



EITEL-McCULLOUGH, INC.
SAN CARLOS · CALIFORNIA

TENTATIVE DATA

4CX300A

**CERAMIC
POWER TETRODE**

The Eimac 4CX300A is a compact integral-finned external-anode power tetrode having a maximum plate-dissipation rating of 300 watts. The 4CX300A may be operated 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 from mechanically-induced noise under conditions of severe acceleration caused by shock or vibration.

GENERAL CHARACTERISTICS

ELECTRICAL

	Min.	Nom.	Max.	
Cathode: Oxide-Coated, Unipotential				
Heating Time - - - - -	30	60		seconds
Cathode-to-Heater Potential - - - - -	-	-	±150	volts
Heater: Voltage (See "Application") - - - - -	-	6.0		volts
Current ($E_r=6.0$ volts) - - - - -	2.5		3.2	amperes
Amplification Factor (Grid to Screen) - - - - -	4.0	4.8	5.6	
Transconductance ($I_b=200$ ma.) - - - - -		12,000		umhos
Direct Interelectrode Capacitances, Grounded Cathode:				
Input - - - - -	25	29	33	uuf
Output - - - - -	3.5	4.0	5.5	uuf
Feedback - - - - -	-	-	0.06	uuf
Direct Interelectrode Capacitances, Grounded Grid and Screen:				
Input - - - - -	-	-	16.2	uuf
Output - - - - -	3.5	4.0	5.5	uuf
Feedback - - - - -	-	0.01	-	uuf
Frequency for Maximum Ratings - - - - -	-	-	500	mc



MECHANICAL

Base - - - - -	Special, breech-block terminal surfaces
Recommended Socket - - - - -	Eimac SK-700 Series
Operating Position - - - - -	Any
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals - - - - -	- 250° C
Anode Core - - - - -	- 250° C
Cooling - - - - -	Forced Air
Maximum Over-All Dimensions:	
Height - - - - -	2.5 inches
Diameter - - - - -	1.65 inches
Net Weight - - - - -	3.75 ounces
Shipping Weight (Approximate) - - - - -	1.5 pounds

**RADIO-FREQUENCY POWER AMPLIFIER
OR OSCILLATOR**

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

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

D-C Plate Voltage -	500	1000	1500	2000	2500***	2000	volts
D-C Screen Voltage -	250	250	250	250	250	250	volts
D-C Grid Voltage -	-90	-90	-90	-90	-90	-90	volts
D-C Plate Current -	250	250	250	250	250	250	ma
D-C Screen Current* -	45	38	21	19	16	10**	ma
D-C Grid Current* -	35	31	28	26	25	25**	ma
Peak R-F Grid Voltage*	114	114	112	112	111	-	volts
Driving Power* -	4.0	3.5	3.2	2.9	2.8	-	watts
Plate Input Power -	125	250	375	500	625	500	watts
Plate Output Power -	70	190	280	390	500	225**	watts
Heater Voltage -	-	-	-	-	-	-	5.5 volts

*Approximate values.

**Measured values for a typical cavity amplifier circuit at 500 Mc.

***For operation below 250Mc. only.

**AUDIO-FREQUENCY AMPLIFIER OR MODULATOR**Class-AB₁

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 (Sinusoidal wave, two tubes unless noted)

D-C Plate Voltage	-	-	-	1000	1500	2000	2500**	volts
D-C Screen Voltage	-	-	-	350	350	350	350	volts
D-C Grid Voltage ¹	-	-	-	-55	-55	-55	-55	volts
Zero-Signal D-C Plate Current	-	-	-	200	200	200	200	ma
Max-Signal D-C Plate Current	-	-	-	500	500	500	500	ma
Max-Signal D-C Screen Current	-	-	-	20	16	10	8	ma
Effective Load, Plate to Plate	-	-	-	3500	6200	9500	11,600	ohms
Peak A-F Grid Input Voltage (per tube)*	-	-	-	50	50	50	50	volts
Driving Power	-	-	-	0	0	0	0	watts
Max-Signal Plate Output Power	-	-	-	240	430	600	800	watts

*Approximate values.

