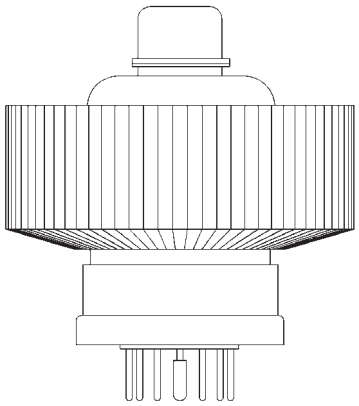


PL8877/ 3CX1500A7

High-Mu Power Triode

The Penta Laboratories PL8877/3CX1500A7 is a rugged ceramic and metal power triode designed for use as cathode driven Class AB_2 or Class B amplifier in audio or rf applications including the VHF band, or as a cathode driven plate modulated Class C rf amplifier. As a linear amplifier, high power gain may be obtained without sacrifice of low intermodulation distortion characteristics.

Low grid interception and high amplification factor combine to make the PL8877/3CX1500A7 drive power requirements exceptionally low for a tube of this power capacity.

General Characteristics[1]

Electrical

Cathode	Oxide Coated, Unipotential	
Cathode Heater		
Voltage	5.0 ± 0.25	Volts
Current (Ef = 5.0 Volts)	10.5	Amperes
Transconductance (Ib = 1.0 Adc)	55,000	µmhos
Amplification Factor (average)	200	
Direct Interelectrode Capacitance (Grounded Filament)[2]		
Cin	38.5	pF
Cout	0.1	pF
Cpg	10	pF
Direct Interelectrode Capacitance (Grounded Grid)[2]		
Cin	38.5	pF
Cout	10	pF
Cpg	0.1	pF
Ck-htr	9.7	pF
Frequency of Maximum Operation (CW)	250	MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as a result of additional data or product refinement.
2. Capacitance values are for a cold tube as measured in a special shielded fixture.

Revised 26 January 2010

P E N T A L A B O R A T O R I E S
9740 COZYCROFT AVENUE * CHATSWORTH * CALIFORNIA 91311
(800) 421-4219 * (818) 882-3872 * FAX: (818) 882-3968

Mechanical

Maximum Overall Dimensions		
Length	4.02	Inch
Diameter	3.38	Inch
Net Weight	25	Ounces
Operating Position	Any	
Maximum Operating Temperatures		
Ceramic/Metal Seals	250°	C
Anode Core	250°	C
Cooling	Forced-Air	
Base	Special 7-pin	
Recommended Air Socket System		
Grounded Cathode	PSK-2200	
Grounded Grid	PSK-2210	
Recommended Air Chimney	PSK-2216	

Range Values For Equipment Design

	Min.	Max.	
Heater Current (Ef = 5.0 Volts)	9.5	11.5	Amperes
Cathode Warm-up Time	180	---	Seconds
Interelectrode Capacitance[1] (Grounded Grid Circuit)			
Input	36.0	41.0	pF
Output	9.2	11.2	pF
Feedback	---	0.2	pF

1. In shielded fixture.

Maximum Ratings and Typical Operating Conditions

Radio Frequency Linear Amplifier Cathode Driven Class AB_2

Absolute Maximum Ratings

DC Plate Voltage	4000	Volts
DC Plate Current	1.0	Amperes
Plate Dissipation	1500	Watts
Grid Dissipation	20	Watts

Typical Operation
(Frequencies to 30 MHz) Class AB_2 Cathode Driven
Peak Envelope or Modulation Crest Conditions

Plate Voltage	2700	3500	Vdc
Cathode Voltage[1]	+8.2	+8.2	Vdc
Zero-Signal Plate Current[3]	92	182	mAdc
Single-Tone Plate Current	740	1000	mA
Two-Tone Plate Current	480	675	mA
Single-Tone Grid Current[3]	40	74	mAdc
Two-Tone Grid Current[3]	16	25	mAdc
Peak rf Cathode Voltage[3]	68	81	Volts
Peak Driving Power[3]	40	64	Watts
Driving Impedance	58	51	Ohms
Single-Tone Useful Output Power[3]	1085	2075	Watts

Resonant Load Impedance	1820	2000	Ohms
Intermodulation Distortion Products[2]			
3rd Order	-40	-38	dB
5th Order	-41	-41	dB

1. Positive cathode bias provided by zener diodes.
2. The intermodulation distortion products are referenced against one tone of a two equal tone signal.
3. Approximate values.

