



E I M A C
 Division of Varian
 SAN CARLOS
 CALIFORNIA

8168
4CX1000A
 CERAMIC
 POWER TETRODE

The EIMAC 8168/4CX1000A is a ceramic and metal, forced-air cooled, radial-beam tetrode with a rated maximum plate dissipation of 1000 watts. It is a low-voltage, high-current tube specifically designed for Class-AB₁ rf linear-amplifier or audio-amplifier applications where its high gain and low distortion characteristics may be used to advantage. At its rated maximum plate voltage of 3000 volts, it is capable of producing 1630 watts of peak-envelope output power. Two 8168/4CX1000As operating in Class-AB₁ will produce 3260 watts of audio power.



GENERAL CHARACTERISTICS

ELECTRICAL

	<i>Min.</i>	<i>Nom.</i>	<i>Max.</i>	
Cathode: Oxide Coated, Unipotential				
Heating Time	3			minutes
Heater: Voltage		6.0		volts
Current	8.1		9.9	amperes
Transconductance (I _b =1.0 ampere)		37,000		μmhos
Direct Interelectrode Capacitances, Grounded Cathode: *				
Input	77		90	pF
Output	11		13	pF
Feedback			0.022	pF
Direct Interelectrode Capacitances, Grounded Grid and Screen: *				
Input			32.5	pF
Output			11	pF
Feedback				0.004 pF
Frequency for Maximum Ratings				110 MHz

*In shielded fixture.

MECHANICAL

Base	Special, breechblock terminal surfaces
Maximum Operating Temperatures:	
Ceramic-to-Metal Seals	250°C
Anode Core	250°C
Recommended Socket	EIMAC SK-800 Series
Operating Position	Any
Maximum Over-all Dimensions:	
Height	4.8 inches
Diameter	3.37 inches
Net Weight	27 ounces
Shipping Weight (approximate)	3 pounds

RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB or B
 (Single Side-Band Suppressed-Carrier Operation)

MAXIMUM RATINGS

DC PLATE VOLTAGE	3000 VOLTS
DC SCREEN VOLTAGE	400 VOLTS
DC PLATE CURRENT	1.0 AMP
PLATE DISSIPATION	1000 WATTS
SCREEN DISSIPATION	12 WATTS
GRID DISSIPATION	0 WATTS

TYPICAL OPERATION (Frequencies below 30 MHz)

DC Plate Voltage	2000	2500	3000	volts
DC Screen Voltage	325	325	325	volts
DC Grid Voltage ¹	-60	-60	-60	volts
Zero-Signal DC Plate Current	250	250	250	mA
Single-Tone DC Plate Current*	890	885	875	mA
Two-Tone Average DC Plate Current				
Current	645	650	635	mA
Zero-Signal DC Screen Current*	8	6	5	mA
Single-Tone DC Screen Current*	35	35	35	mA
Two-Tone Average DC Screen Current*				
Current	10	8	8	mA
Plate Output Power	930	1300	1630	watts

*Approximate values.
¹Adjust grid bias to obtain zero-signal plate current.

**AUDIO AMPLIFIER OR MODULATOR**Class AB₁**MAXIMUM RATINGS**

DC PLATE VOLTAGE	- - -	3000 VOLTS
DC SCREEN VOLTAGE	- - -	400 VOLTS
DC PLATE CURRENT	- - -	1.0 AMP
PLATE DISSIPATION	- - -	1000 WATTS
SCREEN DISSIPATION	- - -	12 WATTS
GRID DISSIPATION	- - -	0 WATTS

TYPICAL OPERATION

(Sinusoidal wave, two tubes unless noted)

DC Plate Voltage	- - -	2000	2500	3000	volts
DC Screen Voltage	- - -	325	325	325	volts
DC Grid Voltage ¹	- - -	-60	-60	-60	volts
Zero-Signal DC Plate Current	-	500	500	500	mA
Max.-Signal DC Plate Current	-	1.78	1.77	1.75	amps
Zero-Signal DC Screen Current*		16	12	10	mA
Max-Signal DC Screen Current*		70	70	70	mA
Effective Load, Plate to Plate	-	2040	2850	3680	ohms
Driving Power	- - -	0	0	0	watts
Max-Signal Plate Output Power		1860	2600	3260	watts

*Approximate values.

