



6161

# POWER TRIODE

FORCED-AIR COOLED

Useful with full input up to 900 Mc  
and with reduced input up to 2000 Mc

6161

The 6161 supersedes type 5588 for new equipment design.

## GENERAL DATA

### Electrical:

Heater, for Unipotential Cathode:

Voltage*	$\left\{ \begin{array}{l} 6.3 \text{ av.} \\ 6.9 \text{ max.} \end{array} \right.$	ac or dc volts
Current at 6.3 volts.		ac or dc volts
Minimum heating time	3.4	amp
at 6.3 volts.	1	minute

Amplification Factor for  
grid volts = -15, and  
plate ma. = 250 . . . . . 25

Direct Interelectrode Capacitances:

Grid to plate $\S$ .	6	$\mu\mu\text{f}$
Grid to cathode and heater $\S$ .	11	$\mu\mu\text{f}$
Plate to cathode and heater $\text{O}$ .	0.19	$\mu\mu\text{f}$

### Mechanical:

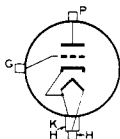
Operating Position.	Any
Overall Length.	3-5/16" $\pm$ 3/32"
Greatest Diameter.	1.750" $\pm$ 0.010"
Weight (Approx.).	8 oz
Radiator.	Integral part of tube
Mounting.	Special
Terminal Connections (See Dimensional Outline):	

G-Grid

K-Cathode

H-Heater

P-Plate



### Air Flow:

The specified air flow for various plate dissipations, as indicated in the tabulation below, should be delivered by a blower onto the respective terminals and seals, and through the radiator before and during the application of any voltages. Heater power, plate power, and air may be removed simultaneously.

Percentage of maximum-rated plate dissipation for each class of service . . . . .	100	80	60	%
Minimum air flow . . . . .	16	10	5.7	cfm
Static pressure . . . . .	0.85	0.4	0.16	in. of water

\* ,  $\S$  ,  $\text{O}$  : See next page.

← Indicates a change.



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The above flow and pressure values are for condition with radiator temperature held constant at 135° C rise above incoming-air temperature. The air flow must be adequate to limit the temperature of the radiator, grid terminal, cathode terminal, and seals to their respective maximum values.

Radiator Temperature (Measured on core at end adjacent to plate flange) . . . . .	180 max.	°C
Grid-Terminal Temperature. . . . .	150 max.	°C
Cathode-Terminal Temperature . . . . .	150 max.	°C
Seal Temperature (Plate, grid, and cathode). . . . .	150 max.	°C

## RF POWER AMPLIFIER — Class B Television Service

*Synchronizing-level conditions per tube unless otherwise specified*

## Maximum CCS\* Ratings, Absolute Values:

DC PLATE VOLTAGE . . . . .	1600 max.	volts
DC PLATE CURRENT . . . . .	0.350 max.	amp
→ DC GRID CURRENT:		
Negative value . . . . .	0.010 max.	amp
Positive value . . . . .	0.100 max.	amp
PLATE INPUT. . . . .	560 max.	watts
PLATE DISSIPATION. . . . .	250 max.	watts

## Typical Operation in Cathode-Drive Circuit at 600 Mc:

*Bandwidth<sup>†</sup> of 6 Mc*

DC Plate-to-Grid Voltage . . . . .	1600	volts
DC Cathode-to-Grid Voltage . . . . .	100	volts
Peak RF Cathode-to-Grid Voltage:		
Synchronizing level. . . . .	130	volts
Pedestal level . . . . .	117	volts
DC Plate Current:		
Synchronizing level. . . . .	0.350	amp
Pedestal level . . . . .	0.285	amp
DC Grid Current (Approx.):		
Synchronizing level. . . . .	0.040	amp
Pedestal level . . . . .	0.013	amp
Driver Power Output (Approx.):‡		
Synchronizing level. . . . .	65#	watts
Pedestal level . . . . .	40	watts
Output-Circuit Efficiency (Approx.). . . . .	89	%
Useful Power Output (Approx.):		
Synchronizing level. . . . .	325••	watts
Pedestal level . . . . .	195••	watts

## Typical Operation in Cathode-Drive Circuit at 900 Mc:

*Bandwidth<sup>†</sup> of 6 Mc*

DC Plate-to-Grid Voltage . . . . .	1600	volts
DC Cathode-to-Grid Voltage . . . . .	100	volts

\* , § , ° , • , † , ‡ , # , •• : See next page.

