



**PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER**

Class-C Telephony (Carrier Conditions)

**MAXIMUM RATINGS****D-C PLATE VOLTAGE:**

|                       |                 |
|-----------------------|-----------------|
| Up to 150 megacycles  | 1600 MAX. VOLTS |
| 150 to 500 megacycles | 1000 MAX. VOLTS |
| D-C SCREEN VOLTAGE    | 300 MAX. VOLTS  |
| D-C GRID VOLTAGE      | —250 MAX. VOLTS |
| D-C PLATE CURRENT     | 200 MAX. MA     |
| PLATE DISSIPATION     | 165 MAX. WATTS  |
| SCREEN DISSIPATION    | 12 MAX. WATTS   |
| GRID DISSIPATION      | 2 MAX. WATTS    |

**TYPICAL OPERATION (Frequencies up to 150 megacycles)**

|                              |      |      |            |
|------------------------------|------|------|------------|
| D-C Plate Voltage            | 500  | 1000 | 1600 volts |
| D-C Screen Voltage           | 250  | 250  | 250 volts  |
| D-C Grid Voltage             | —150 | —150 | —150 volts |
| D-C Plate Current            | 200  | 200  | 200 ma     |
| D-C Screen Current*          | 25   | 20   | 18 ma      |
| D-C Grid Current*            | 23   | 21   | 21 ma      |
| Peak R-F Grid Input Voltage* | 173  | 172  | 172 volts  |
| Driving Power                | 4.0  | 3.6  | 3.6 watts  |
| Plate Input Power            | 100  | 200  | 320 watts  |
| Plate Output Power           | 47   | 140  | 250 watts  |

\*Approximate values.

**AUDIO-FREQUENCY AMPLIFIER OR MODULATOR**Class-AB<sub>1</sub>**MAXIMUM RATINGS (per tube)**

|                    |                 |
|--------------------|-----------------|
| D-C PLATE VOLTAGE  | 2000 MAX. VOLTS |
| D-C SCREEN VOLTAGE | 400 MAX. VOLTS  |
| D-C PLATE CURRENT  | 250 MAX. MA     |
| PLATE DISSIPATION  | 250 MAX. WATTS  |
| SCREEN DISSIPATION | 12 MAX. WATTS   |
| GRID DISSIPATION   | 2 MAX. WATTS    |

**TYPICAL OPERATION (Sinusoidal wave, two tubes unless noted)**

|                                         |      |      |            |
|-----------------------------------------|------|------|------------|
| D-C Plate Voltage                       | 1000 | 1500 | 2000 volts |
| D-C Screen Voltage                      | 350  | 350  | 350 volts  |
| D-C Grid Voltage <sup>1</sup>           | —55  | —55  | —55 volts  |
| Zero-Signal D-C Plate Current           | 200  | 200  | 200 ma     |
| Max-Signal D-C Plate Current            | 500  | 500  | 500 ma     |
| Max-Signal D-C Screen Current           | 20   | 16   | 10 ma      |
| Effective Load, Plate to Plate          | 3500 | 6200 | 9500 ohms  |
| Peak A-F Grid Input Voltage (per tube)* | 50   | 50   | 50 volts   |
| Driving Power                           | 0    | 0    | 0 watts    |
| Max-Signal Plate Output Power           | 240  | 430  | 600 watts  |

\*Approximate values.

<sup>1</sup>Adjust grid bias to obtain listed zero-signal plate current.**RADIO-FREQUENCY LINEAR AMPLIFIER**Class-AB<sub>1</sub> (Carrier Conditions)**MAXIMUM RATINGS****D-C PLATE VOLTAGE:**

|                       |                 |
|-----------------------|-----------------|
| Up to 150 megacycles  | 2000 MAX. VOLTS |
| 150 to 500 megacycles | 1250 MAX. VOLTS |
| D-C SCREEN VOLTAGE    | 400 MAX. VOLTS  |
| D-C PLATE CURRENT     | 250 MAX. MA     |
| PLATE DISSIPATION     | 250 MAX. WATTS  |
| SCREEN DISSIPATION    | 12 MAX. WATTS   |
| GRID DISSIPATION      | 2 MAX. WATTS    |

