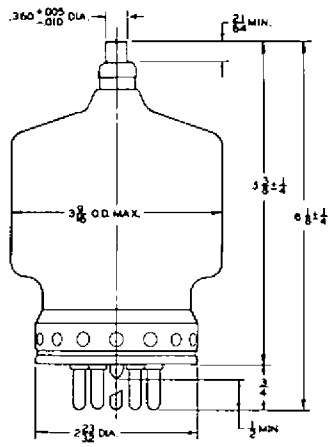
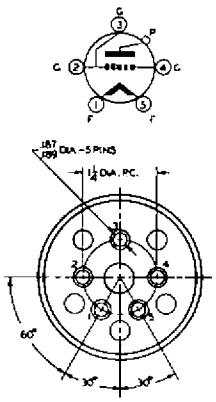




PL-6580

Power Triode

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 v, I_b=200 ma.)	6500 μmhos
Interelectrode Capacitances	
Grid-Filament (Input)	7.6 μμf
Grid-Plate (Output)	3.9 μμf
Plate-Filament (Feedback)	0.10 μμf

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.

1 June 1962

Form 512R-2

PENTA LABORATORIES, INC.

312 NORTH NOPAL STREET • SANTA BARBARA, CALIFORNIA

from JEDEC release #3783, June 25, 1962

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 fed-through 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 fed-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 1 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 1. The average input impedance of the PL-6580 is given by:

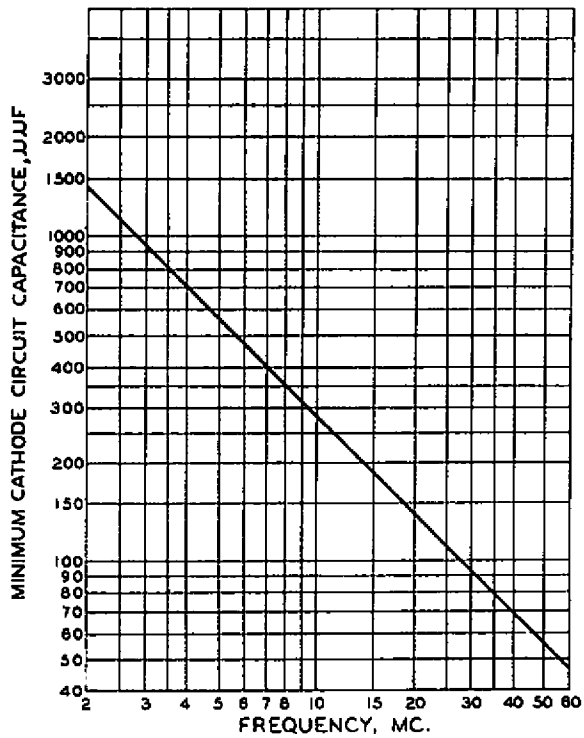


FIG. 1

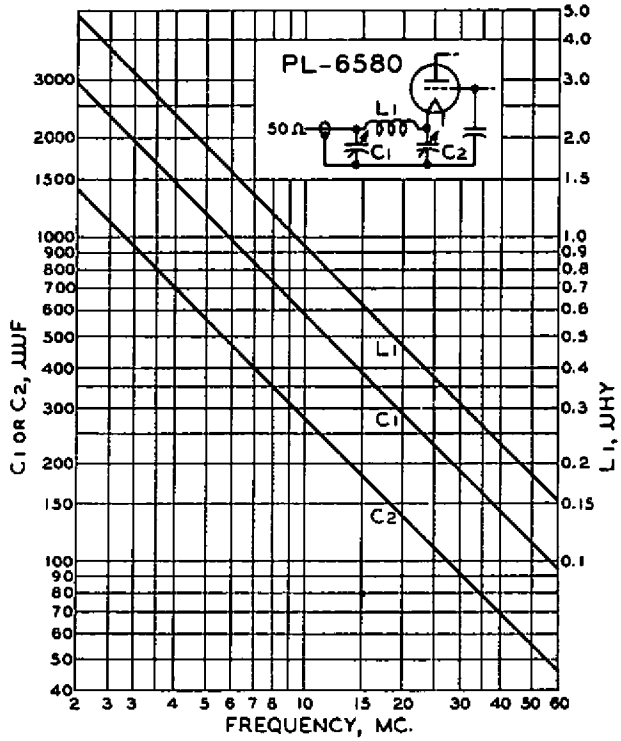


FIG. 2

PL-6580

$$Zin = \frac{(\text{peak r-f driving power})^2}{2 \times \text{driving power}},$$

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 RF Power Amplifiers" (Pucket), QST, December 1954, pg. 36, or 1962 A.R.R.L. Handbook, pg. 165.

