



TECHNICAL DATA

5CX1500A

RADIAL BEAM
POWER PENTODE

The EIMAC 5CX1500A is a ceramic/metal power pentode designed for use as a Class AB₁ linear amplifier in audio or radio frequency applications. Its characteristic low intermodulation distortion makes it especially suitable for single sideband service. The filament is a rugged mesh type.

The tube is also recommended for use as a Class C rf power amplifier in CW, FM and AM service.



GENERAL CHARACTERISTICS¹

ELECTRICAL

Filament: Thoriated Tungsten

Voltage 5.0 ± 0.25 V

Current, at 5.0 volts 38.5 A

Transconductance (Average):

I_b = 1.0 Adc, E_{c2} = 500 Vdc 24,000 μmhos

Amplification Factor (Average):

Grid to Screen 5.5

Direct Interelectrode Capacitance (grounded cathode)²

Input 75 pF

Output 16.5 pF

Feedback 0.20 pF

Frequency of Maximum Rating:

CW 110 MHz

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.

MECHANICAL

Maximum Overall Dimensions:

Length 5.150 in; 130.81 mm

Diameter 3.370 in; 85.60 mm

Net Weight 30 oz; 850.5 gm

Operating Position Axis vertical, base down or up

Maximum Operating Temperature:

Ceramic/Metal Seals 250°C

Anode Core 250°C



Cooling Forced Air
 Base Special ring and breechblock terminal surfaces
 Recommended Air System Socket EIMAC SK-840 series
 Recommended (Air) Chimney EIMAC SK-806

RADIO FREQUENCY LINEAR AMPLIFIER

GRID DRIVEN

Class AB₁

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB₁, Grid Driven

ABSOLUTE MAXIMUM RATINGS:

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

Plate Voltage	2500	3000	4000	Vdc
Suppressor Voltage	0	0	0	Vdc
Screen Voltage	500	500	500	Vdc
Grid Voltage ¹	-87	-89	-90	Vdc
Zero-Signal Plate Current	250	250	250	mAdc
Single-Tone Plate Current	660	690	690	mAdc
Two-Tone Plate Current	470	480	485	mAdc
Single-Tone Screen Current ³ ..	79	71	59	mAdc
Two-Tone Screen Current ³	36	32	25	mAdc
Peak rf Grid Voltage ³	87	89	90	v
Peak Driving Power ³	0	0	0	w
Single-Tone Useful				
Output Power	1090	1330	1785	W
Resonant Load Impedance	2340	2680	3500	Ω
Intermodulation Distortion Products ²				
3rd Order	-38	-36	-33	db
5th Order	-39	-41	-42	db

1. Adjust to specified zero-signal dc plate current.
2. The intermodulation distortion products are referenced against one tone of a two equal tone signal.
3. Approximate values.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy or FM
(Key-Down Conditions)

TYPICAL OPERATION (Frequencies to 30 MHz)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	5000 VOLTS
DC SCREEN VOLTAGE	750 VOLTS
DC PLATE CURRENT	1.0 AMPERE
PLATE DISSIPATION	1500 WATTS
SUPPRESSOR DISSIPATION	25 WATTS
SCREEN DISSIPATION	75 WATTS
GRID DISSIPATION	25 WATTS

Plate Voltage	3000	4000	4500	Vdc
Suppressor Voltage	0	0	0	Vdc
Screen Voltage	500	500	500	Vdc
Grid Voltage	-200	-200	-200	Vdc
Plate Current	900	800	900	mAdc
Screen Current ¹	94	66	88	mAdc
Grid Current ¹	35	25	34	mAdc
Peak rf Grid Voltage ¹	255	245	255	v
Calculated Driving Power	9.0	6.5	9.0	W
Plate Input Power	2700	3200	4050	W
Plate Dissipation	720	850	870	W
Plate Output Power	1980	2350	3180	W
Resonant Load Impedance	1570	2240	2520	Ω

1. Approximate value.

PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN

Class C Telephony
(Carrier Conditions)

