

**MODULATOR  
OSCILLATOR  
AMPLIFIER**

†Guarantee applies only when the 4-400A is used as specified with adequate air in the 4-400A /4000 Air-System Socket or equivalent.

## PLATE MODULATED RADIO FREQUENCY AMPLIFIER

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

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

|                    |   |   |   |                 |
|--------------------|---|---|---|-----------------|
| D-C PLATE VOLTAGE  | - | - | - | 3200 MAX. VOLTS |
| D-C SCREEN VOLTAGE | - | - | - | 600 MAX. VOLTS  |
| D-C GRID VOLTAGE   | - | - | - | -500 MAX. VOLTS |
| D-C PLATE CURRENT  | - | - | - | 275 MAX. MA     |
| PLATE DISSIPATION  | - | - | - | 270 MAX. WATTS  |
| SCREEN DISSIPATION | - | - | - | 35 MAX. WATTS   |
| GRID DISSIPATION   | - | - | - | 10 MAX. WATTS   |

### ▶ MAXIMUM RATINGS (Frequencies below 30 Mc., Intermittent Service)

|                    |   |   |   |                 |
|--------------------|---|---|---|-----------------|
| D-C Plate Voltage  | - | - | - | 4000 MAX. VOLTS |
| D-C Screen Voltage | - | - | - | 600 MAX. VOLTS  |
| D-C Grid Voltage   | - | - | - | -500 MAX. VOLTS |
| D-C Plate Current  | - | - | - | 275 MAX. MA     |
| Plate Dissipation  | - | - | - | 270 MAX. WATTS  |
| Screen Dissipation | - | - | - | 35 MAX. WATTS   |
| Grid Dissipation   | - | - | - | 10 MAX. WATTS   |

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

|                                           |   |   |   |      |      |      |       |
|-------------------------------------------|---|---|---|------|------|------|-------|
| D-C Plate Voltage                         | - | - | - | 2000 | 2500 | 3000 | volts |
| D-C Screen Voltage                        | - | - | - | 500  | 500  | 500  | volts |
| D-C Grid Voltage                          | - | - | - | -220 | -220 | -220 | volts |
| D-C Plate Current                         | - | - | - | 275  | 275  | 275  | ma    |
| D-C Screen Current                        | - | - | - | 30   | 28   | 26   | ma    |
| D-C Grid Current                          | - | - | - | 12   | 12   | 12   | ma    |
| Screen Dissipation                        | - | - | - | 15   | 14   | 13   | watts |
| Grid Dissipation                          | - | - | - | 1.1  | 1.1  | 1.1  | watts |
| Peak A-F Screen Voltage (100% modulation) | - | - | - | 350  | 350  | 350  | volts |
| Peak R-F Grid Input Voltage               | - | - | - | 290  | 290  | 290  | volts |
| Driving Power                             | - | - | - | 3.5  | 3.5  | 3.5  | watts |
| Plate Power Input                         | - | - | - | 550  | 688  | 825  | watts |
| Plate Dissipation                         | - | - | - | 170  | 178  | 195  | watts |
| Plate Power Output                        | - | - | - | 380  | 510  | 630  | watts |

### TYPICAL OPERATION (Frequencies below 30 Mc., Intermittent Service)

|                                           |   |   |   |      |      |      |      |       |
|-------------------------------------------|---|---|---|------|------|------|------|-------|
| D-C Plate Voltage                         | - | - | - | 2000 | 2500 | 3000 | 3650 | volts |
| D-C Screen Voltage                        | - | - | - | 500  | 500  | 500  | 500  | volts |
| D-C Grid Voltage                          | - | - | - | -220 | -220 | -220 | -225 | volts |
| D-C Plate Current                         | - | - | - | 275  | 275  | 275  | 275  | ma    |
| D-C Screen Current                        | - | - | - | 30   | 28   | 26   | 23   | ma    |
| D-C Grid Current                          | - | - | - | 12   | 12   | 12   | 13   | ma    |
| Screen Dissipation                        | - | - | - | 15   | 14   | 13   | 12   | watts |
| Grid Dissipation                          | - | - | - | 1.1  | 1.1  | 1.1  | 1.2  | watts |
| Peak A-F Screen Voltage (100% modulation) | - | - | - | 350  | 350  | 350  | 350  | volts |
| Peak R-F Grid Input Voltage               | - | - | - | 290  | 290  | 290  | 315  | volts |
| Driving Power                             | - | - | - | 3.5  | 3.5  | 3.5  | 4.0  | watts |
| Plate Power Input                         | - | - | - | 550  | 688  | 825  | 1000 | watts |
| Plate Dissipation                         | - | - | - | 170  | 178  | 195  | 235  | watts |
| Plate Power Output                        | - | - | - | 380  | 510  | 630  | 765  | watts |

