



EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

4CX5000A

**RADIAL-BEAM
POWER TETRODE**

The Eimac 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 megacycles and is particularly suited for use as a linear single-sideband amplifier, 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 service and six kilowatts for class-AB operation.

GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten										Min.	Nom.	Max.
Voltage	-	-	-	-	-	-	-	-	-	-	7.5	volts
Current	-	-	-	-	-	-	-	-	-	73		78 amperes
Amplification Factor (Grid-Screen)	-	-	-	-	-	-	-	-	-	4.25		5.0

Direct Interelectrode Capacitances, Grounded Cathode:

Input	-	-	-	-	-	-	-	-	-	-	106	uuf
Output	-	-	-	-	-	-	-	-	-	-	18	uuf
Feedback	-	-	-	-	-	-	-	-	-	-	0.75	uuf

Direct Interelectrode Capacitances, Grounded Grid and Screen:

												Nom.	
Input	-	-	-	-	-	-	-	-	-	-	-	47	uuf
Output	-	-	-	-	-	-	-	-	-	-	-	18	uuf
Feedback	-	-	-	-	-	-	-	-	-	-	-	0.14	uuf

MECHANICAL

Base	-	-	-	-	-	-	-	-	-	-	-	-	-	Special concentric
Maximum Seal Temperature	-	-	-	-	-	-	-	-	-	-	-	-	-	250° C
Maximum Anode-Core Temperature	-	-	-	-	-	-	-	-	-	-	-	-	-	250° C
Recommended Socket	-	-	-	-	-	-	-	-	-	-	-	-	-	Eimac SK-300
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 megacycles)

Class-C Telegraphy (Key-down conditions)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	-	-	-	7500 MAX. VOLTS
D-C SCREEN VOLTAGE	-	-	-	1500 MAX. VOLTS
D-C PLATE CURRENT	-	-	-	3 MAX. AMPERES
PLATE DISSIPATION	-	-	-	5000 MAX. WATTS
SCREEN DISSIPATION	-	-	-	250 MAX. WATTS
GRID DISSIPATION	-	-	-	75 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 megacycles)

D-C Plate Voltage	-	-	-	-	-	-	-	7500 volts
D-C Screen Voltage	-	-	-	-	-	-	-	500 volts
D-C Grid Voltage	-	-	-	-	-	-	-	-350 volts
D-C Plate Current	-	-	-	-	-	-	-	2.8 amperes
D-C Screen Current	-	-	-	-	-	-	-	0.5 ampere
D-C Grid Current	-	-	-	-	-	-	-	0.25 ampere
Peak R-F Grid Voltage	-	-	-	-	-	-	-	590 volts
Driving Power	-	-	-	-	-	-	-	150 watts
Plate Dissipation	-	-	-	-	-	-	-	5000 watts
Plate Output Power	-	-	-	-	-	-	-	16,000 watts

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

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

MAXIMUM RATINGS

D-C PLATE VOLTAGE:

30 to 60 megacycles - - - 7000 MAX. VOLTS

60 to 110 megacycles - - - 6500 MAX. VOLTS

D-C SCREEN VOLTAGE - - - 1500 MAX. VOLTS

D-C PLATE CURRENT:

30 to 60 megacycles - - - 2.8 MAX. AMPERES

60 to 110 megacycles - - - 2.6 MAX. AMPERES

PLATE DISSIPATION - - - 5000 MAX. WATTS

SCREEN DISSIPATION - - - 250 MAX. WATTS

GRID DISSIPATION - - - 75 MAX. WATTS

TYPICAL OPERATION (Frequencies between 88 and 108 megacycles)

D-C Plate Voltage - - - - - 6500 volts

D-C Screen Voltage - - - - - 750 volts

D-C Grid Voltage - - - - - -350 volts

D-C Plate Current - - - - - 2.3 amperes

D-C Screen Current - - - - - 0.2 ampere

D-C Grid Current - - - - - 0.05 ampere

Driving Power - - - - - 25 watts

Useful Output Power - - - - - 10,000 watts

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions except where noted)

