

EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

8170
4CX5000A
RADIAL-BEAM
POWER TETRODE

The EIMAC 8170/4CX5000A is a compact high-power ceramic and metal tetrode cooled by forced air. It is useful as an oscillator, amplifier, or modulator at frequencies up to 110 megahertz and is particularly suited for use as a linear single-sideband amplified, Class-AB₁ audio amplifier, or as a screen-modulated radio-frequency amplifier.

A pair of these tubes will deliver 17.5 kilowatts of audio-frequency or radio-frequency power with zero driving power. The rated plate dissipation is five kilowatts for most classes of services and six kilowatts for Class-AB operation.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	<u>Min.</u>	<u>Nom.</u>	<u>Max.</u>	
Voltage - - - - -		7.5		volts
Current - - - - -	73		78	amperes

Amplification Factor (Grid Screen) - - - - - 4.5

Direct Interelectrode Capacitances, Grounded Cathode:

Input - - - - -	108	122	pF
Output - - - - -	18	23	pF
Feedback - - - - -		1.0	pF

Direct Interelectrode Capacitances, Grounded Grid and Screen:

	<u>Min.</u>	<u>Max.</u>	
Input - - - - -	48	58	pF
Output - - - - -	18	23	pF
Feedback - - - - -		0.16	pF

MECHANICAL

Base - - - - -	Special concentric
Maximum Seal Temperature - - - - -	250°C
Maximum Anode-Core Temperature - - - - -	250°C
Recommended Socket - - - - -	EIMAC SK-300A
Recommended Chimney - - - - -	EIMAC SK-306
Operating Position - - - - -	Axis vertical, base up or down
Maximum Dimensions:	
Height - - - - -	9.13 inches
Diameter - - - - -	4.94 inches
Cooling - - - - -	Forced air
Net Weight - - - - -	9.5 pounds
Shipping Weight (Approximate) - - - - -	22 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR (Up to 30 megahertz)

Class-C Telephony (Key-down conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE - - - - -	7500 VOLTS
DC SCREEN VOLTAGE - - - - -	1500 VOLTS
DC PLATE CURRENT - - - - -	3 AMPS
PLATE DISSIPATION - - - - -	5000 WATTS
SCREEN DISSIPATION - - - - -	250 WATTS
GRID DISSIPATION - - - - -	75 WATTS

TYPICAL OPERATION

(Frequencies below 30 megahertz)

DC Plate Voltage - - - - -	7500 volts
DC Screen Voltage - - - - -	500 volts
DC Grid Voltage - - - - -	—350 volts
DC Plate Current - - - - -	2.8 amps
DC Screen Current - - - - -	0.5 amp
DC Grid Current - - - - -	0.25 amp
Peak RF Grid Voltage - - - - -	590 volts
Driving Power - - - - -	150 watts
Plate Dissipation - - - - -	5000 watts
Plate Output Power - - - - -	16,000 watts



**4CX5000A**

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR (From 30 to 110 megahertz)

Class-C Telephony or FM Telephony
(Key-down conditions)

MAXIMUM RATINGS

DC PLATE VOLTAGE:		
30 to 60 MHz	-	7000 VOLTS
60 to 110 MHz	-	6500 VOLTS
DC SCREEN VOLTAGE	-	1500 VOLTS
DC PLATE CURRENT:		
30 to 60 MHz	-	2.8 AMPS
60 to 110 MHz	-	2.6 AMPS
PLATE DISSIPATION	-	5000 WATTS
SCREEN DISSIPATION	-	250 WATTS
GRID DISSIPATION	-	75 WATTS

TYPICAL OPERATION (Frequencies between 88 and 108 megahertz)

DC Plate Voltage	-	-	-	-	-	-	-	6500 volts
DC Screen Voltage	-	-	-	-	-	-	-	750 volts
DC Grid Voltage	-	-	-	-	-	-	-	—350 volts
DC Plate Current	-	-	-	-	-	-	-	2.3 amperes
DC Screen Current	-	-	-	-	-	-	-	0.2 ampere
DC Grid Current	-	-	-	-	-	-	-	0.05 ampere
Driving Power	-	-	-	-	-	-	-	100 watts
Useful Output Power	-	-	-	-	-	-	-	10,000 watts

PLATE-MODULATED RADIO- FREQUENCY POWER AMPLIFIER

Class-C Telephony

(Carrier conditions except where noted)

MAXIMUM RATINGS

DC PLATE VOLTAGE	-	5500 VOLTS
DC SCREEN VOLTAGE	-	1000 VOLTS
DC PLATE CURRENT	-	2.5 AMPS
PLATE DISSIPATION*	-	3500 WATTS
SCREEN DISSIPATION	-	250 WATTS
GRID DISSIPATION	-	75 WATTS

*Corresponds to 5000 watts at 100-percent sine-wave modulation.