Typical Operation
(200 MHz) Class AB_2 Cathode Driven

Plate Voltage	2500	Volts
Cathode Voltage[1]	+8.2	Volts
Plate Current	1000	mAdc
Grid Current[2]	10	mAdc
Useful Output Power[2]	1520	Watts
Driving Power[2]	57	Watts
Power Gain[2]	14	dB

Radio Frequency Power Amplifier
Class B Telegraphy or FM (Continuous Operating Conditions)

Absolute Maximum Ratings

DC Plate Voltage	4000	Volts
DC Plate Current	1.0	Ampere
Plate Dissipation	1500	Watts
Grid Dissipation	20	Watts

Typical Operation (88-108 MHz)
Measured Values Class B, Cathode Driven

Plate Voltage	2000	2500	3000	4000	Vdc
Cathode Voltage[1, 2]	+9	+12	+15	+20	Vdc
Plate Current	1.0	1.0	1.0	1.0	Adc
Grid Current[2]	60	58	42	25	mAdc
Driving Power[2]	64	54	65	78	Watts
Useful Output Power[3]	1330	1670	1960	2600	Watts
Efficiency[4]	66.5	66.7	65.5	65.2	%
Power Gain[4]	13.2	14.2	14.8	15.3	dB

1. For measured case, idling anode current was set to 10 mAdc.
2. Approximate.
3. Approximate, delivered to load.
4. For the measured case, may vary from tube to tube.

Radio Frequency Power Amplifier
Class C - Cathode Driven, Plate Modulated

Absolute Maximum Ratings

DC Plate Voltage	3200	Volts
DC Plate Current	0.8	Amperes
Plate Dissipation	1000	Watts
Grid Dissipation	20	Watts

Typical Operation
Carrier Conditions, Frequencies to 30 MHz
Cathode Driven

Plate Voltage	2400	Vdc
Cathode Voltage[1]	+22	Vdc
Plate Current	600	mAdc
Grid Current[2]	45	mAdc
Plate Load Resistance	2000	Ohms
Driving Power[3]	41	Watts
Plate Output Power	1000	Watts
Power Gain	14	dB

1. Bias may be obtained from a fixed supply of 15.8 volts in series with a 9.5 ohm resistor. The resistor and supply should be bypassed for audio frequencies.
2. Approximate.
3. Approximate, and driver must be modulated approximately 83%.

Application

Mechanical

Mounting - The PL8877/3CX1500A7 may be mounted in any position.

Socket - The grid of the PL8877/3CX1500A7 terminates to the cylindrical grid ring about the base of the tube. This may be contacted by multiple clips or flexible finger stock. Connection to the heater and cathode are made via the 7-pin base.

Cooling - The maximum temperature limit for external tube surfaces and the anode core is 250°C. Tube life is prolonged if these areas are maintained at lower temperatures. For full 1500 watts anode dissipation 35.0 cfm of air is required at a back-pressure of 0.41 inches of water to hold tube temperature below 225°C with 50°C ambient temperature at sea level. At frequencies higher than 30 MHz, or at higher altitudes, the air quantity must be increased.

