TECHNICAL DATA

# RADIAL BEAM POWER TETRODE 4CX15,000A 4CX15,000R

The EIMAC 4CX15,000A and 4CX15,000R are ceramic/metal power tetrodes intended for use in audio or radio frequency applications.

The 4CX15,000A with the hairpin filament features a type of internal mechanical structure which results in high rf operating efficiency. Low rf losses in this structure permit operation at full ratings up to 110 MHz and at reduced ratings up to 225 MHz. It is recommended for radio-frequency linear power amplifier service and for FM broadcast transmitter service.

The 4CX15,000R is interchangeable with the 4CX15,000A but is more rugged by virtue of a sturdy mesh filament. The mesh filament presents slightly different tuning characteristics, which makes it an ideal replacement for tubes having mesh filaments, but means re-neutralization may be necessary when interchanged with hairpin filament tubes. The 4CX15,000R is recommended for radio-frequency linear power amplifier service and for FM broadcast transmitter service.

## GENERAL CHARACTERISTICS[1]

### ELECTRICAL

Filament: Thoriated Tungsten
- Voltage ..... 6.3 ± 0.3 V
- Current @ 6.3 volts ..... 160 A

Amplification Factor, Average, Grid to Screen: 4.5

Direct Interelectrode Capacitances(grounded cathode)[2]:
- Cin ..... 160 pF
- Cout ..... 24.5 pF
- Cgp ..... 1.5 pF

Direct Interelectrode Capacitances (grounded grid & screen)[2]:
- Cin ..... 67.0 pF
- Cout ..... 25.5 pF
- Cpk ..... 0.2 pF

Frequency of Maximum Ratings (CW) ..... 110 MHz

Frequency of Reduced Ratings (CW) ..... 250 MHz

### MECHANICAL

Maximum Overall Dimensions:
- Length ..... 9.37 in; 23.81 cm
- Diameter ..... 7.58 in; 19.25 cm

Net Weight ..... 12.8 lb; 5.8 kg

Operating Position ..... Axis Vertical, base up or down

Maximum Operating Temperatures:
- Ceramic/Metal Seals ..... 250°C
- Anode ..... 250°C

Cooling ..... Forced Air

Base ..... Special, Concentric

Recommended Air System Sockets:
- LF or HF Applications ..... Eimac SK-300A
- VHF Applications ..... Eimac SK-360

Recommended Chimney:
- For use with SK-300A only ..... Eimac SK-316

Available Screen Grid Bypass Capacitor Kit:
- For SK-360 (8000 pF @ DCWV = 5000) .. Eimac SK-355

Available Anode Connector Clip ..... Eimac ACC-3

[1] Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. CPI Eimac Division should be consulted before using this information for final equipment design.

[2] In shielded fixture.

## RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN, Class AB1

### ABSOLUTE MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC Anode Voltage | 10.0 | Kilovolts |
| DC Screen Voltage | 2.0 | Kilovolts |
| DC Grid Voltage | -1.5 | Kilovolts |
| DC Anode Current | 6.0 | Amperes |
| Anode Dissipation | 15.0 | Kilowatts |
| Screen Dissipation | 450 | Watts |
| Grid Dissipation | 200 | Watts |

* Approximate Value.
# Adjust for specified zero-signal anode current

### TYPICAL OPERATION:
**Peak Envelope or Modulation Crest Conditions:**

| | | | |
|---|---|---|---|
| Anode Voltage | 7.5 | 10.0 | kVdc |
| Screen Voltage | 1.5 | 1.5 | kVdc |
| Grid Voltage# | -350 | -370 | Vdc |
| Zero-signal Anode Current | 1.0 | 1.0 | Adc |
| Single-tone Anode Current | 4.0 | 4.25 | Adc |
| Single-tone Screen Current* | .170 | 150 | mAdc |
| Peak rf. Grid Voltage* | 330 | 340 | V |
| Anode Dissipation* | 12.2 | 14.0 | kW |
| Single-tone Anode Output Power* | 20.8 | .28.5 | kW |
| Resonant Load Impedance | 865 | 1260 | Ohms |

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## RADIO FREQUENCY POWER AMPLIFIER or OSCILLATOR
**Class C Telegraphy or FM (Key-down Conditions)**

### ABSOLUTE MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC Anode Voltage | 10 | Kilovolts |
| DC Screen Voltage | 2.0 | Kilovolts |
| DC Grid Voltage | -1.5 | Kilovolts |
| DC Anode Current | 5.0 | Amperes |
| Anode Dissipation | 15 | Kilowatts |
| Screen Dissipation | 450 | Watts |
| Grid Dissipation | 200 | Watts |

### TYPICAL OPERATION:

| | | | |
|---|---|---|---|
| Anode Voltage | 7.5 | 10.0 | kVdc |
| Screen Voltage | 750 | 750 | Vdc |
| Grid Voltage | -510 | -550 | Vdc |
| Anode Current | 4.65 | 4.55 | Adc |
| Screen Current* | 590 | 540 | mAdc |
| Grid Current* | 300 | 270 | mAdc |
| Peak rf Grid Voltage* | 730 | 790 | V |
| Calculated Driving Power | 220 | 220 | W |
| Anode Dissipation* | 8.1 | 9.0 | kW |
| Anode Output Power* | 26.7 | 36.5 | kW |

*Approximate value.