**TYPICAL OPERATION (Frequencies up to 150 Mc)**

|                               |      |      |            |
|-------------------------------|------|------|------------|
| D-C Plate Voltage             | 1000 | 1500 | 2000 volts |
| D-C Screen Voltage            | 350  | 350  | 350 volts  |
| D-C Grid Voltage <sup>1</sup> | —55  | —55  | —55 volts  |
| Zero-Signal D-C Plate Current | 100  | 100  | 100 ma     |
| D-C Plate Current             | 150  | 150  | 150 ma     |
| D-C Screen Current*           | —3   | —4   | —4 ma      |
| Peak R-F Grid Voltage*        | 25   | 25   | 25 volts   |
| Plate Output Power            | 30   | 50   | 65 watts   |

\*Approximate values.

<sup>1</sup>Adjust grid bias to obtain listed zero-signal plate current.**RADIO-FREQUENCY LINEAR AMPLIFIER, SSB**Class-AB<sub>1</sub> (Single-Tone Conditions)**MAXIMUM RATINGS****D-C PLATE VOLTAGE:**

|                       |                 |
|-----------------------|-----------------|
| Up to 150 megacycles  | 2000 MAX. VOLTS |
| 150 to 500 megacycles | 1250 MAX. VOLTS |
| D-C SCREEN VOLTAGE    | 400 MAX. VOLTS  |
| D-C PLATE CURRENT     | 250 MAX. MA     |
| PLATE DISSIPATION     | 250 MAX. WATTS  |
| SCREEN DISSIPATION    | 12 MAX. WATTS   |
| GRID DISSIPATION      | 2 MAX. WATTS    |

**TYPICAL OPERATION (Frequencies up to 150 megacycles)**

|                                 |      |      |            |
|---------------------------------|------|------|------------|
| D-C Plate Voltage               | 1000 | 1500 | 2000 volts |
| D-C Screen Voltage              | 350  | 350  | 350 volts  |
| D-C Grid Voltage <sup>1</sup>   | —55  | —55  | —55 volts  |
| Peak R-F Grid Voltage*          | 50   | 50   | 50 volts   |
| Zero-Signal D-C Plate Current   | 100  | 100  | 100 ma     |
| Single-Tone D-C Plate Current   | 250  | 250  | 250 ma     |
| Two-Tone D-C Plate Current      | 190  | 190  | 190 ma     |
| Single-Tone D-C Screen Current* | 10   | 8    | 5 ma       |
| Two-Tone D-C Screen Current*    | 2    | —1   | —2 ma      |
| R-F Load Impedance              | 1750 | 3100 | 4750 ohms  |
| Single-Tone Plate Input Power   | 250  | 375  | 500 watts  |
| Single-Tone Plate Output Power  | 120  | 215  | 300 watts  |

\*Approximate values.

<sup>1</sup>Adjust to obtain listed zero-signal plate current.

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made.

In class-C operation, adjustment of the r-f grid drive to obtain listed plate current at the listed grid bias, screen voltage, and plate voltage is assumed. Resultant screen and grid currents will vary from tube to tube, but little change in output power will be noted.

In class-AB<sub>1</sub> linear operation, screen current will also vary from tube to tube but is a useful indicator of relative linearity. In general, less screen current means better linearity, providing other conditions are held constant. The same degree of linearity will be obtained from different tubes if loading and drive are adjusted to give the same plate and screen currents, although output power may vary from tube to tube.



## APPLICATION

### MECHANICAL

**Mounting**—The 4X150R and 4X150S may be operated in any position. An Eimac Air-System Socket, SK-600 series, or a socket having equivalent characteristics, is required. Sockets are available with or without built-in screen capacitors and may be obtained with either grounded or ungrounded cathode terminals.