MAXIMUM RATINGS

D-C PLATE VOLTAGE - - - 5000 MAX. VOLTS

D-C SCREEN VOLTAGE - - - 1000 MAX. VOLTS

D-C PLATE CURRENT - - - 2.5 MAX. AMPERES

PLATE DISSIPATION* - - - 3500 MAX. WATTS

SCREEN DISSIPATION - - - 250 MAX. VOLTS

GRID DISSIPATION - - - 75 MAX. WATTS

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

TYPICAL OPERATION (Frequencies below 30 megacycles)

D-C Plate Voltage - - - - - 5000 volts

D-C Screen Voltage - - - - - 500 volts

Peak A-F Screen Voltage (For 100-percent modulation) 450 Volts

D-C Grid Voltage - - - - - -400 volts

D-C Plate Current - - - - - 1.4 amperes

D-C Screen Current - - - - - 0.26 ampere

D-C Grid Current - - - - - 0.05 ampere

Peak R-F 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

(Carrier conditions except where noted)

MAXIMUM RATINGS, Class-C Telephony (Per Tube)

D-C PLATE VOLTAGE - - - 7500 MAX. VOLTS

D-C SCREEN VOLTAGE - - - 750 MAX. VOLTS

D-C PLATE CURRENT - - - 3.0 MAX. AMPERES

PLATE DISSIPATION - - - 5000 MAX. WATTS

GRID DISSIPATION - - - 75 MAX. WATTS

TYPICAL OPERATION (Frequencies below 30 megacycles, per tube)

D-C Plate Voltage - - - - - 7500 7500 volts

D-C Screen Voltage - - - - - 350 350 volts

Peak A-F Screen Voltage (For 100-percent modulation) 550 550 volts

D-C Grid Voltage - - - - - -300 -300 volts

D-C Plate Current - - - - - 0.9 1.14 amperes

D-C Screen Current* - - - - - -0.01 -0.01 amperes

D-C Grid Current - - - - - 0.015 0.03 amperes

Peak R-F Grid Voltage - - - - - 350 375 volts

Grid Driving Power - - - - - 7 11 watts

R-F Load Impedance - - - - - 2000 1600 ohms

Plate Dissipation - - - - - 4000 5000 watts

Useful Output Power - - - - - 2750 3550 watts

*D-C 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)

D-C PLATE VOLTAGE - - - 7500 MAX. VOLTS

D-C SCREEN VOLTAGE - - - 1500 MAX. VOLTS

D-C PLATE CURRENT - - - 4.0 MAX. AMPERES

PLATE DISSIPATION - - - 6000 MAX. WATTS

SCREEN DISSIPATION - - - 250 MAX. WATTS

GRID DISSIPATION - - - 75 MAX. WATTS

TYPICAL OPERATION, two tubes

D-C Plate Voltage - - - 4000 5000 6000 7000 volts

D-C Screen Voltage - - - 1250 1250 1250 1250 volts

D-C 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 amperes

Zero-Signal Screen Current - - 0 0 0 0 amperes

Peak A-F 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

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB₁

MAXIMUM RATINGS

D-C PLATE VOLTAGE - - - 7500 MAX. VOLTS

D-C SCREEN VOLTAGE - - - 1500 MAX. VOLTS

D-C PLATE CURRENT - - - 4.0 MAX. AMPERES

PLATE DISSIPATION - - - 6000 MAX. WATTS

SCREEN DISSIPATION - - - 250 MAX. WATTS

GRID DISSIPATION - - - 75 MAX. WATTS

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

D-C Plate Voltage - - - - - 7500 volts

D-C Screen Voltage - - - - - 1250 volts

D-C 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 R-F 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 r-f 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 Air-System Socket Type SK-300 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.

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. Air-flow requirements to maintain seal temperatures at 200°C in 50°C ambient air are tabulated below.

Plate Dissipation* (Watts)	SEA LEVEL		10,000 FEET	
	Air Flow (CFM)	Pressure Drop (Inches of water)	Air Flow (CFM)	Pressure Drop (Inches of water)
2000	100	0.6	146	0.9
3000	160	1.4	230	2.0
4000	230	2.8	330	4.0
5000	310	4.0	450	5.8
6000	400	5.1	580	7.4

*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 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 the "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.

