



TECHNICAL DATA

4CX1500A

RADIAL BEAM  
TETRODE

The EIMAC 4CX1500A is a general purpose tetrode for use up to and through VHF. Insulation is ceramic and the thoriated tungsten filament is a rugged mesh design. The screen terminal is a continuous ring which allows good isolation between the plate circuit and the control grid circuit.

The 4CX1500A is recommended for use as a class C power amplifier, class B, or class AB<sub>1</sub> linear amplifier, as a regulator, and in pulse modulator service.



GENERAL CHARACTERISTICS<sup>1</sup>

ELECTRICAL

Filament Voltage . . . . .	5.0 volts	
Filament Current . . . . .	38.5 amps	
Amplification Factor (Grid Screen) . . . . .	5.5	
Transconductance (I <sub>b</sub> = 1 ampere)		
E <sub>c2</sub> = 500 volts, E <sub>b</sub> = 200 volts) . . . . .		26,000 μmho
Frequency for Maximum Ratings . . . . .		150 MHz
Direct Interelectrode Capacitances (Grounded Cathode) <sup>2</sup>		
C <sub>in</sub> . . . . .		78.0 pF
C <sub>out</sub> . . . . .		10.5 pF
C <sub>gp</sub> . . . . .		0.25 pF

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. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Base . . . . .	Special ring and breechblock terminal surfaces
Recommended Socket . . . . .	EIMAC SK-831
Recommended Air Chimney . . . . .	EIMAC SK-806
Operating Position . . . . .	Axis Vertical
Maximum Anode Core Temperature . . . . .	250°C
Maximum Seal Temperature . . . . .	250°C
Cooling . . . . .	Forced Air

Maximum Dimensions

Height .....	4.90 in; 124.5 mm
Diameter .....	3.37 in; 85.6 mm
Net Weight .....	30 oz; 850 gm
Shipping Weight (Approximately) .....	3 lb; 1.21 kg

RANGE VALUES FOR EQUIPMENT DESIGN

	<u>Min.</u>	<u>Max.</u>
Filament Current, $E_f = 5.0$ V .....	36.5	40.5 A
Interelectrode Capacitance (grounded cathode circuit) <sup>1</sup>		
C <sub>in</sub> .....	73.0	83.0 pF
C <sub>out</sub> .....	8.5	12.5 pF
C <sub>gp</sub> .....	---	0.4 pF

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

RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB

MAXIMUM RATINGS:

DC PLATE VOLTAGE .....	4000 VOLTS
DC SCREEN VOLTAGE .....	750 VOLTS
DC PLATE CURRENT .....	1.0 AMPERE
PLATE DISSIPATION .....	1500 WATTS
SCREEN DISSIPATION .....	75 WATTS
CONTROL GRID DISSIPATION .....	25 WATTS

TYPICAL OPERATION Class AB<sub>1</sub>

DC Plate Voltage .....	2500	3900 V
DC Screen Voltage .....	600	600 V
DC Grid Voltage <sup>1</sup> .....	-105	-110 V
Zero-Signal Plate Current .....	250	200 mA
Max-Signal Plate Current .....	765	750 mA
Max-Signal Screen Current <sup>2</sup> .....	46	40 mA
Peak RF Driving Voltage .....	95	100 v
Resonant Plate Load Resistance ...	1670	2900 Ω
Max-Signal Plate Power Out .....	1080	1850 W

1. Adjust to specified zero-signal dc plate current.  
 2. Approximate values.

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy or FM

(Continuous Operating Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE .....	5000 VOLTS
DC SCREEN VOLTAGE .....	750 VOLTS
DC PLATE CURRENT .....	1.0 AMPERE
PLATE DISSIPATION <sup>1</sup> .....	1500 WATTS
SCREEN DISSIPATION .....	75 WATTS
CONTROL GRID DISSIPATION .....	25 WATTS

TYPICAL OPERATION

	Low Freq. Calculated	220 MHz Measured
DC Plate Voltage .....	3000 4000	3000 V
DC Screen Voltage .....	500 500	500 V
DC Grid Voltage .....	-200 -200	-116 V
DC Plate Current .....	800 800	1000 mA
DC Screen Current <sup>2</sup> .....	36 37	35 mA
DC Grid Current <sup>2</sup> .....	17 15	0 mA
Peak RF Grid Voltage .....	240 240	--- v
Driving Power .....	4.1 3.6	31.5 W
Resonant Load Resistance ...	1720 2570	--- Ω
Plate Dissipation .....	600 700	--- W
Power Output .....	1800 2500	1500 W <sup>1</sup>

