



6161

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## POWER TRIODE

FORCED-AIR COOLED

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

The 6161 supersedes type 5588 for new equipment design.

## GENERAL DATA

## Electrical:

Heater, for Unipotential Cathode:

|                       |          |                |
|-----------------------|----------|----------------|
| Voltage*              | 6.3 av.  | ac or dc volts |
|                       | 6.9 max. | ac or dc volts |
| Current at 6.3 volts. | 3.4      | amp            |
| Minimum heating time  |          |                |
| at 6.3 volts:         | 1        | minute         |

Amplification Factor for

grid volts = -15, and

plate ma. = 250 . . . . . 25

Direct Interelectrode Capacitances:

|                                          |      |    |
|------------------------------------------|------|----|
| Grid to plate§.                          | 6    | μf |
| Grid to cathode and heater§.             | 11   | μf |
| Plate to cathode and heater <sup>o</sup> | 0.19 | μf |

## Mechanical:

|                     |                       |
|---------------------|-----------------------|
| Operating Position. | Any                   |
| Overall Length.     | 3-5/16" ± 3/32"       |
| Greatest Diameter.  | 1.750" ± 0.010"       |
| Weight (Approx.).   | 8 oz                  |
| Radiator.           | Integral part of tube |
| Mounting.           | Special               |

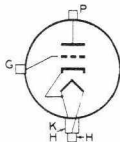
Terminal Connections (See Dimensional Outline):

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 |

\* , § , °: 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.

→ Indicates a change.



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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\* 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 |

\*.S, O, •, •, •, #, ••, ⊕: See next page.

† Indicates a change.





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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<br>600 Mc | Doubler to<br>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.) <sup>*</sup> . . . . . | 125                  | 100                  | watts |
| Output-Circuit Efficiency        |                      |                      |       |
| (Approx.) . . . . .              | 90                   | 80                   | %     |
| Useful Power Output              |                      |                      |       |
| (Approx.) . . . . .              | 180 <sup>**</sup>    | 140 <sup>**</sup>    | 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  | $\mu\text{f}$ |
| Grid to cathode and heater. . .     | -    | 10.5 | 12.5 | $\mu\text{f}$ |
| Plate to cathode and heater . .     | 3    | 0.12 | 0.26 | $\mu\text{f}$ |
| 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 (O), 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.

\*, §, O, ●, ♀, ♀, #, \*\*, ⊕, □, †: See next page. → 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 | %  |

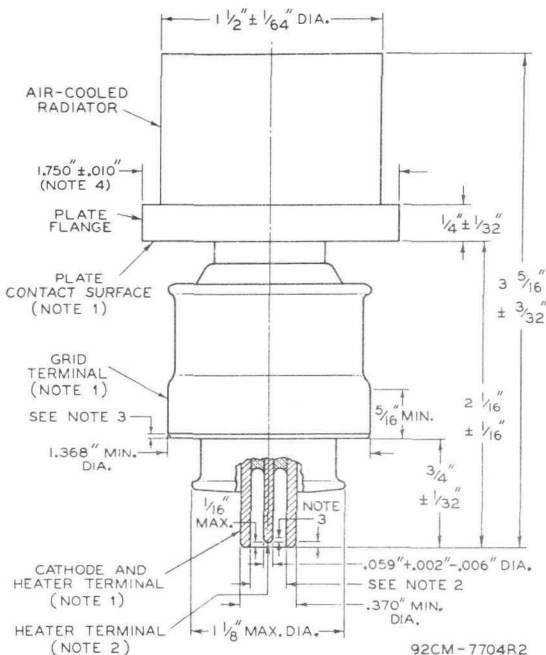


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## OPERATING CONSIDERATIONS

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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**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  $90^{\circ} \pm 2'$  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".

