The Eimac 4-400A is a compact, ruggedly constructed power tetrode having a maximum plate dissipation rating of 400 watts. It is intended for use as an amplifier, oscillator or modulator. The low grid-plate capacitance of this tetrode coupled with its low driving-power requirement allows considerable simplification of the associated circuit and driver stage.

The 4-400A is cooled by radiation from the plate and by circulation of forced-air through the base, around the envelope, and over the plate seal. Cooling can be greatly simplified by using an Eimac 4-400A/4000 Air-System Socket and its accompanying glass chimney. This socket is designed to maintain the correct balance of cooling air between the component parts of the tube.

**GENERAL CHARACTERISTICS**

**ELECTRICAL**
- Filament: Thoriated tungsten
- Voltage: 5.0 volts
- Current: 14.5 amperes
- Grid-Plate Amplification Factor (Average): 5.1
- Direct Inter-electrode Capacitance (Average):
  - Grid-Plate: 0.12 \( \mu \text{F} \)
  - Input: 12.5 \( \mu \text{F} \)
  - Output: 4.7 \( \mu \text{F} \)
- Transconductance \( (I_b = 100 \text{ma}, \ E_b = 2500 \text{volts}, \ E_x = 500 \text{volts}) \): 4,000 \( \mu \text{mhos} \)
- Frequency for Maximum Ratings: 110 Mc.

**MECHANICAL**
- Base: See drawing
- Basing: See drawing
- Mounting Position: Vertical, base down or up
- Cooling: Radiation and forced air
- Recommended Heat Dissipating Plate Connector: Eimac HR-6
- Recommended Socket: Eimac 4-400A/4000 Air-System Socket
- Maximum Over-all Dimensions:
  - Length: 6.38 inches
  - Diameter: 3.56 inches
  - Net Weight: 9 ounces
  - Shipping Weight: 2.5 pounds
- If an Air-System Socket is used, mounted on a \( \frac{1}{4} \) inch deck, the over-all dimensions of the system including chimney and HR-6 Heat Dissipating Plate Connector are:
  - Length: 8.0 inches
  - Diameter: 5.5 inches

**Note:** Typical operation data are based on conditions of adjusting the r-f grid drive to a specified plate current, maintaining fixed conditions of grid bias and screen voltage. It will be found that if this procedure is followed, there will be little variation in power output between different loads with a given drive in a given circuit, as long as the control grid bias is maintained at a value sufficient to hold the plate current to the desired level. Where grid bias is obtained principally by means of a grid resistor, control plate current it is necessary to make the resistor adjustable.

**RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR**
Class-C Telegraphy or FM Telephony

**MAXIMUM RATINGS (Key-down conditions, per tube to 110 Mc.)**
- D/C PLATE VOLTAGE
- D/C SCREEN VOLTAGE
- D/C PLATE CURRENT
- PLATE DISSIPATION
- SCREEN DISSIPATION
- GRID DISSIPATION

**TYPICAL OPERATION (Frequencies below 75 Mc., one tube)**
- D/C Plate Voltage: 2500, 3000, 4000 volts
- D/C Screen Voltage: 500, 500, 500 volts
- D/C Grid Voltage: -200, -220, -220 volts
- D/C Plate Current: 350, 350, 350 ma
- D/C Screen Current: 46, 46, 40 ma
- D/C Grid Current: 18, 19, 18 ma
- Screen Dissipation: 23, 23, 20 watts
- Grid Dissipation: 1.8, 1.9, 1.8 watts
- Peak R.F. Grid Input Voltage: 300, 320, 320 volts
- Driving Power*: 5.4, 6.1, 5.8 watts
- Plate Power Input: 875, 1050, 1400 watts
- Plate Dissipation: 235, 250, 300 watts
- Plate Power Output: 640, 800, 1100 watts

*Driving Power increases as frequency is increased. At 75 Mc, the driving power required is approximately 12 watts.

