



PL-4E27A

Beam Pentode



The Penta PL-4E27A is a beam pentode suitable for use as an amplifier, oscillator, or modulator. In Class-C service it will deliver over 400 watts of usable power output with approximately two watts driving power. As a Class-AB₁ linear amplifier, the PL-4E27A will provide up to 280 watts of usable power output.

The PL-4E27A has a maximum plate dissipation rating of 125 watts and a maximum plate voltage rating of 4000 volts at frequencies up to 75 Mc. Adequate cooling is provided by convection and radiation, except in high ambient temperatures and at frequencies above 75 Mc., where forced-air circulation may be necessary.

ELECTRICAL CHARACTERISTICS

Filament -- Thoriated Tungsten	
Voltage - - - - -	5.0 volts
Current - - - - -	7.5 amperes
Grid-Screen Mu Factor - - - - -	5.0
Interelectrode Capacitances	
Grid-Plate - - - - -	0.08 μ f
Input - - - - -	10.5 μ f
Output - - - - -	4.7 μ f
Transconductance (2500 v. E_b , 500 v. E_{C2} , 0 v. E_{C3} , 50 ma. I_b) - - - - -	2500 μ mhos
Maximum Frequency for Full Ratings - - - - -	75 Mc.

MECHANICAL CHARACTERISTICS

Base ¹ - - - - -	Giant 7-pin, metal shell
Maximum Overall Dimensions	
Length - - - - -	6.19 inches
Diameter - - - - -	2.75 inches
Net Weight (average) - - - - -	6 ounces
Mounting Position	Vertical, base up or down

¹ Fits E. F. Johnson Co. socket 122-237 or equivalent.

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PENTA LABORATORIES, INC.

312 NORTH NOPAL STREET • SANTA BARBARA, CALIFORNIA



PL-4E27A

MOUNTING

The PL-4E27A must be mounted vertically, base up or down. The metal base should be grounded. The plate lead should be flexible.

The tube base fits E. F. Johnson Co. No. 122-237 seven-pin ceramic socket. This socket has a central ventilating hole, and if a socket made by another manufacturer is used, it should be made certain that the socket has a similar hole.

COOLING

A heat-dissipating connector must be used at the plate terminal, and provisions made for the circulation of air through the socket and the hole of the base.

Although convection and radiation cooling will normally be adequate when the tube is operating at frequencies below 75 Mc., it may be necessary to provide forced-air cooling at higher frequencies. The temperature of the plate and base seals must not exceed 225° C. Forced-air cooling, regardless of frequency, will be beneficial to the tube.

Metal-based tubes, such as the PL-4E27A, should not be sub-mounted. Sub-mounting does not improve isolation of the input and output circuits, and can prevent the proper circulation of cooling air.

OPERATION — GENERAL

Maximum ratings and typical operating conditions for the PL-4E27A are given in the accompanying tabular data.

Filament voltage should be maintained as closely as possible to the rated value of 5.0 volts. Variations up to 10 per cent of this value are permissible, but decreased tube life and variations in power output may occur with prolonged operation at voltages more than five per cent from the rated value.

MAXIMUM RATINGS

CCS (Continuous Commercial Service)

	<i>Class C</i> <i>CW or FM</i>	<i>Class AB₂</i> <i>Audio or R-F</i>	<i>Class AB₁</i> <i>Audio or R-F</i>	
D-C Plate Voltage	4000	4000	4000	volts
D-C Screen-Grid Voltage	750	750	750	volts
D-C Suppressor-Grid Voltage	75	75	75	volts
D-C Control-Grid Voltage	-500			volts
D-C Plate Current	200	200	200	ma.
D-C Control-Grid Current	10	10		ma.
Control-Grid Dissipation	5	5		watts
Screen-Grid Input	20	20	20	watts
Suppressor-Grid Input	20	20	20	watts
Plate Dissipation	125	125	125	watts

Screen-grid input exceeding the maximum rating can cause permanent damage to the PL-4E27A. If screen voltage is obtained from a power supply separate from the plate voltage supply, the circuit should be arranged so that it is impossible to apply screen voltage without plate voltage.

RADIO-FREQUENCY OPERATION

When care is taken to isolate the input and output circuits, and the suppressor and screen grids are effectively grounded for radio frequencies, the PL-4E27A may in most cases be operated without neutralization. In low-distortion Class-AB linear amplifier service, where reaction on the driver circuit must be eliminated entirely, it is good practice to neutralize the small feedback capacitance of the tube.