TYPICAL OPERATION (Frequencies to 30 MHz)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE	3500 VOLTS
DC SCREEN VOLTAGE	550 VOLTS
DC PLATE CURRENT	0.8 AMPERE
PLATE DISSIPATION ¹	1000 WATTS
SUPPRESSOR DISSIPATION	25 WATTS
SCREEN DISSIPATION ²	75 WATTS
GRID DISSIPATION ²	25 WATTS

Plate Voltage	2500	3200	Vdc
Suppressor Voltage	0	0	Vdc
Screen Voltage	500	500	Vdc
Grid Voltage	-260	-260	Vdc
Plate Current	800	800	mAdc
Screen Current ¹	90	86	mAdc
Grid Current ¹	32	32	mAdc
Peak af Screen Voltage ¹ (100% modulation)	500	500	v
Peak rf Grid Voltage ¹	315	315	v
Calculated Driving Power	10	10	W
Plate Input Power	2000	2560	W
Plate Dissipation	530	576	W
Plate Output Power	1470	1958	W
Resonant Load Impedance	1360	1863	Ω

1. Corresponds to 1500 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

1. Approximate value.



AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR Class AB, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

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

TYPICAL OPERATION (Two Tubes)

Plate Voltage	2800	3800 Vdc
Suppressor Voltage	0	0 Vdc
Screen Voltage	500	500 Vdc
Grid Voltage	-81	-83 Vdc
Zero-Signal Plate Current	0.50	0.50 Adc
Max. Signal Plate Current	1.30	1.33 Adc
Zero-Signal Screen Current	20	20 mAdc
Max. Signal Screen Current	110	106 mAdc
Peak of Grid Voltage	81	83 v
Peak Driving Power	0	0 w
Max. Signal Plate Dissipation	720	1130 W
Plate Output Power	2200	3220 W
Load Resistance(plate to plate)	4800	6720 Ω

1. Approximate value.
2. Per tube .
3. Nominal drive power is one-half peak power.
4. Adjust to give stated zero-signal plate current.

NOTE: TYPICAL OPERATION data are obtained from 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 voltages 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 the case of 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.

RANGE VALUES FOR EQUIPMENT DESIGN

	<u>Min.</u>	<u>Max.</u>
Filament: Current at 5.0 volts	36.5	40.5 A
Interelectrode Capacitances ¹ (grounded cathode connection)		
Input	70	80 pF
Output	14.5	18.5 pF
Feedback	---	0.25 pF
Interelectrode Capacitances ¹ (grounded grid connection)		
Input	32	37 pF
Output	14.5	18.5 pF
Feedback	---	0.05 pF

APPLICATION

MECHANICAL

MOUNTING - The 5CX1500A 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-840 socket and SK-806 chimney have been designed especially

for the 5CX1500A. 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 exits through the anode cooling fins.



COOLING - The maximum temperature rating for the anode core of the 5CX1500A 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 below (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	.33	33	.40
1500	47	.76	58	.95

* Since the power dissipated by the filament represents about 200 watts and since grid-plus-screen-plus-suppressor dissipation can, under some conditions, represent another 125 watts, allowance has been made in preparing this tabulation for an additional 325 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 5CX1500A is 5.0 volts. Filament voltage, as measured at the socket, should be maintained within ±5% of this value or below to obtain maximum tube life.

INTERMODULATION DISTORTION - The Radio Frequency Linear Amplifier operating conditions including distortion data are the results of operation in a neutralized, grid-driven amplifier. Plots of IM distortion versus power output under two-tone condition for a typical tube are shown on next page.

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 OPERATION - The power dissipated by the screen of the 5CX1500A 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.

