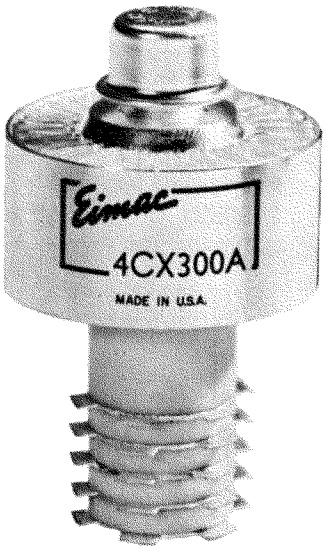
TENTATIVE DATA

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

4CX300A

CERAMIC POWER TETRODE

The Eimac 4CX300A is an integral-finned external-anode miniature power tetrode having a plate dissipation rating of 300 watts. The 4CX300A may be operated at full ratings at frequencies up to 500 megacycles. The all-ceramic-and-metal construction and the internally-unitized electrode structure combine to make the 4CX300A especially durable and free of mechanically-induced noise under conditions of severe acceleration caused by shock or vibration.



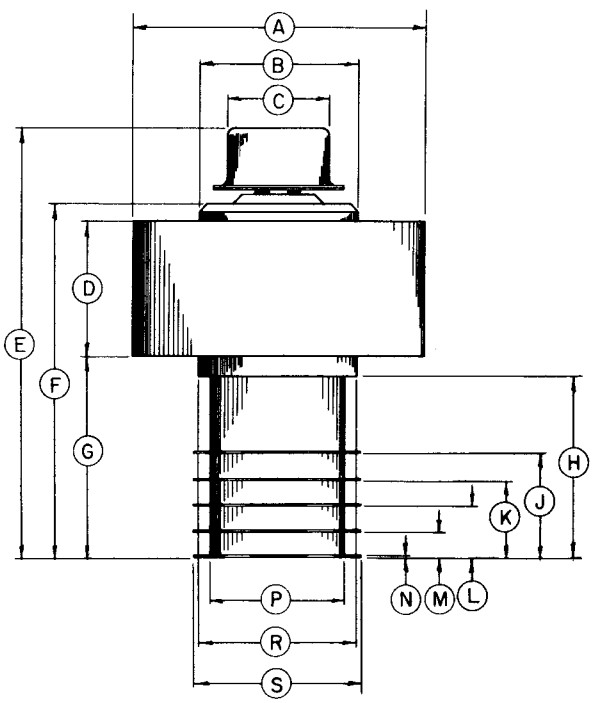
GENERAL CHARACTERISTICS

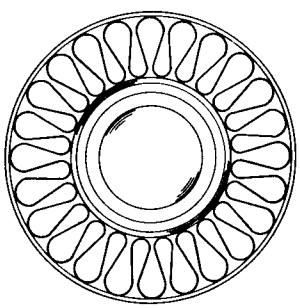
ELECTRICAL

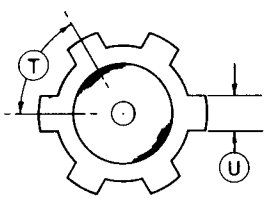
Cathode: Unipotential, Oxide-coated		
Heater Voltage	6.0	volts
Heater Current	2.75	amperes
Heating Time (Minimum)	30	seconds
Grid-Screen Amplification Factor	5.0	
Transconductance (at I_b=0.20 ampere)	12,000	u-mhos
Direct Interelectrode Capacitances:		
Input	29.5	uufds
Output	4.8	uufds
Feedback	0.04	uufds
Highest Frequency for Maximum Ratings	500	megacycles

MECHANICAL

Base	Special, breechlock terminal surfaces
Recommended Socket	Eimac X-648
Operating Position	Any
Max Rated Body Temperature	250°C.
Cooling	Forced Air
Maximum Over-all Dimensions:	
Height	2.4 inches
Diameter	1.65 inches
Net Weight	3.75 ounces
Shipping Weight	1.5 pounds







REF.	NOM.
A	1.625 Dia.
B	.883 Dia.
C	.566 Dia.
D	¾
E	2⅜
F	1.961
G	1.116
H	1.021
J	.564
K	.423
L	.282
M	.141
N	.010 (Typ.)
P	.750 Dia.
R	.883 Dia.
S	.938 Dia.
T	60°
U	.200

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony (Key-down conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C SCREEN VOLTAGE	300 MAX. VOLTS
D-C GRID VOLTAGE	—250 MAX. VOLTS
D-C PLATE CURRENT	250 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS
SCREEN DISSIPATION	12 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 175 Mc, per tube)

