



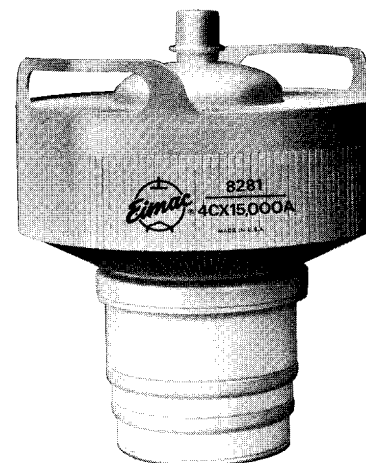
8281
4CX15,000A

TECHNICAL DATA

RADIAL BEAM POWER TETRODE

The EIMAC 8281/4CX15,000A is a ceramic/metal power tetrode intended for use in audio or radio frequency applications. It features a new type of internal mechanical structure which results in higher rf operating efficiency. Low rf losses in this mechanical structure permit operation of the 8281/4CX15,000A at full ratings up to 110 MHz, and at reduced ratings, to 225 MHz.

The 8281/4CX15,000A is also recommended for radio-frequency linear power amplifier service, and for VHF television linear amplifier service.



GENERAL CHARACTERISTICS¹

ELECTRICAL

Filament: Thoriated Tungsten

Voltage 6.3 ± 0.3 V

Current, at 6.3 volts 160 A

Amplification Factor, average

Grid to Screen 4.5

Direct Interelectrode Capacitances (cathode grounded):²

Cin 160.0 pF

Cout 24.5 pF

Cgp 1.5 pF

Direct Interelectrode Capacitances (grid and screen grounded):²

Cin 67.0 pF

Cout 25.5 pF

Cpk 0.2 pF

Maximum Frequency Ratings

CW 110 MHz

1. Characteristics and operating values are based on 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 in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Maximum Overall Dimensions:

Length 9.375 in; 238.13 mm

Diameter 7.580 in; 192.53 mm

Net Weight 12.8 lb; 5.81 kg

Operating Position Axis vertical, base up or down

Cooling Forced air

Operating Temperature, maximum

Ceramic/Metal Seals and Anode Core 250°C

Base Special, concentric

Recommended Air System Socket SK-300A

Recommended Air Chimney SK-316

(Revised 12-15-73) © 1971 by Varian

Printed in U.S.A.



8281/4CX15.000A

**RADIO FREQUENCY LINEAR AMPLIFIER
GRID DRIVEN, Class AB₁****ABSOLUTE MAXIMUM RATINGS**

DC PLATE VOLTAGE	10,000	VOLTS
DC SCREEN VOLTAGE	2000	VOLTS
DC PLATE CURRENT	6.0	AMPERES
PLATE DISSIPATION	15,000	WATTS
SCREEN DISSIPATION	450	WATTS
GRID DISSIPATION	200	WATTS

1. Adjust for specified zero-signal plate current.
2. Approximate value.

TYPICAL OPERATION

Peak Envelope or Modulation Crest Conditions

Plate Voltage	7,500	10,000	Vdc
Screen Voltage	1,500	1,500	Vdc
Grid Voltage ¹	-350	-370	Vdc
Zero-Signal Plate Current	1.0	1.0	Adc
Single-Tone Plate Current	4.0	4.25	Adc
Single-Tone Screen Current ²	170	150	mAdc
Peak rf Grid Voltage ²	330	340	v
Plate Dissipation	12.2	14.0	kW
Single-Tone Plate Output Power	20.8	28.5	kW
Resonant Load Impedance	865	1,260	Ω

**RADIO FREQUENCY POWER AMPLIFIER OR
OSCILLATOR**Class C Telephony or FM Telephony
(Key-Down Conditions)**ABSOLUTE MAXIMUM RATINGS**

DC PLATE VOLTAGE	10,000	VOLTS
DC SCREEN VOLTAGE	2000	VOLTS
DC PLATE CURRENT	5.0	AMPERES
PLATE DISSIPATION	15,000	WATTS
SCREEN DISSIPATION	450	WATTS
GRID DISSIPATION	200	WATTS

TYPICAL OPERATION

Plate Voltage	7,500	10,000	Vdc
Screen Voltage	750	750	Vdc
Grid Voltage	-510	-550	Vdc
Plate Current	4.65	4.55	Adc
Screen Current ¹	0.59	0.54	Adc
Grid Current ¹	0.30	0.27	Adc
Peak rf Grid Voltage ¹	730	790	v
Calculated Driving Power	220	220	W
Plate Dissipation	8.1	9.0	kW
Plate Output Power	26.7	36.5	kW

1. Approximate value.

**PLATE MODULATED RADIO FREQUENCY POWER
AMPLIFIER****GRID DRIVEN** Class C Telephony
(Carrier Conditions)**ABSOLUTE MAXIMUM RATINGS**

DC PLATE VOLTAGE	8000	VOLTS
DC SCREEN VOLTAGE	1500	VOLTS
DC PLATE CURRENT	4.0	AMPERES
PLATE DISSIPATION	10,000	WATTS
SCREEN DISSIPATION	450	WATTS
GRID DISSIPATION	200	WATTS

TYPICAL OPERATION

Plate Voltage	6,000	8,000	Vdc
Screen Voltage	750	750	Vdc
Grid Voltage	-600	-640	Vdc
Plate Current	3.75	3.65	Adc
Screen Current ¹	0.45	0.43	Adc
Grid Current ¹	0.18	0.18	Adc
Peak af Screen Voltage ¹			
100% modulation	740	710	v
Peak rf Grid Voltage ¹	800	840	v
Calculated Driving Power	150	150	W
Plate Dissipation	5.1	5.8	kW
Plate Output Power	17.4	23.5	kW

1. Approximate value.

**AUDIO FREQUENCY POWER AMPLIFIER OR
MODULATOR****GRID DRIVEN**, Class AB₁ (Sinusoidal Wave)**ABSOLUTE MAXIMUM RATINGS (per tube)**

DC PLATE VOLTAGE	10,000	VOLTS
DC SCREEN VOLTAGE	2000	VOLTS
DC PLATE CURRENT	6.0	AMPERES
PLATE DISSIPATION	15,000	WATTS
SCREEN DISSIPATION	450	WATTS
GRID DISSIPATION	200	WATTS

TYPICAL OPERATION (Two tubes)