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## ANODE MODULATED RADIO FREQUENCY POWER AMPLIFIER - GRID DRIVEN
**Class C Telegraphy - Carrier Conditions)**

### ABSOLUTE MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC Anode Voltage | 8.0 | Kilovolts |
| DC Screen Voltage | 1.5 | Kilovolts |
| DC Grid Voltage | -1.5 | Kilovolts |
| DC Anode Current | 4.0 | Amperes |
| Anode Dissipation | 10.0 | Kilowatts |
| Screen Dissipation | 450 | Watts |
| Grid Dissipation | 200 | Watts |

* Approximate Value.

### TYPICAL OPERATION:

| | | | |
|---|---|---|---|
| Anode Voltage | 6.0 | 8.0 | kVdc |
| Screen Voltage | 750 | 750 | Vdc |
| Grid Voltage | -600 | -640 | Vdc |
| Anode Current | 3.75 | 3.65 | Adc |
| Screen Current* | 450 | 430 | mAdc |
| Grid Current* | 180 | 180 | mAdc |
| Peak Audio Freq. Screen Voltage* for 100% modulation | 740 | 710 | V |
| Peak rf Grid Voltage* | 800 | 840 | V |
| Calculated Driving Power | 150 | 150 | W |
| Anode Dissipation* | 5.1 | 5.8 | kW |
| Anode Output Power* | 17.4 | 23.5 | kW |

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## AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR - GRID DRIVEN
**Class AB1 (Sinusoidal Wave)**

### ABSOLUTE MAXIMUM RATINGS (per tube):

| | | |
|---|---|---|
| DC Anode Voltage | 10.0 | Kilovolts |
| DC Screen Voltage | 2.0 | Kilovolts |
| DC Grid Voltage | -1.5 | Kilovolts |
| DC Anode Current | 6.0 | Amperes |
| Anode Dissipation | 15.0 | Kilowatts |
| Screen Dissipation | 450 | Watts |
| Grid Dissipation | 200 | Watts |

### TYPICAL OPERATION (Two tubes):

| | | | |
|---|---|---|---|
| Anode Voltage | 7.5 | 10.0 | kVdc |
| Screen Voltage | 1.5 | 1.5 | kVdc |
| Grid Voltage# | -350 | -370 | Vdc |
| Zero-signal Anode Current## | 1.0 | 1.0 | Adc |
| Maximum-signal Anode Current | 8.8 | 8.5 | Adc |
| Maximum-signal Screen Current* | 340 | 300 | mAdc |
| Peak Audio Freq. Grid Voltage* | 330 | 340 | V |
| Maximum-Signal Anode Dissipation## | 12.2 | 14.0 | kW |
| Anode Output Power | 41.6 | 57.0 | kW |
| Load Resistance (anode to anode) | 1730 | 57.0 | kW |

* Approximate Value
\# Adjust for specified zero-signal anode current
\## Per Tube.

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## TELEVISION LINEAR AMPLIFIER - CATHODE DRIVEN

### ABSOLUTE MAXIMUM RATINGS: 110 MHz to 225 MHz

| | | |
|---|---|---|
| DC Anode Voltage | 6.5 | Kilovolts |
| DC Screen Voltage | 1.5 | Kilovolts |
| DC Anode Current | 5.0 | Amperes |
| Anode Dissipation | 15 | Kilowatts |
| Screen Dissipation | 450 | Watts |
| Grid Dissipation | 200 | Watts |

### TYPICAL OPERATION, Composite Signal Black Level (unless otherwise stated)

| | | | |
|---|---|---|---|
| Anode Voltage | 5.0 | 6.0 | kVdc |
| Screen Voltage | 500 | 700 | Vdc |
| Grid Voltage* | -160 | -180 | Vdc |
| Anode Current (zero signal) | 500 | 650 | mAdc |
| Anode Current | 2.8 | 3.33 | Adc |
| Grid Current* | 75 | 35 | Adc |
| Screen Current* | 60 | 40 | mAdc |
| Peak Cathode Voltage (peak sync) | 310 | 345 | V |
| Cathode Driving Power (peak synch) | 975 | 1350 | W |
| Calculated Driving Power | 150 | 150 | W |
| Anode Output Power (peak synch) | 11.0 | 16.5 | kW |
| Anode Load Resistance | 600 | 600 | Ohms |

*Approximate value.

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified anode current at the specified bias, screen and anode voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid and screen current. The grid and screen currents which result when the desired anode current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current.