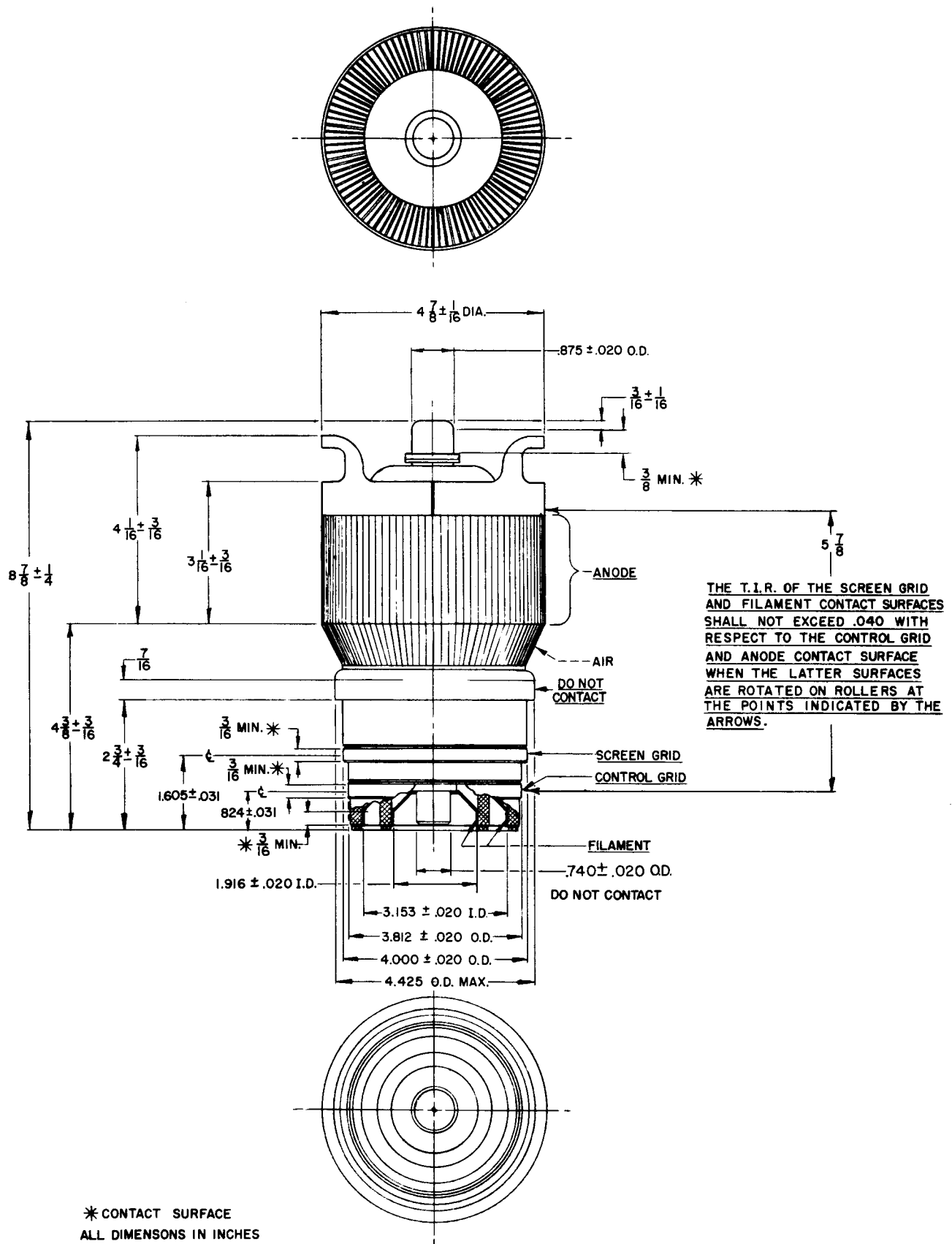
Screen dissipation, in cases where there is no ac applied to the screen, is the simple product of the screen voltage and the screen current. If the screen voltage is modulated, the screen dissipation will depend upon loading, driving power, and carrier screen voltage.