Plate Voltage	7,500	10,000	Vdc
Screen Voltage	1,500	1,500	Vdc
Grid Voltage ¹	-350	-370	Vdc
Zero-Signal Plate Current ³	1.00	1.00	Adc
Maximum Signal Plate Current	8.80	8.50	Adc
Maximum Signal Screen Current ²	0.34	0.30	Adc
Peak af Grid Voltage ²	330	340	v
Maximum Signal Plate Dissipation ³	12.2	14.0	kW
Plate Output Power	41.6	57.0	kW
Load Resistance (plate to plate)	1,730	2,520	Ω

1. Adjust for specified zero-signal plate current.
2. Approximate value.
3. Per Tube.

TELEVISION LINEAR AMPLIFIER

Cathode Driven

ABSOLUTE MAXIMUM RATINGS

110 MHz to 225 MHz	
DC PLATE VOLTAGE	6500 VOLTS
DC SCREEN VOLTAGE	1500 VOLTS
DC PLATE CURRENT	5.0 AMPERES
PLATE DISSIPATION	15,000 WATTS
SCREEN DISSIPATION	450 WATTS
GRID DISSIPATION	200 WATTS

TYPICAL OPERATION, Composite Signal Black Level Unless Otherwise Stated

Plate Voltage	5000	6000	Vdc
Screen Voltage	500	700	Vdc
Grid Voltage ¹	-160	-180	Vdc
Plate Current (zero sig.)	.500	.650	Adc
Plate Current	2.800	3.335	Adc
Grid Current	.075	.035	Adc
Screen Current	.060	.040	Adc
Peak Cath. Volt. (pk synch.)	310	345	v
Cath. Driving Power (pk. synch.)	975	1350	w
Plate Output Power (pk. synch.)	11.0	16.5	kw
Plate Load Resistance	600	600	Ω

1. Approximate value.

TYPICAL OPERATION values are obtained by calculations from published characteristic curves. To obtain the specified plate current at the specified bias, screen, and plate voltages, adjustment of the rf grid voltage is assumed. If this procedure is followed, there will be little variation in output power when the tube is replaced, even though there may be some variation in grid and screen currents. The grid and screen currents which occur when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no performance degradation providing the circuit maintains the correct voltage in the presence of the current variations. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to produce the required bias voltage when the correct rf grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.
Heater Current, at 6.3 volts	152	168 A
Interelectrode Capacitances, cathode grounded ¹		
Cin	154.0	167.0 pF
Cout	22.0	27.0 pF
Cgp	----	2.0 pF
Interelectrode Capacitances, grid and screen grounded ¹		
Cin	62.0	72.0 pF
Cout	23.0	28.0 pF
Cpk	----	0.3 pF

1. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

APPLICATION**MECHANICAL**

MOUNTING - The 4CX15,000A 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-300A is designed especially for the concentric base terminals of the 4CX15,000A. 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 the SK-316 Air Chimney, into the anode cooling fins.

COOLING - The maximum temperature rating for the external surfaces of the 4CX15,000A 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 225°C in 50°C ambient air are tabulated below (for operation below 30 megahertz). This data is for the tube mounted in an SK-300A socket with an SK-316 chimney.

SEA LEVEL			10,000 FEET	
Plate Dissipation * (Watts)	Air Flow (CFM)	Pressure Drop(Inches of Water)	Air Flow (CFM)	Pressure Drop(Inches of Water)
7,500	230	.7	336	1.0
12,500	490	2.7	710	4.1
15,000	645	4.6	945	7.0

*Since the power dissipated by the filament represents about 1000 watts and since grid-plus-screen dissipation can, under some conditions, represent another 600 watts, allowance has been made in preparing this tabulation for an additional 1600 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 4CX15,000A is 6.3 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 plus or minus five percent from the rated value.

ELECTRODE DISSIPATION RATINGS - The maximum dissipation ratings for the 4CX15,000A must be respected to avoid damage to the tube. An exception is the plate dissipation which may be permitted to rise above the rated maximum during brief periods, such as may occur during tuning.

GRID OPERATION - The 4CX15,000A control grid has a maximum dissipation rating of 200 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. The maximum grid circuit resistance should not exceed 100,000 ohms per tube.

SCREEN OPERATION - The power dissipated by the screen of the 4CX15,000A must not exceed 450 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 450 watts in the event of circuit failure.

PLATE DISSIPATION - The plate-dissipation rating for the 4CX15,000A is 15,000 watts.

When the 4CX15,000A 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 10,000 watt maximum plate dissipation rating will be exceeded.

HIGH VOLTAGE - Normal operating voltages used with the 4CX15,000A are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment 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 primary circuits of the power supply 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.

X-RADIATION - High-vacuum tubes operating at voltages higher than 10 kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. The 4CX15,000A, operating at its rated voltages and currents, is a potential X-ray hazard. Only limited shielding is afforded by the tube envelope. Moreover, the X-ray radiation level can increase significantly with aging and gradual deterioration, due to leakage paths or emission characteristics as they are affected by the high voltage. X-ray shielding must be provided on all sides of tubes operating at these voltages to provide adequate protection throughout the tube's life. Periodic checks on the X-ray level should be made, and the tube should never be operated without adequate shielding in place when voltages above 10 kilovolts are in use. Lead glass, which attenuates X-rays, is available for viewing windows. If there is any doubt as to the requirement for or the adequacy of shielding, an expert in this field should be contacted to perform an X-ray survey of the equipment.

Operation of high-voltage equipment with interlock switches "cheated" and cabinet doors open in order to be better able to locate an equipment malfunction can result in serious X-ray exposure.

RADIO FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.



Many EIMAC power tubes, such as the 4CX 15,000A, are specifically designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power tube and its associated circuitry --- the more power involved, the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier unit itself.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground".

