



TECHNICAL DATA

8171
4CX10,000D

**RADIAL-BEAM
POWER TETRODE**

The EIMAC 8171/4CX10,000D is a ceramic/metal tetrode which is identical electrically to the 8170/4CX5000A except for its rated plate dissipation. Its increased dissipation capability, resulting from a larger cooler, is most useful in linear applications where plate dissipation is generally the limiting factor.

The larger cooler also allows the 8171/4CX10,000D to be used in place of the 8170/4CX5000A with less cooling for any given plate dissipation, or results in cooler operation at any given air-flow rate.

The 8171/4CX10,000D is useful as an oscillator, amplifier, or modulator at frequencies up to 110 megahertz and is particularly suited for use as a linear rf amplifier or class-AB₁ audio amplifier.

A pair of these tubes, operating class-AB₁, will deliver more than 30 kilowatts of audio-frequency or radio-frequency plate output power.



GENERAL CHARACTERISTICS¹

ELECTRICAL

Filament: Thoriated Tungsten

Voltage	7.5 ± 0.37 V
Current, at 7.5 volts	75 A
Amplification Factor (Grid Screen), Average	4.5
Direct Interelectrode Capacitances, Grounded Cathode: ²	
C _{in}	115 pF
C _{out}	20.5 pF
C _{gp}	0.7 pF
Direct Interelectrode Capacitances, Grounded Grid: ²	
C _{in}	53 pF
C _{out}	20.5 pF
C _{pk}	0.10 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 concentric
Maximum Seal Temperature	250 °C
Maximum Anode-Core Temperature	250 °C
Recommended Socket	EIMAC SK-300A

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Recommended Air Chimney EIMAC SK-1306
 Operating Position Axis vertical, base up or down
 Cooling Forced Air

Maximum Dimensions:

Length 9.06 in; 230.17 mm
 Diameter 7.05 in; 179.07 mm
 Net Weight (Approximate) 12 lbs; 5.5 kg
 Shipping Weight (Approximate) 23 lbs; 10.5 kg

RANGE VALUES FOR EQUIPMENT DESIGN

	<u>Min.</u>	<u>Max.</u>
Filament: Current at 7.5 volts	73	78 A
Interelectrode Capacitance (grounded cathode connection) ¹		
C _{in}	108	122 pF
C _{out}	18	23 pF
C _{gp}	---	1.0 pF
Interelectrode Capacitance (grounded grid connection) ¹		
C _{in}	48	58 pF
C _{out}	18	23 pF
C _{pk}	---	0.16 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 POWER AMPLIFIER
 OR OSCILLATOR (Up to 110 megahertz)**

Class-C Telephony or FM Telephony (Key-Down Conditions)

TYPICAL OPERATION

(Frequencies below 30 megahertz)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	up to 30 MHz	7500 VOLTS
	30 to 60 MHz	7000 VOLTS
	60 to 110 MHz	6500 VOLTS
DC SCREEN VOLTAGE		1500 VOLTS
DC PLATE CURRENT	up to 30 MHz	3.0 AMPERES
	30 to 60 MHz	2.8 AMPERES
	60 to 110 MHz	2.6 AMPERES
PLATE DISSIPATION		10,000 WATTS
SCREEN DISSIPATION		250 WATTS
GRID DISSIPATION		75 WATTS

DC Plate Voltage	7500 Vdc
DC Screen Voltage	500 Vdc
DC Grid Voltage	-350 Vdc
DC Plate Current	2.8 Adc
DC Screen Current	0.5 Adc
DC Grid Current	0.25 Adc
Peak rf Grid Voltage	590 v
Driving Power	150 W
Plate Dissipation	5000 W
Plate Output Power	16,000 W

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

Class C Telephony (Carrier conditions except where noted)

TYPICAL OPERATION

(Frequencies below 30 megahertz)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	5000 VOLTS
DC SCREEN VOLTAGE	1000 VOLTS
DC PLATE CURRENT	2.5 AMPERES
PLATE DISSIPATION ¹	6650 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