MAXIMUM RATINGS — CCS (Continuous Commercial Service)

D-C Plate Voltage	4000	3200	4000 volts
D-C Plate Current	350	275	350 ma.
D-C Grid Current	120	120	120 ma.
Plate Dissipation	400	270	400 watts

TYPICAL OPERATION — Class C C-W or FM Amplifier

(Grounded-Grid Circuit)

D-C Plate Voltage	2500	3000	4000 volts
D-C Grid Voltage	-70	-90	-110 volts
D-C Plate Current	350	350	350 ma.
D-C Grid Current	95	82	92 ma.
Peak R-F Driving Voltage	210	215	265 volts
Driving Power (approx.)[1]	85	87	105 watts
Plate Power Input	875	1050	1400 watts
Plate Dissipation	280	375	400 watts
Power Output	660	745	1080 watts

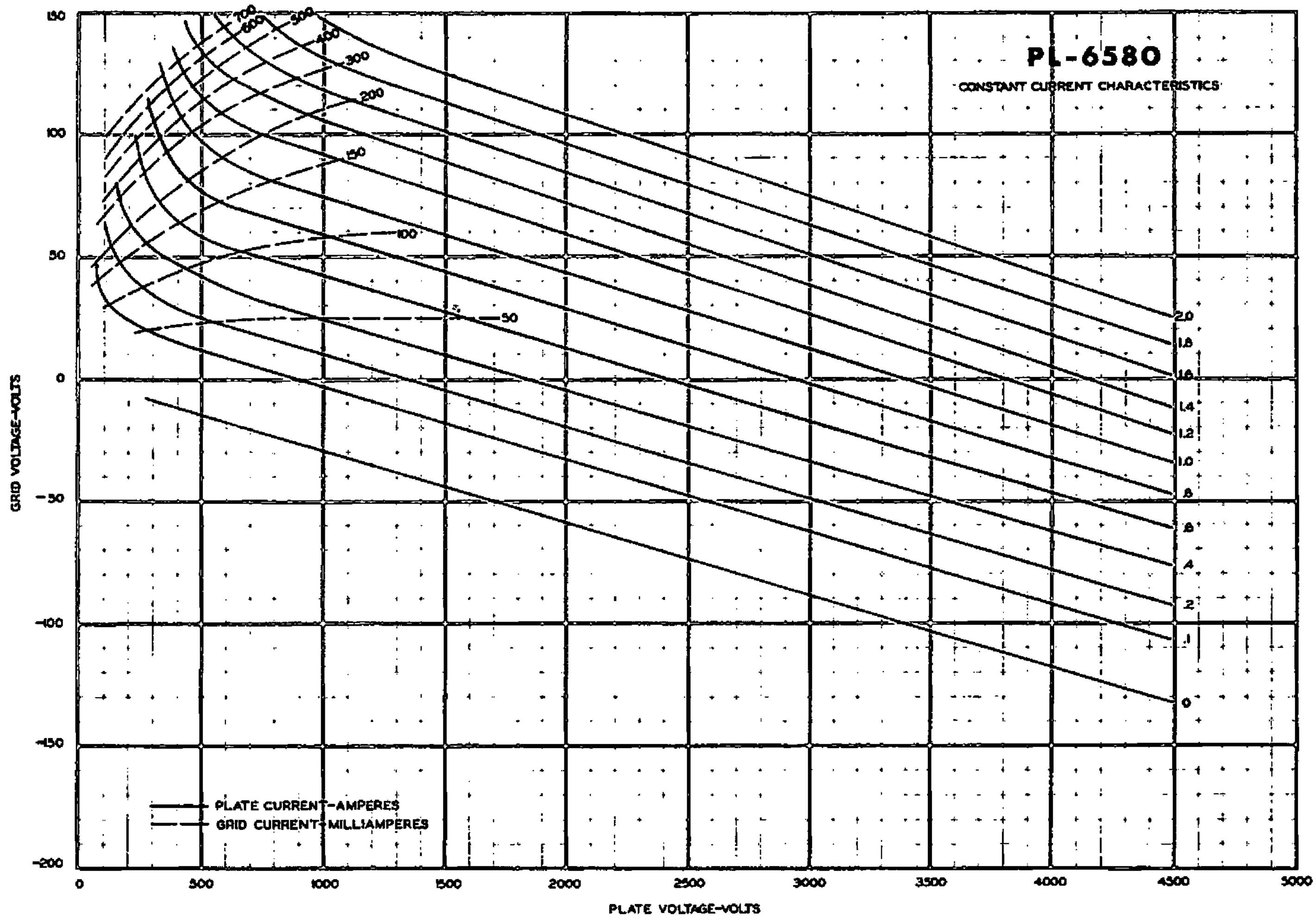
TYPICAL OPERATION — Class B Linear R-F Amplifier