TYPICAL OPERATION (Frequencies below 30 megahertz)

DC Plate Voltage	-	-	-	-	-	-	-	5000 volts
DC Screen Voltage	-	-	-	-	-	-	-	500 volts
Peak AF Screen Voltage (For 100-percent modulation)	-	-	-	-	-	-	-	450 volts
DC Grid Voltage	-	-	-	-	-	-	-	—400 volts
DC Plate Current	-	-	-	-	-	-	-	1.4 amperes
DC Screen Current	-	-	-	-	-	-	-	0.26 ampere
DC Grid Current	-	-	-	-	-	-	-	0.05 ampere
Peak RF Grid Voltage	-	-	-	-	-	-	-	520 volts
Grid Driving Power	-	-	-	-	-	-	-	25 watts
Plate Dissipation	-	-	-	-	-	-	-	1100 watts
Plate Output Power	-	-	-	-	-	-	-	5.8 kilowatts

SCREEN-MODULATED RADIO- FREQUENCY POWER AMPLIFIER

Class-C Telephony

(Carrier conditions except where noted)

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	-	7500 VOLTS
DC SCREEN VOLTAGE	-	750 VOLTS
DC PLATE CURRENT	-	3.0 AMPS
PLATE DISSIPATION	-	5000 WATTS
SCREEN DISSIPATION	-	250 WATTS
GRID DISSIPATION	-	75 WATTS

TYPICAL OPERATION (Frequencies below 30 megahertz per tube)

DC Plate Voltage	-	-	-	-	-	7500	7500 volts
DC Screen Voltage	-	-	-	-	-	350	350 volts
Peak AF Screen Voltage (For 100-percent modulation)	-	-	-	-	-	550	550 volts
DC Grid Voltage	-	-	-	-	-	—300	—300 volts
DC Plate Current	-	-	-	-	-	0.9	1.14 amperes
DC Screen Current*	-	-	-	-	-	—0.01	—0.01 ampere
DC Grid Current	-	-	-	-	-	0.015	0.03 ampere
Peak RF Grid Voltage	-	-	-	-	-	350	375 volts
Grid Driving Power	-	-	-	-	-	7	11 watts
RF Load Impedance	-	-	-	-	-	2000	1600 ohms
Plate Dissipation	-	-	-	-	-	4000	5000 watts
Useful Output Power	-	-	-	-	-	2750	3550 watts

*DC Screen Current is a function of loading; values of plus or minus 20 milliamperes may be considered typical at carrier level.

NOTE: Two tubes can be employed under conditions listed in the first column to obtain more than five kilowatts plate output power. Likewise, three tubes can be utilized at conditions listed in the second column to obtain better than ten kilowatts output power.

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB₁

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	-	7500 VOLTS
DC SCREEN VOLTAGE	-	1500 VOLTS
DC PLATE CURRENT	-	4.0 AMPS
PLATE DISSIPATION	-	6000 WATTS
SCREEN DISSIPATION	-	250 WATTS
GRID DISSIPATION	-	75 WATTS

TYPICAL OPERATION, two tubes

DC Plate Voltage	-	-	-	4000	5000	6000	7000 volts
DC Screen Voltage	-	-	-	1250	1250	1250	1250 volts
DC Grid Voltage	-	-	-	—270	—280	—310	—325 volts
Max-Signal Plate Current	-	-	-	5.10	4.40	4.25	3.65 amperes
Zero-Signal Plate Current	-	-	-	1.25	1.00	0.83	0.70 amperes
Max-Signal Screen Current	-	-	-	0.35	0.33	0.30	0.24 ampere
Zero-Signal Screen Current	-	-	-	0	0	0	0 amperes
Peak AF Driving Voltage	-	-	-	250	240	270	235 volts
Driving Power	-	-	-	0	0	0	0 watts
Load Resistance, Plate-to-Plate	-	-	-	1500	2370	2940	4100 ohms
Max-Signal Plate Dissipation*	-	-	-	4200	4200	4200	4200 watts
Max-Signal Plate Output Power	-	-	-	11,500	13,500	17,000	17,500 watts