The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

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

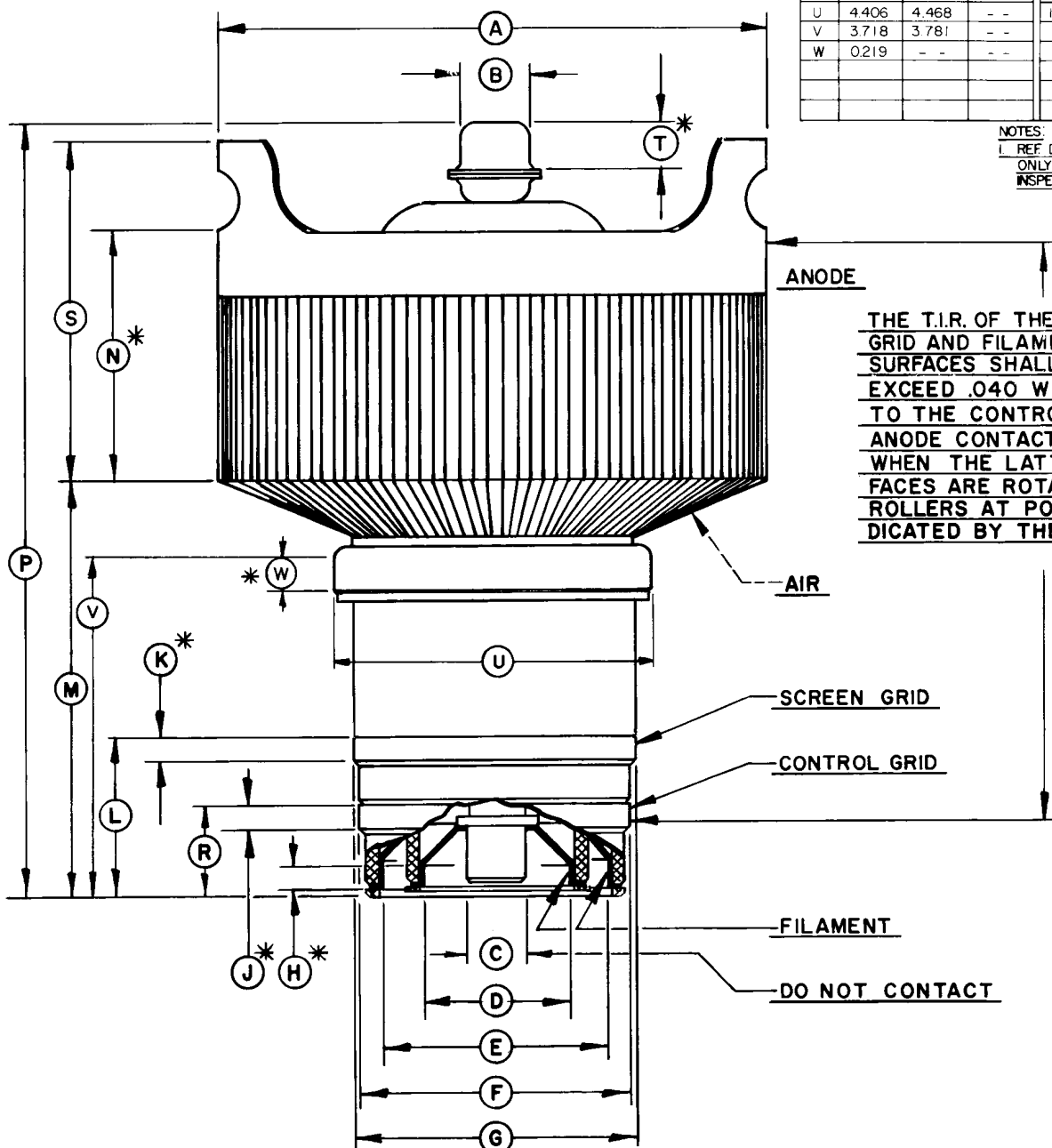


8281/4CX15,000A

DIMENSIONAL DATA

DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	7.460	7.580	--	189.48	192.53	--
B	0.855	0.895	--	21.72	22.73	--
C	0.720	0.760	--	18.29	19.30	--
D	1.896	1.936	--	46.63	49.17	--
E	3.133	3.173	--	79.58	80.59	--
F	3.792	3.832	--	96.32	97.33	--
G	3.980	4.020	--	101.09	102.11	--
H	0.188	--	--	4.78	--	--
J	0.188	--	--	4.78	--	--
K	0.188	--	--	4.78	--	--
L	1.764	1.826	--	44.81	46.38	--
M	4.659	4.783	--	118.34	121.49	--
N	2.412	2.788	--	61.26	70.82	--
P	9.000	9.375	--	228.60	238.13	--
R	0.986	1.050	--	25.04	26.67	--
S	3.560	3.684	--	90.42	93.57	--
T	0.375	--	--	9.53	--	--
U	4.406	4.468	--	111.91	113.49	--
V	3.718	3.781	--	94.44	96.04	--
W	0.219	--	--	5.56	--	--

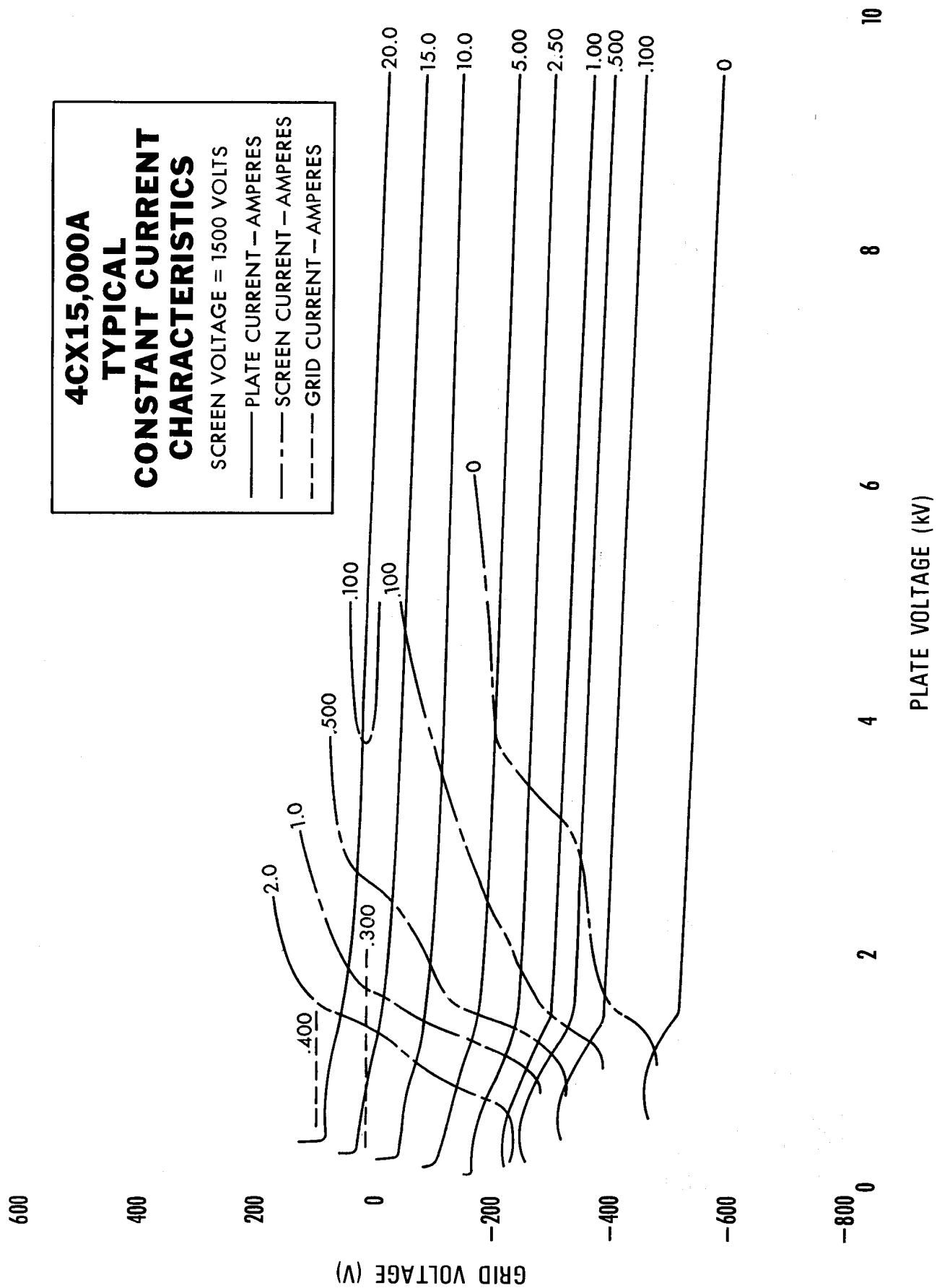
NOTES:
1. REF. DIMENSIONS ARE FOR INFO.
ONLY & ARE NOT REQUIRED FOR
INSPECTION PURPOSES.



