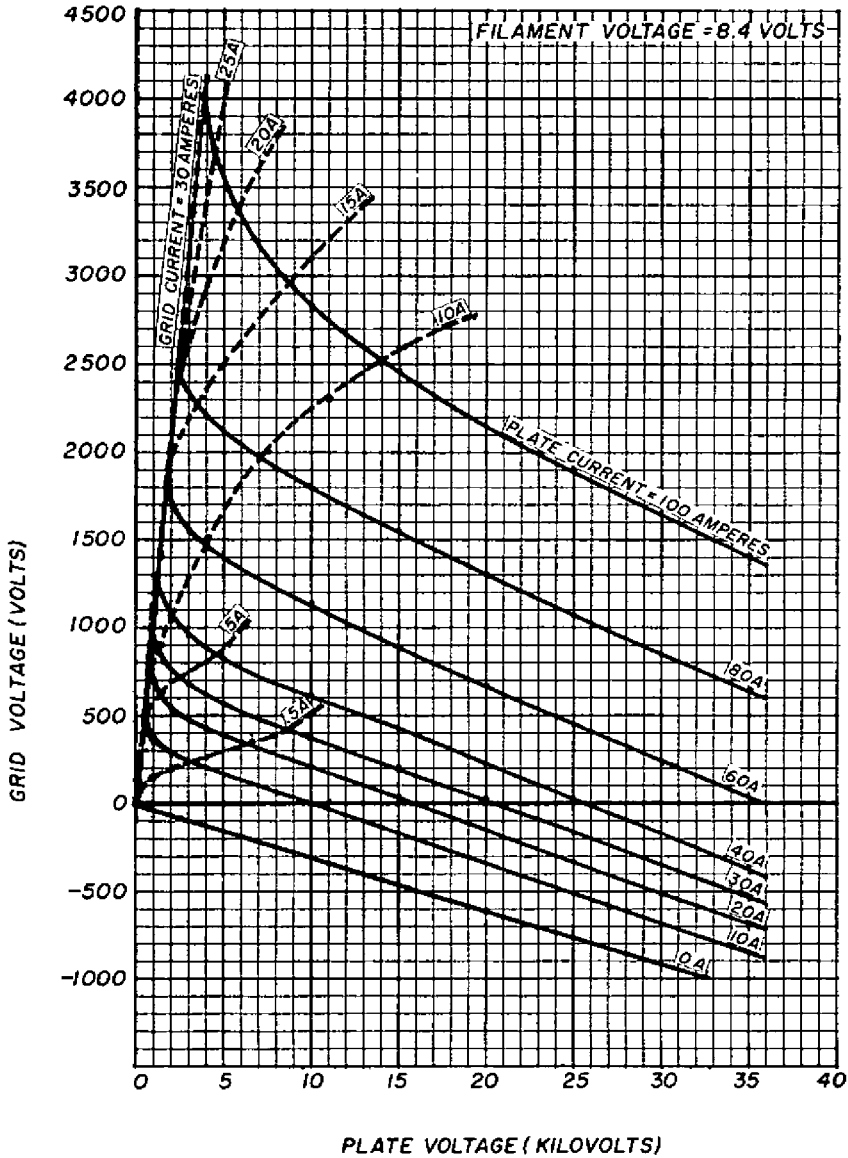
Typical Operation

Filament Voltage	8.4 volts
DC Plate Voltage	15,000 volts
Peak Positive Plate Voltage (Instantaneous)	28,000 volts
DC Grid Voltage	−500 volts
Peak Positive Grid Voltage	2200 volts
Peak Plate Current	70 amps
Peak Grid Current	15 amps
Plate Dissipation	4000 watts
Duty Factor	0.025
Pulse Length	80 μsec
Peak Power Output	200,000 watts


41/64 ± 2/32
36° ± 3°
FILAMENT
6 1/8 MAX.
4 1/2
2 9/16
.374
43/64
3
GRID
5/16
5/16-18 STUD
15/64
1/64
2 15/64
15 7/32
7
ANODE
5/16
3 21/32
6 1/8

7899

CONSTANT CURRENT CHARACTERISTICS



AMPEREX TUBE TYPE 7900

The Amperex type 7900 is a forced air cooled triode specially designed for use in TV transmitters. This tube is valid for operation up to 220 mc and is accurately dimensioned for use in many current cavity configurations. The 7900 features a brazed and silver plated radiator for efficient high frequency operation. This tube is similar to type 7459 except that it incorporates a platinum grid.

GENERAL CHARACTERISTICS

MECHANICAL

Maximum Overall Dimensions	
Length	11 inches
Diameter	4-5/8 inches
Mounting Position	vertical, anode up or down
Max Temperature of Filament Seals	210°C
Max Temperature of Grid and Anode Seals	180°C
Cooling	forced air

Cooling Characteristics

Plate Dissipation (kw)	Altitude (feet)	Inlet Air Temperature (°C)	Min. Air Flow (cu. ft/min.)	Inlet Air Pressure (inches water)
4	0	35	230	1.75
	0	45	270	2.30
	5000	35	270	2.20
	10,000	25	310	2.90

ELECTRICAL

Filament	thoriated tungsten
Voltage	12.6 volts
Current [1]	32 amps
Amplification Factor (I_b = 1 amp; E_b = 6000 volts)	32
Transconductance (I_b = 1 amp; E_b = 6000 volts)	15,000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	16.5 $\mu\mu$f
Grid to Filament	17.0 $\mu\mu$f
Plate to Filament	0.5 $\mu\mu$f

[1] The filament center tap pin must not be used for filament current supply.

from JEDEC release #3275, May 22, 1961

7900

RF Power Amplifier and Oscillator - Class C Telegraphy

Key-Down Conditions Per Tube Without Amplitude Modulation [2]
Frequency = 75 mc max

Maximum Ratings, Absolute Values
(Per Tube)

	CCS
DC Plate Voltage	6000 volts max
Negative DC Grid Voltage	1000 volts max
DC Plate Current	1.5 amps max
DC Grid Current	0.35 amps max
Plate Input	9000 watts max
Plate Dissipation	4000 watts max

Typical Operation
Grounded-Filament Circuit

	CCS	CCS	CCS
Frequency	75	75	75 mc
DC Plate Voltage	6	5	4 kilovolts
Negative DC Grid Voltage	400	300	200 volts
Peak RF Grid Voltage	740	640	500 volts
DC Plate Current	1.5	1.5	1.37 amps
DC Grid Current (approx)	0.31	0.33	0.35 amps
Driving Power	210	190	160 watts
Power Output (approx)	6.9	5.6	4.0 kilowatts

Maximum Ratings, Absolute Values
Grounded-Grid Circuit (Per Tube)

	CCS	CCS	CCS
Frequency	up to 75	up to 110	up to 220 mc [3]
DC Plate Voltage	6000	5000	4000 volts
DC Plate Current	1.5	1.5	1.25 amps
Plate Input	9000	7500	5000 watts

Typical Operation
Grounded-Grid Circuit (Two Tubes)

	CCS	CCS	CCS	CCS
Frequency [3]	75	110	110	220 mc
DC Plate Voltage	6	5	4	4 kilovolts
Negative DC Grid Voltage	400	300	200	200 volts
Peak RF Grid Voltage	740	640	500	450 volts
DC Plate Current	3	3	2.75	2.5 amps
DC Grid Current (approx)	0.62	0.66	0.70	0.40 amps
Driving Power	2240	1840	1350	760 watts
Power Output (approx) [4]	15.6	12.1	8.6	5.6 kilowatts

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[2] Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

[3] When using the tube above 110 mc, particular attention must be given to a careful design of installation, otherwise the tube may be damaged. Therefore, guarantee for tubes operating above 110 mc can only be given after approval of the prototype circuit by Amperex.

[4] Power transferred from driving stage included.

RF Power Amplifier - Class B

Carrier Conditions Per Tube For Use With A Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values
(Per Tube)

	CCS	CCS	CCS
Frequency	up to 75	up to 110	up to 220 mc [3]
DC Plate Voltage	6000	5000	4000 volts
DC Plate Current	1.1	1.1	0.9 amps
Plate Input	6600	5500	3600 watts
Plate Dissipation	4000	4000	4000 watts

Typical Operation

	CCS	CCS
DC Plate Voltage	6	5 kilovolts
Negative DC Grid Voltage	180	145 volts
Peak RF Grid Voltage	250	225 volts
DC Plate Current	0.99	0.9 amps
Driving Power (approx) [5]	140	130 watts
Power Output (approx)	1.9	1.45 kilowatts

Grid Modulated RF Power Amplifier

Class C Television Service

Negative Modulation, Positive Synchronization

Maximum Ratings, Absolute Values
(Per Tube)

	CCS	CCS	CCS
Frequency	up to 75	up to 110	up to 220 mc [3]
DC Plate Voltage	6000	5000	4500 volts
DC Grid No. 1 Voltage - White Level	−1000	−1000	−1000 volts
Plate Current - Sync	1.9	1.9	1.9 amps
Plate Input - Sync	11.4	9.5	8.5 kilowatts
Plate Dissipation	4000	4000	4000 watts
Grid Dissipation	120	120	120 watts

Typical Operation
Two Tubes - Push-Pull
(Frequency at 75 mc)

DC Plate Voltage	5000 volts
Negative DC Grid No. 1 Voltage	
Synchronizing Level	−200 volts
Pedestal Level	−300 volts
White Level	−550 volts
RF Grid No. 1 Voltage Peak to Peak Synchronization Level	1000 volts
DC Plate Current	
Synchronization Level	3.8 amps
Pedestal Level	2.6 amps
DC Grid Current (approx)	
Synchronization Level	0.5 amps
Pedestal Level	0.35 amps
Driving Power at Synchronization Level (approx)	250 watts
Power Output (approx)	
Synchronization Level	9 kilowatts
Pedestal Level	5.35 kilowatts

[5] At crest of audio-frequency cycle with modulation factor of 1.0.

7900

RF Amplifier - Class B Television Service

Negative Modulation and Positive Synchronization

Maximum Ratings, Absolute Values
(Per Tube)

	CCS	CCS
Frequency	up to 75	up to 220 mc
DC Plate Voltage	6000	4500 volts max
Negative DC Grid Voltage	−1000	−1000 volts max
DC Plate Current - Sync	1.9	1.9 amps max
Plate Input - Sync	11.4	9.5 kilowatts max
Plate Dissipation - Sync	4000	4000 watts max
Grid Dissipation - Sync	120	120 watts max

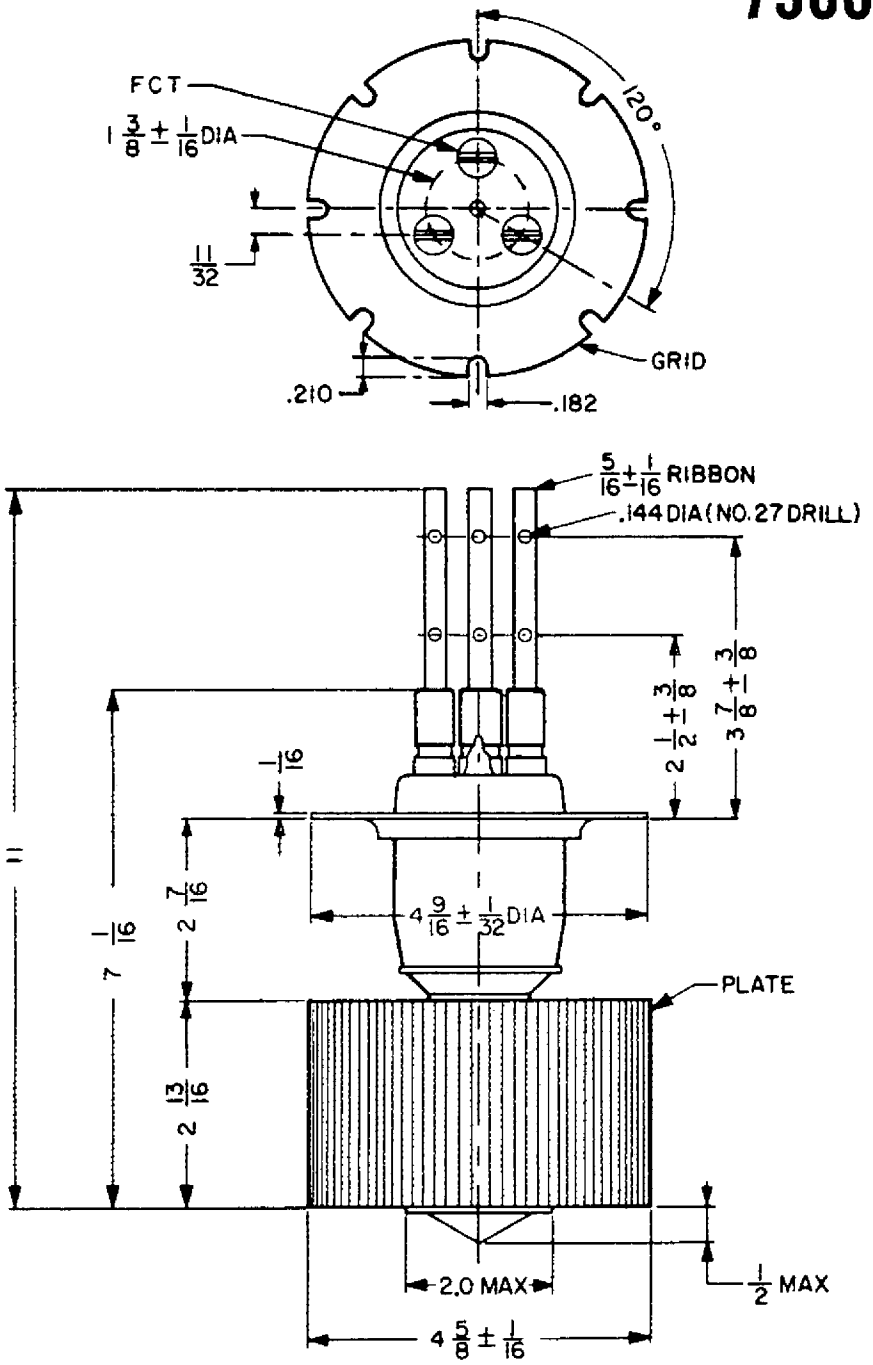
Typical Operation
Two Tubes - Push Pull
(Frequency at 75 mc)

DC Voltage	5000 volts
Negative DC Grid Voltage	200 volts
RF Grid Voltage Peak to Peak	
Synchronization Level	1000 volts
Pedestal Level	800 volts
White Level	0 volts
DC Plate Current	
Synchronization Level	3.8 amps
Pedestal Level	3 amps
White Level	0.2 amps
DC Grid Current	
Synchronization	0.5 amps
Pedestal Level	0.22 amps
White Level	0 amps
Driving Power at Synchronization Level (approx)	250 watts
Power Output (approx)	
Synchronization Level	9 kilowatts
Pedestal Level	5.35 kilowatts

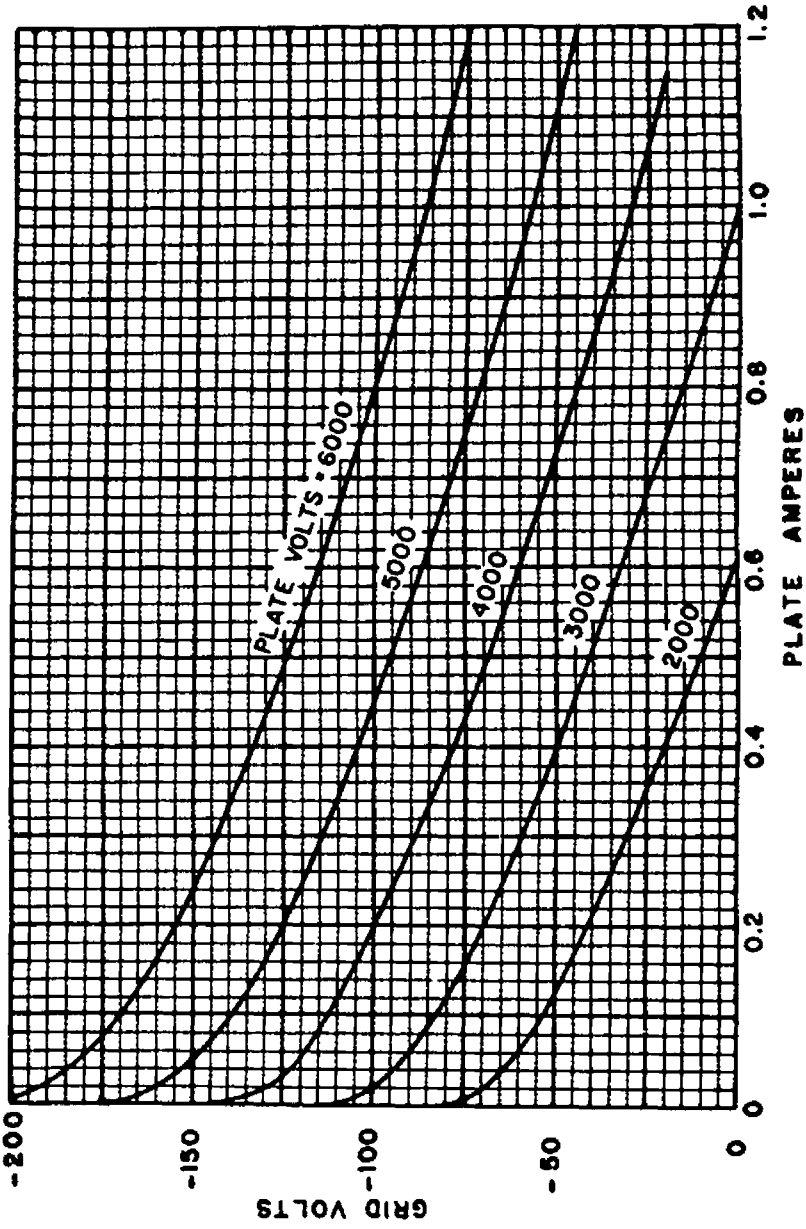
Typical Operation
(Frequency at 216 mc)
One Tube in a Coaxial Cavity

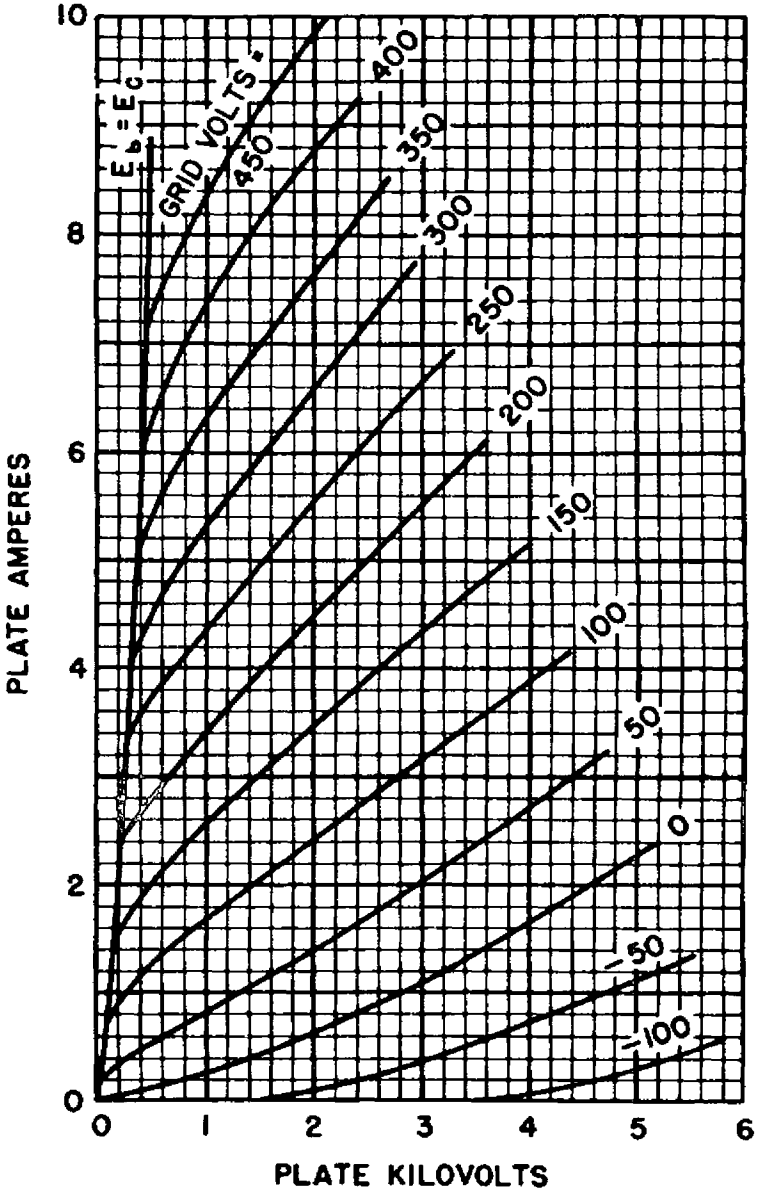
DC Plate Voltage	4000	4500 volts [6]
Negative DC Grid Voltage	125	130 volts
Peak RF Grid Voltage		
Synchronization Level	405	450 volts
Black Level	305	430 volts
White Level	0	0 volts
DC Plate Current		
Synchronization Level	1.59	1.75 amps
Black Level	1.3	1.41 amps
White Level	0.4	0.4 amps
DC Grid Current (approx)		
Synchronization Level	0.35	0.35 amps
Black Level	0.125	0.125 amps
White Level	0	0 amps
Power Output (approx)		
Synchronization Level	5.0	5.6 kilowatts
Black Level	3.0	3.25 kilowatts
Power Input		
Synchronization Level	7.15	8.75 kilowatts
Black Level	5.85	6.75 kilowatts

[6] Maximum TV ratings up to 220 mc are for 25 kw useful peak sync. power output with 5 tubes operating in approved cavity construction or 35 kw useful peak sync. power output with 7 tubes.

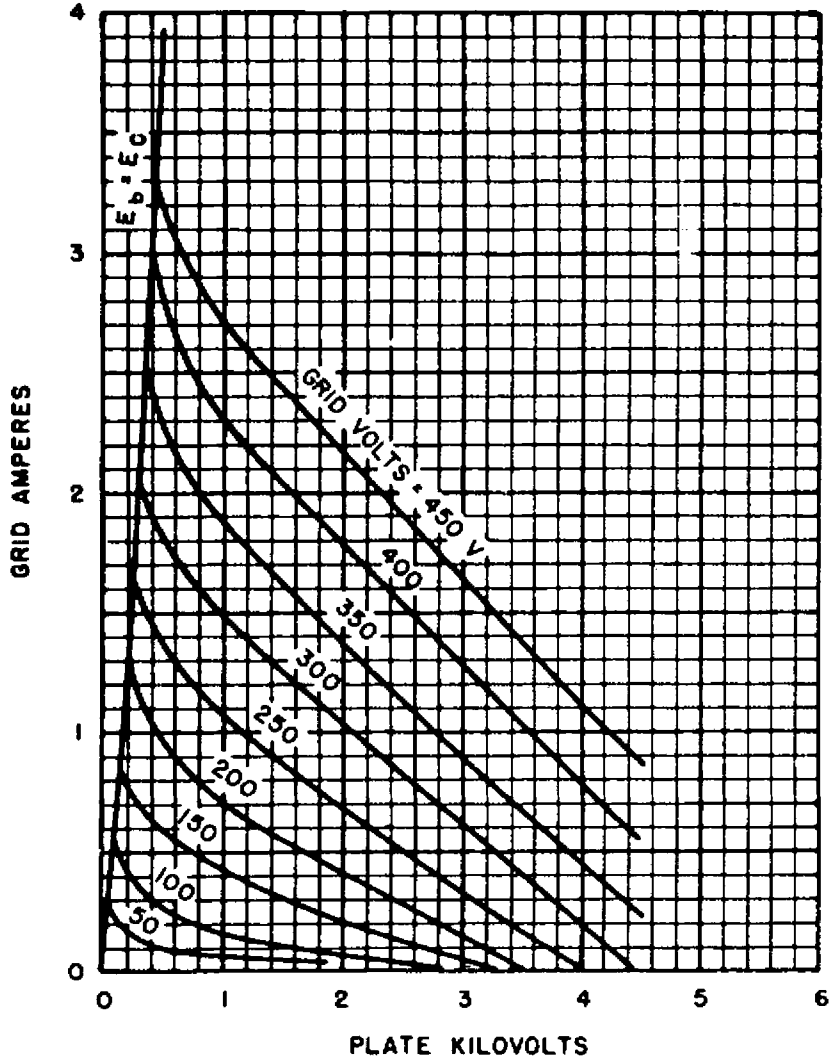

FCT
1 3/8 ± 1/16 DIA
11/32
120°
GRID
.210
.182
5/16 ± 1/16 RIBBON
.144 DIA (NO. 27 DRILL)
2 1/2 +1 3/8
3 7/8 +1 3/8
1/16
11
7 1/16
2 7/16
2 13/16
4 9/16 ± 1/32 DIA
PLATE
2.0 MAX
1/2 MAX
4 5/8 ± 1/16

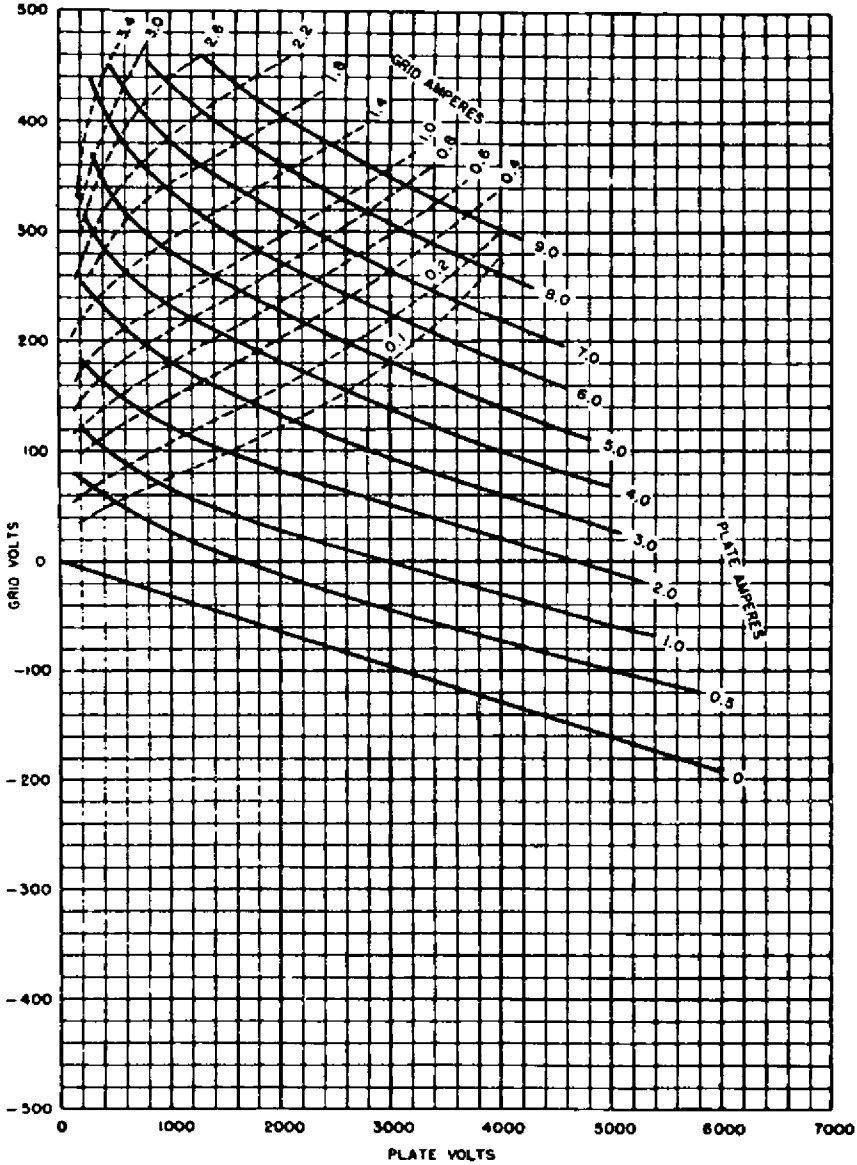
7900


PLATE VOLTS - 6000
5000
4000
3000
2000
PLATE AMPERES
0
0.2
0.4
0.6
0.8
1.0
1.2
GRID VOLTS
-200
-150
-100
-50
0


PLATE AMPERES
PLATE KILOVOLTS
0
2
4
6
8
10
0
1
2
3
4
5
6
$E_b = E_c$
GRID VOLTS
400
350
300
250
200
150
100
50
0
-50
-100

7900


GRID AMPERES
PLATE KILOVOLTS
0
1
2
3
4
5
6
$E_b = E_c$
GRID VOLTS = 450 V
400
350
300
250
200
150
100
50


GRID VOLTS
PLATE VOLTS
GRID AMPERES
PLATE AMPERES
500
400
300
200
100
0
-100
-200
-300
-400
-500
0
1000
2000
3000
4000
5000
6000
7000
3.0
2.8
2.6
2.2
1.8
1.4
1.0
0.8
0.6
0.4
0.2
0.1
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.3
0

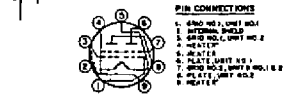
from JEDEC release #3443, Oct. 9, 1961

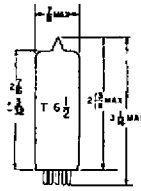
AMPEREX TUBE TYPE 7983

TENTATIVE DATA

The Amperex 7983 is a quick heating double tetrode primarily intended for use as output amplifier, driver or frequency multiplier. The filament has been designed for intermittant operation in hybrid mobile transceivers where low standby current and low heat dissipation are important.

The 7983 has been neutralized internally for frequencies up to 200 mc.





GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6½
Base	Noval
Mounting Position	see note 1
Cooling	radiation & convection (use of a closed can is not permissable)
Maximum Bulb Temperature	225° C
Maximum Pin Temperature	120° C
Net Weight (Approx)	0.6 ounces
Shipping Weight (Approx)	0.7 ounces

ELECTRICAL

Cathode	oxide coated	
Heater Voltage [2]	3.15 volts	
Heater Current	1.65 amps	
Heating Time	0.8 seconds for a power output of −3 db	
Direct Interelectrode Capacitances	Each Unit	Both Units in Push-Pull
Output	3.2	1.7 pf
Input	6.8	5.4 pf
Plate to Grid [3]	0.08 max	-- pf
Typical Characteristics (Each System) [4]		
Amplification Factor, Grid No. 2 to Grid No. 1		7.5
Transconductance		3000 micromhos

[1] If the tube is mounted with its main axis deviating from the vertical it is recommended that pins 2 and 7 are placed in a vertical plane.

[2] Filament supply from a dc/ac inverter is recommended. The permissible deviation from the filament voltage is ±10%. If the dc/ac inverter is fed from a 12.6 volt battery that is charged during operation (driving motor vehicle) the design center value for the supply voltage should be 14 volts.

[3] Internally neutralized up to 200 mc.

[4] At plate and grid no. 2 voltages of 200 volts and a plate current of 30 ma.

7983

RF Class C Telegraphy or FM Telephony

Maximum Ratings, Absolute Values

Frequency	200 mc max
Plate Voltage	300 volts max
Plate Input Power	2x15 watts max
Plate Dissipation	2x7 watts max
Plate Current	2x55 ma max
Grid No. 2 Voltage	200 volts max
Grid No. 2 Dissipation	2x1 watts max
Grid No. 1 Voltage	−150 volts max
Grid No. 1 Dissipation	2x0.2 watts max
Grid No. 1 Current	2x4 ma max
Cathode Current	2x65 ma max
Peak Cathode Current	2x300 ma max

Typical Operation
(Two Systems in Push-Pull) ICAS

Frequency	200	200 mc
Plate Voltage	250	200 volts
Grid No. 2 Supply Voltage	250	200 volts
Grid No. 2 Dropping Resistor	22	6.8 K ohms
Grid No. 1 Bias	−40	−40 volts
Grid No. 1 Bias Resistor	27	27 k ohms
Grid No. 1 Peak-to-Peak Driving Voltage	110	110 volts
Plate Current	2x45	2x45 ma
Grid No. 2 Current	2x4.2	2x5.1 ma
Grid No. 1 Current	2x1.5	2x1.5 ma
Plate Input Power	2x11.2	2x9 ma
Plate Dissipation	2x4.5	2x3.5 watts
Grid No. 2 Dissipation	2x0.65	2x0.85 watts
Output Power in Load	11	9.5 watts [5]
Plate Efficiency	60	61 %

[5] Measured in the circuit of Figure 1.

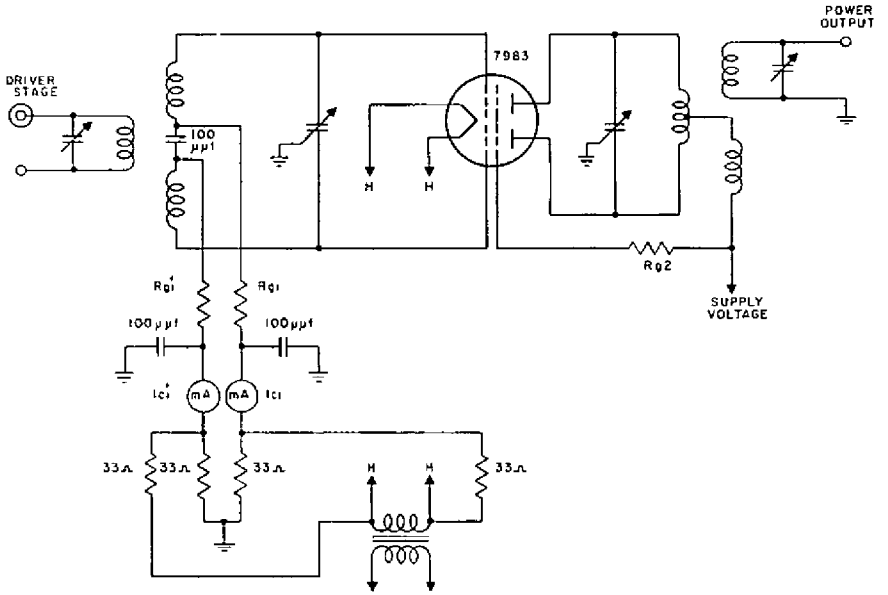

DRIVER STAGE
100 μμf
7983
H
H
POWER OUTPUT
Rg2
SUPPLY VOLTAGE
Rg1'
Rg1
100μμf
100μμf
Ic1'
Ic1
mA
mA
33Ω
33Ω
33Ω
H
H
33Ω

FIG. 1

7983

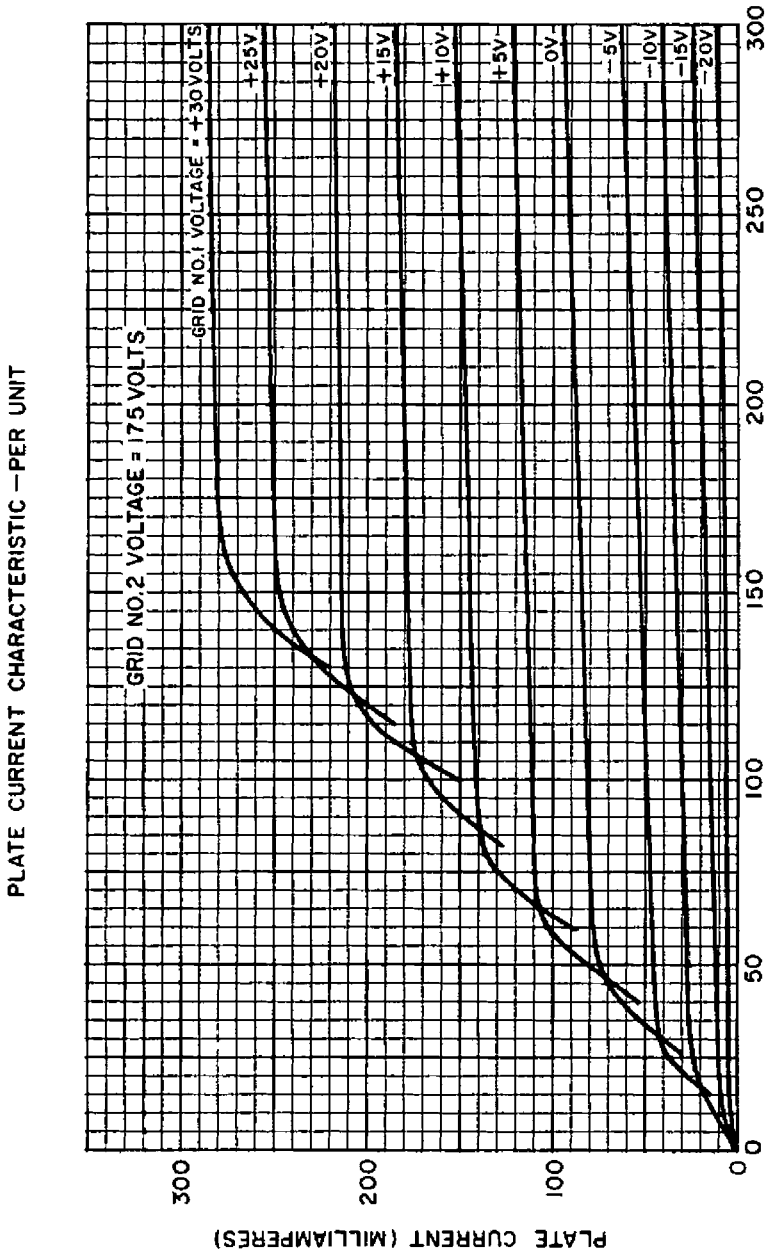
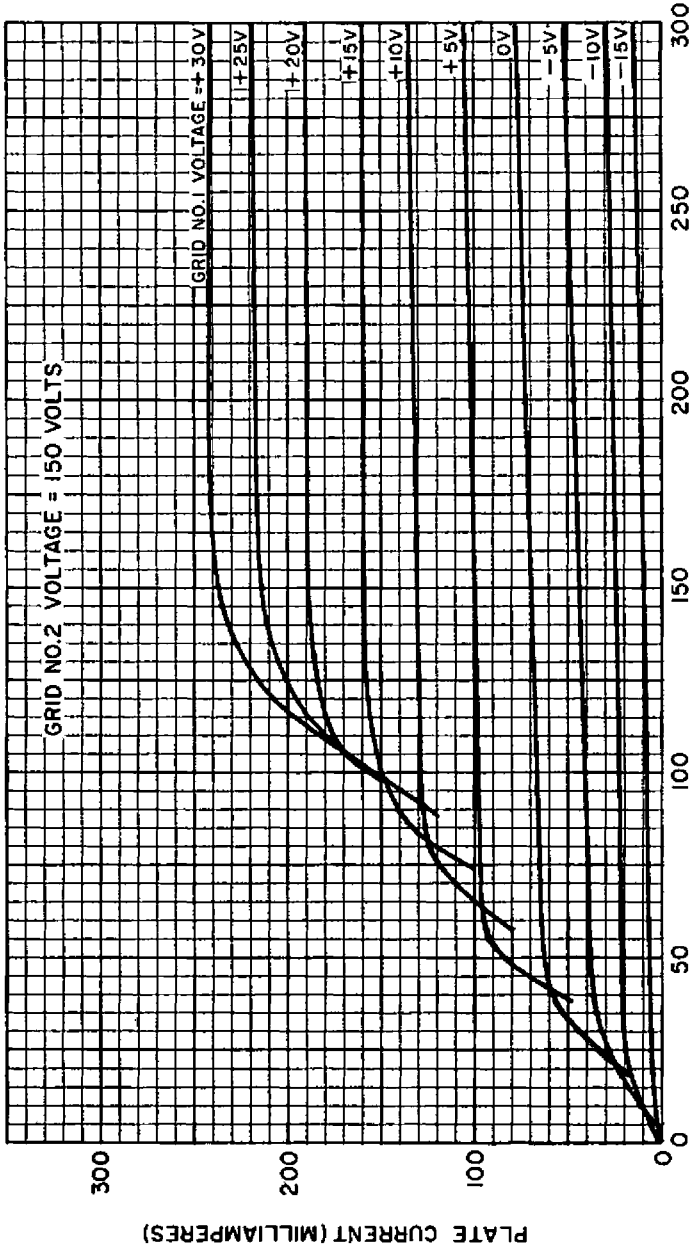
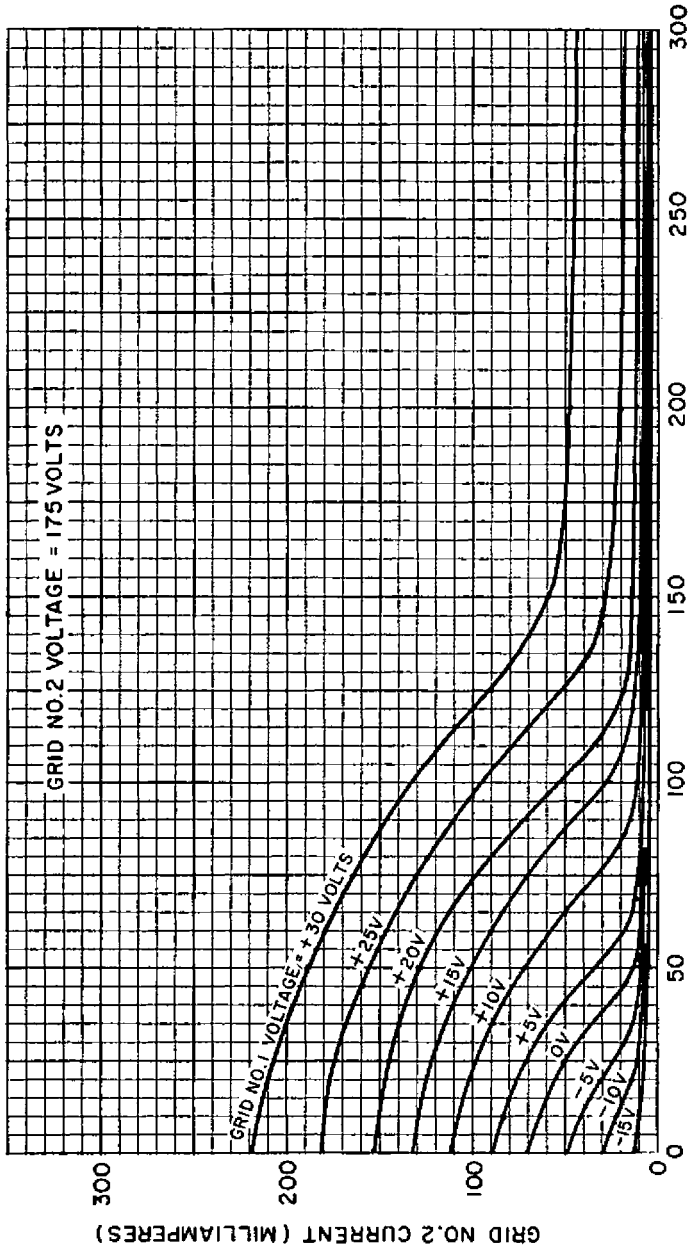

PLATE CURRENT CHARACTERISTIC—PER UNIT
GRID NO.2 VOLTAGE = 175 VOLTS
GRID NO.1 VOLTAGE = +30 VOLTS
+25V
+20V
+15V
+10V
+5V
0V
-5V
-10V
-15V
-20V
PLATE CURRENT (MILLIAMPERES)
0
100
200
300
0
50
100
150
200
250
300
PLATE VOLTAGE (VOLTS)

PLATE CURRENT CHARACTERISTIC – PER UNIT

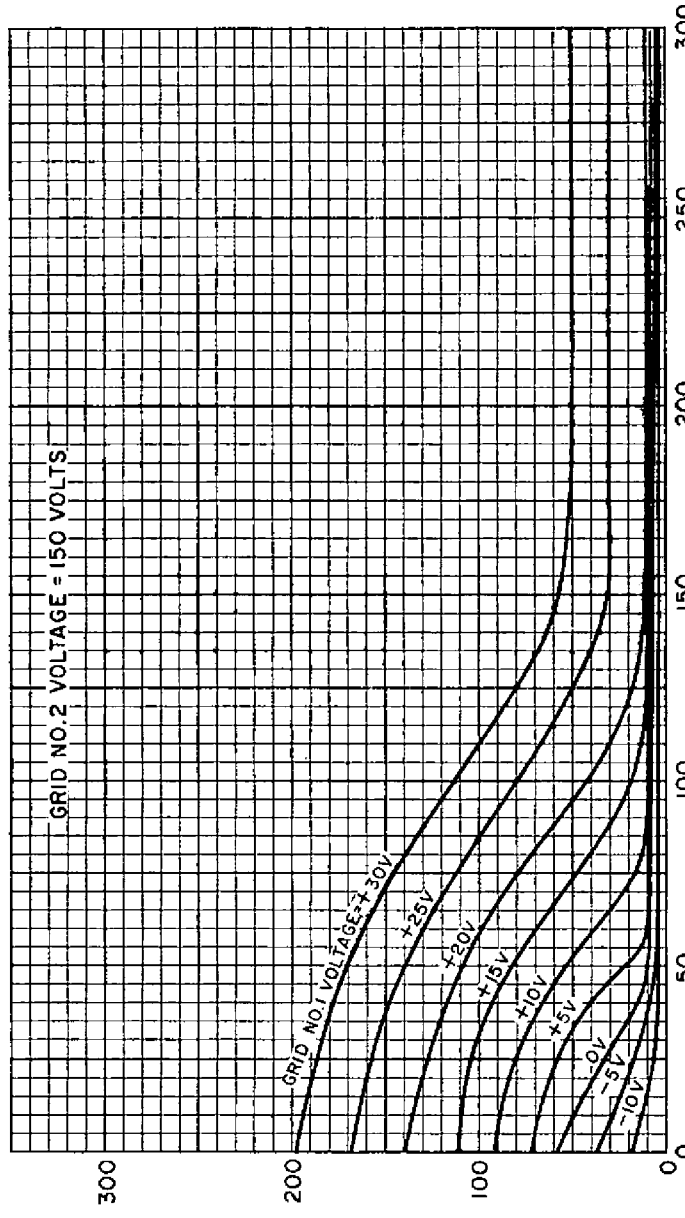


7983

SCREEN CURRENT CHARACTERISTIC—PER UNIT



SCREEN CURRENT CHARACTERISTIC – PER UNIT



R.F. Power Amplifier, Oscillator,

A.F. Power Amplifier, Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—	0	—16
Load Resistance (ohms per tube)	—	1675	2050
Effective Load Resistance (Plate to Plate) (ohms)	—	6700	8200
Zero Signal Plate Current (ma.)	—	148	84
Peak A.F. Grid to Grid Voltage	—	220	250
Max. Signal D.C. Plate Current (ma.)	210	400	400
Max. Signal Plate Input (watts)	315	500	600
Plate Dissipation (watts)	125	—	—
Max. Signal Driving Power (Approx.) (watts)	—	6.5	7
Max. Signal Plate Power Output (watts)	—	320	400

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—	—10	—16
Peak R.F. Grid Voltage	—	70	74
D.C. Plate Current (ma.)	150	120	120
Plate Input (watts)	185	150	180
Plate Dissipation (watts)	125	100	117.5
D.C. Grid Current (Approx.) (ma.)	—	10	10
Driving Power at Peak Modulation (Approx.) (watts)	—	6	7
Plate Power Output (watts)	—	50	62.5
Frequency Limit for Above Operation (mc.)	30	45	30

GENERAL CHARACTERISTICS

Filament Voltage	10
Filament Current (amps)	3.25
Amplification Factor (Approx.)	50
Grid to Plate Transconductance @ 100 ma.	4800 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	6.5 $\mu\mu$f
Grid to Filament	6.5 $\mu\mu$f
Plate to Filament	1.5 $\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C—Telephony

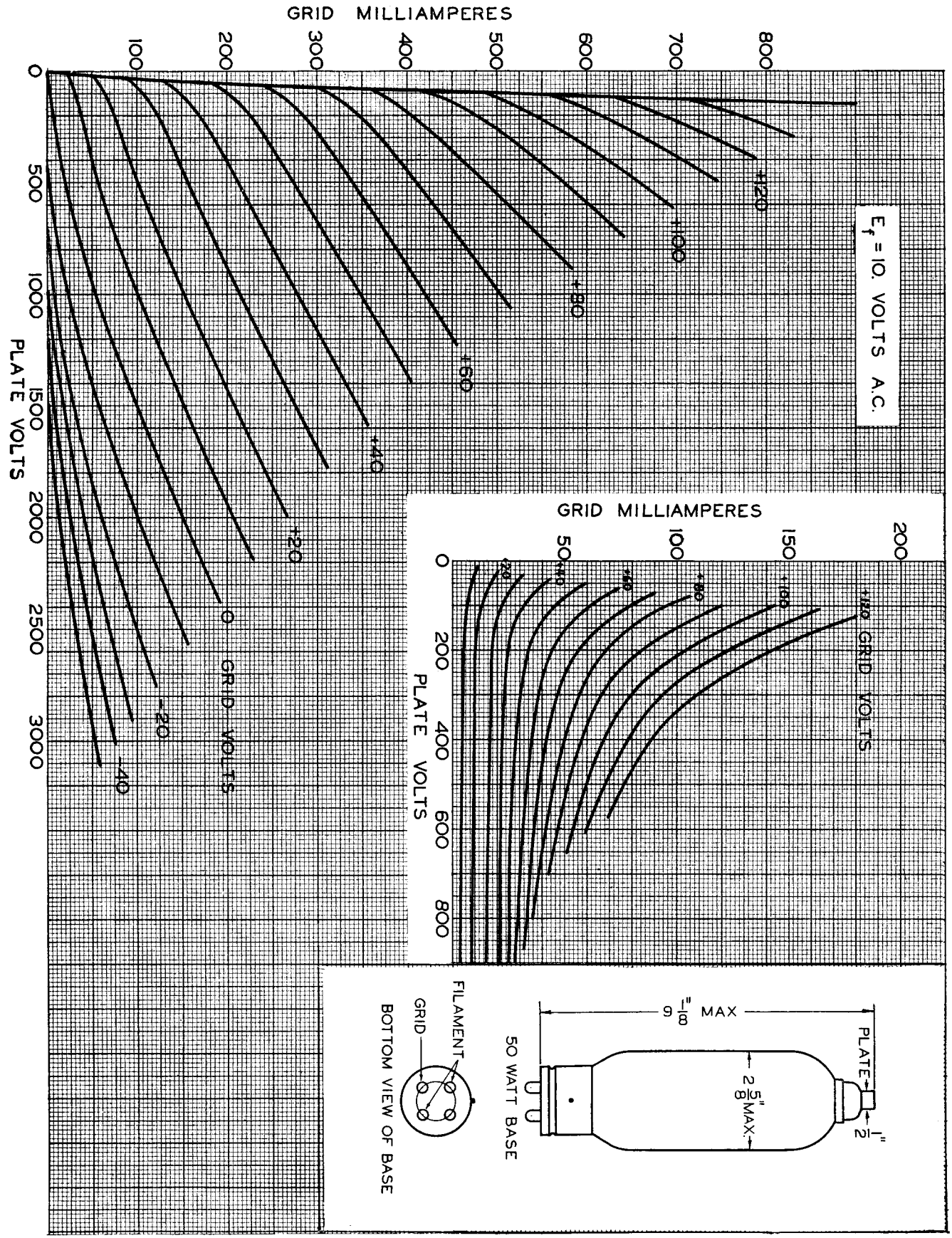
(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—155	—160
Peak R.F. Grid Voltage	—	290	295
D.C. Plate Current (ma.)	175	160	166
Plate Input (watts)	220	160	208
Plate Dissipation (watts)	85	—	58
D.C. Grid Current (Approx.) (ma.)	70	35	35
Driving Power (Approx.) (watts)	—	9	9
Plate Power Output (watts)	—	110	150
Frequency Limit for Above Operation (mc.)	30	40	30
F.C.C. Broadcast Rating (watts)	125	—	125

R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—400	—100	—105
Peak R.F. Grid Voltage	—	235	240
D.C. Plate Current (ma.)	210	200	200
Plate Input (watts)	315	250	300
Plate Dissipation (watts)	125	80	85
D.C. Grid Current (Approx.) (ma.)	70	25	25
Driving Power (Approx.) (watts)	—	5.5	5.5
Plate Power Output (watts)	—	170	215
Frequency Limit for Above Operation (mc.)	30	40	30

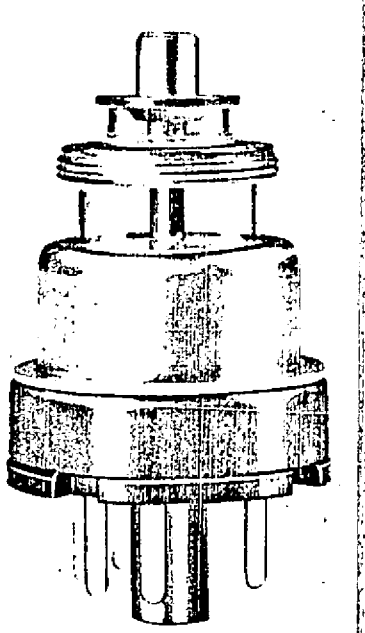
805—AMPEREX TRANSMITTING TUBE



Amperex® ELECTRONIC CORPORATION
HICKSVILLE, L. I., N. Y., 11802

TUBE TYPE 8108

The Amperex 8108 is a disc seal triode designed for use as a CW amplifier, oscillator, frequency doubler or frequency tripler to frequencies over 6000 Mc/sec. The 8108 delivers a saturation power of more than 2 watts with an operating voltage of only 180 volts. Amplifier gain of 19 db or more can be achieved. In suitable cavity circuits the 8108 can operate at full power with sink cooling or free-air convection cooling. Life expectancy is 10,000 hours.



GENERAL CHARACTERISTICS

MECHANICAL

Dimensions	see outline drawing
Base	Octal
Mounting Position[1]	any
Mounting Torque[2]	8.7 lbs. in. min. 13.0 lbs. in. max.
Seal Temperatures	
Anode[3]	150°C max.
Grid[3]	75°C max.
Cathode[3]	75°C max.
Accessories	
Torque Wrench	S-32140

ELECTRICAL

Heater Voltage	6.3 volts ac or dc parallel supply
Heater Current	0.735 amps
Direct Interelectrode Capacitances[4]	
Anode to Grid	1.4 pf
Anode to Cathode	0.035 pf
Grid to Cathode	3.0 pf

	Min.	Nom.	Max.	Typ.
Anode Voltage	--	180	--	180 volts
Anode Current	--	60	--	30 ma
Negative Grid Voltage	0	1.25	2.5	2.8 volts
Transconductance	16,000	21,000	--	18,000 μmhos
Amplification Factor	33	43	52	43

[1] Special attention should be paid to the mounting of the tube in those cases where it is used in portable equipment. Shocks, especially in a direction perpendicular to the axis of the tube should be avoided.

[2] The tube should be screwed into the circuit by means of a key with a torque within the limits specified. The key should fit in the notches of the tube base, the pins of the base being left free. See Accessories.

[3] A low velocity air flow may be necessary. The equipment designer is cautioned that differential cooling of one side of the cathode grid or grid anode glass either by use of excessive cooling air directed from one side or by poorly dispersed cooling air can result in damage to the glass and loss of the tube.

[4] Measured with 6.3 volts on the heater under conditions where no cathode current is drawn.

from JEDEC release #4524, Dec. 9, 1963,
and release #4524A, April 6, 1964

Amperex

MAXIMUM RATINGS, ABSOLUTE VALUES

Anode Voltage (Cut-Off Condition)	500 volts
Anode Voltage	300 volts
Anode Dissipation	12.5 ~~125~~ watts
Negative Grid Voltage	50 volts
Positive Grid Voltage	5 volts
Grid Current	10 ma
Grid Dissipation	200 milliwatts
Grid Input Power (f = 4000 Mc) (Grounded Grid Circuit)	1 watt
Cathode Current	70 ma
Cathode-Heater Voltage	50 volts
Heater Voltage	6.3±2% volts
Peak Negative Grid Voltage	100 volts
Peak Positive Grid Voltage	20 volts

MAXIMUM CIRCUIT VALUES

External Cathode-Heater Resistance	20,000 ohms
External Grid Lead Resistor[5]	3,000 ohms

TYPICAL CHARACTERISTICS AS AMPLIFIER (Frequency = 4000 Mc)

Anode Supply Voltage, E_{bb} (See Figure 1)	200	200 volts
Grid Supply Voltage, E_{cc} (See Figure 1)	+20	+20 volts
Cathode Resistor[6]	--	--
Anode Current	60	30 ma
Bandwidth[7]	50	50 Mc
Power Output (Power Gain = 8 db)		
Typical	1.8	-- watts
Minimum	1.5	-- watts
Power Output (Power Gain = 6 db)		
Typical	--	0.9 watt
Minimum	--	0.35 watt
Power Gain (Power Input = 1 mw)		
Typical	13	13 db
Minimum	10	10 db

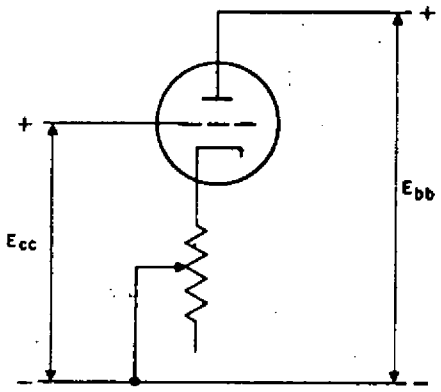


FIGURE 1. RECOMMENDED DC CIRCUIT

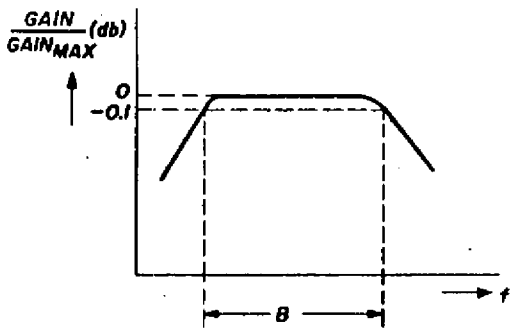


FIGURE 2. BANDWIDTH CHARACTERISTICS

[5] This value can be multiplied by the dc inverse feedback factor to a maximum of 25,000 ohms.
[6] A variable resistor of 500 ohms maximum (at an anode current of 60 ma) or 1000 ohms maximum (at an anode current of 30 ma) is to be used. It should be adjusted for the desired anode current. See Figure 1.
[7] The quoted value is the bandwidth between the 0.1 db points of the flattened response curve. See Figure 2.

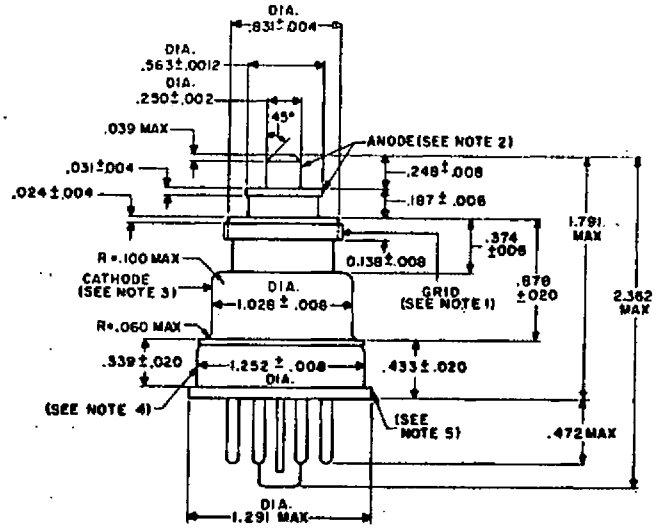


FIGURE 3

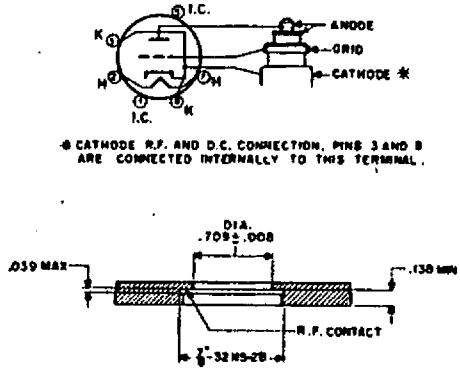


FIGURE 4. RECOMMENDED MOUNT

NOTES: OUTLINE DRAWING (FIGURES 3 AND 4)

Thread of the Grid Disc and of Recommended Mount
32 turns per inch
Thread angle = 60°

	Minor Diameter	Major Diameter	Pitch Diameter	
Figure 3	$0.835\ ^{+0}_{-0.006}$	$0.874\ ^{+0}_{-0.006}$	$0.854\ ^{+0}_{-0.0035}$	inches
Figure 4	$0.847\ ^{+0}_{-0.006}$	0.874 min.	$0.858\ ^{+0}_{-0.0047}$	inches

Note 1: The eccentricities are given with respect to the axis of the threaded hole (see Figure 4) in which the tube is screwed firmly against the flange, the inner diameter of which is 0.709 inches.

Note 2: Eccentricity of the axis of the anode = 0.006 inches maximum.

Note 3: Eccentricity of the axis of the cathode = 0.008 inches maximum.

Note 4: The tolerance of the eccentricity of the axis of the base is such, that this base fits into a hole with a diameter of 1.280 inches, provided this hole is correctly centered with respect to the axis of the hole of Figure 4.

Note 5: The tolerance of the eccentricity of the axis of the base flange is such, that this flange fits into a hole with a diameter of 1.319 inches, provided this hole is correctly centered with respect to the axis of the hole of Figure 4.

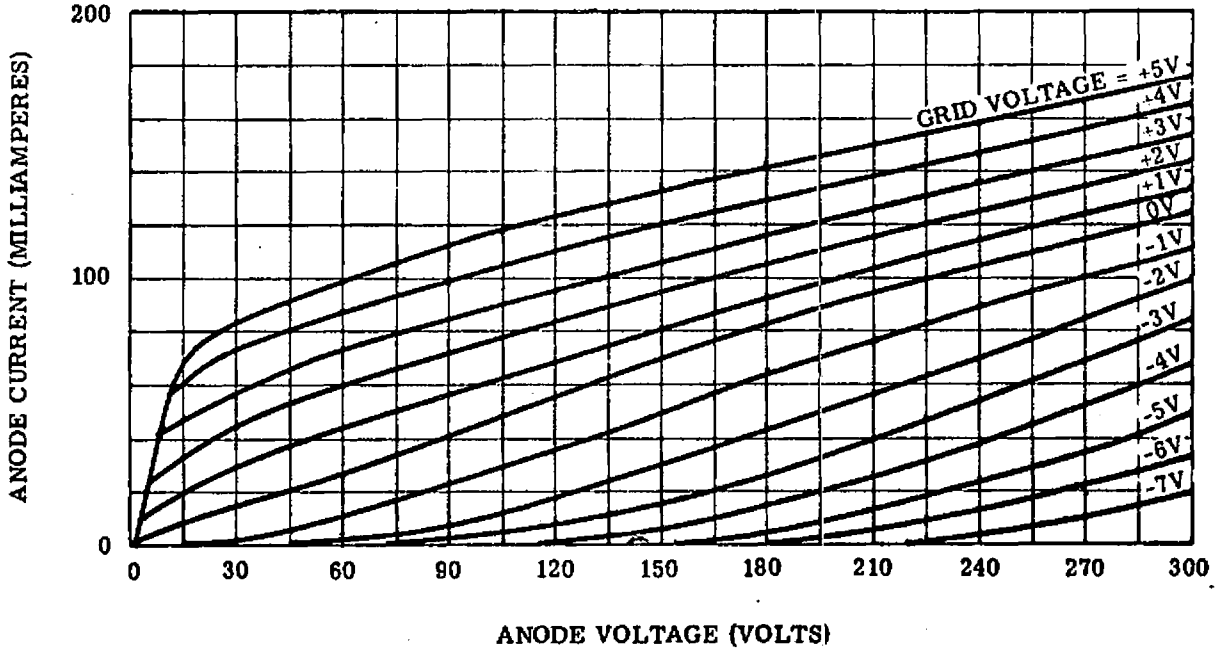


FIGURE 5. ANODE CHARACTERISTICS

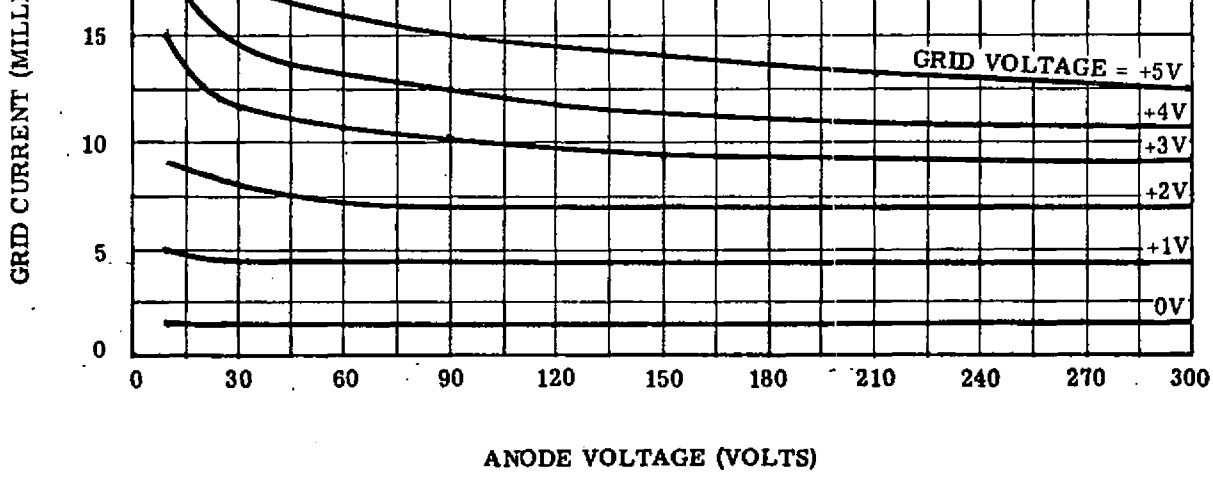


FIGURE 6. GRID-ANODE TRANSFER CHARACTERISTICS

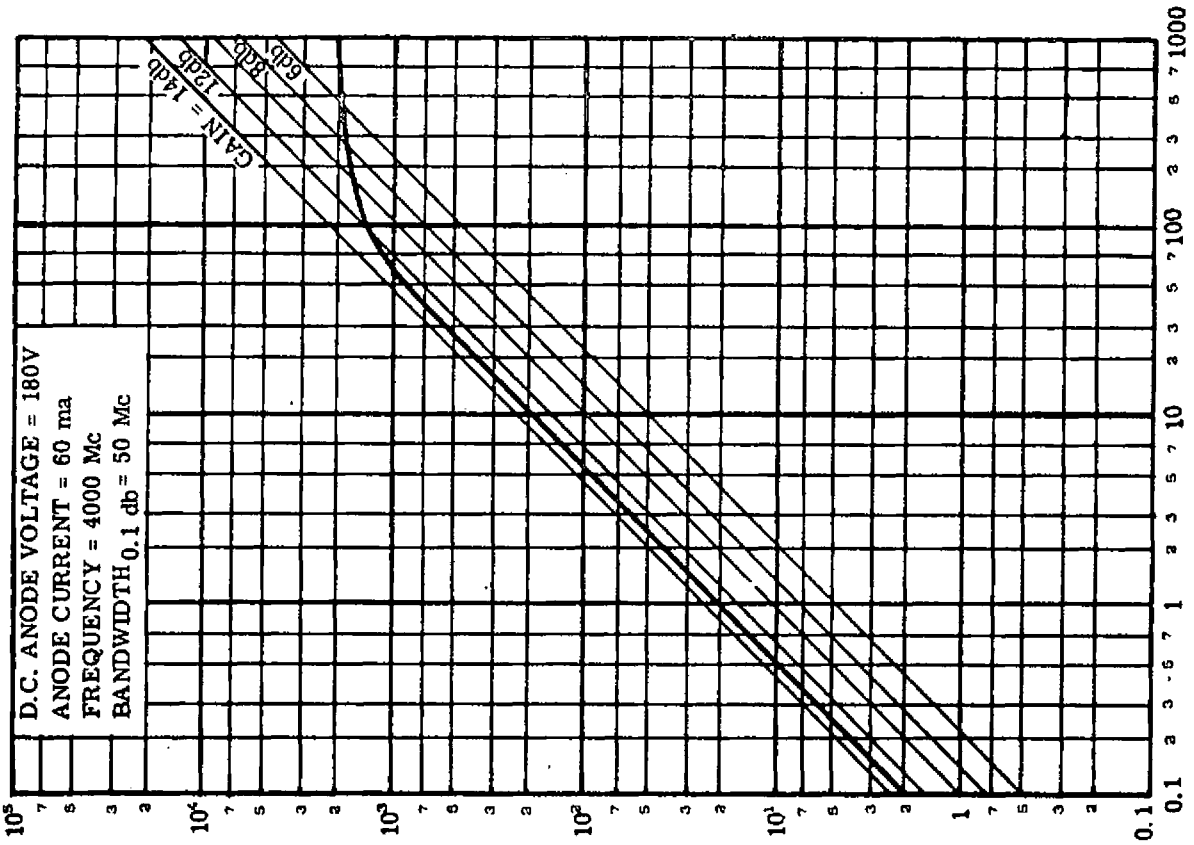


FIGURE 8. POWER GAIN

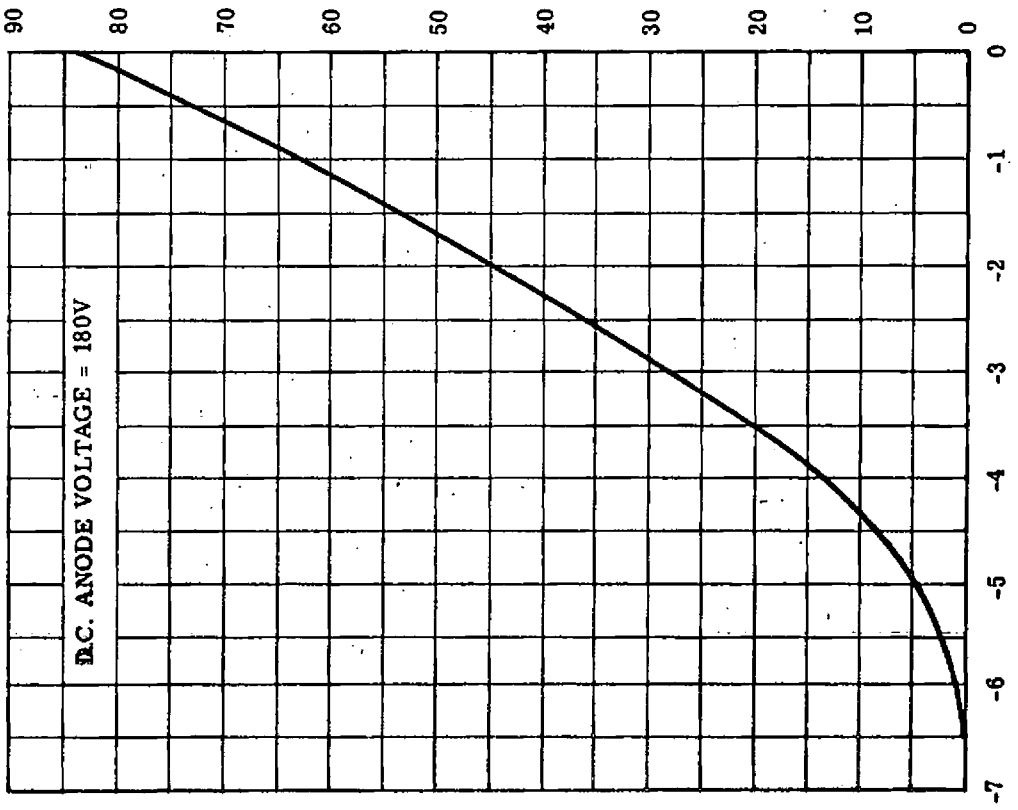
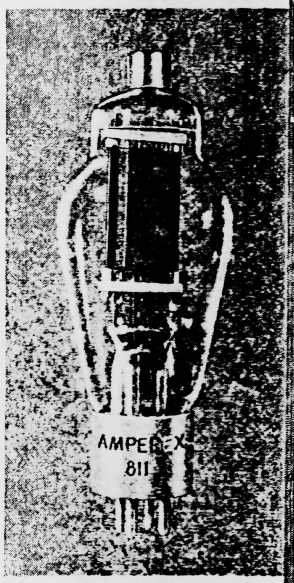


FIGURE 7. TRANSFER CHARACTERISTICS

AMPEREX TRANSMITTING TUBE 811

AF Power Amplifier and Modulator
RF Power Amplifier and Oscillator



GENERAL CHARACTERISTICS

Filament	Thoriated Tungsten
Voltage	6.3 volts (ac or dc)
Current	4 amperes
Amplification Factor	160
Direct Interelectrode Capacitances	
Grid to Plate	5.5 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	0.6 $\mu\mu$f

MAXIMUM CCS AND ICAS RATINGS AND TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service

ICAS = Intermittant Commercial and Amateur Service

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube		Typical Operation Two Tubes	
	CCS	ICAS	CCS	ICAS
D.C. Plate Voltage	1250	1500	1250	1500
D.C. Grid Voltage	....	....	0	—9
Peak A.F. Grid to Grid Voltage	....	....	130	150
Zero Sig. D.C. Plate Current (ma)	....	....	48	20
Max. Sig. D.C. Plate Current (ma)[1]	150	150	200	200
Load Resistance (ohms) (per tube)	....	....	3600	4400
Effective Load Resistance (ohms) (pl-pl)	....	....	14400	17600
Max. Sig. Plate Input (watts)[1]	125	150	....	....
Plate Dissipation (watts)[1]	40	50	....	....
Max. Sig. Driving Power (watts) (approx.)	....	....	2.6	3.0
Max. Sig. Power Output (watts) (approx.)	....	....	175	220

R.F. Power Amplifier—Class B—Telephony

Plate Volts & Input Max. %	100	90	83
For Frequencies Indicated	60	80	100

	Maximum Rating per Tube		Typical Operation One Tube	
	CCS	ICAS	CCS	ICAS
D.C. Plate Voltage	1250	1500	1250	1500
D.C. Grid Voltage	....	....	0	—6
Peak R.F. Grid Voltage	....	....	26	35
D.C. Plate Current (ma)	60	60	48	50
Plate Input (watts)	60	75	....	....
D.C. Grid Current (ma) (approx.)	....	....	6	6
Plate Dissipation (watts)	40	50	....	....
Driving Power (watts) (approx.)[2]	....	....	1	1.5
Power Output (watts) (approx.)	....	....	20	25

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Plate Volts & Input Max. %	100	75	60
For Frequencies Indicated (mc)	60	80	100

(continued)

	Maximum Rating per Tube		Typical Operation One Tube	
	CCS	ICAS	CCS	ICAS
D.C. Plate Voltage	1000	1250	1000	1250
D.C. Grid Voltage	—200	—200	—100	—125
From Grid Resistor (ohms)	....	....	2000	2500
Peak R.F. Grid Voltage	....	....	195	230
D.C. Plate Current (ma)	105	125	105	125
Plate Input (watts)	105	155	....	....
D.C. Grid Current (ma) (approx.)	50	50	50	50
Plate Dissipation (watts)	27	40	....	....
Driving Power (watts) (approx.)	....	....	9	11
Power Output (watts) (approx.)	....	....	82	120

R.F. Power Amplifier and Oscillator—Class C

Key-down conditions without modulation[3]

Plate Volts & Input Max. %	100	75	60
For Frequencies Indicated (mc)	60	80	100

	Maximum Rating per Tube		Typical Operation One Tube	
	CCS	ICAS	CCS	ICAS
D.C. Plate Voltage	1250	1500	1250	1250
D.C. Grid Voltage	—200	—200	—87.5	—113
From Grid Resistor (ohms)	....	....	2500	3200
Or Cathode Resistor (ohms)	....	....	550	610
Peak R.F. Grid Voltage	....	....	180	225
D.C. Plate Current (ma)	125	150	125	150
Plate Input (watts)	155	225	....	....
D.C. Grid Current (ma) (approx.)	50	50	35	35
Plate Dissipation (watts)	40	55	....	....
Driving Power (watts) (approx.)	....	....	7	8
Power Output (watts) (approx.)	....	....	115	170

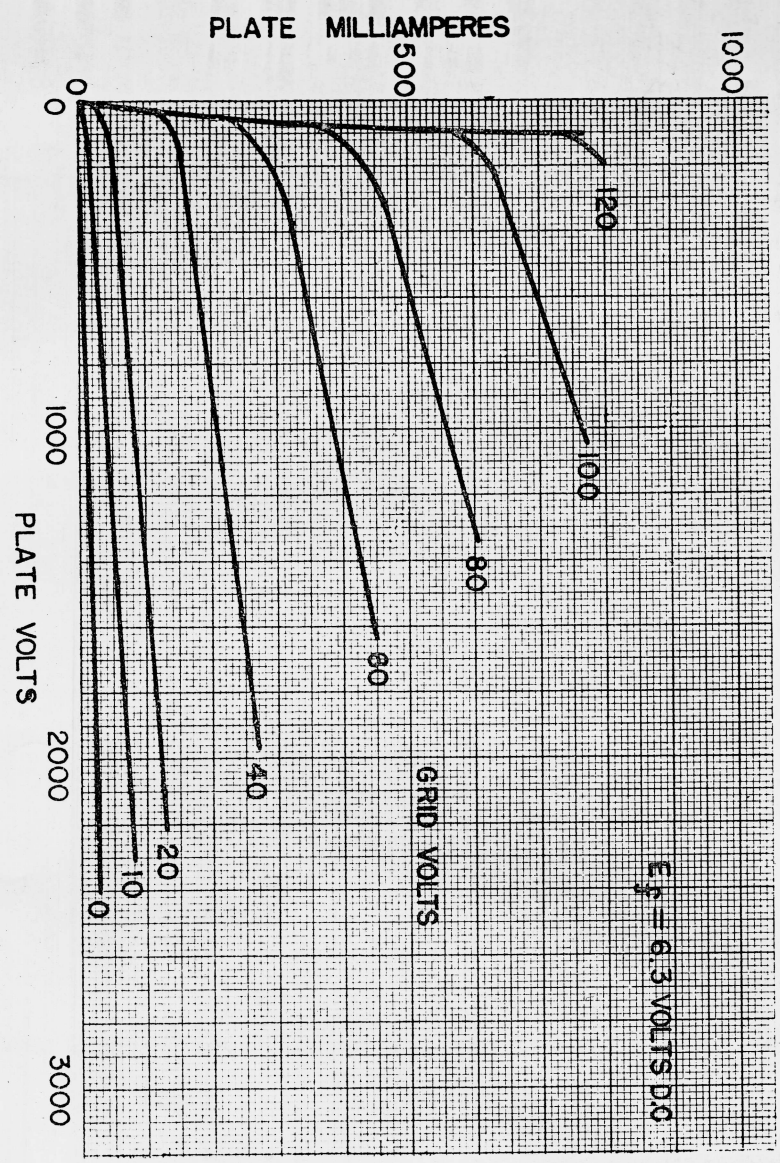
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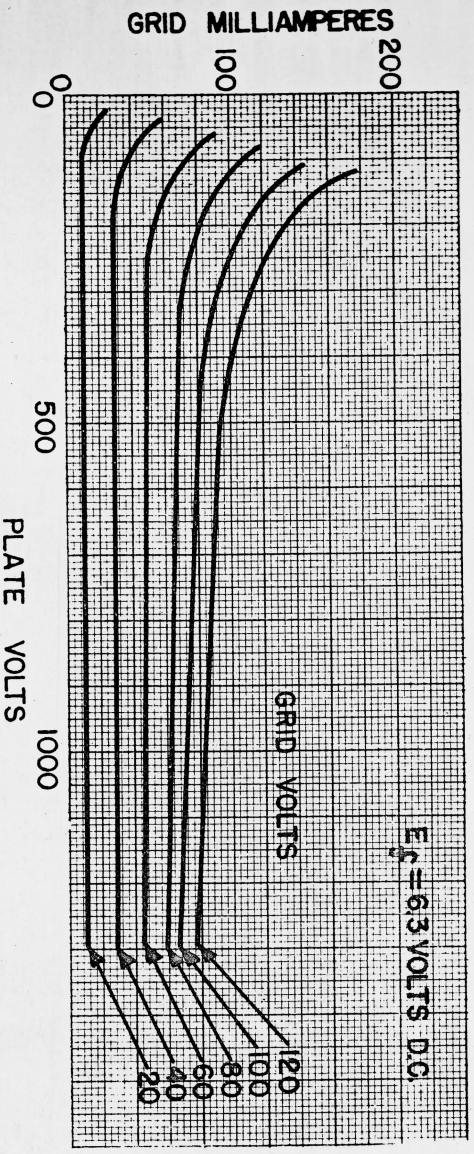
[1]Averaged over any audio-frequency cycle of sine-wave form.

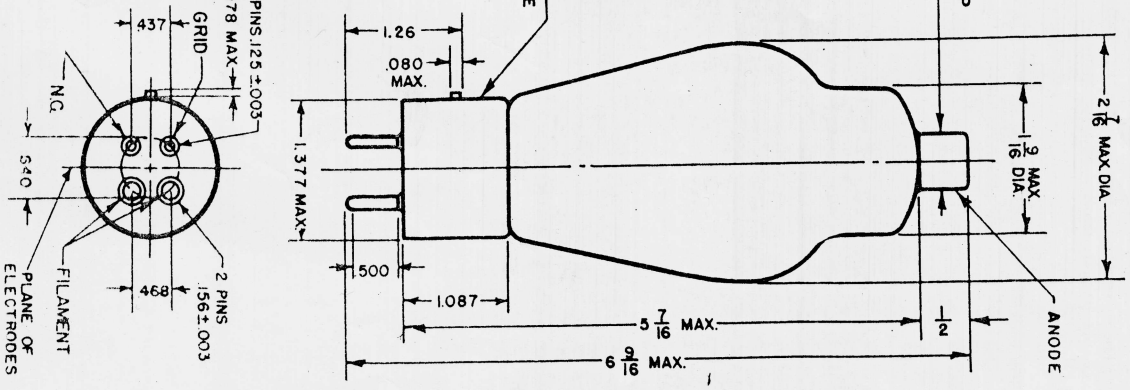
[2]At crest of audio-frequency cycle of sine-wave form.

[3]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

811—AMPEREX TRANSMITTING TUBE







for information on tubes
and semiconductors
for all applications,
ask Amperex®

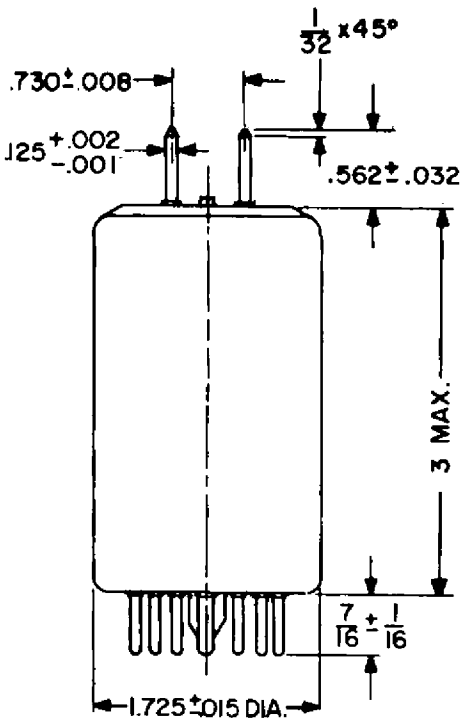
from JEDEC release #3747, May 14, 1962

Amperex® electronic corp. 230 Duffy Avenue, Hicksville, L. I., N. Y.

AMPEREX TUBE TYPE 8116

TENTATIVE DATA

The 8116 is a dual tetrode tube designed for use as a high efficiency linear amplifier in single sideband systems. Each anode is capable of dissipating 30 watts. The tube envelope is a calibrated bulb held to close tolerances. Anode pin dimensions are also held within narrow limits. Dimensionally, the tube is designed for an accurate fit into heat sink cooling equipment. Maximum ratings apply, as indicated below, up to 60 and 175 megacycles.



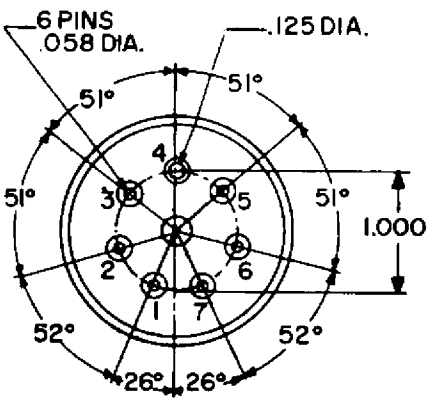
GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical, base up or down horizontal with anode pins in a horizontal plane.
Maximum Glass and seal temperatures[1]	250°C
Accessories	
Socket	Johnson 122-105 or equal
Net Weight, Approx.	2.5 ounces

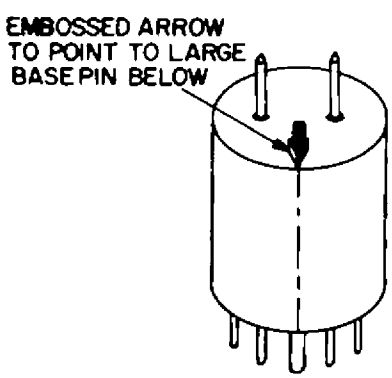
ELECTRICAL

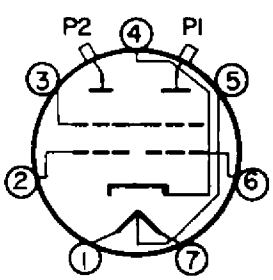
Filament	Indirectly heated, oxide coated
Voltage	
Series	26.5 volts
Parallel	13.25 volts
Current	
Series	0.433 amps
Parallel	0.866 amps



1. Either forced air cooling or heat sink cooling may be used when the tube is operating at or near the maximum ratings. With forced air cooling it is necessary to cool both the lateral bulb surfaces as well as the plate pin seals by directing the flow of air toward the top and sides of the bulb. In most cases approximately 20 cfm is sufficient. However, regardless of the type of cooling being used, the degree of cooling should be determined by direct temperature measurement of both the seals and the bulb.

   The temperature may be measured by means of temperature sensitive compounds, such as Tempilaq made by the Tempil Corporation, 11 West 25th Street, New York, N.Y.





BASE-BOTTOM VIEW

PIN 1 – HEATER
PIN 2 – GRID NO.1 OF UNIT NO.2
PIN 3 – GRID NO.2
PIN 4 – CATHODE & INTERNAL SHIELD
PIN 5 – HEATER CENTER TAP
PIN 6 – GRID NO.1 OF UNIT NO.1
PIN 7 – HEATER
P1 – PLATE OF UNIT NO.1
P2 – PLATE OF UNIT NO.2

Rev. March 1962 - SG

ELECTRICAL (Continued)

Amplification Factor
G_1 - G_2 Mu at E_b = 600 volts
Ec_2 = 250 V, I_b = 40 ma — 7.0

Peak Cathode Current — 700 ma

Direct Interelectrode Capacitances (Grounded Cathode)

	Per Unit	
	Min.	Max.
Grid to Plate		0.09 pf
Input	9.4	11.8 pf
Output	2.6	3.7 pf

RF Power Amplifier and Oscillator

Class C Telegraphy

Maximum Ratings, Absolute Values

Frequency	60 mc max.
D.C. Plate Voltage	850 volts max.
D.C. Grid No. 2 Voltage	300 volts max.
D.C. Grid No. 1 Voltage	-175 volts max.
D.C. Plate Current	2x110 ma max.
D.C. Grid No. 1 Current	2x5 ma max.
Plate Input	2x90 watts max.
Grid No. 2 Input	7 watts max.
Plate Dissipation	2x30 watts max.
Heater-Cathode Voltage	100 volts max.

RF Power Amplifier and Oscillator

Class C Telegraphy

Maximum Ratings, Absolute Values

Frequency	175 mc max.
D.C. Plate Voltage	750 volts max.
D.C. Grid No. 2 Voltage	300 volts max.
D.C. Grid No. 1 Voltage	-175 volts max.
D.C. Plate Current	2x110 ma max.
D.C. Grid No. 1 Current	2x5 ma max.
Plate Input	2x75 watts max.
Grid No. 2 Input	7 watts max.
Plate Dissipation	2x30 watts max.
Heater-Cathode Voltage	100 volts max.

CLASS AB LINEAR RF AMPLIFIER SINGLE SIDEBAND SUPPRESSED CARRIER OPERATION

Both Sections in Parallel

Maximum Ratings, Absolute Values
(Frequencies up to 60 mc)

	CCS	
D.C. Plate Voltage	1000	volts
D.C. Grid No. 2 Voltage	360	volts
D.C. Grid No. 1 Voltage	-175	volts
D.C. Plate Current	220	ma
D.C. Grid No. 1 Current	10	ma
Plate Input	200	watts
Grid No. 2 Input	7	watts
Plate Dissipation	2x30	watts

Typical Operation
Single Tone and/or Two Tone Operation

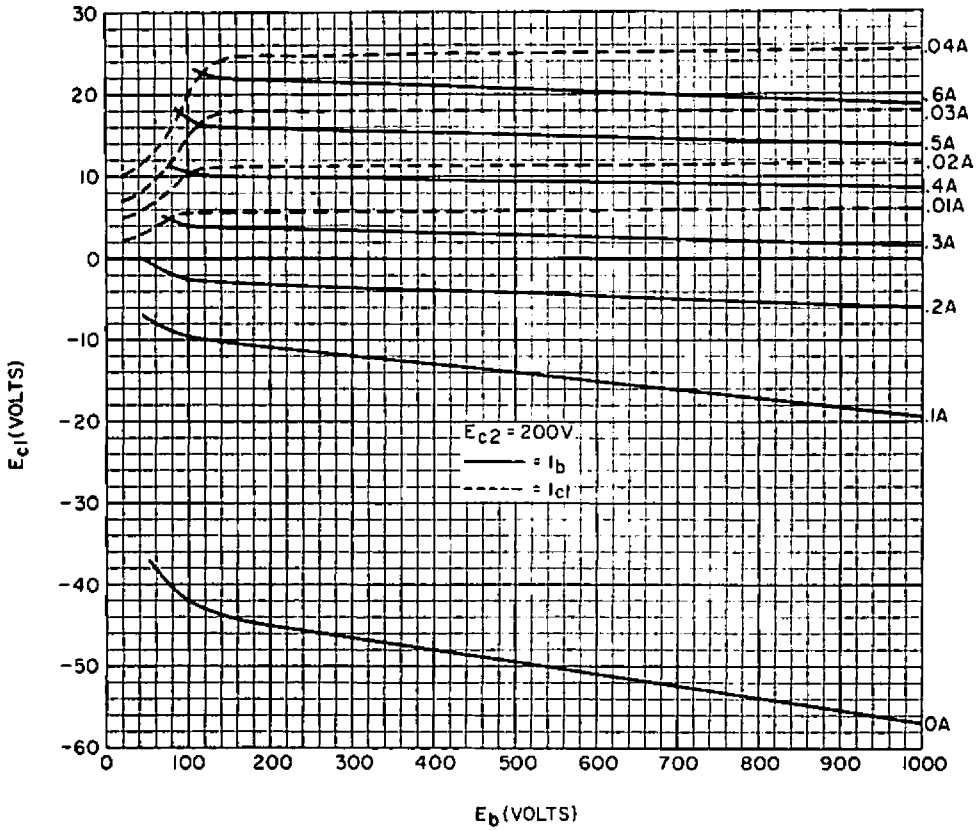
Frequency	7	7	7	mc
D.C. Plate Voltage	1000	800	600	volts
D.C. Grid No. 2 Voltage	250	250	250	volts
D.C. Grid No. 1 Voltage	-34	-34	-32.5	volts
Zero Signal D.C. Plate Current	50	50	60	ma
Zero Signal D.C. Grid No. 2 Current	1.2	1.2	1.9	ma
Effective RF Load Resistance	3100	2300	1410	ohms

Single Tone Modulation

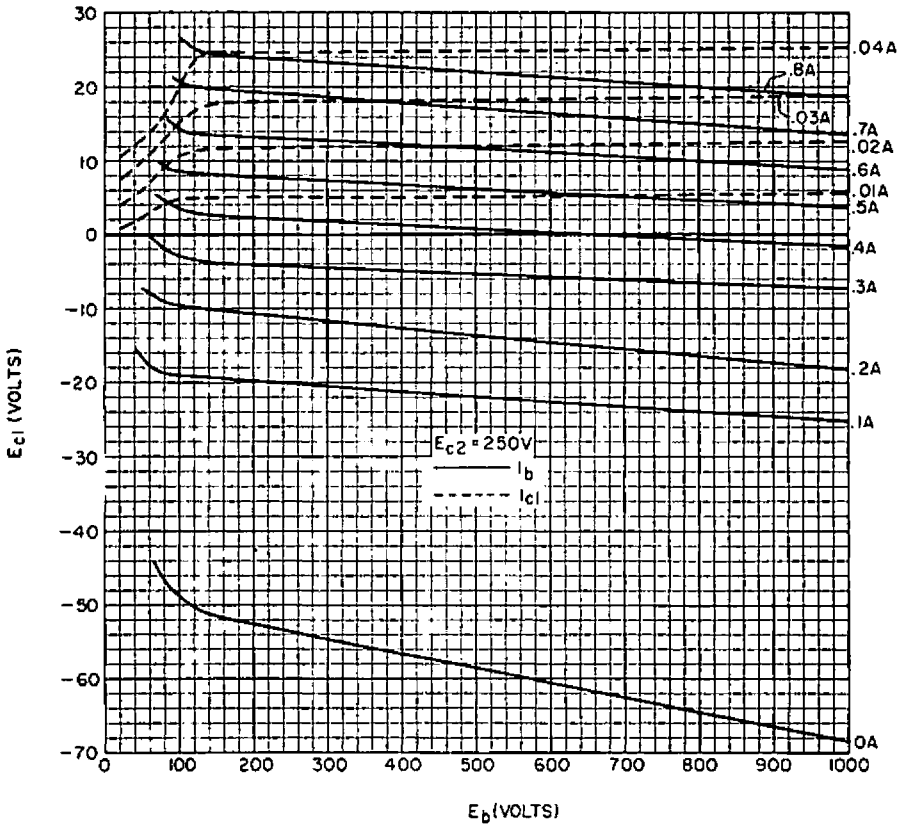
Frequency	7	7	7	mc
Max. Signal D.C. Plate Current	195	197	212	ma
Max. Signal D.C. Grid No. 2 Current	26	26	25	ma
Max. Signal D.C. Grid No. 1 Current	.01	.01	.008	ma
Max. Signal Peak RF Grid Voltage	34	34	32.5	volts
Max. Signal Plate Power Output	141	112	76	watts

Two Tone Modulation

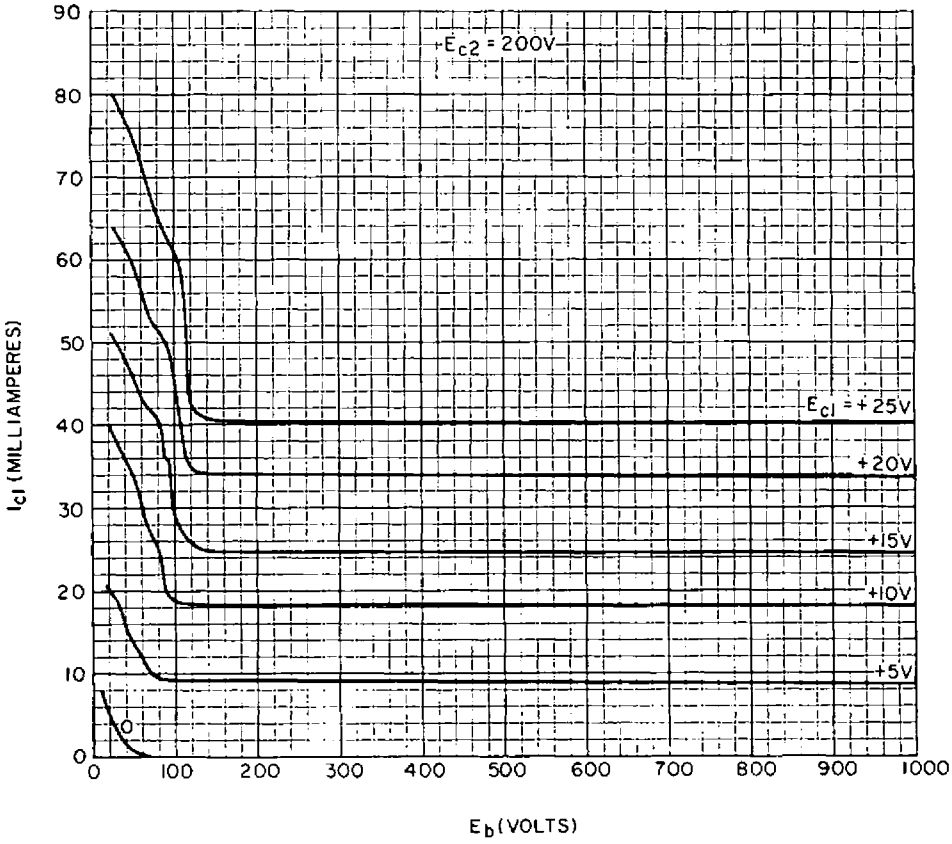
Frequency	7	7	7	mc
Average D.C. Plate Current	131	130	144	ma
Average D.C. Grid No. 2 Current	11.5	12.5	13.5	ma
Average D.C. Grid No. 1 Current	0	0	0	ma
Max. Resultant Peak RF Grid Voltage	34	34	32.5	volts
Average Plate Power Output	70.5	56	38	watts
Peak Envelope Plate Power Output	141	112	76	watts
3rd Order Intermodulation Distortion	30	30	30	db



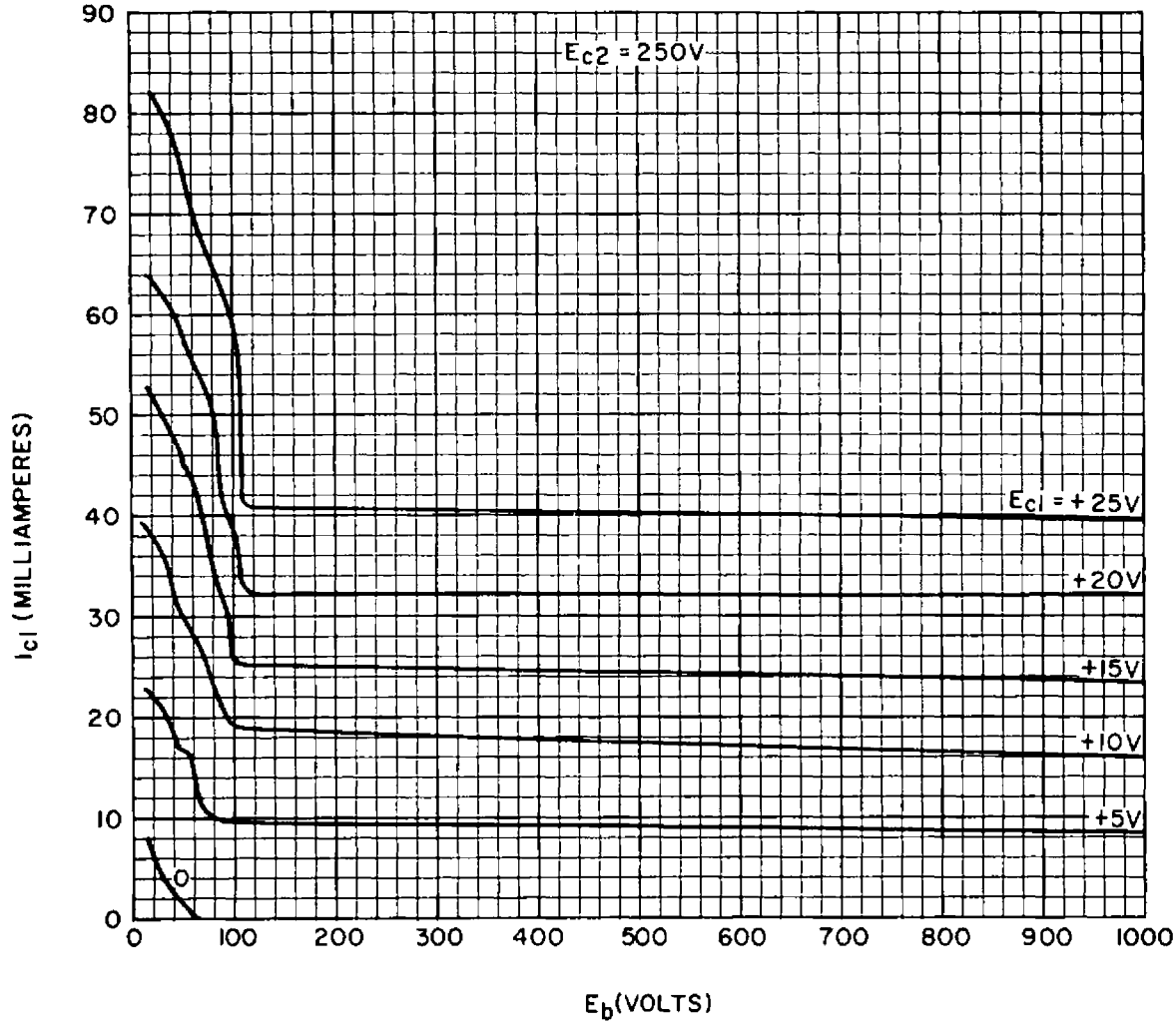
CONSTANT CURRENT CHARACTERISTICS



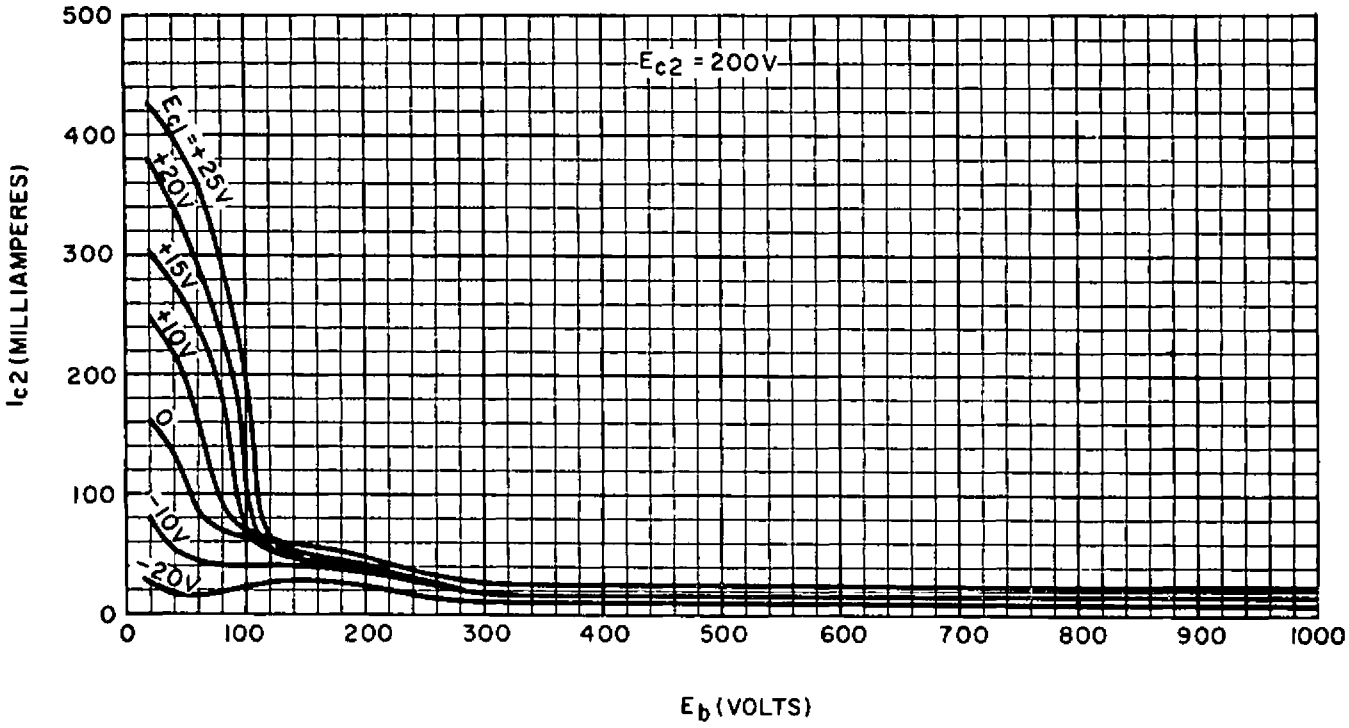
CONSTANT CURRENT CHARACTERISTICS



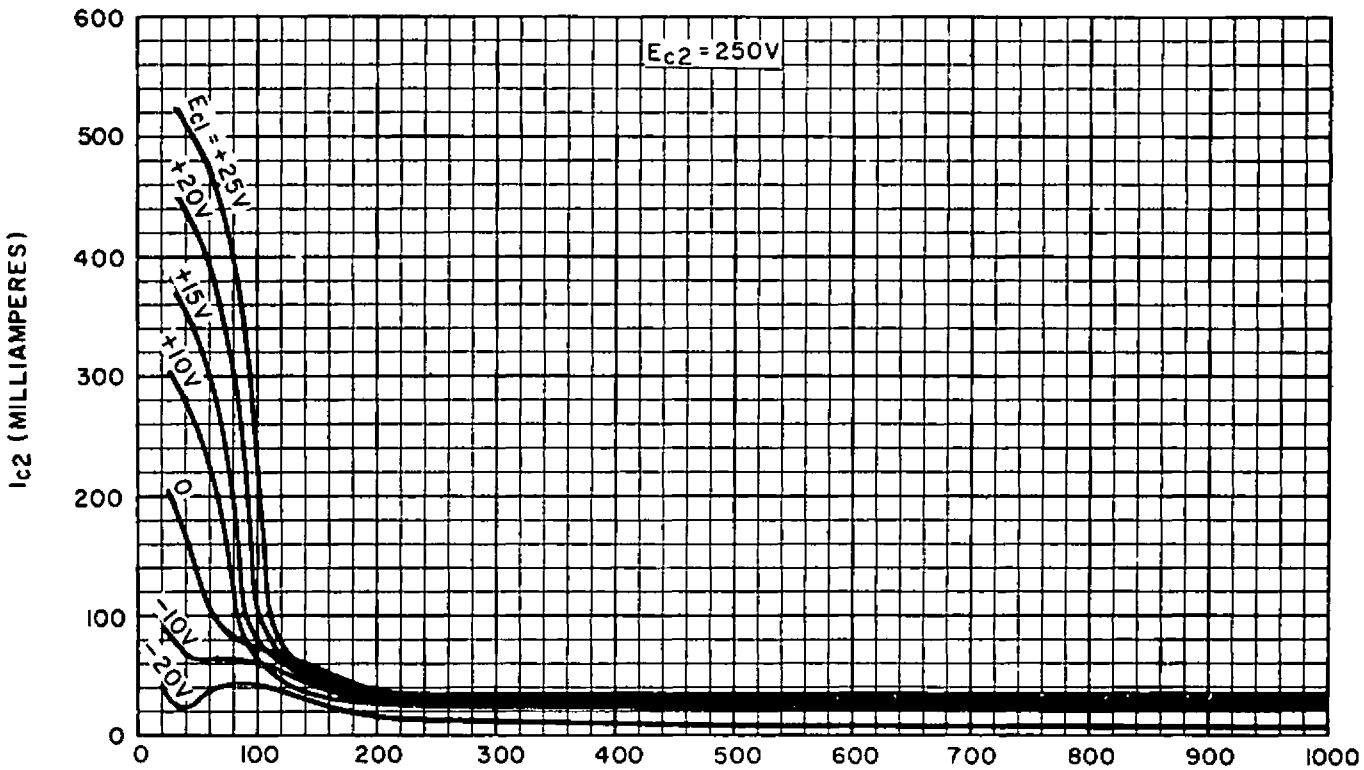
CONTROL GRID CHARACTERISTICS



CONTROL GRID CHARACTERISTICS



SCREEN GRID CHARACTERISTICS



SCREEN GRID CHARACTERISTICS

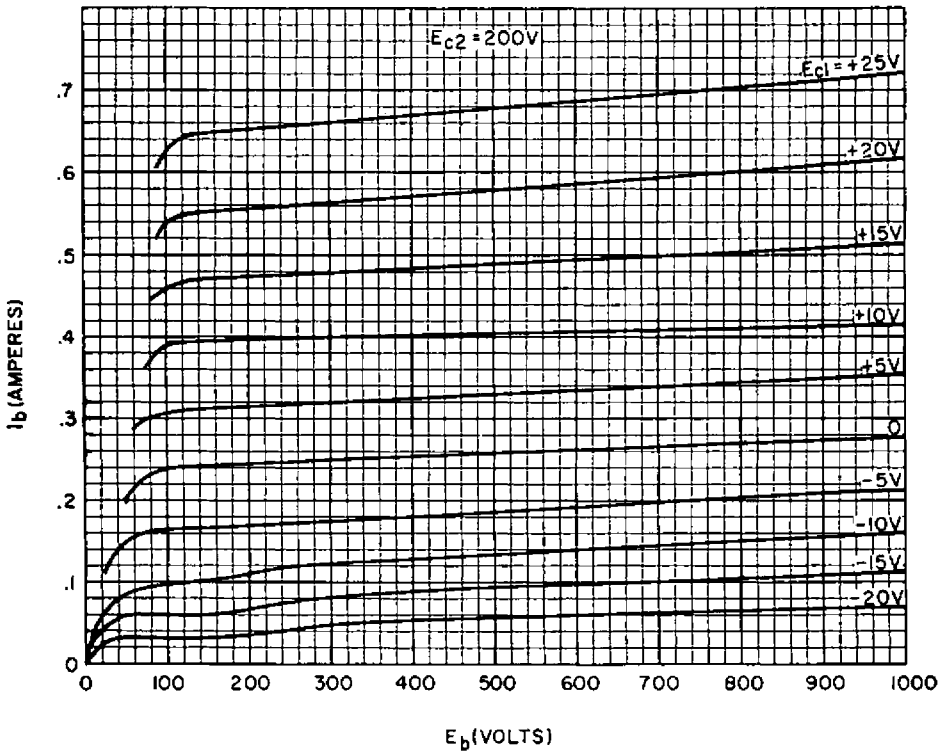


PLATE CHARACTERISTICS

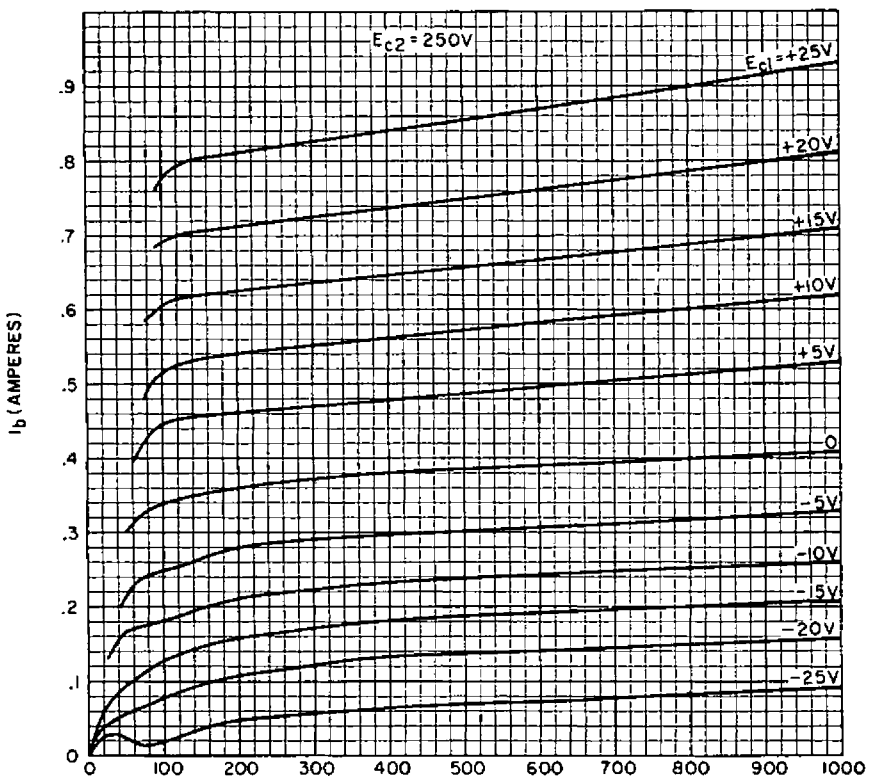


PLATE CHARACTERISTICS

for information on tubes and semiconductors for all applications,

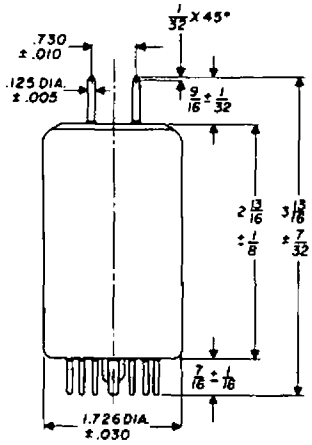
ask Amperex®

Amperex® electronic corp. 230 Duffy Avenue, Hicksville, L. I., N. Y.

AMPEREX TUBE TYPE 8117

TENTATIVE DATA

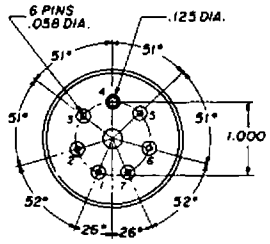
The 8117 is a dual tetrode tube designed for use as a high efficiency linear amplifier in single sideband systems. Each anode is capable of dissipating 30 watts continuously. The cathode is indirectly heated, oxide coated. Maximum ratings apply as indicated below up to 60 and 175 megacycles.



GENERAL CHARACTERISTICS

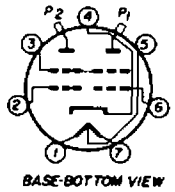
MECHANICAL

Mounting Position	Vertical, base up or down. Horizontal with anode pins in a horizontal plane.
Maximum Glass and Seal Temperatures[1]	250°C
Accessories	
Socket	Johnson 122-105 or equal
Net Weight, Approx.	2.5 ounces



1. Either forced air cooling or heat sink cooling may be used when the tube is operating at or near the maximum ratings. With forced air cooling it is necessary to cool both the lateral bulb surfaces as well as the plate pin seals by directing the flow of air toward the top and sides of the bulb. In most cases approximately 20 cfm is sufficient. However, regardless of the type of cooling being used, the degree of cooling should be determined by direct temperature measurement of both the seals and the bulb.

   The temperature may be measured by means of temperature sensitive compound such as Tempilaq made by the Tempil Corporation, 11 West 25th Street, New York, New York.