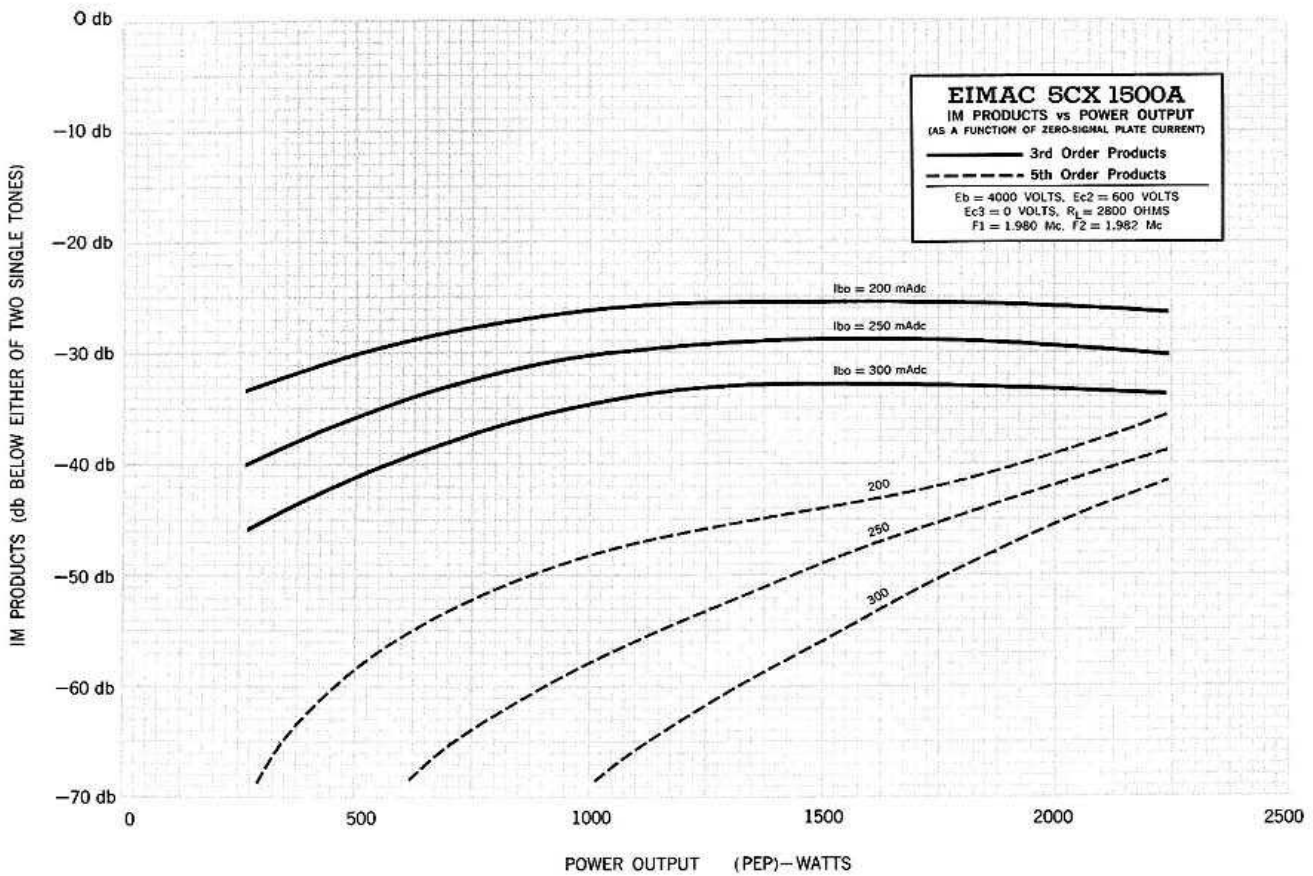
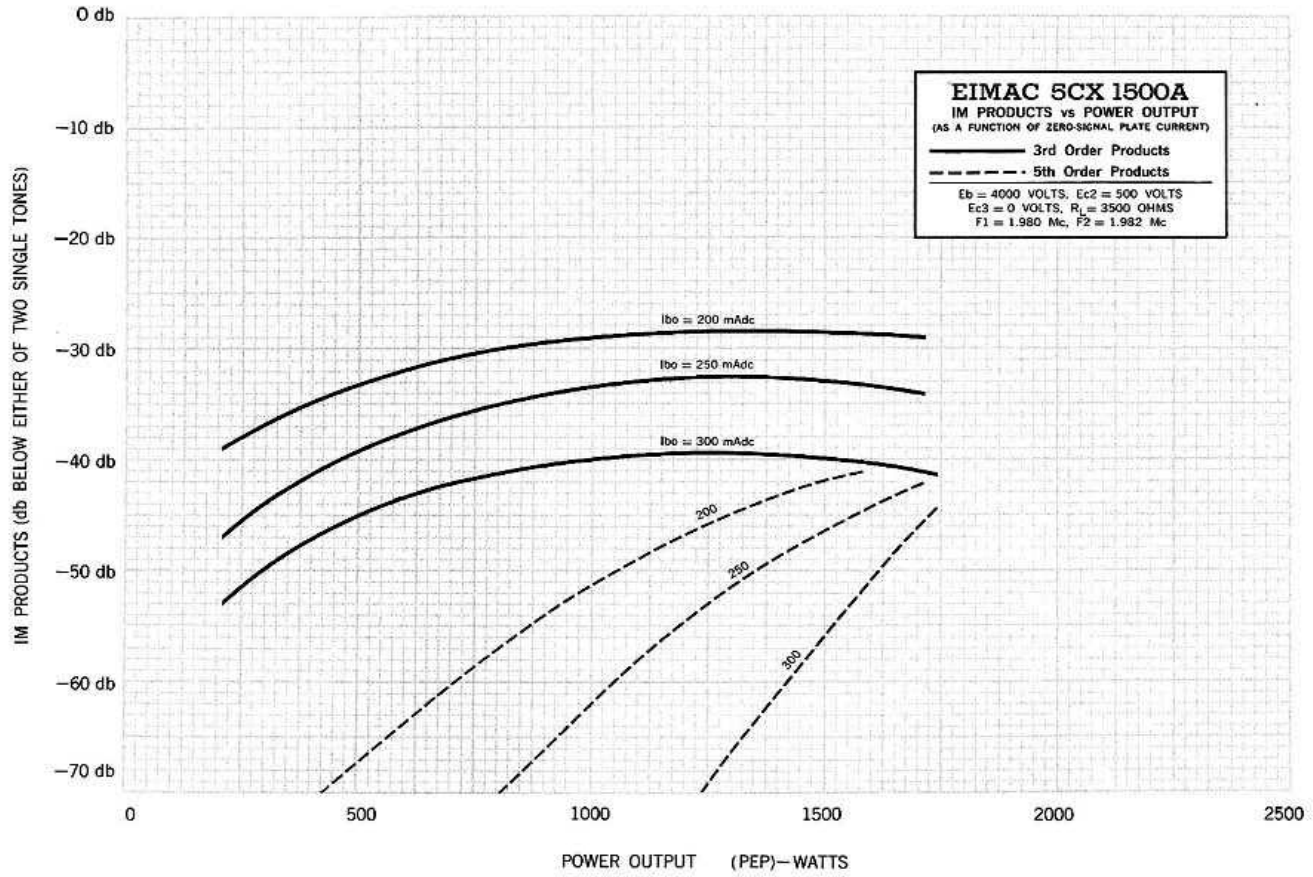
Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 75 watts in the event of circuit failure.