Base-to-Anode Air Flow (Sea Level)			Base-To-Anode Air Flow (10,000 ft.)		
Anode Dissipation (watts)	Air Flow (CFM)	Pressure Drop (In/H_2O)	Anode Dissipation (watts)	Air Flow (CFM)	Pressure Drop (In/H_2O)
500	7.5	0.10	500	11.0	0.15
1000	22.5	0.20	1000	32.5	0.29
1500	35.0	0.41	1500	51.0	0.60

Notes:
1. Tube mounted in PSK-2200 socket with PSK-2216 chimney.
2. An allowance of 20 watts has been made for grid dissipation and 50 watts for filament power.

Electrical

Filament Operation - The rated filament voltage for the PL8877/3CX1500A7 is 5.0 volts. The voltage, as measured at the socket, should be maintained at this value to obtain optimum performance and maximum tube life. In no case should the voltage be allowed to deviate from 5.0 volts by more than plus or minus five percent(5%).

Input Circuit - When the PL8877/3CX1500A7 is operated as a cathode driven rf amplifier, the use of a resonant circuit in the cathode is recommended. For best results with a single-ended amplifier, it is suggested that the cathode tank circuit operate with a "Q" of 5 or more.

Zero-Bias Operation - Operation at zero bias is not recommended with plate potentials over 3000 volts, since plate dissipation may be exceeded. Higher plate voltages may be used with the proper protective bias.

Fault Protection - All power tubes operate at voltages which can cause severe damage in the event of an internal arc, especially in those cases where large amounts of stored energy or follow-on current are involved. Some means of protection is advised in all cases, and it is recommended that a series resistor be used in the anode circuit (20 to 50 ohms) to limit peak current and provide a means of dissipating the energy in the event of a tube or circuit arc. For an oxide-cathode type such as the PL8877/3CX1500A7, a maximum of 4 joules total energy should be permitted to be dumped into an internal arc. Amounts in excess of this may permanently damage the cathode or the grid structure.

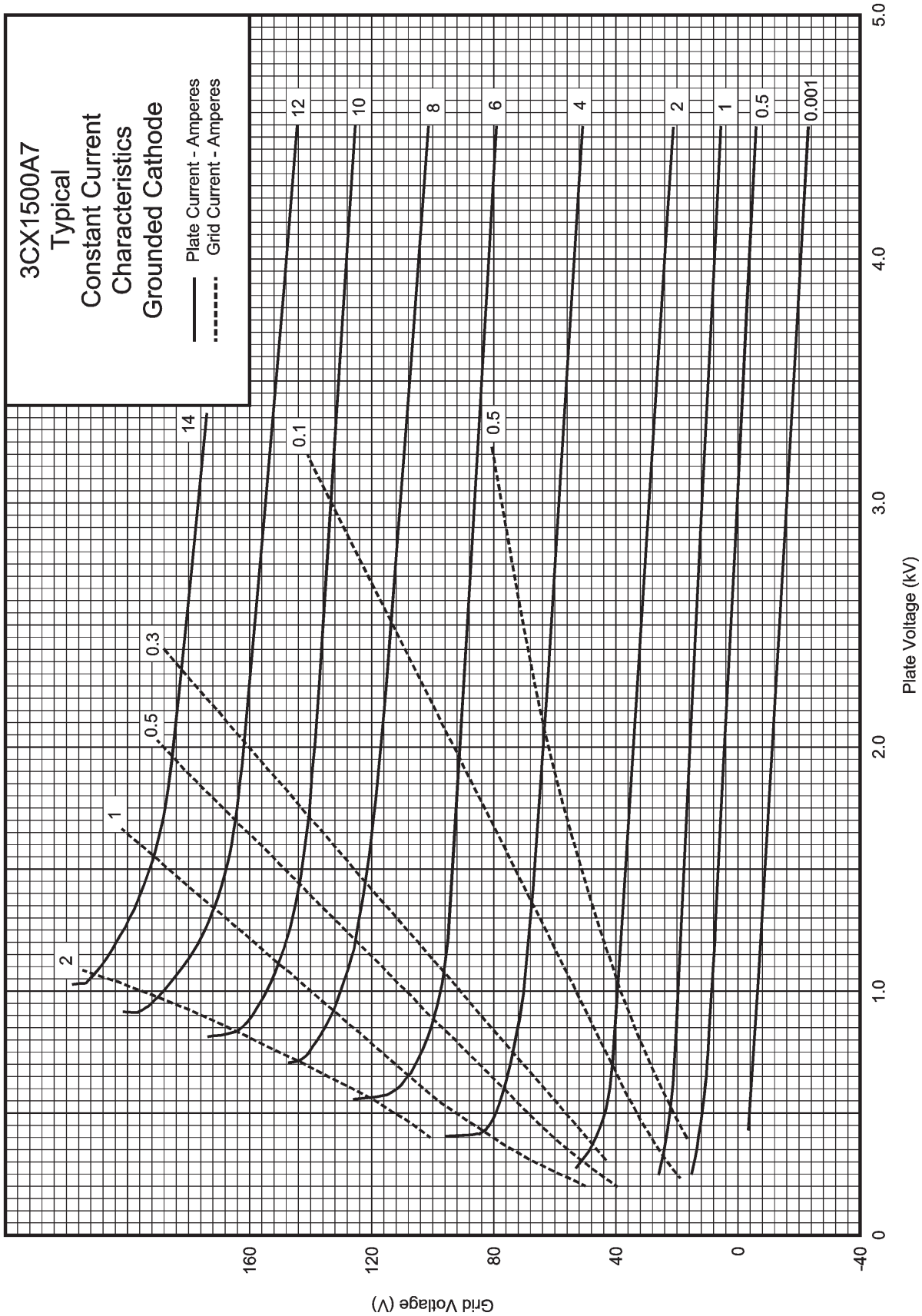
Radio Frequency Radiation - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependant on the frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