PIN 1 - HEATER
PIN 2 - GRID NO.1 OF UNIT NO.2
PIN 3 - GRID NO.2
PIN 4 - CATHODE & INTERNAL SHIELD
PIN 5 - HEATER CENTER TAP
PIN 6 - GRID NO.1 OF UNIT NO.1
PIN 7 - HEATER
P1 - PLATE OF UNIT NO.1
P2 - PLATE OF UNIT NO.2

ELECTRICAL

Heater Voltage

Series	12.6 volts
Parallel	6.3 volts

Heater Current

Series	0.9 amps
Parallel	1.8 amps

Amplification Factor	7.0
G_1 - G_2 Mu at E_b = 600 volts Ec_2 = 250 volts, I_b = 40 ma	
Peak Cathode Current	700 ma

Direct Interelectrode Capacitances

	Per Unit Min.	Max.	
Grid to Plate		0.09	pf
Input	9.4	11.8	pf
Output	2.6	3.7	pf

RF Power Amplifier and Oscillator
Class C Telegraphy

Maximum Ratings, Absolute Values

	CCS
Frequency	60 mc max
D.C. Plate Voltage	850 volts max
D.C. Grid No. 2Voltage	300 volts max
D.C. Grid No. 1 Voltage	-175 volts max
D.C. Plate Current	2 x 110 ma max
D.C. Grid No. 1 Current	2 x 5 ma max
Plate Input	2 x 90 watts max
Grid No. 2 Input	7 watts max
Plate Dissipation	2 x 30 watts max
Heater-Cathode Voltage	100 volts max

RF Power Amplifier and Oscillator
Class C Telegraphy

Maximum Ratings, Absolute Values

	CCS
Frequency	175 mc max
D.C. Plate Voltage	750 volts max
D.C. Grid No. 2 Voltage	300 volts max
D.C. Grid No. 1 Voltage	-175 volts max
D.C. Plate Current	2 x 110 ma max
D.C. Grid No. 1 Current	2 x 5 ma max
Plate Input	2 x 75 watts max
Grid No. 2 Input	7 watts max
Plate Dissipation	2 x 30 watts max
Heater-Cathode Voltage	100 volts max

Class AB_1 Grounded Cathode Linear RF Amplifier Single Sideband

Suppressed Carrier Operations

Maximum Ratings, Absolute Values
Parallel Operation (Frequencies Up to 60 mc)

	CCS	ICAS
D.C. Plate Voltage	1000	1000 volts max
D.C. Grid No. 2 Voltage	360	360 volts max
D.C. Grid No. 1 Voltage	-175	-175 volts max
D.C. Plate Current	220	220 ma max
D.C. Grid No. 1 Current	10	10 ma max
Plate Input	200	220 watts max
Grid No. 2 Dissipation	7	8 watts max
Plate Dissipation	2x30	67.5 watts max

Typical Operation
Single Tone and or Two Tone Operation

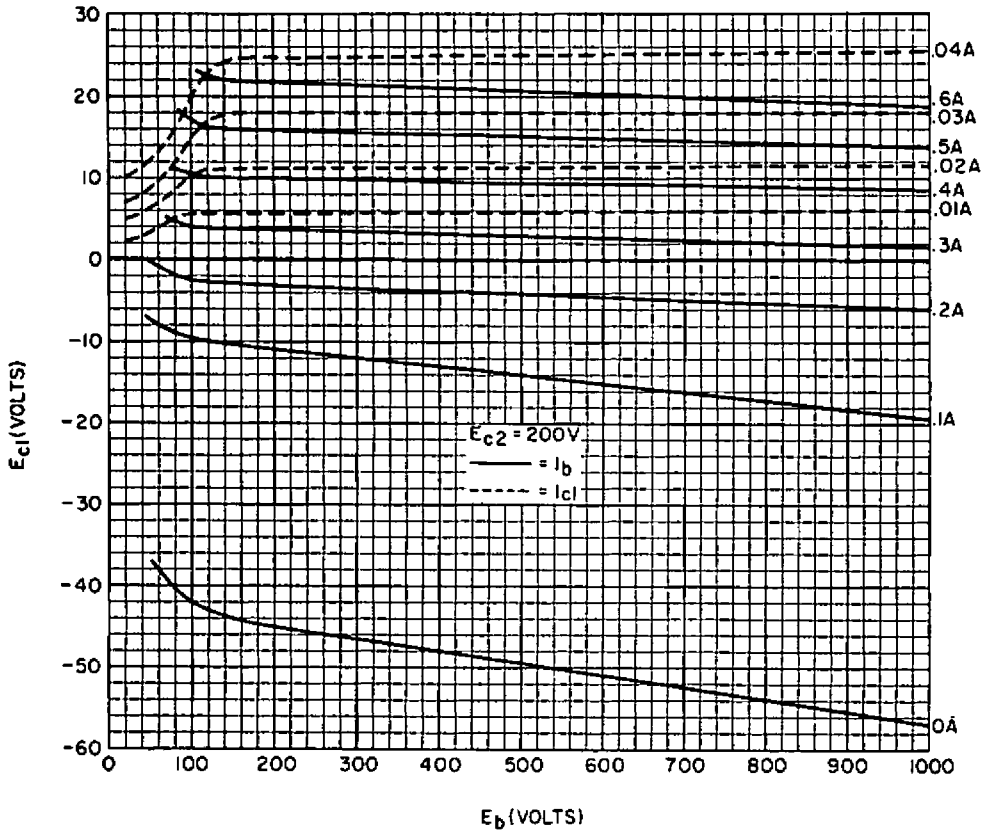
	CCS	CCS	CCS	ICAS
Frequency	7	7	7	7 mc
D.C. Plate Voltage	1000	800	600	1000 volts
D.C. Grid No. 2 Voltage	250	250	250	270 volts
D.C. Grid No. 1 Voltage	-34	-34	-32.5	-36 volts
Zero Signal D.C. Plate Current	50	50	60	55 ma
Zero Signal D.C. Grid No. 2 Current	1.2	1.2	1.9	1 ma
Effective RF Load Resistance	3100	2300	1410	3000 ohms

Single Tone Modulation

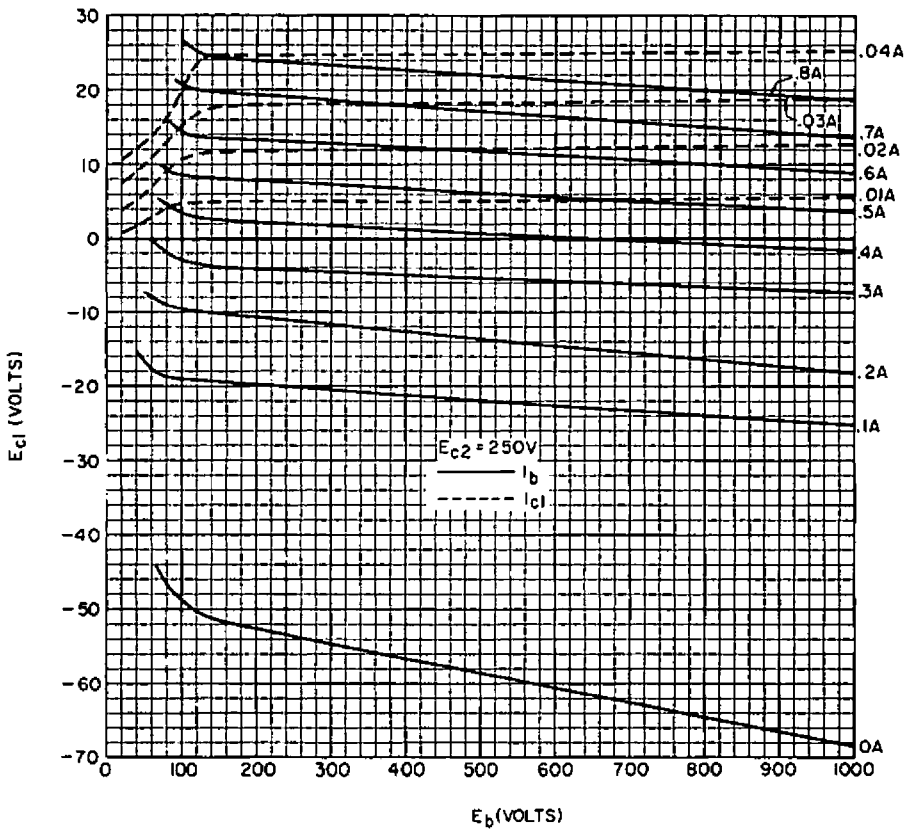
	CCS	CCS	CCS	ICAS	
Frequency	7	7	7	7	mc
Max. Signal D.C. Plate Current	195	197	212	216	ma
Max. Signal D.C. Grid No. 2Current	26	26	25	25	ma
Max. Signal D.C. Grid No.1 Current	.01	.01	.008	.05	ma
Max. Signal Peak RF Grid Voltage	34	34	32.5	36	volts
Max. Signal Plate Power Output	141	112	76	158	watts

Two Tone Modulation

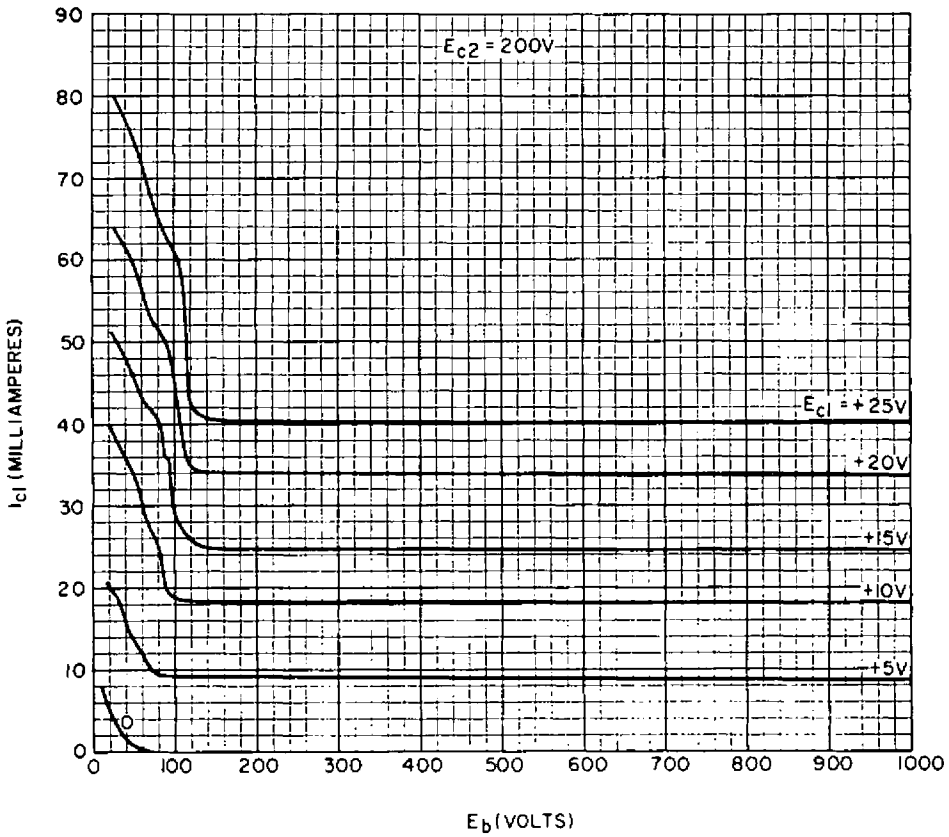
	CCS	CCS	CCS	ICAS	
Frequency	7	7	7	7	mc
Average D.C. Plate Current	131	130	144	144	ma
Average D.C. Grid No. 2 Current	11.5	12.5	13.5	13	ma
Average D.C. Grid No. 1 Current	-	-	-	.014	ma
Max. Resultant Peak RF Grid Voltage	34	34	32.5	36	volts
Average Plate Power Output	70.5	56	38	79	watts
Peak Envelope Plate Power Output	141	112	76	158	watts
3rd Order Intermodulation Distortion	-30	-30	-30	-30	db
5th Order Intermodulation Distortion	-	-	-	-40	db



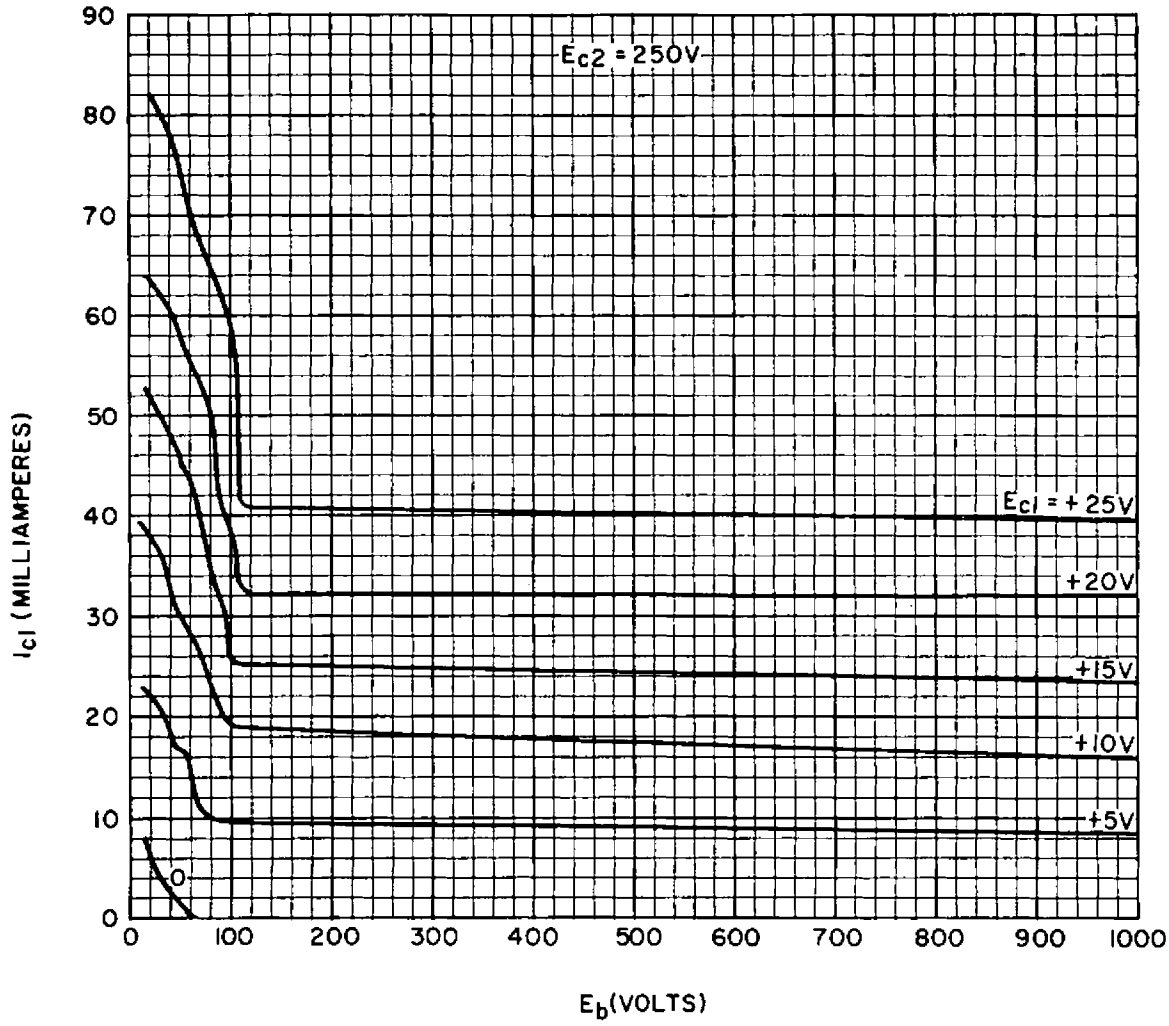
CONSTANT CURRENT CHARACTERISTICS



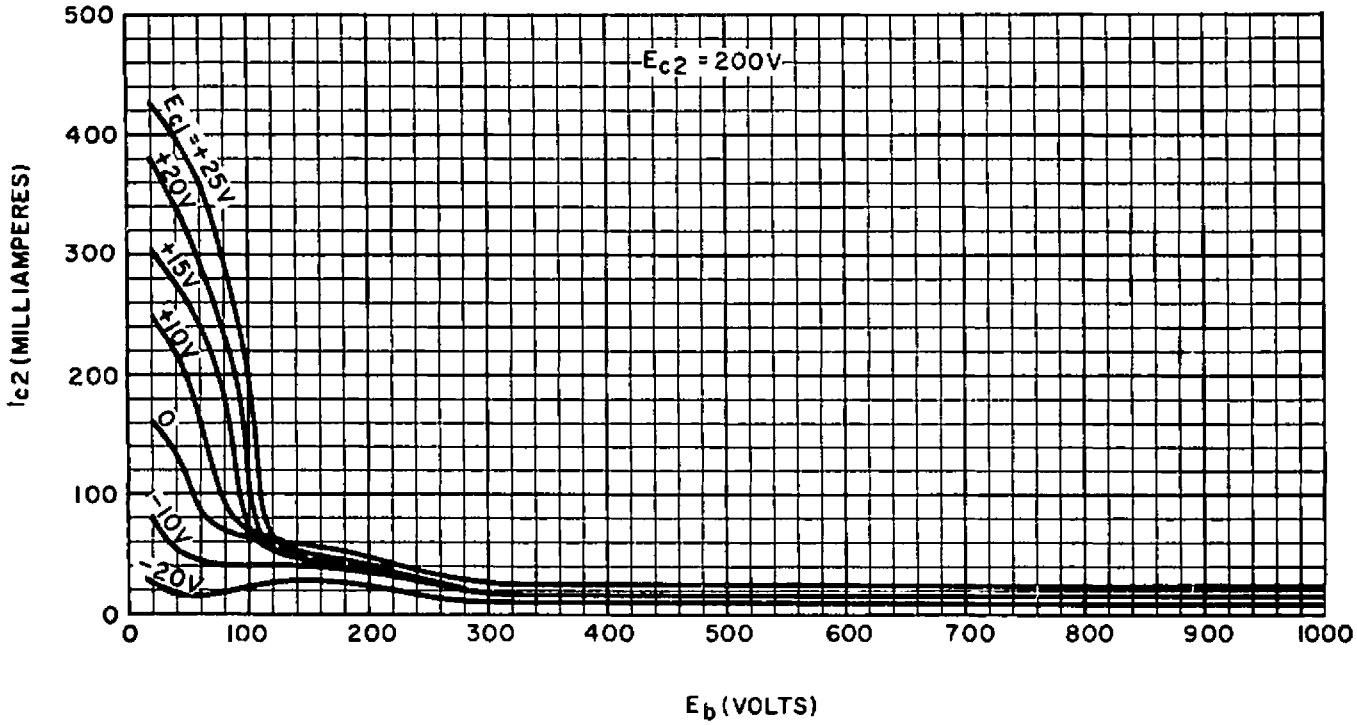
CONSTANT CURRENT CHARACTERISTICS



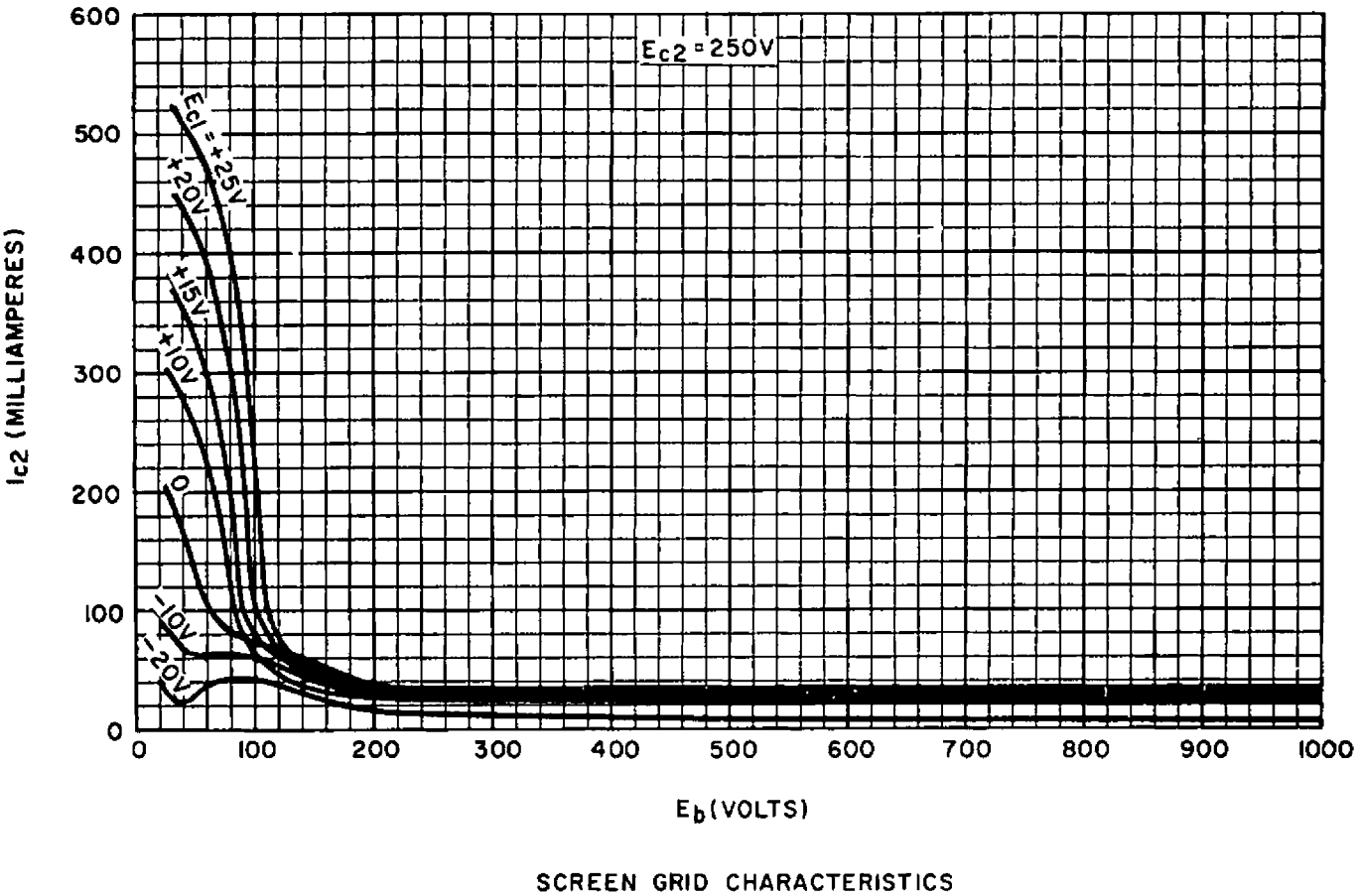
CONTROL GRID CHARACTERISTICS



CONTROL GRID CHARACTERISTICS



SCREEN GRID CHARACTERISTICS

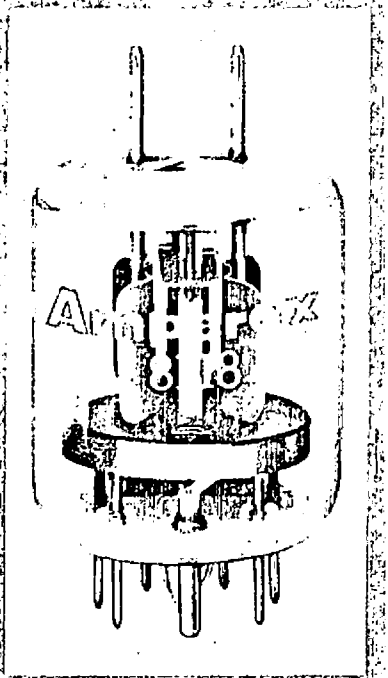


SCREEN GRID CHARACTERISTICS

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE 8118

The 8118 is an instant heating double tetrode for use as output amplifier, driver or frequency multiplier at frequencies up to 500 Mc. The filament service may be intermittent or continuous. The 8118 is especially intended for transistorized mobile equipment.



GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	any
Dimensions	see outline drawing
Base	septar
Maximum Temperature	
Of Bulb and Plate Seals	250°C
Of Bottom Pin Seals	180°C
Net Weight	1.9 oz.
Shipping Weight	4.9 oz.

ELECTRICAL

Filament	oxide coated
Voltage[1]	1.6 ± 15% volts
Current	4.25 amps
Warm-up Time (Power Output = 70% of Full Load)	≤0.5 sec.
Direct Interelectrode Capacitances (push-pull)	
Input	4.5 pf
Output	1.8 pf
Amplification Factor (Grid No. 1 to Grid No. 2)	9
Transconductance	2500 μmhos

Amperex

from JEDEC release #4524, Dec. 9, 1963, and release #4524A, April 6, 1964

[1] The filament supply may be DC or 50 to 60 cps AC (sinusoidal or square wave). Sinusoidal supply voltages within the frequency range of 200 to 2000 cps should not be used.

Class C Telegraphy or FM Telephony
(Two Systems in Push-Pull)

Maximum Ratings, Absolute Values

Frequency	220	500	Mc
DC Plate Voltage	600	450	volts
DC Grid No. 2 Voltage	300	300	volts
Grid No. 2 Dissipation	2x1.5	2x1.5	watts
Grid No. 1 Dissipation	2x0.5	2x0.5	watts
DC Grid No. 1 Current	2x2.5	2x2.5	ma
DC Cathode Current	2x60	2x60	ma
DC Grid No. 1 Voltage	-75	-75	ma
Plate Dissipation	2x10	2x10	watts
Grid No. 1 Circuit Resistor (each section)			
Fixed Bias	50	50	k ohms
Automatic Bias	100	100	k ohms

Typical Operation

Frequency	200	200	200	460	Mc
DC Plate Voltage	300	400	600	400	volts
DC Grid No. 2 Voltage	250	250	250	250	volts
DC Grid No. 1 Voltage	-40	-50	-60	-50	volts
Peak Voltage between the Two Control Grids	116	136	156	140	volts
DC Plate Current	2x50	2x50	2x50	2x50	ma
DC Grid No. 2 Current	2x4	2x3.5	2x3	2x3	ma
DC Grid No. 1 Current	2x1.5	2x1.5	2x1.0	2x0.6	ma
Driving Power	1.2	1.3	1.5	5	watts
Plate Dissipation	2x5.5	2x6.0	2x7.5	2x9.5	watts
Power Output	19	28	45	21	watts
Efficiency	63	70	75	52.5	%
Useful Output Power to Load	16	22	35	17	watts

Class C, Plate and Screen Modulation
(Two Systems in Push-Pull)

Maximum Ratings, Absolute Values

Frequency	220	500	Mc
DC Plate Voltage	500	375	volts
DC Grid No. 2 Voltage	300	300	volts
Grid No. 2 Dissipation	2x1.5	2x1.5	watts
Grid No. 1 Dissipation	2x0.5	2x0.5	watts
DC Grid No. 1 Current	2x2.5	2x2.5	ma
DC Cathode Current	2x55	2x55	ma
DC Grid No. 1 Voltage	-100	-100	volts
Plate Dissipation	2x7	2x7	watts
Grid No. 1 Circuit Resistor (each section)			
Fixed Bias	50	50	k ohms
Automatic Bias	100	100	k ohms

Typical Operation

Frequency	200	200	Mc
DC Plate Voltage	300	500	volts
DC Grid No. 2 Voltage	250	250	volts
DC Grid No. 1 Voltage	-50	-80	volts
Peak Voltage between the Two Control Grids	166	220	volts
DC Plate Current	2x40	2x40	ma
DC Grid No. 2 Current	2x3.5	2x4.0	ma
DC Grid No. 1 Current	2x1.5	2x1.5	ma
Driving Power	1.6	3.0	watts
Plate Dissipation	2x4	2x5.5	watts
Power Output	16	29	watts
Efficiency	67	73	%
Useful Output Power to Load	13	22	watts
Modulation Depth	100	100	%
Modulation Power	12	20	watts
Peak Grid No. 2 Voltage	185	185	volts

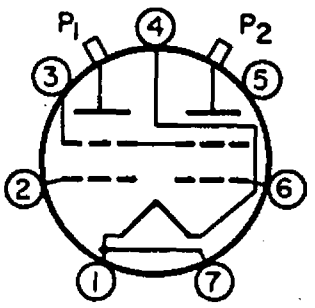
Class C Frequency Tripler
(Two Systems in Push-Pull)

Maximum Ratings, Absolute Values

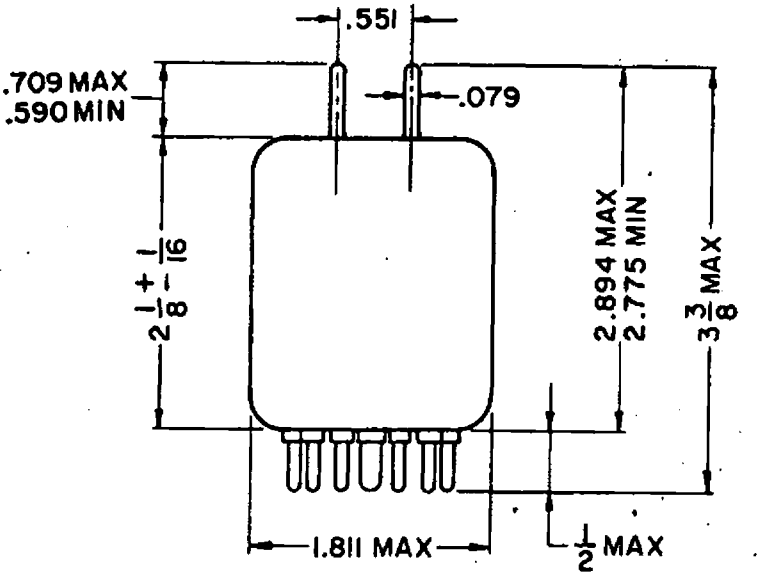
DC Plate Voltage	600	volts
DC Grid No. 2 Voltage	300	volts
DC Grid No. 1 Voltage	-200	volts
Plate Dissipation	2x10	watts
Grid No. 2 Dissipation	2x1.5	watts
Grid No. 1 Dissipation	2x0.5	watts
DC Grid No. 1 Current	2x4.5	ma
DC Cathode Current	2x55	ma
Peak Cathode Current	2x400	ma
Grid No. 1 Circuit Resistor (each section)		
Fixed Bias	50	k ohms
Automatic Bias	100	k ohms

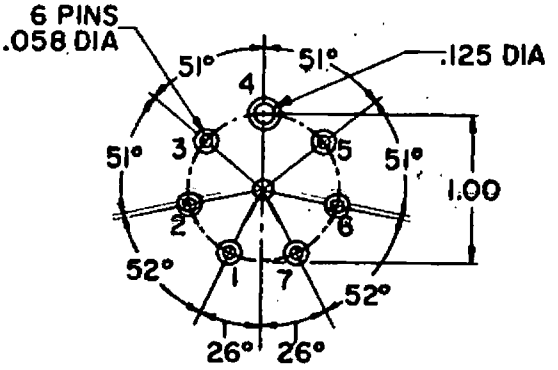
Typical Operation

Frequency	66.7/200	153.3/460	Mc
DC Plate Voltage	300	300	volts
DC Grid No. 2 Voltage	250	250	volts
DC Grid No. 1 Voltage	-175	-175	volts
Peak Voltage between the Two Control Grids	410	410	volts
DC Plate Current	2x45	2x45	ma
DC Grid No. 2 Current	2x4	2x3.5	ma
DC Grid No. 1 Current	2x3	2x2.5	ma
Driving Power	3	5	watts
Plate Dissipation	2x9	2x10	watts
Power Output	9	7	watts
Efficiency	33	26	%
Useful Output Power to Load	7	5.5	watts



PIN CONNECTIONS
1-FILAMENT
2-GRID NO.1, UNIT NO.2
3-GRID NO.2, UNITS NO.1 & 2
4-FILAMENT
5-NO CONNECTION
6-GRID NO.1, UNIT NO.1
7-FILAMENT
P_1=PLATE, UNIT NO.2
P_2-PLATE, UNIT NO.1





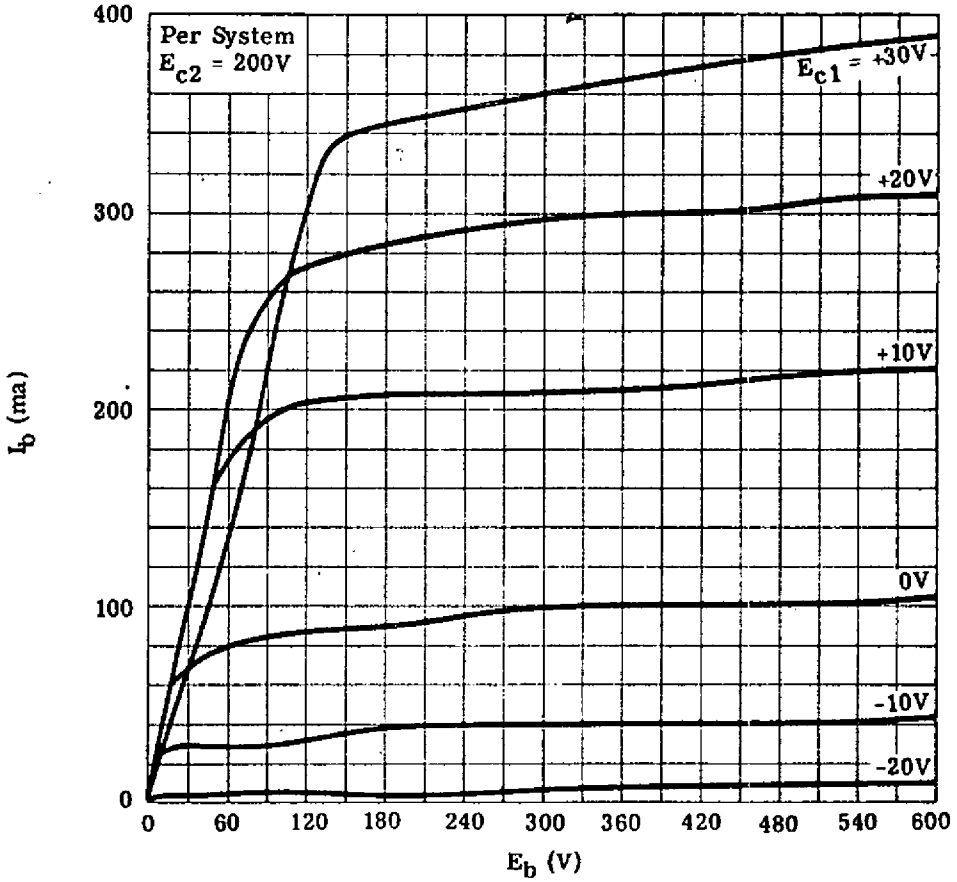


FIGURE 1. PLATE CHARACTERISTICS

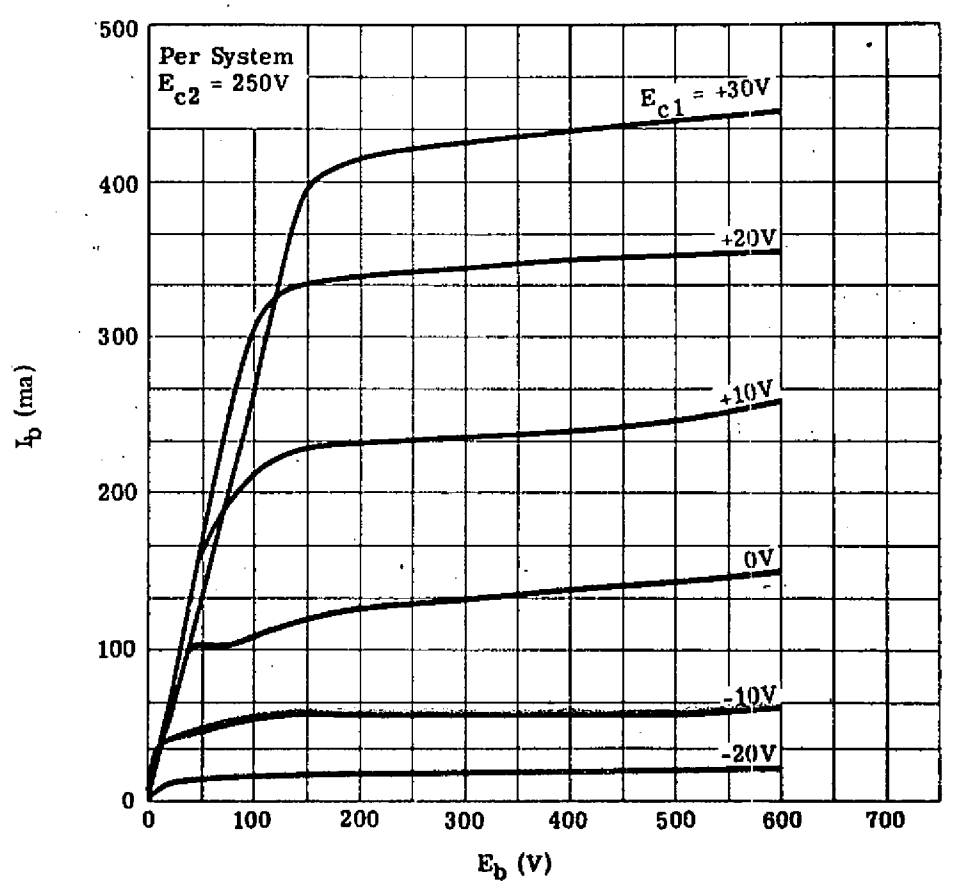


FIGURE 2. PLATE CHARACTERISTICS

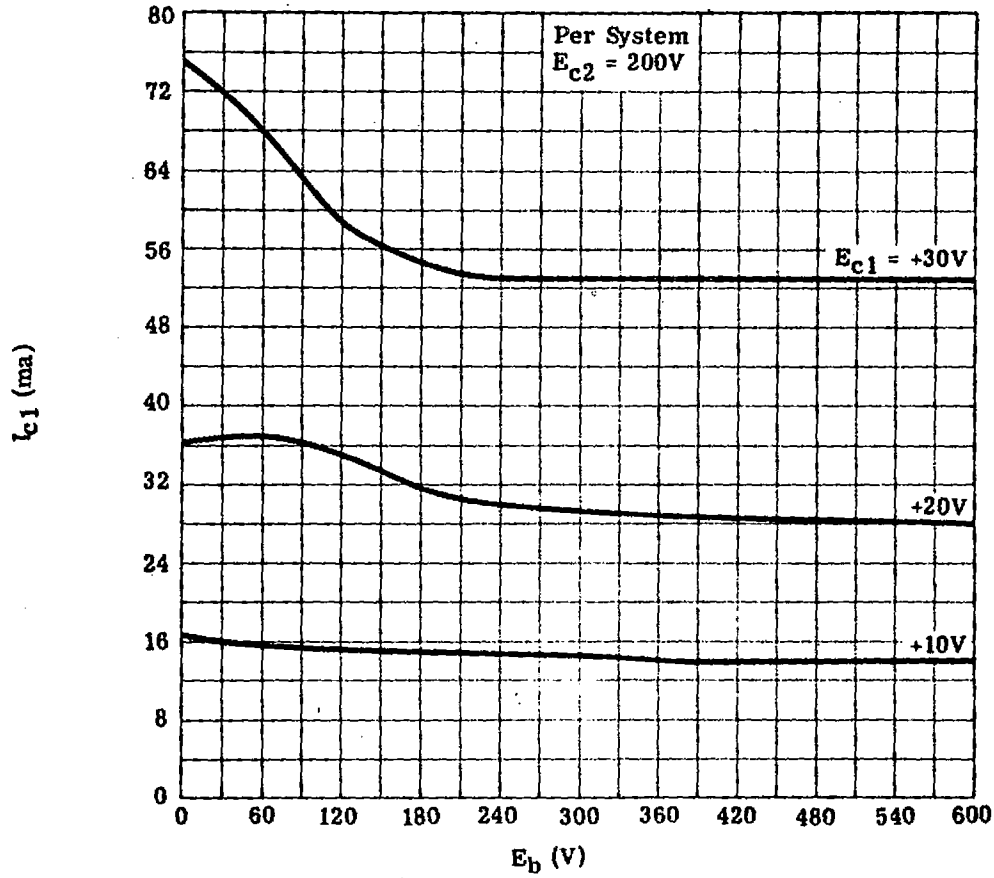


FIGURE 3. CONTROL GRID CHARACTERISTICS

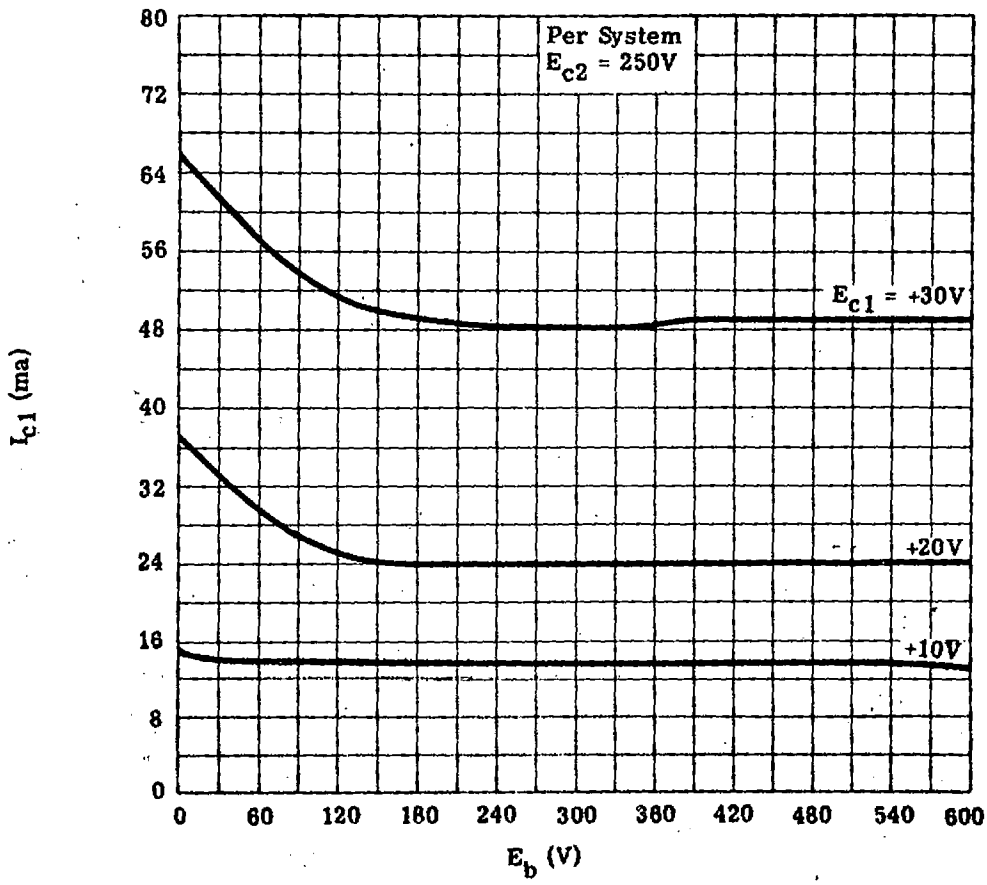


FIGURE 4. CONTROL GRID CHARACTERISTICS

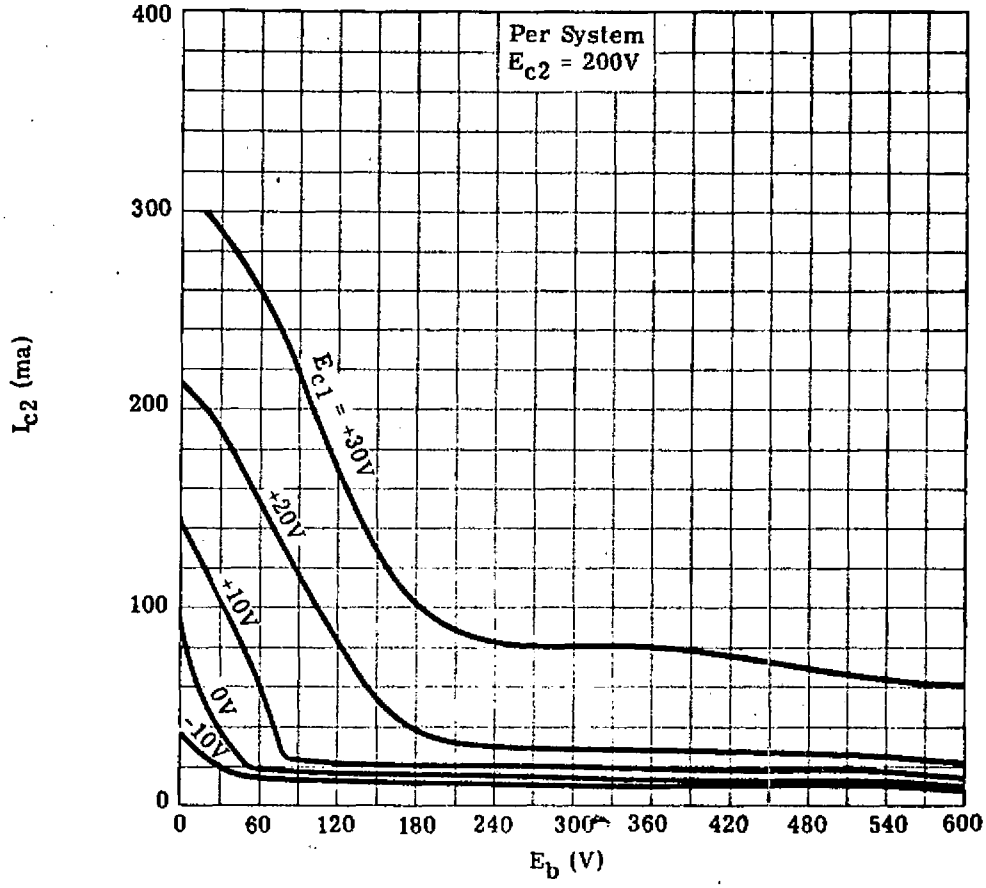


FIGURE 5. SCREEN GRID CHARACTERISTICS

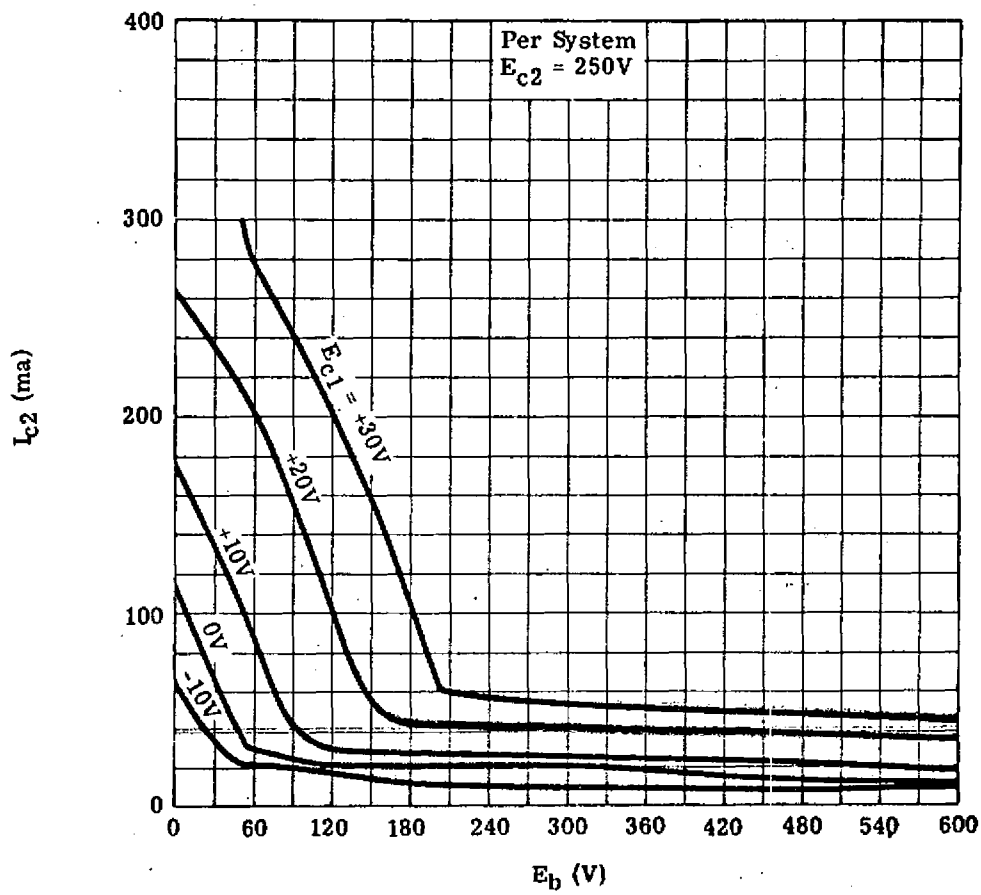


FIGURE 6. SCREEN GRID CHARACTERISTICS

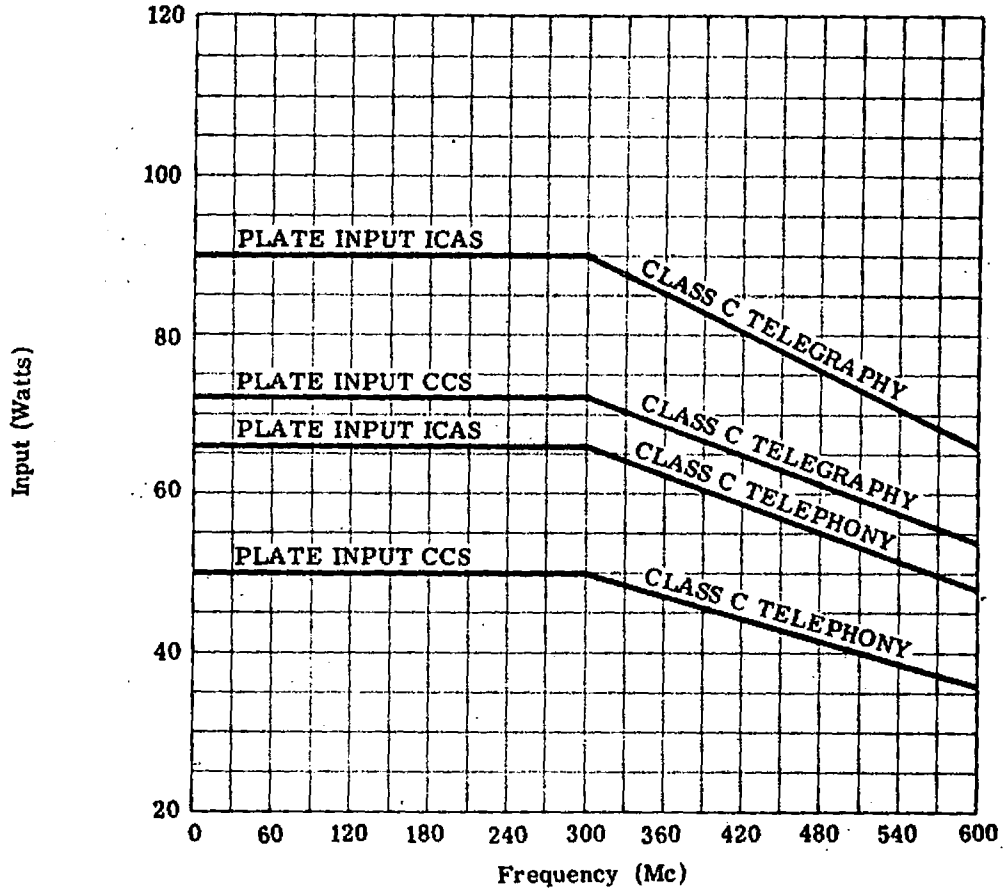


FIGURE 7. DERATING CURVES

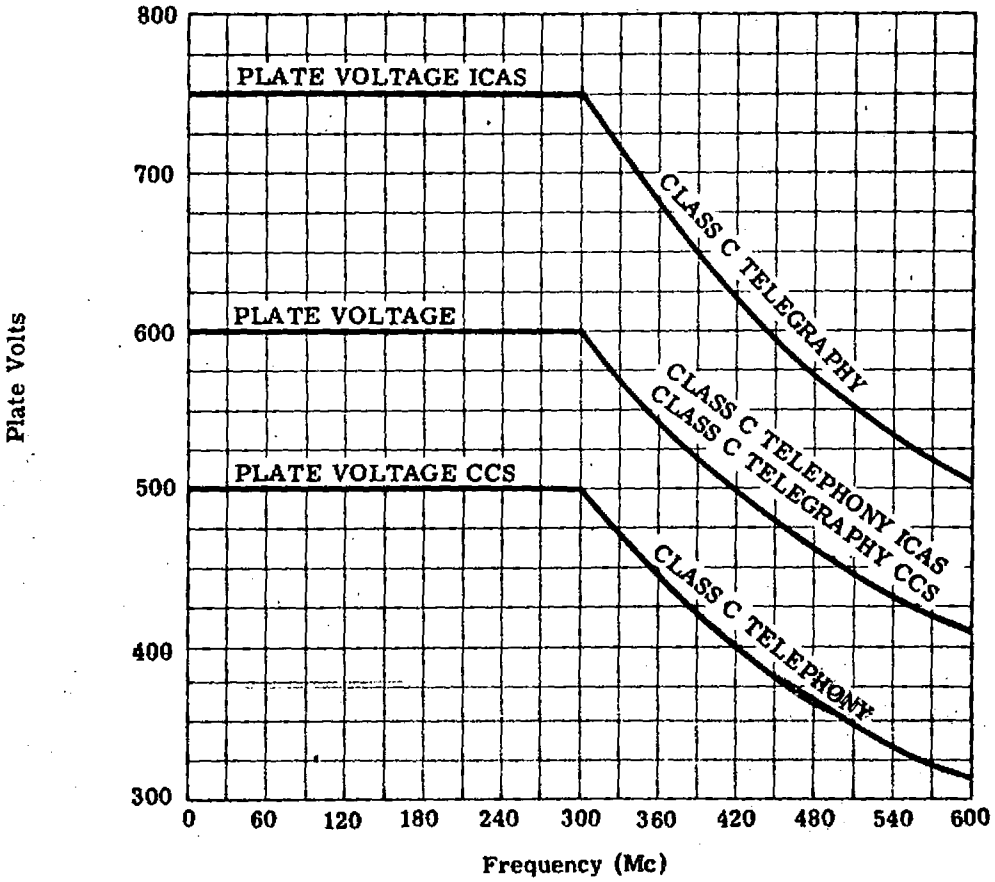


FIGURE 8. DERATING CURVES

for information on tubes
and semiconductors
for all applications,
ask Amperex®

from JEDEC release #3747, May 14, 1962

Amperex® electronic corp. 230 Duffy Avenue, Hicksville, L. I., N. Y.

AMPEREX TUBE TYPE 8177

TENTATIVE DATA

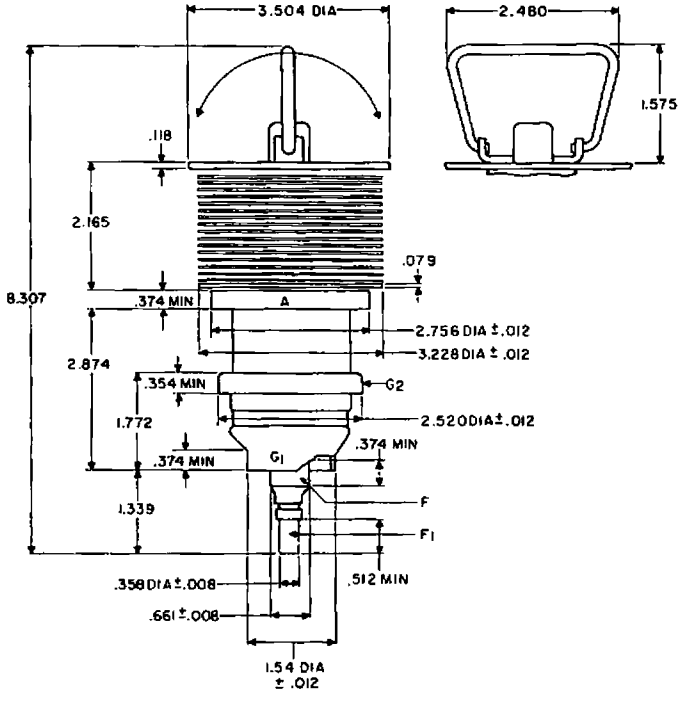
The Amperex 8177 is a ceramic coaxial power tetrode having an integral radiator and a plate dissipation of 1200 watts. It has a directly heated, thoriated tungsten filament. The coaxial terminal arrangement enables use as a "plug in" tube in coaxial circuits. The tube is designed for use as a UHF amplifier or oscillator at frequencies up to 1000 mc.

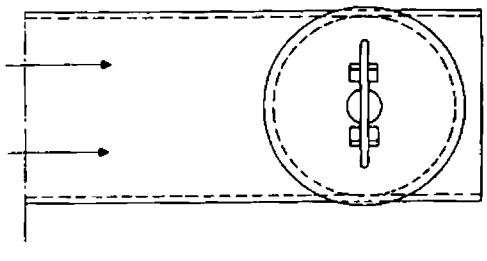
GENERAL CHARACTERISTICS

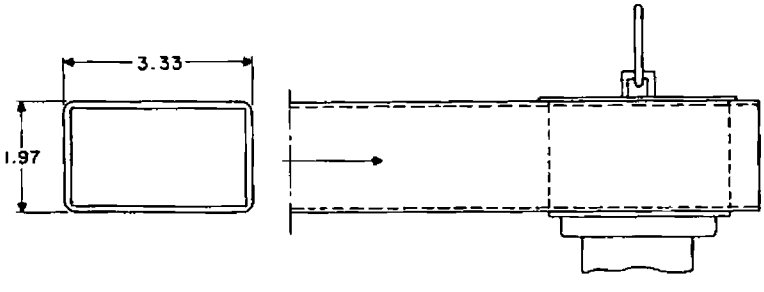
ELECTRICAL

Filament	
Voltage	4 volts[1]
Current	60 amps
Amplification Factor	
(E_b = 3000 v; E_{c2} = 500 v; I_b = 480 ma)	9
Transconductance (above values)	20,000 μmhos

1. The filament voltage must be reduced as a function of the operating conditions and frequency. After tube is placed in operation, the filament voltage should be reduced to a point where performance is affected. Maintain filament voltage slightly above this point. Connect filament so that RF voltages on it are suppressed. For further information contact the Amperex Applications Department.







ELECTRICAL (Continued)

Direct Interelectrode Capacitance

	Grounded Cathode	Grounded Grid No. 1 & No. 2	
Grid to Plate	0.15	7	pf
Output	6.0	-	pf
Plate to Filament	-	0.02	pf
Input	46	-	pf
Control Grid to Filament	-	20	pf

MECHANICAL

Maximum Overall Dimensions	
Length	See Outline Drawing
Diameter	See Outline Drawing
Mounting Position	Vertical
Cooling	Forced Air
Maximum Operating Temperature For All parts of envelope	200°C
Weight	4 lbs. 4 oz.

COOLING CHARACTERISTICS

Plate Dissipation (W)	Altitude (feet)	Inlet Air Temp(°C)	Min Air Flow (cu ft/min)	Inlet Air Pressure (in. of water)
800	0	35	49	.63
	0	45	56	.8
	5000	35	58	.75
	10000	25	60	.7
1200	0	35	67	1.15
	0	45	77	1.5
	5000	35	79	1.4
	10000	25	82	1.35

MAXIMUM RATINGS
UHF Power Amplifier, Class C CW, Cathode Driven[2]
Maximum Ratings, Absolute Values
(Voltages Measured to Grid No. 1)

Frequency	Up to	900 mc
D.C. Plate Voltage		3500 volts (to G1)
D.C. Grid No. 2 Voltage		700 volts (to G1)
D.C. Cathode Voltage		300 volts (to G1)
D.C. Plate Current		950 ma
D.C. Grid No. 1 Current		100 ma
D.C. Grid No. 2 Current		75 ma
Grid No. 2 Dissipation		50 watts
Plate Dissipation		1200 watts

Typical Operation
(Voltages Measured to Grid No. 1)

Frequency	600	900	mc
D.C. Plate Voltage	3110	3110	volts
D.C. Grid No. 2 Voltage	610	610	volts
D.C. Cathode Voltage	110	110	volts
D.C. Plate Current	900	800	ma
D.C. Grid No. 1 Current	60	60	ma
D.C. Grid No. 2 Current	20	20	ma
Driver Output Power	170	200	watts
Plate Dissipation	770	1040	watts
Plate Output Power[3]	2070	1500	watts
Load Power Output[4]	1760	1280	watts
Power Gain	12	7.5	watts

2. In a cathode-driven UHF amplifier circuit a tunable coaxial circuit is placed between control grid and screen to introduce variable capacitive reactance. This results in better efficiency and negligible regeneration from plate to cathode.

3. Includes power transferred from driving stage.

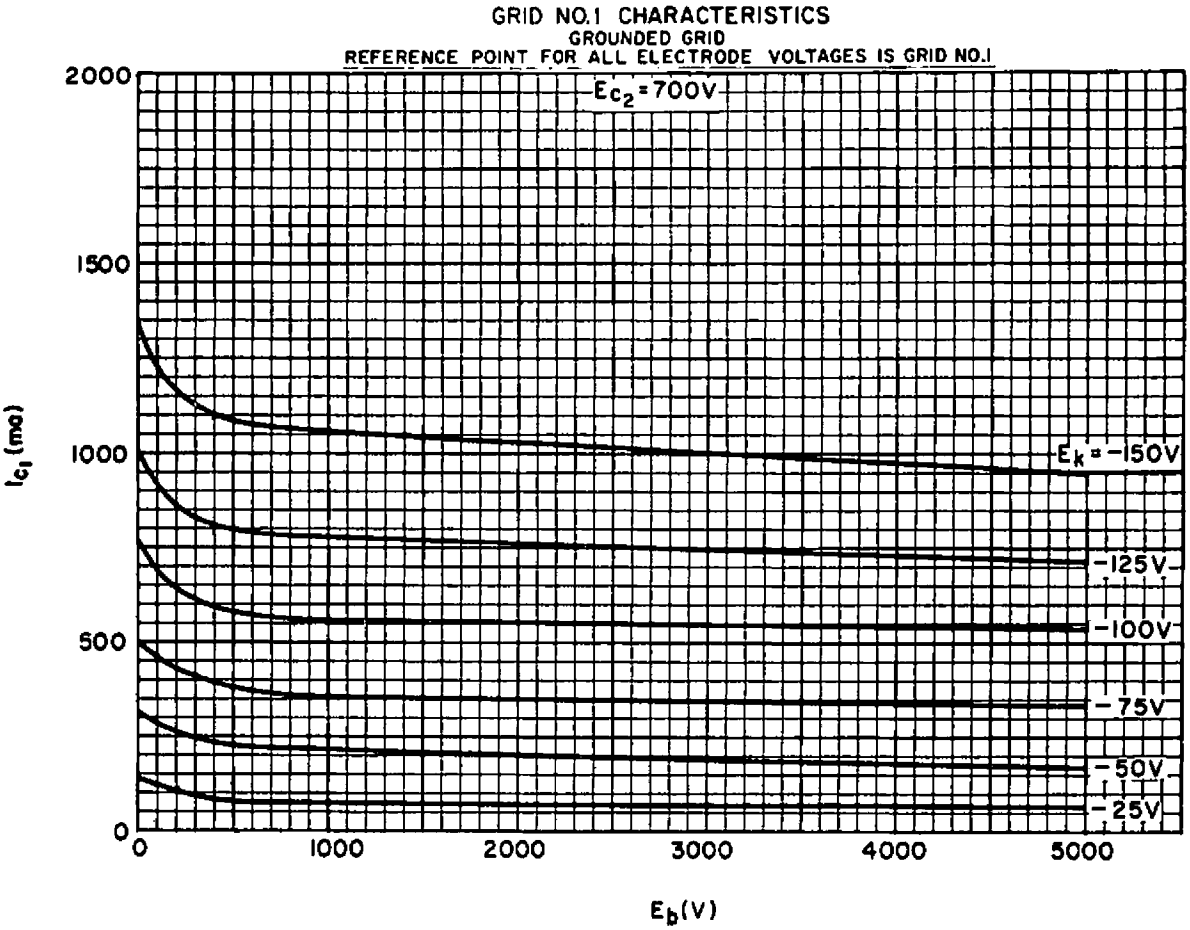
4. In a circuit of 85% efficiency.

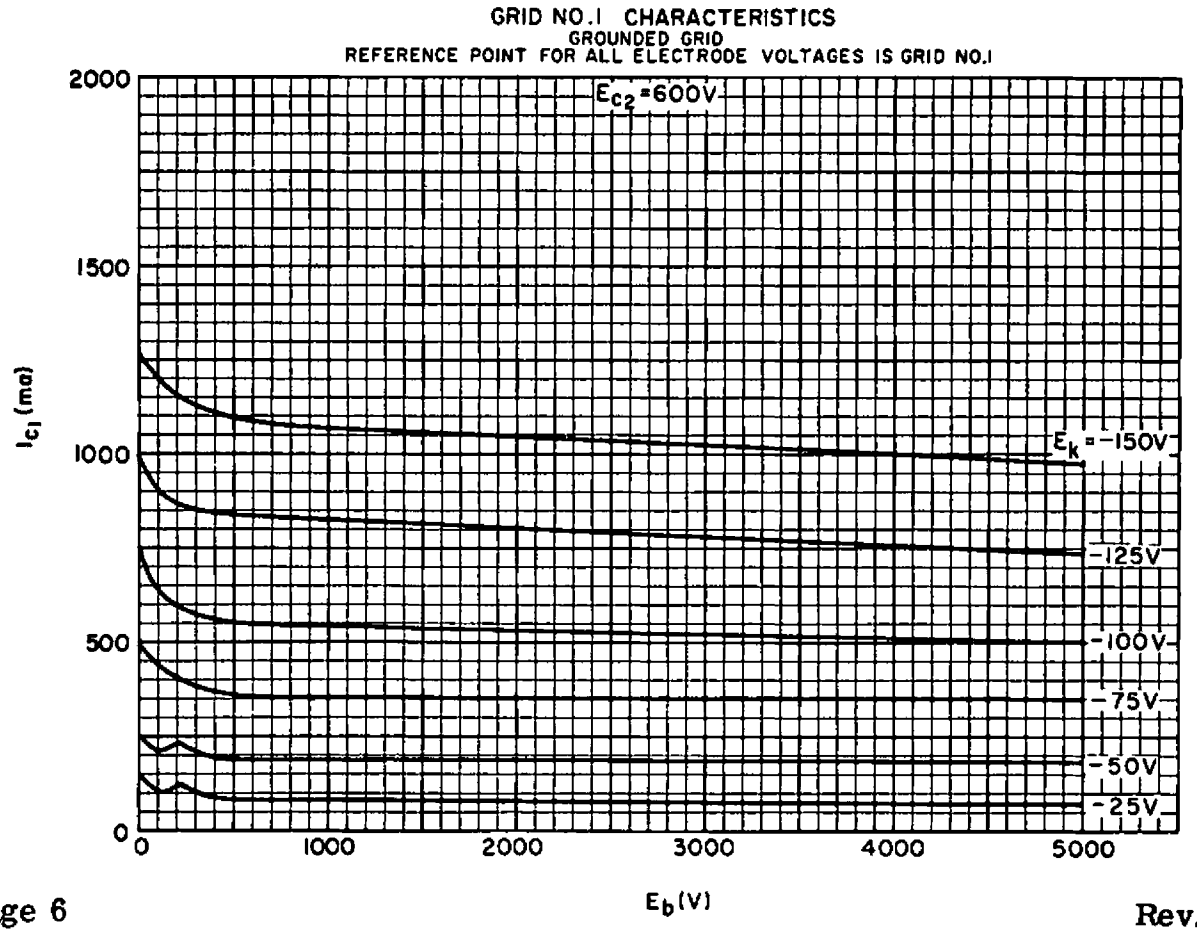
UHF Class C Amplifier for Television Service
Cathode Modulation, Cathode Driven; Negative Modulation
Positive Synchronization[2]
(Voltages Measured to Grid No. 1)
Maximum Ratings, Absolute Values

Frequency	Up to 900 mc
D.C. Plate Voltage	3700 volts
D.C. Grid No. 2 Voltage Sync.	700 volts
D.C. Cathode Voltage	500 volts
D.C. Plate Current Sync.	950 ma
Grid No. 1 Current Sync.	100 ma
Grid No. 2 Current Sync.	75 ma
Grid No. 2 Dissipation	50 watts
Plate Dissipation	1200 watts

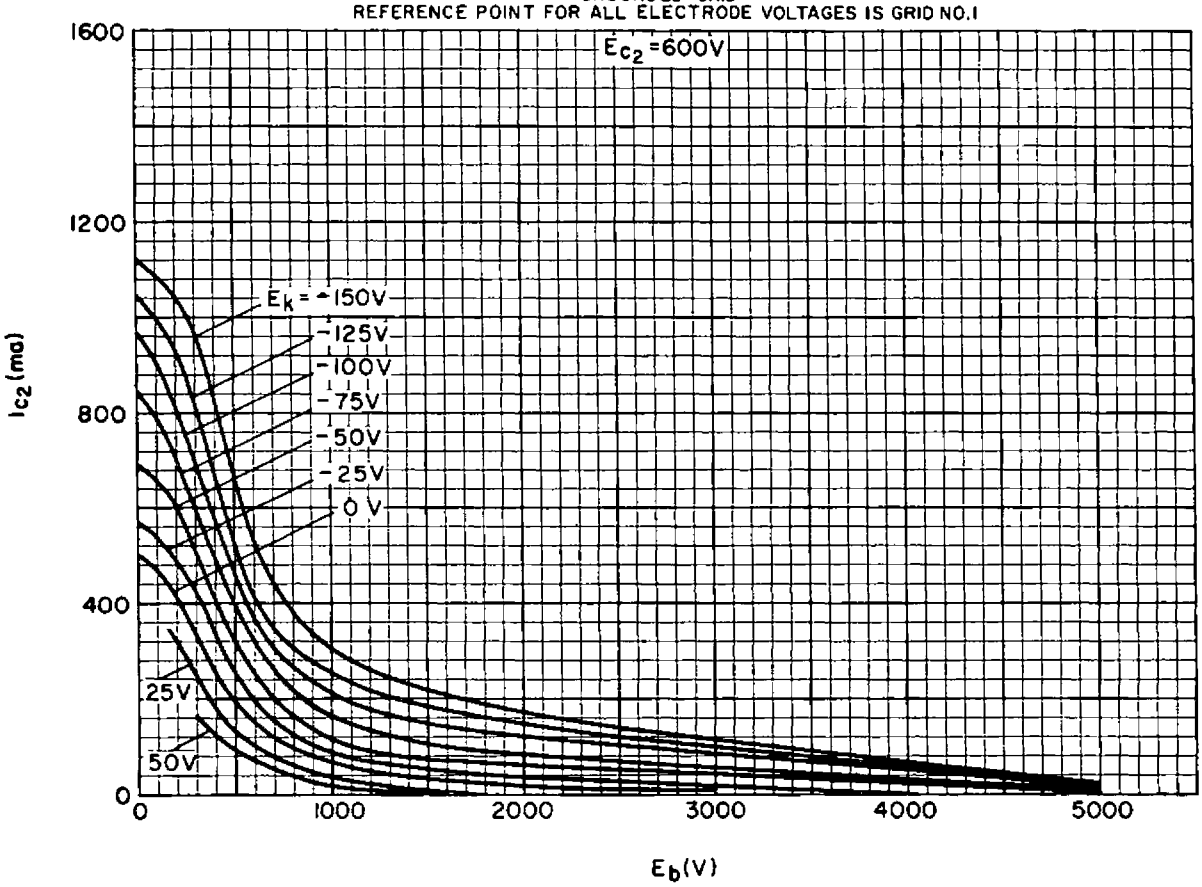
Typical Operation
(Voltages Measured to Grid No. 1)

Frequency	800 mc
Bandwidth to -3 db points	6 mc
D.C. Plate Voltage	3610 volts
D.C. Grid No. 2 Voltage	610 volts
Sync Level	110 volts
D.C. Cathode Voltage, Black Level	210 volts
White	380 volts
D.C. Plate Current, Sync Level	900 ma
Black Level	600 ma
D.C. Grid No. 2 Current, Sync Level	15 ma
Black Level	6 ma
D.C. Grid No. 1 Current, Sync Level	50 ma
Black Level	20 ma
Driver Output Power Sync Level	180 watts
Load Power Output, Sync Level	2000 watts
Black Level	1120 watts

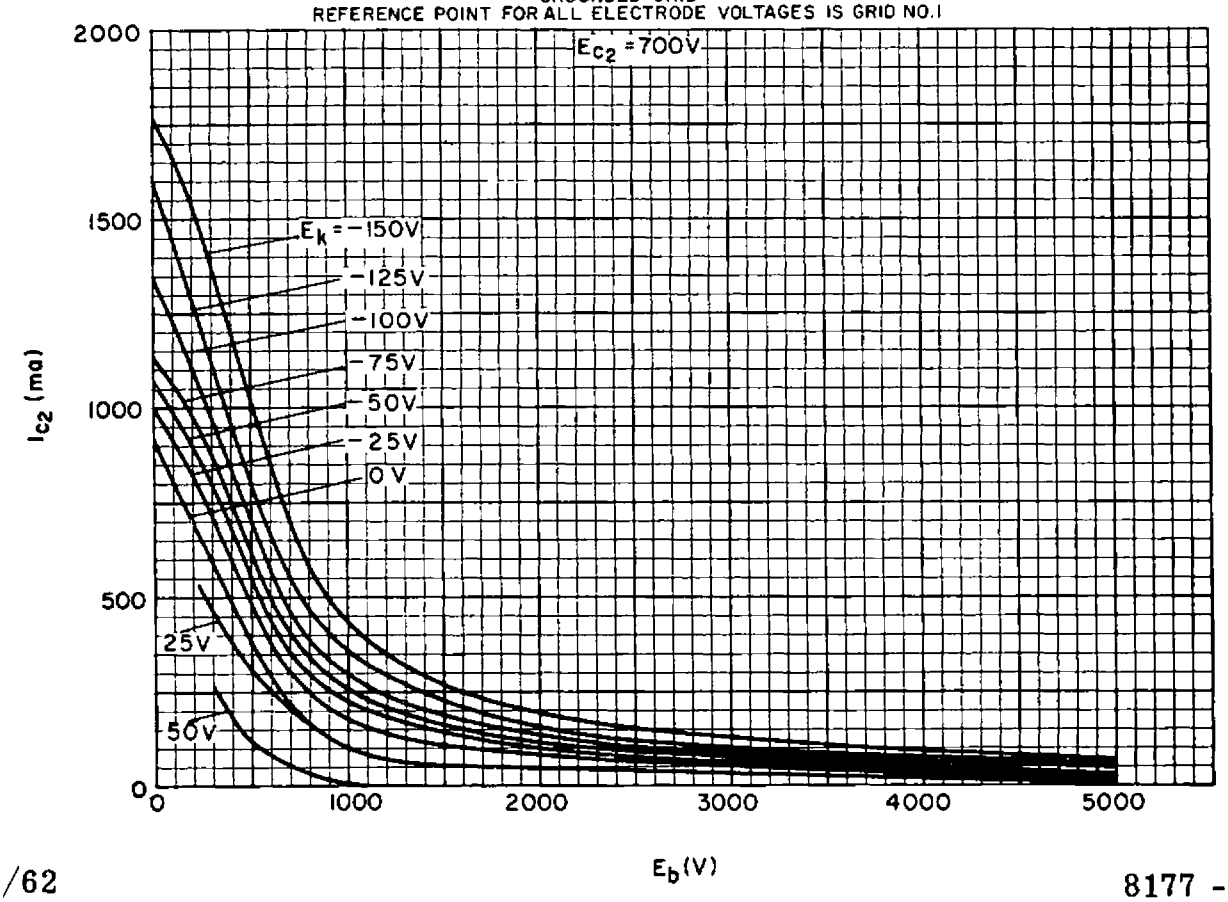

GRID NO.1 CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1
E_{c_2}=700V
E_k=-150V
-125V
-100V
-75V
-50V
-25V
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
I_{c_1} (ma)
E_b(V)

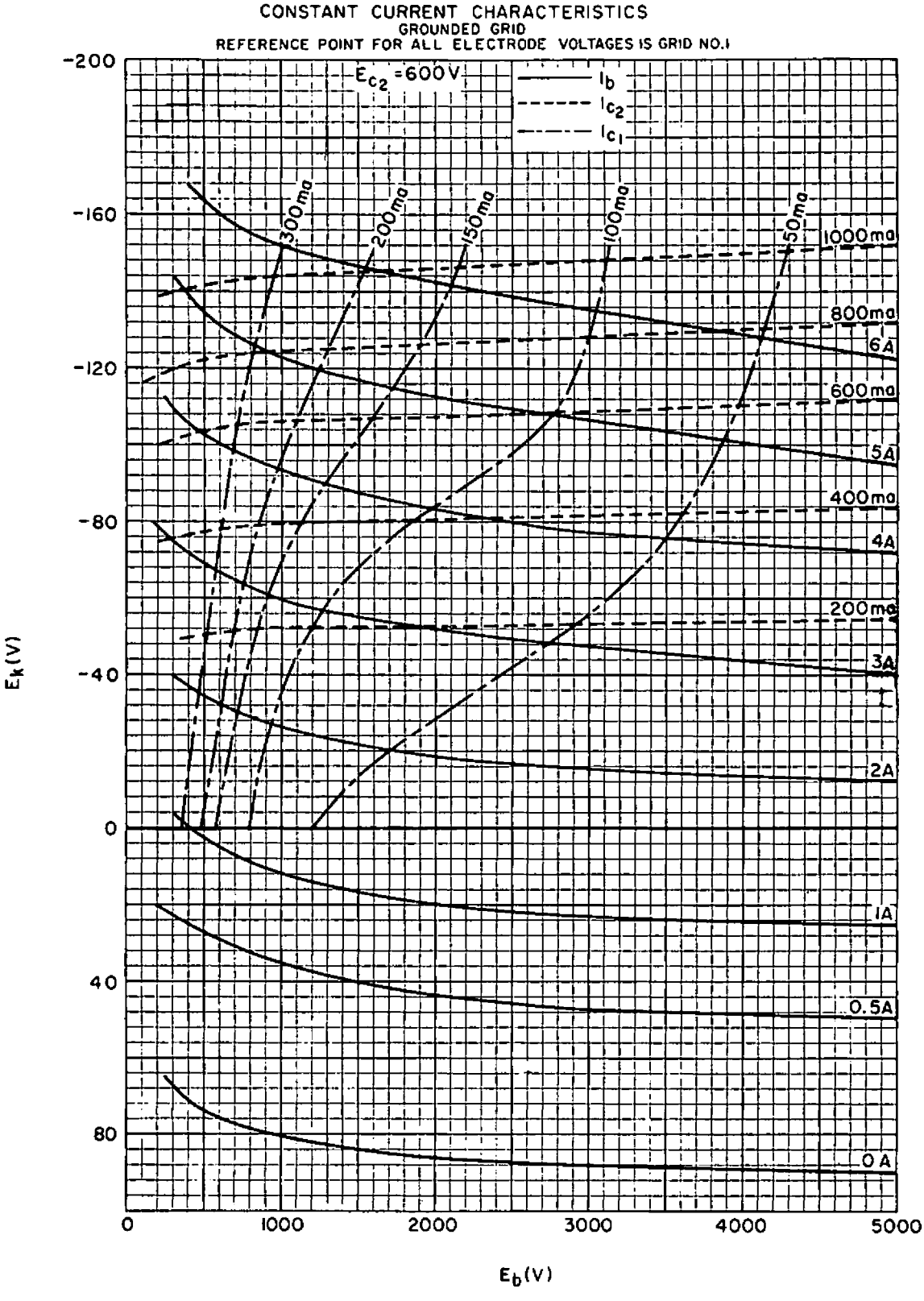

GRID NO.1 CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1
E_{c_2}=600V
E_k=-150V
-125V
-100V
-75V
-50V
-25V
2000
1500
1000
500
0
0
1000
2000
3000
4000
5000
I_{c_1} (ma)
E_b(V)

GRID NO. 2 CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1



GRID NO. 2 CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1




CONSTANT CURRENT CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1
E_{c_2} =600V
I_b
I_{c_2}
I_{c_1}
300ma
200ma
150ma
100ma
50ma
1000ma
800ma
6A
600ma
5A
400ma
4A
200ma
3A
2A
1A
0.5A
0A
-200
-160
-120
-80
-40
0
40
80
0
1000
2000
3000
4000
5000
E_k(V)
E_b(V)

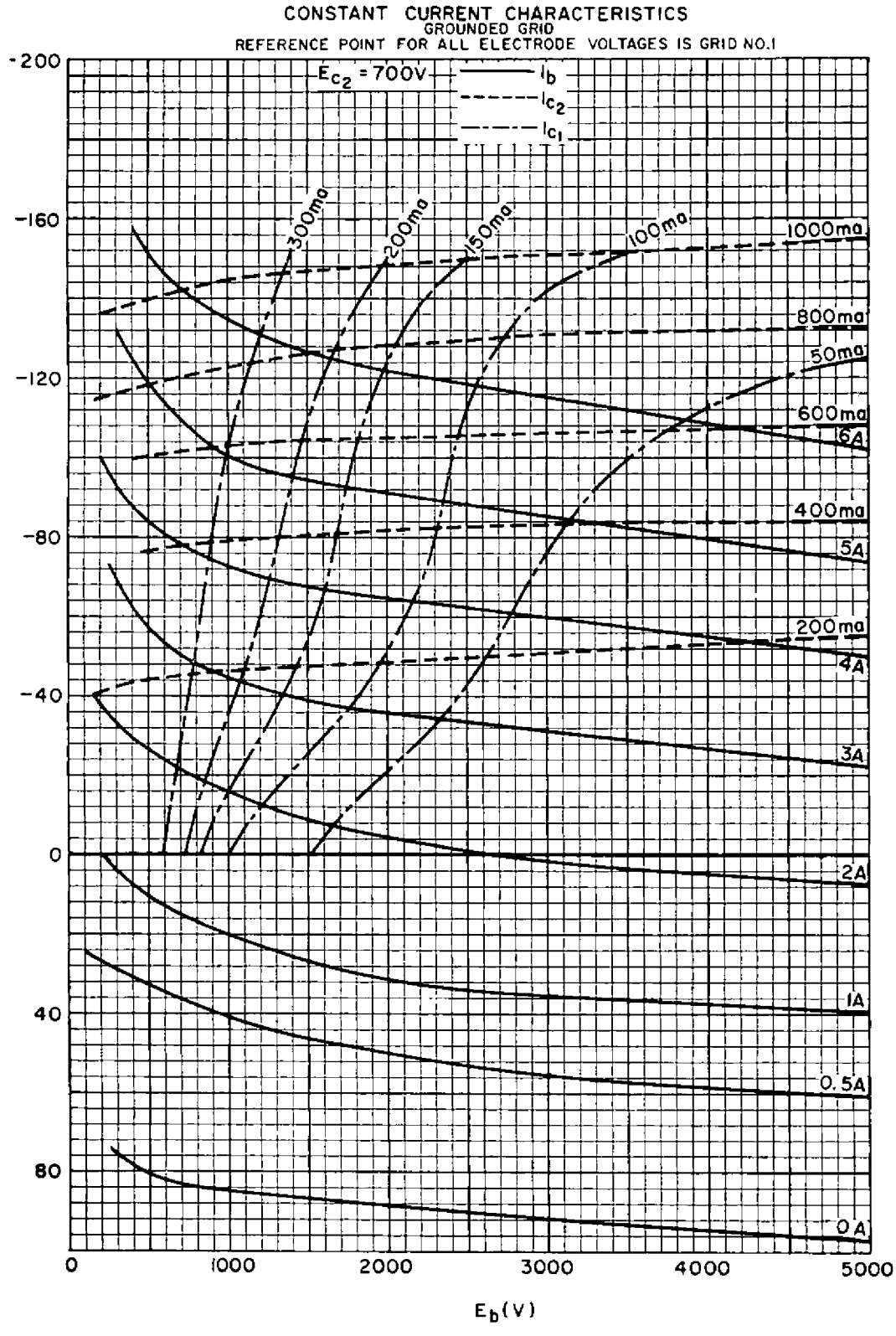

CONSTANT CURRENT CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1
E_{c_2} = 700V
I_b
I_{c_2}
I_{c_1}
300ma
200ma
150ma
100ma
1000ma
800ma
50ma
600ma
6A
400ma
5A
200ma
4A
3A
2A
1A
0.5A
0A
-200
-160
-120
-80
-40
0
40
80
0
1000
2000
3000
4000
5000
E_b(V)

PLATE CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1

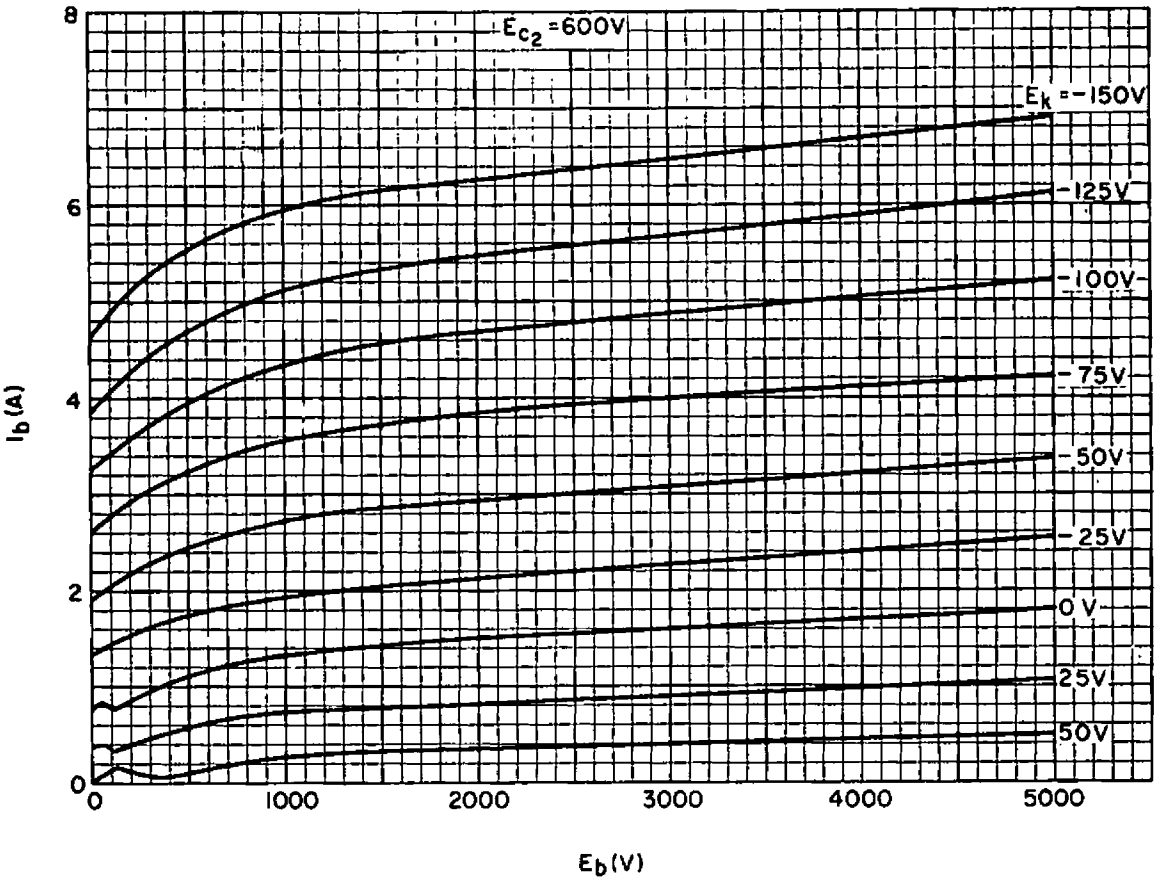
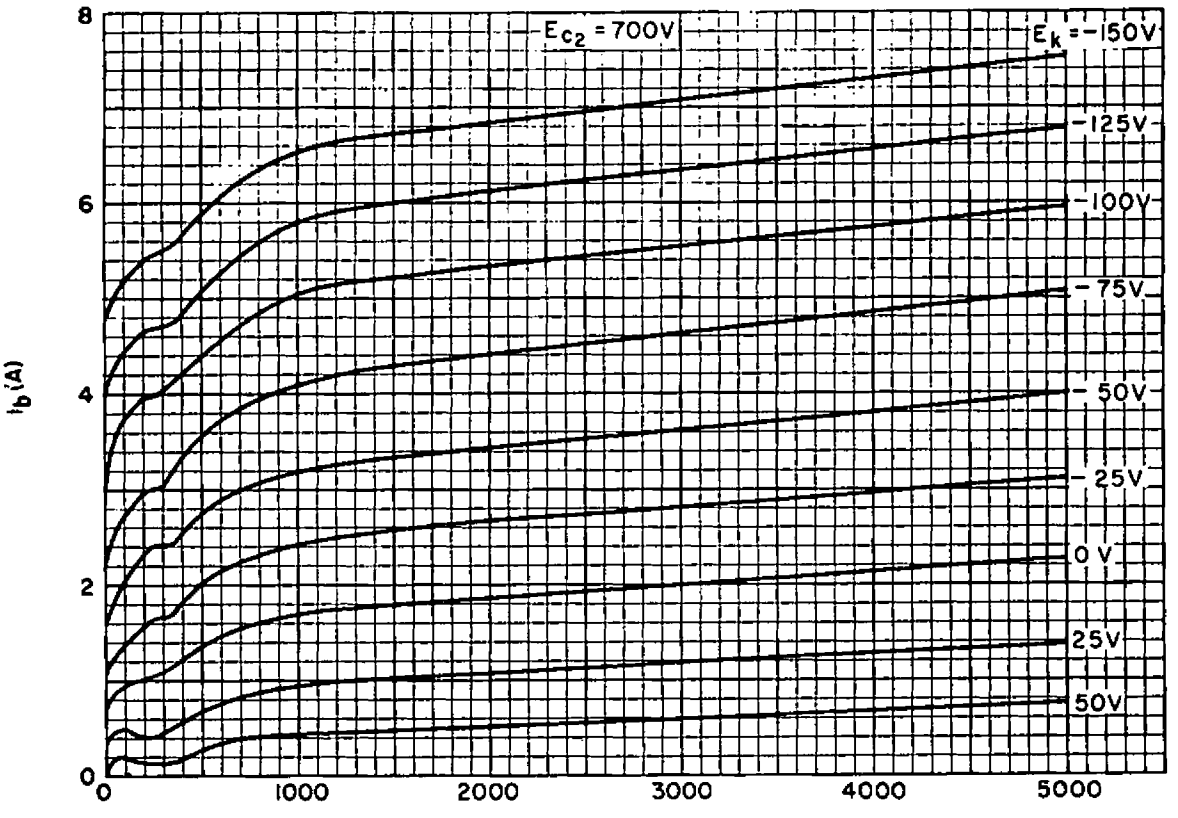


PLATE CHARACTERISTICS
GROUNDED GRID
REFERENCE POINT FOR ALL ELECTRODE VOLTAGES IS GRID NO.1



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and semiconductors
for all applications,
ask Amperex®

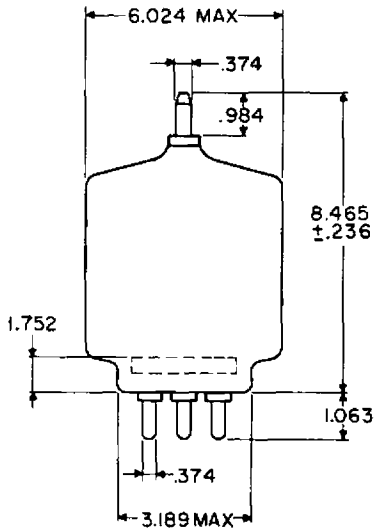


Amperex® electronic corp. 230 Duffy Avenue, Hicksville, L. I., N. Y.

AMPEREX TUBE TYPE 8179

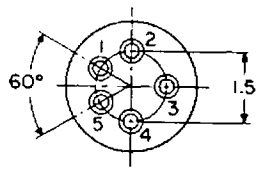
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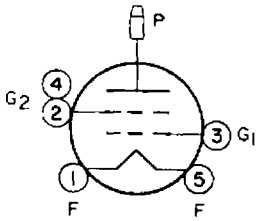
The 8179 is an air-cooled tetrode designed for use as an AM and SSB amplifier. It has a plate dissipation of 800 watts and a thoriated tungsten filament.



GENERAL CHARACTERISTICS

MECHANICAL	
Maximum Overall Dimension	
Length	9.52
Diameter	6.024
Mounting Position	Vertical
Cooling	Low velocity air
Maximum Operating Temperature	
Anode Seal	220°C
Pin Seals	180°C
Glass Envelope	350°C
Net Weight (Approx.)	1 lb 6 oz
Shipping Weight (Approx.)	5 lbs
ACCESSORIES	
Plate Connector	S - 3702
Socket	S - 3703





PIN CONNECTIONS
1. FILAMENT
2. GRID NO.2
3. GRID NO.1
4. GRID NO.2
5. FILAMENT
P-PLATE

ELECTRICAL

Heater	
Voltage	7.5 volts
Current[1]	22.6 amps
Cathode	thoriated tungsten
Amplification Factor	5.1
G1 – G2 Mu at E_b = 4000 volts	
Ec_2 = 600 volts, I_b = 200 ma	
Transconductance	10,000 μmhos
Direct Interelectrode Capacitances	
Input	47.6 pf
Output	9.5 pf
Plate to Control Grid	0.1 pf

1. The filament current must never exceed a peak value of 45A instantaneously at any time during the energizing schedule.

CLASS AB_1 GROUNDED CATHODE LINEAR R.F. AMPLIFIER

SINGLE SIDEBAND SUPPRESSED CARRIER OPERATION

MAXIMUM RATINGS, ABSOLUTE VALUES (FREQUENCIES UP TO 30 MC)

	CCS
D.C. Plate Voltage	5500 volts max.
D.C. Grid No. 2 Voltage	800 volts max.
D.C. Grid No. 1 Voltage	-500 volts max.
D.C. Plate Current	600 ma max.
Plate Input	2500 watts max.
Plate Dissipation	800 watts max.
Grid No. 2 Dissipation	120 watts max.
Grid Resistor	20, 000 ohms max.

TYPICAL OPERATION

SINGLE TONE AND/OR TWO TONE MODULATION

Frequency	7 mc
D.C. Plate Voltage	4000 volts
D.C. Grid No. 2 Voltage	600 volts
D.C. Grid No. 1 Voltage (Approx.)	-105 volts
Zero Signal D.C. Plate Current	150 ma
Zero Signal D. C. Grid No. 2 Current	10 ma
Effective R.F. Load Resistance	4900 ohms

SINGLE TONE MODULATION

	CCS
Max. Signal D.C. Plate Current	515 ma
Max. Signal D.C. Grid No. 2 Current	115 ma
Max. Signal D.C. Grid No. 1 Current	0 ma
Max. Signal Plate Power Output	1410 watts
Tube Efficiency	68 %

TWO TONE MODULATION

Average D.C. Plate Current	360 ma
Average D.C. Grid No. 2 Current	60 ma
Average D.C. Grid No. 1 Current	0 ma
Max. Resultant Peak R.F. Grid Voltage	105 volts
Average Plate Power Output	705 watts
Peak Envelope Plate Power Output	1410 watts
3rd Order Intermodulation Distortion	34 db
5th Order Intermodulation Distortion	38 db
Tube Efficiency	49 %

GROUNDED GRID LINEAR R.F. AMPLIFIER

SINGLE SIDEBAND SUPPRESSED CARRIER OPERATION

TYPICAL OPERATION

SINGLE TONE AND/OR TWO TONE MODULATION

	CCS
Frequency	7 mc
D.C. Plate Voltage	3000 volts
D.C. Grid No. 2 Voltage	500 volts
D.C. Grid No. 1 Voltage (Approx.)	-84 volts
Zero Signal D.C. Plate Current	160 ma
Zero Signal D.C. Grid No. 2 Current	7 ma
Effective R.F. Load Resistance	4400 ohms

SINGLE TONE MODULATION

Max. Signal D.C. Plate Current	470 ma
Max. Signal D.C. Grid No. 2 Current	50 ma
Max. Signal D.C. Grid No. 1 Current	0 ma
Max. Signal Peak R.F. Cathode Voltage	81 volts
Max. Signal Driving Power	31 watts
Max. Signal Plate Power Output	1021 + 26 watts
Max. Signal Driver Feed Thru Power	26 watts
Cathode Impedance	106 ohms
Tube Efficiency	72 %

TWO TONE MODULATION

Average D.C. Plate Current	330 ma
Average D.C. Grid No. 2 Current	25 ma
Average D.C. Grid No. 1 Current	0 ma
Max. Resultant Peak R.F. Grid Voltage	81 volts
Average Plate Power Output	510 + 13 watts
Peak Envelope Plate Power Output	1020 + 26 watts
Average Driver Feed Thru Power	13 watts
Peak Envelope Driver Feed Thru Power	26 watts
3rd Order Intermodulation Distortion	42 db
5th Order Intermodulation Distortion	45+ db
Tube Efficiency	53 %

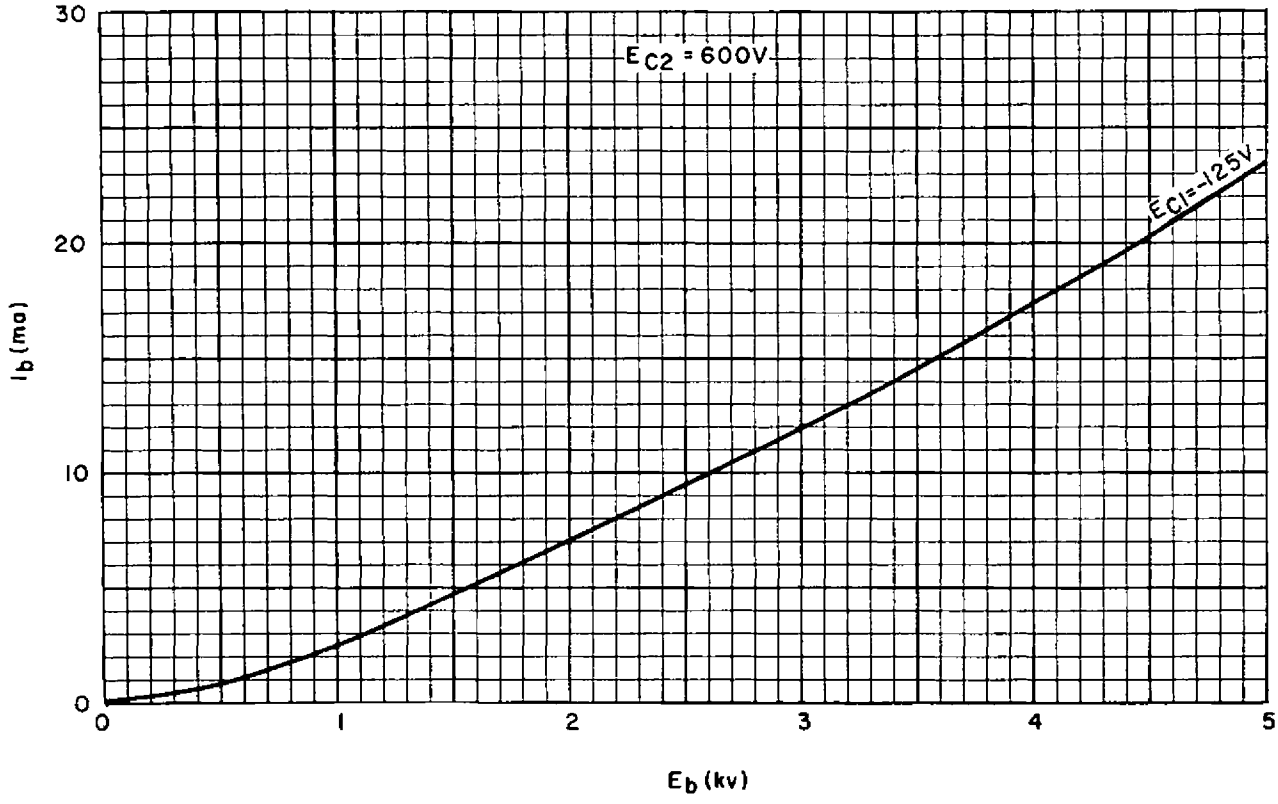


PLATE CHARACTERISTICS

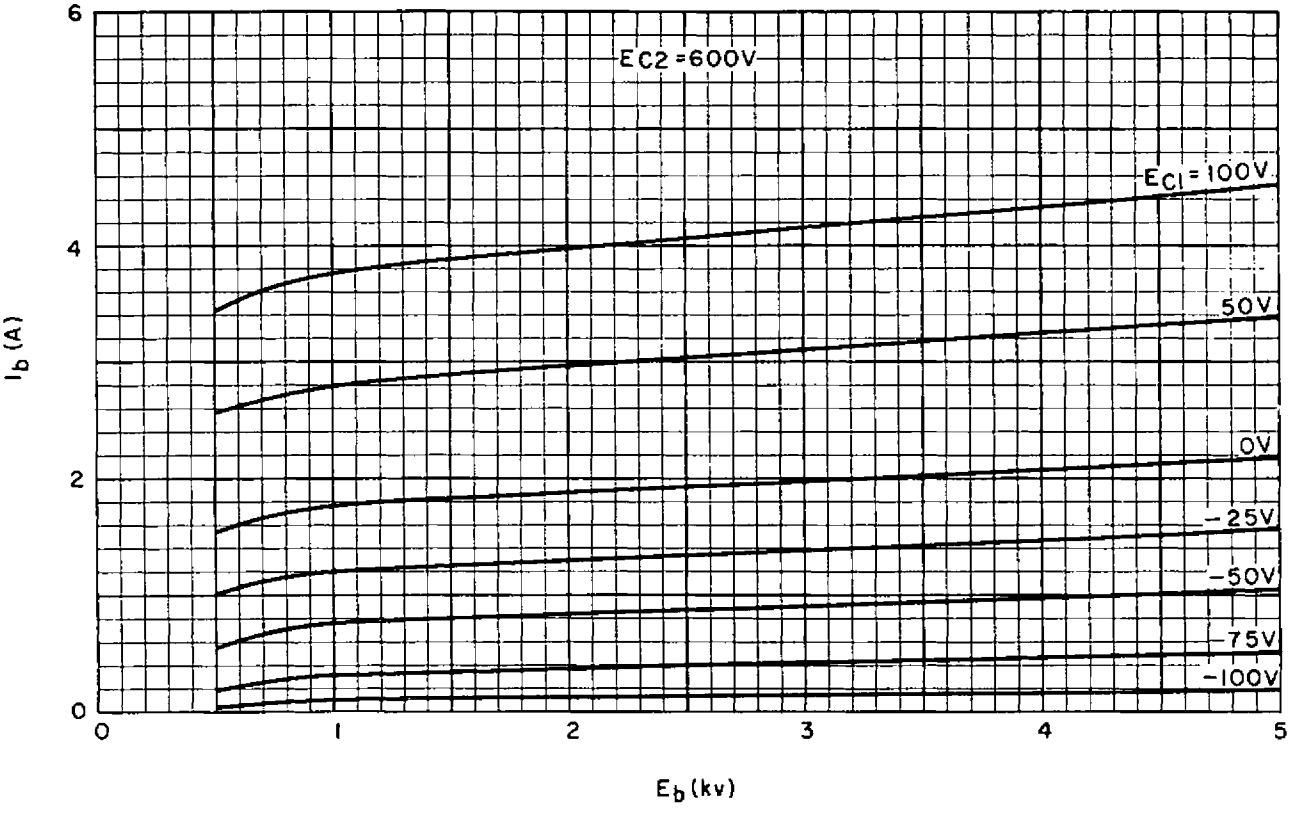
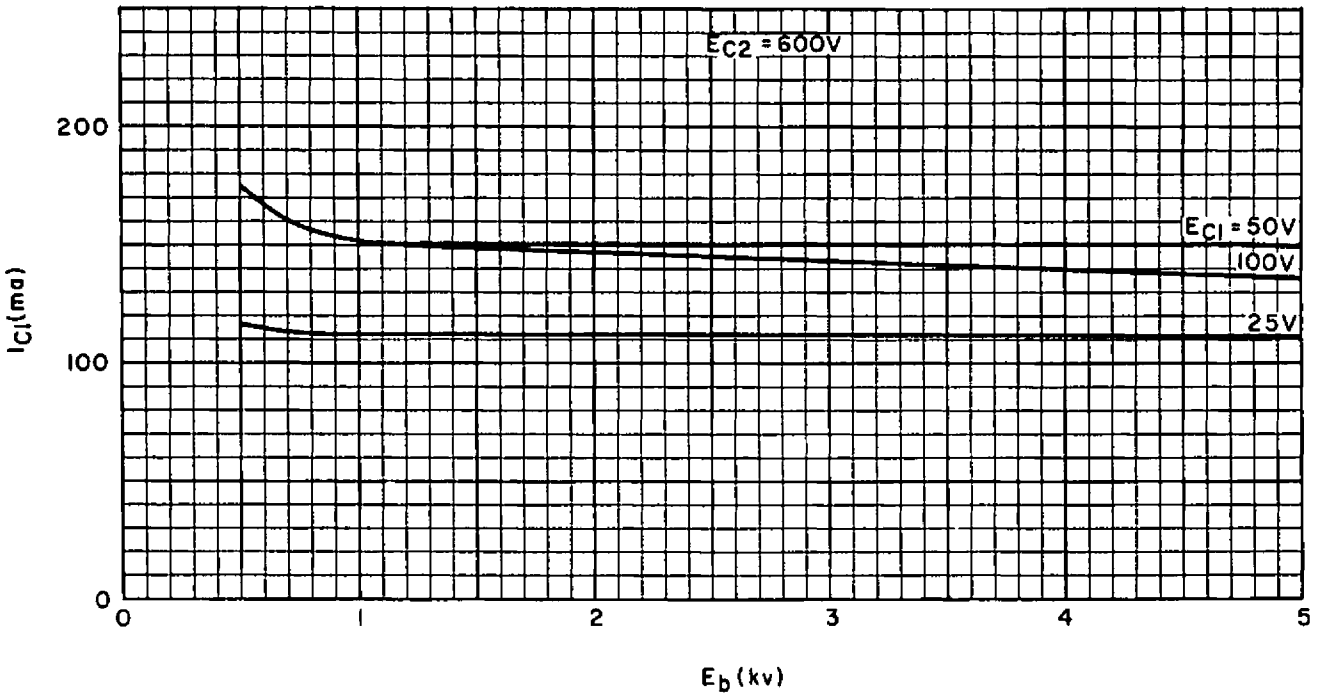
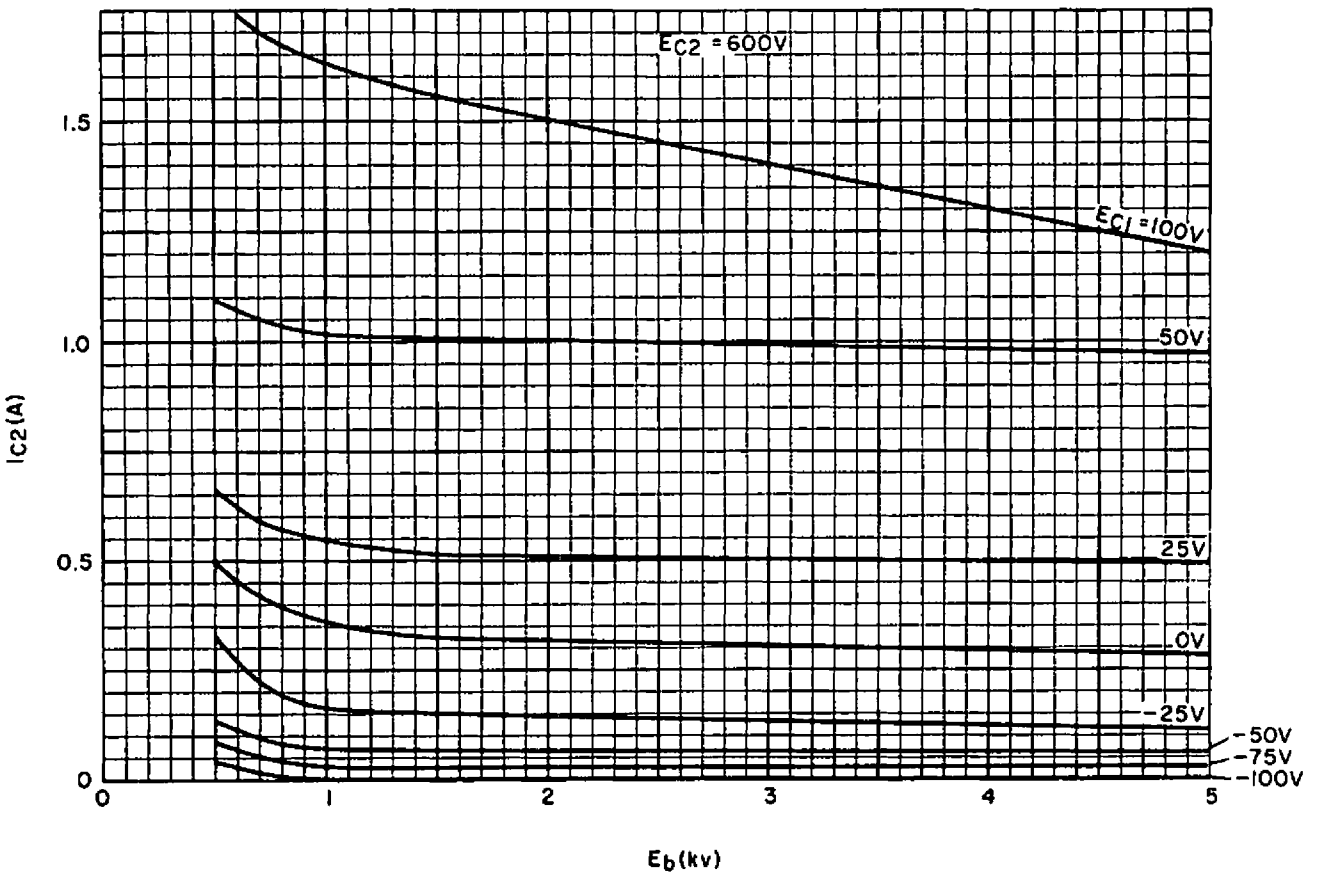


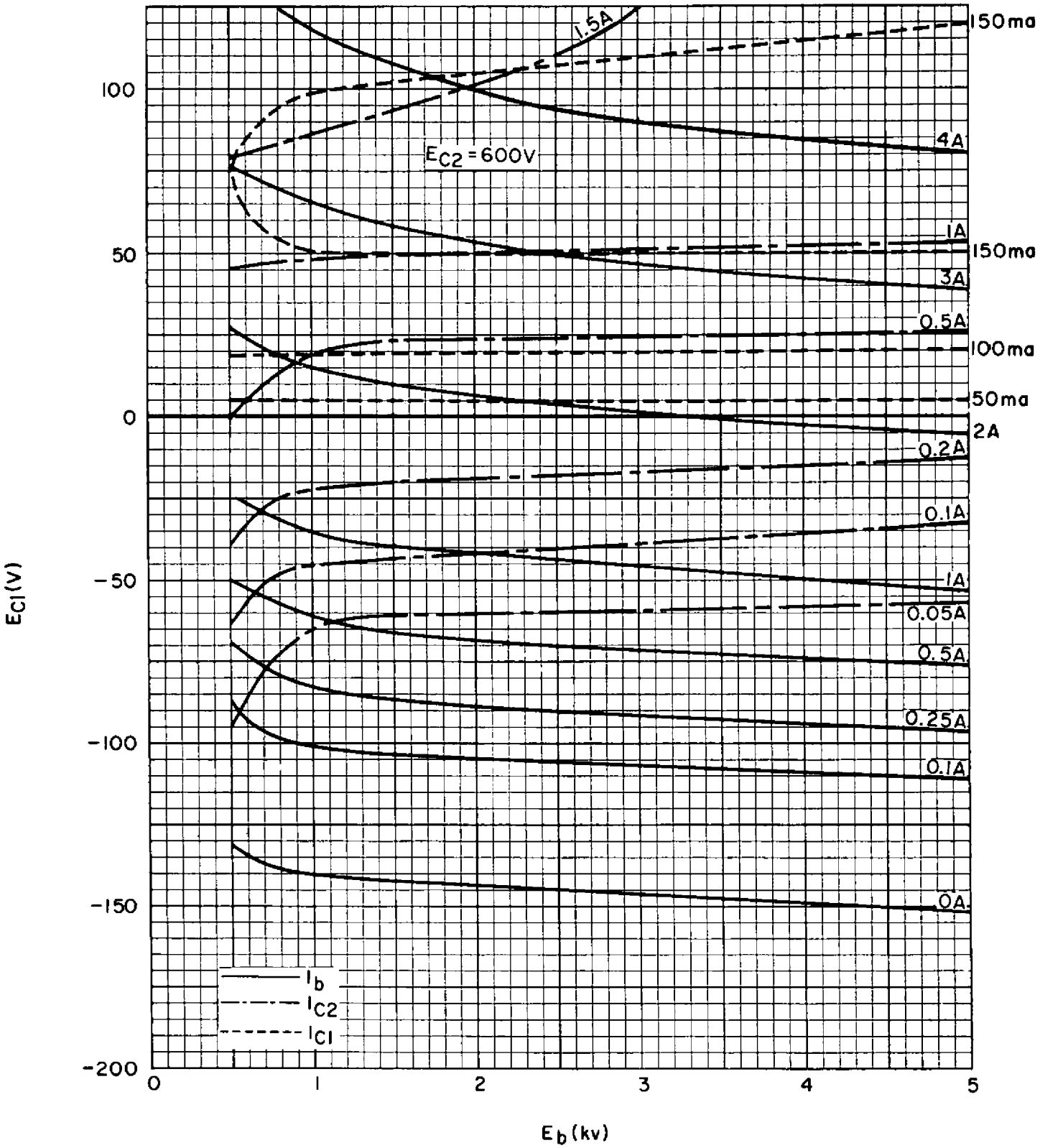
PLATE CHARACTERISTICS



TRANSFER CHARACTERISTICS



TRANSFER CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS

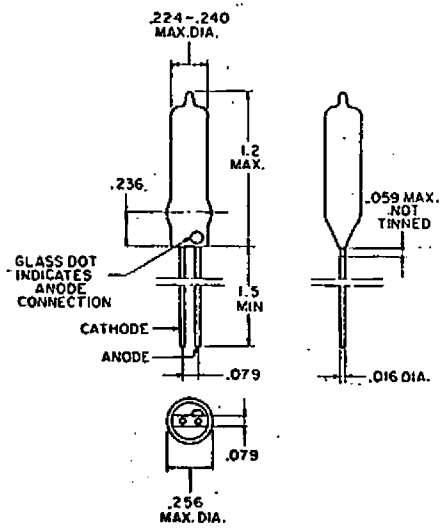
from JEDEC release #4505, Nov. 25, 1963

AMPEREX TUBE TYPE 8228

TENTATIVE DATA

The Amperex 8228 is a subminiature cold-cathode voltage reference tube for use in stable regulated power supplies, dc amplifiers, oscilloscope calibrators and similar applications.

Featuring an extremely low temperature coefficient of .0015% per °C, the 8228 affords excellent regulation and uniformity. The rugged construction of this extremely small voltage reference tube insures reliability. It is designed for a life of 30,000 hours.



JETEC T2

GENERAL CHARACTERISTICS

ELECTRICAL

Absolute Maximum Ratings	Min.	Max.
Cathode Current	2	4 ma
Peak Starting Current (T_{max} = 20 secs.)	--	10 ma [1]
Peak Inverse Voltage	--	100 volts
Bulb Temperature		
Operating	−55°C	+125°C
Storage and Standby	−55°C	+100°C

[1] To maintain maximum reference voltage stability this limit is restricted to once every 4 hours.

Characteristics (T_{amb} = 20 to 30°C)

	Min.	Typ.	Max.	
Cathode Current (Preferred Operating Point)	--	3	--	ma
Starting Voltage	115			volts [2]
DC Operating Voltage (I_C = 3 ma)	80.1	81.0	81.9	volts [3]
Incremental Resistance (I_C = 3 ma)	--	200	350	ohms [4]
AC Impedance (I_C = 2.5 ma to 3.5 ma)	--	--	400	ohms [5]
Temperature Coefficient of Operating Voltage at I_C = 3 ma:				
Averaged over t_{bulb} = + 20°C to + 125°C	--	−1.2	−2	mv/°C
Averaged over t_{bulb} = −55°C to + 20°C	--	−3.2	−4	mv/°C
Jump Voltage (I_C = 2 ma to 4 ma)	--	--	5	mv
Noise Voltage				
Oscillation	--	--	1	mv
Vibration	--	--	100	mv [6]
Ignition Breakdown Delay (In darkness E_b = 115 V)	--	--	5	msec.

Life Performance

Life Expectancy - Continuous Operation	
I_C = 3 ma	30,000 hours
Variation in DC Operating Voltage at	
I_C = 3 ma, t_{bulb} = 45°C	
0 to 1 hour	Δ Va = 100 mv
0 to 100 hours	Δ Va = 200 mv
0 to 2000 hours	Δ Va = 300 mv
Variation in DC Operating Voltage During Storage and Standby	
0 to 2000 hours (t_{bulb} = 25°C)	Δ Va = 100 mv
0 to 100 hours (t_{bulb} = 100°C)	Δ Va = 100 mv

[2] Circuit design should provide ignition voltage of 120 V minimum.

[3] Equilibrium conditions reached within 2 minutes after ignition.

[4] This is slope of V/I characteristic measured at a specified current.

[5] This is impedance of anode-cathode gap measured at I_C = 3 ma dc with 0.5 ma ac peak superimposed at 100 cycles.

[6] Sinusoidal vibration, 10 to 50 cycles, 2.5 g peak acceleration.

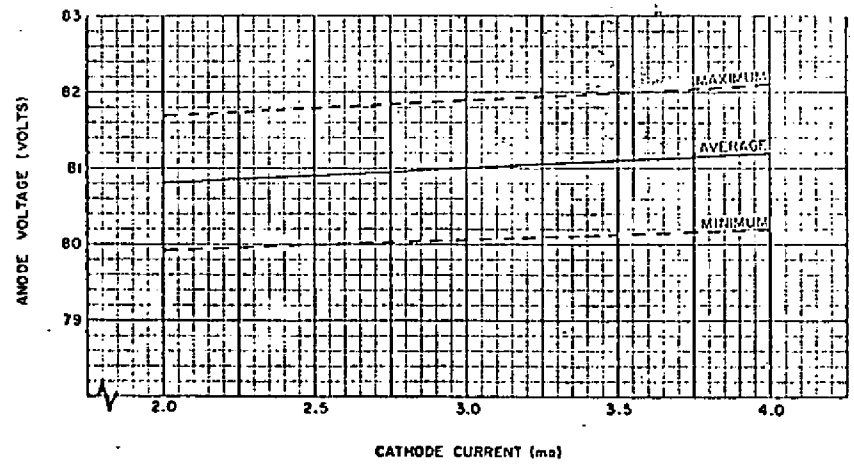
Environmental Ratings [7]

Shock Rating	500 g
NRL impact machine for electronic devices; five blows with 30° hammer angle in each of four different planes.	
Vibration Rating	2.5 g peak
Vibrated for 32 hours at 50 cycles per second in each of three different planes	

Circuit Note - Maximum external shunt capacitor = 0.1 μf maximum

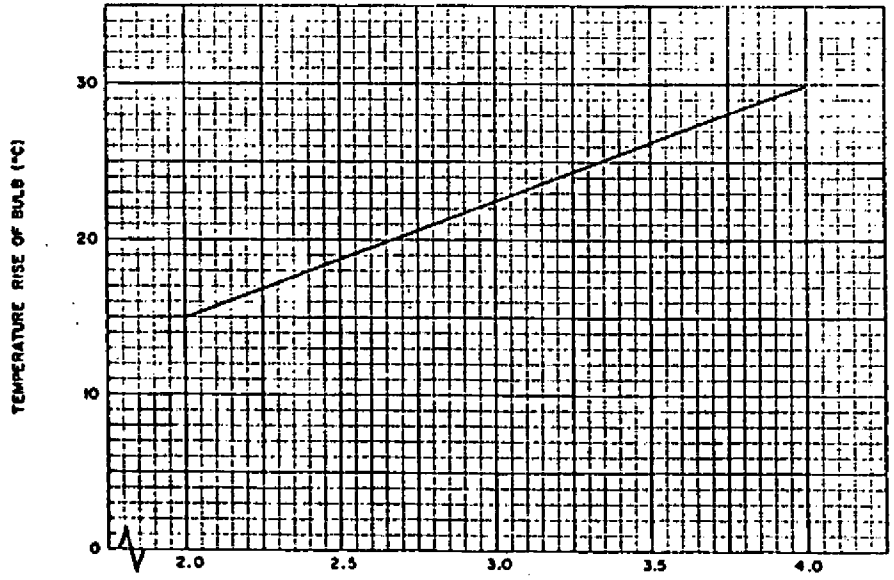
[7] These are quality evaluation conditions only. The tube is not intended to be operated continuously under these conditions.