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Peak RF Cathode-to-Grid Voltage:		
Synchronizing level . . . . .	135	volts
Pedestal level . . . . .	120	volts
DC Plate Current:		
Synchronizing level . . . . .	0.350	amp
Pedestal level . . . . .	0.280	amp
DC Grid Current (Approx.):		
Synchronizing level . . . . .	0.030	amp
Pedestal level . . . . .	0.010	amp
Driver Power Output (Approx.):*		
Synchronizing level . . . . .	75 <sup>Ⓢ</sup>	watts
Pedestal level . . . . .	45	watts
Output-Circuit Efficiency (Approx.) . . . . .		
	65	%
Useful Power Output (Approx.):		
Synchronizing level . . . . .	230 <sup>••</sup>	watts
Pedestal level . . . . .	135 <sup>••</sup>	watts

**BIAS-MODULATED RF POWER AMPLIFIER**  
**Class C Television Service**

*Synchronizing-level conditions per tube unless otherwise specified*

**Maximum CCS<sup>®</sup> Ratings, Absolute Values:**

DC PLATE VOLTAGE . . . . .	1600 max.	volts
DC GRID VOLTAGE (White level) . . . . .	-300 max.	volts
DC PLATE CURRENT . . . . .	0.350 max.	amp
DC GRID CURRENT:		
Negative value . . . . .	0.010 max.	amp
Positive value . . . . .	0.100 max.	amp
PLATE INPUT . . . . .	560 max.	watts
PLATE DISSIPATION . . . . .	250 max.	watts

**Typical Operation in Cathode-Drive Circuit at 600 Mc:**

*Bandwidth<sup>↓</sup> of 6 Mc*

DC Plate-to-Grid Voltage . . . . .	1600	volts
DC Cathode-to-Grid Voltage:		
Synchronizing level . . . . .	100	volts
Pedestal level . . . . .	150	volts
White level . . . . .	230	volts
Peak RF Cathode-to-Grid Voltage . . . . .	130	volts
DC Plate Current:		
Synchronizing level . . . . .	0.350	amp
Pedestal level . . . . .	0.250	amp
DC Grid Current (Approx.):		
Synchronizing level . . . . .	0.040	amp
Pedestal level . . . . .	0.013	amp
Driver Power Output (Approx.):*		
Synchronizing level . . . . .	65 <sup>#</sup>	watts
Output-Circuit Efficiency (Approx.) . . . . .		
	89	%
Useful Power Output (Approx.):		
Synchronizing level . . . . .	325 <sup>••</sup>	watts
Pedestal level . . . . .	195 <sup>••</sup>	watts

\* , § , ○ , ● , ♣ , # , •• , Ⓢ : See next page.

← Indicates a change.



## POWER TRIODE

## Typical Operation in Cathode-Drive Circuit at 900 Mc:

Bandwidth<sup>†</sup> of 6 Mc

DC Plate-to-Grid Voltage . . . . .	1600	volts
DC Cathode-to-Grid Voltage:		
Synchronizing level. . . . .	100	volts
Pedestal level . . . . .	150	volts
White level. . . . .	230	volts
Peak RF Cathode-to-Grid Voltage. . . . .	135	volts
DC Plate Current:		
Synchronizing level. . . . .	0.350	amp
Pedestal level . . . . .	0.250	amp
DC Grid Current (Approx.):		
Synchronizing level. . . . .	0.030	amp
Pedestal level . . . . .	0.010	amp
Driver Power Output (Approx.): <sup>‡</sup>		
Synchronizing level. . . . .	75 <sup>Ⓜ</sup>	watts
Output-Circuit Efficiency (Approx.). . . . .	65	%
Useful Power Output (Approx.):		
Synchronizing level. . . . .	230 <sup>••</sup>	watts
Pedestal level . . . . .	135 <sup>••</sup>	watts