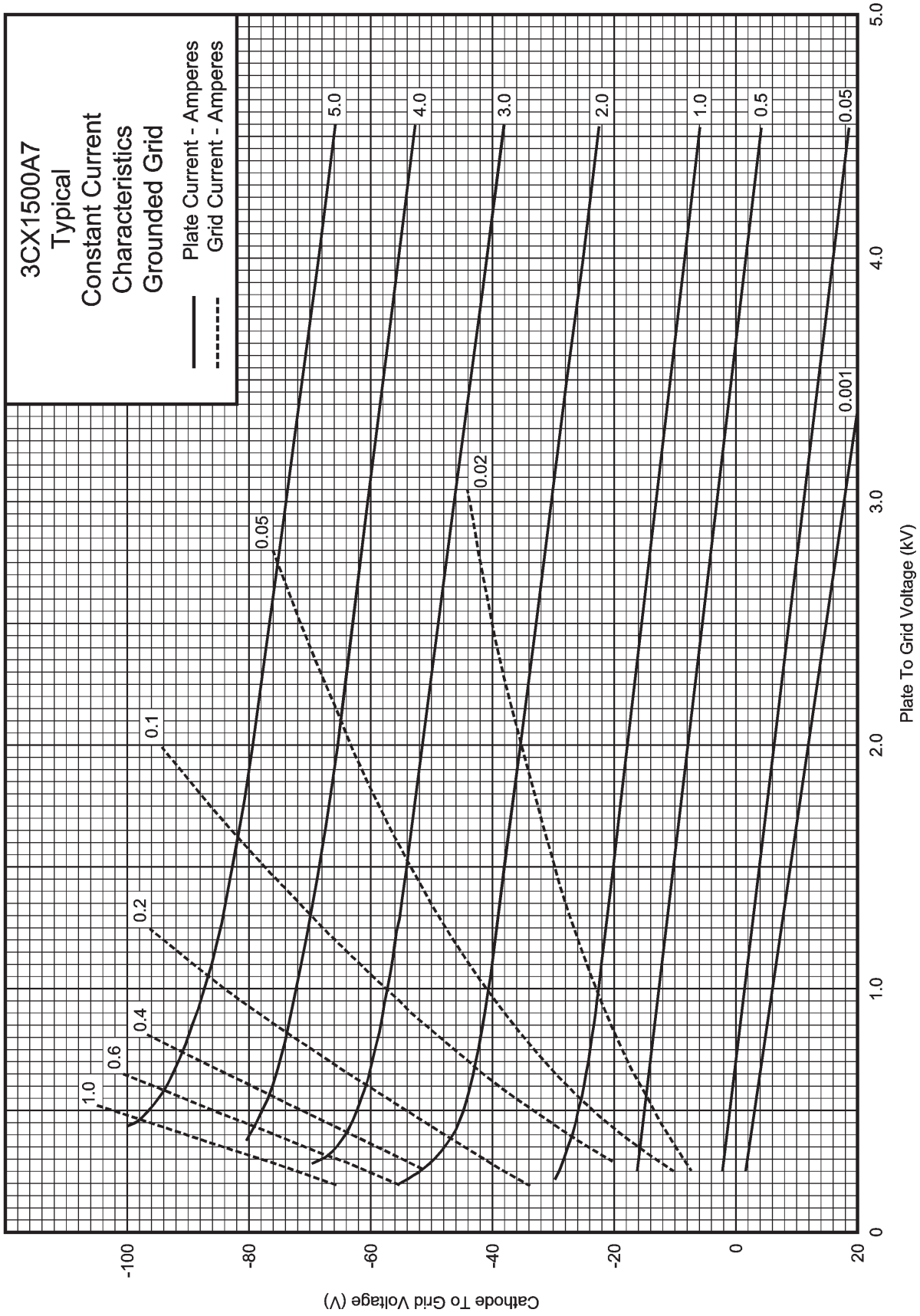
Interelectrode Capacitance - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between the tube terminals, and wiring effects. To control the actual capacitance values within the tube as the key component involved, the industry and military services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminating any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even if the tube is made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