8228



ANODE VOLTAGE VS CATHODE CURRENT

FIGURE 1



APPROX. TEMPERATURE RISE OF BULB VS CATHODE CURRENT (IN FREE AIR)

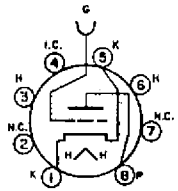
FIGURE 2

from JEDEC release #4426, Sept. 23, 1963

AMPEREX TUBE TYPE 8254/EC1000

TENTATIVE DATA

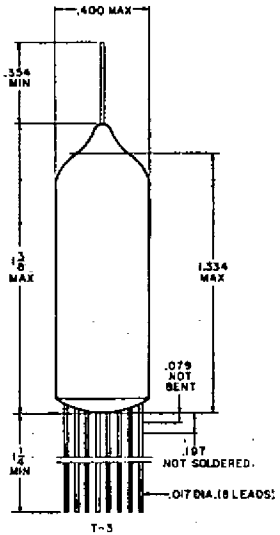
The Amperex 8254/EC1000 is a Premium Quality, subminiature, frame grid Triode designed for use as a high-frequency probe tube. It features a transconductance of 14,500 μmhos at 14 ma, and a maximum grid current of only .01 microampere. The tube has a resonant frequency of 400 mc, while the input impedance at 250 mc is 450 ohms. The input grid is brought out through the top.



PIN CONNECTIONS
1. CATHODE
2. NO CONNECTION
3. HEATER
4. INTERNAL CONNECTION
5. CATHODE
6. HEATER
7. NO CONNECTION
8. PLATE
G - GRID (TOP OF TUBE)

SUBMINIATURE
E8-10

8LW



GENERAL CHARACTERISTICS

MECHANICAL	
Bulb	Subminiature, T-3
Base	See outline drawing, E8-10
Dimensions	See outline drawing
Mounting Position	Any
ELECTRICAL	
Cathode	Indirectly heated
Heater Arrangement	Parallel supply
Heater Voltage (AC or DC)	6.3 volts
Heater Current	185 ma

Interelectrode Capacitance (Without External Shield)

	Symbol	Avg. Values
Grid to Cathode	C_{gk}	3.5 pf
Grid to Plate	C_{gp}	1.9 pf
Grid to Filament	C_{gf}	0.05 pf
Plate to Cathode	C_{pk}	0.5 pf
Plate to Heater	C_{pn}	0.3 pf

8254/EC1000

MAXIMUM RATINGS, ABSOLUTE VALUES

	Symbol	Value
Plate Voltage, Zero Plate Current	E_{bb}	275 volts
Plate Voltage	E_b	110 volts
Plate Dissipation	P_p	1.5 watts
Grid Voltage	e_c	−55 volts
Cathode Current	I_k	22 ma
Voltage Between Heater and Cathode	E_{hk}	55 volts
Bulb Temperature		170°C
Grid Resistance		See note 4

OPERATING CHARACTERISTICS

Parameter	Operating Conditions				Values				Comment
	E_f volts	E_b volts	E_c volts	I_{bo} volts	Avg.	Min.	Max.	Units	
Filament Current, I_f	6.3	–	–	–	185	–	–	ma	–
Plate Current, I_b	6.3	80	−2	–	14	–	–	ma	–
Transconductance, G_m	6.3	80	–	14	14500	–	–	μmhos	–
Amplification Factor, μ	6.3	80	–	14	24	–	–	–	–
High Frequency Input Impedance	6.3	80	−2	–	450	–	–	ohms	at 250 mc
Grid Current, I_g	6.3	80	−2	–	–	–	-10^{-8}	amp	See Note 3
Input Resonant Frequency	6.3	80	−2	–	400	–	–	mc	
Hum	6.3	–	–	–	–	–	1	mv	See Notes 1 and 2
Noise (Flat response filter 0 to 10,000 cps)	6.3	80	−2	–	–	–	1	mv	See Note 2[1]
Microphonics (Acceleration; peak value 4 g, 50 cps)	6.3	80	−2	–	–	–	1	mv	See Note 2

[1] R_g = 500 K ohms, R_k = 100 ohms at 60 cps. The heater is grounded at its center. Frequency of heater supply = 60 cps + 3%. 500 cps flat response low pass filter.

[2] The noise voltage refers to the equivalent RMS value at grid.

[3] Maximum value at 1000 hours.

[4] The grid resistance, R_g, should be restricted to a value which will not permit maximum ratings to be exceeded at a grid current of -10^{-8} ampere. To calculate the maximum permissible value of R_g, the DC feedback of the operating circuit may be taken into account. In practice the maximum value of R_g will also be defined by the required current stability and the permissible hum level.

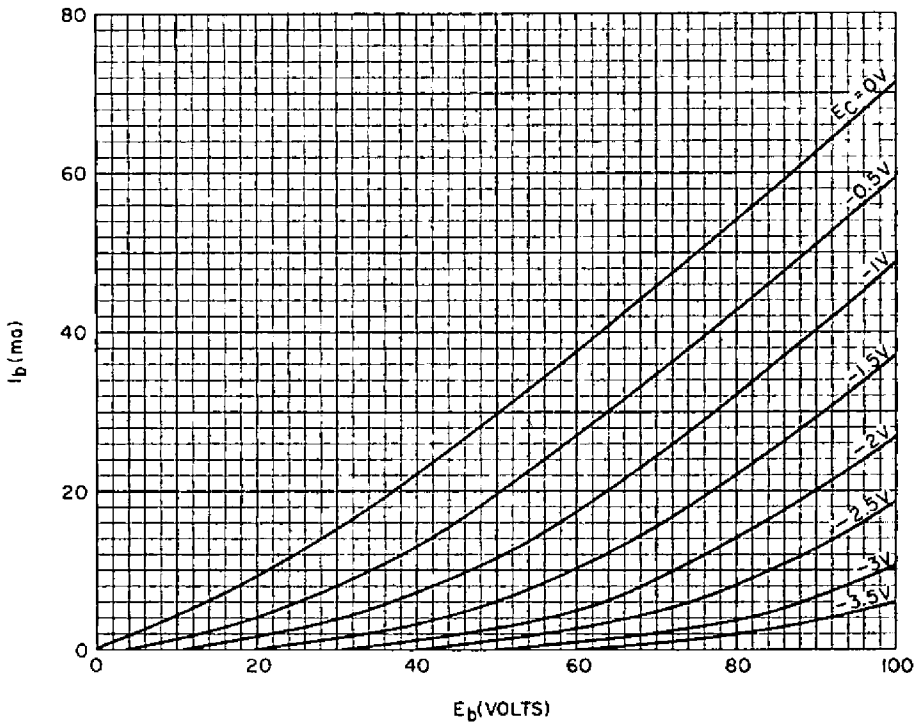
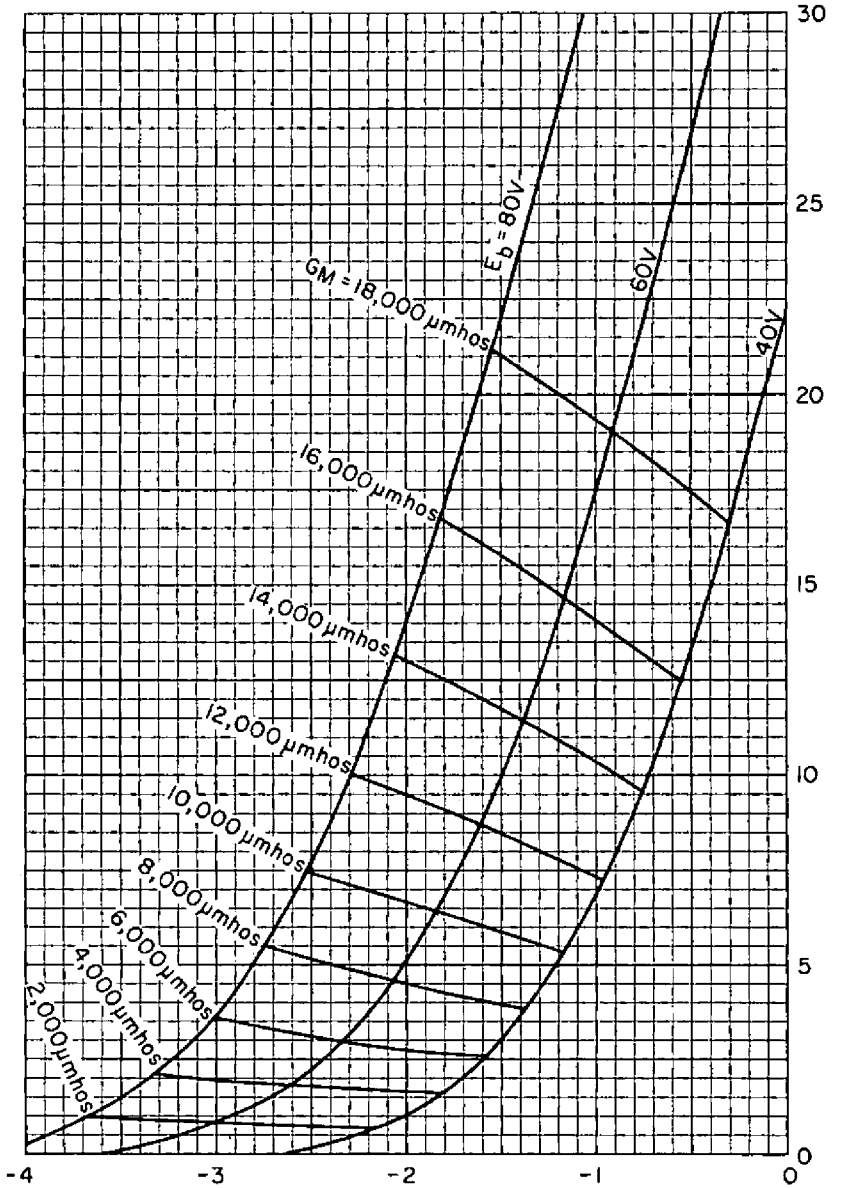


PLATE CHARACTERISTICS

FIGURE 1

8254/EC1000



TRANSFER CHARACTERISTICS

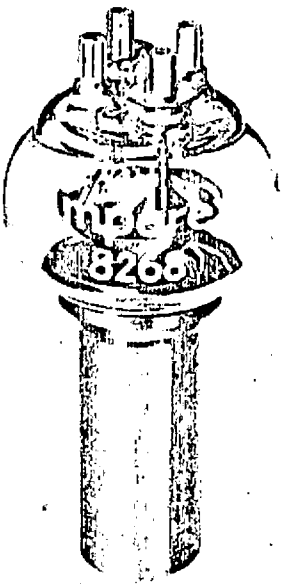
FIGURE 2

from JEDEC release #4524, Dec. 9, 1963

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8268

The 8268 is a water-cooled power triode intended for use in industrial RF heating generators at frequencies up to 50 mc. Its characteristics permit a substantially constant output to be maintained under varying load conditions. Because of the special grid material used, the grid has a very large safety margin.



GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical with anode down	
Accessories		
4 Grid[1] and Filament Connectors	S-3707	
1 Water Jacket	S-31517	
Weight		
	8268	S-31517
Net Weight	1 lb. 4 oz	1 lb. 10 oz.
Shipping Weight	3 lbs.	2 lbs.
Temperatures and Cooling		
Max. Temperatures of All Seals	220°C	
Max. Temperature of Inlet Water	50°C	
Water-Cooling Characteristics	See graphs	

Anode Dissipation (kw)	Inlet Temperature (°C)	Quantity[2] gallons/min.	Pressure Drop lbs./sq.in.
2	20	0.66	0.88
	50	1.32	2.9
4	20	1.06	2.06
	50	2.37	10.3
6	20	1.58	4.4
	50	3.7	28

ELECTRICAL

Filament	Thoriated tungsten, directly heated
Voltage	12.6 +5 -10% volts
Current	33 amps
Direct Interelectrode Capacitances	
Plate to Grid	7.9 pf
Plate to Filament	1 pf
Grid to Filament	14.2 pf
Typical Characteristics at E_b = 6 kv and I_b = 1 amp	
Amplification Factor	24
Transconductance	12,000 μmhos

1. At frequencies above 4 mc the two grid terminals must be connected in parallel. Care should be taken to distribute the RF current equally between both grid terminals to avoid excessive grid seals temperatures.
2. For inlet temperatures between 20 and 50°C the required quantity of water can be found by interpolation.

Amperex

January 1963

MAXIMUM RATINGS AND OPERATING CONDITIONS

HF Class C oscillator for industrial use with anode voltage supplied by a three-phase full wave rectifier without filter (continuous service).

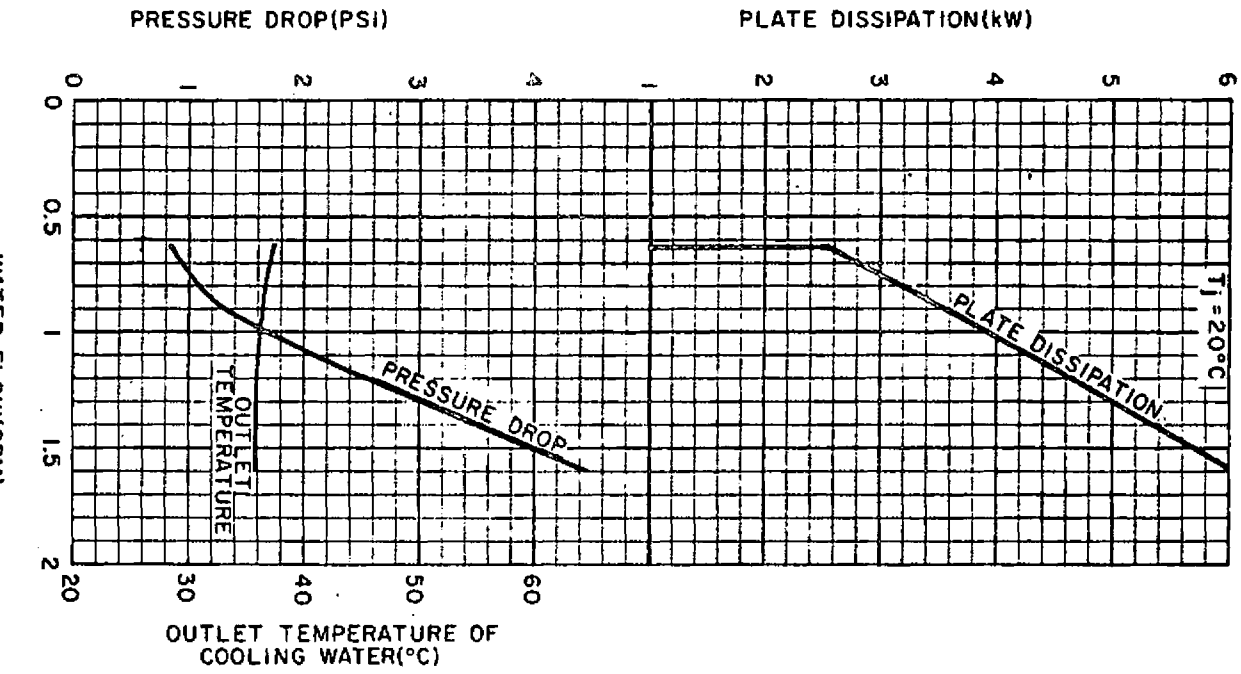
ABSOLUTE MAXIMUM RATINGS

Frequency	50 Mc
DC Plate Voltage	8 kv
DC Plate Current	1.8 amps
DC Plate Input Power	12 kw
DC Plate Dissipation	6 kw
DC Grid No. 1 Voltage	-1250 volts
Grid No. 1 Current (Loaded)	0.4 amp
Grid No. 1 Current (Unloaded)	0.5 amp
Grid Resistance	10 k ohms

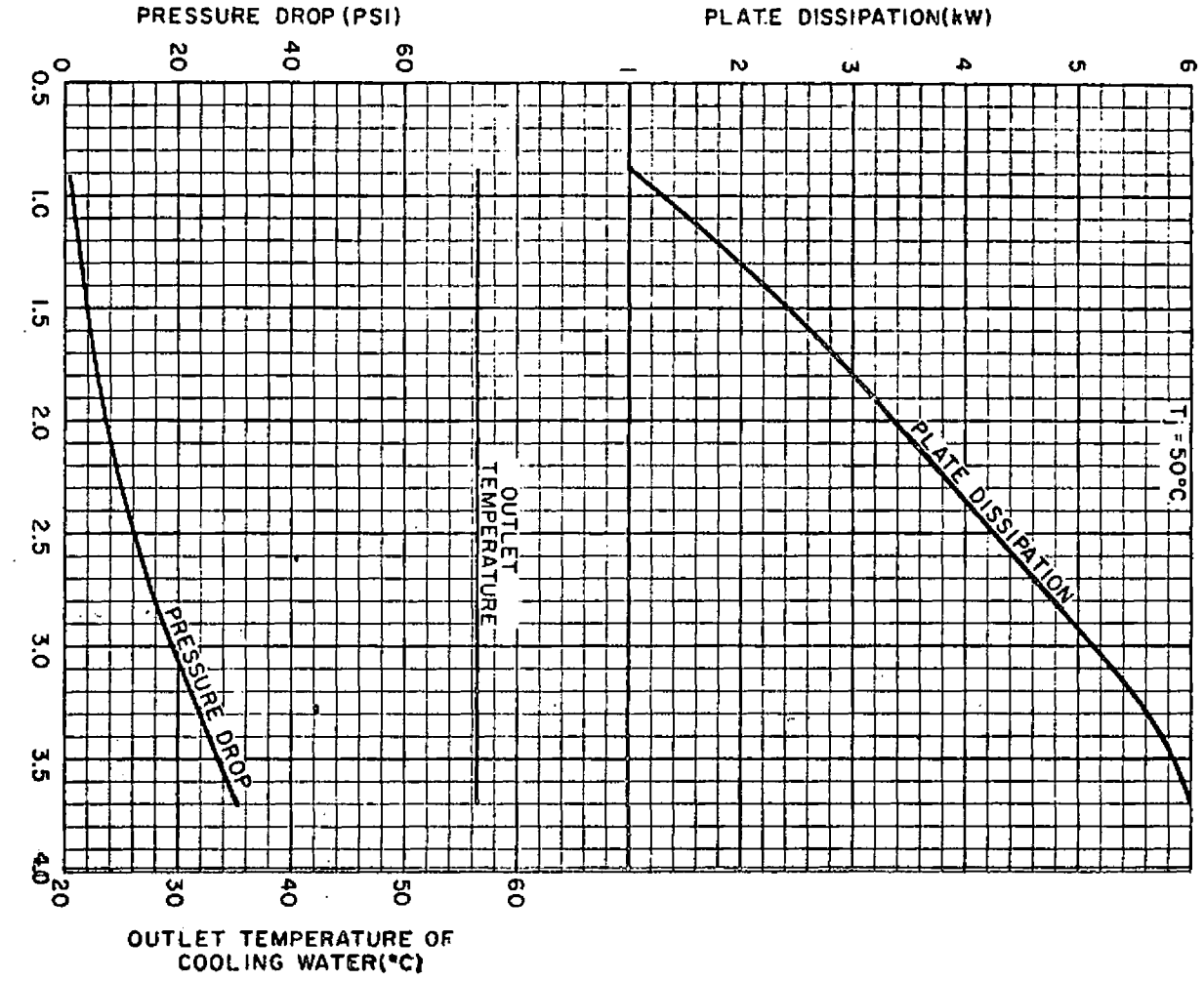
TYPICAL OPERATING CONDITIONS

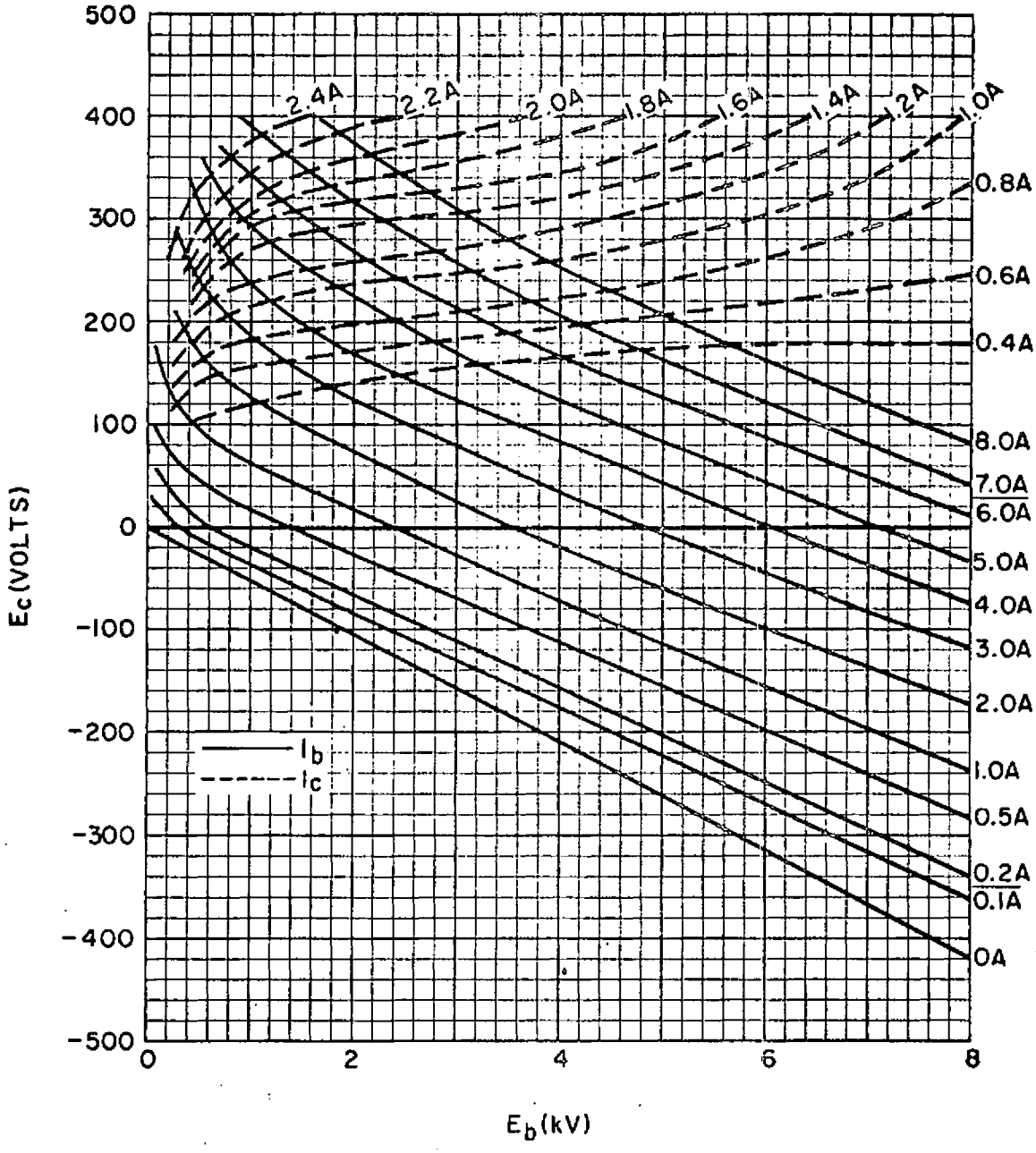
Frequency	50	50 Mc
DC Plate Supply Voltage	7200	6200 volts
DC Plate Current (Loaded)	1.5	1.4 amp
DC Plate Current (Unloaded)	0.37	0.4 amp
Grid Current (Loaded)	0.36	0.37 amp
Grid Current (Unloaded)	0.47	0.47 amp
Grid Resistor	1850	1500 ohms
DC Plate Input Power	10800	8680 watts
DC Plate Dissipation	3300	2500 watts
DC Plate Output Power	7500	6180 watts
Tube Efficiency	70	71 %
Useful Power in Load (Circuit efficiency approx. 85%)	6100	5000 watts
Feedback Factor	17	17 %
Load Impedance	2300	2100 ohms

COOLING CHARACTERISTICS

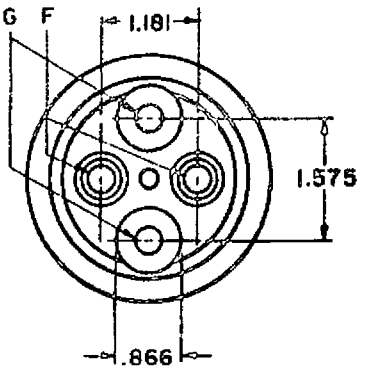


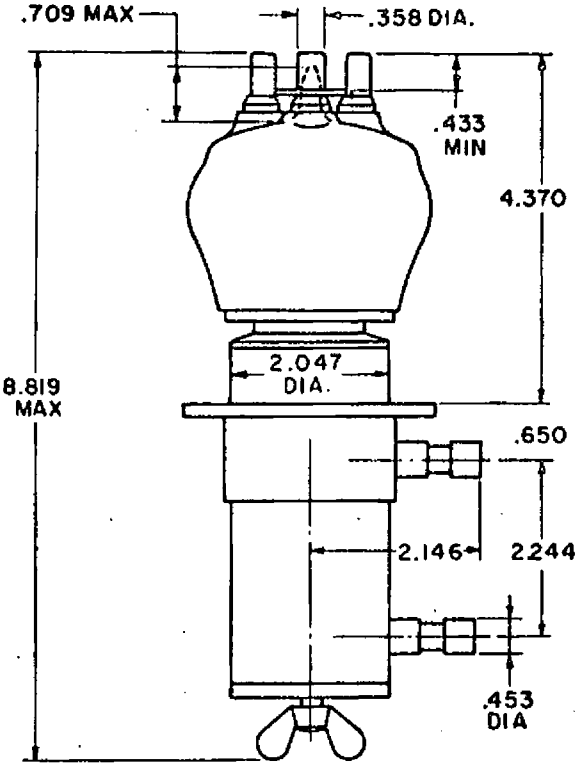
COOLING CHARACTERISTICS

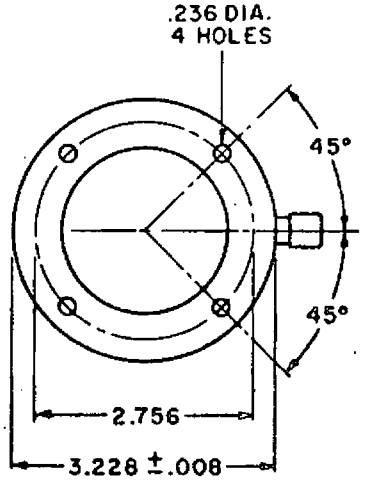




CONSTANT CURRENT CHARACTERISTICS







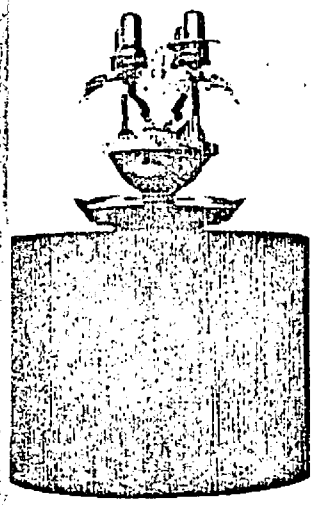
WATER JACKET
NO. S-31517

from JEDEC release #4532, Dec. 16, 1963

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8269

The 8269 is a forced-air cooled power triode intended for use in industrial RF heating generators at frequencies up to 50 mc. Its characteristics permit a substantially constant output to be maintained under varying load conditions. Because of the special grid material used, the grid has a very large safety margin.



GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical	
Accessories		
Four Grid[1] and Filament Connectors	S-3707	
One Insulating Pedestal	S-3705	
Weight		
	8269	S-3705
Net Weight	9 lbs. 11 oz.	4 lbs. 10 oz.
Shipping Weight	22 lbs.	6 lbs. 13 oz.
Temperatures and Cooling		
Max. Temperature of Envelope and Seals	220°C	
Air-Cooling Characteristics:		

Anode Dissipation (kw)[2]	Altitude (ft)	Max. Air Inlet Temp. (°C)	Min. Air Flow (cu.ft./min.)	Total Pressure (in. water)
2	0	35	170	0.8
	0	45	205	1.0
	5000	35	205	0.9
	10000	25	215	0.9
4	0	35	240	1.5
	0	45	280	1.95
	5000	35	275	1.65
	10000	25	296	1.65
6	0	35	325	2.7
	0	45	378	3.5
	5000	35	395	3.2
	10000	25	412	3.2

ELECTRICAL

Filament	Thoriated tungsten
Heating	Direct
Filament Voltage	12.6 +5 -10% volts
Filament Current	33 amps
Direct Interelectrode Capacitances	
Plate to Grid	7.9 pf
Plate to Filament	1 pf
Grid to Filament	14.2 pf
Typical Characteristics at E_b = 6 kv and I_b = 1 amp	
Amplification Factor	24
Transconductance	12,000 μmhos

1. At frequencies above 4 mc the two grid terminals must be connected in parallel. Care should be taken to distribute the RF current equally between both grid terminals to avoid excessive grid seal temperatures.
2. For continuous service; for intermittent service see curves.

Amperex

January 1963

MAXIMUM RATINGS AND OPERATING CONDITIONS

HF Class C oscillator for industrial use with anode voltage supplied by a three-phase full wave rectifier without filter (continous service).

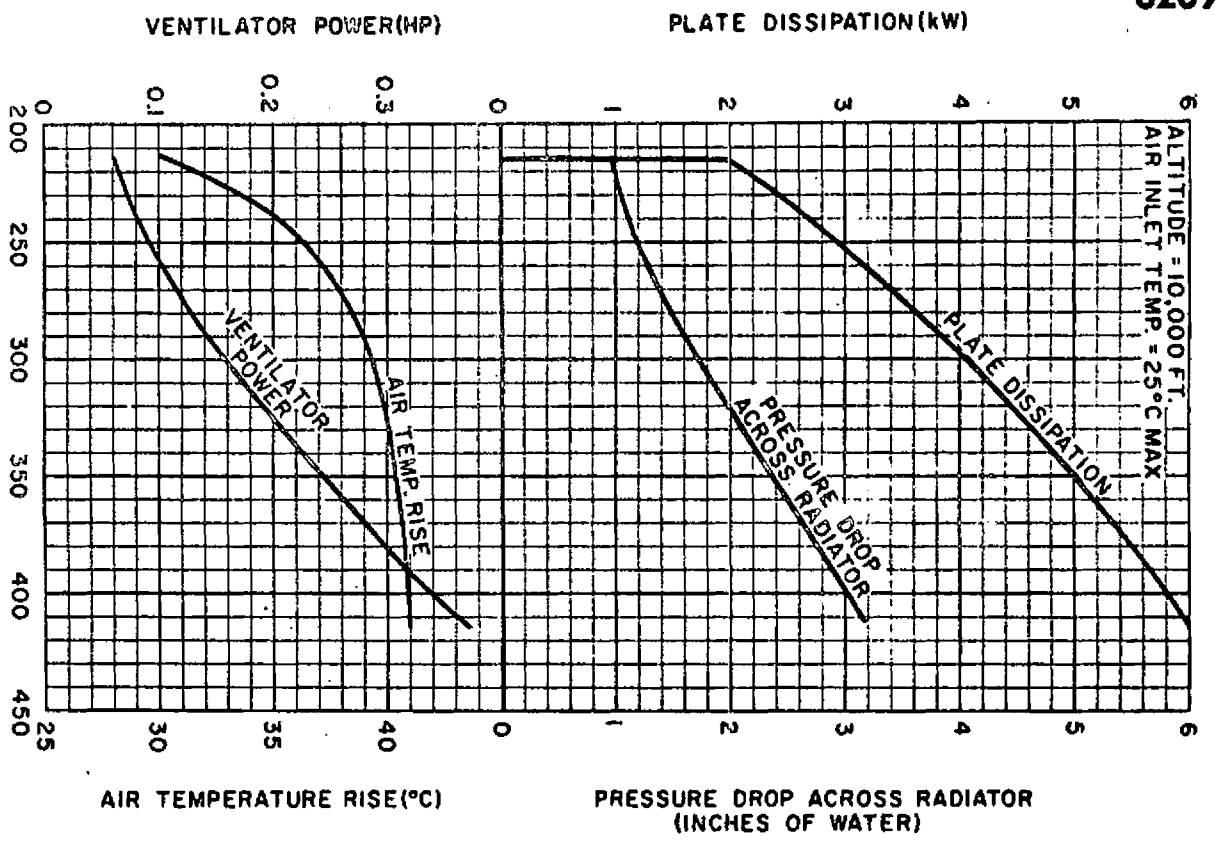
ABSOLUTE MAXIMUM RATINGS

Frequency	50 Mc
DC Plate Voltage	8 kv
DC Plate Current	1.8 amps
DC Plate Input Power	12 kw
DC Plate Dissipation	6 kw
DC Grid Voltage	-1250 volts
Grid Current (Loaded)	0.4 amp
Grid Current (Unloaded)	0.5 amp
Grid Resistor	10 k ohms

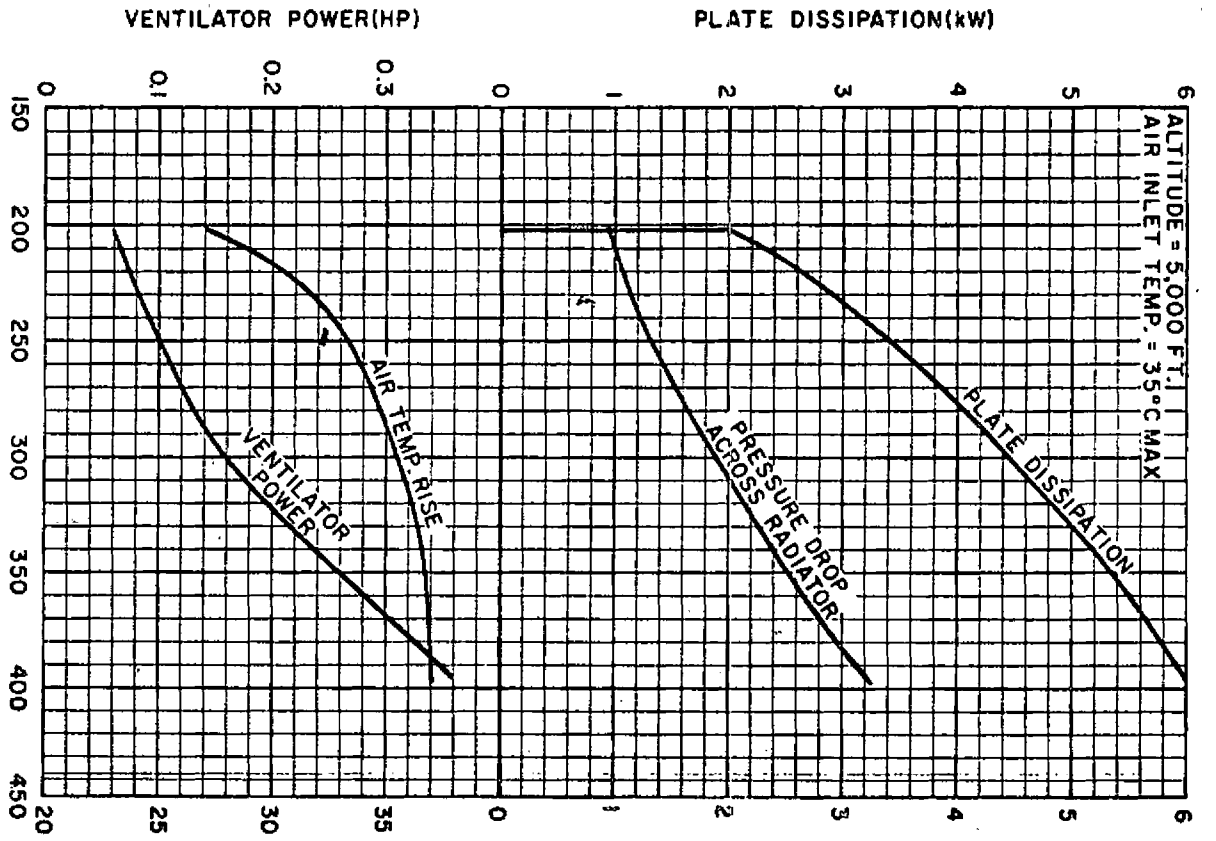
TYPICAL OPERATING CONDITIONS

Frequency	50	50 Mc
DC Plate Supply Voltage	7200	6200 volts
DC Current (Loaded)	1.5	1.4 amp
DC Current (Unloaded)	0.37	0.4 amp
Grid Current (Loaded)	0.36	0.37 amp
Grid Current (Unloaded)	0.47	0.47 amp
Grid Resistor	1850	1500 ohms
DC Plate Input Power	10800	8680 watts
DC Plate Dissipation	3300	2500 watts
DC Plate Output Power	7500	6180 watts
Tube Efficiency	70	71 %
Useful Power in Load (Circuit efficiency approx. 85%)	6100	5000 watts
Feedback Factor	17	17 %
Load Impedance	2300	2100 ohms

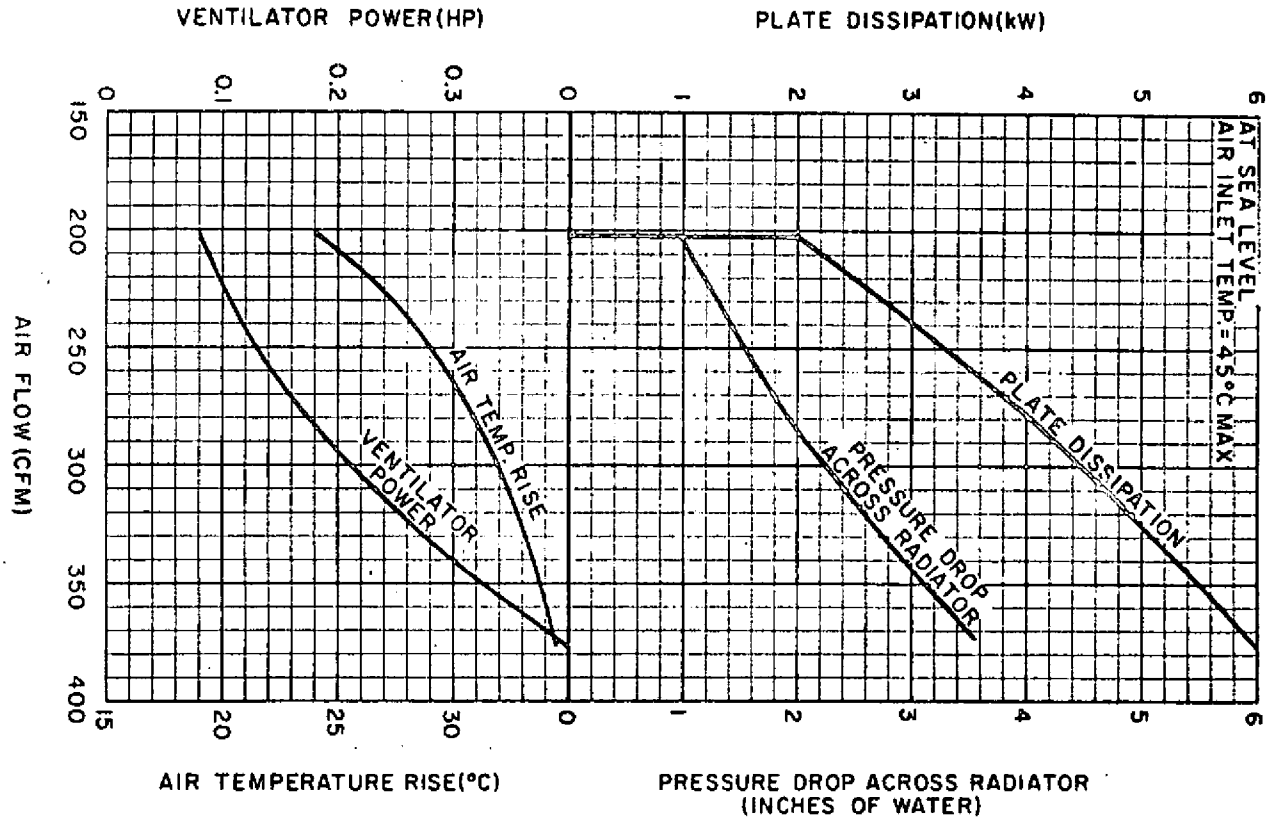
COOLING CHARACTERISTICS



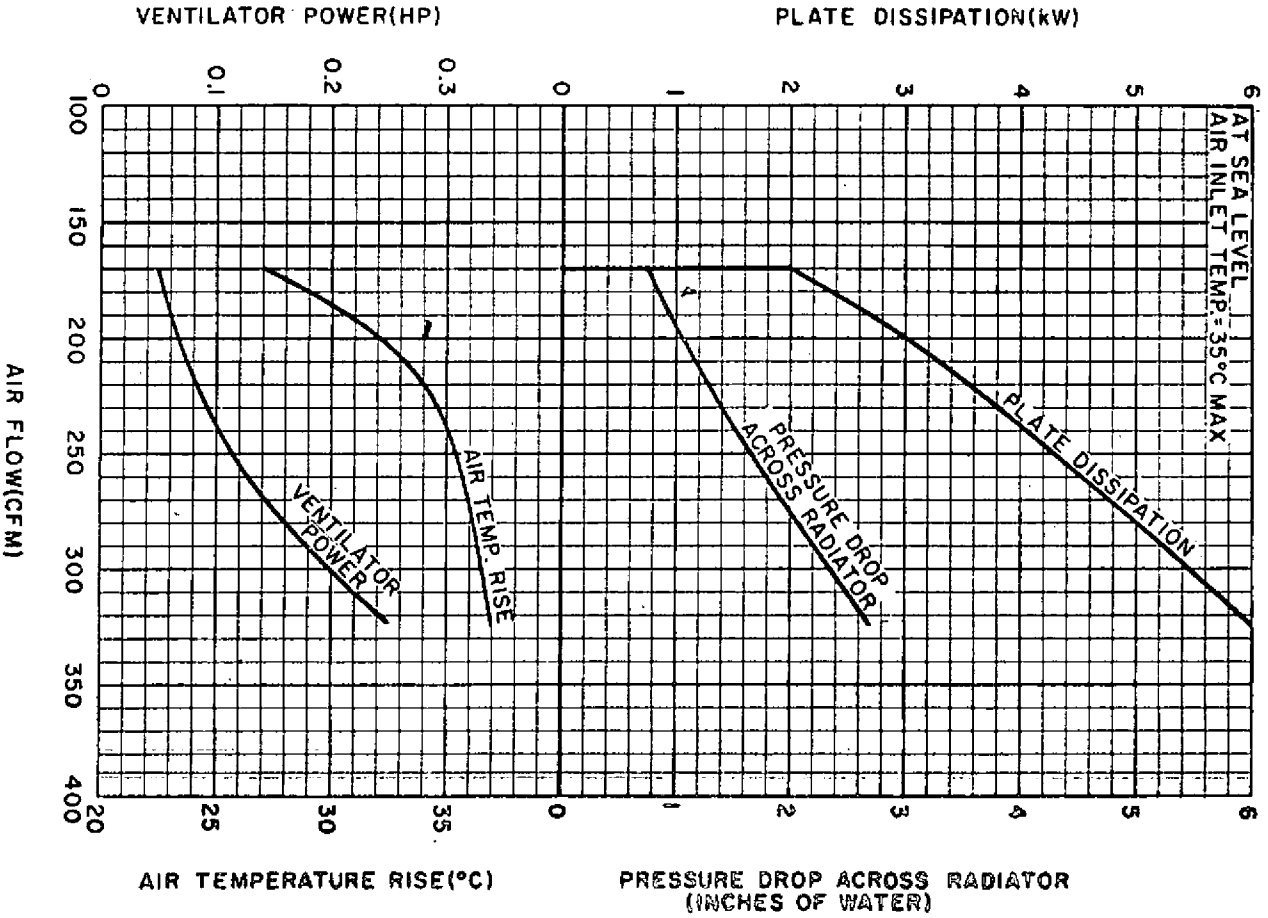
COOLING CHARACTERISTICS



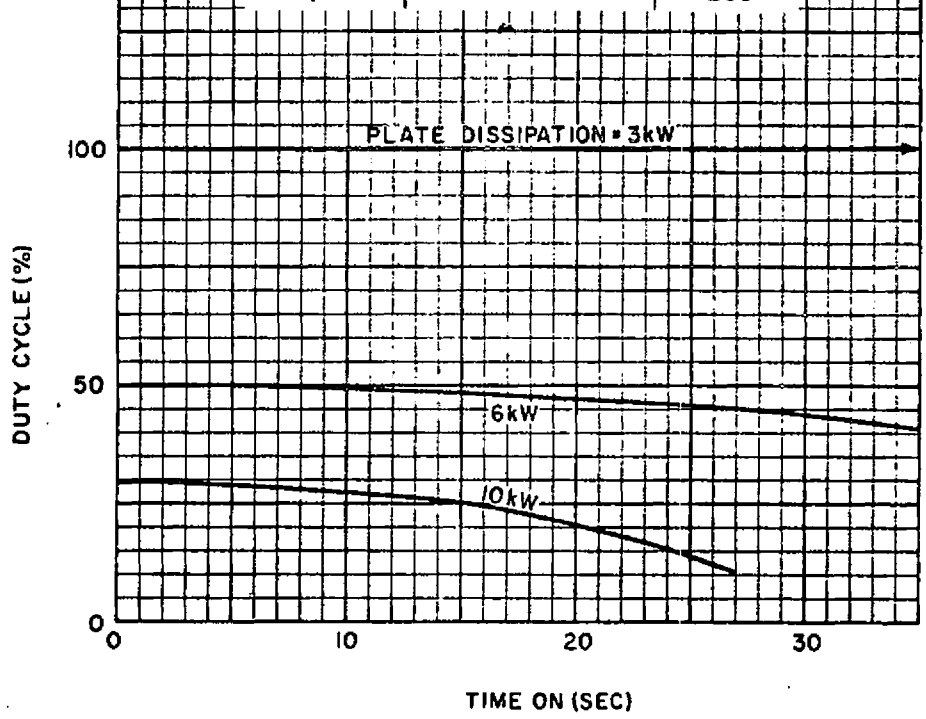
COOLING CHARACTERISTICS



COOLING CHARACTERISTICS

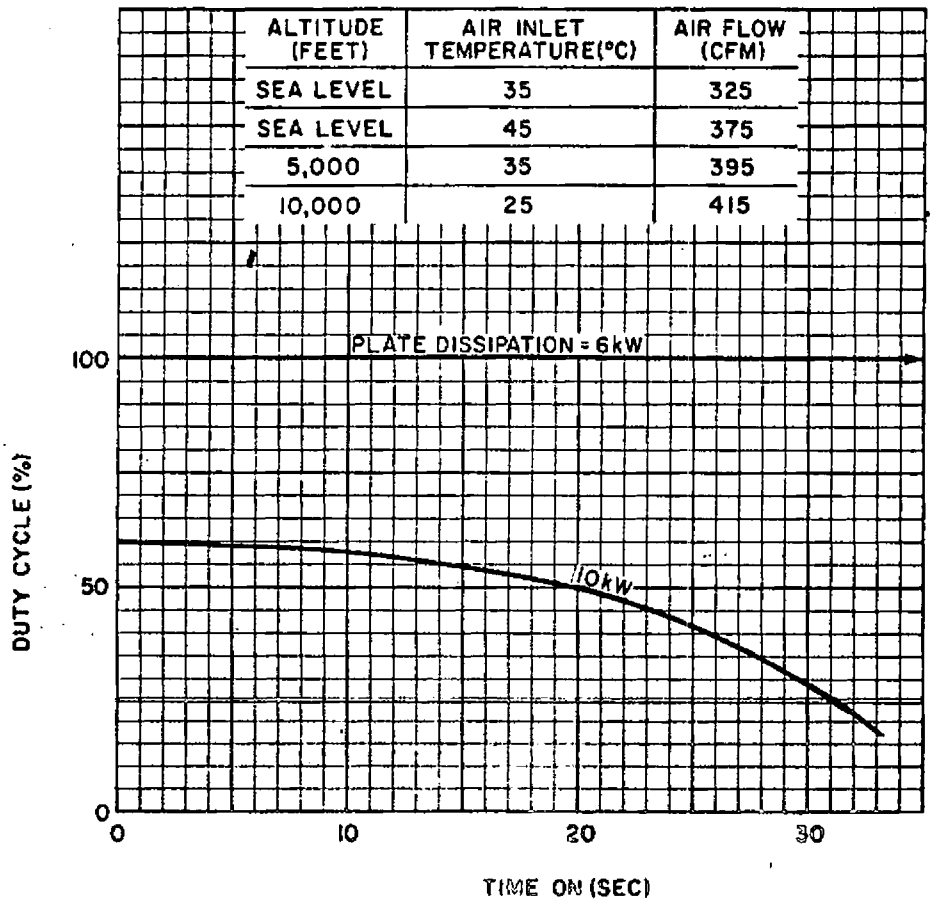


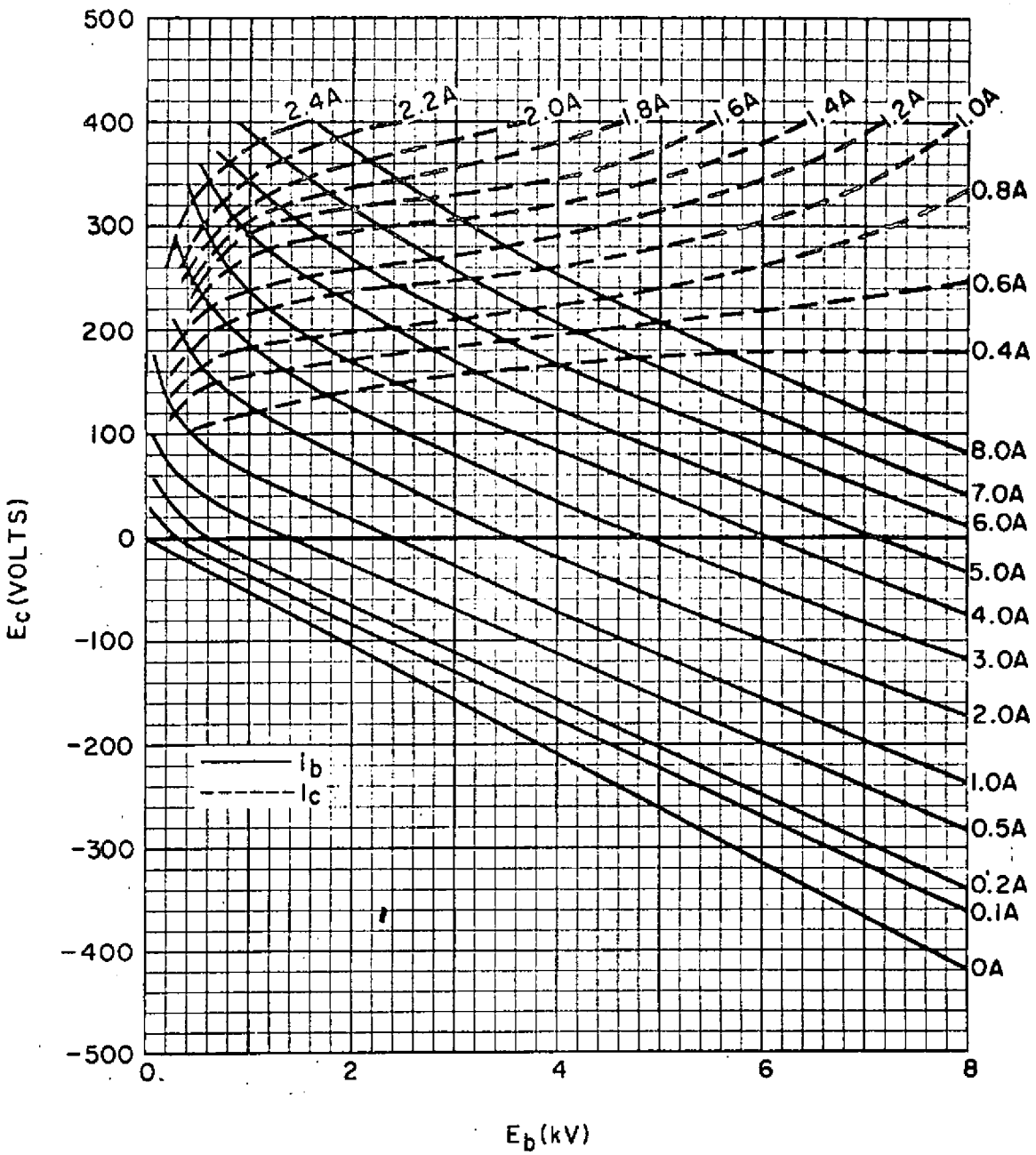
ALTITUDE (FEET)	AIR INLET TEMPERATURE (°C)	AIR FLOW (CFM)
SEA LEVEL	35	200
SEA LEVEL	45	240
5,000	35	230
10,000	25	255



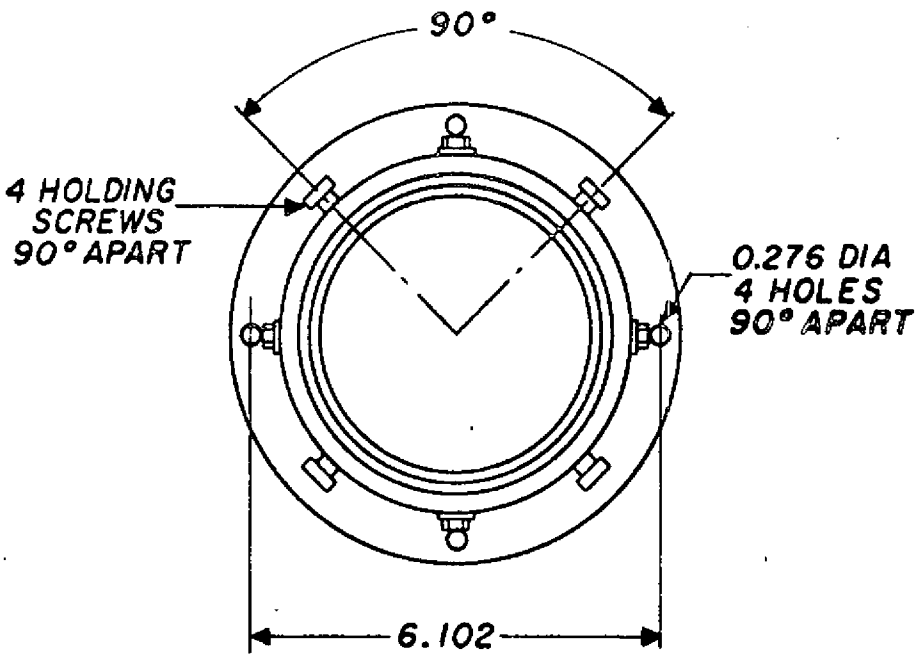
INTERMITTENT SERVICE CHARACTERISTICS

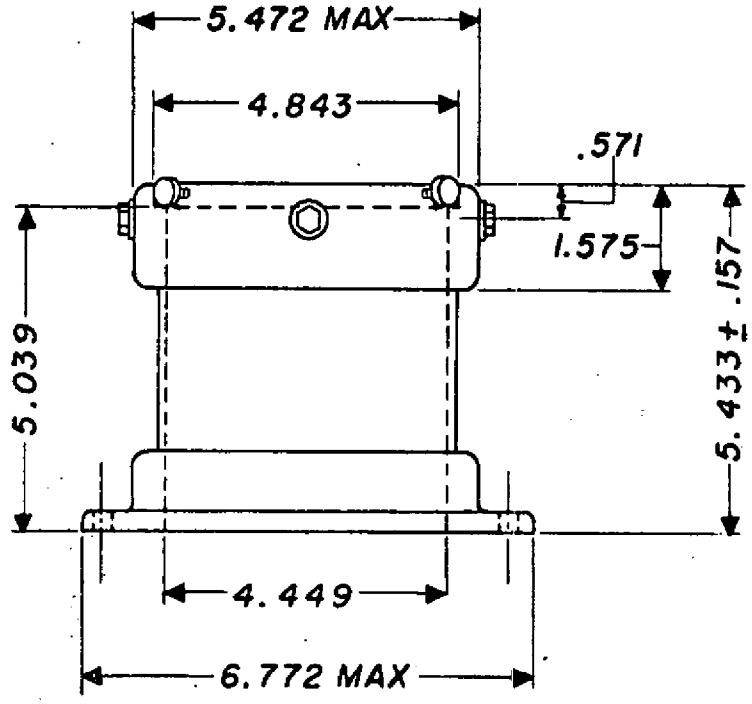
ALTITUDE (FEET)	AIR INLET TEMPERATURE (°C)	AIR FLOW (CFM)
SEA LEVEL	35	325
SEA LEVEL	45	375
5,000	35	395
10,000	25	415



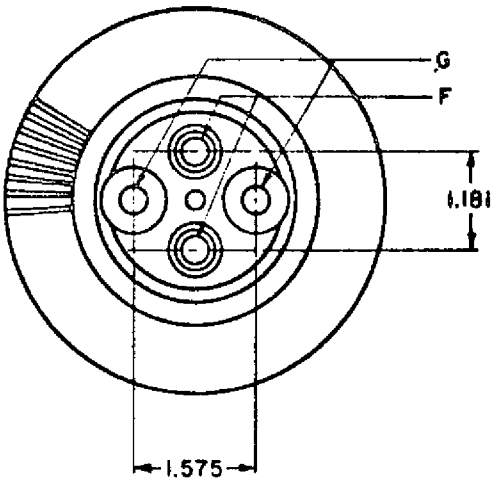


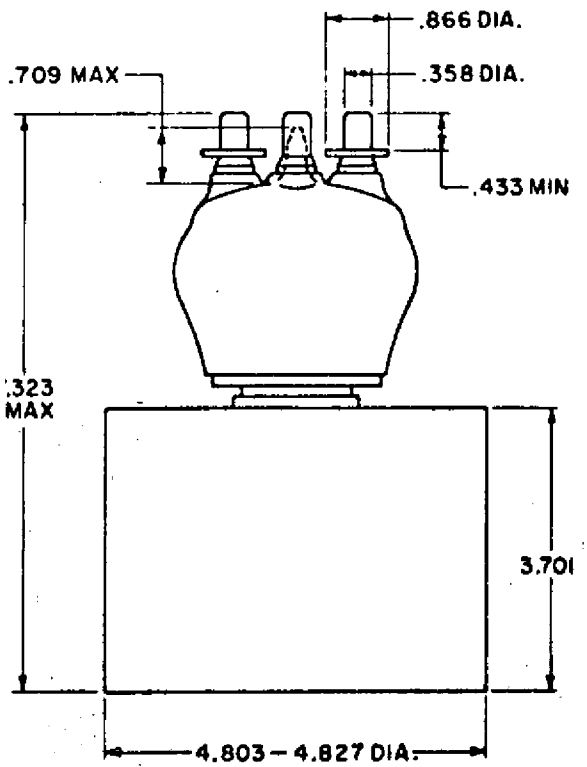
CONSTANT CURRENT CHARACTERISTICS





AIR FLOW CHAMBER
S—3705


G
F
1.181
1.575


.866 DIA.
.709 MAX
.358 DIA.
.433 MIN
.323
MAX
3.701
4.803 – 4.827 DIA.

from JEDEC release #3910, Oct. 1, 1962

AMPEREX TUBE TYPE 8270

same as ZT 1000

TENTATIVE DATA

The Amperex 8270 is a grid controlled mercury vapor half wave rectifier. It has a maximum PIV of 21 kv at an average anode current of 2.5 amps. At a PIV below 15 kv the anode current may rise to 3 amps. Six of these tubes in a three phase full wave circuit provide 12 kv at 9 amps.

MECHANICAL

Mounting Position	vertical, base down
Base	Super Jumbo, 4 pins, with bayonet
Accessories	
Socket	S-31747
Anode Connector	S-31748
Anode Cap (Supplied with the Tube)	S-31749 [1]
Dimensions	See outline drawing
Weight	
Net Weight	1 lb. 1 oz.
Shipping Weight	5 lbs. 1 oz.

ELECTRICAL

Filament	Oxide-Coated
Heating	Direct
Filament Voltage [2]	5 volts
Filament Current	13.0 amps
Filament Warm-Up Time, Minimum [3]	90 sec
Capacitances	
Anode to Grid	4 pf
Grid to Cathode	13 pf
Typical Characteristics	
Ionization Time	10 μsec max
Deionization Time	500 μsec max
Tube Voltage Drop (I_b = 3 amps)	12 volts

---

[1] This cap must always be mounted on the tube, also during preheating.

[2] A phase shift of 90° ± 30° between E_b and E_f and/or use of a center-tapped filament transformer is recommended.

[3] For average conditions, i.e. temperature within limits and proper distribution of mercury, See Table I.
After transport, a storage period, and also after a long interruption of operation a longer warm-up time is required before anode voltage may be applied. In general a time of 60 minutes will be sufficient to ensure proper distribution of the mercury.

8270

MAXIMUM RATINGS, ABSOLUTE VALUES

Frequency	150	150	150 cps
Peak Anode Voltage			
Inverse	21	15	2.5 kv
Forward	21	15	2.5 kv
Anode Current			
Average	2.5	3	5 amps [4]
Peak	10	12	20 amps
Surge	100	120	200 amps [5]
Grid Bias	300	300	300 volts [6]
Grid Resistance	100	100	100 k ohms max [7]
Grid Resistance	10	10	10 k ohms min [7]

TABLE I

Peak Inverse Voltage	21	15	10	2.5	kv
Temperature of Condensed Mercury [8]	25-45	25-55	25-60	27-75	°C
Ambient Temperature [9, 10]	15-30	15-35	15-40	15-55	°C

TYPICAL OPERATION [11]

Grid Voltage (E_b peak inverse 21 kv)	E_{c1}	− 100 volts
(E_b peak inverse 10 kv)	E_{c1}	− 50 volts
Grid Current	I_{c1}	2 ma

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[4] Averaging time T_{av} = max. 30 sec.

[5] Max duration 0.1 sec.

[6] Direct voltage, before conduction.

[7] Recommended value: 33 k ohms

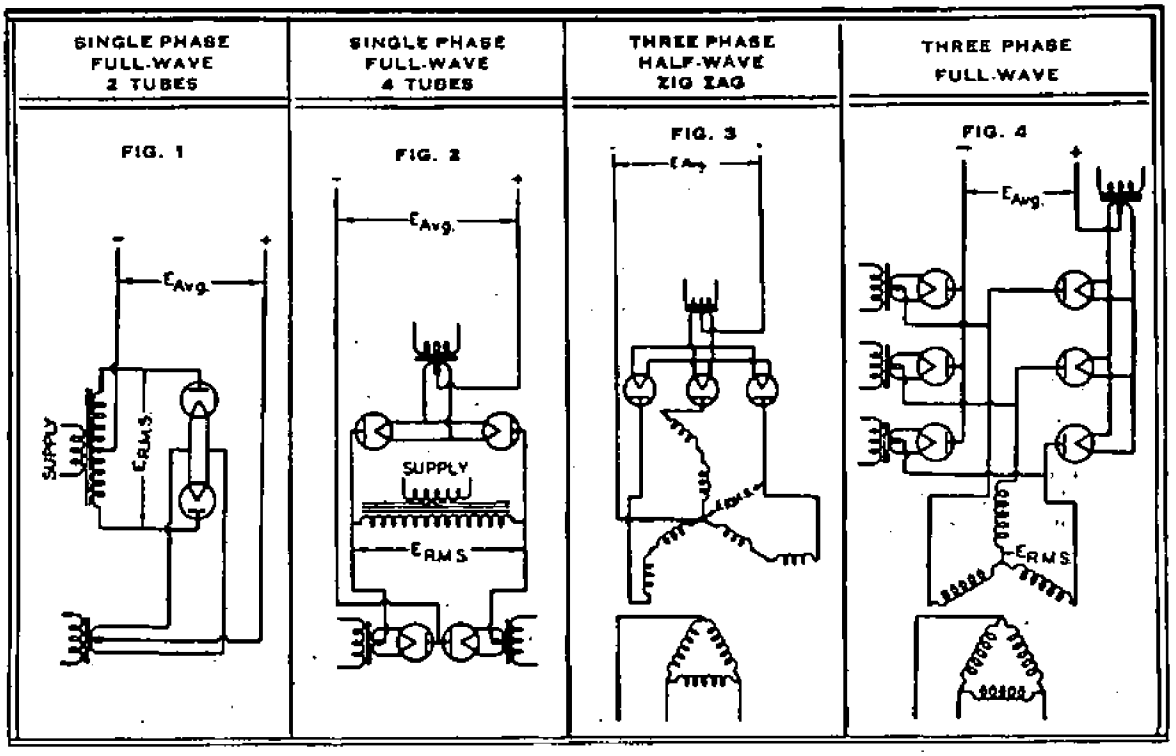
[8] If the equipment is started not more than twice daily, it is permissible to apply high voltage at a condensed-mercury temperature which is 5°C lower than the values mentioned in the table.

[9] With natural cooling, approximate values.

[10] The ambient temperature is defined as the temperature of the surrounding air and should be measured under the following conditions:

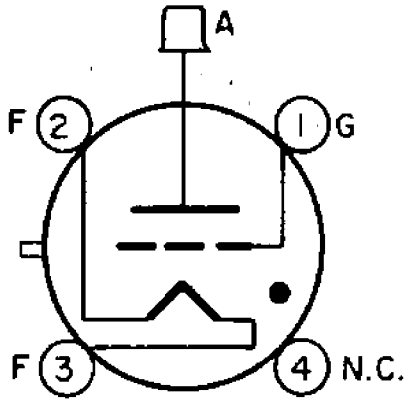
a. Normal atmospheric pressure
b. The tube should be adjusted to the worst possible operating conditions.
c. The temperature should be measured when thermal equilibrium is reached.
d. The distance from the thermometer to the outside of the envelope should be 3 inches (measured in a plane perpendicular to the main axis of the tube at the height of the condensed-mercury boundary).
e. The thermometer should be shielded against direct heat radiation.

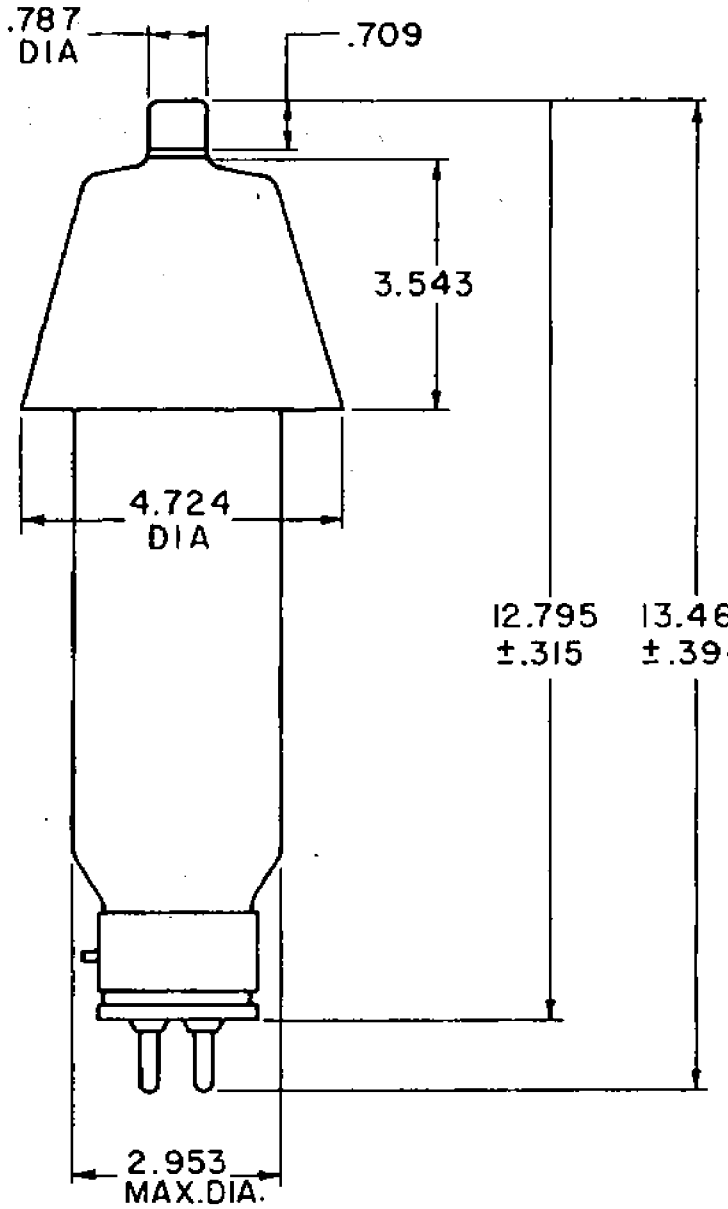
[11] Transformer losses and voltage drops in tubes are neglected.



Peak Inverse Voltage = 21 KV				
	FIG. 1	FIG. 2	FIG. 3	FIG. 4
Transformer secondary Voltage kv. r.m.s.	7.4	14.8	8.5	14.8
Output Voltage kv	6.7	13.4	10	20
Output Current Amps	5	5	7.5	7.5
Output Power kw	33.5	67	75	150
Peak Inverse Voltage = 15 KV				
Transformer Secondary Voltage kv r.m.s.	5.3	10.6	6.1	10.6
Output Voltage kv	4.8	9.6	7.2	14.4
Output Current Amps	6	6	9	9
Output Power kw	28.8	57.6	64.8	130

8270

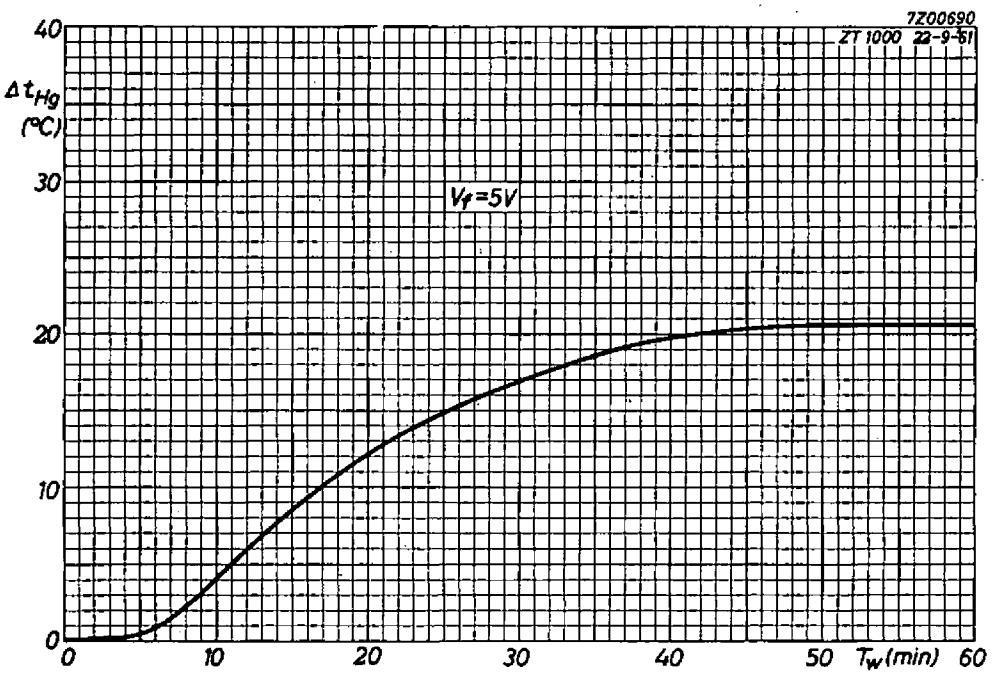




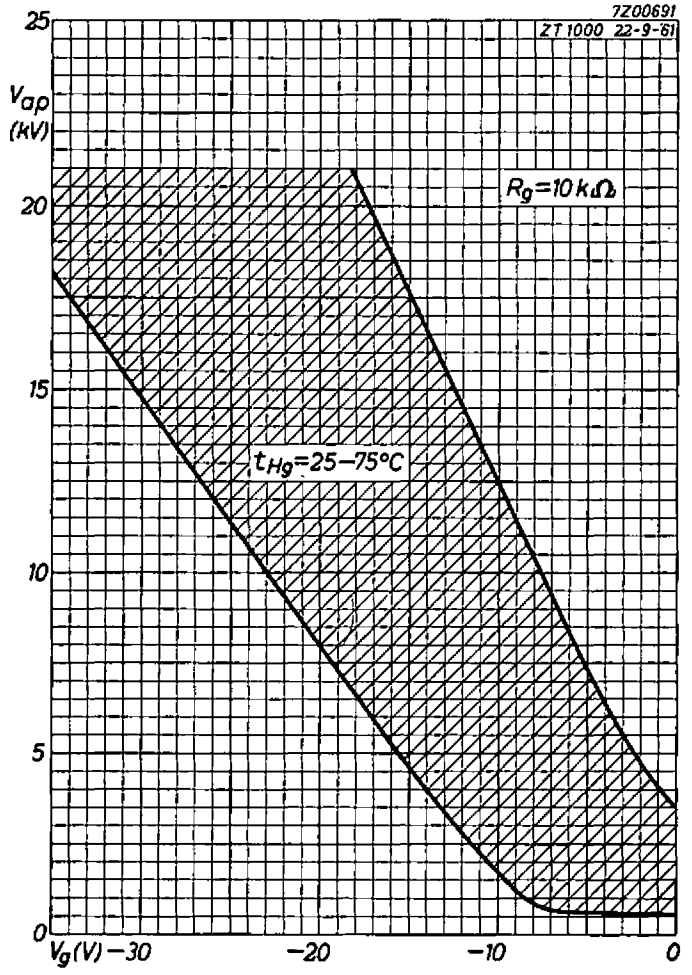
PIN CONNECTIONS

1. GRID
2. FILAMENT
3. FILAMENT
4. NO CONNECTION

CAP – ANODE



Rate of rise of condensed-mercury temperature

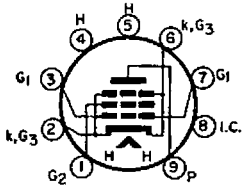


Control characteristics

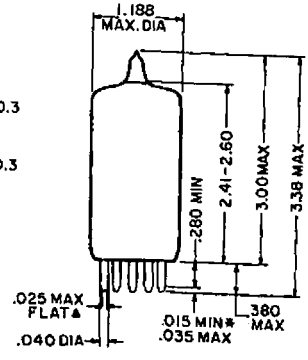
from JEDEC release #4345, July 15, 1963

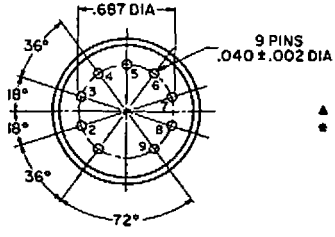
AMPEREX TUBE TYPE 8278

The Amperex 8278 is a novar beam power tetrode designed for 40 watt push-pull audio output with only a 250 volt supply. The very high transconductance of 24,000 micromhos, exceptional uniformity and reliability of this tube are attained through the use of the Amperex ampliframe grid.



PIN CONNECTION
1. GRID NO.2
2. CATHODE, GRID NO.3
3. GRID NO.1
4. HEATER
5. HEATER
6. CATHODE, GRID NO.3
7. GRID NO.1
8. INTERNAL CONNECTION
9. PLATE





▲ NOT TO BE BROUGHT TO A SHARP POINT.
* THIS DIMENSION MAY VARY WITHIN THE LIMITS SHOWN AROUND THE PERIPHERY OF ANY INDIVIDUAL PIN. THE SURFACE OF THE PIN SHALL BE CONVEX OR CONICAL IN SHAPE AND NOT BROUGHT TO A SHARP POINT.

GENERAL CHARACTERISTICS

MECHANICAL		
Bulb		See Outline drawing
Base		Novar
Outline		See Outline drawing
Dimensions		See Outline drawing
ELECTRICAL		
Heating		Indirect AC-DC parallel supply
Heater Voltage		6.3 volts
Heater Current		1.2 amps
MAXIMUM RATINGS (Design Center Values)		
D.C. Plate Voltage (Zero Plate Current)	E_{bb}	550 volts
Screen Grid Voltage (Cold Condition)		550 volts
D.C. Plate Voltage	E_b	300 volts
D.C. Grid No. 2 Voltage	E_{c2}	300 volts
Cathode Current	I_k	200 ma
Plate Dissipation	P_b	25 watts
Grid No. 2 Power Dissipation	P_{c2}	4 watts
Control Grid Circuit Resistance (Automatic Bias)	R_{c1}	0.5 megohm
Cathode-Heater Voltage	E_{kh}	±100 volts

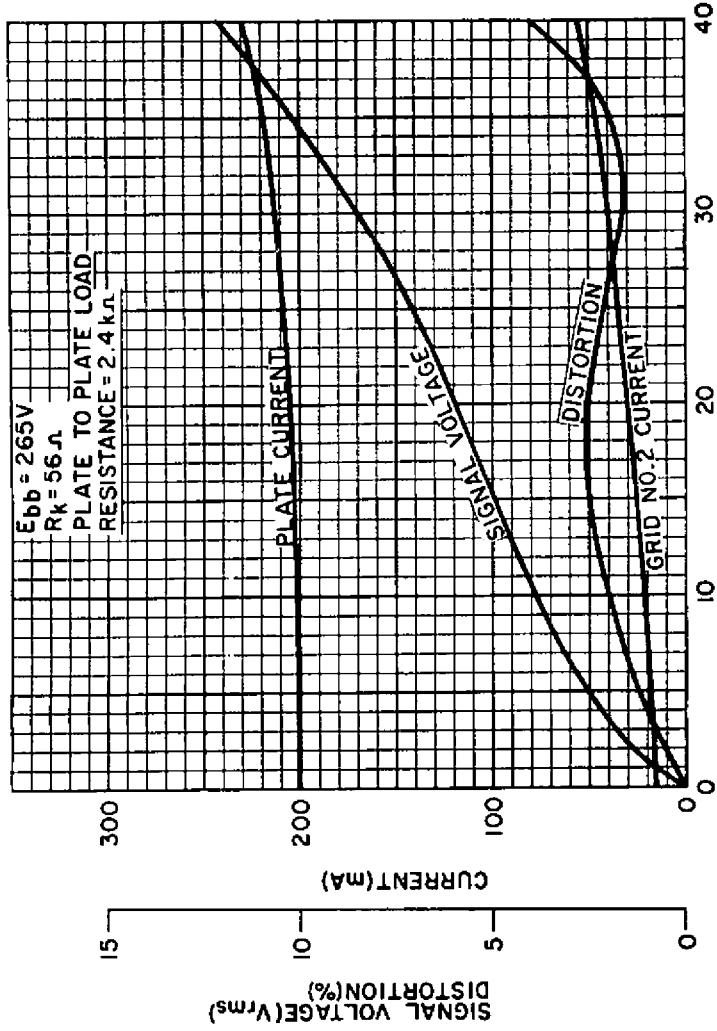
8278

Typical Characteristics

D.C. Plate Current	E_b	250 volts
D.C. Grid No. 2 Voltage	E_{c2}	250 volts
D.C. Grid No. 1 Voltage	E_{c1}	−12.5 volts
Plate Current	I_b	100 ma
D.C. Grid No. 2 Current	I_{c2}	8 ma
Transconductance	G_m	24000 μmhos
Amplification Factor, Grid No. 2 to Grid No. 1	μ_{c2c1}	14
Internal Plate Resistance	r_p	7300 ohms

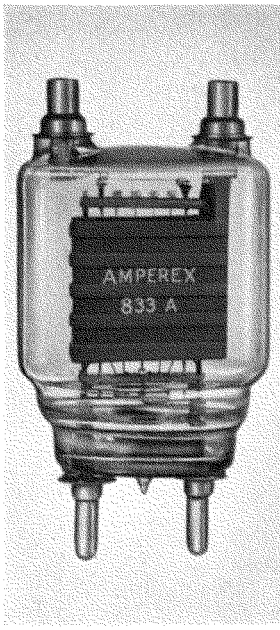
Typical Operating Conditions - Push-Pull Class AB

D.C. Plate Supply Voltage	E_{bb}	265	265 volts
D.C. Grid No. 2 Supply Voltage	E_{cc2}	265	265 volts
Series Cathode Resistor (Common)	R_K	56	56 ohms
Plate to Plate Load Resistance	R_{p-p}	2400	2400 ohms
Plate Current	I_b	2x100	2x115 ma
D.C. Grid No. 2 Current	I_{c2}	2x8	2x27 ma
Signal Voltage	E_{sig}	0	12 volts rms
Harmonic Distortion	D_t	-	4 %
Power Output	P_o	0	40 watts



TYPICAL CHARACTERISTICS AS A FUNCTION OF POWER OUTPUT

R.F. Power Amplifier, Oscillator, A.F. Power Amplifier, or Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Convection Cooling	Forced-Air Cooling**	
	CCS	CCS	ICAS
D.C. Plate Volts	3000	4000	4000
D.C. Plate Current, Max.-Sig. (ma.)*	500	500	500
Plate Input, Max.-Sig. (watts)*	1125	1600	1800
Plate Dissipation (watts)*	300	400	450
Typical Operation: Unless otherwise specified, values are for 2 tubes.			
D.C. Plate Voltage	3000	4000	4000
D.C. Plate Current, Zero-Sig. (ma.)	100	100	100
D.C. Plate Current, Max.-Sig. (ma.)	750	800	900
D.C. Grid Voltage†	—70	—100	—100
Grid-to-Grid Voltage, Peak A.F.	400	480	510
Load Resis. (ohms) (per tube)	2375	3000	2750
Effec. Load Resis. (ohms) (Plate to Plate)	9500	12000	11000
Max.-Sig. Drive Power (watts)	20	29	38
Max.-Sig. Power Out. (watts)	1650	2400	2700

R.F. Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

	Convection Cooling	Forced-Air Cooling**	
	CCS	CCS	ICAS
D.C. Plate Voltage	3000	4000	4000
D.C. Plate Current (ma.)	300	300	300
Plate Input (watts)	450	600	675
Plate Dissipation (watts)	300	400	450
Plate Volts and Input Max. % for 20MC	100%	100%	100%
Plate Volts and Input Max. % for 30MC	100%	..	..
Plate Volts and Input Max. % for 50MC	98%	97%	97%
Plate Volts and Input Max. % for 75MC	94%	93%	93%
Typical Operation:			
D.C. Plate Voltage	3000	4000	4000
D.C. Plate Current (ma.)	150	150	150
D.C. Grid Voltage†	—70	—120	—120
Grid Voltage, Peak R.F.	90	120	130
D.C. Grid Current (ma.)	2	2	3
Driving Power (watts)§	10	14	21
Power Output (watts)	150	225	250

Plate Modulated R.F. Power Amplifier Class C

Carrier conditions per tube for use with a maximum modulation factor of 1.0

	Convection Cooling	Forced-Air Cooling	
	CCS	CCS	ICAS
D.C. Plate Voltage	2500	3000	4000
D.C. Plate Current (ma.)	400	450	450
Plate Input (watts)	835	1250	1800
Plate Dissipation (watts)	200	270	350

GENERAL CHARACTERISTICS

Filament Voltage	10
Filament Current (amps)	10
Amplification Factor	35
Direct Interelectrode Capacitances:	
Grid to Plate	6.3 $\mu\mu$f
Grid to Filament	12.3 $\mu\mu$f
Plate to Filament	8.5 $\mu\mu$f

(Continued from Previous Column)

Plate Volts and Input Max. % for 20MC	100%	100%	100%
Plate Volts and Input Max. % for 30MC	100%	..	..
Plate Volts and Input Max. % for 50MC	90%	83%	83%
Plate Volts and Input Max. % for 75MC	72%	65%	65%
D.C. Grid Voltage	—500	—500	—500
D.C. Grid Current (ma.)	75	100	100
Typical Operation:			
D.C. Plate Voltage	2500	3000	4000
D.C. Plate Current (ma.)	335	415	450
D.C. Grid Voltage (fixed)	—300	—300	—325
From Grid Resistor (ohms)	4000	3600	3600
Grid Voltage, Peak R.F.	460	490	520
D.C. Grid Current (ma.)	75	85	90
Driving Power (watts)	30	37	42
Power Output (watts)	635	1000	1500

R.F. Power Amplifier and Oscillator—Class C

Key-down conditions per tube without modulation‡

	Convection Cooling	Forced-Air Cooling	
	CCS	CCS	ICAS
D.C. Plate Voltage	3000	4000	4000
D.C. Plate Current (ma.)	500	500	500
Plate Input (watts)	1250	1800	2000
Plate Dissipation (watts)	300	400	450
Plate Volts and Input Max. % for 20MC	100%	100%	100%
Plate Volts and Input Max. % for 30MC	100%	..	..
Plate Volts and Input Max. % for 50MC	90%	83%	83%
Plate Volts and Input Max. % for 75MC	72%	65%	65%
D.C. Grid Voltage	—500	—500	—500
D.C. Grid Current (ma.)	75	100	100
Typical Operation:			
D.C. Plate Voltage	3000	4000	4000
D.C. Plate Current (ma.)	415	450	500
D.C. Grid Voltage (fixed)	—200	—200	—225
From Grid Resis. (ohms)	3500	2650	2400
From Cathode Resis. (ohms)	425	380	380
Grid Voltage, Peak R.F.	360	375	415
D.C. Grid Current (ma.)	55	75	95
Driving Power (watts)	20	26	35
Power Output (watts)	1000	1440	1600

*Averaged over any A.F. cycle of sine-wave form.

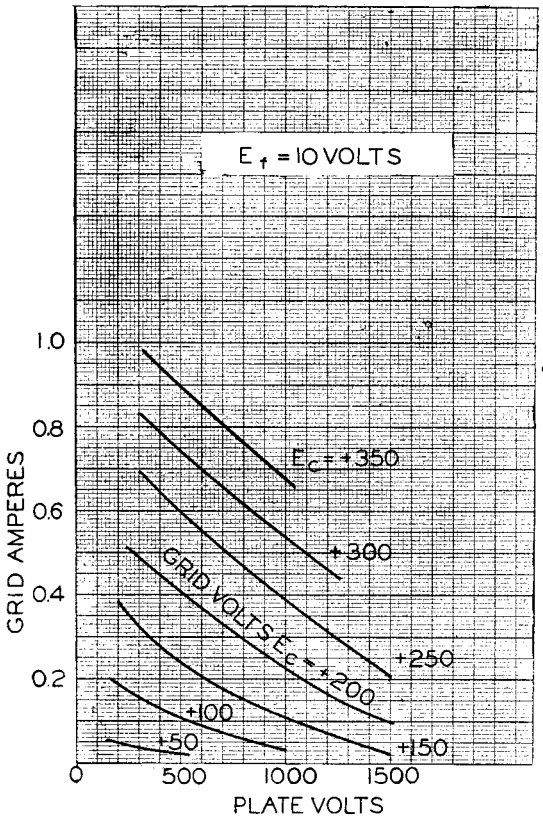
**An air flow of 40 cubic feet per minute is required and above temperature must not exceed 145°C.

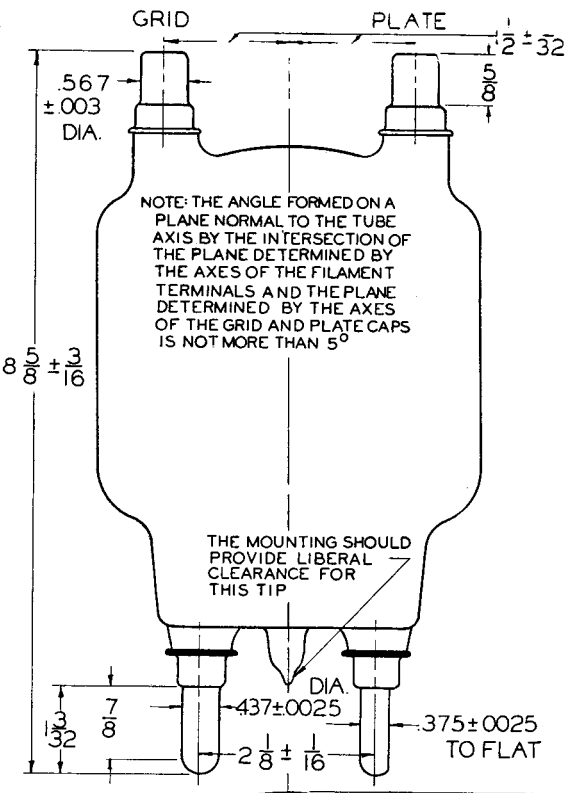
†Grid voltages are given with respect to the midpoint of filament operated on A-C. If D-C is used, each stated value of grid voltage should be decreased by 7 volts and the circuit returns connected to the negative end of the filament.

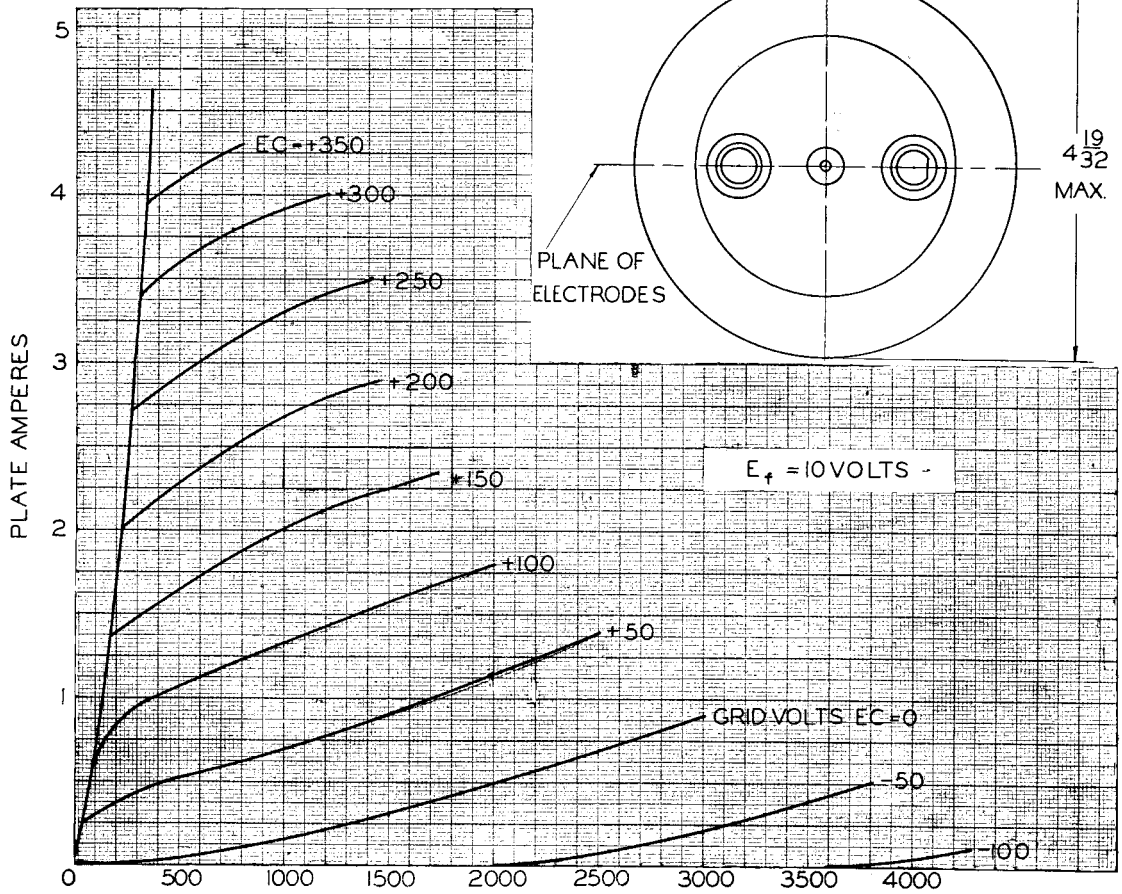
‡Modulation essentially negative may be used if the positive peak of the A.F. envelope does not exceed 115% of the carrier.

§At crest of A.F. cycle with modulation factor of 1.0.

833-A — AMPEREX TRANSMITTING TUBE







Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8348

The Amperex 8348 is an instant heating push-pull tetrode incorporating the Amperex "Harp Cathode". The 8348 is designed for intermittent or continuous filament service in transistorized mobile equipment for output stages, or as a multiplier or modulator. The tube is internally neutralized for frequencies up to 200 Mc.

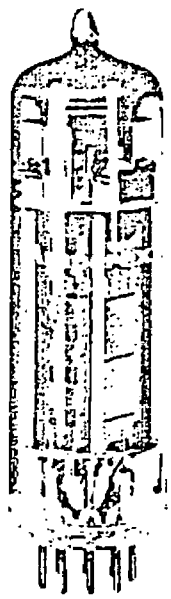
GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical[1]
Dimensions	See outline drawing
Base	Noval E 9-1
Bulb	T 6-1/2
Maximum Bulb Temperature	225°C
Maximum Pin Temperature	120°C
Cooling	Radiation and Convection[2]
Net Weight	0.56 ounces

ELECTRICAL

Heating	Direct, parallel supply
Filament Voltage	1.6 ± 15% volts[3]
Filament Current	2.5 amps
Warm-up Time (power output ≥ 70% max.)	0.5 sec.
Direct Interelectrode Capacitances	
Plate to Grid No. 1 (each section	0.1 pf
Output (each section)	3.2 pf
Input (each section)	8.5 pf
Plate (Section 1) to Grid No. 1 (Section 2)	0.1 pf
Plate (Section 2) to Grid No. 1 (Section 1)	0.1 pf
Grid No. 1 (Section 1) to Grid No. 1 (Section 2)	2.4 pf
Plate (Section 1) to Plate (Section 2)	0.075 pf
Amplification Factor (Grid No. 1, Grid No. 2) at I_b = 30 ma	7.5
Transconductance at I_b = 30 ma	3300 μmhos



[1] If tube is mounted with main axis deviating from the vertical, pins 2 and 7 should be placed in a vertical plane.
[2] Use of a closed tube shield is not recommended.
[3] The filament supply may be DC or 60 to 60 cps AC (sinusoidal or square wave). Sinusoidal supply voltages within the frequency range of 200 to 2000 cps should not be used.

Amperex

from JEDEC release #4541, Dec. 23, 1963

Maximum Ratings (Two Units, Push-Pull)
Class C Telegraphy

	CCS	ICAS	
Frequency	200	200	Mc
Plate Voltage	300	300	volts
Grid No. 2 Voltage	200	200	volts
Grid No. 1 Voltage	-150	-150	volts
Plate Current	2x45	2x55	ma
Grid No. 1 Current	2x3	2x4	ma
Plate Input Power	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
Cathode Current	2x50	2x65	ma
Peak Cathode Current	2x225	2x300	ma
Grid No. 1 Resistor	100	100	k ohms

Maximum Ratings (Two Units, Push-Pull)
Class C Tripler

	CCS	ICAS	
Frequency	200	200	Mc
Plate Voltage	300	300	volts
Grid No. 2 Voltage	200	200	volts
Grid No. 1 Voltage	-150	-150	volts
Plate Current	2x30	2x42	ma
Grid No. 1 Current	2x2	2x3	ma
Plate Input Power	2x7.5	2x10	watts
Plate Dissipation	2x5	2x7	watts
Grid No. 2 Dissipation	2	2	watts
Grid No. 1 Dissipation	2x0.2	2x0.2	watts
Cathode Current	2x35	2x45	ma
Peak Cathode Current	2x225	2x300	ma
Grid No. 1 Resistor	100	100	k ohms

Typical Operation
HF Class C Telegraphy or FM Telephony
Two Systems in Push-Pull
(For Frequencies up to 200 Mc)

	CCS	CCS	CCS	ICAS	
DC Plate Voltage (each section)	300	250	200	300	volts
DC Grid No. 2 Voltage	300	250	200	200	volts
Grid No. 2 Resistor	56	47	22	--	k ohms
Grid No. 1 Bias	-40	--	--	-45	volts
Grid No. 1 Resistor (common)	--	18	15	--	k ohms
Grid No. 1 to Grid No. 1 Driving Voltage	110	110	115	130	volts
Plate Current	2x37.5	2x33.5	2x35	2x50	ma
Grid No. 2 Current	2.3	1.8	2.2	5.5	ma
Grid No. 1 Current	2x0.9	2.2	2.7	3.0	ma
Plate Input Power	2x11.25	2x8.4	2x7.0	2x15.0	watts
Plate Dissipation (each section)	4	2.9	2.8	6.0	watts
Grid No. 2 Dissipation	0.4	0.8	0.88	0.6	watts
Output Power to Load	12	9.0	7.4	17.0	watts
Efficiency	65	65	60	62	%

Typical Operation
HF Class C Frequency Tripler
Two Systems in Push-Pull
(Frequencies up to 67/200 Mc)

	CCS	CCS	CCS	ICAS	
DC Plate Voltage (each section)	300	250	200	300	volts
DC Grid No. 2 Voltage	300	250	250	150	volts
Grid No. 2 Resistor	72	47	15	--	k ohms
Grid No. 1 Bias	-100	--	--	-100	volts
Grid No. 1 Resistor (common)	--	47	33	--	k ohms
Grid No. 1 to Grid No. 1 Driving Voltage	230	230	230	240	volts
Plate Current (each section)	24	25	28.5	32.5	ma
Grid No. 2 Current	2	1.9	3	3.5	ma
Grid No. 1 Current	2x1	2	3.2	2x1.9	ma
Plate Input Power	2x7.2	2x6.25	2x5.7	2x9.75	watts
Plate Dissipation (each section)	4	3.75	3.8	1.95	watts
Grid No. 2 Dissipation	0.3	0.31	0.46	0.53	watts
Output Power to Load	3.5	3.0	2.8	7.8	watts
Efficiency	45	40	33.5	40	%

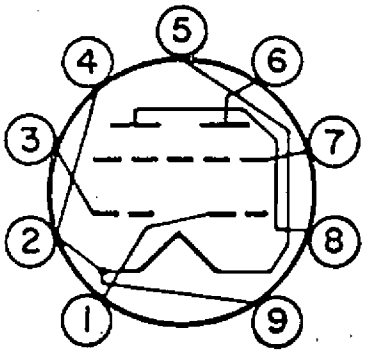
Maximum Ratings and Typical Operating Conditions
HF Class C (Plate and Screen Grid Modulation)
Two Systems in Push-Pull

Maximum Ratings

Frequency	200	Mc
Plate Voltage	240	volts
Plate Dissipation	2x3.3	watts
Plate Input Power	2x7.5	watts
Plate Current	2x37.5	ma
DC Grid No. 2 Voltage	200	volts
Grid No. 2 Dissipation	1.3	watts
Negative Grid No. 1 Voltage	150	volts
Grid No. 1 Dissipation	2x0.2	watts
Grid No. 1 Current	2x3	ma
Cathode Current	2x40	ma
Peak Cathode Current	2x180	ma

Typical Operating Conditions

Frequency	200	Mc
Plate Voltage	200	volts
Grid No. 2 Voltage	See Figure 1	
Grid No. 1 Resistor (common)	33	k ohms
Plate Current	2x33.5	ma
Grid No. 2 Current	2.6	ma
Grid No. 1 Current	1.5	ma
Plate Input Power	2x6.7	watts
Plate Dissipation	2x2.65	watts
Grid No. 2 Dissipation	0.46	watts
Driver Power Output	1.0	watts
Output Power	8.0	watts
Efficiency	60	%
Output Power to Load	7.0	watts
Modulation Factor	100	%
Modulation Power	6.7	watts

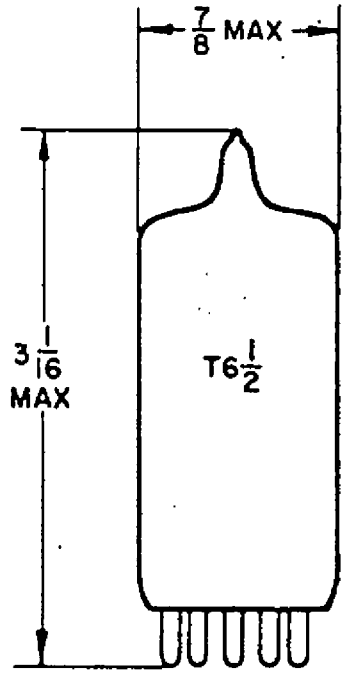


9QN

E9-1 BASE

PIN CONNECTIONS

1. GRID 1, UNIT 1
2. INTERNAL SHIELD, FILAMENT 1
3. GRID 1, UNIT 2
4. FILAMENT 1
5. FILAMENT
6. PLATE, UNIT 1
7. GRID 2, UNIT 1 & UNIT 2
8. PLATE, UNIT 2
9. FILAMENT 1



6-4

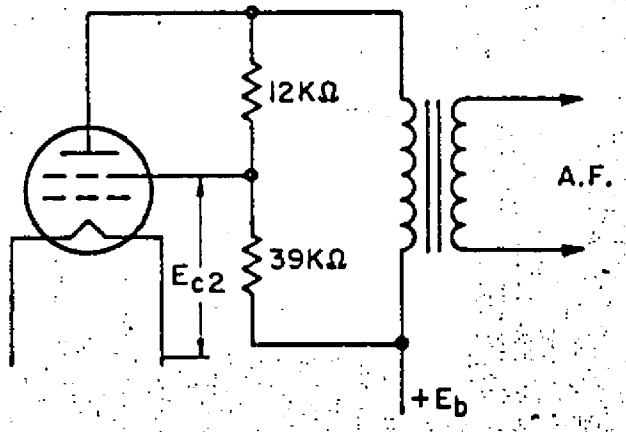
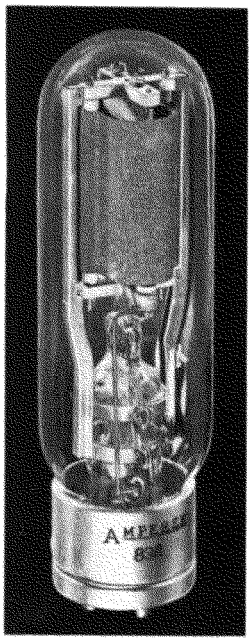


Figure 1.

Class B A.F. Power Amplifier and Modulator, R.F. Power Amplifier, Oscillator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	0	0
Load Resistance (ohms per tube)	—	1725	2250
Effective Load Resistance (Plate to Plate) (ohms)	—	6900	9000
Zero Signal Plate Current (ma.)	—	106	148
Peak A.F. Grid to Grid Voltage	—	200	200
Max. Signal D.C. Plate Current (ma.)	175	320	320
Max. Signal Plate Input (watts)	220	320	400
Plate Dissipation (watts)	100	—	—
Max. Signal Driving Power (Approx.) (watts)	—	6.5	7.0
Max. Signal Plate Power Output (watts)	—	216	280

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—	0	—14
Peak R.F. Grid Voltage	—	65	67
D.C. Plate Current (ma.)	150	130	106
Plate Input (watts)	—	130	132
Plate Dissipation (watts)	100	88	87
D.C. Grid Current (Approx.) (ma.)	—	11	8
Driving Power at Peak Modulation (Approx.) (watts)	—	4.5	4
Plate Power Output (watts)	—	42	45
Frequency Limit for Above Operation (mc.)	30	40	30

GENERAL CHARACTERISTICS

Filament Voltage	10
Filament Current (amps)	3.25
Amplification Factor (Approx.)	50
Grid to Plate Transconductance @ 100 ma.	4800 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	8.0 $\mu\mu f$
Grid to Filament	6.5 $\mu\mu f$
Plate to Filament	3.0 $\mu\mu f$

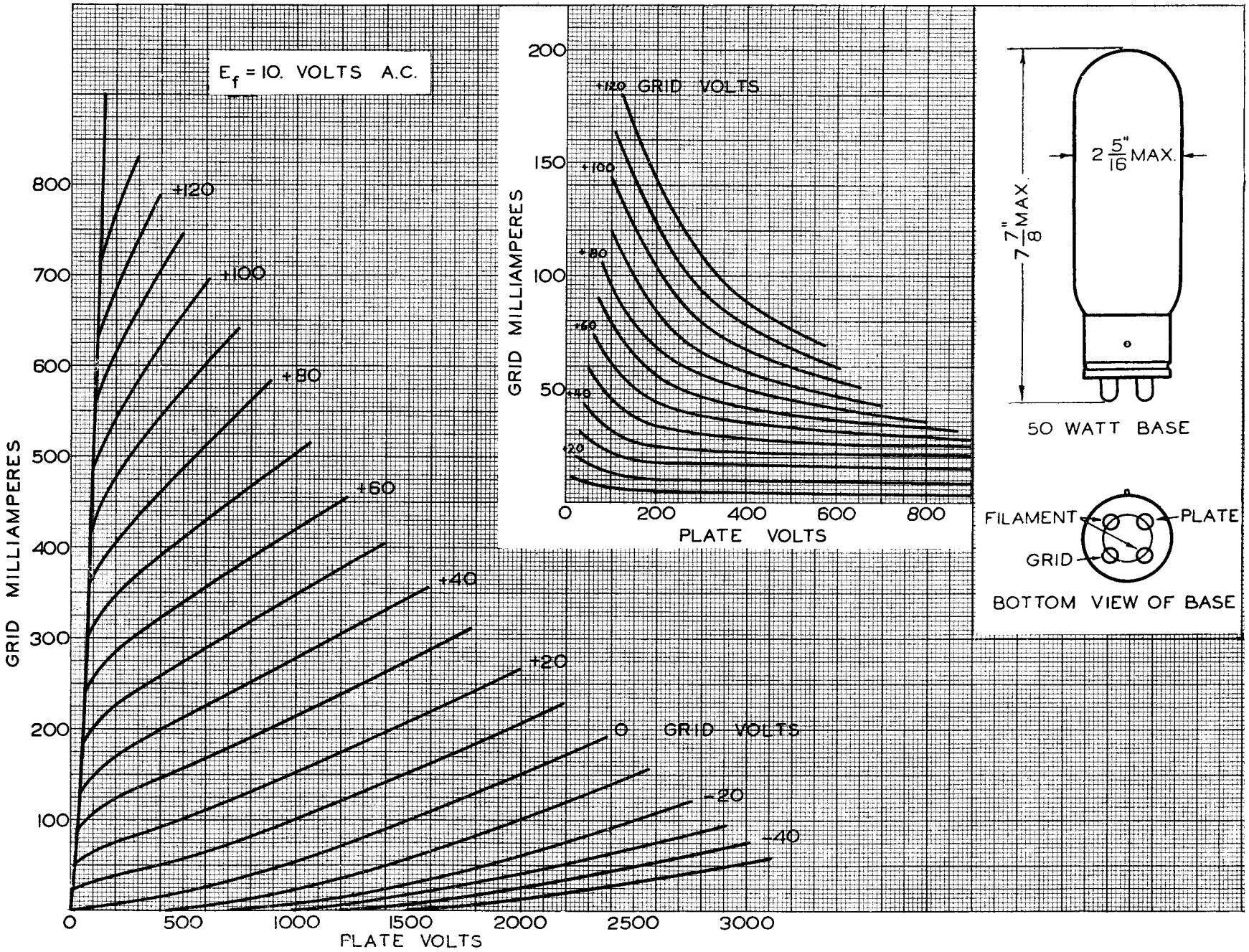
Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1000	750	1000
D.C. Grid Voltage	—400	—100	—135
Peak R.F. Grid Voltage	—	220	255
D.C. Plate Current (ma.)	175	150	150
Plate Input (watts)	175	112	150
Plate Dissipation (watts)	67	42	45
D.C. Grid Current (Approx.) (ma.)	70	30	24
Driving Power (Approx.) (watts)	—	6	6
Plate Power Output (watts)	—	70	105
Frequency Limit for Above Operation (mc.)	30	50	30
F.C.C. Broadcast Rating (watts)	75	—	75

R.F. Power Amplifier or Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—135	—150
Peak R.F. Grid Voltage	—	255	280
D.C. Plate Current (ma.)	175	150	160
Plate Input (watts)	220	150	200
Plate Dissipation (watts)	100	45	50
D.C. Grid Current (Approx.) (ma.)	70	24	26
Driving Power (Approx.) (watts)	—	6	7
Plate Power Output (watts)	—	105	150
Frequency Limit for Above Operation (mc.)	30	50	30


E_f = 10. VOLTS A.C.
GRID MILLIAMPERES
PLATE VOLTS
+120
+100
+80
+60
+40
+20
0 GRID VOLTS
-20
-40
0
500
1000
1500
2000
2500
3000
100
200
300
400
500
600
700
800
+120 GRID VOLTS
+100
+80
+60
+40
+20
50
150
200
400
600
800
$2\frac{5}{16}$ MAX.
$7\frac{7}{8}$ MAX.
50 WATT BASE
FILAMENT
PLATE
GRID
BOTTOM VIEW OF BASE

from JEDEC release #4541, Dec. 23, 1963

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8408

The Amperex 8408 is an instant heating twin tetrode for use as an rf amplifier, frequency multiplier and modulator. The tube is designed for intermittent or continuous filament operation in transistorized mobile or fixed transmitters. The tube is internally neutralized for frequencies up to 500 Mc.

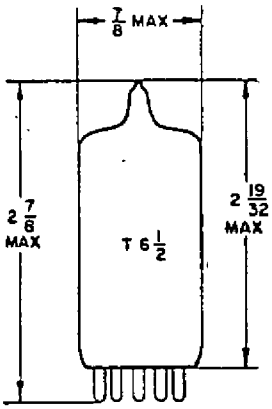
GENERAL CHARACTERISTICS

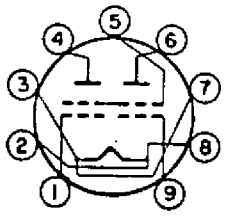
MECHANICAL

Mounting Position[1]	Any
Dimensions	See outline drawing
Filament	Oxide coated
Base	Noval E9-1
Bulb	T 6-1/2
Maximum Bulb Temperature	225°C
Maximum Seal Temperature	120°C
Cooling[2]	Radiation and Convection

ELECTRICAL

Heating	Direct, parallel supply
Filament Voltage	1.1 volts ± 15%[3]
Filament Current	3 amps
Warm-Up Time (Power Output ≥ 70% max)	0.5 second
Amplification Factor at I_b = 40 ma	26
Transconductance (I_b = 40 ma, E_b = E_{g2} = 175V	7000 μmhos





E9-1 BASE
9QV

PIN CONNECTIONS

1. GRID NO. 1, UNIT 2
2. FILAMENT, BEAM SHIELD
3. FILAMENT
4. PLATE, UNIT 2
5. GRID NO. 2, UNIT 1 AND 2
6. PLATE, UNIT 1
7. FILAMENT
8. FILAMENT, BEAM SHIELD
9. GRID NO. 1, UNIT 1



Amperex

1. If the tube is mounted horizontally, it is recommended that pin 2 and 7 be placed in a vertical plane.
2. Use of a closed tube shield is not permitted.
3. The filament supply may be DC or 50 to 60 cps AC (sinusoidal or square wave). Sinusoidal supply voltages within the frequency range of 200 to

RF Power Amplifier and Oscillator
Class C - Telegraphy
(Key down conditions per tube without modulation)
Maximum Ratings, Absolute Values

	CCS	CCS
Frequency	200	500 Mc
DC Plate Voltage	300	200 volts
DC Plate Input Power	2x13.5	2x9.0 watts
Plate Dissipation	2x4	2x4 watts
DC Plate Current	2x45	2x45 ma
DC Grid No. 2 Voltage	200	200 volts
Grid No. 2 Dissipation	2.5	2.5 watts
DC Grid No. 1 Voltage	-150	-100 volts
DC Grid No. 1 Current	2x3	2x3 ma
Grid No. 1 Dissipation	2x0.1	2x0.1 watts
Grid No. 1 Resistor	100	100 k ohms

Typical Operation, Two Units in Push-Pull

	CCS	CCS
Frequency	200	500 Mc
DC Plate Voltage	275	175 volts
Grid No. 2 Resistor	8.2	0.1 k ohms
DC Grid No. 1 Voltage	-25	-18 volts
Grid No. 1 Resistor[3]	10	18 k ohms
Peak Grid No. 1 to Grid No. 1 Voltage	90	75 volts
DC Plate Current	2x40	2x40 ma
DC Grid No. 2 Current	13	12 ma
DC Grid No. 1 Current	2x1.25	2x1.2 ma
DC Plate Input Power	2x11	2x7 watts
Plate Dissipation	2x3.5	2x3 watts
Grid No. 2 Dissipation	2.2	2.1 watts
Driving Power	0.7	1.5 watts
Power Output	15	8 watts
Efficiency	68	57 %
Useful Output Power to Load	13	6 watts

Frequency Tripler
(For Frequencies up to 500 Mc)
Maximum Ratings, Absolute Values

	CCS
DC Plate Voltage	200 volts
Plate Dissipation	2x4 watts
DC Plate Input Power	2x6.0 watts
DC Plate Current	2x35 ma
DC Grid No. 2 Voltage	200 volts
Grid No. 2 Dissipation	2.5 watts
DC Grid No. 1 Voltage	-150 volts
DC Grid No. 1 Current	2x3 ma
Grid No. 1 Resistor	100 k ohms

Typical Operation, Two Units in Push-Pull
(For Frequencies up to 167/500 Mc)

	CCS
DC Plate Voltage	175 volts
Grid No. 2 Resistor	100 ohms
Grid No. 1 Resistor[3,4]	56 k ohms
DC Plate Current	2x30 ma
DC Grid No. 2 Current	9 ma
DC Grid No. 1 Current	2x1.2 ma
DC Plate Input Power	2x5.25 watts
Plate Dissipation	2x3.5 watts
Grid No. 2 Dissipation	1.6 watts
Driving Power	1.5 watts
Power Output	3.5 watts
Efficiency	33 %
Useful Output Power to Load	2.0 watts

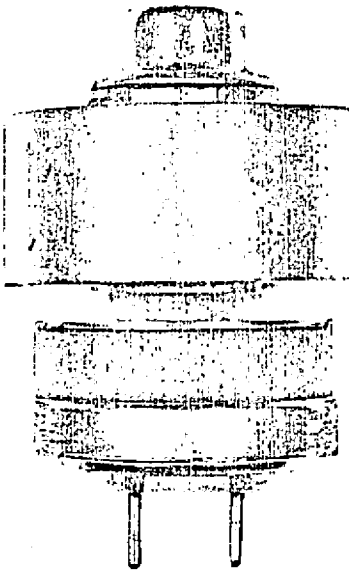
3. Each unit.
4. Fixed bias or a combination of fixed bias and grid current biasing is not recommended.

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

AMPEREX TUBE TYPE 8415

TENTATIVE DATA

The Amperex 8415 is an external anode industrial triode designed for use as an RF oscillator. The anode is capable of dissipating 300 watts. Maximum ratings apply up to 300 megacycles.



GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical, Anode Up or Down
Dimensions	See Outline Drawing
Maximum Operating Temperatures	
Glass to Metal Seal	175°C
Ceramic to Metal Seal	200°C
Anode Core	200°C
Net Weight (approx.)	5 ounces
Required Air Flow at 300 watts Plate Dissipation[1]	10 cfm

ELECTRICAL

Filament	Thoriated Tungsten
Filament Voltage[2]	5 volts
Filament Current	11.5 amps
Amplification Factor I_b = 150 ma, E_b = 2000 volts	28
Peak Cathode Current[3]	1800 ma
Direct Interelectrode Capacitances	
Grid to Plate	5.40 pf
Grid to Filament	5.20 pf
Plate to Filament	0.87 pf

1. Inlet air temperature 25°C maximum.
2. When operating at 300 Mc, the filament voltage should be reduced to 4.8 volts.
3. This figure is the maximum usable cathode current (plate current plus grid current) for any condition of operation.