THE T.I.R. OF THE SCREEN
GRID AND FILAMENT CONTACT
SURFACES SHALL NOT
EXCEED .040 WITH RESPECT
TO THE CONTROL GRID AND
ANODE CONTACT SURFACE
WHEN THE LATTER SUR-
FACES ARE ROTATED ON
ROLLERS AT POINTS IN-
DICATED BY THE ARROWS

* CONTACT SURFACE

4CX15,000A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 1500 VOLTS
—— PLATE CURRENT — AMPERES
- - - SCREEN CURRENT — AMPERES
- - - - GRID CURRENT — AMPERES



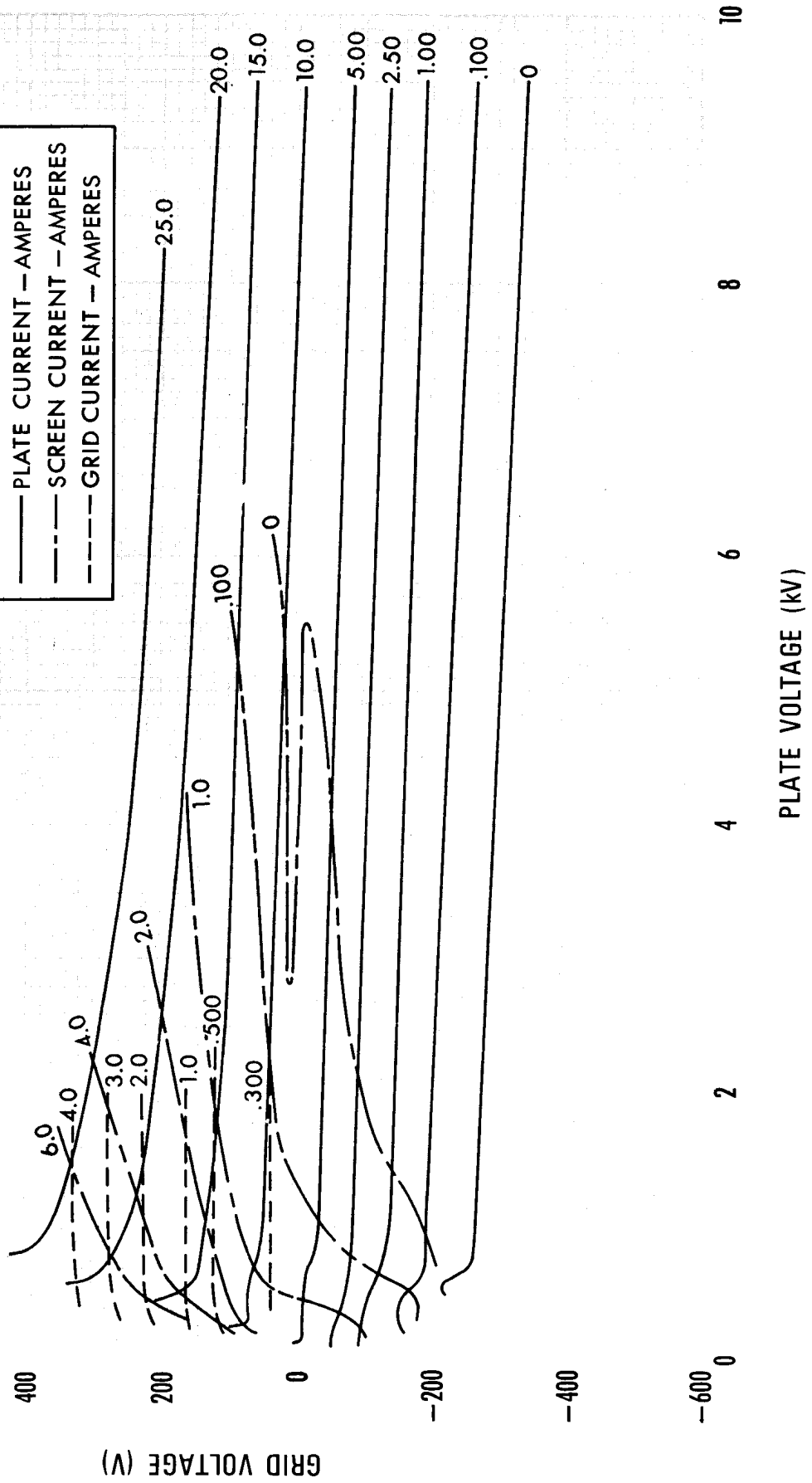


8281/4CX15,000A

4CX15,000A TYPICAL CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE = 750 VOLTS

- PLATE CURRENT — AMPERES
- - - SCREEN CURRENT — AMPERES
- - - - GRID CURRENT — AMPERES





TECHNICAL DATA

**8281
4CX15,000A
RADIAL BEAM
POWER TETRODE**

The EIMAC 8281/4CX15,000A is a ceramic/metal power tetrode intended for use in audio or radio frequency applications. It features a type of internal mechanical structure which results in high rf operating efficiency. Low rf losses in this structure permit operation at full ratings up to 110 MHz, and at reduced ratings up to 225 MHz.