**Cooling**—Sufficient forced-air cooling must be provided for the anode, base seals, and body seals to maintain operating temperatures below the rated maximum values. Air requirements to maintain anode core temperatures at 200°C with an inlet air temperature of 50°C are tabulated below. These requirements apply when a socket of the Eimac SK-600 series and an Eimac SK-606 chimney are used with air flow in the base to anode direction.

| Plate<br>Dissipation<br>(Watts) | SEA LEVEL         |                                       | 10,000 FEET       |                                       |
|---------------------------------|-------------------|---------------------------------------|-------------------|---------------------------------------|
|                                 | Air Flow<br>(CFM) | Pressure<br>Drop (Inches<br>of Water) | Air Flow<br>(CFM) | Pressure<br>Drop (Inches<br>of Water) |
| 200                             | 5.0               | 0.52                                  | 7.3               | 0.76                                  |
| 250                             | 6.4               | 0.82                                  | 9.3               | 1.20                                  |

The blower selected in a given application must be capable of supplying the desired airflow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters. The blower must be designed to deliver the air at the desired altitude.

At 500 Mc or below, base-cooling air requirements are satisfied automatically when the tube is operated in an Eimac Air-System Socket and the recommended air-flow rates are used. Experience has shown that if reliable long-life operation is to be obtained, the cool-

ing air-flow must be maintained during standby periods when only the heater voltage is applied to the tube. The anode cooler should be inspected periodically and cleaned when necessary to remove any dirt which might interfere with effective cooling.

**Shock and Vibration**—The 4X150R and 4X150S are two Eimac tube types unique in that shock and vibration testing are performed with *maximum rated plate and screen voltages* applied. Two samples of production tubes are randomly selected periodically and tested under the conditions outlined below.

With *maximum rated plate and screen voltages* applied, each of the tubes in this sample is subjected to six shocks of 90 G (minimum) half-sine-wave motion, with a duration of  $11 \pm 2$  milliseconds, in each of the three major axes (X1, X2, and Y1).

With *maximum rated plate and screen voltages* applied and with control-grid voltage adjusted to allow the flow of 100 ma through a plate load resistor of 4900 ohms, each of the tubes in this sample is vibrated in the three major axes throughout the range of 5-750-5 cps in a minimum time of six minutes per axis. The vibration level is maintained at 10 G from 28 cps to 750 cps and at 0.25 inch D.A. from 5 cps to 28 cps. During this test noise voltage developed across the plate load resistor cannot exceed 30 volts rms. Sufficient plate power-supply voltage (2500 volts) is employed to assure that a minimum of 2000 volts appears at the plate of the tube under test even though 490 volts drop across the plate load resistor results from d-c plate-current flow.

The equipment designer is cautioned to provide adequate tube support to prevent relative motion between tube and socket in equipments where shock and/or vibration are anticipated.

### ELECTRICAL

**Heater**—The rated heater voltage for the 4X150R and 4X150S is 6.0 volts and 26.5 volts respectively, and the voltage should be maintained as closely as practicable. Short-time changes of  $\pm 10\%$  will not damage the tube, but variations in performance must be expected. The heater voltage must be maintained with  $\pm 5\%$  to minimize these variations and to obtain maximum tube life.

At frequencies above approximately 300 megacycles, transit-time effects begin to influence the cathode temperature. The amount of driving power diverted to heating the cathode by back-bombardment will depend upon frequency, plate current, and driving power. When the tube is driven to maximum input as a "straight-through" class-C amplifier, the heater voltage should be reduced according to the table below:

| Frequency, Mc | 4X150R     | 4X150S     |
|---------------|------------|------------|
| 300 and lower | 6.00 volts | 26.5 volts |
| 301 to 400    | 5.75 volts | 25.5 volts |
| 401 to 500    | 5.50 volts | 24.3 volts |

**Cathode**—The cathode of each type is connected to the four even-numbered base pins to provide a low-inductance path, or permit separation of input and

output circuits if required.

Rated heater voltage should be applied before other operating voltages are applied.

Heater-to-cathode maximum voltage is  $\pm 150$  volts.

**Control-Grid**—Maximum rated d-c bias voltage is -250 volts. D-C resistance, grid-to-cathode, should be no more than 100,000 ohms.

**Screen-Grid**—Maximum screen dissipation for each type is 12 watts, normally computed by multiplying d-c screen voltage by the average screen current. This computation is essentially correct except in the case of heavy plate loading when secondary-emission current may mask the normal screen current.

All tetrodes, under some conditions of loading and drive, will exhibit secondary emission from the screen which changes the net current to the screen and may even cause the screen current meter to reverse. Normally, secondary emission is harmless provided the screen voltage is stable. To insure stable screen voltage, it is recommended that a bleeder resistor calculated to pass 15 ma from screen to ground be used.