DC Plate Voltage	5000 Vdc
DC Screen Voltage	500 Vdc
Peak af Screen Voltage (For 100% modulation)	450 v
DC Grid Voltage	-400 Vdc
DC Plate Current	1.4 Adc
DC Screen Current	0.26 Adc
DC Grid Current	0.05 Adc
Peak rf Grid Voltage	520 v
Grid Driving Power	25 W
Plate Dissipation	1100 W
Plate Output Power	5.8 kW

1. Corresponds to 10,000 watts at 100% sine-wave modulation.

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class AB₁

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	7500 VOLTS
DC SCREEN VOLTAGE	1500 VOLTS
DC PLATE CURRENT	4.0 AMPERES
PLATE DISSIPATION	12,000 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

TYPICAL OPERATION, two tubes

DC Plate Voltage	4000	5000	6000	7500 Vdc
DC Screen Voltage	1500	1500	1500	1500 Vdc
DC Grid Voltage	-315	-320	-330	-340 Vdc
Max.Signal Plate Current	6.66	6.66	6.66	6.66 Adc
Zero-Signal Plate Current ¹	0.50	0.50	0.50	0.50 Adc
Max.Signal Screen Current	0.33	0.32	0.30	0.25 Adc
Zero-Signal Screen Current	0	0	0	0 Adc
Peak af Driving Voltage	305	310	320	330 v
Driving Power	0	0	0	0 W
Load Resistance plate to plate	940	1320	1700	2280 Ω
Max. Signal Plate Dissipation	6670	7950	8100	9050 W
Max.Signal Plate Output Power	13,300	17,500	23,800	31,900 W

1. Per Tube

RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB₁

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	7500 VOLTS
DC SCREEN VOLTAGE	1500 VOLTS
DC PLATE CURRENT	4.0 AMPERES
PLATE DISSIPATION	12,000 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

TYPICAL OPERATION, Peak-Envelope or Modulation-Crest Conditions(Frequencies below 30 megahertz)

DC Plate Voltage	7500 Vdc
DC Screen Voltage	1500 Vdc
DC Grid Voltage ¹	-340 Vdc
Max.Signal Plate Current	3.33 Adc
Zero-Signal Plate Current	0.50 Adc
Max.Signal Screen Current125 Adc
Peak rf Grid Voltage	330 v
Driving Power	0 W
Plate Dissipation	9050 W
Plate Output Power ²	15,950 W

1. Adjust grid voltage to obtain specified Zero-Signal plate current.
2. PEP output or rf output power at crest of modulation envelope.

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 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 4CX10000D 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 Air-System Socket Type

SK-300A has been designed especially for the concentric base terminals of the 4CX10000D. The use of recommended air-flow rates through this socket provides effective forced-air cooling of the tube. Air forced into the bottom of the socket passes over the tube terminals and through an Air Chimney, the SK-1306, into the anode cooling fins.

COOLING - The maximum temperature rating for the external surfaces of the 4CX10000D 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 temperatures at 200°C in 50°C ambient air are tabulated below (for operation below 30 megahertz) for the socket/tube/chimney combination.

Plate Dissipation* (Watts)	SEA LEVEL		10,000 FEET	
	Air Flow (CFM)	Pressure Drop(Inches of water)	Air Flow (CFM)	Pressure Drop(Inches of water)
4000	114	0.36	166	0.53
6000	226	1.0	330	1.46
8000	363	2.0	530	2.90
10000	500	3.5	730	5.10
12000	720	6.0	1050	8.8

* Since the power dissipated by the filament represents about 560 watts and since grid-plus-screen dissipation can, under some conditions, represent another 200 to 300 watts, allowance has been made in preparing this tabulation for an additional 1000 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 4CX10000D is 7.5 volts. Filament voltage, as measured at the socket, should be maintained at this value to obtain maximum tube life. In no case should it be allowed to deviate by more than plus or minus 5 percent from the rated value.

ELECTRODE DISSIPATION RATINGS - The maximum dissipation ratings for the 4CX10000D must be respected to avoid damage to the tube. An exception is the plate dissipation, which may be permitted to rise above the rated maximum during brief periods, such as may occur during tuning.

CONTROL-GRID OPERATION - The 4CX10000D control grid has a maximum dissipation rating of 75 watts. Precautions should be observed to avoid exceeding this rating. The grid bias and driving power should be kept near the values shown in the "Typical Operation" sections of the data sheet whenever possible.