1. Useful Power Output  
 2. Approximate values.

**PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER**

Class C Telephony  
(Carrier Conditions unless noted)

**MAXIMUM RATINGS:**

DC PLATE VOLTAGE . . . . .	3500 VOLTS
DC SCREEN VOLTAGE . . . . .	550 VOLTS
DC PLATE CURRENT . . . . .	.8 AMPERE
PLATE DISSIPATION <sup>1</sup> . . . . .	1000 WATTS
SCREEN DISSIPATION . . . . .	75 WATTS
CONTROL GRID DISSIPATION . . . . .	25 WATTS

1. Corresponds to 1500 watts at 100% sine-wave modulation.

**TYPICAL OPERATION**

	Low Frequency Calculated	
DC Plate Voltage . . . . .	2500	3400 V
DC Screen Voltage . . . . .	500	500 V
DC Grid Voltage . . . . .	-300	-300 V
Peak Audio Screen Voltage (For 100% mod. approx.) . . . . .	500	500 v
DC Plate Current . . . . .	800	900 mA
DC Screen Current <sup>2</sup> . . . . .	46	28 mA
DC Grid Current <sup>2</sup> . . . . .	27	28 mA
Peak RF Grid Voltage . . . . .	365	365 v
Grid Driving Power . . . . .	10	10 W
Resonant Load Resonant . . . . .	3200	1940 Ω
Plate Dissipation . . . . .	620	780 W
Plate Power Out . . . . .	1600	2320 W

2. Approximate value.

**AUDIO-FREQUENCY AMPLIFIER OR MODULATOR**

Class AB

**MAXIMUM RATINGS:**

DC PLATE VOLTAGE . . . . .	4000 VOLTS
DC SCREEN VOLTAGE . . . . .	750 VOLTS
DC PLATE CURRENT . . . . .	1.0 AMPERE
PLATE DISSIPATION . . . . .	1500 WATTS
SCREEN DISSIPATION . . . . .	75 WATTS
CONTROL GRID DISSIPATION . . . . .	25 WATTS

**TYPICAL OPERATION (Two Tubes) Class AB<sub>1</sub>**

DC Plate Voltage . . . . .	2500	3900 V
DC Screen Voltage . . . . .	600	600 V
DC Grid Voltage . . . . .	-105	-110 V
Zero-Signal Plate Current . . . . .	500	400 mA
Max-Signal Plate Current . . . . .	1.530	1.500 A
Max-Signal Screen Current <sup>2</sup> . . . . .	90	80 mA
Peak AF Driving Voltage . . . . .	95	100 v
Load Resistance Plate to Plate . . . . .	3340	5800 Ω
Max-Signal Plate Dissipation <sup>1</sup> . . . . .	820	1070 W
Max-Signal Plate Power Out . . . . .	2160	3700 W

1. Per Tube

2. Approximate value.

NOTE: TYPICAL OPERATION data is obtained by direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias screen and plate voltage 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 plate 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. In Class C service, if grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

**APPLICATION**

**MECHANICAL**

**MOUNTING** - The 4CX1500A must be operated with its axis vertical. The base of the tube may be down or up at the convenience of the circuit designer.

**SOCKET** - The EIMAC SK-831 socket and SK-806 chimney have been designed especially for the 4CX1500A. The use of recommended air-flow rates through these sockets provides effective forced-air cooling of the tube. Air forced into the bottom of the socket passes over the

tube terminals through the Air Chimney, and through the anode cooling fins.

**COOLING** - The maximum temperature rating for the anode core of the 4CX1500A is 250°C. Sufficient forced-air circulation must be provided to keep the temperature of the anode at the base of the cooling fins and the temperature of the ceramic/metal seals below 250°C. Air-flow requirements to maintain seal temperature at 225°C in 50°C ambient air are tabulated on page 4 (for operation below 30 MHz).

Plate Dissipation (Watts)	SEA LEVEL		6000 FEET	
	Air Flow (CFM)	Pressure Drop (Inches of Water)	Air Flow (CFM)	Pressure Drop (Inches of Water)
1000	27	0.33	33	0.40
1500	47	0.76	58	0.95

\*Since the power dissipated by the filament represents about 200 watts and since grid-plus-screen dissipation can, under some conditions, represent another 100 watts, allowance has been made in preparing this tabulation for an additional 300 watts dissipation.

The blower selected in a given application must be capable of supplying the desired air flow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters.

At other altitudes and ambient temperatures the flow rate must be modified to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using rated maximum temperatures as the criteria for satisfactory cooling.