Amperex

Rev. Nov. 1962 - SG

from JEDEC release #4532, Dec. 16, 1963

INDUSTRIAL OSCILLATOR - CLASS C
GROUNDED GRID OPERATION

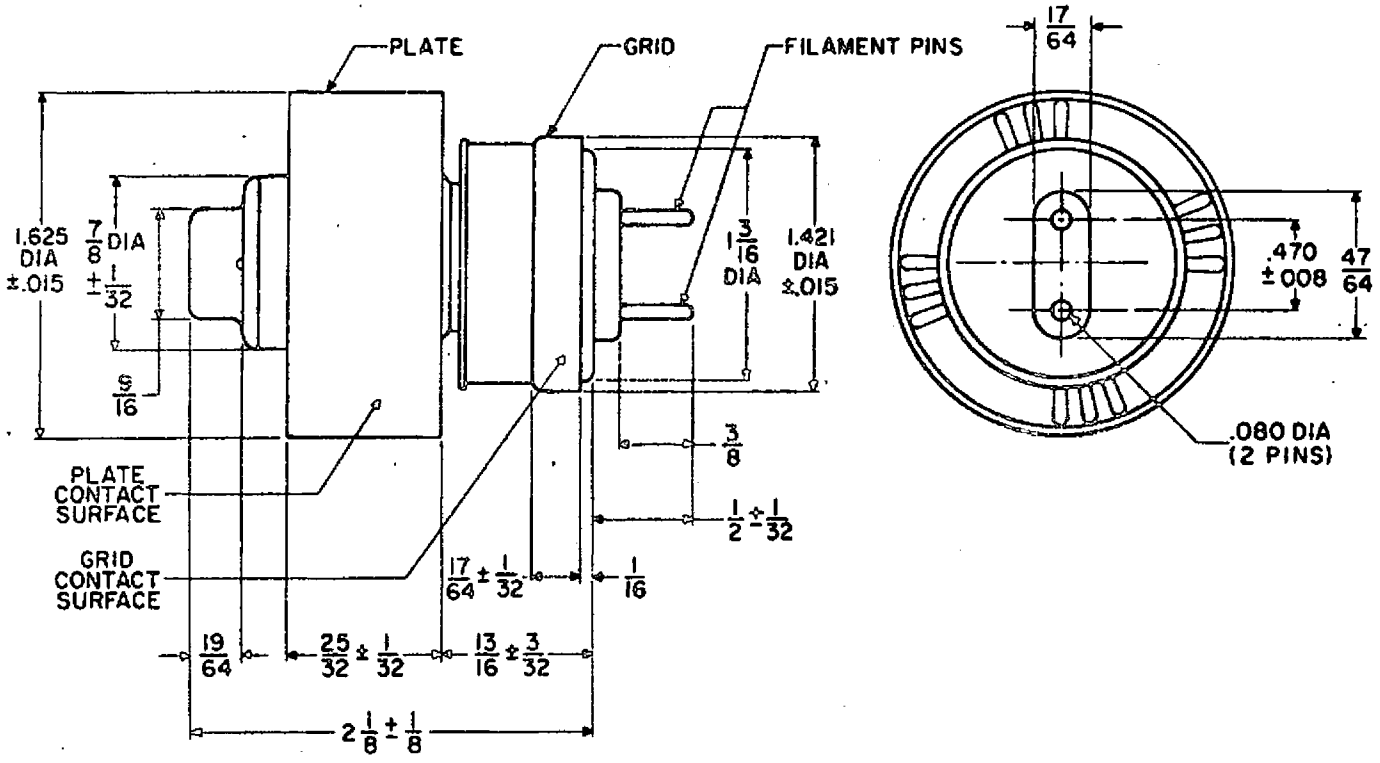
MAXIMUM RATINGS

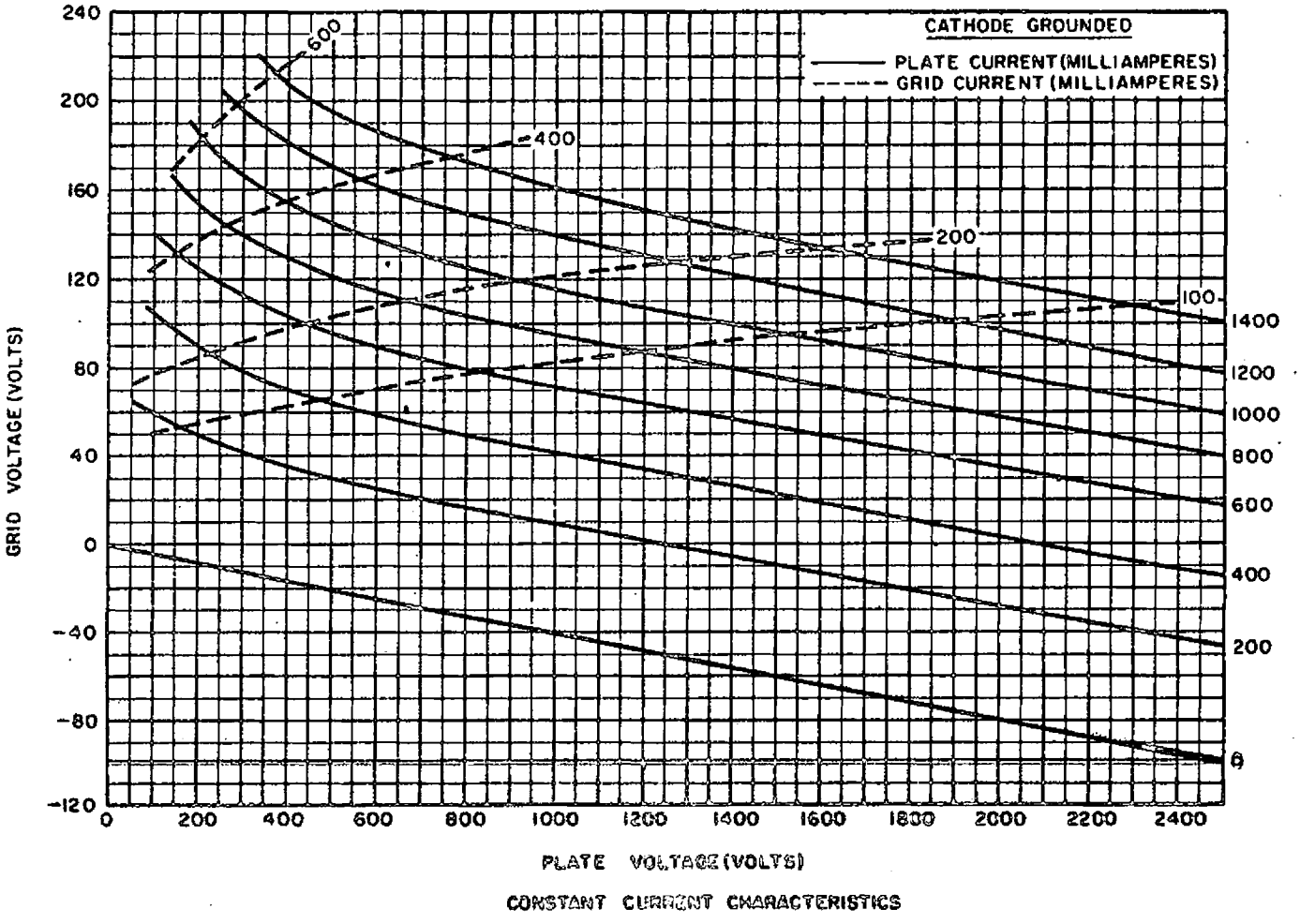
Frequency	300 Mc
DC Plate Voltage	2500 volts
DC Grid Voltage	-250 volts
DC Plate Current	300 ma
DC Grid Current	125 ma
Plate Power Input	750 watts
Plate Dissipation	300 watts
Grid Dissipation	20 watts

TYPICAL OPERATION

Frequency	290	290 Mc
DC Plate Voltage	2000	2250 volts
DC Grid Voltage	-114	-114 volts
Peak RF Grid Voltage	286	285 volts
DC Plate Current (full load)	300	300 ma
DC Plate Current (no load)	174	177 ma
DC Grid Current (full load)	95	95 ma
DC Grid Current (no load)	124	122 ma
Grid Resistor	1200	1200 ohms
Driving Power (approx.)	27	27 watts
Plate Power Input	600	675 watts
Plate Dissipation	250	285 watts
Plate Power Output	350	390 watts
Load Power Output[4]	285	325 watts
Tube Efficiency	58	58 %
Plate Load Impedance	3400	4000 ohms
Feedback Ratio	6	7

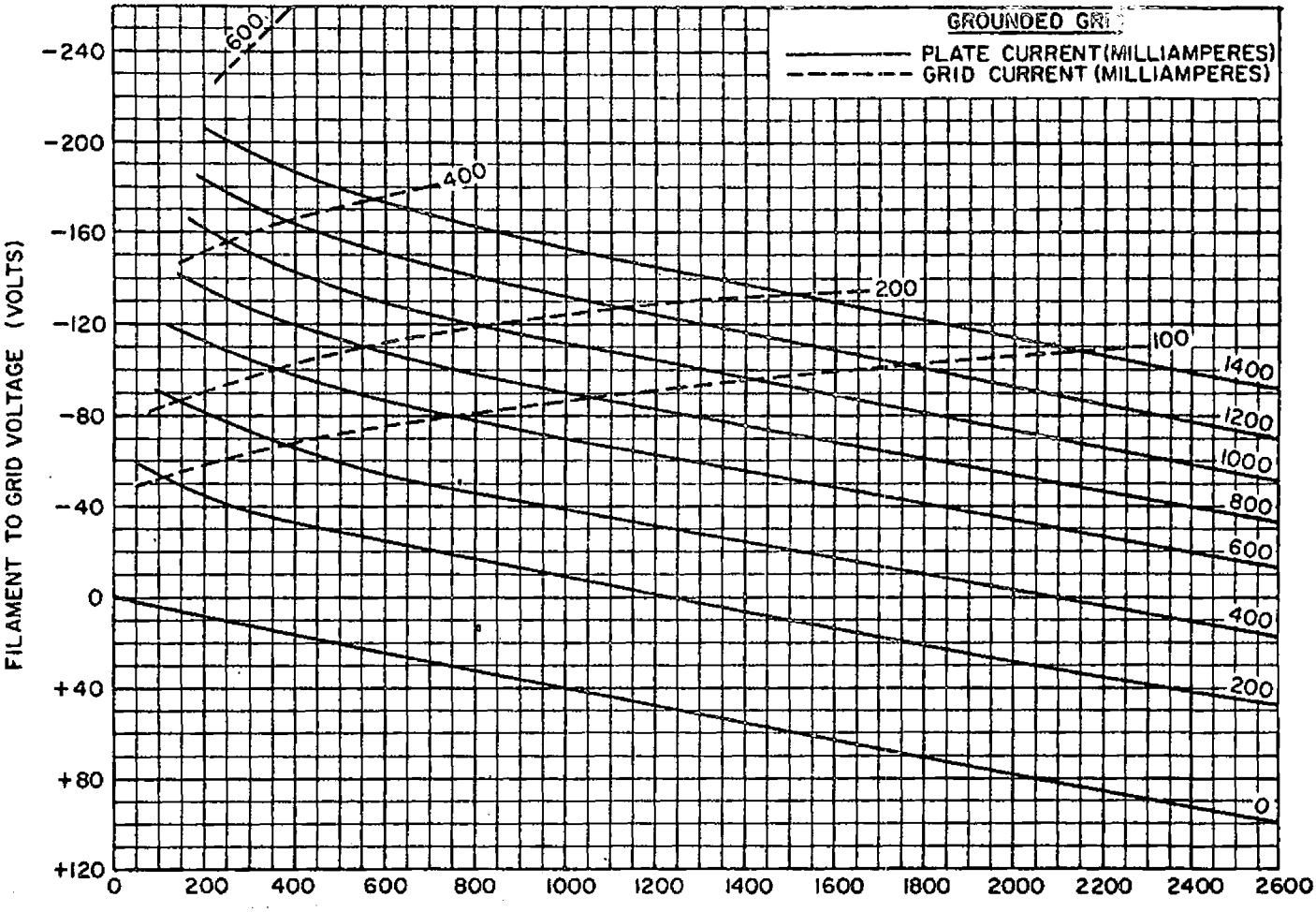
4. Tank circuit efficiency - cavity operation 90%





CONSTANT CURRENT CHARACTERISTICS

8415



CONSTANT CURRENT CHARACTERISTICS

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8429

ADVANCE DATA*

The Amperex 8429 is an exceptionally linear coaxial power tetrode with an external anode designed for linear amplifier single sideband service. The plate dissipation is 4000 watts and the tube can be operated to full ratings up to 60 Mc.

GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	Vertical, plate up or down
Net Weight (approx.)	11 lbs.
Max. Temperatures for All Parts of Envelope	220°C
Cooling Requirements	Forced air cooling on anode and grid terminals

Air Cooling Characteristics:

Plate Dissipation	Altitude	Max. Air Inlet Temp.	Min. Air Flow (cu.ft./min)	Total Pressure (in. of water)
3.5 KW	Sea level	35°C	160	0.86
4.0 KW	Sea level	35°C	212	0.78

Cathode	Oxide coated
Dimensions	See outline drawing

ELECTRICAL

Filament Voltage	15 volts (approx.)
Filament Current	16 amps (approx.)
Direct Interelectrode Capacitances	
Grid No. 1 to Plate	0.2 pf (approx.)
Input	115 pf (approx.)
Output	20 pf (approx.)
Typical Characteristics	
Amplification Factor Grid No. 1 to Grid No. 2 at E_b = 5 kv, E_{c2} = 600V, I_b = 700 ma	3.5
Transconductance at E_b = 1 kv, E_{c2} = 600V, I_b = 6 amps	60,000 μmhos

Amperex

from JEDEC release #4532, Dec. 16, 1963

Rev. February 1963

Class AB_1 Grounded Cathode Linear RF Amplifier
Single Sideband Suppressed Carrier Operation
Maximum Ratings, Absolute Values
(Frequencies up to 60 Mc)

	CCS
DC Plate Voltage	5500 volts
DC Grid No. 2 Voltage	1000 volts
DC Grid No. 1 Voltage	-250 volts
Plate Dissipation	4000 watts
Grid No. 2 Dissipation	200 watts
Grid No. 1 Dissipation	10 watts
DC Plate Current (Single Tone)	2 amps

Typical Operation
Single Tone and/or Two Tone Modulation

Frequency	60 Mc
DC Plate Voltage	5000 volts
DC Grid No. 2 Voltage	600 volts
DC Grid No. 1 Voltage (approx.)[1]	-145 volts
Zero Signal DC Plate Current	700 ma
Zero Signal DC Grid No. 2 Current	5 ma
Zero Signal DC Grid No. 1 Current	0 ma

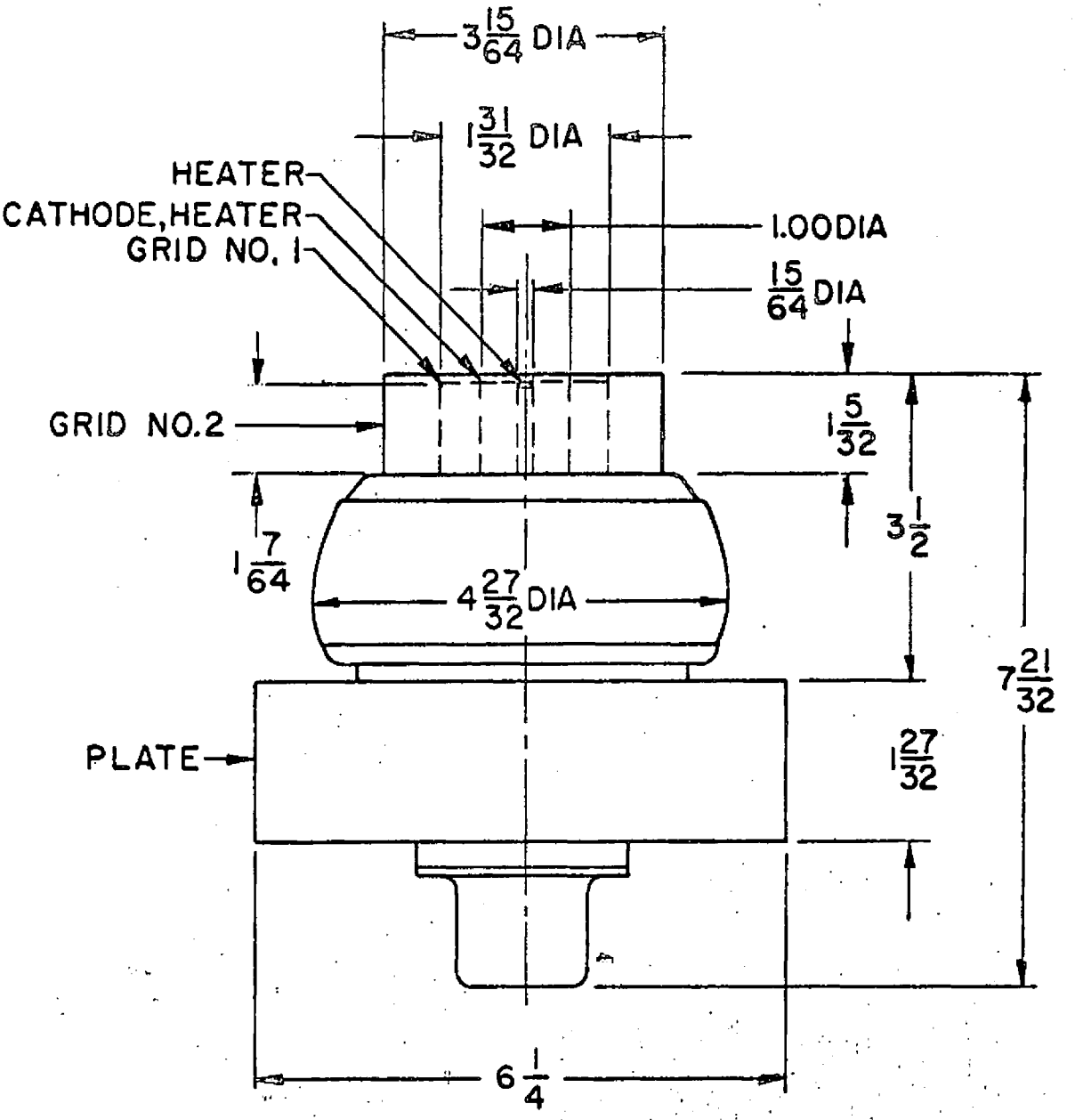
Single Tone Modulation

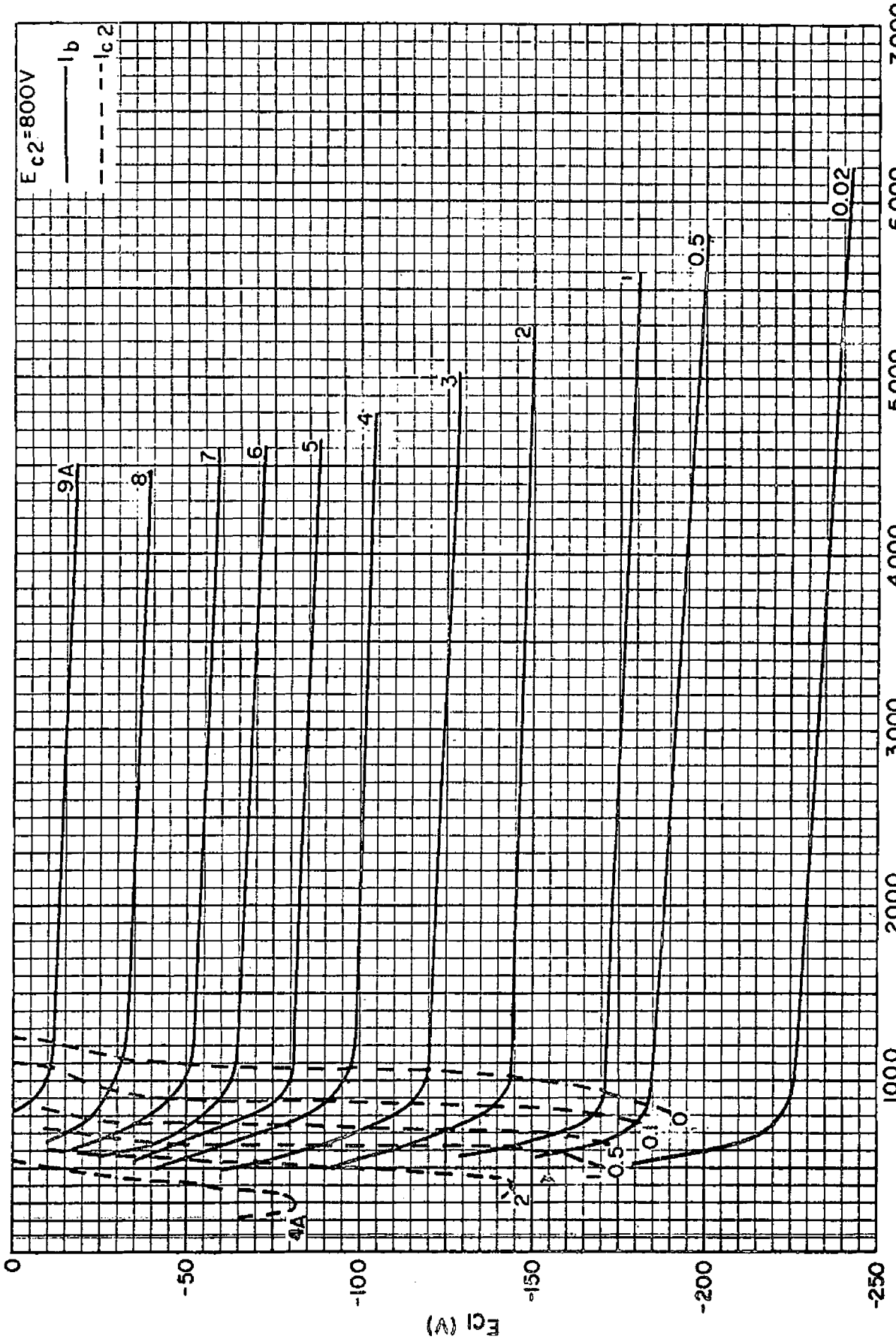
	CCS
Max. Signal DC Plate Current	1800 ma
Max. Signal DC Grid No. 2 Current	80 ma
Max. Signal DC Grid No. 1 Current	0 ma
Max. Signal Plate Power Output	6000 watts
Max. Signal Plate Power Input	9000 watts
Max. Signal Load Power Output (Circuit Efficiency 95%)	5850 watts
Plate Dissipation	2850 watts
Total Efficiency including Circuit Losses	65.0 %

Two Tone Modulation

Average DC Plate Current	1260 ma
Average DC Grid No. 2 Current	30 ma
Average DC Grid No. 1 Current	0 ma
Max. Resultant Peak RF Grid Voltage	160 volts
Average Plate Power Output	3000 watts
Average Load Power Output	2900 watts
Peak Envelope Load Power Output	5850 watts
Third Order Intermodulation Distortion[2]	35 db
Fifth Order Intermodulation Distortion[2]	40 db
Average Power Input	6300 watts
Average Plate Dissipation	3200 watts
Total Efficiency including Circuit Losses	46.0 %

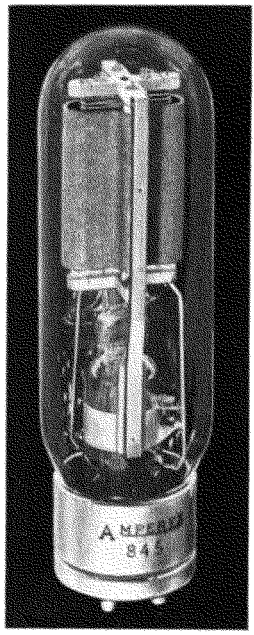
[1] Adjust to give desired value of plate current at zero grid No. 1 signal.
[2] Distortion is referenced to either tone of a two-tone test pattern.


3 15/64 DIA
1 31/32 DIA
HEATER
CATHODE, HEATER
GRID NO. 1
1.00 DIA
15/64 DIA
GRID NO. 2
1 5/32
3 1/2
1 7/64
4 27/32 DIA
7 21/32
PLATE
1 27/32
6 1/4



CONSTANT CURRENT CHARACTERISTICS

Audio Frequency Power Amplifier, Modulator



GENERAL CHARACTERISTICS

Filament Voltage	10	
Filament Current (amps)	3.25	
Amplification Factor	5.3	
Grid to Plate Transconductance @ 100 ma. (micromhos)	3400	
Direct Interelectrode Capacitances:		
Grid to Plate	11.5	$\mu\mu$f
Grid to Filament	5	$\mu\mu$f
Plate to Filament	3.5	$\mu\mu$f

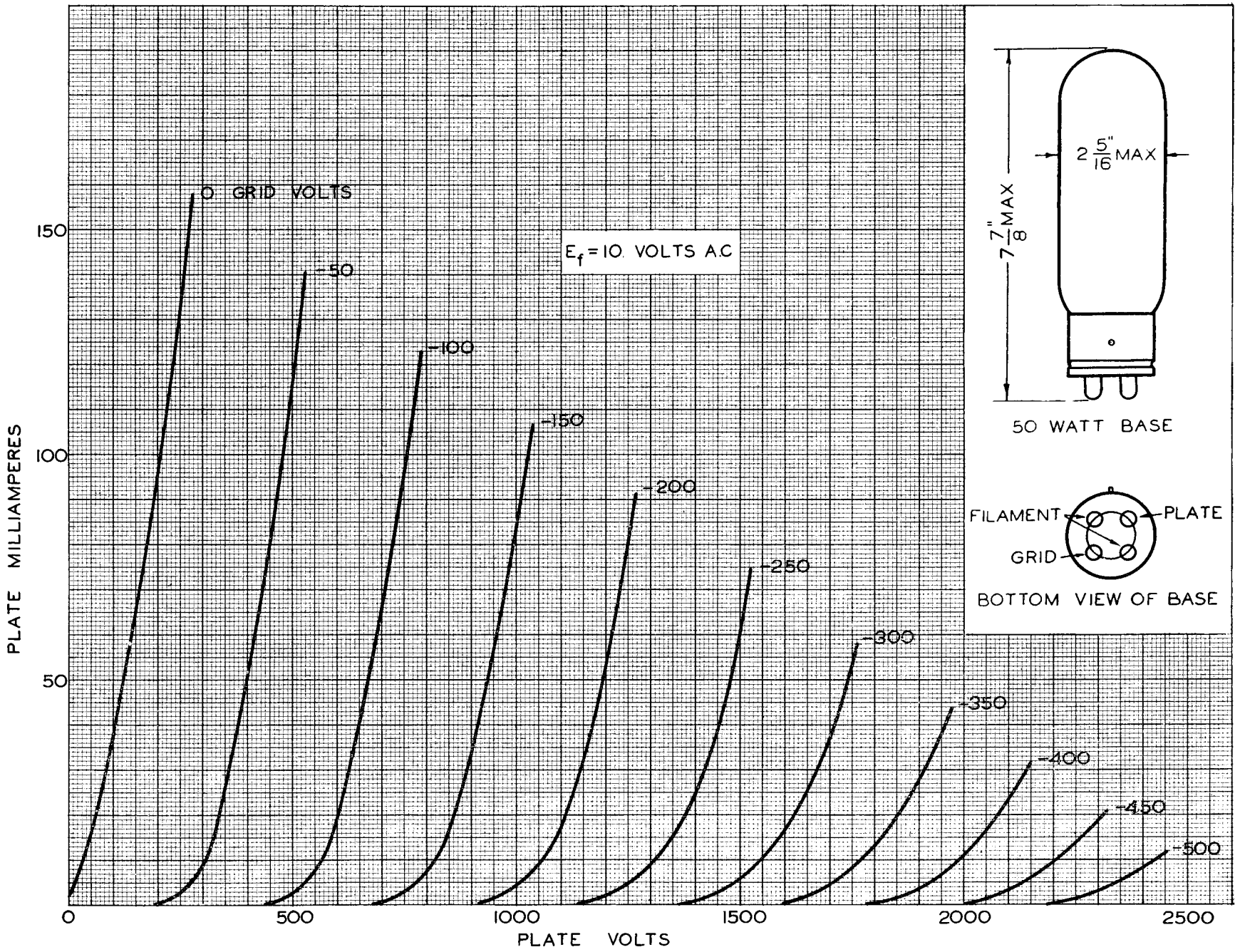
MAXIMUM RATING AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	10	10	10
D.C. Plate Voltage	1250	750	1000	1250
D.C. Grid Voltage	—	—98	—155	—209
Peak A.F. Grid Voltage	—	93	150	204
D.C. Plate Current (ma.)	—	95	65	52
Plate Dissipation (watts)	75	71	65	65
Load Resistance (ohms)	—	3400	9000	16000
Power Output (watts)	—	15	21	24
Distortion (% Second Harmonic)	—	5	5	5

A.F. Power Amplifier and Modulator—Class AB

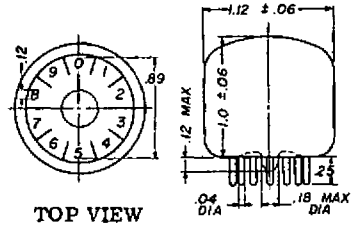
	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	—	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage (Approx.)	—	—175	—225
Load Resistance (ohms per tube)	—	1150	2200
Effective Load Resistance (plate to plate) (ohms)	—	4600	8800
Zero Signal Plate Current (ma.)	—	40	40
Peak A.F. Grid to Grid Voltage (Approx.)	—	340	440
Max. Signal D.C. Plate Current (ma.)	120	220	200
Max. Signal Plate Input (watts)	130	220	250
Plate Dissipation (watts)	75	—	—
Max. Signal Power Output (watts)	—	75	105


0 GRID VOLTS
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
E_f = 10 VOLTS A.C
PLATE MILLIAMPERES
150
100
50
0
500
1000
1500
2000
2500
PLATE VOLTS
$2\frac{5}{16}$" MAX
$7\frac{7}{8}$" MAX
50 WATT BASE
FILAMENT
PLATE
GRID
BOTTOM VIEW OF BASE

AMPEREX TUBE TYPE 8453/Z550M

GENERAL DESCRIPTION

The Amperex 8453/Z550M is a long-life, cold cathode, gas filled numerical indicator tube. It is top viewing with ten numbers 0 to 9 capable of individual indication with a bright red glow. The tube operates with a neon glow discharge on a pure molybdenum cathode. The pulsating dc supply voltage, after full or half wave rectification, causes one of the ten cathode numerals to glow. The particular numeral to glow is selected by raising the voltage level of the corresponding starter to a point at least 5 volts more positive with respect to the remaining starters by means of transistorized control circuits. Since the tube does not draw its power from the transistor control circuits, it presents negligible loading.



TOP VIEW

NOTES

Socket: Amperex Part No. B8.700.67.

Mount tube with pin 1 above pin 8 in vertical axis. Number 0 is aligned with pin 1 to within 3°.

LIMITING VALUES

Peak Anode Voltage, E^1	150 volts ac max. 90 volts ac min.
Frequency of Line Voltage	100 cps max. 40 cps min.
Voltage Between Starter and Anode, E_{st-a} 2, 3	30 volts max. 5 volts min.
Cathode Current, I_k	6 ma max. 2 ma min.
Starter Circuit Resistance, R_{st}	470 k ohms max. 100 k ohms min.
Bulb Temperature	+70°C max. -55°C min.

1. The rectified ac voltage should be freed from spikes by C_k, a capacitor of about 0.033 μf (for full wave rectifier) or 0.25 μf/tube (for a half wave rectifier).
2. To control the indication of a given figure, the potential of the starter of that figure should be raised at least 5 volts with respect to the remaining starters. The common starter bias potential may deviate by a maximum of ±5 volts dc from the anode potential.
3. In order to achieve longer life on continuous display of one digit, apply a voltage between starter and anode, E_{st-a} greater than 5 volts.

from JEDEC release #4362, July 29, 1963

TYPICAL OPERATION

(See Figures 1 and 2 for typical circuit and Figure 3 for voltage sensitivity characteristic)

Line Voltage	117 volts ac
Voltage Between Starter and Anode, E_{st-a}	See Figure 2
Maintaining Voltage, E_a	84 volts
Starter Current, I_{st}	50 μa
Cathode Current, I_k	4 ma
Cathode Resistor, R_k	6.8 k ohms
Starter Series Resistor, R_{st}[4]	330 k ohms
Shunt Capacitor, C_k (full wave rectifier)	0.033 μf
Shunt Capacitor, C_k (half wave rectifier)	0.25 μf/tube

LIFE EXPECTANCY (Under above operating conditions)

Continuous display of one digit	5,000 hrs.
Sequential change of display digit every 100 hours or less	20,000 hrs. min.

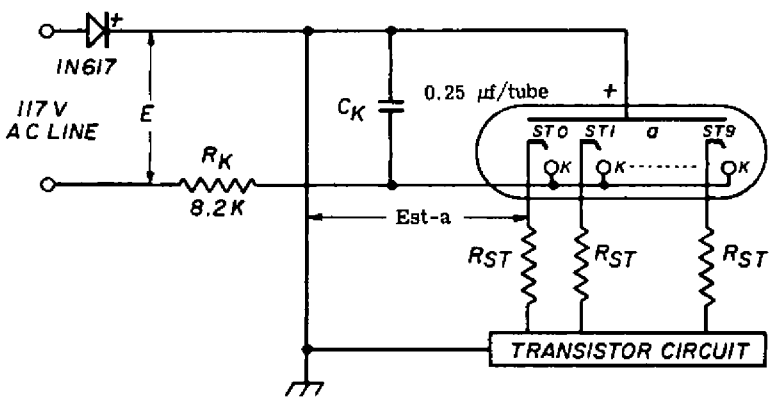


Figure 1. Typical Operating Circuit - Half Wave Rectifier

4. This resistor should be mounted close to the tube socket.

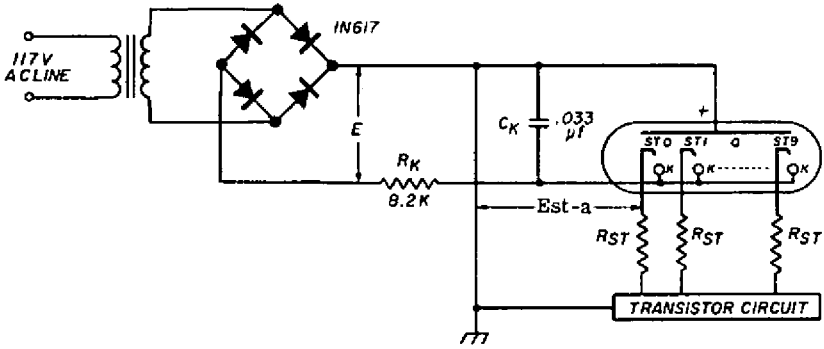


Figure 2. Typical Operating Circuit - Full Wave Rectifier

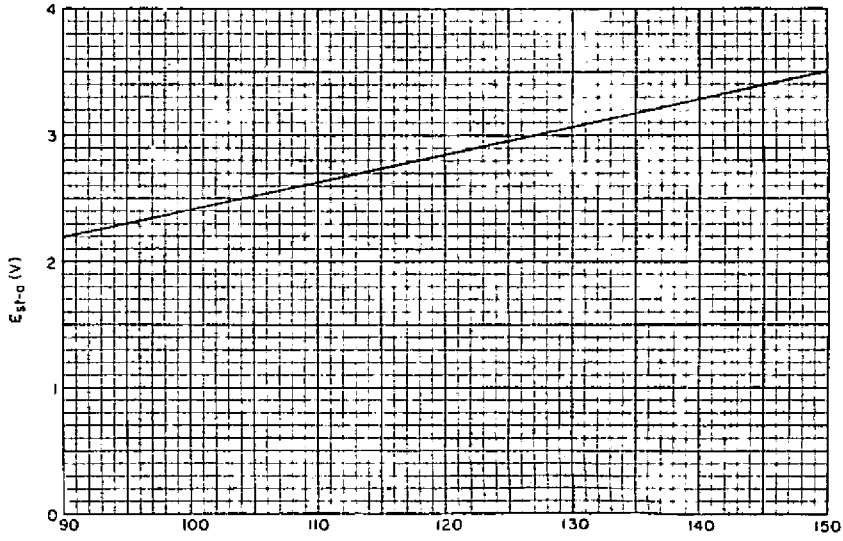


Figure 3. Voltage Sensitivity Curve
Starter to Anode Voltage Required to Switch One Digit to Another vs. Applied Rectified Voltage

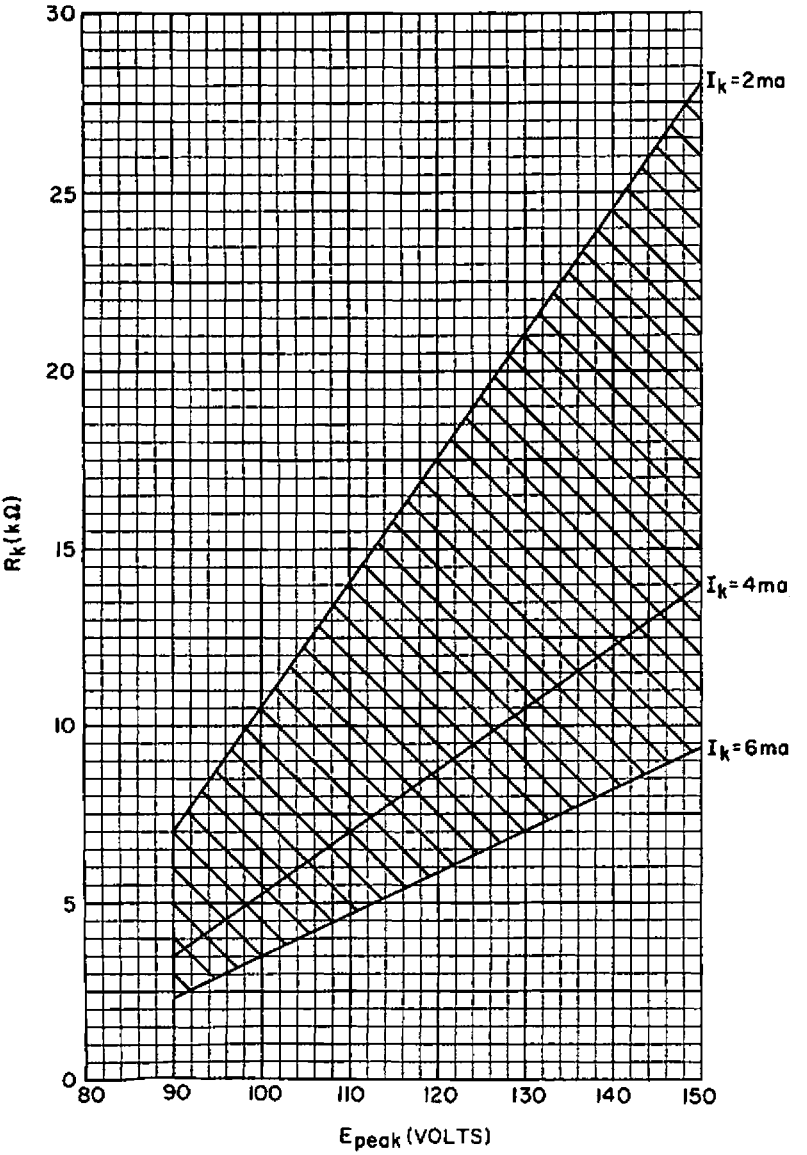


Figure 4. Area of Permissible Operation (shaded) as a Function of R_K and E_{peak}

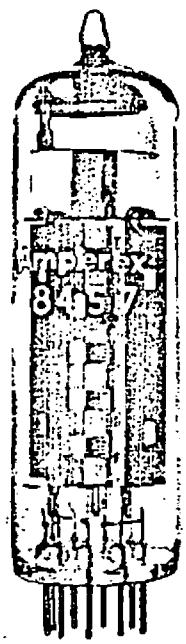
from JEDEC release #4541, Dec. 23, 1963

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE 8457

The 8457 is a twin tetrode for use as a Class C amplifier and oscillator, frequency multiplier and modulator for frequencies up to 200 Mc. The total anode dissipation is 14 watts, ICAS. The cathode is oxide coated, indirectly heated.

The tube is internally neutralized. The heater is designed to withstand battery voltage fluctuations encountered in mobile service. The tube is capable of delivering 16 watts out at 200 Mc, under ICAS conditions.



GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T 6-1/2
Base	small button, 9 pin
Mounting Position	any
Cooling	radiation and convection (use of closed can is not allowed)
Max. Pin Temperature	120°C
Max. Bulb Temperature	225°C
Net Weight (approx.)	0.6 ounce

ELECTRICAL

Cathode	oxide coated, indirectly heated, series or parallel supply		
	Parallel	Series	
Heater Voltage[2]	6.75	13.5	volts
Heater Current	0.76	0.38	amp
Heater Pin Connections	9-(4 + 5)	4-5	
Interelectrode Capacitances	Push-Pull	Per Unit	
Output	1.4	2.6	pf
Input	5.1	6.2	pf
Plate to Grid No. 1 (internally neutralized)		max. 0.1	pf
Grid No. 2 - Grid No. 1 mu at I_p = 30 ma		7.5	
Transconductance at I_p = 30 ma		3300	μmhos

TYPICAL OPERATION, TWO UNITS IN PUSH-PULL - Useful Power Output - Watts

Class C, Telegraphy	(200 Mc)	CCS =	12.0
		ICAS =	16.0
Class C, Frequency Multiplier	(67-200 Mc)	CCS =	3.5
		ICAS =	4.8
Class C, Plate and Screen Grid Modulated	(200 Mc)	CCS =	7.1
		ICAS =	8.8
A.F. Amplifier and Modulator		Class AB_1 =	12.0
		Class AB_2 =	17.5

* Typical operation, maximum ratings and curves are identical to those listed on the Amperex 6360A data sheet.

[1] If the tube is mounted in a horizontal position, it is recommended that pins No. 2 and No. 7 be placed in a vertical line.

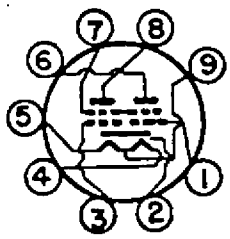
[2] The tube may be used with only half the heater energized during stand-by periods in order to reduce heater current consumption during this time.

Amperex

Rev. June 1963

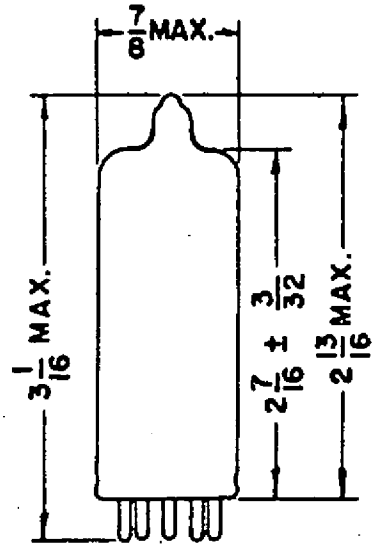
ELECTRODE CONNECTIONS AND DIMENSIONAL OUTLINE

BOTTOM VIEW



9PW

TUBE OUTLINE



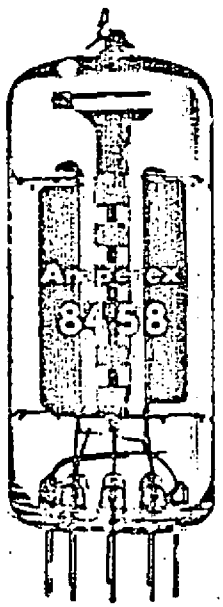
ELECTRODE CONNECTIONS

Pin 1 - Grid No. 1, unit No. 1
Pin 2 - Cathode and internal shield
Pin 3 - Grid No. 1, unit No. 2
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Plate, unit No. 1
Pin 7 - Grid No. 2, units No. 1 and 2
Pin 8 - Plate, unit No. 2
Pin 9 - Heater center tap

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8458

The Amperex 8458 is a single ended twin tetrode with an indirectly heated cathode in the all glass novar base construction. It is designed for mobile service as a Class C amplifier, oscillator, or frequency multiplier up to 200 Mc. It is internally neutralized. The heater is designed to withstand the battery voltage variation normally encountered in mobile service It is capable of delivering 30 watts output as an amplifier under ICAS conditions.



GENERAL CHARACTERISTICS

MECHANICAL

Bulb	T-9
Base	0.040 inch pin dia., novar
Mounting Position	any
Cooling	radiation and convection (use of a closed can is not recommended)
Maximum Pin Seal Temperature	120°C
Maximum Bulb Temperature	225°C

ELECTRICAL

Cathode	oxide coated, indirectly heated		
	Parallel	Series	
Heater Voltage	6.75	13.5	volts
Heater Current	0.76	0.38	amp
Interelectrode Capacitances	Push-Pull Nominal	Per Unit Nominal	
Output	1.7	3.2	pf
Input	5.4	6.8	pf
Plate to Grid No. 1 (internally neutralized)		max. 0.1	pf

Amperex

from JEDEC release #4541, Dec. 23, 1963

RF Power Amplifier and Oscillator
Class C - Telegraphy
Maximum Ratings, Absolute Values
(For frequencies up to 200 Mc)

	CCS	ICAS	
DC Plate Voltage	400	450	volts
DC Plate Current	2x45	2x55	ma
DC Grid No. 2 Voltage	200	200	volts
DC Grid No. 1 Voltage	-150	-150	volts
DC Grid No. 1 Current	2x3	2x4	ma
Plate Dissipation	2x7.5	2x10	watts
Grid No. 2 Dissipation	2x1	2x1	watts
Grid No. 1 Dissipation	2x0.2	2x0.2	watts
Peak Heater Cathode Voltage	100	100	volts
Plate Input Power	36	50	watts

Typical Operation
One Tube Push-Pull up to 200 Mc

	CCS	ICAS	ICAS	
DC Plate Voltage	400	400	450	volts
DC Grid No. 2 Voltage	155	200	200	volts
DC Grid No. 1 Voltage	-59	-50	-50	volts
DC Plate Current	85	110	110	ma
DC Grid No. 2 Current	2.3	3.9	4.0	ma
DC Grid No. 1 Current	3.1	3.1	3.1	ma
Grid No. 1 Resistor	19	16	16	k ohms
Driving Power (tube and circuit)	1.0	1.2	1.2	watts
Grid No. 2 Dissipation	0.5	0.8	0.8	watts
Useful Power Output (measured at load)	20	28	30	watts
Overall Efficiency (tube and circuit)	59	63.6	60.7	%

Frequency Tripler
(For frequencies up to 200 Mc)
Maximum Ratings, Absolute Values

	CCS	ICAS	
DC Plate Voltage	400	450	volts
DC Grid No. 2 Voltage	200	200	volts
DC Grid No. 1 Voltage	-150	-150	volts
DC Plate Current	2x30	2x44	ma
DC Grid No. 1 Current	2x2	2x3	ma
Plate Input Power	2x11.25	2x15	watts
Grid No. 2 Dissipation	2x1	2x1	watts
Plate Dissipation	2x7.5	2x10	watts
Peak Heater-Cathode Voltage	100	100	volts

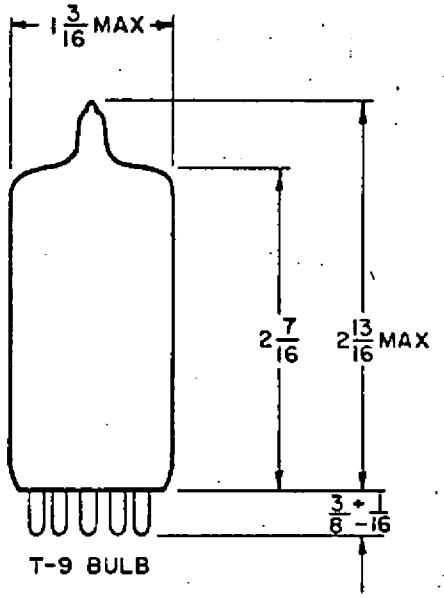
Typical Operation
(Two units of one tube in push-pull)

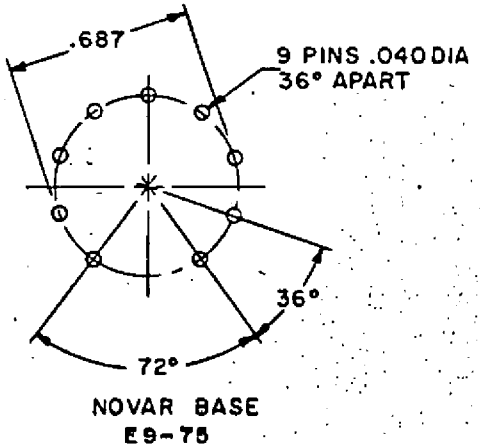
	ICAS	
Frequency	58/174	Mc
DC Plate Voltage	350	volts
DC Grid No. 2 Voltage	165	volts
DC Grid No. 1 Voltage	-150	volts
DC Plate Current	2x43	ma
DC Grid No. 2 Current	5.0	ma
DC Grid No. 1 Current	2x2.2	ma
Grid Resistor	34	k ohms
Driving Power (approx. including circuit losses)	8.6	watts
Efficiency	34	%
Useful Power Output	10	watts

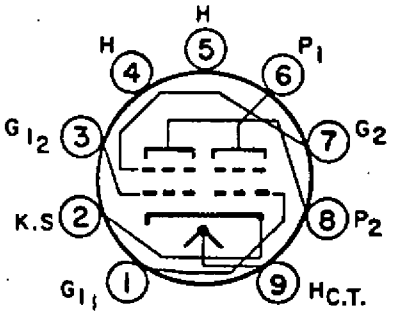
Plate and Screen Grid Modulated, Push-Pull
RF Power Amplifier - Class C Telephony
(Carrier conditions per tube, for use with a maximum modulation factor of 1.0)

Maximum Ratings, Absolute Values
(For frequencies up to 200 Mc)

	CCS	ICAS
DC Plate Voltage	320	360 volts
DC Grid No. 2 Voltage	200	200 volts
DC Grid No. 1 Voltage	-150	-150 volts
DC Plate Current	2x37.5	2x46 ma
DC Grid No. 1 Current	2x3	2x4 ma
Plate Input Power	2x12	2x16.5 watts
Grid No. 2 Dissipation	2x0.65	2x0.65 watts
Plate Dissipation	2x5.0	2x6.5 watts
Peak Heater-Cathode Voltage	100	100 volts







9PW

PIN CONNECTIONS

1. GRID NO. 1, SIDE NO.1
2. CATHODE AND BEAM PLATE
3. GRID NO.1, SIDE NO. 2
4. HEATER
5. HEATER
6. PLATE SIDE 1
7. GRID NO. 2
8. PLATE SIDE 2
9. HEATER CENTER TAP

Water Cooled Oscillator R.F. Power Amplifier



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
D.C. Filament Voltage	—	11
D.C. Plate Voltage	7500	7000
D.C. Grid Voltage	—	—150
Plate Load Resistance (ohms)	—	4000
Peak R.F. Grid Voltage	—	600
D.C. Plate Current (amps.)	0.5	0.45
Plate Input (kw.)	3.75	3.15
Plate Dissipation (kw.)	2.5	2.15
Driving Power (Approx.) (watts)	—	175
Power Output (kw.)	—	1
Frequency Limit for Above Operation (mc.)	50	60

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	11	11	11
D.C. Plate Voltage	6000	4000	5000	6000
D.C. Grid Voltage	—1000	—850	—900	—950
Plate Load Resistance (ohms)	—	5900	5900	5600
Peak R.F. Grid Voltage	—	1600	1700	1950
D.C. Plate Current (amps.)	0.5	0.3	0.4	0.5
Plate Input (kw.)	3	1.2	2.0	3.0
Plate Dissipation (kw.)	1.66	.3	.5	.75
D.C. Grid Current (Approx.) (amps.)	0.15	0.080	0.100	0.125
Driving Power (Approx.) (watts)	—	125	175	200
Power Output (kw.)	—	0.9	1.5	2.25
Frequency Limit for Above Operation (mc.)	50	100	75	50

GENERAL CHARACTERISTICS

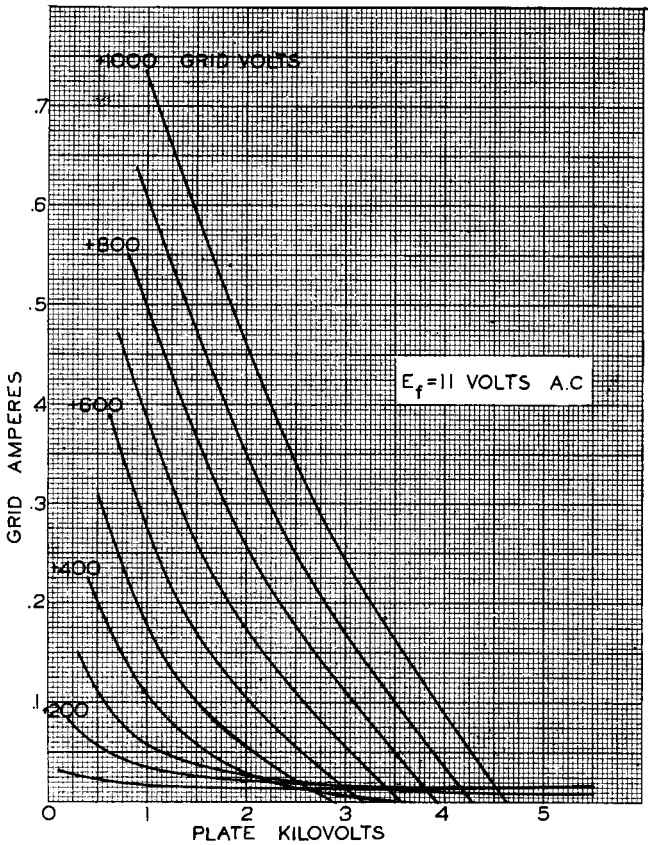
Filament Voltage (AC or DC)	11
Filament Current (amps)	51
Amplification Factor	40
Grid to Plate Transconductance at plate current of .5 Ampere	2800 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	9 $\mu\mu$f
Grid to Filament	6.5 $\mu\mu$f
Plate to Filament	1.5 $\mu\mu$f
Dimensions:	
Maximum Overall Length	9½"
Maximum Radius	3⅜"
Base	None
Water Jacket	Special

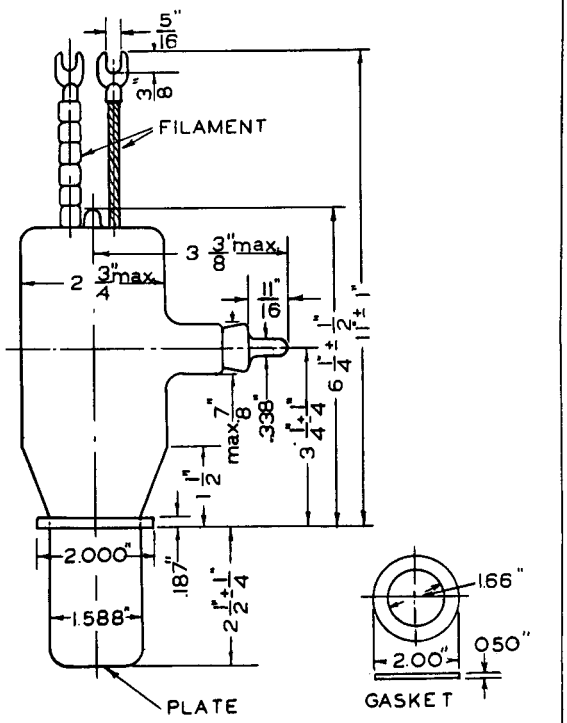
R.F. Power Amplifier and Oscillator—Class C Telegraphy

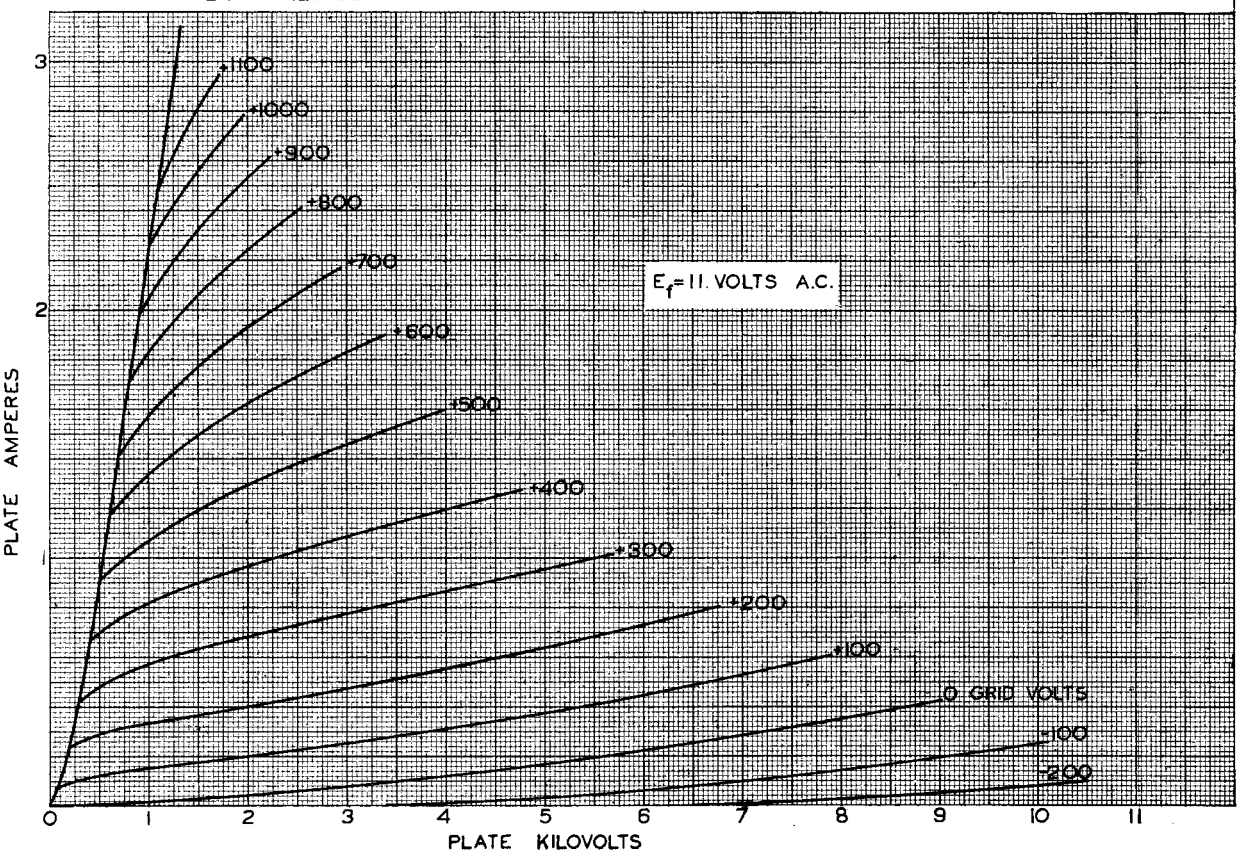
Key-down conditions without modulation.

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	11	11	11
D.C. Plate Voltage	7500	5000	6000	7000
D.C. Grid Voltage	—1000	—800	—850	—900
Plate Load Resistance (ohms)	—	3800	3600	3600
Peak R.F. Grid Voltage	—	1850	2050	2300
D.C. Plate Current (amps.)	1.0	0.60	0.75	0.90
Plate Input (kw.)	7.5	3.0	4.5	6.3
Plate Dissipation (kw.)	2.5	1.0	1.5	2.0
D.C. Grid Current (Approx.) (amps.)	0.15	0.11	0.125	0.14
Driving Power (watts)	—	175	235	300
Plate Power Output (kw.)	—	2	3	4.3
Frequency Limit for Above Operation (mc.)	50	100	75	60

846—AMPEREX TRANSMITTING TUBE







from JEDEC release #4541, Dec. 23, 1963

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

TUBE TYPE
8463

The Amperex 8463 is an instant heating RF power pentode for use as a power amplifier or frequency doubler in mobile equipment up to 200 Mc.

GENERAL CHARACTERISTICS

MECHANICAL

Mounting Position	any
Dimensions	see outline drawing
Base	9 pin
Bulb	T 6-1/2

ELECTRICAL

Filament Voltage[1]	1.1 volts ± 15%
Filament Current	1.05 amps
Warm Up Time (Power Output = 70% of full load)	0.5 sec.
Amplification Factor (Grid No. 1 to Grid No. 2) at I_b = 30 ma	8.0
Transconductance at I_b = 30 ma	4500 μmhos
Direct Interelectrode Capacitances (unshielded)	
Feedback	0.15 pf
Input	6.5 pf
Output	3.8 pf
Modulation Hum[2]	60 db down relative to carrier

[1] The filament supply may be DC or 50 to 60 cps AC (sinusoidal or square wave). Sinusoidal supply voltages within the frequency range of 200 to 2000 cps should not be used.

[2] Center tapped filament transformer on a single stage.

Amperex

Rev. May 1963

Class C Telegraphy
Maximum Ratings, Absolute Values

Frequency	50	175 Mc
DC Plate Voltage	300	300 volts
Plate Dissipation	5.0	5.0 watts
Cathode Current	50	50 ma
Screen Grid Voltage	300	300 volts
Screen Grid Dissipation	1.0	1.0 watt
Negative Control Grid Voltage	100	100 volts
DC Plate Current	40	40 ma
DC Plate Input Power	12	9 watts

Class C Telegraphy
Typical Operation

Frequency	50	50	50	175	175	175	Mc
DC Plate Voltage	300	250	200	300	250	200	volts
DC Grid No. 2 Voltage	150	150	150	150	150	150	volts
DC Grid No. 1 Voltage	-35	-35	-35	-35	-35	-35	volts
Peak Grid No. 1 Voltage	49.5	52	53	--	--	--	volts
DC Plate Current	40	40	40	30	35	40	ma
DC Grid No. 2 Current	3.5	5	6	2	2.5	3	ma
DC Grid No. 1 Current	0.85	0.95	1.05	0.07	0.2	0.5	ma
DC Plate Input Power	12	10	8	9	8.75	8	watts
Plate Dissipation	3.6	3	2.5	4.6	4.2	3.5	watts
Grid No. 2 Dissipation	0.53	0.75	0.9	0.3	0.38	0.45	watts
Useful Output Power to Load	8	6.7	5.2	3.3	3.6	3.6	watts
Driving Power	0.5	--	--	--	1.0	--	watts

Class C Frequency Doubler
Maximum Ratings, Absolute Values

Frequency	50	175 Mc
DC Plate Voltage	300	300 volts
DC Plate Input Power	10	7.5 watts
Plate Dissipation	5	5 watts
DC Plate Current	35	35 ma
DC Grid No. 2 Voltage	300	300 volts
Grid No. 2 Dissipation	1.0	1.0 watt
DC Grid No. 1 Voltage	-100	-100 volts

Class C Frequency Doubler
Typical Operation
(Frequency between 25/50 Mc)

DC Plate Voltage	300	250	200	volts
DC Grid No. 2 Voltage	150	150	150	volts
DC Grid No. 1 Voltage	-90	-90	-90	volts
Peak Grid No. 1 Voltage	105	106	106.5	volts
DC Plate Current	30	30	30	ma
DC Grid No. 2 Current	2.6	3.2	3.6	ma
DC Grid No. 1 Current	0.73	0.8	0.85	ma
DC Plate Input Power	9.0	7.5	6.0	watts
Plate Dissipation	3.5	2.7	2.3	watts
Grid No. 2 Dissipation	0.90	0.48	0.64	watts
Useful Output Power to Load	5.15	4.45	3.5	watts
Driving Power	1.0	--	--	watts

Class C Frequency Doubler
Typical Operation
(Frequency between 87.5/175Mc)

DC Plate Voltage	300	250	200	volts
DC Grid No. 2 Voltage	150	150	150	volts
DC Grid No. 1 Voltage	-90	-90	-90	volts
DC Plate Current	25	30	35	ma
DC Grid No. 2 Current	1.22	1.62	1.85	ma
DC Grid No. 1 Current	0.34	0.6	0.66	ma
DC Plate Input Power	7.5	7.5	7.0	watts
Plate Dissipation	4.4	4.5	3.6	watts
Grid No. 2 Dissipation	0.18	0.25	0.28	watts
Useful Output Power to Load	2.1	2.4	2.55	watts
Driving Power	--	--	1.5	watts

Class C Frequency Tripler
Maximum Ratings, Absolute Values

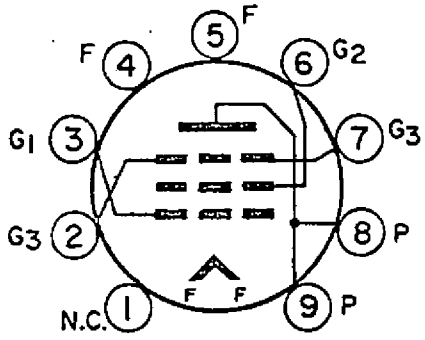
Frequency	50	175	Mc
DC Plate Voltage	300	300	volts
DC Plate Input Power	7.5	6	watts
Plate Dissipation	5	5	watts
DC Plate Current	30	30	ma
DC Grid No. 2 Voltage	300	300	volts
Grid No. 2 Dissipation	1	1	watt
DC Grid No. 1 Voltage	-100	-100	volts

Class C Frequency Tripler
Typical Operation
(Frequency between 16.3/50 Mc)

DC Plate Voltage	250	200	150	volts
DC Grid No. 2 Voltage	150	150	150	volts
DC Grid No. 1 Voltage	-100	-100	-100	volts
Peak Grid No. 1 Voltage	117	117.5	118	volts
DC Plate Current	30	30	30	ma
DC Grid No. 2 Current	2.3	2.5	2.8	ma
DC Grid No. 1 Current	0.7	0.72	0.75	ma
DC Plate Input Power	7.5	6.0	4.5	watts
Plate Dissipation	3.9	3.0	2.3	watts
Grid No. 2 Dissipation	0.4	0.4	0.42	watts
Useful Output Power to Load	3.2	2.7	2.0	watts

Class C Frequency Tripler
Typical Operation
(Frequency between 58.3/175 Mc)

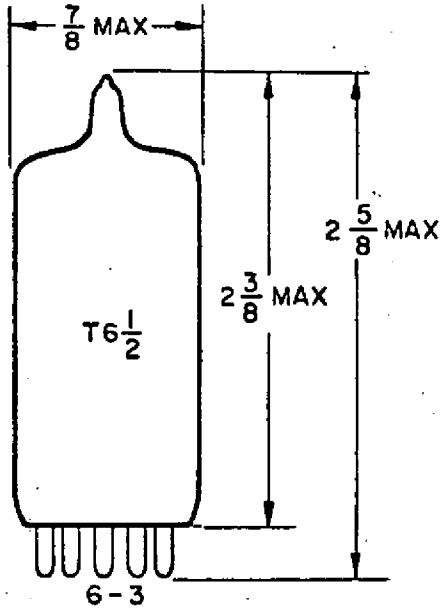
DC Plate Voltage	250	200	150	volts
DC Grid No. 2 Voltage	150	150	150	volts
DC Grid No. 1 Voltage	-100	-100	-100	volts
DC Plate Current	20	30	30	ma
DC Grid No. 2 Current	1.1	1.7	1.9	ma
DC Grid No. 1 Current	0.18	0.6	0.7	ma
DC Plate Input Power	5	6	4.5	watts
Plate Dissipation	3.2	3.7	2.8	watts
Grid No. 2 Dissipation	0.16	0.25	0.3	watt
Useful Output Power to Load	1.0	1.4	1.1	watts
Driving Power	--	1.0	--	watt

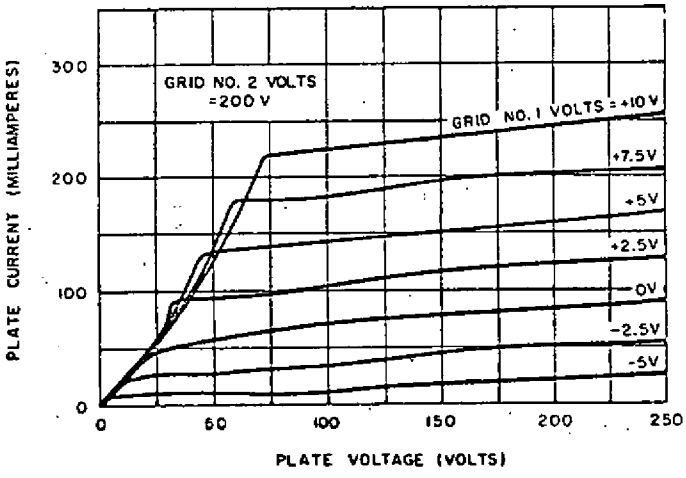


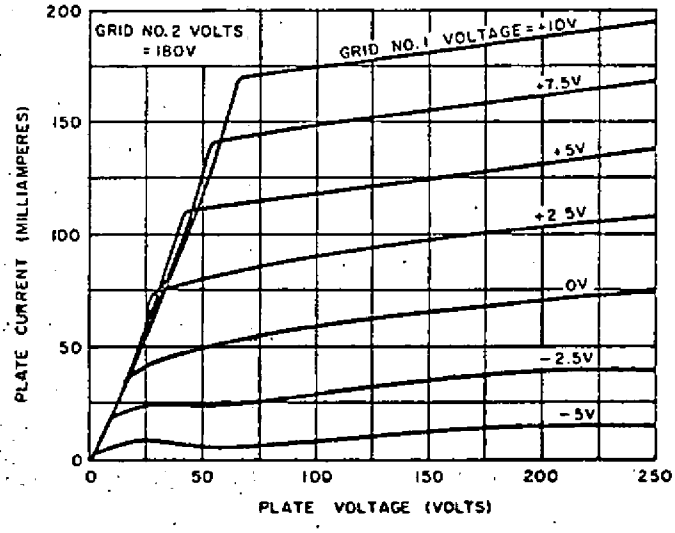
9QX

PIN CONNECTIONS

1 – NO CONNECTION
2 – GRID NO.3
3 – GRID NO.1
4 – FILAMENT
5 – FILAMENT
6 – GRID NO.2
7 – GRID NO.3
8 – PLATE
9 – PLATE







Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

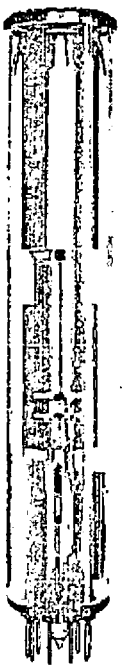
TUBE TYPE
8483

The 8483 is a camera tube of the vidicon type intended for use in either black-and-white or color TV cameras in industrial, medical and broadcast applications.

The high sensitivity of the photoconductive layer employed ensures high-quality pictures under normal room-lighting conditions or under the lighting conditions normally encountered in industrial applications.

Its heater consumption of only 0.6 watt makes the tube very suitable for all-transistorized cameras where heat dissipation must be kept at a minimum.

The resolution capability approaches 900 TV lines when the tube is operated with grids No. 3 and No. 4 at 750 volts and a magnetic-focusing field strength of approximately 70 gauss, and will be in excess of 600 TV lines when operated with grids No. 3 and No. 4 at approximately 285 volts and a magnetic focusing field strength of approximately 40 gauss.



GENERAL CHARACTERISTICS

MECHANICAL

Focusing method	magnetic
Deflection method	magnetic
Dimensions	see outline drawing
Base	small button detetrar 8-pins (JEDEC No. E8-11)
Operating position[1]	any
Weight (approx.)	2.3 oz.

ELECTRICAL

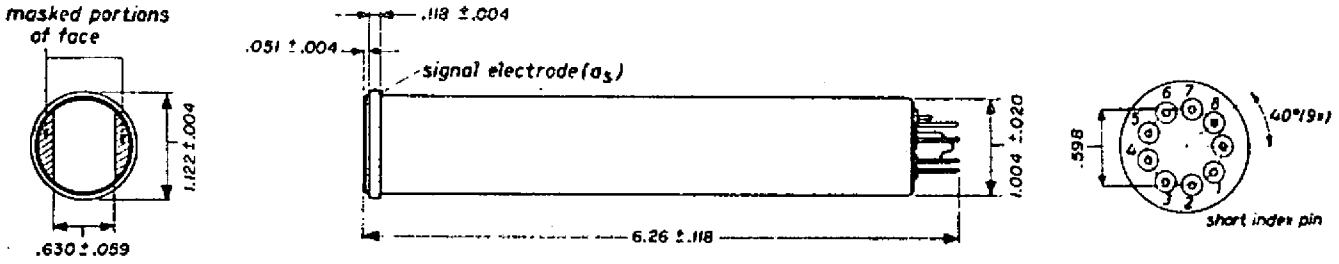
Heating	indirectly by AC or DC supply
Heater voltage	6.3 (±10%) volts
Heater current	90 ma
Capacitance	
Signal electrode to all other electrodes[2]	4.5 pf
Photoconductive layer	
Spectral response	see Figure 7
Useful diagonal of rectangular image (4 : 3 aspect ratio)	0.63 inch max.

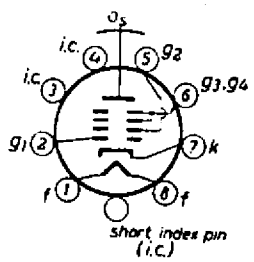
Orientation of quality rectangle:
Proper orientation is obtained when the horizontal scan is essentially parallel to the straight sides of the masked portions of the face plate. The masking is for orientation only and does not define the proper scanned area of the photoconductive layer.

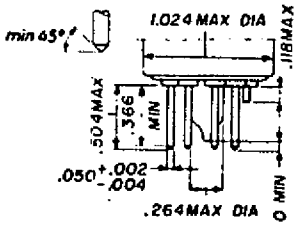
1. When operating at angles below the horizontal, care should be taken not to subject camera to undue shock.
2. This capacitance, which effectively is the output impedance of the 8483 is increased by about 3 pf when the tube is inserted into the deflection and focusing coil-assembly. The resistive component of the output impedance is in the order of 100 megohms.

Amperex

from JEDEC release #4532, Dec. 16, 1963







Mechanical Arrangement

ABSOLUTE MAXIMUM RATINGS

for scanned area of 3/8 inch x 1/2 inch (9.6 mm x 12.8 mm)[3, 4]

Grid No. 3 and grid No. 4 voltage	800 volts
Grid No. 2 voltage	350 volts
Grid No. 1 voltage	
Negative bias	-125 volts
Positive bias	0 volt
Peak heater-cathode voltage	
Heater negative with respect to cathode	125 volts
Heater positive with respect to cathode	10 volts
Signal-electrode voltage[5]	100 volts
Peak signal-electrode current[6]	0.6 μa
Faceplate	
Illumination	500 Ft.-C.
Temperature[7]	80°C

OPERATING CONDITIONS AND PERFORMANCE

For scanned area of 3/8 inch x 1/2 inch (9.6 mm x 12.8 mm)
and faceplate temperature of 25-35°C.

PICK-UP FROM LIMITED-MOTION LIVE SCENES

Conditions	
Grid No. 3 and grid No. 4 (beam focus electrode) voltage[8]	250-300 volts
Grid No. 2 voltage	300 volts
Grid No. 1 voltage adjusted for sufficient beam current to stabilize highlights	
Minimum peak-to-peak blanking voltage	
when applied to grid No. 1	75 volts
when applied to the cathode[9]	20 volts
Field strength at center of focusing coil (approx.)[10]	40 gauss
Field strength of adjustable alignment coils[11]	0-4 gauss

3. The absolute maximum ratings are limiting values of operating and environmental conditions. The equipment designer should design so that, initially and throughout life, no absolute maximum value can be exceeded under the worst probable operating conditions. No claims for readjustments according to the tube manufacturers' warranty will be accepted for tube failures due to non-adherence to the above stipulations.
4. "Full-size scanning", (i.e., scanning of a 3/8 inch x 1/2 inch area of the photoconductive layer) should always be applied. The use of a mask having these dimensions is recommended. Underscanning, (i.e., scanning of an area less than 3/8 inch x 1/2 inch area) may cause permanent damage to the specified full-size area.
5. The signal-electrode voltage should never exceed 100 volts, either during heating-up or stand-by, or during operation. An excessive signal-electrode voltage may cause permanent damage to the photoconductive layer.
6. Video-amplifiers should be capable of handling signal-electrode currents of this magnitude without amplifier overload or picture distortion.
7. Absolute maximum for shelf-life and operation. Under difficult environmental conditions a flow of cooling air directed at the faceplate is recommended. When televising flames and furnaces appropriate infra-red filters should be applied.
8. Beam focus is obtained by the combined effect of the grid No. 3 voltage, which should be adjustable over the indicated range and a focusing coil having an average field strength of 40 gauss. Definition, focus uniformity and picture quality decrease with decreasing grid No. 3 voltage. In general, grid No. 3 should be operated above 250 volts.
9. In transistorized cameras cathode blanking will be preferable. The cathode impedance is in the order of 30 k ohms.
10. The polarity of the focusing coil should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.
11. The alignment coil assembly should be located on the tube so that its center is at a distance of approximately 3-11/16 inches from the face of the tube and be positioned so that its axis coincides with the axis of the tube, the deflecting yoke and the focusing coil.

PICK-UP FROM LIMITED MOTION LIVE SCENES (Cont.)

Performance	
Signal-electrode voltage for dark current of 0.02 μa	
Range[12]	0-100 volts
Typical	40 volts
Grid No. 1 voltage for picture cut-off[13]	-30 to -100 volts
Signal output current, faceplate illumination 0.75 Ft.-C.	
Typical[14]	0.150 μa
Minimum	0.075 μa
Resolution capability in picture center (see Figure 8)[15]	600 TV lines
Decay: 1.32 Ft.-C. on layer, peak white signal of 0.1 μa, rest signal after dark pulse of 200 msec. (typical)	5 %
Average gamma of transfer characteristic for signal output currents between 0.01 and 0.3 μa	0.6
Visual equivalent signal-to-noise ratio (approx.)[16]	300 : 1

PICK-UP FROM FILM (MINIMUM-LAG OPERATION)

Conditions

As under "Pick-up from limited-motion live scenes" with the exception of:	
Faceplate illumination (highlight)	47 Ft.-C.

Performance

As under "Pick-up from limited-motion live scenes" with the exception of:	
Signal-electrode voltage for a dark current of 0.005 μa	10-20 volts
Signal output current (typical)	0.3 μa
Decay: peak white signal of 0.3 μa, rest signal after dark pulse of 200 msec. (typical)	1 %

OPERATION FOR MAXIMUM RESOLUTION

Conditions

As under "Pick-up from limited-motion live scenes" with the exception of:	
Grid No. 3 and grid No. 4 voltage	750 volts
Field strength at center of focusing coil (approx.)[10, 17]	70 gauss

Performance

As in "Pick-up from limited-motion live scenes" with the exception of:	
Resolution capability in picture center (approx.)	900 TV lines

---

12. The deflection circuits must provide sufficient linear scanning for good black-level reproduction. The dark-current signal being proportional to the velocity of scanning, any change in this velocity will produce a black-level error.
13. With no blanking voltage on grid No. 1.
14. Defined as the component of the signal-electrode current after the dark current has been subtracted.
15. With a video-amplifier system having 7.5 Mc bandwidth (-3 db points).
16. Measured with a peak signal output current of 0.2 μa into a high-gain, cascode input type of amplifier with an own-noise of 0.002 μa rms and a bandwidth of 5 Mc. Because the noise in such a system is predominantly of the high-frequency type, the visual equivalent signal-to-noise ratio is taken as the ratio of the highlight video-signal current to the rms noise current multiplied by a factor of 3.
17. With this mode of operation beam-landing errors, resulting in parabolic shading and dark corners, increase. The deflecting and focusing coils should be designed to eliminate these errors. The increased-power requirements for these coils will increase the tube temperature, adequate provisions for cooling should be made.

PRINCIPLE OF OPERATION

SCHEMATIC ARRANGEMENT

The cutaway arrangement of the vidicon 8483 with its accessories is shown in Figure 1.

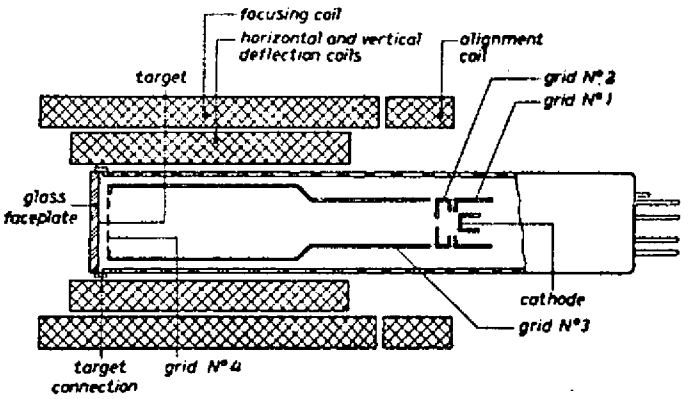


Figure 1. Cutaway Drawing - Electrode and Coil Arrangement.

The vidicon may be assumed to consist of three sections, namely the electron gun, the scanning section, and the target section.

The electron gun contains a thermionic cathode, a grid, g_1, controlling the amount of beam, and a limiter anode, g_2, which accelerates the electrons and releases them in a fine beam through its diaphragm.

The scanning section. The electron beam released by g_2 enters the space enclosed by the cylindrical anode, g_3. By means of the combined action of the adjustable electrical field of g_3 (beam focus control) and a fixed axial magnetic field produced by the focusing coil, the electrons are focused in one loop on to the target.

The far end of the g_3 cylinder is closed with a fine metal mesh, g_4, electrically connected to g_3, which produces a uniform, decelerating field in front of the target. The focused beam is magnetically deflected by two pairs of deflection coils so that it scans the target. Proper alignment of the beam with the axial magnetic field is achieved by either an adjustable magnet, or, as shown in Figure 1, by two sets of alignment coils producing an adjustable transverse magnetic field.

The target section is illustrated in Figure 2. It consists of:

a. an optically flat glass faceplate,
b. a transparent conductive film on the inner surface of the faceplate, connected electrically to the external signal-electrode ring.
c. a thin layer of photoconductive material deposited on the conductive film. In the dark this material has a high specific resistance, which decreases with increasing illumination.

The optical image to be televised is focused on the conductive film by means of a lens system.

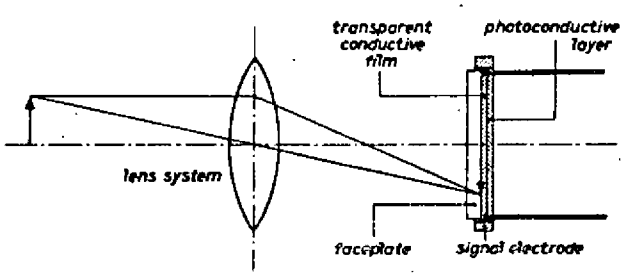


Figure 2. Target Section

OPERATION

The external signal-electrode ring is connected via a load resistor to a positive voltage in the order of 30 volts (see Figure 3).

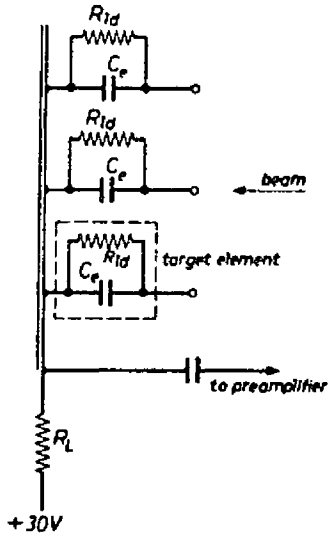


Figure 3.

The target may be assumed to consist of a large number of target elements, corresponding to the number of picture elements, each consisting of a small capacitor (C_e), connected on one side to the signal electrode via the transparent conductive film and shunted by a light-dependent resistor (R_{ld}, see Figure 3).

When the target is scanned by the beam its surface will be stabilized at approximately the cathode potential (low-velocity stabilization) and a potential difference will be established across the photoconductive layer. In other words, each elementary capacitor will be charged to nearly the same potential as applied to the electrode ring.

In the dark, the photoconductive material is a fairly good insulator, so that only a minute fraction of the charge of the elementary capacitors will leak away between successive scans. This charge will be restored by the beam; the resulting current to the signal electrode is termed "dark current".

When an optical image is focused on to the target, those target elements which are illuminated will become more conductive and will be partly discharged. As a consequence a pattern of positive charges corresponding to the optical image will be produced on the side of target facing the gun section.

When scanning this charge pattern the electron beam will deposit electrons on the positive elements until the latter are restored to their original cathode potential, causing a capacitive current to the signal electrode and hence a voltage across the load resistor R_L. This voltage (negative going for the highlights) is the video signal and is fed to the preamplifier.

A vidicon is called "stabilized" when the magnitude of the beam current applied is just sufficient to restore the scanned surface to cathode potential, so that all elementary capacitors, including those at the highlights in the image, are recharged successively.

During the retrace times the beam electrons should be prevented from landing on the target, since, otherwise the scan retraces will appear as dark lines in the picture obtained on the monitor. This may be achieved either by cutting off the beam with suitable negative blanking pulses on the control grid or by cutting off the target with adequate positive blanking pulses applied to the cathode.

EQUIPMENT DESIGN AND OPERATING CONSIDERATIONS

The signal-electrode connection is made by a spring contact, which bears against the metal ring at the face end of the tube. The spring contact may be provided as part of the focusing coil design.

The deflecting yoke and the focusing coil used with the 8483 must be so designed that the beam lands perpendicularly to the target at all points of the scanned area, to ensure high uniformity of sensitivity and focus.

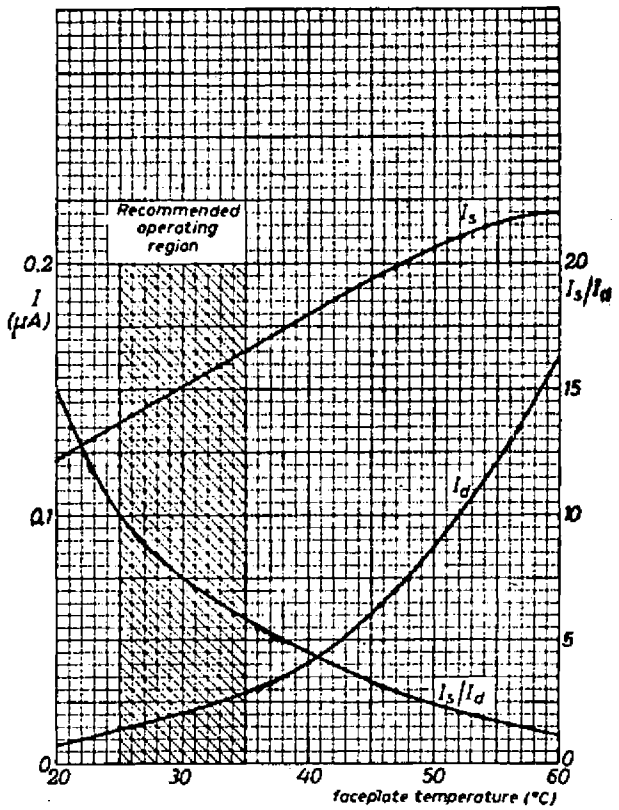
The deflection circuits must provide constant scanning speeds in order to obtain good black-level reproduction. The dark-current signal being proportional to the velocity of scanning, any change in this velocity will produce a black-level error.

The polarity of the focusing coil should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

The alignment coil assembly should be located on the tube so that its center is at a distance of approximately 3-11/16 inches from the face of the tube and be positioned so that its axis coincides with the axis of the tube, the deflecting yoke and the focusing coil.

The temperature of the faceplate should never exceed 80°C, either during operation or storage of the 8483. Operation at a faceplate temperature of 25 to 35°C is recommended.

The effect of the faceplate temperature on sensitivity and dark current of a typical 8483, measured with illumination level and signal-electrode voltage as fixed parameters, is illustrated in Figure 4.



Typical Tube

Signal-electrode voltage and illumination level adjusted for a dark current (I_d) of 0,02 μa and a signal current (I_S) of 0.15 μa at a faceplate temperature of 30°C.

Figure 4. Dark Current vs. Faceplate Temperature

The temperature of the faceplate is determined by the heating effects of the incident illumination, the associated components, the environmental conditions and to a minor extent by the tube itself.

To reduce these heating effects and to permit operation in the preferred temperature range under conditions of high light levels, respectively high ambient temperatures, the use of an infra-red filter between object and camera lens, or a flow of cooling air directed across the faceplate, is recommended.

As the signal-electrode voltage is increased, the dark current and the sensitivity also increase (Figure 5).

Signal Output and Light-transfer Characteristics

The typical signal output as a function of a uniform 2870°K tungsten illumination on the photoconductive layer is shown in Figure 6.

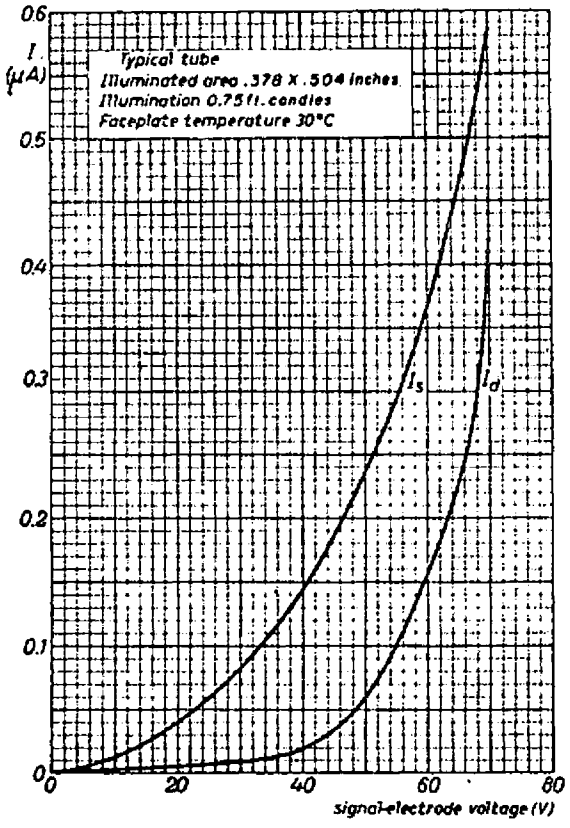


Figure 5. Dark Current vs. Signal-Electrode Voltage

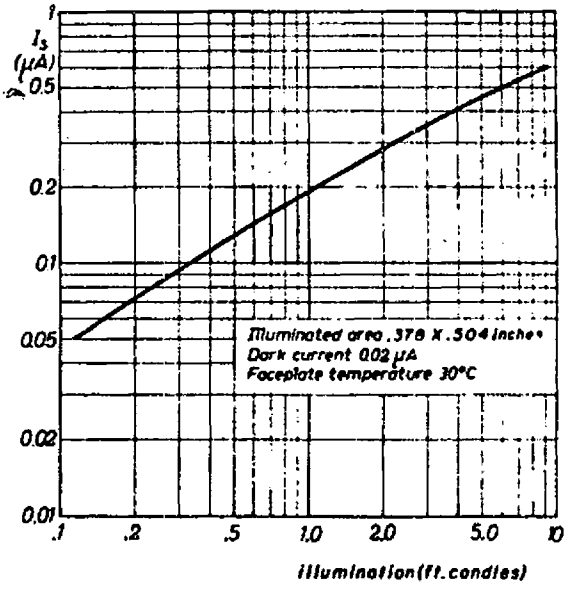


Figure 6. Average Signal Current vs. Illumination on the Photoconductive Layer

The average "gamma" of the light-transfer characteristic is approximately 0.6. This value is relatively constant over a signal output range of 0.01 to 0.3 μa.

Sufficient uniformity in the value of gamma is maintained to ensure satisfactory performance of color cameras, in which the signal output currents of three 8483's, with the aid of γ-correcting circuitry, must match closely over a wide range of scene illumination.

The spectral response of a typical 8483 is shown in Figure 7.

The resolution capability of the 8483 is illustrated in Figure 8.

In general the resolution decreases with decreasing grid No. 3 voltage. The voltage range will depend on the design of the focusing coil, which should be such as to provide a field strength within the range of 36 to 44 gauss. Definition, focus uniformity and picture quality decrease with decreasing grid No. 3 and No. 4 voltage. In general grid No. 3 and grid No. 4 should be operated above 250 volts.

As shown in Figures 8 and 9, a substantial increase in both limiting resolution and amplitude response of the 8483 may be obtained by increasing the operating voltage of grids No. 3 and No. 4 to 750 volts. With this mode of operation, the focusing field strength must be increased to approximately 70 gauss.

Since beam-landing errors increase with increasing grid No. 3 and grid No. 4 voltage, such operation will show a reduced signal output in the corners of the scanned area. When the 8483 is operated in this manner, the deflecting and focusing coils employed must be designed to eliminate beam-landing errors.

Compensation of beam-landing errors can be obtained by supplying modulating voltages of parabolic shape and of both horizontal and vertical scanning frequencies to the cathode and additionally, in order to prevent beam-modulation, to grid No. 1 and grid No. 2.

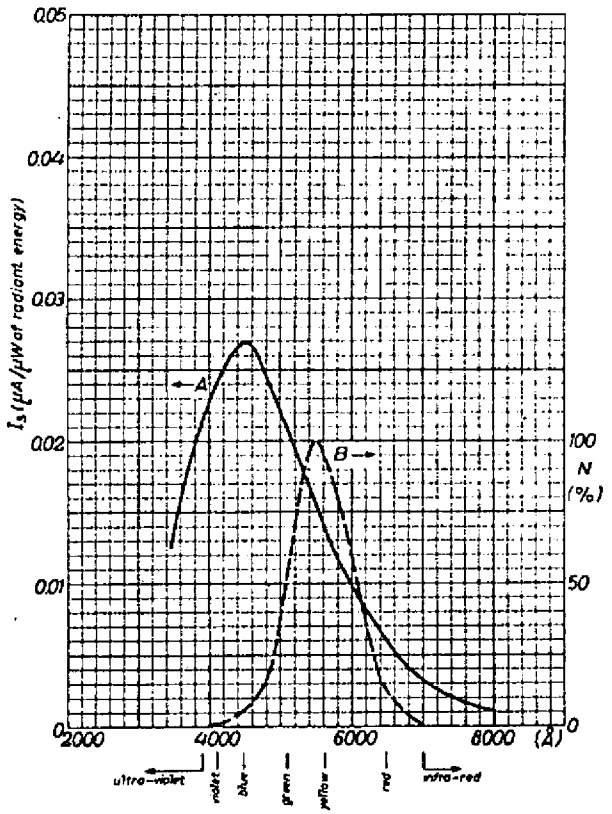


Figure 7. Spectral Sensitivity

A: Spectral sensitivity of 8483
Scanned area = 1/2 inch x 3/8 inch (12.8 mm x 9.6 mm)
Signal current I_S = 0.02 μa

B: Relative spectral sensitivity of the human eye (N).

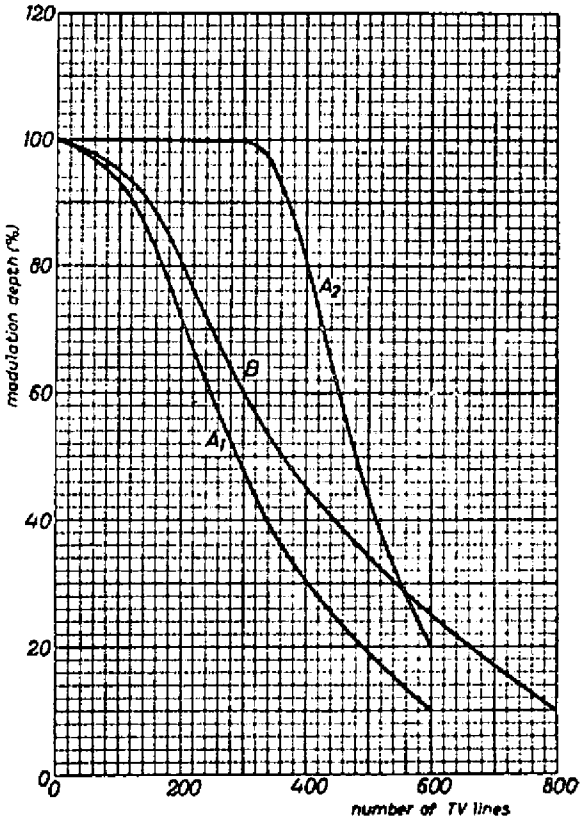
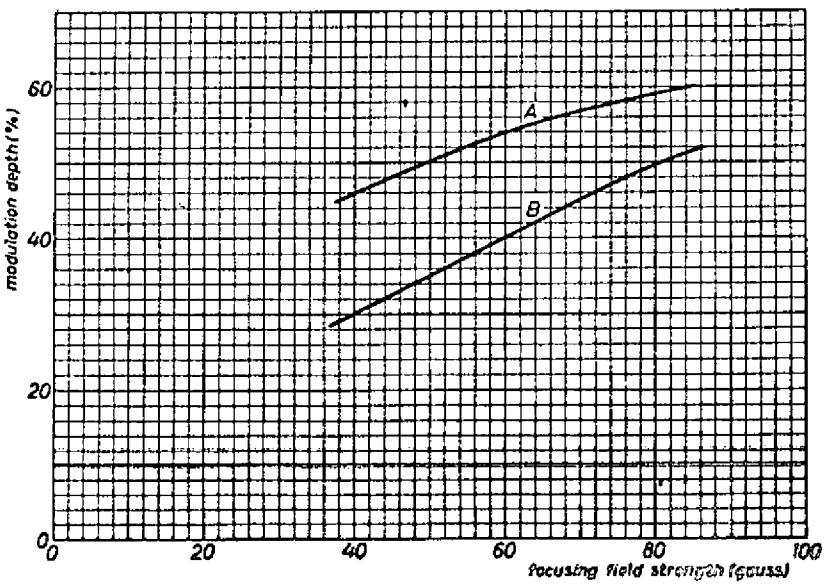


Figure 8. Horizontal Square-wave Response of Typical 8483 Vidicon at Picture Center

Highlight signal current = 0.3 μa
Test pattern: transparent square-wave resolution wedge.
A_1: Uncompensated $V_{g3,\ g4}$ = approx. 285 V, focusing field strength = 40 gauss
A_2: Compensated
B: Uncompensated: $V_{g3,\ g4}$ = 750 V, focusing field strength = approx. 70 gauss



Curve A: Highlight signal current = 0.1 μa
Dark current = 0.02 μa

Curve B: Highlight signal current = 0.3 μa
Dark current = 0.02 μa

Figure 9. Average Uncompensated Horizontal Square-wave Response at 400 TV Lines vs. Focusing Magnetic Field Strength

A suitable amplitude for this mixed parabolic waveform is approximately 4 volts peak-to-peak. The polarity should be chosen such that the potential of the cathode is lowered as the beam approaches the edges of the scanned area. The use of this modulating waveform also improves the center-to-edge focus of the vidicon.

Care must be taken that identical waveforms are applied to the relevant electrodes of each of the three tubes when using the 8483 in 3-color vidicon cameras to ensure good registration of all signals over the entire scanned area.

Operation with grid No. 3 and grid No. 4 voltage at 750 volts and a field strength of 70 gauss demands increased-power requirements for the deflecting and focusing coils which will increase tube temperature unless adequate provisions for cooling are made.

Scanning Amplitude

Full-size scanning of the area of the photoconductive layer should always be applied. To obtain this condition, first adjust the deflection circuits to overscan the photoconductive layer sufficiently so that the edges of the sensitive area can just be seen on the monitor, which itself should not be overscanned.

Then, after centering the image on the sensitive area (see Figure 10), reduce the scanning amplitudes in both directions by 15%.

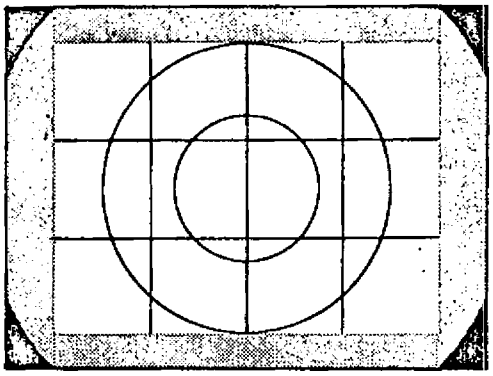
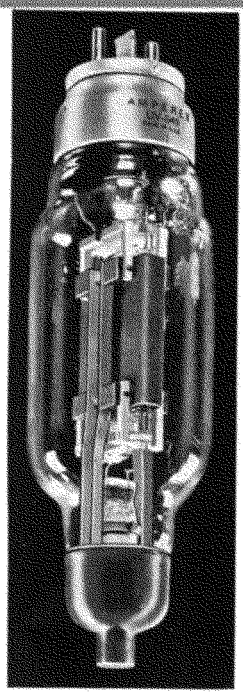


Figure 10. Positioning of the Image on the Sensitive Area

In this way, the maximum signal-to-noise ratio and maximum resolution can be obtained. It should be noted that overscanning of the photoconductive layer produces a picture on the monitor that is smaller than normal.

Underscanning of the photoconductive layer, i.e., scanning of an area of less than 3/8 inch x 1/2 inch (9.6 mm x 12.8 mm) or failure of scanning for eyen the shortest duration should always be avoided, since this may cause permanent damage to the specified full-size area.

Three Electrode Air Cooled Vacuum Tube Modulator, Audio Frequency Power Amplifier, Radio Frequency Amplifier, Oscillator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	11	11	11
D.C. Plate Voltage	3000	2500	3000	3000
D.C. Grid Voltage	—	—102	—132	—132
Peak A.F. Grid Voltage	—	96	126	126
D.C. Plate Current (ma.)	—	120	100	100
Plate Input (watts)	300	300	300	300
Plate Dissipation (watts)	300	—	—	—
Load Resistance (ohms)	—	12000	30000	18000
Power Output (watts)	—	81	75	100
Distortion (% Second Harmonic)	—	4.3	1.5	5

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes			
A.C. Filament Voltage	—	11	11	11	11
D.C. Plate Voltage	3000	2000	2500	2500	3000
D.C. Grid Voltage	—	—90	—115	—115	—150
Load Resistance (ohms per tube)	—	1600	2600	2200	3200
Effective Load Resistance (Plate to Plate) (ohms)	—	6400	10400	8800	12800
Zero Signal Plate Current (ma.)	—	100	100	100	80
Peak A.F. Grid to Grid Voltage	—	420	450	470	500
Max. Signal Plate Current (ma.)	350	680	560	640	540
Max. Signal Plate Input (watts)	825	1360	1400	1600	1720
Plate Dissipation (watts)	300	—	—	—	—
Max. Signal Driving Power (Approx.) (watts)	—	8	11	10	7
Max. Signal Power Output (watts)	—	880	980	1100	1120

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	—	11	11	11
D.C. Plate Voltage	2500	2000	2000	2500
D.C. Grid Voltage	—	—100	—100	—125
Peak R.F. Grid Voltage	—	130	150	140
D.C. Plate Current (ma.)	350	187	245	216
Plate Input (watts)	600	374	490	540
D.C. Grid Current (Approx.) (ma.)	—	5	8	2
R.F. Grid Current (amps.)	8	—	—	—
Plate Dissipation (watts)	400	242	317	360
Driving Power (at Modulation Peak) (Approx.) (watts)	—	10	20	9
Plate Power Output (watts)	—	132	173	180
F.C.C. Broadcast Rating (For Final Stage Use) (watts)	125	125	—	—

GENERAL CHARACTERISTICS

Filament Voltage	11
Filament Current (amps)	5
Direct Interelectrode Capacitances (Approx.)	
Grid to Plate	33 $\mu\mu$f
Grid to Filament	11 $\mu\mu$f
Plate to Filament	2 $\mu\mu$f
Average Characteristics at Plate Voltage of 3000 volts and grid bias of —132 volts.	
Plate Current (ma.)	100
Amplification Factor	19
Plate Resistance (ohms)	3200
Grid to Plate Transconductance	6000 micromhos

Plate Modulated R.F. Power Amplifier Class C—Telephony

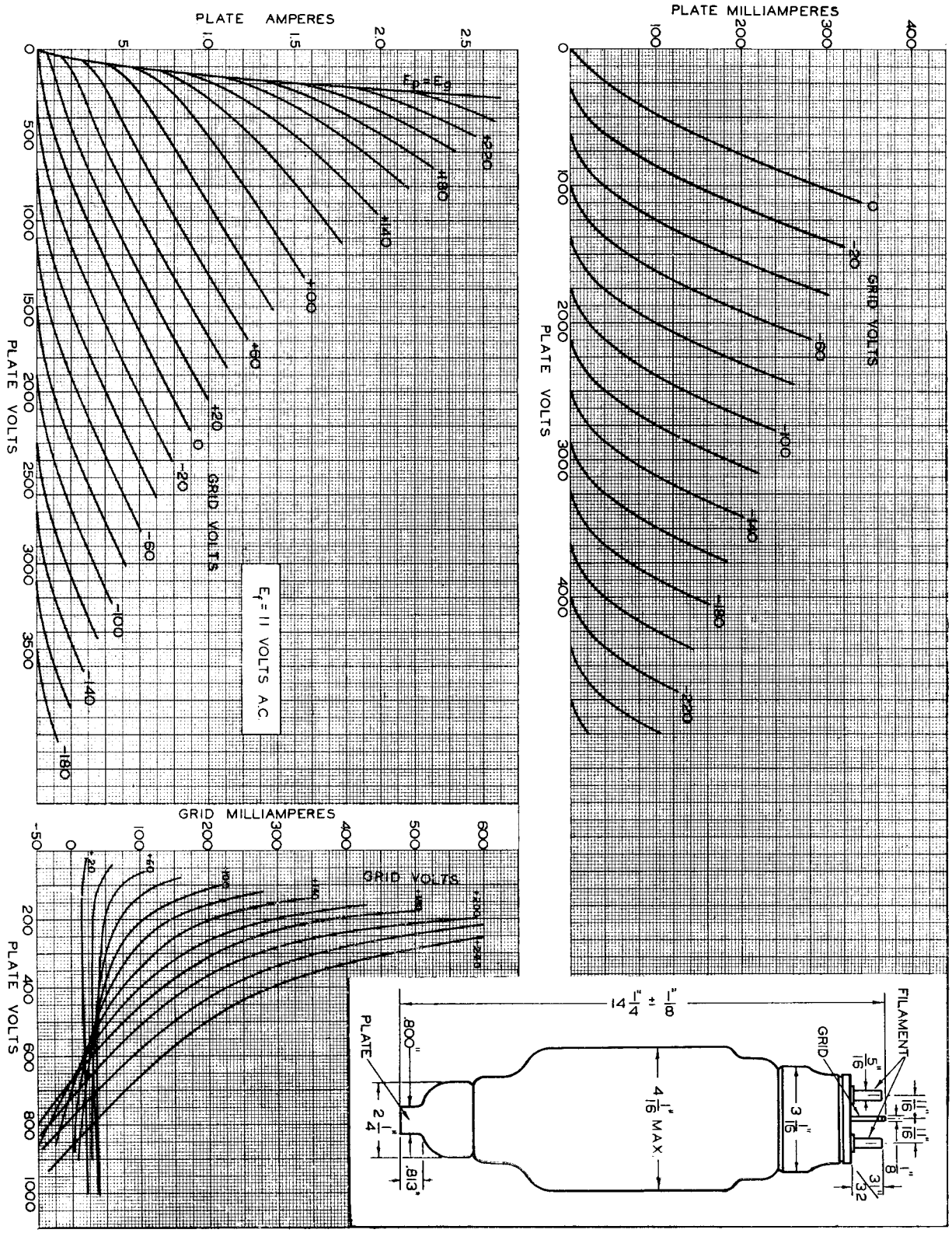
(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	11	11
D.C. Plate Voltage	2000	1500	2000
D.C. Grid Voltage	—500	—250	—300
Peak R.F. Grid Voltage	—	400	450
D.C. Plate Current (ma.)	350	278	300
Plate Input (watts)	700	417	600
D.C. Grid Current (Approx.) (ma.)	125	16	10
R.F. Grid Current (amps.)	8	—	—
Plate Dissipation (watts)	270	127	175
Driving Power (Approx.) (watts)	—	6	4
Plate Power Output (watts)	—	290	425
Frequency Limit for Above Operation (mc.)	3	—	—
F.C.C. Broadcast Rating (For Final Stage Use) (watts)	350	250	—

R.F. Power Amplifier and Oscillator—Class C Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	—	11	11
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	—500	—200	—250
Peak R.F. Grid Voltage	—	350	400
D.C. Plate Current (ma.)	350	340	350
Plate Input (watts)	875	680	875
D.C. Grid Current (Approx.) (ma.)	125	13	9
R.F. Grid Current (amps.)	10	—	—
Plate Dissipation (watts)	400	200	245
Driving Power (Approx.) (watts)	—	4	3
Plate Power Output (watts)	—	480	630
Frequency Limit for Above Operation (mc.)	3	—	—

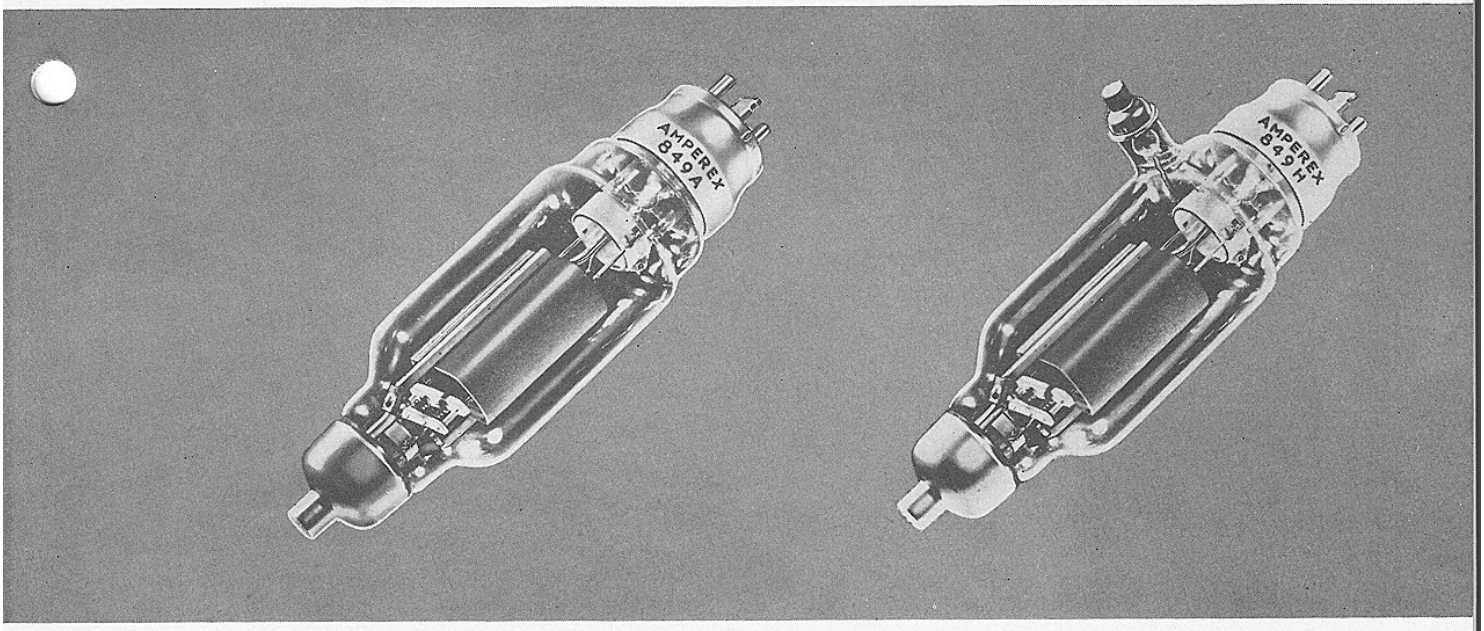
849—AMPEREX TRANSMITTING TUBE



AMPEREX - 849

849

AMPEREX TRANSMITTING TUBES 849-A/849-H



A.F. Power Amplifier or Modulator
R.F. Power Amplifier or Oscillator

The Amperex 849-A supersedes the 849. It is the older model redesigned along modern engineering principles. In its physical configurations and major electrical characteristics it is identical with the 849. Its performance capabilities are far greater.

The Amperex 849-H is identical in all but its interelectrode capacitances with the 849-A. The only other point of difference is the grid connection which terminates in an arm extending from the side of the glass envelope. It is designed for more efficient operation at high frequencies and may be operated at full ratings up to 30 megacycles in many classes of service.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL	849-A	849-H
Filament	Thoriated Tungsten	
Voltage	11.0 volts	10.0 volts
Current	7.7 amperes	11.5 amperes
Amplification Factor	19	19
Grid to Plate Transconductance		
At Plate Current of 200 ma.	7600 micromhos	7600 micromhos
Direct Interelectrode Capacitances		
Grid to Plate	11.5 $\mu\mu$f	11.5 $\mu\mu$f
Grid to Filament	14.0 $\mu\mu$f	10.0 $\mu\mu$f
Plate to Filament	1.8 $\mu\mu$f	1.8 $\mu\mu$f
MECHANICAL		
Maximum Overall Dimensions		
Length	14⅜ inches	14⅜ inches
Radius	2$^{1}/_{32}$ inches	4 inches
Base	Standard Jumbo 3 Pin	
Mounting Position—Vertical	Base up or down	
Net Weight (approx.)	2 pounds	2 pounds
Shipping Weight (approx.) (one tube)	7 pounds	7 pounds

849-A/849-H — AMPEREX TRANSMITTING TUBES

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

Typical Operation:				Maximum Rating per Tube
D.C. Plate Voltage	2500	3000	4000	4000
D.C. Grid Voltage	—100	—130	—185	....
Peak A.F. Grid Voltage	94	124	180	....
D.C. Plate Current (ma)	135	120	100	....
Plate Input (watts)	338	360	400	400
Plate Dissipation (watts)	256	255	250	400
Load Resistance (ohms)	12000	18000	30000	....
Power Output (watts)	82	105	150	....
Distortion (% Second Harmonic)	3	2.5	4	....

A.F. Power Amplifier and Modulator—Class B

Typical Operation:

Unless otherwise specified, values are for 2 tubes.

				Maximum Rating per Tube
D.C. Plate Voltage	2500	3000	3000	4000
D.C. Grid Voltage	—118	—140	—140	....
Load Resistance (ohms) (per tube)	2000	3200	2000	....
Effective Load Resistance (ohms) (pl-pl)	8000	12800	8000	....
Zero Sig. D.C. Plate Current (ma)	120	100	100	....
Max. Sig. D.C. Plate Current[1] (ma)	585	530	900	500
Peak A.F. Grid to Grid Voltage	416	480	600	....
Max. Sig. Plate Input (watts)[1]	1460	1590	2700	1350
Plate Dissipation (watts)[1]	620	490	800	500
Plate Dissipation (watts)[2]	....	....	920	....
Max. Sig. Driving Power (watts) (approx.)	35	55	110	....
Minimum Grid Input Resistance (ohms) (approx.)	1600	500	250	....
Max. Sig. Power Output (watts) (approx.)	840	1100	1900	....

R.F. Power Amplifier—Class B—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Plate Volts & Input Max. %			100	50
For Frequencies Indicated (mc)			20	40
Typical Operation:				Maximum Rating per Tube
D.C. Plate Voltage	2000	2500	3000	3500
D.C. Grid Voltage	—80	—110	—140	....
Peak R.F. Grid Voltage	110	135	160	....
D.C. Plate Current (ma)	215	240	250	350
D.C. Grid Current (ma) (approx.)	8	4	2	....
Plate Input (watts)	430	600	750	750
Plate Dissipation (watts)	285	395	475	500

(Continued)

Plate Load Resistance (ohms)	2800	3100	3550	....
Driving Power (watts) (approx.)[3]	15	20	25	....
Plate Power Output (watts) (approx.)	145	205	275	....
F.C.C. Broadcast Rating (For final stage use) (watts)	125	....	250	250

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0.

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	20	40
Typical Operation:		Maximum Rating per Tube
D.C. Plate Voltage	2500	3000
D.C. Grid Voltage	....	....
Total	—310	—500
Fixed Bias	—150	...
From Grid Resistor (ohms)	2000	....
Peak R.F. Grid Voltage	490	....
D.C. Plate Current (ma)	305	500
D.C. Grid Current (ma) (approx.)	80	100
Driving Power (watts) (approx.)	40	...
Plate Input (watts)	760	1250
Plate Load Resistance (ohms)	4100	....
Plate Dissipation (watts)	130	400
Plate Power Output (watts)	630	...

R.F. Power Amplifier and Oscillator Class C—Telegraphy

Key-down conditions per tube without modulation[4]

Plate Volts & Input Max. %			100	50
For Frequencies Indicated (mc)			20	40
Typical Operation:				Maximum Rating per Tube
D.C. Plate Voltage	2500	3000	3500	
D.C. Grid Voltage	—300	—300	—500	
Peak R.F. Grid Voltage	530	520	....	
D.C. Plate Current (ma)	500	500	500	
D.C. Grid Current (ma) (approx.)	97	93	100	
Plate Load Resistance (ohms)	2450	3000	....	
Plate Input (watts)	1250	1500	1750	
Plate Dissipation (watts)	270	300	500	
Driving Power (watts) (approx.)	46	44	....	
Plate Power Output (watts)	980	1200	....	

NOTES:

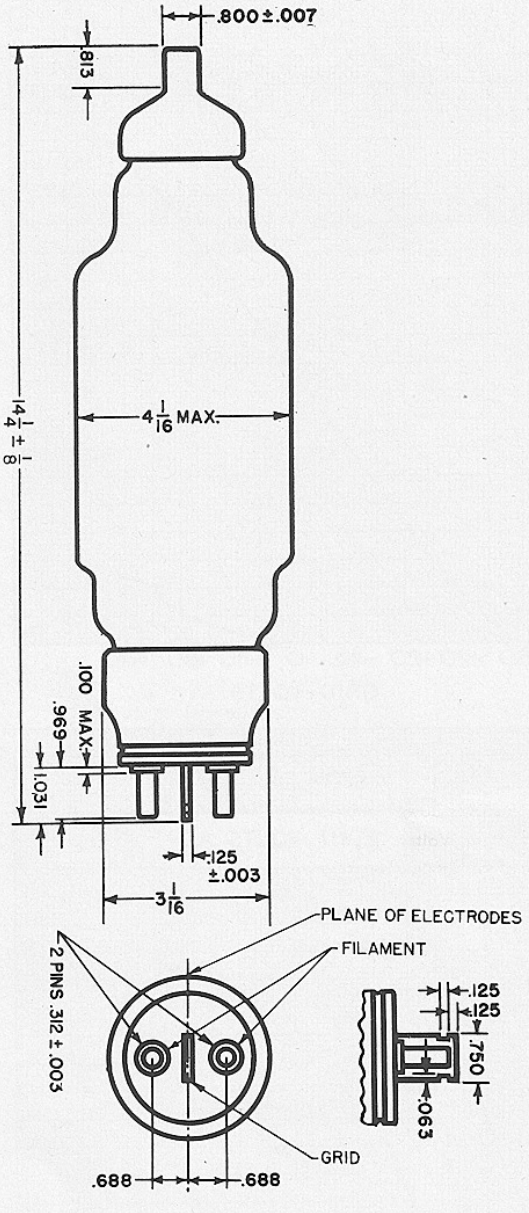
[1] Averaged over any audio-frequency cycle of sine wave form.

[2] Average over any audio-frequency cycle of sine wave form under approximately 70% of maximum drive conditions.

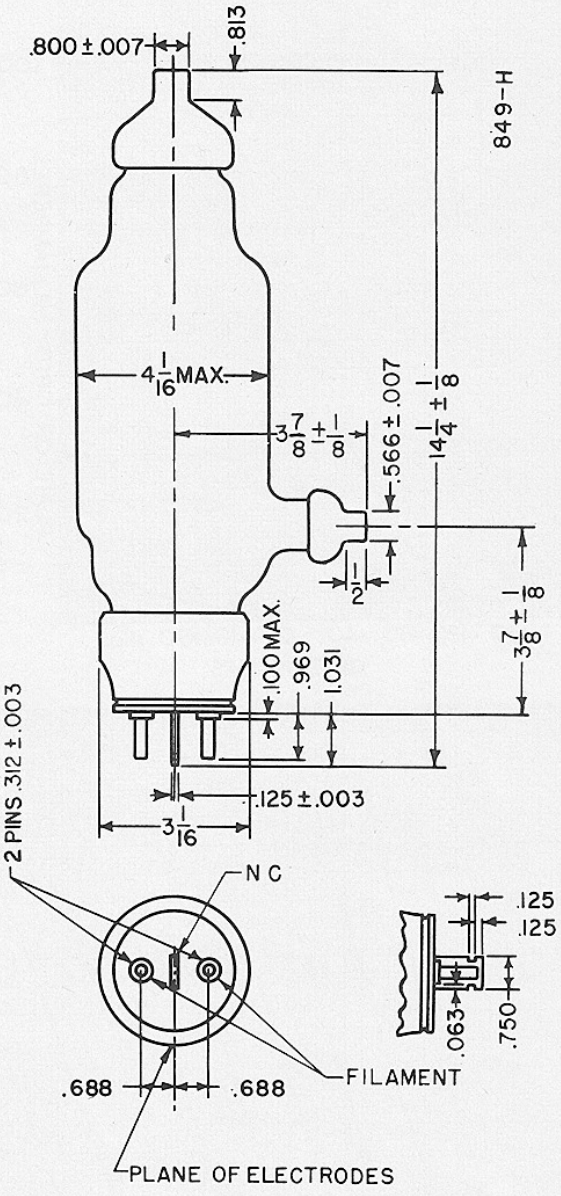
[3] At crest of audio-frequency cycle with a modulation factor of 1.0.