SCREEN-GRID OPERATION - The power dissipated by the screen of the 4CX10000D must not exceed 250 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 loading, driving power, and carrier screen 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 250 watts in the event of circuit failure.

PLATE DISSIPATION - The plate-dissipation rating for the 4CX10000D is 10,000 watts for most applications, but for audio and SSB amplifier applications, the maximum allowable dissipation is 12,000 watts.

When the 4CX10000D is operated as a plate-modulated rf power amplifier, the input power is limited by conditions not connected with the plate efficiency, which is quite high. Therefore, except during tuning there is little possibility that the 6650-watt maximum plate dissipation rating will be exceeded.

HIGH VOLTAGE - Normal operating voltages used with the 4CX10000D 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.

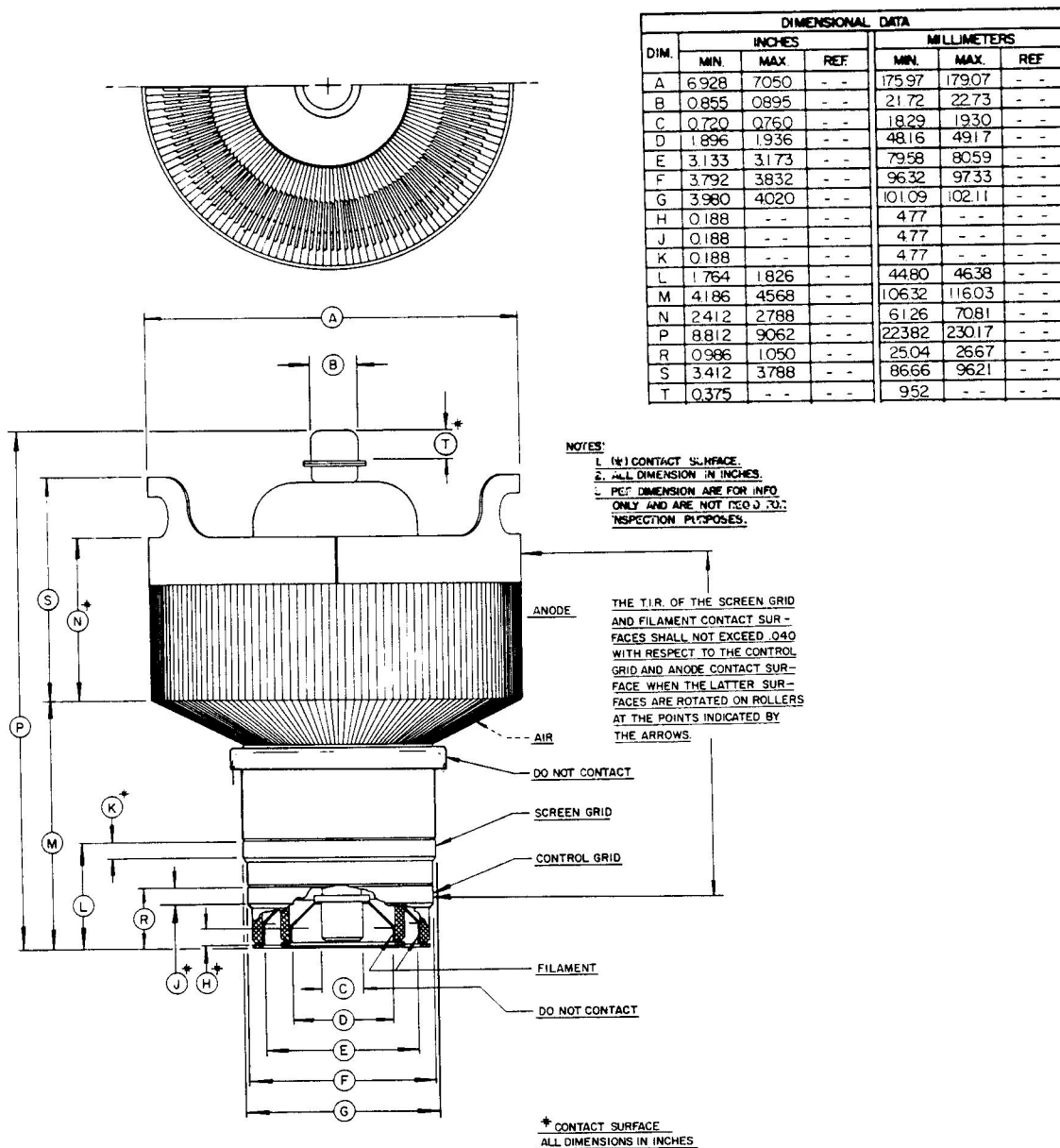
INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most