**TYPICAL OPERATION (110 Mc., two tubes)**
- D/C Plate Voltage: 3500, 4000 volts
- D/C Screen Voltage: 500, 500 volts
- D/C Grid Voltage: -170, -170 volts
- D/C Plate Current: 500, 540 ma
- D/C Screen Current: 34, 31 ma
- D/C Grid Current: 20, 20 ma
- Driving Power (approx.): 20, 20 watts
- Plate Power Output (approx.): 1300, 1600 watts
- Useful Power Output: 1160, 1440 watts


Indicates change from sheet dated 1-30-53.
PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions unless otherwise specified, One tube)

MAXIMUM RATINGS (Frequencies below 75 Mc., Continuous Service)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-C PLATE VOLTAGE</td>
<td>3200 MAX. VOLTS</td>
</tr>
<tr>
<td>D-C SCREEN VOLTAGE</td>
<td>600 MAX. VOLTS</td>
</tr>
<tr>
<td>D-C GRID VOLTAGE</td>
<td>-500 MAX. VOLTS</td>
</tr>
<tr>
<td>D-C PLATE CURRENT</td>
<td>275 MAX. MA</td>
</tr>
<tr>
<td>PLATE DISSIPATION</td>
<td>270 MAX. WATTS</td>
</tr>
<tr>
<td>SCREEN DISSIPATION</td>
<td>35 MAX. WATTS</td>
</tr>
<tr>
<td>GRID DISSIPATION</td>
<td>10 MAX. WATTS</td>
</tr>
</tbody>
</table>

TYPICAL OPERATION (Frequencies below 75 Mc., Continuous Service)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-C Plate Voltage</td>
<td>2000-2500</td>
</tr>
<tr>
<td>D-C Screen Voltage</td>
<td>500-500</td>
</tr>
<tr>
<td>D-C Grid Voltage</td>
<td>-220 -220</td>
</tr>
<tr>
<td>D-C Plate Current</td>
<td>275 -275</td>
</tr>
<tr>
<td>D-C Screen Current</td>
<td>30 -30</td>
</tr>
<tr>
<td>D-C Grid Current</td>
<td>12 -12</td>
</tr>
<tr>
<td>Screen Dissipation</td>
<td>15 -15</td>
</tr>
<tr>
<td>Grid Dissipation</td>
<td>1.1 -1.1</td>
</tr>
</tbody>
</table>

PLATE MODULATED RADIO FREQUENCY AMPLIFIER

AND MODULATOR—CLASS AB

MAXIMUM RATINGS (PER TUBE)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-C PLATE VOLTAGE</td>
<td>4000 MAX. VOLTS</td>
</tr>
<tr>
<td>D-C SCREEN VOLTAGE</td>
<td>600 MAX. VOLTS</td>
</tr>
<tr>
<td>MAX-SIGNAL D-C PLATE CURRENT</td>
<td>350 MAX. WATTS</td>
</tr>
<tr>
<td>PLATE DISSIPATION</td>
<td>350 MAX. WATTS</td>
</tr>
<tr>
<td>SCREEN DISSIPATION</td>
<td>35 MAX. WATTS</td>
</tr>
<tr>
<td>GRID DISSIPATION</td>
<td>10 MAX. WATTS</td>
</tr>
</tbody>
</table>

TYPICAL OPERATION CLASS AB,

(Sinusoidal wave, two tubes unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Typical Value</th>
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</thead>
<tbody>
<tr>
<td>D-C Plate Voltage</td>
<td>2500-3000</td>
</tr>
<tr>
<td>D-C Screen Voltage</td>
<td>750-750</td>
</tr>
<tr>
<td>D-C Grid Voltage (approx.)</td>
<td>130-131-148</td>
</tr>
<tr>
<td>Zero-Signal D-C Plate Current</td>
<td>150-160-170</td>
</tr>
<tr>
<td>Max-Signal D-C Plate Current</td>
<td>635-635-610</td>
</tr>
<tr>
<td>Zero-Signal D-C Screen Current</td>
<td>0-0-0</td>
</tr>
<tr>
<td>Max-Signal D-C Screen Current</td>
<td>28-32-34</td>
</tr>
<tr>
<td>Effective Load, Plate-to-Plate</td>
<td>6800-8900</td>
</tr>
<tr>
<td>Peak A.F. Grid Input Voltage</td>
<td>(per tube)</td>
</tr>
<tr>
<td>Driving Power</td>
<td>137-145-150</td>
</tr>
<tr>
<td>Max-Signal Plate Dissipation</td>
<td>0-0-0</td>
</tr>
<tr>
<td>Max-Signal Power Output</td>
<td>850-1110-1330</td>
</tr>
</tbody>
</table>

Pulse Service—For information on Pulse Service Ratings, "Application Bulletin No. 3, Pulse Service Notes", will be furnished free on request.