## PLATE-MODULATED RF POWER AMPLIFIER — Class C Telephony

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

Maximum CCS<sup>•</sup> Ratings, Absolute Values:

DC PLATE VOLTAGE . . . . .	1300 max.	volts
DC GRID VOLTAGE. . . . .	-300 max.	volts
DC PLATE CURRENT . . . . .	0.210 max.	amp
→ DC GRID CURRENT. . . . .	See Rating Chart	
PLATE INPUT. . . . .	270 max.	watts
PLATE DISSIPATION. . . . .	167 max.	watts

## Typical Operation in Cathode-Drive Circuit at 600 Mc:

DC Plate-to-Grid Voltage . . . . .	1400	volts
DC Cathode-to-Grid Voltage . . . . .	150	volts
Peak RF Cathode-to-Grid Voltage. . . . .	200	volts
DC Plate Current . . . . .	0.210	amp
DC Grid Current (Approx.). . . . .	0.070	amp
Driver Power Output (Approx.) <sup>‡••</sup> . . . . .	70 <sup>**</sup>	watts
Output-Circuit Efficiency (Approx.). . . . .	80	%
Useful Power Output (Approx.). . . . .	180 <sup>••</sup>	watts

## Typical Operation in Cathode-Drive Circuit at 900 Mc:

DC Plate-to-Grid Voltage . . . . .	1400	volts
DC Cathode-to-Grid Voltage . . . . .	150	volts
Peak RF Cathode-to-Grid Voltage. . . . .	200	volts
DC Plate Current . . . . .	0.210	amp
DC Grid Current (Approx.). . . . .	0.070	amp
Driver Power Output (Approx.) <sup>‡••</sup> . . . . .	75 <sup>Ⓜ</sup>	watts

\* , \$ , ○ , ● , ↓ , † , # , Ⓜ , ⊕ , ⊖ , \*\* , ‡ : See next page.

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Output-Circuit Efficiency (Approx.) . . . . .	60	%
Useful Power Output (Approx.) . . . . .	120 <sup>••</sup>	watts

RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy<sup>□</sup>  
and  
RF POWER AMPLIFIER — Class C FM Telephony

Maximum CCS<sup>•</sup> Ratings, Absolute Values:

DC PLATE VOLTAGE . . . . .	1600 max.	volts
DC GRID VOLTAGE . . . . .	-300 max.	volts
DC PLATE CURRENT . . . . .	0.250 max.	amp
DC GRID CURRENT . . . . .	See Rating Chart	←
PLATE INPUT . . . . .	400 max.	watts
PLATE DISSIPATION . . . . .	250 max.	watts

## Typical Operation as Amplifier in Cathode-Drive Circuit at 600 Mc:

DC Plate-to-Grid Voltage . . . . .	1650	volts
DC Cathode-to-Grid Voltage:		
From fixed supply of . . . . .	150	volts
From cathode resistor of . . . . .	500	ohms
Peak RF Cathode-to-Grid Voltage . . . . .	200	volts
DC Plate Current . . . . .	0.250	amp
DC Grid Current (Approx.) . . . . .	0.050	amp
Driver Power Output (Approx.) <sup>*</sup> . . . . .	75 <sup>▲</sup>	watts
Output-Circuit Efficiency (Approx.) . . . . .	82	%
Useful Power Output (Approx.) . . . . .	270 <sup>••</sup>	watts

## Typical Operation as Amplifier in Cathode-Drive Circuit at 900 Mc:

DC Plate-to-Grid Voltage . . . . .	1650	volts
DC Cathode-to-Grid Voltage:		
From fixed supply of . . . . .	150	volts
From cathode resistor of . . . . .	575	ohms
Peak RF Cathode-to-Grid Voltage . . . . .	200	volts
DC Plate Current . . . . .	0.250	amp
DC Grid Current (Approx.) . . . . .	0.010	amp
Driver Power Output (Approx.) <sup>*</sup> . . . . .	80 <sup>†</sup>	watts
Output-Circuit Efficiency (Approx.) . . . . .	60	%
Useful Power Output (Approx.) . . . . .	180 <sup>••</sup>	watts