[4] Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

AMPEREX TRANSMITTING TUBES 849-A/849-H



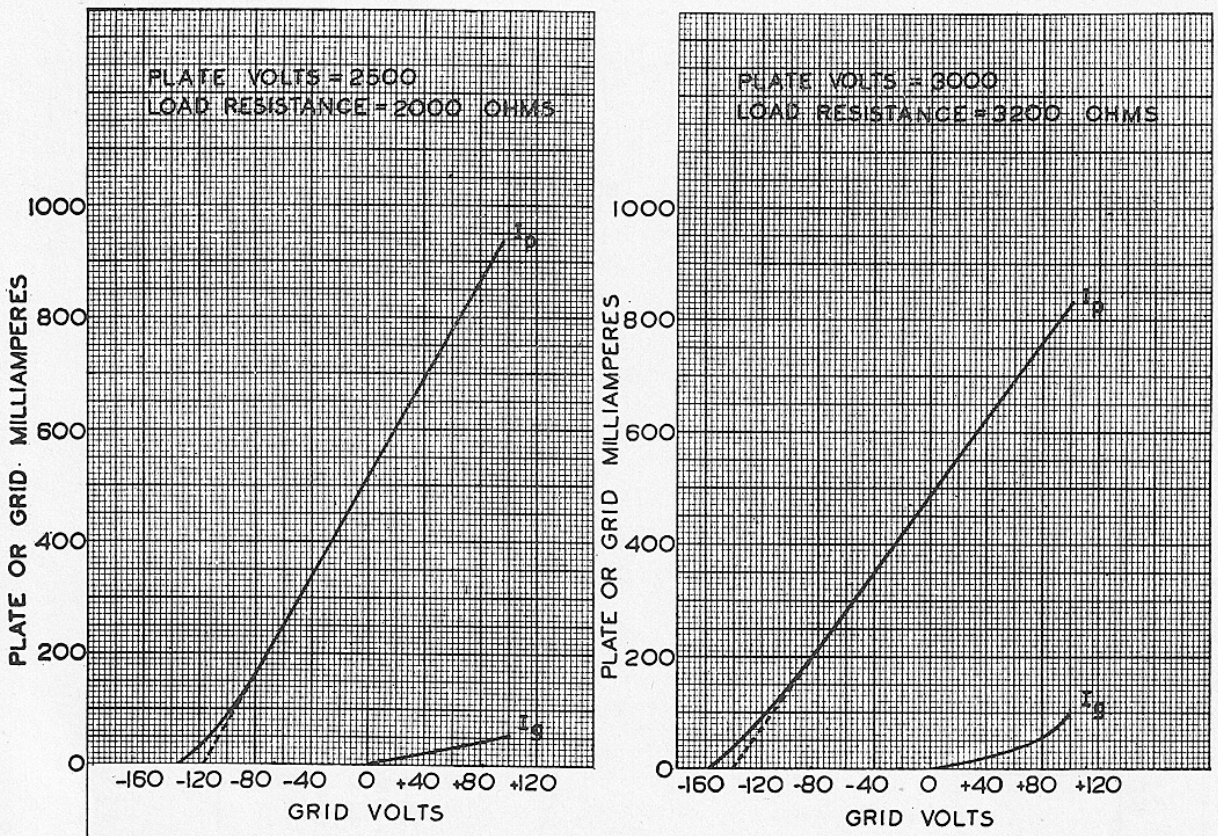
849-A

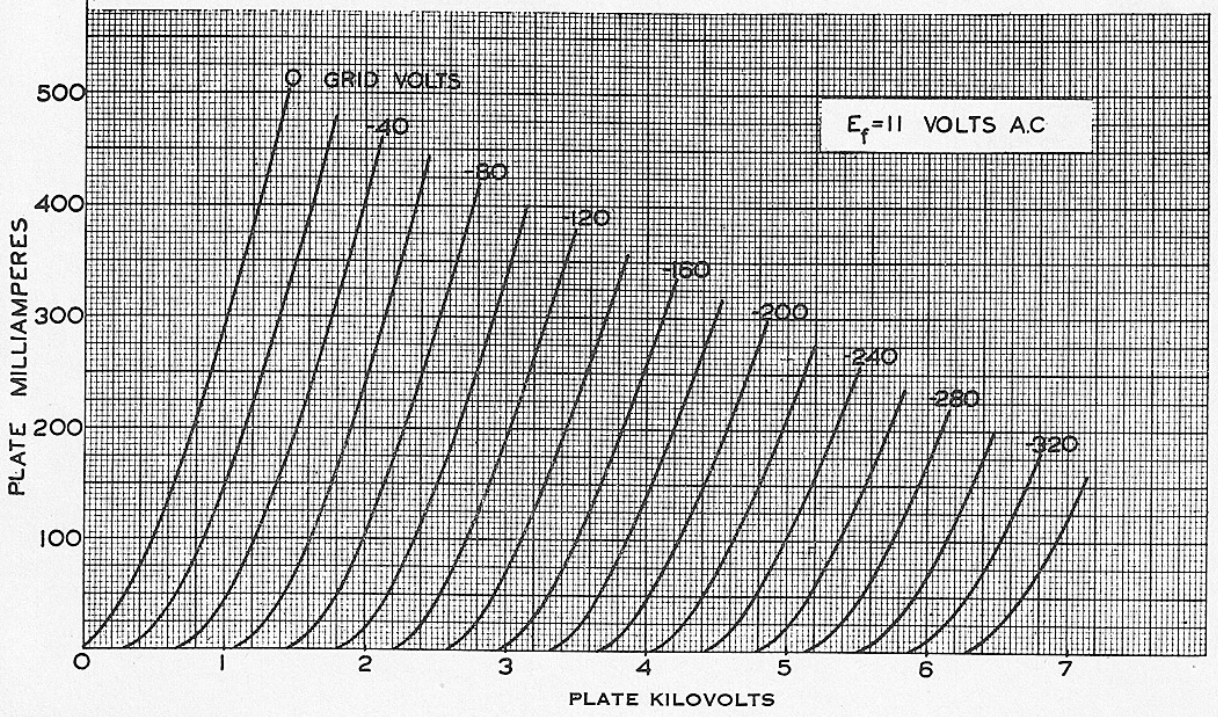


849-H

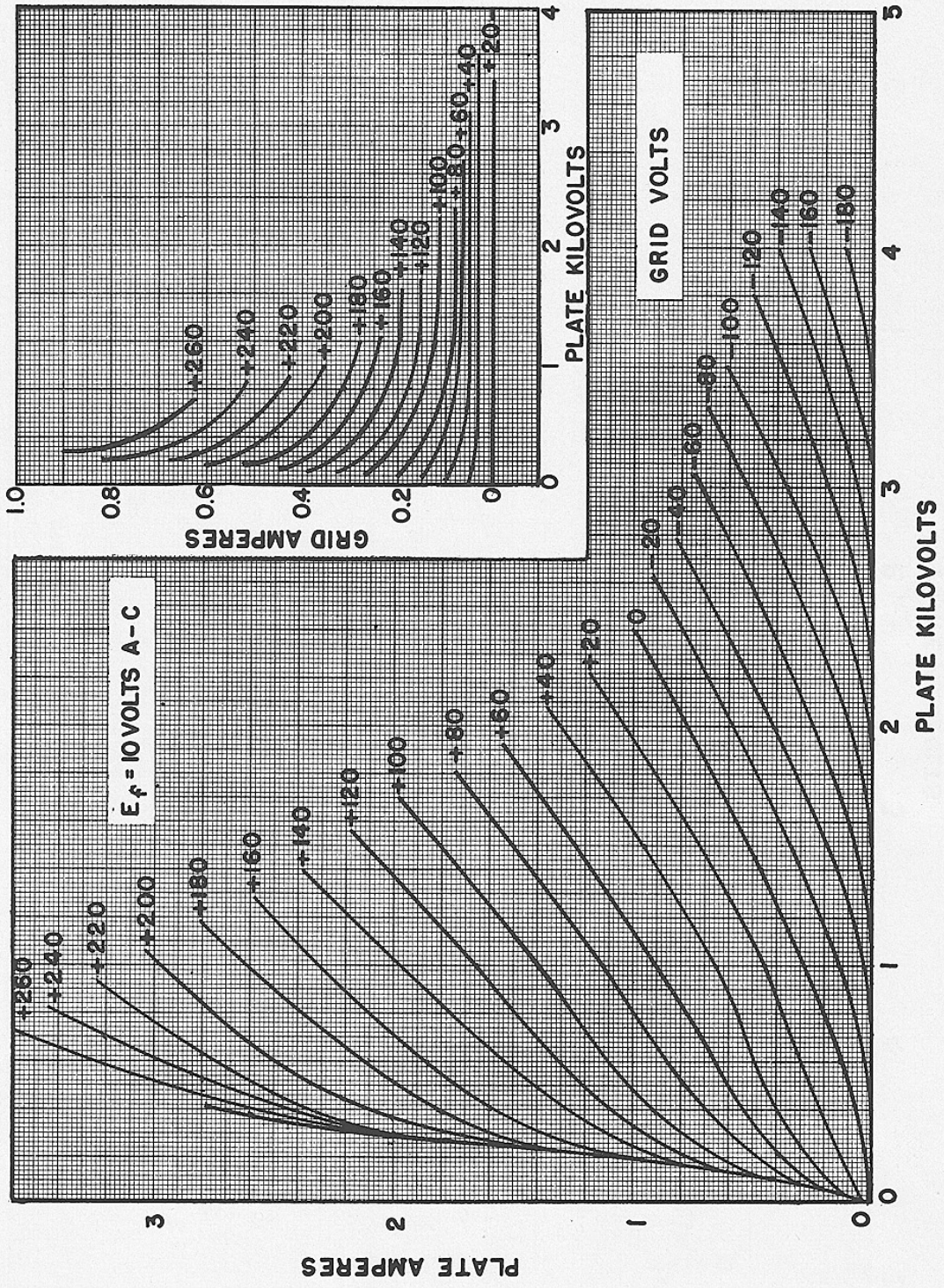
849-A/849-H — AMPEREX TRANSMITTING TUBES

849—A TRANSFER CHARACTERISTICS A F POWER AMPLIFIER AND MODULATOR CLASS—B

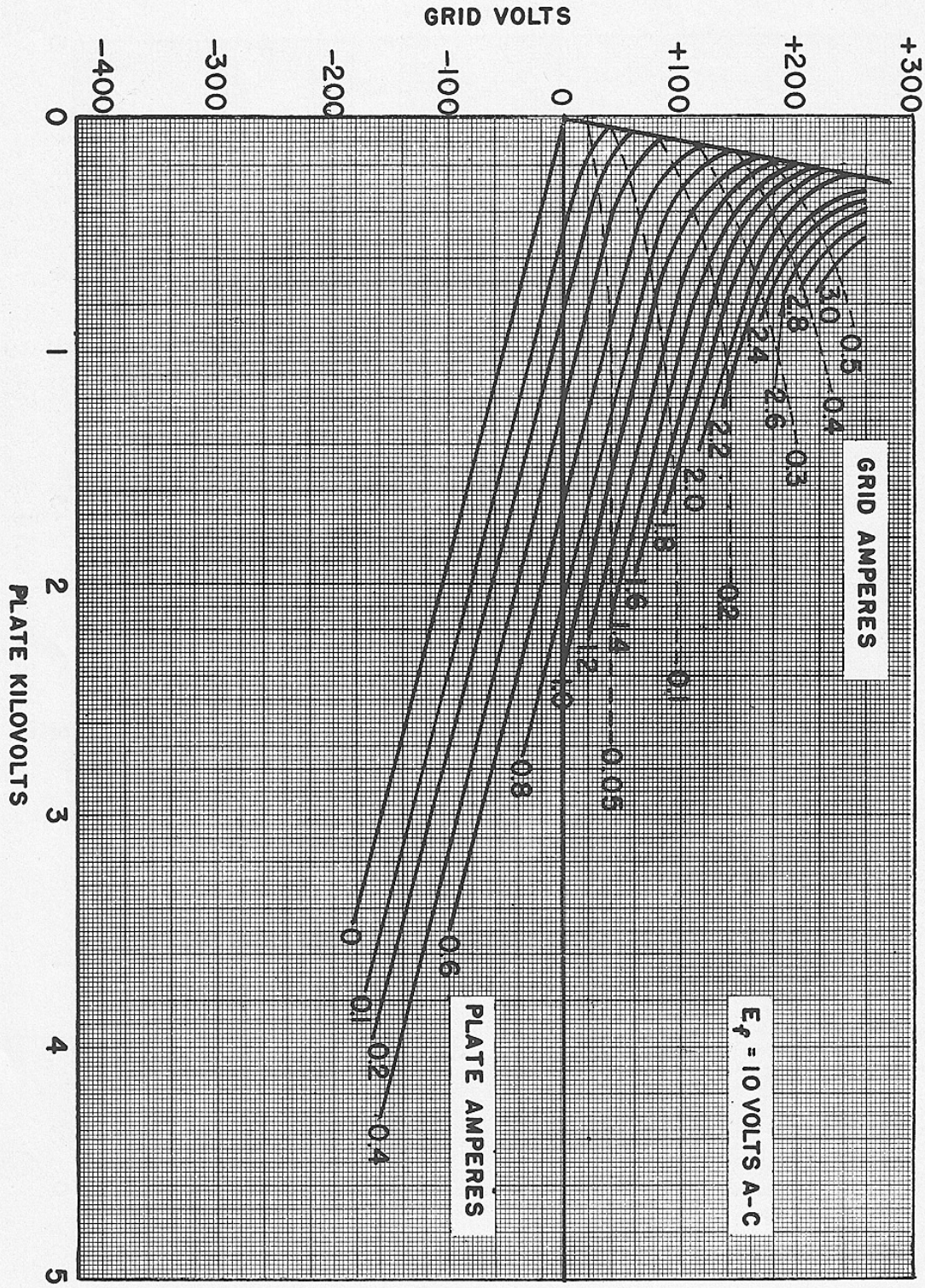




AMPEREX TRANSMITTING TUBES 849-A/849-H

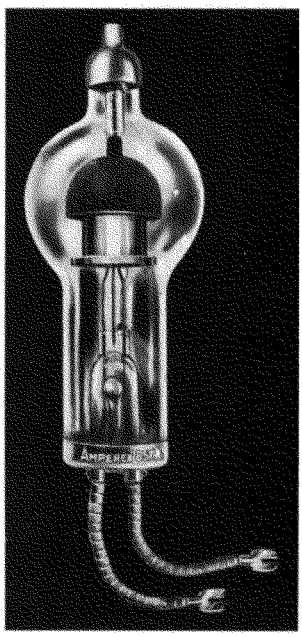


849-A/849-H — AMPEREX TRANSMITTING TUBES



MARCH 1948

AMPEREX MERCURY VAPOR RECTIFIER 857-B



FILAMENT

A.C. Voltage	5.0
Current (amperes)	30.0
Preheating Period (Seconds)*	300

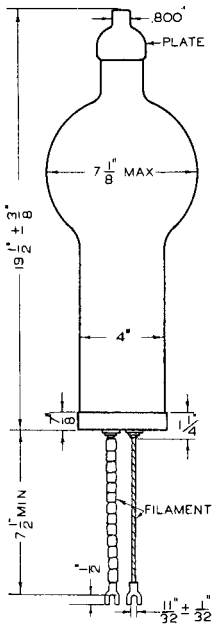
*Before plate voltage is applied.

MAXIMUM RATINGS

For Operation at Supply Frequency Up to 150 Cycles

	Condensed Mercury Temperature Range	
	25°C. to 60°C.	30°C. to 40°C.
Peak Inverse Voltage	10000	22000
Peak Plate Current (amps)	40.0	40.0
Average Plate Current (amps)*	10.0	10.0
Approx. Tube Voltage Drop	10	10

*Averaged over period of 30 seconds.



MAXIMUM OUTPUTS IN TYPICAL CIRCUITS

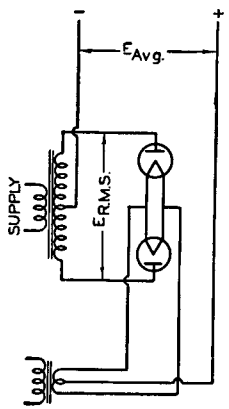
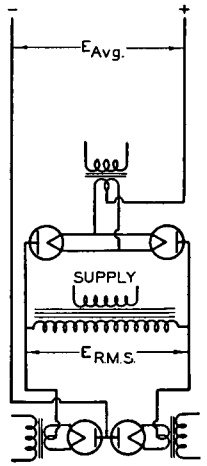
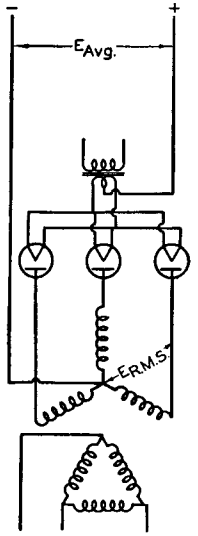
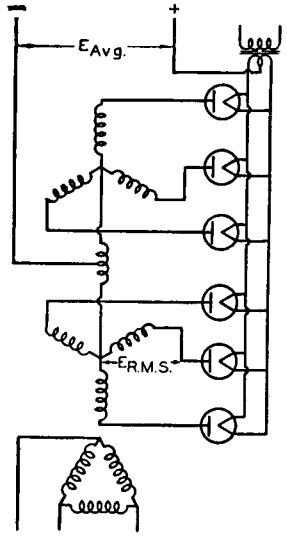
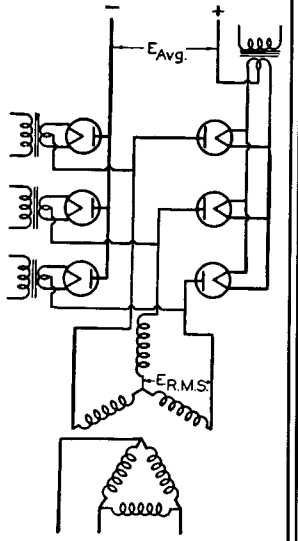
	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes
Single-Phase Full Wave (2 Tubes)	7750*	7000	20
Single-Phase Full Wave Bridge (4 Tubes)	15500†	14000	20
Three-Phase Half Wave (3 Tubes)	9000‡	10500	30
Three-Phase Double Y-Parallel (6 Tubes)	9000‡	10500	60
Three-Phase Full Wave (6 Tubes)	9000‡	21000	30

*Per Tube. †Total. ‡Per Leg.

NOTE: For Out-Of-Phase Filament Excitation information see "Maximum Peak Plate Current" and "Maximum Average Plate Current", pp. 3 and 4, "General Information and Application Notes" section, "Mercury Vapor High Voltage RECTIFIER TUBES".

AMPEREX

857-B

RECTIFIER CIRCUIT	SINGLE PHASE FULL-WAVE 2 TUBES	SINGLE PHASE FULL-WAVE 4 TUBES	THREE PHASE HALF-WAVE	THREE PHASE DOUBLE–Y	THREE PHASE FULL-WAVE
Conditions assumed for following relations 1. Sine-Wave Supply 2. Balanced Phase Voltages 3. Zero Tube Drop 4. Pure Resistance Load 5. No Filter Used NOTE: All rectifier filaments supplied by single phase transformers, with secondaries insulated for voltages greater than the Maximum Peak Inverse Voltage.	FIG. 1 	FIG. 2 	FIG. 3 	FIG. 4 	FIG. 5 
E Average	.450 *E* rms .318 *E* max	.900 *E* rms .636 *E* max	1.170 *E* rms .827 *E* max	1.170 *E* rms .827 *E* max	2.34 *E* rms 1.65 *E* max
E Inverse	3.14 *E* avg	1.57 *E* avg	2.09 *E* avg	2.09 *E* avg	1.045 *E* avg
I Average	.636 *I* max	.636 *I* max	.827 *I* max	1.91 *I* max	.955 *I* max
Ripple Frequency	2 X Supply Freq.	2 X Supply Freq.	3 X Supply Freq.	6 X Supply Freq.	6 X Supply Freq.
Ripple Voltage (Rms)	48.3%	48.3%	18.3%	4.2%	4.2%
† Ratio $\frac{\text{Secondary Kva}}{\text{D.C. Output-Kw}}$	1.57	1.11	1.48	1.48	1.05
† Ratio $\frac{\text{Primary Kva}}{\text{D.C. Output-Kw}}$	1.11	1.11	1.21	1.05	1.05

† These ratios assume that a choke input filter is used to maintain the output current substantially constant.

AMPEREX TRANSMITTING TUBE 859

(Water Cooled)



This Amperex 859 water cooled tube embodies elements of design which minimize inter-electrode capacitances while maintaining a high order of grid to plate transconductance and r.f. voltage tolerance. It is therefore suitable for use at radio frequencies up to 50 Megacycles where high powers are required.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes
A.C. Filament Voltage*	—	22
D.C. Plate Voltage	20000	12000
D.C. Grid Voltage	—	—225
Load Resistance (ohms per tube)	—	1250
Effective Load Resistance (Plate to Plate) (ohms)	—	5000
Zero Signal Plate Current (amps.)	—	0.6
Peak A.F. Grid to Grid Voltage	—	2350
Max. Signal Plate Current (amps.)**	3.0	5.1
Max. Signal Plate Input (kw.)**	50	61
Plate Dissipation (kw.)**	20	—
Minimum Grid Input Resistance (Approx.) (ohms)	—	300
Max. Signal Driving Power (Approx.) (watts)	—	800
Max. Signal Power Output (kw.)	—	40

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
Filament Voltage*	—	22	22
D.C. Plate Voltage	20000	15000	12000
D.C. Grid Voltage	—	—350	—300
Plate Load Resistance (ohms)	—	2750	2500
Peak R.F. Grid Voltage	—	700	625
D.C. Plate Current (amps.)	1.5	1.5	1.3
Plate Input (kw.)	30	22.5	15.6
Plate Dissipation (kw.)	20	15.0	10.2
D.C. Grid Current (Approx.) (ma.)	—	0	10
Driving Power (Approx.) (watts)***	—	400	350
Power Output (kw.)	—	7.5	5.0
Frequency Limit for Above Operation (mc.)	1.6	20	30

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
Filament Voltage*	—	22	22
D.C. Plate Voltage	12000	10000	7000
D.C. Grid Voltage Obtained by Grid Leak Resistor of (ohms)	—3000	—1000	—720
	—	4000	2400
Plate Load Resistance (ohms)	—	3800	2200
Peak R.F. Grid Voltage	—	1800	1600
D.C. Plate Current (amps.)	1.5	1.3	1.5
Plate Input (kw.)	18.0	13	10.5
Plate Dissipation (kw.)	12.0	2.5	2.5
D.C. Grid Current (Approx.) (ma.)	400	250	300

GENERAL CHARACTERISTICS

Filament: Tungsten, Two-unit type for 1 ∅ A.C., 2 ∅ A.C. or D.C. Excitation.	
Filament Voltage per unit	**11**
Filament Current per unit	**71**
Filament Emission	**15**
Average characteristics at plate current of 1 ampere.	
Amplification Constant	**36**
Grid to Plate Transconductance	**8000 micromhos**
Direct Interelectrode Capacitances:	
Grid to Plate	**15 $\mu\mu$f**
Grid to Filament	**20 $\mu\mu$f**
Plate to Filament	**2 $\mu\mu$f**
Dimensions:	
Maximum Overall Length	**24½"**
Maximum Radius	**7½"**
Maximum Anode Diameter	**3¼"**
Maximum Anode Length	**9½"**

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

(Continued)

	Maximum Rating per Tube	Typical Operation One Tube	
Driving Power (Approx.) (watts)	—	450	450
Power Output (kw.)	—	10.5	8
Frequency Limit for Above Operation (mc.)	1.6	20	30

R.F. Power Amplifier and Oscillator—Class C Telegraphy or Frequency Modulated

	Maximum Rating per Tube	Typical Operation One Tube	
Filament Voltage*	—	22	22
D.C. Plate Voltage	20000	15000	8000
D.C. Grid Voltage	—3000	—1100	—600
Plate Load Resistance (ohms)	—	2600	1600
Peak R.F. Grid Voltage	—	2400	1600
D.C. Plate Current (amps.)	3.0	2.9	2.2
Plate Input (kw.)	50	43.5	17.6
Plate Dissipation (kw.)	20	11.0	6.6
D.C. Grid Current (Approx.) (ma.)	400	300	280
Driving Power (Approx) (watts)	—	700	450
Plate Power Output (kw.)	—	32.5	11
Frequency Limit for Above Operation (mc.)	1.5	15	50

*Two filament units in series

**Averaged over any audio-frequency cycle of sine-wave form

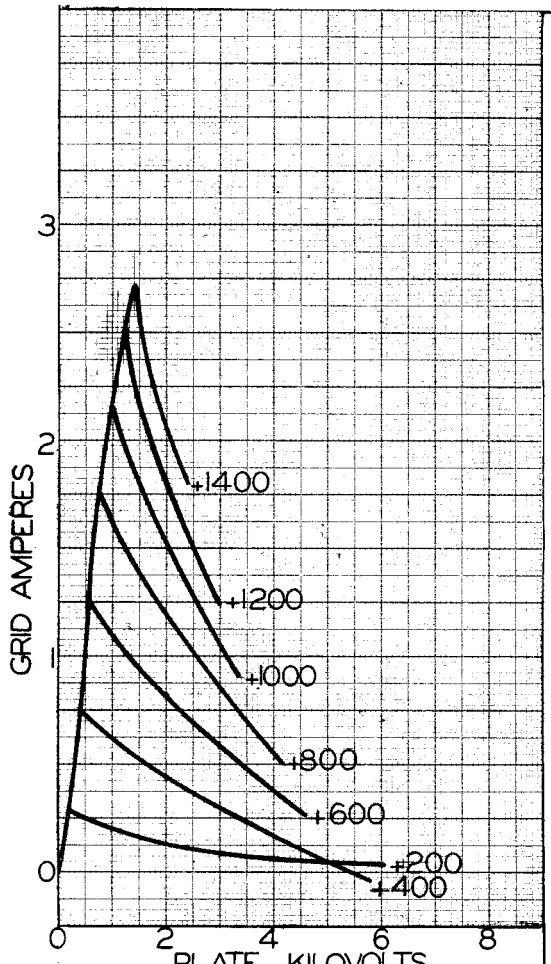
***At crest of audio frequency cycle with modulation factor of 1.0.

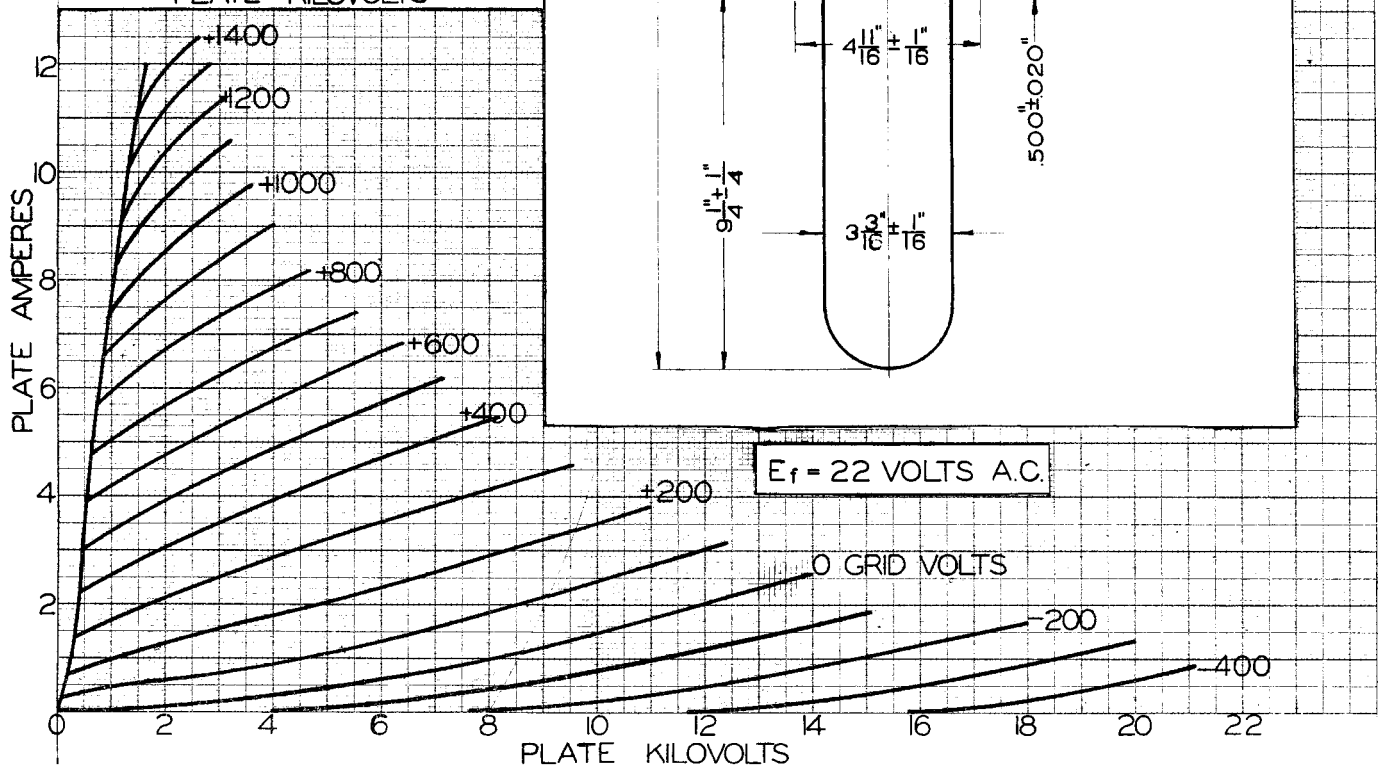
Cooling: A water flow of 8 to 15 gallons per minute must start before the application of any voltages and should be continued for at least 2 minutes after removal of voltages. The water temperature at the outlet must not exceed 70° C.

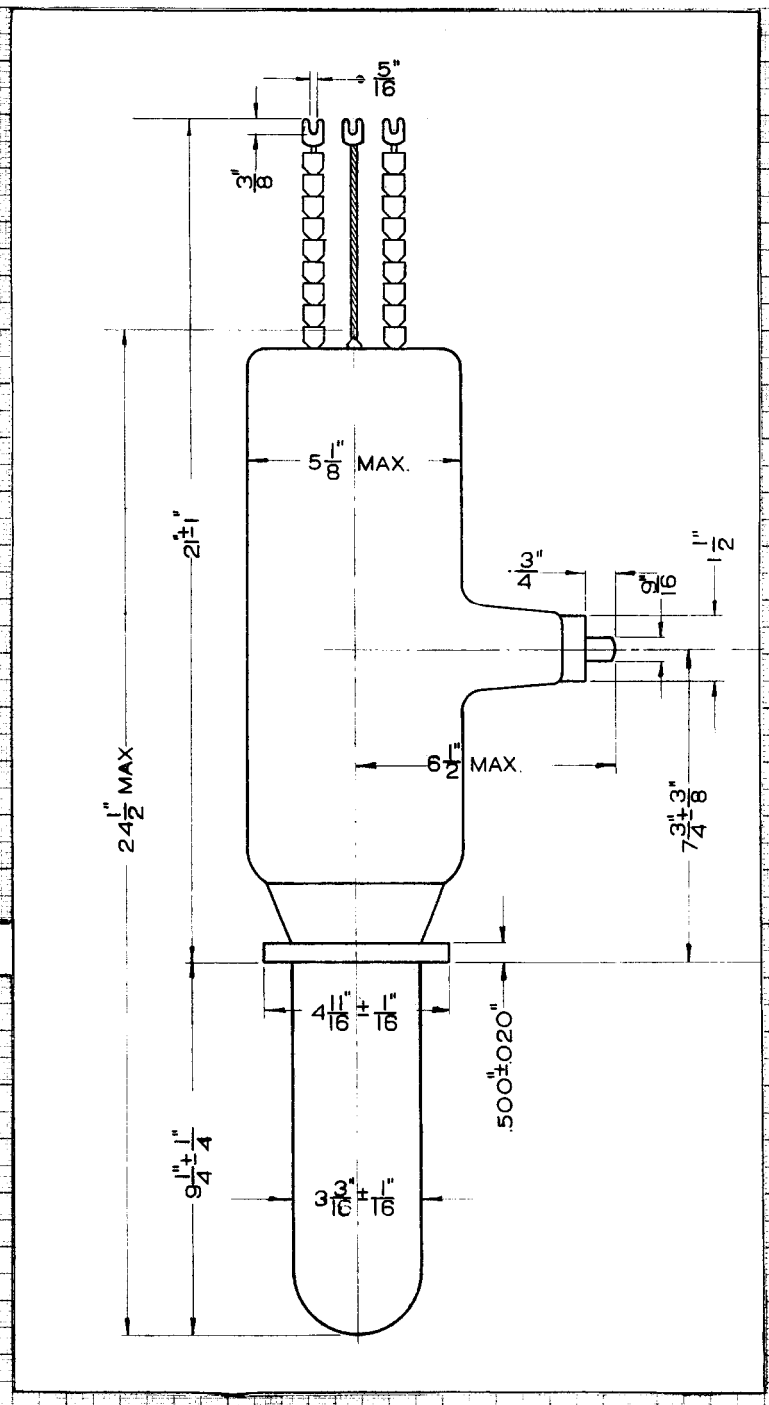
AMPEREX

8 5 9

859 – AMPEREX TRANSMITTING TUBE







E_f = 22 VOLTS A.C.

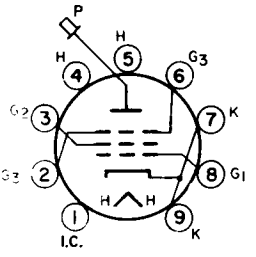
859

AMPEREX TUBE TYPE 8608

TENTATIVE DATA

The 8608 is a Premium Quality power pentode having 10 watts of plate dissipation and a transconductance of 45,000 micromhos at 50 ma. It is particularly suited for use as a wideband video amplifier in applications requiring low output capacitance.

The 8608 is constructed in a magnoval envelope with double frame grids affording high gain and high dissipation with excellent uniformity.

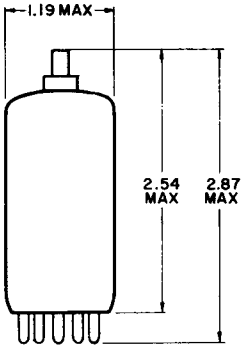


MAGNOVAL
E9-23

PIN CONNECTIONS

1. INTERNAL CONNECTION
2. GRID NO.3
3. GRID NO.2
4. HEATER
5. HEATER
6. GRID NO.3
7. CATHODE
8. GRID NO.1
9. CATHODE

P. PLATE CAP



T-9 BULB

GENERAL CHARACTERISTICS

MECHANICAL

Bulb	See outline drawing
Base	Magnoval, E9-23
Dimensions	See outline drawing

ELECTRICAL

Heating	Indirect, parallel supply, AC or DC
Heater Voltage, E_f	6.3 volts ± 5%
Heater Current, I_f	600 ma

Interelectrode Capacitances

	Without External Shield	
Output, C_{out}	3.2	pf
Input, C_{in}	18	pf
Input with Cathode Current = 55.5 ma	28	pf
Plate to Control Grid, C_{pg} (Avg.)	.110	pf
Plate to Control Grid, C_{pg} (Max.)	.150	pf
Plate to Cathode, C_{pk}	0.125	pf
Control Grid to Heater, C_{g1h} (Avg.)	0.06	pf
Plate to Heater, C_{ph} (Avg.)	0.087	pf
Cathode to Heater, C_{kh} (Avg.)	5.5	pf

8608

Maximum Ratings, Absolute Values

	Symbol	Values
Plate Voltage, Zero Plate Current	E_{bb}	300 volts
Plate Voltage	E_b	150 volts
Plate Dissipation	P_p	10 watts
Screen Grid Voltage, Zero Screen Grid Current		300 volts
Screen Grid Voltage	E_{c2}	150 volts
Screen Grid Dissipation	P_{g2}	1.5 watts
Control Grid Voltage (Negative)	E_{c1}	-55 volts
Control Grid Voltage (Positive)	E_{c1}	0 volts
Cathode Current	I_k	75 ma[1]
Control Grid Circuit Resistance	R_g	125 kohms
Voltage Between Heater and Cathode	E_{hk}	180 volts
Bulb Temperature		200 °C

Operating Conditions

Plate Voltage	140 volts[2]
Screen Grid Voltage	140 volts[2]
Suppressor Grid Voltage	0 volts
Control Grid Voltage	+12 volts[2]
Cathode Resistor	270 ohms
Plate Current	50 ma
Screen Grid Current	5.5 ma
Transconductance	45000 μmhos

Typical Characteristics

	Pentode	Triode[3]
Plate Voltage	125	125 volts
Screen Grid Voltage	125	- volts
Suppressor Grid Voltage	0	0 volts
Control Grid Voltage	-3	-3 volts
Plate Current	50	55.5 ma
Screen Grid Current	5.5	- ma
Transconductance	45000	50000 μmhos
Plate Resistance, r_p	20000	- ohms
Amplification Factor ($\mu_{g2\,g1}$) or MU Factor	30	-
Amplification Factor	-	30
Input Resistance (at 100 mc)	350	- ohms

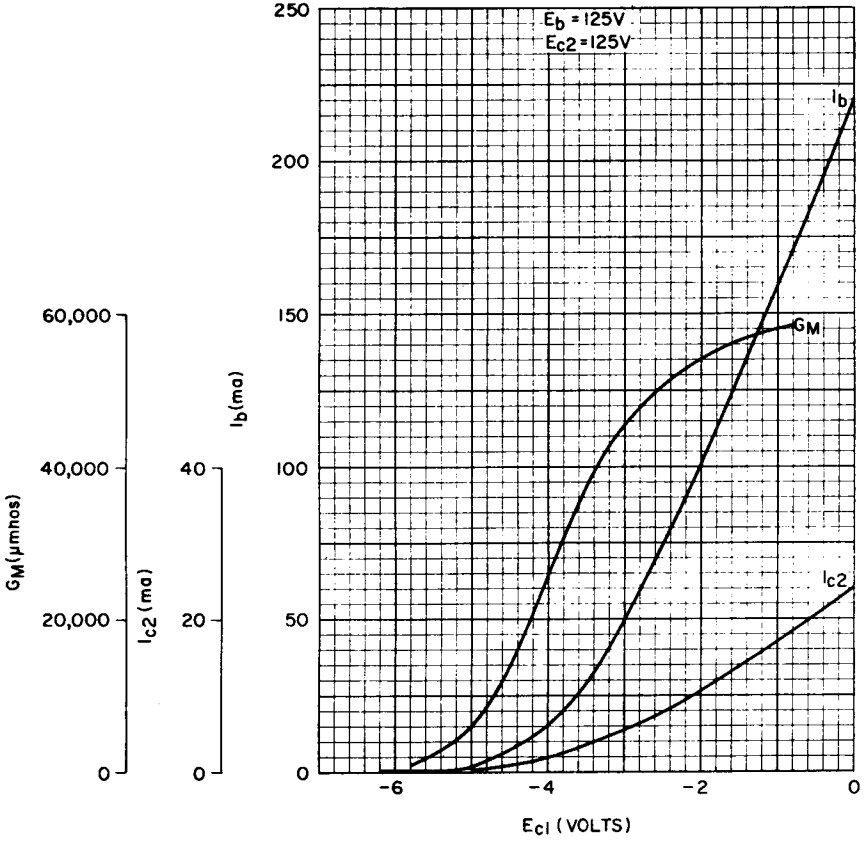
Input Damping (f=100 mc; G_m = 45000 μmhos)

Transit Time	230 μamps/volt
Cathode Lead Inductance	4170 μamps/volt
Total	4400 μamps/volt

1. In applications where a long life is not required, the cathode current can equal 100 ma and the bulb temperature can be increased to 220° C.

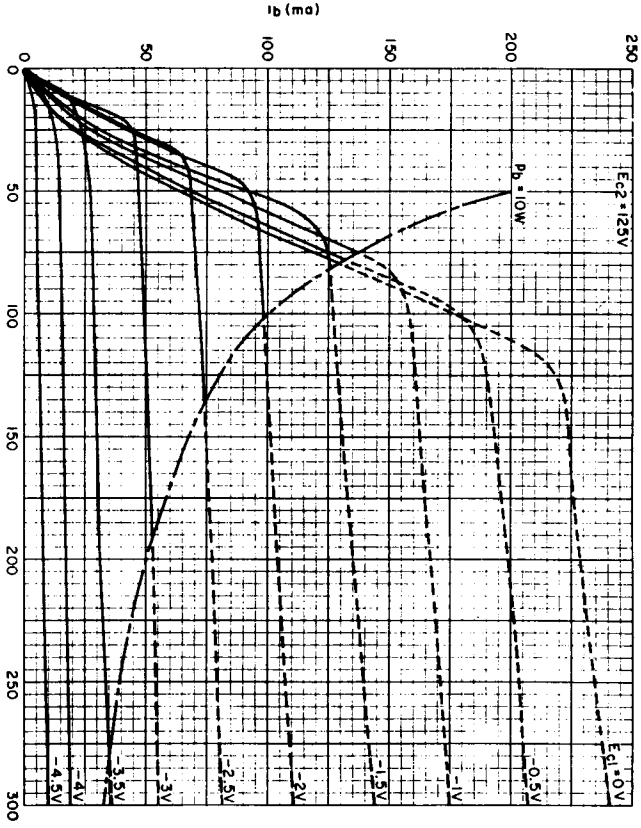
2. With respect to ground

3. Plate connected to screen grid



TYPICAL CURRENT CHARACTERISTICS AS A FUNCTION OF CONTROL GRID VOLTAGE (PENTODE CONNECTED)

FIGURE 1



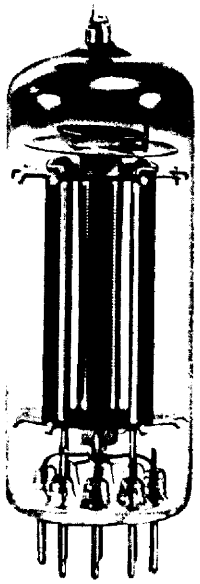
TYPICAL PLATE CHARACTERISTICS

FIGURE 2

Amperex® ELECTRONIC CORPORATION
HICKSVILLE, L. I., N. Y., 11802

TUBE TYPE 8637

The Amperex 8637 is a radiation cooled beam power twin tetrode having high thermal inertia anodes capable of handling the peak dissipation encountered under PTTS service. It is designed for use as an RF power amplifier, oscillator and frequency multiplier in mobile and base station equipment up to 175 MHz. It uses a glass envelope and an indirectly heated cathode. Built in cross neutralization is effective over the entire operating band. It is capable of producing 63 watts from 2.2 watts drive power as a 175 MHz amplifier under PTTS conditions. The 8637 is also rated for class AB_1 SSB service.



TYPICAL OPERATING CHARACTERISTICS

Frequency	Class C Telegraphy		Class C Telephony		Class AB_1 (SSB)	
MHz	Eb(V)	Po(W)	Eb(V)	Po(W)	Eb(V)	Po(WPEP)
7 PTTS	--	--	--	--	600	60*
175 PTTS	560	63	450	42	--	--

*Third order IM Distortion = -34 db

GENERAL CHARACTERISTICS

MECHANICAL

Dimensions	see outline drawing
Mounting Position	any
Net Weight	1.4 ounces
Base	9 pin magnoval
Cooling[1]	radiation and convection
Absolute Maximum Operating Temperature	
Pin Seals	180°C
Bulb	225°C
Accessory - Socket	Amperex #S-331911 or equivalent[2]

ELECTRICAL

Cathode	coated unipotential
Heater	
Voltage	13.5 volts
Current	.80 amperes
Maximum Heater to Cathode Voltage	±100 volts
Amplification Factor (Grid #1 to Grid #2)	
Each unit at Ib = 30 ma	7
Direct Interelectrode Capacitance	each unit
Input	9.3 pf
Output	4.2 pf
Grid to Plate - Maximum	0.2 pf

Amperex

1. Sufficient cooling must be applied to the bulb and seals to avoid exceeding rated maximum temperature. The use of a closed can closer to the bulb than 1/2 inch is not recommended.

2. Socket number listed is for mounting on top of chassis. Socket #B8.702.16 is for mounting on bottom of chassis.

Rev. June 1967

RF POWER AMPLIFIER AND OSCILLATOR DATA

(Class C Telegraphy or FM Telephony)
(Two Units - Push Pull)

MAXIMUM RATINGS - Absolute values

	CCS	ICAS	PTTS[3]	
Frequency	175	175	175	MHz
DC Plate Voltage	400	450	600	volts
DC Grid #2 Voltage	300	300	300	volts
DC Grid #1 Voltage	-150	-150	-150	volts
DC Plate Current	2x110	2x120	2x120	mA
DC Grid #1 Current	2x5	2x5	2x5	mA
Grid #2 Dissipation	7	8	8	watts
Plate Dissipation	2x7.5	2x10	2x25	watts
Plate Input	2x44	2x54	2x72	watts

TYPICAL OPERATION

	PTTS	PTTS[3]	
Frequency	50	174	MHz
DC Plate Voltage	600	560	volts
DC Grid #2 Voltage	154	164	volts
DC Grid #1 Voltage	-50	-50	volts
DC Plate Current	210	200	mA
DC Grid #2 Current	25	18.4	mA
DC Grid #1 Current	7.1	5.0	mA
Drive Power	0.86	2.2	watts
Useful Power Output	84	63	watts

TYPICAL OPERATION

	CCS_1	CCS	ICAS	ICAS	
Frequency	50	174	50	174	MHz
DC Plate Voltage	375	300	450	350	volts
DC Grid #2 Voltage	103	132	110	130	volts
DC Grid #1 Voltage	-50	-42	-50	-42	volts
DC Plate Current	100	110	112	130	mA
DC Grid #2 Current	14	10	14	11	mA
DC Grid #1 Current	5.3	2.6	6.6	3.0	mA
Drive Power	.67	1.4	.82	1.6	watts
Useful Power Output	25	18	34	26	watts

3. Push-To-Talk (PTTS) Service describes an operating cycle of one minute ON (Maximum) and four minutes OFF (Minimum) without impairing the long useful life of this tube. This tube is also capable of being continuously operated under these conditions for reasonably extended periods of time to permit equipment tuning and adjustment.

RF POWER AMPLIFIER AND OSCILLATOR DATA

(Class C Telephony 100% Plate & Screen Modulation)

(Two Units - Push Pull)

MAXIMUM RATINGS - Absolute Values

	CCS	ICAS	PTTS	
Frequency	175	175	175	MHz
DC Plate Voltage	320	360	480	volts
DC Grid #2 Voltage	300	300	300	volts
DC Grid #1 Voltage	-150	-150	-150	volts
DC Plate Current	2x91.5	2x100	2x100	mA
DC Grid #1 Current	2x5	2x5	2x5	mA
Grid #2 Dissipation	4.7	5.3	5.3	watts
Plate Dissipation	2x5	2x6.7	2x16.7	watts
Plate Input	2x29	2x36	2x48	watts

TYPICAL OPERATION

	CCS	CCS	ICAS	ICAS	
Frequency	50	174	50	174	MHz
DC Plate Voltage	300	240	360	280	volts
DC Grid #2 Voltage	85	91.5	90	109	volts
DC Grid #1 Voltage	-50	-42	-50	-42	volts
DC Plate Current	83	91.5	93	107	mA
DC Grid #2 Current	12	8.2	12	9	mA
DC Grid #1 Current	5.3	2.6	6.6	3.0	mA
Drive Power	.67	1.4	.82	1.6	watts
Useful Power Output	16.7	12	23	17.4	watts

TYPICAL OPERATION

	PTTS	PTTS	
Frequency	50	174	MHz
DC Plate Voltage	480	450	volts
DC Grid #2 Voltage	126	134	volts
DC Grid #1 Voltage	-50	-50	volts
DC Plate Current	175	166	mA
DC Grid #2 Current	20	15	mA
DC Grid #1 Current	7.1	5.0	mA
Drive Power	0.86	2.2	watts
Useful Power Output	56	42	watts

LINEAR RF POWER AMPLIFIER

(Class AB_1, SSB Suppressed Carrier Operation)
(Parallel Connected)

MAXIMUM RATINGS - Absolute Values

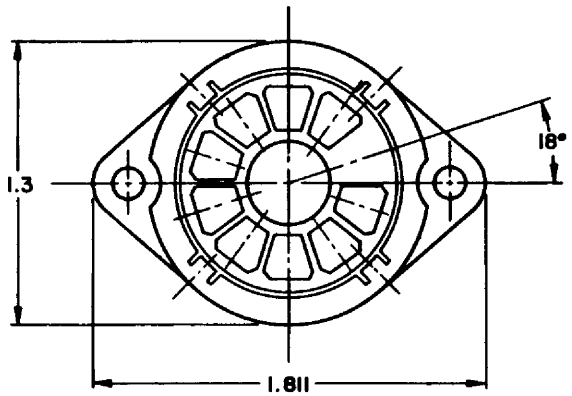
	CCS	ICAS	PTTS[5]	
Frequency	90	90	90	MHz
DC Plate Voltage	400	450	600	volts
DC Grid #2 Voltage	300	300	300	volts
DC Grid #1 Voltage	-150	-150	-150	volts
DC Plate Current	2x110	2x120	2x120	mA
Plate Dissipation	2x7.5	2x10	2x25	watts
Grid #2 Dissipation	7	7	8	watts

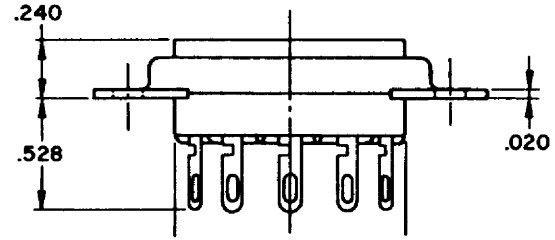
TYPICAL OPERATION

	CCS	ICAS	PTTS	
Frequency	7	7	7	MHz
DC Plate Voltage	375	400	600	volts
DC Grid #2 Voltage	180	200	200	volts
DC Grid #1 Voltage[4]	-27	-30	-26	volts
Effective RF Load Resistance	2025	1965	1940	ohms
Zero Signal Conditions				
Zero Signal DC Plate Current	35	40	80	mA
Zero Signal DC Grid #2 Current	1.5	2	4	mA
Single Tone Modulation				
Peak RF Grid Voltage	27	30	26	volts
DC Plate Current	115	137	175	mA
DC Grid #2 Current	28	32	25	mA
Plate Input Power	43	55	105	watts
Useful Power Output	31	41	60	watts
Efficiency	72	74	57	%
Two-Tone Modulation				
Peak RF Grid Voltage	27	30	36	volts
Average DC Plate Current	83	99	125	mA
Average DC Grid #2 Current	15	20	16	mA
Average Plate Input Power	31	40	76	watts
Useful Average Power Output	16	21	30	watts
Useful Peak Envelope Power Output	32	42	60	watts
Efficiency	43	52	40	%
Intermodulation Distortion				
Third Order	-30	-29	-34	db
Fifth Order	-44	-41	-47	db

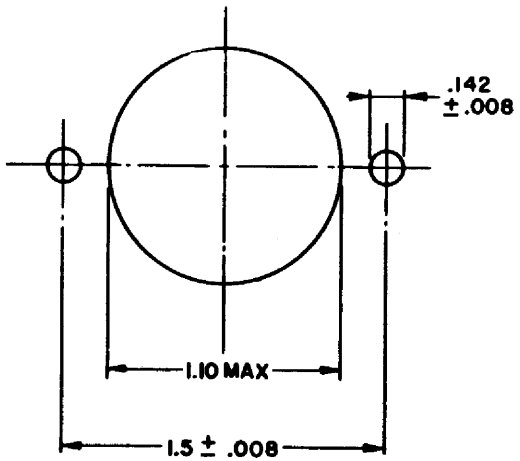
4 Approximate value. Voltage used should be that which results in specified zero signal plate current.
5 Push-to-talk (PTTS) Service describes an operating cycle of one minute ON (maximum) time and four minutes (minimum) OFF time which does not impair the long useful life of the tube. OFF time refers to the condition where no cathode current is flowing within the tube and not to the zero signal condition. A method of accomplishing this would be the use of "vox" or similar circuitry.

TUBE SOCKET MAGNOVAL 9 PINS
PART NUMBER S331911

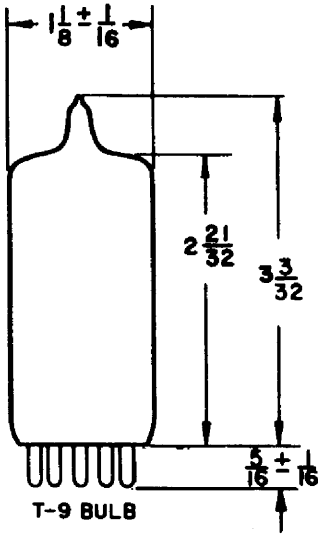




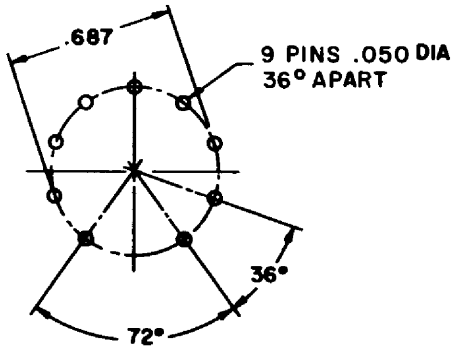
TUBE SOCKET	CERAMIC
CONTACT SPRINGS S331911	SILVER PLATED PHOSPHOR BRONZE
RIM	CADMIUM PLATED STEEL
COLOR	WHITE



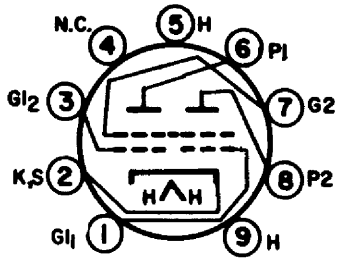
MOUNTING HOLES



T-9 BULB

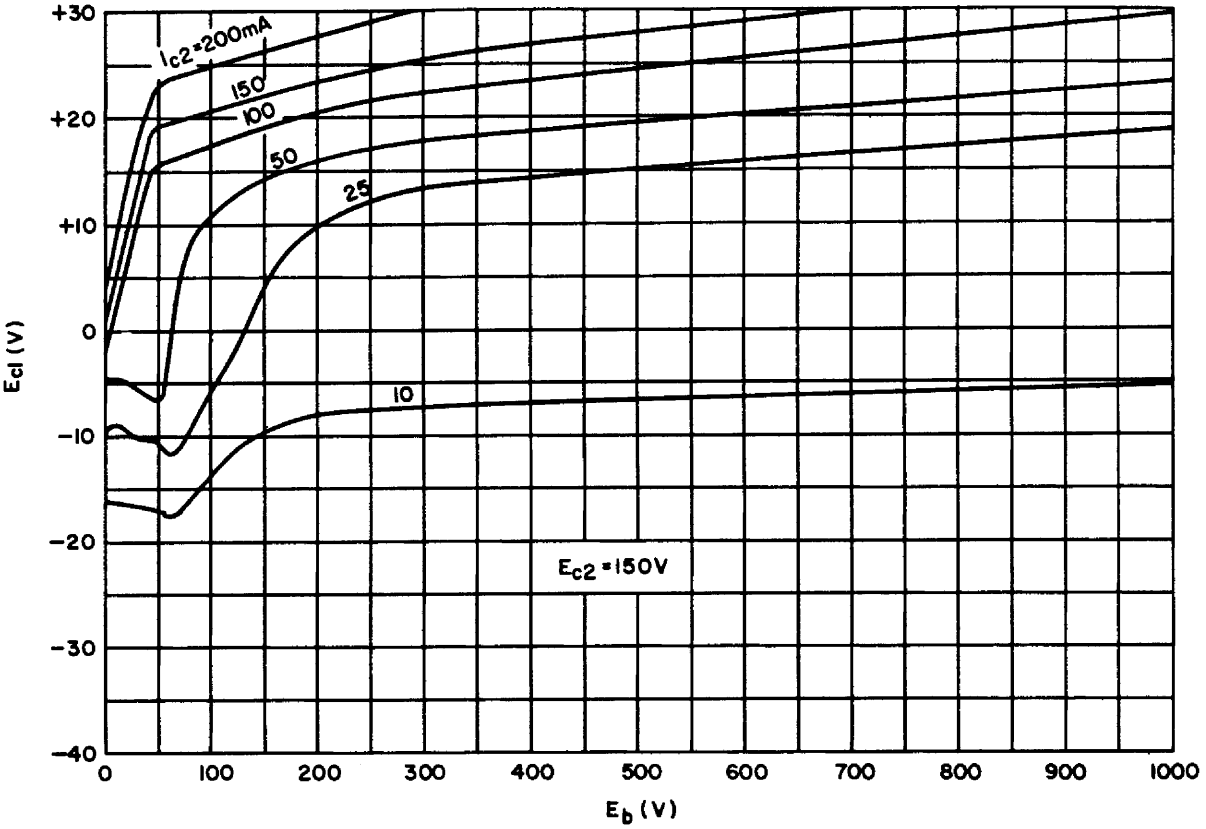


MAGNOVAL BASE
E9-75

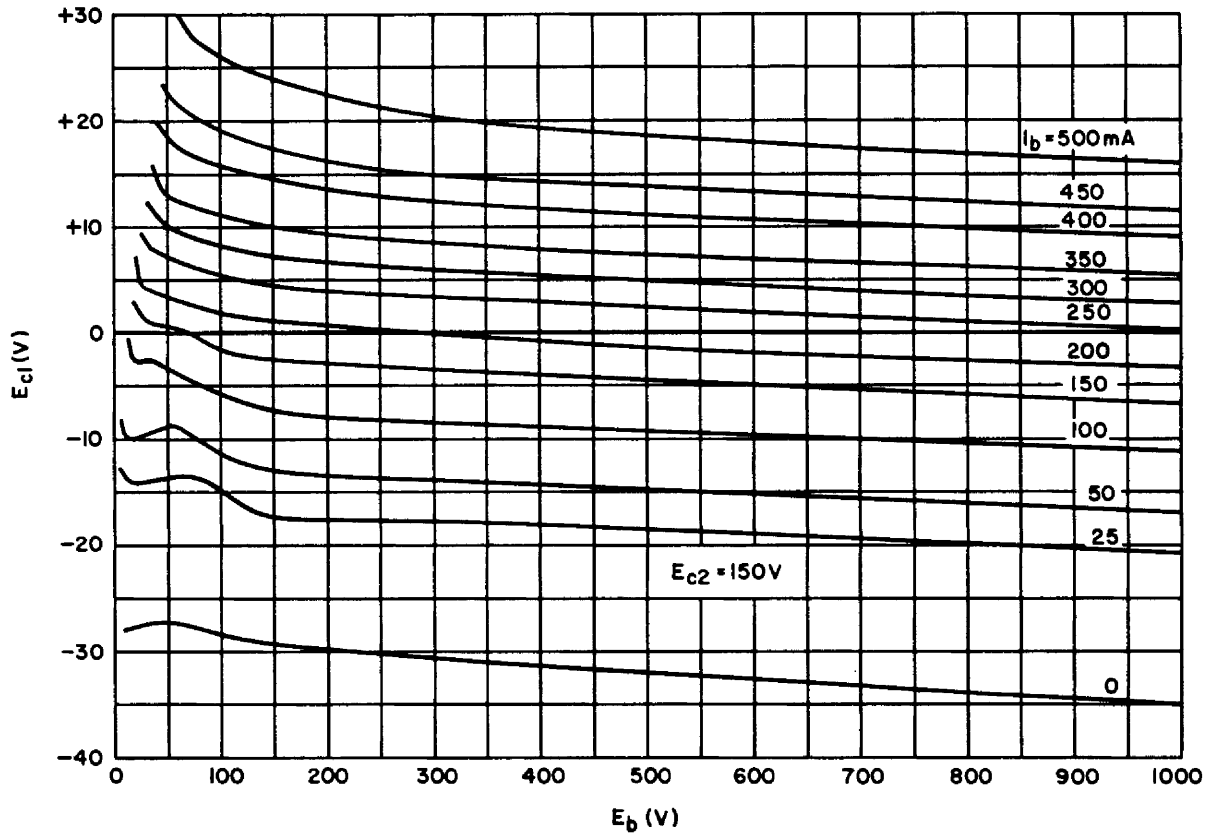


PIN CONNECTIONS

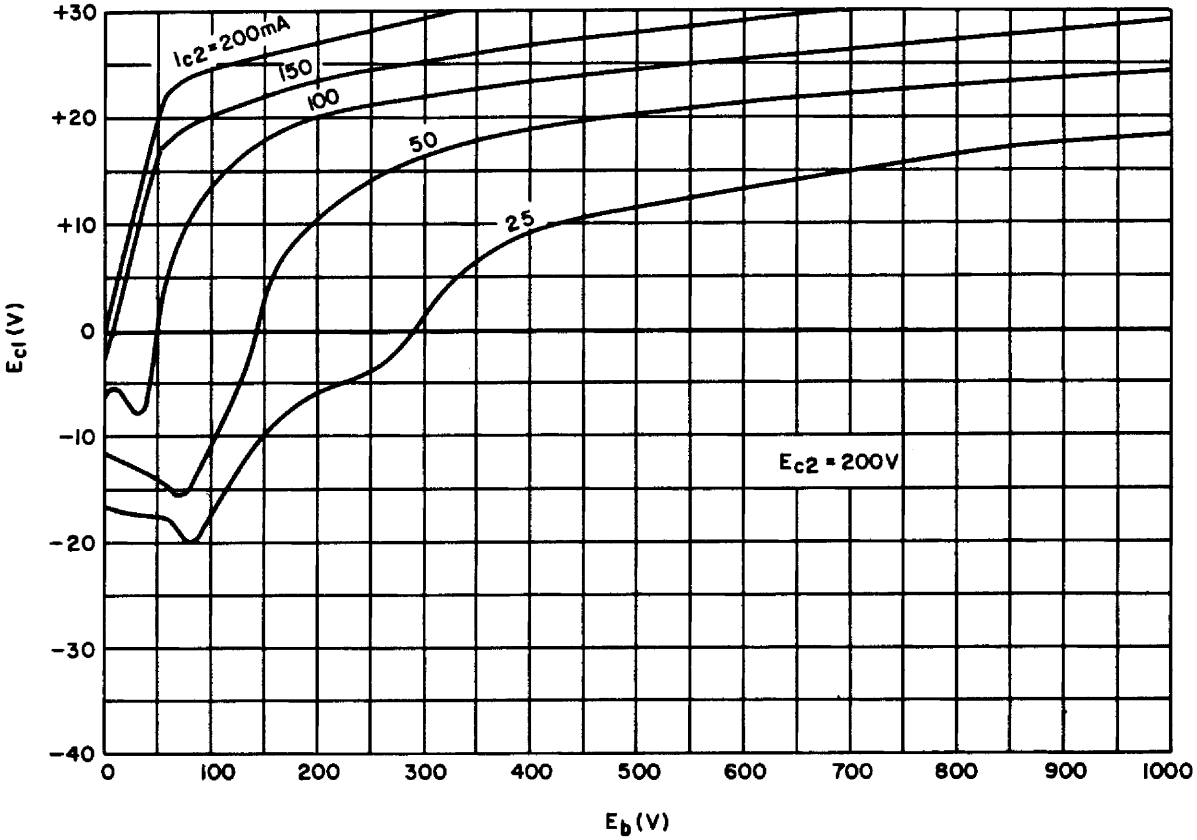
1. GRID NO.1, SIDE NO.1
2. CATHODE AND BEAM PLATE
3. GRID NO.1, SIDE NO.2
4. NO CONNECTION
5. HEATER
6. PLATE, SIDE NO.1
7. GRID NO.2
8. PLATE, SIDE NO.2
9. HEATER



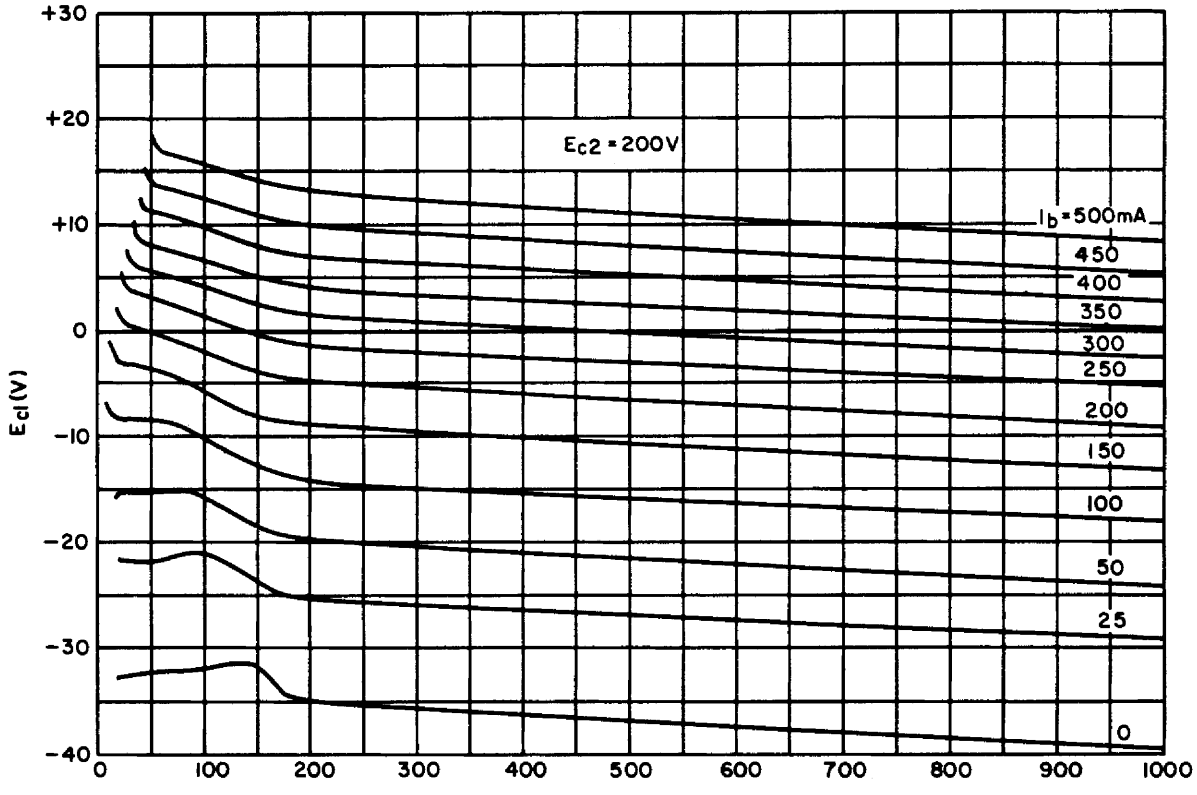
Constant Grid No 2 Current Characteristics (Per Section)



Constant Plate Current Characteristics (Per Section)

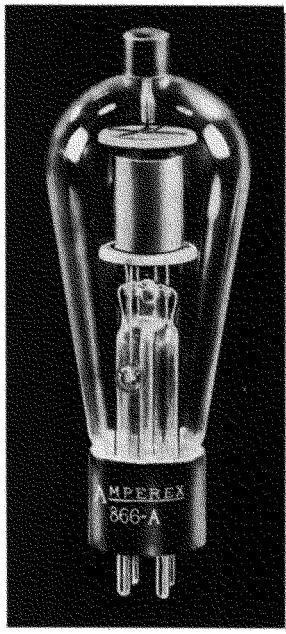


Constant Grid No.2 Current Characteristics (Per Section)



Constant Plate Current Characteristics (Per Section)

AMPEREX MERCURY VAPOR RECTIFIER 866-A



FILAMENT

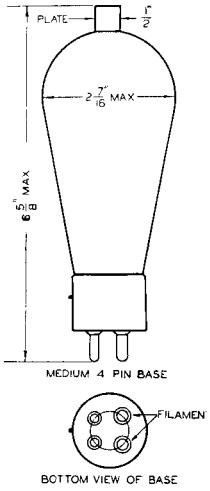
A.C. Voltage	2.5
Current (amperes)	5.0
Preheating Period (Seconds)*	30

*Before plate voltage is applied.

MAXIMUM RATINGS

	For Operation At Supply Frequency Up to 150 Cycles With Condensed Mercury Temperature Range		For Operation At Supply Frequency Up to 1000 Cycles With Condensed Mercury Temperature Range
	25°C. to 60°C.	25°C. to 70°C.	25°C. to 70°C.
Peak Inverse Voltage	10000	2000	5000
Peak Plate Current (ampere)	1.0	2	1.0
Average Plate Current (ampere)*	.25	0.5	.25
Approx. Tube Voltage Drop	10	10	10

*Averaged over period of 10 seconds.



MAXIMUM OUTPUTS IN TYPICAL CIRCUITS

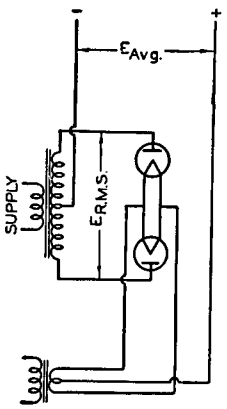
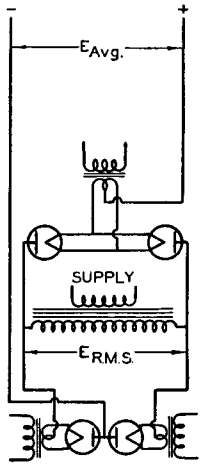
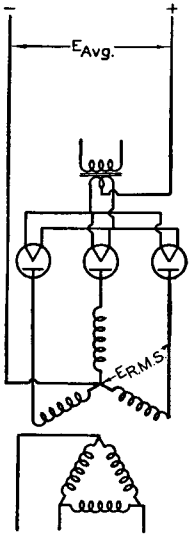
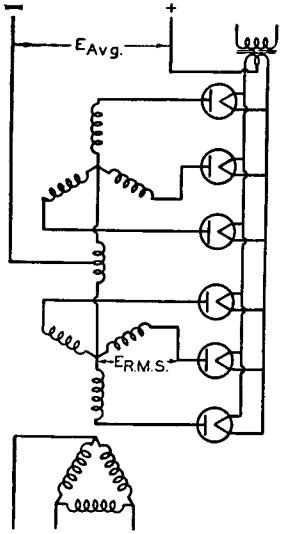
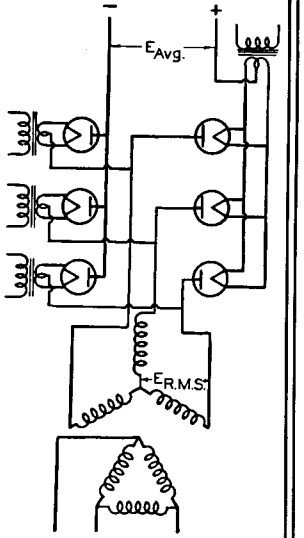
	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes
Single-Phase Full Wave (2 Tubes)	3535*	3180	.5
Single-Phase Full Wave Bridge (4 Tubes)	7070†	6360	.5
Three-Phase Half Wave (3 Tubes)	4080‡	4780	.75
Three-Phase Double Y-Parallel (6 Tubes)	4080‡	4780	1.5
Three-Phase Full Wave (6 Tubes)	4080‡	9570	.75

*Per Tube. †Total. ‡Per Leg.

NOTE: For Out-Of-Phase Filament Excitation information see "Maximum Peak Plate Current" and "Maximum Average Plate Current", pp. 3 and 4, "General Information and Application Notes" section, "Mercury Vapor High Voltage RECTIFIER TUBES".

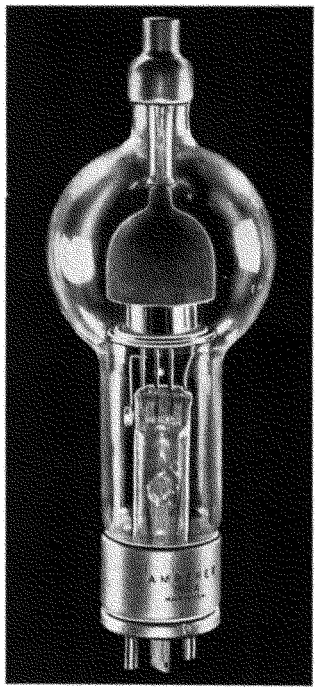
AMPEREX

866-A

RECTIFIER CIRCUIT	SINGLE PHASE FULL-WAVE 2 TUBES	SINGLE PHASE FULL-WAVE 4 TUBES	THREE PHASE HALF-WAVE	THREE PHASE DOUBLE-Y	THREE PHASE FULL-WAVE
Conditions assumed for following relations 1. Sine-Wave Supply 2. Balanced Phase Voltages 3. Zero Tube Drop 4. Pure Resistance Load 5. No Filter Used NOTE: All rectifier filaments supplied by single phase transformers, with secondaries insulated for voltages greater than the Maximum Peak Inverse Voltage.	FIG. 1 	FIG. 2 	FIG. 3 	FIG. 4 	FIG. 5 
E Average	.450 *E* rms .318 *E* max	.900 *E* rms .636 *E* max	1.170 *E* rms .827 *E* max	1.170 *E* rms .827 *E* max	2.34 *E* rms 1.65 *E* max
E Inverse	3.14 *E* avg	1.57 *E* avg	2.09 *E* avg	2.09 *E* avg	1.045 *E* avg
I Average	.636 *I* max	.636 *I* max	.827 *I* max	1.91 *I* max	.955 *I* max
Ripple Frequency	2 X Supply Freq.	2 X Supply Freq.	3 X Supply Freq.	6 X Supply Freq.	6 X Supply Freq.
Ripple Voltage (Rms)	48.3%	48.3%	18.3%	4.2%	4.2%
† Ratio $\frac{\text{Secondary Kva}}{\text{D.C. Output-Kw}}$	1.57	1.11	1.48	1.48	1.05
† Ratio $\frac{\text{Primary Kva}}{\text{D.C. Output-Kw}}$	1.11	1.11	1.21	1.05	1.05

† These ratios assume that a choke input filter is used to maintain the output current substantially constant.

AMPEREX MERCURY VAPOR RECTIFIER 869-B



FILAMENT

A.C. Voltage	5.0
Current (amperes)	18.0
Preheating Period (Seconds)*	60

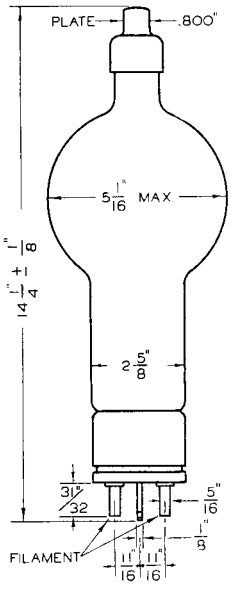
*Before plate voltage is applied.

MAXIMUM RATINGS

For Operation at Supply Frequency Up to 150 Cycles

	Filament Excitation In Phase		Filament Excitation Out of Phase (90° ± 30°)
	Condensed Mercury Temperature Range		Condensed Mercury Temperature Range
	30°C. to 40°C.	25°C. to 60°C.	30°C. to 40°C.
Peak Inverse Voltage	20000	15000	15000
Peak Plate Current (amperes)	10.0	10.0	15.0
Average Plate Current (amperes)*	2.5	2.5	5.0
Approx. Tube Voltage Drop	10.0	10.0	10.0

*Averaged over period of 30 seconds.



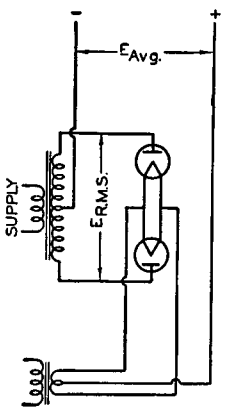
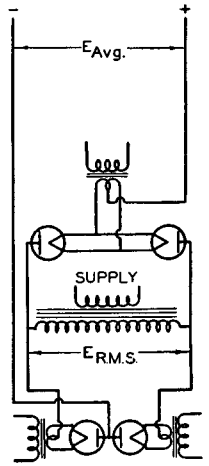
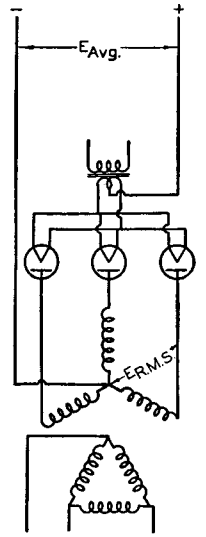
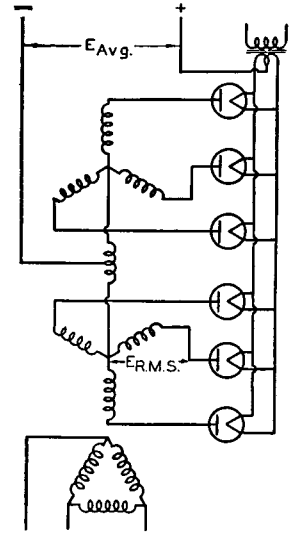
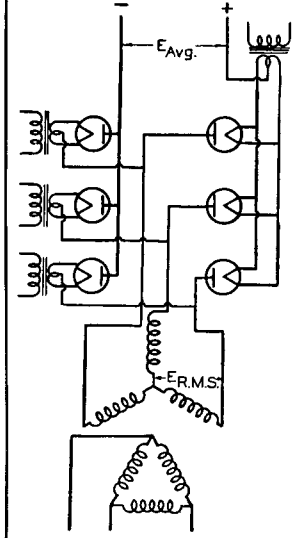
MAXIMUM OUTPUTS IN TYPICAL CIRCUITS

	Filament Excitation in Phase			Filament Excitation Out of Phase		
	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes
Single-Phase Full Wave (2 Tubes)	7000*	6300	5.0	5250*	4725	10.0
Single-Phase Full Wave Bridge (4 Tubes)	14000†	12600	5.0	10500†	9450	10.0
Three-Phase Half Wave (3 Tubes)	8150‡	9550	7.5	6100‡	7150	15.0
Three-Phase Double Y-Parallel (6 Tubes)	8150‡	9550	15.0	6100‡	7150	30.0
Three-Phase Full Wave (6 Tubes)	8150‡	19100	7.5	6100‡	14300	15.0

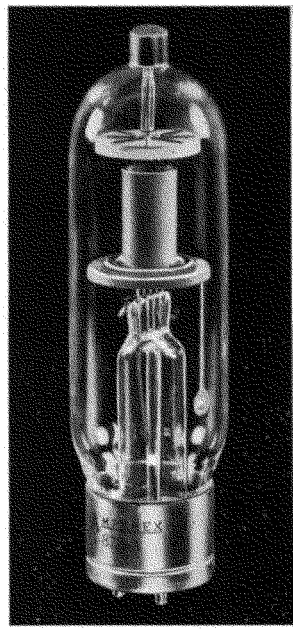
*Per Tube. †Total. ‡Per Leg.

AMPEREX

869-B

RECTIFIER CIRCUIT	SINGLE PHASE FULL-WAVE 2 TUBES	SINGLE PHASE FULL-WAVE 4 TUBES	THREE PHASE HALF-WAVE	THREE PHASE DOUBLE–Y	THREE PHASE FULL-WAVE
Conditions assumed for following relations 1. Sine-Wave Supply 2. Balanced Phase Voltages 3. Zero Tube Drop 4. Pure Resistance Load 5. No Filter Used NOTE: All rectifier filaments supplied by single phase transformers, with secondaries insulated for voltages greater than the Maximum Peak Inverse Voltage.	FIG. 1 	FIG. 2 	FIG. 3 	FIG. 4 	FIG. 5 
E Average	.450 E rms .318 E max	.900 E rms .636 E max	1.170 E rms .827 E max	1.170 E rms .827 E max	2.34 E rms 1.65 E max
E Inverse	3.14 E avg	1.57 E avg	2.09 E avg	2.09 E avg	1.045 E avg
I Average	.636 I max	.636 I max	.827 I max	1.91 I max	.955 I max
Ripple Frequency	2 X Supply Freq.	2 X Supply Freq.	3 X Supply Freq.	6 X Supply Freq.	6 X Supply Freq.
Ripple Voltage (Rms)	48.3%	48.3%	18.3%	4.2%	4.2%
† Ratio $\frac{\text{Secondary Kva}}{\text{D.C. Output-Kw}}$	1.57	1.11	1.48	1.48	1.05
† Ratio $\frac{\text{Primary Kva}}{\text{D.C. Output-Kw}}$	1.11	1.11	1.21	1.05	1.05

† These ratios assume that a choke input filter is used to maintain the output current substantially constant.



FILAMENT

A.C. Voltage	5.0
Current (amperes)	6.75
Preheating Period (Seconds)*	30

*Before plate voltage is applied.

MAXIMUM RATINGS

For Operation at Supply Frequency Up to 150 Cycles

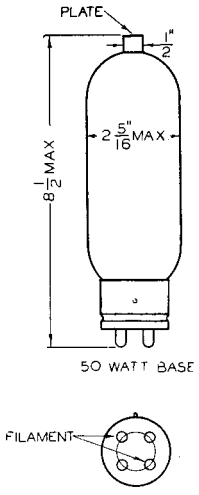
	Condensed Mercury Temperature Range	
	15°C. to 60°C.	15°C. to 50°C.
Peak Inverse Voltage	5000	10000
Peak Plate Current (amperes)	5.0	5.0
Average Plate Current (amperes)*	1.25	1.25
Approx. Tube Voltage Drop	10	10

*Averaged over period of 15 seconds.

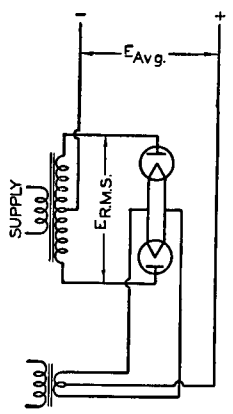
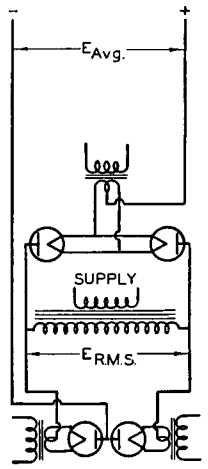
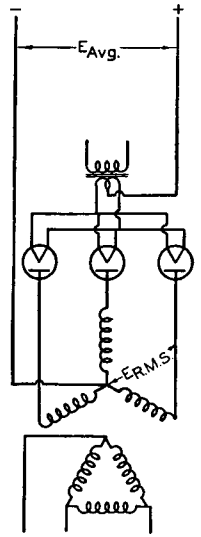
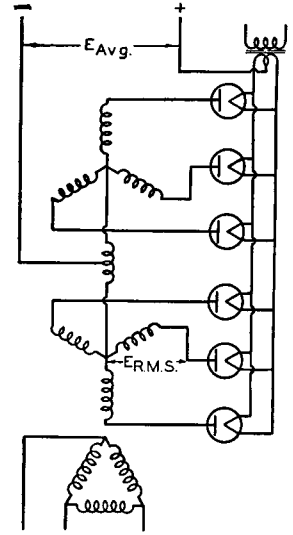
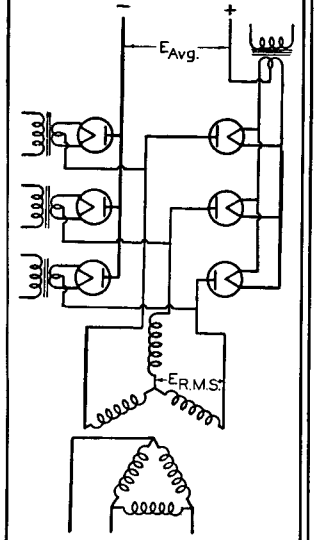
MAXIMUM OUTPUTS IN TYPICAL CIRCUITS

	A.C. Input Volts R.M.S.	D.C. Output Volts to Filter	Max. D.C. Load Current Amperes
Single-Phase Full Wave (2 Tubes)	3535*	3180	2.5
Single-Phase Full Wave Bridge (4 Tubes)	7070†	6360	2.5
Three-Phase Half Wave (3 Tubes)	4080‡	4780	3.75
Three-Phase Double Y-Parallel (6 Tubes)	4080‡	4780	7.50
Three-Phase Full Wave (6 Tubes)	4080‡	9570	3.75

*Per Tube. †Total. ‡Per Leg.



NOTE: For Out-Of-Phase Filament Excitation information see "Maximum Peak Plate Current" and "Maximum Average Plate Current", pp. 3 and 4, "General Information and Application Notes" section, "Mercury Vapor High Voltage RECTIFIER TUBES".

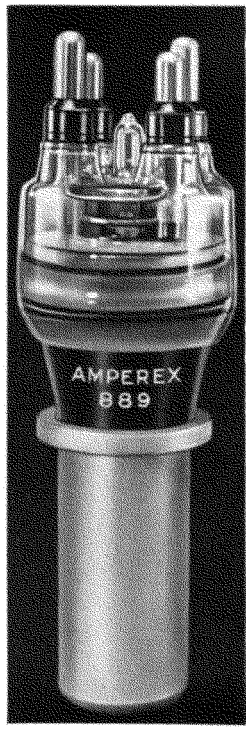
RECTIFIER CIRCUIT	SINGLE PHASE FULL-WAVE 2 TUBES	SINGLE PHASE FULL-WAVE 4 TUBES	THREE PHASE HALF-WAVE	THREE PHASE DOUBLE–Y	THREE PHASE FULL-WAVE
Conditions assumed for following relations 1. Sine-Wave Supply 2. Balanced Phase Voltages 3. Zero Tube Drop 4. Pure Resistance Load 5. No Filter Used NOTE: All rectifier filaments supplied by single phase transformers, with secondaries insulated for voltages greater than the Maximum Peak Inverse Voltage.	FIG. 1 	FIG. 2 	FIG. 3 	FIG. 4 	FIG. 5 
E Average	.450 E rms .318 E max	.900 E rms .636 E max	1.170 E rms .827 E max	1.170 E rms .827 E max	2.34 E rms 1.65 E max
E Inverse	3.14 E avg	1.57 E avg	2.09 E avg	2.09 E avg	1.045 E avg
I Average	.636 I max	.636 I max	.827 I max	1.91 I max	.955 I max
Ripple Frequency	2 X Supply Freq.	2 X Supply Freq.	3 X Supply Freq.	6 X Supply Freq.	6 X Supply Freq.
Ripple Voltage (Rms)	48.3%	48.3%	18.3%	4.2%	4.2%
† Ratio $\frac{\text{Secondary Kva}}{\text{D.C. Output-Kw}}$	1.57	1.11	1.48	1.48	1.05
† Ratio $\frac{\text{Primary Kva}}{\text{D.C. Output-Kw}}$	1.11	1.11	1.21	1.05	1.05

† These ratios assume that a choke input filter is used to maintain the output current substantially constant.

AMPEREX TRANSMITTING TUBE 889

(WATER COOLED†)

Radio Frequency Power Oscillator, Amplifier, Class B Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

D.C. Plate Voltage	8500
D.C. Plate Current, Max.-Signal (amps)*	2.0
Plate Input, Max.-Signal (watts)*	12000
Plate Dissipation (watts)*	5000

Typical Operation:

Unless otherwise specified, values are for 2 tubes

D.C. Plate Voltage	5000	6000	7500
D.C. Plate Current, Zero-Signal (amps)	0.4	0.4	0.4
D.C. Plate Current, Max.-Signal (amps)	3.2	3.6	3.2
Plate Input, Max.-Signal (watts)	16000	21600	24000
D.C. Grid Voltage	—180	—230	—300
Grid-to-Grid Voltage, Peak A.F.	1460	1680	1700
Load Resistance (ohms) (per tube)	630	920	1250
Effective Load (ohms) (Pl-pl)	2520	3680	5000
Max.-Signal Drive (watts)	170	180	150
Max.-Signal Power Output (watts)	8800	12000	15000

R.F. Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D.C. Plate Voltage	8500
D.C. Plate Current (amps)	1.0
Plate Input (watts)	7500
Plate Dissipation (watts)	5000
Plate Volts and Input Max. % for 50MC	100%
Plate Volts and Input Max. % for 75MC	90%
Plate Volts and Input Max. % for 100MC	83%
Plate Volts and Input Max. % for 150MC	72%

Typical Operation:

D.C. Plate Voltage	6000	7500
D.C. Plate Current (amps)	0.9	0.9
D.C. Grid Voltage	—250	—300
Grid Voltage, Peak R.F.	920	1000
Driving Power (watts)**	95	80
Power Output (watts)	1500	2000

Plate Modulated R.F. Power Amplifier Class C

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D.C. Plate Voltage	6000
D.C. Plate Current (amps)	1.0
Plate Input (watts)	6000
Plate Dissipation (watts)	3000
Plate Volts and Input Max. % for 50MC	100%
Plate Volts and Input Max. % for 75MC	85%
Plate Volts and Input Max. % for 100MC	75%
Plate Volts and Input Max. % for 150MC	60%

GENERAL CHARACTERISTICS

Filament Voltage‡	11
Filament Current (amps)	125
Amplification Factor	21
Direct Interelectrode Capacitances:	
Grid to Plate	17.8 $\mu\mu f$
Grid to Filament	19.5 $\mu\mu f$
Plate to Filament	2.5 $\mu\mu f$

Plate Modulated R.F. Power Amplifier Class C

Carrier conditions per tube for use with a maximum modulation factor of 1.0

(Continued)

D.C. Grid Volts	—1000
D.C. Grid Current (amps)	0.25

Typical Operation:

D.C. Plate Voltage	5000	6000
D.C. Plate Current (amps)	0.9	1.0
D.C. Grid Voltage	—800	—900
Grid Voltage, Peak R.F.	1300	1420
D.C. Grid Current (amps)	0.12	0.10
Driving Power (watts)	155	140
Power Output (watts)	2750	4000

R.F. Power Amplifier and Oscillator—Class C

Key-down conditions per tube without modulation§

D.C. Plate Voltage	8500
D.C. Plate Current (amps)	2.0
Plate Input (watts)	16000
Plate Dissipation (watts)	5000

	Volts	Watts
Plate Volts and Input, Watts, Max. % for 50MC	100%	100%
Plate Volts and Input, Watts, Max. % for 75MC	87%	85%
Plate Volts and Input, Watts, Max. % for 100MC	78%	70%
Plate Volts and Input, Watts, Max. % for 150MC	65%	50%
D.C. Grid Volts		—1000
D.C. Grid Current (amps)		0.25

Typical Operation:

D.C. Plate Voltage	5000	6000	7500
D.C. Plate Current (amps)	1.5	1.8	2.0
D.C. Grid Voltage	—500	—600	—800
Grid Voltage, Peak R.F.	1200	1460	1830
D.C. Grid Current (amps)	0.19	0.21	0.24
Driving Power (watts)	220	290	400
Power Output (watts)	5000	7000	10000

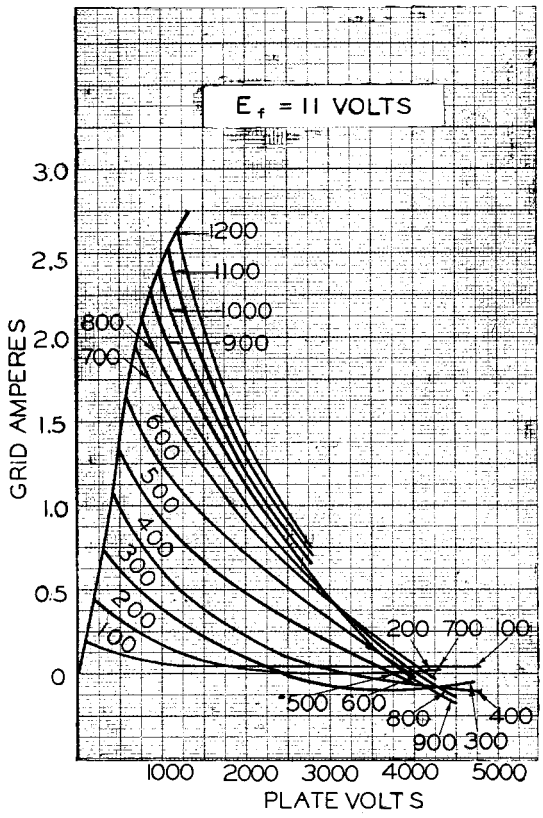
*Averaged over any audio-frequency cycle.

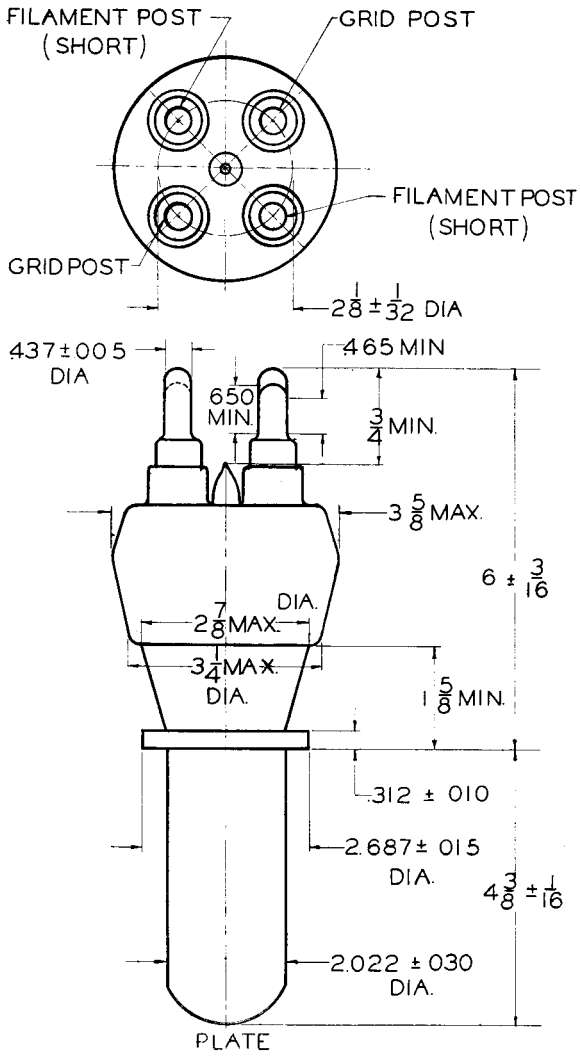
**At crest of A.F. cycle with modulation factor of 1.0.

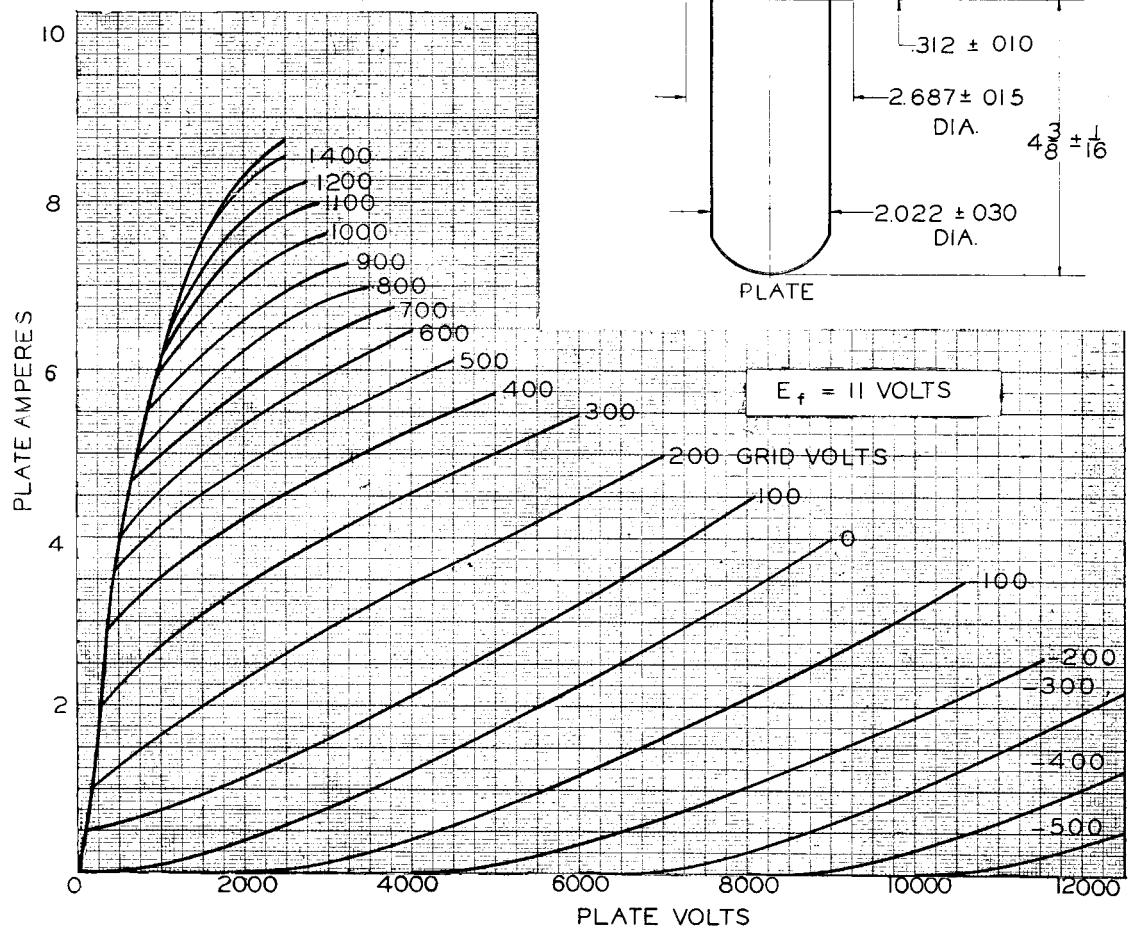
†Water flow of 3 to 6 gallons per minute must start before application of any voltages and continue for at least 5 minutes after removal of voltages. Water temperature must not exceed 70°C. under any conditions of operation. An air flow is required of 15 cubic feet per minute from a three-inch nozzle, directed toward the top portion of the bulb.

‡This tube can usually be operated with reduced filament voltage when the load conditions are lower than maximum.

§Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.


E_f = 11 VOLTS
GRID AMPERES
PLATE VOLTS
3.0
2.5
2.0
1.5
1.0
0.5
0
1000
2000
3000
4000
5000
1200
1100
1000
900
800
700
600
500
400
300
200
100

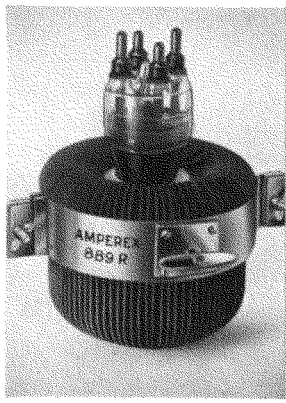

FILAMENT POST (SHORT)
GRID POST
FILAMENT POST (SHORT)
GRID POST
2 1/8 ± 1/32 DIA
437±005 DIA
465 MIN
650 MIN.
3/4 MIN.
3 5/8 MAX.
6 ± 3/16
2 7/8 MAX. DIA.
3/4 MAX. DIA.
1 5/8 MIN.
312 ± 010
2.687± 015 DIA
4 3/8 ± 1/16
2.022 ± 030 DIA
PLATE


E_f = 11 VOLTS
PLATE AMPERES
PLATE VOLTS
10
8
6
4
2
0
2000
4000
6000
8000
10000
12000
1400
1200
1100
1000
900
800
700
600
500
400
300
200 GRID VOLTS
100
0
-100
-200
-300
-400
-500

AMPEREX TRANSMITTING TUBE 889-R

FORCED-AIR COOLED†

R.F. Power Oscillator or Amplifier or Class B Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

D.C. Plate Voltage	8500
D.C. Plate Current, Max.-Signal (amps)*	2.0
Plate Input, Max.-Signal (watts)*	12000
Plate Dissipation (watts)*	5000
Radiator Temperature (Centigrade)†	180°

Typical Operation:

Unless otherwise specified, values are for 2 tubes

D.C. Plate Voltage	5000	6000	7500
D.C. Plate Current, Zero-Signal (amps)	0.4	0.4	0.4
D.C. Plate Current, Max.-Signal (amps)	3.2	3.6	3.2
Plate Input, Max.-Signal (watts)*	16000	21600	24000
D.C. Grid Voltage	—180	—230	—300
Grid-to-Grid Voltage, Peak A.F.	1460	1680	1700
Load Resis. (ohms) (per tube)	630	920	1250
Effective Load (ohms) (Pl-pl)	2520	3680	5000
Max.-Signal Drive (watts)	170	180	150
Max.-Signal Power Output (watts)	8800	12000	15000

R.F. Power Amplifier—Class B

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D.C. Plate Voltage	8500
D.C. Plate Current (amps)	1.0
Plate Input (watts)	7500
Plate Dissipation (watts)	5000
Plate Volts and Input Max. % for 25MC	100%
Plate Volts and Input Max. % for 50MC	89%
Plate Volts and Input Max. % for 75MC	80%
Plate Volts and Input Max. % for 100MC	74%
Radiator Temperature (Centigrade)†	180°

Typical Operation:

D.C. Plate Voltage	6000	7500
D.C. Plate Current (amps)	0.9	0.9
D.C. Grid Voltage	—250	—300
Grid Voltage, Peak R.F.	920	1000
Driving Power ,watts)**	95	80
Plate Power Output (watts)	1500	2000

Plate Modulated R.F. Power Amplifier Class C

Carrier conditions per tube for use with a maximum modulation factor of 1.0

D.C. Plate Voltage	6000
D.C. Plate Current (amps)	1.0
Plate Input (watts)	6000
Plate Dissipation (watts)	3000
Plate Volts and Input Max. % for 25MC	100%
Plate Volts and Input Max. % for 50MC	80%
Plate Volts and Input Max. % for 75MC	68%
Plate Volts and Input Max. % for 100MC	60%
D.C. Grid Voltage	—1000
D.C. Grid Current (amps)	0.25
Radiator Temperature (Centigrade)†	180°

GENERAL CHARACTERISTICS

Filament Voltage‡	11
Filament Current (amps)	125
Amplification Factor	21
Direct Interelectrode Capacitances:	
Grid to Plate	20.7 $\mu\mu$f
Grid to Filament	19.5 $\mu\mu$f
Plate to Filament	2.5 $\mu\mu$f

Plate Modulated R.F. Power Amplifier Class C

Carrier conditions per tube for use with a maximum modulation factor of 1.0

(Continued)

Typical Operation:

D.C. Plate Voltage	5000	6000
D.C. Plate Current (amps)	0.9	1.0
D.C. Grid Voltage	—800	—900
Grid Voltage, Peak R.F.	1300	1420
D.C. Grid Current (amps)	0.12	0.10
Driving Power (watts)	155	140
Plate Power Output (watts)	2750	4000

R.F. Power Amplifier and Oscillator—Class C

Key-down conditions per tube without modulation§

D.C. Plate Voltage		8500
D.C. Plate Current (amps)		2.0
Plate Input (watts)		16000
Plate Dissipation (watts)		5000
	Volts	**Watts**
Plate Volts and Input, Watts, Max. % for 25MC	100%	100%
Plate Volts and Input, Watts, Max. % for 50MC	85%	75%
Plate Volts and Input, Watts, Max. % for 75MC	76%	60%
Plate Volts and Input, Watts, Max. % for 100MC	70%	50%
D.C. Grid Voltage		—100
D.C. Grid Current (amps)		0.25
Radiator Temperature (Centigrade)†		180°

Typical Operation:

D.C. Plate Voltage	5000	6000	7500
D.C. Plate Current (amps)	1.5	1.8	2.0
D.C. Grid Voltage	—500	—600	—800
Grid Voltage, Peak R.F.	1200	1460	1830
D.C. Grid Current (amps)	0.19	0.21	0.24
Driving Power (watts)	220	290	400
Plate Power Output (watts)	5000	7000	10000

*Averaged over any audio-frequency cycle.

**At crest of A.F. cycle with modulation factor of 1.0.

†The temperature of the radiator must be measured in the thermometer well. A vertical air flow of 500 cubic feet per minute with an incoming temperature of not over 45°C. is required. The bulb must be cooled by a downward air flow of 15 cubic feet per minute from a 3-inch diameter nozzle. The glass temperature must not exceed 150°C. at any point.

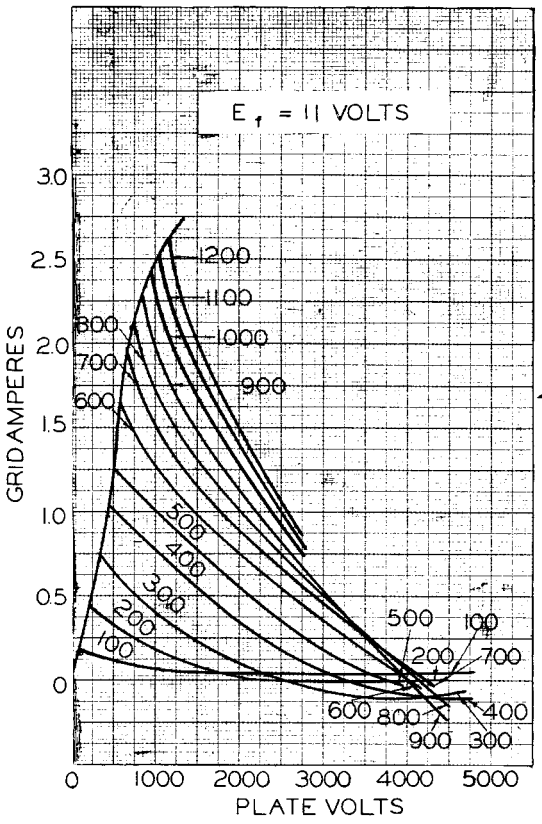
‡This tube can usually be operated with reduced filament voltage when the load conditions are lower than maximum.

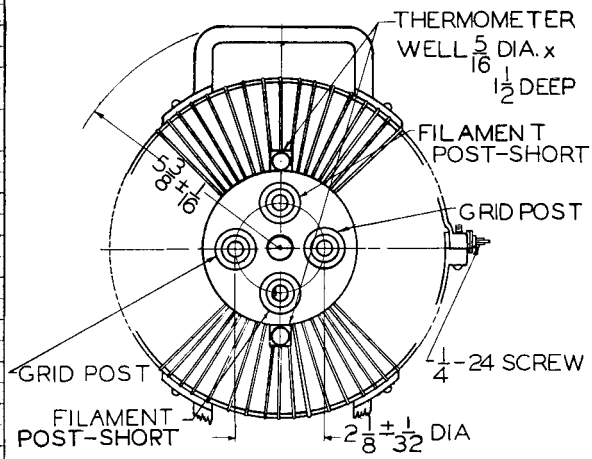
§Modulation, essentially negative, may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

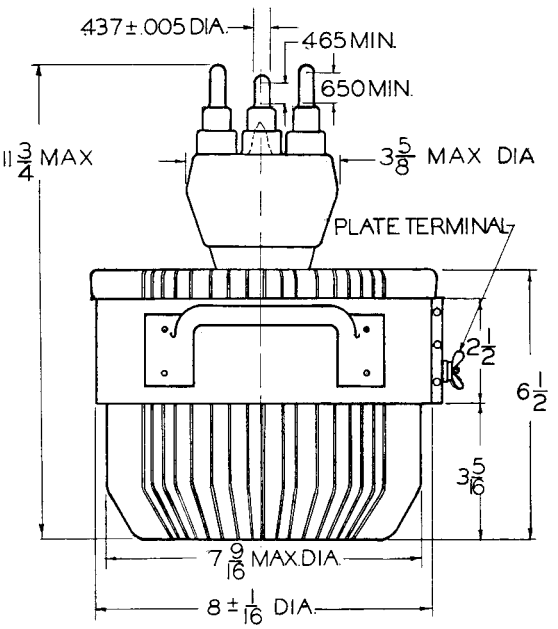
AMPEREX

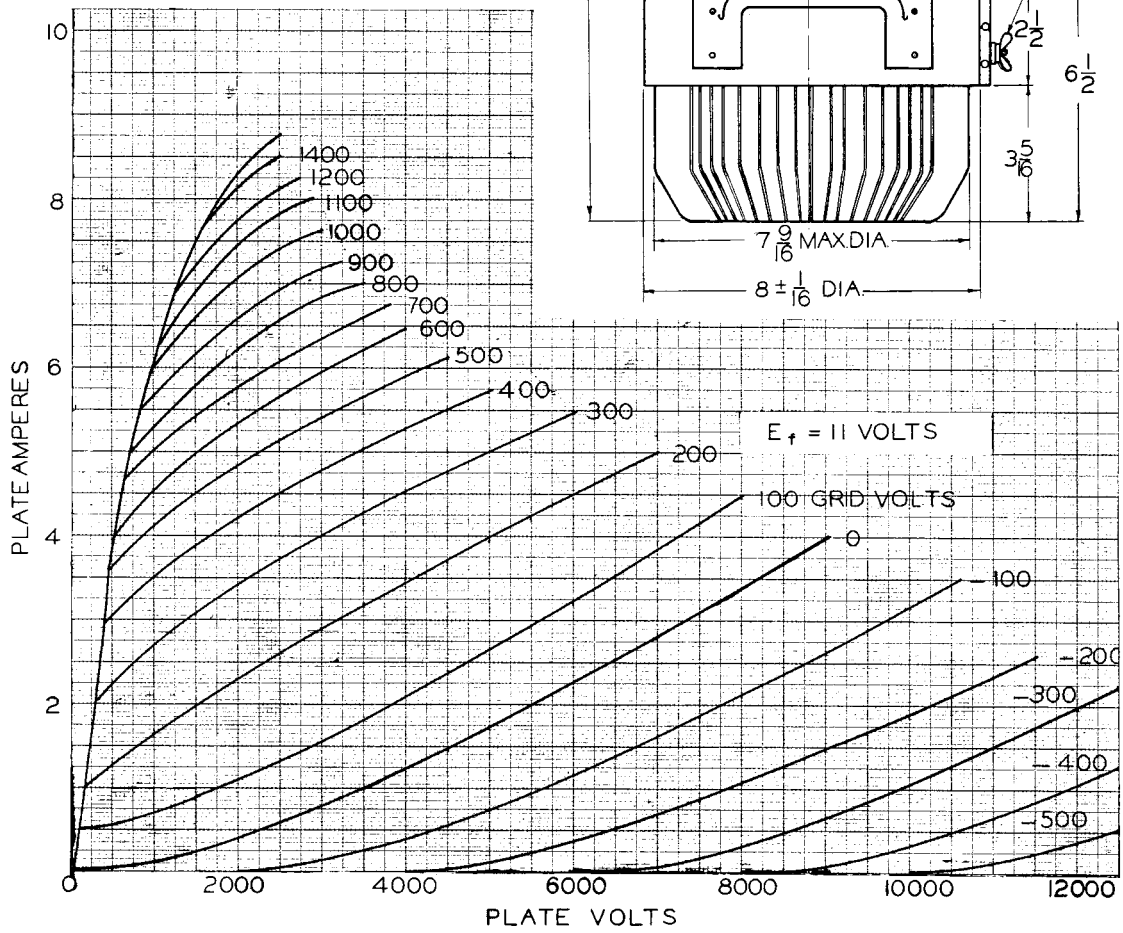
889-R

889-R — AMPEREX TRANSMITTING TUBE

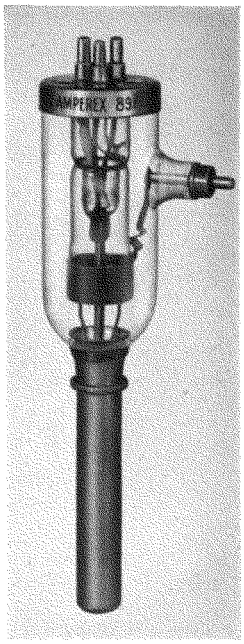








Radio Frequency Power Amplifier: Modulator



GENERAL CHARACTERISTICS

Filament—Two unit type, for single-phase or two-phase A.C. or D.C. operation:	
Voltage per Unit	11
Current per Unit (amps)	60
Amplification Factor	8
Grid to Plate Transconductance at a plate current of 0.75 ampere	4000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	28 $\mu\mu$f
Grid to Filament	16 $\mu\mu$f
Plate to Filament	3 $\mu\mu$f
Dimensions:	
Maximum Overall Length	20⅝"
Maximum Radius	6½"

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube
Filament Voltage*	..	21
D.C. Plate Voltage	12000	8000
D.C. Grid Voltage	..	—630
Plate Load Resistance (ohms)	..	5200
Peak A.F. Grid Voltage	..	700
D.C. Plate Current (amps)	..	0.9
Plate Input (kw.)	7.5	7.2
Plate Dissipation (kw.)†	7.5	7.2
Power Output (kw.)	..	2.0

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
Filament Voltage*	..	21.5	21.5
D.C. Plate Voltage	15000	6000	10000
D.C. Grid Voltage	..	—600	—1100
Load Resistance (per tube) (ohms)	..	1250	2000
Effective Load Resistance (plate to plate) (ohms)	..	5000	8000
Zero Signal Plate Current (amps)	..	0.5	0.5
Peak A.F. Grid to Grid Voltage	..	2000	3200
Max. Signal Plate Current (amps)**	2.0	2.3	2.75
Max. Signal Plate Input (kw.)**	15.0	13.8	27.5
Plate Dissipation (kw.)**	5.0	..	..
Minimum Grid Input Resistance (approx.) (ohms)	..	1000	450
Max. Signal Driving Power (approx.) (watts)	..	80	240
Max. Signal Power Output (kw.)	..	8	18

R.F. Power Amplifier—Class B—Telephony

Carrier conditions for use with a maximum modulation factor of 1.0

	Maximum Rating per Tube	Typical Operation One Tube	
Filament Voltage*	..	21.5	21.5
D.C. Plate Voltage	15000	6000	10000
D.C. Grid Voltage	..	—600	—1100
Plate Load Resistance (ohms)	..	2000	3200
Peak R.F. Grid Voltage	..	600	900
D.C. Plate Current (amps)	1.0	0.7	0.8
Plate Input (kw.)	10.0	4.2	8.0
Plate Dissipation (kw.)	6.0	3.0	5.5
Driving Power (approx.) (watts)***	..	80	0
Power Output (kw.)	..	1.2	2.5
Frequency Limit for Above Operation (mc.)	..	20	10

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0

	Maximum Rating per Tube	Typical Operation One Tube	
Filament Voltage*	..	22.0	22.0
D.C. Plate Voltage	8000	6000	8000
D.C. Grid Voltage	—3000	—2000	—2400
Plate Load Resistance (ohms)	..	3800	5000
Peak R.F. Grid Voltage	..	2650	3100
D.C. Plate Current (amps)	1.0	.75	.78
Plate Input (kw.)	8	4.5	6.3
Plate Dissipation (kw.)	4	1.0	1.3
D.C. Grid Current (approx.) (ma.)	150	100	80
Driving Power (approx.) (watts)	..	260	260
Power Output (kw.)	..	3.5	5.0
Frequency Limit for Above Operation (mc.)	1.6	7.5	1.6
F.C.C. Broadcast Rating (kw.)	5	..	5

R.F. Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions without modulation

	Maximum Rating per Tube	Typical Operation One Tube	
Filament Voltage	..	21.5	22
D.C. Plate Voltage	12000	8000	10000
D.C. Grid Voltage	—3000	—1800	—2000
Plate Load Resistance (ohms)	..	3800	4000
Peak R.F. Grid Voltage	..	2500	2900
D.C. Plate Current (amps)	2.0	1.1	1.45
Plate Input (kw)	18.0	8.8	14.5
Plate Dissipation (kw.)	6.0	2.0	4.0
D.C. Grid Current (approx.) (ma.)	150	60	110
Driving Power (approx.) (watts)	..	150	300
Plate Power Output (kw.)	..	6.5	10
Frequency Limit for Above Operation (mc.)	1.6	15	7.5

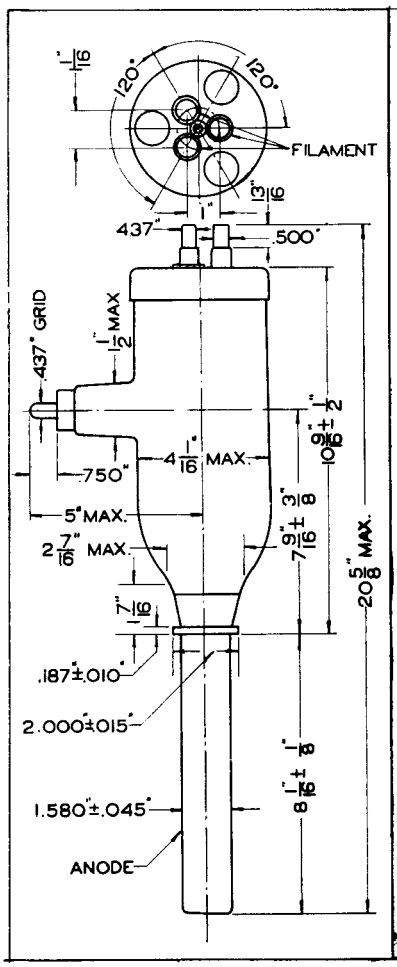
*Two filament units in series.

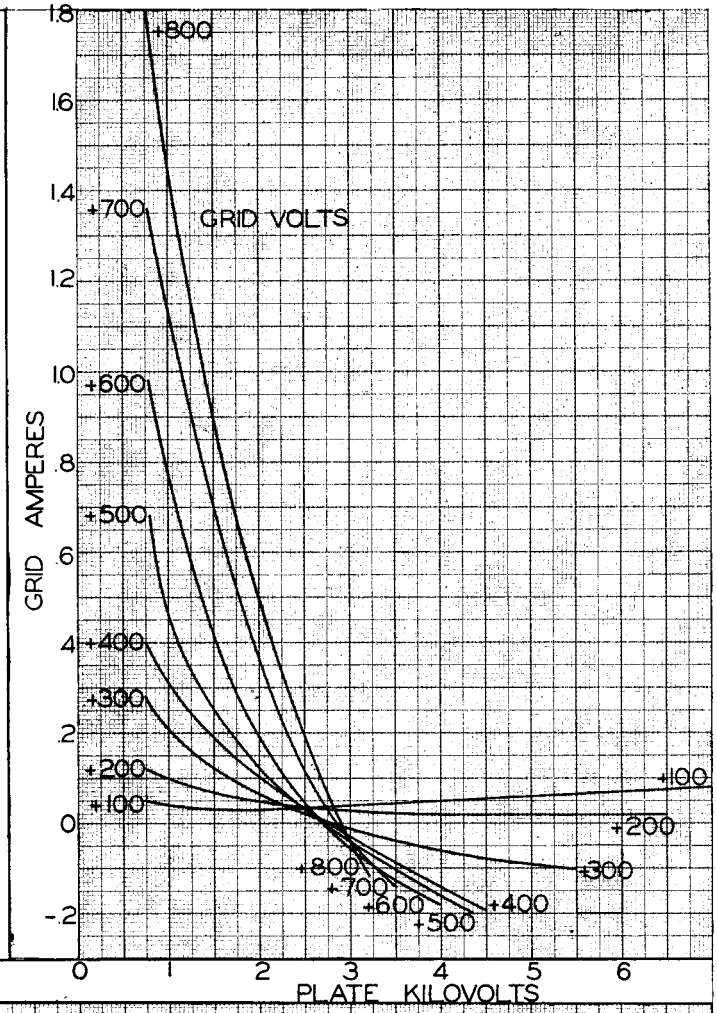
**Averaged over any audio-frequency cycle of sine-wave form.