IF IT IS DESIRED TO OPERATE THIS TUBE UNDER CONDITIONS WIDELY DIFFERENT FROM THOSE GIVEN UNDER 'TYPICAL OPERATION', POSSIBLY EXCEEDING THE MAXIMUM RATINGS GIVEN FOR CW SERVICE, WRITE EITEL-MCCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

APPLICATION

MECHANICAL

Mounting—The 4-400A must be mounted vertically, base up or base down. The socket must be constructed so as to allow an unimpeded flow of air through the holes in the base of the tube and must also provide clearance for the glass tip-off which extends from the center of the base. The metal tube-base shell should be grounded by means of suitable spring fingers. The above requirements are met by the Eimac 4-400A-4000 Air-System Socket. A flexible connecting strap should be provided between the Eimac HR-6 cooler on the plate terminal and the external plate circuit. The tube must be protected from severe vibration and shock.

Cooling— Adequate forced-air cooling must be provided to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C.

When the Eimac 4-400A-4000 Air-System Socket is used, a minimum air flow of 14 cubic feet per minute at a static pressure of 0.25 inches of water, as measured in the socket at sea level, is required to provide adequate cooling under all conditions of operation. Seal temperature limitations may require that cooling air be supplied to the tube even when the filament alone is on during standby periods.

In the event an Air-System Socket is not used, pro-
vision must be made to supply equivalent cooling of the base, the envelope, and the plate lead.

Tube temperatures may be measured with the aid of “Templaq”, a temperature-sensitive lacquer manufactured by the Templ Corporation, 11 West 25th Street, New York 10, N. Y.

**ELECTRICAL**

**Filament Voltage**—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated voltage of 5.0 volts. Variations in filament voltage must be kept within the range from 4.75 to 5.25 volts.

**Bias Voltage**—The d-c bias voltage for the 4-400A should not exceed 500 volts. If grid leak bias is used, suitable means must be provided to prevent excessive plate or screen dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired values from tube to tube. In operation above 50 Mc., it is advisable to keep the bias voltage as low as is practicable.

**Screen Voltage**—The d-c screen voltage for the 4-400A should not exceed 600 volts in r-f applications. In audio applications a maximum d-c screen voltage of 800 volts may be used. The screen voltages shown under “Typical Operation” are representative voltages for the type of operation involved.

**Plate Voltage**—The plate-supply voltage for the 4-400A should not exceed 4000 volts in CW and audio applications. In plate-modulated telephony service the d-c plate-supply voltage should not exceed 3200 volts, except below 30 Mc., intermittent service, where 4000 volts may be used.

**Grid Dissipation**—Grid dissipation for the 4-400A should not be allowed to exceed 10 watts. Grid dissipation may be calculated from the following expression,

\[ P_g = e_{cp}I_c \]

where \( P_g \) = Grid Dissipation

\( e_{cp} \) = Peak positive grid to cathode voltage, and

\( I_c \) = D-c grid current

\( e_{cp} \) may be measured by means of a suitable peak voltmeter connected between filament and grid. (For suitable peak v.t.v.m. circuits see Eimac Application Bulletin Number 6, “Vacuum Tube Ratings.” This bulletin is available on request.)

**Screen Dissipation**—The power dissipated by the screen of the 4-400A must not exceed 35 watts. Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit screen dissipation to 35 watts in event of circuit failure.

**Plate Dissipation**—Under normal operating conditions, the plate dissipation of the 4-400A should not be allowed to exceed 400 watts.

In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 270 watts. The plate dissipation will rise to 400 watts under 100% sinusoidal modulation.

Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

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**GENERAL INFORMATION PERTAINING TO THE OPERATION OF THE 4-400A MAY BE FOUND IN APPLICATION BULLETIN NO. 8, "THE CARE AND FEEDING OF POWER TETRODES." THIS BULLETIN IS AVAILABLE UPON REQUEST.**

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Indicates change from sheet dated 1-30-53.