For maximum power gain and efficiency, the screen voltage applied to the tube in r-f amplifier applications should be no less than 500 volts, and a positive voltage of approximately 60 volts should be applied to the suppressor grid. The tube may be operated with a screen voltage as low as 350 volts, and with the suppressor grid operated at zero potential. However, either of these conditions will result in an increase in driving power requirements. Additionally, efficiency at low plate voltages will be sacrificed with zero-voltage operation of the suppressor grid.

In Class-AB linear amplifier service, the screen voltage for the PL-4E27A must be obtained from a well-regulated source, to prevent excessive screen voltage variations due to the changes in screen current which occur between zero-signal and full-signal conditions.

The suggested Class-AB₁ linear r-f amplifier operating conditions tabulated on page three result in third-order distortion products approximately 25 db below peak envelope power output, without the use of degenerative feedback.



PL-4E27A

In Class-AB applications, grid bias voltage for the PL-4E27A must be obtained from a fixed bias supply. The internal resistance of the bias source should not exceed 2000 ohms. Partial grid leak bias, in combination with fixed or cathode bias, or both, may be used in Class-C application.

Suppressor grid voltage may be obtained from any source capable of supplying approximately 60 volts at 10 ma. Although the suppressor grid voltage requirements are not critical, the voltage should be between 50 and 100 volts for best utilization of the suppressor grid action. A convenient source of suppressor grid voltage is a high-resistance voltage divider between the screen grid and ground.

High-level plate modulation may be accomplished with any of the systems commonly used for screen-grid tubes: by supplying the screen grid through a series resis-

tor from either the modulated or unmodulated plate supply or through an audio-frequency reactor from a separate low-voltage source.

Where maximum extended upward modulation above 100 per cent is desired, it is recommended that modulated voltage be applied to the screen grid. This can be accomplished by taking the screen voltage from the modulated plate supply through a series resistor or, if a low-voltage supply and series screen reactor are used, by connecting a low-capacitance audio coupling capacitor between the screen grid and the modulated plate supply.

Modulation of the suppressor voltage is not necessary in high-level modulated applications. However, the tube and its performance will not be adversely affected if it is necessary to obtain the suppressor grid voltage from the modulated screen supply.

TYPICAL OPERATION — Class AB₁ Linear R-F Amplifier¹

Single-Sideband, Suppressed Carrier

Grounded Cathode Circuit

D-C Plate Voltage	2000	2000	2500	2500	volts
D-C Screen-Grid Voltage	750	750	750	750	volts
D-C Suppressor-Grid Voltage	0	60	0	60	volts
D-C Control-Grid Voltage ²	-130	-132	-134	-136	volts
Zero-Signal D-C Plate Current	40	40	35	35	ma.
Zero-Signal D-C Screen Current	0.5	0.5	0.2	0.2	ma.
Maximum-Signal D-C Plate Current	165	180	165	170	ma.
Maximum-Signal D-C Screen Current	25	16	19	15	ma.
Maximum-Signal Peak R-F Grid Voltage	130	360	134	136	volts
Maximum-Signal Power Input	330	360	413	425	watts
Maximum-Signal Plate Dissipation	125	125	125	125	watts
Maximum-Signal Useful Power Output ³	195	220	265	280	watts

¹ D-C Current values shown are for peak conditions, or for single-tone modulation at full signal.

² Approximate value; adjust to give stated zero-signal plate current.

³ Peak envelope power delivered to load from typical amplifier. So-called "plate power output" is approximately 10 per cent higher than values shown.

TYPICAL OPERATION — Class C C-W or FM Amplifier

Grounded Cathode Circuit

D-C Plate Voltage	2000	2000	2500	2500	3000	3000	volts
D-C Screen-Grid Voltage	500	500	500	500	500	500	volts
D-C Suppressor-Grid Voltage	0	60	0	60	0	60	volts
D-C Control-Grid Voltage	-150	-150	-170	-170	-200	-200	volts
D-C Plate Current	185	220	190	222	163	187	ma.
D-C Screen-Grid Current	29	30	27	26	20	19	ma.
D-C Suppressor-Grid Current	0	6	0	5	0	5	ma.
D-C Control-Grid Current	8	10	8	10	6	7	ma.
Peak R-F Grid Voltage (approx.)	160	174	182	191	190	198	volts
Driving Power (approx.)	1.8	2.4	2.0	2.7	1.6	2.0	watts
Plate Power Input	370	440	475	555	490	560	watts
Plate Dissipation	125	125	130	130	130	125	watts
Useful Power Output ¹	225	285	285	375	325	405	watts

¹ Actual power output delivered to load from typical amplifier. So-called "plate power output" is approximately 10 per cent higher than values shown.



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