**Plate Dissipation**—The maximum plate dissipation for either type is 250 watts. The usual single-sideband voice signal is complex and full peak envelope power



shown in Typical Operating Conditions may be developed without exceeding this plate dissipation. Single-tone testing for short periods with greater than 250 watts plate dissipation is permissible.

**Multiple Operation**—To obtain maximum power with minimum distortion from tubes operated in multiple it is desirable to adjust individual screen or grid-bias voltages so the peak plate current for each tube is equal at the crest of the exciting voltage. Under

these conditions, individual d-c plate currents will be approximately equal for full input signal for class-AB<sub>1</sub> operation.

**Special Application**—If it is desired to use the 4X150R or the 4X150S under conditions widely different from those given here, consult the Power Grid Tube Marketing Department, Eitel-McCullough, Inc., San Carlos, California, or any of our regional offices or representatives.

PIN NO. 1. SCREEN GRID

PIN NO. 2. CATHODE

PIN NO. 3. HEATER

PIN NO. 4. CATHODE

PIN NO. 5. I.C. DO NOT USE FOR  
EXTERNAL CONNECTION

PIN NO. 6. CATHODE

PIN NO. 7. HEATER

PIN NO. 8. CATHODE

CENTER PIN—CONTROL GRID

DIMENSIONS IN INCHES

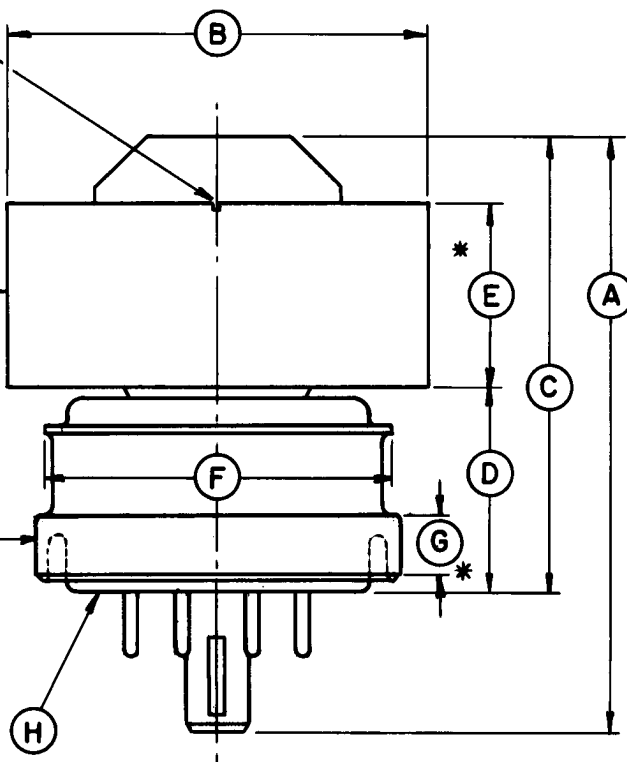
DIMENSIONAL DATA

| REF. | MIN.                                  | MAX.  | NOM. |
|------|---------------------------------------|-------|------|
| A    | 2.224                                 | 2.414 |      |
| B    | 1.610                                 | 1.640 |      |
| C    | 1.710                                 | 1.860 |      |
| D    | .750                                  | .810  |      |
| E    | .710                                  | .790  |      |
| F    |                                       | 1.406 |      |
| G    | .187                                  |       |      |
| H    | BASE : B 8-236<br>(JEDEC DESIGNATION) |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |
|      |                                       |       |      |

INDEX  
(ALIGNED WITH  
CONTROL GRID  
GUIDE LUG)

ANODE  
RADIATOR

SCREEN GRID  
(CONTACT OUTER  
CYLINDRICAL  
SURFACE ONLY)