## FREQUENCY MULTIPLIER — Class C

Maximum CCS<sup>•</sup> Ratings, Absolute Values:

DC PLATE VOLTAGE . . . . .	1600 max.	volts
DC GRID VOLTAGE . . . . .	-300 max.	volts
DC PLATE CURRENT . . . . .	0.250 max.	amp
DC GRID CURRENT . . . . .	See Rating Chart	←
PLATE INPUT . . . . .	400 max.	watts
PLATE DISSIPATION . . . . .	250 max.	watts

\* , § , ○ , ● , ◆ , † , # , •• , ⊕ , ⊖ , \*\* , ‡ , □ , ▲ , † : See next page. ← Indicates a change.



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## Typical Operation in Cathode-Drive Circuit:

	Doubler to 600 Mc	Doubler to 900 Mc	
DC Plate-to-Grid Voltage. . .	1760	1675	volts
DC Cathode-to-Grid Voltage:			
From fixed supply of. . .	260	175	volts
From cathode resistor of.	860	645	ohms
Peak RF Cathode-to-			
Grid Voltage. . . . .	300	300	volts
DC Plate Current. . . . .	0.250	0.250	amp
DC Grid Current (Approx.) .	0.050	0.021	amp
Driver Power Output			
(Approx.)*. . . . .	125	100	watts
Output-Circuit Efficiency			
(Approx.) . . . . .	90	80	%
Useful Power Output			
(Approx.) . . . . .	180**	140**	watts

## CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current. . . . .	1	3.05	3.75	amp
Amplification Factor. . . . .	1,2	18	32	
Direct Interelectrode Capacitances:				
Grid to plate . . . . .	-	5.6	6.6	$\mu\mu\text{f}$
Grid to cathode and heater. . .	-	10.5	12.5	$\mu\mu\text{f}$
Plate to cathode and heater . .	3	0.12	0.26	$\mu\mu\text{f}$
Plate Voltage . . . . .	1,4	500	850	volts
Plate Voltage . . . . .	1,5	690	1140	volts
Grid Voltage. . . . .	1,6	-	-165	volts
Peak Cathode Current. . . . .	1,7	3.2	-	amp
Useful Power Output . . . . .	1,8	225	-	watts

Note 1: With 6.3 volts ac on heater.

Note 2: With dc grid volts = -15, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 3: With external shield, as described under (0), connected to grid terminal.

Note 4: With dc grid volts = -10, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 5: With dc grid volts = -20, and dc plate voltage adjusted to give dc plate current of 250 ma.

Note 6: With dc plate volts = 1600, and dc grid voltage adjusted to give dc plate current of 1 ma.

Note 7: Designers should limit the maximum useable cathode current (plate current and grid current) to this value under any condition of operation.

Note 8: In a self-excited oscillator circuit with dc plate volts = 1600, dc plate ma. = 250, dc grid ma. = 50 to 75, grid resistor (ohms) = 2000  $\pm$  10%, and frequency (Mc) = 15.\* ,  $\circ$  ,  $\bullet$  ,  $\downarrow$  ,  $\#$  ,  $\oplus$  ,  $\otimes$  ,  $\square$  ,  $\triangle$  : See next page.  $\rightarrow$  Indicates a change.