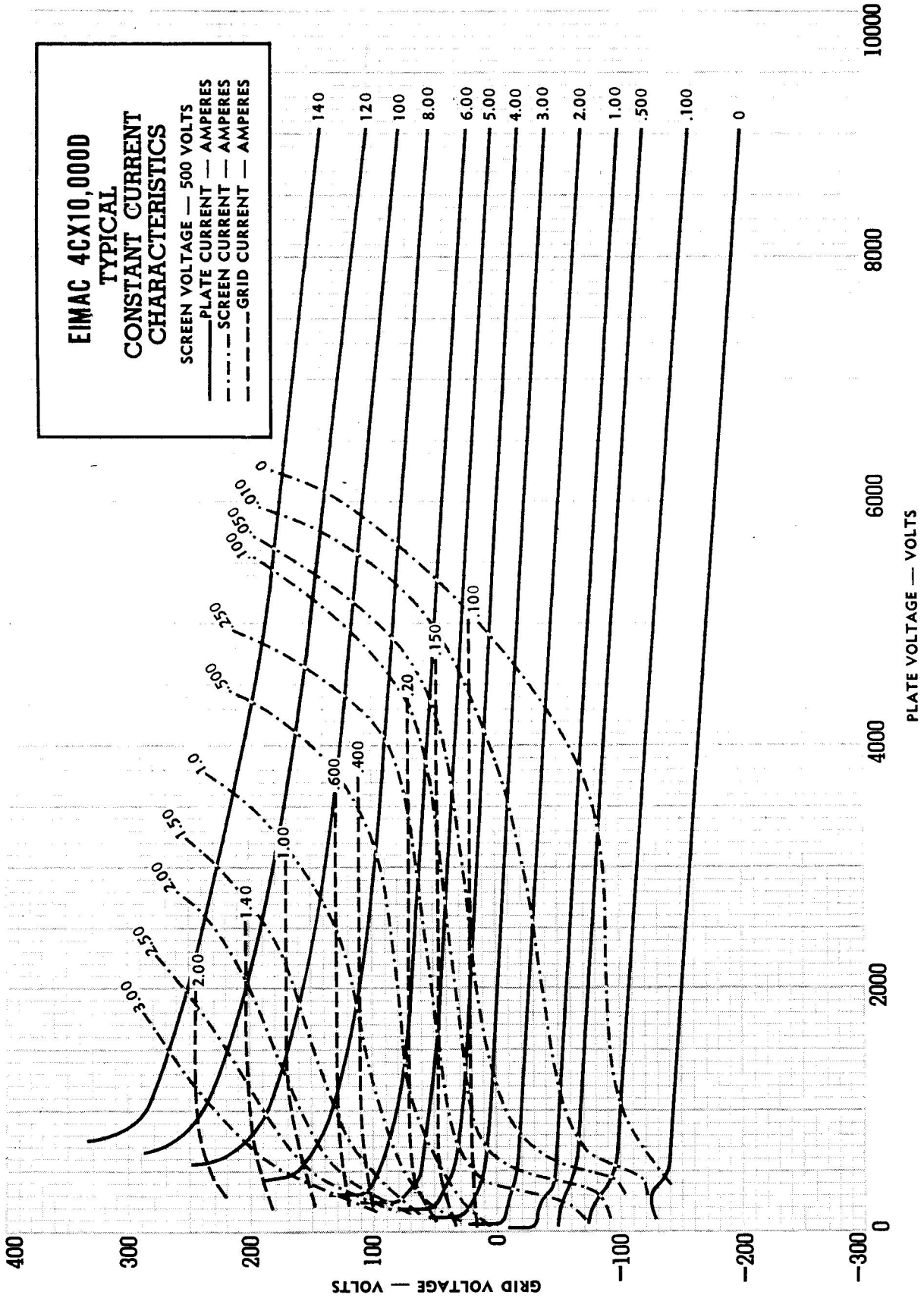
applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test 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 RS-191.

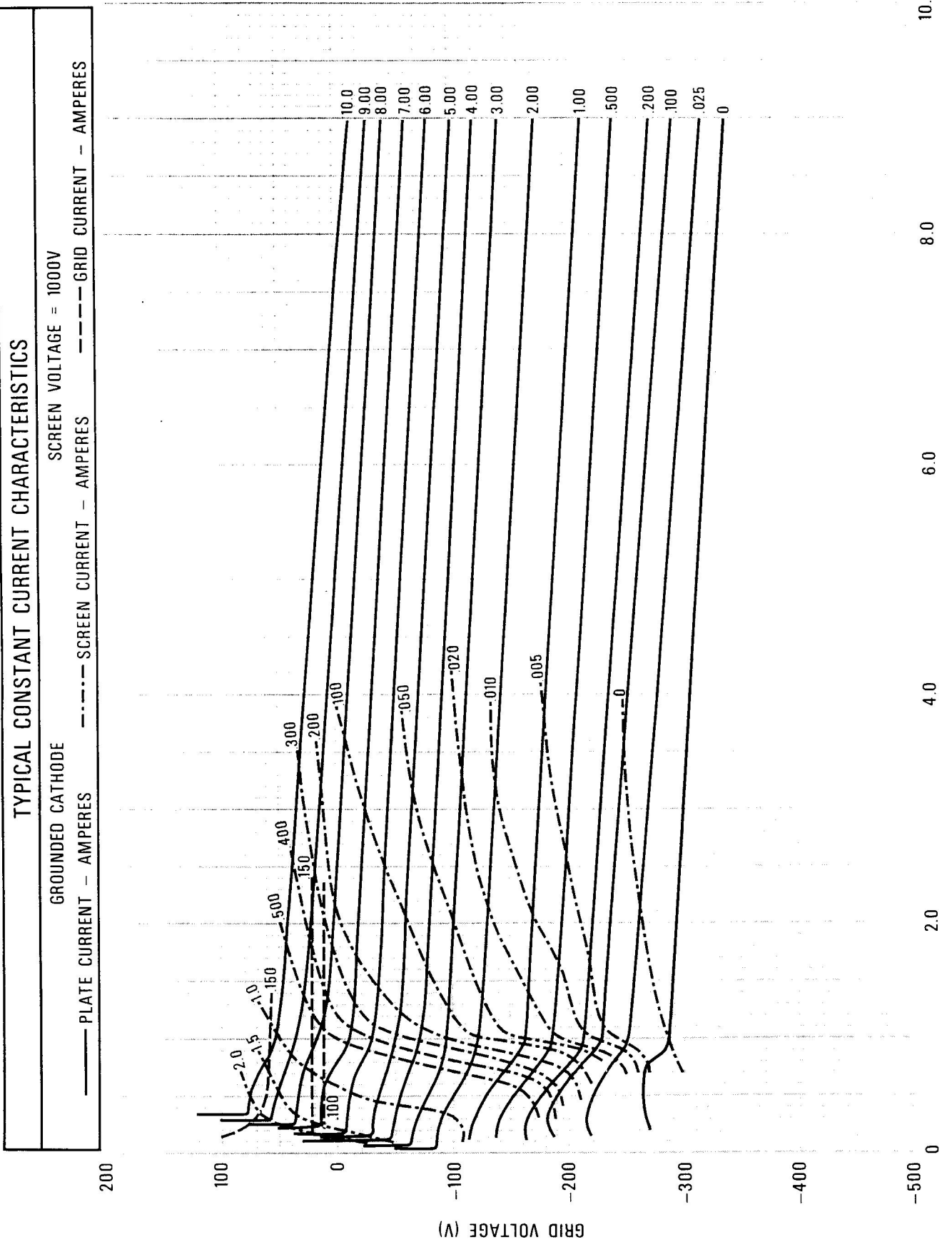
The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

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.



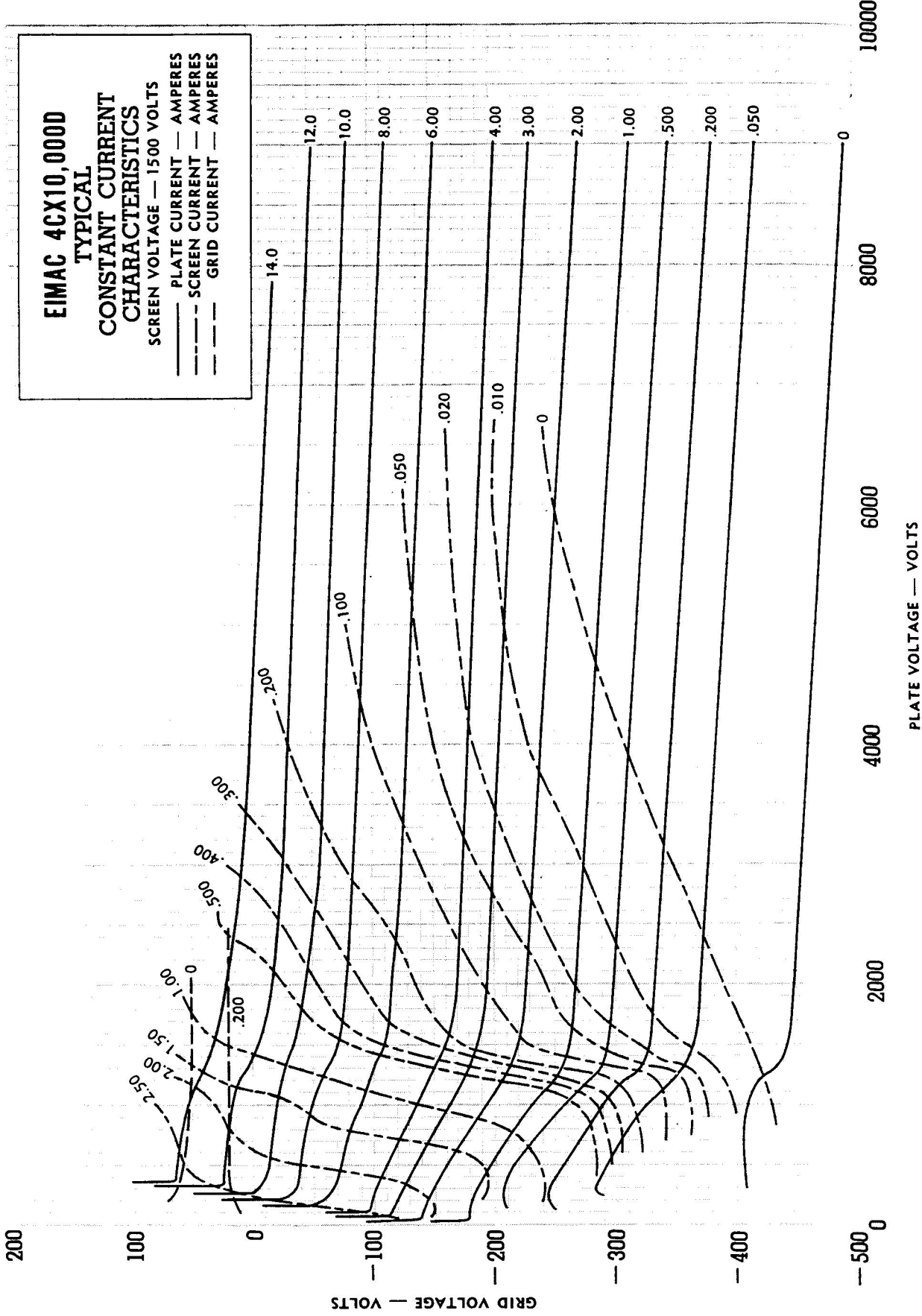


CURVE MA-335



CURVE #MA-333

PLATE VOLTAGE (kV)



CURVE MA-317