SUPPRESSOR OPERATION - The rated dissipation of the suppressor is 25 watts. Suppressor current will be zero or very nearly zero for all typical operating conditions specified. The 5CX1500A has been designed for zero voltage operation of the suppressor grid for most applications.

PLATE DISSIPATION - The plate-dissipation ratings for the 5CX1500A is 1000 watts for Class-C plate-modulated service and 1500 watts for Class-C telegraphy. In Class-AB service the plate dissipation rating is 1500 watts.

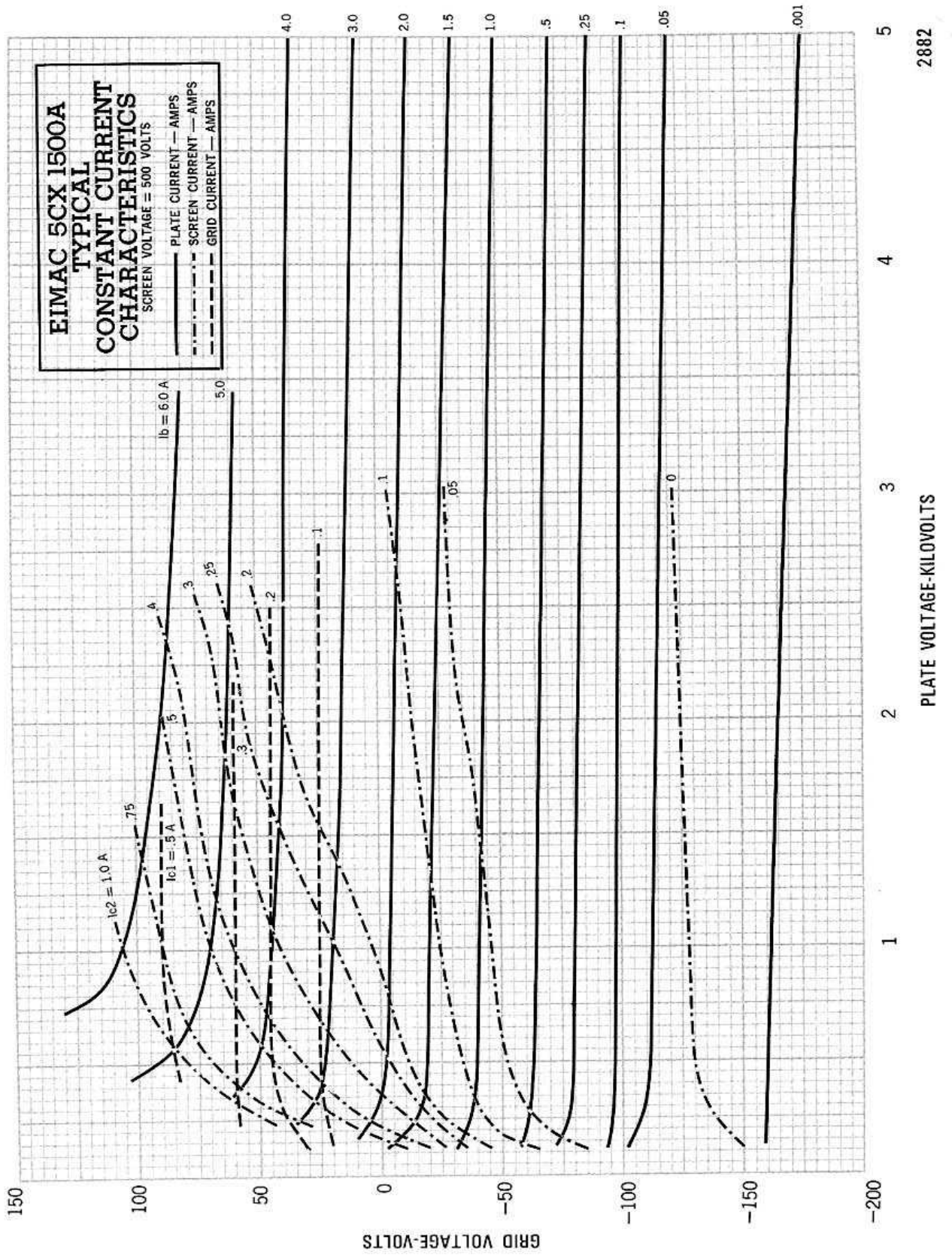
HIGH VOLTAGE - The 5CX1500A operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies 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.