The 8281/4CX15,000A is also recommended for radio-frequency linear power amplifier service, and for VHF TV linear amplifier service.

GENERAL CHARACTERISTICS¹

ELECTRICAL

Filament: Thoriated Tungsten

Voltage 6.3 ± 0.3 V
Current @ 6.3 volts 160 A

Amplification Factor, average

Grid to Screen 4.5

Direct Interelectrode Capacitance (cathode grounded)²

Cin 160 pF
Cout 24.5 pF
Cgp 1.5 pF

Direct Interelectrode Capacitance (grid and screen grounded)²

Cin 67.0 pF
Cout 25.5 pF
Cpk 0.2 pF

Maximum Frequency for Full Ratings (CW) 110 MHz

1. Characteristics and operating values are based on performance tests. These figures may change without notice as the result of additional data or product refinement. Varian EIMAC 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 in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Maximum Overall Dimensions:

Length 9.37 in; 23.81 cm
Diameter 7.58 in; 19.25 cm

Net Weight (approximate) 12.8 Lb; 5.8 kg

Operating Position Axis Vertical, base up or down

Cooling Forced Air

Operating Temperature Maximum:

Ceramic/Metal Seals and Anode Core 250°C

Base Special, Concentric

Recommended Air-System Sockets:

LF or HF Applications EIMAC SK-300A

VHF applications EIMAC SK-360

Recommended Air Chimney, for use with SK-300A socket only EIMAC SK-316

Available Screen Grid Bypass Capacitor Kit for SK-360 (8000 pF @ DCWV = 5000) EIMAC SK-355

RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN, Class AB1

TYPICAL OPERATION Peak Envelope or Modulation Crest Conditions

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE . . . 10 KILOVOLTS
DC SCREEN VOLTAGE . . . 2.0 KILOVOLTS
DC GRID VOLTAGE . . . -1.5 KILOVOLTS
DC PLATE CURRENT . . . 6.0 AMPERES
PLATE DISSIPATION . . . 15 KILOWATTS
SCREEN DISSIPATION . . . 450 WATTS
GRID DISSIPATION . . . 200 WATTS

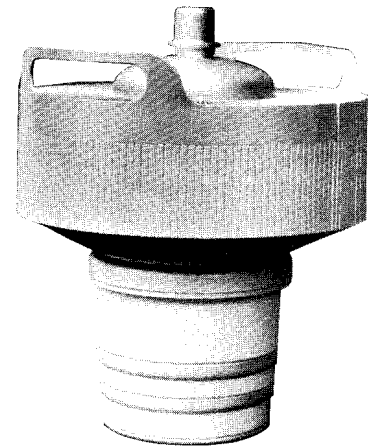
Plate Voltage 7.5 10.0 kVdc
Screen Voltage 1.5 1.5 kVdc
Grid Voltage # -350 -370 Vdc
Zero-signal Plate Current 1.0 1.0 Adc
Single-tone Plate Current 4.0 4.25 Adc
Single-tone Screen Current * 170 150 mAdc
Peak rf Grid Voltage * 330 340 v
Plate Dissipation * 12.2 14.0 kW
Single-tone Plate Output Power * 20.8 28.5 kW
Resonant Load Impedance 865 1260 Ohms

* Approximate value.

Adjust for specified zero-signal plate current.

394900(Effective August 1984 - supersedes 15 Dec 73)
VA4618

Printed in U.S.A.



**RADIO FREQUENCY POWER AMPLIFIER OR
OSCILLATOR**
 Class C Telegraphy or FM
 (Key-down Conditions)

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE . . .	10	KILOVOLTS
DC SCREEN VOLTAGE . .	2.0	KILOVOLTS
DC GRID VOLTAGE . . .	-1.5	KILOVOLTS
DC PLATE CURRENT . . .	5.0	AMPERES
PLATE DISSIPATION . . .	15	KILOWATTS
SCREEN DISSIPATION . .	450	WATTS
GRID DISSIPATION . . .	200	WATTS

TYPICAL OPERATION

Plate Voltage	7.5	10.0	kVdc
Screen Voltage	750	750	Vdc
Grid Voltage	-510	-550	Vdc
Plate Current	4.65	4.55	Adc
Screen Current *	590	540	mAdc
Grid Current *	300	270	mAdc
Peak rf Grid Voltage * . .	730	790	v
Calculated Driving Power .	220	220	W
Plate Dissipation * . . .	8.1	9.0	kW
Plate Output Power * . . .	26.7	36.5	kW

* Approximate value.

**PLATE MODULATED RADIO FREQUENCY POWER
AMPLIFIER - GRID DRIVEN**
 Class C Telephony - Carrier Conditions

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE . . .	8.0	KILOVOLTS
DC SCREEN VOLTAGE . .	1.5	KILOVOLTS
DC GRID VOLTAGE . . .	-1.5	KILOVOLTS
DC PLATE CURRENT . . .	4.0	AMPERES
PLATE DISSIPATION . . .	10.0	KILOWATTS
SCREEN DISSIPATION . .	450	WATTS
GRID DISSIPATION . . .	200	WATTS

TYPICAL OPERATION

Plate Voltage	6.0	8.0	kVdc
Screen Voltage	750	750	Vdc
Grid Voltage	-600	-640	Vdc
Plate Current	3.75	3.65	Adc
Screen Current *	450	430	mAdc
Grid Current *	180	180	mAdc
Peak audio freq. screen voltage * .	740	710	v
for 100% modulation			
Peak rf Grid Voltage	800	840	v
Calculated Driving Power	150	150	W
Plate Dissipation *	5.1	5.8	kW
Plate Output Power *	17.4	23.5	kW

* Approximate value.