**ELECTRICAL**

**FILAMENT OPERATION** - The rated filament voltage for the 4CX1500A is 5.0 volts. Filament voltage, as measured at the socket, should be maintained at this value or below to obtain maximum tube life.

**CONTROL GRID OPERATION** - The rated dissipation of the grid is 25 watts. This is approximately the product of dc grid current and peak positive grid voltage. Operation at bias and drive levels near those listed will insure safe operation.

**SCREEN GRID OPERATION** - The power dissipated by the screen of the 4CX1500A must not exceed 75 watts.

Screen dissipation, in cases where there is no ac applied to the screen, is the simple product of the screen voltage and the screen current. If the screen voltage is modulated, the screen dissipation will depend upon RMS screen current and voltage.

Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 75 watts in the event of circuit failure.

**HIGH VOLTAGE** - Normal operating voltages used with the 4CX1500A are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all 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 primary circuits of the power supply and to discharge high-voltage condensers 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 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 is 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 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 when the tube may be 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 allowance 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.

*MULTIPLE OPERATION* - To obtain maximum power output with minimum distortion from tubes operated in multiple, it is desirable to adjust individual screen or grid bias voltages so that the peak plate current for each tube is equal at the crest of the exciting voltage. Under these conditions, individual dc plate currents will be approximately equal for full input signal.

*SPECIAL APPLICATION* - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.