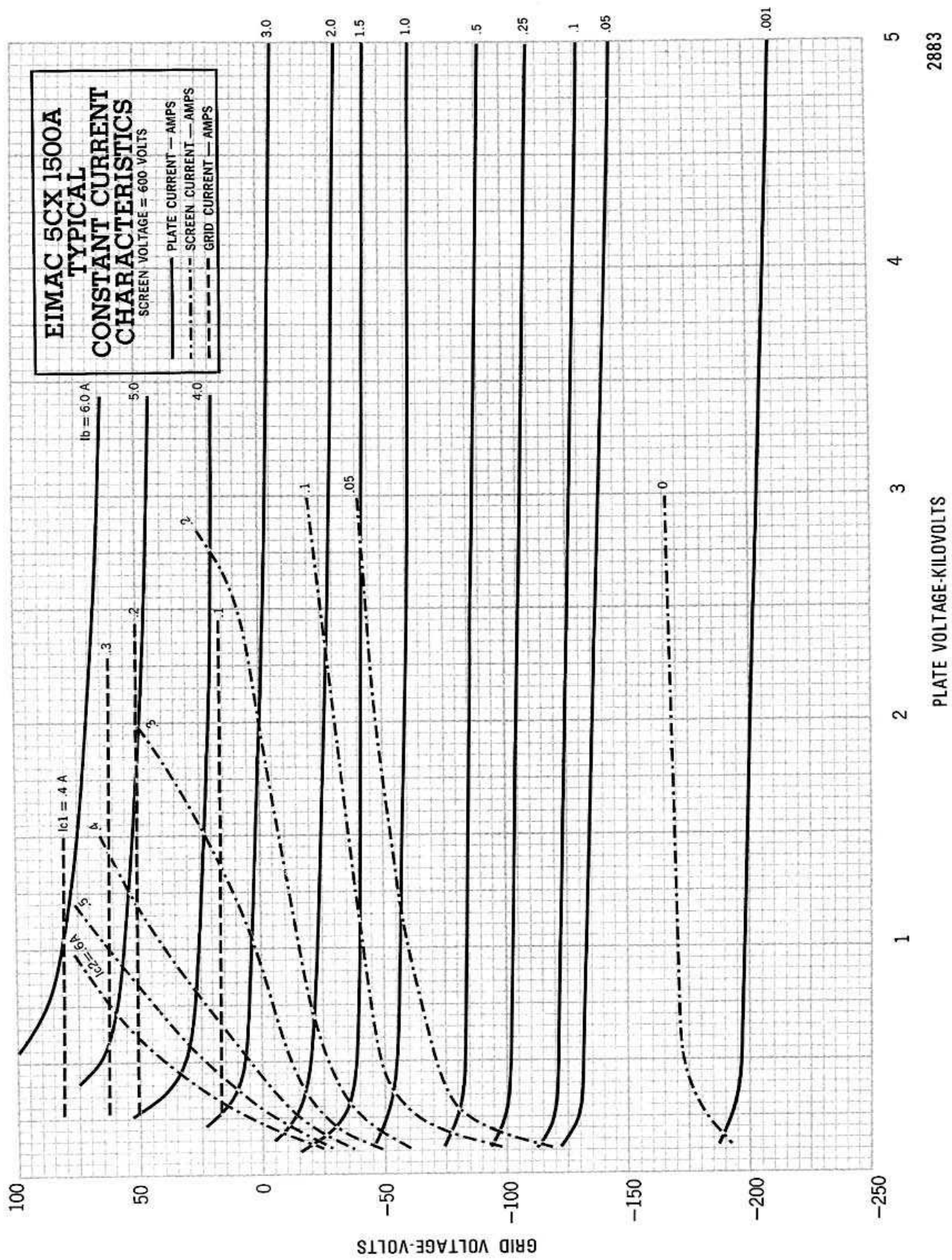
SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here write to the Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.





