The PL-6580 is a 400-watt plate dissipation high-mu power triode designed especially for grounded-grid r-f amplifier service, but also capable of good performance in other applications. Because of its high amplification factor and high perveance, the PL-6580 will give power gains as high as ten as a grounded-grid amplifier. Effective shielding is provided within the PL-6580, and neutralization is not required in ordinary grounded-grid applications.

**ELECTRICAL CHARACTERISTICS**

- **Filament** -- Thoriated Tungsten
  - Voltage: 5.0 volts
  - Current: 14.5 amperes
- **Amplification Factor**: 45
- **Transconductance** \((E_b=2000 \text{ v}, I_b=200 \text{ ma.})\): 6500 \(\mu\)mhos
- **Interelectrode Capacitances**
  - Grid-Filament (Input): 7.6 \(\mu\)f
  - Grid-Plate (Output): 3.9 \(\mu\)f
  - Plate-Filament (Feedback): 0.10 \(\mu\)f

**MECHANICAL CHARACTERISTICS**

- **Base**: Giant 5-pin, Metal Shell
- **Basing**: See base diagram
- **Maximum Overall Dimensions**
  - Length: 6.38 inches
  - Diameter: 3.56 inches
- **Net Weight**: 8 ounces
- **Mounting Position**: Vertical, base up or down

Recommended socket -- E. F. Johnson Co. No. 122-275, in conjunction with the PL-C1 glass chimney and socket cut-out as shown on page 4.
PL-6580

COOLING

Forced-air cooling of the base and seals of the PL-6580 is required for all classes of operation. Such cooling normally is provided through use of a tube socket having holes which align with the holes in the tube base, and with a small fan or blower to pressurize the chassis upon which the tube is mounted. Alternatively, when an open chassis is used, a small fan or blower may be used with the outlet air stream directed at the tube socket. A minimum air flow of five cubic feet per minute through the base of the tube is required during the period that filament power is applied.

Adequate cooling of the envelope and plate seal for operation at frequencies below 30 Mc. can be obtained by convective air flow. Above 30 Mc. the air stream from a small fan or blower directed at the upper portion of the envelope will normally provide adequate cooling. In any event, the temperature of the plate cap should not be permitted to exceed 170° C for any class of continuous service.

RADIO-FREQUENCY OPERATION

The PL-6580 is especially suited for use as a grounded-grid radio-frequency amplifier. The compact construction and low plate-to-filament capacitance make neutralization unnecessary in ordinary grounded-grid applications.

For every value of plate voltage, there is an optimum value of zero-signal plate current at which maximum linearity and minimum third-order intermodulation distortion will be realized. The PL-6580 can be operated over a wide range of plate voltages with excellent linearity by means of properly adjusting the bias voltage to obtain the correct zero-signal plate current. Zero-signal plate current values for typical plate voltages are given in the tabular data.

A typical grounded-grid amplifier circuit is shown in Figure 3. The grid is by-passed to ground, and supplied only with d-c bias voltage. Radio-frequency excitation is applied between filament and ground, and output is taken from the plate-to-ground circuit. The excitation circuit and the output circuit are in series, via the tube, and a portion of the output power "fed through" from the driving circuit is related to the ratio of tube excitation voltage to output voltage. The feedthrough power is minimized by using a tube with a high amplification factor, so that minimum r-f grid voltage is required. A further improvement in the power gain of a grounded-grid amplifier is obtained by using the highest possible plate voltage, since the ratio of r-f output to excitation voltage is thereby increased.

In addition to the feed-through power, the r-f driving source must supply power for normal grid-driving purposes. This power is dissipated in the bias supply and at the grid of the tube, and does not appear in the output circuit. The power lost is ordinarily on the order of one-fiftieth of the output power.