**For operation below 250 megacycles only.

¹Adjust grid bias to obtain listed zero-signal plate current.**RADIO-FREQUENCY LINEAR AMPLIFIER**Class-AB₁ (Carrier conditions)

MAXIMUM RATINGS

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

D-C Plate Voltage	-	-	-	1000	1500	2000	2500**	volts
D-C Screen Voltage	-	-	-	350	350	350	350	volts
D-C Grid Voltage ¹	-	-	-	-55	-55	-55	-55	volts
Zero-Signal D-C Plate Current	-	-	-	100	100	100	100	ma
D-C Plate Current	-	-	-	150	150	150	150	ma
D-C Screen Current*	-	-	-	-3	-4	-4	-4	ma
Peak R-F Grid Voltage*	-	-	-	25	25	25	25	volts
Plate Output Power	-	-	-	30	50	65	85	watts

*Approximate values.

**For operation below 250 megacycles only.

¹Adjust grid bias to obtain listed zero-signal plate current.**RADIO-FREQUENCY LINEAR AMPLIFIER**Class-AB₁ (Single-Sideband Suppressed-Carrier Operation)

MAXIMUM RATINGS

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 (Peak-envelope conditions except where noted)

D-C Plate Voltage	-	-	-	1000	1500	2000	2500**	volts
D-C Screen Voltage	-	-	-	350	350	350	350	volts
D-C Grid Voltage ¹	-	-	-	-55	-55	-55	-55	volts
Zero-Signal D-C Plate Current	-	-	-	100	100	100	100	ma
Peak R-F Grid Voltage*	-	-	-	50	50	50	50	volts
D-C Plate Current	-	-	-	250	250	250	250	ma
D-C Screen Current*	-	-	-	10	8	5	4	ma
Plate Input Power	-	-	-	250	375	500	625	watts
Plate Output Power	-	-	-	120	215	300	400	watts
Two-Tone Average D-C Plate Current	-	-	-	190	190	190	190	ma
Two-Tone Average D-C Screen Current* 2	-	-	-	-1	-2	-2	-2	ma

*Approximate values.

**For operation below 250 megacycles only.

¹Adjust grid bias to obtain listed zero-signal plate current.**PLATE-MODULATED RADIO-FREQUENCY AMPLIFIER**

Class-C Telephony (Carrier conditions)

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

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*	-	-	-	31	22	20	ma
D-C Grid Current*	-	-	-	15	14	14	ma
Peak R-F Grid Input Voltage*	-	-	-	118	117	117	volts
Driving Power*	-	-	-	1.8	1.7	1.7	watts
Plate Input Power	-	-	-	100	200	300	watts
Plate Output Power	-	-	-	60	145	235	watts

*Approximate values.

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. The driving power and power output shown are substantially correct at frequencies below 175 Mc. Allowance must be made for grid and plate circuit losses. At frequencies above 175 Mc. additional allowance must be made for high-frequency effects within the tube itself. Adjustment of the r-f grid drive to obtain the specified plate current at the specified grid bias, screen voltage, and plate voltage is assumed. If this procedure is followed, there will be little variation in output power when tubes are changed, even though there may be some variations in grid and screen currents. 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. 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 r-f driving voltage is applied.

▶ Indicates change from sheet dated 12-24-57

APPLICATION

MECHANICAL

Mounting—The 4CX300A may be operated in any position. Recommended sockets for the 4CX300A are the Eimac Air-System Sockets type SK-700 (ungrounded cathode) or type SK-710 (cathode and one heater grounded). Both sockets provide connections to all electrodes except the plate and each includes a screen by-pass capacitor of 1100 $\mu\mu\text{f}$ 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 6.8 CFM, corresponding to a pressure drop of 0.4 inches of water column across an SK-700 or SK-710 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 rate 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 under impact or vibration capable of disabling a conventional tube of similar power capabilities. Impact forces up to 50g with 11-millisecond duration time, or vibratory accelerations up to 20g at frequencies from 20 to 2000 cycles per second, will not destroy a normal 4CX300A unless unduly prolonged.