**AUDIO FREQUENCY POWER AMPLIFIER OR
MODULATOR - GRID DRIVEN**
 Class AB1 (sinusoidal wave)

ABSOLUTE MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE . . .	10	KILOVOLTS
DC SCREEN VOLTAGE . .	2.0	KILOVOLTS
DC GRID VOLTAGE . . .	-1.5	KILOVOLTS
DC PLATE CURRENT . . .	6.0	AMPERES
PLATE DISSIPATION . . .	15	KILOWATTS
SCREEN DISSIPATION . .	450	WATTS
GRID DISSIPATION . . .	200	WATTS

TYPICAL OPERATION (Two tubes)

Plate Voltage	7.5	10.0	kVdc
Screen Voltage	1.5	1.5	kVdc
Grid Voltage #	-350	-370	Vdc
Zero-signal Plate Current ## . . .	1.0	1.0	Adc
Maximum-signal Plate Current . . .	8.8	8.5	Adc
Maximum-signal Screen Current * .	340	300	mAdc
Peak Audio Freq. Grid Voltage * . .	330	340	v
Maximum-Signal Plate Dissipation ##	12.2	14.0	kW
Plate Output Power *	41.6	57.0	kW
Load Resistance (plate to plate) .	1730	2520	Ohms

Adjust for specified zero-signal plate current.

Per Tube.

TELEVISION LINEAR AMPLIFIER
 Cathode Driven

ABSOLUTE MAXIMUM RATINGS

110 MHz to 225 MHz		
DC PLATE VOLTAGE . . .	6.5	KILOVOLTS
DC SCREEN VOLTAGE . .	1.5	KILOVOLTS
DC PLATE CURRENT . . .	5.0	AMPERES
PLATE DISSIPATION . . .	15	KILOWATTS
SCREEN DISSIPATION . .	450	WATTS
GRID DISSIPATION . . .	200	WATTS

TYPICAL OPERATION, Composite Signal Black Level
 Unless Otherwise Stated

Plate Voltage	5.0	6.0	kVdc
Screen Voltage	500	700	Vdc
Grid Voltage *	-160	-180	Vdc
Plate Current (zero signal) . . .	500	650	mAdc
Plate Current	2.8	3.33	Adc
Grid Current *	75	35	mAdc
Screen Current *	60	40	mAdc
Peak Cathode Voltage (peak synch).	310	345	v
Cathode Driving Power (peak synch)	975	1350	W
Plate Output Power (peak synch) .	11.0	16.5	kW
Plate Load Resistance	600	600	Ohms

* Approximate value.

TYPICAL OPERATION values are obtained by calculation from published characteristic curves. To obtain the specified plate current at the specified bias, screen, and plate voltages, adjustment of the rf grid voltage is assumed. If this procedure is followed, there will be little variation in output power when the tube is replaced, even though there may be some variation in grid and screen currents. The grid and screen currents which occur when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no performance degradation providing the circuit maintains the correct voltage in the presence of the current variations.

RANGE VALUES FOR EQUIPMENT DESIGN

	MIN.	MAX.	A
Heater Current, at 6.3 volts	152	168	A
Interelectrode Capacitances, cathode grounded ¹			
Cin	154.0	167.0	pF
Cout	22.0	27.0	pF
Cgp	---	2.0	pF
Interelectrode Capacitances, grid & screen grounded ¹			
Cin	62.0	72.0	pF
Cout	23.0	28.0	pF
Cpk	---	0.3	pF

1. Capacitance values are for a cold tube in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

A P P L I C A T I O N

MECHANICAL

MOUNTING - The 4CX15,000A must be operated with its axis vertical. The base of the tube may be up or down at the option of the circuit designer.

SOCKETS - The EIMAC air-system sockets SK-300A and SK-360 are designed especially for the concentric base terminals of the 4CX15,000A. The SK-300A is recommended for use through 30 MHz, while the SK-360 is recommended for applications in the VHF range. The use of recommended airflow rates though through the socket provides effective forced-air cooling of the tube. Air forced into the bottom of the socket passes over the base terminals of the tube, through an air chimney, and into the anode cooling fins.

COOLING - The maximum temperature rating for the external surfaces of the tube 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. Airflow requirements to maintain tube temperatures at 225°C with incoming cooling air at 50°C are shown for operation below 30 MHz. The data is for sea level with the tube mounted in an SK-300A socket with an SK-316 air chimney, and the pressure drop values should be considered approximate. At an altitude of 5000 feet both air flow and pressure drop must be increased by a factor of 1.2; at 10,000 feet the factor is 1.46.

Plate Dissipation (kW)	Air Flow (cfm)	Pressure Drop In. Water
7.5	230	0.7
12.5	490	2.7
15.0	645	4.6

The blower selected in a given application must be capable of supplying the desired airflow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters. It is considered good practice to allow for such variables as dirty air filters, rf seal heating, and the fact that the anode cooling fins may not be clean if the tube has been in service for some time without cleaning. Temperature-sensitive paint is available for checking temperatures before any design is finalized, and Application Bulletin #20 titled TEMPERATURE MEASUREMENTS WITH EIMAC POWER TUBES is available on request. Air flow must be applied before or simultaneously

with the application of electrode voltages, including the filament, and normally should be maintained for a short period of time after all power is removed to allow for tube cooldown. An air interlock system should be incorporated in the design to automatically remove all voltages from the tube in case of even partial failure of cooling air.

ELECTRICAL

ABSOLUTE MAXIMUM RATINGS - Values shown for each type of service are based on the "absolute system" and are not to be exceeded under any service conditions. These ratings are limiting values outside which the serviceability of the tube may be impaired. In order not to exceed absolute ratings the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by a safety factor so that the absolute values will never be exceeded under any usual conditions of supply-voltage variation, load variation, or manufacturing variation in the equipment itself. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

FILAMENT OPERATION - At rated (nominal) filament voltage the peak emission capability of the tube is many times that needed for communication service. A reduction in filament voltage will lower the filament temperature, which will substantially increase life expectancy. The correct value of filament voltage should be determined for the particular application. It is recommended the tube be operated at full nominal voltage for an initial stabilization period of 100 to 200 hours before any action is taken to operate at reduced voltage. Voltage should gradually be reduced until there is a slight degradation in performance (such as power output or distortion). The voltage should then be increased approximately two tenths of a volt above the value where performance degradation was noted for operation. The operating point should be rechecked after 24 hours. Filament voltage should be closely regulated when voltage is to be reduced below nominal in this manner, to avoid any adverse influence by normal line voltage variations. Filament voltage should be measured at the tube base or socket, using an accurate rms-responding meter. Periodically throughout the life of the tube the procedure outlined above for reduction of voltage should be repeated, with voltage reset as required, to assure best tube life.