During the portion of the radio-frequency cycle in which plate current flows, heavy demands are made upon the driving source for the grounded-grid amplifier to supply r-f cathode current. This current may be four to six times the average plate current, and unless adequate energy storage (Q) is provided in the driving circuit, distortion of individual cycles of the r-f driving wave can occur, with a consequent serious lowering of efficiency.

It is recommended that the tuned circuit driving the PL-6580 have a loaded Q of at least five, to minimize driving-wave distortion. Figure 4 shows the minimum amount of grid-cathode tank circuit capacitance required for proper Q at frequencies in the 2- to 60 Mc. region. Additional capacitance up to two or three times the recommended minimum may be used, if desired. The input circuit inductance should be selected to resonate at the operating frequency with the capacitance in use.

Where a pi-network coupling circuit is used to feed the PL-6580 from a low-impedance line, as shown in the circuit of Figure 3, the capacitance at the tube end of the network should be equal to or greater than the recommended minimum shown in Figure 4. The average input impedance of the PL-6580 is given by:

**FIG. 1**

**FIG. 2**
and this value should be used in calculating the inductance and input-end capacitance of the pi-network driving circuit. Values for the peak r-f driving voltage and driving power for a number of operating conditions will be found in the tabular data. For practical purposes, the input impedance of the PL-6580 may be taken as 300 ohms in most applications.

Figure 2 shows suggested pi-network capacitance and inductance values for a network feeding the PL-6580 from a 50-ohm non-resonant line.

The grid of the PL-6580 terminates in three base pins. The corresponding three socket terminals should be connected together with a low-inductance connection, and by-passed to chassis with a short low-inductance lead and a low-inductance capacitor. Multiple by-pass capacitors may be used if desired, but will not ordinarily be found necessary.

Filament power for the PL-6580 should be supplied through suitable filament chokes, as indicated in Figure 3. The reactance of the chokes should be several times the input impedance of the amplifier and wound with wire of sufficient size to carry the filament current. It may be found necessary to employ a filament transformer delivering more than the rated filament voltage, to compensate for the voltage drop across the chokes. Examples of commercially available filament chokes are the Barker and Williamson FC-15 (15 amperes) and FC-30 (30 amperes). The current requirements for filament chokes may be reduced by placing them in the primary of the filament transformer, and isolating the transformer from ground. 1

When the PL-6580 is used as a grounded-grid linear amplifier of modulated power, the loading presented to the driving source makes additional "swamping" unnecessary. Typical operating conditions for the PL-6580 as an amplifier of single-sideband, suppressed carrier power are given in the tabular data. The typical operating conditions shown are for continuously applied sinusoidal modulation. Increased output without excessive plate dissipation may be obtained with intermittent modulation having a high ratio of peak-to-average power, such as normal speech. In such cases, increased plate circuit loading and increased drive should be used. The average plate dissipation should not be allowed to exceed 250 watts, except momentarily during adjustment procedures.

1 See "Notes on Grounded-Grid R F Power Amplifiers" (Pickett, QST, December 1954, pg. 36, or 1962 A.R.R.L. Handbook, pg. 165.)

**MAXIMUM RATINGS — CCS (Continuous Commercial Service)**

<table>
<thead>
<tr>
<th>D-C Plate Voltage</th>
<th>4000</th>
<th>3200</th>
<th>4000 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-C Plate Current</td>
<td>350</td>
<td>275</td>
<td>350 ma.</td>
</tr>
<tr>
<td>D-C Grid Current</td>
<td>120</td>
<td>120</td>
<td>120 ma.</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>400</td>
<td>270</td>
<td>400 watts</td>
</tr>
</tbody>
</table>