*Per Tube

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB₁

MAXIMUM RATINGS

DC PLATE VOLTAGE	-	7500 VOLTS
DC SCREEN VOLTAGE	-	1500 VOLTS
DC PLATE CURRENT	-	4.0 AMPS
PLATE DISSIPATION	-	6000 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 volts
DC Screen Voltage	-	-	-	-	-	-	1250 volts
DC Grid Voltage*	-	-	-	-	-	-	—300 volts
Max-Signal Plate Current	-	-	-	-	-	-	1.9 amperes
Zero-Signal Plate Current	-	-	-	-	-	-	0.50 ampere
Max-Signal Screen Current	-	-	-	-	-	-	0.20 ampere
Peak RF Grid Voltage	-	-	-	-	-	-	300 volts
Driving Power	-	-	-	-	-	-	0 watts
Plate Dissipation	-	-	-	-	-	-	4200 watts
Plate Output Power **	-	-	-	-	-	-	10,000 watts

*Adjust grid voltage to obtain specified Zero-Signal plate current.

**PEP output or rf output power at crest of modulation envelope.

NOTE: In most cases, "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made. Exceptions are distinguished by a listing of "Useful" output power as opposed to "Plate" output power. Values appearing in these groups have been obtained from existing equipment(s) and the output power is that measured at the load.



APPLICATION

MECHANICAL

Mounting — The 4CX5000A 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-300A Air-System Socket is designed especially for the concentric base terminals of the 4CX5000A. 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-306, into the anode cooling fins. The SK-300 socket may be used instead of the SK-300A, but its use will result in a slightly less efficient cooling system at high dissipation levels.

Cooling — The maximum temperature rating for the external surfaces of the 4CX5000A 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. Sea level air-flow requirements to maintain seal temperatures at 200°C in 50°C ambient air are tabulated below (for operation below 30 megahertz).

Plate Dissipation* (Watts)	SK-300A Socket		SK-300 Socket	
	Air Flow (CFM)	Pressure Drop (Inches of water)	Air Flow (CFM)	Pressure Drop (inches of water)
2000	75	0.4	75	0.4
3000	105	0.7	100	0.7
4000	145	1.1	135	1.2
5000	190	1.5	165	1.8
6000	230	2.0	200	2.5

*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 higher altitudes, higher frequencies, or higher ambient temperatures the flow rate must be increased to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using maximum rated temperatures as the criteria for satisfactory cooling.

ELECTRICAL

Filament Operation—The rated filament voltage for the 4CX5000A 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 5 percent from the rated value.

Electrode Dissipation Ratings—The maximum dissipation ratings for the 4CX5000A must be respected to avoid damage to the tube. An exception is the plate dissipation, which may be permitted to rise above the maximum rating during brief periods, such as may occur during tuning.

Control Grid Operation — The 4CX5000A 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 "Typical Operation" sections of the data sheet whenever possible.

Screen-Grid Operation — The power dissipated by the screen of the 4CX5000A 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.

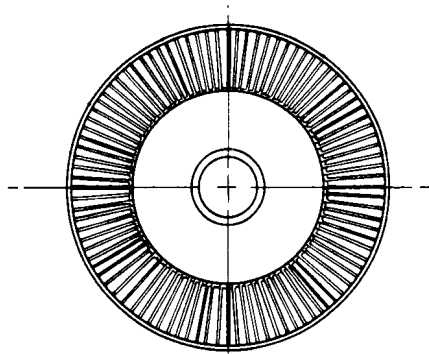
Plate Dissipation—The plate-dissipation rating for the 4CX5000A is 5000 watts for most applications but for audio and SSB amplifier applications, the maximum allowable dissipation is 6000 watts.

When the 4CX5000A 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 3500-watt maximum plate dissipation rating will be exceeded.