D-C Plate Voltage	500	1000	1500	2000	volts
D-C Screen Voltage	250	250	250	250	volts
D-C Grid Voltage	—90	—90	—90	—90	volts
D-C Plate Current	250	250	250	250	ma
D-C Screen Current	45	35	30	25	ma
D-C Grid Current	32	28	28	27	ma
Peak R-F Grid Voltage (approx.)	118	116	116	115	volts
Driving Power	3.6	3.2	3.2	2.8	watts
Plate Power Input	125	250	375	500	watts
Plate Power Output	85	195	300	410	watts

PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions, per tube)

MAXIMUM RATINGS

D-C PLATE VOLTAGE	1500 MAX. VOLTS
D-C SCREEN VOLTAGE	300 MAX. VOLTS
D-C GRID VOLTAGE	—250 MAX. VOLTS
D-C PLATE CURRENT	200 MAX. MA
PLATE DISSIPATION	200 MAX. WATTS
SCREEN DISSIPATION	12 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION (Frequencies up to 175Mc, per tube)

D-C Plate Voltage	500	1000	1500	volts
D-C Screen Voltage	250	250	250	volts
D-C Grid Voltage	—100	—100	—100	volts
D-C Plate Current	200	200	200	ma
D-C Screen Current	45	35	25	ma
D-C Grid Current	22	19	17	ma
Peak R-F Grid Input Voltage	124	122	121	volts
Driving Power	2.7	2.3	2.1	watts
Plate Power Input	100	200	300	watts
Plate Power Output	75	160	250	watts

CLASS-AB POWER AMPLIFIER OR MODULATOR

MAXIMUM RATINGS (Per tube)

D-C PLATE VOLTAGE	2000 MAX. VOLTS
D-C SCREEN VOLTAGE	400 MAX. VOLTS
D-C PLATE CURRENT	250 MAX. MA
PLATE DISSIPATION	300 MAX. WATTS
SCREEN DISSIPATION	12 MAX. WATTS
GRID DISSIPATION	2 MAX. WATTS

TYPICAL OPERATION
Class-AB_1 Audio Amplifier (Sinusoidal wave, two tubes unless otherwise noted)

D-C Plate Voltage	1000	1500	2000	volts,
D-C Screen Voltage	350	350	350	volts
D-C Grid Voltage (approx.)*	—50	—50	—50	volts
Zero-Signal D-C Plate Current	200	200	200	ma
Max-Signal D-C Plate Current	500	500	500	ma
Max-Signal D-C Screen Current	50	40	30	ma
Effective Load, Plate-to-Plate	3260	5760	8260	ohms
Peak A-F Grid Input Voltage (per tube)	50	50	50	volts
Driving Power	0	0	0	watts
Max-Signal Plate Dissipation (per tube)	125	150	175	watts
Max-Signal Plate Power Output	250	450	650	watts
Third-Harmonic Distortion	4.5	4.5	4.5	pct

*Adjust grid voltage to obtain specified zero-signal plate current

TYPICAL OPERATION
Class-AB_1 R-F Linear Amplifier (Frequencies to 175 Mc, per tube)

D-C Plate Voltage	1000	1500	2000	volts
D-C Screen Voltage	350	350	350	volts
D-C Grid Voltage (approx.)*	—50	—50	—50	volts
Zero-Signal D-C Plate Current	100	100	100	ma
Max-Signal D-C Plate Current	250	250	250	ma
Max-Signal D-C Screen Current	25	20	15	ma
Peak R-F Grid Voltage	50	50	50	volts
Driving Power	0	0	0	watts
Max-Signal Plate Dissipation	125	150	175	watts
Max-Signal Plate Power Output	125	225	325	watts

*Adjust grid voltage to obtain specified zero-signal plate current

Note: Typical operation data are based on conditions of adjusting the r-f grid drive to a specified plate current, maintaining fixed conditions of grid bias and screen voltage. It will be found that if this procedure is followed, there will be little variation in power output between tubes even though there may be some variation in grid and screen currents. Where grid bias is obtained principally by means of a grid resistor, to control plate current it is necessary to make the resistor adjustable.

APPLICATION

MECHANICAL

Mounting—The 4CX300A may be operated in any position. The recommended socket for the 4CX300A is the Eimac Air-System Socket type X-648. This socket provides low-inductance connections to all the external circuits except the plate circuit, and incorporates a screen by-pass capacitor in its structure. The breech-block terminal arrangement provides firm mechanical retention of the tube when subjected to shock or vibration.

Cooling—The maximum rated surface temperature for any part of the 4CX300A is 250°C. Adequate forced-air cooling facilities must be provided to assure that this maximum temperature rating is not exceeded. At sea level with an ambient temperature of 20°C adequate cooling for 300 watts plate dissipation can be obtained with an air flow rate of 6.5 CFM, corresponding to a pressure drop of 0.35 inches of water column across the X-648 socket and the cooling-fin assembly of the tube. (Air flow rate in CFM is approximately eleven times the square root of the pressure differential across tube and socket.)