## RANGE VALUES FOR EQUIPMENT DESIGN

| | 4CX15,000A Min. | 4CX15,000A Max. | | 4CX15,000R Min | 4CX15,000R Max | |
|---|---|---|---|---|---|---|
| Filament Current @ 6.3 Volts | 152 | 168 | A | 152 | 168 | A |
| Interelectrode Capacitances[1] (grounded cathode) | | | | | | |
| Cin | 154.0 | 167.0 | pF | 152.0 | 164.0 | pF |
| Cout | 22.0 | 27.0 | pF | 22.0 | 27.0 | pF |
| Cgp | --- | 2.0 | pF | --- | 2.0 | pF |
| Interelectrode Capacitances[1] (grid & screen grounded) | | | | | | |
| Cin | 62.0 | 72.0 | pF | 51.0 | 61.0 | pF |
| Cout | 23.0 | 28.0 | pF | 23.0 | 28.0 | pF |
| Cpk | ---- | 0.3 | pF | --- | 0.3 | pF |

[1] Capacitance values are for a cold tube as measured in a shielded fixture in accordance with Electronic Industries Association Standard RS-191.

## APPLICATION

### MECHANICAL

HANDLING – These products contain a thoriated-tungsten filament. Although the mesh filament of the 4CX15,000R is more rugged than the filament in the 4CX15,000A, both filaments are subject to damage and should be protected from shock and vibration.

STORAGE – If a tube is to be stored as a spare it should be kept in its original shipping carton, with the original packing material, to minimize the possibility of handling damage.

Before storage a new tube should be operated in the equipment for 100 to 200 hours to establish it has not been damaged and operates properly (see Filament Operation for recommendations on initial value of filament voltage during this operation period). If the tube is still in storage 6 months later, it again should be operated in the equipment for 100 to 200 hours to make sure there has been no degradation. If operation is satisfactory, the tube can again be stored with great assurance of being a known-good spare.

MOUNTING - The 4CX15,000A and 4CX15,000R must be operated with the axis vertical. The base of the tube may be up or down at the option of the circuit designer.

SOCKETS – The Eimac air-system sockets SK-300A and SK-360 are designed especially for the concentric base terminals of either tube. The SK-300A is recommended for use through 30 MHz, while the SK-360 is recommended for applications in the VHF range. The use of recommended airflow rates through the socket provides effective forced-air cooling of the tube. Air forced into the bottom of the socket passes over the base of the tube, through an air chimney, and into the anode cooling fins.

The SK-360 incorporates low-inductance filament bypassing in the form of three 5000 pF copper-clad Kapton® capacitors. A screen grid bypass capacitor kit (the SK-355) is also available for the SK-360 socket, and includes eight 1000 pF/5000 DCWV capacitors (Eimac P/N 050706), 16 mounting clips (Eimac P/N 242859), and an assembly drawing.

COOLING – The maximum temperature rating for the external surfaces of the tube is 250°C. Sufficient forced-air cooling must be used in all applications to keep the temperature of the anode (at the base of the cooling fins) and the temperature of the ceramic/metal seals comfortably below this rated maximum.

It is considered good engineering practice to design for a maximum anode core temperature of 225°C. Temperature-sensitive paints are available for checking base and seal temperatures before any design is finalized. Eimac Application Bulletin #20 titled 'TEMPERATURE MEASUREMENTS WITH EIMAC TUBES" is available on request.

It is good practice to allow for variables such as dirty air filters, rf seal heating, and the fact that anode cooling fins may not be clean if the tube has been in service for some length of time. Special attention is required to cool the center of the stem (base), by means of special directors or some other provision. An air interlock system should be incorporated in the design to automatically remove all voltages from the tube in case of even partial failure of the tube cooling air.

Cooling air should be filtered to remove particles of foreign matter that may become embedded in the anode cooling fins and impair cooling efficiency.

It should be noted the contact fingers used in the contact collet assemblies (inner and outer filament, control grid and screen grid) are made of beryllium copper. If operated above 150°C for any appreciable length of time, this material will lose its temper (or springy characteristic) and then will no longer make good contact to the base contact areas of the tube. This can lead to arcing which can melt metal in a contact area (primarily the inner or outer filament contacts) and the tube's vacuum integrity may be destroyed.

If all cooling air is not passed around the base of the tube and through the socket, then arrangements must be made to assure adequate cooling of the base and the socket contacts. Movement of cooling air around the base accomplishes a double purpose in keeping the tube base and the socket contact fingers at a safe operating temperature.

Airflow requirements to maintain tube temperature at 225°C with incoming air at 50°C are shown for operation below 30 MHz. The data is for sea level with the tube mounted in an SK-300A socket with an SK-316 air chimney, and the pressure drop values should be considered approximate. At an altitude of 5000 feet both air flow and pressure drop must be increased by a factor of 1.2; at 10,000 feet the factor is 1.46.

| Anode Dissipation (kW) | Air Flow (cfm) | Pressure Drop In. Water |
|---|---|---|
| 7.5 | 230 | 0.7 |
| 12.5 | 490 | 2.7 |
| 15.0 | 645 | 4.6 |

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.

Air flow must be applied before or simultaneously with the application of electrode voltages, including the filament, and normally should be maintained for a short period of time after all power is removed to allow for tube cool down.