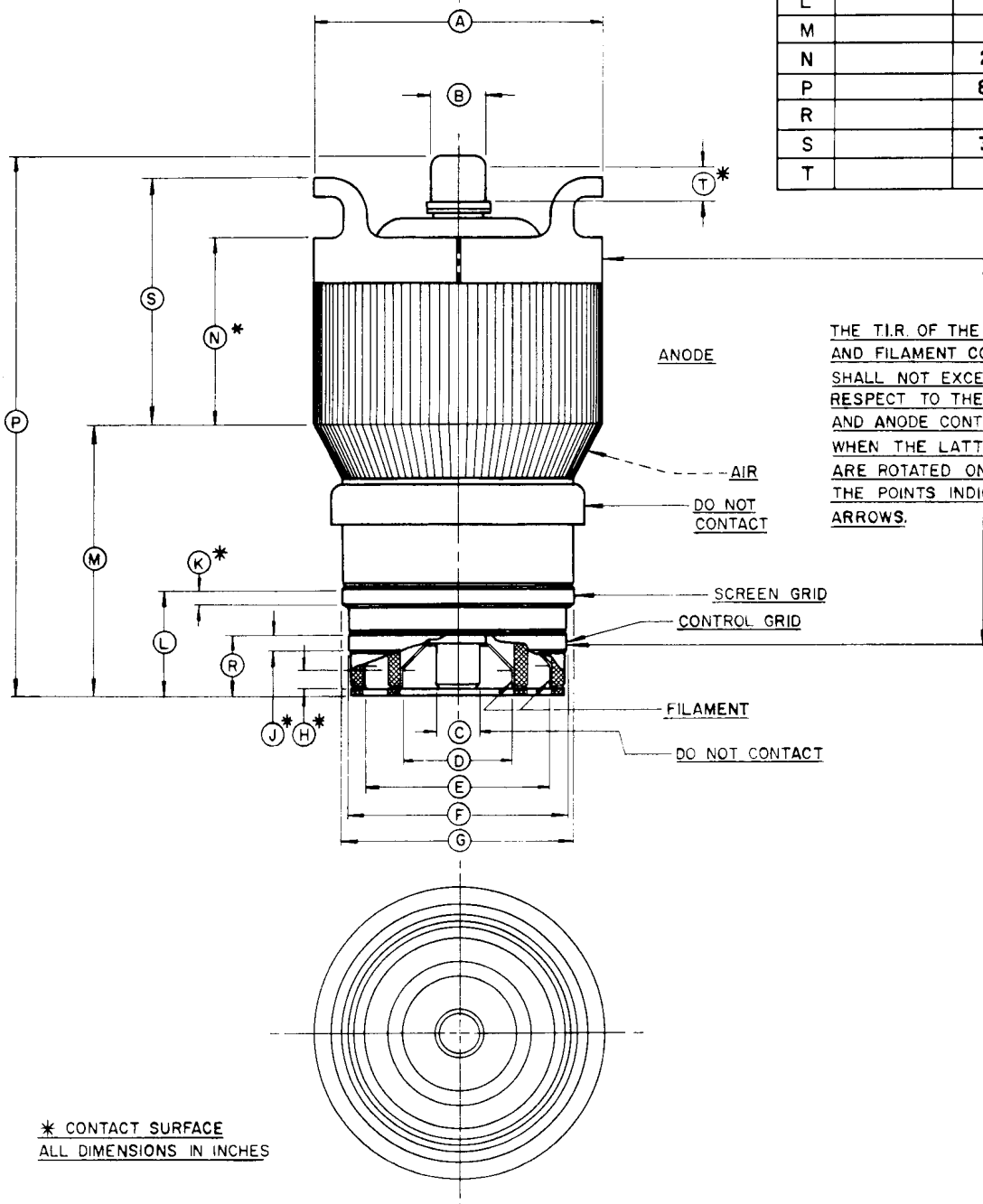
Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California, for information and recommendations.