## AUDIO FREQUENCY POWER AMPLIFIER

### AND MODULATOR—CLASS AB

#### MAXIMUM RATINGS (PER TUBE)

|                              |   |   |   |   |   |   |   |                 |
|------------------------------|---|---|---|---|---|---|---|-----------------|
| D-C PLATE VOLTAGE            | - | - | - | - | - | - | - | 4000 MAX. VOLTS |
| D-C SCREEN VOLTAGE           | - | - | - | - | - | - | - | 800 MAX. VOLTS  |
| MAX-SIGNAL D-C PLATE CURRENT | - | - | - | - | - | - | - | 350 MAX. MA     |
| PLATE DISSIPATION            | - | - | - | - | - | - | - | 400 MAX. WATTS  |
| SCREEN DISSIPATION           | - | - | - | - | - | - | - | 35 MAX. WATTS   |
| GRID DISSIPATION             | - | - | - | - | - | - | - | 10 MAX. WATTS   |

#### TYPICAL OPERATION CLASS AB,

(Sinusoidal wave, two tubes unless otherwise specified)

|                                         |   |   |   |      |      |        |        |       |
|-----------------------------------------|---|---|---|------|------|--------|--------|-------|
| D-C Plate Voltage                       | - | - | - | 2500 | 3000 | 3500   | 4000   | volts |
| D-C Screen Voltage                      | - | - | - | 750  | 750  | 750    | 750    | volts |
| D-C Grid Voltage (approx.)*             | - | - | - | -130 | -137 | -145   | -150   | volts |
| Zero-Signal D-C Plate Current           | - | - | - | 190  | 160  | 140    | 120    | ma    |
| Max-Signal D-C Plate Current            | - | - | - | 635  | 635  | 610    | 585    | ma    |
| Zero-Signal D-C Screen Current          | - | - | - | 0    | 0    | 0      | 0      | ma    |
| Max-Signal D-C Screen Current           | - | - | - | 28   | 26   | 32     | 40     | ma    |
| Effective Load, Plate-to-Plate          | - | - | - | 6800 | 8900 | 11,500 | 14,500 | ohms  |
| Peak A-F Grid Input Voltage (per tube)  | - | - | - | 130  | 137  | 145    | 150    | volts |
| Driving Power                           | - | - | - | 0    | 0    | 0      | 0      | watts |
| Max-Signal Plate Dissipation (per tube) | - | - | - | 370  | 400  | 400    | 400    | watts |
| Max-Signal Plate Power Output           | - | - | - | 850  | 1110 | 1330   | 1540   | watts |

\*Adjust to give stated zero-signal plate current. The D-C resistance in series with the control grid of each tube should not exceed 250,000 ohms.

#### TYPICAL OPERATION CLASS AB,

(Sinusoidal wave, two tubes unless otherwise specified)

|                                         |   |   |   |      |      |        |        |       |
|-----------------------------------------|---|---|---|------|------|--------|--------|-------|
| D-C Plate Voltage                       | - | - | - | 2500 | 3000 | 3500   | 4000   | volts |
| D-C Screen Voltage                      | - | - | - | 500  | 500  | 500    | 500    | volts |
| D-C Grid Voltage (approx.)*             | - | - | - | -75  | -80  | -85    | -90    | volts |
| Zero-Signal D-C Plate Current           | - | - | - | 190  | 160  | 140    | 120    | ma    |
| Max-Signal D-C Plate Current            | - | - | - | 700  | 700  | 700    | 638    | ma    |
| Zero-Signal D-C Screen Current          | - | - | - | 0    | 0    | 0      | 0      | ma    |
| Max-Signal D-C Screen Current           | - | - | - | 50   | 40   | 38     | 32     | ma    |
| Effective Load, Plate-to-Plate          | - | - | - | 7200 | 9100 | 10,800 | 14,000 | ohms  |
| Peak A-F Grid Input Voltage (per tube)  | - | - | - | 133  | 140  | 145    | 140    | volts |
| Max-Signal Peak Driving Power           | - | - | - | 8.6  | 9.0  | 10.2   | 7.0    | watts |
| Max-Signal Nominal Driving Power        | - | - | - | 4.3  | 4.5  | 5.1    | 3.5    | watts |
| Max-Signal Plate Dissipation (per tube) | - | - | - | 320  | 363  | 400    | 400    | watts |
| Max-Signal Plate Power Output           | - | - | - | 1110 | 1375 | 1650   | 1750   | watts |

\*Adjust for stated zero-signal plate current.

**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 "Tempilaq", a temperature-sensitive lacquer manufactured by the Tempil 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, ex-

cept 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,

$$P_g = e_{cmp} I_c$$

where  $P_g$  = Grid Dissipation

$e_{cmp}$  = Peak positive grid to cathode voltage, and

$I_c$  = D-c grid current

$e_{cmp}$  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.

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.