¹Adjust grid bias to obtain listed zero-signal plate current.

NOTE: "TYPICAL OPERATION" data are obtained by calculation from the published characteristic curves and confirmed by direct tests. Adjustment of the grid bias to obtain the specified zero-signal plate current is assumed. When grid drive is applied, the screen voltage required to obtain the specified value of plate current without drawing grid current may vary somewhat from the typical values shown.

APPLICATION**MECHANICAL**

Cooling — Sufficient cooling must be provided for the anode and ceramic-to-metal seals to maintain operating temperatures below the rated maximum values:

Ceramic-to-Metal Seals	250°C
Anode Core	250°C

A flow rate of 25 cubic feet per minute will be adequate for operation at maximum rated plate dissipation at sea level and with inlet air temperatures up to 40°C. Under these conditions, 25 cfm of air flow corresponds to a pressure difference across the tube and socket of 0.2 inch of water column. Experience has shown that if reliable long-life operation is to be obtained, the cooling air flow must be maintained during standby periods when only the heater voltage is applied to the tube.

At higher altitudes and at VHF increased air flow will be required. For example, at an altitude of 10,000 feet, a flow rate of 37 cfm will be required and will be obtained with a pressure drop across tube and socket of 0.3 inch of water column. In selecting a blower for use at high altitudes, care must be taken to assure that the blower is designed to deliver the desired volume of air at the corresponding pressure drop and at the particular altitude.

In cases where there is any doubt regarding the adequacy of the supplied cooling, it should be borne in mind that operating temperature is the sole criterion of cooling effectiveness. Surface temperatures may be easily and effectively measured by using one of the several temperature-sensitive paints or sticks available from various chemical or scientific-equipment suppliers. When these materials are used, extremely thin applications must be made to avoid interference with the transfer of heat from the tube to the air stream, which would cause inaccurate indications.

The 4CX1000A is tested for vibration (noise) from 10 Hz to 500 Hz. Vibration level is 10 G

units peak 28 Hz to 500 Hz. Below 28 Hz vibration double amplitude is .25 inch.

The 4CX1000A is tested for shock, 50 G, 11 ms, three axes, after which the tube must be within specification for grid bias voltage and gas current.

ELECTRICAL

Heater — The rated heater voltage for the 4CX1000A is 6.0 volts. The voltage, as measured at the socket, should be maintained at this value to minimize variations in operation and to obtain maximum tube life. In no case should the voltage be allowed to exceed 5% above the rated value.

The cathode and one side of the heater are internally connected.

It is recommended that the heater voltage be applied for a period of not less than 3 minutes before other operating voltages are applied. From an initial cold condition, tube operation will stabilize after a period of approximately 5 minutes.

Control-Grid Operation — The grid dissipation rating of the 4CX1000A is zero watts. The design features which make the tube capable of maximum power operation without driving the grid into the positive region also make it necessary to avoid positive-grid operation.

Although the average grid-current rating is zero, peak grid currents of less than five-milliamperes as read on a five-milliamperere meter may be permitted to flow for peak-signal monitoring purposes.

Screen-Grid Operation — Tetrode tubes may exhibit reversed screen current to a greater or lesser degree depending on individual tube design. This characteristic is prominent in the 4CX1000A and, under some operating conditions, indicated negative screen currents in the order of 25 milliamperes may be encountered.

The maximum rated power dissipation for the screen grid in the 4CX1000A is 12 watts and



the screen power should be kept below this level. The product of the peak screen voltage and the indicated dc screen current approximates the screen input power except when the screen current indication is near zero or negative. In the usual tetrode amplifier, where no signal voltage appears between cathode and screen, the peak screen voltage is equal to the dc screen voltage. Experience has shown that the screen will operate within the limits established for this tube if the indicated screen current, plate voltage and drive voltage approximate the "Typical Operation" values.