**TYPICAL OPERATION — Class C C-W or FM Amplifier**

**(Grounded-Grid Circuit)**

<table>
<thead>
<tr>
<th>D-C Plate Voltage</th>
<th>2500</th>
<th>3000</th>
<th>4000 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-C Grid Voltage</td>
<td>-70</td>
<td>-90</td>
<td>-110 volts</td>
</tr>
<tr>
<td>D-C Plate Current</td>
<td>350</td>
<td>350</td>
<td>350 ma.</td>
</tr>
<tr>
<td>D-C Grid Current</td>
<td>95</td>
<td>82</td>
<td>92 ma.</td>
</tr>
<tr>
<td>Peak R-F Driving Voltage</td>
<td>210</td>
<td>215</td>
<td>265 volts</td>
</tr>
<tr>
<td>Driving Power (approx.,(\text{3}))</td>
<td>85</td>
<td>87</td>
<td>105 watts</td>
</tr>
<tr>
<td>Plate Power Input</td>
<td>875</td>
<td>1050</td>
<td>1400 watts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>280</td>
<td>375</td>
<td>400 watts</td>
</tr>
<tr>
<td>Power Output</td>
<td>660</td>
<td>745</td>
<td>1080 watts</td>
</tr>
</tbody>
</table>

**TYPICAL OPERATION — Class B Linear R-F Amplifier**

**Single-Sideband, Suppressed Carrier, Grounded-Grid Circuit**

<table>
<thead>
<tr>
<th>D-C Plate Voltage</th>
<th>2500</th>
<th>3000</th>
<th>3500</th>
<th>4000 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-C Grid Voltage</td>
<td>-50</td>
<td>-70</td>
<td>-65</td>
<td>-100 volts</td>
</tr>
<tr>
<td>Zero-Sig. D-C Plate Current</td>
<td>60</td>
<td>50</td>
<td>45</td>
<td>40 ma.</td>
</tr>
<tr>
<td>Max.-Sig. D-C Plate Current</td>
<td>350</td>
<td>335</td>
<td>300</td>
<td>300 ma.</td>
</tr>
<tr>
<td>Max.-Sig. D-C Grid Current</td>
<td>95</td>
<td>80</td>
<td>65</td>
<td>65 ma.</td>
</tr>
<tr>
<td>Max.-Sig. Peak R-F Driving Voltage</td>
<td>195</td>
<td>205</td>
<td>210</td>
<td>230 volts</td>
</tr>
<tr>
<td>Max.-Sig. Driving Power (approx.,(\text{1}), (\text{3}))</td>
<td>75</td>
<td>73</td>
<td>68</td>
<td>72 watts</td>
</tr>
<tr>
<td>Max.-Sig. Plate Power Input</td>
<td>875</td>
<td>1000</td>
<td>1050</td>
<td>1200 watts</td>
</tr>
<tr>
<td>Max.-Sig. Plate Dissipation</td>
<td>320</td>
<td>335</td>
<td>350</td>
<td>345 watts</td>
</tr>
<tr>
<td>Max.-Sig. Power Output</td>
<td>610</td>
<td>720</td>
<td>765</td>
<td>910 watts</td>
</tr>
</tbody>
</table>

\(\text{1}\) Includes bias loss, grid dissipation, and feed-through power.
\(\text{2}\) Approximate value -- adjust to give stated zero-signal plate current.
\(\text{3}\) Max.-Sig. values for peak conditions, or for single-tone modulation at full signal.
PL-6580

Plate Current - Amperes
Grid Current - Milliamperes

PL-6580
Constant Current Characteristics

Figure 3

C1, C2 - See Figure 2.
C3, C5 - .01 μF, 500 volt, mica.
C4, C9 - .003 μF, 1000 volt, mica.
C7, C8 - .002 μF, high-voltage blocking capacitor.
C9, C10 - Capacitors appropriate for use in pi network at desired operating frequency.
L1 - See Figure 2.
L2 - Coil appropriate for use in pi network at desired operating frequency.
RFC-1, RFC-4 - 2.5 mh r-f choke.
RFC-3 - Barker & Williams PC-15 or FC-50 or equivalent, filament choke.
RFC-5 - 150 in., 600 ma. r-f choke (National R-175A)
T-1 - Filament transformer (output voltage to be selected after determining voltage drop across filament choke).