At high altitudes and high ambient temperatures the flow rates must be increased to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using the maximum rated temperature as the criterion for satisfactory cooling.

Cooling effectiveness should also be determined on an individual basis if the 4CX300A is operated immersed in an insulating fluid such as silicone oil, again using the maximum rated temperature as the criterion.

Impact and Vibration—The 4CX300A is designed to operate without failure under impact or vibration conditions capable of disabling a conventional tube of similar power capabilities. Impact forces up to 50g with 11 milli-sec duration time, or vibratory accelerations up to 20g at frequencies from 20 to 2000 cycles per second, will not cause a normal 4CX300A to malfunction.

It is not suggested that the 4CX300A be subjected to abusive treatment unneccessarily, but in applications where operation under severe environmental conditions is unavoidable the 4CX300A will provide more reliable service than will conventional tubes.

ELECTRICAL

Heater Operation—The rated heater voltage for the 4CX300A is 6.0 volts, and the corresponding heater current is 2.75 amperes. At frequencies higher than 300 megacycles the heater voltage should be reduced according to the following schedule:

Frequency (Mc.)	Heater Voltage (Volts)
Up to 300	6.00
300 to 400	5.75
400 to 500	5.50

The heater voltage must be maintained within ±5% of the selected operating voltage if variations in circuit performance are to be minimized and best tube life obtained.

Cathode Operation—The 4CX300A employs a cylindrical indirectly-heated oxide-coated unipotential cathode. The minimum warm-up time is 30 seconds when rated heater voltage is applied.

Grid Operation—The 4CX300A control grid has a maximum dissipation rating of 2.0 watts, and 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.

At frequencies higher than 300 Mc., the driving power required by the circuits associated with the tube begins to increase, until at 500 Mc., as much as 30 watts driving power may be required. The power dissipated by the control grid increases only slightly, however, in spite of the greatly increased driving power required by the circuit.

In stable amplifiers, where the bias is not unnecessarily high, d-c grid current values below approximately 15 milliamperes indicate safe grid operation. In class-A and class AB_1 amplifiers, where no grid current flows, the grid bias voltage may be applied through a resistor. The maximum permissible series resistance per tube is 100,000 ohms.

Screen Operation—The maximum rated screen dissipation for the 4CX300A is 12 watts. The maximum rated d-c screen supply voltage rating is 300 volts when the tube is operated in class-C amplifier or oscillator service, and 400 volts when the tube is operated in class-AB or class-B amplifier service.

Under certain operating conditions the screen current of a tetrode may reverse. This makes it dangerous to rely on a screen dropping resistor or a series regulator to supply the screen voltage unless a bleeder or regulator tube is connected from screen to cathode. This bleeder should draw at least 15 milliamperes per tube connected to the screen supply.

The power input to the screen can be calculated from the voltage and current whenever the screen to cathode potential does not vary. Screen modulation or cathode driving of tetrode amplifiers can lead to errors in measurement of screen input when the effective voltage and current exceed the indicated d-c values. When there is reason to suspect that the screen input exceeds the indicated power, it is advisable to maintain the indicated screen power input below approximately 75% of the rated screen dissipation.

An 1100-uufd screen by-pass capacitance is incorporated into the body of the recommended Eimac Air-System Socket for the 4CX300A, adequate for normal amplifier operation at high- and ultra-high radio frequencies. Operation at low radio frequencies and at audio frequency may require additional capacitance to be connected externally. In the latter case, the screen by-pass capacitance within the socket helps to eliminate the high-frequency parasitic oscillations occasionally encountered in tetrode amplifiers.

The self-neutralizing frequency of the 4CX300A is above the useful high frequency limit for the tube when the recommended socket is used.

Plate Operation—The 4CX300A has a finned external anode for forced-air cooling. Connection to the anode may be made to the 9/16-inch diameter top cap or to the 1-5/8-inch diameter cylindrical cooler shell. The latter is usually used when the tube is installed in coaxial lines or cavities.

The absolute maximum plate dissipation rating for the 4CX300A is 300 watts, which is also the rated maximum dissipation for class-C amplifier or oscillator applications and for class-B or class-AB amplifier applications. When the 4CX300A is used in plate-modulated amplifier applications, the plate dissipation rating is 200 watts under carrier conditions, rising to 300 watts under 100% sine-wave modulation. Plate dissipation may be permitted to exceed the maximum rated value for brief periods, such as may occur while tuning.