## ELECTRICAL

ABSOLUTE MAXIMUM RATINGS - Values shown for each type of service are based on the "absolute system" and are not to be exceeded under any service conditions. Ratings are limiting values outside which the serviceability of the tube may be impaired. In order not to exceed absolute ratings the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by a safety factor so that the absolute values will never be exceeded under any usual conditions of supply-voltage variation, load variation, or manufacturing variation in the equipment itself. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

FILAMENT OPERATION – This tube is designed for commercial service, with no more than one normal off/on filament cycle per day. If additional cycling is anticipated it is recommended the user contact Application Engineering at CPI/Eimac for additional information.

With a new tube, or one which has been in storage for some period of time, operation with filament voltage only applied for a period of 30 to 60 minutes is recommended before full operation begins. This allows the active getter material mounted within the filament structure to absorb any residual gas molecules which have accumulated during storage. Once normal operation has been established a minimum filament warm-up time of five seconds is normally sufficient.

At rated (nominal) filament voltage the peak emission capability of the tube is many times that needed for communication service. A reduction in filament voltage will lower the filament temperature, which will substantially increase life expectancy. The correct value of filament voltage should be determined for the particular application. It is recommended the tube be operated at full nominal voltage for an initial stabilization period of 100 to 200 hours before any action is taken to operate at reduced voltage. The voltage should gradually be reduced until there is a slight degradation in performance (such as power output or distortion). The voltage should then be increased a few tenths of a volt above the value where performance degradation was noted for operation. The operating point should be rechecked after 24 hours.

Filament voltage should be closely regulated when voltage is to be reduced below nominal in this manner, to avoid any adverse influence by normal line voltage variations. Filament voltage should be measured at the tube base or socket, using an accurate rms-responding meter.

Periodically throughout the life of the tube the procedure outlined above for reduction of voltage should be repeated, with voltage reset as required, to assure best tube life.

Eimac Application Bulletin #18 titled "EXTENDING TRANSMITTER TUBE LIFE" contains valuable information and is available on request.

IN-RUSH – When cold, the resistance of a thoriated-tungsten filament is very low, therefore the initial starting (in-rush) current when filament voltage is applied can be many times the normal (hot) current; this can be detrimental to the longevity of a filament structure. Filament in-rush current should never exceed a value of twice the nominal rated current. The use of a special impedance-limited filament transformer or other "step-start" circuitry in the supply side (primary) of the filament transformer is recommended.

ELECTRODE DISSIPATION RATINGS – The maximum dissipation ratings must be respected to avoid damage to the tube. An exception is anode dissipation which may be permitted to rise above the rated maximum during brief periods, such as may occur during tuning.

GRID OPERATION – The maximum control grid dissipation is 200 watts, determined approximately by the product of the dc grid current and the peak positive grid voltage. It is recommended that a protective spark-gap device should be connected between the control grid and the cathode to guard against excessive voltage.

SCREEN OPERATION – The maximum screen grid dissipation is 450 watts. With no ac applied to the dc screen grid, dissipation is simply the product of dc screen voltage and the dc screen current. With screen modulation, dissipation is dependent on rms screen voltage and rms screen current. Anode voltage, anode loading, or bias voltage must never be removed while filament and screen voltages are present, since screen dissipation ratings will be exceeded. A protective spark-gap device should be connected between the screen grid and the cathode to guard against excessive voltage.

FAULT PROTECTION - In addition to normal cooling interlocks and a anode over-current interlock, it is good practice to protect the tube from internal damage which could result from occasional arcing at high anode voltage. In all cases some protective resistance, at least 10 Ohms, should be used in series with the tube anode to absorb power supply stored energy in case an arc should occur. An electronic crowbar, which will discharge power supply capacitors in a few microseconds after the start of an arc, may be required. The test for each electrode supply is to short each electrode to ground, one at a time, through a vacuum relay switch and a 6-inch length of #30 AGW copper wire. The wire will remain intact if protection is adequate. Eimac Application Bulletin #17, FAULT PROTECTION, contains considerable detail and is available upon request.

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 tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the 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 eliminates 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 with tubes made by different manufacturers. 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 allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with mounting which represents approximate final layout if capacitance values are highly significant in the design.

HIGH VOLTAGE - The 4CX15,000A and 4CX15,000R operate at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed 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 supplies 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.

RADIO-FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 300 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, and the published OSHA (Occupational Safety and Health Administration) or other local recommendations to limit prolonged exposure of rf radiation should be followed.

HOT SURFACES - Air-cooled surfaces and other parts of tubes can reach temperatures of several hundred degrees C and cause serious burns if touched for several minutes after all power is removed.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, contact the Application Engineering Dept., CPI Eimac Division, San Carlos, Calif. 94070 U.S.A. for information and recommendations.