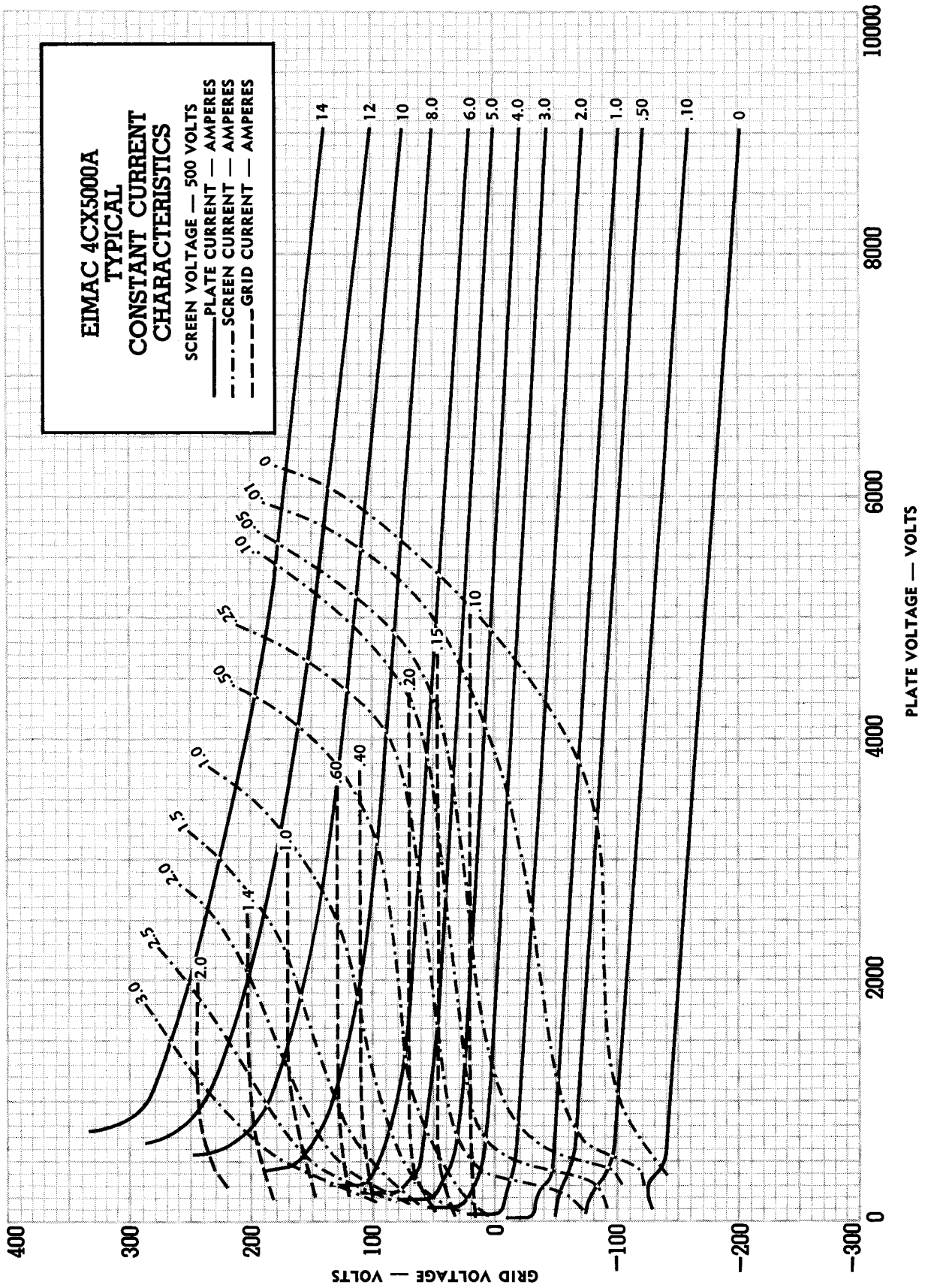
Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 250 watts in the event of circuit failure.

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 r-f 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 the Application Engineering Department, Eitel-McCullough, Inc., 301 Industrial Road, San Carlos, California, for information and recommendations.







4CX5000A