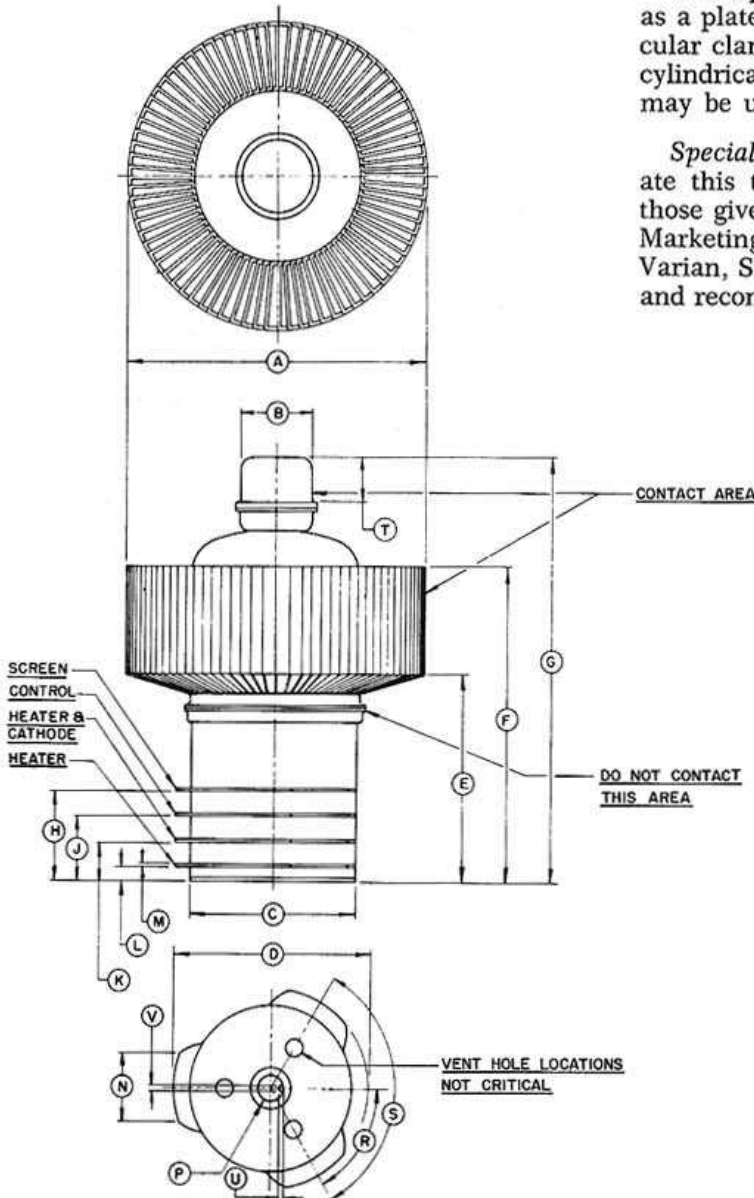
The screen supply voltage must be maintained constant for any values of negative and positive screen currents that may be encountered. Dangerously high plate currents may flow if the screen power supply exhibits a rising

voltage characteristic with negative screen current. Stabilization may be accomplished in several different ways. A bleeder resistor may be connected from screen to cathode; a combination of VR tubes may be connected from screen to cathode; or an electron-tube regulator circuit may be used in the screen supply. It is absolutely essential to use a bleeder if a series electron-tube regulator is employed. The screen bleeder current should approximate 70 milliamperes to adequately stabilize the screen voltage. It should be observed that this bleeder power may be usefully employed to energize low-power stages of the transmitter.

Plate Operation — The maximum rated plate dissipation power is 1000 watts. Except for brief periods during circuit adjustments, this maximum value should not be exceeded.

The top cap on the anode cooler may be used as a plate terminal at low frequencies or a circular clamp or spring-finger collet encircling the cylindrical outer surface of the anode cooler may be used at high frequencies.

Special Applications—If it is desired to operate this tube under conditions different from those given here, write to the Power Grid Tube Marketing Department, EIMAC Division of Varian, San Carlos, California, for information and recommendations.



DIMENSION DATA			
REF.	NOM.	MIN.	MAX.
A	3.335	3.365	
B	.807	.817	
C	1.870	1.900	
D	2.250 DIA.	2.300 DIA.	
E	2.195	2.380	
F	3.410	3.550	
G	4.600	4.800	
H	.950	1.000	
J	.675	.725	
K	.400	.450	
L	.140	.170	
M	.020	.030	
N	.700	.800	
P	.314 DIA.	.326 DIA.	
R	55°	65°	
S	115°	125°	
T	.470	.530	
U	.023	.043	
V	.057 DIA.	.073 DIA.	



4CX1000A