## OPERATING HAZARDS

Proper use and safe operating practices with respect to power tubes are the responsibility of equipment manufacturers and users of such tubes. All persons who work with and are exposed to power tubes, or equipment that utilizes such tubes, must take precautions to protect themselves against possible serious bodily injury. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

The operation of this tube may involve the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

**HIGH VOLTAGE** – Normal operating voltages can be deadly. Remember that HIGH VOLTAGE CAN KILL.

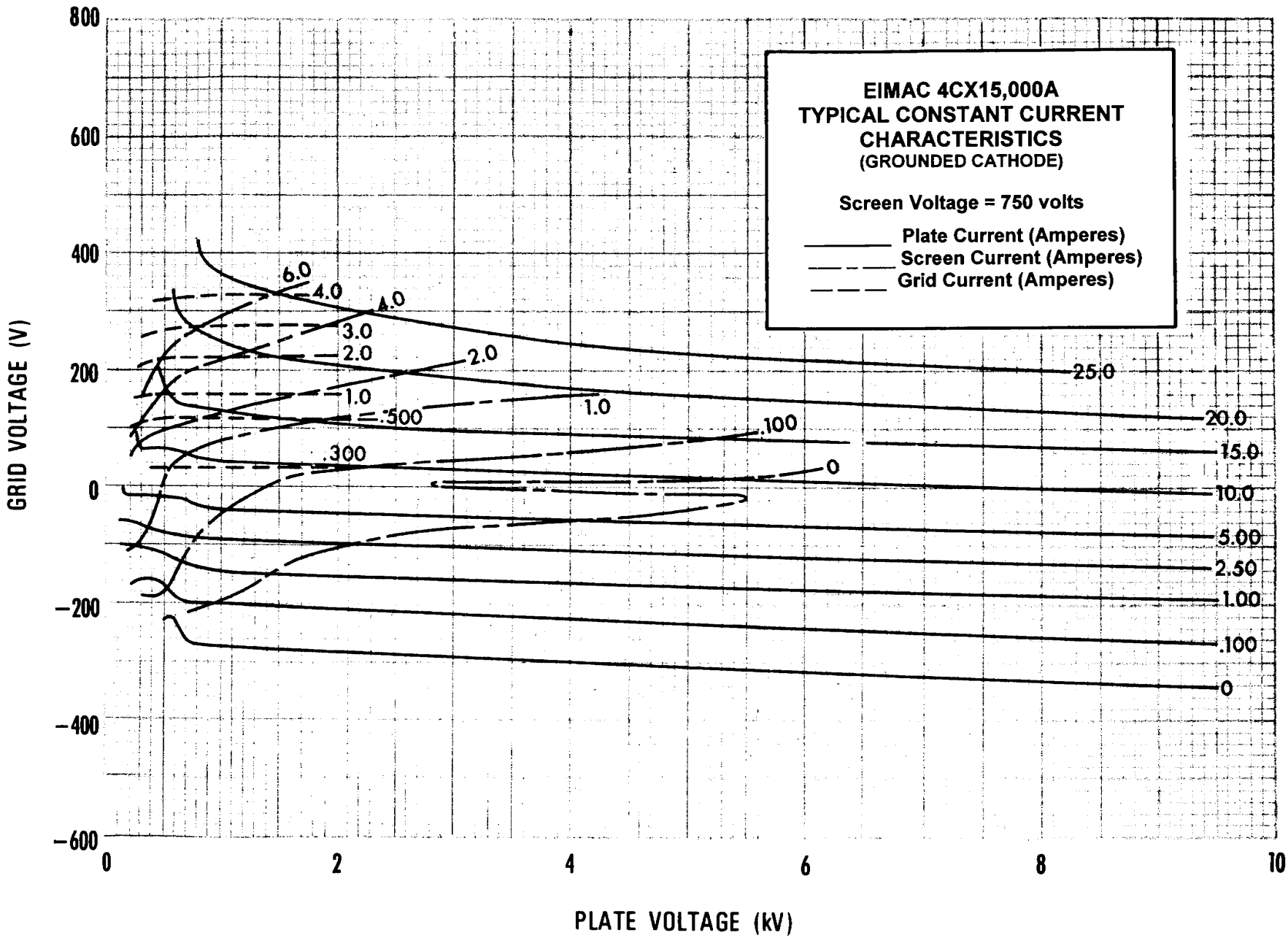
**LOW-VOLTAGE HIGH-CURRENT CIRCUITS** - Personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.