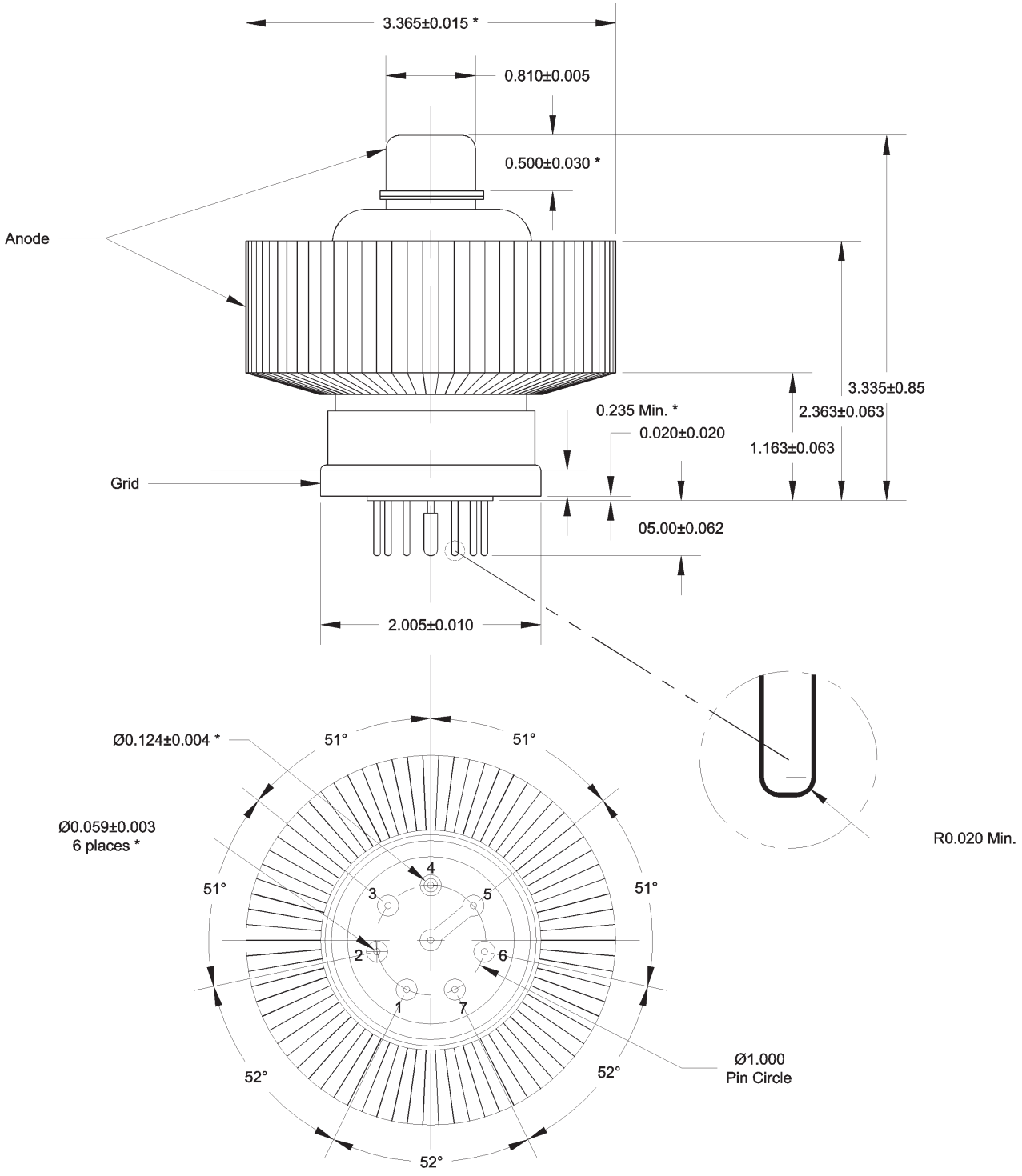
The equipment designer is therefore cautioned to make allowances for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