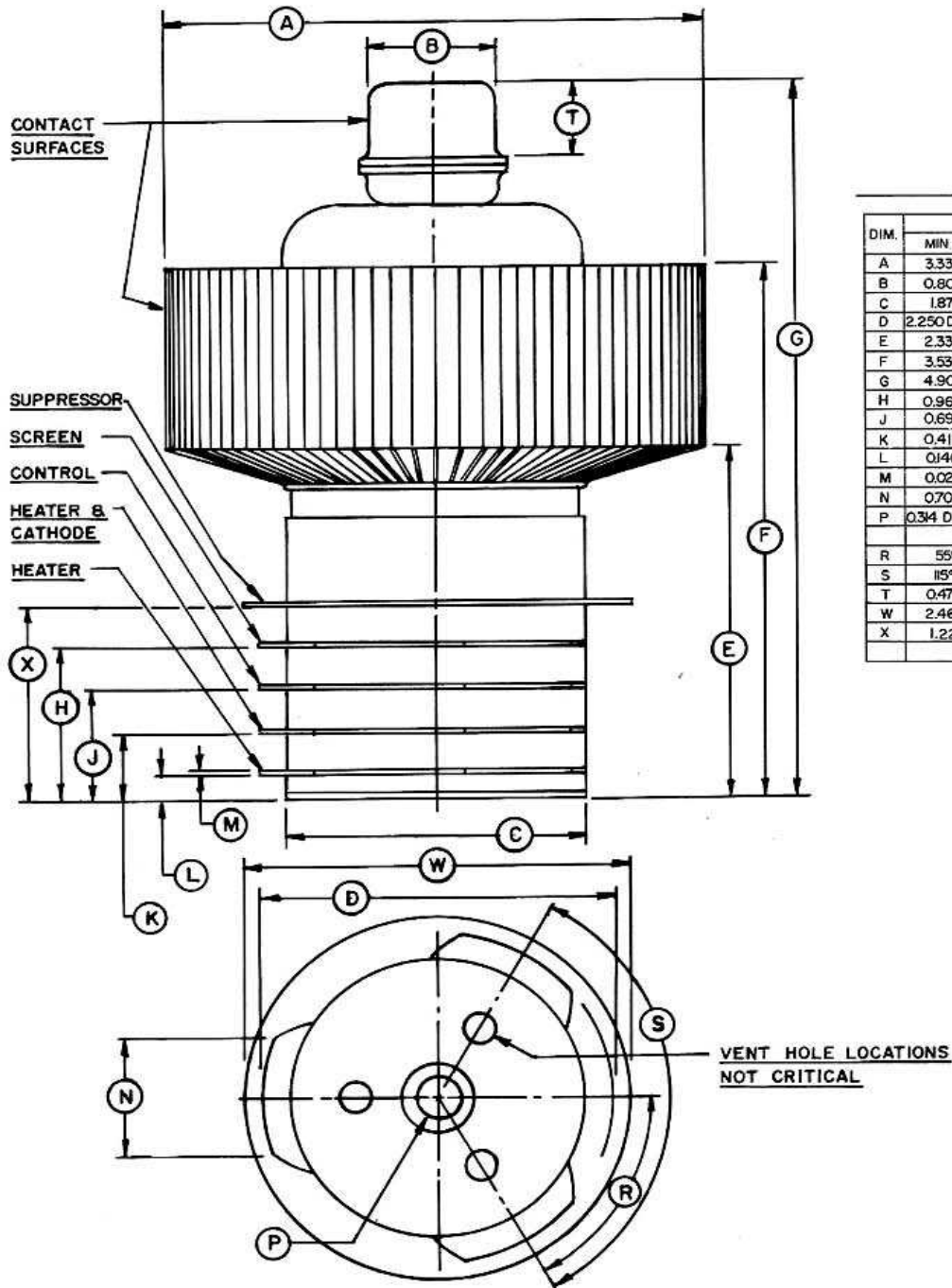
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DIM.	INCHES			MILLIMETERS		
	MIN	MAX	REF	MIN	MAX	REF
A	3.335	3.370	--	84.71	85.60	--
B	0.807	0.820	--	20.50	20.83	--
C	1.870	1.900	--	47.50	48.26	--
D	2.250 DIA	2.300 DIA	--	57.15 DIA	58.42 DIA	--
E	2.335	2.535	--	59.31	64.39	--
F	3.530	3.730	--	89.66	94.74	--
G	4.900	5.150	--	124.46	130.81	--
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	--	--	3.56	--	--
M	0.020	0.030	--	0.51	0.76	--
N	0.700	0.800	--	17.78	20.32	--
P	0.34 DIA	0.326 DIA	--	798 DIA	8.28 DIA	--
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	--
X	1.225	1.275	--	31.12	32.39	--