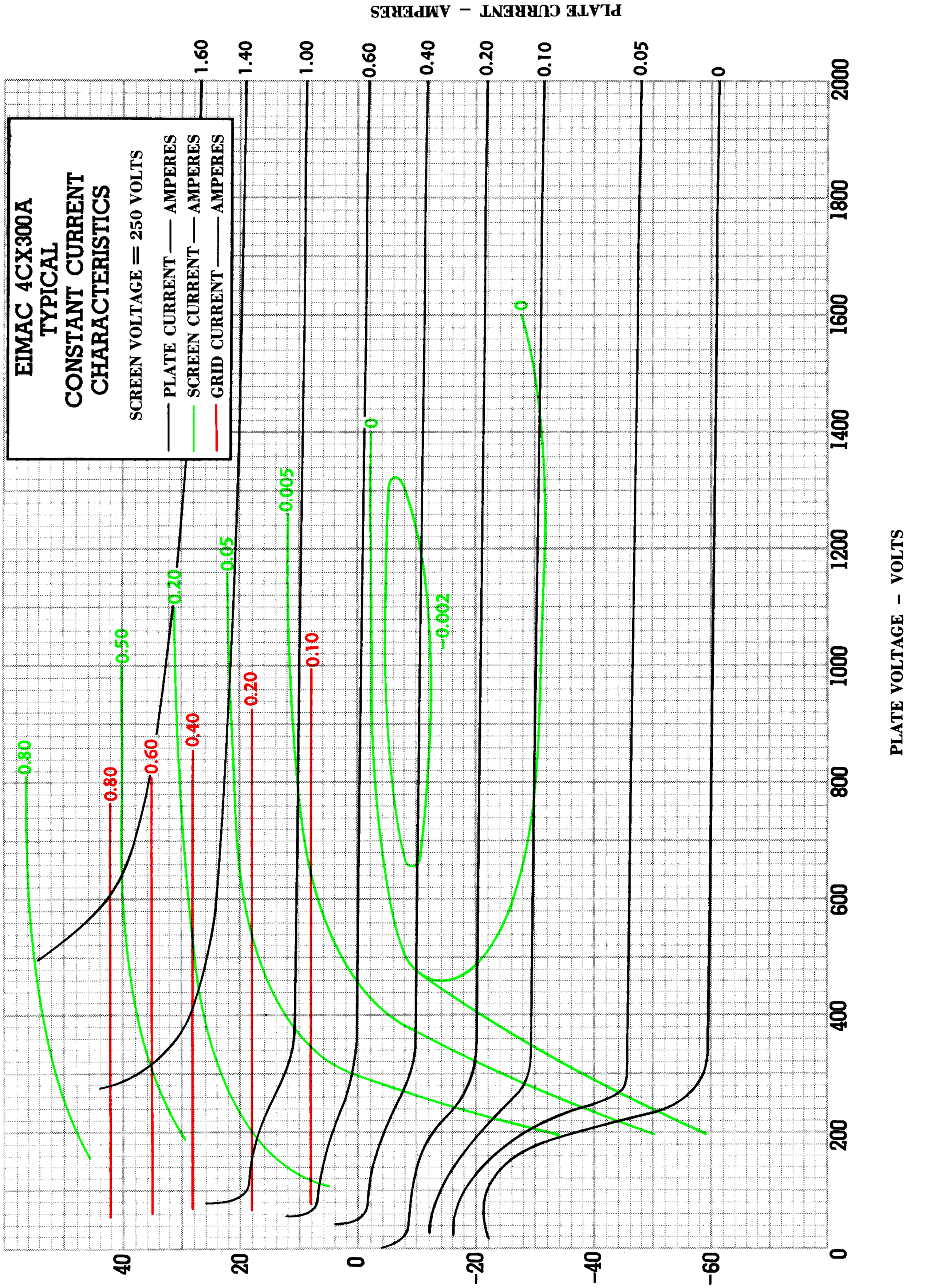
The absolute maximum rated plate voltage is 2000 volts for all except plate modulated amplifier applications, for which the rated maximum is 1500 volts.

Modulation—The 4CX300A can be modulated by any of the methods commonly used with tetrode tubes. Its large reserve plate dissipation makes it especially suited for use in screen-modulated and linear amplifiers in which the plate efficiency is low.

Plate modulation can be applied to the 4CX300A when it is operated as a class-C amplifier. To obtain 100% modulation with minimum distortion the screen voltage supply should be modulated in phase with the modulation applied to the plate supply voltage. Screen voltage modulation factors between 0.75 and 1.00 may be used.

"Self-modulation" of the screen by means of a resistor or reactance in series with the screen supply line is not recommended, because of the effects which require a bleeder from screen to cathode as described under "Screen Operation," above.

Special Applications—If it is desired to operate this tube under conditions widely different than those given here, write to Eitel-McCullough, Inc., San Bruno, California, for information and recommendations.



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