It is not suggested that the 4CX300A be subjected to abusive treatment unnecessarily, 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. 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

► Indicates change from sheet dated 12-24-57

The heater voltage must be maintained within $\pm 5\%$ 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 of 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. Satisfactory 500-megacycle operation of the 4CX300A in a stable, "straight-through" amplifier is indicated by grid-current values below approximately 25 milliamperes.

In class-A and class-AB₁ 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 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 for each 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- $\mu\mu\text{f}$ screen by-pass capacitance is incorporated in the body of the recommended Eimac Air-System Sockets for the 4CX300A, adequate for normal amplifier operation at high and ultra-high radio frequencies. Operation at low radio frequencies or audio frequencies may require additional capacitance to be

connected externally. In the latter case, the screen bypass 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 either of the recommended sockets is used.

Plate Operation—The 4CX300A has a finned external anode for forced-air cooling. Connection to the anode may be made at the top cap or 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 maximum rated plate voltage for frequencies up to 500 megacycles is 2000 volts for all except plate-modulated-amplifier applications, for which the

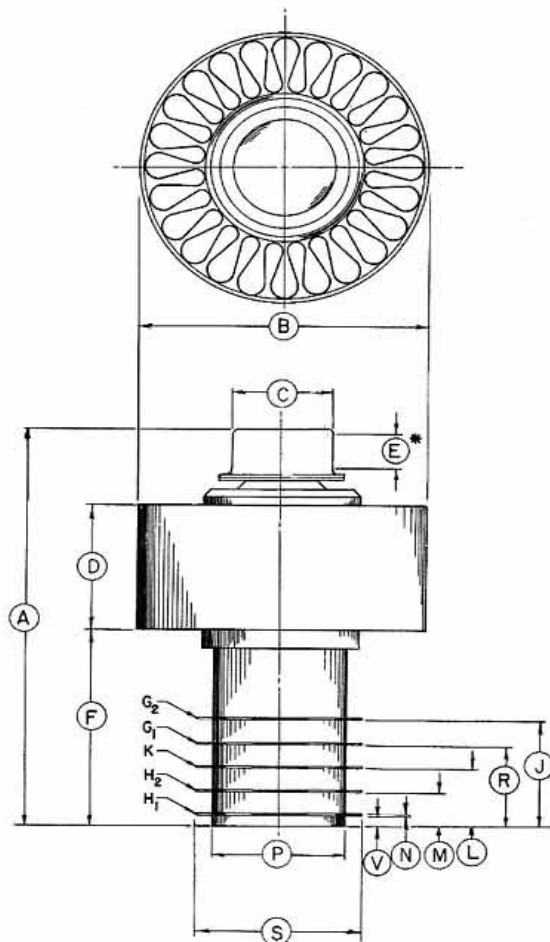
rated maximum is 1500 volts. At frequencies below 250 megacycles, a plate supply voltage of 2500 volts may be employed in all except class-C plate-modulated applications.

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.

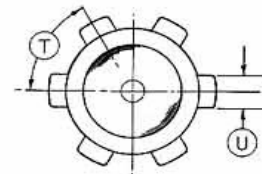
Plate modulation can be applied to the 4CX300A when it is operated as a class-C amplifier. To obtain 100% modulation with minimum distortion the screen supply voltage should be modulated in phase with the modulation applied to the plate supply voltage. Screen voltage modulation factors between 0.75 and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

“Self-modulation” of the screen by means of a resistor 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.