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ELECTRODE DISSIPATION RATINGS - The maximum dissipation ratings must be respected to avoid damage to the tube. An exception is plate dissipation which may be permitted to rise above the rated maximum during brief periods, such as may occur during tuning.

GRID OPERATION - The maximum control grid dissipation is 200 watts, determined approximately by the product of the dc grid current and the peak positive grid voltage. It is recommended that a protective spark-gap device should be connected between the control grid and the cathode to guard against excessive voltage.

SCREEN OPERATION - The maximum screen grid dissipation is 450 watts. With no ac applied to the screen grid, dissipation is simply the product of dc screen voltage and the dc screen current. With screen modulation, dissipation is dependent on rms screen voltage and rms screen current. Plate voltage, plate loading, or bias voltage must never be removed while filament and screen voltages are present, since screen dissipation ratings will be exceeded. A protective spark-gap device should be connected between the screen grid and the cathode to guard against excessive voltage.

HIGH VOLTAGE - Normal operating voltages used with this tube are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. Equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage capacitors 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**.

FAULT PROTECTION - In addition to the normal plate over-current interlock, screen current interlock, and coolant interlock, the tube must be protected from internal damage caused by an internal plate arc which may occur at high plate voltage. A protective resistance should always be connected in series with the tube anode, to help absorb power supply stored energy if an internal arc should occur. The protection criteria for each electrode

supply is to short each electrode to ground, one at a time, through a vacuum relay switch and a 6-inch length of #30 AWG copper wire. The wire will remain intact if protection is adequate.

EIMAC Application Bulletin #17 titled **FAULT PROTECTION** contains considerable detail, and is available on request.

RADIO-FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 300 MHz most of the energy will pass completely through the human body with little attenuation or heating affect. Public health agencies are concerned with the hazard even at these frequencies. OSHA (Occupational Safety and Health Administration) recommends that prolonged exposure to rf radiation should be limited to 10 milliwatts per square centimeter.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of a specially constructed test fixture which shields all external tube leads or contacts from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. The capacitance values shown in the technical data are taken in accordance with Standard RS-191. The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in the application. Measurements should be taken with the mounting which represents approximate final layout if capacitance values are highly significant in the design.

SPECIAL APPLICATIONS - When it is desired to operate this tube under conditions widely different from those listed here, write to Varian EIMAC; attn: Product Manager; 301 Industrial Way; San Carlos, CA 94070 U.S.A.

OPERATING HAZARDS

PROPER USE AND SAFE OPERATING PRACTICES WITH RESPECT TO POWER TUBES ARE THE RESPONSIBILITY OF EQUIPMENT MANUFACTURERS AND USERS OF SUCH TUBES. ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TUBES OR EQUIPMENT WHICH UTILIZES SUCH TUBES MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

The operation of this tube may involve the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel:

- a. **HIGH VOLTAGE** - Normal operating voltages can be deadly. Remember that **HIGH VOLTAGE CAN KILL**.
- b. **LOW-VOLTAGE HIGH-CURRENT CIRCUITS** - personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.
- c. **RF RADIATION** - Exposure to strong rf fields

should be avoided, even at relatively low frequencies. The dangers of rf radiation are more severe at UHF and microwave frequencies and can cause serious bodily and eye injuries. **CARDIAC PACEMAKERS MAY BE EFFECTED**.

- d. **HOT SURFACES** - Surfaces of tubes can reach temperatures of several hundred °C and cause serious burns if touched for several minutes after all power is removed.

Please review the detailed operating hazards sheet enclosed with each tube, or request a copy from: Varian EIMAC, Power Grid Application Engineering, 301 Industrial Way, San Carlos CA 94070.