TYPICAL CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE = 500V

— PLATE CURRENT - AMPERES      - - - - SCREEN CURRENT - AMPERES      - - - - GRID CURRENT - AMPERES

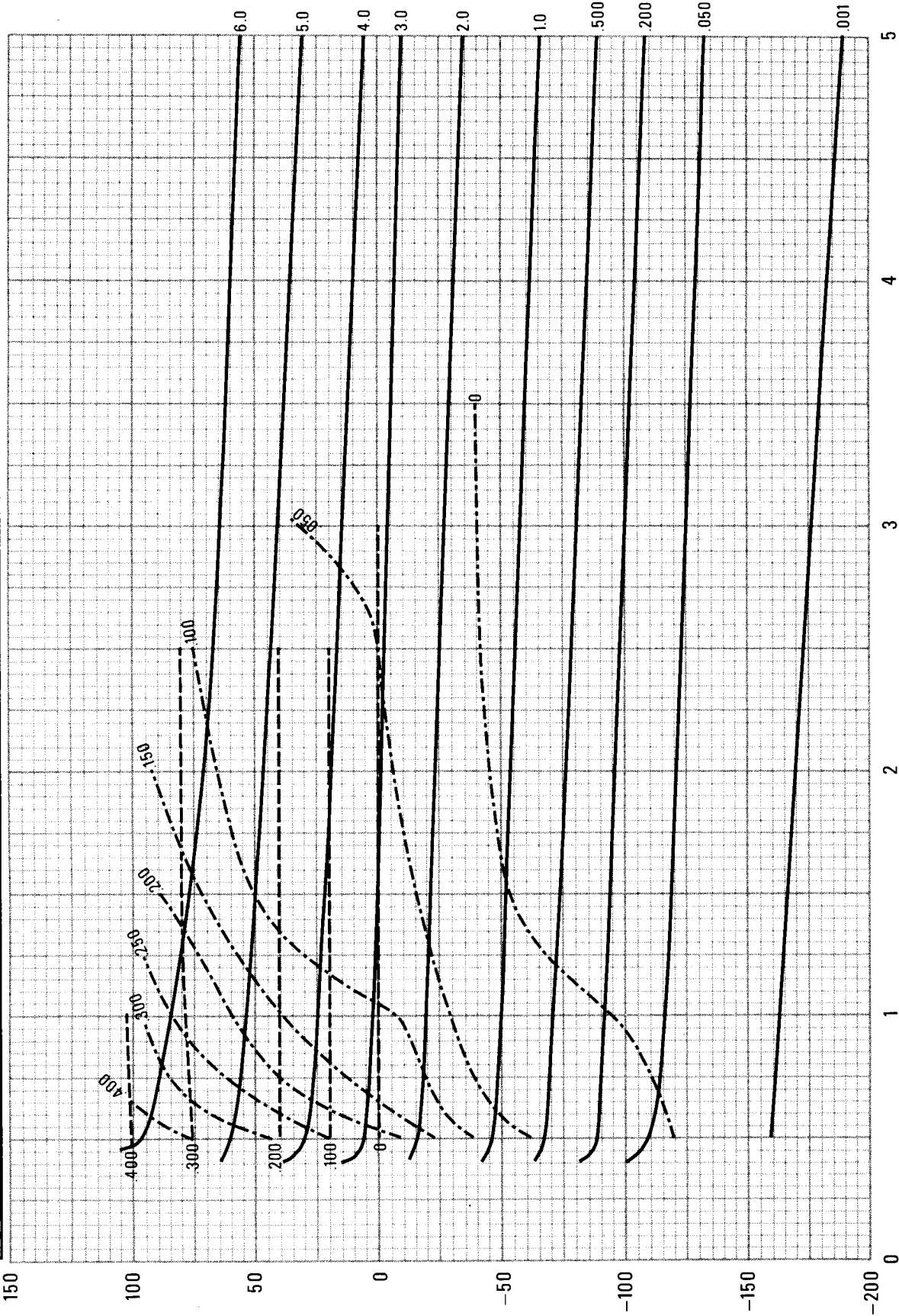
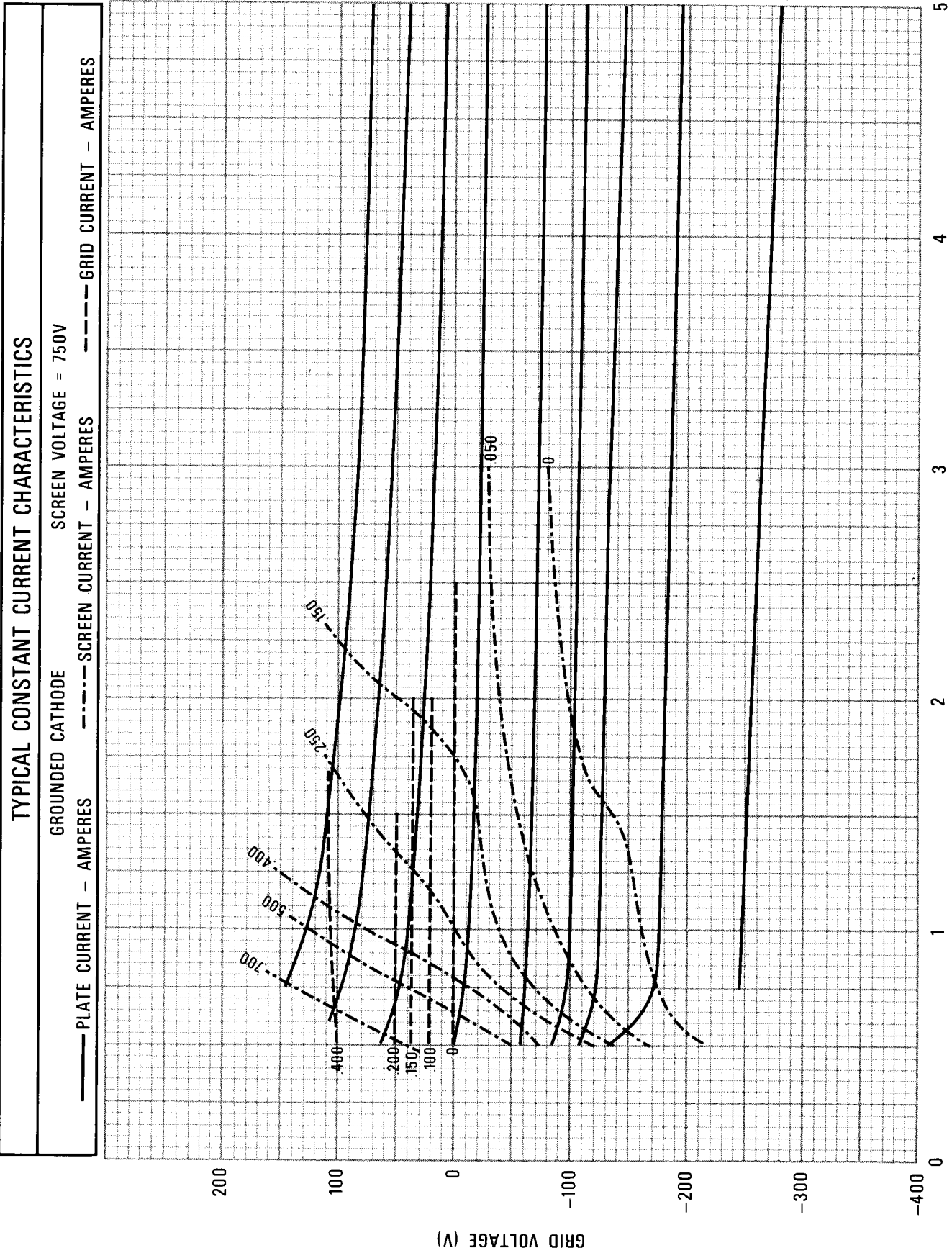
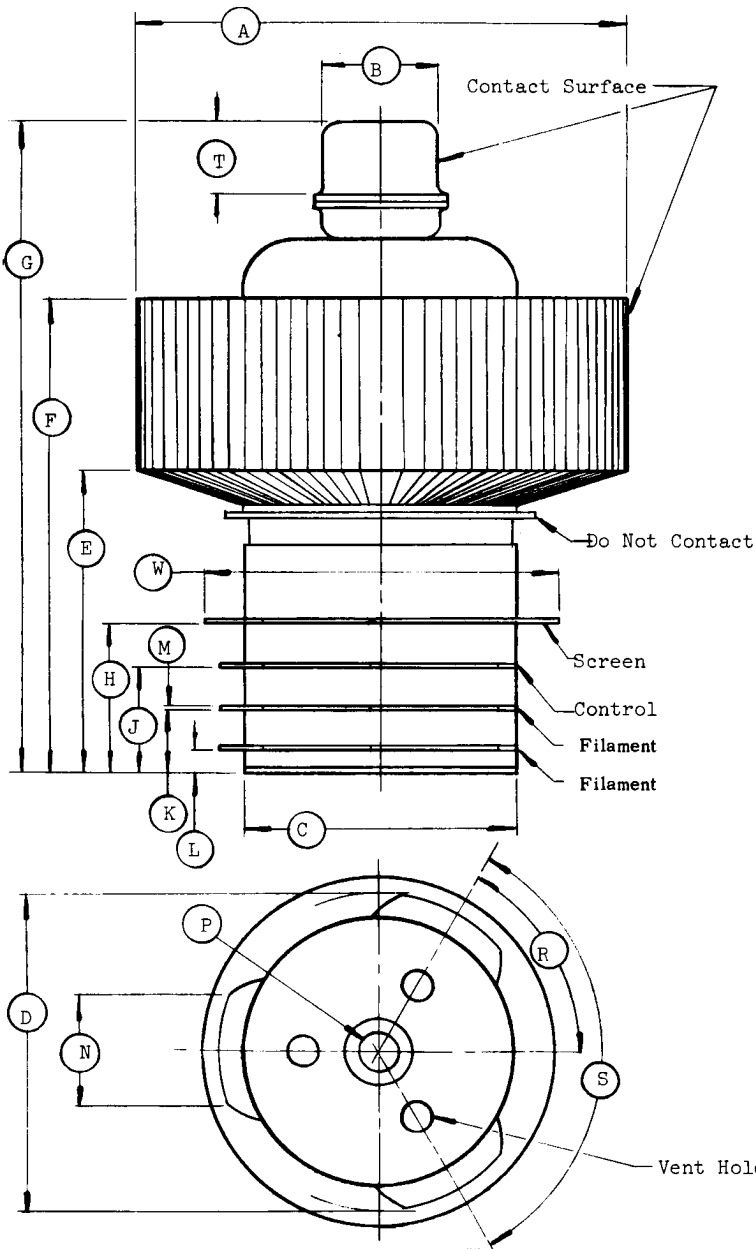