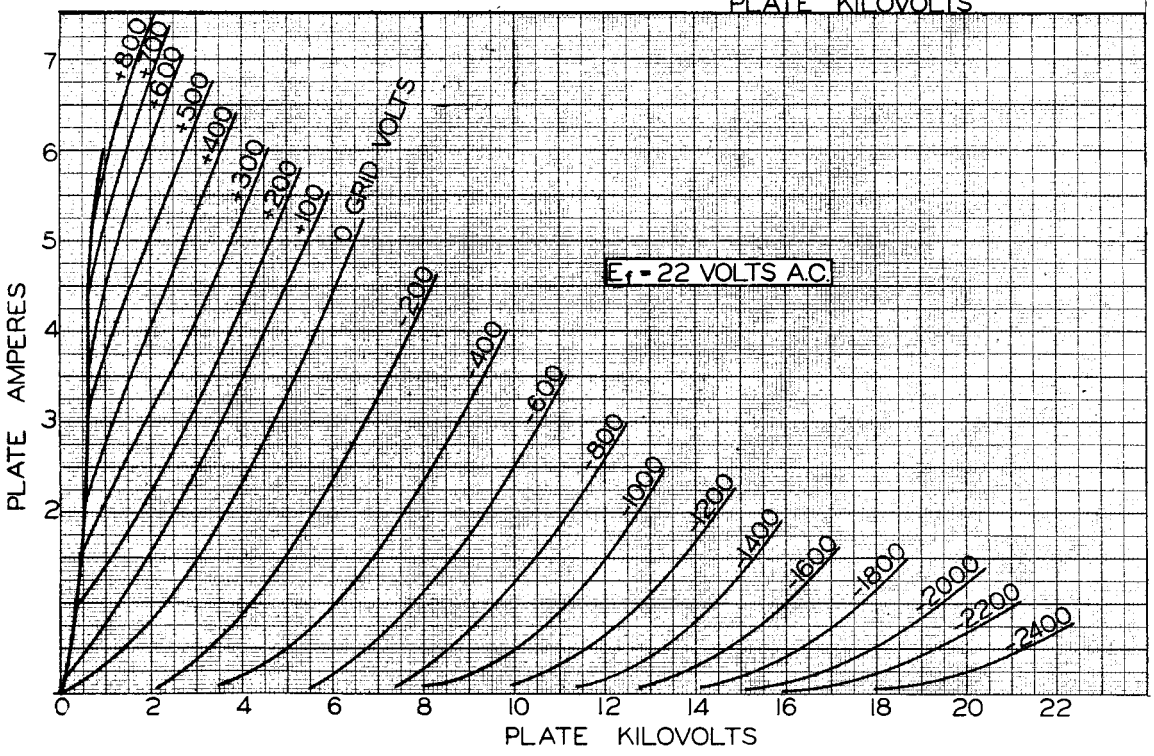
***At crest of audio frequency cycle with modulation factor of 1.0.

†At zero signal.

891—AMPEREX TRANSMITTING TUBE







FORCED-AIR COOLED

Radio Frequency Power Amplifier: Class B Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator Class AB-B

	Maximum Rating per Tube	Typical Operation Two Tubes		
A.C. Filament Voltage*	..	21	21	22
D.C. Plate Voltage	10000	8000	6000	10000
D.C. Grid Voltage	..	—950	—700	—1200
Load Resistance (per tube) (ohms)	..	2000	1250	2100
Effective Load Resistance (plate to plate) (ohms)	..	8000	5000	8400
Zero Signal Plate Current (amps)	..	0.1	0.2	0.1
Peak A.F. Grid to Grid Voltage	..	1800	2400	3400
Max. Signal Plate Current (amps)**	2	1.3	2.3	2.5
Max. Signal Plate Input (kw.)**	15	10.4	13.8	25
Plate Dissipation (kw.)**	4.5	6†	5.8†	8†
Minimum Grid Input Resistance (approx.) (ohms)	..	350	400	300
Max. Signal Driving Power (approx.) (watts)	..	..	260	150
Max. Signal Power Output (kw.)	..	4	8	17
Radiator Temperature (Centigrade)***	160°	135°	125°	160°

R.F. Power Amplifier—Class B—Telephony

Carrier conditions for use with a maximum modulation factor of 1.0.

	Maximum Rating per Tube	Typical Operation One Tube	
D.C. Filament Voltage*	..	21	22
D.C. Plate Voltage	10000	6000	8000
D.C. Grid Voltage	..	—700	—900
Peak R.F. Grid Voltage	..	700	800
D.C. Plate Current (amps)	1	0.7	0.75
Plate Input (kw.)	8	4.2	6
Plate Dissipation (kw.)	4.5	28	4
Driving Power (approx.) (watts)‡	..	82	..
Power Output (kw.)	..	1.4	2
Frequency Limit for Above Operation (mc.)	1.5	20	7.5
Radiator Temperature (Centigrade)***	160°	120°	160°

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0.

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage*	..	22
D.C. Plate Voltage	8500	6000
D.C. Grid Voltage	—3000	—2000
Peak R.F. Grid Voltage	..	2650
D.C. Plate Current (amps)	1	0.75
Plate Input (kw.)	6	4.50

GENERAL CHARACTERISTICS

Filament—Two unit type, for single-phase or two-phase A.C. or D.C. operation:	
Voltage per Unit	11
Current per Unit (amps)	60
Amplification Factor	8
Grid to Plate Transconductance at a plate current of 0.75 ampere	4000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	30 $\mu\mu$f
Grid to Filament	16 $\mu\mu$f
Plate to Filament	3 $\mu\mu$f
Dimensions:	
Maximum Overall Length	22″
Maximum Radius	6½″
Radiator	See Diagram

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0

(Continued)

	Maximum Rating per Tube	Typical Operation One Tube
Plate Dissipation (kw.)	3	1.00
D.C. Grid Current (approx.) (ma.)	150	100
Driving Power (approx.) (watts)	..	260
Power Output (kw.)	..	3.5
Frequency Limit for Above Operation (mc.)	1.5	15
Radiator Temperature (Centigrade)***	160°	80°

R.F. Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions without modulation

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage*	..	22	22
D.C. Plate Voltage	10000	8000	10000
D.C. Grid Voltage	—3000	—1800	—2000
Peak R.F. Grid Voltage	—	2500	2900
D.C. Plate Current (amps)	2	1.1	1.45
Plate Input (kw.)	18	8.8	14.5
Plate Dissipation (kw.)	5	23	45
D.C. Grid Current (approx.) (ma.)	150	60	105
Driving Power (approx.) (watts)	..	150	310
Plate Power Output (kw.)	..	6.5	10.0
Frequency Limit for Above Operation (mc.)	1.5	20	7.5
Radiator Temperature (Centigrade)***	160°	110°	150°

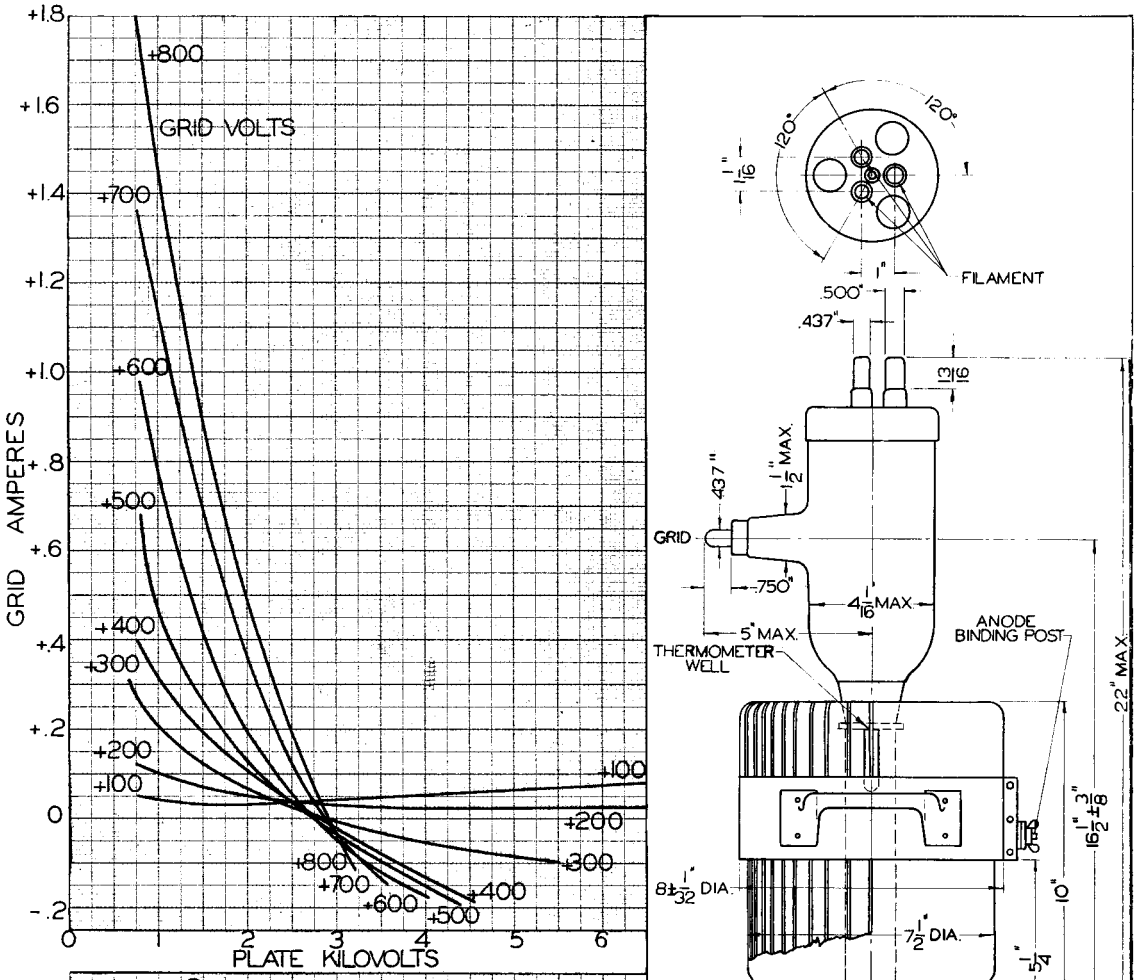
*Two filament units in series.

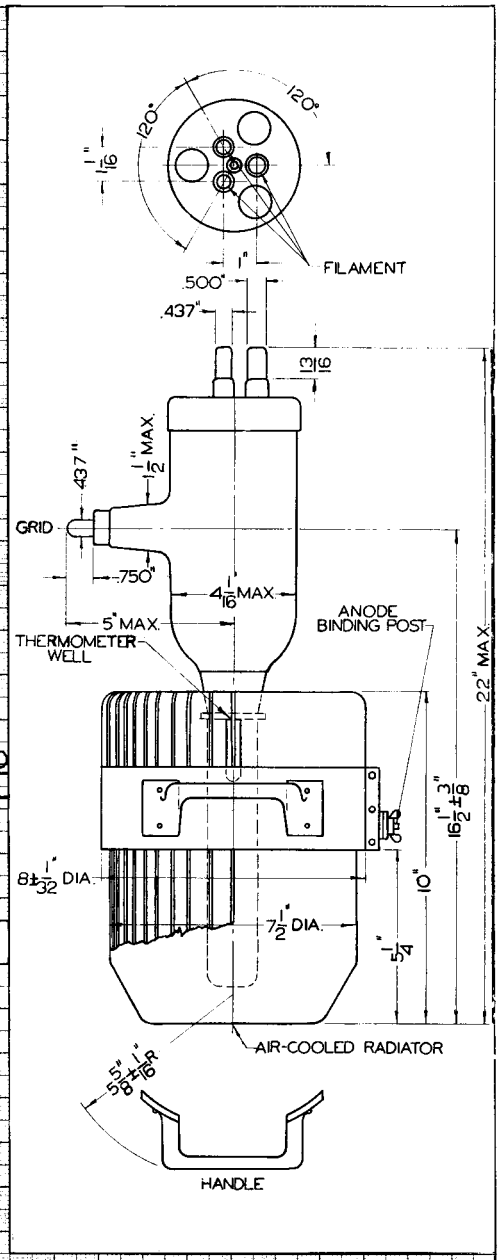
**Averaged over any audio-frequency cycle of sine-wave form.

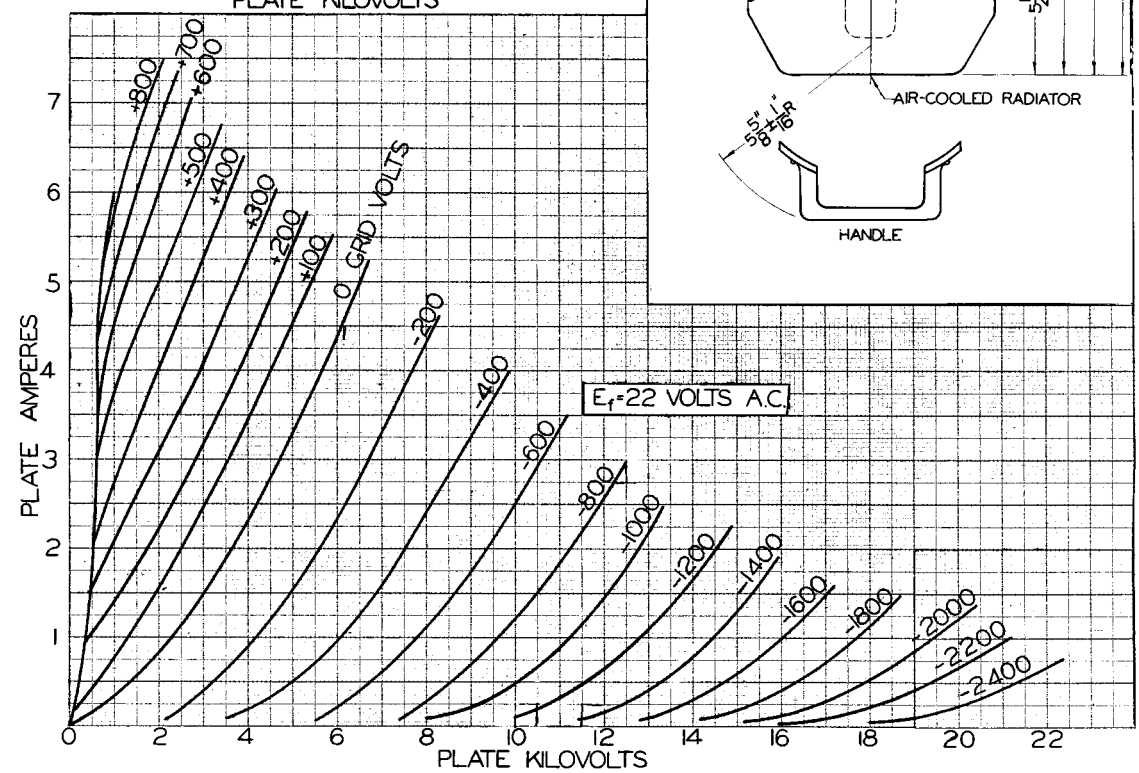
***This temperature in degrees centigrade holds for a rate of flow between 500 to 600 C.F.M. at intake temperatures up to 25°C. For intake temperatures from 25°C. to 45°C. the minimum flow should be 600 cubic feet per minute.

†Averaged over an audio-frequency cycle of sine-wave form under maximum signal conditions.

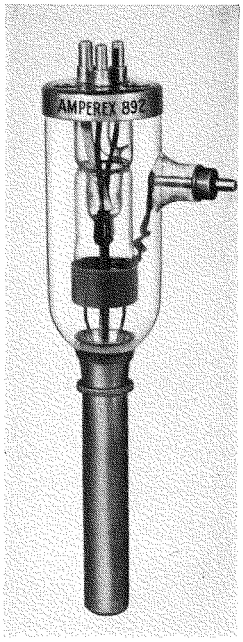
‡At crest of audio frequency cycle with modulation factor of 1.0.


GRID AMPERES
+1.8
+1.6
+1.4
+1.2
+1.0
+.8
+.6
+.4
+.2
0
-.2
GRID VOLTS
+800
+700
+600
+500
+400
+300
+200
+100
0
1
2
3
4
5
6
PLATE KILOVOLTS


120°
1 1/16"
1"
FILAMENT
.500"
.437"
13/16
1 1/2" MAX.
.437"
GRID
.750"
4 1/16" MAX.
5" MAX.
THERMOMETER WELL
ANODE BINDING POST
22" MAX.
16 1/2 ± 3/8"
10"
8 ± 1/32" DIA.
7 1/2" DIA.
1 5/4"
AIR-COOLED RADIATOR
5 5/8 + 1/16 - 1/8"
HANDLE


PLATE AMPERES
7
6
5
4
3
2
1
+800
+700
+600
+500
+400
+300
+200
+100
0 GRID VOLTS
-200
-400
-600
-800
-1000
-1200
-1400
-1600
-1800
-2000
-2200
-2400
Ef=22 VOLTS A.C.
0
2
4
6
8
10
12
14
16
18
20
22
PLATE KILOVOLTS

Radio Frequency Power Amplifier: Class B Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
A.C. Filament Voltage*	..	21	22	22
D.C. Plate Voltage	15000	6000	10000	12500
D.C. Grid Voltage	..	−25	−130	−200
Load Resistance (per tube) (ohms)	..	1050	1600	2500
Effective Load Resistance (Plate to Plate) (ohms)	..	4200	6400	10000
Zero Signal Plate Current (amps)	..	0.4	0.4	0.2
Peak A.F. Grid to Grid Voltage	..	1200	1620	1580
Max. Signal Plate Current** (amps)	2	2.5	3.2	2.7
Max. Signal Plate Input** (kw)	20	15	32	34
Plate Dissipation** (kw)	7.5	7‡	12‡	12‡
Minimum Grid Input Resistance (Approx.) (ohms)	..	400	300	300
Max. Signal Driving Power (Approx.) (watts)	..	150	240	170
Max. Signal Power Output (kw)	..	8	20	22

R.F. Power Amplifier—Class B—Telephony

Carrier conditions for use with 1.0 maximum modulation factor

	Maximum Rating per Tube	Typical Operation One Tube		
D.C. Filament Voltage*	..	21	22	22
D.C. Plate Voltage	15000	6000	10000	14000
D.C. Grid Voltage	..	−60	−120	−200
Plate Load Resistance (ohms)	..	3300	3600	4000
Peak R.F. Grid Voltage	..	310	410	500
D.C. Plate Current (amps)	1	0.5	0.75	0.95
Plate Input (kw)	15	3	7.5	13.3
Plate Dissipation (kw)	10	2	5	8.8
D.C. Grid Current (Approx.) (ma.)	..	38	20	13
Driving Power (Approx.)*** (watts)	..	96	100	80
Power Output (kw)	..	1	2.5	4.5
Frequency Limit for Above Operations (mc.)	1.5	20	7.5	1.5
F.C.C. Broadcast Rating (kw)	2.5	1	2.5	..

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage*	..	22	22	22
D.C. Plate Voltage	10000	6000	8000	10000
D.C. Grid Voltage	−3000	−1000	−1250	−1600
Plate Load Resistance (ohms)	..	3500	3740	6100
Peak R.F. Grid Voltage	..	1650	2000	2300
D.C. Plate Current (amps)	1	0.77	0.96	0.77
Plate Input (kw)	10	4.62	7.68	7.7
Plate Dissipation (kw)	6.6	1.12	1.68	1.33

GENERAL CHARACTERISTICS

FILAMENT:—Two unit type, for single-phase or two-phase A.C., or D.C. operation.

Voltage per Unit	11 volts
Current per Unit	60 amperes
Amplification Factor	50
GRID TO PLATE Transconductance at a plate current of 0.75 ampere	7000 micromhos

DIRECT INTERELECTRODE CAPACITANCES:

Grid to Plate	32 $\mu\mu$f
Grid to Filament	17 $\mu\mu$f
Plate to Filament	1.8 $\mu\mu$f

DIMENSIONS:

Maximum Overall Length	20⅝ ins.
Maximum Radius	6½ ins.
Water Jacket	Amperex type DW 1580 or Standard

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0

(Continued)

	Maximum Rating per Tube	Typical Operation One Tube		
D.C. Grid Current (Approx.) (ma.)	250	160	160	135
Driving Power (Approx.) (watts)	..	250	310	300
Power Output (kw)	..	3.5	6	6.37
Frequency Limit for Above Operation (mc.)	1.5	15	3	1.5
F.C.C. Broadcast Rating (kw)	5	..	5	5

R.F. Power Amplifier and Oscillator Class C—Telegraphy

Key-down conditions without modulation

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage*	..	22	22	22
D.C. Plate Voltage	15000	8000	10000	12000
D.C. Grid Voltage	−3000	−1000	−1300	−1600
Plate Load Resistance (ohms)	..	3000	3200	3500
Peak R.F. Grid Voltage	..	1800	2200	2600
D.C. Plate Current (amps)	2	1.2	1.4	1.55
Plate Input (kw)	30	9.6	14	18.60
Plate Dissipation (kw)	10	2.5	3.5	4.35
D.C. Grid Current (Approx.) (ma.)	250	165	160	165
Driving Power (Approx.) (watts)	..	280	340	420
Plate Power Output (kw)	..	7.1	10.5	14.25
Frequency Limit for Above Operation (mc.)	1.5	20	7.5	3

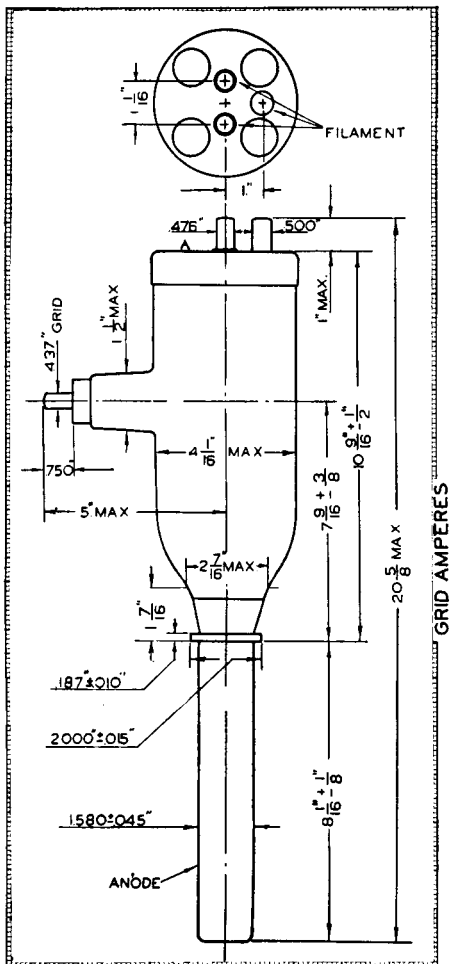
*Two filament units in series.

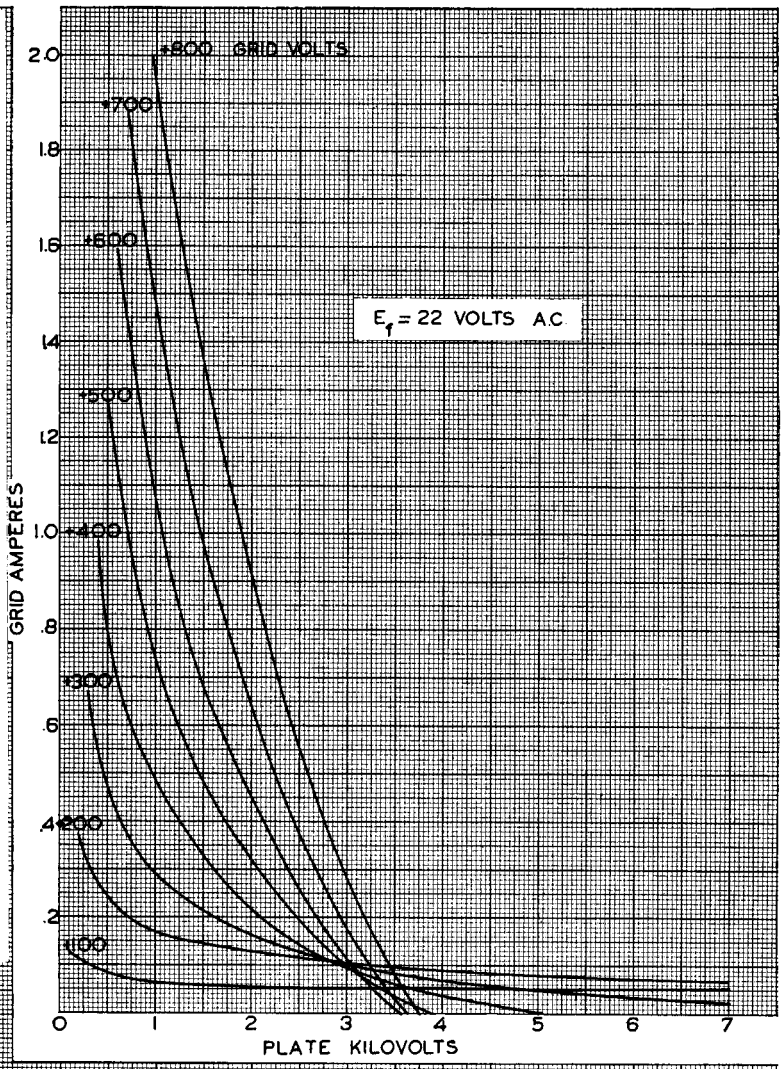
**Averaged over any audio-frequency cycle of sine-wave form.

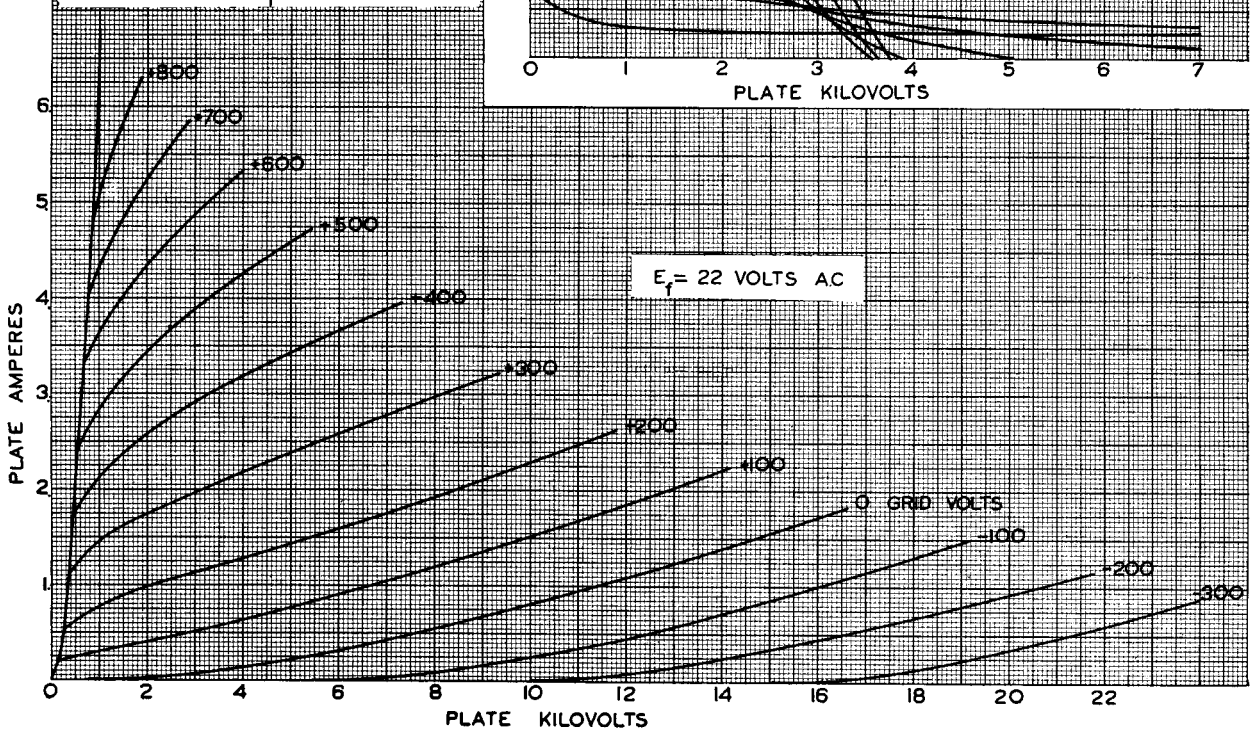
‡Averaged over an audio-frequency cycle of sine-wave form under maximum signal conditions.

***At crest of audio frequency cycle with modulation factor of 1.0.

892—AMPEREX TRANSMITTING TUBE







FORCED-AIR COOLED

Radio Frequency Power Amplifier: Class B Modulator



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage*	..	21	22
D.C. Plate Voltage	12500	6000	10000
D.C. Grid Voltage	..	−25	−120
Load Resistance (per tube) (ohms)	..	1050	2100
Effective Load Resistance (plate to plate) (ohms)	..	4200	8400
Zero Signal Plate Current (amps)	..	0.4	0.5
Peak A.F. Grid to Grid Voltage	..	1200	1400
Max. Signal Plate Current (amps)**	2	2.5	2.5
Max. Signal Plate Input (kw.)**	12.5	15	25
Plate Dissipation (kw.)**	4	7†	8†
Minimum Grid Input Resistance (approx.) (ohms)	..	400	300
Max. Signal Driving Power (approx.) (watts)	..	150	300
Max. Signal Power Output (kw.)	..	8	17
Radiator Temperature (Centigrade)***	160°	125°	160°

R.F. Power Amplifier—Class B—Telephony

Carrier conditions for use with a maximum modulation factor of 1.0

	Maximum Rating per Tube	Typical Operation One Tube	
D.C. Filament Voltage*	..	21	22
D.C. Plate Voltage	12500	6000	8000
D.C. Grid Voltage	..	−60	−80
Plate Load Resistance (ohms)	..	3300	2700
Peak R.F. Grid Voltage	..	310	380
D.C. Plate Current (amps)	1.1	0.5	0.75
Plate Input	6	3	6
Plate Dissipation	4	2	4
D.C. Grid Current (approx)	..	38	20
Driving Power (approx) (watts)‡	..	96	30
Power Output	..	1	2
Frequency Limit for Above Operation	1.5	20	7.5
Radiator Temperature (Centigrade)***	160°	120°	160°

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	22	22
D.C. Plate Voltage	10000	6000	8000
D.C. Grid Voltage	−3000	−1000	−1250
Plate Load Resistance (ohms)	..	3500	3740
Peak R.F. Grid Voltage	..	1650	2000
D.C. Plate Current (amps)	1	0.77	0.96
Plate Input (kw.)	10	4.62	7.68
Plate Dissipation (kw.)	2.5	1.12	1.68

GENERAL CHARACTERISTICS

Filament—Two unit type, for single-phase or two-phase A.C. or D.C. operation:	
Voltage per Unit	11
Current per Unit (amps)	60
Amplification Factor	50
Grid to Plate Transconductance at a plate current of 0.75 ampere	7000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	32 $\mu\mu$f
Grid to Filament	17 $\mu\mu$f
Plate to Filament	2 $\mu\mu$f
Dimensions:	
Maximum Overall Length	22″
Maximum Radius	6½″
Radiator	See Diagram

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions for use with modulation factors up to 1.0

(Continued)

	Maximum Rating per Tube	Typical Operation One Tube	
D.C. Grid Current (approx.) (ma)	250	160	156
Driving Power (approx.) (watts)	..	250	310
Power Output (kw.)	..	3.5	6
Frequency Limit for Above Operation (mc.)	1.5	15	3
F.C.C. Broadcast Rating (kw.)	5	..	5
Radiator Temperature (Centigrade)***	160°	85°	90°

R.F. Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions without modulation

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage*	..	22	22
D.C. Plate Voltage	12500	8000	10000
D.C. Grid Voltage	−3000	−1000	−1300
Plate Load Resistance (ohms)	..	3000	3200
Peak R.F. Grid Voltage	..	1800	2200
D.C. Plate Current (amps)	2	1.2	1.4
Plate Input (kw.)	18	9.6	14
Plate Dissipation (kw.)	4	2.5	3.5
D.C. Grid Current (approx.) (ma.)	250	165	160
Driving Power (approx.) (watts)	..	280	340
Plate Power Output (kw.)	..	7.1	10.5
Frequency Limit for Above Operation (mc.)	1.5	20	7.5
Radiator Temperature (Centigrade)	160°	120°	150°

*Two filament units in series.

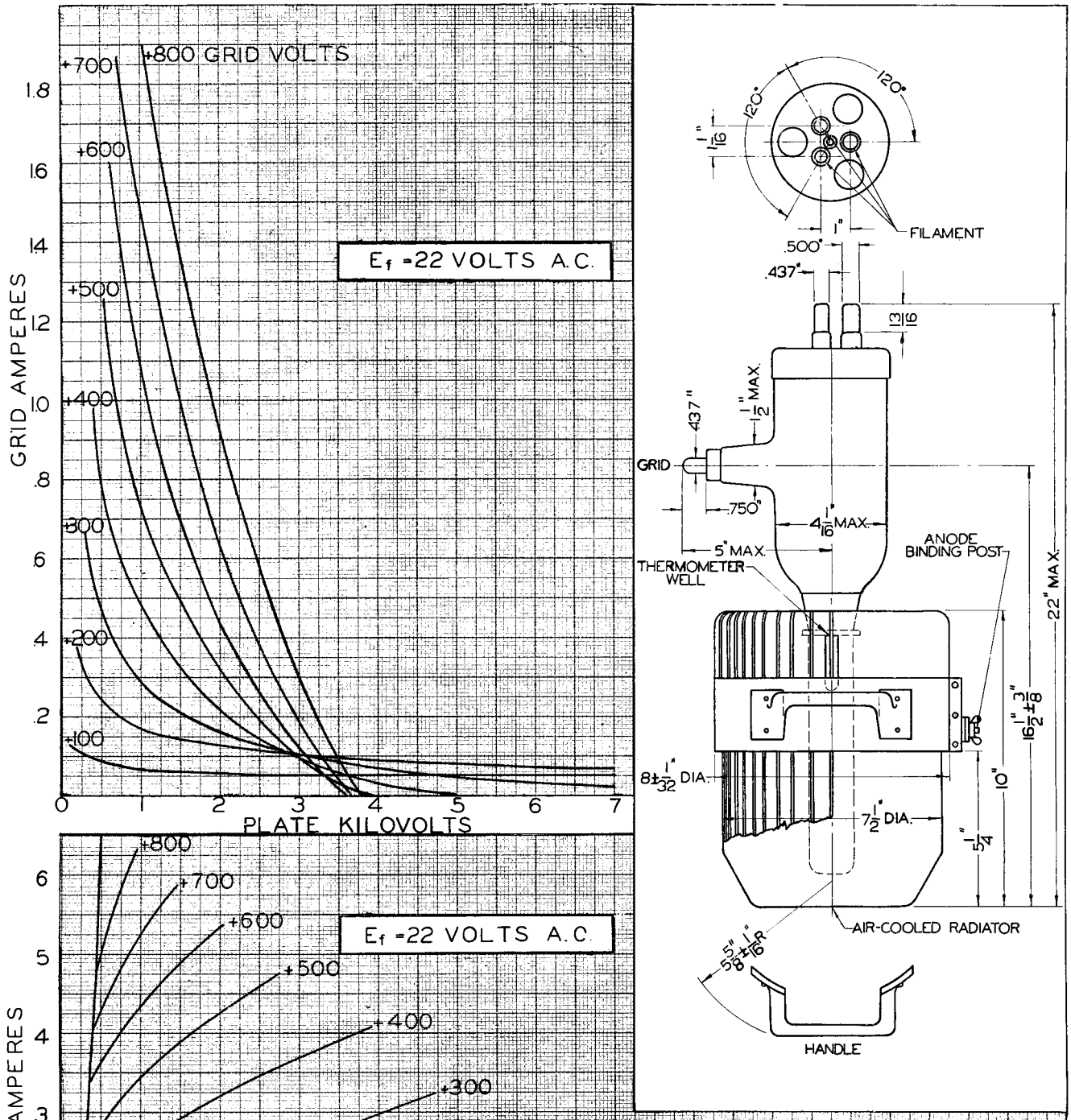
**Averaged over any audio-frequency cycle of sine-wave form.

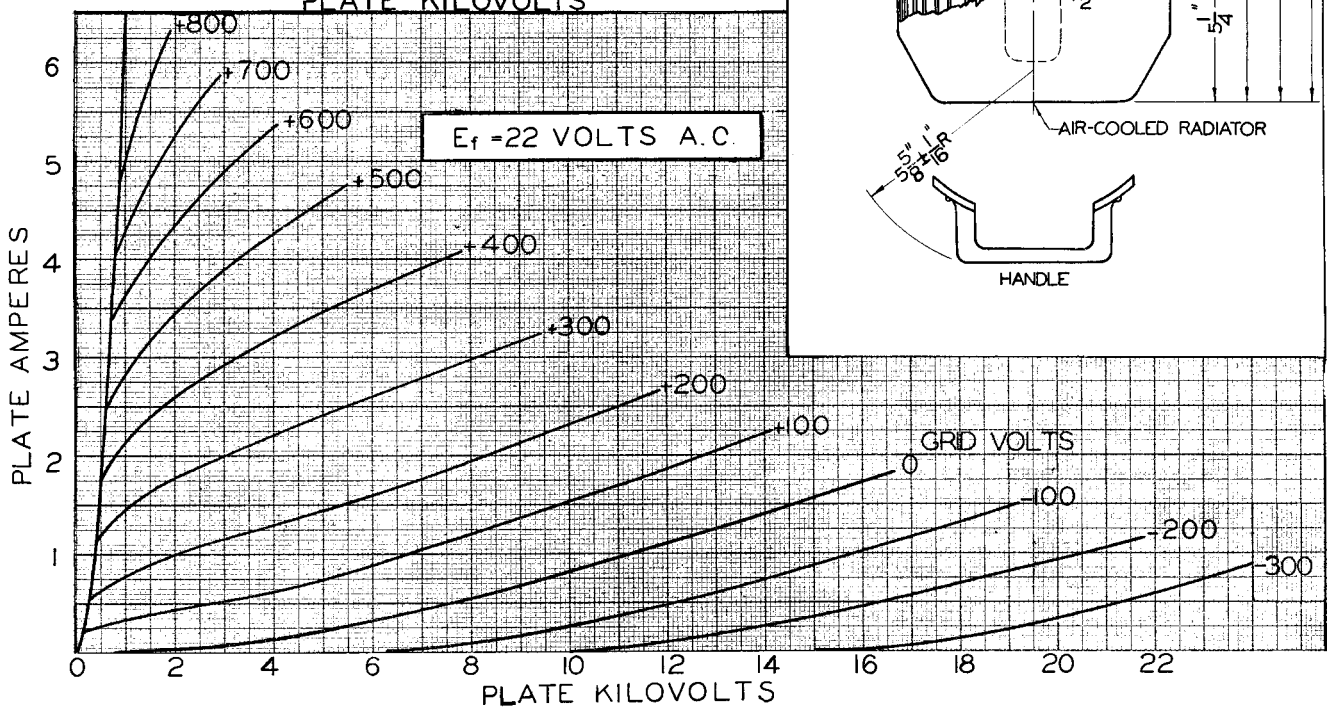
***This temperature holds for a rate of flow between 500 to 600 C.F.M. at intake temperatures up to 25°C. For intake temperatures from 25°C. to 45°C. the minimum flow should be 600 cubic feet per minute.

†Averaged over an audio-frequency cycle of sine-wave form under maximum signal conditions.

‡At crest of audio frequency cycle with modulation factor of 1.0.

892-R — AMPEREX TRANSMITTING TUBE





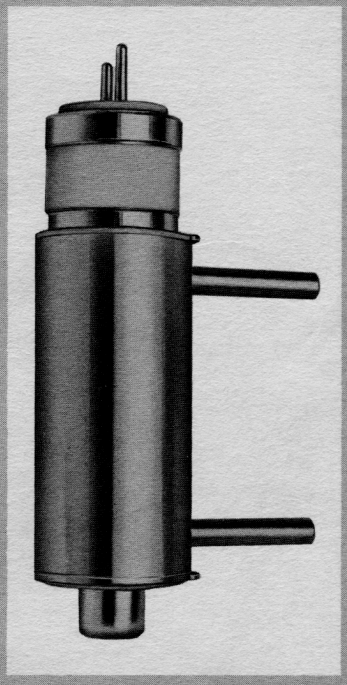
892-R

Amperex® Electronic Corporation
PROFESSIONAL TUBE DIVISION
230 Duffy Avenue Hicksville, L.I., N.Y. 11802
Telephone: 516/931-6200 TWX: 516/433-9045

TUBE TYPE
DX 334

ADVANCE DATA

The Amperex DX334 is a Neotron® [1] featuring an integral water jacket and a maximum anode dissipation of 2000 watts. The Neotron® Tube has no grid and thus eliminates the problems normally encountered with gridded tubes. The tube is designed for use as a medium frequency amplifier or oscillator at frequencies up to 5 MHz. As a Class C amplifier or oscillator the DX334 will produce an anode power output greater than 3 kW with an anode voltage of 5 kV at an input of 4 kW.



GENERAL CHARACTERISTICS

MECHANICAL

Dimensions	see outline drawing		
Mounting Position	vertical		
Weight			
Tube	1 lb.		
Accessories	5 lbs.		
Accessories			
Magnetic Nest	Amperex type S-332275		
Gate Connector	Amperex type S-332274		
Heater and Cathode Connectors (2 required)	Amperex type S-31888		
Maximum Operating Temperatures			
Water Inlet Temperature	50°C		
Seal Temperatures [2]	200° C		
Cooling Characteristics at Anode Dissipation-2000 watts max.			
Inlet Temperature	20	50	°C
Water Flow [3]	1.0	1.5	gpm
Pressure Drop	4.5	9	psi

ELECTRICAL

Cathode	nickel oxide matrix
Heater Voltage	5 volts
Heater Current	6.1 amps
Warm-Up Time	2 minutes
Magnetic Field	1150 gauss min.
Amplification Factor at E_c = 3000V	25
Transconductance at I_c = 500 mA	4000 μmhos
Direct Interelectrode Capacitances	
Anode to Cathode	0.55 pF
Gate to Cathode	9.1 pF
Anode to Gate	10.1 pF

Amperex

Information furnished by Amperex is believed to be accurate and reliable. However, no license for its use is hereby conveyed under any patent and no responsibility is assumed by Amperex for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

Rev. September 1968

R.F. POWER AMPLIFIER AND OSCILLATOR CLASS C - TELEGRAPHY

(Three Phase Full Wave or Single Phase Full Wave Filtered)

MAXIMUM RATINGS - Absolute Values

Frequency	5	MHz
D.C. Anode Voltage	5500	volts
D.C. Anode Current	850	mA
Gate to Cathode Voltage	2000	volts
D.C. Gate-Current	(see note 4)	
D.C. Cathode Current	850	mA
Anode Input Power	4000	watts
Anode Dissipation	2000	watts
Gate Dissipation	25	watts
Gate Bias Resistor	88	k ohms

TYPICAL OPERATION

	Oscillator CCS	Amplifier CCS	
Frequency	3.5	3.5	MHz
D.C. Anode Voltage	5000	5000	volts
D.C. Anode Current	800	800	mA
D.C. Gate Current (loaded)	5	2	mA
D.C. Gate Current (unloaded)	10	-	mA
Anode Load Impedance	3900	3500	ohms
D.C. Anode Input Power	4000	4000	watts
Anode Dissipation	825	890	watts
R.F. Anode Output Power	3175	3110	watts
Peak Anode R.F. Voltage	4650	4600	volts
Anode Efficiency	79	78	%
D.C. Gate Bias Voltage	-400	-400	volts
Gate Dissipation	4.4	1.6	watts
Peak Gate R.F. Voltage	1275	1200	volts
Peak Positive Gate Voltage	875	800	volts
Gate Bias Resistor	80 k ohms	Fixed Bias	
Gate Drive Power	-	*	

CLASS C OSCILLATOR

(Full-Wave Rectified, Unfiltered, Single Phase)

MAXIMUM RATINGS - Absolute Values

	CCS	
Frequency	5	MHz
D.C. Anode Voltage	4500	volts
D.C. Anode Current	725	mA
Gate to Cathode Voltage	2400	volts
D.C. Gate-Current	(see note 4)	
D.C. Cathode Current	730	mA
D.C. Anode Input Power [5]	3240	watts
RMS Anode Input Power	4000	watts
Collector Dissipation	2000	watts
Gate Dissipation	25	watts
Gate Bias Resistor	88	k ohms

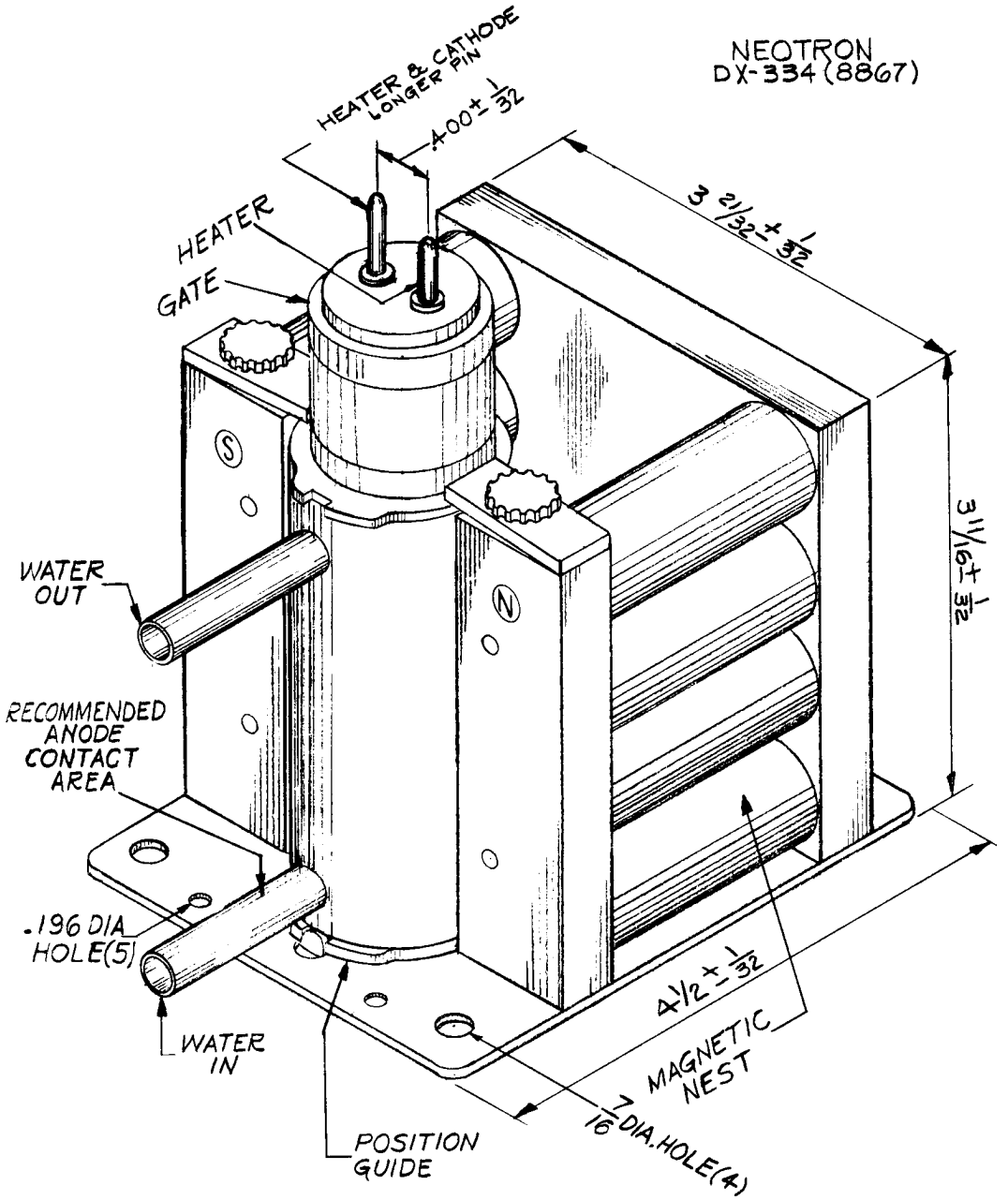
TYPICAL OPERATION

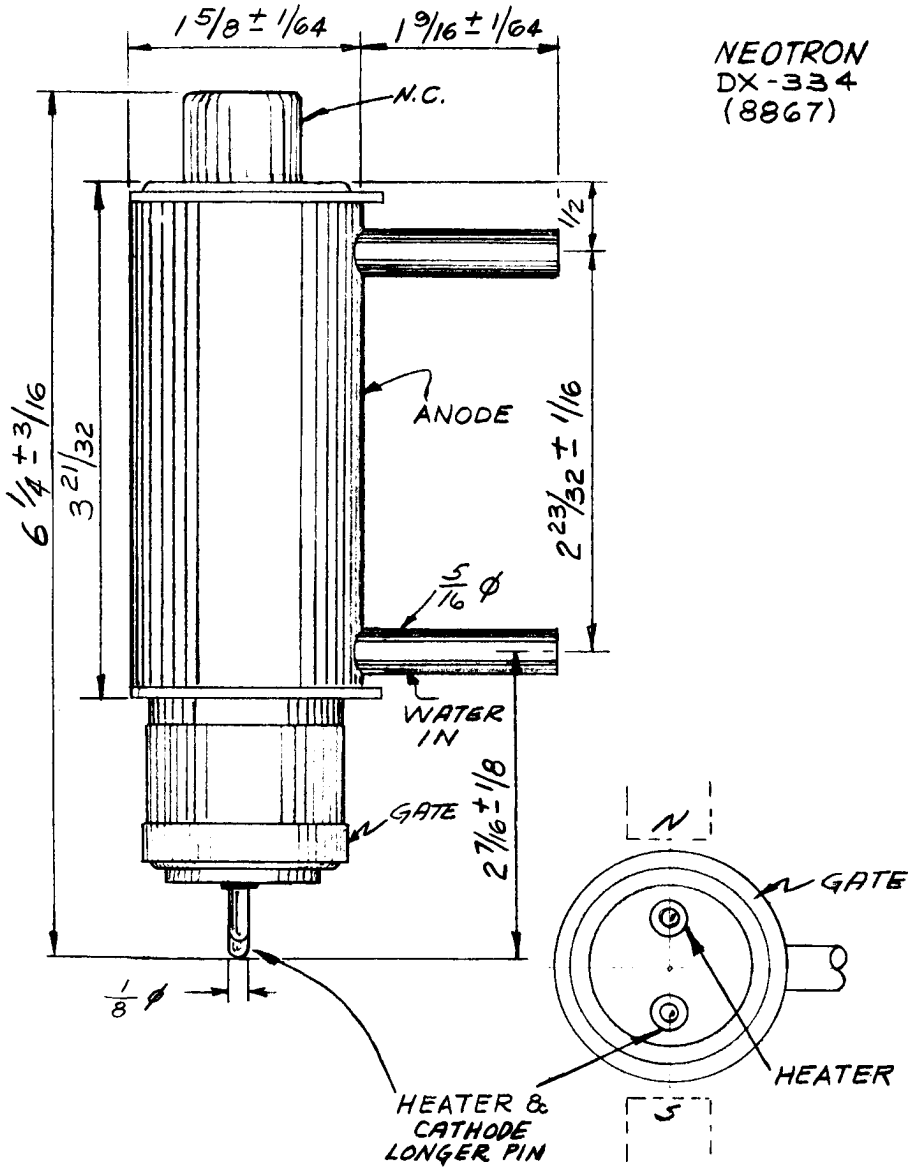
	CCS	
Frequency	5	MHz
D.C. Anode Voltage	4500	volts
D.C. Anode Current	720	mA
D.C. Gate Current (loaded)	4.5	mA
D.C. Gate Current (unloaded)	9	mA
Anode Load Impedance	3900	ohms
D.C. Anode Input Power [5]	3240	watts
R.M.S. Anode Input Power	4000	watts
Anode Dissipation	900	watts
R.F. Anode Output Power	3100	watts
Peak Anode R.F. Voltage	6580	volts
Anode Efficiency	78	%
D.C. Gate Bias Voltage	360	volts
Gate Dissipation	4.4	watts
Peak Gate R.F. Voltage	1800	volts
Peak Positive Gate Voltage	1240	volts
Gate Bias Resistor	80	k ohms

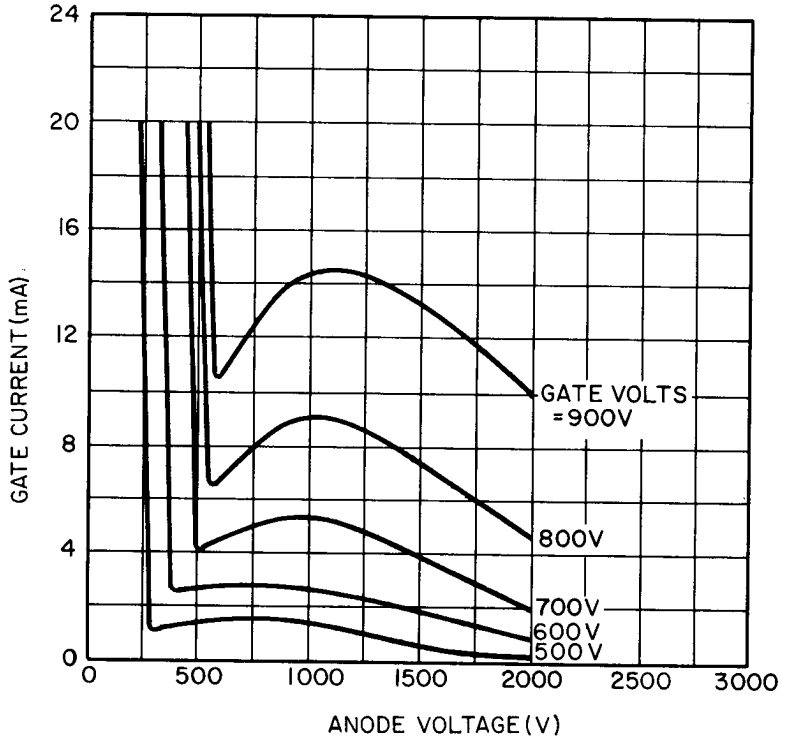
* = To Be Specified

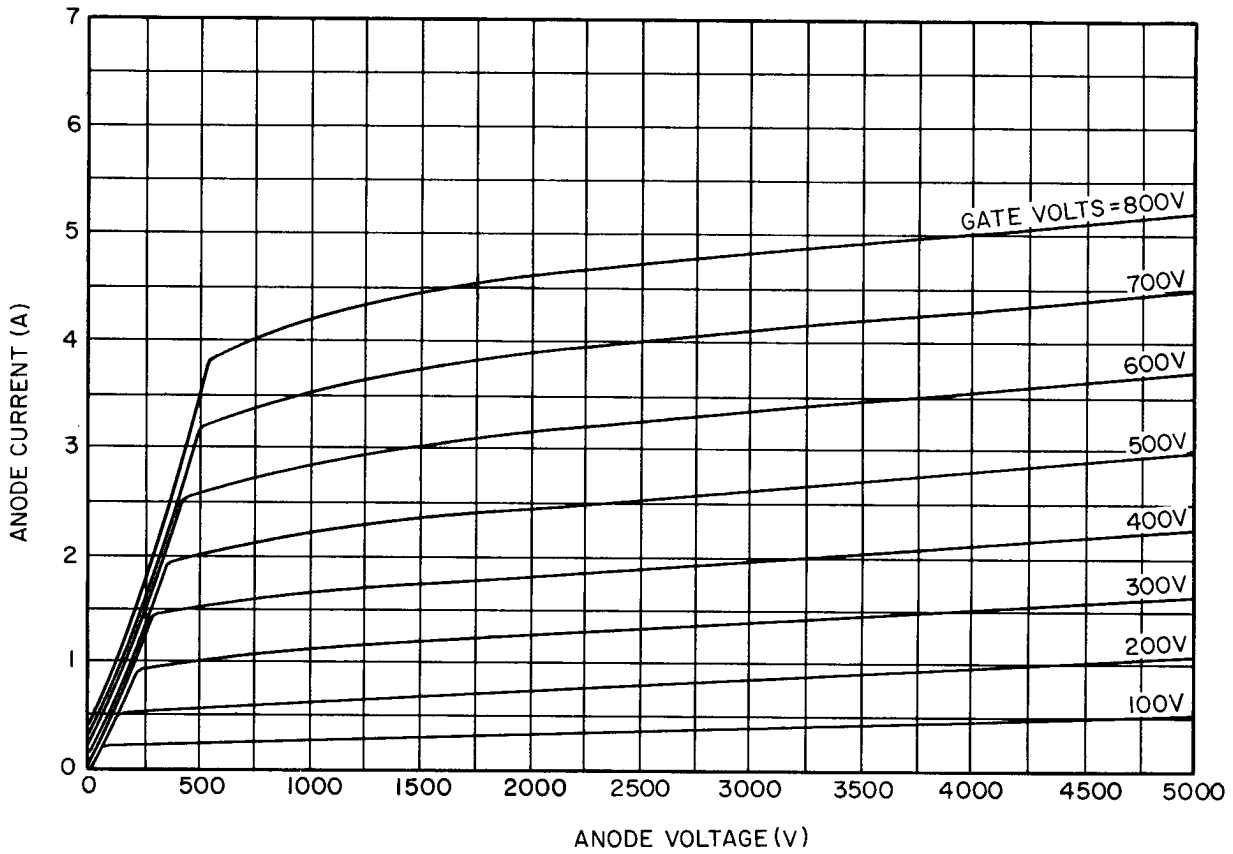
NOTES

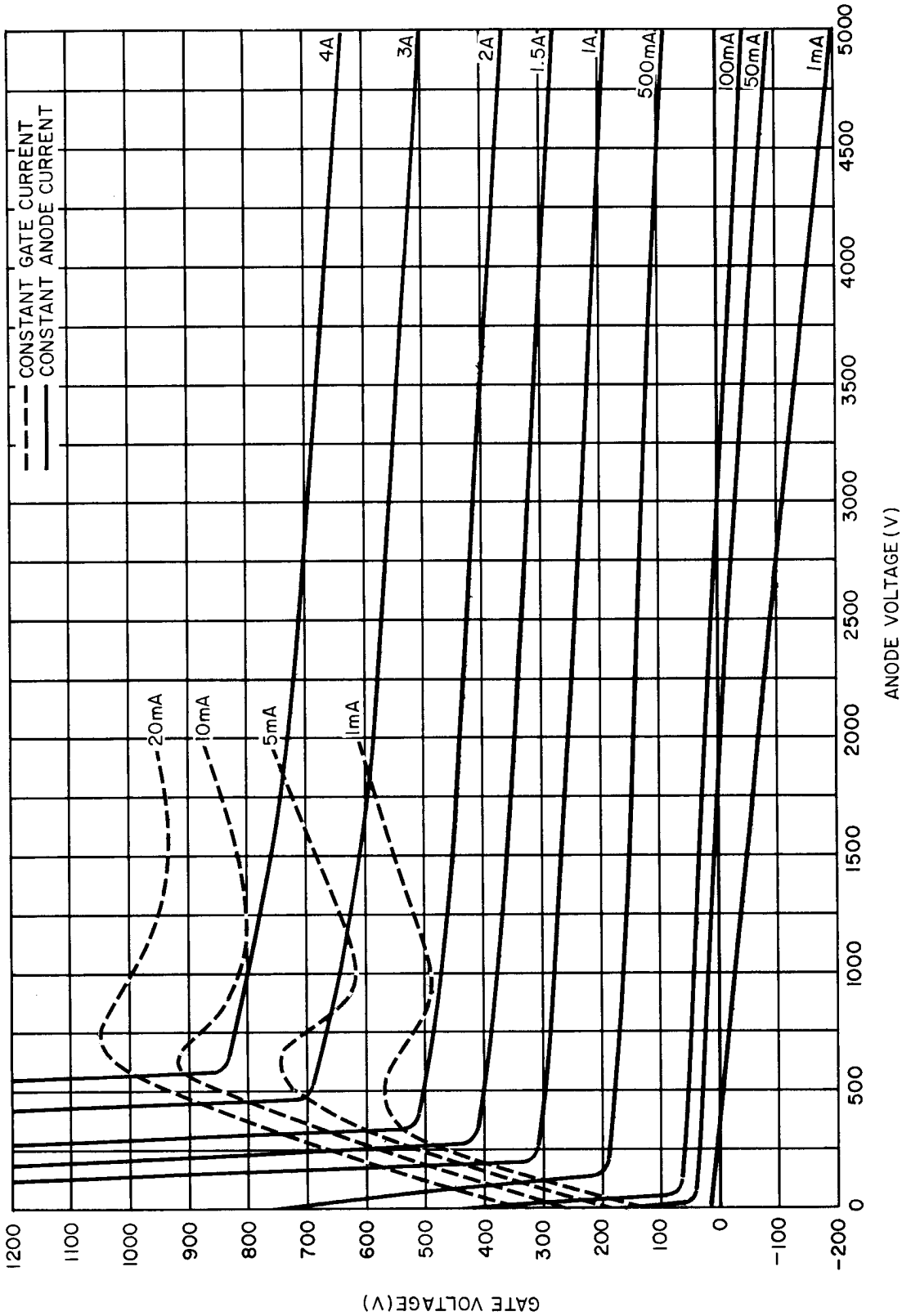
1 A Neotron® is a Field Effect Tube.
2 At higher altitude, higher inlet air temperatures, and higher frequencies, additional cooling must be used in order to stay within maximum seal temperature ratings.
3 Water flow must be maintained for at least 1 minute after anode power is removed.
4 Limited only by maximum gate dissipation and maximum cathode current.
5 Defined as product of average DC Anode Voltage times average DC Anode Current.




1 5/8 ± 1/64
1 9/16 ± 1/64
NEOTRON
DX-334
(8867)
N.C.
1/2
ANODE
6 1/4 ± 3/16
3 21/32
2 23/32 ± 1/16
5/16 ϕ
WATER IN
GATE
2 7/16 ± 1/8
1/8 ϕ
HEATER & CATHODE LONGER PIN
N
GATE
HEATER
S


GATE CURRENT (mA)
24
20
16
12
8
4
0
0
500
1000
1500
2000
2500
3000
ANODE VOLTAGE (V)
GATE VOLTS
=900V
800V
700V
600V
500V


ANODE CURRENT (A)
7
6
5
4
3
2
1
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
ANODE VOLTAGE (V)
GATE VOLTS=800V
700V
600V
500V
400V
300V
200V
100V

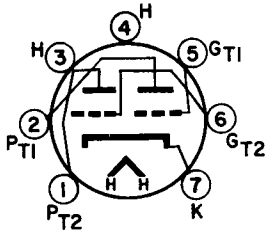


DX-334 CONSTANT CURRENT CURVES

AMPEREX TUBE TYPE E92CC

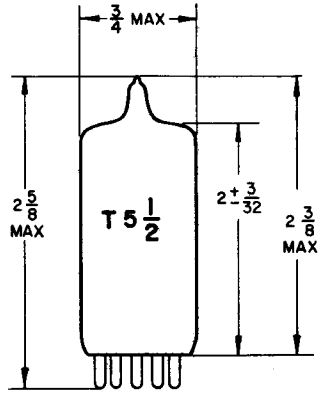
The Amperex E92CC is a reliable miniature twin triode designed for use in computer circuits which are not critical as to hum, microphonics and noise. Operation of the tube for long periods of time under cut-off conditions will not cause deterioration of the emission surface.

The E92CC is one of the Amperex "Premium Quality, 10,000 Hour" tubes.



PIN CONNECTIONS

1- PLATE, TRIODE NO. 2
2- PLATE, TRIODE NO. 1
3- HEATER
4- HEATER
5- GRID, TRIODE NO. 1
6- GRID, TRIODE NO. 2
7- CATHODE



5-3

GENERAL CHARACTERISTICS

MECHANICAL	
Cathode	coated, unipotential
Outline	T 5½
Bulb	5-3
Base	E 7-1
Bulb temperature	170°C max
ELECTRICAL	
Heater voltage	6.3 volts
Heater current	400 mA
Direct Interelectrode Capacitances	
Triode No. 1	
Input	3.1 μμf
Output	0.38 μμf
Plate to grid	2.1 μμf
Triode No. 2	
Input	3.1 μμf
Output	0.32 μμf
Plate to grid	2.2 μμf
Between sections	
Grid to grid	0.29 μμf max
Plate to plate	2.0 μμf max

E92CC

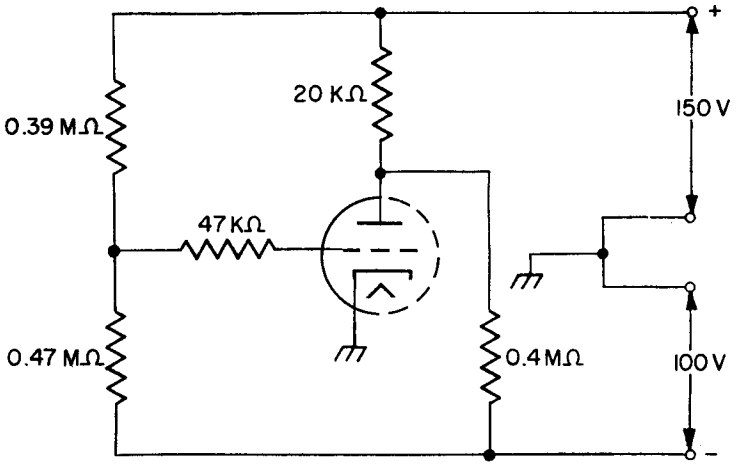
Maximum Ratings, Absolute Values

Plate supply voltage	600 volts max
Plate voltage	300 volts max
Negative grid voltage	100 volts max
Peak Negative grid voltage	200 volts max
Grid voltage	.5 volts max
Cathode to heater voltage	100 volts max
Cathode current	15 mA max
Peak cathode current	75 mA max
Grid current	250 μA max
Peak grid current	1000 μA max
Plate dissipation	2 watts max
Grid resistor (automatic bias)	1 megohm max
Grid resistor (fixed bias)	0.5 megohm max
Bulb temperature	170°C max

Typical Operation, (Each Section)

Plate voltage	150 volts
Plate current	8.5 mA
Negative grid voltage	1.75 volts
Transconductance	6000 micromhos
Amplification Factor	45

Computer Service



CIRCUIT FOR COMPUTER SERVICE

Plate current	0.1 mA max
Cut-off balance ($E_{c1} - E_{c2}$)	2 volts

Characteristic Range Values for Equipment Design

	Initial Life		End of Life [1]		
	Min	Max	Min	Max	
Heater current (E_h = 6.3 V)	380	420	380	420	mA
Plate current (E_b = 150 V, E_c = −1.7 V)	4.5	12.5	-	-	mA
Plate current (E_{bb} = 150 V, E_c = −10 V R_p = 20 kΩ, R_g = 47 kΩ)	-	0.1	-	0.1	mA
Negative grid current (E_b = 150 V, E_c = −1.7 V)	-	0.2	-	1	μA
Cut-off balance ($E_{c1} - E_{c2}$) ($E_{bb} = E_{bb}'$ = 150 V, $R_q = R_q'$ = 47 kΩ, $R_p = R_p'$ = 20 kΩ, $I_a = I_a'$ = 0.1 mA)	-	2	-	2	volts
Cathode to Heater current (cathode positive, R_{series} = 1 meg, V_{hk} = 100 V)	-	15	-	30	μA
Plate resistor current (see Fig. 1)	5.1	5.9	4.75	-	mA
Transconductance (E_b = 150 V, R_k = 200 Ω)	4500	7500	-	-	micromhos
Insulation Resistance (between two arbitrary electrodes)	20	-	20	-	megohms

Direct Interelectrode Capacitances

	Min	Max
Triode No. 1		
Input	2.2	4.0 μμf
Output	0.28	0.48 μμf
Plate to grid	1.7	2.5 μμf
Triode No. 2		
Input	2.2	4.0 μμf
Output	0.22	0.42 μμf
Plate to grid	1.8	2.6 μμf
Between Sections		
Grid to grid	-	0.29 μμf
Plate to plate	-	2.0 μμf

[1] Conditions of life test (see Figure 1)

Heater voltage	6.3 volts	Heater-cathode voltage (cathode negative)	100 volts
Plate supply voltage	165 volts	Input voltage at frequency ca. 300 c/s	
Plate voltage	100 volts		

S = 1:10

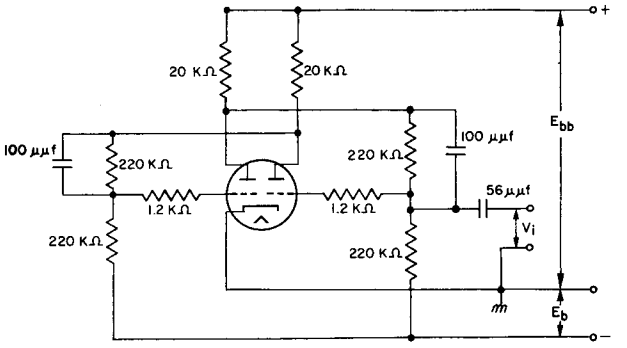
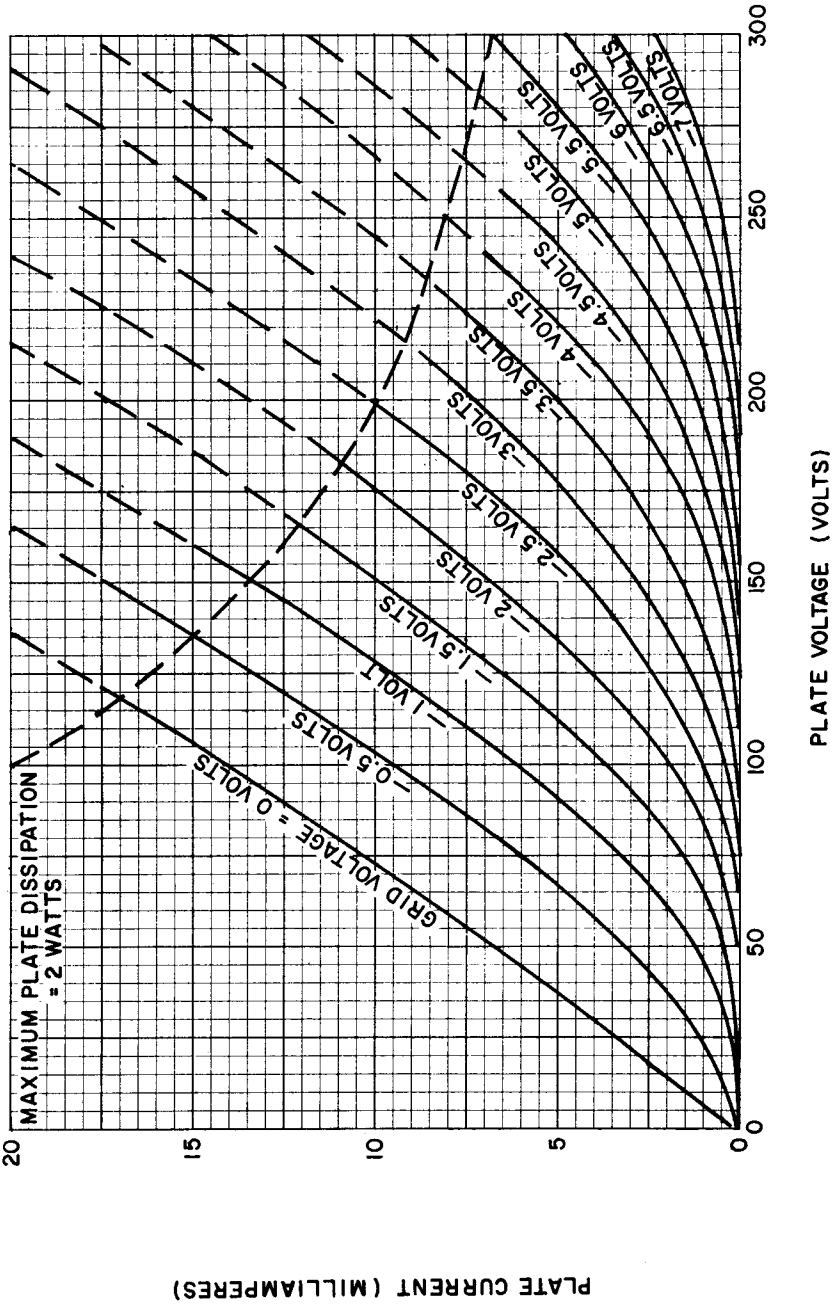


FIG. 1

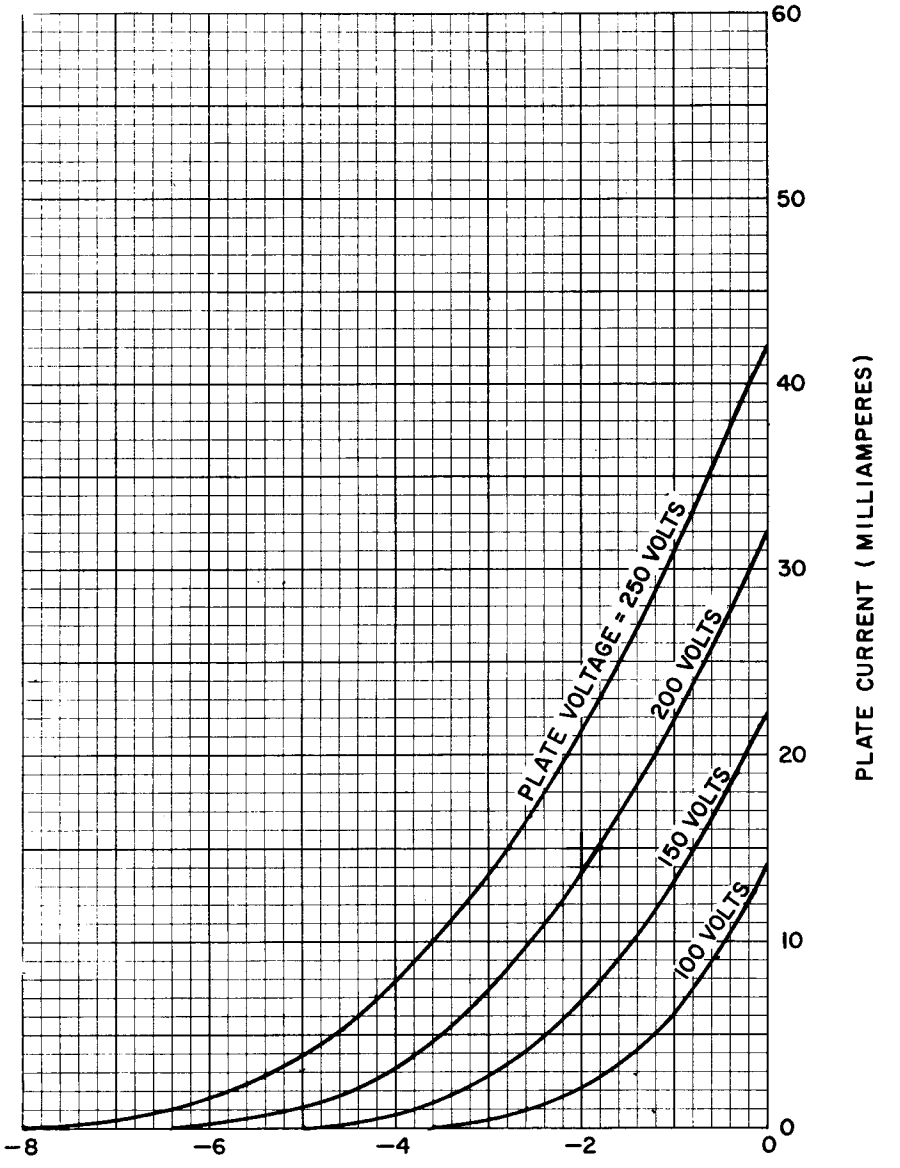
E92CC

PLATE CURRENT CHARACTERISTICS



E92CC

TRANSFER CHARACTERISTICS

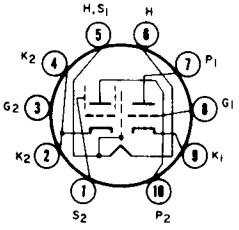


AMPEREX TUBE TYPE ECC2000

TENTATIVE DATA

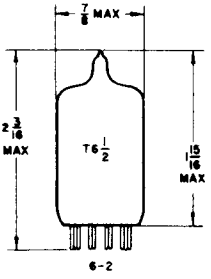
The Amperex ECC2000 is a premium quality, long-life, shock and vibration resistant dual triode for use as a VHF amplifier for frequencies up to 300 Mc in cascode circuits without external neutralization. It is also intended for use as a frequency multiplier.

The tube is provided with a neutralization screen and with gold-plated pins. The tube is interface free and has a low microphonic sensibility.



PIN CONNECTIONS

1- SCREEN NO.2
2- CATHODE NO.2
3- GRID NO.2
4- CATHODE NO.2
5- HEATER, SCREEN NO.1
6- HEATER
7- PLATE NO.1
8- GRID NO.1
9- CATHODE NO.1
10- PLATE NO.2



GENERAL CHARACTERISTICS

MECHANICAL

Base	miniature 10-pin; gold plated pins
Bulb	T 6-1/2
Dimensions	see outline drawing

ELECTRICAL

Heating	indirect, AC or DC, parallel supply
Heater Voltage	6.3 volts
Heater Current	325 ma

Interelectrode Capacitances (without shield)

Section 1

Grid to Cathode Heater and Neutralization Screen	5.5 pf
Grid to Neutralization Screen	1.5 pf
Plate to Cathode, Heater and Neutralization Screen	5.0 pf
Plate to Grid	0.45 pf
Plate to Neutralization Screen	3.3 pf

ELECTRICAL (Cont.)

Interelectrode Capacitances (without shield) (Cont.)

Section 2	
Cathode to Grid and Filament	7.0 pf
Plate to Grid and Filament	3.3 pf
Plate to Cathode	0.2 pf
Plate to Grid	1.5 pf
Between Sections	
Plate to Plate (max.)	0.045 pf

ABSOLUTE MAXIMUM RATINGS (Both Sections)

Plate Voltage (Zero Current)	450 volts
Plate Voltage	250 volts
Plate Dissipation	2.7 watts
Negative Grid Voltage	50 volts
Peak Negative Grid Voltage[1]	150 volts
Grid Circuit Resistance (automatic bias)	1 megohm
Cathode to Heater Voltage	
Cathode Positive	150 volts
Cathode Negative	50 volts
Cathode Current	40 ma
Peak Cathode Current[2]	400 ma
Bulb Temperature	225°C

TYPICAL CHARACTERISTICS

Triode Section 1 (Input System)

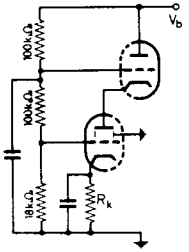
Plate Voltage	90	90 volts
Neutralization Screen Voltage	0	0 volt
Negative Grid Voltage	2.1	1.4 volts
Plate Current	15	27 ma
Transconductance	13,000	17,500 μmhos
Amplification Factor	27	27
Equivalent Noise Resistance	250	200 ohms

Triode Section 2 (Output System)

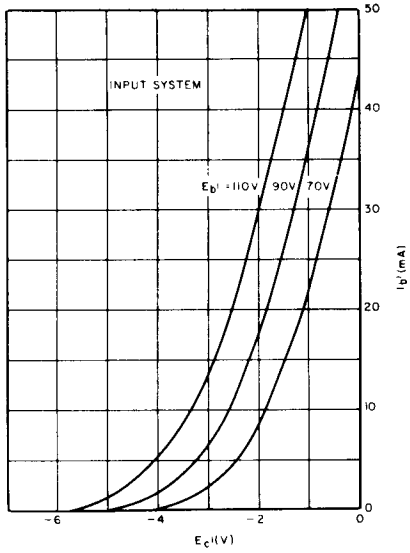
Plate Voltage	90	90 volts
Negative Grid Voltage	2.0	1.4 volts
Plate Current	15	27 ma
Transconductance	17,000	22,000 μmhos
Amplification Factor	28	28
Equivalent Noise Resistance	200	150 ohms

[1] Duty factor maximum 1%, pulse duration maximum 10 μsec.
[2] Duty factor maximum 10%, pulse duration maximum 200 μsec.

RECOMMENDED OPERATING CONDITIONS AND CORRESPONDING CHARACTERISTICS AS CASCODE AMPLIFIER AT 200 Mc

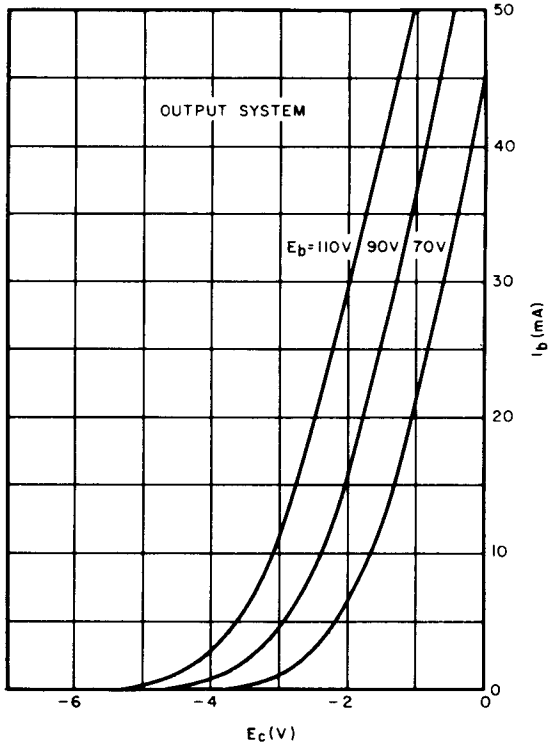


Supply Voltage	200	200 volts
Cathode Resistor	1200	680 ohms
Plate Current	15.5	26.5 ma
Input Resistance	910	670 ohms
Input Capacitance	11	12 pf
Noise Factor	4	4 db[3]

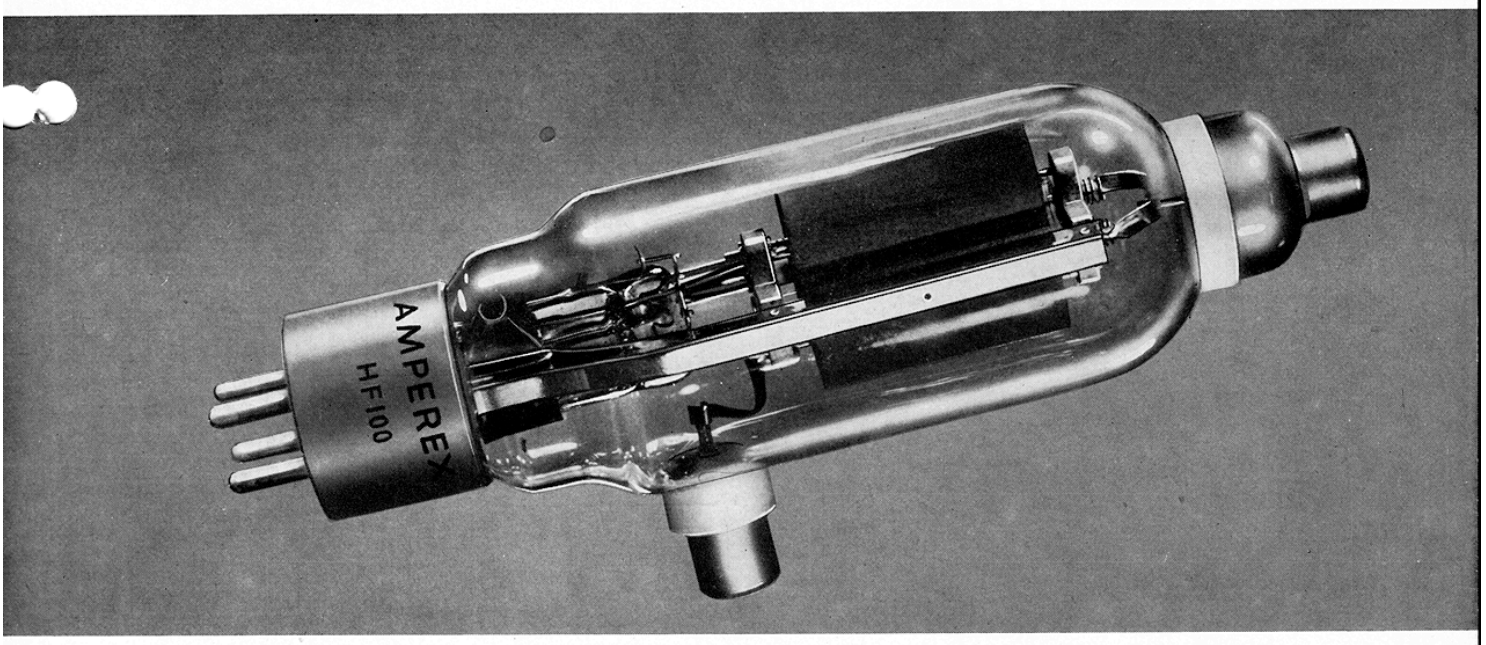


[3] Source impedance adapted to minimum noise.

ECC2000



AMPEREX TRANSMITTING TUBE HF-100



R.F. Power Amplifier and Oscillator
Class B Audio Amplifier or Modulator

The HF-100 is one of a distinctive group of low voltage high current tubes, an original development of the Amperex Engineering Laboratories. It is in addition characterized by an extraordinarily high ratio of transconductance to interelectrode capacitance, a characteristic which is responsible for its outstanding efficiency in high frequency circuits.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 to 10.5 volts
Current	2.5 amperes
Amplification Factor	23
Transconductance (grid to plate) Ip = 100 ma	4200 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	4.5 $\mu\mu$f
Grid to Filament	4.0 $\mu\mu$f
Plate to Filament	2.6 $\mu\mu$f
Frequency for Maximum Ratings	30 megacycles

MECHANICAL

Maximum Overall Dimensions	
Length	$7\frac{5}{8} \pm \frac{1}{4}$ inches
Greatest Radius	$1\frac{15}{16} \pm \frac{1}{8}$ inches
Mounting Position	
Vertical—Base up or down	
Horizontal—Plane of electrodes vertical	
Net Weight (approx.)	5 ounces
Shipping Weight (approx.) (one tube)	2 pounds

HF-100—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	....	10	10
D.C. Plate Voltage	1750	1500	1750
D.C. Grid Voltage	....	−52	−62
Load Resistance (per tube) (ohms)	....	3000	4000
Effective Load Resistance (Plate to Plate) (ohms)	....	12000	16000
Zero-Signal Plate Current (ma)	....	50	40
Peak A.F. Grid to Grid Voltage	....	264	324
Max. Signal Plate Current (ma)	150	270	270
Max. Signal Plate Input (watts)	240	....	....
Plate Dissipation (watts)	75	....	....
Max. Signal Driving Power (approx.) (watts)	....	2	9
Max. Signal Power Output (approx.) (watts)	....	260	350

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	....	10
D.C. Plate Voltage	1500	1500
D.C. Grid Voltage	....	−55
Peak R.F. Grid Voltage	....	80
D.C. Plate Current (ma)	100	75
Plate Input (watts)	115	112
D.C. Grid Current (approx.) (ma)	....	1.5
Plate Dissipation (watts)	75	70
Grid Driving Power at Modulation Peak (approx.) (watts)	....	3
Power Output (approx.) (watts)	....	42

R.F. Power Amplifier—Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	....	10	10	10
D.C. Plate Voltage	1500	1000	1250	1500
D.C. Grid Voltage	−300	−120	−200	−200
Peak R.F. Grid Voltage	....	250	330	340
D.C. Plate Current (ma)	150	150	130	150
Plate Intput (watts)	225	150	162	225
D.C. Grid Current (approx.) (ma)	30	21	18	18
Plate Dissipation (watts)	75	44	42	55
Driving Power (approx.) (watts)	....	5	6	6
Power Output (approx.) (watts)	....	106	120	170
Frequency Limit for Above Operation (mc.)	30	....	....	....

Plate Modulated R.F. Power Amplifier—Class C

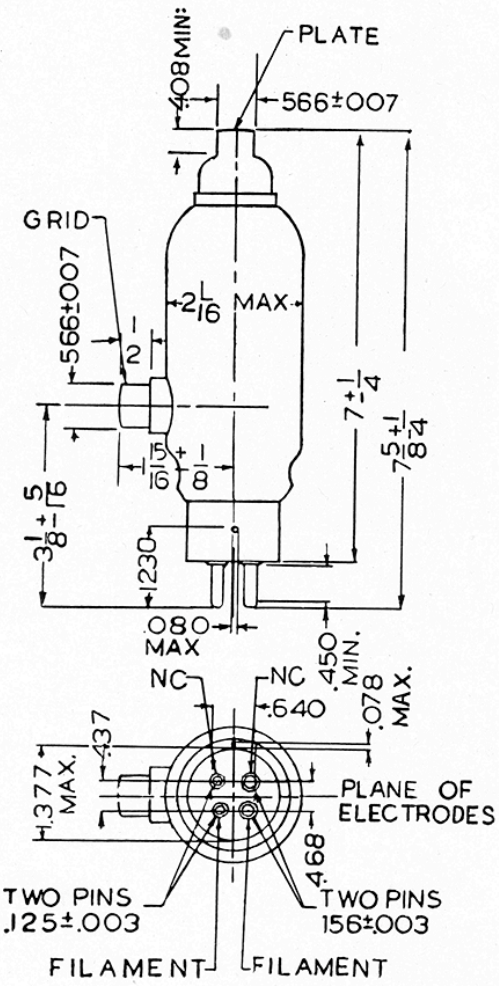
(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage (Total)	−300	−200	−250
Fixed Bias (approx.) (Voltage)	.....	−30	−40
Grid Resistor (approx.) (ohms)	.....	8500	10000
Peak R.F. Grid Voltage	....	330	380
D.C. Plate Current (ma)	120	120	110
Plate Input (watts)	140	120	137
D.C. Grid Current (approx.) (ma)	30	20	21
Plate Dissipation (watts)	50	30	32
Driving Power (approx.) (watts)	....	6.5	8
Plate Power Output (approx.) (watts)	....	90	105
Frequency Limit for Above Operation (mc.)	30	....	....
F.C.C. Broadcast Rating (watts) (Nearest Classification for Final Stage Use)	75	....	....

Grid Modulated R.F. Power Amplifier—Class C

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	....	10.0
D.C. Plate Voltage	1500	1500
D.C. Grid Voltage (Fixed Voltage)	−300	−280
Peak R.F. Grid Voltage	....	340
D.C. Plate Current (ma)	100	72
Plate Input (watts)	110	108
D.C. Grid Current (approx.) (ma)	....	1.5
Plate Dissipation (watts)	75	66
Grid Driving Power at Modulation Peak (approx.) (watts)	....	6
Power Output (approx.) (watts)	....	42
Frequency Limit for Above Operation (mc)	30	.....



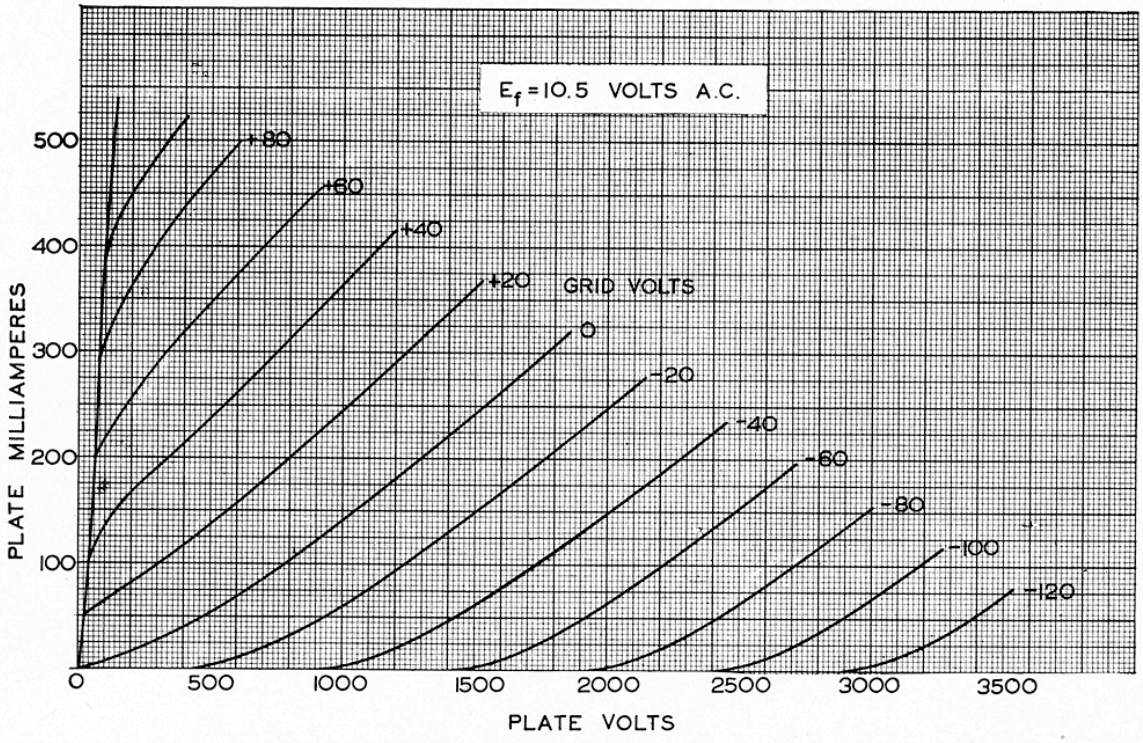
Self-Excited High Frequency Oscillator or Power Amplifier Class C

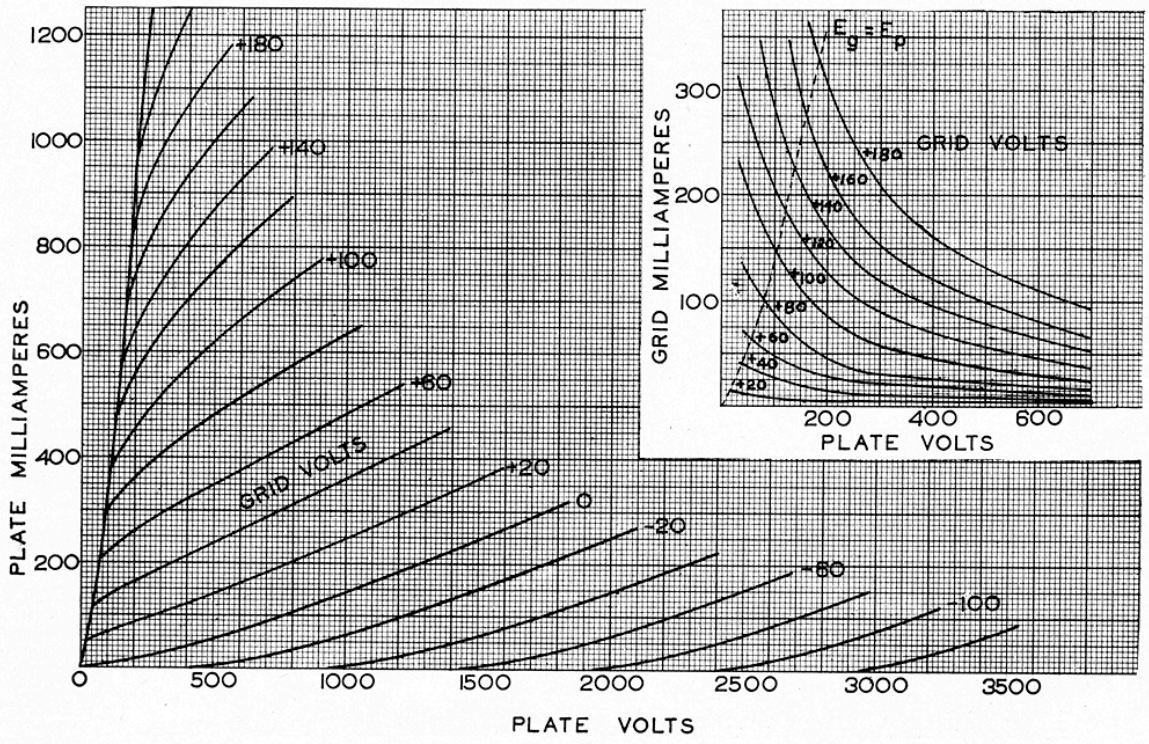
	Maximum Ratings for Operation at 30 mc.	60 mc.	90 mc.
D.C. Plate Voltage	1500	1200	1000
Modulated D.C. Plate Voltage	1250	1000	800
A.C. Plate Voltage	1500	1500	1200
D.C. Plate Current (ma)	150	130	120
D.C. Grid Bias Voltage	−300	−225	−150
D.C. Grid Current (ma)	30	30	20
Plate Dissipation (watts)	75	60	50

Typical High Frequency Performance of 2 Tubes in Tuned-Grid Tuned-Plate Push-Pull Circuits

Frequency	30 mc.	60 mc.	90 mc.
Plate Voltage	1500 A.C.	1200 D.C.	1000 D.C.
Plate Current	280 ma	260 ma	220 ma
Power Delivered to Load Circuit	260 watts	220 watts	120 watts

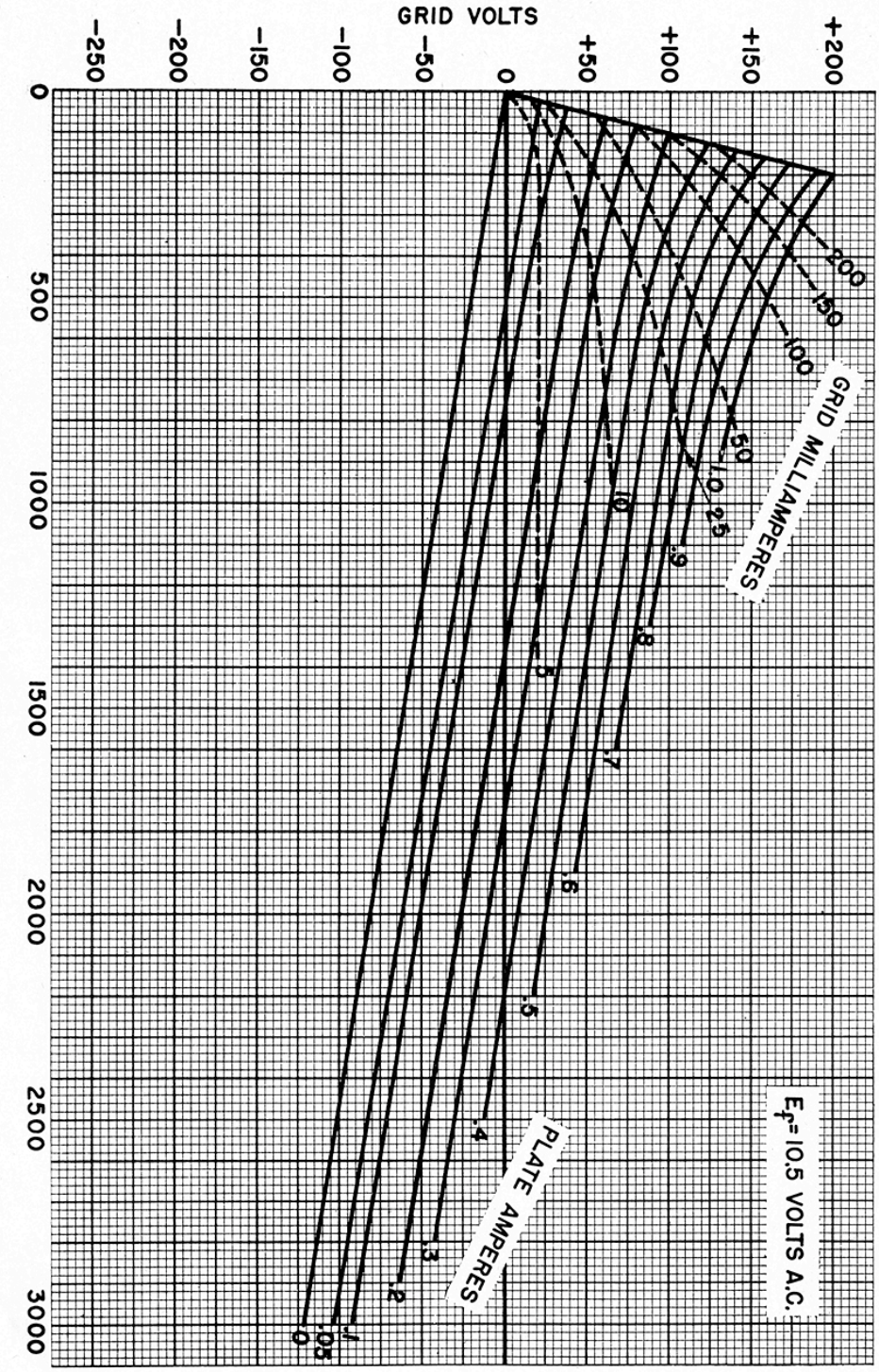
AMPEREX TRANSMITTING TUBE HF-100





HF-100

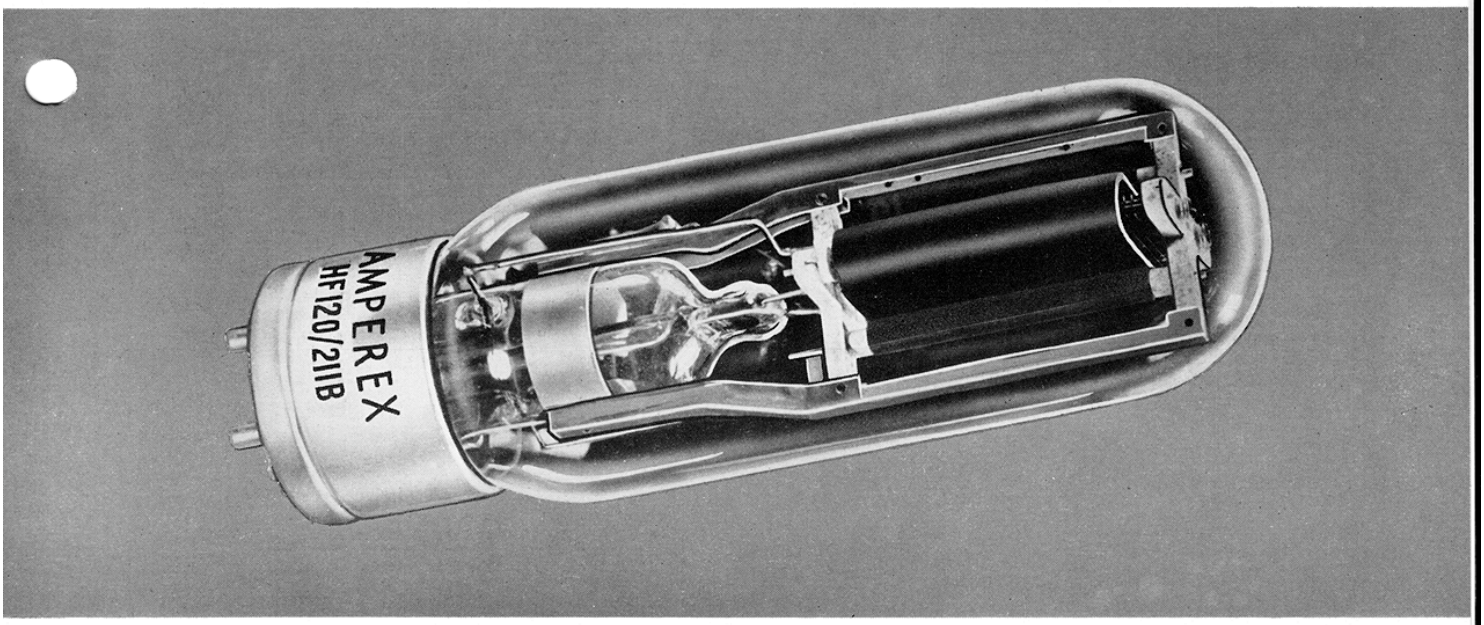
HF-100—AMPEREX TRANSMITTING TUBE



HF-100

SEPTEMBER, 1947

AMPEREX TRANSMITTING TUBE HF-120/211-B



RF Power Amplifier or Oscillator
AF Power Amplifier or Modulator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 volts
Current	3.25 amperes
Amplification Factor	12
Grid to Plate Transconductance, Ip = 100 ma	4500 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	12.5 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	3.5 $\mu\mu$f
Frequency for Maximum Ratings	15 megacycles

MECHANICAL

Overall Dimensions	
Maximum Length	7⅞ inches
Maximum Diameter	2 5/16 inches
Base	Standard Jumbo 4-Pin Bayonet
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	8 ounces
Shipping Weight (approx.) (one tube)	3 pounds

HF-120/ 211-B

HF-120/211-B—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—55	—77
Peak A.F. Grid Voltage	.....	50	72
D.C. Plate Current (ma)	.....	70	60
Plate Dissipation (watts)	75	70	75
Load Resistance (ohms)	.....	7600	9200
Power Output (watts)	.....	12.2	20
Distortion (% Second Harmonic)	.....	2.5	5

A.F. Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—77	—95
Load Resistance (per tube) (ohms)	.....	1725	2250
Effective Load Resistance (plate to plate) (ohms)	.....	6900	9000
Zero Signal Plate Current (ma)	.....	20	20
Peak A.F. Grid to Grid Voltage	.....	348	390
Max. Signal D.C. Plate Current (ma)	175	320	320
Max. Signal Plate Input (watts)	220	320	400
Plate Dissipation (watts)	100	.....	.....
Max. Signal Driving Power (approx) (watts)	.....	5.5	7
Max. Signal Plate Power Output (watts)	.....	216	280

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—60	—80
Peak R.F. Grid Voltage	.....	100	100
D.C. Plate Current (ma)	150	130	106

(continued from previous column)

Plate Input (watts)	150	130	132
Plate Dissipation (watts)	100	88	86
D.C. Grid Current (approx.) (ma)	.....	2	1
Driving Power at Peak Modulation (approx.) (watts)	.....	3.5	2.5
Plate Power Output (watts)	.....	42	46
Frequency Limit for Above Operation (megacycles)	15	20	15

Plate Modulated R.F. Power Amplifier Class C—Telephony

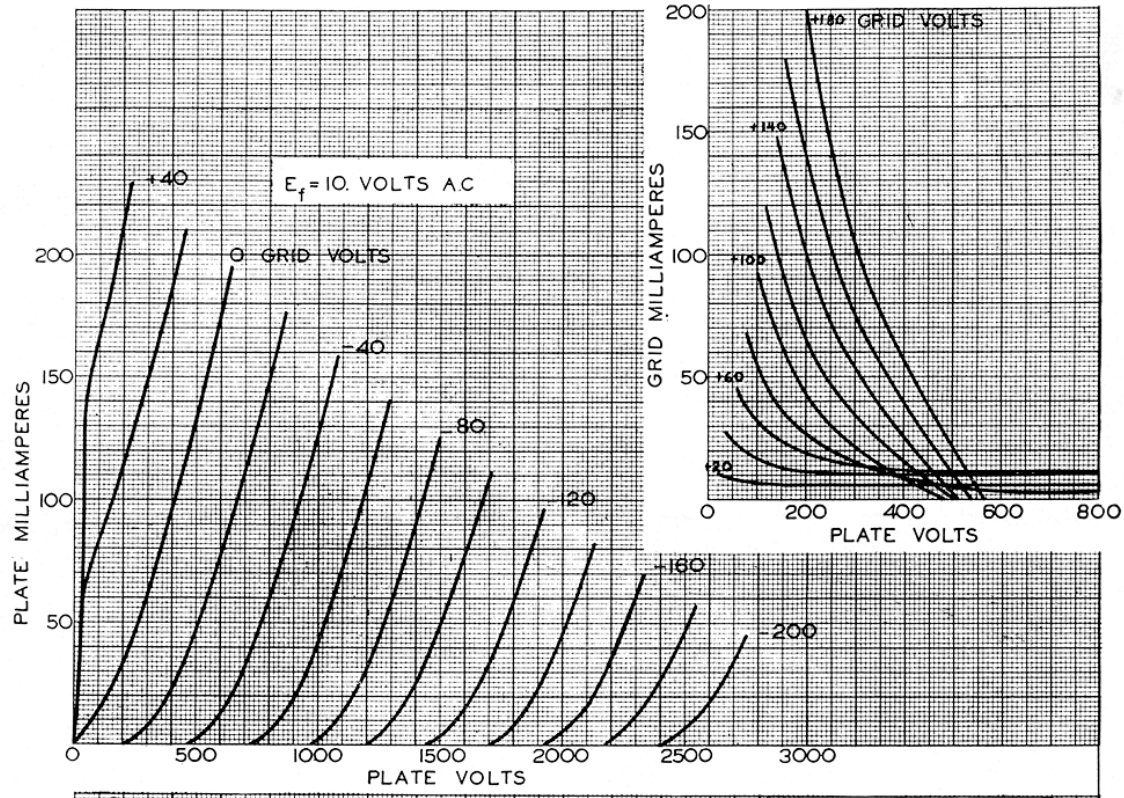
(Carrier conditions for use with modulation factor of 1.0)

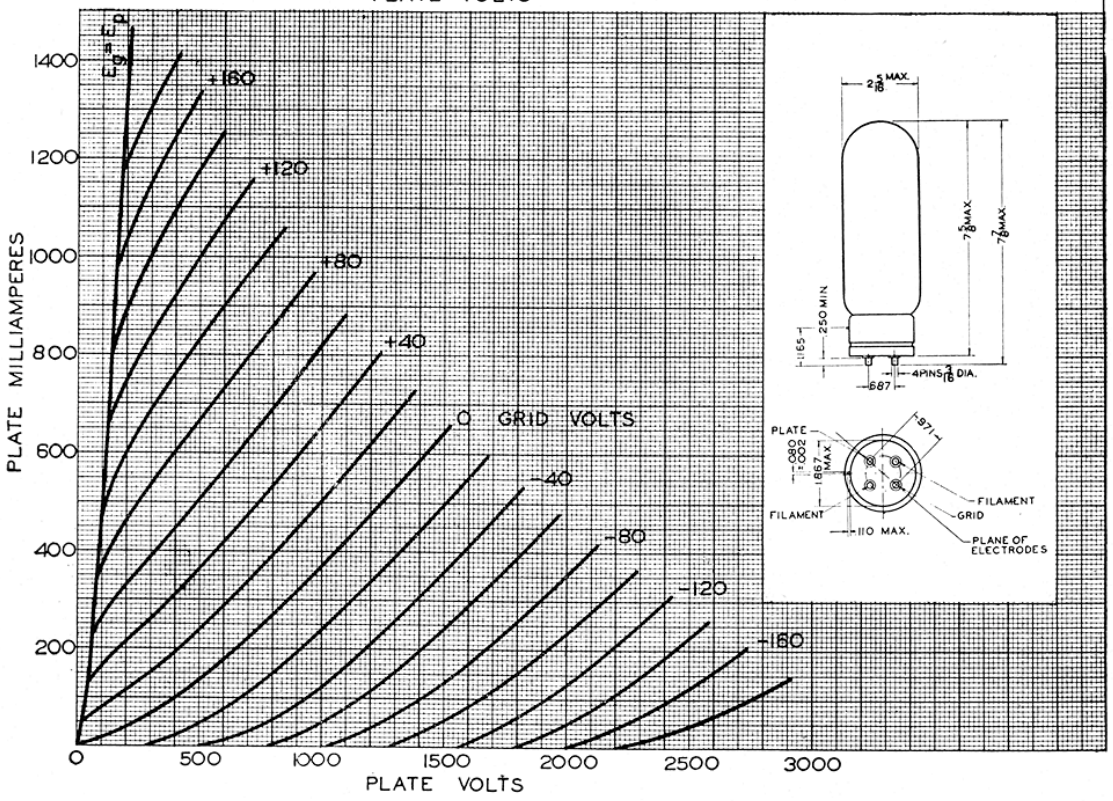
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—260	—300
Peak R.F. Grid Voltage	.....	390	430
D.C. Plate Current (ma)	175	150	166
Plate Input (watts)	210	150	208
Plate Dissipation (watts)	67	35	60
D.C. Grid Current (approx.) (ma)	50	13	8
Driving Power (approx.) (watts)	.....	5	3.5
Plate Power Output (watts)	.....	115	148
Frequency Limit for Above Operation (megacycles)	3	15	3
F.C.C. Broadcast Rating (watts)	125	.....	125

R.F. Power Amplifier or Oscillator Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	.....	390	430
D.C. Plate Current (ma)	175	165	166
Plate Input (watts)	220	165	208
Plate Dissipation (watts)	100	40	60
D.C. Grid Current (approx.) (ma)	50	16	8
Driving Power (approx.) (watts)	.....	6	3.5
Plate Power Output (watts)	.....	125	148
Frequency Limit for Above Operation (megacycles)	15	20	15

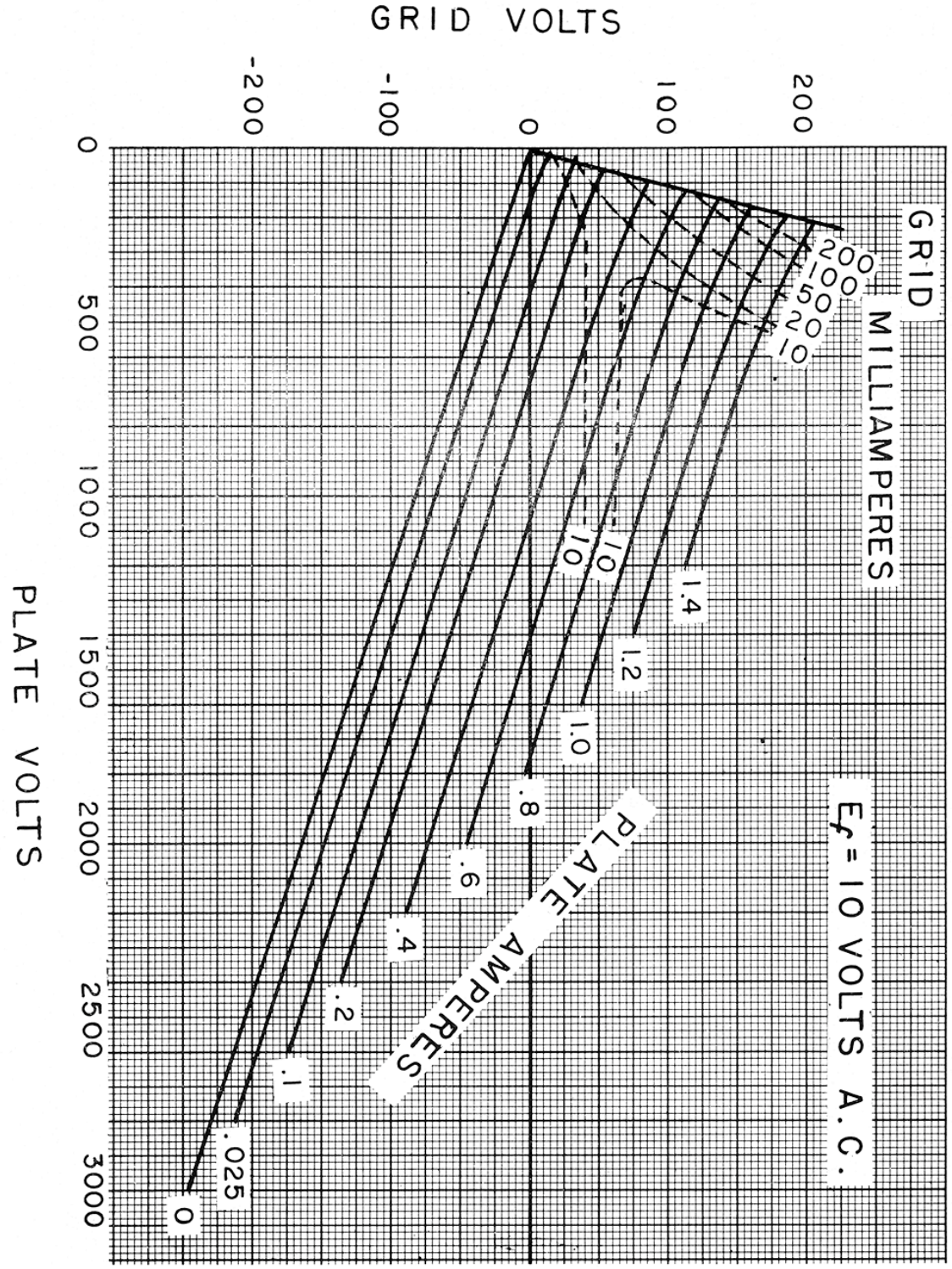
AMPEREX TRANSMITTING TUBE HF-120/211-B





HF-120/ 211-B

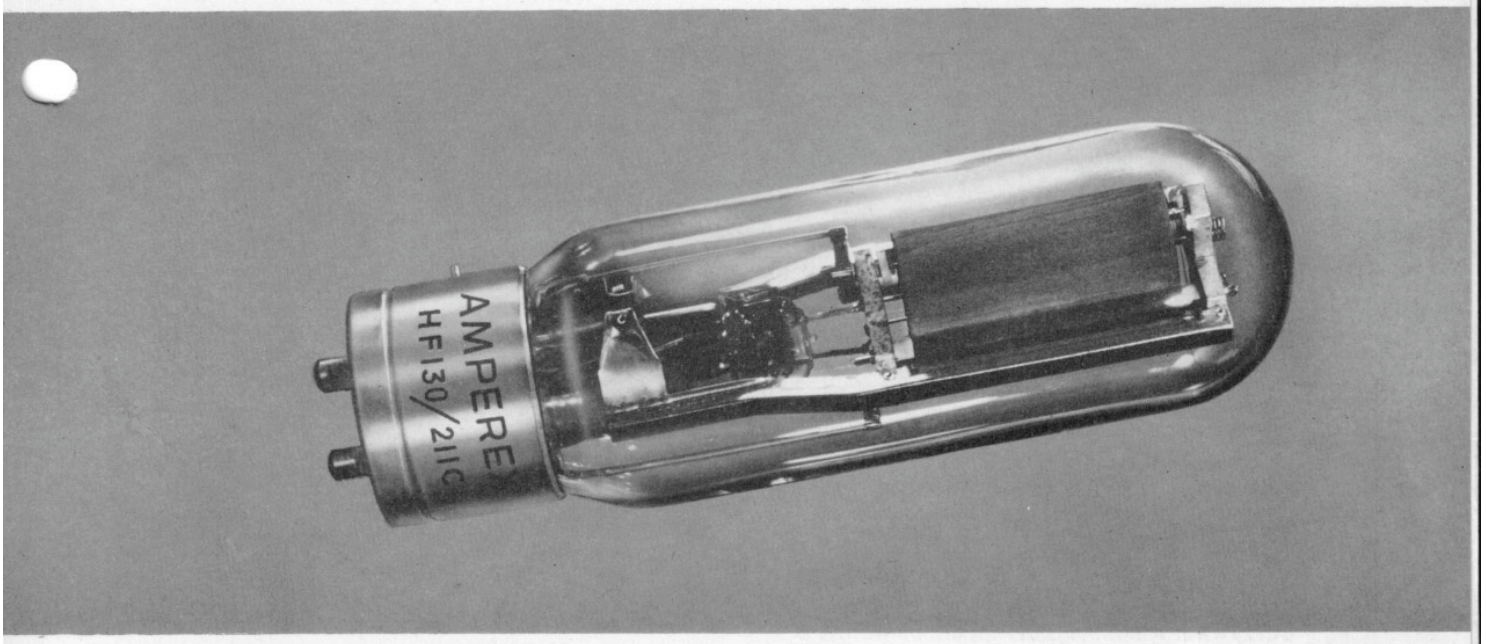
HF-120/211-B—AMPEREX TRANSMITTING TUBE



HF-120/ 211-B

APRIL, 1948

AMPEREX TRANSMITTING TUBE HF-130/211-C



RF Power Amplifier or Oscillator
AF Power Amplifier or Modulator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10-10.5 volts
Current	3.25 amperes
Amplification Factor	12.5
Grid to Plate Transconductance, Ip = 100 ma	4300 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	9.0 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	3.5 $\mu\mu$f
Frequency for Maximum Ratings	20 megacycles