4CX5000A



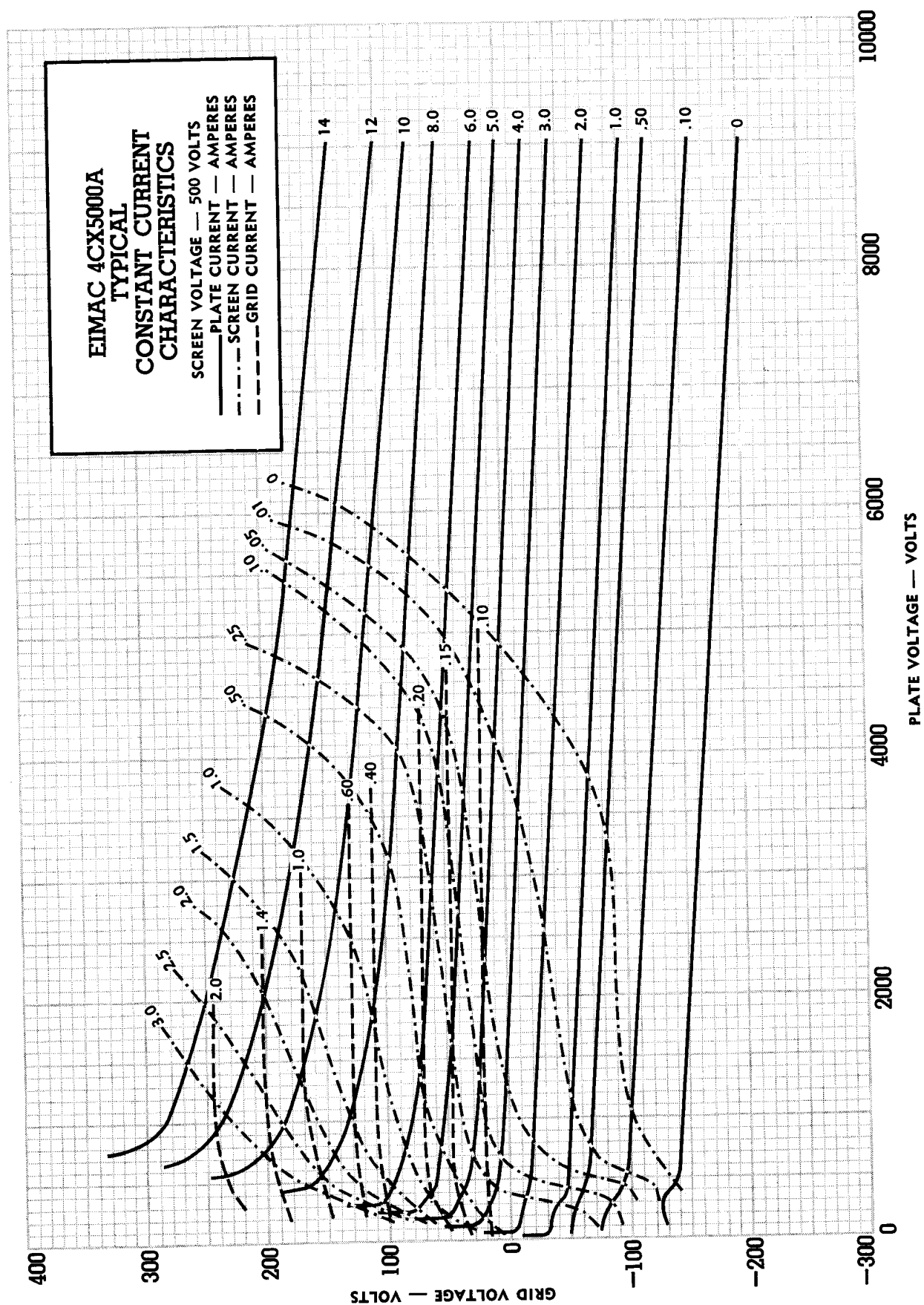
DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A		4.812	4.938
B		.855	.895
C		.720	.760
D		1.896	1.936
E		3.133	3.173
F		3.792	3.832
G		3.980	4.020
H		.188	
J		.188	
K		.188	
L		1.764	1.826
M		4.188	4.563
N		2.875	3.250
P		8.625	9.125
R		.986	1.050
S		3.875	4.250
T		.375	



* CONTACT SURFACE
ALL DIMENSIONS IN INCHES



4CX5000A





4CX5000A

EIMAC 4CX5000A

TYPICAL

CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE — 1250 VOLTS

— PLATE CURRENT — AMPERES

- - - - SCREEN CURRENT — AMPERES

- - - - GRID CURRENT — AMPERES