Hot Surfaces - When the tube is used in air and air cooled, external surfaces of the tube may reach temperatures up to 200 degrees C and higher. In addition to the anode, the cathode insulator and cathode/heater surfaces may remain hot for an extended time after the tube is shut off. To prevent serious burns, take care to avoid any bodily contact with these surfaces both during, and for a reasonable cool down period after, tube operation.

Caution - High Voltage - Operating voltage for the PL8877/3CX1500A7 can be deadly, so the equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high voltage circuits and terminals, with interlock switches to open the primary circuits of the power supply and to discharge high voltage capacitors whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that **HIGH VOLTAGE CAN KILL**.


3CX1500A7
Typical
Constant Current
Characteristics
Grounded Cathode
Plate Current - Amperes
Grid Current - Amperes
Grid Voltage (V)
Plate Voltage (kV)
160
120
80
40
0
-40
0
1.0
2.0
3.0
4.0
5.0
12
10
8
6
4
2
1
0.5
0.001
14
0.1
0.5
0.3
0.5
1
2


3CX1500A7
Typical
Constant Current
Characteristics
Grounded Grid
Plate Current - Amperes
Grid Current - Amperes
5.0
4.0
3.0
2.0
1.0
0.5
0.05
0.001
0.05
0.02
0.1
0.2
0.4
0.6
1.0
-100
-80
-60
-40
-20
0
20
0
1.0
2.0
3.0
4.0
5.0
Cathode To Grid Voltage (V)
Plate To Grid Voltage (kV)



Notes:
1. * Contact Surface.
2. All dimensions in inches.

Pin Connections
1 Heater
2 Cathode
3 Cathode
4 Cathode
5 Heater
6 Cathode
7 Cathode