MECHANICAL

Overall Dimensions	
Maximum Length	8⅛ inches
Maximum Diameter	2 5/16 inches
Base	Standard Jumbo 4-Pin Bayonet
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	8 ounces
Shipping Weight (approx.) (one tube)	3 pounds

HF-130/211-C—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1200
D.C. Grid Voltage	....	—55	—70
Peak A.F. Grid Voltage	.....	50	65
D.C. Plate Current (ma)	.....	75	80
Plate Dissipation (watts)	100	75	96
Load Resistance (ohms)	.....	4800	7600
Power Output (watts)	.....	14	21
Distortion (% Second Harmonic)	.....	5	3

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—72	—90
Load Resistance (ohms per tube)	.....	1250	1675
Effective Load Resistance (plate to plate) (ohms)	.....	5000	6700
Zero Signal Plate Current (ma)	.....	60	50
Peak A.F. Grid to Grid Voltage	.....	344	380
Max. Signal D.C. Plate Current (ma)	210	400	400
Max. Signal Plate Input (watts)	260	400	500
Plate Dissipation (watts)	125	.....	.....
Max. Signal Driving Power (approx.) (watts)	.....	4	4.5
Max. Signal Plate Power Output (watts)	.....	240	320

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—60	—85
Peak R.F. Grid Voltage	.....	100	110

(continued from previous column)

D.C. Plate Current (ma)	150	140	130
Plate Input (watts)	175	140	162
Plate Dissipation (watts)	125	95	107
D.C. Grid Current (approx.) (ma)	.....	2.5	1.0
Driving Power at Peak Modulation (approx.) (watts)	.....	3.5	3.6
Plate Power Output (watts)	.....	45	55
Frequency Limit for Above Operation (mc)	20	30	20

Plate Modulated R.F. Power Amplifier Class C—Telephony

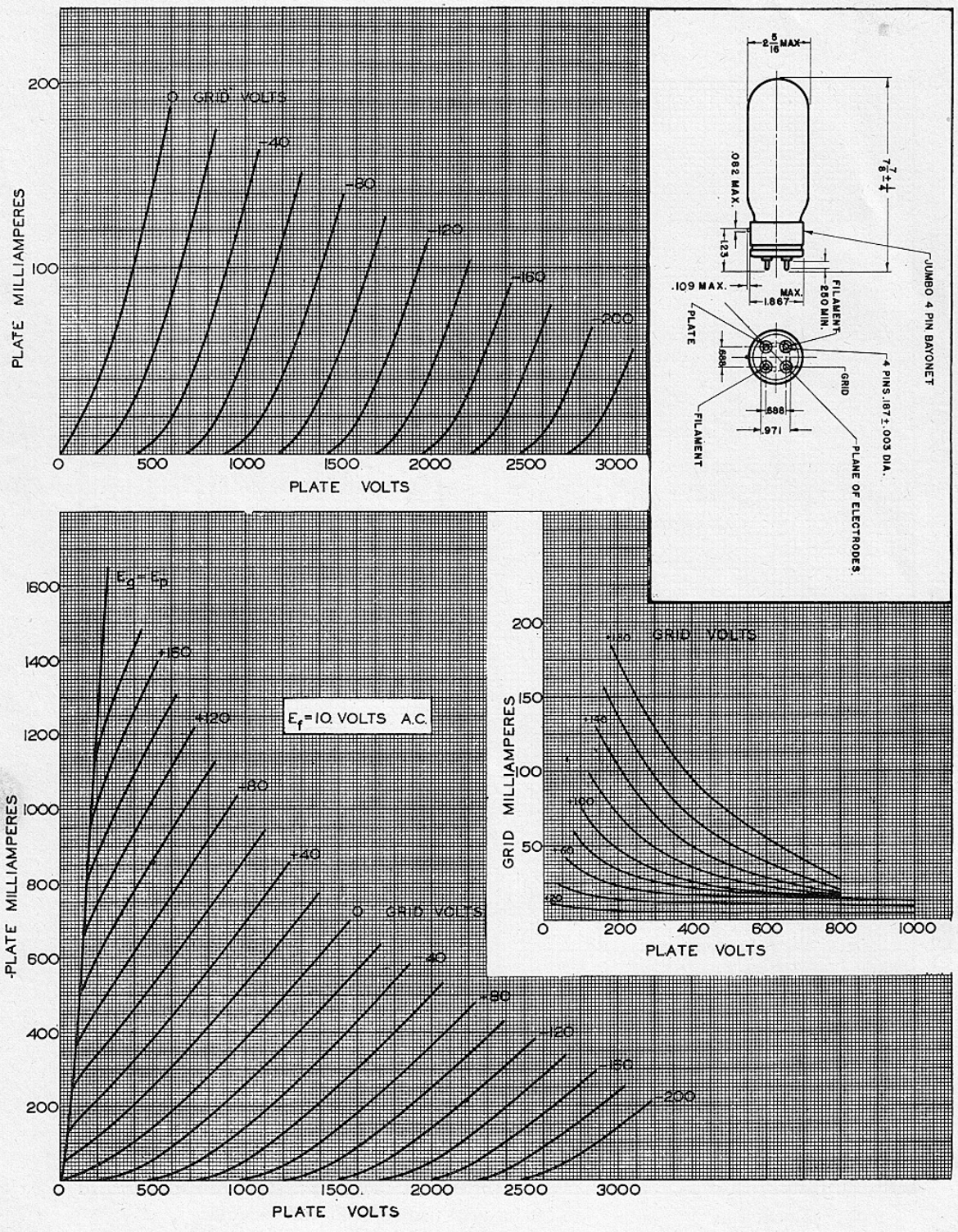
(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	.....	380	430
D.C. Plate Current (ma)	175	170	166
Plate Input (watts)	220	170	208
Plate Dissipation (watts)	85	55	60
D.C. Grid Current (approx.) (ma)	50	10	8
Driving Power (approx.) (watts)	.....	3.5	3.5
Plate Power Output (watts)	.....	115	148
Frequency Limit for Above Operation (mc)	10	20	10
F.C.C. Broadcast Rating (watts)	125	.....	125

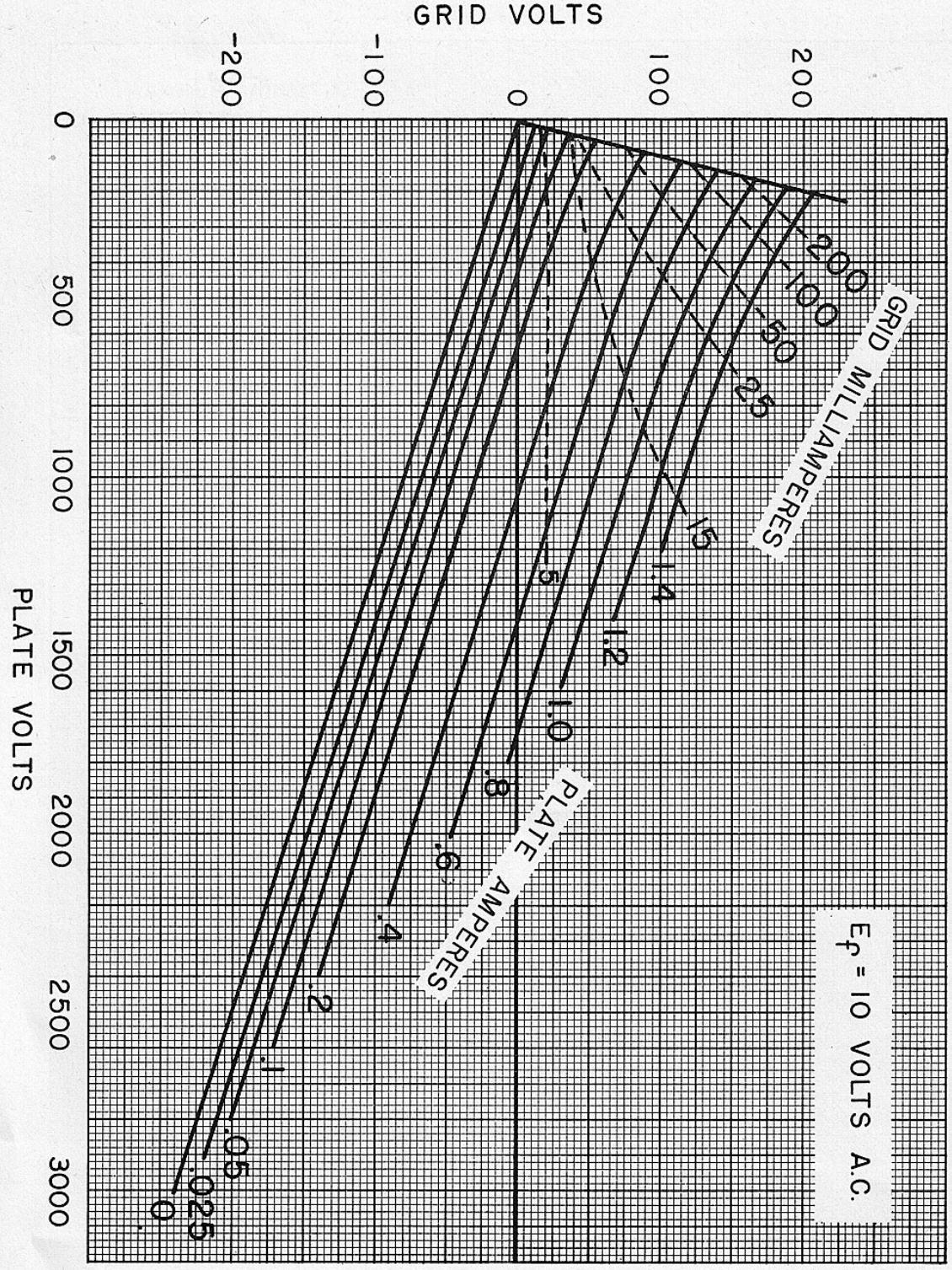
R.F. Power Amplifier or Oscillator Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—200	—250
Peak R.F. Grid Voltage	.....	340	385
D.C. Plate Current (ma)	210	200	200
Plate Input (watts)	260	200	250
Plate Dissipation (watts)	125	55	80
D.C. Grid Current (approx.) (ma)	50	15	10
Driving Power (approx.) (watts)	.....	5	3.5
Plate Power Output (watts)	.....	145	170
Frequency Limit for Above Operation (mc)	20	30	20

AMPEREX TRANSMITTING TUBE HF-130/211-C

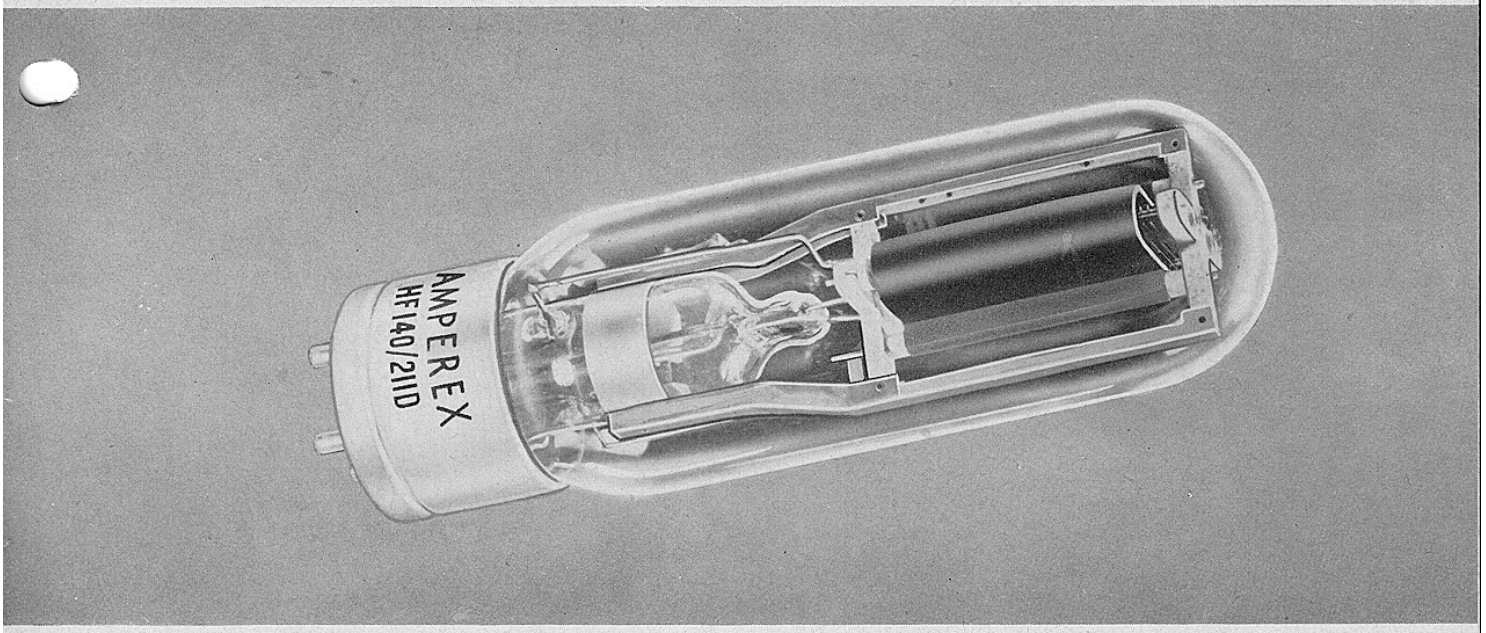


HF-130/211-C—AMPEREX TRANSMITTING TUBE



FEBRUARY, 1948

AMPEREX TRANSMITTING TUBE HF-140 / 211-D



For Replacement Only, Superseded by Type HF-120/211-B

AF Power Amplifier or Modulator
RF Power Amplifier or Oscillator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 volts
Current	3.25 amperes
Amplification Factor	12
Grid to Plate Transconductance, Ip = 100 ma	4500 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	13.0 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	4.5 $\mu\mu$f
Frequency for Maximum Ratings	15 megacycles

MECHANICAL

Overall Dimensions	
Maximum Length	7⅞ inches
Maximum Diameter	2 5/16 inches
Base	Standard Jumbo 4-Pin Bayonet
Mounting Position—Vertical	Base Up or Down
Horizontal	Plane of Electrodes Vertical
Net Weight (approx.)	8 ounces
Shipping Weight (approx.) (one tube)	3 pounds

HF-140 / 211-D AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—55	—77
Peak A.F. Grid Voltage	.....	50	72
D.C. Plate Current (ma)	.....	70	60
Plate Dissipation (watts)	75	70	75
Load Resistance (ohms)	.....	7600	9200
Power Output (watts)	.....	12.2	20
Distortion (% Second Harmonic)	.....	2.5	5

A.F. Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—77	—95
Load Resistance (per tube) (ohms)	.....	1725	2250
Effective Load Resistance (plate to plate) (ohms)	.....	6900	9000
Zero Signal Plate Current (ma)	.....	20	20
Peak A.F. Grid to Grid Voltage	.....	348	390
Max. Signal D.C. Plate Current (ma)	175	320	320
Max. Signal Plate Input (watts)	220	320	400
Plate Dissipation (watts)	100	.....	.....
Max. Signal Driving Power (approx) (watts)	.....	5.5	7
Max. Signal Plate Power Output (watts)	.....	216	280

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	.....	—60	—80
Peak R.F. Grid Voltage	.....	100	100
D.C. Plate Current (ma)	150	130	106

(continued from previous column)

Plate Input (watts)	150	130	132
Plate Dissipation (watts)	100	88	86
D.C. Grid Current (approx.) (ma)	.....	2	1
Driving Power at Peak Modulation (approx.) (watts)	.....	3.5	2.5
Plate Power Output (watts)	.....	42	46
Frequency Limit for Above Operation (megacycles)	15	20	15

Plate Modulated R.F. Power Amplifier Class C—Telephony

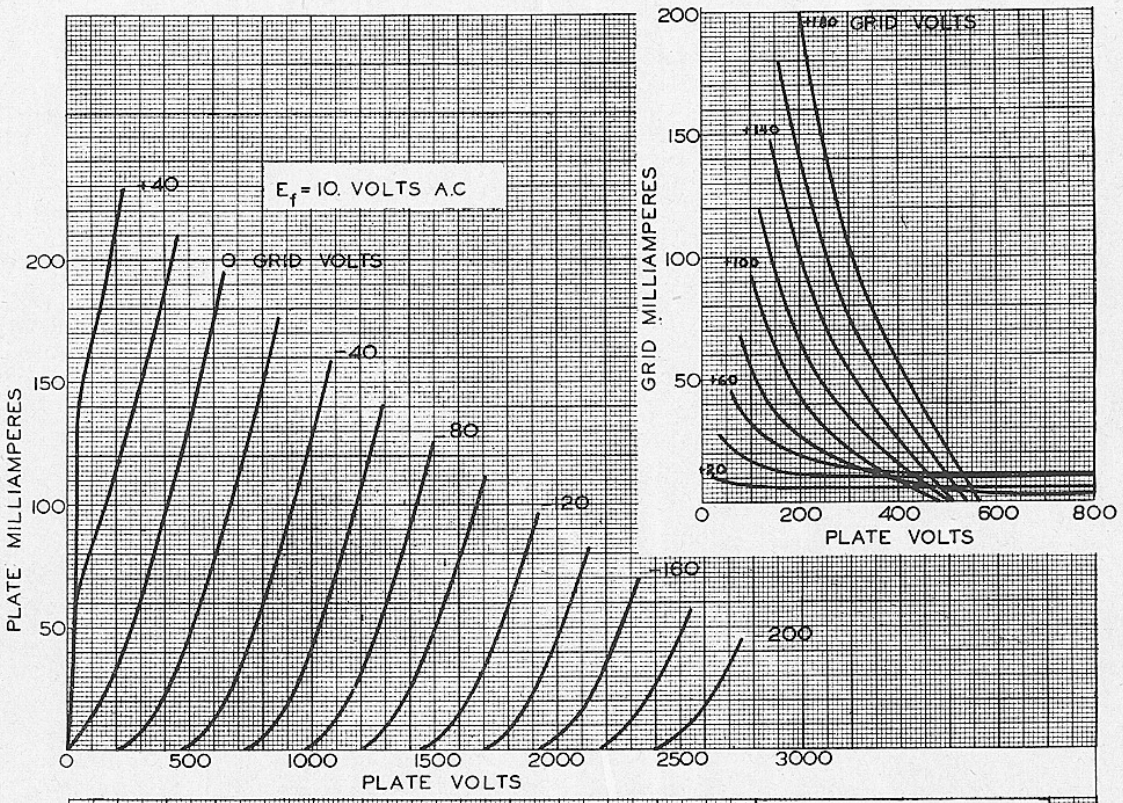
(Carrier conditions for use with modulation factor of 1.0)

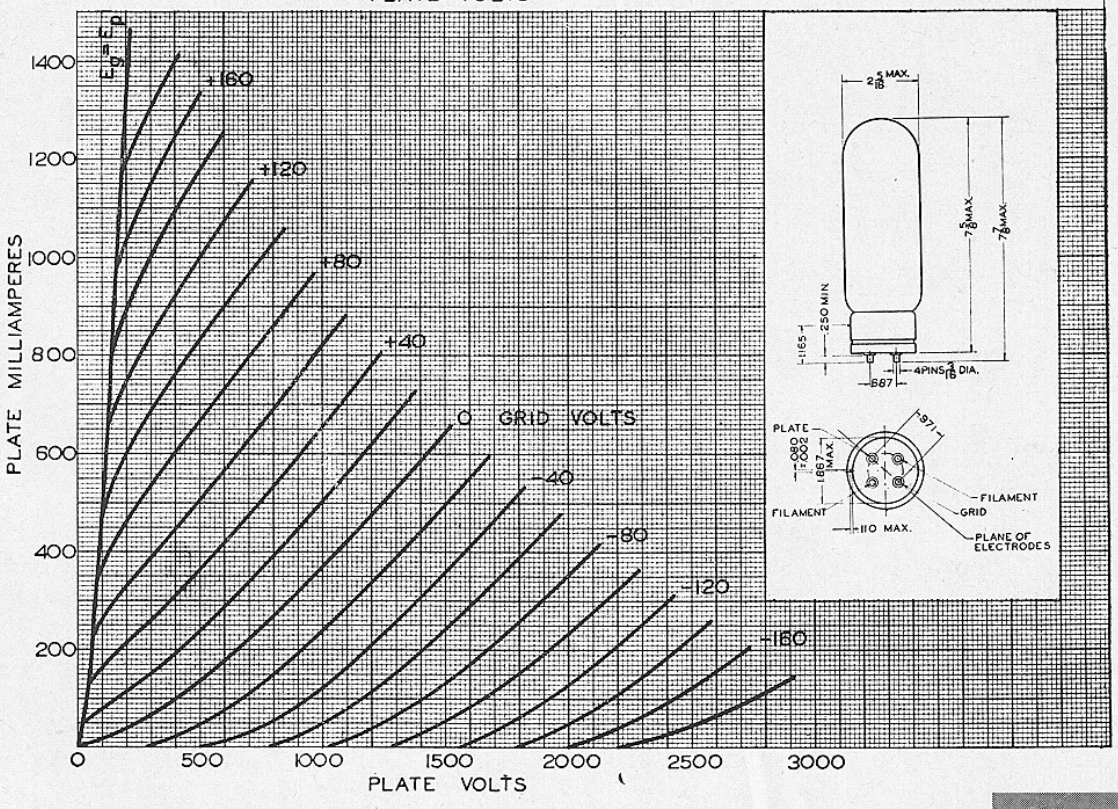
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—260	—300
Peak R.F. Grid Voltage	.....	390	430
D.C. Plate Current (ma)	175	150	166
Plate Input (watts)	210	150	208
Plate Dissipation (watts)	67	35	60
D.C. Grid Current (approx.) (ma)	50	13	8
Driving Power (approx.) (watts)	.....	5	3.5
Plate Power Output (watts)	.....	115	148
Frequency Limit for Above Operation (megacycles)	3	15	3
F.C.C. Broadcast Rating (watts)	125	.....	125

R.F. Power Amplifier or Oscillator Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	.....	390	430
D.C. Plate Current (ma)	175	165	166
Plate Input (watts)	220	165	208
Plate Dissipation (watts)	100	40	60
D.C. Grid Current (approx.) (ma)	50	16	8
Driving Power (approx.) (watts)	.....	6	3.5
Plate Power Output (watts)	.....	125	148
Frequency Limit for Above Operation (megacycles)	15	20	15

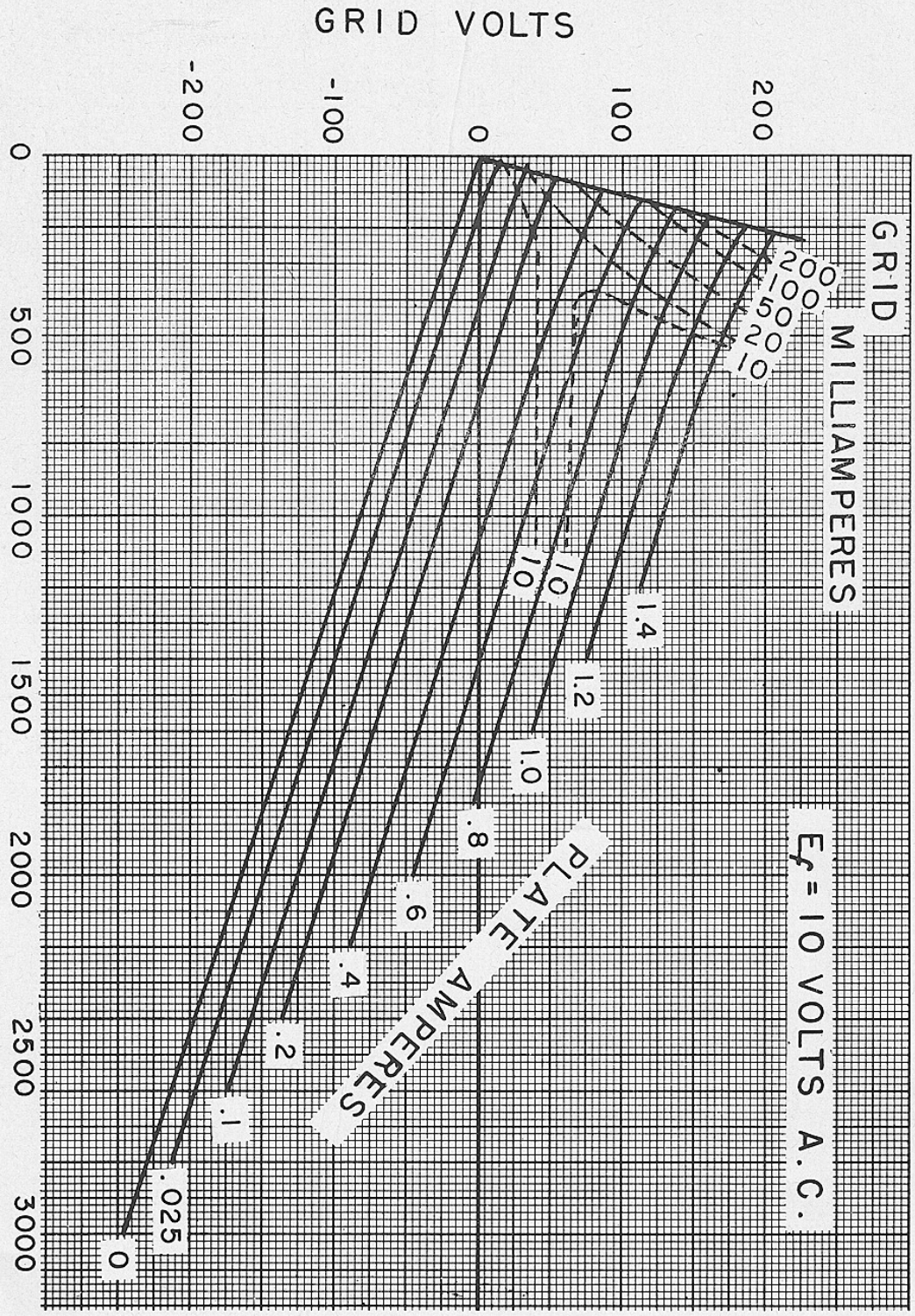
AMPEREX TRANSMITTING TUBE HF-140 / 211-D





HF-140/
211-D

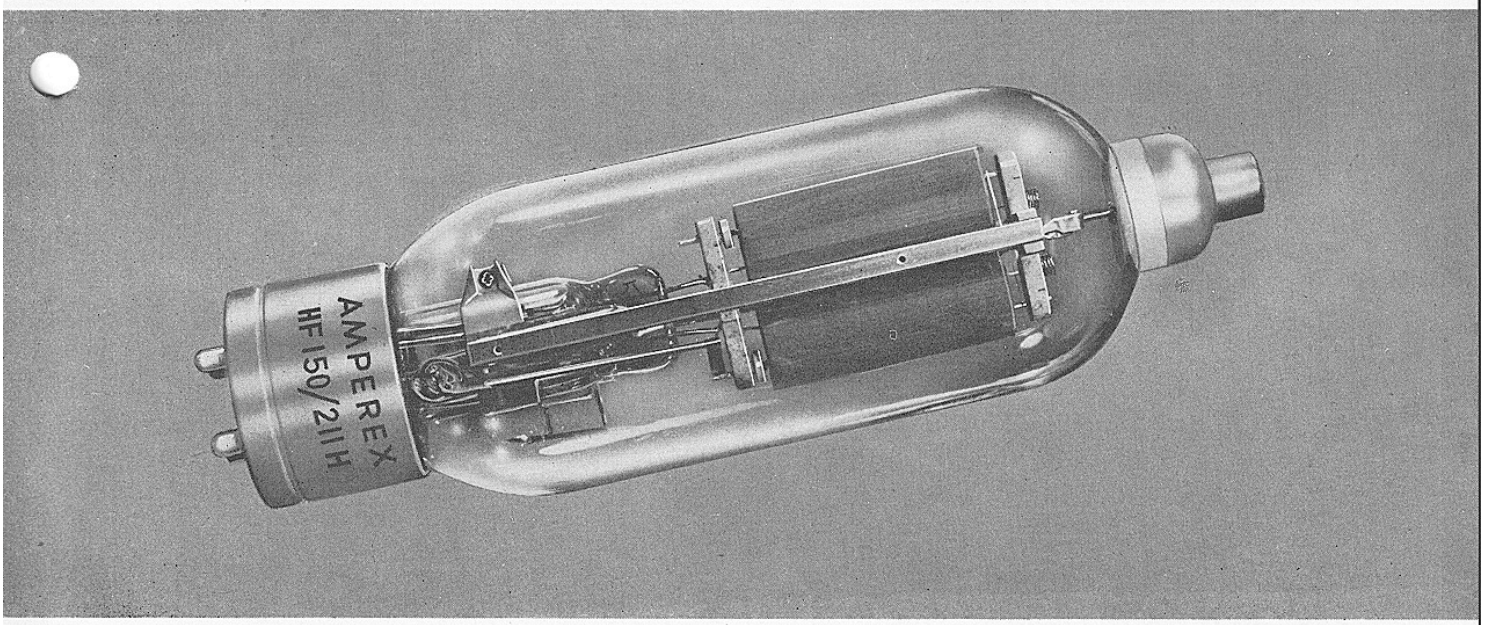
HF-140 / 211-D AMPEREX TRANSMITTING TUBE



HF-140/
211-D

NOVEMBER, 1947

AMPEREX TRANSMITTING TUBE HF-150/211-H



RF Power Amplifier or Oscillator
AF Power Amplifier or Modulator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10-10.5 volts
Current	3.25 amperes
Amplification Factor	12.5
Grid to Plate Transconductance, Ip = 100 ma	4300 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	7.2 $\mu\mu$f
Grid to Filament	5.5 $\mu\mu$f
Plate to Filament	1.9 $\mu\mu$f
Frequency for Maximum Ratings	30 megacycles

MECHANICAL

Overall Dimensions	
Maximum Length	9⅜ inches
Maximum Diameter	2 11/16 inches
Base	Standard Jumbo 4-Pin Bayonet
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	8 ounces
Shipping Weight (approx.) (one tube)	3 pounds

HF-150/211-H—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Amplifier and Modulator—Class A

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1500	1200	1500
D.C. Grid Voltage	.....	—70	—97
Peak A.F. Grid Voltage	.....	65	92
D.C. Plate Current (ma)	.....	80	66
Plate Dissipation (watts)	100	.....	.....
Load Resistance (ohms)	.....	7600	14500
Power Output (watts)	.....	21	30
Distortion (% Second Harmonic)	.....	3	2

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	.....	—90	—110
Load Resistance (ohms per tube)	.....	1675	2050
Effective Load Resistance (ohms)	.....	6700	8200
Zero Signal D.C. Plate Current (ma)	.....	50	50
Peak A.F. Grid to Grid Voltage	.....	380	420
Max. Signal D.C. Plate Current (ma)	210	400	400
Max. Signal Plate Input (watts)	315	500	600
Plate Dissipation (watts)	125	180	200
Max. Signal Driving Power (approx.) (watts)	.....	4.5	5
Max. Signal Plate Power Output (watts)	.....	320	400

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	.....	—85	—110
Peak R.F. Grid Voltage	.....	105	120
D.C. Plate Current (ma)	150	120	120
Plate Input (watts)	185	150	180
D.C. Grid Current (approx.) (ma)	.....	.5	.2

(continued from previous column)

Plate Dissipation (watts)	125	100	118
Driving Power at Peak Modulation (approx.) (watts)	.....	2.5	3.5
Plate Power Output (watts)	.....	50	62.5
Frequency Limit for Above Operation (mc)	30	.....	.....
F.C.C. Rating (for use in final stage of Broadcast Transmitters) (watts)	50	.....	.....

Plate Modulated R.F. Power Amplifier Class C—Telephony

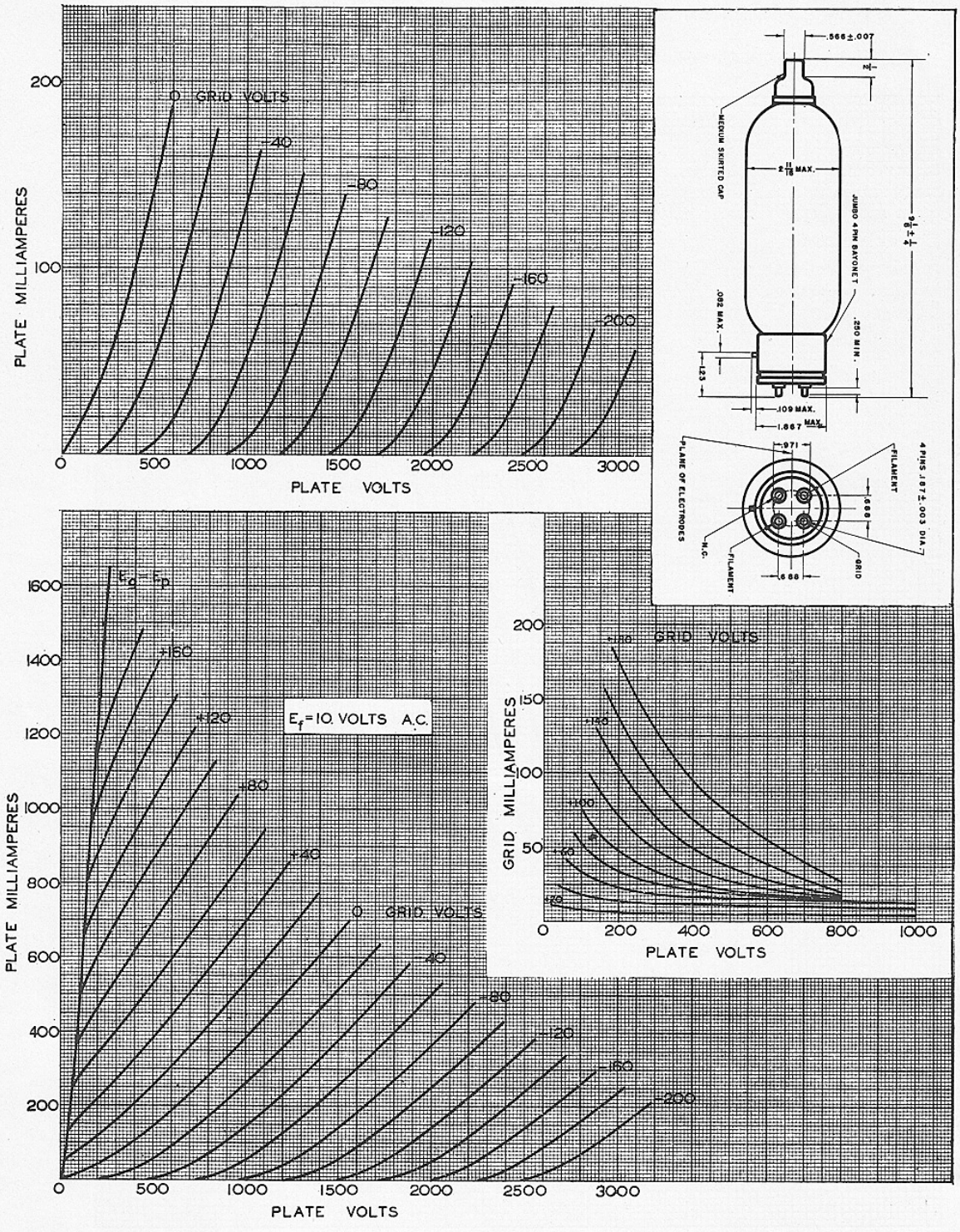
(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10.5	10.5
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	.....	380	430
D.C. Plate Current (ma)	175	170	166
Plate Input (watts)	220	170	207
D.C. Grid Current (approx.) (ma)	50	10	8
Plate Dissipation (watts)	85	55	59
Driving Power (approx.) (watts)	.....	3.5	3.5
Plate Power Output (watts)	.....	115	148
Frequency Limit for Above Operation (mc)	30	.....	.....
F.C.C. Rating (for use in final stage of Broadcast Transmitters) (watts)	125	.....	.....

R.F. Power Amplifier and Oscillator Class C—Telegraphy

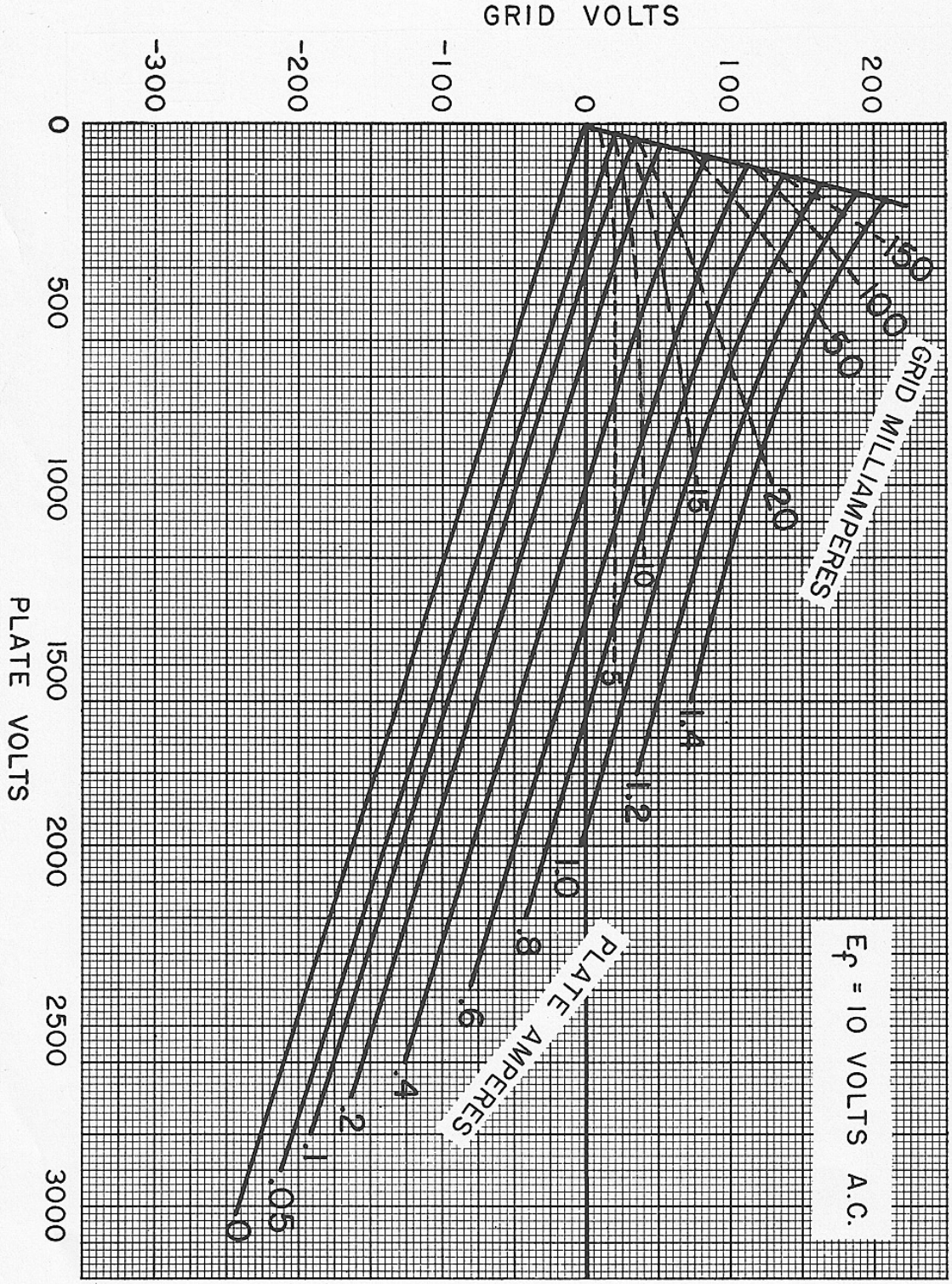
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	10	10
D.C. Plate Voltage	1500	1250	1500
D.C. Grid Voltage	—400	—250	—300
Peak R.F. Grid Voltage	.....	385	440
D.C. Plate Current (ma)	210	200	200
Plate Input (watts)	315	250	300
D.C. Grid Current (approx.) (ma)	50	10	10
Plate Dissipation (watts)	125	80	80
Driving Power (approx.) (watts)	.....	3.5	4
Plate Power Output (watts)	.....	170	220
Frequency Limit for Above Operation (mc)	30	30	30

AMPEREX TRANSMITTING TUBE HF-150/211-H



HF-150/
211-H

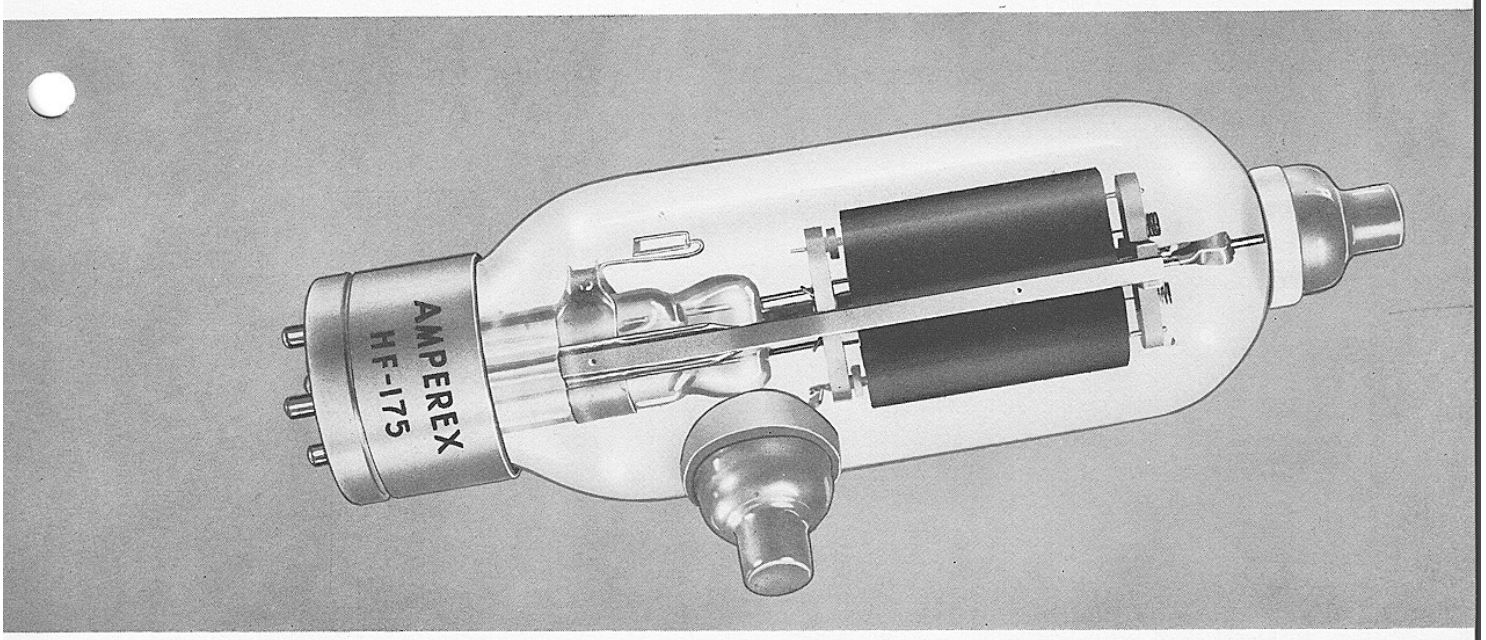
HF-150/211-H—AMPEREX TRANSMITTING TUBE



HF-150/ 211-H

MARCH, 1948

AMPEREX TRANSMITTING TUBE HF-175



AF Power Amplifier and Modulator
RF Power Amplifier and Oscillator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 volts (ac or dc)
Current	4 amperes
Amplification Factor	18
Grid to Plate Transconductance @ plate current of 100 ma	4000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	6.3 $\mu\mu$f
Grid to Filament	4.8 $\mu\mu$f
Plate to Filament	2.7 $\mu\mu$f

MECHANICAL

Maximum Overall Dimensions	
Length	9½ inches
Radius	2¾ inches
Base	Standard jumbo 4 pin bayonet
Mounting Position—Vertical	Base down
Horizontal	With plane of electrodes vertical
Net Weight (approx.)	8½ ounces
Shipping Weight (approx.) (one tube)	4 pounds

HF-175—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

Unless otherwise specified, values given are for 2 tubes

Typical Operation:			Maximum Rating per Tube
D.C. Plate Voltage	1750	2000	2000
D.C. Grid Voltage[2]	—78	—95	....
Load Resistance (ohms) (per tube)	2500	3250	....
Effective Load Resistance (ohms) (pl-pl)	10000	13000	....
Zero Sig. D.C. Plate Current (ma)	70	70	....
Max. Sig. D.C. Plate Current (ma)	350	332	200[1]
Peak A.F. Grid to Grid Voltage	356	390	....
Max. Sig. Plate Input (watts)	....	....	500[1]
Plate Dissipation (watts)	....	....	125[1]
Max. Sig. Driving Power (watts) (approx.)	9	11	....
Max. Sig. Power Output (watts) (approx.)	350	415	....

R.F. Power Amplifier—Class B—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	25	100

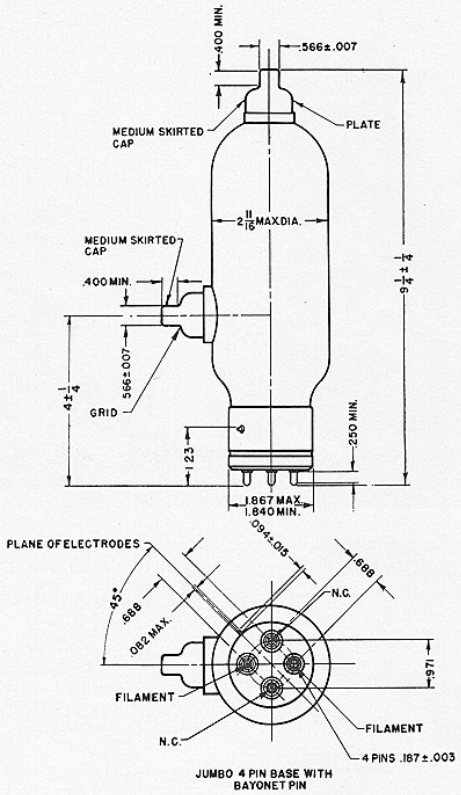
Typical Operation:			Maximum Rating per Tube
D.C. Plate Voltage	1750	2000	2000
D.C. Grid Voltage[2]	—80	—95	....
Peak R.F. Grid Voltage	100	105	....
D.C. Plate Current (ma)	100	97	150
D.C. Grid Current (ma) approx.)	1	0.5	....
Plate Input (watts)	175	194	200
Plate Dissipation (watts)	110	114	125
Grid Driving Power[3] (watts) (approx.)	3	3	....
Power Output (watts) (approx.)	65	80	....

R.F. Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions without modulation[4]

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	25	100

Typical Operation:			Maximum Rating per Tube
D.C. Plate Voltage	1750	2000	2000
D.C. Grid Voltage[2]	—220	—250	—400



(continued from previous column)

Peak R.F. Grid Voltage	390	420	....
D.C. Plate Current (ma)	200	200	200
D.C. Grid Current (ma) (approx.)	25	23	....
Plate Input (watts)	350	400	500
Plate Dissipation (watts)	75	80	125
Driving Power (watts) (approx.)	9	9	....
Power Output (watts) (approx.)	275	320	....

NOTES:

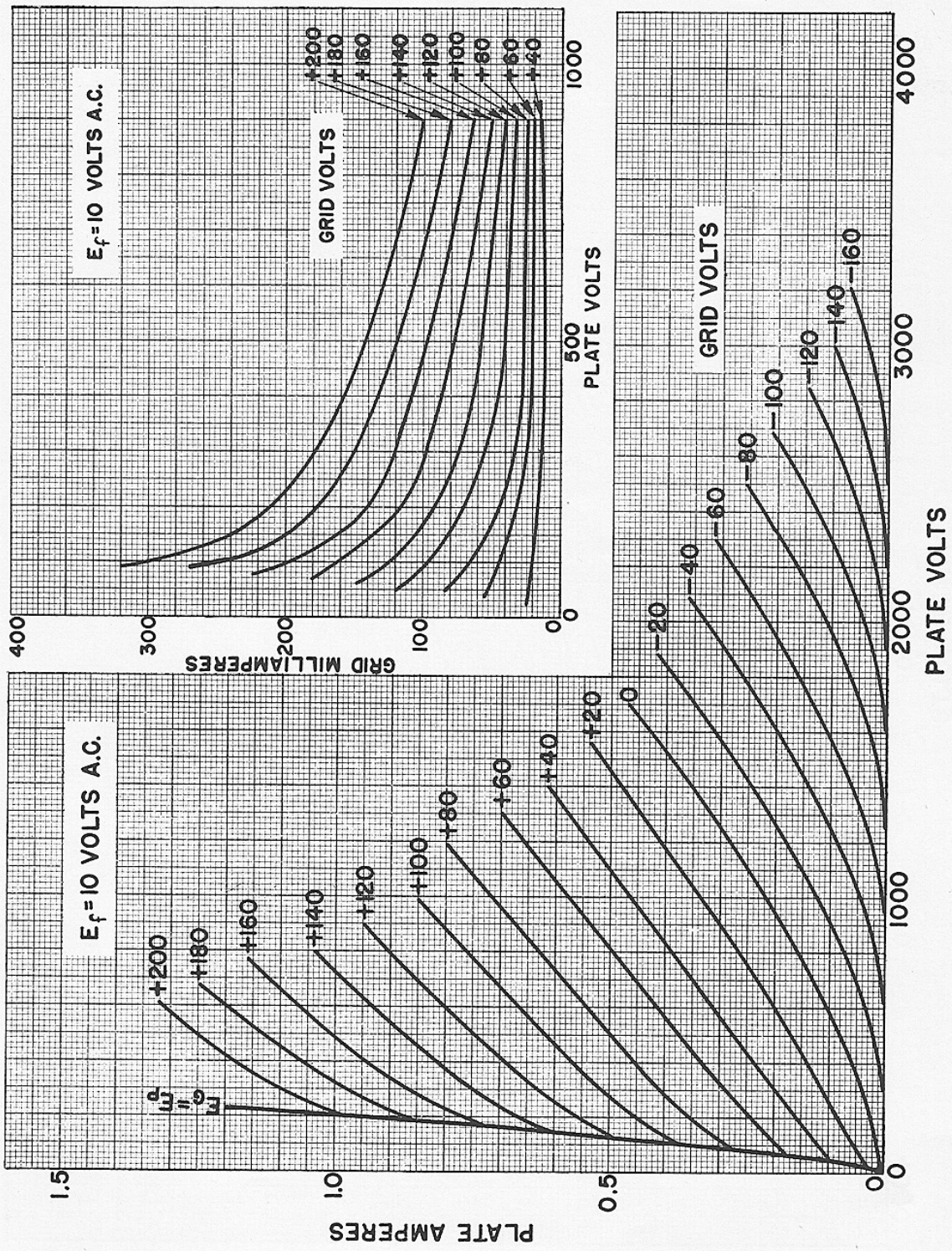
[1]Averaged over any audio-frequency cycle of sine-wave form.

[2]Grid voltages are given with respect to the filament operated on A.C. If D.C. is used, each stated value of grid voltage should be decreased by 5 volts and the circuit returns made to the negative end of the filament.

[3]At crest of audio-frequency cycle with modulation factor of 1.0.

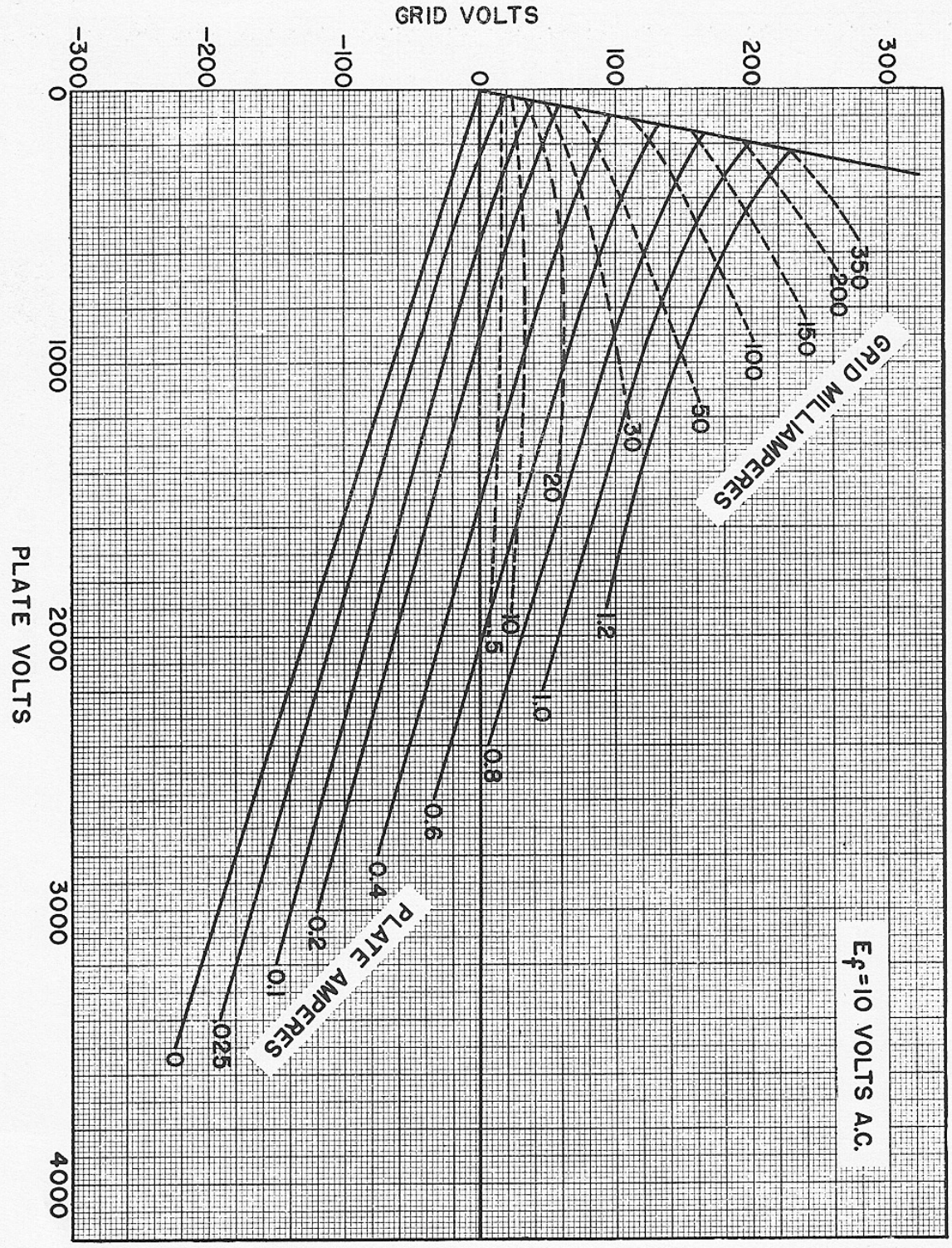
[4]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

AMPEREX TRANSMITTING TUBE HF-175



HF-175

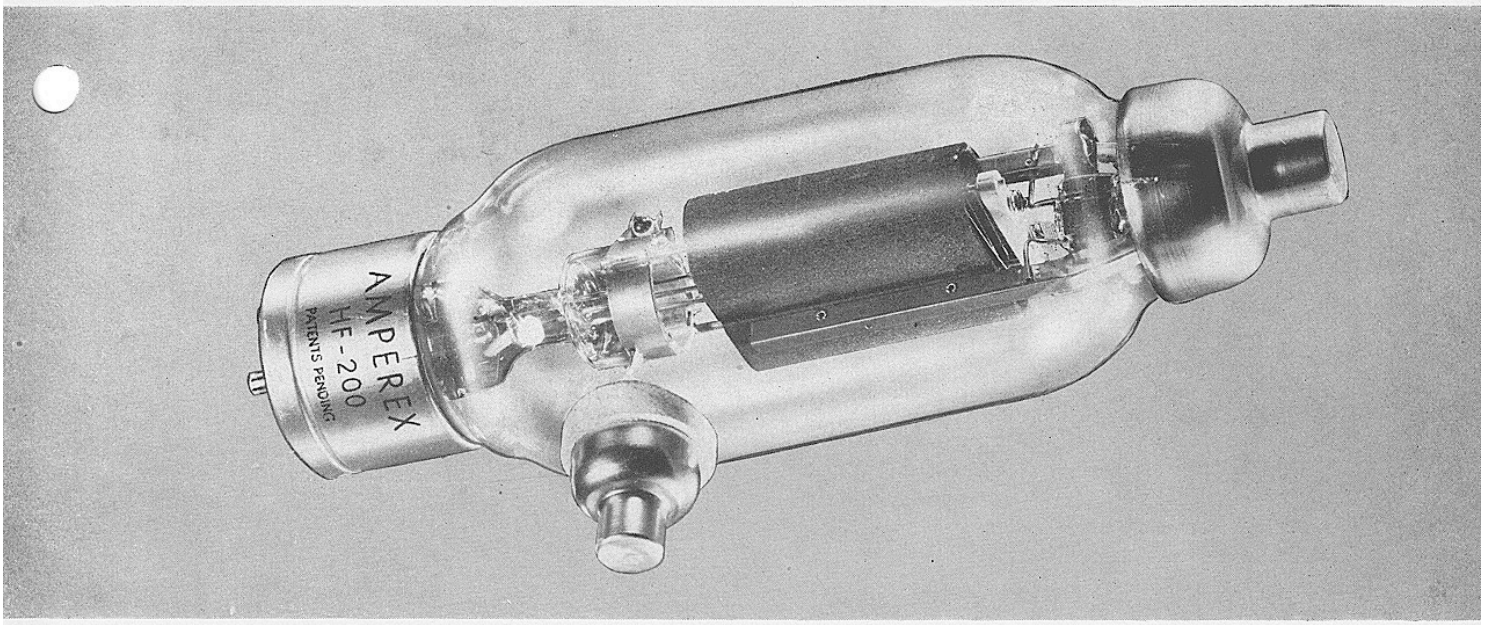
HF-175—AMPEREX TRANSMITTING TUBE



HF-175

MARCH 1943

AMPEREX TRANSMITTING TUBE HF-200



R.F. Power Amplifier and Oscillator
Class B Audio Amplifier or Modulator

The HF-200 is another of the highly proficient high frequency generators of original Amperex design and development. The outstanding features of low voltage, high current and a high ratio of transconductance to interelectrode capacitance are also properties of this tube.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 to 11 volts
Current	4 amperes
Amplification Factor	18
Transconductance (grid to plate) Ip = 150 ma	5000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	6.9 $\mu\mu$f
Grid to Filament	6.2 $\mu\mu$f
Plate to Filament	1.2 $\mu\mu$f
Frequency for Maximum Ratings	30 megacycles

MECHANICAL

Overall Dimensions	
Length	10¼ inches
Maximum Radius	2⅞ inches
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	10½ ounces
Shipping Weight (approx.) (one tube)	4 pounds

HF-200—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
A.C. Filament Voltage	....	10	10	10
D.C. Plate Voltage	2500	2000	2500	2500
D.C. Grid Voltage	....	−100	−130	−130
Load Resistance (per Tube) (ohms)	....	2800	4000	4000
Effective Load Resistance (Plate to Plate) (ohms)	....	11200	16000	16000
Zero Signal D.C. Plate Current (ma)	....	60	60	60
Peak A.F. Grid to Grid Voltage	....	420	410	460
Max. Signal D.C. Plate Current (ma)	200	380	320	360
Max. Signal Plate Input (watts)	450	....	....	....
Plate Dissipation (watts)	160	....	....	....
Max. Signal Driving Power (Approx.) (watts)	....	9	2.5	8
Max. Signal Plate Power Output (Approx.) (watts)	....	500	500	600

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	....	−110	−140
Peak R.F. Grid Voltage	....	125	130
D.C. Plate Current (ma)	150	110	90
Plate Input (watts)	250	220	225
D.C. Grid Current (Approx.) (ma)	....	.5	0
R.F. Grid Current (amps)	10	....	....
Plate Dissipation (watts)	150	140	145
Driving Power (Approx.) at Peak of Modulation (watts)	....	6	4
Plate Power Output (Approx.) (watts)	....	80	80
F.C.C. Broadcast Rating (watts)	50	....	....
(Nearest Classification for Final Stage Use)			

R.F. Power Amplifier—Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	−500	−250	−300
Peak R.F. Grid Voltage	....	410	455
D.C. Plate Current (ma)	200	200	200
Plate Input (watts)	500	400	500
D.C. Grid Current (Approx.) (ma)	50	23	18
R.F. Grid Current (amps)	12	....	....
Plate Dissipation (watts)	150	100	120
Driving Power (Approx.) (watts)	....	9	8
Plate Power Output (Approx.) (watts)	....	300	380
Frequency Limit for Above Operation (mc)	20	....	....

Plate Modulated R.F. Power Amplifier—Class C—Telephony

(Carrier conditions for use with modulation factors of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	11.0	10.5
D.C. Plate Voltage	2000	1750	2000
D.C. Grid Voltage	−500	....	....
Total Bias	....	−300	−350
Fixed Bias	....	−75	−100
Grid Resistor (ohms)	....	7500	12500
Peak R.F. Grid Voltage (per Tube)	....	475	500
D.C. Plate Current (ma)	200	200	160
Plate Input (watts)	400	350	320
D.C. Grid Current (Approx.) (ma)	50	30	20
R.F. Grid Current (amps)	10	....	....
Plate Dissipation (watts)	120	80	70
Driving Power (Approx.) (watts)	....	14	9
Plate Power Output (Approx.) (watts)	....	270	250
Frequency Limit for Above Operation (mc)	30	....	....
F.C.C. Broadcast Rating (watts)	125	....	...
(Nearest Classification for Final Stage Use)			

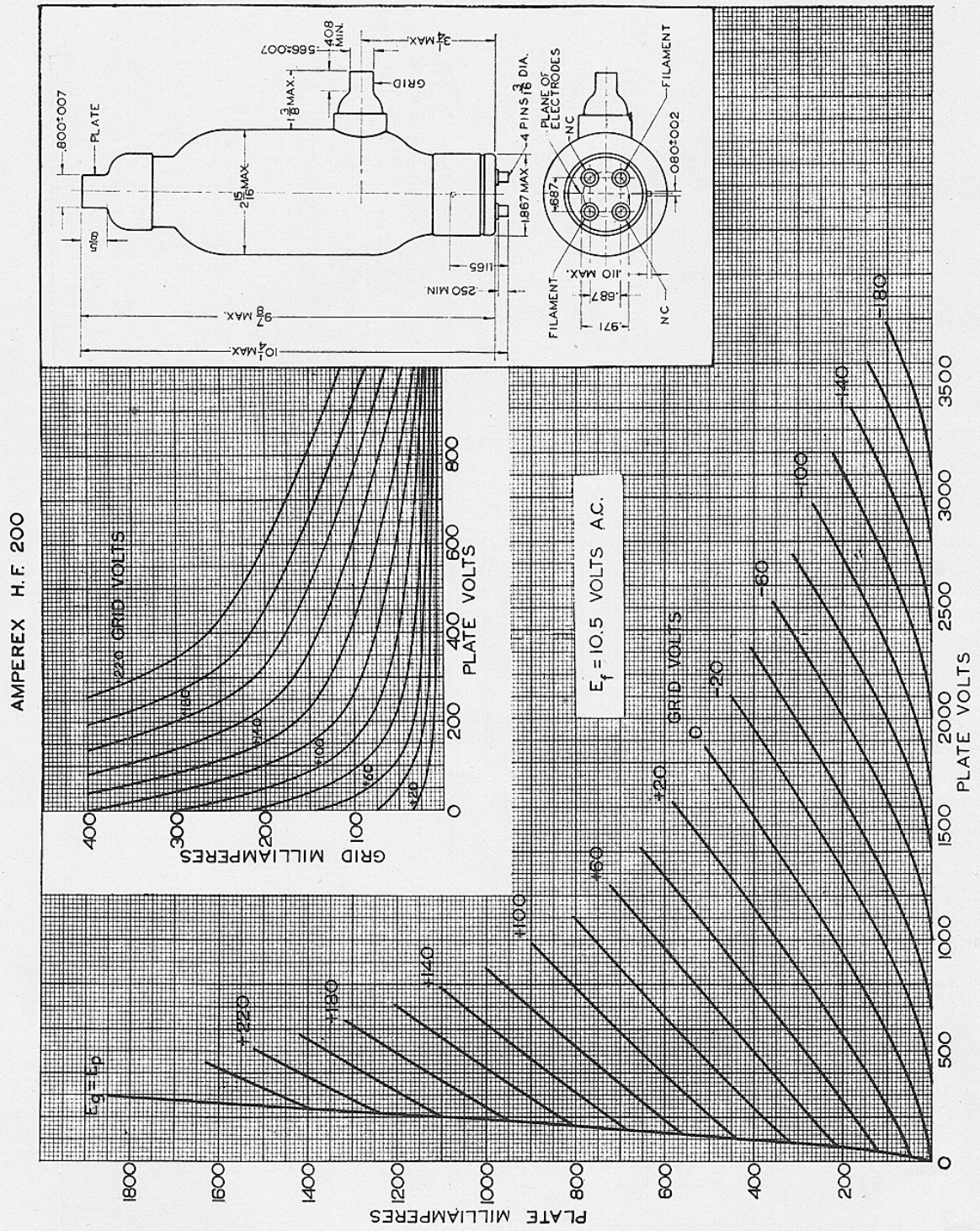
Self-Excited High Frequency Oscillator or Power Amplifier—Class C

Maximum Ratings for Operations at	20 mc.	50 mc.
D.C. Plate Voltage	2500	2000
Modulated D.C. Plate Voltage	2000	1700
A.C. Plate Voltage	3000	2500
D.C. Plate Current (ma)	200	200
D.C. Grid Bias Voltage	500	350
D.C. Grid Current (ma)	50	40
Plate Dissipation (watts)	150	150

Typical Operation (2 Tubes in TNT Push-Pull Circuit)

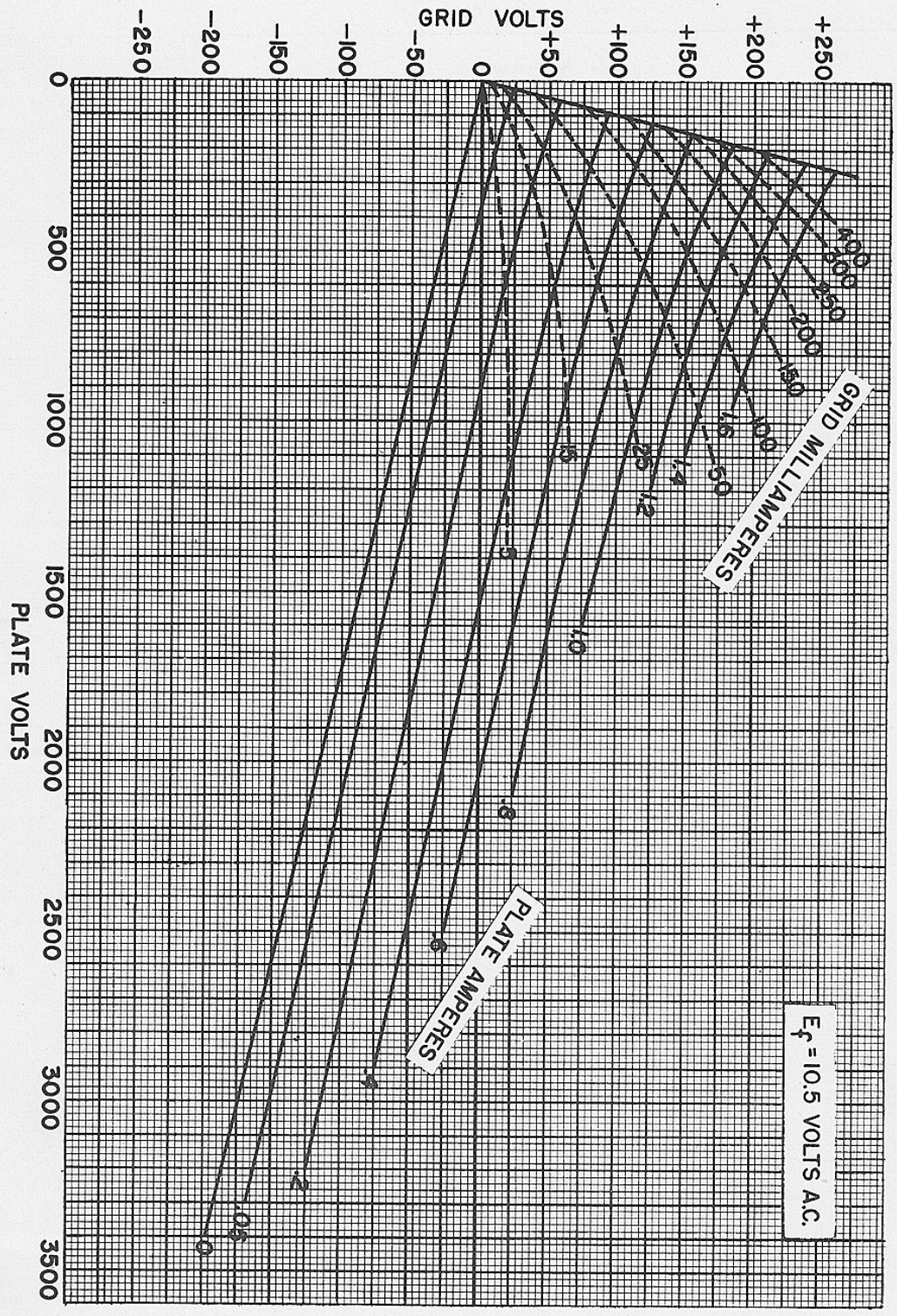
Frequency	20 mc.	50 mc.
A.C. Plate Voltage	2800	2400
D.C. Plate Current	380 ma	340 ma
Power Output to Load	650 watts	450 watts

AMPEREX TRANSMITTING TUBE HF-200



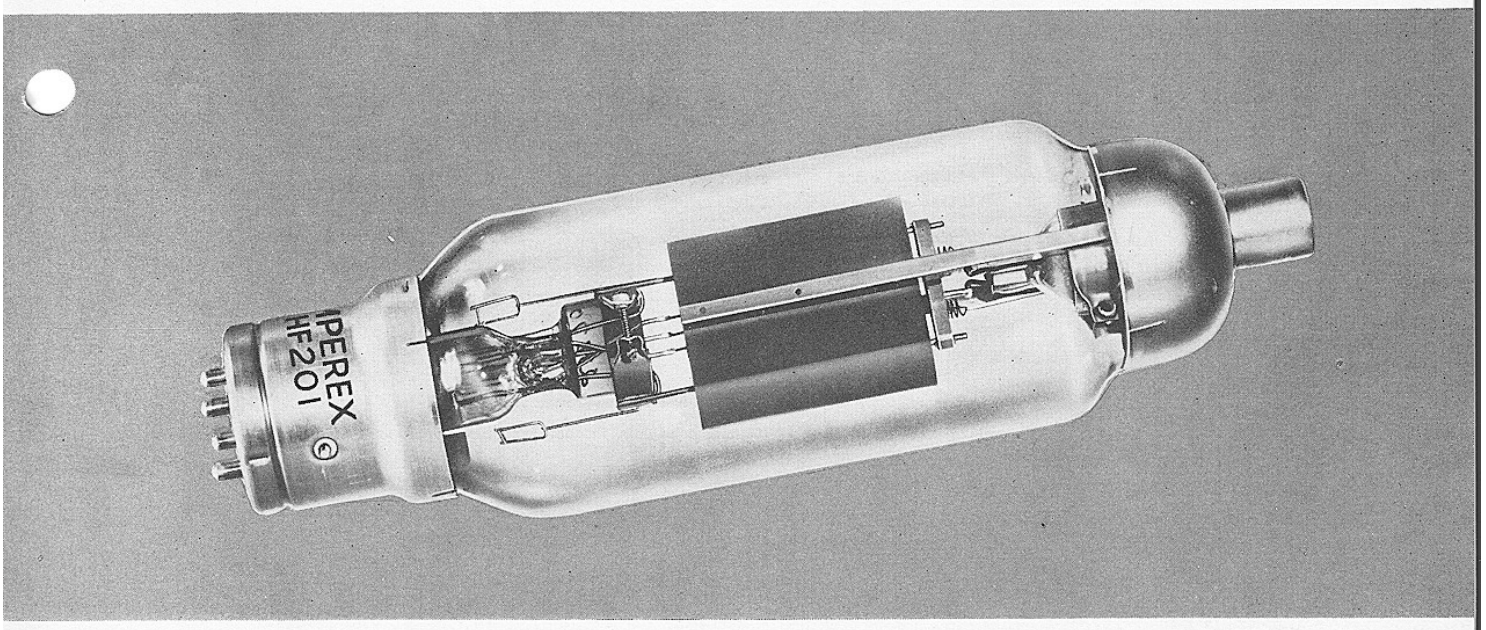
HF-200

HF-200—AMPEREX TRANSMITTING TUBE



HF-200

AMPEREX TRANSMITTING TUBE HF-201



R.F. Power Amplifier and Oscillator
AF Power Amplifier and Modulator

The HF-201 is another of the highly proficient high frequency generators of original Amperex design and development. The outstanding features of low voltage, high current and a high ratio of transconductance to interelectrode capacitance are also properties of this tube.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10 to 11 volts
Current	4 amperes
Amplification Factor	18
Transconductance (grid to plate) IP = 100 ma	4000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	7.0 $\mu\mu$f
Grid to Filament	8.8 $\mu\mu$f
Plate to Filament	1.2 $\mu\mu$f
Frequency for Maximum Ratings	30 megacycles

MECHANICAL

Overall Dimensions	
Length	10⅞ inches
Maximum Diameter	$3\frac{1}{16}$ inches
Base	Skirted Jumbo 4-Pin Bayonet
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	10½ ounces
Shipping Weight (approx.) (one tube)	4 pounds

HF-201—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
A.C. Filament Voltage	....	10	10	10
D.C. Plate Voltage	2500	2000	2500	2500
D.C. Grid Voltage	....	−100	−130	−130
Load Resistance (per Tube) (ohms)	....	2800	4000	4000
Effective Load Resistance (Plate to Plate) (ohms)	....	11200	16000	16000
Zero Signal D.C. Plate Current (ma)	....	60	60	60
Peak A.F. Grid to Grid Voltage	....	420	410	460
Max. Signal D.C. Plate Current (ma)	200	380	320	360
Max. Signal Plate Input (watts)	450	....	....	....
Plate Dissipation (watts)	160	....	....	....
Max. Signal Driving Power (Approx.) (watts)	....	9	2.5	8
Max. Signal Plate Power Output (Approx.) (watts)	....	500	500	600

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factors up to 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	....	−110	−140
Peak R.F. Grid Voltage	....	125	130
D.C. Plate Current (ma)	150	110	90
Plate Input (watts)	250	220	225
D.C. Grid Current (Approx.) (ma)	....	.5	0
R.F. Grid Current (amps)	10	....	....
Plate Dissipation (watts)	150	140	145
Driving Power at Peak of Modulation (watts) (Approx.)	....	6	4
Plate Power Output (Approx.) (watts)	....	80	80
F.C.C. Broadcast Rating (watts) (Nearest Classification for Final Stage Use)	50	....	....

R.F. Power Amplifier—Class C—Telegraphy

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	2500	2000	2500
D.C. Grid Voltage	−500	−250	−300
Peak R.F. Grid Voltage	....	410	455

(continued from previous column)

D.C. Plate Current (ma)	200	200	200
Plate Input (watts)	500	400	500
D.C. Grid Current (Approx.) (ma)	50	23	18
R.F. Grid Current (amps)	12	....	....
Plate Dissipation (watts)	150	100	120
Driving Power (Approx.) (watts)	....	3	8
Plate Power Output (Approx.) (watts)	....	300	380
Frequency Limit for Above Operation (mc)	20	....	....

Plate Modulated R.F. Power Amplifier—Class C—Telephony

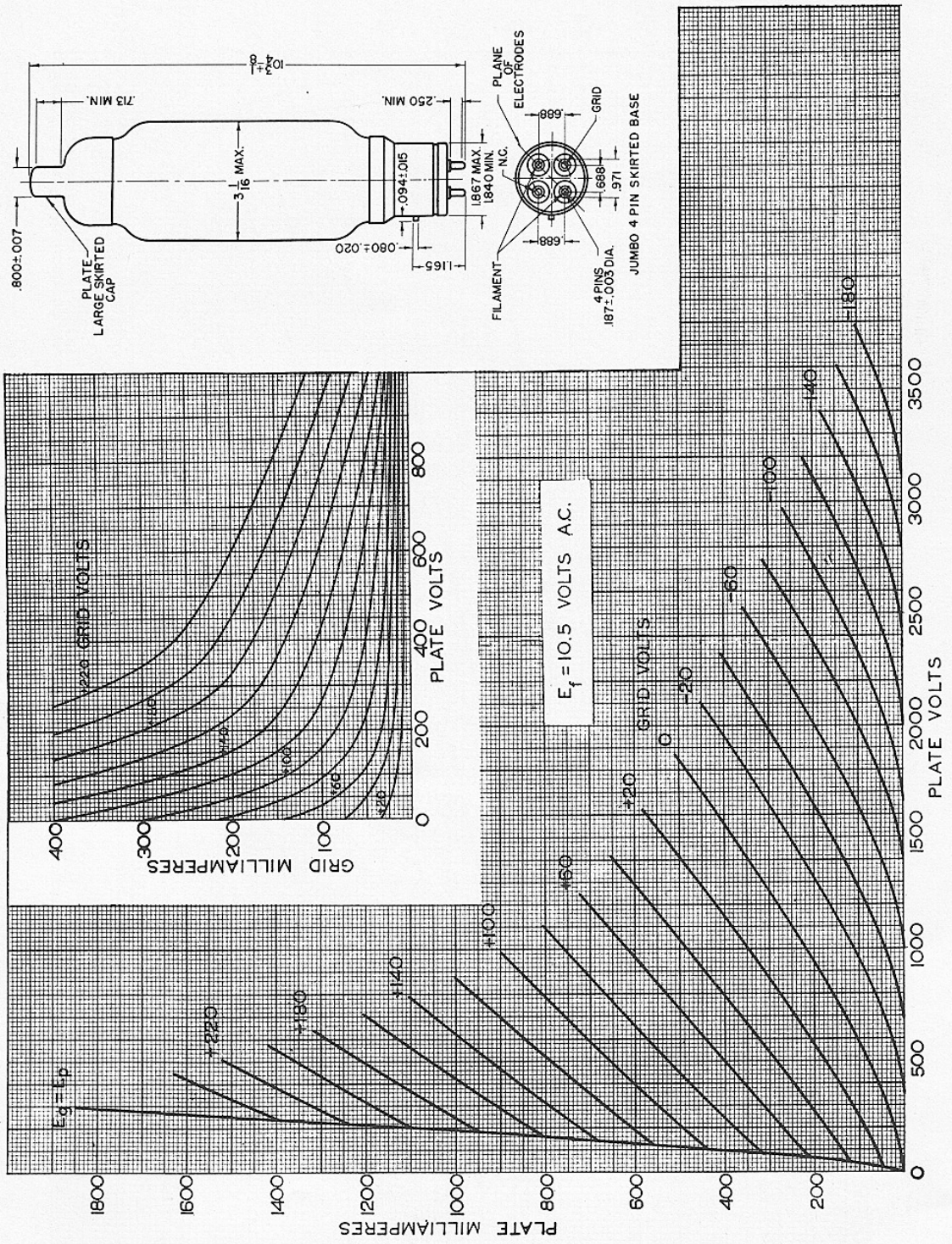
(Carrier conditions for use with modulation factors of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	11.0	10.5
D.C. Plate Voltage	2000	1750	2000
D.C. Grid Voltage	−500	....	....
Total Bias	....	−300	−350
Fixed Bias	....	−75	−100
Grid Resistor (ohms)	....	7500	12500
Peak R.F. Grid Voltage	....	475	500
D.C. Plate Current (ma)	200	200	160
Plate Input (watts)	400	350	320
D.C. Grid Current (Approx.) (ma)	50	30	20
R.F. Grid Current (amps)	10	....	....
Plate Dissipation (watts)	120	80	70
Driving Power (Approx.) (watts)	....	14	9
Plate Power Output (Approx.) (watts)	....	270	250
Frequency Limit for Above Operation (mc)	30	....	....
F.C.C. Broadcast Rating (watts) (Nearest Classification for Final Stage Use)	125	....	..

Self-Excited High Frequency Oscillator or Power Amplifier—Class C

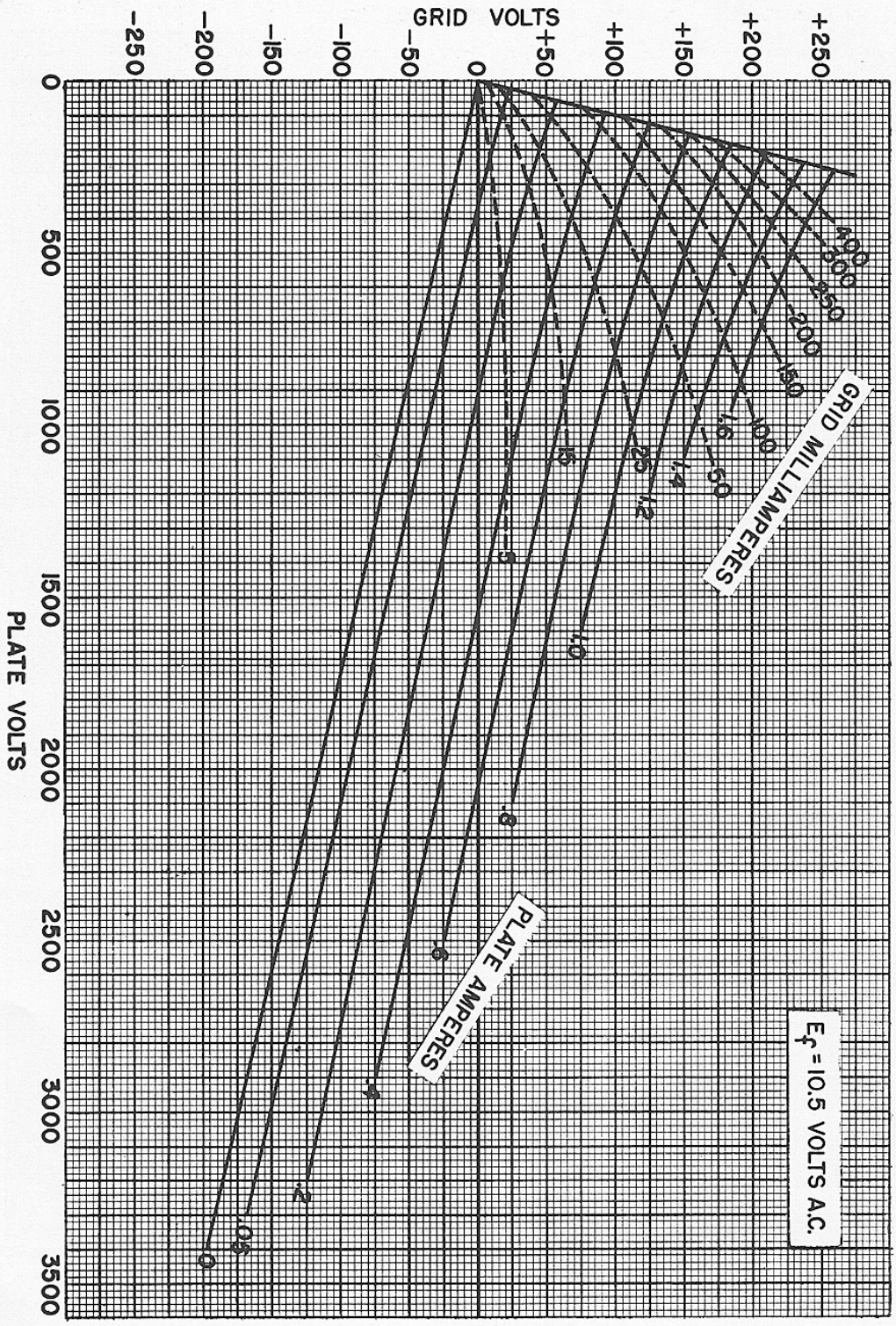
	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	....	10.5	10.5
D.C. Plate Voltage	2000	1800	2000
Modulated D.C. Plate Voltage	2000	1800	2000
A.C. Plate Voltage	2500	2000	2250
D.C. Plate Current (ma)	200	200	200
D.C. Grid Bias Voltage	−350	−250	−300
D.C. Grid Current (ma) (approx.)	40	30	30
Plate Dissipation (watts)	150	140	140
Plate Power Output (watts) (approx.)	....	290	340
Frequency Limit for Above Operation (mc)	30	....	....

AMPEREX TRANSMITTING TUBE HF-201



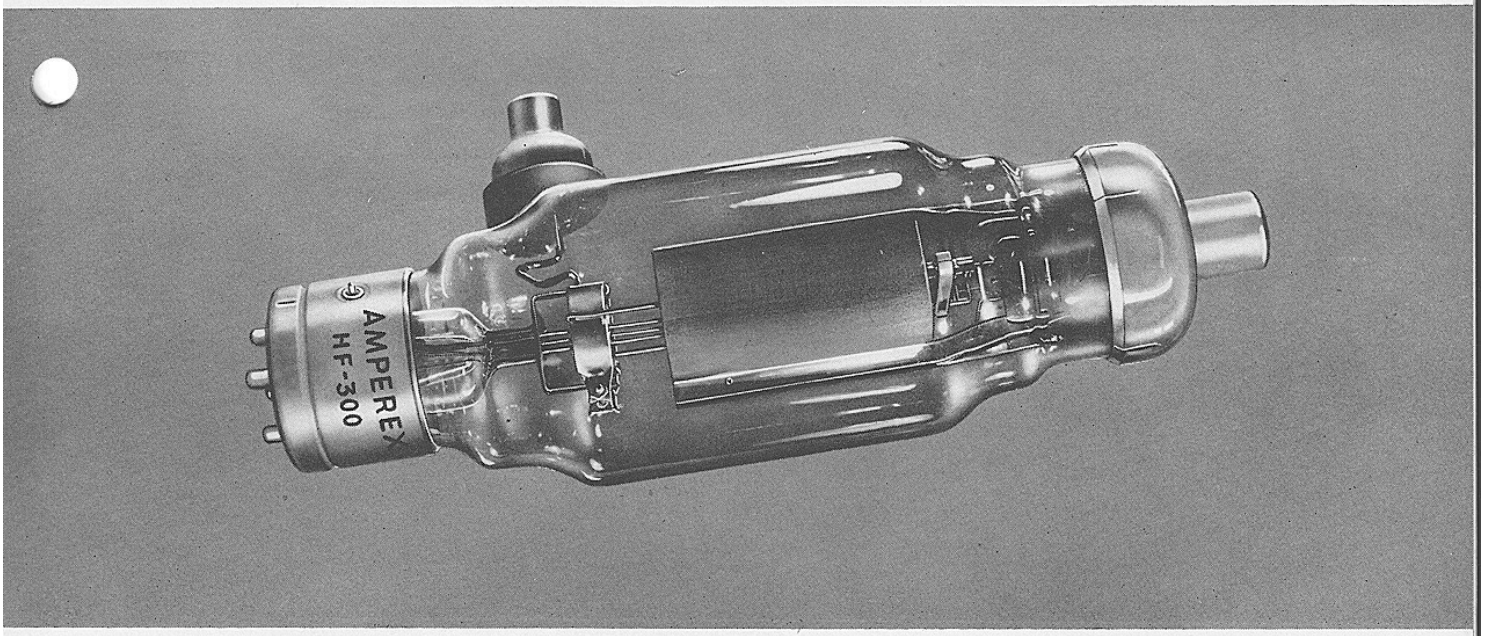
HF-201

HF-201—AMPEREX TRANSMITTING TUBE



APRIL, 1948

AMPEREX TRANSMITTING TUBE HF-300



AF Power Amplifier or Modulator
RF Power Amplifier or Oscillator

The HF-300 has found favor with many broadcasters and transmitter designers as a substitute for the 204A. A study of the operational data will disclose its superiority, in many classes of service, to the latter tube. It also, like the HF-100 and HF-200, in an efficient high frequency generator and possesses the characteristic common to Amperex designed tubes, of a high ratio of transconductance to interelectrode capacitance.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	11-12 volts
Current	4 amperes
Amplification Factor	23
Grid to Plate Transconductance, Ip = 150 ma	5600 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	7.0 $\mu\mu$f
Grid to Filament	6.0 $\mu\mu$f
Plate to Filament	1.0 $\mu\mu$f
Frequency for Maximum Ratings	20 megacycles

MECHANICAL

Overall Dimensions	
Maximum Length	10⅜ inches
Greatest Radius	2⅞ inches
Base	Standard Jumbo 4 Pin Bayonet
Mounting Position—Vertical	Base up or down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	11 ounces
Shipping Weight (approx.) (one tube)	5 pounds

HF-300—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	.....	11	11	11
D.C. Plate Voltage	3000	2000	2500	3000
D.C. Grid Voltage	.....	—72	—95	—115
Load Resistance (per Tube) (ohms)	.....	2400	3400	5000
Effective Load Resistance (plate to plate) (ohms)	.....	9600	13600	20000
Zero Signal Plate Current (ma)	.....	60	60	60
Peak A.F. Grid to Grid Voltage	.....	404	430	450
Max. Signal Plate Current (ma)	275	480	430	360
Max. Signal Plate Input (watts)	600	.....	.....	.....
Plate Dissipation (watts)	200	.....	.....	.....
Max. Signal Driving Power (approx.) (watts)	.....	14	13	13
Max. Signal Plate Power Output (watts)	.....	650	740	780

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	.....	11	11	11
D.C. Plate Voltage	2500	1500	2000	2500
D.C. Grid Voltage	.....	—60	—80	—100
Peak R.F. Grid Voltage	.....	130	125	120
D.C. Plate Current (ma)	200	185	150	120
Plate Input (watts)	320	278	300	300
D.C. Grid Current (approx.) (ma)	.....	5	2	0.5
R.F. Grid Current (amps)	10	.....	.....	.....
Plate Dissipation (watts)	200	186	195	195
Driving Power (at Modulation Peak) (watts)	.....	17	10	6
Plate Power Output (watts)	.....	92	105	105
F.C.C. Broadcast Rating (watts) (Nearest Classification for Final Stage Use)	75	.....	.....	.....

Plate Modulated R.F. Power Amplifier Class C—Telephony

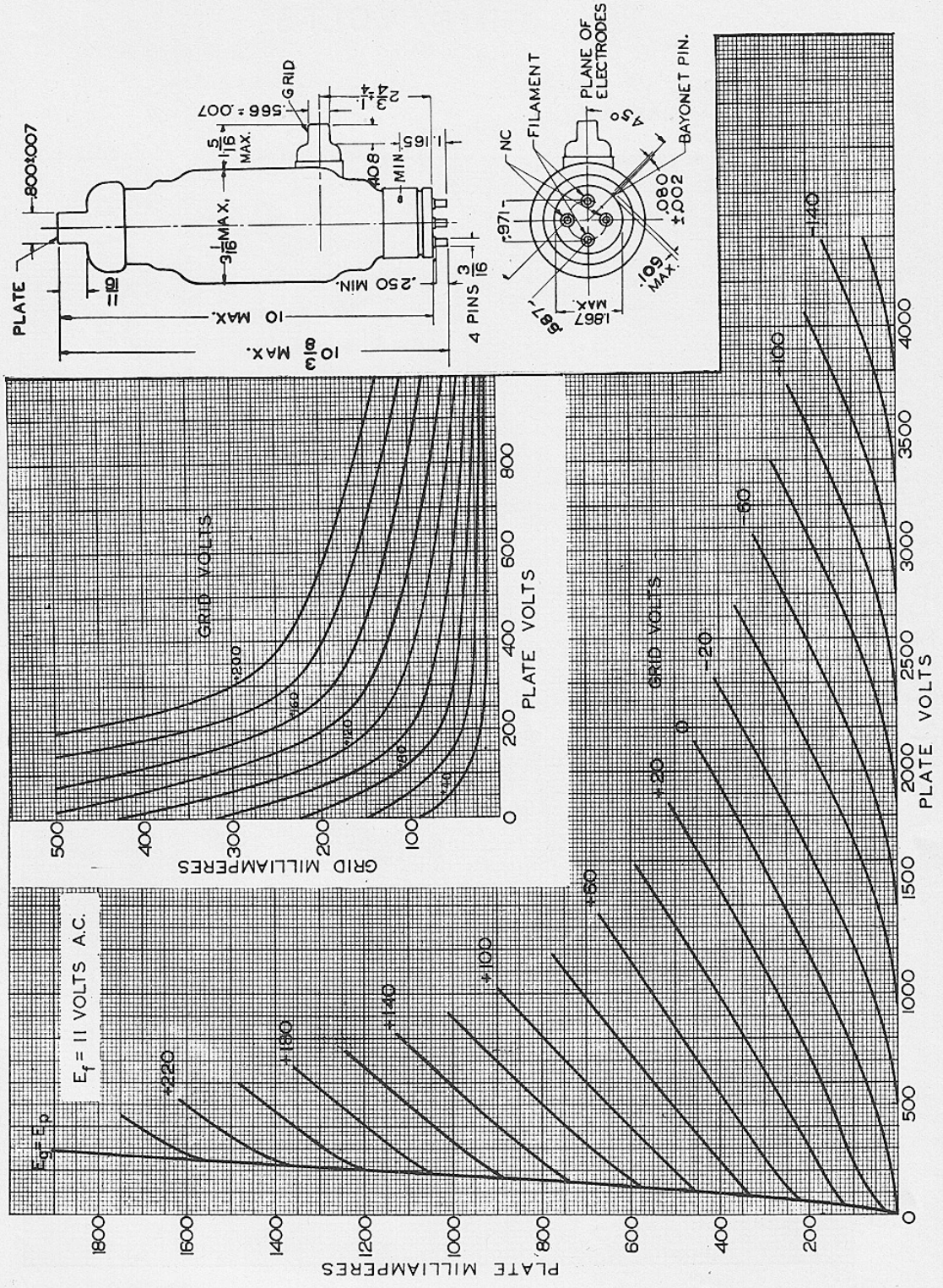
(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	.....	11.5	11.5
D.C. Plate Voltage	2200	1500	2000
D.C. Grid Voltage	—500	—200	—300
Fixed Grid Bias (volts)	.....	—50	—84
Grid Resistor (ohms)	.....	2500	6000
Peak R.F. Grid Voltage	.....	400	490
D.C. Plate Current (ma)	275	275	250
Plate Input (watts)	600	413	500
D.C. Grid Current (ma)	60	60	36
R.F. Grid Current (amps)	10	.....	.....
Plate Dissipation (watts)	150	103	115
Driving Power (approx.) (watts)	.....	22	17
Plate Power Output (watts)	.....	310	385
Frequency Limit for Above Operation (mc)	20	40	30
F.C.C. Broadcast Rating (watts) (Nearest Classification for Final Stage Use)	250	.....	.....

R.F. Power Amplifier—Class C—Telegraphy

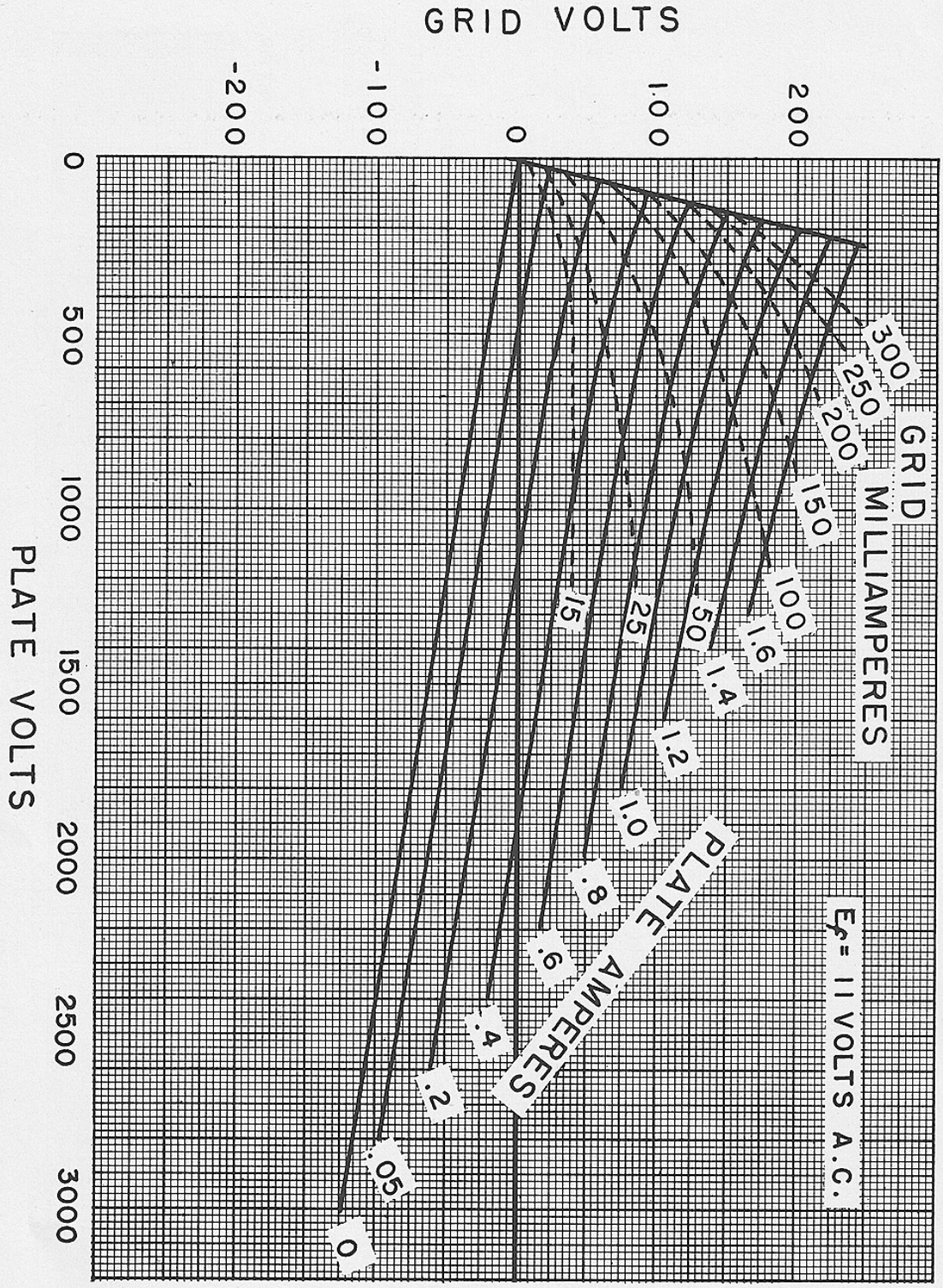
	Maximum Rating per Tube	Typical Operation One Tube		
A.C. Filament Voltage	.....	11	11	11
D.C. Plate Voltage	3000	3000	2500	2000
D.C. Grid Voltage	—500	—400	—300	—200
Peak R.F. Grid Voltage	.....	590	490	385
D.C. Plate Current (ma)	275	250	260	275
Plate Input (watts)	750	750	650	550
D.C. Grid Current (approx.) (ma)	60	28	36	36
R.F. Grid Current (amps)	12	.....	.....	.....
Plate Dissipation (watts)	200	150	130	140
Driving Power (approx.) (watts)	.....	16	17	13
Plate Power Output (watts)	.....	600	520	410
Frequency Limit for Above Operation (mc)	20	20	30	40

AMPEREX TRANSMITTING TUBE HF-300



HF-300

HF-300—AMPEREX TRANSMITTING TUBE



HF-300

AMPEREX TRANSMITTING TUBE HF-3000

An all glass radiation—air cooled high power transmitting triode.



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Plate Modulated R.F. Power Amplifier Class C

(Carrier conditions for use with a maximum modulation factor of 1.0)

	For operation at mc. carrier frequencies up to		
	10	20	40
D.C. Plate Voltage	7000	6000	4000
D.C. Grid Voltage	—2000	—1200	—700
D.C. Plate Current (amps.)	.75	.75	.75
D.C. Grid Current (ma.)	150	150	150
Plate Power Input (kw.)	5	4.5	3.0
Plate Dissipation (kw.)	1.5	1.5	1.5
Nominal Carrier Plate Power Output (kw.)	4.0	3.25	1.8

Typical Operation

(Per tube in the final stage of a two tube 5 KW Broadcast Transmitter)

A.C. Filament Voltage	21.5	21.2
D.C. Plate Voltage	5000	6000
D.C. Grid Voltage obtained by Fixed Biasing Voltage	—925 —225	—1000 —250
Plus Grid Leak Resistor (ohms)	7000	10000
Plate Load Resistance (ohms)	3250	5000
Peak R.F. Grid Voltage	1500	1500
D.C. Plate Current (ma.)	710	575
D.C. Grid Current (ma.)	100	75
Driving Power (watts)	140	110
Plate Power Output (watts)	2700	2700

R.F. Power Amplifier—Class C

Unmodulated, Negatively Modulated or Frequency Modulated Services

	Maximum Rating for Operation at mc. frequencies up to				
	10	20	30	40	50
D.C. Plate Voltage	10000	8000	6000	5000	4000
D.C. Grid Voltage	—2000	—1500	—1200	—900	—700
D.C. Plate Current (amps.)	1.25	1.25	1.25	1.25	1.25

GENERAL CHARACTERISTICS

Filament Voltage	21 to 22
Filament Current (amps)	40.5
Filament Emission (amps)	6
Amplification Factor	16
Grid to Plate Transconductance at plate current of 1 ampere	6500 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	10 $\mu\mu$f
Grid to Filament	13 $\mu\mu$f
Plate to Filament	4 $\mu\mu$f
Dimensions:	
Maximum Overall Length	23"
Diameter of Bulb	6"

R.F. Power Amplifier—Class C

Unmodulated, Negatively Modulated or Frequency Modulated Services

(Continued)

	Maximum Rating for Operation at mc. frequencies up to				
	10	20	30	40	50
D.C. Grid Current (ma.)	150	150	150	150	150
Plate Power Input (kw.)	10	8	6	5	4
Plate Dissipation (kw.)	2.5	2.5	2.25	2	2
Nominal Carrier Plate Power Output (kw.)	8.0	6.0	4.0	3	2

Typical Operation

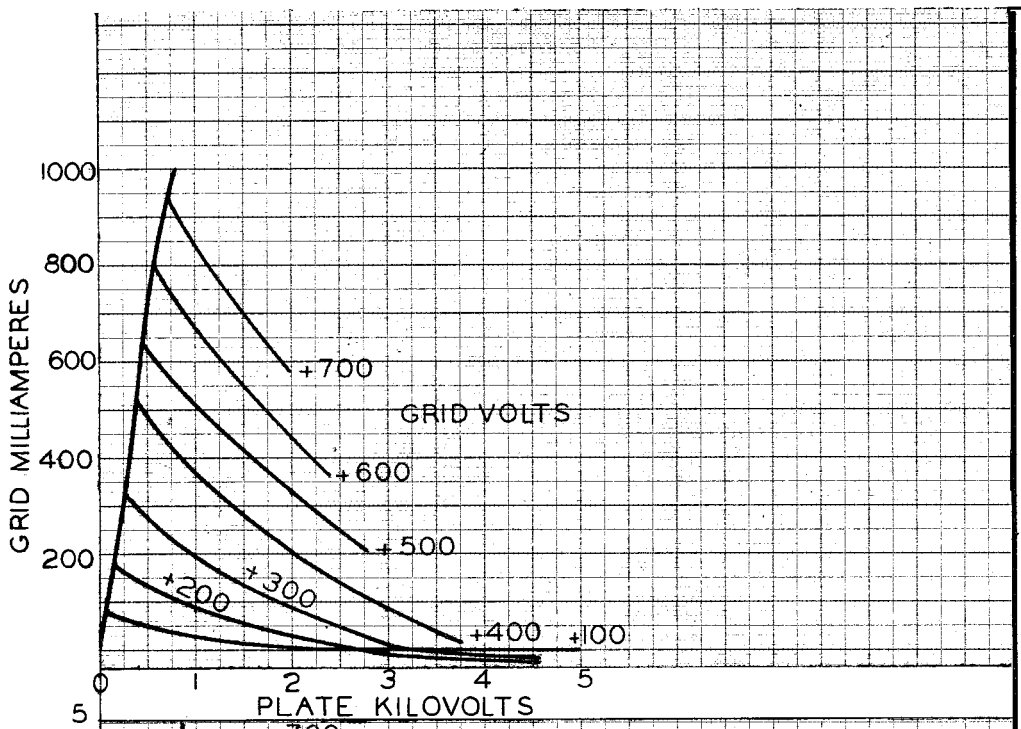
A.C. Filament Voltage	21.5	21.5
D.C. Plate Voltage	6000	8000
D.C. Grid Voltage	—800	—1100
Plate Load Resistance (ohms)	2900	4200
Peak R.F. Grid Voltage	1500	1800
D.C. Plate Current (amps.)	1.0	.95
D.C. Grid Current (ma.)	130	125
Driving Power (watts)	190	220
Plate Power Output (watts)	4600	6100

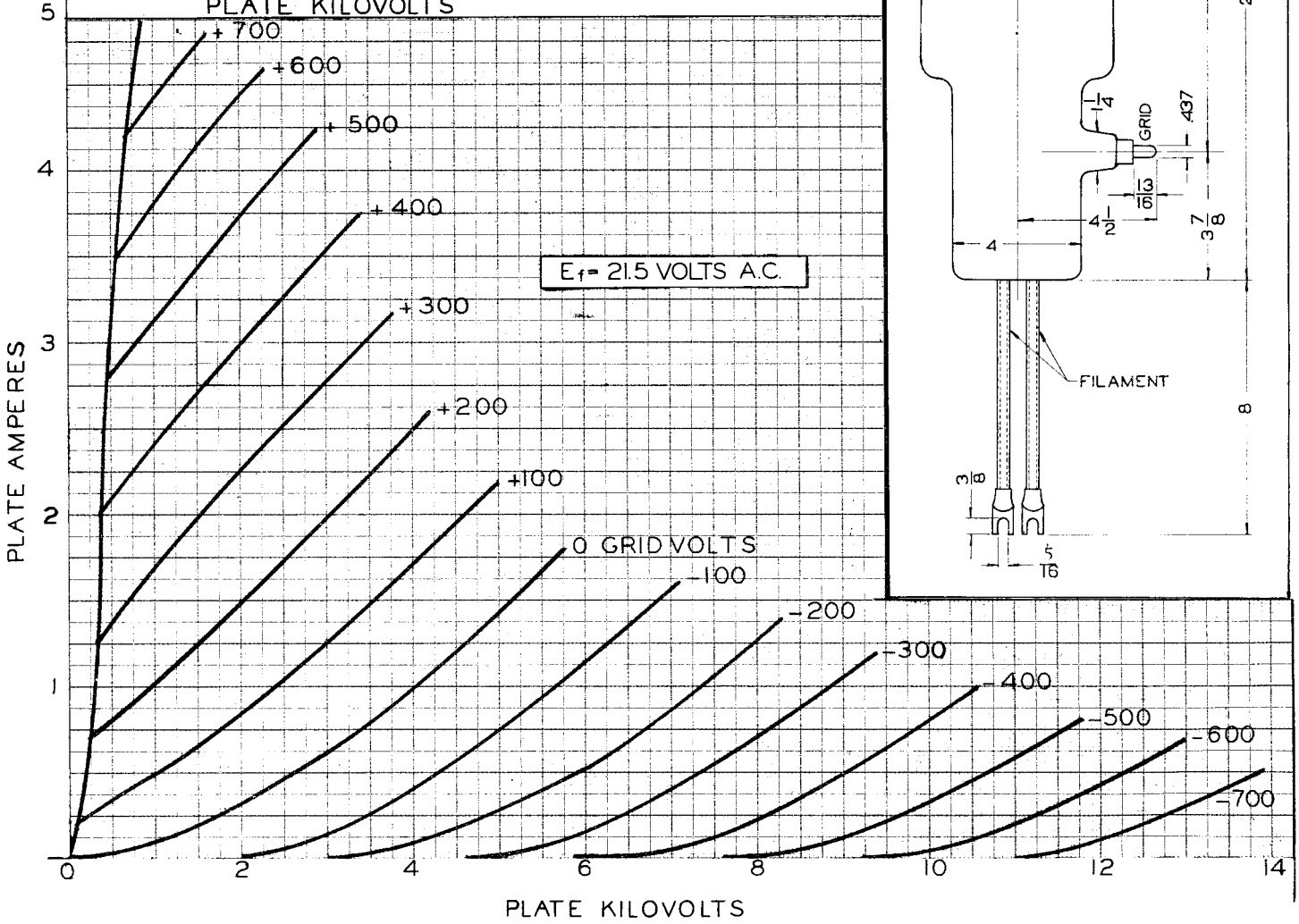
COOLING: Though this tube may in emergencies, and under conditions of low anode dissipation be operated without forced air cooling, an air flow of 200 to 400 cubic feet a minute broadly directed at the bottom of the tube and flowing upward around the bulb will assure optimum life.

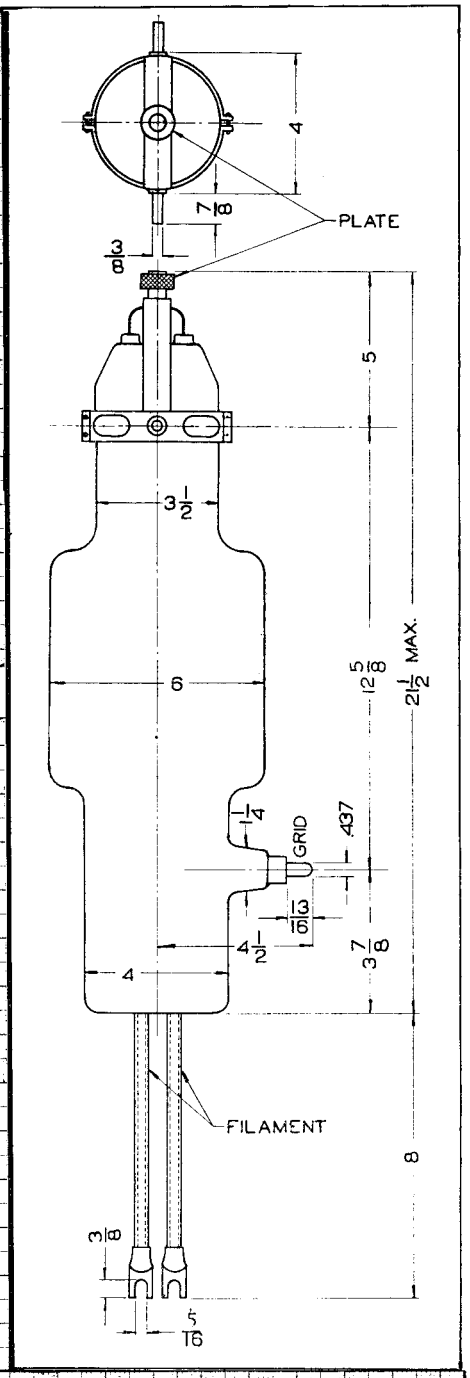
AMPEREX

HF-3000

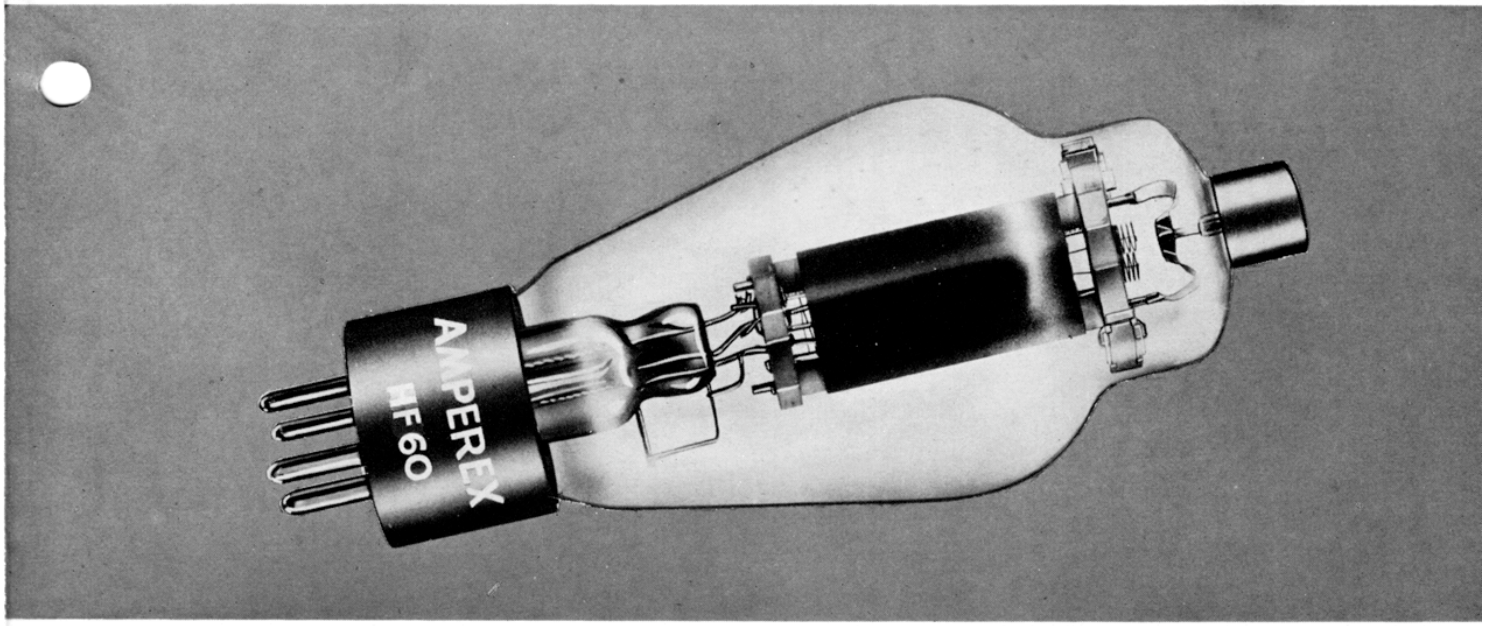
HF-3000 — AMPEREX TRANSMITTING TUBE







AMPEREX TRANSMITTING TUBE HF-60



AF Power Amplifier and Modulator
RF Power Amplifier and Oscillator

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10.0 volts
Current	2.5 amperes
Amplification Factor	28
Grid to Plate Transconductance	5000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	5.2 $\mu\mu$f
Grid to Filament	5.4 $\mu\mu$f
Plate to Filament	1.5 $\mu\mu$f

MECHANICAL

Maximum Overall Dimensions	
Length	$6\frac{13}{16}$ inches
Diameter	$2\frac{7}{16}$ inches
Base	Standard medium 4 pin bayonet
Mounting Position—Vertical	Base down
Horizontal	With plane of electrodes vertical
Net Weight (approx.)	3 ounces
Shipping Weight (approx.) (one tube)	1¾ pounds

HF-60—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class B

Unless otherwise specified, values are for 2 tubes

Typical Operation:			Maximum Rating per Tube
D.C. Plate Voltage	1450	1600	1600
D.C. Grid Voltage[1]	—65	—75	....
Load Resistance (ohms) (per tube)	2850	3450	....
Effective Load Resistance (ohms) (pl-pl)	11400	13800	....
Peak A.F. Grid to Grid Voltage	290	310	....
Zero Sig. D.C. Plate Current (ma)	10	50	....
Max. Sig. D.C. Plate Current (ma)	261	248	160[2]
Max. Sig. Plate Input (watts)	....	....	255[2]
Plate Dissipation (watts)	....	....	75[2]
Driving Power (watts) (approx.)	2	3	....
Max. Sig. Plate Power Output (watts) (approx.)	233	262	....