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- \* Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.
- § Without external shield.
- With external flat shield 7-1/2" min. diameter located in plane of the grid terminal and perpendicular to axis of tube. Shield is connected to grid terminal.
- Continuous Commercial Service.
- ↓ Computed between half-power points and based on tube output capacitance only.
- ✦ The driver stage is required to supply tube losses, rf-circuit losses, and rf power added to plate input. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in tube characteristics during life.
- # This value includes 24 watts of circuit loss and 36 watts added to plate input.
- This value of useful power is measured at load of output circuit having indicated efficiency.
- ⊕ This value includes 28 watts of circuit loss and 40 watts added to plate input.
- In cathode-drive, plate-modulated class C rf power amplifier service, the 6161 can be modulated 100% if the rf driver stage is also modulated 100% simultaneously. Care should be taken to insure that the driver-modulation and amplifier-modulation voltages are exactly in phase.
- \*\* This value includes 18 watts of circuit loss and 40 watts added to plate input.
- ⊕ This value includes 23 watts of circuit loss and 40 watts added to plate input.
- Key-down conditions per tube without amplitude modulation. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.
- ▲ This value includes 18 watts of circuit loss and 45 watts added to plate input.
- † This value includes 23 watts of circuit loss and 45 watts added to plate input.

## MAXIMUM RATINGS vs OPERATING FREQUENCY

FREQUENCY	900	1200	1400	1650	2000	Mc
MAX.-PERMISSIBLE PERCENTAGE OF MAX.-RATED PLATE VOLTAGE AND PLATE INPUT:						
Class B television	100	80	71	62.5	62.5	%
Class C television, biased-modulated	100	80	71	62.5	62.5	%
Class C telephony, plate-modulated	100	80	71	62.5	62.5	%
Class C telegraphy	100	80	71	62.5	62.5	%
Class C FM telephony	100	80	71	62.5	62.5	%

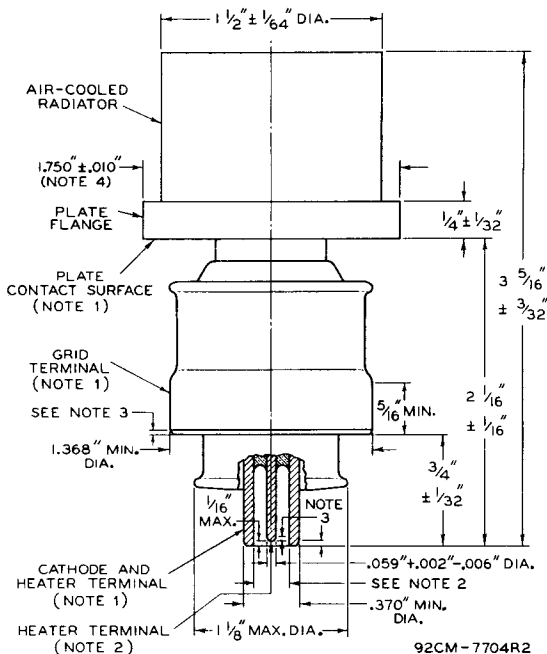


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## OPERATING CONSIDERATIONS

In tuning a cathode-drive rf amplifier, it must be remembered that variations in the load on the output stage will produce corresponding variations in the load on the driving stage. This effect will be noticed by the simultaneous increase in plate currents of both the output and driving stages.

During standby periods of less than 15 minutes, it is recommended that the heater voltage be reduced to 80% of normal to conserve life; for longer standby periods, the heater power should be turned off.



→ Indicates a change.





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**POWER TRIODE**

**NOTE 1:** WITH THE CYLINDRICAL SURFACES OF ITS GRID AND CATHODE TERMINALS CLEAN, SMOOTH, AND FREE OF BURRS, THE TUBE WILL ENTER A GAUGE AS SHOWN IN SKETCH G<sub>1</sub>. THE FOUR CYLINDRICAL HOLES H<sub>1</sub>, H<sub>2</sub>, H<sub>3</sub>, and H<sub>4</sub> HAVE AXES COINCIDENT WITHIN 0.0005", LENGTHS DETERMINED FROM THE DIMENSIONAL OUTLINE, AND SUCCESSIVELY SMALLER DIAMETERS AS SHOWN IN THE SKETCH.

THE PLATE FLANGE WILL BE ENTIRELY ENGAGED BY HOLE H<sub>1</sub>, AND THE CONTACT SURFACE OF THE PLATE FLANGE WILL SEAT ON THE SHOULDER BETWEEN HOLES H<sub>1</sub> AND H<sub>2</sub>. THE PLANE SURFACE OF THIS SHOULDER IS 90° ± 2' TO THE AXES OF THE HOLES. SEATING IS DETERMINED BY FAILURE OF A 0.005"-THICKNESS GAUGE, 1/8" WIDE, TO ENTER MORE THAN 1/16" BETWEEN THE SHOULDER SURFACE AND THE PLATE CONTACT SURFACE.