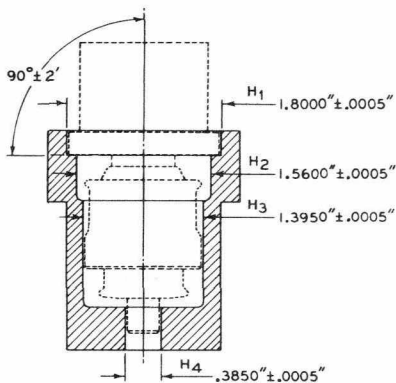
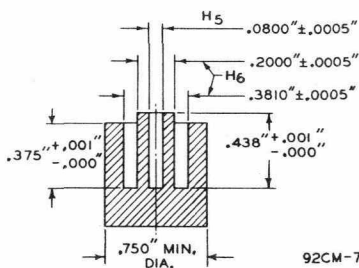
**NOTE 3:** MAY BE ROUNDED OR BEVELED NOT TO EXCEED 1/16".

**NOTE 4:** THE AVERAGE OF THE MINIMUM DIAMETER AND THAT MEASURED  $90^{\circ}$  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>

92CM-7705R1

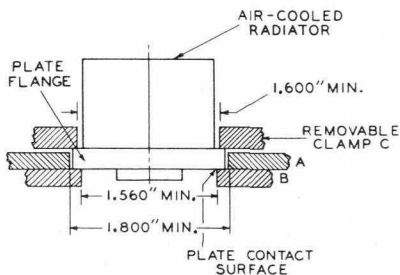


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### MOUNTING ARRANGEMENT FOR USE WITH COAXIAL-LINE-OR CAVITY CIRCUITS



92CS-6833R2

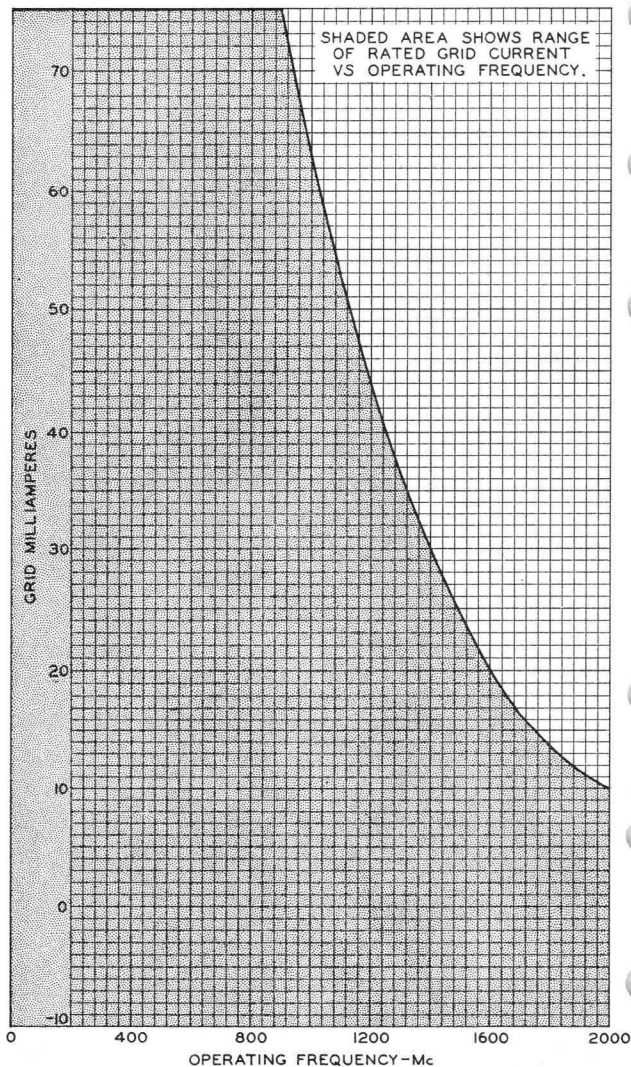
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## RATING CHART

SHADED AREA SHOWS RANGE  
OF RATED GRID CURRENT  
VS OPERATING FREQUENCY.





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## AVERAGE CHARACTERISTICS