R.F. Power Amplifier—Class B—Telephony

Carrier conditions per tube for use with maximum modulation factor of 1.0

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	30	100

Typical Operation:		Maximum Rating per Tube
D.C. Plate Voltage	1600	1600
D.C. Grid Voltage[1]	—65	....
Peak R.F. Grid Voltage	70	....
D.C. Plate Current (ma)	72	100
D.C. Grid Current (ma) (approx.)	0.2	....
Plate Input (watts)	115	115
Driving Power (watts) (approx.)[3]	0.8	....
Plate Dissipation (watts)	75	75
Plate Power Output (watts) (approx.)	41	....

Plate Modulated R.F. Power Amplifier Class C—Telephony

Carrier conditions per tube for use with a maximum modulation factor of 1.0

Plate Volts & Input Max. %	100	50
For Frequency Indicated (mc)	30	100

(continued from previous column)

Typical Operation:			Maximum Rating per Tube
D.C. Plate Voltage	1000	1250	1250
D.C. Grid Voltage[1]	....	....	....
Total Bias	—160	—190	—250
Fixed Bias	—30	—60	....
From Grid Resistor (ohms)	15700	16250	....
Peak R.F. Grid Voltage	280	310	....
D.C. Plate Current (ma)	120	113	120
D.C. Grid Current (ma) (approx.)	8	8	....
Plate Input (watts)	120	141	145
Plate Dissipation (watts)	35	31	50
Driving Power (watts) (approx.)	2.0	2.5	....
Plate Power Output (watts) (approx.)	85	110	....

R.F. Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions without modulation[4]

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	30	100

Typical Operation:				Maximum Rating per Tube
D.C. Plate Voltage	1000	1300	1600	1600
D.C. Grid Voltage[1]	—110	—145	—190	—300
Peak R.F. Grid Voltage	240	275	330	....
D.C. Plate Current (ma)	155	153	158	160
D.C. Grid Current (ma) (approx.)	10.5	9.5	12.0	....
Plate Input (watts)	155	199	252	255
Plate Dissipation (watts)	46	49	52	75
Driving Power (watts) (approx.)	2.3	2.2	3.5	....
Power Output (watts) (approx.)	109	150	200	....

NOTES:

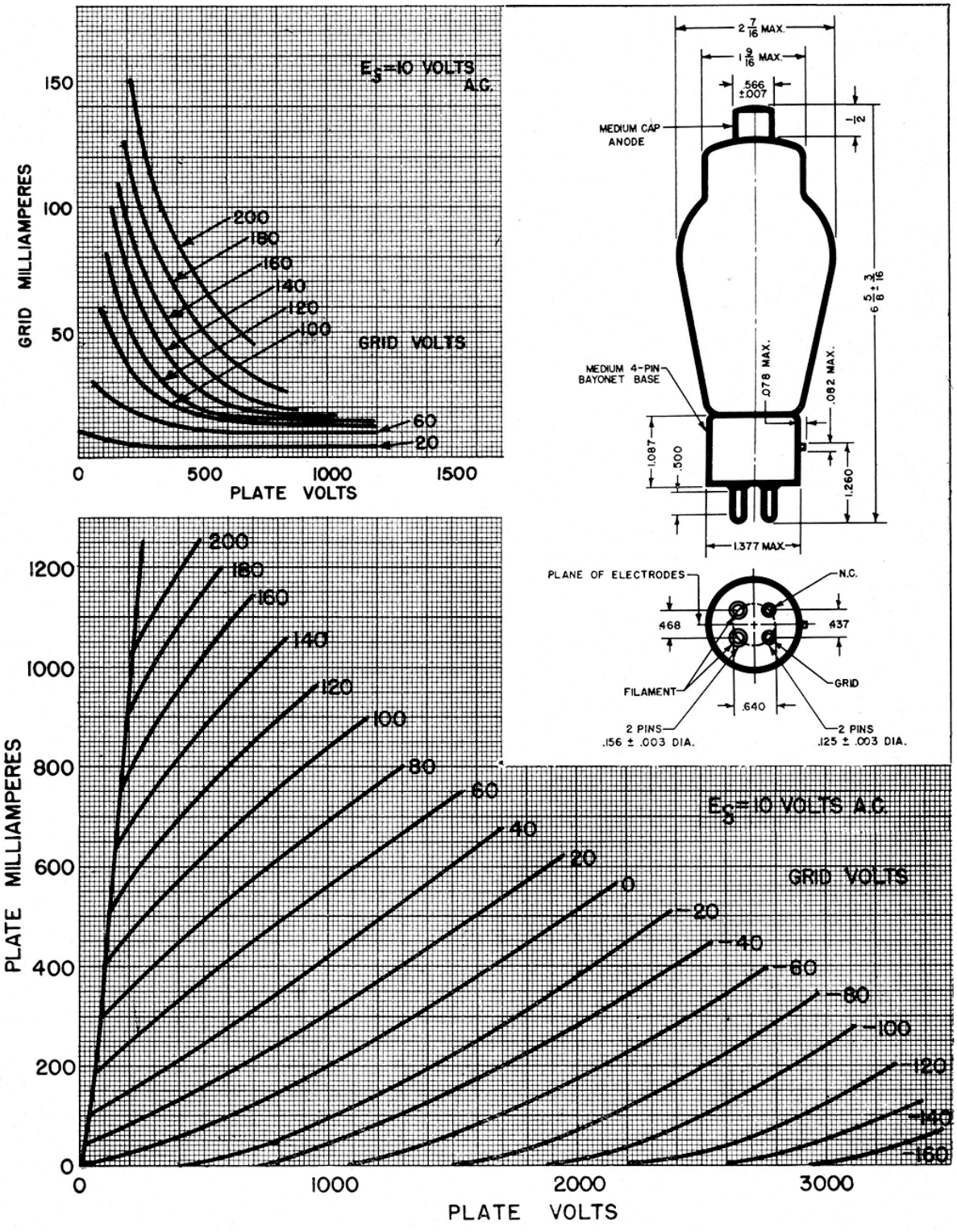
[1]Grid voltages are given with respect to the mid-point of the filament operated on A.C. If D.C. is used, each stated value of grid voltage should be decreased by 5 volts and the circuit returns made to the negative end of the filament.

[2]Averaged over any audio-frequency cycle of sine-wave form.

[3]At crest of audio-frequency cycle with modulation factor of 1.0.

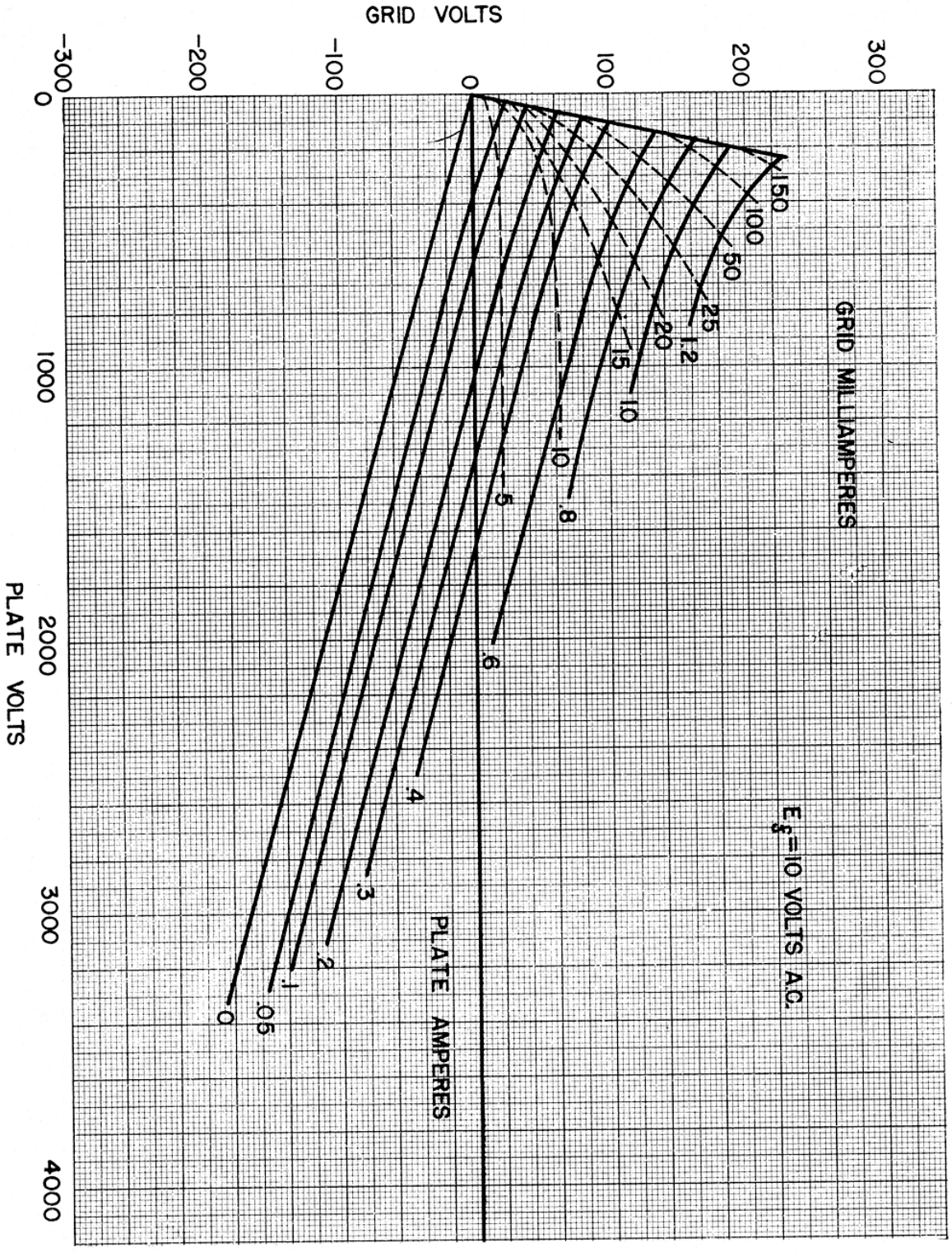
[4]Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

AMPEREX TRANSMITTING TUBE HF-60



HF-60

HF-60—AMPEREX TRANSMITTING TUBE



HF-60

MAY, 1948

Amperex® Electronic Corporation
A NORTH AMERICAN PHILIPS COMPANY
ELECTRO-OPTICAL DEVICES DIVISION
P.O. Box 278 Slatersville, R.I. 02876
Telephone: 401/762-3800 TWX: 710/382-6332

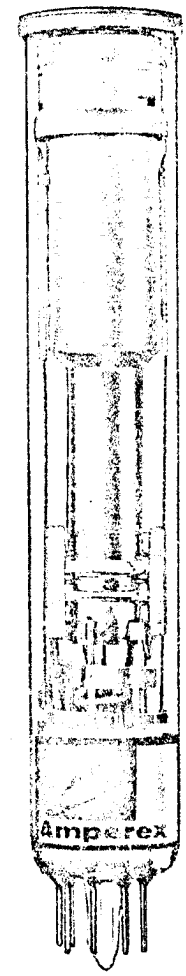
TUBE TYPE
S10XQA
SILICON VIDICON
CAMERA TUBE

DEVELOPMENT SAMPLE DATA

DESCRIPTION

The Amperex S10XQA is a TV camera pick-up tube with a photosensitive target in the form of a mosaic array of silicon diode elements. This pick-up tube offers the advantage of wide spectral response, high quantum efficiency, high sensitivity, low dark current and low lag.

The S10XQA can be exposed to direct sunlight without deleterious effects. It does not exhibit image burn-in and is able to withstand exposure to 100°C environments. It employs velocity stabilization and separate mesh construction in a 1 inch diameter "vidicon style" envelope. It is mechanically interchangeable with any 1 inch vidicon and also electrically interchangeable with any separate mesh "vidicon" such as the XQ1040 or the 8541.



Amperex®

GENERAL CHARACTERISTICS

MECHANICAL

Focusing Method	Magnetic[1]
Deflection Method	Magnetic[1]
Dimensions	See outline drawing, Pg.5
Bulb	T8
Base	JEDEC No. E8-11
Mounting Positions	Any
Weight	2.5 oz.
Accessories	
Socket	Cinch 54A18088 or equiv.
Focusing and Deflection Coil Assembly	Amperex Type AT1102, AT1103 or equivalent [1)]

ELECTRICAL

Heating	Indirectly AC or DC Parallel Supply Only
Heater Voltage	6.3 Volts ± 10%
Heater Current	100 mA max.
Capacitance	
Target To All other Electrodes	3 to 5 pF[2]
Grid No. 1 Voltage for Cutoff at Grid No. 2 Voltage = 300 volts	-30 to -100 Volts[3, 4]
Blanking Voltage, Peak to Peak	
On Grid No. 1	70 volts min.
On Cathode	15 volts min.
Grid No. 2 Current at Normally Required Beam Current[5]	1 mA max
Dark Current at Specified Target Voltage V_t (0 to 25 V) and a Faceplate Temperature of 30°C	50 nA max.
Signal Current, total (i_t)[6]	750 nA max.

The included data, based on the specifications and measured performance of development samples, afford a preliminary indication of the characteristics to be expected of the described product. Distribution of development samples implies no guarantee as to the subsequent availability of the product.

S10XQA

OPTICAL

Dimensions of Scanned Area (4:3 Aspect Ratio)	0.500 in. x 0.375 in. (12.8 mm x 9.6 mm)
Diameter of Scanned Area	0.625 inch (16 mm)
Orientation of Image on Photo-sensitive Surface	See Note 7

SENSITIVITY

CHART A

Light Source[8]	Luminous Sensitivity (μA/lm)[11]	Radiant Sensitivity (mA/W)[9]	Net Signal Current[24] with 0.1 fc incident illumination (nA)
Tungsten	4500	92.0	600
Visible[10]	900	18.5	120
Infrared[12]	2700	55.0	360

CHART B

Wavelength (nm)	Radiant Sensitivity (mA/W)	Quantum Efficiency(%)
550	250	56
750	450	75
950	250	33

Average Gamma of Transfer Characteristic	1.0
Spectral Response:	
Cut-offs at	400 and 1100 nm, approx.
Max Sensitivity at	800 nm, typ.
Index of Refraction of Faceplate	1.5
Target Optical Reflectivity	See Note 25

ABSOLUTE MAXIMUM RATINGS[26]

Grid No. 4 Voltage	650 Volts[4]
Grid No. 3 Voltage	600 Volts[4]
Grid No. 2 Voltage	350 Volts[4]
Grid No. 1 Voltage	
Positive	0 Volts
Negative	125 Volts
Grid No. 4 to Grid No. 3 Voltage Difference	350 Volts
Cathode to Heater Voltage:	
Peak to Peak Positive	125 Volts
Peak to Peak Negative	10 Volts max.
Cathode Current	3 mA
Heater Warm-up	1 Minute min.
Target Voltage	50 Volts[4]
Faceplate:	
Illumination	10^7 fc (14
Temperature:	
(Operation and Storage)	-100°C to 100°Cmax.

TYPICAL OPERATING CONDITIONS AND PERFORMANCE

Cathode Voltage	0 Volts
Grid No. 2 Voltage	300 Volts
Grid No. 3 Voltage	500 Volts[21]
Grid No. 4 Voltage	600 Volts
Target Voltage	6 to 10 Volts[22, 23]
Beam Current	See Note 15
Faceplate Temperature	20°C to 30°C
Faceplate Illumination[15] (Visible)	0.15 fc[8,10]
	0.05 fc[8, 12]
Signal Current Highlight (i_s), net; [24](infrared)	200 nA
Dark Current , Average [23]	15 nA, D.C.
Resolution, Central:	
Limiting	700 TV Lines[17]
Modulation Depth (uncompensated Horizontal Amplitude Response) at 400 TV Lines	40%[18]
Signal to Noise Ratio [19]	300:1
Lag (Persistence)[20, 23]	
Residual Signal after 50 msec.	10%
Uniformity of Sensitivity	20%
Uniformity of Dark Current	6%

FOOTNOTES:

1. Focusing/deflecting coil assembly available from Amperex Electronic Corp.; Cleveland Electronics Inc., and others.

2. The capacitance of the target to all electrodes, which effectively is the output impedance, is measured without the deflection/focussing coil assembly, and may increase when the tube is inserted into such assembly.

3. With no blanking voltage on Grid No. 1.

4. At cathode voltage = 0 Volts.

5. The maximum "Normally Required Beam Current" is taken as that beam current which is just sufficient to stabilize highlights with signal currents of 400 nA (peak value).

6. The total signal current consists of the current due to the signal plus the dark current, i.e., $i_t = i_s + i_d$.

7. For proper orientation of the image on the photo-sensitive layer, the horizontal scan should be essentially parallel to the plane passing through the tube axis and the short base pin.

8. Light source is a tungsten filament lamp in a lime glass envelope, operated at a color temperature of 2854°K.

9. Radiant sensitivity is derived from the luminous sensitivity assuming a luminous efficacy of 20.4 lm/W of 2854°K tungsten light. As with the luminous sensitivity, the level of irradiation is that before the filter where one is specified.

10. With the same light source specified in Footnote 8, except an infra-red absorbing filter Fish Schurman (Schott) Filter KG3, thickness = 4 mm. (.157 in.), is interposed between the light source and the faceplate of the tube. The level of illumination is that of the unfiltered light.

11. As measured under the following conditions:
Tubes are exposed to 0.0755 ft. c. illumination (light flux of .10 millilumen) of black body color temperature of 2854°K. An appropriate filter is inserted in the light path. The signal current obtained in nanoamperes x 10 denotes the luminous sensitivity expressed in terms of microamperes per lumen of white light incident on the filter.

Filters used:	Tungsten	No filter used
	Visible	Schott KG3 thickness 4 mm (.157 in.)
	Infrared	Schott RGN9 thickness 3 mm (.118 in.)

FOOTNOTES (Continued)

12. With the same light source specified in Footnote 8 except an infrared transmitting filter Fish Schurman (Schott) Filter RGN9, thickness = 3 mm (.118 in.) is interposed between the light source and the faceplate of the tube. The level of illumination is that of the unfiltered light.

13. A minimum of 1 minute warm-up time for the heater is to be observed for drawing cathode current.

14. Illumination levels in excess of 10 million foot-candles can be tolerated. This is equivalent to the image of the sun or a high intensity projection lamp being focussed onto the target. Care must be taken that the heat content of the focussed radiation does not cause the temperature of the target to exceed the maximum allowed level.

15. The beam current shall be adjusted for correct stabilization of twice the specified highlight signal current.

16. Illumination on the photo-sensitive layer, Bph, in the case of a black/white camera is related to scene-illumination, Bsc, by the formula:

$$Bph = Bsc \frac{R.T.}{4F^2 (m+1)^2}$$

in which R represents the scene-reflectivity (average or the object under consideration, whichever is relevant), T the lens transmission factor, F the lens aperature, and m the linear magnification from scene to target.

17. Limiting resolution is defined as the resolution at a modulation depth, i.e., uncompensated horizontal amplitude response, of 5% uncorrected for lens resolution losses. The amplitude response of the camera amplifier should be flat to well over 7.5 MHz; no gamma correction should be used.

18. Measured with 100% contrast square wave test pattern, normalized at 50 TVL, and corrected for lens resolution losses. The bandwidth of the camera amplifiers used are flat to beyond 5 MHz.

19. Measured with a high gain, low noise (2 nA rms) cascode-input type amplifier having a bandwidth of 5 MHz and a pulse signal output current of 200 nA. Because the noise in such a system is predominately of the high-frequency type, the "visual equivalent" of signal-to-noise ratio is used which is 3 times the ratio of highlight video-signal current to rms noise current.

20. Measured with an initial net highlight signal current of 200 nA.[15] The sequence of the measurement is as follows: The illumination is turned off at t = 0 immediately preceding a read-out of the initial signal. This read-out is labeled the "zeroth" field. The first residual signal occurs subsequently at t = 16.7 msec., i.e., in the first field. The value of lag listed is the magnitude of the residual signal in the 3rd field, ie., at t = 50 msec.

21. Adjust for minimum shading. The voltage ratio of Grid No. 4 to Grid No. 3 is between 1.1 and 1.5.

22. The target voltage (V_t) is individually selected and specified typically within a range and indicated for each tube. This is to achieve an optimum operating point consistent with optimal beam acceptance and to optimize other performance characteristics, such as dark current, blemishes, uniformity and lag.

23. Data on target voltage, dark current and lag supplied with each tube.

24. The net signal current is to consist of the total signal current less the contributions due to dark current; i.e. $i_s = i_t - i_d$.

25. The optical reflectivity of the silicon target is controlled by application of an anti-reflecting coating. The value of minimum reflectivity, the wavelength at which it occurs, and the wavelength interval over which it applies can be preselected to suit various applications. For example a typical set of values would be– 0.1% target reflectivity, centered at 750 nm with reflectivity <1% over the wavelength interval 650 nm to 850 nm. It should be noted that the residual reflectivity from the faceplate is approximately 8%, independent of wavelength. For special applications it should be possible to reduce the 8% to 4% or less by application of anti-reflection coatings to one or both surfaces of the faceplate.

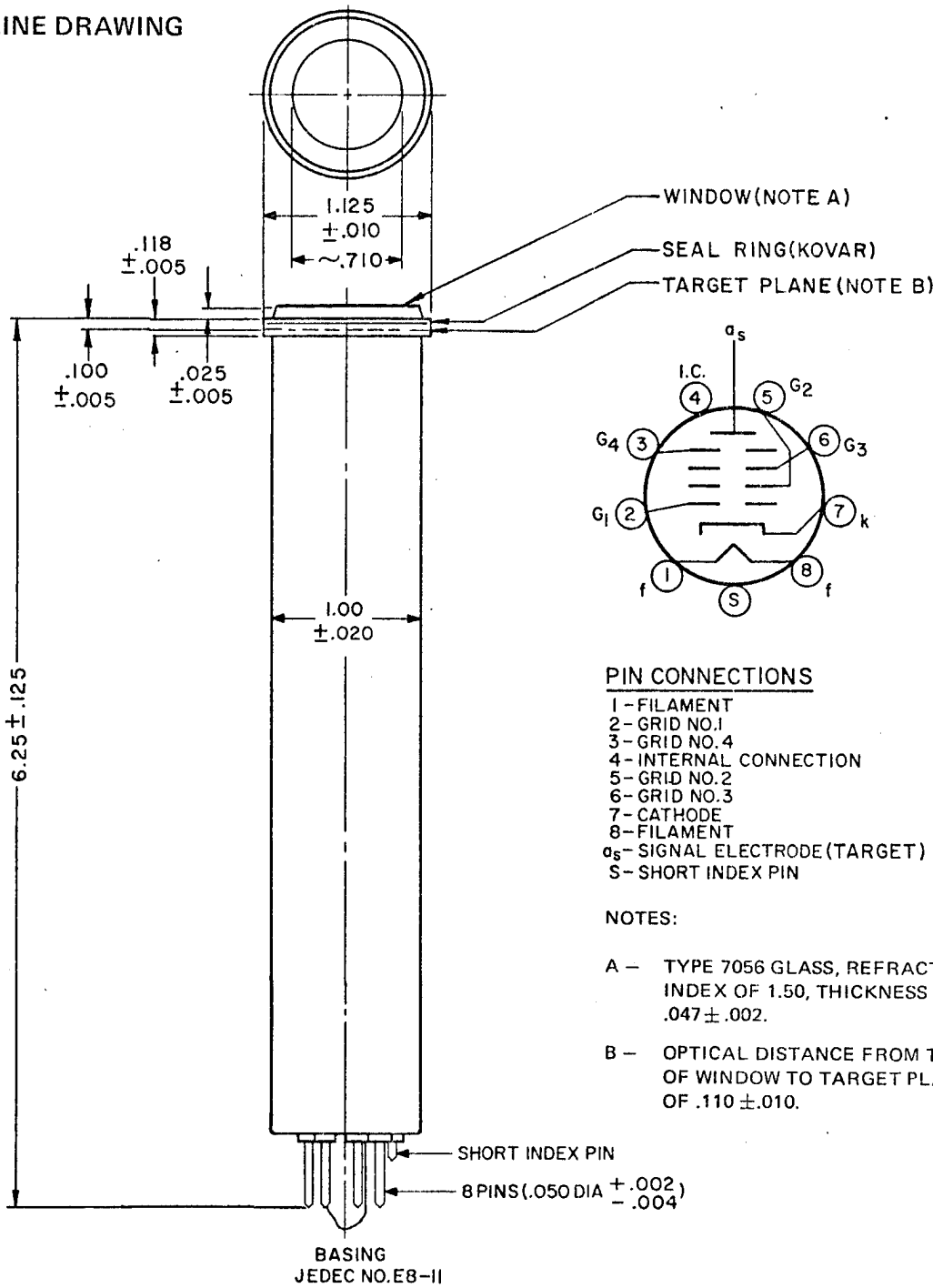
FOOTNOTES (Continued)

26. By definition Absolute Maximum Ratings are limiting values of operating and environmental conditions applicable to any 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 no responsibility for equipment variations, enviornment variations, and 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 Absolute Maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions and variations in device characteristics.

OUTLINE DRAWING



PIN CONNECTIONS

1 - FILAMENT
2 - GRID NO.1
3 - GRID NO.4
4 - INTERNAL CONNECTION
5 - GRID NO.2
6 - GRID NO.3
7 - CATHODE
8 - FILAMENT
a_s - SIGNAL ELECTRODE (TARGET)
S - SHORT INDEX PIN

NOTES:

A — TYPE 7056 GLASS, REFRACTIVE INDEX OF 1.50, THICKNESS OF .047 ± .002.

B — OPTICAL DISTANCE FROM TOP OF WINDOW TO TARGET PLANE OF .110 ± .010.

Amperex® Electronic Corporation
A NORTH AMERICAN PHILIPS COMPANY
ELECTRO-OPTICAL DEVICES DIVISION
P.O. Box 278
Telephone: 401/762-3800
Slatersville, R.I. 02876
TWX: 710/382-6332

TUBE TYPE
S10XQA
SILICON VIDICON
CAMERA TUBE

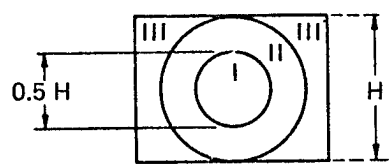
PICTURE QUALITY (due to blemishes)

Blemishes can be regarded as either spots or smudges. A spot or smudge is defined as a blemish with a maximum linear dimension in any direction of 1% or 5% respectively, of the picture height and a contrast in excess of 10% of 100% white level as measured on a waveform oscilloscope (bandwidth 5.5 MHz), black level being defined as zero percent.

The picture quality is evaluated in the following setting in respect of highlight signal current and applied beam current viz:

Highlight signal current	I_s = 200 nA	0
Beam current adjusted for correct stabilization of a signal current of:	I_b = 400 nA	400 nA

The specified area of 0.5 x 0.375 in. on the target is evenly illuminated with light appropriate to the application through a back illuminated test dia. with aspect ratio 4:3. The area of the test chart is divided in three quality zones by two concentric circles with diameters as shown below.



The obtained picture shall be observed on a monitor producing a non-blooming white. The numbers and sizes of blemishes shall not be in excees of those tabulated below.

	Permitted number of blemishes a) c)		
Dimensions in any direction measured in percentage of picture height (approx T.V. lines) at the 10% contrast point.	Zone I	Zone II	Zone III
over 1% (5 TVL)	0	0	0
1% to but not incl. 0.7%	0	1	2
0.7% to but not incl. 0.45%	1	2	4
0.45% to but not incl. 0.2%	2	4	6
0.2% and under (1 TVL)	b)	b)	b)

Notes:

a) The distance between any two spots shall be greater than 5% of picture height in any direction.

b) Spots of this size are not counted unless concentration causes a smudge appearance. Such concentrations are evaluated as smudges. As contrast the average contrast of the concentration is taken.

c) Blemishes with a contrast less than 10% are not counted.

d) Blemishes greater than 5% (25 TV lines) will be considered a variation in uniformity, either of sensitivity or dark current

Revised July 1970

Amperex announces a new family of Plumbicon® tubes with 37% less lag*

When we first introduced the Plumbicon, its obvious superiority made it seem like the "ultimate" TV pickup tube. But in the dozen years since then we have produced a steady stream of advances in technology that have vastly improved its performance.

Now, with the new XQ1410 family of Plumbicons, we bring you the next step forward in pickup tubes for broadcast color: Internal bias lighting—resulting in a dramatic reduction in lag **that conquers even the toughest low-key lighting conditions.**

No more color fringing...vastly reduced picture smear ...even better dynamic resolution than before—and all with the traditional Plumbicon's spectacular color performance.

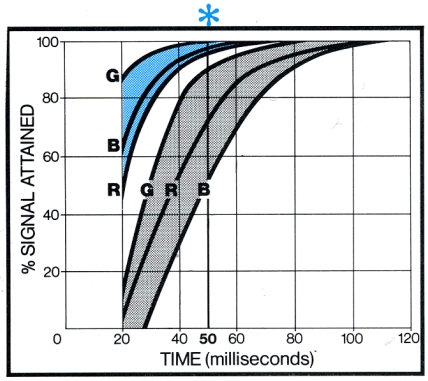
Bias lighting has been offered before...as in our XQ1080, available for the past four years...but never in a fully integrated line of variable- and fixed-bias light tubes. The XQ1410 family is physically and electrically interchangeable with our industry-standard XQ1020 family. Only a minor field change is required to permit adjustment of bias light intensity if you use variable-bias tubes. (We supply complete instructions, of course.)

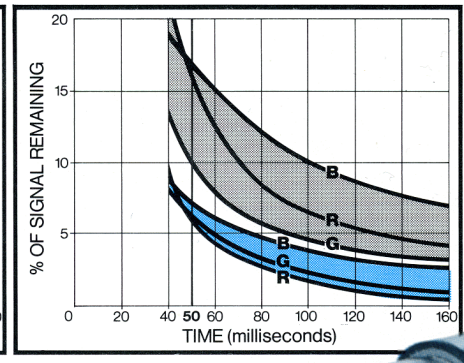
With bias lighting, the Plumbicon's near-zero dark current rises to a few nanoamperes to modify the target's beam-acceptance characteristics. The effect is to sharply decrease both rise time (signal buildup lag) and decay lag in all three channels. As shown below, the result of optimizing all three bias currents, in a "typical" camera, is a 37% reduction in lag.

Since the bias light intensity can be externally adjusted in each of the XQ1410 tubes...luminance (XQ1410L), red channel (XQ1410R), green channel (XQ1410G), and blue channel (XQ1410B)...all channels can be matched within the camera for identical lag characteristics, thus optimizing overall camera performance at levels never before achievable. The result: A new plateau in the quality of broadcast color. You'll have to see it to believe it.

For detailed information on our latest advance in the technology of the Plumbicon...the pickup tube used by 90% of all TV broadcasters...write or telephone: Amperex Electronic Corporation, Slatersville Division, Slatersville, Rhode Island 02876. Telephone: 401-762-3800.

*





IMPROVEMENT IN XQ1410 RISE TIME LAG PERFORMANCE with bias-light-induced dark current

At 50 ms, average % signal attained rises from 71.7% to 98.5%—a 37% overall improvement in rise time lag performance

Selecting optimum dark currents (e.g. Red = 4nA, Blue = 8nA, Green = 3nA) reduces spread in % signal attained from 39.5% to 3%—a 13X improvement in "incremental rise time lag."

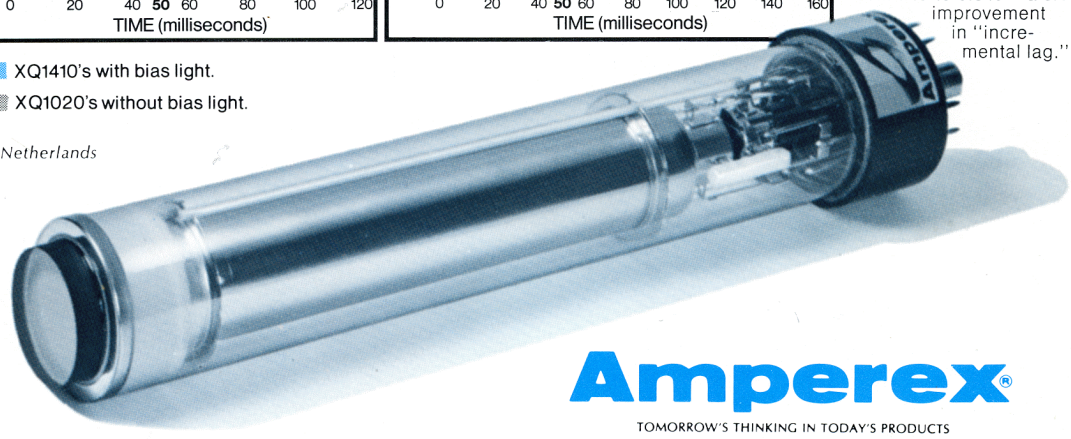
REDUCTION IN XQ1410 DECAY LAG with bias-light-induced dark current

At 50 ms, average % signal remaining falls from 15% to 7%—a 50% overall reduction in decay lag.

Same optimum dark currents reduce spread in % signal remaining from 7% to 0.8%—a 9X improvement in "incremental lag."

XQ1410's with bias light.

XQ1020's without bias light.



® Reg. T.M. of N.V. Philips of the Netherlands

For further details and applications information, send for Bulletin No. 31.

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

A NORTH AMERICAN PHILIPS COMPANY

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TYPE XQ1410 SERIES
PLUMBICON® CAMERA TUBE

® T.M. N.V. Philips of Holland

ADVANCE DATA

The Amperex XQ1410 Series is a 30mm (1.2 in.) diameter Plumbicon television camera tube with high resolution lead oxide photoconductive target, seperate mesh construction, magnetic deflection and magnetic focusing. Special features of this series include an anti-halation disc and internal light bias.

The XQ1410 type is intended for use in monochrome cameras, and the XQ1410L, XQ1410R, XQ1410G, XQ1410B types in color cameras, in broadcast, educational and high quality industrial applications.

The XQ1410 Series is interchangeable with the XQ1020 series, however, the XQ1410 series has increased resolution and internal light bias for reduction of lag under low-key conditions.

NEW PRODUCT INFORMATION

GENERAL CHARACTERISTICS

MECHANICAL

Focusing Method		Magnetic
Deflection Method		Magnetic
Dimensions and Basing		see outline drawing
Mounting Position		any
Weight		3.5 oz
Accessories		
Socket		56021
Variable Light Bias Adaptor (Note 1a)		56106
Fixed Light Bias Adaptor (Note 1b)		
	XQ1410	56122
	XQ1410L	56124
	XQ1410R	56123
	XQ1410G	56124
Deflection and Focus Coil Assembly	monochrome	AT1132, AT1132/01 or equiv.
	color	AT1113, AT1113/01 or equiv.

OPTICAL

Dimensions of quality area of target (note 2)	12.8mm X 17.1mm (.51" X .68")
Image orientation	Vertical scan parallel to plane of tube axis and mark on tube base.

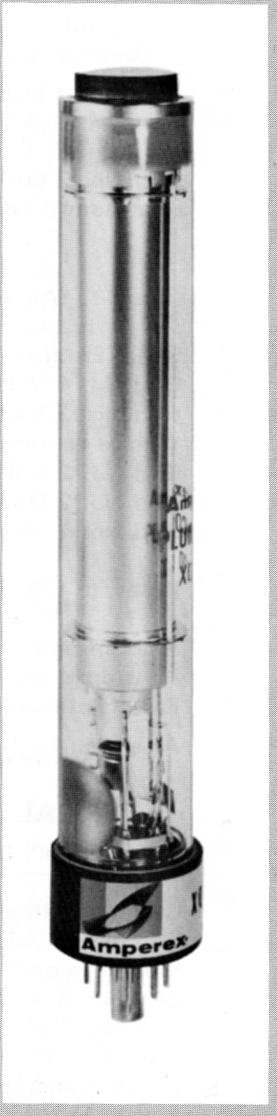
Faceplate

Total Thickness, including anti-halation glass disc	7.2 ± 0.2 mm
Refractive index	n = 1.49
Refractive index of anti-halation glass disc	n = 1.52

Sensitivity

(Illumination = 4.54 lx (.42 f.c.) at black body color temperature of 2856°K)
(measured with filter specified.)

XQ1410, XQ1410L	No Filter	400μA/lm typ.
XQ1410R	Filter 0G570 (3mm Thickness)	85μA/lm typ.
XQ1410G	Filter VG9 (1mm Thickness)	165μA/lm typ.
XQ1410B	Filter BG12 (3mm Thickness)	38μA/lm typ.



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XQ1410 SERIES

ELECTRICAL

Heater	Indirect AC or DC, parallel supply
Heater Voltage	6.3V ± 5%
Heater Current	300mA
(To avoid registration errors in color cameras, stabilization of heater voltage is recommended)	
Capacitance, target to all other electrodes	3 pF to 6 pF
(This capacitance increases when tube is inserted in a coil assembly)	
Gun Cutoff	
Grid No. 1 voltage at V_{g2} = 300V	V_{g1} = -30V to -100V
(without blanking applied)	
Blanking, peak-to-peak, on grid No. 1	50V ± 10V
on cathode	25V
Grid No. 2 Current	
at normal beam currents	I_{g2} = 1mA max.

MAXIMUM RATINGS

(All voltages are referenced to the cathode, unless otherwise stated)

Signal Electrode Voltage	50V
Grid No. 4 Voltage	1100V
Grid No. 3 Voltage	800V
Voltage between Grid No. 3 and Grid No. 4	350V
Grid No. 2 Voltage	350V
Grid No. 2 Dissipation	1W
Grid No. 1 Voltage, positive	0V
negative	125V
Heater to Cathode Voltage, peak, positive	50V
peak, negative	50V
Ambient and Faceplate Temperature (storage and operation)	-30 to +50°C (-22 to + 122° F)
Faceplate illumination (Note 3)	500 lx (46.5 f.c.)

At all times, $V_{g4} \geq V_{g3} \geq V_{g2}$

TYPICAL OPERATING CONDITIONS AND PERFORMANCE

TYPICAL OPERATING CONDITIONS

Cathode Voltage	0V
Grid No. 2 Voltage	300V
Signal Electrode Voltage	45V
Grid No. 3 Voltage	600V
Grid No. 4 Voltage	675V
Beam Current	See Note 4
Focusing and Deflection Coil Current (see also note 5) with V_{g3} = 600V, V_{g4} = 650 to 700V	
Monochrome coil assemblies AT1132, AT1132/01	
Focus Current*	≈ 25mA
Line Current (p–p)	≈ 235mA
Frame Current (p–p)	≈ 35mA
Color coil assemblies AT1113, AT1113/01	
Focus Current*	≈ 100mA
Line Current (p–p)	≈ 235mA
Frame Current (p–p)	≈ 35mA
*adjusted for correct electrical focus.	
Faceplate Temperature	20 to 45°C (60 to 113°F)
Blanking Voltage, peak–to–peak, Grid No. 1	50V

PERFORMANCE

Dark Current (without light bias)	≤ 3nA
Gamma of Transfer Characteristic (Gamma stretching circuitry is recommended)	0.95 ± 0.05
Spectral Response, max	500nm
cutoff	650nm
Limiting Resolution	≥ 750 TV Lines
Spurious Signal – refer to Amperex Spurious Signal spec publication	

Resolution:

	XQ1410 XQ1410L	XQ1410R	XQ1410G	XQ1410B
Highlight Signal Current I_S	300nA	150nA	300nA	150nA
Beam Current I_b	600nA	300nA	600nA	300nA
Modulation Depth (Uncompensated amplitude response at 400 TV Lines)	55%	50%	55%	60%

LAG (TYPICAL VALUES):

LOW KEY CONDITIONS (WITH LIGHT BIAS)

Typical effect of light bias on both build–up and decay lag under low key signal current and beam current settings are shown in figures 3 to 8. (See also note 8)

HIGH KEY CONDITIONS (WITH AND WITHOUT LIGHT BIAS)

	BUILD–UP LAG (Note 6)				DECAY LAG (Note 7)			
	I_s/I_b=150nA/300nA		I_s/I_b=300nA/600nA		I_s/I_b=150nA/300nA		I_s/I_b=300nA/600nA	
	50ms	200ms	50ms	200ms	50ms	200ms	50ms	200ms
XQ1410 XQ1410L XQ1410G	––	––	99	100	––	––	1.6	0.4
XQ1410R	98	100	––	––	2.5	0.5	––	–––
XQ1410B	96	100	––	––	4	2	––	––

SHADING OF LIGHT–BIAS INDUCED DARK CURRENT = 12.5% (See Note 9)

NOTES:

1a Variable Bias Lighting

The light bias lamp assembly supplied with each tube (P/N 56106) fits into the metal cylinder cemented to the pumping stem of the tube. The tube and the light bias assembly will properly fit into the standard 56021 socket.

The wires should be connected to a source supplying a maximum of 110mA at 5V. Considerations and recommendations for the choice of such a source, depending on the application, are supplied with each tube. The light bias lamp projects its light via a blue–green transmitting filter on the pumping stem where it is conducted to the target to cause a bias illumination. The desired amount of light bias can be obtained by adjusting the filament current of the small bulb.

1b Fixed Bias Lighting

A color coded lamp assembly is supplied with each tube together with instructions for fitting. It is fitted onto tube pins prior to the socket. With this arrangement the bias lamp and integral series resistor is automatically connected to heater pins and supply. The camera should be capable of supplying a total of 420 mA to heater plus bias lamp per tube.

2. Underscanning of the specified target area (12.8 mm x 17.1 mm), or failure of scanning, should be avoided since damage to the target may occur.

3. This rating is for short intervals only. During storage the tube must be covered (a plastic hood is provided for this purpose) and when the camera is idle the lens must be capped. If camera is in standby operation, the lens must be capped and the beams turned off.

4. The beam current, obtained by adjusting the control grid (grid No. 1) voltage, is set to 300nA for R and B tubes, 600nA for monochrome, L and G tubes. Note that this beam current is not the actual current available in the scanning beam, but is defined as the maximum amount of signal current that can be obtained with this beam.

5. The direction of the current through the focusing coil should be chosen such that a north–seeking pole will be repelled at the faceplate end of the coil.

6. Build–up Lag. After 10 seconds of complete darkness. Values and curves shown relating to build–up lag represent the typical percentages of the ultimate signal obtained as a function of time, after the illumination has been applied.

7. Decay Lag. After a minimum of 5 seconds of illumination on the target. Values and curves shown relating to decay lag represent the residual signal currents in percentages of the original signal current as a function of time, after the illumination has been removed.

8. a) For monochrome operation a light bias, corresponding to 5nA extra dark current is usually adequate for excellent speed of response.

   b) In a color camera the speeds of response of the tubes can be balanced by adjusting the amount of light bias per tube.

   In a three tube R, G, B camera for instance, it is recommended to first adjust the tubes to their normal highlight signal current and beam current settings and then point the camera at a dark scene comprising a metronome. The moving hand of the metronome carries a small white square.

   The illumination should be chosen such that the square produces a peak signal of approximately 50nA in the green chrominance channel. A maximum of 3nA artificial dark current shall then be induced in the green chrominance tube. Subsequently, light bias shall be applied to the tubes in the red and blue channels, until the lag of the three tubes is neutralized.

   A typical setting for correct speeds of response in a three tube R, G, B camera with a prism color splitter would be 2 to 3nA (R), 1 to 3nA (G) and 6 to 8nA (B).

9. Maximum deviation of the level of any of the four corners, i.e. 10% inwards in H and V direction from the level in picture center.

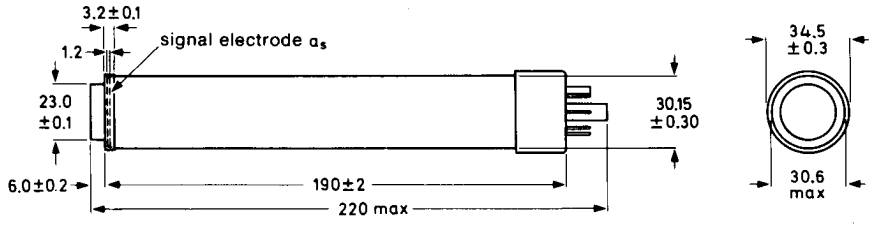
   With the settings suggested in note 8 black shading compensation in the camera video processing amplifier will not normally be required. Further improvement in lag can be obtained by applying still higher light bias levels.

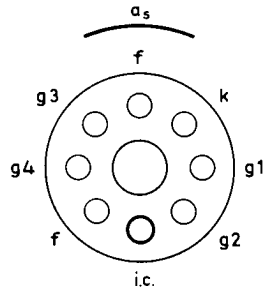
   It may then be necessary to use black shading compensation in the video processing amplifier.

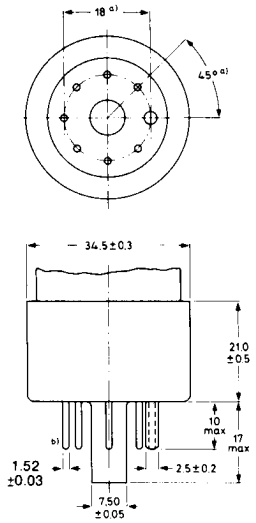
OUTLINE DRAWING

Dimensions in mm

mm	inch
0.03	0.001
0.05	0.002
0.1	0.003
0.15	0.005
0.2	0.007
0.30	0.011
0.5	0.019
1.2	0.047
1.52	0.06
2.0	0.078
2.5	0.098
3.2	0.125
6.0	0.236
7.50	0.295
10.0	0.393
17.0	0.669
18.0	0.708
21.0	0.826
23.0	0.905
30.6	1.204
30.15	1.187
34.5	1.358
190.0	7.480
220.0	8.661







a) The base passes a flat gauge with a center hole 9.00 ± 0.01 mm diameter and holes for passing the pins with the following diameters: 7 holes of 1.750 ± 0.005 mm and one hole of 3.000 ± 0.005 mm.
The holes may deviate max. 0.01 mm from their true geometrical position.
Thickness of gauge 7 mm.

b) The ends of the pins are tapered and/or rounded but not brought to a sharp point.

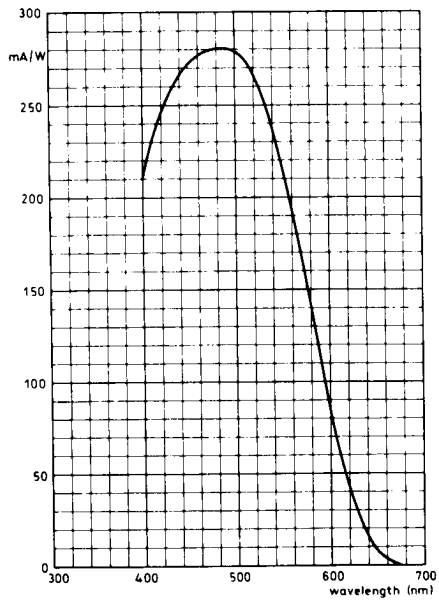


Fig. 1 Spectral response curve

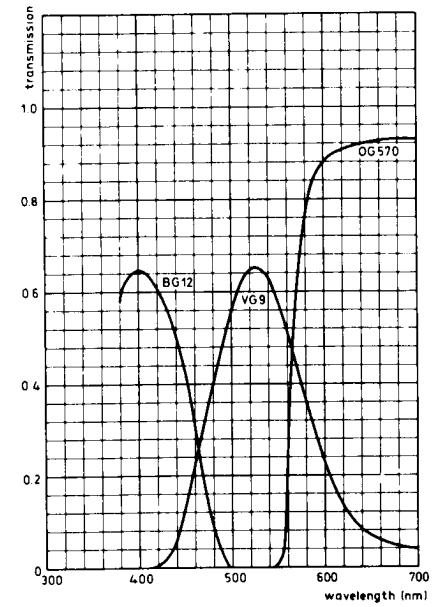


Fig. 2 Transmission of filters BG12, VG9, and OG570

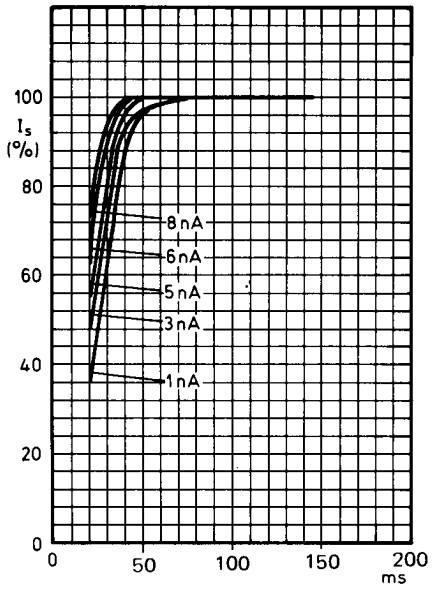


Fig. 3 XQ1410–R
I_s/I_b = 20/300nA

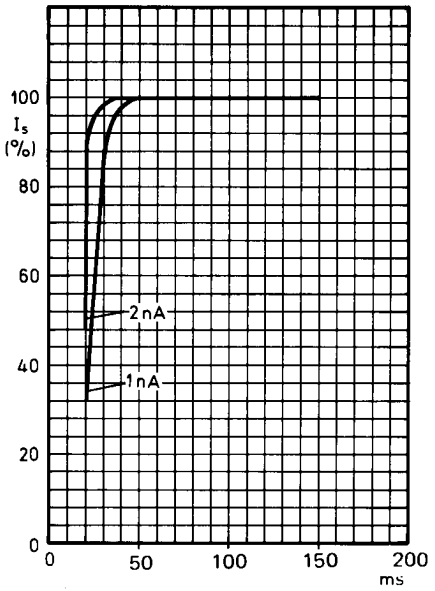


Fig. 4 XQ1410, XQ1410–L, XQ1410–G
I_s/I_b = 40/600nA

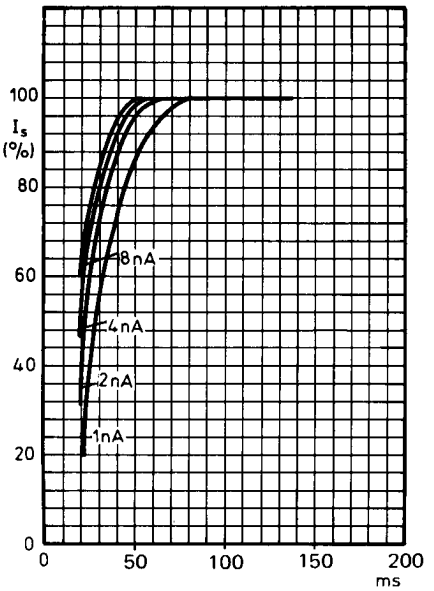


Fig. 5 XQ1410–B
I_s/I_b = 20/300nA

Fig. 3,4,5 – Build–up Lag, with light bias induced dark current

(I_s = Percentage of signal current attained)

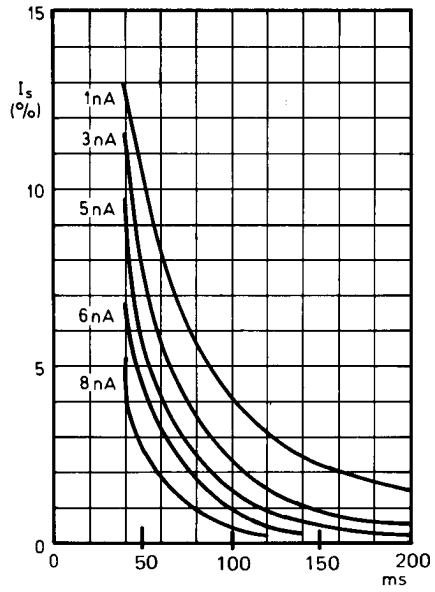


Fig. 6 XQ1410–R
I_s/I_b = 20/300nA

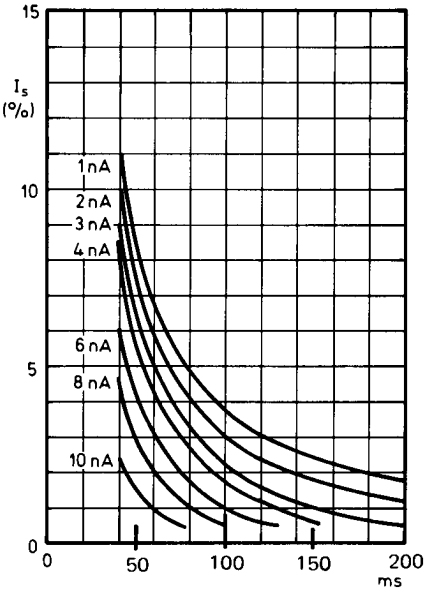


Fig. 7 XQ1410, XQ1410–L, XQ1410–G
I_s/I_b = 40/600nA

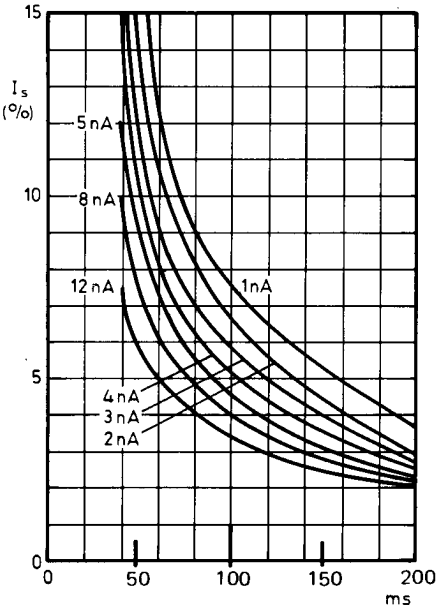


Fig. 8 XQ1410–B
I_s/I_b = 20/300nA

Fig. 6,7,8 – Decay Lag, with light bias induced dark current

(I_s = Percentage of signal current remaining)

Amperex Electronic Corporation
A NORTH AMERICAN PHILIPS COMPANY
SLATERSVILLE DIVISION
Providence Pike
Telephone: 401/762-3800
Slatersville, R.I. 02876
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TUBE TYPE
XQ1427 SERIES
PLUMBICON® CAMERA TUBE
®T.M. N.V. Philips of Holland

The Amperex XQ1427 described here is an improved version of the original 2/3" Plumbicon®camera tube introduced in 1974. It is totally interchangeable with the original tube, but has significant improvements in a number of parameters:

-Improved registration and geometry

-Improved flare (reduced by a factor of 3)

-Improved resolution (typical response 60% in green at 4MHz)

The tube retains the excellent sensitivity and lag performance that made the original XQ1427 instrumental in the success of Electronic News Gathering and small field production cameras. It has excellent highlight handling capabilities and burn-in resistance characteristics.

The XQ1427 is a 17.7mm (2/3 in.) diameter Plumbicon® television camera tube with high resolution lead-oxide photoconductive target, separate mesh construction, low heater power, magnetic deflection and magnetic focusing.

The XQ1427R, XQ1427G and XQ1427B types are intended for use in color cameras in Field Production, Broadcast Studio, Electronic News Gathering, educational and high quality industrial applications while the XQ1427 type is intended for monochrome cameras in these same applications.



GENERAL CHARACTERISTICS

MECHANICAL

Focusing Method		Magnetic
Deflection Method		Magnetic
Dimensions and basing		See outline drawing
Mounting Position		any
Weight		0.8 oz.
Base		JEDEC E7-1, with pumping stem
Accessories		
Socket		56049
Deflection and Focus Coil Assembly	monochrome	KV12 or equivalent
	color	AT1106 or AT1105

OPTICAL

Dimensions of Quality Area of Target (note 1)		6.6mm X 8.8 mm (.26" X .35")
Image Orientation		Horizontal scan parallel to plane of tube axis and gap between pins 1 and 7.
Faceplate		
Refractive index		n = 1.49
Refractive index of antihalation glass disc		n = 1.52
Sensitivity (note 2)		
at color temperature of illumination = 2856°K	XQ1427	375 μA/lm
	XQ1427R	115μA/lm
	XQ1427G	140μA/lm
	XQ1427B	42μA/lm

Amperex®

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ELECTRICAL

Heater	Indirect AC or DC, parallel or series supply
Heater Voltage	6.3V ± 5%
Heater Current	95mA
(When the tube is used in a series heater chain, the heater voltage must not exceed an RMS value of 9.5V when the supply is switched on). (To avoid registration errors in color cameras, stabilization of the heater voltage is recommended.)	
Capacitance, target to all other electrodes (This capacitance increases when tube is inserted in a coil assembly)	1.5pF to 3pF
Gun Cut-off Grid No. 1 voltage for picture cut-off at V_{g2} = 300V without blanking	-30V to -80V
Blanking Voltage, peak-to-peak	
on grid No. 1	50V ± 10V
on cathode	25V
Grid No. 2 Current at normally required beam currents	0.5mA max.

MAXIMUM RATINGS

(All voltages are referred to the cathode, unless otherwise stated)

Signal Electrode Voltage (note 3)	50V
Grid No. 4 Voltage	1000V
Grid No. 3 Voltage	750V
Voltage between Grid No. 4 and Grid No. 3	400V
Grid No. 2 Voltage	350V
Grid No. 1 Voltage, positive	0V
negative	200V
Heater to Cathode Voltage, peak, positive	125V
peak, negative	50V
Ambient and Faceplate Temperature (storage and operation)	-30 to + 50°C (-22 to + 122°F)*
Faceplate Illumination (note 4)	500 lx (46.5 f.c.)

At all times, $V_{g4} \geq V_{g3} \geq V_{g2}$

(Allow a minimum of one minute cathode heating time before drawing cathode current.)

*This tube can withstand short excursions to 70°C (160°F) without any damage or irreversible degradation in performance.

TYPICAL OPERATING CONDITIONS AND PERFORMANCE

TYPICAL OPERATING CONDITIONS

(using coil unit AT1105)

Signal Electrode Voltage	45V
Grid No. 4 Voltage (note 5)	750V
Grid No. 3 Voltage (note 5)	475V
Grid No. 2 Voltage	300V
Cathode Voltage	0V
Beam Current	see note 6
Focusing and Deflection Coil Current	
Color coil assembly AT1105	
Focus Current	40mA
Line Current (P-P)	320mA
Frame Current (P-P)	120mA
Alignment Flux Density	0 - 2.5 Gs
Faceplate Temperature	20 to 45°C (68 to 113°F)
Geometric Distortion (see note 9)	< 1%
Blanking Voltage, peak-to-peak, grid No. 1	50V

PERFORMANCE

Dark Current	$\leq$ 1.5nA
Gamma of Transfer Characteristic	0.95 ± 0.05
(Gamma stretching circuitry is recommended)	
Spectral Response, max	≈ 500nm
cut-off, XQ1427, G, B	≈ 650 to 850nm
XQ1427R	≈ 850nm
Limiting Resolution	$\geq$ 700 TV Lines

RESOLUTION:

	XQ1427	XQ1427R	XQ1427G	XQ1427B
HIGHLIGHT SIGNAL CURRENT I_S	150nA	75nA	150nA	75nA
BEAM CURRENT I_b	300nA	150nA	300nA	150nA
MODULATION DEPTH AT 320 TV LINES	60%	55%	60%	65%

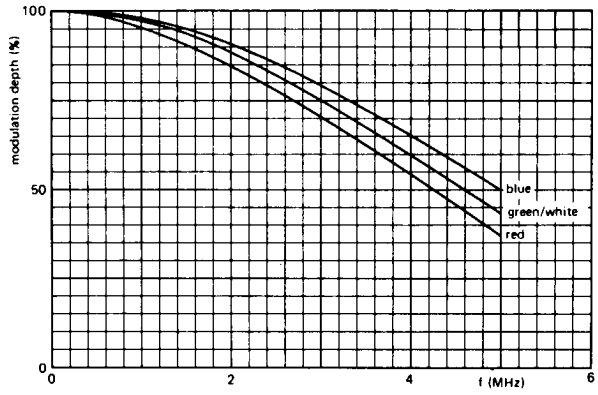


Fig. 1 Modulation Transfer Characteristics

Spurious Signals (Blemishes) - Refer to the Amperex Spurious Signal Specification for Broadcast Quality Plumbicon® TV Camera Tubes.

LAG (TYPICAL VALUES):

LOW KEY CONDITIONS (Zero Bias Light)

	BUILD-UP LAG (NOTE 7)				DECAY LAG (NOTE 8)			
	I_S/I_b =50nA/300nA		I_S/I_b =50nA/150nA		I_S/I_b =50nA/300nA		I_S/I_b =50nA/150nA	
	50ms	200ms	50ms	200ms	50ms	200ms	50ms	200ms
XQ1427	95%	≈100%	–	–	4%	2%	–	–
XQ1427G	95%	≈100%	–	–	4%	2%	–	–
XQ1427R	–	–	95%	≈100%	–	–	3.5%	1%
XQ1427B	–	–	95%	≈100%	–	–	4%	1.5%

HIGH KEY CONDITIONS (Zero Bias Light)

	BUILD-UP LAG (NOTE 7)				DECAY LAG (NOTE 8)			
	I_S/I_b = 150nA/300nA		I_S/I_b = 75nA/150nA		I_S/I_b = 150nA/300nA		I_S/I_b = 75nA/150nA	
	50ms	200ms	50ms	200ms	50ms	200ms	50ms	200ms
XQ1427	96%	100%	–	–	< 2%	1%	–	–
XQ1427G	96%	100%	–	–	< 2%	1%	–	–
XQ1427R	–	–	96%	100%	–	–	< 2%	1%
XQ1427B	–	–	96%	100%	–	–	< 2%	1%

XQ1427

Decay Lag: (Low Key Conditions, 50nA I_s)

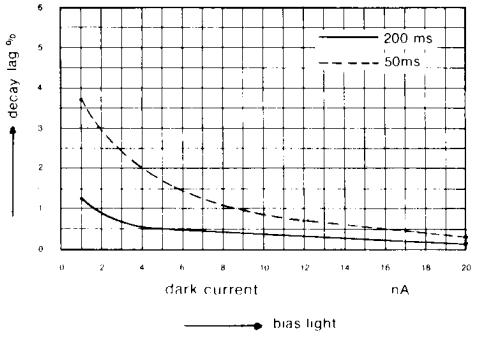


Fig. 2 XQ 1427 R

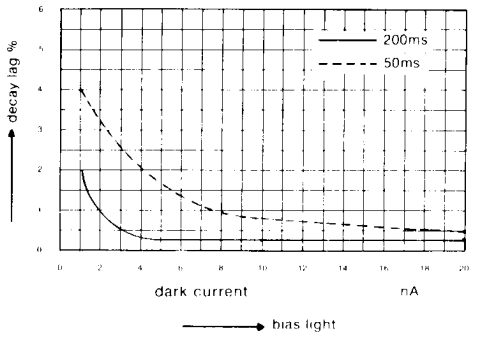


Fig.3 XQ 1427 G

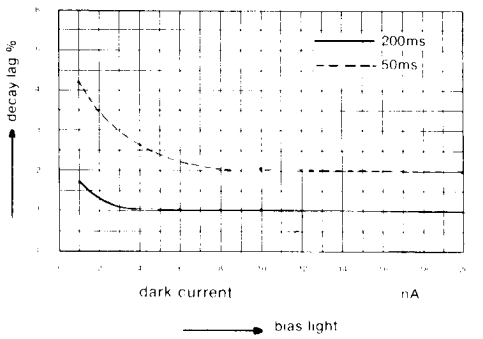


Fig. 4 XQ 1427 B

Fig. 2, 3, 4 Variation of Decay Lag with Bias Light

Build-Up Lag:

The 50 ms Build-Up Lag is essentially 98-100% with any bias light induced dark current above 4 nA. (It is recommended that a Schott KG 3 or equivalent filter be inserted in Bias Light Optics)

NOTES:

1. Underscanning of the specified target area (6.6mm X 8.8mm), or failure of scanning, should be avoided since damage to the target may occur.

2. All measurements are made with an infrared reflecting filter, Balzers Calflex B1/K1, interposed between light source and the target.

   The illumination level is approximately 10.5 lx (.97f.c.) when this filter is removed. For chrominance tubes the appropriate filters are inserted.

   Filters used:

R	Schott OG570	3mm thickness
G	Schott VG9	1mm thickness
B	Schott BG12	3mm thickness

3. Plumbicon tubes do not permit automatic sensitivity control by means of regulation of the signal electrode voltage. Therefore, adequate control is to be achieved by other means such as iris control and neutral density filters.

   If the tube is used in cameras originally designed for vidicon tubes, the automatic sensitivity control circuitry should be made inoperative and the signal electrode voltage set to 45V.

4. This rating is for short intervals only. During storage the tube must be covered (a plastic hood is provided for this purpose) and when the camera is idle the lens must be capped. If camera is in standby operation, the lens must be capped and the beams turned off.

5. The optimum voltage ratio V_{g4}/V_{g3} to minimize beam landing errors (preferably $< 1V$) depends on the type of coil unit used. In the KV12 unit a ratio of 1.5 to 1.6 is recommended, whereas the coil unit AT1105 will require a ratio of 1.6 to 1.7.

6. The beam current, obtained by adjusting the control grid (grid No.1) voltage, is set to 150nA for R and B tubes, 300nA for monochrome and G tubes. Note that this beam current is not the actual current available in the scanning beam, but is defined as the maximum amount of signal current that can be obtained with this beam.

7. Build-up Lag. After 10 seconds of complete darkness. Values shown relating to build-up lag represent the typical percentages of the ultimate signal obtained as a function of time, after the illumination has been applied.

8. Decay Lag. After a minimum of 5 seconds. Values shown relating to decay lag represent the residual signal currents in percentages of the original signal current as a function of time, after the illumination has been removed.

9. At a distance from the picture center equal to 0.70 times the picture diagonal.

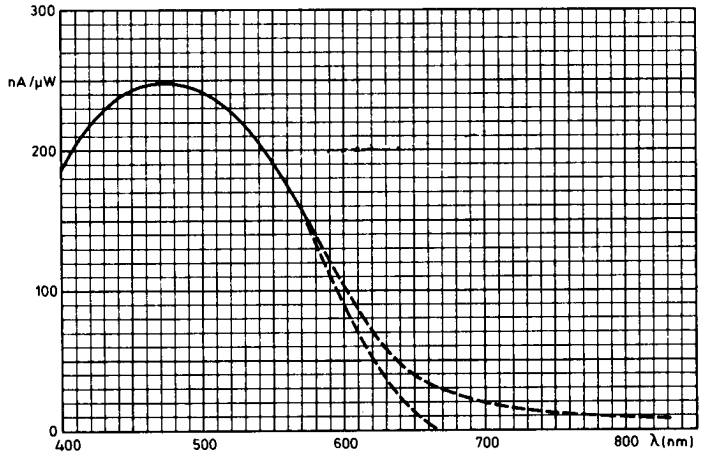


Fig. 5 Typical spectral response curve XQ1427, G, B

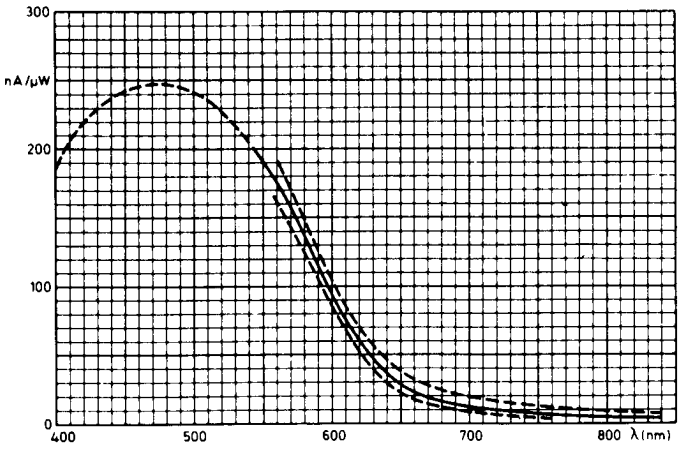


Fig. 6 Typical spectral response curve XQ1427 R

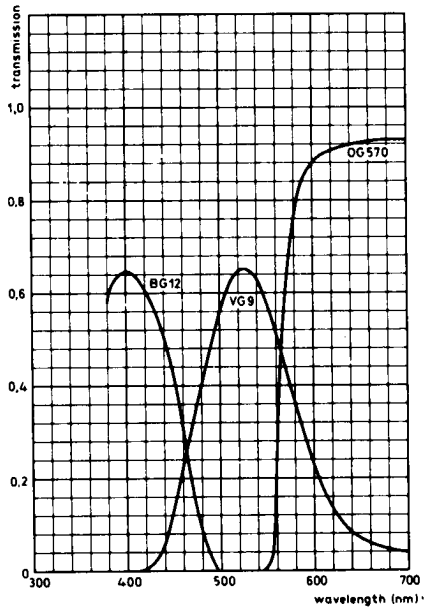


Fig. 7 Transmission of filters BG12, VG9, and OG570

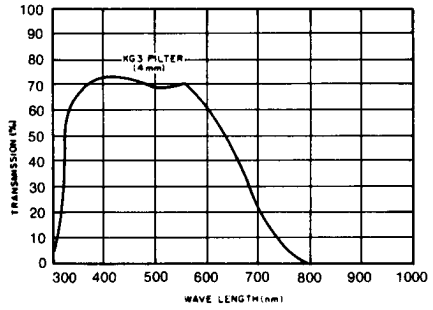


Fig. 8 KG 3 Filter Characteristics

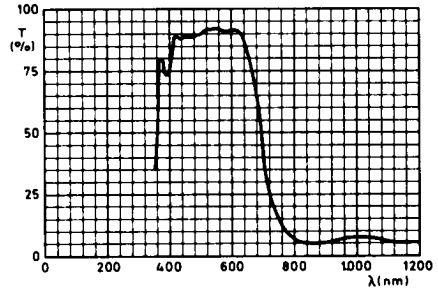
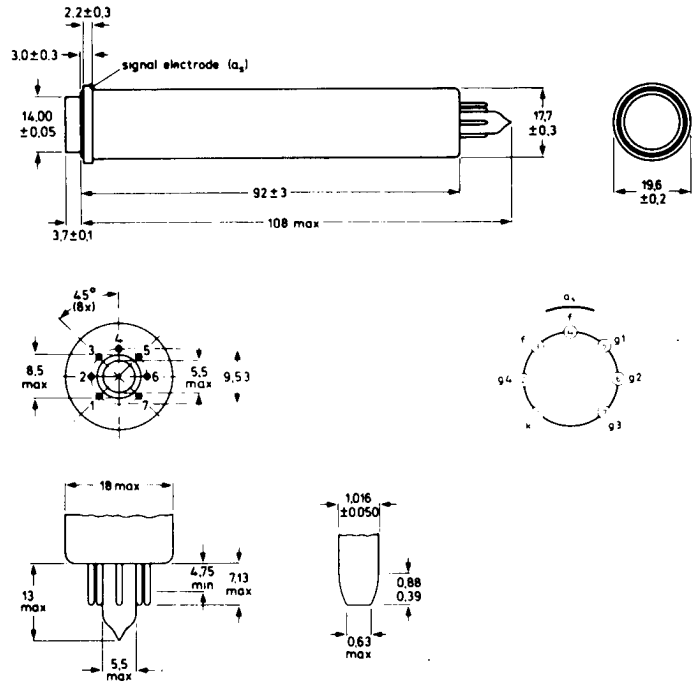


Fig. 9 Typical transmission curve of heat reflecting interference filter CALFLEX B1/K1

mm	INCH
0.050	0.001
0.2	0.007
0.3	0.011
0.39	0.015
0.63	0.024
0.88	0.034
1.0	0.039
1.016	0.04
2.3	0.090
3.0	0.118
4.75	0.187
5.5	0.216
7.13	0.280
8.5	0.334
9.53	0.375
13.0	0.511
17.7	0.696
18.0	0.708
19.6	0.771
92.0	3.622
108.0	4.252



OUTLINE DRAWING

Dimensions in mm

AMPEREX TRANSMITTING TUBE ZB-120

Low Distortion Zero-Bias Class B Amplifier and Modulator, High Efficiency R.F. Frequency Multiplying Power Amplifier, Conventional R.F. Power Amplifier



The ZB-120 is an exclusive Amperex development. In common with other tubes of original Amperex design it is a low voltage high current type and possesses a high ratio of transconductance to interelectrode capacitance. Although it approaches nearer the ideal in a zero-bias class B tube it is also a highly efficient performer in many other classes of service.

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

Audio Frequency Power Amplifier or Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes			
A.C. Filament Voltage	..	10	10	10	10
D.C. Plate Voltage	1500	750	1000	1250	1500
D.C. Grid Voltage	..	0	0	0	−9
Load Resistance (per tube) (ohms)	..	1200	1725	2250	2800
Effective Load Resistance (plate to plate) (ohms)	..	4800	6900	9000	11200
Zero Signal Plate Current (ma.)	..	50	70	95	60
Peak A.F. Grid to Grid Voltage	..	190	190	180	196
Max. Signal D.C. Plate Current (ma.)	160	320	310	300	296
Max. Allowable Average Plate Dissipation (watts)	75	..	..	..	..
Max. Signal Driving Power (Approx.) (watts)	..	5	5	4	5
Max. Signal Power Output (watts)	..	150	200	245	300

(Zero-Bias) R.F. Power Amplifier—Class B Telegraphy

(Key down conditions per tube without modulation)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10.0	10.0
D.C. Plate Voltage	1250	1000	1250
D.C. Grid Voltage	..	0	0
Peak R.F. Grid Voltage	..	95	90
D.C. Plate Current (ma.)	160	155	150
D.C. Grid Current (ma.)	40	25	21
Plate Input (watts)	200	155	187
Plate Dissipation (watts)	75	55	67
Driving Power (watts)	..	1.5	1.2
Plate Power Output (watts)	..	100	120
Frequency Limit for Above Operation (mc.)	30	..	..

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	..	10
D.C. Plate Voltage	1250	1250
D.C. Grid Voltage	..	0
Peak R.F. Grid Voltage	..	55
D.C. Plate Current (ma.)	100	95
D.C. Grid Current (ma.)	..	8
Plate Input (watts)	120	118
Plate Dissipation (watts)	75	73
Grid Driving Power at Modulation Peak (watts)	..	1.5
Plate Power Output (watts)	..	45
Frequency Limit for Above Operation (mc.)	30	..

GENERAL CHARACTERISTICS

Filament:	
Voltage	10-10.5 volts A.C. or D.C.
Current	2.5 amperes
Amplification Factor	90
Grid to Plate Transconductance at 120 ma.	5000 micromhos
Direct Interelectrode Capacitances:	
Grid to Plate	5.2 $\mu\mu$f
Grid to Filament	5.3 $\mu\mu$f
Plate to Filament	3.2 $\mu\mu$f

*R.F. Power Amplifier—Class C—Telegraphy

(Key down conditions per tube without modulation)

	Maximum Rating per Tube	Typical Operation One Tube			
A.C. Filament Voltage	..	10.5	10.0	10.0	10.5
D.C. Plate Voltage	1250	750	1000	1250	1250
D.C. Grid Voltage	−400	−80	−90	−90	−135
or Grid Resistor (ohms)	..	2750	4000	5000	6000
Peak R.F. Grid Voltage	..	200	205	200	260
D.C. Plate Current (ma.)	160	160	150	150	160
Plate Input (watts)	200	120	150	187	190
D.C. Grid Current (ma.)	40	29	23	18	23
Plate Dissipation (watts)	75	35	40	47	55
Driving Power (watts)	..	5.2	4.2	3	5.5
Plate Power Output (watts)	..	85	110	130	145
Frequency Limit for Above Operation (mc.)	30	..	..	..	..

*The ZB-120 is not recommended for use as a self-excited oscillator, if the service involves variable loading of the tube.

Plate Modulated R.F. Power Amplifier Class C—Telephony

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube	
A.C. Filament Voltage	..	10.5	10.5
D.C. Plate Voltage	1000	750	1000
Grid Resistor* (ohms)	..	4500	7000
D.C. Grid Voltage	−400	..	..
Peak R.F. Grid Voltage	..	200	250
D.C. Plate Current (ma.)	120	120	120
Plate Input (watts)	120	90	120
D.C. Grid Current (ma.)	40	22	21
Plate Dissipation (watts)	50	35	25
Driving Power (watts)	..	4	5
Plate Power Output (watts)	..	65	95
Frequency Limit for Above Operation (mc.)	30	..	..

*For minimum modulation distortion, the required grid bias should be obtained with grid resistors of the specified values.

AMPEREX

ZB-120

Grid Modulated R.F. Power Amplifier Class C

(Carrier conditions for use with a maximum modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	..	10
D.C. Plate Voltage	1250	1250
D.C. Grid Voltage From Fixed Bias Supply	—400	—80
Peak R.F. Grid Voltage	..	150
Peak A.F. Grid Voltage	..	70
D.C. Plate Current (ma.)	100	90
Plate Input (watts)	120	112
D.C. Grid Current (Approx.) (ma.)	..	7
Plate Dissipation (watts)	75	70
Grid Driving Power at Modulation Peak (watts)	..	1.6
Plate Power Output (watts)	..	42
Frequency Limit for Above Operation (mc.)	30	..

R.F. Frequency Doubling Power Amplifier Telegraphy

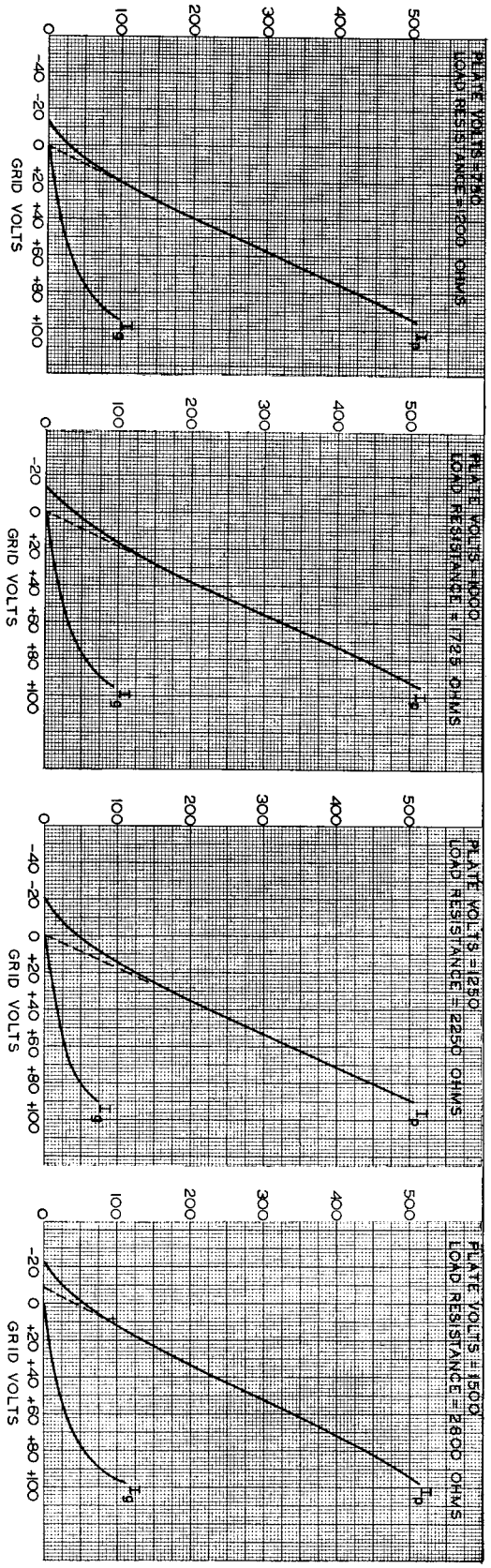
	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	..	10.5
D.C. Plate Voltage	1250	1250
D.C. Grid Voltage	—400	—300
Peak R.F. Grid Voltage	500	430
D.C. Plate Current (ma.)	140	138
Plate Input (watts)	175	172
D.C. Grid Current (ma.)	30	16
Plate Dissipation (watts)	75	33
Driving Power (watts)	..	7
Plate Power Output (at Doubled Frequency) (watts)	..	105
Driving Frequency Limit for Above Operation (mc.)	15	..

Grid Modulated R.F. Frequency Doubling Power Amplifier—Telephony

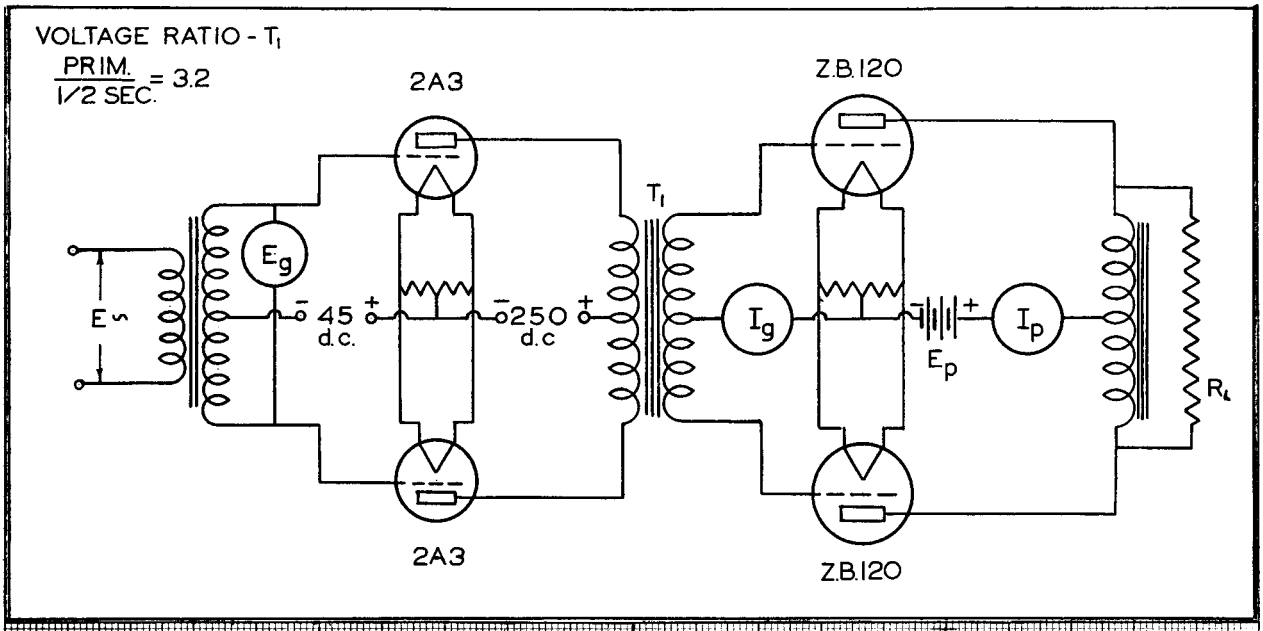
(Carrier conditions for use with a maximum modulation factor of .8)

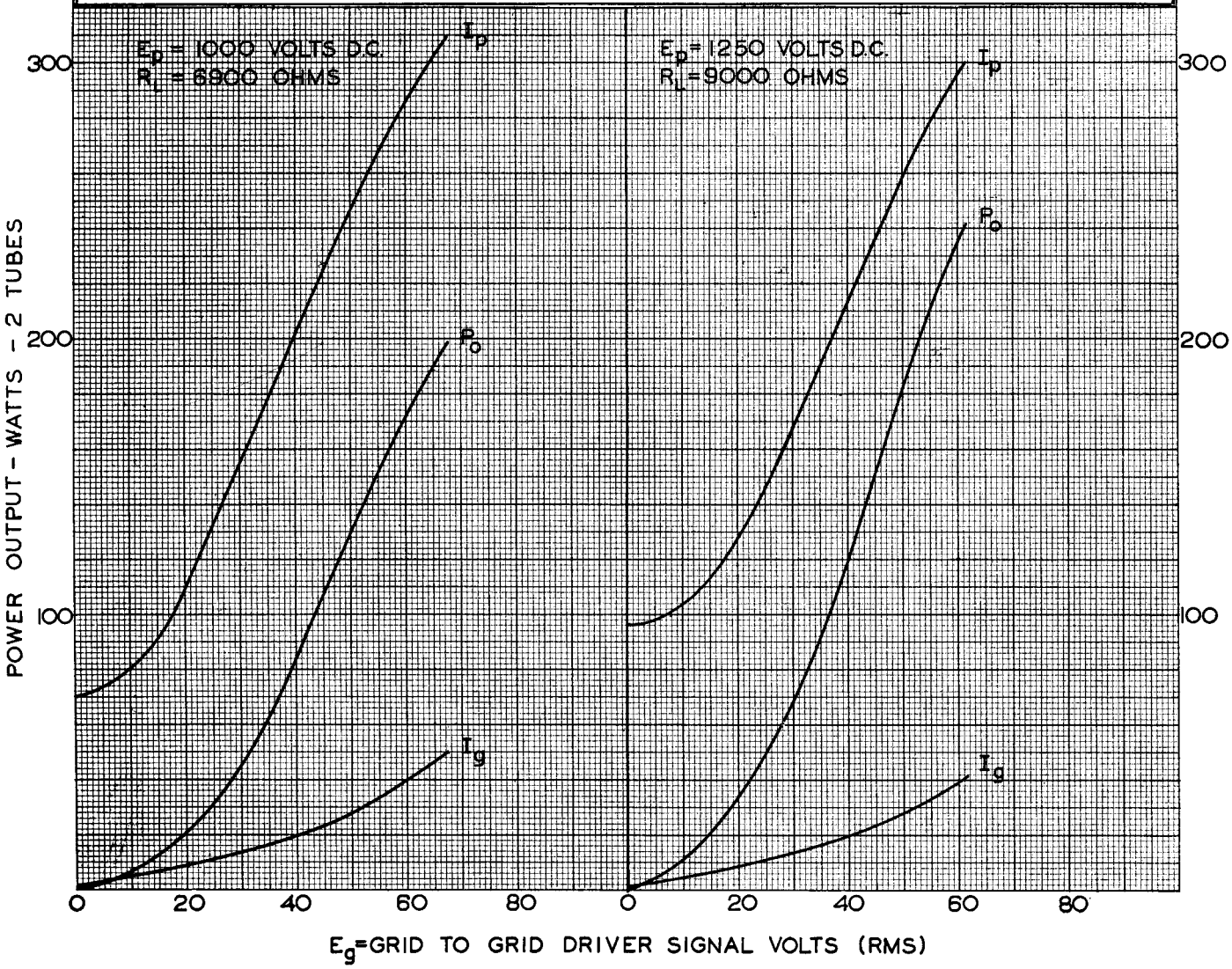
	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	..	10.5
D.C. Plate Voltage	1250	1250
D.C. Grid Voltage (from Fixed Bias Supply)	—400	—330
Peak R.F. Grid Voltage	..	430
Peak A.F. Grid Voltage	..	80
D.C. Plate Current (ma.)	100	95
Plate Input (watts)	120	118
D.C. Grid Current (ma.)	..	6.5
Plate Dissipation (watts)	75	73
Grid Driving Power at Modulation Peak (watts)	..	7
Plate Power Output (watts)	..	45
Driving Frequency Limit for Above Operation (mc.)	15	..

Z.B. 120 TRANSFER CHARACTERISTICS - WITH LOAD

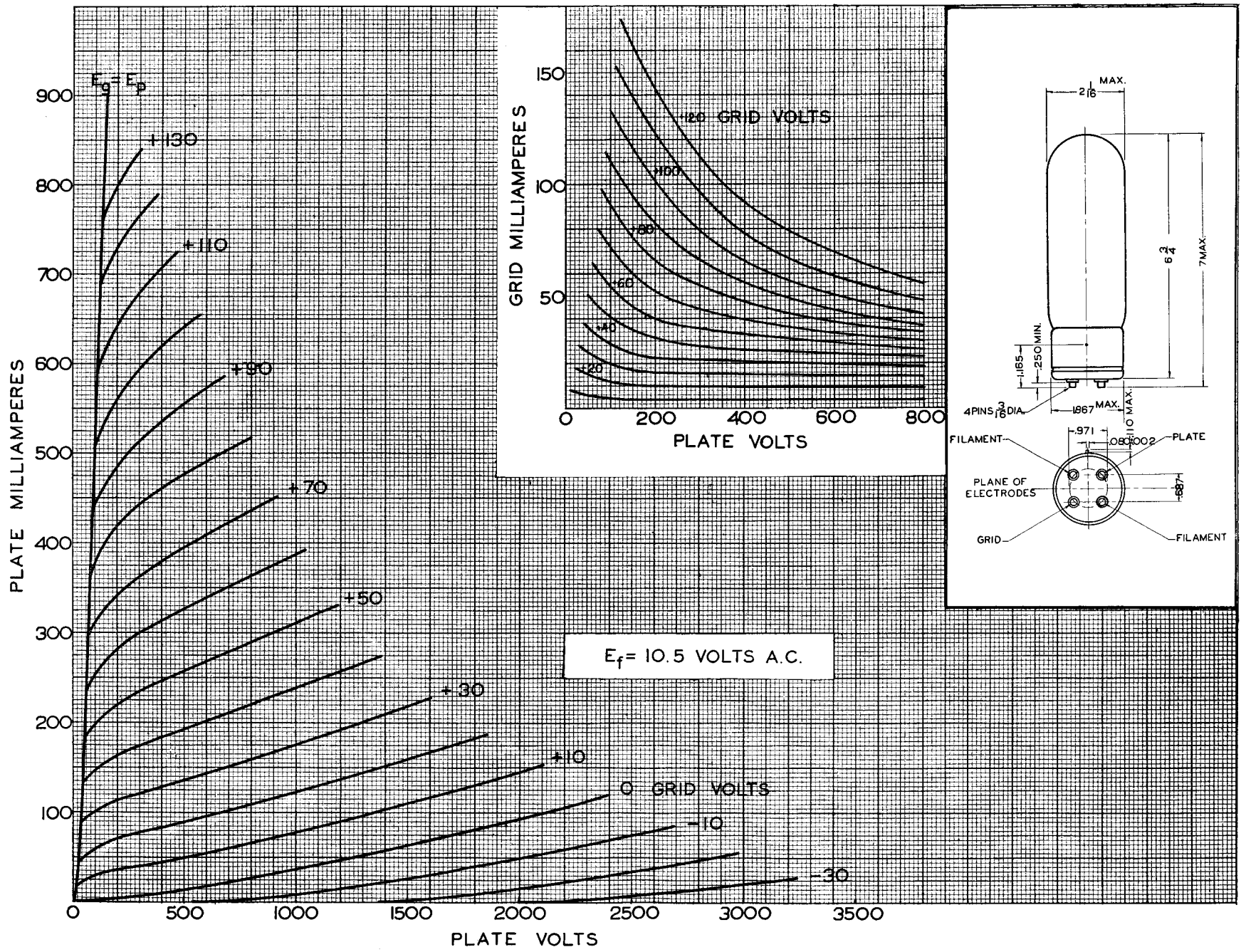


Z.B. 120 OPERATION CHARACTERISTICS–CLASS B AUDIO



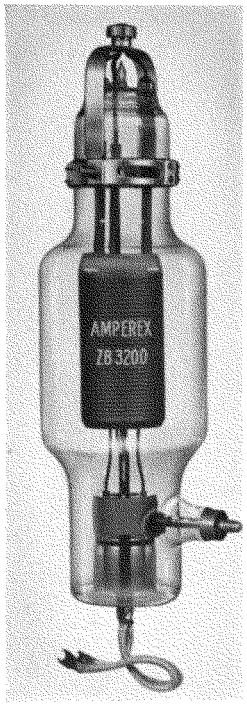


AMPEREX Z.B. 120



AMPEREX TRANSMITTING TUBE ZB-3200

An all glass radiation plus forced air cooled high-power triode especially suitable for use as a zero bias Class B modulator, Class B-RF Power Amplifier, and Class C. Telegraphy RF Power Amplifier.



MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier and Modulator—Class B

	Maximum Rating per Tube	Typical Operation Two Tubes		
		**	**	
A.C. Filament Voltage	..	20.5	20.5	21.0
D.C. Plate Voltage	10000	5000	6000	8000
D.C. Grid Voltage	..	0	0	0
Load Resistance (per tube) (ohms)	..	1750	2250	3000
Effective Load Resistance (plate to plate) (ohms)	..	7000	9000	12000
Zero-Signal Plate Current (ma.)	..	160	200	320
Peak A.F. Grid to Grid Voltage	..	950	800	1080
Max. Signal Plate Current (amps)	1.5	1.34	1.17	1.5
Max. Signal Plate Input (kw.)	6	6.7	7.0	12
Plate Dissipation (per tube) (kw.)*	2.0	1.45	1.6	2
Minimum Grid Input Resistance (ohms)	..	600	1200	400
Max. Signal Driving Power (watts)	..	60	20	110
Max. Signal Power Output (watts)	..	3800	3800	8000
Recommended Driver (tube type)	..	4-845	2-845	2-849A

*Under maximum-signal conditions, plate dissipation should not exceed 2.5 kilowatts when averaged over any audio frequency cycle of sine-wave form.

**Conditions suitable for use as a modulator for a plate modulated 5 KW Broadcast Transmitter.

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	..	21.5
D.C. Plate Voltage	10000	6000
D.C. Grid Voltage	..	0
Plate Load Resistance (ohms)	..	3000
Peak R.F. Grid Voltage	..	350
D.C. Plate Current (ma.)	750	525
Plate Input (kw.)	3.2	3.15
Plate Dissipation (kw.)	2.2	2.10
D.C. Grid Current (ma.)	..	5
Driving Power at Peak Modulation (watts)	..	60

GENERAL CHARACTERISTICS

Filament: Tungsten	
Voltage	**21 to 22**
Current (amps)	**40.5**
Amplification Factor	**85**
Grid to Plate Transconductance @ plate current of 1 ampere	**5000 micromhos**
Direct Interelectrode Capacitances (Approx.):	
Grid to Plate	**10 $\mu\mu$f**
Grid to Filament	**15 $\mu\mu$f**
Plate to Filament	**3 $\mu\mu$f**
Dimensions:	
Maximum Overall Length	**23″**
Bulb Diameter	**6″**

R.F. Power Amplifier—Class B—Telephony

(Carrier conditions for use with modulation factor of 1.0)

(Continued)

	Maximum Rating per Tube	Typical Operation One Tube
Plate Power Output (kw.)	..	1.05
Frequency Limit for above rating (mc.)	10	..
F.C.C. Rating for Use in Final Stage of Broadcast Transmitters (kw.)	1.0	1.0

R.F. Power Amplifier or Oscillator—Class C

Unmodulated, Negatively Modulated or Frequency Modulated Services

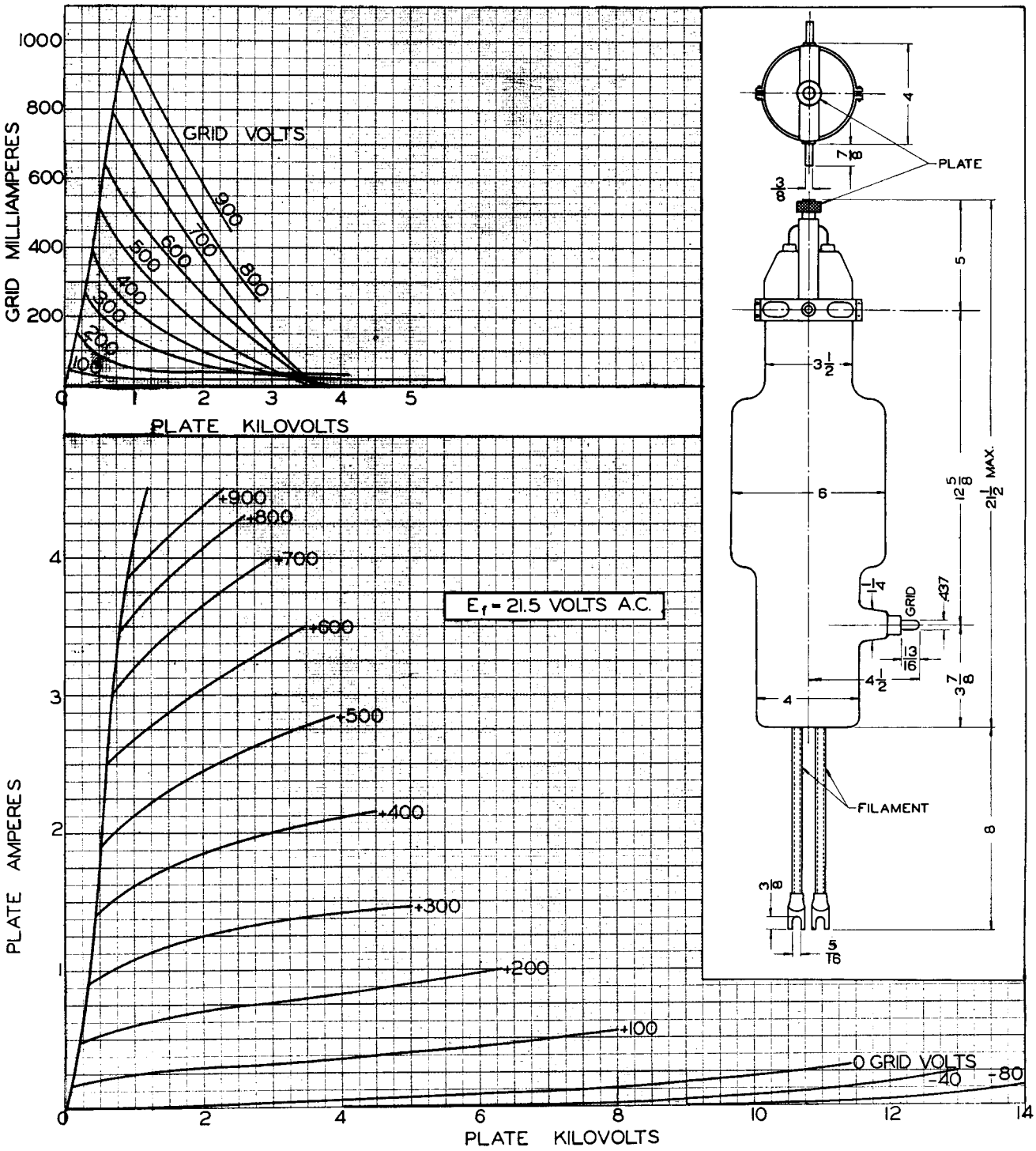
	Maximum Rating per Tube	Typical Operation One Tube
A.C. Filament Voltage	..	21.0
D.C. Plate Voltage	10000	8000
D.C. Grid Voltage	—2000	—400
Plate Load Resistance (ohms)	..	4400
Peak R.F. Grid Voltage	..	1200
D.C. Plate Current (amps)	1.25	.97
D.C. Grid Current (ma.)	200	150
Plate Power Input (kw.)	8	7.8
Plate Dissipation (kw.)	2.5	1.8
Plate Power Output (kw.)	..	6.0
Driving Power (watts)	..	175
Frequency Limit for Above Operation (mc.)	10	20

COOLING: Though this tube may in emergencies, and under conditions of low anode dissipation be operated without forced air cooling, an air flow of 200 to 400 cubic feet a minute broadly directed at the bottom of the tube and flowing upward around the bulb will assure optimum life.

AMPEREX

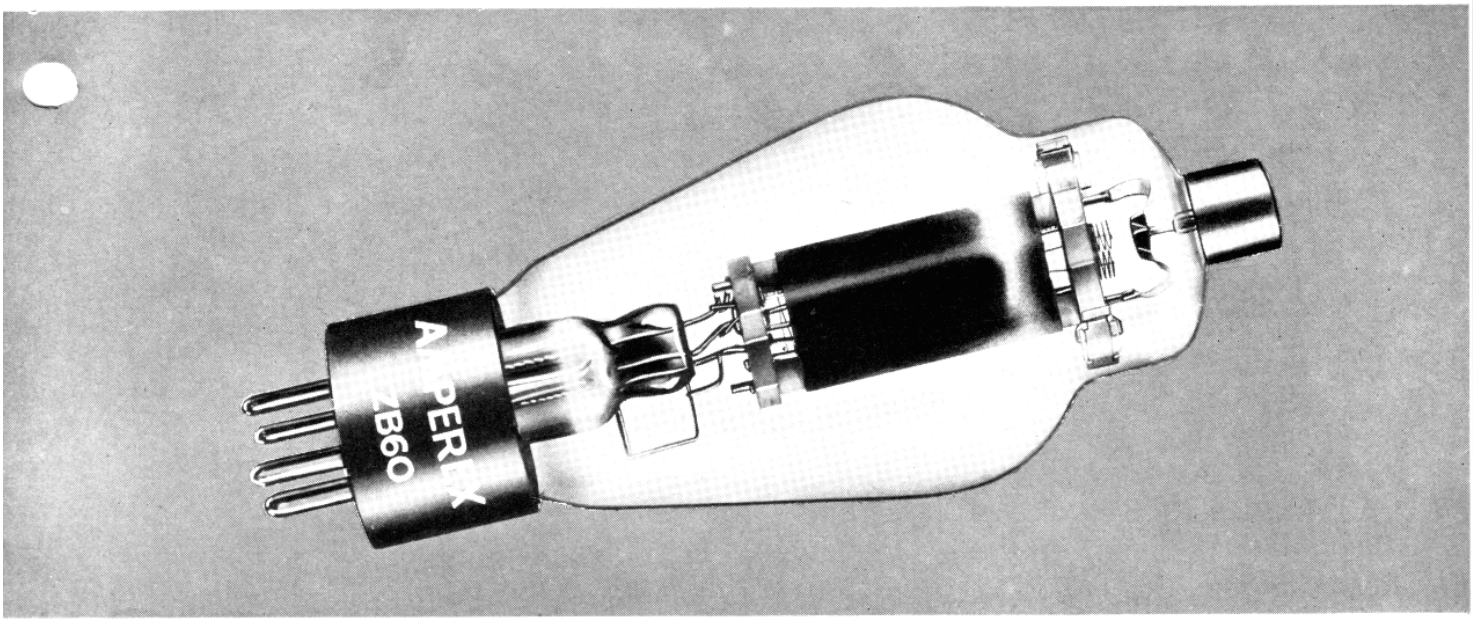
ZB-3200

ZB-3200 — AMPEREX TRANSMITTING TUBE



ZB-3200

AMPEREX TRANSMITTING TUBE ZB-60



Low Distortion Zero-Bias Class B Amplifier and Modulator
Conventional R.F. Power Amplifier

The ZB-60 is an exclusive Amperex development. In common with other tubes of original Amperex design it is a low voltage high current type and possesses a high ratio of transconductance to interelectrode capacitance. Although it approaches nearer the ideal in a zero-bias class B tube it is also a highly efficient performer in many other classes of service.

GENERAL CHARACTERISTICS

RADIATION COOLED TRIODE

ELECTRICAL

Filament	Thoriated Tungsten
Voltage	10.0 volts
Current	2.5 amperes
Amplification Factor	80
Grid to Plate Transconductance at Plate Current of 150 ma.	6000 micromhos
Direct Interelectrode Capacitances	
Grid to Plate	5.8 $\mu\mu$f
Grid to Filament	6.1 $\mu\mu$f
Plate to Filament	1.85 $\mu\mu$f

MECHANICAL

Maximum Overall Dimensions	
Length	$6\frac{13}{16}$ inches
Diameter	$2\frac{7}{16}$ inches
Base	Standard Medium 4 Pin Bayonet
Mounting Position—Vertical	Base down
Horizontal	Plane of electrodes vertical
Net Weight (approx.)	3 ounces
Shipping Weight (approx.) (one tube)	$1\frac{3}{4}$ pounds

ZB-60—AMPEREX TRANSMITTING TUBE

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

A.F. Power Amplifier or Modulator—Class B

Unless otherwise specified, values given are for 2 tubes.

	Typical Operation:				Maximum Rating per Tube
D.C. Plate Voltage	750	1000	1250	1500	1600
D.C. Grid Voltage[2]	0	0	0	—9	....
Load Resistance (ohms) (per tube)	1200	1725	2250	2800	....
Effective Load Resistance (ohms) (pl-pl)	4800	6900	9000	11200	....
Zero Sig. D.C. Plate Current (ma)	30	50	70	30	....
Max. Sig. D.C. Plate Current (ma)[1]	310	310	305	305	160
Peak A.F. Grid—Grid Voltage	190	190	190	208	....
Plate Dissipation (watts)[1]	....	....	....	....	75
Max. Sig. Driving Power (watts) (approx.)	11.5	11.5	11.5	12.5	....
Max. Sig. Power Output (watts)	145	200	255	320	....

(Zero-Bias) R.F. Power Amplifier Class B—Telegraphy

Key-down conditions per tube without modulation[3]

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	30	100

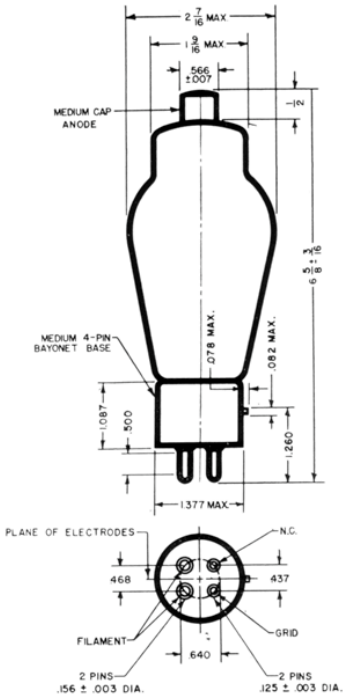
	Typical Operation:		Maximum Rating per Tube
D.C. Plate Voltage	1250	1500	1600
D.C. Grid Voltage[2]	0	0	....
Peak R.F. Grid Voltage	95	85	....
D.C. Plate Current (ma)	160	152	160
D.C. Grid Current (ma) (approx.)	30	30	40
Plate Input (watts)	200	230	255
Plate Dissipation (watts)	65	70	75
Driving Power (watts) (approx.)	3.0	2.5	....
Plate Power Output (watts) (approx.)	135	160	....

R.F. Power Amplifier—Class B—Telephony

Carrier conditions per tube for use with a maximum modulated factor of 1.0.

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	30	100

	Typical Operation:	Maximum Rating per Tube
D.C. Plate Voltage	1500	1600
D.C. Grid Voltage[2]	0	....
Peak R.F. Grid Voltage	30	....
D.C. Plate Current (ma)	64	100
D.C. Grid Current (ma) (approx.)	7	....
Plate Input (watts)	96	150
Plate Dissipation (watts)	61	75
Driving Power (watts)[4] (approx.)	1.5	....
Plate Power Output (watts)	35	....



R.F. Power Amplifier—Class C—Telegraphy

Key-down condition per tube without modulation[3]

Plate Volts & Input Max. %	100	50
For Frequencies Indicated (mc)	30	100

	Typical Operation:				Maximum Rating per Tube
D.C. Plate Voltage	750	1000	1250	1500	1600
D.C. Grid Voltage[2]	—80	—85	—90	—95	—400
Peak R.F. Grid Voltage	200	205	210	215	....
D.C. Plate Current (ma)	160	160	160	158	160
D.C. Grid Current (ma) (approx.)	35	34	32	31	40
Plate Input (watts)	120	160	200	237	255
Plate Dissipation (watts)	35	40	45	47	75
Driving Power (watts) (approx.)	6.5	6.5	6.5	6.0	....
Plate Power Output (watts) (approx.)	85	120	155	190	....

NOTES:

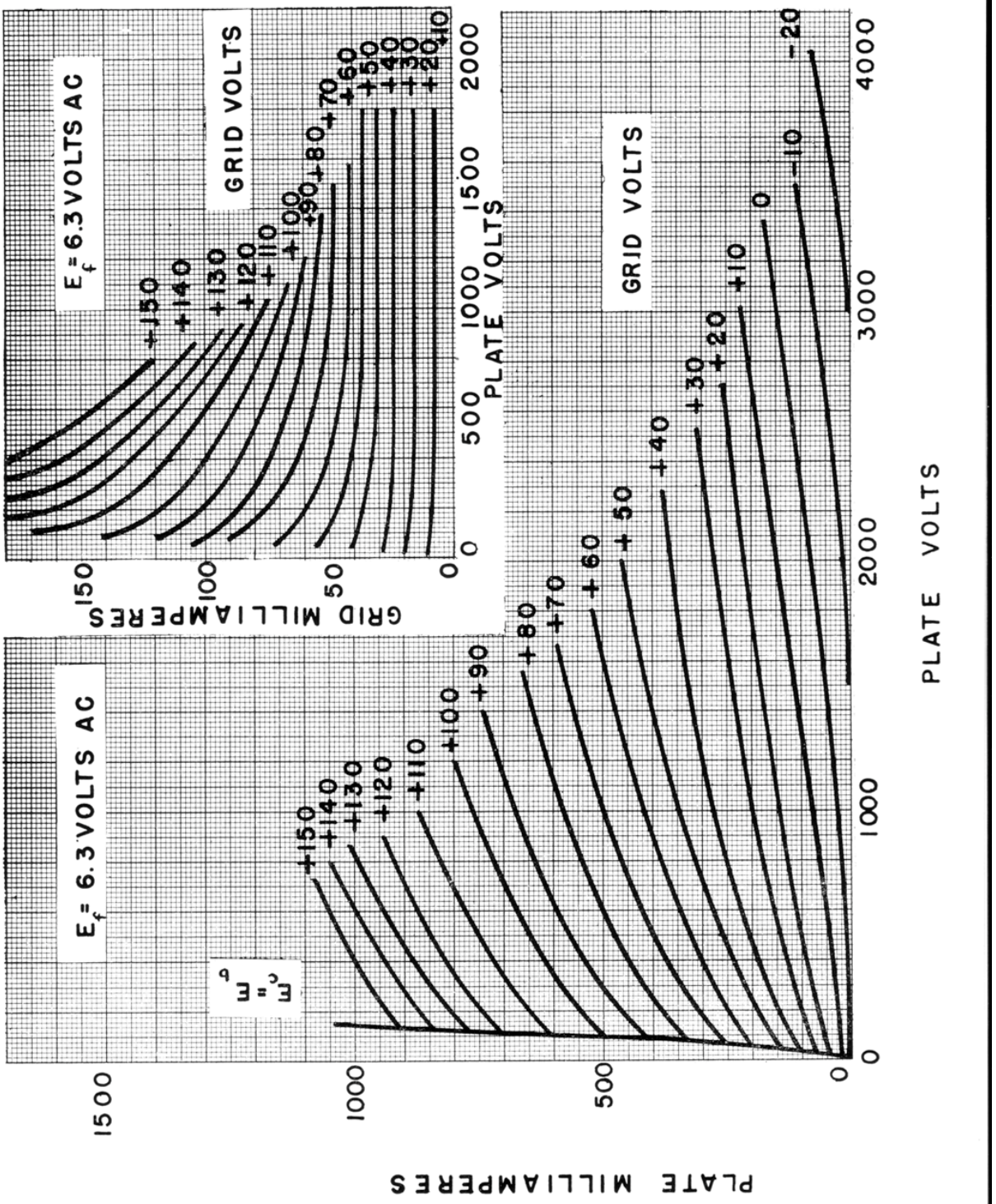
[1] Averaged over any audio-frequency cycle of sine-wave form.

[2] Grid voltages are given with respect to the mid-point of the filament operated on A.C. If D.C. is used, each stated value of grid voltage must be reduced by 5 volts and the circuit returns made to the negative end of the filament.

[3] Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

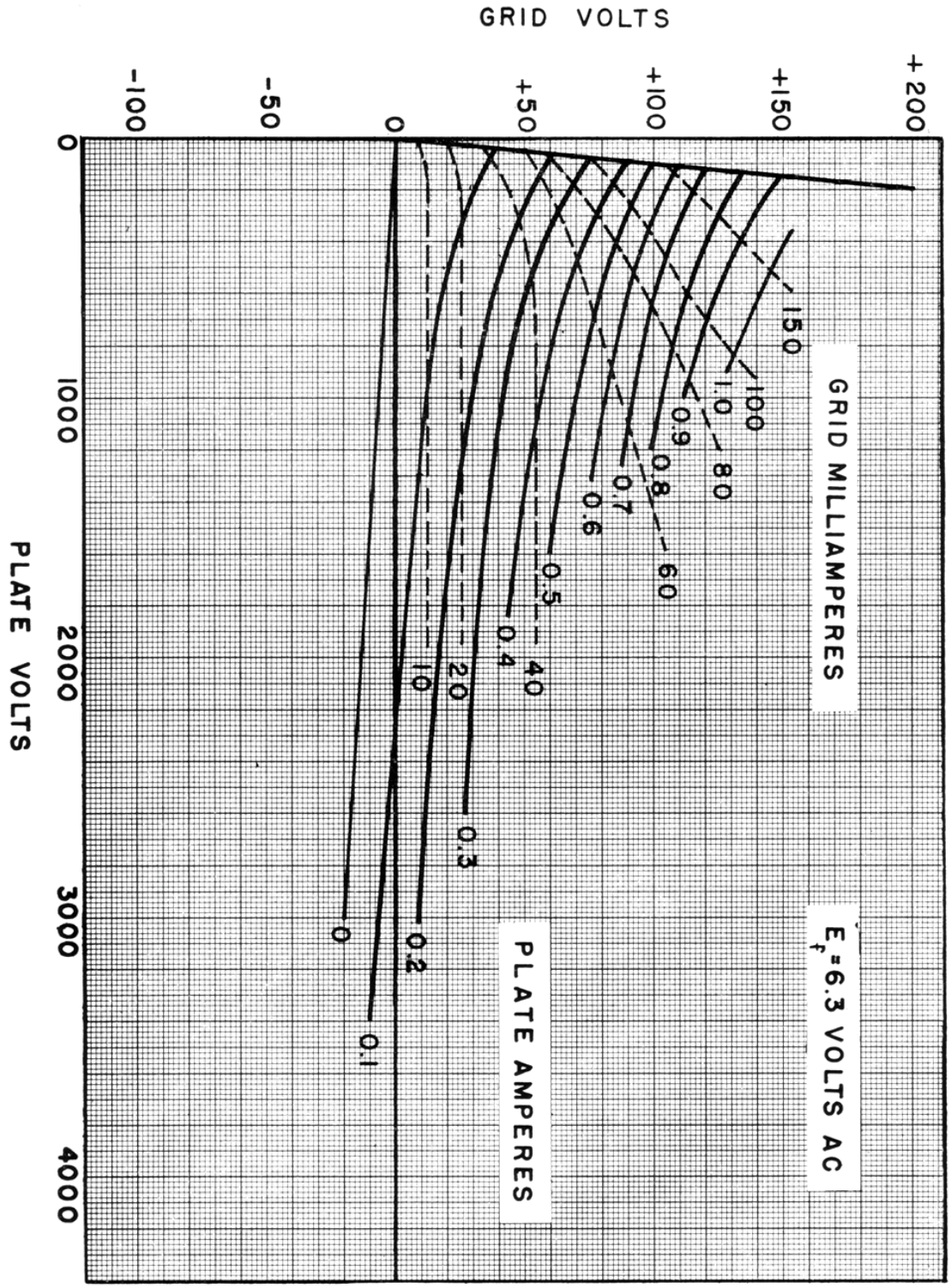
[4] At crest of audio-frequency cycle with modulation factor of 1.0.

AMPEREX TRANSMITTING TUBE ZB-60



ZB-60

ZB-60—AMPEREX TRANSMITTING TUBE

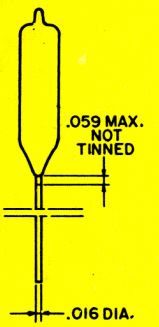


ZB-60

Amperex® ELECTRONIC CORPORATION
230 DUFFY AVENUE, HICKSVILLE, L. I., N. Y.

Item (9)

TYPE 8228/ZZ1000 VOLTAGE REFERENCE TUBE



TENTATIVE DATA

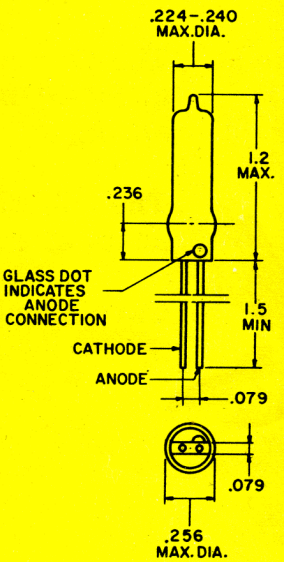
The Amperex 8228/ZZ1000 is a subminiature cold-cathode voltage reference tube for use in stable regulated power supplies, dc amplifiers, oscilloscope calibrators and similar applications.

Featuring an extremely low temperature coefficient of .004% per °C, the 8228/ZZ1000 affords excellent regulation and uniformity. The rugged construction of this extremely small voltage reference tube insures reliability. It is guaranteed for a minimum life of 30,000 hours,

GENERAL CHARACTERISTICS

ELECTRICAL

Maximum Ratings, Absolute Values	
D.C. Starting Voltage (min)	115 volts[1]
D.C. Operating Cathode Current (max)	3.5 ma
D.C. Operating Cathode Current (min)	.5 ma
Inverse Peak Voltage	70 volts
Bulb Temperature Limits	-55 to +100°C[2]
Impact Acceleration (max)	450 g
Vibrational Acceleration for extended periods	2.5 g
Altitude	78,500 ft
Typical Operation	
Recommended D.C. Operating Current	2 ma
A.C. Resistance at 2 ma (max)	500 ohms[3]
D.C. Operating Voltage at 2 ma	82 volts
D.C. Operating Voltage	84 volts max
I_k = 0.5 to 3.5 ma	81 volts min
Regulation	
I_k = 0.5 to 3.5 ma	1 volt



JETEC T2

1. The anode breakdown voltage delay time is 5 msec max and is independent of ambient illumination.
2. The temperature rise of the bulb over the ambient temperature at I_k = 3.5 ma is approximately 25°C.
3. Measured with an alternating current of 1 ma rms at 1000 cps.

Amperex

Rev. March 1962 SG

ELECTRICAL (Continued)

Noise Voltage	
I_k = 0.5 to 3.5 ma	
Frequency Band: 10 cycles to 10 kc	N = 0.5 volts max
Temperature Coefficient of Operating Voltage	-3.0 mv/°C[4] (.004 %/°C)
Change in Operating Voltage	
During First 1000 hours of Life (I_k = 2 ma, T_A = 25°C)	500 mv max
Life Expectancy - Continuous	
Operation (I_k = 2 ma)	30,000 hours min

SOLDERING PRECAUTIONS

The tube may be soldered directly into the circuit but heat conducted to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.

The connecting leads may be dip-soldered to a minimum of 3/16" from the seals at a solder temperature of 240°C for a maximum of 10 seconds.

Care should be taken not to bend the leads closer than 1/16" to the seals.

4. Averaged over the range -55°C to + 70°C.