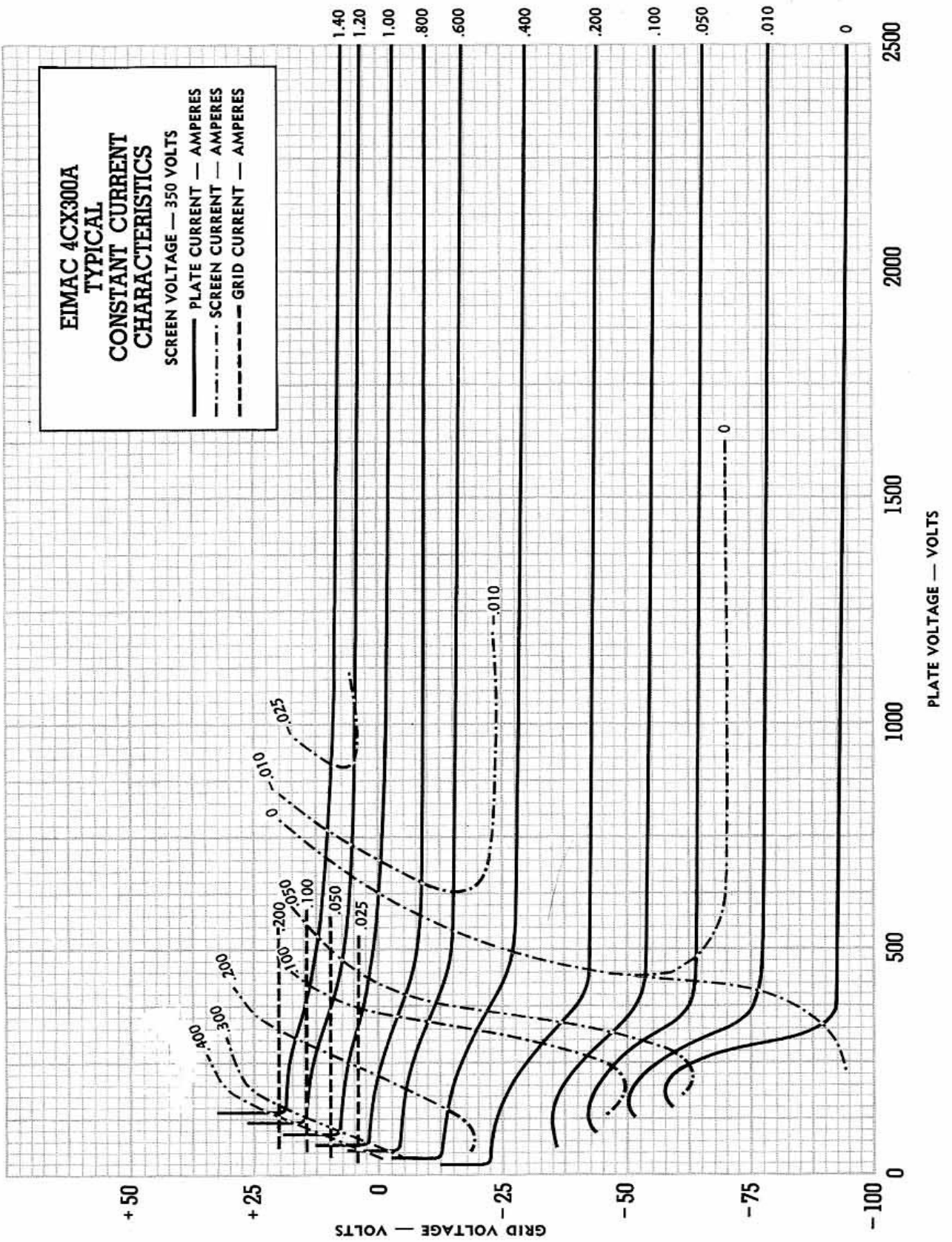
Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Eitel-McCullough, Inc. for information and recommendations.



DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A	2.400	2.300	2.500
B	1.625 DIA.	1.610 DIA.	1.640 DIA.
C	.566 DIA.	.559 DIA.	.573 DIA.
D	.750	.710	.790
E		.240	.280
F	1.164	1.133	1.195
J	.622	.602	.642
L	.344	.329	.359
M	.203	.193	.213
N	.0125 (TYP)	.010 (TYP)	.015 (TYP)
P	.750 DIA.	.740 DIA.	.770 DIA.
R	.485	.470	.500
S	.946 DIA.	.936 DIA.	.956 DIA.
T	60°		
U	.175	.170	.185
V	.061	.050	.072



• CONTACT SURFACE





4CX300A