WITH THE TUBE PROPERLY SEATED AS DESCRIBED ABOVE, THE GRID TERMINAL WILL BE ENTIRELY ENGAGED BY HOLE H<sub>3</sub>, AND THE CATHODE TERMINAL WILL BE ENGAGED BY HOLE H<sub>4</sub> TO A DEPTH OF AT LEAST 1/4".

**NOTE 2:** CONCENTRICITY OF THE HEATER TERMINAL WITH RESPECT TO THE CATHODE TERMINAL IS DETERMINED BY A GAUGE AS SHOWN IN SKETCH G<sub>2</sub>. THE CYLINDRICAL HOLE H<sub>5</sub> AND THE ANNULAR HOLE H<sub>6</sub> HAVE AXES COINCIDENT WITHIN 0.0005". THE CATHODE TERMINAL AND THE HEATER TERMINAL WILL ENTER THIS GAUGE TO A DEPTH OF 3/8".

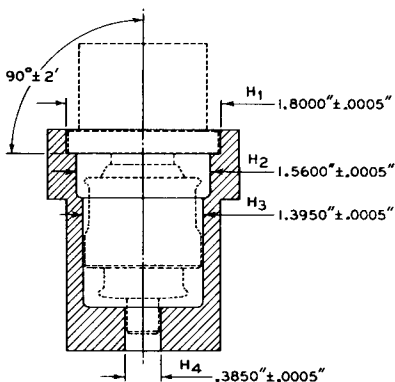
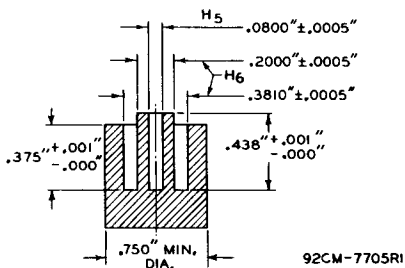
**NOTE 3:** MAY BE ROUNDED OR BEVELED NOT TO EXCEED 1/16".

**NOTE 4:** THE AVERAGE OF THE MINIMUM DIAMETER AND THAT MEASURED 90° FROM THE MINIMUM WILL BE WITHIN THE SPECIFIED RANGE, AND THE DIFFERENCE BETWEEN THESE TWO MEASUREMENTS WILL NOT EXCEED .010".



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SKETCH G<sub>1</sub>SKETCH G<sub>2</sub>

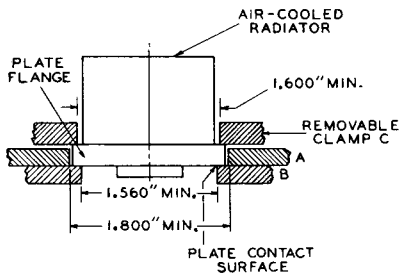


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## MOUNTING ARRANGEMENT FOR USE WITH COAXIAL-LINE-OR CAVITY CIRCUITS