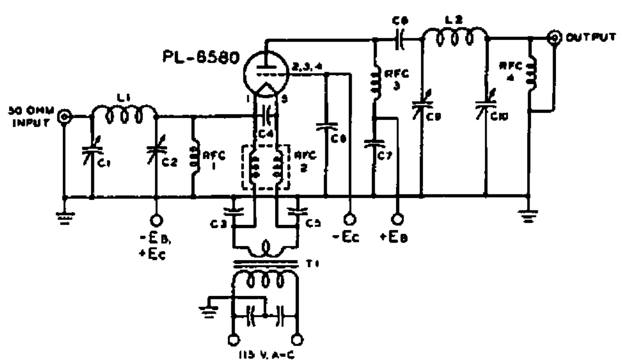
Single-Sideband, Suppressed Carrier; Grounded-Grid Circuit

D-C Plate Voltage	2500	3000	3500	4000 volts
D-C Grid Voltage[2]	-50	-70	-85	-100 volts
Zero-Sig. D-C Plate Current	60	50	45	40 ma.
Max.-Sig. D-C Plate Current[3]	350	335	300	300 ma.
Max.-Sig. D-C Grid Current[3]	95	80	65	65 ma.
Max.-Sig. Peak R-F Driving Voltage[3]	195	205	210	230 volts
Max.-Sig. Driving Power (approx.)[1, 3]	75	73	68	72 watts
Max.-Sig. Plate Power Input[3]	875	1000	1050	1200 watts
Max.-Sig. Plate Dissipation[3]	320	335	335	350 watts
Max.-Sig. Power Output[3]	610	720	765	910 watts

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

PL-6580





C1, C2 - See Figure 2.

C3, C5 - .01 ufd., 500 volts; mica.

C4, C6 - .002 ufd., 1000 volts; mica.

C7, C8 - .002 ufd. 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.

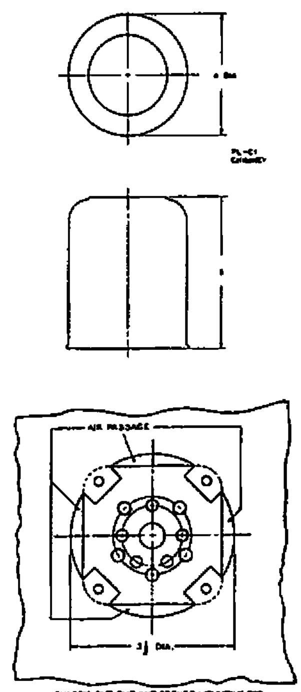
RFC-1, RFC-4 - 2.5 mh r-f choke.

RFC-2 - Barker & Williamson FC-15 or FC-30, or equivalent, filament choke.

RFC-3 - 225 µh., 800 ma. r-f choke (National R-175A)

T-1 - Filament transformer (output voltage to be selected after determining voltage drop across filament choke).

Figure 3



CHASSIS CUT-OUT AND SOCKET MOUNTING FOR PROPER AIR DISTRIBUTION FROM PRESSURIZED CHASSIS (JOHNSON NO. 122-275 SOCKET)