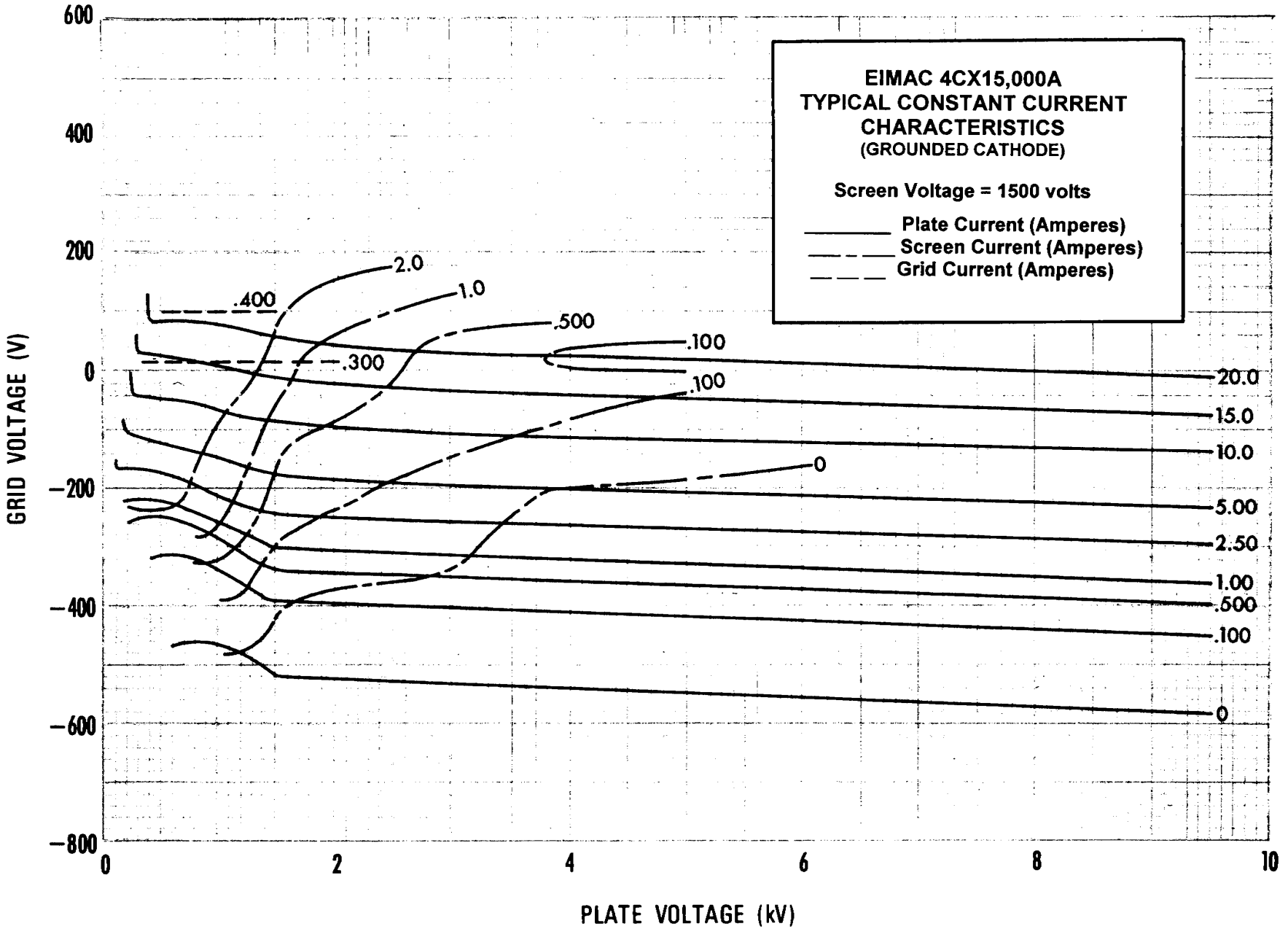
**RF RADIATION** – Exposure to strong rf fields should be avoided, even at relatively low frequencies. CARDIAC PACEMAKERS MAY BE AFFECTED.