PLATE VOLTAGE (kV)

CURVE #4145





DIMENSIONAL DATA						
DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	3.335	3.370	- -	84.71	85.60	- -
B	0.807	0.820	- -	20.50	20.83	- -
C	1.865	1.900	- -	47.37	48.26	- -
D	2.250	2.300	- -	57.15	58.42	- -
E	2.265	2.465	- -	57.53	62.61	- -
F	3.454	3.654	- -	87.73	92.81	- -
G	4.675	4.900	- -	118.74	124.46	- -
H	0.965	0.988	- -	24.51	25.09	- -
J	0.690	0.710	- -	17.53	18.03	- -
K	0.415	0.435	- -	10.54	11.05	- -
L	0.140	0.165	- -	3.56	4.19	- -
M	0.018	0.030	- -	0.46	0.76	- -
N	0.700	0.800	- -	17.78	20.32	- -
P	0.314	0.326	- -	7.97	8.28	- -
R	55°	65°	- -	55°	65°	- -
S	115°	125°	- -	115°	125°	- -
T	0.470	0.530	- -	11.94	13.46	- -
W	2.468	2.531	- -	62.69	64.29	- -

NOTES:  
 1. REF. DIMENSIONS ARE FOR INFO.  
 ONLY & ARE NOT REQUIRED FOR  
 INSPECTION PURPOSES.