DIMENSIONS IN INCHES

\* CONTACT SURFACE



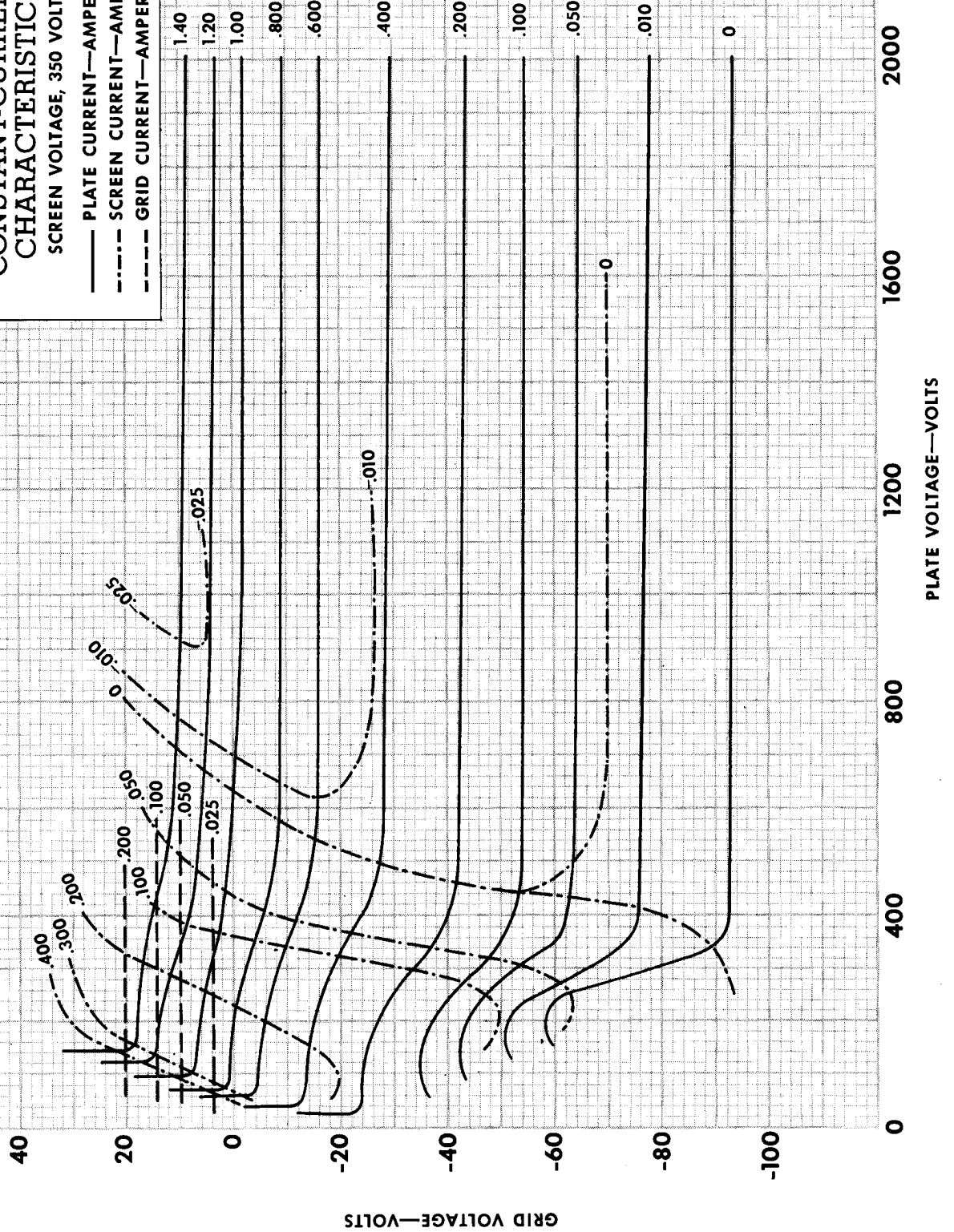
## EIMAC 4X150R &amp; 4X150S

## TYPICAL

CONSTANT-CURRENT  
CHARACTERISTICS

SCREEN VOLTAGE, 350 VOLTS

- PLATE CURRENT—AMPERES  
- - - - SCREEN CURRENT—AMPERES  
- - - - GRID CURRENT—AMPERES





EIMAC 4X150R & 4X150S

TYPICAL

CONSTANT-CURRENT  
CHARACTERISTICS

SCREEN VOLTAGE, 250 VOLTS

— PLATE CURRENT—AMPERES

- - - - SCREEN CURRENT—AMPERES

- - - - GRID CURRENT—AMPERES