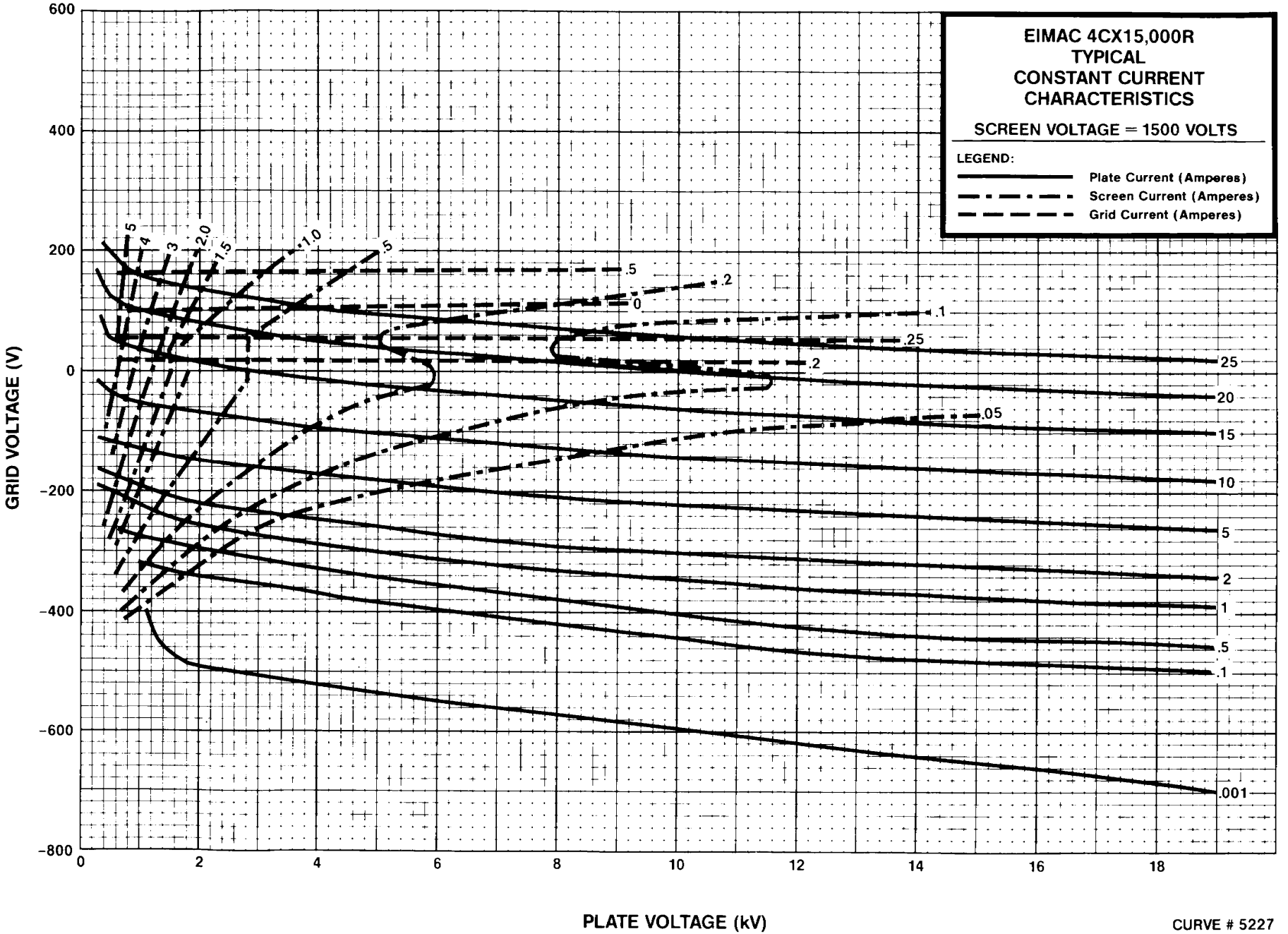
**HOT SURFACES** – Surfaces of tubes can reach temperatures of several hundred °C and cause serious burns if touched for several minutes after all power is removed.

**MATERIAL COMPLIANCE** - This product and package conforms to the conditions and limitations specified in 49CFR 173.424 for radioactive material, excepted package-instruments or articles, UN2910. In addition, this product and package contains no beryllium oxide (BeO).

Please review the detailed Operating Hazards sheet enclosed with each tube, or request a copy from CPI, Eimac Division Application Engineering at 1-650-592-1221.


EIMAC 4CX15,000A
TYPICAL CONSTANT CURRENT
CHARACTERISTICS
(GROUNDED CATHODE)
Screen Voltage = 750 volts
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
GRID VOLTAGE (V)
PLATE VOLTAGE (kV)
800
600
400
200
0
−200
−400
−600
0
2
4
6
8
10
6.0
4.0
4.0
3.0
2.0
2.0
1.0
1.0
.500
.100
.300
0
25.0
20.0
15.0
10.0
5.00
2.50
1.00
.100
0


EIMAC 4CX15,000A
TYPICAL CONSTANT CURRENT
CHARACTERISTICS
(GROUNDED CATHODE)
Screen Voltage = 1500 volts
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
GRID VOLTAGE (V)
PLATE VOLTAGE (kV)
600
400
200
0
−200
−400
−600
−800
0
2
4
6
8
10
2.0
1.0
.500
.400
.300
.100
.100
0
20.0
15.0
10.0
5.00
2.50
1.00
.500
.100
0


EIMAC 4CX15,000R
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 1500 VOLTS
LEGEND:
Plate Current (Amperes)
Screen Current (Amperes)
Grid Current (Amperes)
GRID VOLTAGE (V)
600
400
200
0
-200
-400
-600
-800
0
2
4
6
8
10
12
14
16
18
PLATE VOLTAGE (kV)
.5
4
3
2.0
1.5
1.0
.5
.5
0
.25
.2
.2
.1
.05
25
20
15
10
5
2
1
.5
.1
.001