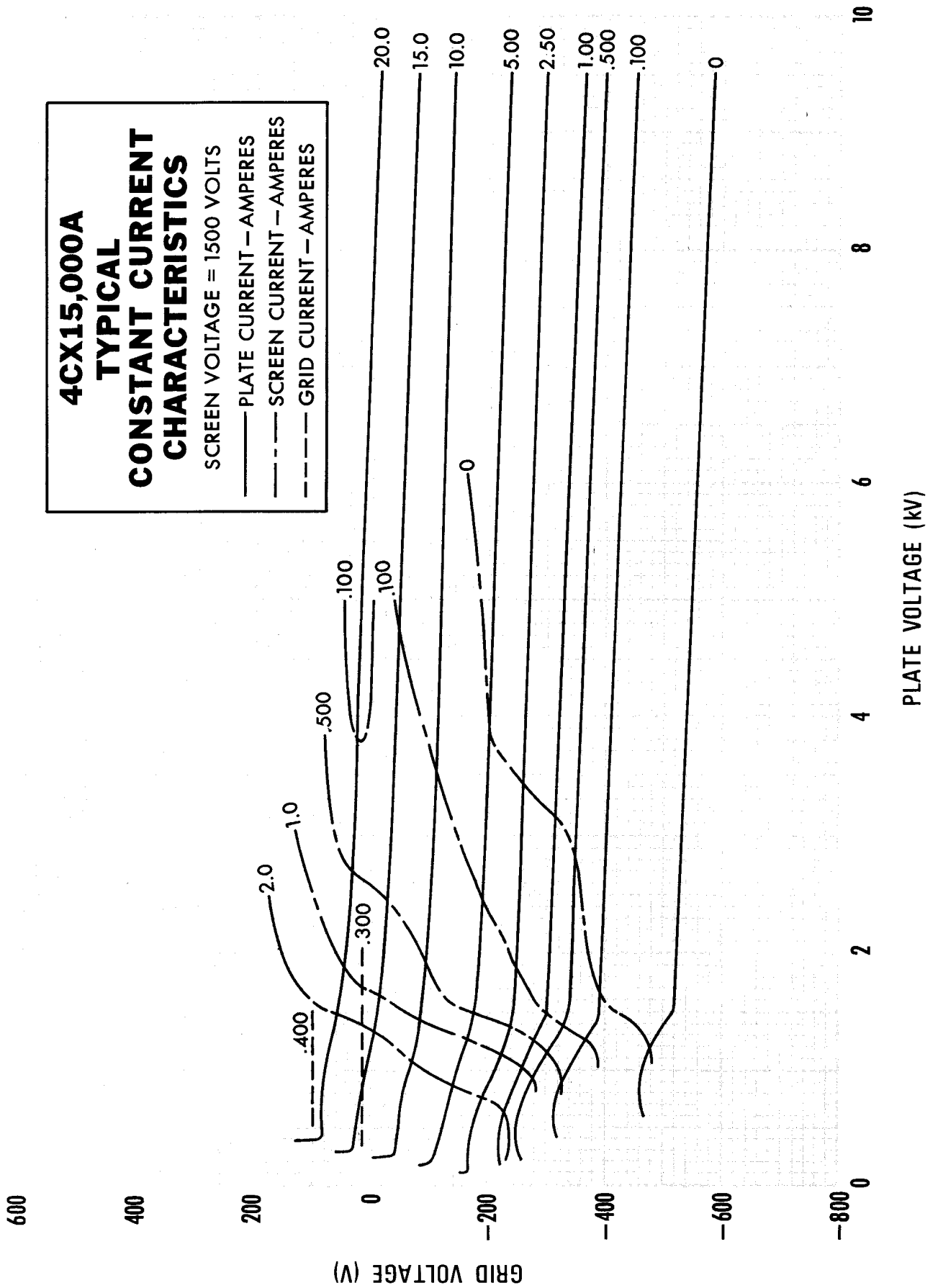
4CX15,000A

TYPICAL

CONSTANT CURRENT CHARACTERISTICS

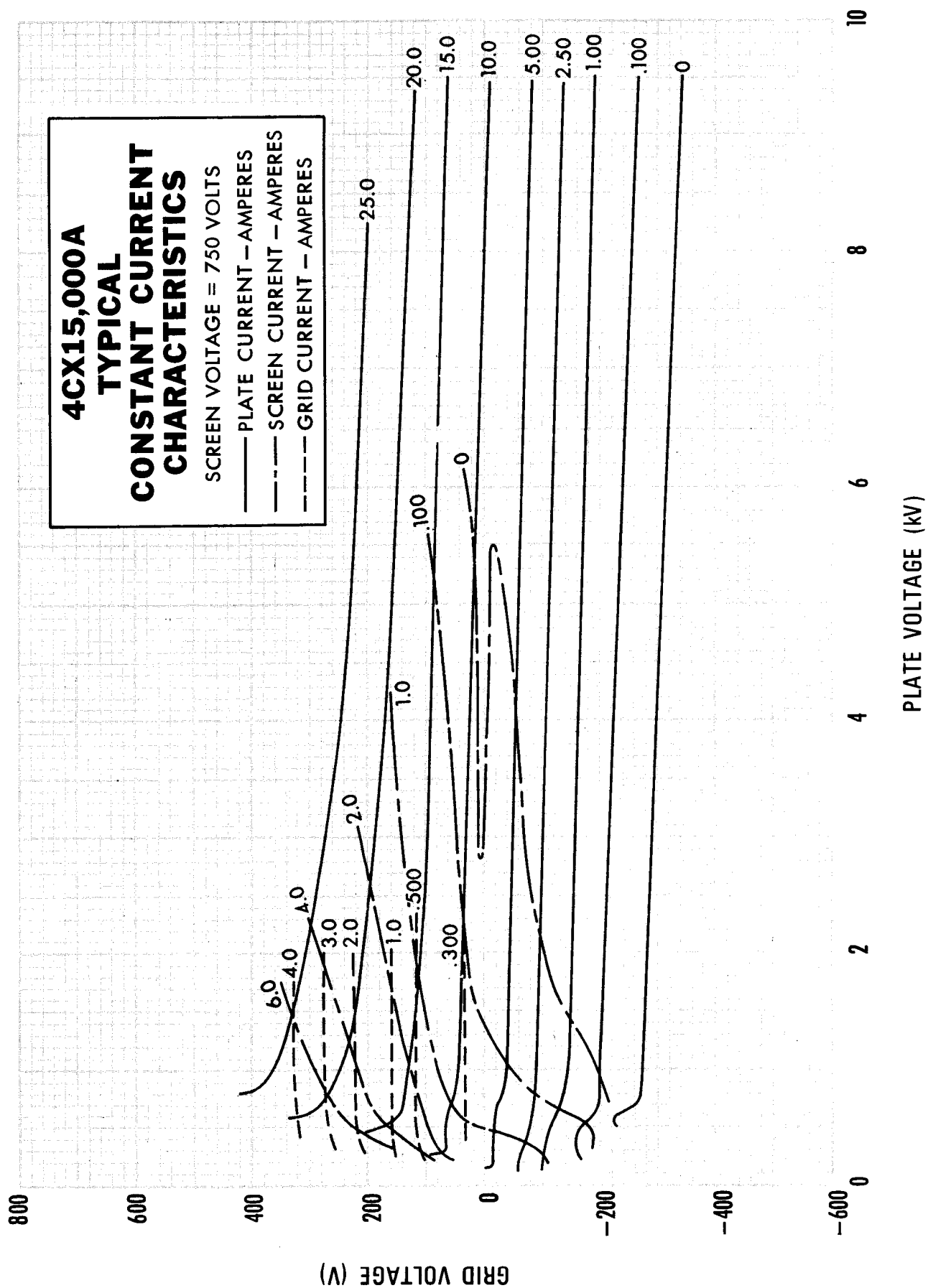
SCREEN VOLTAGE = 1500 VOLTS

- PLATE CURRENT — AMPERES
- - - SCREEN CURRENT — AMPERES
- - - - GRID CURRENT — AMPERES





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DIMENSIONAL DATA						
DIM	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A	7.460	7.580		189.48	192.53	
B	.855	.895		21.72	22.73	
C	.600	.760		15.24	19.30	
D	1.896	1.936		48.16	49.17	
E	3.133	3.173		79.58	80.59	
F	3.792	3.832		96.32	97.33	
G	3.980	4.020		101.09	102.11	
H	.188			4.78		
J	.188			4.78		
K	.188			4.78		
M	4.550	4.783		115.57	121.49	
N	2.412	2.788		61.26	70.82	
P	9.000	9.375		228.60	238.13	
S	3.560	3.684		90.42	93.57	
T	.375			9.53		
U	4.406	4.468		111.91	113.49	
V	3.718	3.781		94.44	96.04	
W	.219			5.56		

NOTES:

1. REF. DIMENSIONS ARE FOR INFO ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. DIMENSIONS IN () ARE MILLIMETERS.
3. * CONTACT SURFACE.
4. OPTIMUM FILAMENT & GRID CONNECTOR HEIGHTS FOR SOCKET DESIGN PURPOSES.