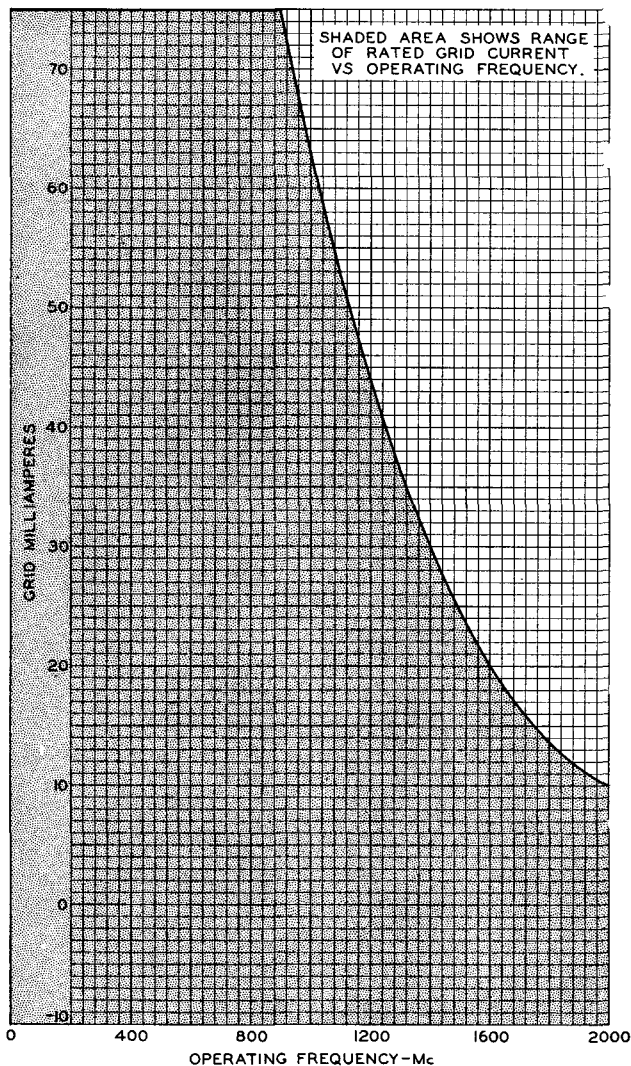
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## RATING CHART

ELECTRON TUBE DIVISION  
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-8321



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# AVERAGE CHARACTERISTICS

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$E_f = 6.3$  VOLTS  
PLATE & CATHODE VOLTAGES  
ARE REFERRED TO GRID.

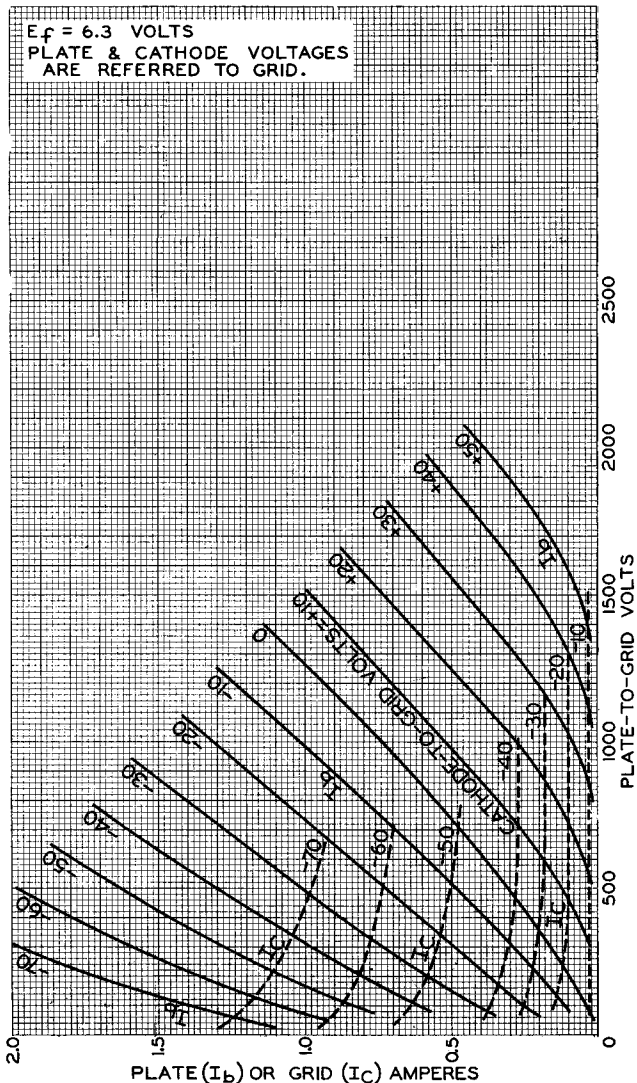


PLATE ( $I_b$ ) OR GRID ( $I_c$ ) AMPERES

ELECTRON TUBE DIVISION

92CL-7771R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY