



TECHNICAL DATA

8171
4CX10,000D

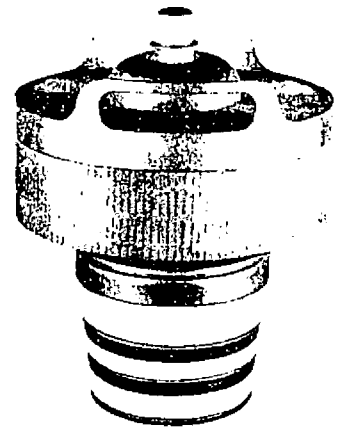
RADIAL-BEAM
POWER TETRODE

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

Cin . . . . . 115 pF

Cout . . . . . 20.5 pF

Cgp . . . . . 0.7 pF

Direct Interelectrode Capacitances, Grounded Grid: 2

Cin . . . . . 53 pF

Cout . . . . . 20.5 pF

Cpk . . . . . 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



8171/4CX10,000D

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) <sup>1</sup>		
Cin . . . . .	108	122 pF
Cout . . . . .	18	23 pF
Cgp . . . . .	---	1.0 pF
Interelectrode Capacitance (grounded grid connection) <sup>1</sup>		
Cin . . . . .	48	58 pF
Cout . . . . .	18	23 pF
Cpk . . . . .	---	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)**

**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

**TYPICAL OPERATION  
 (Frequencies below 30 megahertz)**

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)**

**ABSOLUTE MAXIMUM RATINGS:**

DC PLATE VOLTAGE . . . . . 5000 VOLTS  
 DC SCREEN VOLTAGE . . . . . 1000 VOLTS  
 DC PLATE CURRENT . . . . . 2.5 AMPERES  
 PLATE DISSIPATION <sup>1</sup> . . . . . 6650 WATTS  
 SCREEN DISSIPATION . . . . . 250 WATTS  
 GRID DISSIPATION . . . . . 75 WATTS

**TYPICAL OPERATION  
 (Frequencies below 30 megahertz)**

DC Plate Voltage . . . . . 5000 Vdc  
 DC Screen Voltage . . . . . 500 Vdc  
 Peak of 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 AB<sub>1</sub>

**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 <sup>†</sup> . . . . .	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 AB<sub>1</sub>

**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 <sup>1</sup> . . . . .	-340 Vdc
Max.Signal Plate Current . . . . .	3.33 Adc
Zero-Signal Plate Current . . . . .	0.50 Adc
Max.Signal Screen Current . . . . .	.125 Adc
Peak rf Grid Voltage . . . . .	330 v
Driving Power . . . . .	0 W
Plate Dissipation . . . . .	9025 W
Plate Output Power <sup>2</sup> . . . . .	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.

## 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 OR ARE EXPOSED TO POWER TUBES OR EQUIPMENT WHICH UTILIZES SUCH TUBES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

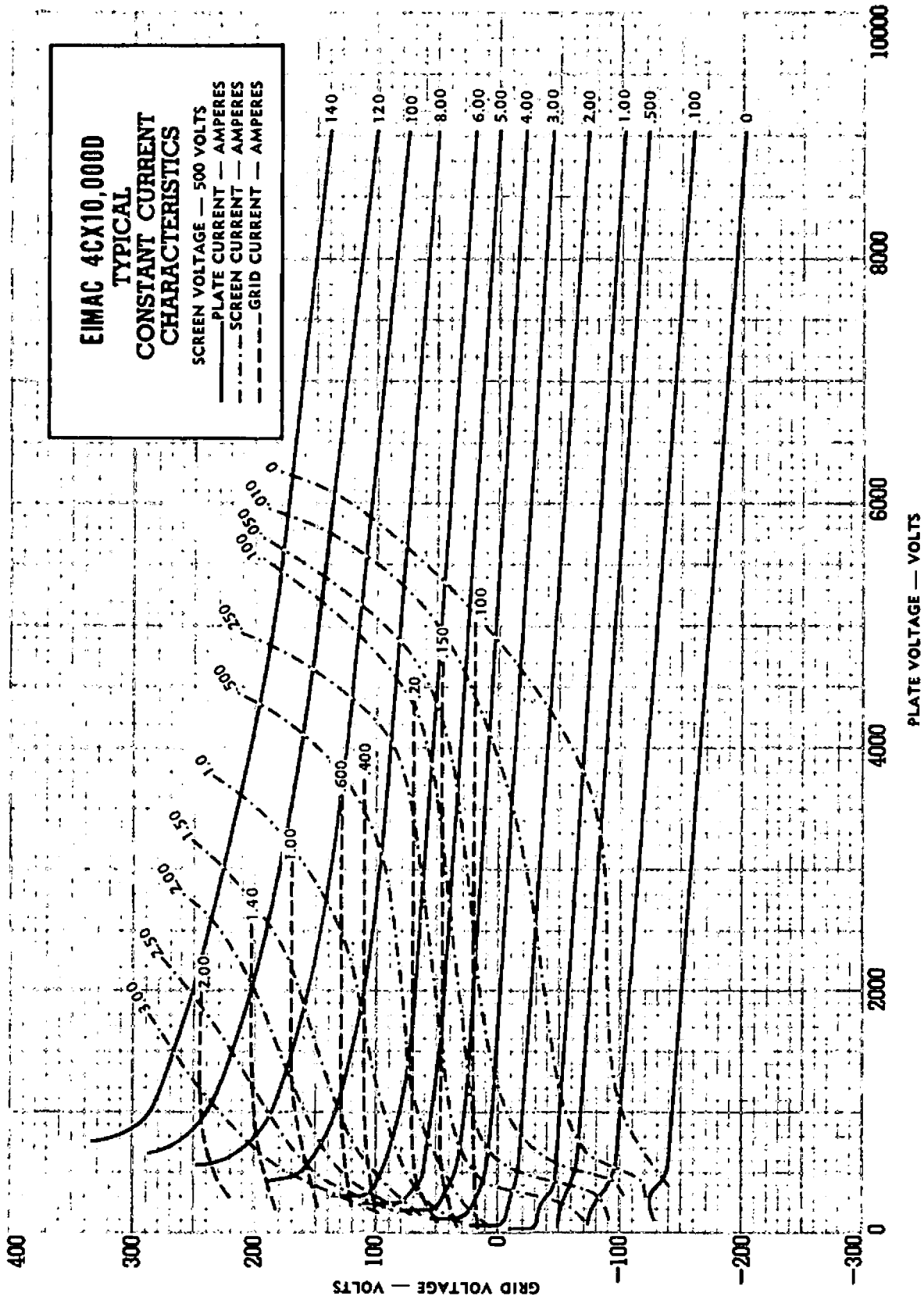
The operation of power tubes involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel:

- a. **HIGH VOLTAGE** - Normal operating voltages can be deadly.
- b. **RF RADIATION** - Exposure to strong rf fields should be avoided, even at relatively low frequencies. The dangers of rf radiation are more severe at UHF and microwave frequencies and can cause serious bodily and eye injuries. **CARDIAC PACEMAKERS MAY BE AFFECTED.**
- c. **X-RAY RADIATION** - High voltage tubes can produce dangerous and possibly fatal x-rays.
- d. **BERYLLIUM OXIDE POISONING** - Dust or fumes from BeO ceramics used as thermal links with some conduction-cooled power tubes are highly toxic and can cause serious injury or death.
- e. **GLASS EXPLOSION** - Many electron tubes have glass envelopes. Breaking the glass can cause an implosion, which will result in an explosive scattering of glass particles. Handle glass tubes carefully.
- f. **HOT WATER** - Water used to cool tubes may reach scalding temperatures. Touching or rupture of the cooling system can cause serious burns.
- g. **HOT SURFACES** - Surfaces of air-cooled radiators and other parts of tubes can reach temperatures of several hundred degrees centigrade and cause serious burns if touched.

Please review the detailed operating hazards sheet enclosed with each tube or request a copy from the address shown below: Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070.



8171/4CX10,000D



CURVE MA-335

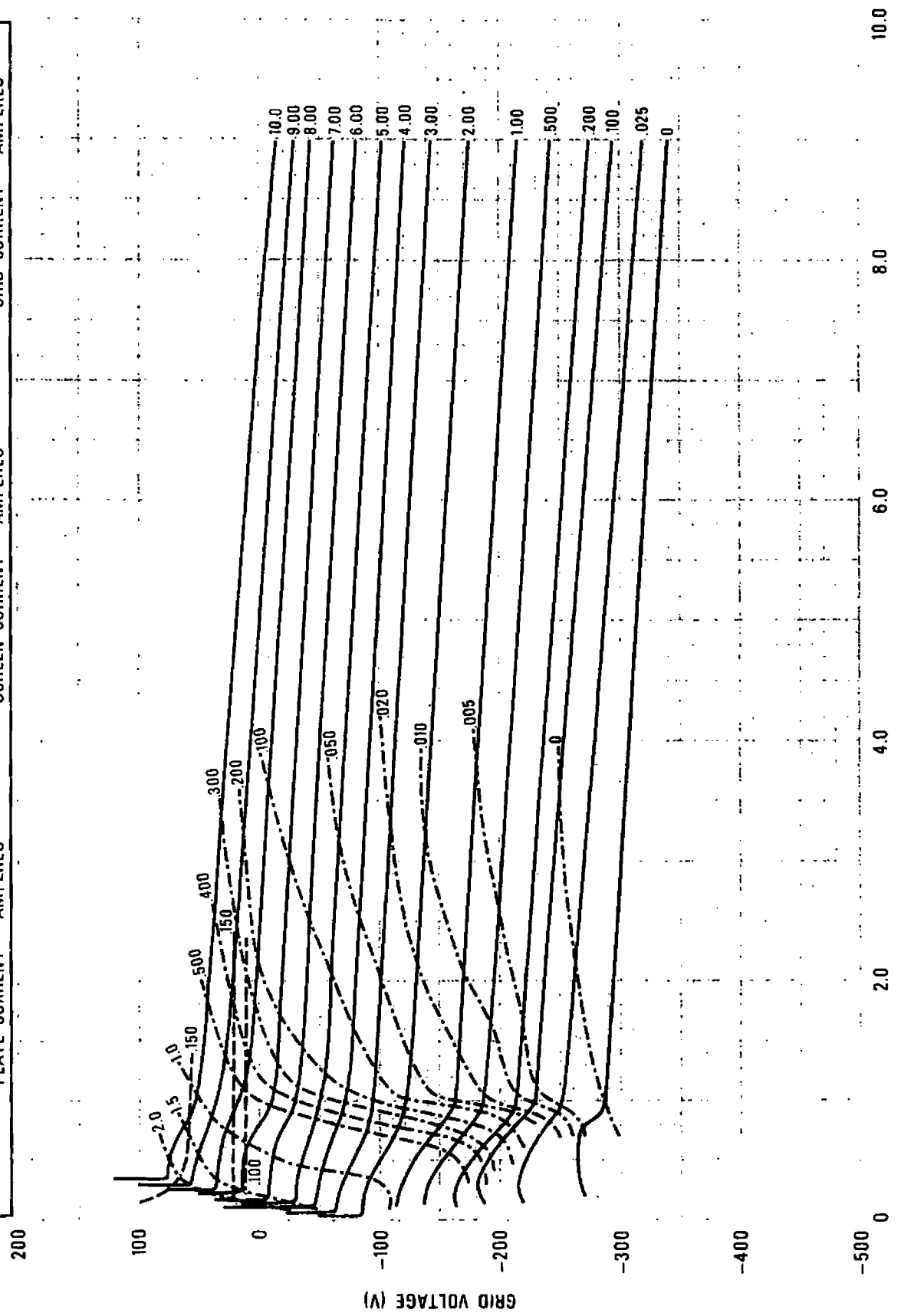


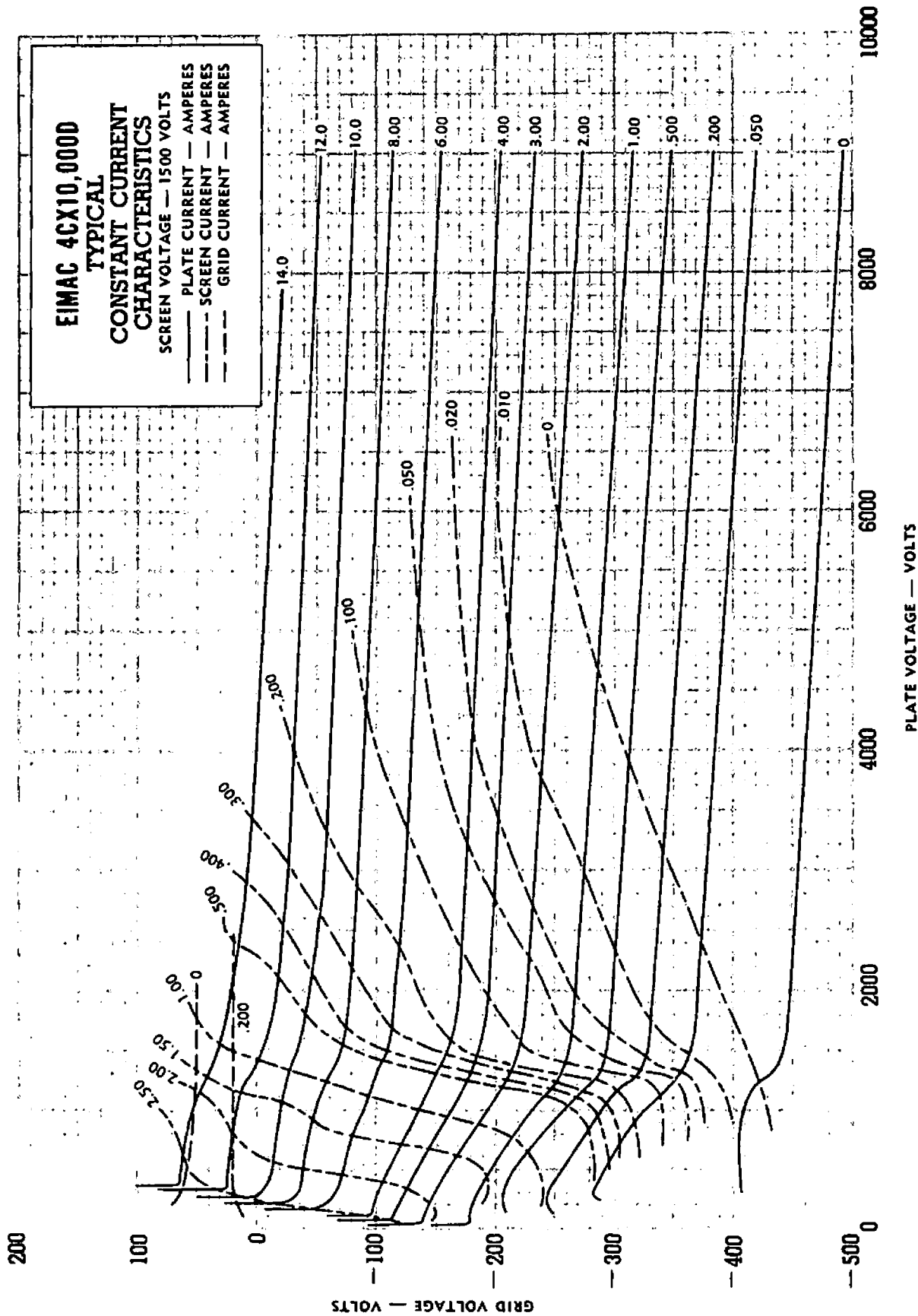
**TYPICAL CONSTANT CURRENT CHARACTERISTICS**

SCREEN VOLTAGE = 1000V

GROUNDING CATHODE

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





CURVE MA-317





NOTES:

1. REF DIMENSIONS ARE FOR INFO ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. DIMENSIONS IN [ ] ARE MILLIMETERS.
3. (\*) CONTACT SURFACE.
4. OPTIMUM FILAMENT & GRID CONNECTOR HEIGHTS FOR SOCKET DESIGN PURPOSES.

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	6.928	7.050		175.97	179.07	
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	4.186	4.568		106.32	116.03	
N	2.412	2.788		61.26	70.82	
P	8.812	9.062		223.82	230.17	
S	3.412	3.788		86.66	96.22	
T	.375			9.53		

# 4CX10,000D