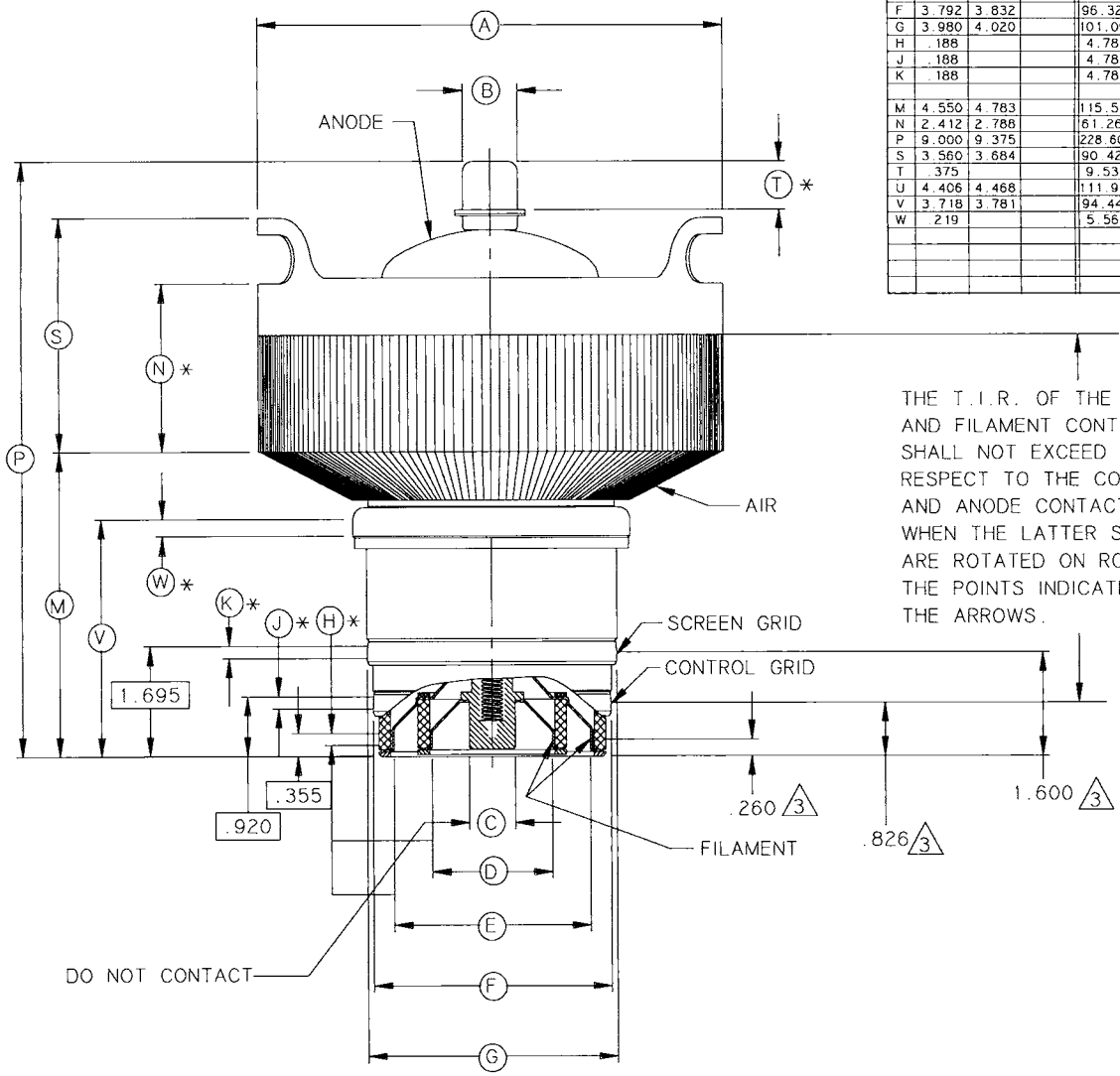
CURVE # 5227

NOTES:

1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. * CONTACT SURFACE.
3. OPTIMUM FILAMENT AND GRID CONNECTOR HEIGHTS FOR SOCKET DESIGN PURPOSES.

DIMENSIONAL DATA

| | INCHES | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|
| DIM. | MIN. | MAX. | REF. | MIN. | MAX. | REF. |
| A | 7.460 | 7.580 | | 189.48 | 192.53 | |
| B | .855 | .895 | | 21.72 | 22.73 | |
| C | .600 | .760 | | 15.24 | 19.30 | |
| D | 1.896 | 1.936 | | 48.16 | 49.17 | |
| E | 3.133 | 3.173 | | 79.58 | 80.59 | |
| F | 3.792 | 3.832 | | 96.32 | 97.33 | |
| G | 3.980 | 4.020 | | 101.09 | 102.11 | |
| H | .188 | | | 4.78 | | |
| J | .188 | | | 4.78 | | |
| K | .188 | | | 4.78 | | |
| M | 4.550 | 4.783 | | 115.57 | 121.49 | |
| N | 2.412 | 2.788 | | 61.26 | 70.82 | |
| P | 9.000 | 9.375 | | 228.60 | 238.13 | |
| S | 3.560 | 3.684 | | 90.42 | 93.57 | |
| T | .375 | | | 9.53 | | |
| U | 4.406 | 4.468 | | 111.91 | 113.49 | |
| V | 3.718 | 3.781 | | 94.44 | 96.04 | |
| W | .219 | | | 5.56 | | |




THE T.I.R. OF THE SCREEN GRID AND FILAMENT CONTACT SURFACE SHALL NOT EXCEED .040 WITH RESPECT TO THE CONTROL GRID AND ANODE CONTACT SURFACE WHEN THE LATTER SURFACES ARE ROTATED ON ROLLERS AT THE POINTS INDICATED BY THE ARROWS.

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